



Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2 | Danish Sector, North Sea

Records of Operations – MV Normand Mermaid

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Executive Summary

Following a decision in the Danish Parliament, Denmark is on the path to establish multiple offshore wind farms in the Danish sectors of the North Sea, Kattegat, and the Baltic Sea. The offshore wind farms will provide offshore energy to the Danish mainland and neighbouring countries.

The offshore part of the project in the North Sea includes the following:

- Multiple offshore wind farms;
- Offshore platforms for substations;
- Subsea cables between offshore wind farms and the Danish mainland.

Energinet Eltransmission A/S has requested Fugro to perform a geotechnical site investigation for the North Sea 1 offshore wind farm area. The planned developments are located in the Danish sector of the North Sea, approximately 20 km off the west coast of Jutland, Denmark. The investigation area is divided into two subareas (Subarea 1 and Subarea 2). The geotechnical site investigation intends to provide relevant geotechnical data to improve the geological and geotechnical understanding of the area, and to support the design and installation requirements for the planned offshore wind farms.

The various site phases of the geotechnical investigation include seafloor in situ testing, geotechnical borehole drilling with downhole sampling, downhole in situ testing, borehole geophysical logging, and offshore geotechnical laboratory testing. An office programme of geotechnical laboratory testing and reporting of results follows the site phase.

This report presents the operations and calibration records of the seafloor in situ testing scope conducted by Normand Mermaid in Subarea 1 and Subarea 2, between 31 October 2023 and 6 March 2024. Water depths at the investigated locations, range from approximately 20 m to 33 m reduced to mean sea level.

1. Introduction

Energinet Eltransmission A/S (Energinet) are performing a large number of site investigations in preparation for development of the Danish offshore wind farm (OWF) 2030 project in the North Sea. Energinet has contracted Fugro to perform a geotechnical site investigation for the developments of the North Sea 1 offshore wind farm area. The planned developments are situated in the Danish sector of the North Sea, approximately 20 km off the west coast of Jutland, Denmark.

The purpose of this geotechnical site investigations is to gather geotechnical data and information as basis for:

- Development of 3D ground models, integrating the results of the geotechnical investigations and the geophysical surveys,
- Evaluation of possibilities to jack up on the seafloor when installing wind turbines,
- Preliminary engineering site assessments,
- General risk assessments for foundation conditions of the wind farms.

This document comprises the operations and calibration records of the seabed scope performed by Normand Mermaid, not included in and supplementing the 'Geotechnical Site Investigation Results Subarea 1 and Subarea 2' (F217703-01, F217703-02).

The operations and calibration records of the downhole scope to be performed by Fugro Voyager, Gargano and Excalibur will be covered in separate documents (F217703-02-OPS-VOY, F217703-03-OPS-GAR and F217703-04-OPS-EXC, respectively).

1.1 Geotechnical Survey Objectives with Normand Mermaid

The aim of the offshore geotechnical survey was providing the soil types and geotechnical properties of the soil units down to 55m below seafloor.

The geotechnical part of the survey included the following:

- 380 CPT tests of the seafloor of which 15 locations will include seismic velocity tests.

1.2 Detailed Site Information

1.2.1 Location

Figure 1.1 presents a project location map.

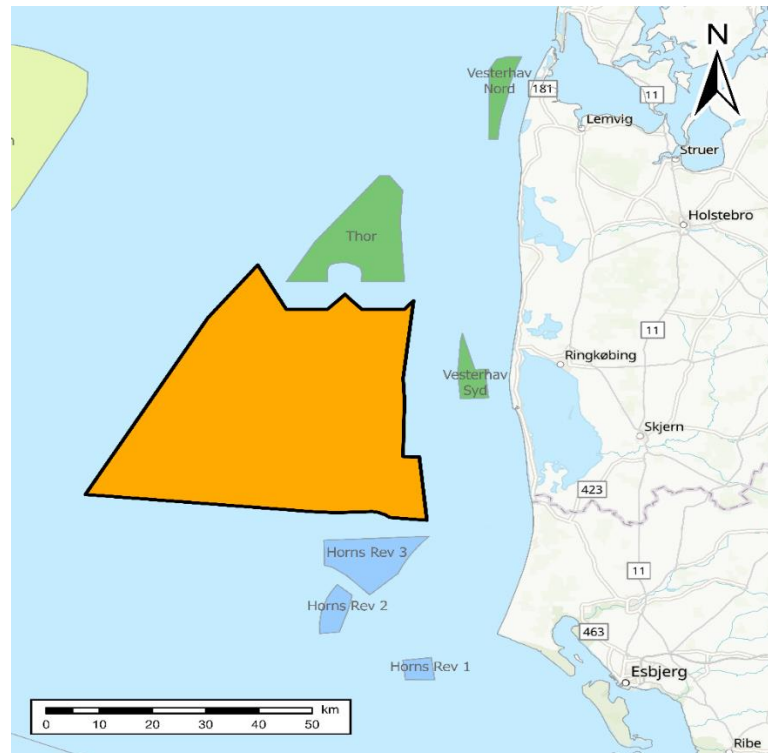


Figure 1.1: North Sea 1 (LOT 2) site in orange shown with neighbouring wind farms either operational (blue) or under construction (green)

1.2.2 Area of Investigation: LOT 2 Site

1.2.2.1 Description

The investigation area covers 2200 km² and is divided into two sub-areas: Subarea 1, covering 1420 km², and Subarea 2, covering 796 km². The water depths range between 10 and 40 meters mean sea level (MSL).

Approximately 3.5 percent of the project scope falls within the 12 nautical mile (NM) zone. The total number of locations within this zone was 15. Survey operations were conducted for no longer than 12 hours in any 24-hour period in compliance with maritime law within the 12 NM zone. The entry and exit times of the 12 NM zone were recorded in DDPRs.

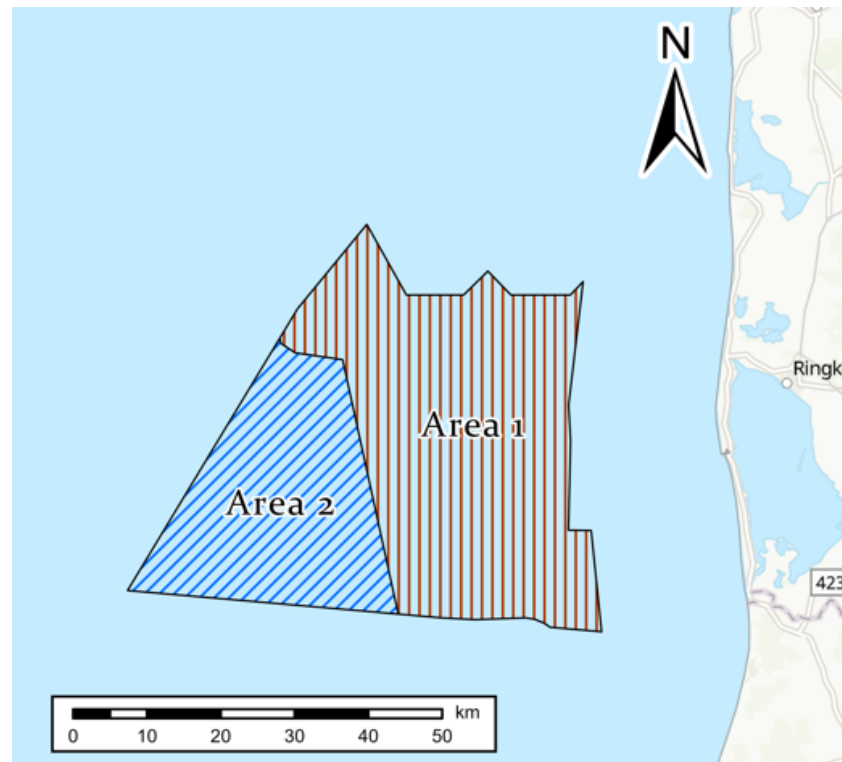


Figure 1.2: Sub-area distribution for the LOT 2 area

1.3 Geospatial Information, Vertical, Horizontal Control and Positioning

Table 1.1 presents the project geodesy and Table 1.2 presents the validation calculation. (refer to Appendix D.2 Positioning Survey Equipment Calibration for details)

Table 1.1: Geodetic parameters

Name: ETRS89 / UTM zone 32N [ETRF2000-ITRF2014], DTU21 MSS height [DTU21 MSS]		
EPSG Code	EPSG:25832	
Global Navigation Satellite System (GNSS) Geodetic Parameters*		
Datum	International Terrestrial Reference Frame 2014 EPSG:1165	
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Local Geodetic Datum Parameters		
Datum	European Terrestrial Reference System 1989 EPSG:6258	
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from ITRF2014 to ETRS89		
X-axis translation 0.056 m	X-axis rotation - 0.002754"	Scale difference 0.00355 ppm
Y-axis translation 0.0535 m	Y-axis rotation - 0.01666"	Coordinate Frame rotation

7-axis translation - 0.0988 m	7-axis rotation 0.026928"	FUGRO:41366
Local Projection Parameters		
Map projection	Transverse Mercator	
Grid system	UTM zone 32N	EPSG:16032
Latitude origin	00° 00' 00.000" N	
Central meridian	009° 00' 00.000" E	
Scale factor on central meridian	0.9996	
False easting	500 000 m	
False northing	0 m	
Project Vertical Parameters		
Vertical coordinate reference system	DTU21 MSS height	
Datum	DTU21 MSS height	
Transformation	WGS 84 to DTU21 MSS height	
Notes		
* The geodetic datum of Fugro's global GNSS correction data is ITRF2014, epoch 2023. 001982 (01/01/2023)		

Table 1.2: Validation calculation

TRF2014	Test Point [Position]	Computed Point
Latitude	56° 18' 54.00000" N	56° 18' 54.00000" N
Longitude	008° 30' 18.00000" E	008° 30' 18.00000" E
Ellipsoidal height	0.000 m Ell.	0.000 m Ell.
ETRS89		
Latitude	56° 18' 53.98049" N	56° 18' 53.98049" N
Longitude	008° 30' 17.96794" E	008° 30' 17.96794" E
Ellipsoidal height	-0.026 m Ell.	-0.026 m Ell.
UTM zone 32N		
Easting	469 379.097 m	469 379.097 m
Northing	6 241 248.598 m	6 241 248.598 m
Mean sea surface height	-39.937 m	-39.937 m

1.4 Scope of Report

The information presented in this report relates to operational details of the site investigation, as follows:

- Milestone Certificates,
- Data acquisition calibration records for the positioning systems,

- Recovery Lists,
- Calibration Certificates,
- Positioning Data,
- Health, Safety and Environment performance.

1.5 Project Responsibilities and Use of Report

This document presents information according to a project specification determined and monitored by Energinet Eltransmission A/S.

Fugro understands that this report will be used for the purpose described in this Main Text section. That purpose was a significant factor in determining the scope and level of the services. Results must not be used if the purpose for which the report was prepared or the client's proposed development or activity changes. Results may possibly suit alternative use. Suitability must be verified.

2. Operations

2.1 Mobilisation and Calibrations

Vessel mobilisation was undertaken on 27 October 2023 in Esbjerg, Denmark. Mobilisation was conducted in port and details of this are outlined in the MV Normand Mermaid mobilisation report (Document No. F217703-MOB-01A). Appendix A.1 presents signed copies of the milestone certificates.

The survey equipment supplied in the frame agreement was mobilised on the MV Normand Mermaid prior to the start of this project. Vessel position and heading systems were calibrated using land survey techniques on 15 October 2023 while alongside Haugesund, Norway. To verify the previous calibration values were correct, GNSS and Gyro verifications were completed while the vessel was alongside Esbjerg, Denmark on 26 and 27 October 2023. Draft measurements were taken prior to vessel departure to facilitate accurate depth readings.

Prior to operations, one cNode transponder, one MST transponder and one mini IPS sensor were installed on the cone penetration test (CPT) seabed frame. Their offsets were measured and entered in the survey system. All surface positioning equipment was fully mobilised and integrated at 18:00 on 27 October 2023. Positioning Survey Mobilisation and Calibration reports for Subarea 1 and Subarea 2 are presented in Appendix D.3.

- Vessel dimensional control survey (December 2021 in Haugesund);
- Heading and motion system calibrations / verifications (October 2023 in Haugesund);
- Positioning System Comparison (October 2023 in Esbjerg);
- Ultra-Short Baseline (USBL) verification (October 2023 in Esbjerg).

MV Normand Mermaid offsets have been provided in Table 2.1 and a corresponding offset diagram in Figure 2.1.

Table 2.1: Normand Mermaid Vessel Offsets

Offset Name	Location Description	Athwart (X) [m]	Along (Y) [m]	Height (Z) [m]
CRP	Common reference point	0.000	0.000	0.000
CPT	CPT launching point	-1.030	-7.866	0.000
MRU2	Motion reference unit	-0.035	5.143	-0.562
MRU5	Motion reference unit	-0.034	4.945	-0.565
Port GNSS	Port antenna	-1.709	16.263	29.047
Stbd GNSS	Starboard antenna	1.904	16.255	29.014
Port HPR	Port HiPAP pole	-6.149	-16.106	-11.521
Stbd HPR	Starboard HiPAP pole	6.150	-16.120	-12.314
Notes: GNSS antenna offset coordinates refer to the antennas' phase centre				

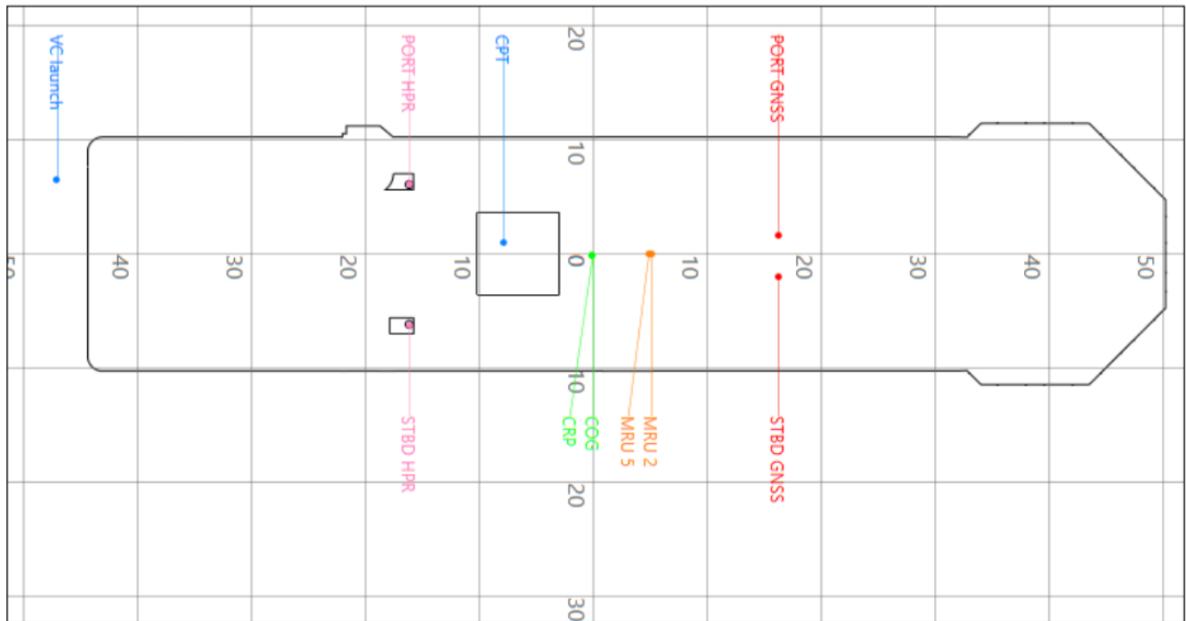


Figure 2.1: MV Normand Mermaid offset diagram

2.1.1 Navigation and Vertical Control

Table 2.2: Vessel Navigation and Vertical Control

Vessel Navigation and Vertical Control	
Requirement	<ul style="list-style-type: none"> ■ The horizontal and vertical uncertainty of the vessel position shall be less than 0.5 m. The accuracy of the horizontal positioning shall be better than 0.2 m for 95% of time (2σ). ■ Horizontal: The horizontal position of borehole and CPT locations shall be determined with an accuracy better than 0.5m. ■ The elevation of the seabed at the investigation positions shall be determined with an accuracy better than 0.1m.
Equipment	<ul style="list-style-type: none"> ■ Primary Positioning System: Fugro StarPack Receiver 101 with Starfix G4+; ■ Secondary Positioning System: Fugro StarPack Receiver 102 with Starfix XP2; ■ Heading: StarPack GNSS Heading, TSS Meridian Surveyor, Simrad GC80 ■ Navigation Software: Starfix NG.
Data Collection	<ul style="list-style-type: none"> ■ All global navigation satellite system (GNSS) positions were acquired in geographic coordinates relative to the World Geodetic System 1984 (WGS84) datum. ■ Fugro navigated and positioned the MV Normand Mermaid to the intended positions given by the client. ■ Two StarPack GNSS receivers were used for the surface positioning during the project. Underwater positioning was performed via the vessel's HiPAP 501 USBL system. All depth measurements were reduced to MSL. Real-time GNSS tides were used throughout the project. ■ Depths at each sample location were measured using a pressure sensor and USBL. ■ During the operations speed of sound measurements were taken and the results were entered into the vessel's USBL system. ■ All positions and peripheral data were sent to the navigation computer which calculated the various offset's positions in the local geodesy and projection, ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366). <p>(refer to Appendix B.3 for positioning reports for Subarea 1 and Subarea 2)</p>

2.2 Equipment

2.2.1 SEACALF® MkV Deep Drive System

A SEACALF® 20 tons MkV Constant Drive System with Deep Drive® technology deployed from 'Normand Mermaid' was used for seafloor in situ testing. The system was deployed through the moonpool of the vessel. It includes a coiled rod of 60 m with penetration length of 54 m. CPTs were performed using Fugro Deepcone® cone penetrometers with an approximate tip area of 1500 mm². The Fugro Deepcone® is a heavy-duty cone penetrometer designed to enhance penetration capacity.

SCPTs were performed using seismic cone penetrometers and Deepcone® penetrometers with an approximate tip area of 1500 mm². The seismic source consisted of a Hydraulic Underwater Shearwave Hammer (HUSH) box, consisting of a spring-driven steel mass hammered to a steel striking plate, mounted on the seabed frame.

2.3 Vessel Details

2.3.1 MV Normand Mermaid

The MV Normand Mermaid is a Norwegian-built multipurpose survey vessel constructed to high standards, it is equipped with advanced technology and machinery suitable for conducting detailed investigations in marine environments. The vessel uses dedicated launch and recovery systems and a crane to efficiently deploy various systems through the moonpool and via the stern, such as Fugro's SEACALF® Mk V Deep Drive® unit, high performance corer®, vibrocorer, piston corer, box corer or lighter SEACALF® and SEASCOUT® units.

A total of 70 bunks are available on this vessel. Survey offsets were determined during vessel mobilisation.



Figure 2.2: MV Normand Mermaid

Table 2.3 below shows the MV Normand Mermaid vessel characteristics.

Table 2.3: Vessel Details – MV Normand Mermaid

Vessel	Normand Mermaid (24 Hrs)
Length	90.1 m
Beam	20.5 m
Gross Tonnage	5528 ton
Draught	7 m
Transit speed	Up to 14 knots

3. Field Procedures

3.1 Summary of Events

The work covered under the contract comprises a combination of seafloor in situ testing onboard the Normand Mermaid, and downhole sampling and in situ testing spread over multiple separate vessels, namely and Fugro Voyager, Gargano and Excalibur.

Seafloor In situ testing operations for the Danish offshore wind farm (OWF) 2030 project commenced on 27 October 2023, with the mobilisation of Normand Mermaid at the Port of Esbjerg, Denmark. Survey operations were run on a 24-hour operational basis with data being QC'd and processed offshore. Geotechnical operations were completed on 06 March 2024. The vessel demobilised in Esbjerg, Denmark.

A summary of key events has been provided in Table 3.1, a break-down of geotechnical operational time (days) for MV Normand Mermaid is provided in Figure 3.1.

Table 3.1: Summary of Key Events (Geotechnical)

Event	Dates
Mobilisation of MV Normand Mermaid (Esbjerg, Denmark)	27 October 2023
USBL verification	27 October 2023
Commencement of Geotechnical operations in Subarea 1	31 October 2023
Completion of Geotechnical operations in Subarea 1	09 January 2024
Commencement of Geotechnical operations in Subarea 2	26 November 2023
Completion of Geotechnical operations in Subarea 2	06 March 2023
Confirmation of Geotechnical operations completed	06 March 2023
Crew Change in Esbjerg	15 November 2023
	13 December 2023
	10 January 2024
	07 February 2024
Demobilisation of MV Normand Mermaid (Esbjerg, Denmark)	06 March 2023

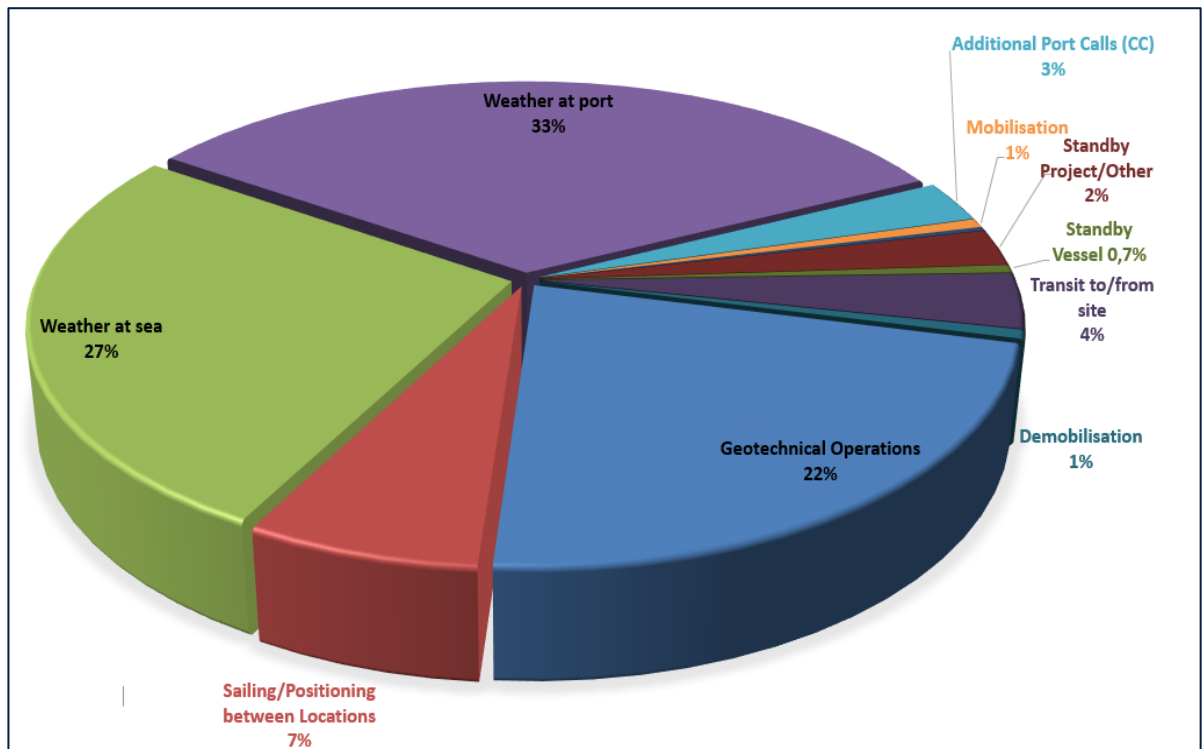


Figure 3.1: MV Normand Mermaid project breakdown (%days)

3.2 Work Package A - MV Normand Mermaid

Fieldwork operations onboard the MV Normand Mermaid were performed between 31 October 2023 and 06 March 2024. Data was processed onboard and preliminary results for individual locations were issued to the onboard client representative. Daily progress reports (DPRs) were issued daily during the mobilisation of the fieldwork and during execution of the scope of work.

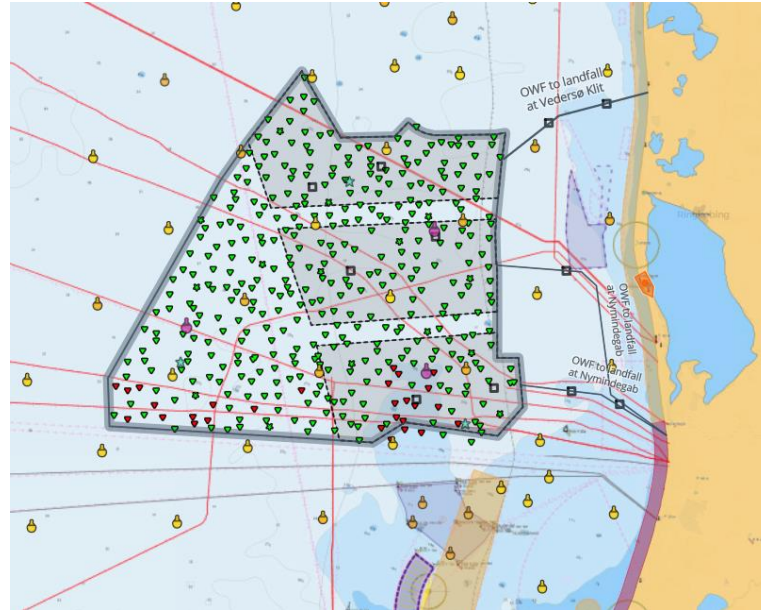
The work scope performed by Normand Mermaid in Subarea 1 and Subarea 2 comprises of:

- Three hundred and fifty-three (353) seafloor cone penetration test (CPT) locations,
- Fifteen (15) seismic CPT (SCPT) locations of which 12 include seismic velocity tests (SVTs).

Table 3.2: Geotechnical Scope of Work

Subarea	Tendered Number of s(CPT)	Acquired Number of s(CPT)
Subarea 1	234	234
Subarea 2	146	134

Figure 3.2: Completed S(CPT) locations with MV Normand Mermaid (green)



A total of forty-six (46) re-tests were conducted in Subarea 1 and Subarea 2, primarily due to challenging soil conditions in the North Sea 1 area. The lack of adequate support in the upper layers, particularly a soft clay layer enclosed between two denser sand layers, led to coil buckling issues, resulting in the loss of 4 CPT cones on the seabed. Location names and additional details are provided in Table 3.3. The lost equipment list and site clearance reports are included in Appendix D.4.

Table 3.3: List of Buried Cones

Buried Cones in North Sea 1			
Location	Coordinates	Water Depth (m)	Reference
CPT140A	Easting 417702.70 - Northing 6226780.83 Latitude 56° 10' 44.0019" N – Longitude 007° 40' 27.3986" E	29,6	Ellipsoid: ETRS89 Projection: UTM Zone 32N, Vertical Datum: DTU21 MSS(MSL) height
CPT293	Easting 386261.07 - Northing 6220591.68 Latitude 56° 07' 00.6379" N – Longitude 007° 10' 14.4481" E	30,0	Ellipsoid: ETRS89 Projection: UTM Zone 32N, Vertical Datum: DTU21 MSS(MSL) height
CPT343A	Easting 380021.66 - Northing 6208990.72 Latitude 56° 00' 40.1169" N – Longitude 007° 04' 32.1192" E	33,4	Ellipsoid: ETRS89 Projection: UTM Zone 32N, Vertical Datum: DTU21 MSS(MSL) height
CPT193	Easting 374209.91 - Northing 6192400.24 Latitude 55° 51' 38.4497" N - Longitude 006° 59' 24.5909" E	35,0	Ellipsoid: ETRS89 Projection: UTM Zone 32N, Vertical Datum: DTU21 MSS (MSL) height

The below table illustrates the components of the Work Package A - Normand Mermaid (Fieldwork Phase - Seafloor s(CPT)s) scope.

Table 3.4: Work Package A methodology

Item	Description
Scope	<ul style="list-style-type: none"> ■ 380 continuous seafloor CPTs to 55 m BSF <ul style="list-style-type: none"> • Of which 15 SCPTs.
Methodology	<p>Seafloor Cone Penetration Tests</p> <p>Seafloor cone penetration tests (CPTs) will be performed using a SEACALF® MkV - Deepdrive System. The system is deployed through the moonpool of the vessel. It includes a coiled rod of 60 m with penetration length of 54 m. Refer to Technical Query TQ-002 for details.</p> <p>It consists of a flexible thick-walled steel rod that is stored in a coil and straightened or re-coiled by a mechanical device during testing. The coiled rod system eliminates the need to manually build a rod from 1-meter sections, significantly reducing HSSE exposure, deployment time and downtime due to potential rod breakages.</p> <p>The cone is pushed with a constant rate of 20 mm/s throughout the whole test while the measurements of cone resistance, sleeve friction and pore pressure are displayed graphically in the control cabin. These data are simultaneously recorded. This facilitates detailed data processing, interpretation and presentation both offshore and onshore.</p> <p>CPTs will be performed using, as base case, penetrometers with a 15 cm² cone. At least ten calibrated piezocones (10 and 15 cm² type) will be on board the vessel.</p> <p>To ensure high quality data CPTs should be of minimum application Class 2 in accordance with ISO 19901-8:2014.</p> <p>Seafloor CPT termination criteria are as follows, whichever occurs first and as applicable:</p> <ul style="list-style-type: none"> ■ As instructed by client; ■ Total thrust equals nominal reaction provided; ■ Cone tip resistance exceeds the tip capacity; ■ Sleeve friction exceeds the sleeve capacity; ■ Cone inclination exceeds 15°; ■ Sudden change of cone inclination exceeds 3°; ■ The operator considers that further penetration would damage the equipment, in which case an explanation is to be provided. <p>In case of refusal less than 10 m below seafloor, an additional CPT will be performed within 5 m from the initial location.</p> <p>Seafloor Seismic Cone Penetration Tests</p> <p>Seafloor seismic CPTs (SCPTs) will be performed with the same system as seafloor CPTs described above. The SEACALF® system is fitted with a seismic S-wave source (HUSH box) and a cone penetrometer with two seismic receivers (geophones) at a 0.5 m spacing. At selected seafloor CPT locations, seismic velocity tests (SVTs) will be performed. Geophones measure the magnitude and arrival time of shear waves. Seismic measurements will be performed in 1 m intervals.</p> <p>The CPT will be positioned in such a way as to provide verticality of push rods.</p> <p>The continuous CPTs will be carried out from the seafloor to target depth or refusal.</p> <p>For seafloor CPTs, the seafloor elevation at the test location will be recorded by pressure transducers mounted on the seabed frame and corrected for specific gravity of the water column at the location.</p> <p>Field checks of cone penetrometers and the data acquisition system will be performed as part of the mobilisation and before a new cone penetrometer is used.</p>

Item	Description
	<p>Before conducting each CPT, the tip, sleeve friction readings and pore pressure reading will be zeroed. Zero readings will be reported.</p> <p>The cone will be pushed into the soil at a constant rate of 20 mm/s.</p> <p>During CPT operations and before start of the penetration of the push rods into the soil, Fugro will record continuously and in real-time the following data in digital and graphical format and in strict accordance with the EN/ISO 22476 1:2012 (or equivalent) and ISSMGE guidelines:</p> <ul style="list-style-type: none"> ■ A record of the individual test zeros. ■ The tip resistance. ■ The sleeve friction. ■ The pore pressure. ■ Inclination. <p>The raw measured results will be stored in digital format and backed up for subsequent processing and interpretation.</p> <p>Operations are conducted on a continuous basis, 24 hours per day, and 7 days per week.</p>
Team composition	Party Chief, Vessel crew, CPT operators, Survey team, Geotechnical Engineers
Equipment	<p>The geotechnical scope of work will be performed using:</p> <ul style="list-style-type: none"> ■ Normand Mermaid – providing a stable platform to execute our operations ■ CPT Testing: Fugro SEACALF® MkV – Deepdrive seafloor CPT system <ul style="list-style-type: none"> • Piezo Cone Penetrometers (15 and 10 cm²) • Seismic Cone Penetrometers (15 cm²) ■ Seismic spread
Preliminary field deliverables	<p>After the completion of a CPT location and within 24 hours the following preliminary field deliverables will be issued to Offshore Client Representatives (OCR):</p> <ul style="list-style-type: none"> ■ Preliminary CPT plots ■ Preliminary interpreted geotechnical logs.
Deliverables	<ul style="list-style-type: none"> ■ Acceptance Test Report <p>Documentation for all equipment will be documented, including but not limited to:</p> <ul style="list-style-type: none"> • Documentation of the positioning system and accuracy. • Documentation and description of the applied vertical and horizontal reference systems including tidal correction. • Calibration reports for CPT cones and CPT equipment. <p>The Acceptance Test Report will be delivered to the OCRs prior to commencement of the Scope.</p> <ul style="list-style-type: none"> ■ Daily Progress Reports <p>For each applied vessel, a separate Daily Progress Report (DPR) will be prepared and submitted from the Party Chief and the Clients Representative not later than 12 hours after end of a day.</p> <p>The format and the recipients of the DPRs will be agreed between the Consultant and the Client at the kick-off meeting.</p> <p>Daily Progress Reports for a vessel will be from start of mobilization and uninterrupted until end of demobilization.</p> <p>The Daily Progress Reports must include information regarding:</p> <ul style="list-style-type: none"> • Status of works: Completed quantities (current day and cumulated) and remaining quantities. • Time break down: Mobilization, Operation, Standby, Transit, etc. (current day and cumulated).

Item	Description
	<ul style="list-style-type: none"> • Weather observations (sea state, wind and visibility). • Weather forecast – next 24 hours. • Deviations from normal operation (break downs, calibration issues, etc.). • HSSE incidents. <p>The Daily Progress Report will be submitted to the Client before noon the following day.</p> <ul style="list-style-type: none"> ■ Records of Operations – Normand Mermaid <ul style="list-style-type: none"> • Document Number: F217703-01-OPS-NMM* <p>The Operational Report will in general describe how the investigations were completed. As such the Operational report must at least include the following:</p> <ul style="list-style-type: none"> • Executive summary. • Description of any QHSSE events • Project introduction and background. • Description of the applied vertical and horizontal reference systems. • Description of all applied vessels. • Detailed description of all equipment. • Documentation of the calibration and system tests (enclose Acceptance Test Reports). • Definition of area of investigation. • Description of all methods for performed works. • Description of completed offshore scope including cumulative quantities. • Description of penetration of legs, seabed frame etc. • Description of deviations from the Scope of Services. • Description of norms and standards applied for the work. • Description of the cumulative time breakdown from the start of the mobilization to the end of the demobilization. <ul style="list-style-type: none"> ■ Weekly Management Reports ■ Monthly HSSE Reports
Task-specific RAMS	<ul style="list-style-type: none"> ■ EUIAF-FNLM-NMM-FO-001 Safety Induction back deck Normand Mermaid ■ EUIAF-FNLM-NMM-PR-001 Normand Mermaid Shallow Gas Procedure ■ EUIAF-FNLM-NMM-PR-002 38mm Coil Change on Single Wire SEACALF MKIV-V onboard Normand Mermaid ■ EUIAF-FNLM-NMM-PR-003 SEACALF MKV Launch and Recovery Procedure onboard Normand Mermaid ■ EUIAF-FNLM-NMM-RA-001 TRA SEACALF Operations onboard Normand Mermaid ■ EUIAF-FNLM-NMM-RA-002 TRA SEACALF MKV Launch & Recovery onboard Normand Mermaid ■ EUIAF-FNLM-OPL-PR-069 Refusal Criteria ■ FNLM-GEO-APP-029 Positioning Survey and Depth Measurement ■ FNLM-GEO-APP-078 Geotechnical Log ■ FNLM/GEO/APP/012 Geotechnical Parameter Values ■ FNLM/GEO/APP/001 Cone Penetration Test ■ FNLM/GEO/APP/032 Seismic CPT Test and Downhole Seismic Test in Borehole ■ FNLM/GEO/APP/033 In Situ pore Pressure Dissipation Test
Notes	

Item	Description
BSF = Below seafloor	
HUSH = Hydraulic underwater shear hammer	
RAMS = Risk assessments and method statements	

4. Health, Safety and Environment

Fugro performed the geotechnical operations with high regard for health and safety and the environment. A health, safety and environmental plan was completed prior to the start of the project operations (refer to F217703-PEP-Vol4_HSSE Plan). This was produced in accordance with the company's Health Safety and Environmental Management System manual. All survey and crew members were required to read and sign this plan, to ensure they understood the work to be performed and the mitigating measures employed to minimise the identified risks.

During mobilisation and at regular intervals thereafter, safety briefings and toolbox talks were conducted to reiterate the risks relating to survey operations and steps taken to minimise these risks. A full safety briefing was also undertaken after each crew change. Further details have been provided in Table 4.1.

Table 4.1: Summary of HSE

Meeting	Number
Vessel Kick off meeting	1
Two-part HIRA	1
Vessel drills	32
Cross department tours	8
Sound Bite Training	23
TBT Lead by other than mngr/supv.	30
Toolbox talks (TBT)	1273
Hazard Observation Cards (HOC)	258
Vessel Safety Meetings	2
Audits / inspections	18
Incidents	1

All crew were required to wear coveralls, hardhats, safety boots, safety glasses, and gloves for all back-deck operations.

During operations a hazard observation card (HOC) system was operated on board allowing crew to report unsafe acts, unsafe conditions, safe acts, or make HSE suggestions. In total 258 HOCs were submitted.

The incidents and quality events reported during the project have been listed in Table 4.2.

Table 4.2: Summary of Project Related Incidents and Quality Events

Date of Occurrence	Type	Fugro Ref #	Details
20/11/2023	Quality Event		3 x Re-testing at location CPT201

Date of Occurrence	Type	Fugro Ref #	Details
01/12/2023	Environmental incident	16482	Burst Hose on SEACALF®

Appendix A

Offshore Activities and Agreements

Contents Appendix A: Offshore Activities and Agreements

A.1: Fieldwork and (De)Mobilisation Acceptance Certificates

A.2: Fieldwork Progress (DDPR)

A.1 Fieldwork and (De)Mobilisation Acceptance Certificates

List of Plates

Acceptance of Mobilisation	1 Plate
Acceptance of Demobilisation	1 Plate
Certificate of Completion of Fieldwork	1 Plate

Project Milestone Completion Acceptance Certificate

Contractor	Fugro Netherlands Marine B.V.
Client	Energinet Eltransmission A/S
Contract Number	F217703
Milestone	MV Normand Mermaid - Mobilisation Completion
Completion Date	27 October 2023

The undersigned PARTIES agree that Fugro Netherlands Marine B.V. (CONTRACTOR) has completed and fulfilled all mobilisation and calibration obligations under the above mentioned contract to the satisfaction of Energinet Eltransmission A/S (CLIENT).



For and on behalf of CONTRACTOR

Name: Rene Wojke
Title: Party Chief
Date: 31 October 2023

For and on behalf of CLIENT

Name: Colin Jacobs / Paskal Nerad
Title: Offshore Client Representative
Date: 31 October 2023

GLOB-MALA-PRM-TP-003 | Project Milestone Completion Acceptance Certificate | Version 0.0



Project Milestone Completion Acceptance Certificate

Contractor	Fugro Netherlands Marine B.V.
Client	Energinet Eltransmission A/S
Contract Number	F217703
Milestone	MV Normand Mermaid - Demobilisation Completion
Completion Date	6 March 2024

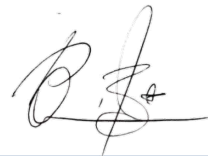
The undersigned PARTIES agree that Fugro Netherlands Marine B.V. (CONTRACTOR) has completed and fulfilled all demobilisation obligations under the above mentioned contract to the satisfaction of Energinet Eltransmission A/S (CLIENT).

GLOB-MALA-PRM-TP-003 | Project Milestone Completion Acceptance Certificate | Version 0.0



For and on behalf of CONTRACTOR

Name: Werner Pretorius
Title: Party Chief
Date: 6 March 2024



For and on behalf of CLIENT

Name: Tom Brogan
Title: Offshore Client Representative
Date: 6 March 2024



Project Milestone Completion Acceptance Certificate

Contractor	Fugro Netherlands Marine B.V.
Client	Energinet Eltransmission A/S
Contract Number	F217703
Milestone	MV Normand Mermaid – Completion of Field Work
Completion Date	6 March 2024

The undersigned PARTIES agree that Fugro Netherlands Marine B.V. (CONTRACTOR) has completed and fulfilled the required fieldwork on site under the above mentioned contract to the satisfaction of Energinet Eltransmission A/S (CLIENT).
The vessel will proceed to demobilise from the project in the Port of Esbjerg, Denmark.

GLOB-MALA-PRM-TP-003 | Project Milestone Completion Acceptance Certificate | Version 0.0



For and on behalf of CONTRACTOR

Name: Werner Pretorius
Title: Party Chief
Date: 6 March 2024



For and on behalf of CLIENT

Name: Tom Brogan
Title: Offshore Client Representative
Date: 6 March 2024



A.2 Fieldwork Progress (DDPR)

Daily Progress Reports have been shared with Energinet Eltransmission A/S separately.

Appendix B

Location and Positioning Survey

Contents Appendix B: Location and Positioning Survey

- B.1: Mean Positioning Reports**
- B.2: Sound Velocity Profiles**
- B.3: Positioning Data Reports for Subarea 1 and Subarea 2**

B.1 Mean Position Reports

List of Plates

Mean Position Reports

202 Plates

Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT135-v2
Start Time	31 Oct 2023, 01:49:29+01:00
End Time	31 Oct 2023, 01:51:31+01:00
Session Length	2m 2s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 15' 53.51885" N	56° 15' 53.53843" N
Longitude	007° 20' 03.37382" E	007° 20' 03.40531" E
Height	9.132 m Ell., -32.248 m ISS	9.158 m Ell., -32.023 m Ort.
Easting	396 829.280 m E (± 0.08 m)	
Northing	6 236 806.455 m N (± 0.12 m)	
Height	-31.553 m MSS (± 0.24 m) , -32.248 m ISS (± 0.20 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	58.6° T, 60.0° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.4 m, USBL= 31.6 m

Table 5: Mean Position to Target

Target	CPT135		
Position	396 830.000 m E, 6 236 810.000 m N		
Range	3.62 m Grid		
Bearing To	11.5° G	Bearing From	191.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	396 829.280 m E, 6 236 806.455 m N , -31.553 m MSS
Heading	58.6° T, 60.0° G
Pitch	0.00 °
Roll	0.00 °



Rene Wojke
Party Chief
FNAS (Fugro Norway AS)

Paskal Nerad
Client Representative
Energinet Eltransmission



Colin Jacobs
Client Representative
Energinet Eltransmission

Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT001-v3
Start Time	31 Oct 2023, 04:21:55+01:00
End Time	31 Oct 2023, 04:23:58+01:00
Session Length	2m 3s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 14' 25.27057" N	56° 14' 25.29015" N
Longitude	007° 19' 56.27203" E	007° 19' 56.30351" E
Height	9.700 m Ell., -31.892 m ISS	9.726 m Ell., -31.467 m Ort.
Easting	396 641.067 m E (± 0.08 m)	
Northing	6 234 081.465 m N (± 0.14 m)	
Height	-30.988 m MSS (± 0.19 m) , -31.892 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	59.1° T, 60.5° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.8 m, USBL= 31.0 m

Table 5: Mean Position to Target

Target	CPT001		
Position	396 643.000 m E, 6 234 080.000 m N		
Range	2.43 m Grid		
Bearing To	127.2° G	Bearing From	307.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	396 641.067 m E, 6 234 081.465 m N , -30.988 m MSS
Heading	59.1° T, 60.5° G
Pitch	0.00 °
Roll	0.00 °



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Paskal Nerad
Client Representative
Energinet Eltransmission



Colin Jacobs
Client Representative
Energinet Eltransmission

Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT120-v5
Start Time	01 Nov 2023, 04:10:43+01:00
End Time	01 Nov 2023, 04:12:49+01:00
Session Length	2m 6s (108 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 48' 22.20005" N	55° 48' 22.21962" N
Longitude	007° 44' 39.88807" E	007° 44' 39.91966" E
Height	17.954 m Ell., -23.685 m ISS	17.979 m Ell., -23.180 m Ort.
Easting	421 302.643 m E (± 0.12 m)	
Northing	6 185 220.089 m N (± 0.05 m)	
Height	-22.762 m MSS (± 0.16 m) , -23.685 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	147.3° T, 148.4° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.5 m, USBL= 22.8 m

Table 5: Mean Position to Target

Target	CPT120		
Position	421 303.000 m E, 6 185 220.000 m N		
Range	0.37 m Grid		
Bearing To	104.0° G	Bearing From	284.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	108 of 120
Position	421 302.643 m E, 6 185 220.089 m N , -22.762 m MSS
Heading	147.3° T, 148.4° G
Pitch	0.00 °
Roll	0.00 °



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Colin Jacobs
Client Representative
Energinet Eltransmission

Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT366-v6
Start Time	01 Nov 2023, 06:04:17+01:00
End Time	01 Nov 2023, 06:06:19+01:00
Session Length	2m 2s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 48' 54.16048" N	55° 48' 54.18005" N
Longitude	007° 44' 27.63069" E	007° 44' 27.66228" E
Height	17.780 m Ell., -23.675 m ISS	17.806 m Ell., -23.353 m Ort.
Easting	421 107.209 m E (± 0.08 m)	
Northing	6 186 211.930 m N (± 0.05 m)	
Height	-22.938 m MSS (± 0.15 m) , -23.675 m ISS (± 0.08 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	136.2° T, 137.2° G	± 1.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.6 m, USBL= 23.0 m

Table 5: Mean Position to Target

Target	CPT366		
Position	421 108.000 m E, 6 186 210.000 m N		
Range	2.09 m Grid		
Bearing To	157.7° G	Bearing From	337.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	421 107.209 m E, 6 186 211.930 m N , -22.938 m MSS
Heading	136.2° T, 137.2° G
Pitch	0.00 °
Roll	0.00 °



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Client Representative
Energinet Eltransmission



Colin Jacobs
Client Representative
Energinet Eltransmission

Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT242-v7
Start Time	05 Nov 2023, 10:43:26+01:00
End Time	05 Nov 2023, 10:45:27+01:00
Session Length	2m 1s (113 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 02' 54.30686" N	56° 02' 54.32643" N
Longitude	007° 41' 30.51545" E	007° 41' 30.54707" E
Height	11.760 m Ell., -29.869 m ISS	11.785 m Ell., -29.369 m Ort.
Easting	418 515.733 m E (± 0.14 m)	
Northing	6 212 240.157 m N (± 0.10 m)	
Height	-28.920 m MSS (± 0.24 m) , -29.869 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	191.1° T, 192.2° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.6 m, USBL= 29.0 m

Table 5: Mean Position to Target

Target	CPT242		
Position	418 516.000 m E, 6 212 240.000 m N		
Range	0.31 m Grid		
Bearing To	120.4° G	Bearing From	300.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	113 of 120
Position	418 515.733 m E, 6 212 240.157 m N , -28.920 m MSS
Heading	191.1° T, 192.2° G
Pitch	0.00 °
Roll	0.00 °



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 Client Representative
 Energinet Eltransmission



Colin Jacobs
 Client Representative
 Energinet Eltransmission

Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT038-v8
Start Time	05 Nov 2023, 12:11:56+01:00
End Time	05 Nov 2023, 12:13:58+01:00
Session Length	2m 2s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 04.51210" N	56° 04' 04.53167" N
Longitude	007° 42' 00.04416" E	007° 42' 00.07578" E
Height	11.514 m Ell., -30.031 m ISS	11.540 m Ell., -29.605 m Ort.
Easting	419 067.468 m E (± 0.12 m)	
Northing	6 214 400.780 m N (± 0.09 m)	
Height	-29.149 m MSS (± 0.18 m) , -30.031 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	187.6° T, 188.7° G	± 3.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.9 m, USBL= 29.2 m

Table 5: Mean Position to Target

Target	CPT038		
Position	419 067.000 m E, 6 214 400.000 m N		
Range	0.91 m Grid		
Bearing To	211.0° G	Bearing From	31.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	419 067.468 m E, 6 214 400.780 m N , -29.149 m MSS
Heading	187.6° T, 188.7° G
Pitch	0.00 °
Roll	0.00 °



Rene Wojke
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FNAS (Fugro Norway AS)

Paskal Nerad
Client Representative
Energinet Eltransmission



Colin Jacobs
Client Representative
Energinet Eltransmission

Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT178-v10
Start Time	05 Nov 2023, 19:41:59+01:00
End Time	05 Nov 2023, 19:44:00+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 40.61926" N	56° 03' 40.63882" N
Longitude	007° 43' 09.61473" E	007° 43' 09.64636" E
Height	12.304 m Ell., -29.549 m ISS	12.330 m Ell., -28.810 m Ort.
Easting	420 256.807 m E (± 0.12 m)	
Northing	6 213 639.689 m N (± 0.09 m)	
Height	-28.353 m MSS (± 0.17 m) , -29.549 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	180.9° T, 181.9° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.1 m, USBL= 28.3 m

Table 5: Mean Position to Target

Target	CPT178		
Position	420 256.000 m E, 6 213 640.000 m N		
Range	0.86 m Grid		
Bearing To	291.1° G	Bearing From	111.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	420 256.807 m E, 6 213 639.689 m N , -28.353 m MSS
Heading	180.9° T, 181.9° G
Pitch	0.00 °
Roll	0.00 °



Rene Wojke
Party Chief
FNAS (Fugro Norway AS)

Paskal Nerad
Client Representative
Energinet Eltransmission



Colin Jacobs
Client Representative
Energinet Eltransmission

Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT310-v11
Start Time	05 Nov 2023, 22:02:00+01:00
End Time	05 Nov 2023, 22:04:01+01:00
Session Length	2m 1s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 28.68744" N	56° 03' 28.70701" N
Longitude	007° 45' 44.82163" E	007° 45' 44.85329" E
Height	12.264 m Ell., -29.409 m ISS	12.290 m Ell., -28.838 m Ort.
Easting	422 934.562 m E (± 0.08 m)	
Northing	6 213 221.887 m N (± 0.06 m)	
Height	-28.392 m MSS (± 0.16 m) , -29.409 m ISS (± 0.08 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	183.1° T, 184.1° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.1 m, USBL= 28.4 m

Table 5: Mean Position to Target

Target	CPT310		
Position	422 933.000 m E, 6 213 220.000 m N		
Range	2.45 m Grid		
Bearing To	219.6° G	Bearing From	39.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	422 934.562 m E, 6 213 221.887 m N , -28.392 m MSS
Heading	183.1° T, 184.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT037-v12
Start Time	05 Nov 2023, 23:37:39+01:00
End Time	05 Nov 2023, 23:39:41+01:00
Session Length	2m 2s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 36.09795" N	56° 04' 36.11752" N
Longitude	007° 45' 59.33574" E	007° 45' 59.36740" E
Height	13.707 m Ell., -27.907 m ISS	13.732 m Ell., -27.385 m Ort.
Easting	423 222.840 m E (± 0.12 m)	
Northing	6 215 301.293 m N (± 0.07 m)	
Height	-26.943 m MSS (± 0.16 m) , -27.907 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	186.1° T, 187.1° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.8 m, USBL= 27.0 m

Table 5: Mean Position to Target

Target	CPT037		
Position	423 221.000 m E, 6 215 300.000 m N		
Range	2.25 m Grid		
Bearing To	234.9° G	Bearing From	54.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	423 222.840 m E, 6 215 301.293 m N , -26.943 m MSS
Heading	186.1° T, 187.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT344-v13
Start Time	06 Nov 2023, 01:24:23+01:00
End Time	06 Nov 2023, 01:26:30+01:00
Session Length	2m 7s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 07.63869" N	56° 05' 07.65826" N
Longitude	007° 45' 45.99815" E	007° 45' 46.02981" E
Height	13.258 m Ell., -28.318 m ISS	13.284 m Ell., -27.831 m Ort.
Easting	423 009.727 m E (± 0.05 m)	
Northing	6 216 280.458 m N (± 0.06 m)	
Height	-27.385 m MSS (± 0.15 m) , -28.318 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	201.3° T, 202.3° G	± 1.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.1 m, USBL= 27.4 m

Table 5: Mean Position to Target

Target	CPT344		
Position	423 009.000 m E, 6 216 280.000 m N		
Range	0.86 m Grid		
Bearing To	237.8° G	Bearing From	57.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	423 009.727 m E, 6 216 280.458 m N , -27.385 m MSS
Heading	201.3° T, 202.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT138-v14
Start Time	06 Nov 2023, 03:00:05+01:00
End Time	06 Nov 2023, 03:02:07+01:00
Session Length	2m 3s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 38.63493" N	56° 04' 38.65450" N
Longitude	007° 42' 50.02343" E	007° 42' 50.05506" E
Height	11.812 m Ell., -29.738 m ISS	11.838 m Ell., -29.298 m Ort.
Easting	419 951.376 m E (± 0.08 m)	
Northing	6 215 439.445 m N (± 0.19 m)	
Height	-28.843 m MSS (± 0.18 m) , -29.738 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	263.0° T, 264.1° G	± 3.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.6 m, USBL= 28.8 m

Table 5: Mean Position to Target

Target	CPT138		
Position	419 951.000 m E, 6 215 440.000 m N		
Range	0.67 m Grid		
Bearing To	325.9° G	Bearing From	145.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	419 951.376 m E, 6 215 439.445 m N , -28.843 m MSS
Heading	263.0° T, 264.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT346-v15
Start Time	06 Nov 2023, 04:21:57+01:00
End Time	06 Nov 2023, 04:24:06+01:00
Session Length	2m 9s (104 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 42.72844" N	56° 05' 42.74801" N
Longitude	007° 41' 48.32166" E	007° 41' 48.35329" E
Height	11.559 m Ell., -30.092 m ISS	11.585 m Ell., -29.549 m Ort.
Easting	418 922.078 m E (± 0.07 m)	
Northing	6 217 440.793 m N (± 0.07 m)	
Height	-29.095 m MSS (± 0.16 m) , -30.092 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	268.9° T, 269.9° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.9 m, USBL= 29.1 m

Table 5: Mean Position to Target

Target	CPT346		
Position	418 922.000 m E, 6 217 440.000 m N		
Range	0.80 m Grid		
Bearing To	185.6° G	Bearing From	5.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	104 of 120
Position	418 922.078 m E, 6 217 440.793 m N , -29.095 m MSS
Heading	268.9° T, 269.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT302-v16
Start Time	06 Nov 2023, 07:40:09+01:00
End Time	06 Nov 2023, 07:42:10+01:00
Session Length	2m 2s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 11.04617" N	56° 06' 11.06573" N
Longitude	007° 41' 08.07623" E	007° 41' 08.10785" E
Height	11.240 m Ell., -30.694 m ISS	11.266 m Ell., -29.869 m Ort.
Easting	418 243.305 m E (± 0.07 m)	
Northing	6 218 329.376 m N (± 0.14 m)	
Height	-29.417 m MSS (± 0.18 m) , -30.694 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	248.0° T, 249.1° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.3 m, USBL= 29.5 m

Table 5: Mean Position to Target

Target	CPT302		
Position	418 242.000 m E, 6 218 330.000 m N		
Range	1.45 m Grid		
Bearing To	295.5° G	Bearing From	115.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	418 243.305 m E, 6 218 329.376 m N , -29.417 m MSS
Heading	248.0° T, 249.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT341-v17
Start Time	06 Nov 2023, 13:03:38+01:00
End Time	06 Nov 2023, 13:05:40+01:00
Session Length	2m 2s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 32.84290" N	56° 06' 32.86246" N
Longitude	007° 43' 55.75308" E	007° 43' 55.78472" E
Height	11.978 m Ell., -29.475 m ISS	12.004 m Ell., -29.110 m Ort.
Easting	421 152.570 m E (± 0.14 m)	
Northing	6 218 948.997 m N (± 0.13 m)	
Height	-28.662 m MSS (± 0.24 m) , -29.475 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	274.7° T, 275.7° G	± 3.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.4 m, USBL= 28.7 m

Table 5: Mean Position to Target

Target	CPT341		
Position	421 152.000 m E, 6 218 950.000 m N		
Range	1.15 m Grid		
Bearing To	330.4° G	Bearing From	150.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	421 152.570 m E, 6 218 948.997 m N , -28.662 m MSS
Heading	274.7° T, 275.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT024-v18
Start Time	06 Nov 2023, 15:00:24+01:00
End Time	06 Nov 2023, 15:02:27+01:00
Session Length	2m 3s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 06.22422" N	56° 07' 06.24379" N
Longitude	007° 43' 56.50423" E	007° 43' 56.53588" E
Height	12.209 m Ell., -29.170 m ISS	12.235 m Ell., -28.874 m Ort.
Easting	421 184.501 m E (± 0.08 m)	
Northing	6 219 980.697 m N (± 0.12 m)	
Height	-28.425 m MSS (± 0.21 m) , -29.170 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	256.2° T, 257.3° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.3 m, USBL= 28.5 m

Table 5: Mean Position to Target

Target	CPT024		
Position	421 184.000 m E, 6 219 980.000 m N		
Range	0.86 m Grid		
Bearing To	215.7° G	Bearing From	35.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	421 184.501 m E, 6 219 980.697 m N , -28.425 m MSS
Heading	256.2° T, 257.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT353-v19
Start Time	06 Nov 2023, 18:26:16+01:00
End Time	06 Nov 2023, 18:28:17+01:00
Session Length	2m 1s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 21.71160" N	56° 07' 21.73116" N
Longitude	007° 41' 51.18807" E	007° 41' 51.21970" E
Height	10.710 m Ell., -30.589 m ISS	10.736 m Ell., -30.384 m Ort.
Easting	419 029.359 m E (± 0.09 m)	
Northing	6 220 499.769 m N (± 0.13 m)	
Height	-29.928 m MSS (± 0.25 m) , -30.589 m ISS (± 0.21 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	267.5° T, 268.6° G	± 1.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.8 m, USBL= 30.0 m

Table 5: Mean Position to Target

Target	CPT353		
Position	419 029.000 m E, 6 220 500.000 m N		
Range	0.43 m Grid		
Bearing To	302.7° G	Bearing From	122.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	419 029.359 m E, 6 220 499.769 m N , -29.928 m MSS
Heading	267.5° T, 268.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT023-v20
Start Time	06 Nov 2023, 20:15:39+01:00
End Time	06 Nov 2023, 20:17:42+01:00
Session Length	2m 3s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 04.22330" N	56° 07' 04.24287" N
Longitude	007° 39' 17.06396" E	007° 39' 17.09558" E
Height	10.370 m Ell., -31.266 m ISS	10.396 m Ell., -30.742 m Ort.
Easting	416 357.447 m E (± 0.06 m)	
Northing	6 220 010.210 m N (± 0.14 m)	
Height	-30.280 m MSS (± 0.18 m) , -31.266 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	242.1° T, 243.2° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.1 m, USBL= 30.3 m

Table 5: Mean Position to Target

Target	CPT023		
Position	416 357.000 m E, 6 220 010.000 m N		
Range	0.49 m Grid		
Bearing To	244.8° G	Bearing From	64.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	416 357.447 m E, 6 220 010.210 m N , -30.280 m MSS
Heading	242.1° T, 243.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT023a-v21
Start Time	07 Nov 2023, 00:24:05+01:00
End Time	07 Nov 2023, 00:26:06+01:00
Session Length	2m 1s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 04.16513" N	56° 07' 04.18470" N
Longitude	007° 39' 16.83009" E	007° 39' 16.86171" E
Height	10.312 m Ell., -31.193 m ISS	10.338 m Ell., -30.800 m Ort.
Easting	416 353.373 m E (± 0.04 m)	
Northing	6 220 008.491 m N (± 0.06 m)	
Height	-30.337 m MSS (± 0.21 m) , -31.193 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	259.2° T, 260.4° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.2 m, USBL= 30.4 m

Table 5: Mean Position to Target

Target	CPT023		
Position	416 357.000 m E, 6 220 010.000 m N		
Range	3.93 m Grid		
Bearing To	67.4° G	Bearing From	247.4° G

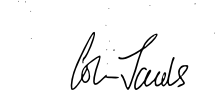
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	416 353.373 m E, 6 220 008.491 m N , -30.337 m MSS
Heading	259.2° T, 260.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT320-v22
Start Time	07 Nov 2023, 02:09:02+01:00
End Time	07 Nov 2023, 02:11:02+01:00
Session Length	2m 0s (106 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 22.51963" N	56° 07' 22.53920" N
Longitude	007° 37' 37.71437" E	007° 37' 37.74597" E
Height	9.418 m Ell., -32.005 m ISS	9.444 m Ell., -31.701 m Ort.
Easting	414 652.952 m E (± 0.07 m)	
Northing	6 220 609.601 m N (± 0.12 m)	
Height	-31.243 m MSS (± 0.20 m) , -32.005 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	234.6° T, 235.7° G	± 1.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.0 m, USBL= 31.3 m

Table 5: Mean Position to Target

Target	CPT320		
Position	414 652.000 m E, 6 220 610.000 m N		
Range	1.03 m Grid		
Bearing To	292.7° G	Bearing From	112.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	106 of 120
Position	414 652.952 m E, 6 220 609.601 m N , -31.243 m MSS
Heading	234.6° T, 235.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT206-v23
Start Time	07 Nov 2023, 03:42:56+01:00
End Time	07 Nov 2023, 03:44:57+01:00
Session Length	2m 1s (110 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 10.68963" N	56° 08' 10.70919" N
Longitude	007° 39' 31.16147" E	007° 39' 31.19309" E
Height	11.006 m Ell., -30.425 m ISS	11.032 m Ell., -30.095 m Ort.
Easting	416 640.854 m E (± 0.05 m)	
Northing	6 222 060.168 m N (± 0.07 m)	
Height	-29.635 m MSS (± 0.18 m) , -30.425 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	246.2° T, 247.4° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.5 m, USBL= 29.7 m

Table 5: Mean Position to Target

Target	CPT206		
Position	416 639.000 m E, 6 222 060.000 m N		
Range	1.86 m Grid		
Bearing To	264.8° G	Bearing From	84.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	110 of 120
Position	416 640.854 m E, 6 222 060.168 m N , -29.635 m MSS
Heading	246.2° T, 247.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT206a-v24
Start Time	07 Nov 2023, 05:49:08+01:00
End Time	07 Nov 2023, 05:51:11+01:00
Session Length	2m 2s (108 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 10.69169" N	56° 08' 10.71126" N
Longitude	007° 39' 30.91788" E	007° 39' 30.94949" E
Height	10.977 m Ell., -30.476 m ISS	11.003 m Ell., -30.124 m Ort.
Easting	416 636.651 m E (± 0.03 m)	
Northing	6 222 060.313 m N (± 0.07 m)	
Height	-29.664 m MSS (± 0.19 m) , -30.476 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	229.1° T, 230.2° G	± 2.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.5 m, USBL= 29.7 m

Table 5: Mean Position to Target

Target	CPT206		
Position	416 639.000 m E, 6 222 060.000 m N		
Range	2.37 m Grid		
Bearing To	97.6° G	Bearing From	277.6° G

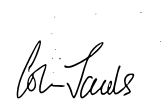
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	108 of 120
Position	416 636.651 m E, 6 222 060.313 m N , -29.664 m MSS
Heading	229.1° T, 230.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT016-v25
Start Time	07 Nov 2023, 08:03:08+01:00
End Time	07 Nov 2023, 08:05:13+01:00
Session Length	2m 4s (108 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 40.54840" N	56° 08' 40.56797" N
Longitude	007° 39' 05.06113" E	007° 39' 05.09275" E
Height	11.055 m Ell., -30.551 m ISS	11.081 m Ell., -30.043 m Ort.
Easting	416 208.366 m E (± 0.07 m)	
Northing	6 222 991.987 m N (± 0.15 m)	
Height	-29.584 m MSS (± 0.20 m) , -30.551 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	229.7° T, 230.8° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.5 m, USBL= 29.7 m

Table 5: Mean Position to Target

Target	CPT016		
Position	416 207.000 m E, 6 222 990.000 m N		
Range	2.41 m Grid		
Bearing To	214.5° G	Bearing From	34.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	108 of 120
Position	416 208.366 m E, 6 222 991.987 m N , -29.584 m MSS
Heading	229.7° T, 230.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT019-v27
Start Time	07 Nov 2023, 11:20:15+01:00
End Time	07 Nov 2023, 11:22:31+01:00
Session Length	2m 16s (113 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 25.85146" N	56° 08' 25.87102" N
Longitude	007° 41' 23.63268" E	007° 41' 23.66431" E
Height	11.122 m Ell., -30.447 m ISS	11.148 m Ell., -29.964 m Ort.
Easting	418 591.191 m E (± 0.05 m)	
Northing	6 222 491.566 m N (± 0.05 m)	
Height	-29.503 m MSS (± 0.19 m) , -30.447 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	227.8° T, 228.9° G	± 1.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.3 m, USBL= 29.5 m

Table 5: Mean Position to Target

Target	CPT019		
Position	418 594.000 m E, 6 222 490.000 m N		
Range	3.22 m Grid		
Bearing To	119.1° G	Bearing From	299.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	113 of 120
Position	418 591.191 m E, 6 222 491.566 m N , -29.503 m MSS
Heading	227.8° T, 228.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT279-v28
Start Time	07 Nov 2023, 18:13:04+01:00
End Time	07 Nov 2023, 18:15:07+01:00
Session Length	2m 2s (109 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 14.54938" N	56° 08' 14.56894" N
Longitude	007° 44' 12.14301" E	007° 44' 12.17467" E
Height	11.788 m Ell., -29.361 m ISS	11.814 m Ell., -29.282 m Ort.
Easting	421 493.253 m E (± 0.14 m)	
Northing	6 222 087.929 m N (± 0.17 m)	
Height	-28.823 m MSS (± 0.19 m) , -29.361 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	237.6° T, 238.7° G	± 4.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.6 m, USBL= 28.9 m

Table 5: Mean Position to Target

Target	CPT279		
Position	421 493.000 m E, 6 222 090.000 m N		
Range	2.09 m Grid		
Bearing To	353.0° G	Bearing From	173.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	109 of 120
Position	421 493.253 m E, 6 222 087.929 m N , -28.823 m MSS
Heading	237.6° T, 238.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT020-v29
Start Time	07 Nov 2023, 19:32:56+01:00
End Time	07 Nov 2023, 19:35:03+01:00
Session Length	2m 7s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 25.90070" N	56° 08' 25.92026" N
Longitude	007° 45' 47.29007" E	007° 45' 47.32174" E
Height	13.085 m Ell., -28.119 m ISS	13.111 m Ell., -27.972 m Ort.
Easting	423 141.910 m E (± 0.10 m)	
Northing	6 222 409.082 m N (± 0.09 m)	
Height	-27.522 m MSS (± 0.23 m) , -28.119 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	249.4° T, 250.4° G	± 3.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.3 m, USBL= 27.5 m

Table 5: Mean Position to Target

Target	CPT020		
Position	423 141.000 m E, 6 222 410.000 m N		
Range	1.29 m Grid		
Bearing To	315.2° G	Bearing From	135.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	423 141.910 m E, 6 222 409.082 m N , -27.522 m MSS
Heading	249.4° T, 250.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT216-v30
Start Time	07 Nov 2023, 21:31:18+01:00
End Time	07 Nov 2023, 21:33:26+01:00
Session Length	2m 8s (112 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 45.54222" N	56° 09' 45.56178" N
Longitude	007° 47' 17.19633" E	007° 47' 17.22802" E
Height	13.880 m Ell., -27.452 m ISS	13.906 m Ell., -27.151 m Ort.
Easting	424 736.947 m E (± 0.07 m)	
Northing	6 224 843.584 m N (± 0.09 m)	
Height	-26.707 m MSS (± 0.21 m) , -27.452 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	215.2° T, 216.2° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.5 m, USBL= 26.8 m

Table 5: Mean Position to Target

Target	CPT216		
Position	424 735.000 m E, 6 224 840.000 m N		
Range	4.08 m Grid		
Bearing To	208.5° G	Bearing From	28.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	112 of 120
Position	424 736.947 m E, 6 224 843.584 m N , -26.707 m MSS
Heading	215.2° T, 216.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT008-v31
Start Time	07 Nov 2023, 22:51:38+01:00
End Time	07 Nov 2023, 22:53:47+01:00
Session Length	2m 9s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 42.97420" N	56° 10' 42.99376" N
Longitude	007° 46' 08.16209" E	007° 46' 08.19377" E
Height	13.407 m Ell., -28.088 m ISS	13.433 m Ell., -27.620 m Ort.
Easting	423 577.795 m E (± 0.12 m)	
Northing	6 226 640.130 m N (± 0.10 m)	
Height	-27.174 m MSS (± 0.26 m) , -28.088 m ISS (± 0.22 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	217.1° T, 218.1° G	± 4.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.9 m, USBL= 27.2 m

Table 5: Mean Position to Target

Target	CPT008		
Position	423 579.000 m E, 6 226 640.000 m N		
Range	1.21 m Grid		
Bearing To	96.2° G	Bearing From	276.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	423 577.795 m E, 6 226 640.130 m N , -27.174 m MSS
Heading	217.1° T, 218.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT368-v32
Start Time	08 Nov 2023, 03:00:39+01:00
End Time	08 Nov 2023, 03:02:41+01:00
Session Length	2m 2s (100 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 11' 18.00761" N	56° 11' 18.02717" N
Longitude	007° 46' 23.19093" E	007° 46' 23.22261" E
Height	14.048 m Ell., -27.096 m ISS	14.074 m Ell., -26.969 m Ort.
Easting	423 856.206 m E (± 0.05 m)	
Northing	6 227 718.540 m N (± 0.06 m)	
Height	-26.520 m MSS (± 0.24 m) , -27.096 m ISS (± 0.20 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	238.0° T, 239.0° G	± 3.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.4 m, USBL= 26.6 m

Table 5: Mean Position to Target

Target	CPT368		
Position	423 855.000 m E, 6 227 720.000 m N		
Range	1.89 m Grid		
Bearing To	320.4° G	Bearing From	140.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	100 of 120
Position	423 856.206 m E, 6 227 718.540 m N , -26.520 m MSS
Heading	238.0° T, 239.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT141-v33
Start Time	08 Nov 2023, 07:09:22+01:00
End Time	08 Nov 2023, 07:11:21+01:00
Session Length	1m 59s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 45.39096" N	56° 10' 45.41052" N
Longitude	007° 43' 15.36807" E	007° 43' 15.39973" E
Height	10.582 m Ell., -30.652 m ISS	10.608 m Ell., -30.466 m Ort.
Easting	420 599.721 m E (± 0.04 m)	
Northing	6 226 769.071 m N (± 0.07 m)	
Height	-30.013 m MSS (± 0.20 m) , -30.652 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	235.4° T, 236.5° G	± 2.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.8 m, USBL= 30.1 m

Table 5: Mean Position to Target

Target	CPT141		
Position	420 597.000 m E, 6 226 770.000 m N		
Range	2.88 m Grid		
Bearing To	288.8° G	Bearing From	108.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	420 599.721 m E, 6 226 769.071 m N , -30.013 m MSS
Heading	235.4° T, 236.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT378-v22
Start Time	08 Nov 2023, 09:38:05+01:00
End Time	08 Nov 2023, 09:40:09+01:00
Session Length	2m 4s (101 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 51.05176" N	56° 09' 51.07132" N
Longitude	007° 43' 46.33467" E	007° 43' 46.36633" E
Height	10.876 m Ell., -30.572 m ISS	10.902 m Ell., -30.178 m Ort.
Easting	421 102.715 m E (± 0.08 m)	
Northing	6 225 079.364 m N (± 0.15 m)	
Height	-29.731 m MSS (± 0.22 m) , -30.572 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	237.1° T, 238.1° G	± 3.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.5 m, USBL= 29.8 m

Table 5: Mean Position to Target

Target	CPT378		
Position	421 102.000 m E, 6 225 080.000 m N		
Range	0.96 m Grid		
Bearing To	311.7° G	Bearing From	131.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	101 of 120
Position	421 102.715 m E, 6 225 079.364 m N , -29.731 m MSS
Heading	237.1° T, 238.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT224-v23
Start Time	08 Nov 2023, 12:58:33+01:00
End Time	08 Nov 2023, 13:00:47+01:00
Session Length	2m 14s (103 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 05.65987" N	56° 09' 05.67944" N
Longitude	007° 42' 06.94974" E	007° 42' 06.98139" E
Height	11.729 m Ell., -29.692 m ISS	11.755 m Ell., -29.345 m Ort.
Easting	419 361.992 m E (± 0.13 m)	
Northing	6 223 708.056 m N (± 0.11 m)	
Height	-28.888 m MSS (± 0.21 m) , -29.692 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	243.0° T, 244.1° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.7 m, USBL= 28.9 m

Table 5: Mean Position to Target

Target	CPT224		
Position	419 362.000 m E, 6 223 710.000 m N		
Range	1.94 m Grid		
Bearing To	0.2° G	Bearing From	180.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	103 of 120
Position	419 361.992 m E, 6 223 708.056 m N , -28.888 m MSS
Heading	243.0° T, 244.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT267-v24
Start Time	09 Nov 2023, 13:06:45+01:00
End Time	09 Nov 2023, 13:08:45+01:00
Session Length	2m 0s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 18.54437" N	56° 09' 18.56394" N
Longitude	007° 39' 31.64641" E	007° 39' 31.67803" E
Height	11.082 m Ell., -30.447 m ISS	11.109 m Ell., -30.006 m Ort.
Easting	416 690.010 m E (± 0.05 m)	
Northing	6 224 157.629 m N (± 0.05 m)	
Height	-29.544 m MSS (± 0.27 m) , -30.447 m ISS (± 0.23 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	243.0° T, 244.1° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.5 m, USBL= 29.5 m

Table 5: Mean Position to Target

Target	CPT267		
Position	416 690.000 m E, 6 224 160.000 m N		
Range	2.37 m Grid		
Bearing To	359.8° G	Bearing From	179.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	416 690.010 m E, 6 224 157.629 m N , -29.544 m MSS
Heading	243.0° T, 244.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT009-v25
Start Time	09 Nov 2023, 15:46:28+01:00
End Time	09 Nov 2023, 15:48:27+01:00
Session Length	2m 0s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 39.16964" N	56° 10' 39.18921" N
Longitude	007° 41' 26.81253" E	007° 41' 26.84418" E
Height	10.719 m Ell., -30.554 m ISS	10.745 m Ell., -30.344 m Ort.
Easting	418 724.307 m E (± 0.06 m)	
Northing	6 226 611.876 m N (± 0.06 m)	
Height	-29.884 m MSS (± 0.20 m) , -30.554 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	200.3° T, 201.4° G	± 2.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.9 m, USBL= 29.9 m

Table 5: Mean Position to Target

Target	CPT009		
Position	418 724.000 m E, 6 226 610.000 m N		
Range	1.90 m Grid		
Bearing To	189.3° G	Bearing From	9.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	418 724.307 m E, 6 226 611.876 m N , -29.884 m MSS
Heading	200.3° T, 201.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT009A-v26
Start Time	09 Nov 2023, 21:57:00+01:00
End Time	09 Nov 2023, 21:59:01+01:00
Session Length	2m 0s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 39.02129" N	56° 10' 39.04085" N
Longitude	007° 41' 26.65622" E	007° 41' 26.68786" E
Height	10.664 m Ell., -30.634 m ISS	10.690 m Ell., -30.399 m Ort.
Easting	418 721.525 m E (± 0.08 m)	
Northing	6 226 607.341 m N (± 0.05 m)	
Height	-29.940 m MSS (± 0.20 m) , -30.634 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	161.8° T, 162.9° G	± 3.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.9 m, USBL= 29.9 m

Table 5: Mean Position to Target

Target	CPT009		
Position	418 724.000 m E, 6 226 610.000 m N		
Range	3.63 m Grid		
Bearing To	43.0° G	Bearing From	223.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	418 721.525 m E, 6 226 607.341 m N , -29.940 m MSS
Heading	161.8° T, 162.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT216A-v27
Start Time	10 Nov 2023, 00:17:53+01:00
End Time	10 Nov 2023, 00:19:53+01:00
Session Length	2m 1s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 45.42979" N	56° 09' 45.44935" N
Longitude	007° 47' 17.20300" E	007° 47' 17.23468" E
Height	13.946 m Ell., -27.674 m ISS	13.972 m Ell., -27.085 m Ort.
Easting	424 737.001 m E (± 0.07 m)	
Northing	6 224 840.106 m N (± 0.04 m)	
Height	-26.641 m MSS (± 0.21 m) , -27.674 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	135.3° T, 136.3° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.5 m, USBL= 26.7 m

Table 5: Mean Position to Target

Target	CPT216		
Position	424 735.000 m E, 6 224 840.000 m N		
Range	2.00 m Grid		
Bearing To	267.0° G	Bearing From	87.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	424 737.001 m E, 6 224 840.106 m N , -26.641 m MSS
Heading	135.3° T, 136.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT308-v28
Start Time	10 Nov 2023, 04:34:58+01:00
End Time	10 Nov 2023, 04:36:59+01:00
Session Length	2m 1s (100 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 11' 11.84932" N	56° 11' 11.86888" N
Longitude	007° 41' 29.04083" E	007° 41' 29.07248" E
Height	10.775 m Ell., -30.351 m ISS	10.801 m Ell., -30.281 m Ort.
Easting	418 781.903 m E (± 0.15 m)	
Northing	6 227 621.399 m N (± 0.13 m)	
Height	-29.823 m MSS (± 0.25 m) , -30.351 m ISS (± 0.22 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	199.9° T, 201.0° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.7 m, USBL= 29.9 m

Table 5: Mean Position to Target

Target	CPT308		
Position	418 780.000 m E, 6 227 620.000 m N		
Range	2.36 m Grid		
Bearing To	233.7° G	Bearing From	53.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	100 of 120
Position	418 781.903 m E, 6 227 621.399 m N , -29.823 m MSS
Heading	199.9° T, 201.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT308A-v29
Start Time	10 Nov 2023, 05:57:09+01:00
End Time	10 Nov 2023, 05:59:16+01:00
Session Length	2m 7s (104 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 11' 11.81590" N	56° 11' 11.83547" N
Longitude	007° 41' 28.75580" E	007° 41' 28.78744" E
Height	10.798 m Ell., -30.334 m ISS	10.824 m Ell., -30.258 m Ort.
Easting	418 776.970 m E (± 0.11 m)	
Northing	6 227 620.459 m N (± 0.13 m)	
Height	-29.799 m MSS (± 0.25 m) , -30.334 m ISS (± 0.22 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	192.9° T, 194.0° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.7 m, USBL= 29.8 m

Table 5: Mean Position to Target

Target	CPT308		
Position	418 780.000 m E, 6 227 620.000 m N		
Range	3.06 m Grid		
Bearing To	98.6° G	Bearing From	278.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	104 of 120
Position	418 776.970 m E, 6 227 620.459 m N , -29.799 m MSS
Heading	192.9° T, 194.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT140-v30
Start Time	10 Nov 2023, 07:38:08+01:00
End Time	10 Nov 2023, 07:40:10+01:00
Session Length	2m 2s (103 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 44.03425" N	56° 10' 44.05381" N
Longitude	007° 40' 27.66507" E	007° 40' 27.69670" E
Height	10.855 m Ell., -30.346 m ISS	10.881 m Ell., -30.213 m Ort.
Easting	417 707.309 m E (± 0.13 m)	
Northing	6 226 781.745 m N (± 0.10 m)	
Height	-29.754 m MSS (± 0.23 m) , -30.346 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	170.7° T, 171.8° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.6 m, USBL= 29.8 m

Table 5: Mean Position to Target

Target	CPT140		
Position	417 706.000 m E, 6 226 780.000 m N		
Range	2.18 m Grid		
Bearing To	216.9° G	Bearing From	36.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	103 of 120
Position	417 707.309 m E, 6 226 781.745 m N , -29.754 m MSS
Heading	170.7° T, 171.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT140A-v31
Start Time	10 Nov 2023, 08:24:40+01:00
End Time	10 Nov 2023, 08:26:54+01:00
Session Length	2m 14s (100 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 44.00195" N	56° 10' 44.02151" N
Longitude	007° 40' 27.39865" E	007° 40' 27.43028" E
Height	10.907 m Ell., -30.313 m ISS	10.933 m Ell., -30.162 m Ort.
Easting	417 702.696 m E (± 0.09 m)	
Northing	6 226 780.835 m N (± 0.15 m)	
Height	-29.702 m MSS (± 0.25 m) , -30.313 m ISS (± 0.22 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	219.8° T, 220.9° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.6 m, USBL= 29.8 m

Table 5: Mean Position to Target

Target	CPT140		
Position	417 706.000 m E, 6 226 780.000 m N		
Range	3.41 m Grid		
Bearing To	104.2° G	Bearing From	284.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	100 of 120
Position	417 702.696 m E, 6 226 780.835 m N , -29.702 m MSS
Heading	219.8° T, 220.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT140B-v32
Start Time	10 Nov 2023, 15:08:48+01:00
End Time	10 Nov 2023, 15:10:57+01:00
Session Length	2m 9s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 43.87209" N	56° 10' 43.89165" N
Longitude	007° 40' 27.62378" E	007° 40' 27.65542" E
Height	10.945 m Ell., -30.439 m ISS	10.971 m Ell., -30.124 m Ort.
Easting	417 706.501 m E (± 0.11 m)	
Northing	6 226 776.746 m N (± 0.08 m)	
Height	-29.665 m MSS (± 0.24 m) , -30.439 m ISS (± 0.20 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	230.0° T, 231.1° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.6 m, USBL= 29.7 m

Table 5: Mean Position to Target

Target	CPT140		
Position	417 706.000 m E, 6 226 780.000 m N		
Range	3.29 m Grid		
Bearing To	351.2° G	Bearing From	171.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	417 706.501 m E, 6 226 776.746 m N , -29.665 m MSS
Heading	230.0° T, 231.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT277-v33
Start Time	10 Nov 2023, 15:58:23+01:00
End Time	10 Nov 2023, 16:00:23+01:00
Session Length	2m 1s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 54.44453" N	56° 10' 54.46409" N
Longitude	007° 39' 05.11725" E	007° 39' 05.14887" E
Height	10.939 m Ell., -30.355 m ISS	10.965 m Ell., -30.137 m Ort.
Easting	416 290.273 m E (± 0.09 m)	
Northing	6 227 131.164 m N (± 0.07 m)	
Height	-29.689 m MSS (± 0.18 m) , -30.355 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	230.0° T, 231.1° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.7 m, USBL= 29.8 m

Table 5: Mean Position to Target

Target	CPT277		
Position	416 290.000 m E, 6 227 130.000 m N		
Range	1.20 m Grid		
Bearing To	193.2° G	Bearing From	13.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	416 290.273 m E, 6 227 131.164 m N , -29.689 m MSS
Heading	230.0° T, 231.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT007-v35
Start Time	10 Nov 2023, 18:08:51+01:00
End Time	10 Nov 2023, 18:10:52+01:00
Session Length	2m 0s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 41.22533" N	56° 10' 41.24490" N
Longitude	007° 37' 41.89975" E	007° 37' 41.93137" E
Height	9.883 m Ell., -31.077 m ISS	9.909 m Ell., -31.205 m Ort.
Easting	414 847.379 m E (± 0.07 m)	
Northing	6 226 750.815 m N (± 0.13 m)	
Height	-30.749 m MSS (± 0.22 m) , -31.077 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	206.5° T, 207.6° G	± 3.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.7 m, USBL= 30.8 m

Table 5: Mean Position to Target

Target	CPT007		
Position	414 848.000 m E, 6 226 750.000 m N		
Range	1.02 m Grid		
Bearing To	142.7° G	Bearing From	322.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	414 847.379 m E, 6 226 750.815 m N , -30.749 m MSS
Heading	206.5° T, 207.6° G
Pitch	0.00 °
Roll	0.00 °



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Colin Jacobs
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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT007A-v36
Start Time	10 Nov 2023, 22:13:11+01:00
End Time	10 Nov 2023, 22:15:14+01:00
Session Length	2m 3s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 41.08446" N	56° 10' 41.10403" N
Longitude	007° 37' 41.95656" E	007° 37' 41.98817" E
Height	9.885 m Ell., -31.209 m ISS	9.911 m Ell., -31.203 m Ort.
Easting	414 848.272 m E (± 0.06 m)	
Northing	6 226 746.441 m N (± 0.05 m)	
Height	-30.747 m MSS (± 0.20 m) , -31.209 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	222.5° T, 223.7° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.7 m, USBL= 30.8 m

Table 5: Mean Position to Target

Target	CPT007		
Position	414 848.000 m E, 6 226 750.000 m N		
Range	3.57 m Grid		
Bearing To	355.6° G	Bearing From	175.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	414 848.272 m E, 6 226 746.441 m N , -30.747 m MSS
Heading	222.5° T, 223.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT154-v37
Start Time	11 Nov 2023, 00:14:35+01:00
End Time	11 Nov 2023, 00:16:53+01:00
Session Length	2m 18s (113 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 12' 05.89556" N	56° 12' 05.91513" N
Longitude	007° 35' 36.88087" E	007° 35' 36.91247" E
Height	7.387 m Ell., -33.975 m ISS	7.413 m Ell., -33.705 m Ort.
Easting	412 745.110 m E (± 0.04 m)	
Northing	6 229 411.680 m N (± 0.05 m)	
Height	-33.245 m MSS (± 0.18 m) , -33.975 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	215.0° T, 216.1° G	± 1.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 33.2 m, USBL= 33.3 m

Table 5: Mean Position to Target

Target	CPT154		
Position	412 746.000 m E, 6 229 410.000 m N		
Range	1.90 m Grid		
Bearing To	152.1° G	Bearing From	332.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	113 of 120
Position	412 745.110 m E, 6 229 411.680 m N , -33.245 m MSS
Heading	215.0° T, 216.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT004-v38
Start Time	11 Nov 2023, 03:00:22+01:00
End Time	11 Nov 2023, 03:02:27+01:00
Session Length	2m 4s (104 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 11' 11.62161" N	56° 11' 11.64119" N
Longitude	007° 33' 01.14818" E	007° 33' 01.17976" E
Height	10.838 m Ell., -30.444 m ISS	10.865 m Ell., -30.277 m Ort.
Easting	410 026.236 m E (± 0.11 m)	
Northing	6 227 789.497 m N (± 0.07 m)	
Height	-29.816 m MSS (± 0.20 m) , -30.444 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	165.8° T, 167.0° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.7 m, USBL= 29.9 m

Table 5: Mean Position to Target

Target	CPT004		
Position	410 026.000 m E, 6 227 790.000 m N		
Range	0.56 m Grid		
Bearing To	334.8° G	Bearing From	154.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	104 of 120
Position	410 026.236 m E, 6 227 789.497 m N , -29.816 m MSS
Heading	165.8° T, 167.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT236-v39
Start Time	11 Nov 2023, 04:39:28+01:00
End Time	11 Nov 2023, 04:41:27+01:00
Session Length	1m 59s (112 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 49.71686" N	56° 10' 49.73643" N
Longitude	007° 34' 25.08835" E	007° 34' 25.11994" E
Height	9.076 m Ell., -31.939 m ISS	9.102 m Ell., -32.033 m Ort.
Easting	411 459.254 m E (± 0.11 m)	
Northing	6 227 082.169 m N (± 0.08 m)	
Height	-31.572 m MSS (± 0.21 m) , -31.939 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	160.2° T, 161.4° G	± 4.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.5 m, USBL= 31.6 m

Table 5: Mean Position to Target

Target	CPT236		
Position	411 459.000 m E, 6 227 080.000 m N		
Range	2.18 m Grid		
Bearing To	186.7° G	Bearing From	6.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	112 of 120
Position	411 459.254 m E, 6 227 082.169 m N , -31.572 m MSS
Heading	160.2° T, 161.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT319-v40
Start Time	11 Nov 2023, 06:27:59+01:00
End Time	11 Nov 2023, 06:30:00+01:00
Session Length	2m 1s (112 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 03.52328" N	56° 10' 03.54285" N
Longitude	007° 36' 58.86065" E	007° 36' 58.89226" E
Height	10.208 m Ell., -30.634 m ISS	10.234 m Ell., -30.890 m Ort.
Easting	414 081.882 m E (± 0.06 m)	
Northing	6 225 600.145 m N (± 0.03 m)	
Height	-30.434 m MSS (± 0.17 m) , -30.634 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	119.1° T, 120.2° G	± 1.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.3 m, USBL= 30.4 m

Table 5: Mean Position to Target

Target	CPT319		
Position	414 082.000 m E, 6 225 600.000 m N		
Range	0.19 m Grid		
Bearing To	140.9° G	Bearing From	320.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	112 of 120
Position	414 081.882 m E, 6 225 600.145 m N , -30.434 m MSS
Heading	119.1° T, 120.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT171-v41
Start Time	11 Nov 2023, 08:59:52+01:00
End Time	11 Nov 2023, 09:01:54+01:00
Session Length	2m 1s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 21.95058" N	56° 09' 21.97016" N
Longitude	007° 35' 48.79807" E	007° 35' 48.82966" E
Height	9.724 m Ell., -31.297 m ISS	9.750 m Ell., -31.388 m Ort.
Easting	412 847.339 m E (± 0.04 m)	
Northing	6 224 339.416 m N (± 0.03 m)	
Height	-30.927 m MSS (± 0.17 m) , -31.297 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	112.8° T, 114.0° G	± 1.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.9 m, USBL= 31.0 m

Table 5: Mean Position to Target

Target	CPT171		
Position	412 849.000 m E, 6 224 340.000 m N		
Range	1.76 m Grid		
Bearing To	70.6° G	Bearing From	250.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	412 847.339 m E, 6 224 339.416 m N , -30.927 m MSS
Heading	112.8° T, 114.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT397-v42
Start Time	11 Nov 2023, 10:16:09+01:00
End Time	11 Nov 2023, 10:18:11+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 39.13547" N	56° 09' 39.15505" N
Longitude	007° 33' 55.52212" E	007° 33' 55.55370" E
Height	10.268 m Ell., -30.794 m ISS	10.294 m Ell., -30.853 m Ort.
Easting	410 904.096 m E (± 0.06 m)	
Northing	6 224 910.856 m N (± 0.03 m)	
Height	-30.388 m MSS (± 0.18 m) , -30.794 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	106.9° T, 108.1° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.3 m, USBL= 30.4 m

Table 5: Mean Position to Target

Target	CPT397		
Position	410 905.000 m E, 6 224 910.000 m N		
Range	1.24 m Grid		
Bearing To	133.4° G	Bearing From	313.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	410 904.096 m E, 6 224 910.856 m N , -30.388 m MSS
Heading	106.9° T, 108.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT013-v43
Start Time	11 Nov 2023, 11:35:25+01:00
End Time	11 Nov 2023, 11:37:31+01:00
Session Length	2m 6s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 09.71900" N	56° 09' 09.73858" N
Longitude	007° 34' 23.16671" E	007° 34' 23.19829" E
Height	10.399 m Ell., -30.793 m ISS	10.425 m Ell., -30.723 m Ort.
Easting	411 362.161 m E (± 0.08 m)	
Northing	6 223 991.610 m N (± 0.03 m)	
Height	-30.262 m MSS (± 0.17 m) , -30.793 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	116.1° T, 117.3° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.2 m, USBL= 30.3 m

Table 5: Mean Position to Target

Target	CPT013		
Position	411 362.000 m E, 6 223 990.000 m N		
Range	1.62 m Grid		
Bearing To	185.7° G	Bearing From	5.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	411 362.161 m E, 6 223 991.610 m N , -30.262 m MSS
Heading	116.1° T, 117.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT230-v44
Start Time	11 Nov 2023, 13:27:30+01:00
End Time	11 Nov 2023, 13:29:38+01:00
Session Length	2m 8s (111 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 30.67062" N	56° 08' 30.69019" N
Longitude	007° 33' 40.17147" E	007° 33' 40.20305" E
Height	11.366 m Ell., -29.966 m ISS	11.393 m Ell., -29.766 m Ort.
Easting	410 595.142 m E (± 0.03 m)	
Northing	6 222 799.919 m N (± 0.03 m)	
Height	-29.306 m MSS (± 0.16 m) , -29.966 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	107.6° T, 108.8° G	± 1.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.3 m, USBL= 29.4 m

Table 5: Mean Position to Target

Target	CPT230		
Position	410 596.000 m E, 6 222 800.000 m N		
Range	0.86 m Grid		
Bearing To	84.6° G	Bearing From	264.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	111 of 120
Position	410 595.142 m E, 6 222 799.919 m N , -29.306 m MSS
Heading	107.6° T, 108.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT294-v45
Start Time	11 Nov 2023, 15:18:59+01:00
End Time	11 Nov 2023, 15:20:58+01:00
Session Length	1m 59s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 41.48220" N	56° 07' 41.50177" N
Longitude	007° 31' 47.01925" E	007° 31' 47.05080" E
Height	13.641 m Ell., -27.625 m ISS	13.667 m Ell., -27.509 m Ort.
Easting	408 609.867 m E (± 0.13 m)	
Northing	6 221 320.549 m N (± 0.06 m)	
Height	-27.044 m MSS (± 0.19 m) , -27.625 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	116.3° T, 117.5° G	± 5.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.9 m, USBL= 27.0 m

Table 5: Mean Position to Target

Target	CPT294		
Position	408 611.000 m E, 6 221 320.000 m N		
Range	1.26 m Grid		
Bearing To	115.9° G	Bearing From	295.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	408 609.867 m E, 6 221 320.549 m N , -27.044 m MSS
Heading	116.3° T, 117.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT155-v46
Start Time	11 Nov 2023, 18:43:09+01:00
End Time	11 Nov 2023, 18:45:09+01:00
Session Length	2m 1s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 44.56141" N	56° 08' 44.58099" N
Longitude	007° 31' 21.04484" E	007° 31' 21.07640" E
Height	12.798 m Ell., -27.996 m ISS	12.824 m Ell., -28.346 m Ort.
Easting	408 203.186 m E (± 0.08 m)	
Northing	6 223 280.079 m N (± 0.06 m)	
Height	-27.884 m MSS (± 0.18 m) , -27.996 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	85.4° T, 86.7° G	± 4.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.8 m, USBL= 27.9 m

Table 5: Mean Position to Target

Target	CPT155		
Position	408 203.000 m E, 6 223 280.000 m N		
Range	0.20 m Grid		
Bearing To	246.9° G	Bearing From	66.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	408 203.186 m E, 6 223 280.079 m N , -27.884 m MSS
Heading	85.4° T, 86.7° G
Pitch	0.00 °
Roll	0.00 °



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 Energinet Eltransmission



Colin Jacobs
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 Energinet Eltransmission

Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT021-v47
Start Time	11 Nov 2023, 20:28:42+01:00
End Time	11 Nov 2023, 20:30:46+01:00
Session Length	2m 4s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 05.72555" N	56° 08' 05.74513" N
Longitude	007° 30' 24.56452" E	007° 30' 24.59606" E
Height	12.905 m Ell., -27.982 m ISS	12.931 m Ell., -28.250 m Ort.
Easting	407 202.521 m E (± 0.07 m)	
Northing	6 222 100.548 m N (± 0.04 m)	
Height	-27.781 m MSS (± 0.18 m) , -27.982 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	103.9° T, 105.2° G	± 3.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.6 m, USBL= 27.8 m

Table 5: Mean Position to Target

Target	CPT021		
Position	407 203.000 m E, 6 222 100.000 m N		
Range	0.73 m Grid		
Bearing To	138.8° G	Bearing From	318.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	407 202.521 m E, 6 222 100.548 m N , -27.781 m MSS
Heading	103.9° T, 105.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT354-v48
Start Time	11 Nov 2023, 22:32:33+01:00
End Time	11 Nov 2023, 22:34:47+01:00
Session Length	2m 14s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 28.16479" N	56° 08' 28.18437" N
Longitude	007° 29' 13.16895" E	007° 29' 13.20049" E
Height	12.936 m Ell., -28.021 m ISS	12.962 m Ell., -28.223 m Ort.
Easting	405 985.323 m E (± 0.13 m)	
Northing	6 222 821.054 m N (± 0.06 m)	
Height	-27.756 m MSS (± 0.22 m) , -28.021 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	97.3° T, 98.6° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.7 m, USBL= 27.8 m

Table 5: Mean Position to Target

Target	CPT354		
Position	405 986.000 m E, 6 222 820.000 m N		
Range	1.25 m Grid		
Bearing To	147.3° G	Bearing From	327.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	405 985.323 m E, 6 222 821.054 m N , -27.756 m MSS
Heading	97.3° T, 98.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT014-v49
Start Time	12 Nov 2023, 00:17:21+01:00
End Time	12 Nov 2023, 00:19:21+01:00
Session Length	2m 0s (112 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 02.49198" N	56° 09' 02.51156" N
Longitude	007° 29' 16.59795" E	007° 29' 16.62949" E
Height	13.373 m Ell., -27.759 m ISS	13.399 m Ell., -27.780 m Ort.
Easting	406 067.765 m E (± 0.05 m)	
Northing	6 223 880.898 m N (± 0.06 m)	
Height	-27.317 m MSS (± 0.21 m) , -27.759 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	67.5° T, 68.7° G	± 3.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.3 m, USBL= 27.4 m

Table 5: Mean Position to Target

Target	CPT014		
Position	406 069.000 m E, 6 223 880.000 m N		
Range	1.53 m Grid		
Bearing To	126.0° G	Bearing From	306.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	112 of 120
Position	406 067.765 m E, 6 223 880.898 m N , -27.317 m MSS
Heading	67.5° T, 68.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT014A-v50
Start Time	12 Nov 2023, 02:23:16+01:00
End Time	12 Nov 2023, 02:25:19+01:00
Session Length	2m 3s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 02.44766" N	56° 09' 02.46724" N
Longitude	007° 29' 16.87358" E	007° 29' 16.90512" E
Height	13.294 m Ell., -27.914 m ISS	13.320 m Ell., -27.859 m Ort.
Easting	406 072.491 m E (± 0.06 m)	
Northing	6 223 879.424 m N (± 0.06 m)	
Height	-27.396 m MSS (± 0.18 m) , -27.914 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	91.6° T, 92.8° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.3 m, USBL= 27.4 m

Table 5: Mean Position to Target

Target	CPT014		
Position	406 069.000 m E, 6 223 880.000 m N		
Range	3.54 m Grid		
Bearing To	279.4° G	Bearing From	99.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	406 072.491 m E, 6 223 879.424 m N , -27.396 m MSS
Heading	91.6° T, 92.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT165-v51
Start Time	12 Nov 2023, 04:45:09+01:00
End Time	12 Nov 2023, 04:47:10+01:00
Session Length	2m 1s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 34.83230" N	56° 09' 34.85188" N
Longitude	007° 29' 14.33505" E	007° 29' 14.36659" E
Height	11.779 m Ell., -29.139 m ISS	11.805 m Ell., -29.370 m Ort.
Easting	406 050.646 m E (± 0.04 m)	
Northing	6 224 881.478 m N (± 0.03 m)	
Height	-28.909 m MSS (± 0.16 m) , -29.139 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	149.1° T, 150.3° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.8 m, USBL= 28.9 m

Table 5: Mean Position to Target

Target	CPT165		
Position	406 051.000 m E, 6 224 880.000 m N		
Range	1.52 m Grid		
Bearing To	166.5° G	Bearing From	346.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	406 050.646 m E, 6 224 881.478 m N , -28.909 m MSS
Heading	149.1° T, 150.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT006-v52
Start Time	12 Nov 2023, 06:24:27+01:00
End Time	12 Nov 2023, 06:26:28+01:00
Session Length	2m 2s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 37.34108" N	56° 10' 37.36066" N
Longitude	007° 28' 53.23321" E	007° 28' 53.26476" E
Height	11.804 m Ell., -28.946 m ISS	11.830 m Ell., -29.340 m Ort.
Easting	405 729.179 m E (± 0.04 m)	
Northing	6 226 821.789 m N (± 0.04 m)	
Height	-28.878 m MSS (± 0.18 m) , -28.946 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	113.8° T, 115.1° G	± 1.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.8 m, USBL= 29.0 m

Table 5: Mean Position to Target

Target	CPT006		
Position	405 730.000 m E, 6 226 820.000 m N		
Range	1.97 m Grid		
Bearing To	155.3° G	Bearing From	335.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	405 729.179 m E, 6 226 821.789 m N , -28.878 m MSS
Heading	113.8° T, 115.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT153-v53
Start Time	12 Nov 2023, 07:48:42+01:00
End Time	12 Nov 2023, 07:50:43+01:00
Session Length	2m 0s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 28.28247" N	56° 10' 28.30205" N
Longitude	007° 27' 36.81915" E	007° 27' 36.85068" E
Height	12.381 m Ell., -28.392 m ISS	12.407 m Ell., -28.772 m Ort.
Easting	404 405.335 m E (± 0.09 m)	
Northing	6 226 570.985 m N (± 0.04 m)	
Height	-28.310 m MSS (± 0.18 m) , -28.392 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	118.7° T, 120.0° G	± 3.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.2 m, USBL= 28.4 m

Table 5: Mean Position to Target

Target	CPT153		
Position	404 406.000 m E, 6 226 570.000 m N		
Range	1.19 m Grid		
Bearing To	146.0° G	Bearing From	326.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	404 405.335 m E, 6 226 570.985 m N , -28.310 m MSS
Heading	118.7° T, 120.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT139-v54
Start Time	12 Nov 2023, 09:20:55+01:00
End Time	12 Nov 2023, 09:22:54+01:00
Session Length	2m 0s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 32.48948" N	56° 10' 32.50907" N
Longitude	007° 24' 39.27083" E	007° 24' 39.30234" E
Height	11.389 m Ell., -29.459 m ISS	11.415 m Ell., -29.778 m Ort.
Easting	401 346.724 m E (± 0.03 m)	
Northing	6 226 770.497 m N (± 0.04 m)	
Height	-29.308 m MSS (± 0.21 m) , -29.459 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	98.7° T, 100.0° G	± 1.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.2 m, USBL= 29.4 m

Table 5: Mean Position to Target

Target	CPT139		
Position	401 348.000 m E, 6 226 770.000 m N		
Range	1.37 m Grid		
Bearing To	111.3° G	Bearing From	291.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	401 346.724 m E, 6 226 770.497 m N , -29.308 m MSS
Heading	98.7° T, 100.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT011-v55
Start Time	12 Nov 2023, 10:46:14+01:00
End Time	12 Nov 2023, 10:48:14+01:00
Session Length	1m 59s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 43.15184" N	56° 09' 43.17142" N
Longitude	007° 26' 08.77008" E	007° 26' 08.80159" E
Height	12.324 m Ell., -28.585 m ISS	12.350 m Ell., -28.841 m Ort.
Easting	402 855.384 m E (± 0.05 m)	
Northing	6 225 210.064 m N (± 0.05 m)	
Height	-28.378 m MSS (± 0.19 m) , -28.585 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	110.6° T, 111.9° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.3 m, USBL= 28.4 m

Table 5: Mean Position to Target

Target	CPT011		
Position	402 856.000 m E, 6 225 210.000 m N		
Range	0.62 m Grid		
Bearing To	95.9° G	Bearing From	275.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	402 855.384 m E, 6 225 210.064 m N , -28.378 m MSS
Heading	110.6° T, 111.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT266-v56
Start Time	12 Nov 2023, 12:42:47+01:00
End Time	12 Nov 2023, 12:44:46+01:00
Session Length	2m 0s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 10.50133" N	56° 09' 10.52091" N
Longitude	007° 26' 11.22951" E	007° 26' 11.26103" E
Height	12.686 m Ell., -28.491 m ISS	12.712 m Ell., -28.483 m Ort.
Easting	402 874.926 m E (± 0.06 m)	
Northing	6 224 199.798 m N (± 0.05 m)	
Height	-28.023 m MSS (± 0.24 m) , -28.491 m ISS (± 0.20 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	131.2° T, 132.5° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.0 m, USBL= 28.1 m

Table 5: Mean Position to Target

Target	CPT266		
Position	402 875.000 m E, 6 224 200.000 m N		
Range	0.22 m Grid		
Bearing To	20.1° G	Bearing From	200.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	402 874.926 m E, 6 224 199.798 m N , -28.023 m MSS
Heading	131.2° T, 132.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT228-v57
Start Time	12 Nov 2023, 14:18:37+01:00
End Time	12 Nov 2023, 14:20:39+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 53.38524" N	56° 08' 53.40483" N
Longitude	007° 24' 04.47662" E	007° 24' 04.50812" E
Height	12.879 m Ell., -28.404 m ISS	12.905 m Ell., -28.301 m Ort.
Easting	400 675.739 m E (± 0.08 m)	
Northing	6 223 720.840 m N (± 0.04 m)	
Height	-27.838 m MSS (± 0.20 m) , -28.404 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	113.4° T, 114.7° G	± 3.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.8 m, USBL= 27.9 m

Table 5: Mean Position to Target

Target	CPT228		
Position	400 676.000 m E, 6 223 720.000 m N		
Range	0.88 m Grid		
Bearing To	162.7° G	Bearing From	342.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	400 675.739 m E, 6 223 720.840 m N , -27.838 m MSS
Heading	113.4° T, 114.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT018-v58
Start Time	12 Nov 2023, 15:48:14+01:00
End Time	12 Nov 2023, 15:50:21+01:00
Session Length	2m 7s (113 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 19.54323" N	56° 08' 19.56281" N
Longitude	007° 23' 52.87825" E	007° 23' 52.90974" E
Height	13.432 m Ell., -27.790 m ISS	13.458 m Ell., -27.753 m Ort.
Easting	400 451.307 m E (± 0.07 m)	
Northing	6 222 679.357 m N (± 0.04 m)	
Height	-27.284 m MSS (± 0.26 m) , -27.790 m ISS (± 0.22 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	118.3° T, 119.6° G	± 3.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.2 m, USBL= 27.3 m

Table 5: Mean Position to Target

Target	CPT018		
Position	400 451.000 m E, 6 222 680.000 m N		
Range	0.71 m Grid		
Bearing To	334.5° G	Bearing From	154.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	113 of 120
Position	400 451.307 m E, 6 222 679.357 m N , -27.284 m MSS
Heading	118.3° T, 119.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT200-v59
Start Time	12 Nov 2023, 18:19:24+01:00
End Time	12 Nov 2023, 18:21:24+01:00
Session Length	2m 1s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 59.97486" N	56° 07' 59.99444" N
Longitude	007° 25' 43.70459" E	007° 25' 43.73610" E
Height	13.173 m Ell., -27.585 m ISS	13.199 m Ell., -28.007 m Ort.
Easting	402 350.366 m E (± 0.07 m)	
Northing	6 222 030.460 m N (± 0.14 m)	
Height	-27.542 m MSS (± 0.24 m) , -27.585 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	113.0° T, 114.3° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.5 m, USBL= 27.6 m

Table 5: Mean Position to Target

Target	CPT200		
Position	402 350.000 m E, 6 222 030.000 m N		
Range	0.59 m Grid		
Bearing To	218.5° G	Bearing From	38.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	402 350.366 m E, 6 222 030.460 m N , -27.542 m MSS
Heading	113.0° T, 114.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT331-v60
Start Time	12 Nov 2023, 19:42:19+01:00
End Time	12 Nov 2023, 19:44:17+01:00
Session Length	1m 59s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 58.96325" N	56° 06' 58.98283" N
Longitude	007° 26' 23.33173" E	007° 26' 23.36324" E
Height	13.950 m Ell., -26.773 m ISS	13.976 m Ell., -27.233 m Ort.
Easting	402 991.771 m E (± 0.06 m)	
Northing	6 220 128.931 m N (± 0.09 m)	
Height	-26.770 m MSS (± 0.18 m) , -26.773 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	122.1° T, 123.4° G	± 3.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.7 m, USBL= 26.8 m

Table 5: Mean Position to Target

Target	CPT331		
Position	402 991.000 m E, 6 220 130.000 m N		
Range	1.32 m Grid		
Bearing To	324.2° G	Bearing From	144.2° G

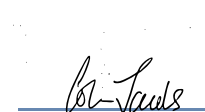
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	402 991.771 m E, 6 220 128.931 m N , -26.770 m MSS
Heading	122.1° T, 123.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT199-v61
Start Time	12 Nov 2023, 22:13:00+01:00
End Time	12 Nov 2023, 22:14:58+01:00
Session Length	1m 58s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 16.11056" N	56° 07' 16.13014" N
Longitude	007° 28' 30.15631" E	007° 28' 30.18784" E
Height	13.917 m Ell., -26.962 m ISS	13.943 m Ell., -27.255 m Ort.
Easting	405 193.737 m E (± 0.10 m)	
Northing	6 220 610.029 m N (± 0.05 m)	
Height	-26.784 m MSS (± 0.20 m) , -26.962 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	124.3° T, 125.6° G	± 4.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.6 m, USBL= 26.9 m

Table 5: Mean Position to Target

Target	CPT199		
Position	405 193.000 m E, 6 220 610.000 m N		
Range	0.74 m Grid		
Bearing To	267.7° G	Bearing From	87.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	405 193.737 m E, 6 220 610.029 m N , -26.784 m MSS
Heading	124.3° T, 125.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT199A-v62
Start Time	13 Nov 2023, 00:24:02+01:00
End Time	13 Nov 2023, 00:26:16+01:00
Session Length	2m 14s (102 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 16.13195" N	56° 07' 16.15153" N
Longitude	007° 28' 29.96243" E	007° 28' 29.99396" E
Height	14.050 m Ell., -27.054 m ISS	14.076 m Ell., -27.122 m Ort.
Easting	405 190.404 m E (± 0.07 m)	
Northing	6 220 610.765 m N (± 0.05 m)	
Height	-26.651 m MSS (± 0.18 m) , -27.054 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	86.4° T, 87.7° G	± 3.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.6 m, USBL= 26.7 m

Table 5: Mean Position to Target

Target	CPT199		
Position	405 193.000 m E, 6 220 610.000 m N		
Range	2.71 m Grid		
Bearing To	106.4° G	Bearing From	286.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	102 of 120
Position	405 190.404 m E, 6 220 610.765 m N , -26.651 m MSS
Heading	86.4° T, 87.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT213-v63
Start Time	13 Nov 2023, 01:49:19+01:00
End Time	13 Nov 2023, 01:51:24+01:00
Session Length	2m 5s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 56.80340" N	56° 06' 56.82297" N
Longitude	007° 30' 22.10445" E	007° 30' 22.13599" E
Height	13.855 m Ell., -27.377 m ISS	13.881 m Ell., -27.309 m Ort.
Easting	407 113.925 m E (± 0.05 m)	
Northing	6 219 970.906 m N (± 0.03 m)	
Height	-26.840 m MSS (± 0.16 m) , -27.377 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	120.2° T, 121.4° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.7 m, USBL= 26.9 m

Table 5: Mean Position to Target

Target	CPT213		
Position	407 113.000 m E, 6 219 970.000 m N		
Range	1.29 m Grid		
Bearing To	225.6° G	Bearing From	45.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	407 113.925 m E, 6 219 970.906 m N , -26.840 m MSS
Heading	120.2° T, 121.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT271-v64
Start Time	13 Nov 2023, 03:13:09+01:00
End Time	13 Nov 2023, 03:15:08+01:00
Session Length	1m 59s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 43.34188" N	56° 05' 43.36147" N
Longitude	007° 29' 24.70028" E	007° 29' 24.73181" E
Height	14.297 m Ell., -26.922 m ISS	14.323 m Ell., -26.881 m Ort.
Easting	406 072.854 m E (± 0.06 m)	
Northing	6 217 721.613 m N (± 0.03 m)	
Height	-26.420 m MSS (± 0.19 m) , -26.922 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	129.1° T, 130.4° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.3 m, USBL= 26.4 m

Table 5: Mean Position to Target

Target	CPT271		
Position	406 073.000 m E, 6 217 720.000 m N		
Range	1.62 m Grid		
Bearing To	174.8° G	Bearing From	354.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	406 072.854 m E, 6 217 721.613 m N , -26.420 m MSS
Heading	129.1° T, 130.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT029-v65
Start Time	13 Nov 2023, 05:53:14+01:00
End Time	13 Nov 2023, 05:55:15+01:00
Session Length	2m 1s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 03.76773" N	56° 06' 03.78732" N
Longitude	007° 27' 46.54695" E	007° 27' 46.57847" E
Height	14.573 m Ell., -26.357 m ISS	14.599 m Ell., -26.611 m Ort.
Easting	404 390.885 m E (± 0.09 m)	
Northing	6 218 390.458 m N (± 0.04 m)	
Height	-26.145 m MSS (± 0.20 m) , -26.357 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	115.3° T, 116.6° G	± 3.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.9 m, USBL= 26.2 m

Table 5: Mean Position to Target

Target	CPT029		
Position	404 392.000 m E, 6 218 390.000 m N		
Range	1.21 m Grid		
Bearing To	112.3° G	Bearing From	292.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	404 390.885 m E, 6 218 390.458 m N , -26.145 m MSS
Heading	115.3° T, 116.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT183-v66
Start Time	13 Nov 2023, 07:17:04+01:00
End Time	13 Nov 2023, 07:19:07+01:00
Session Length	2m 2s (106 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 45.02927" N	56° 05' 45.04885" N
Longitude	007° 25' 41.36254" E	007° 25' 41.39404" E
Height	14.526 m Ell., -26.188 m ISS	14.552 m Ell., -26.668 m Ort.
Easting	402 214.911 m E (± 0.06 m)	
Northing	6 217 859.929 m N (± 0.04 m)	
Height	-26.200 m MSS (± 0.19 m) , -26.188 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	127.3° T, 128.6° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.1 m, USBL= 26.2 m

Table 5: Mean Position to Target

Target	CPT183		
Position	402 215.000 m E, 6 217 860.000 m N		
Range	0.11 m Grid		
Bearing To	51.5° G	Bearing From	231.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	106 of 120
Position	402 214.911 m E, 6 217 859.929 m N , -26.200 m MSS
Heading	127.3° T, 128.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT035-v67
Start Time	13 Nov 2023, 08:53:36+01:00
End Time	13 Nov 2023, 08:55:37+01:00
Session Length	2m 1s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 41.98646" N	56° 04' 42.00604" N
Longitude	007° 25' 41.18387" E	007° 25' 41.21537" E
Height	15.210 m Ell., -25.605 m ISS	15.236 m Ell., -25.989 m Ort.
Easting	402 167.444 m E (± 0.04 m)	
Northing	6 215 911.222 m N (± 0.03 m)	
Height	-25.524 m MSS (± 0.15 m) , -25.605 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	141.4° T, 142.7° G	± 1.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.5 m, USBL= 25.6 m

Table 5: Mean Position to Target

Target	CPT035		
Position	402 167.000 m E, 6 215 910.000 m N		
Range	1.30 m Grid		
Bearing To	199.9° G	Bearing From	19.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	402 167.444 m E, 6 215 911.222 m N , -25.524 m MSS
Heading	141.4° T, 142.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT260-v68
Start Time	13 Nov 2023, 10:14:37+01:00
End Time	13 Nov 2023, 10:16:51+01:00
Session Length	2m 14s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 55.01524" N	56° 04' 55.03482" N
Longitude	007° 27' 32.54294" E	007° 27' 32.57446" E
Height	14.981 m Ell., -25.908 m ISS	15.007 m Ell., -26.210 m Ort.
Easting	404 101.491 m E (± 0.07 m)	
Northing	6 216 270.565 m N (± 0.04 m)	
Height	-25.749 m MSS (± 0.18 m) , -25.908 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	140.5° T, 141.7° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.7 m, USBL= 25.8 m

Table 5: Mean Position to Target

Target	CPT260		
Position	404 102.000 m E, 6 216 270.000 m N		
Range	0.76 m Grid		
Bearing To	138.0° G	Bearing From	318.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	404 101.491 m E, 6 216 270.565 m N , -25.749 m MSS
Heading	140.5° T, 141.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT391-v69
Start Time	13 Nov 2023, 12:53:32+01:00
End Time	13 Nov 2023, 12:55:34+01:00
Session Length	2m 3s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 04.60693" N	56° 04' 04.62652" N
Longitude	007° 29' 22.06919" E	007° 29' 22.10071" E
Height	15.596 m Ell., -25.583 m ISS	15.622 m Ell., -25.590 m Ort.
Easting	405 960.601 m E (± 0.08 m)	
Northing	6 214 670.486 m N (± 0.04 m)	
Height	-25.120 m MSS (± 0.16 m) , -25.583 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	148.2° T, 149.4° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.0 m, USBL= 25.2 m

Table 5: Mean Position to Target

Target	CPT391		
Position	405 960.000 m E, 6 214 670.000 m N		
Range	0.77 m Grid		
Bearing To	231.1° G	Bearing From	51.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	405 960.601 m E, 6 214 670.486 m N , -25.120 m MSS
Heading	148.2° T, 149.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT185-v71
Start Time	16 Nov 2023, 04:22:05+01:00
End Time	16 Nov 2023, 04:24:48+01:00
Session Length	2m 43s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 47' 46.36856" N	55° 47' 46.38815" N
Longitude	007° 27' 40.55672" E	007° 27' 40.58817" E
Height	15.031 m Ell., -26.390 m ISS	15.056 m Ell., -26.094 m Ort.
Easting	403 532.403 m E (± 0.08 m)	
Northing	6 184 470.507 m N (± 0.08 m)	
Height	-25.662 m MSS (± 0.19 m) , -26.390 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	38.3° T, 39.5° G	± 3.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.4 m, USBL= 25.7 m

Table 5: Mean Position to Target

Target	CPT185		
Position	403 533.000 m E, 6 184 470.000 m N		
Range	0.78 m Grid		
Bearing To	130.4° G	Bearing From	310.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	403 532.403 m E, 6 184 470.507 m N , -25.662 m MSS
Heading	38.3° T, 39.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT116-v73
Start Time	16 Nov 2023, 08:04:23+01:00
End Time	16 Nov 2023, 08:06:52+01:00
Session Length	2m 28s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 49' 00.83484" N	55° 49' 00.85443" N
Longitude	007° 26' 30.94592" E	007° 26' 30.97737" E
Height	14.979 m Ell., -25.839 m ISS	15.005 m Ell., -26.161 m Ort.
Easting	402 372.050 m E (± 0.04 m)	
Northing	6 186 799.413 m N (± 0.06 m)	
Height	-25.728 m MSS (± 0.25 m) , -25.839 m ISS (± 0.21 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	43.7° T, 45.0° G	± 2.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.4 m, USBL= 25.7 m

Table 5: Mean Position to Target

Target	CPT116		
Position	402 374.000 m E, 6 186 800.000 m N		
Range	2.04 m Grid		
Bearing To	73.3° G	Bearing From	253.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	402 372.050 m E, 6 186 799.413 m N , -25.728 m MSS
Heading	43.7° T, 45.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT376-v72
Start Time	16 Nov 2023, 06:47:56+01:00
End Time	16 Nov 2023, 06:50:40+01:00
Session Length	2m 44s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 48' 50.28096" N	55° 48' 50.30055" N
Longitude	007° 27' 29.56326" E	007° 27' 29.59472" E
Height	16.706 m Ell., -24.336 m ISS	16.731 m Ell., -24.430 m Ort.
Easting	403 384.955 m E (± 0.04 m)	
Northing	6 186 450.349 m N (± 0.07 m)	
Height	-23.996 m MSS (± 0.17 m) , -24.336 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	46.5° T, 47.8° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.7 m, USBL= 24.1 m

Table 5: Mean Position to Target

Target	CPT376		
Position	403 384.000 m E, 6 186 450.000 m N		
Range	1.02 m Grid		
Bearing To	249.9° G	Bearing From	69.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	403 384.955 m E, 6 186 450.349 m N , -23.996 m MSS
Heading	46.5° T, 47.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT114-v73
Start Time	16 Nov 2023, 21:24:33+01:00
End Time	16 Nov 2023, 21:27:07+01:00
Session Length	2m 34s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 49' 30.18896" N	55° 49' 30.20855" N
Longitude	007° 28' 27.94911" E	007° 28' 27.98058" E
Height	17.664 m Ell., -22.991 m ISS	17.690 m Ell., -23.477 m Ort.
Easting	404 428.353 m E (± 0.07 m)	
Northing	6 187 661.436 m N (± 0.05 m)	
Height	-23.048 m MSS (± 0.19 m) , -22.991 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	79.2° T, 80.4° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.8 m, USBL= 23.1 m

Table 5: Mean Position to Target

Target	CPT114		
Position	404 429.000 m E, 6 187 660.000 m N		
Range	1.58 m Grid		
Bearing To	155.7° G	Bearing From	335.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	404 428.353 m E, 6 187 661.436 m N , -23.048 m MSS
Heading	79.2° T, 80.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT112-v74
Start Time	17 Nov 2023, 00:29:23+01:00
End Time	17 Nov 2023, 00:32:37+01:00
Session Length	3m 14s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 49' 38.45645" N	55° 49' 38.47604" N
Longitude	007° 25' 22.86005" E	007° 25' 22.89149" E
Height	15.382 m Ell., -25.589 m ISS	15.408 m Ell., -25.766 m Ort.
Easting	401 213.583 m E (± 0.06 m)	
Northing	6 187 989.148 m N (± 0.08 m)	
Height	-25.335 m MSS (± 0.17 m) , -25.589 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	88.3° T, 89.6° G	± 4.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.1 m, USBL= 25.4 m

Table 5: Mean Position to Target

Target	CPT112		
Position	401 214.000 m E, 6 187 990.000 m N		
Range	0.95 m Grid		
Bearing To	26.1° G	Bearing From	206.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	401 213.583 m E, 6 187 989.148 m N , -25.335 m MSS
Heading	88.3° T, 89.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT357-v76
Start Time	17 Nov 2023, 02:11:54+01:00
End Time	17 Nov 2023, 02:14:14+01:00
Session Length	2m 20s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 50' 35.96431" N	55° 50' 35.98390" N
Longitude	007° 28' 13.06040" E	007° 28' 13.09187" E
Height	18.246 m Ell., -22.929 m ISS	18.271 m Ell., -22.907 m Ort.
Easting	404 214.210 m E (± 0.07 m)	
Northing	6 189 700.335 m N (± 0.04 m)	
Height	-22.483 m MSS (± 0.19 m) , -22.929 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	85.3° T, 86.6° G	± 1.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.3 m, USBL= 22.5 m

Table 5: Mean Position to Target

Target	CPT357		
Position	404 214.000 m E, 6 189 700.000 m N		
Range	0.40 m Grid		
Bearing To	212.1° G	Bearing From	32.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	404 214.210 m E, 6 189 700.335 m N , -22.483 m MSS
Heading	85.3° T, 86.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT233-v77
Start Time	17 Nov 2023, 03:53:53+01:00
End Time	17 Nov 2023, 03:56:22+01:00
Session Length	2m 29s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 50' 46.80464" N	55° 50' 46.82423" N
Longitude	007° 25' 26.67243" E	007° 25' 26.70388" E
Height	15.972 m Ell., -25.388 m ISS	15.997 m Ell., -25.189 m Ort.
Easting	401 328.010 m E (± 0.07 m)	
Northing	6 190 100.334 m N (± 0.05 m)	
Height	-24.762 m MSS (± 0.22 m) , -25.388 m ISS (± 0.18 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	90.6° T, 91.9° G	± 1.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.4 m, USBL= 24.8 m

Table 5: Mean Position to Target

Target	CPT233		
Position	401 329.000 m E, 6 190 100.000 m N		
Range	1.05 m Grid		
Bearing To	108.6° G	Bearing From	288.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	401 328.010 m E, 6 190 100.334 m N , -24.762 m MSS
Heading	90.6° T, 91.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT127-v78
Start Time	17 Nov 2023, 05:03:56+01:00
End Time	17 Nov 2023, 05:06:14+01:00
Session Length	2m 19s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 50' 45.16597" N	55° 50' 45.18556" N
Longitude	007° 24' 10.23538" E	007° 24' 10.26682" E
Height	17.037 m Ell., -24.326 m ISS	17.063 m Ell., -24.125 m Ort.
Easting	399 997.554 m E (± 0.07 m)	
Northing	6 190 080.149 m N (± 0.06 m)	
Height	-23.690 m MSS (± 0.24 m) , -24.326 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	91.1° T, 92.5° G	± 3.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.5 m, USBL= 23.7 m

Table 5: Mean Position to Target

Target	CPT127		
Position	399 998.000 m E, 6 190 080.000 m N		
Range	0.47 m Grid		
Bearing To	108.5° G	Bearing From	288.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	399 997.554 m E, 6 190 080.149 m N , -23.690 m MSS
Heading	91.1° T, 92.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT245-v79
Start Time	17 Nov 2023, 07:56:22+01:00
End Time	17 Nov 2023, 07:58:58+01:00
Session Length	2m 35s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 51' 28.11501" N	55° 51' 28.13460" N
Longitude	007° 26' 36.29629" E	007° 26' 36.32774" E
Height	17.473 m Ell., -23.456 m ISS	17.498 m Ell., -23.693 m Ort.
Easting	402 567.532 m E (± 0.06 m)	
Northing	6 191 349.879 m N (± 0.07 m)	
Height	-23.253 m MSS (± 0.19 m) , -23.456 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	60.4° T, 61.7° G	± 3.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.8 m, USBL= 23.2 m

Table 5: Mean Position to Target

Target	CPT245		
Position	402 568.000 m E, 6 191 350.000 m N		
Range	0.48 m Grid		
Bearing To	75.5° G	Bearing From	255.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	402 567.532 m E, 6 191 349.879 m N , -23.253 m MSS
Heading	60.4° T, 61.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT098-v80
Start Time	17 Nov 2023, 09:09:56+01:00
End Time	17 Nov 2023, 09:12:21+01:00
Session Length	2m 25s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 19.53629" N	55° 52' 19.55588" N
Longitude	007° 28' 42.66936" E	007° 28' 42.70083" E
Height	16.975 m Ell., -23.717 m ISS	17.000 m Ell., -24.194 m Ort.
Easting	404 799.553 m E (± 0.03 m)	
Northing	6 192 890.517 m N (± 0.07 m)	
Height	-23.748 m MSS (± 0.20 m) , -23.717 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	64.7° T, 65.9° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.6 m, USBL= 23.8 m

Table 5: Mean Position to Target

Target	CPT098		
Position	404 800.000 m E, 6 192 890.000 m N		
Range	0.68 m Grid		
Bearing To	139.1° G	Bearing From	319.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	404 799.553 m E, 6 192 890.517 m N , -23.748 m MSS
Heading	64.7° T, 65.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT283-v81
Start Time	17 Nov 2023, 13:21:44+01:00
End Time	17 Nov 2023, 13:24:20+01:00
Session Length	2m 36s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 15.28162" N	55° 53' 15.30121" N
Longitude	007° 23' 20.83522" E	007° 23' 20.86666" E
Height	15.751 m Ell., -25.303 m ISS	15.777 m Ell., -25.437 m Ort.
Easting	399 246.462 m E (± 0.05 m)	
Northing	6 194 740.240 m N (± 0.06 m)	
Height	-24.999 m MSS (± 0.20 m) , -25.303 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	72.7° T, 74.0° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.7 m, USBL= 25.0 m

Table 5: Mean Position to Target

Target	CPT283		
Position	399 247.000 m E, 6 194 740.000 m N		
Range	0.59 m Grid		
Bearing To	114.1° G	Bearing From	294.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	399 246.462 m E, 6 194 740.240 m N , -24.999 m MSS
Heading	72.7° T, 74.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT283A-v82
Start Time	17 Nov 2023, 14:01:09+01:00
End Time	17 Nov 2023, 14:03:33+01:00
Session Length	2m 25s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 15.40992" N	55° 53' 15.42951" N
Longitude	007° 23' 20.80827" E	007° 23' 20.83971" E
Height	15.740 m Ell., -25.338 m ISS	15.765 m Ell., -25.449 m Ort.
Easting	399 246.086 m E (± 0.04 m)	
Northing	6 194 744.217 m N (± 0.06 m)	
Height	-25.011 m MSS (± 0.19 m) , -25.338 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	69.2° T, 70.5° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.8 m, USBL= 25.0 m

Table 5: Mean Position to Target

Target	CPT283		
Position	399 247.000 m E, 6 194 740.000 m N		
Range	4.32 m Grid		
Bearing To	167.8° G	Bearing From	347.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	399 246.086 m E, 6 194 744.217 m N , -25.011 m MSS
Heading	69.2° T, 70.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT174-v83
Start Time	17 Nov 2023, 15:26:44+01:00
End Time	17 Nov 2023, 15:29:11+01:00
Session Length	2m 27s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 57.71523" N	55° 53' 57.73482" N
Longitude	007° 28' 30.41215" E	007° 28' 30.44364" E
Height	16.489 m Ell., -24.761 m ISS	16.515 m Ell., -24.692 m Ort.
Easting	404 653.418 m E (± 0.03 m)	
Northing	6 195 930.042 m N (± 0.05 m)	
Height	-24.239 m MSS (± 0.20 m) , -24.761 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	70.2° T, 71.4° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.9 m, USBL= 24.3 m

Table 5: Mean Position to Target

Target	CPT174		
Position	404 653.000 m E, 6 195 930.000 m N		
Range	0.42 m Grid		
Bearing To	264.2° G	Bearing From	84.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	404 653.418 m E, 6 195 930.042 m N , -24.239 m MSS
Heading	70.2° T, 71.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT384-v84
Start Time	17 Nov 2023, 17:00:19+01:00
End Time	17 Nov 2023, 17:02:58+01:00
Session Length	2m 39s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 06.61569" N	55° 53' 06.63528" N
Longitude	007° 26' 25.47921" E	007° 26' 25.51068" E
Height	15.974 m Ell., -25.431 m ISS	16.000 m Ell., -25.207 m Ort.
Easting	402 448.093 m E (± 0.03 m)	
Northing	6 194 398.870 m N (± 0.04 m)	
Height	-24.768 m MSS (± 0.16 m) , -25.431 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	66.7° T, 68.0° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.5 m, USBL= 24.8 m

Table 5: Mean Position to Target

Target	CPT384		
Position	402 447.000 m E, 6 194 400.000 m N		
Range	1.57 m Grid		
Bearing To	315.9° G	Bearing From	135.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	402 448.093 m E, 6 194 398.870 m N , -24.768 m MSS
Heading	66.7° T, 68.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT384A-v85
Start Time	17 Nov 2023, 18:47:22+01:00
End Time	17 Nov 2023, 18:50:03+01:00
Session Length	2m 42s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 06.50743" N	55° 53' 06.52702" N
Longitude	007° 26' 25.40846" E	007° 26' 25.43992" E
Height	16.007 m Ell., -25.287 m ISS	16.033 m Ell., -25.174 m Ort.
Easting	402 446.789 m E (± 0.04 m)	
Northing	6 194 395.552 m N (± 0.03 m)	
Height	-24.735 m MSS (± 0.15 m) , -25.287 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	64.1° T, 65.4° G	± 1.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.5 m, USBL= 24.8 m

Table 5: Mean Position to Target

Target	CPT384		
Position	402 447.000 m E, 6 194 400.000 m N		
Range	4.45 m Grid		
Bearing To	2.7° G	Bearing From	182.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	402 446.789 m E, 6 194 395.552 m N , -24.735 m MSS
Heading	64.1° T, 65.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT386-v85
Start Time	17 Nov 2023, 20:01:42+01:00
End Time	17 Nov 2023, 20:04:16+01:00
Session Length	2m 34s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 02.35077" N	55° 55' 02.37036" N
Longitude	007° 24' 06.72241" E	007° 24' 06.75386" E
Height	14.768 m Ell., -26.348 m ISS	14.793 m Ell., -26.432 m Ort.
Easting	400 120.084 m E (± 0.06 m)	
Northing	6 198 031.364 m N (± 0.07 m)	
Height	-25.983 m MSS (± 0.22 m) , -26.348 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	79.6° T, 80.9° G	± 3.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.6 m, USBL= 26.1 m

Table 5: Mean Position to Target

Target	CPT386		
Position	400 121.000 m E, 6 198 030.000 m N		
Range	1.64 m Grid		
Bearing To	146.1° G	Bearing From	326.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	400 120.084 m E, 6 198 031.364 m N , -25.983 m MSS
Heading	79.6° T, 80.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT079-v86
Start Time	17 Nov 2023, 21:41:32+01:00
End Time	17 Nov 2023, 21:43:52+01:00
Session Length	2m 20s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 17.01412" N	55° 55' 17.03371" N
Longitude	007° 25' 58.07824" E	007° 25' 58.10970" E
Height	14.646 m Ell., -26.170 m ISS	14.672 m Ell., -26.550 m Ort.
Easting	402 063.370 m E (± 0.07 m)	
Northing	6 198 440.391 m N (± 0.06 m)	
Height	-26.106 m MSS (± 0.20 m) , -26.170 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	113.0° T, 114.3° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.8 m, USBL= 26.2 m

Table 5: Mean Position to Target

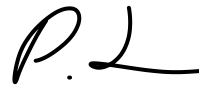
Target	CPT079		
Position	402 063.000 m E, 6 198 440.000 m N		
Range	0.54 m Grid		
Bearing To	223.4° G	Bearing From	43.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	402 063.370 m E, 6 198 440.391 m N , -26.106 m MSS
Heading	113.0° T, 114.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT252-v87
Start Time	17 Nov 2023, 23:28:35+01:00
End Time	17 Nov 2023, 23:30:43+01:00
Session Length	2m 8s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 46.29991" N	55° 55' 46.31950" N
Longitude	007° 25' 19.35642" E	007° 25' 19.38789" E
Height	15.720 m Ell., -25.101 m ISS	15.746 m Ell., -25.480 m Ort.
Easting	401 411.927 m E (± 0.04 m)	
Northing	6 199 360.932 m N (± 0.03 m)	
Height	-25.036 m MSS (± 0.21 m) , -25.101 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	114.4° T, 115.7° G	± 1.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.8 m, USBL= 25.1 m

Table 5: Mean Position to Target

Target	CPT252		
Position	401 413.000 m E, 6 199 360.000 m N		
Range	1.42 m Grid		
Bearing To	131.0° G	Bearing From	311.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	401 411.927 m E, 6 199 360.932 m N , -25.036 m MSS
Heading	114.4° T, 115.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT202-v88
Start Time	18 Nov 2023, 00:53:25+01:00
End Time	18 Nov 2023, 00:55:48+01:00
Session Length	2m 24s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 58.97307" N	55° 55' 58.99266" N
Longitude	007° 22' 57.04456" E	007° 22' 57.07600" E
Height	14.252 m Ell., -26.784 m ISS	14.278 m Ell., -26.954 m Ort.
Easting	398 951.496 m E (± 0.09 m)	
Northing	6 199 809.731 m N (± 0.05 m)	
Height	-26.503 m MSS (± 0.18 m) , -26.784 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	121.7° T, 123.0° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.2 m, USBL= 26.5 m

Table 5: Mean Position to Target

Target	CPT202		
Position	398 952.000 m E, 6 199 810.000 m N		
Range	0.57 m Grid		
Bearing To	61.9° G	Bearing From	241.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	398 951.496 m E, 6 199 809.731 m N , -26.503 m MSS
Heading	121.7° T, 123.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT362-v89
Start Time	18 Nov 2023, 02:17:08+01:00
End Time	18 Nov 2023, 02:19:32+01:00
Session Length	2m 24s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 43.93937" N	55° 56' 43.95896" N
Longitude	007° 24' 35.65230" E	007° 24' 35.68376" E
Height	14.095 m Ell., -27.071 m ISS	14.121 m Ell., -27.109 m Ort.
Easting	400 694.484 m E (± 0.12 m)	
Northing	6 201 160.008 m N (± 0.04 m)	
Height	-26.668 m MSS (± 0.18 m) , -27.071 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	123.2° T, 124.5° G	± 4.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.4 m, USBL= 26.7 m

Table 5: Mean Position to Target

Target	CPT362		
Position	400 695.000 m E, 6 201 160.000 m N		
Range	0.52 m Grid		
Bearing To	90.9° G	Bearing From	270.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	400 694.484 m E, 6 201 160.008 m N , -26.668 m MSS
Heading	123.2° T, 124.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT170-v90
Start Time	18 Nov 2023, 04:02:52+01:00
End Time	18 Nov 2023, 04:05:08+01:00
Session Length	2m 17s (100 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 35.10458" N	55° 56' 35.12416" N
Longitude	007° 27' 24.27632" E	007° 27' 24.30780" E
Height	17.617 m Ell., -23.725 m ISS	17.642 m Ell., -23.577 m Ort.
Easting	403 613.396 m E (± 0.07 m)	
Northing	6 200 820.631 m N (± 0.05 m)	
Height	-23.133 m MSS (± 0.17 m) , -23.725 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	158.5° T, 159.8° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.7 m, USBL= 23.2 m

Table 5: Mean Position to Target

Target	CPT170		
Position	403 613.000 m E, 6 200 820.000 m N		
Range	0.74 m Grid		
Bearing To	212.1° G	Bearing From	32.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	100 of 120
Position	403 613.396 m E, 6 200 820.631 m N , -23.133 m MSS
Heading	158.5° T, 159.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT071-v91
Start Time	18 Nov 2023, 06:29:39+01:00
End Time	18 Nov 2023, 06:32:23+01:00
Session Length	2m 44s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 23.68951" N	55° 57' 23.70909" N
Longitude	007° 29' 15.66074" E	007° 29' 15.69224" E
Height	18.750 m Ell., -22.511 m ISS	18.776 m Ell., -22.438 m Ort.
Easting	405 578.495 m E (± 0.10 m)	
Northing	6 202 279.775 m N (± 0.09 m)	
Height	-21.994 m MSS (± 0.14 m) , -22.511 m ISS (± 0.06 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	152.9° T, 154.1° G	± 4.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 21.8 m, USBL= 22.0 m

Table 5: Mean Position to Target

Target	CPT071		
Position	405 578.000 m E, 6 202 280.000 m N		
Range	0.54 m Grid		
Bearing To	294.5° G	Bearing From	114.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	405 578.495 m E, 6 202 279.775 m N , -21.994 m MSS
Heading	152.9° T, 154.1° G
Pitch	0.00 °
Roll	0.00 °



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Colin Jacobs
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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT258-v92
Start Time	18 Nov 2023, 08:26:32+01:00
End Time	18 Nov 2023, 08:29:16+01:00
Session Length	2m 44s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 33.58719" N	55° 57' 33.60678" N
Longitude	007° 26' 25.54069" E	007° 26' 25.57216" E
Height	16.132 m Ell., -24.889 m ISS	16.158 m Ell., -25.067 m Ort.
Easting	402 635.262 m E (± 0.04 m)	
Northing	6 202 651.273 m N (± 0.06 m)	
Height	-24.627 m MSS (± 0.15 m) , -24.889 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	171.5° T, 172.8° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.3 m, USBL= 24.7 m

Table 5: Mean Position to Target

Target	CPT258		
Position	402 636.000 m E, 6 202 650.000 m N		
Range	1.47 m Grid		
Bearing To	149.9° G	Bearing From	329.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	402 635.262 m E, 6 202 651.273 m N , -24.627 m MSS
Heading	171.5° T, 172.8° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT067-v93
Start Time	18 Nov 2023, 10:09:59+01:00
End Time	18 Nov 2023, 10:12:15+01:00
Session Length	2m 16s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 49.25885" N	55° 57' 49.27844" N
Longitude	007° 24' 07.20920" E	007° 24' 07.24066" E
Height	15.659 m Ell., -25.068 m ISS	15.685 m Ell., -25.548 m Ort.
Easting	400 247.776 m E (± 0.08 m)	
Northing	6 203 190.487 m N (± 0.08 m)	
Height	-25.106 m MSS (± 0.17 m) , -25.068 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	162.2° T, 163.5° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.9 m, USBL= 25.2 m

Table 5: Mean Position to Target

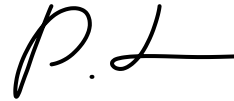
Target	CPT067		
Position	400 249.000 m E, 6 203 190.000 m N		
Range	1.32 m Grid		
Bearing To	111.7° G	Bearing From	291.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	400 247.776 m E, 6 203 190.487 m N , -25.106 m MSS
Heading	162.2° T, 163.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT231-v96
Start Time	20 Nov 2023, 07:39:46+01:00
End Time	20 Nov 2023, 07:43:03+01:00
Session Length	3m 18s (67 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 36.30534" N	55° 57' 36.32493" N
Longitude	007° 22' 29.72774" E	007° 22' 29.75918" E
Height	13.838 m Ell., -27.871 m ISS	13.864 m Ell., -27.373 m Ort.
Easting	398 548.221 m E (± 0.05 m)	
Northing	6 202 829.484 m N (± 0.05 m)	
Height	-26.937 m MSS (± 0.34 m) , -27.871 m ISS (± 0.31 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	133.6° T, 134.9° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.7 m, USBL= 26.9 m

Table 5: Mean Position to Target

Target	CPT231		
Position	398 548.000 m E, 6 202 830.000 m N		
Range	0.56 m Grid		
Bearing To	336.8° G	Bearing From	156.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	67 of 120
Position	398 548.221 m E, 6 202 829.484 m N , -26.937 m MSS
Heading	133.6° T, 134.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT065-v100
Start Time	20 Nov 2023, 10:01:26+01:00
End Time	20 Nov 2023, 10:04:26+01:00
Session Length	3m 1s (95 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 58' 30.28641" N	55° 58' 30.30601" N
Longitude	007° 21' 07.66972" E	007° 21' 07.70116" E
Height	12.079 m Ell., -29.355 m ISS	12.105 m Ell., -29.136 m Ort.
Easting	397 165.149 m E (± 0.09 m)	
Northing	6 204 531.777 m N (± 0.05 m)	
Height	-28.690 m MSS (± 0.24 m) , -29.355 m ISS (± 0.20 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	141.7° T, 143.0° G	± 3.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.4 m, USBL= 28.7 m

Table 5: Mean Position to Target

Target	CPT065		
Position	397 165.000 m E, 6 204 530.000 m N		
Range	1.78 m Grid		
Bearing To	184.8° G	Bearing From	4.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	95 of 120
Position	397 165.149 m E, 6 204 531.777 m N , -28.690 m MSS
Heading	141.7° T, 143.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT201-v102
Start Time	20 Nov 2023, 11:18:46+01:00
End Time	20 Nov 2023, 11:21:25+01:00
Session Length	2m 39s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 58' 39.86220" N	55° 58' 39.88179" N
Longitude	007° 22' 15.61266" E	007° 22' 15.64411" E
Height	14.682 m Ell., -26.540 m ISS	14.708 m Ell., -26.530 m Ort.
Easting	398 349.773 m E (± 0.06 m)	
Northing	6 204 799.857 m N (± 0.04 m)	
Height	-26.083 m MSS (± 0.21 m) , -26.540 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	136.5° T, 137.9° G	± 2.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.9 m, USBL= 26.2 m

Table 5: Mean Position to Target

Target	CPT201		
Position	398 350.000 m E, 6 204 800.000 m N		
Range	0.27 m Grid		
Bearing To	57.8° G	Bearing From	237.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	398 349.773 m E, 6 204 799.857 m N , -26.083 m MSS
Heading	136.5° T, 137.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT201A-v103
Start Time	20 Nov 2023, 16:04:57+01:00
End Time	20 Nov 2023, 16:07:27+01:00
Session Length	2m 30s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 58' 40.01952" N	55° 58' 40.03911" N
Longitude	007° 22' 15.64285" E	007° 22' 15.67430" E
Height	14.652 m Ell., -26.417 m ISS	14.678 m Ell., -26.560 m Ort.
Easting	398 350.411 m E (± 0.07 m)	
Northing	6 204 804.708 m N (± 0.04 m)	
Height	-26.113 m MSS (± 0.22 m) , -26.417 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	132.3° T, 133.6° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.9 m, USBL= 26.2 m

Table 5: Mean Position to Target

Target	CPT201		
Position	398 350.000 m E, 6 204 800.000 m N		
Range	4.73 m Grid		
Bearing To	185.0° G	Bearing From	5.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	398 350.411 m E, 6 204 804.708 m N , -26.113 m MSS
Heading	132.3° T, 133.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT201B-v104
Start Time	20 Nov 2023, 18:29:22+01:00
End Time	20 Nov 2023, 18:31:58+01:00
Session Length	2m 36s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 58' 39.89970" N	55° 58' 39.91929" N
Longitude	007° 22' 15.40408" E	007° 22' 15.43552" E
Height	14.695 m Ell., -26.611 m ISS	14.721 m Ell., -26.518 m Ort.
Easting	398 346.186 m E (± 0.07 m)	
Northing	6 204 801.102 m N (± 0.09 m)	
Height	-26.071 m MSS (± 0.19 m) , -26.611 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	83.2° T, 84.5° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.9 m, USBL= 26.1 m

Table 5: Mean Position to Target

Target	CPT201		
Position	398 350.000 m E, 6 204 800.000 m N		
Range	3.97 m Grid		
Bearing To	106.1° G	Bearing From	286.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	398 346.186 m E, 6 204 801.102 m N , -26.071 m MSS
Heading	83.2° T, 84.5° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT201C-v105
Start Time	20 Nov 2023, 19:56:58+01:00
End Time	20 Nov 2023, 19:59:25+01:00
Session Length	2m 27s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 58' 39.81144" N	55° 58' 39.83103" N
Longitude	007° 22' 15.40137" E	007° 22' 15.43282" E
Height	14.734 m Ell., -26.633 m ISS	14.760 m Ell., -26.478 m Ort.
Easting	398 346.074 m E (± 0.05 m)	
Northing	6 204 798.374 m N (± 0.07 m)	
Height	-26.031 m MSS (± 0.23 m) , -26.633 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	82.8° T, 84.1° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.9 m, USBL= 26.0 m

Table 5: Mean Position to Target

Target	CPT201		
Position	398 350.000 m E, 6 204 800.000 m N		
Range	4.25 m Grid		
Bearing To	67.5° G	Bearing From	247.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	398 346.074 m E, 6 204 798.374 m N , -26.031 m MSS
Heading	82.8° T, 84.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT337-v106
Start Time	20 Nov 2023, 21:41:23+01:00
End Time	20 Nov 2023, 21:43:49+01:00
Session Length	2m 26s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 02.77843" N	55° 59' 02.79801" N
Longitude	007° 25' 05.65437" E	007° 25' 05.68585" E
Height	15.962 m Ell., -25.316 m ISS	15.988 m Ell., -25.243 m Ort.
Easting	401 313.117 m E (± 0.05 m)	
Northing	6 205 439.772 m N (± 0.07 m)	
Height	-24.806 m MSS (± 1.82 m) , -25.316 m ISS (± 1.81 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	94.1° T, 95.5° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.5 m, USBL= 24.6 m

Table 5: Mean Position to Target

Target	CPT337		
Position	401 313.000 m E, 6 205 440.000 m N		
Range	0.26 m Grid		
Bearing To	332.9° G	Bearing From	152.9° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	401 313.117 m E, 6 205 439.772 m N , -24.806 m MSS
Heading	94.1° T, 95.5° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT337A-v107
Start Time	20 Nov 2023, 23:37:02+01:00
End Time	20 Nov 2023, 23:39:34+01:00
Session Length	2m 32s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 02.87499" N	55° 59' 02.89458" N
Longitude	007° 25' 05.67945" E	007° 25' 05.71092" E
Height	16.064 m Ell., -24.962 m ISS	16.090 m Ell., -25.141 m Ort.
Easting	401 313.620 m E (± 0.04 m)	
Northing	6 205 442.747 m N (± 0.06 m)	
Height	-24.704 m MSS (± 0.20 m) , -24.962 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	103.1° T, 104.4° G	± 2.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.6 m, USBL= 24.7 m

Table 5: Mean Position to Target

Target	CPT337		
Position	401 313.000 m E, 6 205 440.000 m N		
Range	2.82 m Grid		
Bearing To	192.7° G	Bearing From	12.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	401 313.620 m E, 6 205 442.747 m N , -24.704 m MSS
Heading	103.1° T, 104.4° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT372-v110
Start Time	21 Nov 2023, 01:06:30+01:00
End Time	21 Nov 2023, 01:08:59+01:00
Session Length	2m 30s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 25.63068" N	55° 59' 25.65027" N
Longitude	007° 27' 54.10959" E	007° 27' 54.14109" E
Height	17.841 m Ell., -23.117 m ISS	17.867 m Ell., -23.354 m Ort.
Easting	404 247.986 m E (± 0.05 m)	
Northing	6 206 080.346 m N (± 0.05 m)	
Height	-22.913 m MSS (± 0.19 m) , -23.117 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	79.6° T, 80.8° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.8 m, USBL= 23.0 m

Table 5: Mean Position to Target

Target	CPT372		
Position	404 248.000 m E, 6 206 080.000 m N		
Range	0.35 m Grid		
Bearing To	177.7° G	Bearing From	357.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	404 247.986 m E, 6 206 080.346 m N , -22.913 m MSS
Heading	79.6° T, 80.8° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT058-v111
Start Time	21 Nov 2023, 02:47:03+01:00
End Time	21 Nov 2023, 02:49:49+01:00
Session Length	2m 47s (106 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 46.07404" N	55° 59' 46.09362" N
Longitude	007° 26' 15.58266" E	007° 26' 15.61415" E
Height	16.931 m Ell., -24.080 m ISS	16.957 m Ell., -24.270 m Ort.
Easting	402 555.167 m E (± 0.07 m)	
Northing	6 206 750.541 m N (± 0.08 m)	
Height	-23.823 m MSS (± 0.17 m) , -24.080 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	67.8° T, 69.1° G	± 3.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.8 m, USBL= 23.9 m

Table 5: Mean Position to Target

Target	CPT058		
Position	402 556.000 m E, 6 206 750.000 m N		
Range	0.99 m Grid		
Bearing To	123.0° G	Bearing From	303.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	106 of 120
Position	402 555.167 m E, 6 206 750.541 m N , -23.823 m MSS
Heading	67.8° T, 69.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT187-v112
Start Time	21 Nov 2023, 04:29:39+01:00
End Time	21 Nov 2023, 04:32:28+01:00
Session Length	2m 49s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 15.19971" N	56° 00' 15.21930" N
Longitude	007° 25' 48.70456" E	007° 25' 48.73604" E
Height	16.608 m Ell., -24.365 m ISS	16.634 m Ell., -24.595 m Ort.
Easting	402 109.994 m E (± 0.06 m)	
Northing	6 207 661.414 m N (± 0.06 m)	
Height	-24.151 m MSS (± 0.19 m) , -24.365 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	73.9° T, 75.2° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.8 m, USBL= 24.2 m

Table 5: Mean Position to Target

Target	CPT187		
Position	402 111.000 m E, 6 207 660.000 m N		
Range	1.74 m Grid		
Bearing To	144.6° G	Bearing From	324.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	402 109.994 m E, 6 207 661.414 m N , -24.151 m MSS
Heading	73.9° T, 75.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT128-v113
Start Time	21 Nov 2023, 06:20:32+01:00
End Time	21 Nov 2023, 06:23:36+01:00
Session Length	3m 4s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 00.32404" N	56° 00' 00.34363" N
Longitude	007° 23' 44.53789" E	007° 23' 44.56936" E
Height	17.632 m Ell., -23.497 m ISS	17.658 m Ell., -23.577 m Ort.
Easting	399 948.749 m E (± 0.04 m)	
Northing	6 207 250.987 m N (± 0.08 m)	
Height	-23.129 m MSS (± 0.20 m) , -23.497 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	74.0° T, 75.3° G	± 4.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.9 m, USBL= 23.2 m

Table 5: Mean Position to Target

Target	CPT128		
Position	399 950.000 m E, 6 207 250.000 m N		
Range	1.59 m Grid		
Bearing To	128.3° G	Bearing From	308.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	399 948.749 m E, 6 207 250.987 m N , -23.129 m MSS
Heading	74.0° T, 75.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT288-v115
Start Time	21 Nov 2023, 08:11:54+01:00
End Time	21 Nov 2023, 08:14:04+01:00
Session Length	2m 10s (106 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 29.72347" N	55° 59' 29.74306" N
Longitude	007° 20' 12.06344" E	007° 20' 12.09488" E
Height	12.129 m Ell., -29.178 m ISS	12.155 m Ell., -29.088 m Ort.
Easting	396 245.556 m E (± 0.11 m)	
Northing	6 206 392.122 m N (± 0.09 m)	
Height	-28.634 m MSS (± 0.28 m) , -29.178 m ISS (± 0.24 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	99.8° T, 101.2° G	± 4.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.5 m, USBL= 28.7 m

Table 5: Mean Position to Target

Target	CPT288		
Position	396 247.000 m E, 6 206 390.000 m N		
Range	2.57 m Grid		
Bearing To	145.8° G	Bearing From	325.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	106 of 120
Position	396 245.556 m E, 6 206 392.122 m N , -28.634 m MSS
Heading	99.8° T, 101.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT169-v117
Start Time	21 Nov 2023, 10:03:31+01:00
End Time	21 Nov 2023, 10:06:21+01:00
Session Length	2m 50s (99 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 22.98243" N	56° 00' 23.00202" N
Longitude	007° 22' 33.10489" E	007° 22' 33.13634" E
Height	17.820 m Ell., -23.268 m ISS	17.846 m Ell., -23.393 m Ort.
Easting	398 727.866 m E (± 0.04 m)	
Northing	6 207 980.295 m N (± 0.04 m)	
Height	-22.942 m MSS (± 0.20 m) , -23.268 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	92.3° T, 93.7° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.8 m, USBL= 23.0 m

Table 5: Mean Position to Target

Target	CPT169		
Position	398 728.000 m E, 6 207 980.000 m N		
Range	0.32 m Grid		
Bearing To	155.6° G	Bearing From	335.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	99 of 120
Position	398 727.866 m E, 6 207 980.295 m N , -22.942 m MSS
Heading	92.3° T, 93.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT396-v118
Start Time	21 Nov 2023, 12:24:29+01:00
End Time	21 Nov 2023, 12:27:09+01:00
Session Length	2m 41s (111 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 40.26092" N	56° 00' 40.28050" N
Longitude	007° 29' 05.55417" E	007° 29' 05.58568" E
Height	17.180 m Ell., -23.571 m ISS	17.206 m Ell., -24.010 m Ort.
Easting	405 536.449 m E (± 0.04 m)	
Northing	6 208 359.988 m N (± 0.05 m)	
Height	-23.564 m MSS (± 0.19 m) , -23.571 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	72.3° T, 73.5° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.3 m, USBL= 23.6 m

Table 5: Mean Position to Target

Target	CPT396		
Position	405 536.000 m E, 6 208 360.000 m N		
Range	0.45 m Grid		
Bearing To	271.6° G	Bearing From	91.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	111 of 120
Position	405 536.449 m E, 6 208 359.988 m N , -23.564 m MSS
Heading	72.3° T, 73.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT054-v119
Start Time	21 Nov 2023, 15:01:04+01:00
End Time	21 Nov 2023, 15:03:56+01:00
Session Length	2m 52s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 50.80012" N	56° 00' 50.81971" N
Longitude	007° 30' 14.84917" E	007° 30' 14.88069" E
Height	17.124 m Ell., -23.451 m ISS	17.150 m Ell., -24.062 m Ort.
Easting	406 743.495 m E (± 0.05 m)	
Northing	6 208 659.626 m N (± 0.07 m)	
Height	-23.616 m MSS (± 0.16 m) , -23.451 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	58.0° T, 59.3° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.4 m, USBL= 23.6 m

Table 5: Mean Position to Target

Target	CPT054		
Position	406 744.000 m E, 6 208 660.000 m N		
Range	0.63 m Grid		
Bearing To	53.5° G	Bearing From	233.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	406 743.495 m E, 6 208 659.626 m N , -23.616 m MSS
Heading	58.0° T, 59.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT321-v121
Start Time	21 Nov 2023, 17:11:39+01:00
End Time	21 Nov 2023, 17:14:21+01:00
Session Length	2m 42s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 33.56086" N	56° 00' 33.58044" N
Longitude	007° 32' 21.16588" E	007° 32' 21.19741" E
Height	17.213 m Ell., -23.316 m ISS	17.239 m Ell., -23.964 m Ort.
Easting	408 919.518 m E (± 0.05 m)	
Northing	6 208 079.917 m N (± 0.07 m)	
Height	-23.518 m MSS (± 0.17 m) , -23.316 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	68.4° T, 69.7° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.3 m, USBL= 23.5 m

Table 5: Mean Position to Target

Target	CPT321		
Position	408 920.000 m E, 6 208 080.000 m N		
Range	0.49 m Grid		
Bearing To	80.2° G	Bearing From	260.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	408 919.518 m E, 6 208 079.917 m N , -23.518 m MSS
Heading	68.4° T, 69.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT330-v122
Start Time	21 Nov 2023, 18:50:52+01:00
End Time	21 Nov 2023, 18:53:16+01:00
Session Length	2m 24s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 50.80583" N	55° 59' 50.82541" N
Longitude	007° 30' 55.39076" E	007° 30' 55.42228" E
Height	17.957 m Ell., -22.813 m ISS	17.983 m Ell., -23.226 m Ort.
Easting	407 405.659 m E (± 0.04 m)	
Northing	6 206 789.935 m N (± 0.05 m)	
Height	-22.778 m MSS (± 0.16 m) , -22.813 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	62.7° T, 64.0° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.6 m, USBL= 22.8 m

Table 5: Mean Position to Target

Target	CPT330		
Position	407 407.000 m E, 6 206 790.000 m N		
Range	1.34 m Grid		
Bearing To	87.2° G	Bearing From	267.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	407 405.659 m E, 6 206 789.935 m N , -22.778 m MSS
Heading	62.7° T, 64.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT063-v123
Start Time	21 Nov 2023, 21:10:33+01:00
End Time	21 Nov 2023, 21:13:02+01:00
Session Length	2m 29s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 58' 51.93764" N	55° 58' 51.95722" N
Longitude	007° 31' 51.56101" E	007° 31' 51.59254" E
Height	17.873 m Ell., -23.153 m ISS	17.898 m Ell., -23.306 m Ort.
Easting	408 340.034 m E (± 0.09 m)	
Northing	6 204 949.401 m N (± 0.04 m)	
Height	-22.856 m MSS (± 0.19 m) , -23.153 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	138.4° T, 139.7° G	± 3.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.7 m, USBL= 22.8 m

Table 5: Mean Position to Target

Target	CPT063		
Position	408 340.000 m E, 6 204 950.000 m N		
Range	0.60 m Grid		
Bearing To	356.8° G	Bearing From	176.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	408 340.034 m E, 6 204 949.401 m N , -22.856 m MSS
Heading	138.4° T, 139.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT269-v125
Start Time	22 Nov 2023, 00:25:24+01:00
End Time	22 Nov 2023, 00:28:25+01:00
Session Length	3m 1s (105 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 58' 43.90922" N	55° 58' 43.92879" N
Longitude	007° 35' 07.10366" E	007° 35' 07.13521" E
Height	17.281 m Ell., -23.411 m ISS	17.306 m Ell., -23.884 m Ort.
Easting	411 723.864 m E (± 0.06 m)	
Northing	6 204 630.523 m N (± 0.05 m)	
Height	-23.436 m MSS (± 0.15 m) , -23.411 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	169.2° T, 170.4° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.3 m, USBL= 23.5 m

Table 5: Mean Position to Target

Target	CPT269		
Position	411 724.000 m E, 6 204 630.000 m N		
Range	0.54 m Grid		
Bearing To	165.5° G	Bearing From	345.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	105 of 120
Position	411 723.864 m E, 6 204 630.523 m N , -23.436 m MSS
Heading	169.2° T, 170.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT069-v126
Start Time	22 Nov 2023, 02:04:23+01:00
End Time	22 Nov 2023, 02:06:40+01:00
Session Length	2m 18s (112 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 35.14398" N	55° 57' 35.16356" N
Longitude	007° 34' 51.77346" E	007° 34' 51.80501" E
Height	18.257 m Ell., -22.242 m ISS	18.282 m Ell., -22.908 m Ort.
Easting	411 414.527 m E (± 0.04 m)	
Northing	6 202 510.284 m N (± 0.05 m)	
Height	-22.463 m MSS (± 0.16 m) , -22.242 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	205.6° T, 206.8° G	± 2.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.3 m, USBL= 22.5 m

Table 5: Mean Position to Target

Target	CPT069		
Position	411 414.000 m E, 6 202 510.000 m N		
Range	0.60 m Grid		
Bearing To	241.7° G	Bearing From	61.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	112 of 120
Position	411 414.527 m E, 6 202 510.284 m N , -22.463 m MSS
Heading	205.6° T, 206.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT332-v127
Start Time	22 Nov 2023, 03:36:36+01:00
End Time	22 Nov 2023, 03:38:58+01:00
Session Length	2m 23s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 27.30216" N	55° 56' 27.32174" N
Longitude	007° 38' 48.01809" E	007° 38' 48.04966" E
Height	17.198 m Ell., -23.300 m ISS	17.224 m Ell., -23.950 m Ort.
Easting	415 470.076 m E (± 0.04 m)	
Northing	6 200 330.986 m N (± 0.05 m)	
Height	-23.506 m MSS (± 0.16 m) , -23.300 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	210.2° T, 211.3° G	± 3.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.3 m, USBL= 23.5 m

Table 5: Mean Position to Target

Target	CPT332		
Position	415 469.000 m E, 6 200 330.000 m N		
Range	1.46 m Grid		
Bearing To	227.5° G	Bearing From	47.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	415 470.076 m E, 6 200 330.986 m N , -23.506 m MSS
Heading	210.2° T, 211.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT276-v128
Start Time	22 Nov 2023, 06:13:04+01:00
End Time	22 Nov 2023, 06:15:36+01:00
Session Length	2m 32s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 31.56825" N	55° 55' 31.58783" N
Longitude	007° 40' 10.65558" E	007° 40' 10.68716" E
Height	17.328 m Ell., -23.484 m ISS	17.354 m Ell., -23.815 m Ort.
Easting	416 870.613 m E (± 0.04 m)	
Northing	6 198 580.290 m N (± 0.07 m)	
Height	-23.383 m MSS (± 0.16 m) , -23.484 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	206.0° T, 207.1° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.1 m, USBL= 23.4 m

Table 5: Mean Position to Target

Target	CPT276		
Position	416 870.000 m E, 6 198 580.000 m N		
Range	0.68 m Grid		
Bearing To	244.6° G	Bearing From	64.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	416 870.613 m E, 6 198 580.290 m N , -23.383 m MSS
Heading	206.0° T, 207.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT053-v129
Start Time	26 Nov 2023, 09:49:23+01:00
End Time	26 Nov 2023, 09:51:36+01:00
Session Length	2m 13s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 53.22242" N	56° 00' 53.24201" N
Longitude	007° 22' 19.40488" E	007° 22' 19.43634" E
Height	17.577 m Ell., -23.492 m ISS	17.603 m Ell., -23.637 m Ort.
Easting	398 512.624 m E (± 0.04 m)	
Northing	6 208 920.637 m N (± 0.05 m)	
Height	-23.185 m MSS (± 0.21 m) , -23.492 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	227.5° T, 228.9° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.8 m, USBL= 23.2 m

Table 5: Mean Position to Target

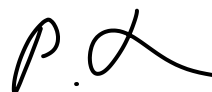
Target	SCPT053		
Position	398 511.000 m E, 6 208 920.000 m N		
Range	1.74 m Grid		
Bearing To	248.6° G	Bearing From	68.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	398 512.624 m E, 6 208 920.637 m N , -23.185 m MSS
Heading	227.5° T, 228.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT089-v131
Start Time	26 Nov 2023, 14:48:48+01:00
End Time	26 Nov 2023, 14:50:57+01:00
Session Length	2m 9s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 43.38177" N	55° 53' 43.40136" N
Longitude	007° 26' 37.03821" E	007° 26' 37.06968" E
Height	15.870 m Ell., -25.571 m ISS	15.896 m Ell., -25.315 m Ort.
Easting	402 674.479 m E (± 0.08 m)	
Northing	6 195 530.829 m N (± 0.09 m)	
Height	-24.871 m MSS (± 0.23 m) , -25.571 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	193.1° T, 194.4° G	± 3.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.6 m, USBL= 24.9 m

Table 5: Mean Position to Target

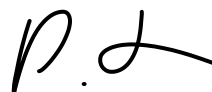
Target	SCPT089		
Position	402 674.000 m E, 6 195 530.000 m N		
Range	0.96 m Grid		
Bearing To	210.0° G	Bearing From	30.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	402 674.479 m E, 6 195 530.829 m N , -24.871 m MSS
Heading	193.1° T, 194.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT117-v132
Start Time	26 Nov 2023, 18:42:34+01:00
End Time	26 Nov 2023, 18:44:43+01:00
Session Length	2m 10s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 48' 49.42784" N	55° 48' 49.44744" N
Longitude	007° 15' 10.86643" E	007° 15' 10.89779" E
Height	11.989 m Ell., -28.745 m ISS	12.015 m Ell., -29.159 m Ort.
Easting	390 527.362 m E (± 0.06 m)	
Northing	6 186 729.300 m N (± 0.04 m)	
Height	-28.713 m MSS (± 0.18 m) , -28.745 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	324.1° T, 325.6° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.4 m, USBL= 28.7 m

Table 5: Mean Position to Target

Target	SCPT117		
Position	390 528.000 m E, 6 186 730.000 m N		
Range	0.95 m Grid		
Bearing To	42.4° G	Bearing From	222.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	390 527.362 m E, 6 186 729.300 m N , -28.713 m MSS
Heading	324.1° T, 325.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT117A-v133
Start Time	26 Nov 2023, 20:56:22+01:00
End Time	26 Nov 2023, 20:58:30+01:00
Session Length	2m 9s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 48' 49.55085" N	55° 48' 49.57045" N
Longitude	007° 15' 10.91824" E	007° 15' 10.94960" E
Height	11.966 m Ell., -28.912 m ISS	11.992 m Ell., -29.182 m Ort.
Easting	390 528.360 m E (± 0.10 m)	
Northing	6 186 733.080 m N (± 0.10 m)	
Height	-28.737 m MSS (± 0.18 m) , -28.912 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	325.5° T, 327.0° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.5 m, USBL= 28.8 m

Table 5: Mean Position to Target

Target	SCPT117		
Position	390 528.000 m E, 6 186 730.000 m N		
Range	3.10 m Grid		
Bearing To	186.7° G	Bearing From	6.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	390 528.360 m E, 6 186 733.080 m N , -28.737 m MSS
Heading	325.5° T, 327.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT103-v134
Start Time	27 Nov 2023, 01:30:17+01:00
End Time	27 Nov 2023, 01:32:34+01:00
Session Length	2m 17s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 51' 16.19503" N	55° 51' 16.21464" N
Longitude	007° 04' 53.22601" E	007° 04' 53.25730" E
Height	8.819 m Ell., -32.602 m ISS	8.845 m Ell., -32.409 m Ort.
Easting	379 903.467 m E (± 0.03 m)	
Northing	6 191 550.222 m N (± 0.04 m)	
Height	-31.940 m MSS (± 0.15 m) , -32.602 m ISS (± 0.06 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	171.6° T, 173.2° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.7 m, USBL= 32.0 m

Table 5: Mean Position to Target

Target	SCPT103		
Position	379 903.000 m E, 6 191 550.000 m N		
Range	0.52 m Grid		
Bearing To	244.6° G	Bearing From	64.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	379 903.467 m E, 6 191 550.222 m N , -31.940 m MSS
Heading	171.6° T, 173.2° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT103A-v135
Start Time	27 Nov 2023, 03:30:41+01:00
End Time	27 Nov 2023, 03:32:43+01:00
Session Length	2m 2s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 51' 16.07379" N	55° 51' 16.09340" N
Longitude	007° 04' 53.21479" E	007° 04' 53.24608" E
Height	8.765 m Ell., -32.466 m ISS	8.791 m Ell., -32.464 m Ort.
Easting	379 903.168 m E (± 0.04 m)	
Northing	6 191 546.480 m N (± 0.04 m)	
Height	-31.995 m MSS (± 0.15 m) , -32.466 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	168.6° T, 170.2° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.7 m, USBL= 32.0 m

Table 5: Mean Position to Target

Target	SCPT103		
Position	379 903.000 m E, 6 191 550.000 m N		
Range	3.52 m Grid		
Bearing To	357.3° G	Bearing From	177.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	379 903.168 m E, 6 191 546.480 m N , -31.995 m MSS
Heading	168.6° T, 170.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT056-v135
Start Time	28 Nov 2023, 07:35:07+01:00
End Time	28 Nov 2023, 07:37:34+01:00
Session Length	2m 27s (112 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 40.13406" N	55° 59' 40.15367" N
Longitude	007° 05' 03.38848" E	007° 05' 03.41979" E
Height	7.865 m Ell., -32.875 m ISS	7.892 m Ell., -33.402 m Ort.
Easting	380 511.694 m E (± 0.08 m)	
Northing	6 207 121.634 m N (± 0.06 m)	
Height	-32.932 m MSS (± 0.18 m) , -32.875 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	96.8° T, 98.4° G	± 3.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 32.6 m, USBL= 33.0 m

Table 5: Mean Position to Target

Target	SCPT056		
Position	380 512.000 m E, 6 207 120.000 m N		
Range	1.66 m Grid		
Bearing To	169.4° G	Bearing From	349.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	112 of 120
Position	380 511.694 m E, 6 207 121.634 m N , -32.932 m MSS
Heading	96.8° T, 98.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT056A-v136
Start Time	28 Nov 2023, 08:14:43+01:00
End Time	28 Nov 2023, 08:16:52+01:00
Session Length	2m 9s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 39.95067" N	55° 59' 39.97028" N
Longitude	007° 05' 03.45213" E	007° 05' 03.48344" E
Height	7.835 m Ell., -32.944 m ISS	7.861 m Ell., -33.432 m Ort.
Easting	380 512.639 m E (± 0.05 m)	
Northing	6 207 115.935 m N (± 0.04 m)	
Height	-32.962 m MSS (± 0.19 m) , -32.944 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	92.1° T, 93.7° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 32.6 m, USBL= 32.9 m

Table 5: Mean Position to Target

Target	SCPT056		
Position	380 512.000 m E, 6 207 120.000 m N		
Range	4.12 m Grid		
Bearing To	351.1° G	Bearing From	171.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	380 512.639 m E, 6 207 115.935 m N , -32.962 m MSS
Heading	92.1° T, 93.7° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT048-v137
Start Time	28 Nov 2023, 11:33:26+01:00
End Time	28 Nov 2023, 11:35:30+01:00
Session Length	2m 4s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 01' 26.63798" N	56° 01' 26.65758" N
Longitude	007° 14' 11.48443" E	007° 14' 11.51582" E
Height	14.008 m Ell., -27.023 m ISS	14.034 m Ell., -27.222 m Ort.
Easting	390 090.683 m E (± 0.05 m)	
Northing	6 210 160.913 m N (± 0.05 m)	
Height	-26.761 m MSS (± 0.22 m) , -27.023 m ISS (± 0.18 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	89.4° T, 90.9° G	± 1.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.5 m, USBL= 26.8 m

Table 5: Mean Position to Target

Target	SCPT048		
Position	390 091.000 m E, 6 210 160.000 m N		
Range	0.97 m Grid		
Bearing To	160.9° G	Bearing From	340.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	390 090.683 m E, 6 210 160.913 m N , -26.761 m MSS
Heading	89.4° T, 90.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT031-v138
Start Time	28 Nov 2023, 14:50:02+01:00
End Time	28 Nov 2023, 14:52:05+01:00
Session Length	2m 2s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 53.12993" N	56° 04' 53.14953" N
Longitude	007° 05' 37.17417" E	007° 05' 37.20551" E
Height	10.701 m Ell., -30.787 m ISS	10.727 m Ell., -30.569 m Ort.
Easting	381 364.051 m E (± 0.03 m)	
Northing	6 216 780.047 m N (± 0.03 m)	
Height	-30.095 m MSS (± 0.21 m) , -30.787 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	120.8° T, 122.4° G	± 1.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.8 m, USBL= 30.1 m

Table 5: Mean Position to Target

Target	SCPT031		
Position	381 364.000 m E, 6 216 780.000 m N		
Range	0.07 m Grid		
Bearing To	227.3° G	Bearing From	47.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	381 364.051 m E, 6 216 780.047 m N , -30.095 m MSS
Heading	120.8° T, 122.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT002-v139
Start Time	28 Nov 2023, 18:38:53+01:00
End Time	28 Nov 2023, 18:40:57+01:00
Session Length	2m 3s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 11' 45.91275" N	56° 11' 45.93234" N
Longitude	007° 16' 38.96174" E	007° 16' 38.99318" E
Height	10.885 m Ell., -30.213 m ISS	10.911 m Ell., -30.311 m Ort.
Easting	393 121.472 m E (± 0.05 m)	
Northing	6 229 239.011 m N (± 0.05 m)	
Height	-29.839 m MSS (± 0.19 m) , -30.213 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	133.7° T, 135.2° G	± 1.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.4 m, USBL= 29.8 m

Table 5: Mean Position to Target

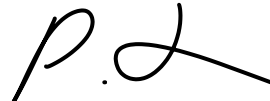
Target	SCPT002		
Position	393 122.000 m E, 6 229 240.000 m N		
Range	1.12 m Grid		
Bearing To	28.1° G	Bearing From	208.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	393 121.472 m E, 6 229 239.011 m N , -29.839 m MSS
Heading	133.7° T, 135.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT026-v140
Start Time	28 Nov 2023, 21:20:22+01:00
End Time	28 Nov 2023, 21:22:41+01:00
Session Length	2m 19s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 15.28163" N	56° 06' 15.30122" N
Longitude	007° 23' 25.09669" E	007° 23' 25.12817" E
Height	15.037 m Ell., -25.996 m ISS	15.063 m Ell., -26.162 m Ort.
Easting	399 882.188 m E (± 0.05 m)	
Northing	6 218 849.356 m N (± 0.05 m)	
Height	-25.694 m MSS (± 0.22 m) , -25.996 m ISS (± 0.18 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	103.7° T, 105.0° G	± 2.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.3 m, USBL= 25.7 m

Table 5: Mean Position to Target


Target	SCPT026		
Position	399 883.000 m E, 6 218 850.000 m N		
Range	1.04 m Grid		
Bearing To	51.6° G	Bearing From	231.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	399 882.188 m E, 6 218 849.356 m N , -25.694 m MSS
Heading	103.7° T, 105.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT026A-v141
Start Time	29 Nov 2023, 00:54:31+01:00
End Time	29 Nov 2023, 00:56:34+01:00
Session Length	2m 2s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 15.43828" N	56° 06' 15.45787" N
Longitude	007° 23' 25.23179" E	007° 23' 25.26327" E
Height	14.945 m Ell., -26.296 m ISS	14.971 m Ell., -26.254 m Ort.
Easting	399 884.635 m E (± 0.10 m)	
Northing	6 218 854.144 m N (± 0.08 m)	
Height	-25.786 m MSS (± 0.19 m) , -26.296 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	102.9° T, 104.3° G	± 3.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.4 m, USBL= 25.8 m

Table 5: Mean Position to Target

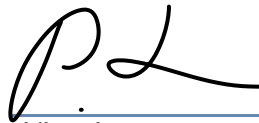
Target	SCPT026		
Position	399 883.000 m E, 6 218 850.000 m N		
Range	4.45 m Grid		
Bearing To	201.5° G	Bearing From	21.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	399 884.635 m E, 6 218 854.144 m N , -25.786 m MSS
Heading	102.9° T, 104.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT026B-v142
Start Time	29 Nov 2023, 02:01:57+01:00
End Time	29 Nov 2023, 02:04:00+01:00
Session Length	2m 4s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 15.18734" N	56° 06' 15.20693" N
Longitude	007° 23' 25.18565" E	007° 23' 25.21713" E
Height	15.016 m Ell., -26.442 m ISS	15.042 m Ell., -26.183 m Ort.
Easting	399 883.657 m E (± 0.06 m)	
Northing	6 218 846.405 m N (± 0.05 m)	
Height	-25.715 m MSS (± 0.19 m) , -26.442 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	95.5° T, 96.8° G	± 3.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.4 m, USBL= 25.7 m

Table 5: Mean Position to Target

Target	SCPT026		
Position	399 883.000 m E, 6 218 850.000 m N		
Range	3.65 m Grid		
Bearing To	349.6° G	Bearing From	169.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	399 883.657 m E, 6 218 846.405 m N , -25.715 m MSS
Heading	95.5° T, 96.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT026C-v143
Start Time	29 Nov 2023, 04:27:07+01:00
End Time	29 Nov 2023, 04:29:10+01:00
Session Length	2m 3s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 15.31234" N	56° 06' 15.33193" N
Longitude	007° 23' 24.89422" E	007° 23' 24.92570" E
Height	14.873 m Ell., -26.548 m ISS	14.899 m Ell., -26.326 m Ort.
Easting	399 878.713 m E (± 0.07 m)	
Northing	6 218 850.387 m N (± 0.06 m)	
Height	-25.858 m MSS (± 0.20 m) , -26.548 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	112.2° T, 113.6° G	± 4.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.4 m, USBL= 25.9 m

Table 5: Mean Position to Target

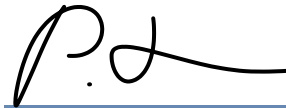
Target	SCPT026		
Position	399 883.000 m E, 6 218 850.000 m N		
Range	4.30 m Grid		
Bearing To	95.2° G	Bearing From	275.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	399 878.713 m E, 6 218 850.387 m N , -25.858 m MSS
Heading	112.2° T, 113.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT177-v144
Start Time	29 Nov 2023, 14:45:01+01:00
End Time	29 Nov 2023, 14:47:04+01:00
Session Length	2m 2s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 32.81632" N	56° 04' 32.83589" N
Longitude	007° 37' 20.07042" E	007° 37' 20.10201" E
Height	9.654 m Ell., -31.811 m ISS	9.680 m Ell., -31.490 m Ort.
Easting	414 243.561 m E (± 0.05 m)	
Northing	6 215 369.628 m N (± 0.09 m)	
Height	-31.024 m MSS (± 0.17 m) , -31.811 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	57.1° T, 58.3° G	± 2.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.7 m, USBL= 31.0 m

Table 5: Mean Position to Target

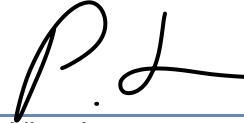
Target	CPT177		
Position	414 244.000 m E, 6 215 370.000 m N		
Range	0.58 m Grid		
Bearing To	49.7° G	Bearing From	229.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	414 243.561 m E, 6 215 369.628 m N , -31.024 m MSS
Heading	57.1° T, 58.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT176-v145
Start Time	29 Nov 2023, 16:43:36+01:00
End Time	29 Nov 2023, 16:45:59+01:00
Session Length	2m 23s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 16.82640" N	56° 03' 16.84598" N
Longitude	007° 35' 54.48142" E	007° 35' 54.51299" E
Height	12.951 m Ell., -28.562 m ISS	12.977 m Ell., -28.207 m Ort.
Easting	412 716.167 m E (± 0.04 m)	
Northing	6 213 050.355 m N (± 0.07 m)	
Height	-27.750 m MSS (± 0.18 m) , -28.562 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	59.7° T, 60.8° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.5 m, USBL= 27.8 m

Table 5: Mean Position to Target

Target	CPT176		
Position	412 717.000 m E, 6 213 050.000 m N		
Range	0.91 m Grid		
Bearing To	113.1° G	Bearing From	293.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	412 716.167 m E, 6 213 050.355 m N , -27.750 m MSS
Heading	59.7° T, 60.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT312-v146
Start Time	29 Nov 2023, 18:46:18+01:00
End Time	29 Nov 2023, 18:48:20+01:00
Session Length	2m 2s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 02' 07.40501" N	56° 02' 07.42459" N
Longitude	007° 35' 38.92121" E	007° 35' 38.95278" E
Height	14.345 m Ell., -26.897 m ISS	14.371 m Ell., -26.818 m Ort.
Easting	412 403.321 m E (± 0.03 m)	
Northing	6 210 909.828 m N (± 0.04 m)	
Height	-26.365 m MSS (± 0.20 m) , -26.897 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	51.6° T, 52.8° G	± 1.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.0 m, USBL= 26.4 m

Table 5: Mean Position to Target

Target	CPT312		
Position	412 405.000 m E, 6 210 910.000 m N		
Range	1.69 m Grid		
Bearing To	84.1° G	Bearing From	264.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	412 403.321 m E, 6 210 909.828 m N , -26.365 m MSS
Heading	51.6° T, 52.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT175-v147
Start Time	29 Nov 2023, 20:17:56+01:00
End Time	29 Nov 2023, 20:20:01+01:00
Session Length	2m 4s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 01' 01.09685" N	56° 01' 01.11642" N
Longitude	007° 35' 37.50108" E	007° 35' 37.53264" E
Height	15.269 m Ell., -25.629 m ISS	15.295 m Ell., -25.894 m Ort.
Easting	412 337.014 m E (± 0.05 m)	
Northing	6 208 860.573 m N (± 0.07 m)	
Height	-25.441 m MSS (± 0.20 m) , -25.629 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	59.1° T, 60.2° G	± 3.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.1 m, USBL= 25.4 m

Table 5: Mean Position to Target

Target	CPT175		
Position	412 338.000 m E, 6 208 860.000 m N		
Range	1.14 m Grid		
Bearing To	120.2° G	Bearing From	300.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	412 337.014 m E, 6 208 860.573 m N , -25.441 m MSS
Heading	59.1° T, 60.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT338-v148
Start Time	30 Nov 2023, 20:01:56+01:00
End Time	30 Nov 2023, 20:04:25+01:00
Session Length	2m 29s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 21.84765" N	56° 00' 21.86723" N
Longitude	007° 34' 55.67285" E	007° 34' 55.70440" E
Height	16.424 m Ell., -24.439 m ISS	16.450 m Ell., -24.742 m Ort.
Easting	411 587.866 m E (± 0.08 m)	
Northing	6 207 662.089 m N (± 0.08 m)	
Height	-24.289 m MSS (± 0.22 m) , -24.439 m ISS (± 0.18 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	79.5° T, 80.7° G	± 3.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.0 m, USBL= 24.3 m

Table 5: Mean Position to Target

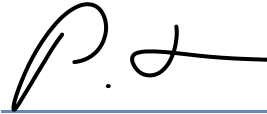
Target	CPT338		
Position	411 589.000 m E, 6 207 660.000 m N		
Range	2.38 m Grid		
Bearing To	151.5° G	Bearing From	331.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	411 587.866 m E, 6 207 662.089 m N , -24.289 m MSS
Heading	79.5° T, 80.7° G
Pitch	0.00 °
Roll	0.00 °



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Colin Jacobs
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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT060-v149
Start Time	30 Nov 2023, 22:27:32+01:00
End Time	30 Nov 2023, 22:29:53+01:00
Session Length	2m 21s (113 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 26.43652" N	55° 59' 26.45609" N
Longitude	007° 36' 18.00711" E	007° 36' 18.03868" E
Height	16.060 m Ell., -24.689 m ISS	16.086 m Ell., -25.100 m Ort.
Easting	412 979.292 m E (± 0.06 m)	
Northing	6 205 920.166 m N (± 0.06 m)	
Height	-24.640 m MSS (± 0.18 m) , -24.689 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	84.1° T, 85.2° G	± 2.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.4 m, USBL= 24.7 m

Table 5: Mean Position to Target

Target	CPT060		
Position	412 980.000 m E, 6 205 920.000 m N		
Range	0.73 m Grid		
Bearing To	103.2° G	Bearing From	283.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	113 of 120
Position	412 979.292 m E, 6 205 920.166 m N , -24.640 m MSS
Heading	84.1° T, 85.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT249-v150
Start Time	01 Dec 2023, 00:25:59+01:00
End Time	01 Dec 2023, 00:28:07+01:00
Session Length	2m 9s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 58' 12.55270" N	55° 58' 12.57227" N
Longitude	007° 39' 32.34260" E	007° 39' 32.37419" E
Height	14.677 m Ell., -26.222 m ISS	14.702 m Ell., -26.470 m Ort.
Easting	416 302.173 m E (± 0.06 m)	
Northing	6 203 569.564 m N (± 0.05 m)	
Height	-26.025 m MSS (± 0.20 m) , -26.222 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	92.7° T, 93.8° G	± 3.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.7 m, USBL= 26.0 m

Table 5: Mean Position to Target

Target	CPT249		
Position	416 302.000 m E, 6 203 570.000 m N		
Range	0.47 m Grid		
Bearing To	338.4° G	Bearing From	158.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	416 302.173 m E, 6 203 569.564 m N , -26.025 m MSS
Heading	92.7° T, 93.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT070-v153
Start Time	01 Dec 2023, 01:56:45+01:00
End Time	01 Dec 2023, 01:58:48+01:00
Session Length	2m 3s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 37.51839" N	55° 57' 37.53796" N
Longitude	007° 39' 17.46010" E	007° 39' 17.49168" E
Height	15.547 m Ell., -25.509 m ISS	15.573 m Ell., -25.600 m Ort.
Easting	416 023.096 m E (± 0.04 m)	
Northing	6 202 491.577 m N (± 0.05 m)	
Height	-25.161 m MSS (± 0.17 m) , -25.509 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	82.3° T, 83.5° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.9 m, USBL= 25.2 m

Table 5: Mean Position to Target

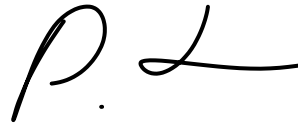
Target	CPT070		
Position	416 024.000 m E, 6 202 490.000 m N		
Range	1.82 m Grid		
Bearing To	150.2° G	Bearing From	330.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	416 023.096 m E, 6 202 491.577 m N , -25.161 m MSS
Heading	82.3° T, 83.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT382-v154
Start Time	01 Dec 2023, 08:01:01+01:00
End Time	01 Dec 2023, 08:03:23+01:00
Session Length	2m 22s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 19.29095" N	55° 57' 19.31052" N
Longitude	007° 41' 09.05409" E	007° 41' 09.08569" E
Height	14.716 m Ell., -26.265 m ISS	14.741 m Ell., -26.427 m Ort.
Easting	417 947.465 m E (± 0.05 m)	
Northing	6 201 890.899 m N (± 0.04 m)	
Height	-25.990 m MSS (± 0.18 m) , -26.265 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	81.3° T, 82.4° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.7 m, USBL= 26.0 m

Table 5: Mean Position to Target

Target	CPT382		
Position	417 947.000 m E, 6 201 890.000 m N		
Range	1.01 m Grid		
Bearing To	207.3° G	Bearing From	27.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	417 947.465 m E, 6 201 890.899 m N , -25.990 m MSS
Heading	81.3° T, 82.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT077-v155
Start Time	01 Dec 2023, 09:47:52+01:00
End Time	01 Dec 2023, 09:50:01+01:00
Session Length	2m 9s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 58.22504" N	55° 55' 58.24461" N
Longitude	007° 43' 27.21453" E	007° 43' 27.24614" E
Height	15.005 m Ell., -25.569 m ISS	15.031 m Ell., -26.133 m Ort.
Easting	420 297.304 m E (± 0.07 m)	
Northing	6 199 340.047 m N (± 0.10 m)	
Height	-25.705 m MSS (± 0.17 m) , -25.569 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	69.2° T, 70.2° G	± 3.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.4 m, USBL= 25.8 m

Table 5: Mean Position to Target

Target	CPT077		
Position	420 298.000 m E, 6 199 340.000 m N		
Range	0.70 m Grid		
Bearing To	93.8° G	Bearing From	273.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	420 297.304 m E, 6 199 340.047 m N , -25.705 m MSS
Heading	69.2° T, 70.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT329-v156
Start Time	01 Dec 2023, 11:15:29+01:00
End Time	01 Dec 2023, 11:17:32+01:00
Session Length	2m 3s (113 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 48.41046" N	55° 55' 48.43003" N
Longitude	007° 42' 16.75801" E	007° 42' 16.78961" E
Height	15.704 m Ell., -24.984 m ISS	15.730 m Ell., -25.435 m Ort.
Easting	419 069.003 m E (± 0.05 m)	
Northing	6 199 059.380 m N (± 0.06 m)	
Height	-25.014 m MSS (± 0.17 m) , -24.984 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	73.6° T, 74.7° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.8 m, USBL= 25.1 m

Table 5: Mean Position to Target

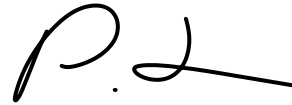
Target	CPT329		
Position	419 069.000 m E, 6 199 060.000 m N		
Range	0.62 m Grid		
Bearing To	359.7° G	Bearing From	179.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	113 of 120
Position	419 069.003 m E, 6 199 059.380 m N , -25.014 m MSS
Heading	73.6° T, 74.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT290 -v157
Start Time	01 Dec 2023, 13:44:19+01:00
End Time	01 Dec 2023, 13:46:23+01:00
Session Length	2m 5s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 04.54202" N	55° 54' 04.56160" N
Longitude	007° 41' 46.54863" E	007° 41' 46.58022" E
Height	17.887 m Ell., -23.002 m ISS	17.913 m Ell., -23.251 m Ort.
Easting	418 484.229 m E (± 0.11 m)	
Northing	6 195 858.397 m N (± 0.08 m)	
Height	-22.832 m MSS (± 0.19 m) , -23.002 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	66.6° T, 67.7° G	± 3.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.6 m, USBL= 22.9 m

Table 5: Mean Position to Target

Target	CPT290		
Position	418 485.000 m E, 6 195 860.000 m N		
Range	1.78 m Grid		
Bearing To	25.7° G	Bearing From	205.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	418 484.229 m E, 6 195 858.397 m N , -22.832 m MSS
Heading	66.6° T, 67.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT327-v158
Start Time	01 Dec 2023, 15:45:18+01:00
End Time	01 Dec 2023, 15:47:20+01:00
Session Length	2m 3s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 48.12886" N	55° 53' 48.14844" N
Longitude	007° 43' 51.76846" E	007° 43' 51.80007" E
Height	16.890 m Ell., -24.241 m ISS	16.916 m Ell., -24.247 m Ort.
Easting	420 649.605 m E (± 0.09 m)	
Northing	6 195 310.587 m N (± 0.05 m)	
Height	-23.816 m MSS (± 0.16 m) , -24.241 m ISS (± 0.08 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	66.4° T, 67.4° G	± 1.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.5 m, USBL= 23.8 m

Table 5: Mean Position to Target

Target	CPT327		
Position	420 650.000 m E, 6 195 310.000 m N		
Range	0.71 m Grid		
Bearing To	146.1° G	Bearing From	326.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	420 649.605 m E, 6 195 310.587 m N , -23.816 m MSS
Heading	66.4° T, 67.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT094-v159
Start Time	01 Dec 2023, 18:19:32+01:00
End Time	01 Dec 2023, 18:21:44+01:00
Session Length	2m 13s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 20.40656" N	55° 53' 20.42613" N
Longitude	007° 44' 32.89210" E	007° 44' 32.92370" E
Height	16.746 m Ell., -24.467 m ISS	16.772 m Ell., -24.391 m Ort.
Easting	421 348.306 m E (± 0.03 m)	
Northing	6 194 440.576 m N (± 0.05 m)	
Height	-23.962 m MSS (± 0.16 m) , -24.467 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	70.3° T, 71.3° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.6 m, USBL= 24.0 m

Table 5: Mean Position to Target

Target	CPT094		
Position	421 349.000 m E, 6 194 440.000 m N		
Range	0.90 m Grid		
Bearing To	129.7° G	Bearing From	309.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	421 348.306 m E, 6 194 440.576 m N , -23.962 m MSS
Heading	70.3° T, 71.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT227-v160
Start Time	01 Dec 2023, 19:34:31+01:00
End Time	01 Dec 2023, 19:36:34+01:00
Session Length	2m 2s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 23.86252" N	55° 52' 23.88209" N
Longitude	007° 45' 41.04542" E	007° 45' 41.07703" E
Height	16.098 m Ell., -24.965 m ISS	16.123 m Ell., -25.042 m Ort.
Easting	422 501.011 m E (± 0.05 m)	
Northing	6 192 671.294 m N (± 0.06 m)	
Height	-24.612 m MSS (± 0.18 m) , -24.965 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	77.6° T, 78.6° G	± 3.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.4 m, USBL= 24.7 m

Table 5: Mean Position to Target

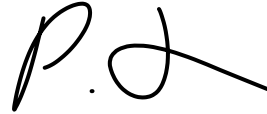
Target	CPT227		
Position	422 503.000 m E, 6 192 670.000 m N		
Range	2.37 m Grid		
Bearing To	123.0° G	Bearing From	303.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	422 501.011 m E, 6 192 671.294 m N , -24.612 m MSS
Heading	77.6° T, 78.6° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT102-v161
Start Time	01 Dec 2023, 22:32:03+01:00
End Time	01 Dec 2023, 22:34:05+01:00
Session Length	2m 2s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 51' 58.35291" N	55° 51' 58.37248" N
Longitude	007° 42' 39.34173" E	007° 42' 39.37331" E
Height	18.689 m Ell., -21.907 m ISS	18.715 m Ell., -22.445 m Ort.
Easting	419 328.410 m E (± 0.05 m)	
Northing	6 191 940.403 m N (± 0.05 m)	
Height	-22.021 m MSS (± 0.17 m) , -21.907 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	87.5° T, 88.6° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 21.6 m, USBL= 22.0 m

Table 5: Mean Position to Target

Target	CPT102		
Position	419 329.000 m E, 6 191 940.000 m N		
Range	0.71 m Grid		
Bearing To	124.4° G	Bearing From	304.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	419 328.410 m E, 6 191 940.403 m N , -22.021 m MSS
Heading	87.5° T, 88.6° G
Pitch	0.00 °
Roll	0.00 °



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Colin Jacobs
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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT272-v162
Start Time	02 Dec 2023, 02:58:42+01:00
End Time	02 Dec 2023, 03:00:46+01:00
Session Length	2m 4s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 51' 23.25751" N	55° 51' 23.27708" N
Longitude	007° 42' 25.95925" E	007° 42' 25.99083" E
Height	19.188 m Ell., -22.019 m ISS	19.214 m Ell., -21.945 m Ort.
Easting	419 075.524 m E (± 0.04 m)	
Northing	6 190 859.863 m N (± 0.03 m)	
Height	-21.522 m MSS (± 0.16 m) , -22.019 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	90.1° T, 91.2° G	± 2.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 21.2 m, USBL= 21.5 m

Table 5: Mean Position to Target

Target	CPT272		
Position	419 076.000 m E, 6 190 860.000 m N		
Range	0.50 m Grid		
Bearing To	73.9° G	Bearing From	253.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	419 075.524 m E, 6 190 859.863 m N , -21.522 m MSS
Heading	90.1° T, 91.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT298-v163
Start Time	02 Dec 2023, 04:29:58+01:00
End Time	02 Dec 2023, 04:32:01+01:00
Session Length	2m 3s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 51' 38.28309" N	55° 51' 38.30267" N
Longitude	007° 40' 05.60699" E	007° 40' 05.63856" E
Height	20.339 m Ell., -21.025 m ISS	20.365 m Ell., -20.795 m Ort.
Easting	416 644.176 m E (± 0.06 m)	
Northing	6 191 370.601 m N (± 0.04 m)	
Height	-20.369 m MSS (± 0.17 m) , -21.025 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	128.8° T, 129.9° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 20.2 m, USBL= 20.4 m

Table 5: Mean Position to Target


Target	CPT298		
Position	416 645.000 m E, 6 191 370.000 m N		
Range	1.02 m Grid		
Bearing To	126.1° G	Bearing From	306.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	416 644.176 m E, 6 191 370.601 m N , -20.369 m MSS
Heading	128.8° T, 129.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT101-v164
Start Time	02 Dec 2023, 07:08:10+01:00
End Time	02 Dec 2023, 07:10:38+01:00
Session Length	2m 28s (112 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 02.42056" N	55° 52' 02.44013" N
Longitude	007° 38' 56.22590" E	007° 38' 56.25746" E
Height	20.130 m Ell., -21.127 m ISS	20.155 m Ell., -21.007 m Ort.
Easting	415 452.557 m E (± 0.03 m)	
Northing	6 192 140.117 m N (± 0.02 m)	
Height	-20.580 m MSS (± 0.14 m) , -21.127 m ISS (± 0.05 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	165.9° T, 167.0° G	± 1.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 20.3 m, USBL= 20.6 m

Table 5: Mean Position to Target

Target	CPT101		
Position	415 453.000 m E, 6 192 140.000 m N		
Range	0.46 m Grid		
Bearing To	104.7° G	Bearing From	284.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	112 of 120
Position	415 452.557 m E, 6 192 140.117 m N , -20.580 m MSS
Heading	165.9° T, 167.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT334-v165
Start Time	02 Dec 2023, 08:51:53+01:00
End Time	02 Dec 2023, 08:53:56+01:00
Session Length	2m 3s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 18.92794" N	55° 53' 18.94752" N
Longitude	007° 40' 07.79656" E	007° 40' 07.82813" E
Height	19.094 m Ell., -21.891 m ISS	19.120 m Ell., -22.045 m Ort.
Easting	416 742.088 m E (± 0.06 m)	
Northing	6 194 481.022 m N (± 0.03 m)	
Height	-21.624 m MSS (± 0.17 m) , -21.891 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	160.4° T, 161.5° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 21.4 m, USBL= 21.7 m

Table 5: Mean Position to Target

Target	CPT334		
Position	416 742.000 m E, 6 194 480.000 m N		
Range	1.03 m Grid		
Bearing To	184.9° G	Bearing From	4.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	416 742.088 m E, 6 194 481.022 m N , -21.624 m MSS
Heading	160.4° T, 161.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT342-v166
Start Time	02 Dec 2023, 10:08:29+01:00
End Time	02 Dec 2023, 10:10:43+01:00
Session Length	2m 15s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 06.52966" N	55° 54' 06.54923" N
Longitude	007° 37' 48.97451" E	007° 37' 49.00606" E
Height	19.565 m Ell., -21.187 m ISS	19.591 m Ell., -21.582 m Ort.
Easting	414 359.548 m E (± 0.04 m)	
Northing	6 195 999.563 m N (± 0.03 m)	
Height	-21.148 m MSS (± 0.15 m) , -21.187 m ISS (± 0.06 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	164.6° T, 165.7° G	± 1.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 20.9 m, USBL= 21.2 m

Table 5: Mean Position to Target

Target	CPT342		
Position	414 359.000 m E, 6 196 000.000 m N		
Range	0.70 m Grid		
Bearing To	308.6° G	Bearing From	128.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	414 359.548 m E, 6 195 999.563 m N , -21.148 m MSS
Heading	164.6° T, 165.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT225-v129
Start Time	02 Dec 2023, 12:23:13+01:00
End Time	02 Dec 2023, 12:25:21+01:00
Session Length	2m 8s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 43.75867" N	55° 54' 43.77825" N
Longitude	007° 38' 17.80565" E	007° 38' 17.83721" E
Height	18.619 m Ell., -22.282 m ISS	18.644 m Ell., -22.528 m Ort.
Easting	414 882.897 m E (± 0.05 m)	
Northing	6 197 140.509 m N (± 0.04 m)	
Height	-22.089 m MSS (± 0.15 m) , -22.282 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	174.5° T, 175.6° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 21.8 m, USBL= 22.1 m

Table 5: Mean Position to Target

Target	CPT225		
Position	414 883.000 m E, 6 197 140.000 m N		
Range	0.52 m Grid		
Bearing To	168.6° G	Bearing From	348.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	414 882.897 m E, 6 197 140.509 m N , -22.089 m MSS
Heading	174.5° T, 175.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT280 -v130
Start Time	02 Dec 2023, 14:03:54+01:00
End Time	02 Dec 2023, 14:05:55+01:00
Session Length	2m 2s (113 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 45.71302" N	55° 53' 45.73260" N
Longitude	007° 35' 15.11731" E	007° 35' 15.14884" E
Height	20.234 m Ell., -20.718 m ISS	20.260 m Ell., -20.920 m Ort.
Easting	411 674.465 m E (± 0.06 m)	
Northing	6 195 409.811 m N (± 0.03 m)	
Height	-20.491 m MSS (± 0.15 m) , -20.718 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	160.2° T, 161.4° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 20.3 m, USBL= 20.5 m

Table 5: Mean Position to Target

Target	CPT280		
Position	411 675.000 m E, 6 195 410.000 m N		
Range	0.57 m Grid		
Bearing To	70.5° G	Bearing From	250.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	113 of 120
Position	411 674.465 m E, 6 195 409.811 m N , -20.491 m MSS
Heading	160.2° T, 161.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT220-v131
Start Time	02 Dec 2023, 16:08:53+01:00
End Time	02 Dec 2023, 16:11:08+01:00
Session Length	2m 15s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 03.60542" N	55° 52' 03.62500" N
Longitude	007° 34' 59.05683" E	007° 34' 59.08836" E
Height	20.262 m Ell., -20.881 m ISS	20.288 m Ell., -20.884 m Ort.
Easting	411 330.878 m E (± 0.06 m)	
Northing	6 192 259.183 m N (± 0.04 m)	
Height	-20.452 m MSS (± 0.18 m) , -20.881 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	171.0° T, 172.1° G	± 2.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 20.2 m, USBL= 20.5 m

Table 5: Mean Position to Target

Target	CPT220		
Position	411 331.000 m E, 6 192 260.000 m N		
Range	0.83 m Grid		
Bearing To	8.5° G	Bearing From	188.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	411 330.878 m E, 6 192 259.183 m N , -20.452 m MSS
Heading	171.0° T, 172.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT232-v132
Start Time	02 Dec 2023, 18:29:09+01:00
End Time	02 Dec 2023, 18:31:13+01:00
Session Length	2m 4s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 06.04692" N	55° 53' 06.06651" N
Longitude	007° 30' 21.19998" E	007° 30' 21.23147" E
Height	20.359 m Ell., -20.939 m ISS	20.385 m Ell., -20.810 m Ort.
Easting	406 542.994 m E (± 0.02 m)	
Northing	6 194 290.914 m N (± 0.06 m)	
Height	-20.369 m MSS (± 0.15 m) , -20.939 m ISS (± 0.05 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	160.5° T, 161.8° G	± 1.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 20.3 m, USBL= 20.4 m

Table 5: Mean Position to Target

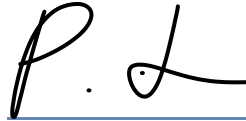
Target	CPT232		
Position	406 543.000 m E, 6 194 290.000 m N		
Range	0.91 m Grid		
Bearing To	179.6° G	Bearing From	359.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	406 542.994 m E, 6 194 290.914 m N , -20.369 m MSS
Heading	160.5° T, 161.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT250-v133
Start Time	02 Dec 2023, 20:56:19+01:00
End Time	02 Dec 2023, 20:58:22+01:00
Session Length	2m 3s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 51.06409" N	55° 53' 51.08367" N
Longitude	007° 31' 45.99835" E	007° 31' 46.02986" E
Height	20.303 m Ell., -20.746 m ISS	20.329 m Ell., -20.865 m Ort.
Easting	408 045.829 m E (± 0.04 m)	
Northing	6 195 650.903 m N (± 0.06 m)	
Height	-20.430 m MSS (± 0.15 m) , -20.746 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	198.9° T, 200.1° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 20.1 m, USBL= 20.4 m

Table 5: Mean Position to Target

Target	CPT250		
Position	408 045.000 m E, 6 195 650.000 m N		
Range	1.23 m Grid		
Bearing To	222.5° G	Bearing From	42.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	408 045.829 m E, 6 195 650.903 m N , -20.430 m MSS
Heading	198.9° T, 200.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT080-v134
Start Time	02 Dec 2023, 22:25:58+01:00
End Time	02 Dec 2023, 22:28:01+01:00
Session Length	2m 2s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 42.61901" N	55° 54' 42.63860" N
Longitude	007° 30' 10.19645" E	007° 30' 10.22795" E
Height	19.482 m Ell., -21.384 m ISS	19.508 m Ell., -21.696 m Ort.
Easting	406 416.429 m E (± 0.03 m)	
Northing	6 197 280.234 m N (± 0.05 m)	
Height	-21.254 m MSS (± 0.16 m) , -21.384 m ISS (± 0.08 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	205.6° T, 206.8° G	± 1.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 21.0 m, USBL= 21.3 m

Table 5: Mean Position to Target

Target	CPT080		
Position	406 417.000 m E, 6 197 280.000 m N		
Range	0.62 m Grid		
Bearing To	112.3° G	Bearing From	292.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	406 416.429 m E, 6 197 280.234 m N , -21.254 m MSS
Heading	205.6° T, 206.8° G
Pitch	0.00 °
Roll	0.00 °



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Client Representative
Energinet Eltransmission

Colin Jacobs
Client Representative
Energinet Eltransmission

Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT395-v136
Start Time	03 Dec 2023, 00:31:33+01:00
End Time	03 Dec 2023, 00:33:36+01:00
Session Length	2m 2s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 16.25707" N	55° 55' 16.27665" N
Longitude	007° 30' 09.76435" E	007° 30' 09.79585" E
Height	19.763 m Ell., -21.215 m ISS	19.789 m Ell., -21.417 m Ort.
Easting	406 431.437 m E (± 0.07 m)	
Northing	6 198 320.201 m N (± 0.07 m)	
Height	-20.976 m MSS (± 0.21 m) , -21.215 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	266.2° T, 267.4° G	± 3.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 20.9 m, USBL= 21.0 m

Table 5: Mean Position to Target

Target	CPT395		
Position	406 431.000 m E, 6 198 320.000 m N		
Range	0.48 m Grid		
Bearing To	245.3° G	Bearing From	65.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	406 431.437 m E, 6 198 320.201 m N , -20.976 m MSS
Heading	266.2° T, 267.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT275-v137
Start Time	03 Dec 2023, 02:04:31+01:00
End Time	03 Dec 2023, 02:06:34+01:00
Session Length	2m 3s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 33.78101" N	55° 56' 33.80060" N
Longitude	007° 31' 21.14260" E	007° 31' 21.17411" E
Height	19.748 m Ell., -21.413 m ISS	19.774 m Ell., -21.430 m Ort.
Easting	407 721.583 m E (± 0.04 m)	
Northing	6 200 689.957 m N (± 0.03 m)	
Height	-20.992 m MSS (± 0.16 m) , -21.413 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	253.7° T, 254.9° G	± 1.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 20.7 m, USBL= 21.0 m

Table 5: Mean Position to Target

Target	CPT275		
Position	407 721.000 m E, 6 200 690.000 m N		
Range	0.58 m Grid		
Bearing To	274.2° G	Bearing From	94.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	407 721.583 m E, 6 200 689.957 m N , -20.992 m MSS
Heading	253.7° T, 254.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT133-v139
Start Time	03 Dec 2023, 03:29:10+01:00
End Time	03 Dec 2023, 03:31:14+01:00
Session Length	2m 4s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 33.32406" N	55° 56' 33.34364" N
Longitude	007° 33' 29.71162" E	007° 33' 29.74315" E
Height	19.443 m Ell., -21.847 m ISS	19.468 m Ell., -21.726 m Ort.
Easting	409 951.693 m E (± 0.05 m)	
Northing	6 200 628.748 m N (± 0.04 m)	
Height	-21.285 m MSS (± 0.17 m) , -21.847 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	282.6° T, 283.8° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 21.0 m, USBL= 21.3 m

Table 5: Mean Position to Target

Target	CPT133		
Position	409 951.000 m E, 6 200 630.000 m N		
Range	1.43 m Grid		
Bearing To	331.0° G	Bearing From	151.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	409 951.693 m E, 6 200 628.748 m N , -21.285 m MSS
Heading	282.6° T, 283.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT074-v140
Start Time	03 Dec 2023, 04:58:49+01:00
End Time	03 Dec 2023, 05:00:52+01:00
Session Length	2m 3s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 13.60401" N	55° 56' 13.62359" N
Longitude	007° 32' 57.91584" E	007° 32' 57.94736" E
Height	19.091 m Ell., -22.361 m ISS	19.117 m Ell., -22.080 m Ort.
Easting	409 387.311 m E (± 0.08 m)	
Northing	6 200 030.700 m N (± 0.03 m)	
Height	-21.641 m MSS (± 0.20 m) , -22.361 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	124.6° T, 125.8° G	± 3.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 21.5 m, USBL= 21.7 m

Table 5: Mean Position to Target

Target	CPT074		
Position	409 388.000 m E, 6 200 030.000 m N		
Range	0.98 m Grid		
Bearing To	135.4° G	Bearing From	315.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	409 387.311 m E, 6 200 030.700 m N , -21.641 m MSS
Heading	124.6° T, 125.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT132-v141
Start Time	03 Dec 2023, 06:31:35+01:00
End Time	03 Dec 2023, 06:33:37+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 10.42747" N	55° 54' 10.44706" N
Longitude	007° 33' 35.21326" E	007° 33' 35.24478" E
Height	19.451 m Ell., -22.030 m ISS	19.476 m Ell., -21.711 m Ort.
Easting	409 955.149 m E (± 0.05 m)	
Northing	6 196 209.554 m N (± 0.03 m)	
Height	-21.279 m MSS (± 0.16 m) , -22.030 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	276.7° T, 277.9° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 20.9 m, USBL= 21.3 m

Table 5: Mean Position to Target

Target	CPT132		
Position	409 954.000 m E, 6 196 210.000 m N		
Range	1.23 m Grid		
Bearing To	291.2° G	Bearing From	111.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	409 955.149 m E, 6 196 209.554 m N , -21.279 m MSS
Heading	276.7° T, 277.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT081-v142
Start Time	03 Dec 2023, 08:46:44+01:00
End Time	03 Dec 2023, 08:48:45+01:00
Session Length	2m 2s (98 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 44.99623" N	55° 54' 45.01581" N
Longitude	007° 34' 20.33262" E	007° 34' 20.36415" E
Height	19.726 m Ell., -21.521 m ISS	19.752 m Ell., -21.435 m Ort.
Easting	410 760.738 m E (± 0.08 m)	
Northing	6 197 261.898 m N (± 0.06 m)	
Height	-21.001 m MSS (± 0.20 m) , -21.521 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	268.2° T, 269.3° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 20.8 m, USBL= 21.0 m

Table 5: Mean Position to Target

Target	CPT081		
Position	410 760.000 m E, 6 197 260.000 m N		
Range	2.04 m Grid		
Bearing To	201.2° G	Bearing From	21.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	98 of 120
Position	410 760.738 m E, 6 197 261.898 m N , -21.001 m MSS
Heading	268.2° T, 269.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT339-v143
Start Time	03 Dec 2023, 10:03:04+01:00
End Time	03 Dec 2023, 10:05:05+01:00
Session Length	2m 2s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 29.27213" N	55° 55' 29.29171" N
Longitude	007° 35' 45.13990" E	007° 35' 45.17144" E
Height	19.657 m Ell., -21.368 m ISS	19.683 m Ell., -21.501 m Ort.
Easting	412 260.909 m E (± 0.04 m)	
Northing	6 198 600.417 m N (± 0.05 m)	
Height	-21.067 m MSS (± 0.17 m) , -21.368 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	291.3° T, 292.5° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 20.8 m, USBL= 21.1 m

Table 5: Mean Position to Target

Target	CPT339		
Position	412 260.000 m E, 6 198 600.000 m N		
Range	1.00 m Grid		
Bearing To	245.4° G	Bearing From	65.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	412 260.909 m E, 6 198 600.417 m N , -21.067 m MSS
Heading	291.3° T, 292.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT086-v144
Start Time	03 Dec 2023, 12:26:03+01:00
End Time	03 Dec 2023, 12:28:05+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 28.42556" N	55° 54' 28.44514" N
Longitude	007° 40' 36.60275" E	007° 40' 36.63433" E
Height	18.180 m Ell., -22.687 m ISS	18.205 m Ell., -22.961 m Ort.
Easting	417 283.612 m E (± 0.05 m)	
Northing	6 196 619.757 m N (± 0.07 m)	
Height	-22.534 m MSS (± 0.20 m) , -22.687 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	259.3° T, 260.4° G	± 4.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.3 m, USBL= 22.6 m

Table 5: Mean Position to Target

Target	CPT086		
Position	417 283.000 m E, 6 196 620.000 m N		
Range	0.66 m Grid		
Bearing To	291.7° G	Bearing From	111.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	417 283.612 m E, 6 196 619.757 m N , -22.534 m MSS
Heading	259.3° T, 260.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT136-v146
Start Time	03 Dec 2023, 15:11:58+01:00
End Time	03 Dec 2023, 15:14:01+01:00
Session Length	2m 3s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 49' 11.84676" N	55° 49' 11.86634" N
Longitude	007° 43' 47.49015" E	007° 43' 47.52174" E
Height	18.456 m Ell., -22.491 m ISS	18.482 m Ell., -22.675 m Ort.
Easting	420 418.571 m E (± 0.05 m)	
Northing	6 186 771.410 m N (± 0.04 m)	
Height	-22.249 m MSS (± 0.18 m) , -22.491 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	263.6° T, 264.7° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.1 m, USBL= 22.3 m

Table 5: Mean Position to Target

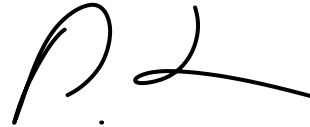
Target	CPT136		
Position	420 419.000 m E, 6 186 770.000 m N		
Range	1.47 m Grid		
Bearing To	163.1° G	Bearing From	343.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	420 418.571 m E, 6 186 771.410 m N , -22.249 m MSS
Heading	263.6° T, 264.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT107-v147
Start Time	03 Dec 2023, 18:29:39+01:00
End Time	03 Dec 2023, 18:31:45+01:00
Session Length	2m 6s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 50' 35.98414" N	55° 50' 36.00371" N
Longitude	007° 44' 54.81814" E	007° 44' 54.84974" E
Height	17.053 m Ell., -24.285 m ISS	17.078 m Ell., -24.084 m Ort.
Easting	421 637.310 m E (± 0.07 m)	
Northing	6 189 350.960 m N (± 0.14 m)	
Height	-23.657 m MSS (± 0.19 m) , -24.285 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	192.6° T, 193.6° G	± 5.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.5 m, USBL= 23.7 m

Table 5: Mean Position to Target

Target	CPT107		
Position	421 637.000 m E, 6 189 350.000 m N		
Range	1.01 m Grid		
Bearing To	197.9° G	Bearing From	17.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	421 637.310 m E, 6 189 350.960 m N , -23.657 m MSS
Heading	192.6° T, 193.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT100-v148
Start Time	03 Dec 2023, 21:26:33+01:00
End Time	03 Dec 2023, 21:28:40+01:00
Session Length	2m 7s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 14.61957" N	55° 52' 14.63914" N
Longitude	007° 48' 42.38956" E	007° 48' 42.42120" E
Height	16.149 m Ell., -24.999 m ISS	16.175 m Ell., -25.002 m Ort.
Easting	425 647.792 m E (± 0.04 m)	
Northing	6 192 330.307 m N (± 0.06 m)	
Height	-24.596 m MSS (± 0.17 m) , -24.999 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	230.9° T, 231.9° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.3 m, USBL= 24.6 m

Table 5: Mean Position to Target

Target	CPT100		
Position	425 648.000 m E, 6 192 330.000 m N		
Range	0.37 m Grid		
Bearing To	145.9° G	Bearing From	325.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	425 647.792 m E, 6 192 330.307 m N , -24.596 m MSS
Heading	230.9° T, 231.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT162-v149
Start Time	04 Dec 2023, 00:21:36+01:00
End Time	04 Dec 2023, 00:23:38+01:00
Session Length	2m 3s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 17.12974" N	55° 52' 17.14931" N
Longitude	007° 49' 10.72380" E	007° 49' 10.75544" E
Height	16.284 m Ell., -24.616 m ISS	16.310 m Ell., -24.870 m Ort.
Easting	426 141.587 m E (± 0.04 m)	
Northing	6 192 399.476 m N (± 0.08 m)	
Height	-24.463 m MSS (± 0.21 m) , -24.616 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	228.6° T, 229.6° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.2 m, USBL= 24.5 m

Table 5: Mean Position to Target

Target	CPT162		
Position	426 141.000 m E, 6 192 400.000 m N		
Range	0.79 m Grid		
Bearing To	311.7° G	Bearing From	131.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	426 141.587 m E, 6 192 399.476 m N , -24.463 m MSS
Heading	228.6° T, 229.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT336-v150
Start Time	04 Dec 2023, 02:18:44+01:00
End Time	04 Dec 2023, 02:21:09+01:00
Session Length	2m 25s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 20.33817" N	55° 53' 20.35774" N
Longitude	007° 48' 44.37067" E	007° 48' 44.40231" E
Height	15.998 m Ell., -25.001 m ISS	16.024 m Ell., -25.152 m Ort.
Easting	425 717.093 m E (± 0.05 m)	
Northing	6 194 361.265 m N (± 0.07 m)	
Height	-24.748 m MSS (± 0.20 m) , -25.001 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	189.9° T, 190.8° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.6 m, USBL= 24.8 m

Table 5: Mean Position to Target

Target	CPT336		
Position	425 716.000 m E, 6 194 360.000 m N		
Range	1.67 m Grid		
Bearing To	220.8° G	Bearing From	40.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	425 717.093 m E, 6 194 361.265 m N , -24.748 m MSS
Heading	189.9° T, 190.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT181-v161
Start Time	04 Dec 2023, 04:10:18+01:00
End Time	04 Dec 2023, 04:12:27+01:00
Session Length	2m 9s (60 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 11.63013" N	55° 55' 11.64970" N
Longitude	007° 45' 59.38696" E	007° 45' 59.41859" E
Height	14.951 m Ell., -26.199 m ISS	14.977 m Ell., -26.188 m Ort.
Easting	422 912.243 m E (± 0.09 m)	
Northing	6 197 851.756 m N (± 0.10 m)	
Height	-25.765 m MSS (± 0.24 m) , -26.199 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	190.0° T, 191.0° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.5 m, USBL= 26.0 m

Table 5: Mean Position to Target

Target	CPT181		
Position	422 911.000 m E, 6 197 850.000 m N		
Range	2.15 m Grid		
Bearing To	215.3° G	Bearing From	35.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	60 of 120
Position	422 912.243 m E, 6 197 851.756 m N , -25.765 m MSS
Heading	190.0° T, 191.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT180-v162
Start Time	04 Dec 2023, 20:09:38+01:00
End Time	04 Dec 2023, 20:11:41+01:00
Session Length	2m 3s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 58' 31.16969" N	55° 58' 31.18925" N
Longitude	007° 46' 04.33068" E	007° 46' 04.36232" E
Height	13.215 m Ell., -27.747 m ISS	13.241 m Ell., -27.916 m Ort.
Easting	423 107.980 m E (± 0.05 m)	
Northing	6 204 018.590 m N (± 0.04 m)	
Height	-27.477 m MSS (± 0.15 m) , -27.747 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	111.9° T, 112.9° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.3 m, USBL= 27.6 m

Table 5: Mean Position to Target

Target	CPT180		
Position	423 108.000 m E, 6 204 020.000 m N		
Range	1.41 m Grid		
Bearing To	0.8° G	Bearing From	180.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	423 107.980 m E, 6 204 018.590 m N , -27.477 m MSS
Heading	111.9° T, 112.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT062-v163
Start Time	04 Dec 2023, 22:04:07+01:00
End Time	04 Dec 2023, 22:06:35+01:00
Session Length	2m 28s (89 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 02.80095" N	55° 59' 02.82052" N
Longitude	007° 45' 51.20080" E	007° 45' 51.23244" E
Height	13.079 m Ell., -27.699 m ISS	13.104 m Ell., -28.050 m Ort.
Easting	422 897.871 m E (± 0.04 m)	
Northing	6 205 000.475 m N (± 0.03 m)	
Height	-27.614 m MSS (± 0.21 m) , -27.699 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	108.9° T, 109.9° G	± 1.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.2 m, USBL= 27.7 m

Table 5: Mean Position to Target

Target	CPT062		
Position	422 899.000 m E, 6 205 000.000 m N		
Range	1.23 m Grid		
Bearing To	112.8° G	Bearing From	292.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	89 of 120
Position	422 897.871 m E, 6 205 000.475 m N , -27.614 m MSS
Heading	108.9° T, 109.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT217-v165
Start Time	05 Dec 2023, 00:41:02+01:00
End Time	05 Dec 2023, 00:43:06+01:00
Session Length	2m 4s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 09.80079" N	56° 00' 09.82036" N
Longitude	007° 45' 52.59708" E	007° 45' 52.62872" E
Height	13.047 m Ell., -27.508 m ISS	13.073 m Ell., -28.076 m Ort.
Easting	422 959.094 m E (± 0.06 m)	
Northing	6 207 071.221 m N (± 0.04 m)	
Height	-27.639 m MSS (± 0.17 m) , -27.508 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	113.1° T, 114.1° G	± 2.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.5 m, USBL= 27.7 m

Table 5: Mean Position to Target

Target	CPT217		
Position	422 959.000 m E, 6 207 070.000 m N		
Range	1.22 m Grid		
Bearing To	184.4° G	Bearing From	4.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	422 959.094 m E, 6 207 071.221 m N , -27.639 m MSS
Heading	113.1° T, 114.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT335-v167
Start Time	05 Dec 2023, 02:13:34+01:00
End Time	05 Dec 2023, 02:15:37+01:00
Session Length	2m 3s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 01' 14.33472" N	56° 01' 14.35429" N
Longitude	007° 45' 40.17805" E	007° 45' 40.20969" E
Height	13.180 m Ell., -27.475 m ISS	13.206 m Ell., -27.937 m Ort.
Easting	422 779.746 m E (± 0.08 m)	
Northing	6 209 070.027 m N (± 0.07 m)	
Height	-27.496 m MSS (± 0.16 m) , -27.475 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	93.9° T, 94.9° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.3 m, USBL= 27.6 m

Table 5: Mean Position to Target

Target	CPT335		
Position	422 780.000 m E, 6 209 070.000 m N		
Range	0.25 m Grid		
Bearing To	96.2° G	Bearing From	276.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	422 779.746 m E, 6 209 070.027 m N , -27.496 m MSS
Heading	93.9° T, 94.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT047-v168
Start Time	05 Dec 2023, 04:02:28+01:00
End Time	05 Dec 2023, 04:04:31+01:00
Session Length	2m 3s (102 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 02' 13.64914" N	56° 02' 13.66871" N
Longitude	007° 44' 45.62233" E	007° 44' 45.65397" E
Height	13.242 m Ell., -27.463 m ISS	13.268 m Ell., -27.873 m Ort.
Easting	421 868.476 m E (± 0.07 m)	
Northing	6 210 920.673 m N (± 0.06 m)	
Height	-27.423 m MSS (± 0.18 m) , -27.463 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	105.3° T, 106.3° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.2 m, USBL= 27.5 m

Table 5: Mean Position to Target

Target	CPT047		
Position	421 869.000 m E, 6 210 920.000 m N		
Range	0.85 m Grid		
Bearing To	142.1° G	Bearing From	322.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	102 of 120
Position	421 868.476 m E, 6 210 920.673 m N , -27.423 m MSS
Heading	105.3° T, 106.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT292-v169
Start Time	05 Dec 2023, 06:10:58+01:00
End Time	05 Dec 2023, 06:13:03+01:00
Session Length	2m 5s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 16.44115" N	55° 56' 16.46072" N
Longitude	007° 45' 47.10456" E	007° 45' 47.13619" E
Height	14.339 m Ell., -26.674 m ISS	14.365 m Ell., -26.799 m Ort.
Easting	422 734.870 m E (± 0.05 m)	
Northing	6 199 859.059 m N (± 0.04 m)	
Height	-26.368 m MSS (± 0.16 m) , -26.674 m ISS (± 0.08 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	97.0° T, 98.0° G	± 2.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.1 m, USBL= 26.4 m

Table 5: Mean Position to Target

Target	CPT292		
Position	422 735.000 m E, 6 199 860.000 m N		
Range	0.95 m Grid		
Bearing To	7.9° G	Bearing From	187.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	422 734.870 m E, 6 199 859.059 m N , -26.368 m MSS
Heading	97.0° T, 98.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT379-v172
Start Time	05 Dec 2023, 07:59:06+01:00
End Time	05 Dec 2023, 08:01:09+01:00
Session Length	2m 2s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 43.17186" N	55° 57' 43.19142" N
Longitude	007° 44' 11.21374" E	007° 44' 11.24536" E
Height	13.500 m Ell., -27.545 m ISS	13.525 m Ell., -27.636 m Ort.
Easting	421 120.101 m E (± 0.06 m)	
Northing	6 202 570.234 m N (± 0.08 m)	
Height	-27.209 m MSS (± 0.18 m) , -27.545 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	98.8° T, 99.9° G	± 3.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.1 m, USBL= 27.2 m

Table 5: Mean Position to Target

Target	CPT379		
Position	421 121.000 m E, 6 202 570.000 m N		
Range	0.93 m Grid		
Bearing To	104.6° G	Bearing From	284.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	421 120.101 m E, 6 202 570.234 m N , -27.209 m MSS
Heading	98.8° T, 99.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT179-v174
Start Time	05 Dec 2023, 09:12:56+01:00
End Time	05 Dec 2023, 09:14:59+01:00
Session Length	2m 3s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 03.49738" N	55° 59' 03.51695" N
Longitude	007° 41' 52.36827" E	007° 41' 52.39987" E
Height	12.943 m Ell., -28.022 m ISS	12.969 m Ell., -28.195 m Ort.
Easting	418 759.329 m E (± 0.06 m)	
Northing	6 205 097.997 m N (± 0.04 m)	
Height	-27.750 m MSS (± 0.19 m) , -28.022 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	111.5° T, 112.6° G	± 3.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.6 m, USBL= 27.8 m

Table 5: Mean Position to Target

Target	CPT179		
Position	418 761.000 m E, 6 205 100.000 m N		
Range	2.61 m Grid		
Bearing To	39.8° G	Bearing From	219.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	418 759.329 m E, 6 205 097.997 m N , -27.750 m MSS
Heading	111.5° T, 112.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT303-v175
Start Time	05 Dec 2023, 10:32:50+01:00
End Time	05 Dec 2023, 10:34:53+01:00
Session Length	2m 3s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 45.24313" N	55° 59' 45.26270" N
Longitude	007° 42' 49.92519" E	007° 42' 49.95680" E
Height	12.533 m Ell., -28.249 m ISS	12.558 m Ell., -28.601 m Ort.
Easting	419 780.794 m E (± 0.03 m)	
Northing	6 206 369.804 m N (± 0.05 m)	
Height	-28.159 m MSS (± 0.17 m) , -28.249 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	97.7° T, 98.8° G	± 1.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.0 m, USBL= 28.2 m

Table 5: Mean Position to Target

Target	CPT303		
Position	419 781.000 m E, 6 206 370.000 m N		
Range	0.28 m Grid		
Bearing To	46.4° G	Bearing From	226.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	419 780.794 m E, 6 206 369.804 m N , -28.159 m MSS
Heading	97.7° T, 98.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT137-v176
Start Time	05 Dec 2023, 12:22:25+01:00
End Time	05 Dec 2023, 12:24:29+01:00
Session Length	2m 4s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 01' 33.70893" N	56° 01' 33.72850" N
Longitude	007° 42' 56.52459" E	007° 42' 56.55621" E
Height	13.297 m Ell., -27.240 m ISS	13.323 m Ell., -27.830 m Ort.
Easting	419 957.454 m E (± 0.05 m)	
Northing	6 209 720.688 m N (± 0.04 m)	
Height	-27.387 m MSS (± 0.15 m) , -27.240 m ISS (± 0.08 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	92.2° T, 93.3° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.2 m, USBL= 27.4 m

Table 5: Mean Position to Target

Target	CPT137		
Position	419 958.000 m E, 6 209 720.000 m N		
Range	0.88 m Grid		
Bearing To	141.5° G	Bearing From	321.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	419 957.454 m E, 6 209 720.688 m N , -27.387 m MSS
Heading	92.2° T, 93.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT356-v177
Start Time	05 Dec 2023, 14:04:22+01:00
End Time	05 Dec 2023, 14:06:24+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 02.01653" N	56° 00' 02.03610" N
Longitude	007° 40' 44.41232" E	007° 40' 44.44392" E
Height	12.712 m Ell., -27.815 m ISS	12.738 m Ell., -28.429 m Ort.
Easting	417 616.252 m E (± 0.04 m)	
Northing	6 206 929.337 m N (± 0.05 m)	
Height	-27.984 m MSS (± 0.17 m) , -27.815 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	94.4° T, 95.5° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.8 m, USBL= 28.0 m

Table 5: Mean Position to Target

Target	CPT356		
Position	417 618.000 m E, 6 206 930.000 m N		
Range	1.87 m Grid		
Bearing To	69.2° G	Bearing From	249.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	417 616.252 m E, 6 206 929.337 m N , -27.984 m MSS
Heading	94.4° T, 95.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT051-v178
Start Time	05 Dec 2023, 20:02:33+01:00
End Time	05 Dec 2023, 20:04:35+01:00
Session Length	2m 2s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 01' 22.48169" N	56° 01' 22.50127" N
Longitude	007° 38' 09.09644" E	007° 38' 09.12802" E
Height	12.383 m Ell., -28.540 m ISS	12.409 m Ell., -28.769 m Ort.
Easting	414 974.927 m E (± 0.04 m)	
Northing	6 209 469.006 m N (± 0.04 m)	
Height	-28.319 m MSS (± 0.16 m) , -28.540 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	80.0° T, 81.1° G	± 1.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.2 m, USBL= 28.3 m

Table 5: Mean Position to Target

Target	CPT051		
Position	414 976.000 m E, 6 209 470.000 m N		
Range	1.46 m Grid		
Bearing To	47.2° G	Bearing From	227.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	414 974.927 m E, 6 209 469.006 m N , -28.319 m MSS
Heading	80.0° T, 81.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT044-v179
Start Time	05 Dec 2023, 21:48:43+01:00
End Time	05 Dec 2023, 21:50:47+01:00
Session Length	2m 3s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 07.49366" N	56° 03' 07.51323" N
Longitude	007° 38' 56.25013" E	007° 38' 56.28173" E
Height	11.116 m Ell., -29.788 m ISS	11.142 m Ell., -30.026 m Ort.
Easting	415 854.767 m E (± 0.03 m)	
Northing	6 212 699.185 m N (± 0.06 m)	
Height	-29.575 m MSS (± 0.17 m) , -29.788 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	87.5° T, 88.7° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.4 m, USBL= 29.6 m

Table 5: Mean Position to Target

Target	CPT044		
Position	415 855.000 m E, 6 212 700.000 m N		
Range	0.85 m Grid		
Bearing To	16.0° G	Bearing From	196.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	415 854.767 m E, 6 212 699.185 m N , -29.575 m MSS
Heading	87.5° T, 88.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT219-v180
Start Time	05 Dec 2023, 23:15:52+01:00
End Time	05 Dec 2023, 23:18:13+01:00
Session Length	2m 21s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 17.45190" N	56° 04' 17.47148" N
Longitude	007° 39' 26.06773" E	007° 39' 26.09933" E
Height	10.630 m Ell., -30.081 m ISS	10.656 m Ell., -30.504 m Ort.
Easting	416 412.646 m E (± 0.08 m)	
Northing	6 214 851.746 m N (± 0.06 m)	
Height	-30.050 m MSS (± 0.28 m) , -30.081 m ISS (± 0.25 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	83.7° T, 84.8° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.9 m, USBL= 30.1 m

Table 5: Mean Position to Target

Target	CPT219		
Position	416 413.000 m E, 6 214 850.000 m N		
Range	1.78 m Grid		
Bearing To	168.5° G	Bearing From	348.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	416 412.646 m E, 6 214 851.746 m N , -30.050 m MSS
Heading	83.7° T, 84.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT052-v182
Start Time	06 Dec 2023, 01:14:08+01:00
End Time	06 Dec 2023, 01:16:13+01:00
Session Length	2m 5s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 01' 17.76498" N	56° 01' 17.78456" N
Longitude	007° 33' 33.41758" E	007° 33' 33.44913" E
Height	16.732 m Ell., -23.890 m ISS	16.758 m Ell., -24.441 m Ort.
Easting	410 199.280 m E (± 0.03 m)	
Northing	6 209 420.094 m N (± 0.05 m)	
Height	-23.994 m MSS (± 0.23 m) , -23.890 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	75.6° T, 76.8° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.9 m, USBL= 24.0 m

Table 5: Mean Position to Target

Target	CPT052		
Position	410 201.000 m E, 6 209 420.000 m N		
Range	1.72 m Grid		
Bearing To	93.1° G	Bearing From	273.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	410 199.280 m E, 6 209 420.094 m N , -23.994 m MSS
Heading	75.6° T, 76.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT156-v184
Start Time	06 Dec 2023, 02:48:05+01:00
End Time	06 Dec 2023, 02:50:07+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 02' 01.67646" N	56° 02' 01.69604" N
Longitude	007° 30' 44.87895" E	007° 30' 44.91047" E
Height	16.284 m Ell., -24.350 m ISS	16.310 m Ell., -24.901 m Ort.
Easting	407 310.669 m E (± 0.05 m)	
Northing	6 210 839.337 m N (± 0.08 m)	
Height	-24.443 m MSS (± 0.22 m) , -24.350 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	88.2° T, 89.5° G	± 3.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.3 m, USBL= 24.5 m

Table 5: Mean Position to Target

Target	CPT156		
Position	407 311.000 m E, 6 210 840.000 m N		
Range	0.74 m Grid		
Bearing To	26.6° G	Bearing From	206.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	407 310.669 m E, 6 210 839.337 m N , -24.443 m MSS
Heading	88.2° T, 89.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT234-v186
Start Time	06 Dec 2023, 04:51:07+01:00
End Time	06 Dec 2023, 04:53:10+01:00
Session Length	2m 2s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 02' 24.08524" N	56° 02' 24.10481" N
Longitude	007° 33' 33.60250" E	007° 33' 33.63405" E
Height	16.131 m Ell., -24.600 m ISS	16.157 m Ell., -25.040 m Ort.
Easting	410 245.242 m E (± 0.06 m)	
Northing	6 211 470.146 m N (± 0.06 m)	
Height	-24.584 m MSS (± 0.23 m) , -24.600 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	86.8° T, 88.0° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.5 m, USBL= 24.6 m

Table 5: Mean Position to Target

Target	CPT234		
Position	410 244.000 m E, 6 211 470.000 m N		
Range	1.25 m Grid		
Bearing To	263.3° G	Bearing From	83.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	410 245.242 m E, 6 211 470.146 m N , -24.584 m MSS
Heading	86.8° T, 88.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT394-v188
Start Time	06 Dec 2023, 06:51:01+01:00
End Time	06 Dec 2023, 06:53:11+01:00
Session Length	2m 11s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 07.63016" N	56° 04' 07.64974" N
Longitude	007° 34' 03.44008" E	007° 34' 03.47164" E
Height	14.830 m Ell., -26.075 m ISS	14.856 m Ell., -26.334 m Ort.
Easting	410 827.960 m E (± 0.04 m)	
Northing	6 214 660.245 m N (± 0.05 m)	
Height	-25.873 m MSS (± 0.19 m) , -26.075 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	77.9° T, 79.1° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.8 m, USBL= 25.9 m

Table 5: Mean Position to Target

Target	CPT394		
Position	410 828.000 m E, 6 214 660.000 m N		
Range	0.25 m Grid		
Bearing To	170.8° G	Bearing From	350.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	410 827.960 m E, 6 214 660.245 m N , -25.873 m MSS
Heading	77.9° T, 79.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT036-v189
Start Time	06 Dec 2023, 08:14:15+01:00
End Time	06 Dec 2023, 08:16:17+01:00
Session Length	2m 2s (107 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 41.98507" N	56° 04' 42.00464" N
Longitude	007° 34' 04.67035" E	007° 34' 04.70192" E
Height	13.520 m Ell., -27.496 m ISS	13.546 m Ell., -27.641 m Ort.
Easting	410 871.263 m E (± 0.05 m)	
Northing	6 215 721.805 m N (± 0.04 m)	
Height	-27.182 m MSS (± 0.19 m) , -27.496 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	92.6° T, 93.8° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.1 m, USBL= 27.2 m

Table 5: Mean Position to Target

Target	CPT036		
Position	410 872.000 m E, 6 215 720.000 m N		
Range	1.95 m Grid		
Bearing To	157.8° G	Bearing From	337.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	107 of 120
Position	410 871.263 m E, 6 215 721.805 m N , -27.182 m MSS
Heading	92.6° T, 93.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT268-v190
Start Time	06 Dec 2023, 09:36:53+01:00
End Time	06 Dec 2023, 09:39:24+01:00
Session Length	2m 31s (112 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 22.35598" N	56° 05' 22.37555" N
Longitude	007° 35' 01.21410" E	007° 35' 01.24567" E
Height	11.505 m Ell., -29.547 m ISS	11.531 m Ell., -29.647 m Ort.
Easting	411 874.359 m E (± 0.04 m)	
Northing	6 216 949.616 m N (± 0.06 m)	
Height	-29.183 m MSS (± 0.18 m) , -29.547 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	75.9° T, 77.1° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.1 m, USBL= 29.3 m

Table 5: Mean Position to Target

Target	CPT268		
Position	411 875.000 m E, 6 216 950.000 m N		
Range	0.75 m Grid		
Bearing To	59.1° G	Bearing From	239.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	112 of 120
Position	411 874.359 m E, 6 216 949.616 m N , -29.183 m MSS
Heading	75.9° T, 77.1° G
Pitch	0.00 °
Roll	0.00 °



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Colin Jacobs
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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT030-v191
Start Time	06 Dec 2023, 10:54:43+01:00
End Time	06 Dec 2023, 10:56:46+01:00
Session Length	2m 3s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 03.12677" N	56° 06' 03.14635" N
Longitude	007° 35' 57.49938" E	007° 35' 57.53096" E
Height	10.300 m Ell., -30.683 m ISS	10.326 m Ell., -30.842 m Ort.
Easting	412 872.678 m E (± 0.06 m)	
Northing	6 218 190.110 m N (± 0.07 m)	
Height	-30.380 m MSS (± 0.18 m) , -30.683 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	81.4° T, 82.5° G	± 3.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.3 m, USBL= 30.4 m

Table 5: Mean Position to Target

Target	CPT030		
Position	412 874.000 m E, 6 218 190.000 m N		
Range	1.33 m Grid		
Bearing To	94.8° G	Bearing From	274.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	412 872.678 m E, 6 218 190.110 m N , -30.380 m MSS
Heading	81.4° T, 82.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT370-v193
Start Time	06 Dec 2023, 12:29:20+01:00
End Time	06 Dec 2023, 12:31:23+01:00
Session Length	2m 3s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 14.14301" N	56° 06' 14.16258" N
Longitude	007° 37' 22.31608" E	007° 37' 22.34767" E
Height	9.374 m Ell., -31.401 m ISS	9.400 m Ell., -31.758 m Ort.
Easting	414 344.879 m E (± 0.04 m)	
Northing	6 218 501.165 m N (± 0.04 m)	
Height	-31.294 m MSS (± 0.16 m) , -31.401 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	79.8° T, 80.9° G	± 1.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.2 m, USBL= 31.3 m

Table 5: Mean Position to Target

Target	CPT370		
Position	414 345.000 m E, 6 218 500.000 m N		
Range	1.17 m Grid		
Bearing To	174.1° G	Bearing From	354.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	414 344.879 m E, 6 218 501.165 m N , -31.294 m MSS
Heading	79.8° T, 80.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT022-v194
Start Time	06 Dec 2023, 14:19:25+01:00
End Time	06 Dec 2023, 14:21:29+01:00
Session Length	2m 4s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 44.58891" N	56° 07' 44.60848" N
Longitude	007° 36' 13.85482" E	007° 36' 13.88641" E
Height	9.460 m Ell., -31.145 m ISS	9.486 m Ell., -31.665 m Ort.
Easting	413 218.716 m E (± 0.06 m)	
Northing	6 221 320.886 m N (± 0.07 m)	
Height	-31.208 m MSS (± 0.19 m) , -31.145 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	77.5° T, 78.7° G	± 3.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.1 m, USBL= 31.2 m

Table 5: Mean Position to Target

Target	CPT022		
Position	413 219.000 m E, 6 221 320.000 m N		
Range	0.93 m Grid		
Bearing To	162.2° G	Bearing From	342.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	413 218.716 m E, 6 221 320.886 m N , -31.208 m MSS
Heading	77.5° T, 78.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT172-v195
Start Time	06 Dec 2023, 16:38:19+01:00
End Time	06 Dec 2023, 16:40:22+01:00
Session Length	2m 3s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 32.35994" N	56° 07' 32.37952" N
Longitude	007° 34' 49.40430" E	007° 34' 49.43588" E
Height	10.728 m Ell., -29.813 m ISS	10.754 m Ell., -30.407 m Ort.
Easting	411 752.929 m E (± 0.06 m)	
Northing	6 220 972.605 m N (± 0.07 m)	
Height	-29.946 m MSS (± 0.18 m) , -29.813 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	71.0° T, 72.2° G	± 3.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.9 m, USBL= 30.0 m

Table 5: Mean Position to Target

Target	CPT172		
Position	411 754.000 m E, 6 220 970.000 m N		
Range	2.82 m Grid		
Bearing To	157.7° G	Bearing From	337.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	411 752.929 m E, 6 220 972.605 m N , -29.946 m MSS
Heading	71.0° T, 72.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT173-v196
Start Time	06 Dec 2023, 18:38:50+01:00
End Time	06 Dec 2023, 18:40:53+01:00
Session Length	2m 3s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 26.19293" N	56° 06' 26.21250" N
Longitude	007° 34' 48.22599" E	007° 34' 48.25757" E
Height	11.553 m Ell., -29.102 m ISS	11.579 m Ell., -29.591 m Ort.
Easting	411 690.494 m E (± 0.03 m)	
Northing	6 218 927.609 m N (± 0.05 m)	
Height	-29.134 m MSS (± 0.16 m) , -29.102 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	71.0° T, 72.2° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.1 m, USBL= 29.2 m

Table 5: Mean Position to Target

Target	CPT173		
Position	411 691.000 m E, 6 218 930.000 m N		
Range	2.44 m Grid		
Bearing To	12.0° G	Bearing From	192.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	411 690.494 m E, 6 218 927.609 m N , -29.134 m MSS
Heading	71.0° T, 72.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT134-v197
Start Time	06 Dec 2023, 20:42:51+01:00
End Time	06 Dec 2023, 20:44:55+01:00
Session Length	2m 4s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 56.36890" N	56° 05' 56.38847" N
Longitude	007° 33' 08.62322" E	007° 33' 08.65478" E
Height	14.423 m Ell., -26.589 m ISS	14.449 m Ell., -26.735 m Ort.
Easting	409 950.584 m E (± 0.04 m)	
Northing	6 218 041.414 m N (± 0.07 m)	
Height	-26.271 m MSS (± 0.23 m) , -26.589 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	66.3° T, 67.5° G	± 2.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.1 m, USBL= 26.3 m

Table 5: Mean Position to Target

Target	CPT134		
Position	409 951.000 m E, 6 218 040.000 m N		
Range	1.47 m Grid		
Bearing To	163.6° G	Bearing From	343.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	409 950.584 m E, 6 218 041.414 m N , -26.271 m MSS
Heading	66.3° T, 67.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT287-v198
Start Time	06 Dec 2023, 22:47:47+01:00
End Time	06 Dec 2023, 22:50:08+01:00
Session Length	2m 21s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 54.02966" N	56° 04' 54.04924" N
Longitude	007° 31' 29.99806" E	007° 31' 30.02961" E
Height	15.481 m Ell., -25.564 m ISS	15.507 m Ell., -25.692 m Ort.
Easting	408 205.361 m E (± 0.03 m)	
Northing	6 216 150.433 m N (± 0.09 m)	
Height	-25.229 m MSS (± 0.20 m) , -25.564 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	65.1° T, 66.3° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.2 m, USBL= 25.3 m

Table 5: Mean Position to Target

Target	CPT287		
Position	408 206.000 m E, 6 216 150.000 m N		
Range	0.77 m Grid		
Bearing To	124.1° G	Bearing From	304.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	408 205.361 m E, 6 216 150.433 m N , -25.229 m MSS
Heading	65.1° T, 66.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT143-v200
Start Time	07 Dec 2023, 00:30:01+01:00
End Time	07 Dec 2023, 00:32:04+01:00
Session Length	2m 3s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 13.38581" N	56° 05' 13.40539" N
Longitude	007° 30' 33.66888" E	007° 30' 33.70042" E
Height	14.392 m Ell., -26.465 m ISS	14.418 m Ell., -26.784 m Ort.
Easting	407 244.595 m E (± 0.07 m)	
Northing	6 216 769.693 m N (± 0.08 m)	
Height	-26.312 m MSS (± 0.20 m) , -26.465 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	87.0° T, 88.2° G	± 2.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.3 m, USBL= 26.4 m

Table 5: Mean Position to Target

Target	CPT143		
Position	407 245.000 m E, 6 216 770.000 m N		
Range	0.51 m Grid		
Bearing To	52.8° G	Bearing From	232.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	407 244.595 m E, 6 216 769.693 m N , -26.312 m MSS
Heading	87.0° T, 88.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT391A-v201
Start Time	07 Dec 2023, 02:09:56+01:00
End Time	07 Dec 2023, 02:12:06+01:00
Session Length	2m 10s (112 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 04.50278" N	56° 04' 04.52236" N
Longitude	007° 29' 21.96433" E	007° 29' 21.99585" E
Height	15.617 m Ell., -25.155 m ISS	15.643 m Ell., -25.570 m Ort.
Easting	405 958.717 m E (± 0.07 m)	
Northing	6 214 667.306 m N (± 0.07 m)	
Height	-25.100 m MSS (± 0.19 m) , -25.155 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	87.3° T, 88.5° G	± 3.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.0 m, USBL= 25.1 m

Table 5: Mean Position to Target

Target	CPT391		
Position	405 960.000 m E, 6 214 670.000 m N		
Range	2.98 m Grid		
Bearing To	25.5° G	Bearing From	205.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	112 of 120
Position	405 958.717 m E, 6 214 667.306 m N , -25.100 m MSS
Heading	87.3° T, 88.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT045-v203
Start Time	07 Dec 2023, 03:37:06+01:00
End Time	07 Dec 2023, 03:39:09+01:00
Session Length	2m 3s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 02' 36.77024" N	56° 02' 36.78982" N
Longitude	007° 27' 00.19657" E	007° 27' 00.22807" E
Height	15.836 m Ell., -24.889 m ISS	15.862 m Ell., -25.363 m Ort.
Easting	403 446.439 m E (± 0.04 m)	
Northing	6 212 009.657 m N (± 0.03 m)	
Height	-24.911 m MSS (± 0.16 m) , -24.889 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	89.6° T, 90.9° G	± 2.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.8 m, USBL= 25.0 m

Table 5: Mean Position to Target

Target	CPT045		
Position	403 447.000 m E, 6 212 010.000 m N		
Range	0.66 m Grid		
Bearing To	58.6° G	Bearing From	238.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	403 446.439 m E, 6 212 009.657 m N , -24.911 m MSS
Heading	89.6° T, 90.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT389-v206
Start Time	07 Dec 2023, 04:43:14+01:00
End Time	07 Dec 2023, 04:45:39+01:00
Session Length	2m 25s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 00.00877" N	56° 03' 00.02835" N
Longitude	007° 25' 38.43422" E	007° 25' 38.46571" E
Height	15.039 m Ell., -25.820 m ISS	15.065 m Ell., -26.164 m Ort.
Easting	402 048.106 m E (± 0.03 m)	
Northing	6 212 759.985 m N (± 0.06 m)	
Height	-25.711 m MSS (± 0.18 m) , -25.820 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	73.0° T, 74.3° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.7 m, USBL= 25.7 m

Table 5: Mean Position to Target

Target	CPT389		
Position	402 049.000 m E, 6 212 760.000 m N		
Range	0.89 m Grid		
Bearing To	89.1° G	Bearing From	269.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	402 048.106 m E, 6 212 759.985 m N , -25.711 m MSS
Heading	73.0° T, 74.3° G
Pitch	0.00 °
Roll	0.00 °



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Colin Jacobs
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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT129-v207
Start Time	07 Dec 2023, 06:36:47+01:00
End Time	07 Dec 2023, 06:38:50+01:00
Session Length	2m 3s (109 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 02' 53.61036" N	56° 02' 53.62995" N
Longitude	007° 23' 37.61182" E	007° 23' 37.64330" E
Height	15.262 m Ell., -25.698 m ISS	15.288 m Ell., -25.948 m Ort.
Easting	399 953.336 m E (± 0.04 m)	
Northing	6 212 610.311 m N (± 0.04 m)	
Height	-25.493 m MSS (± 0.15 m) , -25.698 m ISS (± 0.06 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	78.3° T, 79.6° G	± 2.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.4 m, USBL= 25.5 m

Table 5: Mean Position to Target

Target	CPT129		
Position	399 954.000 m E, 6 212 610.000 m N		
Range	0.73 m Grid		
Bearing To	115.1° G	Bearing From	295.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	109 of 120
Position	399 953.336 m E, 6 212 610.311 m N , -25.493 m MSS
Heading	78.3° T, 79.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT255-v208
Start Time	07 Dec 2023, 08:22:27+01:00
End Time	07 Dec 2023, 08:24:29+01:00
Session Length	2m 2s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 02' 14.44161" N	56° 02' 14.46120" N
Longitude	007° 24' 00.26705" E	007° 24' 00.29853" E
Height	15.568 m Ell., -25.546 m ISS	15.594 m Ell., -25.641 m Ort.
Easting	400 317.227 m E (± 0.06 m)	
Northing	6 211 390.443 m N (± 0.05 m)	
Height	-25.187 m MSS (± 0.16 m) , -25.546 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	80.2° T, 81.5° G	± 3.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.1 m, USBL= 25.2 m

Table 5: Mean Position to Target

Target	CPT255		
Position	400 318.000 m E, 6 211 390.000 m N		
Range	0.89 m Grid		
Bearing To	119.8° G	Bearing From	299.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	400 317.227 m E, 6 211 390.443 m N , -25.187 m MSS
Heading	80.2° T, 81.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT345-v209
Start Time	07 Dec 2023, 09:34:26+01:00
End Time	07 Dec 2023, 09:36:29+01:00
Session Length	2m 3s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 01' 30.45991" N	56° 01' 30.47950" N
Longitude	007° 22' 47.82728" E	007° 22' 47.85874" E
Height	17.664 m Ell., -23.587 m ISS	17.690 m Ell., -23.549 m Ort.
Easting	399 031.759 m E (± 0.04 m)	
Northing	6 210 060.129 m N (± 0.07 m)	
Height	-23.093 m MSS (± 0.17 m) , -23.587 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	73.6° T, 74.9° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.0 m, USBL= 23.1 m

Table 5: Mean Position to Target

Target	CPT345		
Position	399 032.000 m E, 6 210 060.000 m N		
Range	0.27 m Grid		
Bearing To	118.2° G	Bearing From	298.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	399 031.759 m E, 6 210 060.129 m N , -23.093 m MSS
Heading	73.6° T, 74.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT364-v210
Start Time	07 Dec 2023, 11:10:50+01:00
End Time	07 Dec 2023, 11:12:56+01:00
Session Length	2m 6s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 01' 13.25722" N	56° 01' 13.27681" N
Longitude	007° 20' 41.49067" E	007° 20' 41.52211" E
Height	13.754 m Ell., -27.436 m ISS	13.780 m Ell., -27.463 m Ort.
Easting	396 832.067 m E (± 0.05 m)	
Northing	6 209 580.223 m N (± 0.08 m)	
Height	-27.008 m MSS (± 0.15 m) , -27.436 m ISS (± 0.08 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	80.0° T, 81.4° G	± 3.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.9 m, USBL= 27.0 m

Table 5: Mean Position to Target

Target	CPT364		
Position	396 833.000 m E, 6 209 580.000 m N		
Range	0.96 m Grid		
Bearing To	103.4° G	Bearing From	283.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	396 832.067 m E, 6 209 580.223 m N , -27.008 m MSS
Heading	80.0° T, 81.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT392-v212
Start Time	07 Dec 2023, 14:18:25+01:00
End Time	07 Dec 2023, 14:20:28+01:00
Session Length	2m 3s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 06.87117" N	56° 03' 06.89076" N
Longitude	007° 22' 21.15766" E	007° 22' 21.18912" E
Height	17.235 m Ell., -23.635 m ISS	17.261 m Ell., -23.977 m Ort.
Easting	398 640.323 m E (± 0.04 m)	
Northing	6 213 051.192 m N (± 0.04 m)	
Height	-23.521 m MSS (± 0.18 m) , -23.635 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	95.6° T, 97.0° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.4 m, USBL= 23.5 m

Table 5: Mean Position to Target

Target	CPT392		
Position	398 641.000 m E, 6 213 050.000 m N		
Range	1.37 m Grid		
Bearing To	150.4° G	Bearing From	330.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	398 640.323 m E, 6 213 051.192 m N , -23.521 m MSS
Heading	95.6° T, 97.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT273-v213
Start Time	07 Dec 2023, 15:43:25+01:00
End Time	07 Dec 2023, 15:45:28+01:00
Session Length	2m 3s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 26.75864" N	56° 04' 26.77822" N
Longitude	007° 24' 00.49410" E	007° 24' 00.52558" E
Height	15.828 m Ell., -24.935 m ISS	15.854 m Ell., -25.378 m Ort.
Easting	400 415.926 m E (± 0.04 m)	
Northing	6 215 480.492 m N (± 0.05 m)	
Height	-24.914 m MSS (± 0.19 m) , -24.935 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	78.8° T, 80.1° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.8 m, USBL= 24.9 m

Table 5: Mean Position to Target

Target	CPT273		
Position	400 416.000 m E, 6 215 480.000 m N		
Range	0.50 m Grid		
Bearing To	171.5° G	Bearing From	351.5° G

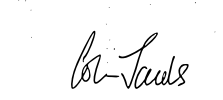
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	400 415.926 m E, 6 215 480.492 m N , -24.914 m MSS
Heading	78.8° T, 80.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT130-v214
Start Time	07 Dec 2023, 18:32:47+01:00
End Time	07 Dec 2023, 18:34:50+01:00
Session Length	2m 3s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 14.90633" N	56° 05' 14.92592" N
Longitude	007° 23' 31.37745" E	007° 23' 31.40893" E
Height	15.692 m Ell., -25.022 m ISS	15.719 m Ell., -25.512 m Ort.
Easting	399 947.207 m E (± 0.11 m)	
Northing	6 216 980.516 m N (± 0.05 m)	
Height	-25.049 m MSS (± 0.23 m) , -25.022 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	112.7° T, 114.1° G	± 4.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.0 m, USBL= 25.1 m

Table 5: Mean Position to Target

Target	CPT130		
Position	399 947.000 m E, 6 216 980.000 m N		
Range	0.56 m Grid		
Bearing To	201.9° G	Bearing From	21.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	399 947.207 m E, 6 216 980.516 m N , -25.049 m MSS
Heading	112.7° T, 114.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT340-v215
Start Time	07 Dec 2023, 20:25:38+01:00
End Time	07 Dec 2023, 20:27:42+01:00
Session Length	2m 4s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 12.31231" N	56° 05' 12.33190" N
Longitude	007° 21' 26.83699" E	007° 21' 26.86845" E
Height	16.255 m Ell., -24.594 m ISS	16.281 m Ell., -24.956 m Ort.
Easting	397 792.914 m E (± 0.04 m)	
Northing	6 216 951.013 m N (± 0.04 m)	
Height	-24.497 m MSS (± 0.22 m) , -24.594 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	116.2° T, 117.5° G	± 1.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.4 m, USBL= 24.5 m

Table 5: Mean Position to Target

Target	CPT340		
Position	397 794.000 m E, 6 216 950.000 m N		
Range	1.49 m Grid		
Bearing To	133.0° G	Bearing From	313.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	397 792.914 m E, 6 216 951.013 m N , -24.497 m MSS
Heading	116.2° T, 117.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT218-v216
Start Time	07 Dec 2023, 22:40:02+01:00
End Time	07 Dec 2023, 22:42:09+01:00
Session Length	2m 7s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 22.01621" N	56° 04' 22.03580" N
Longitude	007° 19' 19.90118" E	007° 19' 19.93262" E
Height	12.912 m Ell., -28.199 m ISS	12.938 m Ell., -28.306 m Ort.
Easting	395 561.314 m E (± 0.04 m)	
Northing	6 215 449.062 m N (± 0.06 m)	
Height	-27.847 m MSS (± 0.15 m) , -28.199 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	137.5° T, 138.9° G	± 1.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.8 m, USBL= 27.9 m

Table 5: Mean Position to Target

Target	CPT218		
Position	395 562.000 m E, 6 215 450.000 m N		
Range	1.16 m Grid		
Bearing To	36.2° G	Bearing From	216.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	395 561.314 m E, 6 215 449.062 m N , -27.847 m MSS
Heading	137.5° T, 138.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT218A-v217
Start Time	07 Dec 2023, 23:22:16+01:00
End Time	07 Dec 2023, 23:24:35+01:00
Session Length	2m 19s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 22.13013" N	56° 04' 22.14972" N
Longitude	007° 19' 19.87915" E	007° 19' 19.91059" E
Height	12.891 m Ell., -28.173 m ISS	12.918 m Ell., -28.326 m Ort.
Easting	395 561.018 m E (± 0.07 m)	
Northing	6 215 452.593 m N (± 0.07 m)	
Height	-27.867 m MSS (± 0.16 m) , -28.173 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	135.4° T, 136.8° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.8 m, USBL= 27.9 m

Table 5: Mean Position to Target

Target	CPT218		
Position	395 562.000 m E, 6 215 450.000 m N		
Range	2.77 m Grid		
Bearing To	159.3° G	Bearing From	339.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	395 561.018 m E, 6 215 452.593 m N , -27.867 m MSS
Heading	135.4° T, 136.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT040-v218
Start Time	08 Dec 2023, 00:32:29+01:00
End Time	08 Dec 2023, 00:34:32+01:00
Session Length	2m 3s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 41.96046" N	56° 03' 41.98005" N
Longitude	007° 18' 35.79733" E	007° 18' 35.82877" E
Height	11.648 m Ell., -29.280 m ISS	11.674 m Ell., -29.572 m Ort.
Easting	394 768.491 m E (± 0.09 m)	
Northing	6 214 229.491 m N (± 0.07 m)	
Height	-29.103 m MSS (± 0.16 m) , -29.280 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	137.9° T, 139.3° G	± 4.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.1 m, USBL= 29.2 m

Table 5: Mean Position to Target

Target	CPT040		
Position	394 769.000 m E, 6 214 230.000 m N		
Range	0.72 m Grid		
Bearing To	45.0° G	Bearing From	225.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	394 768.491 m E, 6 214 229.491 m N , -29.103 m MSS
Heading	137.9° T, 139.3° G
Pitch	0.00 °
Roll	0.00 °



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 Client Representative
 Energinet Eltransmission



Colin Jacobs
 Client Representative
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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT032-v221
Start Time	08 Dec 2023, 01:50:40+01:00
End Time	08 Dec 2023, 01:52:43+01:00
Session Length	2m 3s (91 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 04.28056" N	56° 05' 04.30015" N
Longitude	007° 18' 36.02141" E	007° 18' 36.05285" E
Height	12.466 m Ell., -28.265 m ISS	12.492 m Ell., -28.751 m Ort.
Easting	394 834.662 m E (± 0.08 m)	
Northing	6 216 774.011 m N (± 0.05 m)	
Height	-28.289 m MSS (± 0.21 m) , -28.265 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	136.9° T, 138.3° G	± 4.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.2 m, USBL= 28.4 m

Table 5: Mean Position to Target

Target	CPT032		
Position	394 834.000 m E, 6 216 770.000 m N		
Range	4.07 m Grid		
Bearing To	189.4° G	Bearing From	9.4° G

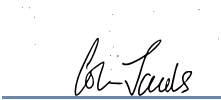
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	91 of 120
Position	394 834.662 m E, 6 216 774.011 m N , -28.289 m MSS
Heading	136.9° T, 138.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT208-v222
Start Time	11 Dec 2023, 03:14:49+01:00
End Time	11 Dec 2023, 03:16:53+01:00
Session Length	2m 4s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 58.75952" N	56° 05' 58.77911" N
Longitude	007° 18' 54.29395" E	007° 18' 54.32540" E
Height	10.880 m Ell., -30.364 m ISS	10.907 m Ell., -30.333 m Ort.
Easting	395 191.592 m E (± 0.05 m)	
Northing	6 218 450.308 m N (± 0.05 m)	
Height	-29.868 m MSS (± 0.17 m) , -30.364 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	200.2° T, 201.6° G	± 3.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.7 m, USBL= 29.9 m

Table 5: Mean Position to Target

Target	CPT208		
Position	395 191.000 m E, 6 218 450.000 m N		
Range	0.67 m Grid		
Bearing To	242.5° G	Bearing From	62.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	395 191.592 m E, 6 218 450.308 m N , -29.868 m MSS
Heading	200.2° T, 201.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT027-v223
Start Time	11 Dec 2023, 04:28:40+01:00
End Time	11 Dec 2023, 04:30:44+01:00
Session Length	2m 3s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 08.49532" N	56° 06' 08.51491" N
Longitude	007° 20' 05.87291" E	007° 20' 05.90437" E
Height	12.647 m Ell., -28.469 m ISS	12.673 m Ell., -28.564 m Ort.
Easting	396 435.523 m E (± 0.06 m)	
Northing	6 218 721.240 m N (± 0.09 m)	
Height	-28.105 m MSS (± 0.22 m) , -28.469 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	196.8° T, 198.2° G	± 4.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.0 m, USBL= 28.2 m

Table 5: Mean Position to Target

Target	CPT027		
Position	396 435.000 m E, 6 218 720.000 m N		
Range	1.35 m Grid		
Bearing To	202.8° G	Bearing From	22.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	396 435.523 m E, 6 218 721.240 m N , -28.105 m MSS
Heading	196.8° T, 198.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT307-v226
Start Time	11 Dec 2023, 07:10:39+01:00
End Time	11 Dec 2023, 07:12:44+01:00
Session Length	2m 5s (104 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 41.13765" N	56° 06' 41.15724" N
Longitude	007° 20' 03.93744" E	007° 20' 03.96889" E
Height	11.600 m Ell., -29.566 m ISS	11.626 m Ell., -29.608 m Ort.
Easting	396 426.440 m E (± 0.05 m)	
Northing	6 219 731.071 m N (± 0.06 m)	
Height	-29.146 m MSS (± 0.20 m) , -29.566 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	188.0° T, 189.4° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.1 m, USBL= 29.2 m

Table 5: Mean Position to Target

Target	CPT307		
Position	396 425.000 m E, 6 219 730.000 m N		
Range	1.80 m Grid		
Bearing To	233.4° G	Bearing From	53.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	104 of 120
Position	396 426.440 m E, 6 219 731.071 m N , -29.146 m MSS
Heading	188.0° T, 189.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT027A-v228
Start Time	11 Dec 2023, 05:30:14+01:00
End Time	11 Dec 2023, 05:32:23+01:00
Session Length	2m 9s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 08.33847" N	56° 06' 08.35806" N
Longitude	007° 20' 06.07468" E	007° 20' 06.10614" E
Height	12.718 m Ell., -28.403 m ISS	12.744 m Ell., -28.493 m Ort.
Easting	396 438.891 m E (± 0.04 m)	
Northing	6 218 716.308 m N (± 0.07 m)	
Height	-28.034 m MSS (± 0.21 m) , -28.403 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	203.4° T, 204.8° G	± 3.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.9 m, USBL= 28.1 m

Table 5: Mean Position to Target

Target	CPT027		
Position	396 435.000 m E, 6 218 720.000 m N		
Range	5.36 m Grid		
Bearing To	313.5° G	Bearing From	133.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]


Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	396 438.891 m E, 6 218 716.308 m N , -28.034 m MSS
Heading	203.4° T, 204.8° G
Pitch	0.00 °
Roll	0.00 °

Comments

Due to vessel movement and currents, CPT frame went out the 5m range ring.



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT113-v3
Start Time	14 Dec 2023, 14:03:29+01:00
End Time	14 Dec 2023, 14:05:32+01:00
Session Length	2m 3s (113 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 49' 49.15531" N	55° 49' 49.17488" N
Longitude	007° 47' 14.44911" E	007° 47' 14.48072" E
Height	16.932 m Ell., -24.468 m ISS	16.957 m Ell., -24.214 m Ort.
Easting	424 040.546 m E (± 0.03 m)	
Northing	6 187 860.141 m N (± 0.04 m)	
Height	-23.794 m MSS (± 0.14 m) , -24.468 m ISS (± 0.05 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	212.9° T, 213.9° G	± 1.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.4 m, USBL= 23.8 m

Table 5: Mean Position to Target

Target	SCPT113		
Position	424 040.000 m E, 6 187 860.000 m N		
Range	0.56 m Grid		
Bearing To	255.5° G	Bearing From	75.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	113 of 120
Position	424 040.546 m E, 6 187 860.141 m N , -23.794 m MSS
Heading	212.9° T, 213.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT084-v4
Start Time	14 Dec 2023, 18:27:53+01:00
End Time	14 Dec 2023, 18:29:55+01:00
Session Length	2m 2s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 34.03920" N	55° 54' 34.05877" N
Longitude	007° 43' 17.18872" E	007° 43' 17.22032" E
Height	16.453 m Ell., -24.527 m ISS	16.478 m Ell., -24.685 m Ort.
Easting	420 075.220 m E (± 0.05 m)	
Northing	6 196 740.852 m N (± 0.03 m)	
Height	-24.253 m MSS (± 0.15 m) , -24.527 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	209.3° T, 210.4° G	± 1.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.0 m, USBL= 24.3 m

Table 5: Mean Position to Target

Target	SCPT084		
Position	420 074.000 m E, 6 196 740.000 m N		
Range	1.49 m Grid		
Bearing To	235.1° G	Bearing From	55.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	420 075.220 m E, 6 196 740.852 m N , -24.253 m MSS
Heading	209.3° T, 210.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT075-v5
Start Time	14 Dec 2023, 21:25:19+01:00
End Time	14 Dec 2023, 21:27:43+01:00
Session Length	2m 24s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 13.22638" N	55° 56' 13.24596" N
Longitude	007° 37' 09.66936" E	007° 37' 09.70092" E
Height	18.338 m Ell., -22.400 m ISS	18.364 m Ell., -22.816 m Ort.
Easting	413 755.138 m E (± 0.06 m)	
Northing	6 199 929.603 m N (± 0.05 m)	
Height	-22.378 m MSS (± 0.17 m) , -22.400 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	214.2° T, 215.3° G	± 2.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.1 m, USBL= 22.4 m

Table 5: Mean Position to Target

Target	SCPT075		
Position	413 754.000 m E, 6 199 930.000 m N		
Range	1.21 m Grid		
Bearing To	289.2° G	Bearing From	109.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	413 755.138 m E, 6 199 929.603 m N , -22.378 m MSS
Heading	214.2° T, 215.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT055-v6
Start Time	15 Dec 2023, 00:53:24+01:00
End Time	15 Dec 2023, 00:55:27+01:00
Session Length	2m 3s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 20.71205" N	56° 00' 20.73162" N
Longitude	007° 43' 04.97039" E	007° 43' 05.00201" E
Height	12.442 m Ell., -28.698 m ISS	12.468 m Ell., -28.689 m Ort.
Easting	420 061.788 m E (± 0.04 m)	
Northing	6 207 461.412 m N (± 0.11 m)	
Height	-28.246 m MSS (± 0.15 m) , -28.698 m ISS (± 0.08 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	213.6° T, 214.6° G	± 4.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.1 m, USBL= 28.3 m

Table 5: Mean Position to Target

Target	SCPT055		
Position	420 061.000 m E, 6 207 460.000 m N		
Range	1.62 m Grid		
Bearing To	209.2° G	Bearing From	29.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	420 061.788 m E, 6 207 461.412 m N , -28.246 m MSS
Heading	213.6° T, 214.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT033-v7
Start Time	15 Dec 2023, 04:27:41+01:00
End Time	15 Dec 2023, 04:29:43+01:00
Session Length	2m 2s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 09.37140" N	56° 05' 09.39097" N
Longitude	007° 37' 18.43461" E	007° 37' 18.46620" E
Height	9.559 m Ell., -31.980 m ISS	9.585 m Ell., -31.581 m Ort.
Easting	414 237.841 m E (± 0.05 m)	
Northing	6 216 500.218 m N (± 0.06 m)	
Height	-31.115 m MSS (± 0.18 m) , -31.980 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	269.2° T, 270.3° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.9 m, USBL= 31.2 m

Table 5: Mean Position to Target

Target	SCPT033		
Position	414 238.000 m E, 6 216 500.000 m N		
Range	0.27 m Grid		
Bearing To	143.9° G	Bearing From	323.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	414 237.841 m E, 6 216 500.218 m N , -31.115 m MSS
Heading	269.2° T, 270.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT043-v8
Start Time	15 Dec 2023, 08:59:18+01:00
End Time	15 Dec 2023, 09:01:20+01:00
Session Length	2m 2s (106 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 13.34006" N	56° 03' 13.35964" N
Longitude	007° 33' 14.90821" E	007° 33' 14.93976" E
Height	15.739 m Ell., -25.198 m ISS	15.765 m Ell., -25.432 m Ort.
Easting	409 953.626 m E (± 0.06 m)	
Northing	6 212 999.494 m N (± 0.08 m)	
Height	-24.974 m MSS (± 0.31 m) , -25.198 m ISS (± 0.28 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	272.5° T, 273.7° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.7 m, USBL= 25.0 m

Table 5: Mean Position to Target

Target	SCPT043		
Position	409 954.000 m E, 6 213 000.000 m N		
Range	0.63 m Grid		
Bearing To	36.5° G	Bearing From	216.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	106 of 120
Position	409 953.626 m E, 6 212 999.494 m N , -24.974 m MSS
Heading	272.5° T, 273.7° G
Pitch	0.00 °
Roll	0.00 °



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Steve Weston
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Energinet Eltransmission

Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT043A-v9
Start Time	31 Dec 2023, 01:00:57+01:00
End Time	31 Dec 2023, 01:03:00+01:00
Session Length	2m 3s (110 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 13.22032" N	56° 03' 13.23990" N
Longitude	007° 33' 14.91965" E	007° 33' 14.95120" E
Height	15.799 m Ell., -25.443 m ISS	15.825 m Ell., -25.372 m Ort.
Easting	409 953.746 m E (± 0.06 m)	
Northing	6 212 995.788 m N (± 0.06 m)	
Height	-24.914 m MSS (± 0.27 m) , -25.443 m ISS (± 0.24 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	215.4° T, 216.6° G	± 1.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.7 m, USBL= 24.9 m

Table 5: Mean Position to Target

Target	SCPT043		
Position	409 954.000 m E, 6 213 000.000 m N		
Range	4.22 m Grid		
Bearing To	3.5° G	Bearing From	183.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	110 of 120
Position	409 953.746 m E, 6 212 995.788 m N , -24.914 m MSS
Heading	215.4° T, 216.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT043B-v10
Start Time	31 Dec 2023, 04:32:00+01:00
End Time	31 Dec 2023, 04:34:16+01:00
Session Length	2m 16s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 13.34604" N	56° 03' 13.36562" N
Longitude	007° 33' 14.68526" E	007° 33' 14.71681" E
Height	15.789 m Ell., -25.823 m ISS	15.815 m Ell., -25.382 m Ort.
Easting	409 949.773 m E (± 0.04 m)	
Northing	6 212 999.760 m N (± 0.05 m)	
Height	-24.924 m MSS (± 0.24 m) , -25.823 m ISS (± 0.20 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	171.5° T, 172.7° G	± 1.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.6 m, USBL= 24.9 m

Table 5: Mean Position to Target

Target	SCPT043		
Position	409 954.000 m E, 6 213 000.000 m N		
Range	4.23 m Grid		
Bearing To	86.7° G	Bearing From	266.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	409 949.773 m E, 6 212 999.760 m N , -24.924 m MSS
Heading	171.5° T, 172.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT026D-v11
Start Time	01 Jan 2024, 15:43:54+01:00
End Time	01 Jan 2024, 15:45:57+01:00
Session Length	2m 2s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 15.21480" N	56° 06' 15.23438" N
Longitude	007° 23' 24.87468" E	007° 23' 24.90616" E
Height	15.050 m Ell., -26.342 m ISS	15.076 m Ell., -26.149 m Ort.
Easting	399 878.305 m E (± 0.05 m)	
Northing	6 218 847.379 m N (± 0.06 m)	
Height	-25.682 m MSS (± 0.25 m) , -26.342 m ISS (± 0.21 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	173.8° T, 175.1° G	± 1.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.5 m, USBL= 25.8 m

Table 5: Mean Position to Target

Target	SCPT026		
Position	399 883.000 m E, 6 218 850.000 m N		
Range	5.38 m Grid		
Bearing To	60.8° G	Bearing From	240.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	399 878.305 m E, 6 218 847.379 m N , -25.682 m MSS
Heading	173.8° T, 175.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT309-v12
Start Time	01 Jan 2024, 18:46:34+01:00
End Time	01 Jan 2024, 18:48:43+01:00
Session Length	2m 10s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 37.12182" N	56° 07' 37.14141" N
Longitude	007° 22' 53.23822" E	007° 22' 53.26970" E
Height	14.355 m Ell., -27.264 m ISS	14.382 m Ell., -26.838 m Ort.
Easting	399 391.172 m E (± 0.04 m)	
Northing	6 221 392.059 m N (± 0.04 m)	
Height	-26.373 m MSS (± 0.20 m) , -27.264 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	177.2° T, 178.5° G	± 1.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.1 m, USBL= 26.4 m

Table 5: Mean Position to Target

Target	CPT309		
Position	399 390.000 m E, 6 221 390.000 m N		
Range	2.37 m Grid		
Bearing To	209.6° G	Bearing From	29.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	399 391.172 m E, 6 221 392.059 m N , -26.373 m MSS
Heading	177.2° T, 178.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT166-v13
Start Time	01 Jan 2024, 21:19:56+01:00
End Time	01 Jan 2024, 21:22:00+01:00
Session Length	2m 4s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 22.89517" N	56° 08' 22.91476" N
Longitude	007° 20' 19.22545" E	007° 20' 19.25692" E
Height	12.109 m Ell., -29.160 m ISS	12.136 m Ell., -29.089 m Ort.
Easting	396 766.237 m E (± 0.06 m)	
Northing	6 222 870.197 m N (± 0.06 m)	
Height	-28.621 m MSS (± 0.23 m) , -29.160 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	200.0° T, 201.4° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.5 m, USBL= 28.7 m

Table 5: Mean Position to Target

Target	CPT166		
Position	396 767.000 m E, 6 222 870.000 m N		
Range	0.79 m Grid		
Bearing To	104.5° G	Bearing From	284.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	396 766.237 m E, 6 222 870.197 m N , -28.621 m MSS
Heading	200.0° T, 201.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT293-v14
Start Time	04 Jan 2024, 14:14:28+01:00
End Time	04 Jan 2024, 14:17:08+01:00
Session Length	2m 40s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 00.63795" N	56° 07' 00.65755" N
Longitude	007° 10' 14.44807" E	007° 10' 14.47945" E
Height	10.479 m Ell., -30.536 m ISS	10.505 m Ell., -30.760 m Ort.
Easting	386 261.070 m E (± 0.05 m)	
Northing	6 220 591.684 m N (± 0.05 m)	
Height	-30.286 m MSS (± 0.28 m) , -30.536 m ISS (± 0.25 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	77.0° T, 78.5° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.0 m, USBL= 30.3 m

Table 5: Mean Position to Target

Target	CPT293		
Position	386 261.000 m E, 6 220 590.000 m N		
Range	1.69 m Grid		
Bearing To	182.4° G	Bearing From	2.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	386 261.070 m E, 6 220 591.684 m N , -30.286 m MSS
Heading	77.0° T, 78.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT017-v15
Start Time	04 Jan 2024, 19:03:48+01:00
End Time	04 Jan 2024, 19:05:52+01:00
Session Length	2m 4s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 11.21340" N	56° 08' 11.23300" N
Longitude	007° 10' 43.32678" E	007° 10' 43.35816" E
Height	11.302 m Ell., -29.854 m ISS	11.329 m Ell., -29.931 m Ort.
Easting	386 817.365 m E (± 0.04 m)	
Northing	6 222 760.023 m N (± 0.06 m)	
Height	-29.453 m MSS (± 0.26 m) , -29.854 m ISS (± 0.23 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	79.2° T, 80.7° G	± 1.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.1 m, USBL= 29.4 m

Table 5: Mean Position to Target

Target	CPT017		
Position	386 817.000 m E, 6 222 760.000 m N		
Range	0.37 m Grid		
Bearing To	266.4° G	Bearing From	86.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	386 817.365 m E, 6 222 760.023 m N , -29.453 m MSS
Heading	79.2° T, 80.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT239-v16
Start Time	04 Jan 2024, 21:49:08+01:00
End Time	04 Jan 2024, 21:51:10+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 49.10636" N	56° 07' 49.12596" N
Longitude	007° 12' 06.63458" E	007° 12' 06.66598" E
Height	11.746 m Ell., -29.381 m ISS	11.772 m Ell., -29.482 m Ort.
Easting	388 237.448 m E (± 0.11 m)	
Northing	6 222 038.951 m N (± 0.09 m)	
Height	-29.012 m MSS (± 0.25 m) , -29.381 m ISS (± 0.21 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	77.0° T, 78.5° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.8 m, USBL= 29.1 m

Table 5: Mean Position to Target

Target	CPT239		
Position	388 238.000 m E, 6 222 040.000 m N		
Range	1.19 m Grid		
Bearing To	27.7° G	Bearing From	207.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	388 237.448 m E, 6 222 038.951 m N , -29.012 m MSS
Heading	77.0° T, 78.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT160-v17
Start Time	04 Jan 2024, 23:35:51+01:00
End Time	04 Jan 2024, 23:37:53+01:00
Session Length	2m 2s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 11.45378" N	56° 08' 11.47338" N
Longitude	007° 14' 42.03306" E	007° 14' 42.06448" E
Height	11.865 m Ell., -29.079 m ISS	11.891 m Ell., -29.352 m Ort.
Easting	390 937.654 m E (± 0.10 m)	
Northing	6 222 660.647 m N (± 0.06 m)	
Height	-28.879 m MSS (± 0.21 m) , -29.079 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	79.0° T, 80.5° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.5 m, USBL= 28.9 m

Table 5: Mean Position to Target

Target	CPT160		
Position	390 938.000 m E, 6 222 660.000 m N		
Range	0.73 m Grid		
Bearing To	151.8° G	Bearing From	331.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	390 937.654 m E, 6 222 660.647 m N , -28.879 m MSS
Heading	79.0° T, 80.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT293A-v18
Start Time	05 Jan 2024, 01:29:46+01:00
End Time	05 Jan 2024, 01:31:51+01:00
Session Length	2m 5s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 00.48336" N	56° 07' 00.50296" N
Longitude	007° 10' 14.42946" E	007° 10' 14.46084" E
Height	10.474 m Ell., -30.368 m ISS	10.500 m Ell., -30.765 m Ort.
Easting	386 260.622 m E (± 0.06 m)	
Northing	6 220 586.914 m N (± 0.08 m)	
Height	-30.291 m MSS (± 0.30 m) , -30.368 m ISS (± 0.27 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	115.0° T, 116.5° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.1 m, USBL= 30.4 m

Table 5: Mean Position to Target

Target	CPT293		
Position	386 261.000 m E, 6 220 590.000 m N		
Range	3.11 m Grid		
Bearing To	7.0° G	Bearing From	187.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	386 260.622 m E, 6 220 586.914 m N , -30.291 m MSS
Heading	115.0° T, 116.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT017-v15
Start Time	04 Jan 2024, 19:03:48+01:00
End Time	04 Jan 2024, 19:05:52+01:00
Session Length	2m 4s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 11.21340" N	56° 08' 11.23300" N
Longitude	007° 10' 43.32678" E	007° 10' 43.35816" E
Height	11.302 m Ell., -29.854 m ISS	11.329 m Ell., -29.931 m Ort.
Easting	386 817.365 m E (± 0.04 m)	
Northing	6 222 760.023 m N (± 0.06 m)	
Height	-29.453 m MSS (± 0.26 m) , -29.854 m ISS (± 0.23 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	79.2° T, 80.7° G	± 1.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.1 m, USBL= 29.4 m

Table 5: Mean Position to Target

Target	CPT017		
Position	386 817.000 m E, 6 222 760.000 m N		
Range	0.37 m Grid		
Bearing To	266.4° G	Bearing From	86.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	386 817.365 m E, 6 222 760.023 m N , -29.453 m MSS
Heading	79.2° T, 80.7° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT239-v16
Start Time	04 Jan 2024, 21:49:08+01:00
End Time	04 Jan 2024, 21:51:10+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 49.10636" N	56° 07' 49.12596" N
Longitude	007° 12' 06.63458" E	007° 12' 06.66598" E
Height	11.746 m Ell., -29.381 m ISS	11.772 m Ell., -29.482 m Ort.
Easting	388 237.448 m E (± 0.11 m)	
Northing	6 222 038.951 m N (± 0.09 m)	
Height	-29.012 m MSS (± 0.25 m) , -29.381 m ISS (± 0.21 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	77.0° T, 78.5° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.8 m, USBL= 29.1 m

Table 5: Mean Position to Target

Target	CPT239		
Position	388 238.000 m E, 6 222 040.000 m N		
Range	1.19 m Grid		
Bearing To	27.7° G	Bearing From	207.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	388 237.448 m E, 6 222 038.951 m N , -29.012 m MSS
Heading	77.0° T, 78.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT160-v17
Start Time	04 Jan 2024, 23:35:51+01:00
End Time	04 Jan 2024, 23:37:53+01:00
Session Length	2m 2s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 11.45378" N	56° 08' 11.47338" N
Longitude	007° 14' 42.03306" E	007° 14' 42.06448" E
Height	11.865 m Ell., -29.079 m ISS	11.891 m Ell., -29.352 m Ort.
Easting	390 937.654 m E (± 0.10 m)	
Northing	6 222 660.647 m N (± 0.06 m)	
Height	-28.879 m MSS (± 0.21 m) , -29.079 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	79.0° T, 80.5° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.5 m, USBL= 28.9 m

Table 5: Mean Position to Target

Target	CPT160		
Position	390 938.000 m E, 6 222 660.000 m N		
Range	0.73 m Grid		
Bearing To	151.8° G	Bearing From	331.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	390 937.654 m E, 6 222 660.647 m N , -28.879 m MSS
Heading	79.0° T, 80.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT293A-v18
Start Time	05 Jan 2024, 01:29:46+01:00
End Time	05 Jan 2024, 01:31:51+01:00
Session Length	2m 5s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 07' 00.48336" N	56° 07' 00.50296" N
Longitude	007° 10' 14.42946" E	007° 10' 14.46084" E
Height	10.474 m Ell., -30.368 m ISS	10.500 m Ell., -30.765 m Ort.
Easting	386 260.622 m E (± 0.06 m)	
Northing	6 220 586.914 m N (± 0.08 m)	
Height	-30.291 m MSS (± 0.30 m) , -30.368 m ISS (± 0.27 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	115.0° T, 116.5° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.1 m, USBL= 30.4 m

Table 5: Mean Position to Target

Target	CPT293		
Position	386 261.000 m E, 6 220 590.000 m N		
Range	3.11 m Grid		
Bearing To	7.0° G	Bearing From	187.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	386 260.622 m E, 6 220 586.914 m N , -30.291 m MSS
Heading	115.0° T, 116.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT125-v19
Start Time	06 Jan 2024, 07:13:12+01:00
End Time	06 Jan 2024, 07:15:15+01:00
Session Length	2m 2s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 02.70589" N	56° 09' 02.72548" N
Longitude	007° 13' 42.45296" E	007° 13' 42.48438" E
Height	11.276 m Ell., -29.616 m ISS	11.302 m Ell., -29.942 m Ort.
Easting	389 949.982 m E (± 0.06 m)	
Northing	6 224 271.190 m N (± 0.10 m)	
Height	-29.478 m MSS (± 0.17 m) , -29.616 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	86.4° T, 87.8° G	± 3.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.2 m, USBL= 29.5 m

Table 5: Mean Position to Target

Target	CPT125		
Position	389 950.000 m E, 6 224 270.000 m N		
Range	1.19 m Grid		
Bearing To	179.1° G	Bearing From	359.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	389 949.982 m E, 6 224 271.190 m N , -29.478 m MSS
Heading	86.4° T, 87.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT125A-v20
Start Time	06 Jan 2024, 09:01:59+01:00
End Time	06 Jan 2024, 09:04:01+01:00
Session Length	2m 3s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 02.55184" N	56° 09' 02.57143" N
Longitude	007° 13' 42.46491" E	007° 13' 42.49633" E
Height	11.307 m Ell., -29.880 m ISS	11.333 m Ell., -29.911 m Ort.
Easting	389 950.065 m E (± 0.10 m)	
Northing	6 224 266.423 m N (± 0.08 m)	
Height	-29.447 m MSS (± 0.17 m) , -29.880 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	67.8° T, 69.2° G	± 3.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.2 m, USBL= 29.5 m

Table 5: Mean Position to Target

Target	CPT125		
Position	389 950.000 m E, 6 224 270.000 m N		
Range	3.58 m Grid		
Bearing To	359.0° G	Bearing From	179.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	389 950.065 m E, 6 224 266.423 m N , -29.447 m MSS
Heading	67.8° T, 69.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT351-v21
Start Time	06 Jan 2024, 10:36:23+01:00
End Time	06 Jan 2024, 10:38:33+01:00
Session Length	2m 11s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 53.32606" N	56° 08' 53.34565" N
Longitude	007° 11' 55.57128" E	007° 11' 55.60268" E
Height	10.462 m Ell., -30.650 m ISS	10.488 m Ell., -30.764 m Ort.
Easting	388 098.303 m E (± 0.03 m)	
Northing	6 224 029.018 m N (± 0.06 m)	
Height	-30.293 m MSS (± 0.16 m) , -30.650 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	57.9° T, 59.4° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.0 m, USBL= 30.3 m

Table 5: Mean Position to Target

Target	CPT351		
Position	388 098.000 m E, 6 224 030.000 m N		
Range	1.03 m Grid		
Bearing To	342.9° G	Bearing From	162.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	388 098.303 m E, 6 224 029.018 m N , -30.293 m MSS
Heading	57.9° T, 59.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT161-v22
Start Time	06 Jan 2024, 12:25:22+01:00
End Time	06 Jan 2024, 12:27:45+01:00
Session Length	2m 24s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 04.60515" N	56° 10' 04.62475" N
Longitude	007° 12' 22.58441" E	007° 12' 22.61582" E
Height	8.104 m Ell., -32.891 m ISS	8.130 m Ell., -33.116 m Ort.
Easting	388 621.720 m E (± 0.03 m)	
Northing	6 226 220.176 m N (± 0.03 m)	
Height	-32.649 m MSS (± 0.16 m) , -32.891 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	67.9° T, 69.4° G	± 1.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 32.3 m, USBL= 32.7 m

Table 5: Mean Position to Target

Target	CPT161		
Position	388 623.000 m E, 6 226 220.000 m N		
Range	1.29 m Grid		
Bearing To	97.8° G	Bearing From	277.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	388 621.720 m E, 6 226 220.176 m N , -32.649 m MSS
Heading	67.9° T, 69.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT197-v23
Start Time	06 Jan 2024, 14:32:09+01:00
End Time	06 Jan 2024, 14:34:11+01:00
Session Length	2m 3s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 47.57859" N	56° 09' 47.59818" N
Longitude	007° 14' 27.88351" E	007° 14' 27.91494" E
Height	10.817 m Ell., -29.881 m ISS	10.843 m Ell., -30.395 m Ort.
Easting	390 769.209 m E (± 0.06 m)	
Northing	6 225 638.196 m N (± 0.06 m)	
Height	-29.928 m MSS (± 0.15 m) , -29.881 m ISS (± 0.08 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	68.4° T, 69.8° G	± 3.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.6 m, USBL= 30.0 m

Table 5: Mean Position to Target

Target	CPT197		
Position	390 769.000 m E, 6 225 640.000 m N		
Range	1.82 m Grid		
Bearing To	353.4° G	Bearing From	173.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	390 769.209 m E, 6 225 638.196 m N , -29.928 m MSS
Heading	68.4° T, 69.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	SCPT026E-v24
Start Time	06 Jan 2024, 21:47:27+01:00
End Time	06 Jan 2024, 21:49:30+01:00
Session Length	2m 3s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 15.46840" N	56° 06' 15.48799" N
Longitude	007° 23' 24.91184" E	007° 23' 24.94332" E
Height	14.959 m Ell., -26.069 m ISS	14.985 m Ell., -26.240 m Ort.
Easting	399 879.130 m E (± 0.04 m)	
Northing	6 218 855.203 m N (± 0.07 m)	
Height	-25.772 m MSS (± 0.14 m) , -26.069 m ISS (± 0.06 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	70.6° T, 72.0° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.4 m, USBL= 25.8 m

Table 5: Mean Position to Target

Target	SCPT026		
Position	399 883.000 m E, 6 218 850.000 m N		
Range	6.48 m Grid		
Bearing To	143.4° G	Bearing From	323.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	399 879.130 m E, 6 218 855.203 m N , -25.772 m MSS
Heading	70.6° T, 72.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT369-v25
Start Time	07 Jan 2024, 04:15:06+01:00
End Time	07 Jan 2024, 04:17:08+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 36.77888" N	56° 06' 36.79848" N
Longitude	007° 15' 37.13189" E	007° 15' 37.16331" E
Height	11.830 m Ell., -28.838 m ISS	11.856 m Ell., -29.390 m Ort.
Easting	391 814.876 m E (± 0.08 m)	
Northing	6 219 710.046 m N (± 0.08 m)	
Height	-28.928 m MSS (± 0.17 m) , -28.838 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	82.3° T, 83.8° G	± 3.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.5 m, USBL= 28.9 m

Table 5: Mean Position to Target

Target	CPT369		
Position	391 816.000 m E, 6 219 710.000 m N		
Range	1.12 m Grid		
Bearing To	92.4° G	Bearing From	272.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	391 814.876 m E, 6 219 710.046 m N , -28.928 m MSS
Heading	82.3° T, 83.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT209-v26
Start Time	07 Jan 2024, 07:36:50+01:00
End Time	07 Jan 2024, 07:38:54+01:00
Session Length	2m 3s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 56.70940" N	56° 06' 56.72899" N
Longitude	007° 17' 43.85480" E	007° 17' 43.88624" E
Height	10.873 m Ell., -29.898 m ISS	10.899 m Ell., -30.340 m Ort.
Easting	394 018.867 m E (± 0.03 m)	
Northing	6 220 271.499 m N (± 0.04 m)	
Height	-29.869 m MSS (± 0.15 m) , -29.898 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	94.8° T, 96.2° G	± 1.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.5 m, USBL= 29.9 m

Table 5: Mean Position to Target

Target	CPT209		
Position	394 017.000 m E, 6 220 270.000 m N		
Range	2.39 m Grid		
Bearing To	231.2° G	Bearing From	51.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	394 018.867 m E, 6 220 271.499 m N , -29.869 m MSS
Heading	94.8° T, 96.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT380-v27
Start Time	07 Jan 2024, 10:59:55+01:00
End Time	07 Jan 2024, 11:02:14+01:00
Session Length	2m 19s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 07.02073" N	56° 08' 07.04033" N
Longitude	007° 18' 12.10334" E	007° 18' 12.13479" E
Height	10.058 m Ell., -31.054 m ISS	10.085 m Ell., -31.148 m Ort.
Easting	394 560.161 m E (± 0.06 m)	
Northing	6 222 432.898 m N (± 0.06 m)	
Height	-30.679 m MSS (± 0.17 m) , -31.054 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	81.7° T, 83.1° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.3 m, USBL= 30.7 m

Table 5: Mean Position to Target

Target	CPT380		
Position	394 560.000 m E, 6 222 430.000 m N		
Range	2.90 m Grid		
Bearing To	183.2° G	Bearing From	3.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	394 560.161 m E, 6 222 432.898 m N , -30.679 m MSS
Heading	81.7° T, 83.1° G
Pitch	0.00 °
Roll	0.00 °



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Aizuddin Darus
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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT012-v28
Start Time	07 Jan 2024, 13:09:13+01:00
End Time	07 Jan 2024, 13:11:18+01:00
Session Length	2m 5s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 00.23507" N	56° 09' 00.25466" N
Longitude	007° 20' 47.92144" E	007° 20' 47.95291" E
Height	11.895 m Ell., -29.022 m ISS	11.921 m Ell., -29.298 m Ort.
Easting	397 289.172 m E (± 0.06 m)	
Northing	6 224 012.539 m N (± 0.06 m)	
Height	-28.829 m MSS (± 0.15 m) , -29.022 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	71.7° T, 73.0° G	± 1.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.4 m, USBL= 28.8 m

Table 5: Mean Position to Target

Target	CPT012		
Position	397 289.000 m E, 6 224 010.000 m N		
Range	2.55 m Grid		
Bearing To	183.9° G	Bearing From	3.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	397 289.172 m E, 6 224 012.539 m N , -28.829 m MSS
Heading	71.7° T, 73.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT015-v29
Start Time	07 Jan 2024, 15:46:22+01:00
End Time	07 Jan 2024, 15:48:50+01:00
Session Length	2m 28s (113 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 08' 39.82487" N	56° 08' 39.84446" N
Longitude	007° 18' 27.13182" E	007° 18' 27.16327" E
Height	10.115 m Ell., -30.532 m ISS	10.142 m Ell., -31.088 m Ort.
Easting	394 844.448 m E (± 0.03 m)	
Northing	6 223 440.551 m N (± 0.05 m)	
Height	-30.615 m MSS (± 0.16 m) , -30.532 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	82.4° T, 83.8° G	± 1.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.0 m, USBL= 30.6 m

Table 5: Mean Position to Target

Target	CPT015		
Position	394 845.000 m E, 6 223 440.000 m N		
Range	0.78 m Grid		
Bearing To	135.0° G	Bearing From	315.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	113 of 120
Position	394 844.448 m E, 6 223 440.551 m N , -30.615 m MSS
Heading	82.4° T, 83.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT226-v30
Start Time	07 Jan 2024, 20:18:03+01:00
End Time	07 Jan 2024, 20:20:06+01:00
Session Length	2m 2s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 05.70785" N	56° 09' 05.72744" N
Longitude	007° 17' 18.17515" E	007° 17' 18.20660" E
Height	10.184 m Ell., -30.548 m ISS	10.210 m Ell., -31.021 m Ort.
Easting	393 674.328 m E (± 0.05 m)	
Northing	6 224 269.996 m N (± 0.05 m)	
Height	-30.553 m MSS (± 0.16 m) , -30.548 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	87.6° T, 89.0° G	± 2.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.2 m, USBL= 30.5 m

Table 5: Mean Position to Target

Target	CPT226		
Position	393 676.000 m E, 6 224 270.000 m N		
Range	1.67 m Grid		
Bearing To	89.9° G	Bearing From	269.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	393 674.328 m E, 6 224 269.996 m N , -30.553 m MSS
Heading	87.6° T, 89.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT264-v31
Start Time	07 Jan 2024, 22:36:28+01:00
End Time	07 Jan 2024, 22:38:30+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 52.02633" N	56° 10' 52.04592" N
Longitude	007° 18' 15.93369" E	007° 18' 15.96515" E
Height	9.134 m Ell., -31.773 m ISS	9.161 m Ell., -32.059 m Ort.
Easting	394 751.684 m E (± 0.08 m)	
Northing	6 227 531.856 m N (± 0.06 m)	
Height	-31.584 m MSS (± 0.19 m) , -31.773 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	81.7° T, 83.1° G	± 2.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.3 m, USBL= 31.6 m

Table 5: Mean Position to Target

Target	CPT264		
Position	394 752.000 m E, 6 227 530.000 m N		
Range	1.88 m Grid		
Bearing To	170.3° G	Bearing From	350.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	394 751.684 m E, 6 227 531.856 m N , -31.584 m MSS
Heading	81.7° T, 83.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT005-v32
Start Time	08 Jan 2024, 00:49:43+01:00
End Time	08 Jan 2024, 00:51:46+01:00
Session Length	2m 3s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 36.25985" N	56° 10' 36.27944" N
Longitude	007° 20' 20.98622" E	007° 20' 21.01769" E
Height	10.907 m Ell., -30.020 m ISS	10.933 m Ell., -30.279 m Ort.
Easting	396 895.909 m E (± 0.09 m)	
Northing	6 226 992.005 m N (± 0.11 m)	
Height	-29.805 m MSS (± 0.19 m) , -30.020 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	99.4° T, 100.8° G	± 7.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.4 m, USBL= 29.8 m

Table 5: Mean Position to Target

Target	CPT005		
Position	396 897.000 m E, 6 226 990.000 m N		
Range	2.28 m Grid		
Bearing To	151.4° G	Bearing From	331.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	396 895.909 m E, 6 226 992.005 m N , -29.805 m MSS
Heading	99.4° T, 100.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT304-v33
Start Time	08 Jan 2024, 02:28:42+01:00
End Time	08 Jan 2024, 02:30:52+01:00
Session Length	2m 10s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 06.88411" N	56° 10' 06.90370" N
Longitude	007° 20' 48.71063" E	007° 20' 48.74211" E
Height	12.034 m Ell., -28.697 m ISS	12.060 m Ell., -29.153 m Ort.
Easting	397 352.176 m E (± 0.04 m)	
Northing	6 226 072.457 m N (± 0.04 m)	
Height	-28.681 m MSS (± 0.16 m) , -28.697 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	109.6° T, 111.0° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.4 m, USBL= 28.7 m

Table 5: Mean Position to Target

Target	CPT304		
Position	397 353.000 m E, 6 226 070.000 m N		
Range	2.59 m Grid		
Bearing To	161.5° G	Bearing From	341.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	397 352.176 m E, 6 226 072.457 m N , -28.681 m MSS
Heading	109.6° T, 111.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT003-v34
Start Time	08 Jan 2024, 04:36:59+01:00
End Time	08 Jan 2024, 04:39:09+01:00
Session Length	2m 10s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 11' 36.08018" N	56° 11' 36.09976" N
Longitude	007° 23' 38.79695" E	007° 23' 38.82846" E
Height	10.810 m Ell., -29.756 m ISS	10.836 m Ell., -30.357 m Ort.
Easting	400 349.750 m E (± 0.05 m)	
Northing	6 228 760.386 m N (± 0.04 m)	
Height	-29.890 m MSS (± 0.16 m) , -29.756 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	85.0° T, 86.3° G	± 1.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.6 m, USBL= 29.9 m

Table 5: Mean Position to Target

Target	CPT003		
Position	400 350.000 m E, 6 228 760.000 m N		
Range	0.46 m Grid		
Bearing To	147.1° G	Bearing From	327.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	400 349.750 m E, 6 228 760.386 m N , -29.890 m MSS
Heading	85.0° T, 86.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT375-v35
Start Time	08 Jan 2024, 06:26:12+01:00
End Time	08 Jan 2024, 06:28:37+01:00
Session Length	2m 25s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 11' 25.86364" N	56° 11' 25.88322" N
Longitude	007° 22' 13.09537" E	007° 22' 13.12686" E
Height	10.998 m Ell., -29.525 m ISS	11.025 m Ell., -30.177 m Ort.
Easting	398 865.202 m E (± 0.03 m)	
Northing	6 228 479.235 m N (± 0.04 m)	
Height	-29.701 m MSS (± 0.15 m) , -29.525 m ISS (± 0.08 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	91.4° T, 92.7° G	± 1.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.5 m, USBL= 29.7 m

Table 5: Mean Position to Target

Target	CPT375		
Position	398 866.000 m E, 6 228 480.000 m N		
Range	1.11 m Grid		
Bearing To	46.2° G	Bearing From	226.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	398 865.202 m E, 6 228 479.235 m N , -29.701 m MSS
Heading	91.4° T, 92.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT198-v36
Start Time	08 Jan 2024, 07:44:34+01:00
End Time	08 Jan 2024, 07:46:38+01:00
Session Length	2m 3s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 11' 41.04853" N	56° 11' 41.06812" N
Longitude	007° 20' 07.75767" E	007° 20' 07.78914" E
Height	10.950 m Ell., -29.671 m ISS	10.976 m Ell., -30.232 m Ort.
Easting	396 716.169 m E (± 0.07 m)	
Northing	6 229 000.246 m N (± 0.06 m)	
Height	-29.759 m MSS (± 0.15 m) , -29.671 m ISS (± 0.08 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	76.6° T, 78.0° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.5 m, USBL= 29.8 m

Table 5: Mean Position to Target

Target	CPT198		
Position	396 718.000 m E, 6 229 000.000 m N		
Range	1.85 m Grid		
Bearing To	97.7° G	Bearing From	277.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	396 716.169 m E, 6 229 000.246 m N , -29.759 m MSS
Heading	76.6° T, 78.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT325-v37
Start Time	08 Jan 2024, 09:26:53+01:00
End Time	08 Jan 2024, 09:28:56+01:00
Session Length	2m 3s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 13' 19.18902" N	56° 13' 19.20861" N
Longitude	007° 19' 55.09335" E	007° 19' 55.12483" E
Height	10.290 m Ell., -30.423 m ISS	10.316 m Ell., -30.884 m Ort.
Easting	396 571.327 m E (± 0.04 m)	
Northing	6 232 039.238 m N (± 0.04 m)	
Height	-30.409 m MSS (± 0.15 m) , -30.423 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	91.8° T, 93.2° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.2 m, USBL= 30.4 m

Table 5: Mean Position to Target

Target	CPT325		
Position	396 571.000 m E, 6 232 040.000 m N		
Range	0.83 m Grid		
Bearing To	336.7° G	Bearing From	156.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	396 571.327 m E, 6 232 039.238 m N , -30.409 m MSS
Heading	91.8° T, 93.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT164-v38
Start Time	08 Jan 2024, 10:59:25+01:00
End Time	08 Jan 2024, 11:01:28+01:00
Session Length	2m 3s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 14' 03.44234" N	56° 14' 03.46193" N
Longitude	007° 21' 22.40574" E	007° 21' 22.43723" E
Height	9.729 m Ell., -31.127 m ISS	9.756 m Ell., -31.434 m Ort.
Easting	398 107.672 m E (± 0.06 m)	
Northing	6 233 371.073 m N (± 0.04 m)	
Height	-30.950 m MSS (± 0.15 m) , -31.127 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	103.2° T, 104.5° G	± 0.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.8 m, USBL= 31.0 m

Table 5: Mean Position to Target

Target	CPT164		
Position	398 107.000 m E, 6 233 370.000 m N		
Range	1.27 m Grid		
Bearing To	212.1° G	Bearing From	32.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	398 107.672 m E, 6 233 371.073 m N , -30.950 m MSS
Heading	103.2° T, 104.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT163-v39
Start Time	08 Jan 2024, 12:42:29+01:00
End Time	08 Jan 2024, 12:44:34+01:00
Session Length	2m 6s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 14' 10.45439" N	56° 14' 10.47398" N
Longitude	007° 18' 03.00529" E	007° 18' 03.03676" E
Height	9.527 m Ell., -31.388 m ISS	9.553 m Ell., -31.649 m Ort.
Easting	394 680.011 m E (± 0.04 m)	
Northing	6 233 671.109 m N (± 0.06 m)	
Height	-31.173 m MSS (± 0.16 m) , -31.388 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	98.4° T, 99.8° G	± 1.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.0 m, USBL= 31.2 m

Table 5: Mean Position to Target

Target	CPT163		
Position	394 681.000 m E, 6 233 670.000 m N		
Range	1.49 m Grid		
Bearing To	138.3° G	Bearing From	318.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	394 680.011 m E, 6 233 671.109 m N , -31.173 m MSS
Heading	98.4° T, 99.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT253-v40
Start Time	08 Jan 2024, 14:17:00+01:00
End Time	08 Jan 2024, 14:19:02+01:00
Session Length	2m 2s (112 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 12' 31.39513" N	56° 12' 31.41472" N
Longitude	007° 18' 00.50398" E	007° 18' 00.53544" E
Height	10.094 m Ell., -30.731 m ISS	10.120 m Ell., -31.093 m Ort.
Easting	394 561.415 m E (± 0.05 m)	
Northing	6 230 610.067 m N (± 0.03 m)	
Height	-30.619 m MSS (± 0.16 m) , -30.731 m ISS (± 0.08 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	133.7° T, 135.1° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.4 m, USBL= 30.6 m

Table 5: Mean Position to Target

Target	CPT253		
Position	394 561.000 m E, 6 230 610.000 m N		
Range	0.42 m Grid		
Bearing To	260.8° G	Bearing From	80.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	112 of 120
Position	394 561.415 m E, 6 230 610.067 m N , -30.619 m MSS
Heading	133.7° T, 135.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT385-v41
Start Time	08 Jan 2024, 15:46:02+01:00
End Time	08 Jan 2024, 15:48:05+01:00
Session Length	2m 3s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 12' 39.22654" N	56° 12' 39.24614" N
Longitude	007° 14' 58.94696" E	007° 14' 58.97840" E
Height	9.839 m Ell., -30.822 m ISS	9.865 m Ell., -31.359 m Ort.
Easting	391 439.711 m E (± 0.05 m)	
Northing	6 230 930.436 m N (± 0.06 m)	
Height	-30.894 m MSS (± 0.15 m) , -30.822 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	119.8° T, 121.2° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.7 m, USBL= 30.9 m

Table 5: Mean Position to Target

Target	CPT385		
Position	391 440.000 m E, 6 230 930.000 m N		
Range	0.52 m Grid		
Bearing To	146.5° G	Bearing From	326.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	391 439.711 m E, 6 230 930.436 m N , -30.894 m MSS
Heading	119.8° T, 121.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT126-v42
Start Time	08 Jan 2024, 18:27:43+01:00
End Time	08 Jan 2024, 18:29:47+01:00
Session Length	2m 4s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 11' 19.44222" N	56° 11' 19.46181" N
Longitude	007° 13' 36.02848" E	007° 13' 36.05990" E
Height	10.078 m Ell., -30.413 m ISS	10.105 m Ell., -31.132 m Ort.
Easting	389 947.838 m E (± 0.05 m)	
Northing	6 228 500.716 m N (± 0.04 m)	
Height	-30.664 m MSS (± 0.16 m) , -30.413 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	122.9° T, 124.4° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.4 m, USBL= 30.7 m

Table 5: Mean Position to Target

Target	CPT126		
Position	389 949.000 m E, 6 228 500.000 m N		
Range	1.36 m Grid		
Bearing To	121.6° G	Bearing From	301.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	389 947.838 m E, 6 228 500.716 m N , -30.664 m MSS
Heading	122.9° T, 124.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT254-v43
Start Time	08 Jan 2024, 19:52:31+01:00
End Time	08 Jan 2024, 19:54:36+01:00
Session Length	2m 5s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 10' 55.45665" N	56° 10' 55.47624" N
Longitude	007° 14' 43.95207" E	007° 14' 43.98350" E
Height	10.671 m Ell., -29.827 m ISS	10.697 m Ell., -30.536 m Ort.
Easting	391 099.753 m E (± 0.04 m)	
Northing	6 227 729.333 m N (± 0.05 m)	
Height	-30.076 m MSS (± 0.16 m) , -29.827 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	93.2° T, 94.7° G	± 1.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.9 m, USBL= 30.1 m

Table 5: Mean Position to Target

Target	CPT254		
Position	391 100.000 m E, 6 227 730.000 m N		
Range	0.71 m Grid		
Bearing To	20.3° G	Bearing From	200.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	391 099.753 m E, 6 227 729.333 m N , -30.076 m MSS
Heading	93.2° T, 94.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT010-v44
Start Time	08 Jan 2024, 23:40:41+01:00
End Time	08 Jan 2024, 23:42:44+01:00
Session Length	2m 3s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 09' 58.88589" N	56° 09' 58.90548" N
Longitude	007° 15' 52.41632" E	007° 15' 52.44775" E
Height	10.317 m Ell., -30.512 m ISS	10.344 m Ell., -30.888 m Ort.
Easting	392 236.050 m E (± 0.07 m)	
Northing	6 225 950.777 m N (± 0.06 m)	
Height	-30.426 m MSS (± 0.16 m) , -30.512 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	79.6° T, 81.0° G	± 2.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.3 m, USBL= 30.5 m

Table 5: Mean Position to Target

Target	CPT010		
Position	392 237.000 m E, 6 225 950.000 m N		
Range	1.23 m Grid		
Bearing To	129.3° G	Bearing From	309.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	392 236.050 m E, 6 225 950.777 m N , -30.426 m MSS
Heading	79.6° T, 81.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT296-v45
Start Time	09 Jan 2024, 01:46:42+01:00
End Time	09 Jan 2024, 01:48:45+01:00
Session Length	2m 3s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 37.65549" N	56° 06' 37.67509" N
Longitude	007° 07' 25.79473" E	007° 07' 25.82609" E
Height	9.927 m Ell., -31.059 m ISS	9.953 m Ell., -31.328 m Ort.
Easting	383 329.333 m E (± 0.04 m)	
Northing	6 219 959.503 m N (± 0.05 m)	
Height	-30.853 m MSS (± 0.17 m) , -31.059 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	223.6° T, 225.1° G	± 0.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.5 m, USBL= 30.9 m

Table 5: Mean Position to Target

Target	CPT296		
Position	383 329.000 m E, 6 219 960.000 m N		
Range	0.60 m Grid		
Bearing To	326.2° G	Bearing From	146.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	383 329.333 m E, 6 219 959.503 m N , -30.853 m MSS
Heading	223.6° T, 225.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT248-v46
Start Time	09 Jan 2024, 04:09:59+01:00
End Time	09 Jan 2024, 04:12:01+01:00
Session Length	2m 2s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 50.56381" N	56° 05' 50.58341" N
Longitude	007° 09' 44.95453" E	007° 09' 44.98590" E
Height	9.734 m Ell., -30.936 m ISS	9.761 m Ell., -31.510 m Ort.
Easting	385 694.071 m E (± 0.03 m)	
Northing	6 218 439.196 m N (± 0.05 m)	
Height	-31.033 m MSS (± 0.19 m) , -30.936 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	243.8° T, 245.3° G	± 1.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.6 m, USBL= 31.0 m

Table 5: Mean Position to Target

Target	CPT248		
Position	385 693.000 m E, 6 218 440.000 m N		
Range	1.34 m Grid		
Bearing To	306.9° G	Bearing From	126.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	385 694.071 m E, 6 218 439.196 m N , -31.033 m MSS
Heading	243.8° T, 245.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT025-v47
Start Time	09 Jan 2024, 10:21:42+01:00
End Time	09 Jan 2024, 10:23:45+01:00
Session Length	2m 2s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 29.36944" N	56° 06' 29.38904" N
Longitude	007° 10' 28.23353" E	007° 10' 28.26491" E
Height	12.034 m Ell., -28.774 m ISS	12.061 m Ell., -29.205 m Ort.
Easting	386 473.556 m E (± 0.07 m)	
Northing	6 219 618.852 m N (± 0.06 m)	
Height	-28.729 m MSS (± 0.16 m) , -28.774 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	337.8° T, 339.3° G	± 1.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.4 m, USBL= 28.8 m

Table 5: Mean Position to Target

Target	CPT025		
Position	386 473.000 m E, 6 219 620.000 m N		
Range	1.28 m Grid		
Bearing To	334.2° G	Bearing From	154.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	386 473.556 m E, 6 219 618.852 m N , -28.729 m MSS
Heading	337.8° T, 339.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT318-v48
Start Time	09 Jan 2024, 12:37:41+01:00
End Time	09 Jan 2024, 12:39:45+01:00
Session Length	2m 4s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 06' 18.06598" N	56° 06' 18.08558" N
Longitude	007° 13' 02.59779" E	007° 13' 02.62919" E
Height	12.876 m Ell., -28.096 m ISS	12.902 m Ell., -28.353 m Ort.
Easting	389 130.824 m E (± 0.08 m)	
Northing	6 219 199.742 m N (± 0.06 m)	
Height	-27.881 m MSS (± 0.20 m) , -28.096 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	306.0° T, 307.5° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.5 m, USBL= 27.9 m

Table 5: Mean Position to Target

Target	CPT318		
Position	389 130.000 m E, 6 219 200.000 m N		
Range	0.86 m Grid		
Bearing To	287.4° G	Bearing From	107.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	389 130.824 m E, 6 219 199.742 m N , -27.881 m MSS
Heading	306.0° T, 307.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT028-v49
Start Time	09 Jan 2024, 14:03:22+01:00
End Time	09 Jan 2024, 14:05:34+01:00
Session Length	2m 13s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 55.37244" N	56° 05' 55.39203" N
Longitude	007° 14' 26.48922" E	007° 14' 26.52063" E
Height	12.689 m Ell., -28.302 m ISS	12.716 m Ell., -28.536 m Ort.
Easting	390 562.103 m E (± 0.11 m)	
Northing	6 218 461.071 m N (± 0.11 m)	
Height	-28.073 m MSS (± 0.22 m) , -28.302 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	292.4° T, 293.8° G	± 1.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.7 m, USBL= 28.1 m

Table 5: Mean Position to Target

Target	CPT028		
Position	390 561.000 m E, 6 218 460.000 m N		
Range	1.54 m Grid		
Bearing To	225.8° G	Bearing From	45.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	390 562.103 m E, 6 218 461.071 m N , -28.073 m MSS
Heading	292.4° T, 293.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT240-v50
Start Time	09 Jan 2024, 16:11:26+01:00
End Time	09 Jan 2024, 16:13:28+01:00
Session Length	2m 3s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 17.20587" N	56° 05' 17.22547" N
Longitude	007° 13' 45.56461" E	007° 13' 45.59602" E
Height	13.283 m Ell., -27.482 m ISS	13.309 m Ell., -27.946 m Ort.
Easting	389 824.775 m E (± 0.08 m)	
Northing	6 217 299.395 m N (± 0.06 m)	
Height	-27.482 m MSS (± 0.16 m) , -27.482 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	330.4° T, 331.8° G	± 1.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.1 m, USBL= 27.5 m

Table 5: Mean Position to Target

Target	CPT240		
Position	389 825.000 m E, 6 217 300.000 m N		
Range	0.65 m Grid		
Bearing To	20.4° G	Bearing From	200.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	389 824.775 m E, 6 217 299.395 m N , -27.482 m MSS
Heading	330.4° T, 331.8° G
Pitch	0.00 °
Roll	0.00 °



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Steve Weston
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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT147-v51
Start Time	09 Jan 2024, 19:19:49+01:00
End Time	09 Jan 2024, 19:22:02+01:00
Session Length	2m 13s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 05' 02.44129" N	56° 05' 02.46088" N
Longitude	007° 16' 13.14001" E	007° 16' 13.17143" E
Height	12.862 m Ell., -27.784 m ISS	12.888 m Ell., -28.361 m Ort.
Easting	392 363.723 m E (± 0.13 m)	
Northing	6 216 778.333 m N (± 0.10 m)	
Height	-27.888 m MSS (± 0.19 m) , -27.784 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	320.0° T, 321.4° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.6 m, USBL= 27.9 m

Table 5: Mean Position to Target

Target	CPT147		
Position	392 364.000 m E, 6 216 780.000 m N		
Range	1.69 m Grid		
Bearing To	9.4° G	Bearing From	189.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	392 363.723 m E, 6 216 778.333 m N , -27.888 m MSS
Heading	320.0° T, 321.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT399-v54
Start Time	08 Feb 2024, 18:54:05+01:00
End Time	08 Feb 2024, 18:56:08+01:00
Session Length	2m 3s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 49' 54.13381" N	55° 49' 54.15341" N
Longitude	007° 23' 05.71368" E	007° 23' 05.74510" E
Height	17.459 m Ell., -23.572 m ISS	17.485 m Ell., -23.695 m Ort.
Easting	398 838.670 m E (± 0.17 m)	
Northing	6 188 528.752 m N (± 0.05 m)	
Height	-23.269 m MSS (± 0.22 m) , -23.572 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	327.2° T, 328.5° G	± 7.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.8 m, USBL= 23.3 m

Table 5: Mean Position to Target

Target	CPT399		
Position	398 839.000 m E, 6 188 530.000 m N		
Range	1.29 m Grid		
Bearing To	14.8° G	Bearing From	194.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	398 838.670 m E, 6 188 528.752 m N , -23.269 m MSS
Heading	327.2° T, 328.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT184-v55
Start Time	08 Feb 2024, 15:03:32+01:00
End Time	08 Feb 2024, 15:05:35+01:00
Session Length	2m 3s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 49' 05.73617" N	55° 49' 05.75577" N
Longitude	007° 21' 12.34078" E	007° 21' 12.37219" E
Height	18.880 m Ell., -22.431 m ISS	18.906 m Ell., -22.266 m Ort.
Easting	396 830.743 m E (± 0.07 m)	
Northing	6 187 079.227 m N (± 0.06 m)	
Height	-21.829 m MSS (± 0.52 m) , -22.431 m ISS (± 0.50 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	321.5° T, 322.9° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 21.4 m, USBL= 21.9 m

Table 5: Mean Position to Target

Target	CPT184		
Position	396 830.000 m E, 6 187 080.000 m N		
Range	1.07 m Grid		
Bearing To	316.1° G	Bearing From	136.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	396 830.743 m E, 6 187 079.227 m N , -21.829 m MSS
Heading	321.5° T, 322.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT152-v53
Start Time	08 Feb 2024, 10:46:32+01:00
End Time	08 Feb 2024, 10:48:40+01:00
Session Length	2m 8s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 48' 31.18919" N	55° 48' 31.20878" N
Longitude	007° 24' 15.19626" E	007° 24' 15.22769" E
Height	16.772 m Ell., -24.455 m ISS	16.798 m Ell., -24.366 m Ort.
Easting	399 988.375 m E (± 0.15 m)	
Northing	6 185 936.854 m N (± 0.11 m)	
Height	-23.930 m MSS (± 0.29 m) , -24.455 m ISS (± 0.25 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	315.7° T, 317.0° G	± 3.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.5 m, USBL= 24.0 m

Table 5: Mean Position to Target

Target	CPT152		
Position	399 985.000 m E, 6 185 940.000 m N		
Range	4.61 m Grid		
Bearing To	313.0° G	Bearing From	133.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	399 988.375 m E, 6 185 936.854 m N , -23.930 m MSS
Heading	315.7° T, 317.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT297-v55
Start Time	08 Feb 2024, 20:56:44+01:00
End Time	08 Feb 2024, 20:58:58+01:00
Session Length	2m 14s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 49' 18.87749" N	55° 49' 18.89709" N
Longitude	007° 18' 40.43121" E	007° 18' 40.46259" E
Height	17.509 m Ell., -23.582 m ISS	17.535 m Ell., -23.641 m Ort.
Easting	394 196.985 m E (± 0.08 m)	
Northing	6 187 549.100 m N (± 0.03 m)	
Height	-23.202 m MSS (± 0.20 m) , -23.582 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	316.0° T, 317.4° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.8 m, USBL= 23.3 m

Table 5: Mean Position to Target

Target	CPT297		
Position	394 198.000 m E, 6 187 550.000 m N		
Range	1.36 m Grid		
Bearing To	48.4° G	Bearing From	228.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	394 196.985 m E, 6 187 549.100 m N , -23.202 m MSS
Heading	316.0° T, 317.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT365-v56
Start Time	08 Feb 2024, 22:43:43+01:00
End Time	08 Feb 2024, 22:46:03+01:00
Session Length	2m 20s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 49' 18.17024" N	55° 49' 18.18984" N
Longitude	007° 14' 45.11862" E	007° 14' 45.14998" E
Height	11.490 m Ell., -29.717 m ISS	11.516 m Ell., -29.664 m Ort.
Easting	390 101.739 m E (± 0.11 m)	
Northing	6 187 629.048 m N (± 0.09 m)	
Height	-29.221 m MSS (± 0.23 m) , -29.717 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	325.3° T, 326.8° G	± 3.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.0 m, USBL= 29.2 m

Table 5: Mean Position to Target


Target	CPT365		
Position	390 103.000 m E, 6 187 630.000 m N		
Range	1.58 m Grid		
Bearing To	53.0° G	Bearing From	233.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	390 101.739 m E, 6 187 629.048 m N , -29.221 m MSS
Heading	325.3° T, 326.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT207-v58
Start Time	09 Feb 2024, 01:03:20+01:00
End Time	09 Feb 2024, 01:05:23+01:00
Session Length	2m 4s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 50' 06.80918" N	55° 50' 06.82878" N
Longitude	007° 16' 22.25832" E	007° 16' 22.28970" E
Height	13.562 m Ell., -27.901 m ISS	13.588 m Ell., -27.598 m Ort.
Easting	391 829.584 m E (± 0.06 m)	
Northing	6 189 089.975 m N (± 0.06 m)	
Height	-27.157 m MSS (± 0.15 m) , -27.901 m ISS (± 0.07 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	322.0° T, 323.5° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.9 m, USBL= 27.2 m

Table 5: Mean Position to Target

Target	CPT207		
Position	391 830.000 m E, 6 189 090.000 m N		
Range	0.42 m Grid		
Bearing To	86.5° G	Bearing From	266.5° G

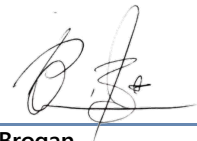
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	391 829.584 m E, 6 189 089.975 m N , -27.157 m MSS
Heading	322.0° T, 323.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT281A-v59
Start Time	12 Feb 2024, 01:06:41+01:00
End Time	12 Feb 2024, 01:08:44+01:00
Session Length	2m 3s (112 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 50' 39.90458" N	55° 50' 39.92418" N
Longitude	007° 20' 32.96259" E	007° 20' 32.99400" E
Height	18.421 m Ell., -22.685 m ISS	18.447 m Ell., -22.743 m Ort.
Easting	396 215.137 m E (± 0.13 m)	
Northing	6 190 006.351 m N (± 0.05 m)	
Height	-22.299 m MSS (± 0.31 m) , -22.685 m ISS (± 0.28 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	134.9° T, 136.3° G	± 4.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 21.9 m, USBL= 22.4 m

Table 5: Mean Position to Target

Target	CPT281		
Position	396 216.000 m E, 6 190 010.000 m N		
Range	3.75 m Grid		
Bearing To	13.3° G	Bearing From	193.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	112 of 120
Position	396 215.137 m E, 6 190 006.351 m N , -22.299 m MSS
Heading	134.9° T, 136.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT322 A-v61
Start Time	12 Feb 2024, 05:02:41+01:00
End Time	12 Feb 2024, 05:05:27+01:00
Session Length	2m 46s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 51' 02.29087" N	55° 51' 02.31046" N
Longitude	007° 23' 18.97705" E	007° 23' 19.00848" E
Height	15.259 m Ell., -26.163 m ISS	15.285 m Ell., -25.907 m Ort.
Easting	399 118.456 m E (± 0.38 m)	
Northing	6 190 630.151 m N (± 0.19 m)	
Height	-25.475 m MSS (± 0.29 m) , -26.163 m ISS (± 0.26 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	175.7° T, 177.1° G	± 19.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.1 m, USBL= 25.5 m

Table 5: Mean Position to Target

Target	CPT322		
Position	399 120.000 m E, 6 190 630.000 m N		
Range	1.55 m Grid		
Bearing To	95.6° G	Bearing From	275.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	399 118.456 m E, 6 190 630.151 m N , -25.475 m MSS
Heading	175.7° T, 177.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT104-v62
Start Time	12 Feb 2024, 07:09:29+01:00
End Time	12 Feb 2024, 07:11:33+01:00
Session Length	2m 4s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 51' 22.73523" N	55° 51' 22.75482" N
Longitude	007° 21' 43.37564" E	007° 21' 43.40706" E
Height	17.449 m Ell., -23.613 m ISS	17.474 m Ell., -23.723 m Ort.
Easting	397 471.040 m E (± 0.06 m)	
Northing	6 191 301.117 m N (± 0.06 m)	
Height	-23.289 m MSS (± 0.22 m) , -23.613 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	172.2° T, 173.6° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.0 m, USBL= 23.3 m

Table 5: Mean Position to Target

Target	CPT104		
Position	397 470.000 m E, 6 191 300.000 m N		
Range	1.53 m Grid		
Bearing To	222.9° G	Bearing From	42.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	397 471.040 m E, 6 191 301.117 m N , -23.289 m MSS
Heading	172.2° T, 173.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT270-v63
Start Time	12 Feb 2024, 09:09:52+01:00
End Time	12 Feb 2024, 09:11:54+01:00
Session Length	2m 2s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 51' 59.65049" N	55° 51' 59.67008" N
Longitude	007° 22' 13.77209" E	007° 22' 13.80352" E
Height	17.958 m Ell., -22.827 m ISS	17.984 m Ell., -23.220 m Ort.
Easting	398 026.380 m E (± 0.12 m)	
Northing	6 192 429.715 m N (± 0.14 m)	
Height	-22.784 m MSS (± 0.34 m) , -22.827 m ISS (± 0.31 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	261.5° T, 262.9° G	± 7.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.3 m, USBL= 22.9 m

Table 5: Mean Position to Target

Target	CPT270		
Position	398 025.000 m E, 6 192 430.000 m N		
Range	1.41 m Grid		
Bearing To	281.7° G	Bearing From	101.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	398 026.380 m E, 6 192 429.715 m N , -22.784 m MSS
Heading	261.5° T, 262.9° G
Pitch	0.00 °
Roll	0.00 °



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Client Representative
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Tom Brogan
Client Representative
Energinet Eltransmission

Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT374-v64
Start Time	12 Feb 2024, 11:24:36+01:00
End Time	12 Feb 2024, 11:26:47+01:00
Session Length	2m 11s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 43.95861" N	55° 52' 43.97821" N
Longitude	007° 19' 24.95652" E	007° 19' 24.98793" E
Height	18.873 m Ell., -22.045 m ISS	18.898 m Ell., -22.314 m Ort.
Easting	395 125.318 m E (± 0.04 m)	
Northing	6 193 869.384 m N (± 0.04 m)	
Height	-21.879 m MSS (± 0.23 m) , -22.045 m ISS (± 0.18 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	258.5° T, 259.8° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 21.7 m, USBL= 21.9 m

Table 5: Mean Position to Target

Target	CPT374		
Position	395 125.000 m E, 6 193 870.000 m N		
Range	0.69 m Grid		
Bearing To	332.7° G	Bearing From	152.7° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	395 125.318 m E, 6 193 869.384 m N , -21.879 m MSS
Heading	258.5° T, 259.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT118-v55
Start Time	08 Feb 2024, 13:23:00+01:00
End Time	08 Feb 2024, 13:25:13+01:00
Session Length	2m 13s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 48' 26.66684" N	55° 48' 26.68643" N
Longitude	007° 20' 31.09005" E	007° 20' 31.12145" E
Height	18.782 m Ell., -22.715 m ISS	18.808 m Ell., -22.358 m Ort.
Easting	396 083.943 m E (± 0.03 m)	
Northing	6 185 888.717 m N (± 0.05 m)	
Height	-21.921 m MSS (± 0.54 m) , -22.715 m ISS (± 0.52 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	284.0° T, 285.4° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 21.1 m, USBL= 21.6 m

Table 5: Mean Position to Target

Target	CPT118		
Position	396 086.000 m E, 6 185 890.000 m N		
Range	2.42 m Grid		
Bearing To	58.1° G	Bearing From	238.1° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	396 083.943 m E, 6 185 888.717 m N , -21.921 m MSS
Heading	284.0° T, 285.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT090-v56
Start Time	12 Feb 2024, 13:13:34+01:00
End Time	12 Feb 2024, 13:15:36+01:00
Session Length	2m 3s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 39.91494" N	55° 53' 39.93454" N
Longitude	007° 22' 12.73505" E	007° 22' 12.76648" E
Height	15.941 m Ell., -25.104 m ISS	15.966 m Ell., -25.253 m Ort.
Easting	398 081.359 m E (± 0.05 m)	
Northing	6 195 529.382 m N (± 0.10 m)	
Height	-24.812 m MSS (± 0.24 m) , -25.104 m ISS (± 0.20 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	264.6° T, 265.9° G	± 3.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.6 m, USBL= 24.8 m

Table 5: Mean Position to Target

Target	CPT090		
Position	398 080.000 m E, 6 195 530.000 m N		
Range	1.49 m Grid		
Bearing To	294.5° G	Bearing From	114.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	398 081.359 m E, 6 195 529.382 m N , -24.812 m MSS
Heading	264.6° T, 265.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT324-v57
Start Time	12 Feb 2024, 14:31:14+01:00
End Time	12 Feb 2024, 14:33:55+01:00
Session Length	2m 41s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 05.55437" N	55° 54' 05.57396" N
Longitude	007° 21' 29.85229" E	007° 21' 29.88372" E
Height	16.034 m Ell., -25.300 m ISS	16.060 m Ell., -25.163 m Ort.
Easting	397 355.339 m E (± 0.09 m)	
Northing	6 196 339.526 m N (± 0.11 m)	
Height	-24.730 m MSS (± 0.26 m) , -25.300 m ISS (± 0.23 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	270.2° T, 271.6° G	± 5.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.6 m, USBL= 24.8 m

Table 5: Mean Position to Target

Target	CPT324		
Position	397 355.000 m E, 6 196 340.000 m N		
Range	0.58 m Grid		
Bearing To	324.5° G	Bearing From	144.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	397 355.339 m E, 6 196 339.526 m N , -24.730 m MSS
Heading	270.2° T, 271.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT146-v58
Start Time	12 Feb 2024, 16:09:53+01:00
End Time	12 Feb 2024, 16:11:56+01:00
Session Length	2m 3s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 19.83210" N	55° 54' 19.85169" N
Longitude	007° 21' 57.45619" E	007° 21' 57.48762" E
Height	15.448 m Ell., -26.179 m ISS	15.474 m Ell., -25.751 m Ort.
Easting	397 845.127 m E (± 0.08 m)	
Northing	6 196 769.511 m N (± 0.09 m)	
Height	-25.317 m MSS (± 0.24 m) , -26.179 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	264.0° T, 265.4° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.2 m, USBL= 25.4 m

Table 5: Mean Position to Target

Target	CPT146		
Position	397 844.000 m E, 6 196 770.000 m N		
Range	1.23 m Grid		
Bearing To	293.4° G	Bearing From	113.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	397 845.127 m E, 6 196 769.511 m N , -25.317 m MSS
Heading	264.0° T, 265.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT281-v59
Start Time	12 Feb 2024, 00:23:45+01:00
End Time	12 Feb 2024, 00:26:02+01:00
Session Length	2m 17s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 50' 40.08063" N	55° 50' 40.10023" N
Longitude	007° 20' 33.08654" E	007° 20' 33.11795" E
Height	18.171 m Ell., -22.798 m ISS	18.197 m Ell., -22.993 m Ort.
Easting	396 217.423 m E (± 0.23 m)	
Northing	6 190 011.741 m N (± 0.04 m)	
Height	-22.550 m MSS (± 0.40 m) , -22.798 m ISS (± 0.37 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	137.2° T, 138.6° G	± 9.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 0.00 m, USBL= 22.6 m

Table 5: Mean Position to Target

Target	CPT281		
Position	396 216.000 m E, 6 190 010.000 m N		
Range	2.25 m Grid		
Bearing To	219.3° G	Bearing From	39.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	396 217.423 m E, 6 190 011.741 m N , -22.550 m MSS
Heading	137.2° T, 138.6° G
Pitch	0.00 °
Roll	0.00 °

Comments

miniIPS not functional during logging of depths



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT082-v60
Start Time	12 Feb 2024, 19:23:44+01:00
End Time	12 Feb 2024, 19:25:47+01:00
Session Length	2m 3s (112 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 17.98973" N	55° 54' 18.00932" N
Longitude	007° 18' 27.10384" E	007° 18' 27.13524" E
Height	17.777 m Ell., -23.489 m ISS	17.803 m Ell., -23.424 m Ort.
Easting	394 191.192 m E (± 0.07 m)	
Northing	6 196 800.393 m N (± 0.12 m)	
Height	-22.986 m MSS (± 0.20 m) , -23.489 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	241.8° T, 243.2° G	± 3.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.7 m, USBL= 23.1 m

Table 5: Mean Position to Target

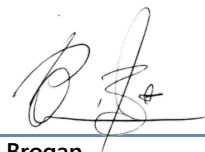
Target	CPT082		
Position	394 190.000 m E, 6 196 800.000 m N		
Range	1.26 m Grid		
Bearing To	251.7° G	Bearing From	71.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	112 of 120
Position	394 191.192 m E, 6 196 800.393 m N , -22.986 m MSS
Heading	241.8° T, 243.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT377-v61
Start Time	12 Feb 2024, 21:22:27+01:00
End Time	12 Feb 2024, 21:24:34+01:00
Session Length	2m 7s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 53.35213" N	55° 54' 53.37173" N
Longitude	007° 18' 58.12141" E	007° 18' 58.15282" E
Height	17.458 m Ell., -23.448 m ISS	17.484 m Ell., -23.747 m Ort.
Easting	394 756.395 m E (± 0.07 m)	
Northing	6 197 880.318 m N (± 0.10 m)	
Height	-23.314 m MSS (± 0.17 m) , -23.448 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	258.3° T, 259.7° G	± 4.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 23.1 m, USBL= 23.3 m

Table 5: Mean Position to Target

Target	CPT377		
Position	394 756.000 m E, 6 197 880.000 m N		
Range	0.51 m Grid		
Bearing To	231.2° G	Bearing From	51.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	394 756.395 m E, 6 197 880.318 m N , -23.314 m MSS
Heading	258.3° T, 259.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT203-v62
Start Time	12 Feb 2024, 22:54:05+01:00
End Time	12 Feb 2024, 22:56:12+01:00
Session Length	2m 8s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 12.99011" N	55° 55' 13.00970" N
Longitude	007° 21' 18.34010" E	007° 21' 18.37153" E
Height	15.019 m Ell., -26.059 m ISS	15.045 m Ell., -26.186 m Ort.
Easting	397 204.995 m E (± 0.26 m)	
Northing	6 198 428.764 m N (± 0.21 m)	
Height	-25.753 m MSS (± 0.27 m) , -26.059 m ISS (± 0.23 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	245.8° T, 247.1° G	± 10.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.6 m, USBL= 25.8 m

Table 5: Mean Position to Target

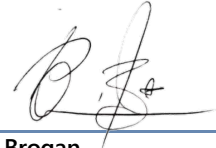
Target	CPT203		
Position	397 203.000 m E, 6 198 430.000 m N		
Range	2.35 m Grid		
Bearing To	301.8° G	Bearing From	121.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	397 204.995 m E, 6 198 428.764 m N , -25.753 m MSS
Heading	245.8° T, 247.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT 078-v64
Start Time	13 Feb 2024, 01:59:50+01:00
End Time	13 Feb 2024, 02:01:52+01:00
Session Length	2m 2s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 32.14263" N	55° 55' 32.16223" N
Longitude	007° 15' 28.25072" E	007° 15' 28.28210" E
Height	15.529 m Ell., -25.840 m ISS	15.555 m Ell., -25.681 m Ort.
Easting	391 143.330 m E (± 0.07 m)	
Northing	6 199 169.579 m N (± 0.09 m)	
Height	-25.241 m MSS (± 0.17 m) , -25.840 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	240.0° T, 241.4° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.1 m, USBL= 25.2 m

Table 5: Mean Position to Target

Target	CPT078		
Position	391 142.000 m E, 6 199 170.000 m N		
Range	1.40 m Grid		
Bearing To	287.6° G	Bearing From	107.6° G

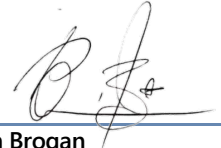
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	391 143.330 m E, 6 199 169.579 m N , -25.241 m MSS
Heading	240.0° T, 241.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT265-v67
Start Time	13 Feb 2024, 05:01:15+01:00
End Time	13 Feb 2024, 05:03:36+01:00
Session Length	2m 21s (49 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 18.81016" N	55° 56' 18.82976" N
Longitude	007° 17' 07.42623" E	007° 17' 07.45763" E
Height	15.982 m Ell., -25.808 m ISS	16.007 m Ell., -25.231 m Ort.
Easting	392 900.264 m E (± 0.08 m)	
Northing	6 200 569.073 m N (± 0.10 m)	
Height	-24.792 m MSS (± 0.26 m) , -25.808 m ISS (± 0.22 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	228.2° T, 229.7° G	± 4.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.6 m, USBL= 25.1 m

Table 5: Mean Position to Target

Target	CPT265		
Position	392 899.000 m E, 6 200 570.000 m N		
Range	1.57 m Grid		
Bearing To	306.3° G	Bearing From	126.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	49 of 120
Position	392 900.264 m E, 6 200 569.073 m N , -24.792 m MSS
Heading	228.2° T, 229.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT204-v68
Start Time	13 Feb 2024, 08:23:16+01:00
End Time	13 Feb 2024, 08:25:31+01:00
Session Length	2m 15s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 08.32304" N	55° 57' 08.34264" N
Longitude	007° 19' 01.72495" E	007° 19' 01.75636" E
Height	14.188 m Ell., -27.022 m ISS	14.214 m Ell., -27.027 m Ort.
Easting	394 920.489 m E (± 0.10 m)	
Northing	6 202 050.829 m N (± 0.11 m)	
Height	-26.583 m MSS (± 0.24 m) , -27.022 m ISS (± 0.20 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	240.9° T, 242.3° G	± 4.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.4 m, USBL= 26.6 m

Table 5: Mean Position to Target

Target	CPT204		
Position	394 919.000 m E, 6 202 050.000 m N		
Range	1.70 m Grid		
Bearing To	240.9° G	Bearing From	60.9° G

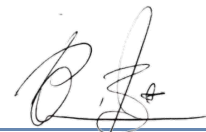
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	394 920.489 m E, 6 202 050.829 m N , -26.583 m MSS
Heading	240.9° T, 242.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT204A-v69
Start Time	13 Feb 2024, 09:50:07+01:00
End Time	13 Feb 2024, 09:52:19+01:00
Session Length	2m 12s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 08.20422" N	55° 57' 08.22382" N
Longitude	007° 19' 01.77185" E	007° 19' 01.80327" E
Height	14.207 m Ell., -26.729 m ISS	14.233 m Ell., -27.007 m Ort.
Easting	394 921.214 m E (± 0.16 m)	
Northing	6 202 047.137 m N (± 0.13 m)	
Height	-26.564 m MSS (± 0.23 m) , -26.729 m ISS (± 0.18 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	253.4° T, 254.8° G	± 7.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.4 m, USBL= 26.6 m

Table 5: Mean Position to Target

Target	CPT204		
Position	394 919.000 m E, 6 202 050.000 m N		
Range	3.62 m Grid		
Bearing To	322.3° G	Bearing From	142.3° G

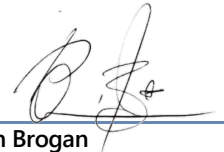
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	394 921.214 m E, 6 202 047.137 m N , -26.564 m MSS
Heading	253.4° T, 254.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT328-v70
Start Time	13 Feb 2024, 13:01:31+01:00
End Time	13 Feb 2024, 13:03:34+01:00
Session Length	2m 4s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 52.35569" N	55° 57' 52.37529" N
Longitude	007° 16' 25.13838" E	007° 16' 25.16977" E
Height	15.570 m Ell., -25.483 m ISS	15.596 m Ell., -25.650 m Ort.
Easting	392 238.823 m E (± 0.07 m)	
Northing	6 203 478.862 m N (± 0.10 m)	
Height	-25.208 m MSS (± 0.23 m) , -25.483 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	242.3° T, 243.7° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.0 m, USBL= 25.3 m

Table 5: Mean Position to Target

Target	CPT328		
Position	392 238.000 m E, 6 203 480.000 m N		
Range	1.40 m Grid		
Bearing To	324.1° G	Bearing From	144.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	392 238.823 m E, 6 203 478.862 m N , -25.208 m MSS
Heading	242.3° T, 243.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT072-v71
Start Time	14 Feb 2024, 07:40:40+01:00
End Time	14 Feb 2024, 07:42:44+01:00
Session Length	2m 4s (90 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 05.07208" N	55° 56' 05.09169" N
Longitude	006° 59' 25.85809" E	006° 59' 25.88935" E
Height	3.597 m Ell., -37.834 m ISS	3.623 m Ell., -37.717 m Ort.
Easting	374 471.360 m E (± 0.06 m)	
Northing	6 200 640.458 m N (± 0.08 m)	
Height	-37.248 m MSS (± 0.19 m) , -37.834 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	237.3° T, 238.9° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 37.2 m, USBL= 37.2 m

Table 5: Mean Position to Target

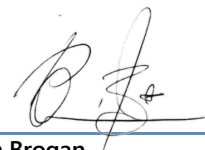
Target	CPT072		
Position	374 470.000 m E, 6 200 640.000 m N		
Range	1.43 m Grid		
Bearing To	251.4° G	Bearing From	71.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	90 of 120
Position	374 471.360 m E, 6 200 640.458 m N , -37.248 m MSS
Heading	237.3° T, 238.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT072A-v72
Start Time	14 Feb 2024, 14:06:51+01:00
End Time	14 Feb 2024, 14:09:05+01:00
Session Length	2m 14s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 05.01630" N	55° 56' 05.03591" N
Longitude	006° 59' 25.73776" E	006° 59' 25.76902" E
Height	3.618 m Ell., -37.540 m ISS	3.644 m Ell., -37.696 m Ort.
Easting	374 469.222 m E (± 0.07 m)	
Northing	6 200 638.794 m N (± 0.13 m)	
Height	-37.226 m MSS (± 0.27 m) , -37.540 m ISS (± 0.23 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	219.0° T, 220.7° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 37.1 m, USBL= 37.2 m

Table 5: Mean Position to Target

Target	CPT072		
Position	374 470.000 m E, 6 200 640.000 m N		
Range	1.43 m Grid		
Bearing To	32.8° G	Bearing From	212.8° G

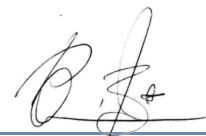
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	374 469.222 m E, 6 200 638.794 m N , -37.226 m MSS
Heading	219.0° T, 220.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT210-v73
Start Time	14 Feb 2024, 15:38:17+01:00
End Time	14 Feb 2024, 15:40:30+01:00
Session Length	2m 13s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 24.82387" N	55° 56' 24.84349" N
Longitude	006° 57' 48.02382" E	006° 57' 48.05507" E
Height	5.232 m Ell., -36.005 m ISS	5.258 m Ell., -36.105 m Ort.
Easting	372 791.965 m E (± 0.07 m)	
Northing	6 201 300.622 m N (± 0.11 m)	
Height	-35.638 m MSS (± 0.25 m) , -36.005 m ISS (± 0.21 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	226.0° T, 227.7° G	± 2.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 35.7 m, USBL= 35.7 m

Table 5: Mean Position to Target

Target	CPT210		
Position	372 792.000 m E, 6 201 300.000 m N		
Range	0.62 m Grid		
Bearing To	176.8° G	Bearing From	356.8° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	372 791.965 m E, 6 201 300.622 m N , -35.638 m MSS
Heading	226.0° T, 227.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT210A-v74
Start Time	14 Feb 2024, 16:44:59+01:00
End Time	14 Feb 2024, 16:47:01+01:00
Session Length	2m 2s (110 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 24.70532" N	55° 56' 24.72494" N
Longitude	006° 57' 48.11543" E	006° 57' 48.14668" E
Height	5.180 m Ell., -36.217 m ISS	5.206 m Ell., -36.156 m Ort.
Easting	372 793.446 m E (± 0.07 m)	
Northing	6 201 296.911 m N (± 0.09 m)	
Height	-35.689 m MSS (± 0.23 m) , -36.217 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	213.5° T, 215.2° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 35.6 m, USBL= 35.8 m

Table 5: Mean Position to Target

Target	CPT210		
Position	372 792.000 m E, 6 201 300.000 m N		
Range	3.41 m Grid		
Bearing To	334.9° G	Bearing From	154.9° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	110 of 120
Position	372 793.446 m E, 6 201 296.911 m N , -35.689 m MSS
Heading	213.5° T, 215.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT190-v75
Start Time	14 Feb 2024, 22:25:21+01:00
End Time	14 Feb 2024, 22:27:23+01:00
Session Length	2m 2s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 43.75432" N	55° 57' 43.77393" N
Longitude	006° 59' 25.51027" E	006° 59' 25.54153" E
Height	5.332 m Ell., -35.585 m ISS	5.358 m Ell., -35.985 m Ort.
Easting	374 553.998 m E (± 0.07 m)	
Northing	6 203 690.760 m N (± 0.05 m)	
Height	-35.521 m MSS (± 0.21 m) , -35.585 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	176.0° T, 177.7° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 35.5 m, USBL= 35.6 m

Table 5: Mean Position to Target

Target	CPT190		
Position	374 553.000 m E, 6 203 690.000 m N		
Range	1.25 m Grid		
Bearing To	232.7° G	Bearing From	52.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	374 553.998 m E, 6 203 690.760 m N , -35.521 m MSS
Heading	176.0° T, 177.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT190A-v76
Start Time	14 Feb 2024, 23:23:27+01:00
End Time	14 Feb 2024, 23:25:29+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 43.60069" N	55° 57' 43.62030" N
Longitude	006° 59' 25.51349" E	006° 59' 25.54476" E
Height	5.350 m Ell., -35.644 m ISS	5.376 m Ell., -35.967 m Ort.
Easting	374 553.916 m E (± 0.12 m)	
Northing	6 203 686.010 m N (± 0.08 m)	
Height	-35.503 m MSS (± 0.24 m) , -35.644 m ISS (± 0.20 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	191.1° T, 192.8° G	± 3.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 35.4 m, USBL= 35.5 m

Table 5: Mean Position to Target

Target	CPT190		
Position	374 553.000 m E, 6 203 690.000 m N		
Range	4.09 m Grid		
Bearing To	347.1° G	Bearing From	167.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	374 553.916 m E, 6 203 686.010 m N , -35.503 m MSS
Heading	191.1° T, 192.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT190B-v77
Start Time	15 Feb 2024, 02:09:47+01:00
End Time	15 Feb 2024, 02:11:49+01:00
Session Length	2m 2s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 43.70253" N	55° 57' 43.72215" N
Longitude	006° 59' 25.28551" E	006° 59' 25.31678" E
Height	5.383 m Ell., -35.794 m ISS	5.409 m Ell., -35.934 m Ort.
Easting	374 550.055 m E (± 0.09 m)	
Northing	6 203 689.273 m N (± 0.10 m)	
Height	-35.470 m MSS (± 0.19 m) , -35.794 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	205.2° T, 206.9° G	± 3.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 35.4 m, USBL= 35.5 m

Table 5: Mean Position to Target

Target	CPT190		
Position	374 553.000 m E, 6 203 690.000 m N		
Range	3.03 m Grid		
Bearing To	76.1° G	Bearing From	256.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	374 550.055 m E, 6 203 689.273 m N , -35.470 m MSS
Heading	205.2° T, 206.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT066-v78
Start Time	15 Feb 2024, 04:30:25+01:00
End Time	15 Feb 2024, 04:32:26+01:00
Session Length	2m 1s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 58' 00.74794" N	55° 58' 00.76755" N
Longitude	007° 01' 15.56155" E	007° 01' 15.59282" E
Height	6.230 m Ell., -35.155 m ISS	6.256 m Ell., -35.067 m Ort.
Easting	376 477.041 m E (± 0.07 m)	
Northing	6 204 160.957 m N (± 0.06 m)	
Height	-34.604 m MSS (± 0.18 m) , -35.155 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	203.1° T, 204.7° G	± 2.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 34.6 m, USBL= 34.7 m

Table 5: Mean Position to Target

Target	CPT066		
Position	376 477.000 m E, 6 204 160.000 m N		
Range	0.96 m Grid		
Bearing To	182.5° G	Bearing From	2.5° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	376 477.041 m E, 6 204 160.957 m N , -34.604 m MSS
Heading	203.1° T, 204.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT348-v79
Start Time	15 Feb 2024, 07:23:08+01:00
End Time	15 Feb 2024, 07:25:11+01:00
Session Length	2m 3s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 07.09895" N	55° 59' 07.11856" N
Longitude	007° 01' 17.94940" E	007° 01' 17.98068" E
Height	6.822 m Ell., -34.615 m ISS	6.848 m Ell., -34.477 m Ort.
Easting	376 577.149 m E (± 0.11 m)	
Northing	6 206 210.610 m N (± 0.08 m)	
Height	-34.011 m MSS (± 0.17 m) , -34.615 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	199.3° T, 201.0° G	± 4.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 33.9 m, USBL= 34.0 m

Table 5: Mean Position to Target

Target	CPT348		
Position	376 577.000 m E, 6 206 210.000 m N		
Range	0.63 m Grid		
Bearing To	193.7° G	Bearing From	13.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	376 577.149 m E, 6 206 210.610 m N , -34.011 m MSS
Heading	199.3° T, 201.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT159-v82
Start Time	15 Feb 2024, 09:55:02+01:00
End Time	15 Feb 2024, 09:57:09+01:00
Session Length	2m 7s (73 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 17.09386" N	56° 00' 17.11347" N
Longitude	007° 01' 45.53563" E	007° 01' 45.56692" E
Height	5.866 m Ell., -35.182 m ISS	5.892 m Ell., -35.431 m Ort.
Easting	377 116.851 m E (± 0.09 m)	
Northing	6 208 360.427 m N (± 0.06 m)	
Height	-34.955 m MSS (± 0.18 m) , -35.182 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	188.0° T, 189.7° G	± 3.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 34.9 m, USBL= 35.0 m

Table 5: Mean Position to Target

Target	CPT159		
Position	377 115.000 m E, 6 208 360.000 m N		
Range	1.90 m Grid		
Bearing To	257.0° G	Bearing From	77.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	73 of 120
Position	377 116.851 m E, 6 208 360.427 m N , -34.955 m MSS
Heading	188.0° T, 189.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT343-v83
Start Time	15 Feb 2024, 12:23:31+01:00
End Time	15 Feb 2024, 12:25:41+01:00
Session Length	2m 10s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 40.09703" N	56° 00' 40.11664" N
Longitude	007° 04' 32.35866" E	007° 04' 32.38997" E
Height	7.185 m Ell., -33.745 m ISS	7.211 m Ell., -34.089 m Ort.
Easting	380 025.786 m E (± 0.06 m)	
Northing	6 208 989.992 m N (± 0.05 m)	
Height	-33.621 m MSS (± 0.17 m) , -33.745 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	191.3° T, 192.9° G	± 2.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 33.4 m, USBL= 33.6 m

Table 5: Mean Position to Target

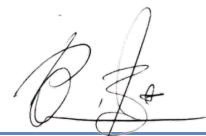
Target	CPT343		
Position	380 025.000 m E, 6 208 990.000 m N		
Range	0.79 m Grid		
Bearing To	270.6° G	Bearing From	90.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	380 025.786 m E, 6 208 989.992 m N , -33.621 m MSS
Heading	191.3° T, 192.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT343A-v84
Start Time	15 Feb 2024, 13:01:24+01:00
End Time	15 Feb 2024, 13:03:26+01:00
Session Length	2m 2s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 40.11693" N	56° 00' 40.13654" N
Longitude	007° 04' 32.11915" E	007° 04' 32.15047" E
Height	7.184 m Ell., -33.750 m ISS	7.210 m Ell., -34.090 m Ort.
Easting	380 021.656 m E (± 0.11 m)	
Northing	6 208 990.722 m N (± 0.06 m)	
Height	-33.622 m MSS (± 0.16 m) , -33.750 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	205.1° T, 206.7° G	± 3.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 33.4 m, USBL= 33.7 m

Table 5: Mean Position to Target

Target	CPT343		
Position	380 025.000 m E, 6 208 990.000 m N		
Range	3.42 m Grid		
Bearing To	102.2° G	Bearing From	282.2° G

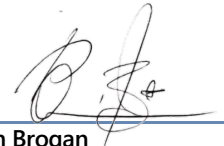
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	380 021.656 m E, 6 208 990.722 m N , -33.622 m MSS
Heading	205.1° T, 206.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT343B-v85
Start Time	15 Feb 2024, 20:13:52+01:00
End Time	15 Feb 2024, 20:15:58+01:00
Session Length	2m 6s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 40.19119" N	56° 00' 40.21080" N
Longitude	007° 04' 32.34581" E	007° 04' 32.37713" E
Height	7.145 m Ell., -34.033 m ISS	7.171 m Ell., -34.129 m Ort.
Easting	380 025.644 m E (± 0.17 m)	
Northing	6 208 992.908 m N (± 0.09 m)	
Height	-33.661 m MSS (± 0.16 m) , -34.033 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	207.3° T, 208.9° G	± 8.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 33.5 m, USBL= 33.7 m

Table 5: Mean Position to Target

Target	CPT343		
Position	380 025.000 m E, 6 208 990.000 m N		
Range	2.98 m Grid		
Bearing To	192.5° G	Bearing From	12.5° G

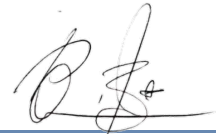
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	380 025.644 m E, 6 208 992.908 m N , -33.661 m MSS
Heading	207.3° T, 208.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT050-v86
Start Time	15 Feb 2024, 22:43:20+01:00
End Time	15 Feb 2024, 22:45:23+01:00
Session Length	2m 3s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 01' 02.44633" N	56° 01' 02.46594" N
Longitude	007° 03' 10.01039" E	007° 03' 10.04169" E
Height	7.300 m Ell., -33.503 m ISS	7.327 m Ell., -33.985 m Ort.
Easting	378 619.341 m E (± 0.06 m)	
Northing	6 209 720.753 m N (± 0.05 m)	
Height	-33.508 m MSS (± 0.16 m) , -33.503 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	217.1° T, 218.7° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 33.4 m, USBL= 33.5 m

Table 5: Mean Position to Target

Target	CPT050		
Position	378 619.000 m E, 6 209 720.000 m N		
Range	0.83 m Grid		
Bearing To	204.4° G	Bearing From	24.4° G

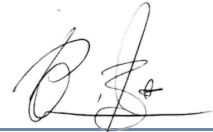
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	378 619.341 m E, 6 209 720.753 m N , -33.508 m MSS
Heading	217.1° T, 218.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT046-v87
Start Time	16 Feb 2024, 01:28:09+01:00
End Time	16 Feb 2024, 01:30:12+01:00
Session Length	2m 3s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 02' 05.87200" N	56° 02' 05.89161" N
Longitude	007° 06' 40.09084" E	007° 06' 40.12217" E
Height	10.655 m Ell., -30.266 m ISS	10.681 m Ell., -30.607 m Ort.
Easting	382 310.080 m E (± 0.05 m)	
Northing	6 211 580.225 m N (± 0.08 m)	
Height	-30.124 m MSS (± 0.16 m) , -30.266 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	217.4° T, 219.0° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.0 m, USBL= 30.2 m

Table 5: Mean Position to Target

Target	CPT046		
Position	382 308.000 m E, 6 211 580.000 m N		
Range	2.09 m Grid		
Bearing To	263.8° G	Bearing From	83.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	382 310.080 m E, 6 211 580.225 m N , -30.124 m MSS
Heading	217.4° T, 219.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT393-v88
Start Time	16 Feb 2024, 03:15:39+01:00
End Time	16 Feb 2024, 03:17:40+01:00
Session Length	2m 2s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 02' 17.44982" N	56° 02' 17.46943" N
Longitude	007° 04' 07.64795" E	007° 04' 07.67927" E
Height	7.392 m Ell., -33.609 m ISS	7.418 m Ell., -33.888 m Ort.
Easting	379 682.043 m E (± 0.11 m)	
Northing	6 212 011.054 m N (± 0.08 m)	
Height	-33.411 m MSS (± 0.17 m) , -33.609 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	204.4° T, 206.0° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 33.3 m, USBL= 33.4 m

Table 5: Mean Position to Target

Target	CPT393		
Position	379 681.000 m E, 6 212 010.000 m N		
Range	1.48 m Grid		
Bearing To	224.7° G	Bearing From	44.7° G

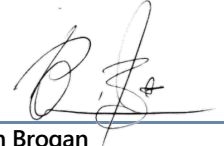
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	379 682.043 m E, 6 212 011.054 m N , -33.411 m MSS
Heading	204.4° T, 206.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT039-v89
Start Time	16 Feb 2024, 04:43:33+01:00
End Time	16 Feb 2024, 04:45:38+01:00
Session Length	2m 5s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 34.14933" N	56° 03' 34.16893" N
Longitude	007° 05' 34.04967" E	007° 05' 34.08101" E
Height	10.286 m Ell., -30.881 m ISS	10.312 m Ell., -30.985 m Ort.
Easting	381 242.596 m E (± 0.14 m)	
Northing	6 214 340.263 m N (± 0.09 m)	
Height	-30.516 m MSS (± 0.16 m) , -30.881 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	206.0° T, 207.6° G	± 7.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.6 m, USBL= 30.6 m

Table 5: Mean Position to Target

Target	CPT039		
Position	381 242.000 m E, 6 214 340.000 m N		
Range	0.65 m Grid		
Bearing To	246.2° G	Bearing From	66.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	381 242.596 m E, 6 214 340.263 m N , -30.516 m MSS
Heading	206.0° T, 207.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT373-v90
Start Time	16 Feb 2024, 07:12:06+01:00
End Time	16 Feb 2024, 07:14:16+01:00
Session Length	2m 10s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 15.86579" N	56° 04' 15.88540" N
Longitude	007° 06' 14.64099" E	007° 06' 14.67233" E
Height	10.800 m Ell., -30.598 m ISS	10.827 m Ell., -30.466 m Ort.
Easting	381 980.003 m E (± 0.09 m)	
Northing	6 215 610.378 m N (± 0.08 m)	
Height	-30.004 m MSS (± 0.16 m) , -30.598 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	199.0° T, 200.6° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.9 m, USBL= 30.0 m

Table 5: Mean Position to Target

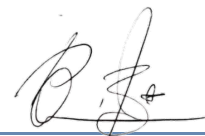
Target	CPT373		
Position	381 979.000 m E, 6 215 610.000 m N		
Range	1.07 m Grid		
Bearing To	249.4° G	Bearing From	69.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	381 980.003 m E, 6 215 610.378 m N , -30.004 m MSS
Heading	199.0° T, 200.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT398-v91
Start Time	16 Feb 2024, 09:18:43+01:00
End Time	16 Feb 2024, 09:21:04+01:00
Session Length	2m 21s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 31.37115" N	56° 04' 31.39075" N
Longitude	007° 08' 20.18213" E	007° 08' 20.21349" E
Height	11.913 m Ell., -29.418 m ISS	11.939 m Ell., -29.340 m Ort.
Easting	384 163.417 m E (± 0.13 m)	
Northing	6 216 030.584 m N (± 0.14 m)	
Height	-28.871 m MSS (± 0.17 m) , -29.418 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	211.4° T, 213.0° G	± 3.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.8 m, USBL= 28.9 m

Table 5: Mean Position to Target

Target	CPT398		
Position	384 163.000 m E, 6 216 030.000 m N		
Range	0.72 m Grid		
Bearing To	215.5° G	Bearing From	35.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	384 163.417 m E, 6 216 030.584 m N , -28.871 m MSS
Heading	211.4° T, 213.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT034-v93
Start Time	16 Feb 2024, 10:43:45+01:00
End Time	16 Feb 2024, 10:45:47+01:00
Session Length	2m 2s (120 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 43.94040" N	56° 04' 43.96000" N
Longitude	007° 09' 43.20048" E	007° 09' 43.23185" E
Height	13.027 m Ell., -28.103 m ISS	13.053 m Ell., -28.219 m Ort.
Easting	385 608.922 m E (± 0.09 m)	
Northing	6 216 380.649 m N (± 0.15 m)	
Height	-27.733 m MSS (± 0.16 m) , -28.103 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	220.3° T, 221.8° G	± 5.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.7 m, USBL= 27.8 m

Table 5: Mean Position to Target

Target	CPT034		
Position	385 608.000 m E, 6 216 380.000 m N		
Range	1.13 m Grid		
Bearing To	234.9° G	Bearing From	54.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	120 of 120
Position	385 608.922 m E, 6 216 380.649 m N , -27.733 m MSS
Heading	220.3° T, 221.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT189-v94
Start Time	16 Feb 2024, 12:22:28+01:00
End Time	16 Feb 2024, 12:24:48+01:00
Session Length	2m 20s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 21.83580" N	56° 04' 21.85540" N
Longitude	007° 11' 08.05731" E	007° 11' 08.08868" E
Height	10.004 m Ell., -31.014 m ISS	10.030 m Ell., -31.236 m Ort.
Easting	387 057.779 m E (± 0.05 m)	
Northing	6 215 658.577 m N (± 0.11 m)	
Height	-30.760 m MSS (± 0.16 m) , -31.014 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	251.0° T, 252.6° G	± 2.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.6 m, USBL= 30.8 m

Table 5: Mean Position to Target

Target	CPT189		
Position	387 056.000 m E, 6 215 660.000 m N		
Range	2.28 m Grid		
Bearing To	308.7° G	Bearing From	128.7° G

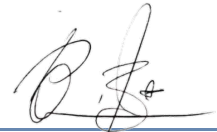
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	387 057.779 m E, 6 215 658.577 m N , -30.760 m MSS
Heading	251.0° T, 252.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT188-v95
Start Time	16 Feb 2024, 14:55:32+01:00
End Time	16 Feb 2024, 14:57:47+01:00
Session Length	2m 15s (112 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 04' 06.56311" N	56° 04' 06.58270" N
Longitude	007° 17' 27.64454" E	007° 17' 27.67596" E
Height	12.377 m Ell., -28.652 m ISS	12.403 m Ell., -28.845 m Ort.
Easting	393 608.686 m E (± 0.10 m)	
Northing	6 215 018.999 m N (± 0.09 m)	
Height	-28.377 m MSS (± 0.16 m) , -28.652 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	247.6° T, 249.0° G	± 4.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.3 m, USBL= 28.4 m

Table 5: Mean Position to Target

Target	CPT188		
Position	393 608.000 m E, 6 215 020.000 m N		
Range	1.21 m Grid		
Bearing To	325.6° G	Bearing From	145.6° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	112 of 120
Position	393 608.686 m E, 6 215 018.999 m N , -28.377 m MSS
Heading	247.6° T, 249.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT313-v96
Start Time	16 Feb 2024, 16:19:06+01:00
End Time	16 Feb 2024, 16:21:19+01:00
Session Length	2m 12s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 19.20298" N	56° 03' 19.22258" N
Longitude	007° 15' 47.15877" E	007° 15' 47.19018" E
Height	12.925 m Ell., -28.238 m ISS	12.951 m Ell., -28.301 m Ort.
Easting	391 834.377 m E (± 0.08 m)	
Northing	6 213 598.419 m N (± 0.09 m)	
Height	-27.835 m MSS (± 0.16 m) , -28.238 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	295.1° T, 296.5° G	± 3.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.7 m, USBL= 27.8 m

Table 5: Mean Position to Target

Target	CPT313		
Position	391 834.000 m E, 6 213 600.000 m N		
Range	1.63 m Grid		
Bearing To	346.6° G	Bearing From	166.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	391 834.377 m E, 6 213 598.419 m N , -27.835 m MSS
Heading	295.1° T, 296.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT142-v97
Start Time	16 Feb 2024, 18:52:26+01:00
End Time	16 Feb 2024, 18:54:36+01:00
Session Length	2m 10s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 33.88316" N	56° 03' 33.90275" N
Longitude	007° 13' 57.70591" E	007° 13' 57.73731" E
Height	12.639 m Ell., -28.884 m ISS	12.665 m Ell., -28.592 m Ort.
Easting	389 952.831 m E (± 0.10 m)	
Northing	6 214 100.235 m N (± 0.12 m)	
Height	-28.127 m MSS (± 0.16 m) , -28.884 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	286.4° T, 287.9° G	± 3.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.0 m, USBL= 28.2 m

Table 5: Mean Position to Target

Target	CPT142		
Position	389 952.000 m E, 6 214 100.000 m N		
Range	0.86 m Grid		
Bearing To	254.2° G	Bearing From	74.2° G

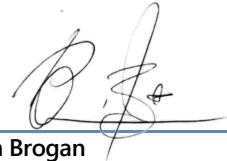
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	389 952.831 m E, 6 214 100.235 m N , -28.127 m MSS
Heading	286.4° T, 287.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT042-v98
Start Time	17 Feb 2024, 11:15:22+01:00
End Time	17 Feb 2024, 11:17:39+01:00
Session Length	2m 16s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 06.52275" N	56° 03' 06.54234" N
Longitude	007° 14' 10.70120" E	007° 14' 10.73259" E
Height	12.196 m Ell., -29.007 m ISS	12.222 m Ell., -29.034 m Ort.
Easting	390 155.977 m E (± 0.10 m)	
Northing	6 213 248.758 m N (± 0.07 m)	
Height	-28.568 m MSS (± 0.21 m) , -29.007 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	341.1° T, 342.5° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.5 m, USBL= 28.6 m

Table 5: Mean Position to Target

Target	CPT042		
Position	390 155.000 m E, 6 213 250.000 m N		
Range	1.58 m Grid		
Bearing To	321.8° G	Bearing From	141.8° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	390 155.977 m E, 6 213 248.758 m N , -28.568 m MSS
Heading	341.1° T, 342.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT358-v99
Start Time	17 Feb 2024, 13:03:06+01:00
End Time	17 Feb 2024, 13:06:37+01:00
Session Length	3m 31s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 21.04364" N	56° 03' 21.06324" N
Longitude	007° 11' 51.98513" E	007° 11' 52.01652" E
Height	12.279 m Ell., -28.808 m ISS	12.305 m Ell., -28.959 m Ort.
Easting	387 768.174 m E (± 0.13 m)	
Northing	6 213 759.567 m N (± 0.09 m)	
Height	-28.487 m MSS (± 0.22 m) , -28.808 m ISS (± 0.18 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	320.0° T, 321.5° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.3 m, USBL= 28.5 m

Table 5: Mean Position to Target

Target	CPT358		
Position	387 768.000 m E, 6 213 760.000 m N		
Range	0.47 m Grid		
Bearing To	338.1° G	Bearing From	158.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	387 768.174 m E, 6 213 759.567 m N , -28.487 m MSS
Heading	320.0° T, 321.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT041-v100
Start Time	17 Feb 2024, 14:42:20+01:00
End Time	17 Feb 2024, 14:44:37+01:00
Session Length	2m 16s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 03' 05.71806" N	56° 03' 05.73766" N
Longitude	007° 09' 55.67358" E	007° 09' 55.70494" E
Height	11.317 m Ell., -29.684 m ISS	11.343 m Ell., -29.928 m Ort.
Easting	385 743.848 m E (± 0.10 m)	
Northing	6 213 338.833 m N (± 0.09 m)	
Height	-29.456 m MSS (± 0.22 m) , -29.684 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	340.8° T, 342.4° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.3 m, USBL= 29.5 m

Table 5: Mean Position to Target

Target	CPT041		
Position	385 744.000 m E, 6 213 340.000 m N		
Range	1.18 m Grid		
Bearing To	7.4° G	Bearing From	187.4° G

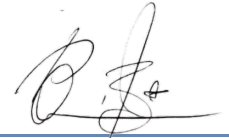
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	385 743.848 m E, 6 213 338.833 m N , -29.456 m MSS
Heading	340.8° T, 342.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT315-v101
Start Time	17 Feb 2024, 16:10:35+01:00
End Time	17 Feb 2024, 16:12:38+01:00
Session Length	2m 3s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 02' 48.32730" N	56° 02' 48.34690" N
Longitude	007° 07' 49.70635" E	007° 07' 49.73770" E
Height	11.445 m Ell., -29.550 m ISS	11.471 m Ell., -29.811 m Ort.
Easting	383 550.323 m E (± 0.11 m)	
Northing	6 212 859.733 m N (± 0.08 m)	
Height	-29.337 m MSS (± 0.25 m) , -29.550 m ISS (± 0.21 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	289.9° T, 291.4° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.2 m, USBL= 29.3 m

Table 5: Mean Position to Target

Target	CPT315		
Position	383 550.000 m E, 6 212 860.000 m N		
Range	0.42 m Grid		
Bearing To	309.6° G	Bearing From	129.6° G

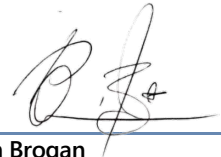
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	383 550.323 m E, 6 212 859.733 m N , -29.337 m MSS
Heading	289.9° T, 291.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT196-v102
Start Time	17 Feb 2024, 18:49:26+01:00
End Time	17 Feb 2024, 18:51:43+01:00
Session Length	2m 17s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 01' 59.44210" N	56° 01' 59.46171" N
Longitude	007° 09' 57.07229" E	007° 09' 57.10365" E
Height	12.524 m Ell., -28.602 m ISS	12.550 m Ell., -28.720 m Ort.
Easting	385 713.629 m E (± 0.05 m)	
Northing	6 211 289.589 m N (± 0.08 m)	
Height	-28.247 m MSS (± 0.18 m) , -28.602 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	269.3° T, 270.8° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.3 m, USBL= 28.3 m

Table 5: Mean Position to Target

Target	CPT196		
Position	385 713.000 m E, 6 211 290.000 m N		
Range	0.75 m Grid		
Bearing To	303.2° G	Bearing From	123.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	385 713.629 m E, 6 211 289.589 m N , -28.247 m MSS
Heading	269.3° T, 270.8° G
Pitch	0.00 °
Roll	0.00 °



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Client Representative
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Tom Brogan
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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT274-v103
Start Time	17 Feb 2024, 20:35:13+01:00
End Time	17 Feb 2024, 20:37:27+01:00
Session Length	2m 14s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 01' 48.91714" N	56° 01' 48.93674" N
Longitude	007° 12' 45.05892" E	007° 12' 45.09030" E
Height	14.223 m Ell., -26.993 m ISS	14.249 m Ell., -27.011 m Ort.
Easting	388 612.436 m E (± 0.07 m)	
Northing	6 210 888.029 m N (± 0.09 m)	
Height	-26.541 m MSS (± 0.21 m) , -26.993 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	275.2° T, 276.7° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.5 m, USBL= 26.6 m

Table 5: Mean Position to Target

Target	CPT274		
Position	388 612.000 m E, 6 210 890.000 m N		
Range	2.02 m Grid		
Bearing To	347.5° G	Bearing From	167.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]


Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	388 612.436 m E, 6 210 888.029 m N , -26.541 m MSS
Heading	275.2° T, 276.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT167-v104
Start Time	17 Feb 2024, 22:25:45+01:00
End Time	17 Feb 2024, 22:27:54+01:00
Session Length	2m 8s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 01' 58.21391" N	56° 01' 58.23350" N
Longitude	007° 17' 55.50981" E	007° 17' 55.54124" E
Height	10.669 m Ell., -30.348 m ISS	10.695 m Ell., -30.553 m Ort.
Easting	393 992.751 m E (± 0.09 m)	
Northing	6 211 039.690 m N (± 0.09 m)	
Height	-30.085 m MSS (± 0.22 m) , -30.348 m ISS (± 0.18 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	287.3° T, 288.7° G	± 3.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.0 m, USBL= 30.1 m

Table 5: Mean Position to Target

Target	CPT167		
Position	393 993.000 m E, 6 211 040.000 m N		
Range	0.40 m Grid		
Bearing To	38.7° G	Bearing From	218.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	393 992.751 m E, 6 211 039.690 m N , -30.085 m MSS
Heading	287.3° T, 288.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT049-v105
Start Time	18 Feb 2024, 00:26:20+01:00
End Time	18 Feb 2024, 00:28:22+01:00
Session Length	2m 2s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 01' 25.78057" N	56° 01' 25.80017" N
Longitude	007° 18' 07.69520" E	007° 18' 07.72663" E
Height	11.130 m Ell., -29.609 m ISS	11.156 m Ell., -30.092 m Ort.
Easting	394 178.997 m E (± 0.05 m)	
Northing	6 210 031.955 m N (± 0.04 m)	
Height	-29.636 m MSS (± 0.15 m) , -29.609 m ISS (± 0.08 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	169.2° T, 170.6° G	± 2.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.6 m, USBL= 29.7 m

Table 5: Mean Position to Target

Target	CPT049		
Position	394 178.000 m E, 6 210 030.000 m N		
Range	2.19 m Grid		
Bearing To	207.0° G	Bearing From	27.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	394 178.997 m E, 6 210 031.955 m N , -29.636 m MSS
Heading	169.2° T, 170.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT387-v106
Start Time	18 Feb 2024, 01:41:15+01:00
End Time	18 Feb 2024, 01:43:18+01:00
Session Length	2m 4s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 01' 06.61047" N	56° 01' 06.63007" N
Longitude	007° 15' 47.35704" E	007° 15' 47.38844" E
Height	13.061 m Ell., -27.636 m ISS	13.087 m Ell., -28.165 m Ort.
Easting	391 734.729 m E (± 0.06 m)	
Northing	6 209 499.796 m N (± 0.04 m)	
Height	-27.706 m MSS (± 0.15 m) , -27.636 m ISS (± 0.08 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	182.2° T, 183.6° G	± 2.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.6 m, USBL= 27.7 m

Table 5: Mean Position to Target

Target	CPT387		
Position	391 735.000 m E, 6 209 500.000 m N		
Range	0.34 m Grid		
Bearing To	53.1° G	Bearing From	233.1° G

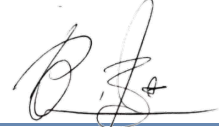
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	391 734.729 m E, 6 209 499.796 m N , -27.706 m MSS
Heading	182.2° T, 183.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT205-v107
Start Time	18 Feb 2024, 03:33:48+01:00
End Time	18 Feb 2024, 03:36:06+01:00
Session Length	2m 18s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 49.65921" N	56° 00' 49.67882" N
Longitude	007° 09' 41.79215" E	007° 09' 41.82351" E
Height	12.585 m Ell., -28.173 m ISS	12.611 m Ell., -28.659 m Ort.
Easting	385 391.775 m E (± 0.12 m)	
Northing	6 209 139.626 m N (± 0.06 m)	
Height	-28.183 m MSS (± 0.15 m) , -28.173 m ISS (± 0.08 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	182.8° T, 184.3° G	± 3.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.1 m, USBL= 28.2 m

Table 5: Mean Position to Target

Target	CPT205		
Position	385 393.000 m E, 6 209 140.000 m N		
Range	1.28 m Grid		
Bearing To	73.0° G	Bearing From	253.0° G

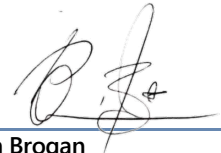
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	385 391.775 m E, 6 209 139.626 m N , -28.183 m MSS
Heading	182.8° T, 184.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT261-v108
Start Time	18 Feb 2024, 09:51:42+01:00
End Time	18 Feb 2024, 09:53:46+01:00
Session Length	2m 5s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 01' 04.68648" N	56° 01' 04.70609" N
Longitude	007° 07' 20.78366" E	007° 07' 20.81500" E
Height	11.138 m Ell., -30.011 m ISS	11.164 m Ell., -30.119 m Ort.
Easting	382 962.866 m E (± 0.09 m)	
Northing	6 209 669.787 m N (± 0.06 m)	
Height	-29.639 m MSS (± 0.18 m) , -30.011 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	190.2° T, 191.8° G	± 3.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.5 m, USBL= 29.7 m

Table 5: Mean Position to Target

Target	CPT261		
Position	382 962.000 m E, 6 209 670.000 m N		
Range	0.89 m Grid		
Bearing To	283.8° G	Bearing From	103.8° G

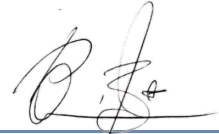
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	382 962.866 m E, 6 209 669.787 m N , -29.639 m MSS
Heading	190.2° T, 191.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT168-v109
Start Time	19 Feb 2024, 00:51:06+01:00
End Time	19 Feb 2024, 00:53:11+01:00
Session Length	2m 6s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 52.52716" N	55° 59' 52.54677" N
Longitude	007° 06' 40.21222" E	007° 06' 40.24355" E
Height	8.881 m Ell., -32.305 m ISS	8.907 m Ell., -32.376 m Ort.
Easting	382 199.472 m E (± 0.07 m)	
Northing	6 207 458.518 m N (± 0.05 m)	
Height	-31.893 m MSS (± 0.22 m) , -32.305 m ISS (± 0.18 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	327.0° T, 328.5° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.8 m, USBL= 31.9 m

Table 5: Mean Position to Target

Target	CPT168		
Position	382 198.000 m E, 6 207 460.000 m N		
Range	2.09 m Grid		
Bearing To	315.2° G	Bearing From	135.2° G

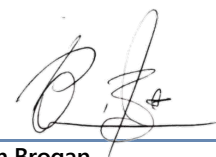
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	382 199.472 m E, 6 207 458.518 m N , -31.893 m MSS
Heading	327.0° T, 328.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT168A-v110
Start Time	19 Feb 2024, 01:45:48+01:00
End Time	19 Feb 2024, 01:47:55+01:00
Session Length	2m 7s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 52.57311" N	55° 59' 52.59272" N
Longitude	007° 06' 39.96578" E	007° 06' 39.99710" E
Height	8.779 m Ell., -32.309 m ISS	8.805 m Ell., -32.479 m Ort.
Easting	382 195.242 m E (± 0.13 m)	
Northing	6 207 460.055 m N (± 0.07 m)	
Height	-31.995 m MSS (± 0.21 m) , -32.309 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	318.7° T, 320.3° G	± 2.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.8 m, USBL= 32.0 m

Table 5: Mean Position to Target

Target	CPT168		
Position	382 198.000 m E, 6 207 460.000 m N		
Range	2.76 m Grid		
Bearing To	91.1° G	Bearing From	271.1° G

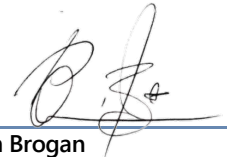
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	382 195.242 m E, 6 207 460.055 m N , -31.995 m MSS
Heading	318.7° T, 320.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT057-v111
Start Time	19 Feb 2024, 04:19:50+01:00
End Time	19 Feb 2024, 04:21:56+01:00
Session Length	2m 6s (87 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 31.76723" N	55° 59' 31.78684" N
Longitude	007° 07' 16.39463" E	007° 07' 16.42596" E
Height	9.646 m Ell., -31.507 m ISS	9.673 m Ell., -31.606 m Ort.
Easting	382 808.768 m E (± 0.10 m)	
Northing	6 206 799.746 m N (± 0.09 m)	
Height	-31.133 m MSS (± 0.19 m) , -31.507 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	325.3° T, 326.9° G	± 4.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.1 m, USBL= 31.2 m

Table 5: Mean Position to Target

Target	CPT057		
Position	382 808.000 m E, 6 206 800.000 m N		
Range	0.81 m Grid		
Bearing To	288.3° G	Bearing From	108.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	87 of 120
Position	382 808.768 m E, 6 206 799.746 m N , -31.133 m MSS
Heading	325.3° T, 326.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT244-v112
Start Time	19 Feb 2024, 08:25:01+01:00
End Time	19 Feb 2024, 08:27:03+01:00
Session Length	2m 2s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 40.32982" N	55° 59' 40.34942" N
Longitude	007° 09' 13.47726" E	007° 09' 13.50861" E
Height	12.777 m Ell., -28.633 m ISS	12.803 m Ell., -28.466 m Ort.
Easting	384 844.236 m E (± 0.07 m)	
Northing	6 207 009.736 m N (± 0.05 m)	
Height	-27.992 m MSS (± 0.17 m) , -28.633 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	298.5° T, 300.1° G	± 1.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.9 m, USBL= 28.0 m

Table 5: Mean Position to Target

Target	CPT244		
Position	384 844.000 m E, 6 207 010.000 m N		
Range	0.35 m Grid		
Bearing To	318.2° G	Bearing From	138.2° G

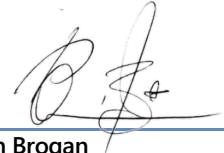
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	384 844.236 m E, 6 207 009.736 m N , -27.992 m MSS
Heading	298.5° T, 300.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT059-v113
Start Time	19 Feb 2024, 15:33:29+01:00
End Time	19 Feb 2024, 15:35:31+01:00
Session Length	2m 2s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 18.59938" N	55° 59' 18.61898" N
Longitude	007° 10' 36.77726" E	007° 10' 36.80862" E
Height	12.387 m Ell., -28.743 m ISS	12.413 m Ell., -28.848 m Ort.
Easting	386 269.562 m E (± 0.07 m)	
Northing	6 206 299.728 m N (± 0.07 m)	
Height	-28.386 m MSS (± 0.22 m) , -28.743 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	270.7° T, 272.2° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.4 m, USBL= 28.4 m

Table 5: Mean Position to Target

Target	CPT059		
Position	386 268.000 m E, 6 206 300.000 m N		
Range	1.59 m Grid		
Bearing To	279.9° G	Bearing From	99.9° G

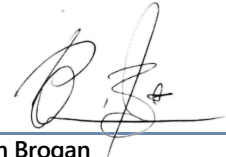
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	386 269.562 m E, 6 206 299.728 m N , -28.386 m MSS
Heading	270.7° T, 272.2° G
Pitch	0.00 °
Roll	0.00 °



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Tom Brogan
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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT235-v114
Start Time	19 Feb 2024, 18:42:52+01:00
End Time	19 Feb 2024, 18:45:04+01:00
Session Length	2m 12s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 57.70202" N	55° 59' 57.72162" N
Longitude	007° 11' 18.86905" E	007° 11' 18.90041" E
Height	13.234 m Ell., -27.916 m ISS	13.260 m Ell., -28.001 m Ort.
Easting	387 030.544 m E (± 0.07 m)	
Northing	6 207 489.215 m N (± 0.09 m)	
Height	-27.544 m MSS (± 0.19 m) , -27.916 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	259.5° T, 261.0° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.5 m, USBL= 27.6 m

Table 5: Mean Position to Target

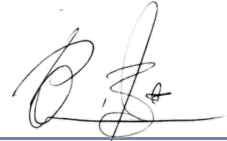
Target	CPT235		
Position	387 030.000 m E, 6 207 490.000 m N		
Range	0.96 m Grid		
Bearing To	325.3° G	Bearing From	145.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	387 030.544 m E, 6 207 489.215 m N , -27.544 m MSS
Heading	259.5° T, 261.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT144-v115
Start Time	19 Feb 2024, 20:34:23+01:00
End Time	19 Feb 2024, 20:36:47+01:00
Session Length	2m 24s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 36.61496" N	55° 59' 36.63456" N
Longitude	007° 12' 43.73436" E	007° 12' 43.76574" E
Height	13.804 m Ell., -27.377 m ISS	13.830 m Ell., -27.426 m Ort.
Easting	388 483.670 m E (± 0.10 m)	
Northing	6 206 799.117 m N (± 0.10 m)	
Height	-26.967 m MSS (± 0.20 m) , -27.377 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	294.5° T, 296.0° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.9 m, USBL= 27.0 m

Table 5: Mean Position to Target

Target	CPT144		
Position	388 483.000 m E, 6 206 800.000 m N		
Range	1.11 m Grid		
Bearing To	322.8° G	Bearing From	142.8° G

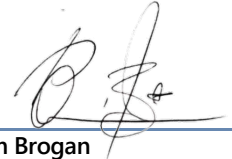
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	388 483.670 m E, 6 206 799.117 m N , -26.967 m MSS
Heading	294.5° T, 296.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT215-v116
Start Time	19 Feb 2024, 22:37:30+01:00
End Time	19 Feb 2024, 22:39:32+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 13.80939" N	56° 00' 13.82899" N
Longitude	007° 13' 27.29958" E	007° 13' 27.33096" E
Height	13.630 m Ell., -27.715 m ISS	13.656 m Ell., -27.599 m Ort.
Easting	389 267.950 m E (± 0.09 m)	
Northing	6 207 929.347 m N (± 0.06 m)	
Height	-27.136 m MSS (± 0.19 m) , -27.715 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	314.3° T, 315.7° G	± 2.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.0 m, USBL= 27.1 m

Table 5: Mean Position to Target


Target	CPT215		
Position	389 267.000 m E, 6 207 930.000 m N		
Range	1.15 m Grid		
Bearing To	304.5° G	Bearing From	124.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	389 267.950 m E, 6 207 929.347 m N , -27.136 m MSS
Heading	314.3° T, 315.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT383-v117
Start Time	20 Feb 2024, 00:52:41+01:00
End Time	20 Feb 2024, 00:54:43+01:00
Session Length	2m 2s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	56° 00' 13.26947" N	56° 00' 13.28907" N
Longitude	007° 17' 24.69892" E	007° 17' 24.73033" E
Height	12.203 m Ell., -29.087 m ISS	12.229 m Ell., -29.019 m Ort.
Easting	393 379.217 m E (± 0.05 m)	
Northing	6 207 808.937 m N (± 0.05 m)	
Height	-28.572 m MSS (± 0.17 m) , -29.087 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	319.7° T, 321.1° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.4 m, USBL= 28.6 m

Table 5: Mean Position to Target

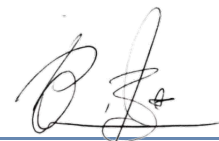
Target	CPT383		
Position	393 379.000 m E, 6 207 810.000 m N		
Range	1.09 m Grid		
Bearing To	348.5° G	Bearing From	168.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	393 379.217 m E, 6 207 808.937 m N , -28.572 m MSS
Heading	319.7° T, 321.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT145-v118
Start Time	20 Feb 2024, 02:48:39+01:00
End Time	20 Feb 2024, 02:50:48+01:00
Session Length	2m 9s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 40.21297" N	55° 59' 40.23256" N
Longitude	007° 17' 40.96640" E	007° 17' 40.99782" E
Height	11.927 m Ell., -29.103 m ISS	11.953 m Ell., -29.294 m Ort.
Easting	393 635.748 m E (± 0.09 m)	
Northing	6 206 780.171 m N (± 0.06 m)	
Height	-28.846 m MSS (± 0.21 m) , -29.103 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	303.1° T, 304.5° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.8 m, USBL= 28.9 m

Table 5: Mean Position to Target

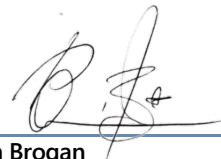
Target	CPT145		
Position	393 636.000 m E, 6 206 780.000 m N		
Range	0.30 m Grid		
Bearing To	124.1° G	Bearing From	304.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	393 635.748 m E, 6 206 780.171 m N , -28.846 m MSS
Heading	303.1° T, 304.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT212-v119
Start Time	20 Feb 2024, 07:07:14+01:00
End Time	20 Feb 2024, 07:09:25+01:00
Session Length	2m 11s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 24.83529" N	55° 59' 24.85489" N
Longitude	007° 15' 32.23890" E	007° 15' 32.27030" E
Height	14.543 m Ell., -26.473 m ISS	14.569 m Ell., -26.681 m Ort.
Easting	391 393.706 m E (± 0.08 m)	
Northing	6 206 360.454 m N (± 0.08 m)	
Height	-26.230 m MSS (± 0.21 m) , -26.473 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	299.6° T, 301.0° G	± 1.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.2 m, USBL= 26.3 m

Table 5: Mean Position to Target

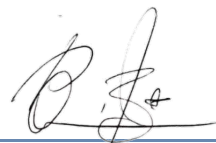
Target	CPT212		
Position	391 393.000 m E, 6 206 360.000 m N		
Range	0.84 m Grid		
Bearing To	237.2° G	Bearing From	57.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	391 393.706 m E, 6 206 360.454 m N , -26.230 m MSS
Heading	299.6° T, 301.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT061-v120
Start Time	20 Feb 2024, 09:13:54+01:00
End Time	20 Feb 2024, 09:16:05+01:00
Session Length	2m 11s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 00.23078" N	55° 59' 00.25038" N
Longitude	007° 16' 39.91997" E	007° 16' 39.95138" E
Height	13.537 m Ell., -27.636 m ISS	13.563 m Ell., -27.684 m Ort.
Easting	392 547.379 m E (± 0.08 m)	
Northing	6 205 570.527 m N (± 0.09 m)	
Height	-27.235 m MSS (± 0.21 m) , -27.636 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	279.9° T, 281.4° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.1 m, USBL= 27.2 m

Table 5: Mean Position to Target

Target	CPT061		
Position	392 547.000 m E, 6 205 570.000 m N		
Range	0.65 m Grid		
Bearing To	215.8° G	Bearing From	35.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	392 547.379 m E, 6 205 570.527 m N , -27.235 m MSS
Heading	279.9° T, 281.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT256-v121
Start Time	20 Feb 2024, 11:33:17+01:00
End Time	20 Feb 2024, 11:35:25+01:00
Session Length	2m 9s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 11.11057" N	55° 59' 11.13017" N
Longitude	007° 18' 06.32205" E	007° 18' 06.35347" E
Height	11.764 m Ell., -29.630 m ISS	11.790 m Ell., -29.456 m Ort.
Easting	394 052.900 m E (± 0.07 m)	
Northing	6 205 869.774 m N (± 0.08 m)	
Height	-29.006 m MSS (± 0.21 m) , -29.630 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	270.9° T, 272.3° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.9 m, USBL= 29.0 m

Table 5: Mean Position to Target

Target	CPT256		
Position	394 052.000 m E, 6 205 870.000 m N		
Range	0.93 m Grid		
Bearing To	284.1° G	Bearing From	104.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	394 052.900 m E, 6 205 869.774 m N , -29.006 m MSS
Heading	270.9° T, 272.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT256A-v122
Start Time	24 Feb 2024, 20:17:57+01:00
End Time	24 Feb 2024, 20:20:04+01:00
Session Length	2m 7s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 11.15940" N	55° 59' 11.17899" N
Longitude	007° 18' 06.17600" E	007° 18' 06.20742" E
Height	11.800 m Ell., -29.228 m ISS	11.826 m Ell., -29.420 m Ort.
Easting	394 050.407 m E (± 0.11 m)	
Northing	6 205 871.346 m N (± 0.06 m)	
Height	-28.970 m MSS (± 0.32 m) , -29.228 m ISS (± 0.29 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	313.8° T, 315.2° G	± 1.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.9 m, USBL= 29.0 m

Table 5: Mean Position to Target

Target	CPT256		
Position	394 052.000 m E, 6 205 870.000 m N		
Range	2.09 m Grid		
Bearing To	130.2° G	Bearing From	310.2° G

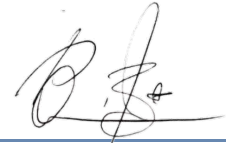
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	394 050.407 m E, 6 205 871.346 m N , -28.970 m MSS
Heading	313.8° T, 315.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT256B-v123
Start Time	24 Feb 2024, 21:08:53+01:00
End Time	24 Feb 2024, 21:11:27+01:00
Session Length	2m 34s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 11.05911" N	55° 59' 11.07871" N
Longitude	007° 18' 06.19849" E	007° 18' 06.22991" E
Height	11.819 m Ell., -29.294 m ISS	11.845 m Ell., -29.400 m Ort.
Easting	394 050.720 m E (± 0.14 m)	
Northing	6 205 868.236 m N (± 0.12 m)	
Height	-28.951 m MSS (± 0.28 m) , -29.294 m ISS (± 0.24 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	308.2° T, 309.6° G	± 2.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 28.8 m, USBL= 29.0 m

Table 5: Mean Position to Target

Target	CPT256		
Position	394 052.000 m E, 6 205 870.000 m N		
Range	2.18 m Grid		
Bearing To	36.0° G	Bearing From	216.0° G

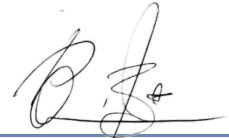
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	394 050.720 m E, 6 205 868.236 m N , -28.951 m MSS
Heading	308.2° T, 309.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT214-v124
Start Time	24 Feb 2024, 22:52:26+01:00
End Time	24 Feb 2024, 22:54:55+01:00
Session Length	2m 30s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 58' 18.87179" N	55° 58' 18.89139" N
Longitude	007° 19' 29.13320" E	007° 19' 29.16463" E
Height	12.749 m Ell., -28.451 m ISS	12.775 m Ell., -28.469 m Ort.
Easting	395 448.681 m E (± 0.10 m)	
Northing	6 204 220.002 m N (± 0.09 m)	
Height	-28.023 m MSS (± 0.22 m) , -28.451 m ISS (± 0.17 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	323.2° T, 324.6° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.9 m, USBL= 28.1 m

Table 5: Mean Position to Target

Target	CPT214		
Position	395 449.000 m E, 6 204 220.000 m N		
Range	0.32 m Grid		
Bearing To	90.4° G	Bearing From	270.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	395 448.681 m E, 6 204 220.002 m N , -28.023 m MSS
Heading	323.2° T, 324.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT124-v125
Start Time	25 Feb 2024, 00:39:31+01:00
End Time	25 Feb 2024, 00:41:46+01:00
Session Length	2m 15s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 35.96211" N	55° 57' 35.98171" N
Longitude	007° 14' 13.07611" E	007° 14' 13.10750" E
Height	15.629 m Ell., -25.772 m ISS	15.655 m Ell., -25.593 m Ort.
Easting	389 936.301 m E (± 0.08 m)	
Northing	6 203 029.926 m N (± 0.07 m)	
Height	-25.130 m MSS (± 0.19 m) , -25.772 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	333.0° T, 334.5° G	± 1.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.9 m, USBL= 25.2 m

Table 5: Mean Position to Target

Target	CPT124		
Position	389 937.000 m E, 6 203 030.000 m N		
Range	0.70 m Grid		
Bearing To	84.0° G	Bearing From	264.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	389 936.301 m E, 6 203 029.926 m N , -25.130 m MSS
Heading	333.0° T, 334.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT347-v126
Start Time	25 Feb 2024, 02:36:33+01:00
End Time	25 Feb 2024, 02:38:39+01:00
Session Length	2m 7s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 55.06135" N	55° 57' 55.08095" N
Longitude	007° 12' 42.15158" E	007° 12' 42.18295" E
Height	13.916 m Ell., -27.597 m ISS	13.942 m Ell., -27.309 m Ort.
Easting	388 375.018 m E (± 0.10 m)	
Northing	6 203 660.786 m N (± 0.07 m)	
Height	-26.848 m MSS (± 0.20 m) , -27.597 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	158.6° T, 160.1° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.7 m, USBL= 26.9 m

Table 5: Mean Position to Target

Target	CPT347		
Position	388 375.000 m E, 6 203 660.000 m N		
Range	0.79 m Grid		
Bearing To	181.3° G	Bearing From	1.3° G

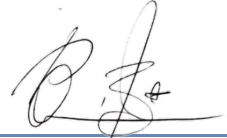
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	388 375.018 m E, 6 203 660.786 m N , -26.848 m MSS
Heading	158.6° T, 160.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT064-v127
Start Time	25 Feb 2024, 04:09:02+01:00
End Time	25 Feb 2024, 04:11:36+01:00
Session Length	2m 34s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 58' 31.16716" N	55° 58' 31.18676" N
Longitude	007° 12' 55.95179" E	007° 12' 55.98316" E
Height	13.985 m Ell., -27.530 m ISS	14.011 m Ell., -27.242 m Ort.
Easting	388 643.085 m E (± 0.13 m)	
Northing	6 204 770.639 m N (± 0.08 m)	
Height	-26.777 m MSS (± 0.19 m) , -27.530 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	158.8° T, 160.3° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.6 m, USBL= 26.8 m

Table 5: Mean Position to Target

Target	CPT064		
Position	388 643.000 m E, 6 204 770.000 m N		
Range	0.64 m Grid		
Bearing To	187.6° G	Bearing From	7.6° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	388 643.085 m E, 6 204 770.639 m N , -26.777 m MSS
Heading	158.8° T, 160.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT291-v128
Start Time	25 Feb 2024, 06:48:52+01:00
End Time	25 Feb 2024, 06:53:32+01:00
Session Length	4m 40s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 58' 40.13011" N	55° 58' 40.14971" N
Longitude	007° 09' 54.18856" E	007° 09' 54.21991" E
Height	10.848 m Ell., -30.209 m ISS	10.874 m Ell., -30.389 m Ort.
Easting	385 500.084 m E (± 0.14 m)	
Northing	6 205 130.179 m N (± 0.10 m)	
Height	-29.926 m MSS (± 0.18 m) , -30.209 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	163.6° T, 165.1° G	± 3.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.8 m, USBL= 29.9 m

Table 5: Mean Position to Target

Target	CPT291		
Position	385 500.000 m E, 6 205 130.000 m N		
Range	0.20 m Grid		
Bearing To	205.2° G	Bearing From	25.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	385 500.084 m E, 6 205 130.179 m N , -29.926 m MSS
Heading	163.6° T, 165.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT057A-v129
Start Time	25 Feb 2024, 09:12:54+01:00
End Time	25 Feb 2024, 09:15:24+01:00
Session Length	2m 31s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 59' 31.80946" N	55° 59' 31.82907" N
Longitude	007° 07' 16.20425" E	007° 07' 16.23558" E
Height	9.608 m Ell., -31.368 m ISS	9.634 m Ell., -31.644 m Ort.
Easting	382 805.506 m E (± 0.12 m)	
Northing	6 206 801.141 m N (± 0.12 m)	
Height	-31.172 m MSS (± 0.20 m) , -31.368 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	169.2° T, 170.7° G	± 2.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.0 m, USBL= 31.2 m

Table 5: Mean Position to Target

Target	CPT057		
Position	382 808.000 m E, 6 206 800.000 m N		
Range	2.74 m Grid		
Bearing To	114.6° G	Bearing From	294.6° G

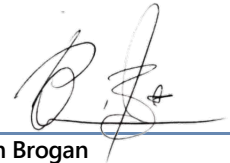
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	382 805.506 m E, 6 206 801.141 m N , -31.172 m MSS
Heading	169.2° T, 170.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT211-v130
Start Time	25 Feb 2024, 11:42:08+01:00
End Time	25 Feb 2024, 11:44:35+01:00
Session Length	2m 27s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 58' 23.83536" N	55° 58' 23.85497" N
Longitude	007° 04' 05.74932" E	007° 04' 05.78062" E
Height	7.842 m Ell., -33.228 m ISS	7.868 m Ell., -33.429 m Ort.
Easting	379 447.268 m E (± 0.14 m)	
Northing	6 204 791.099 m N (± 0.10 m)	
Height	-32.961 m MSS (± 0.18 m) , -33.228 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	162.0° T, 163.6° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 32.8 m, USBL= 33.0 m

Table 5: Mean Position to Target

Target	CPT211		
Position	379 447.000 m E, 6 204 790.000 m N		
Range	1.13 m Grid		
Bearing To	193.7° G	Bearing From	13.7° G

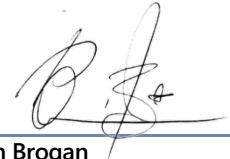
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	379 447.268 m E, 6 204 791.099 m N , -32.961 m MSS
Heading	162.0° T, 163.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT122-v131
Start Time	25 Feb 2024, 13:15:53+01:00
End Time	25 Feb 2024, 13:18:27+01:00
Session Length	2m 34s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 58' 03.21302" N	55° 58' 03.23263" N
Longitude	007° 04' 34.74398" E	007° 04' 34.77529" E
Height	8.169 m Ell., -32.962 m ISS	8.195 m Ell., -33.098 m Ort.
Easting	379 932.080 m E (± 0.13 m)	
Northing	6 204 139.659 m N (± 0.12 m)	
Height	-32.631 m MSS (± 0.19 m) , -32.962 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	163.3° T, 164.9° G	± 3.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 32.4 m, USBL= 32.7 m

Table 5: Mean Position to Target

Target	CPT122		
Position	379 932.000 m E, 6 204 140.000 m N		
Range	0.35 m Grid		
Bearing To	346.7° G	Bearing From	166.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	379 932.080 m E, 6 204 139.659 m N , -32.631 m MSS
Heading	163.3° T, 164.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT068-v124
Start Time	25 Feb 2024, 15:34:32+01:00
End Time	25 Feb 2024, 15:37:00+01:00
Session Length	2m 28s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 29.44706" N	55° 57' 29.46667" N
Longitude	007° 05' 27.00518" E	007° 05' 27.03649" E
Height	6.201 m Ell., -35.185 m ISS	6.227 m Ell., -35.057 m Ort.
Easting	380 809.214 m E (± 0.16 m)	
Northing	6 203 070.854 m N (± 0.12 m)	
Height	-34.587 m MSS (± 0.40 m) , -35.185 m ISS (± 0.37 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	178.8° T, 180.4° G	± 3.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 34.0 m, USBL= 34.5 m

Table 5: Mean Position to Target

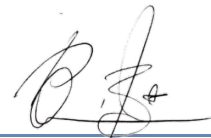
Target	CPT068		
Position	380 808.000 m E, 6 203 070.000 m N		
Range	1.48 m Grid		
Bearing To	234.9° G	Bearing From	54.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	380 809.214 m E, 6 203 070.854 m N , -34.587 m MSS
Heading	178.8° T, 180.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT289-v125
Start Time	25 Feb 2024, 18:49:42+01:00
End Time	25 Feb 2024, 18:53:13+01:00
Session Length	3m 31s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 51.21651" N	55° 56' 51.23612" N
Longitude	007° 05' 02.85246" E	007° 05' 02.88376" E
Height	7.618 m Ell., -33.429 m ISS	7.644 m Ell., -33.640 m Ort.
Easting	380 357.666 m E (± 0.18 m)	
Northing	6 201 900.765 m N (± 0.12 m)	
Height	-33.174 m MSS (± 0.19 m) , -33.429 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	164.9° T, 166.4° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 32.9 m, USBL= 33.3 m

Table 5: Mean Position to Target

Target	CPT289		
Position	380 358.000 m E, 6 201 900.000 m N		
Range	0.83 m Grid		
Bearing To	156.4° G	Bearing From	336.4° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	380 357.666 m E, 6 201 900.765 m N , -33.174 m MSS
Heading	164.9° T, 166.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT323-v126
Start Time	25 Feb 2024, 20:50:11+01:00
End Time	25 Feb 2024, 20:54:53+01:00
Session Length	4m 42s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 17.89675" N	55° 57' 17.91636" N
Longitude	007° 08' 01.86122" E	007° 08' 01.89255" E
Height	7.366 m Ell., -33.573 m ISS	7.392 m Ell., -33.874 m Ort.
Easting	383 484.715 m E (± 0.17 m)	
Northing	6 202 640.508 m N (± 0.13 m)	
Height	-33.408 m MSS (± 0.19 m) , -33.573 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	155.4° T, 156.9° G	± 3.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 33.2 m, USBL= 33.5 m

Table 5: Mean Position to Target

Target	CPT323		
Position	383 484.000 m E, 6 202 640.000 m N		
Range	0.88 m Grid		
Bearing To	234.6° G	Bearing From	54.6° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	383 484.715 m E, 6 202 640.508 m N , -33.408 m MSS
Heading	155.4° T, 156.9° G
Pitch	0.00 °
Roll	0.00 °



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Client Representative
Energinet Eltransmission



Tom Brogan
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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT246-v127
Start Time	26 Feb 2024, 02:33:49+01:00
End Time	26 Feb 2024, 02:36:11+01:00
Session Length	2m 22s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 57' 05.91621" N	55° 57' 05.93581" N
Longitude	007° 10' 52.31229" E	007° 10' 52.34364" E
Height	9.113 m Ell., -32.220 m ISS	9.139 m Ell., -32.114 m Ort.
Easting	386 430.795 m E (± 0.14 m)	
Northing	6 202 191.405 m N (± 0.14 m)	
Height	-31.649 m MSS (± 0.18 m) , -32.220 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	153.9° T, 155.4° G	± 2.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.5 m, USBL= 31.7 m

Table 5: Mean Position to Target

Target	CPT246		
Position	386 430.000 m E, 6 202 190.000 m N		
Range	1.61 m Grid		
Bearing To	209.5° G	Bearing From	29.5° G

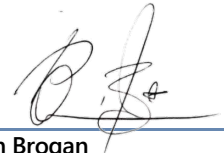
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	386 430.795 m E, 6 202 191.405 m N , -31.649 m MSS
Heading	153.9° T, 155.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT350-v128
Start Time	26 Feb 2024, 04:57:49+01:00
End Time	26 Feb 2024, 05:00:32+01:00
Session Length	2m 43s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 31.78741" N	55° 56' 31.80701" N
Longitude	007° 14' 46.31644" E	007° 14' 46.34782" E
Height	15.701 m Ell., -25.605 m ISS	15.727 m Ell., -25.515 m Ort.
Easting	390 462.338 m E (± 0.10 m)	
Northing	6 201 031.607 m N (± 0.07 m)	
Height	-25.065 m MSS (± 0.20 m) , -25.605 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	157.2° T, 158.6° G	± 2.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 24.9 m, USBL= 25.1 m

Table 5: Mean Position to Target

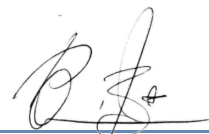
Target	CPT350		
Position	390 462.000 m E, 6 201 030.000 m N		
Range	1.64 m Grid		
Bearing To	191.9° G	Bearing From	11.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	390 462.338 m E, 6 201 031.607 m N , -25.065 m MSS
Heading	157.2° T, 158.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT073-v129
Start Time	26 Feb 2024, 07:33:20+01:00
End Time	26 Feb 2024, 07:35:24+01:00
Session Length	2m 3s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 10.55856" N	55° 56' 10.57816" N
Longitude	007° 11' 59.10701" E	007° 11' 59.13837" E
Height	9.819 m Ell., -31.070 m ISS	9.845 m Ell., -31.400 m Ort.
Easting	387 544.645 m E (± 0.11 m)	
Northing	6 200 449.979 m N (± 0.10 m)	
Height	-30.938 m MSS (± 0.17 m) , -31.070 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	154.6° T, 156.1° G	± 2.5°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.8 m, USBL= 31.0 m

Table 5: Mean Position to Target

Target	CPT073		
Position	387 545.000 m E, 6 200 450.000 m N		
Range	0.36 m Grid		
Bearing To	86.7° G	Bearing From	266.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	387 544.645 m E, 6 200 449.979 m N , -30.938 m MSS
Heading	154.6° T, 156.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT295-v130
Start Time	26 Feb 2024, 08:54:08+01:00
End Time	26 Feb 2024, 08:56:10+01:00
Session Length	2m 2s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 30.16615" N	55° 55' 30.18575" N
Longitude	007° 11' 17.27228" E	007° 11' 17.30363" E
Height	9.989 m Ell., -30.770 m ISS	10.015 m Ell., -31.229 m Ort.
Easting	386 786.110 m E (± 0.09 m)	
Northing	6 199 220.417 m N (± 0.11 m)	
Height	-30.766 m MSS (± 0.17 m) , -30.770 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	166.0° T, 167.5° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.5 m, USBL= 30.8 m

Table 5: Mean Position to Target

Target	CPT295		
Position	386 786.000 m E, 6 199 220.000 m N		
Range	0.43 m Grid		
Bearing To	194.7° G	Bearing From	14.7° G

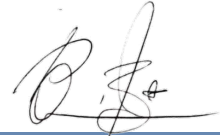
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	386 786.110 m E, 6 199 220.417 m N , -30.766 m MSS
Heading	166.0° T, 167.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT363-v131
Start Time	26 Feb 2024, 11:09:26+01:00
End Time	26 Feb 2024, 11:11:39+01:00
Session Length	2m 13s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 24.68865" N	55° 55' 24.70825" N
Longitude	007° 06' 38.47409" E	007° 06' 38.50540" E
Height	9.246 m Ell., -31.558 m ISS	9.271 m Ell., -31.995 m Ort.
Easting	381 943.069 m E (± 0.12 m)	
Northing	6 199 180.600 m N (± 0.12 m)	
Height	-31.531 m MSS (± 0.17 m) , -31.558 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	162.7° T, 164.3° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.4 m, USBL= 31.6 m

Table 5: Mean Position to Target

Target	CPT363		
Position	381 944.000 m E, 6 199 180.000 m N		
Range	1.11 m Grid		
Bearing To	122.8° G	Bearing From	302.8° G

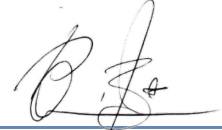
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	381 943.069 m E, 6 199 180.600 m N , -31.531 m MSS
Heading	162.7° T, 164.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT076-v132
Start Time	26 Feb 2024, 12:54:59+01:00
End Time	26 Feb 2024, 12:57:47+01:00
Session Length	2m 48s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 42.56836" N	55° 55' 42.58797" N
Longitude	007° 04' 39.74287" E	007° 04' 39.77417" E
Height	9.314 m Ell., -31.600 m ISS	9.340 m Ell., -31.943 m Ort.
Easting	379 897.851 m E (± 0.15 m)	
Northing	6 199 790.038 m N (± 0.12 m)	
Height	-31.484 m MSS (± 0.18 m) , -31.600 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	163.9° T, 165.5° G	± 3.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.3 m, USBL= 31.5 m

Table 5: Mean Position to Target

Target	CPT076		
Position	379 898.000 m E, 6 199 790.000 m N		
Range	0.15 m Grid		
Bearing To	104.3° G	Bearing From	284.3° G

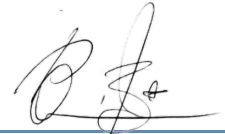
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	379 897.851 m E, 6 199 790.038 m N , -31.484 m MSS
Heading	163.9° T, 165.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT305-v133
Start Time	26 Feb 2024, 15:05:48+01:00
End Time	26 Feb 2024, 15:07:51+01:00
Session Length	2m 3s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 15.82331" N	55° 56' 15.84292" N
Longitude	007° 08' 43.67570" E	007° 08' 43.70703" E
Height	7.711 m Ell., -33.361 m ISS	7.737 m Ell., -33.521 m Ort.
Easting	384 158.354 m E (± 0.09 m)	
Northing	6 200 702.327 m N (± 0.09 m)	
Height	-33.059 m MSS (± 0.18 m) , -33.361 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	166.1° T, 167.7° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 32.9 m, USBL= 33.1 m

Table 5: Mean Position to Target

Target	CPT305		
Position	384 158.000 m E, 6 200 700.000 m N		
Range	2.35 m Grid		
Bearing To	188.6° G	Bearing From	8.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	384 158.354 m E, 6 200 702.327 m N , -33.059 m MSS
Heading	166.1° T, 167.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT241-v134
Start Time	26 Feb 2024, 18:39:03+01:00
End Time	26 Feb 2024, 18:41:20+01:00
Session Length	2m 17s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 02.54989" N	55° 56' 02.56950" N
Longitude	007° 03' 08.81452" E	007° 03' 08.84581" E
Height	7.428 m Ell., -33.553 m ISS	7.454 m Ell., -33.844 m Ort.
Easting	378 337.396 m E (± 0.16 m)	
Northing	6 200 451.801 m N (± 0.13 m)	
Height	-33.378 m MSS (± 0.19 m) , -33.553 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	150.7° T, 152.3° G	± 3.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 33.2 m, USBL= 33.4 m

Table 5: Mean Position to Target

Target	CPT241		
Position	378 338.000 m E, 6 200 450.000 m N		
Range	1.90 m Grid		
Bearing To	161.5° G	Bearing From	341.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	378 337.396 m E, 6 200 451.801 m N , -33.378 m MSS
Heading	150.7° T, 152.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT210B-v135
Start Time	26 Feb 2024, 20:43:32+01:00
End Time	26 Feb 2024, 20:46:09+01:00
Session Length	2m 37s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 56' 24.72412" N	55° 56' 24.74374" N
Longitude	006° 57' 47.92792" E	006° 57' 47.95917" E
Height	5.123 m Ell., -35.700 m ISS	5.149 m Ell., -36.214 m Ort.
Easting	372 790.210 m E (± 0.15 m)	
Northing	6 201 297.588 m N (± 0.13 m)	
Height	-35.747 m MSS (± 0.16 m) , -35.700 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	156.0° T, 157.7° G	± 3.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 35.6 m, USBL= 35.8 m

Table 5: Mean Position to Target

Target	CPT210		
Position	372 792.000 m E, 6 201 300.000 m N		
Range	3.00 m Grid		
Bearing To	36.6° G	Bearing From	216.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	372 790.210 m E, 6 201 297.588 m N , -35.747 m MSS
Heading	156.0° T, 157.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT191-v136
Start Time	26 Feb 2024, 23:05:24+01:00
End Time	26 Feb 2024, 23:07:58+01:00
Session Length	2m 35s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 31.75086" N	55° 55' 31.77047" N
Longitude	006° 59' 25.66600" E	006° 59' 25.69726" E
Height	6.917 m Ell., -33.941 m ISS	6.943 m Ell., -34.396 m Ort.
Easting	374 438.093 m E (± 0.14 m)	
Northing	6 199 610.646 m N (± 0.12 m)	
Height	-33.925 m MSS (± 0.19 m) , -33.941 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	159.2° T, 160.8° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 33.7 m, USBL= 33.9 m

Table 5: Mean Position to Target

Target	CPT191		
Position	374 437.000 m E, 6 199 610.000 m N		
Range	1.27 m Grid		
Bearing To	239.4° G	Bearing From	59.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	374 438.093 m E, 6 199 610.646 m N , -33.925 m MSS
Heading	159.2° T, 160.8° G
Pitch	0.00 °
Roll	0.00 °



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 Energinet Eltransmission

Tom Brogan
 Client Representative
 Energinet Eltransmission

Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT191A-v137
Start Time	27 Feb 2024, 00:20:55+01:00
End Time	27 Feb 2024, 00:23:22+01:00
Session Length	2m 27s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 55' 31.64851" N	55° 55' 31.66812" N
Longitude	006° 59' 25.65598" E	006° 59' 25.68723" E
Height	6.980 m Ell., -34.011 m ISS	7.006 m Ell., -34.333 m Ort.
Easting	374 437.827 m E (± 0.16 m)	
Northing	6 199 607.488 m N (± 0.15 m)	
Height	-33.862 m MSS (± 0.17 m) , -34.011 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	159.6° T, 161.2° G	± 2.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 33.7 m, USBL= 33.9 m

Table 5: Mean Position to Target

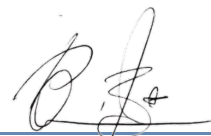
Target	CPT191		
Position	374 437.000 m E, 6 199 610.000 m N		
Range	2.65 m Grid		
Bearing To	341.8° G	Bearing From	161.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	374 437.827 m E, 6 199 607.488 m N , -33.862 m MSS
Heading	159.6° T, 161.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT352-v138
Start Time	27 Feb 2024, 01:31:37+01:00
End Time	27 Feb 2024, 01:33:41+01:00
Session Length	2m 4s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 43.90761" N	55° 54' 43.92723" N
Longitude	006° 57' 31.46008" E	006° 57' 31.49132" E
Height	5.076 m Ell., -36.015 m ISS	5.102 m Ell., -36.261 m Ort.
Easting	372 412.547 m E (± 0.14 m)	
Northing	6 198 189.952 m N (± 0.14 m)	
Height	-35.799 m MSS (± 0.19 m) , -36.015 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	164.9° T, 166.6° G	± 3.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 35.5 m, USBL= 35.8 m

Table 5: Mean Position to Target

Target	CPT352		
Position	372 412.000 m E, 6 198 190.000 m N		
Range	0.55 m Grid		
Bearing To	275.0° G	Bearing From	95.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	372 412.547 m E, 6 198 189.952 m N , -35.799 m MSS
Heading	164.9° T, 166.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT286-v141
Start Time	27 Feb 2024, 04:05:33+01:00
End Time	27 Feb 2024, 04:09:09+01:00
Session Length	3m 36s (67 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 52.65830" N	55° 53' 52.67793" N
Longitude	006° 55' 27.33171" E	006° 55' 27.36293" E
Height	2.335 m Ell., -38.947 m ISS	2.361 m Ell., -39.032 m Ort.
Easting	370 210.199 m E (± 0.14 m)	
Northing	6 196 670.086 m N (± 0.13 m)	
Height	-38.559 m MSS (± 0.16 m) , -38.947 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	163.9° T, 165.6° G	± 4.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 38.4 m, USBL= 38.6 m

Table 5: Mean Position to Target

Target	CPT286		
Position	370 210.000 m E, 6 196 670.000 m N		
Range	0.22 m Grid		
Bearing To	246.6° G	Bearing From	66.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	67 of 120
Position	370 210.199 m E, 6 196 670.086 m N , -38.559 m MSS
Heading	163.9° T, 165.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT085-v142
Start Time	27 Feb 2024, 06:37:32+01:00
End Time	27 Feb 2024, 06:40:58+01:00
Session Length	3m 26s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 57.28969" N	55° 53' 57.30931" N
Longitude	006° 57' 48.45494" E	006° 57' 48.48618" E
Height	6.091 m Ell., -35.058 m ISS	6.117 m Ell., -35.240 m Ort.
Easting	372 665.141 m E (± 0.15 m)	
Northing	6 196 740.378 m N (± 0.13 m)	
Height	-34.776 m MSS (± 0.18 m) , -35.058 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	161.8° T, 163.5° G	± 3.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 34.4 m, USBL= 34.8 m

Table 5: Mean Position to Target

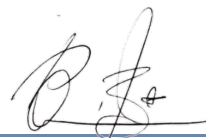
Target	CPT085		
Position	372 665.000 m E, 6 196 740.000 m N		
Range	0.40 m Grid		
Bearing To	200.4° G	Bearing From	20.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	372 665.141 m E, 6 196 740.378 m N , -34.776 m MSS
Heading	161.8° T, 163.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT091-v143
Start Time	27 Feb 2024, 08:00:43+01:00
End Time	27 Feb 2024, 08:02:46+01:00
Session Length	2m 3s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 12.27495" N	55° 53' 12.29457" N
Longitude	006° 58' 44.55564" E	006° 58' 44.58688" E
Height	4.967 m Ell., -35.921 m ISS	4.993 m Ell., -36.347 m Ort.
Easting	373 598.701 m E (± 0.12 m)	
Northing	6 195 320.476 m N (± 0.13 m)	
Height	-35.880 m MSS (± 0.19 m) , -35.921 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	158.1° T, 159.8° G	± 2.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 35.6 m, USBL= 35.9 m

Table 5: Mean Position to Target

Target	CPT091		
Position	373 598.000 m E, 6 195 320.000 m N		
Range	0.85 m Grid		
Bearing To	235.8° G	Bearing From	55.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	373 598.701 m E, 6 195 320.476 m N , -35.880 m MSS
Heading	158.1° T, 159.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT285-v147
Start Time	27 Feb 2024, 09:43:29+01:00
End Time	27 Feb 2024, 09:46:19+01:00
Session Length	2m 50s (88 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 15.02472" N	55° 53' 15.04434" N
Longitude	007° 02' 55.62706" E	007° 02' 55.65834" E
Height	6.199 m Ell., -34.470 m ISS	6.225 m Ell., -35.063 m Ort.
Easting	377 962.499 m E (± 0.12 m)	
Northing	6 195 280.249 m N (± 0.16 m)	
Height	-34.599 m MSS (± 0.18 m) , -34.470 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	144.1° T, 145.7° G	± 7.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 34.4 m, USBL= 34.6 m

Table 5: Mean Position to Target

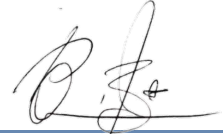
Target	CPT285		
Position	377 962.000 m E, 6 195 280.000 m N		
Range	0.56 m Grid		
Bearing To	243.5° G	Bearing From	63.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	88 of 120
Position	377 962.499 m E, 6 195 280.249 m N , -34.599 m MSS
Heading	144.1° T, 145.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT087-v148
Start Time	27 Feb 2024, 12:25:25+01:00
End Time	27 Feb 2024, 12:29:49+01:00
Session Length	4m 24s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 54.37923" N	55° 53' 54.39885" N
Longitude	007° 03' 47.98283" E	007° 03' 48.01412" E
Height	9.594 m Ell., -31.231 m ISS	9.620 m Ell., -31.663 m Ort.
Easting	378 906.026 m E (± 0.14 m)	
Northing	6 196 471.093 m N (± 0.08 m)	
Height	-31.203 m MSS (± 0.16 m) , -31.231 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	182.0° T, 183.6° G	± 3.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.1 m, USBL= 31.2 m

Table 5: Mean Position to Target

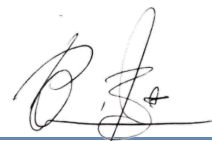
Target	CPT087		
Position	378 904.000 m E, 6 196 470.000 m N		
Range	2.30 m Grid		
Bearing To	241.6° G	Bearing From	61.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	378 906.026 m E, 6 196 471.093 m N , -31.203 m MSS
Heading	182.0° T, 183.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT257-v149
Start Time	27 Feb 2024, 14:02:25+01:00
End Time	27 Feb 2024, 14:04:38+01:00
Session Length	2m 13s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 29.69162" N	55° 54' 29.71124" N
Longitude	007° 03' 51.31241" E	007° 03' 51.34370" E
Height	9.918 m Ell., -31.067 m ISS	9.944 m Ell., -31.341 m Ort.
Easting	378 994.396 m E (± 0.08 m)	
Northing	6 197 560.941 m N (± 0.08 m)	
Height	-30.877 m MSS (± 0.16 m) , -31.067 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	197.7° T, 199.3° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.8 m, USBL= 30.9 m

Table 5: Mean Position to Target

Target	CPT257		
Position	378 994.000 m E, 6 197 560.000 m N		
Range	1.02 m Grid		
Bearing To	202.8° G	Bearing From	22.8° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	378 994.396 m E, 6 197 560.941 m N , -30.877 m MSS
Heading	197.7° T, 199.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT238-v150
Start Time	27 Feb 2024, 20:39:22+01:00
End Time	27 Feb 2024, 20:41:27+01:00
Session Length	2m 5s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 22.64047" N	55° 54' 22.66008" N
Longitude	007° 07' 03.87670" E	007° 07' 03.90801" E
Height	11.007 m Ell., -29.718 m ISS	11.032 m Ell., -30.225 m Ort.
Easting	382 331.734 m E (± 0.08 m)	
Northing	6 197 250.713 m N (± 0.06 m)	
Height	-29.761 m MSS (± 0.16 m) , -29.718 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	186.0° T, 187.5° G	± 2.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 29.6 m, USBL= 29.8 m

Table 5: Mean Position to Target


Target	CPT238		
Position	382 331.000 m E, 6 197 250.000 m N		
Range	1.02 m Grid		
Bearing To	225.8° G	Bearing From	45.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	382 331.734 m E, 6 197 250.713 m N , -29.761 m MSS
Heading	186.0° T, 187.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT371-v151
Start Time	01 Mar 2024, 07:47:04+01:00
End Time	01 Mar 2024, 07:49:14+01:00
Session Length	2m 10s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 28.84048" N	55° 53' 28.86009" N
Longitude	007° 08' 41.79800" E	007° 08' 41.82932" E
Height	10.032 m Ell., -31.459 m ISS	10.057 m Ell., -31.183 m Ort.
Easting	383 987.330 m E (± 0.12 m)	
Northing	6 195 541.851 m N (± 0.08 m)	
Height	-30.724 m MSS (± 0.21 m) , -31.459 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	146.8° T, 148.3° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.6 m, USBL= 30.7 m

Table 5: Mean Position to Target

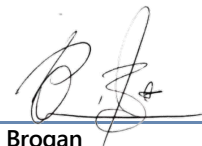
Target	CPT371		
Position	383 987.000 m E, 6 195 540.000 m N		
Range	1.88 m Grid		
Bearing To	190.1° G	Bearing From	10.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	383 987.330 m E, 6 195 541.851 m N , -30.724 m MSS
Heading	146.8° T, 148.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT088-v152
Start Time	01 Mar 2024, 16:26:22+01:00
End Time	01 Mar 2024, 16:28:25+01:00
Session Length	2m 3s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 47.13354" N	55° 53' 47.15314" N
Longitude	007° 10' 46.27584" E	007° 10' 46.30718" E
Height	13.104 m Ell., -28.357 m ISS	13.130 m Ell., -28.103 m Ort.
Easting	386 164.347 m E (± 0.10 m)	
Northing	6 196 049.842 m N (± 0.09 m)	
Height	-27.653 m MSS (± 0.24 m) , -28.357 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	193.3° T, 194.9° G	± 3.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.5 m, USBL= 27.7 m

Table 5: Mean Position to Target


Target	CPT088		
Position	386 164.000 m E, 6 196 050.000 m N		
Range	0.38 m Grid		
Bearing To	294.5° G	Bearing From	114.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	386 164.347 m E, 6 196 049.842 m N , -27.653 m MSS
Heading	193.3° T, 194.9° G
Pitch	0.00 °
Roll	0.00 °



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Party Chief
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Steve Weston
Client Representative
Energinet Eltransmission

Tom Brogan
Client Representative
Energinet Eltransmission

Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT361-v153
Start Time	01 Mar 2024, 18:47:28+01:00
End Time	01 Mar 2024, 18:49:37+01:00
Session Length	2m 9s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 19.87071" N	55° 54' 19.89031" N
Longitude	007° 10' 47.90062" E	007° 10' 47.93196" E
Height	9.792 m Ell., -31.742 m ISS	9.818 m Ell., -31.419 m Ort.
Easting	386 219.192 m E (± 0.07 m)	
Northing	6 197 060.993 m N (± 0.08 m)	
Height	-30.962 m MSS (± 0.23 m) , -31.742 m ISS (± 0.19 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	184.3° T, 185.8° G	± 2.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.7 m, USBL= 30.9 m

Table 5: Mean Position to Target

Target	CPT361		
Position	386 219.000 m E, 6 197 060.000 m N		
Range	1.01 m Grid		
Bearing To	190.9° G	Bearing From	10.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	386 219.192 m E, 6 197 060.993 m N , -30.962 m MSS
Heading	184.3° T, 185.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT262-v154
Start Time	01 Mar 2024, 20:22:56+01:00
End Time	01 Mar 2024, 20:25:08+01:00
Session Length	2m 13s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 04.26770" N	55° 54' 04.28730" N
Longitude	007° 12' 54.14283" E	007° 12' 54.17419" E
Height	9.369 m Ell., -32.020 m ISS	9.395 m Ell., -31.834 m Ort.
Easting	388 398.745 m E (± 0.14 m)	
Northing	6 196 521.581 m N (± 0.10 m)	
Height	-31.375 m MSS (± 0.19 m) , -32.020 m ISS (± 0.14 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	158.7° T, 160.2° G	± 3.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.3 m, USBL= 31.4 m

Table 5: Mean Position to Target


Target	CPT262		
Position	388 397.000 m E, 6 196 520.000 m N		
Range	2.36 m Grid		
Bearing To	227.8° G	Bearing From	47.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	388 398.745 m E, 6 196 521.581 m N , -31.375 m MSS
Heading	158.7° T, 160.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT083-v155
Start Time	01 Mar 2024, 21:43:34+01:00
End Time	01 Mar 2024, 21:45:39+01:00
Session Length	2m 5s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 13.56572" N	55° 54' 13.58532" N
Longitude	007° 13' 10.83666" E	007° 13' 10.86802" E
Height	9.871 m Ell., -31.272 m ISS	9.897 m Ell., -31.333 m Ort.
Easting	388 696.038 m E (± 0.10 m)	
Northing	6 196 801.511 m N (± 0.06 m)	
Height	-30.875 m MSS (± 0.17 m) , -31.272 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	158.5° T, 160.0° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.7 m, USBL= 30.9 m

Table 5: Mean Position to Target

Target	CPT083		
Position	388 695.000 m E, 6 196 800.000 m N		
Range	1.83 m Grid		
Bearing To	214.5° G	Bearing From	34.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	388 696.038 m E, 6 196 801.511 m N , -30.875 m MSS
Heading	158.5° T, 160.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT194-v156
Start Time	02 Mar 2024, 00:25:20+01:00
End Time	02 Mar 2024, 00:28:25+01:00
Session Length	3m 5s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 54' 27.00922" N	55° 54' 27.02882" N
Longitude	007° 15' 42.24788" E	007° 15' 42.27926" E
Height	15.211 m Ell., -25.859 m ISS	15.237 m Ell., -25.991 m Ort.
Easting	391 335.643 m E (± 0.13 m)	
Northing	6 197 150.179 m N (± 0.08 m)	
Height	-25.544 m MSS (± 0.20 m) , -25.859 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	197.0° T, 198.4° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.2 m, USBL= 25.6 m

Table 5: Mean Position to Target

Target	CPT194		
Position	391 336.000 m E, 6 197 150.000 m N		
Range	0.40 m Grid		
Bearing To	116.6° G	Bearing From	296.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	391 335.643 m E, 6 197 150.179 m N , -25.544 m MSS
Heading	197.0° T, 198.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT333-v157
Start Time	02 Mar 2024, 02:04:37+01:00
End Time	02 Mar 2024, 02:07:16+01:00
Session Length	2m 40s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 45.22205" N	55° 53' 45.24165" N
Longitude	007° 18' 43.26944" E	007° 18' 43.30084" E
Height	17.889 m Ell., -23.158 m ISS	17.915 m Ell., -23.307 m Ort.
Easting	394 447.176 m E (± 0.08 m)	
Northing	6 195 780.671 m N (± 0.11 m)	
Height	-22.868 m MSS (± 0.17 m) , -23.158 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	197.0° T, 198.4° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 22.6 m, USBL= 22.8 m

Table 5: Mean Position to Target

Target	CPT333		
Position	394 448.000 m E, 6 195 780.000 m N		
Range	1.06 m Grid		
Bearing To	129.1° G	Bearing From	309.1° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	394 447.176 m E, 6 195 780.671 m N , -22.868 m MSS
Heading	197.0° T, 198.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT095-v158
Start Time	02 Mar 2024, 04:24:51+01:00
End Time	02 Mar 2024, 04:30:41+01:00
Session Length	5m 50s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 32.51771" N	55° 52' 32.53731" N
Longitude	007° 18' 01.12226" E	007° 18' 01.15366" E
Height	18.855 m Ell., -22.302 m ISS	18.881 m Ell., -22.329 m Ort.
Easting	393 659.948 m E (± 0.13 m)	
Northing	6 193 551.282 m N (± 0.16 m)	
Height	-21.890 m MSS (± 0.26 m) , -22.302 m ISS (± 0.23 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	147.0° T, 148.4° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 21.6 m, USBL= 21.9 m

Table 5: Mean Position to Target

Target	CPT095		
Position	393 659.000 m E, 6 193 550.000 m N		
Range	1.59 m Grid		
Bearing To	216.5° G	Bearing From	36.5° G

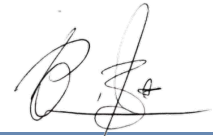
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	393 659.948 m E, 6 193 551.282 m N , -21.890 m MSS
Heading	147.0° T, 148.4° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT381-v159
Start Time	02 Mar 2024, 06:43:00+01:00
End Time	02 Mar 2024, 06:45:15+01:00
Session Length	2m 15s (113 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 16.39413" N	55° 52' 16.41373" N
Longitude	007° 16' 09.93836" E	007° 16' 09.96974" E
Height	15.238 m Ell., -25.996 m ISS	15.264 m Ell., -25.944 m Ort.
Easting	391 715.432 m E (± 0.19 m)	
Northing	6 193 100.793 m N (± 0.08 m)	
Height	-25.502 m MSS (± 0.36 m) , -25.996 m ISS (± 0.33 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	151.5° T, 152.9° G	± 3.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.1 m, USBL= 25.6 m

Table 5: Mean Position to Target

Target	CPT381		
Position	391 715.000 m E, 6 193 100.000 m N		
Range	0.90 m Grid		
Bearing To	208.6° G	Bearing From	28.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	113 of 120
Position	391 715.432 m E, 6 193 100.793 m N , -25.502 m MSS
Heading	151.5° T, 152.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT092-v161
Start Time	02 Mar 2024, 10:50:03+01:00
End Time	02 Mar 2024, 10:52:05+01:00
Session Length	2m 3s (84 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 23.12960" N	55° 53' 23.14920" N
Longitude	007° 15' 53.83397" E	007° 15' 53.86535" E
Height	14.375 m Ell., -26.348 m ISS	14.401 m Ell., -26.818 m Ort.
Easting	391 487.283 m E (± 0.09 m)	
Northing	6 195 170.599 m N (± 0.06 m)	
Height	-26.374 m MSS (± 0.31 m) , -26.348 m ISS (± 0.27 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	163.2° T, 164.6° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.0 m, USBL= 26.6 m

Table 5: Mean Position to Target

Target	CPT092		
Position	391 487.000 m E, 6 195 170.000 m N		
Range	0.66 m Grid		
Bearing To	205.3° G	Bearing From	25.3° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	84 of 120
Position	391 487.283 m E, 6 195 170.599 m N , -26.374 m MSS
Heading	163.2° T, 164.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT243-v162
Start Time	02 Mar 2024, 12:38:59+01:00
End Time	02 Mar 2024, 12:41:02+01:00
Session Length	2m 3s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 53' 05.24396" N	55° 53' 05.26357" N
Longitude	007° 13' 49.93269" E	007° 13' 49.96405" E
Height	9.836 m Ell., -30.922 m ISS	9.862 m Ell., -31.357 m Ort.
Easting	389 320.896 m E (± 0.09 m)	
Northing	6 194 672.271 m N (± 0.05 m)	
Height	-30.906 m MSS (± 0.25 m) , -30.922 m ISS (± 0.21 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	143.2° T, 144.6° G	± 2.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.7 m, USBL= 30.9 m

Table 5: Mean Position to Target

Target	CPT243		
Position	389 321.000 m E, 6 194 670.000 m N		
Range	2.27 m Grid		
Bearing To	177.4° G	Bearing From	357.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	389 320.896 m E, 6 194 672.271 m N , -30.906 m MSS
Heading	143.2° T, 144.6° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT097-v163
Start Time	02 Mar 2024, 15:12:59+01:00
End Time	02 Mar 2024, 15:15:02+01:00
Session Length	2m 3s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 21.51783" N	55° 52' 21.53744" N
Longitude	007° 12' 40.73653" E	007° 12' 40.76788" E
Height	9.357 m Ell., -31.654 m ISS	9.383 m Ell., -31.832 m Ort.
Easting	388 083.824 m E (± 0.10 m)	
Northing	6 193 351.622 m N (± 0.06 m)	
Height	-31.384 m MSS (± 0.28 m) , -31.654 m ISS (± 0.24 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	164.6° T, 166.1° G	± 1.9°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.2 m, USBL= 31.5 m

Table 5: Mean Position to Target

Target	CPT097		
Position	388 084.000 m E, 6 193 350.000 m N		
Range	1.63 m Grid		
Bearing To	173.8° G	Bearing From	353.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	388 083.824 m E, 6 193 351.622 m N , -31.384 m MSS
Heading	164.6° T, 166.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT282-v164
Start Time	02 Mar 2024, 19:15:49+01:00
End Time	02 Mar 2024, 19:17:53+01:00
Session Length	2m 3s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 44.52283" N	55° 52' 44.54244" N
Longitude	007° 11' 15.80998" E	007° 11' 15.84132" E
Height	7.651 m Ell., -33.504 m ISS	7.677 m Ell., -33.546 m Ort.
Easting	386 626.583 m E (± 0.09 m)	
Northing	6 194 101.100 m N (± 0.06 m)	
Height	-33.095 m MSS (± 0.24 m) , -33.504 m ISS (± 0.20 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	143.0° T, 144.5° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 32.8 m, USBL= 33.1 m

Table 5: Mean Position to Target

Target	CPT282		
Position	386 628.000 m E, 6 194 100.000 m N		
Range	1.79 m Grid		
Bearing To	127.8° G	Bearing From	307.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	386 626.583 m E, 6 194 101.100 m N , -33.095 m MSS
Heading	143.0° T, 144.5° G
Pitch	0.00 °
Roll	0.00 °



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Steve Weston
Client Representative
Energinet Eltransmission

Tom Brogan
Client Representative
Energinet Eltransmission

Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT237-v166
Start Time	02 Mar 2024, 22:27:31+01:00
End Time	02 Mar 2024, 22:29:34+01:00
Session Length	2m 2s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 41.19534" N	55° 52' 41.21495" N
Longitude	007° 06' 50.71911" E	007° 06' 50.75041" E
Height	12.828 m Ell., -27.894 m ISS	12.854 m Ell., -28.393 m Ort.
Easting	382 017.795 m E (± 0.11 m)	
Northing	6 194 121.352 m N (± 0.07 m)	
Height	-27.936 m MSS (± 0.32 m) , -27.894 m ISS (± 0.29 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	153.9° T, 155.4° G	± 1.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.6 m, USBL= 28.0 m

Table 5: Mean Position to Target

Target	CPT237		
Position	382 017.000 m E, 6 194 120.000 m N		
Range	1.57 m Grid		
Bearing To	210.5° G	Bearing From	30.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	382 017.795 m E, 6 194 121.352 m N , -27.936 m MSS
Heading	153.9° T, 155.4° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT192-v168
Start Time	03 Mar 2024, 00:25:07+01:00
End Time	03 Mar 2024, 00:27:22+01:00
Session Length	2m 15s (116 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 21.50077" N	55° 52' 21.52038" N
Longitude	007° 04' 29.85530" E	007° 04' 29.88659" E
Height	7.103 m Ell., -33.580 m ISS	7.129 m Ell., -34.137 m Ort.
Easting	379 553.304 m E (± 0.08 m)	
Northing	6 193 580.026 m N (± 0.06 m)	
Height	-33.673 m MSS (± 0.25 m) , -33.580 m ISS (± 0.21 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	156.6° T, 158.2° G	± 2.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 33.4 m, USBL= 33.7 m

Table 5: Mean Position to Target

Target	CPT192		
Position	379 554.000 m E, 6 193 580.000 m N		
Range	0.70 m Grid		
Bearing To	92.1° G	Bearing From	272.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	116 of 120
Position	379 553.304 m E, 6 193 580.026 m N , -33.673 m MSS
Heading	156.6° T, 158.2° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT192A-v169
Start Time	03 Mar 2024, 00:59:07+01:00
End Time	03 Mar 2024, 01:01:12+01:00
Session Length	2m 5s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 21.57020" N	55° 52' 21.58982" N
Longitude	007° 04' 29.97742" E	007° 04' 30.00870" E
Height	7.083 m Ell., -33.577 m ISS	7.109 m Ell., -34.157 m Ort.
Easting	379 555.486 m E (± 0.07 m)	
Northing	6 193 582.113 m N (± 0.03 m)	
Height	-33.693 m MSS (± 0.20 m) , -33.577 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	157.2° T, 158.8° G	± 1.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 33.4 m, USBL= 33.7 m

Table 5: Mean Position to Target

Target	CPT192		
Position	379 554.000 m E, 6 193 580.000 m N		
Range	2.58 m Grid		
Bearing To	215.1° G	Bearing From	35.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	379 555.486 m E, 6 193 582.113 m N , -33.693 m MSS
Heading	157.2° T, 158.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT326-v170
Start Time	03 Mar 2024, 02:18:41+01:00
End Time	03 Mar 2024, 02:20:44+01:00
Session Length	2m 3s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 50' 54.02357" N	55° 50' 54.04319" N
Longitude	007° 01' 59.41153" E	007° 01' 59.44279" E
Height	7.411 m Ell., -33.395 m ISS	7.437 m Ell., -33.848 m Ort.
Easting	376 862.100 m E (± 0.06 m)	
Northing	6 190 949.768 m N (± 0.04 m)	
Height	-33.385 m MSS (± 0.20 m) , -33.395 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	134.6° T, 136.3° G	± 1.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 33.1 m, USBL= 33.4 m

Table 5: Mean Position to Target

Target	CPT326		
Position	376 863.000 m E, 6 190 950.000 m N		
Range	0.93 m Grid		
Bearing To	75.6° G	Bearing From	255.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	376 862.100 m E, 6 190 949.768 m N , -33.385 m MSS
Heading	134.6° T, 136.3° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT096-v166
Start Time	02 Mar 2024, 20:56:55+01:00
End Time	02 Mar 2024, 20:58:58+01:00
Session Length	2m 3s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 19.15069" N	55° 52' 19.17030" N
Longitude	007° 08' 13.25864" E	007° 08' 13.28995" E
Height	14.588 m Ell., -26.356 m ISS	14.614 m Ell., -26.621 m Ort.
Easting	383 433.608 m E (± 0.33 m)	
Northing	6 193 401.113 m N (± 0.10 m)	
Height	-26.163 m MSS (± 0.44 m) , -26.356 m ISS (± 0.42 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	135.6° T, 137.2° G	± 5.8°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.5 m, USBL= 26.1 m

Table 5: Mean Position to Target

Target	CPT096		
Position	383 433.000 m E, 6 193 400.000 m N		
Range	1.27 m Grid		
Bearing To	208.7° G	Bearing From	28.7° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	383 433.608 m E, 6 193 401.113 m N , -26.163 m MSS
Heading	135.6° T, 137.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT193-v171
Start Time	03 Mar 2024, 13:24:38+01:00
End Time	03 Mar 2024, 13:26:40+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 51' 38.44971" N	55° 51' 38.46933" N
Longitude	006° 59' 24.59093" E	006° 59' 24.62218" E
Height	5.498 m Ell., -35.137 m ISS	5.524 m Ell., -35.799 m Ort.
Easting	374 209.912 m E (± 0.06 m)	
Northing	6 192 400.241 m N (± 0.04 m)	
Height	-35.333 m MSS (± 0.18 m) , -35.137 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	136.4° T, 138.1° G	± 1.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 35.0 m, USBL= 35.3 m

Table 5: Mean Position to Target

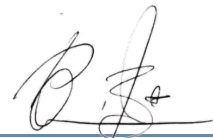
Target	CPT193		
Position	374 210.000 m E, 6 192 400.000 m N		
Range	0.26 m Grid		
Bearing To	159.9° G	Bearing From	339.9° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	374 209.912 m E, 6 192 400.241 m N , -35.333 m MSS
Heading	136.4° T, 138.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT121-v172
Start Time	03 Mar 2024, 19:08:46+01:00
End Time	03 Mar 2024, 19:10:49+01:00
Session Length	2m 3s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 52' 42.97002" N	55° 52' 42.98964" N
Longitude	006° 55' 15.78298" E	006° 55' 15.81420" E
Height	3.724 m Ell., -37.376 m ISS	3.750 m Ell., -37.643 m Ort.
Easting	369 944.911 m E (± 0.09 m)	
Northing	6 194 522.198 m N (± 0.09 m)	
Height	-37.187 m MSS (± 0.18 m) , -37.376 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	111.0° T, 112.7° G	± 1.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 36.9 m, USBL= 37.2 m

Table 5: Mean Position to Target


Target	CPT121		
Position	369 946.000 m E, 6 194 520.000 m N		
Range	2.45 m Grid		
Bearing To	153.6° G	Bearing From	333.6° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	369 944.911 m E, 6 194 522.198 m N , -37.187 m MSS
Heading	111.0° T, 112.7° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT229-v173
Start Time	03 Mar 2024, 20:58:41+01:00
End Time	03 Mar 2024, 21:00:43+01:00
Session Length	2m 2s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 49' 43.21856" N	55° 49' 43.23819" N
Longitude	006° 53' 33.28096" E	006° 53' 33.31215" E
Height	5.064 m Ell., -36.037 m ISS	5.090 m Ell., -36.322 m Ort.
Easting	367 994.810 m E (± 0.13 m)	
Northing	6 189 020.425 m N (± 0.04 m)	
Height	-35.868 m MSS (± 0.18 m) , -36.037 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	113.0° T, 114.7° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 35.6 m, USBL= 35.9 m

Table 5: Mean Position to Target

Target	CPT229		
Position	367 995.000 m E, 6 189 020.000 m N		
Range	0.47 m Grid		
Bearing To	155.9° G	Bearing From	335.9° G

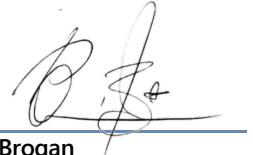
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	367 994.810 m E, 6 189 020.425 m N , -35.868 m MSS
Heading	113.0° T, 114.7° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT360-v174
Start Time	03 Mar 2024, 23:02:07+01:00
End Time	03 Mar 2024, 23:04:08+01:00
Session Length	2m 1s (115 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 50' 35.73287" N	55° 50' 35.75249" N
Longitude	006° 55' 52.30756" E	006° 55' 52.33877" E
Height	5.177 m Ell., -35.636 m ISS	5.203 m Ell., -36.171 m Ort.
Easting	370 461.927 m E (± 0.07 m)	
Northing	6 190 570.559 m N (± 0.05 m)	
Height	-35.712 m MSS (± 0.18 m) , -35.636 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	135.0° T, 136.7° G	± 0.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 35.5 m, USBL= 35.7 m

Table 5: Mean Position to Target

Target	CPT360		
Position	370 461.000 m E, 6 190 570.000 m N		
Range	1.08 m Grid		
Bearing To	238.9° G	Bearing From	58.9° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	115 of 120
Position	370 461.927 m E, 6 190 570.559 m N , -35.712 m MSS
Heading	135.0° T, 136.7° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT195-v175
Start Time	04 Mar 2024, 00:33:20+01:00
End Time	04 Mar 2024, 00:35:24+01:00
Session Length	2m 4s (114 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 49' 44.87966" N	55° 49' 44.89928" N
Longitude	006° 57' 44.61843" E	006° 57' 44.64965" E
Height	5.709 m Ell., -35.071 m ISS	5.735 m Ell., -35.604 m Ort.
Easting	372 368.778 m E (± 0.06 m)	
Northing	6 188 940.852 m N (± 0.05 m)	
Height	-35.148 m MSS (± 0.17 m) , -35.071 m ISS (± 0.10 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	128.5° T, 130.2° G	± 1.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 34.9 m, USBL= 35.2 m

Table 5: Mean Position to Target

Target	CPT195		
Position	372 368.000 m E, 6 188 940.000 m N		
Range	1.15 m Grid		
Bearing To	222.4° G	Bearing From	42.4° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	114 of 120
Position	372 368.778 m E, 6 188 940.852 m N , -35.148 m MSS
Heading	128.5° T, 130.2° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT148-v176
Start Time	04 Mar 2024, 02:27:12+01:00
End Time	04 Mar 2024, 02:29:16+01:00
Session Length	2m 4s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 48' 38.83351" N	55° 48' 38.85313" N
Longitude	007° 02' 00.77070" E	007° 02' 00.80196" E
Height	8.088 m Ell., -32.653 m ISS	8.114 m Ell., -33.155 m Ort.
Easting	376 767.033 m E (± 0.06 m)	
Northing	6 186 770.596 m N (± 0.06 m)	
Height	-32.700 m MSS (± 0.16 m) , -32.653 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	128.1° T, 129.7° G	± 2.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 32.5 m, USBL= 32.8 m

Table 5: Mean Position to Target

Target	CPT148		
Position	376 767.000 m E, 6 186 770.000 m N		
Range	0.60 m Grid		
Bearing To	183.2° G	Bearing From	3.2° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	376 767.033 m E, 6 186 770.596 m N , -32.700 m MSS
Heading	128.1° T, 129.7° G
Pitch	0.00 °
Roll	0.00 °



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Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT149-v177
Start Time	04 Mar 2024, 04:44:55+01:00
End Time	04 Mar 2024, 04:47:07+01:00
Session Length	2m 13s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 48' 44.24212" N	55° 48' 44.26173" N
Longitude	007° 07' 05.19001" E	007° 07' 05.22130" E
Height	9.238 m Ell., -31.630 m ISS	9.264 m Ell., -31.950 m Ort.
Easting	382 070.094 m E (± 0.07 m)	
Northing	6 186 790.524 m N (± 0.05 m)	
Height	-31.480 m MSS (± 0.18 m) , -31.630 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	129.6° T, 131.2° G	± 2.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.3 m, USBL= 31.5 m

Table 5: Mean Position to Target

Target	CPT149		
Position	382 070.000 m E, 6 186 790.000 m N		
Range	0.53 m Grid		
Bearing To	190.1° G	Bearing From	10.1° G

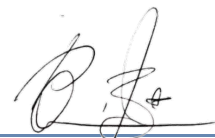
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	382 070.094 m E, 6 186 790.524 m N , -31.480 m MSS
Heading	129.6° T, 131.2° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT150-v178
Start Time	04 Mar 2024, 07:13:32+01:00
End Time	04 Mar 2024, 07:15:34+01:00
Session Length	2m 3s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 48' 48.15621" N	55° 48' 48.17582" N
Longitude	007° 11' 03.62378" E	007° 11' 03.65511" E
Height	9.229 m Ell., -31.847 m ISS	9.255 m Ell., -31.932 m Ort.
Easting	386 223.190 m E (± 0.06 m)	
Northing	6 186 800.700 m N (± 0.05 m)	
Height	-31.478 m MSS (± 0.16 m) , -31.847 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	119.5° T, 121.0° G	± 1.3°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 31.3 m, USBL= 31.5 m

Table 5: Mean Position to Target


Target	CPT150		
Position	386 223.000 m E, 6 186 800.000 m N		
Range	0.72 m Grid		
Bearing To	195.2° G	Bearing From	15.2° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	386 223.190 m E, 6 186 800.700 m N , -31.478 m MSS
Heading	119.5° T, 121.0° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT355-v179
Start Time	04 Mar 2024, 08:51:09+01:00
End Time	04 Mar 2024, 08:53:11+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 50' 16.77281" N	55° 50' 16.79242" N
Longitude	007° 09' 34.76545" E	007° 09' 34.79677" E
Height	9.995 m Ell., -31.077 m ISS	10.020 m Ell., -31.188 m Ort.
Easting	384 749.466 m E (± 0.06 m)	
Northing	6 189 580.594 m N (± 0.07 m)	
Height	-30.733 m MSS (± 0.18 m) , -31.077 m ISS (± 0.12 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	118.4° T, 119.9° G	± 3.1°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.5 m, USBL= 30.8 m

Table 5: Mean Position to Target

Target	CPT355		
Position	384 750.000 m E, 6 189 580.000 m N		
Range	0.80 m Grid		
Bearing To	138.0° G	Bearing From	318.0° G

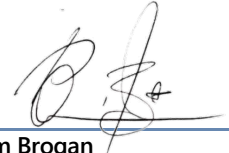
Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	384 749.466 m E, 6 189 580.594 m N , -30.733 m MSS
Heading	118.4° T, 119.9° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT158-v180
Start Time	04 Mar 2024, 10:07:24+01:00
End Time	04 Mar 2024, 10:09:28+01:00
Session Length	2m 4s (95 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 51' 10.83559" N	55° 51' 10.85520" N
Longitude	007° 12' 10.47524" E	007° 12' 10.50658" E
Height	13.533 m Ell., -27.463 m ISS	13.559 m Ell., -27.646 m Ort.
Easting	387 501.201 m E (± 0.08 m)	
Northing	6 191 180.488 m N (± 0.10 m)	
Height	-27.203 m MSS (± 0.21 m) , -27.463 m ISS (± 0.16 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	117.2° T, 118.7° G	± 2.6°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.8 m, USBL= 27.4 m

Table 5: Mean Position to Target

Target	CPT158		
Position	387 501.000 m E, 6 191 180.000 m N		
Range	0.53 m Grid		
Bearing To	202.4° G	Bearing From	22.4° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	95 of 120
Position	387 501.201 m E, 6 191 180.488 m N , -27.203 m MSS
Heading	117.2° T, 118.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT301-v181
Start Time	04 Mar 2024, 11:42:02+01:00
End Time	04 Mar 2024, 11:44:05+01:00
Session Length	2m 3s (118 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 51' 13.46987" N	55° 51' 13.48947" N
Longitude	007° 16' 23.53492" E	007° 16' 23.56630" E
Height	13.415 m Ell., -27.458 m ISS	13.441 m Ell., -27.756 m Ort.
Easting	391 903.194 m E (± 0.08 m)	
Northing	6 191 149.899 m N (± 0.05 m)	
Height	-27.315 m MSS (± 0.16 m) , -27.458 m ISS (± 0.09 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	121.0° T, 122.5° G	± 2.2°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 27.0 m, USBL= 27.4 m

Table 5: Mean Position to Target

Target	CPT301		
Position	391 903.000 m E, 6 191 150.000 m N		
Range	0.22 m Grid		
Bearing To	297.5° G	Bearing From	117.5° G


Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	118 of 120
Position	391 903.194 m E, 6 191 149.899 m N , -27.315 m MSS
Heading	121.0° T, 122.5° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT123-v182
Start Time	04 Mar 2024, 13:52:35+01:00
End Time	04 Mar 2024, 13:54:39+01:00
Session Length	2m 3s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 51' 13.51980" N	55° 51' 13.53940" N
Longitude	007° 14' 29.54502" E	007° 14' 29.57638" E
Height	13.586 m Ell., -27.206 m ISS	13.611 m Ell., -27.588 m Ort.
Easting	389 921.315 m E (± 0.07 m)	
Northing	6 191 201.345 m N (± 0.07 m)	
Height	-27.154 m MSS (± 0.17 m) , -27.206 m ISS (± 0.11 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	116.7° T, 118.1° G	± 1.7°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.8 m, USBL= 27.2 m

Table 5: Mean Position to Target

Target	CPT123		
Position	389 922.000 m E, 6 191 200.000 m N		
Range	1.51 m Grid		
Bearing To	153.0° G	Bearing From	333.0° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	389 921.315 m E, 6 191 201.345 m N , -27.154 m MSS
Heading	116.7° T, 118.1° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT300-v183
Start Time	04 Mar 2024, 15:54:29+01:00
End Time	04 Mar 2024, 15:56:32+01:00
Session Length	2m 2s (119 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 51' 21.31900" N	55° 51' 21.33861" N
Longitude	007° 09' 22.79414" E	007° 09' 22.82546" E
Height	10.088 m Ell., -30.834 m ISS	10.114 m Ell., -31.106 m Ort.
Easting	384 594.388 m E (± 0.10 m)	
Northing	6 191 581.208 m N (± 0.08 m)	
Height	-30.654 m MSS (± 0.19 m) , -30.834 m ISS (± 0.13 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	122.2° T, 123.7° G	± 2.0°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 30.3 m, USBL= 30.6 m

Table 5: Mean Position to Target

Target	CPT300		
Position	384 595.000 m E, 6 191 580.000 m N		
Range	1.35 m Grid		
Bearing To	153.1° G	Bearing From	333.1° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	119 of 120
Position	384 594.388 m E, 6 191 581.208 m N , -30.654 m MSS
Heading	122.2° T, 123.7° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT349-v184
Start Time	04 Mar 2024, 18:46:48+01:00
End Time	04 Mar 2024, 18:48:56+01:00
Session Length	2m 7s (104 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 49' 22.42495" N	55° 49' 22.44456" N
Longitude	007° 11' 01.52593" E	007° 11' 01.55725" E
Height	14.362 m Ell., -26.802 m ISS	14.388 m Ell., -26.804 m Ort.
Easting	386 214.463 m E (± 0.18 m)	
Northing	6 187 860.879 m N (± 0.20 m)	
Height	-26.357 m MSS (± 0.30 m) , -26.802 m ISS (± 0.27 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	102.3° T, 103.8° G	± 5.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 25.9 m, USBL= 26.4 m

Table 5: Mean Position to Target

Target	CPT349		
Position	386 214.000 m E, 6 187 860.000 m N		
Range	0.99 m Grid		
Bearing To	207.8° G	Bearing From	27.8° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	104 of 120
Position	386 214.463 m E, 6 187 860.879 m N , -26.357 m MSS
Heading	102.3° T, 103.8° G
Pitch	0.00 °
Roll	0.00 °



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Mean Position Report

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session Details

Session	CPT367-v185
Start Time	04 Mar 2024, 20:19:51+01:00
End Time	04 Mar 2024, 20:21:53+01:00
Session Length	2m 2s (117 of 120 records for CPT)

Table 3: Mean Position for CPT at CommonReferencePoint

	ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],...	ITRF2014 (EGM2008)
Latitude	55° 48' 35.96071" N	55° 48' 35.98032" N
Longitude	007° 09' 22.01594" E	007° 09' 22.04726" E
Height	13.970 m Ell., -27.235 m ISS	13.995 m Ell., -27.200 m Ort.
Easting	384 444.716 m E (± 0.09 m)	
Northing	6 186 470.481 m N (± 0.08 m)	
Height	-26.736 m MSS (± 0.20 m) , -27.235 m ISS (± 0.15 m)	

Table 4: Sensor Averages

Sensor	Average	SD
Heading	120.3° T, 121.8° G	± 2.4°
Pitch	0.00 °	± 0.00 °
Roll	0.00 °	± 0.00°
Depth (Manual)	0.0 m	Depth (DTU21) : mini IPS = 26.4 m, USBL= 26.8 m

Table 5: Mean Position to Target

Target	CPT367		
Position	384 445.000 m E, 6 186 470.000 m N		
Range	0.56 m Grid		
Bearing To	149.5° G	Bearing From	329.5° G

Table 6: CPT - ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]

Position Source	CPT/Selector/InUse/Navigation Result
Records	117 of 120
Position	384 444.716 m E, 6 186 470.481 m N , -26.736 m MSS
Heading	120.3° T, 121.8° G
Pitch	0.00 °
Roll	0.00 °



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B.2 Sound Velocity Profile

Sound and Velocity Profiles have been shared with Energinet Eltransmission A/S separately.

B.3 Positioning Data Reports

List of Plates

Positioning Data Subarea 1	66 Plates
Positioning Data Subarea 2	49 Plates



Positioning Data for the Normand Mermaid

Positioning Report for Danish Offshore Wind Farm 2030 Lot 2, Sub-area 1 |
North Sea

217703-REP-002 Issue 1 | 19 January 2024

Issued to client

Energinet Eltransmission A/S

ENERGINET

Document Control

Document Information

Document Title	Positioning Data for the Normand Mermaid
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Fugro Document No.	217703-REP-002
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Client Information

Client	Energinet Eltransmission A/S
Client Address	Tonne Kjærsvej 65, DK-7000 Fredericia, Denmark

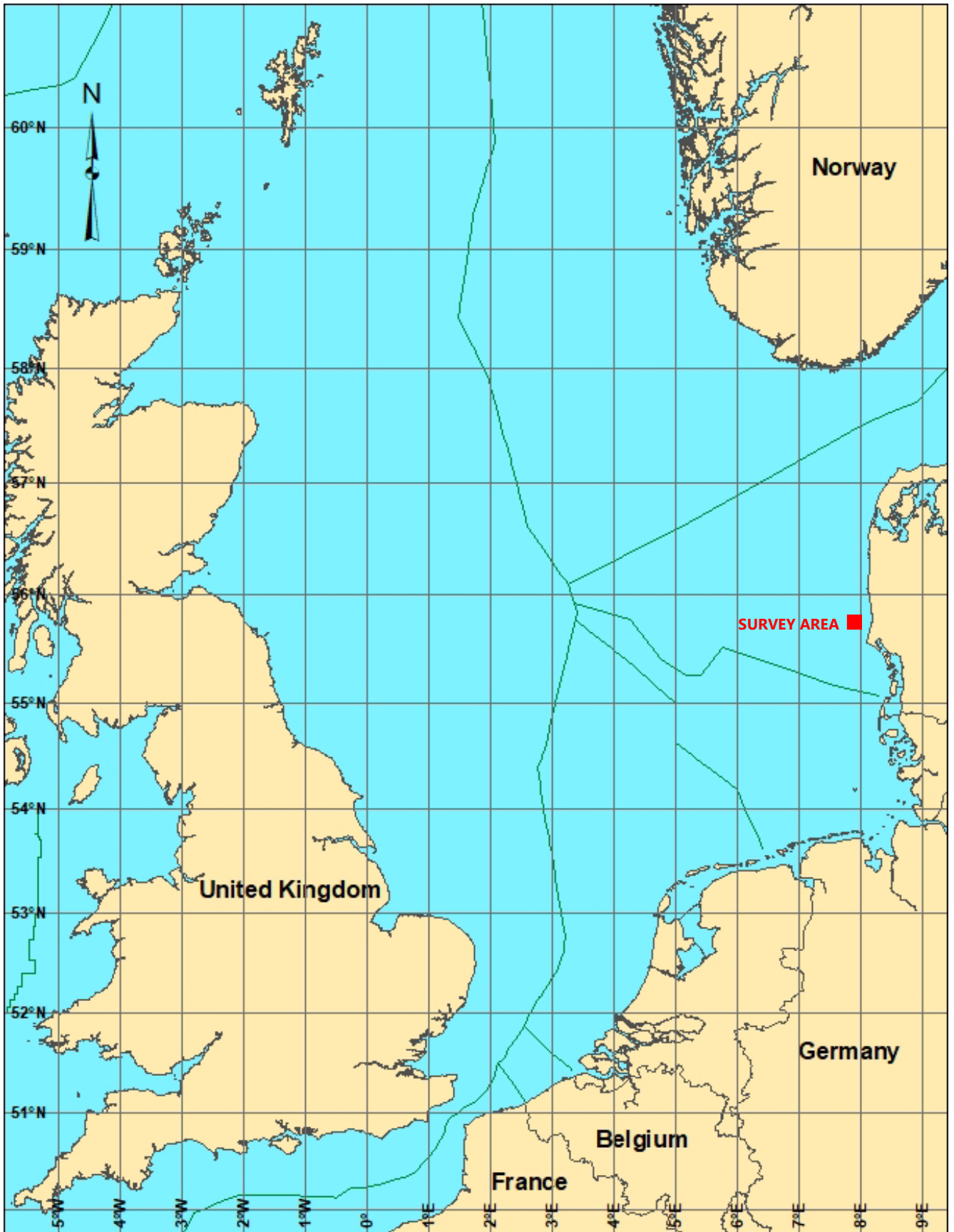
Revision History

Issue	Date	Status	Prepared By	Checked By	Approved By
1	19 January 2024	Issued to client	C. Cristea	D. Van der Straeten	S. Klemetsen

Report Amendment

Issue	Section	Page No.	Table No.	Figure No.	Description

Location Map



Location of DOWF Lot 2, Sub area 1

Executive Summary

Fugro was contracted by Energinet Eltransmission A/S to supply navigation and positioning services for the MV Normand Mermaid at 234 sampling and/or in situ testing locations at Danish Offshore Wind Farm 2030 Lot 2, Sub-area 1.

The sampling and/or in situ testing was carried out between 26 October 2023 and 9 January 2024.

Fugro navigated and positioned the MV Normand Mermaid to the intended positions given by the client.

Two StarPack GNSS receivers were used for the surface positioning during the project. Underwater positioning was performed via the vessel's HiPAP 501 USBL system. All depth measurements were reduced to MSL. Real-time GNSS tides were used throughout the project.

Depths at each sample location were measured using a pressure sensor and USBL.

During the operations speed of sound measurements were taken and the results were entered into the vessel's USBL system.

All positions and peripheral data were sent to the navigation computer which calculated the various offset's positions in the local geodesy and projection, ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366).

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Abbreviations

Accuracy	The accuracy of a measurement is its degree of closeness to its actual (true) value. Accuracy is the combination of the precision and reliability of an observation.
Augmentation Data	Additional information e.g. from a reference or tracking station, applied at a user receiver to improve the positioning solution. See also differential GNSS.
Azimuth	A horizontal angle measured from the spheroidal meridian clockwise from north through 360°. See also bearing and heading.
Bearing	Refers to a direction from one point to another on a chart right rotated from grid north (bearing = azimuth + convergence + arc to chord correction). See also azimuth and heading.
C-O Correction	Calculated minus observed correction. The difference found in a calibration procedure between a fixed value and an observation. The C O correction must always be added to the observation.
Chart Datum	Vertical Datum used in charting. Chart data e.g. Mean Sea Level (MSL), Lowest Astronomical Tide (LAT), Lowest Low Water Springs (LLWS), Normaal Amsterdams Peil (Amsterdam Ordnance Datum) (NAP), Normal Null (NN). See also Vertical Datum.
CM	Central meridian, the meridian that defines the central line of longitude of the chart projection. It is a zone constant used in chart projections.

Convergence	Clockwise angle in a point between true north and grid north.
CRP	Common Reference Point is the origin of all vessel coordinates. It is also referred to as the vessel datum.
Datum (Geodetic)	A mathematical model designed to best-fit part or all of the geoid. It is defined by an ellipsoid and the relationship between the ellipsoid and a point on the topographic surface established as the origin of datum. This relationship can be defined by six quantities, generally (but not necessarily) the geodetic latitude, longitude and the height of the origin, the two components of the deflection of the vertical at the origin, and the geodetic azimuth of a line, from the origin to some other point.
Datum Rotation (Geodetic)	Defined as the anti-clockwise rotation around the X-axis, Y-axis and Z-axis (Rx, Ry, and Rz) in the origin of two spheroids in terms of the Cartesian or geocentric coordinates. See also datum shift and scale.
Datum Shift (Geodetic)	Defined as the difference (ΔX , ΔY , ΔZ) in the origin of two spheroids in terms of the Cartesian or geocentric coordinates. See also datum rotation and scale.
Datum (Vessel)	The vessel datum is the origin of all vessel coordinates. It is referred to as the common reference point or CRP.
DGNSS	Augmentation technique requiring a GNSS receiver(s) to be placed at one or multiple known points from which GNSS observable (pseudo-range) corrections can be deduced. These corrections can then be applied to the offshore mobile receiver.
Differential Positioning	Determination of relative coordinates between two or more satellite receivers that are simultaneously tracking the same satellite signal.
DP	Dynamic positioning, mainly referring to a system keeping the vessel in one position compensating for current, wind and other natural influences, using a variety of positioning systems as reference.
Dynamic Calibration	A technique of calibration on the heading and motion sensors that can be undertaken whilst in port, in transit or during production. GNSS data from three GNSS antennas, placed in large separation along or athwart the vessel, are acquired while the sensor data are also logged. As a result, C-Os for heading, pitch and roll can be determined.
Ellipsoid / Spheroid	In geodesy, unless otherwise specified, a mathematical figure formed by revolving an ellipse about its minor axis. It is often used interchangeably with spheroid. Two quantities define an ellipsoid: these are usually given as the length of the semi-major axis, a , and the inverse flattening, $1/f = a / (a-b)$, where b is the length of the semi-minor axis. Prolate and triaxial ellipsoids are invariably described as such.
False Easting / False Northing	Defined projection coordinate offsets to the origin point of the projection.
Geoid	The particular equipotential surface with coincides with mean sea level, and which may be imagined to extend through the continents. This surface is perpendicular to the force of gravity everywhere.
GLONASS	Russian global navigation satellite system.
GPS	Global positioning system.
GNSS	Global navigation satellite system. A combination solution of GPS and GLONASS with provision for the future European Galileo space system.
HDOP	Horizontal dilution of precision. A measure of the magnitude of DOP errors in latitude and longitude.
Heading	Course of a vessel measured with a heading system, i.e. a gyrocompass, or a GPS vector heading system. If the heading is magnetic this will be stated. See also azimuth and bearing.
HPR	Hydro acoustic positioning reference. See USBL definition.

Line Scale Factor	<p>The ratio of a distance from point A to point B on the grid to the corresponding distance on the spheroid.</p> <p>$K = \text{plane distance} / \text{spheroidal distance}$</p> <p>$1/k = 1/6(1/k_A + 4/k_M + 1/k_B)$. ($k_A$, k_B, k_M being point scale factors at A, B, M. See also point scale factor)</p>
NTRIP	Networked Transport of RTCM via Internet Protocol. NTRIP is a protocol of streaming DGPS corrections over the internet.
Offset	A station offset from the main survey station. Must be defined by an azimuth and distance or ΔX , ΔY , ΔZ , or starboard/port, forward/aft, above/below.
OWF	Offshore Wind Farm.
PDOP	Position dilution of precision. A unit-less figure of merit expressing the relationship between the error in user position and the error in satellite position.
PPP	Precise Point Positioning. A global GNSS augmentation technique that corrects for GNSS satellite clock and orbit errors, and employs additional modelling techniques to further correct and improve the point positioning accuracy.
Precision	A measure of the random errors in observations and estimated parameters.
Reference Station	A GNSS receiver located at a precisely known location and used to determine the differential corrections employed for DGNSS augmentation techniques.
Satellite Configuration	State of the satellite configuration at a specific time, relative to a specific user or set of users.
Satellite Constellation	The arrangement in space of the complete set of satellites of a system such as GPS.
Scale	Reduction/expansion used in datum-datum transformations. Unit: ppm (parts per million). See also datum shift and datum rotation.
Scale Factor (Point)	<p>Ratio of an infinitesimal distance at a point on the grid to the corresponding distance on the spheroid.</p> <p>$K = \Delta (\text{plane distance}) / \Delta (\text{spheroidal distance})$.</p>
S/CTD (probe)	Salinity or conductivity, temperature and depth probe. Used to determine speed of sound through the water column. Pressure to depth conversions may be applied to provide true depth values.
SD	Standard deviation. Measure of the dispersion of random errors about the mean value. If a large number of measurements or observations of the same quantity are made, the standard deviation is the square root of the sum of the squares of deviations from the mean value divided by the number of observations less one.
Starfix.G2	A decimetre accuracy integrated GNSS service which utilises Fugro's own global network of reference stations to measure carrier phase observations. This data is then processed, producing a corrections solution for each navigation satellite. These corrections are applied to the satellite time reference clock and ephemeris ("orbit") information, hence "clock and orbit corrections". This service utilises both GPS and GLONASS L1 and L2 frequencies, thereby providing an accurate measurement of variations in ionospheric thickness. This enables signal delay to be calculated more precisely, resulting in a more accurate satellite to antenna range, and hence a more accurate position solution. Starfix.G2 provides a high availability, high integrity, global solution to an accuracy of 10 cm (95 % confidence level) both horizontally and vertically.

Starfix.G2+/G4+	Ultra-precise (3 cm) GPS and GLONASS Global Positioning Service, using Clock and Orbit Corrections enhanced with carrier-phase corrections from the Fugro G2 Network. Starfix.G2+/G4+ is an enhancement of Starfix.G2 service (based on GPS and GLONASS) and utilises advanced GNSS augmentation algorithms developed in-house by Fugro. The code and carrier-phase signals transmitted by GPS and GLONASS satellites are monitored globally by Fugro's worldwide network of reference stations. These observations are processed centrally in real-time using the company's proprietary algorithms to generate precise corrections which are used to augment the standard signals broadcast by GPS and GLONASS satellites. Corrections are received via communications satellites, providing at least two independent G2+/G4+ data sources.
Starfix.G4	A GPS, GLONASS, Galileo and BeiDou positioning system that is based on orbit and clock corrections generated from Fugro's own expanded network of multiple system reference stations. Starfix.G4 utilises Precise Point Positioning (PPP) technology, which distinguishes itself from the traditional differential approach as satellite errors are not lumped together but estimated at source on a per satellite basis. The GPS, GLONASS, Galileo and BeiDou orbit and clock corrections are computed separately, free of ionospheric and tropospheric effects.
Starfix.XP2	This service utilises a third party global network of reference stations to measure carrier phase observations. This data is then processed, producing a corrections solution for each navigation satellite. These corrections are applied to the satellite time reference clock and ephemeris ("orbit") information, hence "clock and orbit corrections". This service utilises the GPS L1 and L2 frequencies, thereby providing an accurate measurement of variations in ionospheric thickness. This enables signal delay to be calculated more precisely, resulting in a more accurate satellite to antenna range, and hence a more accurate position solution. Starfix.XP2 provides a high performance global solution to an accuracy of 10 cm and 20 cm (95 % confidence level) in the horizontal and vertical planes respectively.
Starfix.NG	Fugro's in-house advanced vessel and ROV positioning software system.
StarPack	A StarPack unit consists of a survey grade GNSS receiver and powerful processor, running Linux multi-tasking operating system. The receiver is capable of tracking all current (GPS, GLONASS) and future (Galileo) systems. A StarPack can be extended with a second receiver (in the same unit), to provide accurate, GNSS derived heading.
Transceiver	A device that can transmit and receive signals.
Transducer	A device that converts electrical energy to acoustic energy and vice-versa.
Transponder	A device that can detect a signal on a particular frequency and in response transmits signal on another frequency.
UTM	Universal Transverse Mercator. A special case of the transverse Mercator projection whereby the projection parameters are specified by worldwide agreement, abbreviated as the UTM grid. It consists of 60 north south zones, each 6 degrees of longitude wide with a unique central meridian.
USBL	Ultra-short baseline acoustic positioning method involving the measurement of range and bearing from a vessel-based transceiver to subsea transponders. It generally operates through phase discrimination of an acoustic signal as it passes over three transducers placed at right angles to each other within the Transducer head. Using this method, a three dimensional position of the beacon(s) can be determined.
Vertical Datum	An arbitrarily assumed value for a particular benchmark or a measured value at sea level at a tide station, or a fixed adjustment of many such measurements in a common adjustment. See also chart datum.
WGS 84	World Geodetic System 1984. A rotational ellipsoid having the following dimensions: semi-major axis 6378137.000 m, semi-minor axis (derived) 6356752.314 m, flattening (derived) 1/298.257224. This ellipsoid reference model / datum is the surface from which GPS coordinates are computed.

1. Introduction

Fugro was contracted by Energinet Eltransmission A/S to supply navigation and positioning services for the MV Normand Mermaid at 234 sampling and/or in situ testing locations at Danish Offshore Wind Farm 2030 Lot 2, Subarea 1.

The positions and depths reported here were checked and quality controlled by the Fugro office staff onshore and supersede the values in the preliminary field report.

The sampling and/or in situ testing was carried out between 26 October 2023 to 9 January 2024. The positioning results are given in Table 2.1, 2.2 and 2.3.

System positioning performance parameters are outlined in Section 4.3.

2. Results

2.1 Field Locations

Table 2.1: Actual Coordinates and Water Depths

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)					Water Depth (MSL)*	
Location	Easting	Northing	Latitude	Longitude	Pressure Sensor	USBL Depth
	[m]	[m]	[North]	[East]	[m]	[m]
CPT001	396 641.07	6 234 081.47	56° 14' 25.2706"	007° 19' 56.2720"	30.8	31.0
CPT003	400 349.75	6 228 760.39	56° 11' 36.0802"	007° 23' 38.7970"	29.6	29.9
CPT004	410 026.24	6 227 789.50	56° 11' 11.6216"	007° 33' 01.1482"	29.7	29.9
CPT005	396 895.91	6 226 992.01	56° 10' 36.2599"	007° 20' 20.9862"	29.4	29.8
CPT006	405 729.18	6 226 821.79	56° 10' 37.3411"	007° 28' 53.2332"	28.8	29.0
CPT007	414 847.38	6 226 750.82	56° 10' 41.2253"	007° 37' 41.8998"	30.7	30.8
CPT007A	414 848.27	6 226 746.44	56° 10' 41.0845"	007° 37' 41.9566"	30.7	30.8
CPT008	423 577.79	6 226 640.13	56° 10' 42.9742"	007° 46' 08.1621"	26.9	27.2
CPT009	418 724.31	6 226 611.88	56° 10' 39.1696"	007° 41' 26.8125"	29.9	29.9
CPT009A	418 721.52	6 226 607.34	56° 10' 39.0213"	007° 41' 26.6562"	29.9	29.9
CPT010	392 236.05	6 225 950.78	56° 09' 58.8859"	007° 15' 52.4163"	30.3	30.5
CPT011	402 855.38	6 225 210.06	56° 09' 43.1518"	007° 26' 08.7701"	28.3	28.4
CPT012	397 289.17	6 224 012.54	56° 09' 00.2351"	007° 20' 47.9214"	28.4	28.8
CPT013	411 362.16	6 223 991.61	56° 09' 09.7190"	007° 34' 23.1667"	30.2	30.3
CPT014	406 067.77	6 223 880.90	56° 09' 02.4920"	007° 29' 16.5979"	27.3	27.4
CPT014A	406 072.49	6 223 879.42	56° 09' 02.4477"	007° 29' 16.8736"	27.3	27.4
CPT015	394 844.45	6 223 440.55	56° 08' 39.8249"	007° 18' 27.1318"	30.0	30.6
CPT016	416 208.37	6 222 991.99	56° 08' 40.5484"	007° 39' 05.0611"	29.5	29.7
CPT017	386 817.37	6 222 760.02	56° 08' 11.2134"	007° 10' 43.3268"	29.1	29.4
CPT018	400 451.31	6 222 679.36	56° 08' 19.5432"	007° 23' 52.8782"	27.2	27.3
CPT019	418 591.19	6 222 491.57	56° 08' 25.8515"	007° 41' 23.6327"	29.3	29.5
CPT020	423 141.91	6 222 409.08	56° 08' 25.9007"	007° 45' 47.2901"	27.3	27.5
CPT021	407 202.52	6 222 100.55	56° 08' 05.7256"	007° 30' 24.5645"	27.6	27.8
CPT022	413 218.72	6 221 320.89	56° 07' 44.5889"	007° 36' 13.8548"	31.1	31.2
CPT023	416 357.45	6 220 010.21	56° 07' 04.2233"	007° 39' 17.0640"	30.1	30.3
CPT023A	416 353.37	6 220 008.49	56° 07' 04.1651"	007° 39' 16.8301"	30.2	30.4
CPT024	421 184.50	6 219 980.70	56° 07' 06.2242"	007° 43' 56.5042"	28.3	28.5
CPT027	396 435.52	6 218 721.24	56° 06' 08.4953"	007° 20' 05.8729"	28.0	28.2
CPT027A	396 438.89	6 218 716.31	56° 06' 08.3385"	007° 20' 06.0747"	27.9	28.1

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)					Water Depth (MSL)*	
Location	Easting	Northing	Latitude	Longitude	Pressure Sensor	USBL Depth
	[m]	[m]	[North]	[East]	[m]	[m]
CPT029	404 390.89	6 218 390.46	56° 06' 03.7677"	007° 27' 46.5470"	25.9	26.2
CPT030	412 872.68	6 218 190.11	56° 06' 03.1268"	007° 35' 57.4994"	30.3	30.4
CPT032	394 834.66	6 216 774.01	56° 05' 04.2806"	007° 18' 36.0214"	28.2	28.4
CPT035	402 167.44	6 215 911.22	56° 04' 41.9865"	007° 25' 41.1839"	25.5	25.6
CPT036	410 871.26	6 215 721.81	56° 04' 41.9851"	007° 34' 04.6704"	27.1	27.2
CPT037	423 222.84	6 215 301.29	56° 04' 36.0980"	007° 45' 59.3357"	26.8	27.0
CPT038	419 067.47	6 214 400.78	56° 04' 04.5121"	007° 42' 00.0442"	28.9	29.2
CPT040	394 768.49	6 214 229.49	56° 03' 41.9605"	007° 18' 35.7973"	29.1	29.2
CPT044	415 854.77	6 212 699.19	56° 03' 07.4937"	007° 38' 56.2501"	29.4	29.6
CPT045	403 446.44	6 212 009.66	56° 02' 36.7702"	007° 27' 00.1966"	24.8	25.0
CPT047	421 868.48	6 210 920.67	56° 02' 13.6491"	007° 44' 45.6223"	27.2	27.5
CPT051	414 974.93	6 209 469.01	56° 01' 22.4817"	007° 38' 09.0964"	28.2	28.3
CPT052	410 199.28	6 209 420.09	56° 01' 17.7650"	007° 33' 33.4176"	23.9	24.0
CPT054	406 743.50	6 208 659.63	56° 00' 50.8001"	007° 30' 14.8492"	23.4	23.6
CPT058	402 555.17	6 206 750.54	55° 59' 46.0740"	007° 26' 15.5827"	23.8	23.9
CPT060	412 979.29	6 205 920.17	55° 59' 26.4365"	007° 36' 18.0071"	24.4	24.7
CPT062	422 897.87	6 205 000.47	55° 59' 02.8010"	007° 45' 51.2008"	27.2	27.7
CPT063	408 340.03	6 204 949.40	55° 58' 51.9376"	007° 31' 51.5610"	22.7	22.8
CPT065	397 165.15	6 204 531.78	55° 58' 30.2864"	007° 21' 07.6697"	28.4	28.7
CPT067	400 247.78	6 203 190.49	55° 57' 49.2588"	007° 24' 07.2092"	24.9	25.2
CPT069	411 414.53	6 202 510.28	55° 57' 35.1440"	007° 34' 51.7735"	22.3	22.5
CPT070	416 023.10	6 202 491.58	55° 57' 37.5184"	007° 39' 17.4601"	24.9	25.2
CPT071	405 578.49	6 202 279.77	55° 57' 23.6895"	007° 29' 15.6607"	21.8	22.0
CPT074	409 387.31	6 200 030.70	55° 56' 13.6040"	007° 32' 57.9158"	21.5	21.7
CPT077	420 297.30	6 199 340.05	55° 55' 58.2250"	007° 43' 27.2145"	25.4	25.8
CPT079	402 063.37	6 198 440.39	55° 55' 17.0141"	007° 25' 58.0782"	25.8	26.2
CPT080	406 416.43	6 197 280.23	55° 54' 42.6190"	007° 30' 10.1964"	21.0	21.3
CPT081	410 760.74	6 197 261.90	55° 54' 44.9962"	007° 34' 20.3326"	20.8	21.0
CPT086	417 283.61	6 196 619.76	55° 54' 28.4256"	007° 40' 36.6028"	22.3	22.6
CPT094	421 348.31	6 194 440.58	55° 53' 20.4066"	007° 44' 32.8921"	23.6	24.0
CPT098	404 799.55	6 192 890.52	55° 52' 19.5363"	007° 28' 42.6694"	23.6	23.8
CPT100	425 647.79	6 192 330.31	55° 52' 14.6196"	007° 48' 42.3896"	24.3	24.6
CPT101	415 452.56	6 192 140.12	55° 52' 02.4206"	007° 38' 56.2259"	20.3	20.6
CPT102	419 328.41	6 191 940.40	55° 51' 58.3529"	007° 42' 39.3417"	21.6	22.0

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)					Water Depth (MSL)*	
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]	Pressure Sensor [m]	USBL Depth [m]
CPT107	421 637.31	6 189 350.96	55° 50' 35.9841"	007° 44' 54.8181"	23.5	23.7
CPT112	401 213.58	6 187 989.15	55° 49' 38.4564"	007° 25' 22.8601"	25.1	25.4
CPT114	404 428.35	6 187 661.44	55° 49' 30.1890"	007° 28' 27.9491"	22.8	23.1
CPT116	402 372.05	6 186 799.41	55° 49' 00.8348"	007° 26' 30.9459"	25.4	25.7
CPT120	421 302.64	6 185 220.09	55° 48' 22.2000"	007° 44' 39.8881"	22.5	22.8
CPT125	389 949.98	6 224 271.19	56° 09' 02.7059"	007° 13' 42.4530"	29.2	29.5
CPT125A	389 950.07	6 224 266.42	56° 09' 02.5518"	007° 13' 42.4649"	29.2	29.5
CPT126	389 947.84	6 228 500.72	56° 11' 19.4422"	007° 13' 36.0285"	30.4	30.7
CPT127	399 997.55	6 190 080.15	55° 50' 45.1660"	007° 24' 10.2354"	23.5	23.7
CPT128	399 948.75	6 207 250.99	56° 00' 00.3240"	007° 23' 44.5379"	22.9	23.2
CPT129	399 953.34	6 212 610.31	56° 02' 53.6104"	007° 23' 37.6118"	25.4	25.5
CPT130	399 947.21	6 216 980.52	56° 05' 14.9063"	007° 23' 31.3774"	25.0	25.1
CPT132	409 955.15	6 196 209.55	55° 54' 10.4275"	007° 33' 35.2133"	20.9	21.3
CPT133	409 951.69	6 200 628.75	55° 56' 33.3241"	007° 33' 29.7116"	21.0	21.3
CPT134	409 950.58	6 218 041.41	56° 05' 56.3689"	007° 33' 08.6232"	26.1	26.3
CPT135	396 829.28	6 236 806.46	56° 15' 53.5188"	007° 20' 03.3738"	31.4	31.6
CPT136	420 418.57	6 186 771.41	55° 49' 11.8468"	007° 43' 47.4902"	22.1	22.3
CPT137	419 957.45	6 209 720.69	56° 01' 33.7089"	007° 42' 56.5246"	27.2	27.4
CPT138	419 951.38	6 215 439.44	56° 04' 38.6349"	007° 42' 50.0234"	28.6	28.8
CPT139	401 346.72	6 226 770.50	56° 10' 32.4895"	007° 24' 39.2708"	29.2	29.4
CPT140	417 707.31	6 226 781.74	56° 10' 44.0342"	007° 40' 27.6651"	29.6	29.8
CPT140A	417 702.70	6 226 780.83	56° 10' 44.0019"	007° 40' 27.3986"	29.6	29.8
CPT140B	417 706.50	6 226 776.75	56° 10' 43.8721"	007° 40' 27.6238"	29.6	29.7
CPT141	420 599.72	6 226 769.07	56° 10' 45.3910"	007° 43' 15.3681"	29.8	30.1
CPT143	407 244.60	6 216 769.69	56° 05' 13.3858"	007° 30' 33.6689"	26.3	26.4
CPT153	404 405.33	6 226 570.99	56° 10' 28.2825"	007° 27' 36.8191"	28.2	28.4
CPT154	412 745.11	6 229 411.68	56° 12' 05.8956"	007° 35' 36.8809"	33.2	33.3
CPT155	408 203.19	6 223 280.08	56° 08' 44.5614"	007° 31' 21.0448"	27.8	27.9
CPT156	407 310.67	6 210 839.34	56° 02' 01.6765"	007° 30' 44.8789"	24.3	24.5
CPT160	390 937.65	6 222 660.65	56° 08' 11.4538"	007° 14' 42.0331"	28.5	28.9
CPT161	388 621.72	6 226 220.18	56° 10' 04.6052"	007° 12' 22.5844"	32.3	32.7
CPT162	426 141.59	6 192 399.48	55° 52' 17.1297"	007° 49' 10.7238"	24.2	24.5
CPT163	394 680.01	6 233 671.11	56° 14' 10.4544"	007° 18' 03.0053"	31.0	31.2
CPT164	398 107.67	6 233 371.07	56° 14' 03.4423"	007° 21' 22.4057"	30.8	31.0

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)					Water Depth (MSL)*	
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]	Pressure Sensor [m]	USBL Depth [m]
CPT165	406 050.65	6 224 881.48	56° 09' 34.8323"	007° 29' 14.3350"	28.8	28.9
CPT166	396 766.24	6 222 870.20	56° 08' 22.8952"	007° 20' 19.2255"	28.5	28.7
CPT169	398 727.87	6 207 980.30	56° 00' 22.9824"	007° 22' 33.1049"	22.8	23.0
CPT170	403 613.40	6 200 820.63	55° 56' 35.1046"	007° 27' 24.2763"	22.7	23.2
CPT171	412 847.34	6 224 339.42	56° 09' 21.9506"	007° 35' 48.7981"	30.9	31.0
CPT172	411 752.93	6 220 972.61	56° 07' 32.3599"	007° 34' 49.4043"	29.9	30.0
CPT173	411 690.49	6 218 927.61	56° 06' 26.1929"	007° 34' 48.2260"	29.1	29.2
CPT174	404 653.42	6 195 930.04	55° 53' 57.7152"	007° 28' 30.4122"	23.9	24.3
CPT175	412 337.01	6 208 860.57	56° 01' 01.0968"	007° 35' 37.5011"	25.1	25.4
CPT176	412 716.17	6 213 050.36	56° 03' 16.8264"	007° 35' 54.4814"	27.5	27.8
CPT177	414 243.56	6 215 369.63	56° 04' 32.8163"	007° 37' 20.0704"	30.7	31.0
CPT178	420 256.81	6 213 639.69	56° 03' 40.6193"	007° 43' 09.6147"	28.1	28.3
CPT179	418 759.33	6 205 098.00	55° 59' 03.4974"	007° 41' 52.3683"	27.6	27.8
CPT180	423 107.98	6 204 018.59	55° 58' 31.1697"	007° 46' 04.3307"	27.3	27.6
CPT181	422 912.24	6 197 851.76	55° 55' 11.6301"	007° 45' 59.3870"	25.5	26.0
CPT183	402 214.91	6 217 859.93	56° 05' 45.0293"	007° 25' 41.3625"	26.1	26.2
CPT185	403 532.40	6 184 470.51	55° 47' 46.3686"	007° 27' 40.5567"	25.4	25.7
CPT187	402 109.99	6 207 661.41	56° 00' 15.1997"	007° 25' 48.7046"	23.8	24.2
CPT197	390 769.21	6 225 638.20	56° 09' 47.5786"	007° 14' 27.8835"	29.6	30.0
CPT198	396 716.17	6 229 000.25	56° 11' 41.0485"	007° 20' 07.7577"	29.5	29.8
CPT199	405 193.74	6 220 610.03	56° 07' 16.1106"	007° 28' 30.1563"	26.6	26.9
CPT199A	405 190.40	6 220 610.76	56° 07' 16.1319"	007° 28' 29.9624"	26.6	26.7
CPT200	402 350.37	6 222 030.46	56° 07' 59.9749"	007° 25' 43.7046"	27.5	27.6
CPT201	398 349.77	6 204 799.86	55° 58' 39.8622"	007° 22' 15.6127"	25.9	26.2
CPT201A	398 350.41	6 204 804.71	55° 58' 40.0195"	007° 22' 15.6429"	25.9	26.2
CPT201B	398 346.19	6 204 801.10	55° 58' 39.8997"	007° 22' 15.4041"	25.9	26.1
CPT201C	398 346.07	6 204 798.37	55° 58' 39.8114"	007° 22' 15.4014"	25.9	26.0
CPT202	398 951.50	6 199 809.73	55° 55' 58.9731"	007° 22' 57.0446"	26.2	26.5
CPT206	416 640.85	6 222 060.17	56° 08' 10.6896"	007° 39' 31.1615"	29.5	29.7
CPT206A	416 636.65	6 222 060.31	56° 08' 10.6917"	007° 39' 30.9179"	29.5	29.7
CPT208	395 191.59	6 218 450.31	56° 05' 58.7595"	007° 18' 54.2940"	29.7	29.9
CPT209	394 018.87	6 220 271.50	56° 06' 56.7094"	007° 17' 43.8548"	29.5	29.9
CPT213	407 113.92	6 219 970.91	56° 06' 56.8034"	007° 30' 22.1044"	26.7	26.9
CPT216	424 736.95	6 224 843.58	56° 09' 45.5422"	007° 47' 17.1963"	26.5	26.8

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)					Water Depth (MSL)*	
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]	Pressure Sensor [m]	USBL Depth [m]
CPT216A	424 737.00	6 224 840.11	56° 09' 45.4298"	007° 47' 17.2030"	26.5	26.7
CPT217	422 959.09	6 207 071.22	56° 00' 09.8008"	007° 45' 52.5971"	27.5	27.7
CPT218	395 561.31	6 215 449.06	56° 04' 22.0162"	007° 19' 19.9012"	27.8	27.9
CPT218A	395 561.02	6 215 452.59	56° 04' 22.1301"	007° 19' 19.8791"	27.8	27.9
CPT219	416 412.65	6 214 851.75	56° 04' 17.4519"	007° 39' 26.0677"	29.9	30.1
CPT220	411 330.88	6 192 259.18	55° 52' 03.6054"	007° 34' 59.0568"	20.2	20.5
CPT224	419 361.99	6 223 708.06	56° 09' 05.6599"	007° 42' 06.9497"	28.7	28.9
CPT225	414 882.90	6 197 140.51	55° 54' 43.7587"	007° 38' 17.8057"	21.8	22.1
CPT226	393 674.33	6 224 270.00	56° 09' 05.7079"	007° 17' 18.1752"	30.2	30.5
CPT227	422 501.01	6 192 671.29	55° 52' 23.8625"	007° 45' 41.0454"	24.4	24.7
CPT228	400 675.74	6 223 720.84	56° 08' 53.3852"	007° 24' 04.4766"	27.8	27.9
CPT230	410 595.14	6 222 799.92	56° 08' 30.6706"	007° 33' 40.1715"	29.3	29.4
CPT231	398 548.22	6 202 829.48	55° 57' 36.3053"	007° 22' 29.7277"	26.7	26.9
CPT232	406 542.99	6 194 290.91	55° 53' 06.0469"	007° 30' 21.2000"	20.3	20.4
CPT233	401 328.01	6 190 100.33	55° 50' 46.8046"	007° 25' 26.6724"	24.4	24.8
CPT234	410 245.24	6 211 470.15	56° 02' 24.0852"	007° 33' 33.6025"	24.5	24.6
CPT236	411 459.25	6 227 082.17	56° 10' 49.7169"	007° 34' 25.0884"	31.5	31.6
CPT239	388 237.45	6 222 038.95	56° 07' 49.1064"	007° 12' 06.6346"	28.8	29.1
CPT242	418 515.73	6 212 240.16	56° 02' 54.3069"	007° 41' 30.5155"	28.6	29.0
CPT245	402 567.53	6 191 349.88	55° 51' 28.1150"	007° 26' 36.2963"	22.8	23.2
CPT249	416 302.17	6 203 569.56	55° 58' 12.5527"	007° 39' 32.3426"	25.7	26.0
CPT250	408 045.83	6 195 650.90	55° 53' 51.0641"	007° 31' 45.9984"	20.1	20.4
CPT252	401 411.93	6 199 360.93	55° 55' 46.2999"	007° 25' 19.3564"	24.8	25.1
CPT253	394 561.42	6 230 610.07	56° 12' 31.3951"	007° 18' 00.5040"	30.4	30.6
CPT254	391 099.75	6 227 729.33	56° 10' 55.4567"	007° 14' 43.9521"	29.9	30.1
CPT255	400 317.23	6 211 390.44	56° 02' 14.4416"	007° 24' 00.2671"	25.1	25.2
CPT258	402 635.26	6 202 651.27	55° 57' 33.5872"	007° 26' 25.5407"	24.3	24.7
CPT260	404 101.49	6 216 270.57	56° 04' 55.0152"	007° 27' 32.5429"	25.7	25.8
CPT264	394 751.68	6 227 531.86	56° 10' 52.0263"	007° 18' 15.9337"	31.3	31.6
CPT266	402 874.93	6 224 199.80	56° 09' 10.5013"	007° 26' 11.2295"	28.0	28.1
CPT267	416 690.01	6 224 157.63	56° 09' 18.5444"	007° 39' 31.6464"	29.5	29.5
CPT268	411 874.36	6 216 949.62	56° 05' 22.3560"	007° 35' 01.2141"	29.1	29.3
CPT269	411 723.86	6 204 630.52	55° 58' 43.9092"	007° 35' 07.1037"	23.3	23.5
CPT271	406 072.85	6 217 721.61	56° 05' 43.3419"	007° 29' 24.7003"	26.3	26.4

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)					Water Depth (MSL)*	
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]	Pressure Sensor [m]	USBL Depth [m]
CPT272	419 075.52	6 190 859.86	55° 51' 23.2575"	007° 42' 25.9592"	21.2	21.5
CPT273	400 415.93	6 215 480.49	56° 04' 26.7586"	007° 24' 00.4941"	24.8	24.9
CPT275	407 721.58	6 200 689.96	55° 56' 33.7810"	007° 31' 21.1426"	20.7	21.0
CPT276	416 870.61	6 198 580.29	55° 55' 31.5683"	007° 40' 10.6556"	23.1	23.4
CPT277	416 290.27	6 227 131.16	56° 10' 54.4445"	007° 39' 05.1173"	29.7	29.8
CPT278	419 803.51	6 183 870.35	55° 47' 37.6637"	007° 43' 15.2380"	21.1	21.4
CPT279	421 493.25	6 222 087.93	56° 08' 14.5494"	007° 44' 12.1430"	28.6	28.9
CPT280	411 674.47	6 195 409.81	55° 53' 45.7130"	007° 35' 15.1173"	20.3	20.5
CPT283	399 246.46	6 194 740.24	55° 53' 15.2816"	007° 23' 20.8352"	24.7	25.0
CPT283A	399 246.09	6 194 744.22	55° 53' 15.4099"	007° 23' 20.8083"	24.8	25.0
CPT284	395 489.26	6 212 380.87	56° 02' 42.7598"	007° 19' 20.0458"	28.6	28.8
CPT287	408 205.36	6 216 150.43	56° 04' 54.0297"	007° 31' 29.9981"	25.2	25.3
CPT288	396 245.56	6 206 392.12	55° 59' 29.7235"	007° 20' 12.0634"	28.5	28.7
CPT290	418 484.23	6 195 858.40	55° 54' 04.5420"	007° 41' 46.5486"	22.6	22.9
CPT292	422 734.87	6 199 859.06	55° 56' 16.4412"	007° 45' 47.1046"	26.1	26.4
CPT293	386 261.07	6 220 591.68	56° 07' 00.6379"	007° 10' 14.4481"	30.0	30.3
CPT293A	386 260.62	6 220 586.91	56° 07' 00.4834"	007° 10' 14.4295"	30.1	30.4
CPT294	408 609.87	6 221 320.55	56° 07' 41.4822"	007° 31' 47.0192"	26.9	27.0
CPT298	416 644.18	6 191 370.60	55° 51' 38.2831"	007° 40' 05.6070"	20.2	20.4
CPT302	418 243.30	6 218 329.38	56° 06' 11.0462"	007° 41' 08.0762"	29.3	29.5
CPT303	419 780.79	6 206 369.80	55° 59' 45.2431"	007° 42' 49.9252"	28.0	28.2
CPT304	397 352.18	6 226 072.46	56° 10' 06.8841"	007° 20' 48.7106"	28.4	28.7
CPT307	396 426.44	6 219 731.07	56° 06' 41.1377"	007° 20' 03.9374"	29.1	29.2
CPT308	418 781.90	6 227 621.40	56° 11' 11.8493"	007° 41' 29.0408"	29.7	29.9
CPT308A	418 776.97	6 227 620.46	56° 11' 11.8159"	007° 41' 28.7558"	29.7	29.8
CPT309	399 391.17	6 221 392.06	56° 07' 37.1218"	007° 22' 53.2382"	26.1	26.4
CPT310	422 934.56	6 213 221.89	56° 03' 28.6874"	007° 45' 44.8216"	28.1	28.4
CPT312	412 403.32	6 210 909.83	56° 02' 07.4050"	007° 35' 38.9212"	26.0	26.4
CPT319	414 081.88	6 225 600.15	56° 10' 03.5233"	007° 36' 58.8607"	30.3	30.4
CPT320	414 652.95	6 220 609.60	56° 07' 22.5196"	007° 37' 37.7144"	31.0	31.3
CPT321	408 919.52	6 208 079.92	56° 00' 33.5609"	007° 32' 21.1659"	23.3	23.5
CPT325	396 571.33	6 232 039.24	56° 13' 19.1890"	007° 19' 55.0933"	30.2	30.4
CPT327	420 649.60	6 195 310.59	55° 53' 48.1289"	007° 43' 51.7685"	23.5	23.8
CPT329	419 069.00	6 199 059.38	55° 55' 48.4105"	007° 42' 16.7580"	24.8	25.1

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)					Water Depth (MSL)*	
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]	Pressure Sensor [m]	USBL Depth [m]
CPT330	407 405.66	6 206 789.94	55° 59' 50.8058"	007° 30' 55.3908"	22.6	22.8
CPT331	402 991.77	6 220 128.93	56° 06' 58.9632"	007° 26' 23.3317"	26.7	26.8
CPT332	415 470.08	6 200 330.99	55° 56' 27.3022"	007° 38' 48.0181"	23.3	23.5
CPT334	416 742.09	6 194 481.02	55° 53' 18.9279"	007° 40' 07.7966"	21.4	21.7
CPT335	422 779.75	6 209 070.03	56° 01' 14.3347"	007° 45' 40.1780"	27.3	27.6
CPT336	425 717.09	6 194 361.27	55° 53' 20.3382"	007° 48' 44.3707"	24.6	24.8
CPT337	401 313.12	6 205 439.77	55° 59' 02.7784"	007° 25' 05.6544"	24.5	24.6
CPT337A	401 313.62	6 205 442.75	55° 59' 02.8750"	007° 25' 05.6795"	24.6	24.7
CPT338	411 587.87	6 207 662.09	56° 00' 21.8476"	007° 34' 55.6728"	24.0	24.3
CPT339	412 260.91	6 198 600.42	55° 55' 29.2721"	007° 35' 45.1399"	20.8	21.1
CPT340	397 792.91	6 216 951.01	56° 05' 12.3123"	007° 21' 26.8370"	24.4	24.5
CPT341	421 152.57	6 218 949.00	56° 06' 32.8429"	007° 43' 55.7531"	28.4	28.7
CPT342	414 359.55	6 195 999.56	55° 54' 06.5297"	007° 37' 48.9745"	20.9	21.2
CPT344	423 009.73	6 216 280.46	56° 05' 07.6387"	007° 45' 45.9981"	27.1	27.4
CPT345	399 031.76	6 210 060.13	56° 01' 30.4599"	007° 22' 47.8273"	23.0	23.1
CPT346	418 922.08	6 217 440.79	56° 05' 42.7284"	007° 41' 48.3217"	28.9	29.1
CPT351	388 098.30	6 224 029.02	56° 08' 53.3261"	007° 11' 55.5713"	30.0	30.3
CPT353	419 029.36	6 220 499.77	56° 07' 21.7116"	007° 41' 51.1881"	29.8	30.0
CPT354	405 985.32	6 222 821.05	56° 08' 28.1648"	007° 29' 13.1690"	27.7	27.8
CPT356	417 616.25	6 206 929.34	56° 00' 02.0165"	007° 40' 44.4123"	27.8	28.0
CPT357	404 214.21	6 189 700.33	55° 50' 35.9643"	007° 28' 13.0604"	22.3	22.5
CPT362	400 694.48	6 201 160.01	55° 56' 43.9394"	007° 24' 35.6523"	26.4	26.7
CPT364	396 832.07	6 209 580.22	56° 01' 13.2572"	007° 20' 41.4907"	26.9	27.0
CPT366	421 107.21	6 186 211.93	55° 48' 54.1605"	007° 44' 27.6307"	22.6	23.0
CPT368	423 856.21	6 227 718.54	56° 11' 18.0076"	007° 46' 23.1909"	26.4	26.6
CPT369	391 814.88	6 219 710.05	56° 06' 36.7789"	007° 15' 37.1319"	28.5	28.9
CPT370	414 344.88	6 218 501.17	56° 06' 14.1430"	007° 37' 22.3161"	31.2	31.3
CPT372	404 247.99	6 206 080.35	55° 59' 25.6307"	007° 27' 54.1096"	22.8	23.0
CPT375	398 865.20	6 228 479.24	56° 11' 25.8636"	007° 22' 13.0954"	29.5	29.7
CPT376	403 384.95	6 186 450.35	55° 48' 50.2810"	007° 27' 29.5633"	23.7	24.1
CPT378	421 102.71	6 225 079.36	56° 09' 51.0518"	007° 43' 46.3347"	29.5	29.8
CPT379	421 120.10	6 202 570.23	55° 57' 43.1719"	007° 44' 11.2137"	27.1	27.2
CPT380	394 560.16	6 222 432.90	56° 08' 07.0207"	007° 18' 12.1033"	30.3	30.7
CPT382	417 947.46	6 201 890.90	55° 57' 19.2909"	007° 41' 09.0541"	25.7	26.0

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)					Water Depth (MSL)*	
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]	Pressure Sensor [m]	USBL Depth [m]
CPT384	402 448.09	6 194 398.87	55° 53' 06.6157"	007° 26' 25.4792"	24.5	24.8
CPT384A	402 446.79	6 194 395.55	55° 53' 06.5074"	007° 26' 25.4085"	24.5	24.8
CPT385	391 439.71	6 230 930.44	56° 12' 39.2265"	007° 14' 58.9470"	30.7	30.9
CPT386	400 120.08	6 198 031.36	55° 55' 02.3508"	007° 24' 06.7224"	25.6	26.1
CPT389	402 048.11	6 212 759.99	56° 03' 00.0088"	007° 25' 38.4342"	25.7	25.7
CPT391	405 960.60	6 214 670.49	56° 04' 04.6069"	007° 29' 22.0692"	25.0	25.2
CPT391A	405 958.72	6 214 667.31	56° 04' 04.5028"	007° 29' 21.9643"	25.0	25.1
CPT392	398 640.32	6 213 051.19	56° 03' 06.8712"	007° 22' 21.1577"	23.4	23.5
CPT394	410 827.96	6 214 660.25	56° 04' 07.6302"	007° 34' 03.4401"	25.8	25.9
CPT395	406 431.44	6 198 320.20	55° 55' 16.2571"	007° 30' 09.7643"	20.9	21.0
CPT396	405 536.45	6 208 359.99	56° 00' 40.2609"	007° 29' 05.5542"	23.3	23.6
CPT397	410 904.10	6 224 910.86	56° 09' 39.1355"	007° 33' 55.5221"	30.3	30.4
SCPT002	393 121.47	6 229 239.01	56° 11' 45.9127"	007° 16' 38.9617"	29.4	29.8
SCPT026	399 882.19	6 218 849.36	56° 06' 15.2816"	007° 23' 25.0967"	25.3	25.7
SCPT026A	399 884.64	6 218 854.14	56° 06' 15.4383"	007° 23' 25.2318"	25.4	25.8
SCPT026B	399 883.66	6 218 846.41	56° 06' 15.1873"	007° 23' 25.1856"	25.4	25.7
SCPT026C	399 878.71	6 218 850.39	56° 06' 15.3123"	007° 23' 24.8942"	25.4	25.9
SCPT026D	399 878.30	6 218 847.38	56° 06' 15.2148"	007° 23' 24.8747"	25.5	25.8
SCPT026E	399 879.13	6 218 855.20	56° 06' 15.4684"	007° 23' 24.9118"	25.4	25.8
SCPT033	414 237.84	6 216 500.22	56° 05' 09.3714"	007° 37' 18.4346"	30.9	31.2
SCPT043	409 953.63	6 212 999.49	56° 03' 13.3401"	007° 33' 14.9082"	24.7	25.0
SCPT043A	409 953.75	6 212 995.79	56° 03' 13.2203"	007° 33' 14.9196"	24.7	24.9
SCPT043B	409 949.77	6 212 999.76	56° 03' 13.3460"	007° 33' 14.6853"	24.6	24.9
SCPT053	398 512.62	6 208 920.64	56° 00' 53.2224"	007° 22' 19.4049"	22.8	23.2
SCPT055	420 061.79	6 207 461.41	56° 00' 20.7121"	007° 43' 04.9704"	28.1	28.3
SCPT075	413 755.14	6 199 929.60	55° 56' 13.2264"	007° 37' 09.6694"	22.1	22.4
SCPT084	420 075.22	6 196 740.85	55° 54' 34.0392"	007° 43' 17.1887"	24.0	24.3
SCPT089	402 674.48	6 195 530.83	55° 53' 43.3818"	007° 26' 37.0382"	24.6	24.9
SCPT113	424 040.55	6 187 860.14	55° 49' 49.1553"	007° 47' 14.4491"	23.4	23.8

Notes:
* = Refer to Section 5 Methodology for details on the different water depth measurement

Table 2.2: Actual Coordinates in ITRF2014

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT001	56° 14' 25.2902"	007° 19' 56.3035"
CPT003	56° 11' 36.0998"	007° 23' 38.8285"
CPT004	56° 11' 11.6412"	007° 33' 01.1798"
CPT005	56° 10' 36.2794"	007° 20' 21.0177"
CPT006	56° 10' 37.3607"	007° 28' 53.2648"
CPT007	56° 10' 41.2449"	007° 37' 41.9314"
CPT007A	56° 10' 41.1040"	007° 37' 41.9882"
CPT008	56° 10' 42.9938"	007° 46' 08.1938"
CPT009	56° 10' 39.1892"	007° 41' 26.8442"
CPT009A	56° 10' 39.0409"	007° 41' 26.6879"
CPT010	56° 09' 58.9055"	007° 15' 52.4478"
CPT011	56° 09' 43.1714"	007° 26' 08.8016"
CPT012	56° 09' 00.2547"	007° 20' 47.9529"
CPT013	56° 09' 09.7386"	007° 34' 23.1983"
CPT014	56° 09' 02.5116"	007° 29' 16.6295"
CPT014A	56° 09' 02.4672"	007° 29' 16.9051"
CPT015	56° 08' 39.8445"	007° 18' 27.1633"
CPT016	56° 08' 40.5680"	007° 39' 05.0927"
CPT017	56° 08' 11.2330"	007° 10' 43.3582"
CPT018	56° 08' 19.5628"	007° 23' 52.9097"
CPT019	56° 08' 25.8710"	007° 41' 23.6643"
CPT020	56° 08' 25.9203"	007° 45' 47.3217"
CPT021	56° 08' 05.7451"	007° 30' 24.5961"
CPT022	56° 07' 44.6085"	007° 36' 13.8864"
CPT023	56° 07' 04.2429"	007° 39' 17.0956"
CPT023A	56° 07' 04.1847"	007° 39' 16.8617"
CPT024	56° 07' 06.2438"	007° 43' 56.5359"
CPT027	56° 06' 08.5149"	007° 20' 05.9044"
CPT027A	56° 06' 08.3581"	007° 20' 06.1061"
CPT029	56° 06' 03.7873"	007° 27' 46.5785"
CPT030	56° 06' 03.1463"	007° 35' 57.5310"
CPT032	56° 05' 04.3002"	007° 18' 36.0529"
CPT035	56° 04' 42.0060"	007° 25' 41.2154"
CPT036	56° 04' 42.0046"	007° 34' 04.7019"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT037	56° 04' 36.1175"	007° 45' 59.3674"
CPT038	56° 04' 04.5317"	007° 42' 00.0758"
CPT040	56° 03' 41.9801"	007° 18' 35.8288"
CPT044	56° 03' 07.5132"	007° 38' 56.2817"
CPT045	56° 02' 36.7898"	007° 27' 00.2281"
CPT047	56° 02' 13.6687"	007° 44' 45.6540"
CPT051	56° 01' 22.5013"	007° 38' 09.1280"
CPT052	56° 01' 17.7846"	007° 33' 33.4491"
CPT054	56° 00' 50.8197"	007° 30' 14.8807"
CPT058	55° 59' 46.0936"	007° 26' 15.6141"
CPT060	55° 59' 26.4561"	007° 36' 18.0387"
CPT062	55° 59' 02.8205"	007° 45' 51.2324"
CPT063	55° 58' 51.9572"	007° 31' 51.5925"
CPT065	55° 58' 30.3060"	007° 21' 07.7012"
CPT067	55° 57' 49.2784"	007° 24' 07.2407"
CPT069	55° 57' 35.1636"	007° 34' 51.8050"
CPT070	55° 57' 37.5380"	007° 39' 17.4917"
CPT071	55° 57' 23.7091"	007° 29' 15.6922"
CPT074	55° 56' 13.6236"	007° 32' 57.9474"
CPT077	55° 55' 58.2446"	007° 43' 27.2461"
CPT079	55° 55' 17.0337"	007° 25' 58.1097"
CPT080	55° 54' 42.6386"	007° 30' 10.2279"
CPT081	55° 54' 45.0158"	007° 34' 20.3642"
CPT086	55° 54' 28.4451"	007° 40' 36.6343"
CPT094	55° 53' 20.4261"	007° 44' 32.9237"
CPT098	55° 52' 19.5559"	007° 28' 42.7008"
CPT100	55° 52' 14.6391"	007° 48' 42.4212"
CPT101	55° 52' 02.4401"	007° 38' 56.2575"
CPT102	55° 51' 58.3725"	007° 42' 39.3733"
CPT107	55° 50' 36.0037"	007° 44' 54.8497"
CPT112	55° 49' 38.4760"	007° 25' 22.8915"
CPT114	55° 49' 30.2085"	007° 28' 27.9806"
CPT116	55° 49' 00.8544"	007° 26' 30.9774"
CPT120	55° 48' 22.2196"	007° 44' 39.9197"
CPT125	56° 09' 02.7255"	007° 13' 42.4844"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT125A	56° 09' 02.5714"	007° 13' 42.4963"
CPT126	56° 11' 19.4618"	007° 13' 36.0599"
CPT127	55° 50' 45.1856"	007° 24' 10.2668"
CPT128	56° 00' 00.3436"	007° 23' 44.5694"
CPT129	56° 02' 53.6299"	007° 23' 37.6433"
CPT130	56° 05' 14.9259"	007° 23' 31.4089"
CPT132	55° 54' 10.4471"	007° 33' 35.2448"
CPT133	55° 56' 33.3436"	007° 33' 29.7431"
CPT134	56° 05' 56.3885"	007° 33' 08.6548"
CPT135	56° 15' 53.5384"	007° 20' 03.4053"
CPT136	55° 49' 11.8663"	007° 43' 47.5217"
CPT137	56° 01' 33.7285"	007° 42' 56.5562"
CPT138	56° 04' 38.6545"	007° 42' 50.0551"
CPT139	56° 10' 32.5091"	007° 24' 39.3023"
CPT140	56° 10' 44.0538"	007° 40' 27.6967"
CPT140A	56° 10' 44.0215"	007° 40' 27.4303"
CPT140B	56° 10' 43.8917"	007° 40' 27.6554"
CPT141	56° 10' 45.4105"	007° 43' 15.3997"
CPT143	56° 05' 13.4054"	007° 30' 33.7004"
CPT153	56° 10' 28.3020"	007° 27' 36.8507"
CPT154	56° 12' 05.9151"	007° 35' 36.9125"
CPT155	56° 08' 44.5810"	007° 31' 21.0764"
CPT156	56° 02' 01.6960"	007° 30' 44.9105"
CPT160	56° 08' 11.4734"	007° 14' 42.0645"
CPT161	56° 10' 04.6248"	007° 12' 22.6158"
CPT162	55° 52' 17.1493"	007° 49' 10.7554"
CPT163	56° 14' 10.4740"	007° 18' 03.0368"
CPT164	56° 14' 03.4619"	007° 21' 22.4372"
CPT165	56° 09' 34.8519"	007° 29' 14.3666"
CPT166	56° 08' 22.9148"	007° 20' 19.2569"
CPT169	56° 00' 23.0020"	007° 22' 33.1363"
CPT170	55° 56' 35.1242"	007° 27' 24.3078"
CPT171	56° 09' 21.9702"	007° 35' 48.8297"
CPT172	56° 07' 32.3795"	007° 34' 49.4359"
CPT173	56° 06' 26.2125"	007° 34' 48.2576"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT174	55° 53' 57.7348"	007° 28' 30.4436"
CPT175	56° 01' 01.1164"	007° 35' 37.5326"
CPT176	56° 03' 16.8460"	007° 35' 54.5130"
CPT177	56° 04' 32.8359"	007° 37' 20.1020"
CPT178	56° 03' 40.6388"	007° 43' 09.6464"
CPT179	55° 59' 03.5169"	007° 41' 52.3999"
CPT180	55° 58' 31.1893"	007° 46' 04.3623"
CPT181	55° 55' 11.6497"	007° 45' 59.4186"
CPT183	56° 05' 45.0489"	007° 25' 41.3940"
CPT185	55° 47' 46.3882"	007° 27' 40.5882"
CPT187	56° 00' 15.2193"	007° 25' 48.7360"
CPT197	56° 09' 47.5982"	007° 14' 27.9149"
CPT198	56° 11' 41.0681"	007° 20' 07.7891"
CPT199	56° 07' 16.1301"	007° 28' 30.1878"
CPT199A	56° 07' 16.1515"	007° 28' 29.9940"
CPT200	56° 07' 59.9944"	007° 25' 43.7361"
CPT201	55° 58' 39.8818"	007° 22' 15.6441"
CPT201A	55° 58' 40.0391"	007° 22' 15.6743"
CPT201B	55° 58' 39.9193"	007° 22' 15.4355"
CPT201C	55° 58' 39.8310"	007° 22' 15.4328"
CPT202	55° 55' 58.9927"	007° 22' 57.0760"
CPT206	56° 08' 10.7092"	007° 39' 31.1931"
CPT206A	56° 08' 10.7113"	007° 39' 30.9495"
CPT208	56° 05' 58.7791"	007° 18' 54.3254"
CPT209	56° 06' 56.7290"	007° 17' 43.8862"
CPT213	56° 06' 56.8230"	007° 30' 22.1360"
CPT216	56° 09' 45.5618"	007° 47' 17.2280"
CPT216A	56° 09' 45.4494"	007° 47' 17.2347"
CPT217	56° 00' 09.8204"	007° 45' 52.6287"
CPT218	56° 04' 22.0358"	007° 19' 19.9326"
CPT218A	56° 04' 22.1497"	007° 19' 19.9106"
CPT219	56° 04' 17.4715"	007° 39' 26.0993"
CPT220	55° 52' 03.6250"	007° 34' 59.0884"
CPT224	56° 09' 05.6794"	007° 42' 06.9814"
CPT225	55° 54' 43.7782"	007° 38' 17.8372"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT226	56° 09' 05.7274"	007° 17' 18.2066"
CPT227	55° 52' 23.8821"	007° 45' 41.0770"
CPT228	56° 08' 53.4048"	007° 24' 04.5081"
CPT230	56° 08' 30.6902"	007° 33' 40.2030"
CPT231	55° 57' 36.3249"	007° 22' 29.7592"
CPT232	55° 53' 06.0665"	007° 30' 21.2315"
CPT233	55° 50' 46.8242"	007° 25' 26.7039"
CPT234	56° 02' 24.1048"	007° 33' 33.6340"
CPT236	56° 10' 49.7364"	007° 34' 25.1199"
CPT239	56° 07' 49.1260"	007° 12' 06.6660"
CPT242	56° 02' 54.3264"	007° 41' 30.5471"
CPT245	55° 51' 28.1346"	007° 26' 36.3277"
CPT249	55° 58' 12.5723"	007° 39' 32.3742"
CPT250	55° 53' 51.0837"	007° 31' 46.0299"
CPT252	55° 55' 46.3195"	007° 25' 19.3879"
CPT253	56° 12' 31.4147"	007° 18' 00.5354"
CPT254	56° 10' 55.4762"	007° 14' 43.9835"
CPT255	56° 02' 14.4612"	007° 24' 00.2985"
CPT258	55° 57' 33.6068"	007° 26' 25.5722"
CPT260	56° 04' 55.0348"	007° 27' 32.5745"
CPT264	56° 10' 52.0459"	007° 18' 15.9651"
CPT266	56° 09' 10.5013"	007° 26' 11.2295"
CPT267	56° 09' 18.5639"	007° 39' 31.6780"
CPT268	56° 05' 22.3756"	007° 35' 01.2457"
CPT269	55° 58' 43.9288"	007° 35' 07.1352"
CPT271	56° 05' 43.3615"	007° 29' 24.7318"
CPT272	55° 51' 23.2771"	007° 42' 25.9908"
CPT273	56° 04' 26.7782"	007° 24' 00.5256"
CPT275	55° 56' 33.8006"	007° 31' 21.1741"
CPT276	55° 55' 31.5878"	007° 40' 10.6872"
CPT277	56° 10' 54.4641"	007° 39' 05.1489"
CPT278	55° 47' 37.6833"	007° 43' 15.2695"
CPT279	56° 08' 14.5689"	007° 44' 12.1747"
CPT280	55° 53' 45.7326"	007° 35' 15.1488"
CPT283	55° 53' 15.3012"	007° 23' 20.8667"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT283A	55° 53' 15.4295"	007° 23' 20.8397"
CPT284	56° 02' 42.7794"	007° 19' 20.0772"
CPT287	56° 04' 54.0492"	007° 31' 30.0296"
CPT288	55° 59' 29.7431"	007° 20' 12.0949"
CPT290	55° 54' 04.5616"	007° 41' 46.5802"
CPT292	55° 56' 16.4607"	007° 45' 47.1362"
CPT293	56° 07' 00.6575"	007° 10' 14.4795"
CPT293A	56° 07' 00.5030"	007° 10' 14.4608"
CPT294	56° 07' 41.5018"	007° 31' 47.0508"
CPT298	55° 51' 38.3027"	007° 40' 05.6386"
CPT302	56° 06' 11.0657"	007° 41' 08.1079"
CPT303	55° 59' 45.2627"	007° 42' 49.9568"
CPT304	56° 10' 06.9037"	007° 20' 48.7421"
CPT307	56° 06' 41.1572"	007° 20' 03.9689"
CPT308	56° 11' 11.8689"	007° 41' 29.0725"
CPT308A	56° 11' 11.8355"	007° 41' 28.7874"
CPT309	56° 07' 37.1414"	007° 22' 53.2697"
CPT310	56° 03' 28.7070"	007° 45' 44.8533"
CPT312	56° 02' 07.4246"	007° 35' 38.9528"
CPT319	56° 10' 03.5428"	007° 36' 58.8923"
CPT320	56° 07' 22.5392"	007° 37' 37.7460"
CPT321	56° 00' 33.5804"	007 °32' 21.1974"
CPT325	56° 13' 19.2086"	007° 19' 55.1248"
CPT327	55° 53' 48.1484"	007° 43' 51.8001"
CPT329	55° 55' 48.4300"	007° 42' 16.7896"
CPT330	55° 59' 50.8254"	007° 30' 55.4223"
CPT331	56° 06' 58.9828"	007° 26' 23.3632"
CPT332	55° 56' 27.3217"	007° 38' 48.0497"
CPT334	55° 53' 18.9475"	007° 40' 07.8281"
CPT335	56° 01' 14.3543"	007° 45' 40.2097"
CPT336	55° 53' 20.3577"	007° 48' 44.4023"
CPT337	55° 59' 02.7980"	007° 25' 05.6858"
CPT337A	55° 59' 02.8946"	007° 25' 05.7109"
CPT338	56° 00' 21.8672"	007° 34' 55.7044"
CPT339	55° 55' 29.2917"	007° 35' 45.1714"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT340	56° 05' 12.3319"	007° 21' 26.8685"
CPT341	56° 06' 32.8625"	007° 43' 55.7847"
CPT342	55° 54' 06.5492"	007° 37' 49.0061"
CPT344	56° 05' 07.6583"	007° 45' 46.0298"
CPT345	56° 01' 30.4795"	007° 22' 47.8587"
CPT346	56° 05' 42.7480"	007° 41' 48.3533"
CPT351	56° 08' 53.3457"	007° 11' 55.6027"
CPT353	56° 07' 21.7312"	007° 41' 51.2197"
CPT354	56° 08' 28.1844"	007° 29' 13.2005"
CPT356	56° 00' 02.0361"	007° 40' 44.4439"
CPT357	55° 50' 35.9839"	007° 28' 13.0919"
CPT362	55° 56' 43.9590"	007° 24' 35.6838"
CPT364	56° 01' 13.2768"	007° 20' 41.5221"
CPT366	55° 48' 54.1801"	007° 44' 27.6623"
CPT368	56° 11' 18.0272"	007° 46' 23.2226"
CPT369	56° 06' 36.7985"	007° 15' 37.1633"
CPT370	56° 06' 14.1626"	007° 37' 22.3477"
CPT372	55° 59' 25.6503"	007° 27' 54.1411"
CPT375	56° 11' 25.8832"	007° 22' 13.1269"
CPT376	55° 48' 50.3006"	007° 27' 29.5947"
CPT378	56° 09' 51.0713"	007° 43' 46.3663"
CPT379	55° 57' 43.1914"	007° 44' 11.2454"
CPT380	56° 08' 07.0403"	007° 18' 12.1348"
CPT382	55° 57' 19.3105"	007° 41' 09.0857"
CPT384	55° 53' 06.6353"	007° 26' 25.5107"
CPT384A	55° 53' 06.5270"	007° 26' 25.4399"
CPT385	56° 12' 39.2461"	007° 14' 58.9784"
CPT386	55° 55' 02.3704"	007° 24' 06.7539"
CPT389	56° 03' 00.0284"	007° 25' 38.4657"
CPT391	56° 04' 04.6265"	007° 29' 22.1007"
CPT391A	56° 04' 04.5224"	007° 29' 21.9958"
CPT392	56° 03' 06.8908"	007° 22' 21.1891"
CPT394	56° 04' 07.6497"	007° 34' 03.4716"
CPT395	55° 55' 16.2767"	007° 30' 09.7958"
CPT396	56° 00' 40.2805"	007° 29' 05.5857"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT397	56° 09' 39.1550"	007° 33' 55.5537"
SCPT002	56° 11' 45.9323"	007° 16' 38.9932"
SCPT026	56° 06' 15.3012"	007° 23' 25.1282"
SCPT026A	56° 06' 15.4579"	007° 23' 25.2633"
SCPT026B	56° 06' 15.2069"	007° 23' 25.2171"
SCPT026C	56° 06' 15.3319"	007° 23' 24.9257"
SCPT026D	56° 06' 15.2344"	007° 23' 24.9062"
SCPT026E	56° 06' 15.4880"	007° 23' 24.9433"
SCPT033	56° 05' 09.3910"	007° 37' 18.4662"
SCPT043	56° 03' 13.3596"	007° 33' 14.9398"
SCPT043A	56° 03' 13.2399"	007° 33' 14.9512"
SCPT043B	56° 03' 13.3656"	007° 33' 14.7168"
SCPT053	56° 00' 53.2420"	007° 22' 19.4363"
SCPT055	56° 00' 20.7316"	007° 43' 05.0020"
SCPT075	55° 56' 13.2460"	007° 37' 09.7009"
SCPT084	55° 54' 34.0588"	007° 43' 17.2203"
SCPT089	55° 53' 43.4014"	007° 26' 37.0697"
SCPT113	55° 49' 49.1749"	007° 47' 14.4807"

Table 2.3: Actual Location Details

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	No. of Fixes	X [m]	Y [m]	Distance [m]	Bearing [°G]
CPT001	396 641.07	6 234 081.47	100	0.08	0.14	2.43	307.2
CPT003	400 349.75	6 228 760.39	100	0.05	0.04	0.46	327.1
CPT004	410 026.24	6 227 789.50	100	0.11	0.07	0.56	154.8
CPT005	396 895.91	6 226 992.01	100	0.09	0.11	2.28	331.4
CPT006	405 729.18	6 226 821.79	100	0.04	0.04	1.97	335.3
CPT007	414 847.38	6 226 750.82	100	0.07	0.13	1.02	322.7
CPT007A	414 848.27	6 226 746.44	100	0.06	0.05	3.57	175.6
CPT008	423 577.79	6 226 640.13	100	0.12	0.10	1.21	276.2
CPT009	418 724.31	6 226 611.88	100	0.06	0.06	1.90	009.3
CPT009A	418 721.52	6 226 607.34	100	0.08	0.05	3.63	223.0
CPT010	392 236.05	6 225 950.78	100	0.07	0.06	1.23	309.3
CPT011	402 855.38	6 225 210.06	100	0.05	0.05	0.62	275.9

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	No. of Fixes	X [m]	Y [m]	Distance [m]	Bearing [°G]
CPT012	397 289.17	6 224 012.54	100	0.06	0.06	2.55	003.9
CPT013	411 362.16	6 223 991.61	100	0.08	0.03	1.62	005.7
CPT014	406 067.77	6 223 880.90	100	0.05	0.06	1.53	306.0
CPT014A	406 072.49	6 223 879.42	100	0.06	0.06	3.54	099.4
CPT015	394 844.45	6 223 440.55	100	0.03	0.05	0.78	315.0
CPT016	416 208.37	6 222 991.99	100	0.07	0.15	2.41	034.5
CPT017	386 817.37	6 222 760.02	100	0.04	0.06	0.37	086.4
CPT018	400 451.31	6 222 679.36	100	0.07	0.04	0.71	154.5
CPT019	418 591.19	6 222 491.57	100	0.05	0.05	3.22	299.1
CPT020	423 141.91	6 222 409.08	100	0.10	0.09	1.29	135.2
CPT021	407 202.52	6 222 100.55	100	0.07	0.04	0.73	318.8
CPT022	413 218.72	6 221 320.89	100	0.06	0.07	0.93	342.2
CPT023	416 357.45	6 220 010.21	100	0.06	0.14	0.49	064.8
CPT023A	416 353.37	6 220 008.49	100	0.04	0.06	3.93	247.4
CPT024	421 184.50	6 219 980.70	100	0.08	0.12	0.86	035.7
CPT027	396 435.52	6 218 721.24	100	0.06	0.09	1.35	022.8
CPT027A	396 438.89	6 218 716.31	100	0.04	0.07	5.36	133.5
CPT029	404 390.89	6 218 390.46	100	0.09	0.04	1.21	292.3
CPT030	412 872.68	6 218 190.11	100	0.06	0.07	1.33	274.8
CPT032	394 834.66	6 216 774.01	100	0.08	0.05	4.07	009.4
CPT035	402 167.44	6 215 911.22	100	0.04	0.03	1.30	019.9
CPT036	410 871.26	6 215 721.81	100	0.05	0.04	1.95	337.8
CPT037	423 222.84	6 215 301.29	100	0.12	0.07	2.25	054.9
CPT038	419 067.47	6 214 400.78	100	0.12	0.09	0.91	031.0
CPT040	394 768.49	6 214 229.49	100	0.09	0.07	0.72	225.0
CPT044	415 854.77	6 212 699.19	100	0.03	0.06	0.85	196.0
CPT045	403 446.44	6 212 009.66	100	0.04	0.03	0.66	238.6
CPT047	421 868.48	6 210 920.67	100	0.07	0.06	0.85	322.1
CPT051	414 974.93	6 209 469.01	100	0.04	0.04	1.46	227.2
CPT052	410 199.28	6 209 420.09	100	0.03	0.05	1.72	273.1
CPT054	406 743.50	6 208 659.63	100	0.05	0.07	0.63	233.5
CPT058	402 555.17	6 206 750.54	100	0.07	0.08	0.99	303.0
CPT060	412 979.29	6 205 920.17	100	0.06	0.06	0.73	283.2
CPT062	422 897.87	6 205 000.47	100	0.04	0.03	1.23	292.8

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	No. of Fixes	X [m]	Y [m]	Distance [m]	Bearing [°G]
CPT063	408 340.03	6 204 949.40	100	0.09	0.04	0.60	176.8
CPT065	397 165.15	6 204 531.78	100	0.09	0.05	1.78	004.8
CPT067	400 247.78	6 203 190.49	100	0.08	0.08	1.32	291.7
CPT069	411 414.53	6 202 510.28	100	0.04	0.05	0.60	061.7
CPT070	416 023.10	6 202 491.58	100	0.04	0.05	1.82	330.2
CPT071	405 578.49	6 202 279.77	100	0.10	0.09	0.54	114.5
CPT074	409 387.31	6 200 030.70	100	0.08	0.03	0.98	315.4
CPT077	420 297.30	6 199 340.05	100	0.07	0.10	0.70	273.8
CPT079	402 063.37	6 198 440.39	100	0.07	0.06	0.54	043.4
CPT080	406 416.43	6 197 280.23	100	0.03	0.05	0.62	292.3
CPT081	410 760.74	6 197 261.90	100	0.08	0.06	2.04	021.2
CPT086	417 283.61	6 196 619.76	100	0.05	0.07	0.66	111.7
CPT094	421 348.31	6 194 440.58	100	0.03	0.05	0.90	309.7
CPT098	404 799.55	6 192 890.52	100	0.03	0.07	0.68	319.1
CPT100	425 647.79	6 192 330.31	100	0.04	0.06	0.37	325.9
CPT101	415 452.56	6 192 140.12	100	0.03	0.02	0.46	284.7
CPT102	419 328.41	6 191 940.40	100	0.05	0.05	0.71	304.4
CPT107	421 637.31	6 189 350.96	100	0.07	0.14	1.01	017.9
CPT112	401 213.58	6 187 989.15	100	0.06	0.08	0.95	206.1
CPT114	404 428.35	6 187 661.44	100	0.07	0.05	1.58	335.7
CPT116	402 372.05	6 186 799.41	100	0.04	0.06	2.04	253.3
CPT120	421 302.64	6 185 220.09	100	0.12	0.05	0.37	284.0
CPT125	389 949.98	6 224 271.19	100	0.06	0.10	1.19	359.1
CPT125A	389 950.07	6 224 266.42	100	0.10	0.08	3.58	179.0
CPT126	389 947.84	6 228 500.72	100	0.05	0.04	1.36	301.6
CPT127	399 997.55	6 190 080.15	100	0.07	0.06	0.47	288.5
CPT128	399 948.75	6 207 250.99	100	0.04	0.08	1.59	308.3
CPT129	399 953.34	6 212 610.31	100	0.04	0.04	0.73	295.1
CPT130	399 947.21	6 216 980.52	100	0.11	0.05	0.56	021.9
CPT132	409 955.15	6 196 209.55	100	0.05	0.03	1.23	111.2
CPT133	409 951.69	6 200 628.75	100	0.05	0.04	1.43	151.0
CPT134	409 950.58	6 218 041.41	100	0.04	0.07	1.47	343.6
CPT135	396 829.28	6 236 806.46	100	0.08	0.12	3.62	191.5
CPT136	420 418.57	6 186 771.41	100	0.05	0.04	1.47	343.1

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	No. of Fixes	X [m]	Y [m]	Distance [m]	Bearing [°G]
CPT137	419 957.45	6 209 720.69	100	0.05	0.04	0.88	321.5
CPT138	419 951.38	6 215 439.44	100	0.08	0.19	0.67	145.9
CPT139	401 346.72	6 226 770.50	100	0.03	0.04	1.37	291.3
CPT140	417 707.31	6 226 781.74	100	0.13	0.10	2.18	036.9
CPT140A	417 702.70	6 226 780.83	100	0.09	0.15	3.41	284.2
CPT140B	417 706.50	6 226 776.75	100	0.11	0.08	3.29	171.2
CPT141	420 599.72	6 226 769.07	100	0.04	0.07	2.88	108.8
CPT143	407 244.60	6 216 769.69	100	0.07	0.08	0.51	232.8
CPT153	404 405.33	6 226 570.99	100	0.09	0.04	1.19	326.0
CPT154	412 745.11	6 229 411.68	100	0.04	0.05	1.90	332.1
CPT155	408 203.19	6 223 280.08	100	0.08	0.06	0.20	066.9
CPT156	407 310.67	6 210 839.34	100	0.05	0.08	0.74	206.6
CPT160	390 937.65	6 222 660.65	100	0.10	0.06	0.73	331.8
CPT161	388 621.72	6 226 220.18	100	0.03	0.03	1.29	277.8
CPT162	426 141.59	6 192 399.48	100	0.04	0.08	0.79	131.7
CPT163	394 680.01	6 233 671.11	100	0.04	0.06	1.49	318.3
CPT164	398 107.67	6 233 371.07	100	0.06	0.04	1.27	032.1
CPT165	406 050.65	6 224 881.48	100	0.04	0.03	1.52	346.5
CPT166	396 766.24	6 222 870.20	100	0.06	0.06	0.79	284.5
CPT169	398 727.87	6 207 980.30	100	0.04	0.04	0.32	335.6
CPT170	403 613.40	6 200 820.63	100	0.07	0.05	0.74	032.1
CPT171	412 847.34	6 224 339.42	100	0.04	0.03	1.76	250.6
CPT172	411 752.93	6 220 972.61	100	0.06	0.07	2.82	337.7
CPT173	411 690.49	6 218 927.61	100	0.03	0.05	2.44	192.0
CPT174	404 653.42	6 195 930.04	100	0.03	0.05	0.42	084.2
CPT175	412 337.01	6 208 860.57	100	0.05	0.07	1.14	300.2
CPT176	412 716.17	6 213 050.36	100	0.04	0.07	0.91	293.1
CPT177	414 243.56	6 215 369.63	100	0.05	0.09	0.58	229.7
CPT178	420 256.81	6 213 639.69	100	0.12	0.09	0.86	111.1
CPT179	418 759.33	6 205 098.00	100	0.06	0.04	2.61	219.8
CPT180	423 107.98	6 204 018.59	100	0.05	0.04	1.41	180.8
CPT181	422 912.24	6 197 851.76	100	0.09	0.10	2.15	035.3
CPT183	402 214.91	6 217 859.93	100	0.06	0.04	0.11	231.5
CPT185	403 532.40	6 184 470.51	100	0.08	0.08	0.78	310.4

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	No. of Fixes	X [m]	Y [m]	Distance [m]	Bearing [°G]
CPT187	402 109.99	6 207 661.41	100	0.06	0.06	1.74	324.6
CPT197	390 769.21	6 225 638.20	100	0.06	0.06	1.82	173.4
CPT198	396 716.17	6 229 000.25	100	0.07	0.06	1.85	277.7
CPT199	405 193.74	6 220 610.03	100	0.10	0.05	0.74	087.7
CPT199A	405 190.40	6 220 610.76	100	0.07	0.05	2.71	286.4
CPT200	402 350.37	6 222 030.46	100	0.07	0.14	0.59	038.5
CPT201	398 349.77	6 204 799.86	100	0.06	0.04	0.27	237.8
CPT201A	398 350.41	6 204 804.71	100	0.07	0.04	4.73	005.0
CPT201B	398 346.19	6 204 801.10	100	0.07	0.09	3.97	286.1
CPT201C	398 346.07	6 204 798.37	100	0.05	0.07	4.25	247.5
CPT202	398 951.50	6 199 809.73	100	0.09	0.05	0.57	241.9
CPT206	416 640.85	6 222 060.17	100	0.05	0.07	1.86	084.8
CPT206A	416 636.65	6 222 060.31	100	0.03	0.07	2.37	277.6
CPT208	395 191.59	6 218 450.31	100	0.05	0.05	0.67	062.5
CPT209	394 018.87	6 220 271.50	100	0.03	0.04	2.39	051.2
CPT213	407 113.92	6 219 970.91	100	0.05	0.03	1.29	045.6
CPT216	424 736.95	6 224 843.58	100	0.07	0.09	4.08	028.5
CPT216A	424 737.00	6 224 840.11	100	0.07	0.04	2.00	087.0
CPT217	422 959.09	6 207 071.22	100	0.06	0.04	1.22	004.4
CPT218	395 561.31	6 215 449.06	100	0.04	0.06	1.16	216.2
CPT218A	395 561.02	6 215 452.59	100	0.07	0.07	2.77	339.3
CPT219	416 412.65	6 214 851.75	100	0.08	0.06	1.78	348.5
CPT220	411 330.88	6 192 259.18	100	0.06	0.04	0.83	188.5
CPT224	419 361.99	6 223 708.06	100	0.13	0.11	1.94	180.2
CPT225	414 882.90	6 197 140.51	100	0.05	0.04	0.52	348.6
CPT226	393 674.33	6 224 270.00	100	0.05	0.05	1.67	269.9
CPT227	422 501.01	6 192 671.29	100	0.05	0.06	2.37	303.0
CPT228	400 675.74	6 223 720.84	100	0.08	0.04	0.88	342.7
CPT230	410 595.14	6 222 799.92	100	0.03	0.03	0.86	264.6
CPT231	398 548.22	6 202 829.48	100	0.05	0.05	0.56	156.8
CPT232	406 542.99	6 194 290.91	100	0.02	0.06	0.91	359.6
CPT233	401 328.01	6 190 100.33	100	0.07	0.05	1.05	288.6
CPT234	410 245.24	6 211 470.15	100	0.06	0.06	1.25	083.3
CPT236	411 459.25	6 227 082.17	100	0.11	0.08	2.18	006.7

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	No. of Fixes	X [m]	Y [m]	Distance [m]	Bearing [°G]
CPT239	388 237.45	6 222 038.95	100	0.11	0.09	1.19	207.7
CPT242	418 515.73	6 212 240.16	100	0.14	0.10	0.31	300.4
CPT245	402 567.53	6 191 349.88	100	0.06	0.07	0.48	255.5
CPT249	416 302.17	6 203 569.56	100	0.06	0.05	0.47	158.4
CPT250	408 045.83	6 195 650.90	100	0.04	0.06	1.23	042.5
CPT252	401 411.93	6 199 360.93	100	0.04	0.03	1.42	311.0
CPT253	394 561.42	6 230 610.07	100	0.05	0.03	0.42	080.8
CPT254	391 099.75	6 227 729.33	100	0.04	0.05	0.71	200.3
CPT255	400 317.23	6 211 390.44	100	0.06	0.05	0.89	299.8
CPT258	402 635.26	6 202 651.27	100	0.04	0.06	1.47	329.9
CPT260	404 101.49	6 216 270.57	100	0.07	0.04	0.76	318.0
CPT264	394 751.68	6 227 531.86	100	0.08	0.06	1.88	350.3
CPT266	402 874.93	6 224 199.80	100	0.06	0.05	0.22	200.1
CPT267	416 690.01	6 224 157.63	100	0.05	0.05	2.37	179.8
CPT268	411 874.36	6 216 949.62	100	0.04	0.06	0.75	239.1
CPT269	411 723.86	6 204 630.52	100	0.06	0.05	0.54	345.5
CPT271	406 072.85	6 217 721.61	100	0.06	0.03	1.62	354.8
CPT272	419 075.52	6 190 859.86	100	0.04	0.03	0.50	253.9
CPT273	400 415.93	6 215 480.49	100	0.04	0.05	0.50	351.5
CPT275	407 721.58	6 200 689.96	100	0.04	0.03	0.58	094.2
CPT276	416 870.61	6 198 580.29	100	0.04	0.07	0.68	064.6
CPT277	416 290.27	6 227 131.16	100	0.09	0.07	1.20	013.2
CPT278	419 803.51	6 183 870.35	100	0.08	0.07	0.60	305.1
CPT279	421 493.25	6 222 087.93	100	0.14	0.17	2.09	173.0
CPT280	411 674.47	6 195 409.81	100	0.06	0.03	0.57	250.5
CPT283	399 246.46	6 194 740.24	100	0.05	0.06	0.59	294.1
CPT283A	399 246.09	6 194 744.22	100	0.04	0.06	4.32	347.8
CPT284	395 489.26	6 212 380.87	100	0.03	0.03	1.14	319.4
CPT287	408 205.36	6 216 150.43	100	0.03	0.09	0.77	304.1
CPT288	396 245.56	6 206 392.12	100	0.11	0.09	2.57	325.8
CPT290	418 484.23	6 195 858.40	100	0.11	0.08	1.78	205.7
CPT292	422 734.87	6 199 859.06	100	0.05	0.04	0.95	187.9
CPT293	386 261.07	6 220 591.68	100	0.05	0.05	1.69	002.4
CPT293A	386 260.62	6 220 586.91	100	0.06	0.08	3.11	187.0

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	No. of Fixes	X [m]	Y [m]	Distance [m]	Bearing [°G]
CPT294	408 609.87	6 221 320.55	100	0.13	0.06	1.26	295.9
CPT298	416 644.18	6 191 370.60	100	0.06	0.04	1.02	306.1
CPT302	418 243.30	6 218 329.38	100	0.07	0.14	1.45	115.5
CPT303	419 780.79	6 206 369.80	100	0.03	0.05	0.28	226.4
CPT304	397 352.18	6 226 072.46	100	0.04	0.04	2.59	341.5
CPT307	396 426.44	6 219 731.07	100	0.05	0.06	1.80	053.4
CPT308	418 781.90	6 227 621.40	100	0.15	0.13	2.36	053.7
CPT308A	418 776.97	6 227 620.46	100	0.11	0.13	3.06	278.6
CPT309	399 391.17	6 221 392.06	100	0.04	0.04	2.37	029.6
CPT310	422 934.56	6 213 221.89	100	0.08	0.06	2.45	039.6
CPT312	412 403.32	6 210 909.83	100	0.03	0.04	1.69	264.1
CPT319	414 081.88	6 225 600.15	100	0.06	0.03	0.19	320.9
CPT320	414 652.95	6 220 609.60	100	0.07	0.12	1.03	112.7
CPT321	408 919.52	6 208 079.92	100	0.05	0.07	0.49	260.2
CPT325	396 571.33	6 232 039.24	100	0.04	0.04	0.83	156.7
CPT327	420 649.60	6 195 310.59	100	0.09	0.05	0.71	326.1
CPT329	419 069.00	6 199 059.38	100	0.05	0.06	0.62	179.7
CPT330	407 405.66	6 206 789.94	100	0.04	0.05	1.34	267.2
CPT331	402 991.77	6 220 128.93	100	0.06	0.09	1.32	144.2
CPT332	415 470.08	6 200 330.99	100	0.04	0.05	1.46	047.5
CPT334	416 742.09	6 194 481.02	100	0.06	0.03	1.03	004.9
CPT335	422 779.75	6 209 070.03	100	0.08	0.07	0.25	276.2
CPT336	425 717.09	6 194 361.27	100	0.05	0.07	1.67	040.8
CPT337	401 313.12	6 205 439.77	100	0.05	0.07	0.26	152.9
CPT337A	401 313.62	6 205 442.75	100	0.04	0.06	2.82	012.7
CPT338	411 587.87	6 207 662.09	100	0.08	0.08	2.38	331.5
CPT339	412 260.91	6 198 600.42	100	0.04	0.05	1.00	065.4
CPT340	397 792.91	6 216 951.01	100	0.04	0.04	1.49	313.0
CPT341	421 152.57	6 218 949.00	100	0.14	0.13	1.15	150.4
CPT342	414 359.55	6 195 999.56	100	0.04	0.03	0.70	128.6
CPT344	423 009.73	6 216 280.46	100	0.05	0.06	0.86	057.8
CPT345	399 031.76	6 210 060.13	100	0.04	0.07	0.27	298.2
CPT346	418 922.08	6 217 440.79	100	0.07	0.07	0.80	005.6
CPT351	388 098.30	6 224 029.02	100	0.03	0.06	1.03	162.9

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	No. of Fixes	X [m]	Y [m]	Distance [m]	Bearing [°G]
CPT353	419 029.36	6 220 499.77	100	0.09	0.13	0.43	122.7
CPT354	405 985.32	6 222 821.05	100	0.13	0.06	1.25	327.3
CPT356	417 616.25	6 206 929.34	100	0.04	0.05	1.87	249.2
CPT357	404 214.21	6 189 700.33	100	0.07	0.04	0.40	032.1
CPT362	400 694.48	6 201 160.01	100	0.12	0.04	0.52	270.9
CPT364	396 832.07	6 209 580.22	100	0.05	0.08	0.96	283.4
CPT366	421 107.21	6 186 211.93	100	0.08	0.05	2.09	337.7
CPT368	423 856.21	6 227 718.54	100	0.05	0.06	1.89	140.4
CPT369	391 814.88	6 219 710.05	100	0.08	0.08	1.12	272.4
CPT370	414 344.88	6 218 501.17	100	0.04	0.04	1.17	354.1
CPT372	404 247.99	6 206 080.35	100	0.05	0.05	0.35	357.7
CPT375	398 865.20	6 228 479.24	100	0.03	0.04	1.11	226.2
CPT376	403 384.95	6 186 450.35	100	0.04	0.07	1.02	069.9
CPT378	421 102.71	6 225 079.36	100	0.08	0.15	0.96	131.7
CPT379	421 120.10	6 202 570.23	100	0.06	0.08	0.93	284.6
CPT380	394 560.16	6 222 432.90	100	0.06	0.06	2.90	003.2
CPT382	417 947.46	6 201 890.90	100	0.05	0.04	1.01	027.3
CPT384	402 448.09	6 194 398.87	100	0.03	0.04	1.57	135.9
CPT384A	402 446.79	6 194 395.55	100	0.04	0.03	4.45	182.7
CPT385	391 439.71	6 230 930.44	100	0.05	0.06	0.52	326.5
CPT386	400 120.08	6 198 031.36	100	0.06	0.07	1.64	326.1
CPT389	402 048.11	6 212 759.99	100	0.03	0.06	0.89	269.1
CPT391	405 960.60	6 214 670.49	100	0.08	0.04	0.77	051.1
CPT391A	405 958.72	6 214 667.31	100	0.07	0.07	2.98	205.5
CPT392	398 640.32	6 213 051.19	100	0.04	0.04	1.37	330.4
CPT394	410 827.96	6 214 660.25	100	0.04	0.05	0.25	350.8
CPT395	406 431.44	6 198 320.20	100	0.07	0.07	0.48	065.3
CPT396	405 536.45	6 208 359.99	100	0.04	0.05	0.45	091.6
CPT397	410 904.10	6 224 910.86	100	0.06	0.03	1.24	313.4
SCPT002	393 121.47	6 229 239.01	100	0.05	0.05	1.12	208.1
SCPT026	399 882.19	6 218 849.36	100	0.05	0.05	1.04	231.6
SCPT026A	399 884.64	6 218 854.14	100	0.10	0.08	4.45	021.5
SCPT026B	399 883.66	6 218 846.41	100	0.06	0.05	3.65	169.6
SCPT026C	399 878.71	6 218 850.39	100	0.07	0.06	4.30	275.2

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	No. of Fixes	X [m]	Y [m]	Distance [m]	Bearing [°G]
SCPT026D	399 878.30	6 218 847.38	100	0.05	0.06	5.38	240.8
SCPT026E	399 879.13	6 218 855.20	100	0.04	0.07	6.48	323.4
SCPT033	414 237.84	6 216 500.22	100	0.05	0.06	0.27	323.9
SCPT043	409 953.63	6 212 999.49	100	0.06	0.08	0.63	216.5
SCPT043A	409 953.75	6 212 995.79	100	0.06	0.06	4.22	183.5
SCPT043B	409 949.77	6 212 999.76	100	0.04	0.05	4.23	266.7
SCPT053	398 512.62	6 208 920.64	100	0.04	0.05	1.74	068.6
SCPT055	420 061.79	6 207 461.41	100	0.04	0.11	1.62	029.2
SCPT075	413 755.14	6 199 929.60	100	0.06	0.05	1.21	109.2
SCPT084	420 075.22	6 196 740.85	100	0.05	0.03	1.49	055.1
SCPT089	402 674.48	6 195 530.83	100	0.08	0.09	0.96	030.0
SCPT113	424 040.55	6 187 860.14	100	0.03	0.04	0.56	075.5

3. Operations

3.1 Scope of Work

Fugro was contracted to provide positioning support for navigation between the sampling and/or in situ testing locations position at each location. Sampling and/or in situ testing was carried out at 234 locations.

Table 3.1: Proposed Coordinates

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]
CPT001	396 643.00	6 234 080.00	56° 14' 25.2247"	007° 19' 56.3863"
CPT003	400 350.00	6 228 760.00	56° 11' 36.0679"	007° 23' 38.8120"
CPT004	410 026.00	6 227 790.00	56° 11' 11.6377"	007° 33' 01.1339"
CPT005	396 897.00	6 226 990.00	56° 10' 36.1959"	007° 20' 21.0523"
CPT006	405 730.00	6 226 820.00	56° 10' 37.2838"	007° 28' 53.2831"
CPT007	414 848.00	6 226 750.00	56° 10' 41.1994"	007° 37' 41.9367"
CPT008	423 579.00	6 226 640.00	56° 10' 42.9707"	007° 46' 08.2321"
CPT009	418 724.00	6 226 610.00	56° 10' 39.1088"	007° 41' 26.7968"
CPT010	392 237.00	6 225 950.00	56° 09' 58.8615"	007° 15' 52.4725"
CPT011	402 856.00	6 225 210.00	56° 09' 43.1502"	007° 26' 08.8058"
CPT012	397 289.00	6 224 010.00	56° 09' 00.1528"	007° 20' 47.9150"
CPT013	411 362.00	6 223 990.00	56° 09' 09.6668"	007° 34' 23.1593"
CPT014	406 069.00	6 223 880.00	56° 09' 02.4638"	007° 29' 16.6706"
CPT015	394 845.00	6 223 440.00	56° 08' 39.8075"	007° 18' 27.1646"
CPT016	416 207.00	6 222 990.00	56° 08' 40.4833"	007° 39' 04.9843"
CPT017	386 817.00	6 222 760.00	56° 08' 11.2123"	007° 10' 43.3057"
CPT018	400 451.00	6 222 680.00	56° 08' 19.5638"	007° 23' 52.8596"
CPT019	418 594.00	6 222 490.00	56° 08' 25.8025"	007° 41' 23.7971"
CPT020	423 141.00	6 222 410.00	56° 08' 25.9298"	007° 45' 47.2364"
CPT021	407 203.00	6 222 100.00	56° 08' 05.7082"	007° 30' 24.5929"
CPT022	413 219.00	6 221 320.00	56° 07' 44.5604"	007° 36' 13.8723"
CPT023	416 357.00	6 220 010.00	56° 07' 04.2162"	007° 39' 17.0383"
CPT024	421 184.00	6 219 980.00	56° 07' 06.2014"	007° 43' 56.4760"
CPT027	396 435.00	6 218 720.00	56° 06' 08.4548"	007° 20' 05.8444"
CPT029	404 392.00	6 218 390.00	56° 06' 03.7537"	007° 27' 46.6120"
CPT030	412 874.00	6 218 190.00	56° 06' 03.1241"	007° 35' 57.5760"
CPT032	394 834.00	6 216 770.00	56° 05' 04.1503"	007° 18' 35.9888"

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]
CPT035	402 167.00	6 215 910.00	56° 04' 41.9466"	007° 25' 41.1598"
CPT036	410 872.00	6 215 720.00	56° 04' 41.9272"	007° 34' 04.7152"
CPT037	423 221.00	6 215 300.00	56° 04' 36.0551"	007° 45' 59.2307"
CPT038	419 067.00	6 214 400.00	56° 04' 04.4866"	007° 42' 00.0180"
CPT040	394 769.00	6 214 230.00	56° 03' 41.9773"	007° 18' 35.8260"
CPT044	415 855.00	6 212 700.00	56° 03' 07.5202"	007° 38' 56.2627"
CPT045	403 447.00	6 212 010.00	56° 02' 36.7817"	007° 27' 00.2285"
CPT047	421 869.00	6 210 920.00	56° 02' 13.6277"	007° 44' 45.6533"
CPT051	414 976.00	6 209 470.00	56° 01' 22.5145"	007° 38' 09.1572"
CPT052	410 201.00	6 209 420.00	56° 01' 17.7631"	007° 33' 33.5170"
CPT054	406 744.00	6 208 660.00	56° 00' 50.8126"	007° 30' 14.8778"
CPT058	402 556.00	6 206 750.00	55° 59' 46.0572"	007° 26' 15.6314"
CPT060	412 980.00	6 205 920.00	55° 59' 26.4316"	007° 36' 18.0482"
CPT062	422 899.00	6 205 000.00	55° 59' 02.7862"	007° 45' 51.2664"
CPT063	408 340.00	6 204 950.00	55° 58' 51.9570"	007° 31' 51.5583"
CPT065	397 165.00	6 204 530.00	55° 58' 30.2288"	007° 21' 07.6636"
CPT067	400 249.00	6 203 190.00	55° 57' 49.2440"	007° 24' 07.2804"
CPT069	411 414.00	6 202 510.00	55° 57' 35.1345"	007° 34' 51.7434"
CPT070	416 024.00	6 202 490.00	55° 57' 37.4680"	007° 39' 17.5140"
CPT071	405 578.00	6 202 280.00	55° 57' 23.6964"	007° 29' 15.6319"
CPT074	409 388.00	6 200 030.00	55° 56' 13.5818"	007° 32' 57.9564"
CPT077	420 298.00	6 199 340.00	55° 55' 58.2240"	007° 43' 27.2547"
CPT079	402 063.00	6 198 440.00	55° 55' 17.0012"	007° 25' 58.0575"
CPT080	406 417.00	6 197 280.00	55° 54' 42.6119"	007° 30' 10.2296"
CPT081	410 760.00	6 197 260.00	55° 54' 44.9344"	007° 34' 20.2924"
CPT086	417 283.00	6 196 620.00	55° 54' 28.4330"	007° 40' 36.5673"
CPT094	421 349.00	6 194 440.00	55° 53' 20.3883"	007° 44' 32.9327"
CPT098	404 800.00	6 192 890.00	55° 52' 19.5199"	007° 28' 42.6957"
CPT100	425 648.00	6 192 330.00	55° 52' 14.6097"	007° 48' 42.4018"
CPT101	415 453.00	6 192 140.00	55° 52' 02.4171"	007° 38' 56.2515"
CPT102	419 329.00	6 191 940.00	55° 51' 58.3402"	007° 42' 39.3761"
CPT107	421 637.00	6 189 350.00	55° 50' 35.9529"	007° 44' 54.8013"
CPT112	401 214.00	6 187 990.00	55° 49' 38.4843"	007° 25' 22.8829"
CPT114	404 429.00	6 187 660.00	55° 49' 30.1430"	007° 28' 27.9881"
CPT116	402 374.00	6 186 800.00	55° 49' 00.8552"	007° 26' 31.0571"

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]
CPT120	421 303.00	6 185 220.00	55° 48' 22.1974"	007° 44' 39.9087"
CPT125	389 950.00	6 224 270.00	56° 09' 02.6674"	007° 13' 42.4558"
CPT126	389 949.00	6 228 500.00	56° 11' 19.4200"	007° 13' 36.0969"
CPT127	399 998.00	6 190 080.00	55° 50' 45.1615"	007° 24' 10.2612"
CPT128	399 950.00	6 207 250.00	56° 00' 00.2931"	007° 23' 44.6114"
CPT129	399 954.00	6 212 610.00	56° 02' 53.6008"	007° 23' 37.6506"
CPT130	399 947.00	6 216 980.00	56° 05' 14.8895"	007° 23' 31.3662"
CPT132	409 954.00	6 196 210.00	55° 54' 10.4411"	007° 33' 35.1466"
CPT133	409 951.00	6 200 630.00	55° 56' 33.3641"	007° 33' 29.6702"
CPT134	409 951.00	6 218 040.00	56° 05' 56.3234"	007° 33' 08.6490"
CPT135	396 830.00	6 236 810.00	56° 15' 53.6340"	007° 20' 03.4107"
CPT136	420 419.00	6 186 770.00	55° 49' 11.8014"	007° 43' 47.5163"
CPT137	419 958.00	6 209 720.00	56° 01' 33.6870"	007° 42' 56.5569"
CPT138	419 951.00	6 215 440.00	56° 04' 38.6527"	007° 42' 50.0011"
CPT139	401 348.00	6 226 770.00	56° 10' 32.4744"	007° 24' 39.3454"
CPT140	417 706.00	6 226 780.00	56° 10' 43.9770"	007° 40' 27.5911"
CPT141	420 597.00	6 226 770.00	56° 10' 45.4194"	007° 43' 15.2093"
CPT143	407 245.00	6 216 770.00	56° 05' 13.3960"	007° 30' 33.6919"
CPT153	404 406.00	6 226 570.00	56° 10' 28.2511"	007° 27' 36.8590"
CPT154	412 746.00	6 229 410.00	56° 12' 05.8418"	007° 35' 36.9345"
CPT155	408 203.00	6 223 280.00	56° 08' 44.5587"	007° 31' 21.0342"
CPT156	407 311.00	6 210 840.00	56° 02' 01.6981"	007° 30' 44.8973"
CPT160	390 938.00	6 222 660.00	56° 08' 11.4332"	007° 14' 42.0541"
CPT161	388 623.00	6 226 220.00	56° 10' 04.6006"	007° 12' 22.6588"
CPT162	426 141.00	6 192 400.00	55° 52' 17.1463"	007° 49' 10.6895"
CPT163	394 681.00	6 233 670.00	56° 14' 10.4193"	007° 18' 03.0643"
CPT164	398 107.00	6 233 370.00	56° 14' 03.4071"	007° 21' 22.3682"
CPT165	406 051.00	6 224 880.00	56° 09' 34.7848"	007° 29' 14.3574"
CPT166	396 767.00	6 222 870.00	56° 08' 22.8894"	007° 20' 19.2699"
CPT169	398 728.00	6 207 980.00	56° 00' 22.9730"	007° 22' 33.1130"
CPT170	403 613.00	6 200 820.00	55° 56' 35.0839"	007° 27' 24.2543"
CPT171	412 849.00	6 224 340.00	56° 09' 21.9706"	007° 35' 48.8936"
CPT172	411 754.00	6 220 970.00	56° 07' 32.2764"	007° 34' 49.4694"
CPT173	411 691.00	6 218 930.00	56° 06' 26.2706"	007° 34' 48.2524"
CPT174	404 653.00	6 195 930.00	55° 53' 57.7136"	007° 28' 30.3881"

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]
CPT175	412 338.00	6 208 860.00	56° 01' 01.0790"	007° 35' 37.5586"
CPT176	412 717.00	6 213 050.00	56° 03' 16.8155"	007° 35' 54.5300"
CPT177	414 244.00	6 215 370.00	56° 04' 32.8286"	007° 37' 20.0954"
CPT178	420 256.00	6 213 640.00	56° 03' 40.6288"	007° 43' 09.5678"
CPT179	418 761.00	6 205 100.00	55° 59' 03.5632"	007° 41' 52.4625"
CPT180	423 108.00	6 204 020.00	55° 58' 31.2153"	007° 46' 04.3304"
CPT181	422 911.00	6 197 850.00	55° 55' 11.5726"	007° 45' 59.3172"
CPT183	402 215.00	6 217 860.00	56° 05' 45.0316"	007° 25' 41.3676"
CPT185	403 533.00	6 184 470.00	55° 47' 46.3526"	007° 27' 40.5916"
CPT187	402 111.00	6 207 660.00	56° 00' 15.1547"	007° 25' 48.7644"
CPT197	390 769.00	6 225 640.00	56° 09' 47.6368"	007° 14' 27.8688"
CPT198	396 718.00	6 229 000.00	56° 11' 41.0420"	007° 20' 07.8642"
CPT199	405 193.00	6 220 610.00	56° 07' 16.1091"	007° 28' 30.1137"
CPT200	402 350.00	6 222 030.00	56° 07' 59.9597"	007° 25' 43.6840"
CPT201	398 350.00	6 204 800.00	55° 58' 39.8670"	007° 22' 15.6255"
CPT202	398 952.00	6 199 810.00	55° 55' 58.9821"	007° 22' 57.0732"
CPT206	416 639.00	6 222 060.00	56° 08' 10.6830"	007° 39' 31.0543"
CPT208	395 191.00	6 218 450.00	56° 05' 58.7491"	007° 18' 54.2602"
CPT209	394 017.00	6 220 270.00	56° 06' 56.6594"	007° 17' 43.7489"
CPT213	407 113.00	6 219 970.00	56° 06' 56.7734"	007° 30' 22.0521"
CPT216	424 735.00	6 224 840.00	56° 09' 45.4252"	007° 47' 17.0872"
CPT217	422 959.00	6 207 070.00	56° 00' 09.7612"	007° 45' 52.5929"
CPT218	395 562.00	6 215 450.00	56° 04' 22.0471"	007° 19' 19.9395"
CPT219	416 413.00	6 214 850.00	56° 04' 17.3957"	007° 39' 26.0902"
CPT220	411 331.00	6 192 260.00	55° 52' 03.6319"	007° 34' 59.0629"
CPT224	419 362.00	6 223 710.00	56° 09' 05.7227"	007° 42' 06.9481"
CPT225	414 883.00	6 197 140.00	55° 54' 43.7423"	007° 38' 17.8121"
CPT226	393 676.00	6 224 270.00	56° 09' 05.7093"	007° 17' 18.2720"
CPT227	422 503.00	6 192 670.00	55° 52' 23.8218"	007° 45' 41.1611"
CPT228	400 676.00	6 223 720.00	56° 08' 53.3583"	007° 24' 04.4929"
CPT230	410 596.00	6 222 800.00	56° 08' 30.6738"	007° 33' 40.2210"
CPT231	398 548.00	6 202 830.00	55° 57' 36.3218"	007° 22' 29.7143"
CPT232	406 543.00	6 194 290.00	55° 53' 06.0174"	007° 30' 21.2014"
CPT233	401 329.00	6 190 100.00	55° 50' 46.7946"	007° 25' 26.7298"
CPT234	410 244.00	6 211 470.00	56° 02' 24.0797"	007° 33' 33.5310"

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]
CPT236	411 459.00	6 227 080.00	56° 10' 49.6465"	007° 34' 25.0762"
CPT239	388 238.00	6 222 040.00	56° 07' 49.1407"	007° 12' 06.6649"
CPT242	418 516.00	6 212 240.00	56° 02' 54.3020"	007° 41' 30.5311"
CPT245	402 568.00	6 191 350.00	55° 51' 28.1193"	007° 26' 36.3230"
CPT249	416 302.00	6 203 570.00	55° 58' 12.5667"	007° 39' 32.3321"
CPT250	408 045.00	6 195 650.00	55° 53' 51.0343"	007° 31' 45.9518"
CPT252	401 413.00	6 199 360.00	55° 55' 46.2706"	007° 25' 19.4195"
CPT253	394 561.00	6 230 610.00	56° 12' 31.3926"	007° 18' 00.4800"
CPT254	391 100.00	6 227 730.00	56° 10' 55.4784"	007° 14' 43.9654"
CPT255	400 318.00	6 211 390.00	56° 02' 14.4278"	007° 24' 00.3123"
CPT258	402 636.00	6 202 650.00	55° 57' 33.5466"	007° 26' 25.5849"
CPT260	404 102.00	6 216 270.00	56° 04' 54.9973"	007° 27' 32.5731"
CPT264	394 752.00	6 227 530.00	56° 10' 51.9666"	007° 18' 15.9547"
CPT266	402 875.00	6 224 200.00	56° 09' 10.5079"	007° 26' 11.2335"
CPT267	416 690.00	6 224 160.00	56° 09' 18.6210"	007° 39' 31.6432"
CPT268	411 875.00	6 216 950.00	56° 05' 22.3688"	007° 35' 01.2507"
CPT269	411 724.00	6 204 630.00	55° 58' 43.8924"	007° 35' 07.1121"
CPT271	406 073.00	6 217 720.00	56° 05' 43.2898"	007° 29' 24.7108"
CPT272	419 076.00	6 190 860.00	55° 51' 23.2622"	007° 42' 25.9864"
CPT273	400 416.00	6 215 480.00	56° 04' 26.7428"	007° 24' 00.4990"
CPT275	407 721.00	6 200 690.00	55° 56' 33.7820"	007° 31' 21.1089"
CPT276	416 870.00	6 198 580.00	55° 55' 31.5585"	007° 40' 10.6206"
CPT277	416 290.00	6 227 130.00	56° 10' 54.4067"	007° 39' 05.1027"
CPT278	419 804.00	6 183 870.00	55° 47' 37.6528"	007° 43' 15.2665"
CPT279	421 493.00	6 222 090.00	56° 08' 14.6162"	007° 44' 12.1262"
CPT280	411 675.00	6 195 410.00	55° 53' 45.7195"	007° 35' 15.1479"
CPT283	399 247.00	6 194 740.00	55° 53' 15.2742"	007° 23' 20.8665"
CPT284	395 490.00	6 212 380.00	56° 02' 42.7324"	007° 19' 20.0899"
CPT287	408 206.00	6 216 150.00	56° 04' 54.0161"	007° 31' 30.0355"
CPT288	396 247.00	6 206 390.00	55° 59' 29.6560"	007° 20' 12.1497"
CPT290	418 485.00	6 195 860.00	55° 54' 04.5943"	007° 41' 46.5912"
CPT292	422 735.00	6 199 860.00	55° 56' 16.4717"	007° 45' 47.1111"
CPT293	386 261.00	6 220 590.00	56° 07' 00.5834"	007° 10' 14.4466"
CPT294	408 611.00	6 221 320.00	56° 07' 41.4652"	007° 31' 47.0855"
CPT298	416 645.00	6 191 370.00	55° 51' 38.2642"	007° 40' 05.6550"

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]
CPT302	418 242.00	6 218 330.00	56° 06' 11.0655"	007° 41' 08.0000"
CPT303	419 781.00	6 206 370.00	55° 59' 45.2496"	007° 42' 49.9369"
CPT304	397 353.00	6 226 070.00	56° 10' 06.8053"	007° 20' 48.7618"
CPT307	396 425.00	6 219 730.00	56° 06' 41.1019"	007° 20' 03.8556"
CPT308	418 780.00	6 227 620.00	56° 11' 11.8029"	007° 41' 28.9320"
CPT309	399 390.00	6 221 390.00	56° 07' 37.0544"	007° 22' 53.1732"
CPT310	422 933.00	6 213 220.00	56° 03' 28.6255"	007° 45' 44.7333"
CPT312	412 405.00	6 210 910.00	56° 02' 07.4117"	007° 35' 39.0180"
CPT319	414 082.00	6 225 600.00	56° 10' 03.5187"	007° 36' 58.8677"
CPT320	414 652.00	6 220 610.00	56° 07' 22.5319"	007° 37' 37.6588"
CPT321	408 920.00	6 208 080.00	56° 00' 33.5639"	007° 32' 21.1936"
CPT325	396 571.00	6 232 040.00	56° 13' 19.2134"	007° 19' 55.0733"
CPT327	420 650.00	6 195 310.00	55° 53' 48.1101"	007° 43' 51.7918"
CPT329	419 069.00	6 199 060.00	55° 55' 48.4305"	007° 42' 16.7572"
CPT330	407 407.00	6 206 790.00	55° 59' 50.8088"	007° 30' 55.4681"
CPT331	402 991.00	6 220 130.00	56° 06' 58.9973"	007° 26' 23.2857"
CPT332	415 469.00	6 200 330.00	55° 56' 27.2696"	007° 38' 47.9572"
CPT334	416 742.00	6 194 480.00	55° 53' 18.8948"	007° 40' 07.7926"
CPT335	422 780.00	6 209 070.00	56° 01' 14.3340"	007° 45' 40.1927"
CPT336	425 716.00	6 194 360.00	55° 53' 20.2966"	007° 48' 44.3090"
CPT337	401 313.00	6 205 440.00	55° 59' 02.7857"	007° 25' 05.6473"
CPT338	411 589.00	6 207 660.00	56° 00' 21.7809"	007° 34' 55.7408"
CPT339	412 260.00	6 198 600.00	55° 55' 29.2581"	007° 35' 45.0880"
CPT340	397 794.00	6 216 950.00	56° 05' 12.2804"	007° 21' 26.9012"
CPT341	421 152.00	6 218 950.00	56° 06' 32.8750"	007° 43' 55.7190"
CPT342	414 359.00	6 196 000.00	55° 54' 06.5434"	007° 37' 48.9425"
CPT344	423 009.00	6 216 280.00	56° 05' 07.6235"	007° 45' 45.9566"
CPT345	399 032.00	6 210 060.00	56° 01' 30.4559"	007° 22' 47.8414"
CPT346	418 922.00	6 217 440.00	56° 05' 42.7027"	007° 41' 48.3180"
CPT351	388 098.00	6 224 030.00	56° 08' 53.3576"	007° 11' 55.5522"
CPT353	419 029.00	6 220 500.00	56° 07' 21.7188"	007° 41' 51.1670"
CPT354	405 986.00	6 222 820.00	56° 08' 28.1312"	007° 29' 13.2095"
CPT356	417 618.00	6 206 930.00	56° 00' 02.0391"	007° 40' 44.5124"
CPT357	404 214.00	6 189 700.00	55° 50' 35.9533"	007° 28' 13.0488"
CPT362	400 695.00	6 201 160.00	55° 56' 43.9395"	007° 24' 35.6821"

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]
CPT364	396 833.00	6 209 580.00	56° 01' 13.2507"	007° 20' 41.5448"
CPT366	421 108.00	6 186 210.00	55° 48' 54.0985"	007° 44' 27.6781"
CPT368	423 855.00	6 227 720.00	56° 11' 18.0541"	007° 46' 23.1195"
CPT369	391 816.00	6 219 710.00	56° 06' 36.7783"	007° 15' 37.1970"
CPT370	414 345.00	6 218 500.00	56° 06' 14.1054"	007° 37' 22.3244"
CPT372	404 248.00	6 206 080.00	55° 59' 25.6195"	007° 27' 54.1108"
CPT375	398 866.00	6 228 480.00	56° 11' 25.8890"	007° 22' 13.1406"
CPT376	403 384.00	6 186 450.00	55° 48' 50.2690"	007° 27' 29.5089"
CPT378	421 102.00	6 225 080.00	56° 09' 51.0719"	007° 43' 46.2926"
CPT379	421 121.00	6 202 570.00	55° 57' 43.1648"	007° 44' 11.2658"
CPT380	394 560.00	6 222 430.00	56° 08' 06.9269"	007° 18' 12.0981"
CPT382	417 947.00	6 201 890.00	55° 57' 19.2616"	007° 41' 09.0283"
CPT384	402 447.00	6 194 400.00	55° 53' 06.6514"	007° 26' 25.4148"
CPT385	391 440.00	6 230 930.00	56° 12' 39.2127"	007° 14' 58.9644"
CPT386	400 121.00	6 198 030.00	55° 55' 02.3074"	007° 24' 06.7770"
CPT389	402 049.00	6 212 760.00	56° 03' 00.0099"	007° 25' 38.4859"
CPT391	405 960.00	6 214 670.00	56° 04' 04.5908"	007° 29' 22.0351"
CPT392	398 641.00	6 213 050.00	56° 03' 06.8331"	007° 22' 21.1984"
CPT394	410 828.00	6 214 660.00	56° 04' 07.6223"	007° 34' 03.4427"
CPT395	406 431.00	6 198 320.00	55° 55' 16.2503"	007° 30' 09.7394"
CPT396	405 536.00	6 208 360.00	56° 00' 40.2610"	007° 29' 05.5282"
CPT397	410 905.00	6 224 910.00	56° 09' 39.1084"	007° 33' 55.5755"
SCPT002	393 122.00	6 229 240.00	56° 11' 45.9451"	007° 16' 38.9909"
SCPT026	399 883.00	6 218 850.00	56° 06' 15.3031"	007° 23' 25.1428"
SCPT033	414 238.00	6 216 500.00	56° 05' 09.3645"	007° 37' 18.4441"
SCPT043	409 954.00	6 213 000.00	56° 03' 13.3567"	007° 33' 14.9292"
SCPT053	398 511.00	6 208 920.00	56° 00' 53.2006"	007° 22' 19.3120"
SCPT055	420 061.00	6 207 460.00	56° 00' 20.6659"	007° 43' 04.9264"
SCPT075	413 754.00	6 199 930.00	55° 56' 13.2385"	007° 37' 09.6033"
SCPT084	420 074.00	6 196 740.00	55° 54' 34.0109"	007° 43' 17.1194"
SCPT089	402 674.00	6 195 530.00	55° 53' 43.3546"	007° 26' 37.0117"
SCPT113	424 040.00	6 187 860.00	55° 49' 49.1504"	007° 47' 14.4179"

Table 3.2: Proposed Coordinates in ITRF2014

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT001	56° 14' 25.2443"	007° 19' 56.4178"
CPT003	56° 11' 36.0875"	007° 23' 38.8435"
CPT004	56° 11' 11.6573"	007° 33' 01.1654"
CPT005	56° 10' 36.2155"	007° 20' 21.0837"
CPT006	56° 10' 37.3034"	007° 28' 53.3146"
CPT007	56° 10' 41.2189"	007° 37' 41.9683"
CPT008	56° 10' 42.9902"	007° 46' 08.2638"
CPT009	56° 10' 39.1283"	007° 41' 26.8284"
CPT010	56° 09' 58.8811"	007° 15' 52.5040"
CPT011	56° 09' 43.1698"	007° 26' 08.8373"
CPT012	56° 09' 00.1724"	007° 20' 47.9465"
CPT013	56° 09' 09.6864"	007° 34' 23.1909"
CPT014	56° 09' 02.4834"	007° 29' 16.7021"
CPT015	56° 08' 39.8271"	007° 18' 27.1960"
CPT016	56° 08' 40.5029"	007° 39' 05.0159"
CPT017	56° 08' 11.2319"	007° 10' 43.3371"
CPT018	56° 08' 19.5834"	007° 23' 52.8911"
CPT019	56° 08' 25.8221"	007° 41' 23.8287"
CPT020	56° 08' 25.9494"	007° 45' 47.2681"
CPT021	56° 08' 05.7277"	007° 30' 24.6245"
CPT022	56° 07' 44.5800"	007° 36' 13.9039"
CPT023	56° 07' 04.2358"	007° 39' 17.0699"
CPT024	56° 07' 06.2210"	007° 43' 56.5076"
CPT027	56° 06' 08.4744"	007° 20' 05.8759"
CPT029	56° 06' 03.7733"	007° 27' 46.6435"
CPT030	56° 06' 03.1436"	007° 35' 57.6076"
CPT032	56° 05' 04.1699"	007° 18' 36.0203"
CPT035	56° 04' 41.9662"	007° 25' 41.1913"
CPT036	56° 04' 41.9468"	007° 34' 04.7467"
CPT037	56° 04' 36.0746"	007° 45' 59.2623"
CPT038	56° 04' 04.5062"	007° 42' 00.0496"
CPT040	56° 03' 41.9969"	007° 18' 35.8575"
CPT044	56° 03' 07.5397"	007° 38' 56.2943"
CPT045	56° 02' 36.8013"	007° 27' 00.2600"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT047	56° 02' 13.6473"	007° 44' 45.6849"
CPT051	56° 01' 22.5341"	007° 38' 09.1888"
CPT052	56° 01' 17.7827"	007° 33' 33.5486"
CPT054	56° 00' 50.8321"	007° 30' 14.9094"
CPT058	55° 59' 46.0767"	007° 26' 15.6629"
CPT060	55° 59' 26.4512"	007° 36' 18.0797"
CPT062	55° 59' 02.8058"	007° 45' 51.2981"
CPT063	55° 58' 51.9766"	007° 31' 51.5898"
CPT065	55° 58' 30.2484"	007° 21' 07.6950"
CPT067	55° 57' 49.2636"	007° 24' 07.3119"
CPT069	55° 57' 35.1540"	007° 34' 51.7750"
CPT070	55° 57' 37.4875"	007° 39' 17.5456"
CPT071	55° 57' 23.7160"	007° 29' 15.6634"
CPT074	55° 56' 13.6014"	007° 32' 57.9879"
CPT077	55° 55' 58.2435"	007° 43' 27.2863"
CPT079	55° 55' 17.0208"	007° 25' 58.0889"
CPT080	55° 54' 42.6314"	007° 30' 10.2611"
CPT081	55° 54' 44.9539"	007° 34' 20.3239"
CPT086	55° 54' 28.4526"	007° 40' 36.5988"
CPT094	55° 53' 20.4079"	007° 44' 32.9643"
CPT098	55° 52' 19.5395"	007° 28' 42.7272"
CPT100	55° 52' 14.6293"	007° 48' 42.4335"
CPT101	55° 52' 02.4366"	007° 38' 56.2831"
CPT102	55° 51' 58.3598"	007° 42' 39.4077"
CPT107	55° 50' 35.9725"	007° 44' 54.8329"
CPT112	55° 49' 38.5039"	007° 25' 22.9143"
CPT114	55° 49' 30.1626"	007° 28' 28.0196"
CPT116	55° 49' 00.8748"	007° 26' 31.0886"
CPT120	55° 48' 22.2170"	007° 44' 39.9403"
CPT125	56° 09' 02.6870"	007° 13' 42.4872"
CPT126	56° 11' 19.4396"	007° 13' 36.1283"
CPT127	55° 50' 45.1811"	007° 24' 10.2926"
CPT128	56° 00' 00.3127"	007° 23' 44.6429"
CPT129	56° 02' 53.6204"	007° 23' 37.6821"
CPT130	56° 05' 14.9091"	007° 23' 31.3976"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT132	55° 54' 10.4607"	007° 33' 35.1781"
CPT133	55° 56' 33.3837"	007° 33' 29.7017"
CPT134	56° 05' 56.3430"	007° 33' 08.6806"
CPT135	56° 15' 53.6536"	007° 20' 03.4422"
CPT136	55° 49' 11.8210"	007° 43' 47.5478"
CPT137	56° 01' 33.7066"	007° 42' 56.5885"
CPT138	56° 04' 38.6722"	007° 42' 50.0327"
CPT139	56° 10' 32.4940"	007° 24' 39.3770"
CPT140	56° 10' 43.9966"	007° 40' 27.6227"
CPT141	56° 10' 45.4389"	007° 43' 15.2410"
CPT143	56° 05' 13.4156"	007° 30' 33.7234"
CPT153	56° 10' 28.2707"	007° 27' 36.8905"
CPT154	56° 12' 05.8614"	007° 35' 36.9661"
CPT155	56° 08' 44.5783"	007° 31' 21.0657"
CPT156	56° 02' 01.6981"	007° 30' 44.8973"
CPT160	56° 08' 11.4527"	007° 14' 42.0855"
CPT161	56° 10' 04.6201"	007° 12' 22.6902"
CPT162	55° 52' 17.1659"	007° 49' 10.7212"
CPT163	56° 14' 10.4389"	007° 18' 03.0957"
CPT164	56° 14' 03.4267"	007° 21' 22.3997"
CPT165	56° 09' 34.8043"	007° 29' 14.3889"
CPT166	56° 08' 22.9090"	007° 20' 19.3014"
CPT169	56° 00' 22.9926"	007° 22' 33.1445"
CPT170	55° 56' 35.1035"	007° 27' 24.2858"
CPT171	56° 09' 21.9901"	007° 35' 48.9252"
CPT172	56° 07' 32.2960"	007° 34' 49.5010"
CPT173	56° 06' 26.2902"	007° 34' 48.2840"
CPT174	55° 53' 57.7332"	007° 28' 30.4196"
CPT175	56° 01' 01.0985"	007° 35' 37.5902"
CPT176	56° 03' 16.8350"	007° 35' 54.5616"
CPT177	56° 04' 32.8482"	007° 37' 20.1270"
CPT178	56° 03' 40.6484"	007° 43' 09.5994"
CPT179	55° 59' 03.5827"	007° 41' 52.4941"
CPT180	55° 58' 31.2348"	007° 46' 04.3620"
CPT181	55° 55' 11.5922"	007° 45' 59.3488"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT183	56° 05' 45.0512"	007° 25' 41.3991"
CPT185	55° 47' 46.3722"	007° 27' 40.6231"
CPT187	56° 00' 15.1743"	007° 25' 48.7959"
CPT197	56° 09' 47.6563"	007° 14' 27.9002"
CPT198	56° 11' 41.0616"	007° 20' 07.8956"
CPT199	56° 07' 16.1287"	007° 28' 30.1452"
CPT200	56° 07' 59.9793"	007° 25' 43.7155"
CPT201	55° 58' 39.8866"	007° 22' 15.6570"
CPT202	55° 55' 59.0017"	007° 22' 57.1047"
CPT206	56° 08' 10.7026"	007° 39' 31.0859"
CPT208	56° 05' 58.7687"	007° 18' 54.2916"
CPT209	56° 06' 56.6790"	007° 17' 43.7803"
CPT213	56° 06' 56.7930"	007° 30' 22.0836"
CPT216	56° 09' 45.4448"	007° 47' 17.1189"
CPT217	56° 00' 09.7808"	007° 45' 52.6246"
CPT218	56° 04' 22.0667"	007° 19' 19.9710"
CPT219	56° 04' 17.4152"	007° 39' 26.1218"
CPT220	55° 52' 03.6515"	007° 34' 59.0944"
CPT224	56° 09' 05.7423"	007° 42' 06.9798"
CPT225	55° 54' 43.7619"	007° 38' 17.8437"
CPT226	56° 09' 05.7289"	007° 17' 18.3034"
CPT227	55° 52' 23.8414"	007° 45' 41.1928"
CPT228	56° 08' 53.3779"	007° 24' 04.5244"
CPT230	56° 08' 30.6934"	007° 33' 40.2526"
CPT231	55° 57' 36.3414"	007° 22' 29.7457"
CPT232	55° 53' 06.0370"	007° 30' 21.2329"
CPT233	55° 50' 46.8142"	007° 25' 26.7612"
CPT234	56° 02' 24.0992"	007° 33' 33.5625"
CPT236	56° 10' 49.6661"	007° 34' 25.1078"
CPT239	56° 07' 49.1603"	007° 12' 06.6963"
CPT242	56° 02' 54.3215"	007° 41' 30.5627"
CPT245	55° 51' 28.1388"	007° 26' 36.3545"
CPT249	55° 58' 12.5863"	007° 39' 32.3637"
CPT250	55° 53' 51.0539"	007° 31' 45.9833"
CPT252	55° 55' 46.2902"	007° 25' 19.4509"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT253	56° 12' 31.4122"	007° 18' 00.5114"
CPT254	56° 10' 55.4980"	007° 14' 43.9969"
CPT255	56° 02' 14.4474"	007° 24' 00.3438"
CPT258	55° 57' 33.5662"	007° 26' 25.6163"
CPT260	56° 04' 55.0169"	007° 27' 32.6046"
CPT264	56° 10' 51.9862"	007° 18' 15.9861"
CPT266	56° 09' 10.5275"	007° 26' 11.2650"
CPT267	56° 09' 18.6406"	007° 39' 31.6748"
CPT268	56° 05' 22.3884"	007° 35' 01.2823"
CPT269	55° 58' 43.9120"	007° 35' 07.1437"
CPT271	56° 05' 43.3094"	007° 29' 24.7423"
CPT272	55° 51' 23.2818"	007° 42' 26.0180"
CPT273	56° 04' 26.7624"	007° 24' 00.5305"
CPT275	55° 56' 33.8016"	007° 31' 21.1405"
CPT276	55° 55' 31.5781"	007° 40' 10.6522"
CPT277	56° 10' 54.4263"	007° 39' 05.1344"
CPT278	55° 47' 37.6724"	007° 43' 15.2981"
CPT279	56° 08' 14.6358"	007° 44' 12.1578"
CPT280	55° 53' 45.7195"	007° 35' 15.1479"
CPT283	55° 53' 15.2938"	007° 23' 20.8979"
CPT284	56° 02' 42.7520"	007° 19' 20.1213"
CPT287	56° 04' 54.0357"	007° 31' 30.0671"
CPT288	55° 59' 29.6756"	007° 20' 12.1811"
CPT290	55° 54' 04.6139"	007° 41' 46.6228"
CPT292	55° 56' 16.4912"	007° 45' 47.1427"
CPT293	56° 07' 00.6030"	007° 10' 14.4780"
CPT294	56° 07' 41.4848"	007° 31' 47.1171"
CPT298	55° 51' 38.2837"	007° 40' 05.6866"
CPT302	56° 06' 11.0851"	007° 41' 08.0317"
CPT303	55° 59' 45.2692"	007° 42' 49.9685"
CPT304	56° 10' 06.8249"	007° 20' 48.7933"
CPT307	56° 06' 41.1215"	007° 20' 03.8870"
CPT308	56° 11' 11.8225"	007° 41' 28.9637"
CPT309	56° 07' 37.0739"	007° 22' 53.2046"
CPT310	56° 03' 28.6451"	007° 45' 44.7650"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT312	56° 02' 07.4313"	007° 35' 39.0495"
CPT319	56° 10' 03.5382"	007° 36' 58.8993"
CPT320	56° 07' 22.5515"	007° 37' 37.6904"
CPT321	56° 00' 33.5835"	007° 32' 21.2252"
CPT325	56° 13' 19.2330"	007° 19' 55.1048"
CPT327	55° 53' 48.1297"	007° 43' 51.8234"
CPT329	55° 55' 48.4501"	007° 42' 16.7888"
CPT330	55° 59' 50.8284"	007° 30' 55.4996"
CPT331	56° 06' 59.0168"	007° 26' 23.3172"
CPT332	55° 56' 27.2892"	007° 38' 47.9888"
CPT334	55° 53' 18.9144"	007° 40' 07.8242"
CPT335	56° 01' 14.3535"	007° 45' 40.2244"
CPT336	55° 53' 20.3162"	007° 48' 44.3407"
CPT337	55° 59' 02.8053"	007° 25' 05.6788"
CPT338	56° 00' 21.8004"	007° 34' 55.7723"
CPT339	55° 55' 29.2776"	007° 35' 45.1196"
CPT340	56° 05' 12.3000"	007° 21' 26.9327"
CPT341	56° 06' 32.8945"	007° 43' 55.7507"
CPT342	55° 54' 06.5630"	007° 37' 48.9740"
CPT344	56° 05' 07.6430"	007° 45' 45.9882"
CPT345	56° 01' 30.4755"	007° 22' 47.8728"
CPT346	56° 05' 42.7223"	007° 41' 48.3497"
CPT351	56° 08' 53.3772"	007° 11' 55.5836"
CPT353	56° 07' 21.7384"	007° 41' 51.1986"
CPT354	56° 08' 28.1508"	007° 29' 13.2410"
CPT356	56° 00' 02.0586"	007° 40' 44.5440"
CPT357	55° 50' 35.9729"	007° 28' 13.0802"
CPT362	55° 56' 43.9591"	007° 24' 35.7135"
CPT364	56° 01' 13.2703"	007° 20' 41.5763"
CPT366	55° 48' 54.1181"	007° 44' 27.7097"
CPT368	56° 11' 18.0737"	007° 46' 23.1511"
CPT369	56° 06' 36.7979"	007° 15' 37.2284"
CPT370	56° 06' 14.1250"	007° 37' 22.3560"
CPT372	55° 59' 25.6391"	007° 27' 54.1423"
CPT375	56° 11' 25.9086"	007° 22' 13.1721"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT376	55° 48' 50.2886"	007° 27' 29.5403"
CPT378	56° 09' 51.0915"	007° 43' 46.3242"
CPT379	55° 57' 43.1844"	007° 44' 11.2974"
CPT380	56° 08' 06.9465"	007° 18' 12.1296"
CPT382	55° 57' 19.2812"	007° 41' 09.0599"
CPT384	55° 53' 06.6710"	007° 26' 25.4463"
CPT385	56° 12' 39.2323"	007° 14' 58.9958"
CPT386	55° 55' 02.3270"	007° 24' 06.8084"
CPT389	56° 03' 00.0295"	007° 25' 38.5173"
CPT391	56° 04' 04.6104"	007° 29' 22.0666"
CPT392	56° 03' 06.8527"	007° 22' 21.2299"
CPT394	56° 04' 07.6418"	007° 34' 03.4742"
CPT395	55° 55' 16.2698"	007° 30' 09.7709"
CPT396	56° 00' 40.2806"	007° 29' 05.5597"
CPT397	56° 09' 39.1280"	007° 33' 55.6071"
SCPT002	56° 11' 45.9647"	007° 16' 39.0224"
SCPT026	56° 06' 15.3227"	007° 23' 25.1743"
SCPT033	56° 05' 09.3840"	007° 37' 18.4756"
SCPT043	56° 03' 13.3763"	007° 33' 14.9608"
SCPT053	56° 00' 53.2202"	007° 22' 19.3434"
SCPT055	56° 00' 20.6855"	007° 43' 04.9581"
SCPT075	55° 56' 13.2581"	007° 37' 09.6349"
SCPT084	55° 54' 34.0305"	007° 43' 17.1510"
SCPT089	55° 53' 43.3742"	007° 26' 37.0432"
SCPT113	55° 49' 49.1700"	007° 47' 14.4495"

3.2 Resources

Table 3.3 lists the project personnel.

Table 3.3: Project Personnel

Personnel	Name	From	To
Party Chief/Engineer/ Surveyor	R. Wojke	26 October 2023	15 November 2023
Surveyor	M. Andrei	26 October 2023	15 November 2023
Surveyor	C. Dorobantu	26 October 2023	15 November 2023
Party Chief/Engineer/ Surveyor	W. Pretorius	15 November 2023	13 December 2023
Surveyor	R. Pralea	15 November 2023	13 December 2023
Surveyor	N. Neculescu	15 November 2023	13 December 2023
Party Chief/Engineer/ Surveyor	R. Wojke	13 December 2023	10 January 2024
Surveyor	M. Andrei	13 December 2023	10 January 2024
Surveyor	C. Dorobantu	13 December 2023	10 January 2024
Party Chief/Engineer/ Surveyor	W. Pretorius	10 January 2024	-
Surveyor	C. Cristea	10 January 2024	-
Surveyor	M. Labes	10 January 2024	-

Equipment used in the project is listed in Table 3.4 and Table 3.5; refer to Section 5 Methodology for procedural explanations.

Table 3.4: Positioning Equipment

Navigation software	Starfix online navigation suite
Primary positioning	StarPack 101 with StarfixG4+ solution, corrections via ERSAT
Secondary positioning	StarPack 102 with Starfix.XP2 solution, corrections via SASAT
Tertiary positioning	StarPack 102 with Starfix.G4+ solution, corrections via SASAT
Quaternary positioning	StarPack 101 with Starfix.G2 solution, corrections via ERSAT
Primary Acoustic positioning	Kongsberg HiPAP 501 USBL system, starboard
Secondary Acoustic positioning	Kongsberg HiPAP 500 USBL system, port
Primary heading system	GNSS Heading from Survey StarPack 101
Secondary heading system	TSS Meridian Surveyor gyro
Tertiary heading system	Vessel Gyro 1, Simrad GC80
Quaternary heading system	Vessel Gyro 2, Simrad GC80
Quinary heading system	GNSS Heading from Survey StarPack 102
Spare correction source	NTRIP

Table 3.5: Depth Measurement Equipment

Primary System	Valeport Mini IPS
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Secondary System	Kongsberg HiPAP 501 USBL
Data Recording	Starfix online navigation suite and CTD internally

3.3 Offsets

3.3.1 MV Normand Mermaid Vessel Offsets

An offset survey was conducted onboard the vessel between 3 and 5 December 2021 while the vessel was in Haugesund, Norway.

Figure 3.1 illustrates the locations of the offsets.

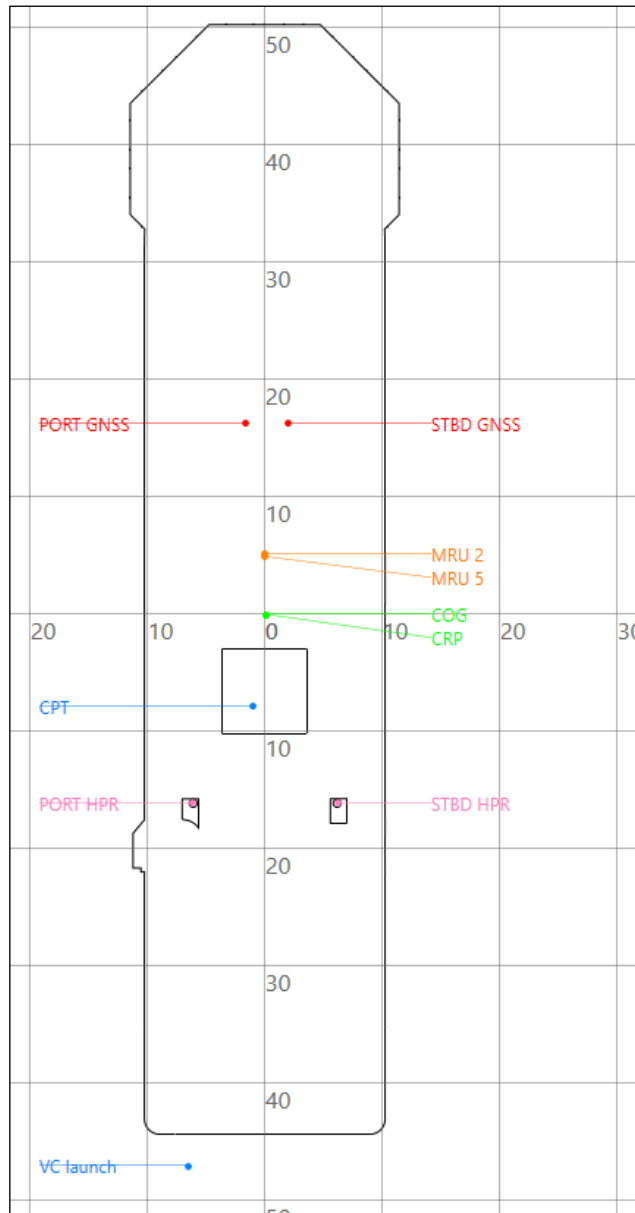


Figure 3.1: MV Normand Mermaid Offsets

Table 3.6 lists the offset coordinates used on the MV Normand Mermaid.

Table 3.6: MV Normand Mermaid Vessel Offsets

Point Name	Location Description	X [m]	Y [m]	Z [m]
CRP	Common reference point	0.000	0.000	0.000
CPT	CPT launching point	-1.030	-7.866	0.000
MRU2	Motion reference unit	-0.035	5.143	-0.562
MRU5	Motion reference unit	-0.034	4.945	-0.565
PORT GNSS	Port antenna	-1.709	16.263	29.047
Stbd GNSS	Starboard antenna	1.904	16.255	29.014
PORT HPR	Port HiPAP pole	-6.149	-16.106	-11.521
Stbd HPR	Starboard HiPAP pole	6.150	-16.120	-12.314
VC	Vibrocore launching point	-6.520	-47.000	0.000
Notes: GNSS antenna offset coordinates refer to the antennas' phase centre				

3.3.2 CPT Offset Coordinates

Figure 3.2 illustrates the location of the offsets.

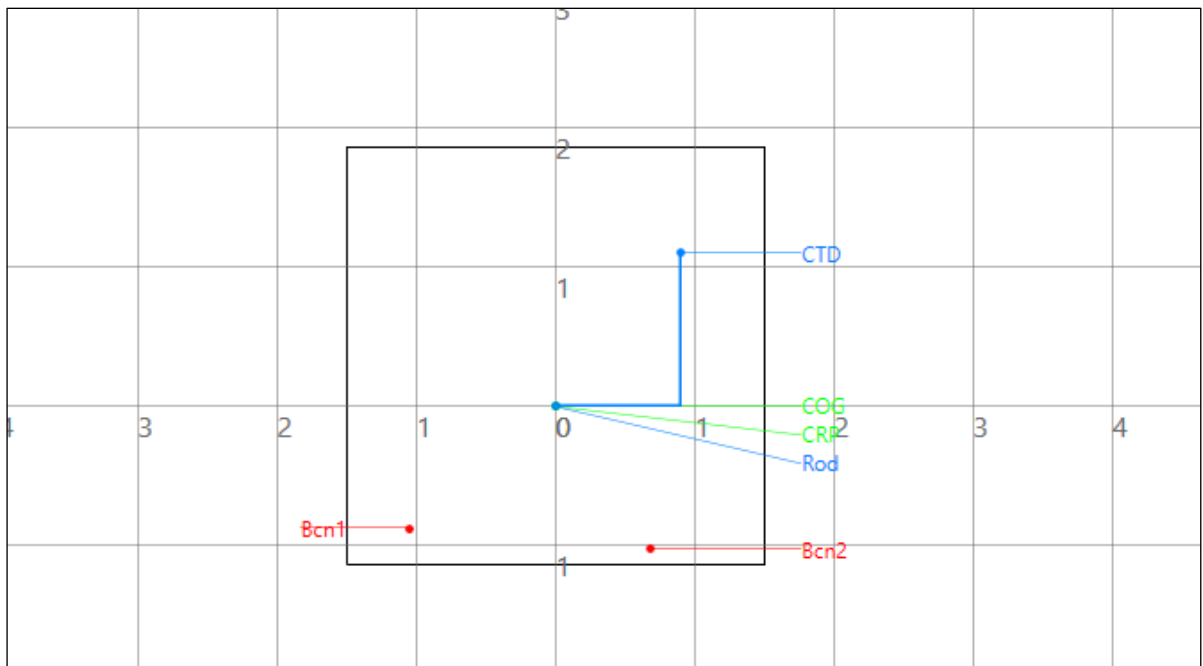


Figure 3.2: CPT offset diagram

Table 3.7 lists the offset coordinates used on the CPT frame.

Table 3.7: CPT Frame Offsets

Point Name	Location Description	X [m]	Y [m]	Z [m]
CRP	Common reference point	0.000	0.000	0.000
Rod	Central rod	0.000	0.000	0.000
Bcn1	Port frame mounted transponder	-1.050	-0.880	3.600
Bcn2	Starboard frame mounted transponder	0.680	-1.030	3.600
CTD	Frame mounted CTD / Mini IPS	0.900	1.100	2.550

3.4 Calibration and Verification Results

This section details the results of the system calibrations that were carried out prior to positioning operations. Refer to Section 5 Methodology, for a detailed description of the calibration procedures. Detailed results of the calibrations are available on request.

3.4.1 Surface Positioning Systems

A surface positioning system verification was carried out on 15 October 2023 in Haugesund, Norway, using land survey techniques. The results of the verifications are presented in Table 3.8.

Table 3.8: Positioning System Verification

Date	Location	Positioning system	ΔE [m]	S.D. [m]	ΔN [m]	S.D. [m]
15 October 2023	Haugesund, Norway	Survey StarPack 101, Starfix.G4+	0.02	0.13	-0.10	0.07
15 October 2023	Haugesund, Norway	Survey StarPack 102, Starfix.XP2	-0.03	0.14	-0.11	0.07
15 October 2023	Haugesund, Norway	Survey StarPack 102, Starfix.G4+	-0.01	0.13	-0.11	0.07
15 October 2023	Haugesund, Norway	Survey StarPack 101, Starfix.XP2	0.00	0.14	-0.10	0.07

A GNSS verification was conducted prior to the project to verify the positioning systems.

3.4.2 Heading System Calibration

The heading systems were calibrated using land survey techniques, in Haugesund, Norway, on 15 October 2023. After completing the checks, the surveyor entered the corrections into the online navigation software. The results of the calibration are presented in Table 3.9.

Table 3.9: Heading Calibration

Date	Location	Heading system	Method	C-O [°]
15 October 2023	Haugesund, Norway	GNSS Heading from Survey StarPack 101	Land Survey	-90.00
15 October 2023	Haugesund, Norway	TSS Meridian Surveyor gyro	Land survey	-86.61
15 October 2023	Haugesund, Norway	Vessel Gyro 1, Simrad GC80	Land survey	-0.99
15 October 2023	Haugesund, Norway	Vessel Gyro 2, Simrad GC80	Land survey	-2.24

A heading system verification was performed prior to the project to verify the results of the calibration.

3.4.3 Speed of Sound and Water Density Measurements

Before the start of project data acquisition and at regular intervals during the project, conductivity, temperature and pressure measurements were taken to establish the local speed of sound profile and average water density. The speed of sound profile was entered into the Kongsberg APOS USBL system. The average water density was used for depth determination in conjunction with the pressure sensor.

The results of these measurements are presented in Table 3.10.

Table 3.10: Speed of Sound and Water Density Measurements

Date	Location Name	Mean [m/s]	Transducer [m/s]	Seabed [m/s]	Density [kg/m ³]
28 October 2023	CPT135	1499.18	1499.04	1499.43	1025.12
1 November 2023	CPT278	1495.12	1495.01	1495.39	1024.40
5 November 2023	CPT242	1497.05	1496.49	1497.98	1024.79
7 November 2023	CPT206	1498.16	1498.03	1498.40	1024.99
11 November 2023	CPT354	1498.93	1498.32	1499.86	1025.32
16 November 2023	CPT185	1495.55	1494.35	1496.89	1025.33
20 November 2023	CPT065	1496.19	1496.00	1496.47	1025.64
22 November 2023	CPT332	1492.77	1491.33	1494.71	1025.29
26 November 2023	SCPT089	1487.35	1485.38	1490.71	1025.22
27 November 2023	SCPT103	1493.64	1493.31	1493.90	1026.16
28 November 2023	SCPT002	1491.16	1490.90	1491.67	1026.13
30 November 2023	CPT060	1483.66	1482.66	1487.22	1025.55
1 December 2023	CPT290	1481.95	1480.99	1483.19	1025.29
14 December 2023	SCPT113	1471.75	1469.89	1475.02	1025.41
14 December 2023	SCPT075	1476.50	1476.38	1477.62	1026.01
15 December 2023	SCPT033	1478.09	1477.85	1478.64	1026.22
31 December 2023	SCPT043	1480.92	1480.70	1481.10	1026.36
31 December 2023	SCPT026	1481.20	1481.01	1481.37	1026.40
31 December 2023	CPT293	1481.20	1480.99	1481.37	1026.40
8 January 2024	CPT005	1473.28	1468.37	1476.50	1026.30

3.4.4 Kongsberg HiPAP 500 and 501 USBL System

The Kongsberg HiPAP 500 (port) and 501 (starboard) USBL systems, installed onboard the MV Normand Mermaid, were interfaced to StarfixNG. The HiPAP 501 system was used as the primary subsea positioning system.

A USBL calibration was performed on 22 October 2023. The calibration was undertaken in Skudefjorden outside Stavanger, Norway in a water depth of 400 m. The results of the calibration are presented in Table 3.11.

Table 3.11: USBL Calibration Results

System	Date	Orientation [°]	Pitch [°]	Roll [°]
HiPAP 501 Starboard	22 October 2023	0.07	0.06	0.10
HiPAP 500 Port	22 October 2023	0.65	-0.18	-0.02

After the calibration, a spin test was performed to check the validity of the corrections entered.

4. Datum and Tolerances

4.1 Geodetic and Projection Parameters

Table 4.1 lists the project geodetic parameters.

Table 4.1: Project Geodetic Parameters

Name: ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]		
EPSG Code	EPSG:25832	
Global Navigation Satellite System (GNSS) Geodetic Parameters*		
Datum	International Terrestrial Reference Frame 2014	EPSG:1165
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Local Geodetic Datum Parameters		
Datum	European Terrestrial Reference System 1989	EPSG:6258
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from ITRF2014 to ETRS89		
X-axis translation 0.05600 m	X-axis rotation -0.0027542"	Scale difference 0.00355022 ppm
Y-axis translation 0.05350 m	Y-axis rotation -0.016661"	Coordinate Frame rotation
Z-axis translation -0.09880 m	Z-axis rotation 0.0269296"	FUGRO:41366
Local Projection Parameters		
Map projection	Transverse Mercator	
Grid system	UTM zone 32N	EPSG:16032
Latitude origin	00° 00' 00.000" N	
Central meridian	009° 00' 00.000" E	
Scale factor on central meridian	0.9996	
False easting	500 000 m	
False northing	0 m	
Project Vertical Parameters		
Vertical coordinate reference system	DTU21 MSS height	FUGRO:41088
Datum	DTU21 MSS height	FUGRO:40943
Transformation	WGS 84 to DTU21 MSS height	FUGRO:41478
Notes		
* The geodetic datum of Fugro's global GNSS correction data is ITRF2014, epoch 2023.001982 (01/01/2023 17:22:00)		

4.2 Vertical Control

Table 4.2 holds information on the vertical control.

Table 4.2: Vertical Control

Vertical Datum	MSL
Tidal Data	Real time GNSS tides reduced to MSL based on the DTU21
Barometric pressure variation	Factored in pressure to depth calculation
Effect of wind	Factored in GNSS elevation measurements

4.3 System Performance Parameters

Table 4.3 lists the accuracy of the components interfaced to the navigation system.

Table 4.3: Component Specifications

System	Component	Accuracy (2 σ)
GNSS Positioning	Starfix.G4+	± 0.03 m
GNSS Positioning	Starfix.G4	± 0.10 m
GNSS Positioning	Starfix.XP2	± 0.10 m
Heading	StarPack GNSS Heading	$\pm 0.20^\circ$ secant latitude
Heading	TSS Meridian Surveyor	$\pm 0.40^\circ$ secant latitude
Heading	Simrad GC80	$\pm 1.0^\circ$ secant latitude
Motion	Kongsberg MRU 5	$\pm 0.04^\circ$
Relative Depth	Valeport Mini IPS	± 0.01 % of full range
Real Time GNSS Tide	DTU21MSS	± 0.02 m
USBL Positioning	Kongsberg HiPAP 501 (Cymbal)	Angular accuracy $\pm 0.24^\circ$ Range accuracy ± 0.04 m
USBL Positioning	Kongsberg HiPAP 501	Angular accuracy $\pm 0.24^\circ$ Range accuracy ± 0.20 m
USBL Positioning	Kongsberg HiPAP 500	Angular accuracy $\pm 0.24^\circ$ Range accuracy ± 0.20 m
Notes: The values stated above are taken from the manufacturer's specifications		

5. Methodology

5.1 Introduction

Sections 5.2 to 5.4 inclusive describe the procedures for determining the coordinates and water depths of geotechnical sample and/or in situ testing locations. Section 5.5 describes the calibration and verification procedures carried out for the heading system, surface and subsurface positioning systems, and the echo sounder. The use of subsurface positioning systems, primarily USBL and sector scan sonar, depends on the type of geotechnical sampling and/or in situ testing methods used, hence some descriptions in the sections below may not be applicable to this report.

5.2 Position Determination

The actual location may be determined by surface positioning alone or with additional use of USBL. The USBL determines the position of the centre of the seabed frame on the seafloor. Particularly in deeper water, use of USBL provides a more accurate position of the sample and/or in situ testing location since the seabed frame may be offset from the surface position due to currents.

The position is determined as soon as the seabed frame makes contact with the seafloor. A minimum of 100 position fixes are logged at five-second intervals. Data outliers are then discarded in accordance with standard statistical procedures. To determine the final seabed position of a sample and/or in situ testing location the following general sequence applies:

- From the global navigation satellite system (GNSS) receiver, the antenna's latitude and longitude in WGS 84 are transmitted to the navigation computer and converted to Easting and Northing on the local projection by the navigation software;
- The grid heading and X and Y offsets from the antenna to the common reference point (CRP) are applied to the antenna Easting and Northing in order to compute the position of the CRP on the local projection. If the USBL system is not used then the CPT or VC launch offset corresponds to the sample and/or in situ testing position;
- The grid heading and X and Y offsets from the CRP to the USBL transducer, mounted on the vessel's hull, are applied to the CRP Easting and Northing to determine the transducer position on the local projection;
- The USBL system measures the slant range and relative bearing (measured clockwise from the vessel centreline) from the USBL transducer to the beacon, mounted on the seabed frame, and also the depth of the beacon relative to the transducer. These values are converted to ΔX , ΔY in the horizontal plane and ΔZ in the vertical plane by the USBL processor;
- The ΔX , ΔY , and ΔZ values are transmitted to the navigation computer where the Z offset of the USBL transducer is applied;

- The position of the beacon is computed in the local projection Easting and Northing and the beacon depth is computed relative to the water surface. The centre of the seabed frame, which corresponds to the seabed sample and/or in situ testing position, is derived from the USBL beacon position by applying the USBL beacons horizontal offsets. The heading of the frame is assumed to be the same as the vessel heading. When heading changes are implemented to the vessel after the location of the frame on the seafloor, the frame will be locked in its original heading by the use of a manual heading, derived from the position fix, in which heading information was logged.

5.3 System Configuration

5.3.1 Survey Position and Navigation Systems

The survey team used two StarPack GNSS Precise Point Positioning (PPP) receivers for the surface positioning during the project. The three single modus calculation position solutions Starfix.G4+, Starfix.XP2, and Starfix.G2 from the two StarPack receivers were interfaced to the survey computer by means of a network connection and were made available for comparison and QC. Differential correction signal redundancy was achieved by cross-linking the two StarPack receivers to provide corrections from different satellite transmissions, if required. All of the position solutions were fed into StarPack QC suite for QC purposes.

All positions and peripheral data such as heading systems, USBL, etc., were sent to the navigation computer where all data transformations, offset and survey calculations, and data integration and logging were performed. All data can be graphically and numerically presented on the navigation computer or any other computer connected to the survey network. An off-line computer is available for the survey crew to post-process and report survey data.

The geodetic and the datum transformation parameters used are presented in Section 4.1.

5.3.1.1 Primary Positioning System

The primary survey positioning service used by the survey team was Starfix.G4+ solution generated from StarPack Receiver 101. Positions were calculated by using clock and orbit corrections enhanced with carrier-phase corrections from the Fugro Reference Station Network. These corrections were received by the StarPack via ERSAT transmissions, and positions were output to the Starfix Suite.

5.3.1.2 Secondary Positioning System

The secondary positioning service used by the survey team was Starfix.XP2 solution generated from StarPack Receiver 102. Positions were calculated by using clock and orbit corrections. The corrections are received by the StarPack via SASAT satellite transmissions, and positions are output to the Starfix Suite software package.

5.3.1.3 Tertiary Positioning System

The tertiary positioning service used by the survey team was Starfix.G4+ solution generated from StarPack Receiver 102. Positions were calculated by using clock and orbit corrections enhanced with carrier-phase corrections from the Fugro Reference Station Network. The corrections are received by the StarPack via SASAT satellite transmissions and positions are output to the Starfix Suite.

5.3.1.4 Quaternary Positioning System

The quaternary positioning service used by the survey team was Starfix.G2 solution generated from StarPack Receiver 101. Positions were calculated by using carrier phase corrections from the Fugro Starfix network. The corrections were received by the StarPack via ERSAT satellite transmissions and positions were output to the Starfix Suite.

5.3.2 Quality Control

The GNSS positioning quality was controlled through the measures available through the StarPacks' web interface.

Numerically, the *Status* view shows:

- Standard deviations of the latitude, longitude and height;
- Correction age;
- PDOP;
- Number of satellites;
- F-Test;
- Number of resets;
- Lock time;
- Number of Stations.

Real-time time series plots of delta Easting, Northing and Height against the *Best Position* are also available.

Within the area, of operations the accuracy and repeatability of the Starfix.G4+ system was designed to be 0.03 m in the horizontal plane and 0.06 m in the vertical plane at the 95 % confidence level.

5.4 Depth Determination

The depth at each location was measured using a combination of the following techniques:

- Pressure sensor;
- USBL depth reading;

5.4.1 Pressure Sensor

The pressure sensor fitted to the miniIPS measures absolute pressure, i.e., it includes atmospheric pressure; it has a temperature compensated piezo-resistive sensor. The pressure tare function allows the atmospheric pressure, as measured by the sensor before deployment, to be removed from the readings, so the output is simply pressure of water. By taking a tare reading at any fixed point in the water column, readings will then be output relative to that point. The sensor allows real time depth data to be continually updated for density variations in the water column. Data is presented in units of metres or feet of seawater, calculated using the UNESCO Simple Pressure/Depth relationship, which assumes "standard" water density. The miniIPS is mounted on the seabed frame.

5.4.2 USBL Depth Reading

This is a measurement made by taking the HiPAP 501 system USBL beacon Z-values (depth) and applying the vertical offset of the frame-mounted beacon above the seabed frame base.

5.5 System Calibration and Verification Procedures

Calibrations and verifications of all position and depth measuring equipment are carried out prior to sampling and/or in situ testing. This checks that all equipment is operating within acceptable limits and that the accuracy of the logged data is within specifications. Most equipment is permanently installed on the vessel and therefore not all calibrations are performed before the start of every sampling and/or in situ testing programme. The most recent calibrations of the equipment are assessed, and new calibrations are carried out if deemed necessary.

5.5.1 Offset Measurements

At the start of the mobilisation, offsets from the vessel's datum to the various GNSS antennas and other relevant offset points are measured. These measurements are compared with measurements taken from a scaled vessel plan or a previous vessel offset diagram. Seabed frame offsets from the frame's CRP to its transponder and the Z offset for the pressure sensor are also measured. Offsets are entered into the navigation software. The USBL transducer offset is already corrected to the vessel's CRP by the vessel's APOS programme.

5.5.2 Heading System Alignment Check

Three methods are possible when performing a heading system alignment check alongside. The resulting differences between computed and observed headings are entered into the navigation software as the heading system's computed minus observed C-O correction.

5.5.2.1 Total Station

These methods of performing a heading system alignment check uses land survey techniques. Reflectors are placed at or near the bow and stern of the vessel on the centreline and their positions fixed at regular intervals. Simultaneous heading system readings and heading observations are taken. The true bearing between the reflectors is calculated and compared to the observed heading system reading.

5.5.2.2 Sun Azimuth

Sun azimuth observations are performed with a total station and a sun filter, when the sun is at a maximum elevation of approximately 30°. The vessel's heading is determined by measuring the angle between the vessel's centreline and the sun azimuth and applying this angle to the computed sun azimuth. The logged heading subtracted from the heading derived from the azimuth of the sun will give the heading system's C-O correction.

5.5.2.3 Taped Offsets

This method requires the known heading of the quay and two measurements are taken simultaneously from the quay to the vessel's centreline. The distance between the two measurements provides a baseline for calculating the angle of the vessel's centreline relative to the quay, which is then applied to the quay heading to derive the computed grid vessel heading. The convergence is applied to the computed grid heading to obtain the true heading which is compared with the observed heading system's reading in order to obtain the C-O correction.

5.5.3 Positioning Systems

In order to determine the integrity and reliability of the surface positioning systems, two main procedures are followed:

5.5.3.1 Positioning Verification

The position of the GNSSs antennas, in WGS 84/ITRF coordinates, as exported from the navigation system, are compared to positions derived by land survey techniques. The total station measures directly to the GNSS antennas, or to a prism mounted near the antennas, from a known point on the quay.

5.5.3.2 Positioning System Comparison

Once the position verification results are acceptable, a position comparison against all position computations is conducted. The antenna positions for all systems are logged and using the heading system and the measured antenna offsets are reduced to the vessel's CRP. The difference in the positions are represented as Delta Easting (ΔE) and Delta Northing (ΔN).

5.5.4 Ultra-Short Baseline System

A USBL system allows the measurement of range and bearing from a vessel-based transceiver to one or more subsea transponders. It generally operates through the phase discrimination of an acoustic signal recorded by three orthogonal transducers combined in one head. A USBL calibration is executed whenever work is carried out on the transducer and at least once a year. Calibrations are carried out in water depths slightly deeper than those in which the operations will occur.

5.5.4.1 Preparation

During the USBL calibration sequence, the vessel must be free to manoeuvre around a stationary transponder. Before starting the actual USBL calibration, it is assumed that:

- The vessel's positioning system has been verified;
- The vessel's heading system alignment has been checked;
- All relevant offsets, including the height of the transponder's transducer above the seabed, have been measured.

The actual water depth, measured by the echo sounder, and not corrected for tide, should also be known at the calibration site.

A speed of sound profile, determined at the calibration site, is entered into the USBL system before calibration data is collected.

For the USBL calibration a transponder, equipped with a remote-controlled release mechanism or a surface buoy, is deployed, clear of all structures and pipelines, in an area with an approximate water depth slightly deeper than the proposed survey area. The surface positioning system is used to navigate the vessel during the calibration.

5.5.4.2 Range Scale, Orientation, Pitch and Roll

This phase of the calibration is carried out with the vessel positioned on the circumference of a circle of radius 1.5 to 2 times the water depth, centred on the beacon. The following describes a calibration with the vessel lying to the north, east, south, and west of the beacon with the vessel maintaining the same north heading. In the case of bad weather, this pattern may be rotated so that the vessel is heading into the current. The surface position of the vessel and the USBL position of the beacon are logged at each cardinal point. Generally, a minimum of 100 fixes, at 5 second intervals, are logged at each cardinal point.

When the vessel is due north or south of the beacon and heading due north, roll errors are minimised and pitch errors are observed. Transducer alignment errors will plot the beacon offset to the east or west of its actual position. Range scaling errors will plot the beacon to the north or south of the actual position.

When the vessel moves to a position due east or west of the beacon, while still maintaining a heading of due north, roll errors are observed and pitch errors are minimised. Transducer alignment error will plot the beacon offset from its actual position. Range scaling errors will plot the beacon to the east or west of the actual position.

Any resultant errors will show the beacon plotted in four quadrants. If there are no errors, the beacon position will be shown as a circular scatter plot around the actual position.

The range error consists of a fixed error and the scalar multiplier. Overall, it accounts for errors in ray path and speed of sound. The USBL module in Starfix.NG derives a range error value that contains and accounts for the range fixed error.

StarfixNG computes the errors and displays the results as four parameters:

- Pitch error;
- Roll error;
- Transceiver misalignment;
- Range error.

5.5.4.3 Offset (Spin) Test

The first part of the calibration is carried out to verify the offsets between the USBL system and the navigation system. This is normally done by manoeuvring the vessel directly over a beacon deployed on the seabed and then rotating the vessel through 360° while logging the surface and USBL position. Any offset errors are displayed as a 'snail trail' showing the beacon position describing a circle around the intended beacon position. Alternatively, the vessel is positioned directly over the beacon, and an equal number of fixes are logged while the vessel is heading in each of the four cardinal directions.

The Z-offset is checked by comparing the Z component of the USBL observation and the value from the echo sounder, allowing for beacon height above the seafloor. As the vessel is

directly over the seafloor beacon, this minimises any errors due to Range Scale and USBL transducer misalignment.

5.5.4.4 Verification of Results

The calibration results are checked using one of two methods:

1. Two lines are run at right angles and in opposite directions over the top of the beacon.
2. A static spin test at a location in a distance of 10 % of water depth from the calibrated beacon position.

In both cases the beacon's position is continuously logged and should not deviate, within operational parameters, from its calibrated position. A reasonably tight, circular scatter plot a few metres across, depending on the navigation system performance, the USBL system performance, and the depth of water, is an indication of a good calibration result.



Positioning Data for the Normand Mermaid

Positioning Report for Danish Offshore Wind Farm 2030 Lot 2, Sub-area 2 |
North Sea

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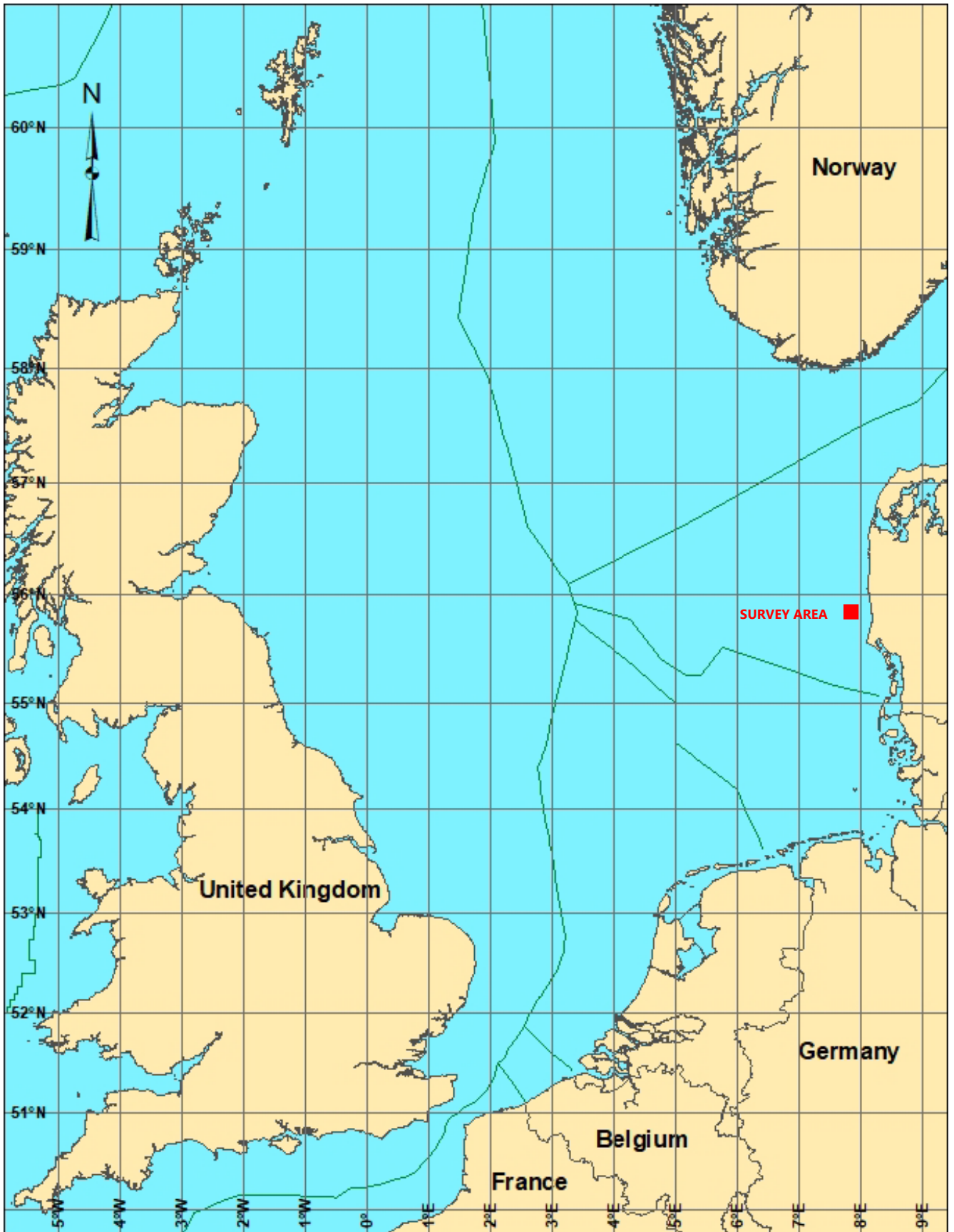
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2	2,3	6, 10, 15, 19, 23	2.1, 2.2, 2.3, 3.1, 3.2		Added location SCPT031 to results

Location Map



Location of DOWF Lot 2, Sub area 2

Executive Summary

Fugro was contracted by Energinet Eltransmission A/S to supply navigation and positioning services for the MV Normand Mermaid at 134 sampling and/or in situ testing locations at Danish Offshore Wind Farm 2030 Lot 2, Sub-area 2.

The sampling and/or in situ testing was carried out between 9 January 2024 and 6 March 2024.

Fugro navigated and positioned the MV Normand Mermaid to the intended positions given by the client.

Two StarPack GNSS receivers were used for the surface positioning during the project. Underwater positioning was performed via the vessel's HiPAP 501 USBL system. All depth measurements were reduced to MSL. Real-time GNSS tides were used throughout the project.

Depths at each sample location were measured using a pressure sensor and USBL.

During the operations speed of sound measurements were taken and the results were entered into the vessel's USBL system.

All positions and peripheral data were sent to the navigation computer which calculated the various offset's positions in the local geodesy and projection, ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366).

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Abbreviations

Accuracy	The accuracy of a measurement is its degree of closeness to its actual (true) value. Accuracy is the combination of the precision and reliability of an observation.
Augmentation Data	Additional information e.g. from a reference or tracking station, applied at a user receiver to improve the positioning solution. See also differential GNSS.
Azimuth	A horizontal angle measured from the spheroidal meridian clockwise from north through 360°. See also bearing and heading.
Bearing	Refers to a direction from one point to another on a chart right rotated from grid north (bearing = azimuth + convergence + arc to chord correction). See also azimuth and heading.
C-O Correction	Calculated minus observed correction. The difference found in a calibration procedure between a fixed value and an observation. The C O correction must always be added to the observation.
Chart Datum	Vertical Datum used in charting. Chart data e.g. Mean Sea Level (MSL), Lowest Astronomical Tide (LAT), Lowest Low Water Springs (LLWS), Normaal Amsterdams Peil (Amsterdam Ordnance Datum) (NAP), Normal Null (NN). See also Vertical Datum.
CM	Central meridian, the meridian that defines the central line of longitude of the chart projection. It is a zone constant used in chart projections.

Convergence	Clockwise angle in a point between true north and grid north.
CRP	Common Reference Point is the origin of all vessel coordinates. It is also referred to as the vessel datum.
Datum (Geodetic)	A mathematical model designed to best-fit part or all of the geoid. It is defined by an ellipsoid and the relationship between the ellipsoid and a point on the topographic surface established as the origin of datum. This relationship can be defined by six quantities, generally (but not necessarily) the geodetic latitude, longitude and the height of the origin, the two components of the deflection of the vertical at the origin, and the geodetic azimuth of a line, from the origin to some other point.
Datum Rotation (Geodetic)	Defined as the anti-clockwise rotation around the X-axis, Y-axis and Z-axis (Rx, Ry, and Rz) in the origin of two spheroids in terms of the Cartesian or geocentric coordinates. See also datum shift and scale.
Datum Shift (Geodetic)	Defined as the difference (ΔX , ΔY , ΔZ) in the origin of two spheroids in terms of the Cartesian or geocentric coordinates. See also datum rotation and scale.
Datum (Vessel)	The vessel datum is the origin of all vessel coordinates. It is referred to as the common reference point or CRP.
DGNSS	Augmentation technique requiring a GNSS receiver(s) to be placed at one or multiple known points from which GNSS observable (pseudo-range) corrections can be deduced. These corrections can then be applied to the offshore mobile receiver.
Differential Positioning	Determination of relative coordinates between two or more satellite receivers that are simultaneously tracking the same satellite signal.
DP	Dynamic positioning, mainly referring to a system keeping the vessel in one position compensating for current, wind and other natural influences, using a variety of positioning systems as reference.
Dynamic Calibration	A technique of calibration on the heading and motion sensors that can be undertaken whilst in port, in transit or during production. GNSS data from three GNSS antennas, placed in large separation along or athwart the vessel, are acquired while the sensor data are also logged. As a result, C-Os for heading, pitch and roll can be determined.
Ellipsoid / Spheroid	In geodesy, unless otherwise specified, a mathematical figure formed by revolving an ellipse about its minor axis. It is often used interchangeably with spheroid. Two quantities define an ellipsoid: these are usually given as the length of the semi-major axis, a , and the inverse flattening, $1/f = a / (a-b)$, where b is the length of the semi-minor axis. Prolate and triaxial ellipsoids are invariably described as such.
False Easting / False Northing	Defined projection coordinate offsets to the origin point of the projection.
Geoid	The particular equipotential surface with coincides with mean sea level, and which may be imagined to extend through the continents. This surface is perpendicular to the force of gravity everywhere.
GLONASS	Russian global navigation satellite system.
GPS	Global positioning system.
GNSS	Global navigation satellite system. A combination solution of GPS and GLONASS with provision for the future European Galileo space system.
HDOP	Horizontal dilution of precision. A measure of the magnitude of DOP errors in latitude and longitude.
Heading	Course of a vessel measured with a heading system, i.e. a gyrocompass, or a GPS vector heading system. If the heading is magnetic this will be stated. See also azimuth and bearing.
HPR	Hydro acoustic positioning reference. See USBL definition.

Line Scale Factor	<p>The ratio of a distance from point A to point B on the grid to the corresponding distance on the spheroid.</p> <p>$K = \text{plane distance} / \text{spheroidal distance}$</p> <p>$1/k = 1/6(1/k_A + 4/k_M + 1/k_B)$. ($k_A$, k_B, k_M being point scale factors at A, B, M. See also point scale factor)</p>
NTRIP	Networked Transport of RTCM via Internet Protocol. NTRIP is a protocol of streaming DGPS corrections over the internet.
Offset	A station offset from the main survey station. Must be defined by an azimuth and distance or ΔX , ΔY , ΔZ , or starboard/port, forward/aft, above/below.
OWF	Offshore Wind Farm.
PDOP	Position dilution of precision. A unit-less figure of merit expressing the relationship between the error in user position and the error in satellite position.
PPP	Precise Point Positioning. A global GNSS augmentation technique that corrects for GNSS satellite clock and orbit errors, and employs additional modelling techniques to further correct and improve the point positioning accuracy.
Precision	A measure of the random errors in observations and estimated parameters.
Reference Station	A GNSS receiver located at a precisely known location and used to determine the differential corrections employed for DGNSS augmentation techniques.
Satellite Configuration	State of the satellite configuration at a specific time, relative to a specific user or set of users.
Satellite Constellation	The arrangement in space of the complete set of satellites of a system such as GPS.
Scale	Reduction/expansion used in datum-datum transformations. Unit: ppm (parts per million). See also datum shift and datum rotation.
Scale Factor (Point)	<p>Ratio of an infinitesimal distance at a point on the grid to the corresponding distance on the spheroid.</p> <p>$K = \Delta (\text{plane distance}) / \Delta (\text{spheroidal distance})$.</p>
S/CTD (probe)	Salinity or conductivity, temperature and depth probe. Used to determine speed of sound through the water column. Pressure to depth conversions may be applied to provide true depth values.
SD	Standard deviation. Measure of the dispersion of random errors about the mean value. If a large number of measurements or observations of the same quantity are made, the standard deviation is the square root of the sum of the squares of deviations from the mean value divided by the number of observations less one.
Starfix.G2	A decimetre accuracy integrated GNSS service which utilises Fugro's own global network of reference stations to measure carrier phase observations. This data is then processed, producing a corrections solution for each navigation satellite. These corrections are applied to the satellite time reference clock and ephemeris ("orbit") information, hence "clock and orbit corrections". This service utilises both GPS and GLONASS L1 and L2 frequencies, thereby providing an accurate measurement of variations in ionospheric thickness. This enables signal delay to be calculated more precisely, resulting in a more accurate satellite to antenna range, and hence a more accurate position solution. Starfix.G2 provides a high availability, high integrity, global solution to an accuracy of 10 cm (95 % confidence level) both horizontally and vertically.

Starfix.G2+/G4+	Ultra-precise (3 cm) GPS and GLONASS Global Positioning Service, using Clock and Orbit Corrections enhanced with carrier-phase corrections from the Fugro G2 Network. Starfix.G2+/G4+ is an enhancement of Starfix.G2 service (based on GPS and GLONASS) and utilises advanced GNSS augmentation algorithms developed in-house by Fugro. The code and carrier-phase signals transmitted by GPS and GLONASS satellites are monitored globally by Fugro’s worldwide network of reference stations. These observations are processed centrally in real-time using the company’s proprietary algorithms to generate precise corrections which are used to augment the standard signals broadcast by GPS and GLONASS satellites. Corrections are received via communications satellites, providing at least two independent G2+/G4+ data sources.
Starfix.G4	A GPS, GLONASS, Galileo and BeiDou positioning system that is based on orbit and clock corrections generated from Fugro’s own expanded network of multiple system reference stations. Starfix.G4 utilises Precise Point Positioning (PPP) technology, which distinguishes itself from the traditional differential approach as satellite errors are not lumped together but estimated at source on a per satellite basis. The GPS, GLONASS, Galileo and BeiDou orbit and clock corrections are computed separately, free of ionospheric and tropospheric effects.
Starfix.XP2	This service utilises a third party global network of reference stations to measure carrier phase observations. This data is then processed, producing a corrections solution for each navigation satellite. These corrections are applied to the satellite time reference clock and ephemeris (“orbit”) information, hence “clock and orbit corrections”. This service utilises the GPS L1 and L2 frequencies, thereby providing an accurate measurement of variations in ionospheric thickness. This enables signal delay to be calculated more precisely, resulting in a more accurate satellite to antenna range, and hence a more accurate position solution. Starfix.XP2 provides a high performance global solution to an accuracy of 10 cm and 20 cm (95 % confidence level) in the horizontal and vertical planes respectively.
Starfix.NG	Fugro’s in-house advanced vessel and ROV positioning software system.
StarPack	A StarPack unit consists of a survey grade GNSS receiver and powerful processor, running Linux multi-tasking operating system. The receiver is capable of tracking all current (GPS, GLONASS) and future (Galileo) systems. A StarPack can be extended with a second receiver (in the same unit), to provide accurate, GNSS derived heading.
Transceiver	A device that can transmit and receive signals.
Transducer	A device that converts electrical energy to acoustic energy and vice-versa.
Transponder	A device that can detect a signal on a particular frequency and in response transmits signal on another frequency.
UTM	Universal Transverse Mercator. A special case of the transverse Mercator projection whereby the projection parameters are specified by worldwide agreement, abbreviated as the UTM grid. It consists of 60 north south zones, each 6 degrees of longitude wide with a unique central meridian.
USBL	Ultra-short baseline acoustic positioning method involving the measurement of range and bearing from a vessel-based transceiver to subsea transponders. It generally operates through phase discrimination of an acoustic signal as it passes over three transducers placed at right angles to each other within the Transducer head. Using this method, a three dimensional position of the beacon(s) can be determined.
Vertical Datum	An arbitrarily assumed value for a particular benchmark or a measured value at sea level at a tide station, or a fixed adjustment of many such measurements in a common adjustment. See also chart datum.
WGS 84	World Geodetic System 1984. A rotational ellipsoid having the following dimensions: semi-major axis 6378137.000 m, semi-minor axis (derived) 6356752.314 m, flattening (derived) 1/298.257224. This ellipsoid reference model / datum is the surface from which GPS coordinates are computed.

1. Introduction

Fugro was contracted by Energinet Eltransmission A/S to supply navigation and positioning services for the MV Normand Mermaid at 134 sampling and/or in situ testing locations at Danish Offshore Wind Farm 2030 Lot 2, Sub-area 2.

The positions and depths reported here were checked and quality controlled by the Fugro office staff onshore and supersede the values in the preliminary field report.

The sampling and/or in situ testing was carried out between 9 January 2024 to 6 March 2024. The positioning results are given in Table 2.1, 2.2 and 2.3.

System positioning performance parameters are outlined in Section 4.3.

2. Results

2.1 Field Locations

Table 2.1: Actual Coordinates and Water Depths

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)					Water Depth (MSL)*	
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]	Pressure Sensor [m]	USBL Depth [m]
CPT025	386 473.56	6 219 618.85	56° 06' 29.3694"	007° 10' 28.2335"	28.4	28.8
CPT028	390 562.10	6 218 461.07	56° 05' 55.3724"	007° 14' 26.4892"	27.7	28.1
CPT034	385 608.92	6 216 380.65	56° 04' 43.9404"	007° 09' 43.2005"	27.7	27.8
CPT039	381 242.60	6 214 340.26	56° 03' 34.1493"	007° 05' 34.0497"	30.6	30.6
CPT041	385 743.85	6 213 338.83	56° 03' 05.7181"	007° 09' 55.6736"	29.3	29.5
CPT042	390 155.98	6 213 248.76	56° 03' 06.5227"	007° 14' 10.7012"	28.5	28.6
CPT046	382 310.08	6 211 580.22	56° 02' 05.8720"	007° 06' 40.0908"	30.0	30.2
CPT049	394 179.00	6 210 031.95	56° 01' 25.7806"	007° 18' 07.6952"	29.6	29.7
CPT050	378 619.34	6 209 720.75	56° 01' 02.4463"	007° 03' 10.0104"	33.4	33.5
CPT057	382 808.77	6 206 799.75	55° 59' 31.7672"	007° 07' 16.3946"	31.1	31.2
CPT057A	382 805.51	6 206 801.14	55° 59' 31.8095"	007° 07' 16.2043"	31.0	31.2
CPT059	386 269.56	6 206 299.73	55° 59' 18.5994"	007° 10' 36.7773"	28.4	28.4
CPT061	392 547.38	6 205 570.53	55° 59' 00.2308"	007° 16' 39.9200"	27.1	27.2
CPT064	388 643.08	6 204 770.64	55° 58' 31.1672"	007° 12' 55.9518"	26.6	26.8
CPT066	376 477.04	6 204 160.96	55° 58' 00.7479"	007° 01' 15.5615"	34.6	34.7
CPT068	380 809.21	6 203 070.85	55° 57' 29.4471"	007° 05' 27.0052"	34.0	34.5
CPT072	374 471.36	6 200 640.46	55° 56' 05.0721"	006° 59' 25.8581"	37.2	37.2
CPT072A	374 469.22	6 200 638.79	55° 56' 05.0163"	006° 59' 25.7378"	37.1	37.2
CPT073	387 544.65	6 200 449.98	55° 56' 10.5586"	007° 11' 59.1070"	30.8	31.0
CPT076	379 897.85	6 199 790.04	55° 55' 42.5684"	007° 04' 39.7429"	31.3	31.5
CPT078	391 143.33	6 199 169.58	55° 55' 32.1426"	007° 15' 28.2507"	25.1	25.2
CPT082	394 191.19	6 196 800.39	55° 54' 17.9897"	007° 18' 27.1038"	22.7	23.1
CPT083	388 696.04	6 196 801.51	55° 54' 13.5657"	007° 13' 10.8367"	30.7	30.9
CPT085	372 665.14	6 196 740.38	55° 53' 57.2897"	006° 57' 48.4549"	34.4	34.8
CPT087	378 906.03	6 196 471.09	55° 53' 54.3792"	007° 03' 47.9828"	31.1	31.2
CPT088	386 164.35	6 196 049.84	55° 53' 47.1335"	007° 10' 46.2758"	27.5	27.7
CPT090	398 081.36	6 195 529.38	55° 53' 39.9149"	007° 22' 12.7351"	24.6	24.8
CPT091	373 598.70	6 195 320.48	55° 53' 12.2749"	006° 58' 44.5556"	35.6	35.9
CPT092	391 487.28	6 195 170.60	55° 53' 23.1296"	007° 15' 53.8340"	26.0	26.6

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)					Water Depth (MSL)*	
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]	Pressure Sensor [m]	USBL Depth [m]
CPT095	393 659.95	6 193 551.28	55° 52' 32.5177"	007° 18' 01.1223"	21.6	21.9
CPT096	383 433.61	6 193 401.11	55° 52' 19.1507"	007° 08' 13.2586"	25.5	26.1
CPT097	388 083.82	6 193 351.62	55° 52' 21.5178"	007° 12' 40.7365"	31.2	31.5
CPT104	397 471.04	6 191 301.12	55° 51' 22.7352"	007° 21' 43.3756"	23.0	23.3
CPT118	396 083.94	6 185 888.72	55° 48' 26.6668"	007° 20' 31.0901"	21.1	21.6
CPT121	369 944.91	6 194 522.20	55° 52' 42.9700"	006° 55' 15.7830"	36.9	37.2
CPT122	379 932.08	6 204 139.66	55° 58' 03.2130"	007° 04' 34.7440"	32.4	32.7
CPT123	389 921.31	6 191 201.35	55° 51' 13.5198"	007° 14' 29.5450"	26.8	27.2
CPT124	389 936.30	6 203 029.93	55° 57' 35.9621"	007° 14' 13.0761"	24.9	25.2
CPT142	389 952.83	6 214 100.23	56° 03' 33.8832"	007° 13' 57.7059"	28.0	28.2
CPT144	388 483.67	6 206 799.12	55° 59' 36.6150"	007° 12' 43.7344"	26.9	27.0
CPT145	393 635.75	6 206 780.17	55° 59' 40.2130"	007° 17' 40.9664"	28.8	28.9
CPT146	397 845.13	6 196 769.51	55° 54' 19.8321"	007° 21' 57.4562"	25.2	25.4
CPT147	392 363.72	6 216 778.33	56° 05' 02.4413"	007° 16' 13.1400"	27.6	27.9
CPT148	376 767.03	6 186 770.60	55° 48' 38.8335"	007° 02' 00.7707"	32.5	32.8
CPT149	382 070.09	6 186 790.52	55° 48' 44.2421"	007° 07' 05.1900"	31.3	31.5
CPT150	386 223.19	6 186 800.70	55° 48' 48.1562"	007° 11' 03.6238"	31.3	31.5
CPT152	399 988.37	6 185 936.85	55° 48' 31.1892"	007° 24' 15.1963"	23.5	24.0
CPT158	387 501.20	6 191 180.49	55° 51' 10.8356"	007° 12' 10.4752"	26.8	27.3
CPT159	377 116.85	6 208 360.43	56° 00' 17.0939"	007° 01' 45.5356"	34.9	35.0
CPT167	393 992.75	6 211 039.69	56° 01' 58.2139"	007° 17' 55.5098"	30.0	30.1
CPT168	382 199.47	6 207 458.52	55° 59' 52.5272"	007° 06' 40.2122"	31.8	31.9
CPT168A	382 195.24	6 207 460.05	55° 59' 52.5731"	007° 06' 39.9658"	31.8	32.0
CPT184	396 830.74	6 187 079.23	55° 49' 05.7362"	007° 21' 12.3408"	21.4	21.9
CPT188	393 608.69	6 215 019.00	56° 04' 06.5631"	007° 17' 27.6445"	28.3	28.4
CPT189	387 057.78	6 215 658.58	56° 04' 21.8358"	007° 11' 08.0573"	30.6	30.8
CPT190	374 554.00	6 203 690.76	55° 57' 43.7543"	006° 59' 25.5103"	35.5	35.6
CPT190A	374 553.92	6 203 686.01	55° 57' 43.6007"	006° 59' 25.5135"	35.4	35.5
CPT190B	374 550.05	6 203 689.27	55° 57' 43.7025"	006° 59' 25.2855"	35.4	35.5
CPT191	374 438.09	6 199 610.65	55° 55' 31.7509"	006° 59' 25.6660"	33.7	33.9
CPT191A	374 437.83	6 199 607.49	55° 55' 31.6485"	006° 59' 25.6560"	33.7	33.9
CPT192	379 553.30	6 193 580.03	55° 52' 21.5008"	007° 04' 29.8553"	33.4	33.7
CPT192A	379 555.49	6 193 582.11	55° 52' 21.5702"	007° 04' 29.9774"	33.4	33.7
CPT193	374 209.91	6 192 400.24	55° 51' 38.4497"	006° 59' 24.5909"	35.0	35.3

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)					Water Depth (MSL)*	
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]	Pressure Sensor [m]	USBL Depth [m]
CPT194	391 335.64	6 197 150.18	55° 54' 27.0092"	007° 15' 42.2479"	25.2	25.6
CPT195	372 368.78	6 188 940.85	55° 49' 44.8797"	006° 57' 44.6184"	34.9	35.2
CPT196	385 713.63	6 211 289.59	56° 01' 59.4421"	007° 09' 57.0723"	28.3	28.3
CPT203	397 204.99	6 198 428.76	55° 55' 12.9901"	007° 21' 18.3401"	25.6	25.8
CPT204	394 920.49	6 202 050.83	55° 57' 08.3230"	007° 19' 01.7249"	26.4	26.6
CPT204A	394 921.21	6 202 047.14	55° 57' 08.2042"	007° 19' 01.7718"	26.4	26.6
CPT205	385 391.78	6 209 139.63	56° 00' 49.6592"	007° 09' 41.7922"	28.1	28.2
CPT207	391 829.58	6 189 089.97	55° 50' 06.8092"	007° 16' 22.2583"	26.9	27.2
CPT210	372 791.96	6 201 300.62	55° 56' 24.8239"	006° 57' 48.0238"	35.7	35.7
CPT210A	372 793.45	6 201 296.91	55° 56' 24.7053"	006° 57' 48.1154"	35.6	35.8
CPT210B	372 790.21	6 201 297.59	55° 56' 24.7241"	006° 57' 47.9279"	35.6	35.8
CPT211	379 447.27	6 204 791.10	55° 58' 23.8354"	007° 04' 05.7493"	32.8	33.0
CPT212	391 393.71	6 206 360.45	55° 59' 24.8353"	007° 15' 32.2389"	26.2	26.3
CPT214	395 448.68	6 204 220.00	55° 58' 18.8718"	007° 19' 29.1332"	27.9	28.1
CPT215	389 267.95	6 207 929.35	56° 00' 13.8094"	007° 13' 27.2996"	27.0	27.1
CPT229	367 994.81	6 189 020.42	55° 49' 43.2186"	006° 53' 33.2810"	35.6	35.9
CPT235	387 030.54	6 207 489.21	55° 59' 57.7020"	007° 11' 18.8690"	27.5	27.6
CPT237	382 017.79	6 194 121.35	55° 52' 41.1953"	007° 06' 50.7191"	27.6	28.0
CPT238	382 331.73	6 197 250.71	55° 54' 22.6405"	007° 07' 03.8767"	29.6	29.8
CPT240	389 824.77	6 217 299.40	56° 05' 17.2059"	007° 13' 45.5646"	27.1	27.5
CPT241	378 337.40	6 200 451.80	55° 56' 02.5499"	007° 03' 08.8145"	33.2	33.4
CPT243	389 320.90	6 194 672.27	55° 53' 05.2440"	007° 13' 49.9327"	30.7	30.9
CPT244	384 844.24	6 207 009.74	55° 59' 40.3298"	007° 09' 13.4773"	27.9	28.0
CPT246	386 430.80	6 202 191.40	55° 57' 05.9162"	007° 10' 52.3123"	31.5	31.7
CPT248	385 694.07	6 218 439.20	56° 05' 50.5638"	007° 09' 44.9545"	30.6	31.0
CPT256	394 052.90	6 205 869.77	55° 59' 11.1106"	007° 18' 06.3221"	28.9	29.0
CPT256A	394 050.41	6 205 871.35	55° 59' 11.1594"	007° 18' 06.1760"	28.9	29.0
CPT256B	394 050.72	6 205 868.24	55° 59' 11.0591"	007° 18' 06.1985"	28.8	29.0
CPT257	378 994.40	6 197 560.94	55° 54' 29.6916"	007° 03' 51.3124"	30.8	30.9
CPT261	382 962.87	6 209 669.79	56° 01' 04.6865"	007° 07' 20.7837"	29.5	29.7
CPT262	388 398.75	6 196 521.58	55° 54' 04.2677"	007° 12' 54.1428"	31.3	31.4
CPT265	392 900.26	6 200 569.07	55° 56' 18.8102"	007° 17' 07.4262"	24.6	25.1
CPT270	398 026.38	6 192 429.72	55° 51' 59.6505"	007° 22' 13.7721"	22.3	22.9
CPT274	388 612.44	6 210 888.03	56° 01' 48.9171"	007° 12' 45.0589"	26.5	26.6

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)					Water Depth (MSL)*	
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]	Pressure Sensor [m]	USBL Depth [m]
CPT281	396 217.42	6 190 011.74	55° 50' 40.0806"	007° 20' 33.0865"	NA	22.6
CPT281A	396 215.14	6 190 006.35	55° 50' 39.9046"	007° 20' 32.9626"	21.9	22.4
CPT282	386 626.58	6 194 101.10	55° 52' 44.5228"	007° 11' 15.8100"	32.8	33.1
CPT285	377 962.50	6 195 280.25	55° 53' 15.0247"	007° 02' 55.6271"	34.4	34.6
CPT286	370 210.20	6 196 670.09	55° 53' 52.6583"	006° 55' 27.3317"	38.4	38.6
CPT289	380 357.67	6 201 900.77	55° 56' 51.2165"	007° 05' 02.8525"	32.9	33.3
CPT291	385 500.08	6 205 130.18	55° 58' 40.1301"	007° 09' 54.1886"	29.8	29.9
CPT295	386 786.11	6 199 220.42	55° 55' 30.1661"	007° 11' 17.2723"	30.5	30.8
CPT296	383 329.33	6 219 959.50	56° 06' 37.6555"	007° 07' 25.7947"	30.5	30.9
CPT297	394 196.99	6 187 549.10	55° 49' 18.8775"	007° 18' 40.4312"	22.8	23.3
CPT300	384 594.39	6 191 581.21	55° 51' 21.3190"	007° 09' 22.7941"	30.3	30.6
CPT301	391 903.19	6 191 149.90	55° 51' 13.4699"	007° 16' 23.5349"	27.0	27.4
CPT305	384 158.35	6 200 702.33	55° 56' 15.8233"	007° 08' 43.6757"	32.9	33.1
CPT313	391 834.38	6 213 598.42	56° 03' 19.2030"	007° 15' 47.1588"	27.7	27.8
CPT315	383 550.32	6 212 859.73	56° 02' 48.3273"	007° 07' 49.7064"	29.2	29.3
CPT318	389 130.82	6 219 199.74	56° 06' 18.0660"	007° 13' 02.5978"	27.5	27.9
CPT322	399 118.46	6 190 630.15	55° 51' 02.2909"	007° 23' 18.9770"	25.1	25.5
CPT323	383 484.71	6 202 640.51	55° 57' 17.8968"	007° 08' 01.8612"	33.2	33.5
CPT324	397 355.34	6 196 339.53	55° 54' 05.5544"	007° 21' 29.8523"	24.6	24.8
CPT326	376 862.10	6 190 949.77	55° 50' 54.0236"	007° 01' 59.4115"	33.1	33.4
CPT328	392 238.82	6 203 478.86	55° 57' 52.3557"	007° 16' 25.1384"	25.0	25.3
CPT333	394 447.18	6 195 780.67	55° 53' 45.2221"	007° 18' 43.2694"	22.6	22.8
CPT343	380 025.79	6 208 989.99	56° 00' 40.0970"	007° 04' 32.3587"	33.4	33.6
CPT343A	380 021.66	6 208 990.72	56° 00' 40.1169"	007° 04' 32.1192"	33.4	33.7
CPT343B	380 025.64	6 208 992.91	56° 00' 40.1912"	007° 04' 32.3458"	33.5	33.7
CPT347	388 375.02	6 203 660.79	55° 57' 55.0614"	007° 12' 42.1516"	26.7	26.9
CPT348	376 577.15	6 206 210.61	55° 59' 07.0989"	007° 01' 17.9494"	33.9	34.0
CPT349	386 214.46	6 187 860.88	55° 49' 22.4250"	007° 11' 01.5259"	25.9	26.4
CPT350	390 462.34	6 201 031.61	55° 56' 31.7874"	007° 14' 46.3164"	24.9	25.1
CPT352	372 412.55	6 198 189.95	55° 54' 43.9076"	006° 57' 31.4601"	35.5	35.8
CPT355	384 749.47	6 189 580.59	55° 50' 16.7728"	007° 09' 34.7655"	30.5	30.8
CPT358	387 768.17	6 213 759.57	56° 03' 21.0436"	007° 11' 51.9851"	28.3	28.5
CPT360	370 461.93	6 190 570.56	55° 50' 35.7329"	006° 55' 52.3076"	35.5	35.7
CPT361	386 219.19	6 197 060.99	55° 54' 19.8707"	007° 10' 47.9006"	30.7	30.9

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)					Water Depth (MSL)*	
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]	Pressure Sensor [m]	USBL Depth [m]
CPT363	381 943.07	6 199 180.60	55° 55' 24.6886"	007° 06' 38.4741"	31.4	31.6
CPT365	390 101.74	6 187 629.05	55° 49' 18.1702"	007° 14' 45.1186"	29.0	29.2
CPT367	384 444.72	6 186 470.48	55° 48' 35.9607"	007° 09' 22.0159"	26.4	26.8
CPT371	383 987.33	6 195 541.85	55° 53' 28.8405"	007° 08' 41.7980"	30.6	30.7
CPT373	381 980.00	6 215 610.38	56° 04' 15.8658"	007° 06' 14.6410"	29.9	30.0
CPT374	395 125.32	6 193 869.38	55° 52' 43.9586"	007° 19' 24.9565"	21.7	21.9
CPT377	394 756.39	6 197 880.32	55° 54' 53.3521"	007° 18' 58.1214"	23.1	23.3
CPT381	391 715.43	6 193 100.79	55° 52' 16.3941"	007° 16' 09.9384"	25.1	25.6
CPT383	393 379.22	6 207 808.94	56° 00' 13.2695"	007° 17' 24.6989"	28.4	28.6
CPT387	391 734.73	6 209 499.80	56° 01' 06.6105"	007° 15' 47.3570"	27.6	27.7
CPT393	379 682.04	6 212 011.05	56° 02' 17.4498"	007° 04' 07.6480"	33.3	33.4
CPT398	384 163.42	6 216 030.58	56° 04' 31.3711"	007° 08' 20.1821"	28.8	28.9
CPT399	398 838.67	6 188 528.75	55° 49' 54.1338"	007° 23' 05.7137"	22.8	23.3
SCPT031	381 364.05	6 216 780.05	56° 04' 53.1299"	007° 05' 37.1742"	29.8	30.1
SCPT048	390 090.68	6 210 160.91	56° 01' 26.6380"	007° 14' 11.4844"	26.5	26.8
SCPT056	380 511.69	6 207 121.63	55° 59' 40.1341"	007° 05' 03.3885"	32.6	33.0
SCPT056A	380 512.64	6 207 115.93	55° 59' 39.9507"	007° 05' 03.4521"	32.6	32.9
SCPT103	379 903.47	6 191 550.22	55° 51' 16.1950"	007° 04' 53.2260"	31.7	32.0
SCPT103A	379 903.17	6 191 546.48	55° 51' 16.0738"	007° 04' 53.2148"	31.7	32.0
SCPT117	390 527.36	6 186 729.30	55° 48' 49.4278"	007° 15' 10.8664"	28.4	28.7
SCPT117A	390 528.36	6 186 733.08	55° 48' 49.5508"	007° 15' 10.9182"	28.5	28.8
Notes: * = Refer to Section 5 Methodology for details on the different water depth measurement						

Table 2.2: Actual Coordinates in ITRF2014

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT025	56° 06' 29.3890"	007° 10' 28.2649"
CPT028	56° 05' 55.3920"	007° 14' 26.5206"
CPT034	56° 04' 43.9600"	007° 09' 43.2319"
CPT039	56° 03' 34.1689"	007° 05' 34.0810"
CPT041	56° 03' 05.7377"	007° 09' 55.7049"
CPT042	56° 03' 06.5423"	007° 14' 10.7326"
CPT046	56° 02' 05.8916"	007° 06' 40.1222"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT049	56° 01' 25.8002"	007° 18' 07.7266"
CPT050	56° 01' 02.4659"	007° 03' 10.0417"
CPT057	55° 59' 31.7868"	007° 07' 16.4260"
CPT057A	55° 59' 31.8291"	007° 07' 16.2356"
CPT059	55° 59' 18.6190"	007° 10' 36.8086"
CPT061	55° 59' 00.2504"	007° 16' 39.9514"
CPT064	55° 58' 31.1868"	007° 12' 55.9832"
CPT066	55° 58' 00.7675"	007° 01' 15.5928"
CPT068	55° 57' 29.4667"	007° 05' 27.0365"
CPT072	55° 56' 05.0917"	006° 59' 25.8893"
CPT072A	55° 56' 05.0359"	006° 59' 25.7690"
CPT073	55° 56' 10.5782"	007° 11' 59.1384"
CPT076	55° 55' 42.5880"	007° 04' 39.7742"
CPT078	55° 55' 32.1622"	007° 15' 28.2821"
CPT082	55° 54' 18.0093"	007° 18' 27.1352"
CPT083	55° 54' 13.5853"	007° 13' 10.8680"
CPT085	55° 53' 57.3093"	006° 57' 48.4862"
CPT087	55° 53' 54.3988"	007° 03' 48.0141"
CPT088	55° 53' 47.1531"	007° 10' 46.3072"
CPT090	55° 53' 39.9345"	007° 22' 12.7665"
CPT091	55° 53' 12.2946"	006° 58' 44.5869"
CPT092	55° 53' 23.1492"	007° 15' 53.8654"
CPT095	55° 52' 32.5373"	007° 18' 01.1537"
CPT096	55° 52' 19.1703"	007° 08' 13.2900"
CPT097	55° 52' 21.5374"	007° 12' 40.7679"
CPT104	55° 51' 22.7548"	007° 21' 43.4071"
CPT118	55° 48' 26.6864"	007° 20' 31.1215"
CPT121	55° 52' 42.9896"	006° 55' 15.8142"
CPT122	55° 58' 03.2326"	007° 04' 34.7753"
CPT123	55° 51' 13.5394"	007° 14' 29.5764"
CPT124	55° 57' 35.9817"	007° 14' 13.1075"
CPT142	56° 03' 33.9028"	007° 13' 57.7373"
CPT144	55° 59' 36.6346"	007° 12' 43.7657"
CPT145	55° 59' 40.2326"	007° 17' 40.9978"
CPT146	55° 54' 19.8517"	007° 21' 57.4876"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT147	56° 05' 02.4609"	007° 16' 13.1714"
CPT148	55° 48' 38.8531"	007° 02' 00.8020"
CPT149	55° 48' 44.2617"	007° 07' 05.2213"
CPT150	55° 48' 48.1758"	007° 11' 03.6551"
CPT152	55° 48' 31.2088"	007° 24' 15.2277"
CPT158	55° 51' 10.8552"	007° 12' 10.5066"
CPT159	56° 00' 17.1135"	007° 01' 45.5669"
CPT167	56° 01' 58.2335"	007° 17' 55.5412"
CPT168	55° 59' 52.5468"	007° 06' 40.2435"
CPT168A	55° 59' 52.5927"	007° 06' 39.9971"
CPT184	55° 49' 05.7558"	007° 21' 12.3722"
CPT188	56° 04' 06.5827"	007° 17' 27.6760"
CPT189	56° 04' 21.8554"	007° 11' 08.0887"
CPT190	55° 57' 43.7739"	006° 59' 25.5415"
CPT190A	55° 57' 43.6203"	006° 59' 25.5448"
CPT190B	55° 57' 43.7221"	006° 59' 25.3168"
CPT191	55° 55' 31.7705"	006° 59' 25.6973"
CPT191A	55° 55' 31.6681"	006° 59' 25.6872"
CPT192	55° 52' 21.5204"	007° 04' 29.8866"
CPT192A	55° 52' 21.5898"	007° 04' 30.0087"
CPT193	55° 51' 38.4693"	006° 59' 24.6222"
CPT194	55° 54' 27.0288"	007° 15' 42.2793"
CPT195	55° 49' 44.8993"	006° 57' 44.6497"
CPT196	56° 01' 59.4617"	007° 09' 57.1037"
CPT203	55° 55' 13.0097"	007° 21' 18.3715"
CPT204	55° 57' 08.3426"	007° 19' 01.7564"
CPT204A	55° 57' 08.2238"	007° 19' 01.8033"
CPT205	56° 00' 49.6788"	007° 09' 41.8235"
CPT207	55° 50' 06.8288"	007° 16' 22.2897"
CPT210	55° 56' 24.8435"	006° 57' 48.0551"
CPT210A	55° 56' 24.7249"	006° 57' 48.1467"
CPT210B	55° 56' 24.7437"	006° 57' 47.9592"
CPT211	55° 58' 23.8550"	007° 04' 05.7806"
CPT212	55° 59' 24.8549"	007° 15' 32.2703"
CPT214	55° 58' 18.8914"	007° 19' 29.1646"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT215	56° 00' 13.8290"	007° 13' 27.3310"
CPT229	55° 49' 43.2382"	006° 53' 33.3122"
CPT235	55° 59' 57.7216"	007° 11' 18.9004"
CPT237	55° 52' 41.2149"	007° 06' 50.7504"
CPT238	55° 54' 22.6601"	007° 07' 03.9080"
CPT240	56° 05' 17.2255"	007° 13' 45.5960"
CPT241	55° 56' 02.5695"	007° 03' 08.8458"
CPT243	55° 53' 05.2636"	007° 13' 49.9641"
CPT244	55° 59' 40.3494"	007° 09' 13.5086"
CPT246	55° 57' 05.9358"	007° 10' 52.3436"
CPT248	56° 05' 50.5834"	007° 09' 44.9859"
CPT256	55° 59' 11.1302"	007° 18' 06.3535"
CPT256A	55° 59' 11.1790"	007° 18' 06.2074"
CPT256B	55° 59' 11.0787"	007° 18' 06.2299"
CPT257	55° 54' 29.7112"	007° 03' 51.3437"
CPT261	56° 01' 04.7061"	007° 07' 20.8150"
CPT262	55° 54' 04.2873"	007° 12' 54.1742"
CPT265	55° 56' 18.8298"	007° 17' 07.4576"
CPT270	55° 51' 59.6701"	007° 22' 13.8035"
CPT274	56° 01' 48.9367"	007° 12' 45.0903"
CPT281	55° 50' 40.1002"	007° 20' 33.1179"
CPT281A	55° 50' 39.9242"	007° 20' 32.9940"
CPT282	55° 52' 44.5424"	007° 11' 15.8413"
CPT285	55° 53' 15.0443"	007° 02' 55.6583"
CPT286	55° 53' 52.6779"	006° 55' 27.3629"
CPT289	55° 56' 51.2361"	007° 05' 02.8838"
CPT291	55° 58' 40.1497"	007° 09' 54.2199"
CPT295	55° 55' 30.1858"	007° 11' 17.3036"
CPT296	56° 06' 37.6751"	007° 07' 25.8261"
CPT297	55° 49' 18.8971"	007° 18' 40.4626"
CPT300	55° 51' 21.3386"	007° 09' 22.8255"
CPT301	55° 51' 13.4895"	007° 16' 23.5663"
CPT305	55° 56' 15.8429"	007° 08' 43.7070"
CPT313	56° 03' 19.2226"	007° 15' 47.1902"
CPT315	56° 02' 48.3469"	007° 07' 49.7377"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
CPT318	56° 06' 18.0856"	007° 13' 02.6292"
CPT322	55° 51' 02.3105"	007° 23' 19.0085"
CPT323	55° 57' 17.9164"	007° 08' 01.8926"
CPT324	55° 54' 05.5740"	007° 21' 29.8837"
CPT326	55° 50' 54.0432"	007° 01' 59.4428"
CPT328	55° 57' 52.3753"	007° 16' 25.1698"
CPT333	55° 53' 45.2417"	007° 18' 43.3008"
CPT343	56° 00' 40.1166"	007° 04' 32.3900"
CPT343A	56° 00' 40.1365"	007° 04' 32.1505"
CPT343B	56° 00' 40.2108"	007° 04' 32.3771"
CPT347	55° 57' 55.0810"	007° 12' 42.1829"
CPT348	55° 59' 07.1186"	007° 01' 17.9807"
CPT349	55° 49' 22.4446"	007° 11' 01.5573"
CPT350	55° 56' 31.8070"	007° 14' 46.3478"
CPT352	55° 54' 43.9272"	006° 57' 31.4913"
CPT355	55° 50' 16.7924"	007° 09' 34.7968"
CPT358	56° 03' 21.0632"	007° 11' 52.0165"
CPT360	55° 50' 35.7525"	006° 55' 52.3388"
CPT361	55° 54' 19.8903"	007° 10' 47.9320"
CPT363	55° 55' 24.7083"	007° 06' 38.5054"
CPT365	55° 49' 18.1898"	007° 14' 45.1500"
CPT367	55° 48' 35.9803"	007° 09' 22.0473"
CPT371	55° 53' 28.8601"	007° 08' 41.8293"
CPT373	56° 04' 15.8854"	007° 06' 14.6723"
CPT374	55° 52' 43.9782"	007° 19' 24.9879"
CPT377	55° 54' 53.3717"	007° 18' 58.1528"
CPT381	55° 52' 16.4137"	007° 16' 09.9697"
CPT383	56° 00' 13.2891"	007° 17' 24.7303"
CPT387	56° 01' 06.6301"	007° 15' 47.3884"
CPT393	56° 02' 17.4694"	007° 04' 07.6793"
CPT398	56° 04' 31.3908"	007° 08' 20.2135"
CPT399	55° 49' 54.1534"	007° 23' 05.7451"
SCPT031	56° 04' 53.1495"	007° 05' 37.2055"
SCPT048	56° 01' 26.6576"	007° 14' 11.5158"
SCPT056	55° 59' 40.1537"	007° 05' 03.4198"

Datum: ITRF2014, EPSG code: 1165		
Location	Latitude [North]	Longitude [East]
SCPT056A	55° 59' 39.9703"	007° 05' 03.4834"
SCPT103	55° 51' 16.2146"	007° 04' 53.2573"
SCPT103A	55° 51' 16.0934"	007° 04' 53.2461"
SCPT117	55° 48' 49.4474"	007° 15' 10.8978"
SCPT117A	55° 48' 49.5705"	007° 15' 10.9496"

Table 2.3: Actual Location Details

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	No. of Fixes	X [m]	Y [m]	Distance [m]	Bearing [°G]
CPT025	386 473.56	6 219 618.85	100	0.07	0.06	1.28	154.2
CPT028	390 562.10	6 218 461.07	100	0.11	0.11	1.54	045.8
CPT034	385 608.92	6 216 380.65	100	0.09	0.15	1.13	054.9
CPT039	381 242.60	6 214 340.26	100	0.14	0.09	0.65	066.2
CPT041	385 743.85	6 213 338.83	100	0.10	0.09	1.18	187.4
CPT042	390 155.98	6 213 248.76	100	0.10	0.07	1.58	141.8
CPT046	382 310.08	6 211 580.22	100	0.05	0.08	2.09	083.8
CPT049	394 179.00	6 210 031.95	100	0.05	0.04	2.19	027.0
CPT050	378 619.34	6 209 720.75	100	0.06	0.05	0.83	024.4
CPT057	382 808.77	6 206 799.75	100	0.10	0.09	0.81	108.3
CPT057A	382 805.51	6 206 801.14	100	0.12	0.12	2.74	294.6
CPT059	386 269.56	6 206 299.73	100	0.07	0.07	1.59	099.9
CPT061	392 547.38	6 205 570.53	100	0.08	0.09	0.65	035.8
CPT064	388 643.08	6 204 770.64	100	0.13	0.08	0.64	007.6
CPT066	376 477.04	6 204 160.96	100	0.07	0.06	0.96	002.5
CPT068	380 809.21	6 203 070.85	100	0.16	0.12	1.48	054.9
CPT072	374 471.36	6 200 640.46	100	0.06	0.08	1.43	071.4
CPT072A	374 469.22	6 200 638.79	100	0.07	0.13	1.43	212.8
CPT073	387 544.65	6 200 449.98	100	0.11	0.10	0.36	266.7
CPT076	379 897.85	6 199 790.04	100	0.15	0.12	0.15	284.3
CPT078	391 143.33	6 199 169.58	100	0.07	0.09	1.40	107.6
CPT082	394 191.19	6 196 800.39	100	0.07	0.12	1.26	071.7
CPT083	388 696.04	6 196 801.51	100	0.10	0.06	1.83	034.5
CPT085	372 665.14	6 196 740.38	100	0.15	0.13	0.40	020.4
CPT087	378 906.03	6 196 471.09	100	0.14	0.08	2.30	061.6

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	No. of Fixes	X [m]	Y [m]	Distance [m]	Bearing [°G]
CPT088	386 164.35	6 196 049.84	100	0.10	0.09	0.38	114.5
CPT090	398 081.36	6 195 529.38	100	0.05	0.10	1.49	114.5
CPT091	373 598.70	6 195 320.48	100	0.12	0.13	0.85	055.8
CPT092	391 487.28	6 195 170.60	100	0.09	0.06	0.66	025.3
CPT095	393 659.95	6 193 551.28	100	0.13	0.16	1.59	036.5
CPT096	383 433.61	6 193 401.11	100	0.33	0.10	1.27	028.7
CPT097	388 083.82	6 193 351.62	100	0.10	0.06	1.63	353.8
CPT104	397 471.04	6 191 301.12	100	0.06	0.06	1.53	042.9
CPT118	396 083.94	6 185 888.72	100	0.03	0.05	2.42	238.1
CPT121	369 944.91	6 194 522.20	100	0.09	0.09	2.45	333.6
CPT122	379 932.08	6 204 139.66	100	0.13	0.12	0.35	166.7
CPT123	389 921.31	6 191 201.35	100	0.07	0.07	1.51	333.0
CPT124	389 936.30	6 203 029.93	100	0.08	0.07	0.70	264.0
CPT142	389 952.83	6 214 100.23	100	0.10	0.12	0.86	074.2
CPT144	388 483.67	6 206 799.12	100	0.10	0.10	1.11	142.8
CPT145	393 635.75	6 206 780.17	100	0.09	0.06	0.30	304.1
CPT146	397 845.13	6 196 769.51	100	0.08	0.09	1.23	113.4
CPT147	392 363.72	6 216 778.33	100	0.13	0.10	1.69	189.4
CPT148	376 767.03	6 186 770.60	100	0.06	0.06	0.60	003.2
CPT149	382 070.09	6 186 790.52	100	0.07	0.05	0.53	010.1
CPT150	386 223.19	6 186 800.70	100	0.06	0.05	0.72	015.2
CPT152	399 988.37	6 185 936.85	100	0.15	0.11	4.61	133.0
CPT158	387 501.20	6 191 180.49	100	0.08	0.10	0.53	022.4
CPT159	377 116.85	6 208 360.43	100	0.09	0.06	1.90	077.0
CPT167	393 992.75	6 211 039.69	100	0.09	0.09	0.40	218.7
CPT168	382 199.47	6 207 458.52	100	0.07	0.05	2.09	135.2
CPT168A	382 195.24	6 207 460.05	100	0.13	0.07	2.76	271.1
CPT184	396 830.74	6 187 079.23	100	0.07	0.06	1.07	136.1
CPT188	393 608.69	6 215 019.00	100	0.10	0.09	1.21	145.6
CPT189	387 057.78	6 215 658.58	100	0.05	0.11	2.28	128.7
CPT190	374 554.00	6 203 690.76	100	0.07	0.05	1.25	052.7
CPT190A	374 553.92	6 203 686.01	100	0.12	0.08	4.09	167.1
CPT190B	374 550.05	6 203 689.27	100	0.09	0.10	3.03	256.1
CPT191	374 438.09	6 199 610.65	100	0.14	0.12	1.27	059.4

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	No. of Fixes	X [m]	Y [m]	Distance [m]	Bearing [°G]
CPT191A	374 437.83	6 199 607.49	100	0.16	0.15	2.65	161.8
CPT192	379 553.30	6 193 580.03	100	0.08	0.06	0.70	272.1
CPT192A	379 555.49	6 193 582.11	100	0.07	0.03	2.58	035.1
CPT193	374 209.91	6 192 400.24	100	0.06	0.04	0.26	339.9
CPT194	391 335.64	6 197 150.18	100	0.13	0.08	0.40	296.6
CPT195	372 368.78	6 188 940.85	100	0.06	0.05	1.15	042.4
CPT196	385 713.63	6 211 289.59	100	0.05	0.08	0.75	123.2
CPT203	397 204.99	6 198 428.76	100	0.26	0.21	2.35	121.8
CPT204	394 920.49	6 202 050.83	100	0.10	0.11	1.70	060.9
CPT204A	394 921.21	6 202 047.14	100	0.16	0.13	3.62	142.3
CPT205	385 391.78	6 209 139.63	100	0.12	0.06	1.28	253.0
CPT207	391 829.58	6 189 089.97	100	0.06	0.06	0.42	266.5
CPT210	372 791.96	6 201 300.62	100	0.07	0.11	0.62	356.8
CPT210A	372 793.45	6 201 296.91	100	0.07	0.09	3.41	154.9
CPT210B	372 790.21	6 201 297.59	100	0.15	0.13	3.00	216.6
CPT211	379 447.27	6 204 791.10	100	0.14	0.10	1.13	013.7
CPT212	391 393.71	6 206 360.45	100	0.08	0.08	0.84	057.2
CPT214	395 448.68	6 204 220.00	100	0.10	0.09	0.32	270.4
CPT215	389 267.95	6 207 929.35	100	0.09	0.06	1.15	124.5
CPT229	367 994.81	6 189 020.42	100	0.13	0.04	0.47	335.9
CPT235	387 030.54	6 207 489.21	100	0.07	0.09	0.96	145.3
CPT237	382 017.79	6 194 121.35	100	0.11	0.07	1.57	030.5
CPT238	382 331.73	6 197 250.71	100	0.08	0.06	1.02	045.8
CPT240	389 824.77	6 217 299.40	100	0.08	0.06	0.65	200.4
CPT241	378 337.40	6 200 451.80	100	0.16	0.13	1.90	341.5
CPT243	389 320.90	6 194 672.27	100	0.09	0.05	2.27	357.4
CPT244	384 844.24	6 207 009.74	100	0.07	0.05	0.35	138.2
CPT246	386 430.80	6 202 191.40	100	0.14	0.14	1.61	029.5
CPT248	385 694.07	6 218 439.20	100	0.03	0.05	1.34	126.9
CPT256	394 052.90	6 205 869.77	100	0.07	0.08	0.93	104.1
CPT256A	394 050.41	6 205 871.35	100	0.11	0.06	2.09	310.2
CPT256B	394 050.72	6 205 868.24	100	0.14	0.12	2.18	216.0
CPT257	378 994.40	6 197 560.94	100	0.08	0.08	1.02	022.8
CPT261	382 962.87	6 209 669.79	100	0.09	0.06	0.89	103.8

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	No. of Fixes	X [m]	Y [m]	Distance [m]	Bearing [°G]
CPT262	388 398.75	6 196 521.58	100	0.14	0.10	2.36	047.8
CPT265	392 900.26	6 200 569.07	100	0.08	0.10	1.57	126.3
CPT270	398 026.38	6 192 429.72	100	0.12	0.14	1.41	101.7
CPT274	388 612.44	6 210 888.03	100	0.07	0.09	2.02	167.5
CPT281	396 217.42	6 190 011.74	100	0.23	0.04	2.25	039.3
CPT281A	396 215.14	6 190 006.35	100	0.13	0.05	3.75	193.3
CPT282	386 626.58	6 194 101.10	100	0.09	0.06	1.79	307.8
CPT285	377 962.50	6 195 280.25	100	0.12	0.16	0.56	063.5
CPT286	370 210.20	6 196 670.09	100	0.14	0.13	0.22	066.6
CPT289	380 357.67	6 201 900.77	100	0.18	0.12	0.83	336.4
CPT291	385 500.08	6 205 130.18	100	0.14	0.10	0.20	025.2
CPT295	386 786.11	6 199 220.42	100	0.09	0.11	0.43	014.7
CPT296	383 329.33	6 219 959.50	100	0.04	0.05	0.60	146.2
CPT297	394 196.99	6 187 549.10	100	0.08	0.03	1.36	228.4
CPT300	384 594.39	6 191 581.21	100	0.10	0.08	1.35	333.1
CPT301	391 903.19	6 191 149.90	100	0.08	0.05	0.22	117.5
CPT305	384 158.35	6 200 702.33	100	0.09	0.09	2.35	008.6
CPT313	391 834.38	6 213 598.42	100	0.08	0.09	1.63	166.6
CPT315	383 550.32	6 212 859.73	100	0.11	0.08	0.42	129.6
CPT318	389 130.82	6 219 199.74	100	0.08	0.06	0.86	107.4
CPT322	399 118.46	6 190 630.15	100	0.38	0.19	1.55	275.6
CPT323	383 484.71	6 202 640.51	100	0.17	0.13	0.88	054.6
CPT324	397 355.34	6 196 339.53	100	0.09	0.11	0.58	144.5
CPT326	376 862.10	6 190 949.77	100	0.06	0.04	0.93	255.6
CPT328	392 238.82	6 203 478.86	100	0.07	0.10	1.40	144.1
CPT333	394 447.18	6 195 780.67	100	0.08	0.11	1.06	309.1
CPT343	380 025.79	6 208 989.99	100	0.06	0.05	0.79	090.6
CPT343A	380 021.66	6 208 990.72	100	0.11	0.06	3.42	282.2
CPT343B	380 025.64	6 208 992.91	100	0.17	0.09	2.98	012.5
CPT347	388 375.02	6 203 660.79	100	0.10	0.07	0.79	001.3
CPT348	376 577.15	6 206 210.61	100	0.11	0.08	0.63	013.7
CPT349	386 214.46	6 187 860.88	100	0.18	0.20	0.99	027.8
CPT350	390 462.34	6 201 031.61	100	0.10	0.07	1.64	011.9
CPT352	372 412.55	6 198 189.95	100	0.14	0.14	0.55	095.0

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				Standard Deviation		Proposed to Actual	
Location	Easting [m]	Northing [m]	No. of Fixes	X [m]	Y [m]	Distance [m]	Bearing [°G]
CPT355	384 749.47	6 189 580.59	100	0.06	0.07	0.80	318.0
CPT358	387 768.17	6 213 759.57	100	0.13	0.09	0.47	158.1
CPT360	370 461.93	6 190 570.56	100	0.07	0.05	1.08	058.9
CPT361	386 219.19	6 197 060.99	100	0.07	0.08	1.01	010.9
CPT363	381 943.07	6 199 180.60	100	0.12	0.12	1.11	302.8
CPT365	390 101.74	6 187 629.05	100	0.11	0.09	1.58	233.0
CPT367	384 444.72	6 186 470.48	100	0.09	0.08	0.56	329.5
CPT371	383 987.33	6 195 541.85	100	0.12	0.08	1.88	010.1
CPT373	381 980.00	6 215 610.38	100	0.09	0.08	1.07	069.4
CPT374	395 125.32	6 193 869.38	100	0.04	0.04	0.69	152.7
CPT377	394 756.39	6 197 880.32	100	0.07	0.10	0.51	051.2
CPT381	391 715.43	6 193 100.79	100	0.19	0.08	0.90	028.6
CPT383	393 379.22	6 207 808.94	100	0.05	0.05	1.09	168.5
CPT387	391 734.73	6 209 499.80	100	0.06	0.04	0.34	233.1
CPT393	379 682.04	6 212 011.05	100	0.11	0.08	1.48	044.7
CPT398	384 163.42	6 216 030.58	100	0.13	0.14	0.72	035.5
CPT399	398 838.67	6 188 528.75	100	0.17	0.05	1.29	194.8
SCPT031	381 364.05	6 216 780.05	100	0.03	0.03	0.07	047.3
SCPT048	390 090.68	6 210 160.91	100	0.05	0.05	0.97	340.9
SCPT056	380 511.69	6 207 121.63	100	0.08	0.06	1.66	349.4
SCPT056A	380 512.64	6 207 115.93	100	0.05	0.04	4.12	171.1
SCPT103	379 903.47	6 191 550.22	100	0.03	0.04	0.52	064.6
SCPT103A	379 903.17	6 191 546.48	100	0.04	0.04	3.52	177.3
SCPT117	390 527.36	6 186 729.30	100	0.06	0.04	0.95	222.4
SCPT117A	390 528.36	6 186 733.08	100	0.10	0.10	3.10	006.7

3. Operations

3.1 Scope of Work

Fugro was contracted to provide positioning support for navigation between the sampling and/or in situ testing locations position at each location. Sampling and/or in situ testing was carried out at 134 locations.

Table 3.1: Proposed Coordinates

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]
CPT025	386 473.00	6 219 620.00	56° 06' 29.4061"	007° 10' 28.1996"
CPT028	390 561.00	6 218 460.00	56° 05' 55.3369"	007° 14' 26.4270"
CPT034	385 608.00	6 216 380.00	56° 04' 43.9186"	007° 09' 43.1482"
CPT039	381 242.00	6 214 340.00	56° 03' 34.1403"	007° 05' 34.0157"
CPT041	385 744.00	6 213 340.00	56° 03' 05.7559"	007° 09' 55.6806"
CPT042	390 155.00	6 213 250.00	56° 03' 06.5621"	007° 14' 10.6429"
CPT046	382 308.00	6 211 580.00	56° 02' 05.8629"	007° 06' 39.9711"
CPT049	394 178.00	6 210 030.00	56° 01' 25.7166"	007° 18' 07.6404"
CPT050	378 619.00	6 209 720.00	56° 01' 02.4217"	007° 03' 09.9919"
CPT057	382 808.00	6 206 800.00	55° 59' 31.7748"	007° 07' 16.3499"
CPT059	386 268.00	6 206 300.00	55° 59' 18.6068"	007° 10' 36.6868"
CPT061	392 547.00	6 205 570.00	55° 59' 00.2134"	007° 16' 39.8988"
CPT064	388 643.00	6 204 770.00	55° 58' 31.1464"	007° 12' 55.9478"
CPT066	376 477.00	6 204 160.00	55° 58' 00.7169"	007° 01' 15.5607"
CPT068	380 808.00	6 203 070.00	55° 57' 29.4184"	007° 05' 26.9366"
CPT072	374 470.00	6 200 640.00	55° 56' 05.0560"	006° 59' 25.7805"
CPT073	387 545.00	6 200 450.00	55° 56' 10.5595"	007° 11' 59.1274"
CPT076	379 898.00	6 199 790.00	55° 55' 42.5673"	007° 04' 39.7515"
CPT078	391 142.00	6 199 170.00	55° 55' 32.1552"	007° 15' 28.1735"
CPT082	394 190.00	6 196 800.00	55° 54' 17.9761"	007° 18' 27.0358"
CPT083	388 695.00	6 196 800.00	55° 54' 13.5160"	007° 13' 10.7791"
CPT085	372 665.00	6 196 740.00	55° 53' 57.2773"	006° 57' 48.4475"
CPT087	378 904.00	6 196 470.00	55° 53' 54.3421"	007° 03' 47.8680"
CPT088	386 164.00	6 196 050.00	55° 53' 47.1384"	007° 10' 46.2556"
CPT090	398 080.00	6 195 530.00	55° 53' 39.9339"	007° 22' 12.6560"
CPT091	373 598.00	6 195 320.00	55° 53' 12.2589"	006° 58' 44.5161"
CPT092	391 487.00	6 195 170.00	55° 53' 23.1100"	007° 15' 53.8185"

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]
CPT095	393 659.00	6 193 550.00	55° 52' 32.4755"	007° 18' 01.0696"
CPT096	383 433.00	6 193 400.00	55° 52' 19.1142"	007° 08' 13.2254"
CPT097	388 084.00	6 193 350.00	55° 52' 21.4656"	007° 12' 40.7491"
CPT104	397 470.00	6 191 300.00	55° 51' 22.6983"	007° 21' 43.3174"
CPT118	396 086.00	6 185 890.00	55° 48' 26.7099"	007° 20' 31.2064"
CPT121	369 946.00	6 194 520.00	55° 52' 42.9000"	006° 55' 15.8494"
CPT122	379 932.00	6 204 140.00	55° 58' 03.2240"	007° 04' 34.7388"
CPT123	389 922.00	6 191 200.00	55° 51' 13.4769"	007° 14' 29.5864"
CPT124	389 937.00	6 203 030.00	55° 57' 35.9651"	007° 14' 13.1163"
CPT142	389 952.00	6 214 100.00	56° 03' 33.8749"	007° 13' 57.6583"
CPT144	388 483.00	6 206 800.00	55° 59' 36.6429"	007° 12' 43.6944"
CPT145	393 636.00	6 206 780.00	55° 59' 40.2076"	007° 17' 40.9812"
CPT146	397 844.00	6 196 770.00	55° 54' 19.8470"	007° 21' 57.3906"
CPT147	392 364.00	6 216 780.00	56° 05' 02.4954"	007° 16' 13.1536"
CPT148	376 767.00	6 186 770.00	55° 48' 38.8142"	007° 02' 00.7698"
CPT149	382 070.00	6 186 790.00	55° 48' 44.2251"	007° 07' 05.1854"
CPT150	386 223.00	6 186 800.00	55° 48' 48.1334"	007° 11' 03.6139"
CPT152	399 985.00	6 185 940.00	55° 48' 31.2884"	007° 24' 14.9983"
CPT158	387 501.00	6 191 180.00	55° 51' 10.8196"	007° 12' 10.4644"
CPT159	377 115.00	6 208 360.00	56° 00' 17.0784"	007° 01' 45.4296"
CPT167	393 993.00	6 211 040.00	56° 01' 58.2241"	007° 17' 55.5237"
CPT168	382 198.00	6 207 460.00	55° 59' 52.5738"	007° 06' 40.1249"
CPT184	396 830.00	6 187 080.00	55° 49' 05.7606"	007° 21' 12.2970"
CPT188	393 608.00	6 215 020.00	56° 04' 06.5949"	007° 17' 27.6035"
CPT189	387 056.00	6 215 660.00	56° 04' 21.8803"	007° 11' 07.9523"
CPT190	374 553.00	6 203 690.00	55° 57' 43.7288"	006° 59' 25.4540"
CPT191	374 437.00	6 199 610.00	55° 55' 31.7289"	006° 59' 25.6041"
CPT192	379 554.00	6 193 580.00	55° 52' 21.5006"	007° 04' 29.8954"
CPT193	374 210.00	6 192 400.00	55° 51' 38.4420"	006° 59' 24.5964"
CPT194	391 336.00	6 197 150.00	55° 54' 27.0037"	007° 15' 42.2687"
CPT195	372 368.00	6 188 940.00	55° 49' 44.8514"	006° 57' 44.5752"
CPT196	385 713.00	6 211 290.00	56° 01' 59.4549"	007° 09' 57.0353"
CPT203	397 203.00	6 198 430.00	55° 55' 13.0285"	007° 21' 18.2236"
CPT204	394 919.00	6 202 050.00	55° 57' 08.2951"	007° 19' 01.6403"
CPT205	385 393.00	6 209 140.00	56° 00' 49.6723"	007° 09' 41.8623"

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]
CPT207	391 830.00	6 189 090.00	55° 50' 06.8103"	007° 16' 22.2822"
CPT210	372 792.00	6 201 300.00	55° 56' 24.8038"	006° 57' 48.0269"
CPT211	379 447.00	6 204 790.00	55° 58' 23.7996"	007° 04' 05.7356"
CPT212	391 393.00	6 206 360.00	55° 59' 24.8200"	007° 15' 32.1988"
CPT214	395 449.00	6 204 220.00	55° 58' 18.8720"	007° 19' 29.1516"
CPT215	389 267.00	6 207 930.00	56° 00' 13.8297"	007° 13' 27.2438"
CPT229	367 995.00	6 189 020.00	55° 49' 43.2050"	006° 53' 33.2926"
CPT235	387 030.00	6 207 490.00	55° 59' 57.7270"	007° 11' 18.8365"
CPT237	382 017.00	6 194 120.00	55° 52' 41.1509"	007° 06' 50.6755"
CPT238	382 331.00	6 197 250.00	55° 54' 22.6168"	007° 07' 03.8356"
CPT240	389 825.00	6 217 300.00	56° 05' 17.2256"	007° 13' 45.5767"
CPT241	378 338.00	6 200 450.00	55° 56' 02.4922"	007° 03' 08.8522"
CPT243	389 321.00	6 194 670.00	55° 53' 05.1706"	007° 13' 49.9420"
CPT244	384 844.00	6 207 010.00	55° 59' 40.3382"	007° 09' 13.4632"
CPT246	386 430.00	6 202 190.00	55° 57' 05.8701"	007° 10' 52.2686"
CPT248	385 693.00	6 218 440.00	56° 05' 50.5889"	007° 09' 44.8913"
CPT256	394 052.00	6 205 870.00	55° 59' 11.1172"	007° 18' 06.2698"
CPT257	378 994.00	6 197 560.00	55° 54' 29.6608"	007° 03' 51.2912"
CPT261	382 962.00	6 209 670.00	56° 01' 04.6926"	007° 07' 20.7334"
CPT262	388 397.00	6 196 520.00	55° 54' 04.2151"	007° 12' 54.0448"
CPT265	392 899.00	6 200 570.00	55° 56' 18.8391"	007° 17' 07.3521"
CPT270	398 025.00	6 192 430.00	55° 51' 59.6586"	007° 22' 13.6923"
CPT274	388 612.00	6 210 890.00	56° 01' 48.9805"	007° 12' 45.0308"
CPT281	396 216.00	6 190 010.00	55° 50' 40.0232"	007° 20' 33.0071"
CPT282	386 628.00	6 194 100.00	55° 52' 44.4885"	007° 11' 15.8931"
CPT285	377 962.00	6 195 280.00	55° 53' 15.0162"	007° 02' 55.5988"
CPT286	370 210.00	6 196 670.00	55° 53' 52.6553"	006° 55' 27.3204"
CPT289	380 358.00	6 201 900.00	55° 56' 51.1921"	007° 05' 02.8729"
CPT291	385 500.00	6 205 130.00	55° 58' 40.1242"	007° 09' 54.1840"
CPT295	386 786.00	6 199 220.00	55° 55' 30.1526"	007° 11' 17.2666"
CPT296	383 329.00	6 219 960.00	56° 06' 37.6713"	007° 07' 25.7747"
CPT297	394 198.00	6 187 550.00	55° 49' 18.9074"	007° 18' 40.4882"
CPT300	384 595.00	6 191 580.00	55° 51' 21.2805"	007° 09' 22.8312"
CPT301	391 903.00	6 191 150.00	55° 51' 13.4730"	007° 16' 23.5236"
CPT305	384 158.00	6 200 700.00	55° 56' 15.7478"	007° 08' 43.6589"

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]
CPT313	391 834.00	6 213 600.00	56° 03' 19.2538"	007° 15' 47.1347"
CPT315	383 550.00	6 212 860.00	56° 02' 48.3357"	007° 07' 49.6873"
CPT318	389 130.00	6 219 200.00	56° 06' 18.0736"	007° 13' 02.5497"
CPT322	399 120.00	6 190 630.00	55° 51' 02.2871"	007° 23' 19.0660"
CPT323	383 484.00	6 202 640.00	55° 57' 17.8797"	007° 08' 01.8208"
CPT324	397 355.00	6 196 340.00	55° 54' 05.5694"	007° 21' 29.8322"
CPT326	376 863.00	6 190 950.00	55° 50' 54.0319"	007° 01' 59.4629"
CPT328	392 238.00	6 203 480.00	55° 57' 52.3918"	007° 16' 25.0893"
CPT333	394 448.00	6 195 780.00	55° 53' 45.2010"	007° 18' 43.3178"
CPT343	380 025.00	6 208 990.00	56° 00' 40.0966"	007° 04' 32.3133"
CPT347	388 375.00	6 203 660.00	55° 57' 55.0359"	007° 12' 42.1517"
CPT348	376 577.00	6 206 210.00	55° 59' 07.0791"	007° 01' 17.9418"
CPT349	386 214.00	6 187 860.00	55° 49' 22.3961"	007° 11' 01.5006"
CPT350	390 462.00	6 201 030.00	55° 56' 31.7352"	007° 14' 46.2993"
CPT352	372 412.00	6 198 190.00	55° 54' 43.9086"	006° 57' 31.4285"
CPT355	384 750.00	6 189 580.00	55° 50' 16.7541"	007° 09' 34.7970"
CPT358	387 768.00	6 213 760.00	56° 03' 21.0575"	007° 11' 51.9744"
CPT360	370 461.00	6 190 570.00	55° 50' 35.7139"	006° 55' 52.2553"
CPT361	386 219.00	6 197 060.00	55° 54' 19.8384"	007° 10' 47.8911"
CPT363	381 944.00	6 199 180.00	55° 55' 24.6701"	007° 06' 38.5286"
CPT365	390 103.00	6 187 630.00	55° 49' 18.2021"	007° 14' 45.1897"
CPT367	384 445.00	6 186 470.00	55° 48' 35.9454"	007° 09' 22.0330"
CPT371	383 987.00	6 195 540.00	55° 53' 28.7803"	007° 08' 41.7819"
CPT373	381 979.00	6 215 610.00	56° 04' 15.8527"	007° 06' 14.5836"
CPT374	395 125.00	6 193 870.00	55° 52' 43.9783"	007° 19' 24.9374"
CPT377	394 756.00	6 197 880.00	55° 54' 53.3415"	007° 18' 58.0991"
CPT381	391 715.00	6 193 100.00	55° 52' 16.3681"	007° 16' 09.9147"
CPT383	393 379.00	6 207 810.00	56° 00' 13.3037"	007° 17' 24.6849"
CPT387	391 735.00	6 209 500.00	56° 01' 06.6173"	007° 15' 47.3724"
CPT393	379 681.00	6 212 010.00	56° 02' 17.4148"	007° 04' 07.5894"
CPT398	384 163.00	6 216 030.00	56° 04' 31.3519"	007° 08' 20.1590"
CPT399	398 839.00	6 188 530.00	55° 49' 54.1744"	007° 23' 05.7310"
SCPT031	381 364.00	6 216 780.00	56° 04' 53.1284"	007° 05' 37.1713"
SCPT048	390 091.00	6 210 160.00	56° 01' 26.6087"	007° 14' 11.5041"
SCPT056	380 512.00	6 207 120.00	55° 59' 40.0815"	007° 05' 03.4087"

Datum: ETRS89 / UTM zone 32N (EPSG::25832), ITRF2014 to ETRS89 (FUGRO::41366)				
Location	Easting [m]	Northing [m]	Latitude [North]	Longitude [East]
SCPT103	379 903.00	6 191 550.00	55° 51' 16.1874"	007° 04' 53.1995"
SCPT117	390 528.00	6 186 730.00	55° 48' 49.4510"	007° 15' 10.9021"

Table 3.2: Proposed Coordinates In ITRF2014

Datum: ITRF2014, EPSG: 1165		
Location	Latitude [North]	Longitude [East]
CPT025	56° 06' 29.4257"	007° 10' 28.2310"
CPT028	56° 05' 55.3369"	007° 14' 26.4270"
CPT034	56° 04' 43.9382"	007° 09' 43.1795"
CPT039	56° 03' 34.1599"	007° 05' 34.0470"
CPT041	56° 03' 05.7755"	007° 09' 55.7119"
CPT042	56° 03' 06.5817"	007° 14' 10.6743"
CPT046	56° 02' 05.8825"	007° 06' 40.0024"
CPT049	56° 01' 25.7362"	007° 18' 07.6718"
CPT050	56° 01' 02.4413"	007° 03' 10.0232"
CPT057	55° 59' 31.7944"	007° 07' 16.3813"
CPT059	55° 59' 18.6264"	007° 10' 36.7181"
CPT061	55° 59' 00.2330"	007° 16' 39.9303"
CPT064	55° 58' 31.1660"	007° 12' 55.9792"
CPT066	55° 58' 00.7366"	007° 01' 15.5920"
CPT068	55° 57' 29.4380"	007° 05' 26.9679"
CPT072	55° 56' 05.0756"	006° 59' 25.8118"
CPT073	55° 56' 10.5791"	007° 11' 59.1588"
CPT076	55° 55' 42.5869"	007° 04' 39.7828"
CPT078	55° 55' 32.1748"	007° 15' 28.2049"
CPT082	55° 54' 17.9957"	007° 18' 27.0672"
CPT083	55° 54' 13.5356"	007° 13' 10.8105"
CPT085	55° 53' 57.2969"	006° 57' 48.4787"
CPT087	55° 53' 54.3617"	007° 03' 47.8993"
CPT088	55° 53' 47.1580"	007° 10' 46.2869"
CPT090	55° 53' 39.9535"	007° 22' 12.6874"
CPT091	55° 53' 12.2785"	006° 58' 44.5474"
CPT092	55° 53' 23.1296"	007° 15' 53.8499"
CPT095	55° 52' 32.4951"	007° 18' 01.1010"
CPT096	55° 52' 19.1338"	007° 08' 13.2567"

Datum: ITRF2014, EPSG: 1165		
Location	Latitude [North]	Longitude [East]
CPT097	55° 52' 21.4852"	007° 12' 40.7804"
CPT104	55° 51' 22.7179"	007° 21' 43.3488"
CPT118	55° 48' 26.7295"	007° 20' 31.2378"
CPT121	55° 52' 42.9197"	006° 55' 15.8806"
CPT122	55° 58' 03.2436"	007° 04' 34.7701"
CPT123	55° 51' 13.4965"	007° 14' 29.6177"
CPT124	55° 57' 35.9847"	007° 14' 13.1477"
CPT142	56° 03' 33.8945"	007° 13' 57.6896"
CPT144	55° 59' 36.6625"	007° 12' 43.7258"
CPT145	55° 59' 40.2272"	007° 17' 41.0126"
CPT146	55° 54' 19.8666"	007° 21' 57.4221"
CPT147	56° 05' 02.5150"	007° 16' 13.1850"
CPT148	55° 48' 38.8338"	007° 02' 00.8010"
CPT149	55° 48' 44.2447"	007° 07' 05.2167"
CPT150	55° 48' 48.1530"	007° 11' 03.6453"
CPT152	55° 48' 31.3080"	007° 24' 15.0298"
CPT158	55° 51' 10.8392"	007° 12' 10.4958"
CPT159	56° 00' 17.0980"	007° 01' 45.4609"
CPT167	56° 01' 58.2437"	007° 17' 55.5552"
CPT168	55° 59' 52.5934"	007° 06' 40.1563"
CPT184	55° 49' 05.7802"	007° 21' 12.3284"
CPT188	56° 04' 06.6145"	007° 17' 27.6349"
CPT189	56° 04' 21.8999"	007° 11' 07.9837"
CPT190	55° 57' 43.7484"	006° 59' 25.4853"
CPT191	55° 55' 31.7486"	006° 59' 25.6354"
CPT192	55° 52' 21.5202"	007° 04' 29.9267"
CPT193	55° 51' 38.4616"	006° 59' 24.6276"
CPT194	55° 54' 27.0233"	007° 15' 42.3001"
CPT195	55° 49' 44.8710"	006° 57' 44.6064"
CPT196	56° 01' 59.4745"	007° 09' 57.0667"
CPT203	55° 55' 13.0481"	007° 21' 18.2550"
CPT204	55° 57' 08.3146"	007° 19' 01.6717"
CPT205	56° 00' 49.6919"	007° 09' 41.8936"
CPT207	55° 50' 06.8299"	007° 16' 22.3136"
CPT210	55° 56' 24.8234"	006° 57' 48.0582"

Datum: ITRF2014, EPSG: 1165		
Location	Latitude [North]	Longitude [East]
CPT211	55° 58' 23.8192"	007° 04' 05.7669"
CPT212	55° 59' 24.8396"	007° 15' 32.2302"
CPT214	55° 58' 18.8916"	007° 19' 29.1830"
CPT215	56° 00' 13.8493"	007° 13' 27.2752"
CPT229	55° 49' 43.2246"	006° 53' 33.3238"
CPT235	55° 59' 57.7466"	007° 11' 18.8679"
CPT237	55° 52' 41.1705"	007° 06' 50.7068"
CPT238	55° 54' 22.6364"	007° 07' 03.8669"
CPT240	56° 05' 17.2452"	007° 13' 45.6082"
CPT241	55° 56' 02.5118"	007° 03' 08.8835"
CPT243	55° 53' 05.1902"	007° 13' 49.9734"
CPT244	55° 59' 40.3578"	007° 09' 13.4946"
CPT246	55° 57' 05.8897"	007° 10' 52.3000"
CPT248	56° 05' 50.6085"	007° 09' 44.9227"
CPT256	55° 59' 11.1368"	007° 18' 06.3012"
CPT257	55° 54' 29.6805"	007° 03' 51.3224"
CPT261	56° 01' 04.7122"	007° 07' 20.7647"
CPT262	55° 54' 04.2347"	007° 12' 54.0761"
CPT265	55° 56' 18.8587"	007° 17' 07.3835"
CPT270	55° 51' 59.6782"	007° 22' 13.7238"
CPT274	56° 01' 49.0001"	007° 12' 45.0622"
CPT281	55° 50' 40.0428"	007° 20' 33.0385"
CPT282	55° 52' 44.5081"	007° 11' 15.9245"
CPT285	55° 53' 15.0358"	007° 02' 55.6301"
CPT286	55° 53' 52.6749"	006° 55' 27.3516"
CPT289	55° 56' 51.2117"	007° 05' 02.9042"
CPT291	55° 58' 40.1438"	007° 09' 54.2153"
CPT295	55° 55' 30.1722"	007° 11' 17.2980"
CPT296	56° 06' 37.6909"	007° 07' 25.8061"
CPT297	55° 49' 18.9270"	007° 18' 40.5196"
CPT300	55° 51' 21.3001"	007° 09' 22.8625"
CPT301	55° 51' 13.4926"	007° 16' 23.5550"
CPT305	55° 56' 15.7674"	007° 08' 43.6903"
CPT313	56° 03' 19.2734"	007° 15' 47.1661"
CPT315	56° 02' 48.3553"	007° 07' 49.7186"

Datum: ITRF2014, EPSG: 1165		
Location	Latitude [North]	Longitude [East]
CPT318	56° 06' 18.0932"	007° 13' 02.5812"
CPT322	55° 51' 02.3067"	007° 23' 19.0974"
CPT323	55° 57' 17.8993"	007° 08' 01.8522"
CPT324	55° 54' 05.5890"	007° 21' 29.8636"
CPT326	55° 50' 54.0515"	007° 01' 59.4941"
CPT328	55° 57' 52.4114"	007° 16' 25.1207"
CPT333	55° 53' 45.2206"	007° 18' 43.3492"
CPT343	56° 00' 40.1162"	007° 04' 32.3446"
CPT347	55° 57' 55.0555"	007° 12' 42.1831"
CPT348	55° 59' 07.0987"	007° 01' 17.9731"
CPT349	55° 49' 22.4157"	007° 11' 01.5320"
CPT350	55° 56' 31.7548"	007° 14' 46.3307"
CPT352	55° 54' 43.9283"	006° 57' 31.4597"
CPT355	55° 50' 16.7737"	007° 09' 34.8284"
CPT358	56° 03' 21.0771"	007° 11' 52.0058"
CPT360	55° 50' 35.7335"	006° 55' 52.2865"
CPT361	55° 54' 19.8580"	007° 10' 47.9224"
CPT363	55° 55' 24.6897"	007° 06' 38.5599"
CPT365	55° 49' 18.2217"	007° 14' 45.2210"
CPT367	55° 48' 35.9650"	007° 09' 22.0643"
CPT371	55° 53' 28.7999"	007° 08' 41.8132"
CPT373	56° 04' 15.8723"	007° 06' 14.6149"
CPT374	55° 52' 43.9979"	007° 19' 24.9688"
CPT377	55° 54' 53.3611"	007° 18' 58.1305"
CPT381	55° 52' 16.3877"	007° 16' 09.9460"
CPT383	56° 00' 13.3233"	007° 17' 24.7163"
CPT387	56° 01' 06.6369"	007° 15' 47.4038"
CPT393	56° 02' 17.4344"	007° 04' 07.6207"
CPT398	56° 04' 31.3715"	007° 08' 20.1903"
CPT399	55° 49' 54.1940"	007° 23' 05.7624"
SCPT031	56° 04' 53.1480"	007° 05' 37.2026"
SCPT048	56° 01' 26.6283"	007° 14' 11.5355"
SCPT056	55° 59' 40.1011"	007° 05' 03.4401"
SCPT103	55° 51' 16.2070"	007° 04' 53.2308"
SCPT117	55° 48' 49.4706"	007° 15' 10.9334"

3.2 Resources

Table 3.3 lists the project personnel.

Table 3.3: Project Personnel

Personnel	Name	From	To
Party Chief/Engineer/ Surveyor	W. Pretorius	7 February 2024	6 March 2024
Surveyor	M. Andrei	7 February 2024	6 March 2024
Surveyor	G. Botea	7 February 2024	6 March 2024

Only equipment used is listed Table 3.4 and Table 3.5; refer to Section 5 Methodology for procedural explanations.

Table 3.4: Positioning Equipment

Navigation software	Starfix online navigation suite
Primary positioning	StarPack 101 with StarfixG4+ solution, corrections via ERSAT
Secondary positioning	StarPack 102 with Starfix.XP2 solution, corrections via SASAT
Tertiary positioning	StarPack 102 with Starfix.G4+ solution, corrections via SASAT
Quaternary positioning	StarPack 101 with Starfix.G2 solution, corrections via ERSAT
Primary Acoustic positioning	Kongsberg HiPAP 501 USBL system, starboard
Secondary Acoustic positioning	Kongsberg HiPAP 500 USBL system, port
Primary heading system	GNSS Heading from Survey StarPack 101
Secondary heading system	TSS Meridian Surveyor gyro
Tertiary heading system	Vessel Gyro 1, Simrad GC80
Quaternary heading system	Vessel Gyro 2, Simrad GC80
Quinary heading system	GNSS Heading from Survey StarPack 102
Spare correction source	NTRIP

Table 3.5: Depth Measurement Equipment

Primary System	Valeport Mini IPS
Secondary System	Kongsberg HiPAP 501 USBL
Data Recording	Starfix online navigation suite and CTD internally

3.3 Offsets

3.3.1 MV Normand Mermaid Vessel Offsets

An offset survey was conducted onboard the vessel between 3 and 5 December 2021 while the vessel was in Haugesund, Norway.

Figure 3.1 illustrates the locations of the offsets.

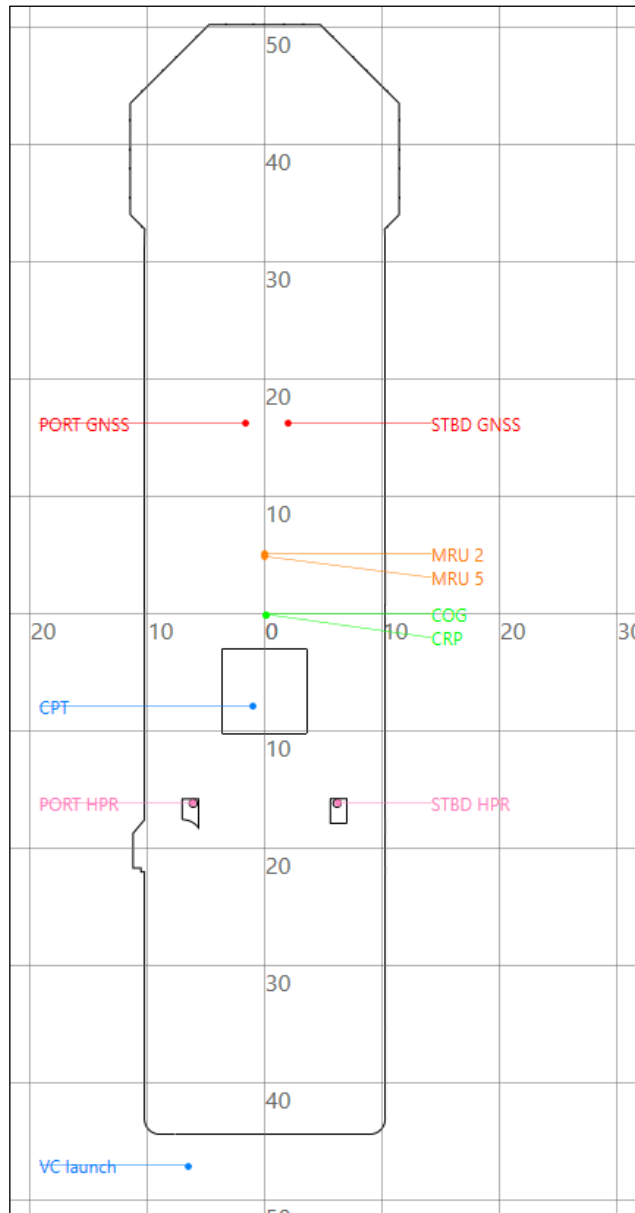


Figure 3.1: MV Normand Mermaid Offsets

Table 3.6 lists the offset coordinates used on the MV Normand Mermaid.

Table 3.6: MV Normand Mermaid Vessel Offsets

Point Name	Location Description	X [m]	Y [m]	Z [m]
CRP	Common reference point	0.000	0.000	0.000
CPT	CPT launching point	-1.030	-7.866	0.000
MRU2	Motion reference unit	-0.035	5.143	-0.562
MRU5	Motion reference unit	-0.034	4.945	-0.565
PORT GNSS	Port antenna	-1.709	16.263	29.047
Stbd GNSS	Starboard antenna	1.904	16.255	29.014
PORT HPR	Port HiPAP pole	-6.149	-16.106	-11.521
Stbd HPR	Starboard HiPAP pole	6.150	-16.120	-12.314
VC	Vibrocore launching point	-6.520	-47.000	0.000
Notes: GNSS antenna offset coordinates refer to the antennas' phase centre				

3.3.2 CPT Offset Coordinates

Figure 3.2 illustrates the location of the offsets.

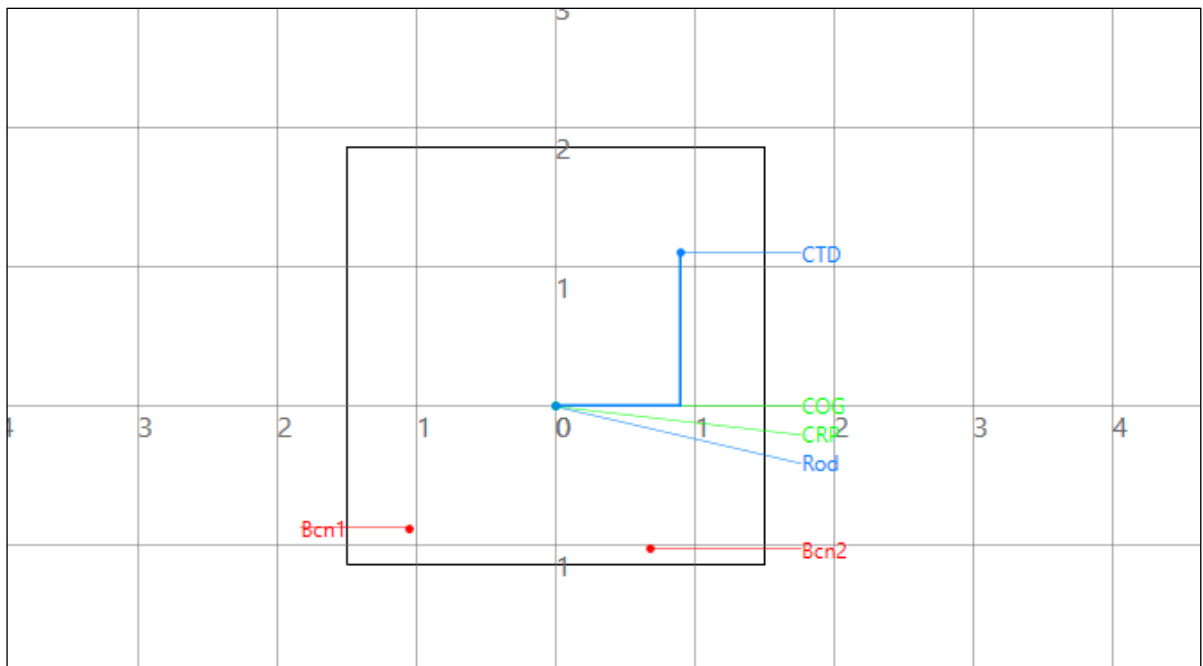


Figure 3.2: CPT offset diagram

Table 3.7 lists the offset coordinates used on the CPT frame.

Table 3.7: CPT Frame Offsets

Point Name	Location Description	X [m]	Y [m]	Z [m]
CRP	Common reference point	0.000	0.000	0.000
Rod	Central rod	0.000	0.000	0.000
Bcn1	Port frame mounted transponder	-1.050	-0.880	3.600
Bcn2	Starboard frame mounted transponder	0.680	-1.030	3.600
Mini IPS	Frame mounted Mini IPS	0.900	1.100	2.550

3.4 Calibration and Verification Results

This section details the results of the system calibrations that were carried out prior to positioning operations. Refer to Section 5 Methodology, for a detailed description of the calibration procedures. Detailed results of the calibrations are available on request.

3.4.1 Surface Positioning Systems

A surface positioning system verification was carried out on 15 October 2023 in Haugesund, Norway, using land survey techniques. The results of the verifications are presented in Table 3.8.

Table 3.8: Positioning System Verification

Date	Location	Positioning system	ΔE [m]	S.D. [m]	ΔN [m]	S.D. [m]
15 October 2023	Haugesund, Norway	Survey StarPack 101, Starfix.G4+	0.02	0.13	-0.10	0.07
15 October 2023	Haugesund, Norway	Survey StarPack 102, Starfix.XP2	-0.03	0.14	-0.11	0.07
15 October 2023	Haugesund, Norway	Survey StarPack 102, Starfix.G4+	-0.01	0.13	-0.11	0.07
15 October 2023	Haugesund, Norway	Survey StarPack 101, Starfix.XP2	0.00	0.14	-0.10	0.07

A GNSS verification was conducted prior to the project to verify the positioning systems.

3.4.2 Heading System Calibration

The heading systems were calibrated using land survey techniques, in Haugesund, Norway, on 15 October 2023. After completing the checks, the surveyor entered the corrections into the online navigation software. The results of the calibration are presented in Table 3.9.

Table 3.9: Heading Calibration

Date	Location	Heading system	Method	C-O [°]
15 October 2023	Haugesund, Norway	GNSS Heading from Survey StarPack 101	Land Survey	-90.00
15 October 2023	Haugesund, Norway	TSS Meridian Surveyor gyro	Land survey	-86.61
15 October 2023	Haugesund, Norway	Vessel Gyro 1, Simrad GC80	Land survey	-0.99
15 October 2023	Haugesund, Norway	Vessel Gyro 2, Simrad GC80	Land survey	-2.24

A heading system verification was performed prior to the project to verify the results of the calibration.

3.4.3 Speed of Sound and Water Density Measurements

Before the start of project data acquisition and at regular intervals during the project, conductivity, temperature and pressure measurements were taken to establish the local speed of sound profile and average water density. The speed of sound profile was entered into the Kongsberg APOS USBL system. The average water density was used for depth determination in conjunction with the pressure sensor.

The results of these measurements are presented in Table 3.10.

Table 3.10: Speed of Sound and Water Density Measurements

Date	Location Name	Mean [m/s]	Transducer [m/s]	Seabed [m/s]	Density [kg/m ³]
11 January 2024	CPT152	1463.35	1460.58	1472.01	1024.84
29 January 2024	CPT152	1470.60	1469.84	1470.63	1025.59
8 February 2024	CPT152	1473.50	1473.30	1473.73	1026.37
11 February 2024	CPT281	1466.83	1466.68	1467.33	1024.75
13 February 2024	CPT204	1470.87	1470.62	1471.18	1025.87
14 February 2024	CPT072	1466.37	1465.43	1467.22	1022.43
15 February 2024	CPT343	1471.94	1471.42	1472.58	1026.16
16 February 2024	CPT188	1471.61	1471.41	1471.94	1025.96
18 February 2024	CPT261	1472.60	1471.38	1473.65	1026.21
20 February 2024	CPT383	1473.64	1472.76	1474.02	1026.34
24 February 2024	CPT256	1474.37	1474.16	1474.57	1026.24
25 February 2024	CPT057	1474.45	1474.12	1474.45	1026.24
27 February 2024	CPT286	1474.63	1473.89	1475.68	1026.32
1 March 2024	CPT371	1474.71	1474.45	1474.90	1026.22

3.4.4 Kongsberg HiPAP 500 and 501 USBL System

The Kongsberg HiPAP 500 (port) and 501 (starboard) USBL systems, installed onboard the MV Normand Mermaid, were interfaced to StarfixNG. The HiPAP 501 system was used as the primary subsea positioning system.

A USBL calibration was performed on 22 October 2023. The calibration was undertaken in Skudefjorden outside Stavanger, Norway in a water depth of 400 m. The results of the calibration are presented in Table 3.11.

Table 3.11: USBL Calibration Results

System	Date	Orientation [°]	Pitch [°]	Roll [°]
HiPAP 501 Starboard	22 October 2023	0.07	0.06	0.10
HiPAP 500 Port	22 October 2023	0.65	-0.18	-0.02

After the calibration, a spin test was performed to check the validity of the corrections entered.

4. Datum and Tolerances

4.1 Geodetic and Projection Parameters

Table 4.1 lists the project geodetic parameters.

Table 4.1: Project Geodetic Parameters

Name: ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]		
EPSG Code	EPSG:25832	
Global Navigation Satellite System (GNSS) Geodetic Parameters*		
Datum	International Terrestrial Reference Frame 2014	EPSG:1165
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Local Geodetic Datum Parameters		
Datum	European Terrestrial Reference System 1989	EPSG:6258
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from ITRF2014 to ETRS89		
X-axis translation 0.05600 m	X-axis rotation -0.0027542"	Scale difference 0.00355022 ppm
Y-axis translation 0.05350 m	Y-axis rotation -0.016661"	Coordinate Frame rotation
Z-axis translation -0.09880 m	Z-axis rotation 0.0269296"	FUGRO:41366
Local Projection Parameters		
Map projection	Transverse Mercator	
Grid system	UTM zone 32N	EPSG:16032
Latitude origin	00° 00' 00.000" N	
Central meridian	009° 00' 00.000" E	
Scale factor on central meridian	0.9996	
False easting	500 000 m	
False northing	0 m	
Project Vertical Parameters		
Vertical coordinate reference system	DTU21 MSS height	FUGRO:41088
Datum	DTU21 MSS height	FUGRO:40943
Transformation	WGS 84 to DTU21 MSS height	FUGRO:41478
Notes		
* The geodetic datum of Fugro's global GNSS correction data is ITRF2014, epoch 2023.001982 (01/01/2023 17:22:00)		

4.2 Vertical Control

Table 4.2 holds information on the vertical control.

Table 4.2: Vertical Control

Vertical Datum	MSL
Tidal Data	Real time GNSS tides reduced to MSL based on the DTU21
Barometric pressure variation	Factored in pressure to depth calculation
Effect of wind	Factored in GNSS elevation measurements

4.3 System Performance Parameters

Table 4.3 lists the accuracy of the components interfaced to the navigation system.

Table 4.3: Component Specifications

System	Component	Accuracy (2σ)
GNSS Positioning	Starfix.G4+	± 0.03 m
GNSS Positioning	Starfix.G4	± 0.10 m
GNSS Positioning	Starfix.XP2	± 0.10 m
Heading	StarPack GNSS Heading	$\pm 0.20^\circ$ secant latitude
Heading	TSS Meridian Surveyor	$\pm 0.40^\circ$ secant latitude
Heading	Simrad GC80	$\pm 1.0^\circ$ secant latitude
Motion	Kongsberg MRU 5	$\pm 0.04^\circ$
Relative Depth	Valeport Mini IPS	± 0.01 % of full range
Real Time GNSS Tide	DTU21MSS	± 0.02 m
USBL Positioning	Kongsberg HiPAP 501 (Cymbal)	Angular accuracy $\pm 0.24^\circ$ Range accuracy ± 0.04 m
USBL Positioning	Kongsberg HiPAP 501	Angular accuracy $\pm 0.24^\circ$ Range accuracy ± 0.20 m
USBL Positioning	Kongsberg HiPAP 500	Angular accuracy $\pm 0.24^\circ$ Range accuracy ± 0.20 m
Notes: The values stated above are taken from the manufacturer's specifications		

5. Methodology

5.1 Introduction

Sections 5.2 to 5.4 inclusive describe the procedures for determining the coordinates and water depths of geotechnical sample and/or in situ testing locations. Section 5.5 describes the calibration and verification procedures carried out for the heading system, surface and subsurface positioning systems, and the echosounder. The use of subsurface positioning systems, primarily USBL and sector scan sonar, depends on the type of geotechnical sampling and/or in situ testing methods used, hence some descriptions in the sections below may not be applicable to this report.

5.2 Position Determination

The actual location may be determined by surface positioning alone or with additional use of USBL. The USBL determines the position of the centre of the seabed frame on the seafloor. Particularly in deeper water, use of USBL provides a more accurate position of the sample and/or in situ testing location since the seabed frame may be offset from the surface position due to currents.

The position is determined as soon as the seabed frame makes contact with the seafloor. A minimum of 100 position fixes are logged at five-second intervals. Data outliers are then discarded in accordance with standard statistical procedures. To determine the final seabed position of a sample and/or in situ testing location the following general sequence applies:

- From the global navigation satellite system (GNSS) receiver, the antenna's latitude and longitude in WGS 84 are transmitted to the navigation computer and converted to Easting and Northing on the local projection by the navigation software;
- The grid heading and X and Y offsets from the antenna to the common reference point (CRP) are applied to the antenna Easting and Northing in order to compute the position of the CRP on the local projection. If the USBL system is not used then the CPT or VC launch offset corresponds to the sample and/or in situ testing position;
- The grid heading and X and Y offsets from the CRP to the USBL transducer, mounted on the vessel's hull, are applied to the CRP Easting and Northing to determine the transducer position on the local projection;
- The USBL system measures the slant range and relative bearing (measured clockwise from the vessel centreline) from the USBL transducer to the beacon, mounted on the seabed frame, and also the depth of the beacon relative to the transducer. These values are converted to ΔX , ΔY in the horizontal plane and ΔZ in the vertical plane by the USBL processor;
- The ΔX , ΔY , and ΔZ values are transmitted to the navigation computer where the Z offset of the USBL transducer is applied;

- The position of the beacon is computed in the local projection Easting and Northing and the beacon depth is computed relative to the water surface. The centre of the seabed frame, which corresponds to the seabed sample and/or in situ testing position, is derived from the USBL beacon position by applying the USBL beacons horizontal offsets. The heading of the frame is assumed to be the same as the vessel heading. When heading changes are implemented to the vessel after the location of the frame on the seafloor, the frame will be locked in its original heading by the use of a manual heading, derived from the position fix, in which heading information was logged.

5.3 System Configuration

5.3.1 Survey Position and Navigation Systems

The survey team used two StarPack GNSS Precise Point Positioning (PPP) receivers for the surface positioning during the project. The three single modus calculation position solutions Starfix.G4+, Starfix.XP2, and Starfix.G2 from the two StarPack receivers were interfaced to the survey computer by means of a network connection and were made available for comparison and QC. Differential correction signal redundancy was achieved by cross-linking the two StarPack receivers to provide corrections from different satellite transmissions, if required. All of the position solutions were fed into StarPack QC suite for QC purposes.

All positions and peripheral data such as heading systems, USBL, etc., were sent to the navigation computer where all data transformations, offset and survey calculations, and data integration and logging were performed. All data can be graphically and numerically presented on the navigation computer or any other computer connected to the survey network. An off-line computer is available for the survey crew to post-process and report survey data.

The geodetic and the datum transformation parameters used are presented in Section 4.1.

5.3.1.1 Primary Positioning System

The primary survey positioning service used by the survey team was Starfix.G4+ solution generated from StarPack Receiver 101. Positions were calculated by using clock and orbit corrections enhanced with carrier-phase corrections from the Fugro Reference Station Network. These corrections were received by the StarPack via ERSAT transmissions, and positions were output to the Starfix Suite.

5.3.1.2 Secondary Positioning System

The secondary positioning service used by the survey team was Starfix.XP2 solution generated from StarPack Receiver 102. Positions were calculated by using clock and orbit corrections. The corrections are received by the StarPack via SASAT satellite transmissions, and positions are output to the Starfix Suite software package.

5.3.1.3 Tertiary Positioning System

The tertiary positioning service used by the survey team was Starfix.G4+ solution generated from StarPack Receiver 102. Positions were calculated by using clock and orbit corrections enhanced with carrier-phase corrections from the Fugro Reference Station Network. The corrections are received by the StarPack via SASAT satellite transmissions and positions are output to the Starfix Suite.

5.3.1.4 Quaternary Positioning System

The quaternary positioning service used by the survey team was Starfix.G2 solution generated from StarPack Receiver 101. Positions were calculated by using carrier phase corrections from the Fugro Starfix network. The corrections were received by the StarPack via ERSAT satellite transmissions and positions were output to the Starfix Suite.

5.3.2 Quality Control

The GNSS positioning quality was controlled through the measures available through the StarPacks' web interface.

Numerically, the *Status* view shows:

- Standard deviations of the latitude, longitude and height;
- Correction age;
- PDOP;
- Number of satellites;
- F-Test;
- Number of resets;
- Lock time;
- Number of Stations.

Real-time time series plots of delta Easting, Northing and Height against the *Best Position* are also available.

Within the area, of operations the accuracy and repeatability of the Starfix.G4+ system was designed to be 0.03 m in the horizontal plane and 0.06 m in the vertical plane at the 95 % confidence level.

5.4 Depth Determination

The depth at each location was measured using a combination of the following techniques:

- Pressure sensor;
- USBL depth reading;

5.4.1 Pressure Sensor

The pressure sensor fitted to the miniIPS measures absolute pressure, i.e., it includes atmospheric pressure; it has a temperature compensated piezo-resistive sensor. The pressure tare function allows the atmospheric pressure, as measured by the sensor before deployment, to be removed from the readings, so the output is simply pressure of water. By taking a tare reading at any fixed point in the water column, readings will then be output relative to that point. The sensor allows real time depth data to be continually updated for density variations in the water column. Data is presented in units of metres or feet of seawater, calculated using the UNESCO Simple Pressure/Depth relationship, which assumes "standard" water density. The miniIPS is mounted on the seabed frame.

5.4.2 USBL Depth Reading

This is a measurement made by taking the HiPAP 501 system USBL beacon Z-values (depth) and applying the vertical offset of the frame-mounted beacon above the seabed frame base.

5.5 System Calibration and Verification Procedures

Calibrations and verifications of all position and depth measuring equipment are carried out prior to sampling and/or in situ testing. This checks that all equipment is operating within acceptable limits and that the accuracy of the logged data is within specifications. Most equipment is permanently installed on the vessel and therefore not all calibrations are performed before the start of every sampling and/or in situ testing programme. The most recent calibrations of the equipment are assessed, and new calibrations are carried out if deemed necessary.

5.5.1 Offset Measurements

At the start of the mobilisation, offsets from the vessel's datum to the various GNSS antennas and other relevant offset points are measured. These measurements are compared with measurements taken from a scaled vessel plan or a previous vessel offset diagram. Seabed frame offsets from the frame's CRP to its transponder and the Z offset for the pressure sensor are also measured. Offsets are entered into the navigation software. The USBL transducer offset is already corrected to the vessel's CRP by the vessel's APOS programme.

5.5.2 Heading System Alignment Check

Three methods are possible when performing a heading system alignment check alongside. The resulting differences between computed and observed headings are entered into the navigation software as the heading system's computed minus observed C-O correction.

5.5.2.1 Total Station

These methods of performing a heading system alignment check uses land survey techniques. Reflectors are placed at or near the bow and stern of the vessel on the centreline and their positions fixed at regular intervals. Simultaneous heading system readings and heading observations are taken. The true bearing between the reflectors is calculated and compared to the observed heading system reading.

5.5.2.2 Sun Azimuth

Sun azimuth observations are performed with a total station and a sun filter, when the sun is at a maximum elevation of approximately 30°. The vessel's heading is determined by measuring the angle between the vessel's centreline and the sun azimuth and applying this angle to the computed sun azimuth. The logged heading subtracted from the heading derived from the azimuth of the sun will give the heading system's C-O correction.

5.5.2.3 Taped Offsets

This method requires the known heading of the quay and two measurements are taken simultaneously from the quay to the vessel's centreline. The distance between the two measurements provides a baseline for calculating the angle of the vessel's centreline relative to the quay, which is then applied to the quay heading to derive the computed grid vessel heading. The convergence is applied to the computed grid heading to obtain the true heading which is compared with the observed heading system's reading in order to obtain the C-O correction.

5.5.3 Positioning Systems

In order to determine the integrity and reliability of the surface positioning systems, two main procedures are followed:

5.5.3.1 Positioning Verification

The position of the GNSSs antennas, in WGS 84/ITRF coordinates, as exported from the navigation system, are compared to positions derived by land survey techniques. The total station measures directly to the GNSS antennas, or to a prism mounted near the antennas, from a known point on the quay.

5.5.3.2 Positioning System Comparison

Once the position verification results are acceptable, a position comparison against all position computations is conducted. The antenna positions for all systems are logged and using the heading system and the measured antenna offsets are reduced to the vessel's CRP. The difference in the positions are represented as Delta Easting (ΔE) and Delta Northing (ΔN).

5.5.4 Ultra-Short Baseline System

A USBL system allows the measurement of range and bearing from a vessel-based transceiver to one or more subsea transponders. It generally operates through the phase discrimination of an acoustic signal recorded by three orthogonal transducers combined in one head. A USBL calibration is executed whenever work is carried out on the transducer and at least once a year. Calibrations are carried out in water depths slightly deeper than those in which the operations will occur.

5.5.4.1 Preparation

During the USBL calibration sequence, the vessel must be free to manoeuvre around a stationary transponder. Before starting the actual USBL calibration, it is assumed that:

- The vessel's positioning system has been verified;
- The vessel's heading system alignment has been checked;
- All relevant offsets, including the height of the transponder's transducer above the seabed, have been measured.

The actual water depth, measured by the echosounder, and not corrected for tide, should also be known at the calibration site.

A speed of sound profile, determined at the calibration site, is entered into the USBL system before calibration data is collected.

For the USBL calibration a transponder, equipped with a remote-controlled release mechanism or a surface buoy, is deployed, clear of all structures and pipelines, in an area with an approximate water depth slightly deeper than the proposed survey area. The surface positioning system is used to navigate the vessel during the calibration.

5.5.4.2 Range Scale, Orientation, Pitch and Roll

This phase of the calibration is carried out with the vessel positioned on the circumference of a circle of radius 1.5 to 2 times the water depth, centred on the beacon. The following describes a calibration with the vessel lying to the north, east, south, and west of the beacon with the vessel maintaining the same north heading. In the case of bad weather, this pattern may be rotated so that the vessel is heading into the current. The surface position of the vessel and the USBL position of the beacon are logged at each cardinal point. Generally, a minimum of 100 fixes, at 5 second intervals, are logged at each cardinal point.

When the vessel is due north or south of the beacon and heading due north, roll errors are minimised and pitch errors are observed. Transducer alignment errors will plot the beacon offset to the east or west of its actual position. Range scaling errors will plot the beacon to the north or south of the actual position.

When the vessel moves to a position due east or west of the beacon, while still maintaining a heading of due north, roll errors are observed and pitch errors are minimised. Transducer alignment error will plot the beacon offset from its actual position. Range scaling errors will plot the beacon to the east or west of the actual position.

Any resultant errors will show the beacon plotted in four quadrants. If there are no errors, the beacon position will be shown as a circular scatter plot around the actual position.

The range error consists of a fixed error and the scalar multiplier. Overall, it accounts for errors in ray path and speed of sound. The USBL module in Starfix.NG derives a range error value that contains and accounts for the range fixed error.

StarfixNG computes the errors and displays the results as four parameters:

- Pitch error;
- Roll error;
- Transceiver misalignment;
- Range error.

5.5.4.3 Offset (Spin) Test

The first part of the calibration is carried out to verify the offsets between the USBL system and the navigation system. This is normally done by manoeuvring the vessel directly over a beacon deployed on the seabed and then rotating the vessel through 360° while logging the surface and USBL position. Any offset errors are displayed as a 'snail trail' showing the beacon position describing a circle around the intended beacon position. Alternatively, the vessel is positioned directly over the beacon, and an equal number of fixes are logged while the vessel is heading in each of the four cardinal directions.

The Z-offset is checked by comparing the Z component of the USBL observation and the value from the echosounder, allowing for beacon height above the seafloor. As the vessel is

directly over the seafloor beacon, this minimises any errors due to Range Scale and USBL transducer misalignment.

5.5.4.4 Verification of Results

The calibration results are checked using one of two methods:

1. Two lines are run at right angles and in opposite directions over the top of the beacon.
2. A static spin test at a location in a distance of 10 % of water depth from the calibrated beacon position.

In both cases the beacon's position is continuously logged and should not deviate, within operational parameters, from its calibrated position. A reasonably tight, circular scatter plot a few metres across, depending on the navigation system performance, the USBL system performance, and the depth of water, is an indication of a good calibration result.

Appendix C

In Situ Testing Records

Contents Appendix C: In Situ Testing Records

C.1: Recovery Lists

C.2: Operator Logs

C.1 Recovery Lists

List of Plates

Recovery List

64 Plates

Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 31-Oct-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT001	CPT	16.05	16.05	Operator discretion; Risk of rod buckling
CPT135	CPT	23.19	23.19	Max penetration force; Maximum total thrust limit exceeded

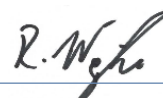
Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 2	Total in situ test recovery	: 39.24 m
Number of cone penetration test points	: 2	Total cone penetration test recovery	: 39.24 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:

Client Representative:
Colin Jacobs / Paskal Nerad



Fugro Representative:
Rene Wojke



Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 01-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT120	CPT	19.29	19.29	Operator/Driller discretion; Risk of rod buckling
CPT278	CPT	21.01	21.01	Operator/Driller discretion; Risk of rod buckling
CPT366	CPT	26.34	26.34	Operator/Driller discretion; Risk of rod buckling

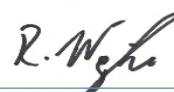
Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 3	Total in situ test recovery	: 66.64 m
Number of cone penetration test points	: 3	Total cone penetration test recovery	: 66.64 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:

Client Representative:
Colin Jacobs / Paskal Nerad



Fugro Representative:
Rene Wojke



DAILY RECOVERY LIST

Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 05-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT038	CPT	45.24	45.24	Max penetration force
CPT178	CPT	42.88	42.88	Max penetration force
CPT242	CPT	13.70	13.70	Operator/Driller discretion; Risk of rod buckling
CPT310	CPT	26.22	26.22	Max inclination value

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 4	Total in situ test recovery	: 128.04 m
Number of cone penetration test points	: 4	Total cone penetration test recovery	: 128.04 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Paskal Nerad	Fugro Representative: Rene Wojke

Daily Recovery List



GAIA TOPAZ 2.17.16 / FLD Daily recovery list with summary (Seabed) (Energinet) / 2023-11-05 23:16:28 +01:00



Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 06-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT037	CPT	22.58	22.58	Max penetration force; Maximum total thrust limit exceeded
CPT344	CPT	25.33	25.33	Max penetration force; Maximum total thrust limit exceeded
CPT138	CPT	21.15	21.15	Max penetration force; Maximum total thrust limit exceeded
CPT346	CPT	34.44	34.44	Max penetration force; Maximum total thrust limit exceeded
CPT302	CPT	15.97	15.97	Max penetration force; Maximum total thrust limit exceeded
CPT341	CPT	25.74	25.74	Max penetration force; Maximum total thrust limit exceeded
CPT024	CPT	53.37	53.37	End depth reached
CPT353	CPT	25.45	25.45	Buckling danger
CPT023	CPT	12.21	12.21	Slipping clamps

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 9	Total in situ test recovery	: 236.24 m
Number of cone penetration test points	: 9	Total cone penetration test recovery	: 236.24 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks: CPT023 recovery not included in project production summary.

Client Representative: Colin Jacobs / Paskal Nerad		Fugro Representative: Rene Wojke	
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Daily Recovery List

Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 07-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT008	CPT	23.91	23.91	Maximum penetration force; Maximum total thrust limit exceeded
CPT016	CPT	53.95	53.95	Target depth reached
CPT019	CPT	28.82	28.82	Maximum penetration force; Maximum total thrust limit exceeded
CPT020	CPT	26.04	26.04	Maximum penetration force; Maximum total thrust limit exceeded
CPT023A	CPT	27.51	27.51	Maximum penetration force; Maximum total thrust limit exceeded
CPT206	CPT	10.87	10.87	Operator/Driller discretion; Weather conditions
CPT206A	CPT	54.03	54.03	Target depth reached; Target depth reached
CPT216	CPT	5.90	5.90	Operator/Driller discretion; Risk of rod buckling
CPT279	CPT	15.85	15.85	Maximum penetration force; Maximum total thrust limit exceeded
CPT320	CPT	27.96	27.96	Maximum penetration force; Maximum total thrust limit exceeded

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 10	Total in situ test recovery	: 274.84 m
Number of cone penetration test points	: 10	Total cone penetration test recovery	: 274.84 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Paskal Nerad	Fugro Representative: Rene Wojke

Daily Recovery List



Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 08-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Recovery reason and comment
CPT224	CPT	25.61	25.61	Maximum penetration force; Maximum total thrust limit exceeded
CPT378	CPT	22.55	22.55	Maximum penetration force; Maximum total thrust limit exceeded
CPT141	CPT	52.05	52.05	Maximum penetration force; Maximum total thrust limit exceeded
CPT368	CPT	51.04	51.04	Maximum penetration force; Maximum total thrust limit exceeded

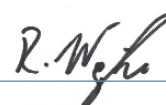
Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 4	Total in situ test recovery	: 151.25 m
Number of cone penetration test points	: 4	Total cone penetration test recovery	: 151.25 m
Number of seismic cone penetration test points	: 0		
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m
		Total seismic cone penetration test recovery	: 0.00 m

Remarks:

Client Representative:
Colin Jacobs / Paskal Nerad



Fugro Representative:
Rene Wojke



Daily Recovery List


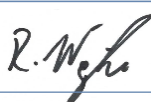
Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 09-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT009	CPT	15.12	15.12	Equipment failure
CPT267	CPT	53.62	53.62	Target depth reached
CPT009A	CPT	17.93	17.93	Operator/Driller discretion; Risk of rod buckling

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 3	Total in situ test recovery	: 86.67 m
Number of cone penetration test points	: 3	Total cone penetration test recovery	: 86.67 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

GAIA TOPAZ 2.17.16 / FLD Daily recovery list with summary (Seabed) (Energinet) / 2023-11-09 22:57:32 +01:00

Remarks:	CPT009 not included in production summary.		
Client Representative:		Fugro Representative:	
Colin Jacobs / Paskal Nerad		Rene Wojke	



Daily Recovery List

Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 10-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT007	CPT	0.55	0.55	Equipment failure; CDS Issues; Data invalidated
CPT007A	CPT	27.19	27.19	Maximum penetration force; Maximum total thrust limit exceeded
CPT277	CPT	17.20	17.20	Operator/Driller discretion; Risk of rod buckling
CPT140	CPT	9.41	9.41	Operator/Driller discretion; Weather conditions
CPT140A	CPT	4.24	4.24	Rod buckling; lost cone
CPT140B	CPT	4.36	4.36	Operator/Driller discretion; Risk of rod buckling
CPT308	CPT	4.80	4.80	Operator/Driller discretion; Risk of rod buckling
CPT308A	CPT	4.41	4.41	Operator/Driller discretion; Risk of rod buckling
CPT216A	CPT	54.21	54.21	Target depth reached

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 9	Total in situ test recovery	: 126.37 m
Number of cone penetration test points	: 9	Total cone penetration test recovery	: 126.37 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks: CPT007 not included in production summary.	
Client Representative: Colin Jacobs / Paskal Nerad 	Fugro Representative: Rene Wojke 

Daily Recovery List

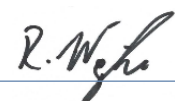
Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 11-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT354	CPT	19.44	19.44	Max Inclination; Maximum inclination limit exceeded
CPT021	CPT	22.19	22.19	Maximum penetration force; Maximum total thrust limit exceeded
CPT155	CPT	34.80	34.80	Maximum penetration force; Maximum total thrust limit exceeded
CPT294	CPT	25.47	25.47	Maximum penetration force; Maximum total thrust limit exceeded
CPT230	CPT	30.81	30.81	Operator/Driller discretion; Risk of rod buckling
CPT013	CPT	20.25	20.25	Operator/Driller discretion; Risk of rod buckling
CPT397	CPT	22.47	22.47	Operator/Driller discretion; Risk of rod buckling
CPT171	CPT	17.71	17.71	Operator/Driller discretion; Risk of rod buckling
CPT236	CPT	17.32	17.32	Operator/Driller discretion; Risk of rod buckling
CPT319	CPT	33.58	33.58	Maximum penetration force; Maximum total thrust limit exceeded
CPT154	CPT	52.73	52.73	Target depth reached; Target depth reached
CPT004	CPT	32.59	32.59	Operator/Driller discretion; Risk of rod buckling

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 12	Total in situ test recovery	: 329.36 m
Number of cone penetration test points	: 12	Total cone penetration test recovery	: 329.36 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Paskal Nerad	Fugro Representative: Rene Wojke

Daily Recovery List


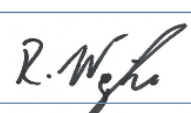
Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 12-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT199	CPT	6.07	6.07	Equipment failure; Broken cone; Test invalidated
CPT331	CPT	53.48	53.48	Target depth reached
CPT200	CPT	17.80	17.80	Operator/Driller discretion; Risk of rod buckling
CPT018	CPT	25.94	25.94	Operator/Driller discretion; Risk of rod buckling
CPT228	CPT	19.68	19.68	Operator/Driller discretion; Risk of rod buckling
CPT266	CPT	23.43	23.43	Operator/Driller discretion; Risk of rod buckling
CPT011	CPT	24.56	24.56	Operator/Driller discretion; Risk of rod buckling
CPT139	CPT	21.01	21.01	Operator/Driller discretion; Risk of rod buckling
CPT153	CPT	22.29	22.29	Maximum penetration force; Maximum total thrust limit exceeded
CPT006	CPT	16.92	16.92	Operator/Driller discretion; Risk of rod buckling
CPT165	CPT	17.43	17.43	Operator/Driller discretion; Risk of rod buckling
CPT014A	CPT	52.58	52.58	Target depth reached; Target depth reached
CPT014	CPT	14.94	14.94	Operator/Driller discretion; Maximum inclination limit exceeded

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 13	Total in situ test recovery	: 316.13 m
Number of cone penetration test points	: 13	Total cone penetration test recovery	: 316.13 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks: CPT199 recovery not included in production summary.

Client Representative: Colin Jacobs / Paskal Nerad		Fugro Representative: Rene Wojke	
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Daily Recovery List

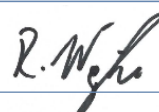
Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 13-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT260	CPT	53.15	53.15	Target depth reached
CPT391	CPT	8.31	8.31	Operator/Driller discretion; Obstacle
CPT035	CPT	20.22	20.22	Operator/Driller discretion; Risk of rod buckling
CPT183	CPT	29.26	29.26	Operator/Driller discretion; Risk of rod buckling
CPT199A	CPT	20.73	20.73	Maximum penetration force; Maximum total thrust limit exceeded
CPT213	CPT	16.76	16.76	Operator/Driller discretion; Risk of rod buckling
CPT271	CPT	47.22	47.22	Max inclination; Maximum inclination limit exceeded
CPT029	CPT	16.93	16.93	Maximum penetration force; Maximum total thrust limit exceeded

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 8	Total in situ test recovery	: 212.58 m
Number of cone penetration test points	: 8	Total cone penetration test recovery	: 212.58 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Paskal Nerad	Fugro Representative: Rene Wojke

Daily Recovery List



Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 16-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT185	CPT	12.21	12.21	Risk of rod buckling; CP15 1715-0037
CPT376	CPT	18.64	18.64	Risk of rod buckling; CP15 1715-0037
CPT116	CPT	20.59	20.59	Maximum total thrust limit exceeded; CP15 715-0037
CPT114	CPT	33.82	33.82	Maximum inclination limit exceeded; CP15 1715-0037

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 4	Total in situ test recovery	: 85.26 m
Number of cone penetration test points	: 4	Total cone penetration test recovery	: 85.26 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Phil Hodgson	Fugro Representative: Werner Pretorius




Daily Recovery List

Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 17-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT112	CPT	20.12	20.12	Maximum total thrust limit exceeded; CP15 1715-0037
CPT357	CPT	18.18	18.18	Maximum total thrust limit exceeded; CP15 1715-0037
CPT233	CPT	10.79	10.79	Maximum total thrust limit exceeded; CP15 1715-0037
CPT127	CPT	52.55	52.55	Maximum stroke; CP15 1715-0037
CPT245	CPT	14.36	14.36	Maximum total thrust limit exceeded; CP15 1715-0037
CPT098	CPT	50.31	50.31	Sudden rise in inclination limit exceeded; CP15 1715-0037
CPT283	CPT	3.69	3.69	Sudden rise in inclination limit exceeded; CP15 1715-0018
CPT283A	CPT	8.40	8.40	Sudden rise in inclination limit exceeded; CP15 1715-0018
CPT174	CPT	16.02	16.02	Sudden rise in inclination limit exceeded; CP15 1715-0018
CPT384	CPT	4.54	4.54	Sudden rise in inclination limit exceeded; CP15 1715-0018
CPT384A	CPT	2.69	2.69	Sudden rise in inclination limit exceeded; CP15 1715-0018
CPT386	CPT	16.49	16.49	Maximum total thrust limit exceeded; CP15 1715-0018
CPT079	CPT	27.61	27.61	Risk of rod buckling; CP15 1715-0018

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 13	Total in situ test recovery	: 245.75 m
Number of cone penetration test points	: 13	Total cone penetration test recovery	: 245.75 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks: CPT098 was unclassified as the sleeve was damaged at the end of the push, Energinet will decide if this needs re-run after QC ashore <i>Col-Jacobs</i>	
Client Representative: Colin Jacobs / Phil Hodgson <i>Col-Jacobs</i>	Fugro Representative: Werner Pretorius <i>Werner Pretorius</i>

Daily Recovery List



Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 18-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT252	CPT	15.56	15.56	Sudden rise in inclination limit exceeded; CP15 1715-0018
CPT202	CPT	10.35	10.35	Risk of rod buckling; CP15 1715-0018
CPT362	CPT	31.72	31.72	Maximum total thrust limit exceeded; CP15 1715-0018
CPT170	CPT	39.50	39.50	Maximum total thrust limit exceeded; CP15 1715-0018
CPT071	CPT	20.36	20.36	Sudden rise in inclination limit exceeded; CP15 1715-0018
CPT258	CPT	27.40	27.40	Sudden rise in inclination limit exceeded; CP15 1715-0018
CPT067	CPT	17.27	17.27	Maximum total thrust limit exceeded; CP15 1715-0018

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 7	Total in situ test recovery	: 162.16 m
Number of cone penetration test points	: 7	Total cone penetration test recovery	: 162.16 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Phil Hodgson	Fugro Representative: Werner Pretorius

Daily Recovery List

GAIA TOPAZ 2.17.18 / FLD Daily recovery list with summary (Seabed) (Energinet) / 2023-11-18 17:23:36 +01:00



Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 20-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT231	CPT	30.22	30.22	Maximum inclination limit exceeded; CP15 1715-0015
CPT065	CPT	13.77	13.77	Sudden rise in tip resistance limit exceeded; CP15 1715-0015
CPT201	CPT	12.01	12.01	Operator decision; Issues with the coil; CP15 1715-0015
CPT201A	CPT	19.43	19.43	Maximum total thrust limit exceeded; CP15 1715-0015
CPT201B	CPT	13.85	13.85	Maximum inclination limit exceeded; CP15 1715-0047
CPT201C	CPT	23.26	23.26	Maximum total thrust limit exceeded; CP15 1715-0047
CPT337	CPT	12.83	12.83	Maximum total thrust limit exceeded; CP15 1715-0047
CPT337A	CPT	20.23	20.23	Risk of rod buckling; CP15 1715-0019

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 8	Total in situ test recovery	: 145.60 m
Number of cone penetration test points	: 8	Total cone penetration test recovery	: 145.60 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks: CPT201A - out of class, CPT201B - max inclination, sounding continued at >1° per metre, cross-over found to be bent = equipment problem	
Client Representative: Colin Jacobs / Phil Hodgson	Fugro Representative: Werner Pretorius

Daily Recovery List



Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 21-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT372	CPT	16.19	16.19	Risk of rod buckling; CP15 1715-0019
CPT058	CPT	32.59	32.59	Risk of rod buckling; CP15 1715-0019
CPT187	CPT	21.15	21.15	Risk of rod buckling; CP15 1715-0019
CPT128	CPT	24.75	24.75	Risk of rod buckling; CP15 1715-0019
CPT288	CPT	34.39	34.39	Risk of rod buckling; CP15 1715-0019
CPT169	CPT	25.35	25.35	Risk of rod buckling; CP15 1715-0019
CPT396	CPT	29.38	29.38	Maximum total thrust limit exceeded; CP15 1715-0019
CPT054	CPT	44.72	44.72	Maximum total thrust limit exceeded; CP15 1715-0019
CPT321	CPT	14.74	14.74	Sudden rise in inclination limit exceeded; CP15 1715-0019
CPT330	CPT	37.05	37.05	Risk of rod buckling; CP15 1715-0019
CPT063	CPT	29.58	29.58	Risk of rod buckling; CP15 1715-0019

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 11	Total in situ test recovery	: 309.89 m
Number of cone penetration test points	: 11	Total cone penetration test recovery	: 309.89 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:

Client Representative:
 Colin Jacobs / Phil Hodgson



Fugro Representative:
 Werner Pretorius



Daily Recovery List

Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 22-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT269	CPT	24.82	24.82	Risk of rod buckling; CP15 1715-0019
CPT069	CPT	12.51	12.51	Risk of rod buckling; CP15 1715-0019
CPT332	CPT	34.91	34.91	Risk of rod buckling; CP15 1715-0019
CPT276	CPT	28.62	28.62	Risk of rod buckling; CP15 1715-0019

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 4	Total in situ test recovery	: 100.86 m
Number of cone penetration test points	: 4	Total cone penetration test recovery	: 100.86 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Phil Hodgson	Fugro Representative: Werner Pretorius

Daily Recovery List

Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 26-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
SCPT053	SCPT	15.06	15.06	Risk of rod buckling; CP15 1715-0068/SP15 1734-0092; No. of SVTs:14
SCPT089	SCPT	15.49	15.49	Risk of rod buckling; CP15 1715-0068/SP15 1734-0092; No. of SVTs:14

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 2	Total in situ test recovery	: 30.55 m
Number of cone penetration test points	: 0	Total cone penetration test recovery	: 0.00 m
Number of seismic cone penetration test points	: 2	Total seismic cone penetration test recovery	: 30.55 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

GAIA TOPAZ 2.17.18 / FLD Daily recovery list with summary (Seabed) (Energinet) / 2023-11-26 22:37:34 +01:00

Remarks:	
Client Representative: Colin Jacobs / Phil Hodgson	Fugro Representative: Werner Pretorius




Daily Recovery List

Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 26-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
SCPT117	SCPT	6.44	0.00	Equipment failure; CP15 1715-0068/SP15 1734-0092; No. of SVTs:0
SCPT117A	SCPT	38.09	38.09	Sudden rise in inclination limit exceeded; CP15 1715-0078/SP15 1734-0096; No. of SVTs:37

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 2	Total in situ test recovery	: 38.09 m
Number of cone penetration test points	: 0	Total cone penetration test recovery	: 0.00 m
Number of seismic cone penetration test points	: 2	Total seismic cone penetration test recovery	: 38.09 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:

Client Representative:
Colin Jacobs / Phil Hodgson



Fugro Representative:
Werner Pretorius



DAILY RECOVERY LIST

Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 27-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
SCPT103	SCPT	8.61	8.61	Risk of rod buckling; CP15 1715-0078/SP15 1734-0096; No. of SVTs:7
SCPT103A	SCPT	10.50	10.50	Operator decision; Multiple obstacles in a row; CP15-1701-3549/1734-0091; No. of SVTs: 4

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 2	Total in situ test recovery	: 19.11 m
Number of cone penetration test points	: 0	Total cone penetration test recovery	: 0.00 m
Number of seismic cone penetration test points	: 2	Total seismic cone penetration test recovery	: 19.11 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:

Client Representative:
Colin Jacobs / Phil Hodgson



Fugro Representative:
Werner Pretorius



DAILY RECOVERY LIST

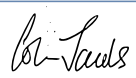
Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 28-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
SCPT002	SCPT	13.50	13.50	Sudden rise in inclination limit exceeded; CP15 1701-3281/SP15 1734-0051; No. of SVTs:12
SCPT026	SCPT	10.51	10.51	Equipment failure; Lost communication to cone; CP15 1701-3281/SP15 1734-0051; No. of SVTs: 8

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 2	Total in situ test recovery	: 24.01 m
Number of cone penetration test points	: 0	Total cone penetration test recovery	: 0.00 m
Number of seismic cone penetration test points	: 2	Total seismic cone penetration test recovery	: 24.01 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Phil Hodgson	Fugro Representative: Werner Pretorius




Daily Recovery List



Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 28-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
SCPT056	SCPT	0.73	0.73	Sudden rise in inclination limit exceeded; CP15 1701-3179/SP15 1734-0036
SCPT056A	SCPT	16.85	16.85	Maximum inclination limit exceeded; CP15 1701-3179/SP15 1734-0036; No. of SVTs:16
SCPT048	SCPT	19.35	19.35	Maximum tip resistance limit exceeded; CP15 1701-3281/SP15 1734-0051; No. of SVTs:18
SCPT031	SCPT	12.64	12.64	Sudden rise in inclination limit exceeded; CP15 1701-3281/SP15 1734-0051; No. of SVTs:11

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 4	Total in situ test recovery	: 49.57 m
Number of cone penetration test points	: 0	Total cone penetration test recovery	: 0.00 m
Number of seismic cone penetration test points	: 4	Total seismic cone penetration test recovery	: 49.57 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:

Client Representative:
Colin Jacobs / Phil Hodgson



Fugro Representative:
Werner Pretorius



DAILY RECOVERY LIST

Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 29-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
SCPT026A	SCPT	0.00	0.00	Equipment failure; Lost comunication with cone; CP1 51701-2983/SP15 1734-0024;
SCPT026B	SCPT	0.38	0.00	Equipment failure; Lost comunication with cone; CP1 51701-2983/SP15 1734-0024;
SCPT026C	SCPT	21.51	21.51	Equipment failure; Lost comunication with cone; CP15 1701-2983/SP15 1734-0024; No. of SVTs: 10
CPT177	CPT	22.58	22.58	Maximum sleeve resistance limit exceeded; CP15 1715-0019
CPT176	CPT	15.84	15.84	Risk of rod buckling; CP15 1715-0019
CPT312	CPT	22.07	22.07	Risk of rod buckling; CP15 1701-0019
CPT175	CPT	19.33	19.33	Sudden rise in inclination limit exceeded; CP15 1701-0019

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 7	Total in situ test recovery	: 101.33 m
Number of cone penetration test points	: 4	Total cone penetration test recovery	: 79.82 m
Number of seismic cone penetration test points	: 3	Total seismic cone penetration test recovery	: 21.51 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Stephen Weston / Aizuddin Darus	Fugro Representative: Rene Wojke

GAIA TOPAZ 2.17.18 / FLD Daily recovery list with summary (Seabed) (Energinet) / 2023-11-29 22:52:32 +01:00

Daily Recovery List



Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 29-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
SCPT026A	SCPT	0.00	0.00	Equipment failure; Lost communication to cone; CP15 1701-2983/SP15 1734-0024;
SCPT026B	SCPT	0.38	0.00	Equipment failure; Lost communication to cone; CP15 1701-2983/SP15 1734-0024;
SCPT026C	SCPT	21.51	0.00	Equipment failure; Lost communication to cone; CP15 1701-2983/SP15 1734-0024; No. of SVTs: 0
CPT177	CPT	22.58	22.58	Maximum sleeve resistance limit exceeded; CP15 1715-0019
CPT176	CPT	15.84	15.84	Risk of rod buckling; CP15 1715-0019
CPT312	CPT	22.07	22.07	Risk of rod buckling; CP15 1701-0019
CPT175	CPT	19.33	19.33	Sudden rise in inclination limit exceeded; CP15 1701-0019

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 7	Total in situ test recovery	: 79.82 m
Number of cone penetration test points	: 4	Total cone penetration test recovery	: 79.82 m
Number of seismic cone penetration test points	: 3	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Phil Hodgson	Fugro Representative: Werner Pretorius




Daily Recovery List



Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 30-Nov-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT338	CPT	19.87	19.87	Sudden rise in inclination limit exceeded; CP15 1701-0081
CPT060	CPT	18.59	18.59	Sudden rise in inclination limit exceeded; CP15 1701-0081

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 2	Total in situ test recovery	: 38.46 m
Number of cone penetration test points	: 2	Total cone penetration test recovery	: 38.46 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Phil Hodgson	Fugro Representative: Werner Pretorius




Daily Recovery List

Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 01-Dec-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT249	CPT	21.64	21.64	Sudden rise in tip resistance limit exceeded; CP15 1701-0081
CPT070	CPT	26.66	26.66	Risk of rod buckling; CP15 1701-0081
CPT382	CPT	29.44	29.44	Risk of rod buckling; CP15 1715-0081
CPT077	CPT	21.16	21.16	Risk of rod buckling; CP15 1701-0081
CPT329	CPT	23.32	23.32	Risk of rod buckling; CP15 1701-0081
CPT290	CPT	30.18	30.18	Risk of rod buckling; CP15 1701-0081
CPT327	CPT	28.72	28.72	Risk of rod buckling; CP15 1701-0081
CPT094	CPT	15.41	15.41	Risk of rod buckling; CP15 1701-0081
CPT227	CPT	29.44	29.44	Risk of rod buckling; CP15 1701-0081
CPT102	CPT	33.04	33.04	Risk of rod buckling; CP15 1701-0081

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 10	Total in situ test recovery	: 259.01 m
Number of cone penetration test points	: 10	Total cone penetration test recovery	: 259.01 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Phil Hodgson	Fugro Representative: Werner Pretorius

Daily Recovery List



Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 02-Dec-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT272	CPT	26.66	26.66	Risk of rod buckling; CP15 1701-0081
CPT298	CPT	41.07	41.07	Risk of rod buckling; CP15 1701-0081
CPT101	CPT	34.17	34.17	Risk of rod buckling; CP15 1701-0081
CPT334	CPT	13.91	13.91	Risk of rod buckling; CP15 1701-0081
CPT342	CPT	35.86	35.86	Risk of rod buckling; CP15 1701-0081
CPT225	CPT	23.77	23.77	Maximum sleeve resistance limit exceeded; CP15 1701-0081
CPT280	CPT	31.27	31.27	Maximum sleeve resistance limit exceeded; CP15 1701-0081
CPT220	CPT	23.25	23.25	Risk of rod buckling; CP15 1701-0070
CPT232	CPT	53.66	53.66	Target depth reached; CP15 1701-0070
CPT250	CPT	21.95	21.95	Sudden rise in inclination limit exceeded; CP15 1701-0070
CPT080	CPT	41.39	41.39	Sudden rise in tip resistance limit exceeded; CP15 1701-0070

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 11	Total in situ test recovery	: 346.96 m
Number of cone penetration test points	: 11	Total cone penetration test recovery	: 346.96 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:

Client Representative:
Colin Jacobs / Phil Hodgson



Fugro Representative:
Werner Pretorius



Daily Recovery List

Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 03-Dec-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT395	CPT	24.23	24.23	Risk of rod buckling; CP15 1715-0070
CPT275	CPT	21.13	21.13	Risk of rod buckling; CP15 1715-0070
CPT133	CPT	30.75	30.75	Risk of rod buckling; CP15 1715-0070
CPT074	CPT	13.26	13.26	Risk of rod buckling; CP15 1715-0070
CPT132	CPT	53.30	53.30	Target depth reached; CP15 1715-0070
CPT081	CPT	17.19	17.19	Risk of rod buckling; CP15 1715-0070
CPT339	CPT	37.48	37.48	Risk of rod buckling; CP15 1715-0070
CPT086	CPT	33.31	33.31	Risk of rod buckling; CP15 1715-0070
CPT136	CPT	53.05	53.05	Target depth reached; CPT15 1715-0082
CPT107	CPT	53.43	53.43	Target depth reached; CP15 1715-0082
CPT100	CPT	45.84	45.84	Maximum total thrust limit exceeded; CP15 1715-0082

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 11	Total in situ test recovery	: 382.97 m
Number of cone penetration test points	: 11	Total cone penetration test recovery	: 382.97 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Phil Hodgson	Fugro Representative: Werner Pretorius




Daily Recovery List





Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 04-Dec-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT162	CPT	33.44	33.44	Maximum inclination limit exceeded; CP15 1715-0082
CPT336	CPT	10.98	10.98	Risk of rod buckling; CP15 1715-0082
CPT181	CPT	25.60	25.60	Maximum inclination limit exceeded; CP15 1715-0082
CPT180	CPT	28.00	28.00	Risk of rod buckling; CP15 1715-0083
CPT062	CPT	28.43	28.43	Risk of rod buckling; CP15 1715-0083

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 5	Total in situ test recovery	: 126.45 m
Number of cone penetration test points	: 5	Total cone penetration test recovery	: 126.45 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Phil Hodgson 	Fugro Representative: Werner Pretorius 

Daily Recovery List



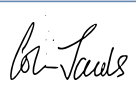
Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 05-Dec-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT217	CPT	22.46	22.46	Risk of rod buckling; CP15 1715-0083
CPT335	CPT	27.84	27.84	Risk of rod buckling; CP15 1715-0083
CPT047	CPT	20.38	20.38	Risk of rod buckling; CP15 1715-0083
CPT292	CPT	31.97	31.97	Maximum inclination limit exceeded; CP15 1715-0083
CPT379	CPT	14.01	14.01	Risk of rod buckling; CP15 1715-0083
CPT179	CPT	18.64	18.64	Risk of rod buckling; CP15 1715-0083
CPT303	CPT	19.69	19.69	Risk of rod buckling; CP15 1715-0083
CPT137	CPT	22.38	22.38	Risk of rod buckling; CP15 1715-0083
CPT356	CPT	20.84	20.84	Risk of rod buckling; CP15 1715-0083
CPT051	CPT	20.01	20.01	Risk of rod buckling; CP15 1715-0083
CPT044	CPT	18.95	18.95	Operator's discretion; Obstacle; CP15 1715-0083
CPT219	CPT	21.06	21.06	Operator's discretion; Obstacle; CP15 1715-0083

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 12	Total in situ test recovery	: 258.23 m
Number of cone penetration test points	: 12	Total cone penetration test recovery	: 258.23 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Phil Hodgson	Fugro Representative: Werner Pretorius




Daily Recovery List



Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 06-Dec-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT052	CPT	26.24	26.24	Risk of rod buckling; CP15 1715-0083
CPT156	CPT	36.19	36.19	Maximum inclination limit exceeded; CP15 1715-0083
CPT234	CPT	28.14	28.14	Risk of rod buckling; CP15 1715-0083
CPT394	CPT	25.53	25.53	Risk of rod buckling; CP15 1715-0083
CPT036	CPT	22.26	22.26	Risk of rod buckling; CP15 1715-0083
CPT268	CPT	16.65	16.65	Maximum inclination limit exceeded; CP15 1715-0083
CPT030	CPT	14.52	14.52	Risk of rod buckling; CP15 1715-0083
CPT370	CPT	20.81	20.81	Risk of rod buckling; CP15 1715-0083
CPT022	CPT	40.18	40.18	Risk of rod buckling; CP15 1715-0084
CPT172	CPT	17.94	17.94	Risk of rod buckling; CP15 1715-0084
CPT173	CPT	29.16	29.16	Risk of rod buckling; CP15 1715-0084
CPT134	CPT	28.92	28.92	Risk of rod buckling; CP15 1715-0084
CPT287	CPT	19.84	19.84	Risk of rod buckling; CP15 1715-0084

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 13	Total in situ test recovery	: 326.38 m
Number of cone penetration test points	: 13	Total cone penetration test recovery	: 326.38 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Phil Hodgson	Fugro Representative: Werner Pretorius

Daily Recovery List



Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 07-Dec-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT143	CPT	27.47	27.47	Risk of rod buckling; CP15 1715-0084
CPT391A	CPT	14.74	14.74	Risk of rod buckling; CP15 1715-0084
CPT045	CPT	14.60	14.60	Risk of rod buckling; CP15 1715-0084
CPT389	CPT	22.39	22.39	Risk of rod buckling; CP15 1715-0084
CPT129	CPT	36.92	36.92	Risk of rod buckling; CP15 1715-0084
CPT255	CPT	12.70	12.70	Risk of rod buckling; CP15 1715-0084
CPT345	CPT	27.71	27.71	Risk of rod buckling; CP15 1715-0084
CPT364	CPT	15.51	15.51	Risk of rod buckling; CP15 1715-0084
CPT284	CPT	15.11	15.11	Risk of rod buckling; CP15 1715-0084
CPT392	CPT	12.45	12.45	Risk of rod buckling; CP15 1715-0084
CPT273	CPT	20.70	20.70	Risk of rod buckling; CP15 1715-0084
CPT130	CPT	23.95	23.95	Risk of rod buckling; CP15 1715-0084
CPT340	CPT	20.81	20.81	Maximum inclination limit exceeded; CP15 1715-0084
CPT218	CPT	9.10	9.10	Maximum total thrust limit exceeded; CP15 1715-0085
CPT218A	CPT	8.31	8.31	Maximum total thrust limit exceeded

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 15	Total in situ test recovery	: 282.47 m
Number of cone penetration test points	: 15	Total cone penetration test recovery	: 282.47 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Phil Hodgson	Fugro Representative: Werner Pretorius

GAIA TOPAZ 2.17.18 / FLD Daily recovery list with summary (Seabed) (Energinet) / 2023-12-08 00:38:41 +01:00

Daily Recovery List



Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 08-Dec-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT040	CPT	12.38	12.38	Operator's Discretion - Obstacle; CP15 1715-0085
CPT032	CPT	46.91	46.91	Operator's Discretion - Obstacle; CP15 1715-0085

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 2	Total in situ test recovery	: 59.29 m
Number of cone penetration test points	: 2	Total cone penetration test recovery	: 59.29 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:

Client Representative:
 Colin Jacobs / Phil Hodgson



Fugro Representative:
 Werner Pretorius



Daily Recovery List

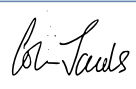
Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 11-Dec-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT208	CPT	12.38	12.38	Operator's discretion ; Obstacle ; CP15 1715-0085
CPT027	CPT	5.81	0.00	Operator's discretion ; Obstacle; Operator decision; Obstacle; CP15-1715-0085; Data are not issued to the Client
CPT027A	CPT	33.49	33.49	Maximum inclination limit exceeded; CP15 1715-0086
CPT307	CPT	21.64	21.64	Risk of rod buckling; CP15 1715-0086

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 4	Total in situ test recovery	: 67.51 m
Number of cone penetration test points	: 4	Total cone penetration test recovery	: 67.51 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Colin Jacobs / Phil Hodgson	Fugro Representative: Werner Pretorius




GAIA TOPAZ 2.17.18 / FLD Daily recovery list with summary (Seabed) (Energinet) / 2023-12-12 06:19:08 +01:00

Daily Recovery List



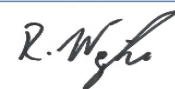
Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 14-Dec-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
SCPT113	SCPT	23.63	23.63	Maximum total thrust limit exceeded; CP15 1715-0079/SP15 1734-0097; No. of SVTs:22
SCPT075	SCPT	17.64	17.64	Risk of rod buckling; CP15 1715-0079/SP15 1734-0097; No. of SVTs:15; Missed SVT at 11.65m
SCPT084	SCPT	12.62	12.62	Risk of rod buckling; CP15 1715-0079/SP15 1734-0097; No. of SVTs:11

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 3	Total in situ test recovery	: 53.89 m
Number of cone penetration test points	: 0	Total cone penetration test recovery	: 0.00 m
Number of seismic cone penetration test points	: 3	Total seismic cone penetration test recovery	: 53.89 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Stephen Weston / Aizuddin Mohamad	Fugro Representative: Rene Wojke

Daily Recovery List

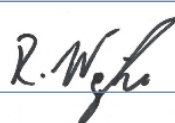
Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 15-Dec-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
SCPT033	SCPT	20.21	20.21	Risk of rod buckling; CP15 1715-0079/SP15 1734-0097; No. of SVTs:19
SCPT055	SCPT	20.56	20.56	Risk of rod buckling; CP15 1715-0079/SP15 1734-0097; No. of SVTs:19
SCPT043	SCPT	8.60	8.60	Weather conditions; CP15 1715-0079/SP15 1734-0097; No. of SVTs:7

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 3	Total in situ test recovery	: 49.37 m
Number of cone penetration test points	: 0	Total cone penetration test recovery	: 0.00 m
Number of seismic cone penetration test points	: 3	Total seismic cone penetration test recovery	: 49.37 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Stephen Weston / Aizuddin Mohamad	Fugro Representative: Rene Wojke

Daily Recovery List



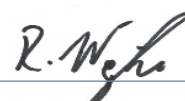
Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 31-Dec-2023

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
SCPT043A	SCPT	31.00	31.00	Maximum total thrust limit exceeded; CP15 1715-0067/SP15 1734-0095; No. of SVTs:25; Y-trace SVT Data invalidated
SCPT043B	SCPT	31.49	31.49	Maximum total thrust limit exceeded; CP15 1715-0079/SP15 1734-0097; No. of SVTs:26

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 2	Total in situ test recovery	: 62.49 m
Number of cone penetration test points	: 0	Total cone penetration test recovery	: 0.00 m
Number of seismic cone penetration test points	: 2	Total seismic cone penetration test recovery	: 62.49 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Stephen Weston / Aizuddin Mohamad	Fugro Representative: Rene Wojke

Daily Recovery List

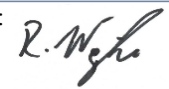
Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 01-Jan-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
SCPT026D	SCPT	19.77	19.77	Maximum total thrust limit exceeded; CP15 1715-0079/SP15 1734-0097; No. of SVTs:0
CPT309	CPT	53.14	53.14	Target depth reached; CP15 1715-0086;
CPT166	CPT	43.05	43.05	Maximum total thrust limit exceeded; CP15 1715-0086;

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 3	Total in situ test recovery	: 115.96 m
Number of cone penetration test points	: 2	Total cone penetration test recovery	: 96.19 m
Number of seismic cone penetration test points	: 1	Total seismic cone penetration test recovery	: 19.77 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Stephen Weston / Aizuddin Mohamad	Fugro Representative: Rene Wojke

Daily Recovery List



Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 04-Jan-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT293	CPT	11.58	11.58	Risk of rod buckling;; Lost connection
CPT017	CPT	53.45	53.45	Target depth reached
CPT239	CPT	28.43	28.43	Maximum tip resistance limit exceeded

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 3	Total in situ test recovery	: 93.46 m
Number of cone penetration test points	: 3	Total cone penetration test recovery	: 93.46 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:

Client Representative:
 Stephen Weston / Aizuddin Mohamad



Fugro Representative:
 Rene Wojke



Daily Recovery List

Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea


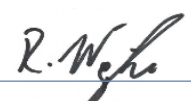
Date : 05-Jan-2024

Location	Type	Penetration [m]	Recovery [m]	nation reason and comment
CPT293A	CPT	22.49	22.49	Maximum total thrust limit exceeded; CP15 1715-0087;
CPT160	CPT	13.50	13.50	Maximum total thrust limit exceeded; CP15 1715-0087;

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 2	Total in situ test recovery	: 35.99 m
Number of cone penetration test points	: 2	Total cone penetration test recovery	: 35.99 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

GAIA TOPAZ 2.17.18 / FLD Daily recovery list with summary (Seabed) (Energinet) / 2024-01-05 11:52:20 +01:00

Remarks:	
Client Representative: Stephen Weston / Aizuddin Mohamad	Fugro Representative: Rene Wojke

Daily Recovery List

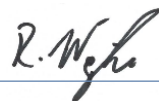
Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 06-Jan-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT125	CPT	5.43	5.43	Equipment failure; CP15 1715-0087;
CPT125A	CPT	14.25	14.25	Risk of rod buckling; CP15 1715-0087;
CPT161	CPT	39.18	39.18	Risk of rod buckling; CP15 1715-0087;
CPT197	CPT	19.19	19.19	Risk of rod buckling, Rod buckled; CP15 1715-0087;
CPT351	CPT	34.54	34.54	Maximum total thrust limit exceeded; CP15 1715-0087;

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 5	Total in situ test recovery	: 112.59 m
Number of cone penetration test points	: 5	Total cone penetration test recovery	: 112.59 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Stephen Weston / Aizuddin Mohamad	Fugro Representative: Rene Wojke

Daily Recovery List



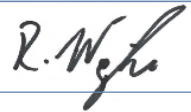
Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 07-Jan-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT369	CPT	50.86	50.86	Maximum inclination limit exceeded; CP15 1715-0075;
CPT209	CPT	50.38	50.38	Maximum inclination limit exceeded; CP15 1715-0075;
CPT380	CPT	38.51	38.51	Risk of rod buckling; CP15 1715-0075;
SCPT026E	SCPT	31.36	31.36	Maximum total thrust limit exceeded; CP15 1715-0079/SP15 1734-0097; No. of SVTs:23
CPT012	CPT	43.03	43.03	Maximum inclination limit exceeded; CP15 1715-0075;
CPT015	CPT	52.55	52.55	Target depth reached; CP15 1715-0073; Max inclination at 38.81m
CPT226	CPT	36.66	36.66	Maximum inclination limit exceeded; CP15 1715-0073;
CPT264	CPT	15.05	15.05	Risk of rod buckling; CP15 1715-0073;

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 8	Total in situ test recovery	: 318.40 m
Number of cone penetration test points	: 7	Total cone penetration test recovery	: 287.04 m
Number of seismic cone penetration test points	: 1	Total seismic cone penetration test recovery	: 31.36 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Stephen Weston / Aizuddin Mohamad	Fugro Representative: Rene Wojke

Daily Recovery List



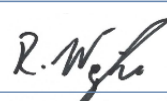
Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 08-Jan-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT003	CPT	11.80	11.80	Risk of rod buckling; CP15 1715-0073;
CPT005	CPT	26.88	26.88	Maximum total thrust limit exceeded; CP15 1715-0073;
CPT126	CPT	12.11	12.11	Risk of rod buckling; CP15 1715-0073
CPT163	CPT	20.30	20.30	Risk of rod buckling; CP15 1715-0073
CPT164	CPT	16.07	16.07	Risk of rod buckling; CP15 1715-0073;
CPT198	CPT	23.48	23.48	Risk of rod buckling; CP15 1715-0073;
CPT253	CPT	13.29	13.29	Risk of rod buckling; CP15 1715-0073
CPT254	CPT	53.56	53.56	Target depth reached; CP15 1715-0073
CPT304	CPT	30.78	30.78	Risk of rod buckling; CP15 1715-0073;
CPT325	CPT	21.52	21.52	Risk of rod buckling; CP15 1715-0073;
CPT375	CPT	12.84	12.84	Risk of rod buckling; CP15 1715-0073;
CPT385	CPT	26.22	26.22	Risk of rod buckling; CP15 1715-0073

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 12	Total in situ test recovery	: 268.85 m
Number of cone penetration test points	: 12	Total cone penetration test recovery	: 268.85 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Stephen Weston / Aizuddin Mohamad	Fugro Representative: Rene Wojke

Daily Recovery List



Project ID : F217703 - Subarea 1
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 1
 Client : Energinet
 Project area : Danish Sector, North Sea

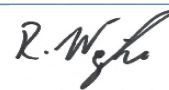
Date : 09-Jan-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT010	CPT	13.27	13.27	Risk of rod buckling; CP15 1715-0035

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 1	Total in situ test recovery	: 13.27 m
Number of cone penetration test points	: 1	Total cone penetration test recovery	: 13.27 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

GAIA TOPAZ 2.17.18 / FLD Daily recovery list with summary (Seabed) (Energinet) / 2024-01-09 12:47:32 +01:00

Remarks:	
Client Representative: Stephen Weston / Aizuddin Mohamad	Fugro Representative: Rene Wojke

Daily Recovery List



Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 09-Jan-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT147	CPT	35.10	35.10	Risk of rod buckling; CP15 1715-0035
CPT240	CPT	32.18	32.18	Maximum inclination limit exceeded; CP15 1715-0035
CPT028	CPT	25.86	25.86	Maximum total thrust limit exceeded; CP15 1715-0035
CPT318	CPT	17.53	17.53	Maximum total thrust limit exceeded; CP15 1715-0035
CPT025	CPT	10.42	10.42	Maximum total thrust limit exceeded; CP15 1715-0035
CPT248	CPT	37.69	37.69	Maximum inclination limit exceeded; CP15 1715-0035
CPT296	CPT	46.07	46.07	Maximum total thrust limit exceeded; CP15 1715-0035

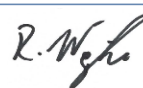
Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 7	Total in situ test recovery	: 204.85 m
Number of cone penetration test points	: 7	Total cone penetration test recovery	: 204.85 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:

Client Representative:
 Stephen Weston / Aizuddin Mohamad



Fugro Representative:
 Rene Wojke



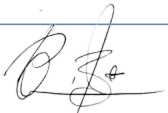

DAILY RECOVERY LIST

Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 08-Feb-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT152	CPT	32.04	32.04	Operator decision; Possible slipping; CP15 1715-0042
CPT118	CPT	27.12	27.12	Maximum total thrust limit exceeded; CP15 1715-0042
CPT184	CPT	17.84	17.84	Maximum sleeve resistance limit exceeded; CP15 1715-0042
CPT399	CPT	23.16	23.16	Maximum total thrust limit exceeded; CP15 1715-0042
CPT297	CPT	14.32	14.32	Maximum total thrust limit exceeded; CP15 1715-0042

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 5	Total in situ test recovery	: 114.48 m
Number of cone penetration test points	: 5	Total cone penetration test recovery	: 114.48 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Tom Brogan / Stephen Weston 	Fugro Representative: Werner Pretorius 

Daily Recovery List



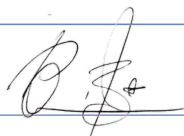

Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 09-Feb-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT365	CPT	35.03	35.03	Maximum total thrust limit exceeded; CP15 1715-0042
CPT207	CPT	17.42	17.42	Operators Decision; Obstacle; CP15 1715-0042

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 2	Total in situ test recovery	: 52.45 m
Number of cone penetration test points	: 2	Total cone penetration test recovery	: 52.45 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

GAIA TOPAZ 2.17.18 / FLD Daily recovery list with summary (Seabed) (Energinet) / 2024-02-09 10:14:56 +01:00

Remarks:	
Client Representative: Tom Brogan / Stephen Weston 	Fugro Representative: Werner Pretorius 

Daily Recovery List



Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 12-Feb-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT281	CPT	1.71	0.00	Low penetration speed; CP15 1715-0009
CPT281A	CPT	32.08	32.08	Maximum inclination limit exceeded; CP15 1715-0089
CPT322	CPT	11.70	11.70	Operator decision; Very high values and slipping; CP15 1715-0089
CPT104	CPT	28.27	28.27	Maximum total thrust limit exceeded; CP15 1715-0089
CPT270	CPT	25.02	25.02	Maximum total thrust limit exceeded; CP15 1715-0089
CPT374	CPT	16.70	16.70	Maximum total thrust limit exceeded; CP15 1715-0089
CPT090	CPT	13.84	13.84	Maximum total thrust limit exceeded; CP15 1715-0089
CPT324	CPT	28.63	28.63	Maximum total thrust limit exceeded; CP15 1715-0089
CPT146	CPT	30.57	30.57	Maximum inclination limit exceeded; CP15 1715-0089
CPT082	CPT	30.98	30.98	Maximum inclination limit exceeded; CP15 1715-0089
CPT377	CPT	20.81	20.81	Maximum inclination limit exceeded; CP15 1715-0089

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 11	Total in situ test recovery	: 238.60 m
Number of cone penetration test points	: 11	Total cone penetration test recovery	: 238.60 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Tom Brogan / Stephen Weston	Fugro Representative: Werner Pretorius

Daily Recovery List



Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 13-Feb-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT203	CPT	11.67	11.67	Operator decision; Rising values; CP15 1715-0089
CPT078	CPT	53.71	53.71	Target depth reached; CP15 1715-0009
CPT265	CPT	34.51	34.51	Maximum total thrust limit exceeded; CP15 1715-0009
CPT204	CPT	1.33	0	Low penetration speed; CP15 1715-0009
CPT204A	CPT	21.16	21.16	Maximum total thrust limit exceeded; CP15 1715-0009
CPT328	CPT	23.08	23.08	Maximum total thrust limit exceeded; CP15 1715-0009

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 6	Total in situ test recovery	: 144.13 m
Number of cone penetration test points	: 6	Total cone penetration test recovery	: 144.13 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Tom Brogan / Stephen Weston	Fugro Representative: Werner Pretorius

Daily Recovery List



Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 14-Feb-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT072	CPT	0.96	0.00	Low penetration speed; CP15 1715-0009
CPT072A	CPT	16.58	16.58	Maximum total thrust limit exceeded; CP15 1715-0009
CPT210	CPT	5.20	5.20	Other; Issues with the clamps; CP15 1715-0009
CPT210A	CPT	16.15	16.15	Other; Issues with the clamps; CP15 1715-0009
CPT190	CPT	4.62	4.62	Other; Issues with the clamps; CP15 1715-0009
CPT190A	CPT	5.90	5.90	Other; Issues with the clamps; CP15 1715-0009

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 6	Total in situ test recovery	: 48.45 m
Number of cone penetration test points	: 6	Total cone penetration test recovery	: 48.45 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Tom Brogan / Stephen Weston	Fugro Representative: Werner Pretorius

Daily Recovery List



Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 15-Feb-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT190B	CPT	34.52	34.52	Maximum total thrust limit exceeded; CP15 1715-0009
CPT066	CPT	28.78	28.78	Maximum total thrust limit exceeded; CP15 1715-0009
CPT348	CPT	23.59	23.59	Maximum total thrust limit exceeded; CP15 1715-0009
CPT159	CPT	28.05	28.05	Maximum inclination limit exceeded; CP15 1715-0009
CPT343	CPT	0.00	0.00	Other; Test aborted due to software issue; CP151715-0009
CPT343A	CPT	9.98	9.98	Coil buckled and coil was lost in the ground; CP15 1715-0009
CPT343B	CPT	10.57	10.57	Maximum total thrust limit exceeded; CP15 1715-0060

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 7	Total in situ test recovery	: 135.49 m
Number of cone penetration test points	: 7	Total cone penetration test recovery	: 135.49 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Tom Brogan / Stephen Weston	Fugro Representative: Werner Pretorius

Daily Recovery List



Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 16-Feb-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT050	CPT	43.78	43.78	Maximum total thrust limit exceeded; CP15 1715-0060
CPT046	CPT	16.86	16.86	Risk of rod buckling; CP15 1715-0060
CPT393	CPT	12.22	12.22	Risk of rod buckling; CP15 1715-0060
CPT039	CPT	16.63	16.63	Risk of rod buckling; CP15 1715-0060
CPT373	CPT	16.44	16.44	Risk of rod buckling; CP15 1715-0060
CPT398	CPT	16.10	16.10	Risk of rod buckling; CP15 1715-0033
CPT034	CPT	16.91	16.91	Risk of rod buckling; CP15 1715-0033
CPT189	CPT	12.40	12.40	Risk of rod buckling; CP15 1715-0033
CPT188	CPT	10.80	10.80	Risk of rod buckling; CP15 1715-0038
CPT313	CPT	14.71	14.71	Risk of rod buckling; CP15 1715-0038
CPT142	CPT	17.44	17.44	Risk of rod buckling; CP15 1715-0038

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 11	Total in situ test recovery	: 194.29 m
Number of cone penetration test points	: 11	Total cone penetration test recovery	: 194.29 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Tom Brogan / Stephen Weston	Fugro Representative: Werner Pretorius

Daily Recovery List



Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 17-Feb-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT042	CPT	13.64	13.64	Risk of rod buckling; CP15 1715-0038
CPT358	CPT	15.11	15.11	Risk of rod buckling; CP15 1715-0038
CPT041	CPT	15.37	15.37	Risk of rod buckling; CP15 1715-0038
CPT315	CPT	16.35	16.35	Risk of rod buckling; CP15 1715-0038
CPT196	CPT	18.37	18.37	Risk of rod buckling; CP15 1715-0038
CPT274	CPT	19.79	19.79	Risk of rod buckling; CP15 1715-0038
CPT167	CPT	14.19	14.19	Risk of rod buckling; CP15 1715-0038

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 7	Total in situ test recovery	: 112.82 m
Number of cone penetration test points	: 7	Total cone penetration test recovery	: 112.82 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Tom Brogan / Stephen Weston	Fugro Representative: Werner Pretorius

Daily Recovery List

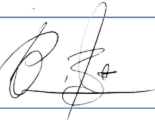



Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 18-Feb-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT049	CPT	13.63	13.63	Risk of rod buckling; CP15 1715-0038
CPT387	CPT	17.63	17.63	Risk of rod buckling; CP15 1715-0038
CPT205	CPT	22.82	22.82	Risk of rod buckling; CP15 1715-0038
CPT261	CPT	41.27	41.27	Maximum total thrust limit exceeded; CP15 1715-0038

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 4	Total in situ test recovery	: 95.35 m
Number of cone penetration test points	: 4	Total cone penetration test recovery	: 95.35 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Tom Brogan / Stephen Weston 	Fugro Representative: Werner Pretorius 

Daily Recovery List

Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 19-Feb-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT168	CPT	12.97	12.97	Other; Obstacle; CP15 1715-0038
CPT168A	CPT	53.73	53.73	Target depth reached; CP15 1715-0038
CPT057	CPT	53.66	53.66	Target depth reached; CP15 1715-0038
CPT244	CPT	42.41	42.41	Maximum total thrust limit exceeded; CP15 1715-0058
CPT059	CPT	34.91	34.91	Maximum total thrust limit exceeded; CP15 1715-0058
CPT235	CPT	29.14	29.14	Maximum total thrust limit exceeded; CP15 1715-0058
CPT144	CPT	33.22	33.22	Maximum total thrust limit exceeded; CP15 1715-0058
CPT215	CPT	16.57	16.57	Risk of rod buckling; CP15 1715-0058

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 8	Total in situ test recovery	: 276.61 m
Number of cone penetration test points	: 8	Total cone penetration test recovery	: 276.61 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Tom Brogan / Stephen Weston	Fugro Representative: Werner Pretorius

Daily Recovery List



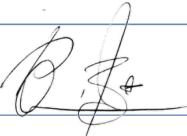

Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 20-Feb-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT383	CPT	29.93	29.93	Maximum total thrust limit exceeded; CP15 1715-0058
CPT145	CPT	41.53	41.53	Maximum total thrust limit exceeded; CP15 1715-0058
CPT212	CPT	17.46	17.46	Maximum total thrust limit exceeded; CP15 1715-0058
CPT061	CPT	23.09	23.09	Maximum total thrust limit exceeded; CP15 1715-0058
CPT256	CPT	0.00	0.00	UPC cable was hitting the side of the moonpool; CP15 1715-0058

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 5	Total in situ test recovery	: 112.01 m
Number of cone penetration test points	: 5	Total cone penetration test recovery	: 112.01 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

GAIA TOPAZ 2.17.18 / FLD Daily recovery list with summary (Seabed) (Energinet) / 2024-02-20 14:32:06 +01:00

Remarks:	
Client Representative: Tom Brogan / Stephen Weston 	Fugro Representative: Werner Pretorius 

Daily Recovery List



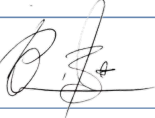

Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 24-Feb-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT256A	CPT	5.28	5.28	Other; Obstacle; CP15 1715-0062
CPT256B	CPT	15.74	15.74	Maximum inclination limit exceeded; CP15 1715-0062
CPT214	CPT	13.15	13.15	Maximum total thrust limit exceeded; CP15 1715-0017

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 3	Total in situ test recovery	: 34.17 m
Number of cone penetration test points	: 3	Total cone penetration test recovery	: 34.17 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

GAIA TOPAZ 2.17.18 / FLD Daily recovery list with summary (Seabed) (Energinet) / 2024-02-24 23:35:46 +01:00

Remarks:	
Client Representative: Tom Brogan / Stephen Weston 	Fugro Representative: Werner Pretorius 

Daily Recovery List



Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 25-Feb-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT124	CPT	31.70	31.70	Maximum total thrust limit exceeded; CP15 1715-0017
CPT347	CPT	25.42	25.42	Maximum total thrust limit exceeded; CP15 1715-0017
CPT064	CPT	38.07	38.07	Maximum total thrust limit exceeded; CP15 1715-0017
CPT291	CPT	20.97	20.97	Maximum total thrust limit exceeded; CP15 1715-0017
CPT057A	CPT	53.65	53.65	Target depth reached; CP15 1715-0027
CPT211	CPT	25.82	25.82	Maximum total thrust limit exceeded; CP15 1715-0027
CPT122	CPT	50.32	50.32	Maximum inclination limit exceeded; CP15 1715-0027
CPT068	CPT	49.09	49.09	Maximum total thrust limit exceeded; CP15 1715-0027
CPT289	CPT	34.69	34.69	Maximum total thrust limit exceeded; CP15 1715-0027
CPT323	CPT	29.92	29.92	Maximum total thrust limit exceeded; CP15 1715-0027

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 10	Total in situ test recovery	: 359.65 m
Number of cone penetration test points	: 10	Total cone penetration test recovery	: 359.65 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Tom Brogan / Stephen Weston	Fugro Representative: Werner Pretorius

Daily Recovery List

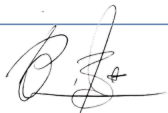



Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 26-Feb-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT246	CPT	40.44	40.44	Maximum total thrust limit exceeded; CP15 1715-0074
CPT350	CPT	29.53	29.53	Maximum total thrust limit exceeded; CP15 1715-0074
CPT073	CPT	16.05	16.05	Maximum total thrust limit exceeded; CP15 1715-0074
CPT295	CPT	14.36	14.36	Maximum total thrust limit exceeded; CP15 1715-0074
CPT363	CPT	25.84	25.84	Maximum total thrust limit exceeded; CP15 1715-0074
CPT076	CPT	28.97	28.97	Maximum total thrust limit exceeded; CP15 1715-0074
CPT305	CPT	19.12	19.12	Risk of rod buckling; CP15 1715-0074
CPT241	CPT	27.73	27.73	Maximum total thrust limit exceeded; CP15 1715-0074
CPT210B	CPT	15.67	15.67	Maximum total thrust limit exceeded; CP15 1715-0074
CPT191	CPT	9.54	9.54	Maximum total thrust limit exceeded; CP15 1715-0074

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 10	Total in situ test recovery	: 227.25 m
Number of cone penetration test points	: 10	Total cone penetration test recovery	: 227.25 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Tom Brogan / Stephen Weston 	Fugro Representative: Werner Pretorius 

Daily Recovery List



Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 27-Feb-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT191A	CPT	8.90	8.90	Maximum total thrust limit exceeded; CP15 1715-0074
CPT352	CPT	36.99	36.99	Maximum total thrust limit exceeded; CP15 1715-0074
CPT286	CPT	14.84	14.84	Maximum total thrust limit exceeded; CP15 1715-0074
CPT085	CPT	21.12	21.12	Maximum total thrust limit exceeded; CP15 1715-0074
CPT091	CPT	13.53	13.53	Risk of rod buckling; CP15 1715-0074
CPT285	CPT	30.19	30.19	Maximum total thrust limit exceeded; CP15 1715-0088
CPT087	CPT	23.26	23.26	Maximum inclination limit exceeded; CP15 1715-0088
CPT257	CPT	43.71	43.71	Maximum inclination limit exceeded; CP15 1715-0088
CPT238	CPT	32.36	32.36	Maximum total thrust limit exceeded; CP15 1715-0088

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 9	Total in situ test recovery	: 224.90 m
Number of cone penetration test points	: 9	Total cone penetration test recovery	: 224.90 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Tom Brogan / Stephen Weston	Fugro Representative: Werner Pretorius

Daily Recovery List



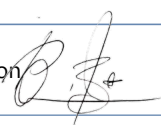

Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 01-Mar-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT371	CPT	34.83	34.83	Maximum total thrust limit exceeded; CP15 1715-0088
CPT088	CPT	28.64	28.64	Maximum total thrust limit exceeded; CP15 1715-0088
CPT361	CPT	20.24	20.24	Maximum total thrust limit exceeded; CP15 1715-0088
CPT262	CPT	20.24	20.24	Maximum total thrust limit exceeded; CP15 1715-0088
CPT083	CPT	25.06	25.06	Maximum total thrust limit exceeded; CP15 1715-0088

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 5	Total in situ test recovery	: 129.01 m
Number of cone penetration test points	: 5	Total cone penetration test recovery	: 129.01 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

TOPAZ 2.18.1 / FLD Daily recovery list with summary (Seabed) (Energinet) / 2024-03-01 22:58:56 +01:00

Remarks:	
Client Representative: Tom Brogan / Stephen Weston 	Fugro Representative: Werner Pretorius 

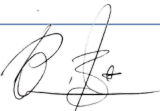

Daily Recovery List

Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 02-Mar-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT194	CPT	21.60	21.60	Maximum total thrust limit exceeded; CP15 1715-0088
CPT333	CPT	15.48	15.48	Other; Obstacle; CP15 1715-0088
CPT095	CPT	11.76	11.76	Other; Obstacle; CP15 1715-0023
CPT381	CPT	25.33	25.33	Maximum total thrust limit exceeded; CP15 1715-0021
CPT092	CPT	26.33	26.33	Maximum total thrust limit exceeded; CP15 1715-0021
CPT243	CPT	25.68	25.68	Maximum total thrust limit exceeded; CP15 1715-0021
CPT097	CPT	19.07	19.07	Risk of rod buckling; CP15 1715-0021
CPT282	CPT	15.70	15.70	Maximum total thrust limit exceeded; CP15 1715-0021
CPT096	CPT	23.00	23.00	Risk of rod buckling; CP15 1715-0021
CPT237	CPT	26.82	26.82	Maximum total thrust limit exceeded; CP15 1715-0021

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 10	Total in situ test recovery	: 210.77 m
Number of cone penetration test points	: 10	Total cone penetration test recovery	: 210.77 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Tom Brogan / Stephen Weston 	Fugro Representative: Werner Pretorius 

Daily Recovery List

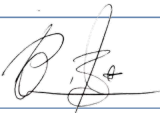



Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 03-Mar-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT192	CPT	5.59	5.59	Maximum total thrust limit exceeded; CP15 1715-0021
CPT192A	CPT	6.30	6.30	Maximum total thrust limit exceeded; CP15 1715-0021
CPT326	CPT	9.91	9.91	Coil Buckled; CP15 1715-0021
CPT193	CPT	26.99	26.99	Other; Coil buckled and lost connection with cone; CP15 1715-0021
CPT121	CPT	10.02	10.02	Risk of rod buckling; CP15 1715-0030
CPT229	CPT	6.23	6.23	Risk of rod buckling; CP15 1715-0030
CPT360	CPT	18.93	18.93	Risk of rod buckling; CP15 1715-0030

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 7	Total in situ test recovery	: 83.97 m
Number of cone penetration test points	: 7	Total cone penetration test recovery	: 83.97 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Tom Brogan / Stephen Weston 	Fugro Representative: Werner Pretorius 

Daily Recovery List

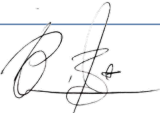



Project ID : F217703 - Subarea 2
 Project title : Danish Offshore Wind 2030 - North Sea I - Subarea 2
 Client : Energinet
 Project area : Danish Sector, North Sea

Date : 04-Mar-2024

Location	Type	Penetration [m]	Recovery [m]	Termination reason and comment
CPT195	CPT	27.59	27.59	Risk of rod buckling; CP15 1715-0030
CPT148	CPT	31.67	31.67	Risk of rod buckling; CP15 1715-0030
CPT149	CPT	28.62	28.62	Risk of rod buckling; CP15 1715-0030
CPT150	CPT	19.35	19.35	Risk of rod buckling; CP15 1715-0030
CPT355	CPT	6.60	6.60	Maximum total thrust limit exceeded; CP15 1715-0030
CPT158	CPT	11.30	11.30	Maximum total thrust limit exceeded; CP15 1715-0030
CPT301	CPT	41.12	41.12	Maximum inclination limit exceeded; CP15 1715-0030
CPT123	CPT	22.45	22.45	Maximum total thrust limit exceeded; CP15 1715-0030
CPT300	CPT	27.36	27.36	Maximum total thrust limit exceeded; CP15 1715-0030
CPT349	CPT	16.36	16.36	Risk of rod buckling; CP15 1715-0030
CPT367	CPT	18.50	18.50	Maximum total thrust limit exceeded; CP15 1715-0030

Number of vibrocore points	: 0	Total vibrocore recovery	: 0.00 m
Number of in situ test points	: 11	Total in situ test recovery	: 250.92 m
Number of cone penetration test points	: 11	Total cone penetration test recovery	: 250.92 m
Number of seismic cone penetration test points	: 0	Total seismic cone penetration test recovery	: 0.00 m
Number of thermal cone penetration test points	: 0	Total thermal cone penetration test recovery	: 0.00 m

Remarks:	
Client Representative: Tom Brogan / Stephen Weston 	Fugro Representative: Werner Pretorius 

Daily Recovery List



C.2 Operator Logs

Operator logs have been shared with Energinet Eltransmission A/S separately.

Appendix D

System Performance

Contents Appendix D: System Performance

- D.1: Cone Penetrometer Calibration
- D.2: Positioning Survey Equipment Calibration
- D.3: Survey Mobilisation and Calibration Report
- D.4: Lost and Damaged Equipment List and Site Clearance Reports

D.1 Cone Penetrometer Calibration

List of Plates

Cone Penetrometer Calibration Certificates:

486 Plates

Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031885

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E1M4-V1
Serial Number 1715-0074

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 04-Dec-2023

Calibrate before 04-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 05-Dec-2023

This certificate is issued provided that Fugro assumes no liability.

Ruud Schrijvers
Deputy Manager Transducer Workshop

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Fugro Transducer Workshop, P.O. Box 130, 2630 AC Nootdorp, The Netherlands, Phone +31-70-3111444, www.fugro.com
Page 1 of 6



Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0074
Electronics	159
Node Type	7001
Hardware Version	5.01
Software Version	8.01

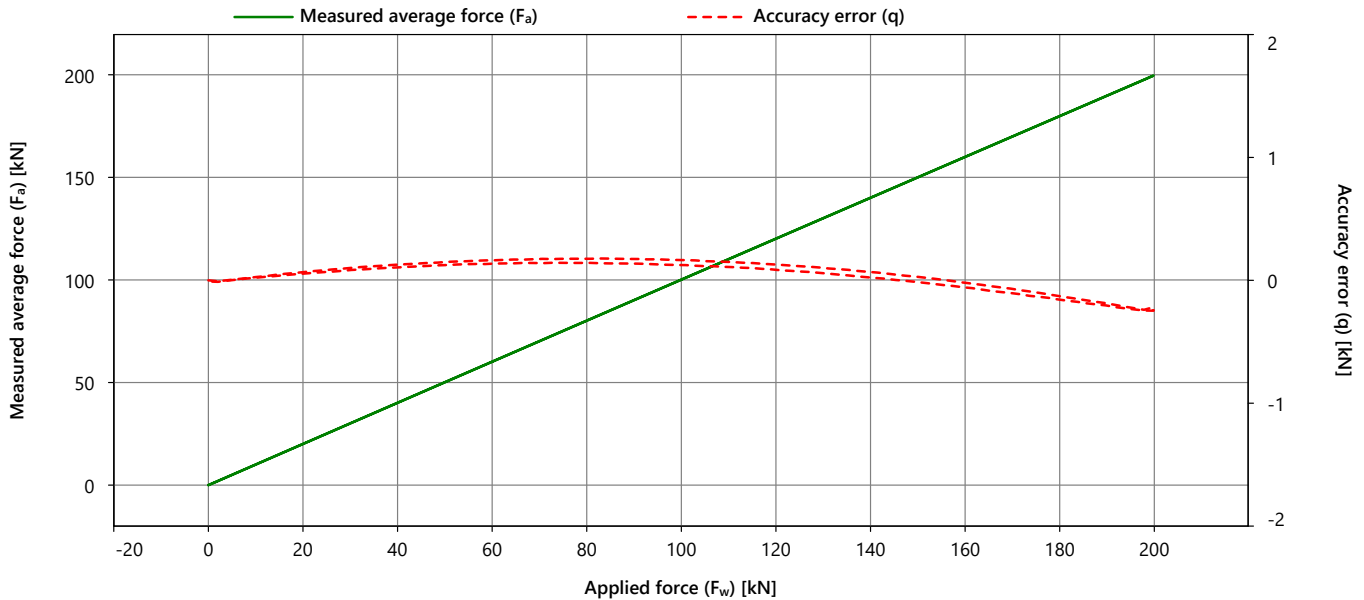
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031885

Calibration Details	
Calibration Date	04 Dec 2023 09:59:17
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.216
Max repeatability error (b)	[kN]	0.022
Max reversibility error (v)	[kN]	0.043
Zero load error (F _{c0})	[kN]	0.009
Zero load offset (F ₀)	[kN]	-0.010
Resolution	[kN]	8.65E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.004	0.001	-0.005	0.000	0.000	0.008		0.023
40.000	40.131	40.127	40.125	40.128	0.128	0.006	-0.023	0.142
80.000	80.177	80.173	80.174	80.175	0.175	0.004	-0.033	0.265
120.000	120.127	120.129	120.128	120.128	0.128	0.002	-0.043	0.388
160.000	159.978	159.983	159.980	159.980	-0.020	0.005	-0.039	0.510
200.000	199.795	199.773	199.786	199.784	-0.216	0.022		0.631
160.000	159.946	159.941	159.939	159.942	-0.058	0.006	-0.039	0.510
120.000	120.089	120.083	120.083	120.085	0.085	0.006	-0.043	0.388
80.000	80.145	80.142	80.139	80.142	0.142	0.006	-0.033	0.265
40.000	40.109	40.104	40.102	40.105	0.105	0.007	-0.023	0.142
0.000	-0.006	-0.010	-0.013	-0.009	-0.009	0.007		0.022

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0074
Electronics	159
Node Type	7001
Hardware Version	5.01
Software Version	8.01

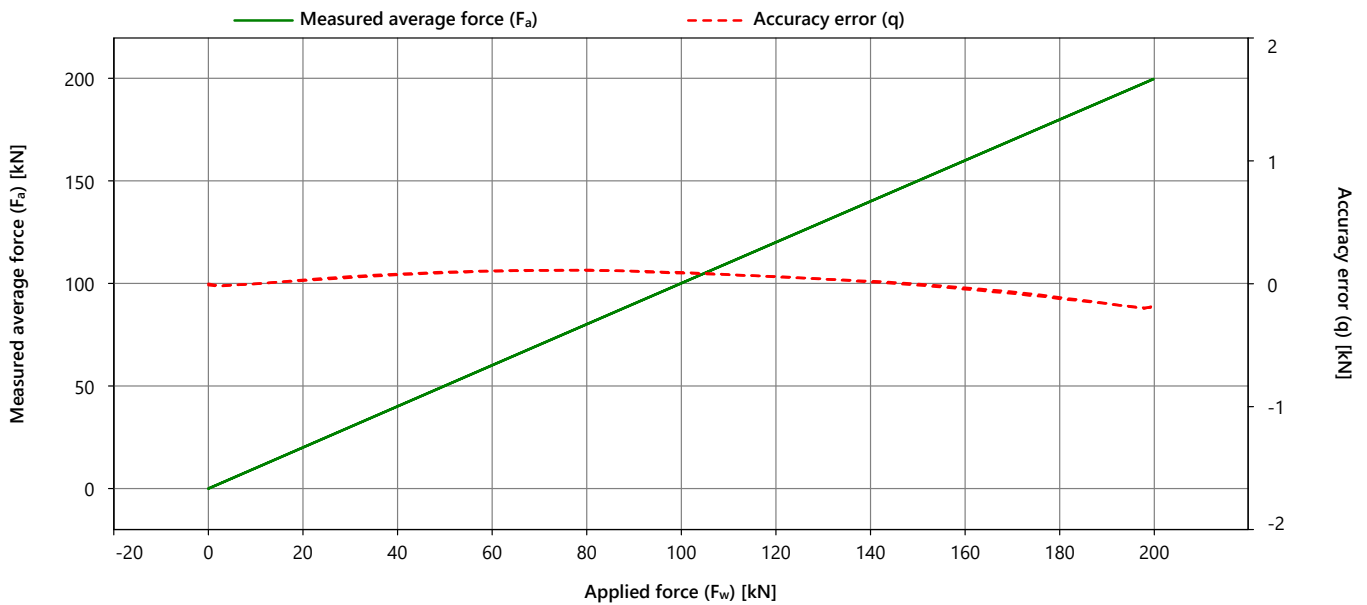
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031885

Calibration Details	
Calibration Date	04 Dec 2023 09:59:17
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.177
Max repeatability error (b)	[kN]	0.032
Max reversibility error (v)	[kN]	0.012
Zero load error (F _{c0})	[kN]	0.011
Zero load offset (F ₀)	[kN]	0.007
Resolution	[kN]	8.66E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.032



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.007	0.001	-0.008	0.000	0.000	0.016		0.033
40.000	40.080	40.069	40.071	40.073	0.073	0.010	0.006	0.140
80.000	80.114	80.102	80.107	80.108	0.108	0.012	0.005	0.262
120.000	120.065	120.054	120.060	120.059	0.059	0.011	-0.004	0.385
160.000	159.971	159.964	159.968	159.968	-0.032	0.007	-0.012	0.508
200.000	199.838	199.806	199.827	199.823	-0.177	0.032		0.632
160.000	159.962	159.951	159.953	159.955	-0.045	0.011	-0.012	0.508
120.000	120.065	120.049	120.052	120.055	0.055	0.016	-0.004	0.385
80.000	80.120	80.108	80.110	80.113	0.113	0.013	0.005	0.262
40.000	40.087	40.075	40.075	40.079	0.079	0.012	0.006	0.140
0.000	-0.008	-0.011	-0.013	-0.011	-0.011	0.005		0.023

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0074
Electronics	159
Node Type	7001
Hardware Version	5.01
Software Version	8.01

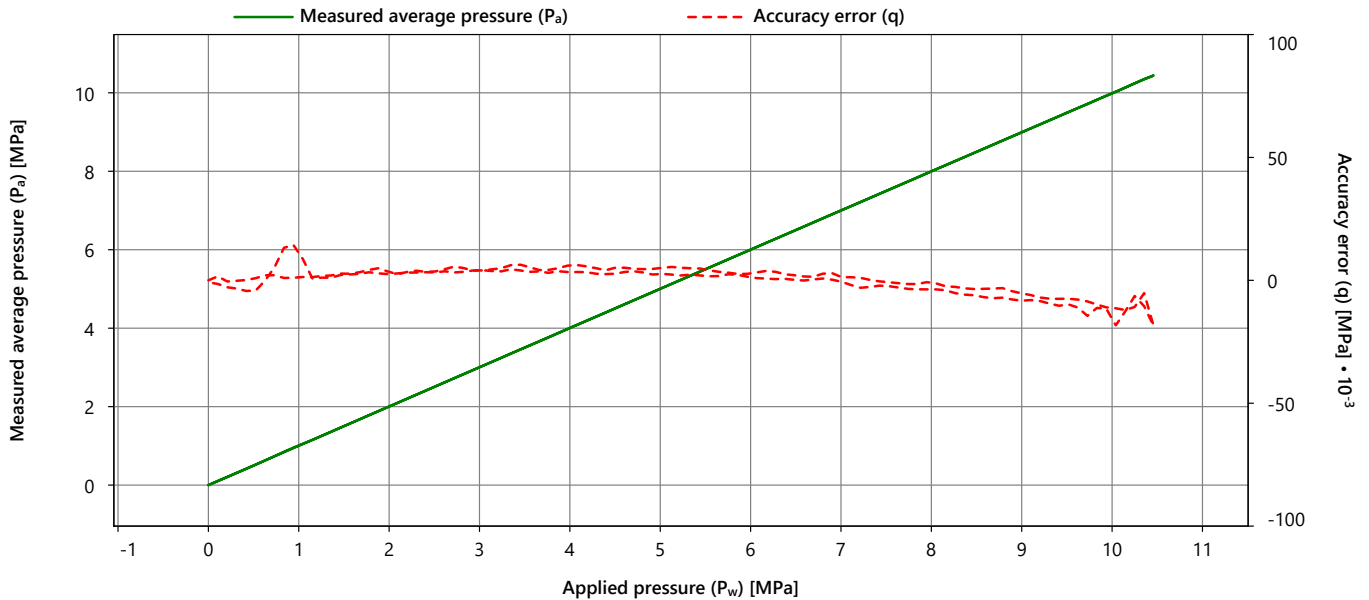
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031885

Calibration Details	
Calibration Date	04 Dec 2023 12:11:30
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.011
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	-0.005
Resolution	[MPa]	2.08E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.001		0.003
2.000	2.005	2.003	2.003	2.003	0.003	0.002	-0.001	0.004
4.000	4.005	4.007	4.006	4.006	0.006	0.002	-0.003	0.007
6.000	6.003	6.003	6.003	6.003	0.003	0.000	-0.002	0.006
8.000	7.998	8.000	8.000	7.999	-0.001	0.002	-0.003	0.008
10.000	9.989	9.988	9.989	9.989	-0.011	0.001		0.008
8.000	7.997	7.998	7.994	7.996	-0.004	0.004	-0.003	0.009
6.000	6.001	6.002	6.001	6.001	0.001	0.001	-0.002	0.006
4.000	4.003	4.003	4.004	4.003	0.003	0.001	-0.003	0.006
2.000	2.003	2.003	2.001	2.003	0.003	0.002	-0.001	0.004
0.000	-0.001	-0.001	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0074
Electronics	159
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

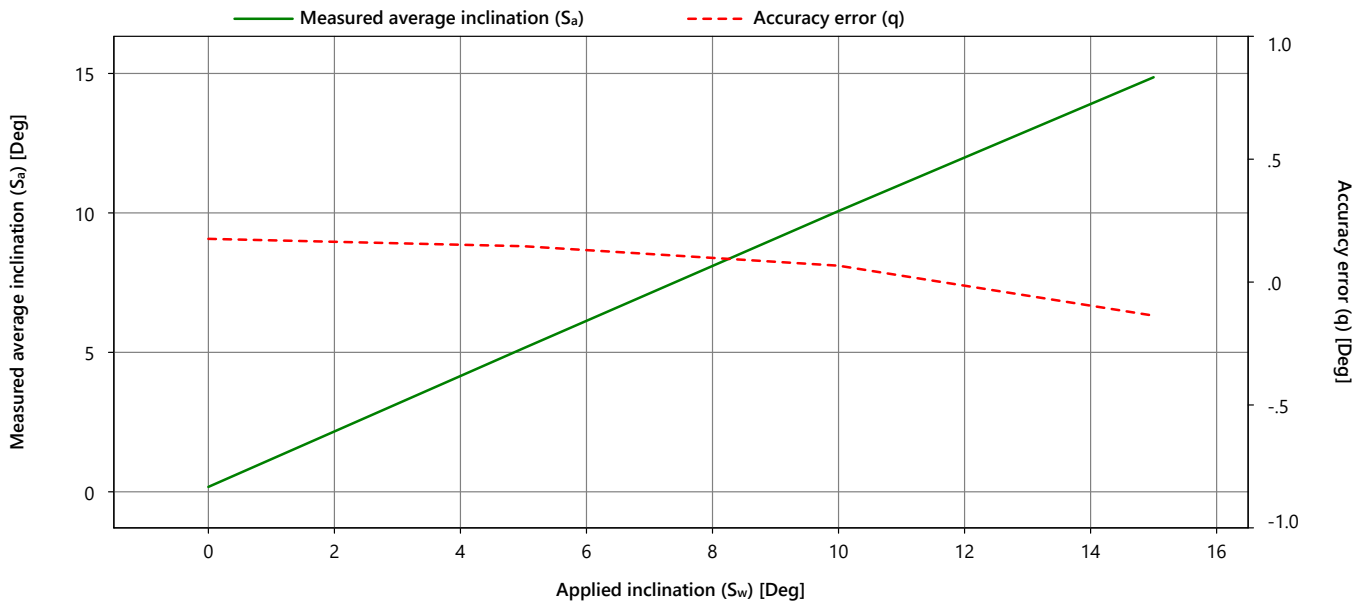
Certificate Number
FCN23031885

Calibration Details	
Calibration Date	04 Dec 2023 10:03:20
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.3E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.7
5.0	5.0	5.2	5.2	5.1	0.1	0.2	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.9	14.9	14.8	14.9	-0.1	0.0	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031885

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E1M4-V1
Serial Number	1715-0074

Appendix Applicable to
Certificate Number
FCN23031885

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

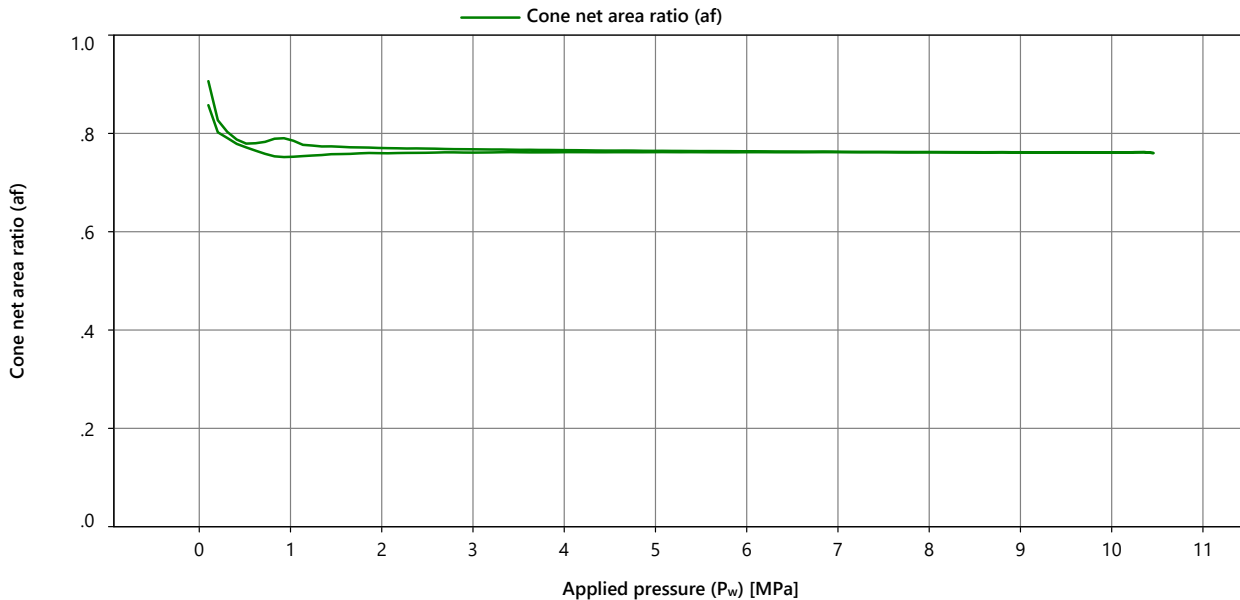
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E1M4-V1	Serial Number	3257-0002
Serial Number	1715-0074	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	159	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 12:11:30
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23031885

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.756	0.760	0.763	0.760
4.000	0.759	0.762	0.764	0.762
6.000	0.760	0.762	0.763	0.762
8.000	0.761	0.762	0.762	0.762
10.000	0.761	0.762	0.762	0.762
8.000	0.761	0.762	0.763	0.762
6.000	0.762	0.764	0.765	0.764
4.000	0.764	0.766	0.768	0.766
2.000	0.767	0.771	0.773	0.770

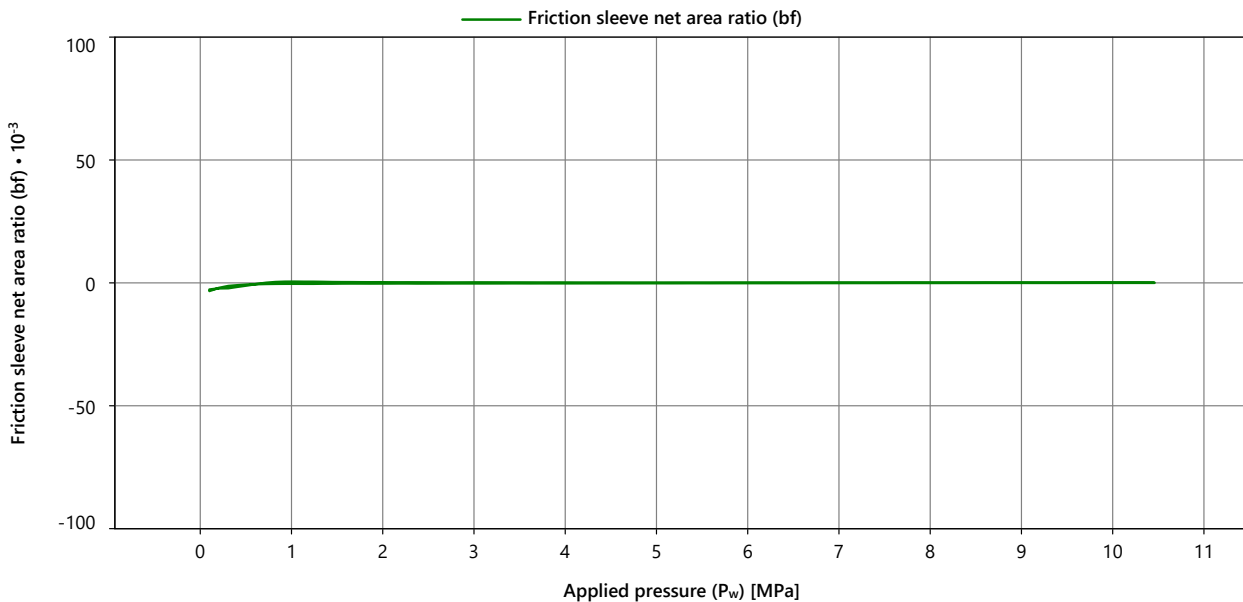
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E1M4-V1	Serial Number	3257-0002
Serial Number	1715-0074	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	159	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 12:11:31
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

**Appendix Applicable to
Certificate Number
FCN23031885**

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00003

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031885

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
---	----------

Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032119

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0023

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 04-Dec-2023

Calibrate before 04-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	13.6 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	14.3 $\mu\text{V/V}$	0.13 %	0.03 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	7.26 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	8.69 $\mu\text{V/V}$	0.14 %	0.07 %
Pore 2 [Pressure]	1.59 mV/V/MPa	573 $\mu\text{V/V}$	1.59 mV/V/MPa	563 $\mu\text{V/V}$	0.07 %	-0.06 %

Nootdorp, 05-Dec-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0023
Electronics	7604
Node Type	7001
Hardware Version	5.01
Software Version	8.01

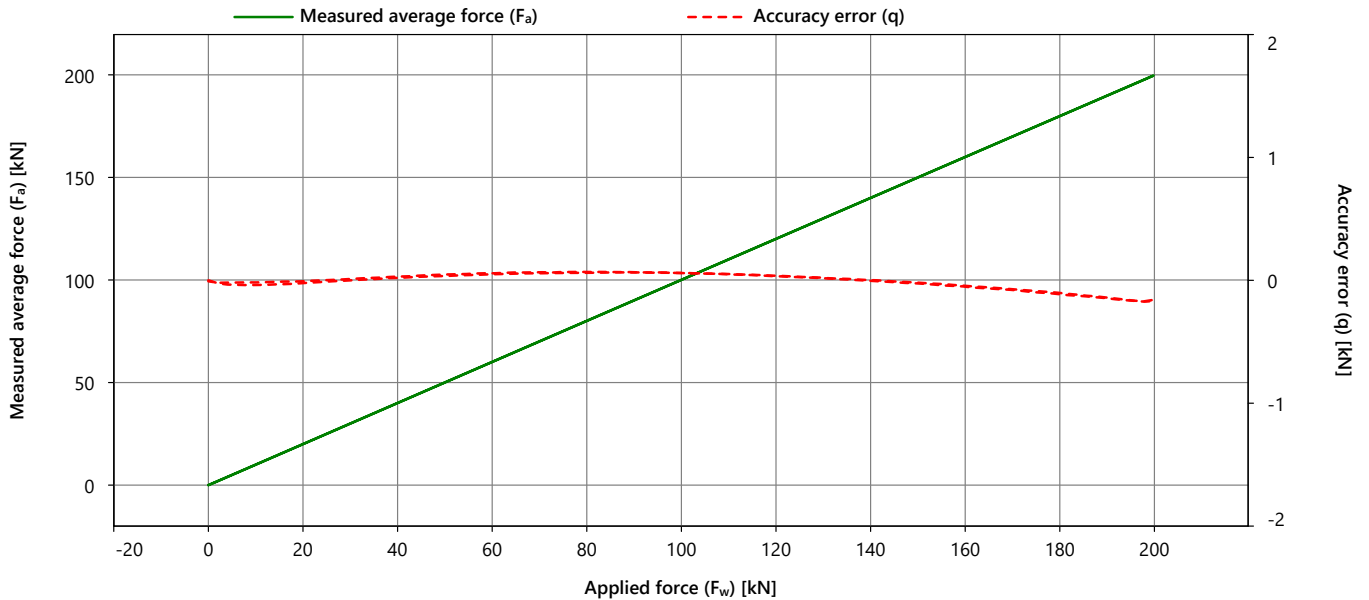
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032119

Calibration Details	
Calibration Date	04 Dec 2023 07:41:27
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.156
Max repeatability error (b)	[kN]	0.152
Max reversibility error (v)	[kN]	0.011
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	0.022
Resolution	[kN]	8.56E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.004	-0.002	-0.002	0.000	0.000	0.006		0.020
40.000	40.081	40.015	39.962	40.019	0.019	0.119	0.011	0.235
80.000	80.128	80.058	79.998	80.061	0.061	0.131	0.007	0.313
120.000	120.109	120.033	119.969	120.037	0.037	0.140	-0.003	0.419
160.000	160.028	159.950	159.887	159.955	-0.045	0.142	-0.007	0.534
200.000	199.925	199.833	199.773	199.844	-0.156	0.152		0.656
160.000	160.023	159.942	159.881	159.949	-0.051	0.142	-0.007	0.535
120.000	120.105	120.029	119.968	120.034	0.034	0.137	-0.003	0.417
80.000	80.130	80.064	80.009	80.068	0.068	0.121	0.007	0.301
40.000	40.084	40.026	39.981	40.030	0.030	0.103	0.011	0.206
0.000	-0.006	-0.008	-0.009	-0.008	-0.008	0.003		0.019

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0023
Electronics	7604
Node Type	7001
Hardware Version	5.01
Software Version	8.01

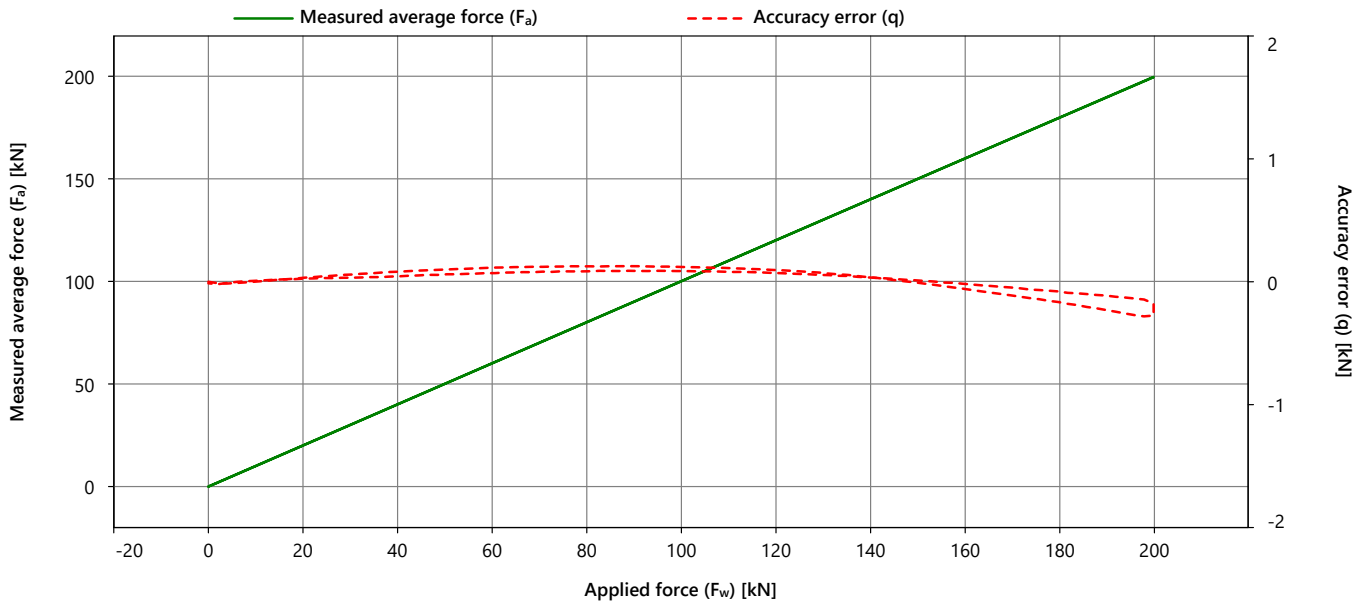
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032119

Calibration Details	
Calibration Date	04 Dec 2023 07:41:27
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.273
Max repeatability error (b)	[kN]	0.026
Max reversibility error (v)	[kN]	0.041
Zero load error (F _{c0})	[kN]	0.012
Zero load offset (F ₀)	[kN]	0.003
Resolution	[kN]	8.6E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.048



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.007	-0.002	-0.005	0.000	0.000	0.012		0.029
40.000	40.087	40.080	40.077	40.081	0.081	0.010	-0.037	0.146
80.000	80.133	80.127	80.117	80.126	0.126	0.015	-0.040	0.267
120.000	120.103	120.091	120.090	120.095	0.095	0.013	-0.024	0.386
160.000	159.944	159.936	159.942	159.941	-0.059	0.008	0.041	0.510
200.000	199.734	199.715	199.732	199.727	-0.273	0.020		0.631
160.000	159.981	159.976	159.990	159.982	-0.018	0.014	0.041	0.510
120.000	120.060	120.068	120.085	120.071	0.071	0.025	-0.024	0.387
80.000	80.073	80.083	80.099	80.085	0.085	0.026	-0.040	0.268
40.000	40.048	40.039	40.046	40.044	0.044	0.009	-0.037	0.146
0.000	-0.009	-0.014	-0.014	-0.012	-0.012	0.005		0.025

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0023
Electronics	7604
Node Type	7001
Hardware Version	5.01
Software Version	8.01

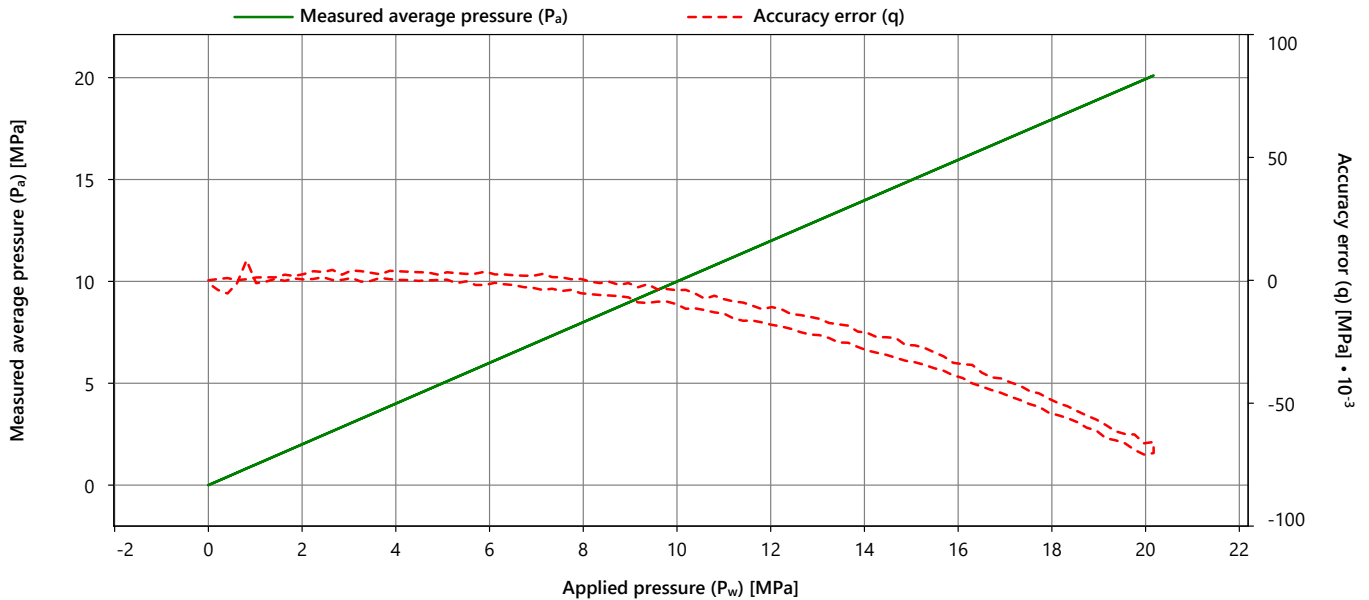
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23032119

Calibration Details	
Calibration Date	04 Dec 2023 10:18:25
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.006
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.006
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	0.001
Resolution	[MPa]	4.68E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.002	-0.002	0.000	0.000	0.000	0.004		0.009
2.000	2.002	2.002	2.002	2.002	0.002	0.000	-0.002	0.004
4.000	4.005	4.004	4.002	4.004	0.004	0.003	-0.004	0.008
6.000	6.004	6.001	6.004	6.003	0.003	0.003	-0.005	0.010
8.000	8.000	8.001	7.999	8.000	0.000	0.002	-0.006	0.011
10.000	9.996	9.996	9.996	9.996	-0.004	0.001		0.007
8.000	7.994	7.996	7.993	7.994	-0.006	0.003	-0.006	0.011
6.000	5.998	5.998	5.998	5.998	-0.002	0.001	-0.005	0.009
4.000	3.999	4.001	3.999	4.000	0.000	0.002	-0.004	0.008
2.000	2.001	2.000	2.000	2.000	0.000	0.001	-0.002	0.005
0.000	-0.001	-0.001	-0.001	-0.001	-0.001	0.001		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0023
Electronics	7604
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

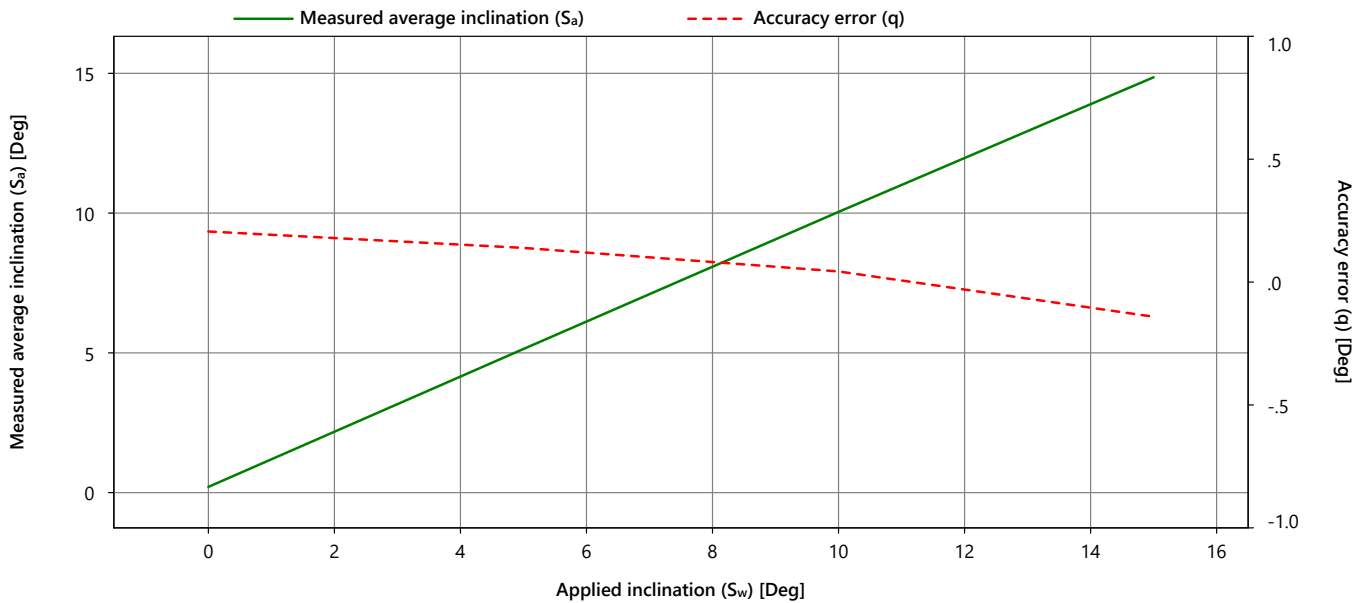
Certificate Number
FCN23032119

Calibration Details	
Calibration Date	04 Dec 2023 07:50:24
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.29E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.2	0.3	0.2	0.2	0.2	0.7
5.0	5.0	5.2	5.2	5.1	0.1	0.2	0.7
10.0	10.0	10.1	10.1	10.0	0.0	0.1	0.7
15.0	14.8	14.9	14.9	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23032119

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Fugro Transducer Workshop, P.O. Box 130, 2630 AC Nootdorp, The Netherlands, Phone +31-70-3111444, www.fugro.com
Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0023

Appendix Applicable to
Certificate Number
FCN23032119

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

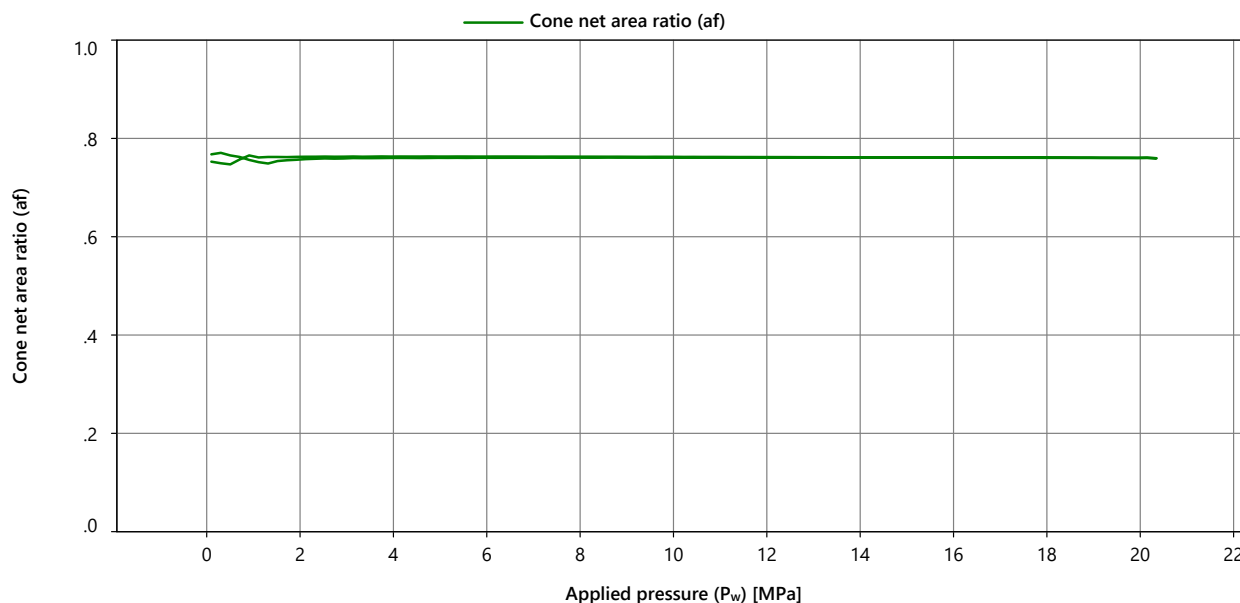
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0023	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7604	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 10:18:25
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032119

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.757	0.757	0.757	0.757
4.000	0.761	0.760	0.760	0.760
6.000	0.761	0.760	0.761	0.761
8.000	0.761	0.761	0.761	0.761
10.000	0.761	0.761	0.761	0.761
8.000	0.763	0.763	0.763	0.763
6.000	0.763	0.763	0.763	0.763
4.000	0.763	0.763	0.763	0.763
2.000	0.763	0.762	0.763	0.763

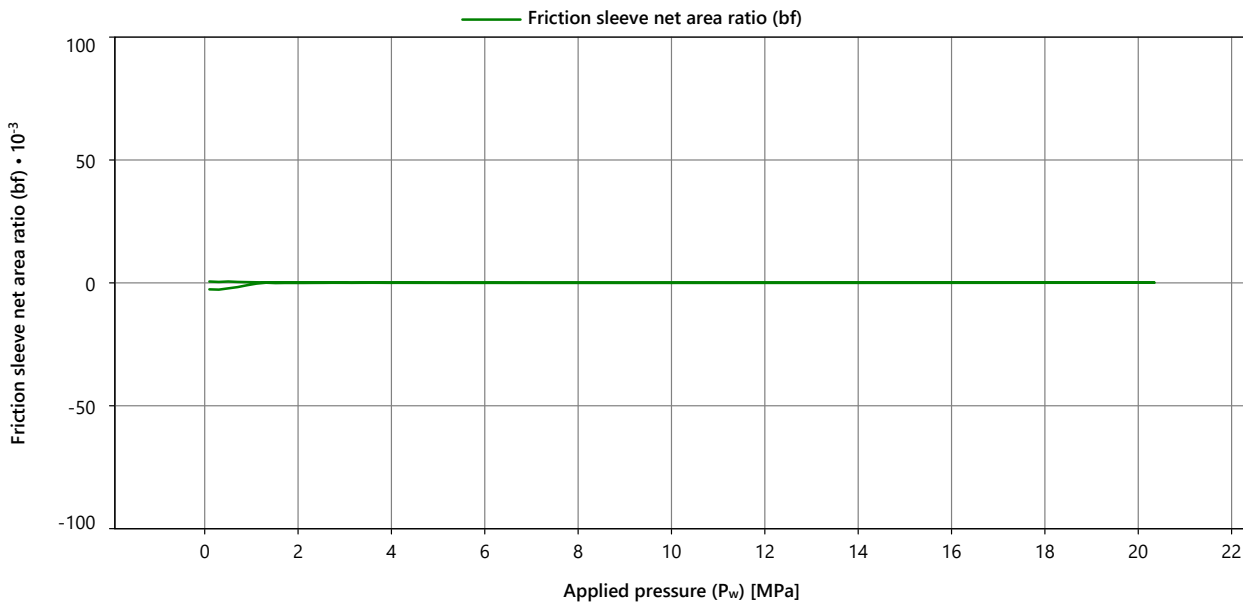
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0023	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7604	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 10:18:25
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

**Appendix Applicable to
Certificate Number
FCN23032119**

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00009

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23032119

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032125

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0042

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration period 04-Dec-2023 through 05-Dec-2023

Calibrate before 04-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	3.00 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	6.93 $\mu\text{V/V}$	0.10 %	0.18 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	3.76 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	6.88 $\mu\text{V/V}$	0.02 %	0.14 %
Pore 2 [Pressure]	3.33 mV/V/MPa	0.946 mV/V	3.26 mV/V/MPa	1.22 mV/V	-2.31 %	0.83 %

Nootdorp, 06-Dec-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0042
Electronics	7694
Node Type	7001
Hardware Version	5.01
Software Version	8.01

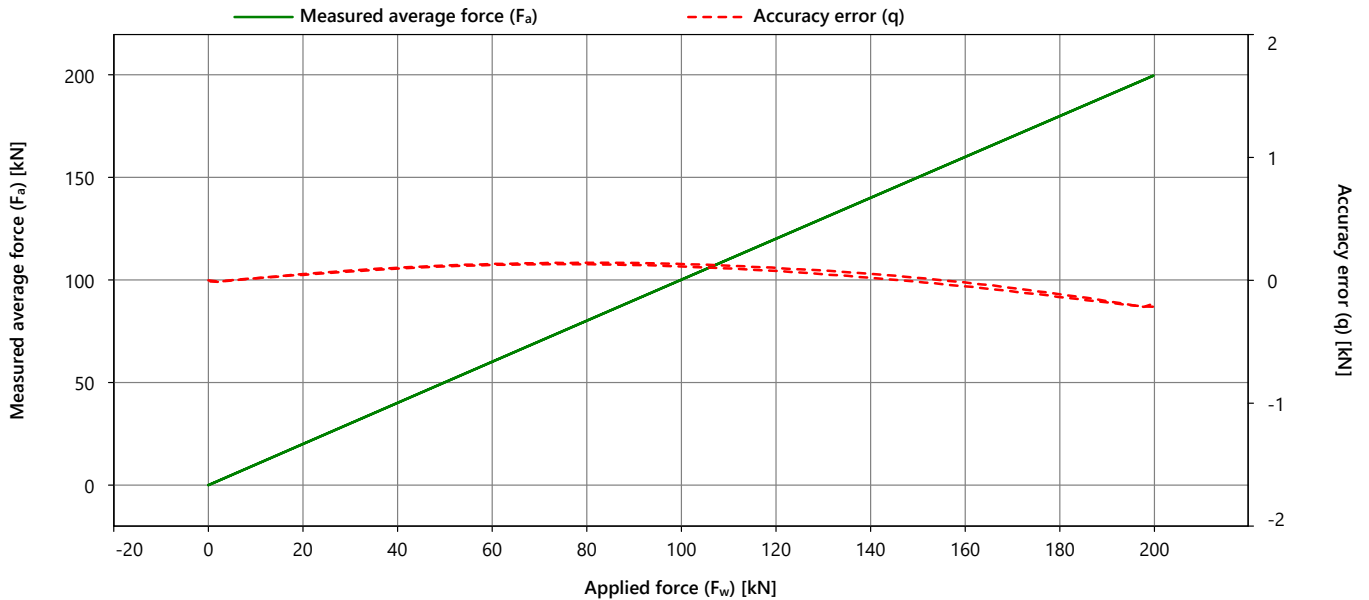
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032125

Calibration Details	
Calibration Date	04 Dec 2023 09:21:46
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.187
Max repeatability error (b)	[kN]	0.026
Max reversibility error (v)	[kN]	0.032
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	-0.009
Resolution	[kN]	8.53E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.003	0.000	-0.003	0.000	0.000	0.006		0.021
40.000	40.108	40.099	40.098	40.102	0.102	0.009	-0.006	0.139
80.000	80.149	80.138	80.141	80.143	0.143	0.011	-0.012	0.262
120.000	120.110	120.099	120.096	120.102	0.102	0.015	-0.024	0.386
160.000	159.991	159.979	159.978	159.983	-0.017	0.013	-0.032	0.509
200.000	199.824	199.818	199.798	199.813	-0.187	0.026		0.631
160.000	159.957	159.945	159.951	159.951	-0.049	0.012	-0.032	0.509
120.000	120.087	120.071	120.075	120.078	0.078	0.015	-0.024	0.386
80.000	80.139	80.125	80.128	80.131	0.131	0.013	-0.012	0.262
40.000	40.103	40.090	40.094	40.096	0.096	0.013	-0.006	0.140
0.000	-0.005	-0.009	-0.011	-0.008	-0.008	0.006		0.021

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0042
Electronics	7694
Node Type	7001
Hardware Version	5.01
Software Version	8.01

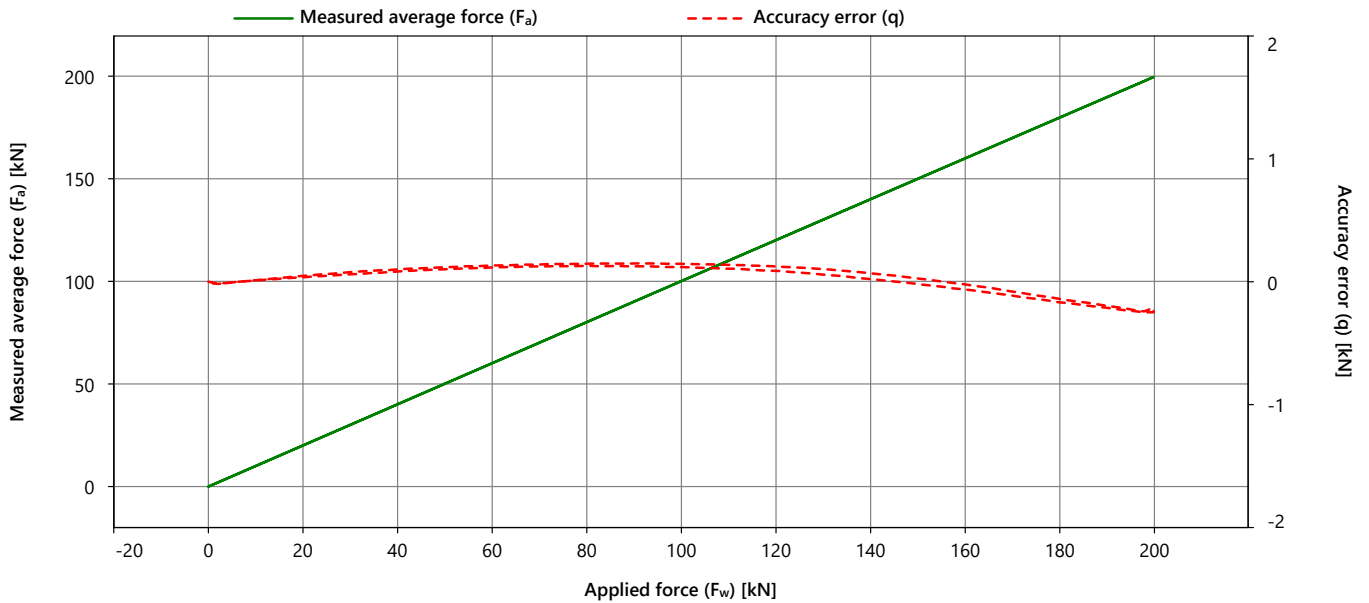
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032125

Calibration Details	
Calibration Date	04 Dec 2023 09:21:46
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.210
Max repeatability error (b)	[kN]	0.024
Max reversibility error (v)	[kN]	0.041
Zero load error (F _{c0})	[kN]	0.011
Zero load offset (F ₀)	[kN]	-0.012
Resolution	[kN]	8.58E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.018



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.004	0.001	-0.004	0.000	0.000	0.008		0.024
40.000	40.105	40.099	40.097	40.100	0.100	0.008	-0.017	0.141
80.000	80.151	80.145	80.144	80.147	0.147	0.007	-0.018	0.263
120.000	120.130	120.123	120.119	120.124	0.124	0.010	-0.035	0.387
160.000	159.981	159.977	159.977	159.978	-0.022	0.005	-0.041	0.510
200.000	199.799	199.797	199.775	199.790	-0.210	0.024		0.631
160.000	159.938	159.934	159.939	159.937	-0.063	0.005	-0.041	0.510
120.000	120.094	120.087	120.087	120.089	0.089	0.007	-0.035	0.387
80.000	80.136	80.126	80.126	80.129	0.129	0.010	-0.018	0.263
40.000	40.088	40.079	40.083	40.084	0.084	0.009	-0.017	0.141
0.000	-0.008	-0.011	-0.013	-0.011	-0.011	0.005		0.022

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0042
Electronics	7694
Node Type	7001
Hardware Version	5.01
Software Version	8.01

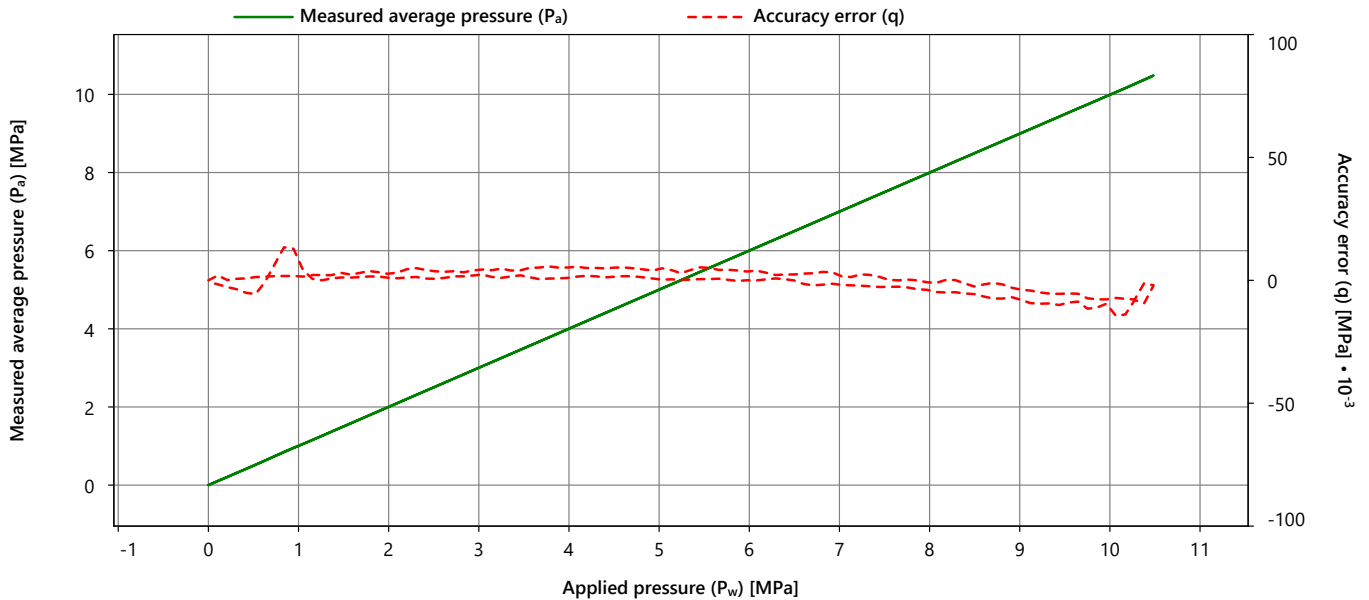
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23032125

Calibration Details	
Calibration Date	04 Dec 2023 11:13:13
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.008
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.004
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	-0.017
Resolution	[MPa]	2.29E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.002	2.004	2.002	2.003	0.003	0.002	-0.002	0.005
4.000	4.004	4.007	4.005	4.005	0.005	0.002	-0.004	0.009
6.000	6.006	6.002	6.003	6.004	0.004	0.004	-0.003	0.009
8.000	7.999	7.999	7.999	7.999	-0.001	0.001	-0.003	0.008
10.000	9.992	9.994	9.991	9.992	-0.008	0.003		0.009
8.000	7.997	7.996	7.995	7.996	-0.004	0.003	-0.003	0.008
6.000	6.000	6.000	6.000	6.000	0.000	0.001	-0.003	0.007
4.000	4.002	4.000	4.002	4.001	0.001	0.002	-0.004	0.008
2.000	2.002	2.000	2.001	2.001	0.001	0.001	-0.002	0.004
0.000	-0.001	0.000	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0042
Electronics	7694
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

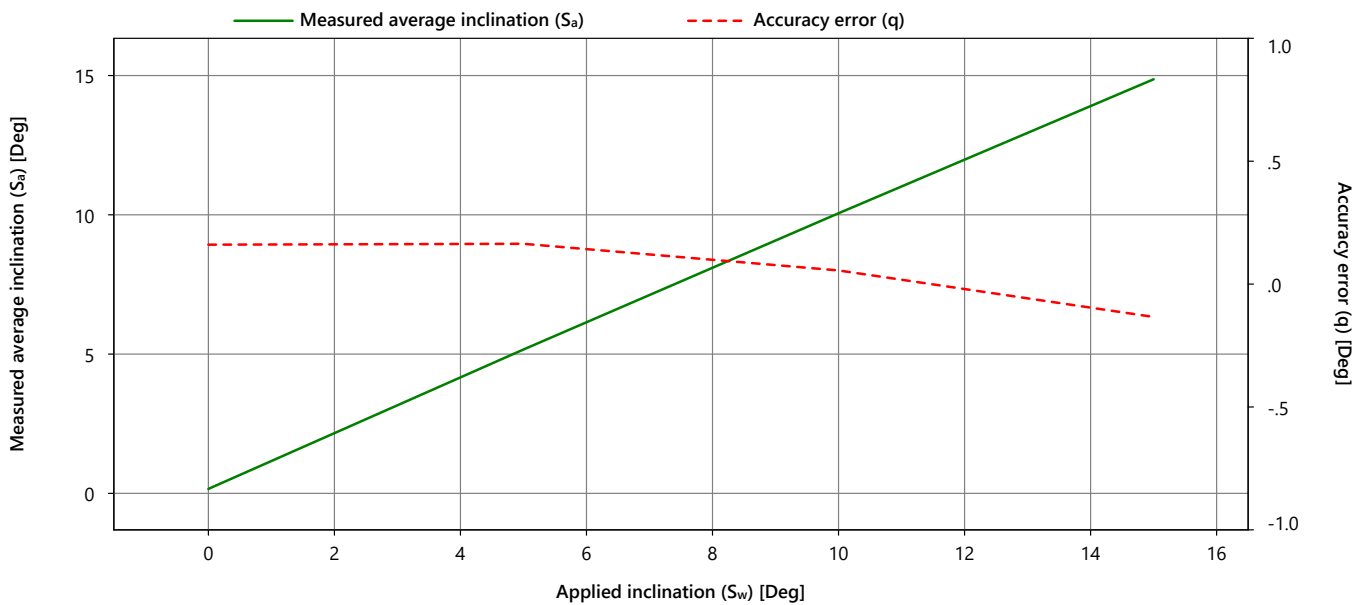
Certificate Number
FCN23032125

Calibration Details	
Calibration Date	04 Dec 2023 09:25:30
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.0
Resolution	[Deg]	1.31E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.8
5.0	5.0	5.2	5.2	5.2	0.2	0.2	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.2	0.7
15.0	14.9	14.8	14.9	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23032125

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0042

Appendix Applicable to
Certificate Number
FCN23032125

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

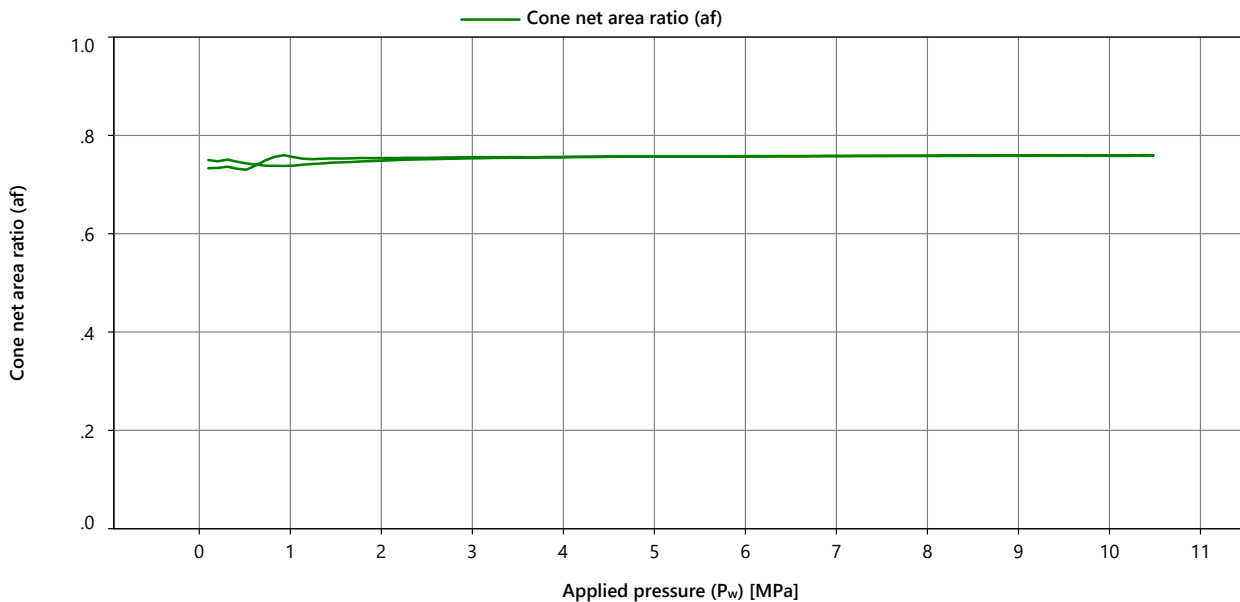
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0042	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7694	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 11:13:13
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032125

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.748	0.749	0.748	0.748
4.000	0.756	0.756	0.756	0.756
6.000	0.758	0.758	0.758	0.758
8.000	0.759	0.759	0.759	0.759
10.000	0.759	0.759	0.759	0.759
8.000	0.758	0.758	0.758	0.758
6.000	0.757	0.757	0.757	0.757
4.000	0.756	0.756	0.756	0.756
2.000	0.755	0.754	0.754	0.754

Friction Sleeve Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0042
Electronics	7694
Node Type	7001
Hardware Version	5.01
Software Version	8.01

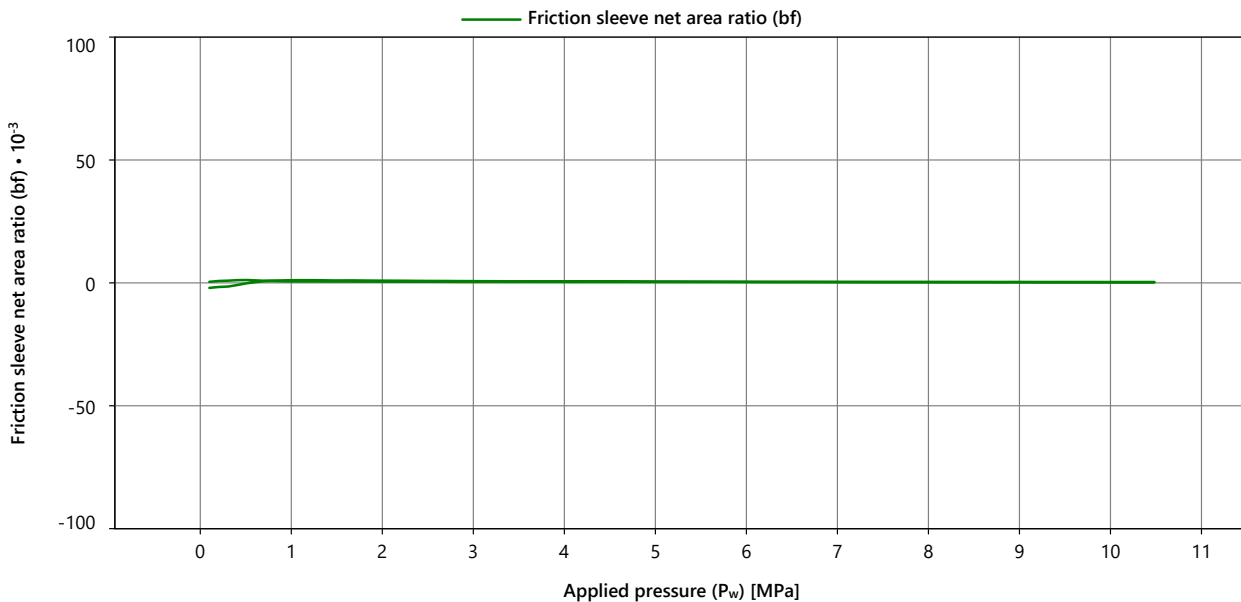
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23032125

Measurement Details	
Measurement Date	04 Dec 2023 11:13:13
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00030

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.001	0.001	0.001	0.001
4.000	0.001	0.001	0.001	0.001
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.001	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23032125

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032115

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0058

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration	20.5 ± 3 °C
Atmospheric pressure during calibration	1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 04-Dec-2023

Calibrate before 04-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.7 $\mu\text{V/V/kN}$	-1.34 $\mu\text{V/V}$	10.7 $\mu\text{V/V/kN}$	4.05 $\mu\text{V/V}$	0.08 %	0.25 %
Cone+Fric. [Force]	10.7 $\mu\text{V/V/kN}$	1.52 $\mu\text{V/V}$	10.7 $\mu\text{V/V/kN}$	6.49 $\mu\text{V/V}$	0.07 %	0.23 %
Pore 2 [Pressure]	3.32 mV/V/MPa	1.26 mV/V	3.32 mV/V/MPa	1.25 mV/V	-0.01 %	-0.02 %

Nootdorp, 05-Dec-2023

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Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0058
Electronics	9334
Node Type	7001
Hardware Version	6.00
Software Version	8.01

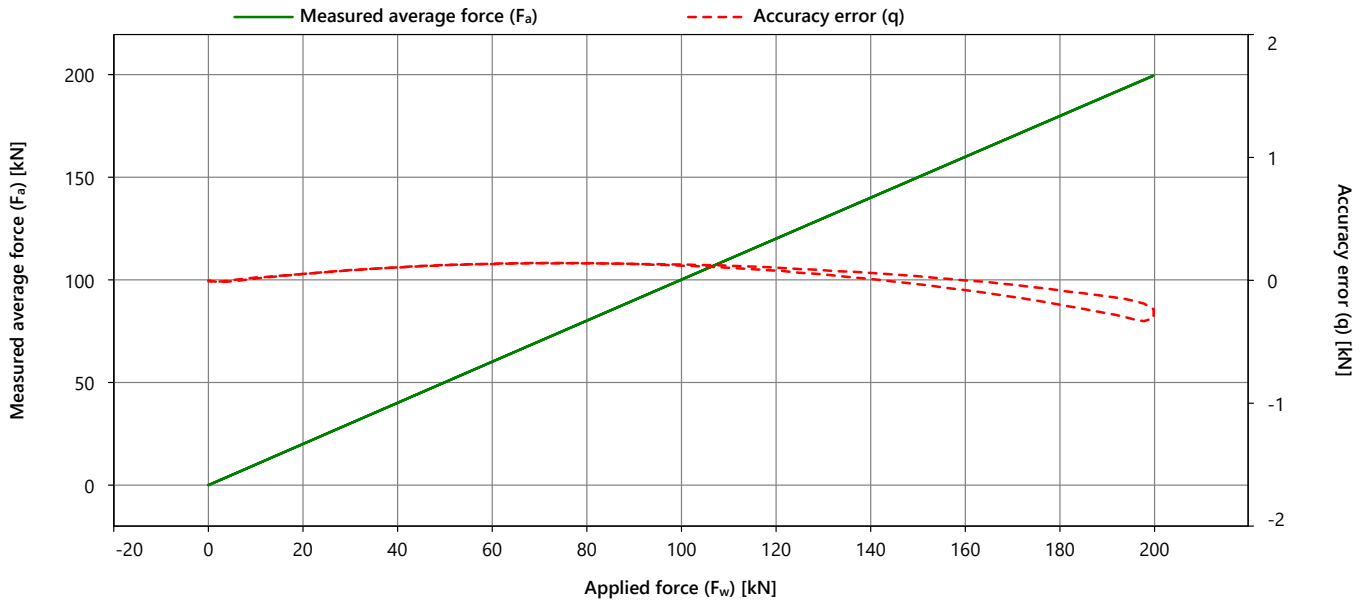
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032115

Calibration Details	
Calibration Date	04 Dec 2023 06:33:13
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.305
Max repeatability error (b)	[kN]	0.016
Max reversibility error (v)	[kN]	0.079
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	0.001
Resolution	[kN]	8.7E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.005	0.000	-0.005	0.000	0.000	0.011		0.024
40.000	40.109	40.099	40.106	40.105	0.105	0.010	-0.001	0.139
80.000	80.143	80.136	80.140	80.140	0.140	0.007	-0.002	0.262
120.000	120.082	120.077	120.078	120.079	0.079	0.005	0.024	0.386
160.000	159.924	159.915	159.922	159.920	-0.080	0.009	0.079	0.516
200.000	199.694	199.688	199.704	199.695	-0.305	0.016		0.631
160.000	160.000	159.998	160.000	159.999	-0.001	0.003	0.079	0.516
120.000	120.106	120.101	120.103	120.103	0.103	0.005	0.024	0.386
80.000	80.144	80.133	80.137	80.138	0.138	0.011	-0.002	0.262
40.000	40.107	40.098	40.107	40.104	0.104	0.009	-0.001	0.139
0.000	-0.005	-0.009	-0.011	-0.008	-0.008	0.005		0.020

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0058
Electronics	9334
Node Type	7001
Hardware Version	6.00
Software Version	8.01

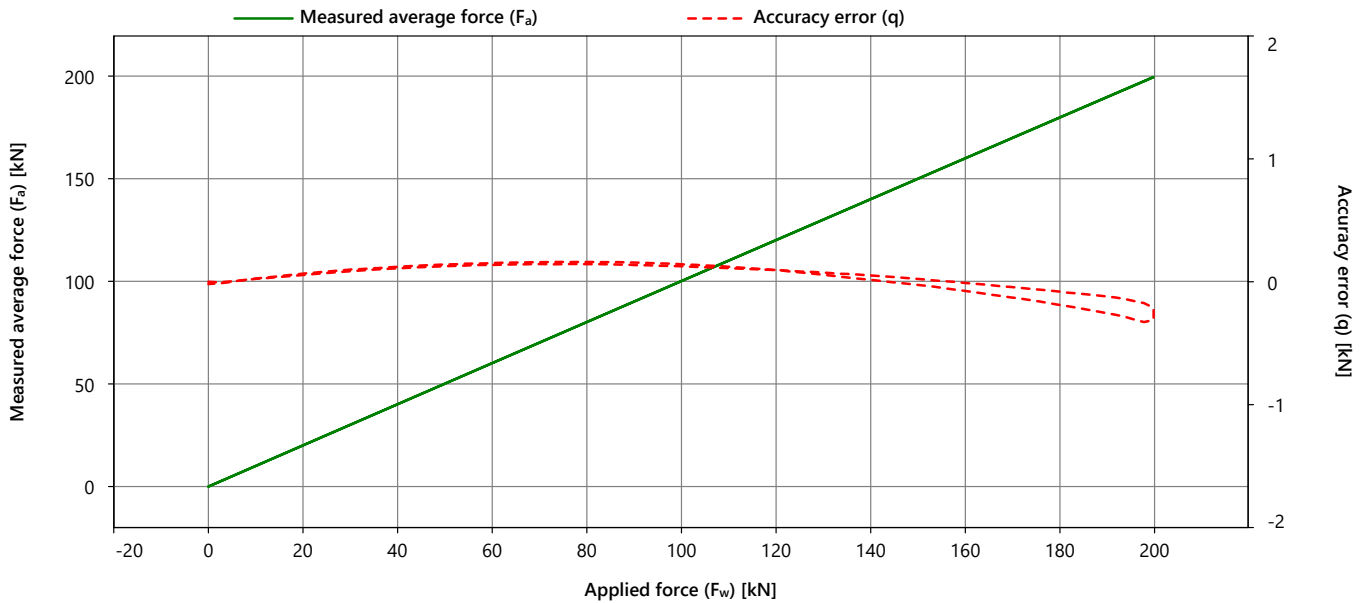
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032115

Calibration Details	
Calibration Date	04 Dec 2023 06:33:13
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.309
Max repeatability error (b)	[kN]	0.021
Max reversibility error (v)	[kN]	0.065
Zero load error (F _{c0})	[kN]	0.019
Zero load offset (F ₀)	[kN]	0.004
Resolution	[kN]	8.71E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.034



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.010	0.001	-0.011	0.000	0.000	0.021		0.047
40.000	40.126	40.117	40.120	40.121	0.121	0.008	-0.012	0.141
80.000	80.164	80.160	80.160	80.161	0.161	0.004	-0.018	0.263
120.000	120.103	120.094	120.089	120.095	0.095	0.013	0.000	0.385
160.000	159.932	159.925	159.918	159.925	-0.075	0.013	0.065	0.514
200.000	199.693	199.692	199.689	199.691	-0.309	0.003		0.631
160.000	159.989	159.987	159.994	159.990	-0.010	0.007	0.065	0.514
120.000	120.096	120.094	120.097	120.096	0.096	0.003	0.000	0.385
80.000	80.148	80.141	80.141	80.144	0.144	0.007	-0.018	0.263
40.000	40.114	40.106	40.107	40.109	0.109	0.008	-0.012	0.141
0.000	-0.015	-0.020	-0.021	-0.019	-0.019	0.006		0.036

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0058
Electronics	9334
Node Type	7001
Hardware Version	6.00
Software Version	8.01

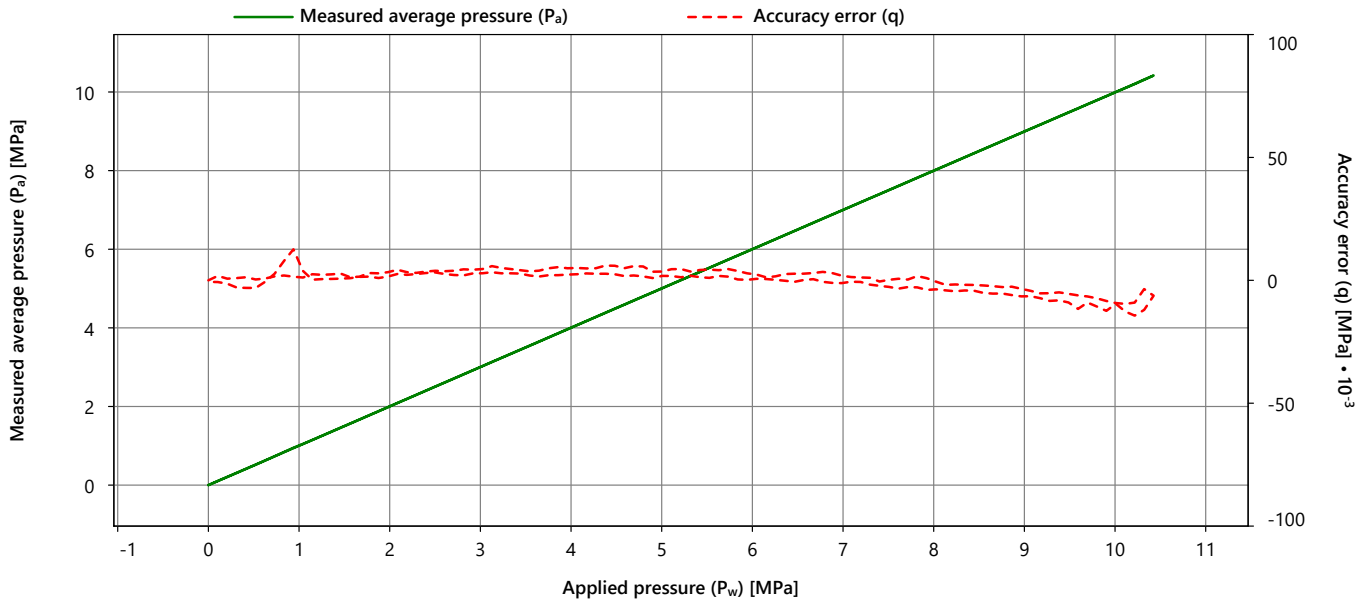
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23032115

Calibration Details	
Calibration Date	04 Dec 2023 07:56:17
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.009
Max repeatability error (b)	[MPa]	0.005
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	0.003
Resolution	[MPa]	2.24E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.003	2.002	2.006	2.004	0.004	0.004	-0.002	0.008
4.000	4.004	4.005	4.005	4.005	0.005	0.001	-0.003	0.006
6.000	6.006	6.001	6.002	6.003	0.003	0.005	-0.003	0.009
8.000	8.000	7.999	8.000	8.000	0.000	0.001	-0.003	0.008
10.000	9.990	9.990	9.993	9.991	-0.009	0.004		0.009
8.000	7.996	7.997	7.995	7.996	-0.004	0.002	-0.003	0.008
6.000	6.000	6.001	6.000	6.000	0.000	0.002	-0.003	0.007
4.000	4.003	4.003	4.002	4.002	0.002	0.001	-0.003	0.006
2.000	2.000	2.002	2.002	2.002	0.002	0.002	-0.002	0.005
0.000	-0.001	-0.001	0.000	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0058
Electronics	9334
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

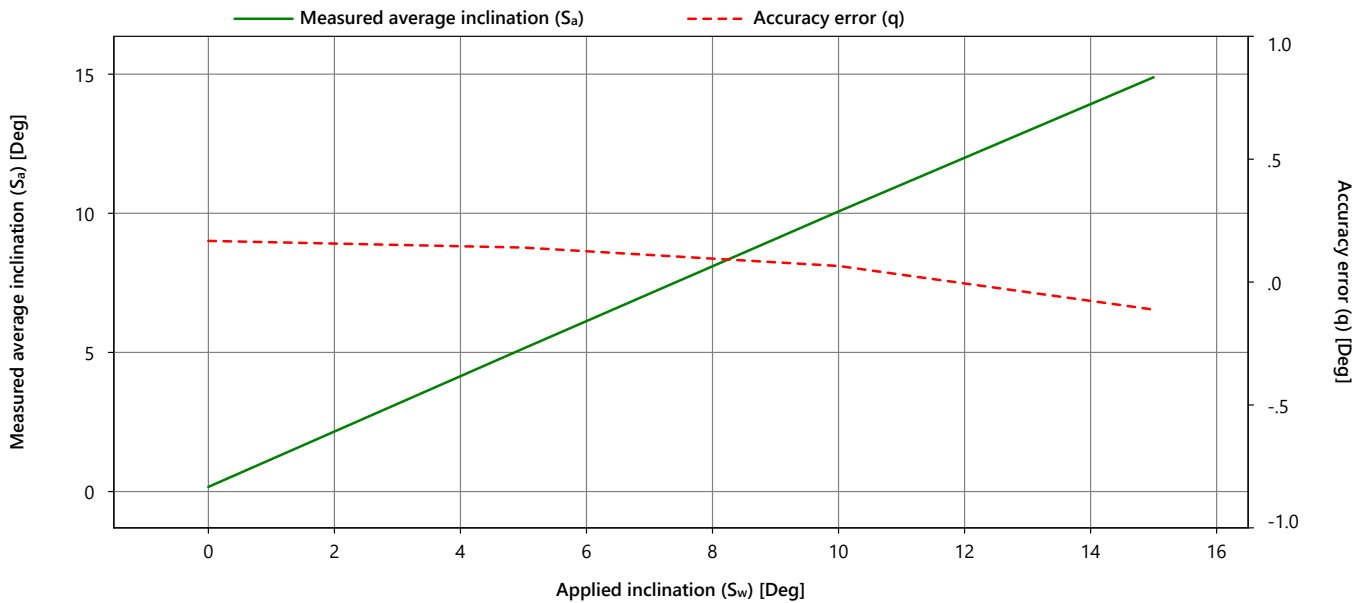
Certificate Number
FCN23032115

Calibration Details	
Calibration Date	04 Dec 2023 06:40:49
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.0
Resolution	[Deg]	1.32E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w)	Measured inclination 1 ($S_{a,1}$)	Measured inclination 2 ($S_{a,2}$)	Measured inclination 3 ($S_{a,3}$)	Measured average inclination (S_a)	Accuracy error (q)	Repeatability error (b)	Expanded Uncertainty (U)
[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]
0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.7
5.0	5.1	5.2	5.2	5.1	0.1	0.1	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.9	14.8	14.9	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23032115

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0058

Appendix Applicable to
Certificate Number
FCN23032115

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0058
Electronics	9334
Node Type	7001
Hardware Version	6.00
Software Version	8.01

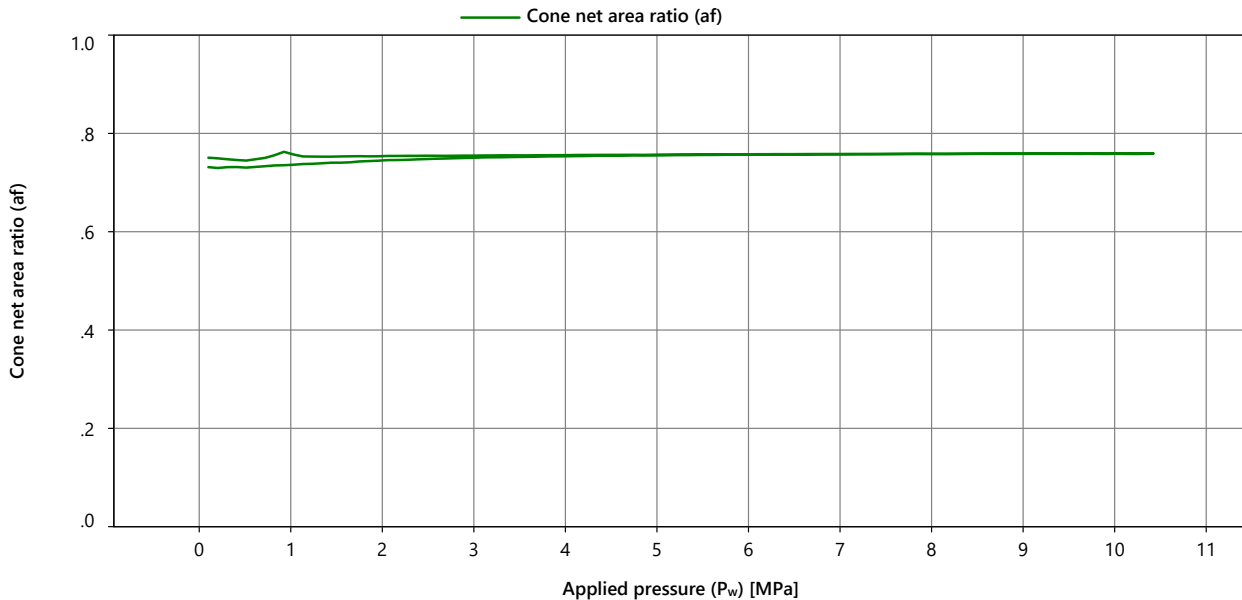
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23032115

Measurement Details	
Measurement Date	04 Dec 2023 07:56:17
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.745	0.744	0.746	0.745
4.000	0.754	0.753	0.753	0.753
6.000	0.757	0.756	0.756	0.757
8.000	0.758	0.758	0.758	0.758
10.000	0.759	0.759	0.759	0.759
8.000	0.758	0.759	0.758	0.758
6.000	0.758	0.758	0.757	0.758
4.000	0.756	0.756	0.755	0.756
2.000	0.754	0.754	0.754	0.754

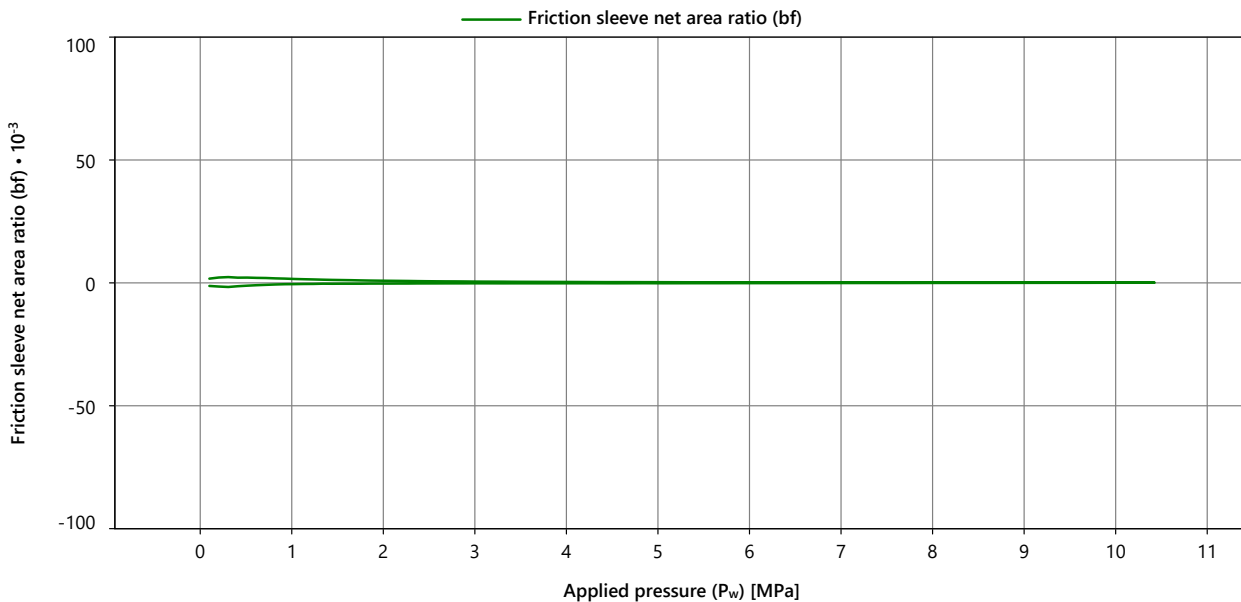
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0058	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9334	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 07:56:17
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032115

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00009

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.001	0.001	0.001	0.001
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23032115

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031887

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0087

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 09-Nov-2023

Calibrate before 09-May-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 10-Nov-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Page 1 of 6



Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0087
Electronics	249
Node Type	7001
Hardware Version	5.01
Software Version	8.01

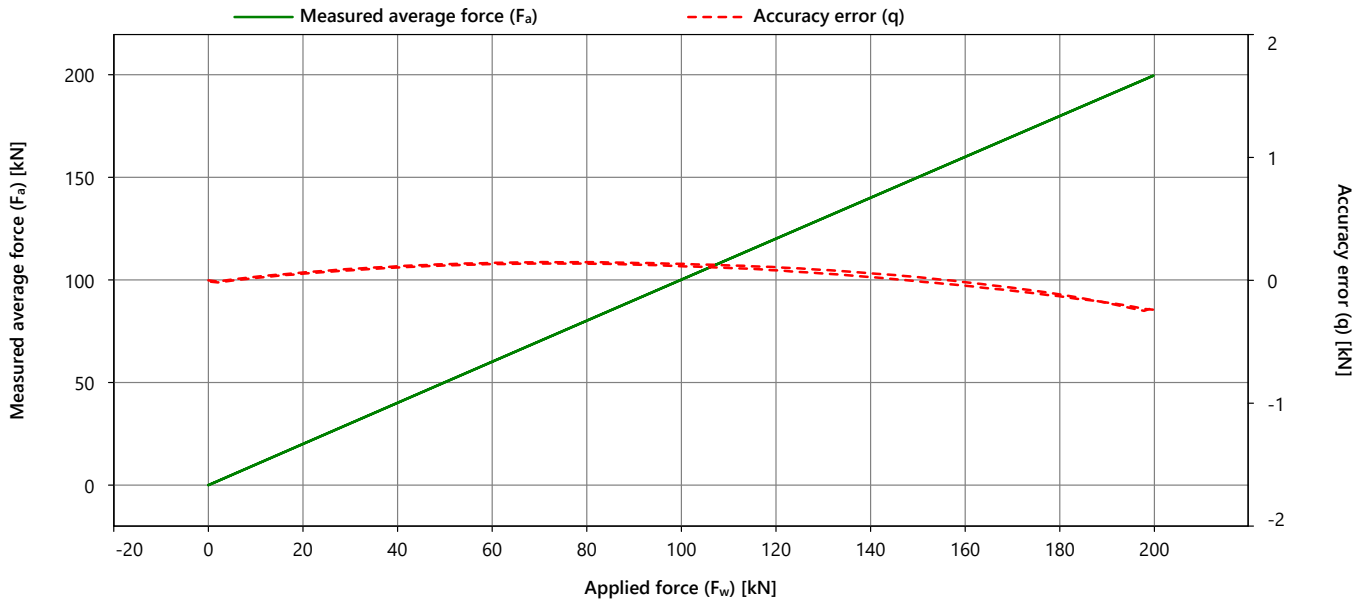
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031887

Calibration Details	
Calibration Date	09 Nov 2023 08:24:48
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.217
Max repeatability error (b)	[kN]	0.017
Max reversibility error (v)	[kN]	0.028
Zero load error (F _{c0})	[kN]	0.009
Zero load offset (F ₀)	[kN]	-0.025
Resolution	[kN]	8.69E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.005	-0.002	-0.003	0.000	0.000	0.009		0.023
40.000	40.117	40.115	40.111	40.115	0.115	0.006	-0.010	0.140
80.000	80.156	80.148	80.141	80.148	0.148	0.015	-0.013	0.263
120.000	120.113	120.104	120.104	120.107	0.107	0.010	-0.026	0.386
160.000	159.990	159.983	159.981	159.984	-0.016	0.009	-0.028	0.509
200.000	199.790	199.787	199.773	199.783	-0.217	0.017		0.631
160.000	159.960	159.958	159.950	159.956	-0.044	0.011	-0.028	0.509
120.000	120.086	120.082	120.076	120.082	0.082	0.010	-0.026	0.386
80.000	80.137	80.136	80.133	80.136	0.136	0.004	-0.013	0.262
40.000	40.107	40.105	40.101	40.104	0.104	0.007	-0.010	0.140
0.000	-0.004	-0.007	-0.017	-0.009	-0.009	0.013		0.027

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0087
Electronics	249
Node Type	7001
Hardware Version	5.01
Software Version	8.01

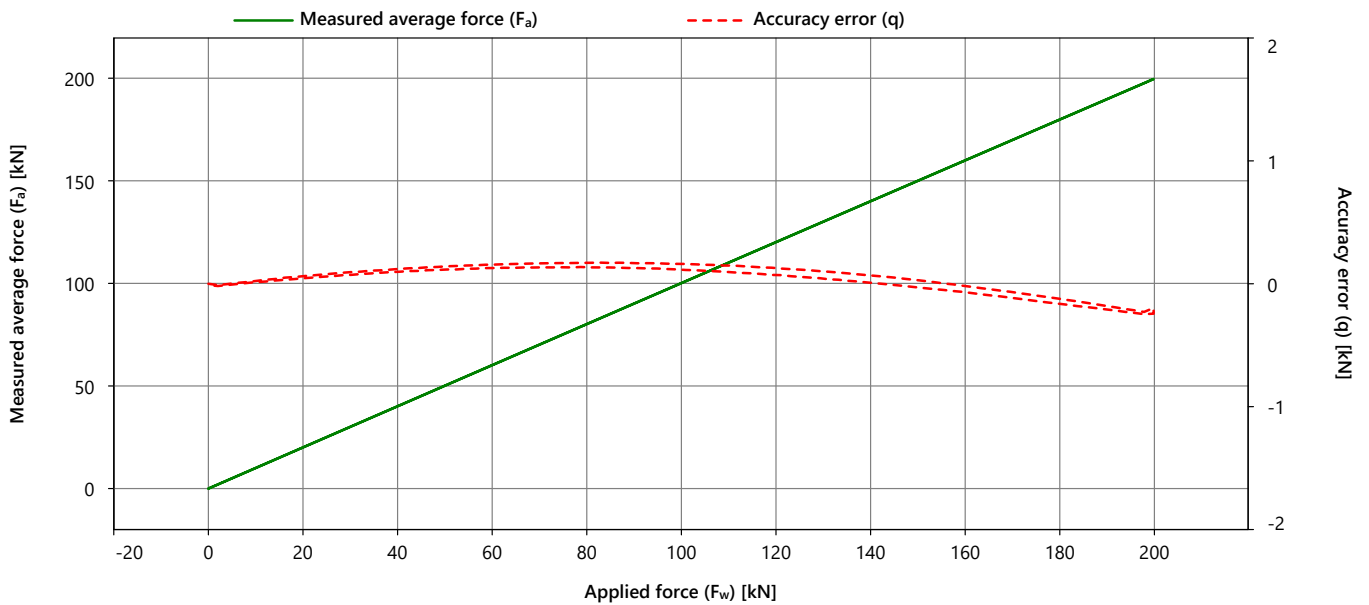
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031887

Calibration Details	
Calibration Date	09 Nov 2023 08:24:48
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.192
Max repeatability error (b)	[kN]	0.017
Max reversibility error (v)	[kN]	0.056
Zero load error (F _{c0})	[kN]	0.011
Zero load offset (F ₀)	[kN]	-0.028
Resolution	[kN]	8.73E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.009



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.005	-0.002	-0.003	0.000	0.000	0.008		0.024
40.000	40.124	40.120	40.117	40.120	0.120	0.007	-0.022	0.142
80.000	80.176	80.171	80.163	80.170	0.170	0.013	-0.035	0.265
120.000	120.132	120.127	120.124	120.128	0.128	0.008	-0.056	0.390
160.000	159.985	159.980	159.980	159.981	-0.019	0.005	-0.050	0.511
200.000	199.815	199.811	199.798	199.808	-0.192	0.017		0.631
160.000	159.935	159.934	159.927	159.932	-0.068	0.007	-0.050	0.511
120.000	120.074	120.073	120.069	120.072	0.072	0.005	-0.056	0.390
80.000	80.136	80.135	80.134	80.135	0.135	0.002	-0.035	0.265
40.000	40.101	40.099	40.093	40.098	0.098	0.007	-0.022	0.142
0.000	-0.005	-0.009	-0.019	-0.011	-0.011	0.014		0.030

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0087
Electronics	249
Node Type	7001
Hardware Version	5.01
Software Version	8.01

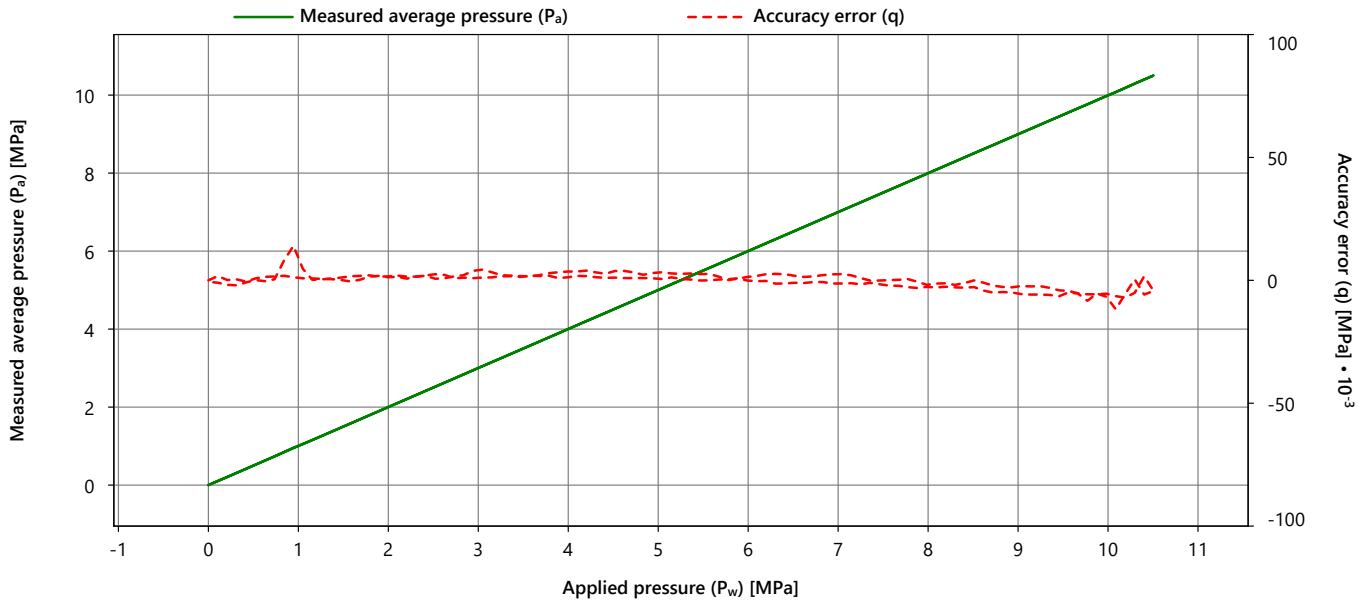
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031887

Calibration Details	
Calibration Date	09 Nov 2023 09:17:54
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.1.55350

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.006
Max repeatability error (b)	[MPa]	0.002
Max reversibility error (v)	[MPa]	0.002
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	-0.003
Resolution	[MPa]	2.46E-06
Noise RMS	[MPa]	0.002



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.004
2.000	2.001	2.002	2.001	2.001	0.001	0.001	0.000	0.005
4.000	4.003	4.003	4.005	4.004	0.004	0.002	-0.002	0.007
6.000	6.003	6.001	6.001	6.001	0.001	0.002	-0.002	0.007
8.000	7.998	7.997	7.999	7.998	-0.002	0.002	-0.001	0.008
10.000	9.995	9.994	9.994	9.994	-0.006	0.000		0.008
8.000	7.998	7.997	7.997	7.997	-0.003	0.001	-0.001	0.007
6.000	6.000	5.999	6.000	6.000	0.000	0.001	-0.002	0.007
4.000	4.001	4.003	4.000	4.001	0.001	0.002	-0.002	0.007
2.000	2.001	2.002	2.001	2.002	0.002	0.001	0.000	0.005
0.000	-0.001	-0.001	-0.001	-0.001	-0.001	0.000		0.004

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0087
Electronics	249
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

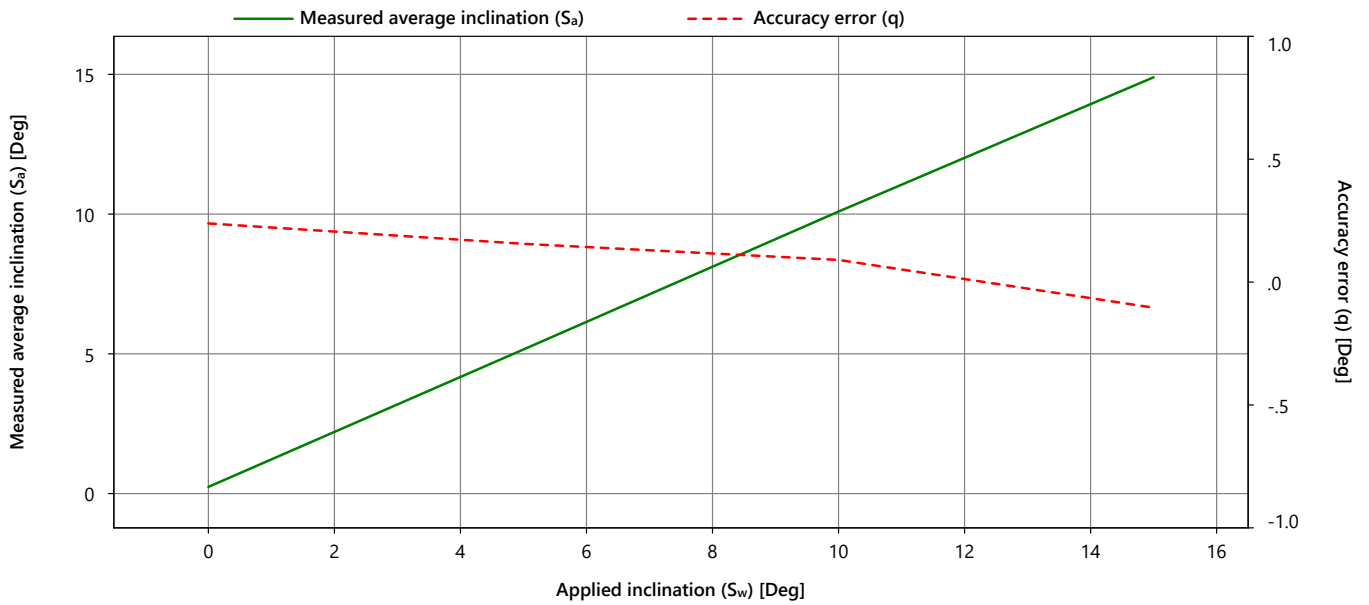
Certificate Number
FCN23031887

Calibration Details	
Calibration Date	09 Nov 2023 08:43:28
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.1.55350

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	-0.1
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.28E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.3	0.1	0.4	0.2	0.2	0.3	0.8
5.0	5.0	5.2	5.2	5.2	0.2	0.2	0.7
10.0	10.1	10.1	10.1	10.1	0.1	0.0	0.7
15.0	15.0	14.9	14.9	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031887

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0087

Appendix Applicable to
Certificate Number
FCN23031887

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

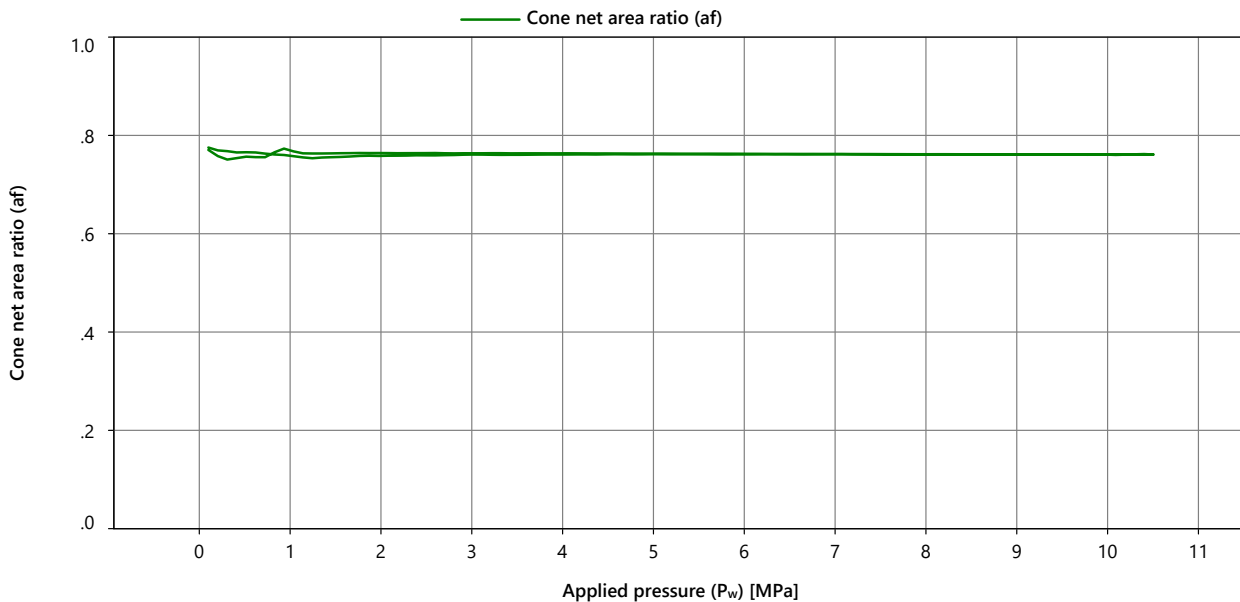
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0087	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	249	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 09:17:54
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031887

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.758	0.759	0.758	0.758
4.000	0.761	0.761	0.761	0.761
6.000	0.762	0.761	0.761	0.761
8.000	0.762	0.761	0.762	0.761
10.000	0.761	0.762	0.761	0.761
8.000	0.762	0.762	0.762	0.762
6.000	0.763	0.763	0.763	0.763
4.000	0.763	0.764	0.763	0.764
2.000	0.764	0.764	0.764	0.764

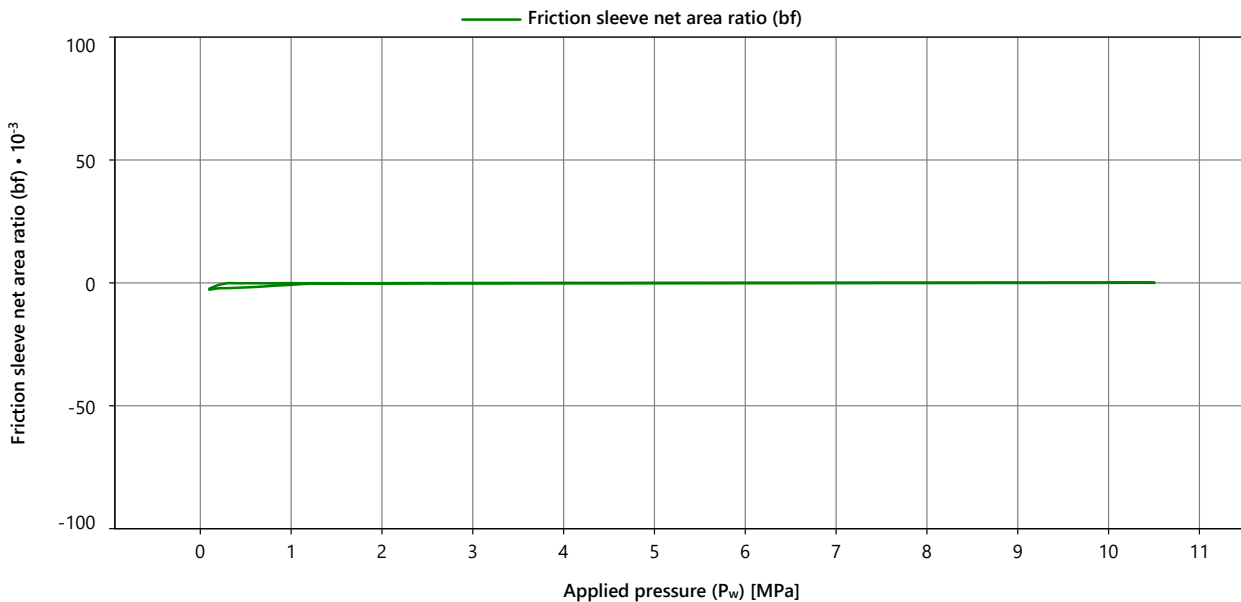
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0087	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	249	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 09:17:54
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

**Appendix Applicable to
Certificate Number
FCN23031887**

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00003

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031887

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032133

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0088

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 04-Dec-2023

Calibrate before 04-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 05-Dec-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0088
Electronics	287
Node Type	7001
Hardware Version	5.01
Software Version	8.01

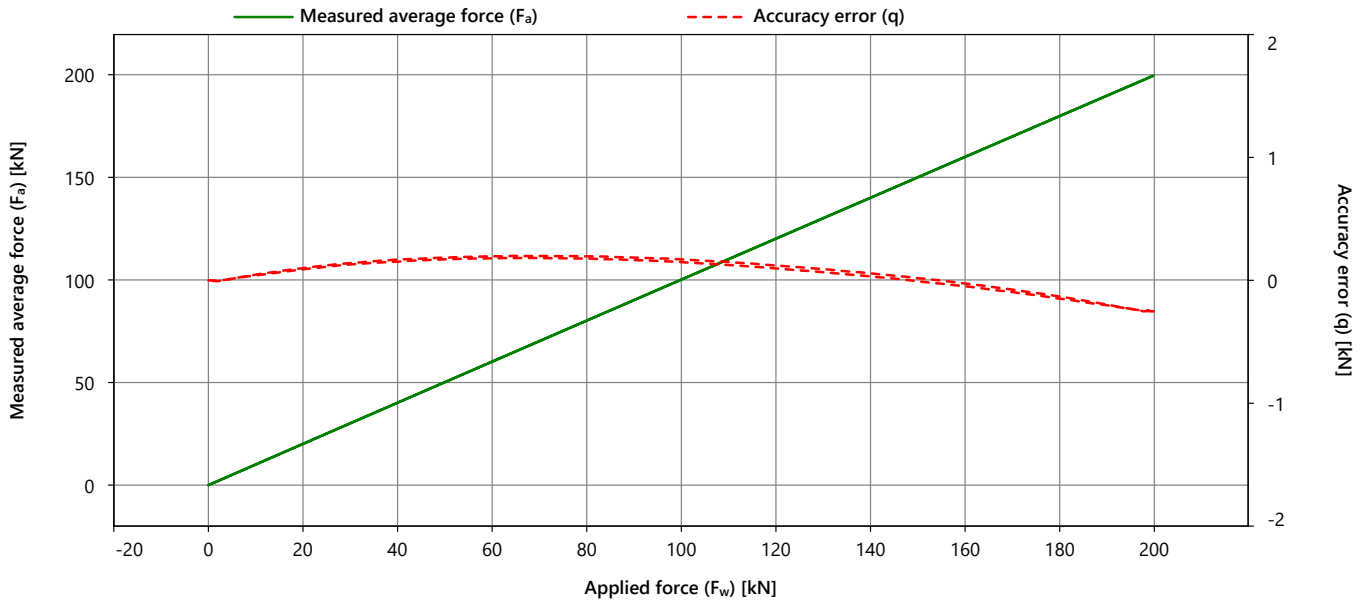
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032133

Calibration Details	
Calibration Date	04 Dec 2023 10:59:29
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.230
Max repeatability error (b)	[kN]	0.029
Max reversibility error (v)	[kN]	0.024
Zero load error (F _{c0})	[kN]	0.004
Zero load offset (F ₀)	[kN]	-0.023
Resolution	[kN]	8.67E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.001	0.002	-0.003	0.000	0.000	0.005		0.017
40.000	40.162	40.169	40.175	40.169	0.169	0.012	-0.017	0.141
80.000	80.189	80.196	80.201	80.195	0.195	0.012	-0.018	0.263
120.000	120.113	120.122	120.126	120.120	0.120	0.013	-0.024	0.386
160.000	159.967	159.976	159.979	159.974	-0.026	0.012	-0.023	0.508
200.000	199.753	199.775	199.782	199.770	-0.230	0.029		0.631
160.000	159.946	159.952	159.957	159.952	-0.048	0.012	-0.023	0.508
120.000	120.092	120.094	120.102	120.096	0.096	0.010	-0.024	0.386
80.000	80.171	80.178	80.182	80.177	0.177	0.011	-0.018	0.263
40.000	40.150	40.152	40.153	40.151	0.151	0.003	-0.017	0.140
0.000	-0.002	-0.003	-0.006	-0.004	-0.004	0.003		0.017

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0088
Electronics	287
Node Type	7001
Hardware Version	5.01
Software Version	8.01

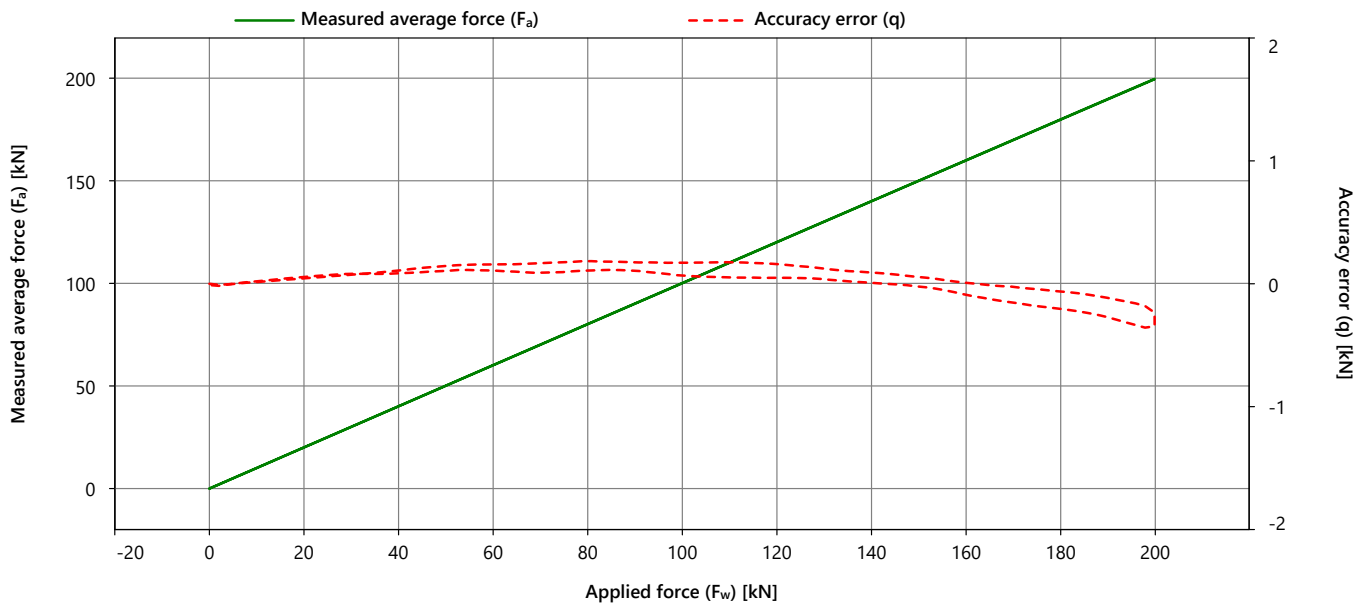
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032133

Calibration Details	
Calibration Date	04 Dec 2023 10:59:29
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.344
Max repeatability error (b)	[kN]	0.061
Max reversibility error (v)	[kN]	0.111
Zero load error (F _{c0})	[kN]	0.011
Zero load offset (F ₀)	[kN]	-0.013
Resolution	[kN]	8.71E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.032



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.005	0.000	-0.005	0.000	0.000	0.010		0.025
40.000	40.101	40.083	40.072	40.085	0.085	0.029	0.022	0.146
80.000	80.126	80.102	80.093	80.107	0.107	0.033	0.078	0.280
120.000	120.083	120.040	120.022	120.049	0.049	0.061	0.111	0.413
160.000	159.915	159.911	159.906	159.910	-0.090	0.009	0.097	0.521
200.000	199.677	199.653	199.639	199.656	-0.344	0.039		0.632
160.000	160.001	160.008	160.013	160.008	0.008	0.013	0.097	0.521
120.000	120.152	120.162	120.165	120.160	0.160	0.014	0.111	0.407
80.000	80.179	80.184	80.191	80.185	0.185	0.012	0.078	0.278
40.000	40.107	40.108	40.108	40.108	0.108	0.002	0.022	0.141
0.000	-0.009	-0.009	-0.013	-0.011	-0.011	0.004		0.022

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0088
Electronics	287
Node Type	7001
Hardware Version	5.01
Software Version	8.01

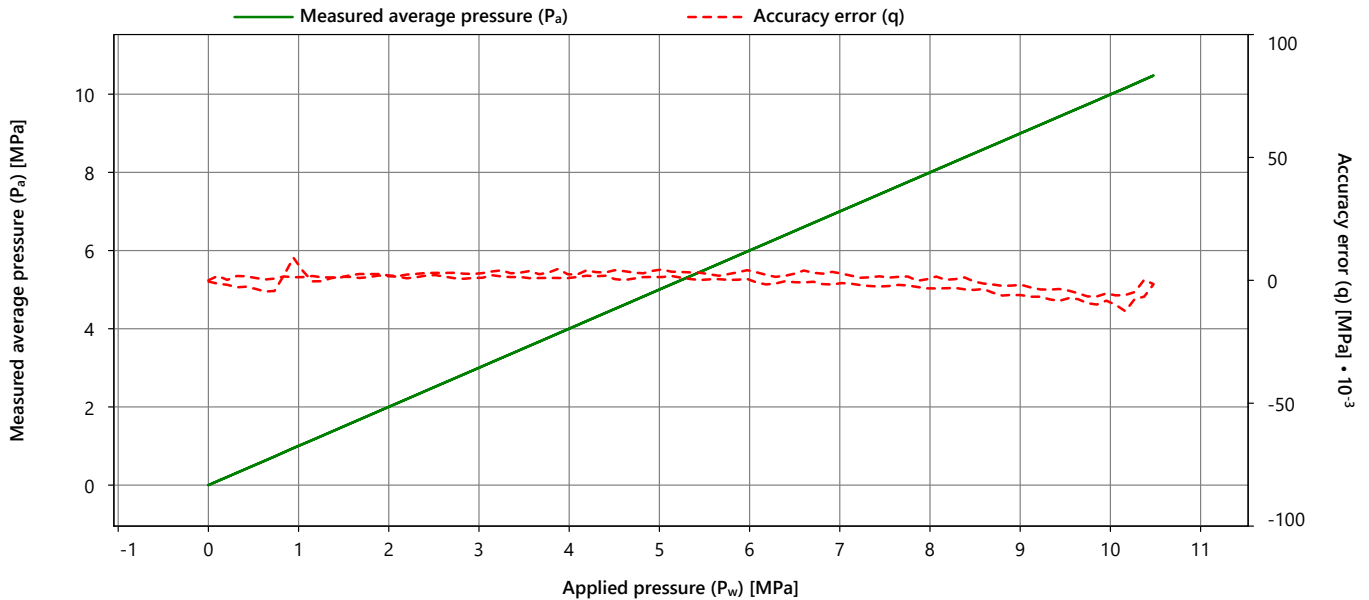
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23032133

Calibration Details	
Calibration Date	04 Dec 2023 12:21:34
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.006
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.004
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	-0.003
Resolution	[MPa]	2.4E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.002	2.002	2.002	2.002	0.002	0.000	0.000	0.004
4.000	4.003	4.002	4.001	4.002	0.002	0.001	-0.001	0.005
6.000	6.004	6.004	6.004	6.004	0.004	0.001	-0.004	0.007
8.000	8.002	8.000	8.001	8.001	0.001	0.002	-0.004	0.009
10.000	9.993	9.995	9.995	9.994	-0.006	0.003		0.008
8.000	7.998	7.996	7.996	7.997	-0.003	0.002	-0.004	0.009
6.000	6.002	5.999	6.000	6.000	0.000	0.003	-0.004	0.008
4.000	4.000	4.001	4.002	4.001	0.001	0.002	-0.001	0.005
2.000	2.000	2.002	2.003	2.002	0.002	0.003	0.000	0.006
0.000	0.000	-0.001	0.000	0.000	0.000	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0088
Electronics	287
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

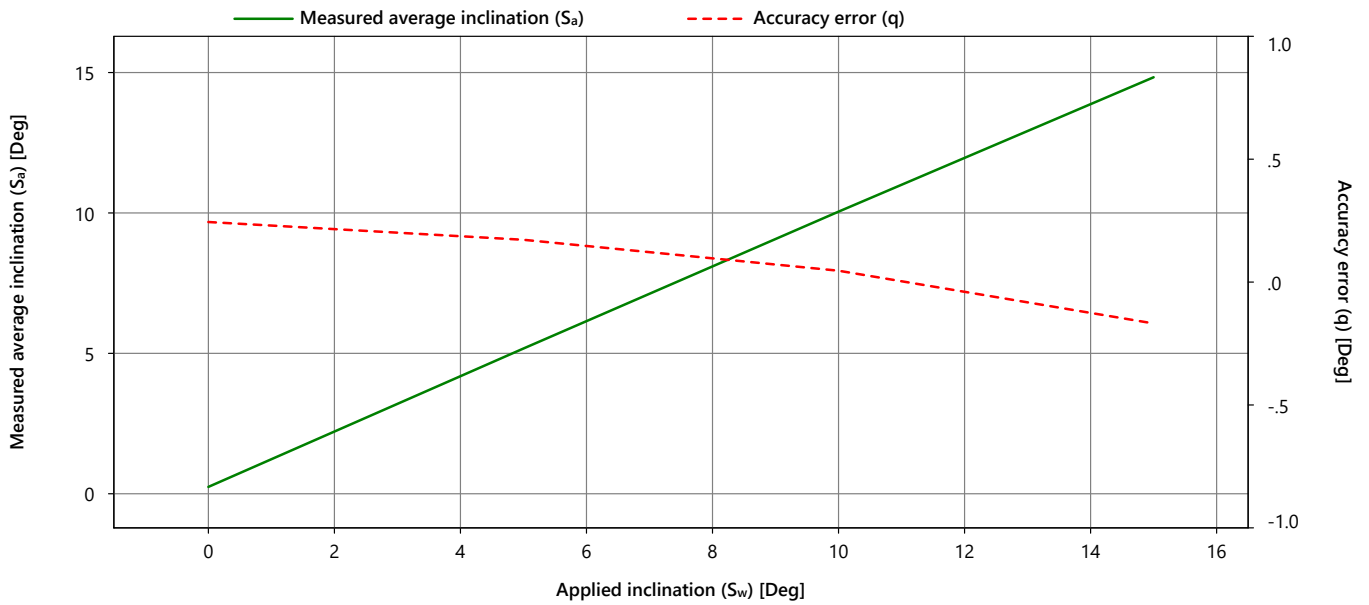
Certificate Number
FCN23032133

Calibration Details	
Calibration Date	04 Dec 2023 11:03:58
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.3E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.3	0.3	0.2	0.2	0.3	0.8
5.0	5.0	5.2	5.3	5.2	0.2	0.2	0.8
10.0	9.9	10.1	10.1	10.0	0.0	0.2	0.7
15.0	14.8	14.9	14.8	14.8	-0.2	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23032133

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0088

Appendix Applicable to
Certificate Number
FCN23032133

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

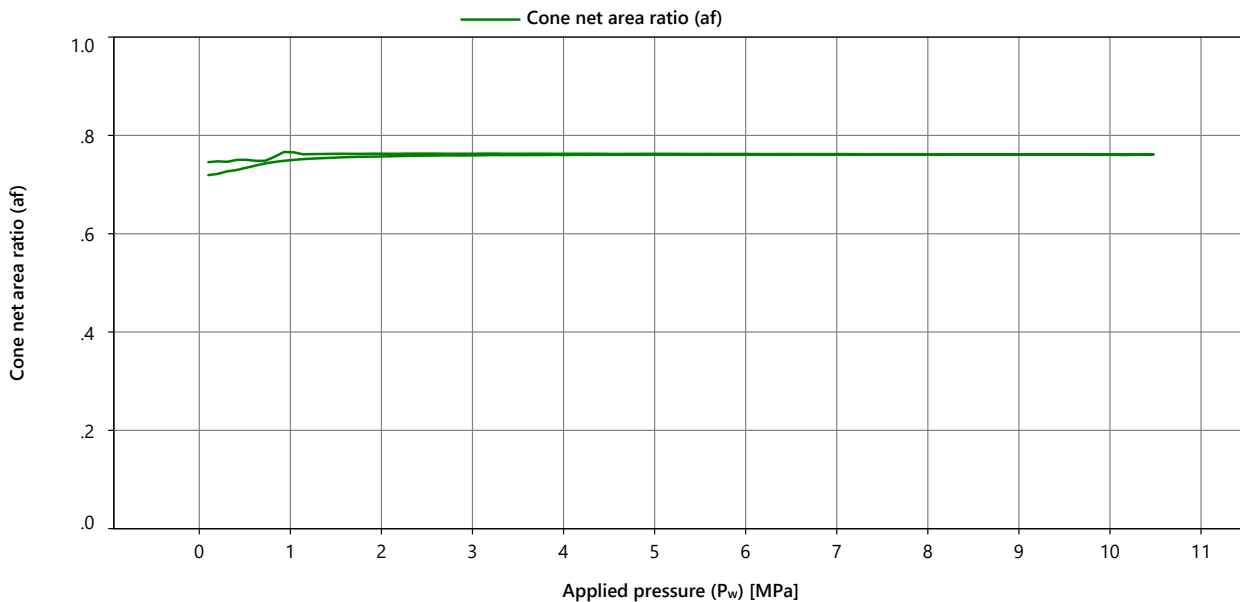
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0088	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	287	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 12:21:34
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032133

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.757	0.757	0.757	0.757
4.000	0.761	0.760	0.760	0.760
6.000	0.761	0.761	0.761	0.761
8.000	0.761	0.761	0.761	0.761
10.000	0.761	0.761	0.761	0.761
8.000	0.762	0.762	0.762	0.762
6.000	0.763	0.762	0.762	0.762
4.000	0.763	0.763	0.763	0.763
2.000	0.763	0.763	0.763	0.763

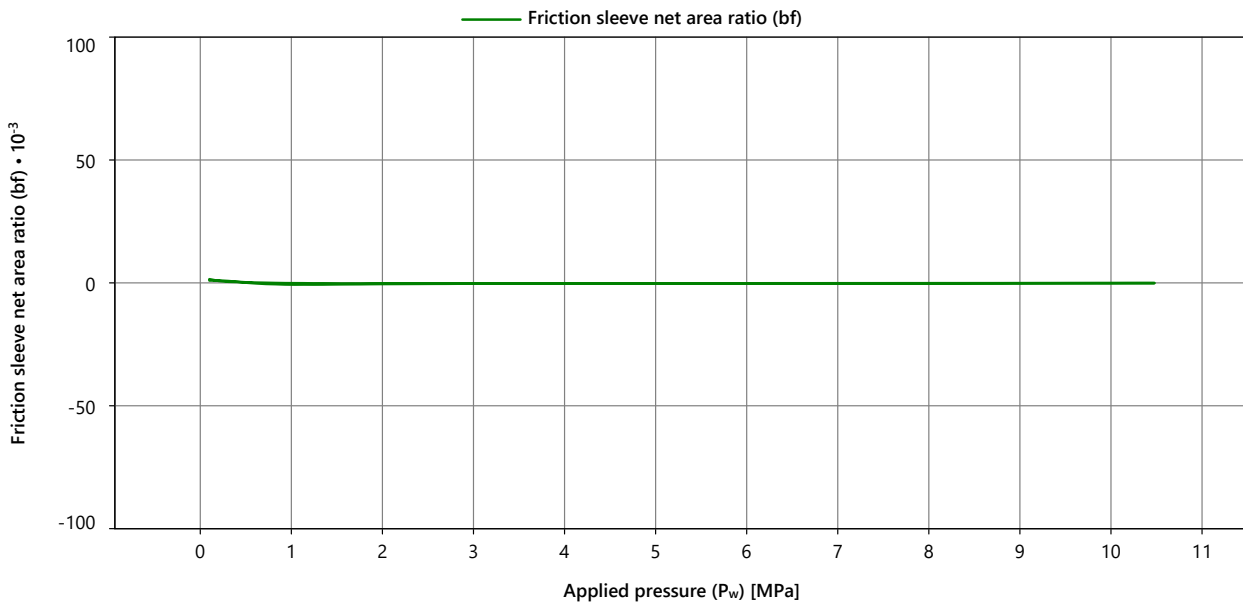
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0088	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	287	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 12:21:34
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032133

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	-0.00008

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23032133

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032156

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E10M4-V1
Serial Number 1715-0067

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 06-Dec-2023

Calibrate before 06-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.7 $\mu\text{V/V/kN}$	2.79 $\mu\text{V/V}$	10.7 $\mu\text{V/V/kN}$	5.53 $\mu\text{V/V}$	0.04 %	0.13 %
Cone+Fric. [Force]	10.7 $\mu\text{V/V/kN}$	0.0709 $\mu\text{V/V}$	10.7 $\mu\text{V/V/kN}$	2.34 $\mu\text{V/V}$	0.01 %	0.11 %
Pore 2 [Pressure]	3.24 mV/V/MPa	1.10 mV/V	3.24 mV/V/MPa	1.06 mV/V	0.00 %	-0.10 %

Nootdorp, 07-Dec-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0067
Electronics	9329
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference

Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032156

Calibration Details

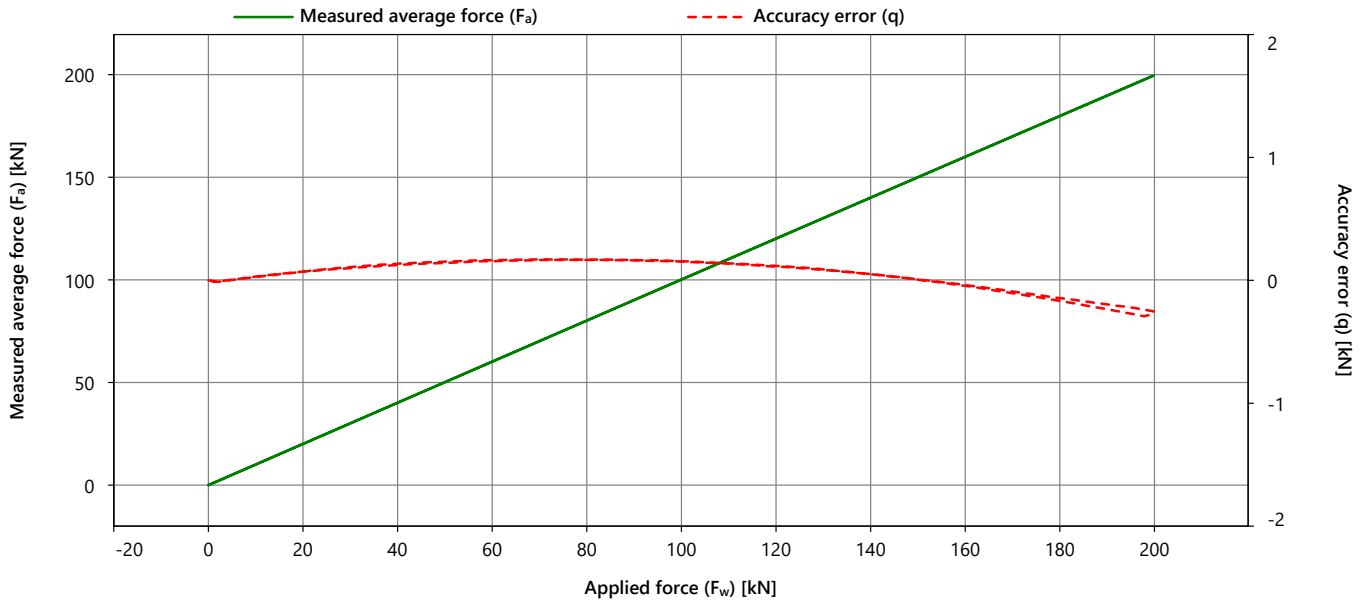
Calibration Date	06 Dec 2023 08:00:45
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor

Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.270
Max repeatability error (b)	[kN]	0.023
Max reversibility error (v)	[kN]	0.011
Zero load error (F _{c0})	[kN]	0.009
Zero load offset (F ₀)	[kN]	-0.006
Resolution	[kN]	8.67E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.005	-0.001	-0.004	0.000	0.000	0.010		0.023
40.000	40.127	40.125	40.123	40.125	0.125	0.004	0.011	0.139
80.000	80.167	80.165	80.165	80.166	0.166	0.002	0.002	0.262
120.000	120.111	120.111	120.114	120.112	0.112	0.003	0.006	0.385
160.000	159.952	159.956	159.957	159.955	-0.045	0.005	0.007	0.508
200.000	199.732	199.717	199.740	199.730	-0.270	0.023		0.631
160.000	159.958	159.962	159.966	159.962	-0.038	0.008	0.007	0.508
120.000	120.115	120.116	120.122	120.118	0.118	0.007	0.006	0.385
80.000	80.163	80.170	80.171	80.168	0.168	0.008	0.002	0.262
40.000	40.135	40.136	40.135	40.135	0.135	0.001	0.011	0.139
0.000	-0.005	-0.006	-0.017	-0.009	-0.009	0.012		0.026

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0067
Electronics	9329
Node Type	7001
Hardware Version	6.00
Software Version	8.01

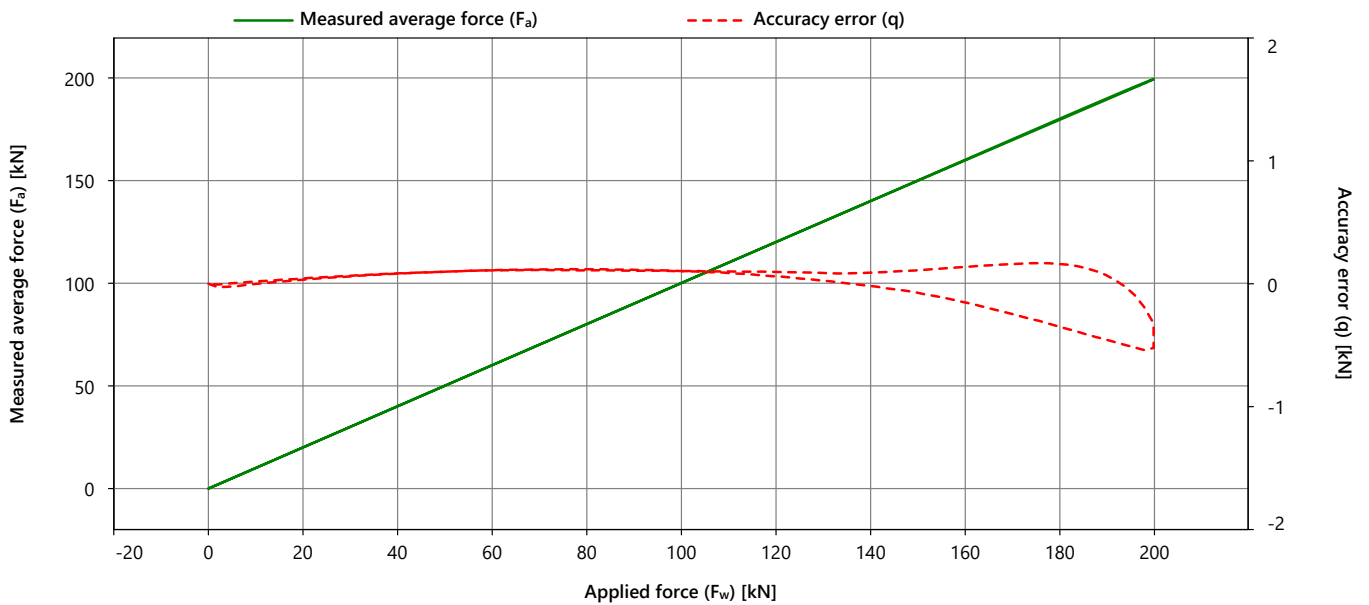
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032156

Calibration Details	
Calibration Date	06 Dec 2023 08:00:45
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.520
Max repeatability error (b)	[kN]	0.052
Max reversibility error (v)	[kN]	0.289
Zero load error (F _{c0})	[kN]	0.003
Zero load offset (F ₀)	[kN]	-0.002
Resolution	[kN]	8.73E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.056



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.002	0.003	-0.005	0.000	0.000	0.007		0.018
40.000	40.086	40.081	40.078	40.082	0.082	0.008	0.003	0.139
80.000	80.122	80.115	80.115	80.117	0.117	0.008	-0.009	0.262
120.000	120.062	120.060	120.060	120.061	0.061	0.002	0.035	0.387
160.000	159.837	159.846	159.860	159.848	-0.152	0.023	0.289	0.637
200.000	199.471	199.465	199.504	199.480	-0.520	0.039		0.632
160.000	160.162	160.139	160.110	160.137	0.137	0.052	0.289	0.639
120.000	120.106	120.094	120.088	120.096	0.096	0.018	0.035	0.387
80.000	80.113	80.108	80.104	80.109	0.109	0.009	-0.009	0.262
40.000	40.091	40.084	40.079	40.085	0.085	0.012	0.003	0.139
0.000	0.001	-0.002	-0.008	-0.003	-0.003	0.009		0.020

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0067
Electronics	9329
Node Type	7001
Hardware Version	6.00
Software Version	8.01

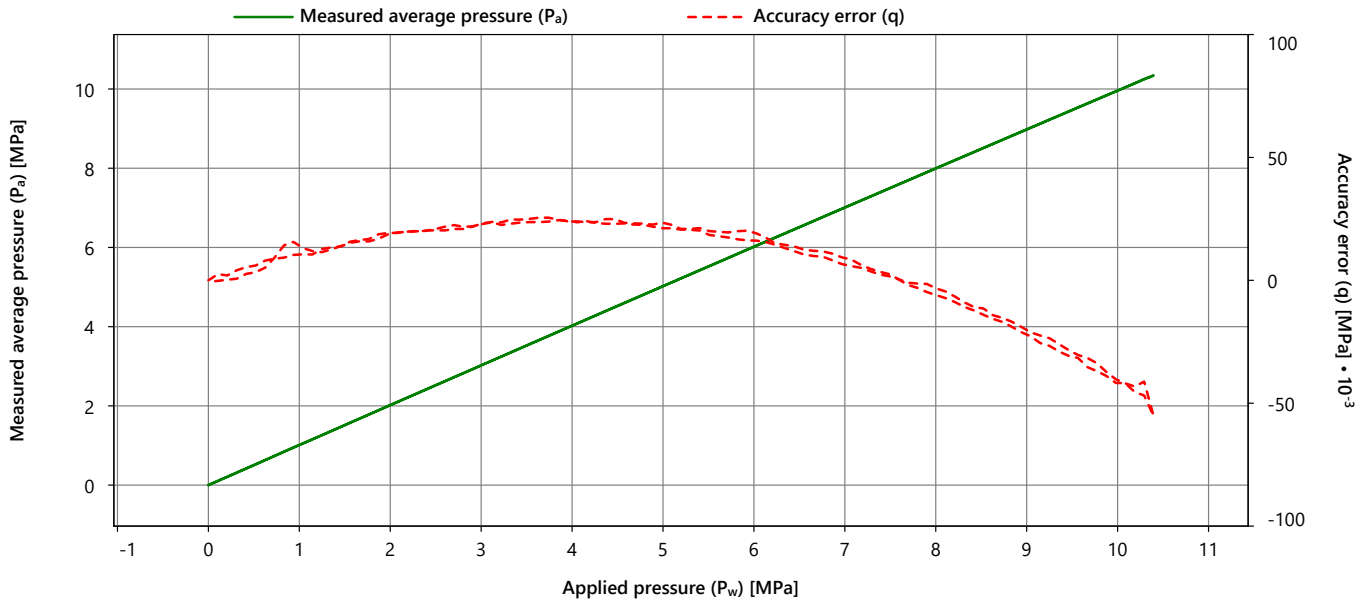
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23032156

Calibration Details	
Calibration Date	06 Dec 2023 08:15:31
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.041
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	-0.005
Resolution	[MPa]	2.3E-06
Noise RMS	[MPa]	0.002



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.001		0.005
2.000	2.019	2.019	2.019	2.019	0.019	0.001	0.000	0.005
4.000	4.025	4.024	4.023	4.024	0.024	0.002	0.000	0.006
6.000	6.018	6.020	6.020	6.019	0.019	0.001	-0.003	0.008
8.000	7.997	7.997	7.997	7.997	-0.003	0.000	-0.003	0.008
10.000	9.961	9.958	9.959	9.959	-0.041	0.003		0.009
8.000	7.995	7.994	7.993	7.994	-0.006	0.002	-0.003	0.008
6.000	6.016	6.017	6.015	6.016	0.016	0.002	-0.003	0.008
4.000	4.025	4.023	4.024	4.024	0.024	0.001	0.000	0.006
2.000	2.019	2.019	2.020	2.019	0.019	0.001	0.000	0.006
0.000	-0.001	-0.001	-0.001	-0.001	-0.001	0.000		0.005

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0067
Electronics	9329
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

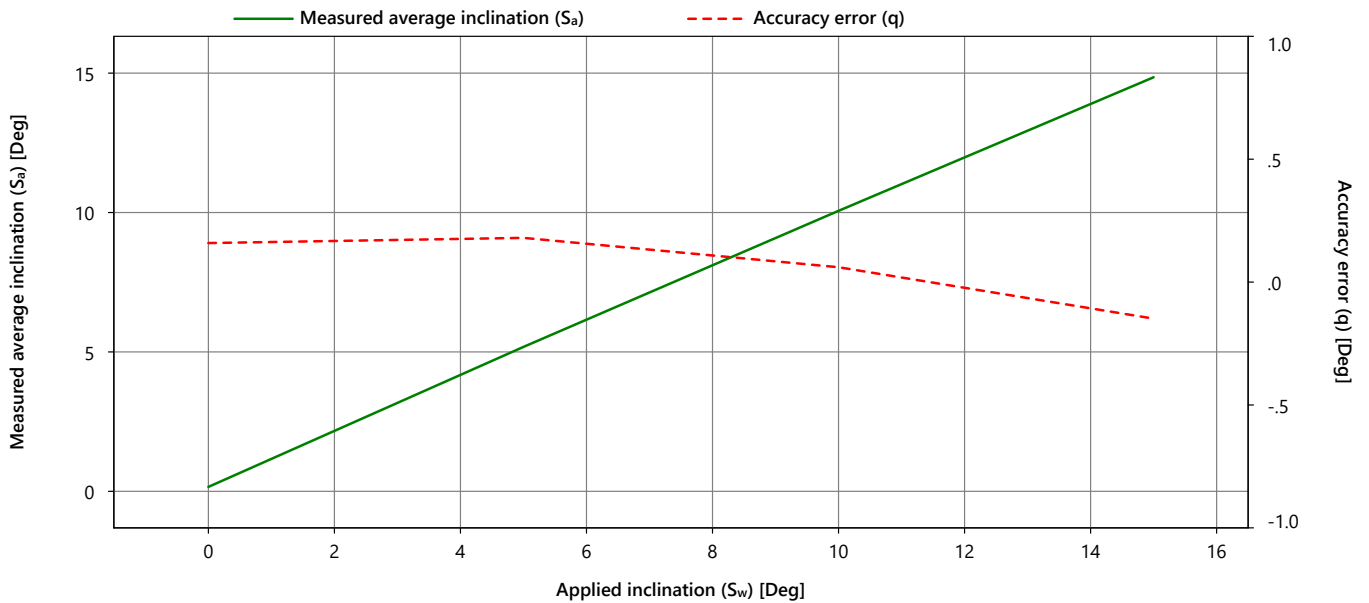
Certificate Number
FCN23032156

Calibration Details	
Calibration Date	06 Dec 2023 08:05:07
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.33E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w)	Measured inclination 1 ($S_{a,1}$)	Measured inclination 2 ($S_{a,2}$)	Measured inclination 3 ($S_{a,3}$)	Measured average inclination (S_a)	Accuracy error (q)	Repeatability error (b)	Expanded Uncertainty (U)
[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]
0.0	0.0	0.2	0.3	0.2	0.2	0.2	0.8
5.0	5.0	5.2	5.3	5.2	0.2	0.2	0.8
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.9	14.8	14.9	14.9	-0.1	0.0	0.7

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Symbols, Definitions and References

Certificate Number
FCN23032156

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0067

Appendix Applicable to
Certificate Number
FCN23032156

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

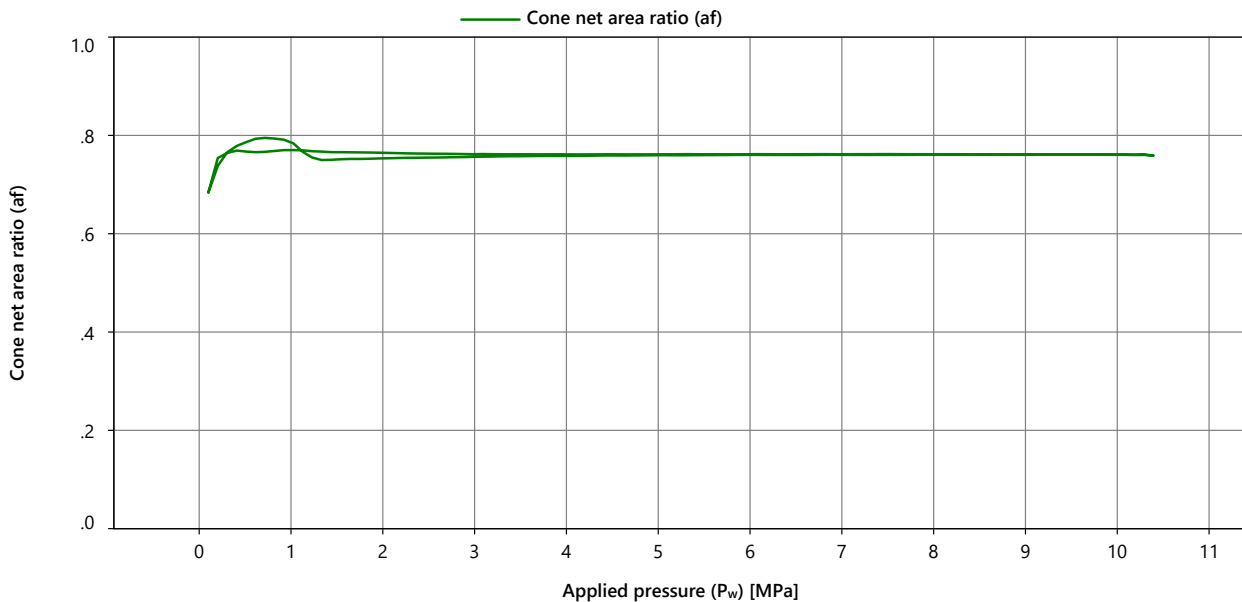
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P1E10M4-V1	Serial Number	3257-0002
Serial Number	1715-0067	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9329	Measurement Details	
Node Type	7001	Measurement Date	06 Dec 2023 08:15:31
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032156

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.748	0.755	0.757	0.753
4.000	0.756	0.759	0.760	0.758
6.000	0.759	0.761	0.762	0.760
8.000	0.760	0.761	0.761	0.761
10.000	0.760	0.761	0.761	0.761
8.000	0.761	0.762	0.762	0.762
6.000	0.761	0.762	0.762	0.762
4.000	0.761	0.761	0.763	0.761
2.000	0.762	0.765	0.767	0.765

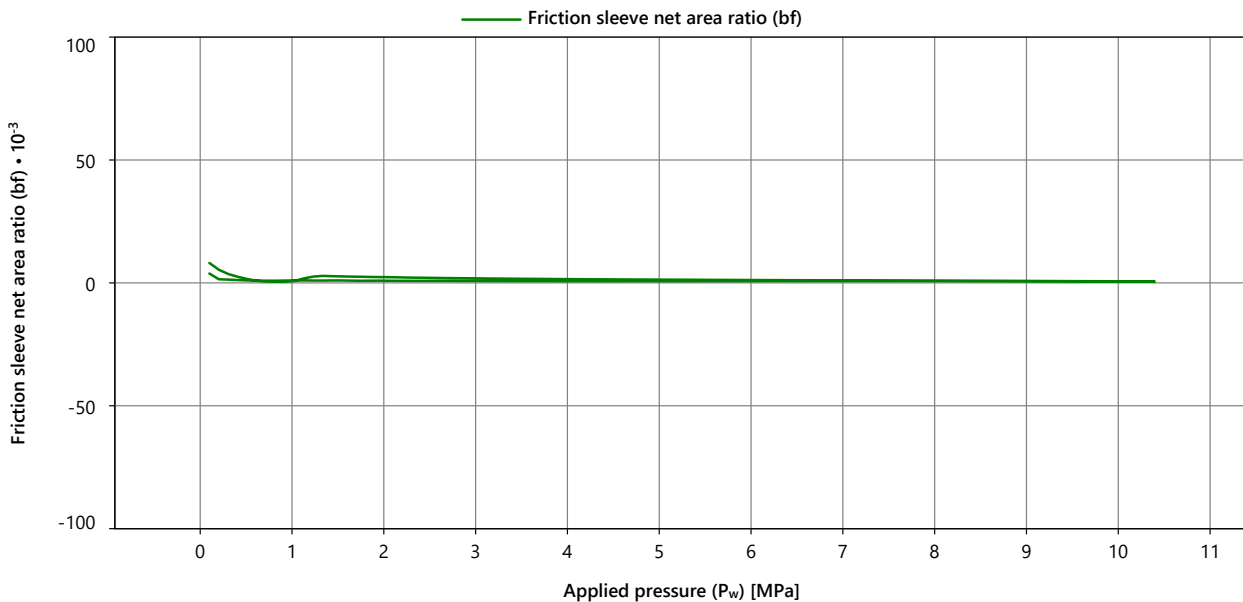
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P1E10M4-V1	Serial Number	3257-0002
Serial Number	1715-0067	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9329	Measurement Details	
Node Type	7001	Measurement Date	06 Dec 2023 08:15:31
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032156

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00053

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.002	0.002	0.002	0.002
4.000	0.002	0.002	0.002	0.002
6.000	0.001	0.001	0.001	0.001
8.000	0.001	0.001	0.001	0.001
10.000	0.001	0.001	0.001	0.001
8.000	0.001	0.001	0.001	0.001
6.000	0.001	0.001	0.001	0.001
4.000	0.001	0.001	0.001	0.001
2.000	0.001	0.001	0.001	0.001

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23032156

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
---	----------

Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032138

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB20SN2-P1E2M4-V2
Serial Number 1715-0027

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 2 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 05-Dec-2023

Calibrate before 05-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/200bar (81188)	0 to 20 MPa	0 to 30 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	5.80 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	5.96 $\mu\text{V/V}$	0.05 %	0.01 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	2.34 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	3.16 $\mu\text{V/V}$	0.10 %	0.04 %
Pore 2 [Pressure]	1.77 mV/V/MPa	1.30 mV/V	1.77 mV/V/MPa	1.32 mV/V	0.01 %	0.05 %

Nootdorp, 06-Dec-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0027
Electronics	7567
Node Type	7001
Hardware Version	5.01
Software Version	8.01

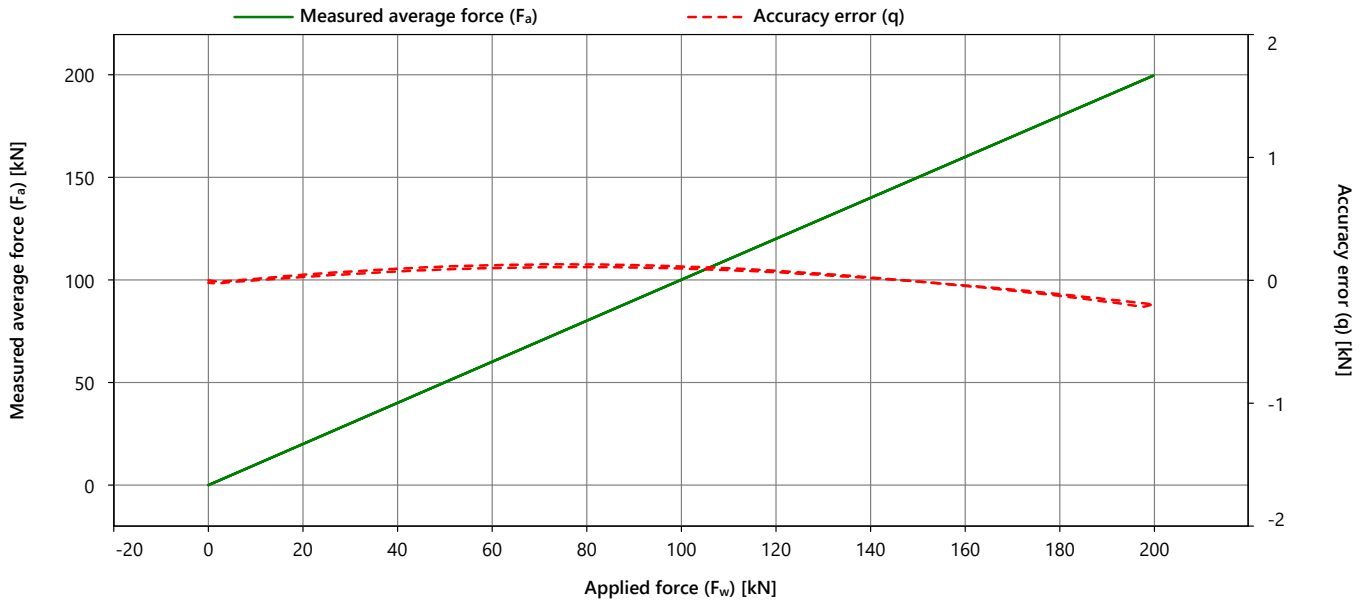
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032138

Calibration Details	
Calibration Date	05 Dec 2023 08:43:24
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.190
Max repeatability error (b)	[kN]	0.077
Max reversibility error (v)	[kN]	0.023
Zero load error (F _{c0})	[kN]	0.020
Zero load offset (F ₀)	[kN]	0.010
Resolution	[kN]	8.56E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.007	0.000	-0.007	0.000	0.000	0.015		0.041
40.000	40.106	40.093	40.083	40.094	0.094	0.023	-0.023	0.146
80.000	80.150	80.125	80.112	80.129	0.129	0.037	-0.022	0.267
120.000	120.103	120.075	120.056	120.078	0.078	0.046	-0.012	0.389
160.000	159.982	159.950	159.929	159.954	-0.046	0.053	0.005	0.512
200.000	199.852	199.802	199.775	199.810	-0.190	0.077		0.637
160.000	159.977	159.956	159.943	159.958	-0.042	0.034	0.005	0.510
120.000	120.083	120.064	120.051	120.066	0.066	0.032	-0.012	0.387
80.000	80.120	80.105	80.095	80.107	0.107	0.025	-0.022	0.265
40.000	40.083	40.071	40.061	40.072	0.072	0.022	-0.023	0.145
0.000	-0.015	-0.020	-0.025	-0.020	-0.020	0.010		0.040

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0027
Electronics	7567
Node Type	7001
Hardware Version	5.01
Software Version	8.01

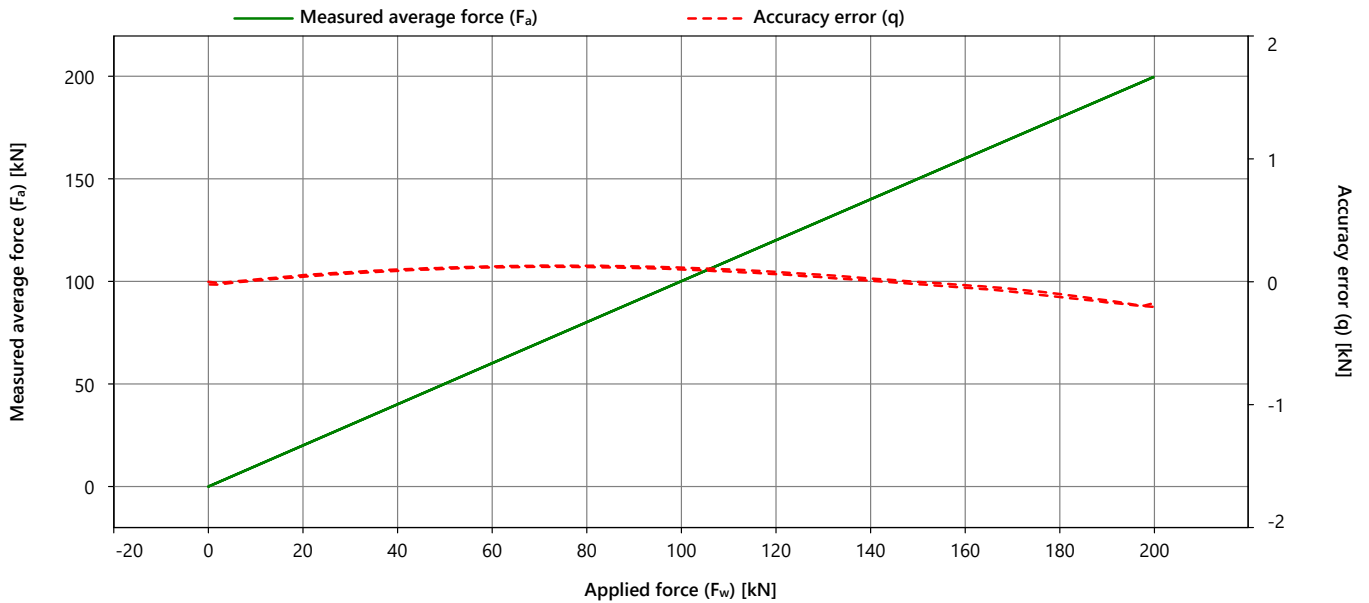
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032138

Calibration Details	
Calibration Date	05 Dec 2023 08:43:24
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.170
Max repeatability error (b)	[kN]	0.051
Max reversibility error (v)	[kN]	0.020
Zero load error (F _{c0})	[kN]	0.022
Zero load offset (F ₀)	[kN]	-0.007
Resolution	[kN]	8.6E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.019



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.011	0.000	-0.011	0.000	0.000	0.023		0.052
40.000	40.111	40.097	40.092	40.100	0.100	0.019	-0.011	0.143
80.000	80.142	80.126	80.121	80.130	0.130	0.021	-0.010	0.264
120.000	120.092	120.079	120.070	120.080	0.080	0.022	-0.018	0.387
160.000	159.987	159.969	159.959	159.972	-0.028	0.028	-0.020	0.510
200.000	199.858	199.823	199.807	199.830	-0.170	0.051		0.634
160.000	159.970	159.950	159.937	159.952	-0.048	0.033	-0.020	0.510
120.000	120.077	120.060	120.049	120.062	0.062	0.028	-0.018	0.387
80.000	80.132	80.118	80.109	80.120	0.120	0.024	-0.010	0.264
40.000	40.101	40.086	40.078	40.088	0.088	0.023	-0.011	0.144
0.000	-0.012	-0.022	-0.031	-0.022	-0.022	0.020		0.049

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0027
Electronics	7567
Node Type	7001
Hardware Version	5.01
Software Version	8.01

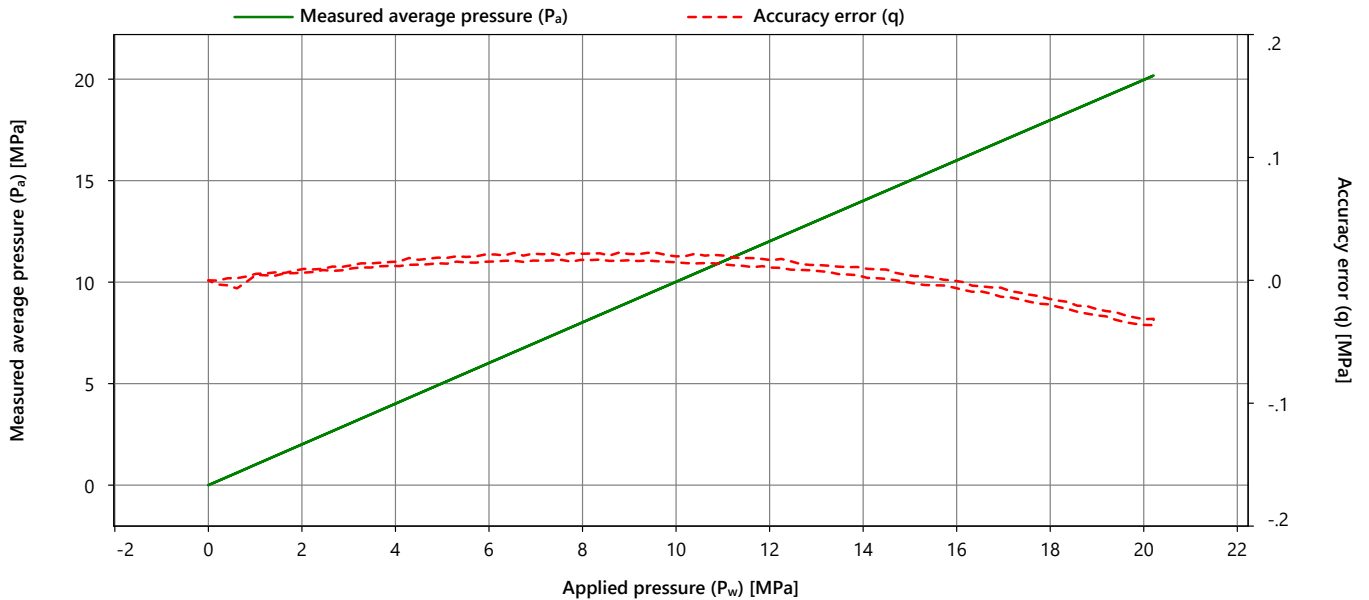
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23032138

Calibration Details	
Calibration Date	05 Dec 2023 10:40:51
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/200bar (81188)
Calibrated Range	0 to 20 MPa
Maximum Rating	0 to 30 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.032
Max repeatability error (b)	[MPa]	0.005
Max reversibility error (v)	[MPa]	0.006
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	-0.004
Resolution	[MPa]	4.2E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	-0.001	-0.002	0.003	0.000	0.000	0.005		0.015
4.000	4.015	4.014	4.016	4.015	0.015	0.002	-0.004	0.008
8.000	8.021	8.021	8.023	8.022	0.022	0.002	-0.005	0.010
12.000	12.016	12.017	12.018	12.017	0.017	0.002	-0.006	0.013
16.000	16.000	16.000	15.998	15.999	-0.001	0.002	-0.006	0.013
20.000	19.970	19.967	19.968	19.968	-0.032	0.003		0.013
16.000	15.993	15.994	15.994	15.993	-0.007	0.001	-0.006	0.013
12.000	12.011	12.010	12.010	12.011	0.011	0.001	-0.006	0.013
8.000	8.017	8.017	8.016	8.017	0.017	0.001	-0.005	0.010
4.000	4.011	4.012	4.010	4.011	0.011	0.001	-0.004	0.008
0.000	0.001	-0.001	0.000	0.000	0.000	0.002		0.004

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0027
Electronics	7567
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0001
Uncertainty	0.6 [Deg]

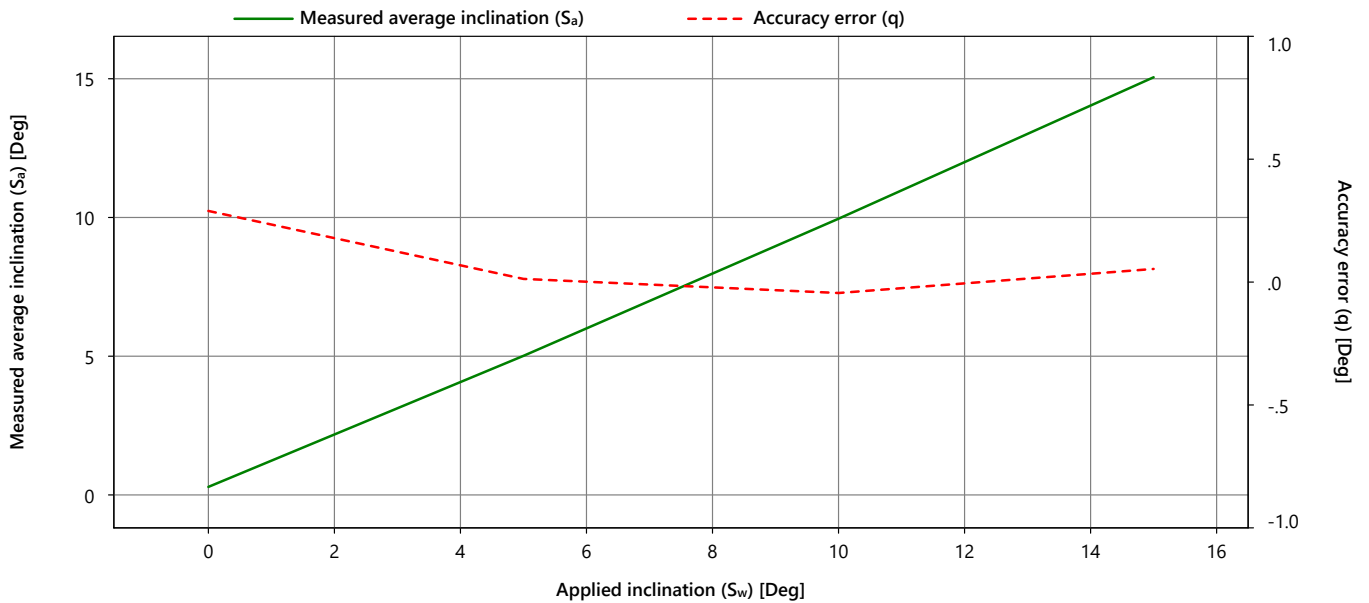
Certificate Number
FCN23032138

Calibration Details	
Calibration Date	05 Dec 2023 09:43:46
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.3
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.3
Resolution	[Deg]	1.32E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w)	Measured inclination 1 ($S_{a,1}$)	Measured inclination 2 ($S_{a,2}$)	Measured inclination 3 ($S_{a,3}$)	Measured average inclination (S_a)	Accuracy error (q)	Repeatability error (b)	Expanded Uncertainty (U)
[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]
0.0	0.2	0.2	0.4	0.3	0.3	0.2	0.7
5.0	5.1	5.0	5.0	5.0	0.0	0.1	0.7
10.0	10.0	10.0	9.9	10.0	0.0	0.1	0.7
15.0	15.1	15.1	15.0	15.1	0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23032138

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Fugro Transducer Workshop, P.O. Box 130, 2630 AC Nootdorp, The Netherlands, Phone +31-70-3111444, www.fugro.com
Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P1E2M4-V2
Serial Number	1715-0027

Appendix Applicable to
Certificate Number
FCN23032138

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

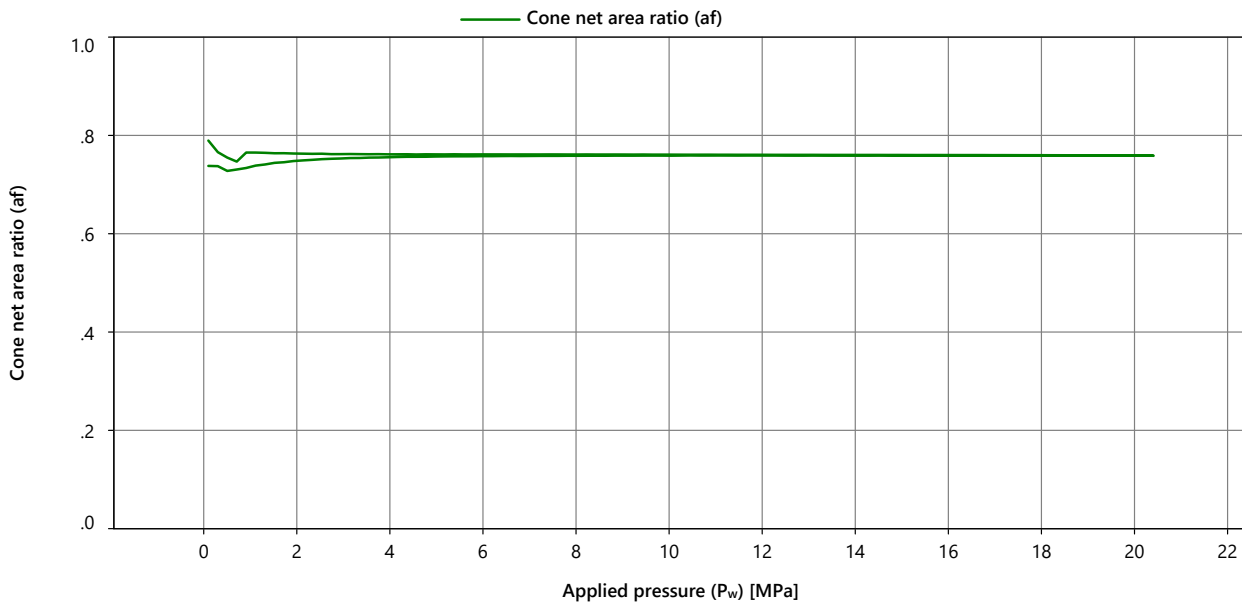
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB20SN2-P 1E2M4-V2	Serial Number	3257-0002
Serial Number	1715-0027	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7567	Measurement Details	
Node Type	7001	Measurement Date	05 Dec 2023 10:40:51
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032138

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
4.000	0.756	0.755	0.755	0.756
8.000	0.759	0.759	0.759	0.759
12.000	0.759	0.759	0.759	0.759
16.000	0.759	0.759	0.759	0.759
20.000	0.759	0.759	0.759	0.759
16.000	0.760	0.760	0.760	0.760
12.000	0.761	0.761	0.761	0.761
8.000	0.761	0.761	0.761	0.761
4.000	0.761	0.762	0.761	0.761

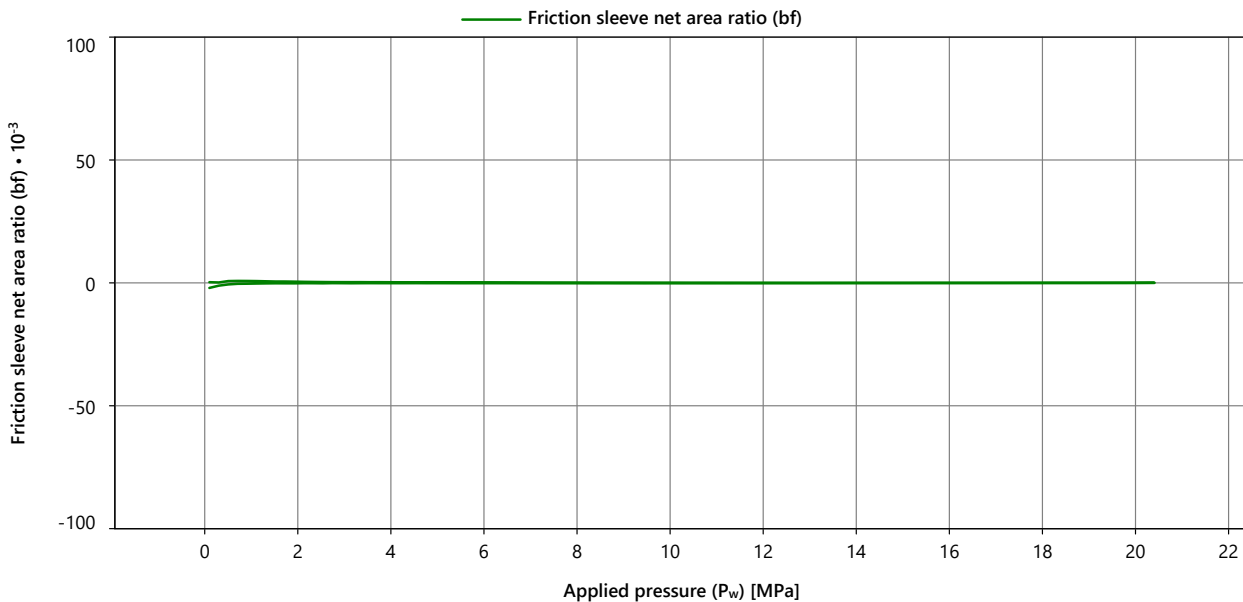
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB20SN2-P 1E2M4-V2	Serial Number	3257-0002
Serial Number	1715-0027	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7567	Measurement Details	
Node Type	7001	Measurement Date	05 Dec 2023 10:40:51
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032138

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00002

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
4.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
12.000	0.000	0.000	0.000	0.000
16.000	0.000	0.000	0.000	0.000
20.000	0.000	0.000	0.000	0.000
16.000	0.000	0.000	0.000	0.000
12.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23032138

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23029815

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0041

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration period 01-May-2023 through 02-May-2023

Calibrate before 01-Nov-2023

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	7.10 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	11.7 $\mu\text{V/V}$	-0.08 %	0.21 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	3.21 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	7.84 $\mu\text{V/V}$	0.00 %	0.21 %
Pore 2 [Pressure]	3.31 mV/V/MPa	1.44 mV/V	3.31 mV/V/MPa	1.42 mV/V	0.03 %	-0.05 %

Nootdorp, 15-May-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0041
Electronics	8994
Node Type	7001
Hardware Version	6.00
Software Version	8.01

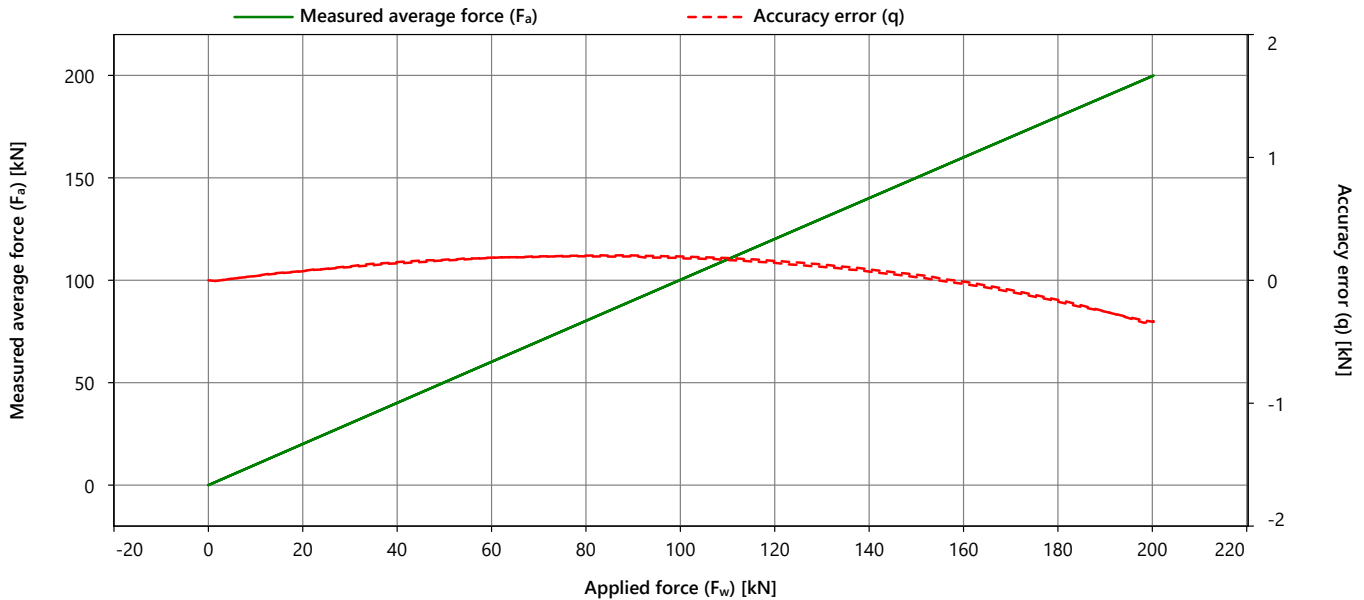
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23029815

Calibration Details	
Calibration Date	01 May 2023 07:12:58
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	3.10.0.53922

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.337
Max repeatability error (b)	[kN]	0.043
Max reversibility error (v)	[kN]	0.019
Zero load error (F _{c0})	[kN]	0.011
Zero load offset (F ₀)	[kN]	-0.044
Resolution	[kN]	8.57E-05
Noise RMS	[kN]	0.003



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.000	0.002	-0.002	0.000	0.000	0.004		0.023
40.000	40.128	40.140	40.145	40.138	0.138	0.017	0.011	0.141
80.000	80.188	80.197	80.213	80.200	0.200	0.025	-0.005	0.263
120.000	120.145	120.160	120.167	120.158	0.158	0.022	-0.014	0.386
160.000	159.970	159.988	160.010	159.990	-0.010	0.040	-0.019	0.510
200.000	199.639	199.669	199.682	199.663	-0.337	0.043		0.633
160.000	159.958	159.970	159.984	159.971	-0.029	0.027	-0.019	0.509
120.000	120.132	120.141	120.157	120.143	0.143	0.025	-0.014	0.386
80.000	80.182	80.194	80.206	80.194	0.194	0.023	-0.005	0.263
40.000	40.142	40.145	40.159	40.149	0.149	0.016	0.011	0.141
0.000	-0.004	-0.011	-0.016	-0.011	-0.011	0.013		0.028

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0041
Electronics	8994
Node Type	7001
Hardware Version	6.00
Software Version	8.01

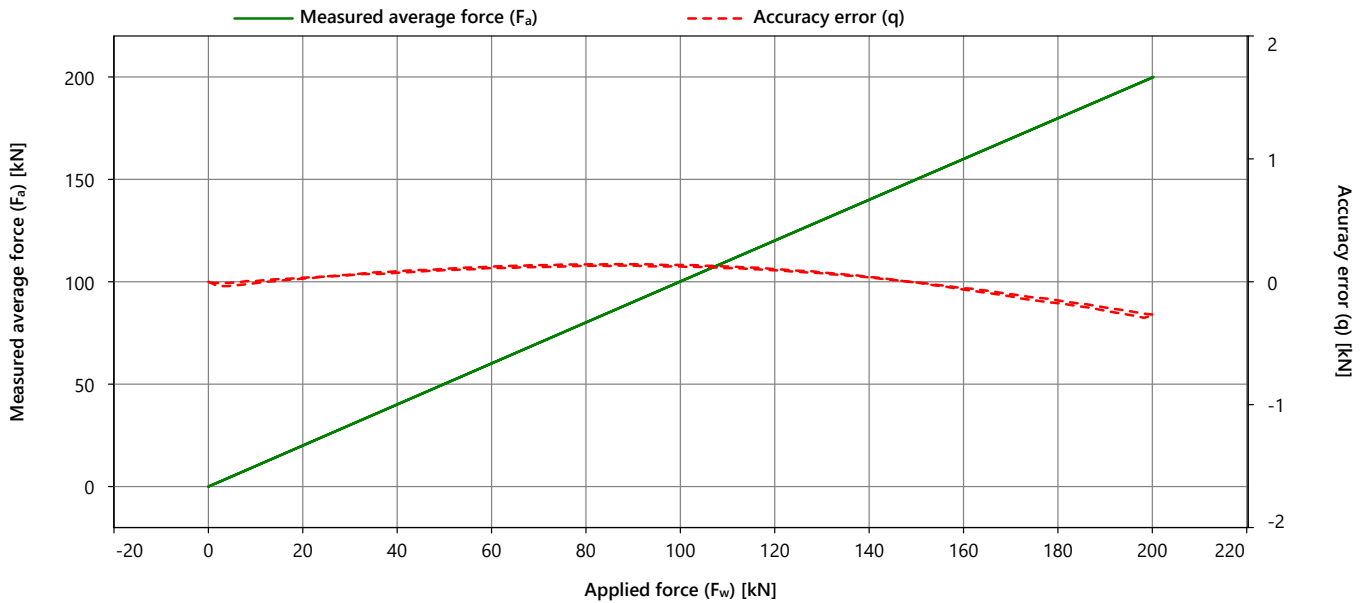
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23029815

Calibration Details	
Calibration Date	01 May 2023 07:12:59
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	3.10.0.53922

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.275
Max repeatability error (b)	[kN]	0.046
Max reversibility error (v)	[kN]	0.012
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	-0.003
Resolution	[kN]	8.6E-05
Noise RMS	[kN]	0.003
Tip-Sleeve Interaction %	[%]	0.113



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.001	0.002	-0.003	0.000	0.000	0.004		0.019
40.000	40.099	40.090	40.067	40.085	0.085	0.032	-0.012	0.145
80.000	80.160	80.137	80.126	80.141	0.141	0.034	-0.012	0.265
120.000	120.122	120.099	120.086	120.102	0.102	0.036	-0.009	0.387
160.000	159.960	159.935	159.914	159.936	-0.064	0.046	0.011	0.511
200.000	199.745	199.730	199.699	199.725	-0.275	0.046		0.633
160.000	159.965	159.950	159.927	159.948	-0.052	0.038	0.011	0.510
120.000	120.114	120.096	120.072	120.094	0.094	0.042	-0.009	0.388
80.000	80.144	80.131	80.111	80.129	0.129	0.033	-0.012	0.265
40.000	40.087	40.072	40.060	40.073	0.073	0.027	-0.012	0.143
0.000	-0.008	-0.008	-0.006	-0.008	-0.008	0.002		0.019

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0041
Electronics	8994
Node Type	7001
Hardware Version	6.00
Software Version	8.01

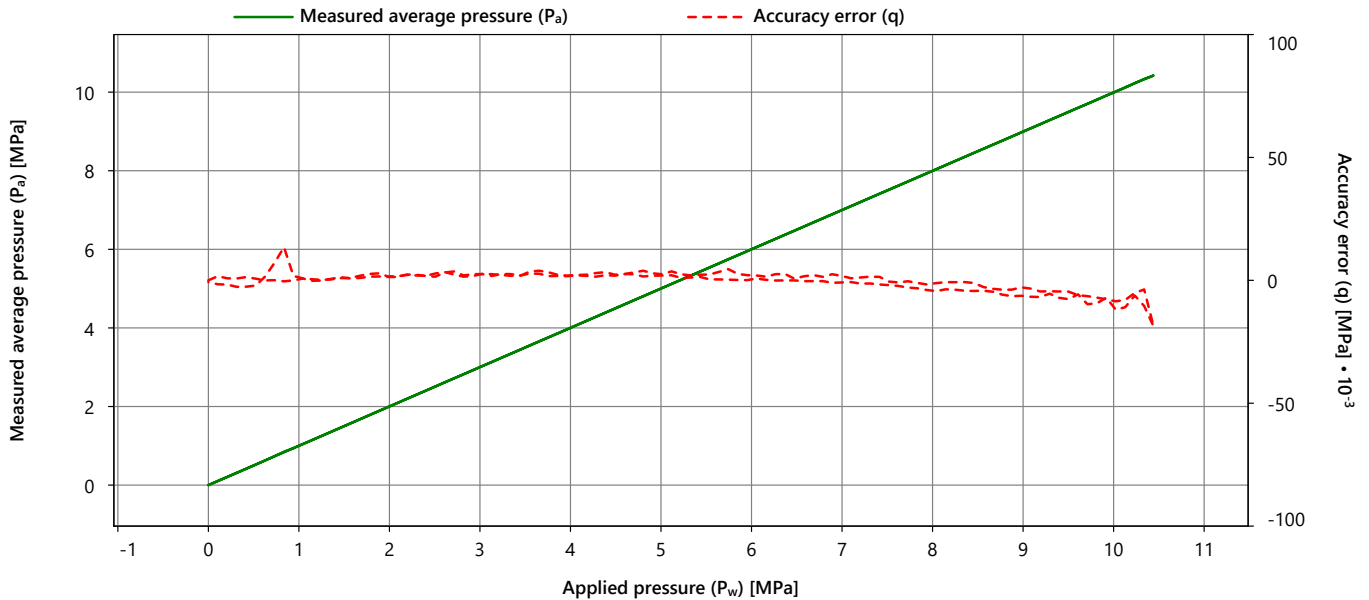
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23029815

Calibration Details	
Calibration Date	01 May 2023 07:54:33
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	3.10.0.53922

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.008
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	-0.001
Resolution	[MPa]	2.25E-06
Noise RMS	[MPa]	0.001



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.001		0.003
2.000	2.000	2.001	2.003	2.001	0.001	0.003	0.000	0.006
4.000	4.002	4.002	4.002	4.002	0.002	0.001	0.000	0.005
6.000	6.004	6.002	6.000	6.002	0.002	0.004	-0.002	0.008
8.000	7.999	7.999	7.997	7.999	-0.001	0.002	-0.003	0.008
10.000	9.991	9.993	9.991	9.992	-0.008	0.002		0.008
8.000	7.996	7.995	7.996	7.996	-0.004	0.001	-0.003	0.007
6.000	5.999	6.000	6.001	6.000	0.000	0.001	-0.002	0.006
4.000	4.000	4.003	4.002	4.002	0.002	0.003	0.000	0.007
2.000	2.002	2.000	2.002	2.001	0.001	0.002	0.000	0.005
0.000	0.000	-0.001	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0041
Electronics	8994
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

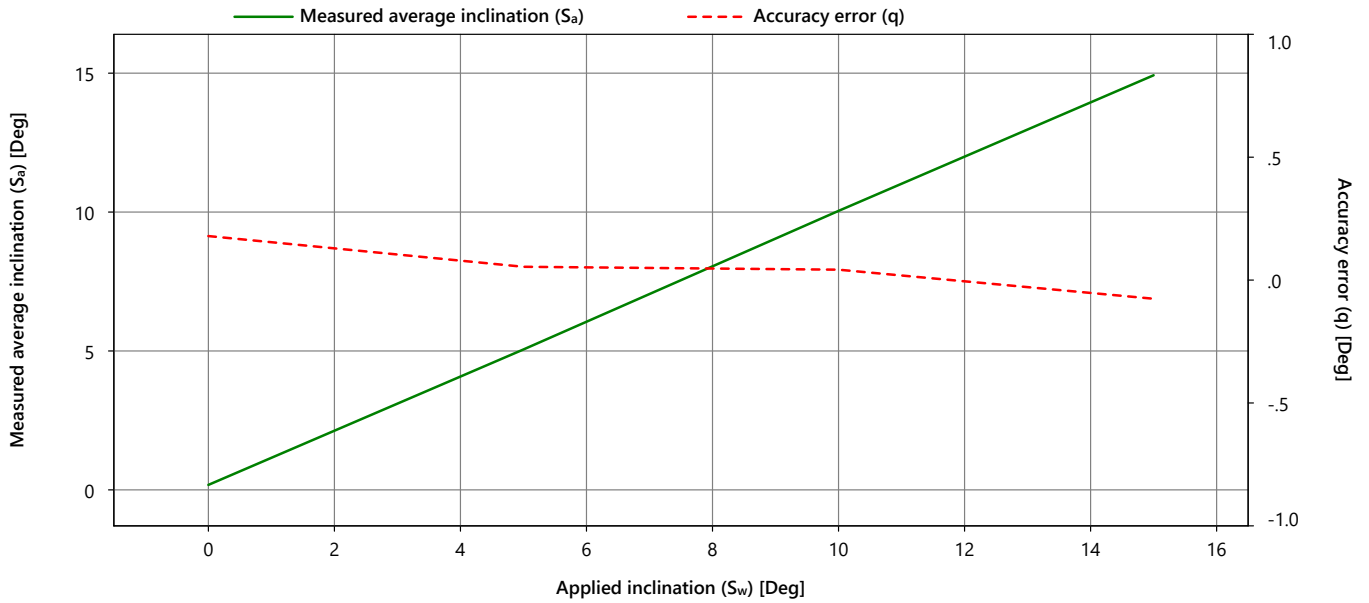
Certificate Number
FCN23029815

Calibration Details	
Calibration Date	01 May 2023 07:17:36
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	3.10.0.53922

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.1
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.35E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w)	Measured inclination 1 ($S_{a,1}$)	Measured inclination 2 ($S_{a,2}$)	Measured inclination 3 ($S_{a,3}$)	Measured average inclination (S_a)	Accuracy error (q)	Repeatability error (b)	Expanded Uncertainty (U)
[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]
0.0	0.2	0.2	0.1	0.2	0.2	0.1	0.7
5.0	5.0	5.0	5.1	5.1	0.1	0.1	0.7
10.0	10.0	10.1	10.1	10.0	0.0	0.1	0.7
15.0	14.9	14.9	14.9	14.9	-0.1	0.0	0.7

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Symbols, Definitions and References

Certificate Number
FCN23029815

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Fugro Transducer Workshop, P.O. Box 130, 2630 AC Nootdorp, The Netherlands, Phone +31-70-3111444, www.fugro.com
Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0041

Appendix Applicable to
Certificate Number
FCN23029815

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

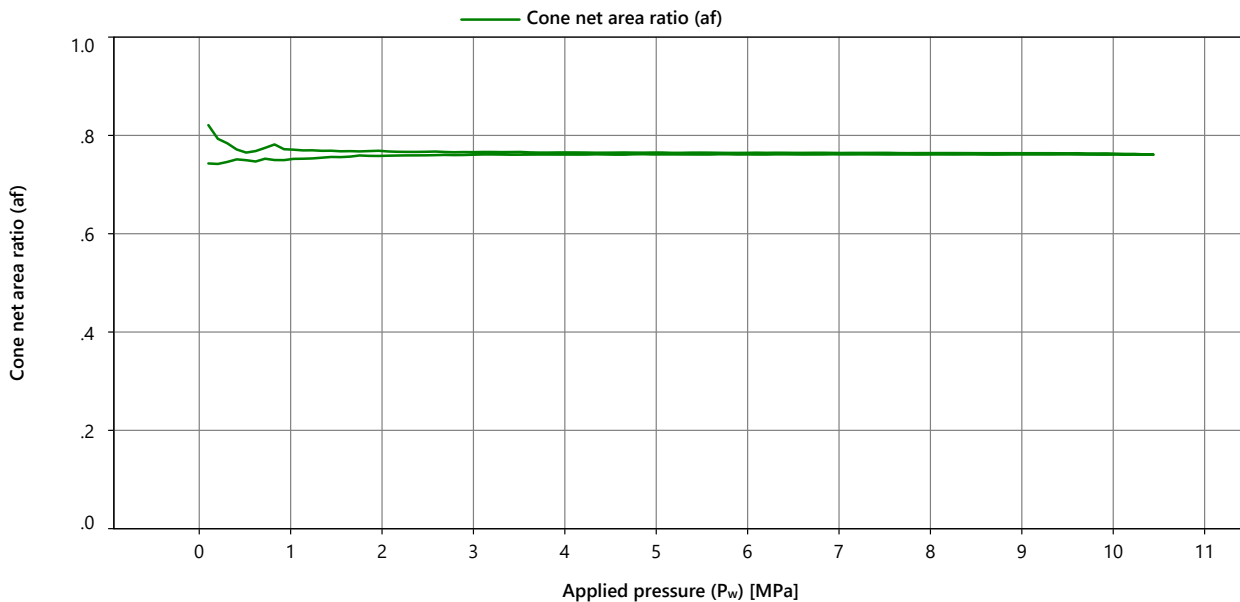
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0041	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	8994	Measurement Details	
Node Type	7001	Measurement Date	01 May 2023 07:54:34
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	3.10.0.53922

Appendix Applicable to
Certificate Number
FCN23029815

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.755	0.759	0.761	0.758
4.000	0.759	0.762	0.763	0.761
6.000	0.760	0.761	0.762	0.761
8.000	0.760	0.762	0.762	0.761
10.000	0.760	0.761	0.761	0.761
8.000	0.764	0.764	0.765	0.764
6.000	0.764	0.765	0.765	0.765
4.000	0.764	0.766	0.766	0.765
2.000	0.768	0.767	0.769	0.768

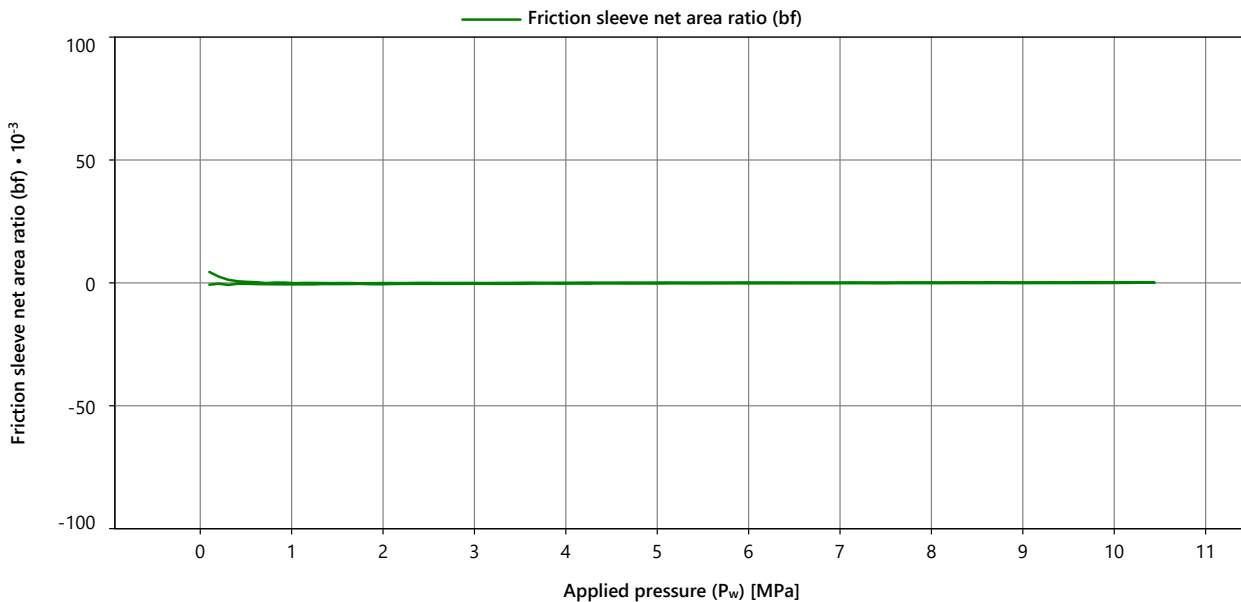
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0041	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	8994	Measurement Details	
Node Type	7001	Measurement Date	01 May 2023 07:54:34
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	3.10.0.53922

Appendix Applicable to
Certificate Number
FCN23029815

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00011

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	-0.001	0.000	0.000	-0.001

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23029815

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23030144

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0017

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 24-May-2023

Calibrate before 24-Nov-2023

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	2.21 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	8.34 $\mu\text{V/V}$	0.03 %	0.28 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	-4.81 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	-3.08 $\mu\text{V/V}$	0.03 %	0.08 %
Pore 2 [Pressure]	3.28 mV/V/MPa	2.06 mV/V	3.28 mV/V/MPa	2.07 mV/V	0.04 %	0.02 %

Nootdorp, 25-May-2023

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Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0017
Electronics	7717
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference

Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23030144

Calibration Details

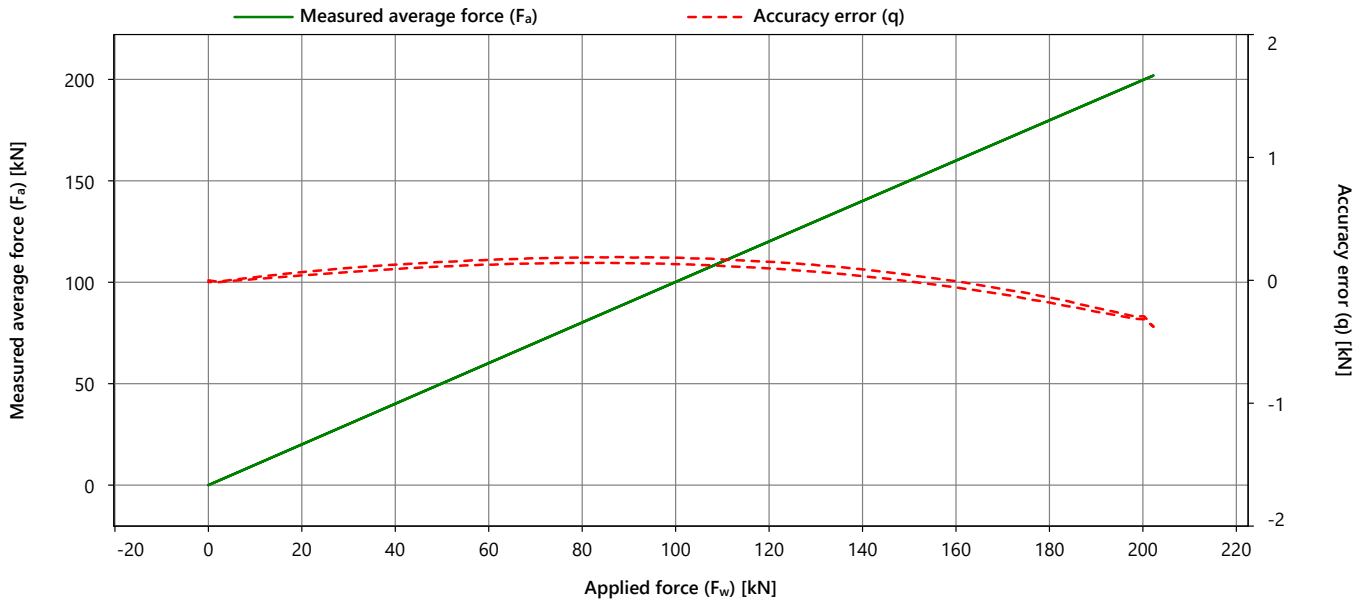
Calibration Date	24 May 2023 13:41:58
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	3.10.0.53922

Sensor

Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.295
Max repeatability error (b)	[kN]	0.015
Max reversibility error (v)	[kN]	0.054
Zero load error (F _{c0})	[kN]	0.013
Zero load offset (F ₀)	[kN]	-0.017
Resolution	[kN]	8.55E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.006	0.000	-0.006	0.000	0.000	0.011		0.029
40.000	40.133	40.127	40.123	40.128	0.128	0.010	-0.036	0.146
80.000	80.195	80.186	80.181	80.187	0.187	0.013	-0.046	0.268
120.000	120.154	120.150	120.148	120.151	0.151	0.006	-0.054	0.390
160.000	159.995	159.990	159.994	159.993	-0.007	0.005	-0.051	0.511
200.000	199.714	199.702	199.700	199.705	-0.295	0.014		0.631
160.000	159.949	159.941	159.937	159.942	-0.058	0.012	-0.051	0.511
120.000	120.106	120.095	120.091	120.097	0.097	0.015	-0.054	0.390
80.000	80.150	80.140	80.135	80.142	0.142	0.015	-0.046	0.268
40.000	40.097	40.092	40.086	40.092	0.092	0.011	-0.036	0.146
0.000	-0.008	-0.014	-0.017	-0.013	-0.013	0.009		0.028

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0017
Electronics	7717
Node Type	7001
Hardware Version	5.01
Software Version	8.01

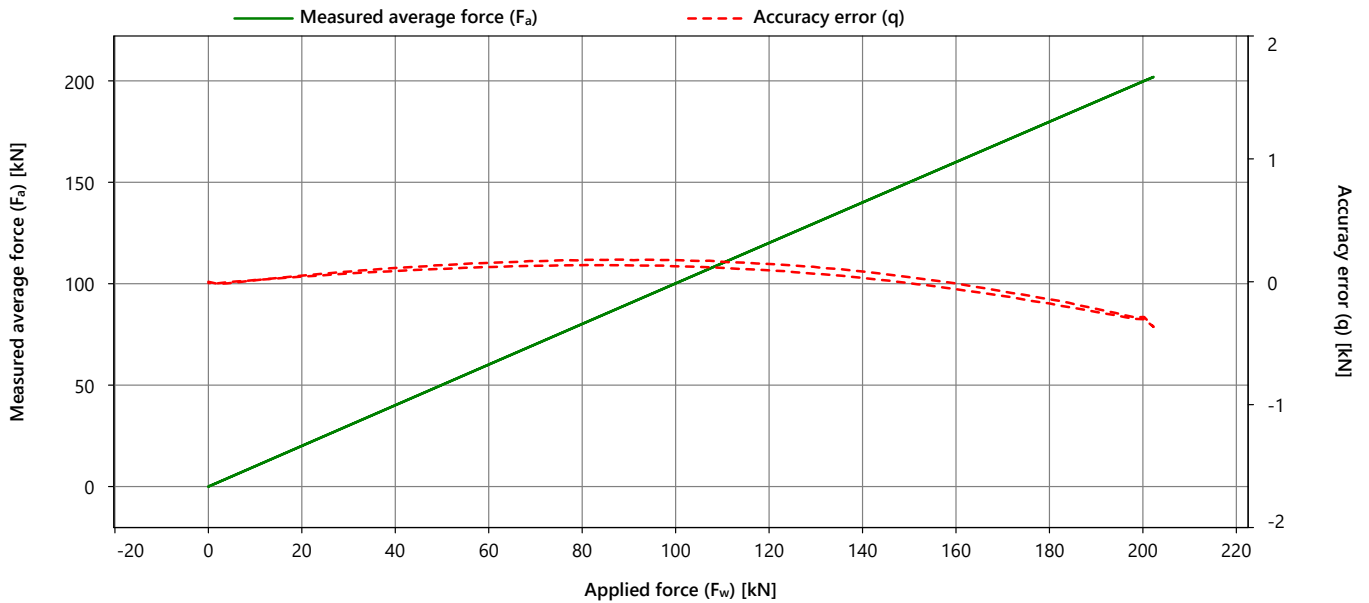
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23030144

Calibration Details	
Calibration Date	24 May 2023 13:41:58
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	3.10.0.53922

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.289
Max repeatability error (b)	[kN]	0.012
Max reversibility error (v)	[kN]	0.052
Zero load error (F _{c0})	[kN]	0.010
Zero load offset (F ₀)	[kN]	-0.022
Resolution	[kN]	8.61E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.032



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.004	0.000	-0.004	0.000	0.000	0.008		0.023
40.000	40.117	40.111	40.109	40.112	0.112	0.007	-0.026	0.142
80.000	80.180	80.176	80.174	80.177	0.177	0.006	-0.041	0.266
120.000	120.145	120.145	120.145	120.145	0.145	0.001	-0.052	0.390
160.000	159.986	159.984	159.988	159.986	-0.014	0.004	-0.047	0.511
200.000	199.715	199.710	199.707	199.711	-0.289	0.008		0.631
160.000	159.943	159.940	159.936	159.940	-0.060	0.006	-0.047	0.511
120.000	120.099	120.092	120.087	120.093	0.093	0.012	-0.052	0.390
80.000	80.141	80.134	80.132	80.136	0.136	0.010	-0.041	0.266
40.000	40.092	40.088	40.080	40.087	0.087	0.012	-0.026	0.143
0.000	-0.006	-0.011	-0.013	-0.010	-0.010	0.007		0.023

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0017
Electronics	7717
Node Type	7001
Hardware Version	5.01
Software Version	8.01

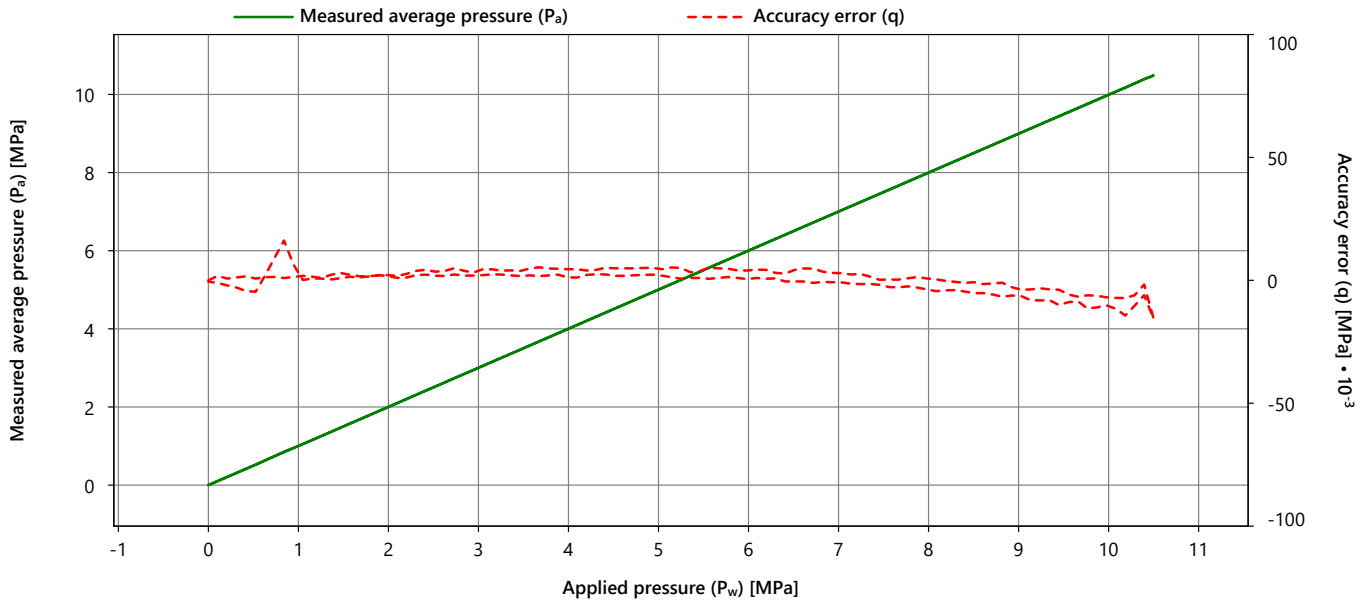
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23030144

Calibration Details	
Calibration Date	24 May 2023 14:02:28
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	3.10.0.53922

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.007
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.005
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	0.004
Resolution	[MPa]	2.27E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.002	2.002	2.002	2.002	0.002	0.001	0.000	0.004
4.000	4.004	4.005	4.005	4.005	0.005	0.001	-0.003	0.007
6.000	6.004	6.004	6.004	6.004	0.004	0.000	-0.003	0.007
8.000	8.002	8.000	8.000	8.001	0.001	0.003	-0.005	0.010
10.000	9.994	9.993	9.992	9.993	-0.007	0.001		0.008
8.000	7.996	7.996	7.996	7.996	-0.004	0.000	-0.005	0.009
6.000	6.000	6.000	6.002	6.001	0.001	0.002	-0.003	0.007
4.000	4.002	4.001	4.001	4.001	0.001	0.002	-0.003	0.007
2.000	2.001	2.003	2.001	2.002	0.002	0.002	0.000	0.005
0.000	-0.001	-0.001	0.000	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0017
Electronics	7717
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

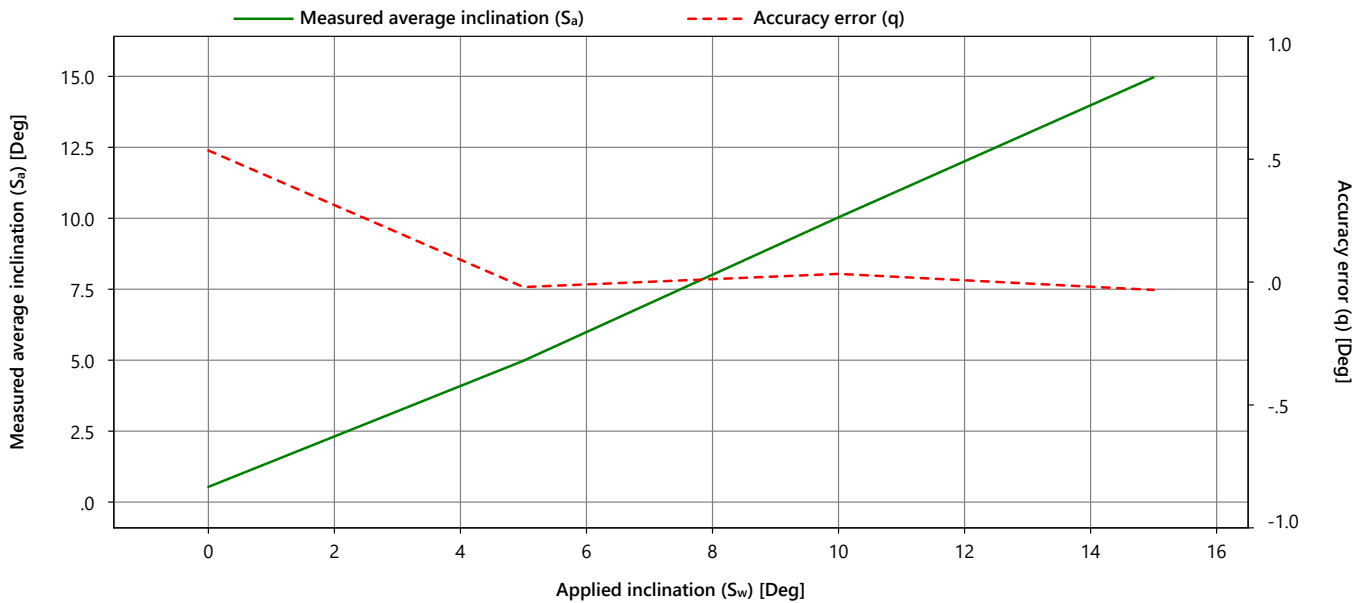
Certificate Number
FCN23030144

Calibration Details	
Calibration Date	24 May 2023 13:47:12
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	3.10.0.53922

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.5
Max repeatability error (b)	[Deg]	0.6
Zero load error (S_{c0})	[Deg]	-0.1
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.34E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.7	0.8	0.5	0.5	0.6	1.2
5.0	5.1	5.0	4.8	5.0	0.0	0.3	0.8
10.0	10.1	10.1	10.0	10.0	0.0	0.1	0.7
15.0	14.9	15.1	14.9	15.0	0.0	0.2	0.8

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Symbols, Definitions and References

Certificate Number
FCN23030144

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0017

Appendix Applicable to
Certificate Number
FCN23030144

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0017
Electronics	7717
Node Type	7001
Hardware Version	5.01
Software Version	8.01

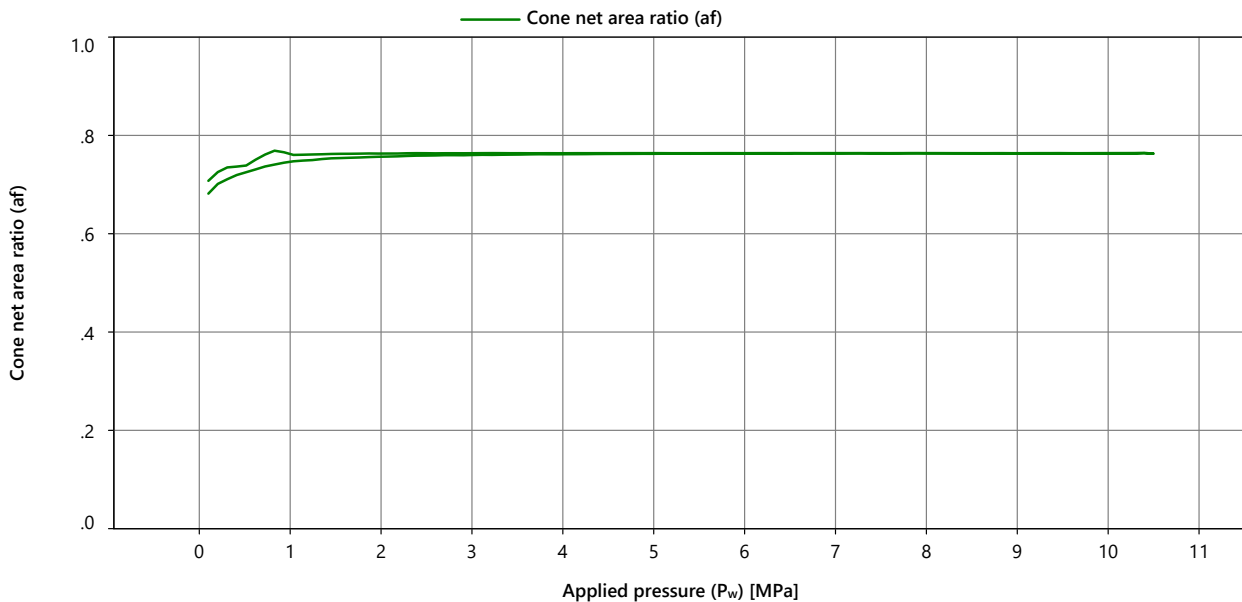
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23030144

Measurement Details	
Measurement Date	24 May 2023 14:02:29
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	3.10.0.53922

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.756	0.757	0.757	0.757
4.000	0.761	0.762	0.762	0.762
6.000	0.763	0.763	0.763	0.763
8.000	0.764	0.764	0.764	0.764
10.000	0.764	0.764	0.764	0.764
8.000	0.764	0.764	0.764	0.764
6.000	0.764	0.764	0.764	0.764
4.000	0.764	0.764	0.764	0.764
2.000	0.762	0.764	0.763	0.763

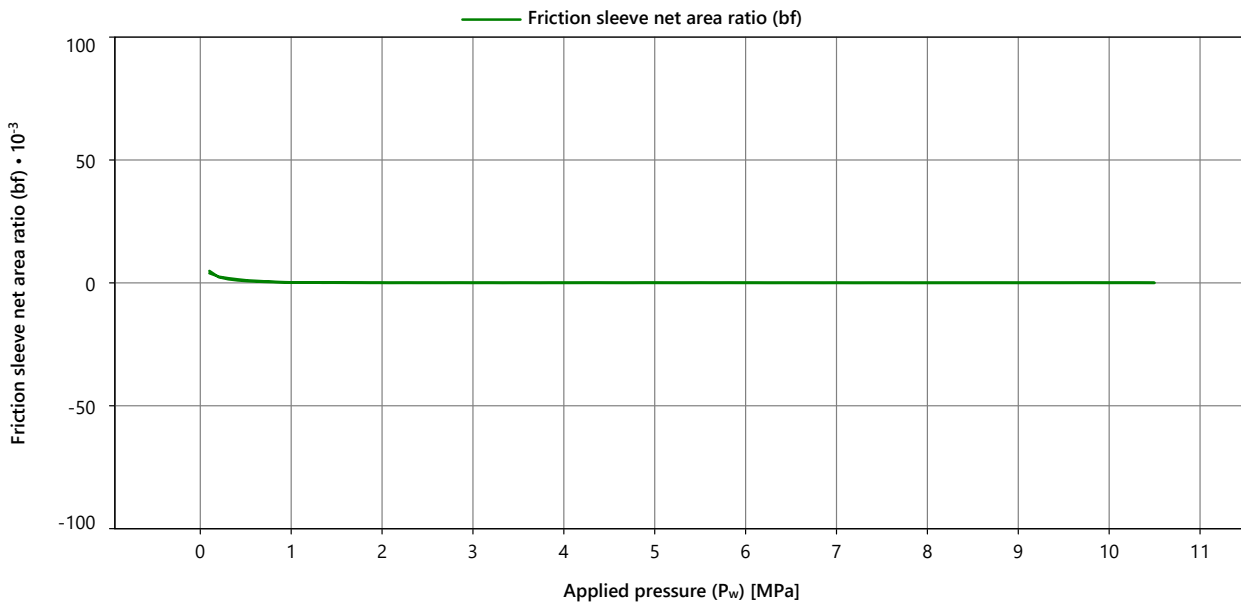
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0017	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7717	Measurement Details	
Node Type	7001	Measurement Date	24 May 2023 14:02:29
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	3.10.0.53922

Appendix Applicable to
Certificate Number
FCN23030144

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00001

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23030144

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23030146

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB20SN2-P1E2M4-V2
Serial Number 1715-0025

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 24-May-2023

Calibrate before 24-Nov-2023

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/200bar (81188)	0 to 20 MPa	0 to 30 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	-4.31 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	-2.32 $\mu\text{V/V}$	-0.05 %	0.09 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	13.2 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	17.8 $\mu\text{V/V}$	-0.03 %	0.21 %
Pore 2 [Pressure]	1.89 mV/V/MPa	851 $\mu\text{V/V}$	1.89 mV/V/MPa	883 $\mu\text{V/V}$	0.01 %	0.08 %

Nootdorp, 25-May-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0025
Electronics	7711
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference

Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23030146

Calibration Details

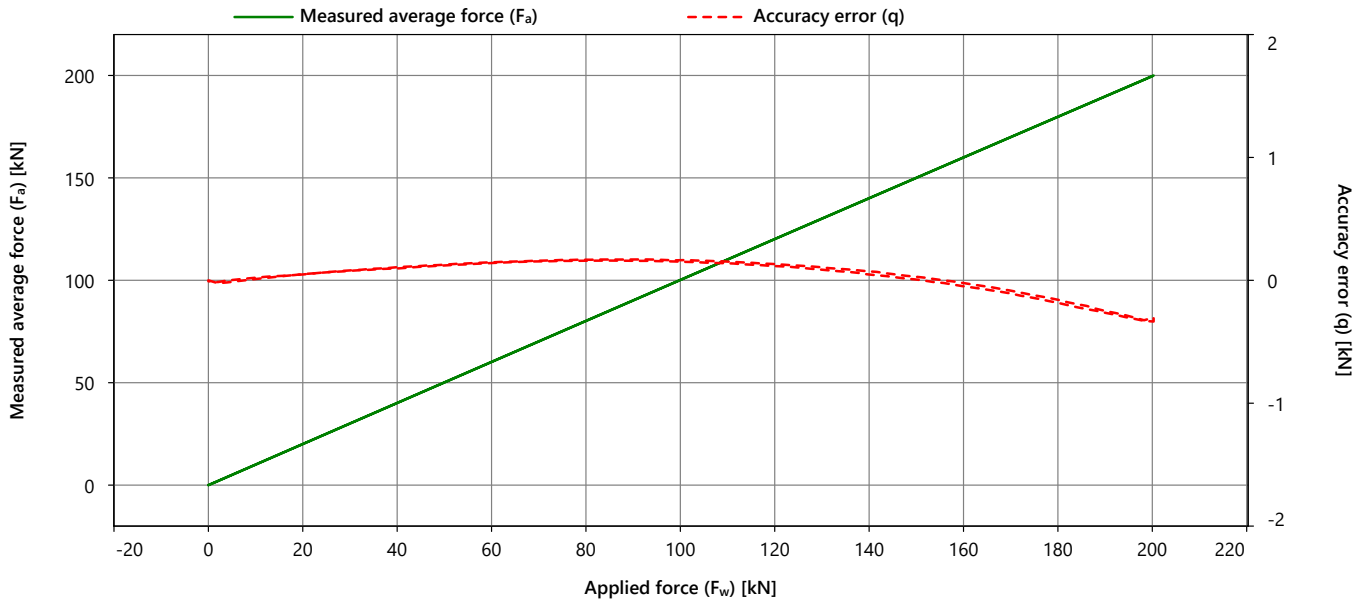
Calibration Date	24 May 2023 14:07:13
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	3.10.0.53922

Sensor

Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.309
Max repeatability error (b)	[kN]	0.031
Max reversibility error (v)	[kN]	0.026
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	0.003
Resolution	[kN]	8.57E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.006	-0.001	-0.006	0.000	0.000	0.012		0.025
40.000	40.118	40.106	40.098	40.107	0.107	0.020	-0.011	0.141
80.000	80.182	80.166	80.156	80.168	0.168	0.026	-0.008	0.264
120.000	120.150	120.129	120.119	120.132	0.132	0.031	-0.017	0.387
160.000	159.993	159.975	159.966	159.978	-0.022	0.027	-0.026	0.509
200.000	199.701	199.690	199.682	199.691	-0.309	0.018		0.631
160.000	159.967	159.948	159.940	159.951	-0.049	0.027	-0.026	0.509
120.000	120.132	120.112	120.104	120.116	0.116	0.027	-0.017	0.386
80.000	80.170	80.157	80.152	80.160	0.160	0.018	-0.008	0.263
40.000	40.107	40.094	40.088	40.096	0.096	0.020	-0.011	0.141
0.000	-0.005	-0.008	-0.010	-0.008	-0.008	0.005		0.019

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0025
Electronics	7711
Node Type	7001
Hardware Version	5.01
Software Version	8.01

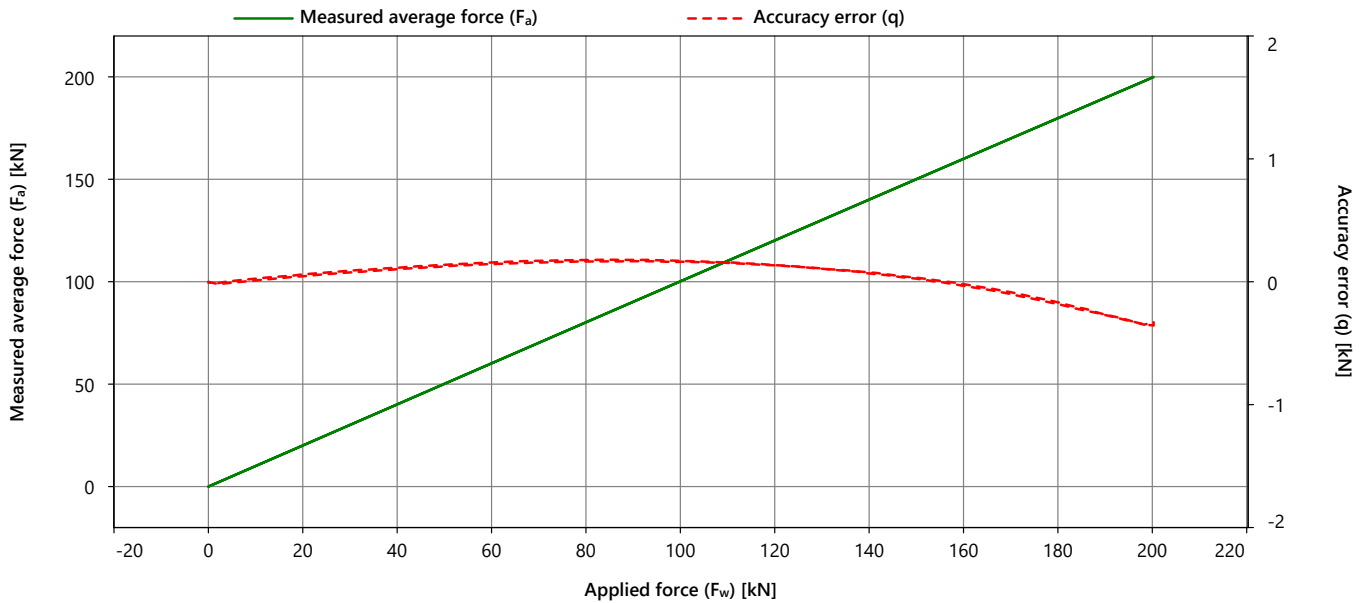
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23030146

Calibration Details	
Calibration Date	24 May 2023 14:07:14
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	3.10.0.53922

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.333
Max repeatability error (b)	[kN]	0.025
Max reversibility error (v)	[kN]	0.014
Zero load error (F _{c0})	[kN]	0.007
Zero load offset (F ₀)	[kN]	-0.011
Resolution	[kN]	8.62E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.017



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.009	-0.003	-0.006	0.000	0.000	0.015		0.029
40.000	40.114	40.102	40.091	40.102	0.102	0.023	0.011	0.142
80.000	80.178	80.164	80.154	80.165	0.165	0.024	0.012	0.263
120.000	120.148	120.131	120.123	120.134	0.134	0.025	0.001	0.386
160.000	159.991	159.977	159.975	159.981	-0.019	0.017	-0.014	0.508
200.000	199.671	199.667	199.663	199.667	-0.333	0.008		0.631
160.000	159.977	159.965	159.959	159.967	-0.033	0.018	-0.014	0.508
120.000	120.147	120.132	120.126	120.135	0.135	0.021	0.001	0.385
80.000	80.188	80.173	80.171	80.177	0.177	0.017	0.012	0.263
40.000	40.124	40.112	40.106	40.114	0.114	0.018	0.011	0.141
0.000	-0.002	-0.008	-0.011	-0.007	-0.007	0.009		0.021

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0025
Electronics	7711
Node Type	7001
Hardware Version	5.01
Software Version	8.01

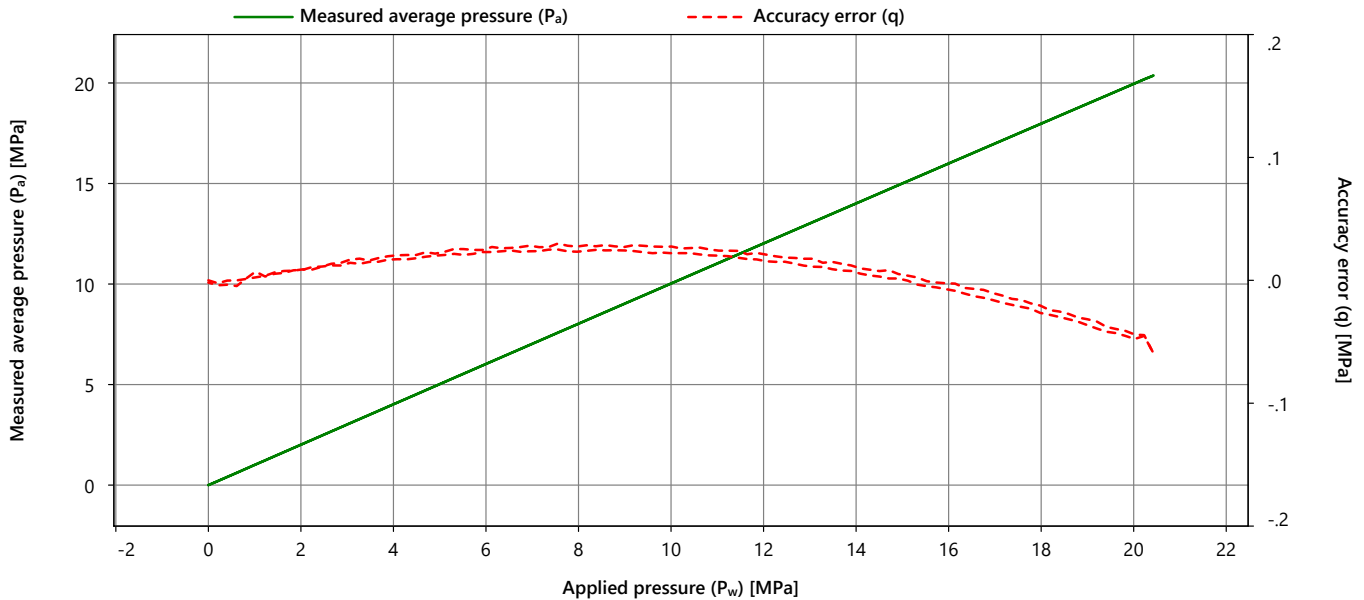
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23030146

Calibration Details	
Calibration Date	24 May 2023 14:32:34
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	3.10.0.53922

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/200bar (81188)
Calibrated Range	0 to 20 MPa
Maximum Rating	0 to 30 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.044
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.006
Zero load error (P _{c0})	[MPa]	0.002
Zero load offset (P ₀)	[MPa]	0.002
Resolution	[MPa]	3.94E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.001	0.000	-0.001	0.000	0.000	0.001		0.004
4.000	4.020	4.022	4.020	4.020	0.020	0.002	-0.003	0.007
8.000	8.028	8.027	8.028	8.028	0.028	0.001	-0.004	0.009
12.000	12.020	12.022	12.022	12.022	0.022	0.002	-0.005	0.012
16.000	15.997	16.000	15.997	15.998	-0.002	0.003	-0.006	0.013
20.000	19.957	19.955	19.957	19.956	-0.044	0.003		0.013
16.000	15.994	15.991	15.992	15.992	-0.008	0.003	-0.006	0.014
12.000	12.016	12.016	12.016	12.016	0.016	0.001	-0.005	0.011
8.000	8.024	8.023	8.023	8.023	0.023	0.001	-0.004	0.009
4.000	4.019	4.017	4.015	4.017	0.017	0.003	-0.003	0.008
0.000	-0.001	-0.002	-0.002	-0.002	-0.002	0.001		0.004

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0025
Electronics	7711
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

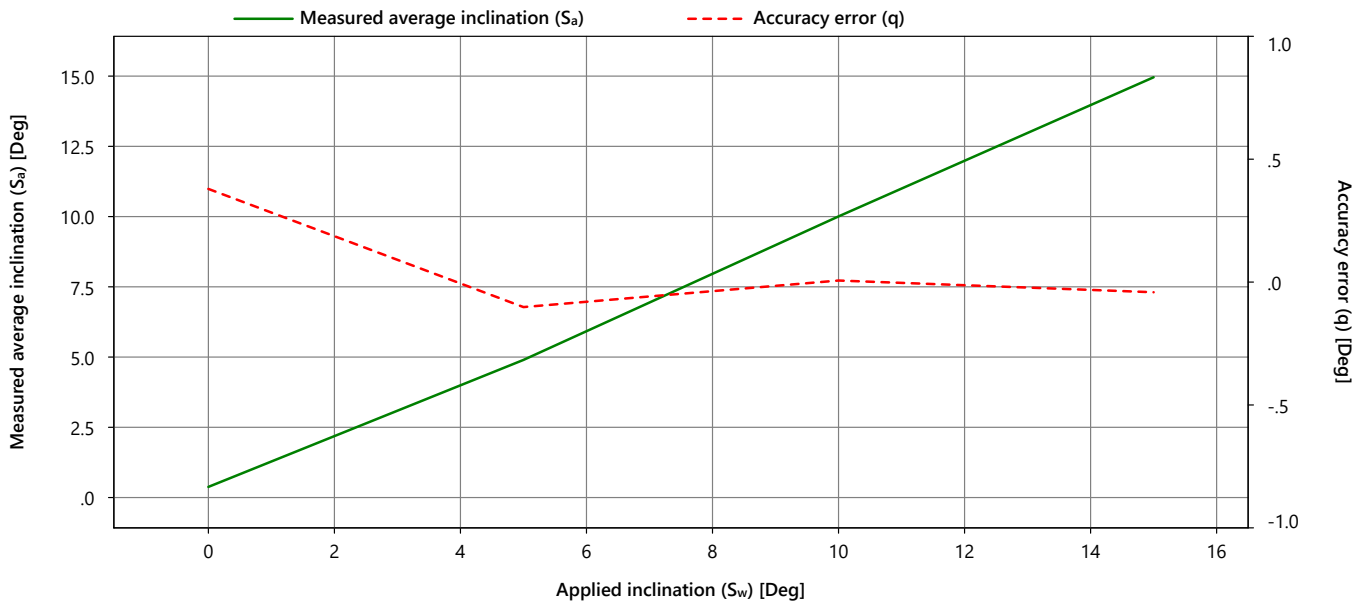
Certificate Number
FCN23030146

Calibration Details	
Calibration Date	24 May 2023 14:13:14
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	3.10.0.53922

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.4
Max repeatability error (b)	[Deg]	0.4
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.36E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.6	0.4	0.4	0.4	0.4	0.9
5.0	5.0	4.9	4.7	4.9	-0.1	0.3	0.8
10.0	9.9	10.1	10.0	10.0	0.0	0.1	0.7
15.0	14.8	15.1	15.0	15.0	0.0	0.2	0.8

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Symbols, Definitions and References

Certificate Number
FCN23030146

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P1E2M4-V2
Serial Number	1715-0025

Appendix Applicable to
Certificate Number
FCN23030146

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0025
Electronics	7711
Node Type	7001
Hardware Version	5.01
Software Version	8.01

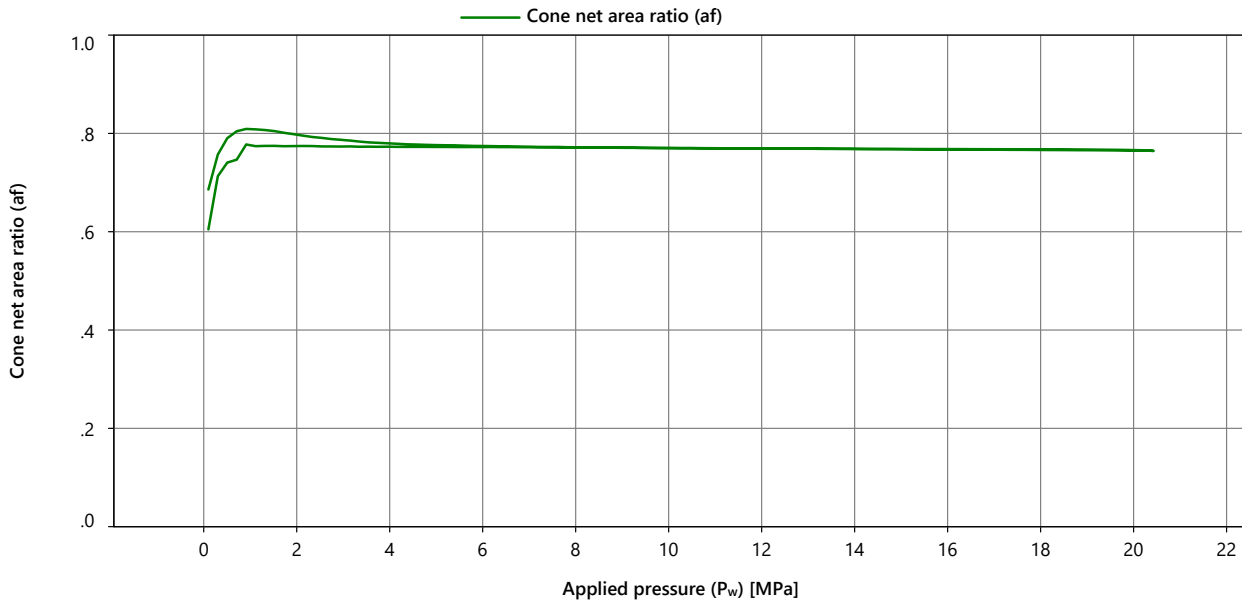
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23030146

Measurement Details	
Measurement Date	24 May 2023 14:32:35
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	3.10.0.53922

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
4.000	0.775	0.780	0.784	0.780
8.000	0.769	0.772	0.774	0.772
12.000	0.767	0.769	0.771	0.769
16.000	0.766	0.767	0.768	0.767
20.000	0.764	0.765	0.766	0.765
16.000	0.768	0.768	0.769	0.768
12.000	0.769	0.769	0.770	0.769
8.000	0.770	0.771	0.773	0.771
4.000	0.771	0.773	0.776	0.773

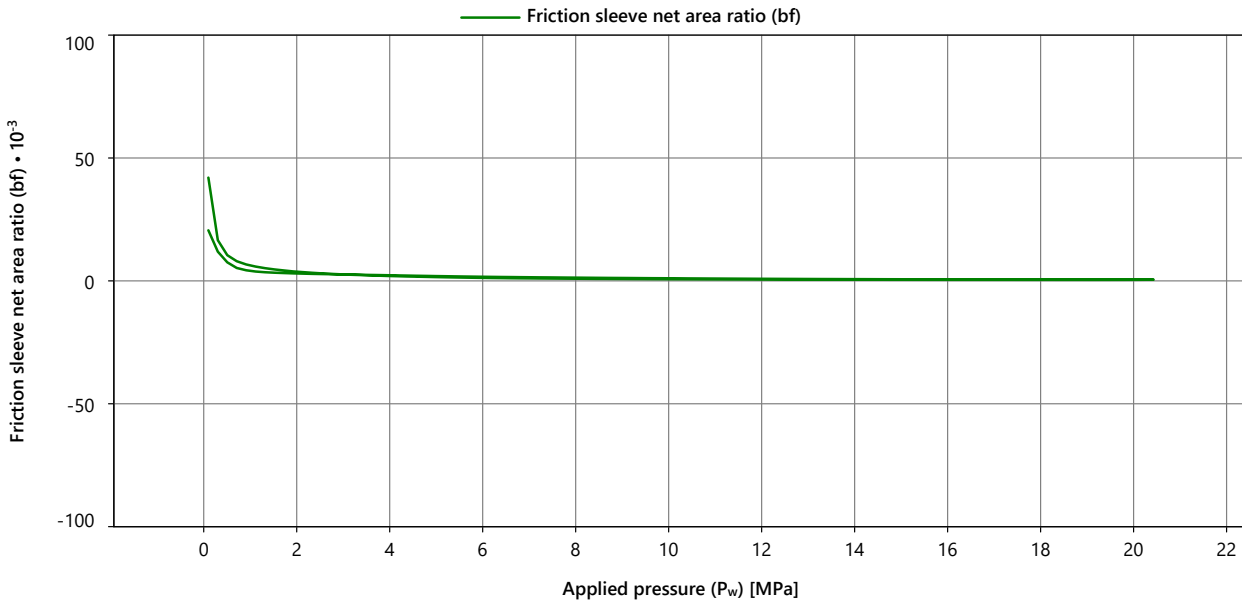
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB20SN2-P 1E2M4-V2	Serial Number	3257-0002
Serial Number	1715-0025	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7711	Measurement Details	
Node Type	7001	Measurement Date	24 May 2023 14:32:35
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	3.10.0.53922

Appendix Applicable to
Certificate Number
FCN23030146

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00049

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
4.000	0.002	0.002	0.002	0.002
8.000	0.001	0.001	0.001	0.001
12.000	0.001	0.001	0.001	0.001
16.000	0.001	0.001	0.001	0.001
20.000	0.001	0.001	0.000	0.001
16.000	0.000	0.000	0.000	0.000
12.000	0.001	0.001	0.001	0.001
8.000	0.001	0.001	0.001	0.001
4.000	0.002	0.002	0.002	0.002

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23030146

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23030586

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0044

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 04-Jul-2023

Calibrate before 04-Jan-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	9.23 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	12.8 $\mu\text{V/V}$	0.03 %	0.16 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	-2.39 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	-0.496 $\mu\text{V/V}$	0.11 %	0.09 %
Pore 2 [Pressure]	3.19 mV/V/MPa	633 $\mu\text{V/V}$	3.19 mV/V/MPa	618 $\mu\text{V/V}$	0.01 %	-0.05 %

Nootdorp, 05-Jul-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0044
Electronics	7624
Node Type	7001
Hardware Version	5.01
Software Version	8.01

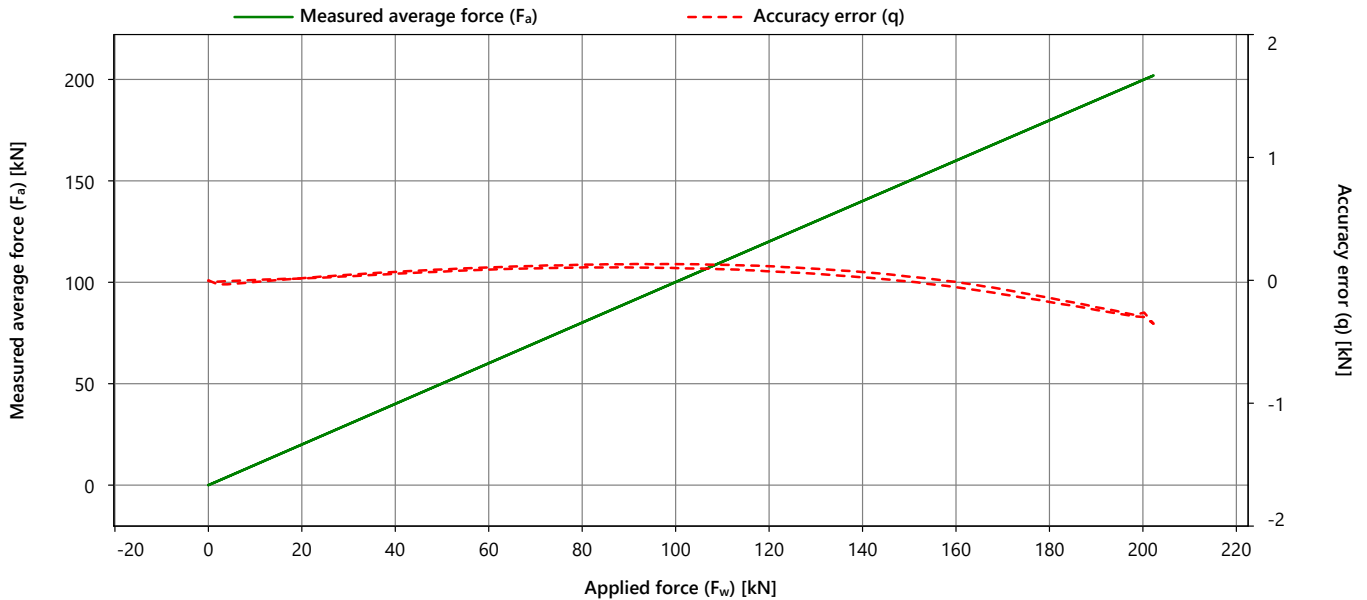
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23030586

Calibration Details	
Calibration Date	04 Jul 2023 07:52:34
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	3.10.0.53922

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.266
Max repeatability error (b)	[kN]	0.017
Max reversibility error (v)	[kN]	0.043
Zero load error (F _{c0})	[kN]	0.005
Zero load offset (F ₀)	[kN]	0.019
Resolution	[kN]	8.58E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.001	0.002	-0.002	0.000	0.000	0.004		0.017
40.000	40.077	40.066	40.061	40.068	0.068	0.016	-0.014	0.141
80.000	80.136	80.128	80.119	80.127	0.127	0.017	-0.023	0.264
120.000	120.123	120.114	120.109	120.115	0.115	0.015	-0.043	0.388
160.000	159.992	159.988	159.980	159.987	-0.013	0.012	-0.043	0.510
200.000	199.735	199.738	199.728	199.734	-0.266	0.010		0.631
160.000	159.949	159.944	159.938	159.944	-0.056	0.011	-0.043	0.510
120.000	120.083	120.070	120.066	120.073	0.073	0.017	-0.043	0.388
80.000	80.114	80.103	80.097	80.105	0.105	0.017	-0.023	0.264
40.000	40.060	40.053	40.048	40.054	0.054	0.013	-0.014	0.140
0.000	-0.001	-0.006	-0.009	-0.005	-0.005	0.009		0.020

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0044
Electronics	7624
Node Type	7001
Hardware Version	5.01
Software Version	8.01

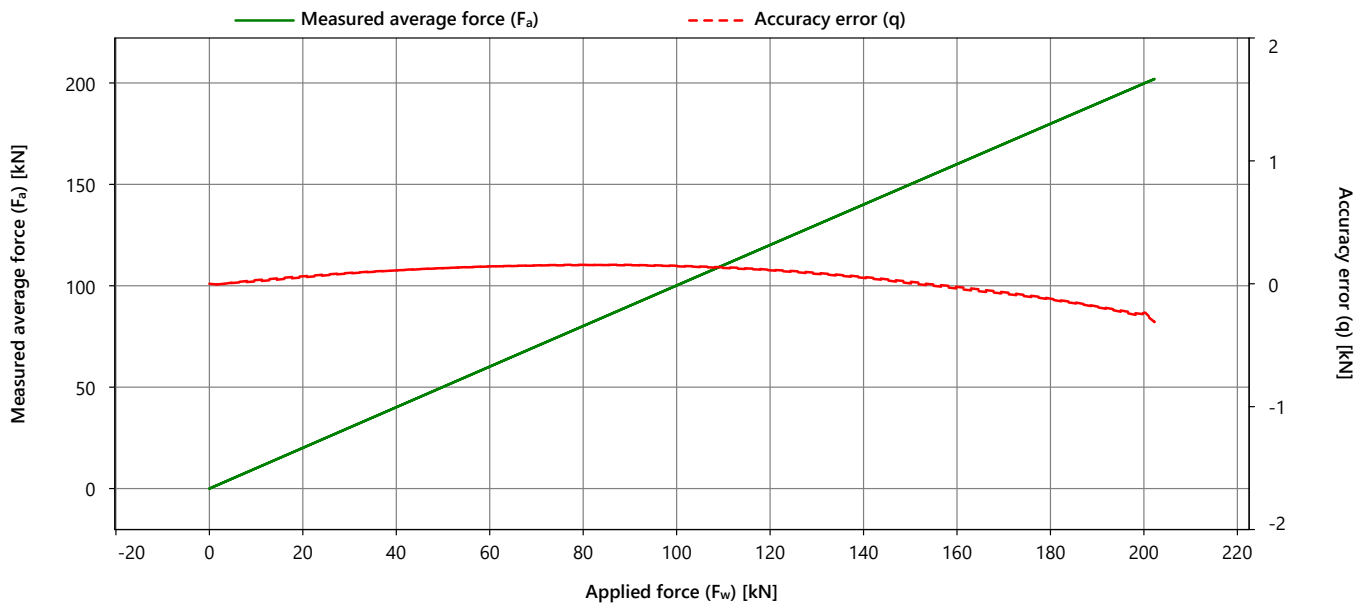
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23030586

Calibration Details	
Calibration Date	04 Jul 2023 07:52:35
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	3.10.0.53922

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.238
Max repeatability error (b)	[kN]	0.008
Max reversibility error (v)	[kN]	0.014
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	-0.011
Resolution	[kN]	8.58E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.088



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.004	0.000	-0.004	0.000	0.000	0.008		0.021
40.000	40.110	40.110	40.106	40.109	0.109	0.003	0.001	0.139
80.000	80.150	80.152	80.154	80.152	0.152	0.003	0.002	0.262
120.000	120.107	120.110	120.112	120.110	0.110	0.005	0.004	0.385
160.000	159.961	159.962	159.961	159.961	-0.039	0.001	0.014	0.508
200.000	199.759	199.766	199.761	199.762	-0.238	0.007		0.631
160.000	159.974	159.974	159.976	159.975	-0.025	0.002	0.014	0.508
120.000	120.116	120.111	120.113	120.114	0.114	0.006	0.004	0.385
80.000	80.156	80.152	80.154	80.154	0.154	0.004	0.002	0.262
40.000	40.109	40.109	40.111	40.110	0.110	0.002	0.001	0.139
0.000	-0.004	-0.009	-0.012	-0.008	-0.008	0.008		0.021

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0044
Electronics	7624
Node Type	7001
Hardware Version	5.01
Software Version	8.01

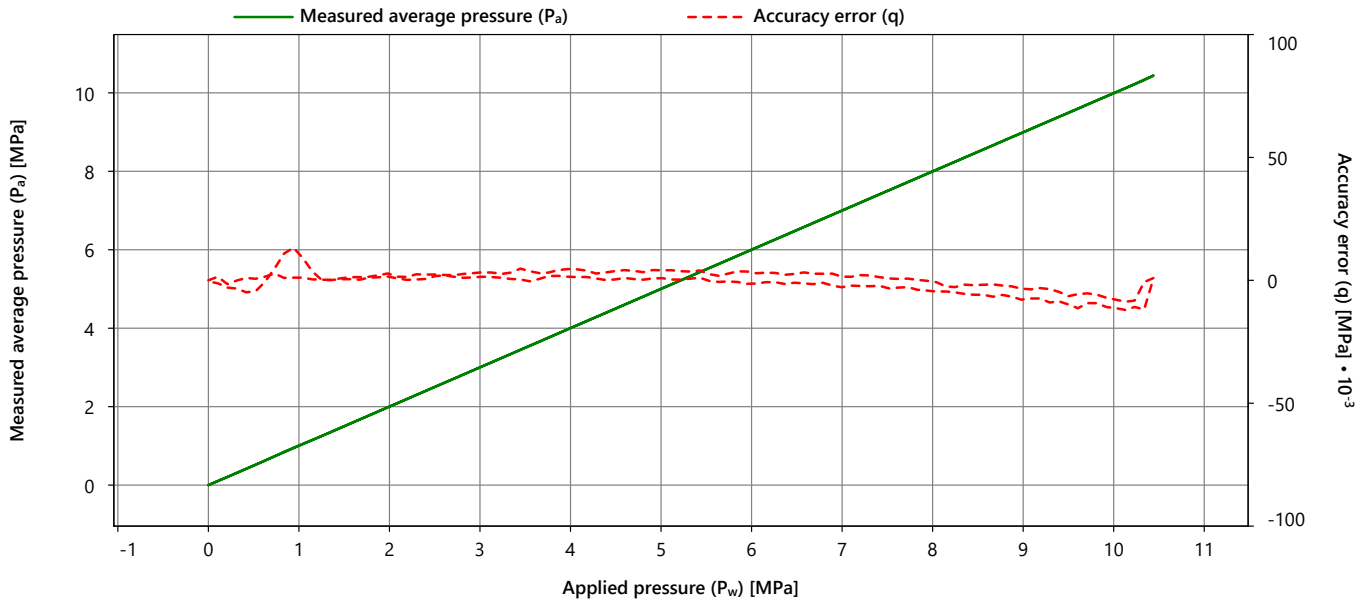
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23030586

Calibration Details	
Calibration Date	04 Jul 2023 09:11:46
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	3.10.0.53922

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.008
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.005
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	0.003
Resolution	[MPa]	2.34E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.002	2.002	2.004	2.003	0.003	0.002	-0.001	0.005
4.000	4.004	4.005	4.005	4.005	0.005	0.002	-0.003	0.007
6.000	6.005	6.003	6.002	6.003	0.003	0.003	-0.005	0.010
8.000	8.000	8.000	7.998	8.000	0.000	0.002	-0.004	0.009
10.000	9.991	9.991	9.994	9.992	-0.008	0.003		0.008
8.000	7.995	7.997	7.995	7.996	-0.004	0.002	-0.004	0.009
6.000	6.000	5.999	5.997	5.999	-0.001	0.003	-0.005	0.010
4.000	4.000	4.002	4.001	4.001	0.001	0.002	-0.003	0.007
2.000	2.001	2.002	2.002	2.001	0.001	0.001	-0.001	0.004
0.000	-0.001	0.000	-0.001	0.000	0.000	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0044
Electronics	7624
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

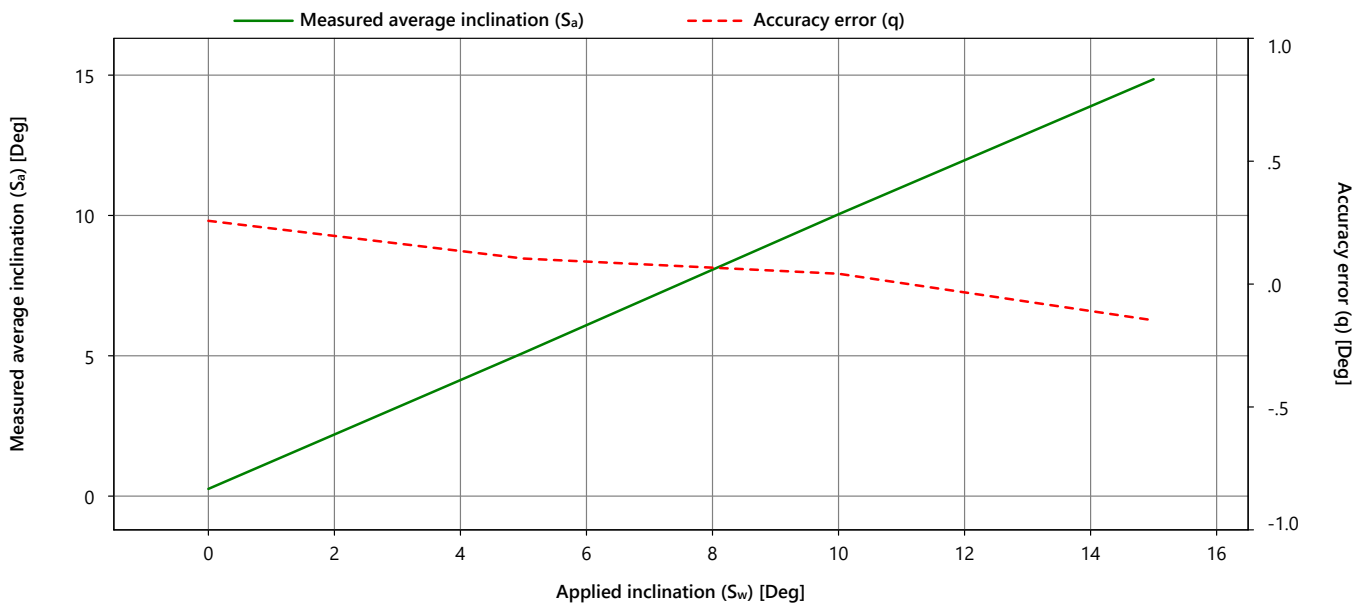
Certificate Number
FCN23030586

Calibration Details	
Calibration Date	04 Jul 2023 07:56:10
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	3.10.0.53922

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.3
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.29E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.3	0.2	0.3	0.3	0.3	0.1	0.7
5.0	5.1	5.2	5.1	5.1	0.1	0.1	0.7
10.0	10.0	10.1	10.0	10.0	0.0	0.1	0.7
15.0	14.7	14.9	14.9	14.9	-0.1	0.2	0.7

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Symbols, Definitions and References

Certificate Number
FCN23030586

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0044

Appendix Applicable to
Certificate Number
FCN23030586

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0044
Electronics	7624
Node Type	7001
Hardware Version	5.01
Software Version	8.01

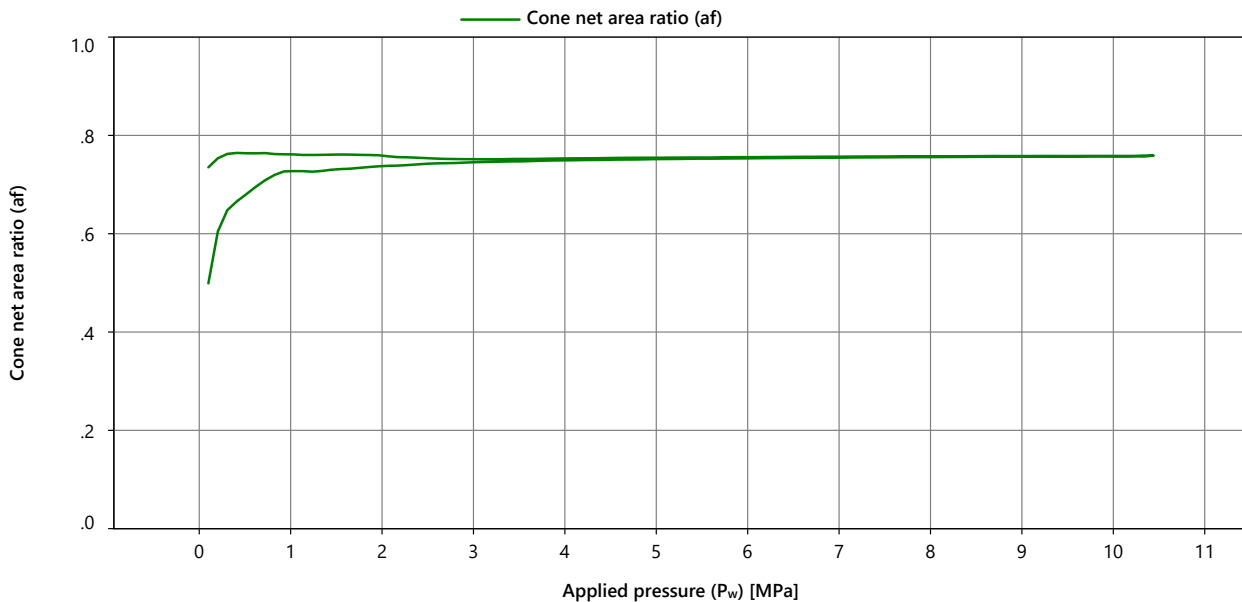
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23030586

Measurement Details	
Measurement Date	04 Jul 2023 09:11:47
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	3.10.0.53922

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.762	0.759	0.756	0.759
4.000	0.755	0.752	0.753	0.753
6.000	0.758	0.755	0.755	0.756
8.000	0.758	0.757	0.757	0.758
10.000	0.758	0.758	0.758	0.758
8.000	0.755	0.756	0.756	0.756
6.000	0.752	0.754	0.754	0.753
4.000	0.747	0.750	0.751	0.749
2.000	0.735	0.737	0.741	0.738

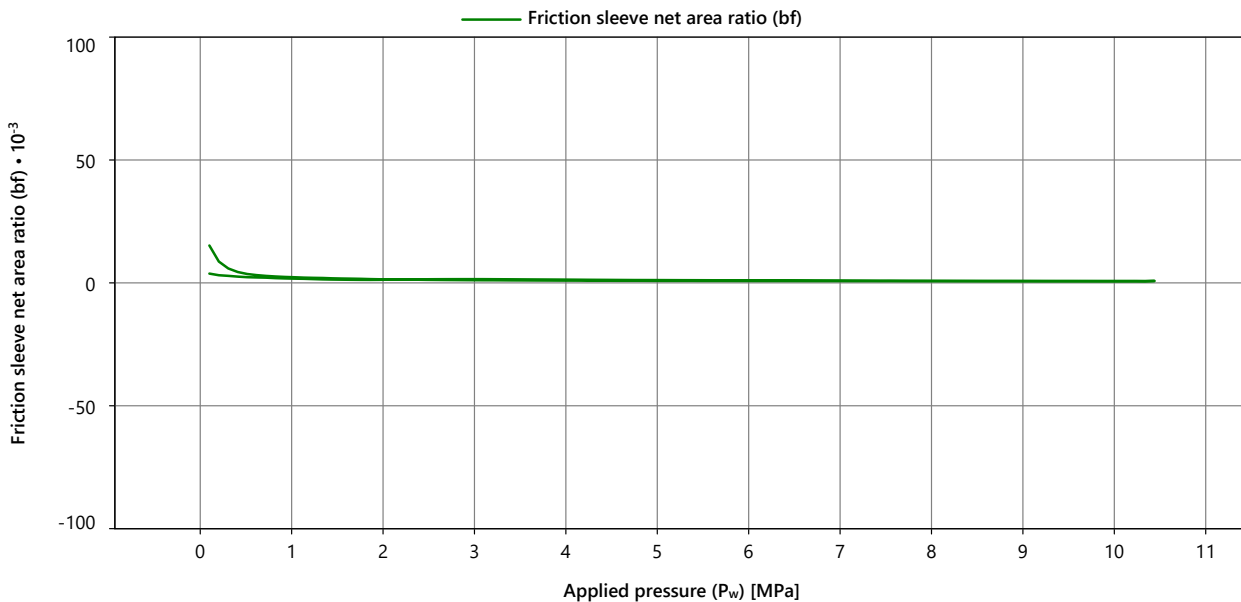
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0044	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7624	Measurement Details	
Node Type	7001	Measurement Date	04 Jul 2023 09:11:47
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	3.10.0.53922

Appendix Applicable to
Certificate Number
FCN23030586

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00078

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.001	0.001	0.001	0.001
4.000	0.001	0.001	0.001	0.001
6.000	0.001	0.001	0.001	0.001
8.000	0.001	0.001	0.001	0.001
10.000	0.001	0.001	0.001	0.001
8.000	0.001	0.001	0.001	0.001
6.000	0.001	0.001	0.001	0.001
4.000	0.001	0.001	0.001	0.001
2.000	0.002	0.001	0.001	0.001

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23030586

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23030664

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E1M4-V1
Serial Number 1715-0031

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 06-Jul-2023

Calibrate before 06-Jan-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 07-Jul-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Page 1 of 6



Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0031
Electronics	9390
Node Type	7001
Hardware Version	6.00
Software Version	8.01

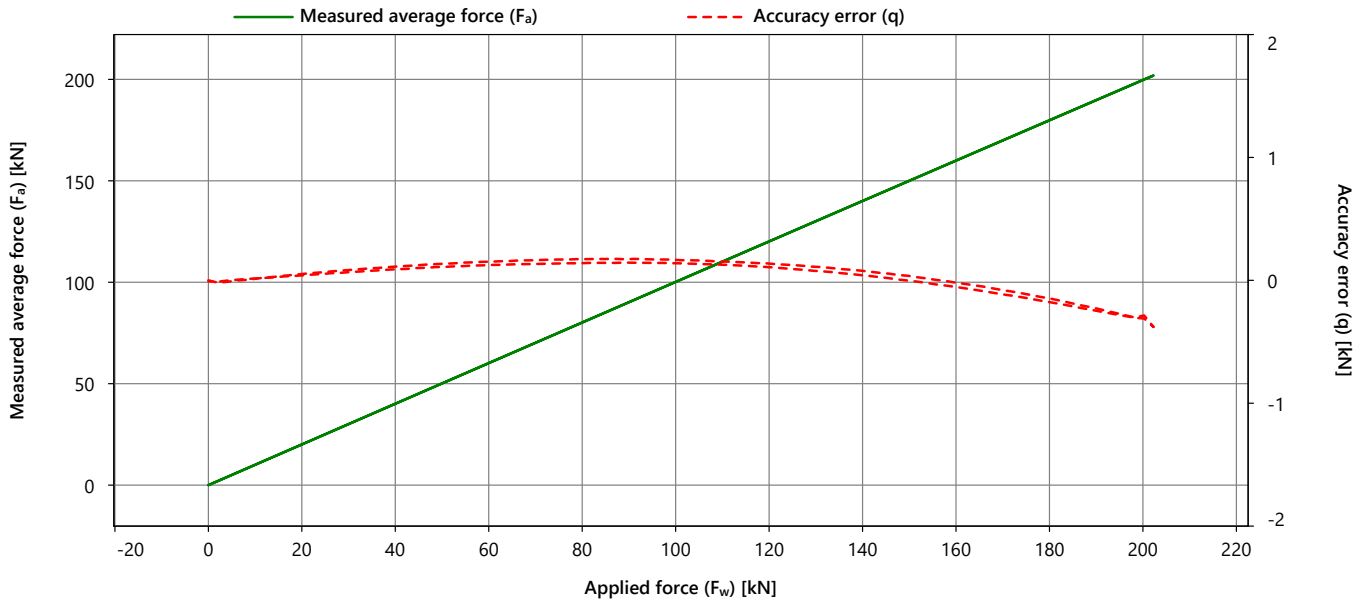
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23030664

Calibration Details	
Calibration Date	06 Jul 2023 07:30:33
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	3.10.0.53922

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.290
Max repeatability error (b)	[kN]	0.019
Max reversibility error (v)	[kN]	0.035
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	-0.006
Resolution	[kN]	8.57E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.000	0.001	-0.001	0.000	0.000	0.002		0.019
40.000	40.114	40.112	40.108	40.112	0.112	0.005	-0.022	0.141
80.000	80.173	80.174	80.170	80.172	0.172	0.004	-0.032	0.264
120.000	120.141	120.138	120.132	120.137	0.137	0.009	-0.030	0.386
160.000	159.983	159.980	159.978	159.980	-0.020	0.005	-0.035	0.509
200.000	199.718	199.715	199.699	199.710	-0.290	0.019		0.631
160.000	159.951	159.946	159.940	159.946	-0.054	0.011	-0.035	0.509
120.000	120.108	120.107	120.107	120.108	0.108	0.001	-0.030	0.386
80.000	80.140	80.139	80.140	80.140	0.140	0.002	-0.032	0.264
40.000	40.091	40.090	40.088	40.090	0.090	0.003	-0.022	0.141
0.000	-0.006	-0.009	-0.010	-0.008	-0.008	0.004		0.020

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0031
Electronics	9390
Node Type	7001
Hardware Version	6.00
Software Version	8.01

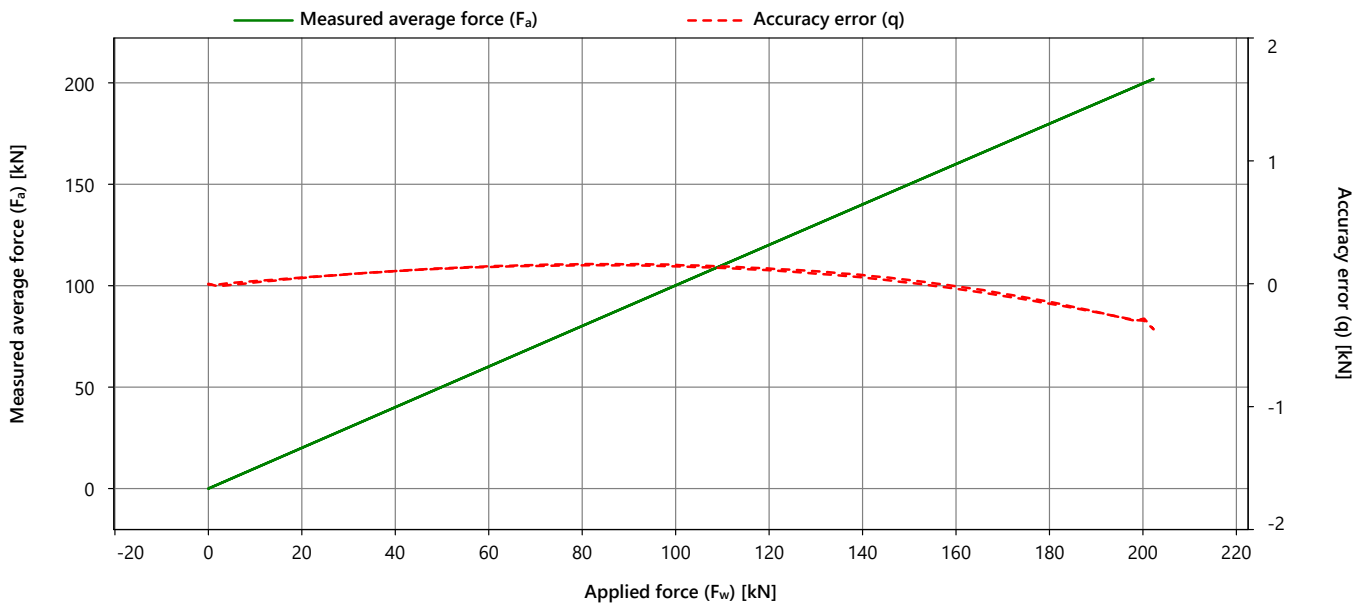
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23030664

Calibration Details	
Calibration Date	06 Jul 2023 07:30:34
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	3.10.0.53922

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.287
Max repeatability error (b)	[kN]	0.016
Max reversibility error (v)	[kN]	0.020
Zero load error (F _{c0})	[kN]	0.007
Zero load offset (F ₀)	[kN]	-0.023
Resolution	[kN]	8.62E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.016



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	-0.001	0.001	-0.001	0.000	0.000	0.002		0.018
40.000	40.105	40.103	40.102	40.103	0.103	0.003	0.000	0.139
80.000	80.163	80.160	80.158	80.160	0.160	0.004	-0.009	0.262
120.000	120.129	120.124	120.121	120.124	0.124	0.008	-0.014	0.385
160.000	159.983	159.979	159.976	159.979	-0.021	0.008	-0.020	0.508
200.000	199.718	199.718	199.702	199.713	-0.287	0.016		0.631
160.000	159.964	159.960	159.954	159.959	-0.041	0.011	-0.020	0.508
120.000	120.112	120.109	120.111	120.111	0.111	0.003	-0.014	0.385
80.000	80.151	80.150	80.151	80.151	0.151	0.001	-0.009	0.262
40.000	40.106	40.103	40.102	40.104	0.104	0.004	0.000	0.139
0.000	-0.005	-0.008	-0.009	-0.007	-0.007	0.004		0.018

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0031
Electronics	9390
Node Type	7001
Hardware Version	6.00
Software Version	8.01

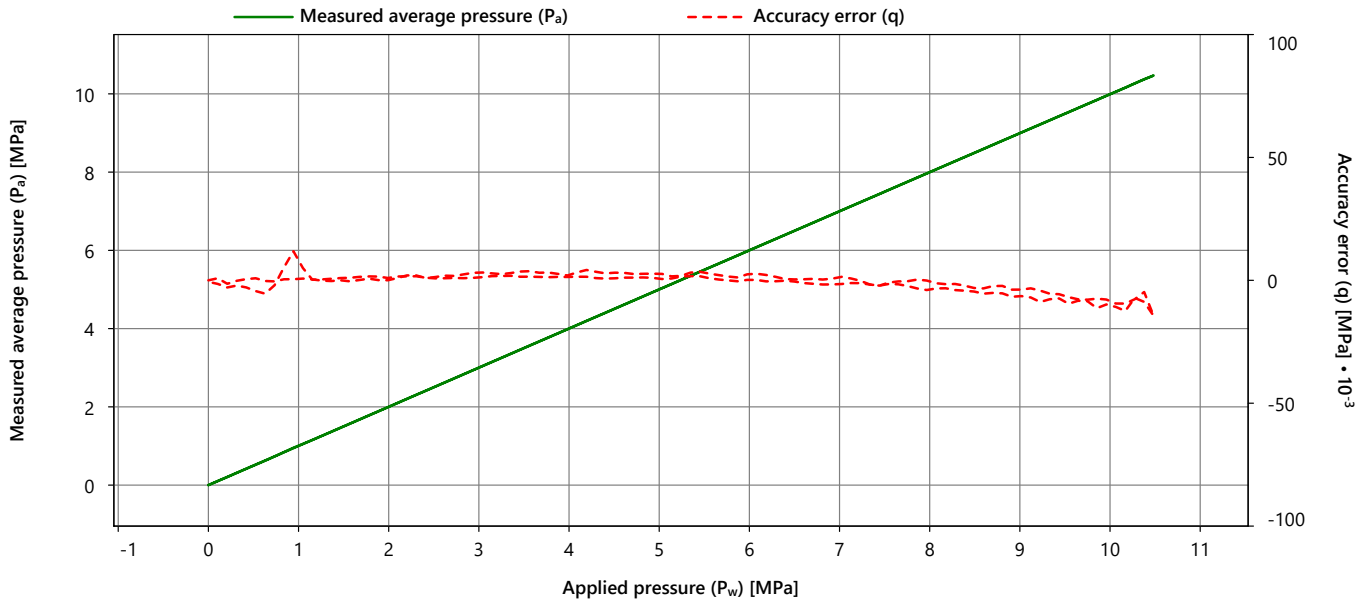
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23030664

Calibration Details	
Calibration Date	06 Jul 2023 08:27:33
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	3.10.0.53922

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.008
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	0.007
Resolution	[MPa]	2.3E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	1.999	2.002	1.999	2.000	0.000	0.003	0.001	0.006
4.000	4.002	4.002	4.003	4.002	0.002	0.001	-0.001	0.005
6.000	6.002	6.002	6.004	6.003	0.003	0.002	-0.002	0.006
8.000	7.998	8.000	8.001	8.000	0.000	0.002	-0.003	0.008
10.000	9.991	9.993	9.991	9.992	-0.008	0.002		0.008
8.000	7.997	7.995	7.997	7.996	-0.004	0.002	-0.003	0.008
6.000	6.000	6.000	6.001	6.000	0.000	0.000	-0.002	0.006
4.000	4.003	4.001	4.001	4.001	0.001	0.002	-0.001	0.005
2.000	2.001	2.000	2.002	2.001	0.001	0.001	0.001	0.004
0.000	-0.001	0.000	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0031
Electronics	9390
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

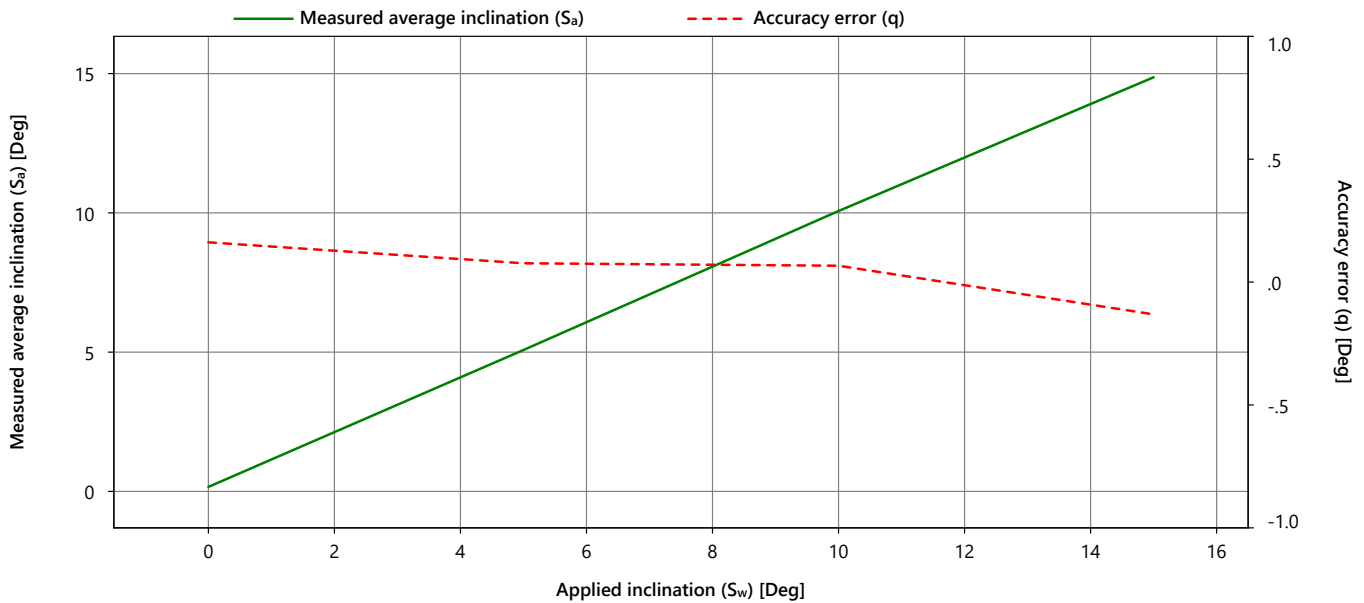
Certificate Number
FCN23030664

Calibration Details	
Calibration Date	06 Jul 2023 07:39:27
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	3.10.0.53922

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.34E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.2	0.2	0.1	0.2	0.2	0.1	0.7
5.0	5.1	5.1	5.1	5.1	0.1	0.0	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.8	15.0	14.8	14.9	-0.1	0.2	0.8

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Symbols, Definitions and References

Certificate Number
FCN23030664

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E1M4-V1
Serial Number	1715-0031

Appendix Applicable to
Certificate Number
FCN23030664

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

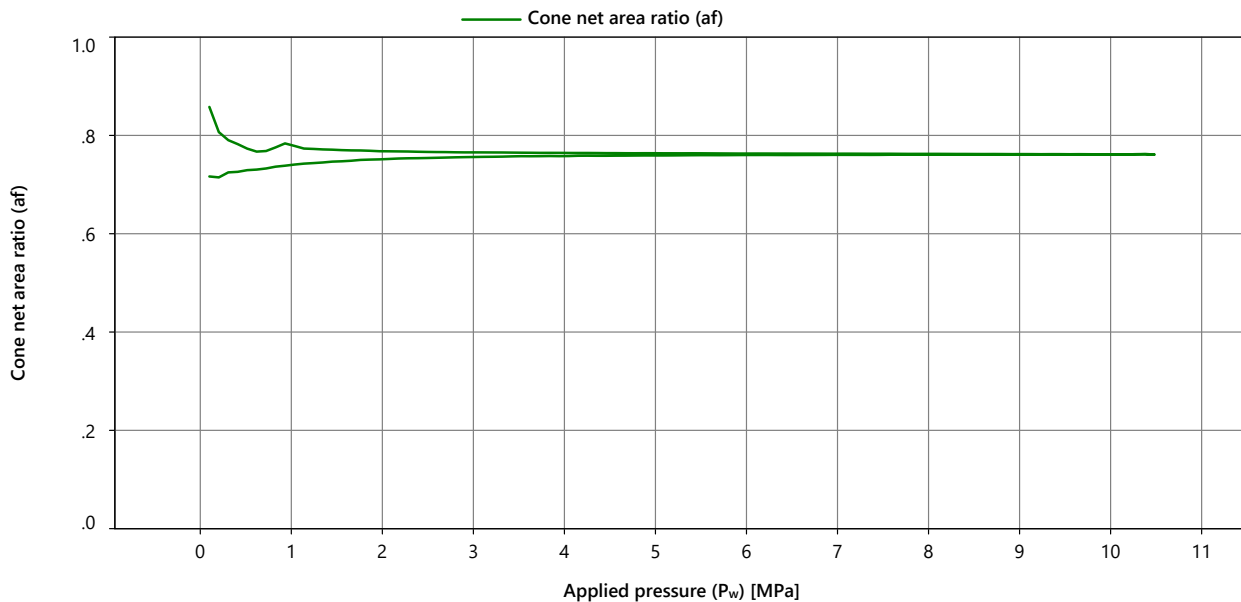
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E1M4-V1	Serial Number	3257-0002
Serial Number	1715-0031	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9390	Measurement Details	
Node Type	7001	Measurement Date	06 Jul 2023 08:27:33
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	3.10.0.53922

Appendix Applicable to
Certificate Number
FCN23030664

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.749	0.753	0.752	0.751
4.000	0.756	0.758	0.759	0.758
6.000	0.760	0.760	0.761	0.760
8.000	0.760	0.761	0.761	0.761
10.000	0.761	0.762	0.762	0.762
8.000	0.762	0.762	0.763	0.762
6.000	0.763	0.763	0.763	0.763
4.000	0.764	0.764	0.765	0.764
2.000	0.767	0.767	0.769	0.768

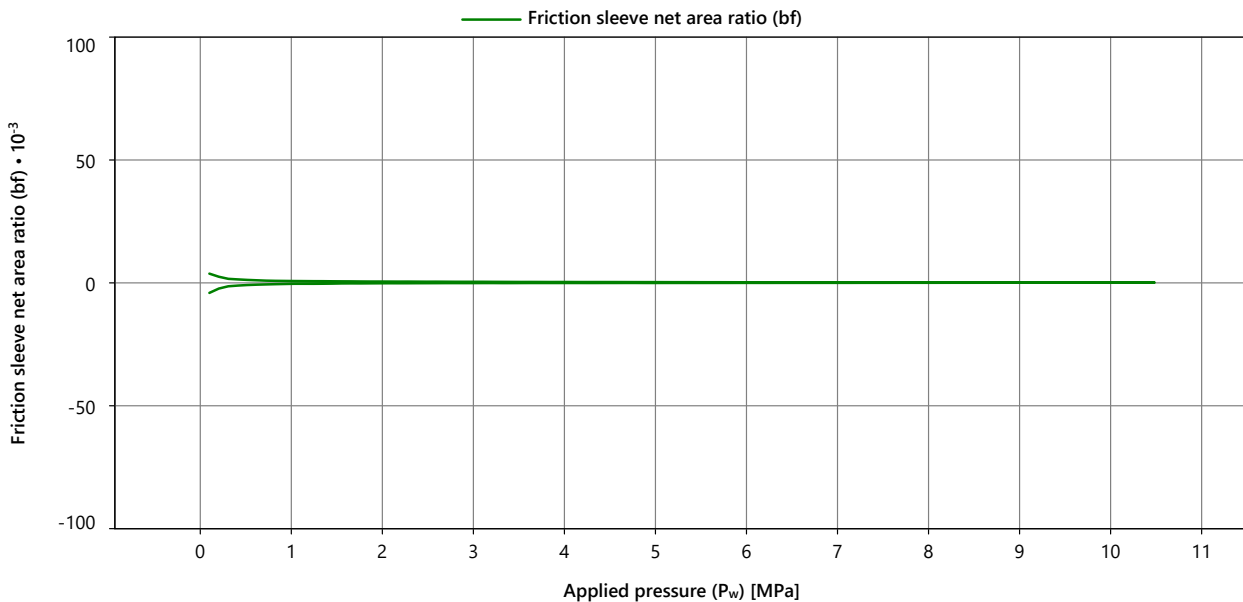
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E1M4-V1	Serial Number	3257-0002
Serial Number	1715-0031	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9390	Measurement Details	
Node Type	7001	Measurement Date	06 Jul 2023 08:27:33
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	3.10.0.53922

Appendix Applicable to
Certificate Number
FCN23030664

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00013

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.001	0.000	0.001	0.001
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23030664

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
----------------	-----------------------------------

Quantities

P	Pressure
---	----------

Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031505

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF100PB20SN2-P1E2M4-V1
Serial Number 1701-3179

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 11-Oct-2023

Calibrate before 11-Apr-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 100 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 100 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Kulite HKM-150-375-200bar SG	0 to 20 MPa	0 to 30 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	16.3 $\mu\text{V/V/kN}$	-1.25 $\mu\text{V/V}$	16.3 $\mu\text{V/V/kN}$	-3.68 $\mu\text{V/V}$	0.23 %	-0.15 %
Cone+Fric. [Force]	16.4 $\mu\text{V/V/kN}$	8.23 $\mu\text{V/V}$	16.5 $\mu\text{V/V/kN}$	8.37 $\mu\text{V/V}$	0.28 %	0.01 %
Pore 2 [Pressure]	506 $\mu\text{V/V/MPa}$	-17.4 $\mu\text{V/V}$	506 $\mu\text{V/V/MPa}$	-27.1 $\mu\text{V/V}$	-0.03 %	-0.10 %

Nootdorp, 12-Oct-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB20SN2-P 1E2M4-V1
Serial Number	1701-3179
Electronics	9024
Node Type	7001
Hardware Version	6.00
Software Version	8.01

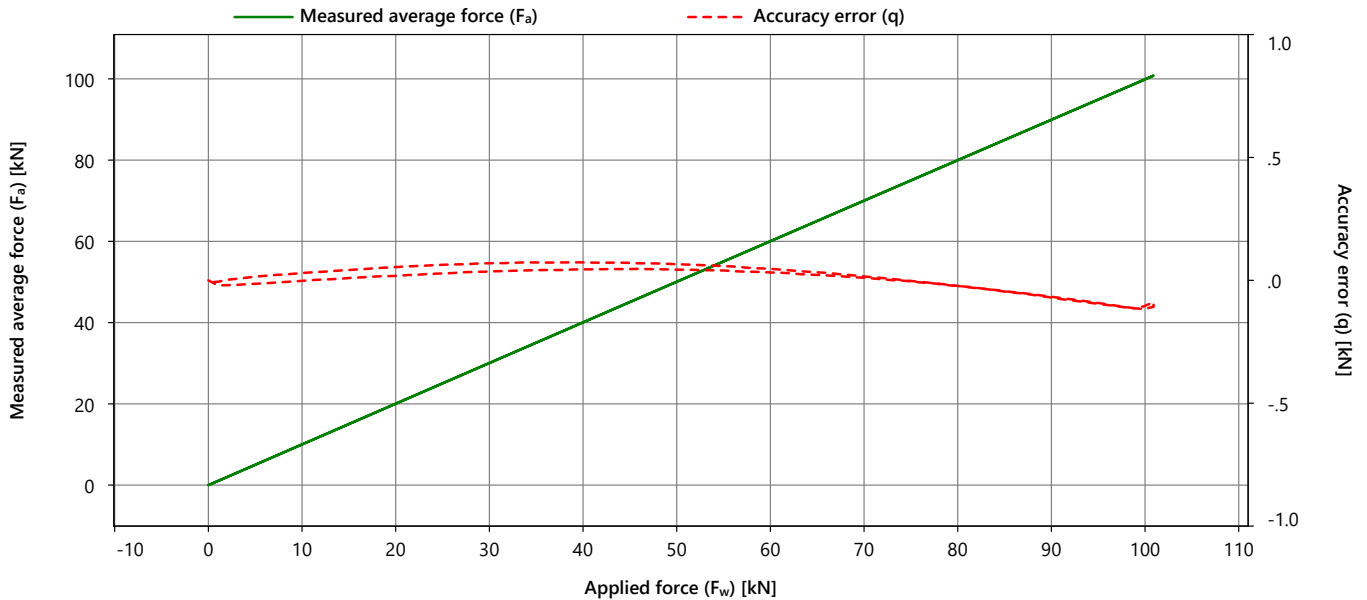
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031505

Calibration Details	
Calibration Date	11 Oct 2023 09:51:16
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 100 kN
Maximum Rating	0 to 100 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.104
Max repeatability error (b)	[kN]	0.011
Max reversibility error (v)	[kN]	0.036
Zero load error (F _{c0})	[kN]	0.007
Zero load offset (F ₀)	[kN]	-0.002
Resolution	[kN]	5.7E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.001	0.001	-0.001	0.000	0.000	0.002		0.018
20.000	20.020	20.017	20.017	20.018	0.018	0.003	0.036	0.089
40.000	40.045	40.045	40.044	40.045	0.045	0.001	0.028	0.143
60.000	60.032	60.033	60.031	60.032	0.032	0.002	0.015	0.201
80.000	79.976	79.978	79.976	79.977	-0.023	0.002	0.001	0.262
100.000	99.900	99.889	99.900	99.896	-0.104	0.011		0.323
80.000	79.978	79.979	79.975	79.977	-0.023	0.005	0.001	0.262
60.000	60.047	60.048	60.045	60.047	0.047	0.003	0.015	0.201
40.000	40.074	40.073	40.072	40.073	0.073	0.002	0.028	0.143
20.000	20.057	20.052	20.053	20.054	0.054	0.005	0.036	0.089
0.000	-0.007	-0.009	-0.006	-0.007	-0.007	0.002		0.018

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB20SN2-P 1E2M4-V1
Serial Number	1701-3179
Electronics	9024
Node Type	7001
Hardware Version	6.00
Software Version	8.01

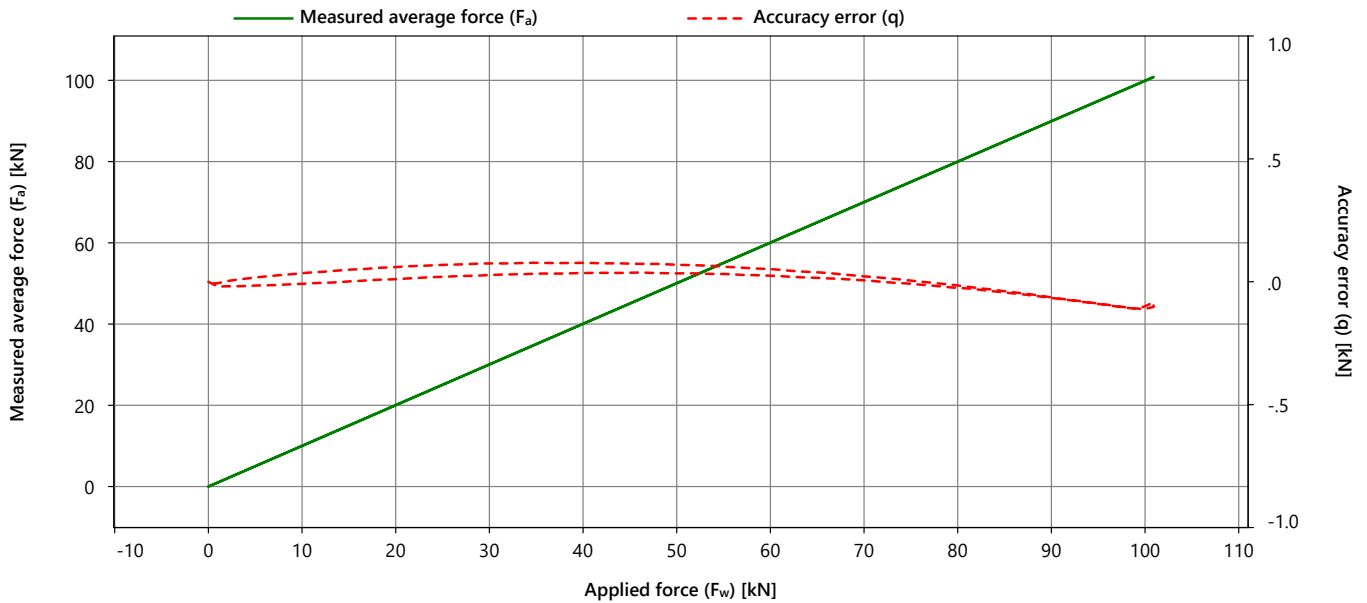
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031505

Calibration Details	
Calibration Date	11 Oct 2023 09:51:16
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 100 kN
Maximum Rating	0 to 100 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.099
Max repeatability error (b)	[kN]	0.011
Max reversibility error (v)	[kN]	0.049
Zero load error (F _{c0})	[kN]	0.007
Zero load offset (F ₀)	[kN]	-0.013
Resolution	[kN]	5.66E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.011



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.000	0.001	-0.001	0.000	0.000	0.002		0.018
20.000	20.012	20.010	20.008	20.010	0.010	0.004	0.049	0.103
40.000	40.036	40.037	40.034	40.036	0.036	0.003	0.041	0.147
60.000	60.025	60.025	60.023	60.025	0.025	0.002	0.027	0.203
80.000	79.975	79.976	79.974	79.975	-0.025	0.002	0.010	0.262
100.000	99.904	99.894	99.904	99.901	-0.099	0.011		0.323
80.000	79.987	79.986	79.983	79.985	-0.015	0.004	0.010	0.262
60.000	60.053	60.052	60.050	60.052	0.052	0.003	0.027	0.203
40.000	40.079	40.076	40.076	40.077	0.077	0.003	0.041	0.147
20.000	20.062	20.058	20.059	20.060	0.060	0.004	0.049	0.103
0.000	-0.007	-0.008	-0.006	-0.007	-0.007	0.002		0.018

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB20SN2-P 1E2M4-V1
Serial Number	1701-3179
Electronics	9024
Node Type	7001
Hardware Version	6.00
Software Version	8.01

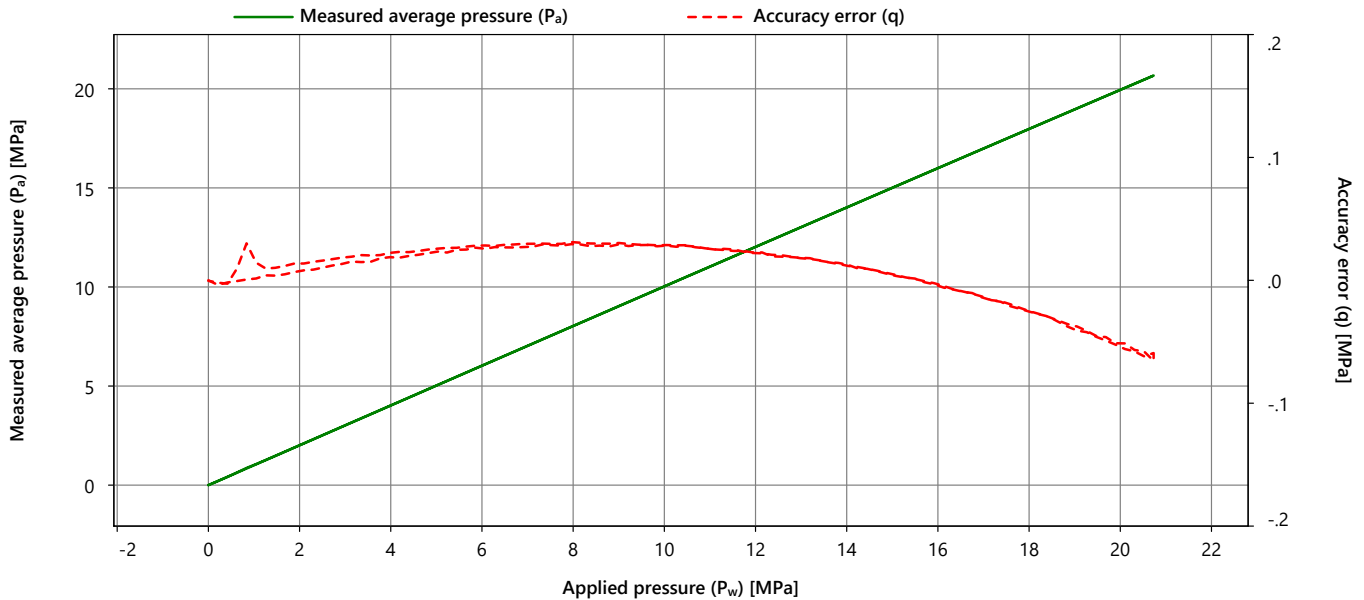
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031505

Calibration Details	
Calibration Date	11 Oct 2023 12:35:40
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.0.2.54728

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Kulite HKM-150-375-200bar SG
Calibrated Range	0 to 20 MPa
Maximum Rating	0 to 30 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.054
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	-0.016
Resolution	[MPa]	7.36E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.002
4.000	4.020	4.017	4.019	4.019	0.019	0.003	0.003	0.008
8.000	8.029	8.029	8.030	8.029	0.029	0.001	0.002	0.007
12.000	12.021	12.023	12.024	12.022	0.022	0.003	0.000	0.009
16.000	15.996	15.994	15.997	15.995	-0.005	0.003	0.001	0.011
20.000	19.945	19.948	19.946	19.946	-0.054	0.003		0.013
16.000	15.998	15.996	15.995	15.997	-0.003	0.003	0.001	0.011
12.000	12.022	12.023	12.022	12.022	0.022	0.001	0.000	0.008
8.000	8.031	8.032	8.030	8.031	0.031	0.002	0.002	0.007
4.000	4.023	4.022	4.023	4.022	0.022	0.001	0.003	0.007
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB20SN2-P 1E2M4-V1
Serial Number	1701-3179
Electronics	9024
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

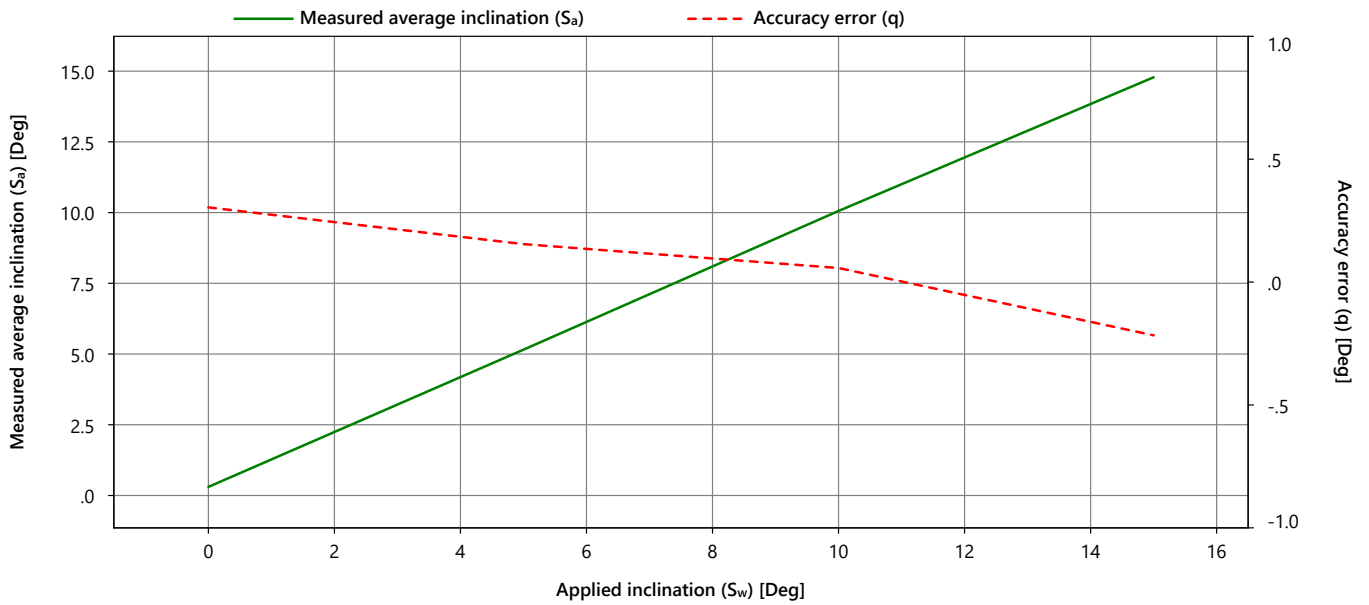
Certificate Number
FCN23031505

Calibration Details	
Calibration Date	11 Oct 2023 09:55:28
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.0.2.54728

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.3
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	0.2
Zero load offset (S_0)	[Deg]	0.3
Resolution	[Deg]	1.29E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.2	0.3	0.4	0.3	0.3	0.3	0.8
5.0	5.1	5.1	5.3	5.2	0.2	0.2	0.8
10.0	9.9	10.1	10.1	10.1	0.1	0.2	0.8
15.0	14.7	14.8	14.9	14.8	-0.2	0.2	0.8

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Symbols, Definitions and References

Certificate Number
FCN23031505

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Page 6 of 6

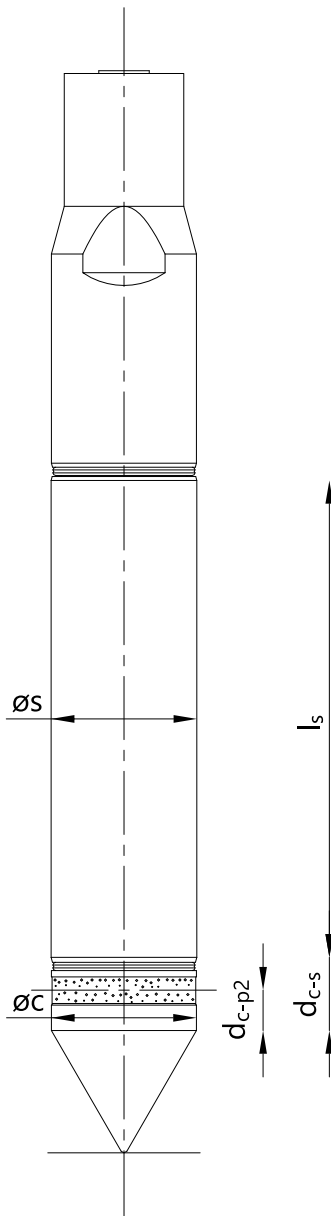


Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF100PB20SN2-P1E2M4-V1
Serial Number	1701-3179

Appendix Applicable to
Certificate Number
FCN23031505



Typical Dimensions

A_c	Cross-sectional projected area of the cone	0.0015 m ²
A_s	Surface area of the friction sleeve	0.02 m ²
af	Cone net area ratio	0.58
bf	Friction sleeve net area ratio	0.01392
$\varnothing c$	Diameter of the cylindrical part of the cone	43.85 mm
$\varnothing s$	Diameter of the friction sleeve	44.1 mm
l_s	Length of the friction sleeve	143.6 mm
d_{c-s}	Cone - friction sleeve distance	16 mm
d_{c-p2}	Cone - pore 2 distance	6.9 mm

Diagram is not to scale

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB20SN2-P 1E2M4-V1
Serial Number	1701-3179
Electronics	9024
Node Type	7001
Hardware Version	6.00
Software Version	8.01

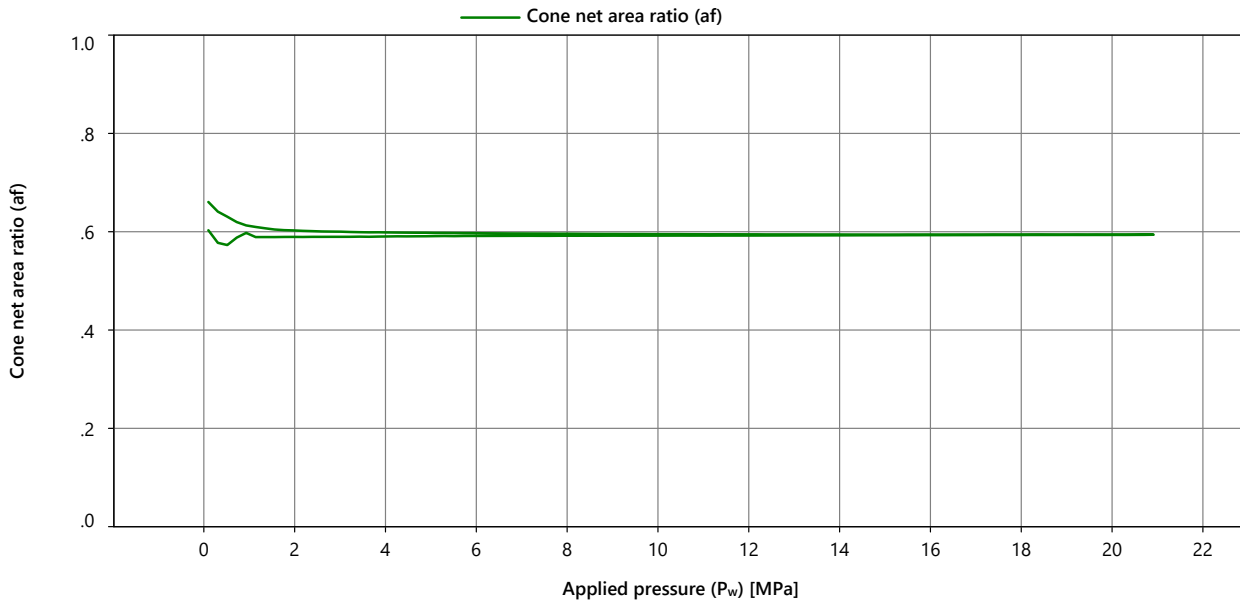
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23031505

Measurement Details	
Measurement Date	11 Oct 2023 12:35:40
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.59

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
4.000	0.599	0.598	0.599	0.599
8.000	0.596	0.596	0.596	0.596
12.000	0.595	0.595	0.595	0.595
16.000	0.594	0.594	0.594	0.594
20.000	0.594	0.594	0.594	0.594
16.000	0.593	0.593	0.593	0.593
12.000	0.592	0.592	0.592	0.592
8.000	0.592	0.592	0.592	0.592
4.000	0.591	0.590	0.590	0.590

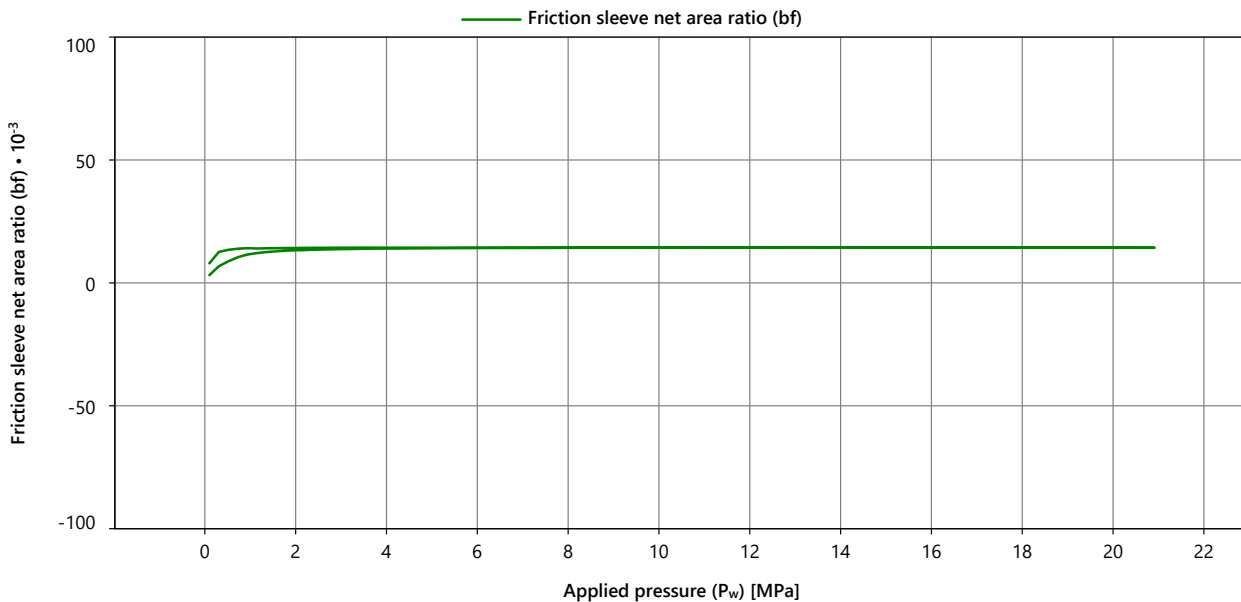
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF100PB20SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1701-3179	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9024	Measurement Details	
Node Type	7001	Measurement Date	11 Oct 2023 12:35:40
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.0.2.54728

Appendix Applicable to
Certificate Number
FCN23031505

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.01428

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
4.000	0.014	0.014	0.014	0.014
8.000	0.014	0.014	0.014	0.014
12.000	0.014	0.014	0.014	0.014
16.000	0.014	0.014	0.014	0.014
20.000	0.014	0.014	0.014	0.014
16.000	0.014	0.014	0.014	0.014
12.000	0.014	0.014	0.014	0.014
8.000	0.014	0.014	0.014	0.014
4.000	0.014	0.014	0.014	0.014

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031505

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
----------------	-----------------------------------

Quantities

P	Pressure
---	----------

Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031507

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF100PB20SN2-P1E2M4-V1
Serial Number 1701-3281

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration	20.5 ± 3 °C
Atmospheric pressure during calibration	1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 11-Oct-2023

Calibrate before 11-Apr-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 100 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 100 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Kulite HKM-150-375-200bar SG	0 to 20 MPa	0 to 30 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	16.4 $\mu\text{V/V/kN}$	-5.91 $\mu\text{V/V}$	16.5 $\mu\text{V/V/kN}$	-1.10 $\mu\text{V/V}$	0.23 %	0.29 %
Cone+Fric. [Force]	16.5 $\mu\text{V/V/kN}$	114 $\mu\text{V/V}$	16.5 $\mu\text{V/V/kN}$	116 $\mu\text{V/V}$	0.17 %	0.14 %
Pore 2 [Pressure]	491 $\mu\text{V/V/MPa}$	-2.59 $\mu\text{V/V}$	491 $\mu\text{V/V/MPa}$	2.08 $\mu\text{V/V}$	-0.02 %	0.05 %

Nootdorp, 12-Oct-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB20SN2-P 1E2M4-V1
Serial Number	1701-3281
Electronics	9073
Node Type	7001
Hardware Version	6.00
Software Version	8.01

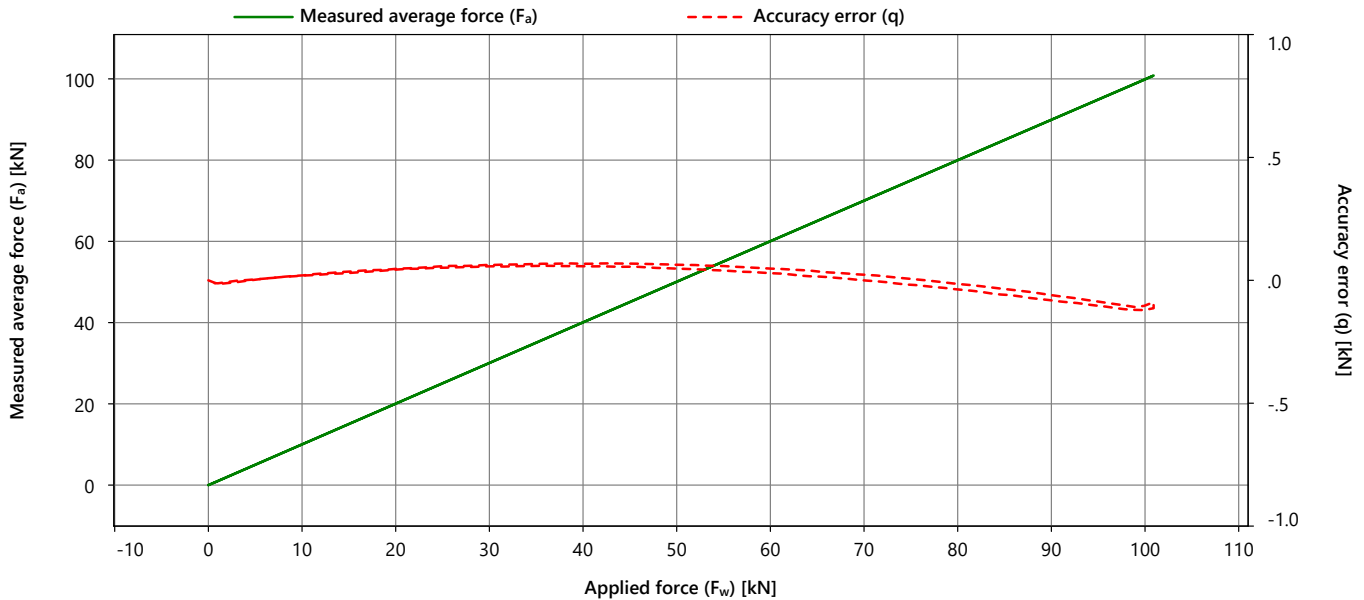
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031507

Calibration Details	
Calibration Date	11 Oct 2023 10:06:48
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 100 kN
Maximum Rating	0 to 100 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.103
Max repeatability error (b)	[kN]	0.012
Max reversibility error (v)	[kN]	0.022
Zero load error (F _{c0})	[kN]	0.010
Zero load offset (F ₀)	[kN]	-0.001
Resolution	[kN]	5.65E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.001	0.000	-0.001	0.000	0.000	0.002		0.021
20.000	20.048	20.044	20.048	20.047	0.047	0.004	-0.004	0.078
40.000	40.067	40.066	40.069	40.067	0.067	0.003	-0.010	0.139
60.000	60.048	60.046	60.049	60.048	0.048	0.003	-0.019	0.201
80.000	79.985	79.985	79.985	79.985	-0.015	0.000	-0.022	0.263
100.000	99.890	99.903	99.899	99.897	-0.103	0.012		0.323
80.000	79.959	79.962	79.968	79.963	-0.037	0.010	-0.022	0.263
60.000	60.024	60.029	60.034	60.029	0.029	0.009	-0.019	0.202
40.000	40.053	40.057	40.062	40.057	0.057	0.008	-0.010	0.140
20.000	20.041	20.043	20.047	20.043	0.043	0.006	-0.004	0.078
0.000	-0.009	-0.010	-0.011	-0.010	-0.010	0.002		0.021

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB20SN2-P 1E2M4-V1
Serial Number	1701-3281
Electronics	9073
Node Type	7001
Hardware Version	6.00
Software Version	8.01

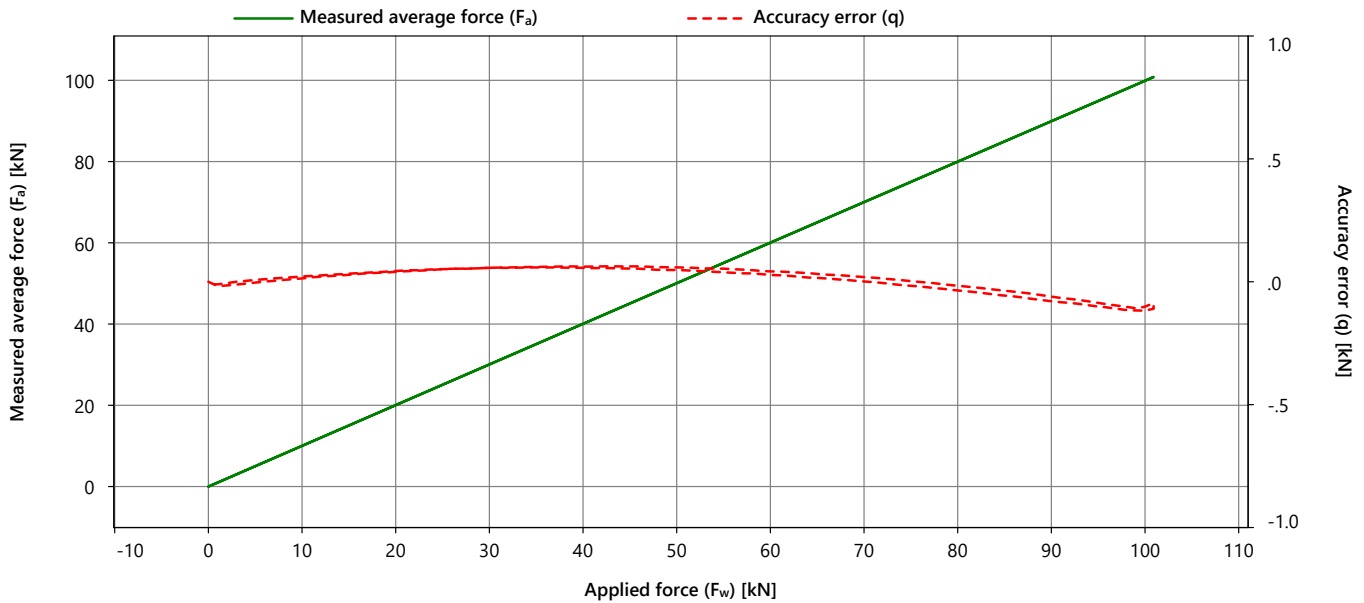
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031507

Calibration Details	
Calibration Date	11 Oct 2023 10:06:48
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 100 kN
Maximum Rating	0 to 100 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.101
Max repeatability error (b)	[kN]	0.010
Max reversibility error (v)	[kN]	0.019
Zero load error (F _{c0})	[kN]	0.009
Zero load offset (F ₀)	[kN]	-0.002
Resolution	[kN]	5.64E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.020



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.002	0.000	-0.002	0.000	0.000	0.003		0.020
20.000	20.044	20.039	20.040	20.041	0.041	0.005	0.003	0.078
40.000	40.063	40.059	40.062	40.062	0.062	0.004	-0.005	0.139
60.000	60.042	60.043	60.041	60.042	0.042	0.002	-0.014	0.201
80.000	79.985	79.983	79.982	79.984	-0.016	0.002	-0.019	0.263
100.000	99.894	99.904	99.899	99.899	-0.101	0.010		0.323
80.000	79.962	79.963	79.968	79.965	-0.035	0.006	-0.019	0.263
60.000	60.024	60.028	60.031	60.028	0.028	0.008	-0.014	0.201
40.000	40.055	40.057	40.057	40.056	0.056	0.003	-0.005	0.139
20.000	20.043	20.043	20.045	20.044	0.044	0.002	0.003	0.078
0.000	-0.008	-0.009	-0.012	-0.009	-0.009	0.004		0.021

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB20SN2-P 1E2M4-V1
Serial Number	1701-3281
Electronics	9073
Node Type	7001
Hardware Version	6.00
Software Version	8.01

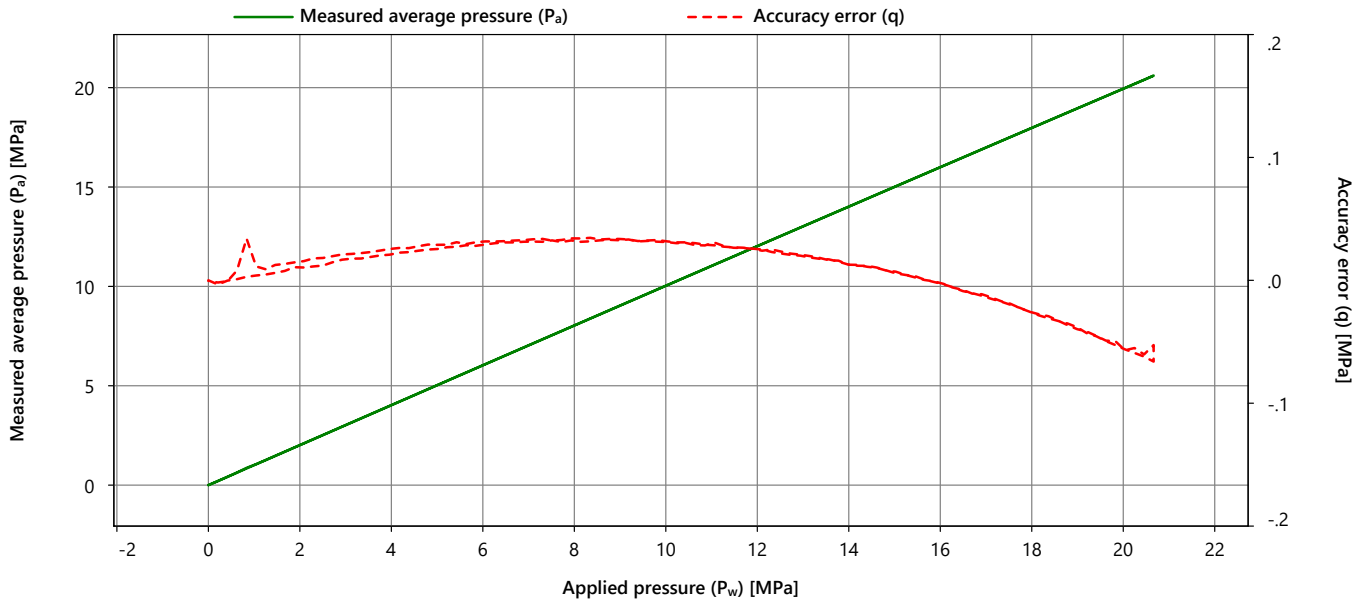
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031507

Calibration Details	
Calibration Date	11 Oct 2023 12:11:53
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.0.2.54728

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Kulite HKM-150-375-200bar SG
Calibrated Range	0 to 20 MPa
Maximum Rating	0 to 30 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.056
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.004
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	-0.017
Resolution	[MPa]	7.58E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
4.000	4.022	4.021	4.020	4.021	0.021	0.002	0.004	0.009
8.000	8.031	8.032	8.034	8.032	0.032	0.003	0.002	0.008
12.000	12.025	12.025	12.025	12.025	0.025	0.001	0.001	0.008
16.000	15.997	15.998	15.999	15.998	-0.002	0.002	-0.001	0.011
20.000	19.945	19.943	19.945	19.944	-0.056	0.002		0.013
16.000	15.996	15.998	15.999	15.997	-0.003	0.003	-0.001	0.011
12.000	12.025	12.025	12.027	12.026	0.026	0.002	0.001	0.009
8.000	8.033	8.034	8.035	8.034	0.034	0.001	0.002	0.007
4.000	4.026	4.025	4.026	4.025	0.025	0.001	0.004	0.009
0.000	0.000	0.000	-0.001	0.000	0.000	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB20SN2-P 1E2M4-V1
Serial Number	1701-3281
Electronics	9073
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

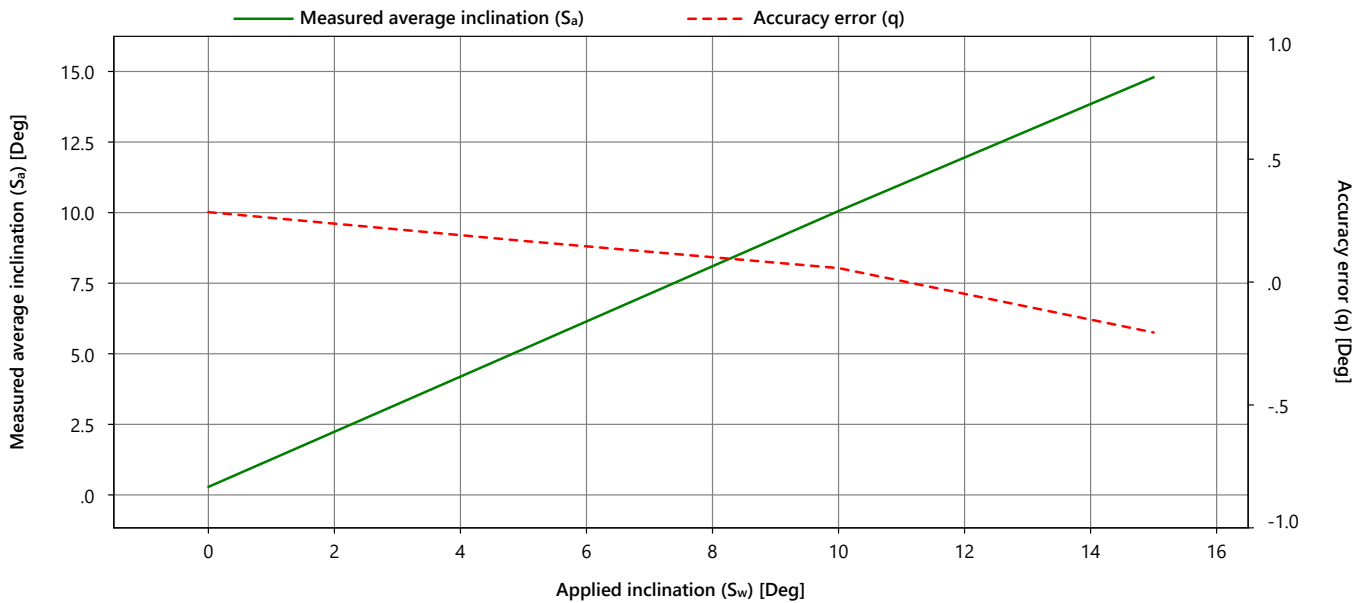
Certificate Number
FCN23031507

Calibration Details	
Calibration Date	11 Oct 2023 10:10:41
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.0.2.54728

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.3
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.3
Resolution	[Deg]	1.28E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.2	0.2	0.4	0.3	0.3	0.2	0.7
5.0	5.1	5.2	5.2	5.2	0.2	0.1	0.7
10.0	9.9	10.1	10.2	10.1	0.1	0.2	0.8
15.0	14.7	14.8	14.8	14.8	-0.2	0.2	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031507

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Page 6 of 6

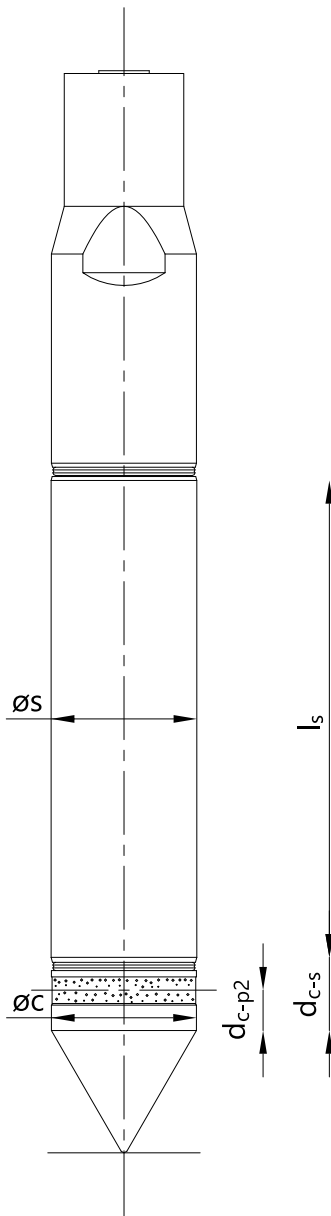


Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF100PB20SN2-P1E2M4-V1
Serial Number	1701-3281

Appendix Applicable to
Certificate Number
FCN23031507



Typical Dimensions

A_c	Cross-sectional projected area of the cone	0.0015 m ²
A_s	Surface area of the friction sleeve	0.02 m ²
af	Cone net area ratio	0.58
bf	Friction sleeve net area ratio	0.01392
$\varnothing c$	Diameter of the cylindrical part of the cone	43.85 mm
$\varnothing s$	Diameter of the friction sleeve	44.1 mm
l_s	Length of the friction sleeve	143.6 mm
d_{c-s}	Cone - friction sleeve distance	16 mm
d_{c-p2}	Cone - pore 2 distance	6.9 mm

Diagram is not to scale

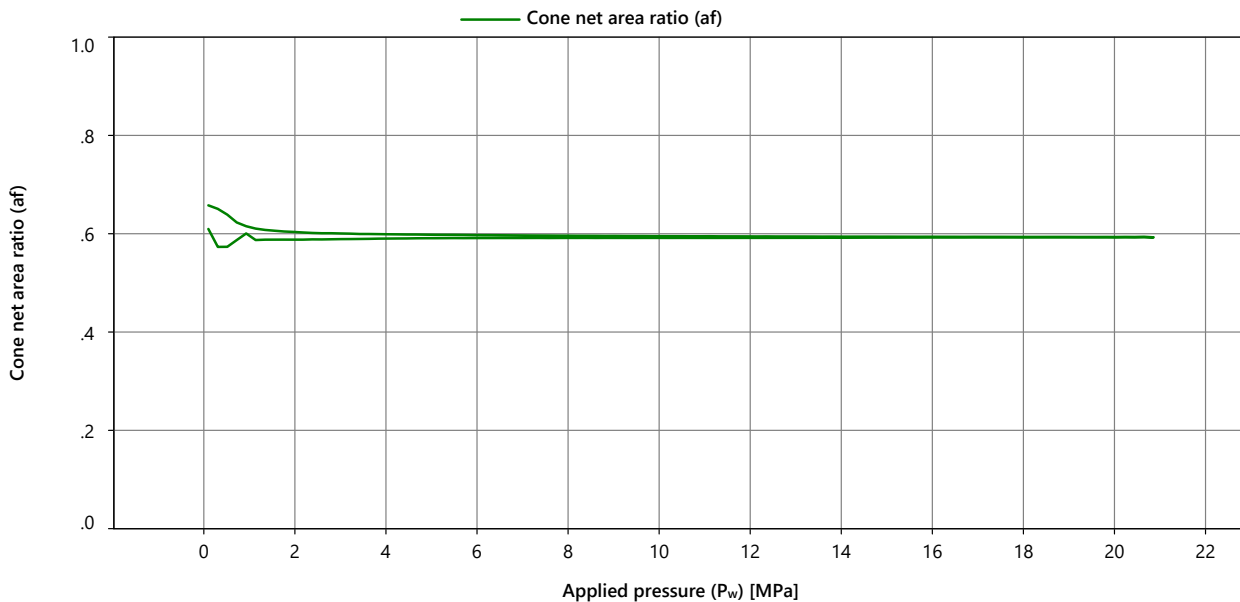
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF100PB20SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1701-3281	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9073	Measurement Details	
Node Type	7001	Measurement Date	11 Oct 2023 12:11:53
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.0.2.54728

Appendix Applicable to
Certificate Number
FCN23031507

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.59

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
4.000	0.599	0.599	0.599	0.599
8.000	0.596	0.596	0.596	0.596
12.000	0.595	0.595	0.595	0.595
16.000	0.594	0.594	0.594	0.594
20.000	0.593	0.593	0.593	0.593
16.000	0.592	0.592	0.592	0.592
12.000	0.592	0.592	0.592	0.592
8.000	0.591	0.591	0.591	0.591
4.000	0.590	0.590	0.590	0.590

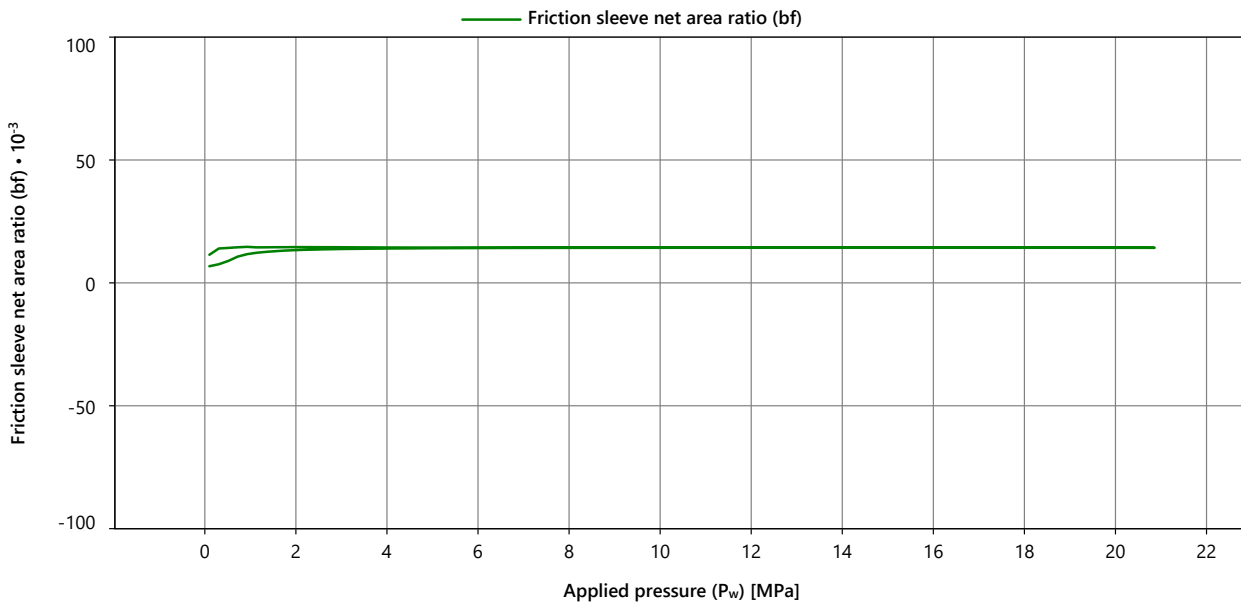
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF100PB20SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1701-3281	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9073	Measurement Details	
Node Type	7001	Measurement Date	11 Oct 2023 12:11:53
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.0.2.54728

Appendix Applicable to
Certificate Number
FCN23031507

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.01427

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
4.000	0.014	0.014	0.014	0.014
8.000	0.014	0.014	0.014	0.014
12.000	0.014	0.014	0.014	0.014
16.000	0.014	0.014	0.014	0.014
20.000	0.014	0.014	0.014	0.014
16.000	0.014	0.014	0.014	0.014
12.000	0.014	0.014	0.014	0.014
8.000	0.014	0.014	0.014	0.014
4.000	0.014	0.014	0.014	0.014

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031507

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031513

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0037

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 12-Oct-2023

Calibrate before 12-Apr-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	-4.02 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	-1.33 $\mu\text{V/V}$	0.31 %	0.12 %
Cone+Fric. [Force]	10.9 $\mu\text{V/V/kN}$	-5.17 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	-3.98 $\mu\text{V/V}$	0.28 %	0.05 %
Pore 2 [Pressure]	3.46 mV/V/MPa	1.10 mV/V	3.46 mV/V/MPa	1.10 mV/V	0.03 %	0.01 %

Nootdorp, 13-Oct-2023

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Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0037
Electronics	9000
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference

Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031513

Calibration Details

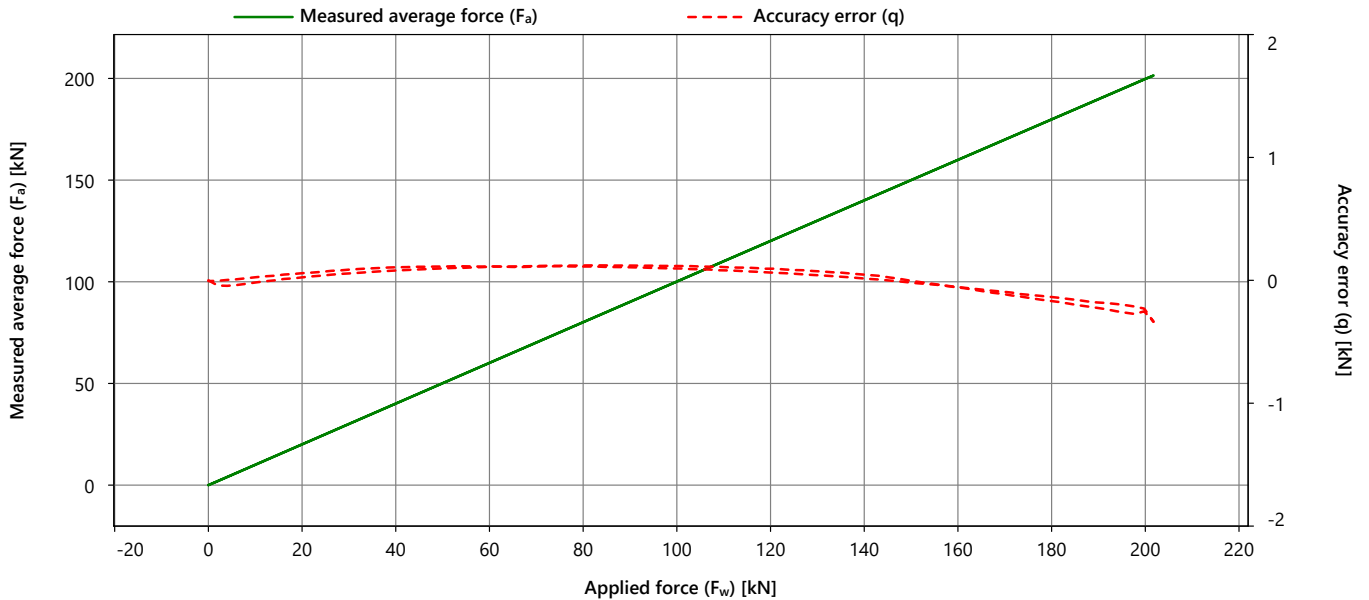
Calibration Date	12 Oct 2023 04:57:41
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor

Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.248
Max repeatability error (b)	[kN]	0.023
Max reversibility error (v)	[kN]	0.031
Zero load error (F _{c0})	[kN]	0.006
Zero load offset (F ₀)	[kN]	-0.003
Resolution	[kN]	8.52E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	-0.002	0.000	0.002	0.000	0.000	0.004		0.018
40.000	40.086	40.078	40.075	40.080	0.080	0.011	0.027	0.143
80.000	80.130	80.119	80.115	80.121	0.121	0.016	-0.009	0.262
120.000	120.104	120.091	120.089	120.095	0.095	0.015	-0.031	0.387
160.000	159.954	159.942	159.932	159.942	-0.058	0.022	0.003	0.508
200.000	199.751	199.755	199.751	199.752	-0.248	0.004		0.630
160.000	159.958	159.944	159.934	159.945	-0.055	0.023	0.003	0.508
120.000	120.071	120.061	120.057	120.063	0.063	0.014	-0.031	0.387
80.000	80.119	80.111	80.106	80.112	0.112	0.013	-0.009	0.262
40.000	40.108	40.107	40.103	40.106	0.106	0.005	0.027	0.142
0.000	-0.004	-0.003	-0.010	-0.006	-0.006	0.007		0.019

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Cone+Fric. Calibration Result [Force]

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0037
Electronics	9000
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference

Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031513

Calibration Details

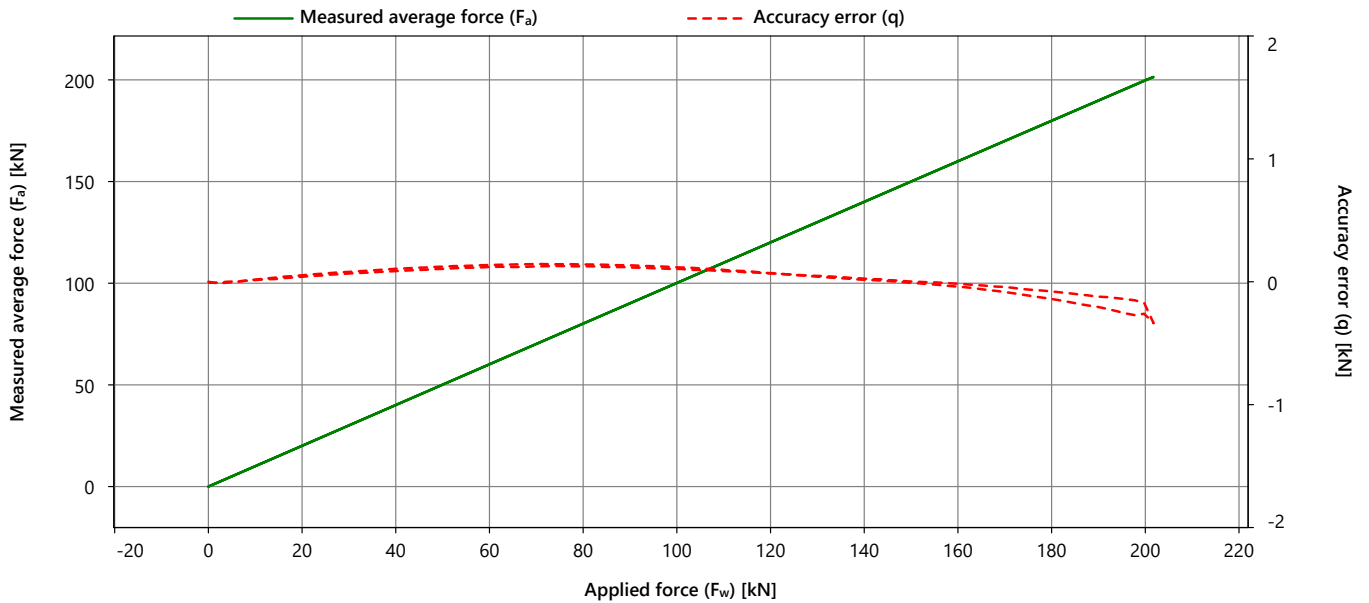
Calibration Date	12 Oct 2023 04:57:41
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor

Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.258
Max repeatability error (b)	[kN]	0.020
Max reversibility error (v)	[kN]	0.024
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	-0.010
Resolution	[kN]	8.55E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.096



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.002	-0.001	-0.002	0.000	0.000	0.004		0.020
40.000	40.106	40.104	40.107	40.106	0.106	0.003	-0.019	0.141
80.000	80.138	80.140	80.145	80.141	0.141	0.007	-0.016	0.262
120.000	120.064	120.069	120.079	120.071	0.071	0.015	-0.003	0.385
160.000	159.957	159.960	159.964	159.960	-0.040	0.007	0.024	0.508
200.000	199.734	199.740	199.754	199.742	-0.258	0.020		0.631
160.000	159.982	159.988	159.983	159.984	-0.016	0.006	0.024	0.508
120.000	120.064	120.069	120.068	120.067	0.067	0.005	-0.003	0.385
80.000	80.122	80.126	80.127	80.125	0.125	0.005	-0.016	0.262
40.000	40.083	40.087	40.090	40.087	0.087	0.007	-0.019	0.141
0.000	-0.007	-0.008	-0.011	-0.008	-0.008	0.004		0.020

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0037
Electronics	9000
Node Type	7001
Hardware Version	6.00
Software Version	8.01

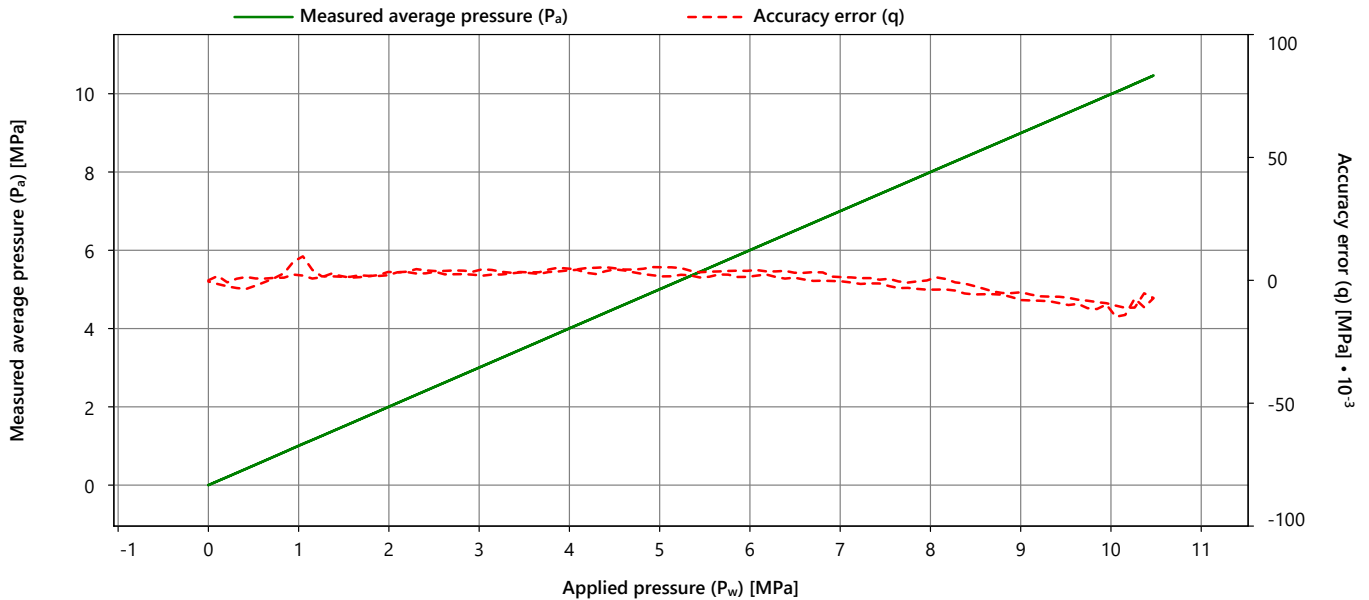
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031513

Calibration Details	
Calibration Date	12 Oct 2023 06:12:57
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.0.2.54728

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.010
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.004
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	0.001
Resolution	[MPa]	2.15E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.004	2.004	2.002	2.003	0.003	0.003	-0.001	0.006
4.000	4.006	4.005	4.003	4.005	0.005	0.003	-0.001	0.006
6.000	6.004	6.003	6.005	6.004	0.004	0.002	-0.002	0.007
8.000	8.000	8.001	8.000	8.000	0.000	0.001	-0.004	0.009
10.000	9.992	9.990	9.990	9.990	-0.010	0.002		0.008
8.000	7.997	7.996	7.996	7.996	-0.004	0.001	-0.004	0.009
6.000	6.002	6.001	6.001	6.001	0.001	0.000	-0.002	0.006
4.000	4.005	4.004	4.004	4.004	0.004	0.001	-0.001	0.005
2.000	2.002	2.002	2.003	2.002	0.002	0.001	-0.001	0.004
0.000	-0.001	0.000	-0.001	0.000	0.000	0.001		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0037
Electronics	9000
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

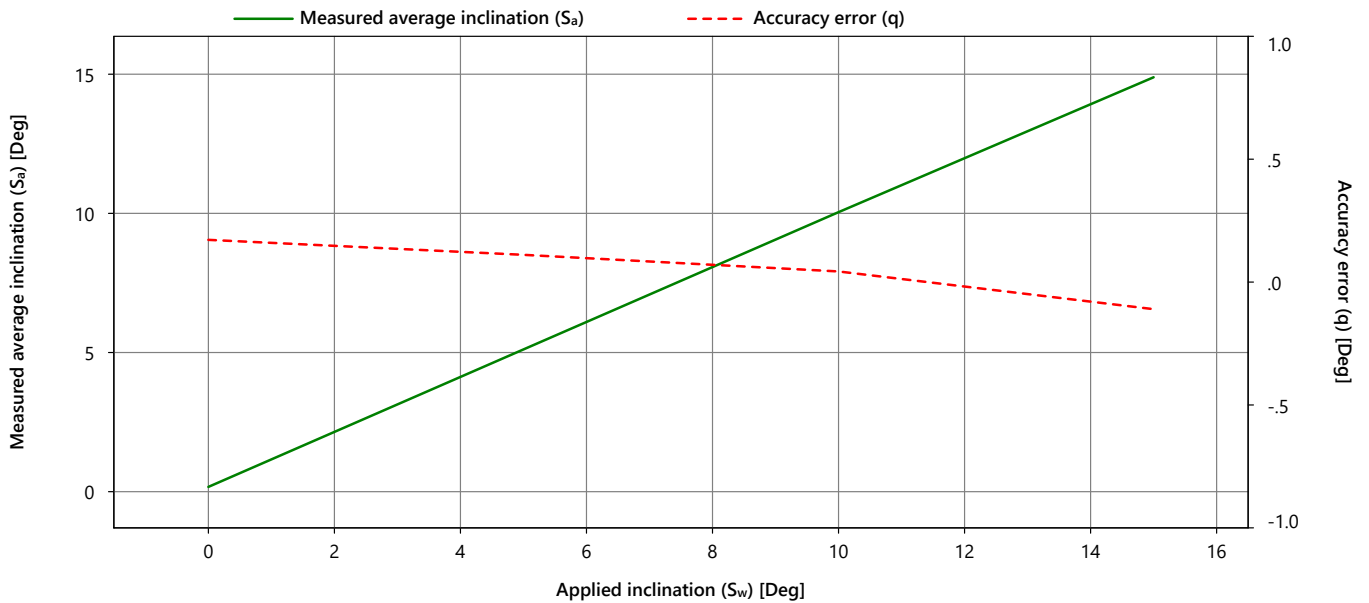
Certificate Number
FCN23031513

Calibration Details	
Calibration Date	12 Oct 2023 05:02:12
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.0.2.54728

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.2
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.33E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.1	0.3	0.2	0.2	0.2	0.7
5.0	5.1	5.1	5.1	5.1	0.1	0.1	0.7
10.0	10.0	10.1	10.1	10.0	0.0	0.1	0.7
15.0	14.9	14.9	14.9	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031513

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Fugro Transducer Workshop, P.O. Box 130, 2630 AC Nootdorp, The Netherlands, Phone +31-70-3111444, www.fugro.com
Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0037

Appendix Applicable to
Certificate Number
FCN23031513

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0037
Electronics	9000
Node Type	7001
Hardware Version	6.00
Software Version	8.01

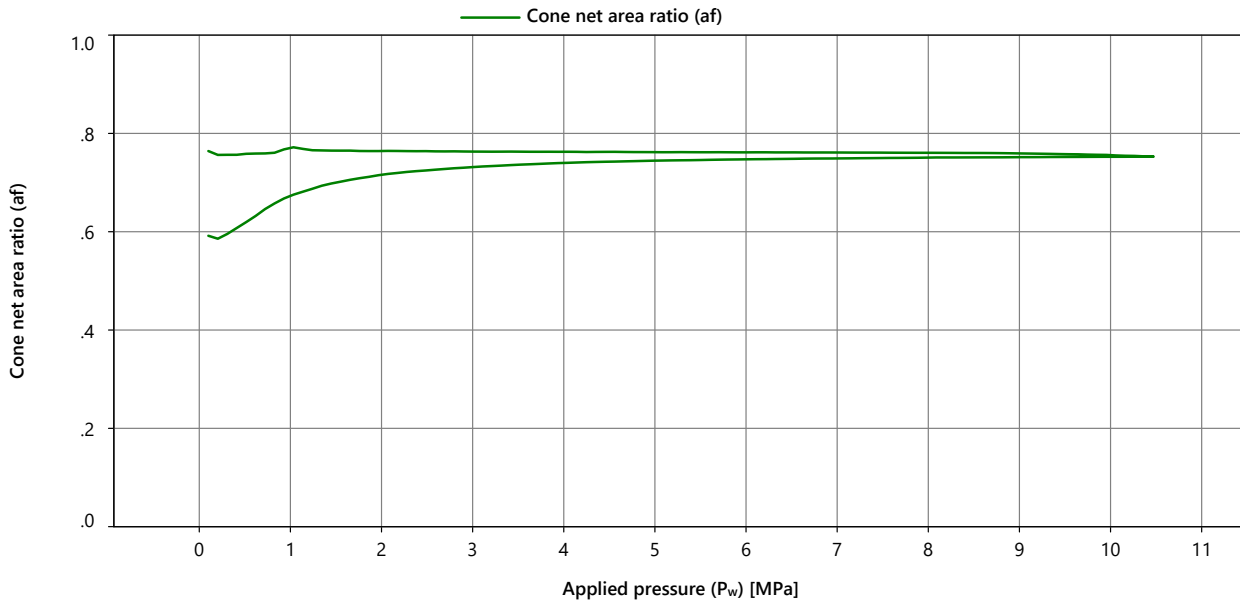
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23031513

Measurement Details	
Measurement Date	12 Oct 2023 06:12:57
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.75

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.717	0.716	0.715	0.716
4.000	0.740	0.740	0.739	0.740
6.000	0.747	0.747	0.747	0.747
8.000	0.751	0.751	0.751	0.751
10.000	0.753	0.752	0.752	0.752
8.000	0.761	0.761	0.760	0.761
6.000	0.761	0.761	0.761	0.761
4.000	0.763	0.763	0.762	0.763
2.000	0.764	0.764	0.764	0.764

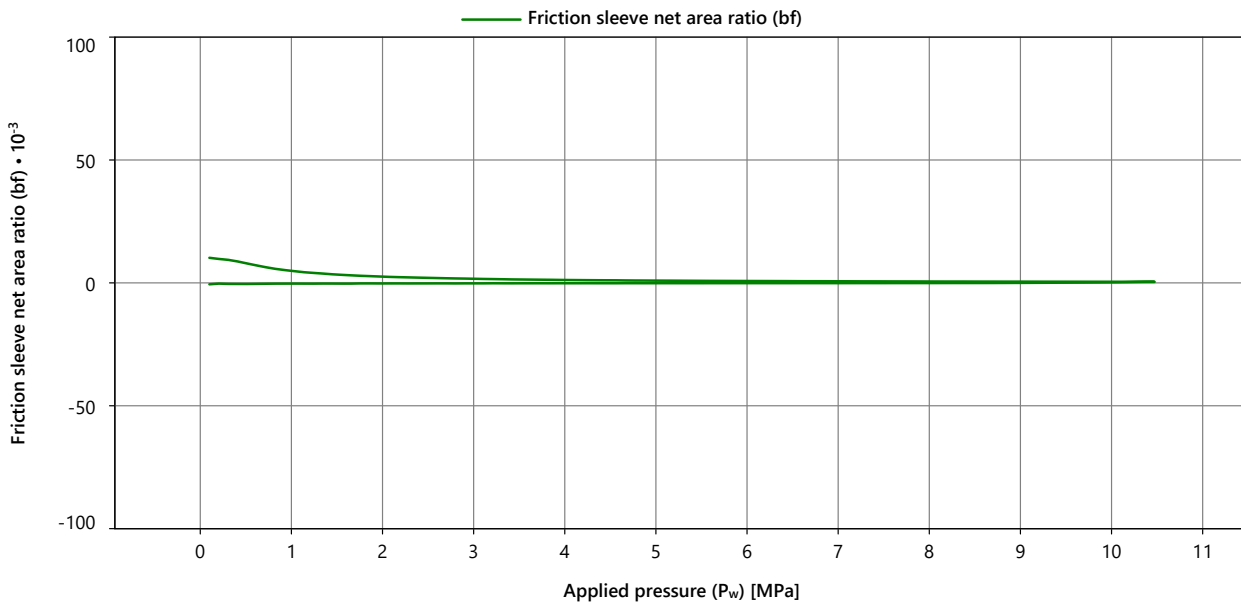
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0037	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9000	Measurement Details	
Node Type	7001	Measurement Date	12 Oct 2023 06:12:57
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.0.2.54728

Appendix Applicable to
Certificate Number
FCN23031513

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00042

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.003	0.003	0.003	0.003
4.000	0.001	0.001	0.001	0.001
6.000	0.001	0.001	0.001	0.001
8.000	0.001	0.001	0.001	0.001
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031513

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031514

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0049

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 12-Oct-2023

Calibrate before 12-Apr-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.8 $\mu\text{V/V/kN}$	-0.396 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	3.37 $\mu\text{V/V}$	0.34 %	0.17 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	0.393 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	3.57 $\mu\text{V/V}$	0.32 %	0.15 %
Pore 2 [Pressure]	3.25 mV/V/MPa	765 $\mu\text{V/V}$	3.25 mV/V/MPa	779 $\mu\text{V/V}$	0.06 %	0.04 %

Nootdorp, 13-Oct-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0049
Electronics	7534
Node Type	7001
Hardware Version	5.01
Software Version	8.01

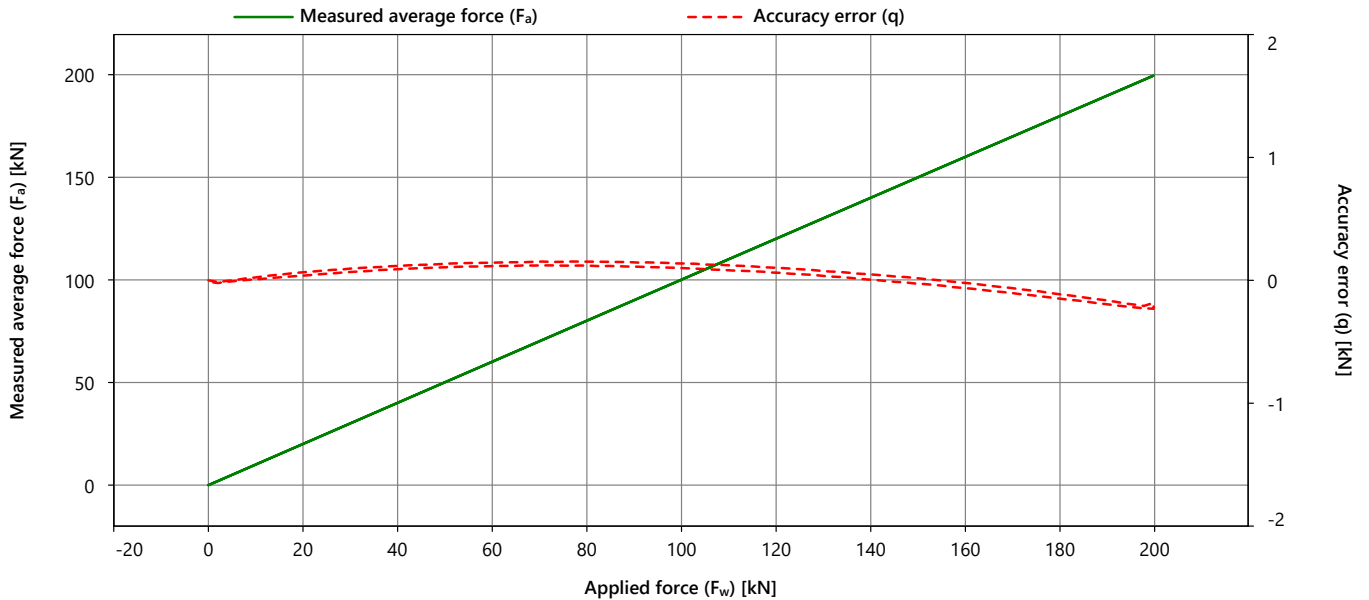
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031514

Calibration Details	
Calibration Date	12 Oct 2023 05:12:16
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.179
Max repeatability error (b)	[kN]	0.031
Max reversibility error (v)	[kN]	0.042
Zero load error (F _{c0})	[kN]	0.012
Zero load offset (F ₀)	[kN]	-0.019
Resolution	[kN]	8.56E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.004	-0.002	-0.002	0.000	0.000	0.006		0.025
40.000	40.123	40.112	40.116	40.117	0.117	0.010	-0.027	0.143
80.000	80.157	80.146	80.152	80.151	0.151	0.011	-0.032	0.265
120.000	120.106	120.097	120.104	120.102	0.102	0.009	-0.040	0.388
160.000	159.984	159.973	159.978	159.978	-0.022	0.011	-0.042	0.510
200.000	199.837	199.820	199.806	199.821	-0.179	0.031		0.632
160.000	159.942	159.932	159.937	159.937	-0.063	0.011	-0.042	0.510
120.000	120.064	120.061	120.062	120.062	0.062	0.003	-0.040	0.388
80.000	80.123	80.116	80.120	80.120	0.120	0.007	-0.032	0.265
40.000	40.094	40.088	40.089	40.090	0.090	0.006	-0.027	0.143
0.000	-0.010	-0.012	-0.015	-0.012	-0.012	0.005		0.024

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0049
Electronics	7534
Node Type	7001
Hardware Version	5.01
Software Version	8.01

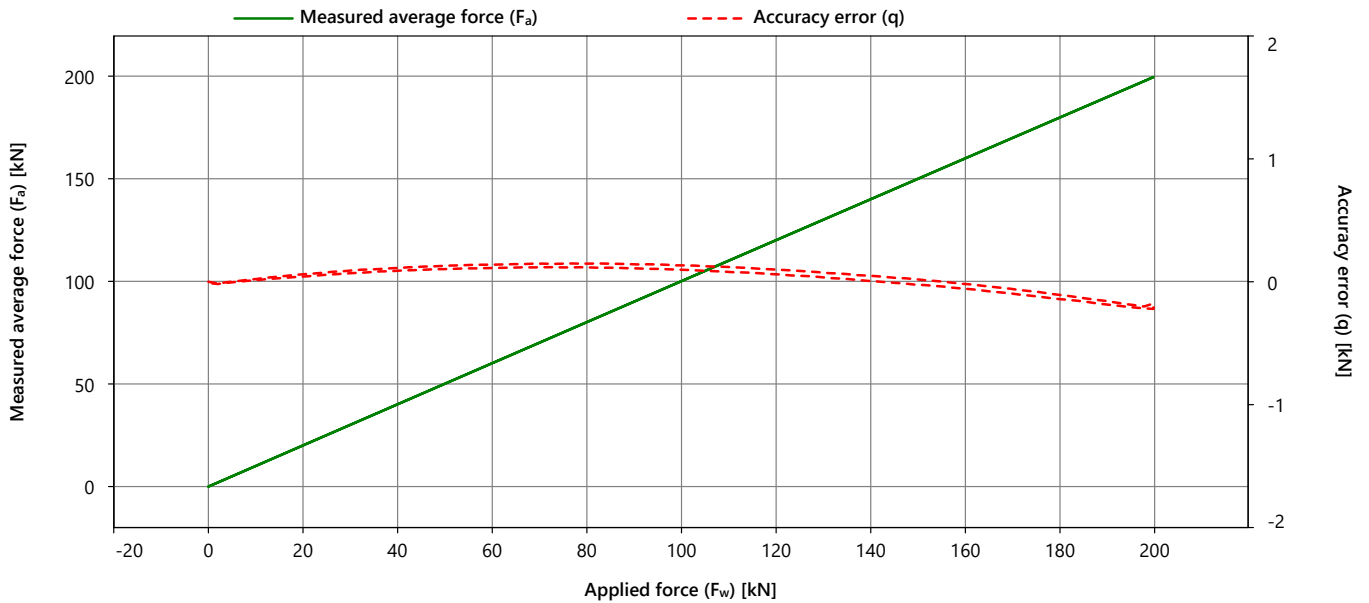
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031514

Calibration Details	
Calibration Date	12 Oct 2023 05:12:16
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.172
Max repeatability error (b)	[kN]	0.029
Max reversibility error (v)	[kN]	0.039
Zero load error (F _{c0})	[kN]	0.011
Zero load offset (F ₀)	[kN]	-0.044
Resolution	[kN]	8.61E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.011



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.005	-0.003	-0.002	0.000	0.000	0.008		0.025
40.000	40.118	40.107	40.112	40.112	0.112	0.011	-0.023	0.142
80.000	80.153	80.141	80.148	80.147	0.147	0.012	-0.030	0.265
120.000	120.101	120.094	120.103	120.100	0.100	0.009	-0.039	0.388
160.000	159.986	159.976	159.983	159.982	-0.018	0.010	-0.039	0.510
200.000	199.843	199.826	199.814	199.828	-0.172	0.029		0.631
160.000	159.949	159.938	159.943	159.943	-0.057	0.011	-0.039	0.510
120.000	120.063	120.059	120.061	120.061	0.061	0.003	-0.039	0.387
80.000	80.121	80.113	80.117	80.117	0.117	0.008	-0.030	0.264
40.000	40.094	40.086	40.089	40.090	0.090	0.008	-0.023	0.142
0.000	-0.010	-0.011	-0.012	-0.011	-0.011	0.002		0.023

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0049
Electronics	7534
Node Type	7001
Hardware Version	5.01
Software Version	8.01

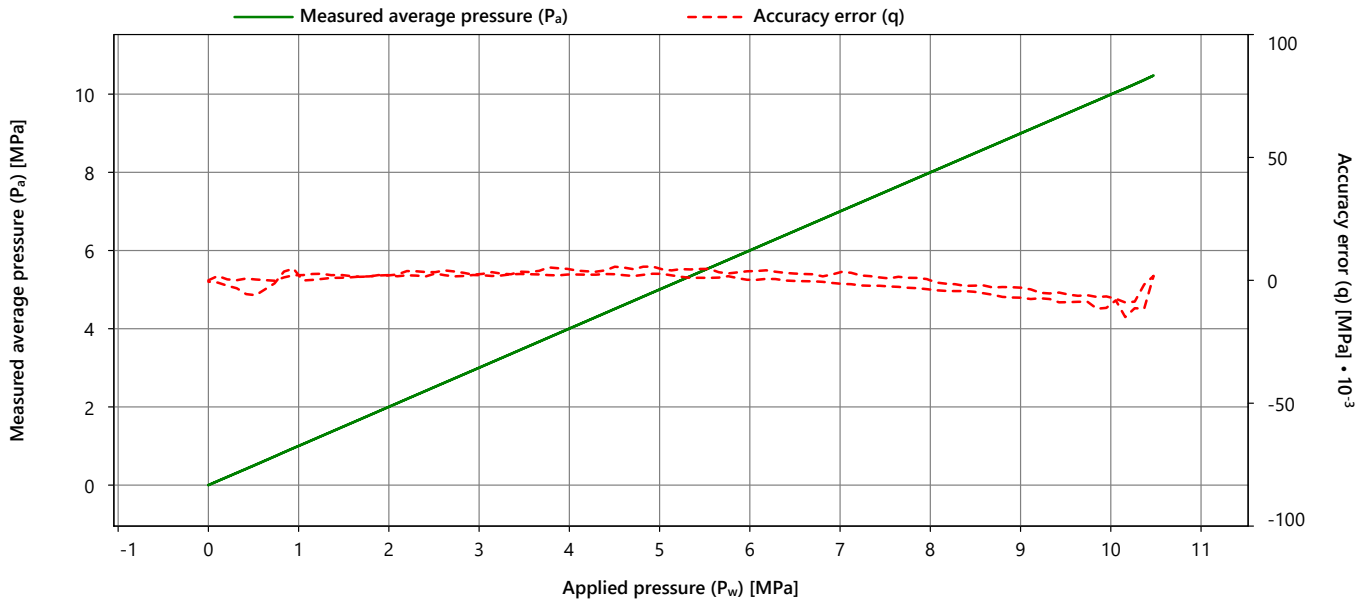
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031514

Calibration Details	
Calibration Date	12 Oct 2023 06:22:50
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.0.2.54728

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.007
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.004
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	0.000
Resolution	[MPa]	2.29E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.004	2.001	2.001	2.002	0.002	0.003	0.000	0.006
4.000	4.003	4.005	4.006	4.005	0.005	0.003	-0.002	0.007
6.000	6.004	6.003	6.004	6.004	0.004	0.001	-0.003	0.007
8.000	7.999	7.999	8.002	8.000	0.000	0.003	-0.004	0.009
10.000	9.994	9.993	9.993	9.993	-0.007	0.001		0.007
8.000	7.997	7.996	7.996	7.996	-0.004	0.002	-0.004	0.008
6.000	6.000	6.001	6.000	6.000	0.000	0.002	-0.003	0.007
4.000	4.004	4.002	4.002	4.002	0.002	0.002	-0.002	0.006
2.000	2.002	2.001	2.003	2.002	0.002	0.002	0.000	0.004
0.000	-0.001	0.000	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0049
Electronics	7534
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

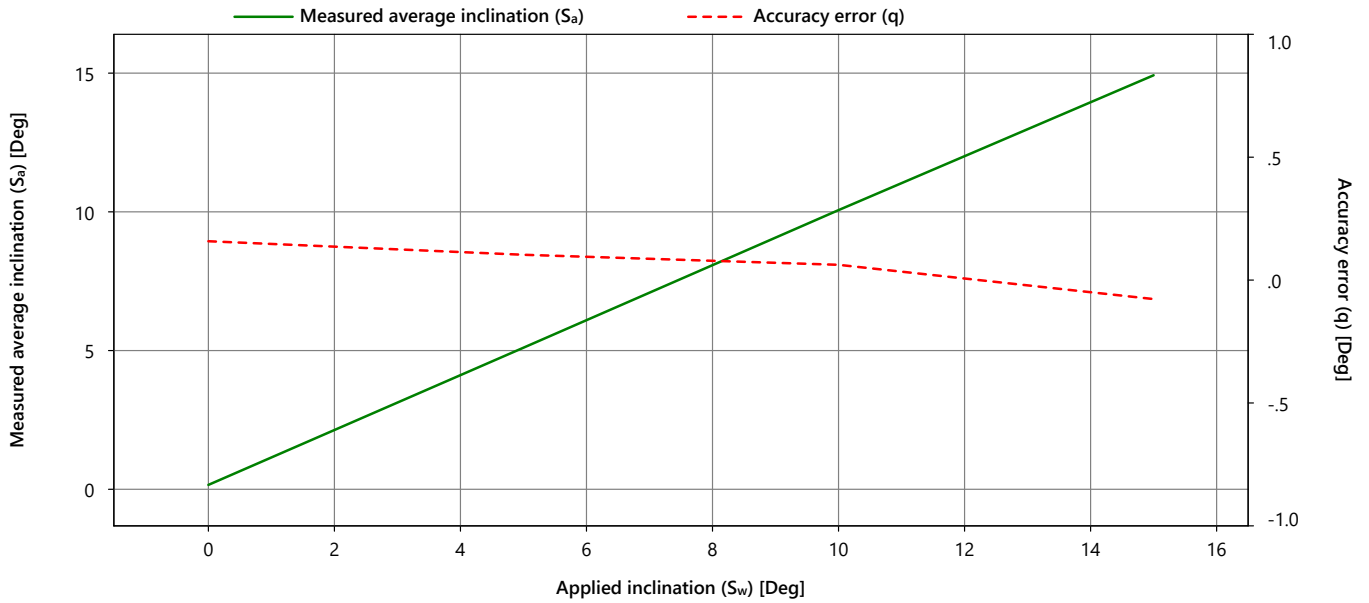
Certificate Number
FCN23031514

Calibration Details	
Calibration Date	12 Oct 2023 05:15:49
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.0.2.54728

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.1
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.3E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.2	0.1	0.2	0.2	0.2	0.1	0.7
5.0	5.0	5.1	5.2	5.1	0.1	0.1	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.0	0.7
15.0	15.0	14.9	14.9	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031514

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Fugro Transducer Workshop, P.O. Box 130, 2630 AC Nootdorp, The Netherlands, Phone +31-70-3111444, www.fugro.com
Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0049

Appendix Applicable to
Certificate Number
FCN23031514

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

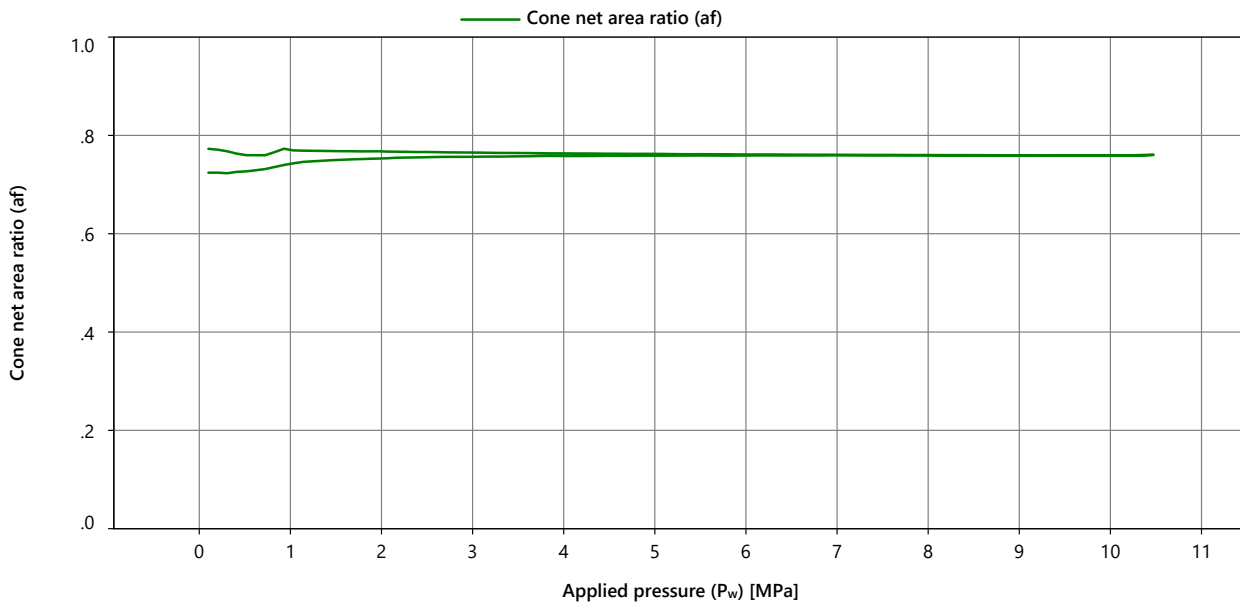
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0049	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7534	Measurement Details	
Node Type	7001	Measurement Date	12 Oct 2023 06:22:50
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.0.2.54728

Appendix Applicable to
Certificate Number
FCN23031514

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.754	0.753	0.752	0.753
4.000	0.758	0.758	0.758	0.758
6.000	0.759	0.759	0.759	0.759
8.000	0.760	0.760	0.760	0.760
10.000	0.760	0.760	0.760	0.760
8.000	0.760	0.760	0.760	0.760
6.000	0.761	0.761	0.761	0.761
4.000	0.764	0.763	0.763	0.763
2.000	0.767	0.768	0.767	0.767

Friction Sleeve Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0049
Electronics	7534
Node Type	7001
Hardware Version	5.01
Software Version	8.01

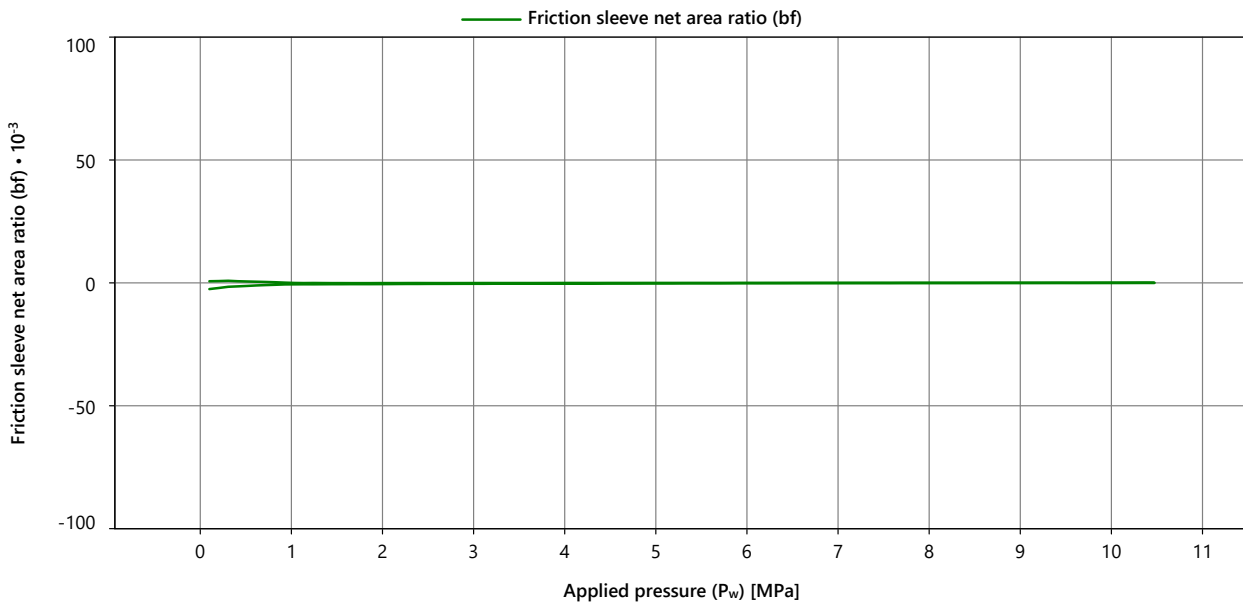
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23031514

Measurement Details	
Measurement Date	12 Oct 2023 06:22:50
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00001

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	-0.001	-0.001	-0.001

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031514

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031515

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0032

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions
Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 12-Oct-2023

Calibrate before 12-Apr-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Pore 2 [Pressure]	3.41 mV/V/MPa	975 μ V/V	3.41 mV/V/MPa	991 μ V/V	-0.01 %	0.05 %

Nootdorp, 13-Oct-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0032
Electronics	9301
Node Type	7001
Hardware Version	6.00
Software Version	8.01

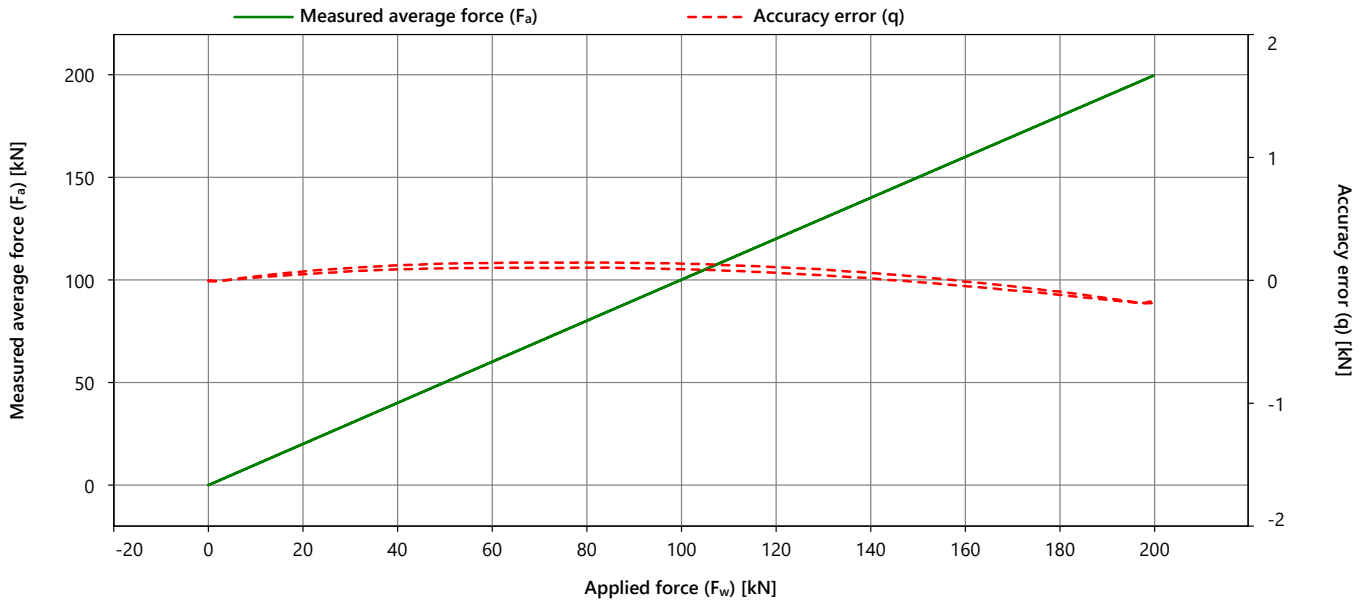
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031515

Calibration Details	
Calibration Date	12 Oct 2023 05:34:51
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.163
Max repeatability error (b)	[kN]	0.014
Max reversibility error (v)	[kN]	0.045
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	-0.026
Resolution	[kN]	8.52E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.002	-0.001	-0.002	0.000	0.000	0.004		0.019
40.000	40.126	40.119	40.122	40.123	0.123	0.007	-0.033	0.144
80.000	80.149	80.144	80.141	80.145	0.145	0.008	-0.042	0.266
120.000	120.110	120.107	120.102	120.106	0.106	0.008	-0.045	0.388
160.000	159.992	159.987	159.985	159.988	-0.012	0.007	-0.035	0.509
200.000	199.838	199.844	199.830	199.837	-0.163	0.014		0.631
160.000	159.952	159.953	159.953	159.953	-0.047	0.001	-0.035	0.509
120.000	120.064	120.059	120.060	120.061	0.061	0.004	-0.045	0.388
80.000	80.103	80.103	80.102	80.103	0.103	0.001	-0.042	0.266
40.000	40.093	40.088	40.088	40.090	0.090	0.005	-0.033	0.144
0.000	-0.006	-0.008	-0.010	-0.008	-0.008	0.004		0.019

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0032
Electronics	9301
Node Type	7001
Hardware Version	6.00
Software Version	8.01

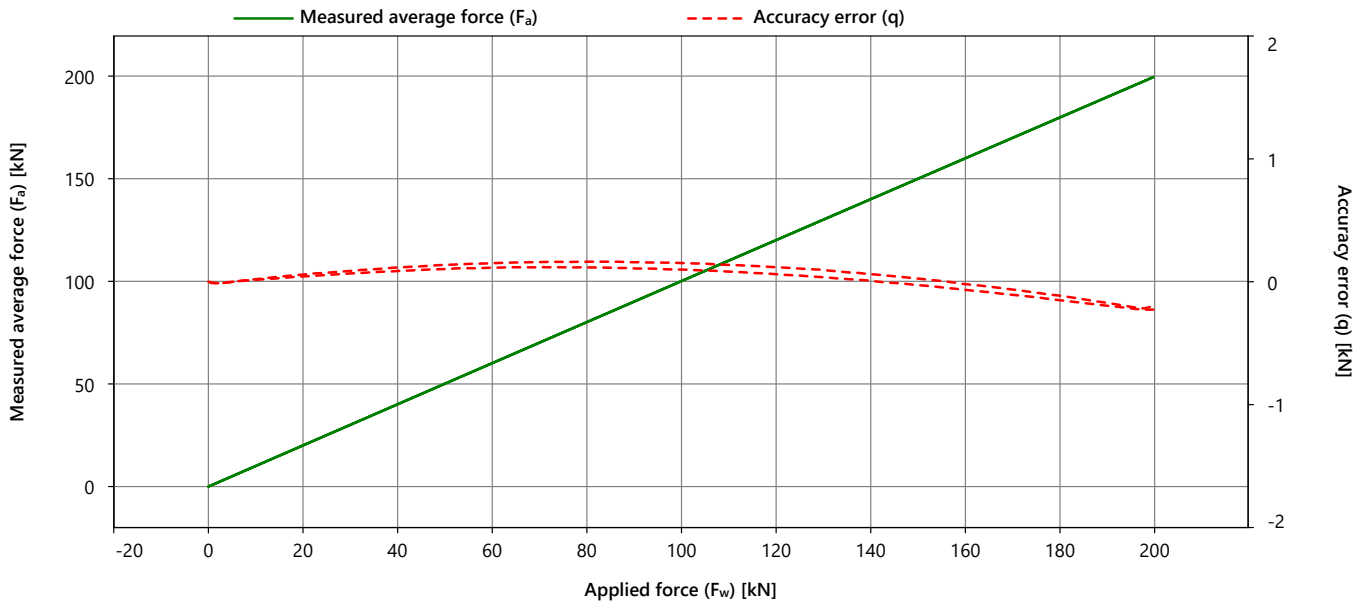
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031515

Calibration Details	
Calibration Date	12 Oct 2023 05:34:51
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.197
Max repeatability error (b)	[kN]	0.020
Max reversibility error (v)	[kN]	0.057
Zero load error (F _{c0})	[kN]	0.009
Zero load offset (F ₀)	[kN]	-0.027
Resolution	[kN]	8.56E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.027



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.001	0.001	-0.001	0.000	0.000	0.002		0.020
40.000	40.120	40.115	40.115	40.116	0.116	0.005	-0.028	0.143
80.000	80.166	80.166	80.157	80.163	0.163	0.009	-0.046	0.267
120.000	120.121	120.119	120.114	120.118	0.118	0.006	-0.057	0.390
160.000	159.982	159.980	159.976	159.979	-0.021	0.006	-0.045	0.510
200.000	199.804	199.813	199.792	199.803	-0.197	0.020		0.631
160.000	159.933	159.937	159.933	159.934	-0.066	0.005	-0.045	0.510
120.000	120.064	120.062	120.058	120.061	0.061	0.006	-0.057	0.390
80.000	80.116	80.119	80.116	80.117	0.117	0.004	-0.046	0.267
40.000	40.090	40.088	40.085	40.088	0.088	0.004	-0.028	0.143
0.000	-0.009	-0.009	-0.008	-0.009	-0.009	0.001		0.019

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0032
Electronics	9301
Node Type	7001
Hardware Version	6.00
Software Version	8.01

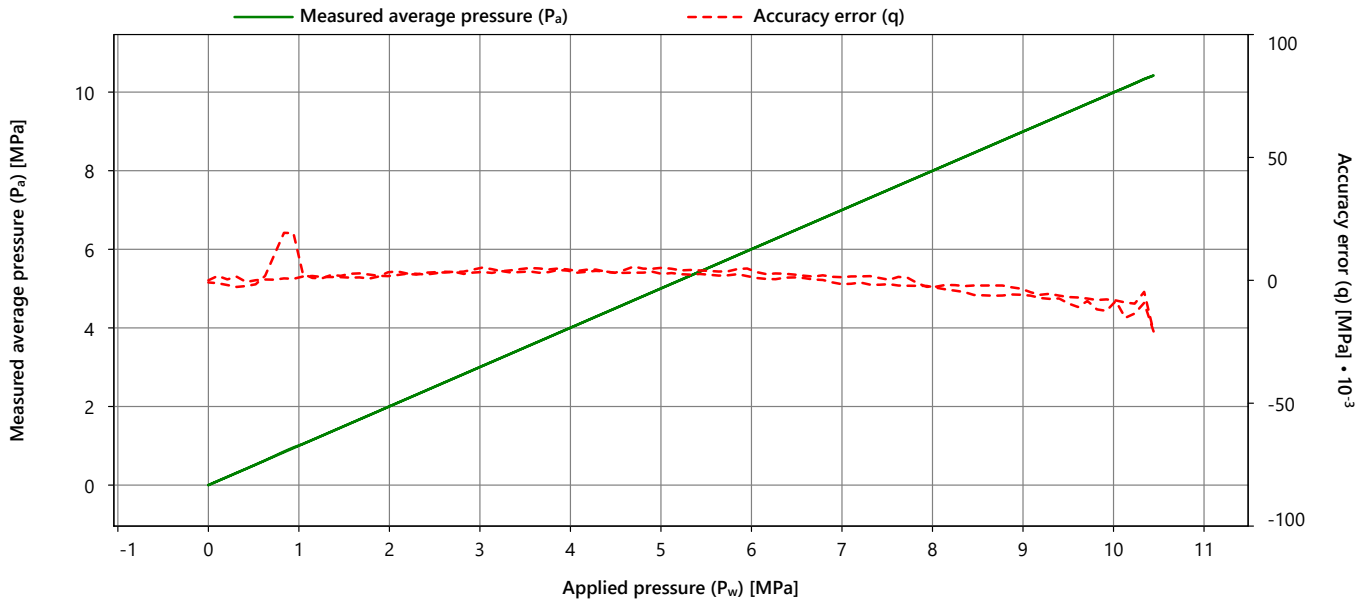
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031515

Calibration Details	
Calibration Date	12 Oct 2023 06:05:25
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.0.2.54728

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.008
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	-0.003
Resolution	[MPa]	2.19E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.003	2.004	2.004	2.003	0.003	0.001	-0.002	0.005
4.000	4.006	4.005	4.002	4.004	0.004	0.003	-0.001	0.006
6.000	6.004	6.005	6.003	6.004	0.004	0.002	-0.003	0.007
8.000	7.997	7.996	7.998	7.997	-0.003	0.002	0.000	0.007
10.000	9.992	9.991	9.994	9.992	-0.008	0.004		0.009
8.000	7.998	7.997	7.997	7.997	-0.003	0.001	0.000	0.007
6.000	6.001	6.001	6.001	6.001	0.001	0.000	-0.003	0.007
4.000	4.003	4.004	4.003	4.004	0.004	0.001	-0.001	0.005
2.000	2.002	2.002	2.001	2.002	0.002	0.001	-0.002	0.005
0.000	-0.001	-0.001	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0032
Electronics	9301
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

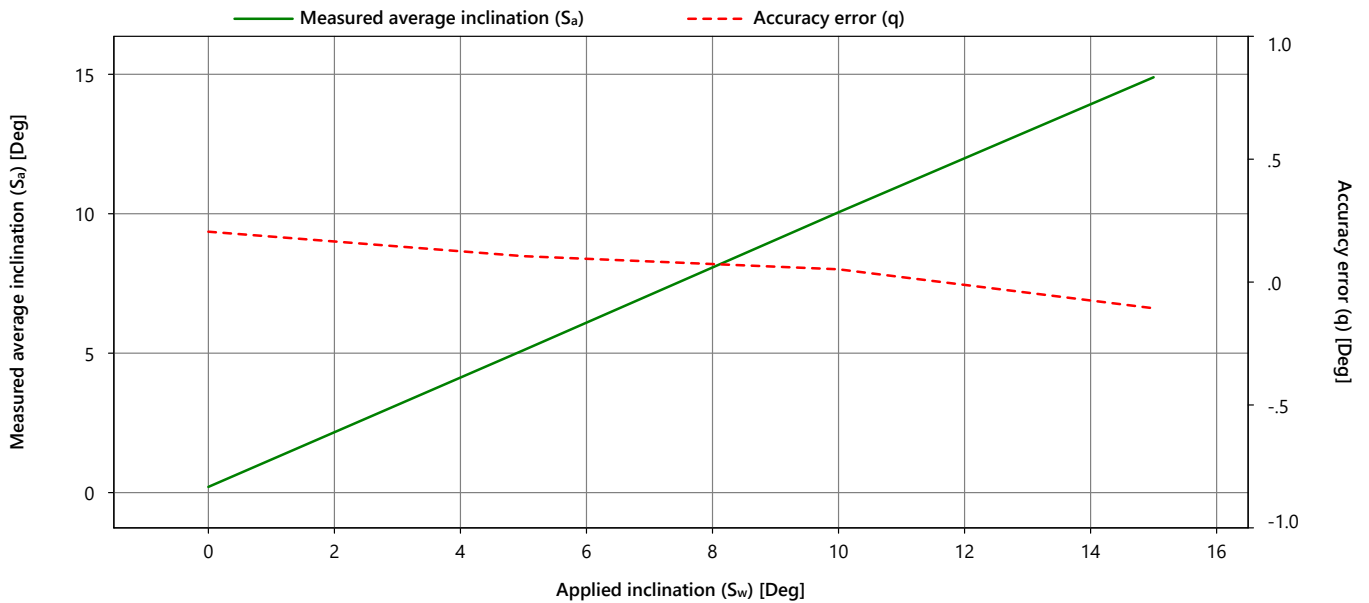
Certificate Number
FCN23031515

Calibration Details	
Calibration Date	12 Oct 2023 05:40:35
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.0.2.54728

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.34E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.2	0.1	0.3	0.2	0.2	0.1	0.7
5.0	5.0	5.1	5.2	5.1	0.1	0.2	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.9	14.9	14.9	14.9	-0.1	0.0	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031515

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0032

Appendix Applicable to
Certificate Number
FCN23031515

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

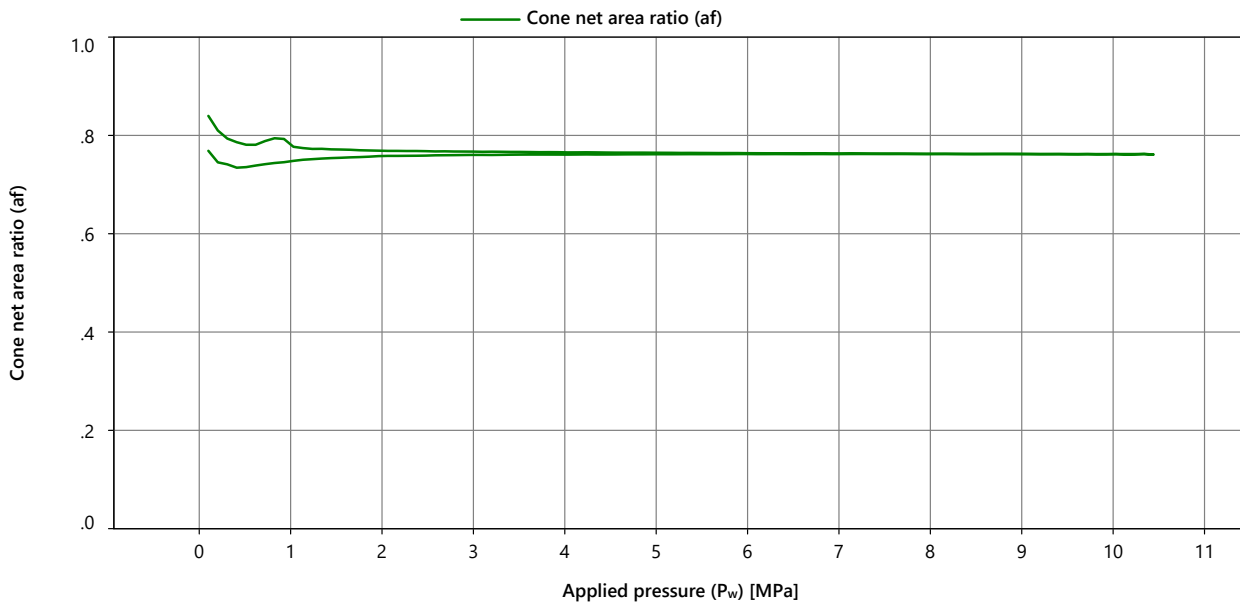
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0032	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9301	Measurement Details	
Node Type	7001	Measurement Date	12 Oct 2023 06:05:25
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.0.2.54728

Appendix Applicable to
Certificate Number
FCN23031515

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.757	0.759	0.759	0.758
4.000	0.761	0.761	0.761	0.761
6.000	0.761	0.763	0.762	0.762
8.000	0.761	0.762	0.762	0.762
10.000	0.762	0.762	0.763	0.762
8.000	0.762	0.763	0.763	0.763
6.000	0.763	0.764	0.764	0.764
4.000	0.765	0.766	0.766	0.766
2.000	0.768	0.770	0.769	0.769

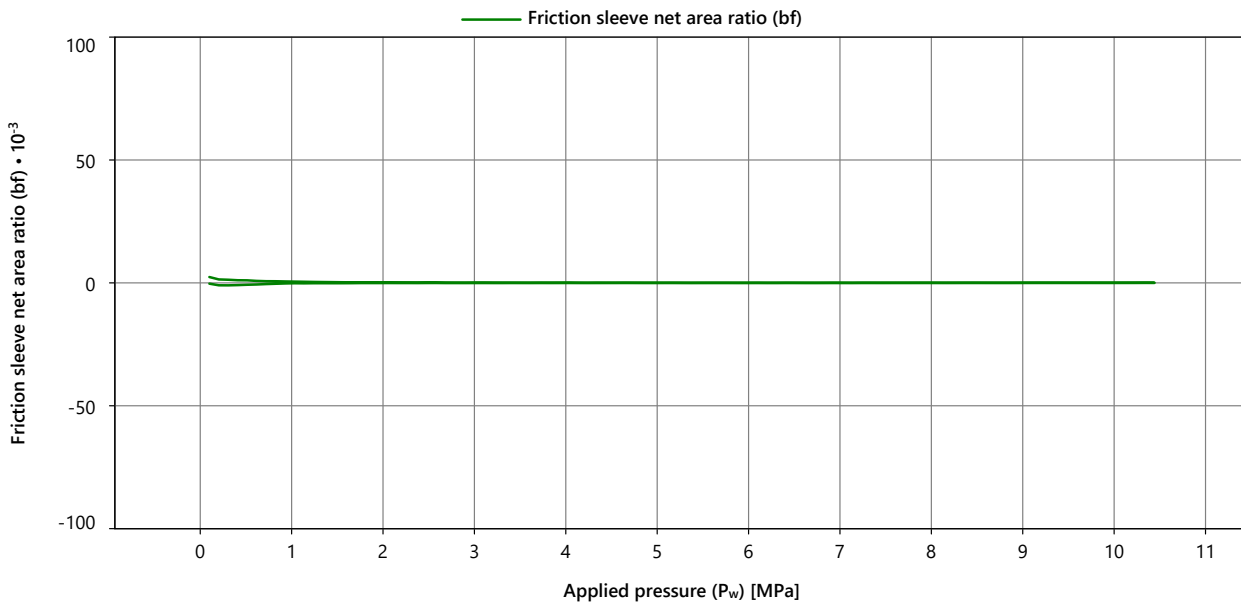
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0032	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9301	Measurement Details	
Node Type	7001	Measurement Date	12 Oct 2023 06:05:25
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.0.2.54728

Appendix Applicable to
Certificate Number
FCN23031515

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00002

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031515

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031517

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0034

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 12-Oct-2023

Calibrate before 12-Apr-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	5.29 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	8.08 $\mu\text{V/V}$	0.46 %	0.13 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	-4.19 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	0.327 $\mu\text{V/V}$	0.19 %	0.21 %
Pore 2 [Pressure]	3.02 mV/V/MPa	881 $\mu\text{V/V}$	3.02 mV/V/MPa	855 $\mu\text{V/V}$	0.09 %	-0.08 %

Nootdorp, 13-Oct-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0034
Electronics	7629
Node Type	7001
Hardware Version	5.01
Software Version	8.01

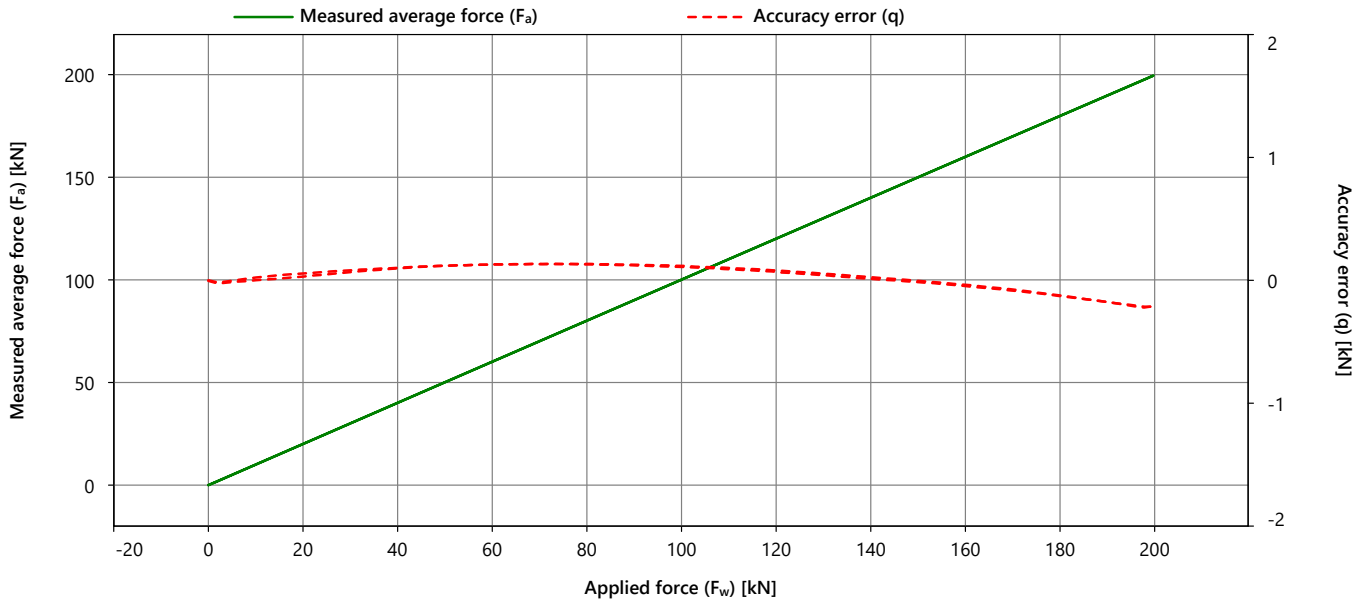
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031517

Calibration Details	
Calibration Date	12 Oct 2023 06:17:49
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.206
Max repeatability error (b)	[kN]	0.056
Max reversibility error (v)	[kN]	0.012
Zero load error (F _{c0})	[kN]	0.004
Zero load offset (F ₀)	[kN]	-0.004
Resolution	[kN]	8.53E-05
Noise RMS	[kN]	0.002



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.002	0.001	-0.003	0.000	0.000	0.005		0.017
40.000	40.084	40.120	40.101	40.102	0.102	0.036	-0.004	0.145
80.000	80.111	80.157	80.134	80.134	0.134	0.046	-0.004	0.267
120.000	120.055	120.104	120.081	120.080	0.080	0.050	-0.012	0.389
160.000	159.941	159.985	159.965	159.964	-0.036	0.044	-0.010	0.510
200.000	199.771	199.809	199.803	199.794	-0.206	0.038		0.632
160.000	159.927	159.982	159.950	159.953	-0.047	0.056	-0.010	0.512
120.000	120.047	120.090	120.066	120.068	0.068	0.043	-0.012	0.388
80.000	80.111	80.147	80.130	80.130	0.130	0.036	-0.004	0.265
40.000	40.081	40.112	40.099	40.097	0.097	0.031	-0.004	0.143
0.000	-0.002	-0.005	-0.007	-0.004	-0.004	0.005		0.018

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0034
Electronics	7629
Node Type	7001
Hardware Version	5.01
Software Version	8.01

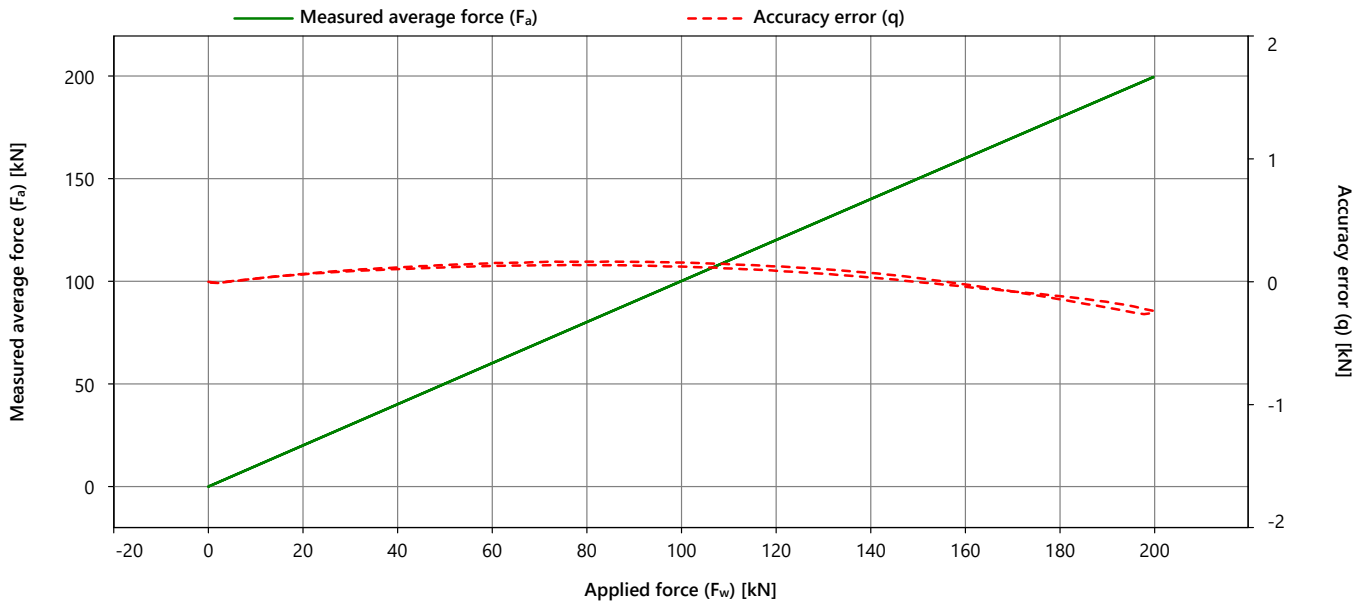
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031517

Calibration Details	
Calibration Date	12 Oct 2023 06:17:49
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.249
Max repeatability error (b)	[kN]	0.029
Max reversibility error (v)	[kN]	0.036
Zero load error (F _{c0})	[kN]	0.006
Zero load offset (F ₀)	[kN]	-0.024
Resolution	[kN]	8.61E-05
Noise RMS	[kN]	0.002
Tip-Sleeve Interaction %	[%]	0.048



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.004	0.001	-0.005	0.000	0.000	0.009		0.021
40.000	40.130	40.110	40.111	40.117	0.117	0.020	-0.013	0.142
80.000	80.178	80.156	80.158	80.164	0.164	0.022	-0.028	0.265
120.000	120.138	120.117	120.120	120.125	0.125	0.021	-0.036	0.388
160.000	159.992	159.968	159.975	159.978	-0.022	0.024	-0.019	0.509
200.000	199.763	199.734	199.756	199.751	-0.249	0.029		0.631
160.000	159.969	159.960	159.949	159.959	-0.041	0.020	-0.019	0.508
120.000	120.102	120.083	120.082	120.089	0.089	0.020	-0.036	0.388
80.000	80.148	80.128	80.131	80.136	0.136	0.021	-0.028	0.265
40.000	40.114	40.096	40.099	40.103	0.103	0.018	-0.013	0.141
0.000	-0.003	-0.007	-0.008	-0.006	-0.006	0.005		0.018

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0034
Electronics	7629
Node Type	7001
Hardware Version	5.01
Software Version	8.01

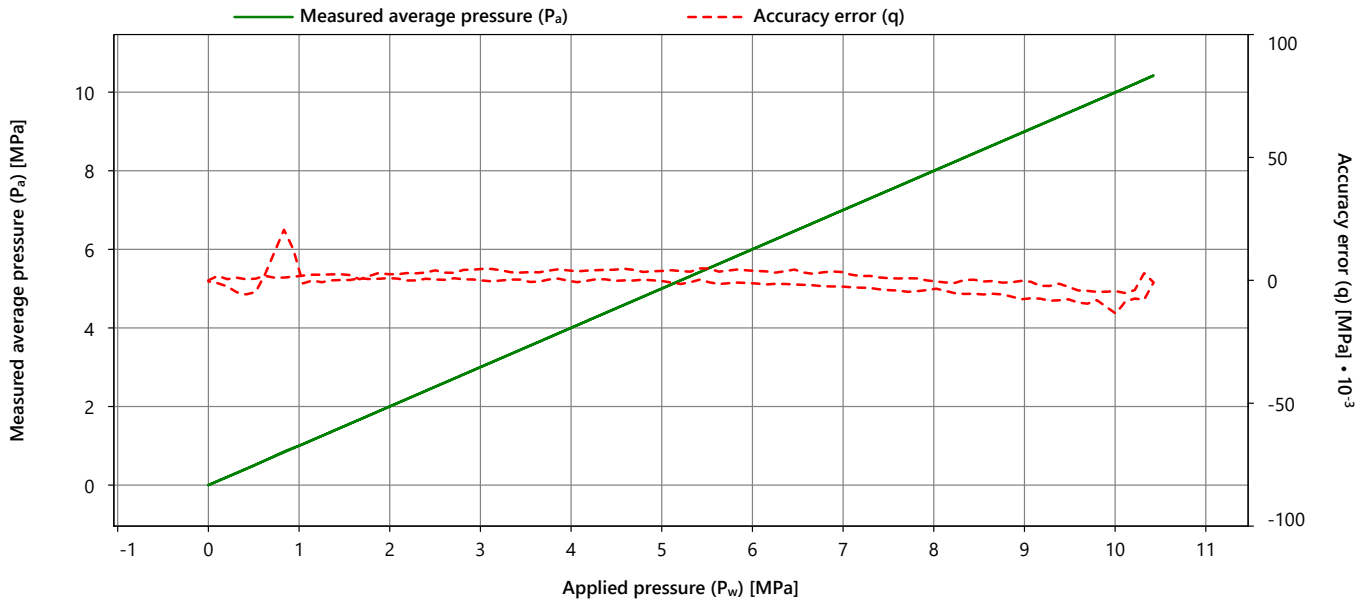
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031517

Calibration Details	
Calibration Date	12 Oct 2023 07:03:37
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.0.2.54728

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.004
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.005
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	-0.004
Resolution	[MPa]	2.47E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.004	2.001	2.002	2.002	0.002	0.003	-0.002	0.007
4.000	4.005	4.003	4.003	4.004	0.004	0.002	-0.004	0.008
6.000	6.005	6.004	6.003	6.004	0.004	0.002	-0.005	0.010
8.000	8.001	7.998	8.000	8.000	0.000	0.003	-0.003	0.008
10.000	9.996	9.996	9.994	9.996	-0.004	0.002		0.008
8.000	7.996	7.996	7.997	7.996	-0.004	0.001	-0.003	0.008
6.000	6.000	5.998	5.999	5.999	-0.001	0.002	-0.005	0.010
4.000	4.000	3.999	4.000	4.000	0.000	0.001	-0.004	0.008
2.000	2.001	2.001	2.000	2.001	0.001	0.001	-0.002	0.004
0.000	-0.001	0.000	0.000	0.000	0.000	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0034
Electronics	7629
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

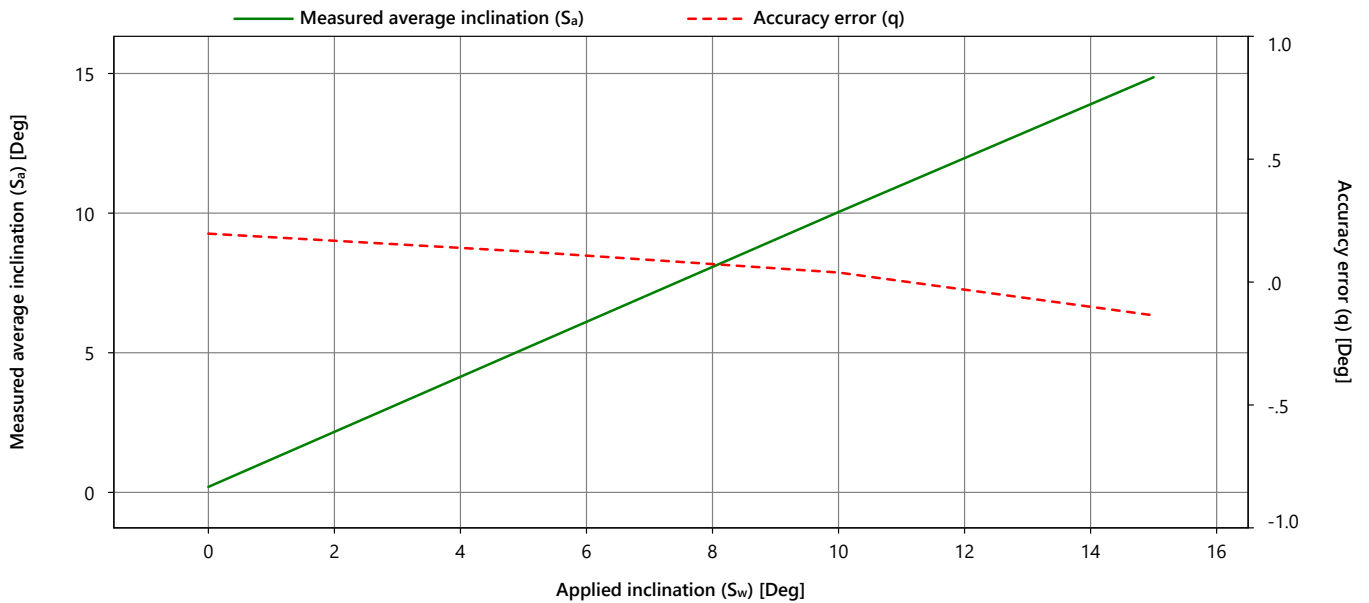
Certificate Number
FCN23031517

Calibration Details	
Calibration Date	12 Oct 2023 06:21:28
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.0.2.54728

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.31E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.1	0.3	0.2	0.2	0.2	0.7
5.0	5.0	5.1	5.2	5.1	0.1	0.2	0.7
10.0	9.9	10.0	10.1	10.0	0.0	0.2	0.7
15.0	14.8	14.9	14.9	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031517

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Fugro Transducer Workshop, P.O. Box 130, 2630 AC Nootdorp, The Netherlands, Phone +31-70-3111444, www.fugro.com
Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0034

Appendix Applicable to
Certificate Number
FCN23031517

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0034
Electronics	7629
Node Type	7001
Hardware Version	5.01
Software Version	8.01

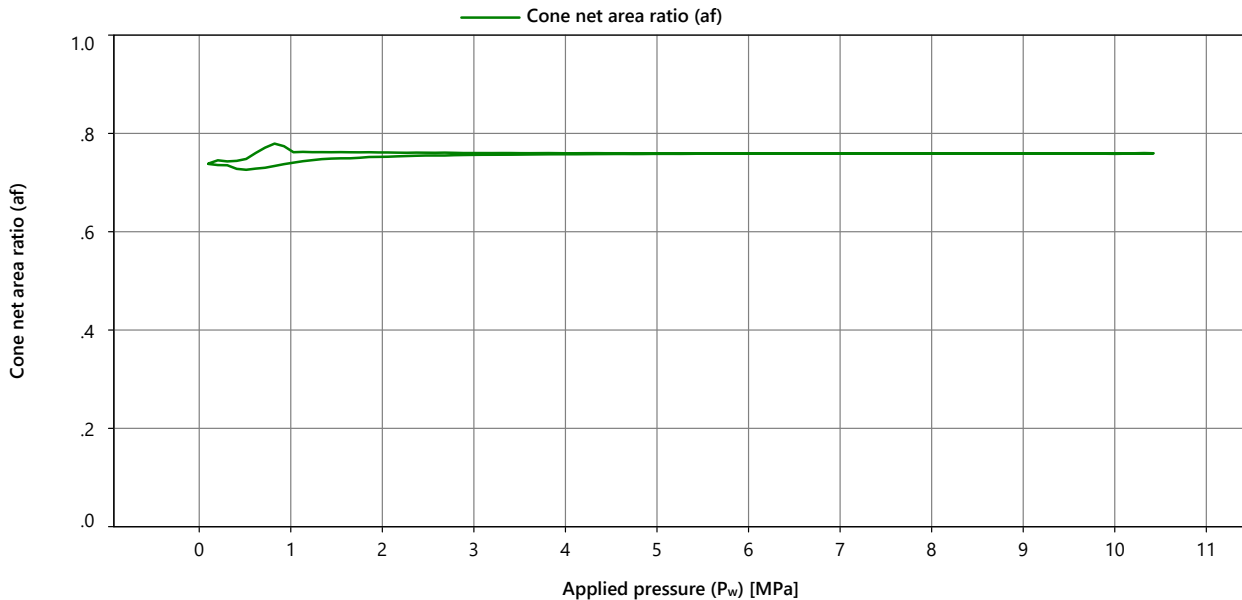
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23031517

Measurement Details	
Measurement Date	12 Oct 2023 07:03:37
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.753	0.751	0.752	0.752
4.000	0.758	0.758	0.757	0.758
6.000	0.759	0.759	0.759	0.759
8.000	0.759	0.759	0.759	0.759
10.000	0.760	0.760	0.759	0.760
8.000	0.759	0.759	0.759	0.759
6.000	0.760	0.759	0.759	0.759
4.000	0.760	0.759	0.760	0.760
2.000	0.761	0.761	0.761	0.761

Friction Sleeve Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0034
Electronics	7629
Node Type	7001
Hardware Version	5.01
Software Version	8.01

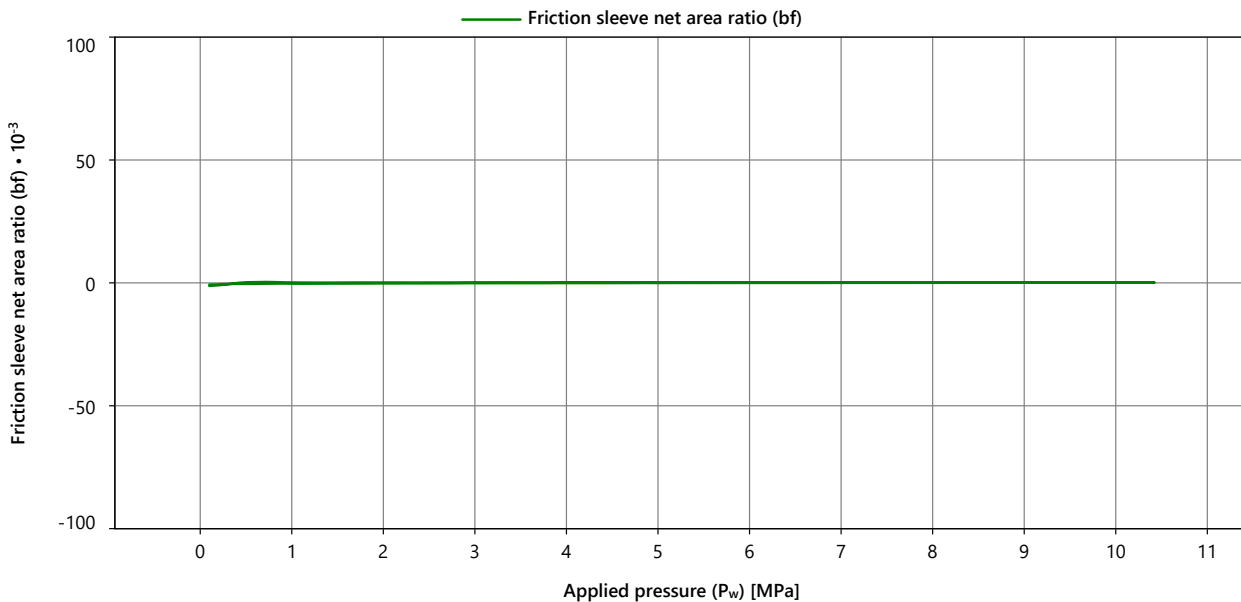
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23031517

Measurement Details	
Measurement Date	12 Oct 2023 07:03:37
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00011

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031517

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
---	----------

Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031518

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0018

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 12-Oct-2023

Calibrate before 12-Apr-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	4.19 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	6.65 $\mu\text{V/V}$	0.25 %	0.11 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	-0.778 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	-0.506 $\mu\text{V/V}$	0.26 %	0.01 %
Pore 2 [Pressure]	3.36 mV/V/MPa	1.38 mV/V	3.36 mV/V/MPa	1.35 mV/V	0.03 %	-0.09 %

Nootdorp, 13-Oct-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0018
Electronics	7596
Node Type	7001
Hardware Version	5.01
Software Version	8.01

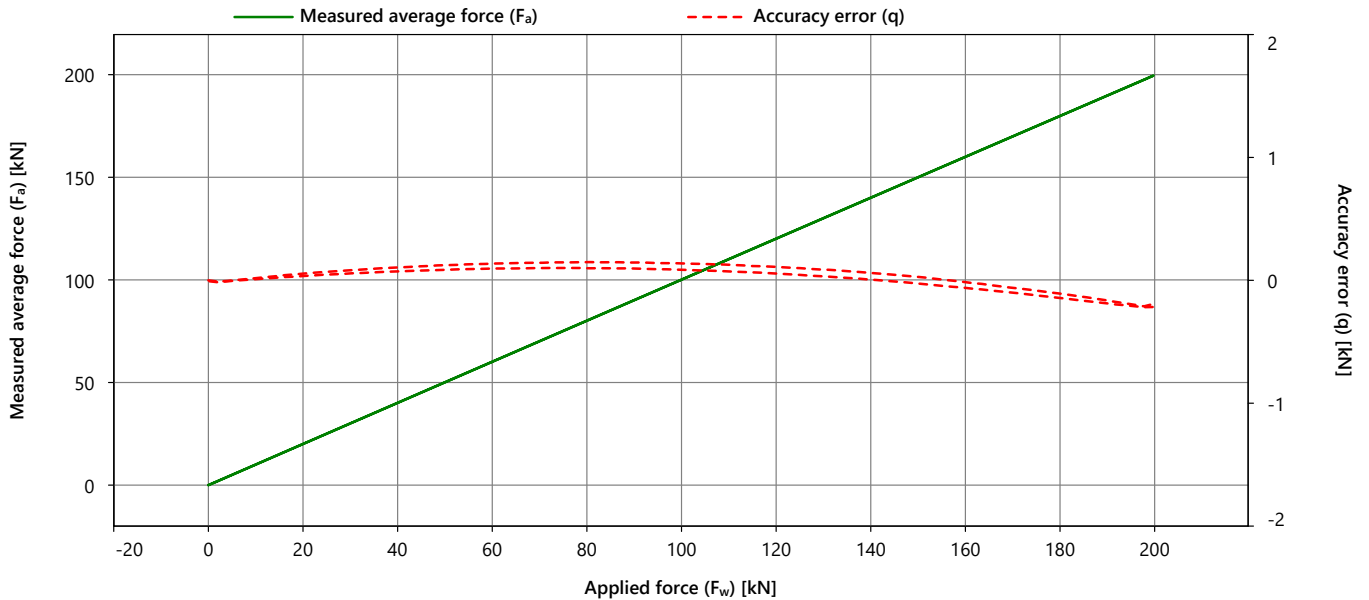
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031518

Calibration Details	
Calibration Date	12 Oct 2023 06:33:43
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.186
Max repeatability error (b)	[kN]	0.015
Max reversibility error (v)	[kN]	0.054
Zero load error (F _{c0})	[kN]	0.007
Zero load offset (F ₀)	[kN]	0.002
Resolution	[kN]	8.55E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.003	0.001	-0.004	0.000	0.000	0.007		0.020
40.000	40.109	40.104	40.100	40.105	0.105	0.009	-0.032	0.144
80.000	80.152	80.151	80.143	80.149	0.149	0.009	-0.050	0.268
120.000	120.116	120.110	120.102	120.109	0.109	0.014	-0.054	0.390
160.000	159.987	159.985	159.982	159.985	-0.015	0.005	-0.046	0.510
200.000	199.819	199.817	199.804	199.814	-0.186	0.015		0.631
160.000	159.942	159.937	159.937	159.939	-0.061	0.005	-0.046	0.510
120.000	120.064	120.052	120.050	120.055	0.055	0.013	-0.054	0.390
80.000	80.106	80.098	80.092	80.099	0.099	0.014	-0.050	0.269
40.000	40.077	40.072	40.068	40.072	0.072	0.009	-0.032	0.144
0.000	-0.002	-0.004	-0.015	-0.007	-0.007	0.014		0.027

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0018
Electronics	7596
Node Type	7001
Hardware Version	5.01
Software Version	8.01

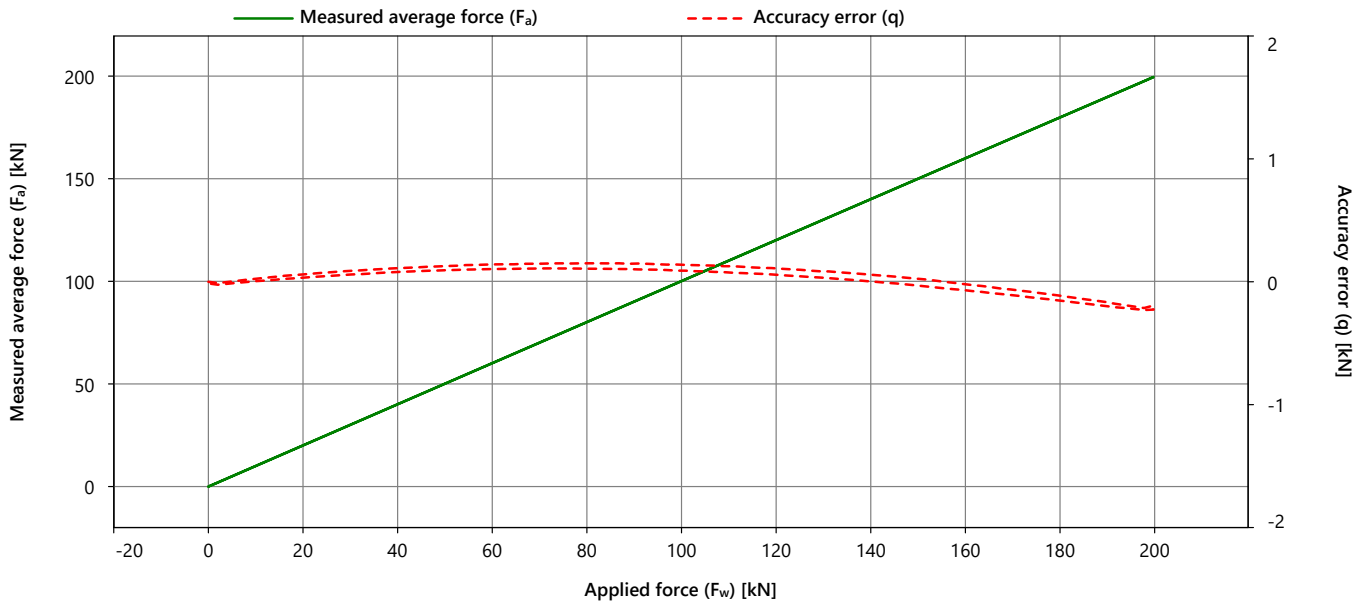
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031518

Calibration Details	
Calibration Date	12 Oct 2023 06:33:43
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.188
Max repeatability error (b)	[kN]	0.025
Max reversibility error (v)	[kN]	0.052
Zero load error (F _{c0})	[kN]	0.014
Zero load offset (F ₀)	[kN]	-0.002
Resolution	[kN]	8.6E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.029



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.010	0.000	-0.010	0.000	0.000	0.020		0.042
40.000	40.119	40.110	40.103	40.110	0.110	0.015	-0.031	0.145
80.000	80.158	80.148	80.145	80.150	0.150	0.014	-0.044	0.267
120.000	120.117	120.109	120.101	120.109	0.109	0.016	-0.052	0.390
160.000	159.985	159.980	159.974	159.980	-0.020	0.011	-0.049	0.511
200.000	199.821	199.815	199.801	199.812	-0.188	0.020		0.631
160.000	159.936	159.929	159.928	159.931	-0.069	0.008	-0.049	0.511
120.000	120.066	120.055	120.050	120.057	0.057	0.016	-0.052	0.390
80.000	80.117	80.104	80.098	80.107	0.107	0.019	-0.044	0.268
40.000	40.088	40.076	40.075	40.080	0.080	0.014	-0.031	0.145
0.000	-0.002	-0.012	-0.027	-0.014	-0.014	0.025		0.051

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0018
Electronics	7596
Node Type	7001
Hardware Version	5.01
Software Version	8.01

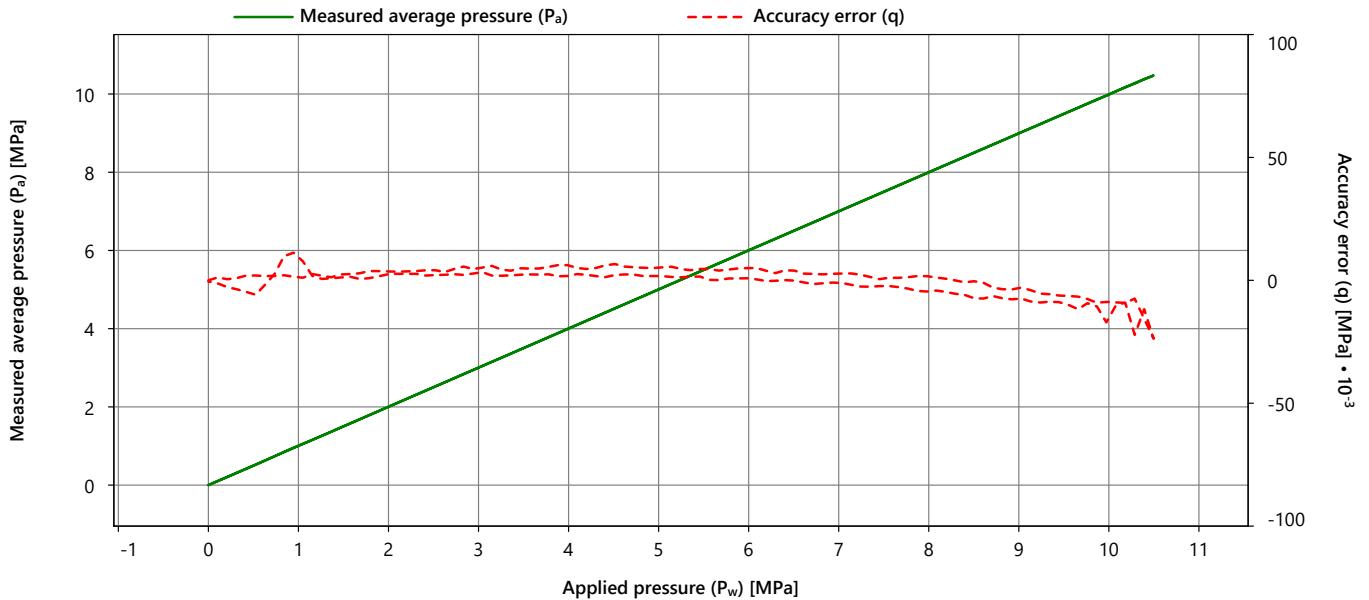
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031518

Calibration Details	
Calibration Date	12 Oct 2023 07:11:28
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.0.2.54728

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.009
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.006
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	-0.007
Resolution	[MPa]	2.22E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.004	2.003	2.004	2.004	0.004	0.001	-0.001	0.004
4.000	4.006	4.005	4.007	4.006	0.006	0.001	-0.004	0.008
6.000	6.005	6.006	6.004	6.005	0.005	0.002	-0.004	0.009
8.000	8.001	8.002	8.002	8.002	0.002	0.001	-0.006	0.012
10.000	9.992	9.989	9.992	9.991	-0.009	0.003		0.008
8.000	7.995	7.995	7.996	7.996	-0.004	0.001	-0.006	0.012
6.000	6.000	6.001	6.001	6.001	0.001	0.001	-0.004	0.008
4.000	4.001	4.002	4.003	4.002	0.002	0.001	-0.004	0.008
2.000	2.003	2.002	2.002	2.002	0.002	0.001	-0.001	0.004
0.000	0.000	-0.001	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0018
Electronics	7596
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

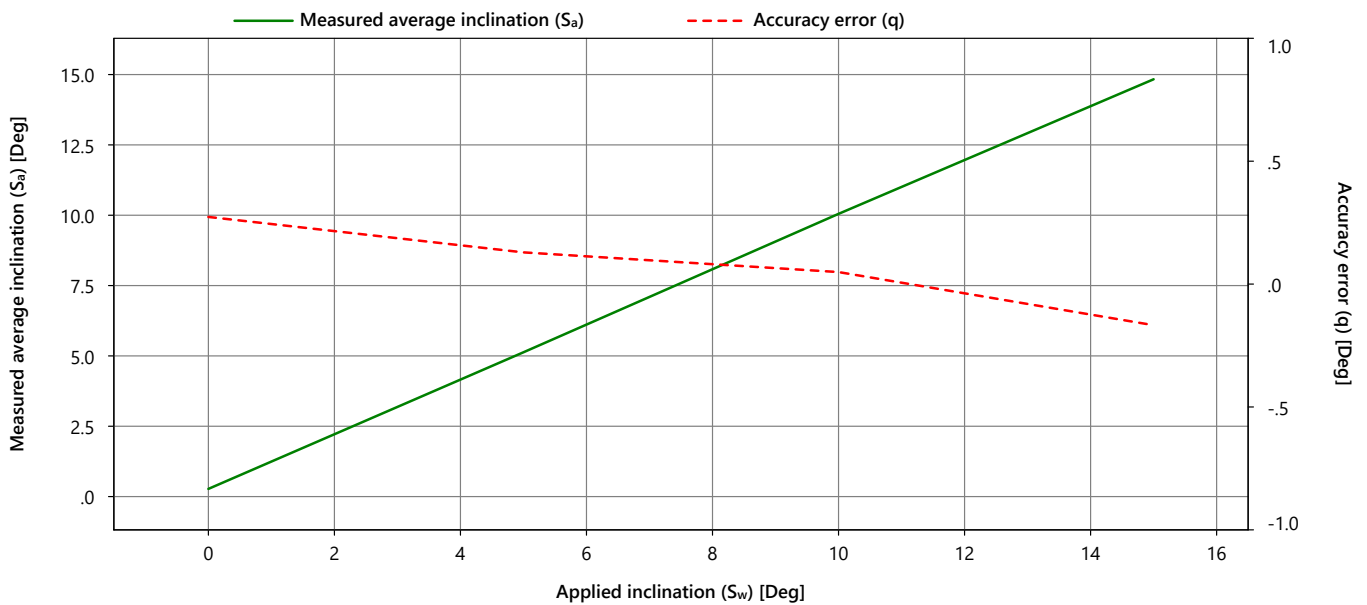
Certificate Number
FCN23031518

Calibration Details	
Calibration Date	12 Oct 2023 06:37:47
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.0.2.54728

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.3
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.3
Resolution	[Deg]	1.33E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.3	0.2	0.3	0.3	0.3	0.2	0.7
5.0	5.1	5.1	5.2	5.1	0.1	0.1	0.7
10.0	10.0	10.1	10.1	10.0	0.0	0.2	0.7
15.0	14.7	14.9	14.9	14.8	-0.2	0.2	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031518

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Fugro Transducer Workshop, P.O. Box 130, 2630 AC Nootdorp, The Netherlands, Phone +31-70-3111444, www.fugro.com
Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0018

Appendix Applicable to
Certificate Number
FCN23031518

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0018
Electronics	7596
Node Type	7001
Hardware Version	5.01
Software Version	8.01

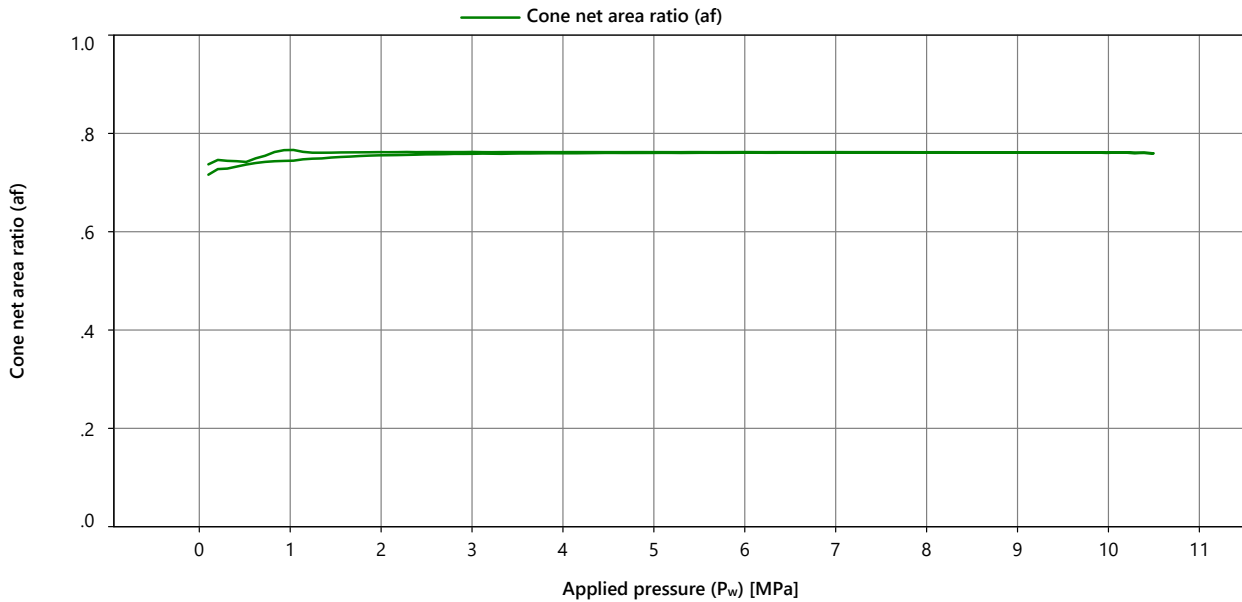
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23031518

Measurement Details	
Measurement Date	12 Oct 2023 07:11:28
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.755	0.756	0.756	0.755
4.000	0.760	0.759	0.760	0.760
6.000	0.761	0.761	0.760	0.761
8.000	0.761	0.761	0.761	0.761
10.000	0.761	0.761	0.761	0.761
8.000	0.762	0.762	0.762	0.762
6.000	0.762	0.762	0.762	0.762
4.000	0.762	0.762	0.762	0.762
2.000	0.762	0.762	0.762	0.762

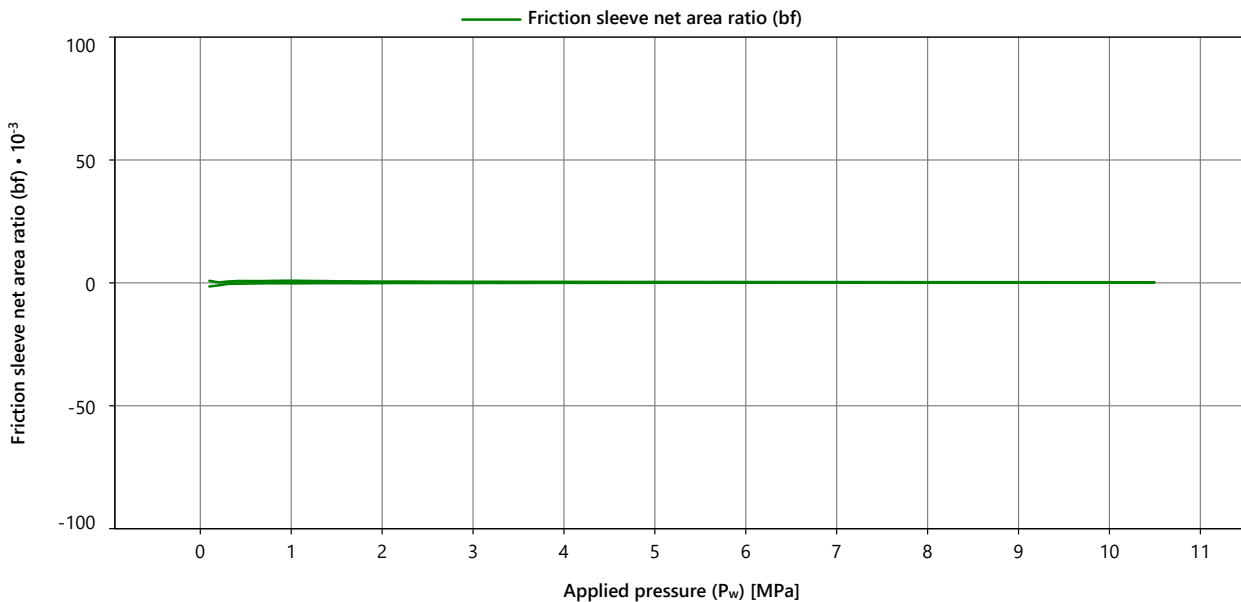
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0018	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7596	Measurement Details	
Node Type	7001	Measurement Date	12 Oct 2023 07:11:28
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.0.2.54728

**Appendix Applicable to
Certificate Number
FCN23031518**

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00025

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.001	0.001	0.000	0.001
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031518

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031519

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0015

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 12-Oct-2023

Calibrate before 12-Apr-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	3.03 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	6.06 $\mu\text{V/V}$	0.23 %	0.14 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	1.04 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	6.50 $\mu\text{V/V}$	0.21 %	0.25 %
Pore 2 [Pressure]	3.45 mV/V/MPa	1.45 mV/V	3.45 mV/V/MPa	1.43 mV/V	-0.06 %	-0.06 %

Nootdorp, 13-Oct-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0015
Electronics	7590
Node Type	7001
Hardware Version	5.01
Software Version	8.01

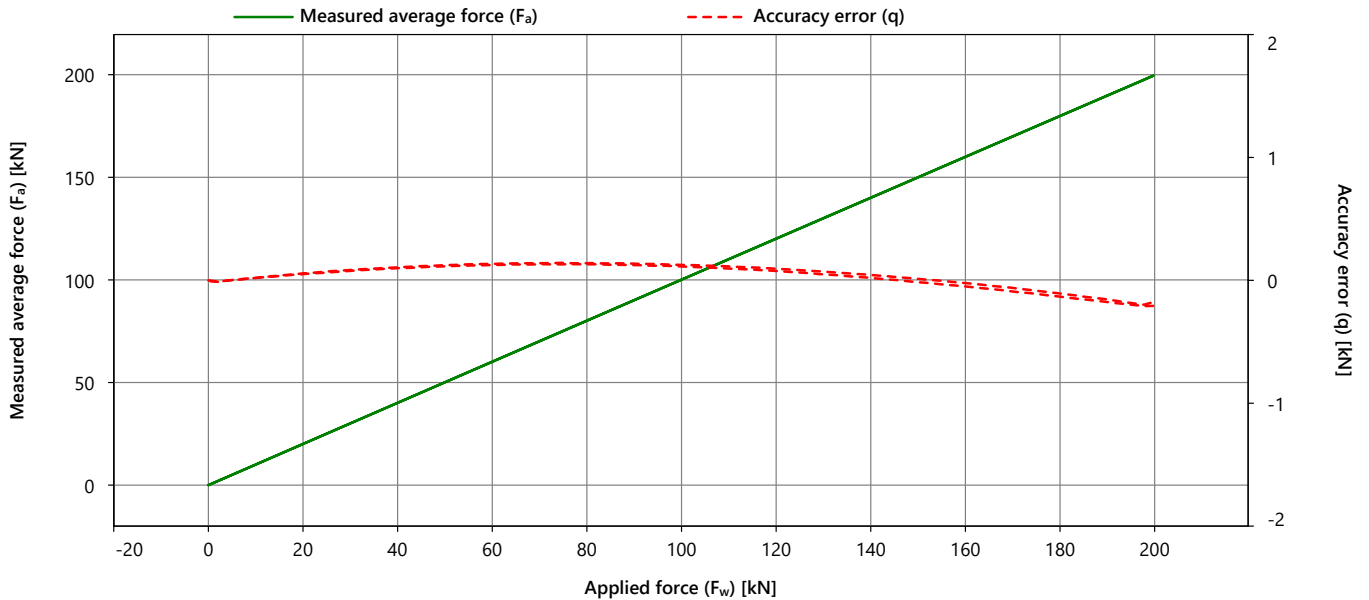
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031519

Calibration Details	
Calibration Date	12 Oct 2023 06:51:01
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.173
Max repeatability error (b)	[kN]	0.021
Max reversibility error (v)	[kN]	0.027
Zero load error (F _{c0})	[kN]	0.007
Zero load offset (F ₀)	[kN]	-0.015
Resolution	[kN]	8.54E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.003	-0.001	-0.002	0.000	0.000	0.006		0.019
40.000	40.108	40.105	40.103	40.106	0.106	0.005	-0.007	0.139
80.000	80.141	80.138	80.139	80.139	0.139	0.003	-0.010	0.262
120.000	120.097	120.092	120.094	120.094	0.094	0.005	-0.018	0.385
160.000	159.983	159.975	159.975	159.978	-0.022	0.008	-0.027	0.509
200.000	199.835	199.830	199.815	199.827	-0.173	0.021		0.631
160.000	159.954	159.949	159.949	159.950	-0.050	0.005	-0.027	0.508
120.000	120.080	120.075	120.073	120.076	0.076	0.007	-0.018	0.385
80.000	80.134	80.129	80.126	80.130	0.130	0.007	-0.010	0.262
40.000	40.105	40.098	40.094	40.099	0.099	0.010	-0.007	0.139
0.000	-0.004	-0.007	-0.009	-0.007	-0.007	0.006		0.019

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0015
Electronics	7590
Node Type	7001
Hardware Version	5.01
Software Version	8.01

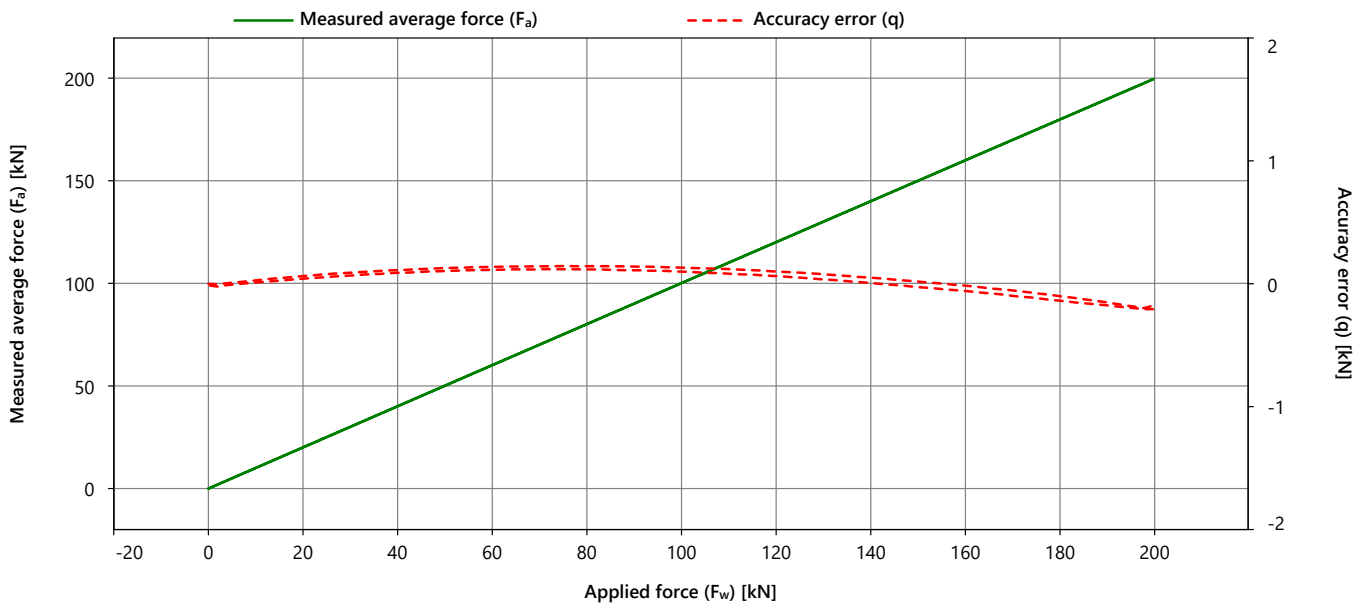
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031519

Calibration Details	
Calibration Date	12 Oct 2023 06:51:01
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.173
Max repeatability error (b)	[kN]	0.024
Max reversibility error (v)	[kN]	0.043
Zero load error (F _{c0})	[kN]	0.014
Zero load offset (F ₀)	[kN]	-0.009
Resolution	[kN]	8.6E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.038



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.008	-0.002	-0.006	0.000	0.000	0.015		0.033
40.000	40.116	40.108	40.108	40.111	0.111	0.008	-0.021	0.142
80.000	80.149	80.140	80.138	80.142	0.142	0.011	-0.026	0.264
120.000	120.106	120.097	120.094	120.099	0.099	0.012	-0.037	0.387
160.000	159.989	159.984	159.981	159.985	-0.015	0.007	-0.043	0.510
200.000	199.838	199.828	199.814	199.827	-0.173	0.024		0.631
160.000	159.947	159.940	159.938	159.942	-0.058	0.009	-0.043	0.510
120.000	120.068	120.062	120.058	120.063	0.063	0.009	-0.037	0.387
80.000	80.122	80.115	80.113	80.116	0.116	0.009	-0.026	0.264
40.000	40.098	40.087	40.084	40.090	0.090	0.015	-0.021	0.143
0.000	-0.011	-0.015	-0.014	-0.014	-0.014	0.004		0.027

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0015
Electronics	7590
Node Type	7001
Hardware Version	5.01
Software Version	8.01

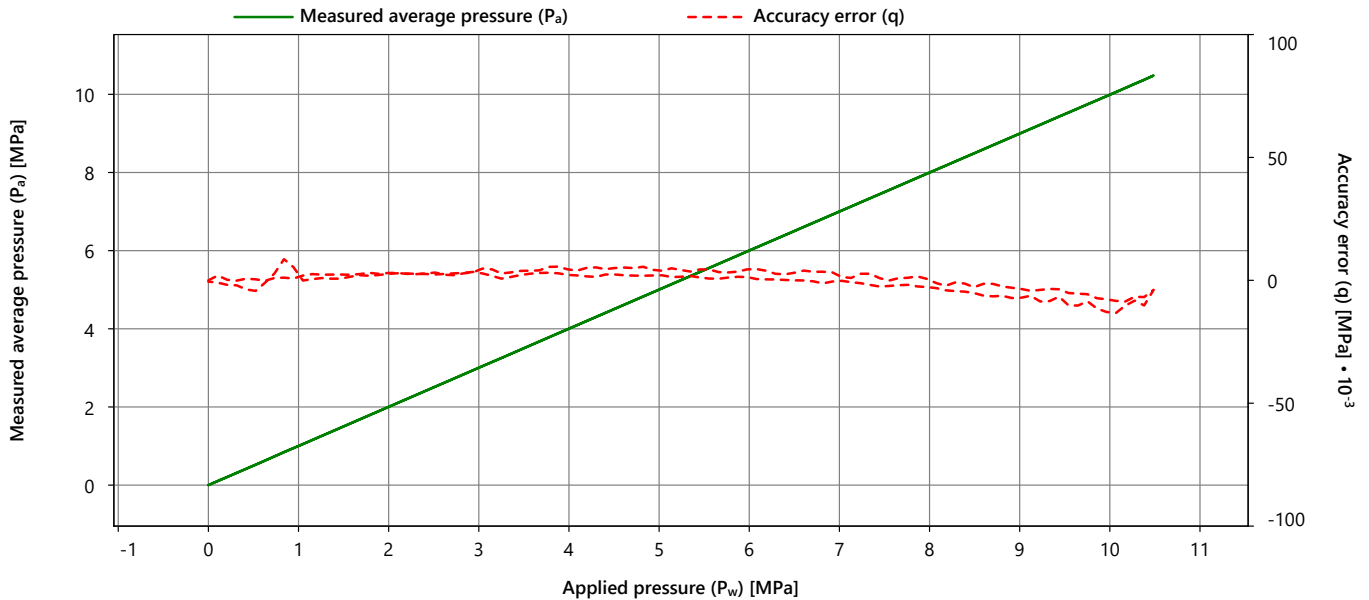
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031519

Calibration Details	
Calibration Date	12 Oct 2023 11:27:46
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.0.2.54728

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.008
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	-0.002
Resolution	[MPa]	2.16E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.004	2.003	2.002	2.003	0.003	0.002	0.000	0.005
4.000	4.004	4.004	4.005	4.004	0.004	0.002	-0.002	0.006
6.000	6.005	6.005	6.004	6.005	0.005	0.001	-0.003	0.007
8.000	7.999	8.001	8.000	8.000	0.000	0.002	-0.003	0.008
10.000	9.993	9.991	9.993	9.992	-0.008	0.002		0.008
8.000	7.997	7.998	7.997	7.997	-0.003	0.002	-0.003	0.008
6.000	6.002	6.001	6.001	6.001	0.001	0.001	-0.003	0.007
4.000	4.001	4.004	4.002	4.002	0.002	0.003	-0.002	0.007
2.000	2.002	2.003	2.003	2.003	0.003	0.001	0.000	0.004
0.000	-0.001	0.000	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0015
Electronics	7590
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

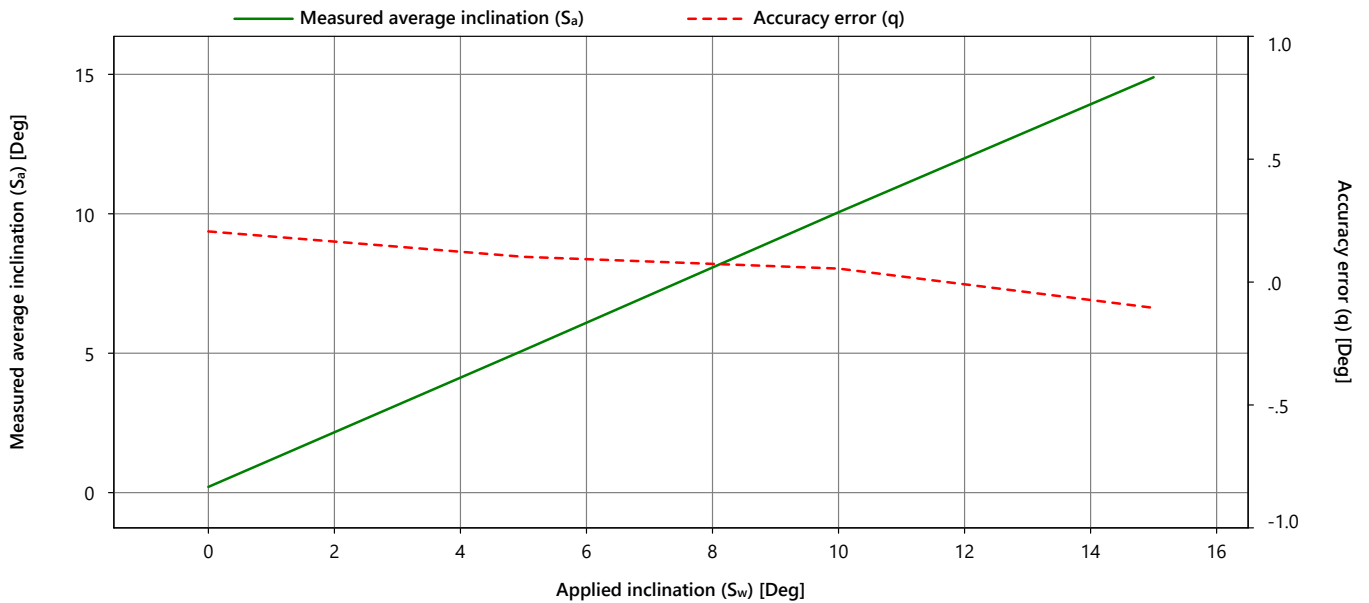
Certificate Number
FCN23031519

Calibration Details	
Calibration Date	12 Oct 2023 06:54:28
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.0.2.54728

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.1
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.31E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.2	0.2	0.2	0.2	0.2	0.1	0.7
5.0	5.0	5.1	5.2	5.1	0.1	0.1	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.9	14.9	14.9	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031519

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0015

Appendix Applicable to
Certificate Number
FCN23031519

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0015
Electronics	7590
Node Type	7001
Hardware Version	5.01
Software Version	8.01

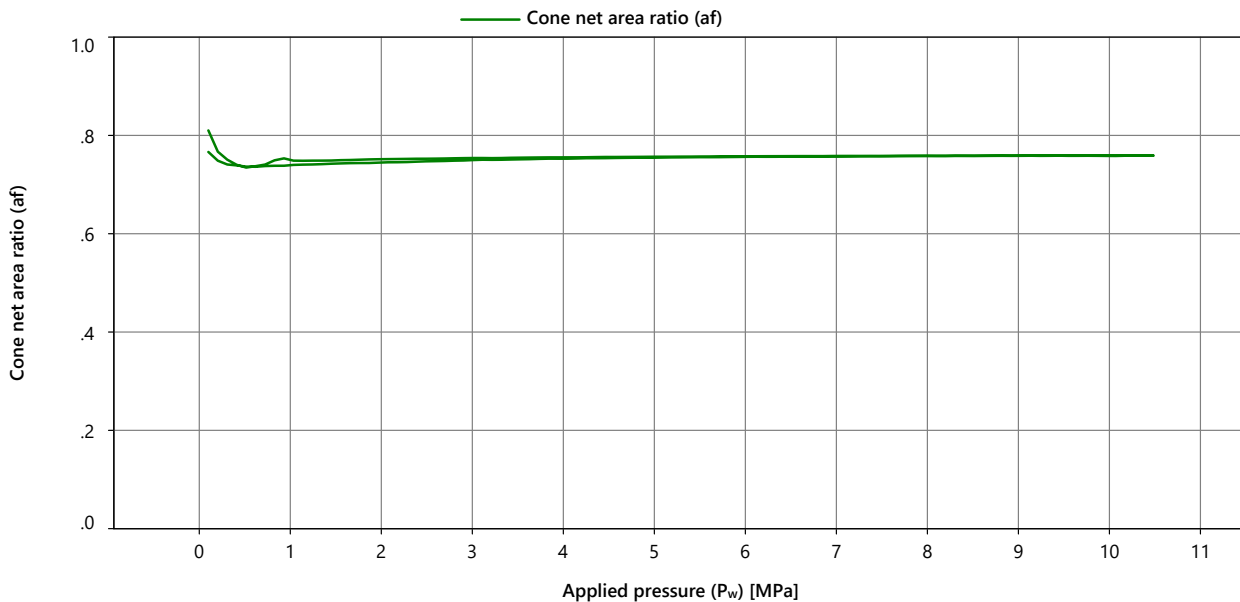
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23031519

Measurement Details	
Measurement Date	12 Oct 2023 11:27:46
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.743	0.746	0.747	0.745
4.000	0.751	0.753	0.754	0.753
6.000	0.756	0.757	0.757	0.756
8.000	0.758	0.758	0.758	0.758
10.000	0.759	0.759	0.759	0.759
8.000	0.758	0.759	0.759	0.759
6.000	0.757	0.757	0.758	0.758
4.000	0.754	0.756	0.756	0.755
2.000	0.750	0.752	0.753	0.752

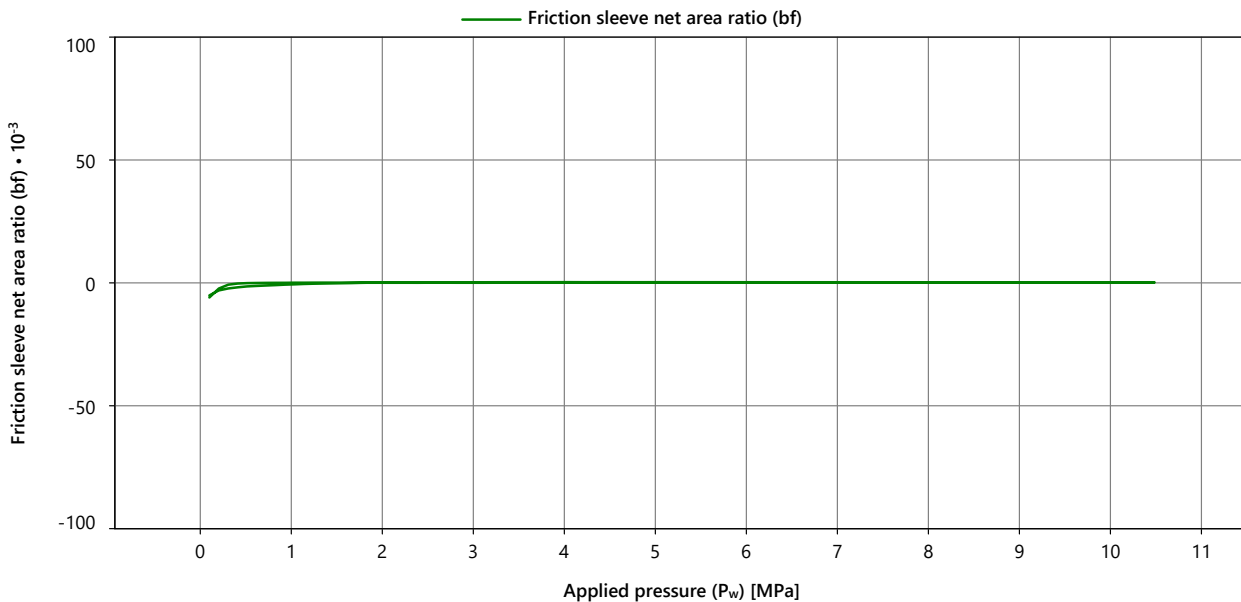
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0015	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7590	Measurement Details	
Node Type	7001	Measurement Date	12 Oct 2023 11:27:46
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.0.2.54728

Appendix Applicable to
Certificate Number
FCN23031519

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00019

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031519

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031520

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB20SN2-P1E2M4-V2
Serial Number 1715-0020

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 12-Oct-2023

Calibrate before 12-Apr-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/200bar (81188)	0 to 20 MPa	0 to 30 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.8 $\mu\text{V/V/kN}$	6.31 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	7.47 $\mu\text{V/V}$	0.54 %	0.05 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	2.74 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	6.72 $\mu\text{V/V}$	0.52 %	0.18 %
Pore 2 [Pressure]	2.04 mV/V/MPa	1.14 mV/V	2.04 mV/V/MPa	1.15 mV/V	0.01 %	0.03 %

Nootdorp, 13-Oct-2023

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Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0020
Electronics	7583
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference

Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031520

Calibration Details

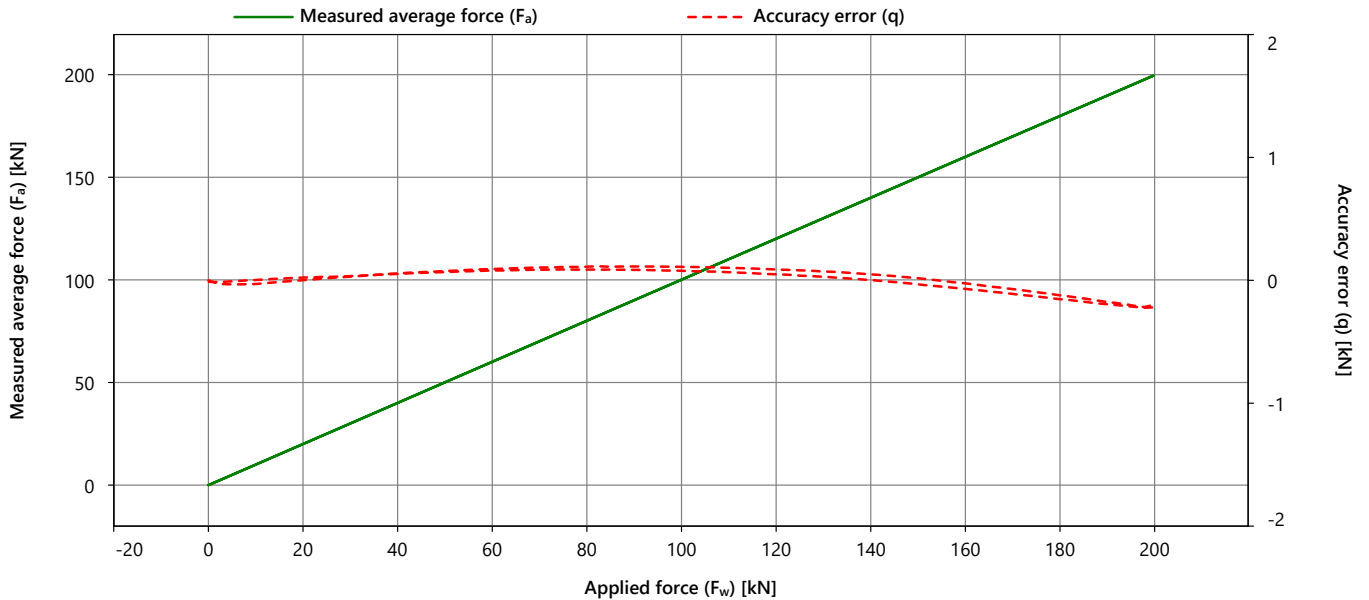
Calibration Date	12 Oct 2023 07:49:58
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor

Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.197
Max repeatability error (b)	[kN]	0.041
Max reversibility error (v)	[kN]	0.046
Zero load error (F _{c0})	[kN]	0.012
Zero load offset (F ₀)	[kN]	0.002
Resolution	[kN]	8.56E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.004	0.002	-0.006	0.000	0.000	0.009		0.026
40.000	40.067	40.058	40.042	40.056	0.056	0.025	-0.004	0.142
80.000	80.125	80.115	80.090	80.110	0.110	0.035	-0.023	0.266
120.000	120.101	120.095	120.071	120.089	0.089	0.030	-0.039	0.389
160.000	159.989	159.981	159.957	159.975	-0.025	0.032	-0.046	0.512
200.000	199.817	199.797	199.794	199.803	-0.197	0.023		0.631
160.000	159.946	159.937	159.905	159.930	-0.070	0.041	-0.046	0.513
120.000	120.061	120.057	120.030	120.050	0.050	0.031	-0.039	0.389
80.000	80.100	80.092	80.071	80.088	0.088	0.029	-0.023	0.265
40.000	40.063	40.055	40.037	40.052	0.052	0.026	-0.004	0.143
0.000	-0.004	-0.013	-0.018	-0.012	-0.012	0.013		0.030

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0020
Electronics	7583
Node Type	7001
Hardware Version	5.01
Software Version	8.01

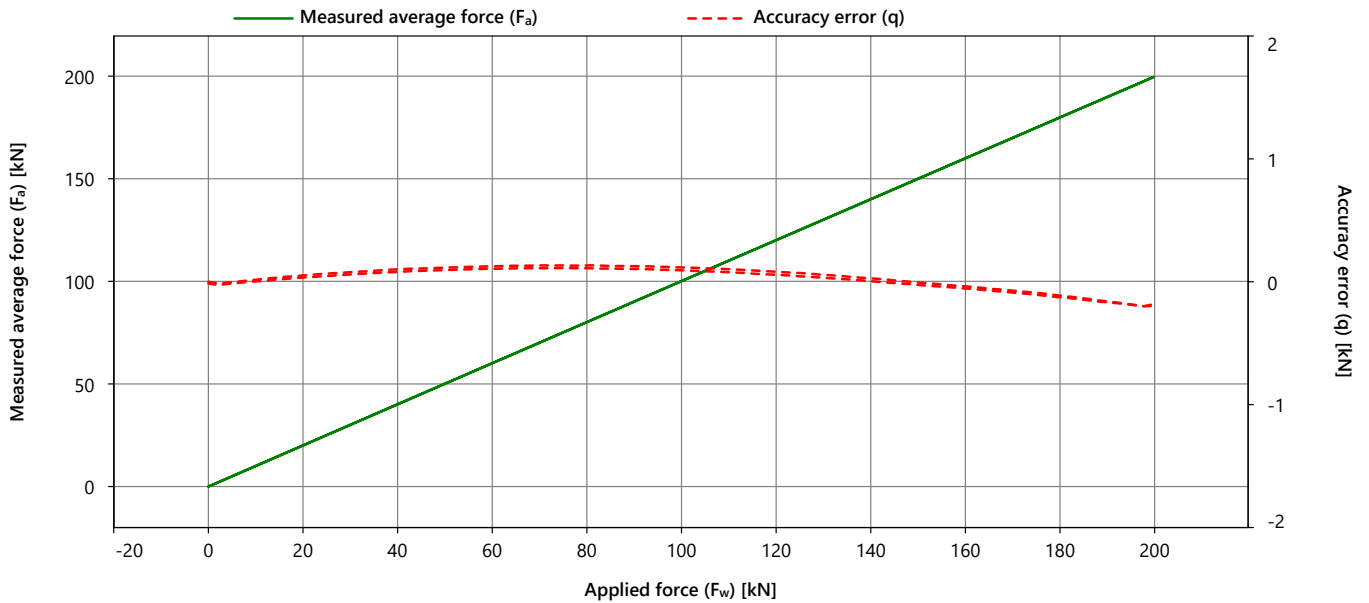
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031520

Calibration Details	
Calibration Date	12 Oct 2023 07:49:58
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.178
Max repeatability error (b)	[kN]	0.032
Max reversibility error (v)	[kN]	0.025
Zero load error (F _{c0})	[kN]	0.014
Zero load offset (F ₀)	[kN]	-0.031
Resolution	[kN]	8.58E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.055



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.006	0.002	-0.008	0.000	0.000	0.013		0.032
40.000	40.110	40.105	40.087	40.101	0.101	0.024	-0.021	0.145
80.000	80.142	80.139	80.116	80.133	0.133	0.026	-0.022	0.265
120.000	120.090	120.090	120.066	120.082	0.082	0.025	-0.025	0.387
160.000	159.971	159.970	159.947	159.963	-0.037	0.024	-0.018	0.509
200.000	199.834	199.816	199.816	199.822	-0.178	0.018		0.631
160.000	159.957	159.954	159.924	159.945	-0.055	0.032	-0.018	0.510
120.000	120.067	120.067	120.039	120.057	0.057	0.029	-0.025	0.387
80.000	80.121	80.117	80.094	80.111	0.111	0.028	-0.022	0.265
40.000	40.091	40.083	40.064	40.079	0.079	0.026	-0.021	0.145
0.000	-0.002	-0.017	-0.024	-0.014	-0.014	0.021		0.044

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0020
Electronics	7583
Node Type	7001
Hardware Version	5.01
Software Version	8.01

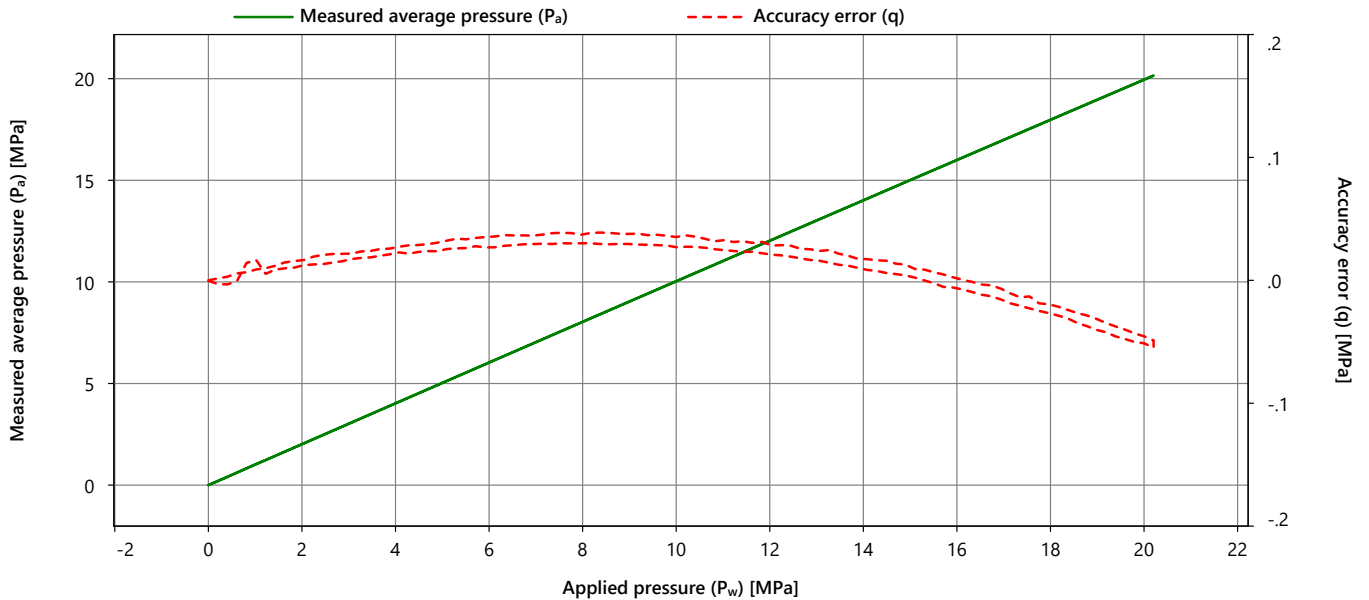
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031520

Calibration Details	
Calibration Date	12 Oct 2023 15:37:10
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.0.2.54728

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/200bar (81188)
Calibrated Range	0 to 20 MPa
Maximum Rating	0 to 30 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.046
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.008
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	-0.005
Resolution	[MPa]	3.65E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.001		0.003
4.000	4.026	4.026	4.027	4.026	0.026	0.001	-0.004	0.007
8.000	8.038	8.037	8.037	8.037	0.037	0.001	-0.007	0.015
12.000	12.028	12.029	12.027	12.028	0.028	0.001	-0.007	0.014
16.000	16.003	16.001	16.001	16.002	0.002	0.002	-0.008	0.016
20.000	19.953	19.956	19.955	19.954	-0.046	0.003		0.013
16.000	15.992	15.993	15.996	15.994	-0.006	0.004	-0.008	0.016
12.000	12.021	12.022	12.021	12.021	0.021	0.001	-0.007	0.014
8.000	8.028	8.031	8.030	8.030	0.030	0.003	-0.007	0.014
4.000	4.022	4.023	4.023	4.023	0.023	0.001	-0.004	0.007
0.000	-0.001	-0.001	0.000	0.000	0.000	0.001		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0020
Electronics	7583
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

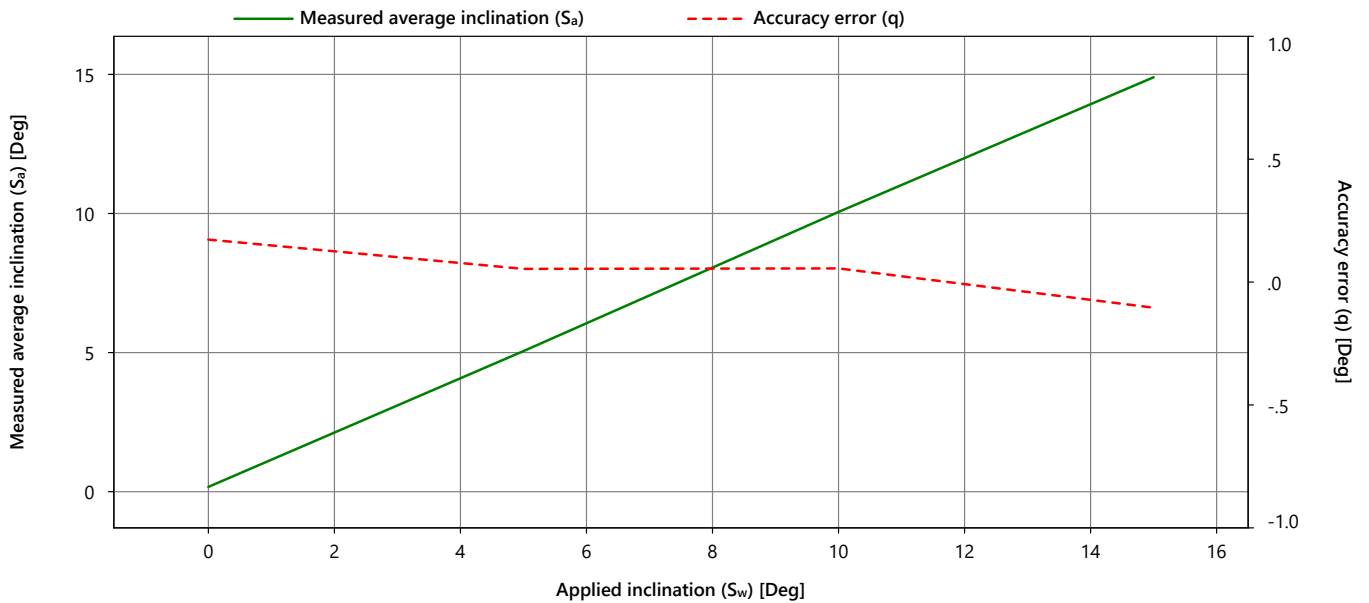
Certificate Number
FCN23031520

Calibration Details	
Calibration Date	12 Oct 2023 11:53:02
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.0.2.54728

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.1
Zero load error (S_{c0})	[Deg]	-0.1
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.32E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.2	0.2	0.1	0.2	0.2	0.1	0.7
5.0	5.0	5.1	5.1	5.1	0.1	0.1	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.8	14.9	14.9	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031520

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P1E2M4-V2
Serial Number	1715-0020

Appendix Applicable to
Certificate Number
FCN23031520

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

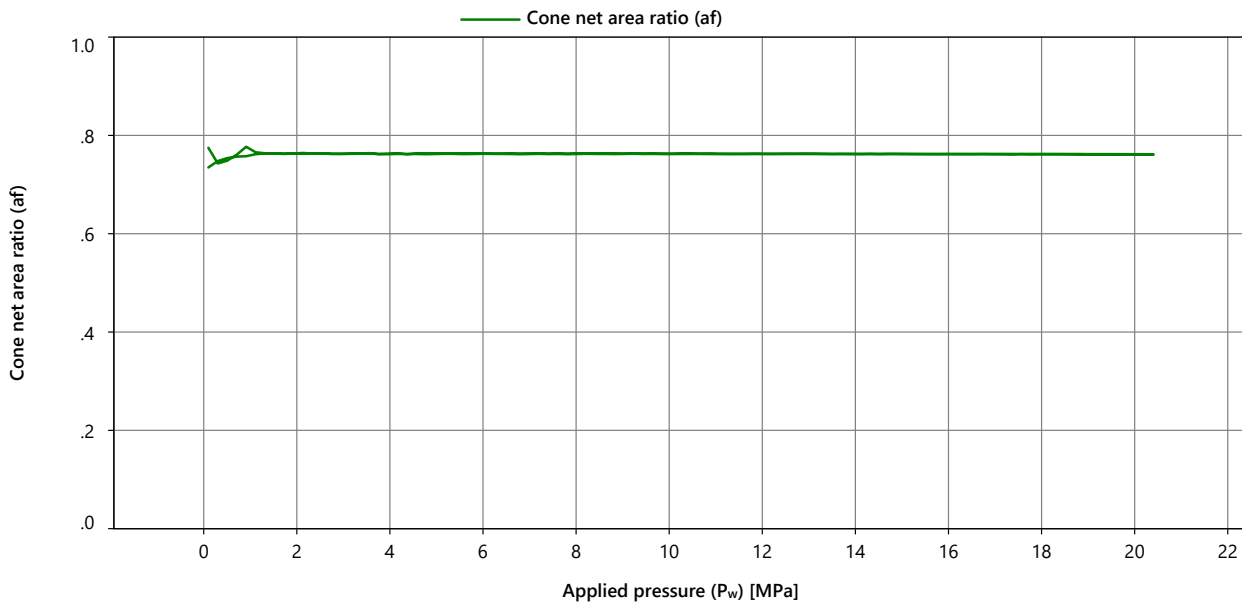
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB20SN2-P 1E2M4-V2	Serial Number	3257-0002
Serial Number	1715-0020	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7583	Measurement Details	
Node Type	7001	Measurement Date	12 Oct 2023 15:37:10
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.0.2.54728

Appendix Applicable to
Certificate Number
FCN23031520

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
4.000	0.761	0.763	0.761	0.762
8.000	0.762	0.762	0.762	0.762
12.000	0.762	0.762	0.762	0.762
16.000	0.762	0.762	0.762	0.762
20.000	0.761	0.761	0.761	0.761
16.000	0.762	0.762	0.763	0.762
12.000	0.763	0.763	0.763	0.763
8.000	0.763	0.764	0.763	0.763
4.000	0.763	0.764	0.763	0.763

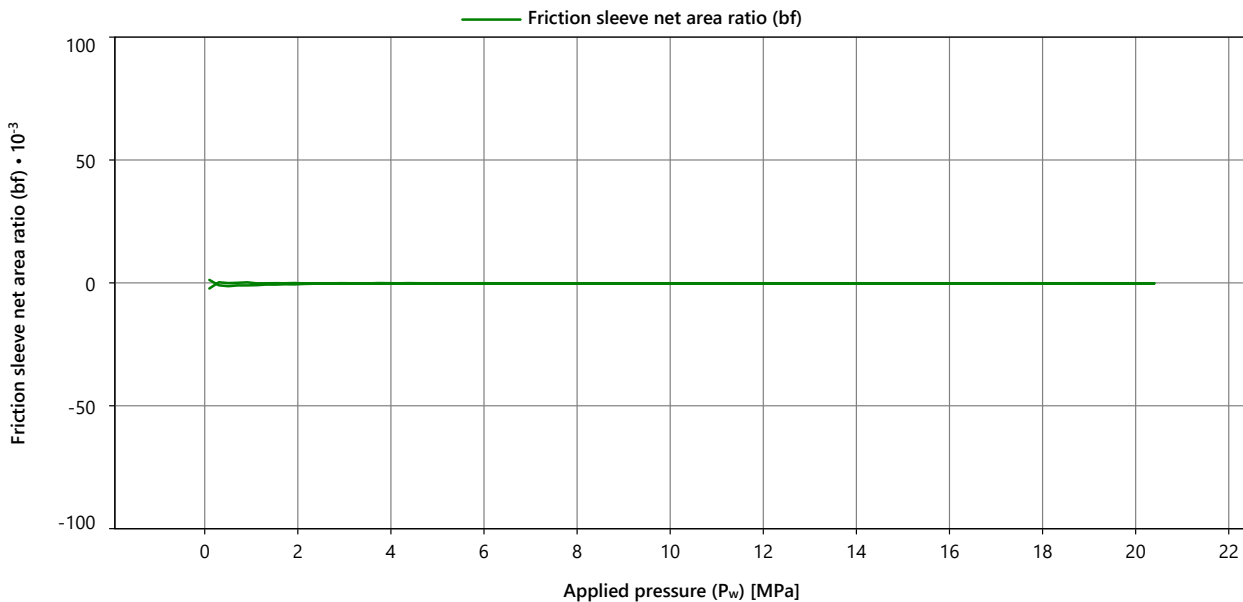
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB20SN2-P 1E2M4-V2	Serial Number	3257-0002
Serial Number	1715-0020	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7583	Measurement Details	
Node Type	7001	Measurement Date	12 Oct 2023 15:37:10
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.0.2.54728

Appendix Applicable to
Certificate Number
FCN23031520

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	-0.00019

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
4.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
12.000	0.000	0.000	0.000	0.000
16.000	0.000	0.000	0.000	0.000
20.000	0.000	0.000	0.000	0.000
16.000	0.000	0.000	0.000	0.000
12.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031520

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031521

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0019

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 12-Oct-2023

Calibrate before 12-Apr-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	6.86 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	8.68 $\mu\text{V/V}$	0.29 %	0.08 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	1.15 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	3.40 $\mu\text{V/V}$	0.26 %	0.10 %
Pore 2 [Pressure]	3.28 mV/V/MPa	1.36 mV/V	3.28 mV/V/MPa	1.34 mV/V	0.02 %	-0.07 %

Nootdorp, 13-Oct-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0019
Electronics	7566
Node Type	7001
Hardware Version	5.01
Software Version	8.01

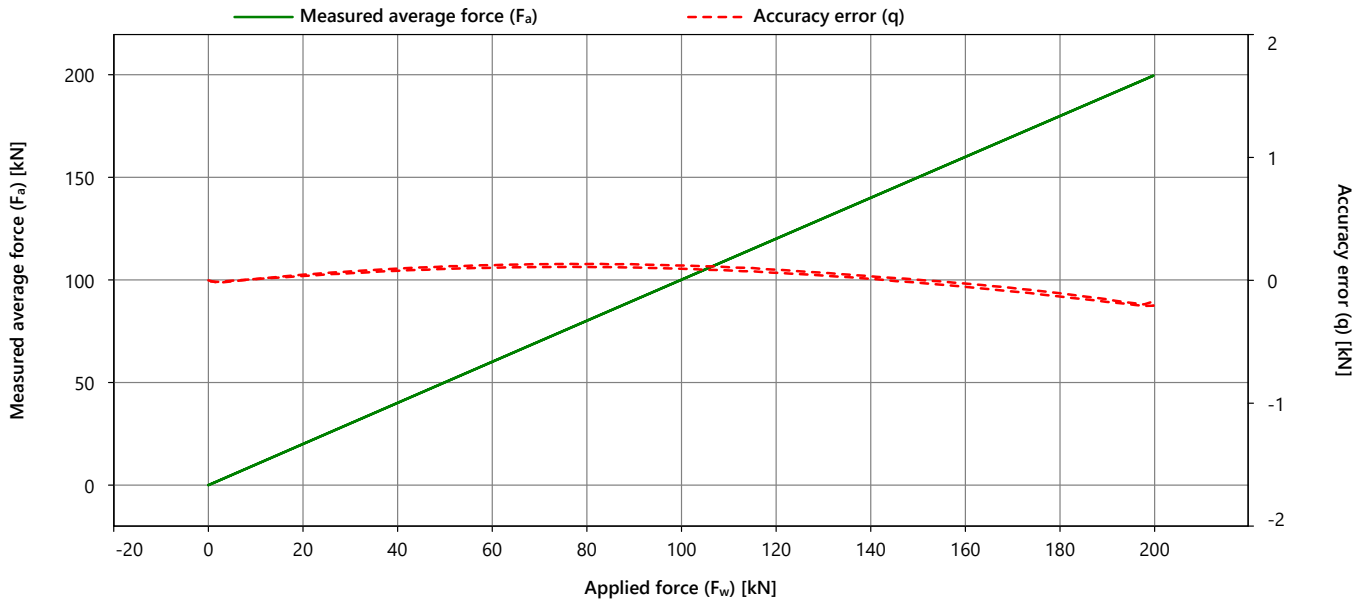
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031521

Calibration Details	
Calibration Date	12 Oct 2023 10:29:23
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.168
Max repeatability error (b)	[kN]	0.048
Max reversibility error (v)	[kN]	0.027
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	0.003
Resolution	[kN]	8.54E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.007	-0.001	-0.006	0.000	0.000	0.013		0.027
40.000	40.107	40.088	40.091	40.095	0.095	0.020	-0.018	0.142
80.000	80.144	80.126	80.126	80.132	0.132	0.019	-0.024	0.264
120.000	120.102	120.078	120.081	120.087	0.087	0.024	-0.025	0.387
160.000	159.992	159.963	159.967	159.974	-0.026	0.029	-0.027	0.510
200.000	199.857	199.831	199.809	199.832	-0.168	0.048		0.633
160.000	159.957	159.945	159.939	159.947	-0.053	0.019	-0.027	0.509
120.000	120.072	120.059	120.053	120.061	0.061	0.019	-0.025	0.386
80.000	80.118	80.103	80.103	80.108	0.108	0.015	-0.024	0.264
40.000	40.089	40.070	40.072	40.077	0.077	0.019	-0.018	0.142
0.000	0.002	-0.011	-0.015	-0.008	-0.008	0.017		0.033

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0019
Electronics	7566
Node Type	7001
Hardware Version	5.01
Software Version	8.01

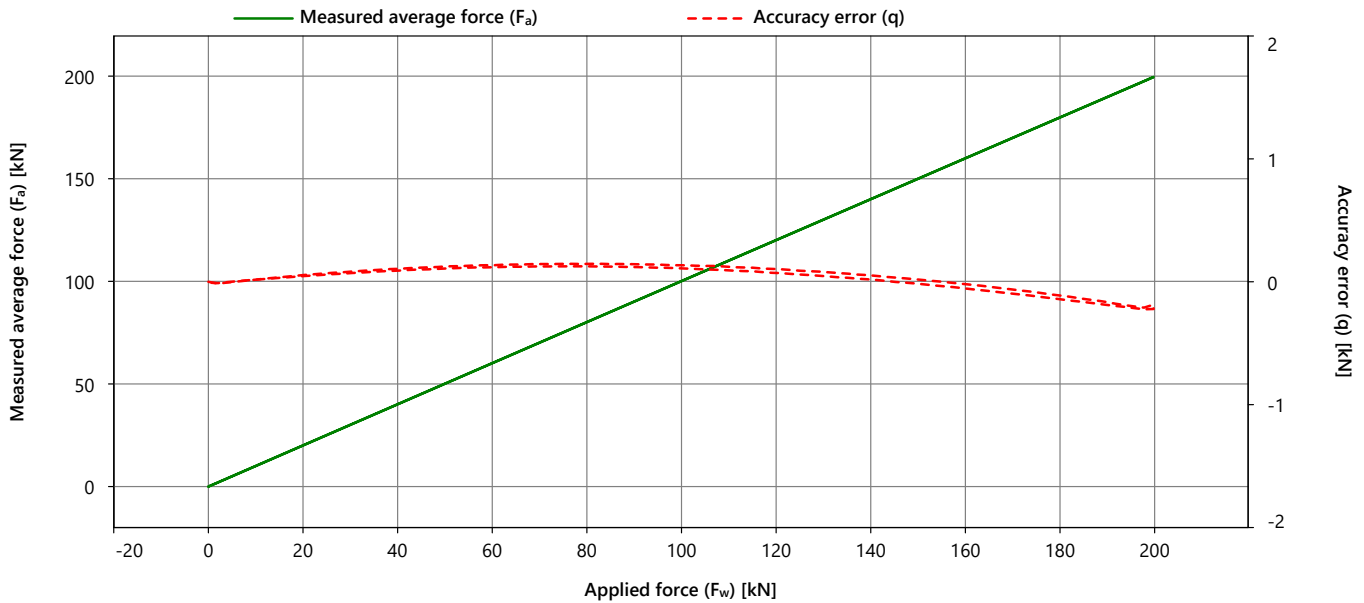
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031521

Calibration Details	
Calibration Date	12 Oct 2023 10:29:23
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.182
Max repeatability error (b)	[kN]	0.033
Max reversibility error (v)	[kN]	0.036
Zero load error (F _{c0})	[kN]	0.007
Zero load offset (F ₀)	[kN]	-0.008
Resolution	[kN]	8.58E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.017



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.007	-0.002	-0.005	0.000	0.000	0.013		0.026
40.000	40.113	40.101	40.102	40.105	0.105	0.012	-0.015	0.140
80.000	80.152	80.142	80.142	80.145	0.145	0.010	-0.020	0.263
120.000	120.111	120.100	120.100	120.104	0.104	0.012	-0.032	0.387
160.000	159.988	159.976	159.979	159.981	-0.019	0.013	-0.036	0.509
200.000	199.832	199.822	199.799	199.818	-0.182	0.033		0.632
160.000	159.951	159.944	159.940	159.945	-0.055	0.011	-0.036	0.509
120.000	120.077	120.072	120.065	120.072	0.072	0.012	-0.032	0.387
80.000	80.132	80.123	80.122	80.126	0.126	0.010	-0.020	0.263
40.000	40.097	40.088	40.086	40.090	0.090	0.011	-0.015	0.140
0.000	0.002	-0.010	-0.014	-0.007	-0.007	0.016		0.032

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0019
Electronics	7566
Node Type	7001
Hardware Version	5.01
Software Version	8.01

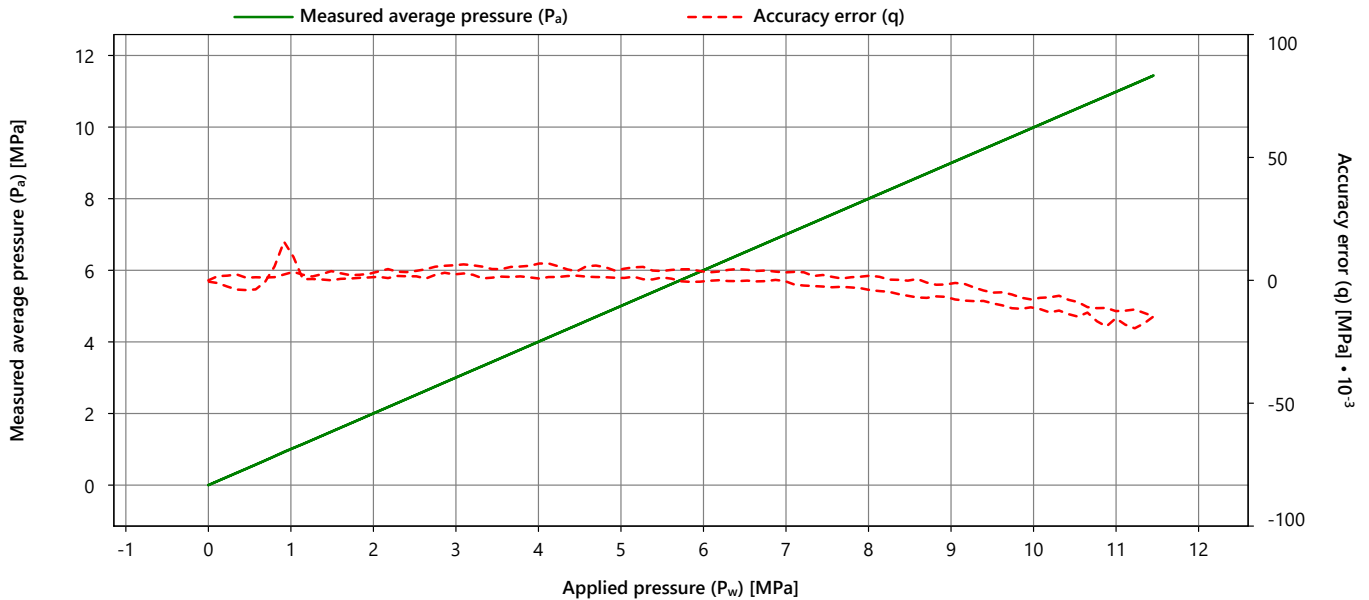
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031521

Calibration Details	
Calibration Date	12 Oct 2023 11:39:02
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.0.2.54728

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.008
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.006
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	-0.005
Resolution	[MPa]	2.27E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.001	2.004	2.003	2.003	0.003	0.003	-0.001	0.006
4.000	4.006	4.008	4.007	4.007	0.007	0.002	-0.006	0.012
6.000	6.004	6.004	6.002	6.003	0.003	0.002	-0.004	0.008
8.000	8.003	8.001	8.002	8.002	0.002	0.002	-0.006	0.011
10.000	9.992	9.993	9.993	9.992	-0.008	0.001		0.007
8.000	7.997	7.996	7.996	7.996	-0.004	0.002	-0.006	0.011
6.000	6.000	5.998	6.000	6.000	0.000	0.002	-0.004	0.008
4.000	4.001	4.001	4.001	4.001	0.001	0.000	-0.006	0.013
2.000	2.002	2.000	2.002	2.001	0.001	0.002	-0.001	0.005
0.000	0.000	-0.001	0.000	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0019
Electronics	7566
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

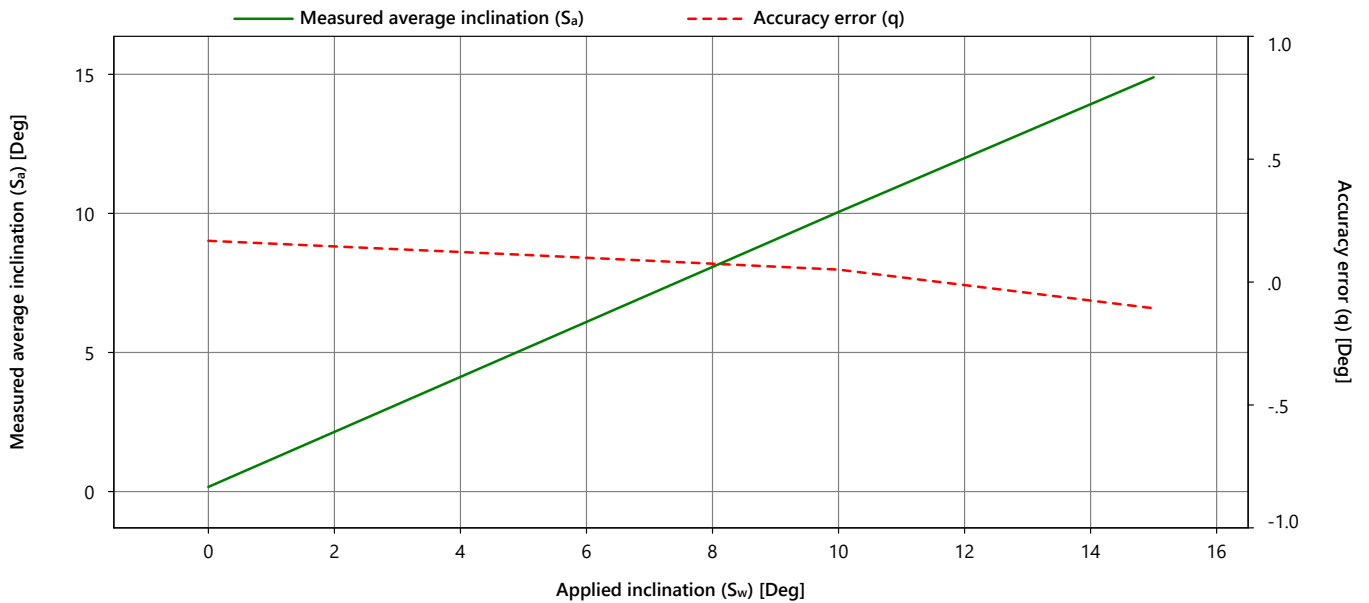
Certificate Number
FCN23031521

Calibration Details	
Calibration Date	12 Oct 2023 10:32:21
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.0.2.54728

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.32E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.7
5.0	5.0	5.2	5.1	5.1	0.1	0.1	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.9	14.8	15.0	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031521

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Fugro Transducer Workshop, P.O. Box 130, 2630 AC Nootdorp, The Netherlands, Phone +31-70-3111444, www.fugro.com
Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0019

Appendix Applicable to
Certificate Number
FCN23031521

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

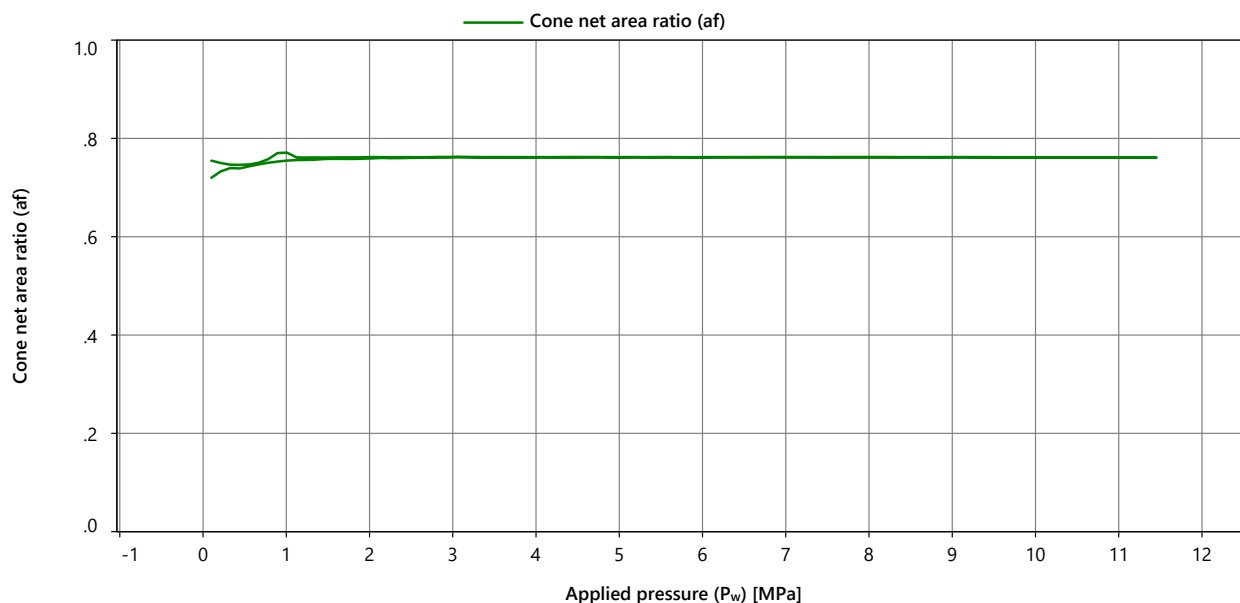
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0019	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7566	Measurement Details	
Node Type	7001	Measurement Date	12 Oct 2023 11:39:02
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.0.2.54728

Appendix Applicable to
Certificate Number
FCN23031521

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.759	0.760	0.759	0.759
4.000	0.761	0.762	0.762	0.762
6.000	0.762	0.762	0.761	0.762
8.000	0.762	0.761	0.761	0.762
10.000	0.761	0.761	0.761	0.761
8.000	0.762	0.762	0.762	0.762
6.000	0.762	0.762	0.762	0.762
4.000	0.762	0.762	0.762	0.762
2.000	0.763	0.761	0.762	0.762

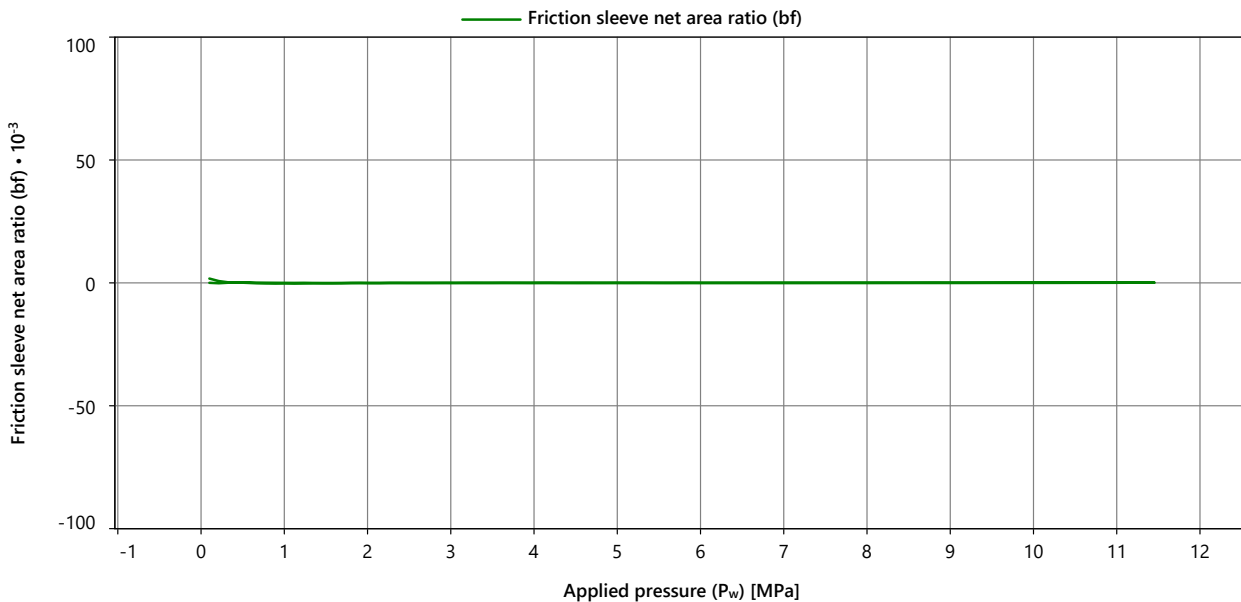
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0019	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7566	Measurement Details	
Node Type	7001	Measurement Date	12 Oct 2023 11:39:02
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.0.2.54728

Appendix Applicable to
Certificate Number
FCN23031521

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00009

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031521

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031524

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0047

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 12-Oct-2023

Calibrate before 12-Apr-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	-3.44 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	6.17 $\mu\text{V/V}$	0.24 %	0.44 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	-2.87 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	5.61 $\mu\text{V/V}$	0.22 %	0.39 %
Pore 2 [Pressure]	2.97 mV/V/MPa	775 $\mu\text{V/V}$	2.97 mV/V/MPa	773 $\mu\text{V/V}$	0.07 %	-0.01 %

Nootdorp, 13-Oct-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0047
Electronics	7602
Node Type	7001
Hardware Version	5.01
Software Version	8.01

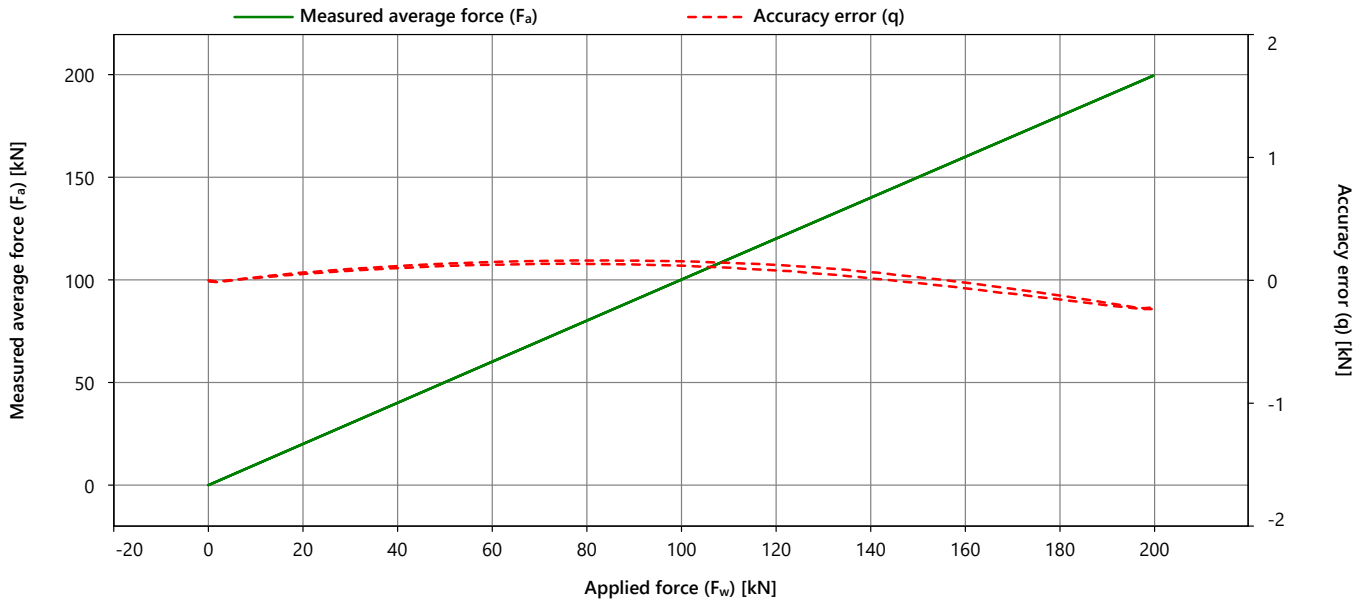
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031524

Calibration Details	
Calibration Date	12 Oct 2023 12:04:04
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.218
Max repeatability error (b)	[kN]	0.013
Max reversibility error (v)	[kN]	0.046
Zero load error (F _{c0})	[kN]	0.009
Zero load offset (F ₀)	[kN]	-0.005
Resolution	[kN]	8.53E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.004	0.000	-0.004	0.000	0.000	0.008		0.022
40.000	40.117	40.116	40.114	40.116	0.116	0.004	-0.016	0.140
80.000	80.164	80.164	80.156	80.161	0.161	0.008	-0.029	0.264
120.000	120.130	120.130	120.120	120.127	0.127	0.010	-0.046	0.389
160.000	159.985	159.983	159.975	159.981	-0.019	0.010	-0.046	0.511
200.000	199.785	199.783	199.777	199.782	-0.218	0.008		0.631
160.000	159.940	159.937	159.928	159.935	-0.065	0.011	-0.046	0.511
120.000	120.082	120.081	120.077	120.080	0.080	0.005	-0.046	0.388
80.000	80.136	80.135	80.126	80.132	0.132	0.010	-0.029	0.264
40.000	40.102	40.101	40.095	40.099	0.099	0.007	-0.016	0.140
0.000	-0.004	-0.007	-0.017	-0.009	-0.009	0.013		0.027

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0047
Electronics	7602
Node Type	7001
Hardware Version	5.01
Software Version	8.01

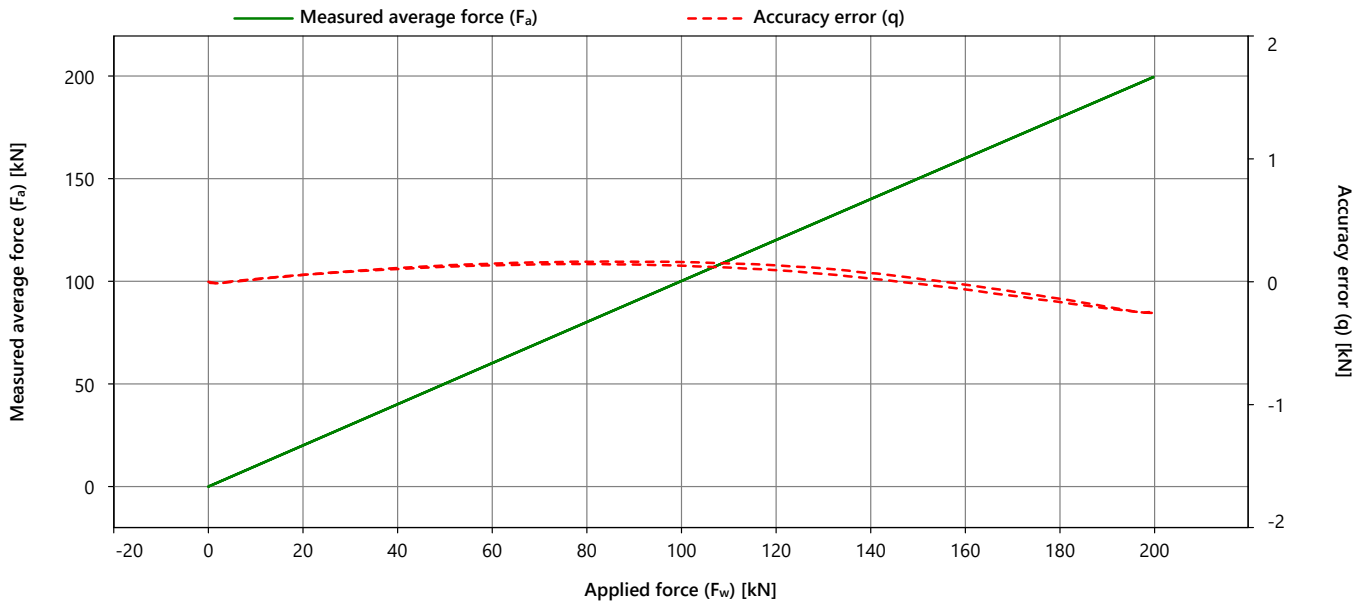
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031524

Calibration Details	
Calibration Date	12 Oct 2023 12:04:04
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.242
Max repeatability error (b)	[kN]	0.014
Max reversibility error (v)	[kN]	0.040
Zero load error (F _{c0})	[kN]	0.009
Zero load offset (F ₀)	[kN]	-0.018
Resolution	[kN]	8.59E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.016



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.004	0.000	-0.004	0.000	0.000	0.009		0.022
40.000	40.112	40.114	40.109	40.112	0.112	0.005	-0.008	0.139
80.000	80.164	80.167	80.158	80.163	0.163	0.008	-0.020	0.263
120.000	120.137	120.138	120.128	120.134	0.134	0.010	-0.040	0.388
160.000	159.975	159.981	159.971	159.976	-0.024	0.010	-0.038	0.510
200.000	199.755	199.763	199.756	199.758	-0.242	0.009		0.631
160.000	159.940	159.941	159.933	159.938	-0.062	0.008	-0.038	0.510
120.000	120.095	120.098	120.089	120.094	0.094	0.009	-0.040	0.388
80.000	80.145	80.148	80.138	80.143	0.143	0.010	-0.020	0.263
40.000	40.106	40.105	40.099	40.103	0.103	0.007	-0.008	0.139
0.000	-0.002	-0.007	-0.016	-0.009	-0.009	0.014		0.028

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0047
Electronics	7602
Node Type	7001
Hardware Version	5.01
Software Version	8.01

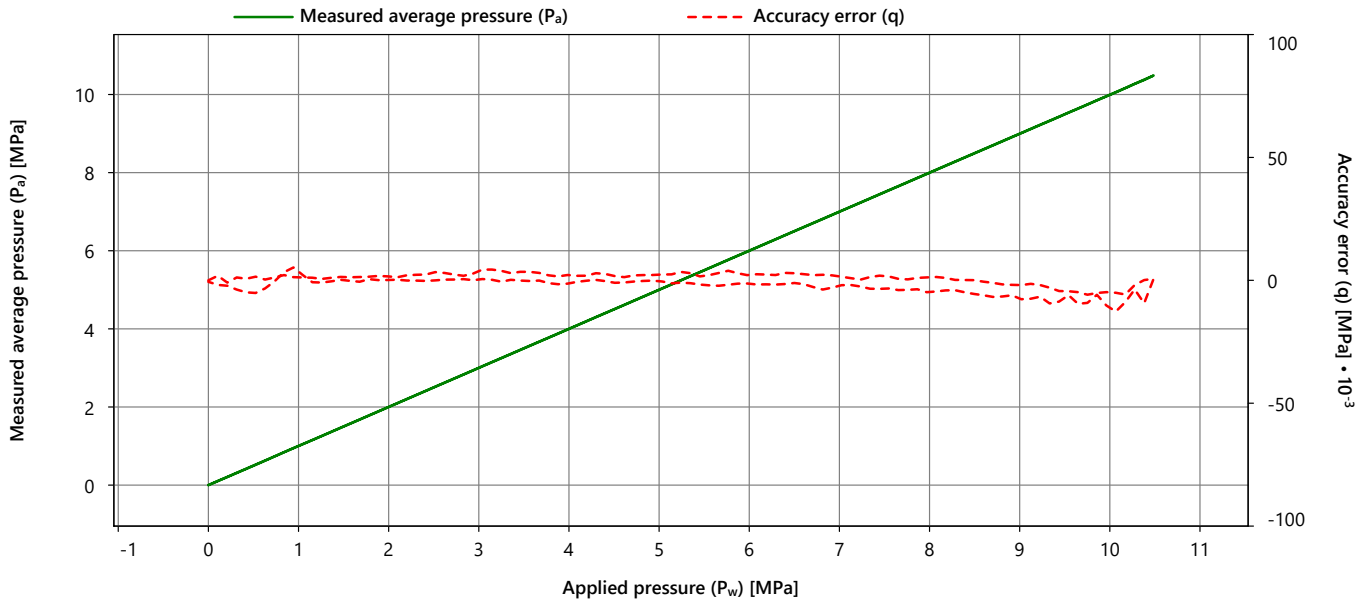
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031524

Calibration Details	
Calibration Date	12 Oct 2023 12:19:08
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.0.2.54728

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.005
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.006
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	0.000
Resolution	[MPa]	2.51E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.001		0.003
2.000	2.002	2.001	2.002	2.002	0.002	0.000	-0.001	0.004
4.000	4.002	4.002	4.003	4.002	0.002	0.000	-0.003	0.007
6.000	6.003	6.002	6.002	6.002	0.002	0.001	-0.004	0.007
8.000	8.002	8.000	8.002	8.001	0.001	0.003	-0.006	0.012
10.000	9.995	9.997	9.993	9.995	-0.005	0.004		0.009
8.000	7.995	7.996	7.994	7.995	-0.005	0.001	-0.006	0.012
6.000	5.999	6.000	5.997	5.999	-0.001	0.003	-0.004	0.008
4.000	3.998	4.000	3.998	3.999	-0.001	0.002	-0.003	0.007
2.000	2.001	2.000	2.000	2.000	0.000	0.002	-0.001	0.004
0.000	0.000	-0.001	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0047
Electronics	7602
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

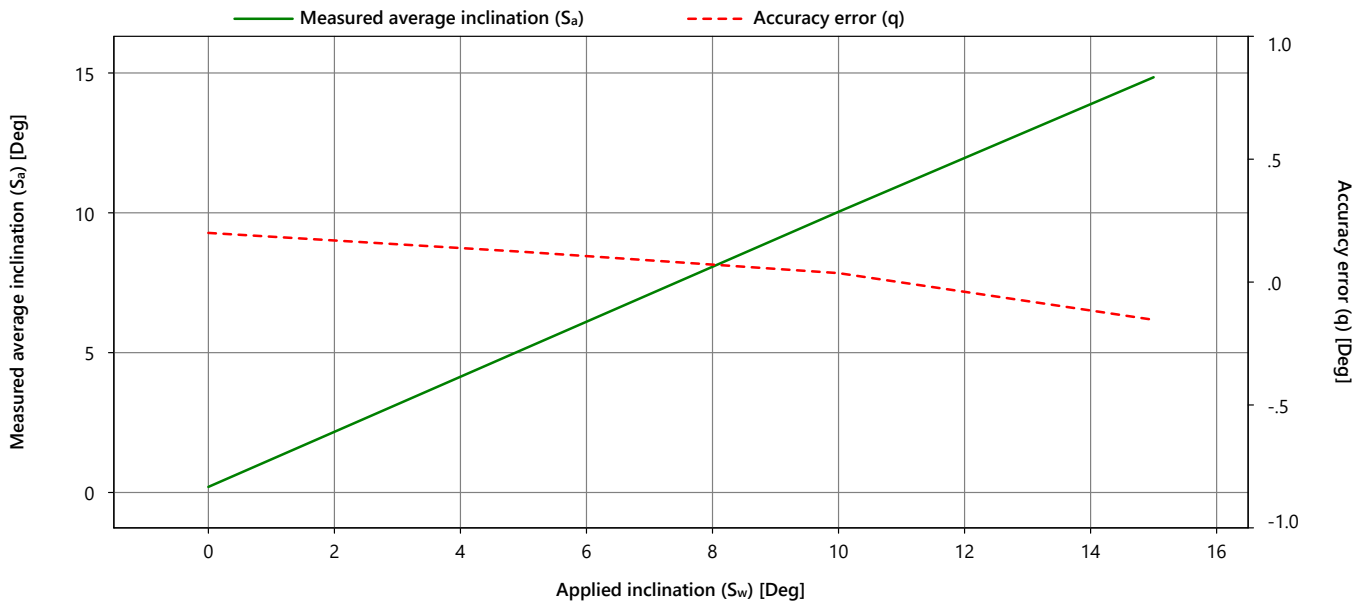
Certificate Number
FCN23031524

Calibration Details	
Calibration Date	12 Oct 2023 12:07:25
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.0.2.54728

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.3
Resolution	[Deg]	1.31E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.2	0.1	0.2	0.2	0.2	0.1	0.7
5.0	5.0	5.2	5.2	5.1	0.1	0.1	0.7
10.0	9.9	10.1	10.1	10.0	0.0	0.2	0.7
15.0	14.8	14.8	14.9	14.8	-0.2	0.2	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031524

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0047

Appendix Applicable to
Certificate Number
FCN23031524

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0047
Electronics	7602
Node Type	7001
Hardware Version	5.01
Software Version	8.01

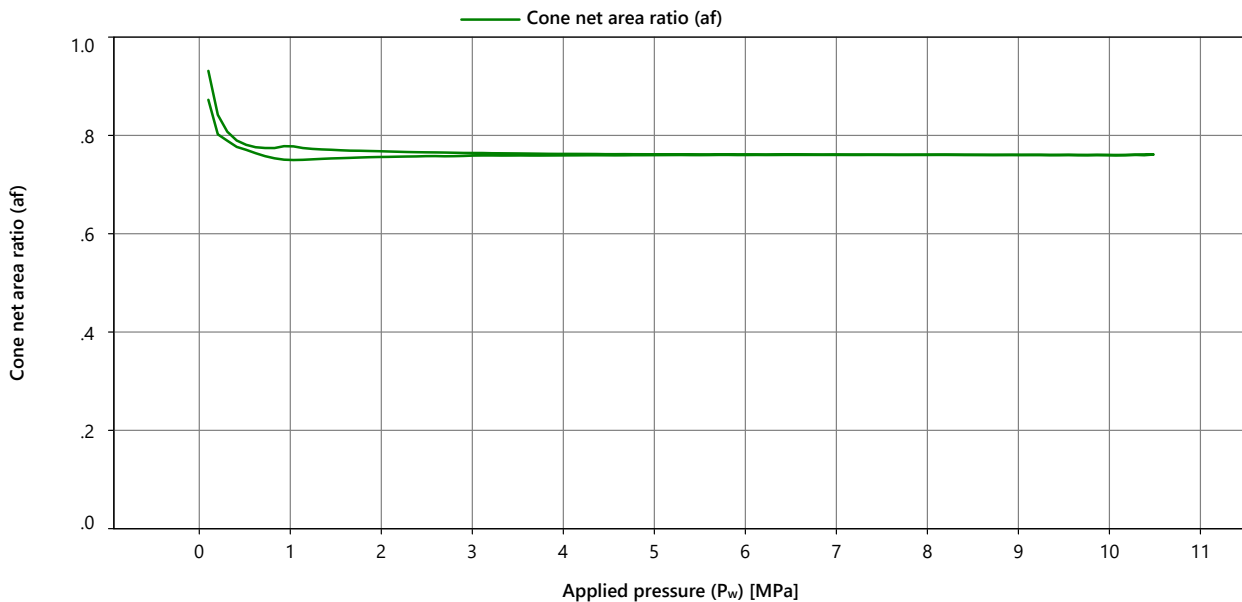
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23031524

Measurement Details	
Measurement Date	12 Oct 2023 12:19:08
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.0.2.54728

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.752	0.757	0.759	0.756
4.000	0.757	0.760	0.761	0.759
6.000	0.759	0.760	0.761	0.760
8.000	0.760	0.760	0.761	0.760
10.000	0.760	0.761	0.761	0.760
8.000	0.760	0.761	0.761	0.761
6.000	0.760	0.761	0.762	0.761
4.000	0.761	0.763	0.764	0.762
2.000	0.765	0.768	0.770	0.768

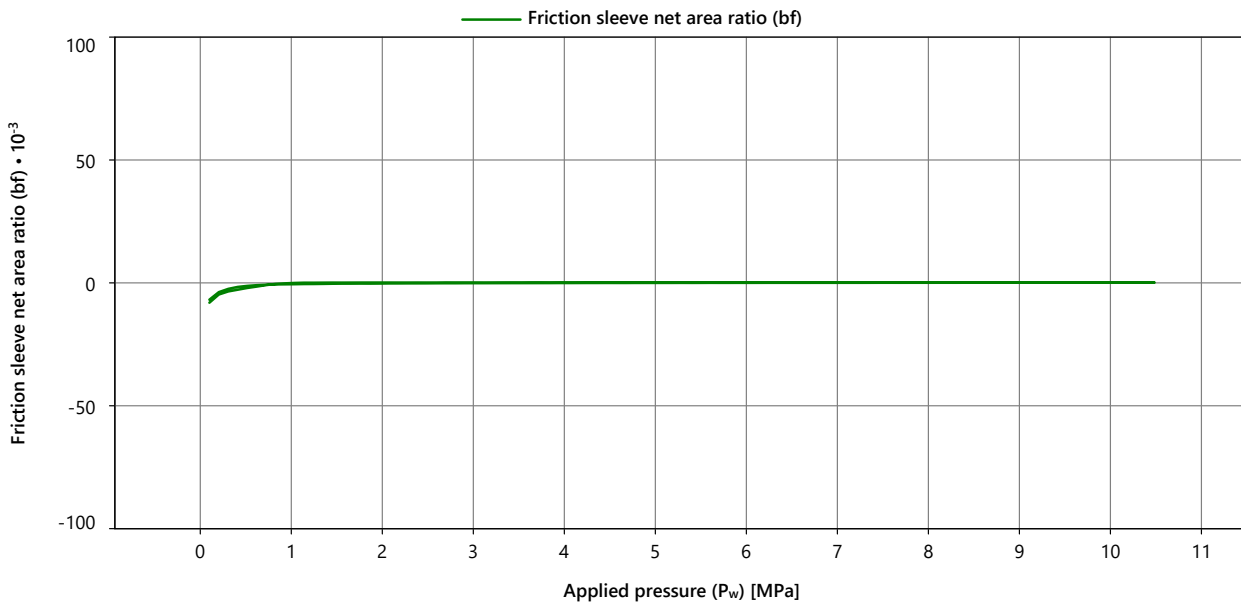
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0047	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7602	Measurement Details	
Node Type	7001	Measurement Date	12 Oct 2023 12:19:08
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.0.2.54728

Appendix Applicable to
Certificate Number
FCN23031524

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00013

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031524

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031871

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0081

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration period 08-Nov-2023 through 09-Nov-2023

Calibrate before 08-May-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 10-Nov-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0081
Electronics	282
Node Type	7001
Hardware Version	5.01
Software Version	8.01

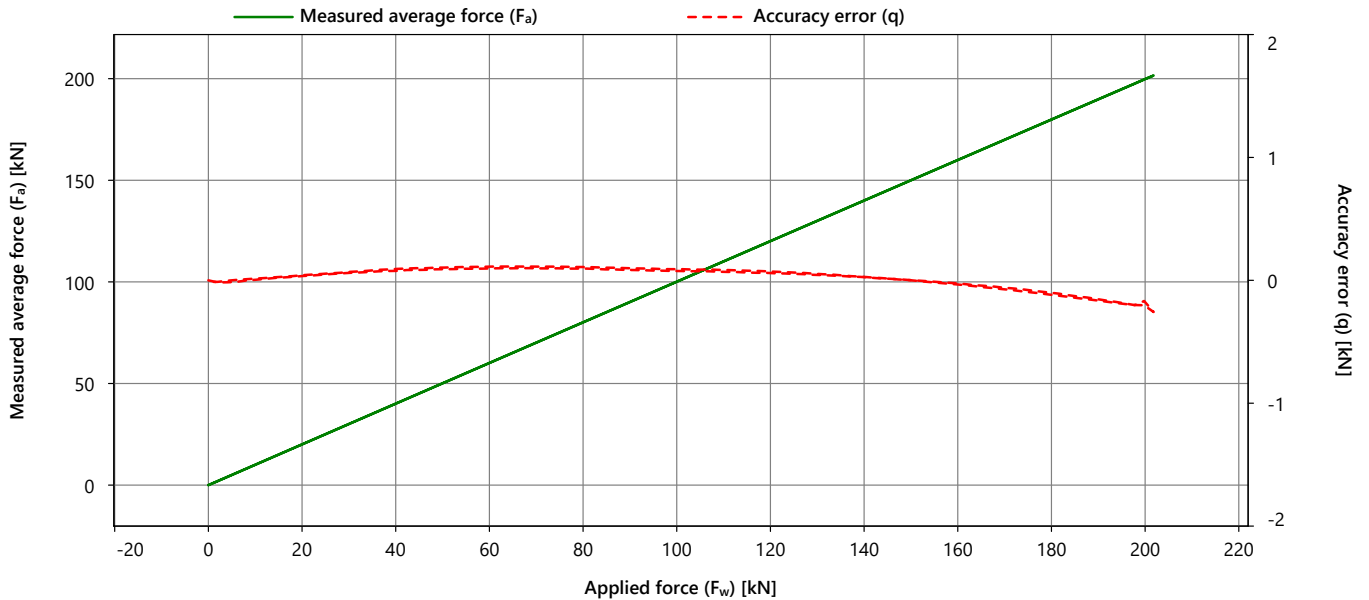
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031871

Calibration Details	
Calibration Date	08 Nov 2023 12:39:51
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.0.55345

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.164
Max repeatability error (b)	[kN]	0.015
Max reversibility error (v)	[kN]	0.016
Zero load error (F _{c0})	[kN]	0.013
Zero load offset (F ₀)	[kN]	0.008
Resolution	[kN]	8.69E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.007	-0.001	-0.007	0.000	0.000	0.014		0.032
40.000	40.085	40.076	40.070	40.077	0.077	0.015	0.016	0.142
80.000	80.104	80.093	80.090	80.096	0.096	0.014	0.013	0.263
120.000	120.067	120.058	120.052	120.059	0.059	0.015	0.013	0.385
160.000	159.984	159.971	159.970	159.975	-0.025	0.014	-0.009	0.508
200.000	199.844	199.832	199.831	199.836	-0.164	0.013		0.631
160.000	159.973	159.965	159.959	159.966	-0.034	0.014	-0.009	0.508
120.000	120.080	120.070	120.067	120.072	0.072	0.012	0.013	0.385
80.000	80.113	80.109	80.103	80.108	0.108	0.011	0.013	0.263
40.000	40.098	40.092	40.087	40.092	0.092	0.011	0.016	0.141
0.000	-0.008	-0.015	-0.018	-0.013	-0.013	0.010		0.028

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0081
Electronics	282
Node Type	7001
Hardware Version	5.01
Software Version	8.01

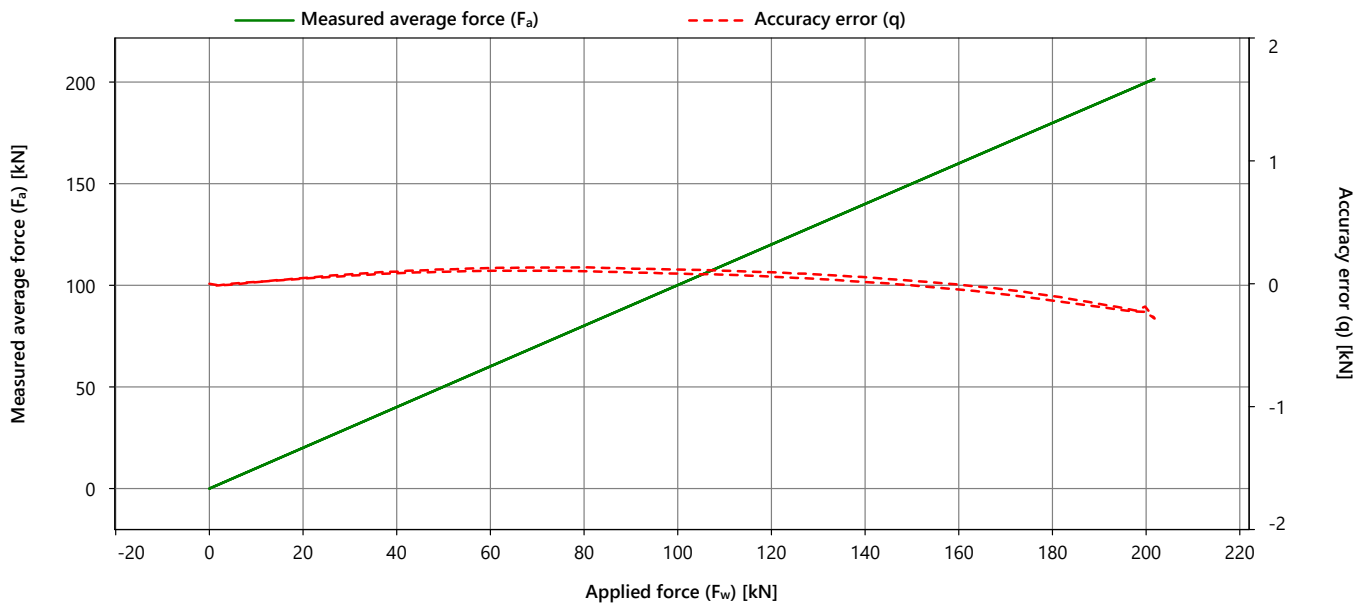
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031871

Calibration Details	
Calibration Date	08 Nov 2023 12:39:51
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.0.55345

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.182
Max repeatability error (b)	[kN]	0.018
Max reversibility error (v)	[kN]	0.040
Zero load error (F _{c0})	[kN]	0.015
Zero load offset (F ₀)	[kN]	-0.003
Resolution	[kN]	8.72E-05
Noise RMS	[kN]	0.002
Tip-Sleeve Interaction %	[%]	0.016



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.006	0.000	-0.006	0.000	0.000	0.012		0.032
40.000	40.106	40.097	40.093	40.098	0.098	0.013	-0.013	0.141
80.000	80.142	80.131	80.130	80.134	0.134	0.012	-0.032	0.265
120.000	120.103	120.092	120.087	120.094	0.094	0.015	-0.036	0.388
160.000	160.001	159.991	159.989	159.993	-0.007	0.012	-0.040	0.510
200.000	199.828	199.816	199.810	199.818	-0.182	0.018		0.631
160.000	159.960	159.952	159.947	159.953	-0.047	0.013	-0.040	0.510
120.000	120.065	120.055	120.054	120.058	0.058	0.010	-0.036	0.387
80.000	80.107	80.102	80.097	80.102	0.102	0.010	-0.032	0.265
40.000	40.091	40.085	40.081	40.085	0.085	0.011	-0.013	0.141
0.000	-0.009	-0.016	-0.019	-0.015	-0.015	0.010		0.030

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0081
Electronics	282
Node Type	7001
Hardware Version	5.01
Software Version	8.01

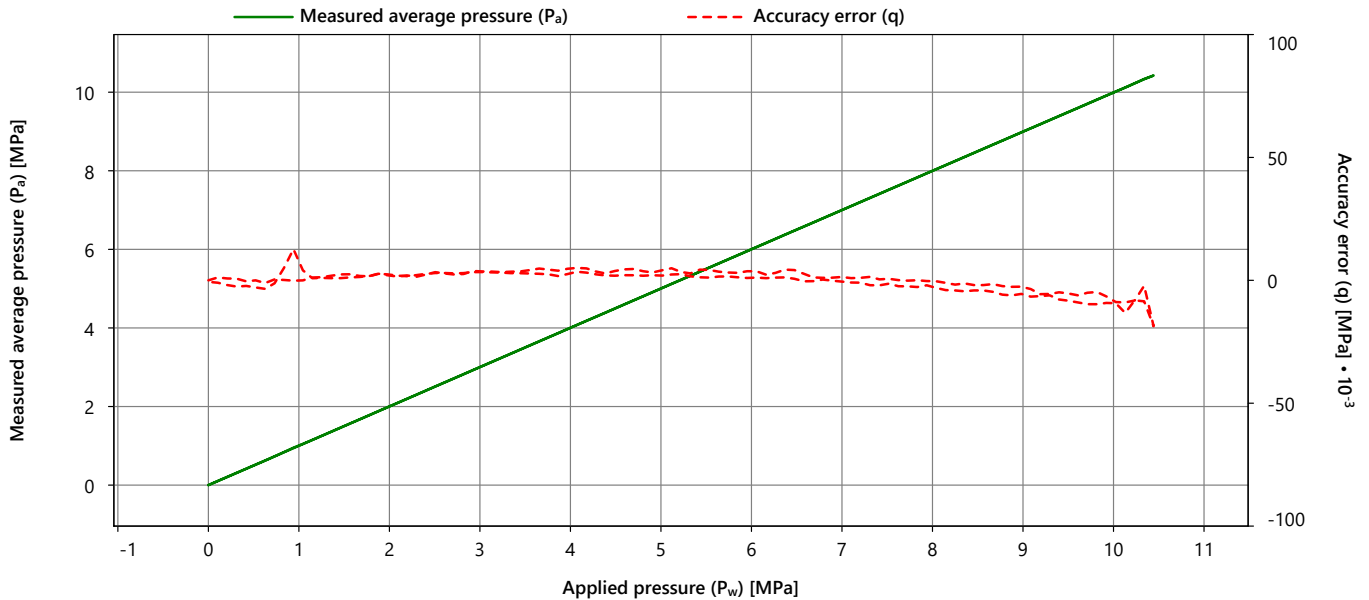
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031871

Calibration Details	
Calibration Date	09 Nov 2023 07:04:09
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.1.55350

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.009
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	-0.001
Resolution	[MPa]	2.29E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.003	2.001	2.002	2.002	0.002	0.002	0.000	0.004
4.000	4.003	4.005	4.007	4.005	0.005	0.004	-0.002	0.007
6.000	6.003	6.004	6.004	6.004	0.004	0.001	-0.003	0.007
8.000	8.000	7.998	8.001	8.000	0.000	0.003	-0.002	0.008
10.000	9.991	9.992	9.992	9.991	-0.009	0.001		0.007
8.000	7.997	7.998	7.997	7.997	-0.003	0.001	-0.002	0.007
6.000	6.001	6.001	6.001	6.001	0.001	0.001	-0.003	0.007
4.000	4.003	4.003	4.003	4.003	0.003	0.000	-0.002	0.005
2.000	2.000	2.003	2.003	2.002	0.002	0.003	0.000	0.006
0.000	-0.001	-0.001	0.000	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0081
Electronics	282
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

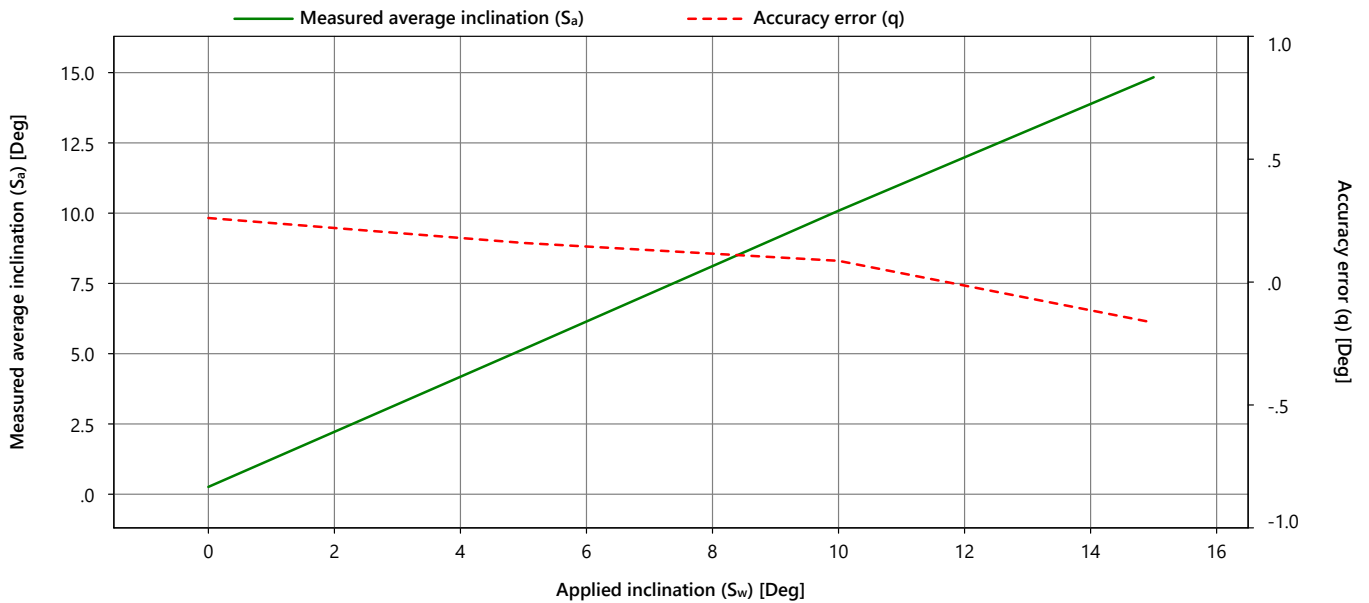
Certificate Number
FCN23031871

Calibration Details	
Calibration Date	08 Nov 2023 12:51:36
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.0.55345

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.3
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	-0.1
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.29E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.3	0.1	0.4	0.3	0.3	0.2	0.8
5.0	5.0	5.2	5.3	5.2	0.2	0.3	0.8
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.8	14.9	14.8	14.8	-0.2	0.0	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031871

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0081

Appendix Applicable to
Certificate Number
FCN23031871

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

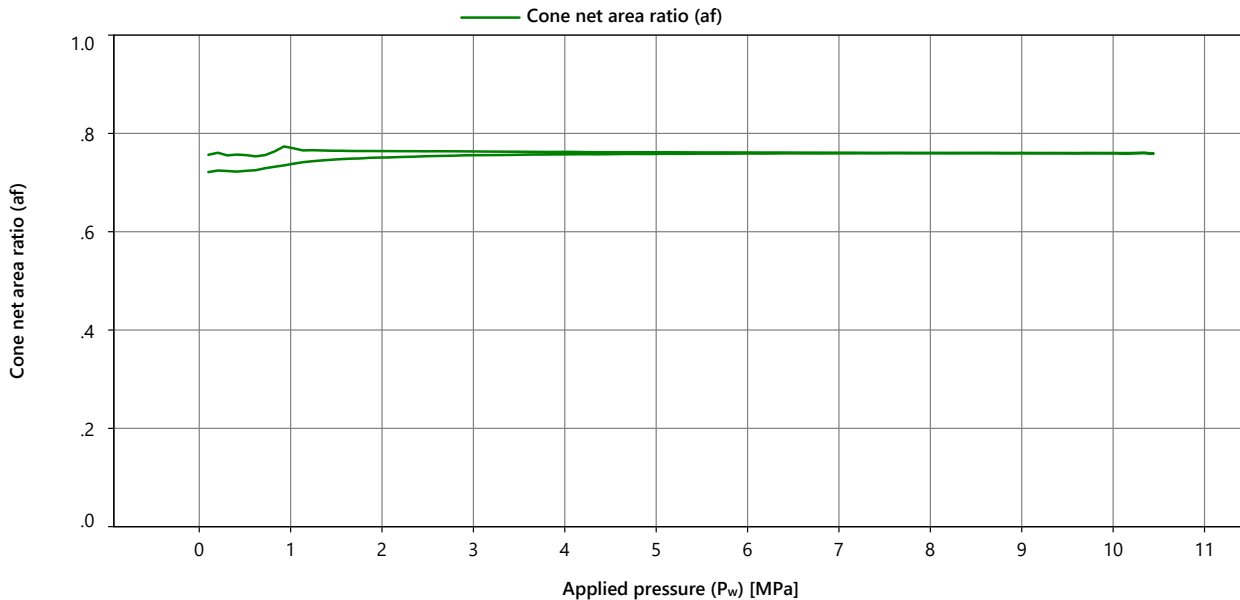
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0081	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	282	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 07:04:09
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031871

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.752	0.751	0.750	0.751
4.000	0.757	0.757	0.757	0.757
6.000	0.759	0.759	0.759	0.759
8.000	0.760	0.760	0.760	0.760
10.000	0.760	0.760	0.760	0.760
8.000	0.760	0.760	0.760	0.760
6.000	0.761	0.761	0.761	0.761
4.000	0.763	0.762	0.762	0.762
2.000	0.764	0.764	0.764	0.764

Friction Sleeve Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0081
Electronics	282
Node Type	7001
Hardware Version	5.01
Software Version	8.01

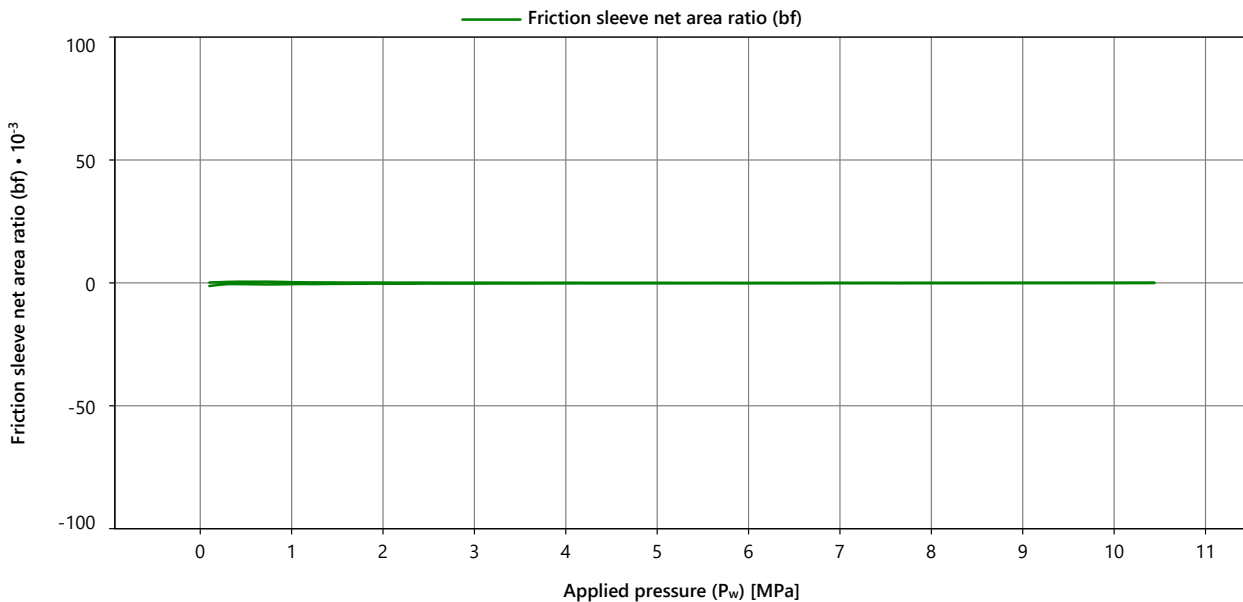
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23031871

Measurement Details	
Measurement Date	09 Nov 2023 07:04:09
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00000

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031871

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
----------------	-----------------------------------

Quantities

P	Pressure
---	----------

Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031875

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0082

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration period 08-Nov-2023 through 09-Nov-2023

Calibrate before 08-May-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 10-Nov-2023

This certificate is issued provided that Fugro assumes no liability.

Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0082
Electronics	265
Node Type	7001
Hardware Version	5.01
Software Version	8.01

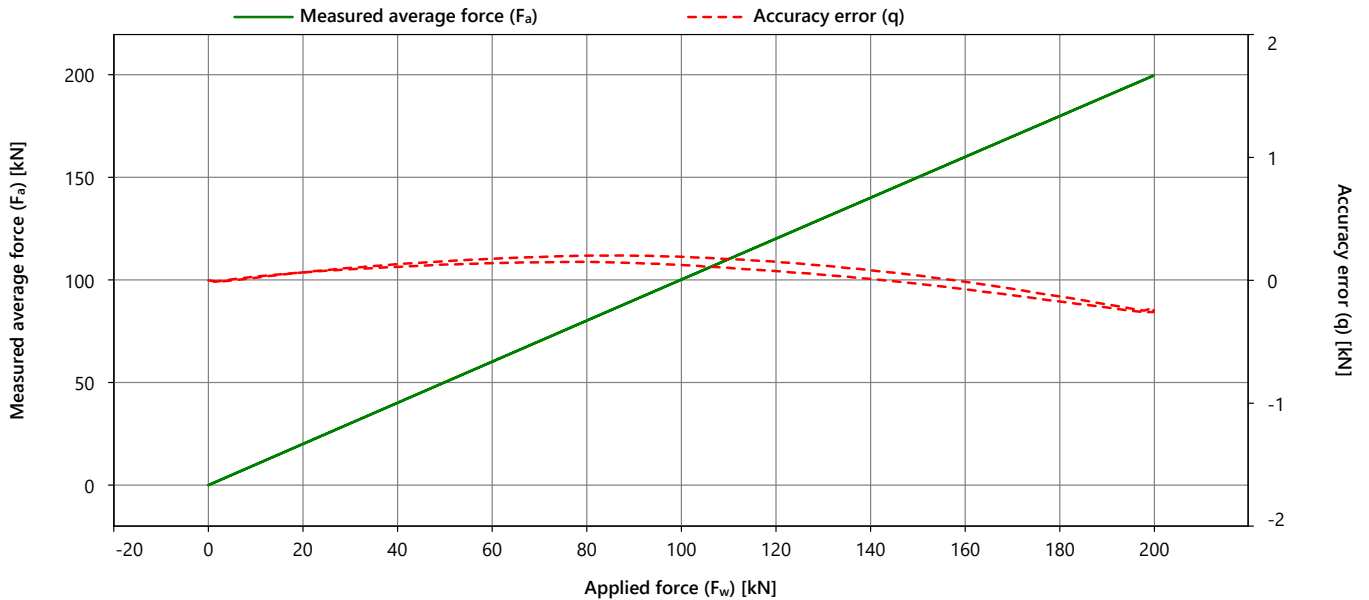
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031875

Calibration Details	
Calibration Date	08 Nov 2023 13:15:36
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.0.55345

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.221
Max repeatability error (b)	[kN]	0.017
Max reversibility error (v)	[kN]	0.075
Zero load error (F _{c0})	[kN]	0.010
Zero load offset (F ₀)	[kN]	-0.017
Resolution	[kN]	8.66E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.004	0.000	-0.004	0.000	0.000	0.009		0.024
40.000	40.137	40.133	40.126	40.132	0.132	0.011	-0.023	0.142
80.000	80.207	80.200	80.195	80.201	0.201	0.012	-0.051	0.269
120.000	120.157	120.147	120.147	120.150	0.150	0.010	-0.075	0.395
160.000	159.993	159.987	159.985	159.988	-0.012	0.008	-0.061	0.513
200.000	199.783	199.768	199.785	199.779	-0.221	0.017		0.631
160.000	159.935	159.926	159.922	159.927	-0.073	0.014	-0.061	0.513
120.000	120.081	120.075	120.070	120.075	0.075	0.011	-0.075	0.395
80.000	80.158	80.147	80.146	80.150	0.150	0.012	-0.051	0.269
40.000	40.115	40.110	40.103	40.109	0.109	0.013	-0.023	0.142
0.000	-0.002	-0.012	-0.017	-0.010	-0.010	0.015		0.032

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0082
Electronics	265
Node Type	7001
Hardware Version	5.01
Software Version	8.01

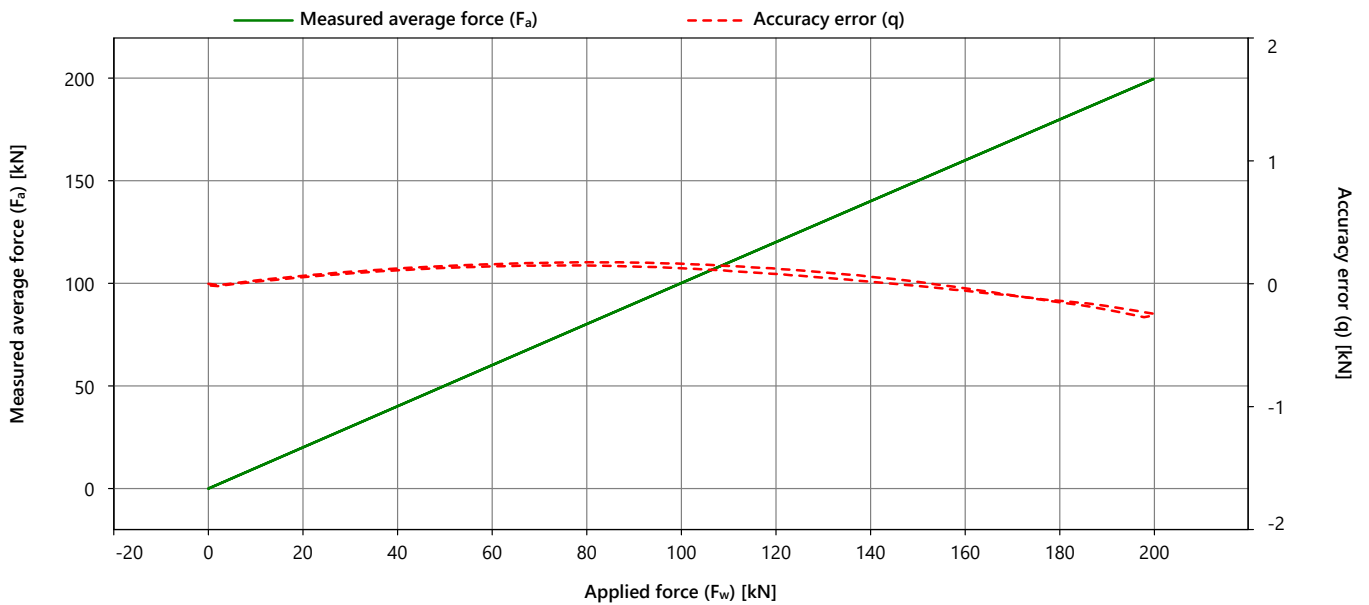
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031875

Calibration Details	
Calibration Date	08 Nov 2023 13:15:36
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.0.55345

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.257
Max repeatability error (b)	[kN]	0.021
Max reversibility error (v)	[kN]	0.043
Zero load error (F _{c0})	[kN]	0.013
Zero load offset (F ₀)	[kN]	-0.016
Resolution	[kN]	8.7E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.045



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.002	0.001	-0.003	0.000	0.000	0.005		0.026
40.000	40.131	40.123	40.118	40.124	0.124	0.013	-0.015	0.141
80.000	80.183	80.173	80.171	80.176	0.176	0.012	-0.027	0.264
120.000	120.130	120.120	120.118	120.123	0.123	0.013	-0.043	0.388
160.000	159.969	159.961	159.958	159.963	-0.037	0.012	-0.019	0.508
200.000	199.747	199.732	199.749	199.743	-0.257	0.017		0.631
160.000	159.956	159.942	159.935	159.944	-0.056	0.021	-0.019	0.509
120.000	120.089	120.079	120.072	120.080	0.080	0.017	-0.043	0.389
80.000	80.155	80.146	80.145	80.149	0.149	0.010	-0.027	0.264
40.000	40.114	40.109	40.106	40.110	0.110	0.007	-0.015	0.141
0.000	-0.002	-0.017	-0.020	-0.013	-0.013	0.018		0.038

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0082
Electronics	265
Node Type	7001
Hardware Version	5.01
Software Version	8.01

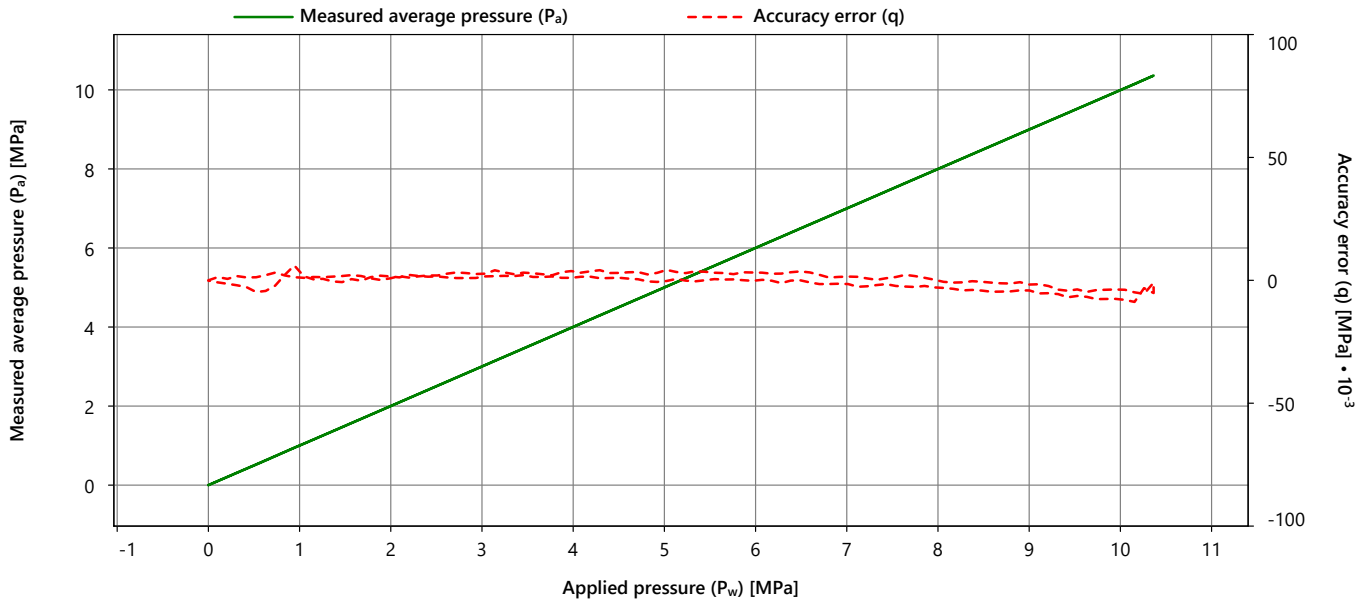
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031875

Calibration Details	
Calibration Date	09 Nov 2023 06:36:54
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.1.55350

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.004
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	0.001
Resolution	[MPa]	2.46E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	1.999	2.003	2.001	2.001	0.001	0.004	0.001	0.008
4.000	4.003	4.003	4.005	4.004	0.004	0.002	-0.003	0.006
6.000	6.003	6.005	6.002	6.003	0.003	0.002	-0.003	0.007
8.000	7.999	8.001	7.999	8.000	0.000	0.003	-0.003	0.008
10.000	9.997	9.996	9.996	9.996	-0.004	0.001		0.007
8.000	7.997	7.996	7.998	7.997	-0.003	0.003	-0.003	0.008
6.000	5.999	6.001	6.000	6.000	0.000	0.001	-0.003	0.007
4.000	4.000	4.002	4.001	4.001	0.001	0.002	-0.003	0.006
2.000	2.002	2.003	2.000	2.002	0.002	0.002	0.001	0.005
0.000	0.000	-0.001	0.000	0.000	0.000	0.001		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0082
Electronics	265
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

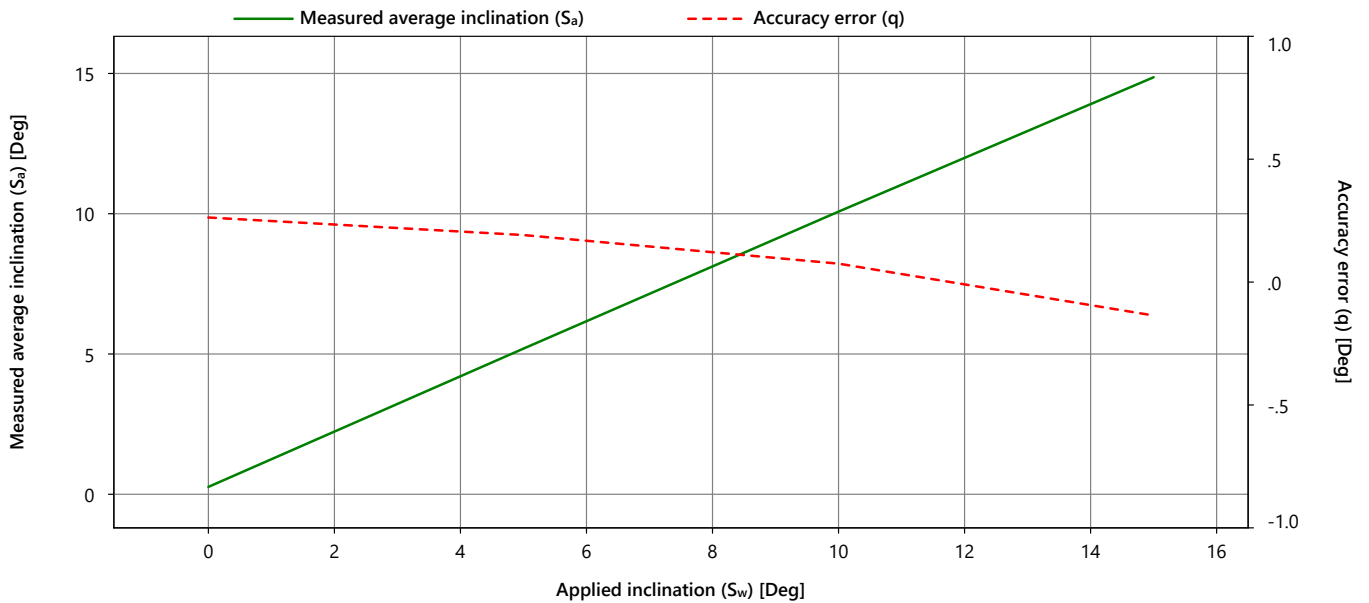
Certificate Number
FCN23031875

Calibration Details	
Calibration Date	08 Nov 2023 13:19:06
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.0.55345

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.3
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.31E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.3	0.4	0.3	0.3	0.3	0.8
5.0	5.1	5.2	5.3	5.2	0.2	0.2	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.9	14.8	14.8	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number

FCN23031875

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0082

Appendix Applicable to
Certificate Number
FCN23031875

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0082
Electronics	265
Node Type	7001
Hardware Version	5.01
Software Version	8.01

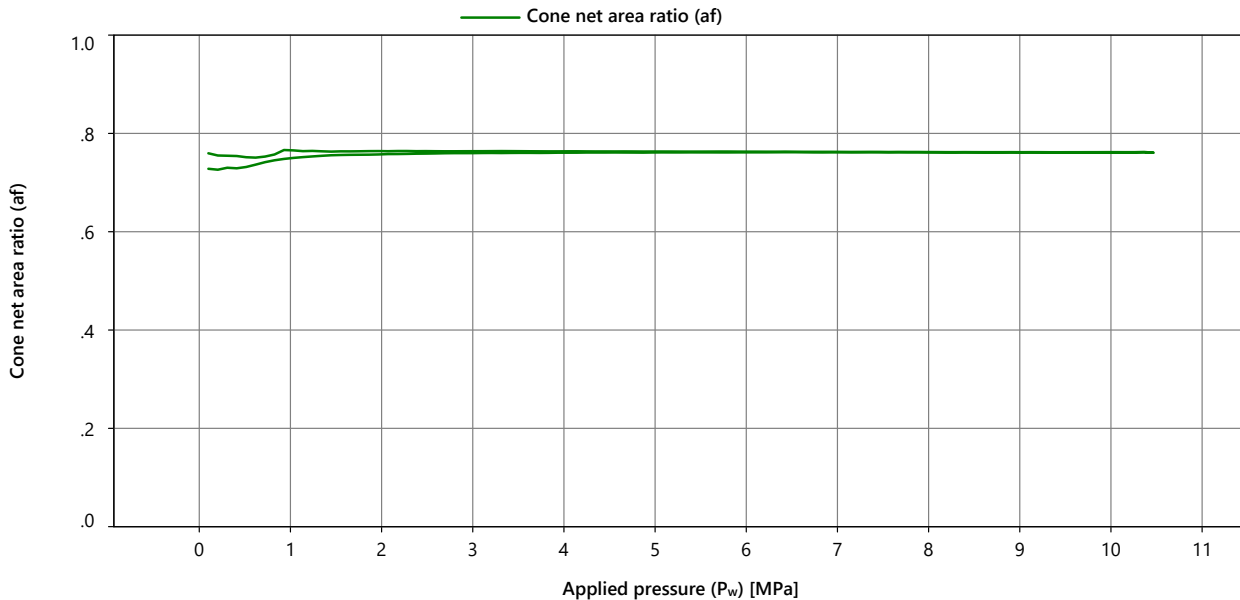
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23031875

Measurement Details	
Measurement Date	09 Nov 2023 06:36:54
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.757	0.758	0.757	0.757
4.000	0.760	0.761	0.761	0.761
6.000	0.761	0.762	0.761	0.761
8.000	0.762	0.762	0.762	0.762
10.000	0.762	0.762	0.762	0.762
8.000	0.762	0.762	0.762	0.762
6.000	0.763	0.763	0.763	0.763
4.000	0.763	0.764	0.763	0.764
2.000	0.764	0.764	0.763	0.764

Friction Sleeve Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0082
Electronics	265
Node Type	7001
Hardware Version	5.01
Software Version	8.01

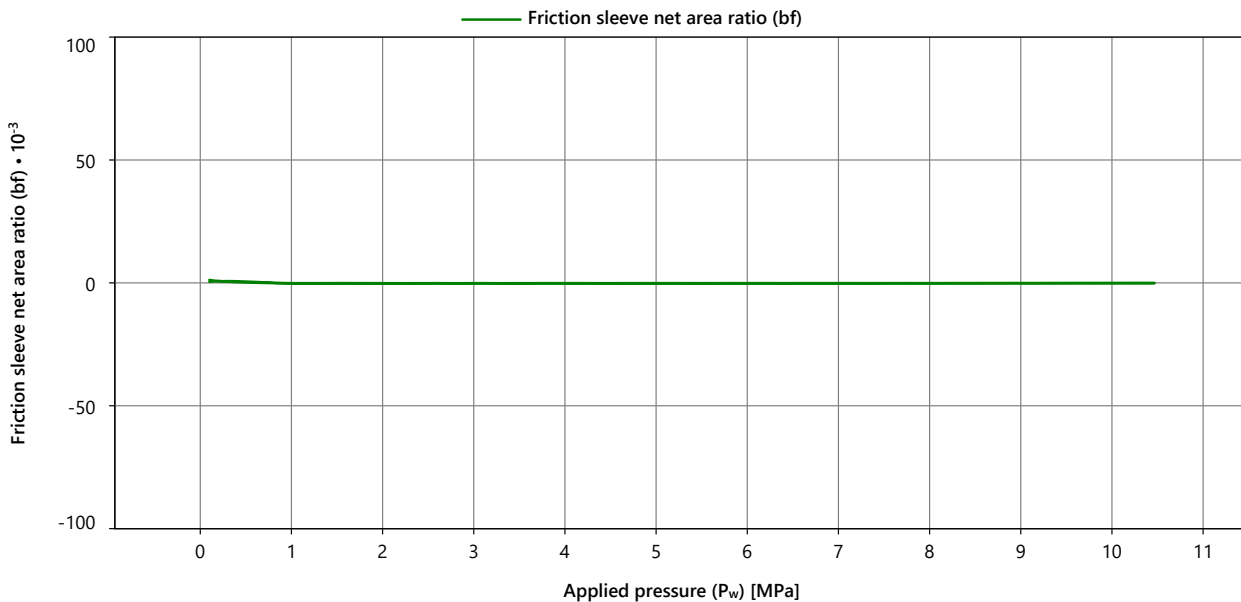
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

**Appendix Applicable to
Certificate Number
FCN23031875**

Measurement Details	
Measurement Date	09 Nov 2023 06:36:54
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	-0.00009

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031875

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
----------------	-----------------------------------

Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031883

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E1M4-V1
Serial Number 1715-0086

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 09-Nov-2023

Calibrate before 09-May-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 10-Nov-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Page 1 of 6



Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0086
Electronics	220
Node Type	7001
Hardware Version	5.01
Software Version	8.01

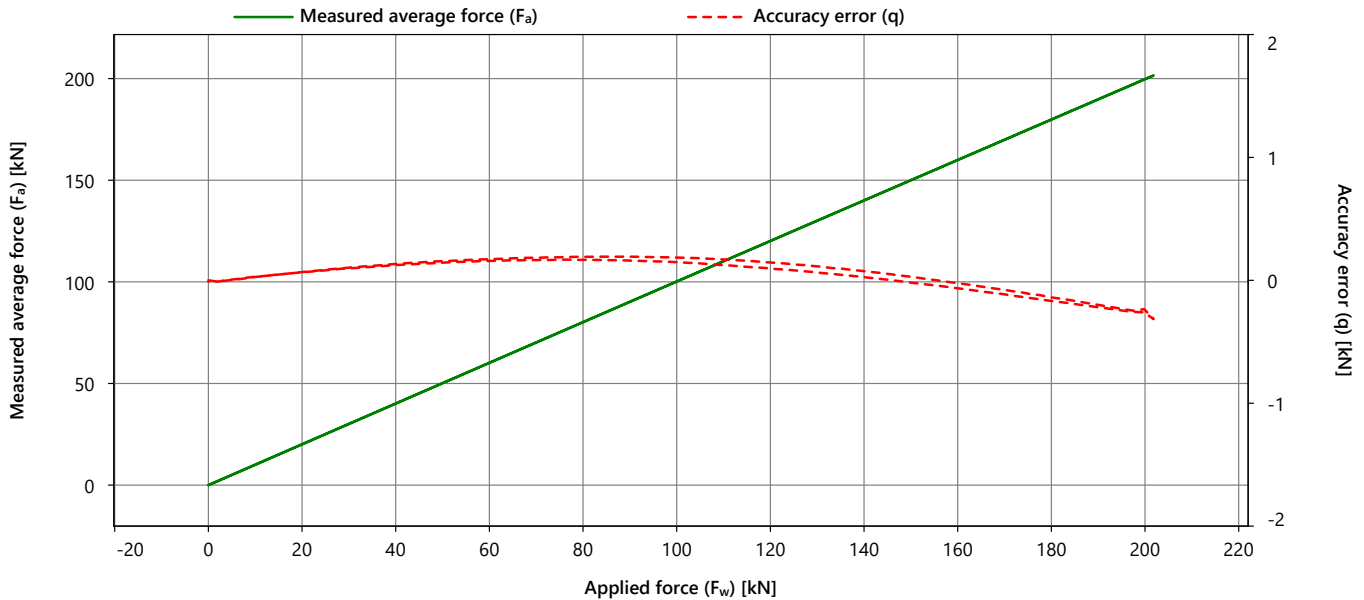
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031883

Calibration Details	
Calibration Date	09 Nov 2023 06:14:06
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.233
Max repeatability error (b)	[kN]	0.011
Max reversibility error (v)	[kN]	0.048
Zero load error (F _{c0})	[kN]	0.011
Zero load offset (F ₀)	[kN]	-0.009
Resolution	[kN]	8.7E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.003	0.000	-0.003	0.000	0.000	0.006		0.024
40.000	40.135	40.133	40.130	40.133	0.133	0.005	-0.009	0.140
80.000	80.194	80.191	80.189	80.191	0.191	0.005	-0.025	0.263
120.000	120.147	120.146	120.141	120.145	0.145	0.006	-0.048	0.389
160.000	159.980	159.976	159.975	159.977	-0.023	0.005	-0.042	0.510
200.000	199.765	199.763	199.774	199.767	-0.233	0.011		0.631
160.000	159.941	159.934	159.930	159.935	-0.065	0.010	-0.042	0.510
120.000	120.098	120.097	120.094	120.096	0.096	0.005	-0.048	0.389
80.000	80.168	80.167	80.164	80.166	0.166	0.005	-0.025	0.263
40.000	40.125	40.123	40.123	40.124	0.124	0.002	-0.009	0.140
0.000	-0.008	-0.011	-0.015	-0.011	-0.011	0.006		0.024

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0086
Electronics	220
Node Type	7001
Hardware Version	5.01
Software Version	8.01

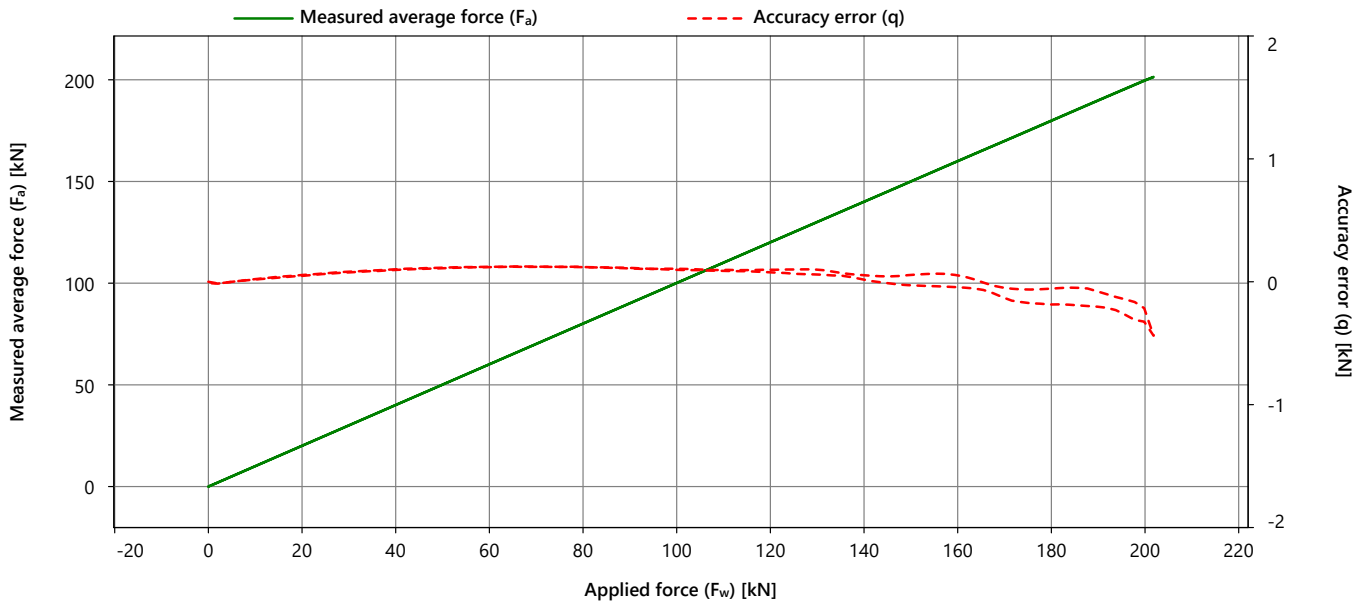
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031883

Calibration Details	
Calibration Date	09 Nov 2023 06:14:06
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.326
Max repeatability error (b)	[kN]	0.014
Max reversibility error (v)	[kN]	0.097
Zero load error (F _{c0})	[kN]	0.011
Zero load offset (F ₀)	[kN]	-0.022
Resolution	[kN]	8.71E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.016



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.002	0.000	-0.002	0.000	0.000	0.004		0.022
40.000	40.104	40.102	40.098	40.101	0.101	0.006	-0.005	0.139
80.000	80.124	80.120	80.117	80.120	0.120	0.007	-0.001	0.262
120.000	120.079	120.076	120.074	120.076	0.076	0.005	0.022	0.385
160.000	159.962	159.956	159.949	159.956	-0.044	0.014	0.097	0.521
200.000	199.674	199.668	199.679	199.674	-0.326	0.011		0.631
160.000	160.058	160.051	160.049	160.052	0.052	0.009	0.097	0.520
120.000	120.101	120.099	120.094	120.098	0.098	0.007	0.022	0.386
80.000	80.121	80.120	80.116	80.119	0.119	0.005	-0.001	0.262
40.000	40.099	40.098	40.093	40.097	0.097	0.005	-0.005	0.139
0.000	-0.008	-0.010	-0.014	-0.011	-0.011	0.006		0.023

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0086
Electronics	220
Node Type	7001
Hardware Version	5.01
Software Version	8.01

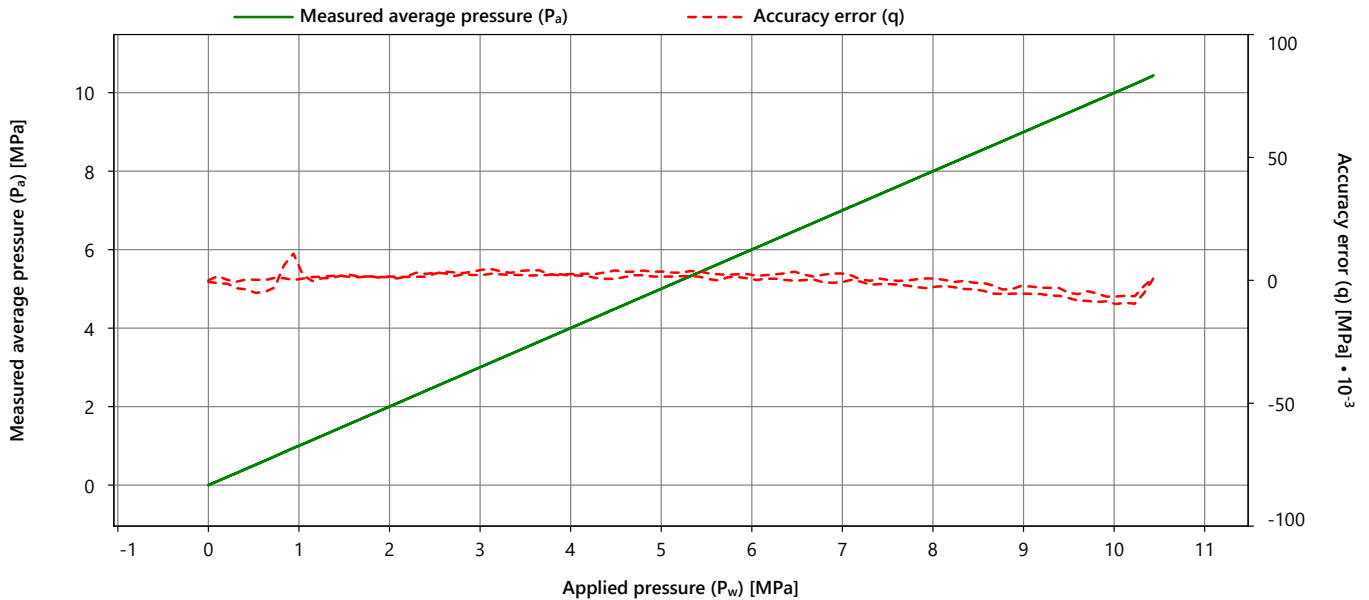
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031883

Calibration Details	
Calibration Date	09 Nov 2023 08:00:35
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.1.55350

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.007
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	-0.004
Resolution	[MPa]	2.35E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.002	2.002	2.001	2.002	0.002	0.000	0.000	0.004
4.000	4.004	4.003	4.001	4.002	0.002	0.003	-0.001	0.006
6.000	6.003	6.002	6.002	6.002	0.002	0.002	-0.002	0.006
8.000	8.001	7.999	8.002	8.001	0.001	0.003	-0.003	0.009
10.000	9.993	9.993	9.994	9.993	-0.007	0.001		0.007
8.000	7.998	7.997	7.996	7.997	-0.003	0.001	-0.003	0.008
6.000	6.000	6.000	6.001	6.000	0.000	0.001	-0.002	0.006
4.000	4.002	4.002	4.001	4.002	0.002	0.001	-0.001	0.005
2.000	2.001	2.002	2.000	2.001	0.001	0.002	0.000	0.004
0.000	-0.001	0.000	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0086
Electronics	220
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

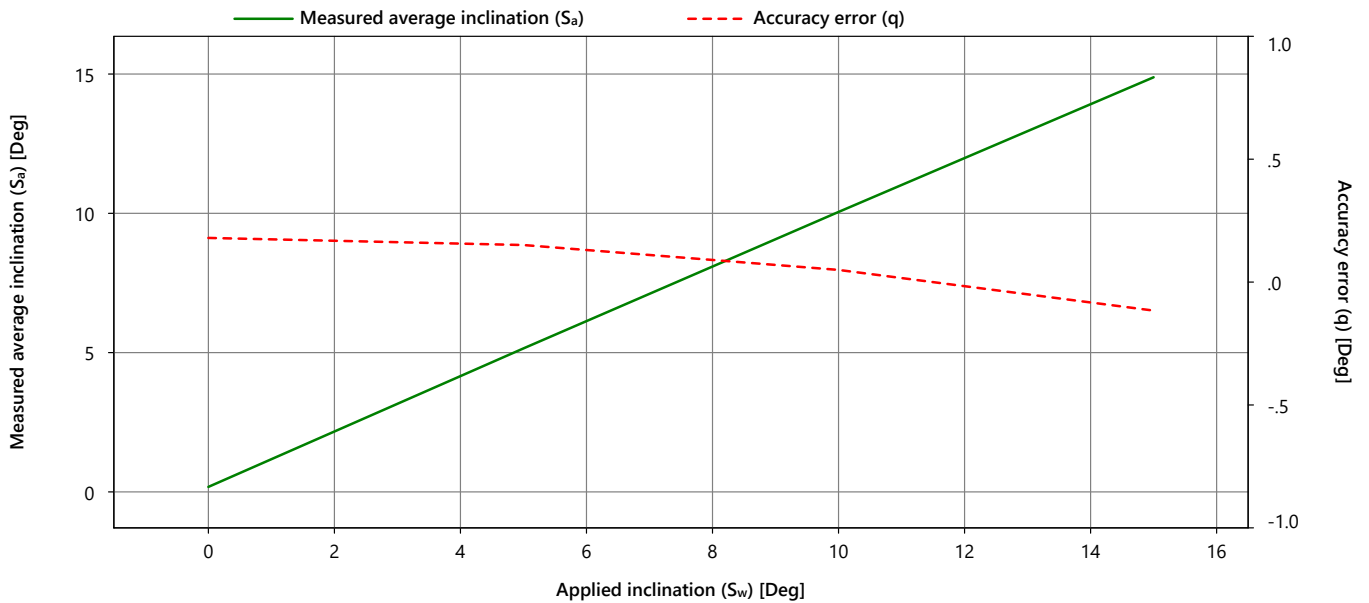
Certificate Number
FCN23031883

Calibration Details	
Calibration Date	09 Nov 2023 06:21:17
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.1.55350

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.28E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.2	0.3	0.2	0.2	0.2	0.7
5.0	5.1	5.2	5.2	5.2	0.2	0.2	0.7
10.0	10.0	10.1	10.1	10.0	0.0	0.1	0.7
15.0	14.9	14.8	14.9	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031883

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E1M4-V1
Serial Number	1715-0086

Appendix Applicable to
Certificate Number
FCN23031883

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0086
Electronics	220
Node Type	7001
Hardware Version	5.01
Software Version	8.01

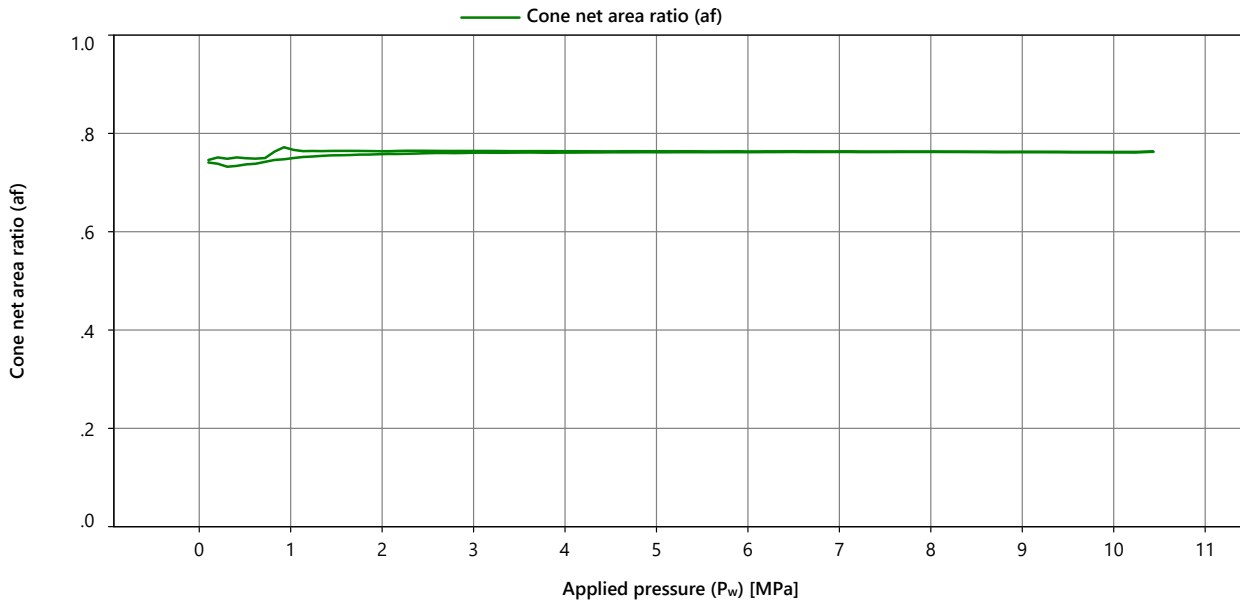
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23031883

Measurement Details	
Measurement Date	09 Nov 2023 08:00:35
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.758	0.758	0.758	0.758
4.000	0.761	0.761	0.761	0.761
6.000	0.762	0.762	0.762	0.762
8.000	0.762	0.762	0.762	0.762
10.000	0.762	0.762	0.762	0.762
8.000	0.763	0.763	0.763	0.763
6.000	0.763	0.763	0.763	0.763
4.000	0.764	0.764	0.764	0.764
2.000	0.764	0.764	0.763	0.764

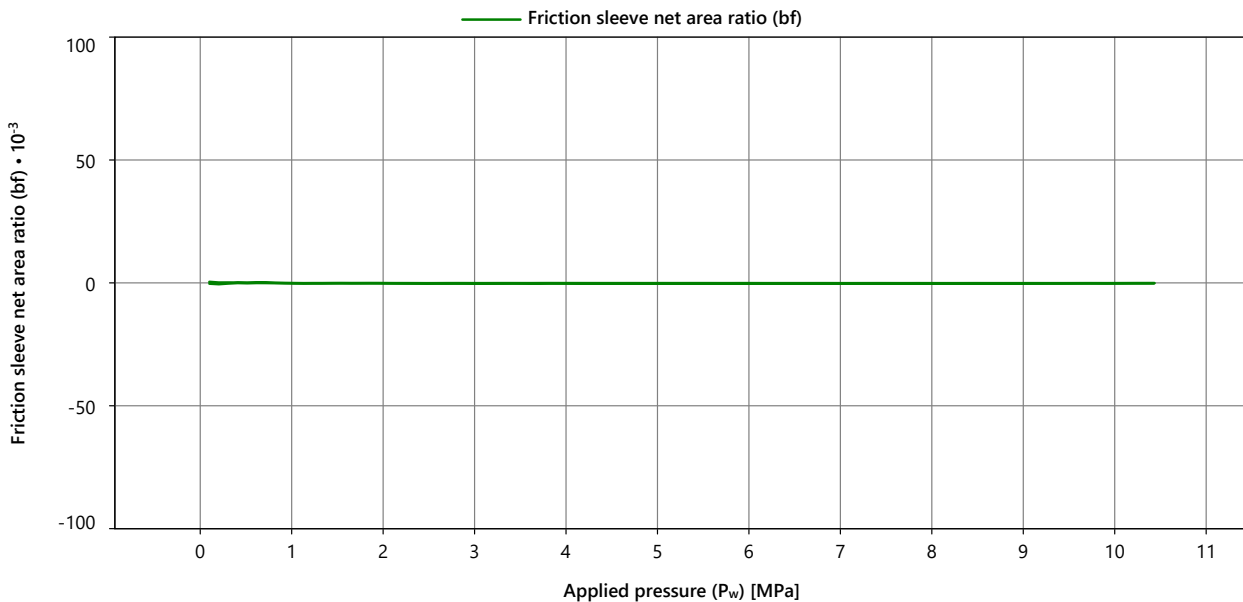
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E1M4-V1	Serial Number	3257-0002
Serial Number	1715-0086	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	220	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 08:00:35
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031883

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	-0.00011

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031883

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
----------------	-----------------------------------

Quantities

P	Pressure
---	----------

Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031884

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E1M4-V1
Serial Number 1715-0075

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 09-Nov-2023

Calibrate before 09-May-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 10-Nov-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0075
Electronics	215
Node Type	7001
Hardware Version	5.01
Software Version	8.01

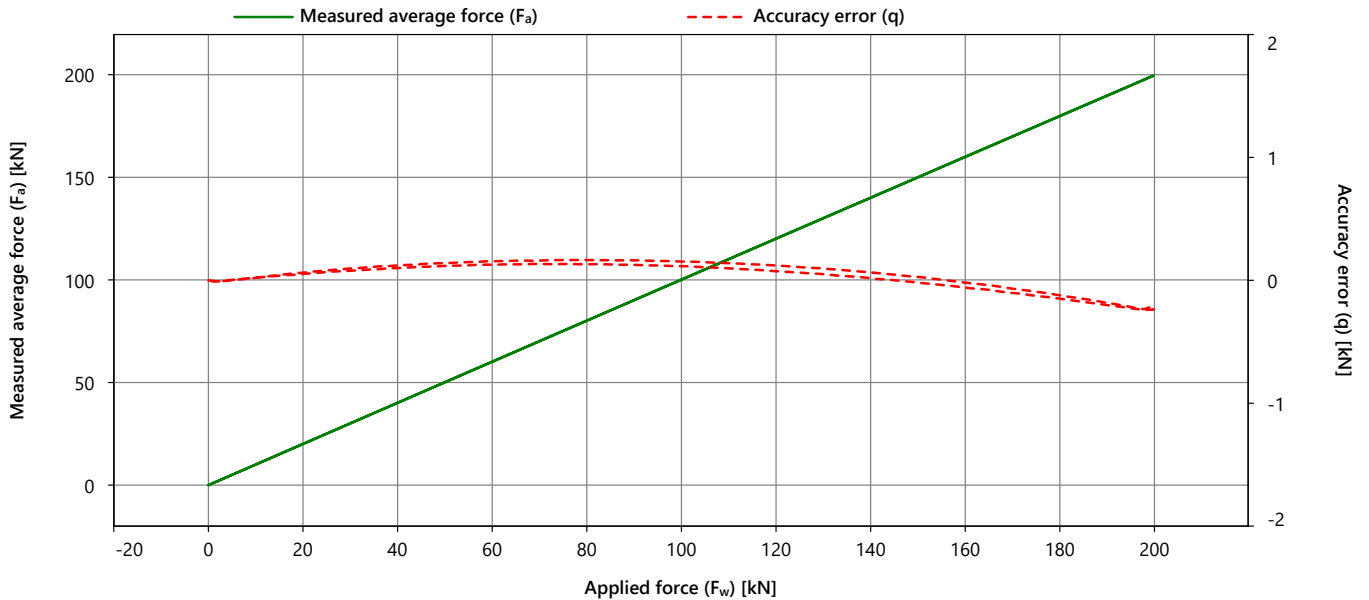
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031884

Calibration Details	
Calibration Date	09 Nov 2023 06:59:42
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.207
Max repeatability error (b)	[kN]	0.010
Max reversibility error (v)	[kN]	0.046
Zero load error (F _{c0})	[kN]	0.007
Zero load offset (F ₀)	[kN]	-0.015
Resolution	[kN]	8.68E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.002	-0.001	-0.001	0.000	0.000	0.003		0.018
40.000	40.123	40.122	40.120	40.121	0.121	0.003	-0.021	0.141
80.000	80.167	80.166	80.160	80.165	0.165	0.006	-0.034	0.265
120.000	120.123	120.122	120.118	120.121	0.121	0.005	-0.046	0.388
160.000	159.985	159.981	159.978	159.981	-0.019	0.007	-0.041	0.510
200.000	199.788	199.794	199.798	199.793	-0.207	0.010		0.631
160.000	159.942	159.941	159.938	159.940	-0.060	0.004	-0.041	0.510
120.000	120.075	120.074	120.074	120.074	0.074	0.001	-0.046	0.388
80.000	80.134	80.131	80.128	80.131	0.131	0.006	-0.034	0.265
40.000	40.104	40.100	40.098	40.100	0.100	0.006	-0.021	0.141
0.000	-0.005	-0.007	-0.009	-0.007	-0.007	0.004		0.019

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0075
Electronics	215
Node Type	7001
Hardware Version	5.01
Software Version	8.01

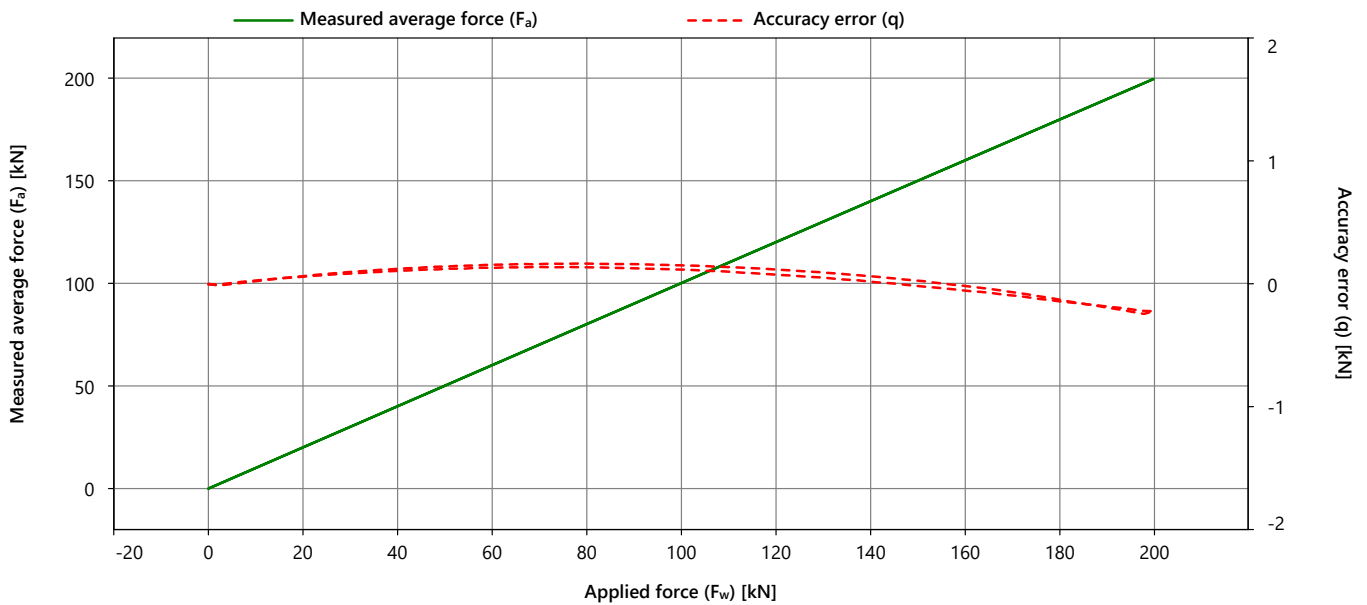
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031884

Calibration Details	
Calibration Date	09 Nov 2023 06:59:42
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.220
Max repeatability error (b)	[kN]	0.012
Max reversibility error (v)	[kN]	0.042
Zero load error (F _{c0})	[kN]	0.006
Zero load offset (F ₀)	[kN]	-0.029
Resolution	[kN]	8.72E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.018



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.001	-0.001	0.000	0.000	0.000	0.002		0.017
40.000	40.123	40.122	40.121	40.122	0.122	0.001	-0.017	0.140
80.000	80.165	80.166	80.161	80.164	0.164	0.006	-0.030	0.264
120.000	120.117	120.117	120.113	120.116	0.116	0.004	-0.042	0.388
160.000	159.985	159.981	159.980	159.982	-0.018	0.004	-0.038	0.509
200.000	199.773	199.781	199.785	199.780	-0.220	0.012		0.631
160.000	159.946	159.945	159.940	159.944	-0.056	0.005	-0.038	0.510
120.000	120.074	120.075	120.073	120.074	0.074	0.002	-0.042	0.388
80.000	80.136	80.135	80.131	80.134	0.134	0.005	-0.030	0.264
40.000	40.107	40.104	40.102	40.105	0.105	0.005	-0.017	0.140
0.000	-0.004	-0.008	-0.007	-0.006	-0.006	0.003		0.018

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0075
Electronics	215
Node Type	7001
Hardware Version	5.01
Software Version	8.01

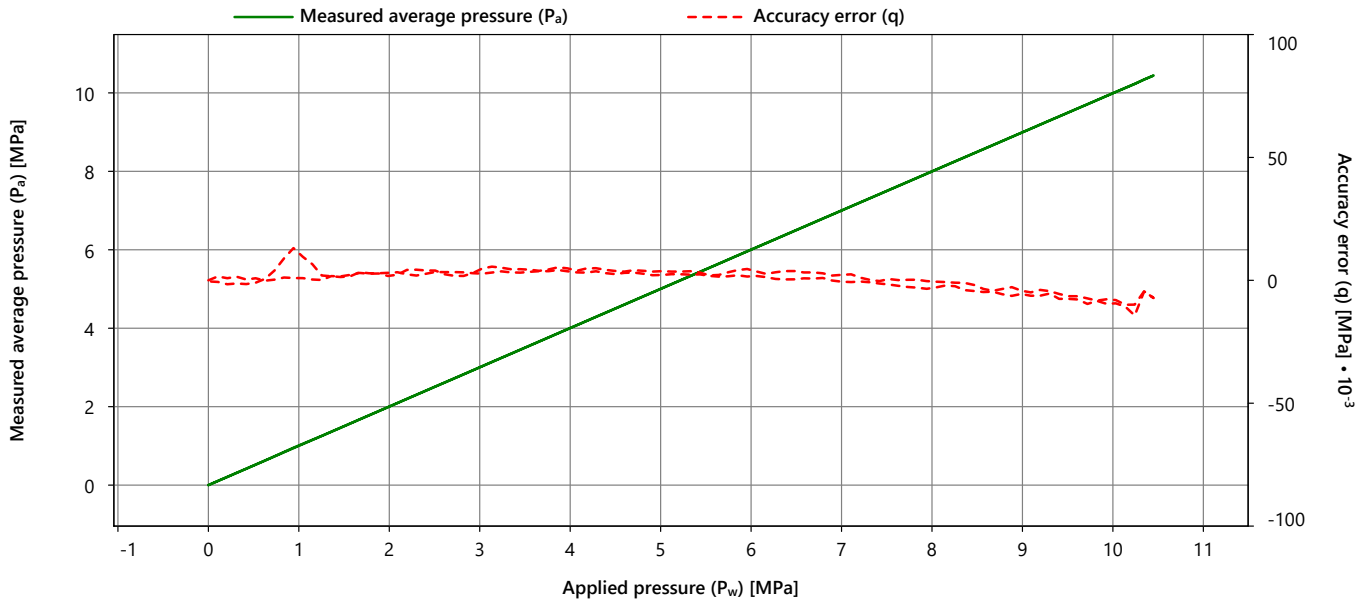
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031884

Calibration Details	
Calibration Date	09 Nov 2023 07:49:19
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.1.55350

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.008
Max repeatability error (b)	[MPa]	0.005
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	-0.001
Resolution	[MPa]	2.28E-06
Noise RMS	[MPa]	0.001



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.004
2.000	2.002	2.002	2.001	2.002	0.002	0.002	0.002	0.005
4.000	4.007	4.005	4.002	4.005	0.005	0.005	-0.001	0.009
6.000	6.004	6.004	6.004	6.004	0.004	0.000	-0.003	0.007
8.000	7.999	7.999	8.001	8.000	0.000	0.002	-0.003	0.008
10.000	9.991	9.993	9.993	9.992	-0.008	0.002		0.008
8.000	7.996	7.998	7.996	7.997	-0.003	0.002	-0.003	0.008
6.000	6.000	6.001	6.003	6.001	0.001	0.003	-0.003	0.008
4.000	4.004	4.004	4.003	4.004	0.004	0.000	-0.001	0.005
2.000	2.003	2.003	2.003	2.003	0.003	0.000	0.002	0.005
0.000	0.000	0.000	-0.001	0.000	0.000	0.000		0.004

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E1M4-V1
Serial Number	1715-0075
Electronics	215
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

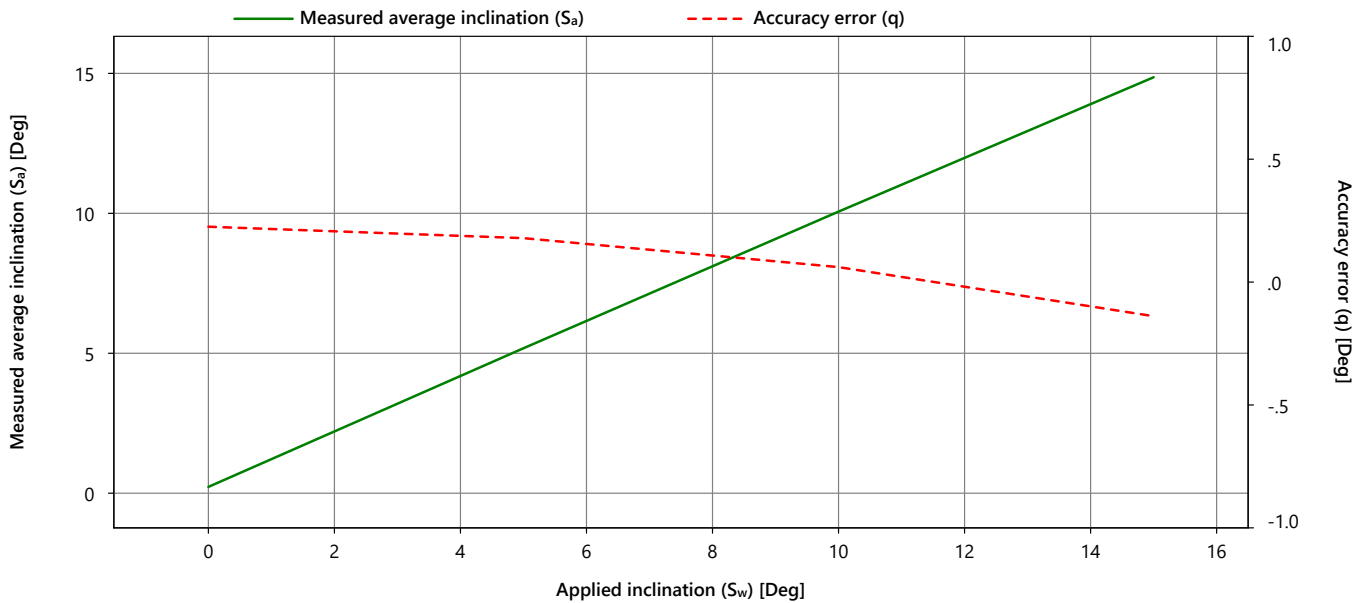
Certificate Number
FCN23031884

Calibration Details	
Calibration Date	09 Nov 2023 07:03:05
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.1.55350

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.27E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.2	0.4	0.2	0.2	0.3	0.8
5.0	5.0	5.2	5.3	5.2	0.2	0.2	0.8
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.9	14.8	14.9	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031884

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E1M4-V1
Serial Number	1715-0075

Appendix Applicable to
Certificate Number
FCN23031884

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

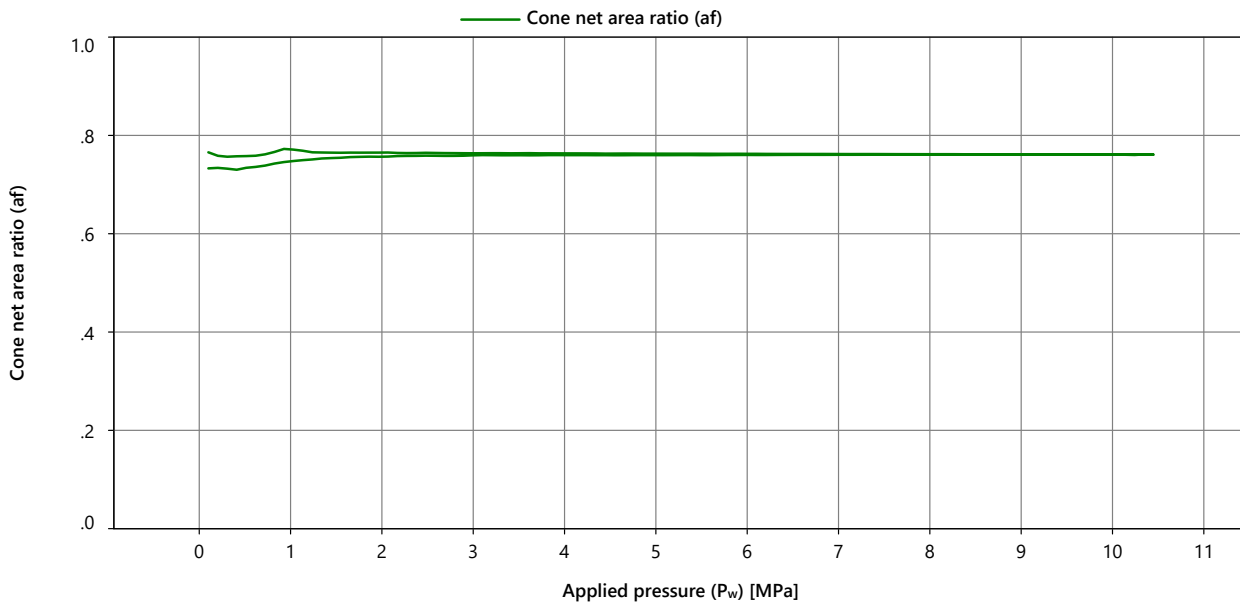
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E1M4-V1	Serial Number	3257-0002
Serial Number	1715-0075	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	215	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 07:49:19
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031884

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.757	0.756	0.756	0.756
4.000	0.760	0.760	0.760	0.760
6.000	0.760	0.760	0.761	0.760
8.000	0.761	0.761	0.761	0.761
10.000	0.761	0.761	0.761	0.761
8.000	0.762	0.762	0.762	0.762
6.000	0.762	0.762	0.763	0.763
4.000	0.763	0.763	0.763	0.763
2.000	0.765	0.765	0.765	0.765

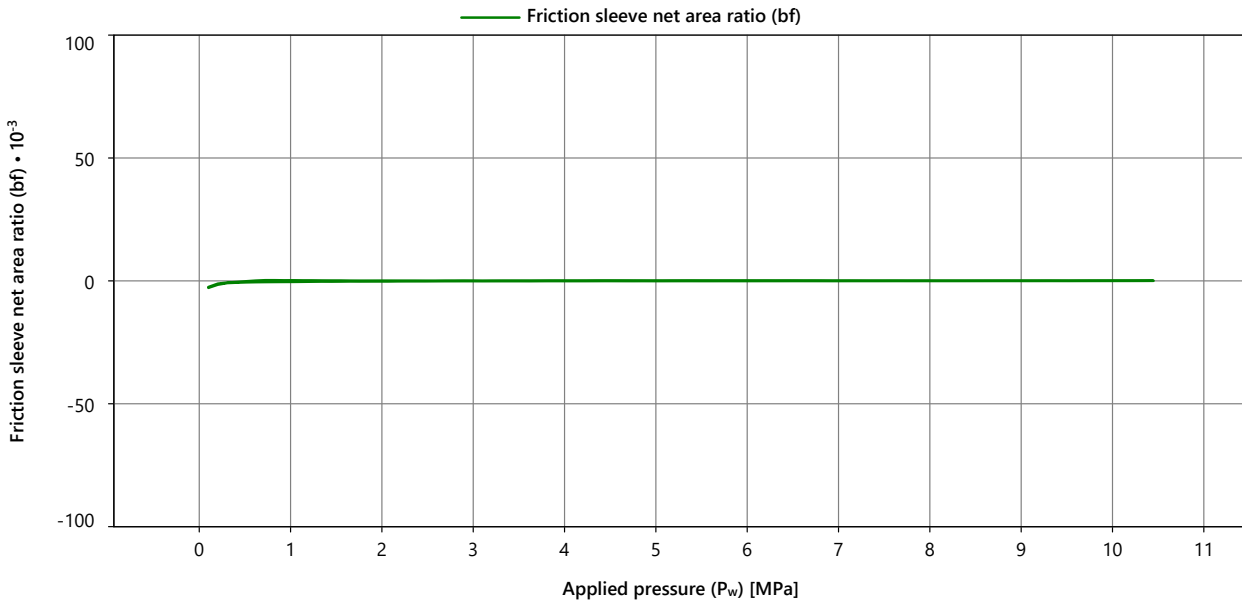
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E1M4-V1	Serial Number	3257-0002
Serial Number	1715-0075	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	215	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 07:49:19
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031884

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00004

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031884

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031886

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0073

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 09-Nov-2023

Calibrate before 09-May-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 10-Nov-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Fugro Transducer Workshop, P.O. Box 130, 2630 AC Nootdorp, The Netherlands, Phone +31-70-3111444, www.fugro.com
Page 1 of 6



Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0073
Electronics	224
Node Type	7001
Hardware Version	5.01
Software Version	8.01

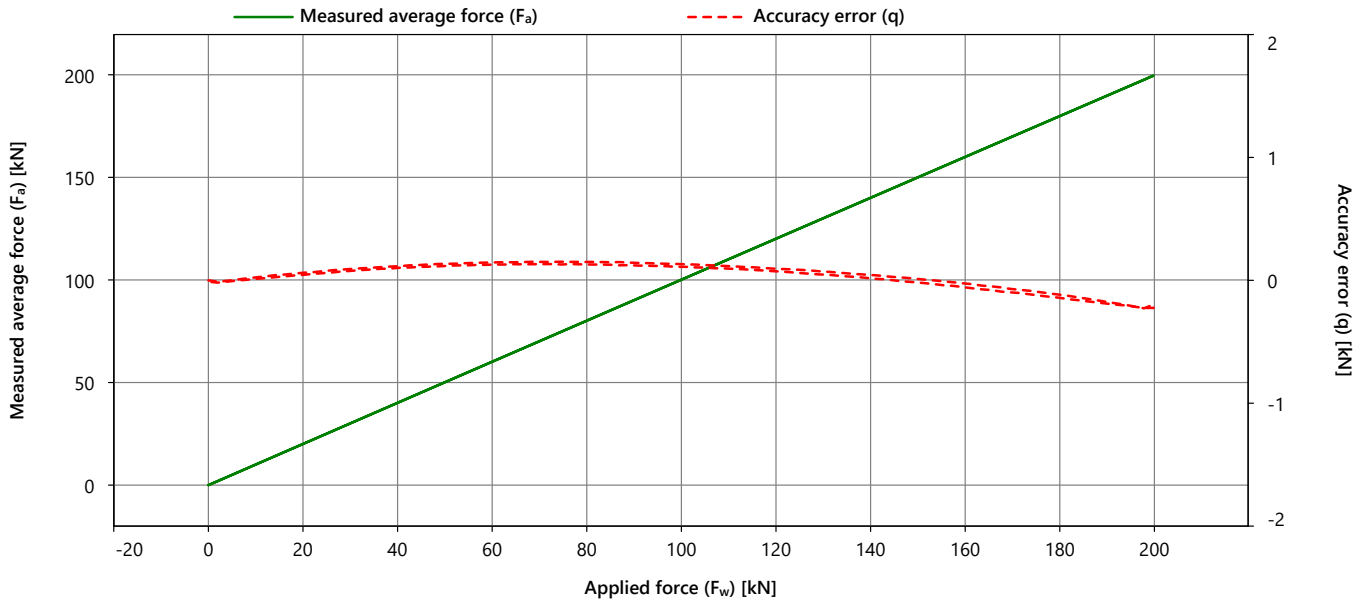
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031886

Calibration Details	
Calibration Date	09 Nov 2023 07:42:43
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.193
Max repeatability error (b)	[kN]	0.012
Max reversibility error (v)	[kN]	0.032
Zero load error (F _{c0})	[kN]	0.012
Zero load offset (F ₀)	[kN]	-0.013
Resolution	[kN]	8.67E-05
Noise RMS	[kN]	0.002



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.005	-0.001	-0.004	0.000	0.000	0.009		0.025
40.000	40.118	40.113	40.112	40.114	0.114	0.005	-0.014	0.140
80.000	80.153	80.150	80.147	80.150	0.150	0.006	-0.020	0.263
120.000	120.097	120.094	120.092	120.094	0.094	0.005	-0.022	0.386
160.000	159.977	159.973	159.974	159.974	-0.026	0.004	-0.032	0.509
200.000	199.805	199.808	199.807	199.807	-0.193	0.003		0.631
160.000	159.945	159.943	159.939	159.942	-0.058	0.005	-0.032	0.509
120.000	120.074	120.074	120.069	120.072	0.072	0.006	-0.022	0.386
80.000	80.133	80.129	80.126	80.129	0.129	0.008	-0.020	0.263
40.000	40.103	40.102	40.097	40.101	0.101	0.006	-0.014	0.140
0.000	-0.009	-0.007	-0.019	-0.012	-0.012	0.012		0.028

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0073
Electronics	224
Node Type	7001
Hardware Version	5.01
Software Version	8.01

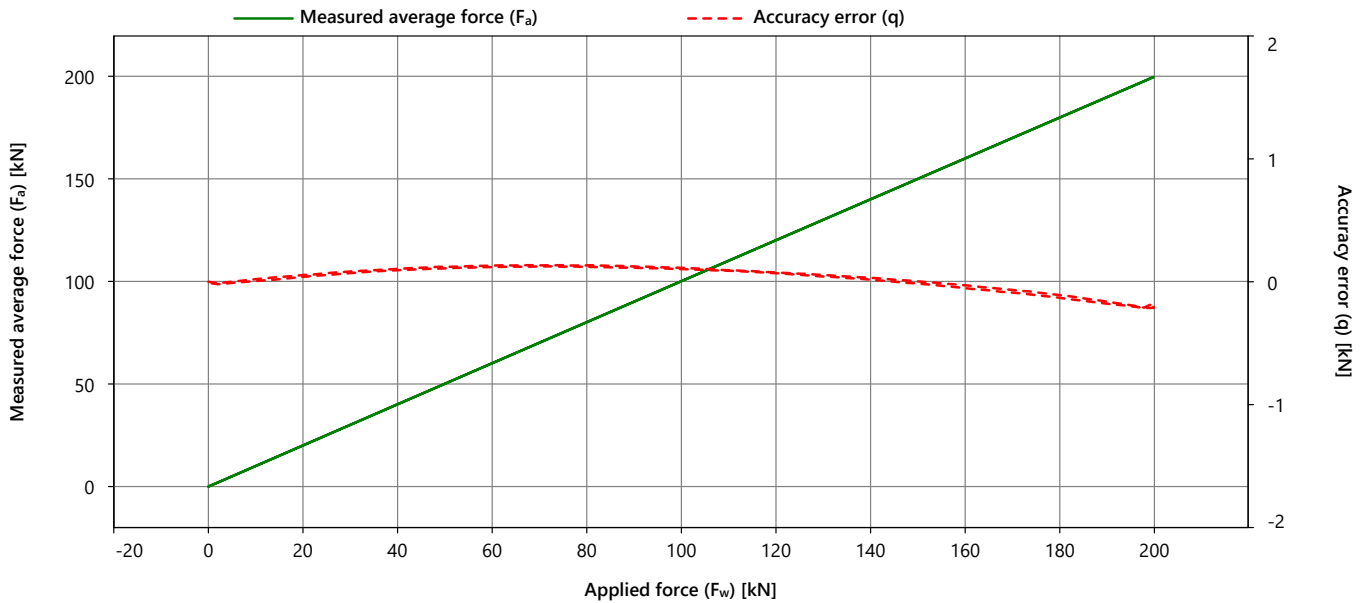
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031886

Calibration Details	
Calibration Date	09 Nov 2023 07:42:43
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.171
Max repeatability error (b)	[kN]	0.011
Max reversibility error (v)	[kN]	0.023
Zero load error (F _{c0})	[kN]	0.010
Zero load offset (F ₀)	[kN]	-0.026
Resolution	[kN]	8.69E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.009



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.003	0.000	-0.003	0.000	0.000	0.006		0.022
40.000	40.105	40.104	40.104	40.105	0.105	0.001	-0.010	0.139
80.000	80.135	80.134	80.132	80.134	0.134	0.003	-0.012	0.262
120.000	120.076	120.076	120.076	120.076	0.076	0.001	-0.007	0.385
160.000	159.972	159.971	159.971	159.971	-0.029	0.001	-0.023	0.508
200.000	199.827	199.830	199.831	199.829	-0.171	0.003		0.631
160.000	159.949	159.948	159.947	159.948	-0.052	0.003	-0.023	0.508
120.000	120.069	120.070	120.067	120.069	0.069	0.003	-0.007	0.385
80.000	80.124	80.124	80.117	80.122	0.122	0.007	-0.012	0.262
40.000	40.097	40.094	40.091	40.094	0.094	0.006	-0.010	0.140
0.000	-0.006	-0.006	-0.018	-0.010	-0.010	0.011		0.026

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0073
Electronics	224
Node Type	7001
Hardware Version	5.01
Software Version	8.01

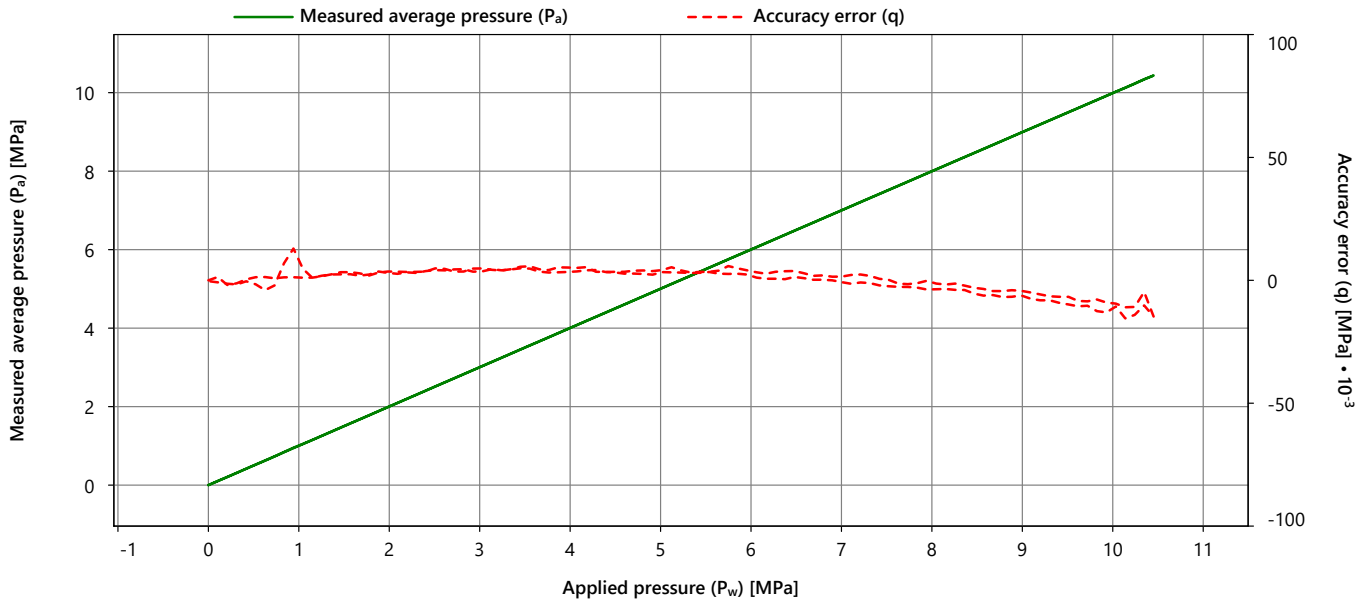
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031886

Calibration Details	
Calibration Date	09 Nov 2023 09:30:46
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.1.55350

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.009
Max repeatability error (b)	[MPa]	0.002
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	-0.002
Resolution	[MPa]	2.18E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.004	2.004	2.003	2.004	0.004	0.001	-0.001	0.004
4.000	4.005	4.006	4.004	4.005	0.005	0.002	-0.002	0.006
6.000	6.004	6.004	6.003	6.004	0.004	0.001	-0.002	0.006
8.000	8.000	7.999	7.999	7.999	-0.001	0.001	-0.003	0.008
10.000	9.990	9.990	9.992	9.991	-0.009	0.001		0.007
8.000	7.996	7.996	7.997	7.996	-0.004	0.001	-0.003	0.008
6.000	6.001	6.003	6.001	6.002	0.002	0.001	-0.002	0.006
4.000	4.004	4.004	4.002	4.003	0.003	0.002	-0.002	0.005
2.000	2.002	2.004	2.003	2.003	0.003	0.002	-0.001	0.005
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.002

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0073
Electronics	224
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

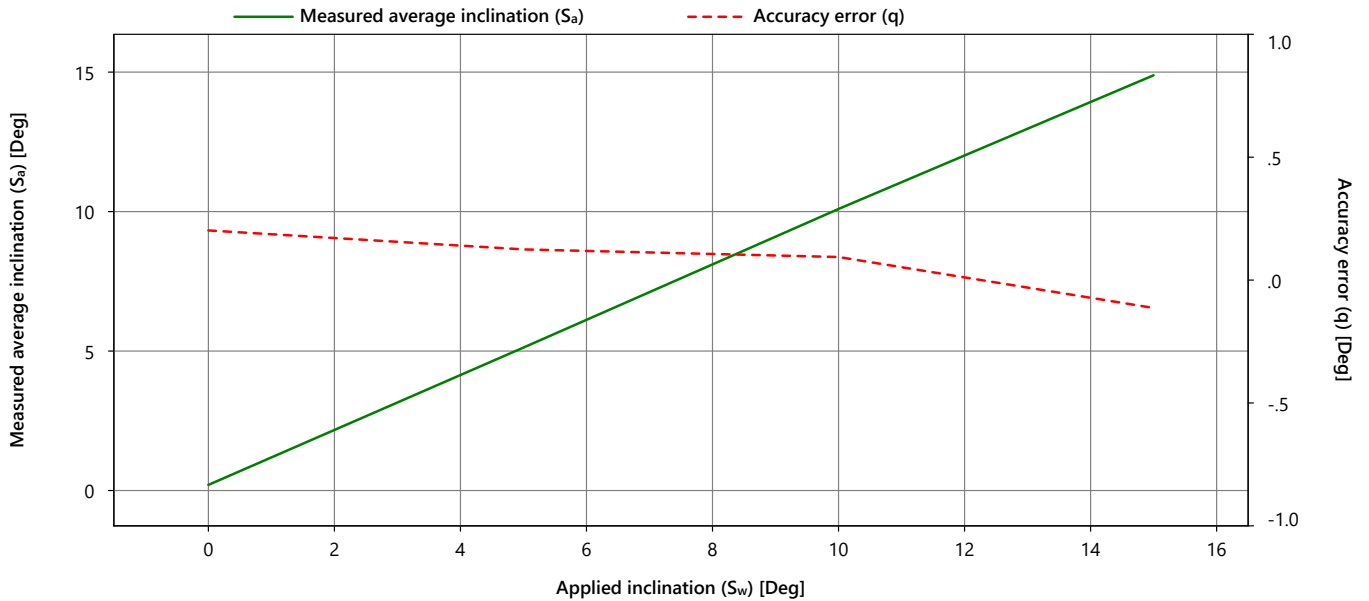
Certificate Number
FCN23031886

Calibration Details	
Calibration Date	09 Nov 2023 07:59:05
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.1.55350

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.32E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.2	0.3	0.2	0.2	0.2	0.7
5.0	5.1	5.1	5.2	5.1	0.1	0.1	0.7
10.0	10.1	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.9	14.9	14.9	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031886

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0073

Appendix Applicable to
Certificate Number
FCN23031886

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0073
Electronics	224
Node Type	7001
Hardware Version	5.01
Software Version	8.01

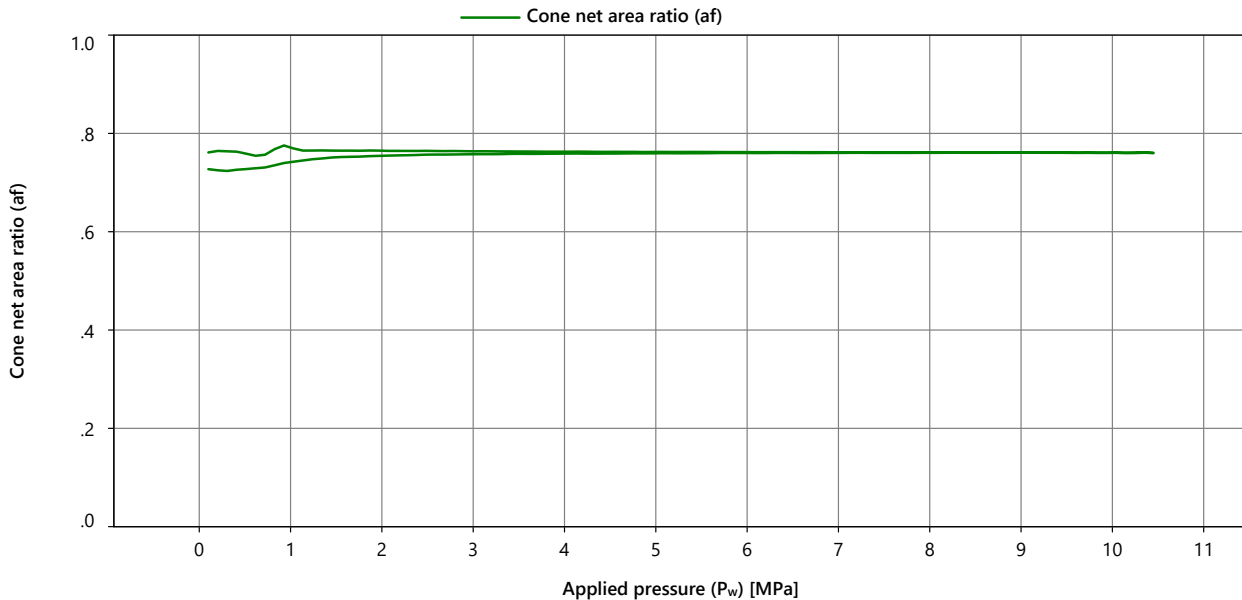
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23031886

Measurement Details	
Measurement Date	09 Nov 2023 09:30:46
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.755	0.754	0.754	0.754
4.000	0.759	0.759	0.759	0.759
6.000	0.760	0.760	0.760	0.760
8.000	0.761	0.761	0.760	0.761
10.000	0.761	0.761	0.761	0.761
8.000	0.761	0.761	0.761	0.761
6.000	0.762	0.762	0.762	0.762
4.000	0.763	0.763	0.763	0.763
2.000	0.765	0.765	0.764	0.765

Friction Sleeve Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0073
Electronics	224
Node Type	7001
Hardware Version	5.01
Software Version	8.01

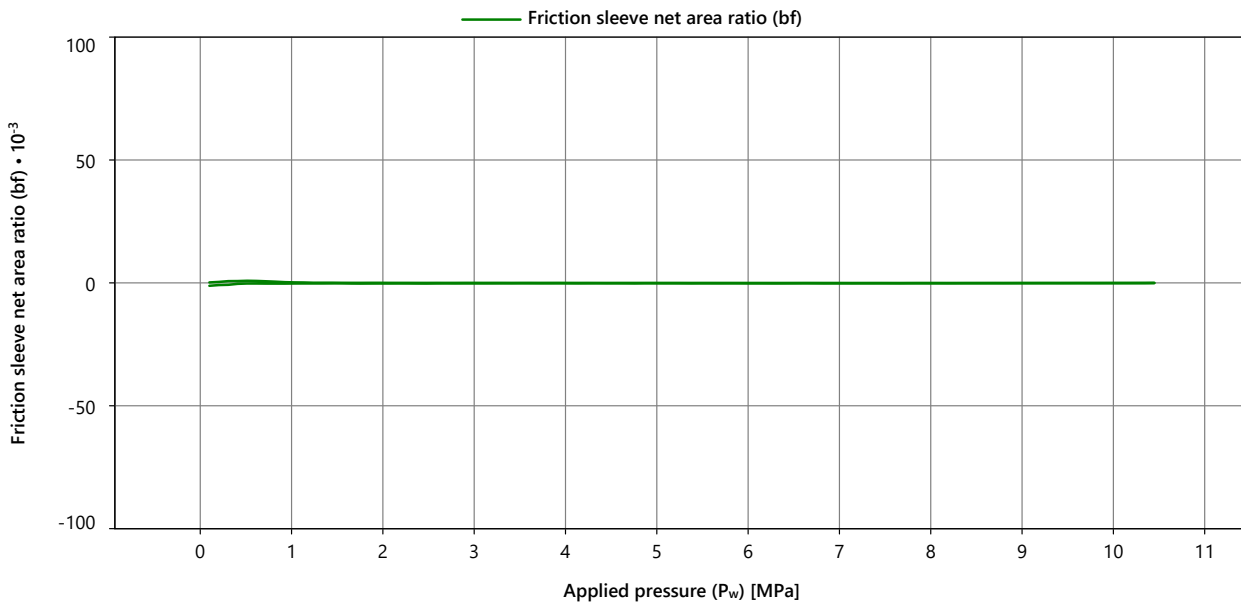
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

**Appendix Applicable to
Certificate Number
FCN23031886**

Measurement Details	
Measurement Date	09 Nov 2023 09:30:46
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	-0.00004

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031886

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
----------------	-----------------------------------

Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031888

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0070

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 09-Nov-2023

Calibrate before 09-May-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 10-Nov-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0070
Electronics	155
Node Type	7001
Hardware Version	5.01
Software Version	8.01

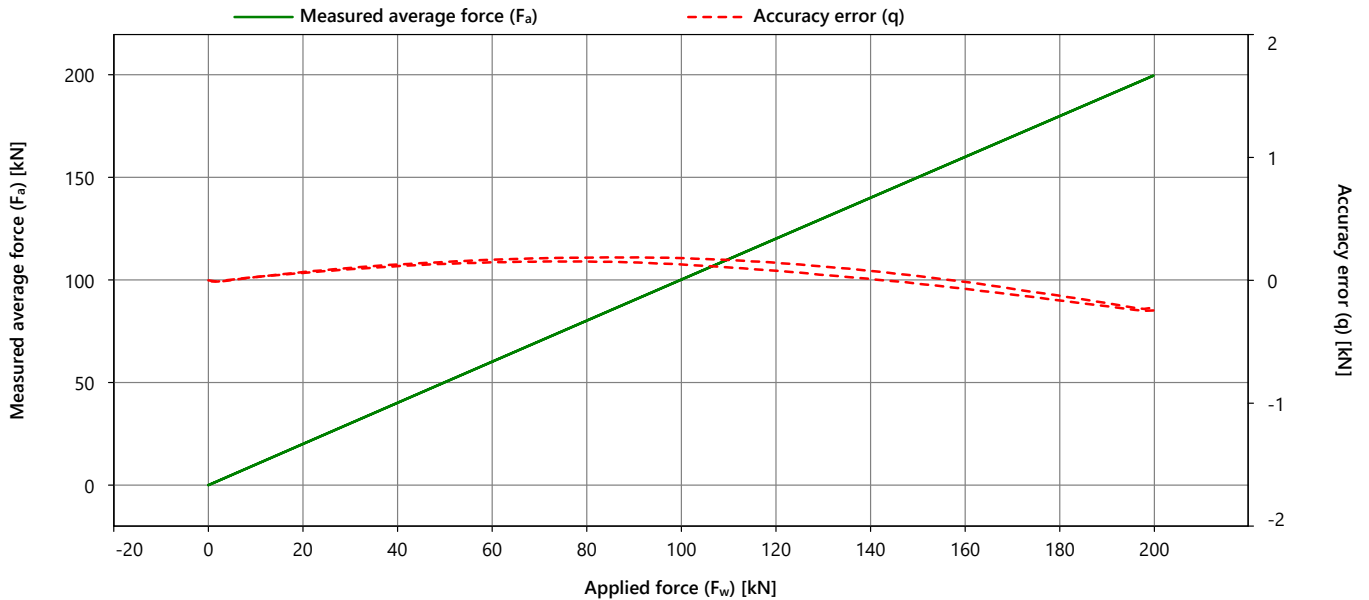
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031888

Calibration Details	
Calibration Date	09 Nov 2023 08:53:42
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.220
Max repeatability error (b)	[kN]	0.015
Max reversibility error (v)	[kN]	0.064
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	-0.029
Resolution	[kN]	8.68E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.005	0.000	-0.006	0.000	0.000	0.011		0.024
40.000	40.131	40.129	40.126	40.129	0.129	0.004	-0.013	0.140
80.000	80.188	80.183	80.182	80.185	0.185	0.005	-0.031	0.264
120.000	120.145	120.141	120.140	120.142	0.142	0.004	-0.064	0.392
160.000	159.991	159.988	159.983	159.987	-0.013	0.008	-0.056	0.512
200.000	199.789	199.777	199.774	199.780	-0.220	0.015		0.631
160.000	159.937	159.932	159.925	159.931	-0.069	0.013	-0.056	0.512
120.000	120.082	120.079	120.073	120.078	0.078	0.009	-0.064	0.392
80.000	80.157	80.154	80.148	80.153	0.153	0.008	-0.031	0.264
40.000	40.118	40.113	40.113	40.115	0.115	0.005	-0.013	0.140
0.000	-0.006	-0.008	-0.010	-0.008	-0.008	0.004		0.019

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0070
Electronics	155
Node Type	7001
Hardware Version	5.01
Software Version	8.01

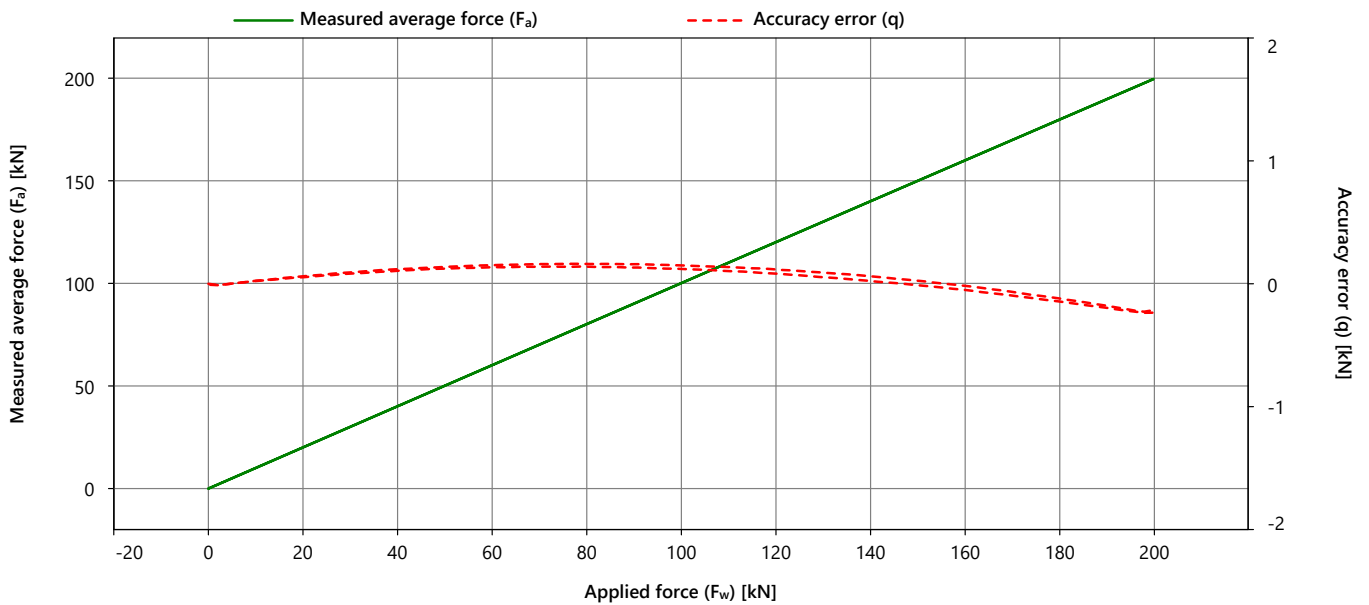
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031888

Calibration Details	
Calibration Date	09 Nov 2023 08:53:42
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.214
Max repeatability error (b)	[kN]	0.008
Max reversibility error (v)	[kN]	0.033
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	-0.049
Resolution	[kN]	8.71E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.017



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.004	-0.001	-0.003	0.000	0.000	0.006		0.020
40.000	40.118	40.120	40.120	40.119	0.119	0.002	-0.014	0.140
80.000	80.162	80.162	80.162	80.162	0.162	0.000	-0.022	0.263
120.000	120.115	120.114	120.117	120.115	0.115	0.003	-0.033	0.386
160.000	159.983	159.983	159.983	159.983	-0.017	0.000	-0.033	0.509
200.000	199.791	199.782	199.786	199.786	-0.214	0.008		0.631
160.000	159.954	159.949	159.948	159.950	-0.050	0.006	-0.033	0.509
120.000	120.084	120.084	120.080	120.083	0.083	0.004	-0.033	0.386
80.000	80.143	80.139	80.136	80.139	0.139	0.007	-0.022	0.263
40.000	40.106	40.105	40.105	40.105	0.105	0.001	-0.014	0.140
0.000	-0.008	-0.006	-0.009	-0.008	-0.008	0.002		0.018

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0070
Electronics	155
Node Type	7001
Hardware Version	5.01
Software Version	8.01

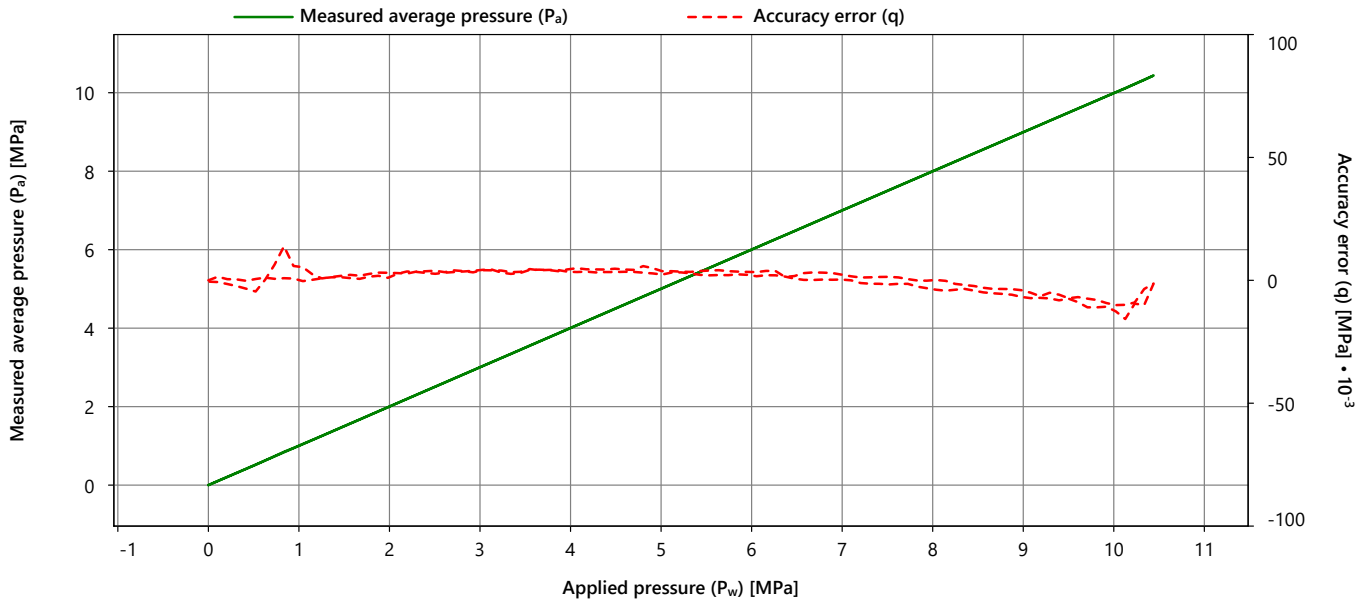
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031888

Calibration Details	
Calibration Date	09 Nov 2023 09:09:28
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.1.55350

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.010
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.004
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	-0.001
Resolution	[MPa]	2.19E-06
Noise RMS	[MPa]	0.002



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.004
2.000	2.001	2.001	2.002	2.001	0.001	0.001	0.002	0.006
4.000	4.004	4.004	4.006	4.005	0.005	0.002	-0.001	0.007
6.000	6.003	6.005	6.002	6.003	0.003	0.003	-0.001	0.008
8.000	8.003	7.999	7.999	8.000	0.000	0.004	-0.004	0.010
10.000	9.990	9.989	9.991	9.990	-0.010	0.001		0.008
8.000	7.997	7.997	7.995	7.996	-0.004	0.002	-0.004	0.009
6.000	6.003	6.001	6.002	6.002	0.002	0.002	-0.001	0.007
4.000	4.004	4.002	4.004	4.003	0.003	0.001	-0.001	0.006
2.000	2.003	2.004	2.002	2.003	0.003	0.001	0.002	0.006
0.000	-0.001	0.000	-0.001	-0.001	-0.001	0.000		0.004

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0070
Electronics	155
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

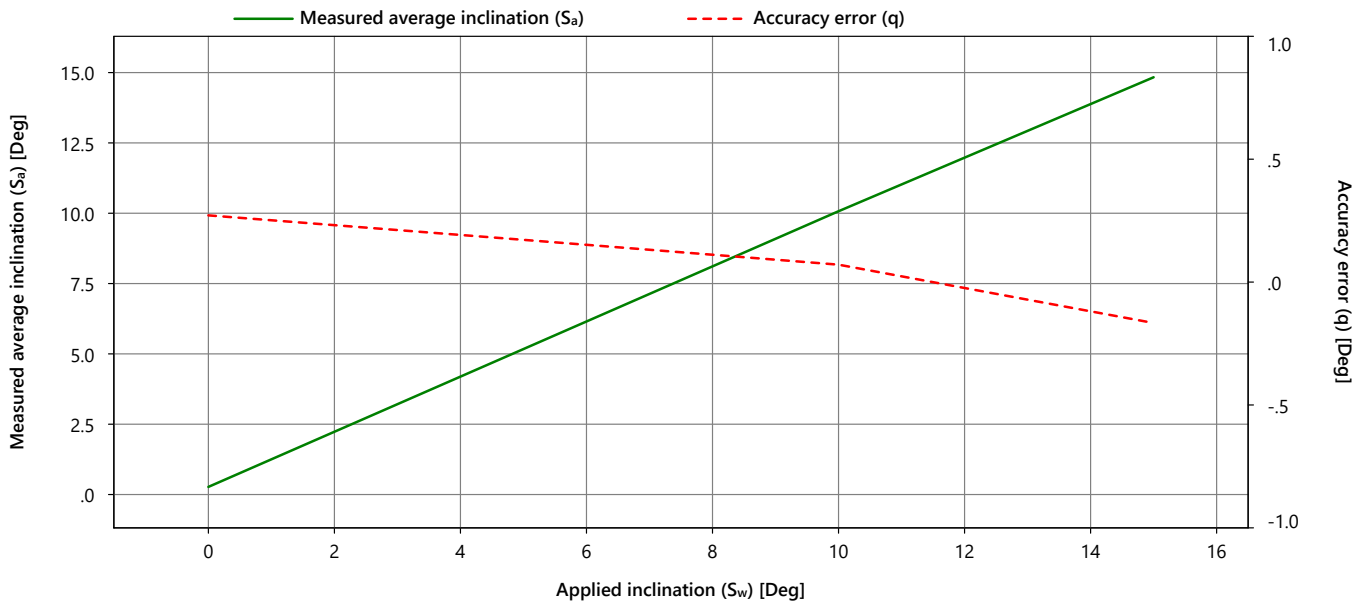
Certificate Number
FCN23031888

Calibration Details	
Calibration Date	09 Nov 2023 08:59:32
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.1.55350

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.3
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.25E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.2	0.2	0.4	0.3	0.3	0.3	0.8
5.0	5.1	5.2	5.3	5.2	0.2	0.2	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.8	14.8	14.8	14.8	-0.2	0.0	0.7

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Symbols, Definitions and References

Certificate Number

FCN23031888

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0070

Appendix Applicable to
Certificate Number
FCN23031888

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

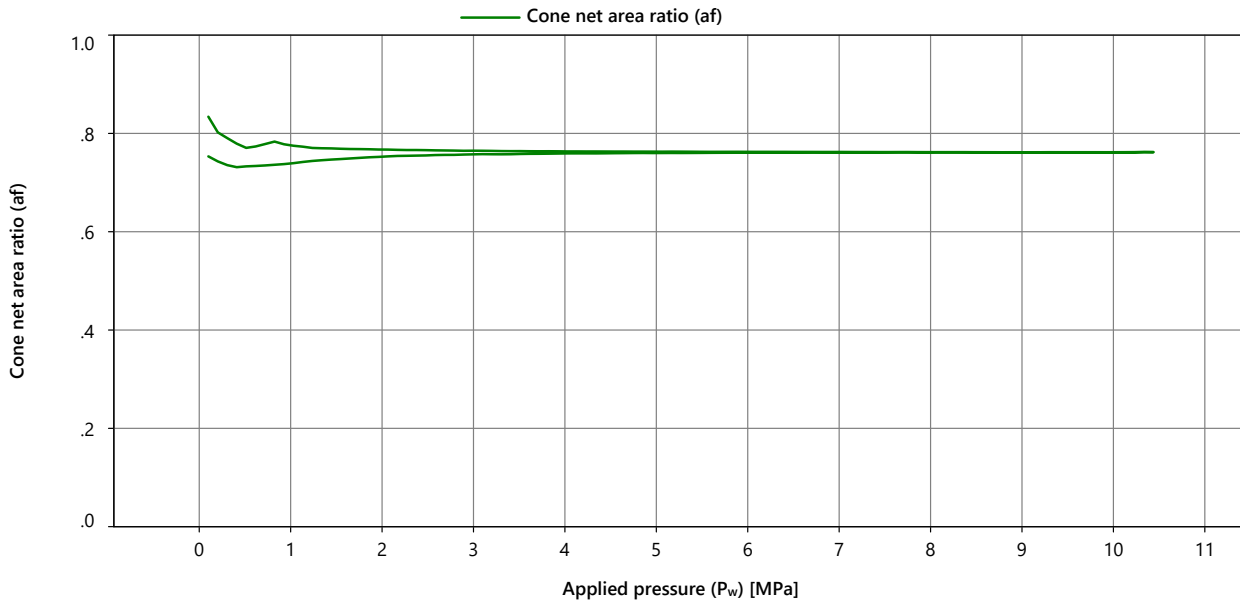
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0070	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	155	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 09:09:28
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031888

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.751	0.753	0.754	0.753
4.000	0.758	0.759	0.760	0.759
6.000	0.760	0.761	0.761	0.761
8.000	0.761	0.761	0.762	0.762
10.000	0.761	0.762	0.762	0.762
8.000	0.761	0.762	0.762	0.762
6.000	0.762	0.763	0.763	0.763
4.000	0.762	0.763	0.765	0.763
2.000	0.765	0.768	0.768	0.767

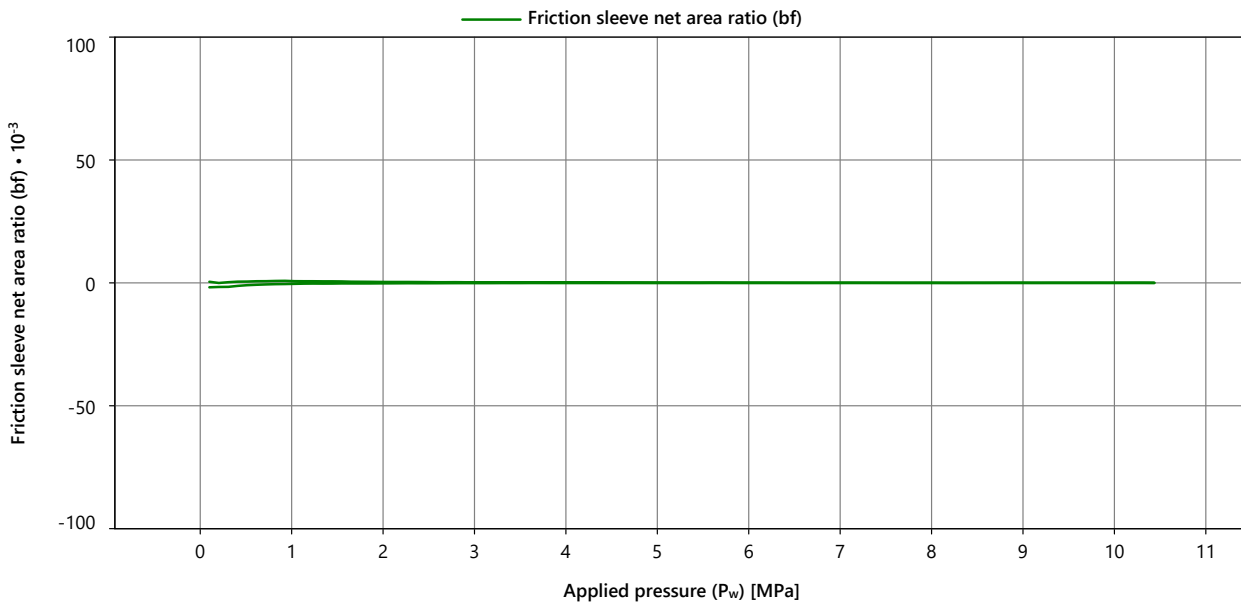
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0070	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	155	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 09:09:28
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031888

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	-0.00001

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031888

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031889

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0083

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 09-Nov-2023

Calibrate before 09-May-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 10-Nov-2023

This certificate is issued provided that Fugro assumes no liability.

Ruud Schrijvers
Deputy Manager Transducer Workshop

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Page 1 of 6



Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0083
Electronics	151
Node Type	7001
Hardware Version	5.01
Software Version	8.01

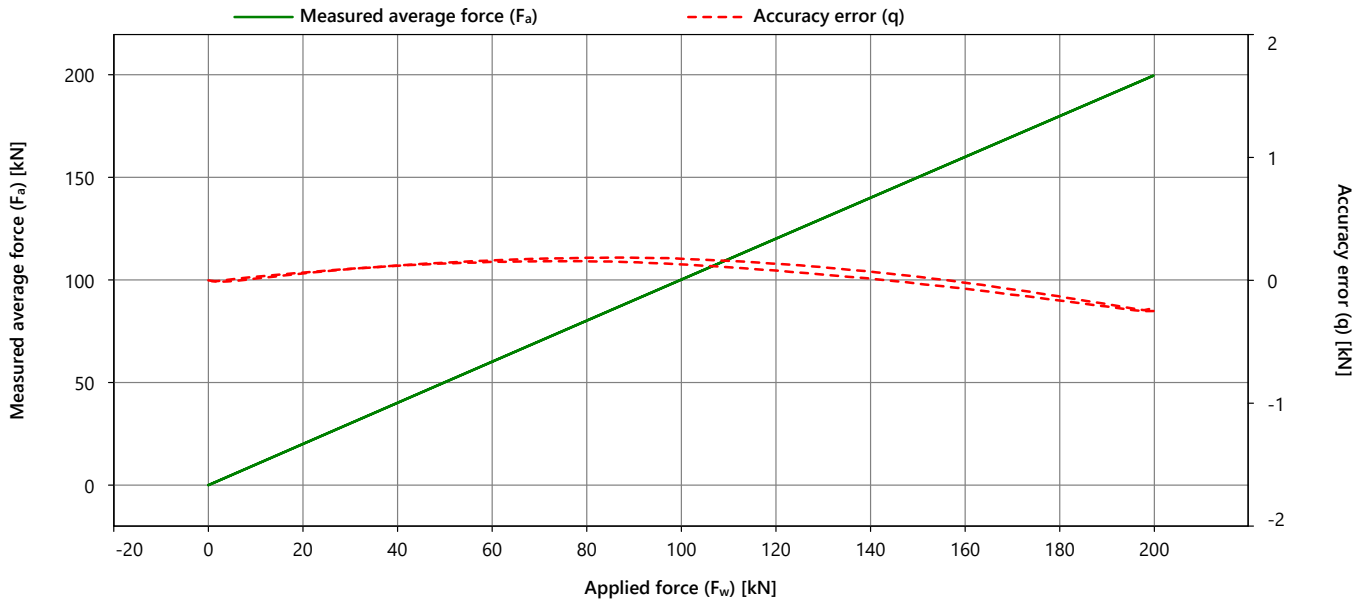
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031889

Calibration Details	
Calibration Date	09 Nov 2023 09:13:27
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.224
Max repeatability error (b)	[kN]	0.022
Max reversibility error (v)	[kN]	0.054
Zero load error (F _{c0})	[kN]	0.007
Zero load offset (F ₀)	[kN]	-0.012
Resolution	[kN]	8.66E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.002	0.001	-0.003	0.000	0.000	0.005		0.018
40.000	40.125	40.120	40.118	40.121	0.121	0.006	-0.003	0.139
80.000	80.186	80.185	80.181	80.184	0.184	0.005	-0.030	0.264
120.000	120.139	120.133	120.131	120.134	0.134	0.008	-0.054	0.390
160.000	159.983	159.979	159.977	159.980	-0.020	0.006	-0.048	0.511
200.000	199.790	199.770	199.768	199.776	-0.224	0.022		0.631
160.000	159.936	159.931	159.930	159.932	-0.068	0.006	-0.048	0.511
120.000	120.088	120.076	120.077	120.080	0.080	0.012	-0.054	0.390
80.000	80.159	80.153	80.152	80.155	0.155	0.007	-0.030	0.264
40.000	40.122	40.119	40.114	40.118	0.118	0.008	-0.003	0.139
0.000	-0.005	-0.008	-0.007	-0.007	-0.007	0.003		0.018

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0083
Electronics	151
Node Type	7001
Hardware Version	5.01
Software Version	8.01

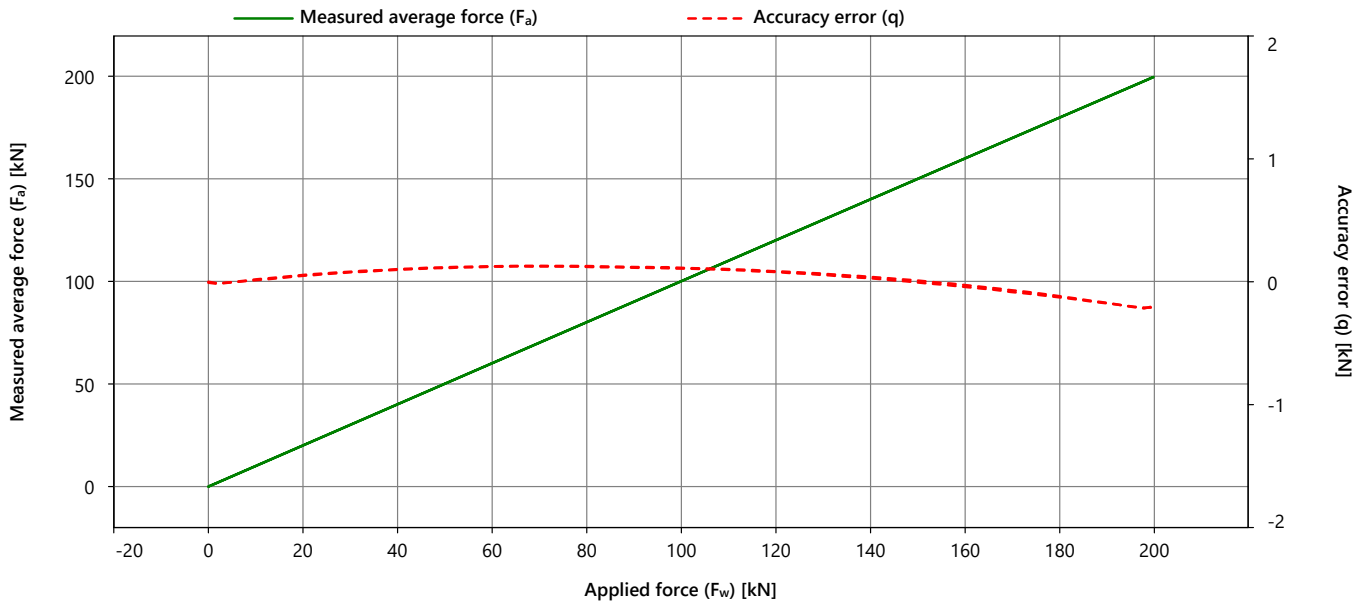
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031889

Calibration Details	
Calibration Date	09 Nov 2023 09:13:27
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.196
Max repeatability error (b)	[kN]	0.026
Max reversibility error (v)	[kN]	0.015
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	-0.020
Resolution	[kN]	8.69E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.030



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.002	0.002	-0.005	0.000	0.000	0.007		0.020
40.000	40.109	40.102	40.099	40.103	0.103	0.010	-0.006	0.139
80.000	80.131	80.127	80.125	80.127	0.127	0.006	-0.007	0.262
120.000	120.089	120.085	120.082	120.085	0.085	0.007	-0.006	0.385
160.000	159.977	159.972	159.970	159.973	-0.027	0.008	-0.015	0.508
200.000	199.820	199.798	199.794	199.804	-0.196	0.026		0.631
160.000	159.963	159.957	159.954	159.958	-0.042	0.008	-0.015	0.508
120.000	120.087	120.076	120.075	120.079	0.079	0.012	-0.006	0.385
80.000	80.127	80.120	80.115	80.121	0.121	0.011	-0.007	0.262
40.000	40.101	40.097	40.094	40.097	0.097	0.008	-0.006	0.139
0.000	-0.006	-0.008	-0.009	-0.008	-0.008	0.003		0.019

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0083
Electronics	151
Node Type	7001
Hardware Version	5.01
Software Version	8.01

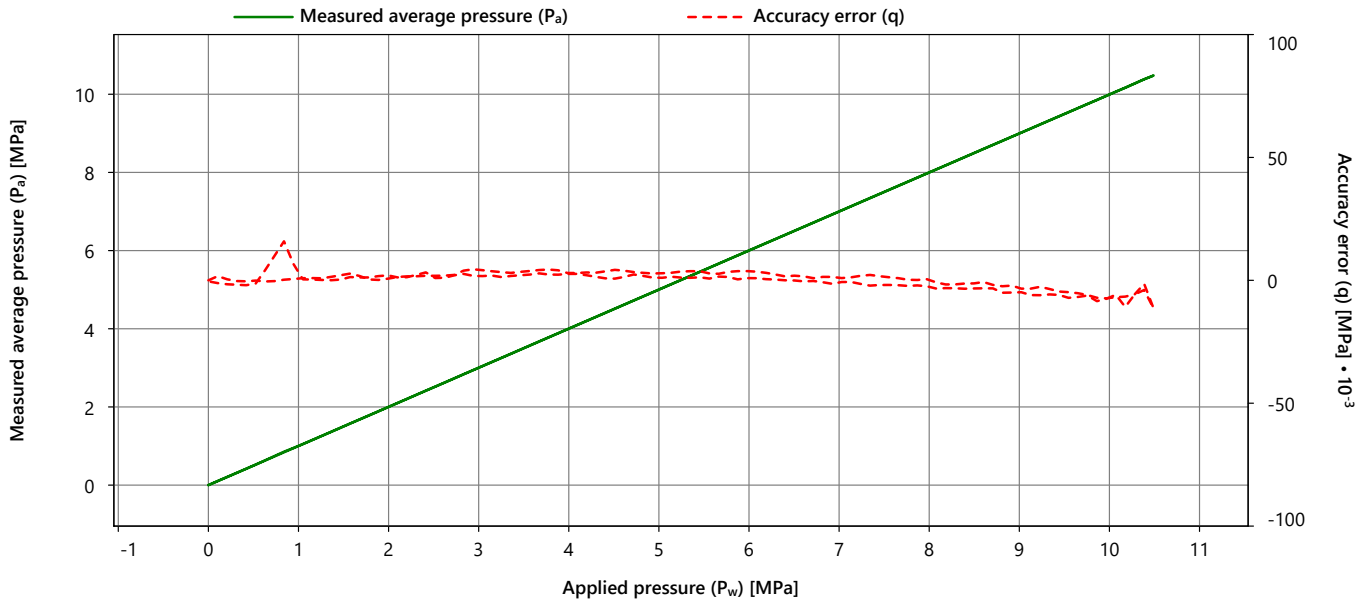
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031889

Calibration Details	
Calibration Date	09 Nov 2023 10:21:07
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.1.55350

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.007
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	-0.006
Resolution	[MPa]	2.48E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.002	2.001	2.000	2.001	0.001	0.002	0.001	0.005
4.000	4.005	4.003	4.001	4.003	0.003	0.003	0.000	0.007
6.000	6.005	6.004	6.003	6.004	0.004	0.002	-0.003	0.007
8.000	8.000	8.001	8.000	8.000	0.000	0.001	-0.003	0.007
10.000	9.991	9.993	9.993	9.993	-0.007	0.002		0.008
8.000	7.998	7.996	7.998	7.997	-0.003	0.001	-0.003	0.007
6.000	6.001	6.001	6.000	6.001	0.001	0.001	-0.003	0.007
4.000	4.002	4.003	4.003	4.003	0.003	0.000	0.000	0.004
2.000	2.002	2.001	2.003	2.002	0.002	0.002	0.001	0.005
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0083
Electronics	151
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

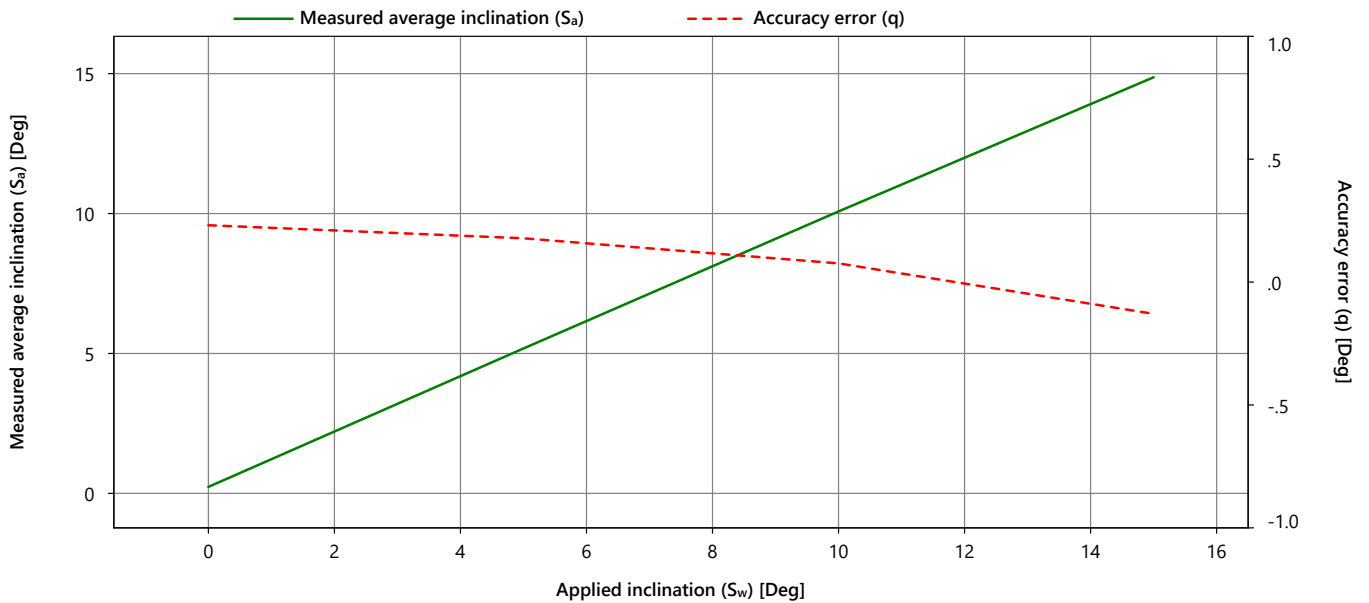
Certificate Number
FCN23031889

Calibration Details	
Calibration Date	09 Nov 2023 09:16:59
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.1.55350

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.28E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.2	0.4	0.2	0.2	0.3	0.8
5.0	5.1	5.2	5.3	5.2	0.2	0.2	0.8
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.9	14.8	14.8	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031889

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0083

Appendix Applicable to
Certificate Number
FCN23031889

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

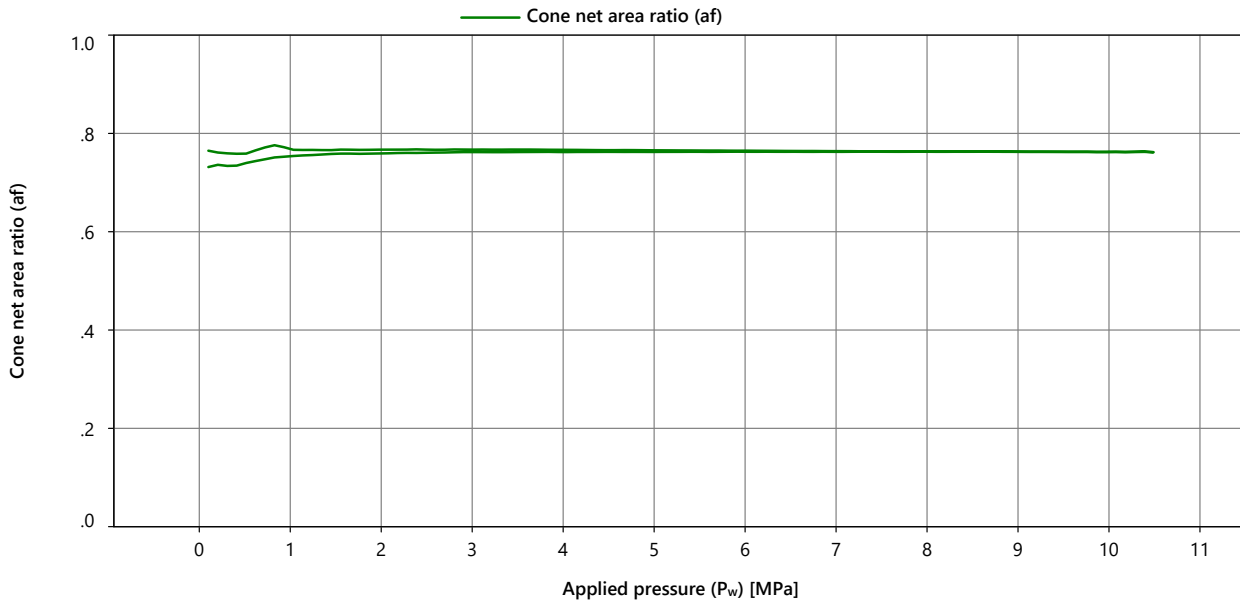
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0083	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	151	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 10:21:07
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031889

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.760	0.759	0.759	0.759
4.000	0.762	0.762	0.762	0.762
6.000	0.763	0.763	0.763	0.763
8.000	0.763	0.763	0.763	0.763
10.000	0.762	0.763	0.763	0.763
8.000	0.763	0.763	0.763	0.763
6.000	0.765	0.765	0.765	0.765
4.000	0.767	0.767	0.767	0.767
2.000	0.766	0.767	0.768	0.767

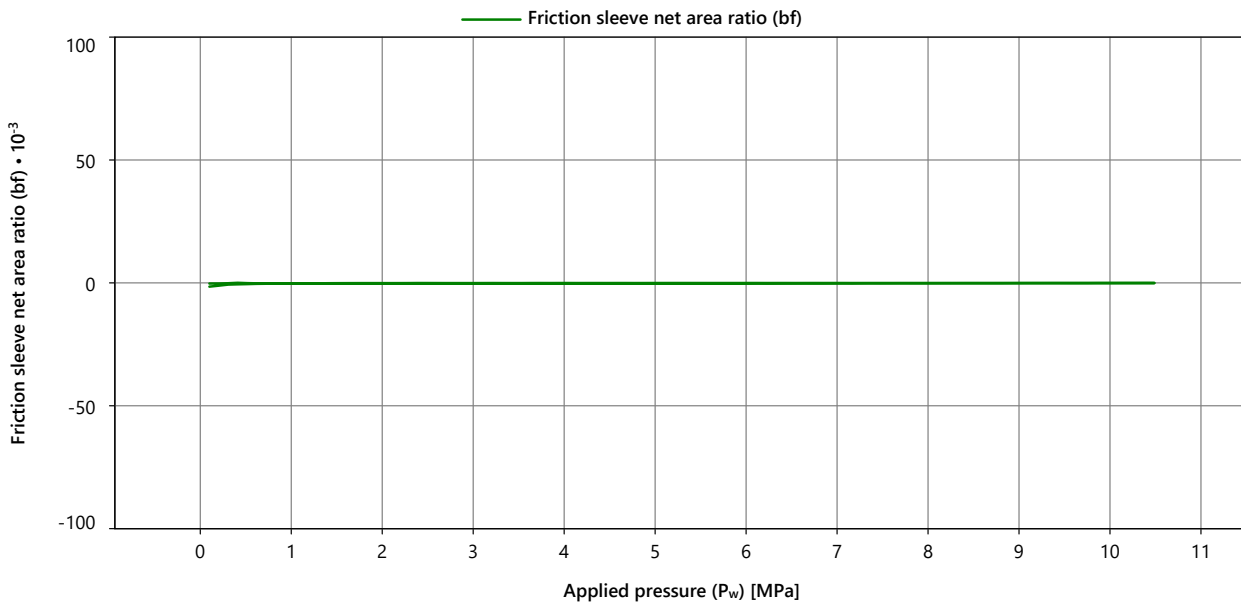
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0083	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	151	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 10:21:07
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

**Appendix Applicable to
Certificate Number
FCN23031889**

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	-0.00006

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031889

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
----------------	-----------------------------------

Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031890

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0084

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 09-Nov-2023

Calibrate before 09-May-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 10-Nov-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0084
Electronics	254
Node Type	7001
Hardware Version	5.01
Software Version	8.01

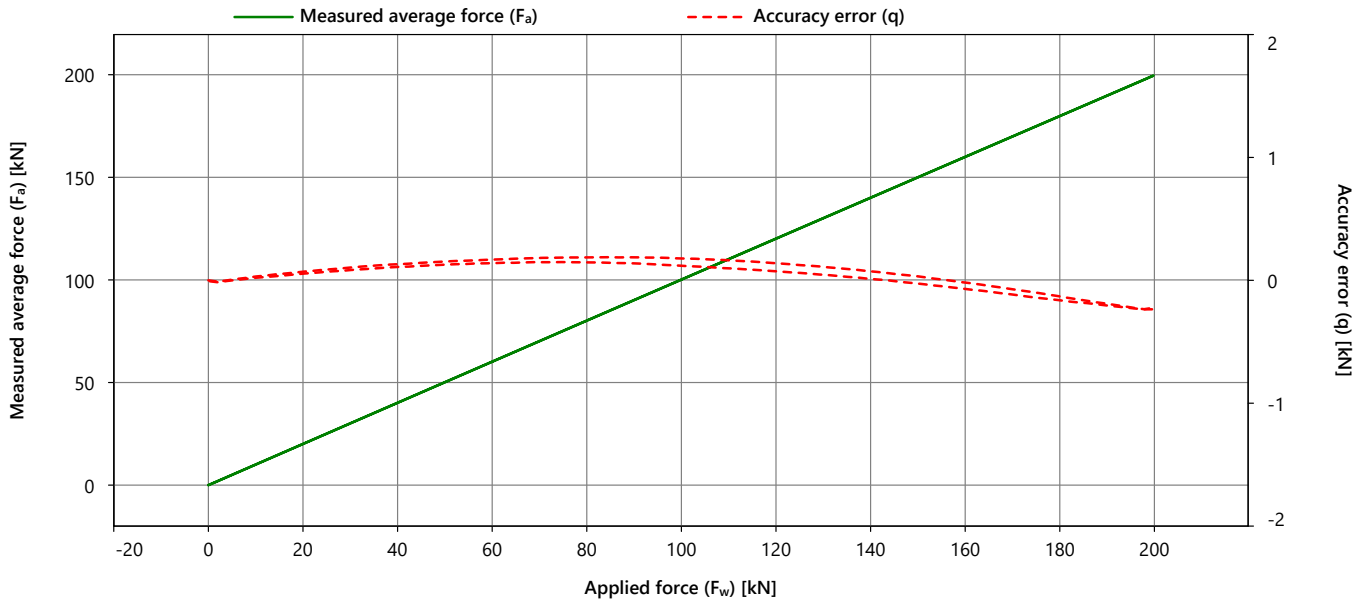
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031890

Calibration Details	
Calibration Date	09 Nov 2023 09:36:43
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.220
Max repeatability error (b)	[kN]	0.015
Max reversibility error (v)	[kN]	0.065
Zero load error (F _{c0})	[kN]	0.007
Zero load offset (F ₀)	[kN]	-0.020
Resolution	[kN]	8.67E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.003	-0.001	-0.002	0.000	0.000	0.005		0.018
40.000	40.134	40.131	40.127	40.131	0.131	0.006	-0.022	0.141
80.000	80.191	80.183	80.184	80.186	0.186	0.008	-0.040	0.266
120.000	120.145	120.140	120.131	120.139	0.139	0.014	-0.065	0.392
160.000	159.989	159.982	159.974	159.982	-0.018	0.015	-0.051	0.511
200.000	199.779	199.776	199.784	199.780	-0.220	0.008		0.630
160.000	159.935	159.932	159.924	159.930	-0.070	0.012	-0.051	0.511
120.000	120.078	120.074	120.069	120.074	0.074	0.009	-0.065	0.392
80.000	80.151	80.146	80.142	80.146	0.146	0.009	-0.040	0.266
40.000	40.112	40.110	40.105	40.109	0.109	0.008	-0.022	0.141
0.000	-0.006	-0.006	-0.008	-0.007	-0.007	0.002		0.018

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0084
Electronics	254
Node Type	7001
Hardware Version	5.01
Software Version	8.01

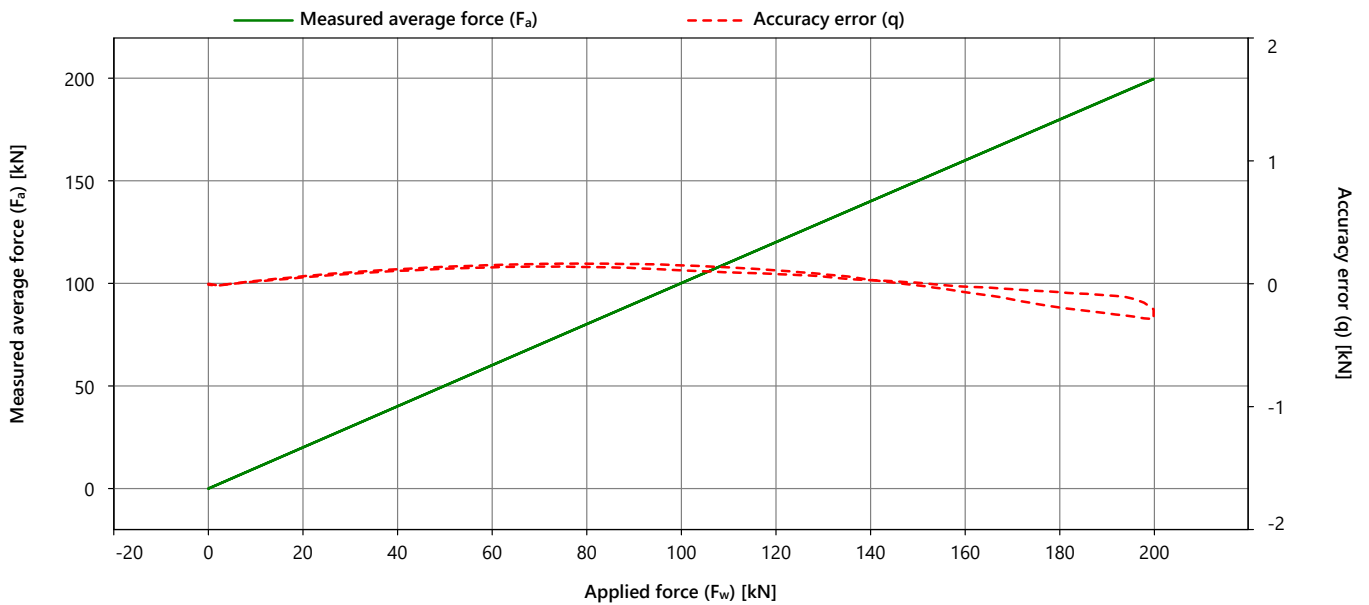
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031890

Calibration Details	
Calibration Date	09 Nov 2023 09:36:43
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.288
Max repeatability error (b)	[kN]	0.017
Max reversibility error (v)	[kN]	0.045
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	-0.027
Resolution	[kN]	8.69E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.010



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.003	-0.001	-0.001	0.000	0.000	0.004		0.019
40.000	40.120	40.118	40.117	40.118	0.118	0.003	-0.013	0.140
80.000	80.168	80.161	80.162	80.164	0.164	0.007	-0.028	0.264
120.000	120.113	120.107	120.105	120.109	0.109	0.008	-0.029	0.386
160.000	159.934	159.934	159.926	159.931	-0.069	0.008	0.045	0.510
200.000	199.706	199.710	199.721	199.712	-0.288	0.016		0.631
160.000	159.985	159.976	159.968	159.976	-0.024	0.017	0.045	0.511
120.000	120.084	120.079	120.075	120.079	0.079	0.009	-0.029	0.386
80.000	80.140	80.138	80.130	80.136	0.136	0.010	-0.028	0.264
40.000	40.108	40.106	40.101	40.105	0.105	0.007	-0.013	0.140
0.000	-0.007	-0.009	-0.008	-0.008	-0.008	0.001		0.019

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0084
Electronics	254
Node Type	7001
Hardware Version	5.01
Software Version	8.01

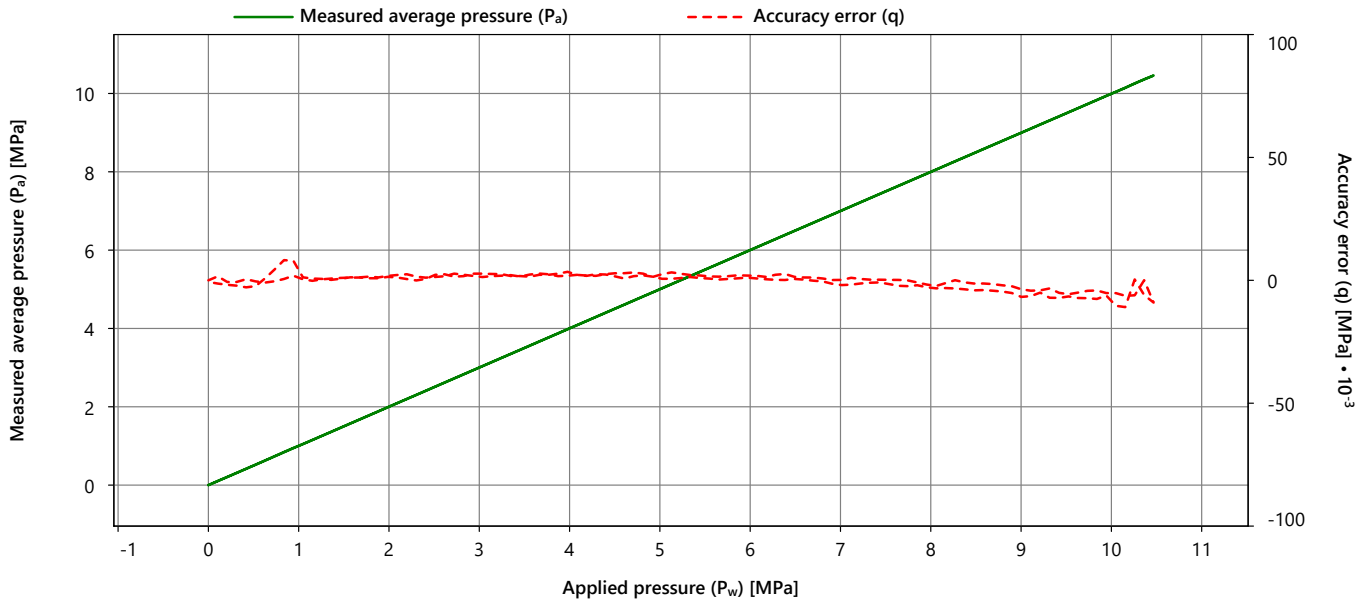
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031890

Calibration Details	
Calibration Date	09 Nov 2023 10:12:00
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.1.55350

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.005
Max repeatability error (b)	[MPa]	0.002
Max reversibility error (v)	[MPa]	0.001
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	-0.003
Resolution	[MPa]	2.42E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.001		0.003
2.000	2.002	2.000	2.002	2.001	0.001	0.002	0.000	0.004
4.000	4.003	4.003	4.004	4.003	0.003	0.001	-0.001	0.005
6.000	6.003	6.001	6.001	6.002	0.002	0.002	-0.001	0.006
8.000	7.997	8.000	7.997	7.998	-0.002	0.002	-0.001	0.007
10.000	9.995	9.995	9.995	9.995	-0.005	0.001		0.007
8.000	7.996	7.996	7.998	7.997	-0.003	0.002	-0.001	0.007
6.000	6.001	6.001	6.001	6.001	0.001	0.000	-0.001	0.006
4.000	4.002	4.002	4.002	4.002	0.002	0.000	-0.001	0.005
2.000	2.003	2.001	2.002	2.002	0.002	0.002	0.000	0.005
0.000	0.000	-0.001	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0084
Electronics	254
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

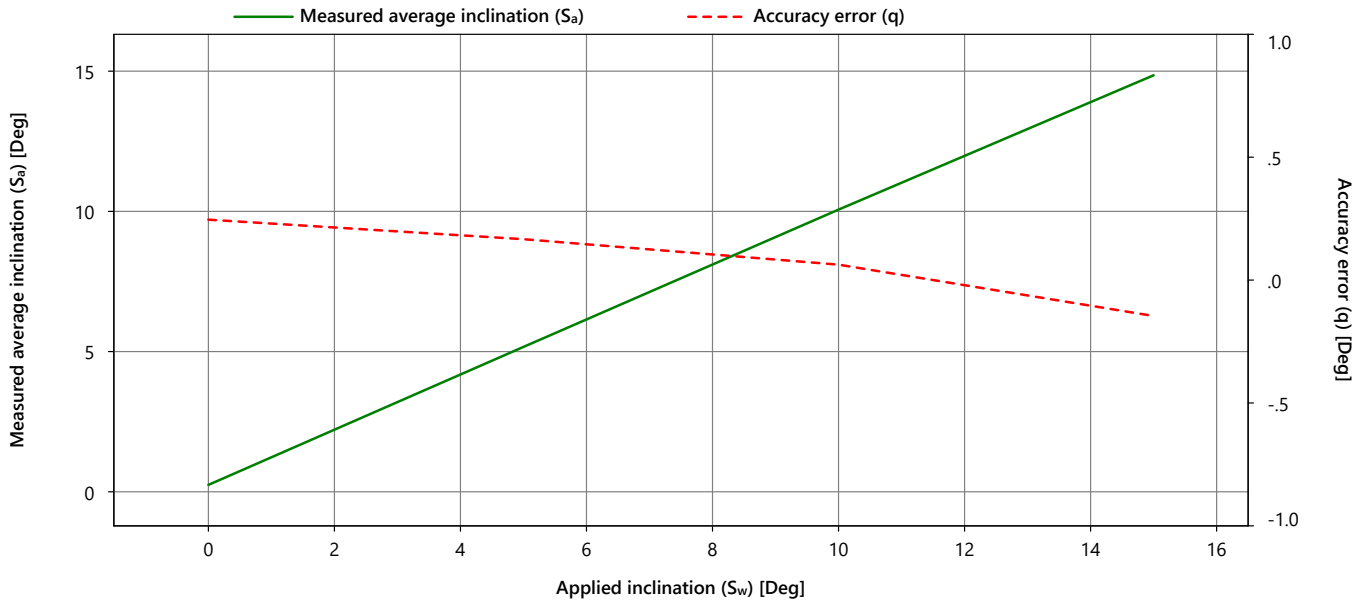
Certificate Number
FCN23031890

Calibration Details	
Calibration Date	09 Nov 2023 09:40:56
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.1.55350

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.27E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.2	0.2	0.3	0.2	0.2	0.1	0.7
5.0	5.0	5.2	5.2	5.2	0.2	0.2	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.2	0.7
15.0	14.9	14.8	14.9	14.9	-0.1	0.0	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031890

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0084

Appendix Applicable to
Certificate Number
FCN23031890

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

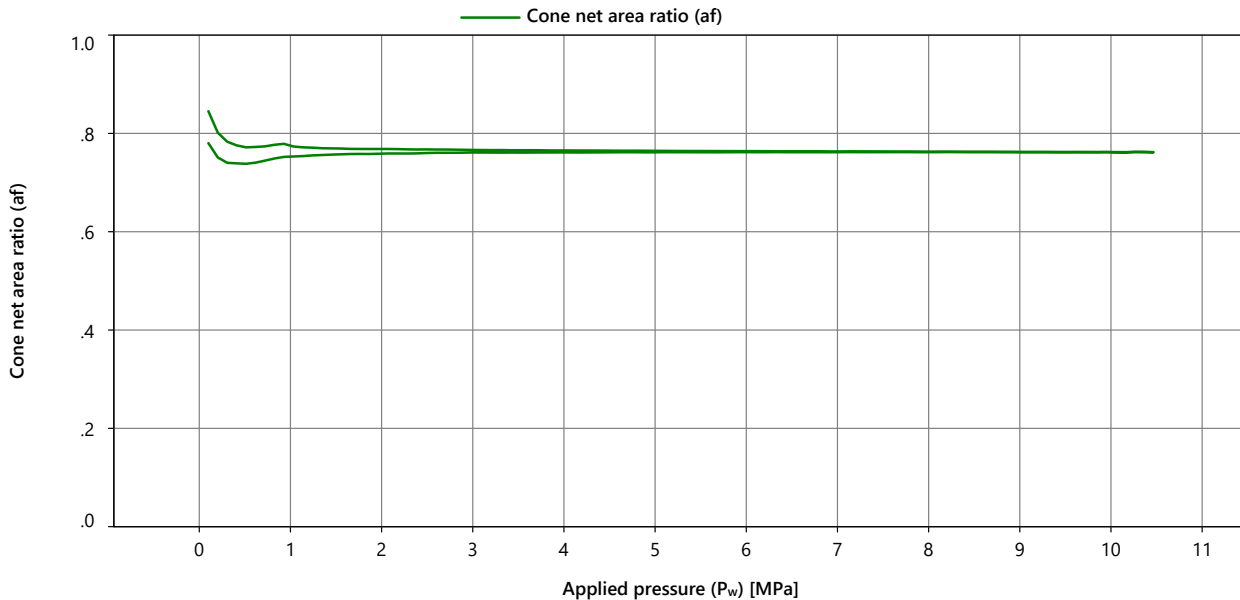
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0084	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	254	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 10:12:00
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031890

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.756	0.759	0.762	0.759
4.000	0.760	0.762	0.763	0.761
6.000	0.761	0.762	0.763	0.762
8.000	0.761	0.762	0.762	0.762
10.000	0.761	0.762	0.762	0.762
8.000	0.762	0.763	0.763	0.763
6.000	0.763	0.764	0.764	0.764
4.000	0.764	0.766	0.766	0.765
2.000	0.767	0.768	0.770	0.768

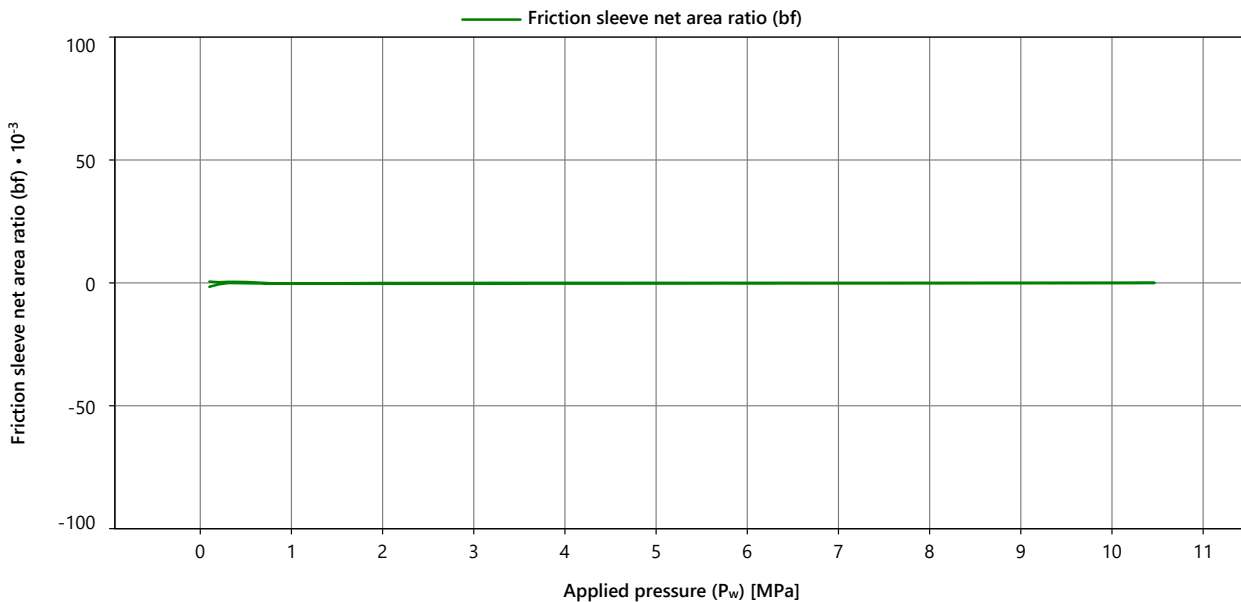
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0084	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	254	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 10:12:00
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031890

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	-0.00001

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031890

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031892

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0085

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration	20.5 ± 3 °C
Atmospheric pressure during calibration	1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 09-Nov-2023

Calibrate before 09-May-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 10-Nov-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0085
Electronics	255
Node Type	7001
Hardware Version	5.01
Software Version	8.01

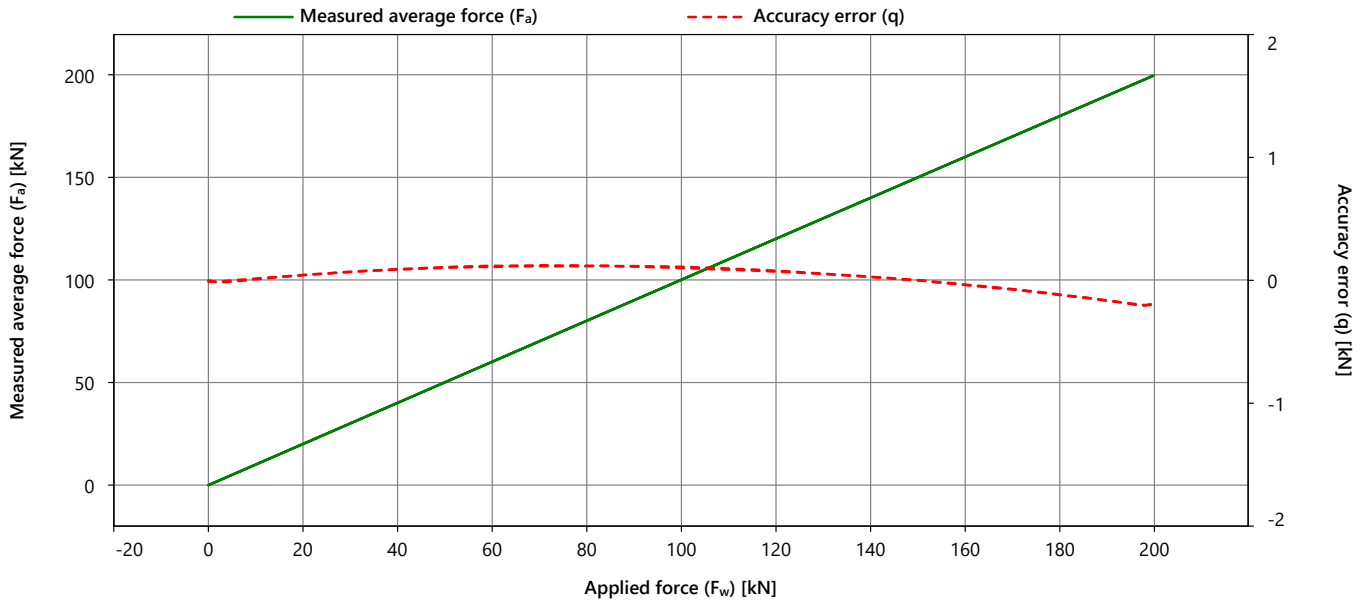
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031892

Calibration Details	
Calibration Date	09 Nov 2023 09:57:33
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.186
Max repeatability error (b)	[kN]	0.025
Max reversibility error (v)	[kN]	0.007
Zero load error (F _{c0})	[kN]	0.011
Zero load offset (F ₀)	[kN]	-0.018
Resolution	[kN]	8.65E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.001	0.001	-0.002	0.000	0.000	0.003		0.022
40.000	40.094	40.092	40.091	40.092	0.092	0.002	-0.004	0.139
80.000	80.118	80.120	80.117	80.118	0.118	0.003	-0.003	0.262
120.000	120.074	120.072	120.066	120.071	0.071	0.008	0.007	0.385
160.000	159.965	159.966	159.965	159.965	-0.035	0.001	-0.003	0.508
200.000	199.831	199.806	199.806	199.814	-0.186	0.025		0.631
160.000	159.967	159.959	159.959	159.962	-0.038	0.008	-0.003	0.508
120.000	120.080	120.078	120.077	120.078	0.078	0.003	0.007	0.385
80.000	80.118	80.114	80.113	80.115	0.115	0.005	-0.003	0.262
40.000	40.092	40.088	40.084	40.088	0.088	0.008	-0.004	0.139
0.000	-0.010	-0.010	-0.013	-0.011	-0.011	0.003		0.022

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0085
Electronics	255
Node Type	7001
Hardware Version	5.01
Software Version	8.01

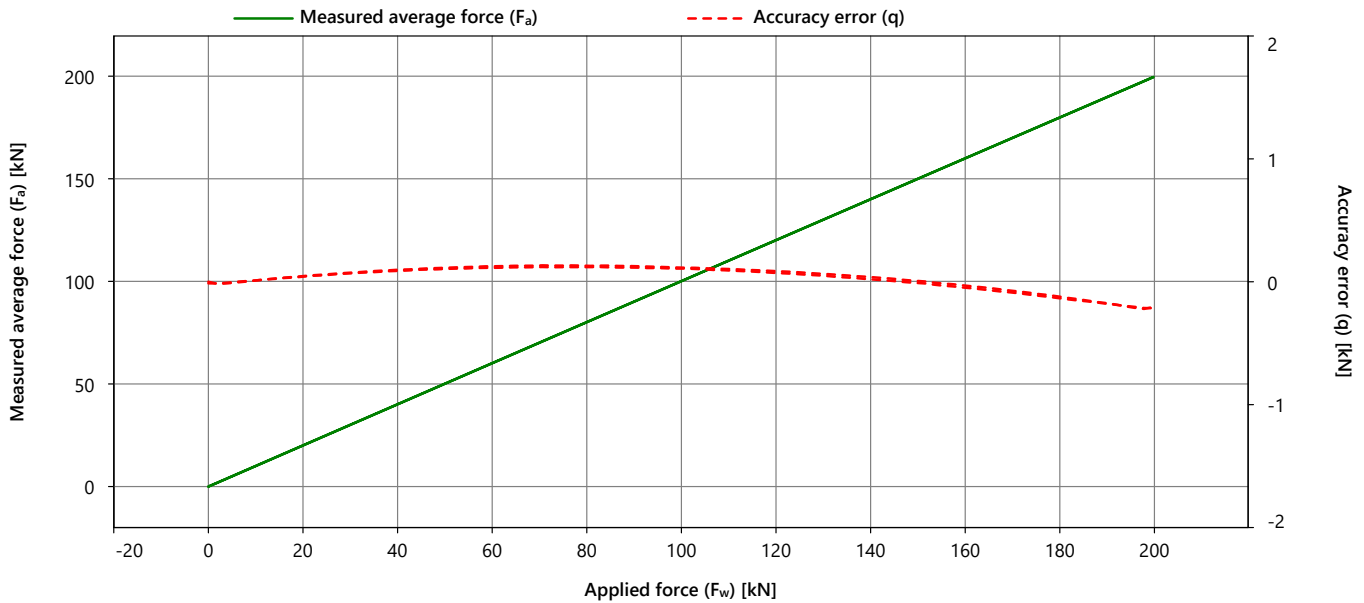
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031892

Calibration Details	
Calibration Date	09 Nov 2023 09:57:33
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.202
Max repeatability error (b)	[kN]	0.031
Max reversibility error (v)	[kN]	0.017
Zero load error (F _{c0})	[kN]	0.013
Zero load offset (F ₀)	[kN]	-0.021
Resolution	[kN]	8.67E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.011



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.000	0.003	-0.003	0.000	0.000	0.006		0.026
40.000	40.099	40.100	40.096	40.098	0.098	0.004	-0.010	0.140
80.000	80.131	80.131	80.129	80.130	0.130	0.002	-0.011	0.262
120.000	120.091	120.088	120.081	120.087	0.087	0.010	-0.015	0.385
160.000	159.969	159.970	159.968	159.969	-0.031	0.002	-0.017	0.508
200.000	199.818	199.789	199.787	199.798	-0.202	0.031		0.632
160.000	159.956	159.949	159.948	159.951	-0.049	0.008	-0.017	0.508
120.000	120.074	120.073	120.068	120.071	0.071	0.006	-0.015	0.385
80.000	80.121	80.118	80.118	80.119	0.119	0.003	-0.011	0.262
40.000	40.091	40.090	40.084	40.088	0.088	0.008	-0.010	0.140
0.000	-0.010	-0.013	-0.015	-0.013	-0.013	0.005		0.025

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0085
Electronics	255
Node Type	7001
Hardware Version	5.01
Software Version	8.01

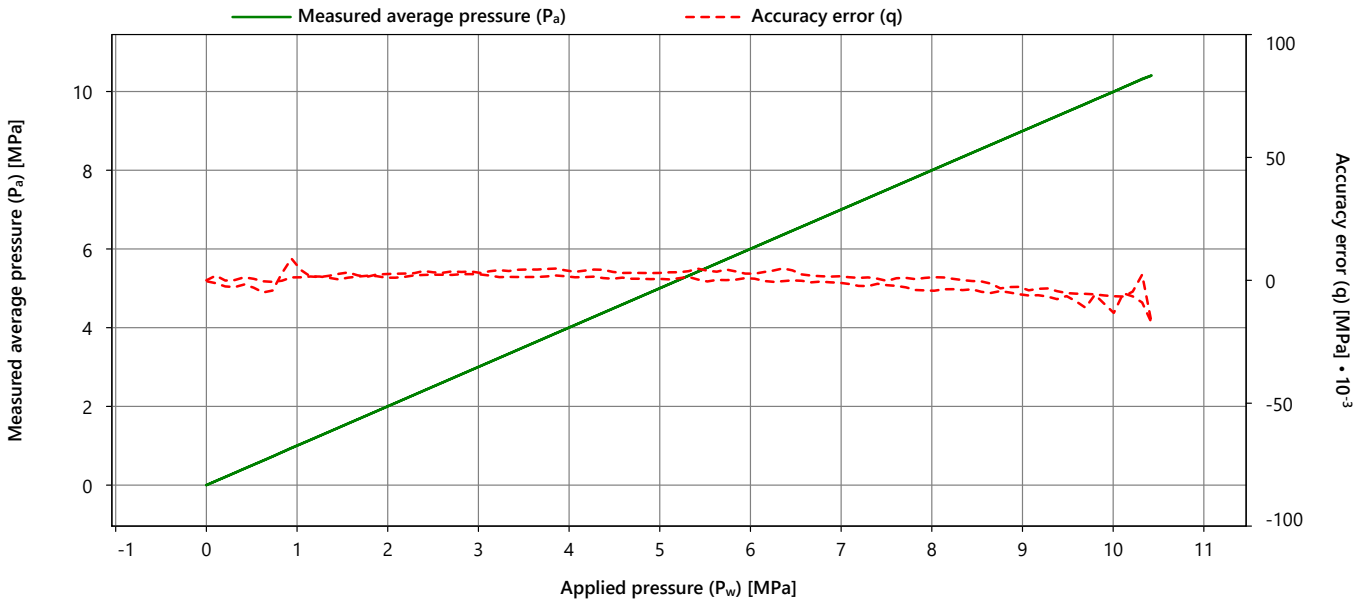
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031892

Calibration Details	
Calibration Date	09 Nov 2023 10:31:41
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.1.55350

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.006
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.005
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	-0.003
Resolution	[MPa]	2.36E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.002
2.000	2.005	2.001	2.002	2.003	0.003	0.004	-0.002	0.008
4.000	4.002	4.002	4.006	4.003	0.003	0.003	-0.002	0.007
6.000	6.002	6.004	6.003	6.003	0.003	0.002	-0.002	0.006
8.000	8.002	8.001	8.001	8.001	0.001	0.001	-0.005	0.011
10.000	9.994	9.994	9.993	9.994	-0.006	0.002		0.008
8.000	7.995	7.997	7.995	7.996	-0.004	0.002	-0.005	0.011
6.000	6.001	6.000	6.001	6.001	0.001	0.001	-0.002	0.006
4.000	4.001	4.002	4.001	4.002	0.002	0.001	-0.002	0.005
2.000	2.001	2.002	2.000	2.001	0.001	0.002	-0.002	0.005
0.000	0.000	-0.001	0.000	0.000	0.000	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0085
Electronics	255
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

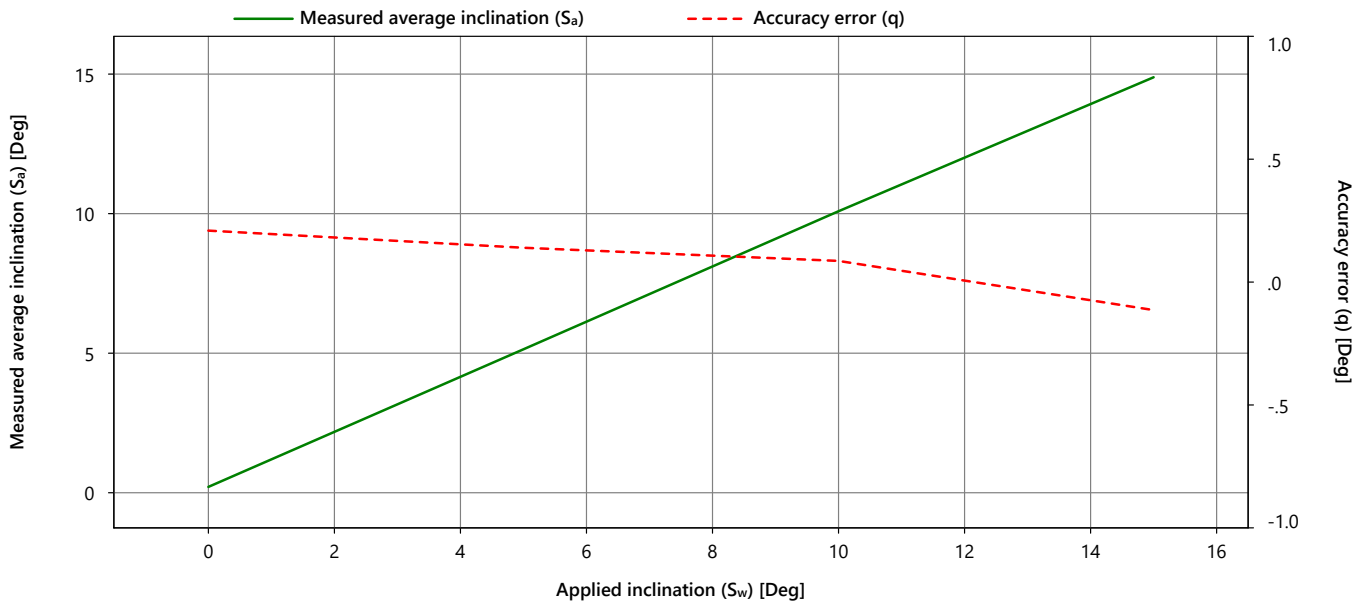
Certificate Number
FCN23031892

Calibration Details	
Calibration Date	09 Nov 2023 10:01:28
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.1.55350

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.27E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.2	0.3	0.2	0.2	0.2	0.7
5.0	5.0	5.1	5.2	5.1	0.1	0.2	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.9	14.9	14.8	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031892

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0085

Appendix Applicable to
Certificate Number
FCN23031892

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0085
Electronics	255
Node Type	7001
Hardware Version	5.01
Software Version	8.01

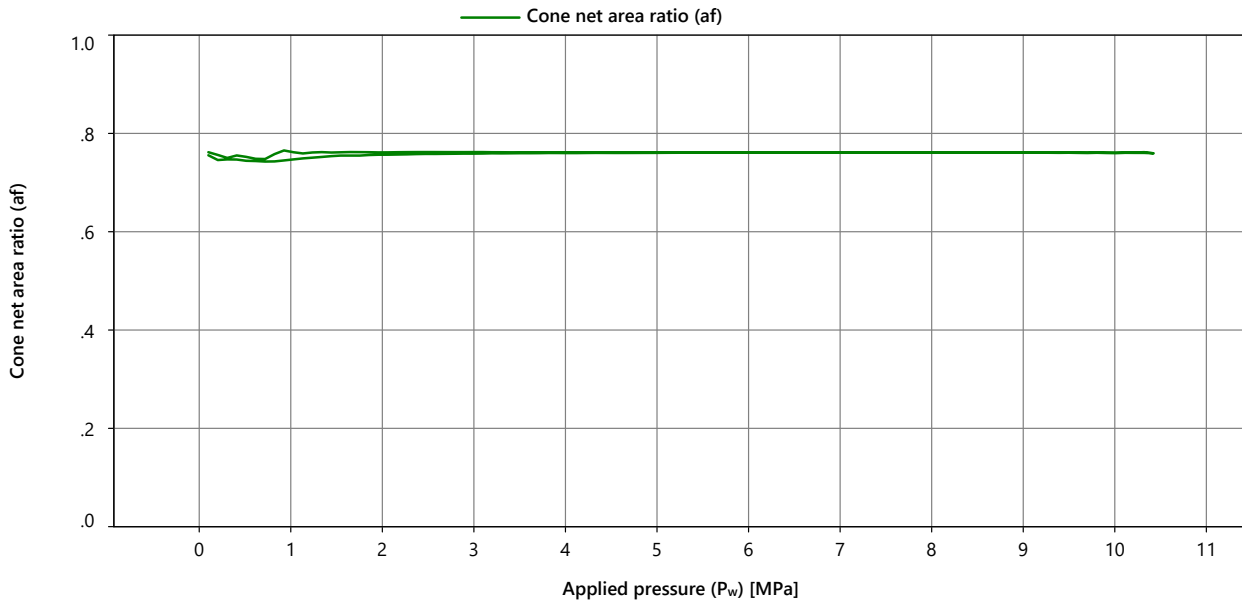
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23031892

Measurement Details	
Measurement Date	09 Nov 2023 10:31:41
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.758	0.756	0.756	0.757
4.000	0.760	0.760	0.760	0.760
6.000	0.761	0.761	0.761	0.761
8.000	0.761	0.761	0.761	0.761
10.000	0.761	0.761	0.761	0.761
8.000	0.761	0.761	0.761	0.761
6.000	0.761	0.761	0.762	0.761
4.000	0.762	0.762	0.762	0.762
2.000	0.762	0.762	0.761	0.761

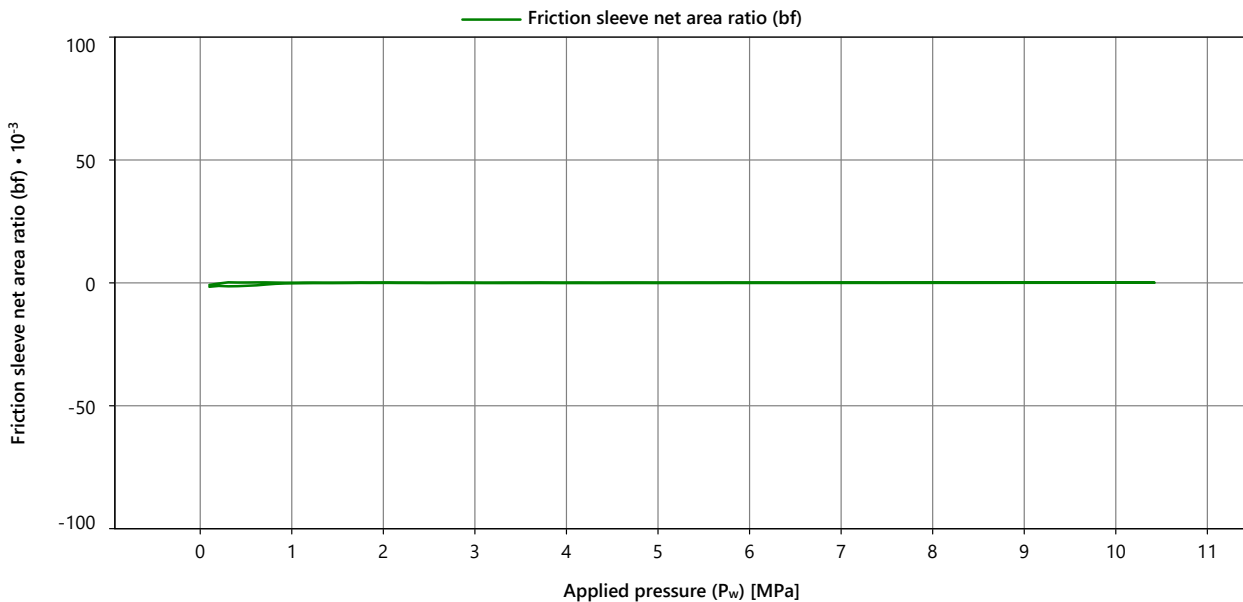
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0085	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	255	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 10:31:41
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031892

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00007

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031892

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
----------------	-----------------------------------

Quantities

P	Pressure
---	----------

Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031903

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF100PB7SN2-P1E2M4-V3
Serial Number 1701-3549

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 09-Nov-2023

Calibrate before 09-May-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 100 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 100 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Kistler 4043A70V0408	0 to 7 MPa	0 to 10.5 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 10-Nov-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB7SN2-P1 E2M4-V3
Serial Number	1701-3549
Electronics	9351
Node Type	7001
Hardware Version	6.00
Software Version	8.01

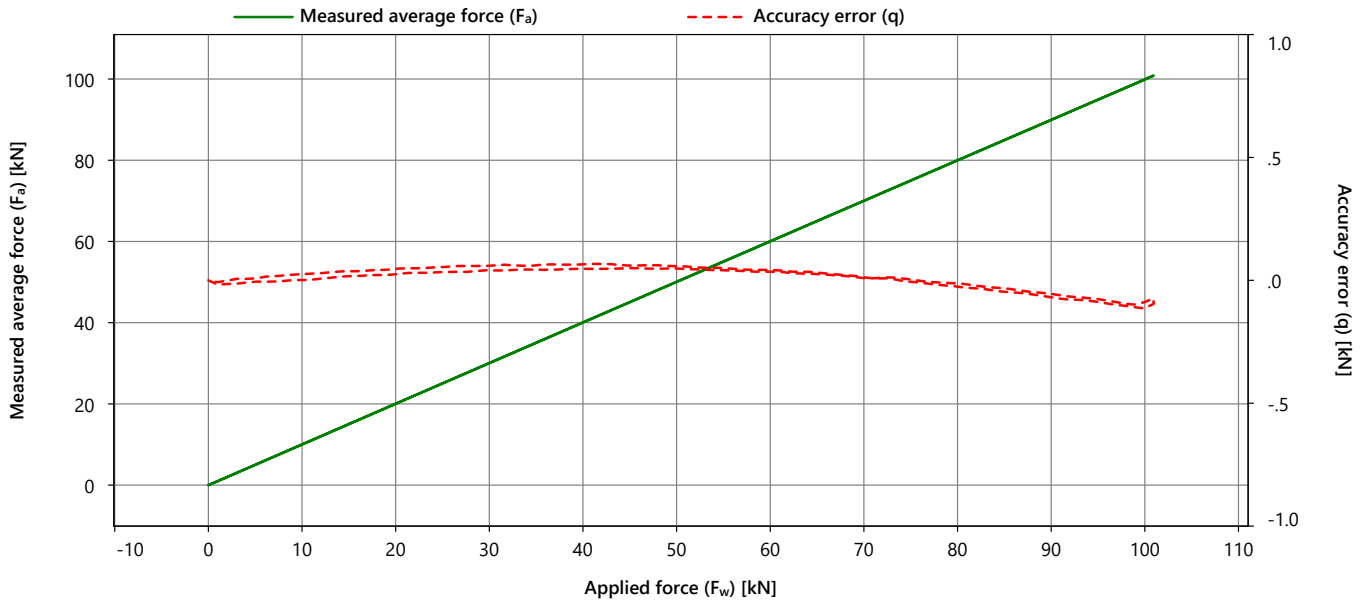
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031903

Calibration Details	
Calibration Date	09 Nov 2023 12:39:19
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 100 kN
Maximum Rating	0 to 100 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.088
Max repeatability error (b)	[kN]	0.012
Max reversibility error (v)	[kN]	0.022
Zero load error (F _{c0})	[kN]	0.003
Zero load offset (F ₀)	[kN]	-0.005
Resolution	[kN]	5.64E-05
Noise RMS	[kN]	0.002



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	-0.003	0.003	0.000	0.000	0.000	0.007		0.018
20.000	20.025	20.026	20.024	20.025	0.025	0.002	0.022	0.081
40.000	40.049	40.047	40.045	40.047	0.047	0.004	0.018	0.140
60.000	60.037	60.034	60.034	60.035	0.035	0.003	0.007	0.200
80.000	79.988	79.992	79.982	79.987	-0.013	0.010	-0.013	0.262
100.000	99.920	99.907	99.909	99.912	-0.088	0.012		0.323
80.000	79.975	79.975	79.973	79.974	-0.026	0.002	-0.013	0.262
60.000	60.040	60.038	60.049	60.042	0.042	0.011	0.007	0.201
40.000	40.066	40.065	40.063	40.065	0.065	0.003	0.018	0.140
20.000	20.046	20.043	20.051	20.047	0.047	0.007	0.022	0.082
0.000	0.000	0.000	-0.008	-0.003	-0.003	0.008		0.019

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB7SN2-P1 E2M4-V3
Serial Number	1701-3549
Electronics	9351
Node Type	7001
Hardware Version	6.00
Software Version	8.01

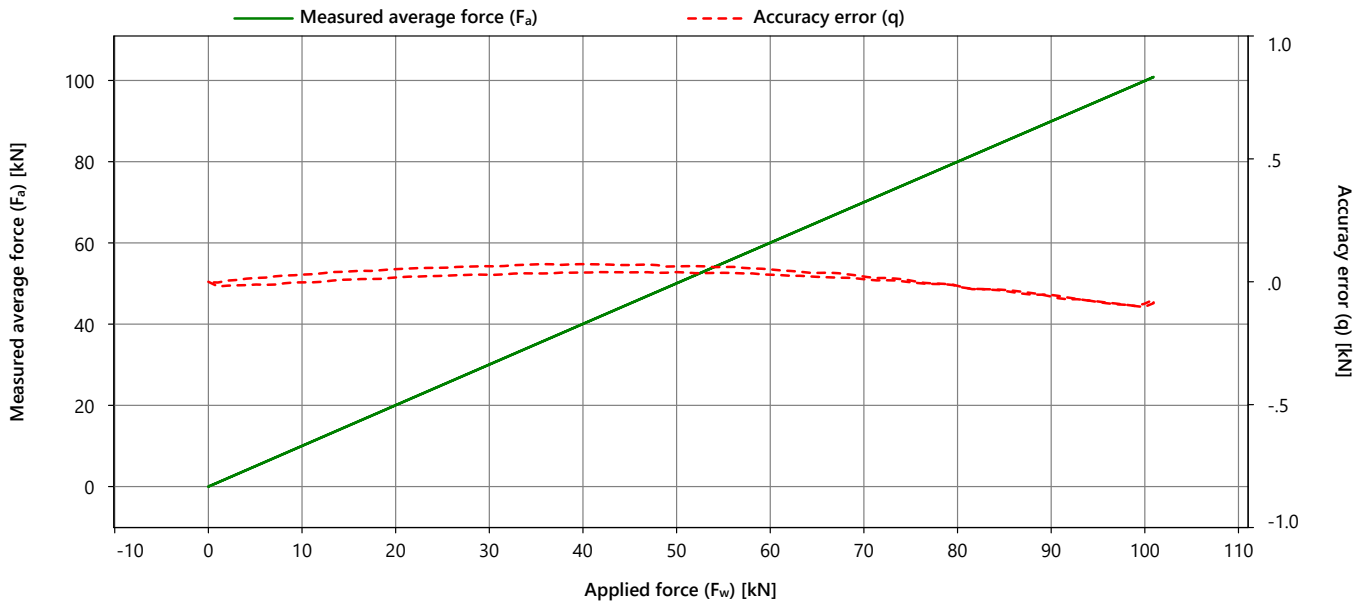
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031903

Calibration Details	
Calibration Date	09 Nov 2023 12:39:19
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 100 kN
Maximum Rating	0 to 100 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.088
Max repeatability error (b)	[kN]	0.017
Max reversibility error (v)	[kN]	0.034
Zero load error (F _{c0})	[kN]	0.002
Zero load offset (F ₀)	[kN]	-0.021
Resolution	[kN]	5.62E-05
Noise RMS	[kN]	0.003
Tip-Sleeve Interaction %	[%]	0.049



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	-0.001	0.005	-0.003	0.000	0.000	0.008		0.019
20.000	20.020	20.017	20.016	20.018	0.018	0.004	0.034	0.087
40.000	40.039	40.041	40.033	40.038	0.038	0.007	0.034	0.144
60.000	60.028	60.029	60.029	60.028	0.028	0.001	0.022	0.202
80.000	79.985	79.975	79.987	79.982	-0.018	0.012	0.001	0.262
100.000	99.918	99.915	99.902	99.912	-0.088	0.017		0.324
80.000	79.982	79.989	79.980	79.984	-0.016	0.008	0.001	0.262
60.000	60.048	60.052	60.051	60.050	0.050	0.003	0.022	0.202
40.000	40.069	40.073	40.072	40.072	0.072	0.004	0.034	0.144
20.000	20.052	20.051	20.051	20.051	0.051	0.001	0.034	0.087
0.000	-0.003	-0.002	-0.001	-0.002	-0.002	0.001		0.016

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB7SN2-P1 E2M4-V3
Serial Number	1701-3549
Electronics	9351
Node Type	7001
Hardware Version	6.00
Software Version	8.01

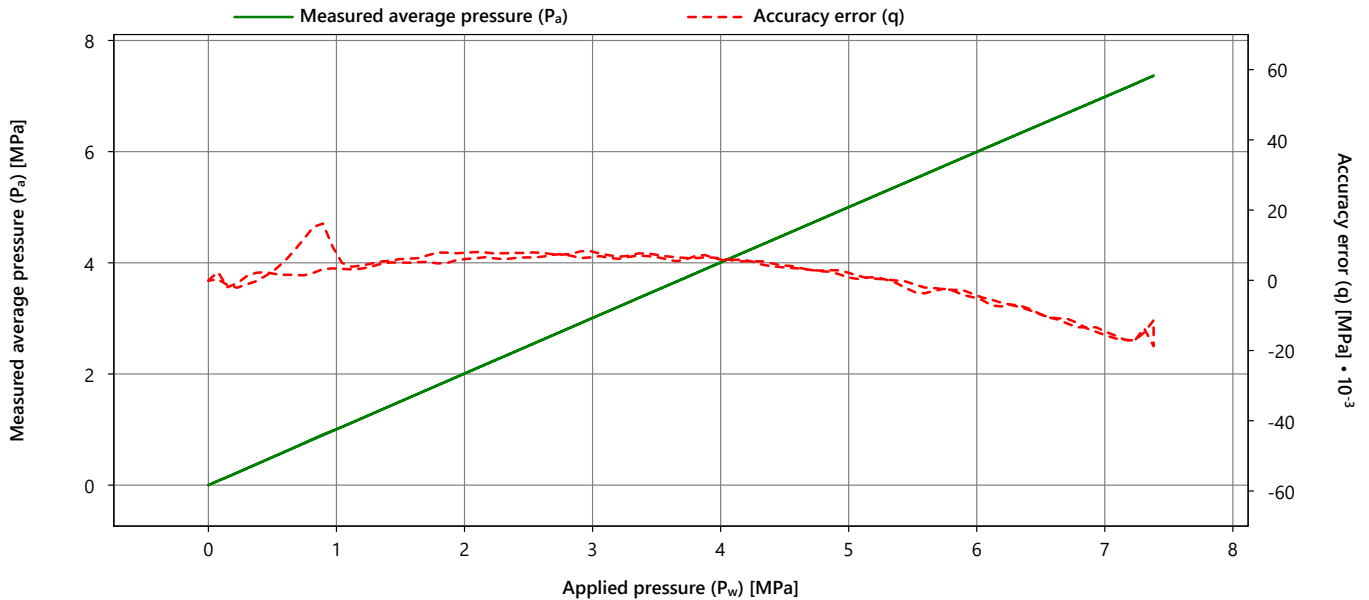
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031903

Calibration Details	
Calibration Date	09 Nov 2023 13:07:21
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.1.55350

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Kistler 4043A70V0408
Calibrated Range	0 to 7 MPa
Maximum Rating	0 to 10.5 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.016
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.002
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	-0.001
Resolution	[MPa]	2.68E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.002
1.400	1.405	1.405	1.406	1.405	0.005	0.001	0.000	0.003
2.800	2.808	2.806	2.808	2.807	0.007	0.002	0.000	0.005
4.200	4.205	4.206	4.206	4.206	0.006	0.001	0.000	0.005
5.600	5.595	5.597	5.596	5.596	-0.004	0.002	0.002	0.006
7.000	6.986	6.984	6.983	6.984	-0.016	0.003		0.007
5.600	5.599	5.598	5.597	5.598	-0.002	0.003	0.002	0.006
4.200	4.205	4.206	4.205	4.205	0.005	0.001	0.000	0.005
2.800	2.808	2.807	2.807	2.807	0.007	0.002	0.000	0.004
1.400	1.405	1.405	1.406	1.405	0.005	0.001	0.000	0.004
0.000	0.000	0.000	0.000	0.000	0.000	0.001		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB7SN2-P1 E2M4-V3
Serial Number	1701-3549
Electronics	9351
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

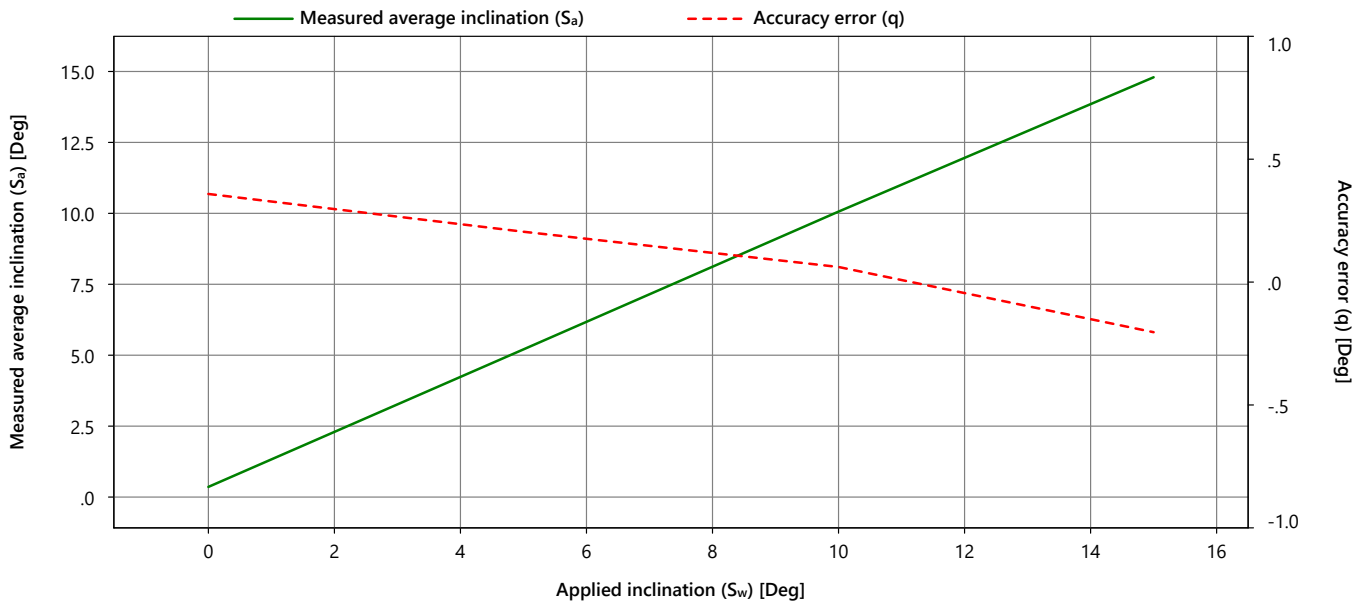
Certificate Number
FCN23031903

Calibration Details	
Calibration Date	09 Nov 2023 12:43:25
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.1.55350

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.4
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.3
Resolution	[Deg]	1.28E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w)	Measured inclination 1 ($S_{a,1}$)	Measured inclination 2 ($S_{a,2}$)	Measured inclination 3 ($S_{a,3}$)	Measured average inclination (S_a)	Accuracy error (q)	Repeatability error (b)	Expanded Uncertainty (U)
[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]
0.0	0.3	0.2	0.5	0.4	0.4	0.3	0.8
5.0	5.1	5.2	5.3	5.2	0.2	0.2	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.2	0.7
15.0	14.7	14.8	14.8	14.8	-0.2	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031903

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Page 6 of 6

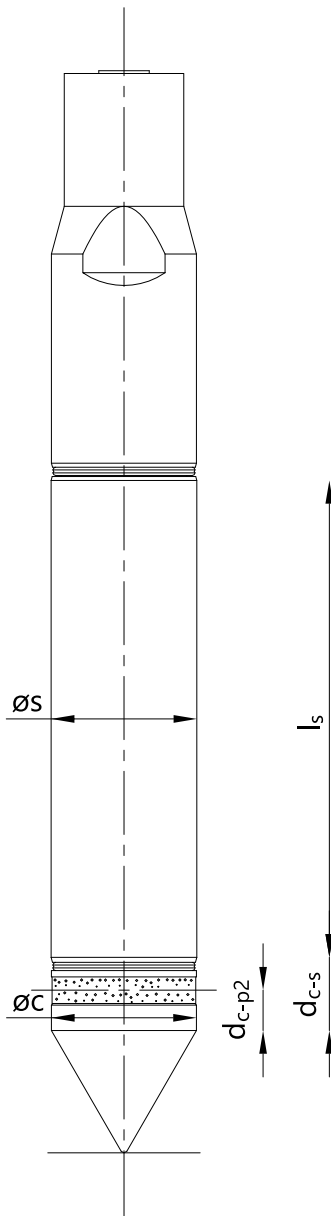


Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF100PB7SN2-P1E2M4-V3
Serial Number	1701-3549

Appendix Applicable to
Certificate Number
FCN23031903



Typical Dimensions

A_c	Cross-sectional projected area of the cone	0.0015 m ²
A_s	Surface area of the friction sleeve	0.02 m ²
af	Cone net area ratio	0.58
bf	Friction sleeve net area ratio	0.01392
\varnothing_c	Diameter of the cylindrical part of the cone	43.85 mm
\varnothing_s	Diameter of the friction sleeve	44.1 mm
l_s	Length of the friction sleeve	143.6 mm
d_{c-s}	Cone - friction sleeve distance	16 mm
d_{c-p2}	Cone - pore 2 distance	6.9 mm

Diagram is not to scale

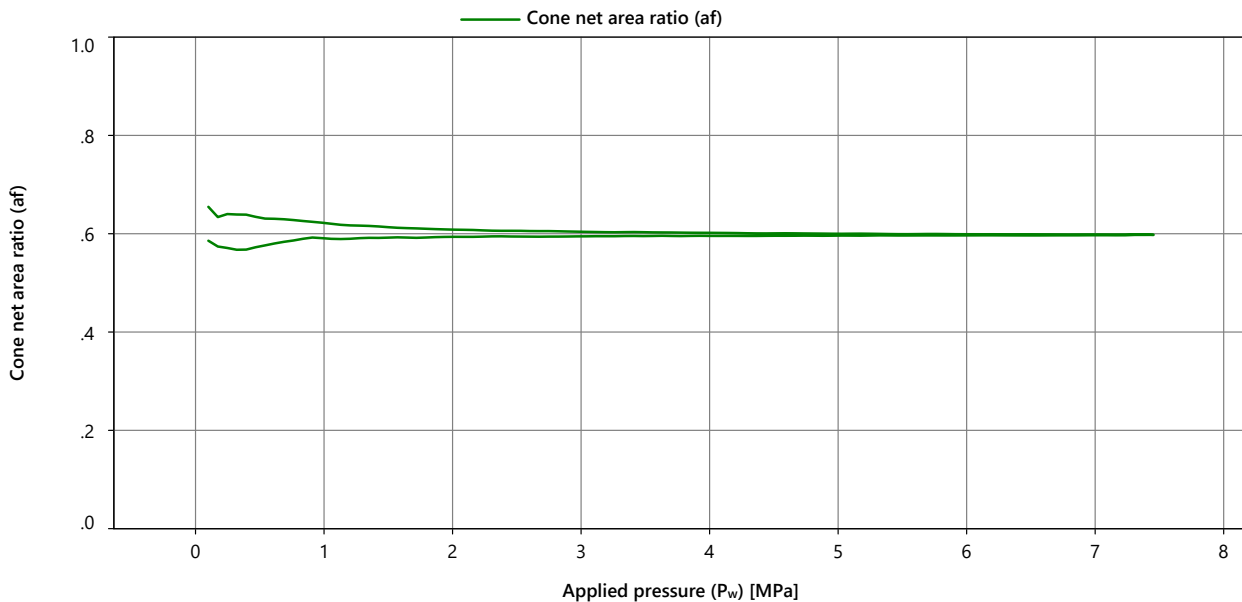
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF100PB7SN2-P1 E2M4-V3	Serial Number	3257-0002
Serial Number	1701-3549	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9351	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 13:07:21
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031903

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.60

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
1.400	0.614	0.616	0.616	0.615
2.800	0.605	0.605	0.605	0.605
4.200	0.601	0.601	0.602	0.601
5.600	0.599	0.600	0.599	0.599
7.000	0.599	0.598	0.598	0.599
5.600	0.597	0.596	0.596	0.596
4.200	0.595	0.596	0.596	0.596
2.800	0.593	0.595	0.595	0.594
1.400	0.592	0.591	0.591	0.592

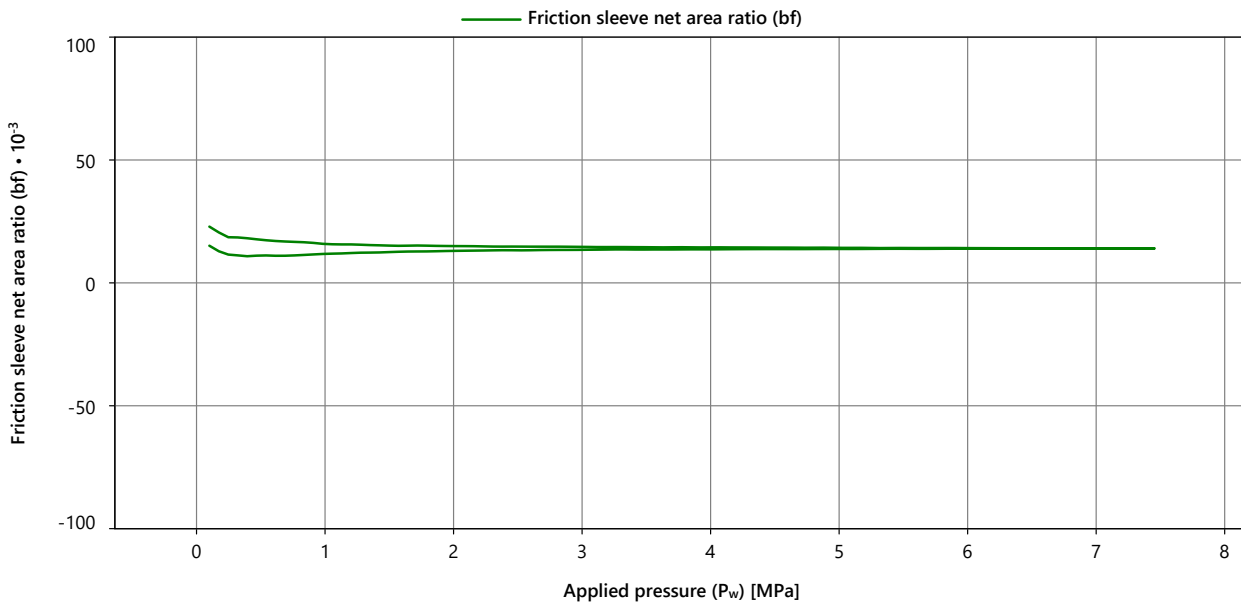
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF100PB7SN2-P1 E2M4-V3	Serial Number	3257-0002
Serial Number	1701-3549	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9351	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 13:07:21
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031903

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.01403

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
1.400	0.012	0.012	0.012	0.012
2.800	0.013	0.013	0.013	0.013
4.200	0.014	0.014	0.014	0.014
5.600	0.014	0.014	0.014	0.014
7.000	0.014	0.014	0.014	0.014
5.600	0.014	0.014	0.014	0.014
4.200	0.014	0.014	0.014	0.014
2.800	0.015	0.015	0.015	0.015
1.400	0.015	0.015	0.015	0.015

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031903

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031904

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF100PB30SN2-P1E2M4-V1
Serial Number 1701-2983

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 09-Nov-2023

Calibrate before 09-May-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 100 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 100 kN	0 to 100 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Kistler 4043A300V0408	0 to 30 MPa	0 to 45 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	16.4 $\mu\text{V/V/kN}$	18.3 $\mu\text{V/V}$	16.4 $\mu\text{V/V/kN}$	28.2 $\mu\text{V/V}$	0.23 %	0.60 %
Cone+Fric. [Force]	16.5 $\mu\text{V/V/kN}$	42.1 $\mu\text{V/V}$	16.6 $\mu\text{V/V/kN}$	47.7 $\mu\text{V/V}$	0.22 %	0.34 %
Pore 2 [Pressure]	1.12 mV/V/MPa	204 $\mu\text{V/V}$	1.12 mV/V/MPa	228 $\mu\text{V/V}$	-0.02 %	0.07 %

Nootdorp, 10-Nov-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB30SN2-P 1E2M4-V1
Serial Number	1701-2983
Electronics	5508
Node Type	7001
Hardware Version	4.00
Software Version	8.01

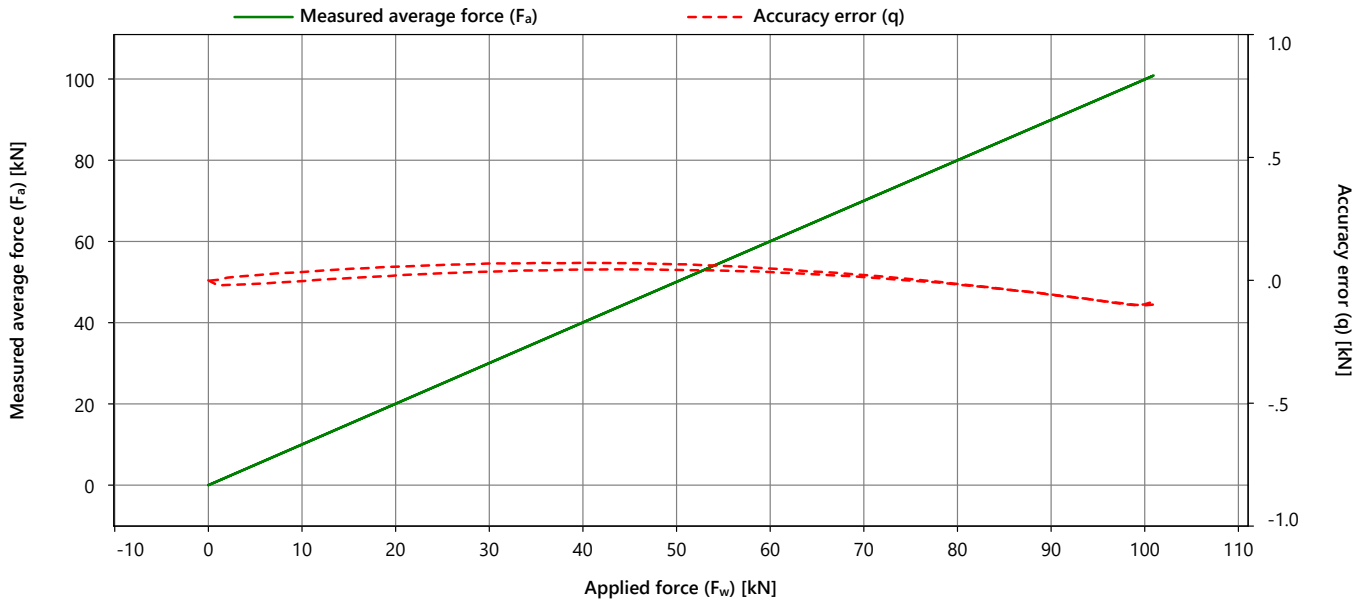
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031904

Calibration Details	
Calibration Date	09 Nov 2023 13:06:27
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 100 kN
Maximum Rating	0 to 100 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.097
Max repeatability error (b)	[kN]	0.010
Max reversibility error (v)	[kN]	0.036
Zero load error (F _{c0})	[kN]	0.002
Zero load offset (F ₀)	[kN]	-0.013
Resolution	[kN]	5.66E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	-0.002	0.001	0.000	0.000	0.000	0.003		0.016
20.000	20.020	20.019	20.021	20.020	0.020	0.002	0.036	0.089
40.000	40.044	40.043	40.045	40.044	0.044	0.001	0.027	0.142
60.000	60.034	60.033	60.033	60.034	0.034	0.001	0.014	0.201
80.000	79.983	79.982	79.984	79.983	-0.017	0.002	0.002	0.261
100.000	99.903	99.908	99.897	99.903	-0.097	0.010		0.323
80.000	79.982	79.985	79.988	79.985	-0.015	0.006	0.002	0.261
60.000	60.047	60.048	60.049	60.048	0.048	0.001	0.014	0.201
40.000	40.070	40.072	40.071	40.071	0.071	0.002	0.027	0.142
20.000	20.054	20.055	20.057	20.056	0.056	0.003	0.036	0.089
0.000	-0.003	-0.001	-0.002	-0.002	-0.002	0.001		0.016

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB30SN2-P 1E2M4-V1
Serial Number	1701-2983
Electronics	5508
Node Type	7001
Hardware Version	4.00
Software Version	8.01

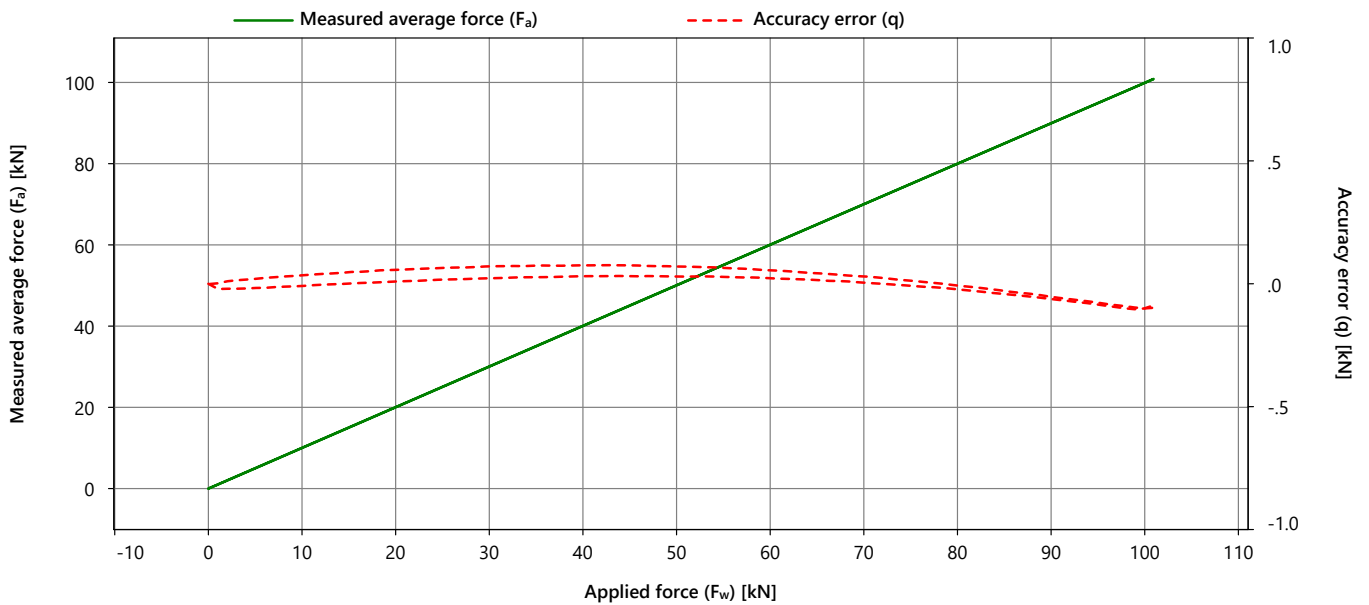
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031904

Calibration Details	
Calibration Date	09 Nov 2023 13:06:27
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 100 kN
Maximum Rating	0 to 100 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.100
Max repeatability error (b)	[kN]	0.010
Max reversibility error (v)	[kN]	0.047
Zero load error (F _{c0})	[kN]	0.002
Zero load offset (F ₀)	[kN]	-0.019
Resolution	[kN]	5.62E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.010



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	-0.002	0.002	0.000	0.000	0.000	0.004		0.016
20.000	20.008	20.009	20.010	20.009	0.009	0.001	0.047	0.101
40.000	40.031	40.030	40.031	40.031	0.031	0.002	0.044	0.148
60.000	60.024	60.021	60.023	60.022	0.022	0.003	0.032	0.204
80.000	79.978	79.976	79.978	79.977	-0.023	0.002	0.015	0.262
100.000	99.902	99.904	99.895	99.900	-0.100	0.010		0.323
80.000	79.990	79.993	79.994	79.993	-0.007	0.004	0.015	0.262
60.000	60.054	60.054	60.056	60.055	0.055	0.003	0.032	0.204
40.000	40.074	40.076	40.075	40.075	0.075	0.002	0.044	0.148
20.000	20.054	20.057	20.058	20.056	0.056	0.004	0.047	0.101
0.000	-0.002	-0.001	-0.001	-0.002	-0.002	0.002		0.016

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB30SN2-P 1E2M4-V1
Serial Number	1701-2983
Electronics	5508
Node Type	7001
Hardware Version	4.00
Software Version	8.01

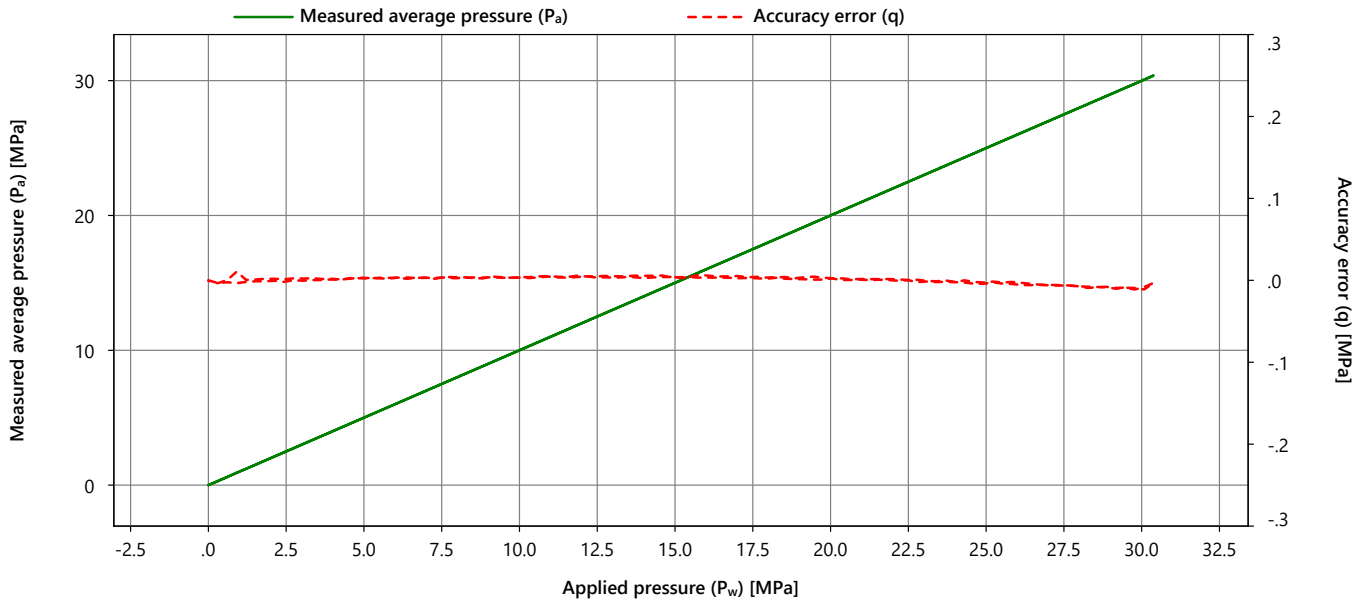
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031904

Calibration Details	
Calibration Date	09 Nov 2023 13:41:41
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.1.55350

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Kistler 4043A300V0408
Calibrated Range	0 to 30 MPa
Maximum Rating	0 to 45 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.010
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.002
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	0.009
Resolution	[MPa]	1.33E-05
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.001		0.003
6.000	6.002	6.003	6.003	6.003	0.003	0.001	0.001	0.006
12.000	12.007	12.004	12.005	12.005	0.005	0.002	-0.001	0.009
18.000	18.003	18.004	18.003	18.003	0.003	0.002	-0.002	0.012
24.000	23.998	23.999	23.998	23.998	-0.002	0.001	0.000	0.014
30.000	29.988	29.990	29.990	29.990	-0.010	0.002		0.018
24.000	23.998	23.997	23.998	23.998	-0.002	0.001	0.000	0.014
18.000	18.003	18.000	18.002	18.002	0.002	0.003	-0.002	0.012
12.000	12.004	12.004	12.005	12.004	0.004	0.001	-0.001	0.009
6.000	6.004	6.004	6.003	6.004	0.004	0.001	0.001	0.006
0.000	0.000	-0.001	-0.001	-0.001	-0.001	0.001		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF100PB30SN2-P 1E2M4-V1
Serial Number	1701-2983
Electronics	5508
Node Type	7001
Hardware Version	4.00
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

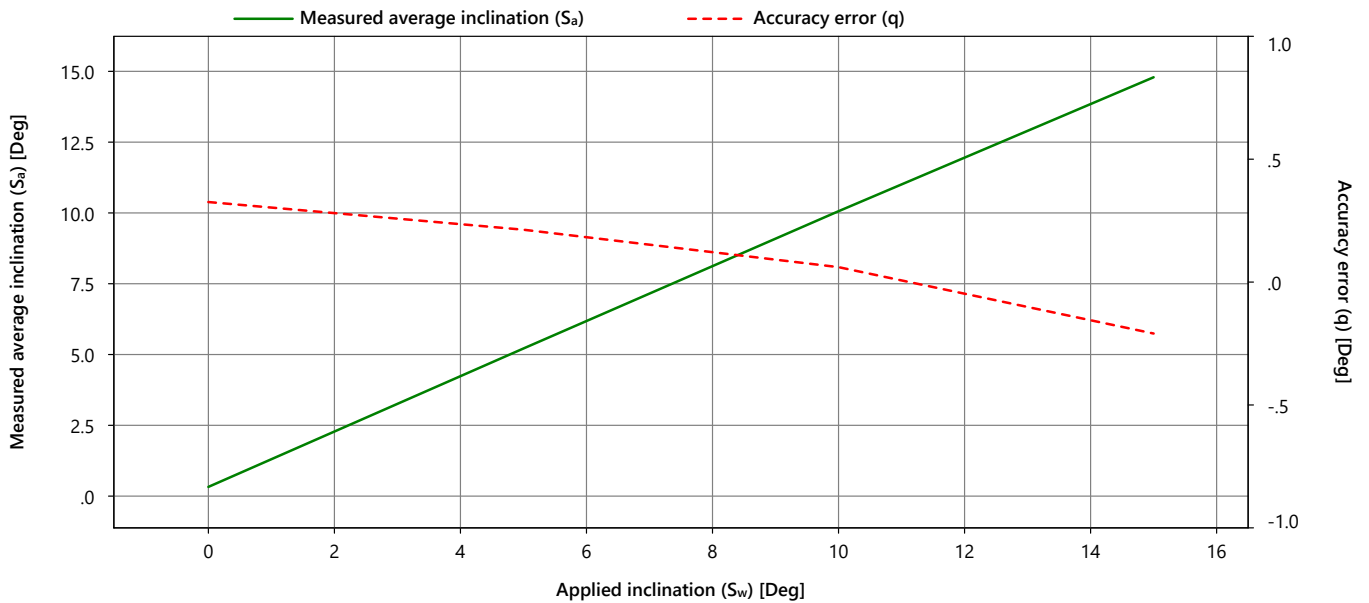
Certificate Number
FCN23031904

Calibration Details	
Calibration Date	09 Nov 2023 13:14:16
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.1.55350

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.3
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.3
Resolution	[Deg]	1.25E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.2	0.3	0.5	0.3	0.3	0.3	0.8
5.0	5.1	5.3	5.3	5.2	0.2	0.3	0.8
10.0	9.9	10.1	10.2	10.1	0.1	0.2	0.8
15.0	14.7	14.8	14.8	14.8	-0.2	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031904

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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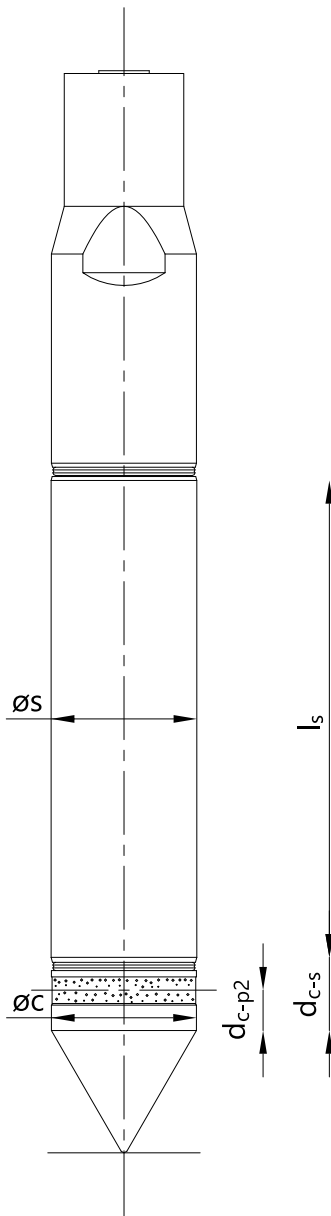


Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF100PB30SN2-P1E2M4-V1
Serial Number	1701-2983

Appendix Applicable to
Certificate Number
FCN23031904



Typical Dimensions

A_c	Cross-sectional projected area of the cone	0.0015 m ²
A_s	Surface area of the friction sleeve	0.02 m ²
af	Cone net area ratio	0.58
bf	Friction sleeve net area ratio	0.01392
\varnothing_c	Diameter of the cylindrical part of the cone	43.85 mm
\varnothing_s	Diameter of the friction sleeve	44.1 mm
l_s	Length of the friction sleeve	143.6 mm
d_{c-s}	Cone - friction sleeve distance	16 mm
d_{c-p2}	Cone - pore 2 distance	6.9 mm

Diagram is not to scale

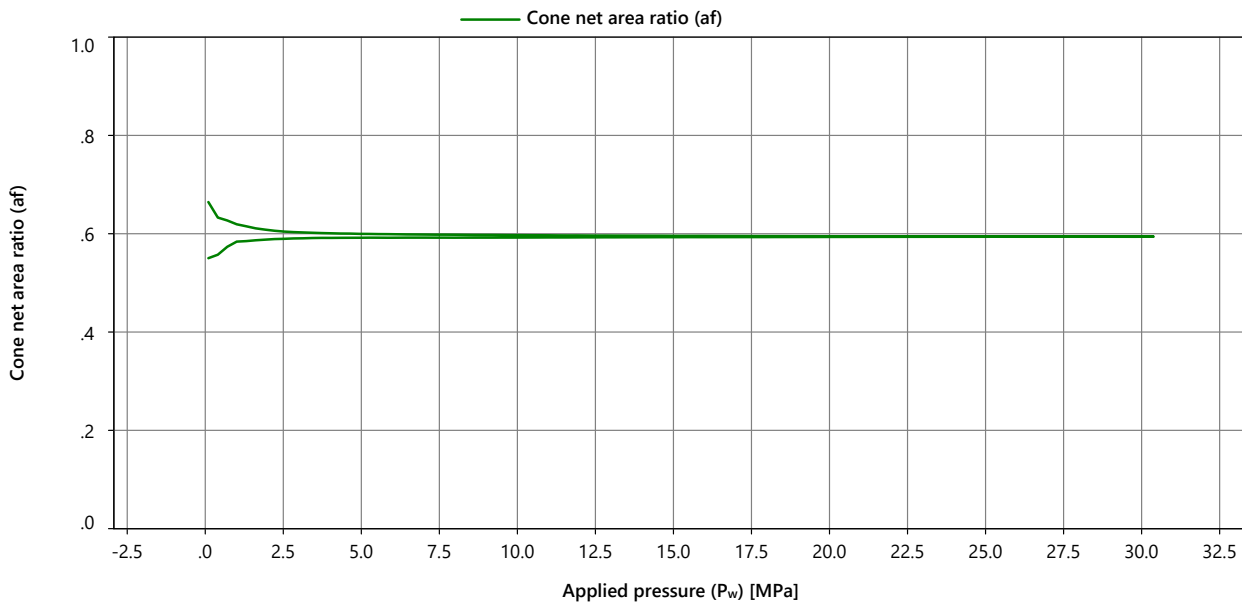
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF100PB30SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1701-2983	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	5508	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 13:41:41
Hardware Version	4.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031904

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.59

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
6.000	0.599	0.599	0.599	0.599
12.000	0.597	0.596	0.596	0.596
18.000	0.595	0.595	0.595	0.595
24.000	0.594	0.594	0.594	0.594
30.000	0.594	0.594	0.594	0.594
24.000	0.594	0.594	0.594	0.594
18.000	0.593	0.593	0.593	0.593
12.000	0.593	0.593	0.593	0.593
6.000	0.592	0.592	0.592	0.592

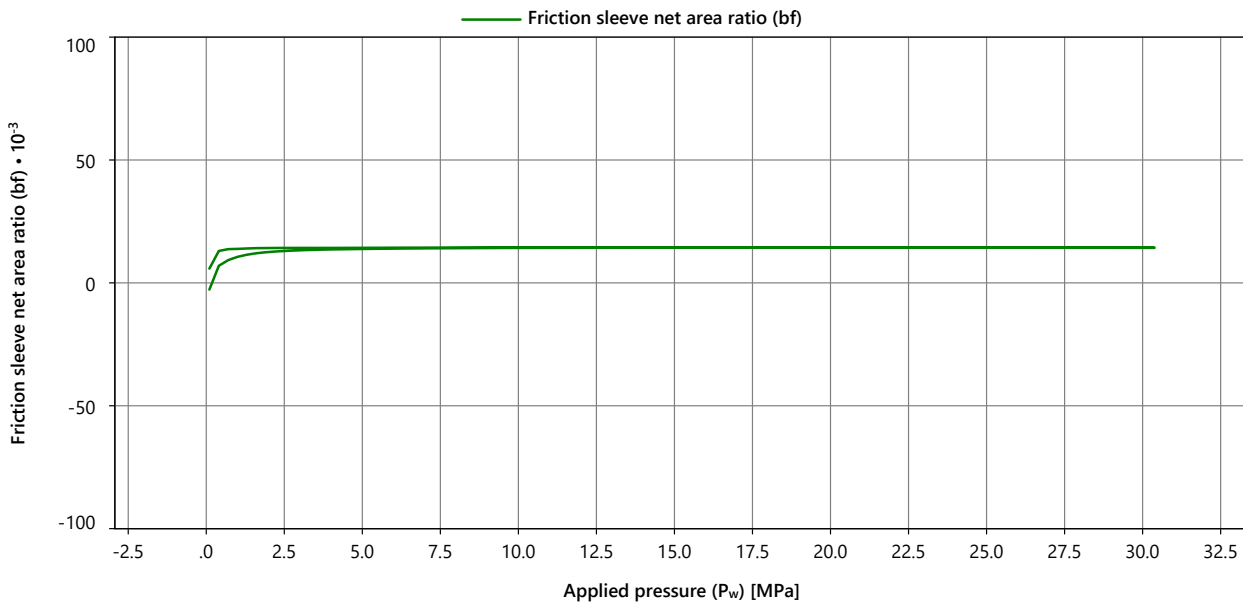
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF100PB30SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1701-2983	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	5508	Measurement Details	
Node Type	7001	Measurement Date	09 Nov 2023 13:41:41
Hardware Version	4.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031904

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.01428

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
6.000	0.014	0.014	0.014	0.014
12.000	0.014	0.014	0.014	0.014
18.000	0.014	0.014	0.014	0.014
24.000	0.014	0.014	0.014	0.014
30.000	0.014	0.014	0.014	0.014
24.000	0.014	0.014	0.014	0.014
18.000	0.014	0.014	0.014	0.014
12.000	0.014	0.014	0.014	0.014
6.000	0.014	0.014	0.014	0.014

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031904

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
----------------	-----------------------------------

Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031921

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E10M4-V1
Serial Number 1715-0068

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 10-Nov-2023

Calibrate before 10-May-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 13-Nov-2023

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Gerry Sinjorgo
Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0068
Electronics	8905
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference

Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031921

Calibration Details

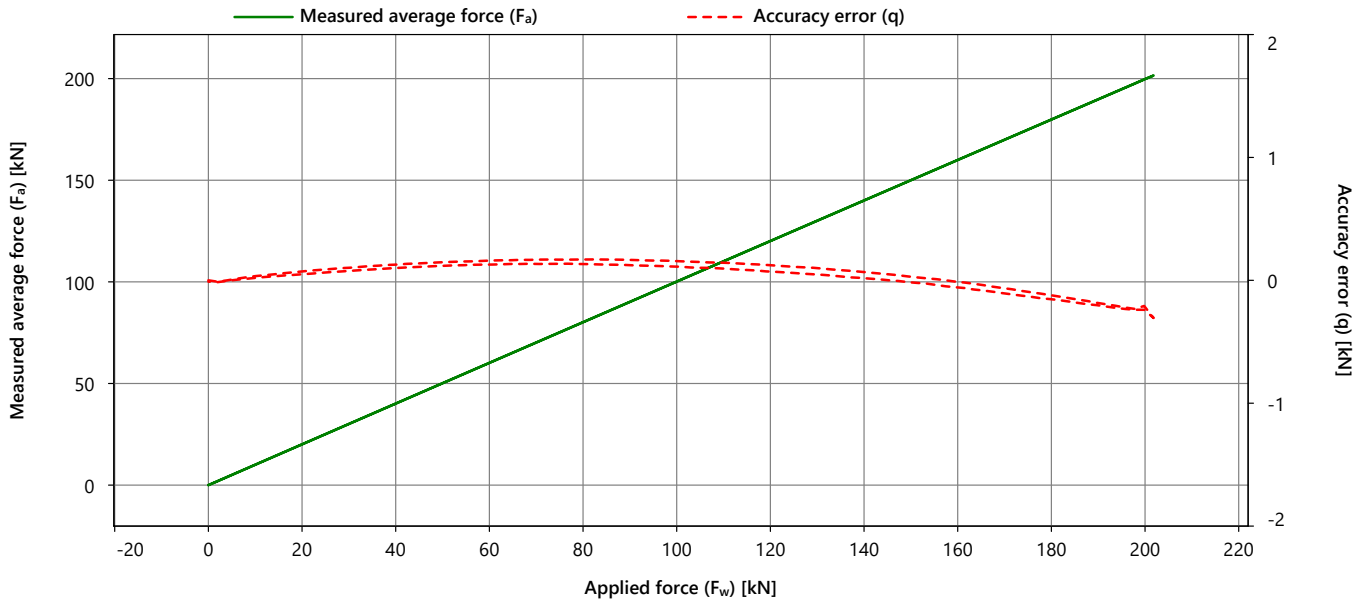
Calibration Date	10 Nov 2023 11:30:22
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor

Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.204
Max repeatability error (b)	[kN]	0.026
Max reversibility error (v)	[kN]	0.053
Zero load error (F _{c0})	[kN]	0.011
Zero load offset (F ₀)	[kN]	0.000
Resolution	[kN]	8.66E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.003	0.000	-0.003	0.000	0.000	0.006		0.023
40.000	40.134	40.128	40.121	40.127	0.127	0.012	-0.027	0.143
80.000	80.180	80.168	80.160	80.169	0.169	0.020	-0.037	0.266
120.000	120.135	120.121	120.113	120.123	0.123	0.022	-0.053	0.390
160.000	159.999	159.987	159.976	159.987	-0.013	0.023	-0.045	0.511
200.000	199.801	199.793	199.793	199.796	-0.204	0.008		0.631
160.000	159.958	159.938	159.932	159.942	-0.058	0.026	-0.045	0.511
120.000	120.078	120.073	120.059	120.070	0.070	0.019	-0.053	0.390
80.000	80.143	80.132	80.123	80.132	0.132	0.020	-0.037	0.266
40.000	40.106	40.098	40.097	40.100	0.100	0.009	-0.027	0.143
0.000	-0.008	-0.011	-0.014	-0.011	-0.011	0.006		0.023

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0068
Electronics	8905
Node Type	7001
Hardware Version	6.00
Software Version	8.01

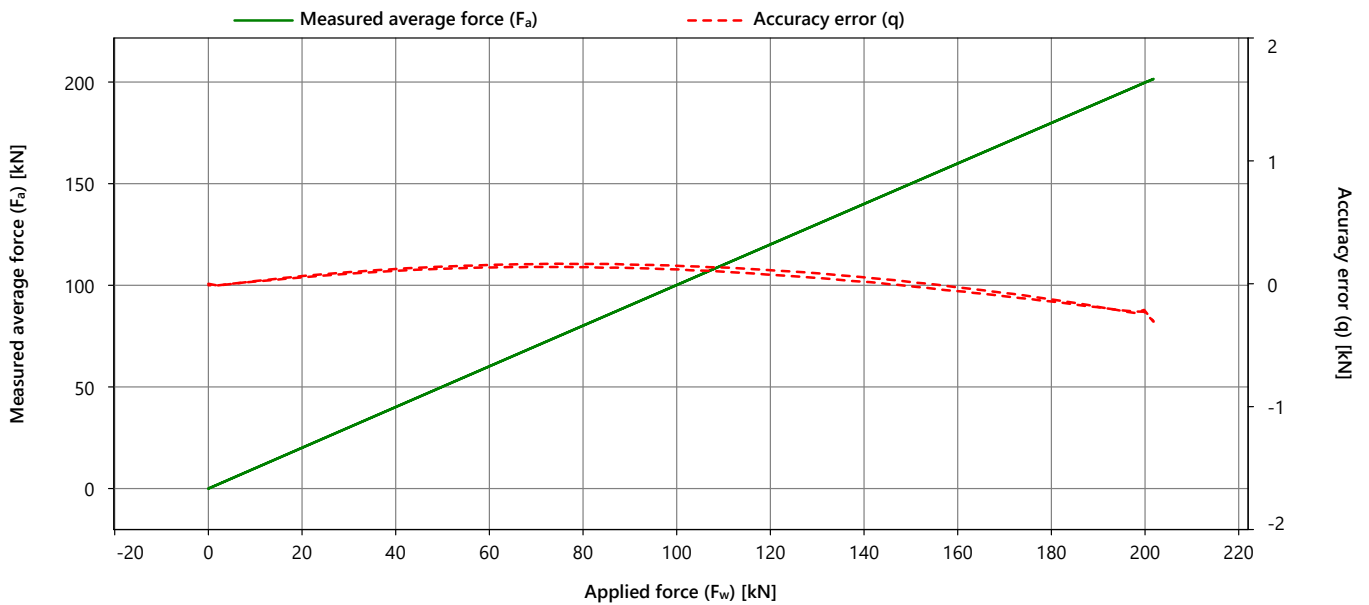
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031921

Calibration Details	
Calibration Date	10 Nov 2023 11:30:22
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.209
Max repeatability error (b)	[kN]	0.021
Max reversibility error (v)	[kN]	0.037
Zero load error (F _{c0})	[kN]	0.012
Zero load offset (F ₀)	[kN]	-0.007
Resolution	[kN]	8.69E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.014



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.003	0.001	-0.003	0.000	0.000	0.006		0.024
40.000	40.126	40.120	40.114	40.120	0.120	0.012	-0.015	0.141
80.000	80.169	80.158	80.155	80.161	0.161	0.014	-0.026	0.264
120.000	120.119	120.109	120.102	120.110	0.110	0.017	-0.037	0.388
160.000	159.978	159.970	159.963	159.970	-0.030	0.015	-0.030	0.509
200.000	199.794	199.790	199.790	199.791	-0.209	0.004		0.631
160.000	159.953	159.937	159.931	159.940	-0.060	0.021	-0.030	0.509
120.000	120.078	120.075	120.064	120.073	0.073	0.014	-0.037	0.388
80.000	80.146	80.134	80.127	80.135	0.135	0.019	-0.026	0.264
40.000	40.112	40.106	40.099	40.105	0.105	0.013	-0.015	0.141
0.000	-0.008	-0.012	-0.016	-0.012	-0.012	0.008		0.025

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0068
Electronics	8905
Node Type	7001
Hardware Version	6.00
Software Version	8.01

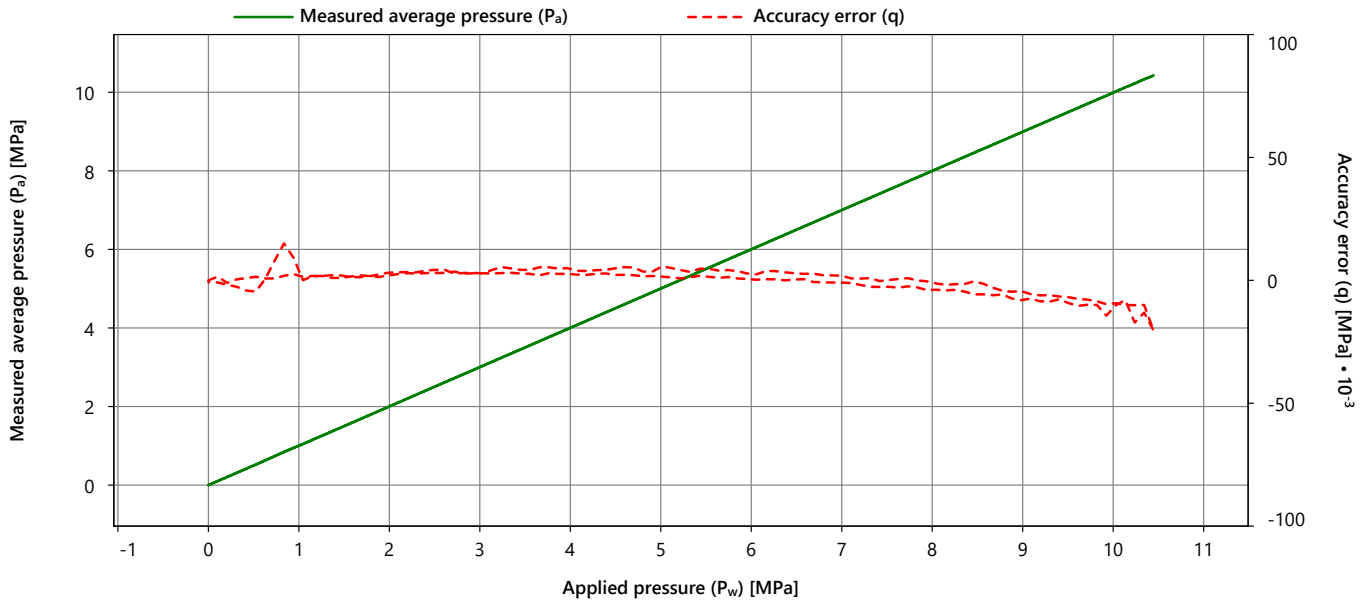
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031921

Calibration Details	
Calibration Date	10 Nov 2023 16:11:32
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.1.55350

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.010
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	0.001
Resolution	[MPa]	2.21E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.003	2.004	2.002	2.003	0.003	0.002	-0.001	0.005
4.000	4.004	4.004	4.006	4.005	0.005	0.002	-0.002	0.006
6.000	6.002	6.001	6.005	6.003	0.003	0.003	-0.002	0.008
8.000	7.999	8.001	7.997	7.999	-0.001	0.004	-0.003	0.009
10.000	9.991	9.991	9.989	9.990	-0.010	0.003		0.008
8.000	7.997	7.995	7.997	7.996	-0.004	0.003	-0.003	0.008
6.000	6.002	5.999	6.000	6.000	0.000	0.003	-0.002	0.007
4.000	4.004	4.002	4.003	4.003	0.003	0.002	-0.002	0.006
2.000	2.003	2.002	2.001	2.002	0.002	0.002	-0.001	0.004
0.000	-0.001	-0.001	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0068
Electronics	8905
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

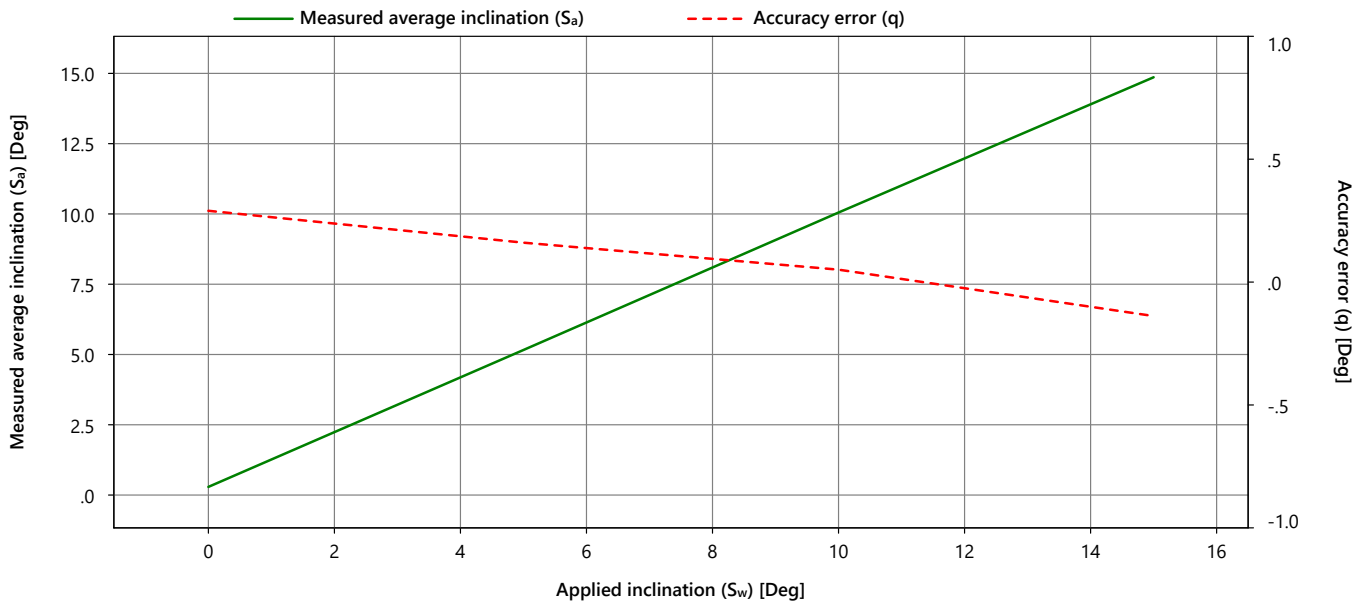
Certificate Number
FCN23031921

Calibration Details	
Calibration Date	10 Nov 2023 11:34:58
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.1.55350

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.3
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.28E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.3	0.4	0.3	0.3	0.3	0.8
5.0	5.0	5.2	5.3	5.2	0.2	0.3	0.8
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.9	14.8	14.9	14.9	-0.1	0.0	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031921

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0068

Appendix Applicable to
Certificate Number
FCN23031921

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

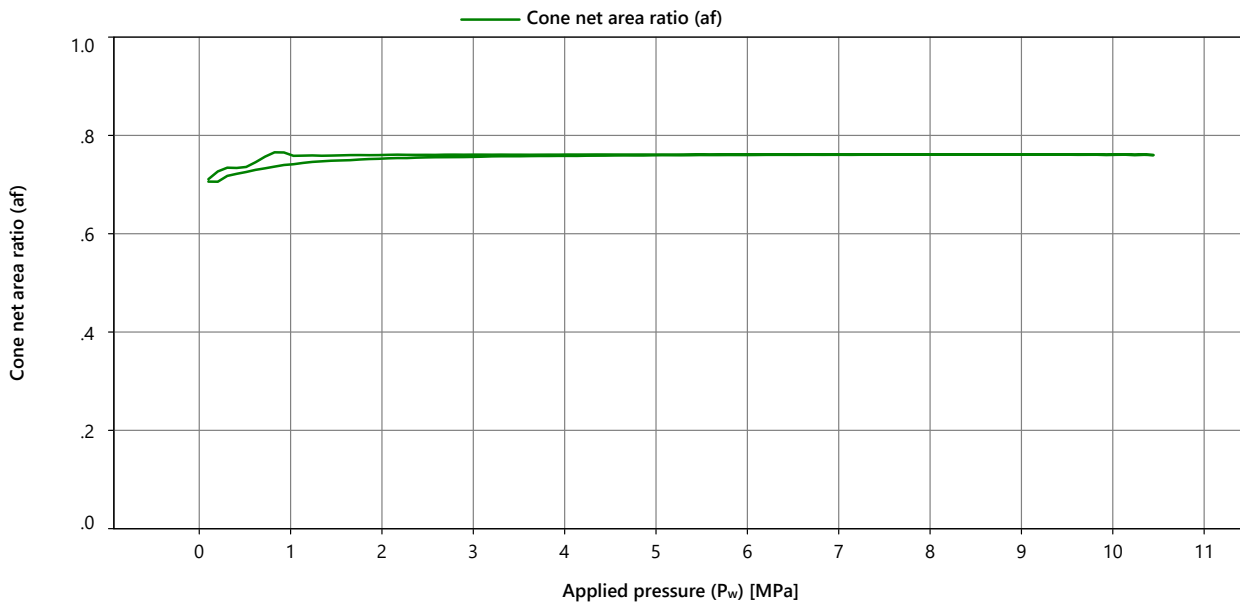
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P1E10M4-V1	Serial Number	3257-0002
Serial Number	1715-0068	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	8905	Measurement Details	
Node Type	7001	Measurement Date	10 Nov 2023 16:11:32
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031921

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.752	0.754	0.753	0.753
4.000	0.758	0.758	0.759	0.758
6.000	0.760	0.760	0.760	0.760
8.000	0.761	0.761	0.761	0.761
10.000	0.761	0.761	0.761	0.761
8.000	0.761	0.761	0.761	0.761
6.000	0.761	0.761	0.761	0.761
4.000	0.761	0.761	0.761	0.761
2.000	0.760	0.760	0.761	0.760

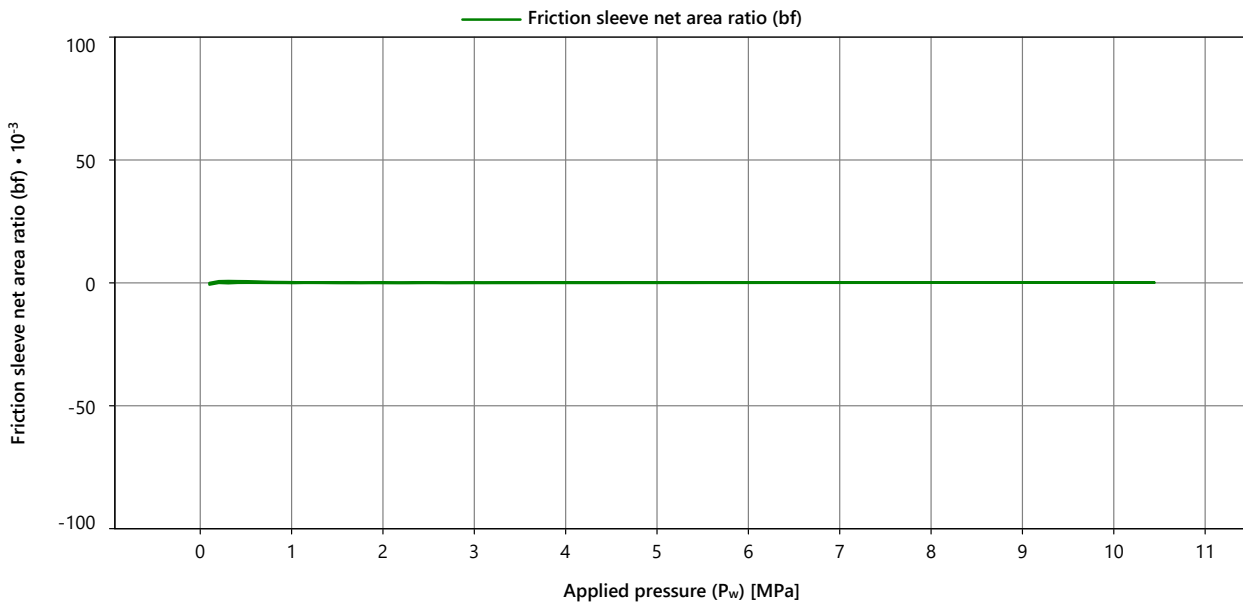
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P1E10M4-V1	Serial Number	3257-0002
Serial Number	1715-0068	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	8905	Measurement Details	
Node Type	7001	Measurement Date	10 Nov 2023 16:11:32
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031921

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00010

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031921

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
----------------	-----------------------------------

Quantities

P	Pressure
---	----------

Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031923

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E10M4-V1
Serial Number 1715-0078

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 10-Nov-2023

Calibrate before 10-May-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 13-Nov-2023

This certificate is issued provided that Fugro assumes no liability.

Gerry Sinjorgo
Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0078
Electronics	247
Node Type	7001
Hardware Version	5.01
Software Version	8.01

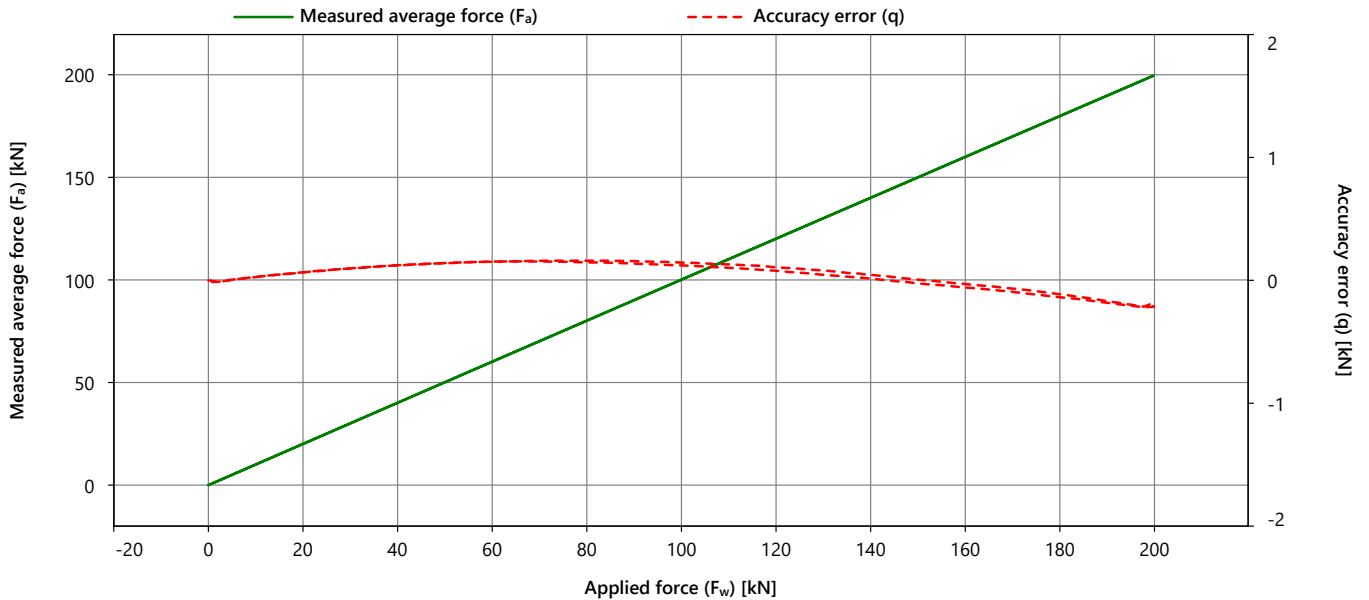
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031923

Calibration Details	
Calibration Date	10 Nov 2023 11:54:13
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.180
Max repeatability error (b)	[kN]	0.028
Max reversibility error (v)	[kN]	0.029
Zero load error (F _{c0})	[kN]	0.015
Zero load offset (F ₀)	[kN]	-0.022
Resolution	[kN]	8.68E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.002	0.000	-0.002	0.000	0.000	0.004		0.029
40.000	40.123	40.119	40.120	40.121	0.121	0.004	0.003	0.140
80.000	80.162	80.160	80.157	80.160	0.160	0.005	-0.014	0.263
120.000	120.108	120.106	120.103	120.106	0.106	0.005	-0.028	0.386
160.000	159.975	159.968	159.967	159.970	-0.030	0.008	-0.029	0.509
200.000	199.832	199.827	199.803	199.820	-0.180	0.028		0.632
160.000	159.947	159.941	159.935	159.941	-0.059	0.012	-0.029	0.509
120.000	120.080	120.079	120.075	120.078	0.078	0.005	-0.028	0.386
80.000	80.148	80.145	80.144	80.146	0.146	0.004	-0.014	0.263
40.000	40.127	40.123	40.121	40.123	0.123	0.006	0.003	0.140
0.000	-0.013	-0.014	-0.018	-0.015	-0.015	0.005		0.029

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0078
Electronics	247
Node Type	7001
Hardware Version	5.01
Software Version	8.01

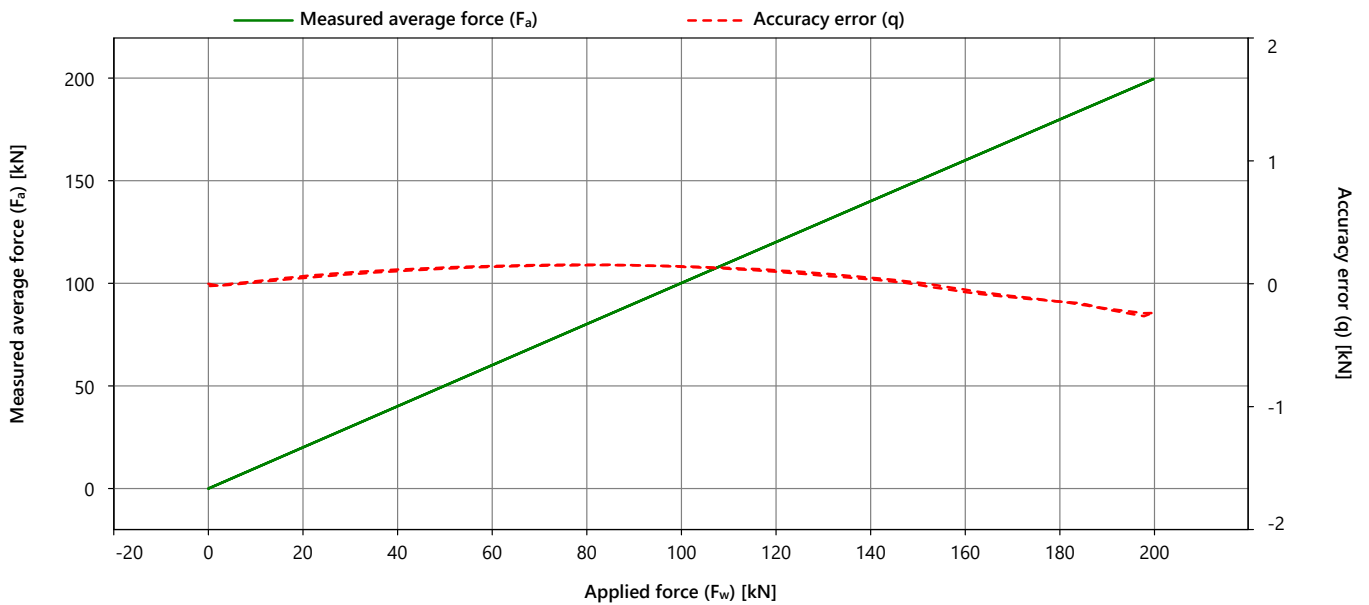
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23031923

Calibration Details	
Calibration Date	10 Nov 2023 11:54:13
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.1.55350

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.231
Max repeatability error (b)	[kN]	0.029
Max reversibility error (v)	[kN]	0.020
Zero load error (F _{c0})	[kN]	0.019
Zero load offset (F ₀)	[kN]	-0.024
Resolution	[kN]	8.72E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.017



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.003	0.000	-0.003	0.000	0.000	0.006		0.039
40.000	40.104	40.101	40.101	40.102	0.102	0.003	0.014	0.141
80.000	80.155	80.151	80.148	80.151	0.151	0.007	0.004	0.262
120.000	120.113	120.110	120.106	120.110	0.110	0.007	-0.011	0.385
160.000	159.956	159.951	159.950	159.952	-0.048	0.007	-0.020	0.509
200.000	199.780	199.776	199.751	199.769	-0.231	0.029		0.632
160.000	159.938	159.933	159.925	159.932	-0.068	0.012	-0.020	0.509
120.000	120.102	120.099	120.094	120.098	0.098	0.008	-0.011	0.385
80.000	80.157	80.157	80.151	80.155	0.155	0.006	0.004	0.262
40.000	40.120	40.116	40.113	40.116	0.116	0.007	0.014	0.141
0.000	-0.017	-0.018	-0.022	-0.019	-0.019	0.005		0.039

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0078
Electronics	247
Node Type	7001
Hardware Version	5.01
Software Version	8.01

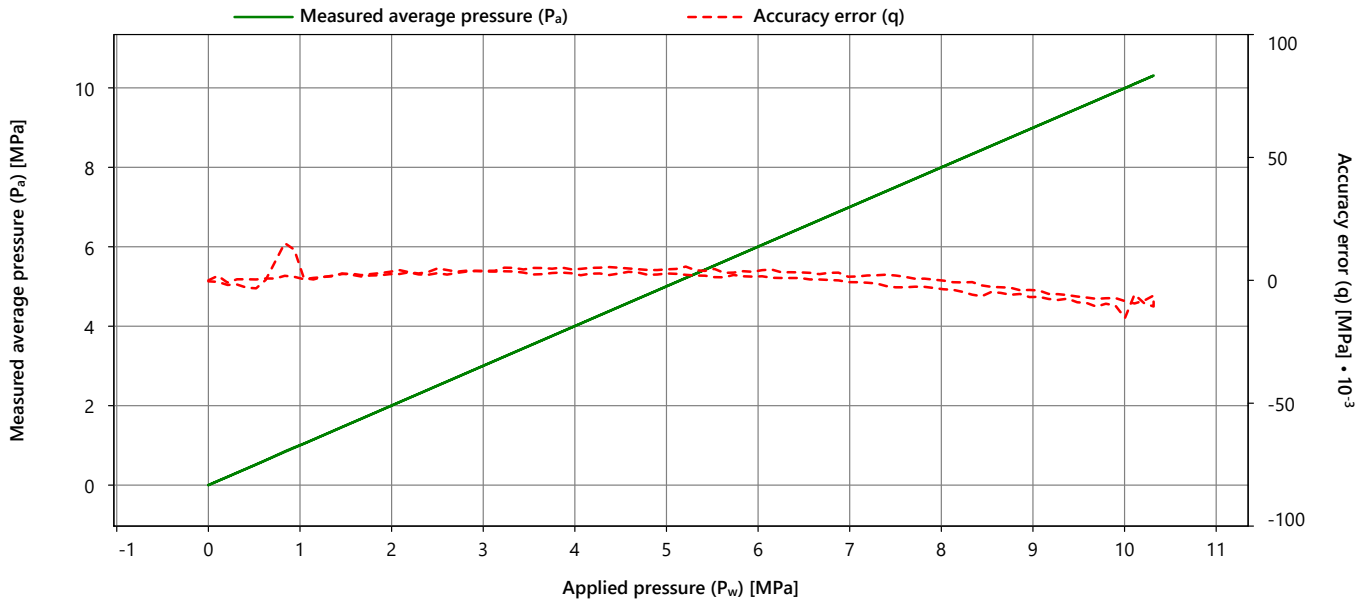
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23031923

Calibration Details	
Calibration Date	10 Nov 2023 15:55:46
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.1.55350

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.008
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	-0.013
Resolution	[MPa]	2.18E-06
Noise RMS	[MPa]	0.003



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.001		0.006
2.000	2.004	2.003	2.004	2.004	0.004	0.002	-0.001	0.007
4.000	4.005	4.005	4.003	4.004	0.004	0.003	-0.002	0.008
6.000	6.003	6.003	6.005	6.004	0.004	0.002	-0.002	0.009
8.000	7.998	8.000	8.002	8.000	0.000	0.004	-0.003	0.011
10.000	9.992	9.992	9.991	9.992	-0.008	0.002		0.009
8.000	7.996	7.996	7.997	7.996	-0.004	0.002	-0.003	0.010
6.000	6.002	6.002	6.002	6.002	0.002	0.000	-0.002	0.008
4.000	4.002	4.003	4.003	4.003	0.003	0.001	-0.002	0.008
2.000	2.003	2.002	2.003	2.002	0.002	0.000	-0.001	0.007
0.000	0.000	-0.001	-0.001	0.000	0.000	0.001		0.006

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0078
Electronics	247
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

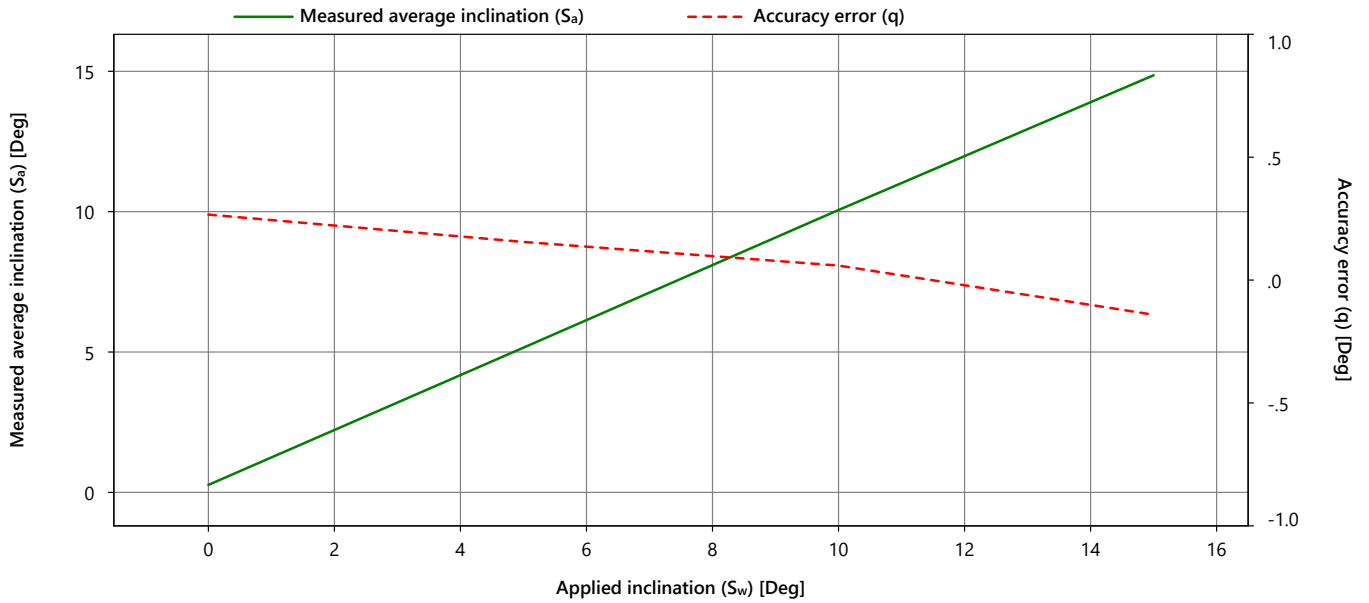
Certificate Number
FCN23031923

Calibration Details	
Calibration Date	10 Nov 2023 11:57:36
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.1.55350

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.3
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.2
Resolution	[Deg]	1.29E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.3	0.4	0.3	0.3	0.3	0.8
5.0	5.0	5.2	5.3	5.2	0.2	0.2	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.2	0.7
15.0	14.9	14.8	14.9	14.9	-0.1	0.0	0.7

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Symbols, Definitions and References

Certificate Number
FCN23031923

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0078

Appendix Applicable to
Certificate Number
FCN23031923

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

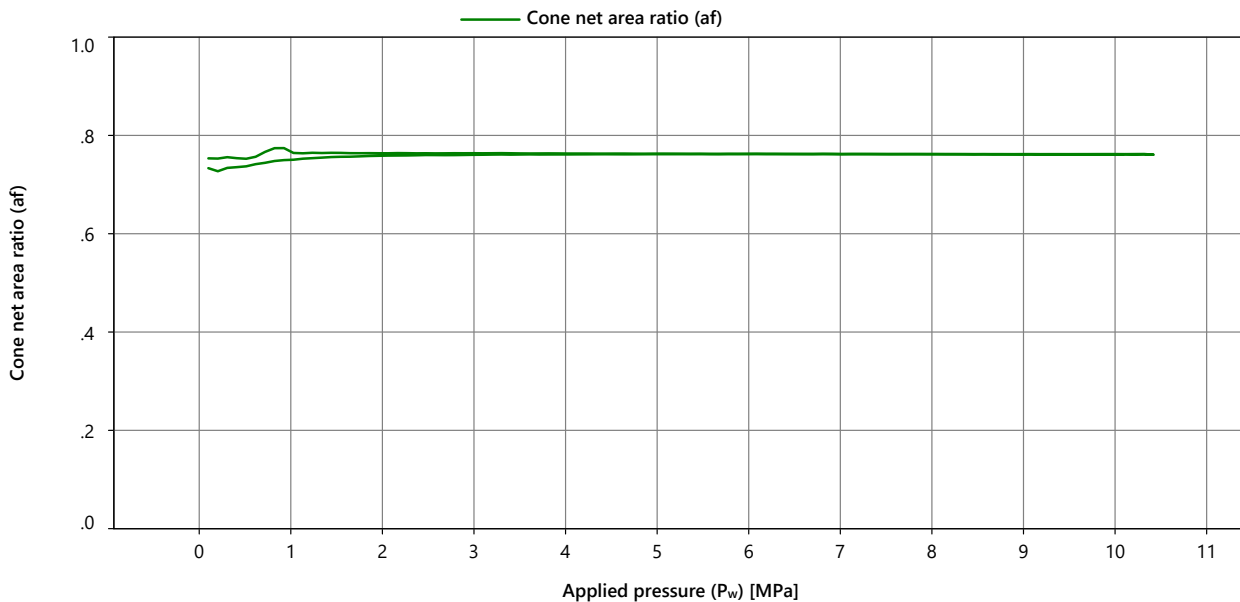
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P1E10M4-V1	Serial Number	3257-0002
Serial Number	1715-0078	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	247	Measurement Details	
Node Type	7001	Measurement Date	10 Nov 2023 15:55:46
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031923

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.759	0.758	0.759	0.759
4.000	0.761	0.762	0.761	0.761
6.000	0.762	0.762	0.762	0.762
8.000	0.762	0.762	0.762	0.762
10.000	0.762	0.762	0.762	0.762
8.000	0.762	0.762	0.762	0.762
6.000	0.762	0.763	0.763	0.763
4.000	0.763	0.763	0.763	0.763
2.000	0.764	0.764	0.764	0.764

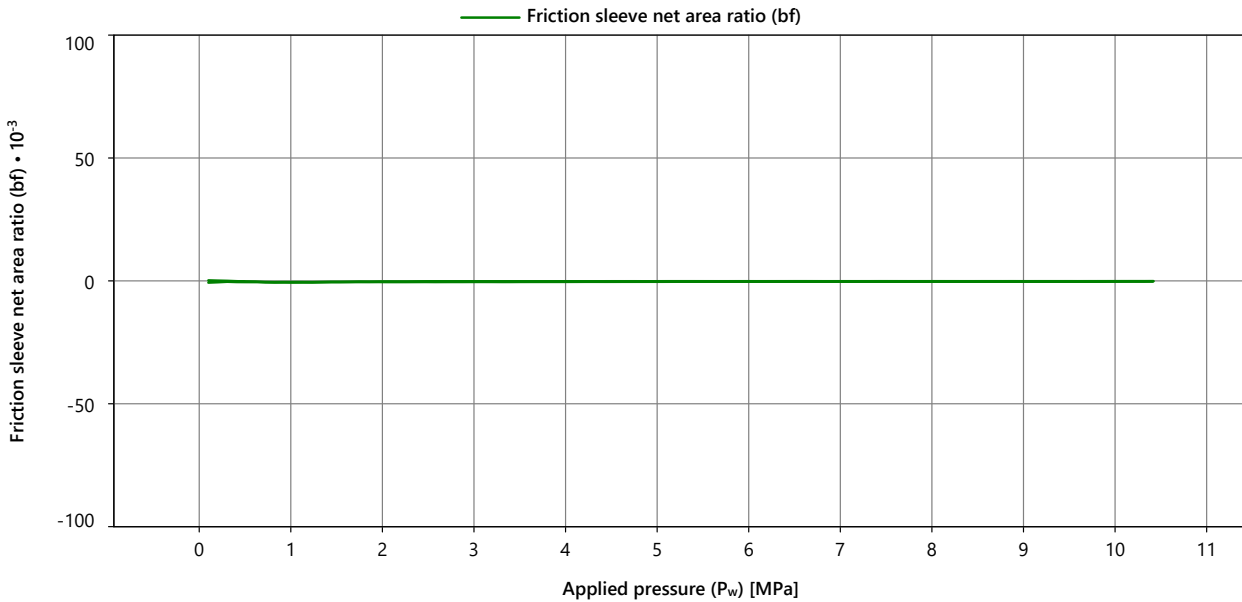
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P1E10M4-V1	Serial Number	3257-0002
Serial Number	1715-0078	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	247	Measurement Details	
Node Type	7001	Measurement Date	10 Nov 2023 15:55:46
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.1.55350

Appendix Applicable to
Certificate Number
FCN23031923

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	-0.00013

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23031923

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
----------------	-----------------------------------

Quantities

P	Pressure
---	----------

Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032112

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0035

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions
Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration period 04-Dec-2023 through 05-Dec-2023

Calibrate before 04-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	-6.84 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	-121 $\mu\text{V/V}$	0.00 %	-5.22 %
Cone+Fric. [Force]	10.9 $\mu\text{V/V/kN}$	-1.07 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	2.23 $\mu\text{V/V}$	-0.11 %	0.15 %
Pore 2 [Pressure]	3.39 mV/V/MPa	1.29 mV/V	3.39 mV/V/MPa	1.26 mV/V	0.00 %	-0.08 %

Nootdorp, 06-Dec-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0035
Electronics	7642
Node Type	7001
Hardware Version	5.01
Software Version	8.01

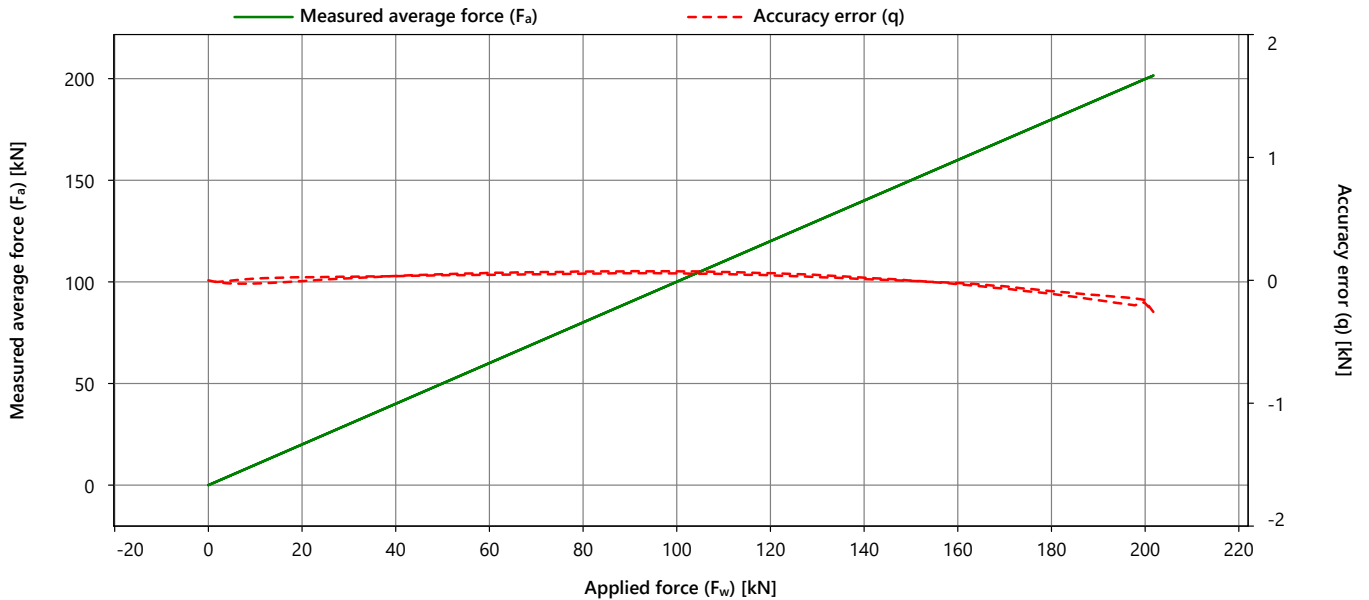
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032112

Calibration Details	
Calibration Date	04 Dec 2023 05:58:26
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.175
Max repeatability error (b)	[kN]	0.047
Max reversibility error (v)	[kN]	0.017
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	0.023
Resolution	[kN]	8.54E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.001	0.001	-0.002	0.000	0.000	0.003		0.019
40.000	40.055	40.031	40.019	40.035	0.035	0.035	-0.001	0.145
80.000	80.094	80.066	80.055	80.072	0.072	0.039	-0.017	0.266
120.000	120.082	120.055	120.038	120.058	0.058	0.043	-0.017	0.388
160.000	159.994	159.964	159.948	159.969	-0.031	0.047	0.009	0.511
200.000	199.843	199.829	199.801	199.825	-0.175	0.042		0.632
160.000	159.992	159.976	159.965	159.978	-0.022	0.027	0.009	0.509
120.000	120.064	120.036	120.024	120.041	0.041	0.040	-0.017	0.388
80.000	80.077	80.050	80.039	80.055	0.055	0.038	-0.017	0.266
40.000	40.052	40.029	40.020	40.034	0.034	0.032	-0.001	0.144
0.000	-0.006	-0.008	-0.011	-0.008	-0.008	0.005		0.020

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0035
Electronics	7642
Node Type	7001
Hardware Version	5.01
Software Version	8.01

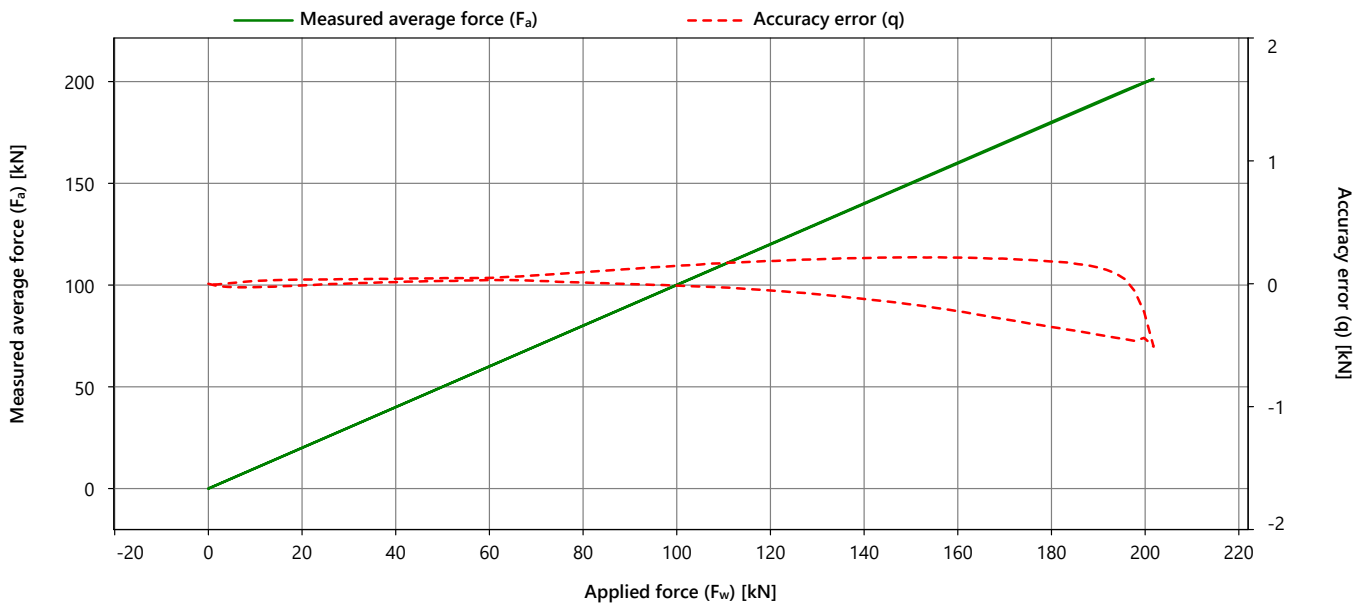
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032112

Calibration Details	
Calibration Date	04 Dec 2023 05:58:26
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.437
Max repeatability error (b)	[kN]	0.068
Max reversibility error (v)	[kN]	0.436
Zero load error (F _{c0})	[kN]	0.007
Zero load offset (F ₀)	[kN]	0.008
Resolution	[kN]	8.58E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.033



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.008	0.001	-0.009	0.000	0.000	0.017		0.033
40.000	40.032	40.011	39.996	40.013	0.013	0.035	0.028	0.148
80.000	80.040	80.004	79.986	80.010	0.010	0.054	0.084	0.287
120.000	119.979	119.937	119.920	119.946	-0.054	0.058	0.240	0.511
160.000	159.816	159.769	159.748	159.777	-0.223	0.068	0.436	0.863
200.000	199.596	199.563	199.529	199.563	-0.437	0.067		0.635
160.000	160.200	160.220	160.221	160.214	0.214	0.021	0.436	0.858
120.000	120.176	120.189	120.191	120.185	0.185	0.016	0.240	0.506
80.000	80.100	80.093	80.091	80.094	0.094	0.009	0.084	0.280
40.000	40.064	40.035	40.023	40.041	0.041	0.041	0.028	0.151
0.000	0.002	-0.008	-0.015	-0.007	-0.007	0.017		0.033

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0035
Electronics	7642
Node Type	7001
Hardware Version	5.01
Software Version	8.01

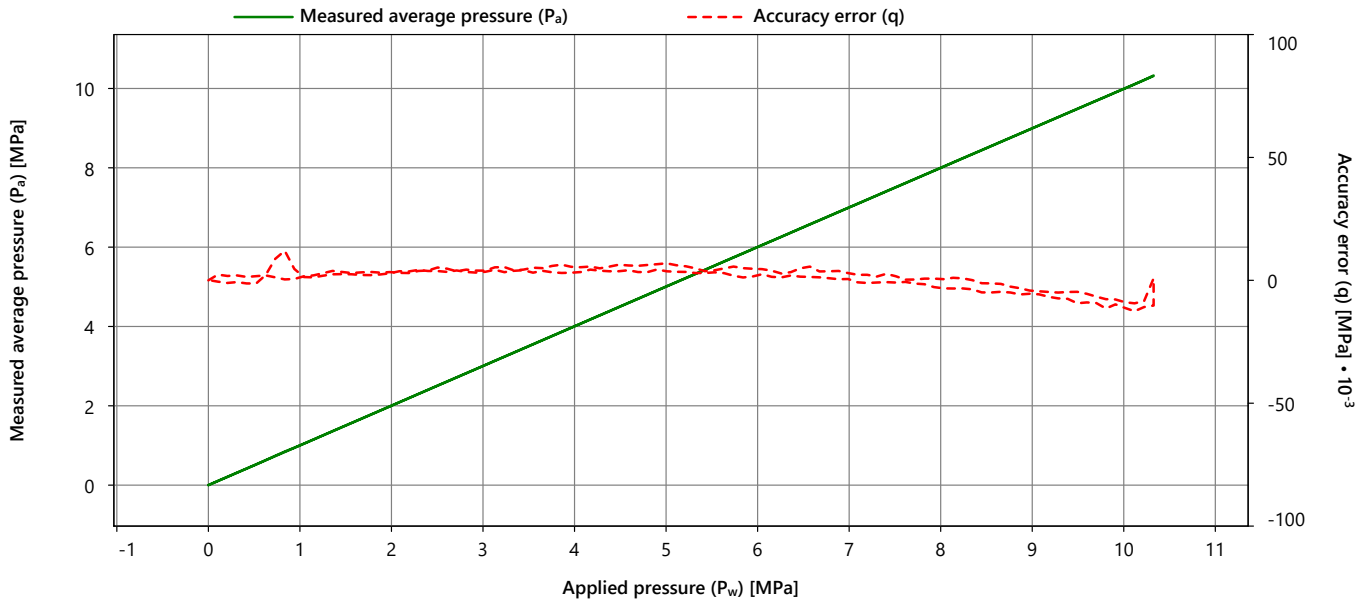
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23032112

Calibration Details	
Calibration Date	05 Dec 2023 06:36:03
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.009
Max repeatability error (b)	[MPa]	0.006
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	0.000
Resolution	[MPa]	2.2E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.001		0.003
2.000	2.004	2.003	2.003	2.003	0.003	0.002	0.000	0.004
4.000	4.006	4.006	4.004	4.005	0.005	0.002	-0.002	0.006
6.000	6.003	6.006	6.005	6.005	0.005	0.003	-0.002	0.007
8.000	8.002	8.001	7.997	8.000	0.000	0.006	-0.003	0.012
10.000	9.993	9.992	9.989	9.991	-0.009	0.003		0.008
8.000	7.996	7.998	7.996	7.997	-0.003	0.002	-0.003	0.008
6.000	6.002	6.002	6.003	6.002	0.002	0.001	-0.002	0.006
4.000	4.003	4.003	4.003	4.003	0.003	0.000	-0.002	0.005
2.000	2.003	2.003	2.003	2.003	0.003	0.001	0.000	0.004
0.000	0.001	0.000	0.000	0.000	0.000	0.001		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0035
Electronics	7642
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

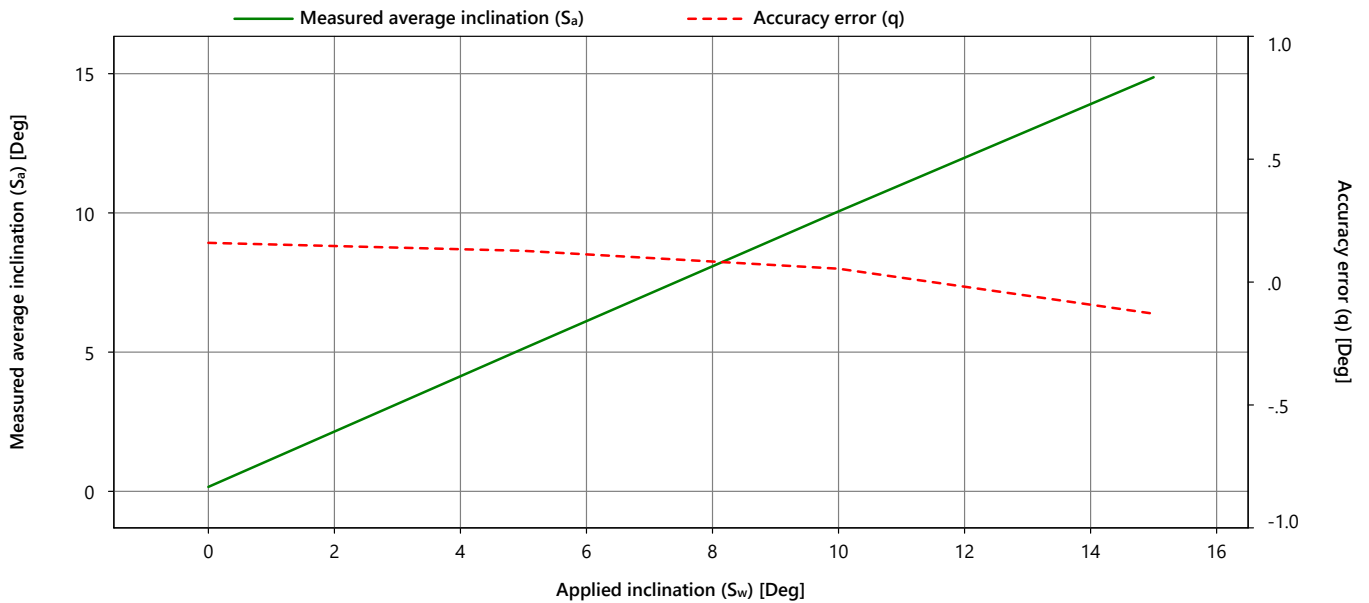
Certificate Number
FCN23032112

Calibration Details	
Calibration Date	05 Dec 2023 05:43:51
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.32E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.2	0.2	0.2	0.2	0.1	0.7
5.0	5.0	5.2	5.2	5.1	0.1	0.2	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.9	14.9	14.9	14.9	-0.1	0.0	0.7

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Symbols, Definitions and References

Certificate Number
FCN23032112

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0035

Appendix Applicable to
Certificate Number
FCN23032112

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

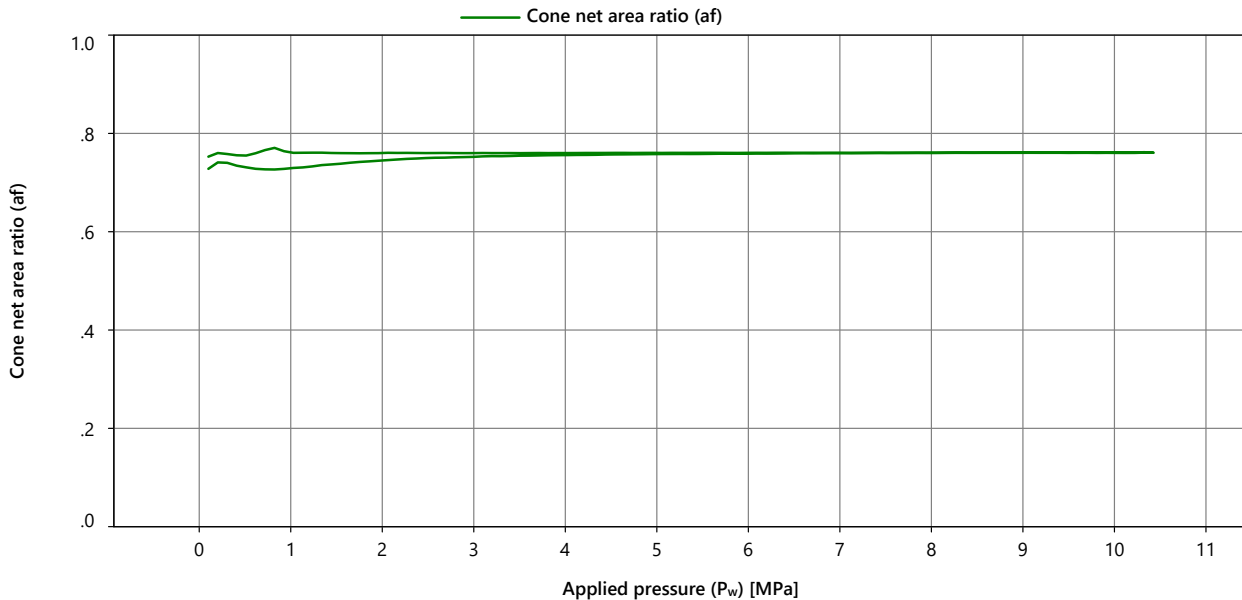
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0035	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7642	Measurement Details	
Node Type	7001	Measurement Date	05 Dec 2023 06:36:03
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032112

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.746	0.744	0.745	0.745
4.000	0.756	0.756	0.756	0.756
6.000	0.759	0.759	0.759	0.759
8.000	0.761	0.760	0.760	0.760
10.000	0.761	0.761	0.761	0.761
8.000	0.760	0.761	0.761	0.761
6.000	0.760	0.761	0.761	0.761
4.000	0.760	0.760	0.760	0.760
2.000	0.760	0.760	0.760	0.760

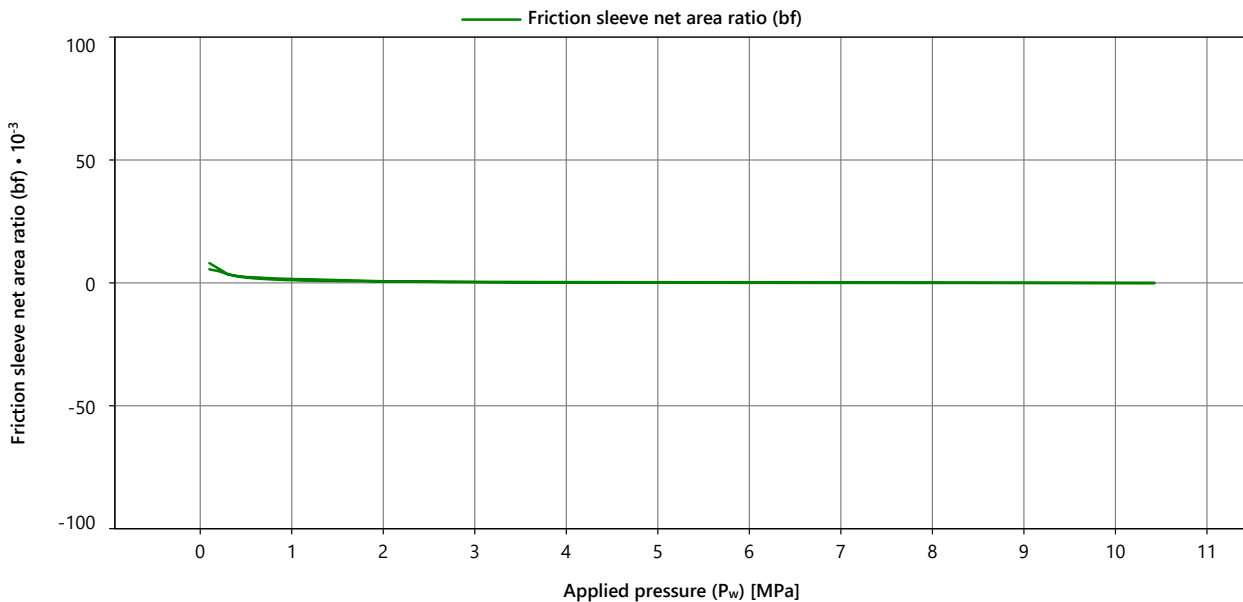
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0035	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7642	Measurement Details	
Node Type	7001	Measurement Date	05 Dec 2023 06:36:03
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

**Appendix Applicable to
Certificate Number
FCN23032112**

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	-0.00006

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.001	0.001	0.001	0.001
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.001	0.001	0.001	0.001

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23032112

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032114

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB20SN2-P1E2M4-V2
Serial Number 1715-0009

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 04-Dec-2023

Calibrate before 04-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/200bar (81188)	0 to 20 MPa	0 to 30 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.7 $\mu\text{V/V/kN}$	26.0 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	30.5 $\mu\text{V/V}$	0.26 %	0.21 %
Cone+Fric. [Force]	10.7 $\mu\text{V/V/kN}$	1.66 $\mu\text{V/V}$	10.7 $\mu\text{V/V/kN}$	4.26 $\mu\text{V/V}$	0.02 %	0.12 %
Pore 2 [Pressure]	2.23 mV/V/MPa	1.05 mV/V	2.23 mV/V/MPa	1.04 mV/V	-0.03 %	-0.01 %

Nootdorp, 05-Dec-2023

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Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0009
Electronics	7393
Node Type	7001
Hardware Version	5.01
Software Version	8.01

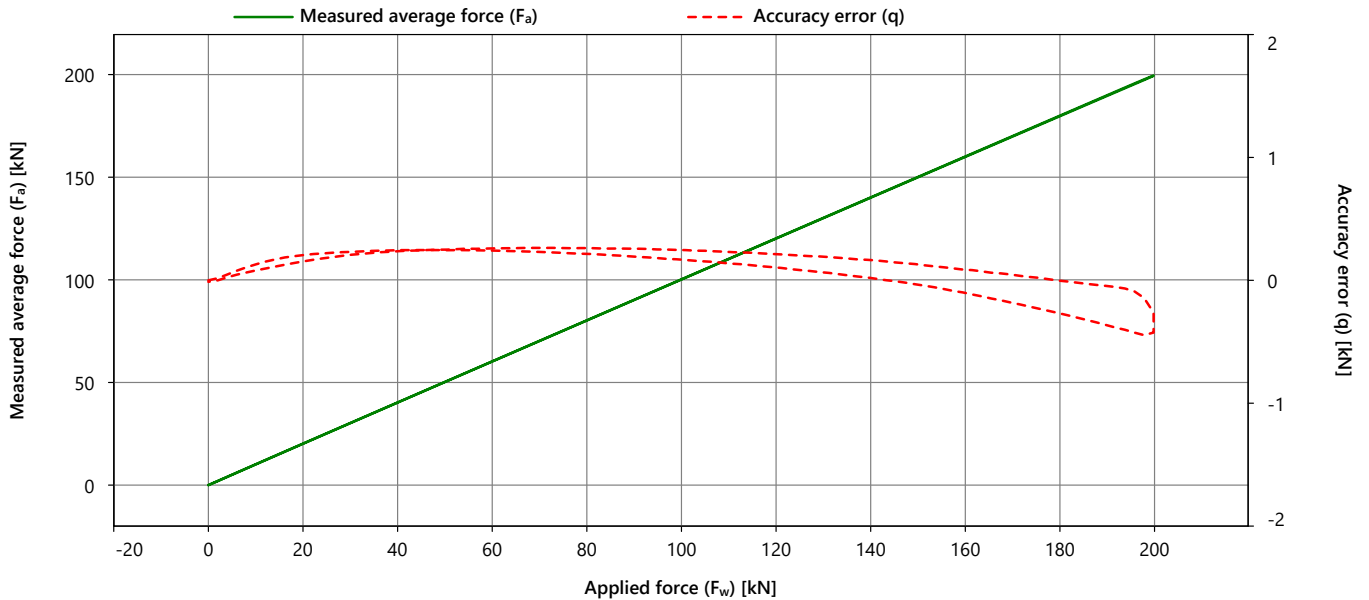
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032114

Calibration Details	
Calibration Date	04 Dec 2023 06:20:09
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.420
Max repeatability error (b)	[kN]	0.065
Max reversibility error (v)	[kN]	0.189
Zero load error (F _{c0})	[kN]	0.012
Zero load offset (F ₀)	[kN]	-0.067
Resolution	[kN]	8.65E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.005	-0.001	-0.004	0.000	0.000	0.008		0.026
40.000	40.235	40.249	40.252	40.245	0.245	0.017	-0.009	0.141
80.000	80.206	80.217	80.221	80.215	0.215	0.015	0.048	0.269
120.000	120.097	120.107	120.110	120.104	0.104	0.013	0.109	0.406
160.000	159.885	159.901	159.905	159.897	-0.103	0.020	0.189	0.555
200.000	199.568	199.583	199.589	199.580	-0.420	0.021		0.631
160.000	160.049	160.096	160.114	160.086	0.086	0.065	0.189	0.560
120.000	120.179	120.224	120.238	120.214	0.214	0.059	0.109	0.412
80.000	80.239	80.270	80.281	80.263	0.263	0.042	0.048	0.272
40.000	40.217	40.243	40.250	40.237	0.237	0.032	-0.009	0.145
0.000	-0.010	-0.012	-0.015	-0.012	-0.012	0.005		0.024

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0009
Electronics	7393
Node Type	7001
Hardware Version	5.01
Software Version	8.01

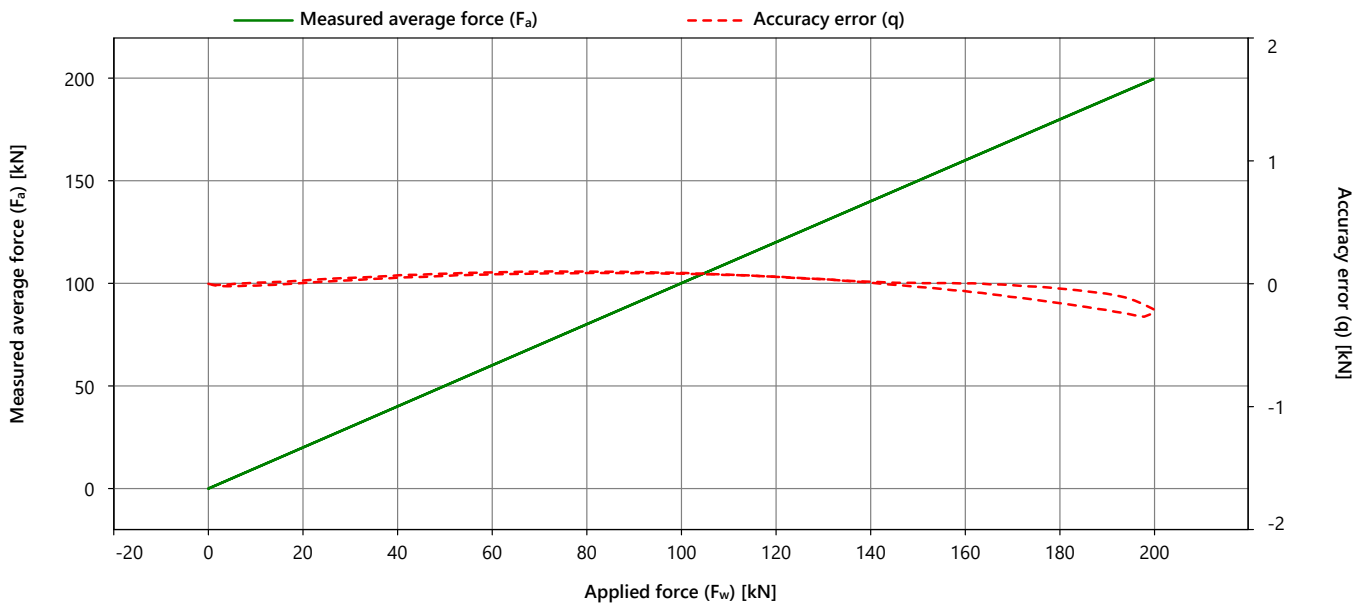
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032114

Calibration Details	
Calibration Date	04 Dec 2023 06:20:09
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.233
Max repeatability error (b)	[kN]	0.025
Max reversibility error (v)	[kN]	0.063
Zero load error (F _{c0})	[kN]	0.009
Zero load offset (F ₀)	[kN]	-0.004
Resolution	[kN]	8.69E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.125



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.008	-0.001	-0.006	0.000	0.000	0.014		0.028
40.000	40.054	40.045	40.048	40.049	0.049	0.009	0.019	0.141
80.000	80.092	80.080	80.088	80.087	0.087	0.013	0.013	0.263
120.000	120.067	120.050	120.056	120.058	0.058	0.016	-0.001	0.385
160.000	159.952	159.934	159.934	159.940	-0.060	0.018	0.063	0.513
200.000	199.781	199.760	199.760	199.767	-0.233	0.020		0.631
160.000	160.017	159.997	159.994	160.003	0.003	0.022	0.063	0.514
120.000	120.071	120.052	120.047	120.057	0.057	0.023	-0.001	0.386
80.000	80.115	80.091	80.094	80.100	0.100	0.025	0.013	0.264
40.000	40.081	40.063	40.061	40.068	0.068	0.020	0.019	0.143
0.000	-0.005	-0.010	-0.012	-0.009	-0.009	0.007		0.022

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0009
Electronics	7393
Node Type	7001
Hardware Version	5.01
Software Version	8.01

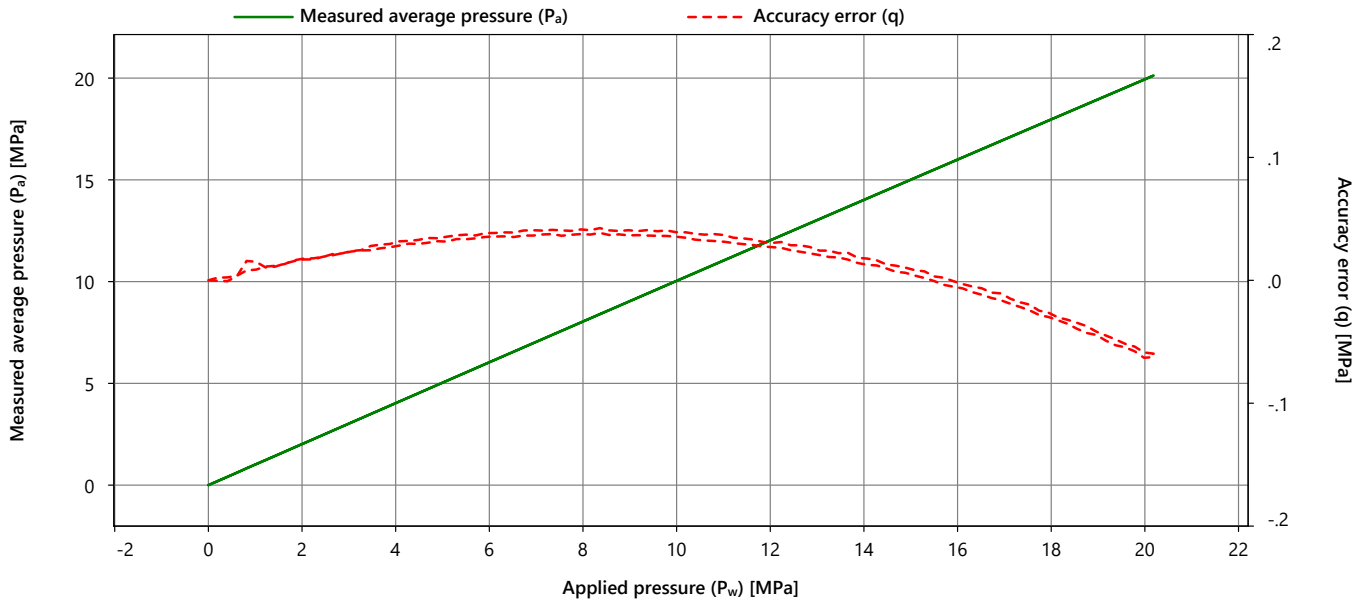
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23032114

Calibration Details	
Calibration Date	04 Dec 2023 09:48:16
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/200bar (81188)
Calibrated Range	0 to 20 MPa
Maximum Rating	0 to 30 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.059
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.004
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	-0.006
Resolution	[MPa]	3.34E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.001	-0.001	0.000	0.000	0.001		0.003
4.000	4.033	4.030	4.031	4.031	0.031	0.003	-0.003	0.008
8.000	8.041	8.042	8.041	8.041	0.041	0.000	-0.004	0.008
12.000	12.029	12.032	12.031	12.031	0.031	0.002	-0.004	0.010
16.000	15.999	15.998	15.998	15.998	-0.002	0.002	-0.004	0.012
20.000	19.941	19.941	19.941	19.941	-0.059	0.001		0.012
16.000	15.995	15.995	15.993	15.994	-0.006	0.001	-0.004	0.011
12.000	12.026	12.028	12.027	12.027	0.027	0.002	-0.004	0.010
8.000	8.038	8.036	8.037	8.037	0.037	0.002	-0.004	0.009
4.000	4.027	4.029	4.027	4.028	0.028	0.002	-0.003	0.007
0.000	-0.001	0.002	-0.001	0.000	0.000	0.002		0.005

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E2M4-V2
Serial Number	1715-0009
Electronics	7393
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

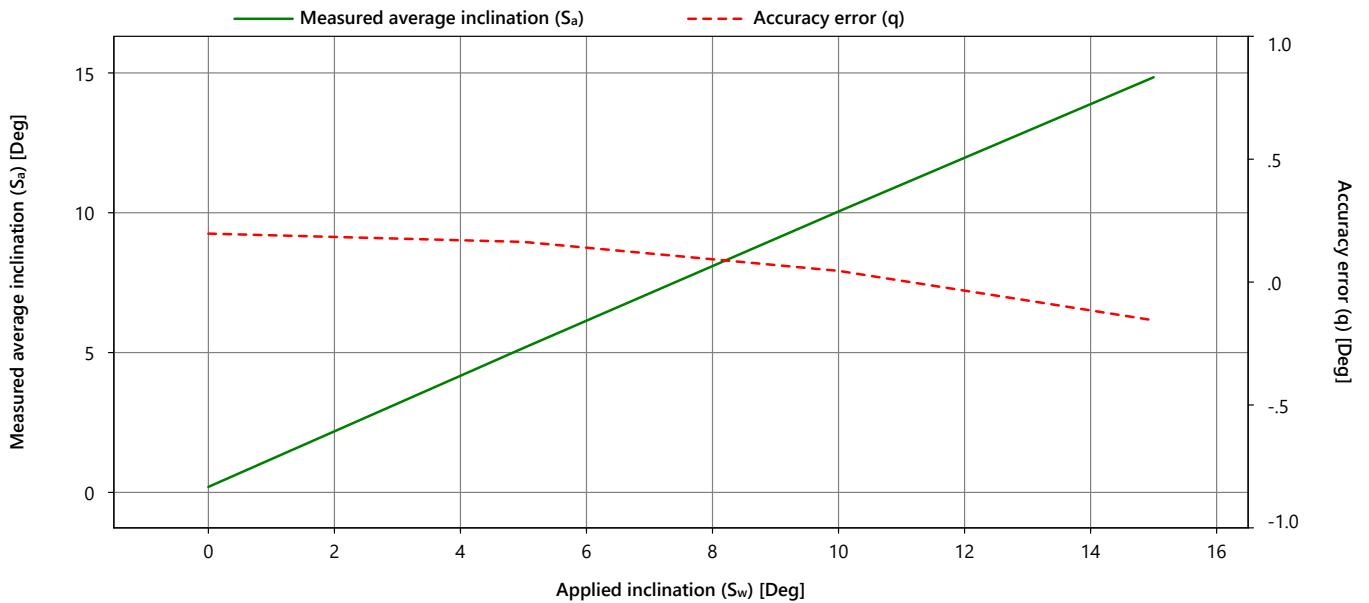
Certificate Number
FCN23032114

Calibration Details	
Calibration Date	04 Dec 2023 06:23:51
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.29E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.2	0.3	0.2	0.2	0.2	0.7
5.0	5.0	5.2	5.3	5.2	0.2	0.2	0.7
10.0	10.0	10.1	10.1	10.0	0.0	0.1	0.7
15.0	14.8	14.8	14.9	14.8	-0.2	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23032114

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P1E2M4-V2
Serial Number	1715-0009

Appendix Applicable to
Certificate Number
FCN23032114

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

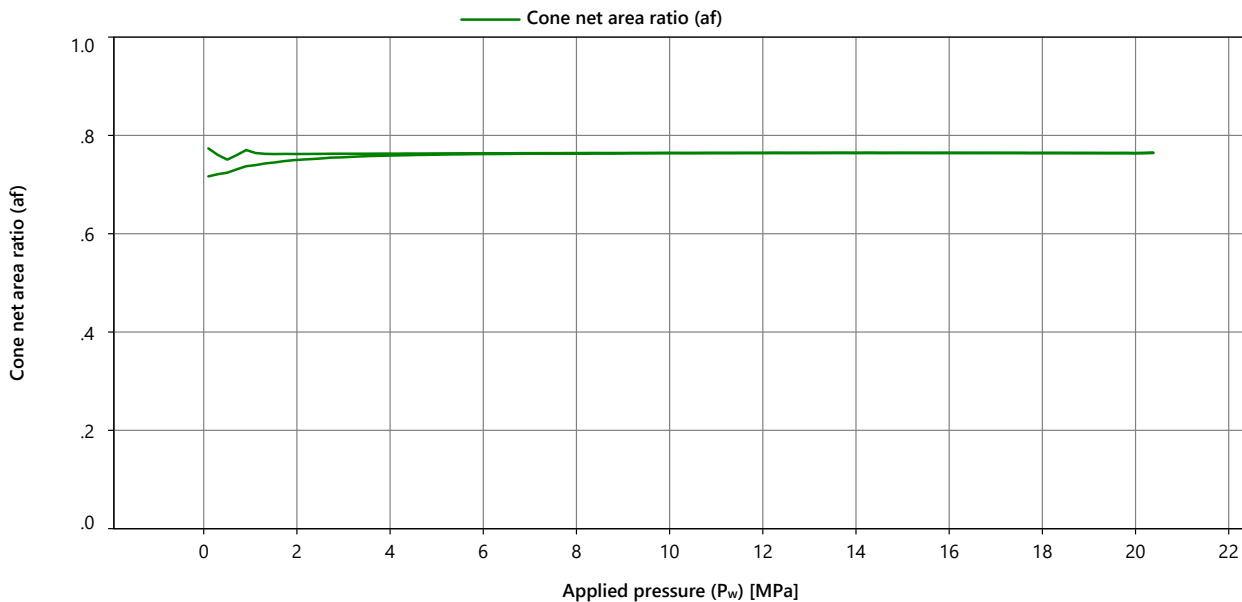
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB20SN2-P 1E2M4-V2	Serial Number	3257-0002
Serial Number	1715-0009	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7393	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 09:48:16
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032114

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
4.000	0.759	0.759	0.759	0.759
8.000	0.763	0.763	0.763	0.763
12.000	0.764	0.764	0.764	0.764
16.000	0.764	0.764	0.764	0.764
20.000	0.764	0.764	0.764	0.764
16.000	0.765	0.764	0.764	0.764
12.000	0.764	0.765	0.765	0.765
8.000	0.764	0.764	0.764	0.764
4.000	0.763	0.763	0.763	0.763

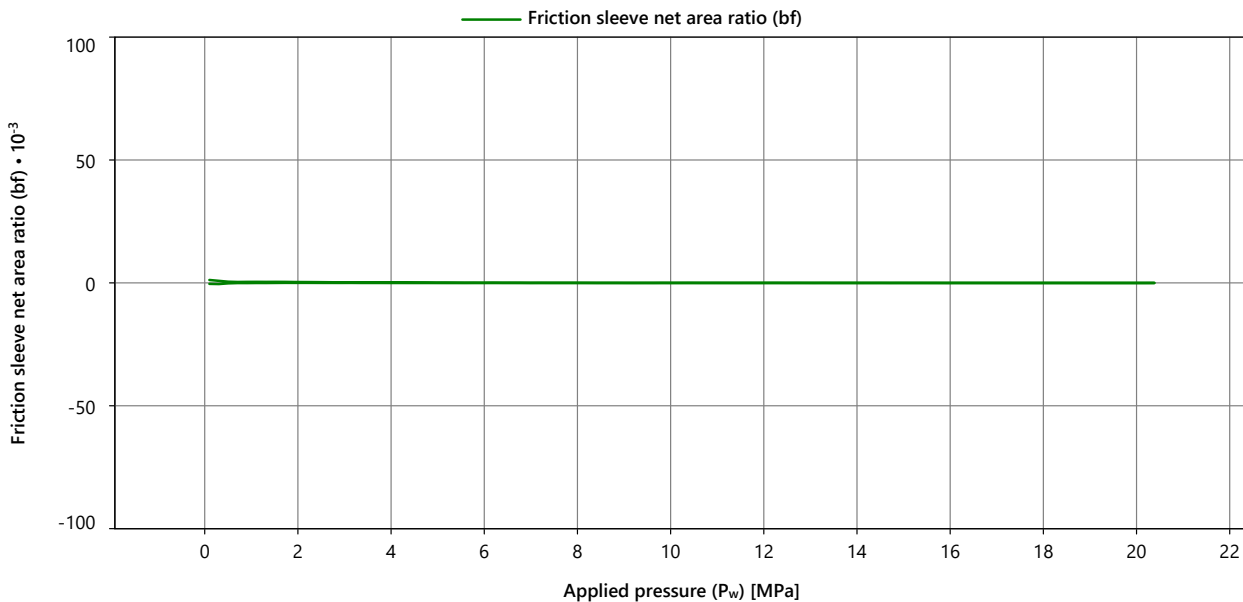
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB20SN2-P 1E2M4-V2	Serial Number	3257-0002
Serial Number	1715-0009	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7393	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 09:48:16
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032114

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	-0.00004

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
4.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
12.000	0.000	0.000	0.000	0.000
16.000	0.000	0.000	0.000	0.000
20.000	0.000	0.000	0.000	0.000
16.000	0.000	0.000	0.000	0.000
12.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23032114

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032117

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0060

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 04-Dec-2023

Calibrate before 04-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.8 $\mu\text{V/V/kN}$	6.07 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	10.5 $\mu\text{V/V}$	0.06 %	0.21 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	6.48 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	11.8 $\mu\text{V/V}$	0.05 %	0.25 %
Pore 2 [Pressure]	3.28 mV/V/MPa	951 $\mu\text{V/V}$	3.28 mV/V/MPa	939 $\mu\text{V/V}$	-0.06 %	-0.04 %

Nootdorp, 05-Dec-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0060
Electronics	7640
Node Type	7001
Hardware Version	5.01
Software Version	8.01

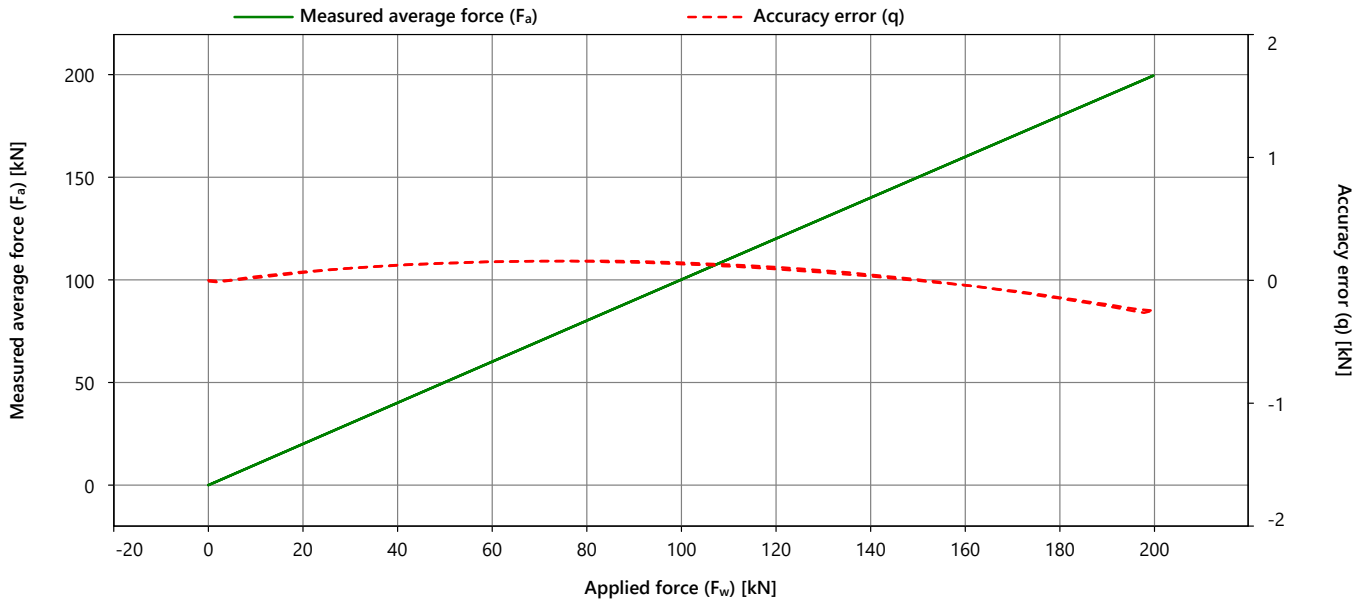
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032117

Calibration Details	
Calibration Date	04 Dec 2023 07:03:02
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.242
Max repeatability error (b)	[kN]	0.024
Max reversibility error (v)	[kN]	0.015
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	-0.006
Resolution	[kN]	8.61E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.004	0.000	-0.005	0.000	0.000	0.009		0.022
40.000	40.120	40.124	40.121	40.121	0.121	0.004	0.003	0.139
80.000	80.156	80.159	80.158	80.157	0.157	0.004	-0.004	0.262
120.000	120.108	120.107	120.106	120.107	0.107	0.002	-0.015	0.385
160.000	159.961	159.965	159.957	159.961	-0.039	0.008	-0.003	0.508
200.000	199.773	199.751	199.749	199.758	-0.242	0.024		0.631
160.000	159.953	159.959	159.962	159.958	-0.042	0.008	-0.003	0.508
120.000	120.090	120.096	120.089	120.092	0.092	0.007	-0.015	0.385
80.000	80.154	80.154	80.153	80.154	0.154	0.001	-0.004	0.262
40.000	40.126	40.125	40.122	40.124	0.124	0.004	0.003	0.139
0.000	-0.006	-0.006	-0.011	-0.008	-0.008	0.005		0.020

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0060
Electronics	7640
Node Type	7001
Hardware Version	5.01
Software Version	8.01

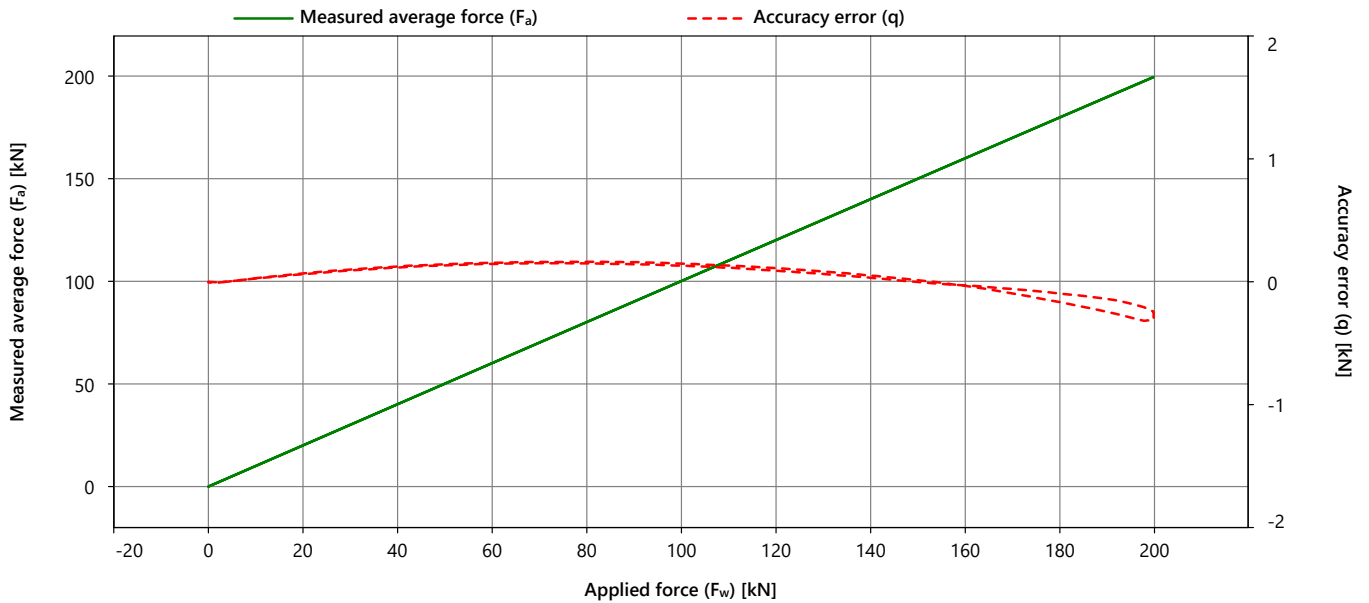
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032117

Calibration Details	
Calibration Date	04 Dec 2023 07:03:02
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.308
Max repeatability error (b)	[kN]	0.046
Max reversibility error (v)	[kN]	0.020
Zero load error (F _{c0})	[kN]	0.006
Zero load offset (F ₀)	[kN]	-0.012
Resolution	[kN]	8.66E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.026



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.002	0.001	-0.004	0.000	0.000	0.006		0.018
40.000	40.122	40.124	40.126	40.124	0.124	0.005	-0.008	0.139
80.000	80.157	80.163	80.166	80.162	0.162	0.009	-0.012	0.262
120.000	120.106	120.112	120.114	120.110	0.110	0.008	-0.020	0.385
160.000	159.962	159.972	159.968	159.968	-0.032	0.010	0.002	0.508
200.000	199.719	199.686	199.672	199.692	-0.308	0.046		0.633
160.000	159.960	159.968	159.982	159.970	-0.030	0.022	0.002	0.508
120.000	120.088	120.092	120.092	120.091	0.091	0.004	-0.020	0.385
80.000	80.149	80.150	80.151	80.150	0.150	0.002	-0.012	0.262
40.000	40.116	40.116	40.116	40.116	0.116	0.001	-0.008	0.139
0.000	-0.003	-0.007	-0.008	-0.006	-0.006	0.005		0.018

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0060
Electronics	7640
Node Type	7001
Hardware Version	5.01
Software Version	8.01

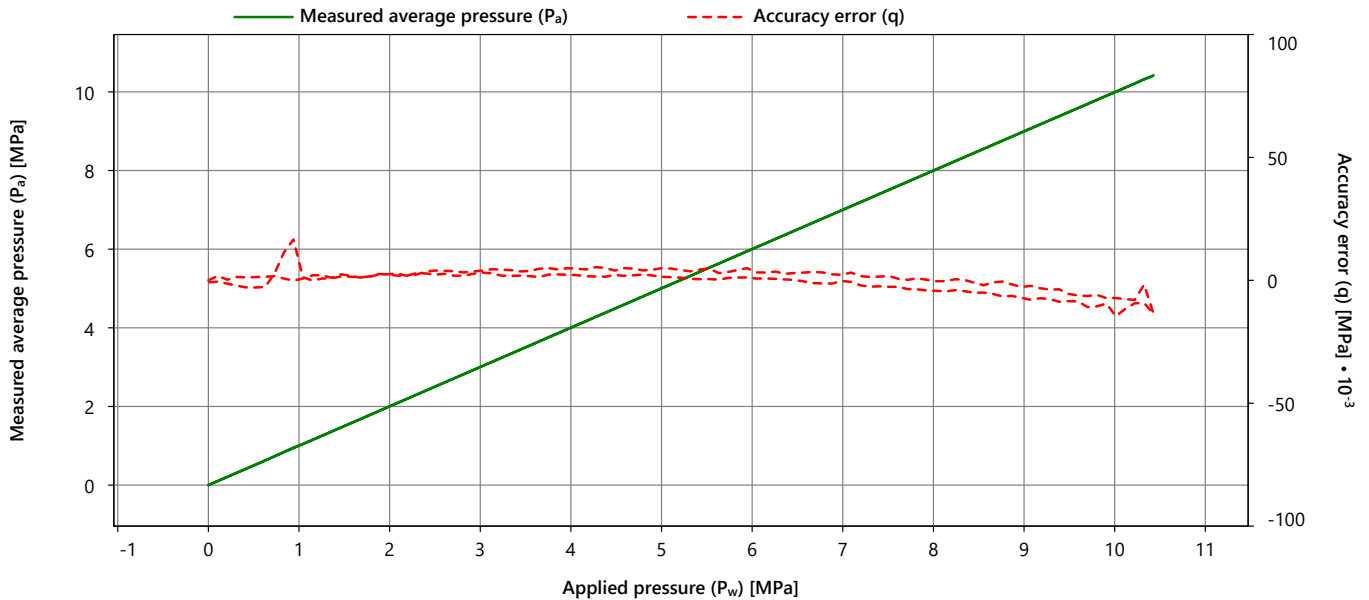
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23032117

Calibration Details	
Calibration Date	04 Dec 2023 07:46:42
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.007
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.004
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	0.002
Resolution	[MPa]	2.27E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.001	2.003	2.003	2.003	0.003	0.002	0.000	0.004
4.000	4.007	4.002	4.006	4.005	0.005	0.004	-0.003	0.009
6.000	6.005	6.004	6.003	6.004	0.004	0.002	-0.003	0.007
8.000	7.999	8.001	8.000	8.000	0.000	0.001	-0.004	0.009
10.000	9.993	9.994	9.992	9.993	-0.007	0.002		0.008
8.000	7.995	7.997	7.996	7.996	-0.004	0.002	-0.004	0.009
6.000	6.000	6.001	6.002	6.001	0.001	0.002	-0.003	0.007
4.000	4.004	4.001	4.002	4.002	0.002	0.003	-0.003	0.007
2.000	2.001	2.003	2.002	2.002	0.002	0.002	0.000	0.004
0.000	-0.001	-0.001	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0060
Electronics	7640
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

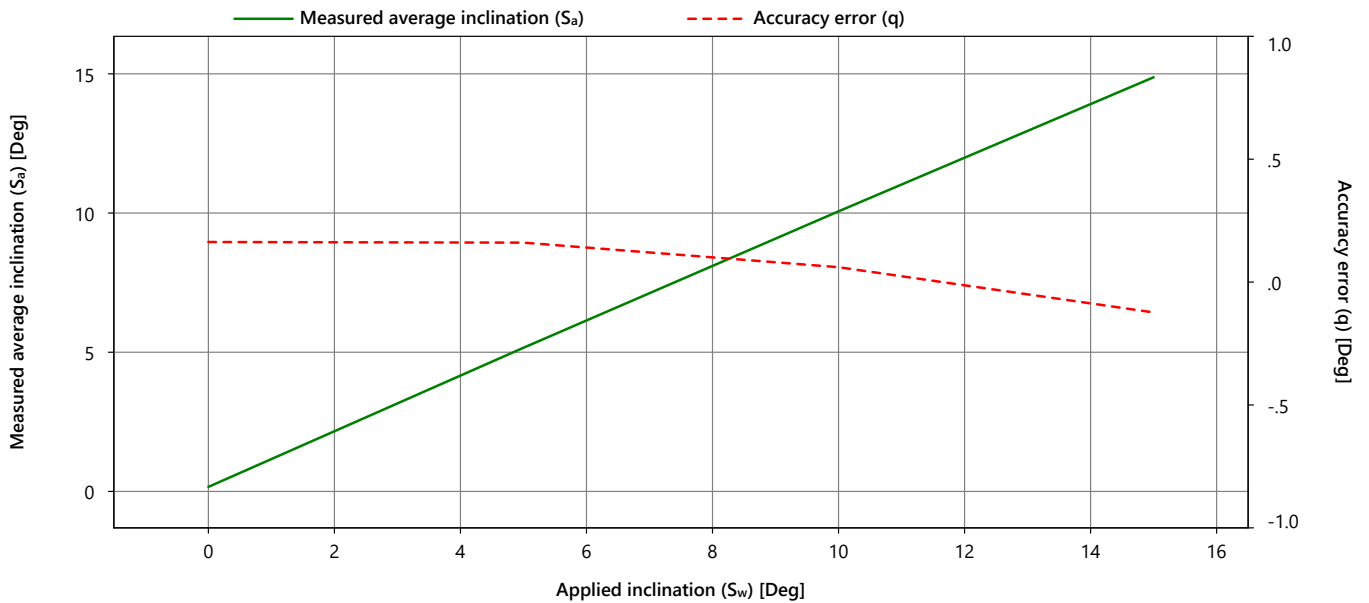
Certificate Number
FCN23032117

Calibration Details	
Calibration Date	04 Dec 2023 07:07:00
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.3E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.2	0.3	0.2	0.2	0.2	0.7
5.0	5.0	5.2	5.3	5.2	0.2	0.2	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.9	14.9	14.8	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23032117

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Fugro Transducer Workshop, P.O. Box 130, 2630 AC Nootdorp, The Netherlands, Phone +31-70-3111444, www.fugro.com
Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0060

Appendix Applicable to
Certificate Number
FCN23032117

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0060
Electronics	7640
Node Type	7001
Hardware Version	5.01
Software Version	8.01

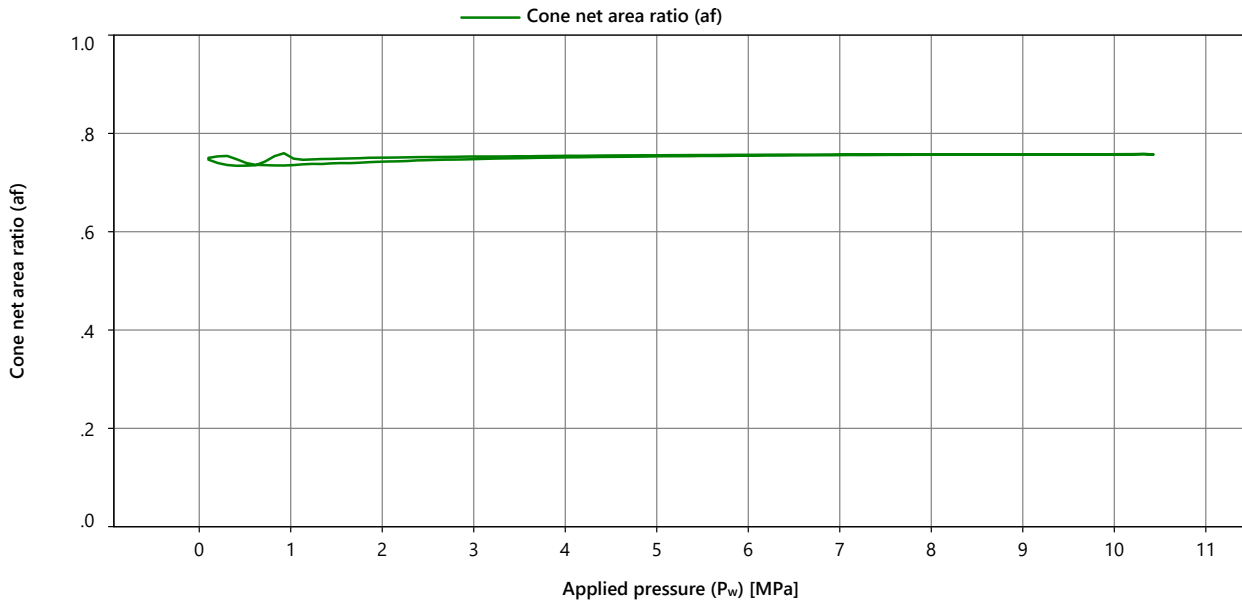
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23032117

Measurement Details	
Measurement Date	04 Dec 2023 07:46:42
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.741	0.743	0.743	0.743
4.000	0.751	0.751	0.752	0.751
6.000	0.755	0.755	0.755	0.755
8.000	0.757	0.757	0.757	0.757
10.000	0.758	0.758	0.758	0.758
8.000	0.757	0.757	0.758	0.757
6.000	0.756	0.756	0.757	0.756
4.000	0.755	0.754	0.754	0.754
2.000	0.750	0.751	0.750	0.751

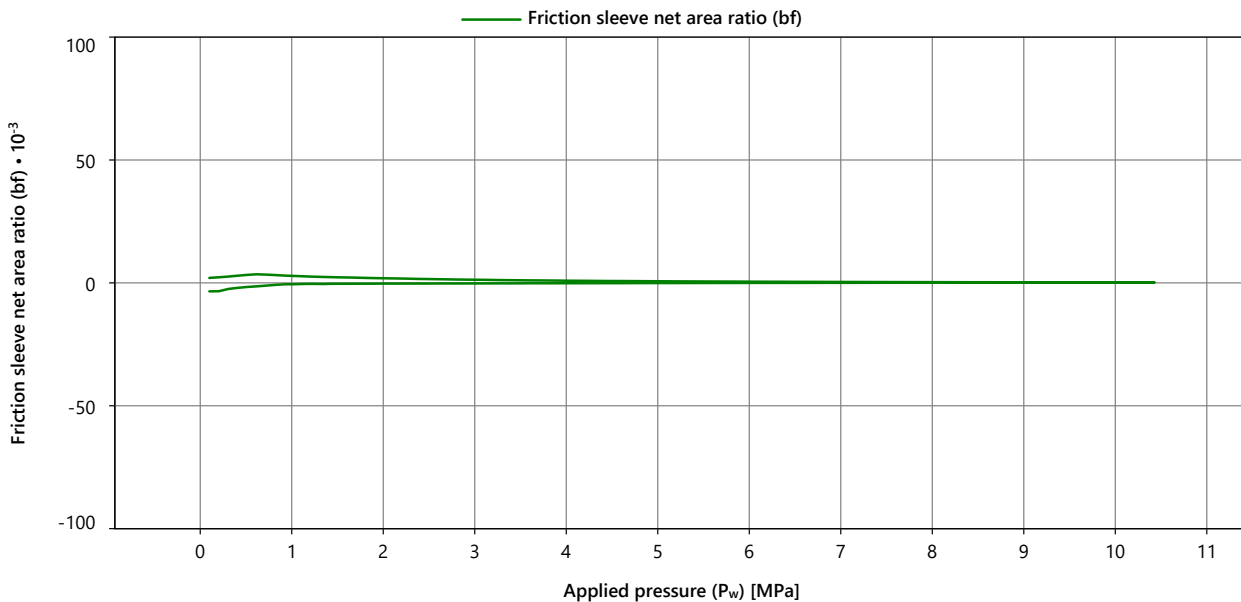
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0060	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7640	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 07:46:42
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032117

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00019

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.002	0.002	0.002	0.002
4.000	0.001	0.001	0.001	0.001
6.000	0.001	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23032117

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032118

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0062

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 04-Dec-2023

Calibrate before 04-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.8 $\mu\text{V/V/kN}$	1.10 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	7.05 $\mu\text{V/V}$	0.08 %	0.28 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	-5.12 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	1.08 $\mu\text{V/V}$	0.03 %	0.29 %
Pore 2 [Pressure]	3.32 mV/V/MPa	1.26 mV/V	3.32 mV/V/MPa	1.25 mV/V	-0.02 %	-0.05 %

Nootdorp, 05-Dec-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0062
Electronics	9353
Node Type	7001
Hardware Version	6.00
Software Version	8.01

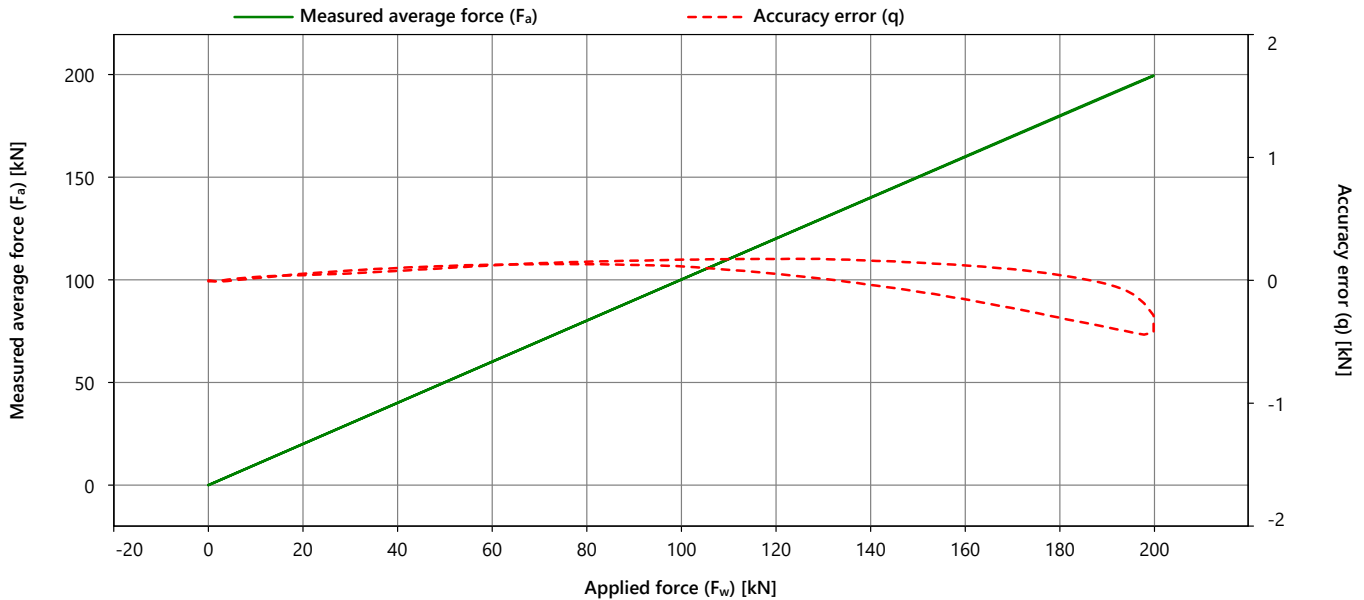
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032118

Calibration Details	
Calibration Date	04 Dec 2023 07:17:36
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.420
Max repeatability error (b)	[kN]	0.042
Max reversibility error (v)	[kN]	0.275
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	0.001
Resolution	[kN]	8.62E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.002	0.000	-0.001	0.000	0.000	0.003		0.019
40.000	40.105	40.097	40.099	40.100	0.100	0.008	-0.024	0.142
80.000	80.134	80.121	80.138	80.131	0.131	0.017	0.021	0.263
120.000	120.056	120.042	120.060	120.053	0.053	0.019	0.120	0.411
160.000	159.854	159.833	159.851	159.846	-0.154	0.021	0.275	0.627
200.000	199.608	199.566	199.567	199.580	-0.420	0.042		0.632
160.000	160.110	160.134	160.119	160.121	0.121	0.024	0.275	0.627
120.000	120.165	120.187	120.167	120.173	0.173	0.022	0.120	0.411
80.000	80.148	80.157	80.150	80.152	0.152	0.010	0.021	0.263
40.000	40.079	40.078	40.074	40.077	0.077	0.005	-0.024	0.142
0.000	-0.006	-0.008	-0.011	-0.008	-0.008	0.005		0.020

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0062
Electronics	9353
Node Type	7001
Hardware Version	6.00
Software Version	8.01

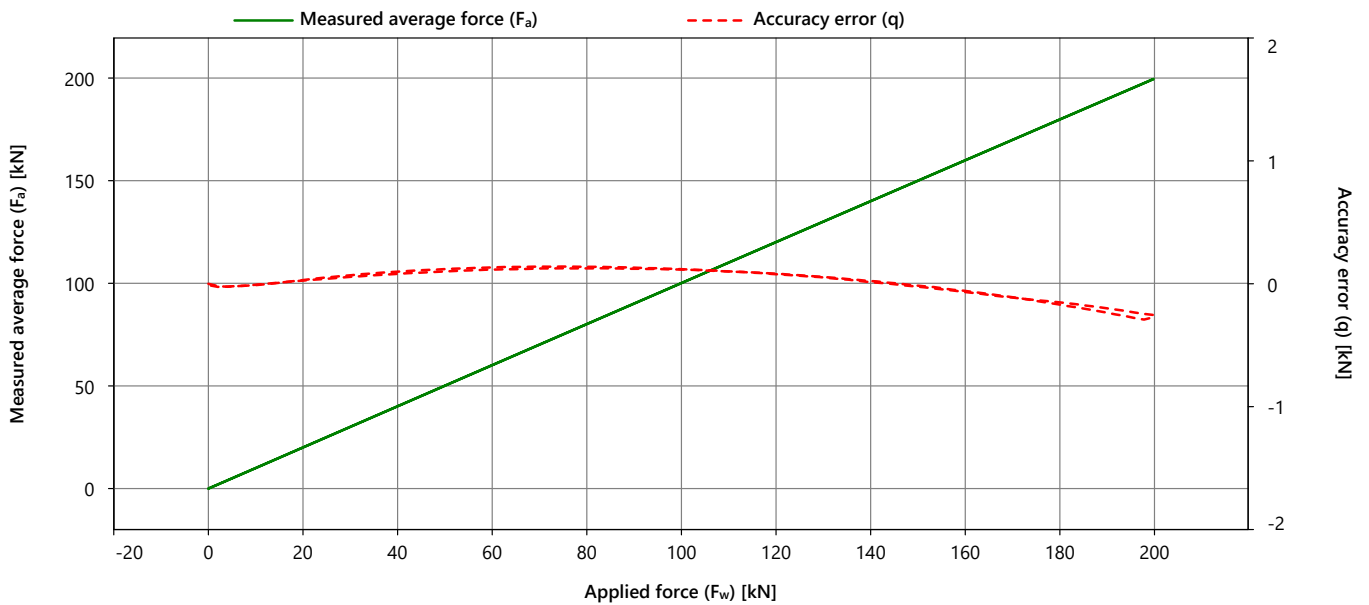
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032118

Calibration Details	
Calibration Date	04 Dec 2023 07:17:36
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.269
Max repeatability error (b)	[kN]	0.065
Max reversibility error (v)	[kN]	0.018
Zero load error (F _{c0})	[kN]	0.011
Zero load offset (F ₀)	[kN]	0.024
Resolution	[kN]	8.65E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.068



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.007	-0.001	-0.006	0.000	0.000	0.013		0.028
40.000	40.101	40.073	40.068	40.081	0.081	0.033	0.018	0.146
80.000	80.152	80.112	80.112	80.125	0.125	0.040	0.013	0.266
120.000	120.113	120.067	120.066	120.082	0.082	0.047	-0.005	0.389
160.000	159.975	159.926	159.925	159.942	-0.058	0.051	-0.009	0.511
200.000	199.773	199.713	199.708	199.731	-0.269	0.065		0.635
160.000	159.963	159.920	159.914	159.932	-0.068	0.049	-0.009	0.511
120.000	120.108	120.064	120.061	120.077	0.077	0.047	-0.005	0.389
80.000	80.167	80.126	80.122	80.138	0.138	0.045	0.013	0.267
40.000	40.123	40.087	40.086	40.099	0.099	0.036	0.018	0.147
0.000	-0.008	-0.010	-0.015	-0.011	-0.011	0.007		0.023

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0062
Electronics	9353
Node Type	7001
Hardware Version	6.00
Software Version	8.01

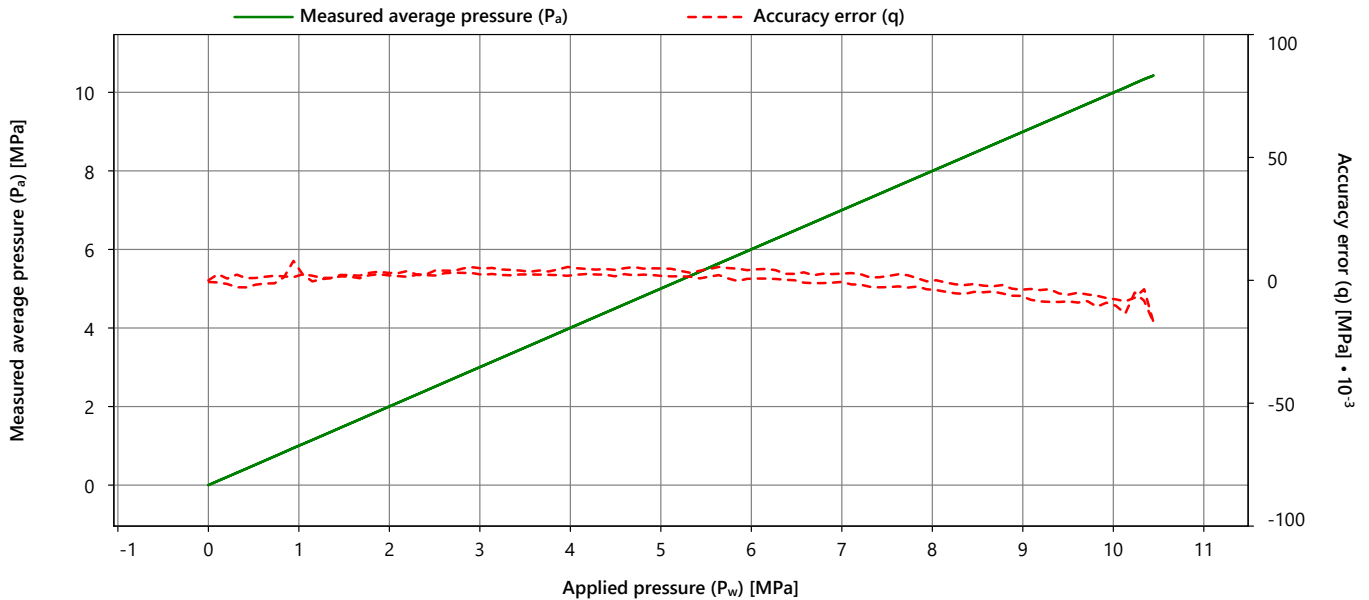
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23032118

Calibration Details	
Calibration Date	04 Dec 2023 07:36:05
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.008
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.004
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	-0.001
Resolution	[MPa]	2.25E-06
Noise RMS	[MPa]	0.001



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.004
2.000	2.002	2.002	2.005	2.003	0.003	0.003	-0.001	0.007
4.000	4.005	4.004	4.006	4.005	0.005	0.002	-0.003	0.007
6.000	6.002	6.004	6.006	6.004	0.004	0.004	-0.003	0.009
8.000	7.998	8.001	8.000	8.000	0.000	0.002	-0.004	0.009
10.000	9.994	9.993	9.991	9.992	-0.008	0.003		0.008
8.000	7.997	7.997	7.995	7.996	-0.004	0.002	-0.004	0.009
6.000	6.001	6.000	6.001	6.001	0.001	0.001	-0.003	0.008
4.000	4.003	4.002	4.001	4.002	0.002	0.001	-0.003	0.007
2.000	2.001	2.003	2.002	2.002	0.002	0.002	-0.001	0.005
0.000	-0.001	-0.001	-0.001	-0.001	-0.001	0.000		0.004

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0062
Electronics	9353
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

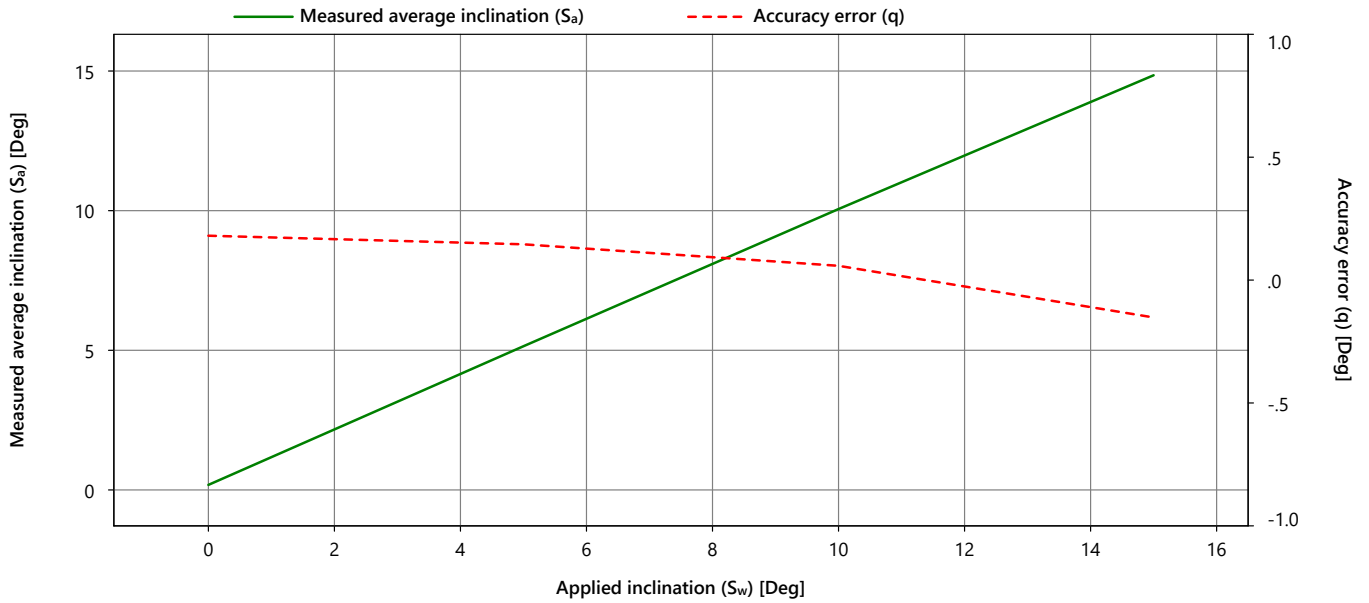
Certificate Number
FCN23032118

Calibration Details	
Calibration Date	04 Dec 2023 07:21:50
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.32E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.2	0.3	0.2	0.2	0.2	0.7
5.0	5.0	5.1	5.3	5.1	0.1	0.2	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.1	0.7
15.0	14.8	14.9	14.8	14.8	-0.2	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23032118

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0062

Appendix Applicable to
Certificate Number
FCN23032118

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

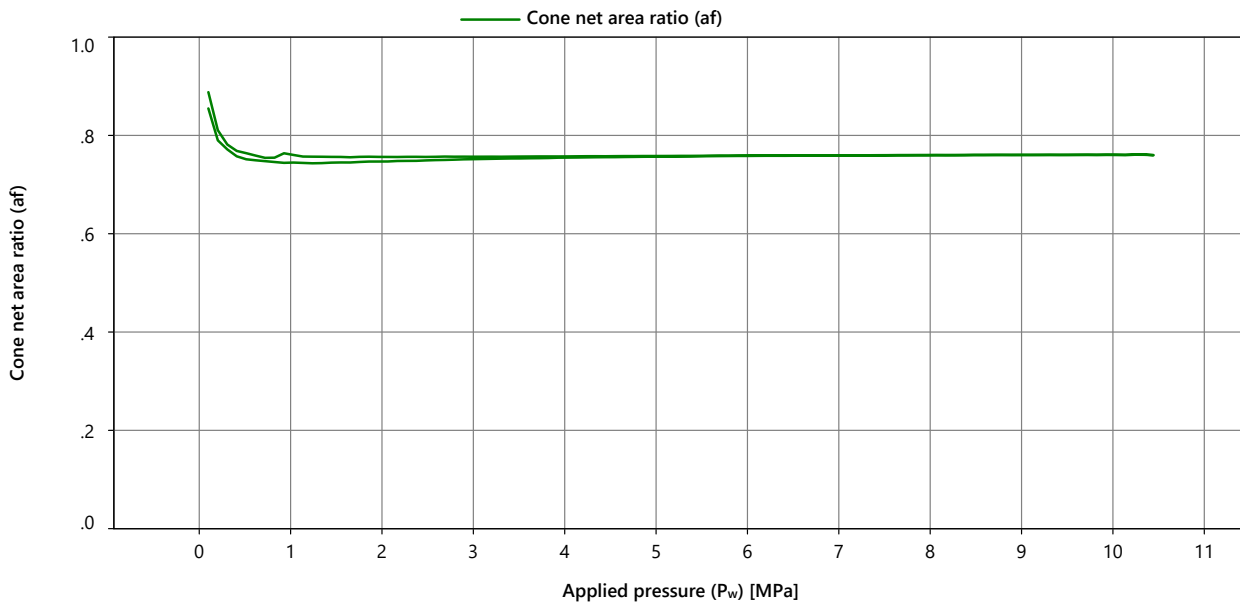
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0062	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9353	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 07:36:05
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032118

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.744	0.747	0.750	0.747
4.000	0.754	0.755	0.756	0.755
6.000	0.757	0.758	0.759	0.758
8.000	0.760	0.760	0.760	0.760
10.000	0.761	0.761	0.761	0.761
8.000	0.760	0.760	0.760	0.760
6.000	0.759	0.759	0.759	0.759
4.000	0.757	0.757	0.758	0.757
2.000	0.755	0.757	0.757	0.756

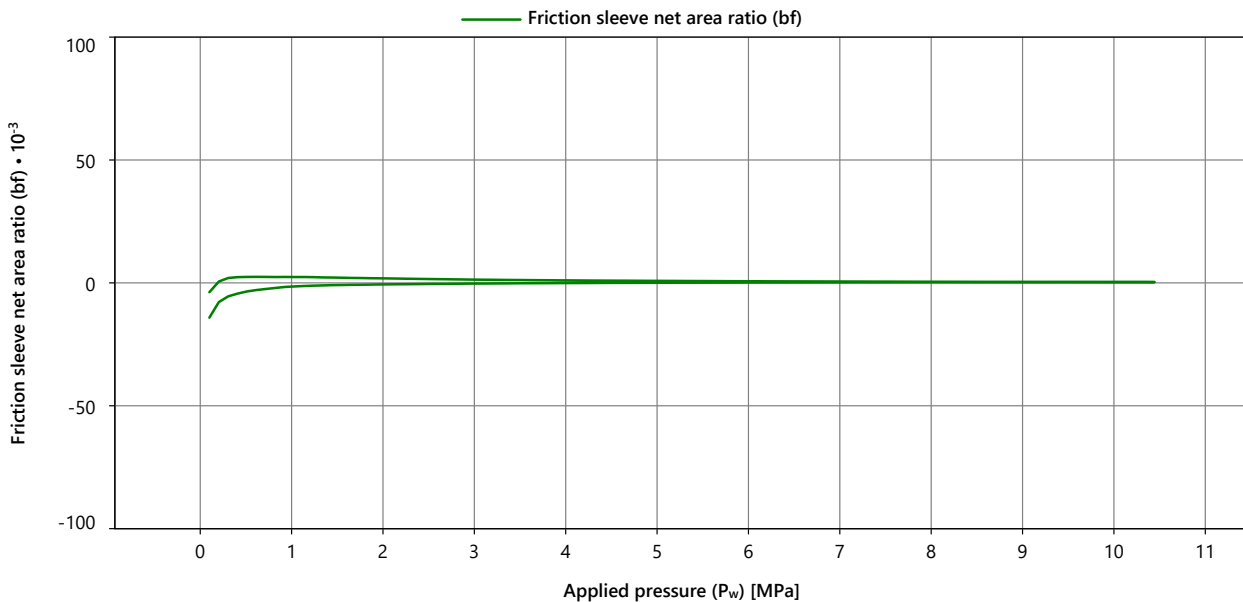
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0062	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9353	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 07:36:05
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

**Appendix Applicable to
Certificate Number
FCN23032118**

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00032

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.002	0.002	0.002	0.002
4.000	0.001	0.001	0.001	0.001
6.000	0.001	0.001	0.001	0.001
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	-0.001	-0.001	-0.001	-0.001

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23032118

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032121

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0033

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 04-Dec-2023

Calibrate before 04-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	4.80 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	6.92 $\mu\text{V/V}$	0.48 %	0.10 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	8.63 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	10.5 $\mu\text{V/V}$	0.48 %	0.09 %
Pore 2 [Pressure]	3.37 mV/V/MPa	1.07 mV/V	3.37 mV/V/MPa	1.04 mV/V	0.02 %	-0.08 %

Nootdorp, 05-Dec-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0033
Electronics	9131
Node Type	7001
Hardware Version	6.00
Software Version	8.01

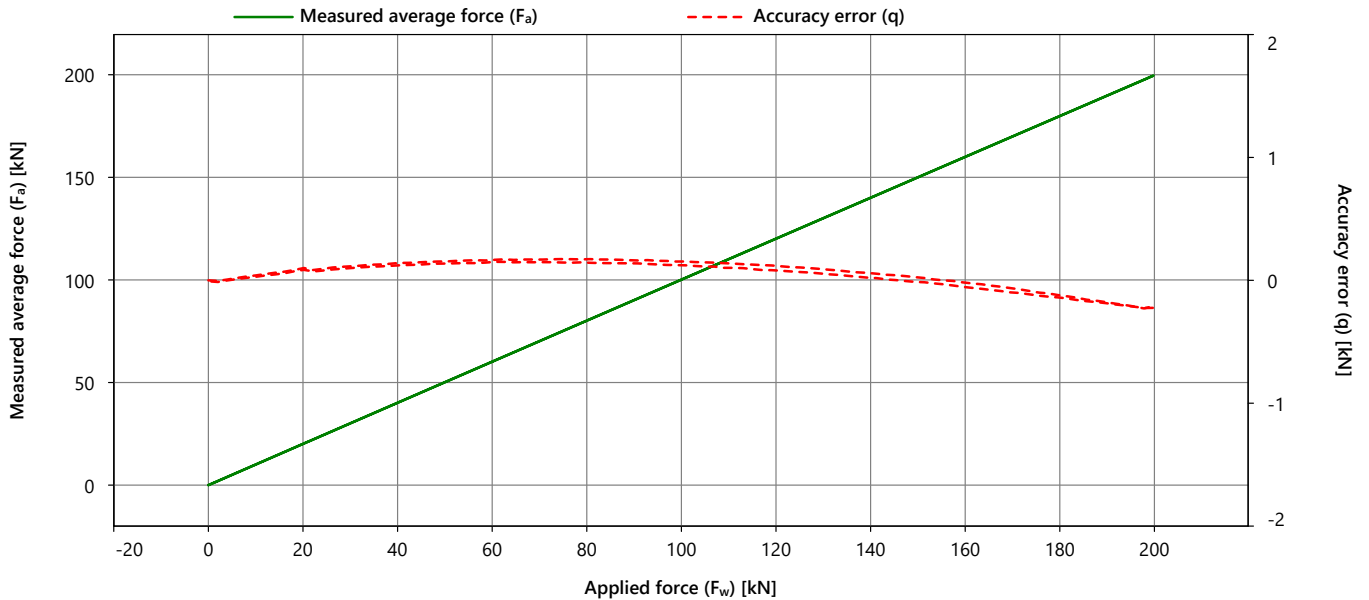
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032121

Calibration Details	
Calibration Date	04 Dec 2023 08:09:27
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.205
Max repeatability error (b)	[kN]	0.066
Max reversibility error (v)	[kN]	0.038
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	-0.011
Resolution	[kN]	8.53E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.002	0.002	-0.003	0.000	0.000	0.005		0.020
40.000	40.120	40.153	40.149	40.140	0.140	0.033	-0.019	0.146
80.000	80.146	80.189	80.181	80.172	0.172	0.043	-0.028	0.268
120.000	120.093	120.134	120.130	120.119	0.119	0.041	-0.038	0.390
160.000	159.950	159.999	159.991	159.980	-0.020	0.049	-0.035	0.512
200.000	199.759	199.826	199.800	199.795	-0.205	0.066		0.635
160.000	159.914	159.963	159.957	159.945	-0.055	0.049	-0.035	0.512
120.000	120.053	120.099	120.091	120.081	0.081	0.046	-0.038	0.391
80.000	80.119	80.161	80.153	80.144	0.144	0.042	-0.028	0.268
40.000	40.099	40.140	40.127	40.122	0.122	0.041	-0.019	0.148
0.000	-0.008	-0.006	-0.010	-0.008	-0.008	0.004		0.019

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0033
Electronics	9131
Node Type	7001
Hardware Version	6.00
Software Version	8.01

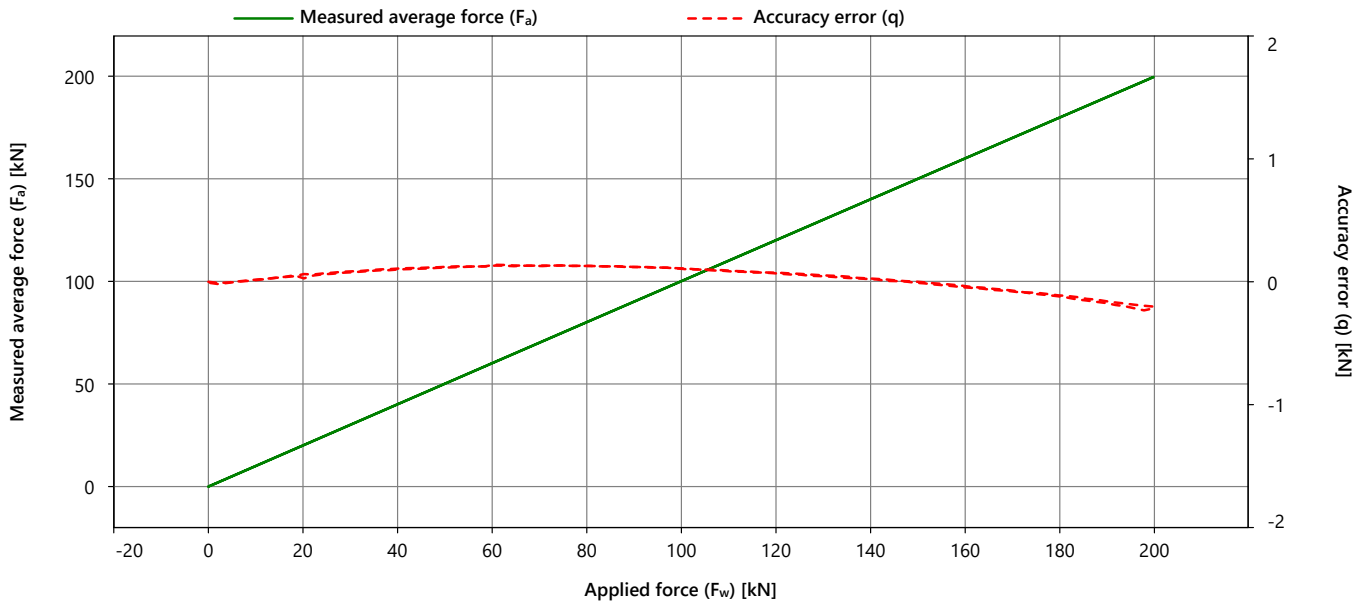
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032121

Calibration Details	
Calibration Date	04 Dec 2023 08:09:27
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.212
Max repeatability error (b)	[kN]	0.011
Max reversibility error (v)	[kN]	0.011
Zero load error (F _{c0})	[kN]	0.008
Zero load offset (F ₀)	[kN]	0.002
Resolution	[kN]	8.57E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.067



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.000	0.004	-0.004	0.000	0.000	0.008		0.021
40.000	40.104	40.097	40.098	40.100	0.100	0.007	0.007	0.139
80.000	80.132	80.127	80.129	80.129	0.129	0.005	0.000	0.262
120.000	120.074	120.074	120.073	120.074	0.074	0.001	-0.006	0.385
160.000	159.960	159.971	159.961	159.964	-0.036	0.011	-0.011	0.508
200.000	199.791	199.792	199.781	199.788	-0.212	0.011		0.631
160.000	159.958	159.948	159.955	159.953	-0.047	0.010	-0.011	0.508
120.000	120.070	120.067	120.068	120.068	0.068	0.003	-0.006	0.385
80.000	80.132	80.128	80.129	80.130	0.130	0.004	0.000	0.262
40.000	40.109	40.105	40.107	40.107	0.107	0.005	0.007	0.139
0.000	-0.006	-0.009	-0.008	-0.008	-0.008	0.003		0.019

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0033
Electronics	9131
Node Type	7001
Hardware Version	6.00
Software Version	8.01

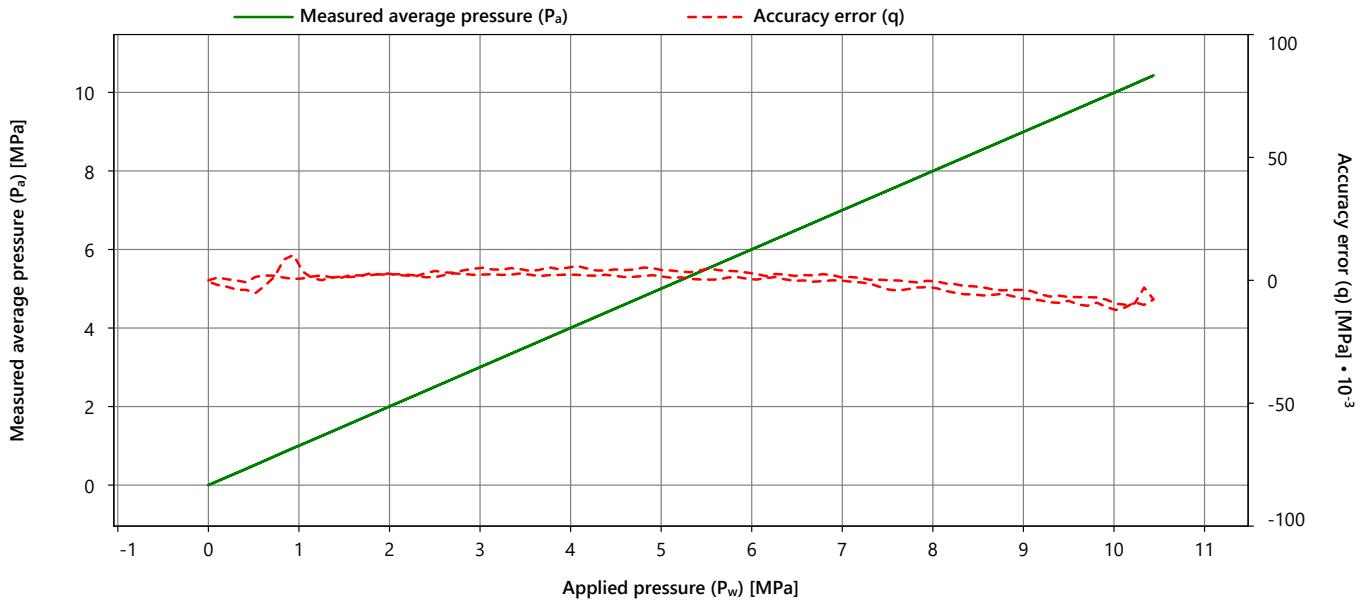
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23032121

Calibration Details	
Calibration Date	04 Dec 2023 11:05:01
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.009
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	-0.003
Resolution	[MPa]	2.21E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.002	2.004	2.002	2.003	0.003	0.002	0.000	0.005
4.000	4.006	4.006	4.005	4.006	0.006	0.002	-0.003	0.007
6.000	6.004	6.003	6.002	6.003	0.003	0.001	-0.003	0.006
8.000	8.000	7.999	8.001	8.000	0.000	0.003	-0.003	0.008
10.000	9.990	9.992	9.990	9.991	-0.009	0.002		0.008
8.000	7.998	7.996	7.997	7.997	-0.003	0.002	-0.003	0.008
6.000	6.001	6.000	6.000	6.000	0.000	0.001	-0.003	0.007
4.000	4.003	4.002	4.002	4.002	0.002	0.001	-0.003	0.007
2.000	2.002	2.002	2.003	2.002	0.002	0.001	0.000	0.004
0.000	0.000	-0.001	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0033
Electronics	9131
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

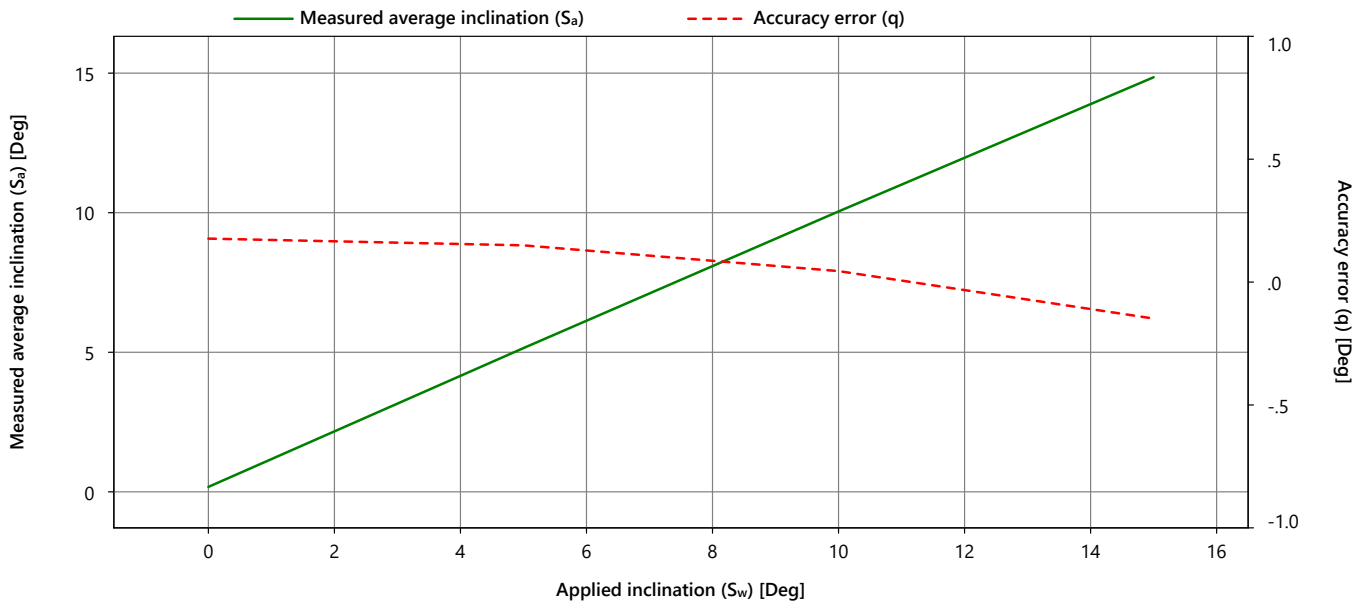
Certificate Number
FCN23032121

Calibration Details	
Calibration Date	04 Dec 2023 08:13:03
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.29E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.2	0.3	0.2	0.2	0.2	0.7
5.0	5.1	5.1	5.2	5.1	0.1	0.2	0.7
10.0	9.9	10.1	10.1	10.0	0.0	0.2	0.7
15.0	14.8	14.9	14.8	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23032121

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

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International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0033

Appendix Applicable to
Certificate Number
FCN23032121

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

Cone Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0033
Electronics	9131
Node Type	7001
Hardware Version	6.00
Software Version	8.01

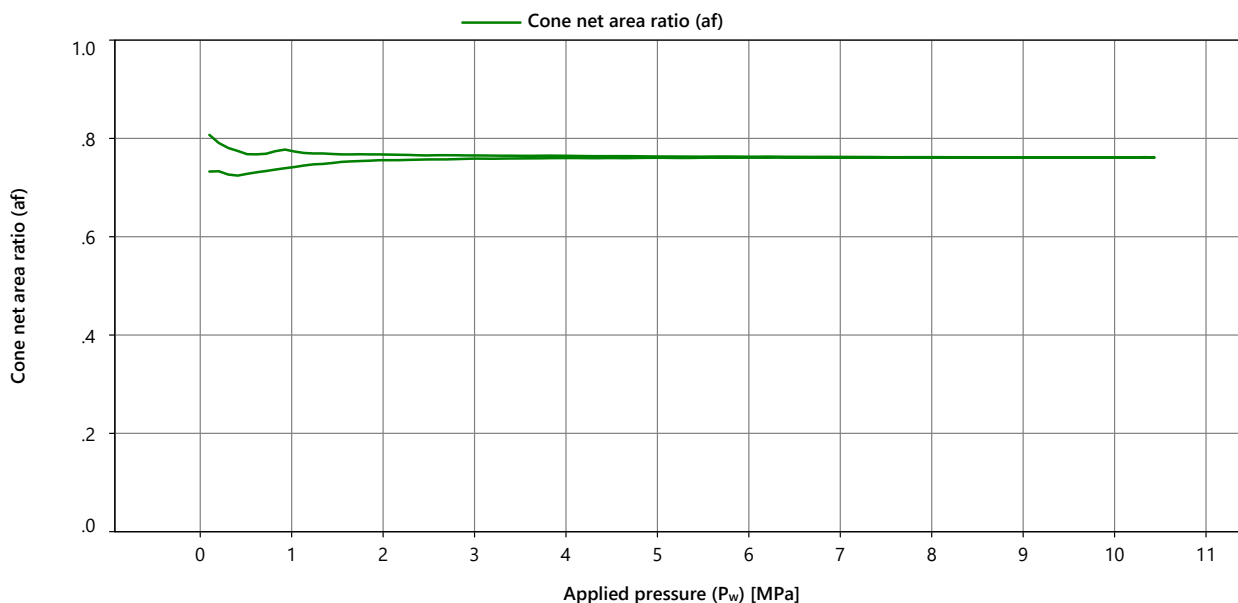
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23032121

Measurement Details	
Measurement Date	04 Dec 2023 11:05:01
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.755	0.758	0.755	0.756
4.000	0.760	0.760	0.760	0.760
6.000	0.761	0.761	0.761	0.761
8.000	0.761	0.761	0.761	0.761
10.000	0.761	0.761	0.761	0.761
8.000	0.762	0.762	0.762	0.762
6.000	0.763	0.763	0.763	0.763
4.000	0.765	0.765	0.764	0.765
2.000	0.767	0.767	0.768	0.767

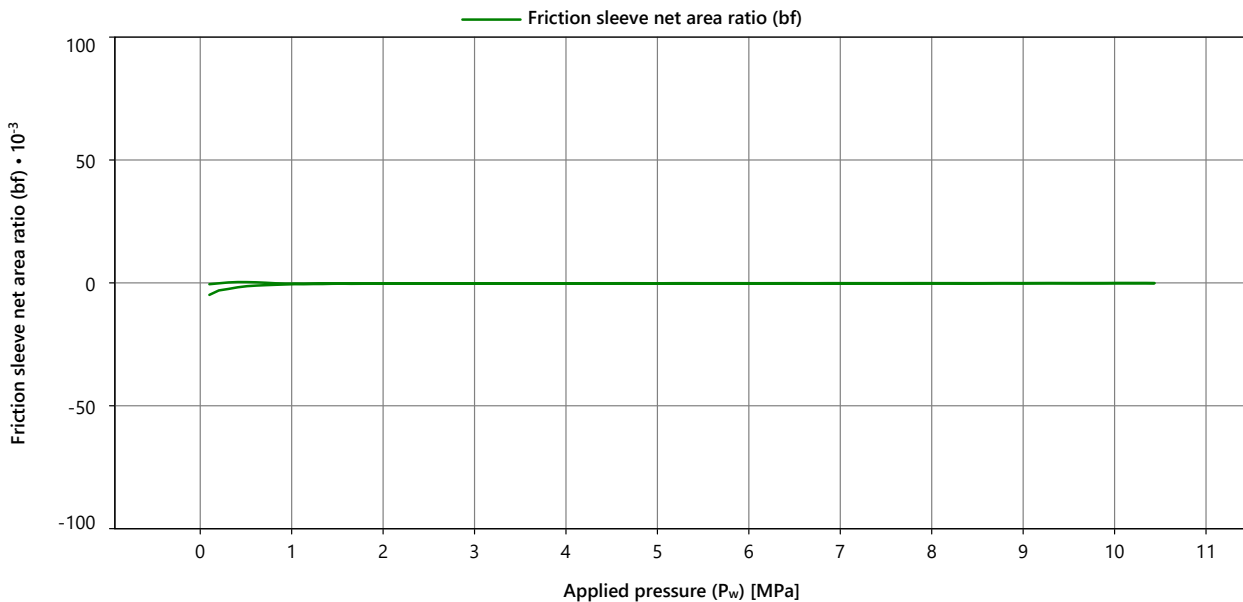
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0033	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	9131	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 11:05:01
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032121

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	-0.00011

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23032121

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
----------------	-----------------------------------

Quantities

P	Pressure
---	----------

Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032122

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0038

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 04-Dec-2023

Calibrate before 04-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	-0.110 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	-0.213 $\mu\text{V/V}$	0.27 %	0.00 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	-1.54 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	-3.10 $\mu\text{V/V}$	0.42 %	-0.07 %
Pore 2 [Pressure]	3.42 mV/V/MPa	1.26 mV/V	3.42 mV/V/MPa	1.19 mV/V	-0.01 %	-0.21 %

Nootdorp, 05-Dec-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0038
Electronics	8958
Node Type	7001
Hardware Version	6.00
Software Version	8.01

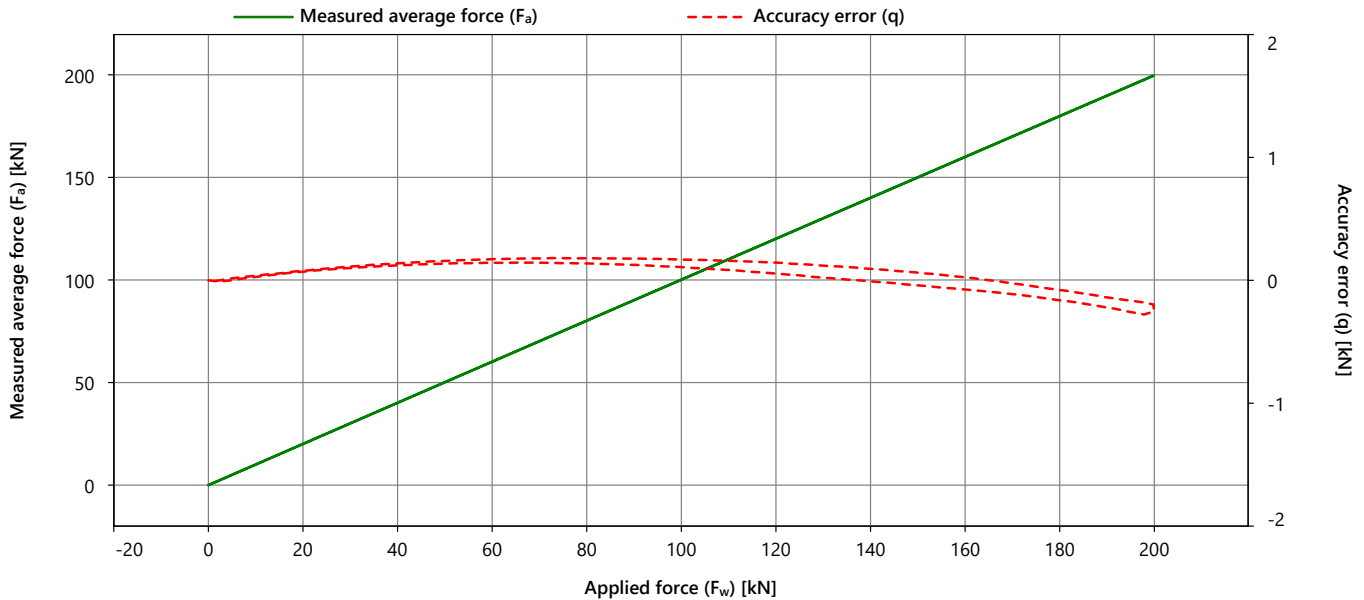
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032122

Calibration Details	
Calibration Date	04 Dec 2023 08:25:08
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.252
Max repeatability error (b)	[kN]	0.055
Max reversibility error (v)	[kN]	0.100
Zero load error (F _{c0})	[kN]	0.005
Zero load offset (F ₀)	[kN]	-0.030
Resolution	[kN]	8.55E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.001	0.001	-0.002	0.000	0.000	0.003		0.017
40.000	40.117	40.127	40.125	40.123	0.123	0.010	0.015	0.140
80.000	80.127	80.145	80.140	80.137	0.137	0.018	0.043	0.267
120.000	120.033	120.088	120.044	120.055	0.055	0.054	0.090	0.404
160.000	159.914	159.958	159.903	159.925	-0.075	0.055	0.100	0.525
200.000	199.754	199.760	199.731	199.748	-0.252	0.030		0.631
160.000	160.027	160.002	160.046	160.025	0.025	0.043	0.100	0.524
120.000	120.152	120.117	120.165	120.145	0.145	0.048	0.090	0.403
80.000	80.186	80.165	80.190	80.180	0.180	0.025	0.043	0.268
40.000	40.140	40.132	40.142	40.138	0.138	0.010	0.015	0.140
0.000	-0.003	-0.007	-0.006	-0.005	-0.005	0.004		0.017

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0038
Electronics	8958
Node Type	7001
Hardware Version	6.00
Software Version	8.01

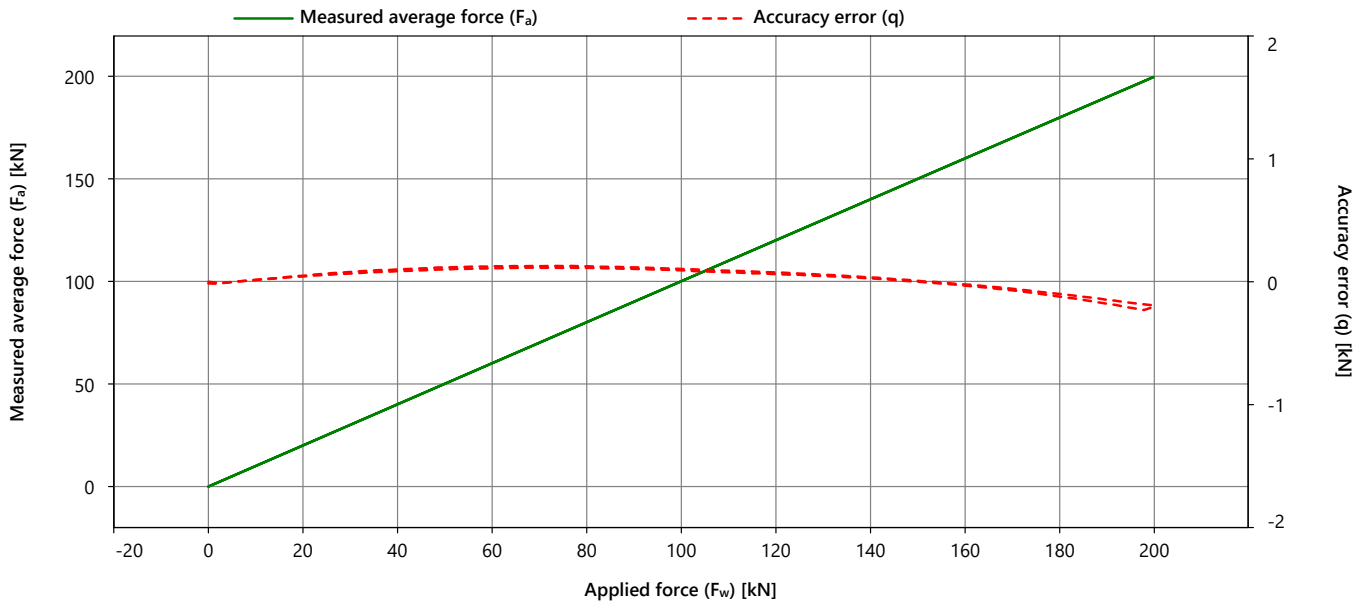
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032122

Calibration Details	
Calibration Date	04 Dec 2023 08:25:08
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.201
Max repeatability error (b)	[kN]	0.103
Max reversibility error (v)	[kN]	0.015
Zero load error (F _{c0})	[kN]	0.014
Zero load offset (F ₀)	[kN]	-0.013
Resolution	[kN]	8.59E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.050



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.004	-0.001	-0.003	0.000	0.000	0.007		0.028
40.000	40.045	40.128	40.087	40.087	0.087	0.083	0.014	0.179
80.000	80.061	80.162	80.116	80.113	0.113	0.101	0.012	0.288
120.000	120.012	120.111	120.063	120.062	0.062	0.100	0.015	0.403
160.000	159.921	160.021	159.962	159.968	-0.032	0.100	0.010	0.521
200.000	199.776	199.838	199.784	199.799	-0.201	0.062		0.635
160.000	159.925	160.028	159.982	159.978	-0.022	0.103	0.010	0.522
120.000	120.036	120.120	120.074	120.077	0.077	0.083	0.015	0.398
80.000	80.083	80.169	80.125	80.126	0.126	0.086	0.012	0.281
40.000	40.067	40.134	40.100	40.101	0.101	0.067	0.014	0.164
0.000	-0.009	-0.015	-0.017	-0.014	-0.014	0.008		0.028

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0038
Electronics	8958
Node Type	7001
Hardware Version	6.00
Software Version	8.01

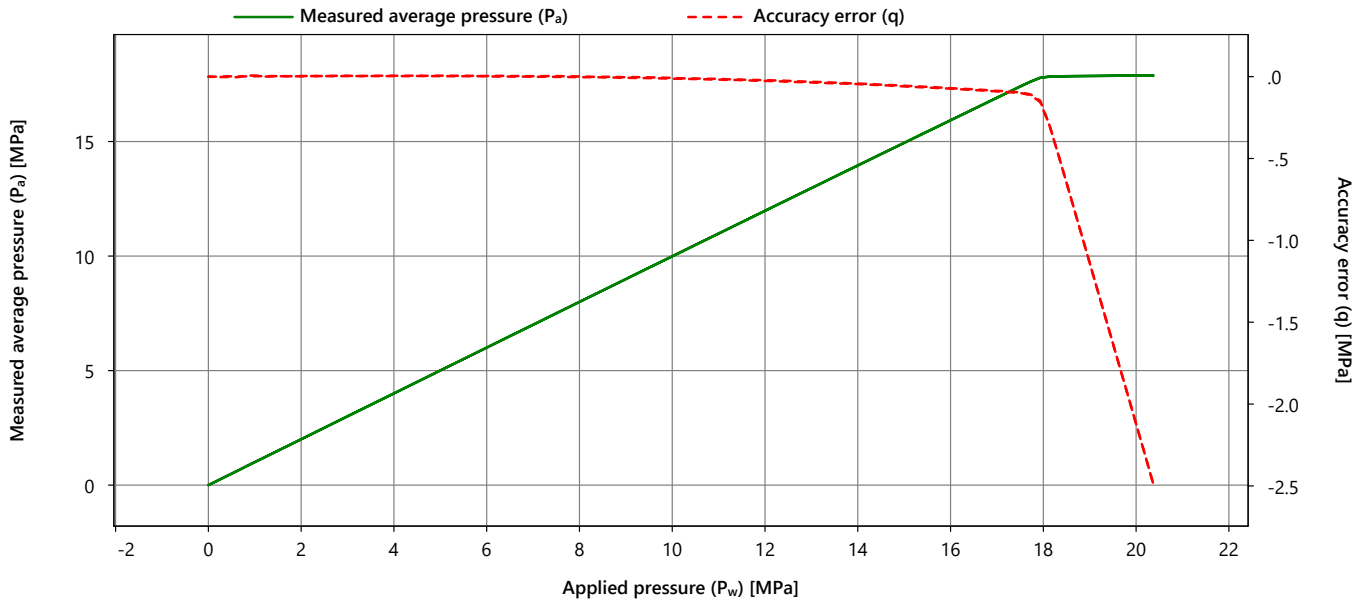
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23032122

Calibration Details	
Calibration Date	04 Dec 2023 10:51:01
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.008
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.004
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	-0.016
Resolution	[MPa]	2.18E-06
Noise RMS	[MPa]	0.001



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.005	2.004	2.002	2.004	0.004	0.003	-0.001	0.006
4.000	4.007	4.004	4.006	4.006	0.006	0.003	-0.002	0.007
6.000	6.005	6.004	6.004	6.004	0.004	0.001	-0.001	0.006
8.000	8.001	8.002	8.002	8.001	0.001	0.002	-0.004	0.009
10.000	9.992	9.992	9.993	9.992	-0.008	0.001		0.008
8.000	7.998	7.997	7.996	7.997	-0.003	0.001	-0.004	0.009
6.000	6.003	6.004	6.002	6.003	0.003	0.001	-0.001	0.006
4.000	4.004	4.004	4.004	4.004	0.004	0.000	-0.002	0.005
2.000	2.004	2.002	2.002	2.003	0.003	0.002	-0.001	0.005
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0038
Electronics	8958
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

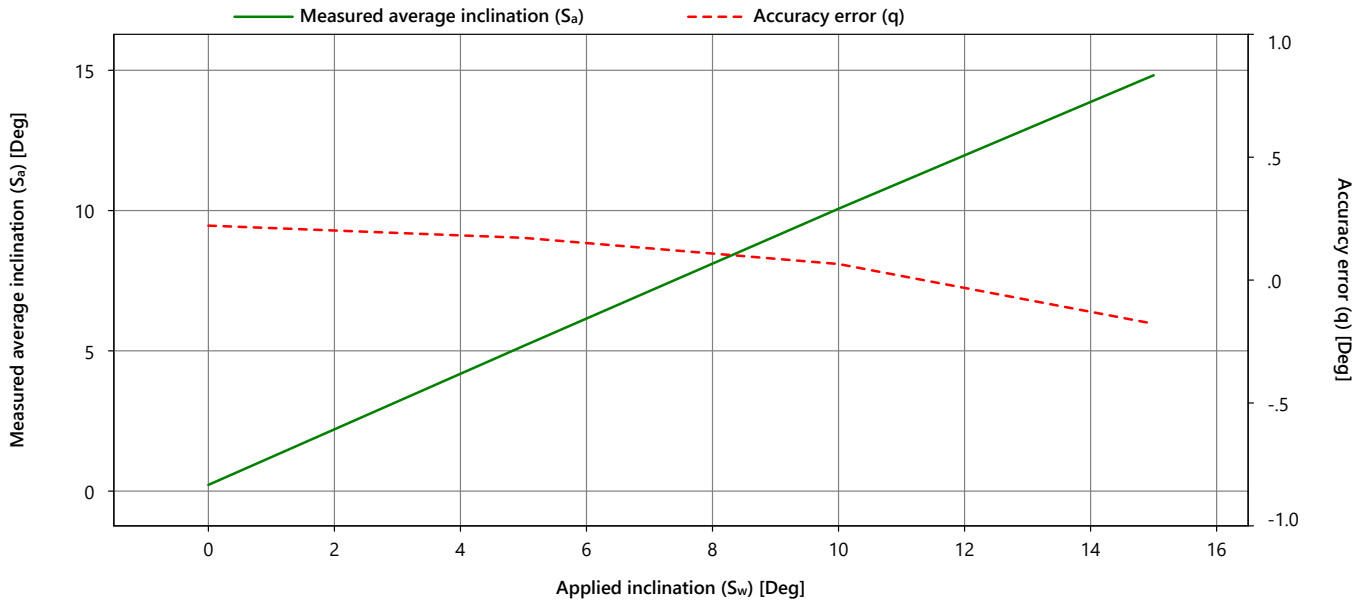
Certificate Number
FCN23032122

Calibration Details	
Calibration Date	04 Dec 2023 08:33:33
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.3E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w)	Measured inclination 1 ($S_{a,1}$)	Measured inclination 2 ($S_{a,2}$)	Measured inclination 3 ($S_{a,3}$)	Measured average inclination (S_a)	Accuracy error (q)	Repeatability error (b)	Expanded Uncertainty (U)
[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]
0.0	0.0	0.3	0.3	0.2	0.2	0.3	0.8
5.0	5.0	5.2	5.3	5.2	0.2	0.2	0.8
10.0	10.0	10.1	10.1	10.1	0.1	0.2	0.7
15.0	14.8	14.9	14.8	14.8	-0.2	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23032122

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Fugro Transducer Workshop, P.O. Box 130, 2630 AC Nootdorp, The Netherlands, Phone +31-70-3111444, www.fugro.com
Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0038

Appendix Applicable to
Certificate Number
FCN23032122

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

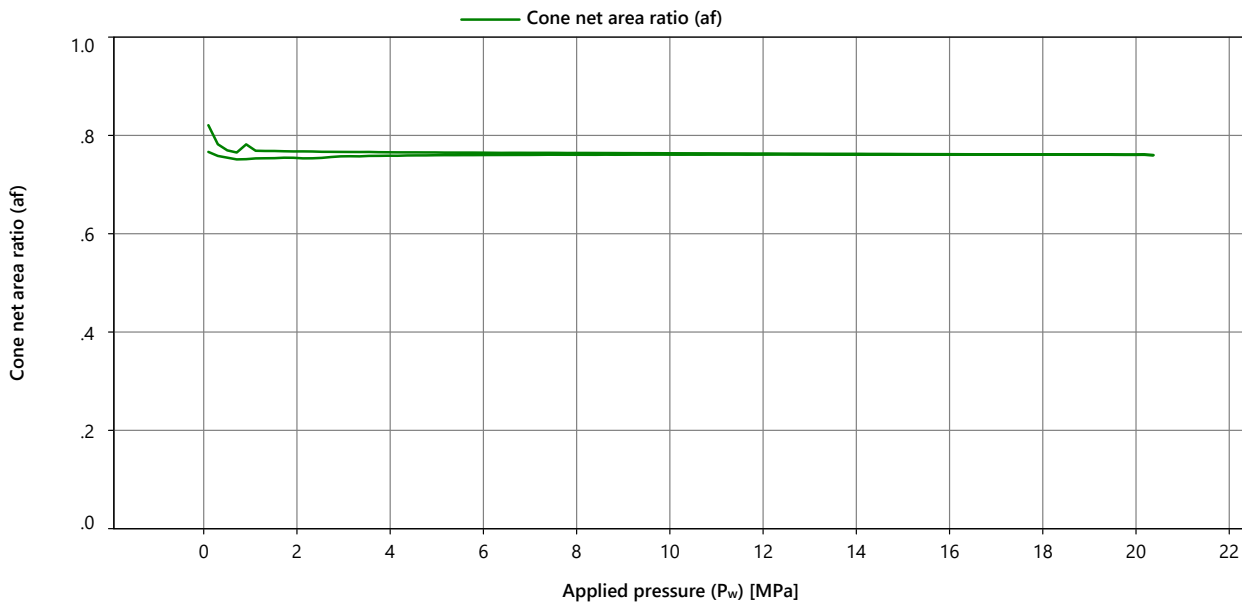
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0038	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	8958	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 10:51:01
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032122

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.752	0.758	0.752	0.754
4.000	0.759	0.758	0.759	0.759
6.000	0.760	0.760	0.760	0.760
8.000	0.760	0.761	0.761	0.761
10.000	0.761	0.761	0.761	0.761
8.000	0.764	0.764	0.764	0.764
6.000	0.765	0.765	0.765	0.765
4.000	0.766	0.766	0.766	0.766
2.000	0.768	0.767	0.767	0.767

Friction Sleeve Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0038
Electronics	8958
Node Type	7001
Hardware Version	6.00
Software Version	8.01

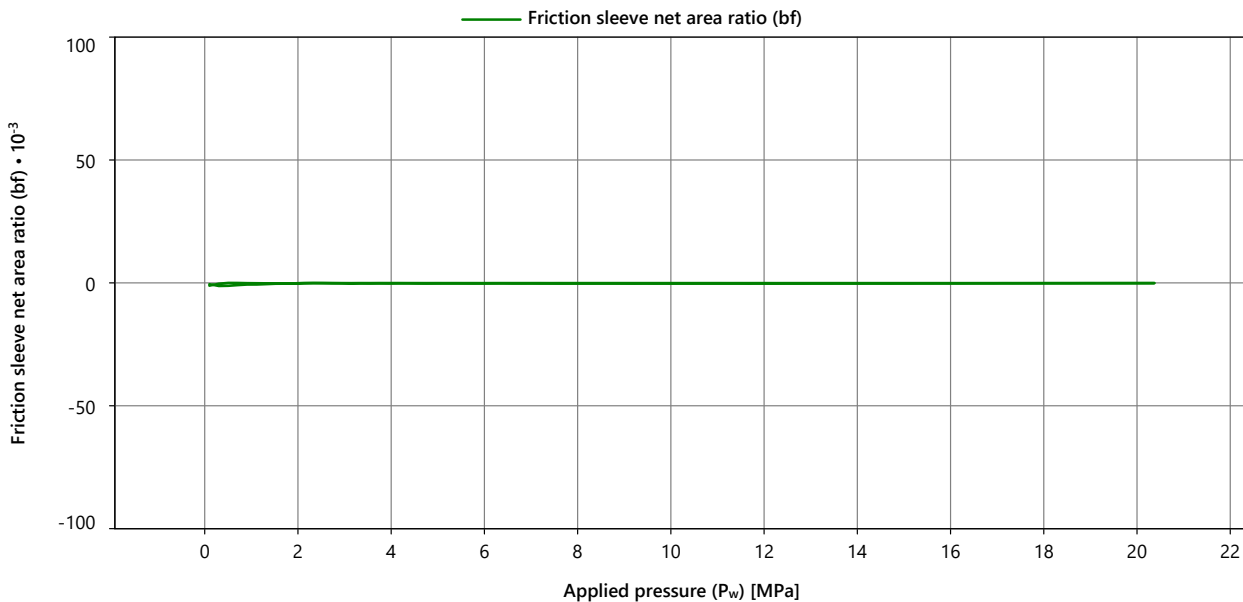
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Appendix Applicable to
Certificate Number
FCN23032122

Measurement Details	
Measurement Date	04 Dec 2023 10:51:01
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	-0.00009

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23032122

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032124

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB20SN2-P1E1M4-V1
Serial Number 1715-0021

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 04-Dec-2023

Calibrate before 04-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/200bar (81188)	0 to 20 MPa	0 to 30 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.8 $\mu\text{V/V/kN}$	14.1 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	18.6 $\mu\text{V/V}$	0.35 %	0.21 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	4.53 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	11.2 $\mu\text{V/V}$	0.06 %	0.31 %
Pore 2 [Pressure]	1.64 mV/V/MPa	347 $\mu\text{V/V}$	1.64 mV/V/MPa	352 $\mu\text{V/V}$	0.05 %	0.02 %

Nootdorp, 05-Dec-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E1M4-V1
Serial Number	1715-0021
Electronics	7593
Node Type	7001
Hardware Version	5.01
Software Version	8.01

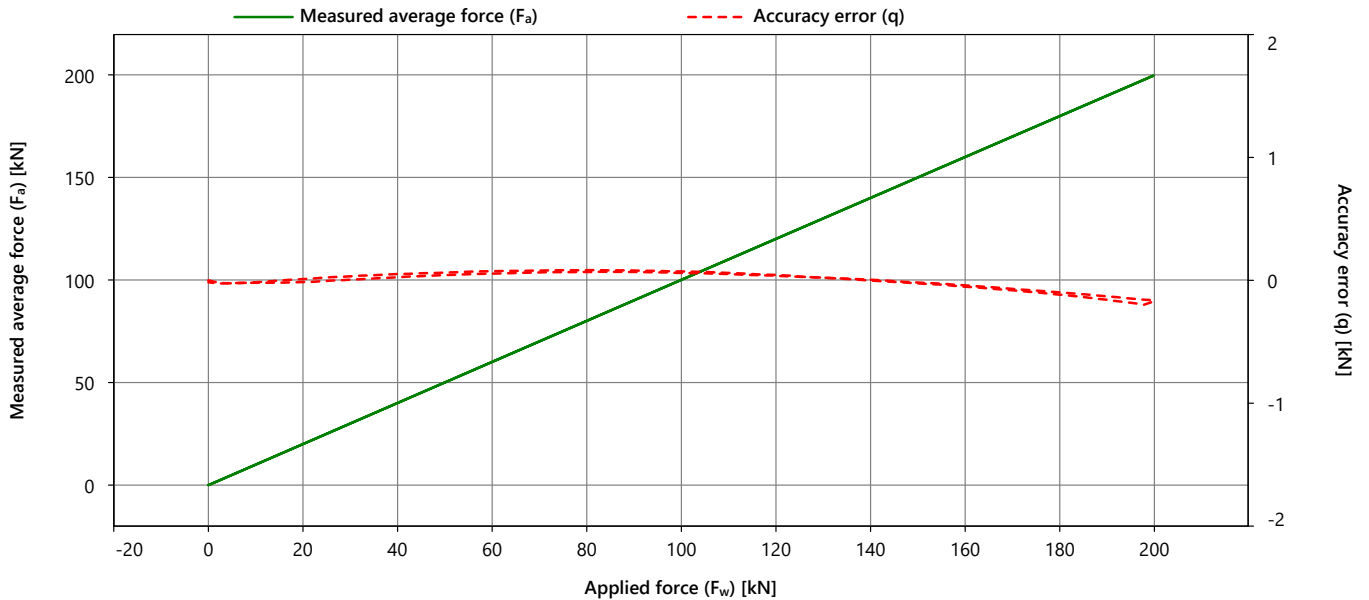
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032124

Calibration Details	
Calibration Date	04 Dec 2023 08:58:23
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.168
Max repeatability error (b)	[kN]	0.041
Max reversibility error (v)	[kN]	0.026
Zero load error (F _{c0})	[kN]	0.015
Zero load offset (F ₀)	[kN]	0.023
Resolution	[kN]	8.55E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.007	-0.002	-0.006	0.000	0.000	0.013		0.034
40.000	40.065	40.054	40.035	40.052	0.052	0.030	-0.026	0.147
80.000	80.100	80.081	80.066	80.082	0.082	0.033	-0.014	0.266
120.000	120.061	120.043	120.026	120.044	0.044	0.035	-0.007	0.387
160.000	159.967	159.948	159.929	159.948	-0.052	0.038	0.012	0.510
200.000	199.848	199.843	199.806	199.832	-0.168	0.041		0.633
160.000	159.976	159.959	159.943	159.960	-0.040	0.033	0.012	0.509
120.000	120.053	120.039	120.020	120.037	0.037	0.033	-0.007	0.387
80.000	80.082	80.069	80.053	80.068	0.068	0.029	-0.014	0.265
40.000	40.038	40.025	40.012	40.025	0.025	0.026	-0.026	0.146
0.000	-0.009	-0.017	-0.020	-0.015	-0.015	0.010		0.032

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E1M4-V1
Serial Number	1715-0021
Electronics	7593
Node Type	7001
Hardware Version	5.01
Software Version	8.01

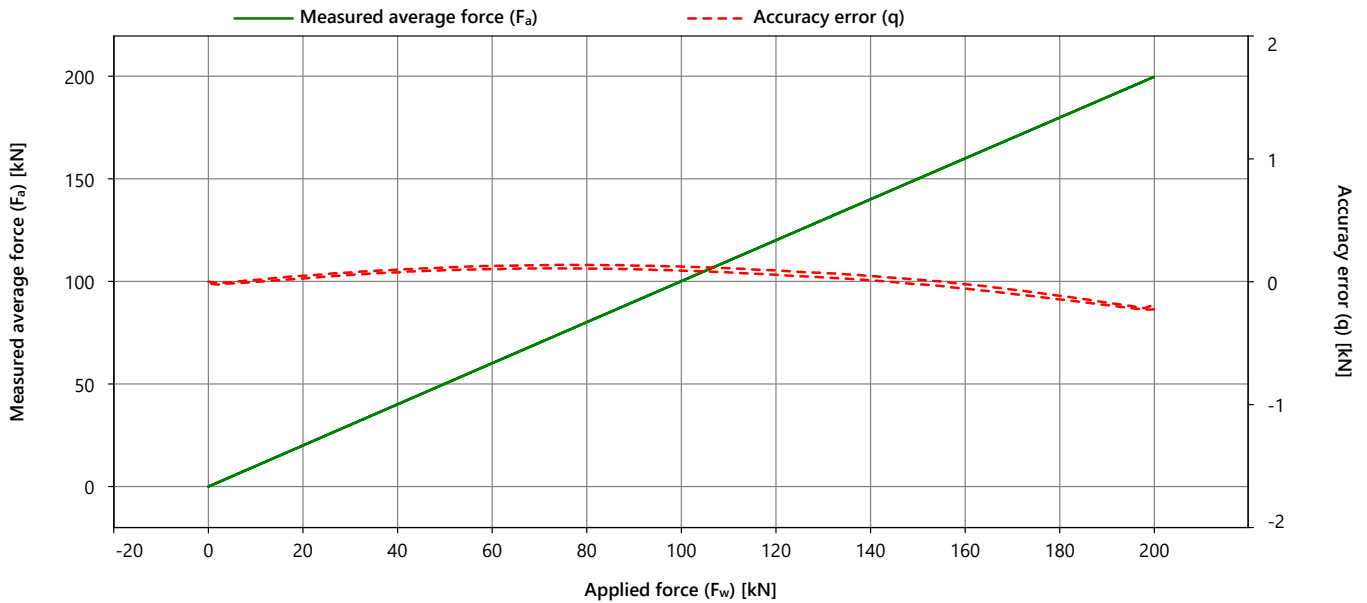
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032124

Calibration Details	
Calibration Date	04 Dec 2023 08:58:23
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.185
Max repeatability error (b)	[kN]	0.024
Max reversibility error (v)	[kN]	0.036
Zero load error (F _{c0})	[kN]	0.013
Zero load offset (F ₀)	[kN]	0.002
Resolution	[kN]	8.59E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.038



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.009	-0.001	-0.008	0.000	0.000	0.016		0.035
40.000	40.108	40.099	40.092	40.099	0.099	0.016	-0.023	0.143
80.000	80.146	80.133	80.131	80.137	0.137	0.016	-0.030	0.265
120.000	120.102	120.089	120.087	120.093	0.093	0.015	-0.036	0.387
160.000	159.991	159.977	159.971	159.980	-0.020	0.019	-0.035	0.510
200.000	199.823	199.823	199.799	199.815	-0.185	0.024		0.631
160.000	159.952	159.946	159.936	159.945	-0.055	0.017	-0.035	0.510
120.000	120.069	120.055	120.046	120.057	0.057	0.023	-0.036	0.388
80.000	80.118	80.105	80.098	80.107	0.107	0.020	-0.030	0.265
40.000	40.086	40.077	40.067	40.077	0.077	0.019	-0.023	0.144
0.000	-0.005	-0.015	-0.020	-0.013	-0.013	0.015		0.034

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E1M4-V1
Serial Number	1715-0021
Electronics	7593
Node Type	7001
Hardware Version	5.01
Software Version	8.01

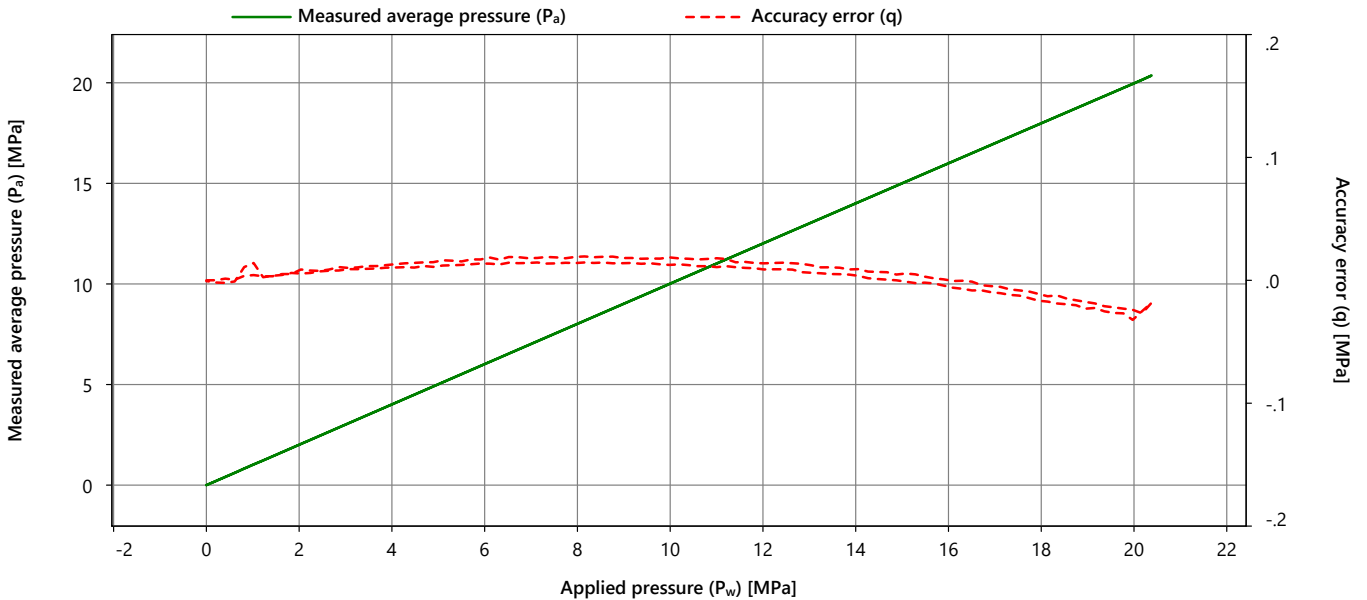
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23032124

Calibration Details	
Calibration Date	04 Dec 2023 09:19:07
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/200bar (81188)
Calibrated Range	0 to 20 MPa
Maximum Rating	0 to 30 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.025
Max repeatability error (b)	[MPa]	0.004
Max reversibility error (v)	[MPa]	0.006
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	0.003
Resolution	[MPa]	4.55E-06
Noise RMS	[MPa]	0.001



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
4.000	4.011	4.013	4.014	4.013	0.013	0.004	-0.003	0.008
8.000	8.019	8.018	8.021	8.019	0.019	0.003	-0.004	0.010
12.000	12.013	12.014	12.013	12.014	0.014	0.001	-0.005	0.011
16.000	16.002	16.000	15.998	16.000	0.000	0.004	-0.006	0.014
20.000	19.975	19.976	19.975	19.975	-0.025	0.001		0.013
16.000	15.994	15.994	15.994	15.994	-0.006	0.001	-0.006	0.013
12.000	12.008	12.010	12.009	12.009	0.009	0.001	-0.005	0.011
8.000	8.014	8.015	8.015	8.015	0.015	0.001	-0.004	0.009
4.000	4.010	4.010	4.010	4.010	0.010	0.000	-0.003	0.006
0.000	-0.001	-0.001	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P 1E1M4-V1
Serial Number	1715-0021
Electronics	7593
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

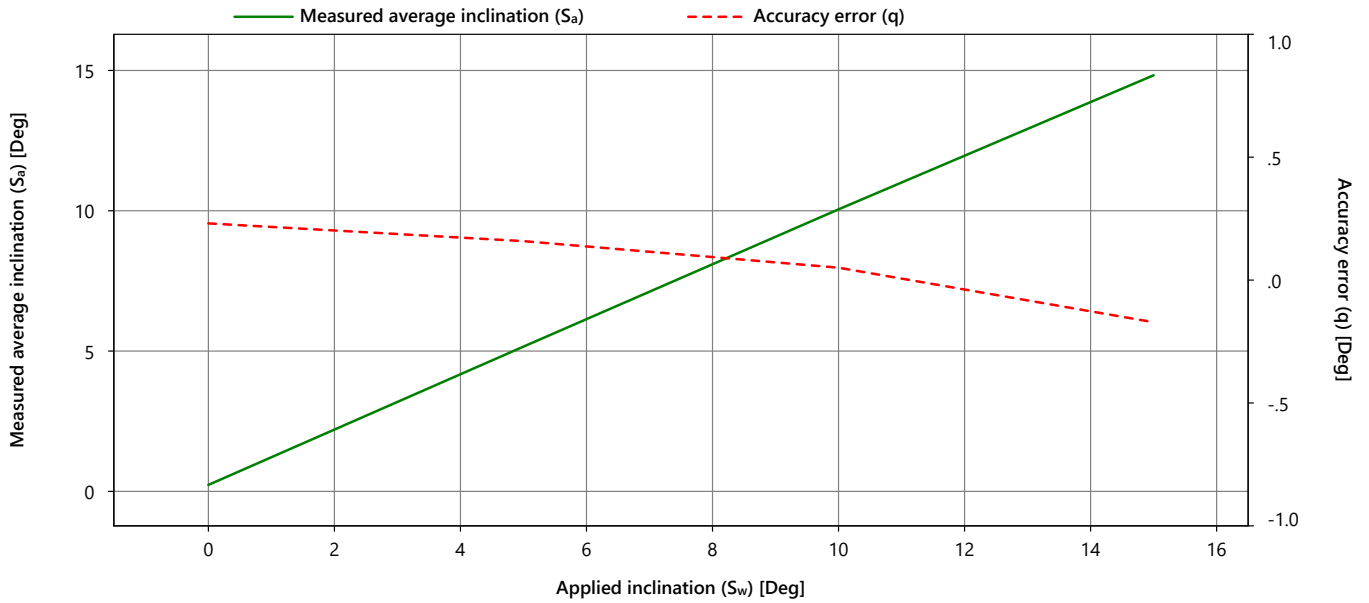
Certificate Number
FCN23032124

Calibration Details	
Calibration Date	04 Dec 2023 09:03:13
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.3E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.3	0.3	0.2	0.2	0.3	0.8
5.0	5.0	5.2	5.2	5.2	0.2	0.2	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.2	0.7
15.0	14.8	14.8	14.9	14.8	-0.2	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23032124

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB20SN2-P1E1M4-V1
Serial Number	1715-0021

Appendix Applicable to
Certificate Number
FCN23032124

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

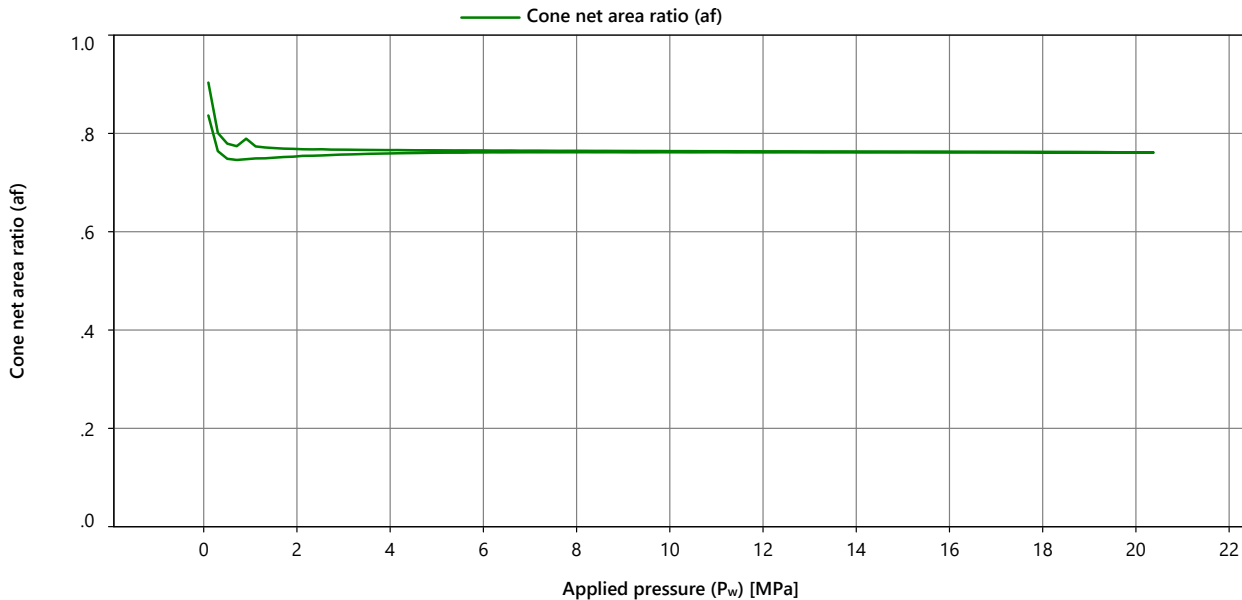
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB20SN2-P 1E1M4-V1	Serial Number	3257-0002
Serial Number	1715-0021	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7593	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 09:19:07
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032124

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
4.000	0.758	0.759	0.760	0.759
8.000	0.761	0.762	0.762	0.762
12.000	0.761	0.761	0.762	0.761
16.000	0.761	0.761	0.761	0.761
20.000	0.761	0.761	0.761	0.761
16.000	0.763	0.763	0.763	0.763
12.000	0.764	0.764	0.764	0.764
8.000	0.765	0.765	0.765	0.765
4.000	0.766	0.766	0.766	0.766

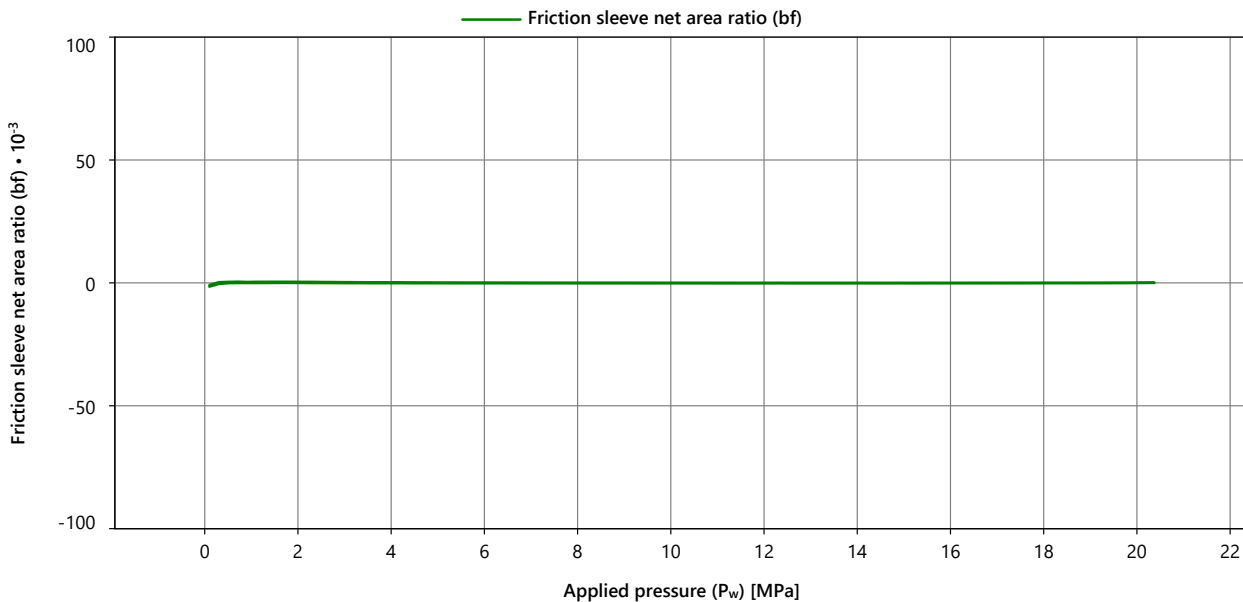
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB20SN2-P 1E1M4-V1	Serial Number	3257-0002
Serial Number	1715-0021	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	7593	Measurement Details	
Node Type	7001	Measurement Date	04 Dec 2023 09:19:07
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032124

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00003

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
4.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
12.000	0.000	0.000	0.000	0.000
16.000	0.000	0.000	0.000	0.000
20.000	0.000	0.000	0.000	0.000
16.000	0.000	0.000	0.000	0.000
12.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23032124

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
----------------	-----------------------------------

Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032137

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0089

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions
Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 05-Dec-2023

Calibrate before 05-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.7 $\mu\text{V/V/kN}$	-4.28 $\mu\text{V/V}$	10.7 $\mu\text{V/V/kN}$	-3.34 $\mu\text{V/V}$	-0.10 %	0.04 %
Cone+Fric. [Force]	10.7 $\mu\text{V/V/kN}$	-7.31 $\mu\text{V/V}$	10.7 $\mu\text{V/V/kN}$	-5.50 $\mu\text{V/V}$	-0.16 %	0.08 %
Pore 2 [Pressure]	3.35 mV/V/MPa	1.12 mV/V	3.35 mV/V/MPa	1.13 mV/V	-0.02 %	0.04 %

Nootdorp, 06-Dec-2023

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Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0089
Electronics	279
Node Type	7001
Hardware Version	5.01
Software Version	8.01

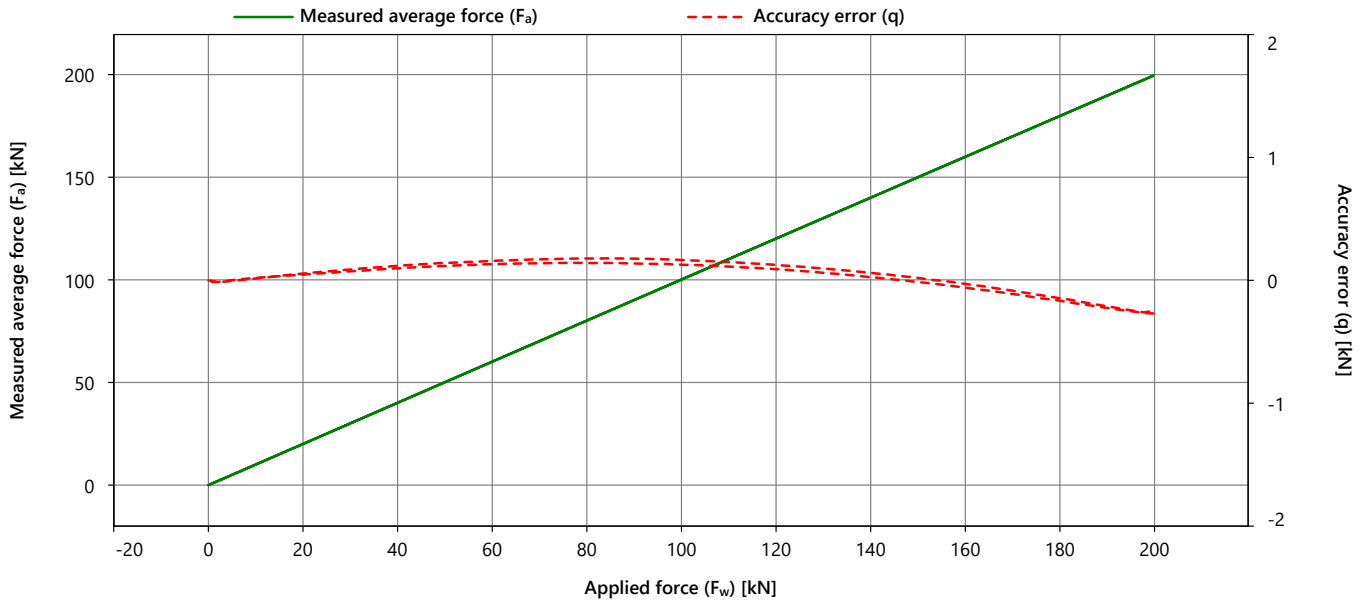
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032137

Calibration Details	
Calibration Date	05 Dec 2023 05:54:54
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.244
Max repeatability error (b)	[kN]	0.025
Max reversibility error (v)	[kN]	0.037
Zero load error (F _{c0})	[kN]	0.013
Zero load offset (F ₀)	[kN]	0.007
Resolution	[kN]	8.69E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.001	0.001	-0.002	0.000	0.000	0.003		0.026
40.000	40.121	40.118	40.115	40.118	0.118	0.005	-0.021	0.142
80.000	80.183	80.178	80.171	80.177	0.177	0.011	-0.037	0.266
120.000	120.128	120.126	120.123	120.126	0.126	0.006	-0.035	0.387
160.000	159.972	159.971	159.969	159.971	-0.029	0.003	-0.030	0.509
200.000	199.769	199.757	199.744	199.756	-0.244	0.025		0.631
160.000	159.942	159.940	159.939	159.940	-0.060	0.004	-0.030	0.509
120.000	120.094	120.090	120.089	120.091	0.091	0.005	-0.035	0.387
80.000	80.146	80.139	80.136	80.141	0.141	0.010	-0.037	0.266
40.000	40.100	40.099	40.092	40.097	0.097	0.007	-0.021	0.142
0.000	-0.010	-0.013	-0.016	-0.013	-0.013	0.006		0.026

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0089
Electronics	279
Node Type	7001
Hardware Version	5.01
Software Version	8.01

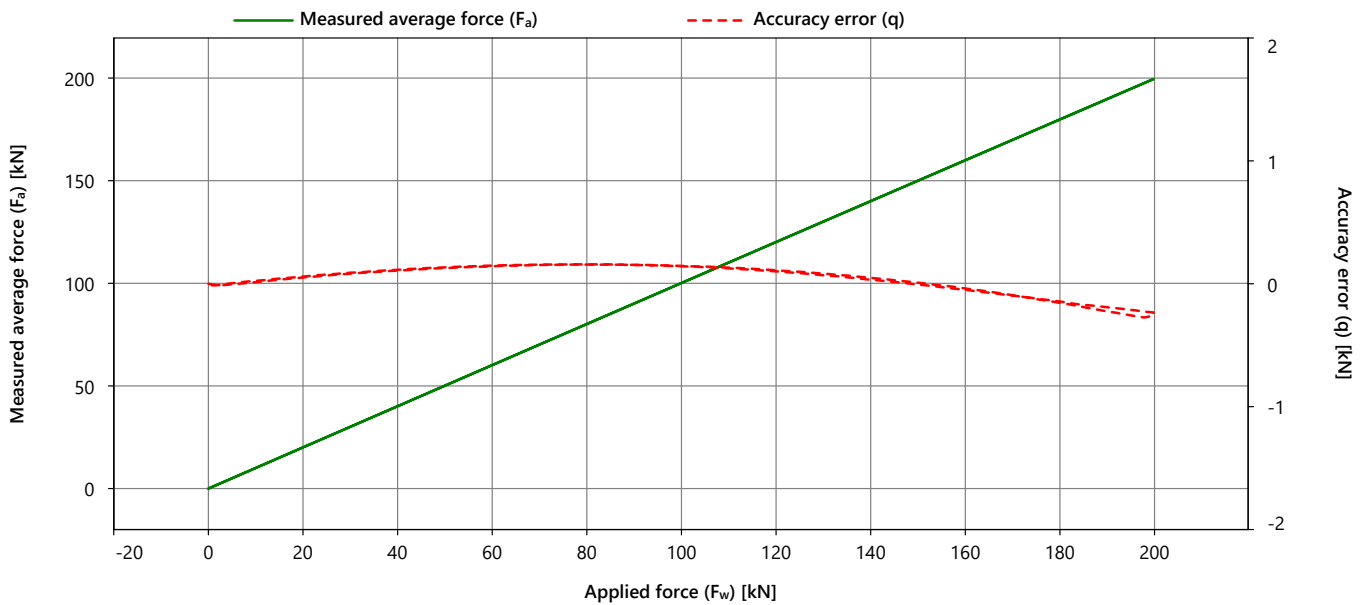
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032137

Calibration Details	
Calibration Date	05 Dec 2023 05:54:54
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.257
Max repeatability error (b)	[kN]	0.028
Max reversibility error (v)	[kN]	0.010
Zero load error (F _{c0})	[kN]	0.014
Zero load offset (F ₀)	[kN]	0.008
Resolution	[kN]	8.72E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.017



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.004	0.000	-0.004	0.000	0.000	0.008		0.028
40.000	40.111	40.108	40.105	40.108	0.108	0.006	0.005	0.140
80.000	80.160	80.157	80.152	80.156	0.156	0.008	0.001	0.262
120.000	120.113	120.111	120.106	120.110	0.110	0.006	-0.008	0.385
160.000	159.962	159.963	159.960	159.962	-0.038	0.003	-0.010	0.508
200.000	199.758	199.742	199.730	199.743	-0.257	0.028		0.631
160.000	159.953	159.950	159.950	159.951	-0.049	0.004	-0.010	0.508
120.000	120.108	120.101	120.096	120.101	0.101	0.012	-0.008	0.385
80.000	80.165	80.157	80.150	80.158	0.158	0.015	0.001	0.263
40.000	40.118	40.115	40.107	40.113	0.113	0.011	0.005	0.140
0.000	-0.009	-0.014	-0.018	-0.014	-0.014	0.010		0.029

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0089
Electronics	279
Node Type	7001
Hardware Version	5.01
Software Version	8.01

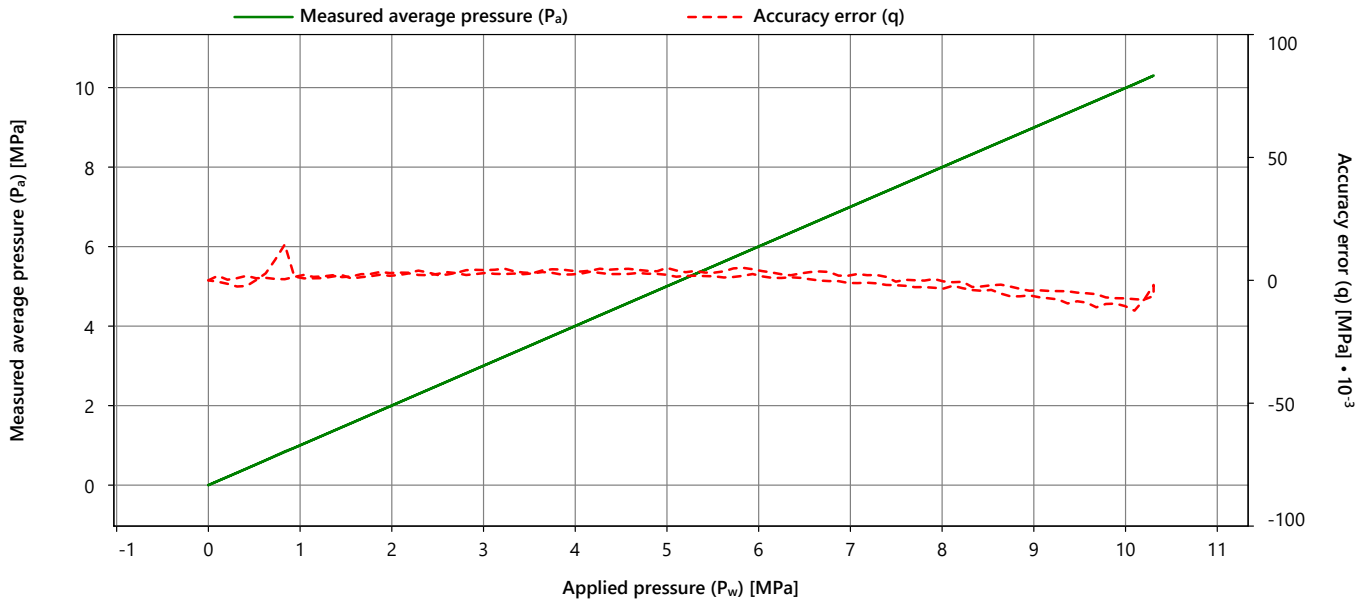
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23032137

Calibration Details	
Calibration Date	05 Dec 2023 06:17:15
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.007
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.000
Zero load offset (P ₀)	[MPa]	0.001
Resolution	[MPa]	2.22E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.002
2.000	2.002	2.005	2.002	2.003	0.003	0.003	-0.001	0.006
4.000	4.003	4.004	4.004	4.004	0.004	0.002	-0.001	0.005
6.000	6.005	6.002	6.005	6.004	0.004	0.003	-0.002	0.007
8.000	7.998	8.000	8.001	8.000	0.000	0.003	-0.003	0.009
10.000	9.991	9.994	9.992	9.993	-0.007	0.003		0.008
8.000	7.995	7.997	7.997	7.996	-0.004	0.002	-0.003	0.008
6.000	6.002	6.002	6.002	6.002	0.002	0.000	-0.002	0.006
4.000	4.004	4.001	4.002	4.003	0.003	0.002	-0.001	0.006
2.000	2.002	2.002	2.002	2.002	0.002	0.000	-0.001	0.004
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0089
Electronics	279
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

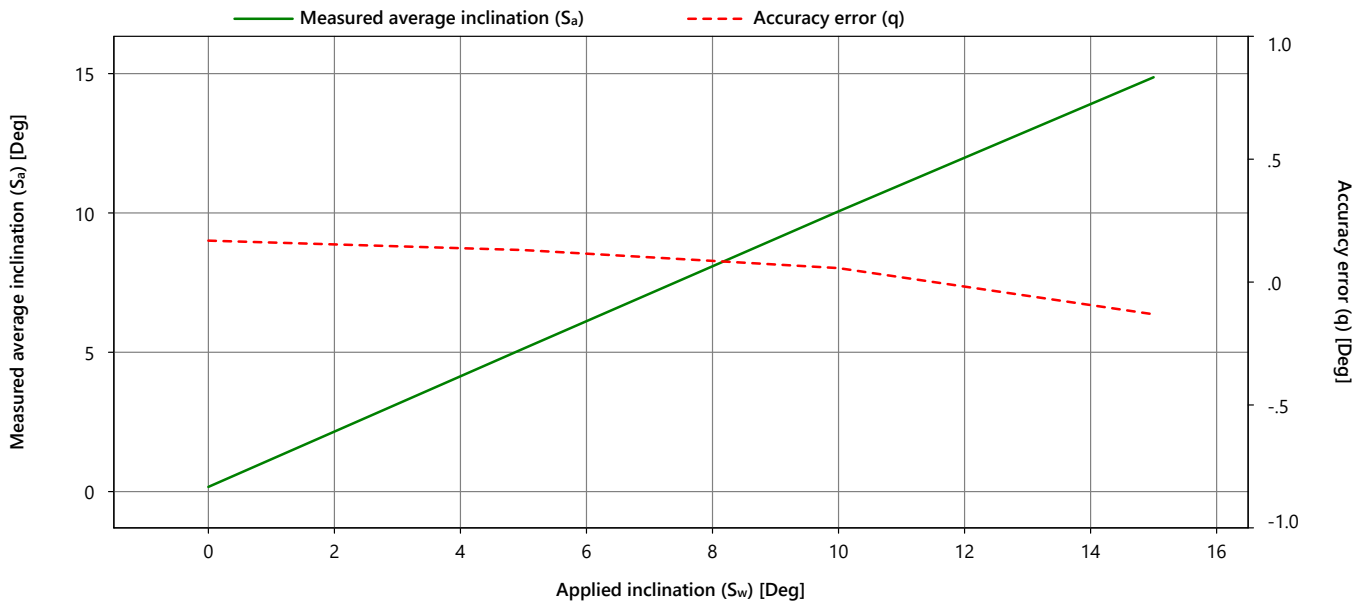
Certificate Number
FCN23032137

Calibration Details	
Calibration Date	05 Dec 2023 05:58:24
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.2
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.1
Resolution	[Deg]	1.29E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.1	0.2	0.2	0.2	0.2	0.1	0.7
5.0	5.0	5.2	5.2	5.1	0.1	0.1	0.7
10.0	10.0	10.1	10.1	10.1	0.1	0.2	0.7
15.0	14.9	14.8	14.9	14.9	-0.1	0.0	0.7

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Symbols, Definitions and References

Certificate Number
FCN23032137

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0089

Appendix Applicable to
Certificate Number
FCN23032137

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

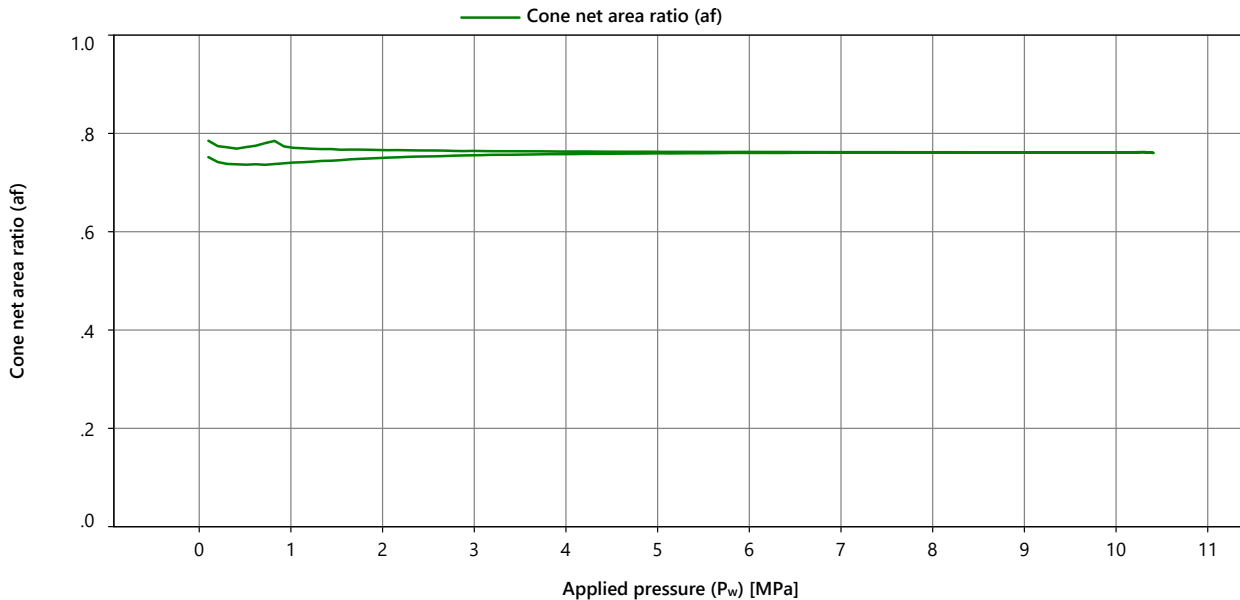
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0089	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	279	Measurement Details	
Node Type	7001	Measurement Date	05 Dec 2023 06:17:15
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032137

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.750	0.751	0.750	0.750
4.000	0.758	0.758	0.758	0.758
6.000	0.760	0.760	0.760	0.760
8.000	0.761	0.761	0.761	0.761
10.000	0.762	0.762	0.762	0.762
8.000	0.762	0.762	0.762	0.762
6.000	0.762	0.762	0.762	0.762
4.000	0.763	0.763	0.763	0.763
2.000	0.766	0.766	0.766	0.766

Friction Sleeve Net Area Ratio Result

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0089
Electronics	279
Node Type	7001
Hardware Version	5.01
Software Version	8.01

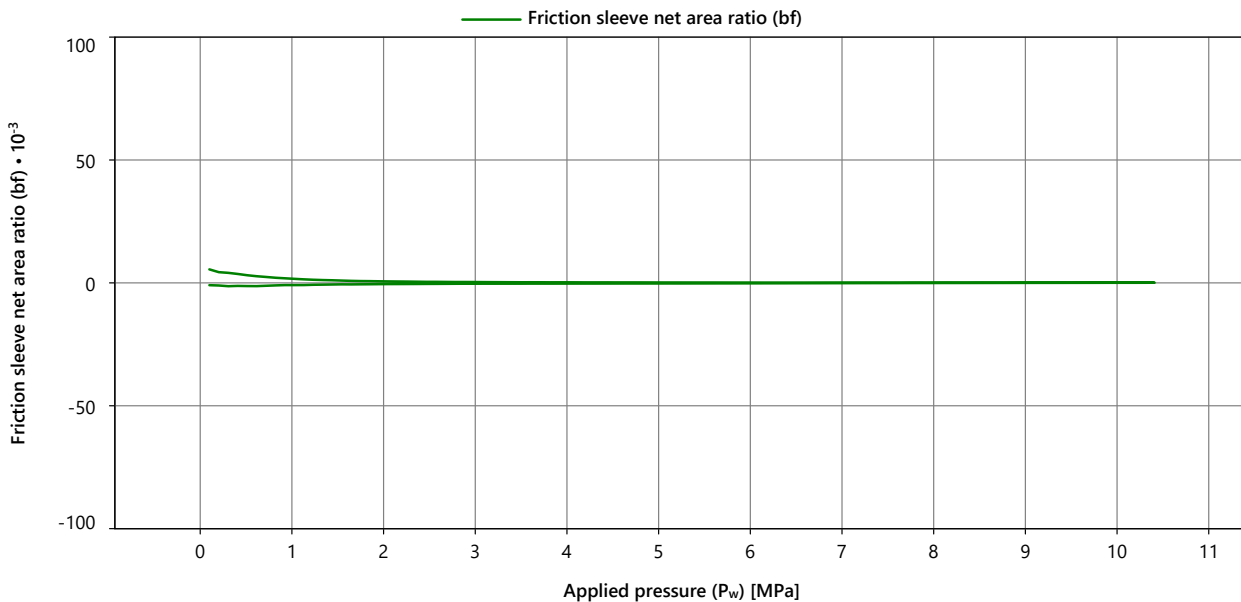
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

**Appendix Applicable to
Certificate Number
FCN23032137**

Measurement Details	
Measurement Date	05 Dec 2023 06:17:15
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00006

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.001	0.001	0.001	0.001
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	-0.001	-0.001	-0.001

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23032137

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032167

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E10M4-V1
Serial Number 1715-0079

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions

Temperature during calibration	20.5 ± 3 °C
Atmospheric pressure during calibration	1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 2 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 06-Dec-2023

Calibrate before 06-Jun-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Nootdorp, 07-Dec-2023

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Page 1 of 6



Cone Calibration Result [Force]

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0079
Electronics	204
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference

Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032167

Calibration Details

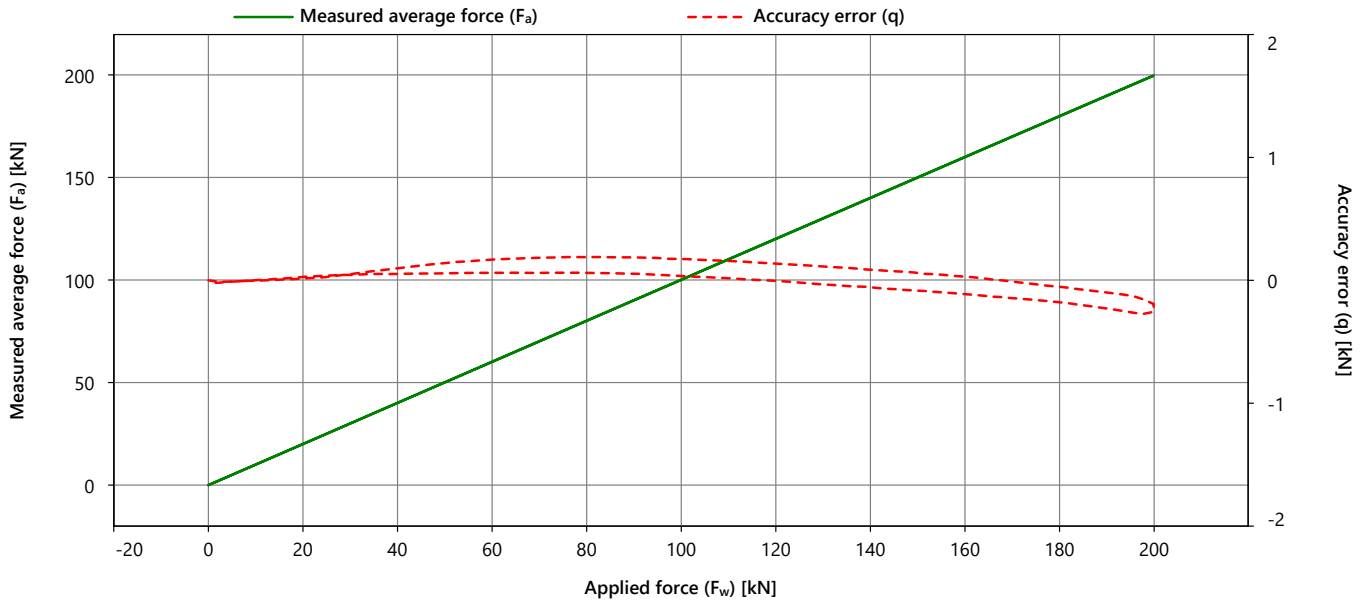
Calibration Date	06 Dec 2023 15:42:56
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor

Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.256
Max repeatability error (b)	[kN]	0.114
Max reversibility error (v)	[kN]	0.142
Zero load error (F _{c0})	[kN]	0.018
Zero load offset (F ₀)	[kN]	0.006
Resolution	[kN]	8.69E-05
Noise RMS	[kN]	0.001



Applied force (F _w)	Measured force 1 (F _{a,1})	Measured force 2 (F _{a,2})	Measured force 3 (F _{a,3})	Measured average force (F _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
0.000	0.001	0.001	-0.002	0.000	0.000	0.003		0.037
40.000	40.042	40.033	40.082	40.052	0.052	0.048	0.046	0.161
80.000	80.060	80.035	80.088	80.061	0.061	0.053	0.128	0.315
120.000	119.990	119.980	120.016	119.995	-0.005	0.036	0.140	0.421
160.000	159.886	159.861	159.916	159.888	-0.112	0.055	0.142	0.539
200.000	199.739	199.725	199.768	199.744	-0.256	0.044		0.633
160.000	160.006	159.985	160.099	160.030	0.030	0.114	0.142	0.552
120.000	120.107	120.096	120.203	120.136	0.136	0.106	0.140	0.438
80.000	80.160	80.150	80.257	80.189	0.189	0.107	0.128	0.338
40.000	40.084	40.072	40.139	40.098	0.098	0.067	0.046	0.173
0.000	-0.017	-0.019	-0.018	-0.018	-0.018	0.002		0.037

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0079
Electronics	204
Node Type	7001
Hardware Version	5.01
Software Version	8.01

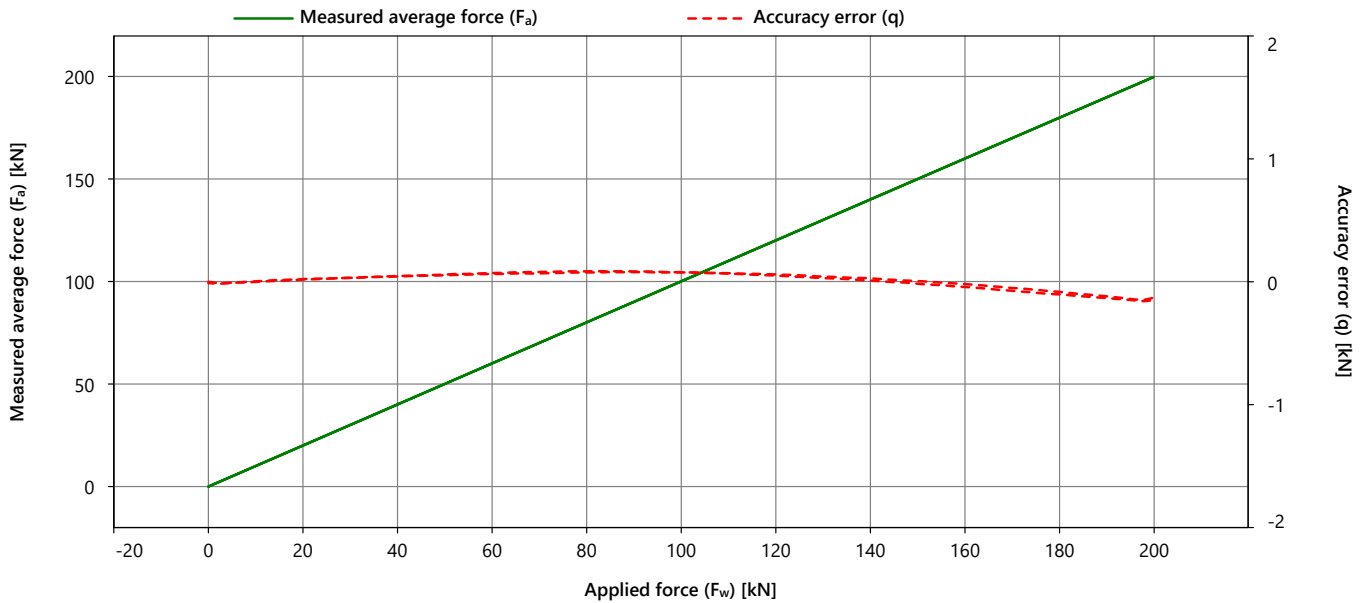
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN23032167

Calibration Details	
Calibration Date	06 Dec 2023 15:42:56
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.130
Max repeatability error (b)	[kN]	0.054
Max reversibility error (v)	[kN]	0.023
Zero load error (F _{c0})	[kN]	0.010
Zero load offset (F ₀)	[kN]	0.004
Resolution	[kN]	8.73E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.025



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.001	0.002	-0.003	0.000	0.000	0.005		0.022
40.000	40.048	40.053	40.028	40.043	0.043	0.025	0.004	0.142
80.000	80.086	80.091	80.050	80.076	0.076	0.041	0.009	0.266
120.000	120.074	120.075	120.029	120.059	0.059	0.046	-0.010	0.389
160.000	159.998	159.995	159.949	159.981	-0.019	0.049	-0.023	0.512
200.000	199.886	199.888	199.835	199.870	-0.130	0.054		0.634
160.000	159.969	159.975	159.929	159.958	-0.042	0.046	-0.023	0.511
120.000	120.062	120.064	120.023	120.050	0.050	0.041	-0.010	0.388
80.000	80.100	80.098	80.056	80.085	0.085	0.044	0.009	0.267
40.000	40.056	40.056	40.029	40.047	0.047	0.028	0.004	0.143
0.000	-0.004	-0.015	-0.012	-0.010	-0.010	0.011		0.025

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0079
Electronics	204
Node Type	7001
Hardware Version	5.01
Software Version	8.01

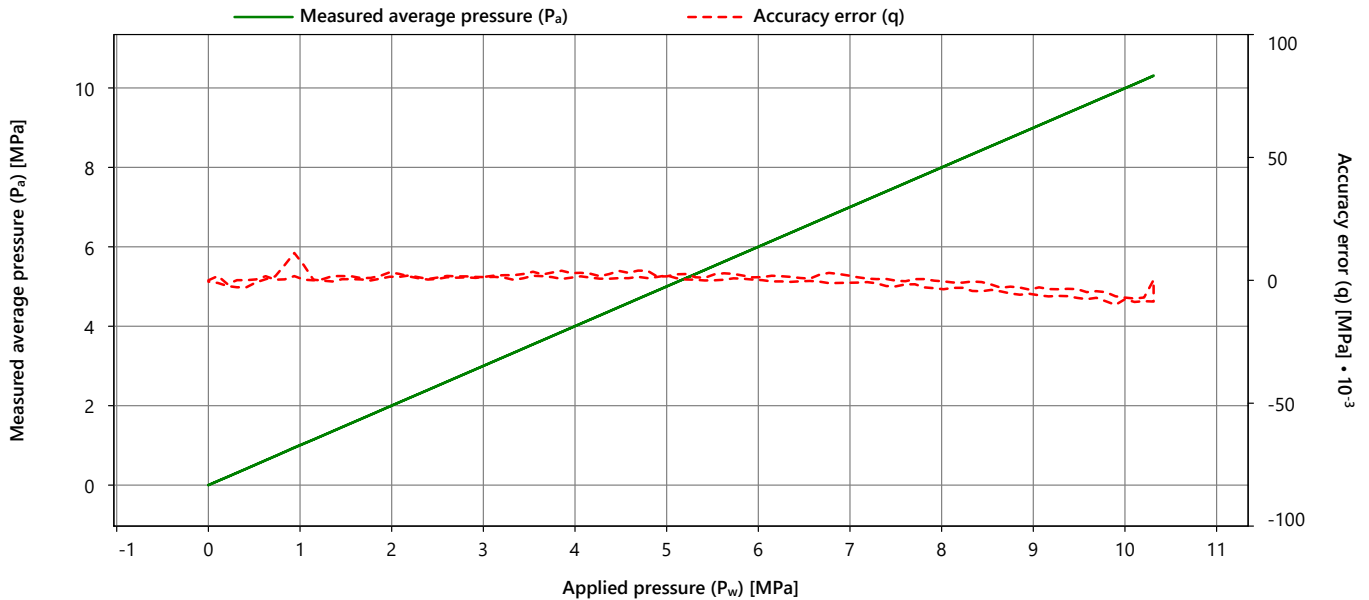
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN23032167

Calibration Details	
Calibration Date	06 Dec 2023 16:28:57
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.007
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.003
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	0.000
Resolution	[MPa]	2.48E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w) [MPa]	Measured pressure 1 (P _{a,1}) [MPa]	Measured pressure 2 (P _{a,2}) [MPa]	Measured pressure 3 (P _{a,3}) [MPa]	Measured average pressure (P _a) [MPa]	Accuracy error (q) [MPa]	Repeatability error (b) [MPa]	Reversibility error (v) [MPa]	Expanded Uncertainty (U) [MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.004	2.003	2.003	2.003	0.003	0.002	-0.002	0.005
4.000	4.001	4.003	4.004	4.003	0.003	0.003	-0.001	0.006
6.000	6.000	6.003	6.001	6.001	0.001	0.002	-0.001	0.006
8.000	7.999	8.001	7.999	8.000	0.000	0.002	-0.003	0.008
10.000	9.991	9.994	9.994	9.993	-0.007	0.003		0.008
8.000	7.996	7.996	7.997	7.996	-0.004	0.001	-0.003	0.008
6.000	6.000	6.001	6.000	6.000	0.000	0.002	-0.001	0.006
4.000	4.001	4.001	4.003	4.002	0.002	0.002	-0.001	0.005
2.000	2.001	2.002	2.002	2.001	0.001	0.001	-0.002	0.005
0.000	-0.001	-0.001	0.000	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0079
Electronics	204
Node Type	7001
Hardware Version	5.01
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

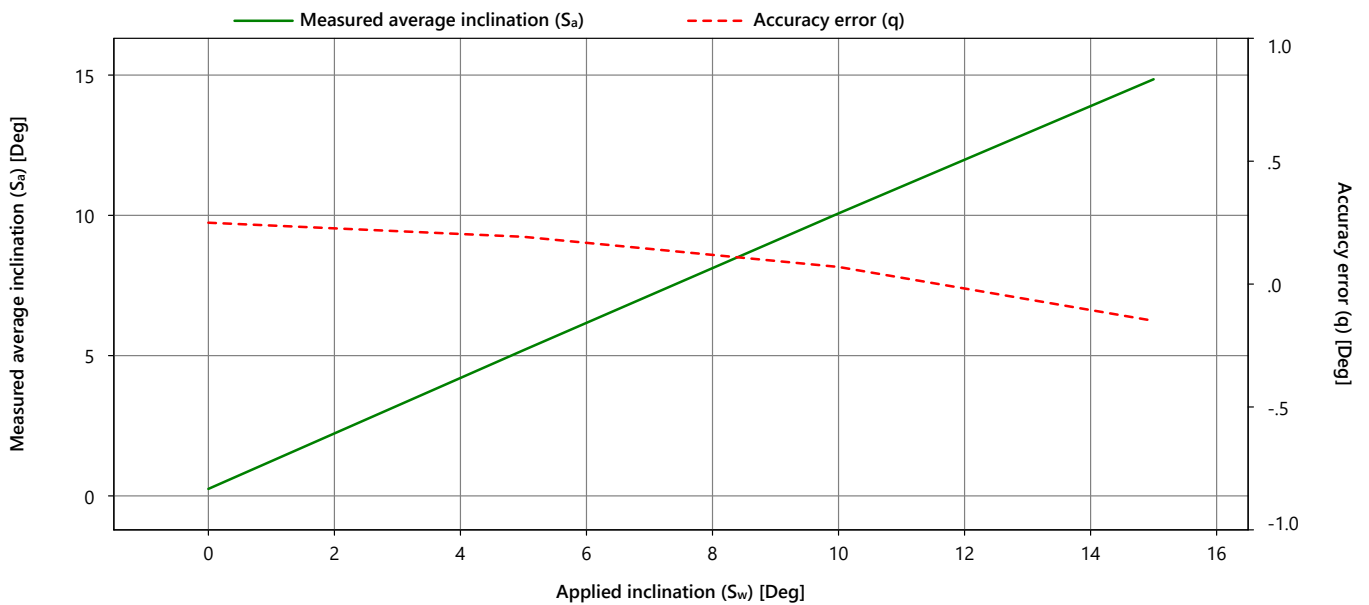
Certificate Number
FCN23032167

Calibration Details	
Calibration Date	06 Dec 2023 15:53:31
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.2
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	0.0
Zero load offset (S_0)	[Deg]	0.0
Resolution	[Deg]	1.3E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w) [Deg]	Measured inclination 1 ($S_{a,1}$) [Deg]	Measured inclination 2 ($S_{a,2}$) [Deg]	Measured inclination 3 ($S_{a,3}$) [Deg]	Measured average inclination (S_a) [Deg]	Accuracy error (q) [Deg]	Repeatability error (b) [Deg]	Expanded Uncertainty (U) [Deg]
0.0	0.0	0.3	0.4	0.2	0.2	0.3	0.8
5.0	5.0	5.2	5.3	5.2	0.2	0.3	0.8
10.0	10.0	10.1	10.2	10.1	0.1	0.2	0.7
15.0	14.9	14.8	14.8	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN23032167

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Fugro Transducer Workshop, P.O. Box 130, 2630 AC Nootdorp, The Netherlands, Phone +31-70-3111444, www.fugro.com
Page 6 of 6



Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E10M4-V1
Serial Number	1715-0079

Appendix Applicable to
Certificate Number
FCN23032167

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

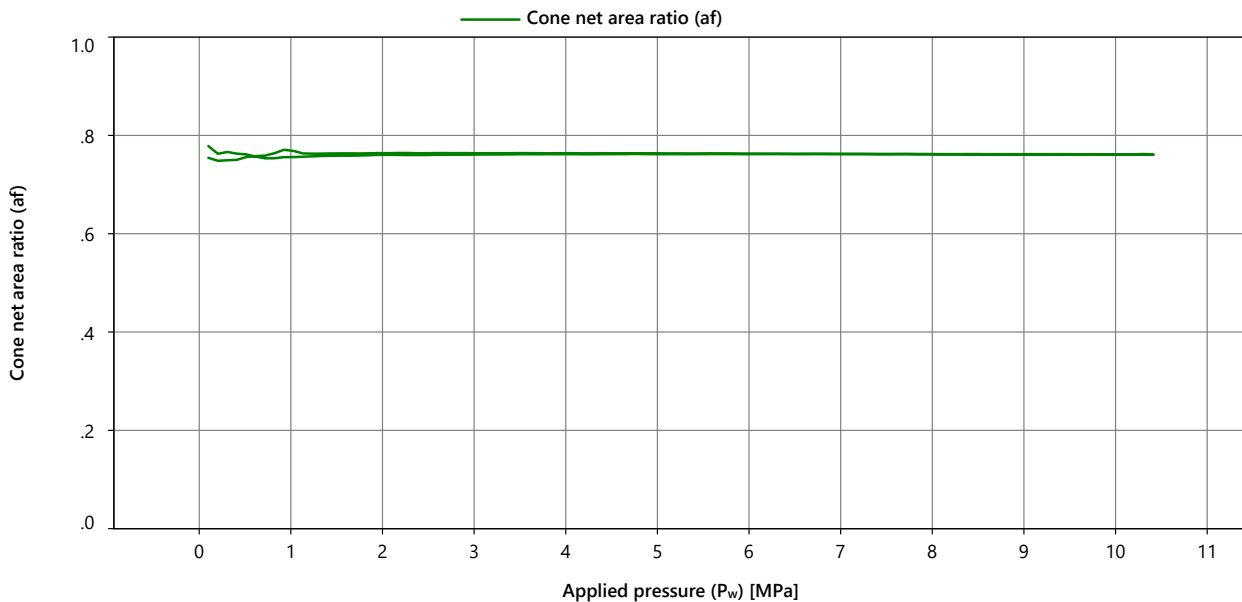
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P1E10M4-V1	Serial Number	3257-0002
Serial Number	1715-0079	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	204	Measurement Details	
Node Type	7001	Measurement Date	06 Dec 2023 16:28:57
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032167

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.761	0.760	0.761	0.761
4.000	0.762	0.762	0.762	0.762
6.000	0.762	0.762	0.762	0.762
8.000	0.762	0.762	0.762	0.762
10.000	0.762	0.762	0.762	0.762
8.000	0.762	0.762	0.762	0.762
6.000	0.763	0.763	0.763	0.763
4.000	0.763	0.764	0.764	0.764
2.000	0.763	0.764	0.764	0.764

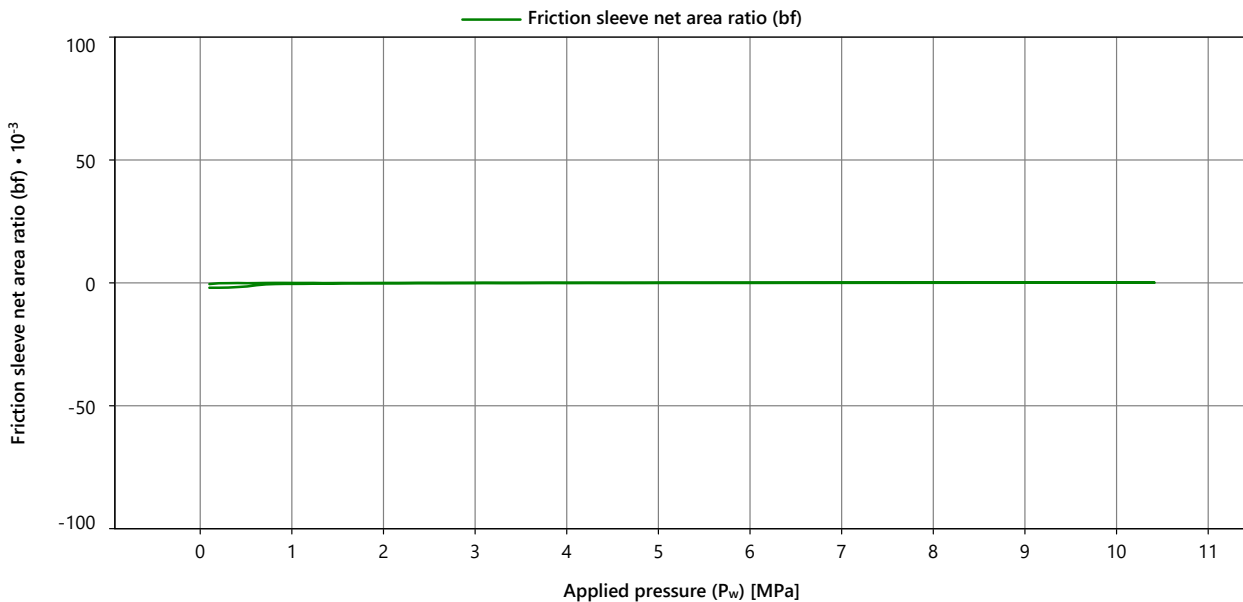
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P1E10M4-V1	Serial Number	3257-0002
Serial Number	1715-0079	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	204	Measurement Details	
Node Type	7001	Measurement Date	06 Dec 2023 16:28:57
Hardware Version	5.01	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN23032167

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	0.00009

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN23032167

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
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Quantities

P	Pressure
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Calibration Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN24032342

Instrument Cone Penetrometer
Manufacturer Fugro
Type CP15-CF200PB10SN2-P1E2M4-V1
Serial Number 1715-0030

Calibration method The instrument was calibrated according to Fugro procedures using a comparison technique against a reference standard.

Environmental Conditions
Temperature during calibration 20.5 ± 3 °C
Atmospheric pressure during calibration 1000 ± 100 mbar

Result The condition of the cone penetrometer meets the requirements of ISO 22476-1:2012 Section 4.1 through 4.7. The calibration results are reported on the next page(s).

The calibration results indicate that the cone penetrometer meets the requirements for use in Application Class 1 as defined in ISO 22476-1:2012 Section 5.2.

Uncertainty The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which provides a confidence level of approximately 95%. The standard uncertainty has been determined in accordance with EA-4/02.

Traceability Fugro reference standards are periodically recertified and are traceable to the International System of Units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2008, ISO 10012:2003 and ISO/IEC 17025:2017.

Calibration date 03-Jan-2024

Calibrate before 03-Jul-2024

Calibrated Sensor	Manufacturer / Type	Calibrated Range	Maximum Rating	Procedure
Cone [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Cone+Fric. [Force]	Fugro Loadcell	0 to 200 kN	0 to 200 kN	EUAF-FNLM- CAL-PR-003
Pore 2 [Pressure]	Keller PA-6L/100bar (81188)	0 to 10 MPa	0 to 20 MPa	EUAF-FNLM- CAL-PR-004
Slope [Inclination]	ADXL	0 to 15 Deg	0 to 20 Deg	EUAF-FNLM- CAL-PR-005

Calibrated Sensor	Before adjustment		After adjustment		Drift	
	Sensitivity	Zero Load	Sensitivity	Zero Load	Sensitivity	Zero Load
Cone [Force]	10.9 $\mu\text{V/V/kN}$	3.15 $\mu\text{V/V}$	10.9 $\mu\text{V/V/kN}$	1.30 $\mu\text{V/V}$	0.24 %	-0.08 %
Cone+Fric. [Force]	10.8 $\mu\text{V/V/kN}$	0.610 $\mu\text{V/V}$	10.8 $\mu\text{V/V/kN}$	-2.70 $\mu\text{V/V}$	0.23 %	-0.15 %
Pore 2 [Pressure]	3.27 mV/V/MPa	1.23 mV/V	3.27 mV/V/MPa	1.23 mV/V	0.00 %	-0.01 %

Nootdorp, 04-Jan-2024

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Ruud Schrijvers
Deputy Manager Transducer Workshop

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Cone Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0030
Electronics	8982
Node Type	7001
Hardware Version	6.00
Software Version	8.01

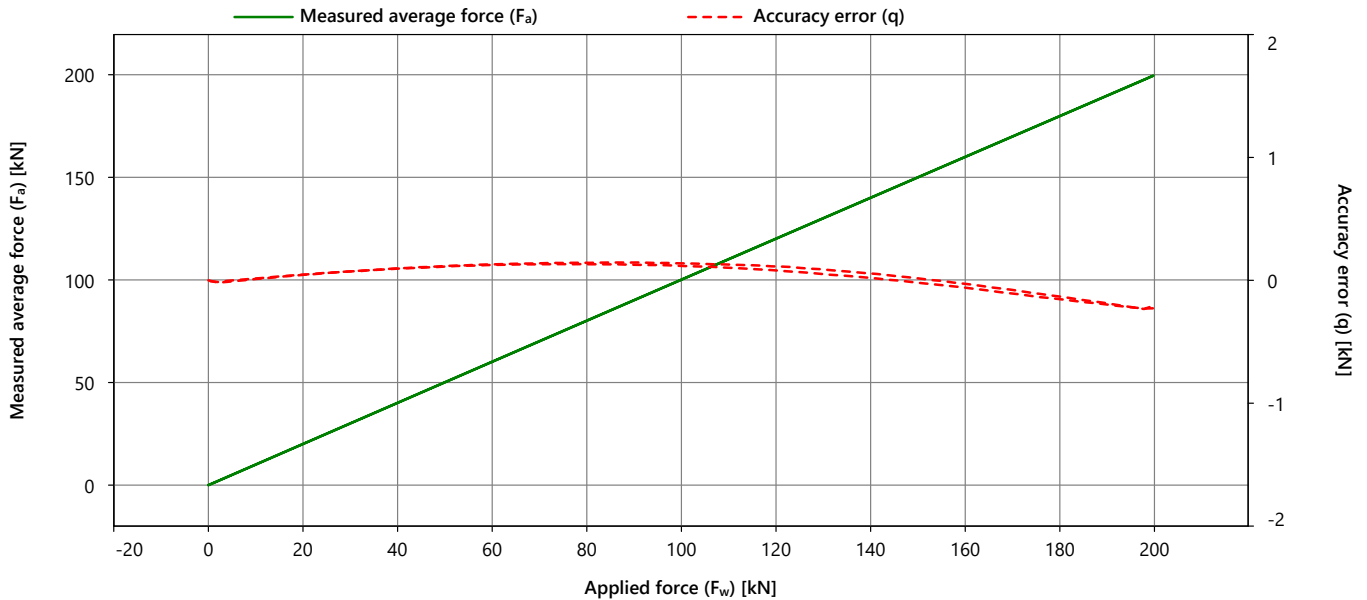
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN24032342

Calibration Details	
Calibration Date	03 Jan 2024 11:20:39
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.204
Max repeatability error (b)	[kN]	0.038
Max reversibility error (v)	[kN]	0.032
Zero load error (F _{c0})	[kN]	0.006
Zero load offset (F ₀)	[kN]	-0.010
Resolution	[kN]	8.55E-05
Noise RMS	[kN]	0.001



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.003	0.000	-0.003	0.000	0.000	0.006		0.018
40.000	40.108	40.095	40.091	40.098	0.098	0.017	-0.002	0.140
80.000	80.154	80.139	80.134	80.142	0.142	0.020	-0.012	0.263
120.000	120.123	120.109	120.106	120.113	0.113	0.018	-0.032	0.387
160.000	159.982	159.969	159.963	159.972	-0.028	0.019	-0.031	0.509
200.000	199.817	199.792	199.780	199.796	-0.204	0.038		0.632
160.000	159.952	159.936	159.933	159.940	-0.060	0.019	-0.031	0.509
120.000	120.089	120.079	120.074	120.081	0.081	0.014	-0.032	0.387
80.000	80.140	80.129	80.124	80.131	0.131	0.017	-0.012	0.263
40.000	40.102	40.094	40.089	40.095	0.095	0.013	-0.002	0.139
0.000	-0.003	-0.007	-0.007	-0.006	-0.006	0.003		0.017

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Cone+Fric. Calibration Result [Force]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0030
Electronics	8982
Node Type	7001
Hardware Version	6.00
Software Version	8.01

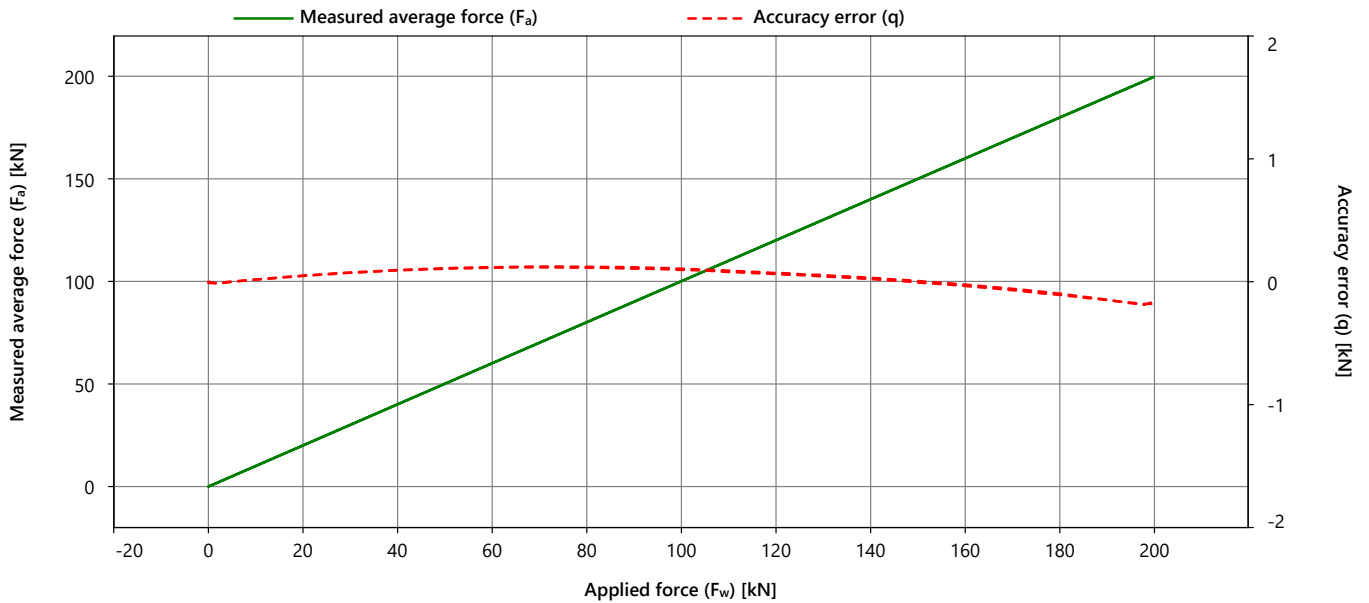
Reference	
Manufacturer	Zwick/Roell
Serial Number	6034-0003
Uncertainty	0.003•F _w +0.015 [kN]

Certificate Number
FCN24032342

Calibration Details	
Calibration Date	03 Jan 2024 11:20:39
Procedure	EUAF-FNLM- CAL-PR-003
Software Version	4.1.3.55360

Sensor	
Channel	Cone+Fric. [Force]
Manufacturer	Fugro Loadcell
Calibrated Range	0 to 200 kN
Maximum Rating	0 to 200 kN

Characteristics	Unit	Value
Max accuracy error (q)	[kN]	0.158
Max repeatability error (b)	[kN]	0.026
Max reversibility error (v)	[kN]	0.011
Zero load error (F _{c0})	[kN]	0.010
Zero load offset (F ₀)	[kN]	-0.010
Resolution	[kN]	8.59E-05
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction %	[%]	0.022



Applied force (F _w) [kN]	Measured force 1 (F _{a,1}) [kN]	Measured force 2 (F _{a,2}) [kN]	Measured force 3 (F _{a,3}) [kN]	Measured average force (F _a) [kN]	Accuracy error (q) [kN]	Repeatability error (b) [kN]	Reversibility error (v) [kN]	Expanded Uncertainty (U) [kN]
0.000	0.007	-0.001	-0.006	0.000	0.000	0.013		0.027
40.000	40.100	40.095	40.092	40.096	0.096	0.008	-0.004	0.139
80.000	80.126	80.120	80.119	80.122	0.122	0.006	-0.007	0.262
120.000	120.075	120.069	120.070	120.071	0.071	0.006	-0.009	0.385
160.000	159.980	159.976	159.974	159.977	-0.023	0.006	-0.011	0.508
200.000	199.856	199.840	199.830	199.842	-0.158	0.026		0.631
160.000	159.969	159.965	159.961	159.965	-0.035	0.008	-0.011	0.508
120.000	120.065	120.063	120.059	120.063	0.063	0.006	-0.009	0.385
80.000	80.117	80.115	80.111	80.114	0.114	0.006	-0.007	0.262
40.000	40.096	40.093	40.087	40.092	0.092	0.009	-0.004	0.139
0.000	-0.006	-0.009	-0.013	-0.010	-0.010	0.007		0.022

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Pore 2 Calibration Result [Pressure]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0030
Electronics	8982
Node Type	7001
Hardware Version	6.00
Software Version	8.01

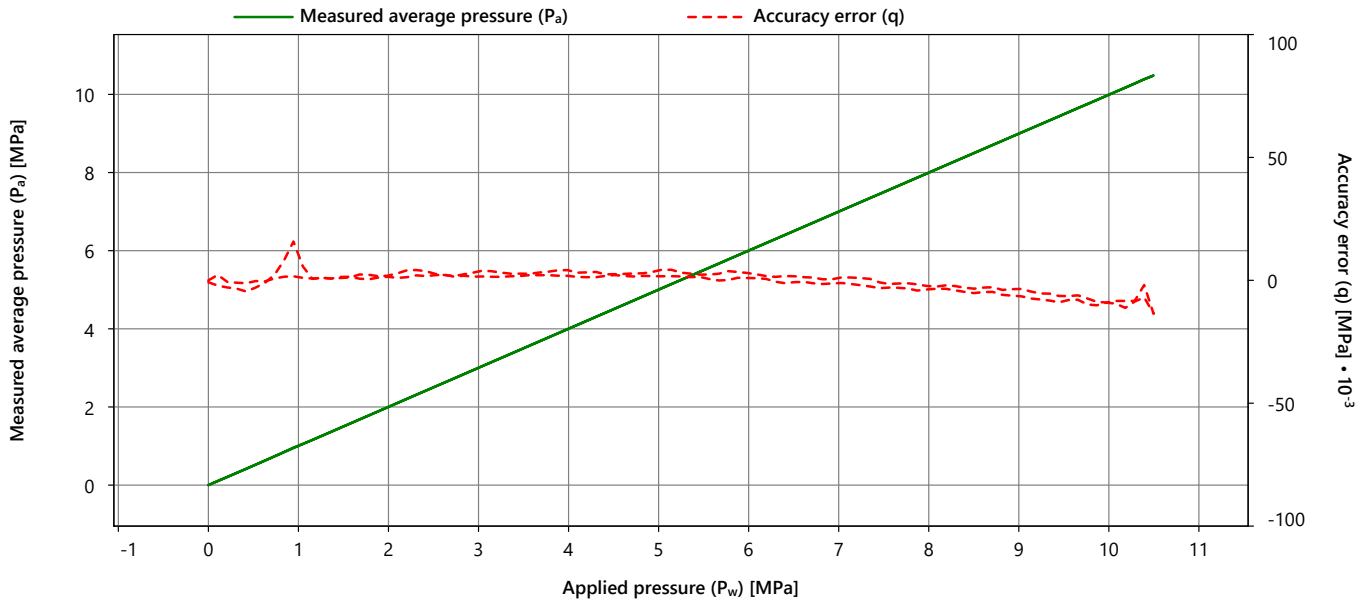
Reference	
Manufacturer	Keller PA-33X
Serial Number	3257-0002
Uncertainty	0.0005•P _w +0.002 [MPa]

Certificate Number
FCN24032342

Calibration Details	
Calibration Date	03 Jan 2024 14:26:40
Procedure	EUAF-FNLM- CAL-PR-004
Software Version	4.1.3.55360

Sensor	
Channel	Pore 2 [Pressure]
Manufacturer	Keller PA-6L/100bar (81188)
Calibrated Range	0 to 10 MPa
Maximum Rating	0 to 20 MPa

Characteristics	Unit	Value
Max accuracy error (q)	[MPa]	0.009
Max repeatability error (b)	[MPa]	0.003
Max reversibility error (v)	[MPa]	0.002
Zero load error (P _{c0})	[MPa]	0.001
Zero load offset (P ₀)	[MPa]	0.002
Resolution	[MPa]	2.28E-06
Noise RMS	[MPa]	0.000



Applied pressure (P _w)	Measured pressure 1 (P _{a,1})	Measured pressure 2 (P _{a,2})	Measured pressure 3 (P _{a,3})	Measured average pressure (P _a)	Accuracy error (q)	Repeatability error (b)	Reversibility error (v)	Expanded Uncertainty (U)
[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]	[MPa]
0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003
2.000	2.002	2.000	2.004	2.002	0.002	0.003	0.000	0.006
4.000	4.004	4.003	4.005	4.004	0.004	0.002	-0.002	0.006
6.000	6.002	6.003	6.004	6.003	0.003	0.002	-0.002	0.007
8.000	7.998	7.999	7.996	7.998	-0.002	0.003	-0.001	0.008
10.000	9.991	9.990	9.992	9.991	-0.009	0.002		0.008
8.000	7.996	7.996	7.997	7.996	-0.004	0.001	-0.001	0.007
6.000	6.001	6.002	6.001	6.001	0.001	0.001	-0.002	0.006
4.000	4.001	4.002	4.002	4.002	0.002	0.001	-0.002	0.006
2.000	2.002	2.002	2.001	2.001	0.001	0.001	0.000	0.004
0.000	-0.001	-0.001	-0.001	-0.001	-0.001	0.000		0.003

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Slope Calibration Result [Inclination]

Instrument	
Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P 1E2M4-V1
Serial Number	1715-0030
Electronics	8982
Node Type	7001
Hardware Version	6.00
Software Version	8.01

Reference	
Manufacturer	Hoek-O-Mat
Serial Number	2109-0002
Uncertainty	0.6 [Deg]

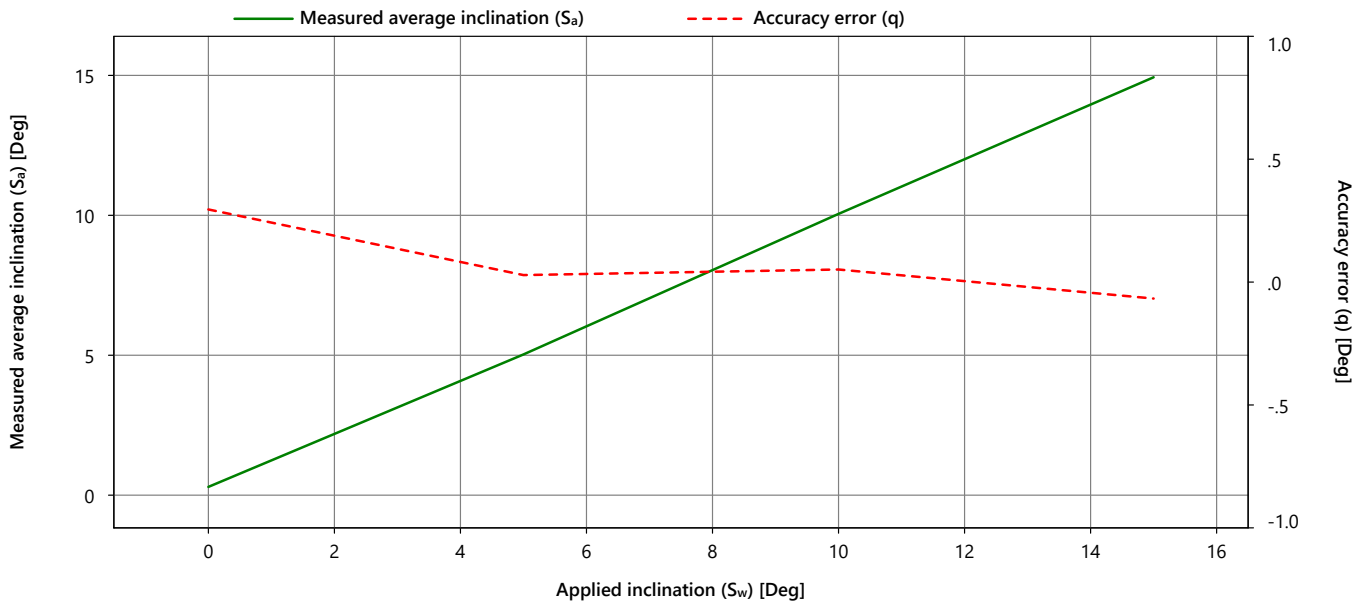
Certificate Number
FCN24032342

Calibration Details	
Calibration Date	03 Jan 2024 11:27:57
Procedure	EUAF-FNLM- CAL-PR-005
Software Version	4.1.3.55360

Sensor	
Channel	Slope [Inclination]
Manufacturer	ADXL
Calibrated Range	0 to 15 Deg
Maximum Rating	0 to 20 Deg

Characteristics	Unit	Value
Max accuracy error (q)	[Deg]	0.3
Max repeatability error (b)	[Deg]	0.3
Zero load error (S_{c0})	[Deg]	0.1
Zero load offset (S_0)	[Deg]	0.3
Resolution	[Deg]	1.32E-05
Noise RMS	[Deg]	0.0

Inclination is defined as the angular deviation of the cone penetrometer from the vertical.



Applied inclination (S_w)	Measured inclination 1 ($S_{a,1}$)	Measured inclination 2 ($S_{a,2}$)	Measured inclination 3 ($S_{a,3}$)	Measured average inclination (S_a)	Accuracy error (q)	Repeatability error (b)	Expanded Uncertainty (U)
[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]	[Deg]
0.0	0.3	0.4	0.2	0.3	0.3	0.3	0.8
5.0	5.1	5.0	5.0	5.0	0.0	0.1	0.7
10.0	10.0	10.1	10.0	10.1	0.1	0.1	0.7
15.0	14.9	15.0	14.9	14.9	-0.1	0.1	0.7

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Symbols, Definitions and References

Certificate Number
FCN24032342

Symbols and Definitions (general)

b	Repeatability error, defined as the maximum difference between the measurements of the instrument at the applied value.
Noise RMS	Signal noise, defined as the quadratic mean when the sensor is not subjected to load.
q	Accuracy error, defined as the difference between the average indicated value by the instrument and the applied value.
Resolution	Smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.
U	The stated uncertainty is that of the average indicated quantity, and includes the entire calibration method, including the reference and calibrated sensor, but excludes the difference between average indicated value by the instrument and the applied value.
v	Reversibility error, defined as the difference between the average indicated value by the instrument at a certain applied value when it was increased and when it was decreased.

Symbols and Definitions (quantity specific: Q may be substituted for F, P or S, as appropriate)

Q₀	Zero load offset, instrument output where the specified measured quantity value is zero.
Q_a	Average indicated quantity value by the instrument.
Q_{a,x}	Quantity value indicated by the instrument at measurement x.
Q_{c0}	Zero load error, defined as the difference between the average indicated value by the instrument before and after the load cycle has been applied.
Q_w	Applied reference quantity value.

Quantities

F	Force
P	Pressure
S	Inclination

References

International Organization for Standardization, 2012. *ISO 22476-1:2012 Geotechnical investigation and testing, Field testing, Electrical cone and piezocone penetration test*. Geneva: ISO.

European Co-operation For Accreditation, 2013. *Evaluation of the uncertainty of measurement in calibration*. European Co-operation For Accreditation, Publication; EA-4/02 M:2013.

International Organization for Standardization, 2005. *ISO 17025:2005 General requirements for the competence of testing and calibration laboratories*. Geneva: ISO.

International Organization for Standardization, 2003. *ISO 10012:2003 Measurement management systems - requirements for measurement processes and measuring equipment*. Geneva: ISO.

International Organization for Standardization, 2008. *ISO 9001:2008 Quality management systems - Requirements*. Geneva: ISO.

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	CP15-CF200PB10SN2-P1E2M4-V1
Serial Number	1715-0030

Appendix Applicable to
Certificate Number
FCN24032342

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Surface area of the friction sleeve	0.023 m ²
Cone net area ratio	0.76
Friction sleeve net area ratio	0
Diameter of the cylindrical part of the cone	43.85 mm
Diameter of the friction sleeve	44.1 mm
Length of the friction sleeve	162.75 mm
Cone - friction sleeve distance	15.75 mm
Cone - pore 2 distance	3 mm

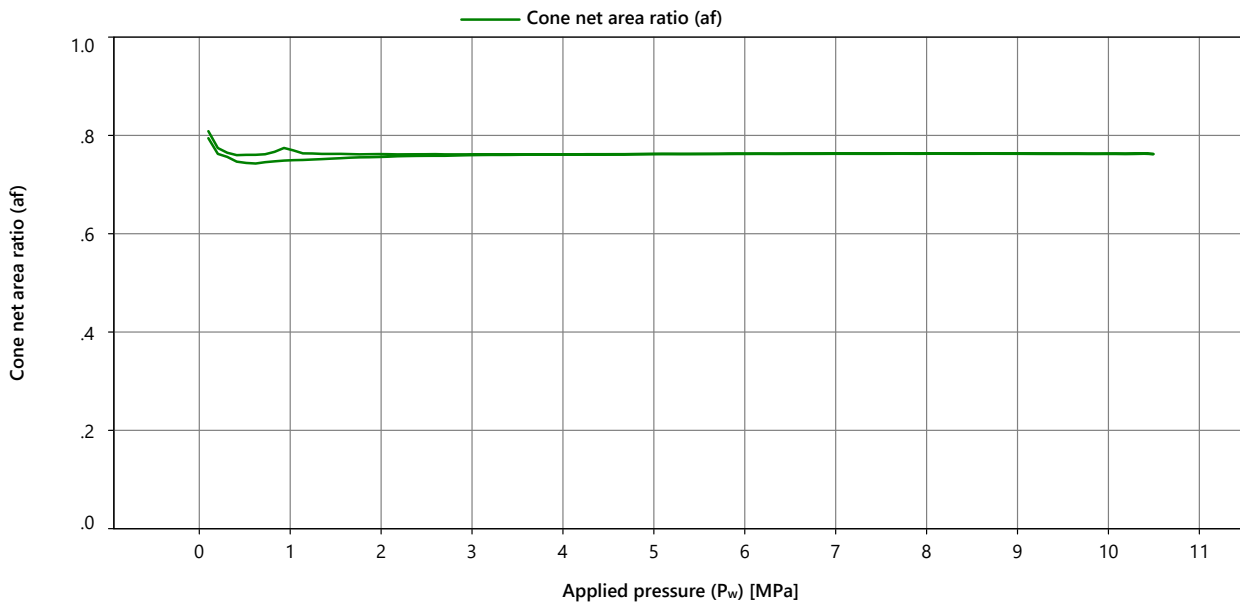
Cone Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0030	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	8982	Measurement Details	
Node Type	7001	Measurement Date	03 Jan 2024 14:26:40
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN24032342

Characteristics	Unit	Value
Cone net area ratio (af)	[-]	0.76

The cone net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured cone net area ratio 1 (af,1)	Measured cone net area ratio 2 (af,2)	Measured cone net area ratio 3 (af,3)	Measured average cone net area ratio (af)
2.000	0.754	0.756	0.759	0.756
4.000	0.760	0.761	0.763	0.761
6.000	0.762	0.763	0.764	0.763
8.000	0.762	0.763	0.763	0.763
10.000	0.763	0.763	0.763	0.763
8.000	0.762	0.763	0.763	0.763
6.000	0.762	0.762	0.763	0.762
4.000	0.760	0.762	0.762	0.761
2.000	0.760	0.763	0.764	0.762

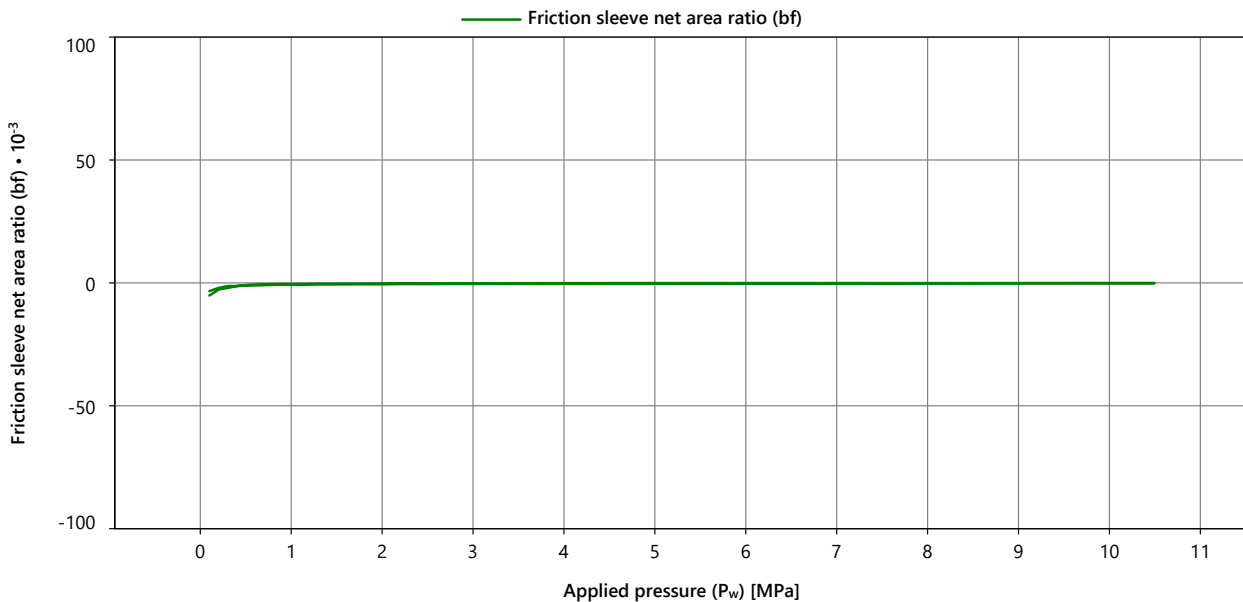
Friction Sleeve Net Area Ratio Result

Instrument		Reference	
Manufacturer	Fugro	Manufacturer	Keller PA-33X
Type	CP15-CF200PB10SN2-P 1E2M4-V1	Serial Number	3257-0002
Serial Number	1715-0030	Uncertainty	0.0005•P _w +0.002 [MPa]
Electronics	8982	Measurement Details	
Node Type	7001	Measurement Date	03 Jan 2024 14:26:40
Hardware Version	6.00	Procedure	EUAF-FNLM- CAL-PR-003
Software Version	8.01	Software Version	4.1.3.55360

Appendix Applicable to
Certificate Number
FCN24032342

Characteristics	Unit	Value
Friction sleeve net area ratio (bf)	[-]	-0.00010

The friction sleeve net area ratio presented above is determined at the maximum applied pressure during the measurement.



Applied pressure (P _w) [MPa]	Measured friction sleeve net area ratio (bf) 1 (bf,1)	Measured friction sleeve net area ratio (bf) 2 (bf,2)	Measured friction sleeve net area ratio (bf) 3 (bf,3)	Measured average Friction sleeve net area ratio (bf)
2.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
10.000	0.000	0.000	0.000	0.000
8.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000
2.000	-0.001	-0.001	-0.001	-0.001

Symbols and Definitions

Appendix Applicable to
Certificate Number
FCN24032342

Symbols and Definitions (general)

af	Cone net area ratio, defined as the factor between the applied pressure to the instrument and the indicated cone resistance.
af,x	Measured cone net area ratio at measurement x.
bf	Friction sleeve net area ratio, defined as the factor between the applied pressure to the instrument and the indicated sleeve friction.
bf,x	The measured friction sleeve net area ratio at measurement x.

Symbols and Definitions (quantity specific: Q may be substituted for P, as appropriate)

Q _w	Applied reference quantity value.
----------------	-----------------------------------

Quantities

P	Pressure
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Seismic Cone Inspection Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031511

Instrument Seismic Penetrometer
Manufacturer Fugro
Type SP15-G0-P1E2M4-V2
Serial Number 1734-0036

Method The instrument has been inspected according to Fugro procedures in Digital Seismic Manual M8400000.THE, paragraph 5.6.

Environmental Conditions

Temperature during certification	20.5 ± 3 °C
Atmospheric pressure during certification	1000 ± 100 mbar

Result The certification result is satisfactory.

Certification date 11-Oct-2023

Certificate valid to 11-Apr-2024

Nootdorp, 11-Oct-2023

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Deputy Manager Transducer Workshop

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	SP15-G0-P1E2M4-V2
Serial Number	1734-0036

Appendix Applicable to
Certificate Number
FCN23031511

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Diameter of the cylindrical part of the cone	43.85 mm
Cone - seismic distance	271 mm
Seismic array spacing	0.5 m

Seismic Cone Inspection Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031512

Instrument Seismic Penetrometer
Manufacturer Fugro
Type SP15-G0-P1E2M4-V2
Serial Number 1734-0051

Method The instrument has been inspected according to Fugro procedures in Digital Seismic Manual M8400000.THE, paragraph 5.6.

Environmental Conditions

Temperature during certification	20.5 ± 3 °C
Atmospheric pressure during certification	1000 ± 100 mbar

Result The certification result is satisfactory.

Certification date 11-Oct-2023

Certificate valid to 11-Apr-2024

Nootdorp, 11-Oct-2023

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	SP15-G0-P1E2M4-V2
Serial Number	1734-0051

Appendix Applicable to
Certificate Number
FCN23031512

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Diameter of the cylindrical part of the cone	43.85 mm
Cone - seismic distance	271 mm
Seismic array spacing	0.5 m

Seismic Cone Inspection Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031910

Instrument Seismic Penetrometer
Manufacturer Fugro
Type SP15-G0-P1E2M4-V2
Serial Number 1734-0024

Method The instrument has been inspected according to Fugro procedures in Digital Seismic Manual M8400000.THE, paragraph 5.6.

Environmental Conditions

Temperature during certification	20.5 ± 3 °C
Atmospheric pressure during certification	1000 ± 100 mbar

Result The certification result is satisfactory.

Certification date 09-Nov-2023

Certificate valid to 09-May-2024

Nootdorp, 09-Nov-2023

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	SP15-G0-P1E2M4-V2
Serial Number	1734-0024

Appendix Applicable to
Certificate Number
FCN23031910

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Diameter of the cylindrical part of the cone	43.85 mm
Cone - seismic distance	271 mm
Seismic array spacing	0.5 m

Seismic Cone Inspection Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031915

Instrument Seismic Penetrometer
Manufacturer Fugro
Type SP15-G0-P1E2M4-V2
Serial Number 1734-0092

Method The instrument has been inspected according to Fugro procedures in Digital Seismic Manual M8400000.THE, paragraph 5.6.

Environmental Conditions

Temperature during certification	20.5 ± 3 °C
Atmospheric pressure during certification	1000 ± 100 mbar

Result The certification result is satisfactory.

Certification date 10-Nov-2023

Certificate valid to 10-May-2024

Nootdorp, 13-Nov-2023

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Gerry Sinjorgo
Manager Transducer Workshop

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	SP15-G0-P1E2M4-V2
Serial Number	1734-0092

Appendix Applicable to
Certificate Number
FCN23031915

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Diameter of the cylindrical part of the cone	43.85 mm
Cone - seismic distance	271 mm
Seismic array spacing	0.5 m

Seismic Cone Inspection Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031919

Instrument Seismic Penetrometer
Manufacturer Fugro
Type SP15-G0-P1E2M4-V2
Serial Number 1734-0096

Method The instrument has been inspected according to Fugro procedures in Digital Seismic Manual M8400000.THE, paragraph 5.6.

Environmental Conditions

Temperature during certification	20.5 ± 3 °C
Atmospheric pressure during certification	1000 ± 100 mbar

Result The certification result is satisfactory.

Certification date 10-Nov-2023

Certificate valid to 10-May-2024

Nootdorp, 13-Nov-2023

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Deputy Manager Transducer Workshop

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	SP15-G0-P1E2M4-V2
Serial Number	1734-0096

Appendix Applicable to
Certificate Number
FCN23031919

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Diameter of the cylindrical part of the cone	43.85 mm
Cone - seismic distance	271 mm
Seismic array spacing	0.5 m

Seismic Cone Inspection Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23031911

Instrument Seismic Penetrometer
Manufacturer Fugro
Type SP15-G0-P1E2M4-V2
Serial Number 1734-0091

Method The instrument has been inspected according to Fugro procedures in Digital Seismic Manual M8400000.THE, paragraph 5.6.

Environmental Conditions

Temperature during certification 20.5 ± 3 °C
Atmospheric pressure during certification 1000 ± 100 mbar

Result The certification result is satisfactory.

Certification date 09-Nov-2023

Certificate valid to 09-May-2024

Nootdorp, 09-Nov-2023

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	SP15-G0-P1E2M4-V2
Serial Number	1734-0091

Appendix Applicable to
Certificate Number
FCN23031911

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Diameter of the cylindrical part of the cone	43.85 mm
Cone - seismic distance	271 mm
Seismic array spacing	0.5 m

Seismic Cone Inspection Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032169

Instrument Seismic Penetrometer
Manufacturer Fugro
Type SP15-G0-P1E2M4-V2
Serial Number 1734-0095

Method The instrument has been inspected according to Fugro procedures in Digital Seismic Manual M8400000.THE, paragraph 5.6.

Environmental Conditions

Temperature during certification	20.5 ± 3 °C
Atmospheric pressure during certification	1000 ± 100 mbar

Result The certification result is satisfactory.

Certification date 06-Dec-2023

Certificate valid to 06-Jun-2024

Nootdorp, 06-Dec-2023

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	SP15-G0-P1E2M4-V2
Serial Number	1734-0095

Appendix Applicable to
Certificate Number
FCN23032169

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Diameter of the cylindrical part of the cone	43.85 mm
Cone - seismic distance	271 mm
Seismic array spacing	0.5 m

Seismic Cone Inspection Certificate

Applicant Fugro Netherlands Marine B.V.
Prismastraat 4
2631 RT, Nootdorp
The Netherlands

Certificate Number
FCN23032164

Instrument Seismic Penetrometer
Manufacturer Fugro
Type SP15-G0-P1E2M4-V2
Serial Number 1734-0097

Method The instrument has been inspected according to Fugro procedures in Digital Seismic Manual M8400000.THE, paragraph 5.6.

Environmental Conditions

Temperature during certification 20.5 ± 3 °C
Atmospheric pressure during certification 1000 ± 100 mbar

Result The certification result is satisfactory.

Certification date 06-Dec-2023

Certificate valid to 06-Jun-2024

Nootdorp, 06-Dec-2023

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Typical Dimensions

Instrument

Manufacturer	Fugro
Type	SP15-G0-P1E2M4-V2
Serial Number	1734-0097

Appendix Applicable to
Certificate Number
FCN23032164

Typical Dimensions

Cross-sectional projected area of the cone	0.0015 m ²
Diameter of the cylindrical part of the cone	43.85 mm
Cone - seismic distance	271 mm
Seismic array spacing	0.5 m

D.2 Positioning Survey Equipment Calibration

List of Plates

Positioning Survey Equipment Calibration

38 Plates

Project Coordinate Reference System

Table 1: Geodetic parameters

Name: ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]		
EPSG Code	EPSG:25832	
Global Navigation Satellite System (GNSS) Geodetic Parameters*		
Datum	International Terrestrial Reference Frame 2014	EPSG:1165
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Local Geodetic Datum Parameters		
Datum	European Terrestrial Reference System 1989	EPSG:6258
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from ITRF2014 to ETRS89		
X-axis translation 0.05600 m	X-axis rotation -0.0027542"	Scale difference 0.00355022 ppm
Y-axis translation 0.05350 m	Y-axis rotation -0.016661"	Coordinate Frame rotation
Z-axis translation -0.09880 m	Z-axis rotation 0.0269296"	FUGRO:41366
Local Projection Parameters		
Map projection	Transverse Mercator	
Grid system	UTM zone 32N	EPSG:16032
Latitude origin	00° 00' 00.000" N	
Central meridian	009° 00' 00.000" E	
Scale factor on central meridian	0.9996	
False easting	500 000 m	
False northing	0 m	
Project Vertical Parameters		
Vertical coordinate reference system	DTU21 MSS height	FUGRO:41088
Datum	DTU21 MSS height	FUGRO:40943
Transformation	WGS 84 to DTU21 MSS height	FUGRO:41478
Notes		
* The geodetic datum of Fugro's global GNSS correction data is ITRF2014, epoch 2023.001982 (01/01/2023 17:22:00)		

Table 2: Validation calculation

ITRF2014	Test Point [Position]	Computed Point
Latitude	56° 18' 54.00000" N	56° 18' 54.00000" N
Longitude	008° 30' 18.00000" E	008° 30' 18.00000" E
Ellipsoidal height	0.000 m Ell.	0.000 m Ell.
ETRS89		
Latitude	56° 18' 53.98049" N	56° 18' 53.98049" N
Longitude	008° 30' 17.96794" E	008° 30' 17.96794" E
Ellipsoidal height	-0.026 m Ell.	-0.026 m Ell.
UTM zone 32N		
Easting	469 379.097 m	469 379.097 m
Northing	6 241 248.598 m	6 241 248.598 m
Mean sea surface height	-39.937 m	-39.937 m



Rene Wojke
Party Chief
FNAS (Fugro Norway AS)

Paskal Nerad
Client Representative
Energinet Eltransmission

Colin Jacobs
Client Representative
Energinet Eltransmission

Position comparison

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Session

Session name	DGNSS verification alongside Esbjerg-v1
Units and Format	Local grid (World Standard)
Start Time	26 Oct 2023, 22:17:13+02:00
End Time	26 Oct 2023, 23:17:14+02:00
Duration	1h 0m
Number of Observations	3600

Table 3: Positioning system CRS and offsets

	System	CRS	X [m]	Y [m]	Z [m]
1	SPK Port-10.47.67.101-Starfix.G4 Plus 10105	WGS 84(2D)	-1.71	16.26	29.05
2	SPK Stbd-10.47.67.102-Starfix.XP2 10202	WGS 84(2D)	1.90	16.26	29.01
3	SPK Stbd-10.47.67.102-Starfix.G4 Plus 10205	WGS 84(2D)	1.90	16.26	29.01
4	SPK Port-10.47.67.101-Starfix.XP2 10102	WGS 84(2D)	-1.71	16.26	29.05

Table 4: Sensor data (mean values over data periods)

	Antenna Positions	East [m]	North [m]	H [m]	East SD [m]	North SD [m]	H SD [m]	Obs
1	SPK Port-10.47.67.101-Starfix.G4 Plus 10105	464 199.193 E	6 147 040.412 N	32.400 MSS	± 0.04	± 0.03	± 0.91	3533
2	SPK Stbd-10.47.67.102-Starfix.XP2 10202	464 196.341 E	6 147 038.240 N	32.435 MSS	± 0.03	± 0.03	± 0.91	3509
3	SPK Stbd-10.47.67.102-Starfix.G4 Plus 10205	464 196.327 E	6 147 038.215 N	32.462 MSS	± 0.03	± 0.02	± 0.91	3491
4	SPK Port-10.47.67.101-Starfix.XP2 10102	464 199.185 E	6 147 040.445 N	32.432 MSS	± 0.02	± 0.03	± 0.91	3445

Table 5: Heading sensor data

	Heading Sensors	Obs T [°]	Obs G [°]	Conv [°]	SD [°]	(C-O) [°]	Obs T [°]	Obs G [°]	Diff [°]	Records
1	SPK Port-10.47.67.101	231.7	232.2	-0.46666	0.08	-90.00	141.7	142.2	0.00	3600
2	TSS Meridian	228.6	229.1	-0.46666	0.02	-86.61	142.0	142.4	-0.23	3600

Table 6: Pitch sensor data

	Pitch Sensors	Observed [°]	SD [°]	(C-O) [°]	Computed [°]	Difference [°]	Records
1	MRU5	0.57	0.02	-0.12	0.45	0.00	3600

Table 7: Roll sensor data

	Roll Sensors	Observed [°]	SD [°]	(C-O) [°]	Computed [°]	Difference [°]	Records
1	MRU5	-0.21	0.02	-0.13	-0.34	0.00	3600

Table 8: Results: Normand Mermaid3 Mean Position at CommonReferencePoint (UTM zone 32N CM 9° E)

	Name	East [m]	North [m]	H [m]	1xDRMS [m]	ΔEast [m]	ΔNorth [m]	ΔH [m]	Obs
1	SPK Port-10.47.67.101-Starfix.G4 Plus 10105	464 187.886 E	6 147 051.925 N	3.239 MSS	0.04	0.00	0.00	0.00	3533
2	SPK Stbd-10.47.67.102-Starfix.XP2 10202	464 187.893 E	6 147 051.961 N	3.285 MSS	0.03	0.01	0.04	0.05	3509
3	SPK Stbd-10.47.67.102-Starfix.G4 Plus 10205	464 187.880 E	6 147 051.936 N	3.313 MSS	0.03	-0.01	0.01	0.07	3491
4	SPK Port-10.47.67.101-Starfix.XP2 10102	464 187.878 E	6 147 051.961 N	3.275 MSS	0.03	-0.01	0.04	0.04	3445

Table 9: Geodetic parameters

Name: ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]		
EPSG Code	EPSG:25832	
Global Navigation Satellite System (GNSS) Geodetic Parameters*		
Datum	International Terrestrial Reference Frame 2014	EPSG:1165
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Local Geodetic Datum Parameters		
Datum	European Terrestrial Reference System 1989	EPSG:6258
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from ITRF2014 to ETRS89		
X-axis translation 0.05600 m	X-axis rotation -0.0027542"	Scale difference 0.00355022 ppm
Y-axis translation 0.05350 m	Y-axis rotation -0.016661"	Coordinate Frame rotation
Z-axis translation -0.09880 m	Z-axis rotation 0.0269296"	FUGRO:41366
Local Projection Parameters		
Map projection	Transverse Mercator	
Grid system	UTM zone 32N	EPSG:16032
Latitude origin	00° 00' 00.000" N	
Central meridian	009° 00' 00.000" E	
Scale factor on central meridian	0.9996	
False easting	500 000 m	
False northing	0 m	
Project Vertical Parameters		
Vertical coordinate reference system	DTU21 MSS height	FUGRO:41088
Datum	DTU21 MSS height	FUGRO:40943
Transformation	WGS 84 to DTU21 MSS height	FUGRO:41478
Notes		
* The geodetic datum of Fugro's global GNSS correction data is ITRF2014, epoch 2023.001982 (01/01/2023 17:22:00)		

Table 10: Validation calculation

ITRF2014	Test Point [Position]	Computed Point
Latitude	56° 18' 54.00000" N	56° 18' 54.00000" N
Longitude	008° 30' 18.00000" E	008° 30' 18.00000" E
Ellipsoidal height	0.000 m Ell.	0.000 m Ell.
ETRS89		
Latitude	56° 18' 53.98049" N	56° 18' 53.98049" N
Longitude	008° 30' 17.96794" E	008° 30' 17.96794" E
Ellipsoidal height	-0.026 m Ell.	-0.026 m Ell.
UTM zone 32N		
Easting	469 379.097 m	469 379.097 m
Northing	6 241 248.598 m	6 241 248.598 m
Mean sea surface height	-39.937 m	-39.937 m



Rene Wojke
Party Chief
FNAS (Fugro Norway AS)

Paskal Nerad
Client Representative
Energinet Eltransmission

Colin Jacobs
Client Representative
Energinet Eltransmission

Point Report

Table 1: Project Details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Geodetic parameters

Name: ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]		
EPSG Code	EPSG:25832	
Global Navigation Satellite System (GNSS) Geodetic Parameters*		
Datum	International Terrestrial Reference Frame 2014	EPSG:1165
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Local Geodetic Datum Parameters		
Datum	European Terrestrial Reference System 1989	EPSG:6258
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from ITRF2014 to ETRS89		
X-axis translation 0.05600 m	X-axis rotation -0.0027542"	Scale difference 0.00355022 ppm
Y-axis translation 0.05350 m	Y-axis rotation -0.016661"	Coordinate Frame rotation
Z-axis translation -0.09880 m	Z-axis rotation 0.0269296"	FUGRO:41366
Local Projection Parameters		
Map projection	Transverse Mercator	
Grid system	UTM zone 32N	EPSG:16032
Latitude origin	00° 00' 00.000" N	
Central meridian	009° 00' 00.000" E	
Scale factor on central meridian	0.9996	
False easting	500 000 m	
False northing	0 m	
Project Vertical Parameters		
Vertical coordinate reference system	DTU21 MSS height	FUGRO:41088
Datum	DTU21 MSS height	FUGRO:40943
Transformation	WGS 84 to DTU21 MSS height	FUGRO:41478
Notes		
* The geodetic datum of Fugro's global GNSS correction data is ITRF2014, epoch 2023.001982 (01/01/2023 17:22:00)		

Table 3: Waypoints

ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS] EPSG:25832			
Point Name	Easting [m]	Northing [m]	Height [m Mea.]
CPT001	396 643.000	6 234 080.000	0.000
CPT002	393 122.000	6 229 240.000	0.000
CPT003	400 350.000	6 228 760.000	0.000
CPT004	410 026.000	6 227 790.000	0.000
CPT005	396 897.000	6 226 990.000	0.000

Table 3: Waypoints

ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS] EPSG:25832			
Point Name	Easting [m]	Northing [m]	Height [m Mea.]
CPT006	405 730.000	6 226 820.000	0.000
CPT007	414 848.000	6 226 750.000	0.000
CPT008	423 579.000	6 226 640.000	0.000
CPT009	418 724.000	6 226 610.000	0.000
CPT010	392 237.000	6 225 950.000	0.000
CPT011	402 856.000	6 225 210.000	0.000
CPT012	397 289.000	6 224 010.000	0.000
CPT013	411 362.000	6 223 990.000	0.000
CPT014	406 069.000	6 223 880.000	0.000
CPT015	394 845.000	6 223 440.000	0.000
CPT016	416 207.000	6 222 990.000	0.000
CPT017	386 817.000	6 222 760.000	0.000
CPT018	400 451.000	6 222 680.000	0.000
CPT019	418 594.000	6 222 490.000	0.000
CPT020	423 141.000	6 222 410.000	0.000
CPT021	407 203.000	6 222 100.000	0.000
CPT022	413 219.000	6 221 320.000	0.000
CPT023	416 357.000	6 220 010.000	0.000
CPT024	421 184.000	6 219 980.000	0.000
CPT026	399 883.000	6 218 850.000	0.000
CPT027	396 435.000	6 218 720.000	0.000
CPT029	404 392.000	6 218 390.000	0.000
CPT030	412 874.000	6 218 190.000	0.000
CPT032	394 834.000	6 216 770.000	0.000
CPT033	414 238.000	6 216 500.000	0.000
CPT035	402 167.000	6 215 910.000	0.000
CPT036	410 872.000	6 215 720.000	0.000
CPT037	423 221.000	6 215 300.000	0.000
CPT038	419 067.000	6 214 400.000	0.000
CPT040	394 769.000	6 214 230.000	0.000
CPT043	409 954.000	6 213 000.000	0.000
CPT044	415 855.000	6 212 700.000	0.000
CPT045	403 447.000	6 212 010.000	0.000
CPT047	421 869.000	6 210 920.000	0.000
CPT051	414 976.000	6 209 470.000	0.000
CPT052	410 201.000	6 209 420.000	0.000
CPT053	398 511.000	6 208 920.000	0.313

Table 3: Waypoints

ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS] EPSG:25832			
Point Name	Easting [m]	Northing [m]	Height [m Mea.]
CPT054	406 744.000	6 208 660.000	0.000
CPT055	420 061.000	6 207 460.000	0.000
CPT058	402 556.000	6 206 750.000	0.000
CPT060	412 980.000	6 205 920.000	0.000
CPT062	422 899.000	6 205 000.000	0.000
CPT063	408 340.000	6 204 950.000	0.000
CPT065	397 165.000	6 204 530.000	0.000
CPT067	400 249.000	6 203 190.000	0.000
CPT069	411 414.000	6 202 510.000	0.000
CPT070	416 024.000	6 202 490.000	0.000
CPT071	405 578.000	6 202 280.000	0.000
CPT074	409 388.000	6 200 030.000	0.000
CPT075	413 754.000	6 199 930.000	0.000
CPT077	420 298.000	6 199 340.000	0.000
CPT079	402 063.000	6 198 440.000	0.000
CPT080	406 417.000	6 197 280.000	0.000
CPT081	410 760.000	6 197 260.000	0.000
CPT084	420 074.000	6 196 740.000	0.000
CPT086	417 283.000	6 196 620.000	0.000
CPT089	402 674.000	6 195 530.000	0.000
CPT093	408 742.000	6 194 770.000	0.000
CPT094	421 349.000	6 194 440.000	0.000
CPT098	404 800.000	6 192 890.000	0.000
CPT100	425 648.000	6 192 330.000	0.000
CPT101	415 453.000	6 192 140.000	0.000
CPT102	419 329.000	6 191 940.000	0.000
CPT106	410 536.000	6 190 040.000	0.000
CPT107	421 637.000	6 189 350.000	0.000
CPT110	417 034.000	6 188 390.000	0.000
CPT112	401 214.000	6 187 990.000	0.000
CPT113	424 040.000	6 187 860.000	0.000
CPT114	404 429.000	6 187 660.000	0.000
CPT116	402 374.000	6 186 800.000	0.000
CPT119	410 175.000	6 185 860.000	0.000
CPT120	421 303.000	6 185 220.000	0.000
CPT125	389 950.000	6 224 270.000	0.000
CPT126	389 949.000	6 228 500.000	0.000

Table 3: Waypoints

ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS] EPSG:25832			
Point Name	Easting [m]	Northing [m]	Height [m Mea.]
CPT127	399 998.000	6 190 080.000	0.000
CPT128	399 950.000	6 207 250.000	0.000
CPT129	399 954.000	6 212 610.000	0.000
CPT130	399 947.000	6 216 980.000	0.000
CPT131	409 952.000	6 187 130.000	0.000
CPT132	409 954.000	6 196 210.000	0.000
CPT133	409 951.000	6 200 630.000	0.000
CPT134	409 951.000	6 218 040.000	0.000
CPT135	396 830.000	6 236 810.000	0.000
CPT136	420 419.000	6 186 770.000	0.000
CPT137	419 958.000	6 209 720.000	0.000
CPT138	419 951.000	6 215 440.000	0.000
CPT139	401 348.000	6 226 770.000	0.000
CPT140	417 706.000	6 226 780.000	0.000
CPT141	420 597.000	6 226 770.000	0.000
CPT143	407 245.000	6 216 770.000	0.000
CPT151	407 544.000	6 186 720.000	0.000
CPT153	404 406.000	6 226 570.000	0.000
CPT154	412 746.000	6 229 410.000	0.000
CPT155	408 203.000	6 223 280.000	0.000
CPT156	407 311.000	6 210 840.000	0.000
CPT157	408 994.000	6 187 640.000	0.000
CPT160	390 938.000	6 222 660.000	0.000
CPT161	388 623.000	6 226 220.000	0.000
CPT162	426 141.000	6 192 400.000	0.000
CPT163	394 681.000	6 233 670.000	0.000
CPT164	398 107.000	6 233 370.000	0.000
CPT165	406 051.000	6 224 880.000	0.000
CPT166	396 767.000	6 222 870.000	0.000
CPT169	398 728.000	6 207 980.000	0.000
CPT170	403 613.000	6 200 820.000	0.000
CPT171	412 849.000	6 224 340.000	0.000
CPT172	411 754.000	6 220 970.000	0.000
CPT173	411 691.000	6 218 930.000	0.000
CPT174	404 653.000	6 195 930.000	0.000
CPT175	412 338.000	6 208 860.000	0.000
CPT176	412 717.000	6 213 050.000	0.000

Table 3: Waypoints

ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS] EPSG:25832			
Point Name	Easting [m]	Northing [m]	Height [m Mea.]
CPT177	414 244.000	6 215 370.000	0.000
CPT178	420 256.000	6 213 640.000	0.000
CPT179	418 761.000	6 205 100.000	0.000
CPT180	423 108.000	6 204 020.000	0.000
CPT181	422 911.000	6 197 850.000	0.000
CPT182	409 447.000	6 193 900.000	0.000
CPT183	402 215.000	6 217 860.000	0.000
CPT185	403 533.000	6 184 470.000	0.000
CPT186	412 570.000	6 185 370.000	0.000
CPT187	402 111.000	6 207 660.000	0.000
CPT197	390 769.000	6 225 640.000	0.000
CPT198	396 718.000	6 229 000.000	0.000
CPT199	405 193.000	6 220 610.000	0.000
CPT200	402 350.000	6 222 030.000	0.000
CPT201	398 350.000	6 204 800.000	0.000
CPT202	398 952.000	6 199 810.000	0.000
CPT206	416 639.000	6 222 060.000	0.000
CPT208	395 191.000	6 218 450.000	0.000
CPT209	394 017.000	6 220 270.000	0.000
CPT213	407 113.000	6 219 970.000	0.000
CPT216	424 735.000	6 224 840.000	0.000
CPT217	422 959.000	6 207 070.000	0.000
CPT218	395 562.000	6 215 450.000	0.000
CPT219	416 413.000	6 214 850.000	0.000
CPT220	411 331.000	6 192 260.000	0.000
CPT221	414 314.000	6 186 770.000	0.000
CPT224	419 362.000	6 223 710.000	0.000
CPT225	414 883.000	6 197 140.000	0.000
CPT226	393 676.000	6 224 270.000	0.000
CPT227	422 503.000	6 192 670.000	0.000
CPT228	400 676.000	6 223 720.000	0.000
CPT230	410 596.000	6 222 800.000	0.000
CPT231	398 548.000	6 202 830.000	0.000
CPT232	406 543.000	6 194 290.000	0.000
CPT233	401 329.000	6 190 100.000	0.000
CPT234	410 244.000	6 211 470.000	0.000
CPT236	411 459.000	6 227 080.000	0.000

Table 3: Waypoints

ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS] EPSG:25832			
Point Name	Easting [m]	Northing [m]	Height [m Mea.]
CPT239	388 238.000	6 222 040.000	0.000
CPT242	418 516.000	6 212 240.000	0.000
CPT245	402 568.000	6 191 350.000	0.000
CPT247	408 820.000	6 189 690.000	0.000
CPT249	416 302.000	6 203 570.000	0.000
CPT250	408 045.000	6 195 650.000	0.000
CPT251	407 948.000	6 192 570.000	0.000
CPT252	401 413.000	6 199 360.000	0.000
CPT253	394 561.000	6 230 610.000	0.000
CPT254	391 100.000	6 227 730.000	0.000
CPT255	400 318.000	6 211 390.000	0.000
CPT258	402 636.000	6 202 650.000	0.000
CPT260	404 102.000	6 216 270.000	0.000
CPT263	417 947.000	6 186 540.000	0.000
CPT264	394 752.000	6 227 530.000	0.000
CPT266	402 875.000	6 224 200.000	0.000
CPT267	416 690.000	6 224 160.000	0.000
CPT268	411 875.000	6 216 950.000	0.000
CPT269	411 724.000	6 204 630.000	0.000
CPT271	406 073.000	6 217 720.000	0.000
CPT272	419 076.000	6 190 860.000	0.000
CPT273	400 416.000	6 215 480.000	0.000
CPT275	407 721.000	6 200 690.000	0.000
CPT276	416 870.000	6 198 580.000	0.000
CPT277	416 290.000	6 227 130.000	0.000
CPT278	419 804.000	6 183 870.000	0.000
CPT279	421 493.000	6 222 090.000	0.000
CPT280	411 675.000	6 195 410.000	0.000
CPT283	399 247.000	6 194 740.000	0.000
CPT284	395 490.000	6 212 380.000	0.000
CPT287	408 206.000	6 216 150.000	0.000
CPT288	396 247.000	6 206 390.000	0.000
CPT290	418 485.000	6 195 860.000	0.000
CPT292	422 735.000	6 199 860.000	0.000
CPT293	386 261.000	6 220 590.000	0.000
CPT294	408 611.000	6 221 320.000	0.000
CPT298	416 645.000	6 191 370.000	0.000

Table 3: Waypoints

ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS] EPSG:25832			
Point Name	Easting [m]	Northing [m]	Height [m Mea.]
CPT299	408 174.000	6 184 420.000	0.000
CPT302	418 242.000	6 218 330.000	0.000
CPT303	419 781.000	6 206 370.000	0.000
CPT304	397 353.000	6 226 070.000	0.000
CPT306	415 112.000	6 189 020.000	0.000
CPT307	396 425.000	6 219 730.000	0.000
CPT308	418 780.000	6 227 620.000	0.000
CPT309	399 390.000	6 221 390.000	0.000
CPT310	422 933.000	6 213 220.000	0.000
CPT312	412 405.000	6 210 910.000	0.000
CPT314	415 718.000	6 185 000.000	0.000
CPT316	411 723.000	6 189 280.000	0.000
CPT319	414 082.000	6 225 600.000	0.000
CPT320	414 652.000	6 220 610.000	0.000
CPT321	408 920.000	6 208 080.000	0.000
CPT325	396 571.000	6 232 040.000	0.000
CPT327	420 650.000	6 195 310.000	0.000
CPT329	419 069.000	6 199 060.000	0.000
CPT330	407 407.000	6 206 790.000	0.000
CPT331	402 991.000	6 220 130.000	0.000
CPT332	415 469.000	6 200 330.000	0.000
CPT334	416 742.000	6 194 480.000	0.000
CPT335	422 780.000	6 209 070.000	0.000
CPT336	425 716.000	6 194 360.000	0.000
CPT337	401 313.000	6 205 440.000	0.000
CPT338	411 589.000	6 207 660.000	0.000
CPT339	412 260.000	6 198 600.000	0.000
CPT340	397 794.000	6 216 950.000	0.000
CPT341	421 152.000	6 218 950.000	0.000
CPT342	414 359.000	6 196 000.000	0.000
CPT344	423 009.000	6 216 280.000	0.000
CPT345	399 032.000	6 210 060.000	0.000
CPT346	418 922.000	6 217 440.000	0.000
CPT351	388 098.000	6 224 030.000	0.000
CPT353	419 029.000	6 220 500.000	0.000
CPT354	405 986.000	6 222 820.000	0.000
CPT356	417 618.000	6 206 930.000	0.000

Table 3: Waypoints

ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS] EPSG:25832			
Point Name	Easting [m]	Northing [m]	Height [m Mea.]
CPT357	404 214.000	6 189 700.000	0.000
CPT362	400 695.000	6 201 160.000	0.000
CPT364	396 833.000	6 209 580.000	0.000
CPT366	421 108.000	6 186 210.000	0.000
CPT368	423 855.000	6 227 720.000	0.000
CPT369	391 816.000	6 219 710.000	0.000
CPT370	414 345.000	6 218 500.000	0.000
CPT372	404 248.000	6 206 080.000	0.000
CPT375	398 866.000	6 228 480.000	0.000
CPT376	403 384.000	6 186 450.000	0.000
CPT378	421 102.000	6 225 080.000	0.000
CPT379	421 121.000	6 202 570.000	0.000
CPT380	394 560.000	6 222 430.000	0.000
CPT382	417 947.000	6 201 890.000	0.000
CPT384	402 447.000	6 194 400.000	0.000
CPT385	391 440.000	6 230 930.000	0.000
CPT386	400 121.000	6 198 030.000	0.000
CPT388	413 744.000	6 191 760.000	0.000
CPT389	402 049.000	6 212 760.000	0.000
CPT390	406 771.000	6 186 160.000	0.000
CPT391	405 960.000	6 214 670.000	0.000
CPT392	398 641.000	6 213 050.000	0.000
CPT394	410 828.000	6 214 660.000	0.000
CPT395	406 431.000	6 198 320.000	0.000
CPT396	405 536.000	6 208 360.000	0.000
CPT397	410 905.000	6 224 910.000	0.000
CPT400	414 541.000	6 194 010.000	0.000



Rene Wojke
Party Chief
FNAS (Fugro Norway AS)



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Client Representative
Energinet Eltransmission



Colin Jacobs
Client Representative
Energinet Eltransmission

Starfix Gyro Calibration

Table 1: Project details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Vessel	Normand Mermaid3
Client	Energinet Eltransmission
Project Type	Positioning
Location	North Sea, German Sector

Table 2: Calibration settings

Calibration Type	Multi-Target
Description	Gyro verification alongside Esbjerg

Table 3: Calibration results



Reference Gyro						
 SPK Port-10.47.67.101						
Target Gyro	Calculated C-O [°]	SD [°]	Minimum C-O [°]	Maximum C-O [°]	Observations Used	Observations Rejected
 TSS Meridian	-0.30	0.04	-0.43	-0.11	3488	1

Table 4: Gyro configuration


	Reference Gyro	SPK Port-10.47.67.101		Target Gyro	TSS Meridian
	Model	Nmea		Model	Nmea
	C-O Correction	-3.39°		C-O Correction	-86.61°
	Sensor Latitude			Sensor Latitude	59° 20' 20.59998" N

Table 5: Gyro information

Gyro	Average [°]	Standard Deviation [°]
Reference	231.58	0.06
Target	228.49	0.04

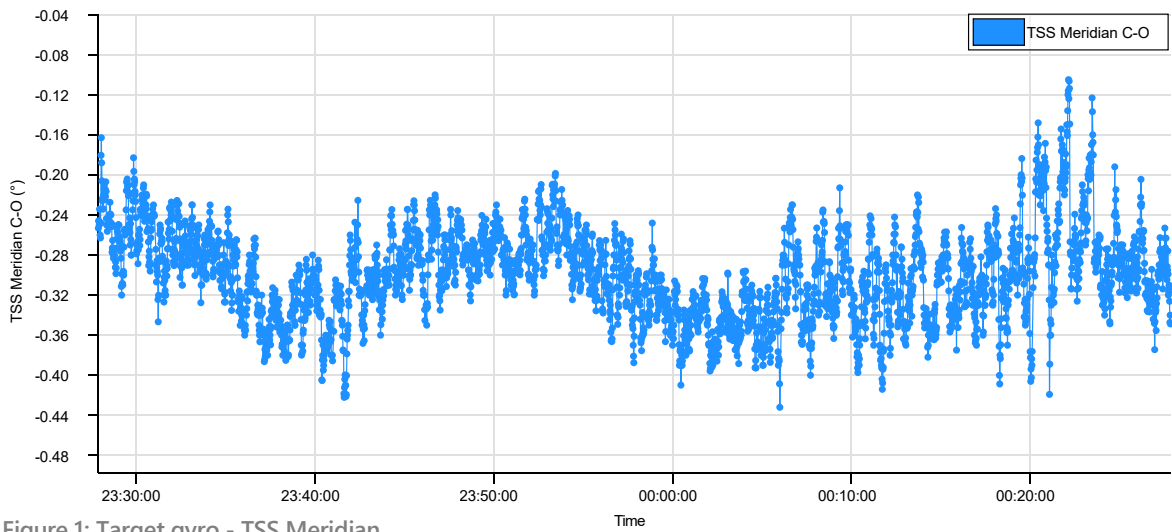


Figure 1: Target gyro - TSS Meridian

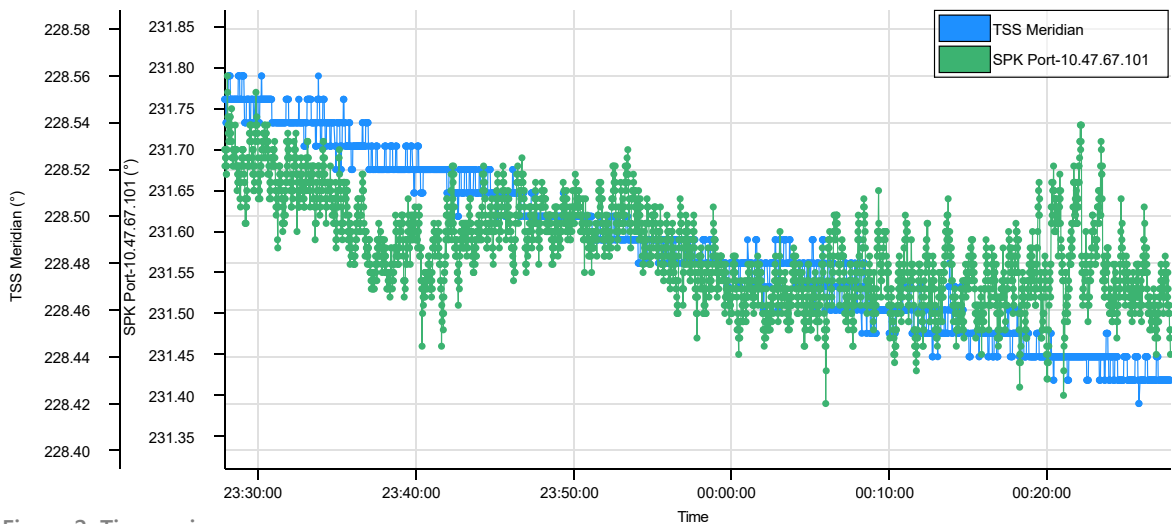


Figure 2: Time series

Project Summary Report

Table 1: Project details

Project Number	217703
Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Vessel	Normand Mermaid3
Client	Energinet Eltransmission
OPCO	FNAS (Fugro Norway AS)
Project Type	Positioning
Starfix Version	v2022.1124.9 (build 0)
Location	North Sea, German Sector
Description	Geotechnical

Table 2: Project Files

Project Files
217703 NMM Planned Locations.dwg

Table 3: Message manager settings

Message Manager Settings	
Mode: Reliable Multicast: 233.33.33.33	Base port: 10.47.67.11:3333

Project Coordinate Reference System

Table 4: Geodetic parameters

Name: ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]		
EPSG Code	EPSG:25832	
Global Navigation Satellite System (GNSS) Geodetic Parameters*		
Datum	International Terrestrial Reference Frame 2014	EPSG:1165
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Local Geodetic Datum Parameters		
Datum	European Terrestrial Reference System 1989	EPSG:6258
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from ITRF2014 to ETRS89		
X-axis translation 0.05600 m	X-axis rotation -0.0027542"	Scale difference 0.00355022 ppm
Y-axis translation 0.05350 m	Y-axis rotation -0.016661"	Coordinate Frame rotation
Z-axis translation -0.09880 m	Z-axis rotation 0.0269296"	FUGRO:41366
Local Projection Parameters		
Map projection	Transverse Mercator	
Grid system	UTM zone 32N	EPSG:16032
Latitude origin	00° 00' 00.000" N	
Central meridian	009° 00' 00.000" E	
Scale factor on central meridian	0.9996	
False easting	500 000 m	
False northing	0 m	
Project Vertical Parameters		
Vertical coordinate reference system	DTU21 MSS height	FUGRO:41088
Datum	DTU21 MSS height	FUGRO:40943
Transformation	WGS 84 to DTU21 MSS height	FUGRO:41478
Notes		
* The geodetic datum of Fugro's global GNSS correction data is ITRF2014, epoch 2023.001982 (01/01/2023 17:22:00)		

Table 5: Validation calculation

ITRF2014	Test Point [Position]	Computed Point
Latitude	56° 18' 54.00000" N	56° 18' 54.00000" N
Longitude	008° 30' 18.00000" E	008° 30' 18.00000" E
Ellipsoidal height	0.000 m Ell.	0.000 m Ell.
ETRS89		
Latitude	56° 18' 53.98049" N	56° 18' 53.98049" N
Longitude	008° 30' 17.96794" E	008° 30' 17.96794" E
Ellipsoidal height	-0.026 m Ell.	-0.026 m Ell.
UTM zone 32N		
Easting	469 379.097 m	469 379.097 m
Northing	6 241 248.598 m	6 241 248.598 m
Mean sea surface height	-39.937 m	-39.937 m

Vessels

Vessel: Normand Mermaid3

Table 6: Normand Mermaid3 - Offsets

Name	Purpose	X offset [m]	Y offset [m]	Z offset [m]
CentreOfGravity	Centre of gravity	0.00	0.00	0.00
CommonReferencePoint	The common reference point of the vessel.	0.00	0.00	0.00
CPT		-1.03	-7.87	0.00
MRU2		-0.04	5.14	-0.56
MRU5		-0.03	4.95	-0.57
PORT GNSS		-1.71	16.26	29.05
PORT HPR		-6.15	-16.11	-11.52
STBD GNSS		1.90	16.26	29.01
STBD HPR		6.15	-16.12	-12.31
VC launch		-6.52	-47.00	0.00

Table 7: Normand Mermaid3 - Selectors

Type	Auto Switching	Primary	Secondary	Tertiary
Position	ON	SPK Port-10.47.67.101- Starfix.G4 Plus-10105-Nmea filter	SPK Stbd-10.47.67.102- Starfix.XP2-10202-Nmea filter	SPK Stbd-10.47.67.102- Starfix.G4 Plus-10205-Nmea filter
Heading	ON	SPK Port-10.47.67.101 - GNSS Heading-10104	TSS Meridian - Port J4	None
Motion	ON	MRU5 - D1	None	None
Heave	ON	MRU5 - D1	None	None
Height	ON	None	None	None
Depth	ON	None	None	None
Speed	ON	SPK Port-10.47.67.101 - GNSS- 10106	None	None

Table 8: Normand Mermaid3 - Sensor details

Name	Offsets	Ports	Settings
Generic AIS	n/a	Port A-AISDecoder NAV - 6024 UdplInput	Mode = RealTime WGS 84(2D)
Gyro1	CentreOfGravity	Port A-NmeaDecoder NAV - 4026 UdplInput	Mode = RealTime WGS 84(2D) Azimuth = -0.99°
Gyro2	CentreOfGravity	Port A-NmeaDecoder NAV - 4027 UdplInput	Mode = RealTime WGS 84(2D) Azimuth = -2.24°

Table 8: Normand Mermaid3 - Sensor details

Name	Offsets	Ports	Settings
HPR PORT	PORT HPR CentreOfGravity	Port D-SimradHpr400NmeaDecoder NAV - 6022 UdpInput	Mode = RealTime WGS 84(2D) Correction Pitch = -0.18° Roll = -0.02° Orientation = 0.65° Point Scale Factor = 1.000000000 Offset Error X = 0.00m Y = 0.00m Z = 0.00m Attitude Correction Pitch = 0.00° Roll = 0.00° Azimuth = 0.00°
MRU2	CentreOfGravity	Port A-NmeaDecoder NAV - 4028 UDPIInput	Mode = RealTime WGS 84(2D) Pitch = -0.09° Roll = -0.52° Azimuth = 0.00°
MRU5	CentreOfGravity CentreOfGravity	D1-SimradEMDecoder NAV - 6021 UdpInput	Mode = RealTime WGS 84(2D) Pitch = -0.12° Roll = -0.13° Azimuth = 0.00°
PTB210	CentreOfGravity	Port A-PTB210EncoderDecoder COM3 - 9600,8,None,One,None	Mode = RealTime WGS 84(2D)
SPK Port- 10.47.67.101	PORT GNSS	GNSS Heading-10104-GNSS Heading-10104 NAV - 10104/10.47.67.101:10104 TCP Client GNSS-10106-HPDecoder NAV - 10106/10.47.67.101:10106 TCP Client Starfix.G2-10103-HPDecoder NAV - 10103/10.47.67.101:10103 TCP Client Starfix.G4 Plus-10105-HPDecoder NAV - 10105/10.47.67.101:10105 TCP Client Starfix.HP-10101-HPDecoder NAV - 10101/10.47.67.101:10101 TCP Client Starfix.XP2-10102-HPDecoder NAV - 10102/10.47.67.101:10102 TCP Client	Mode = RealTime WGS 84(2D) Pitch = 0.00° Roll = 0.00° Azimuth = -90.00°
SPK Stbd- 10.47.67.102	STBD GNSS	GNSS Heading-10204-GNSS Heading-10204 NAV - 10204/10.47.67.102:10204 TCP Client GNSS-10206-HPDecoder NAV - 10206/10.47.67.102:10206 TCP Client Starfix.G2-10203-HPDecoder NAV - 10203/10.47.67.102:10203 TCP Client Starfix.G4 Plus-10205-HPDecoder NAV - 10205/10.47.67.102:10205 TCP Client Starfix.HP-10201-HPDecoder NAV - 10201/10.47.67.102:10201 TCP Client Starfix.XP2-10202-HPDecoder NAV - 10202/10.47.67.102:10202 TCP Client	Mode = RealTime WGS 84(2D) Azimuth = -270.00°

Table 8: Normand Mermaid3 - Sensor details

Name	Offsets	Ports	Settings
Stbd Hipap	STBD HPR CentreOfGravity	D1-Hpr400 NAV - 4029 UdpInput	Mode = RealTime WGS 84(2D) Correction Pitch = 0.06° Roll = 0.10° Orientation = 0.07° Point Scale Factor = 1.000000000 Offset Error X = 0.00m Y = 0.00m Z = 0.00m Attitude Correction Pitch = 0.00° Roll = 0.00° Azimuth = 0.00°
TSS Meridian	CentreOfGravity	Port J4-NmeaDecoder COM4 - 9600,8,None,One,None	Mode = RealTime WGS 84(2D) Azimuth = -86.61°
Valeport MINI IPS	CentreOfGravity	Port A-ValeportDecoder COM2 - 19200,8,None,One,None	Mode = RealTime WGS 84(2D)

Table 9: Normand Mermaid3 - Height calculation

Vertical Reference Datum: Waterline	
Time	Waterline
26 Oct 2023, 19:06:41+02:00	-3.24 m
27 Oct 2023, 12:20:26+02:00	-2.99 m

Normand Mermaid3

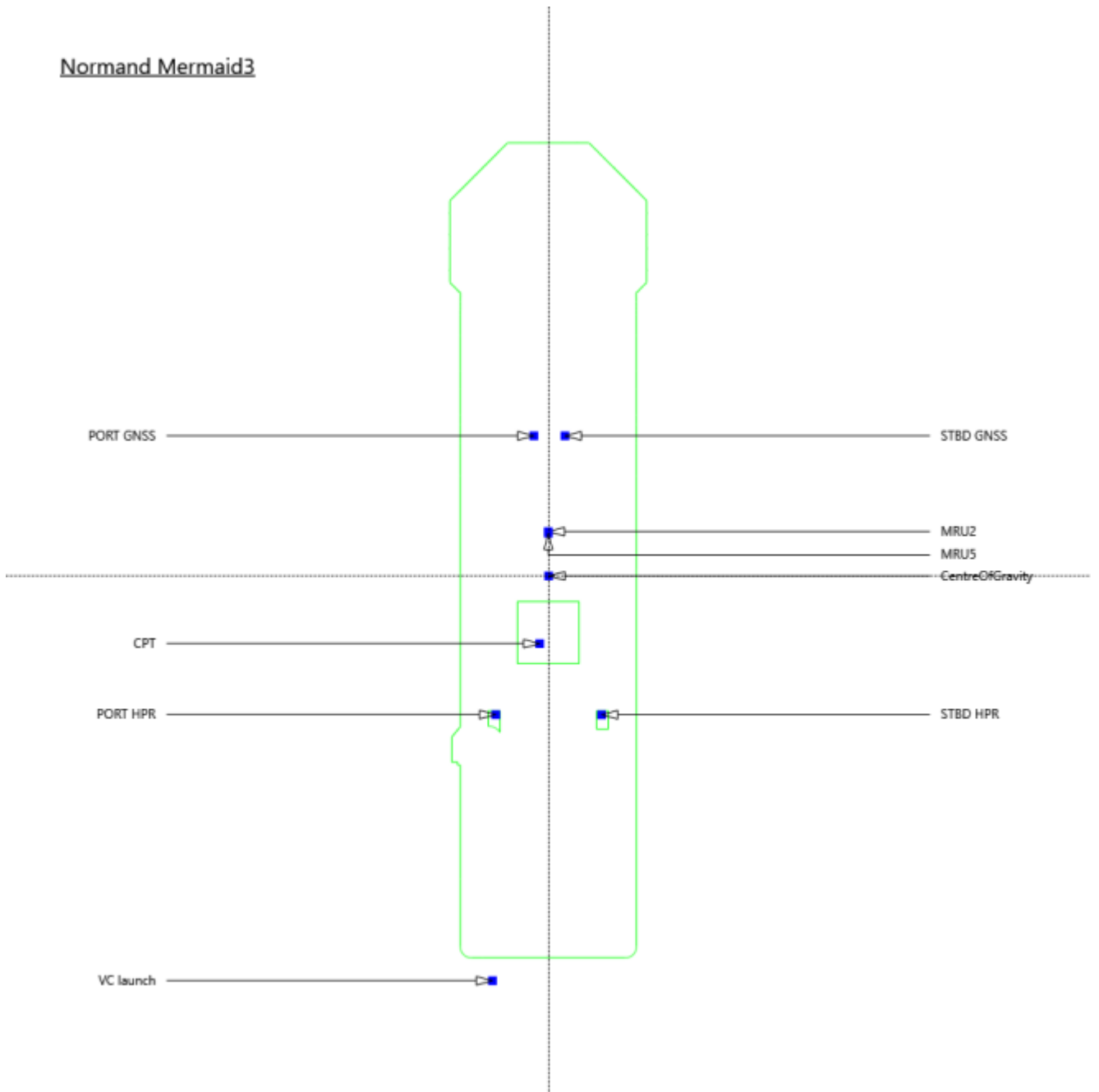


Figure 1: Vessel shape & offsets of the 'Normand Mermaid3'

Vessel: CPT

Table 10: CPT - Offsets

Name	Purpose	X offset [m]	Y offset [m]	Z offset [m]
CentreOfGravity	Centre of gravity	0.00	0.00	0.00
CommonReferencePoint	The common reference point of the vessel.	0.00	0.00	0.00
Mini IPS	Mini IPS	0.90	1.10	2.55
Port transponder	Port mounted transponder	-1.05	-0.88	3.60
Sector scan sonar	Sector scan sonar	-0.35	1.40	0.00
Starboard transponder	Starboard mounted transponder	0.68	-1.03	3.60

Table 11: CPT - Selectors

Type	Auto Switching	Primary	Secondary	Tertiary
Position	ON	Transponder B15 - Position	Transponder M08 - Position	None
Heading	ON	Dual Position Heading	Manual Systems	None
Motion	ON	None	None	None
Heave	ON	None	None	None
Height	ON	Transponder B15 - Depth	Transponder M08 - Depth	None
Depth	ON	None	None	None
Speed	ON	None	None	None

Table 12: CPT - Sensors

Name	Offset	Transducer	Identifier
Transponder B15	Starboard transponder	Normand Mermaid3 / Stbd Hipap	B15
Transponder M08	Port transponder	Normand Mermaid3 / Stbd Hipap	M08

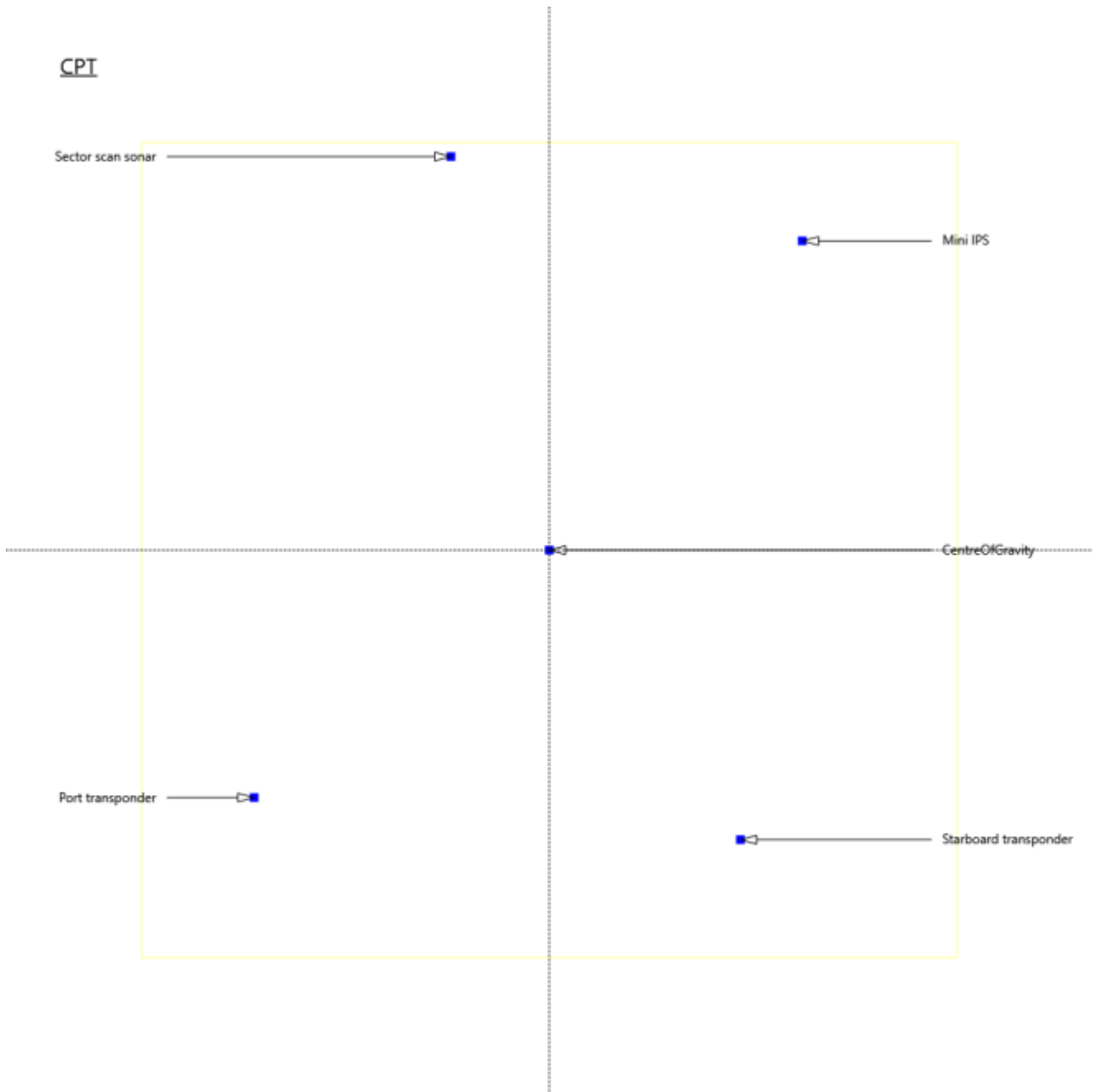


Figure 2: Vessel shape & offsets of the 'CPT'

Personnel details

Table 13: Fugro personnel

Name	Position	Company	Date On	Date Off
Rene Wojke	Party Chief	FNAS (Fugro Norway AS)	18 Oct 2023	

Table 14: Client personnel

Name	Position	Company	Date On	Date Off
Colin Jacobs	Client Representative	Energinet Eltransmission	27 Oct 2023	
Paskal Nerad	Client Representative	Energinet Eltransmission	27 Oct 2023	



Rene Wojke
Party Chief
FNAS (Fugro Norway AS)

Paskal Nerad
Client Representative
Energinet Eltransmission

Colin Jacobs
Client Representative
Energinet Eltransmission

Point Report

Table 1: Project Details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Geodetic parameters

Name: ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]		
EPSG Code	EPSG:25832	
Global Navigation Satellite System (GNSS) Geodetic Parameters*		
Datum	International Terrestrial Reference Frame 2014	EPSG:1165
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Local Geodetic Datum Parameters		
Datum	European Terrestrial Reference System 1989	EPSG:6258
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from ITRF2014 to ETRS89		
X-axis translation 0.05600 m	X-axis rotation -0.0027542"	Scale difference 0.00355022 ppm
Y-axis translation 0.05350 m	Y-axis rotation -0.016661"	Coordinate Frame rotation
Z-axis translation -0.09880 m	Z-axis rotation 0.0269296"	FUGRO:41366
Local Projection Parameters		
Map projection	Transverse Mercator	
Grid system	UTM zone 32N	EPSG:16032
Latitude origin	00° 00' 00.000" N	
Central meridian	009° 00' 00.000" E	
Scale factor on central meridian	0.9996	
False easting	500 000 m	
False northing	0 m	
Project Vertical Parameters		
Vertical coordinate reference system	DTU21 MSS height	FUGRO:41088
Datum	DTU21 MSS height	FUGRO:40943
Transformation	WGS 84 to DTU21 MSS height	FUGRO:41478
Notes		
* The geodetic datum of Fugro's global GNSS correction data is ITRF2014, epoch 2023.001982 (01/01/2023 17:22:00)		

Table 3: Waypoints

ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS] EPSG:25832			
Point Name	Easting [m]	Northing [m]	Height [m Mea.]
CPT025	386 473.000	6 219 620.000	0.521
CPT028	390 561.000	6 218 460.000	0.443
CPT034	385 608.000	6 216 380.000	0.426
CPT039	381 242.000	6 214 340.000	0.434
CPT041	385 744.000	6 213 340.000	0.430

Table 3: Waypoints

ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS] EPSG:25832			
Point Name	Easting [m]	Northing [m]	Height [m Mea.]
CPT042	390 155.000	6 213 250.000	0.452
CPT046	382 308.000	6 211 580.000	0.431
CPT049	394 178.000	6 210 030.000	0.439
CPT050	378 619.000	6 209 720.000	0.405
CPT057	382 808.000	6 206 800.000	0.438
CPT059	386 268.000	6 206 300.000	0.397
CPT061	392 547.000	6 205 570.000	0.426
CPT064	388 643.000	6 204 770.000	0.404
CPT066	376 477.000	6 204 160.000	0.434
CPT068	380 808.000	6 203 070.000	0.432
CPT072	374 470.000	6 200 640.000	0.421
CPT073	387 545.000	6 200 450.000	0.443
CPT076	379 898.000	6 199 790.000	0.441
CPT078	391 142.000	6 199 170.000	0.446
CPT082	394 190.000	6 196 800.000	0.455
CPT083	388 695.000	6 196 800.000	0.455
CPT085	372 665.000	6 196 740.000	0.450
CPT087	378 904.000	6 196 470.000	0.356
CPT088	386 164.000	6 196 050.000	0.395
CPT090	398 080.000	6 195 530.000	0.412
CPT091	373 598.000	6 195 320.000	0.472
CPT092	391 487.000	6 195 170.000	0.470
CPT095	393 659.000	6 193 550.000	0.459
CPT096	383 433.000	6 193 400.000	0.444
CPT097	388 084.000	6 193 350.000	0.453
CPT099	370 076.000	6 192 520.000	0.348
CPT104	397 470.000	6 191 300.000	0.415
CPT105	382 407.000	6 190 110.000	0.393
CPT108	388 394.000	6 189 340.000	0.448
CPT109	375 057.000	6 188 490.000	0.457
CPT111	369 956.000	6 188 380.000	0.418
CPT115	379 635.000	6 187 440.000	0.318
CPT118	396 086.000	6 185 890.000	0.475
CPT121	369 946.000	6 194 520.000	0.473
CPT122	379 932.000	6 204 140.000	0.456
CPT123	389 922.000	6 191 200.000	0.436
CPT124	389 937.000	6 203 030.000	0.488

Table 3: Waypoints

ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS] EPSG:25832			
Point Name	Easting [m]	Northing [m]	Height [m Mea.]
CPT142	389 952.000	6 214 100.000	0.319
CPT144	388 483.000	6 206 800.000	0.164
CPT145	393 636.000	6 206 780.000	0.434
CPT146	397 844.000	6 196 770.000	0.254
CPT147	392 364.000	6 216 780.000	0.415
CPT148	376 767.000	6 186 770.000	0.424
CPT149	382 070.000	6 186 790.000	0.502
CPT150	386 223.000	6 186 800.000	0.504
CPT152	399 985.000	6 185 940.000	0.402
CPT158	387 501.000	6 191 180.000	0.451
CPT159	377 115.000	6 208 360.000	0.448
CPT167	393 993.000	6 211 040.000	0.352
CPT168	382 198.000	6 207 460.000	0.254
CPT184	396 830.000	6 187 080.000	0.296
CPT188	393 608.000	6 215 020.000	0.442
CPT189	387 056.000	6 215 660.000	0.449
CPT190	374 553.000	6 203 690.000	0.418
CPT191	374 437.000	6 199 610.000	0.306
CPT192	379 554.000	6 193 580.000	0.321
CPT193	374 210.000	6 192 400.000	0.438
CPT194	391 336.000	6 197 150.000	0.457
CPT195	372 368.000	6 188 940.000	0.412
CPT196	385 713.000	6 211 290.000	0.376
CPT203	397 203.000	6 198 430.000	0.219
CPT204	394 919.000	6 202 050.000	0.458
CPT205	385 393.000	6 209 140.000	0.423
CPT207	391 830.000	6 189 090.000	0.231
CPT210	372 792.000	6 201 300.000	0.524
CPT211	379 447.000	6 204 790.000	0.201
CPT212	391 393.000	6 206 360.000	0.240
CPT214	395 449.000	6 204 220.000	0.457
CPT215	389 267.000	6 207 930.000	0.419
CPT222	381 569.000	6 187 860.000	0.439
CPT223	395 304.000	6 191 860.000	0.496
CPT229	367 995.000	6 189 020.000	0.465
CPT235	387 030.000	6 207 490.000	0.406
CPT237	382 017.000	6 194 120.000	0.423

Table 3: Waypoints

ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS] EPSG:25832			
Point Name	Easting [m]	Northing [m]	Height [m Mea.]
CPT238	382 331.000	6 197 250.000	0.391
CPT240	389 825.000	6 217 300.000	0.496
CPT241	378 338.000	6 200 450.000	0.324
CPT243	389 321.000	6 194 670.000	0.225
CPT244	384 844.000	6 207 010.000	0.462
CPT246	386 430.000	6 202 190.000	0.454
CPT248	385 693.000	6 218 440.000	0.447
CPT256	394 052.000	6 205 870.000	0.449
CPT257	378 994.000	6 197 560.000	0.430
CPT259	371 799.000	6 192 900.000	0.433
CPT261	382 962.000	6 209 670.000	0.287
CPT262	388 397.000	6 196 520.000	0.439
CPT265	392 899.000	6 200 570.000	0.446
CPT270	398 025.000	6 192 430.000	0.436
CPT274	388 612.000	6 210 890.000	0.416
CPT281	396 216.000	6 190 010.000	0.433
CPT282	386 628.000	6 194 100.000	0.455
CPT285	377 962.000	6 195 280.000	0.439
CPT286	370 210.000	6 196 670.000	0.341
CPT289	380 358.000	6 201 900.000	0.307
CPT291	385 500.000	6 205 130.000	0.404
CPT295	386 786.000	6 199 220.000	0.305
CPT296	383 329.000	6 219 960.000	0.452
CPT297	394 198.000	6 187 550.000	0.312
CPT300	384 595.000	6 191 580.000	0.467
CPT301	391 903.000	6 191 150.000	0.455
CPT305	384 158.000	6 200 700.000	0.488
CPT311	379 423.000	6 188 420.000	0.429
CPT313	391 834.000	6 213 600.000	0.343
CPT315	383 550.000	6 212 860.000	0.455
CPT317	373 901.000	6 190 290.000	0.413
CPT318	389 130.000	6 219 200.000	0.396
CPT322	399 120.000	6 190 630.000	0.423
CPT323	383 484.000	6 202 640.000	0.447
CPT324	397 355.000	6 196 340.000	0.314
CPT326	376 863.000	6 190 950.000	0.496
CPT328	392 238.000	6 203 480.000	0.223


Table 3: Waypoints

ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS] EPSG:25832			
Point Name	Easting [m]	Northing [m]	Height [m Mea.]
CPT333	394 448.000	6 195 780.000	0.438
CPT343	380 025.000	6 208 990.000	0.454
CPT347	388 375.000	6 203 660.000	0.426
CPT348	376 577.000	6 206 210.000	0.441
CPT349	386 214.000	6 187 860.000	0.418
CPT350	390 462.000	6 201 030.000	0.448
CPT352	372 412.000	6 198 190.000	0.421
CPT355	384 750.000	6 189 580.000	0.333
CPT358	387 768.000	6 213 760.000	0.509
CPT359	368 384.000	6 193 190.000	0.409
CPT360	370 461.000	6 190 570.000	0.424
CPT361	386 219.000	6 197 060.000	0.441
CPT363	381 944.000	6 199 180.000	0.461
CPT365	390 103.000	6 187 630.000	0.442
CPT367	384 445.000	6 186 470.000	0.518
CPT371	383 987.000	6 195 540.000	0.482
CPT373	381 979.000	6 215 610.000	0.431
CPT374	395 125.000	6 193 870.000	0.439
CPT377	394 756.000	6 197 880.000	0.461
CPT381	391 715.000	6 193 100.000	0.426
CPT383	393 379.000	6 207 810.000	0.452
CPT387	391 735.000	6 209 500.000	0.403
CPT393	379 681.000	6 212 010.000	0.421
CPT398	384 163.000	6 216 030.000	0.422
CPT399	398 839.000	6 188 530.000	0.437



Werner Pretorius
Party Chief
FNAS (Fugro Norway AS)

Phil Hodgson
Client Representative
Energinet Eltransmission



Colin Jacobs
Client Representative
Energinet Eltransmission

Point Report

Table 1: Project Details

Project Name	Preliminary Geotechnical Investigations for Danish Offshore Wind Farm 2030 Lot 2
Project Number	217703
Client	Energinet Eltransmission
Project Type	Positioning
Project Description	Geotechnical
Starfix Version	v2022.1124.9 (build 0)

Table 2: Geodetic parameters

Name: ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]		
EPSG Code	EPSG:25832	
Global Navigation Satellite System (GNSS) Geodetic Parameters*		
Datum	International Terrestrial Reference Frame 2014	EPSG:1165
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Local Geodetic Datum Parameters		
Datum	European Terrestrial Reference System 1989	EPSG:6258
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from ITRF2014 to ETRS89		
X-axis translation 0.05600 m	X-axis rotation -0.0027542"	Scale difference 0.00355022 ppm
Y-axis translation 0.05350 m	Y-axis rotation -0.016661"	Coordinate Frame rotation
Z-axis translation -0.09880 m	Z-axis rotation 0.0269296"	FUGRO:41366
Local Projection Parameters		
Map projection	Transverse Mercator	
Grid system	UTM zone 32N	EPSG:16032
Latitude origin	00° 00' 00.000" N	
Central meridian	009° 00' 00.000" E	
Scale factor on central meridian	0.9996	
False easting	500 000 m	
False northing	0 m	
Project Vertical Parameters		
Vertical coordinate reference system	DTU21 MSS height	FUGRO:41088
Datum	DTU21 MSS height	FUGRO:40943
Transformation	WGS 84 to DTU21 MSS height	FUGRO:41478
Notes		
* The geodetic datum of Fugro's global GNSS correction data is ITRF2014, epoch 2023.001982 (01/01/2023 17:22:00)		

Table 3: Waypoints

ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS] EPSG:25832			
Point Name	Easting [m]	Northing [m]	Height [m Mea.]
SCPT002	393 122.000	6 229 240.000	0.000
SCPT026	399 883.000	6 218 850.000	0.000
SCPT031	381 364.000	6 216 780.000	0.084
SCPT033	414 238.000	6 216 500.000	0.000
SCPT043	409 954.000	6 213 000.000	0.000
SCPT048	390 091.000	6 210 160.000	0.433
SCPT053	398 511.000	6 208 920.000	0.313
SCPT055	420 061.000	6 207 460.000	0.000
SCPT056	380 512.000	6 207 120.000	0.441
SCPT075	413 754.000	6 199 930.000	0.000
SCPT084	420 074.000	6 196 740.000	0.000
SCPT089	402 674.000	6 195 530.000	0.000
SCPT103	379 903.000	6 191 550.000	0.469
SCPT113	424 040.000	6 187 860.000	0.000
SCPT117	390 528.000	6 186 730.000	0.104



Werner Pretorius
Party Chief
FNAS (Fugro Norway AS)

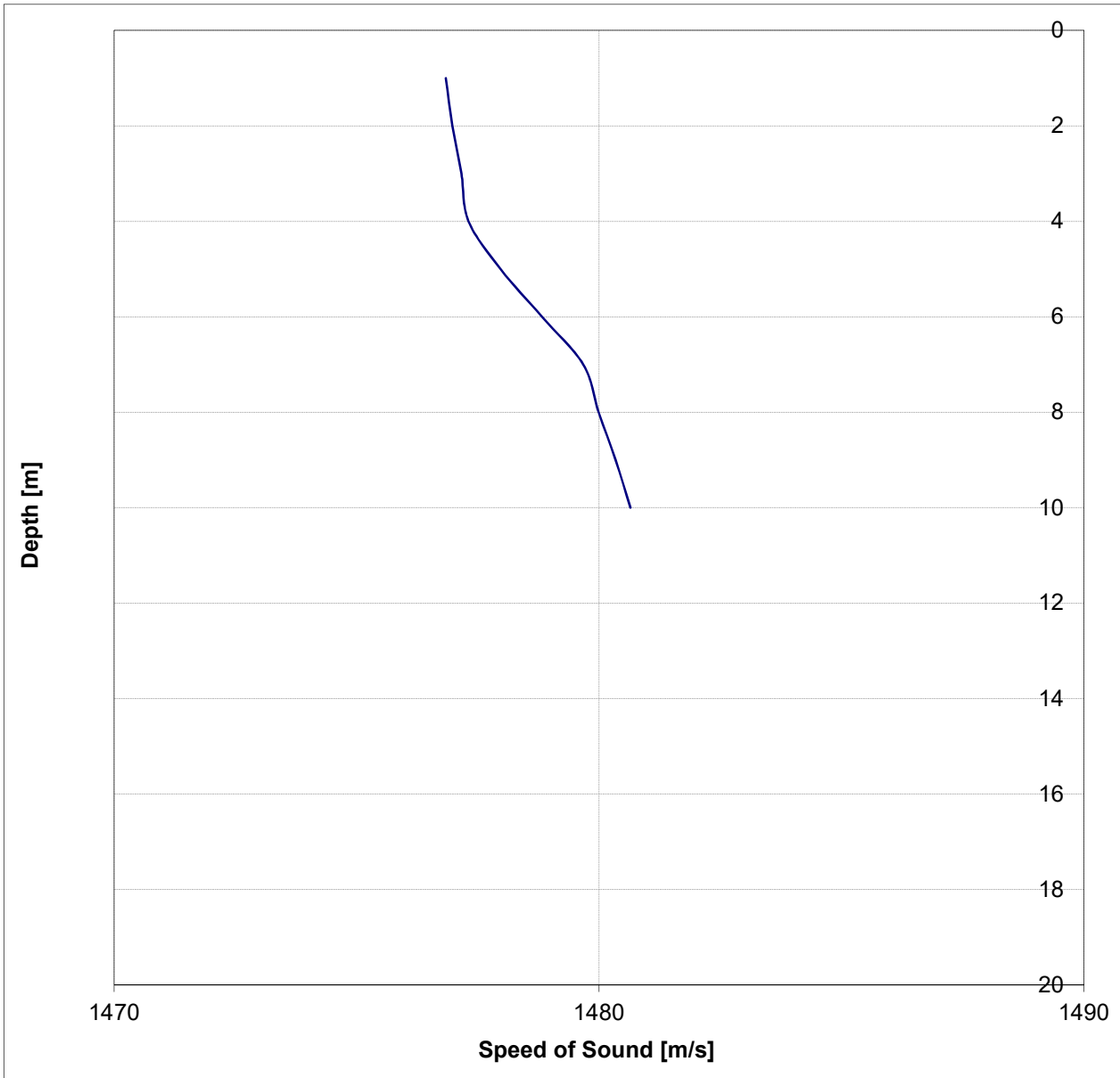
Phil Hodgson
Client Representative
Energinet Eltransmission



Colin Jacobs
Client Representative
Energinet Eltransmission

SPEED OF SOUND PROFILE REPORT

Vessel	Normand Mermaid	Date and time	04:26 27/Oct/2023
Project number	217703	Water depth	11 m
Client	Energinet Eltransmission	Transducer depth	3.02 m
Survey area	Esbjerg	Maximum sample depth	10.9105 m
Easting	463604 m	Transducer speed of sound	1477.16 m/s
Northing	6146930 m	Bottom speed of sound	1480.84 m/s
Sensor type	SAIV	Average speed of sound	1479.25 m/s
Sensor S/N	955	Average density	1020.22 kg/m ³



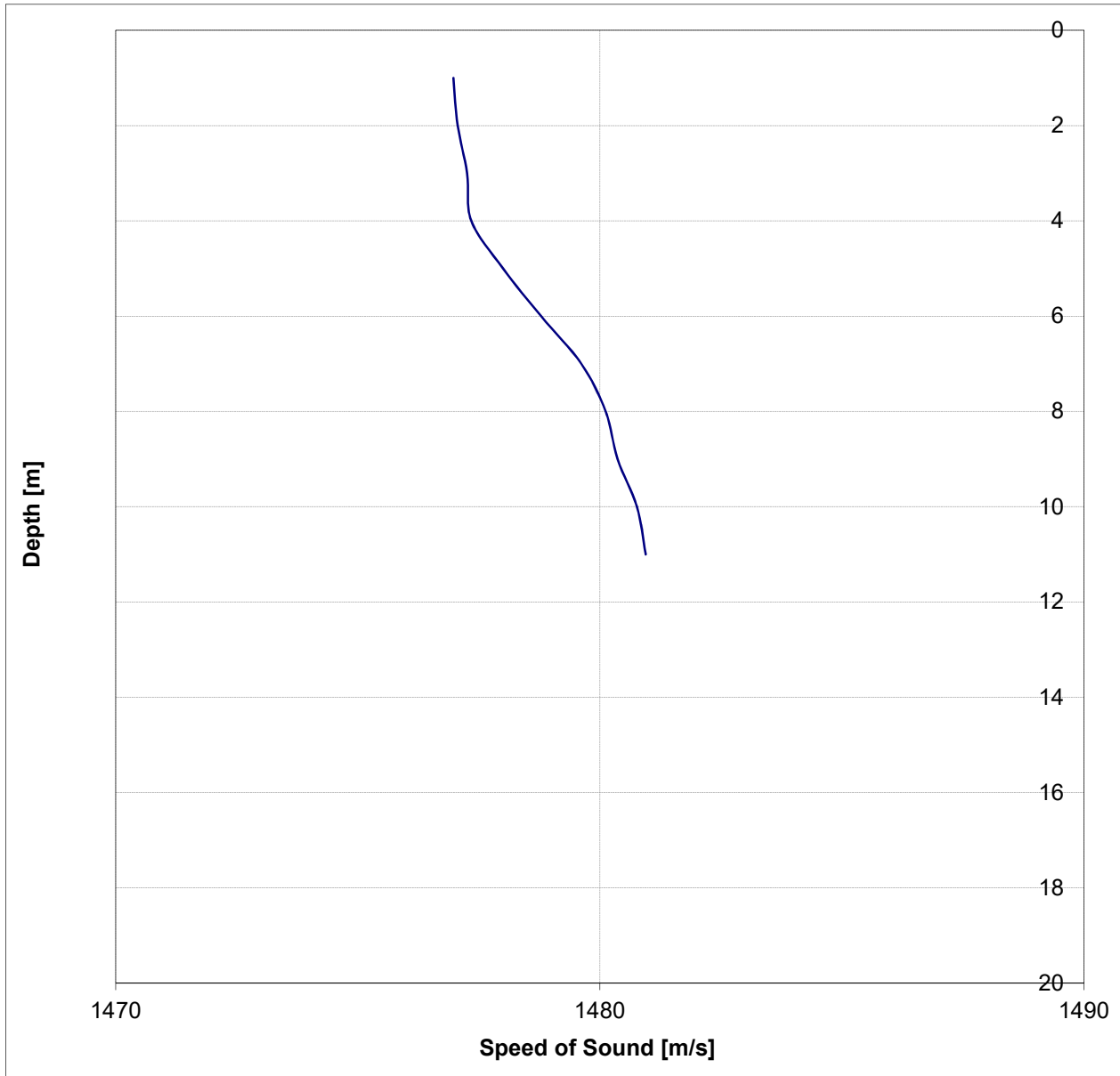
For Fugro Survey AS

For Client

R. Wehr

SPEED OF SOUND PROFILE REPORT

Vessel	Normand Mermaid	Date and time	04:26 27/Oct/2023
Project number	217703	Water depth	11 m
Client	Energinet Eltransmission	Transducer depth	3.02 m
Survey area	Esbjerg	Maximum sample depth	11.0393 m
Easting	463604 m	Transducer speed of sound	1477.27 m/s
Northing	6146930 m	Bottom speed of sound	1481 m/s
Sensor type	SAIV	Average speed of sound	1479.49 m/s
Sensor S/N	1717	Average density	1020.36 kg/m ³



For Fugro Survey AS

R. Weh

For Client

D.3 Survey Mobilisation and Calibration Documents

List of Plates

Mobilisation and Calibration Report MV Normand Mermaid 36 Plates



Normand Mermaid Mobilisation and Calibration

Field Report | North Sea, Danish Sector

217703-REP-001 Issue 1 | 29 October 2023

Issued to client

Energinet Eltransmission A/S

ENERGINET

Document Control

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Client Address	Tonne Kjærsvej 65, DK-7000 Fredericia, Denmark

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Issue	Section	Page No.	Table No.	Figure No.	Description

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1. Introduction

This field report concerns the survey aspects associated with the mobilisation and calibration of the Normand Mermaid.

The Normand Mermaid equipment was mobilised whilst the vessel was in Esbjerg, Denmark between 26 and 27 October 2023.

The scope of work for the Normand Mermaid mobilisation and calibration was as follows

- Powering up and testing of survey equipment;
- Configuration of project data;
- Geodesy check;
- Offset measurements;
- Heading and motion systems alignment check;
- GNSS position verification;
- GNSS position comparisons;
- Speed of sound sensors comparison;

Full mobilisation and calibration operational details are contained within the daily log presented in Appendix A.

All raw survey data for these calibrations are available upon request.

2. Survey Parameters

2.1 Geodetic and Projection Parameters

Table 2.1: Project Geodetic and Projection Parameters

Name: ETRS89 / UTM zone 32N [ETRF2000-ITRF2014][2023.001982],DTU21 MSS height [DTU21 MSS]		
EPSG Code	EPSG:25832	
Global Navigation Satellite System (GNSS) Geodetic Parameters*		
Datum	International Terrestrial Reference Frame 2014	EPSG:1165
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Local Geodetic Datum Parameters		
Datum	European Terrestrial Reference System 1989	EPSG:6258
Ellipsoid	GRS 1980	
Semi major axis	a = 6 378 137.00 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from ITRF2014 to ETRS89		
X-axis translation 0.05600 m	X-axis rotation -0.0027542"	Scale difference 0.00355022 ppm
Y-axis translation 0.05350 m	Y-axis rotation -0.016661"	Coordinate Frame rotation
Z-axis translation -0.09880 m	Z-axis rotation 0.0269296"	FUGRO:41366
Local Projection Parameters		
Map projection	Transverse Mercator	
Grid system	UTM zone 32N	EPSG:16032
Latitude origin	00° 00' 00.000" N	
Central meridian	009° 00' 00.000" E	
Scale factor on central meridian	0.9996	
False easting	500 000 m	
False northing	0 m	
Project Vertical Parameters		
Vertical coordinate reference system	DTU21 MSS height	FUGRO:41088
Datum	DTU21 MSS height	FUGRO:40943
Transformation	WGS 84 to DTU21 MSS height	FUGRO:41478
Notes		
* The geodetic datum of Fugro's global GNSS correction data is ITRF2014, epoch 2023.001982 (01/01/2023 17:22:00)		

In this report all coordinates for mobilisation operations are in above local datum, unless otherwise specified.

A printout of the StarfixNG online navigation system configuration can be found in Appendix C.1.

2.2 Convergence

All bearings were related to Grid north. Where a true bearing is quoted, convergence needs to be applied to correct to grid bearing.

The convergence at Esbjerg, Denmark, during mobilisation and calibrations was -0.47° .

Grid bearing = True bearing – Convergence, True bearing = Grid bearing + Convergence.

2.3 Time Datum

All survey data was logged in UTC. All times in this report are in local time (UTC+1) unless otherwise stated.

2.4 Sign Convention

Throughout this document the following Fugro vessel sign convention has been used:

- Positive X-Axis is towards starboard side of the vessel;
- Positive Y-Axis is towards the vessel's bow;
- Positive Z-Axis is up;
- Positive Roll is Port Side up;
- Positive Pitch is Bow up.

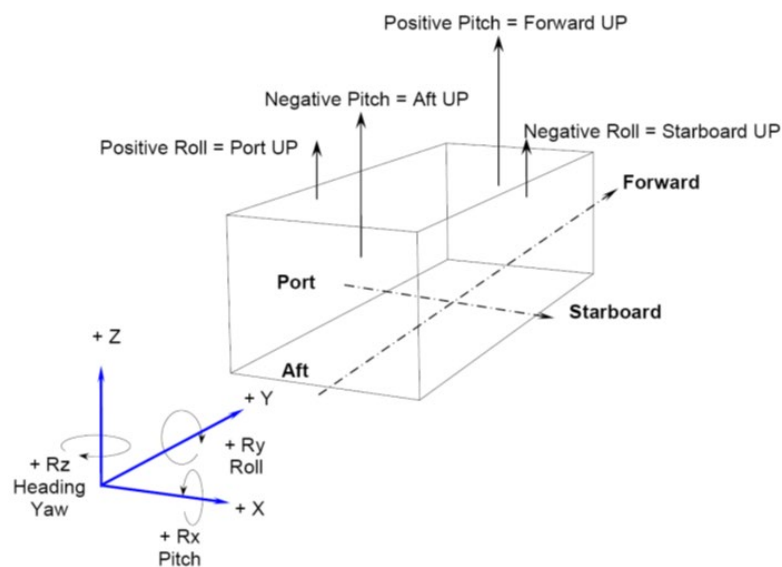


Figure 2.1: Fugro pitch and roll sign convention

3. Operations

The survey equipment supplied in the frame agreement was mobilised on the MV Normand Mermaid prior to the start of this project. Vessel position and heading systems were calibrated using land survey techniques on 15 October 2023 while alongside Haugesund, Norway. To verify the previous calibration values were correct, GNSS and Gyro verifications were completed while the vessel was alongside Esbjerg, Denmark on 26 and 27 October 2023. Draft measurements were taken prior to vessel departure to facilitate accurate depth readings.

Prior to operations, one cNode transponder, one MST transponder and one mini IPS sensor were installed on the cone penetration test (CPT) seabed frame. Their offsets were measured and entered in the survey system.

All surface positioning equipment was fully mobilised and integrated at 18:00 on 27 October 2023.

See Appendix C.1 for the StarfixNG online navigation system configuration.

4. Offsets

4.1 Normand Mermaid Offsets

The Normand Mermaid vessel offsets were determined during a dimensional control survey conducted between 3 and 5 December 2021 in Haugesund, Norway; see Appendix B.1 for the full offset survey report. The CRP was set as the vessel’s centre of gravity (COG) as defined in the dynamic positioning (DP) system.

Figure 4.1 illustrates the locations of the offsets and Table 4.1 lists the offset coordinates.

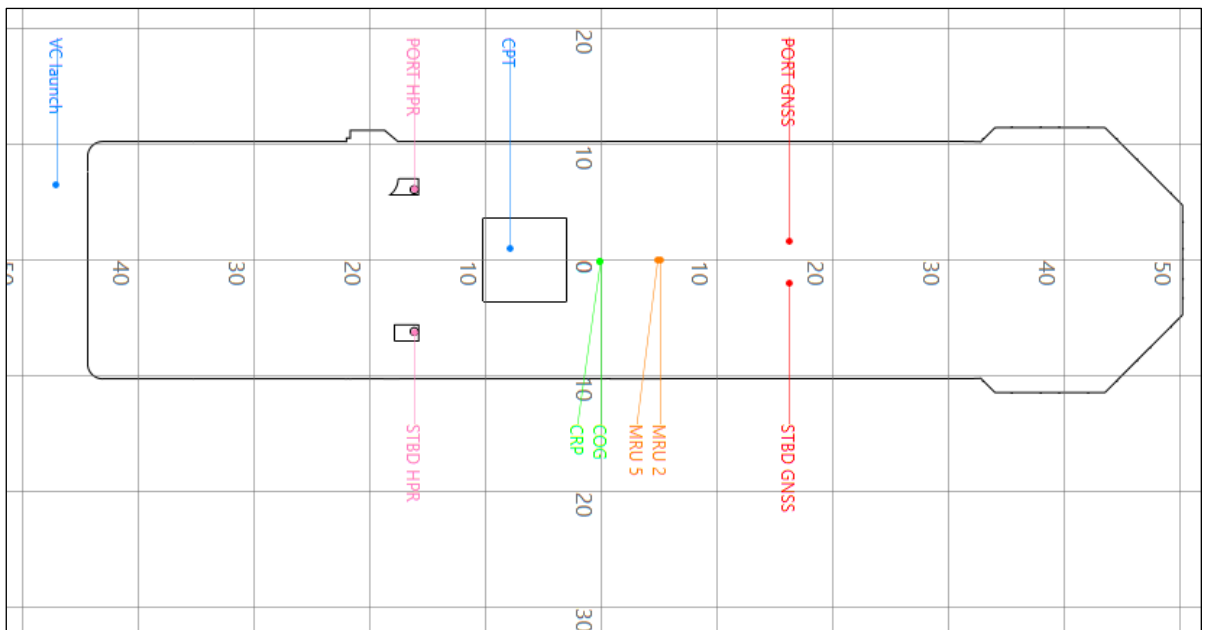


Figure 4.1: Normand Mermaid Offsets

Table 4.1: Normand Mermaid Vessel Offsets

Point Name	Location Description	X [m]	Y [m]	Z [m]
CRP	Common reference point	0.000	0.000	0.000
CPT	CPT launching point	-1.030	-7.866	0.000
MRU2	Motion reference unit	-0.035	5.143	-0.562
MRU5	Motion reference unit	-0.034	4.945	-0.565
PORT GNSS	Port antenna	-1.709	16.263	29.047
Stbd GNSS	Starboard antenna	1.904	16.255	29.014
PORT HPR	Port HiPAP pole	-6.149	-16.106	-11.521
Stbd HPR	Starboard HiPAP pole	6.150	-16.120	-12.314
VC	Vibrocore launching point	-6.520	-47.000	0.000

Notes:
GNSS antenna offset coordinates refer to the antennas' phase centre

4.2 CPT Offset Coordinates

Figure 4.2 illustrates the location of the offsets.

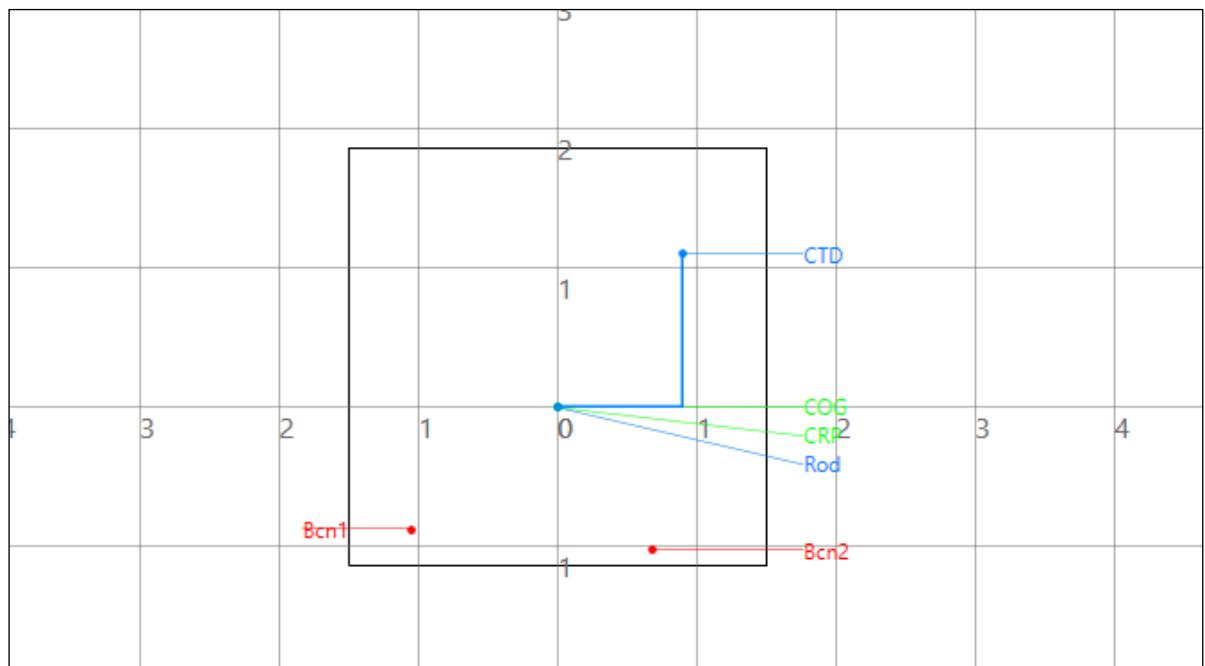


Figure 4.2: CPT offset diagram

Table 4.2 lists the offset coordinates used on the CPT frame.

Table 4.2: CPT Frame Offsets

Point Name	Location Description	X [m]	Y [m]	Z [m]
CRP	Common reference point	0.000	0.000	0.000
Rod	Central rod	0.000	0.000	0.000
Bcn1	Port frame mounted transponder	-1.050	-0.880	3.600
Bcn2	Starboard frame mounted transponder	0.680	-1.030	3.600
CTD	Frame mounted IPS	0.900	1.100	2.550

5. Heading and Motion Systems Alignment Check

The heading and motion systems were calibrated using land survey techniques, in Haugesund, Norway, on 15 October 2023. See Appendix B.2 for the full calibration and verification report.

After completing the checks, the surveyor entered the corrections into the online navigation software. The results of the calibration are presented in Table 5.1.

Table 5.1: Heading Calibration

Date	Location	Heading system	Method	C-O [°]
15 October 2023	Haugesund, Norway	GNSS Heading from Survey StarPack 101	Land Survey	-90.00
15 October 2023	Haugesund, Norway	TSS Meridian Surveyor gyro	Land survey	-86.61
15 October 2023	Haugesund, Norway	Vessel Gyro 1, Simrad GC80	Land survey	-0.99
15 October 2023	Haugesund, Norway	Vessel Gyro 2, Simrad GC80	Land survey	-2.24

Table 5.2 presents the results of the motion system calibration.

Table 5.2: Motion reference units alignment check results

Date	Location	MRU	Method	C-O [°]	SD [°]
15 October 2023	Haugesund, Norway	MRU2 - Pitch	Land survey	-0.09	0.05
15 October 2023	Haugesund, Norway	MRU2 - Roll	Land survey	-0.52	0.06
15 October 2023	Haugesund, Norway	MRU5 - Pitch	Land survey	-0.12	0.04
15 October 2023	Haugesund, Norway	MRU5 - Roll	Land survey	-0.13	0.06

To monitor possible heading solution drifts and differences between the heading solution values, a comparison between all heading sources and the primary heading solution was logged for one hour between 23:28 and 00:28 between 26 and 27 October 2023 whilst the vessel was in Esbjerg, Denmark. The comparison results are presented in Table 5.3.

Table 5.3: Vessel's heading systems comparison results

Heading Solution	Difference [°]	SD [°]
StarPack GNSS Heading (Reference)	0.00	NA
TSS Meridian Surveyor gyro	-0.30	0.04
Notes: SD = Standard deviation		

The full heading verification report is available in Appendix C.3.

6. Positioning Systems

6.1 GNSS Positioning System Verification

A surface positioning system verification was carried out on 15 October 2023 in Haugesund, Norway, using land survey techniques. The results of the verifications are presented in Table 6.1.

Table 6.1: Positioning System Verification

Date	Location	Positioning system	ΔE [m]	S.D. [m]	ΔN [m]	S.D. [m]
15 October 2022	Haugesund, Norway	Survey StarPack 101, Starfix.G4+	0.02	0.13	-0.10	0.07
15 October 2022	Haugesund, Norway	Survey StarPack 102, Starfix.XP2	-0.03	0.14	-0.11	0.07
15 October 2022	Haugesund, Norway	Survey StarPack 102, Starfix.G4+	-0.01	0.13	-0.11	0.07
15 October 2022	Haugesund, Norway	Survey StarPack 101, Starfix.XP2	0.00	0.14	-0.10	0.07

See Appendix B.2 for the full calibration and verification report.

6.2 GNSS Positioning System Comparison

To check the integrity of the positioning systems, a positioning system comparison was performed on 26 October 2023, in Esbjerg, Denmark. The positioning system comparison was performed between the primary positioning system, Starfix.G4+ from StarPack 101 and other systems. From the antenna locations, with respect to the vessel primary heading source, positions of the vessel's datum point (CRP) were calculated and compared. The differences between the positioning systems were within the expected system accuracy. The results of the comparisons are presented in Table 6.2..

Table 6.2: Positioning system comparison

Date	Location	Positioning system	ΔE [m]	S.D. [m]	ΔN [m]	S.D. [m]
26 October 2023	Esbjerg, Denmark	StarPack 101, StarfixG4+	NA	0.04	NA	0.03
26 October 2023	Esbjerg, Denmark	StarPack 102, Starfix.XP2	0.01	0.03	0.04	0.03
26 October 2023	Esbjerg, Denmark	StarPack 102, Starfix.G4+	-0.01	0.03	0.01	0.02
26 October 2023	Esbjerg, Denmark	StarPack 101, Starfix.G2	-0.01	0.02	0.04	0.03

The full position verification report is available in Appendix C.2

7. Normand Mermaid USBL Calibration and Verification

7.1 USBL Calibration

The vessel's HiPAP USBL systems, the starboard HiPAP 501 system and the port HiPAP 500 system, were interfaced to the Starfix Suite; the starboard system was used as the primary subsea positioning system. A USBL calibration was performed on 22 October 2023. The calibration was undertaken in Skudefjorden outside Stavanger, Norway in a water depth of 400 m. The results of the calibration and the settings in both the systems are presented in Table 7.1.

The full USBL calibration report is available in Appendix B.3.

Table 7.1: USBL settings

System	Date	Orientation [°]	Pitch [°]	Roll [°]
HiPAP 501 Starboard	22 October 2023	0.07	0.06	0.10
HiPAP 500 Port	22 October 2023	0.65	-0.18	-0.02

Prior to the starting the calibration, Fugro entered the latest calculated minus observed (C-O) values for the gyros and MRUs into the Starfix Suite, and zeroed all corrections applied to the USBL system. Fugro also acquired a sound velocity profile, cleaned it, and entered it into the vessel's USBL system. Fugro did not make any further changes to the vessel's USBL system.

The modified cardinal point method was utilised for the USBL calibration. The survey system acquired a minimum of 200 observations at each of the locations shown in Figure 7.1.

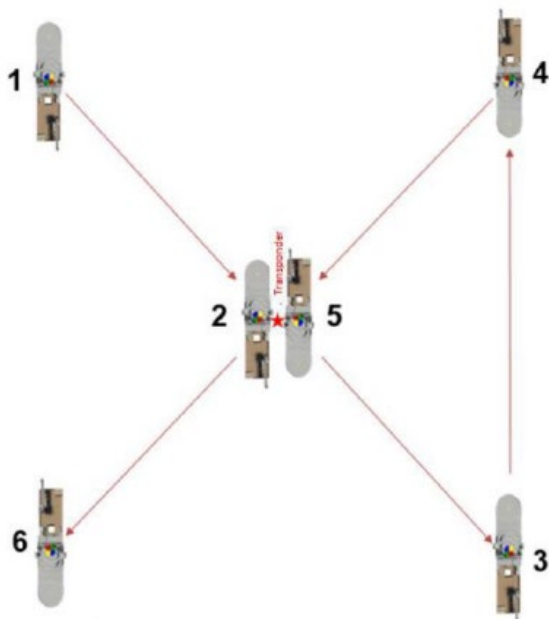


Figure 7.1: USBL Calibration Pattern Schematic

The standoff distance used for the data collection was 100 m, and the vessel headings were 100° and 280°.

After data collection, the positions were edited to remove outliers, and then processed to determine the pitch, roll, azimuth, and scale errors of the USBL systems. These values were applied in the online Starfix software, before performing a spin test to verify the results of the calibration.

The data acquired during the USBL calibration were of good quality, with low spread and good agreement after calibration.

The USBL calibration and verification was successful, and the results indicate that the USBL system on board the Normand Mermaid has been successfully calibrated and is performing to specifications.

Since the Port HiPAP only supports FSK channels, Fugro recommends that the Starboard HiPAP system is used as the main system, and the Port HiPAP system as a backup.

Figure 7.2 shows the raw and corrected data for HiPAP 501 Starboard.

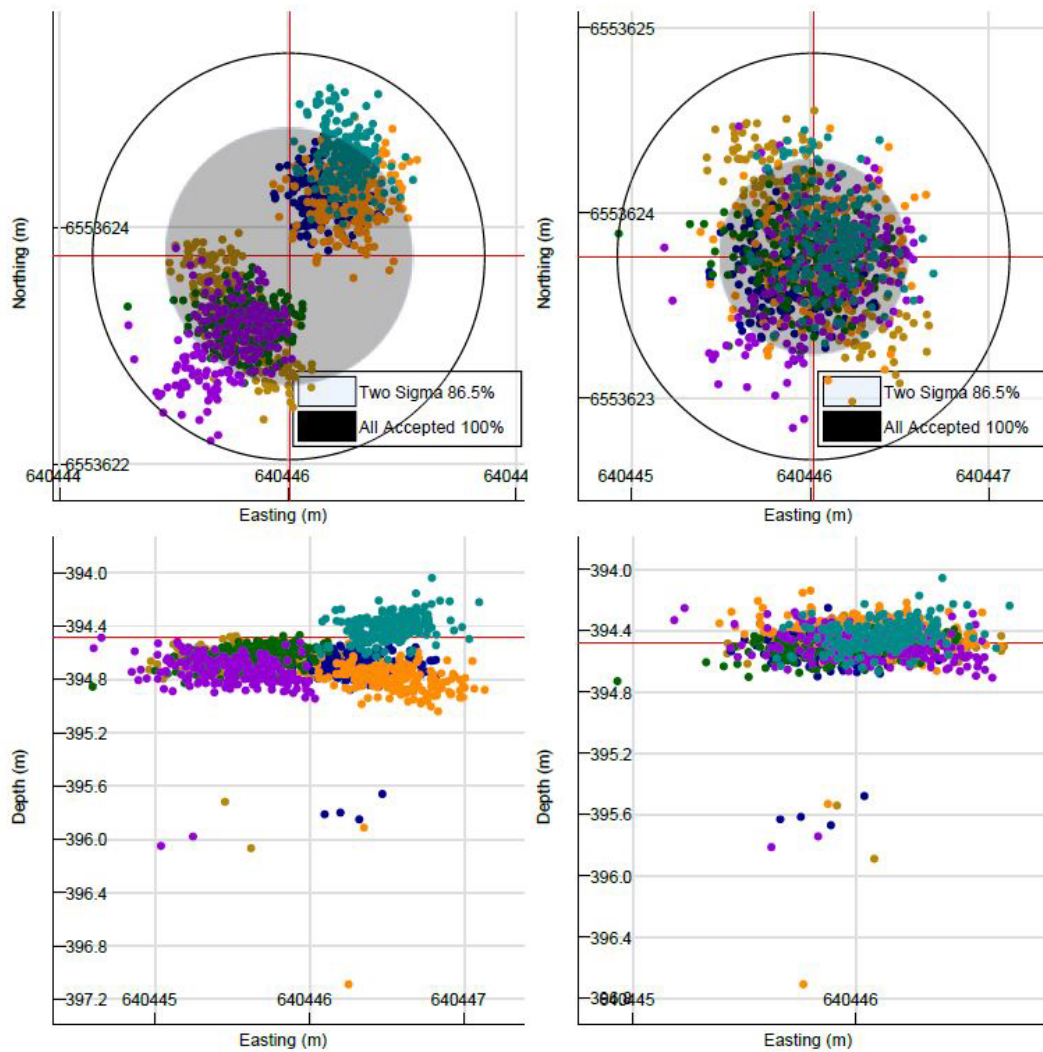


Figure 7.2: Raw data (left) and Corrected Data (right) for HiPAP 501 Starboard

Figure 7.3 shows the raw and corrected data for HiPAP 500 Port.

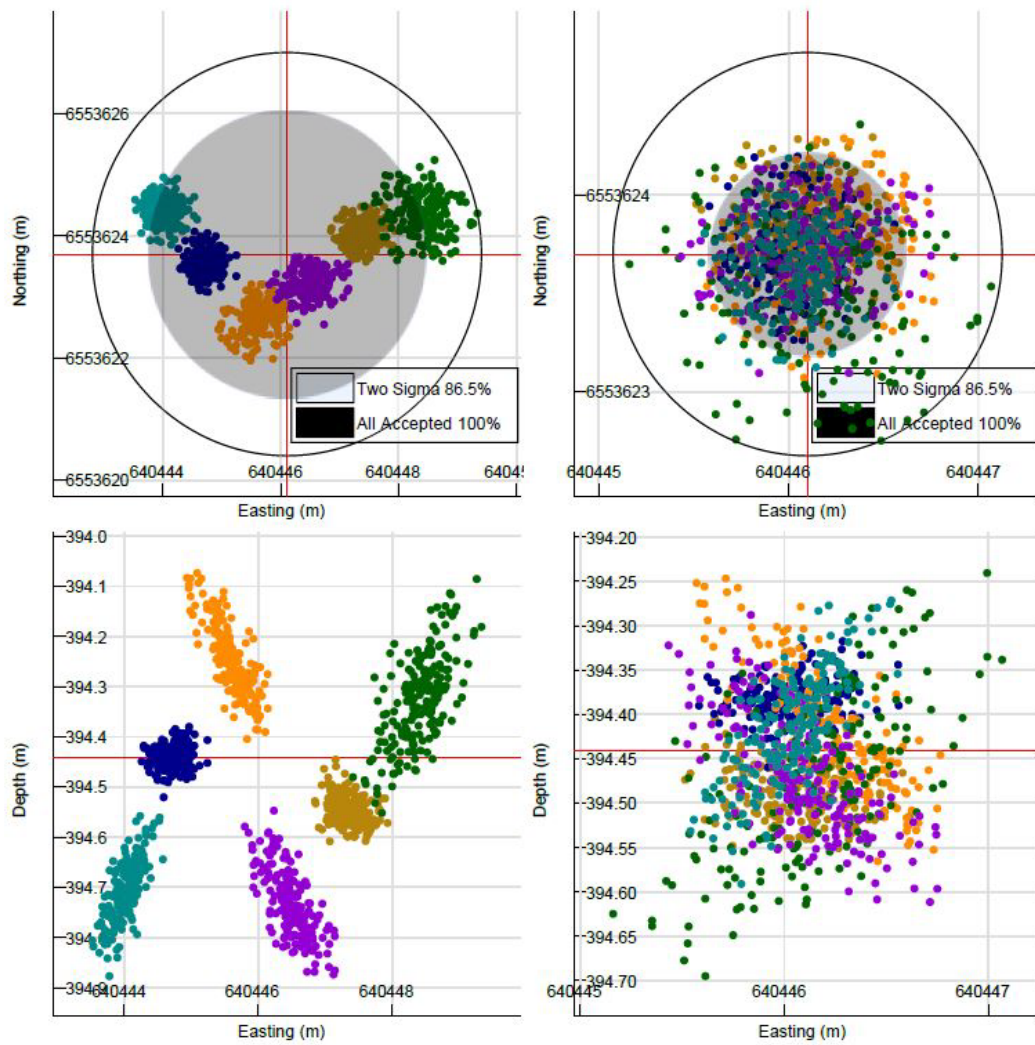


Figure 7.3: Raw data (left) and Corrected Data (right) for HiPAP 500 Port

7.2 USBL Verification and Offshore Position Check

7.2.1 HiPAP 501 Starboard Spin Test

Fugro rejected 2 of the 600 observations recorded for quality reasons.

The average spread (2SD) of the 4 individual data sets is 0.60 mE and 0.54 mN, corresponding to 0.14% of the slant range from the beacon to the transducer. This is a good indicator of the noise in the system. For comparison, the entire data set collected during the verification has a spread of 0.61 mE and 0.59 mN (2SD, 95%). The greater the difference between the average SDs from the individual data sets and the SD of the entire data set, the larger the pitch, roll, and offset system errors in the data.

The supplied known position is 0.99 m on a bearing of 069°G from the found mean position. The greater this distance is, the larger the heading and geodesy system errors in the data.

Figure 7.4 presents the results of the HiPAP 501 Starboard spin test.

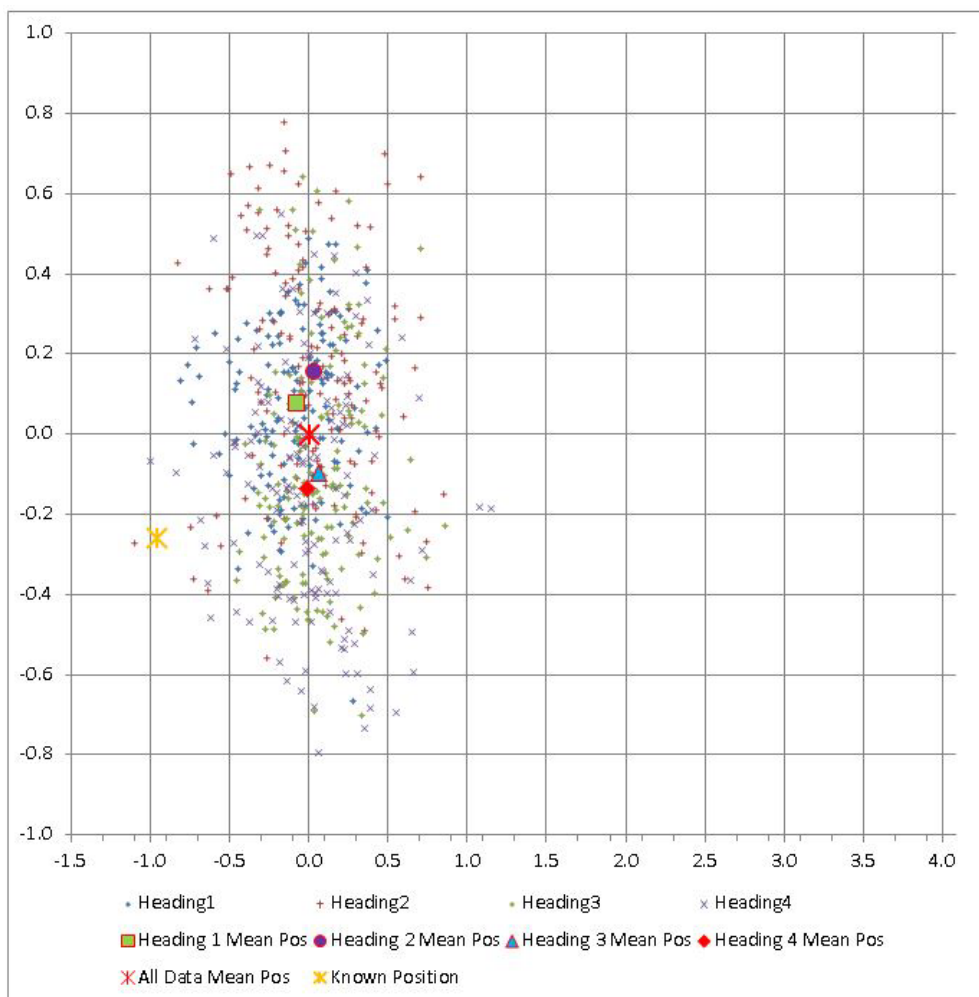


Figure 7.4: HiPAP 501 Starboard USBL spin test results

7.2.1 HiPAP 500 Port Spin Test

Fugro rejected 0 of the 600 observations recorded for quality reasons.

The average spread (2SD) of the 4 individual data sets is 0.66 mE and 0.62 mN, corresponding to 0.16% of the slant range from the beacon to the transducer. This is a good indicator of the noise in the system. For comparison, the entire data set collected during the verification has a spread of 0.72 mE and 0.69 mN (2SD, 95%). The greater the difference between the average SDs from the individual data sets and the SD of the entire data set, the larger the pitch, roll, and offset system errors in the data.

The supplied known position is 0.23 m on a bearing of 008°G from the found mean position. The greater this distance is, the larger the heading and geodesy system errors in the data.

Figure 7.5 presents the results of the HiPAP 500 Port spin test.

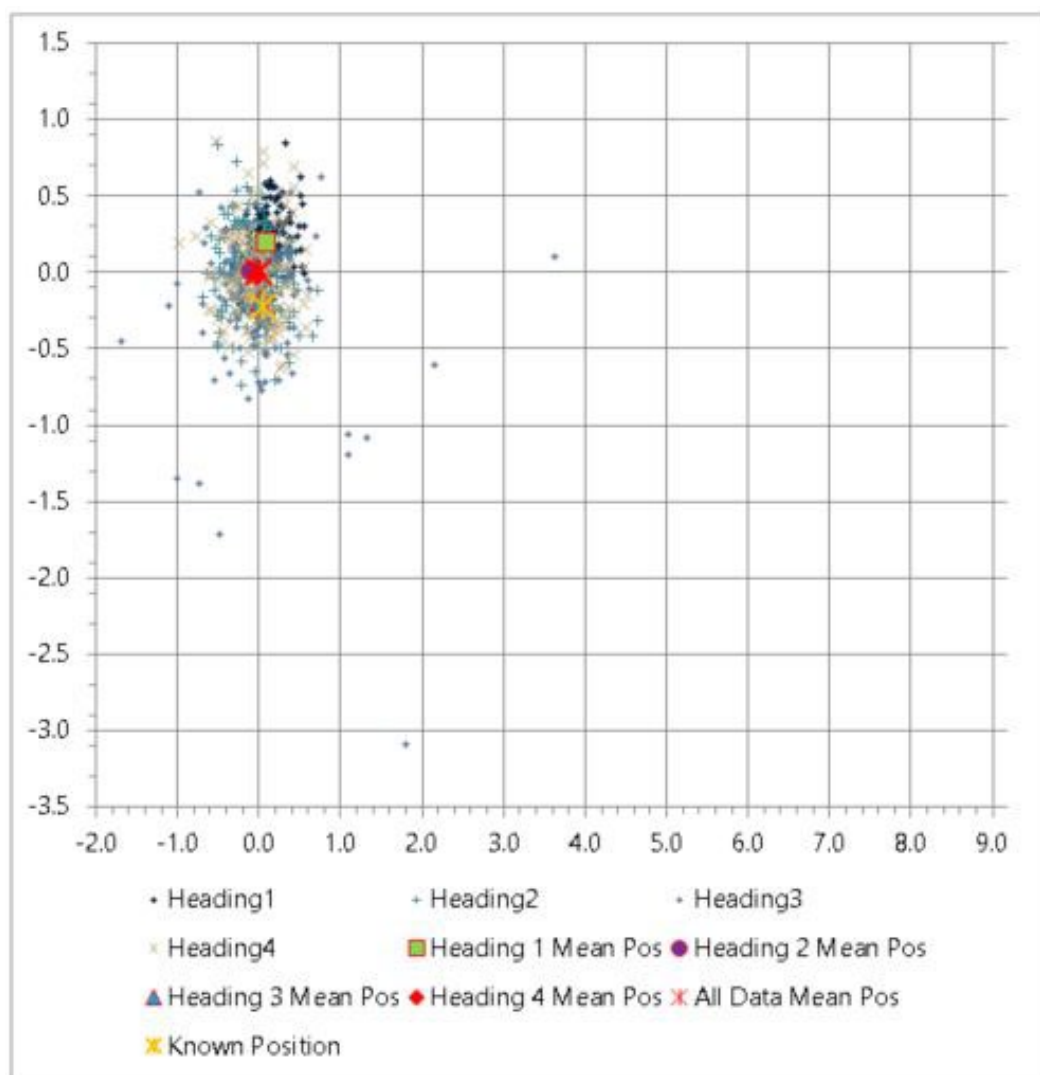


Figure 7.5: HiPAP 500 Port USBL spin test results

7.3 Speed of Sound and Water Density Measurements

Before the start of the project, conductivity, temperature and pressure measurements were taken to establish the local speed of sound profile and average water density. The speed of sound profile was entered into the HiPAP system.

The results of these measurements are presented in Table 7.2.

Table 7.2: Speed of sound and water density measurements

Date	Sensor S/N	Mean [m/s]	Transducer [m/s]	Seabed [m/s]	Density [kg/m ³]
27 October 2023	955	1479.25	1477.16	1480.84	1020.22
27 October 2023	171	1479.49	1477.27	1481.00	1020.36

See Appendix C.4 for the full sound velocity profile (SVP) plots.

8. Personnel and Equipment

8.1 Personnel

The following Fugro team was involved in the mobilisation and calibration:

Personnel	Name	From	To
Party Chief/Engineer/Surveyor	R. Wojke	18 October 2023	27 October 2023
Surveyor	M. Andrei	18 October 2023	27 October 2023
Surveyor	C. Dorobantu	18 October 2023	27 October 2023

8.2 Equipment Summary

The following is an equipment summary of the survey equipment onboard the Normand Mermaid as part of the service contract between Energinet Eltransmission A/S and Fugro.

Navigation software	Starfix online navigation suite
Primary positioning	StarPack 101 with StarfixG4+ solution, corrections via ERSAT
Secondary positioning	StarPack 102 with Starfix.XP2 solution, corrections via SASAT
Tertiary positioning	StarPack 102 with Starfix.G4+ solution, corrections via SASAT
Quaternary positioning	StarPack 101 with Starfix.G2 solution, corrections via ERSAT
Primary Acoustic positioning	Kongsberg HiPAP 501 USBL system, starboard
Secondary Acoustic positioning	Kongsberg HiPAP 500 USBL system, port
Primary heading system	GNSS Heading from Survey StarPack 101
Secondary heading system	TSS Meridian Surveyor gyro
Tertiary heading system	Vessel Gyro 1, Simrad GC80
Quaternary heading system	Vessel Gyro 2, Simrad GC80
Quinary heading system	GNSS Heading from Survey StarPack 102
Spare correction source	NTRIP

8.3 Equipment Installation Diagram

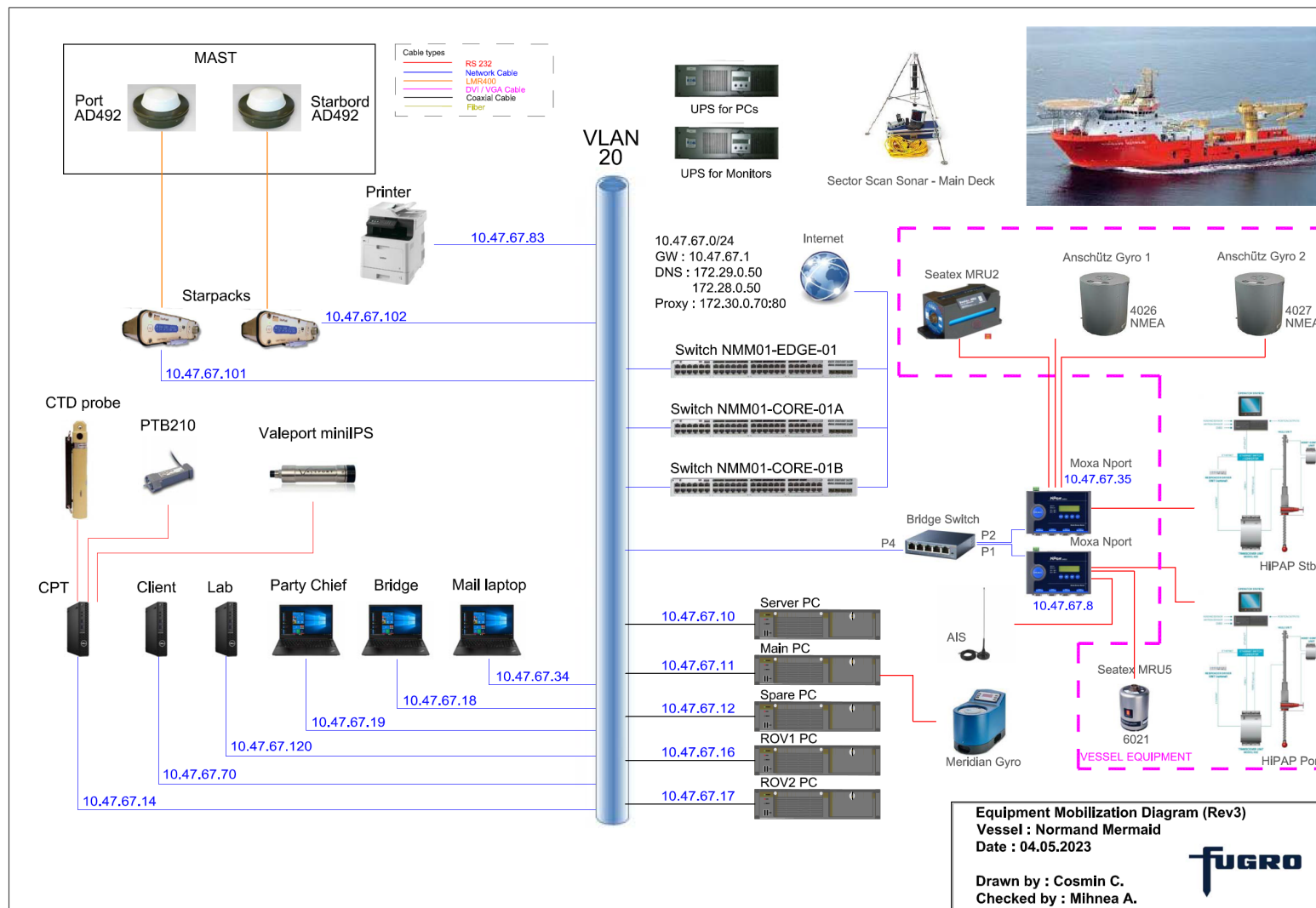


Figure 8.1: Equipment Installation Diagram

9. Health, Safety and Environment

The captain of the Normand Mermaid was responsible for the safety of the vessel and all onboard. Fugro personnel complied with any and all instructions issued by the captain and adhered to all applicable offshore safety regulations.

All Fugro personnel onboard Normand Mermaid conducted themselves in a safe and responsible manner and did not compromise the QHSE practices and policies of Energinet Eltransmission A/S nor Fugro at any time. Additionally, they attended the safety briefings and vessel tour which ensured all personnel were fully familiar with emergency procedures, standard work practices and safety policies before project activities commenced.

In addition to Fugro and vessel work practices, a toolbox talk and TRAs were held between all Fugro personnel prior to commencement of any new task or operation. The vessel Permit-To-Work (PTW) system was strictly followed during mobilisation.

Appendix A

Daily Log

A.1 Daily Log for the Mobilisation of the Normand Mermaid

26 October 2023	
Time [UTC+2]	Event
21:50	Vessel alongside Esbjerg
22:17	Start logging for DGNSS alongside verification
23:28	Start logging for gyro alongside verification

27 October 2023	
Time [UTC+2]	Event
00:00	Midnight position: 55° 28' 05 N, 008° 26' 01" E. Vessel alongside Esbjerg
04:27	Performing SVP alongside verification
12:19	Performing vessel draft measurements
18:00	Vessel starts transit to work site

Appendix B

Offset Surveys and Alongside
Calibrations and Verifications

B.1 Offset Survey report

Click the PDF icon below to access the offset survey report.



B.2 Gyro and MRU Calibration and GNSS Verification

Click the PDF icon below to access the calibration and verification report.



B.3 USBL Calibration Report

Click the PDF icon below to access the USBL calibration report.



Appendix C

Configuration and Onboard System Verifications

C.1 StarfixNG Configuration Summary

Click the PDF icon below to access the StarfixNG Configuration Summary.



C.2 GNSS Verifications



C.2.1 GNSS Positioning System Comparison on 26 October 2023

	Antenna Positions	East [m]	North [m]	H [m]	East SD [m]	North SD [m]	H SD [m]	Obs
1	SPK Port-10.47.67.101-Starfix.G4 Plus 10105	464 199.193 E	6 147 040.412 N	32.400 MSS	± 0.04	± 0.03	± 0.91	3533
2	SPK Stbd-10.47.67.102-Starfix.XP2 10202	464 196.341 E	6 147 038.240 N	32.435 MSS	± 0.03	± 0.03	± 0.91	3509
3	SPK Stbd-10.47.67.102-Starfix.G4 Plus 10205	464 196.327 E	6 147 038.215 N	32.462 MSS	± 0.03	± 0.02	± 0.91	3491
4	SPK Port-10.47.67.101-Starfix.XP2 10102	464 199.185 E	6 147 040.445 N	32.432 MSS	± 0.02	± 0.03	± 0.91	3445

	Name	East [m]	North [m]	H [m]	1xDRMS [m]	ΔEast [m]	ΔNorth [m]	ΔH [m]	Obs
1	SPK Port-10.47.67.101-Starfix.G4 Plus 10105	464 187.886 E	6 147 051.925 N	3.239 MSS	0.04	0.00	0.00	0.00	3533
2	SPK Stbd-10.47.67.102-Starfix.XP2 10202	464 187.893 E	6 147 051.961 N	3.285 MSS	0.03	0.01	0.04	0.05	3509
3	SPK Stbd-10.47.67.102-Starfix.G4 Plus 10205	464 187.880 E	6 147 051.936 N	3.313 MSS	0.03	-0.01	0.01	0.07	3491
4	SPK Port-10.47.67.101-Starfix.XP2 10102	464 187.878 E	6 147 051.961 N	3.275 MSS	0.03	-0.01	0.04	0.04	3445

C.3 Heading Verifications

C.3.1 Heading Verification on 26 October 2023

Reference Gyro						
 SPK Port-10.47.67.101						
Target Gyro	Calculated C-O [°]	SD [°]	Minimum C-O [°]	Maximum C-O [°]	Observations Used	Observations Rejected
 TSS Meridian	-0.30	0.04	-0.43	-0.11	3488	1

C.4 Sound Velocity Profiles

Sound velocity profiles have been shared with Energinet Eltransmission A/S separately.

Appendix D

Calibration Certificates

D.1 Conductivity, Temperature and Depth Sensors

D.1.1 SAIV 955

MINI STD/CTD Calibration Certificate

Certificate no: **5430**

Instrument model: **SD204** Serial number: **955** Owner: **FUGRO AS**

Calibrated date: **2022-09-26** Certificate issued date: **2022-09-26** Env. temp (degr. C): **19.1**

Calibrated by: **Sensordata a.s and SAIV A/S Bergen Norway**

Calibration procedure:
 Conductivity and temperature are calibrated by setting the MINI STD/CTD instrument in raw data mode and keeping it in three 200 l stirred, temperature stabilised calibration baths. Raw conductivity and temperature data are recorded with bath temperature and bath conductivity as measured by reference temperature* and conductivity** instruments. Calibration coefficients A1, B1, C1 for temperature and A3, B3, C3, D3 for conductivity are calculated from least square equations included in the MINISOFT software packet. Output temperature and conductivity from calibrated instrument must correspond with reference readings within +/- 1/100 degr. C and +/- 1/100 mmho/cm. Pressure is calibrated by connecting to a reference DWT*** and successively generate 6 pressures from 1 bar to FS. Pressure coefficients A2, B2, C2, D2 are calculated from least squares equations included in the instruments software. Output CTD data must correspond to data from reference instruments within specified accuracy.

TEMPERATURE degr. C			CONDUCTIVITY mmho/cm			PRESSURE dbar		
Bef. cal.	After cal.	Reference	Bef. cal.	After cal.	Reference	Bef. cal.	After cal.	Reference
	19.61	19.612		50.48	50.483	9.99	NO CHANGE	10.01
	12.16	12.162		34.38	34.383	100.12		100.13
	0.41	0.411		9.47	9.472	400.50		400.52
						600.77		600.78
						1001.28		1001.30
						2002.62		2002.60

All calibration coefficients are shown on attached calibration sheet

Working references:
 Temperature* Falmouth Scientific Model OTM S-112 S/N 1377-09JUL96 Accuracy +/- 2/1000 deg.C
 Conductivity** Falmouth Scientific Model OCM S-112 S/N 1354-09JUL96 Accuracy +/- 2/1000 mmho/cm
 Pressure*** Buderberg DWT Model 280L S/N 9050 Accuracy 0.008% FS (600 bar)

Traceable references:
Temperature:
 Subreference 1: General Oceanics ATB 1250 temp. bridge serial no 1235 (Working ref. is controlled by subref.1 four times per year) (Subref.1 is controlled by subref.2 twice per year)
 Subreference 2: Distilled water tripple point cell at +0.010 degr.C
 Phenoxybenzene tripple point cell at +26.868 degr.C

Conductivity:
 Subreference 1: Neil Brown Cond./Temp. transfer standard mod. CT-2 serial no.3 (Working reference is controlled by subref.1 four times per year) (Subref.1 is controlled by subref.2 four times per year) (Subref.2 is controlled by subref.3 four times per year)
 Subreference 2: Guildline Portasal 8410 Portable Salinometer serial no.59
 Subreference 3: Ocean Scientific International Standard Seawater

Pressure:
 Subreference: Pressure reference at FIMAS Coastal Base Calibration Center 5363 Agdenes Norway
 Control frequency Calibration equipment: Once per year

Calibrated by **STEINHAR BERJEN**
 Signature **S. Ivar**

D.1.2 SAIV 1717

MINI STD/CTD Calibration Certificate

Certificate no: **5529**

Instrument model: **SD204** Serial number: **1717** Owner: **FUGRO AS**

Calibrated date: **2023-01-30** Certificate issued date: **2023-01-30** Env. temp (degr. C): **19'**

Calibrated by: **Sensordata a.s and SAIVA/S Bergen Norway**

Calibration procedure:
 Conductivity and temperature are calibrated by setting the MINI STD/CTD instrument in raw data mode and keeping it in three 200 l stirred, temperature stabilised calibration baths. Raw conductivity and temperature data are recorded with bath temperature and bath conductivity as measured by reference temperature* and conductivity** instruments. Calibration coefficients A1, B1, C1 for temperature and A3, B3, C3, D3 for conductivity are calculated from least square equations included in the MINISOFT software packet. Output temperature and conductivity from calibrated instrument must correspond with reference readings within +/- 1/100 degr. C and +/- 1/100 mmho/cm. Pressure is calibrated by connecting to a reference DWT*** and successively generate 6 pressures from 1 bar to FS. Pressure coefficients A2, B2, C2, D2 are calculated from least squares equations included in the instruments software. Output CTD data must correspond to data from reference instruments within specified accuracy.

TEMPERATURE degr. C			CONDUCTIVITY mmho/cm			PRESSURE dbar		
Bef. cal.	After cal.	Reference	Bef. cal.	After cal.	Reference	Bef. cal.	After cal.	Reference
	19.61	19.612		50.48	50.482		10.00	10.01
	12.16	12.161		34.38	34.383		100.12	100.13
	0.41	0.411		9.47	9.472		200.25	200.26
							400.53	400.52
							600.78	600.78
							1001.32	1001.30

All calibration coefficients are shown on attached calibration sheet

Working references:
 Temperature* Falmouth Scientific Model OTM S-112 S/N 1377-09JUL96 Accuracy +/- 2/1000 deg.C
 Conductivity** Falmouth Scientific Model OCM S-112 S/N 1354-09JUL96 Accuracy +/- 2/1000 mmho/cm
 Pressure*** Budenberg DWT Model 280L S/N 9050 Accuracy 0.008% FS (600 bar)

Traceable references:

Temperature:
 Subreference 1: General Oceanics ATB 1250 temp. bridge serial no 1235 (Working ref. is controlled by subref. 1 four times per year) (Subref. 1 is controlled by subref. 2 twice per year)
 Subreference 2: Distilled water tripple point cell at +0.010 degr.C
 Phenoxybenzene tripple point cell at +26.868 degr.C

Conductivity:
 Subreference 1: Neil Brown Cond./Temp. transfer standard mod. CT-2 serial no.3 (Working reference is controlled by subref. 1 four times per year) (Subref. 1 is controlled by subref. 2 four times per year) (Subref. 2 is controlled by subref. 3 four times per year)
 Subreference 2: Guildline Portasal 8410 Portable Salinometer serial no.59

Pressure:
 Subreference: Pressure reference at FIMAS Coastal Base Calibration Center 5363 Ågotnes Norway
 Control frequency Calibration equipment: Once per year
 Subreference 3: Ocean Scientific International Standard Seawater

Calibrated by STEINAR LØRSEN
 Signature S. Løren

D.4 Lost and Damaged Equipment List and Site Clearance Reports

List of Plates

Lost and Damaged Equipment Record	4 Plates
Lost Equipment Site Clearance Reports	16 Plates



Energinet – Danish OWF 2030 Lot2

Lost Equipment / Site clearance Assessment | CPT140A

F217703-SCA-001 01 | 10 November 2023

Issue: 01

Energinet Eltransmission A/S

ENERGINET



1. Summary

This document presents results of a site clearance assessment following a lost equipment event during sea floor cone penetration testing at location CPT140A, within the Energinet – Danish OWF 2030 Lot 2 site on 10/11/2023 ~08:35hrs (UTC+1). The assessment shows that the top of the rod of the lost assembly is buried around 2.47m below current seafloor level.

2. Site Clearance Assessment

Table 1 provides the exact location where the site clearance assessment is applicable:

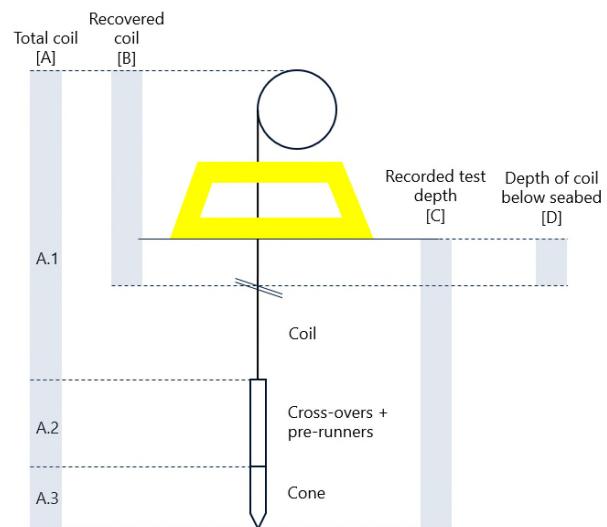
Table 1: Location details

Location	CPT140A	Coordinates	Easting 417702.70 - Northing 6226780.83 Latitude 56° 10' 44.0019" N – Longitude 007° 40' 27.3986" E
Water Depth [m]	29.6	Reference	Ellipsoid: ETRS89 Projection: UTM Zone 32N, Vertical Datum: DTU21 MSS(MSL) height

The burial below seabed is calculated in three steps:

1. Calculate total length of the coil [A]
2. Calculate length of the lost coil; by subtracting the recovered coil length [B] from the total coil length [A]
3. Calculate the depth of burial [D]; by subtracting the lost coil length from the recorded test depth [C].

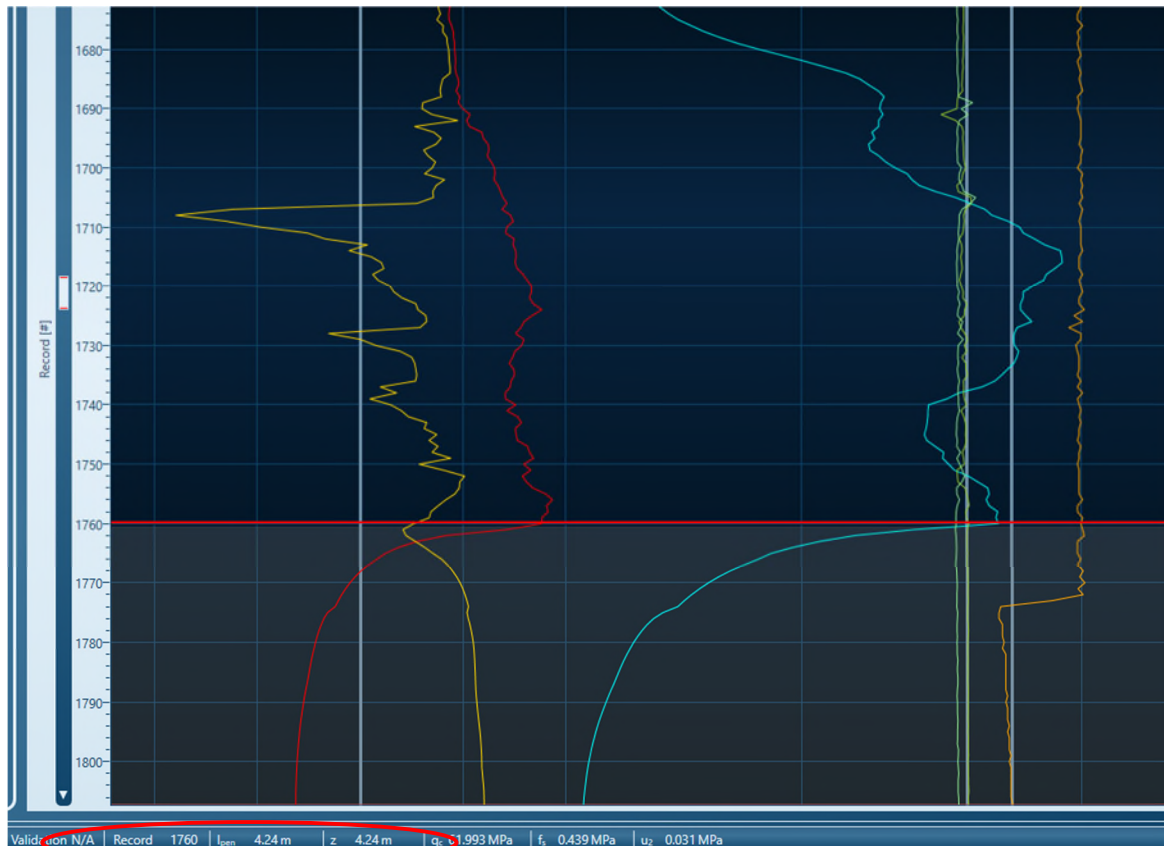
The calculation and all individual measurements are shown below:



A.1	Initial coil length [m]	60	
A.2	Length of cross-over and 2x pre-runners [m]	(0.60+2x0.9) 2.40	
A.3	Length cone [m]	0.27	+
A	Total Length coil [m]	62.67	62.67
B	Length recovered coil [m]	60.90	-
	Length of coil lost [m]	1.77	1.77
C	Recorded test length at lost equipment event [m]		4.24 -
D	Depth of coil below seafloor [m]		-2.47

3. Supporting Information

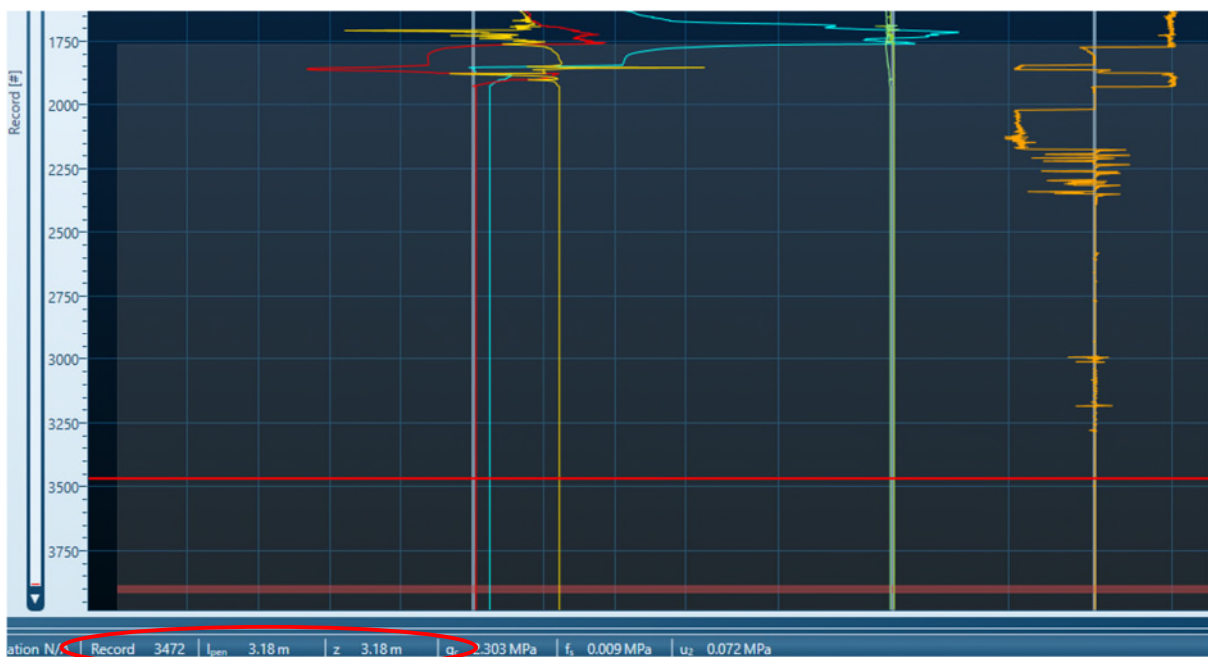
The first screen shot of the processing software below, shows the cone penetration test CPT140A reached a penetration depth of 4.24 m, at this point the cone appeared to stop moving, as indicated by dissipating $q_c/u_2/f_s$ readings (light blue, yellow & red lines), even though the unit kept pushing (orange line shows penetration rate).



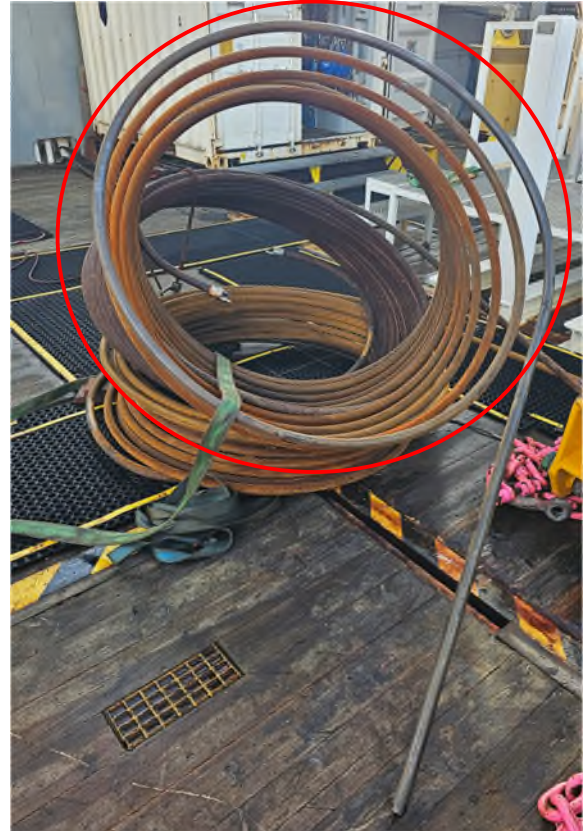
The second screen shot shows the end of pushing at 4.36 m penetration length, however additional penetration went into lateral buckling and subsequential shearing of the rod, as indicated by the above mentioned dissipation of cone readings.



The operators started retracting, however, the connection to the cone was then lost (cable snapped), they kept retracting until 3.18m test length as shown below. At this point the bent coil was stuck on the casing and couldn't be retracted further, so the seabedframe was lifted back to deck, the remaining rod section above the breaking point was pulled out of the ground.



The SBF was brought back to deck, the recovered buckled section of the rod was cut off and the remaining coil lifted out of the SBF and replaced with a new coil. The picture below shows the recovered remaining coil section on deck, the bent section had to be cut from the remaining coil before taking it out of the CDS. Only the coil on the top in the right picture is the recovered coil, two coils below were on deck from previous coil changes. The entire coil and one pre-runner were recovered to deck. One pre-runner (0.9m length). One cross-over (0.6m length) and one cone (0.27m length) were lost in the ground.





Energinet – Danish OWF 2030 Lot2

Lost Equipment / Site clearance Assessment | CPT293

F217703-SCA-002 01 | 5 January 2024

Issue: 01

Energinet Eltransmission A/S

ENERGINET



1. Summary

This document presents results of a site clearance assessment following a lost equipment event during seafloor cone penetration testing at location CPT293, within the Energinet – Danish OWF 2030 Lot 2 site on 04/01/2024 ~14:50hrs (UTC+1). The assessment shows that the top of the rod of the lost assembly is buried around 2.98m below current seafloor level.

2. Site Clearance Assessment

Table 1 provides the exact location where the site clearance assessment is applicable:

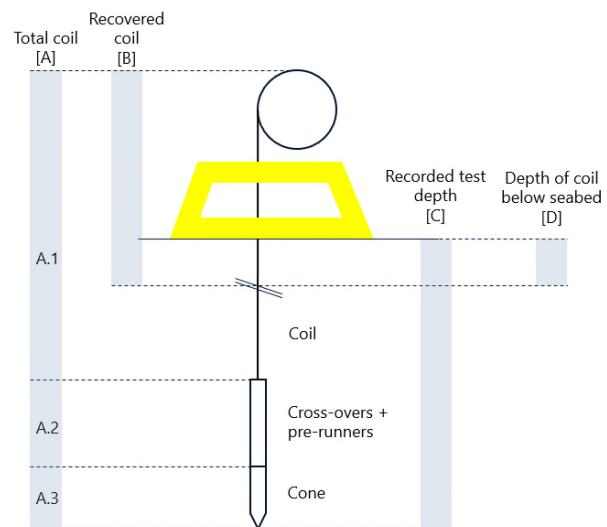
Table 1: Location details

Location	CPT293	Coordinates	Easting 386261.07 - Northing 6220591.68 Latitude 56° 07' 00.6379" N – Longitude 007° 10' 14.4481" E
Water Depth [m]	30.0	Reference	Ellipsoid: ETRS89 Projection: UTM Zone 32N, Vertical Datum: DTU21 MSS(MSL) height

The burial below seabed is calculated in three steps:

1. Calculate total length of the coil [A]
2. Calculate length of the lost coil; by subtracting the recovered coil length [B] from the total coil length [A]
3. Calculate the depth of burial [D]; by subtracting the lost coil length from the recorded test depth [C].

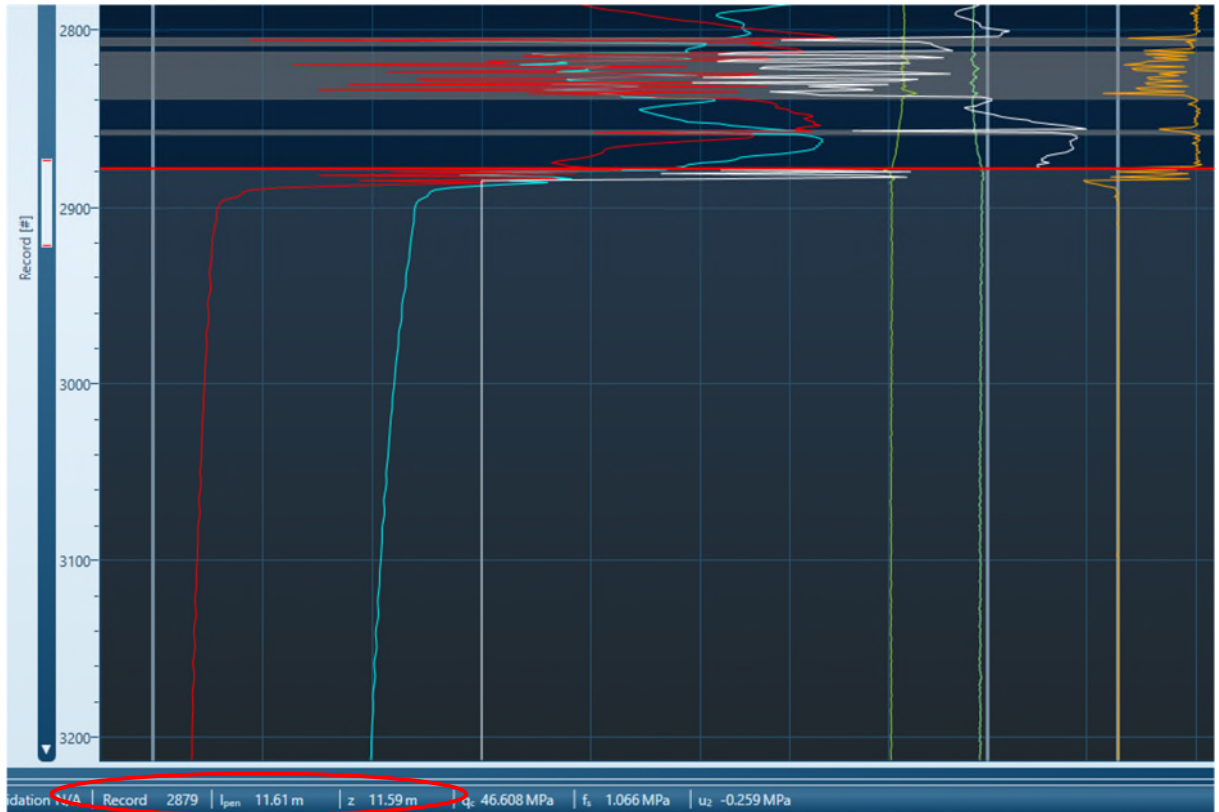
The calculation and all individual measurements are shown below:



A.1	Initial coil length [m]	60		
A.2	Length of cross-over and 2x pre-runners [m]	(0.60+2x0.9) 2.40		
A.3	Length cone [m]	0.27	+	
A	Total Length coil [m]	62.67		62.67
B	Length recovered coil [m]			52.50
	Length of coil lost [m]			10.17
C	Recorded test length at lost equipment event [m]			13.15
D	Depth of coil below seafloor [m]			-2.98

3. Supporting Information

The first screen shot of the processing software below, shows the cone penetration test CPT293 reached a penetration length of 11.61 m, at this point the test was stopped for a moment, suspecting possible risk of buckling. The operators checked the data and the test was then continued.



The second screen shot shows the test at a penetration length of 12.87 m, at this point the rod started to buckle and further penetration was translated into deformation of the rod in a weak section of the ground profile, likely a softer layer ~3mbsf. The push was stopped at 13.15 m penetration length, by that point the rod was already sheared off.



The operators started retracting, however, the connection to the cone was then lost (cable snapped), they kept retracting until 8.28m test length. At this point the buckled & sheared end of the coil was stuck at the clamps and couldn't move further, the seabedframe was then lifted back to deck. Once the frame was back on the landing blocks it was clear that the remaining coil was lost.

The picture below shows the recovered remaining coil section on deck, the bent section had to be cut from the remaining coil before taking it out of the CDS. A 7.5m section of the coil, two pre-runner (2x0.9m length), one cross-over (0.6m length) and one cone (0.27m length) were lost in the ground.





Energinet – Danish OWF 2030 Lot2

Lost Equipment / Site clearance Assessment | CPT343A

F217703-SCA-003 01 | 16 February 2024

Issue: 01

Energinet Eltransmission A/S

ENERGINET



1. Summary

This document presents results of a site clearance assessment following a lost equipment event during seafloor cone penetration testing at location CPT343A, within the Energinet – Danish OWF 2030 Lot 2 site on 15/02/2024 ~13:15hrs (UTC+1). The assessment shows that the top of the rod of the lost assembly is buried around 0.31m below current seafloor level.

2. Site Clearance Assessment

Table 1 provides the exact location where the site clearance assessment is applicable:

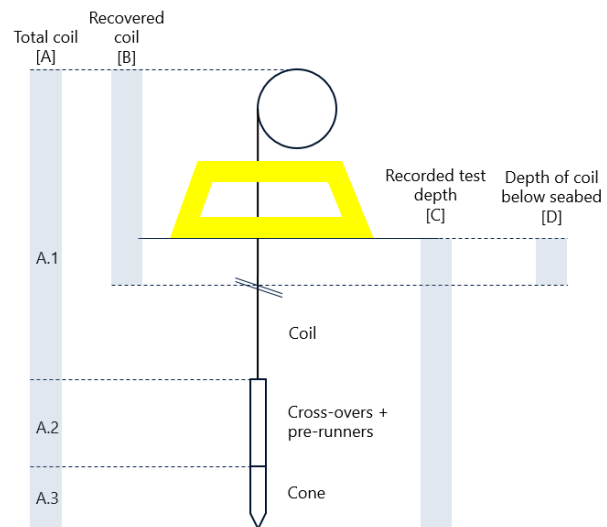
Table 1: Location details

Location	CPT343A	Coordinates	Easting 380021.66- Northing 6208990.72 Latitude 56° 00' 40.1169" N – Longitude 007° 04' 32.1192" E
Water Depth [m]	33.4	Reference	Ellipsoid: ETRS89 Projection: UTM Zone 32N, Vertical Datum: DTU21 MSS(MSL) height

The burial below seabed is calculated in three steps:

1. Calculate total length of the coil [A]
2. Calculate length of the lost coil; by subtracting the recovered coil length [B] from the total coil length [A]
3. Calculate the depth of burial [D]; by subtracting the lost coil length from the recorded test depth [C].

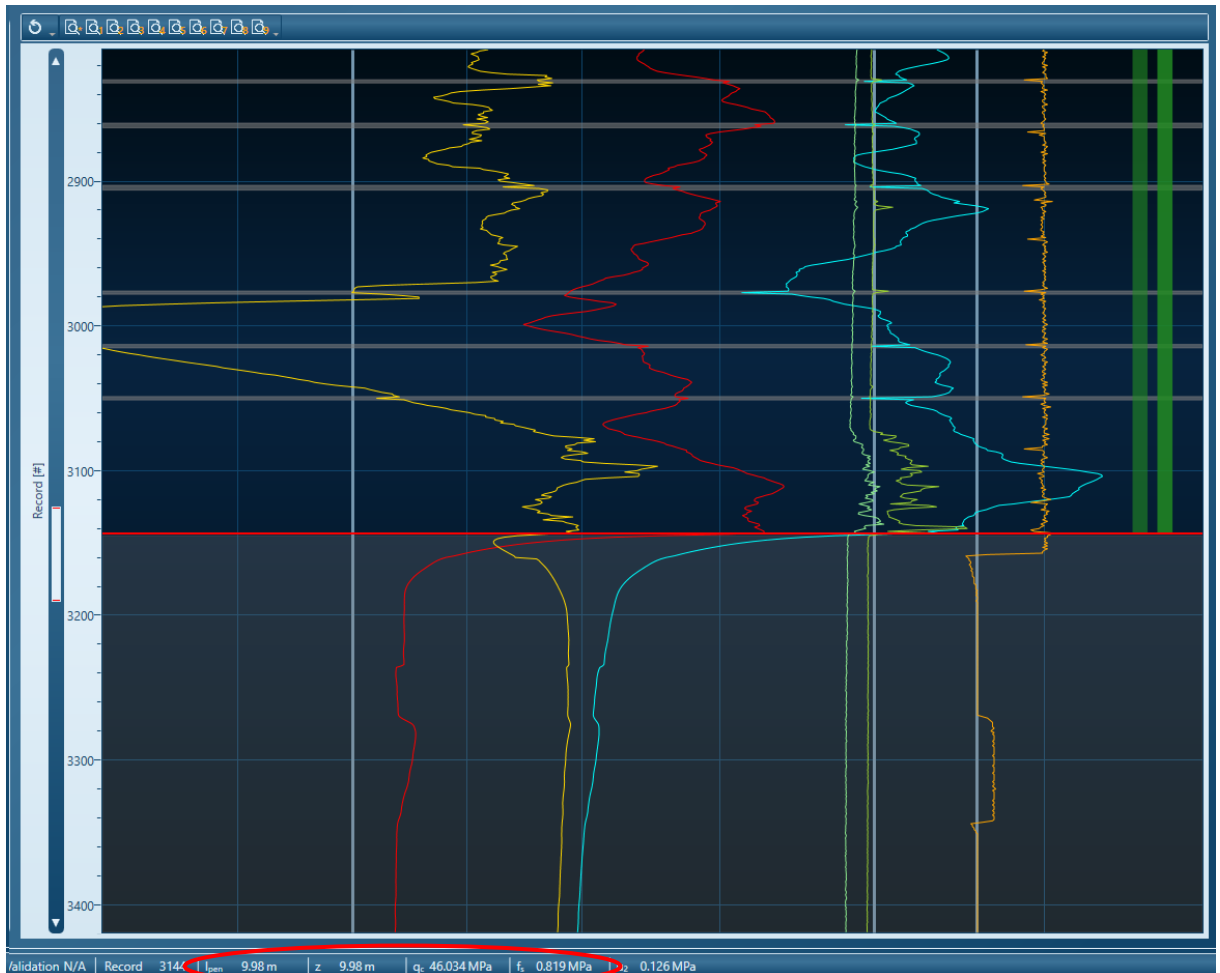
The calculation and all individual measurements are shown below:



A.1	Initial coil length [m]	60	
A.2	Length of cross-over and 2x pre-runners [m]	(0.60+2x0.9) 2.40	
A.3	Length cone [m]	0.27	+
A	Total Length coil [m]	62.67	62.67
B	Length recovered coil [m]	53.00	-
	Length of coil lost [m]	9.67	9.67
C	Recorded test length at lost equipment event [m]	9.98	-
D	Depth of coil below seafloor [m]		-0.31

3. Supporting Information

The screen shot of the processing software below, shows the cone penetration test CPT343A reached a penetration length of 9.98m, at this point the test was stopped due to possible buckling.



The operators started retracting until 9.40m. At this point, the buckled & sheared end of the coil was stuck at the clamps and couldn't move further, the seabed-frame was then lifted back to deck. During hoisting of the seabed-frame connection to the cone was lost. Once the frame was back on the landing blocks it was clear that the remaining coil was lost.

The bent section had to be cut from the remaining coil before taking it out of the CDS. A 7.0m section of the coil, two pre-runner (2x0.9m length), one cross-over (0.6m length) and one cone (0.27m length) were lost in the ground.



Energinet – Danish OWF 2030 Lot2

Lost Equipment / Site clearance Assessment | CPT193

F217703-SCA-004 01 | 3 March 2024

Issue: 01

Energinet Eltransmission A/S

ENERGINET



1. Summary

This document presents results of a site clearance assessment following a lost equipment event during seafloor cone penetration testing at location CPT193, within the Energinet – Danish OWF 2030 Lot 2 site on 03/03/2024 ~14:00hrs (UTC+1). The assessment shows that the top of the rod of the lost assembly is buried around 1.32m below current seafloor level.

2. Site Clearance Assessment

Table 1 provides the exact location where the site clearance assessment is applicable:

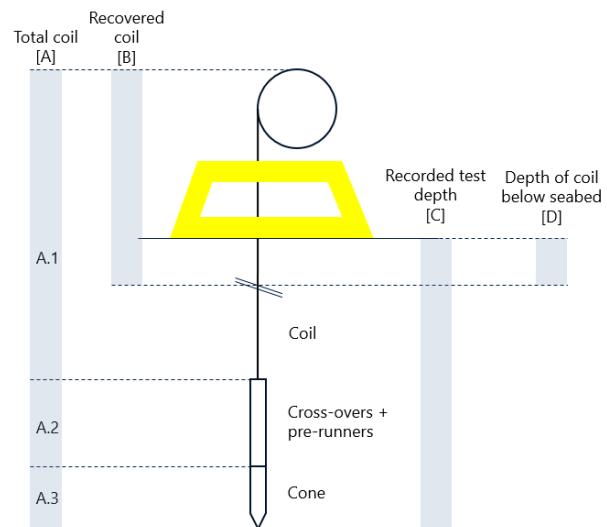
Table 1: Location details

Location	CPT193	Coordinates	Easting 374209.91 ; Northing 6192400.24 Latitude 55° 51' 38.4497" N ; Longitude 006° 59' 24.5909" E
Water Depth [m]	35.0	Reference	Ellipsoid: ETRS89 Projection: UTM Zone 32N, Vertical Datum: DTU21 MSS (MSL) height

The burial below seabed is calculated in three steps:

1. Calculate total length of the coil [A]
2. Calculate length of the lost coil; by subtracting the recovered coil length [B] from the total coil length [A]
3. Calculate the depth of burial [D]; by subtracting the lost coil length from the recorded test depth [C].

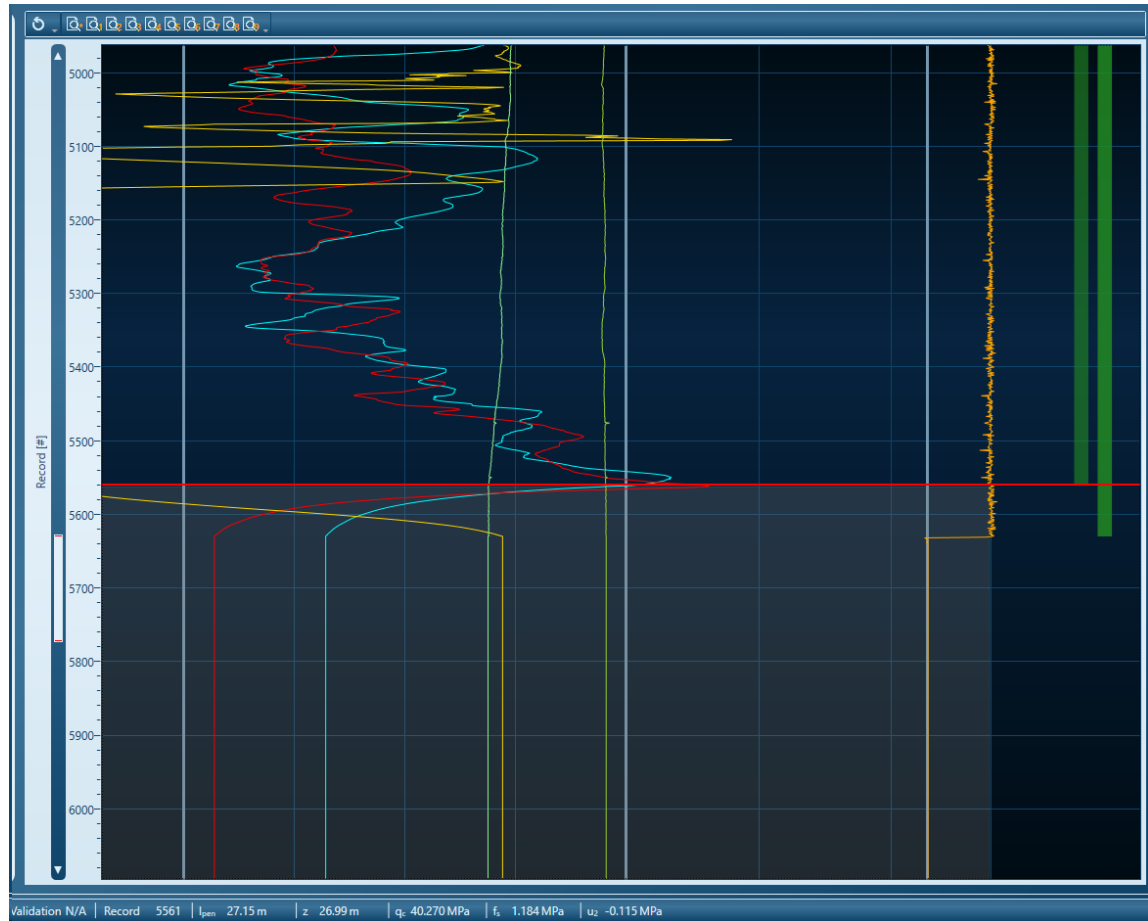
The calculation and all individual measurements are shown below:



A.1	Initial coil length [m]	60	
A.2	Length of cross-over and 2x pre-runners [m]	(0.60+2x0.9) 2.40	
A.3	Length cone [m]	0.27	+
A	Total Length coil [m]	62.67	62.67
B	Length recovered coil [m]	37.00	-
	Length of coil lost [m]	25.67	25.67
C	Recorded test length at lost equipment event [m]	26.99	-
D	Depth of coil below seafloor [m]		-1.32

3. Supporting Information

The screen shot of the processing software below, shows the cone penetration test CPT193 reached a penetration length of 26.99m, at this point the test was stopped due to buckling.



The operators started retracting until the coil couldn't pass through the clamps (registered in software as 25.40m). At this point, the frame was then lifted back to deck. Once the frame was back on the landing blocks it was clear that the remaining coil was lost.

The bent section had to be cut from the remaining coil before taking it out of the CDS. A 23m section of the coil, two pre-runner (2x0.9m length), one cross-over (0.6m length) and one cone (0.27m length) were lost in the ground.

Appendix E

Health, Safety and Environment

Contents Appendix E: Health, Safety and Environment

- E.1: **Toolbox Meetings**
- E.2: **Incident Notification Reports**
- E.3: **Hazard Observation Cards**

E.1 Toolbox Meetings

Toolbox Meetings records have been shared with Energinet Eltransmission A/S separately.

E.2 Incident Reports

Incident Reports have been shared with Energinet Eltransmission A/S separately.

E.3 Hazard Observation Cards

List of Plates

Hazard observation card register form have been shared with Energinet Eltransmission A/S separately.