



KONGSBERG

Instruction Manual

# μPAP

Portable acoustic positioning system







KONGSBERG

***μPAP***  
***Portable Acoustic Positioning system***  
***Instruction Manual***

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## Document information

- **Product:** Kongsberg  $\mu$ PAP
- **Document:** Instruction Manual
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## 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. You must be familiar with the contents of the appropriate manuals before attempting to operate or work on the equipment.*

*Kongsberg Discovery disclaims any responsibility for damage or injury caused by improper installation, use or maintenance of the equipment.*

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## Support information

If you require maintenance or repair, contact Kongsberg Discovery's support organisation. You can also contact us at the following email address: [support.hpr@kd.kongsberg.com](mailto:support.hpr@kd.kongsberg.com). If you need information about our other products, visit <https://www.kongsberg.com/discovery/>.

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# About this manual

This manual includes all necessary documentation to safely install, operate and maintain the system.

## **Target audience**

This manual is intended for all users of the system.

## **Online information**

All end-user documentation can be downloaded from our website.

<https://www.kongsberg.com/discovery/>

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HiPAP® is a registered trademark of Kongsberg Discovery AS in Norway and other countries.

cNODE® is a registered trademark of Kongsberg Discovery AS in Norway and other countries.

# Introduction

## Topics

[System description, page 7](#)

[System diagram, page 8](#)

[System units, page 9](#)

[Scope of supply, page 12](#)

[General supply conditions, page 13](#)

[Support information, page 14](#)

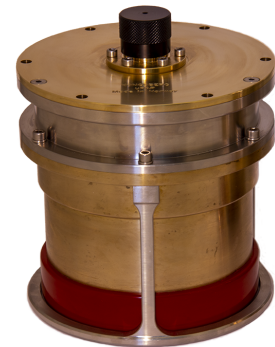


## System description

The product range consists of several models.

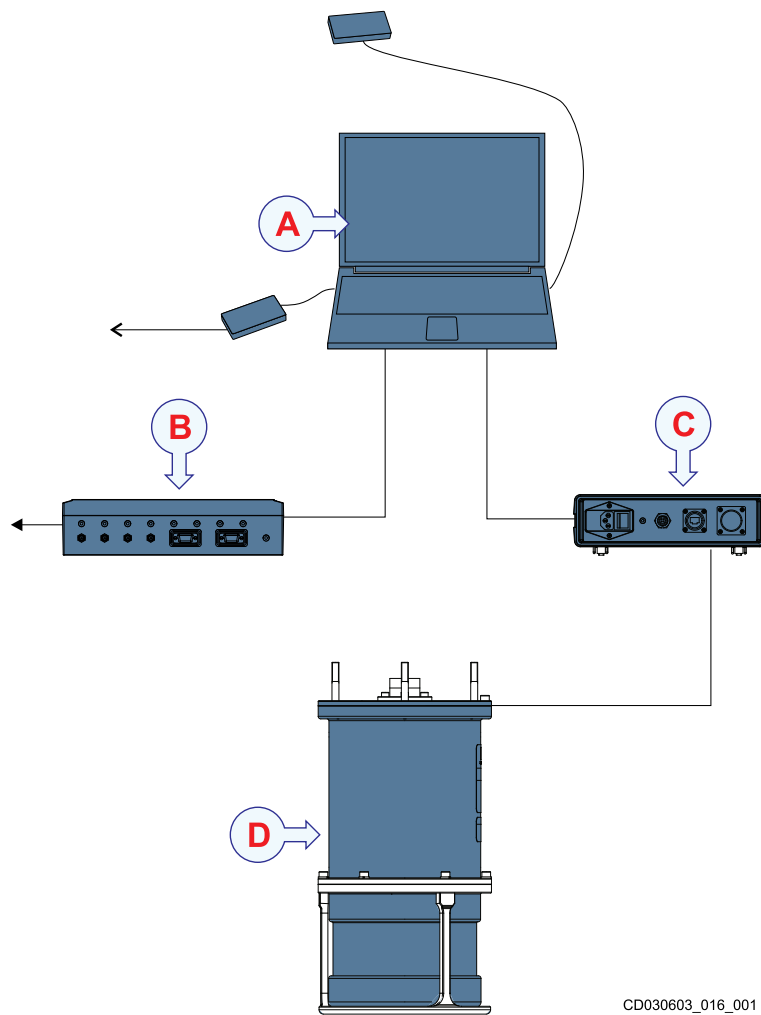


$\mu$ PAP is a portable and compact acoustic positioning system for tracking ROVs, tow fish, divers or other subsea objects at several thousand metres range. The transducers are mounted on a pole for installation over-the-side or through a ship's moon pool. The system is easy to install on ships or other surface units and comes with a wide range of transponder channels and cNODE<sup>®</sup> transponder models for depths down to 4000 metres.



## System diagram

The system diagram outlines the standard configuration of a μPAP portable acoustic positioning system and its main units. Only the main connections between the units are included in the diagram.



- A Computer
- B Responder Driver Unit (optional)
- C Interface Unit
- D Transducer

## System units

### $\mu$ PAP transducers

The transducer's casing is made of stainless steel and bronze in order to obtain optimal anti-corrosion properties. The casing encloses and protects the electronics and the acoustic transducer elements needed for transmitting and receiving acoustic signals, as well as the roll and pitch motion sensor and the power supply. A frame fitted to the casing protects the lower part of the transducer and its underside, or face, from accidental damage. The frame also functions as a stand and supports the transducer when it is placed on deck or on any other level surface. The transducer has mounting brackets for easy mounting on a pole and can be tilted sideways if needed during operations.

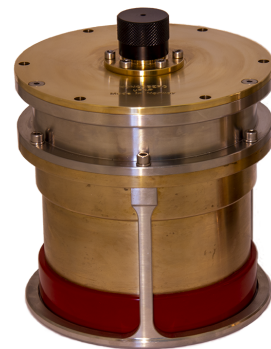
The transducer is delivered in a sturdy transport case.

#### Note

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*Care must be taken to avoid accidental damage to the transducer's lower part and its underside, or face. The transducer **must not** be placed in direct sunlight when stored on deck.*

---





## Interface unit description

The interface unit connects the transducer and the APOS operator station.

The interface unit includes a power supply that also powers the transducer. It connects to the transducer, the computer and optionally to a responder.



## Responder Driver Unit (optional)

The Responder Driver Unit controls and distributes responder trigger signals to responders.

The Responder Driver Unit is a stand-alone unit. The Responder Driver Unit is connected to the interface unit. APOS controls and activates the designated drive prior to reception of the sync/timing signal from the transceiver.



## Repeater unit (optional)

A repeater unit is needed to amplify the signals if the length of the transducer cable is more than 70 metres.

The subsea repeater unit amplifies the signals between the transducer and the interface unit.



## Scope of supply

All main units needed are included in the standard delivery.

When unpacking the μPAP system delivery, make sure the following items are included:

- Transducer
- Transducer cable
- Operator station
  - Laptop computer  
USB to serial line unit
  
  - Stationary computer  
Display  
Keyboard
- Interface unit
- Instruction Manual

Optional items

- Responder Driver Unit
- Ethernet switch
- Repeater unit

## General supply conditions

General supply conditions apply to this  $\mu$ PAP delivery.

### Receipt, unpacking and storage

Upon accepting shipment of the equipment, the shipyard and/or the dealer must ensure that the delivery is complete and inspect each shipping container for evidence of physical damage.

If the inspection reveals any indication of crushing, dropping, immersion in water or any other form of damage, the recipient should request that a representative from the company used to transport the equipment be present during unpacking.

All equipment must be inspected for physical damage, i.e. broken controls and indicators, dents, scratches etc. during unpacking. If any damage to the equipment is discovered, the recipient must notify both the transportation company and Kongsberg Discovery so that Kongsberg Discovery can arrange for replacement or repair of the damaged equipment.

Once unpacked, the equipment must be stored in a controlled environment with an atmosphere free of corrosive agents, excessive humidity or temperature extremes.

The equipment must be covered to protect it from dust and other forms of contamination when stored.

### Equipment responsibility

Unless otherwise stated in the contract, the shipyard doing the installation and/or equipment dealer becomes fully responsible for the equipment upon receipt.

The duration of responsibility cover:

- The period of time the equipment is stored locally before installation
- The entire installation process
- Commissioning
- The period of time between commissioning and the final acceptance of the equipment by the end user or owner

Unless other arrangements have been made in the contract, the Kongsberg  $\mu$ PAP warranty period (as specified in the contract) begins when the acceptance documents have been signed.

## Support information

Should you need technical support for your μPAP system you must contact a Kongsberg Discovery office. A list of all our offices is available on our website. You can also contact our main support office in Norway.

Manuals and technical information can be downloaded from our support website.

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<b>Support website</b>	<a href="#">Product support A to Z</a>
<b>E-mail address</b>	<a href="mailto:support.hpr@kd.kongsberg.com">support.hpr@kd.kongsberg.com</a>

Kongsberg Discovery support is also available in the KM-Support App. Our support application is available for free in the App Store and Google Play. Search for KM-Support. The use of our support application is free of charge. Your mobile phone provider may charge you the cost of the communication.



# Installation

## Topics

[Installing the transducer, page 16](#)

[Installing the repeater unit \(optional\), page 17](#)

[Installing the Responder Driver Unit \(optional\), page 17](#)

[Converting from fibre optical to electrical signal, page 18](#)

## Installing the transducer

μPAP is designed for easy installation onboard ships and other surface units.

### Prerequisites

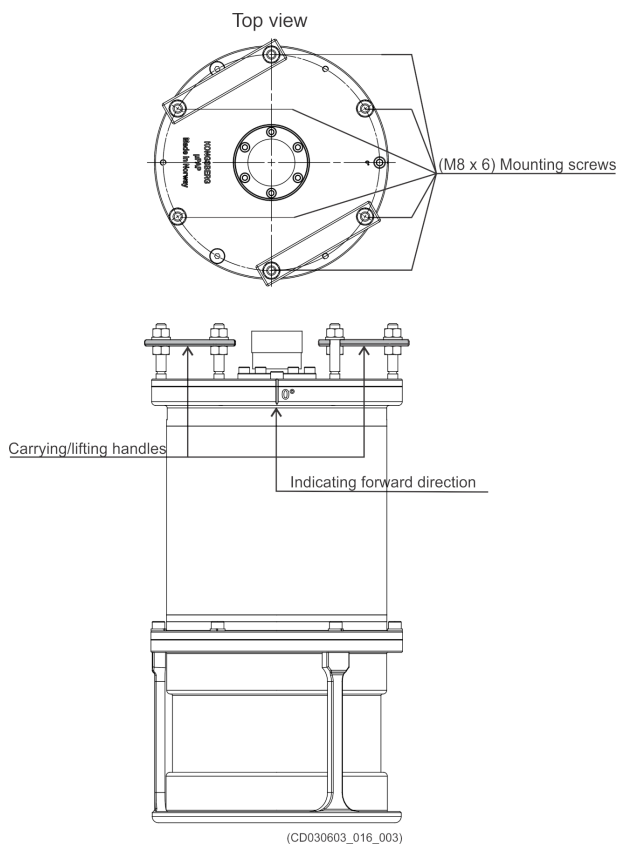
#### Caution

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*The cabling must be done before installing the transducer.*

---

### Context



The transducer is mounted on the ship's arrangement for the transducer. This may be on a pole lowered through a moon pool or a hull unit.

The location of the transducer arrangement must be as far away as possible from thrusters, aerated water, noise sources or other equipment sensitive to acoustic noise in the water.

[Installing the transducer to the ship's side pole, page 49](#)

### Procedure

- 1 Remove the lifting handles.

- 2 Mount the transducer with the forward indicator pointing forward.
- 3 Fasten the stud bolts.

## Installing the repeater unit (optional)

The transducer cables should be connected before mounting the repeater unit.

### Prerequisites

Mount the repeater unit to make sure it is not hanging by the cable. There are stud bolts for mounting at the top and the bottom of the unit.

### Procedure

- 1 Mount the unit with the arrow pointing upwards.
- 2 Fasten the bolts.

## Installing the Responder Driver Unit (optional)

The Responder Driver Unit is a stand-alone unit and can be mounted either horizontally or vertically.

### Prerequisites

The unit should be located where it is most suitable for connecting the cables to the responders. This can be close to the Remote Operating Vehicle (ROV) operation room. The unit must be installed so it is easily accessible for operators to check the working condition of the responder trigger status diodes.

### Procedure

- 1 Remove the four screws securing the lid.
- 2 Lift off the lid and locate the four mounting holes, one in each corner.
- 3 Mount the responder driver unit where suitable.  
Mounting screws, nuts and washers are included.
- 4 Close the unit.

### Note

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*Keep the protecting caps on the fibre-optic connectors to avoid accidental damage and contamination when not in use.*

---

## Converting from fibre optical to electrical signal

The converter works both ways and can be used to create an optical isolation between high voltage equipment and a transceiver.

### Context

You need one kit for each responder signal. Connectors are included to lengthen the cable if needed.

### Procedure

- 1 Produce the cable from the responder driver unit to the converter in accordance with drawing 308850 in the drawing file chapter. The connectors are included in the converter kit.
- 2 Secure the cable and connect it.
- 3 For an optical isolation, produce the cable from the converter to the ROV in accordance with drawing 308850 in the drawing file chapter. The connector is included.
- 4 Secure the cable and connect it.
- 5 Continue with fibre optical or electrical cables as needed.

# Cabling

## Topics

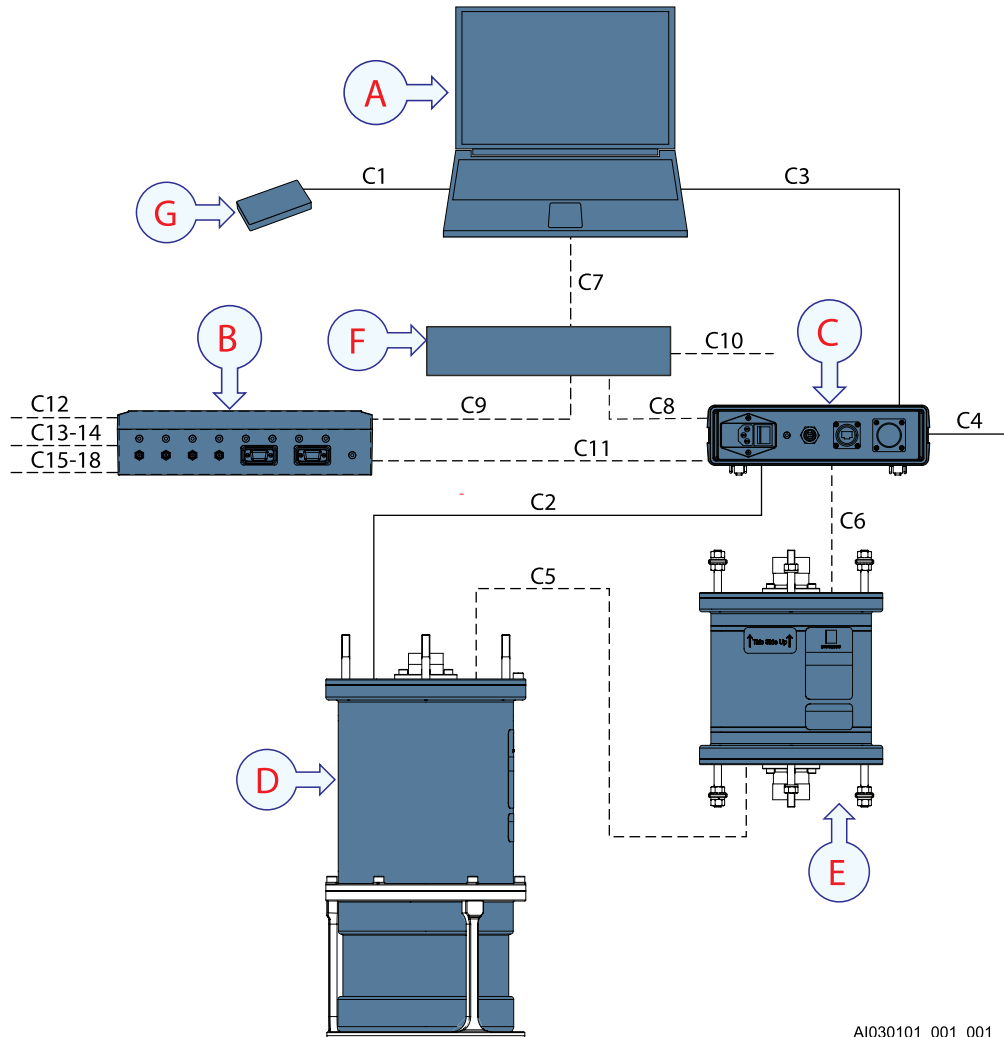
[Cable plan, page 20](#)

[Cable list, page 21](#)

[Connecting the system cables, page 22](#)

## Cable plan

The cables are part of the delivery with the main units.



AI030101\_001\_001

- A** Computer
- B** Responder Driver Unit (optional)
- C** Interface unit
- D** Transducer
- E** Repeater unit (optional)
- F** Ethernet switch (optional)
- G** USB to serial adapter

## Cable list

A set of designated system cables and power cables are required to make the system operational.

Cable	Type	From/To
C1	USB cable	From computer to USB/serial adapter
C2	Transducer cable	From Interface Unit to Transducer
C3	Ethernet cable	From Interface Unit to computer
C4	Power cable	From Interface Unit to power outlet
C5, optional	Transducer cable	From Repeater Unit to Transducer
C6, optional	Transducer cable	From Repeater Unit to Interface Unit
C7, optional	Ethernet cable	From Ethernet Switch to computer
C8, optional	Ethernet cable	From Ethernet Switch to Interface Unit
C9, optional	Ethernet cable	From Ethernet Switch to Responder Driver Unit
C10, optional	Power cable	From Ethernet Switch to power outlet
C11, optional	Responder sync cable	From Responder Driver Unit to Interface Unit
C12, optional	Power cable	From Responder Driver Unit to power outlet
C13-14, optional	Serial cables	From Responder Driver Unit to Responder
C15-18, optional	Fibre optic cables	From Responder Driver Unit to Responder

## Connecting the system cables

The system cables includes power cables and control cables.

### Procedure

- 1 Connect the USB cable to the computer and to the USB/serial adapter. (C1)
- 2 Connect the transducer cable to the Transducer and to the Interface Unit. (C2)  
An optional Repeater Unit is needed to amplify the signals if the length of the transducer cable is more than 70 metres. If this is the case, skip this step and see steps 4 & 5.
- 3 Connect the Ethernet cable to the computer and to the Interface Unit. (C3)  
An optional Responder Driver Unit together with an Ethernet Switch may be part of the system. If this is the case, skip this step and see steps 6-12.
- 4 Connect the transducer cable to the Transducer and to the Repeater Unit. (C5)
- 5 Connect the transducer cable to the Repeater Unit and to the Interface Unit. (C6)
- 6 Connect the Ethernet cable to the Computer and to the Ethernet Switch. (C7)
- 7 Connect the Ethernet cable to the Ethernet Switch and to the Interface Unit. (C8)
- 8 Connect the Ethernet cable to the Responder Driver Unit and to the Ethernet Switch. (C9)
- 9 Connect the responder sync cable to the Responder Driver Unit and to the Interface Unit (C11)
- 10 Terminate the responder trigger signal cables with D-sub connectors. (C13-14)  
For more information, see [Pinout responder trigger signal cables with D-sub connectors, page 23](#)
- 11 Connect the responder trigger signal cables to the Responder Driver Unit and to the responders. (C13-14)
- 12 Connect the responder trigger signal cables to the Responder Driver Unit and to the responders. (C15-18) Use fibre to electrical signal converters if necessary.



## Pinout responder trigger signal cables with D-sub connectors

The responder trigger signal cables connecting the Responder Driver Unit and the responders are not included in the delivery and must be supplied by the installation shipyard.

Pinout Responder drive signal 1 to 4 for Responder Drive Unit	
<b>Responder 1</b>	<b>9p D-sub</b>
Power 1 +24V	1
Drive signal 1	2
Ground	3
<b>Responder 2</b>	<b>9p D-sub</b>
Power 2 +24V	6
Drive signal 2	7
Ground	8
<b>Responder 3</b>	<b>9p D-sub</b>
Power 3 +24V	1
Drive signal 1	2
Ground	3
<b>Responder 4</b>	<b>9p D-sub</b>
Power 4 +24V	6
Drive signal 2	7
Ground	8

RDU Front view

Male 9-pin D-sub connector

The diagram shows a front view of a male 9-pin D-sub connector. The pins are arranged in two rows. The top row has pins 1 and 5. The bottom row has pins 6 and 9. The connector is labeled 'RDU Front view' and 'Male 9-pin D-sub connector'.

CD0801\_003\_004

Terminate the responder trigger signal cables as illustrated with D-sub connectors.

# Operating procedures

See APOS online help.

# Positioning principles and processing

## μPAP Processing

### **SSBL Mode**

**Super short baseline** - The μPAP system identifies the position of a subsea target, either a transponder or a responder, by directing a reception beam towards the target and measure the heading and range to the target. The target's position is displayed on the APOS' display either as a 2D or a 3D position projection of the target relative to the ship.

The system's digital beam-former receives data from every element within the transducer and uses the data to measure the horizontal and vertical angle to the target. The range to the target is calculated by timing the delay between interrogation and reception. The reception beam is controlled in real time using data from built in motion sensors and data from a gyrocompass, ensuring the reception beam stays fixed on the target unaffected by target movement and ship motion.

The μPAP transceiver can operate with several hundred transponders channels.

### **Telemetry**

The unit transmits acoustic telemetry messages, and receives and decodes acoustic telemetry messages from a transponder.

### **LBL Mode**

**Long Base Line** - LBL mode is similar to SSBL mode but the transceiver positions up to 8 LBL transponders for each interrogation. Range and heading to the transponders are measured.

### **MULBL Mode**

**Multi-User Long Base Line** - In this mode the transceiver continuously listen for replies from the transponder. Each reply is detected, and headings and the time difference between the replies are fed to the APOS. The time differences are used as delta ranges by the system in MULBL mode.

# Maintenance

## Topics

[Preventive maintenance schedule, page 27](#)

[Inspecting and cleaning the transducer, page 28](#)

[Creating a backup, page 28](#)

## Preventive maintenance schedule

Preventive maintenance must be carried out periodically in order to preserve reliability and ensure safe operation during the system's service life. The preventive maintenance activity is broken down into specific tasks and the tasks are organized periodically in a *preventive maintenance schedule*. The preventive maintenance schedule detailed below is for portable systems only.

- Maintenance tasks carried out after every use
  - Clean the transducer and remove marine growth.
  - Clean the repeater unit.
  - Lubricate the connectors.
  - Make sure all bolts and nuts are tightened.
  - Check the unit for physical damage.
- Maintenance tasks carried out every month
  - Gently wipe the dust off all system units.
  - Make a backup of the APOS configuration.
- Maintenance tasks carried out every six months
  - Check all cable connections.
  - Check all system units for physical damage.

## Inspecting and cleaning the transducer

The transducer must always be handled correctly in order to preserve its accuracy and prolong its service life.

### Context

A transducer is a delicate precision instrument and must be treated as such. Incorrect handling may damage the transducer beyond repair.

### Procedure

- 1 Clean the unit thoroughly with a lot of fresh water.

*Caution*

---

**Do not use high-pressure water, sandblasting, metal tools or strong solvents to clean the transducer face.**

---

- 2 Inspect for damages or growth.
- 3 Remove any growth and dirt with a stiff brush, or with a wooden scraper or with a plastic scraper.  
Be careful not to damage the unit.
- 4 Lubricate the connector.

## Creating a backup

For backup procedures, refer to the backup files document. This is a separate manual supplied with the computer delivery.

Take a backup of all operator stations at regular intervals (1-3 months), and every time major changes have been performed in the configuration and/or user settings.

**Important**

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A backup must be performed when the software has been upgraded.

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# Spare parts

## Topics

[Portable operator station spare part, page 30](#)

[Operator station spare part, page 30](#)

[μPAP 200 spare part, page 30](#)

[μPAP 201 spare parts, page 31](#)

[μPAP 202-m30 spare part, page 31](#)

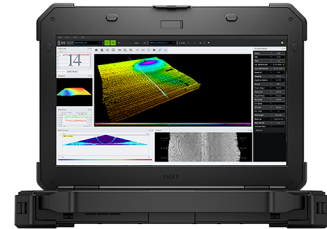
[HiPAP interface unit spare part, page 32](#)

[Repeater unit spare part, page 32](#)

[Responder driver unit spare part, page 32](#)

## Portable operator station spare part

- **Part name:** Portable operator station spare part
- **Part number:** 448755



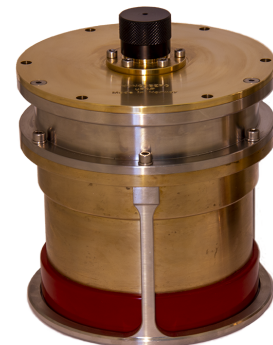
## Operator station spare part

- **Part name:** Operator station spare part
- **Part number:** 472733



## μPAP 200 spare part

- **Part name:** μPAP 200
- **Part number:** 337711





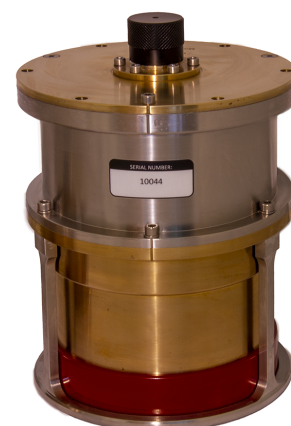
## μPAP 201 spare parts

- **Part name:** μPAP 201-H
- **Part number:** 332288
  
- **Part name:** μPAP 201-MGC-R2
- **Part number:** 400606
  
- **Part name:** μPAP 201-MGC-R3
- **Part number:** 337766



## μPAP 202-m30 spare part

- **Part name:** μPAP 202-m30
- **Part name:** **Part number:** 462804



## HiPAP interface unit spare part

- **Part name:** HiPAP interface unit spare part
- **Part number:** 300134



## Repeater unit spare part

- **Part name:** Repeater unit spare part
- **Part number:** 399779

The cable is supplied with the unit.



## Responder driver unit spare part

- **Part name:** Responder driver unit spare part
- **Part number:** 321990

The spare part kit consists of:

- Responder Driver Unit
- AC/DC Power supply
- Trigger cable
- 4 M4x25 Bolts
- 4 M4 Spring lock washers
- 4 M4 Nuts
- 3 D-sub connectors
- Ethernet switch
- 3 Ethernet cables



# Technical specifications

## **Topics**

[Performance specifications, page 34](#)

[Power specifications, page 36](#)

[Environmental specifications, page 37](#)

[Weights and outline dimensions, page 38](#)

## Performance specifications

These performance specifications summarize the main functional and operational characteristics of the system.

### Transducer

- **Frequency:** 20-30 kHz
- **Range capability:** 4000+ m. Range capability is depending on line of sight, transponder's transmit power setting, ship's acoustic system and influence of ambient noise and ray bending.
- **Operational coverage:**  $\pm 90^\circ$ . Operational coverage defines the sector where acoustic positioning and communications are operational.
- **Main coverage:**  $\pm 80^\circ$ . Main coverage is the sector where maximum range and angular accuracy can be achieved. Outside the main coverage range and elevation angular accuracy are reduced, therefore a depth input for aiding is recommended.
- **Receiver beam:**  $22^\circ$
- **Source level (re 1μPa):** 190 dB
- **Transponder channels:** cNODE compatible with 560 Cymbal channels and 56 FSK channels.
- **Operation mode:** SSBL (Super short baseline), LBL (Long baseline) and acoustic modem.
- **Transducer cable length:** 25, 50 or 70 m
- **Transducer deployment depth:** < 100 m

### Position accuracy

Model	Motion sensor accuracy	System position accuracy (in X and Y direction)
μPAP 200 Part number: 337711	Roll & Pitch: $0.2^\circ$ Range: $\pm 180^\circ$	$0.32^\circ / 0.56\%$ , Range: $\pm 0.02$ m
μPAP 201-H Part number: 332288	Roll & Pitch: $0.05^\circ$ Range: $\pm 180^\circ$	$0.26^\circ / 0.45\%$ , Range: $\pm 0.02$ m
μPAP 201-MGC-R2 Part number: 400606	Roll & Pitch: $0.02^\circ$ Heading: $0.2^\circ$ Range: $\pm 180^\circ$	$0.25^\circ / 0.44\%$ , Range: $\pm 0.02$ m

Model	Motion sensor accuracy	System position accuracy (in X and Y direction)
<b>μPAP 201-MGC-R3</b> Part number: 337766	Roll & Pitch: 0.01° Heading: 0.1° Range: ±180°	0.25° / 0.44 %, Range: ±0.02 m
<b>μPAP 202-m30</b> Part number: 462804	Roll & Pitch: 0.08° Range: ±45°	0.26° / 0.45 %, Range: ±0.02 m

## Power specifications

These power characteristics summarize the supply power requirements for the system.

### Computer

- **Make and model:** Hatteland HSC 1 5i
- **Voltage requirement:** 100/240 VAC, 50 to 60 Hz, autosensing
- **Maximum power consumption:** 240 W

### Laptop

- **Make and model:** Dell Latitude 5430 Rugged
- **Power:** 90 W Rugged Elbow AC adapter

### HiPAP interface unit

- **Make and model:** HiPAP interface unit
- **Voltage requirement:** 88-264 VAC, 47-63 Hz
- **Maximum current draw:** 4 A at 115 VAC / 2 A at 230 VAC
- **Normal current draw:** 0.5 A
- **Nominal power consumption:** 350 W

### Repeater unit

- **Voltage requirement:** 48 VDC

### Responder Driver Unit

- **Make and model:** HiPAP Responder Driver Unit
- **Voltage requirement:** 88-264 VAC, 47-63 Hz
- **Maximum current draw:** 0.4 A
- **Normal current draw:** 0.06 A
- **Nominal power consumption:** 15 W

## Environmental specifications

These environmental specifications summarize the temperature and humidity specifications for the system.

### **μPAP unit**

- **Operating temperature:** 0° C to +35° C
- **Storage temperature:** -20–70 °C

### **Stationary computer**

- **Make and model:** Hatteland HSC 1-i5 HA
- **Operating temperature:** -15° C to +55° C
- **Storage temperature:** -20–70 °C
- **Relative humidity:** 5 to 95% relative, non-condensing

### **Laptop computer**

- **Make and model:** Dell Latitude 5430 Rugged
- **Operating temperature:** -29° C to + 63 ° C
- **Storage temperature:** -51° C to + 71 ° C

### **Interface unit**

- **Operating temperature:** +10° C to +55 ° C
- **Storage temperature:** +10° C to +70 ° C
- **Relative humidity:** 5 to 95% relative, non-condensing
- **Vibration range:** 5-100 Hz
- **Excitation level:** 5-13.2 Hz ±1.5 mm, 13.2-100 Hz 1 g

### **Repeater unit**

- **Operating temperature:** -10° C to +45° C
- **Storage temperature:** -20–70 °C
- **Depth rating:** 50 m

### **Responder Driver Unit**

- **Operating temperature:** 0 ° C to +55 ° C
- **Storage temperature:** -40° C to +75 ° C
- **Relative humidity:** 15 to 95% relative non-condensing
- **Vibration range:** 5-100 Hz
- **Excitation level:** 5-13.2 Hz ±1.5 mm, 13.2-100 Hz 1 g
- **Ingress protection:** IP44

## **Weights and outline dimensions**

These weights and outline dimension characteristics summarize the physical properties of the system.

### **μPAP 200**

- **Diameter:** 199 mm
- **Height:** 247 mm
- **Weight:** 11.7 kg

### **μPAP 201-H**

- **Diameter:** 199 mm
- **Height:** 404 mm
- **Weight:** 16.8 kg

### **μPAP 201-MGC-R2**

- **Diameter:** 199 mm
- **Height:** 404 mm
- **Weight:** 22.6 kg

### **μPAP 201-MGC-R3**

- **Diameter:** 199 mm
- **Height:** 404 mm
- **Weight:** 22.6 kg



### **μPAP 202-m30**

- **Diameter:** 199 mm
- **Height:** 294 mm
- **Weight:** 14.0 kg

### **Stationary computer**

- **Make and model:** Hatteland HSC 1-i5 HA
- **Depth:** 360 mm
- **Width:** 380 mm
- **Height:** 89 mm
- **Weight:** 7.5 kg

### **Laptop computer**

- **Make and model:** Dell Latitude 5430 Rugged
- **Depth:** 220 mm
- **Width:** 340 mm
- **Height:** 33.6 mm
- **Weight:** 3 kg

### **Interface unit**

- **Depth:** 324 mm
- **Width:** 258 mm
- **Height:** 78 mm
- **Weight:** 3.7 kg

### **Repeater unit**

- **Diameter:** 199 mm
- **Height:** 279 mm
- **Weight:** 11.5 kg

**Responder Driver Unit**

- **Depth:** 200 mm
- **Width:** 280 mm
- **Height:** 73 mm
- **Weight:** 2.8 kg

# Drawing file

## Topics

[Computer dimensions, page 42](#)

[μPAP 200 series outline dimensions, page 43](#)

[μPAP 201 series outline dimensions, page 44](#)

[μPAP 202 series outline dimensions, page 45](#)

[Interface unit dimensions, page 46](#)

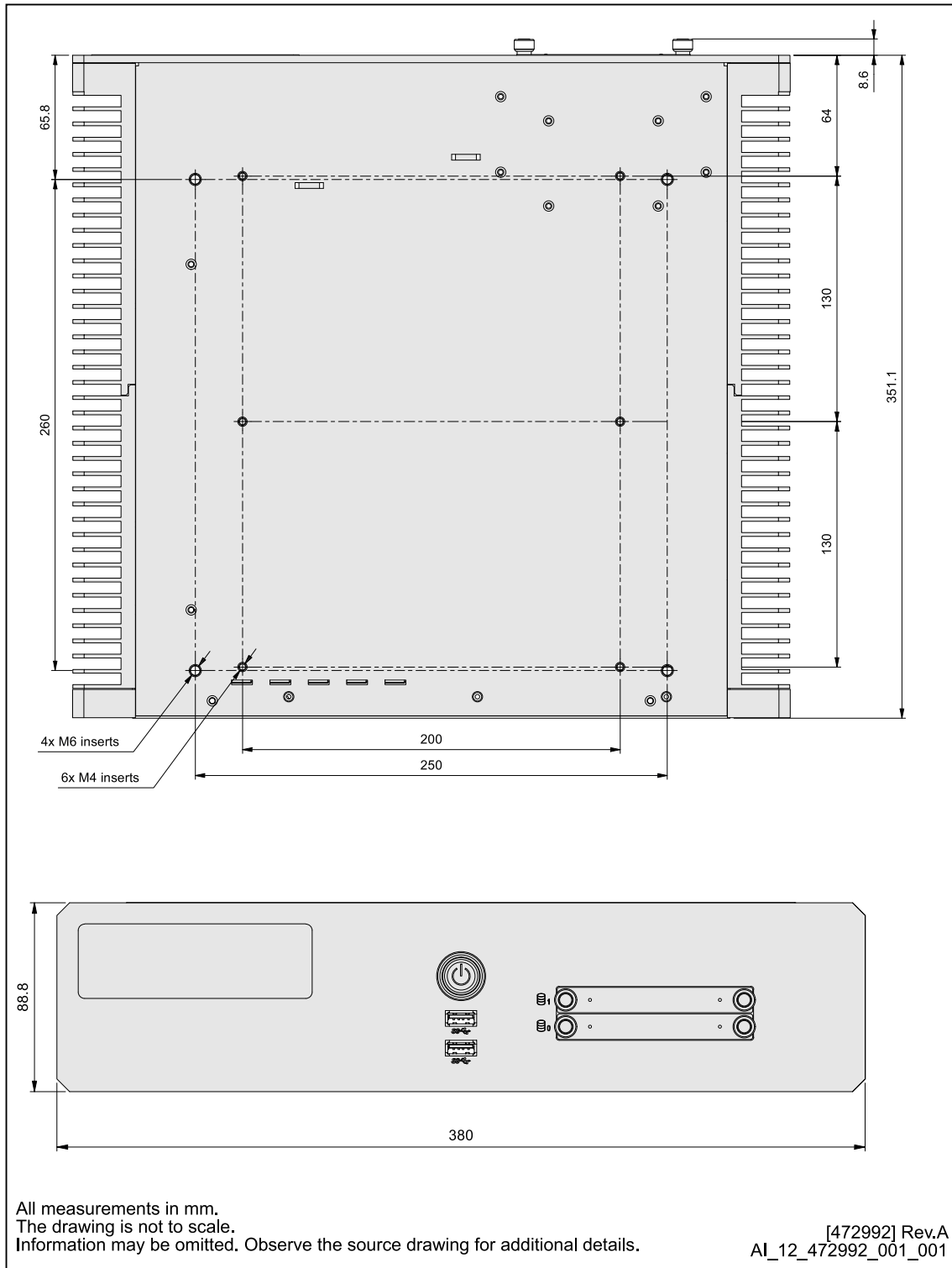
[Repeater unit dimensions, page 47](#)

[Responder Driver Unit dimensions, page 48](#)

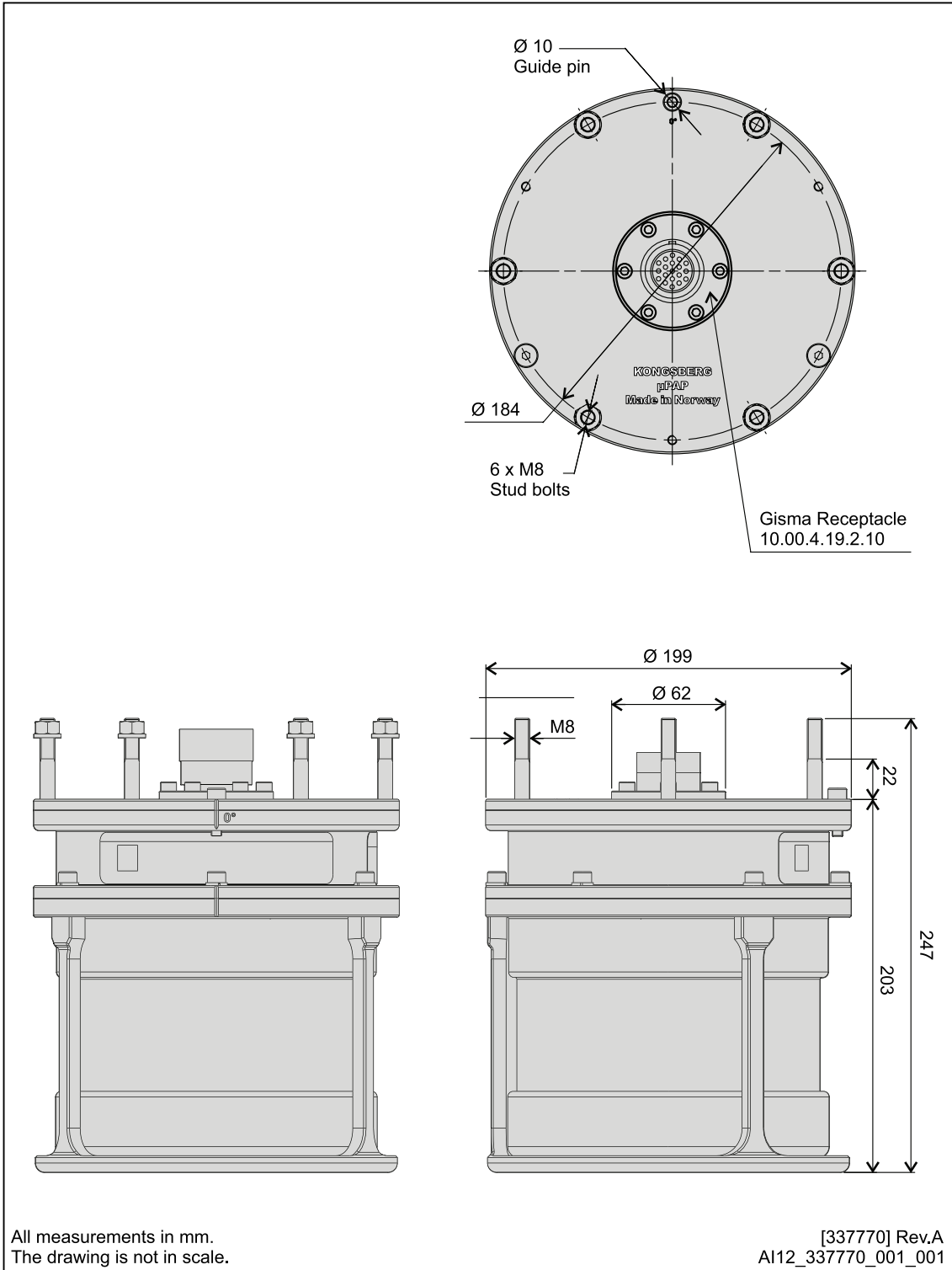
[Installing the transducer to the ship's side pole, page 49](#)

[Fibre to responder drive converter, wiring diagram, page 50](#)

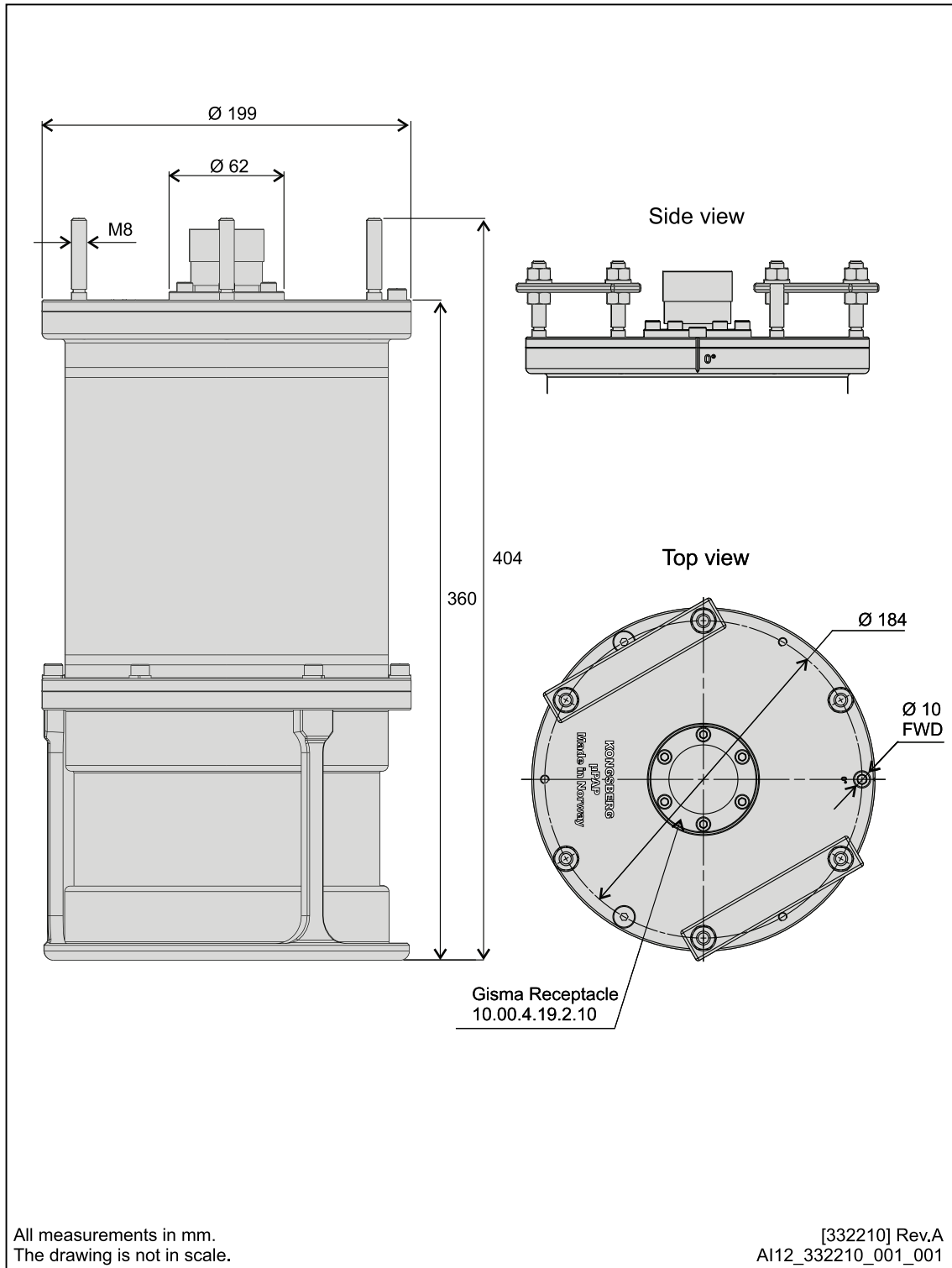
## Computer dimensions



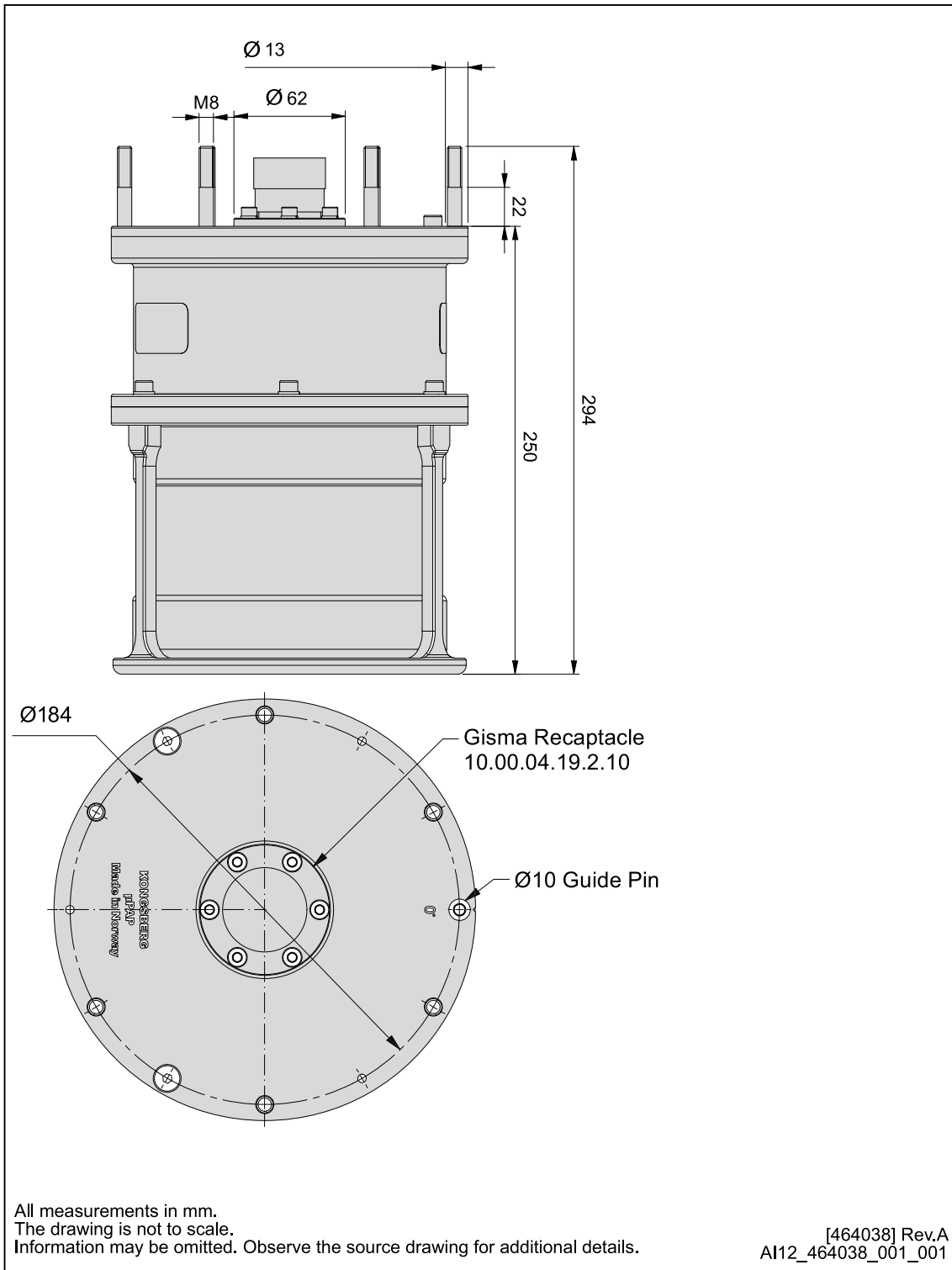
# μPAP 200 series outline dimensions



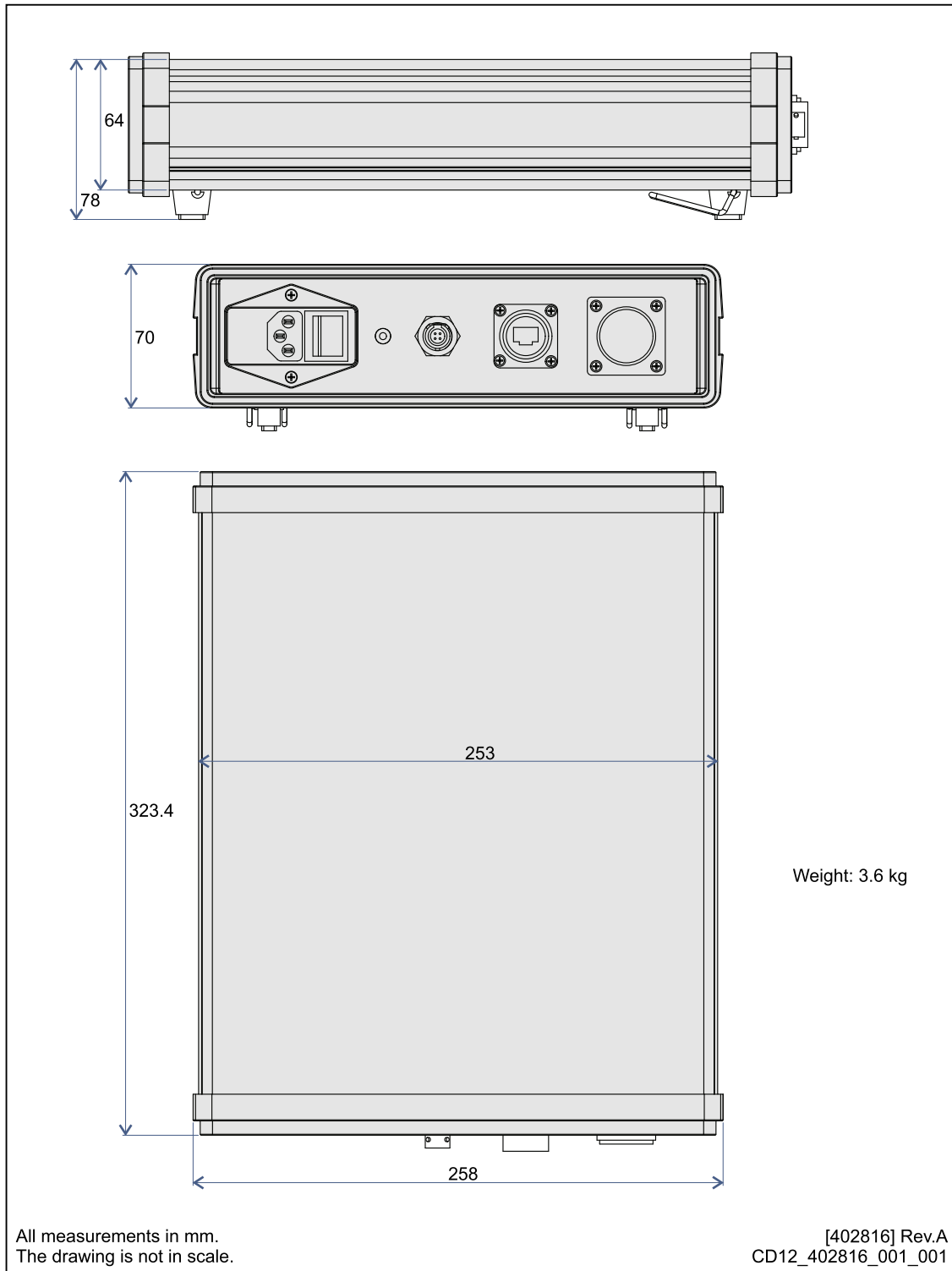
## μPAP 201 series outline dimensions



# μPAP 202 series outline dimensions

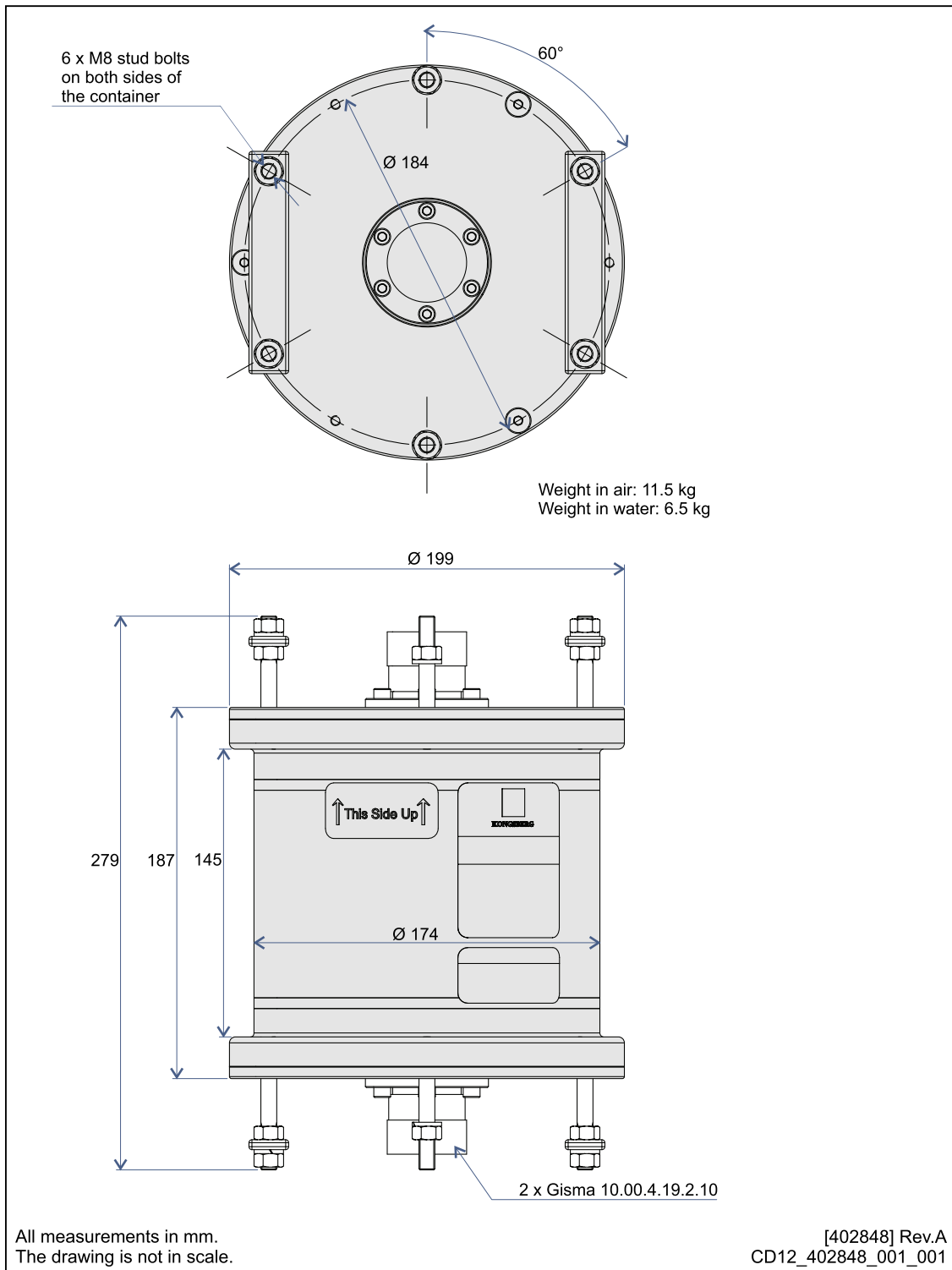


## Interface unit dimensions

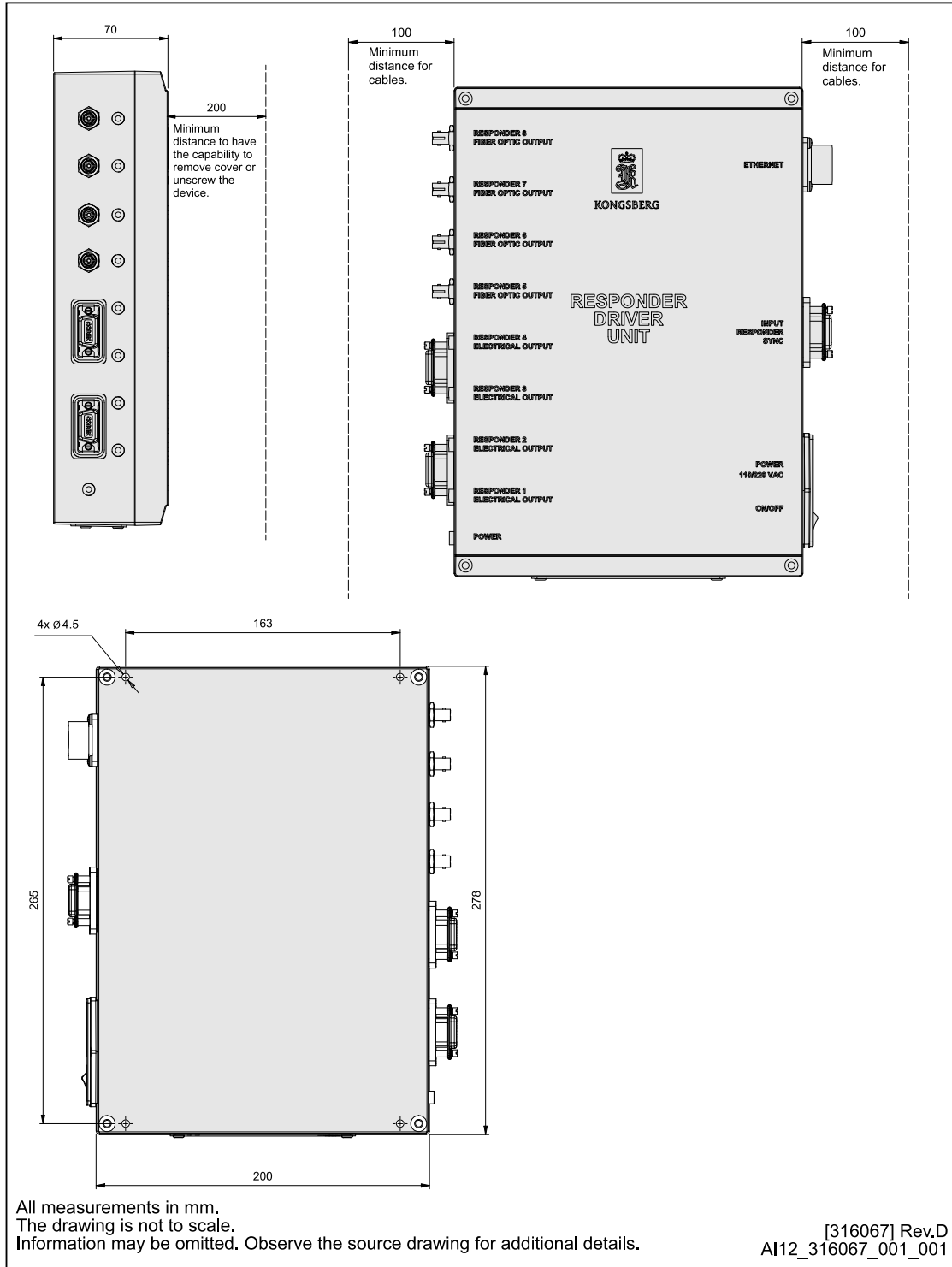




# Repeater unit dimensions

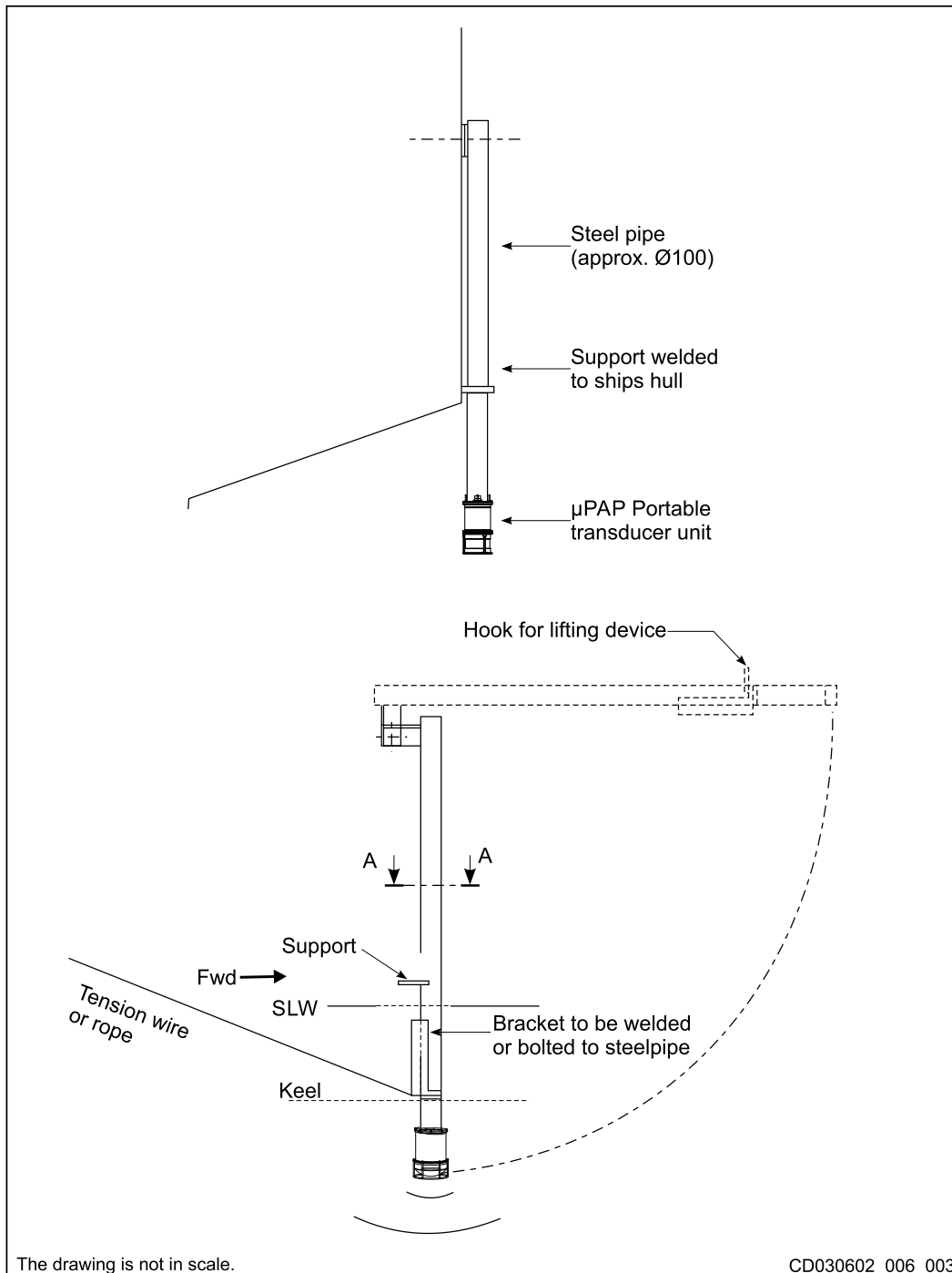


## Responder Driver Unit dimensions

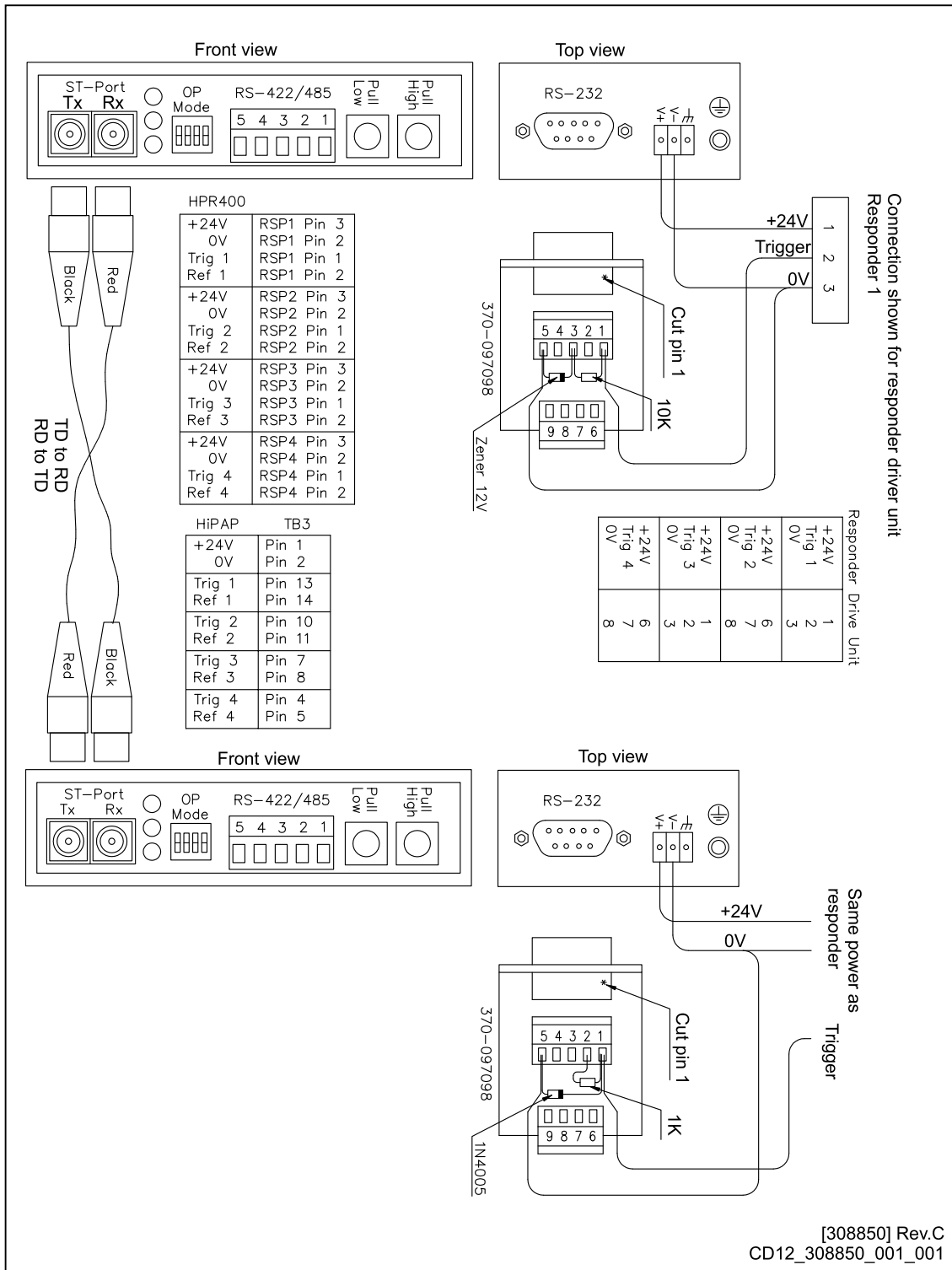


# Installing the transducer to the ship's side pole

This is an example of how to install the  $\mu$ PAP transducer to the pole.



# Fibre to responder drive converter, wiring diagram





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