

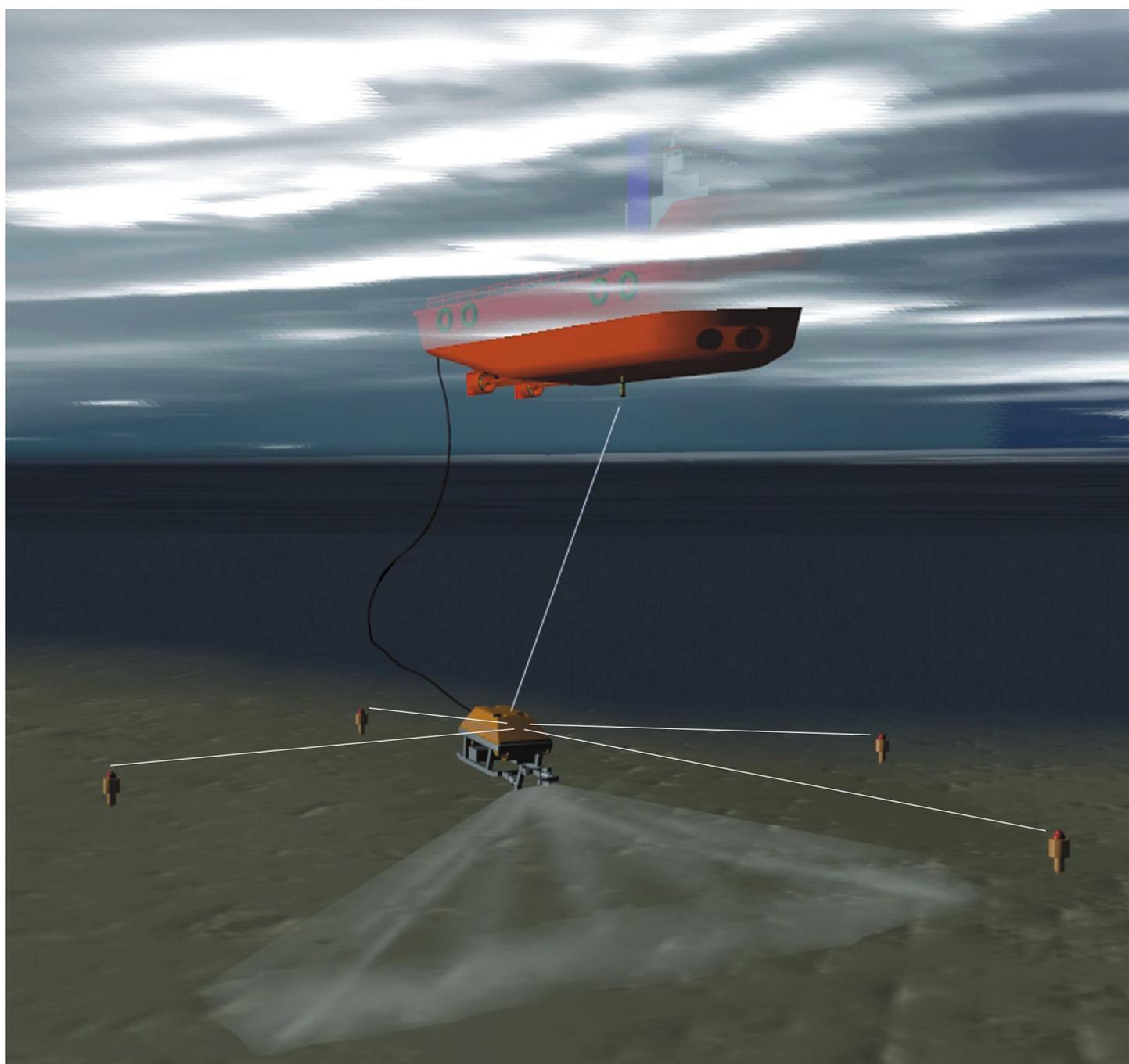
Instruction manual



KONGSBERG

cPAP®

Subsea transceiver MF and LF



cPAP[®]

Subsea Transceiver MF and LF

Instruction manual

Document history

Rev	Date	Written by	Checked by	Approved by
B	2 July 2015	IJG	TGE	SER
Added cPAP 17 with all relevant information and outline drawing.				

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Disclaimer

Kongsberg Maritime endeavors to ensure that all information in this document is correct and fairly stated, but does not accept liability for any errors or omission.

Warning

The equipment to which this manual applies must only be used for the purpose for which it was designed. Improper use or maintenance may cause damage to the equipment and/or injury to personnel. The user must be familiar with the contents of the appropriate manuals before attempting to operate or work on the equipment. Kongsberg Maritime disclaims any responsibility for damage or injury caused by improper installation, use or maintenance of the equipment.

Support

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HIGH VOLTAGE SAFETY WARNING

The voltages used to power this equipment are potentially lethal. Even 110/230 Vac can kill.

Whenever possible, the following precautionary measures should be taken before any work is carried out inside the equipment:

- Switch off all high-voltage power supplies.
- Check the operation of any door interlocks and any other safety devices.
- Completely discharge all high-voltage capacitors.

It should be noted that interlocks and safety devices are normally located only at regular access points, and high voltages may be exposed during dismantling.

Caution

*Never work alone on high-voltage equipment!
Refer to general safety procedures.*

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1 ABOUT THIS MANUAL

This is the Instruction manual for the cPAP Subsea transceiver.

Manual content

This manual describes the cPAP Subsea transceiver.

The manual provides a general introduction to the unit, technical specifications, operating information and maintenance procedures. It also includes spare part list and outline dimension drawings.

Abbreviations

APC	Acoustic Positioning Computer
APOS	Acoustic Positioning Operator Station
AUV	Autonomous Underwater Vehicle
HiPAP®	High Precision Acoustic Positioning
LBL	Long Base Line
LF	Low Frequency
MF	Medium Frequency
N/A	Not applicable
ROV	Remotely Operated Vehicle
SBL	Short Base Line
SSBL	Super Short Base Line
TD	Transducer
TDR	Remote transducer
TP	Transponder

2 BASIC SYSTEM INFORMATION

This chapter gives an overall description of the cPAP Subsea transceiver.

Topics

- *Short description – on page 2*
- *Models – on page 3*
- *Remote transducers – on page 3*
- *Topside system – on page 4*
- *Subsea system – on page 4*

Short description



Figure 1 cPAP 34 with TDR30H

- The cPAP is designed for ROV LBL positioning and other underwater umbilical connected vehicle or module.
- The cPAP subsea transceiver is compatible with both Cymbal acoustic protocol for positioning and data link, and HPR 400 channels and telemetry.
- LBL positioning
- Acoustic telemetry link for command and data transfer.
- SSBL Range measurement positioning
- The subsea transceiver unit is designed with a modular construction such that the transducer, transceiver electronics and end cap modules can be replaced individually to suit its purpose.
- cPAP 34 is a medium frequency transceiver with a 4000 metre depth rating.
- cPAP 17 is a low frequency transceiver with a 7000 metre depth rating.

Models

Medium frequency

cPAP 34



- Basic unit - subsea transceiver without transducer
- Up to three (3) remote transducers connected

P/N: 330098

cPAP 34-30H



- Subsea transceiver with integrated transducer
- 30° horizontal beam width

P/N: 349741

Low frequency

cPAP 17



- Basic unit - subsea transceiver without transducer
- Up to three (3) remote transducers connected

P/N: 392298

Remote transducers

Medium frequency

TDR30H



- 30° horizontal beam width

P/N: 345773

TDR180



- 180° beam width
- P/N: 349742

TDR40V



- 40° vertical beam width
- P/N: 349743

Low frequency

TDR180



- 180° beam width
- P/N: 394674

Topside system

The topside HiPAP/HPR system and the operation station are described in separate manuals.

System description

→ *Refer to the HiPAP / HPR Instruction manuals.*

Operation

→ *Refer to APOS Instruction manual/APOS online help.*

Subsea system

The cPAP system has the subsea transceiver unit installed on the ROV together with the transducer(s).

The cPAP Subsea transceiver unit is connected to the topside HiPAP/HPR operator station via optical fibers or RS-422 line in an umbilical. The interface to the topside HiPAP/HPR secures full operation from the APOS.

The cPAP system uses the same positioning transponders as a topside HiPAP/HPR system, and the operational principles are identical to those systems.

3 TECHNICAL SPECIFICATIONS

This chapter lists the main technical specification for the cPAP Subsea transceiver units.

Topics

- *Medium frequency - on page 5*
- *Low frequency – on page 5*
- *Remote transducers – on page 6*

Medium frequency

Frequency band	30 kHz
Depth rating	4000 m
Operating temperature	-5 °C to 55 °C
Power supply	110/230 Vac or Max. 15 V DC (optional)
Power consumption	Max. 250 W (transmitting pulses)
Data interface	RS-422 and RS-232
Baud rate	9600 baud
Housing	Anodised aluminium
Housing coating	Polyurethane

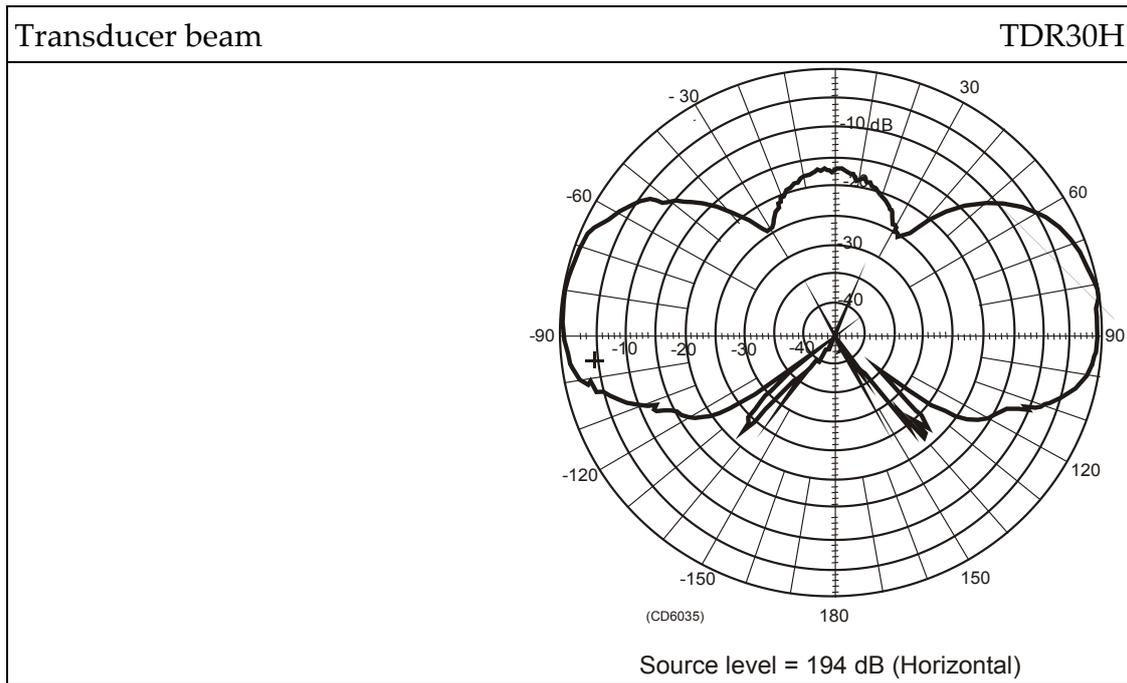
Low frequency

Frequency band	10-16 kHz
Depth rating	7000 m
Operating temperature	-5 °C to 55 °C
Power supply	110/230 Vac or Max. 15 V DC (optional)
Power consumption	Max. 250 W (transmitting pulses)
Data interface	RS-422 and RS-232

Baud rate	9600 baud
Housing	Stainless steel
Housing coating	Polyurethane

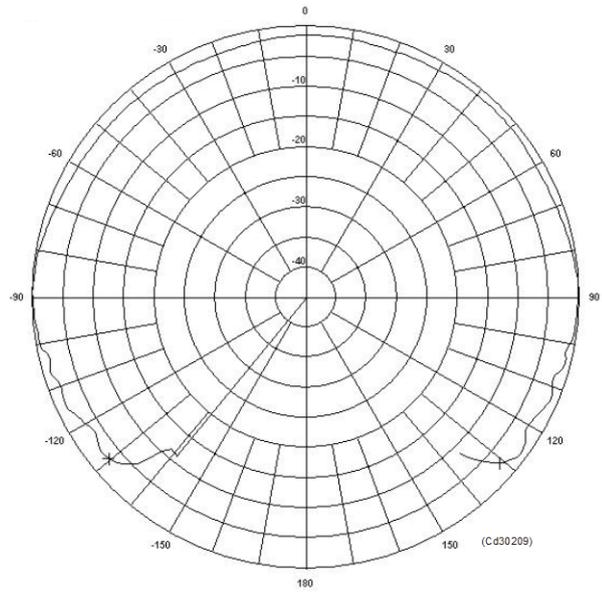
Remote transducers

Transducer beam widths



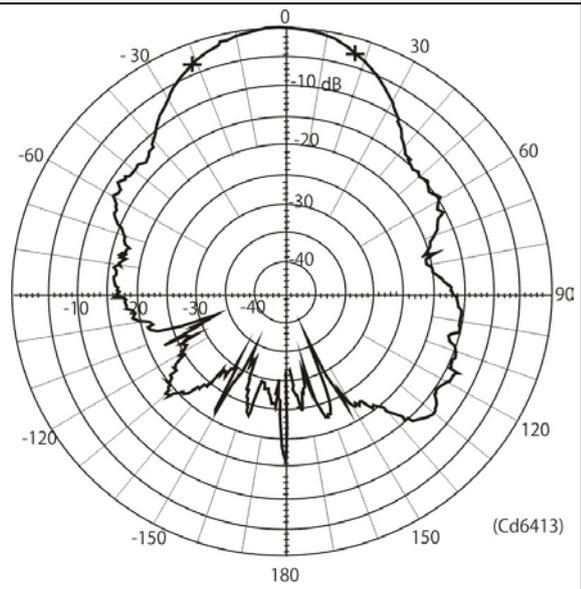
Transducer beam

TDR180



Transducer beam

TDR40V



Source level = 203 dB

4 SETUP AND CONFIGURATION

This chapter gives a brief overview of the basic system setup for the cPAP Subsea transceiver.

Topics

- *Installing the transducer - on page 8*
- *Connecting the subsea cable to the cPAP and the transducer - on page 9*
- *Connecting the subsea interface cable to the cPAP and the external unit on page 9*
- *Turning the cPAP ON and OFF- on page 10*
- *Data interface - on page 10*
- *Setting up the cPAP in APOS - on page 10*

Installing the transducer

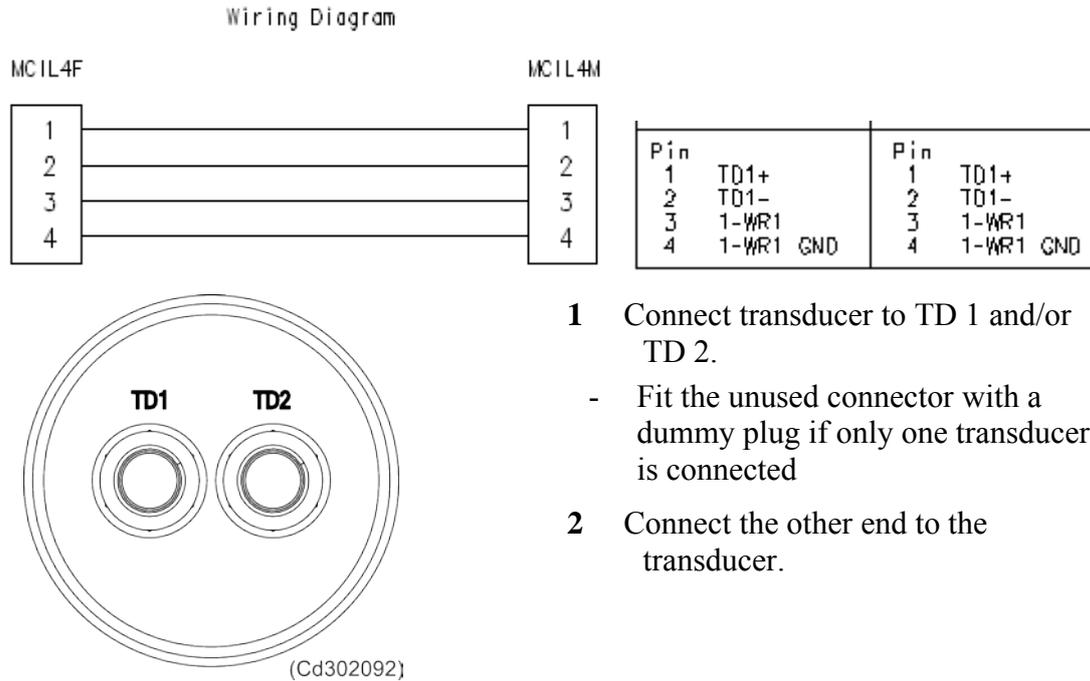


The transducer needs to be protected during launch and recovery of the ROV. It is also important to get a good line of sight to the LBL transponders while the ROV is navigating close to the seabed. This can be solved by using a hydraulic ram to raise and lower the transducer as needed.

Power supply

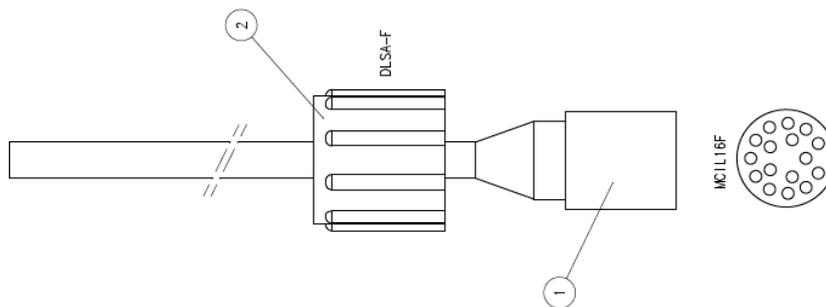
cPAP automatically detects 110/230 Vac and 15 V DC (optional).

Connecting the subsea cable to the cPAP and the transducer



- 1 Connect transducer to TD 1 and/or TD 2.
 - Fit the unused connector with a dummy plug if only one transducer is connected
- 2 Connect the other end to the transducer.

Connecting the subsea interface cable to the cPAP and the external unit



→ See wiring diagram for this cable in the drawing file chapter on page 27.

Caution

Max. 15 V DC Ext power connected to the 16 pin connector on the cPAP.

- 1 Connect the 16 pin connector (1) to the connector on the cPAP.
- 2 Fasten the cable with the plastic sleeve (2) once connected.

- 3 The customer has to add their plug to the cable.

Turning the cPAP ON and OFF



The ON/OFF switch has 4 positions. The subsea transceiver is only switched ON when the two marker dots are aligned. All other positions are OFF.

Data interface

cPAP automatically detects both RS-232 and RS-422 signal.

Setting up the cPAP in APOS

→ *For all information about the setup and configuration of the cPAP subsea transceiver - see APOS Online Help.*

5 DEPLOYMENT AND OPERATION

This chapter describes how to start using the cPAP Subsea transceiver.

Topics

- *Pre-deployment checks - on page 11*
- *Mounting - on page 11*
- *Operation - on page 12*

Pre-deployment checks

Before you deploy the subsea transceiver, you must:

- 1 Ensure that interface cable and transducer cables are properly connected to the cPAP.
- 2 Ensure the on/off switch on the end cap is switched ON.
- 3 Perform a visual inspection of the subsea transceiver.
 - The ventscrew and the pressure relief valve must be closed.
 - The lock cords are inserted.
- 4 Perform a functional check before deployment.

The functional check can be performed as follows:

- *Refer to the APOS Instruction manual/APOS online help.*
- On deck test:
 - Operate the cPAP together with a transponder on deck.
 - Place the cPAP transducer face to face with the transponder transducer.

Mounting

Mounting brackets

The subsea transceiver may be secured to a ROV using mounting brackets.

- *See proposed installation of transducer on page 8.*

Transducers

Ensure free sight between the cPAP transducers on the ROV and transponders on the sea bed.

Warning

Do not install any metal clamps etc. onto aluminium surfaces on the subsea transceiver, as this can generate galvanic current, causing corrosion on the subsea transceiver.

Operation

→ *For all information about the operation of the cPAP subsea transceiver - see APOS Online Help.*

6 MAINTENANCE

The following maintenance is normally required:

- Washing the unit.
- Lubrication of the external connector

Caution

Electronic devices can be destroyed by static electricity. It is therefore essential that full protection against static is practised by service engineers. Although the unit is resistant to mechanical vibration and shock, every effort must be made to avoid careless handling when the unit is in use or being transported.

Topics

- *O-rings - on page 13*
- *Preventive maintenance - on page 13*
- *Opening the transponder - on page 14*
- *Replacing the transducer - on page 15*
- *Assembling the transponder - on page 15*
- *Lubricating the subsea connectors - on page 16*

O-rings

Whenever the subsea transceiver is opened and the O-rings are exposed, precautions must be taken. This includes keeping the O-rings and mating surfaces free of dust and debris. If any of the mentioned surfaces is to be cleaned, it is important to use lint-free objects. Q-tips must never be used to clean areas anywhere near an O-ring.

When inserting an O-ring, make sure the surface is clean, and that it is covered with a thin film of silicone grease.

Preventive maintenance

Preventive maintenance is limited to keeping the unit clean.

Caution

Do not use high pressure water as this will damage the transducer face.

- Remove all traces of salt and debris.
- Before any connectors are disconnected, ensure the surrounding areas are dry.
- Inspect the unit for damage at regular intervals. Pay particular attention to the transducer surface. This is manufactured of a synthetic rubber material, and can easily be damaged.

Opening the cPAP

Before you open the unit:

- 1 Wash the unit thoroughly in fresh water, and dry off any moisture on the outside.
- 2 Place the subsea transceiver horizontally on a flat, clean work-bench, and support it so it cannot roll off.
- 3 Turn OFF the subsea transceiver.
- 4 Disconnect any external cables.

Opening the unit:

The unit is held together by a lock cord inserted in a groove between the tube and the end cap / transducer. Access to the cord is via two clearly visible slots at either end of the subsea transceiver tube. The cord is inserted by hand, and it is removed by picking up the free end visible in one slot, and pushing the other end (visible in the other slot).

Caution Take care not to use sharp objects that can damage the anodized surface of the aluminium.

Caution Observe the 5 mm orientation peg at either end of the tube. When pulling apart, make sure to keep this orientation until parts are completely free from each other. Forceful twisting of the parts relative to each other while the internal parts are still mated, will damage the unit.

- 1 Remove the retaining cord between the bottom end cap (interface) and the tube, as described above.
- 2 Carefully pull the bottom end cap from the unit.
- 3 The bottom end cap is fitted with two guiding pins that fit into two holes in the electronic chassis.

- 4 Remove the lock cord between the top end cap (transducer) and the tube, as described above.
- 5 Pull the tube from the top end cap (transducer). Support the top end cap (transducer) as it is withdrawn.
 - All internal parts are now clearly visible and accessible.
- 6 Once the O-ring is clear of the housing, the top end cap (transducer) and electronics chassis may be removed.

Replacing the transducer

If the transducer is not working, the whole module must be replaced.

- 1 Open the cPAP.



- 2 Remove the transducer from the electronics chassis (2 fixing screws).
- 3 Assembly is basically the reverse of dismantling.

Assembling the cPAP

Before you start:

- 1 Inspect the O-rings and backup rings for damage. If in doubt, or if they have been used for more than one year, they should be replaced.
- 2 Place the new bag of silica-gel desiccant into the housing to absorb any humidity that may have entered the unit while it was open.

- 3 Ensure all surfaces, O-rings and backup rings are *completely* clean and then wipe a thin film of silica-gel over the rings and mating surfaces.

Assembling:

Assembly is the reverse of disassembly.

Handling the O-rings:

- 1 Check the condition of the rings and carry out any necessary replacements.
- 2 Ensure the O-ring surfaces are clean and free from any dust, debris or old grease.
- 3 Lightly grease the rings prior to assembly using Molykote 33 grease or similar.
- 4 Re-fit the O-rings (see figure below).

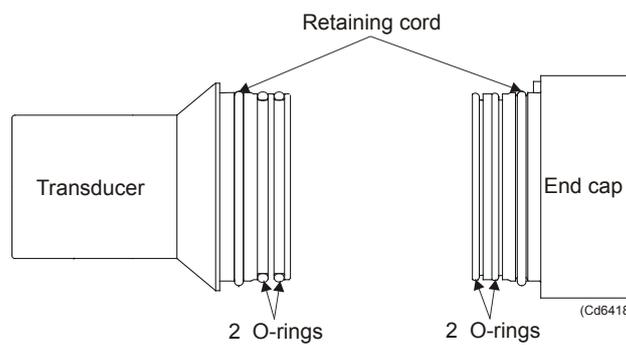


Figure 2 O-ring locations on transponder

Lubricating the subsea connectors

The subsea connectors should be kept free from grit and dirt.

The manufacturer recommends lubricating the pins with:

- Molykote 44M silicone based grease.
 - Do *not* use silicone based sprays like 5-55, WD-40 or similar. These will degrade the rubber fused around the metal pins.

Note

Use it sparingly; half a match-head dose per contact is adequate.

7 SPARE PARTS

This chapter lists the parts and modules defined by Kongsberg Maritime as *Line Replaceable Units (LRUs)*. The required mounting components (such as nuts, bolts, washers etc.) are identified on the diagrams, but have not been allocated order numbers as we regard these items as standard commercial parts available from retail outlets around the world.

Maintenance kit

Unit name	Unit P/N
cPAP Maintenance kit	404321

Medium frequency

cPAP units

Unit name	Unit P/N
cPAP 34	330098
cPAP 34-30H	349741

cPAP Main modules

Unit name	Unit P/N
Transponder main units	
Chassis w/circuit boards and power modules	341776
Housing coated (tube)	381381
Top end cap (transducer)	
Options Top end cap 2 x TD	342293
Transducer TD30H	361662
Bottom end cap	
Bottom end cap	341743

Remote transducers

Unit name	Unit P/N
TDR30H	345773

Unit name	Unit P/N
TDR180	349742
TDR40V	349743

Low frequency

cPAP units

Unit name	Unit P/N
cPAP 17	392298

cPAP Main modules

Unit name	Unit P/N
Transponder main units	
Chassis w/circuit boards and power modules	392300
Housing coated (tube)	381337
Top end cap	
Top end cap 2 x TD	392227
Bottom end cap	
Bottom end cap	381219

Remote transducer

Unit name	Unit P/N
TDR180 LF	394674

Cables for all cPAP's

Unit name	Unit P/N
Subsea cable for cPAP transducer	345772
Subsea cable for cPAP interface	345771

8 DRAWING FILE

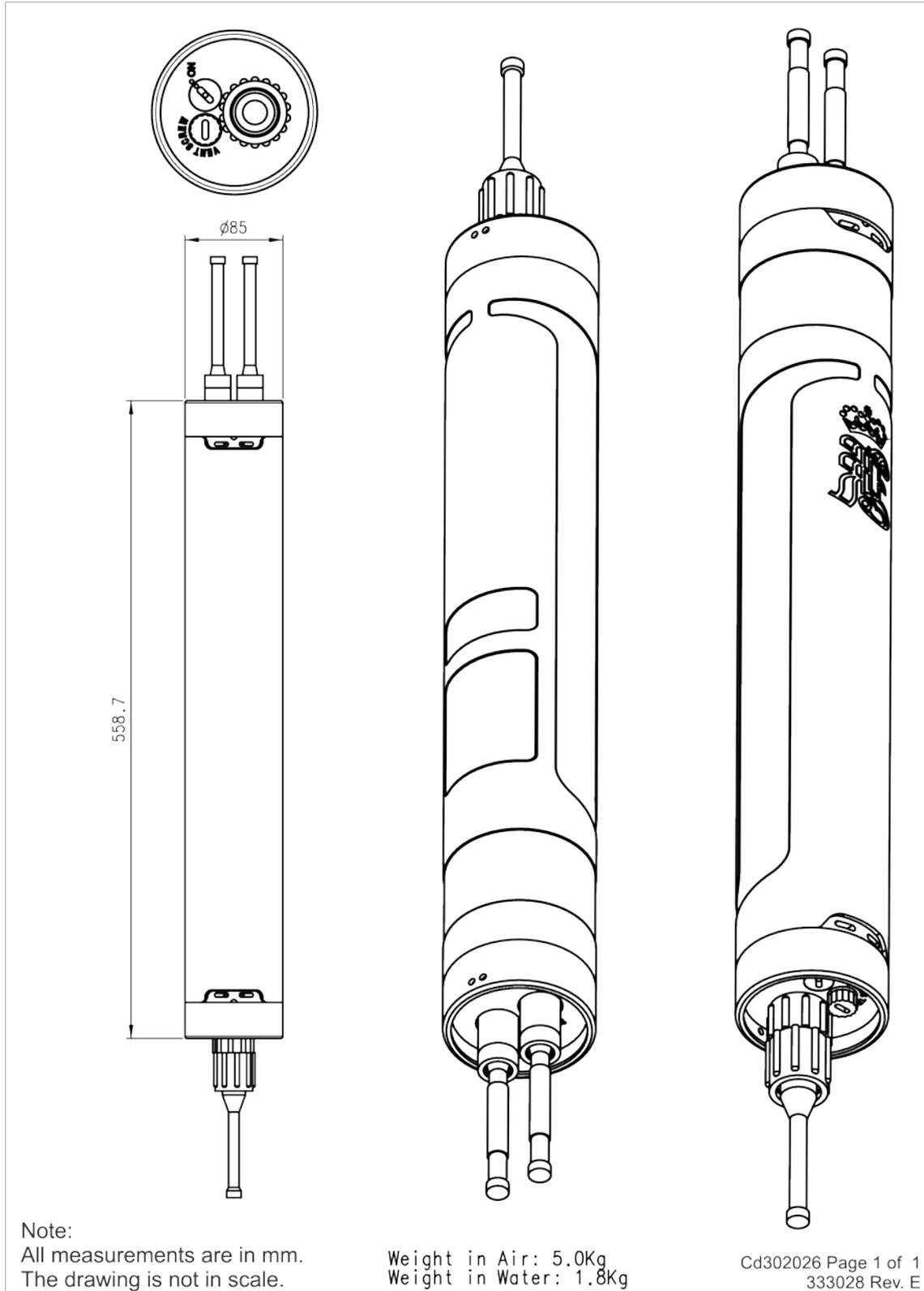
This chapter holds illustrations referred to in various sections in this manual. The illustrations are based on the original system drawings and wiring diagrams.

- The original drawings are available in electronic format on request.

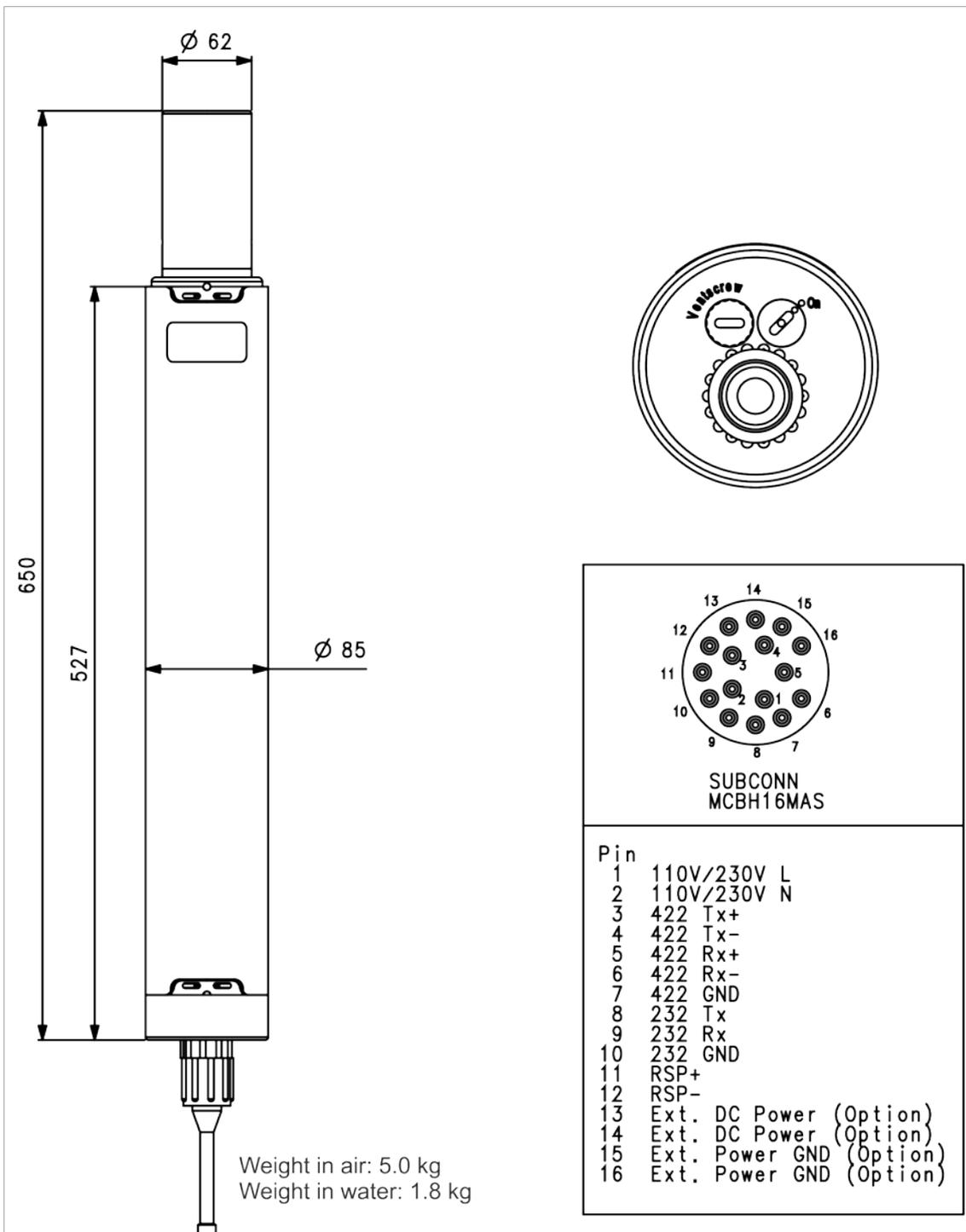
Drawings

Draw. No.	Rev.	Description	Ref.
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333028	E	Outline drawing – cPAP 34	on page 20
367370	A	Outline drawing – cPAP 34-30H	on page 21
402065		Outline drawing – TDR180	on page
830-219523	A	Outline drawing – TDR30H	on page 22
386439	A	Outline drawing – TDR40V	on page 23
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393810	A	Outline drawing – cPAP 17	on page 24
394785	A	Outline drawing – TDR180 LF	on page 25
Cables			
345771	A	Subsea interface cable	on page 26
345772	A	Subsea cable for transducer	on page 28

Outline drawing – cPAP 34

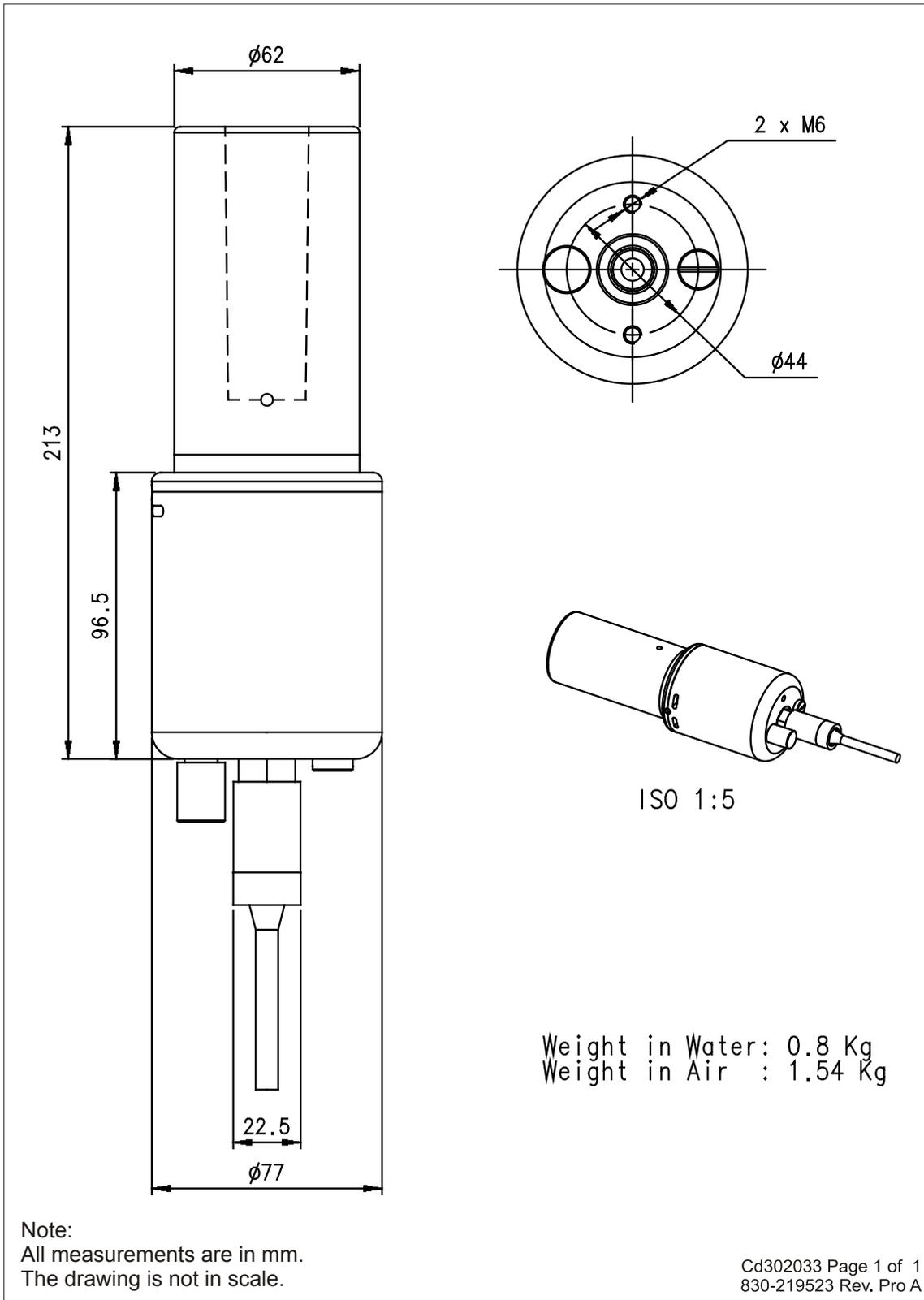


Outline drawing – cPAP 34-30H

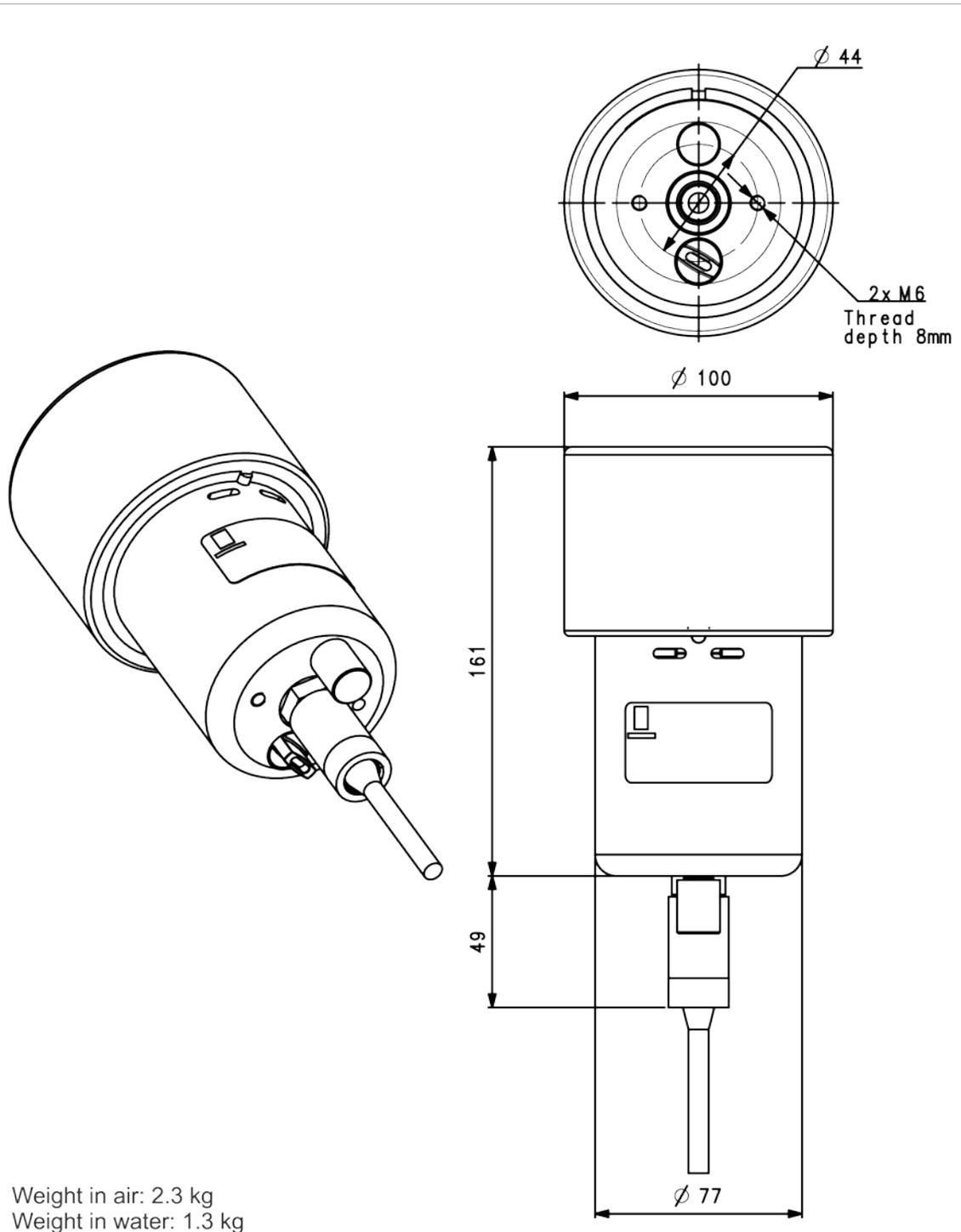


Note:
All measurements are in mm.
The drawing is not in scale.

Outline drawing – TDR30H



Outline drawing – TDR40V

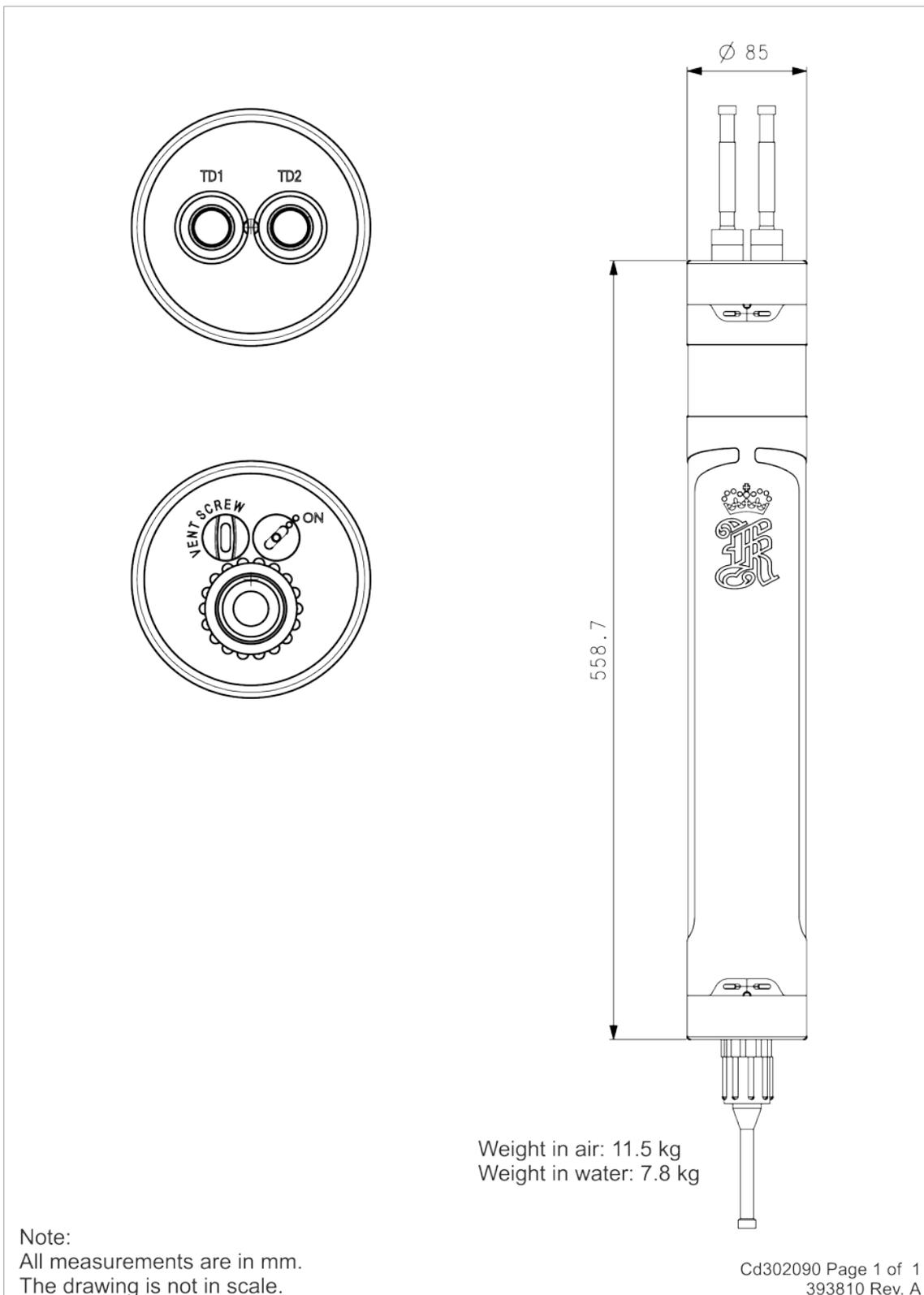


Weight in air: 2.3 kg
 Weight in water: 1.3 kg

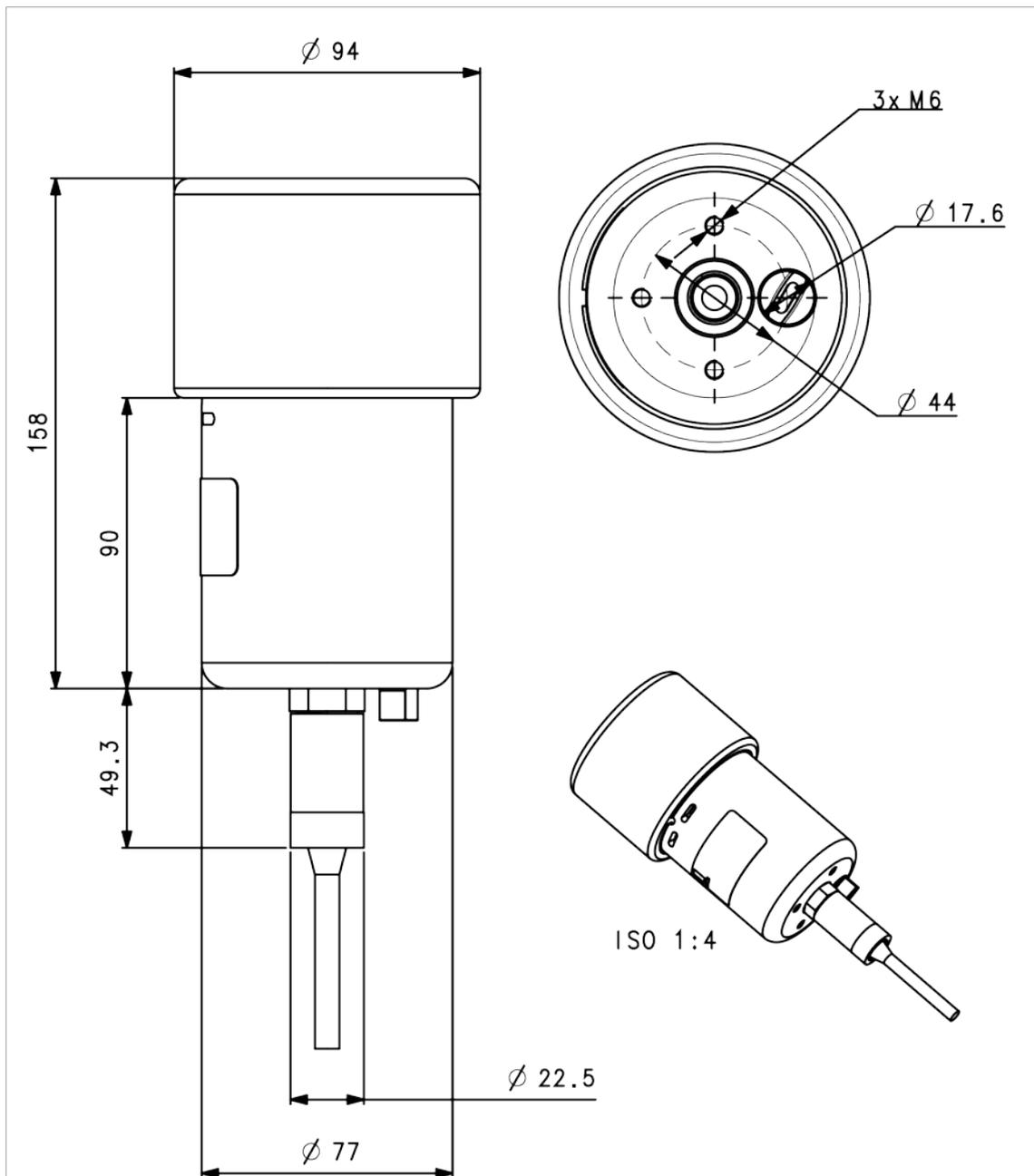
Note:
 All measurements are in mm.
 The drawing is not in scale.

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 386439 Rev. A

Outline drawing – cPAP 17



Outline drawing – TDR180LF

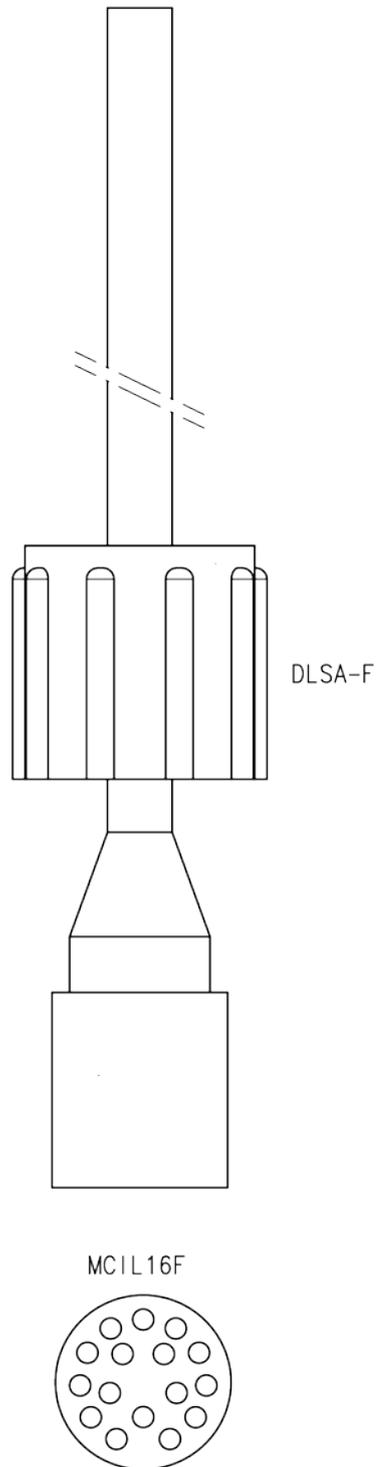


Weight in air: 4 kg
 Weight in water: 3.5 kg

Note:
 All measurements are in mm.
 The drawing is not in scale.

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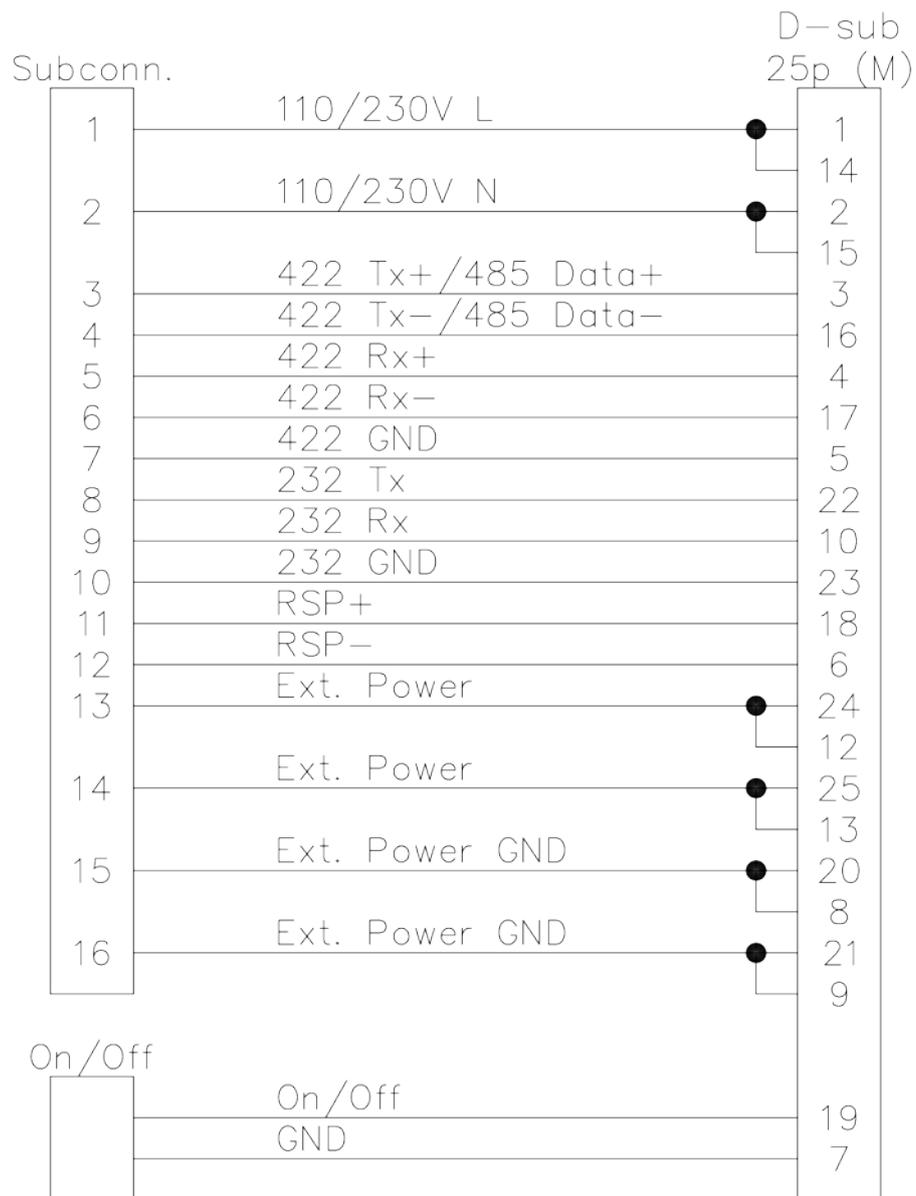
Subsea interface cable



Note:
All measurements are in mm.
The drawing is not in scale.

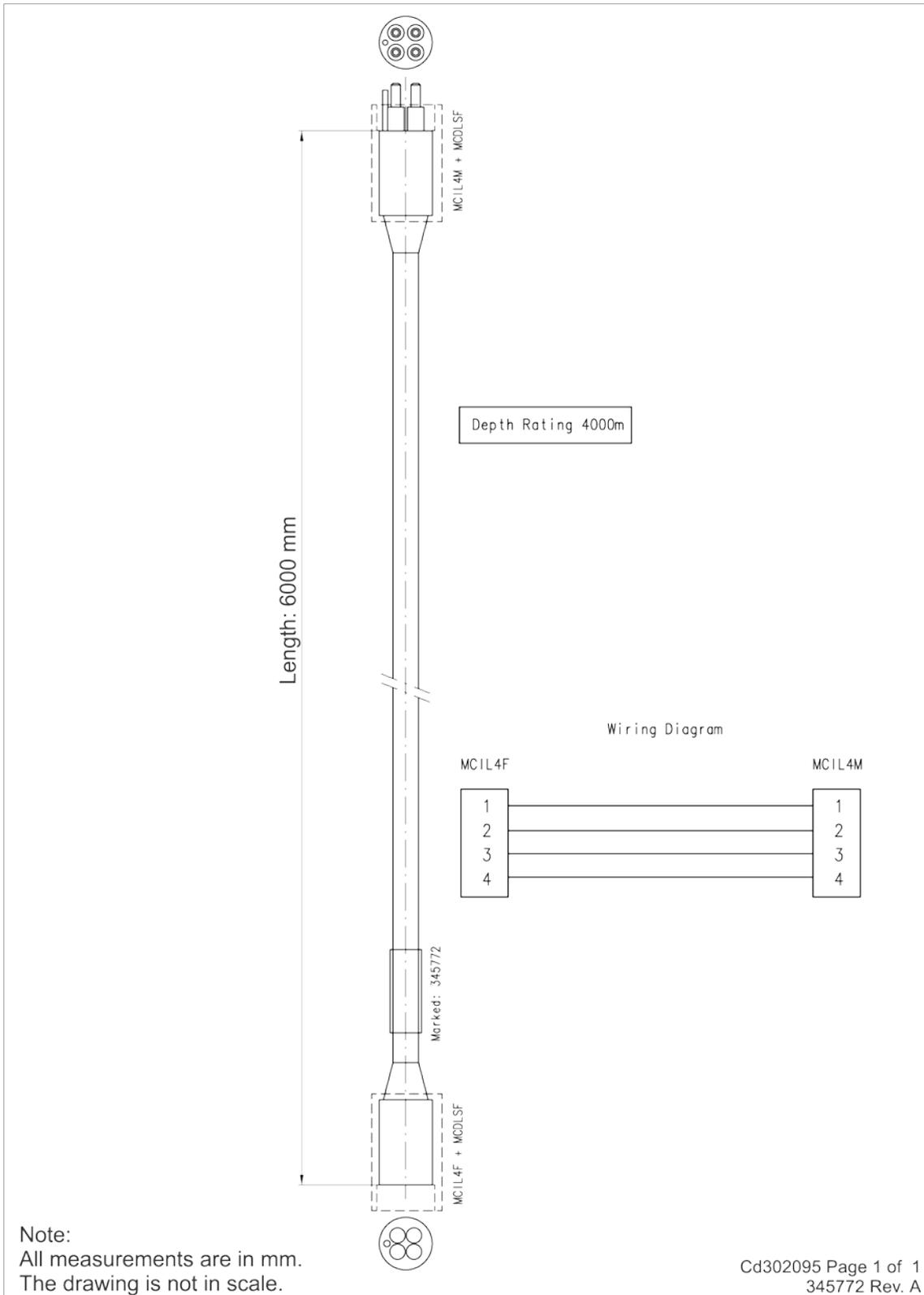
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Subsea interface cable – wiring diagram



Note:
 All measurements are in mm.
 The drawing is not in scale.

Subsea cable for transducer



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