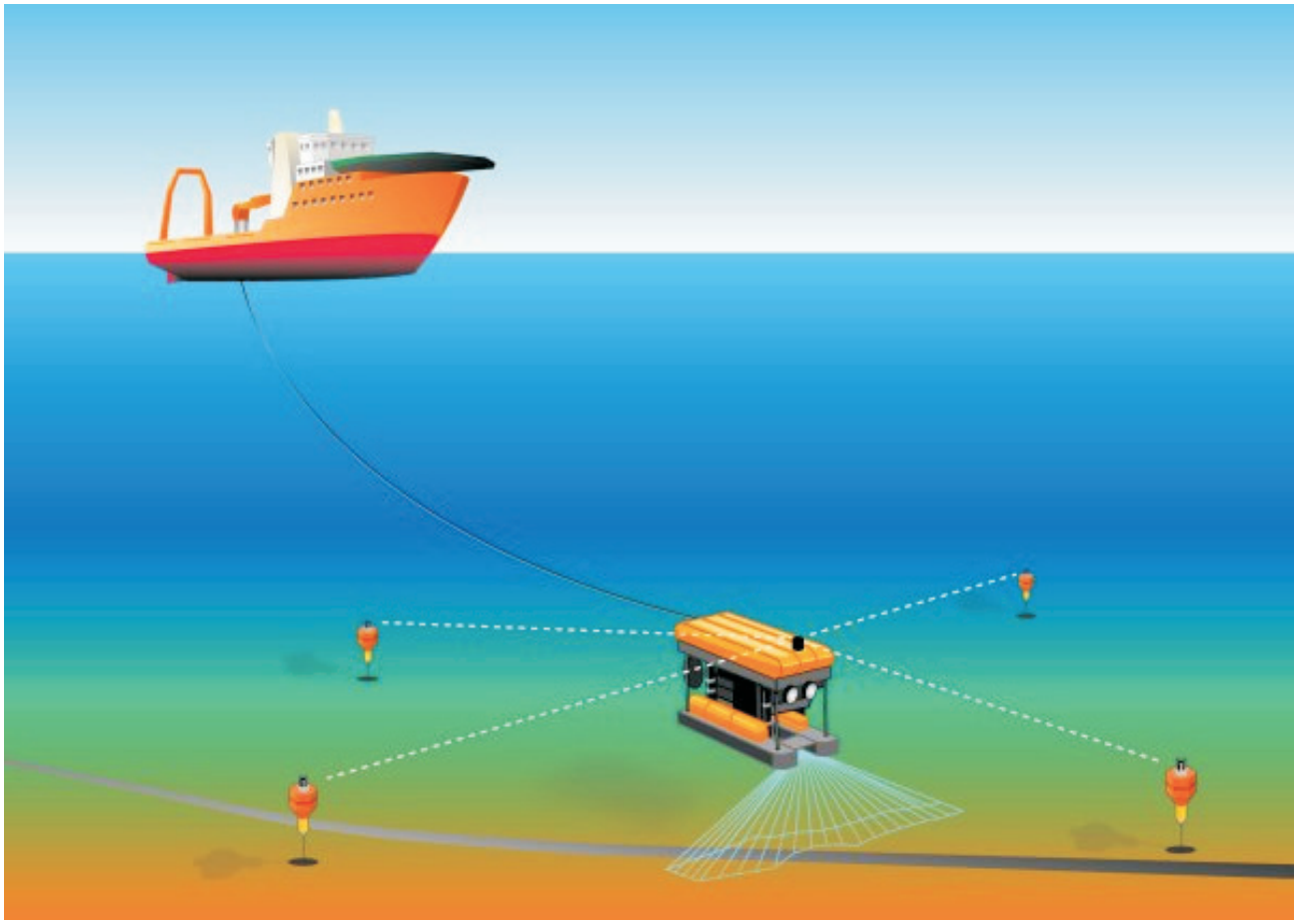
Instruction Manual

KONGSBERG

HPR 400S

Hydroacoustic Positioning Reference Subsea system



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HPR 400S

Instruction Manual

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	Implemented modified connection for RS-232 as an option, and APC 1x. Updated layout. Minor corrections in the text.			

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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. 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.

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INTRODUCTION

Manual contents

This manual describes the Hydroacoustic Positioning Reference Subsea system (HPR 400S).

It provides a general introduction to the system, technical specifications, operating information and maintenance procedures. It also includes spare parts lists and outline dimensions drawings.

List of abbreviations

APC	Acoustic Positioning Computer
APOS	Acoustic Positioning Operator Station
AUV	Autonomous Underwater Vehicle
HiPAP	High Precision Acoustic Positioning
HPR	Hydroacoustic Position Reference
HPR 400S	Hydroacoustic Positioning Reference Subsea system
LBL	Long Base Line
LF	Low Frequency
MF	Medium Frequency
MPT	Multifunction Positioning Transponder
N/A	Not Applicable
ROV	Remotely Operated Vehicle
SBL	Short Base Line
SSBL	SuperShort Base Line
TP	TransPonder
UW	Under Water
UUV	Untethered Underwater Vehicle

SYSTEM DESCRIPTION

General

The HPR 400S is used to perform LBL and SBL of underwater vehicles and structures.

- **Long baseline (LBL)**
  - In LBL the unit will use only one active transducer.
- **Short baseline (SBL) (Option)**
  - In SBL the unit will use one active transducer for transmitting/receiving and three for receiving only. This communication also includes transponder commands, using telemetry.

The HPR 400S can perform both LBL and telemetry functions as for standard HPR 400.

SuperShort Base Line (SSBL)

- SSBL is only available for Range measurement.

System overview

Subsea system

The HPR 400 Subsea unit is connected to the topside HiPAP / HPR operator station via optical fibres or RS-422 line in an umbilical. It receives the control instructions and operational parameters from there.

→ *Refer to the figure on page 3.*

- The operational principles are identical to a topside HiPAP / HPR system.
- The HPR 400S system has the subsea transceiver (Subsea unit) installed on the ROV/seabed structure together with the transducer(s). The interface to the topside HiPAP / HPR secure full operation from the APOS.
- The HPR 400S system uses the same multifunction positioning transponders (MPT) as a topside HiPAP / HPR system, and the operational principles are identical to those systems.

Topside system

The topside HiPAP / HPR system and the operational principles are described in separate manuals.

System description

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

Operation

→ *Refer to APOS Instruction manual/ APOS o-line help.*

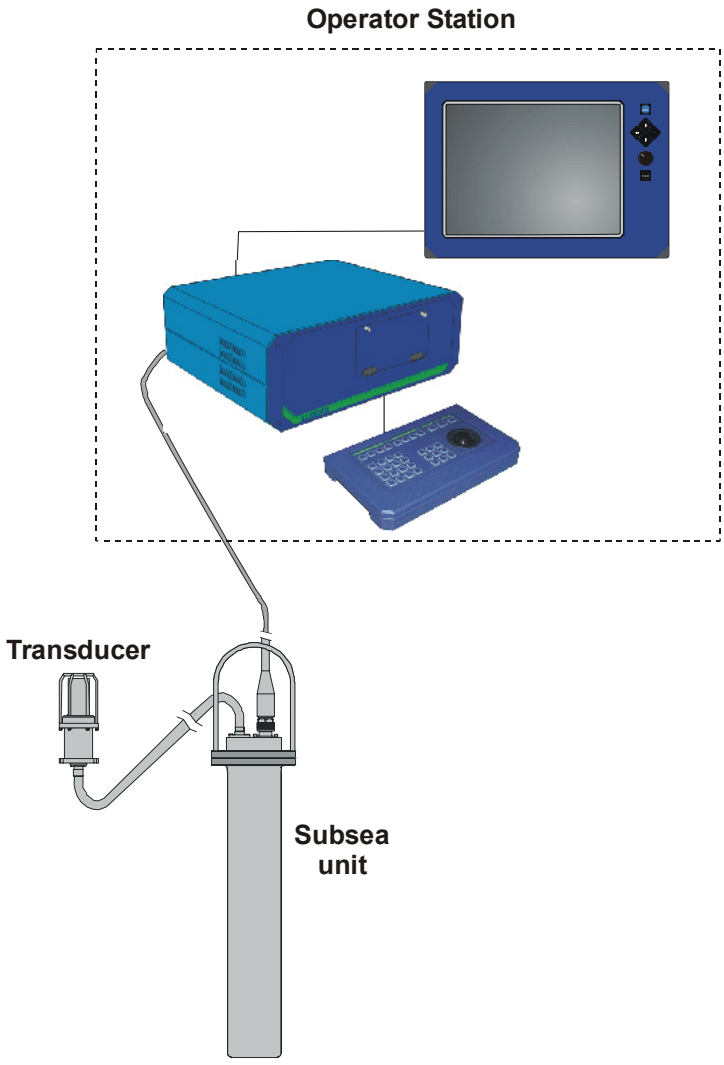


Figure 1 Complete system overview

HPR 400S system models

The system includes the following models:

- **HPR 400 S31** - This is a MF system, and is deep water rated to 1000 meter.
- **HPR 400 S33** - This is a MF system, and is deep water rated to 3000 meter.
- **HPR 400 S36** - This is a MF system, and is deep water rated to 6000 meter.
- **HPR 400 S16** - This is a LF system, and is deep water rated to 6000 meter.

System units

The system comprises of the following units:

- HPR 400 Subsea unit
- Transducer(s)

The HPR 400 Subsea unit is a subsea version of the standard HPR 400 transceiver, built in a pressure housing.

The HPR 400S can be mounted on:

- An ROV
- A seabed structures

The transducer(s) are connected to the Subsea unit via a cable. A maximum of 4 transducers may be used at a time:

- Two of these transducers can both transmit and receive.
- The other two can only receive.

The HPR 400S LBL system uses a special beam-forming ROV transducer with a doughnut shaped beam. This beam design is used to concentrate the sensitivity towards the transponder array, and hence reduce the sensitivity towards ROV and surface vessel generated noise. The system may also use omnidirectional transducers.

Interfaces

The following interfaces are available:

- Optoisolated serial line
- Synch. interface
- External interface
- Power interface

External connectors and cables are described in the section on page 50.

Optoisolated serial line

There is a optoisolated serial line RS-422 for communication with APC 1x.

Synchronisation interface

A maximum of four transceivers can be connected to one operator station, and this enables more than one transceiver (HPR 400) may be in operation transmitting at the same time. This interface synchronises the active transducers/transceivers.

External interface

In addition to the APC 1x serial line there are optional serial lines for:

- CTD probe RS-422
- Depth/temp sensor RS-422
- Interfaces for a maximum of 4 LBL transducers. Two transducers share one plug on the container (split cable).
- Connections to External equipment Multiplexer/Optical fibre.

Power interface

Power interface is available for 110 / 220 Vac (select by a strap on ac power), or 24 Vdc.

Theory of operation

General

With its high accuracy, good repeatability and high reliability, HPR 400S can be used as a multi-purpose hydroacoustic positioning system for ROVs, UUVs, AUVs and other subsea devices.

Information about the theory of operation, is described in:

- APOS Instruction manual

ROV-track plot example

The HPR LBL system may be interfaced to accurate sound velocity profiling sensors, and the software will compensate both for ray bending and range errors caused by variations in sound velocities in the different thermal layers. However, the accuracy of an LBL system is not determined by range measurement accuracy only. It is totally dependent on the number of transponders, the network geometry, baseline lengths and network calibration. When these details are known is it possible to define the position accuracy for a given application.

Range accuracy down to a few centimetres can be obtained, while ROV/module positions can be calculated within a few decimetres.

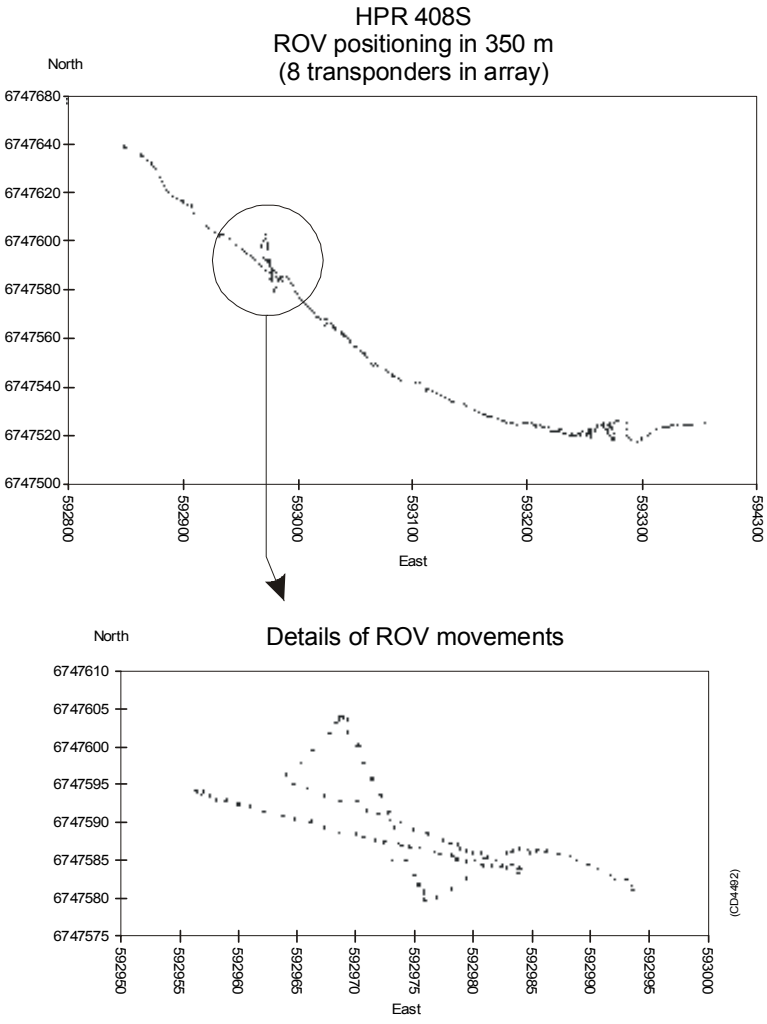


Figure 2 Examples of HPR 400S ROV LBL positioning plots

System set-up

For information about set-up of the HPR 400S system, refer to the following related manuals:

- APOS Instruction manual / APOS on-line help.

Operation

The operation of the HPR 400S is performed at the HiPAP/HPR topside operator station. For information about operation, refer to the following related manuals:

- APOS Instruction manual/On-line help system.

Mounting

The transducer is normally mounted on an ROV.

- If the ROV is to work close to the seabed, the transducer must be mounted on the top of the ROV to ensure good communication.
- If the ROV is to work high above the seabed, the transducer can be mounted underneath the ROV.

Mount the transducer(s) as far from any known source of noise as possible. It is also important to keep a clear line of sight between the transducer(s) and the seabed mounted transponders.

TECHNICAL SPECIFICATION

HPR 400 Subsea unit models

The HPR 400 Subsea systems:

- **HPR 400 S31** - a MF (3) system, deep water rated to 1000 (1) meters.
- **HPR 400 S33** - a MF (3) system, deep water rated to 3000 (3) meters.
- **HPR 400 S36** - a MF (3) system, deep water rated to 6000 (6) meters.
- **HPR 400 S16** - a LF (1) system, deep water rated to 6000 (6) meters.

General specifications

The electrical characteristics and environment conditions are the same for all models.

Electrical characteristics

Power supply	110/230 Vac or 24 Vdc
Power consumption	max. 25 W
Transmitter power	min 100 W IN 10 ms

Environmental conditions

Temperature at operation	0° C to 55° C
Temperature at storage	-40° C to +70° C

HPR 400 S31

Mechanical characteristics

Maximum depth rating	1000 meters
Tube material	Aluminium
Lid material	Aluminium

→ *Outline dimension, connectors and weight, refer to page 73.*

Source level

Source level with wide beam transducer - Transducer: RTD 333 Aluminium	min. 188 dB

HPR 400 S33

Mechanical characteristics

Maximum depth rating	3000 meters
Tube material	Stainless steel
Lid material	Aluminium Bronze

→ *Outline dimension, connectors and weight, refer to page 74.*

Source level

Source level with wide beam transducer - Transducer: RTD 333 Bronze	min. 188 dB

HPR 400 S36

Mechanical characteristics

Maximum depth rating	6500 meters
Tube material	Aluminium
Lid material	Aluminium

→ *Outline dimension, connectors and weight, refer to page 75.*

Source level

Source level with wide beam transducer - Transducer: RTD 343	min. 188 dB

HPR 400 S16

Mechanical characteristics

Maximum depth rating	6500 meters
Tube material	Aluminium
Lid material	Aluminium

→ *Outline dimension, connectors and weight, refer to page 76.*

Source level

Source level with wide beam transducer - Transducer: RTD 169	Positioning: Telemetry:	min. 180 dB min. 170 dB
Receiver sensitivity		max. 100 dB

Transducers

The technical specification for the transducer depends on which transducer is used. The following types are available:

RTD 333 transducer (MF) Bronze

Maximum depth rating	3000 meters
Connector	Gisma 10.00.1.04.2.10

→ *Outline dimension and weight, refer to page 77.*

RTD 333 transducer (MF) Aluminium

Maximum depth rating	3000 meters
Connector	Subconn LPBH3MNM Special
Kongsberg Maritime order no.	370-087991

→ *Outline dimension and weight, refer to page 78.*

RTD 343 transducer (MF) Aluminium

Maximum depth rating	4000 meters
Connector	Subconn MCBH4MSS

→ *Outline dimension and weight, refer to page 79.*

Omnidirectional transducer (Option for MF)

Maximum depth rating	3000 meters
Housing material	Bronze
Connector	Burton 5506-2004

→ *Outline dimension and weight, refer to page 80.*

RTD 169 transducer (LF) (omnidirectional)

Maximum depth rating	6500 meters
Housing material	Duplex steel
Weight in air / water	21 kg / 17 kg
Length	340 mm
Outside diameter	178 mm
Connector	Gisma 10.06.1.04.2.00

→ *Outline dimension and weight, refer to page 81.*

Cables

Cable for topside system connection

The cables for the topside are similar for all models.

Plugs	Gisma 10.06.3.12.2.00
Cable length	4 meters
Coating	Polyurethane

Cable for transducer connection

The technical specification for the cables depends on which transducer is used. The following type of cables are available:

- **Used with the RTD 333 transducer (MF) Bronze**

Plug - for HPR 400S unit conn.	Gisma 10.06.1.0.04.2.00
Plug - for transducer	Gisma 10.06.1.0.04.2.10
Cable length	6 meters
Coating	Polyurethane

- **Used with the RTD 333 transducer (MF) Aluminium**

Plug - for HPR 400S unit conn.	Gisma 10.06.1.0.04.2.00
Plug - for transducer conn.	Subconn LPIL3F
Cable length	9 meters
Coating	Polyurethane

- **Used with the RTD 343 transducer (MF) Aluminium**

Plug - for HPR 400S unit conn.	Gisma 10.06.1.0.04.2.00
Plug - for transducer conn.	Subconn MCIL4F
Cable length	6 meters
Coating	Polyurethane

- **Used with the RDT 169 transducer**

The cable is included in the transducer design, refer to page 81.

Cable length	1.5 meters
Coating	Polyurethane

- **Used with the omnidirectional transducer**
  (Option for MF)

Plug - for HPR 400S unit conn.	Gisma 10.06.1.0.04.2.00
Plug - for transducer conn.	Burton 5506-2004
Cable length	5 meters
Coating	Polyurethane

SUBSEA UNIT MAIN PARTS

Introduction

A HPR 400S unit consists of the following main parts (the same for all models):

- Unit top
- Housing
- Electronic chassis
- Circuit boards
- Power supply
- Backplanes
- Bottom end cap (not for the S33 model)

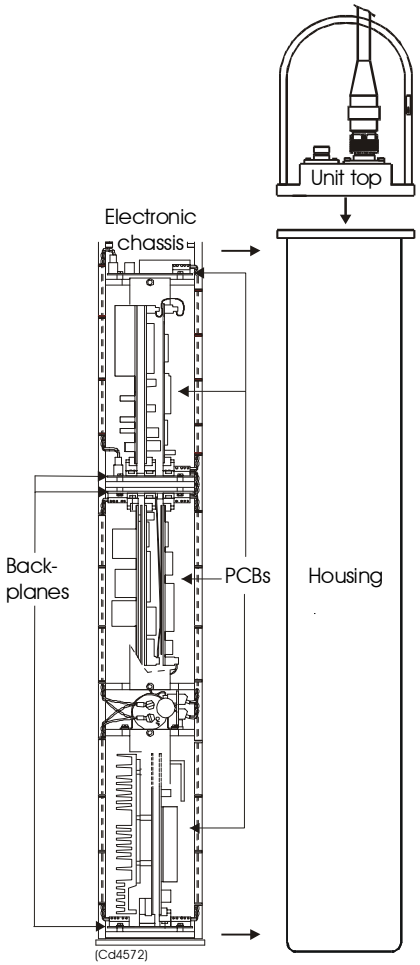


Figure 3 HPR 400S unit main parts

Unit top

The unit top is illustrated in the figure below. It is provided with a cage to protect the cables connectors.

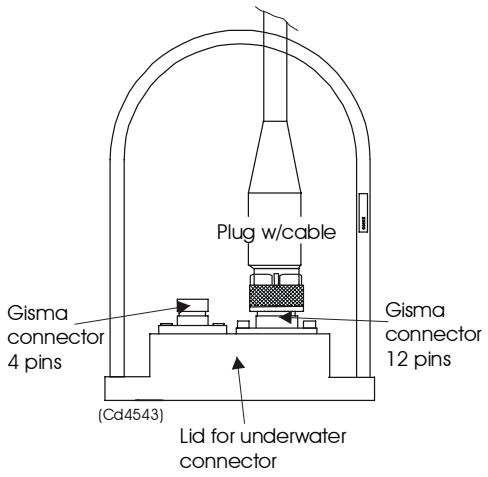


Figure 4 Example of Unit top with connected cable

Housing

For information regarding the housing, refer to the *Technical specifications*.

Circuit boards

→ *Refer to section on page 18.*

Bottom end cap

A standard bottom end cap with a shackle.

Electronic chassis

The electronic chassis holds all the unit electronic.

MAINTENANCE

General

No maintenance is normally required, apart from washing the unit.

Caution — *Electronic devices can be destroyed by static electricity. It is essential therefore 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.

Caution — *Maintenance beyond preventive precautions, must be carried out by a qualified service engineer.*

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 be damaged easily.

HPR 400S unit dismantling

Pressure housing assembly:

The pressure housing comprises the cylinder body (housing), and the unit top. The S16, S31 and S36 units are fitted with a bottom end cap.

→ *Refer to figure on page 12.*

The unit top comprises of the external connectors and a cage. The unit top is mounted on the housing, using two O-rings and secured by six socked-head screws.

Note *The socked head screws are manufactured of stainless steel, and must only be replaced by screws of the same material.*

Before you start:

Ensure the cables to the HiPAP / HPR system and to the transducer are disconnected.

Before you open the unit:

1 Wash the unit thoroughly in fresh water, and dry off any moisture on the outside.

2 Place the unit horizontally on a flat, clean work-bench, and support it so it can not roll off.

Opening the unit:

1 Remove the six socket-head screws that secure the unit top to the housing. Use a screwdriver-handled hexagonal key.

- There is no need to remove the bottom end cap (if fitted).

2 Remove the housing.

- Do not change coating or sealing surfaces.

Replacement of circuit boards

General

All the circuit boards may be replaced, apart from the Preamplfier board. All the replaceable boards are mounted in the same way.

Replacement

To replace a circuit board, follow the procedure below:

1 Dismantle the Subsea Unit.

→ *Refer to section on page 14.*

2 For placement of each circuit board, see figure *Exploded view of the HPR 400S Unit*, (depends on required model).

3 Remove the required PCB supports (one on each side).

4 Remove any connected flat cables.

5 Remove the required circuit board.

6 Mount the new circuit board.

7 Replace the PCB supports (one on each side).

8 Assemble the Subsea Unit.

→ *Refer to section on page 16.*

HPR 400S unit assembly

To replace the electronics chassis into the housing, follow the procedure below:

Before you start:

1 Inspect the O-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 the mating surfaces and O-rings are *completely* clean, then wipe a thin film of silicon over the rings and mating surfaces.

Assembling:

1 Connect the cables to the unit top connectors.

2 Carefully insert the chassis into the housing. Do not allow the circuit boards to knock against the housing, and ensure no wires are trapped between the chassis and the housing or left protruding from the housing.

3 Ensure the bag of silica-gel is positioned such that it will not prevent the chassis from fully entering the housing.

4 Place the unit top on the housing and align the screw holes and screw the six socket-head screws into the holes.

5 Tighten the screws using a screwdriver-handled hexagonal key.

6 Wipe off any excess silicon and clean the unit.

7 Perform a final check to ensure all the screws are correctly tightened and nothing has been left out.

Replacement of the transducer

The transducer is a sealed unit and can not be opened. If the unit is not working, the whole unit must be replaced.

Replacement of the bottom end cap

The bottom end cap is sealed into the transponder housing. A number of socked-head screws are positioned around the unit flange.

1 Remove the socket-head screws that secure the bottom end cap unit into the housing. (The screws where the heads are flush with the surface of the mechanism flange).

2 Hold the transponder securely, and agitate the bottom end cap back and forth in the tube to break the seal.

3 Pull the bottom end cap out. The bottom end cap should seal tightly into the housing, so some force will be required to withdraw it.

- Once the O-ring is clear of the housing, it will be loos.

Note *DO NOT use a screw-driver or similar tool in an attempt to lever the unit out. This will damage the sealing surfaces resulting in water ingress.*

---

4 The bottom end cap may now be removed.

5 Assembly is basically the reverse of dismantling. Proceed as follows:

- When the O-ring on the end cap meet the lead-in chamfer at the entrance to the housing, support the base of the transponder unit and push firmly on the transducer cage. Ensure the O-ring compress easily as the end cap enters the housing, and are not crimped or damaged.
- When the end cap is fully home, align the screw holes and screw the socket-head screws into the holes. Tighten the screws using a screwdriver-handled hexagonal key.
- Wipe off any excess silicon and clean the unit.
- Perform a final check to ensure all the screws are correctly tightened and nothing has been left out.

CIRCUIT BOARDS

General

This technical description is created to assist the maintenance engineer with “Intermediate level” maintenance operations. This means that the maintenance engineer is expected to be able to locate and replace faulty Line Replaceable Units (LRUs) (circuit boards etc.) but not to perform circuit board repairs. To locate the faulty component, the engineer is further expected to have access to and know how to use standard electronic instruments such as multimeters and oscilloscopes.

Boards

The HPR 400S unit electronics include the following nine circuit boards:

- Preamplifier board
- DSPM 50 board
- ADCM board
- InputM board
- I/O M board
- CPUEX board
- Transmitter boards (TXM)
- Power supplies:
  - DC power
  - AC power

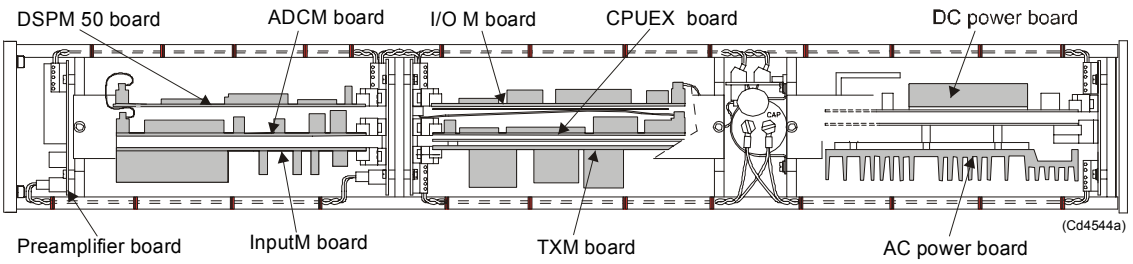


Figure 5 Circuit boards placement

The circuit boards are similar for all models.

A description of each board is given on the following pages.

→ *HPR 400S - internal wiring, see page 82.*

Functional description

The transducer signals are amplified approximately 32 dB in the preamplifier (depends on the HPR 400S model), and then they are fed into the InputM board and amplified additional. The amplifier on the Input board is voltage controlled. Max gain is 60 dB. The signals are then demodulated to base-band and filtered. The output of the Input board is a sampled real and imaginary part from each of the four channels. These signals are multiplexed and analogue to digital converted in the ADCM board.

The DSPM board performs FFT and signal processing. The signal data is further proceeded in the CPUEX board.

The program here calculates the ranges, and perform some decoding of the telemetry pulses. The CPUEX control all the other PCB‘s except the powers.

The I/O M board holds optoisolated serial line drivers for communication with APC 1x, and driver for the synch pulse. It also has a digital to analogue converter, which is used for generation of the gain control voltage.

The TXM board holds a frequency generator which generates the clocks for the transmitter frequency and the receiver frequency. The transmitter pulse is generated from a transmitter enable (txen) signal from the cpuex gated with the tx clock. The maximum output power in this application is 100W. The transmitter pulse is connected to the preamplifier board in parallel with the transducer. The preamplifier board have filters and diodes to handle T/R switching.

The AC power generates 24Vdc 4 amperes nominal and 8 amperes peak. This 24Vdc is connected to the TXM and the DC power. The high peak performance ensures a stable output effect when transmitting telemetry pulses. The DC power generates all the DC voltage needed in the unit.

Preamplifier board

Location and purpose

The preamplifier board is located at the top of the electronic chassis. The purpose of the preamplifier HPR 400 S is to amplify the signals from up to four LBL transducers. Two of the channels have connections for transmitter.

Physical description

The preamplifier board holds 4 connectors one on each side of the board as follows:

- P1 8-pin connector - for channel input/output
- P2 8-pin connector - for channel input (to InputM)
- P3 5-pin connector - for internal power
- P4 5-pin connector - for transmitter signals (from TXM)

Circuit description

The preamplifier contains four identical channels, each of them have an input Isolation transformer (T1,T2,T3 and T4) and a filter (L1(2-4)).

P1 - is for connections to transducers.

P4 - is for connecting to output of a TXM board. P4 is parallel connected to two of the channels on P1. The main component is four channel hybrid amplifier 244-110545 QTVG. The output from QTVG is isolated (T5(6-8)).

R3 and R4 - is a voltage divider which determines the gain of the QTVG. It is possible to control the gain externally on P3 pin 1 if you remove R3 and R4, and put in a link on LK2 and on R3 position.

The gain in the HPR 400S application is approximately 32 dB rel.1Vrms, 20dB in the QTVG and 12 dB in one filter. The gain in the QTVG is tuned for each of the two HPR 400S models.

→ *Refer to the block diagram on the following page.*

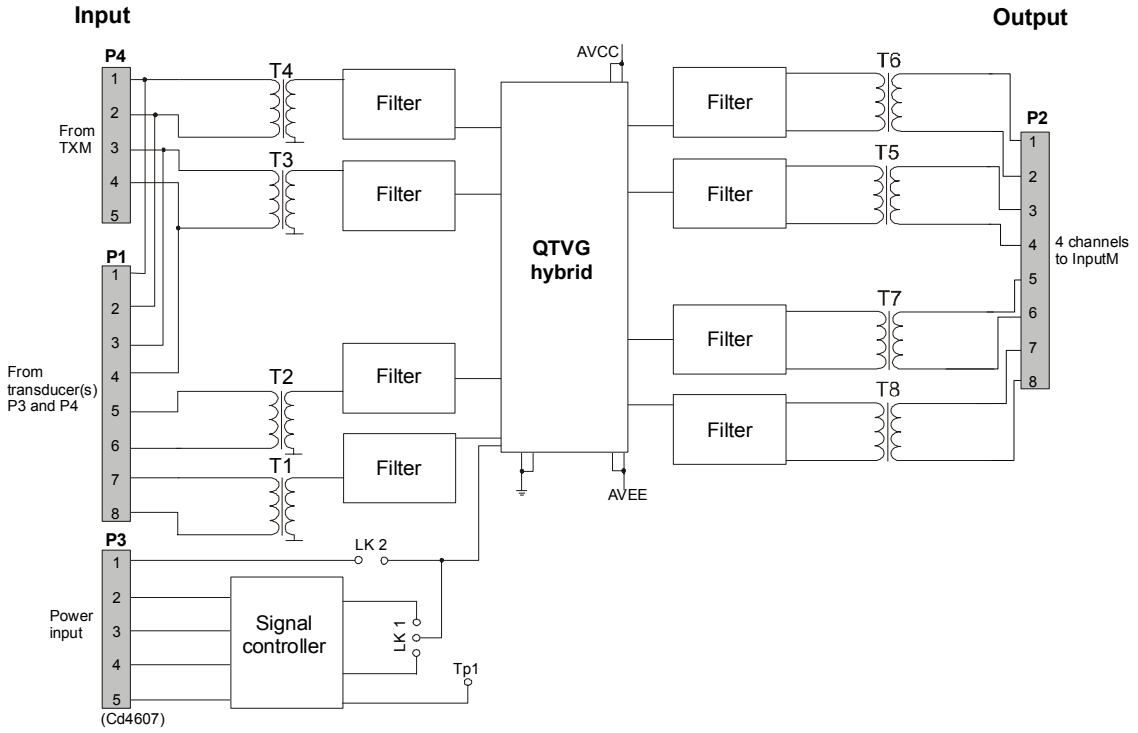


Figure 6 Preamplifier board- block diagram

Connections

The preamplifier board holds four connectors:

P1 (at the back edge of the board) comprises of:	SMKDS1/2-3,81 SMKDS1/3-3,81 SMKDS1/3-3,81
P2 (at the front left side of the board)	90130-1116 16 pin
P3 (at the front right side of the board) comprises of:	SMKDS1/2-3,81 SMKDS1/3-3,81
P4 (at the back left side of the board) comprises of:	SMKDS1/2-3,81 SMKDS1/3-3,81

The pin layout and description is presented in the tables below.

P1-Input		
Pin	**Signal**	**Description**
1	Ch1 in	Input channel 1
2	Ch1 in~	Input channel 1
3	Ch2 in	Input channel 2
4	Ch2 in~	Input channel 2
5	Ch3 in	Input channel 3
6	Ch3 in~	Input channel 3
7	Ch4 in	Input channel 4
8	Ch4 in~	Input channel 4

P2-Output		
Pin	**Signal**	**Description**
1	Ch1 out	Output channel 1
2	Ch1 out	Output channel 1
3	Ch2 out	Output channel 2
4	Ch2 out	Output channel 2
5	Ch3 out	Output channel 3
6	Ch3 out	Output channel 3
7	Ch4 out	Output channel 4
8	Ch4 out	Output channel 4

P3-Power		
Pin	**Signal**	**Description**
1	TGV	Gain control
2	AVCC	Analog +5V
3	AVEE	Analog -5V
4	GND	Internal ground
5	AGND	Chassis ground

P4-Tx		
Pin	**Signal**	**Description**
1	Tx A	Transmitter A
2	Tx A~	Transmitter A~
3	Tx B	Transmitter B
4	Tx B~	Transmitter B~
5	NC	Not connected

Maintenance aids

Test points

Tp1	GND point

Links

- Link LK1:
  - Pin 1 and 2 for negative voltage
  - Pin 2 and 3 for positive voltage
- Link LK2:
  - To control the gain externally on P3 pin 1 if you remove R3 and R4, and put in a link on LK2 and on R3 position.

Adjustments

The control voltage is from -1,2 V to +1 V.

Adjust divider R3 and R4 the wanted voltage.

Digital signal processor (DSPM 50)

Location and purpose

The Digital Signal Processor (DSPM) board is located at the top section of the chassis.

It is designed as a general purpose single board computer, and its main task is to perform digital signal processing.

Physical description

The DSPM is a single euro-card circuit board, constructed of six layers. It holds one test-point and one 50-pin connector, P2, on its front edge. Test-point 1 is located at the top of the board.

Circuit description

The DSPM is a general purpose digital signal processor board. It utilizes the *TMS 320C50 Digital Signal Processor* manufactured by Texas Instruments. It is equipped with 32 inputs and outputs.

The DSPM board comprises the following functional modules:

- Digital Signal Processor
- Memory
- I/O Expansion Bus
- FIFO Buffer
- 8 Digital Inputs
- 8 Digital Outputs
- Control circuitry
- Bus Interface
- Power +5 Vdc (340 mA measured)

The Texas Instrument signal processor is a fixed point 16-bit processor with a 16-bit address bus. The DSPM has separate program and data addressing space.

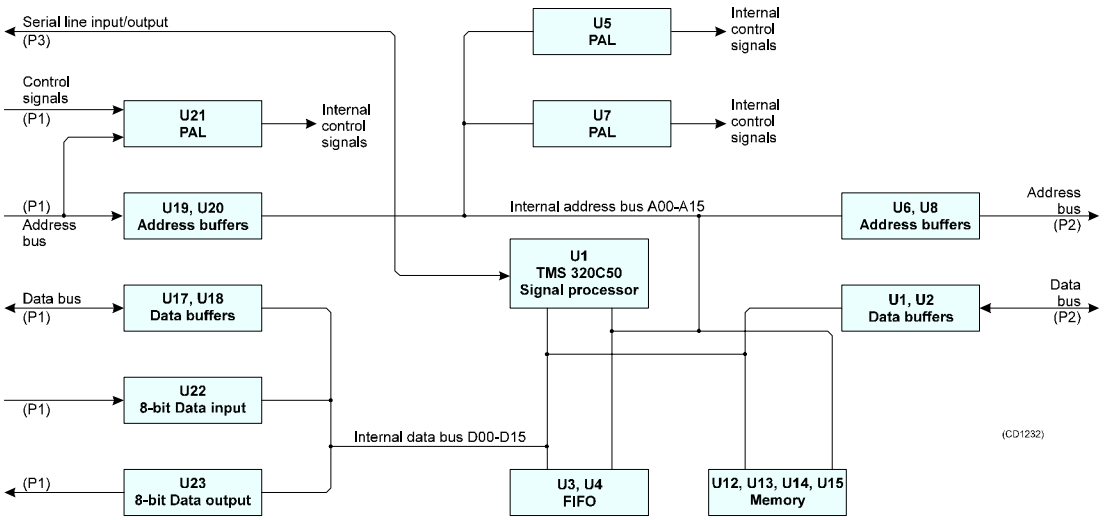


Figure 7 Digital Signal Processor (DSPM) - block diagram

U14 and U12 are the program memory units, and U13 and U15 are the data memory. Both memories can be read or written to from an external computer.

Serial line signals CLKR, CLKX, DR, DX, FSR and FSX are connected directly from the DSP to P3.

The board requires +5 Vdc, and consumes approximately 350 mA.

Connections

P1	96-pin, male, right-angled Europa connector placed at the back edge of the circuit board
P2	50-pin, male, low-profile flat ribbon cable connector placed at the front edge of the circuit board

The user may check basic functions by using an oscilloscope and measure on the following points:

- The HOLD/ signal on U16 P2 and RS/ on U16 P5. These must both be low when loading the program memory.
- The signal STRB/ on U9 P4. A pulse train will be observed when the signal processor is running.

LK 01	Connects SW controlled reset (RS/) to the signal processor. (normally ON).
LK 02	Selects internal ROM when low (normally OFF).

Analogue digital converter (ADCM)

Location and purpose

The Analogue Digital Converter (ADCM) circuit board is located in the top chassis section.

The purpose of the ADCM is to perform analogue to digital conversion.

It offers conversion of 32 analogue input channels and temporary storage of data in dual port RAM. Up to eight conversion sequences can be programmed into an EPROM. Data sets are stored alternately in two banks of RAM.

Physical description

The ADCM is designed to the single Euro-card circuit board standard, with four layers. Two layers are used for the signals, two layers are used for the power supply. The board is equipped with two connectors, one located at each end. A 50-pin connector (P2) is the only front mounted device visible when the board is in position in the HPR 400 Transceiver Unit.

Circuit description

The ADCM circuit board provides 32 multiplexed analogue input channels. Dual 16-bit multiplexers are used to select analogue input signals obtained from the sample-and-hold outputs of the Input-M circuit board. Each output from the Input-M provides a real and imaginary analogue signal between ±2.5 Vdc.

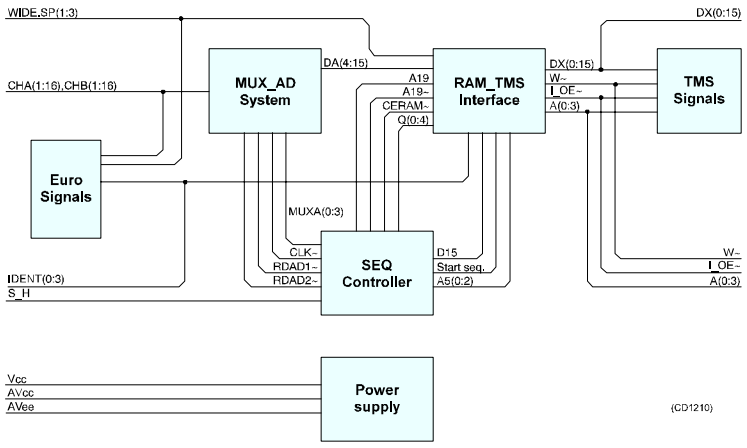


Figure 8 A / D Converter (ADCM) - block diagram

The control lines IDENT (0:3) (ref block diagram) provide the board with a unique identification code which is set by jumpers S1 - S4. The external address lines A (0:3) must match this code to select the board.

Connections

The board carries two connectors, one located at each end of the board. **P1** is a 96-pin, male, right-angled connector. It connects the ADCM into the motherboard. **P2** is a 50-pin, male, right-angled connector with ejector/latch. It is located on the front edge of the board.

Test points

TP 1	ADC, IC4 input (real signal)
TP 2	ADC, IC4 BUSY~
TP 3	ADC, IC8 input (imaginary signal)
TP 4	ADC, IC8 BUSY~
TP 5	START_SEQ
TP 6	CLK~
TP 7	IC21 CK (multiplexer address latch)
TP 8	S_H
TP 9	+5 Vdc digital
TP 10	DGND
TP 11	+12 Vdc analogue
TP 12	Analogue ground
TP 13	-12 Vdc analogue

InputM board

Location and purpose

The Input M board is located in the top section.

The purpose of the InputM circuit board is to amplify transducer signals, perform de-modulation and narrow band filtering, and present the output signals via Sample and hold circuitry.

Physical description

The InputM board is a single Euro-card circuit board.

Circuit description

The InputM circuit board is designed for eight individual channels, using identical analogue channel hybrid circuits. However, only four are fitted. The board is also equipped with digital circuitry common to all the analogue channels.

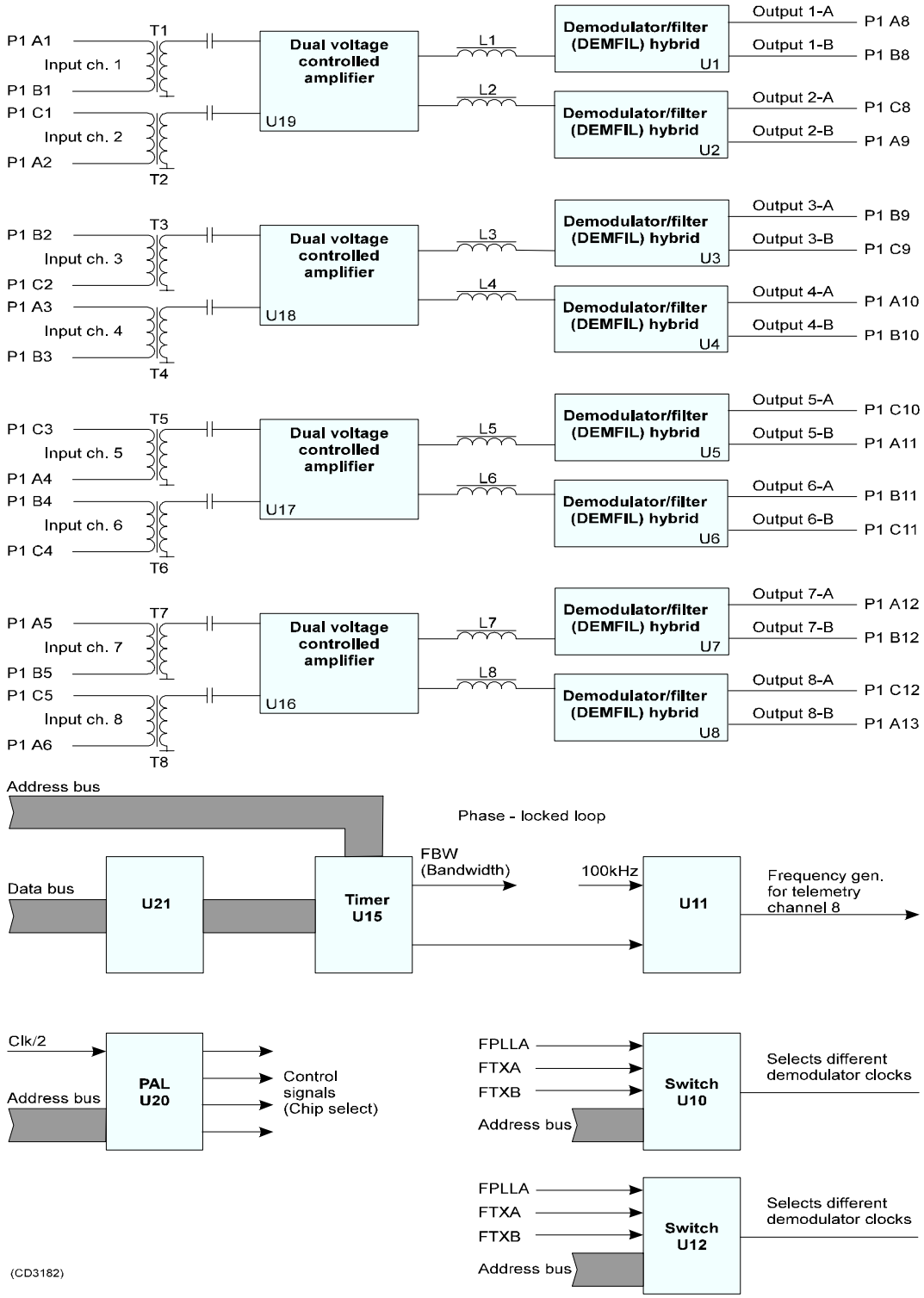


Figure 9 Input M A/B circuit board - block diagram

Connections

The InputM circuit board carries one connector. This is a 96-pin Europe connector mounted on the rear edge of the board, used to link the board into the backplane.

TP 1	Transducer signal channel 1
TP 2	Transducer signal channel 2
TP 3	Transducer signal channel 3
TP 4	Transducer signal channel 4
TP 5	Not fitted
TP 6	Not fitted
TP 7	Not fitted
TP 8	Not fitted

- The de-modulator frequency should be present at “Demfil” pins 1 and 2. The frequency should be two times the actual listening frequency. Note that the frequency will shift by the transmitter pulse after the reply is received. (50 Hz off).
- The bandwidth clock should be present on “Demfil” pin 14, and should be 50 times the actual bandwidth.
- The Sample / Hold clock should be present on U13 pin 13, and then go to pin 15 on all the “Demfil” packages.

The signal reply pulses (5 to 7 Vp-p) should be present on the test points in front of the “Demfils”. (TPs 1, 2, 3, 4 and 8).

- The signal pulse envelope should be present on “Demfil” pins 27 and 28. Maximum amplitude should be 4 V p-p.
- **LK1**

Link 1-2	Not used
Link 2-3	2 x mod. freq. telemetry normally closed

- **LK2**

Link 1-2 / Link 2-3	Not used

- **LK3**

Link 1-2 / Link 2-3	Not used

- **LK4 / LK5**

Link 1-2	LK 4 pin 2 is linked to LK 5 pin 2 to set bandwidth for wide and telemetry

Link 1-2	Lk 4 pin 2 is linked to Lk 5 pin 2 to set bandwidth for wide and telemetry

Input/output board (I/O M)

Purpose

The Input/Output board (IO/M) is designed to the single Euro-card circuit board standard. It is designed to interface the most common SSBL and LBL inputs and outputs, such as a vertical reference unit, course gyro, external synchronization and serial lines.

Board description

The vertical reference unit, gyro and serial line 1 (to the system controller) are galvanically isolated. Serial lines 2 and 3 are dedicated to tracking interface. These serial lines are galvanically isolated on the Serial Interface board, SIF.

Serial line 1 is available with a programmable baud-rate control, coming from the CPU board. Selection between RS-232 and RS-422 is made using links on the inputs. The serial line may also be inverted by links on the board. The serial line may supply RS-232 and RS-422 as outputs simultaneously.

Serial lines 2 and 3 are RS 422 only, controlled by U3, 82530.

Circuit description

U13 is the address buffer for the system bus. It contains two address bits. The bus is available on P1. U5 and U6 are the bidirectional data transceivers. The data bus is also available on P1.

The 82530 (U3) Serial Communication Controller contains two serial lines identified as 2 and 3”.

Front mounted devices

A 50-pin connector, P2, is the only device mounted on the front edge of the board.

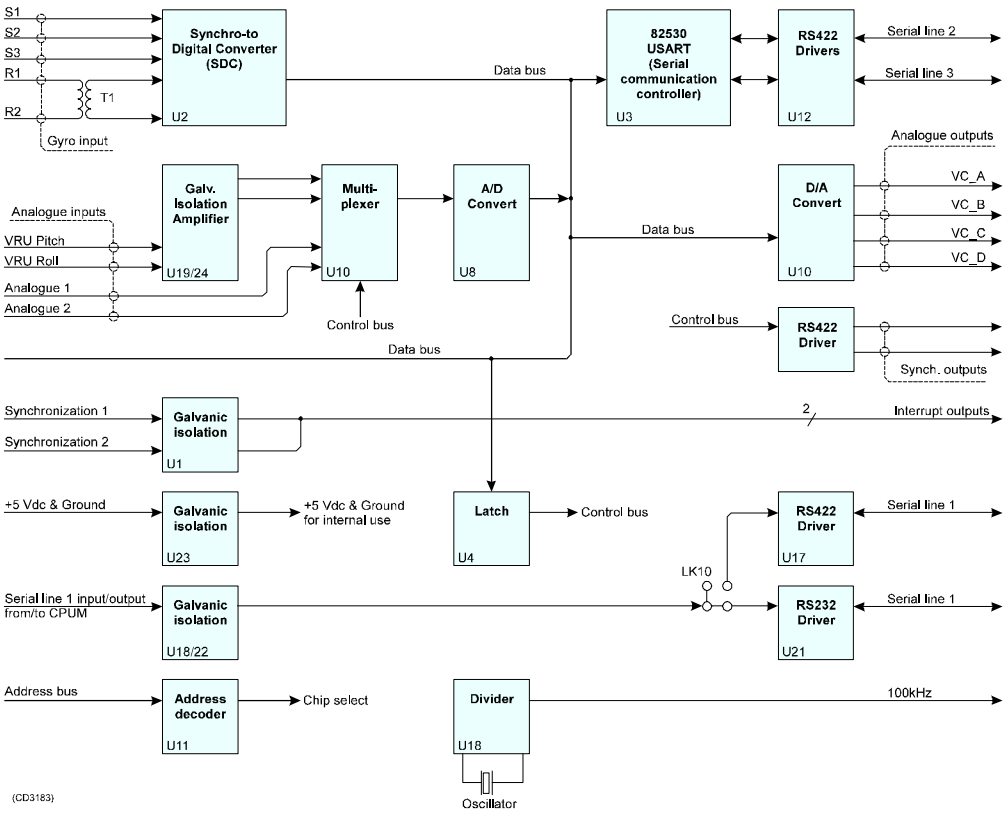


Figure 10 Input/Output circuit board (IO/M) - block diagram

Connections

There are two connectors; one at each end of the circuit board.

P1	96-pin, male, right-angled connector
P2	50-pin, male, flat ribbon cable connector

Maintenance aids

Test points

TP 01	GND
TP 02	Analogue inputs, between multiplexer and AD
TP 03	Pitch
TP 04	Roll
TP 05	VCC
TP 06	VCC1
TP 07	GND1
TP 08	Pitch input
TP 09	VRU common
TP 10	Roll input

Links

LK 01	Link 1-2 for direct Analog_1 input Link 2-3 for Analog_1 input via amplifier.
LK 02	Link 1-2 for direct Analog_2 input Link 2-3 for Analog_2 input via amplifier.
LK 03	Link between analogue and digital ground Normally closed.
LK 04	Digital ground to D/A converter. Normally closed.
LK 05	-5 Vdc to D/A converter.
LK 06	A/D converter 20 V input. Normally closed.
LK 07	A/D converter 10 V input.
LK 08	Link 1-2 for inverted Serial line 1, Tx. Link 2-3 for non-inverted Serial line 1, Tx. Normally closed.
LK 09	Link 1-2 for inverted Serial line 1, Rx. Link 2-3 for non-inverted Serial line 1, Rx. Normally closed.
LK 10	Link 1-2 for RS422 input serial line 1 Normally closed. Link 2-3 for RS232 input serial line 1.
LK 11	Analogue ground to D/A converter.
LK 12	200 Hz reference frequency.
LK 13	100 Hz reference frequency. Normally closed.

Potentiometers

R 13	Adjustment of bipolar offset, A/D converter.
R 14	Adjustment of reference voltage A/D converter.

Switches

The IO/M board holds no switches.

Control processing unit (CPUEX)

Location and purpose

The CPUEX is a single-board computer utilizing the 80386EX microprocessor. The purpose of the board is to control the operation of the transceiver unit.

The Control Processor Unit (CPUEX) is located in the middle chassis section. The CPUEX is a single-board computer utilizing the 80386EX microprocessor. The purpose of the board is to control the operation of the HPR 400 Transceiver Unit.

Physical description

The CPUEX is a standard eight-layer single-Europe board. One edge connector connects to the motherboard. The front edge holds a 34-pin connector, four LEDs, two test points and link Lk7.

Circuit description

The CPUEX is designed as a Control Processor Unit using the 80386EX microprocessor from Intel. The board has sockets for an 80387SL numeric processor and flash memory. The board also holds RAM memory for program and data storage, serial lines, interrupt inputs, general I/O lines and a general bus interface (96-pin Europa connector).

The Bus Interface contains address buffers and bidirectional data buffers to the system bus, which is in the 96-pin Europa connector.

The board contains 6 TTL inputs (ID1 to ID6), 12 TTL outputs (ID9 to ID16 and OUT1 to OUT4), nine external interrupt inputs and six 16-bit timers.

Two separate serial lines with separate programmable baud-rate control are available. Selection between RS-232 and RS-422 is made by links on the inputs. Both serial lines supply RS-232 and RS-422 as outputs at the same time.

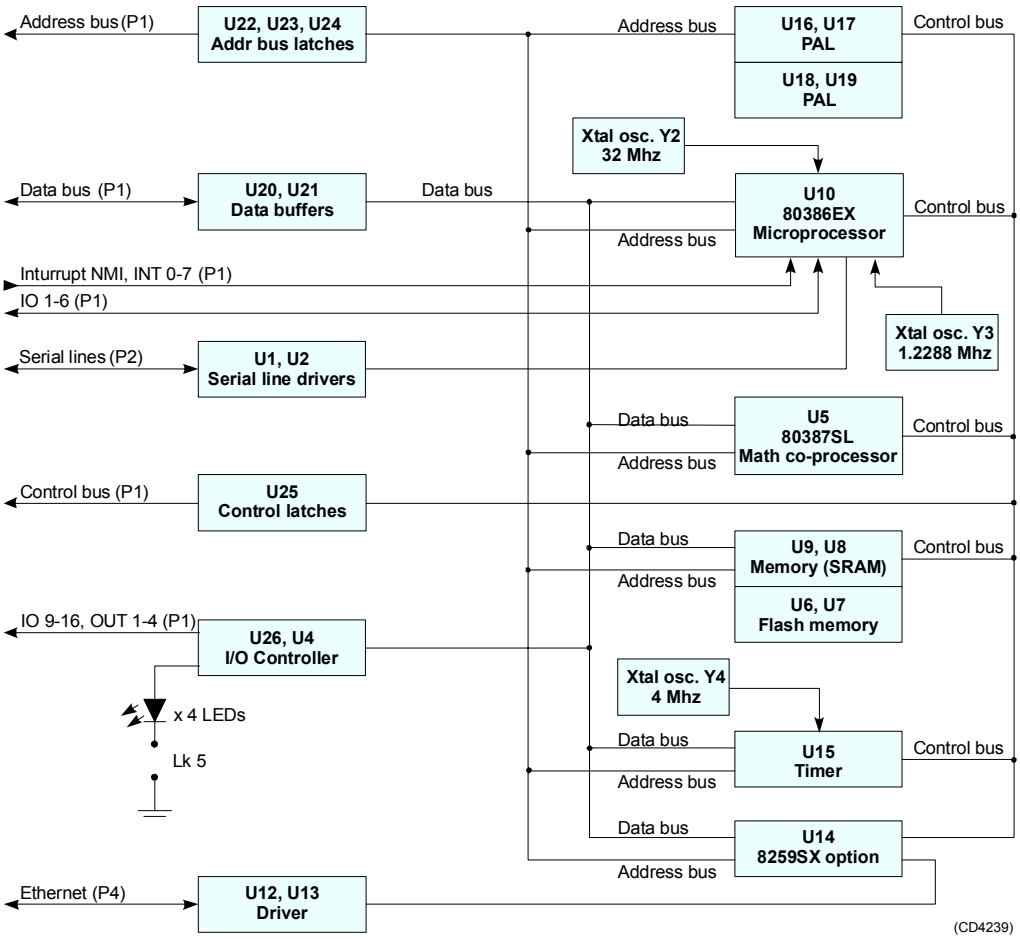


Figure 11 Control processor unit (CPUEX) circuit board - block diagram

Connections

There are two connectors; one placed at each end of the circuit board.

P1	96-pin, male, right-angled Europa connector
P2	34-pin, male, flat ribbon cable connector

Maintenance aids

Test points

TP 1	GND
TP 2	+5 V

Links

LK 01	Link 1-2 for RS 422 input serial line A Link 2-3 for RS 232 input serial line A
LK 02	Link 1-2 for RS 422 input serial line B Link 2-3 for RS 232 input serial line B
LK 03	Normally closed, software control
LK 04	Ram dependent
LK 05	On = enables D1 - D4
LK 06	On = WD enable
LK 07	Reset connector

LEDs

D1 -D4	Software-controlled, front mounted

Oscilloscope check points

The maintenance engineer can check the basic functions by using an oscilloscope and measuring on the following points:

- The signal ADS/ on U16 Pin 3, observe the pulses when the board is (should be) running. Check for one positive pulse to start every instruction cycle.

Transmitter board (Tx)

The Transmitter board is a general purpose transmitter, containing its own frequency generator, power control and power supply circuits, (the board feeds both the receiver and microcontroller circuit boards.

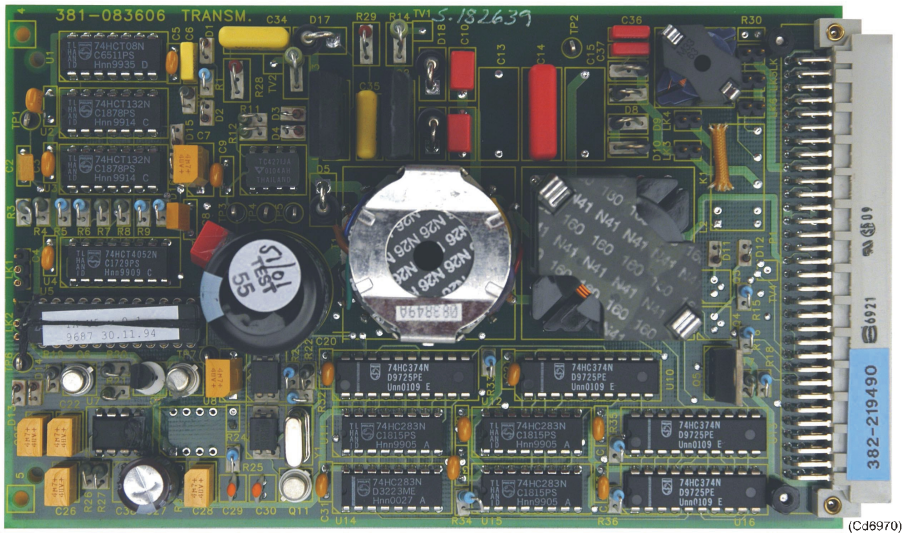


Figure 12 Transmitter circuit board

→ *Refer to figure on page 38 for the block diagram.*

The board holds two voltage regulators which output the voltages required by the other boards. It also has a crystal oscillator which is used as the Tx frequency source, and a direct numerical synthesizer for generating the correct Tx frequency. Driver stages with power control, an output stage with over-current protection, and transducer matching circuits, complete the board.

Note

The Relay is only used with the following transponders:
- MPT 163series.

Note

The Relay is only used with the following transponders:
- Dual beam models.

Note

The Relay (K1) is only used with the following transponders:
- MPT 313 series.

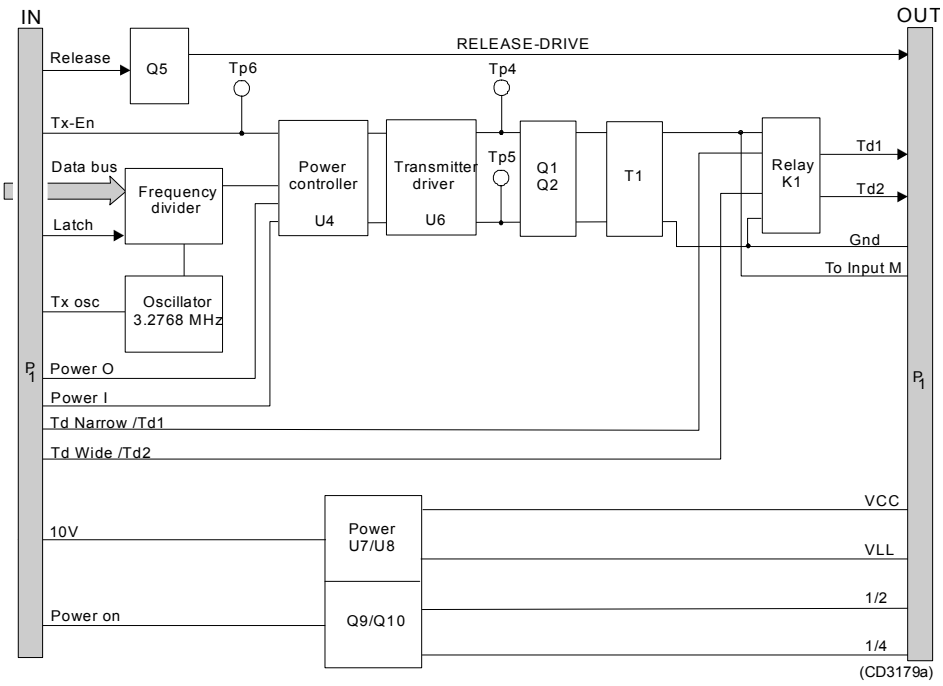


Figure 13 Transmitter circuit board - block diagram

POWERM board (Power MKI/24)

Location and purpose

The POWERM board is located at the lower section of the electronic chassis. The purpose of the POWERM (MUNAV Power Supply) is to supply the electronic circuitry with low level DC voltages. The unit cam provide several different voltages.

In this system 15 Vdc is used.

Physical description

The POWERM board is a single euroboard with 96 pin Euro connector.

Low power version (25W) uses one converter.

Circuit description

Inputt voltage:

DC-IN1, DC-IN2	21 Vcd to 35 Vdc

Output load:

Refer to the signal description list for P1 on page 50.

The DC/DC converter generates the following voltages:

+5 Vdc, +15 Vdc, -15 Vdc

The ±15 Vdc is converted to ±5 Vdc by means of serial regulators.

Input power to the board is switched ON/OFF with TTL signals on the POWER-ON line or the POWER-UP line. Input power to the board, 24 Vdc, can be supplied to two different input lines:

DC-IN1 and DC-IN2.

Input detection circuitry is implemented. In addition this board contains a 2 A constant current output.

The POWERM board contains:

- **On/OFF Switch**
- **Constant Current supply**
- **Voltage sensor**
- **DC/DC converter**
- **Regulator +5 Vdc and -5 Vdc**

On/OFF Switch

The circuitry used for this function comprises:

Q1, Q2, R2, R3, R9 and D2.

When a TTL level signal is applied to either POWER-ON or POWER-UP, the gate on Q1 will be forced to a low level by Q2. This will set the Q2 to a ON condition, and thus pass this power, supplied to input DC-IN1 or DC-IN2.

Note

It is a startup delay of approximately 40 mS between the arrival of a Power On puls and a settled +5 Vdc output.

Constant Current supply

This block is based on a three terminal voltage regulator (U1) LM317HVK and a serial resistor (R1).

The output current will increase until the voltage across R1 is equal to $V_{REF.}$ (1.2 Vdc). Using a 1 ohm resistor gives a current of approximately 1.2 A.

Voltage sensor

Voltages from both inputs (DC-IN1 and DC-IN2) are fed to the input pins on a voltage comparator, U4. The voltage divider on the comparator inputs are calculated in such a way that it will give a level shift on the Batt output when the DC-IN1 voltage falls to 90% of the DC-IN2 voltage.

DC/DC converter

The DC/DC converter used is a 25W Eri Power, the PKA2000.

- The PKA2000 series require an input voltage between 19 Vdc and 35 Vdc.

PKA2232P has the following output data:

+5 Vdc output:

Nominal load	3.9 A
Maximum load	5 A

±15 Vdc output:

Nominal load	0.25 A
Maximum load	1 A

Warning ***The sum of loads must never exceed 25W.***

Regulator +5 Vdc and -5 Vdc

To generate ±5 Vdc analogue voltage (AVCC/AVEE) the ±15 Vdc output from the DC/DC converter are fed to U2 and U3.

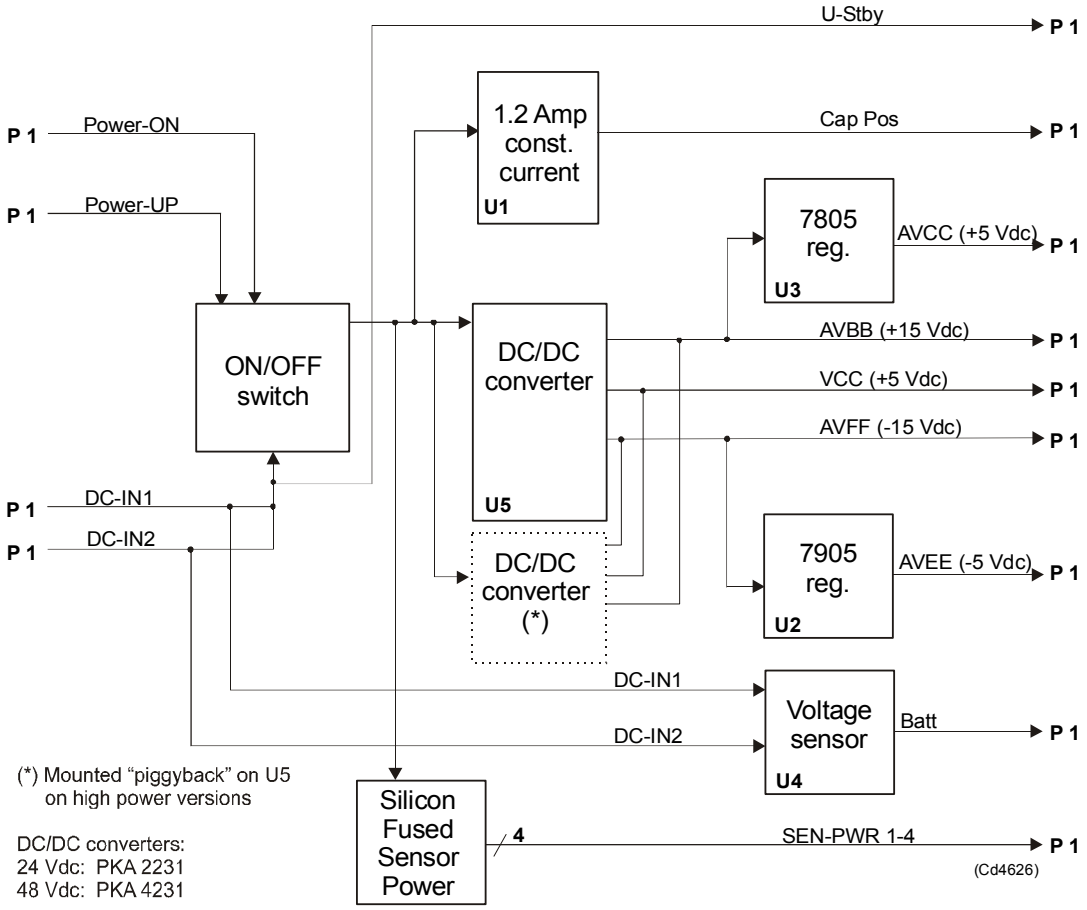


Figure 14 POWERM board- block diagram

Connections

The pin layout and description is presented below.

P1 - Pin configuration 96-pin Europa male connector on the board edge					
Pin	**A**	**Pin**	**B**	**Pin**	**C**
1	VCC	1	VCC	1	VCC
2	GND	2	GND	2	GND
3		3		3	
4	DC-IN1	4	DC-IN1	4	DC-IN1
5	DC-IN1	5	DC-IN1	5	DC-IN1
6	GND	6	GND	6	GND
7	GND	7	GND	7	GND
8	DC-IN2	8	DC-IN2	8	DC-IN2
9	DC-IN2	9	DC-IN2	9	DC-IN2
10	GND	10	GND	10	GND
11	GND	11		11	GND
12	U-STBY	12	GND	12	U-STBY
13		13	U-STBY	13	
14	CAP-POS	14		14	CAP-POS
15		15	CAP-POS	15	
16	GND	16		16	GND
17		17	GND	17	
18	POWER-ON	18		18	POWER-UP
19		19		19	
20		20		20	BATT
21		21		21	
22		22		22	
23		23		23	
24	AVCC (+5 Vdc)	24	AVCC (+5 Vdc)	24	AVCC (+5 Vdc)
25	GND	25	GND	25	GND
26	AVEE (-5V)	26	AVEE (-5 Vdc)	26	AVEE (-5 Vdc)
27		27		27	
28	AVFF (-15 Vdc)	28	AVFF (-15Vdc)	28	AVFF (-15 Vdc)
29	GND	29	GND	29	GND
30	AVBB (+5 Vdc)	30	AVBB (+15Vd)	30	AVBB (+15 Vdc)
31	GND	31	GND	31	GND
32	VCC	32	VCC	32	VCC

Signal descriptions, inputs

DC-IN1	Main DC power source to the board
DC-IN2	Backup DC power source to the board
Power-ON	Switches power ON (1) or OFF (0) TTL level signal
Power-UP	Switches power ON (1) or OFF (0) TTL level signal

Signal descriptions, outputs

VCC	+5 Vdc, digital power max. 4 A (8 A)
AVBB	+15 Vdc power max 0.7 A (1.4 A)
AVFF	-15 Vdc power max 0.7 A (1.4 A)
AVCC	+5 Vdc analogue power max 0.7 A (1.4 A)
AVEE	-5 Vdc analogue power max 0.7 A (1.4 A)
U-Stby	Unswitched supply, outputs the highest input voltage - 1 Vdc.
Cap-pos	Transmitter supply, constant charge circuit of 1.2 A
Batt	This output gives a high level when the Main DC power source voltage drops below the backup DC power source voltage

Maintenance aids

Test points

None.

Links

LK1 consists of four links, S1, S2, S3 and S4.

These links are used to swap polarity on the DC/DC converter input pins.

- When PKA2232P (24 Vdc) is used, link S2 and S4 must be connected.

Adjustments

None.

"Powerbox" AC power supply

This power supply is a sealed unit. In the event of malfunction, replace the unit.

Purpose

The **POWERBOX ESA-K104U/SS** AC power supply enables the HPR 400 system to be powered from a 230 Vac or 115 Vac supply.

Board description

The unit is purchased from an external supplier. It is based on a commercially available power supply, though has been altered to Simrad's specifications. The unit is open to allow cooling air around the components, but is designated "Repair by replacement". It is designed to be installed in a standard 19 rack.

Technical specifications

Operating temperature	0°C to 80°C
Storage temperature	-25°C to +85°C
Efficiency	80% typical
Isolation and safety	To EN 60 950
EMI/RFI standards	To EN 55 022B (VDE 0871 B)

Electrical characteristics

The unit requires a supply of 230 Vac or 115 Vac, and provides an output of 48 Vdc, 4 A (8 A peak).

Note

To switch between 115 Vac and 230 Vac, use the straps inside the unit.

Socket-mounted components

None - this power supply is a sealed unit and must not be "adjusted" by the system maintainer.

Connections

The power supply unit is plugged into the backplane by a connector comprising fifteen 5 mm spade terminals. The terminals are allocated as follows:

P1 pin allocation 15-pin connection block	
Pin	**Signal description**
4	+ Vo1
6	+ Vo1
8	+ Vo1
10	+ S
12	- S
14	- Vo1
16	- Vo1
18	- Vo1
20	
22	
24	
26	
28	230/115 Vac in (L)
30	230/115 Vac in (N)
32	GND

Maintenance aids

LEDs

The front of the unit holds 1 green LED which indicates the existence of the 48 Vdc output.

The front of the unit holds 1 green LED which indicates the existence of the 48 Vdc output.

Fuses

The unit holds an input fuse, located in the rear of the unit. The fuse is:

- 5 mm x 20 mm, 250 V, 2.5 A, slow-blow

Caution *Other fuses must not be used.*

BACKPLANES

Three backplanes are used in the HPR 400S. These are:

- **Backplane 1**
  - Connections to the InputM, ADCM and DSPM boards. This backplane is placed at the bottom of the top section of the electronic chassis.
- **Backplane 2**
  - Connections to the I/O M, CPUEX and TX boards. This backplane is placed at the top of the middle section of the electronic chassis.
- **Backplane 3**
  - Connections for power.
    This backplane is placed at the bottom of the electronic chassis.

→ *For placement of the backplanes, refer to figure on page 12.*

Backplane 1

Purpose and description

The purpose of Backplane 1 is to enable communication between the circuit boards plugged into it, and between these circuit boards and Backplane 2 and 3.

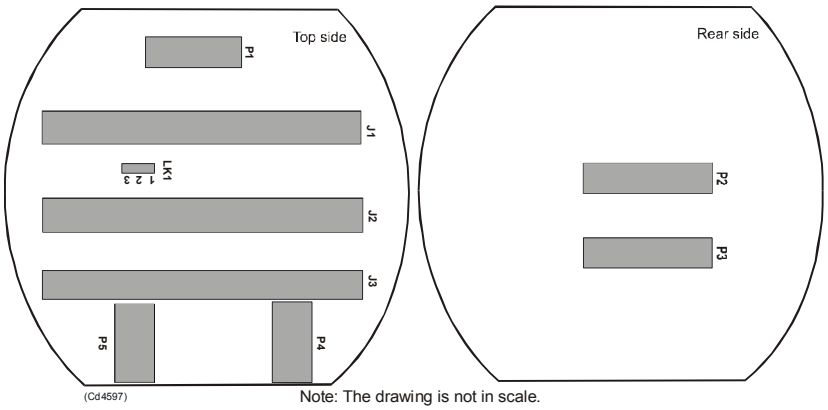


Figure 15 HPR 400S - Backplane 1

Links

LK 1 (link 1-2) - used to select which DA output from the I/O M board on the Backplane 2 is to be used as gain control at the InputM board.

Connections

The socket on the top side of Backplane 1 are:

P1	Connection to the Preamplifier board
P4	Power - Connection to Backplane 3
P5	Power - Connection to: The Amplifier board, Backplane 2 and 3.

J1	Connection to the InputM board
J2	Connection to the ADCM board
J3	Connection to the DSPM board

Backplane 2 and 3 are connected to each other back to back, with connectors on the rear side of the backplane. These are:

P2	Connection to Backplane 2
P3	Connection to Backplane 2

→ *HPR 400S wiring diagram, refer to page 82.*

Backplane 2

Purpose and description

The purpose of Backplane 2 is to enable communication between the circuit boards plugged into it, and between these circuit boards and Backplane 1 and 3. It holds an address decoder for the TXM board, drivers for some signals and mono-stable multi-vibrator to protect the transmitter from latch up.

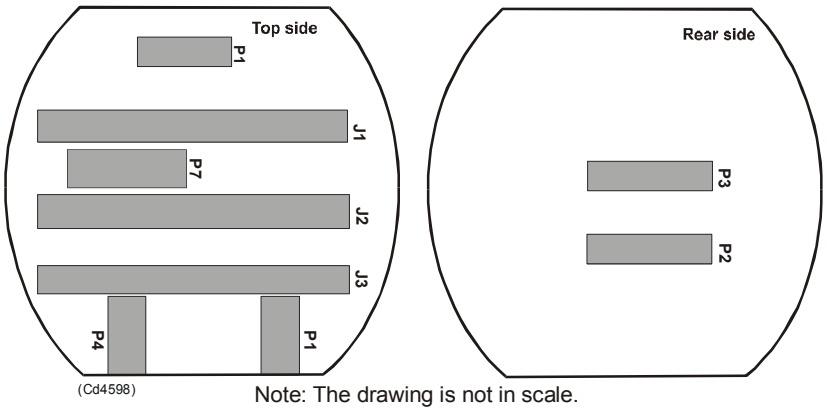


Figure 16 HPR 400S - Backplane 2

Connections

The socket on the top side of Backplane 2 are:

P1	Connection to the Preamplifier board
P4	Connection to: External connector and Backplane 3
P5	Connection to Backplane 3.
P6	Connection to: Preamplifier board and Backplane 3

J1	Connection to the I/O M board
J2	Connection to the CPUEX board
J3	Connection to the TXM board

Backplane 2 and 1 are connected to each other back to back, with connectors on the rear side of the backplane. These are:

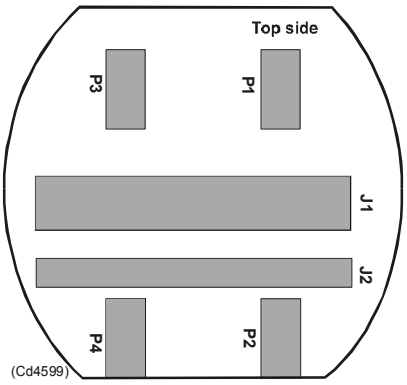
P2	Connection to Backplane 1
P3	Connection to Backplane 1

→ *HPR 400S wiring diagram, see figure on page 82.*

Backplane 3

Purpose and description

The purpose of Backplane 3 is to enable communication between the circuit boards plugged into it, and between these circuit boards and Backplane 1 and 2. It also holds connector for AC power, a power plug and varistors for power input (110/230 Vac and 24 Vdc)



Note: The drawing is not in scale.

Figure 17 HPR 400S - Backplane 3

Connections

The socket on the top side of Backplane 3 are:

P1	Connection to the external P1 (12p)
P2	Power - connection to: the Preamplifier board, Backplane 1 and 2
P3	Connection to Backplane 2.
P4	Power - connection to: the Preamplifier board, Backplane 1 and

J1	Connection to the AC power
J2	Connection to the DC power

→ *HPR 400S wiring diagram, see figure on page 82.*

EXTERNAL CONNECTORS AND CABLES

HPR 400S is delivered with P1, P3 and P4 as a standard. This is illustrated in the figure below (receptacle front view). As an option it can be delivered with P2 for additional serial interfaces.

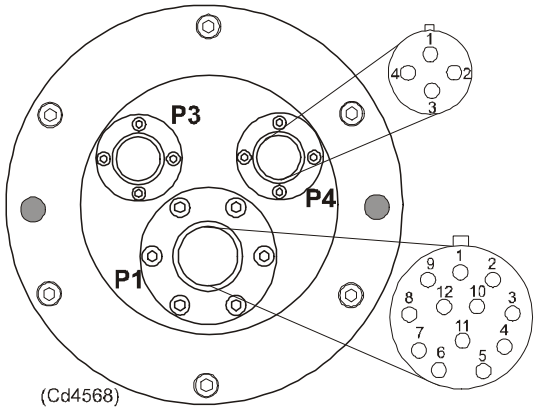


Figure 18 HPR 400S top view

System connector - P1

P1 is a 12 pins gisma connector. It is used to connect the HPR 400S to the APC 1x topside unit. The connector pin no. and function are shown in table 1.

P1 gisma 12 pins		
Pin	**Signal**	**Description**
1	110/230Vac	110/230Vac supply
2	110/230Vac	110/230Vac supply
3	Synch -	Synch-
4	Synch +	Synch+
5	RS422I+	Serial line from system controller
6	RS422I-	Serial line from system controller
7	RS4220+	Serial line to system controller
8	RS4220-	Serial line to system controller
9	NC	Not Connected
10	AGND(110VAC)	Chassis ground (110/230VAC)
11	24Vdc	24V dc supply
12	GND	Internal ground (24vdc)

Table 1 System connector - P1

Transducer connector - P3

P3 is a 4 pins gisma connector. It is used to connect transducers to the HPR 400S Unit. Two transducers can be connected at the same time.
The connector pin number and function are shown in table 2.

P3 gisma 4 pins		
Pin	**Signal**	**Description**
1	TD1+	Transducer 1
2	TD1-	
3	TD2+	Transducer 2
4	TD2-	

Table 2 Transducer connector - P3

Transducer connector - P4

P4 is a 4 pins gisma connector. It is used to connect transducers to the HPR 400S Unit. Two transducers can be connected at the same time. The connector pin number and function are shown in table 3.

P4 gisma 4 pins		
Pin	**Signal**	**Description**
1	TD3+	Transducer 3
2	TD3-	
3	TD4+	Transducer 4
4	TD4-	

Table 3 Transducer connector - P4

Optional connector - P2

P2 is a 12 pins gisma connector. This connector is optional, and may be used for additional serial interfaces. The connector pin number and function are shown in table 4.

P2 gisma 12 pin (optional)		
Pin	**Signal**	**Description**
1	RS-422 Rx2	RS-422 receive2
2	RS-422 Rx2~	RS-422 receive2
3	RS-422 tx2	RS-422 transmit2
4	RS-422 tx2~	RS-422 transmit2
5	GND	GND
6	RS-422 Rx3	RS422 receive3
7	RS-422 Rx3~	RS422 receive3
8	RS-422 tx3	RS422 transmit3
9	RS-422 tx3~	RS422 transmit3
10	+15V	15V supply serial line converter
11	RS-232D Rx	RS-232debug receive
12	RS-232D tx	RS-232debug transmit

Table 4 Optional connector - P2

Cables

→ *For information regarding cables refer to page 11.*

Operator station/HPR 400S connection

→ *For information regarding the cable/connector refer to page 11.*

The APC 1x topside unit, and the HPR 400S unit interconnection is illustrated in the figure below. The unit shown is an APC 10.

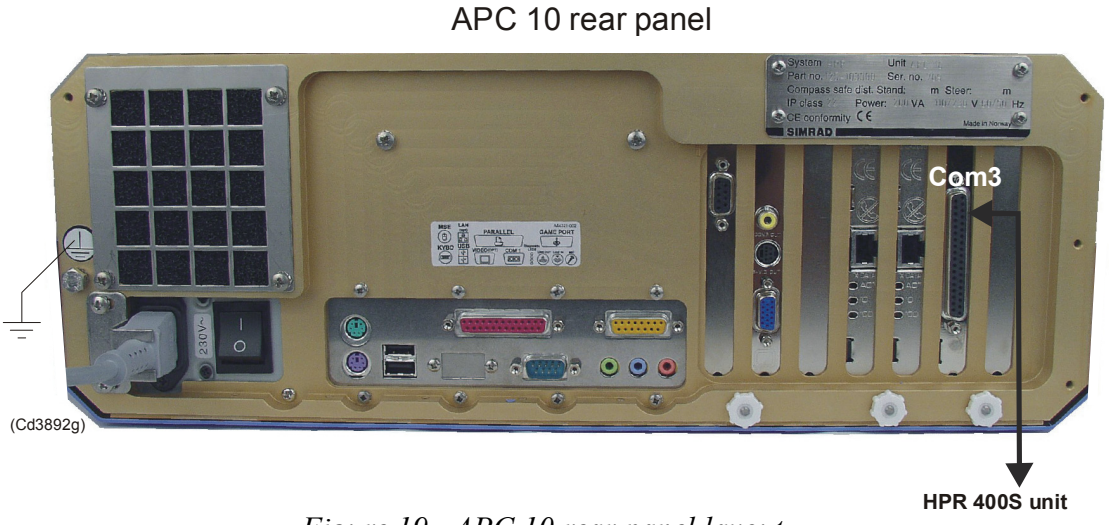


Figure 19 APC 10 rear panel layout

Serial line

The serial line is an RS-422 interface (in the umbilical). The cable plugs into socket COM3 on the rear of the APC 1x, and to the dedicated connector on the subsea unit.

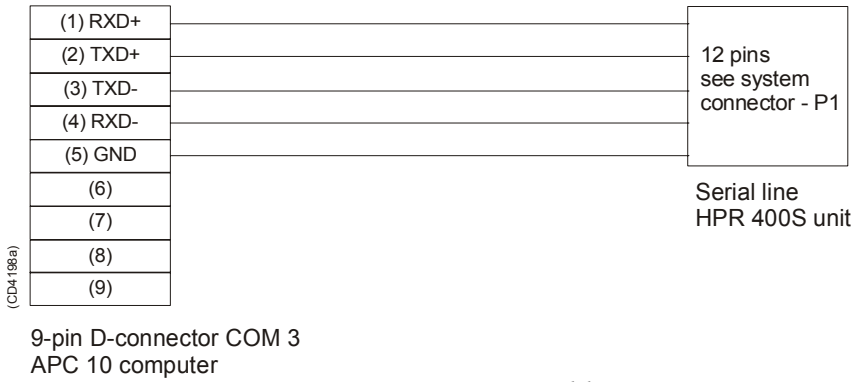


Figure 20 Cable A, RS-422

Note *RS-422 is the standard. RS-232 can be supplied on special order.*

Modified connection for RS-232(option)

The HPR 400S33 transceiver can be modified for RS-232 communication according to the table below.

P1 Gisma 12 pins		
Pin	**Signal**	**Description**
1	110V/230Vac	110V/230Vac supply
2	110V/230Vac	110V/230Vac supply
3	Synch –	Synch –
4	Synch +	Synch +
5	RS-232 RX	Serial data from system controller
6	RS-232 TX	Serial data to system controller
7	RS-232 GND	Isolated ground for RS-232
8	NC	Not connected
9	NC	Not connected
10	AGND(110Vac)	Chassis Ground (110V/230Vac)
11	24 Vdc	24 Vdc supply
12	GND	0 Vdc supply

Note *The link LK10 on the I/O M-board (382-217516) must be mounted in the position closest to the DC/DC-converter (U23) for RS-232 communication.*

Connection to external equipments

Both the APC 1x and the HPR 400S unit can be connected to the multiplexers/optical fibre (customer supplied), using a RS-422 serial line. Baud Rate = 9600.

TRANSDUCERS

Overview

The transducer is connected to the HPR 400S unit via a cable provided with pigtail.

For use with the MF system:

- ROV transducer RTD 333 Bronze
- ROV transducer RTD 333 Aluminium
- ROV transducer RTD 343 Aluminium
- Omnidirectional transducer (Option)

For use with the LF system:

- ROV transducer RTD 169 (Omnidirectional)

→ *For technical specifications for the transducers, refer to page 10.*

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SPARE PARTS

Introduction

This chapter lists the parts and modules defined by Kongsberg Maritime AS 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.

Codes used

The following codes are used in the parts lists:

Part no. - Kongsberg Maritime AS part number.

Item name -The name of the item.

Technical data - Technical specifications and any other relevant information.

Drw. ref. - Reference number of the production or illustration drawing where the item is included. If a number is given here, the drawing will be included in the manual's/document's drawing file.

Drw. pos. - The item's position number on the drawing referenced above.

No. in sys. - The quantity of the item used in the system. *Note that this information is not provided for standard components such as nuts, bolts and washers.*

Rec. spares - The quantity of the item recommended to be carried as spares onboard the vessel. *Note that this information is not provided for standard components such as nuts, bolts and washers.*

Accessories

This list includes the common accessories used for all the HPR 400S units. Since the figure position differs on the figures for these common items, the Drw. pos. is left out.

Part no.	Item name	Drw. ref.	No. in sys.
	Technical data	**Drw. pos.**	**Rec.spares**
654-077261	Silicone grease	N/A	1
-	-	-	1
560-017864	Cap	N/A	4
-	M6X30 / DIN912 A4	-	-
577-033992	Lockwasher	N/A	4
-	M6 DIN7980 A4	-	-
577-033992	Dehydrating agent	N/A	1
-	(10gr)	-	-
198-085263	Zink anode	N/A	2
-	124,3 x 5,7	-	2

HPR 400 S31 unit

Complete unit

Part no.	Item name	Drw. ref.	No. in sys.
-	Technical data	Drw. pos.	Rec.spares
129-215770	HPR 400 S31 Subsea unit	Figure on page 60	-
-	Complete unit	N/A	-

Main modules

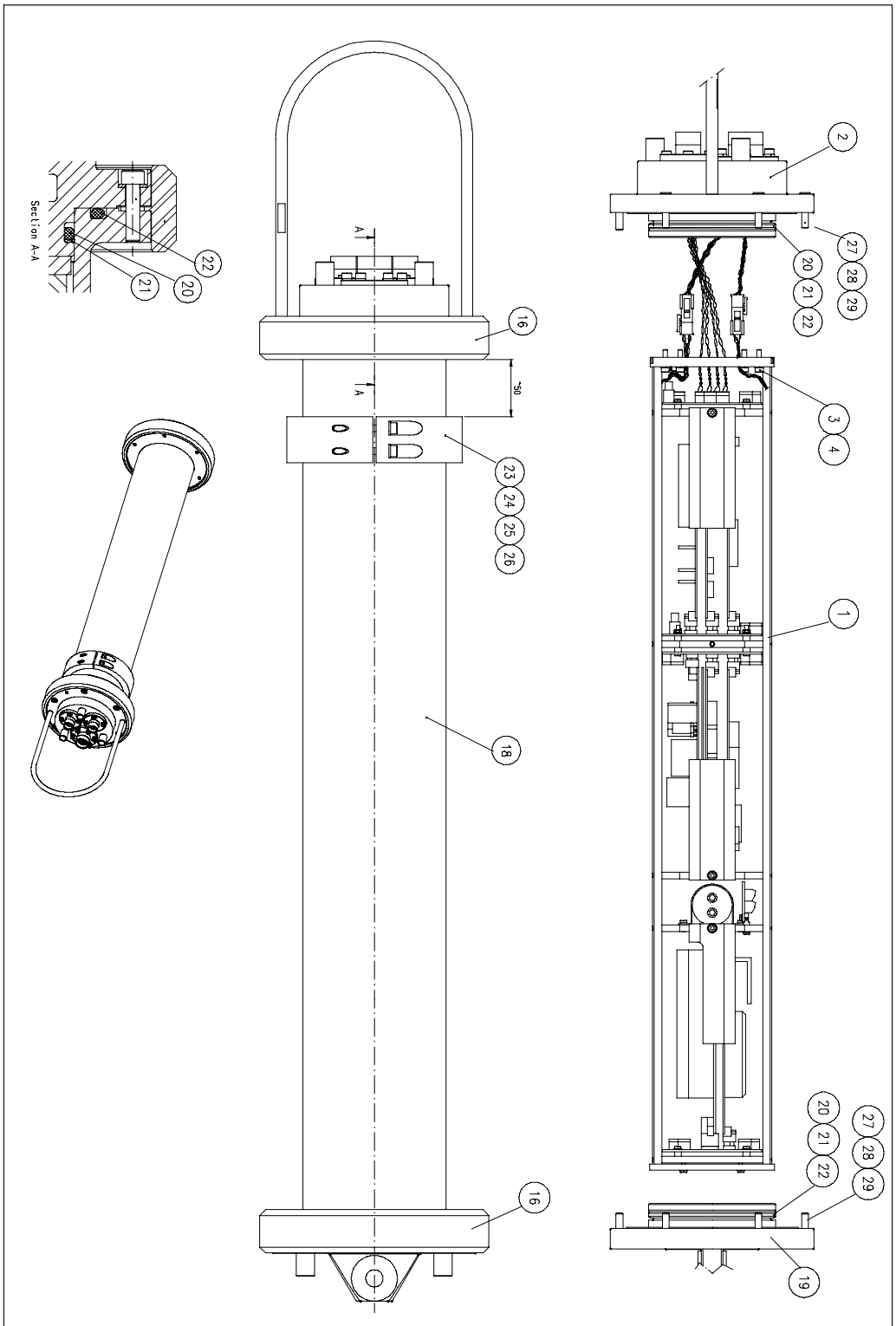
This list includes the main modules for the HPR 400 S31 unit.

Part no.	Item name	Drw. ref.	No. in sys.
-	Technical data	Drw. pos.	Rec.spares
299-220334	Electronic chassis	Figure on page 60	1
-	Complete unit	1	-
→ *Electronic chassis spare parts, refer to page 66.*			
499-220335	Top End cap	Figure on page 60	1
-	Aluminium	2	-
599-215178	Protection ring	Figure on page 60	1
-	-	16	-
599-215768	Housing	Figure on page 60	1
-	-	18	-
499-215049	Bottom End cap	Figure on page 60	1
-	-	19	-
540-021249	O-ring	Figure on page 60	2
-	101.0 x 5,34	20	2
549-086691	Backup ring	Figure on page 60	2
-	for O-ring: 101.0 x 5,34	21	2
540-084173	O-ring	Figure on page 60	2
-	124.3 x 5,7	22	2
599-215777	Identification clamp 1	Figure on page 60	1
-	-	23	-
599-215779	Identification clamp 2	Figure on page 60	1
-	-	24	-

→ *Transducer and cable refer to page 71.*

→ *Topside cable refer to page 71.*

→ *Accessories refer to page 58.*



Page 1 of 1 (Cd33033)	HPR 400 S31 assembly	**860-215771** Rev.B

HPR 400 S33 unit

Complete unit

Part no.	Item name	Drw. ref.	No. in sys.
-	**Technical data**	**Drw. pos.**	**Rec.spares**
129-089956	HPR 400 S33 - Subsea unit	Figure on page 62	-
-	Complete unit	N/A	-

Main modules

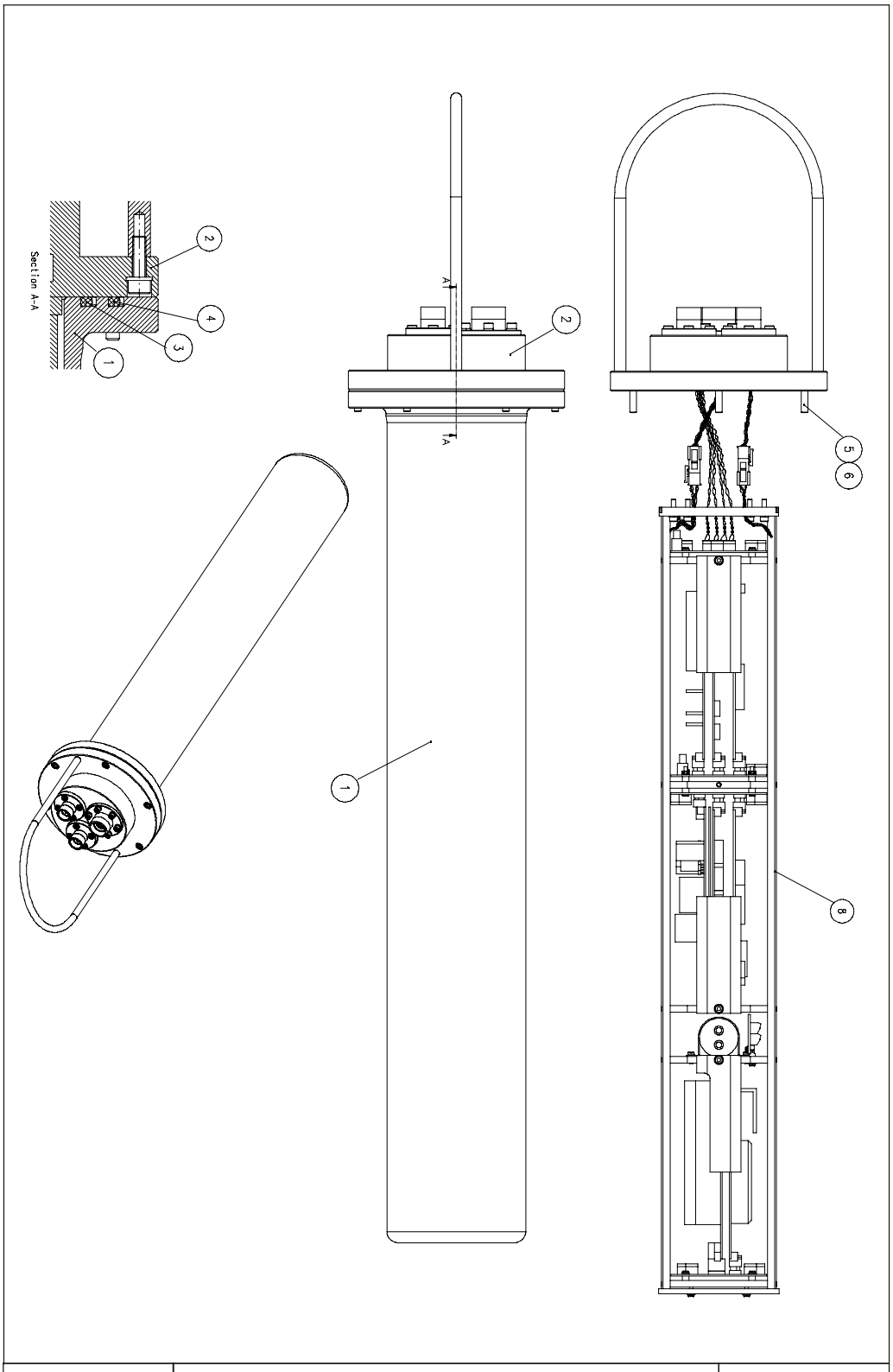
This list includes the main modules for the HPR 400 S33 unit.

Part no.	Item name	Drw. ref.	No. in sys.
-	**Technical data**	**Drw. pos.**	**Rec.spares**
299-220334	Electronic chassis	Figure on page 62	1
-	Complete unit	8	-
→ *Electronic chassis spare parts, refer to page 66.*			
599-102645	Housing	Figure on page 62	1
-	-	1	
499-220337	Top End cap	Figure on page 62	1
-	Stainless steel	2	-
540-075045	O-ring	Figure on page 62	1
-	149,3 X 5,7	4	2
540-084173	O-ring	Figure on page 62	1
-	124.3 x 5,7	3	2

→ *Transducer and cable refer to page 71.*

→ *Topside cable refer to page 71.*

→ *Accessories refer to page 58.*



Page 1 of 1 (Cd33035)	HPR 400 S33 assembly	**129-089956** Rev.B

HPR 400 S36 unit

Complete unit

Part no.	Item name	Drw. ref.	No. in sys.
-	**Technical data**	**Drw. pos.**	**Rec.spares**
129-217865	HPR 400 S36 - Subsea unit	Figure on page 64	-
-	Complete unit	N/A	-

Main modules

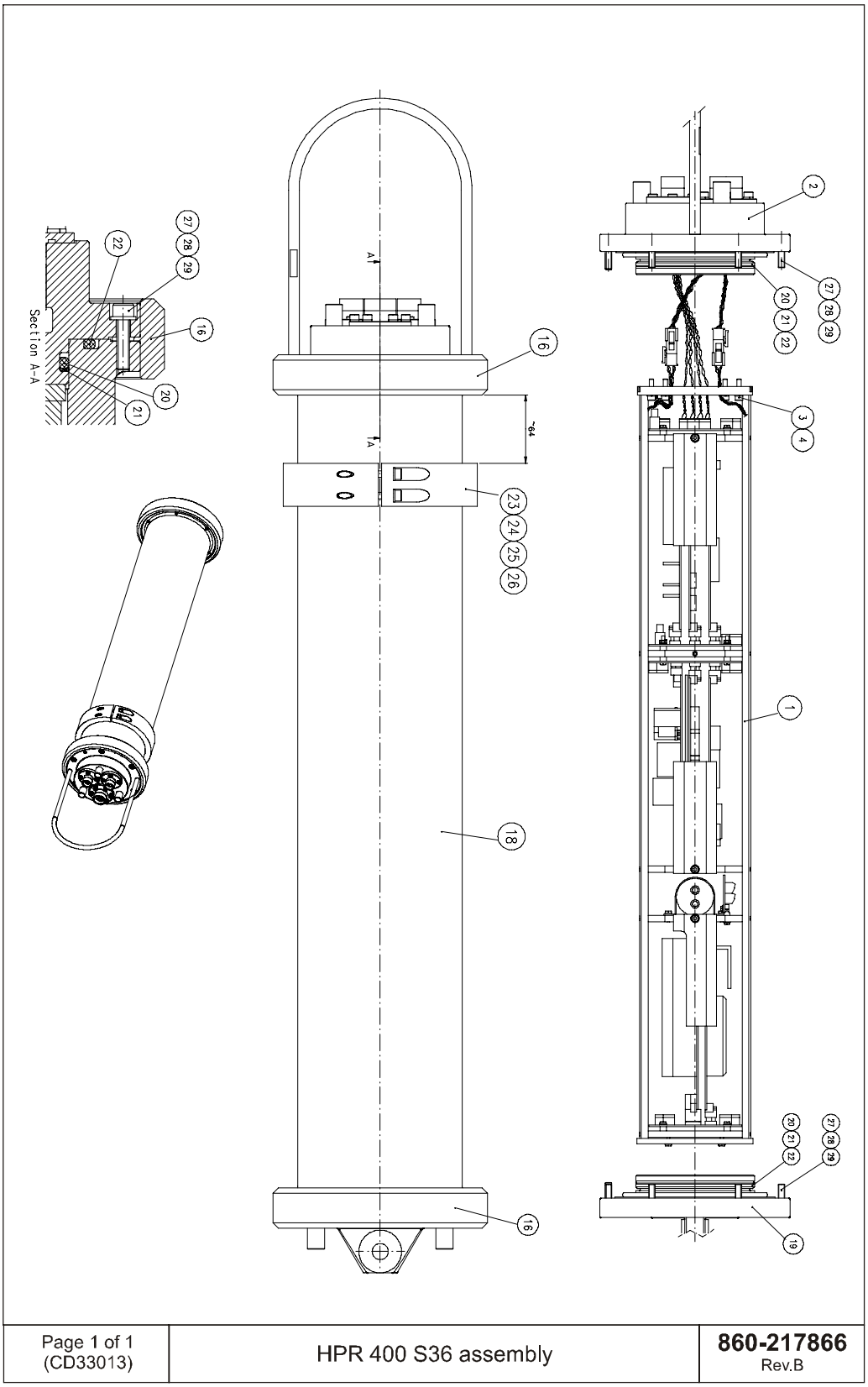
This list includes the main modules for the HPR 400 S36 unit.

Part no.	Item name	Drw. ref.	No. in sys.
-	**Technical data**	**Drw. pos.**	**Rec.spares**
299-220334	Electronic chassis	Figure on page 64	1
-	Complete unit	1	-
	→ *Electronic chassis spare parts, refer to page 66.*		
499-220335	Top End cap	Figure on page 64	1
-	Aluminium	2	-
599-215178	Protection ring	Figure on page 64	1
-	-	16	-
599-213037	Housing	Figure on page 64	1
-	-	18	-
499-215049	Bottom End cap	Figure on page 64	1
-	-	19	
540-021249	O-ring	Figure on page 64	1
-	101.0 x 5,34	20	2
549-086691	Backup ring	Figure on page 64	1
-	for O-ring: 101.0 x 5,34	21	2
540-084173	O-ring	Figure on page 64	1
-	124.3 x 5,7	22	2
599-220059	Identification clamp 1	Figure on page 64	1
-	-	23	-
599-213329	Identification clamp 2	Figure on page 64	1
-	-	24	-

→ *Transducer and cable refer to page 71.*

→ *Topside cable refer to page 71.*

→ *Accessories refer to page 58.*



Page 1 of 1 (CD33013)	HPR 400 S36 assembly	**860-217866** Rev.B

HPR 400S MF Electronic chassis

Complete unit

Part no.	Item name	Drw. ref.	No. in sys.
-	Technical data	Drw. pos.	Rec.spares
299-220334	Electronic chassis	Figure on page 66	1
-	Complete unit	N/A	-

Main modules

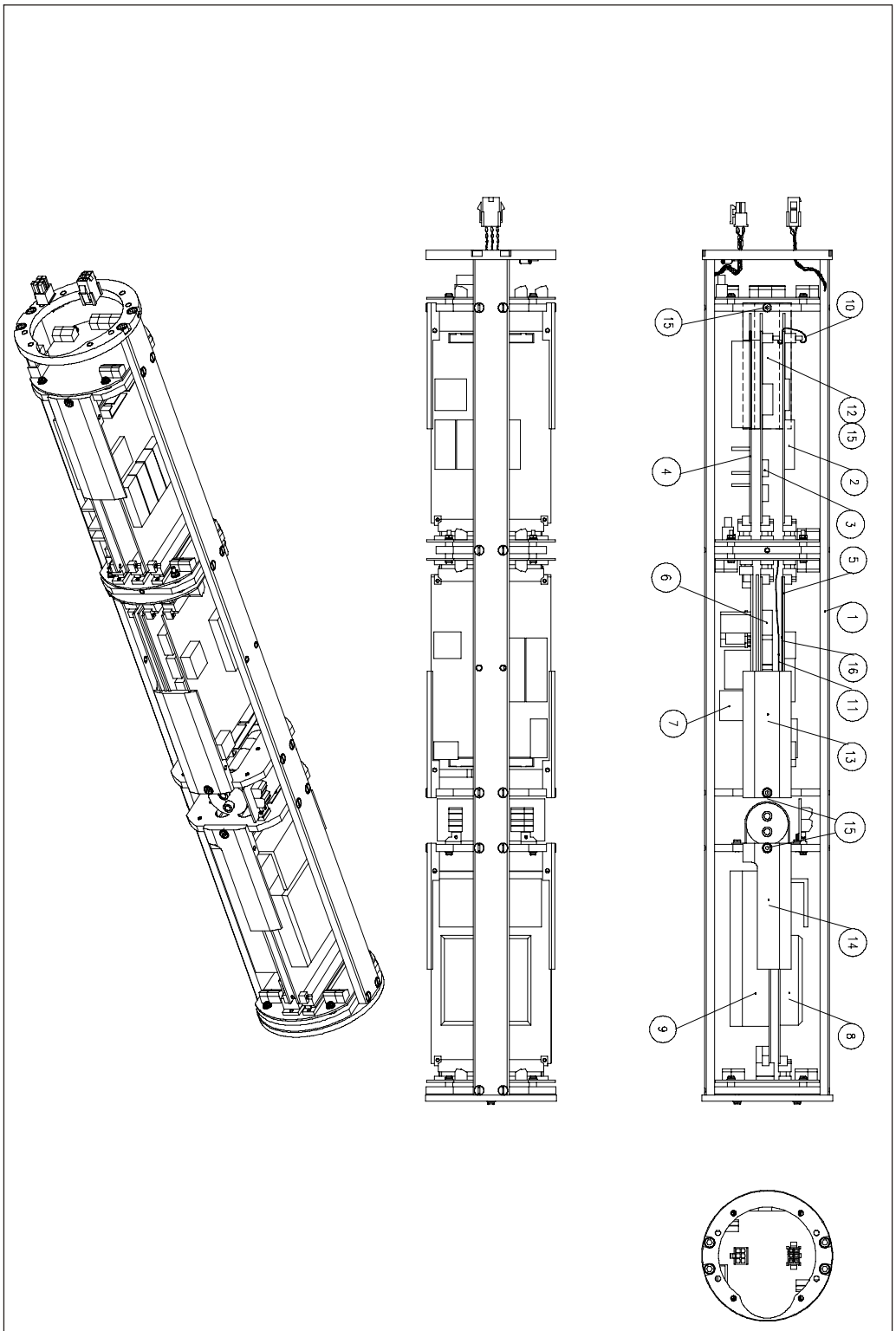
This list includes the main modules for the HPR 400S MF electronic chassis.

Part no.	Item name	Drw. ref.	No. in sys.
-	Technical data	Drw. pos.	Rec.spares
382-110358	DSPM 50 board	Figure on page 66	1
-	-	2	-
382-083755	ADCM board	Figure on page 66	1
-	-	3	-
382-102409	Input M board	Figure on page 66	1
-	4-channels	4	-
382-217516	I/O M board	Figure on page 66	1
-	-	5	-
382-112510	CPUEX board	Figure on page 66	1
-	-	6	-
382-102681	Transmitter board	Figure on page 66	1
-	-	7	-
382-102682	Power board	Figure on page 66	1
-	MKI/24	8	-
382-087237	Power supply	Figure on page 66	1
-	ESA-K104U/SS	9	-
499-103207	PCB guide	Figure on page 66	1
-	Top section	12	-
499-103208	PCB guide	Figure on page 66	1
-	Mid section	13	-
499-103209	PCB guide	Figure on page 66	1
-	Bottom section	14	-

→ *Transducer and cable refer to page 71.*

→ *Topside cable refer to page 71.*

→ *Accessories refer to page 58.*



Page 1 of 1 (Cd33034)	HPR 400S MF - electronic chassis assembly	**299-220334** Rev.A

HPR 400 S16 unit

Complete unit

Part no.	Item name	Drw. ref.	No. in sys.
-	**Technical data**	**Drw. pos.**	**Rec.spares**
129-213088	HPR 400 S16 Subsea unit	Figure on page 68	-
-	Complete unit	N/A	-

Main modules

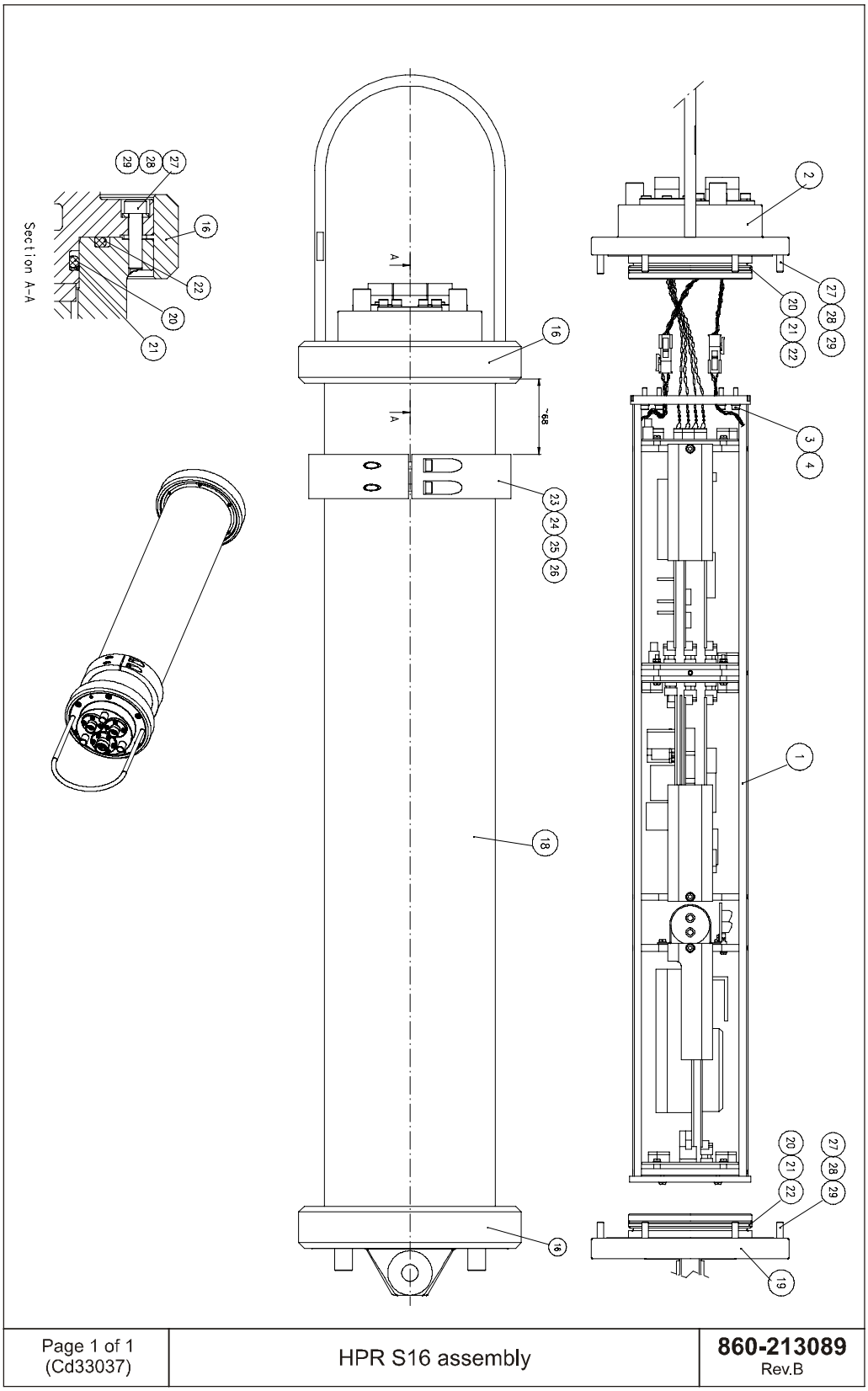
This list includes the main modules for the HPR 400 S16 unit.

Part no.	Item name	Drw. ref.	No. in sys.
-	**Technical data**	**Drw. pos.**	**Rec.spares**
299-220336	Electronic chassis	Figure on page 68	1
-	Complete unit	1	-
→ *Electronic chassis spare parts, refer to page 69.*			
599-215178	Protection ring	Figure on page 68	1
-	-	16	-
599-213037	Housing	Figure on page 68	1
-	-	18	2
499-220335	Top End cap	Figure on page 68	1
-	-	2	2
499-215049	Bottom End cap	Figure on page 68	
-	-	19	2
540-021249	O-ring	Figure on page 68	2
-	101,0 x 5,34	20	2
549-086691	Backup ring	Figure on page 68	2
-	124,3 x 5,7	21	2
540-084173	O-ring	Figure on page 68	2
-	124,3 x 5,7	22	2
599-213736	Identification clamp 1	Figure on page 60	1
-	-	23	-
599-213329	Identification clamp 2	Figure on page 60	1
-	-	24	-

→ *Transducer and cable refer to page 71.*

→ *Topside cable refer to page 71.*

→ *Accessories refer to page 58.*



Page 1 of 1 (Cd33037)	HPR S16 assembly	**860-213089** Rev.B

HPR 400S LF Electronic chassis

Complete unit

Part no.	Item name	Drw. ref.	No. in sys.
-	Technical data	Drw. pos.	Rec.spares
299-220336	Electronic chassis	Figure on page 70	1
-	Complete unit	N/A	-

Main modules

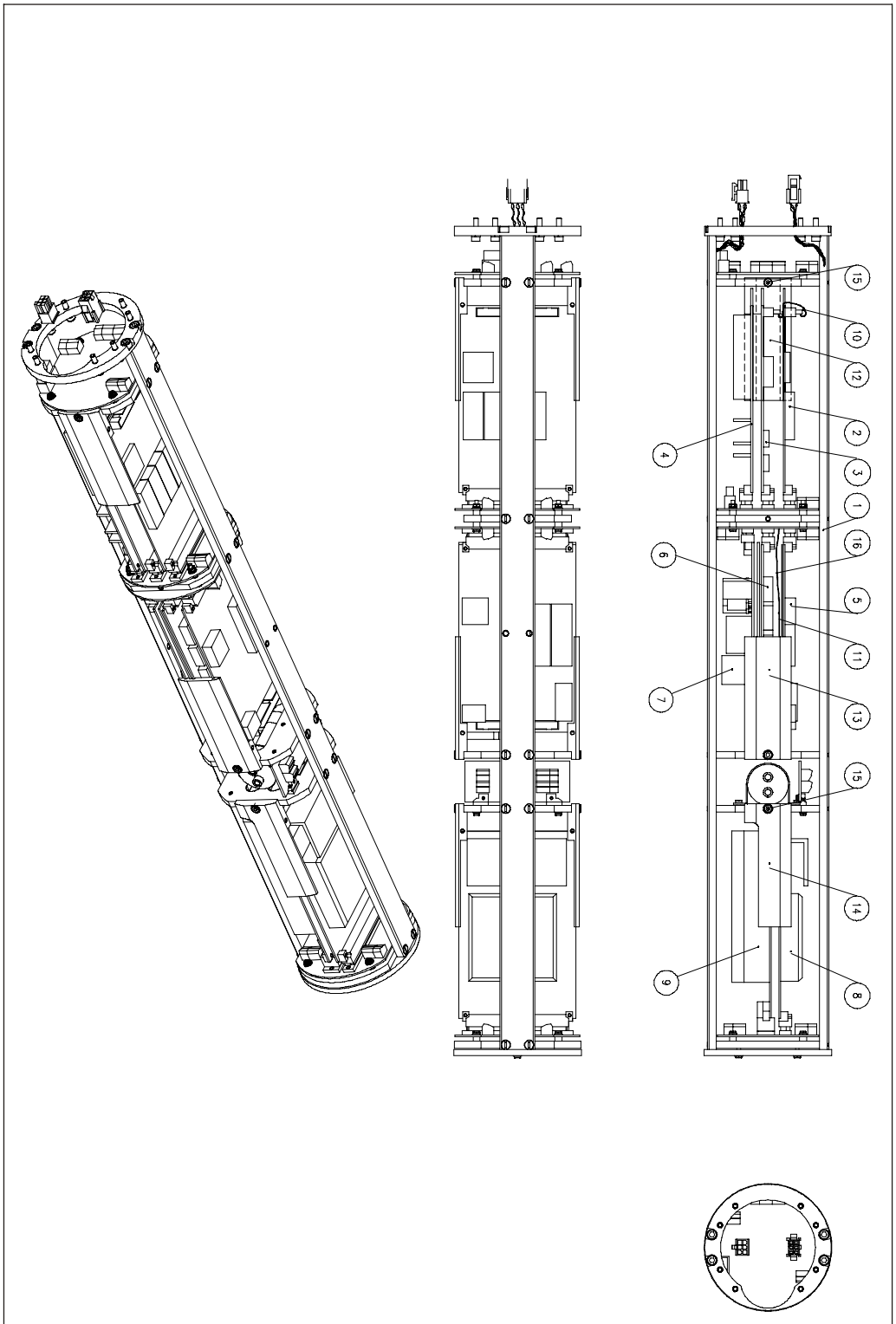
This list includes the main modules for the HPR 400S MF electronic chassis.

Part no.	Item name	Drw. ref.	No. in sys.
-	Technical data	Drw. pos.	Rec.spares
382-110358	DSPM 50 board	Figure on page 70	1
-	-	2	-
382-083755	ADCM board	Figure on page 70	1
-	-	3	-
382-102409	Input M board	Figure on page 70	1
-	4-channels	4	-
382-213072	I/O M board	Figure on page 70	1
-	-	5	-
382-112510	CPUEX board	Figure on page 70	1
-	-	6	-
382-213571	Transmitter board	Figure on page 70	1
-	-	7	-
382-102682	Power board	Figure on page 70	1
-	MKI/24	8	-
382-087237	Power supply	Figure on page 70	1
-	ESA-K104U/SS	9	-
499-103207	PCB guide	Figure on page 70	1
-	Top section	12	-
499-103208	PCB guide	Figure on page 70	1
-	Mid section	13	-
499-103209	PCB guide	Figure on page 70	1
-	Bottom section	14	-

→ *Transducer and cable refer to page 71.*

→ *Topside cable refer to page 71.*

→ *Accessories refer to page 58.*



Page 1 of 1 (Cd33036)	HPR 400S LF - electronic chassis assembly	**299-220336** Rev.A

Transducers and cables

This list includes the transducers and cables used with a HPR 400S system.

Deep water rated to	Part no.	Item name
3000 m	312-089793	ROV Transducer, RTD 333 Bronze
	380-087735	Cable for RTD 333 Bronze - 6 m
3000 m	100-213493	ROV Transducer, RTD 333 Aluminium
	380-215834	Cable for RTD 333 Aluminium - 9 m
4000 m	100-217805	RTD 343 Aluminium
	380-099101	Cable for RTD 343 Aluminium - 6 m
6000 m	100-213782	RTD 169
		Welded cable - 1.5 m
	100-089092	Omnidirectional TD
	380-086745	For omnidirectional TD - 5 m

Cable

Part no.	Item name
-	**Technical data**
370-087235	Cable (pigtail)
-	For topside connection, 4 m

Plugs

This list includes the connectors used with the HPR 400S units.

Part no.	Item name
-	**Technical data**
370-086717	UW connector
-	Gisma 10.00.3.12.2.10 12 pins
370-086715	UW connector
-	Gisma 10.00.1.04.2.10 4 pins
599-102606	Plug cap
-	-

DRAWING FILE

Overview

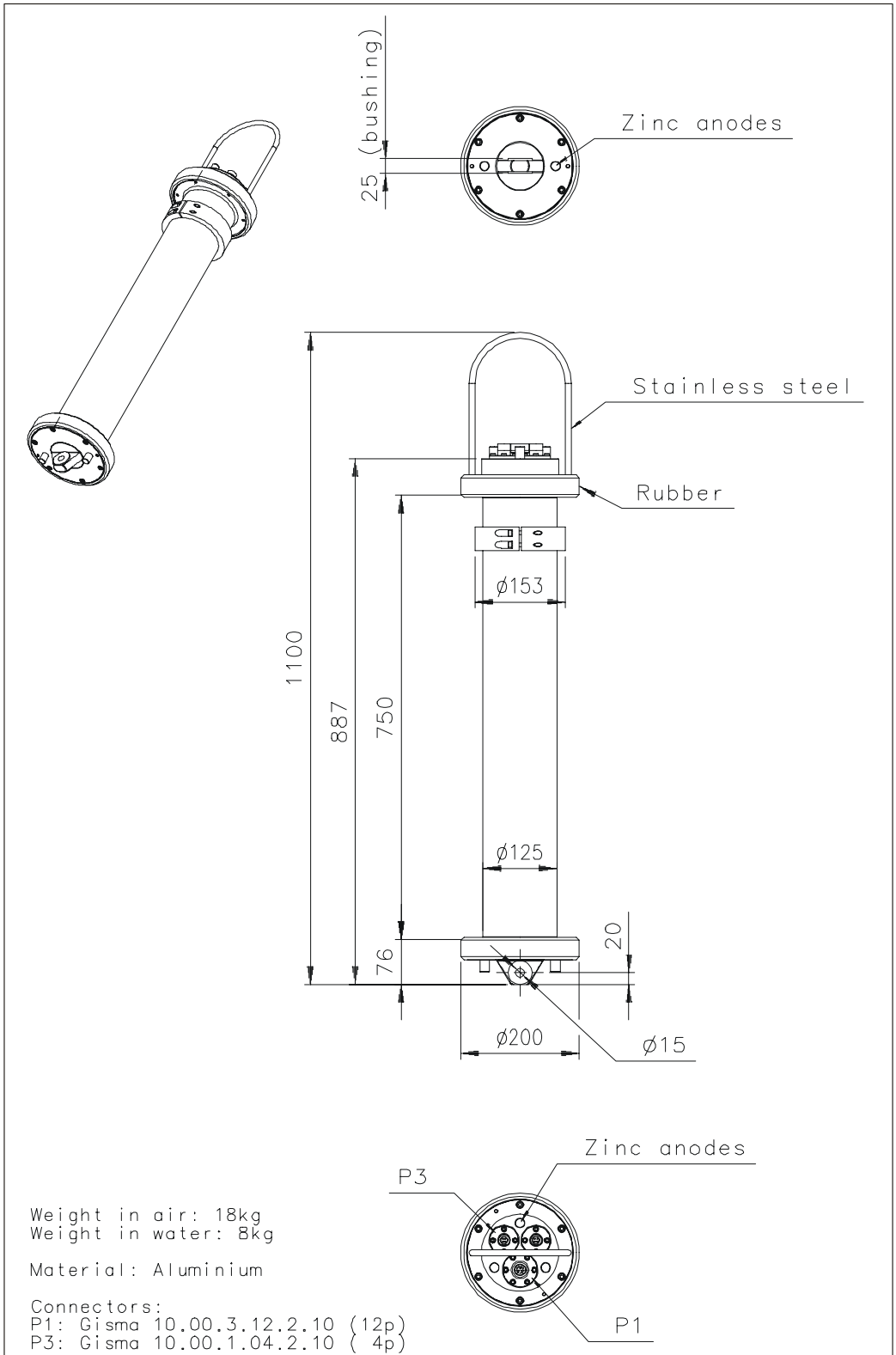
This section contains drawings referred to in various sections in this manual. These are based on the original system drawings and wiring diagrams.

- All measurements are in mm.
- The drawings are not in scale.
- The original drawings are available in electronic format (AutoCAD) upon request.

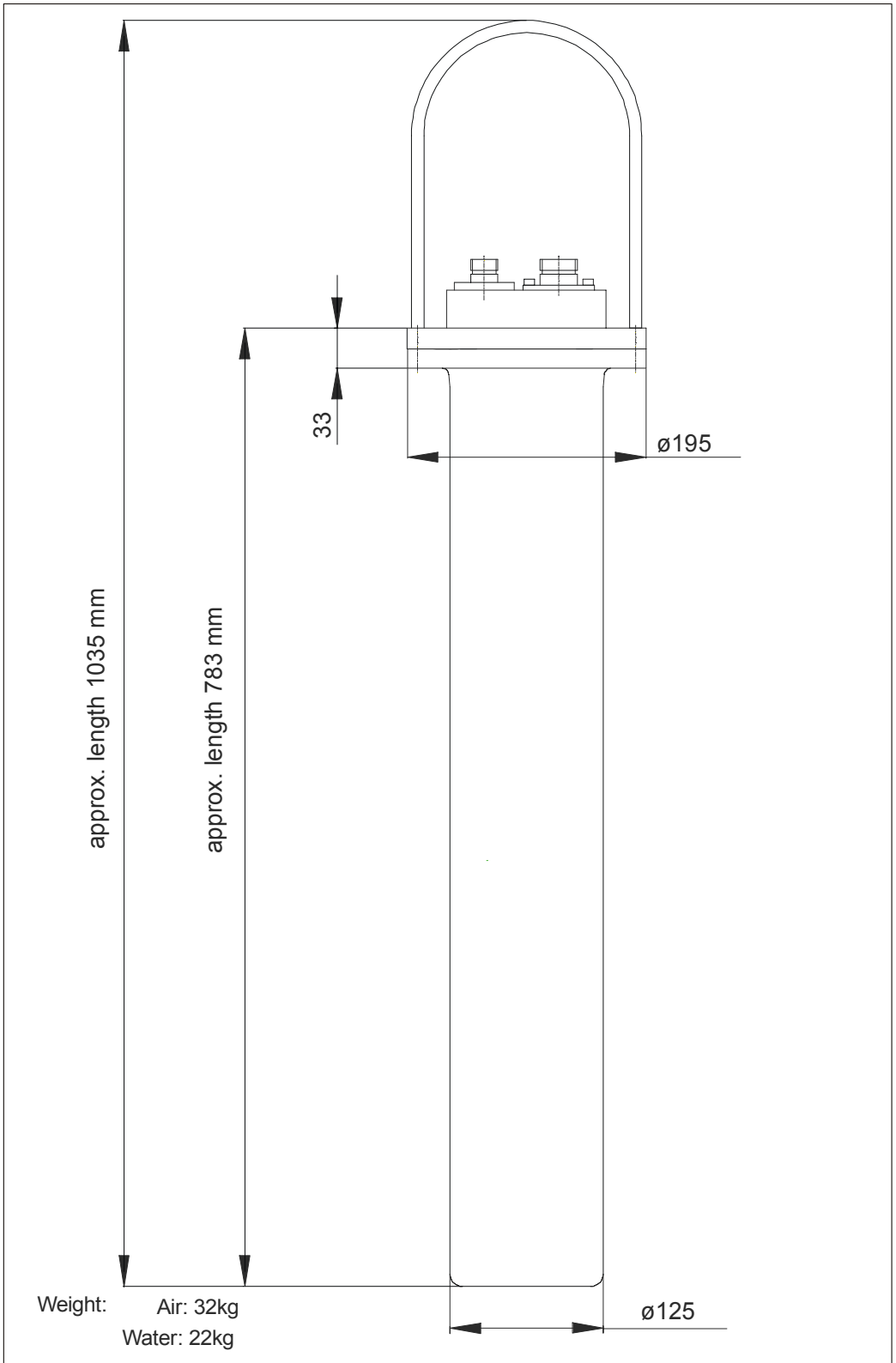
Drawings

The following illustrations are implemented:

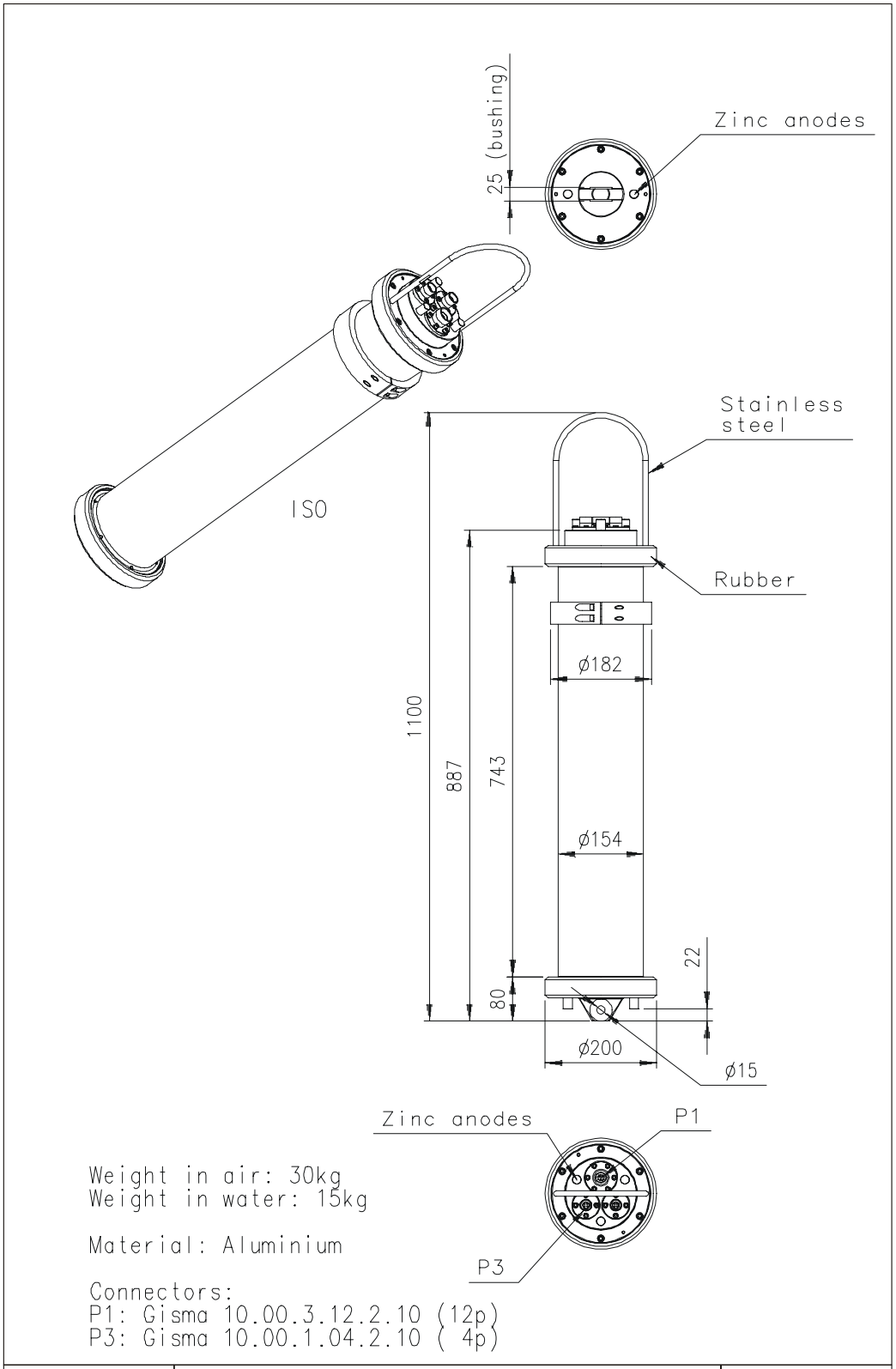
- **Outline dimensions subsea units**
  - HPR 400 S31, see page 73.
  - HPR 400 S33, see page 74.
  - HPR 400 S36, see page 75.
  - HPR 400 S16, see page 76.
- **Outline dimensions transducers**
  - RTD 333 Bronze, see page 77.
  - RTD 333 Aluminium, see page 78.
  - RTD 343 Aluminium, see page 79.
  - Omnidirectional transducer (option for MF), see page 80.
  - RTD 169 transducer (LF) omnidirectional, see page 81.
- **HPR 400S - wiring diagram**
  - See page 82.



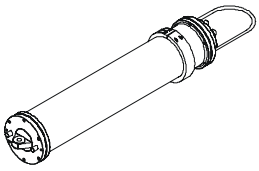
Page 1 of 1 (CD6117)	HPR 400 S31 - outline dimensions	**860-215772** Rev.A

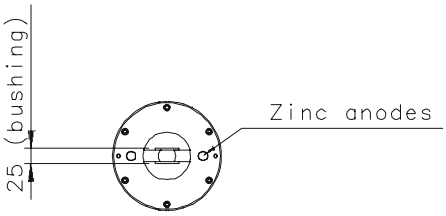


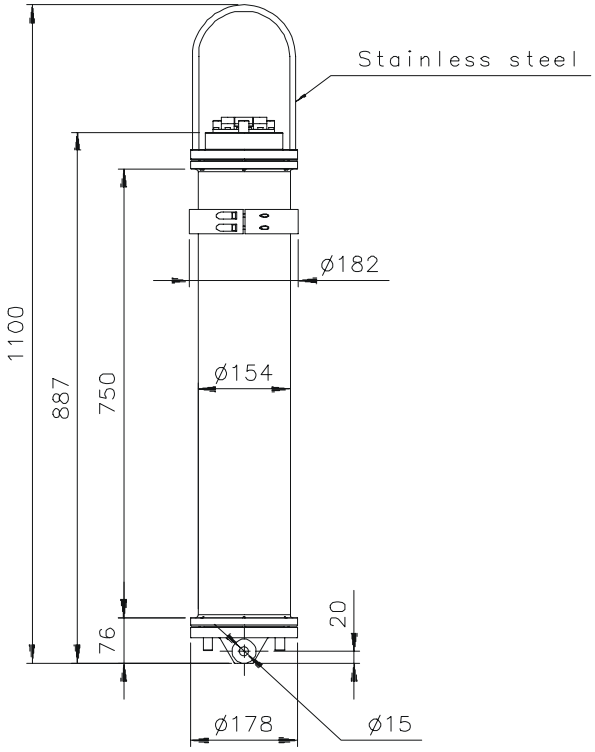
Page 1 of 1 (CD6454)	HPR 400 S33 - outline dimensions	**830-210043** Rev.A

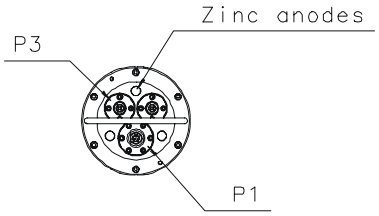


Page 1 of 1 (CD33012)	HPR 400 S36 - outline dimensions	**830-220190** Rev.A







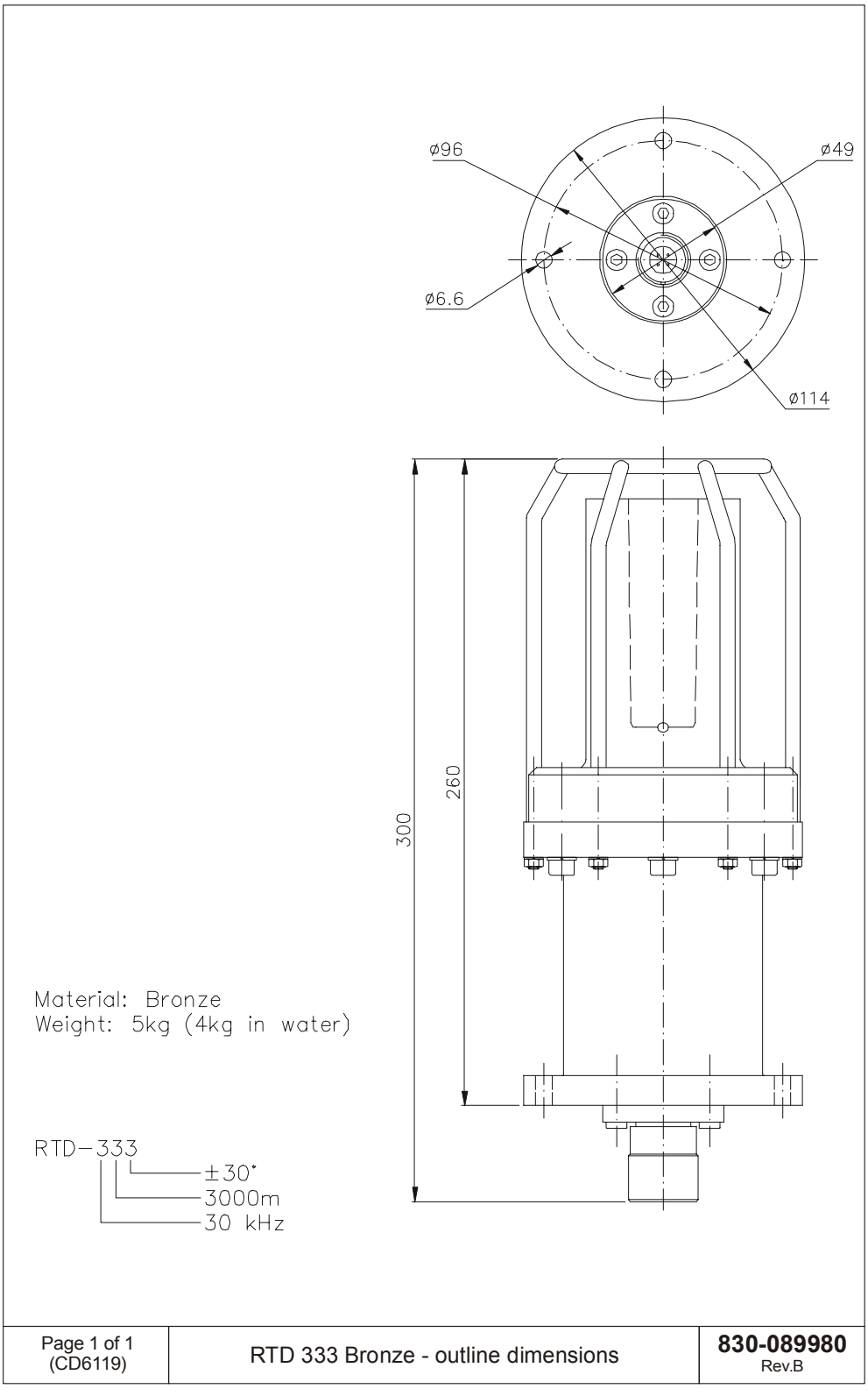


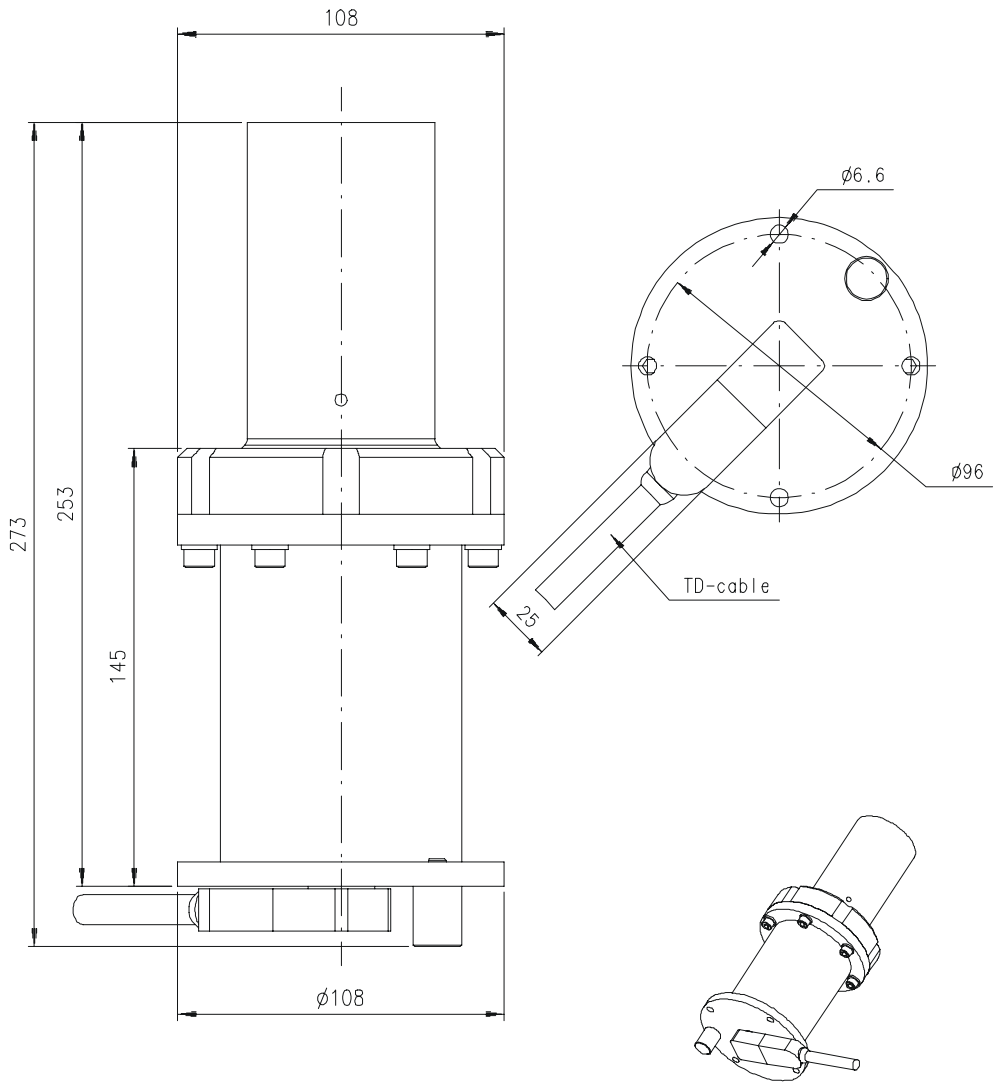
Weight in air: 30kg
Weight in water: 15kg

Material: Aluminium

Connectors:
P1: Gisma 10.00.3.12.2.10 (12p)
P3: Gisma 10.00.1.04.2.10 (4p)

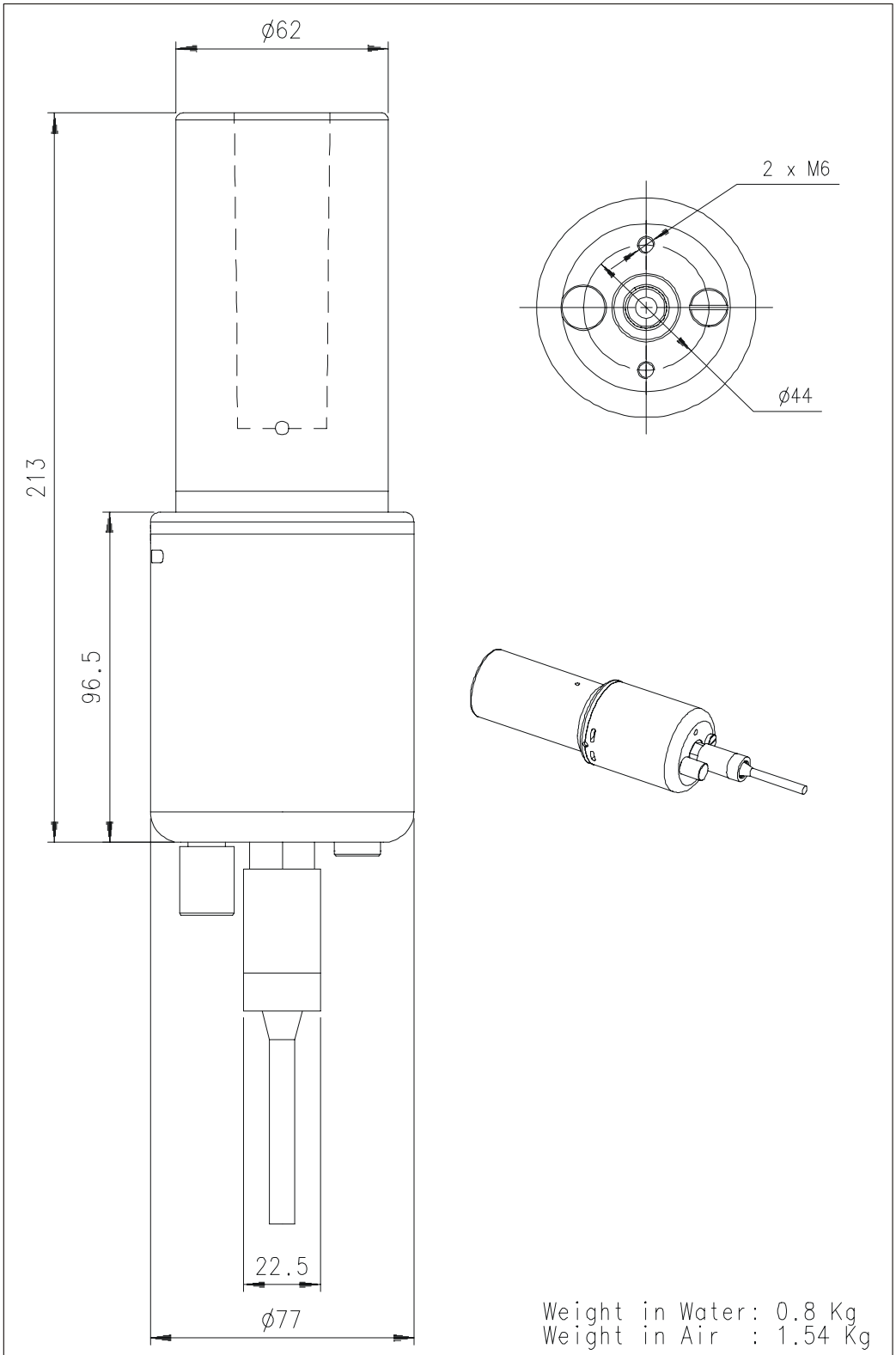
Page 1 of 1 (CD6455)	HPR 400 S16 - outline dimensions	**830-23087** Rev.A


ø96
ø49
ø6.6
ø114
260
300
Material: Bronze
Weight: 5kg (4kg in water)
RTD-333
±30°
3000m
30 kHz
Page 1 of 1
(CD6119)
RTD 333 Bronze - outline dimensions
830-089980
Rev.B

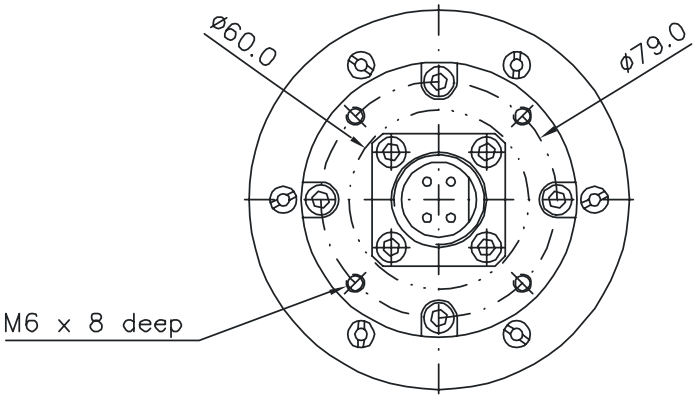


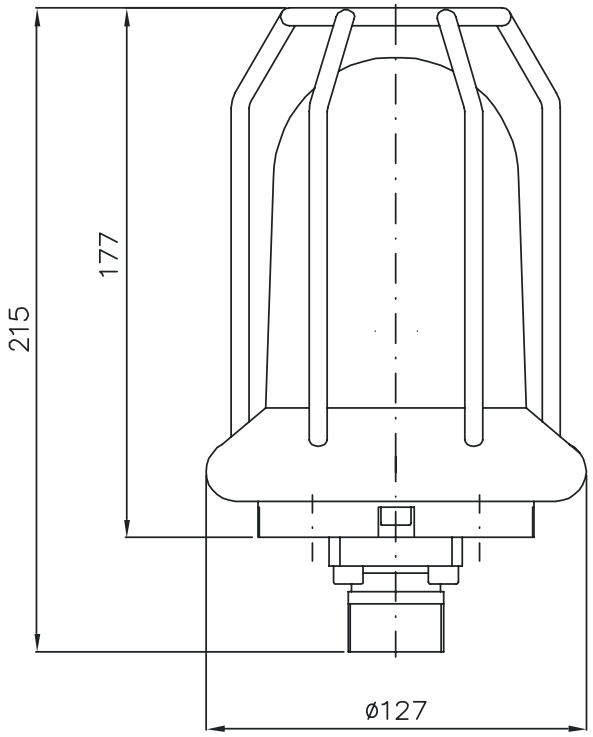
Weight:
in Air 2.3kg
in Water 1.2kg
Material: Aluminium, anodized

Page 1 of 1 (CD6118)	RTD 333 Aluminium - outline dimensions	**830-215804** Rev.A



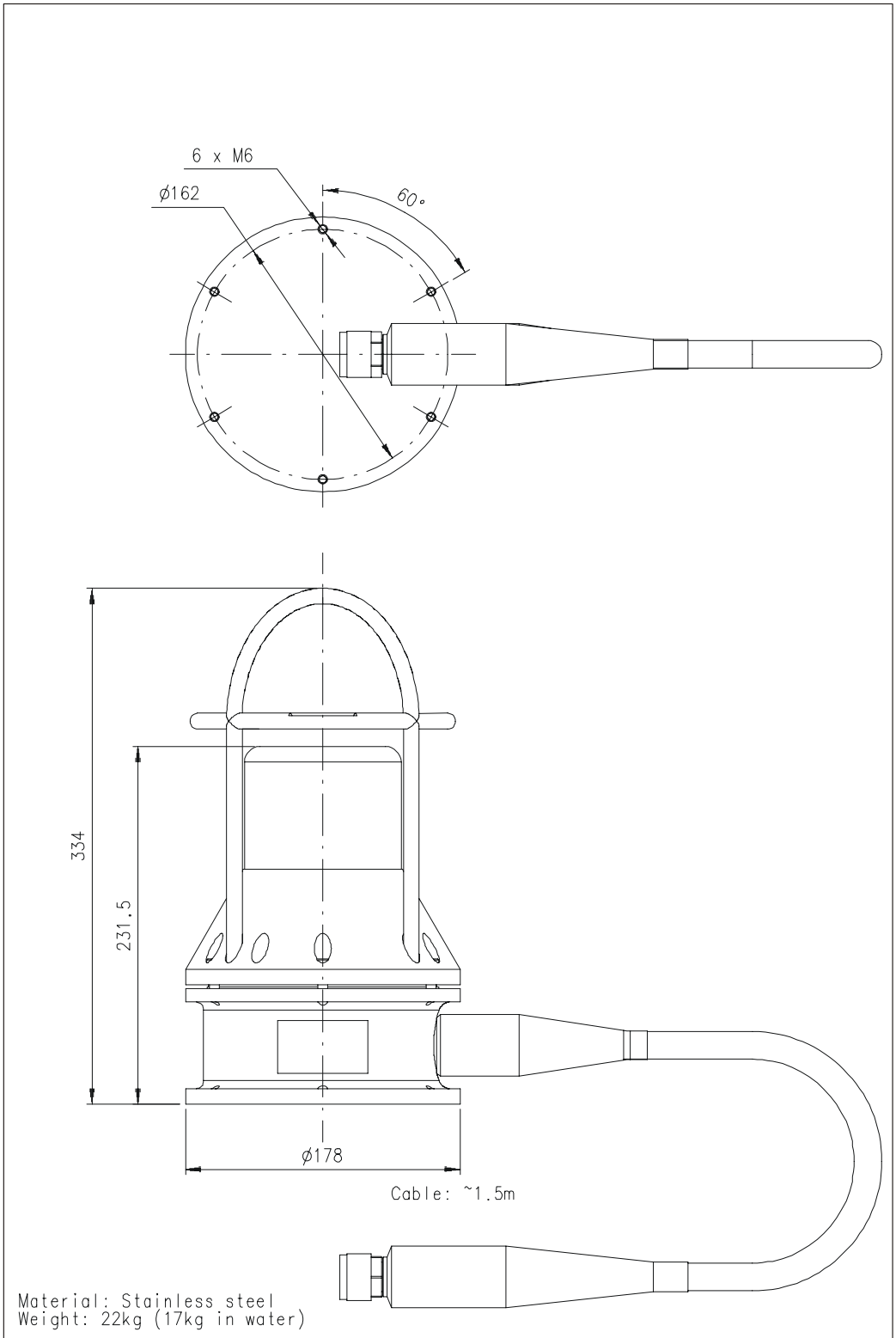
Page 1 of 1 (CD33011)	RTD 343 aluminium - outline dimensions	**830-219523** Rev.A



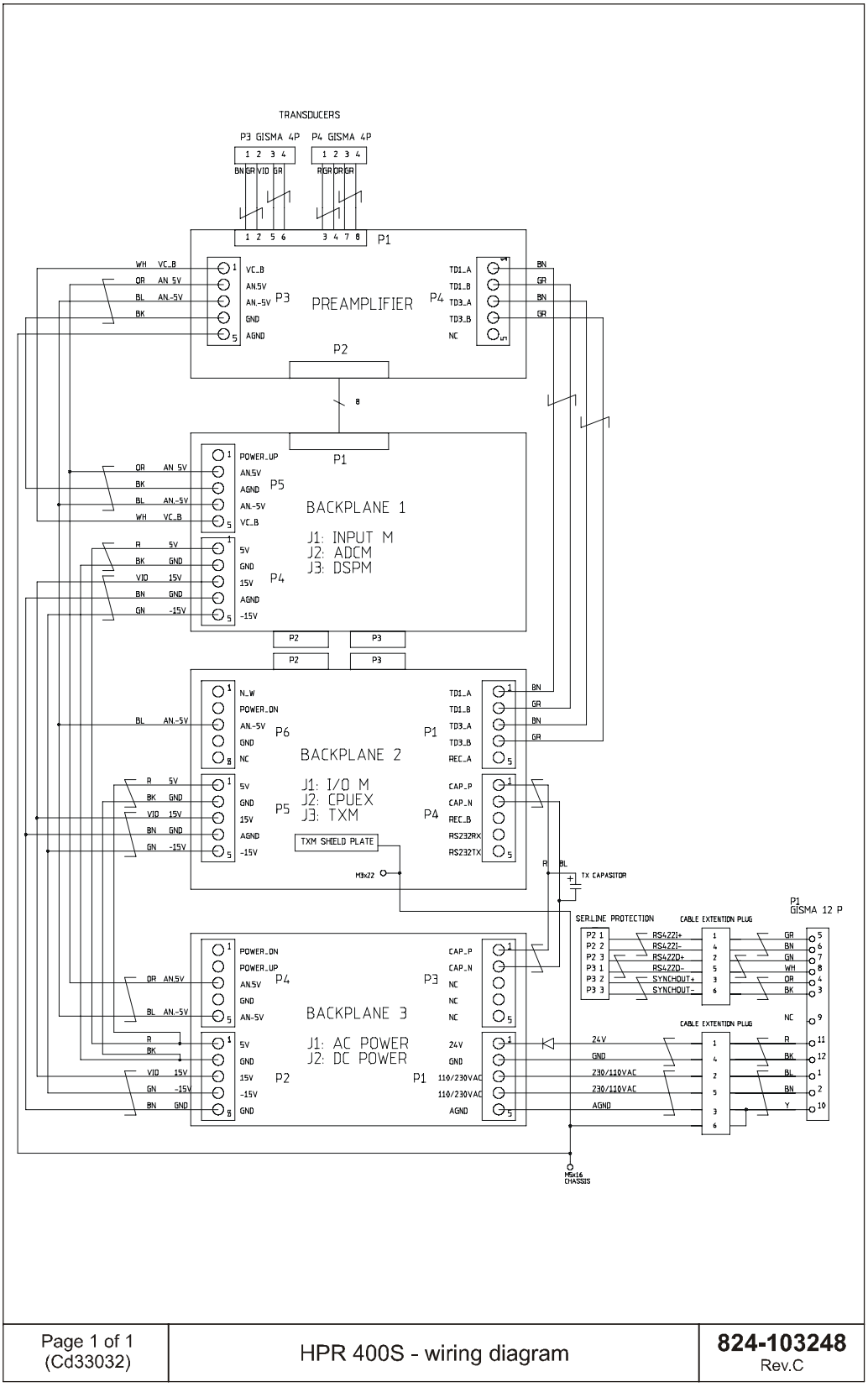


Weight:
in Air 3.5kg
in Water 2.5kg

Page 1 of 1 (CD6121)	Omndirectional TD - outline dimensions	830-089080 Rev.B



Page 1 of 1 (CD6526)	ROV TD 169 - outline dimensions	**830-213718** Rev.A



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