KONGSBERG

Instruction Manual

µPAP 201-C

Portable acoustic positioning system

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Portable Acoustic Positioning system

Instruction Manual

494326/D

Document information

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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.

Disclaimer

Kongsberg Discovery AS endeavours to ensure that all information in this document is correct and fairly stated, but does not accept liability for any errors or omissions.

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. If you need information about our other products, visit https://www.kongsberg.com/discovery/.

Table of contents

About this manual

This manual contains all the necessary documentation for the safe installation, operation and maintenance of 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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Introduction

Topics

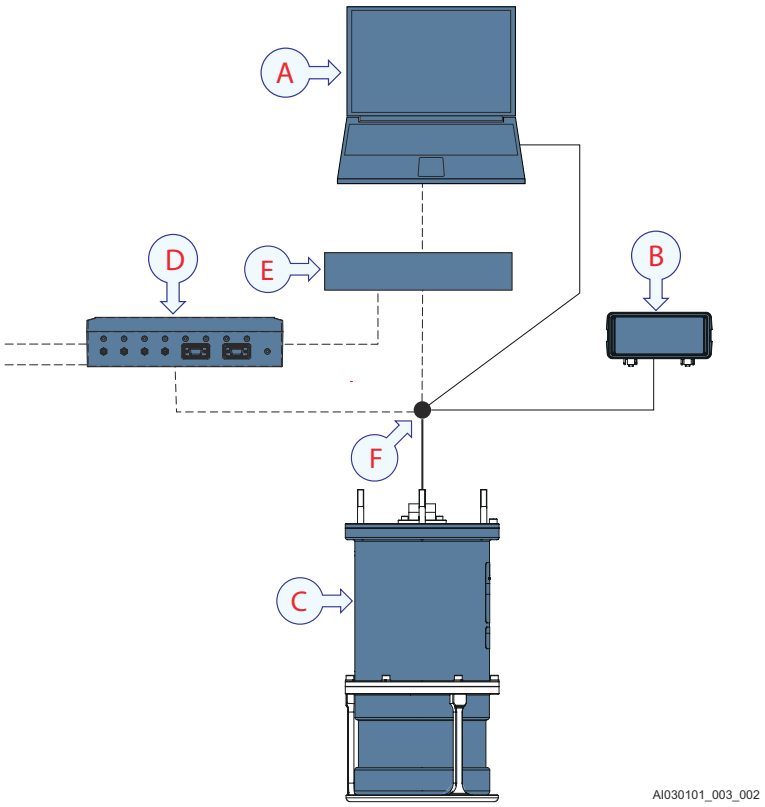
System description

The product range consists of several models.

µPAP is a portable and compact acoustic positioning system for tracking ROVs, tow fish, divers or other subsea objects at several thousand metres range. The system is housed in a compact transducer casing, making it well suited for installation onboard an Uncrewed Surface Vehicle (USV). It is remotely operated from an external computer over Ethernet and the user selects and controls the transponders to be used, or sends data for acoustic modem transfer to a modem onboard a subsea vehicle.

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. Customer's computer

B. Customer's power supply unit

C. Transducer

D. Responder Driver Unit (optional)

E. Ethernet switch (optional)

F. Junction box (optional)

System units

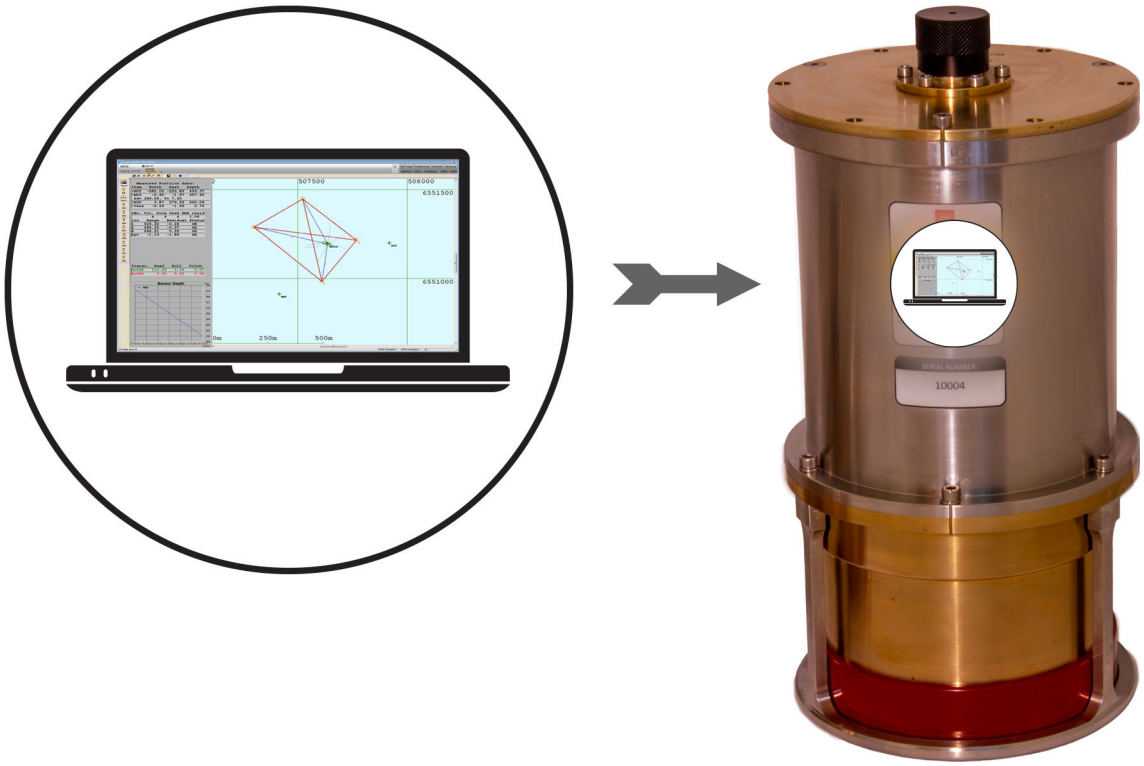
µPAP 201-C transducers

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. In addition, the µPAP 201-C transducer has a built-in PC running Windows OS with APOS software pre-installed. 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:

*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.*



Responder Driver Unit (optional)

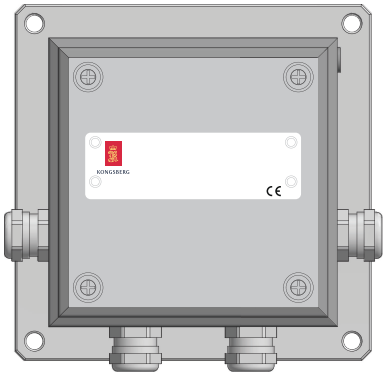
The Responder Driver Unit controls and distributes responder trigger signals to responders.

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

Junction box (optional)

The junction box is designed for surface mounting. It includes built-in terminals for connecting wires between the transducer and the customer's power source, and between the transducer and the customer's computer.

A Responder Driver Unit and an Ethernet switch can also be connected to the junction box.



APOS - the µPAP 201-C operator system

A µPAP 201-C transducer is operated from an acoustic positioning operator station (APOS). The acoustic positioning operator station, or APOS for short, is a PC running Windows OS with dedicated acoustic positioning software (APOS software).

The µPAP 201-C transducer has a built-in PC running Windows OS with an APOS pre-installed. Use the following logon credentials to logon to a µPAP 201-C' built-in PC.
Remote desktop logon: IP 192.169.200.81/255.255.255.0
The computer you logon from must have an adapter configured on the same subnet, for example 192.169.200.90/255.255.255.0

Username: APOS

Password: dpos

Scope of supply

All main units needed are included in the standard delivery.

When unpacking the µPAP 201-C system delivery, make sure the following items are included:

- Transducer

Optional items

- Pigtail cable
- Responder Driver Unit
- Ethernet switch
- Junction box

General supply conditions

General supply conditions apply to this µPAP 201-C 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 µPAP 201-C 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 201-C 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.

Company name	Kongsberg Discovery AS
Address	Strandpromenaden 50, 3183 Horten, Norway
Telephone 24hr Support	+47 33 03 24 07
Website	https://www.kongsberg.com/discovery/
Support website	Product support A to Z
E-mail address	support.hpr@kd.kongsberg.com

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

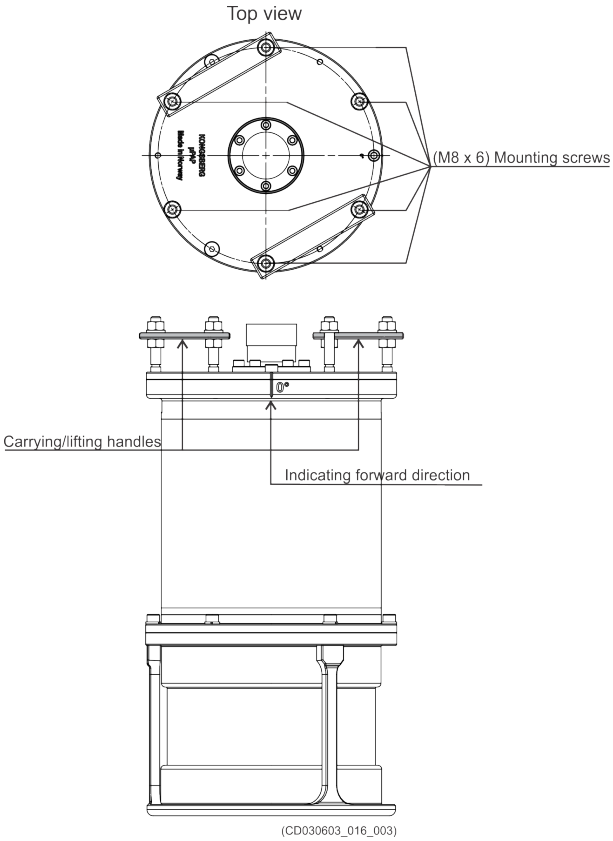
µPAP is designed for easy installation onboard ships and other surface units.

Prerequisites

CAUTION:

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 40

Procedure

1. Remove the lifting handles.
2. Mount the transducer with the forward indicator pointing forward.

3. Fasten the stud 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:

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

Converting the responder signal from fibre optical to electrical

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

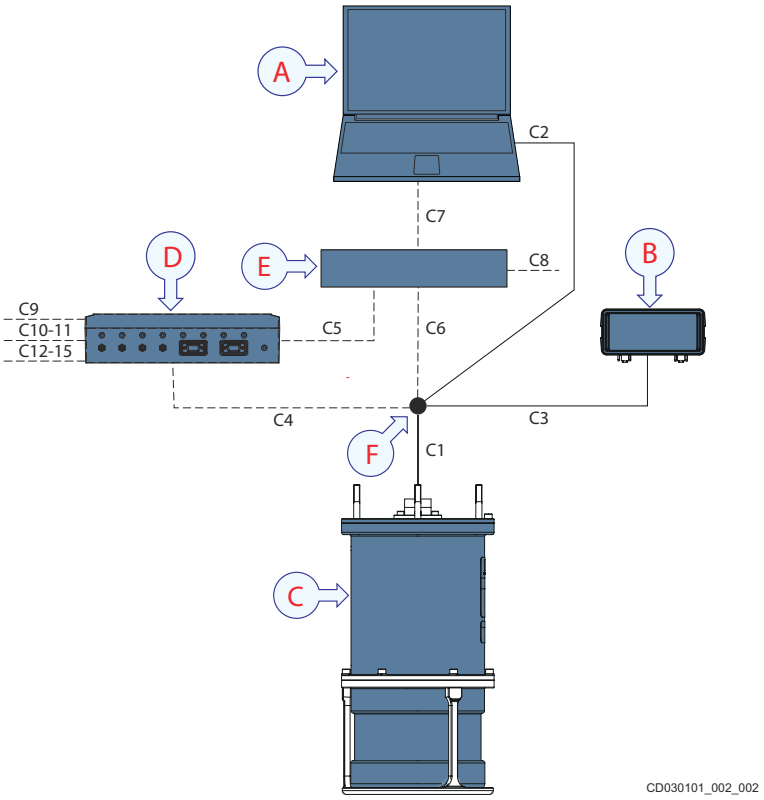
1. Produce the cable from the responder driver unit to the converter in accordance with drawing 308850 in the drawing file chapter. The connectors are included in the converter kit.
2. Secure the cable and connect it.
3. For an optical isolation, produce the cable from the converter to the ROV in accordance 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

The cables are not part of the delivery with the main units.



A. Customer's computer

B. Customer's power supply unit

C. Transducer

D. Responder Driver Unit (optional)

E. Ethernet switch (optional)

F. Junction box (optional)

Cable list

Cables C1-C3 are required to make the system operational. Cables C4-C15 are required if an optional Responder Driver Unit together with an Ethernet Switch are part of the system. An optional special pigtail cable is available upon request.

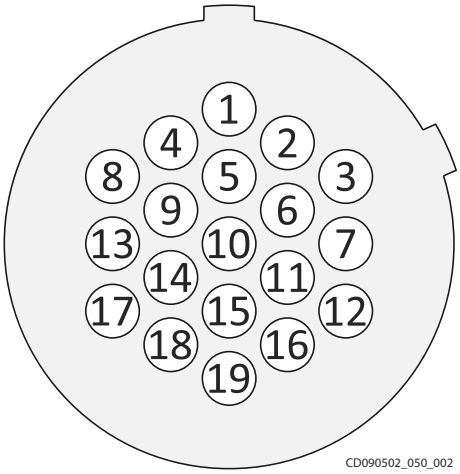
Cable	Type	From/To
C1	Pigtail cable	
C2	Ethernet cable	From pigtail to customer’s computer
C3	DC Power cable	From customer’s power supply unit to pigtail
C4, optional	Responder sync cable	From pigtail to Responder Driver Unit
C5, optional	Ethernet cable	From Ethernet Switch to Responder Driver Unit
C6, optional	Ethernet cable	From pigtail to Ethernet Switch
C7, optional	Ethernet cable	From Ethernet Switch to computer
C8, optional	AC Power cable	From Ethernet Switch to power outlet
C9, optional	AC Power cable	From Responder Driver Unit to power outlet
C10-11, optional	Serial cables	From Responder Driver Unit to Responder
C12-15, optional	Fibre-optic cables	From Responder Driver Unit to Responder

µPAP 201-C pinout

This is the pin configuration for a male connector, as seen towards the connector (face view).

The connector is a Gisma 10.00.4.19.2.10-Y 19 pin male with keyway 66°.

Pin number	Signal
1	Ethernet Tx –
2	Ethernet Rx +
3	Ethernet Rx –
4	Ethernet Tx +
5	COM1 Tx
6	COM1 Rx
7	COM2 Rx +
8	1PPS
9	GND
10	Not connected
11	COM2 Tx –
12	COM2 Rx –
13	Responder sync +
14	Responder sync –
15	COM2 Tx +
16	0 V
17	+24 V
18	0 V
19	+24 V



Connecting the system cables

All relevant wires in the pigtail cable must be terminated before connecting the system units. Make sure all wire terminations have been performed correctly.

Procedure

1. Connect the pigtail cable to the transducer. (C1)
2. Connect the ethernet cable to the pigtail and to the Computer. (C2)
3. Connect the DC power cable to the pigtail and to the Power Supply Unit. (C3)

   An optional Responder Driver Unit together with an Ethernet Switch may be part of the system. If this is the case, see steps 4-10.
4. Connect the responder sync cable to the Responder Driver Unit and to the pigtail. (C4)
5. Connect the Ethernet cable to the Responder Driver Unit and to the Ethernet Switch. (C5)
6. Connect the Ethernet cable to the Ethernet Switch and to the pigtail. (C6)
7. Connect the Ethernet cable to the Computer and to the Ethernet Switch. (C7)
8. Terminate the responder trigger signal cables with D-sub connectors. (C10-11)

   For more information, see Pinout responder trigger signal cables with D-sub connectors, page 24
9. Connect the responder trigger signal cables to the Responder Driver Unit and to the responders. (C10-11)
10. Connect the responder trigger signal cables to the Responder Driver Unit and to the responders. (C12-15) 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.

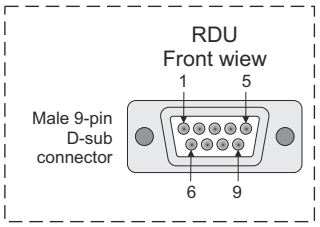
Pinout Responder drive signal 1 to 4 for Responder Drive Unit

Responder 1	9p D-sub
Power 1 +24V	1
Drive signal 1	2
Ground	3

Responder 2	9p D-sub
Power 2 +24V	6
Drive signal 2	7
Ground	8

Responder 3	9p D-sub
Power 3 +24V	1
Drive signal 1	2
Ground	3

Responder 4	9p D-sub
Power 4 +24V	6
Drive signal 2	7
Ground	8



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

Operating procedures

Topics

Accessing APOS online help on a µPAP 201-C

A µPAP 201-C transducer is operated from an acoustic positioning operator station (APOS). The acoustic positioning operator station, or APOS for short, is a PC running Windows OS with dedicated acoustic positioning software (APOS software).

Context

The µPAP 201-C transducer has a built-in PC running Windows OS with an APOS pre-installed. Use the following logon credentials to access APOS online help on a µPAP 201-C' built-in PC.

Procedure

1. Remote desktop logon: IP 192.169.200.81/255.255.255.0
2. The computer you logon from must have an adapter configured on the same subnet, for example 192.169.200.90/255.255.255.0
3. Username: APOS
4. Password: dpos

Positioning principles and processing

µPAP Processing

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.

Maintenance

Topics

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.
  - 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 maintain 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 system delivery.

Backup all operator stations regularly (1-3 months), and whenever the configuration and/or user settings of the operator stations are updated.

Important:

Always do a backup after a software update.

Spare parts

Topics

µPAP 201-C spare parts

- **Part name:** µPAP 201-C
- **Part number: Part number:** 468079
- **Part name:** µPAP 201-C-m30
- **Part number: Part number:** 465865
- **Part name:** µPAP 201-C-X
- **Part number: Part number:** 468078

Responder driver unit spare part

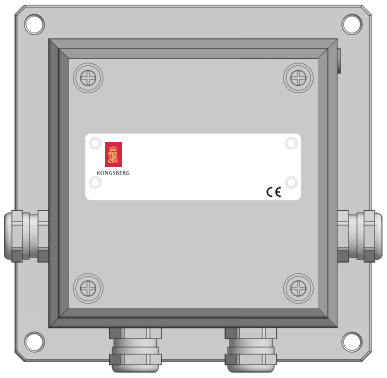
- **Part name:** Responder driver unit spare part
- **Part number:** 321990

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

Junction box spare part

- **Part name:** Junction box
- **Part number:** 484278



Technical specifications

Topics

Performance specifications

The performance specifications are listed below.

Transducer

Frequency: 20 – 30 kHz (MF)

Operational coverage: ±90°[(2)]

Receiver beam: 22°

Navigation channels: cNODE compatible with 560 Cymbal channels and 56 FSK channels.

Ethernet cable length: ≤ 75 m

Range capability (m): 4000+[(1)]

Main coverage: ±80°[(3)]

Source level (re 1µPa): 190 dB

Operation mode: SSBL (Super short baseline), LBL (Long baseline) and acoustic modem

Transducer deployment depth: < 100 m

[(1)] 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.

[(2)] Operational coverage defines the sector where acoustic positioning and communications are operational.

[(3)] 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.

Position accuracy

Model	Motion sensor accuracy	System position accuracy (in X and Y direction)
µPAP 201-C Part number: 468079	N/A	0.25° / 0.45 %, Range: ±0.02 m
µPAP 201-C-X Part number: 468078	Roll & Pitch: 0.02° Heading: 0.2° Range: ±180°	0.39° / 0.68 %, Range:±0.02 m
µPAP 201-C-m30 Part number: 465865	Roll & Pitch: 0.01° Heading: 0.1° Range: ±180°	0.26° / 0.44 %, Range: ±0.02 m

Power requirements

The power requirements are listed below.

Transducer

Voltage requirement: 24 VDC nominal (18–36 VDC)

Power consumption: Nominal 25 watts & maximum 75 watts

Responder Driver Unit

Voltage requirement: 88–264 VAC, 47–63 Hz

Maximum current draw: 0.4 A

Nominal power consumption: 15 W

Make and model: HiPAP Responder Driver Unit

Normal current draw: 0.06 A

Environmental requirements

The environmental requirements are listed below.

Transducer

Operating temperature: 0 °C – 35 °C

Storage humidity: 95 % relative, non-condensing

Storage temperature: -20 °C – 70 °C

Responder Driver Unit

Operating temperature: 0 °C – 55 °C

Relative humidity: 15% to 95% relative non-condensing

Excitation level: 5–13.2 Hz ±1.5 mm, 13.2–100 Hz 1 g

Storage temperature: -40 °C – 75 °C

Vibration range: 5–100 Hz

Ingress protection rating: IP44

Junction box

Operating temperature: 0 °C – 55 °C

Relative humidity: 15% to 95% relative non-condensing

Storage temperature: -40 °C – 75 °C

Ingress protection rating: IP44

Weight and outline dimensions

The weight and outline dimensions are listed below.

Transducers

Model	Height	Diameter	Weight
µPAP 201-C	404 mm	199 mm	16.0 kg
µPAP 201-C-X	404 mm	199 mm	16.0 kg
µPAP 201-C-m30	404 mm	199 mm	16.0 kg

Other system units

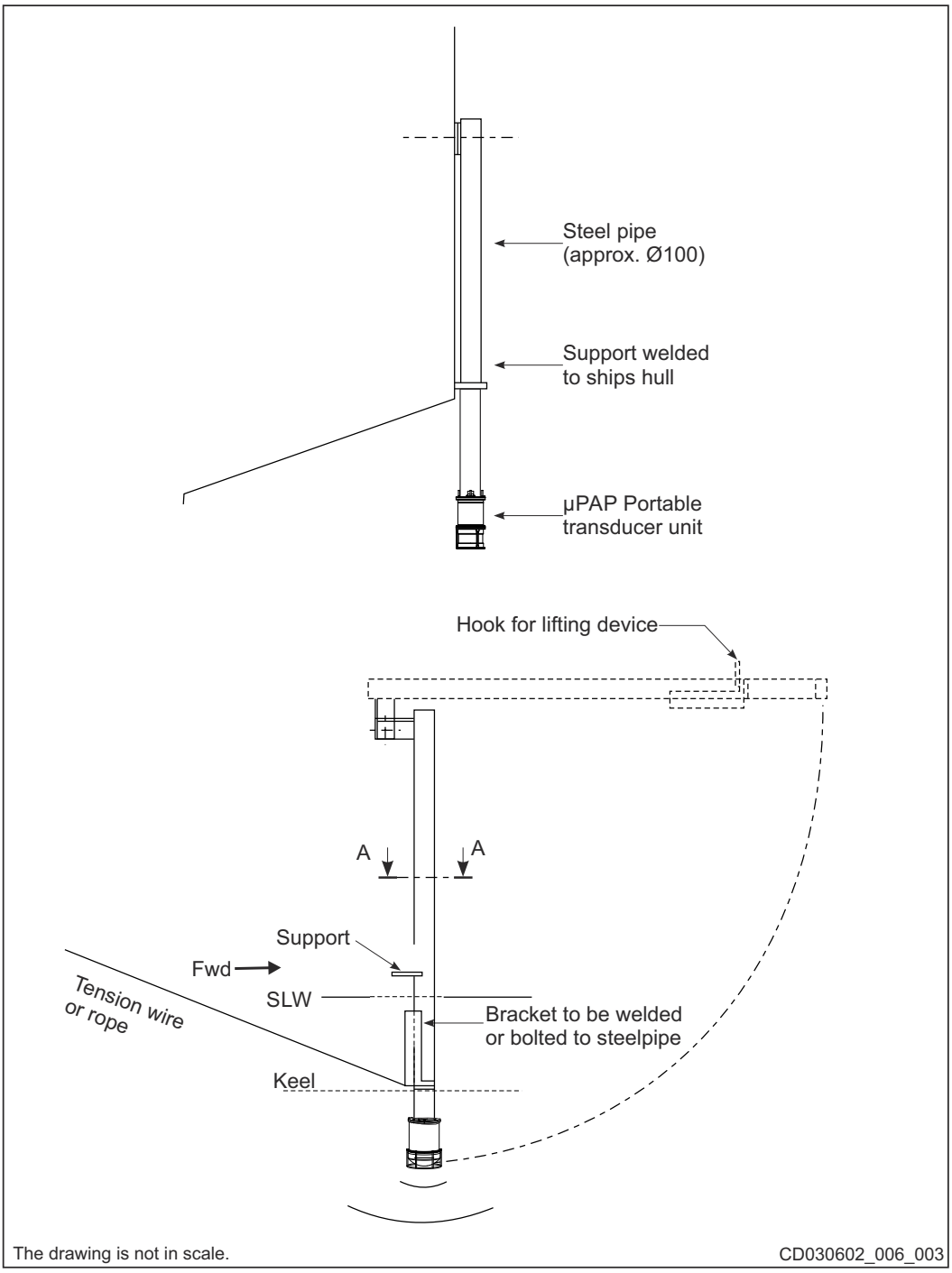
Unit	Height	Width	Depth	Weight
Responder Driver Unit	73 mm	280 mm	200 mm	2.8 kg
Junction box	93.1 mm	196.2 mm	190.6 mm	2.2 kg

Drawing file

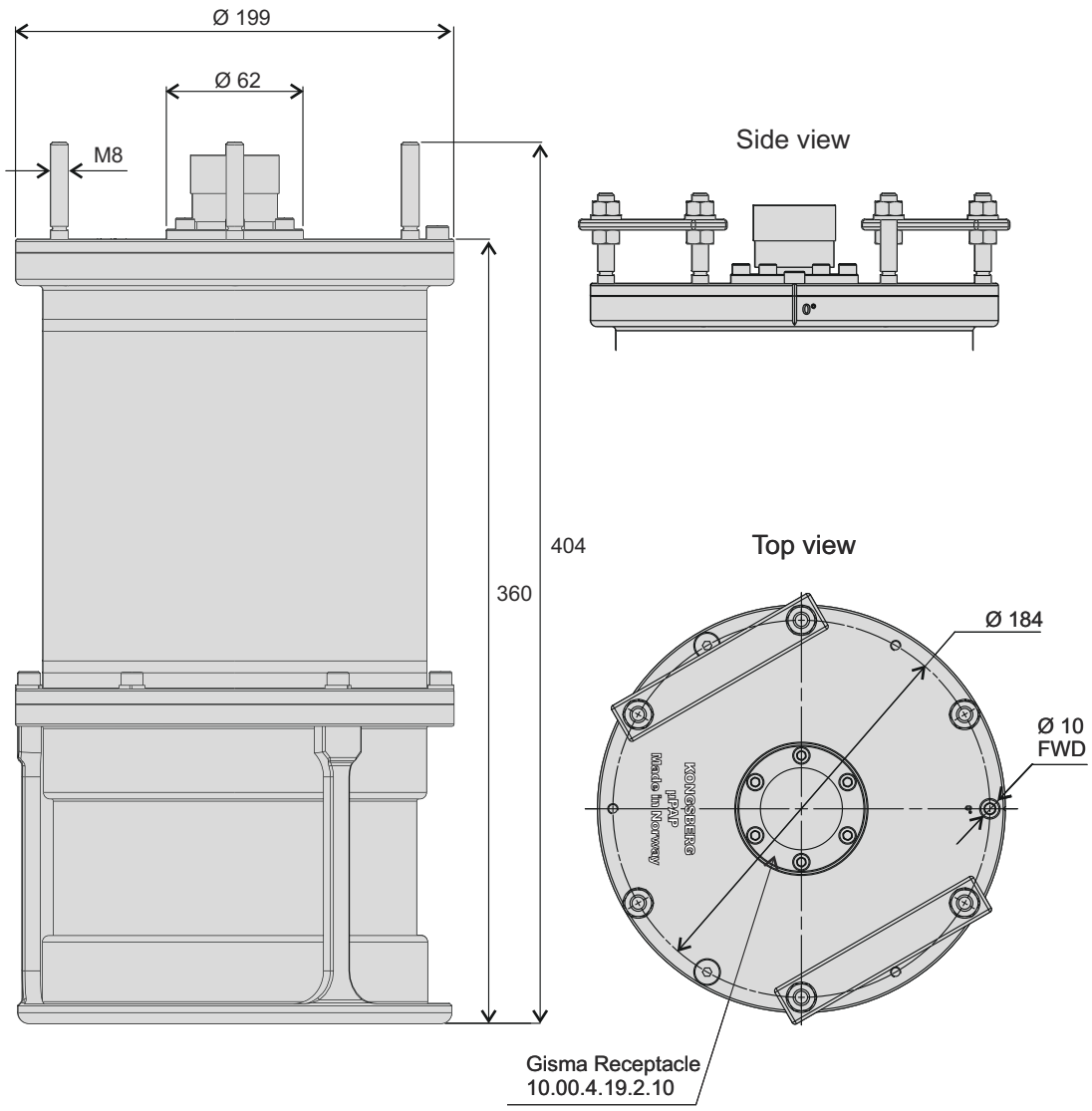
Topics

Installing the transducer to the ship's side pole

This is an example of how to install the µPAP transducer to the pole.



µPAP 201-C series outline dimensions



All measurements in mm.
The drawing is not in scale.

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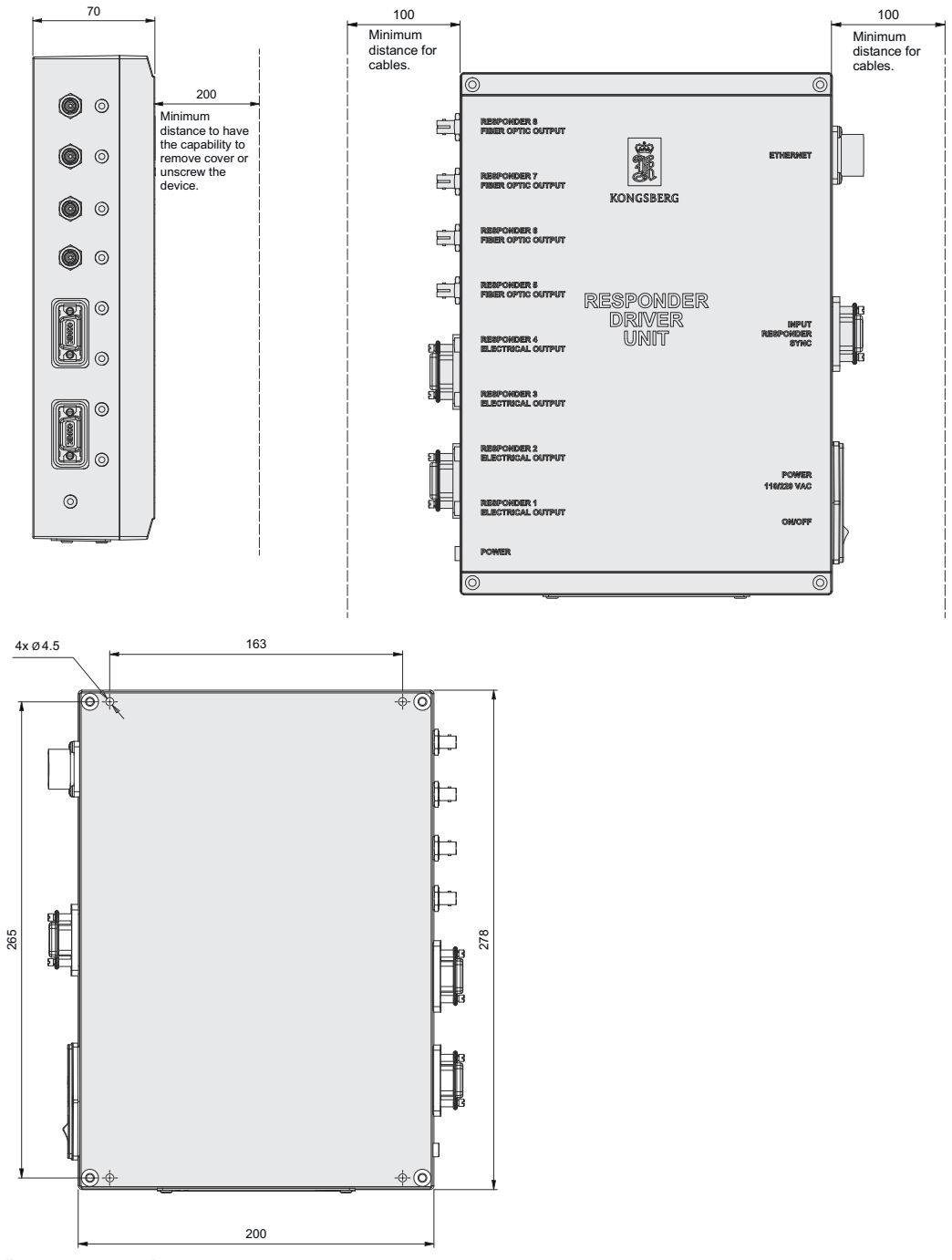
Responder Driver Unit dimensions



All measurements in mm.
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[316067] Rev.D
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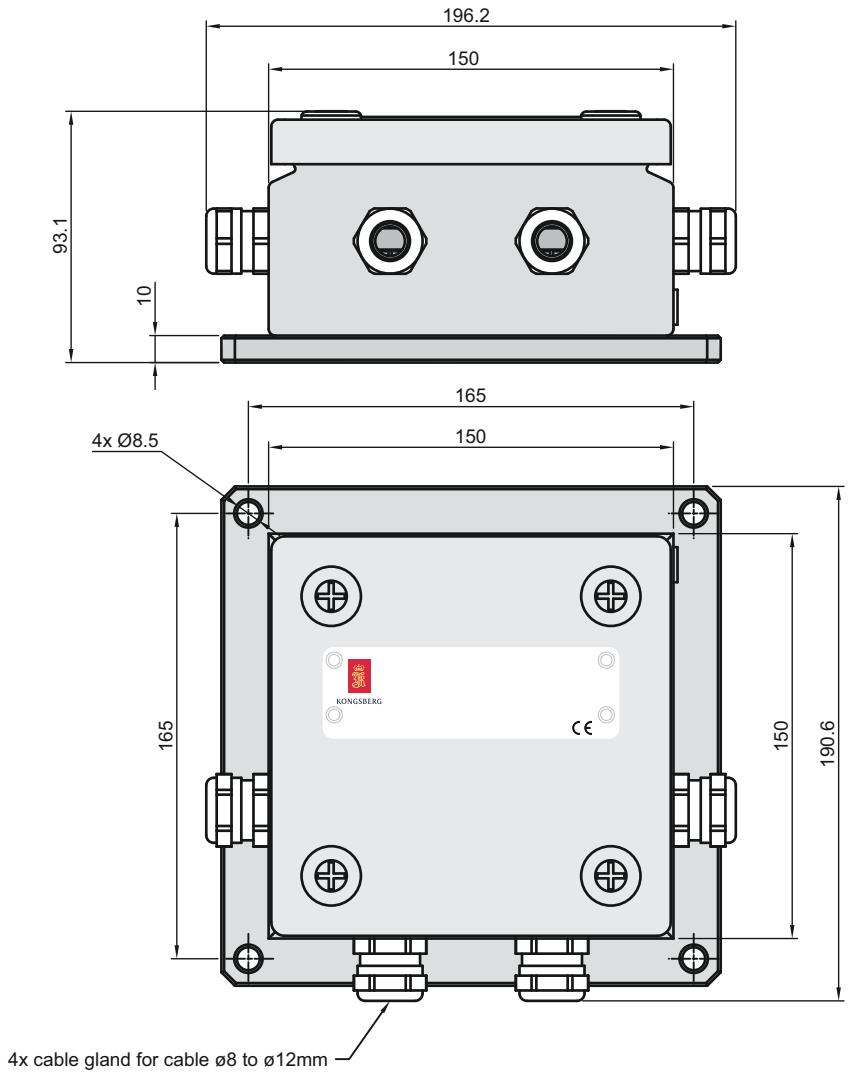
Junction box dimensions



All measurements in mm.
The drawing is not to scale.
Information may be omitted. Observe the source drawing for additional details.

[484363] Rev.A
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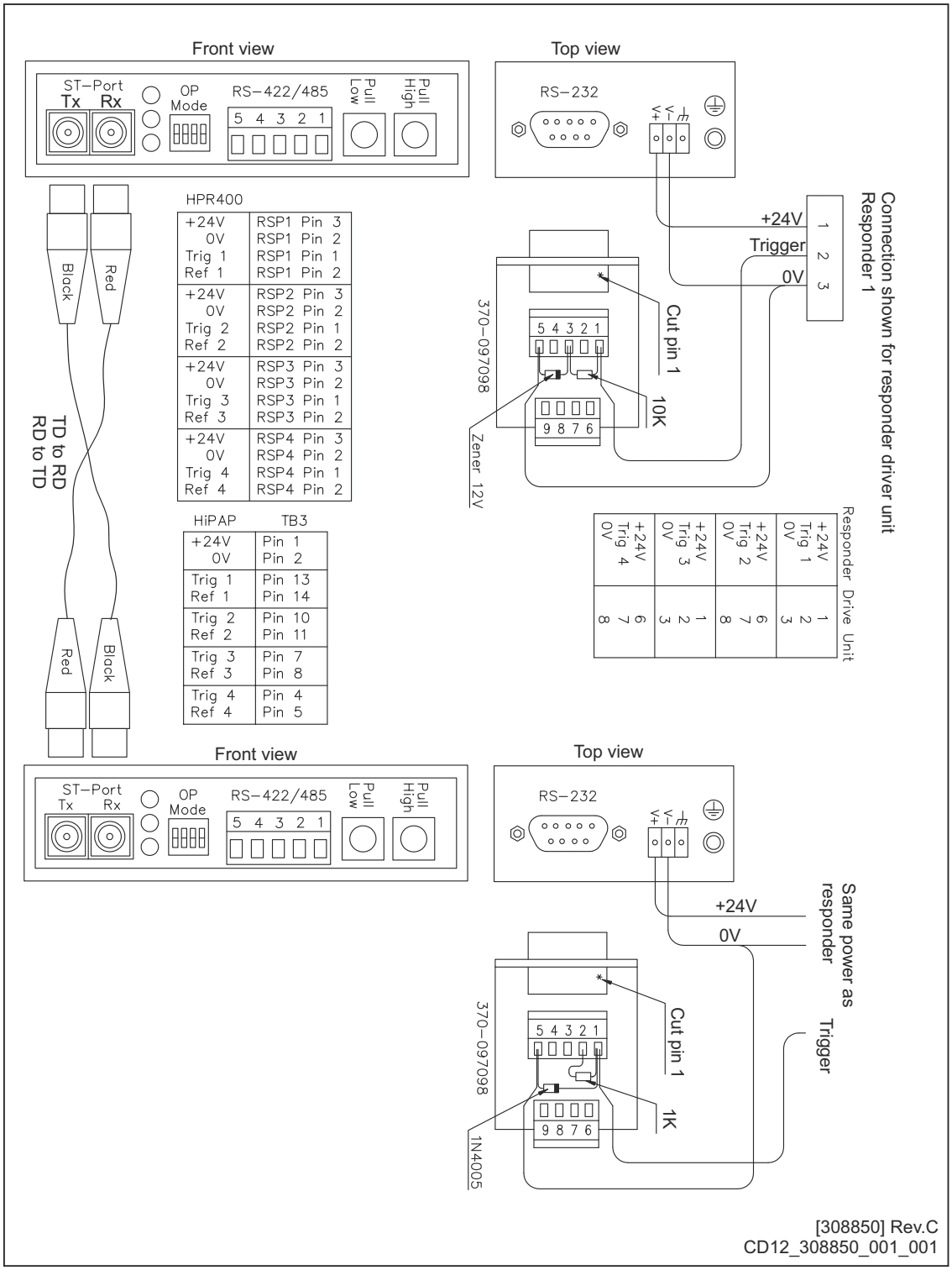
Fibre to responder drive converter wiring



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