



KONGSBERG

EM 2040P
Multibeam echo sounder
Maintenance manual



417420/A

December 2017 © Kongsberg Maritime AS

Document information

- **Product:** Kongsberg EM 2040P
- **Document:** Maintenance manual
- **Document number:** 417420
- **Revision:** A
- **Date of issue:** December 2017

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

Comments

To assist us in making improvements to the product and to this manual, we welcome comments and constructive criticism.

e-mail: km.documentation@km.kongsberg.com

For technical support issues, please contact km.support@km.kongsberg.com.

Support information

If you require maintenance or repair, contact your local dealer. You can also contact us using the following address: km.hydrographic.support@kongsberg.com. If you need information about our other products, visit <http://www.km.kongsberg.com>

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About this manual

The purpose of this manual is to present the descriptions and drawings required to do basic maintenance tasks on the EM 2040P Multibeam echo sounder. The equipment described in this manual includes the complete system with associated cabinets, but not those system units provided locally by the customer, installation shipyard or local dealer.

Target audience

The manual is intended for technical personnel; qualified maintenance engineers and technicians. You must understand the general principles of maritime electronic equipment. You must also be familiar with computer hardware, signal processing, interface technology and traditional troubleshooting on electronic and mechanical products.

We assume that you are familiar with the basic acoustic principles of sound in water. We also expect that you have some experience with multibeam, split beam and/or single beam echo sounders in scientific applications.

Online information

All relevant end user documentation provided for your EM 2040P can be downloaded from our website.

- <https://www.km.kongsberg.com>

Our website also provides information about other Kongsberg products.

Technical information is available for registered users in our password protected database.

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EM 2040P

Topics

[System description, page 8](#)

[System diagram, page 9](#)

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System description

The EM 2040 Portable is a true wide band high resolution shallow water multibeam echo sounder. It is an ideal tool for any high resolution mapping and inspection application. EM 2040P is based on the EM 2040 technology. The receiver and transmitter are integrated in a common sonar head.

Key features

- Frequency range from 200 to 400 kHz
- High resolution
- Dual swath option, allowing sufficient sound density alongtrack at reasonable survey speed
- FM chirp allowing much longer range capability (depth and coverage) compared to CW pulses
- Complete roll, pitch and yaw stabilization
- Nearfield focusing on both transmit and receive
- Short pulse lengths, large bandwidth. Shortest pulse is 14 μ s
- IHO-S44 special order compliant
- Seabed image
- Water column logging as an option
- Swath coverage: 140 degrees

- Beam width: 1x1 degree at 400 kHz
- Sonar head depth rating: 30 metres
- Easy to install

System diagram

The system diagram identifies the main components of a basic EM 2040P system. Only the main connections between the units are shown. Detailed interface capabilities and power cables are not shown.

A Hydrographic Work Station

B Interfaces:

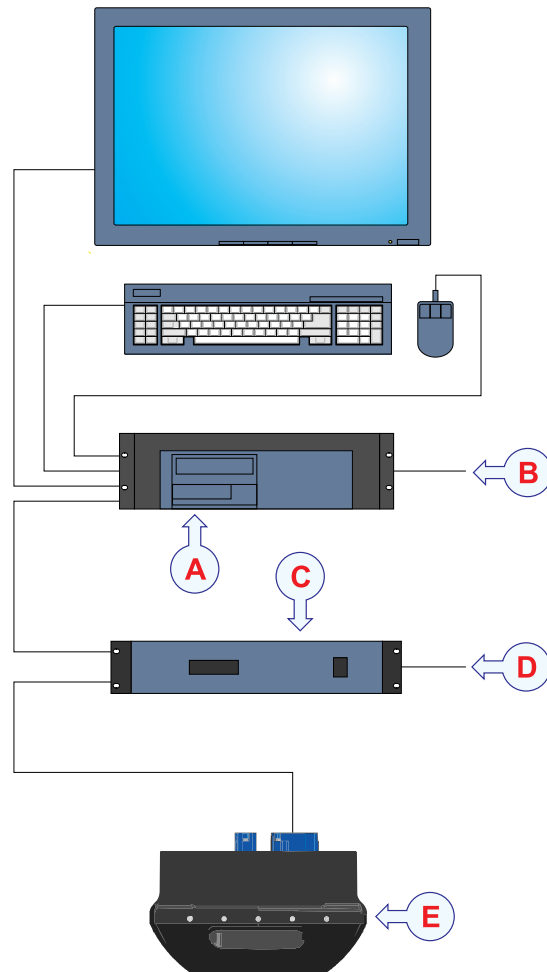
- Sound speed sensor
- Tide
- Centre depth output

C Processing Unit

D Interfaces:

- Positioning systems
- Attitude (roll, pitch and heave)
- Sound speed sensor
 - With K-Controller upgrade
- Velocity
- Heading
- Clock
- Trigger input/output
- Clock synchronisation (1PPS)

E Sonar head



(CD020107_101_001)

System units

Transducer description

A transducer is a device that converts one form of energy to another. In an echo sounder system the transducer converts between electric energy and sound. The EM 2040P has transducers for transmitting and receiving sound pulses in one housing, and we call this housing a "sonar head".

A single cable with an underwater plug, connects the sonar head to the Processing Unit.

The EM 2040P sonar head has separate linear transducer arrays for transmit and receive in a Mills cross configuration. The sonar head contains all analog electronics and digital control units with Ethernet interface to the Processing Unit. The transmitter is electronically steerable alongtrack while the receiver is steerable athwartship.



The transmit transducer consists of three separate line arrays, one looking straight down and the two others pointing 45 degrees to each side.

The transducers are made from composite ceramics which enables a wide bandwidth. The material in the part of the sonar head housing which is exposed to sea water is hard anodised aluminium.

Processing Unit description

The Processing Unit is the central controlling device in the EM multibeam system. It is provided to process the signals to and from the sonar head(s).

It is an industrial computer which is designed and tested for rugged use.

The Processing Unit also supplies 48 Vdc power to the sonar head(s).



Portable Processing Unit description

The EM 2040P Processing Unit is available in a portable version.

The portable version has the same functionality as the standard EM Processing Unit in a rugged, splash proof enclosure. It also supports a single cable interface to the Seapath 130 Series.



Hydrographic Work Station description

The Hydrographic Work Station is the operator station for the EM 2040P.

A dedicated maritime computer is provided with the EM 2040P Multibeam echo sounder. It is set up with all necessary software.

The Hydrographic Work Station is based on the Microsoft® OperatingSystem operating system.

The Hydrographic Work Station is normally mounted near the operator work space.



Rugged Hydrographic Work Station description

The Hydrographic Work Station is the operator station for the EM 2040P.

A dedicated maritime computer is provided with the EM 2040P Multibeam echo sounder. It is set up with all necessary software.

The Hydrographic Work Station is also available in a semi rugged or fully rugged version for portable use.



Remote Control Unit (K-Rem) description

A dedicated junction box has been designed to provide remote on/off switches with light indication and interface to a remote synchronizing system. The junction box contains a terminal block and four switches with lamps mounted in the front.

Note _____

The Remote Control Unit is not a standard part of the EM 2040P delivery.



The Remote Control Unit is called K-Rem. It is prepared for remote control and interface to an external synchronization system for four Kongsberg echo sounders.

- One Sub-bottom profiler (SBP 120 or SBP 300)
- Two EM multibeam echo sounders
- One EA single beam echo sounder

The Remote Control Unit is designed to be mounted in a 19 inch rack, but it is also possible to mount it on a flat surface or in a bulkhead. It is also prepared for mounting on telescopic rails.

Troubleshooting

Topics

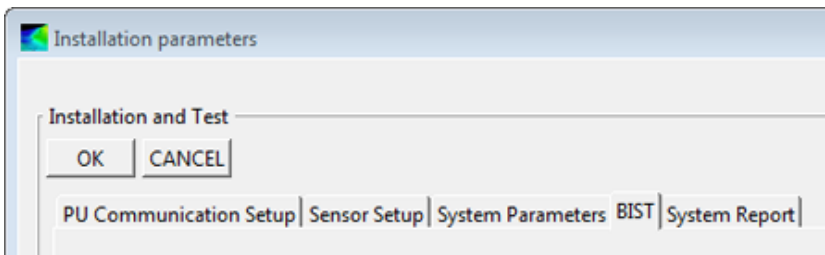
[BIST \(Built-In Self Test\) dialog box, page 14](#)

BIST (Built-In Self Test) dialog box

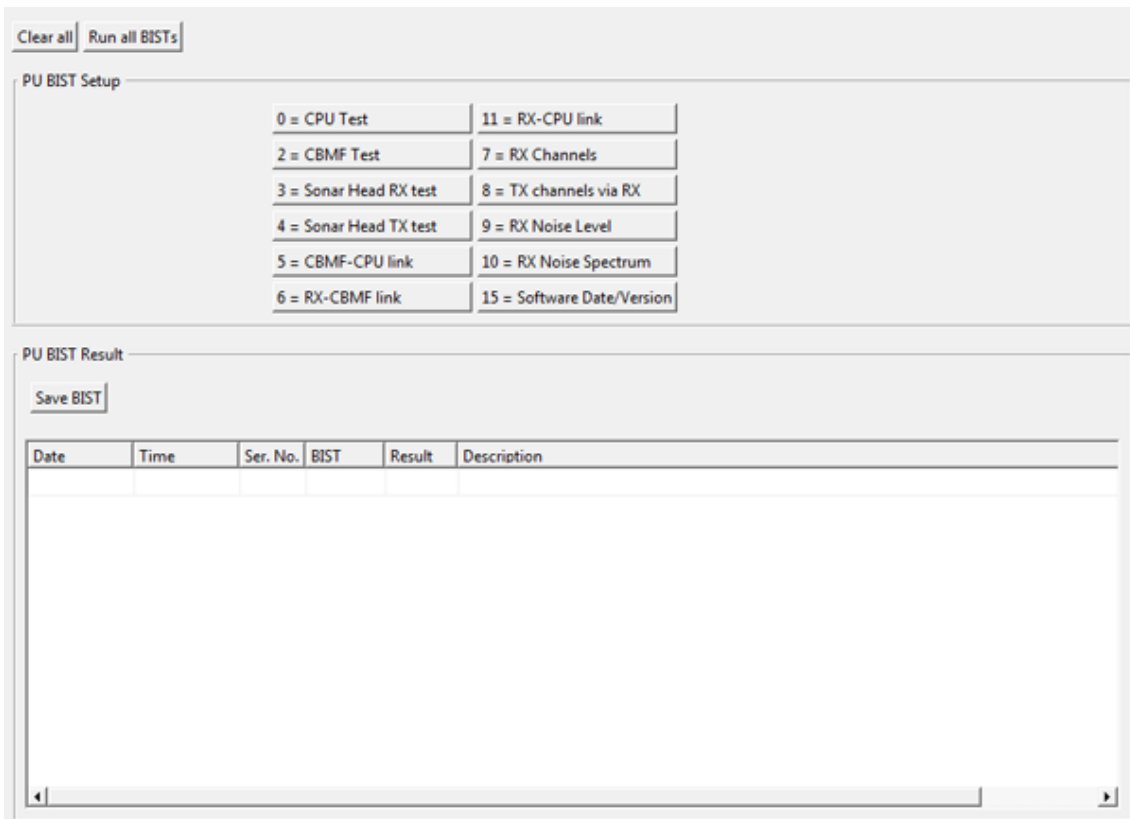
The **BIST** (Built-In System Test) dialog box controls the test and diagnose program that checks the performance of the EM 2040P.

How to open

This dialog box is opened from the BIST tab in the **Installation parameters** frame.



Description



Details

Clear all

Select **Clear all** to clear results of previous BIST tests.

Run all BISTs

Select **Run all BISTs** to run all available BIST tests.

Caution

Do not use this option in dry dock. Some of the BIST tests will cause the echo sounder to ping, and this must not be performed with the transducers out of water.

PU BIST Setup

You can run each BIST test separately, select the one you want to run in the list in **PU BIST Setup**.

Note

The test is executed when the button is selected.

Verify that all BIST test buttons turns green when test is performed. If any of the tests fails the specific test button will turn red or yellow, and a description of the test result will be displayed in the **PU BIST result** field.

- 0 CPU Test
This test presents the CPU type, the CPU clock frequency, the current and maximum temperatures for the CPU die and for the CPU board. In addition some key voltages are reported, and finally the network addresses for the board's interfaces.
- 2 CBMF test
This test presents the number of CBMF boards, part number and serial number, firmware and software revision number and the current FPGA die temperature. In addition some key voltages are reported.
- 3 Sonar Head RX test
This test presents the number of RX units detected, serial number and part number of the Sonar Head, firmware and software revision number and the current FPGA die temperature. In addition some key voltages are reported.
- 4 Sonar Head TX test
This test presents the number of TX units detected, serial number and part number of the Sonar Head, firmware and software revision number, the current FPGA die temperature and several temperatures inside the Sonar Head. In addition some key voltages are reported.
- 5 CBMF-CPU link
This test checks the GBit Ethernet interface between the CPU board and the CBMF board. A large set of known data is transferred from the CBMF board and the data received is checked by the CPU board.

- 6 RX-CBMF link
This test checks the GBit Ethernet interface between the RX transducer unit and the CBMF board. A large set of known data is transferred from the RX transducer unit to the CBMF board. The data received is checked by the CBMF board.
- 7 RX Channels
The Sonar Head has a programmable signal generator board that is used to inject a test signal at the preamplifier inputs. This test checks all RX channels. The BIST report lists phase and amplitude response of all RX channels for 200, 300 and 400 kHz.
- 8 TX channels via RX
This test checks all TX channels (including the transducers). This is done by transmitting at one by one TX channel and checking the received level (through the water) by the receiver unit(s). This test may require that the water depth is not too large. A warning will be given if this is the case.
Caution _____
Do not ping in dry dock. For the EM 2040P this BIST test must not be run in dry dock.

- 9 RX Noise Level
This test measures the average isotropic spectral noise level for each receiver channel (in dB rel 1 μ Pa/Hz) at three bands: 180 - 220 kHz, 280 - 320 kHz and 360 - 400 kHz
The receiver directivity index, the transducer sensitivity and the filter bandwidth is used to convert to isotropic spectral noise level. The noise level should normally be below 50 dB.
- 10 RX Noise Spectrum
This test measures the isotropic spectral noise level for each receiver channel as done in the RX noise level test. The noise spectrum level is displayed for 5 kHz bands for groups of 32 channels. In addition the average level for all channels are displayed. This spectrum test can be used to search for external noise sources.
- 11 RX-CPU link
This test is not implemented yet.
- 15 Software Date/Version
This test presents the software date and versions for the Processing Unit and Sonar Head.

PU BIST Result

Save: When the test sequence has run to completion the test results may be saved by selecting **Save**.

The test results will be saved as a `.txt` file and you can select file name and storage location in the dialog box that appears.

The results of the test will be shown in the **PU BIST Result** fields, containing:

- **Date:** Date when test was run
- **Time:** System time when test was run
- **Ser.no:** Serial number
- **BIST:** The number of the BIST test that has been run
- **Result:** The overall result of the test
- **Description:** A description of the test returned from the Processing Unit (PU)

Preventive maintenance

Topics

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[Painting the sonar head face, page 20](#)

[Approved anti-fouling paints, page 22](#)

Inspecting and cleaning the sonar head face

Marine growth (biological fouling) on the sonar head face reduces the EM 2040P performance. For this reason, it is important to keep the sonar head face clean. Every time your vessel is in dry dock, you must remove the marine growth. At the same time, you must inspect the sonar head closely for physical damage.

Prerequisites

The following tools and consumables are required.

- Personal protection
- Fresh water
- A mild synthetic detergent and a plastic brush
- A piece of wood or plastic without sharp corners
- Citric acid (<50%) (only if required)

Context

During normal use, the sonar head is subjected to biological fouling. If this marine growth is excessive, it will reduce the performance of the EM 2040P. Whenever opportunity arise, typically when the vessel is dry docked, the sonar head face must be cleaned for shells and other marine growth.

It is important to check the sonar head for physical damage. Any cracks, fractures or holes in the red protective coating may result in a water leak, and a leak may cause irreparable damage to the sonar head.

A sonar head must always be handled as a delicate item. Wrongful actions may damage the sonar head beyond repair. Observe these sonar head handling rules:

- **Do not** activate the sonar head when it is out of the water.
- **Do not** handle the sonar head roughly, avoid impacts.
- **Do not** expose the sonar head to direct sunlight or excessive heat.
- **Do not** use high pressure water, sand blasting, metal tools or strong solvents to clean the sonar head face.
- **Do not** damage the outer protective skin on the sonar head face.
- **Do not** lift the sonar head by the cables.
- **Do not** step on the sonar head cables.
- **Do not** damage the sonar head cables, avoid sharp objects.

Procedure

- 1 Allow for sufficient access to clean and inspect the entire surface of the sonar head.
- 2 Remove biological fouling carefully using a plastic brush, a suitable synthetic detergent and fresh water.

Biological material which is strongly rooted in the substrate can be removed carefully with a piece of wood or plastic.

If required, you can also use citric acid. Apply, leave it working for several hours, and rinse thoroughly with fresh water.

Note

Do not use high pressure water, sand blasting, metal tools or strong solvents to clean the sonar head face.

Do not damage the outer protective skin on the sonar head face.

- 3 Allow the sonar head surface to dry.
- 4 Do a thorough visual inspection of the sonar head. Check for dents, scratches, holes or other damage to the surface.

If you suspect damage, take a high resolution photo. Contact your dealer or the Kongsberg support organization for advice.
- 5 Apply anti-fouling paint as described in the dedicated procedure.

Note

Because some paint types may be aggressive to the polyurethane in the sonar head, consult our list of approved paints.

The list can also be found on <http://www.km.kongsberg.com>.

Painting the sonar head face

Marine growth (biological fouling) on the sonar head face reduces the EM 2040P performance. We recommend that you paint the sonar head face immediately after installation, and then again as often as required to maintain the protection.

Prerequisites

The following tools and consumables are required.

- Personal protection
- Fresh water
- A mild synthetic detergent and a plastic brush
- Fine-grade sandpaper (240 inch grit size)
- Primer
- Anti-fouling paint
- Wet film gauge

Because some paint types may be aggressive to the polyurethane in the sonar head, consult our list of approved paints.

Context

The sonar head has not been designed with any protection against biological fouling.

Anti-fouling paint may therefore be applied to the sonar head face.

To minimize the negative acoustical effects the layer of anti-fouling paint must be as thin as possible.

Note

The anti-fouling paint will reduce the acoustical performance of the sonar head.

The surface roughness of the sonar head substrate and the thickness of the paint may also influence the performance.

Kongsberg Maritime can not be held responsible for any negative consequences of the anti-fouling paint.

Observe the relevant instructions and safety information provided by the paint manufacturer.

Procedure

- 1 Clean the sonar head thoroughly. Make sure that you remove all oil grease residues, as well as salt and other contamination.
- 2 Allow the sonar head surface to dry.
- 3 Abrade the sonar head surface using a sanding paper with 240 inch grit size.
Do not exceed a surface roughness (R_{max}) of 35 microns as this can influence the EM 2040P performance.
- 4 Remove all dust.
- 5 Apply the primer, and let it dry.
- 6 Apply the paint.

Observe the instructions provided by the paint manufacturer. Use airless spray. Apply the minimum specified film thickness per coat and for the complete layer. It is not possible to measure dry film thickness on sonar head surface. You must therefore use a wet film gauge to frequently measure the paint thickness.

Note

We strongly recommend that you do not use a paintbrush and/or a roller.

- 7 Allow the paint to dry.

Further requirements

The contractor or shipyard must keep a daily paint log recording all relevant information from the surface treatment.

Approved anti-fouling paints

This is our list of approved antifouling paints for all sonar head types. Always refer to the manufacturer's documentation and data sheets for a complete procedure and for relevant safety information.

Important

Do not paint the sonar head with traditional hull plating paint. Use only the correct type of approved paint specified below.

Do not use high pressure water, sand blasting, metal tools or strong solvents to clean the sonar head face.

Jotun

Address: P.O.Box 2021, N-3248 Sandefjord, Norway

<http://www.jotun.com>

- **Primer:** Safeguard Universal ES
Apply 80 µm wet film thickness (50 µm dry film thickness)
- **Paint:** SeaQuantum Ultra S
Apply 250 µm wet film thickness (125 µm dry film thickness)

Data sheets and application guides can be downloaded from: <http://www.jotun.com/ww/en/b2b/technical-info/tds/index.aspx>

International Marine Coatings

Address: Stonegate Lane, Felling, Gateshead, Tyne & Wear, NE10 0JY United Kingdom

www.international-marine.com

- Intersleek 1100SR
 - **Primer:** Intersleek 737
Apply 50µm dry film thickness
 - **Paint:** Intersleek 1100SR
Apply 150µm dry film thickness
- Intersmooth 360 Ecoloflex SPC

The list can also be found on <http://www.km.kongsberg.com>.

Illustrated spare parts catalogue

Topics

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[List of spare parts, page 25](#)

Ordering spare parts

To make the order process as short and as effective as possible, you must provide accurate information about the product, the part you need, and yourself.

The following information must be provided with your order.

- Part name and/or description
- Our part number
- Number of items required
- Your shipment address
- Preferred shipment method
- Required date of delivery from us

For certain spare parts (typically complete units, printed circuit boards and software) the vessel name is also useful, as this allows us to update our vessel database.

List of spare parts

Topics

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Processing Unit spare part - dual version - two CBMF boards, page 25

CBMF board spare part, page 26

Concurrent PP833 CPU board spare part, page 26

Ethernet switch spare part, page 27

Fan unit spare part, page 27

Power supply spare part, page 28

Processing Unit spare part - single version - one CBMF board

The complete Processing Unit can be supplied as a spare part. There are two different versions of the EM 2040P Processing Unit. The two versions hold one or two CBMF boards.

A single head single swath system uses one Processing Unit with one CBMF board.



- **Part name:** Processing Unit single version
- **Part number:** 407926
- **Number in use:** 1 or 2
- **Recommended number in spare:** 1
- **True manufacturer:** Kongsberg Maritime (<https://www.km.kongsberg.com>)

Processing Unit spare part - dual version - two CBMF boards

The complete Processing Unit can be supplied as a spare part. There are two different versions of the EM 2040P Processing Unit. The two versions hold one or two CBMF boards.

A dual head or dual swath system uses one Processing Unit with two CBMF boards.



A dual head dual swath system uses two Processing Units, each with two CBMF boards.

- **Part name:** Processing Unit dual version
- **Part number:** 410578
- **Number in use:** 1 or 2

- **Recommended number in spare:** 1
- **True manufacturer:** Kongsberg Maritime (<https://www.km.kongsberg.com>)

CBMF board spare part

There are one or two Compact Beamformer (CBMF) boards in the Processing Unit. The number of CBMF boards depend upon the configuration of the EM 2040P system.

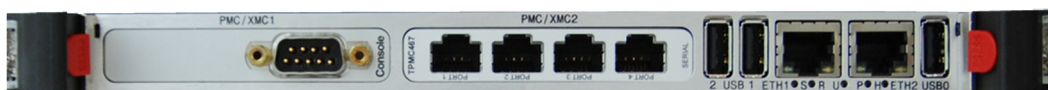
This is a generic photo. The CBMF board used by the EM 2040P may look slightly different due to minor design changes on the protective lid and/or the front panel.

- **Part name:** CBMF board
- **Part number:** 381169
- **Number in use:** 1 or 2
- **Recommended number in spare:** 1
- **True manufacturer:** Kongsberg Maritime (<https://www.km.kongsberg.com>)



Concurrent PP833 CPU board spare part

There is one Concurrent PP833 CPU board in the Processing Unit.



This is a generic photo. The Concurrent CP833 CPU board used by the EM 2040P may look slightly different due to minor design changes on the protective lid and/or the front panel.

- **Part name:** Concurrent PP833 CPU board
- **Part number:** 407777
- **Number in use:** 1
- **Recommended number in spare:** 1
- **True manufacturer:** Concurrent Technologies Plc.
Concurrent Technologies (<http://www.gocct.com>)

Ethernet switch spare part

There is one VadaTech CP219 Ethernet switch in the Processing Unit.

This is a generic photo. The Vadatech CP219 board used by the EM 2040P may look slightly different due to minor design changes on the protective lid and/or the front panel.



- **Part name:** VadaTech CP219 Ethernet switch board
- **Part number:** 384691
- **Number in use:** 1
- **Recommended number in spare:** 1
- **True manufacturer:** VadaTech Incorporated
VadaTech (<http://www.vadatech.com>)

Fan unit spare part

Two fan units are used in the EM 2040P Processing Unit for side to side cooling.

- **Part name:** Fan unit
- **Part number:** 385387
- **Number in use:** 2
- **Recommended number in spare:** 1
- **True manufacturer:** Recab/Schroff



Power supply spare part

One power supply unit is used in the EM 2040P Processing Unit for supply of 5, 24 and 48 VDC.

- **Part name:** Power supply, Excelsys XLB
- **Part number:** 373897
- **Number in use:** 1
- **Recommended number in spare:** 1
- **True manufacturer:** Excelsys
Excelsys Technologies
(<http://www.excelsys.com>)



Processing Unit

Topics

[Processing Unit overview, page 30](#)

[Processing Unit familiarization, page 30](#)

[Processing Unit front panel description, page 31](#)

[Processing Unit rear panel description, page 32](#)

[Processing Unit circuit boards and modules, page 33](#)

[Concurrent PP833 CPU board, page 34](#)

[CP219 Ethernet switch, page 36](#)

[CBMF board, page 37](#)

Processing Unit overview

The Processing Unit is the central controlling device in the EM multibeam system. It is provided to process the signals to and from the sonar head(s).

It is an industrial computer which is designed and tested for rugged use.



The Processing Unit also supplies 48 Vdc power to the sonar head(s).

One or two Processing Units may be required, depending on the system configuration.

Processing Unit familiarization

The Processing Unit consists of an instrument case with integrated rack mounting in a 19 inch rack.

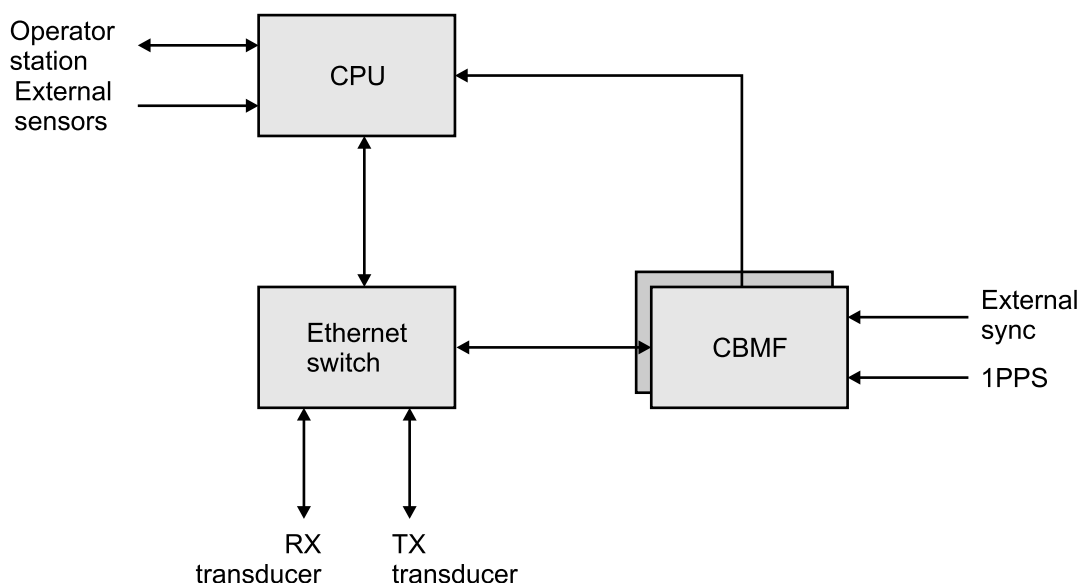
It uses both COTS (commercial off-the-shelf) components and custom made components. Ventilation is provided through slits located on the sides. The front panel of the Processing Unit holds a mains power switch and an information display.

The Processing Unit can be switched on/off with a remote switch.

The sonar head(s) are connected to the Ethernet switch in the Processing Unit.

The receive data from the Gbit link is filtered and beamformed by an FPGA unit on the CBMF board. The result is transferred to the CPU board via the cPCI backplane.

Simplified block diagram



(CD029501_001_001)

Processing Unit front panel description

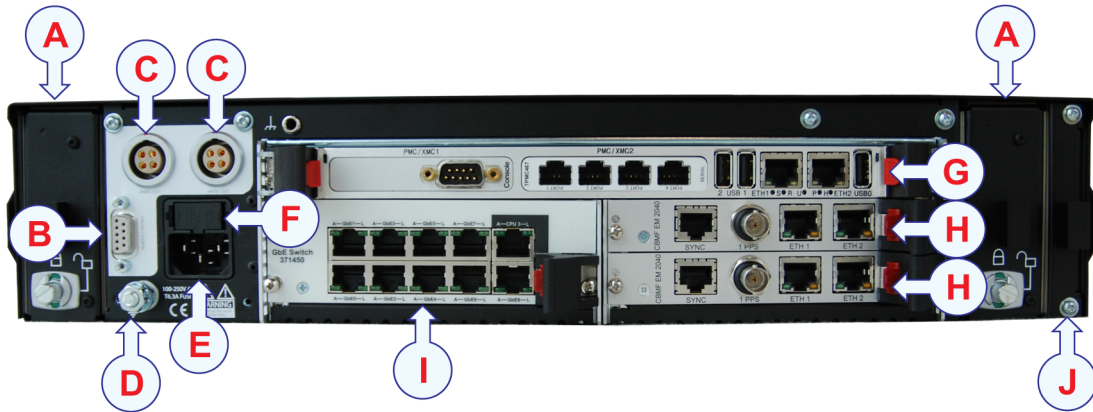
The front panel of the Processing Unit holds a mains power switch and an information display.



- A** *Information display*
- B** *Mains power switch*

Processing Unit rear panel description

The rear panel of the Processing Unit holds all the connectors used to communicate with external devices and the power input socket. It also holds a fuse for the power input.



A Fan unit

The Processing Unit has two fan units for cooling purposes.

B Remote Control connector

C 48 Vdc output connector

D Ground connector

E AC power socket

F Fuse for the main supply

G Concurrent PP833 CPU board

H CBMF board

There are one or two Compact Beamformer (CBMF) boards in the Processing Unit. The number of CBMF boards depend upon the configuration of the EM 2040P system.

I CP219 Ethernet switch

J Air filter unit

Processing Unit circuit boards and modules

In order to do the necessary tasks, and to fulfill the operational requirements, the Processing Unit is equipped with several circuit boards and modules. All circuit boards and modules are line replaceable units (LRU).



The following circuit boards and modules are used in the EM 2040P Processing Unit. All are line replaceable units.

A Concurrent PP833 CPU board

The Concurrent PP833 is the Central Processing Unit (CPU) of the EM 2040P Processing Unit.

B CBMF board

The Compact Beamformer (CBMF) board is used by the Processing Unit for beamforming and signal processing purposes.

There are one or two Compact Beamformer (CBMF) boards in the Processing Unit. The number of CBMF boards depend upon the configuration of the EM 2040P system.

C VadaTech CP219 board

The VadaTech CP219 board is used as an Ethernet switch in the EM 2040P Processing Unit.

D Fan unit

The Processing Unit has two fan units for cooling purposes.

- **Power supply**

One power supply unit is used in the EM 2040P Processing Unit for supply of 5, 24 and 48 VDC.

The Excelsys XLB power supply is located inside the Processing Unit, and is not visible from the outside.

Concurrent PP833 CPU board

Topics

[Concurrent PP833 CPU board overview, page 34](#)

[Concurrent PP833 CPU board connectors, page 35](#)

Concurrent PP833 CPU board overview

The Concurrent PP833 is the Central Processing Unit (CPU) of the EM 2040P Processing Unit.

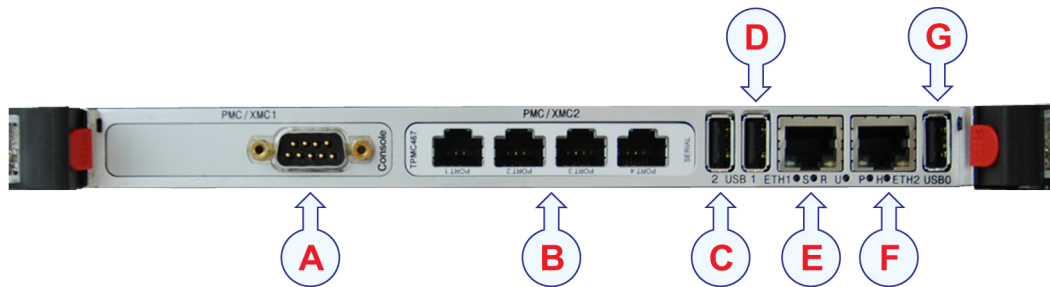


The Concurrent PP833 is a PC-compatible high functionality Compact PCI (cPCI) board used by the EM 2040P Processing Unit as the Central Processing Unit (CPU).

The circuit board is manufactured by Concurrent Technologies and configured by Kongsberg Maritime AS.

Concurrent PP833 CPU board connectors

The Concurrent PP833 CPU board holds two large connectors for the backplane, as well as several front mounted connectors. Not all of these connectors are used in the EM 2040P.



- A** *PMC/XMC1 Console - for Kongsberg Maritime use only*
- B** *COM1 to COM4 - Four serial ports with RJ45 connectors. The ports can be configured to be RS-232 or RS-422*
- C** *USB 2 - not used*
- D** *USB 1 - not used*
- E** *Ethernet 1 - used for communication to the Operator Station (Hydrographic Work Station)*
- F** *Ethernet 2 - not used*
- G** *USB 0 - not used*

CP219 Ethernet switch

Topics

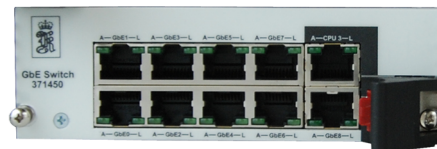
[Ethernet switch overview, page 36](#)

[Ethernet switch connectors, page 36](#)

Ethernet switch overview

The VadaTech CP219 board is used as an Ethernet switch in the EM 2040P Processing Unit.

This is a generic photo. The Vadatech CP219 board used by the EM 2040P may look slightly different due to minor design changes on the protective lid and/or the front panel.

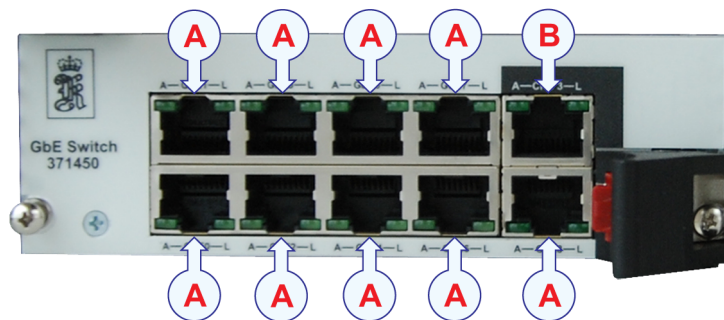


The VadaTech CP219 is a compact PCI module that provides 10 Gigabit Ethernet ports on the front panel.

Ethernet switch connectors

The VadaTech CP219 Ethernet switch holds 10 front mounted connectors, as well as one large connector for the backplane.

This is a generic photo. The Vadatech CP219 board used by the EM 2040P may look slightly different due to minor design changes on the protective lid and/or the front panel.



The Vadatech CP219 board is fitted with the following connectors.

- A** GbE0 to GbE8 - regular Gigabit Ethernet ports
- B** CPU3 - Gigabit Ethernet port reserved for Attitude Velocity sensor

CBMF board

Topics

[CBMF board overview, page 37](#)

[CBMF board configuration, page 38](#)

[CBMF board connectors, page 39](#)

CBMF board overview

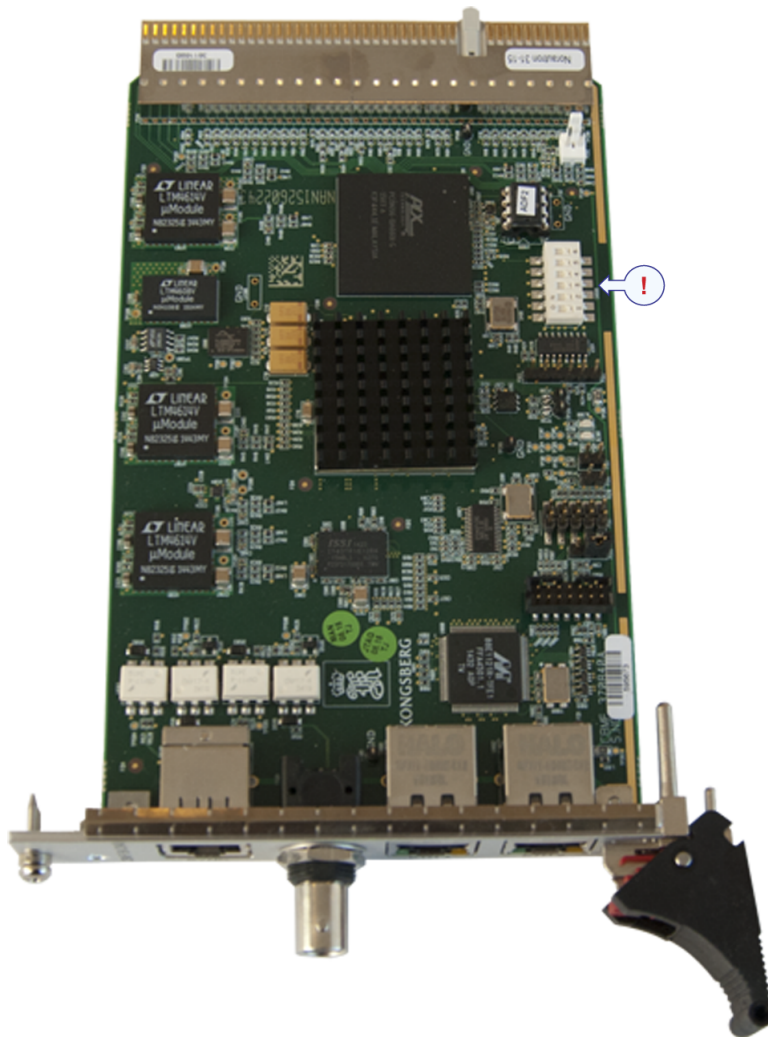
The Compact Beamformer (CBMF) board is used by the Processing Unit for beamforming and signal processing purposes.



This is a generic photo. The CBMF board used by the EM 2040P may look slightly different due to minor design changes on the protective lid and/or the front panel.

CBMF board configuration

The CBMF board is a generic circuit board designed for multiple applications and operational frequencies. By means of the on-board software, the links and the switches it can be configured for specific use. When a board is provided as a spare part, it is readily configured.

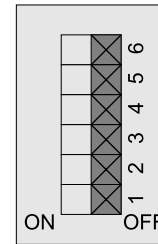


This is a generic photo. The CBMF board used by the EM 2040P may look slightly different due to minor design changes on the protective lid and/or the front panel.

Switches and links

The CBMF board holds several switches and links. These are implemented to allow the circuit board to be used in several different configurations.

The switch setting on the CBMF board has to be correct. All the switches on all the CBMF boards in the Processing Unit should be set to OFF. OFF is when they are pushed towards the edge of the circuit board.



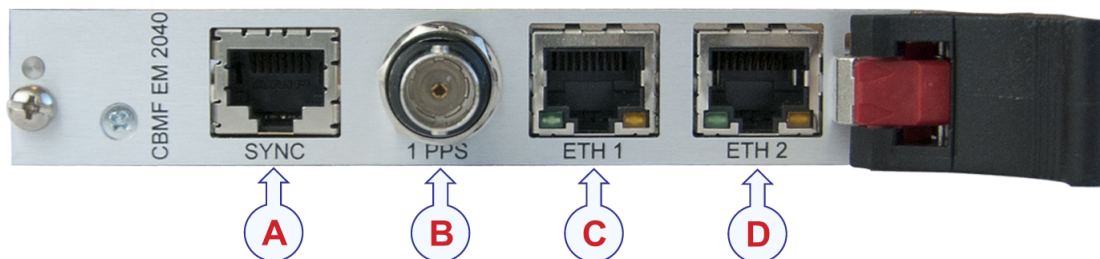
(CD090306_001_001)

Do not touch other switches or link settings.

The CBMF board is configured by Kongsberg Maritime for use in the EM 2040P. If you receive a spare CBMF board, this is also set up correctly before it is shipped.

CBMF board connectors

The CBMF board holds a large connector for the backplane, as well as several front mounted connectors.



This is a generic photo. The CBMF board used by the EM 2040P may look slightly different due to minor design changes on the protective lid and/or the front panel.

The CBMF board is fitted with the following connectors.

- A** *SYNC - signal used for synchronisation when multiple echo sounders are employed on a vessel*
- B** *1PPS - one pulse per second input signal used to synchronise the internal clock in the Processing Unit*
- C** *ETH1 - Ethernet connection to internal switch in the Processing Unit*
- D** *ETH2 - not used for EM 2040P*

Cable layout and interconnections

Topics

[Read this first, page 41](#)

[Cable plans, page 42](#)

[List of EM 2040P cables, page 47](#)

[Cable drawings and specifications, page 49](#)

Read this first

Detailed information about cable specifications, termination and connectors is provided. Unless otherwise specified, all cables are supplied by Kongsberg Maritime as a part of the EM 2040P delivery.

Detailed drawings are provided for relevant cables. Each drawing provides additional information, and may, when applicable, include minimum specifications, connector terminations and the required number of cores. Drawings are generally not provided for standard commercial cables. Cables fall into three categories.

- 1 **System cables:** These cables are provided by Kongsberg Maritime as a part of the EM 2040P delivery.
- 2 **Shipyard cables:** These cables must be provided by the shipyard performing the installation, or the shipowner. It is very important that the cables used meet the minimum specifications provided in this manual.
- 3 **Commercial cables:** These cables may be provided by Kongsberg Maritime as a part of the EM 2040P delivery. They may also be included with third party items that are used with the EM 2040P.

All electronic installations and corresponding wiring must be in accordance with the vessel's national registry and corresponding maritime authority and/or classification society. If no such guidelines exist, we recommend that Det Norske Veritas (DNV GL) Report No. 80-P008 "Guidelines for Installation and Proposal for Test of Equipment" is used as a guide.

Note

It is very important that all cables are properly installed and correctly terminated. Observe the relevant regulations and work standards. Always leave enough cable slack close to system units and cabinets to allow for maintenance.

Only skilled and authorized personnel can install the EM 2040P cables.

Kongsberg Maritime accepts no responsibility for damage to the system, or reduced operational performance, when this is caused by improper wiring.

Before you perform the EM 2040P cabling, ensure that the mains circuit breaker for the system is switched off.

Cable plans

Topics

[Processing Unit, single swath, cable plan, page 43](#)

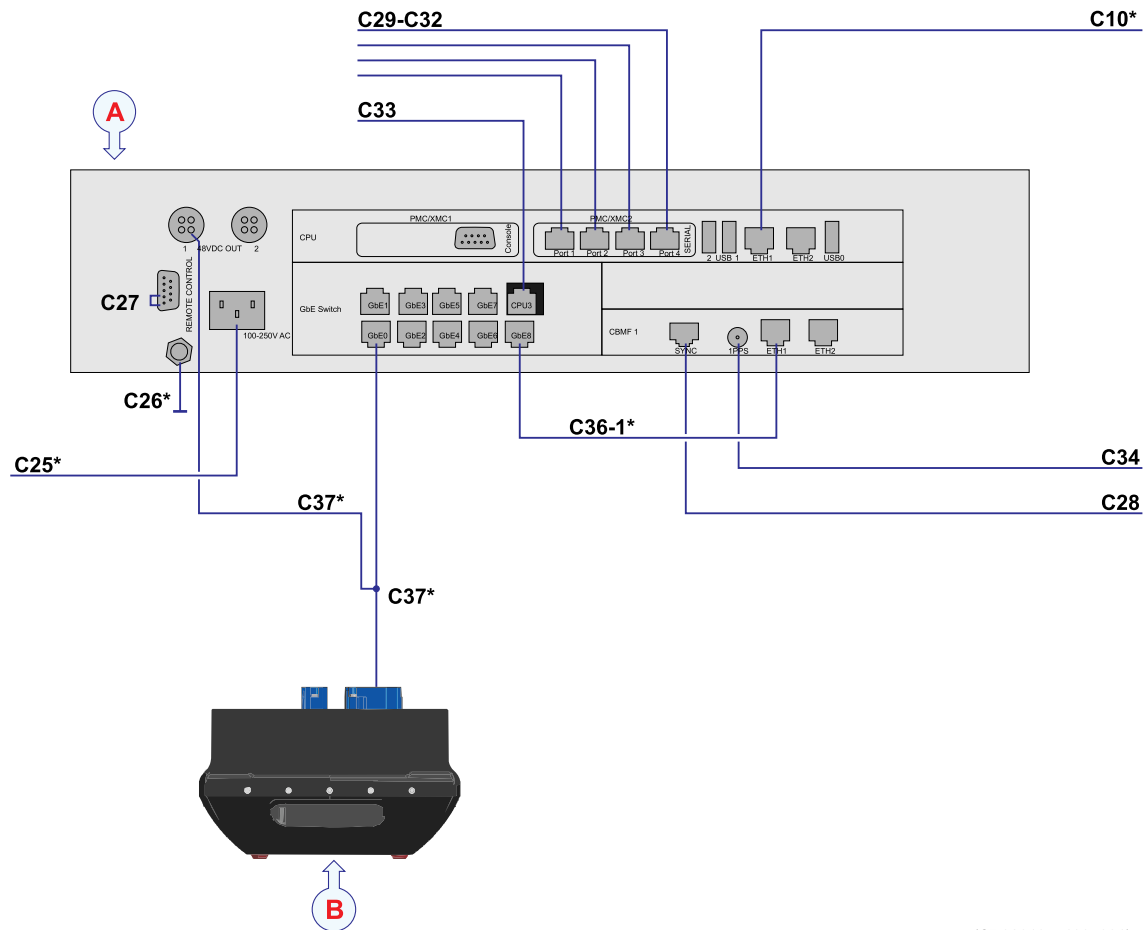
[Processing Unit, dual swath, cable plan, page 44](#)

[Portable Processing Unit, cable plan, page 45](#)

[Topside cable plan, page 46](#)

Processing Unit, single swath, cable plan

The Processing Unit cables include those used to connect the EM 2040P Processing Unit to AC mains power, and to the sonar head. One Ethernet cable is used to connect the Processing Unit to the Hydrographic Work Station.



(CD020107_100_001)

A Processing Unit

B Sonar head

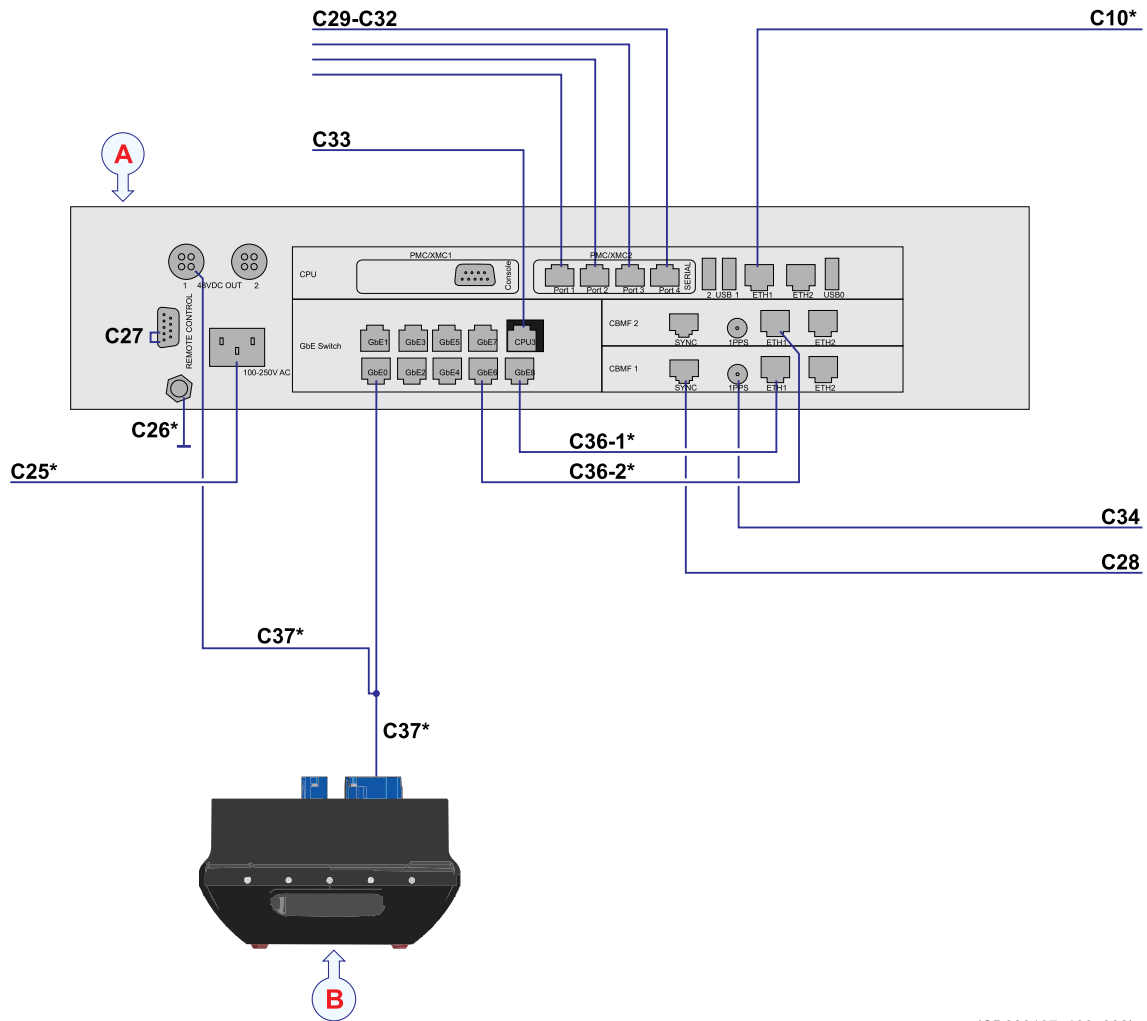
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040P delivery.

Related topics

[List of EM 2040P cables, page 47](#)

Processing Unit, dual swath, cable plan

The Processing Unit cables include those used to connect the EM 2040P Processing Unit to AC mains power, and to the sonar head. One Ethernet cable is used to connect the Processing Unit to the Hydrographic Work Station.



(CD020107_100_002)

A *Processing Unit*

B *Sonar head*

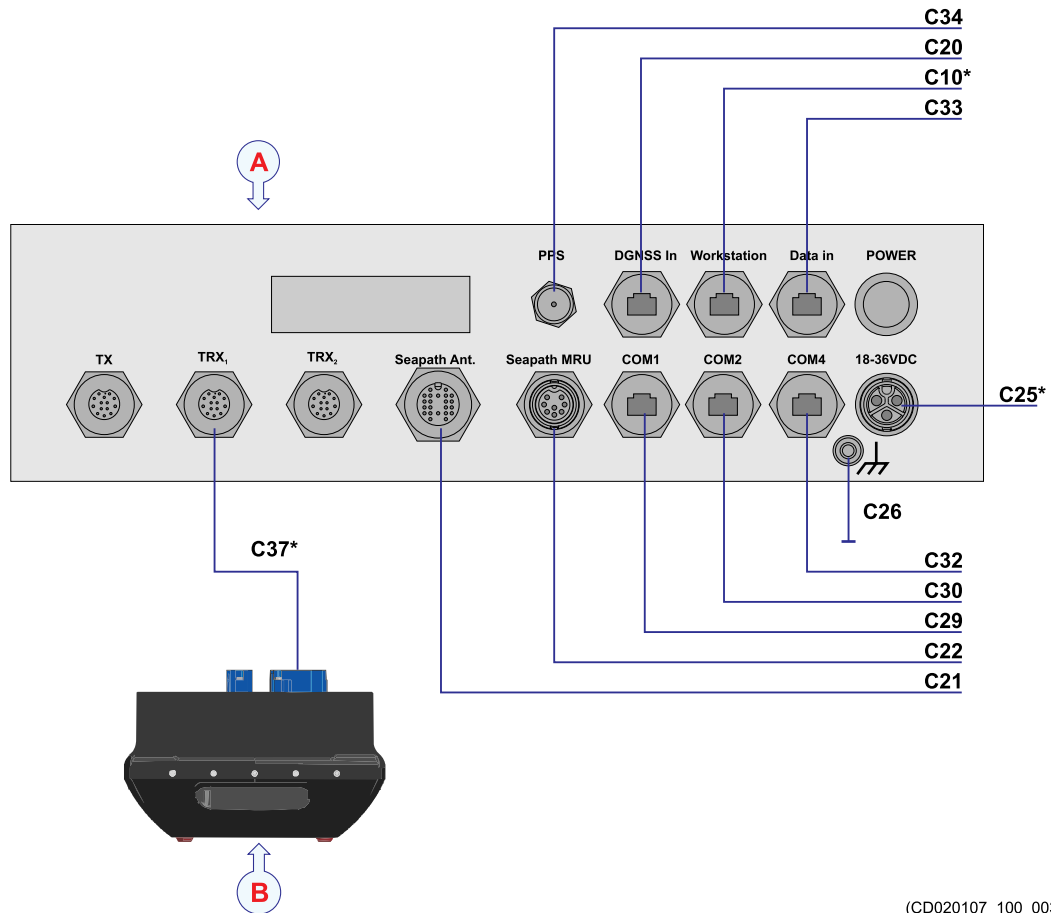
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040P delivery.

Related topics

[List of EM 2040P cables, page 47](#)

Portable Processing Unit, cable plan

The Processing Unit cables include those used to connect the EM 2040P Processing Unit to DC power, and to the sonar head. One Ethernet cable is used to connect the Processing Unit to the Hydrographic Work Station.



(CD020107_100_003)

A *Processing Unit*

B *Sonar head*

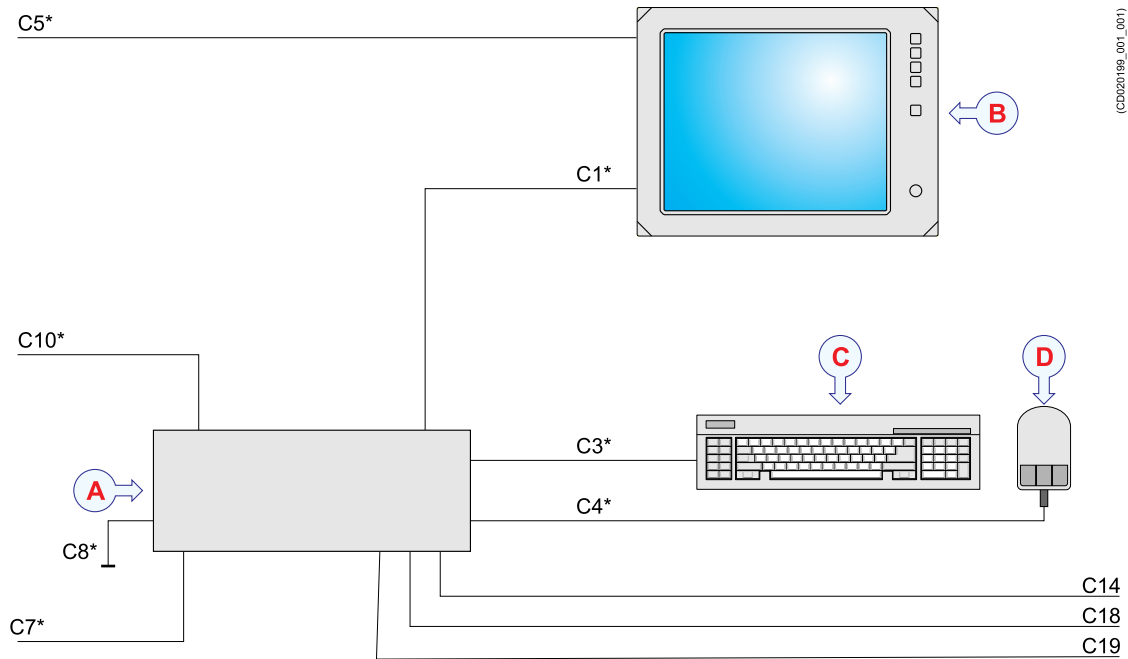
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040P delivery.

Related topics

[List of EM 2040P cables, page 47](#)

Topside cable plan

The topside/bridge cables include those used to connect the EM 2040P Hydrographic Work Station (computer) and the display to each other, to AC mains power, and to external devices.



- A Hydrographic Work Station
- B Display
- C Computer keyboard
- D Computer mouse or trackball

Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040P delivery.

Related topics

[List of EM 2040P cables, page 47](#)

List of EM 2040P cables

A set of cables is required to connect the EM 2040P units to each other, and to the relevant power source(s).

Cable	Signal	From/To
C1	Video cable	From Hydrographic Work Station to display This is a commercial cable. It is normally provided with the display.
C3	Keyboard	From Hydrographic Work Station to keyboard This is a commercial cable. It is normally provided with the keyboard.
C4	Mouse	From Hydrographic Work Station to mouse (or another similar device) This is a commercial cable. It is normally provided with the mouse.
C5	AC power cable	From display to AC power outlet
C7	AC power cable	From Hydrographic Work Station to AC power outlet
C8	Ground cable	From Hydrographic Work Station to vessel ground
C10	Ethernet cable	From Hydrographic Work Station to Processing Unit
C14	Serial cable	From Hydrographic Work Station to external device(s)
C18	Serial cable	From Hydrographic Work Station to external device(s)
C19	Serial cable	From Hydrographic Work Station to external device(s)
C20	Serial cable	From DGNSS provider to Processing Unit. Input for correction services. See Seapath 130 manual for supported solutions. RS-232 serial line used for DGNSS input, page 52 RS-422 serial line used for DGNSS input, page 53
C21	Special cable	From Portable Processing Unit to Seapath antenna. Seapath antenna interface cable - with plug, page 63 Antenna interface cable, page 65
C22	Special cable	From Portable Processing Unit to Seapath MRU. Seapath MRU interface cable, page 66
C25	Power cable	From Processing Unit to AC power outlet From Processing Unit to DC power outlet DC Power cable, page 67 Two versions, one for Portable Processing Unit and one for regular Processing Unit.
C26	Ground cable	From Processing Unit to vessel ground
C27	Control cable	From Processing Unit to remote control device Remote on/off switch If remote control is not used, a termination plug has to be inserted in the Remote control plug on the Processing Unit. This plug is a 9 pin D-SUB supplied with the Processing Unit. The remote control function is not available for the Portable Processing Unit. Remote control, page 55 Remote Control using K-Rem, page 56 Dummy plug for not using remote control, page 57
C28	Control cable	From Processing Unit to synchronization device External synchronization External synchronisation, page 58

Cable	Signal	From/To
C29	Serial cable	From Processing Unit to external device(s) RS-232 serial line using three wires and RJ45 connector, page 50 RS-422 serial line using five wires and RJ45 connector, page 51
C30		
C31		
C32		
C33	Ethernet cable	From Processing Unit to external device(s) Attitude Velocity sensor
C34	Coax cable	From Processing Unit to external device(s) 1 PPS (one pulse per second) clock synchronisation Clock synchronisation (1PPS) using a coax cable, page 54
C36	Ethernet cable	Processing Unit internal connection
C37	Sonar head cable	From Processing Unit to sonar head The sonar head cable is provided with the sonar head. Two versions, one for Portable Processing Unit and one for regular Processing Unit. Transducer cable, page 59 Transducer cable for Portable Processing Unit, page 61

Comments

Note

It is very important that high quality Ethernet cables are used. You must use CAT-5E STP (Shielded Twisted Pair) quality or better. Using cables with lower bandwidth capacity will reduce the EM 2040P performance.

Identifying EM 2040P cables on a project cable drawing

The EM 2040P is often a part of a project delivery. For such deliveries, specific project cable drawings are established to show all the main cables, and how the various products are connected. In such project cable drawings, the EM 2040P cables are identified as **EM 2040P/Cx**.

Related topics

[Processing Unit, single swath, cable plan, page 43](#)

[Processing Unit, dual swath, cable plan, page 44](#)

[Portable Processing Unit, cable plan, page 45](#)

[Topside cable plan, page 46](#)

Cable drawings and specifications

Topics

[RS-232 serial line using three wires and RJ45 connector, page 50](#)

[RS-422 serial line using five wires and RJ45 connector, page 51](#)

[RS-232 serial line used for DGNSS input, page 52](#)

[RS-422 serial line used for DGNSS input, page 53](#)

[Clock synchronisation \(1PPS\) using a coax cable, page 54](#)

[Remote control, page 55](#)

[Remote Control using K-Rem, page 56](#)

[Dummy plug for not using remote control, page 57](#)

[External synchronisation, page 58](#)

[Transducer cable, page 59](#)

[Transducer cable for Portable Processing Unit, page 61](#)

[Seapath antenna interface cable - with plug, page 63](#)

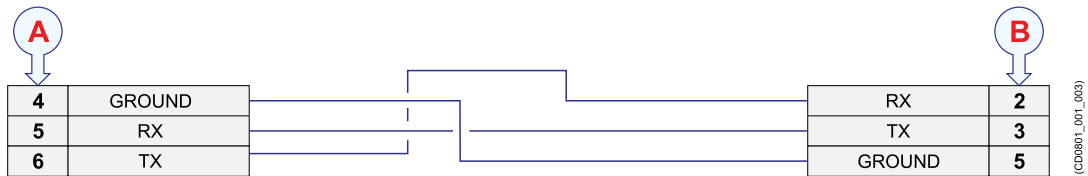
[Antenna interface cable, page 65](#)

[Seapath MRU interface cable, page 66](#)

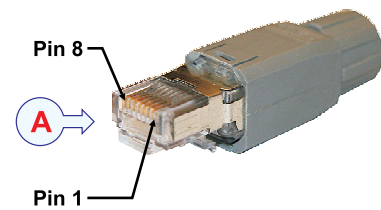
[DC Power cable, page 67](#)

RS-232 serial line using three wires and RJ45 connector

An RS-232 serial line connection using three (3) wires is a common way to connect the EM 2040P to external devices.



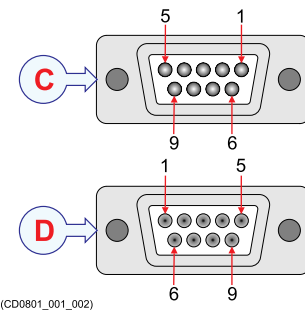
- A** *Local connection*
RJ45 connector
- B** *Connection on remote device*
- C** *Female 9-pin D-connector*
- D** *Male 9-pin D-connector*



Unless otherwise specified, this cable must be provided by the installation shipyard. Note that this cable does not support all the signals in the standard RS-232 specification.

Minimum cable requirements

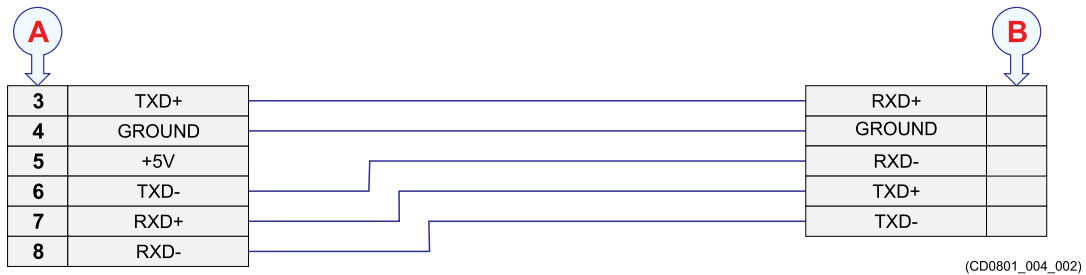
- **Conductors:** 2 x 2 x 0.2 mm²
- **Screen:** Overall braided
- **Voltage:** 30 V
- **Maximum outer diameter:** Defined by the plugs and/or the cable gland



We recommend using a shielded CAT-6A quality or better cable.

RS-422 serial line using five wires and RJ45 connector

An RS-422 serial line connection is a common way to connect the EM 2040P to external devices. An RS-422 serial line connection can transmit data at rates as high as 10 million bits per second, and may be sent on cables as long as 1500 meters.

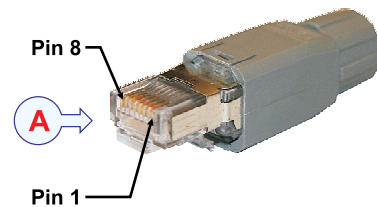


A *Local connection*

RJ45 connector

B *Connection on remote device*

Unless otherwise specified, this cable must be provided by the installation shipyard.



(CD0804_001_004)

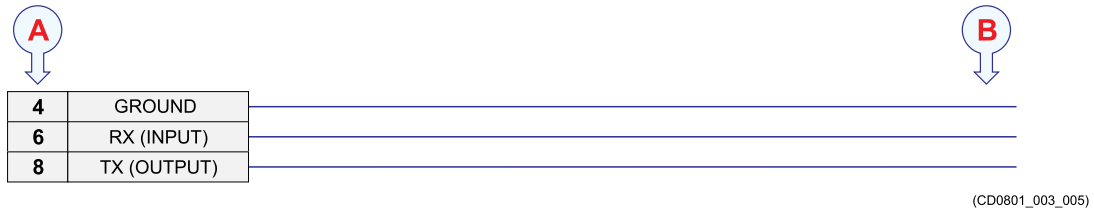
Minimum cable requirements

- **Conductors:** 2 x 3 x 0.2 mm²
- **Screen:** Overall braided
- **Voltage:** 30 V
- **Maximum outer diameter:** Defined by the plugs and/or the cable gland

We recommend using a shielded CAT-6A quality or better cable.

RS-232 serial line used for DGNSS input

The EM 2040P Portable Processing Unit has a dedicated interface for GNSS correction using RS-422 or RS-232 serial communication.

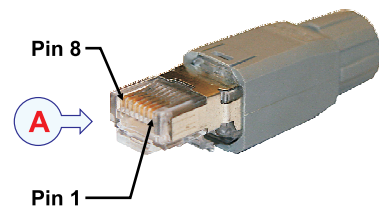


A *Local connection*

RJ45 connector

B *Connection on remote device*

Unless otherwise specified, this cable must be provided by the installation shipyard.



(CD0804_001_004)

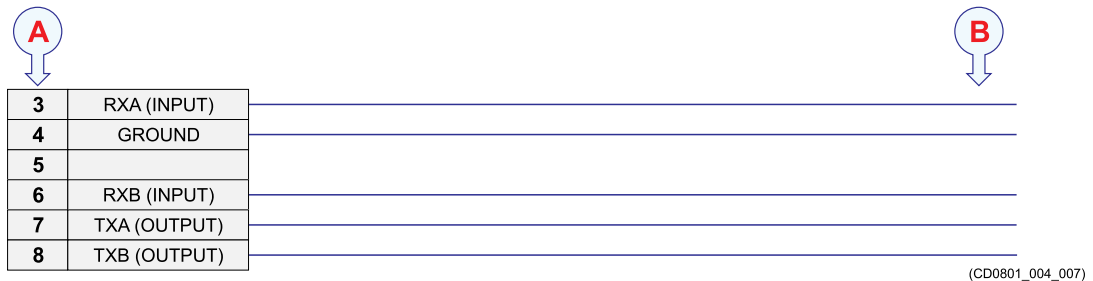
Minimum cable requirements

- **Conductors:** 2 x 3 x 0.2 mm²
- **Screen:** Overall braided
- **Voltage:** 30 V
- **Maximum outer diameter:** Defined by the plugs and/or the cable gland

We recommend using a shielded CAT-6A quality or better cable.

RS-422 serial line used for DGNSS input

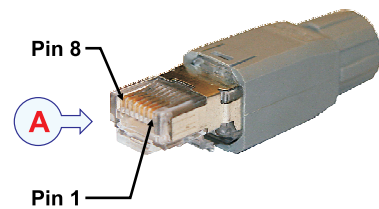
The EM 2040P Portable Processing Unit has a dedicated interface for GNSS correction using RS-422 or RS-232 serial communication.



A *Local connection*
RJ45 connector

B *Connection on remote device*

Unless otherwise specified, this cable must be provided by the installation shipyard.



Minimum cable requirements

- **Conductors:** 2 x 3 x 0.2 mm²
- **Screen:** Overall braided
- **Voltage:** 30 V
- **Maximum outer diameter:** Defined by the plugs and/or the cable gland

We recommend using a shielded CAT-6A quality or better cable.

(CD0804_001_004)

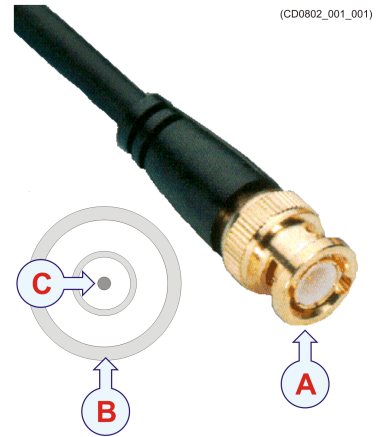
Clock synchronisation (1PPS) using a coax cable

The Processing Unit is equipped with a 1PPS signal input for clock synchronisation.

- A *Male BNC connector*
- B *Ground*
- C *1PPS signal*

This cable must be provided by the installation shipyard.

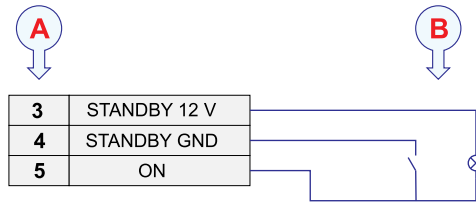
The 1PPS (one pulse per second) signal is normally provided by a positioning system.



Remote control

The Processing Unit can be switched on/off with a remote switch. This switch is connected to a 9-pin D-connector on the Processing Unit.

- A** Local connection, male 9-pin D-connector
- B** Connection to remote lamp and on/off switch
- C** Female 9-pin D-connector
- D** Male 9-pin D-connector

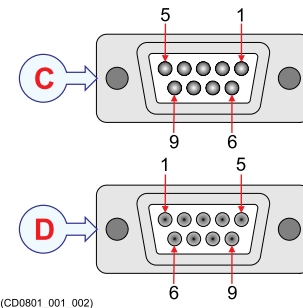


(CD0806_701_010)

Minimum cable requirements

- **Conductors:** 3 x 0.5 mm²
- **Screen:** Overall braided
- **Voltage:** 60 V
- **Maximum outer diameter:** Defined by the plugs and/or the cable gland

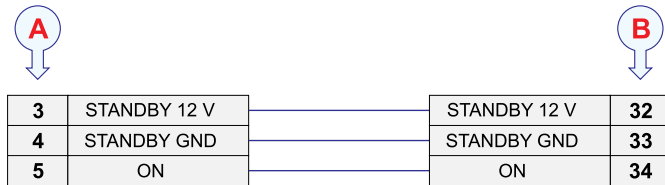
This cable must be provided by the installation shipyard.



(CD0801_001_002)

Remote Control using K-Rem

The Processing Unit can be switched on/off with a remote switch. This switch is connected to a 9-pin D-connector on the Processing Unit. A dedicated junction box with on/off switches and light indication has been designed for this purpose (K-Rem).



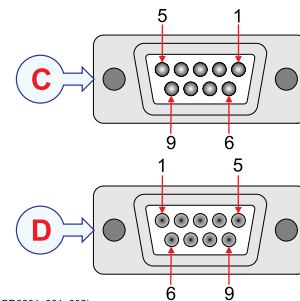
(CD0806_701_011)

- A** Local connection, male 9-pin D-connector
- B** Connection at the terminal strip in Remote Control Unit (K-Rem)
- C** Female 9-pin D-connector
- D** Male 9-pin D-connector

Minimum cable requirements

- **Conductors:** 3 x 0.5 mm²
- **Screen:** Overall braided
- **Voltage:** 60 V
- **Maximum outer diameter:** Defined by the plugs and/or the cable gland

This cable must be provided by the installation shipyard.



(CD0801_001_002)

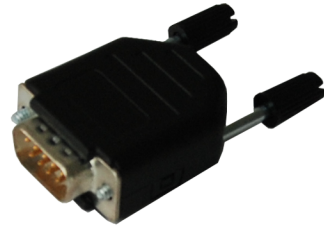
Dummy plug for not using remote control

The Processing Unit can be switched on/off with a remote switch. If remote control is not used, the enclosed remote control dummy plug has to be inserted in the **Remote Control** connector in the Processing Unit.



Note

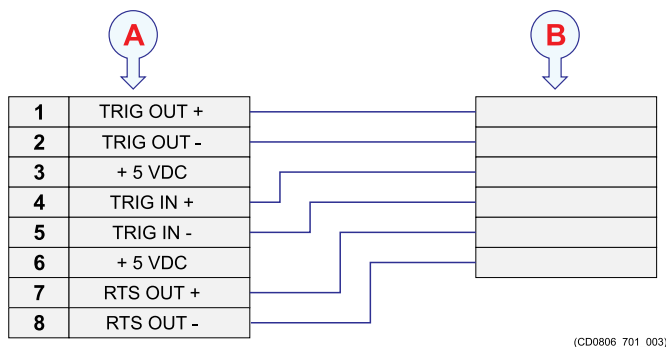
*If remote control is not used, the enclosed remote control dummy plug has to be inserted in the **Remote Control** connector in the Processing Unit. The Processing Unit will not work without this dummy plug.*



External synchronisation

The Processing Unit (PU) is equipped with a connection for interface to an external synchronisation system.

This connection is used for interface to an external synchronisation system (for example K-Sync) used when multiple echo sounders are employed on the same vessel. The external synchronisation connector is located on the CBMF board of the processing unit. The connector is RJ45 type.



A *Local connection* The connector is RJ45 type.

Note _____

Pin 3 and 6 is used by Kongsberg Maritime only.

B *Connection on remote device*

Unless otherwise specified, this cable must be provided by the installation shipyard.

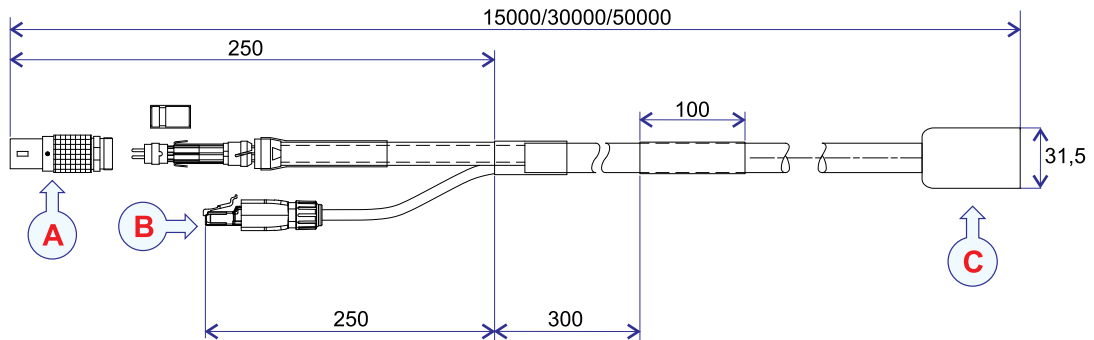
Minimum cable requirements

- **Conductors:** 2 x 3 x 0.2 mm²
- **Screen:** Overall braided
- **Voltage:** 30 V
- **Maximum outer diameter:** Defined by the plugs and/or the cable gland

We recommend using a shielded CAT-6A quality or better cable.

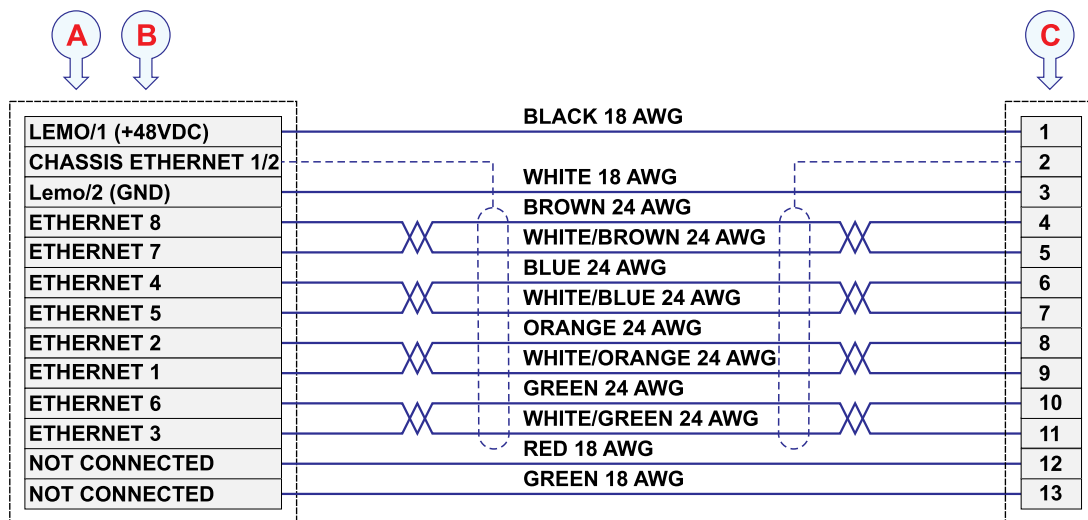
Transducer cable

The sonar head is connected to the Processing Unit with a special cable. The sonar head cable is part of the sonar head delivery.



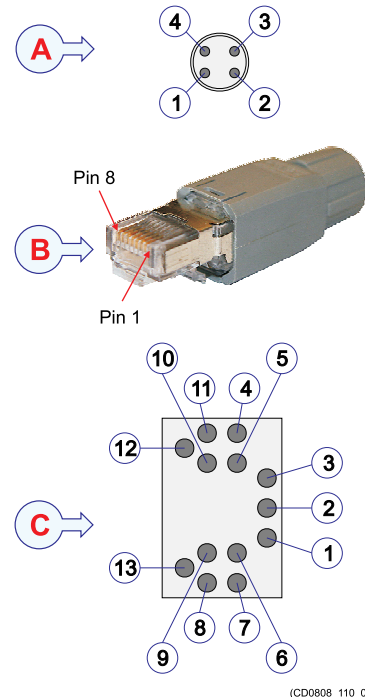
All measurements in mm.
The drawing is not in scale.

(CD0808_110_002)



(CD0808_110_001)

- A *LEMO Connector for power in Processing Unit end. Solder side view.*
- B *RJ45 connector for signal in Processing Unit end.*
- C *Underwater connector type SubConn® DLPIL13F in transducer end. Face view.*



Cable specifications

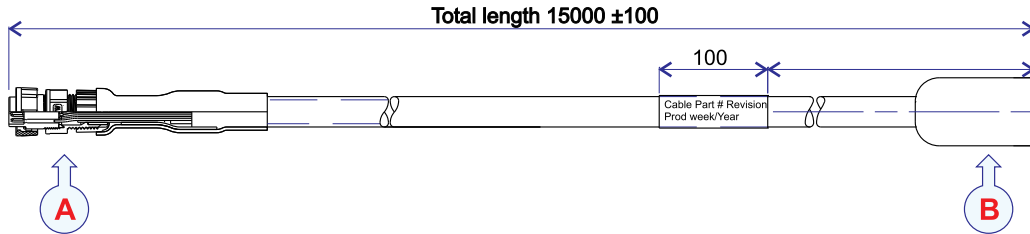
- Cable length: 15, 30 or 50 meters
- Maximum outer diameter: 13.97 mm nom.
- Minimum bending radius: 130 mm
- Conductors: 4 twisted pairs (Ethernet), 4 power conductors and 1 screen
- SubConn® Power/Ethernet Cable, Type D/P-P4TP24#/4C18#
- Connector width: 31.5 mm (transducer end)
- Weight in air: 246 kg/km nom.
- Weight in sea water: 90 kg/km nom.
- Depth rating: 6000 metres
- Screen: Overall braided
- Voltage:
 - Power conductor: 600V, max. 4 A
 - Twisted pairs: 250V, max. 1 A

Important

Sacrificial anodes must be mounted near the sonar head to protect the connectors. Inspect the anodes regularly, and replace them if needed.

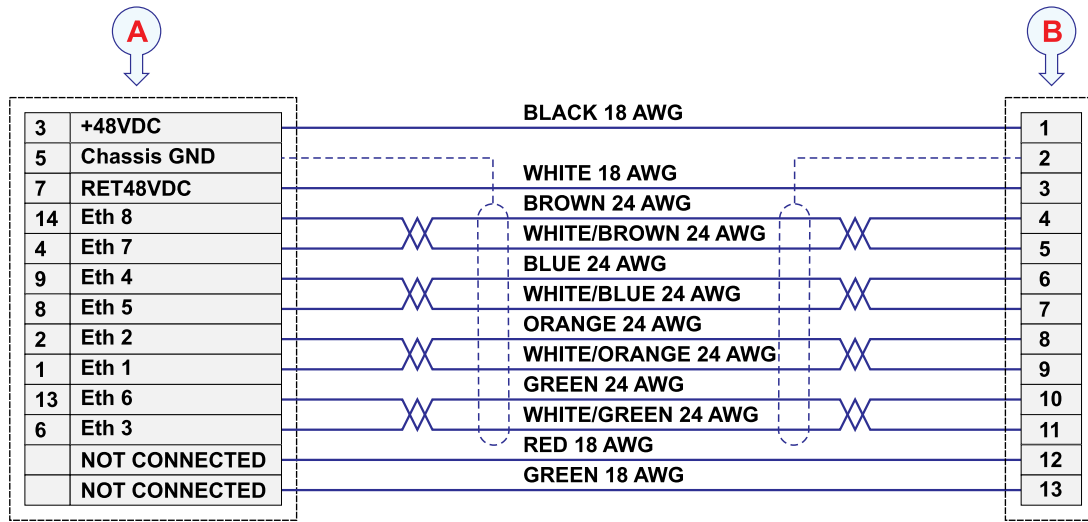
Transducer cable for Portable Processing Unit

The sonar head is connected to the Processing Unit with a special cable. The sonar head cable is part of the sonar head delivery.



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

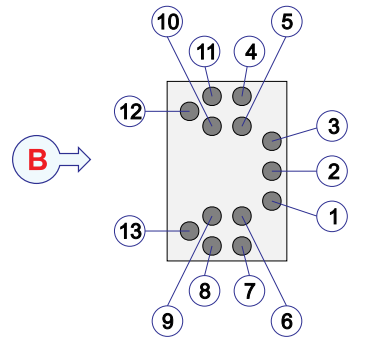
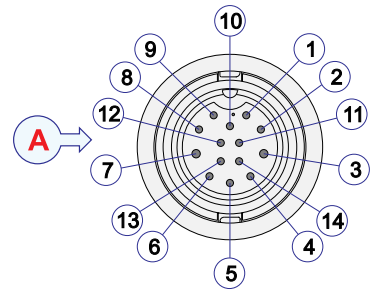
(CD0808_111_002)



(CD0808_111_001)

A *Ampehnol connector in Processing Unit end.
LTW, CDU-14BFMA-LL7001. Face view*

B *Underwater connector type SubConn® DLPIL13F
in transducer end. Face view.*



(CD0808_111_003)

Cable specifications

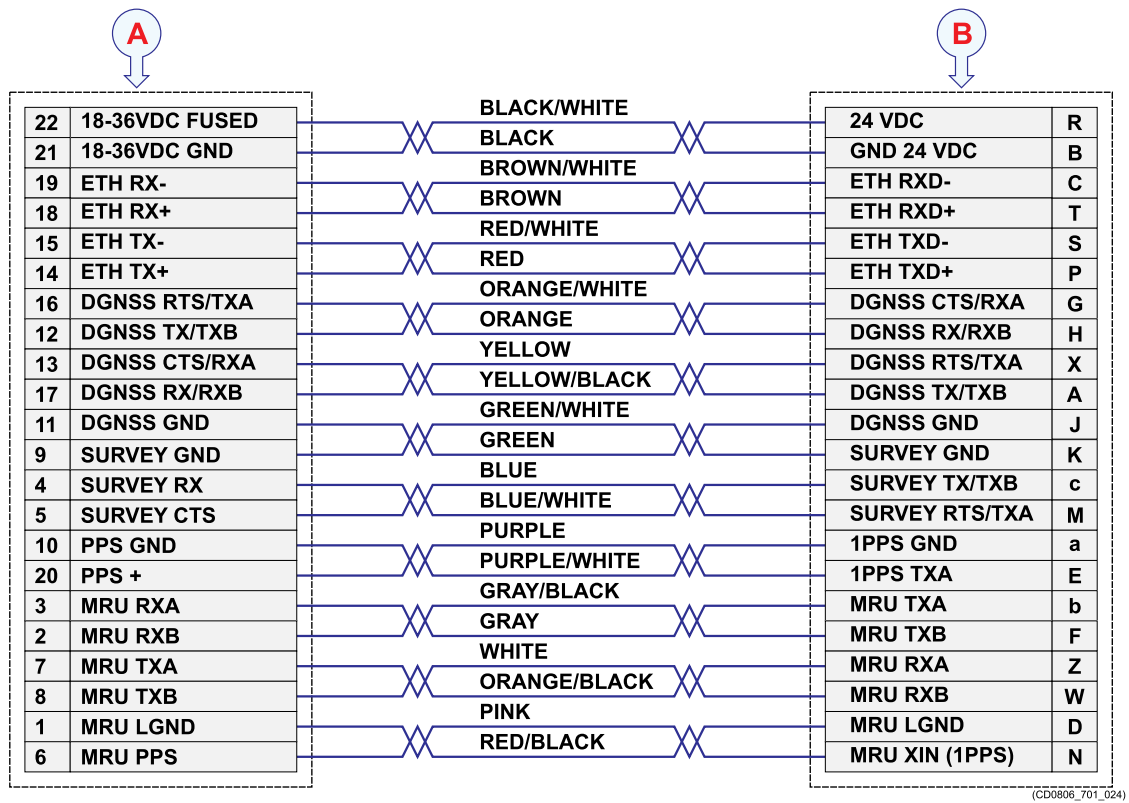
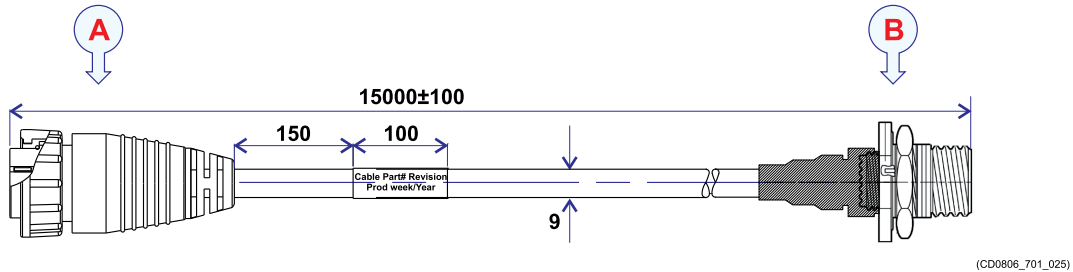
- Cable length: 15, 30 or 50 meters
- Maximum outer diameter: 13.97 mm nom.
- Minimum bending radius: 130 mm
- Conductors: 4 twisted pairs (Ethernet), 2 power conductors and 1 screen
- SubConn® Power/Ethernet Cable, Type D/P-P4TP24#/4C18#
- Connector width: 31.5 mm (transducer end)
- Weight in air: 246 kg/km nom.
- Weight in sea water: 90 kg/km nom.
- Depth rating: 6000 metres
- Screen: Overall braided
- Voltage:
 - Power conductor: 600V, max. 4 A
 - Twisted pairs: 250V, max. 1 A

Important

Sacrificial anodes must be mounted near the sonar head to protect the connectors. Inspect the anodes regularly, and replace them if needed.

Seapath antenna interface cable - with plug

The Portable Processing Unit can be connected to a Seapath 130 antenna with a dedicated cable. The cable is delivered with the Seapath 130 unit.



A Local connection

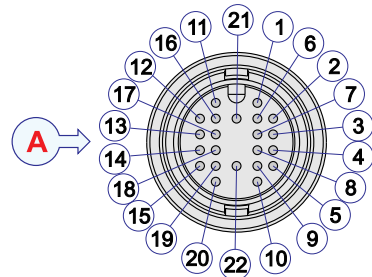
Amphenol LTW DU-22BFFA-SL7000

B Connection to Seapath 130 antenna

JVS07A1726SN

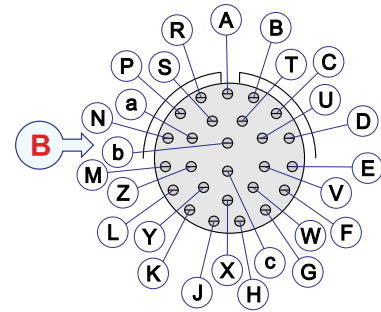
The DGNSS signal can be configured to be either RS-232 or RS-422.

Relation between RS-232 and RS-422 pins



(CD090503_020_001)

- **RS-232/RS-422**
- CTS/RXA
- RX/RXB
- GND/GND
- RTS/TXA
- TX/TXB

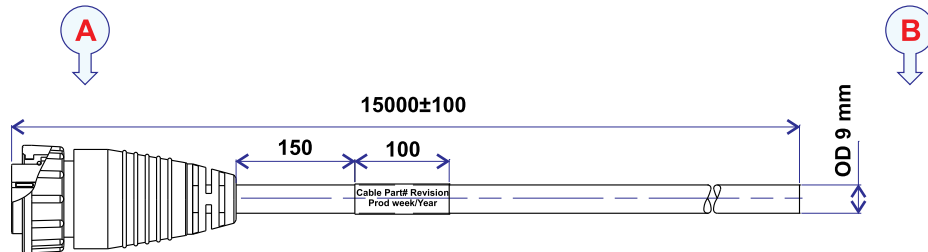


Cable specifications

- Cable length: 15 m
- Maximum outer diameter: 9 mm
- Minimum bending radius: 10 x diameter
- Conductors: 11 twisted pairs, 26 AWG
- Provided by Amphenol with soldered connector
UL2464 26AWG * 11 Pairs+Drain+AL.Mylar PVC Jacket UV Resistant
- 22pin 2 ethernet TPs, 2 power conductors, 12 serial com leads (4xRS422), 4 1PPS leads and 1 screen
- +Drain+AP.Mylar PVC Jacket UV Resistant
- Screen: Aluminium Mylar
- Voltage: 300V
- Temperature: 80 °C

Antenna interface cable

The Portable Processing Unit can be connected to a Seapath antenna with a dedicated cable. The cable is delivered with the Portable Processing Unit.



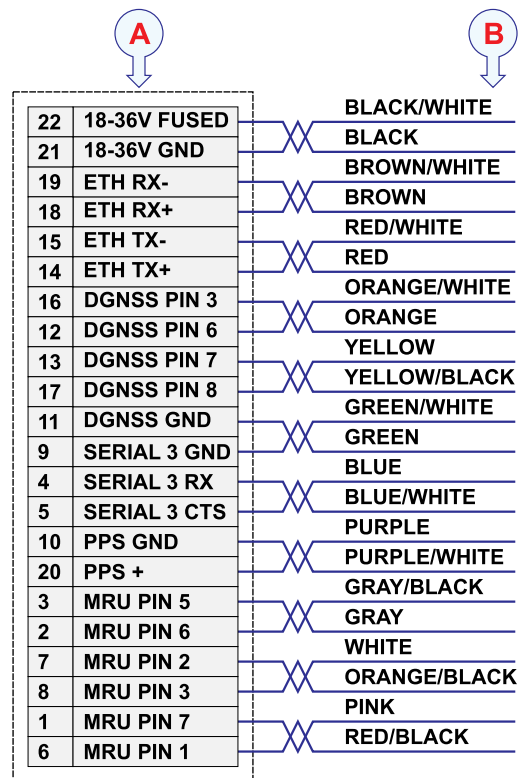
(CD0806_701_021)

A Local connection, Amphenol LTW
DU-22BFFA-SL7000

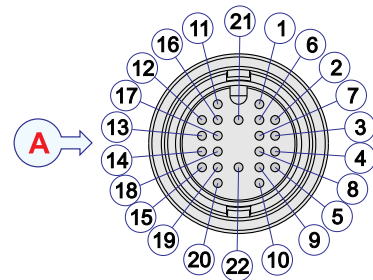
B Connection Seapath antenna

Cable specifications

- Cable length: 15 m
- Maximum outer diameter: 9 mm
- Minimum bending radius: 10 x diameter
- Conductors: 11 twisted pairs, 26 AWG
- Provided by Amphenol with soldered connector
- UL2464 26AWG * 11
Pairs+Drain+AL.Mylar PVC Jacket UV Resistant
- 22pin 2 ethernet TPs, 2 power conductors, 12 serial com leads (4xRS422), 4 1PPS leads and 1 screen
- +Drain+AP.Mylar PVC Jacket UV Resistant
- Screen: Aluminium Mylar
- Voltage: 300 V
- Temperature: 80 °C



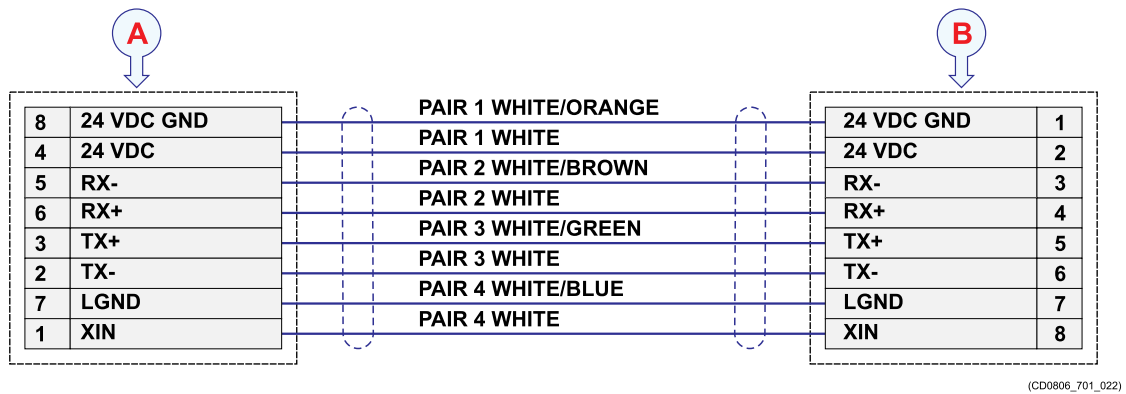
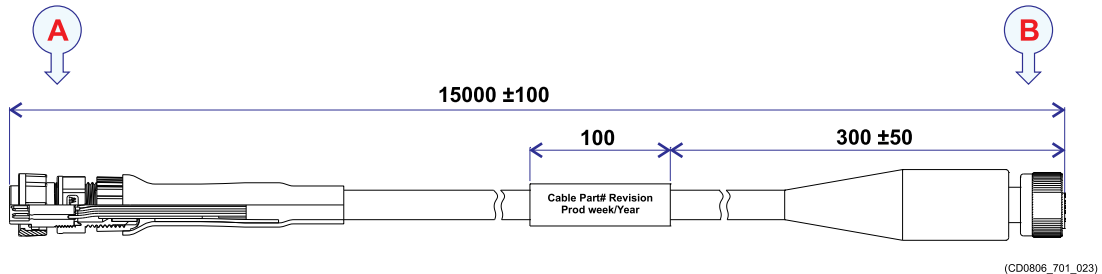
(CD0806_701_020)



(CD090503_020_001)

Seapath MRU interface cable

The Portable Processing Unit can be connected to a Seapath Motion Reference Unit with a dedicated cable. The cable is delivered with the Seapath 130 system.



A Local connection

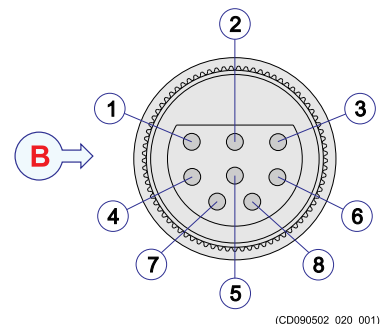
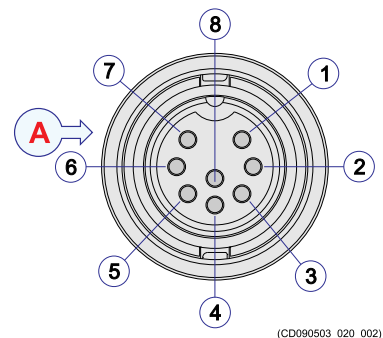
Amphenol LTW CD-08BFMA-LL7001

B Connection Seapath MRU

SEACON 5501-1508

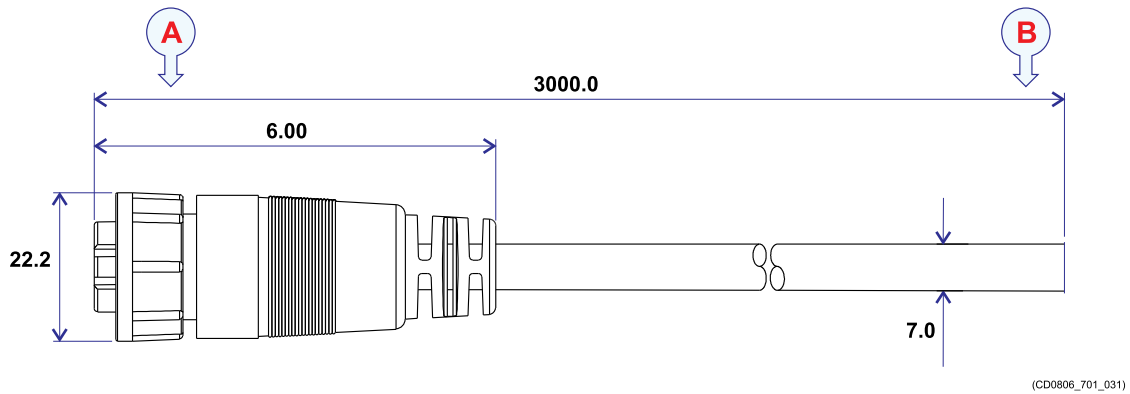
Cable specifications

- Cable length: 15 m
- Maximum outer diameter: 12.6 mm
- Minimum bending radius: 10 x diameter
- Conductors: 4 pairs, 23 AWG



DC Power cable

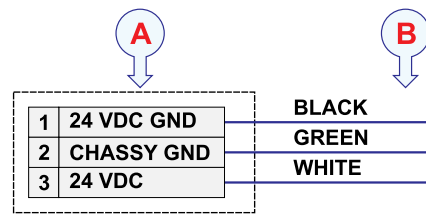
This cable is used to connect the Portable Processing Unit to DC power supply. The cable is delivered with the Portable Processing Unit.



A Local connection

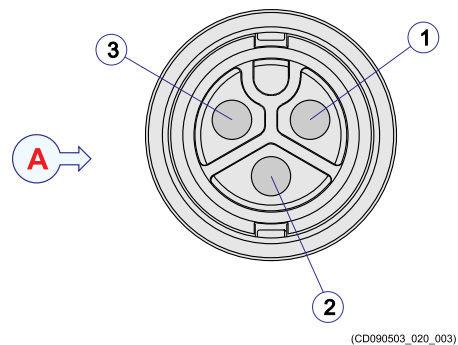
Amphenol LTW PWC-03AFFM-LL7A03

B Remote connection



Cable specifications

- Cable length: 3 m
- Maximum outer diameter: 7 mm
- Minimum bending radius: 10 x diameter
- Conductors: 3, 14 AWG
- Provided by Amphenol with soldered connector UL2464 14AWG * 3 Conductors + Talcum, Black, PVC Jacket
- Voltage: 36V max, 20A



Drawing file

Topics

[Sonar head dimensions, page 69](#)

[Transducer mounting bracket, page 70](#)

[385422 Processing Unit dimensions, page 71](#)

[424178 Portable Processing Unit dimensions, page 72](#)

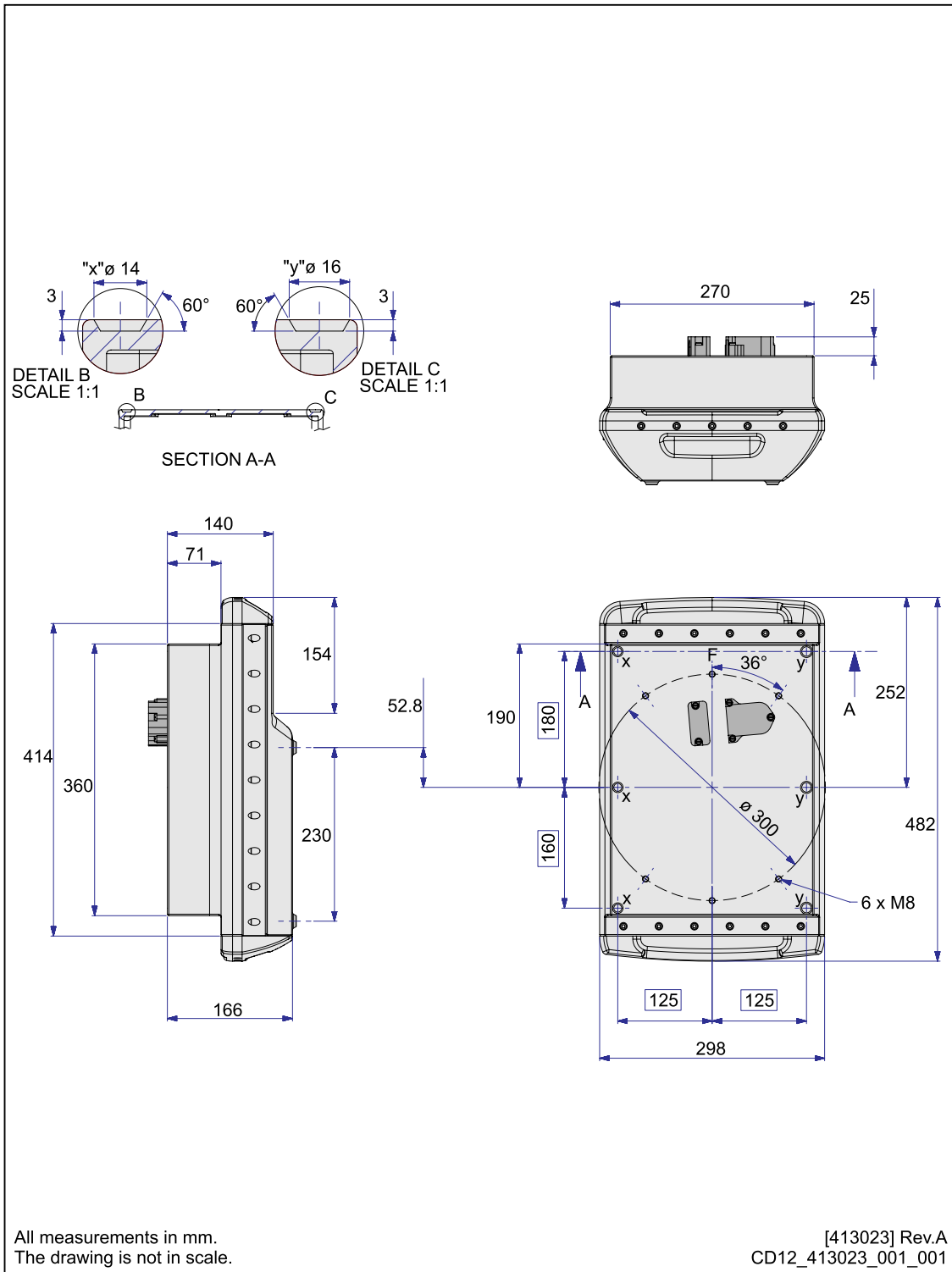
[378828 Hydrographic Work Station dimensions, page 73](#)

[370275 Remote Control Unit \(K-REM\) dimensions, page 75](#)

[373962 Remote Control Unit \(K-REM\) wiring diagram, page 77](#)

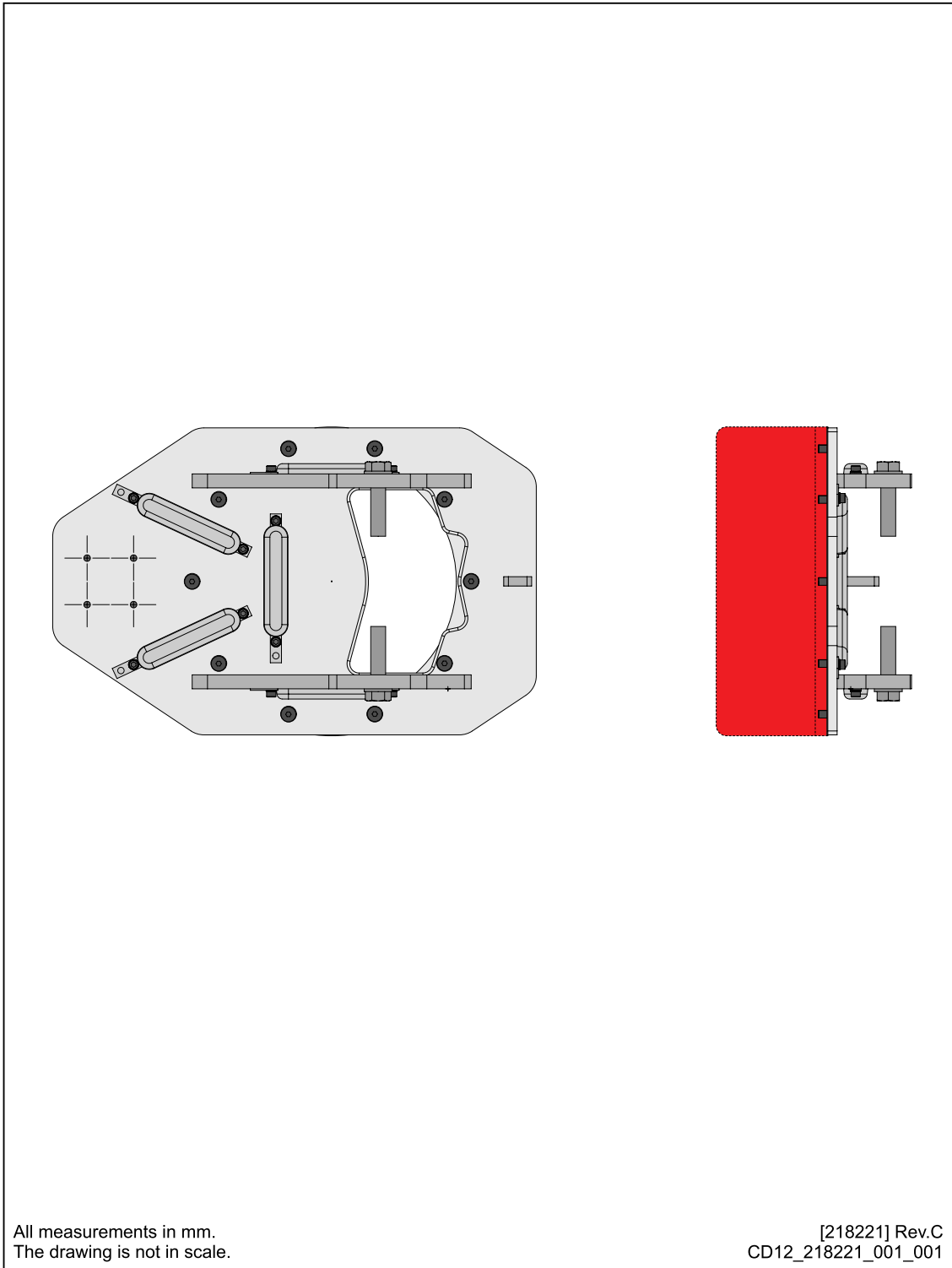
Sonar head dimensions

Drawing 413023

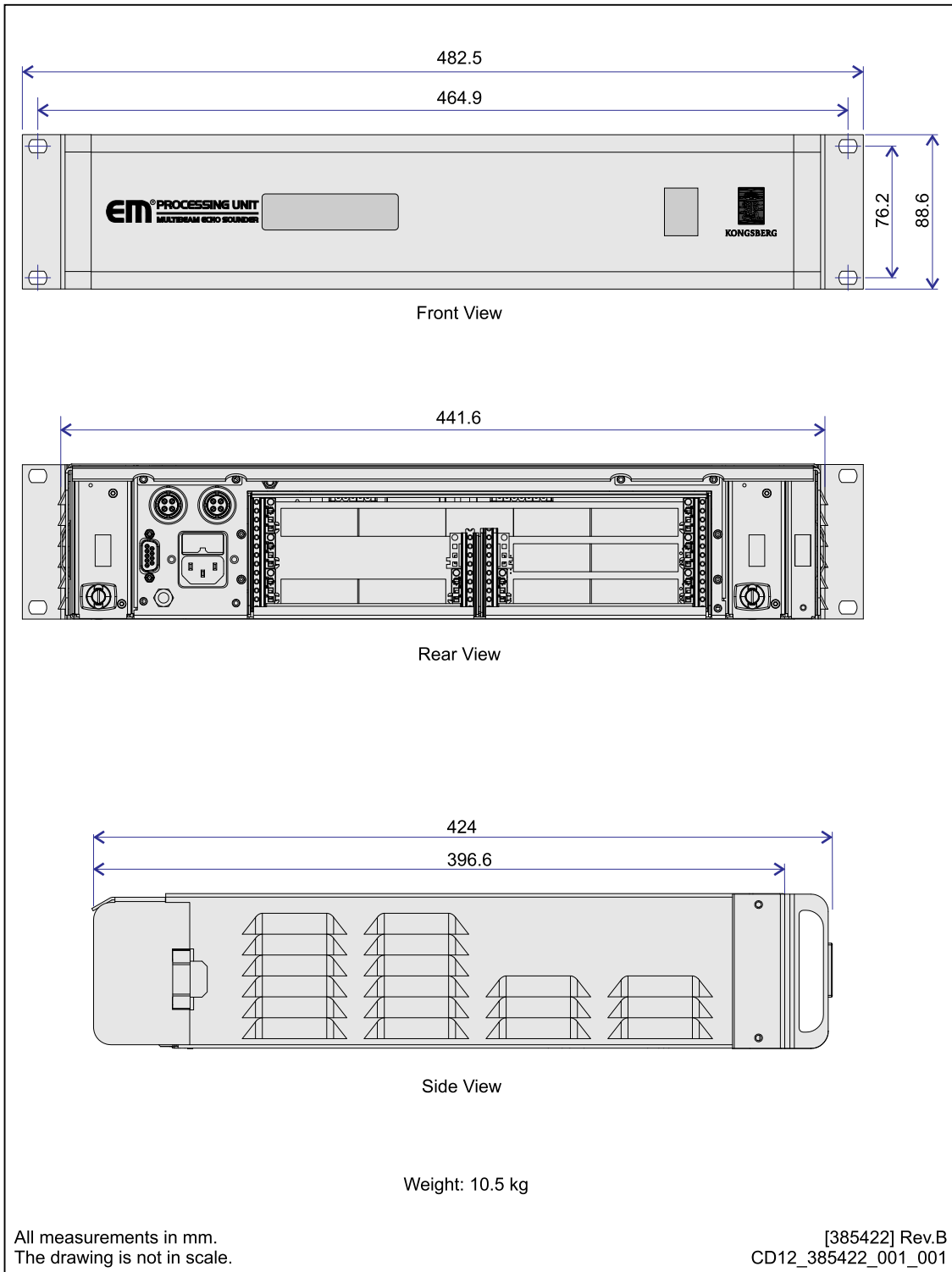


Transducer mounting bracket

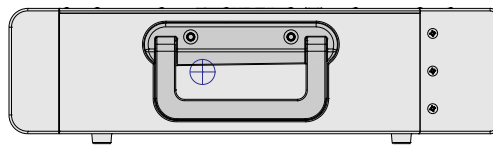
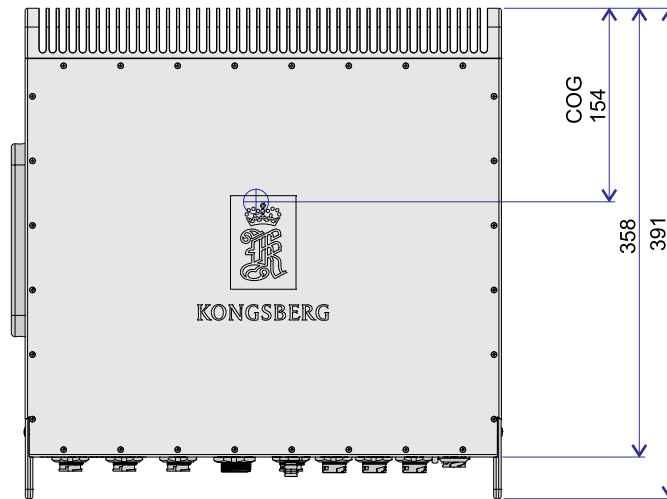
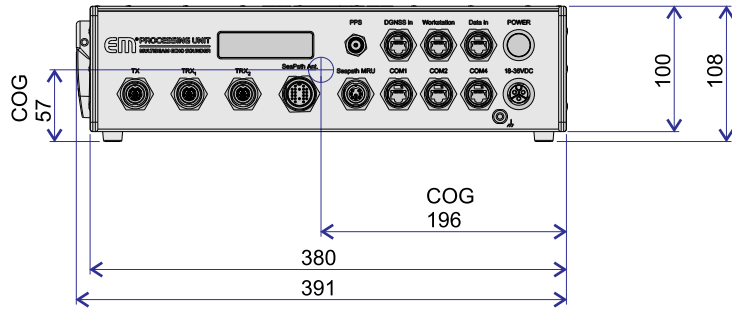
Drawing 499-218221



385422 Processing Unit dimensions



424178 Portable Processing Unit dimensions

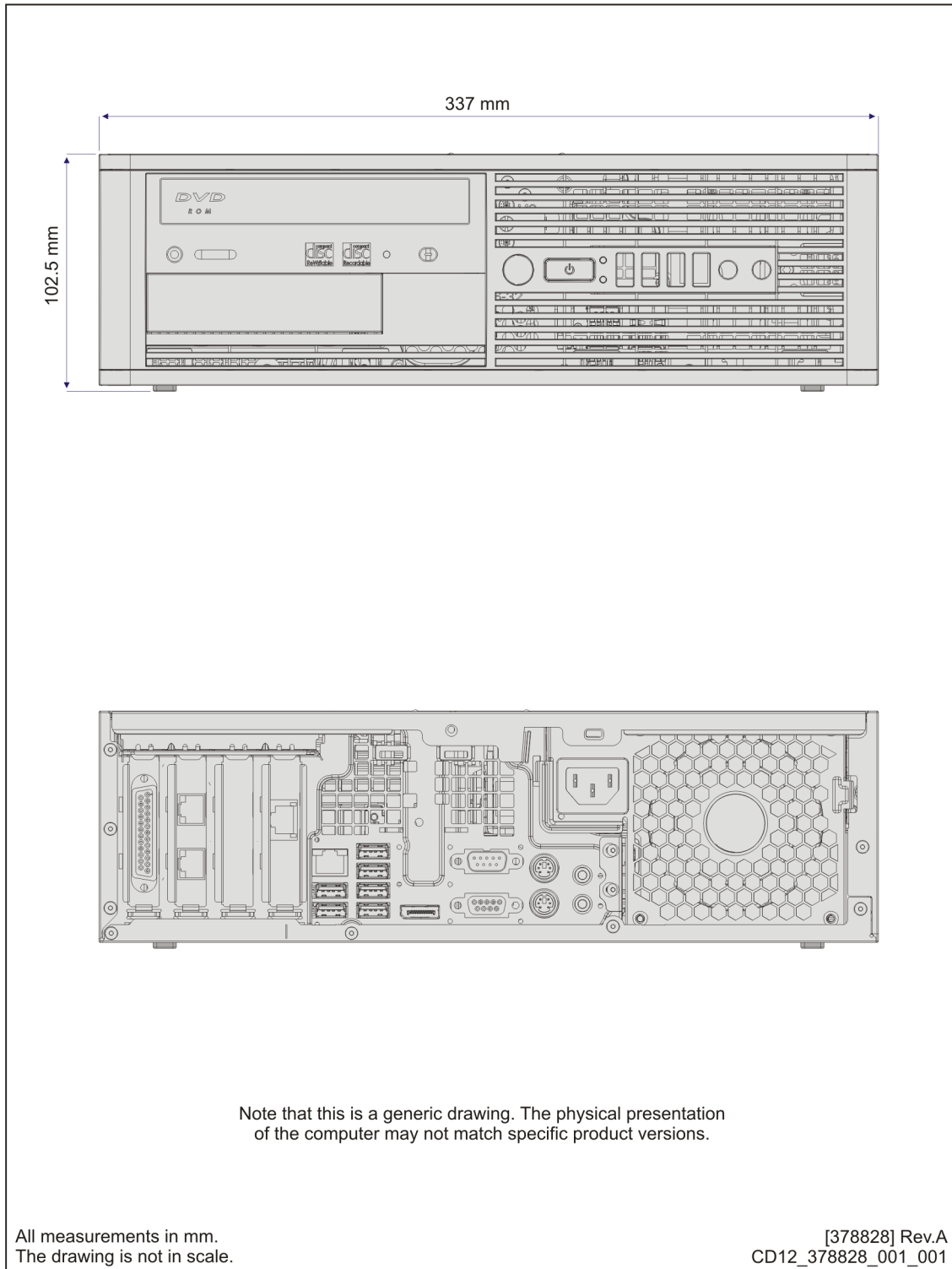


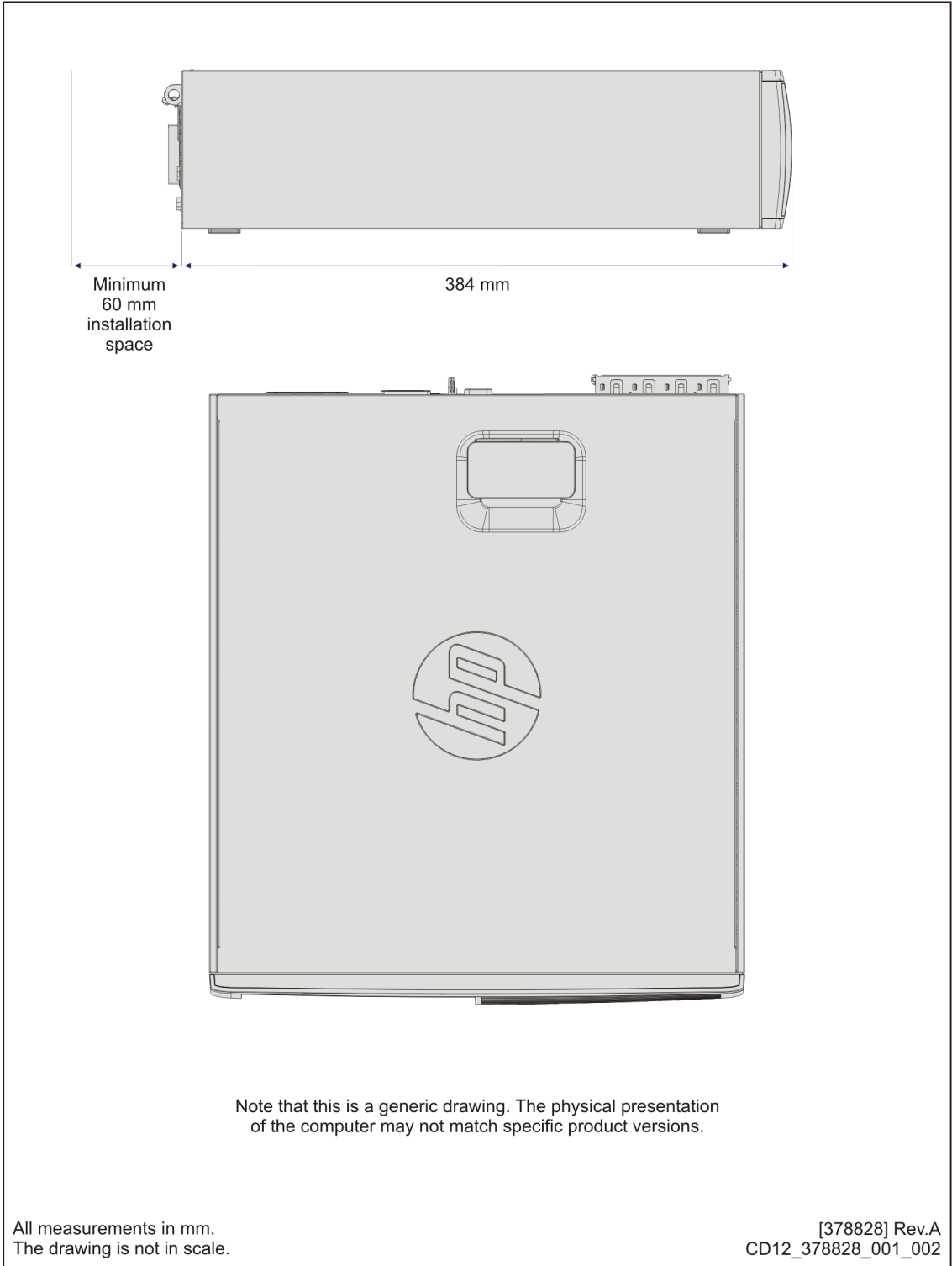
Weight: approximately 11 kg

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

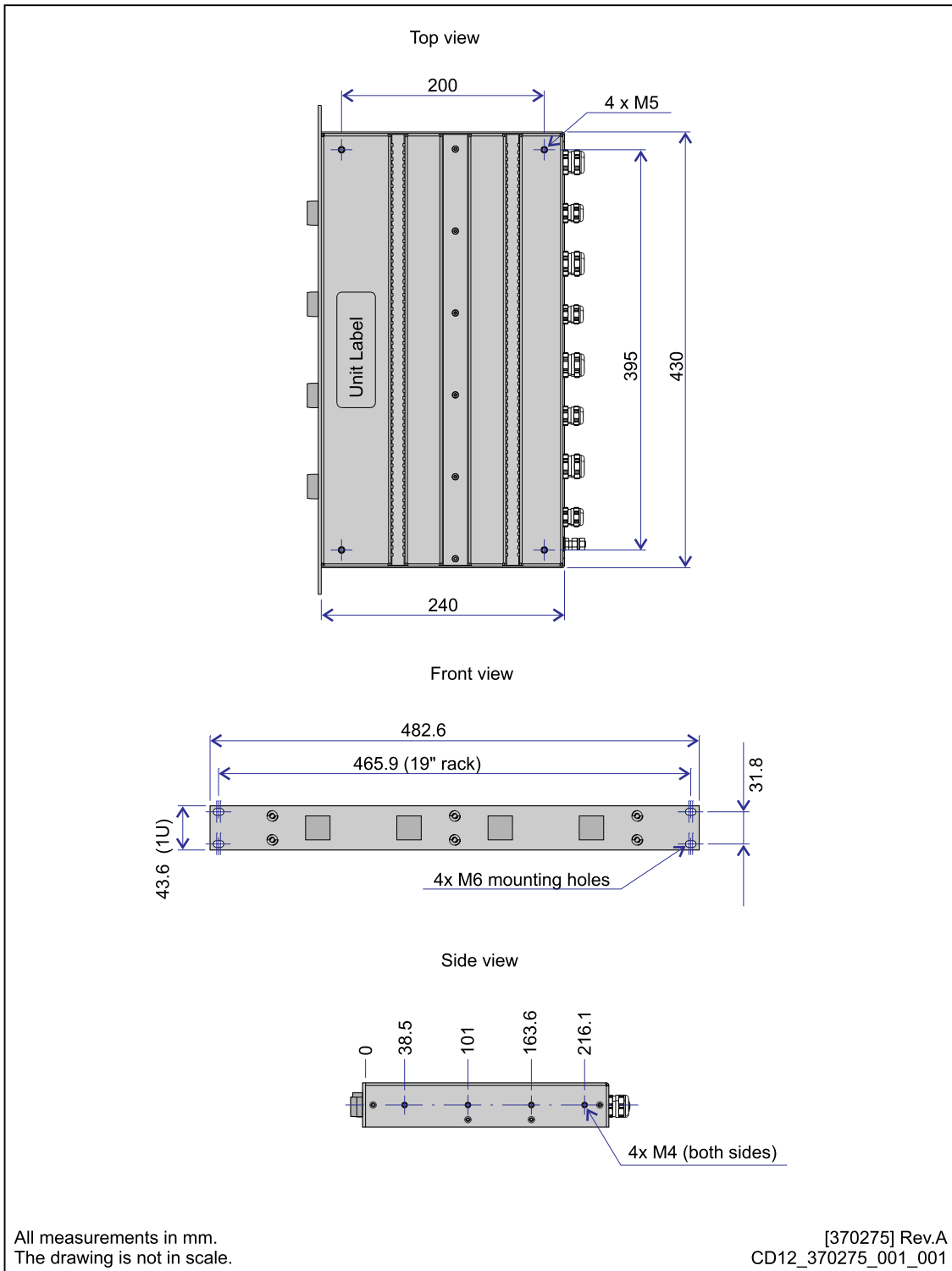
[424178] Rev.A
CD12_424178_001_001

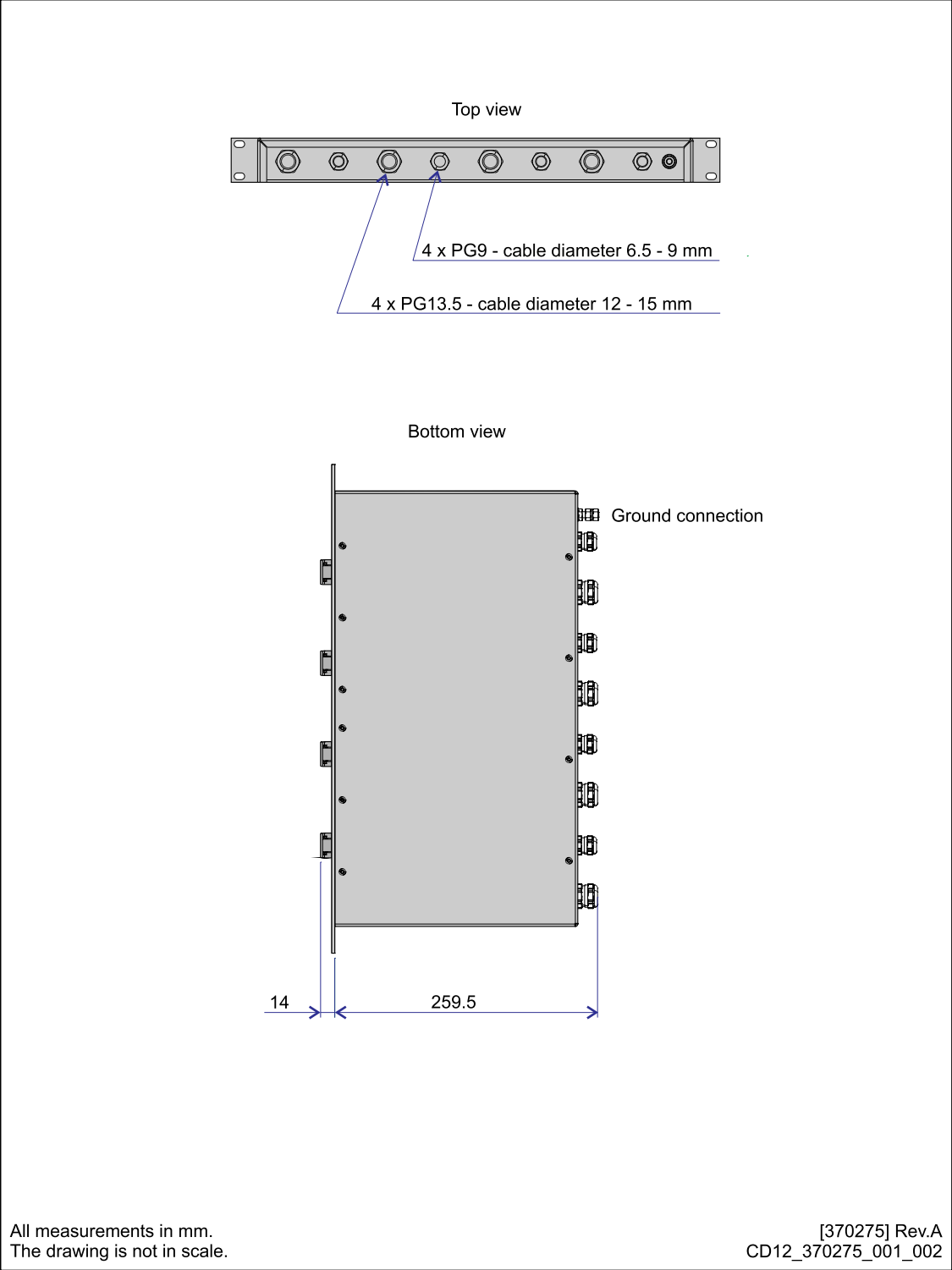
378828 Hydrographic Work Station dimensions



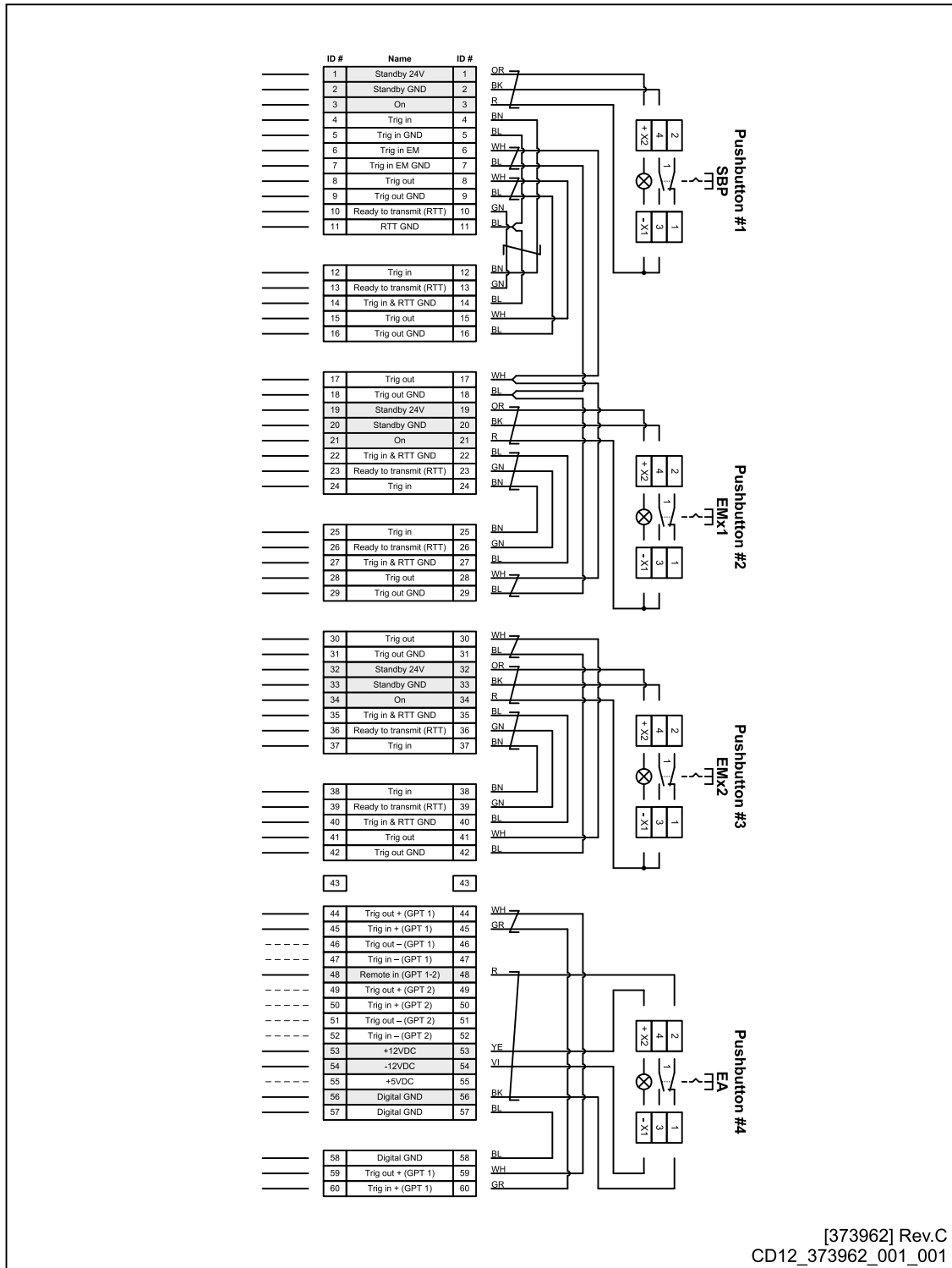


370275 Remote Control Unit (K-REM) dimensions





373962 Remote Control Unit (K-REM) wiring diagram



[373962] Rev.C
CD12_373962_001_001

Technical specifications

Topics

[Performance specifications, page 79](#)

[Interface specifications, page 80](#)

[Weights and outline dimensions, page 84](#)

[Power requirements, page 85](#)

[Environmental requirements, page 87](#)

[Alignment specifications, page 88](#)

Performance specifications

These performance specifications summarize the main functional and operational characteristics of the EM 2040P system.

- **Frequency range:** 200 to 400 kHz
- **Selectable frequencies:** 200, 300 and 400 kHz operating mode
- **Detected depth (Maximum):** Limited to 600 m relative to the surface
- **Detected depth (Minimum):** 0.5 m relative to transducer face
- **Ping rate (Maximum):** 50 Hz
- **Number of soundings per ping:** Up to 800 (400 per swath)
- **Swath coverage sector:**
 - **200 kHz:** Up to 140 degrees (± 70), 5.5 times water depth on a flat bottom
 - **300 kHz:** Up to 140 degrees (± 70), 5.5 times water depth on a flat bottom
 - **400 kHz:** Up to 120 degrees (± 60), 3.5 times water depth on a flat bottom
- **Depth and coverage (Maximum):**

Cold ocean water, bottom type rock (BS = - 10 dB), NL = 45 dB, FM mode

Operating mode	Max depth	Max coverage across
200 kHz	600 m	830 m
300 kHz	450 m	610 m
400 kHz	270 m	360 m

- **Beamwidth (Tx x Rx):**
 - **200 kHz:** 2 x 2 degrees
 - **300 kHz:** 1.3 x 1.3 degrees
 - **400 kHz:** 1 x 1 degree
- **TX Source level @ 300 kHz:** Up to 209 dB re 1 μ Pa at 1 m
- **Receive beam spacing:**
 - Equiangular
 - Equidistant
 - High density equidistant
- **Transmit beam steering, along:** Stabilised for pitch and yaw (± 10 degrees)

The transmit fans may be electronically stabilised for pitch and yaw movements in order to always point vertically. Pitch, yaw, heave and the applied stabilisation are fully taken into account when calculating sounding depths and positions.

- **Receive beam steering, across:** Stabilised for roll (± 15 degrees)
The receive beams are electronically stabilised for roll. In the near field the receive beams are dynamically focused to maintain angular resolution even at very short ranges.
- **Range resolution (defined as $cT_{\text{eff}}/2$):** 10.5 mm at 14 μs pulse
- **Output sampling rate:** Up to 58.8 kHz (12.8 mm)
- **Pulse length, CW:**
 - **Pulse shading:** Hanning
 - **Total pulse length:** 37 to 865 μs
 - **Nominal pulse length:** 25 to 600 μs
 - **Effective pulse length:** 14 to 324 μs (BS footprint)
- **Pulse length, FM:**
 - **Total pulse length:** Up to 12 ms
- **Effective pulse length:**

	200 kHz mode		300 kHz mode		400 kHz mode	
	CW	FM	CW	FM	CW	FM
Normal mode	38, 108 and 324 μs	3 and 12 ms	38, 108 and 324 μs	2 and 6 ms	27, 54 and 108 μs	N/A
Single sector mode	19, 38 and 81 μs	1.5 ms	19, 38 and 81 μs	1.5 ms	14, 27 and 54 μs	N/A

Interface specifications

The EM 2040P system will interface with peripheral systems and sensors using standard and/or proprietary datagram formats.

Processing Unit

Supported datagram formats for position information

The EM 2040P supports the following datagram format for position information.

These datagram formats are received using a serial communication line.

- **PTNL G GK**

This third party datagram format is used to transfer latitude and longitude of vessel position, time of position fix and status from a global positioning system (GPS).

- **NMEA GGA**

The NMEA GGA datagram transfers the time, position and fix related data from a global positioning system (GPS).

- **Simrad 90**

The Simrad 90 datagram is a proprietary format created by Kongsberg Maritime to interface position sensors.

Supported datagram formats for external clock

The EM 2040P supports the following datagram format from an external clock.

This datagram format is received using a serial communication line.

- **NMEA ZDA**

The NMEA ZDA datagram contains the universal time code (UTC), day, month, year and local time zone.

Supported datagram formats for heading information

The EM 2040P supports the following datagram formats for vessel heading and/or gyro information.

These datagram formats are received using a serial communication line.

- **NMEA HDT**

The NMEA HDT datagram provides the true vessel heading. The information is normally provided by a course gyro.

- **SKR82 Heading**

This is a third-party proprietary datagram format for heading. It was created by Simrad Yachting (<https://www.simrad-yachting.com>) for use with their Simrad Robertson SKR80(82) gyrocompass.

Supported datagram formats for depth information

The EM 2040P supports the following datagram formats for depth information from an echo sounder.

These datagram formats are received using a serial communication line.

- **NMEA DBS**

The NMEA DBS datagram provides the current depth from the surface. The datagram is no longer recommended for use in new designs. It is frequently replaced by the NMEA DPT datagram.

- **NMEA DPT**

The NMEA DPT datagram provides the water depth relative to the transducer, and the offset of the measuring transducer.

- **Simrad EK500 Depth**

Simrad EK500 Depth is a proprietary datagram format created by Kongsberg Maritime. It was originally defined for the Simrad EK500 scientific echo sounder. It provides the current depth from three channels, as well as the bottom surface backscattering strength and the athwartships bottom slope. This telegram has been designed for output on either a serial line or a local area network Ethernet connection.

Supported datagram formats for motion information

The EM 2040P supports the following datagram format from a motion sensor.

These datagram formats are received using a serial communication line.

- **Kongsberg EM Attitude 3000**

The EM Attitude 3000 is a proprietary datagram format created by Kongsberg Maritime for use with digital motion sensors. It holds roll, pitch, heave and heading information. The datagram contains a 10-bytes long message.

Supported datagram formats for motion information including velocity

The EM 2040P supports the following datagram formats from a motion sensor.

These datagram formats are received using an Ethernet (LAN) line.

- **Seapath Binary 11**

This is a proprietary format created by Kongsberg Seatex (<http://www.km.kongsberg.com/seatex>) for position, attitude and velocity data from the Seapath sensor.

- **Seatex Binary 23**

The Seatex Binary 23 is a proprietary datagram format created by Kongsberg Seatex (<http://www.km.kongsberg.com/seatex>) to provide position, motion and heading data from a Seapath sensor system.

- **Seapath Binary 26**

This is a proprietary format created by Kongsberg Seatex (<http://www.km.kongsberg.com/seatex>) for position, attitude and velocity data from the Seapath sensor.

- **POS-MV GRP 102/103**

This is a third party proprietary datagram format created by Applanix (<http://www.applanix.com>) for position, attitude and sound speed data.

- **Coda Octopus MCOM**

The Coda Octopus MCOM is a third party proprietary datagram format created by Oxford Technical Solutions Limited (<http://www.oxts.com>) for efficient communication of marine navigation measurements and other data. This format is used by Coda Octopus for transmitting position, attitude and sound speed data.

Special interfaces

- Trigger input/output for synchronisation
- 1 pulse per second (1PPS) clock synchronisation signal

Doppler shifts

All new generation of multibeam echo sounders from Kongsberg Maritime have an extended range performance by use of a frequency modulated transmitter pulse (FM), also called chirp pulse. In the FM mode, the Doppler shift made by the movements of the survey vessel relative to the bottom, causes a range error. This error must be corrected.

The following motion sensors have specifications that fullfills Kongsberg Maritime requirements for doppler shift corrections

- Kongsberg Maritime – Seapath series
- Applanix – Pos MV
- Coda Octopus – F180
- IXSEA – Phins

Velocity sensor accuracy requirements

- Velocity: 0.03 m/s RMS
- Roll, pitch and yaw rate: 0.03 deg/s RMS
- Latency: Maximum 5 ms
- Update rate: 100 Hz

Motion sensor accuracy requirements

The accuracy of the sensor data, as specified by the sensor manufacturer, must fulfill (preferably surpass) the following requirements

- **Roll:** 0.02 degrees RMS
 - An accuracy of 0.05 degrees RMS can be accepted unless you have very long pulse length and large beam angles.
- **Pitch:** 0.05 degrees RMS
- **Heading:** 0.2 degrees RMS
- **Heave:** 5 cm or 5% whichever is highest (real-time output)

Hydrographic Work Station

- Sound speed at transducer
- Printer/plotter
- Interface for input of sound speed profile (Ethernet or serial line)
- Tide input (Ethernet or serial line)
- Single beam echo sounder depths (Ethernet)
- Output of all data normally logged to disk (to Ethernet)
- Output of depth below keel in NMEA DPT format (serial line)
- Output to autopilot in NMEA APB format (serial line)

Weights and outline dimensions

These weights and outline dimension characteristics summarize the physical properties of the EM 2040P system.

For more detailed information about the physical dimensions, see the *Drawing file*.

Sonar head

- **Outline dimensions:**
 - **Length:** 560 mm
 - **Width:** 300 mm
 - **Height:** 166 mm
- **Weight:**
 - **In air:** 19.5 kg
 - **In water:** 1.7 kg

Processing Unit

- **Make and model:** Kongsberg Maritime, EM PU
- **Outline dimensions:**
 - **Depth:** 424 mm
 - **Width:** 482.5 mm (19" rack)
 - **Height:** 88.6 mm (2U)
- **Weight:** 10.5 kg

Portable Processing Unit

Make and model: Kongsberg Maritime, EM PPU

- **Outline dimensions:**
 - **Depth:** 391 mm
 - **Width:** 391 mm
 - **Height:** 108 mm
- **Weight:** 10.5 kg

Hydrographic Work Station

Make and model: Hewlett Packard MP5810

The standard commercial computer has been configured to fit the operational requirements of the EM 2040P.

- **Outline dimensions:**
 - **Depth:** 379 mm
 - **Width:** 338 mm
 - **Height:** 100 mm
- **Weight:** 7 kg (Approximately)

Display

- **Manufacturer:** Isic (<http://www.isic-systems.com>)
- **Model:** MD24 (DuraMON WS 24)
- **Outline dimensions:**
 - **Depth:** 68 mm
 - **Width:** 601 mm
 - **Height:** 408 mm
- **Weight:** 10 kg (Approximately)

Related topics

[Drawing file, page 68](#)

Power requirements

These power characteristics summarize the supply power requirements for the EM 2040P system.

Note

The use of an Uninterruptible Power Supply (UPS) is highly recommended.

Sonar head

The power is normally supplied by the Processing Unit.

- **Voltage requirement:** 48 Vdc
- **Maximum voltage deviation:** 10 %
- **Maximum power consumption:** 1.3 A

Processing Unit

- **Make and model:** Kongsberg Maritime, EM PU
- **Voltage requirement:** 100 to 250 Vac, 47 to 63 Hz
- **Maximum power consumption:**
 - **With one CBMF board (without sonar head):** 115 W
 - **With two CBMF boards (without sonar head):** 125 W
 - **With one sonar head (pinging):** 160 W
 - **With one sonar head (pinging with long FM pulse):** 175 W

Portable Processing Unit

- **Make and model:** Kongsberg Maritime, EM PPU
- **Voltage requirement:** 18 to 36 Vdc
- **Maximum power consumption:**
 - **With one CBMF board (without sonar head):** 115 W
 - **With two CBMF boards (without sonar head):** 125 W
 - **With one sonar head (pinging):** 160 W
 - **With one sonar head (pinging with long FM pulse):** 175 W

Hydrographic Work Station

- **Make and model:** Hewlett Packard MP5810
The standard commercial computer has been configured to fit the operational requirements of the EM 2040P.
- **Voltage requirement:** 100/240 VAC, 50 to 60 Hz, autosensing
- **Maximum power consumption:** 240 W (Approximately)

Display

- **Input voltage:** Standard: 90–264 VAC, Optional: 18–36 VDC, 50–60 Hz
- **Power consumption:** Max. 40 W

Environmental requirements

These specifications summarize the temperature requirements and other environmental standards for the EM 2040P system.

Sonar head

- **Operational temperature:** -5 to +40 °C
- **Storage temperature:** -20 to +60 °C
- **Depth rating:** 30 m

Processing Unit

- **Operational temperature:** 0 to 50 °C
- **Storage temperature:** -30 to 70 °C
- **Relative humidity:** 5 to 95% relative non-condensing
- **Ingress protection (IP) rating:** IP22
- **Certificates:**
 - IEC 60945:2002 and CORRIGENDUM 1:2008
 - IACS E10:2006

Portable Processing Unit

- **Make and model:** Kongsberg Maritime, EM PPU
- **Operational temperature:** 0 to 50 °C
- **Storage temperature:** -30 to 70 °C
- **Ingress protection (IP) rating:** IP67
- **Certificates:**

Designed to meet

 - IEC 60945:2002 and CORRIGENDUM 1:2008
 - IACS E10:2006

Hydrographic Work Station

- **Make and model:** Hewlett Packard MP5810
- **Operational temperature:** 0 to +50 °C
- **Storage temperature:** -20 to 70 °C
- **Relative humidity:** 5 to 95% relative non-condensing
- **Ingress protection (IP) rating:** IP22

This IP rating is only applicable when the unit is mounted using the optional kit for 19-inch rack.

- **Certificates:**
 - IEC 60945
 - IACS E10

Display

- **Manufacturer:** Isic (<http://www.isic-systems.com>)
- **Model:** MD22/24/27 (DuraMON WS 22/24/27)
- **Operational temperature:** -15 to 55 °C
- **Storage temperature:** -25 to 70 °C
- **Relative humidity:** 8 to 95% relative non-condensing
- **Ingress protection (IP) rating**
 - Front: IP65
 - Rear: IP20
- **Certificates**
 - IEC 60945
 - IACS E10

Alignment specifications

These alignment specifications summarize the alignment accuracy requirements of the EM 2040P system.

Note

The following accuracy requirements are minimum requirements. Higher accuracy will provide better results and should therefore always be aimed at.

Sonar head alignment accuracy

- **Position (x):** ± 0.02 m

- **Position (y):** ± 0.02 m
- **Position (z):** ± 0.005 m
- **Pitch:** ± 0.05 deg
- **Roll:** ± 0.02 degrees
- **Heading:** ± 0.05 degrees
- **Flatness:** ± 0.5 mm
 - The mounting structure must not deviate from a flat surface more than ± 0.5 mm.

Motion sensor alignment accuracy

- **Position (x):** ± 0.05 m
- **Position (y):** ± 0.05 m
- **Position (z):** ± 0.05 m
- **Pitch:** ± 0.05 deg
- **Roll:** ± 0.02 degrees
- **Heading:** ± 0.05 degrees

Heading sensor alignment accuracy

- **Heading:** ± 0.1 degrees

Position sensor alignment accuracy

- **Position (x):** ± 0.05 m
- **Position (y):** ± 0.05 m
- **Position (z):** ± 0.005 m

Waterline determination accuracy

- **Position (z):** ± 0.005 m

Equipment handling

Observe these basic rules for transportation, storage and handling of units. In this context, a *unit* may be any large or small part of the system. It can be supplied as part of the initial delivery, or as a spare part. The phrase *box* is used to describe all kinds of cases, wooden or cardboard boxes etc used to hold the *unit*.

Topics

[Transporting Kongsberg Maritime equipment, page 91](#)

[Lifting units and transportation boxes, page 92](#)

[Inspection of units and transportation boxes after arrival, page 94](#)

[Specifications for storage prior to installation or use, page 95](#)

[Unpacking instructions, page 97](#)

[Specifications for storage after unpacking, page 102](#)

Transporting Kongsberg Maritime equipment

Unless otherwise stated in the accompanying documentation, electronic, electromechanical and mechanical units supplied by Kongsberg Maritime can be only transported using methods approved for delicate and fragile equipment.

Prerequisites

Transportation methods approved for delicate equipment includes transportation by road, rail, air or sea.

Context

The units are to be transported in accordance with general or specific instructions for the appropriate unit(s), using pallets, transport cases, wooden boxes, or carton boxes as appropriate.

Observe the packing instructions.

Note

Special local restrictions concerning air transportation may be applied to units containing certain types of batteries. These units must be checked properly, and the regulations must be investigated by the packer/shipper before the unit is dispatched.

Procedure

- 1 Ensure that all local transportation is done according to the same specifications as for the initial delivery.
- 2 Make sure that the box containing the unit is kept dry at all times, and sheltered from the weather.

It must not be subjected to shocks, excessive vibration or other rough handling. The box will normally be marked with text or symbols indicating which way it is to be placed. Follow the instructions provided, and make sure that the box is always placed with its “top” facing upwards.

- 3 Make sure that the box is not used for any purpose for which it was not intended (step, table, etc.).

In the absence of other information, no other boxes must be stacked on top of it.

- 4 Handle all boxes and units with care.

Note

Due to the nature of Kongsberg Maritime’s products, and the extensive use of delicate electronic parts, all units and boxes must be regarded and handled as fragile equipment.

Lifting units and transportation boxes

Some of the boxes used to hold equipment units may be heavy. Use caution when lifting.

Prerequisites

Units and boxes may be heavy. Make sure that you have the necessary equipment required for lifting heavy items. Persons using the lifting equipment must be skilled and have the relevant certificate(s).

Context

A heavy box will normally be marked with its weight. The weights of other boxes in the shipment will normally be entered on the packing list(s).

Heavy units may be equipped with dedicated lifting lugs for transportation by crane within the workshop or installation area.

Note

Observe the local rules and regulations related to the use of lifting equipment.

Procedure

- 1 Check the weight of the box or unit before you attempt to lift it.
- 2 Make sure that you have the relevant lifting apparatus required, and that this equipment is approved and certified for the load.
- 3 If you need to use a crane:
 - a Check the applicable weight certificate for the crane.
 - b Check the security of the lifting lugs.
 - c If the unit to be lifted is provided with dedicated lifting lugs, make sure that all available lugs are used.
 - d Make sure that the unit remains under full control during the lifting operation.
This is important to avoid damage to the unit, equipment or personnel.
- 4 If you need to use a forklift truck:
 - a Check the applicable weight certificate for the truck.
 - b Check the limitations for lifting height and angles.
 - c Pay special attention to the position of the unit's centre of gravity.
 - d Make sure that the unit is properly secured to the truck during the lifting and transportation operations.
- 5 Handle all units and boxes with care.

Note

Due to the nature of Kongsberg Maritime's products, and the extensive use of delicate electronic parts, all units and boxes must be regarded and handled as fragile equipment.

Inspection of units and transportation boxes after arrival

A visual inspection must be done immediately after the box(es) have arrived at their destination.

Prerequisites

If you suspect that the equipment has been damaged during the transport, request that a representative of the carrier is present during the inspection.

Procedure

- 1 Check all boxes (wooden or cardboard boxes, plastic bags and/or pallets) for physical damage.
Look for signs of dropping, immersion in water or other mishandling.
- 2 If external damage is detected, open the box to check its contents.
Request that a representative of the carrier to be present while the box is opened, so any transportation damage can be identified and documented.
- 3 If a unit has been damaged, prepare an inspection report stating the condition of the unit and actions taken.
Describe the damage, and collect photographic evidence if possible. Return the inspection report to Kongsberg Maritime as soon as possible.
- 4 If units are not damaged, check the humidity absorbing material.
If required, dry or replace the bags, then re-pack the unit(s) according to the packing instructions.

Specifications for storage prior to installation or use

When a system, a unit or a spare part has been delivered to the customer, it may be subject to long time storage prior to installation and use.

General specifications

During this storage period, certain specifications must be met. The equipment must be preserved and stored in such a way that it does not constitute any danger to health, environment or personal injury.

- 1 The equipment must be stored in its original transportation box.
- 2 Ensure that the units are clearly separated in the shelves and that each unit is easily identifiable.
- 3 The box must not be used for any purpose for which it was not intended (work platform, steps, table etc.).
- 4 Boxes must not be placed on top of each other, unless specific markings permit this.
- 5 Boxes must not be placed directly on a dirt floor.
- 6 Do not open a box for inspection unless special circumstances permit so.
“Special circumstances” may be suspected damage to the box and its content, or inspections by civil authorities.
 - a If a unit is damaged, prepare an inspection report stating the condition of the unit and the actions taken. Describe the damage and collect photographic evidence if possible. Re-preserve the equipment.
 - b If the unit is not damaged, check the humidity absorbing material. If required, dry or replace the bags, then re-pack the unit according to the packing instructions.
- 7 If a box has been opened, make sure that it is closed and sealed after the inspection. Use the original packing material as far as possible.
- 8 The storage room/area must be dry with a non-condensing atmosphere. It must be free from corrosive agents.
- 9 The storage room/area’s mean temperature must not be lower than -10° C, and not warmer than +50° C. If other limitations apply, the crates will be marked accordingly.
- 10 Boxes must not be exposed to moisture from fluid leakages.
- 11 Boxes must not be exposed to direct sunlight or excessive warmth from heaters.
- 12 Boxes must not be subjected to excessive shock and vibration.
- 13 If the unit contained in a box holds normal batteries, these may have been disconnected/isolated before the unit was packed. These must only be reconnected before the installation starts. Units containing batteries are marked.

Caution

Units containing lithium or alkaline batteries must be handled separately and with care. Such units are marked accordingly. Do not attempt to recharge such batteries, open them, or dispose of them by incineration.

Refer to the applicable product data sheets or battery handling procedures for further details.

Temperature protection

Any units that requires protection against extreme temperatures are identified as such in the applicable documentation. The box used to transport and store such units are clearly marked, for example:

Must not be transported or stored in temperatures below -5 °C.

Other temperature limits may be used if applicable.

If a unit needs temperature protection, the box to be used for storage and transportation must be lined on all walls, base and lid, using minimum 5 cm thick polyurethane or polystyrene foam.

Most system units can normally be stored in temperatures between -30° C and +70° C. Refer to the relevant technical specifications for details.

Note

Unless otherwise specified, transducers and hydrophones must not be stored in temperatures below -10°C and above +50°C.

Unpacking instructions

Prior to installation or use, electronic, electromechanical and mechanical units must be unpacked from their transport boxes. It is important that this unpacking is done according to the relevant instructions, and without inflicting damage to the equipment.

Topics

[Unpacking standard parts and units, page 97](#)

[Unpacking mechanical units, page 98](#)

[Unpacking electronic and electromechanical units, page 99](#)

[Unpacking transducers, page 100](#)

Unpacking standard parts and units

Prior to installation or use, parts and units must be inspected, and then unpacked from their transport boxes. It is important that this unpacking is done without inflicting damage to the equipment.

Context

This procedure provides the basic tasks of unpacking units (main unit, spare parts etc) from boxes shipped from Kongsberg Maritime.

Note

If the unit in question is not unpacked for immediate use, you may consider storing it unopened in its original box. However, it may be useful to open the box to check its contents for damage and retrieve any accompanying documentation.

Do not use a knife to open cardboard boxes - the contents may be located close to the surface, and can then be damaged by the blade.

Procedure

- 1 Check the carton before opening it to ensure it shows no signs of dropping, immersion in water or other mishandling.
 - 1 If external damage is detected, open the box to check its contents.
 - 2 Request that a representative of the carrier to be present while the box is opened, so any transportation damage can be identified and documented.
 - 3 If a unit has been damaged, prepare an inspection report stating the condition of the unit and actions taken.

Describe the damage, and collect photographic evidence if possible. Return the inspection report to Kongsberg Maritime as soon as possible.

- 2 Place the box on a stable work bench or on the floor with the top of the box facing upwards.
- 3 In the absence of other instructions, always open the top of the carton first.
The contents of the box will normally have been lowered into the carton from above, so this will usually be the easiest route to follow. Be careful when you open the box, and make sure that the contents are not damaged. Do not use a knife to open cardboard boxes.
- 4 If the box has been closed using staples, remove the staples from the carton as you open it.
This will reduce the possibilities of scratch injury to yourself and damage to the contents.
- 5 If a wooden box has been closed using screws, always remove them using a screwdriver.
Do not attempt to force the lid open with a crowbar or similar tool.
- 6 Once the carton is open, carefully remove all loose packing and insulation material.
- 7 Check for user manuals and other documents that may have been added to the carton during packing.
- 8 Check also for special tools, door keys etc.

Unpacking mechanical units

Prior to installation or use, mechanical units must be unpacked from their transport boxes. It is important that this unpacking is done without inflicting damage to the equipment.

Prerequisites

Observe the procedure for unpacking of standard parts and units.

Context

Mechanical and electromechanical units may be heavy.

Procedure

- 1 Obtain the necessary lifting equipment, and make sure that the equipment is certified for the weight.
- 2 Lift the unit out of the transportation box.
- 3 Place it in a stable position on the floor/work bench.
- 4 Inspect the unit for visual damage.
- 5 Remove any packing material that may be inside the unit.
- 6 Collect and keep the relevant user manuals and/or documents provided with the unit.

Unpacking electronic and electromechanical units

Prior to installation or use, electronic and electromechanical units must be unpacked from their transport boxes. It is important that this unpacking is done without inflicting damage to the equipment.

Prerequisites

Observe the procedure for unpacking of standard parts and units.

Context

Electronic and electromechanical units will normally be wrapped in a clear antistatic plastic bag.

Do not break the seal to open a circuit board package before the board is to be used. If the board package is returned to the manufacturer with the seal broken, the contents will be assumed to have been used and the customer will be billed accordingly.

Note

When you handle electronic circuit boards and modules, you must beware of the dangers of electrostatic discharge (ESD), both to yourself and to the equipment. In order to ensure safe transport and storage, circuit boards and other electronic units will always be wrapped in a clear plastic protective bag, and the bag will be sealed.

Procedure

- 1 Lift the unit, in its bag, out of the box.

Note

*Cables must **never** be used as carrying handles or lifting points.*

- 2 Place it in a stable position on the floor or a work bench.
- 3 Inspect the unit for visual damage before opening the antistatic plastic bag.
- 4 Assuming all is well, open the bag and remove the unit.
- 5 If applicable, open the unit and check inside.
- 6 Remove any packing and desiccant material that may be inside the unit.
- 7 Collect and keep the relevant user manuals and/or documents provided with the unit.

Unpacking transducers

Prior to installation or use, transducers, sonar heads and hydrophones must be unpacked from their transport boxes. It is important that this unpacking is done without inflicting damage to the equipment.

Prerequisites

Observe the procedure for unpacking of standard parts and units.

Context

Transducers may be supplied mounted to a hull unit (if any), or packed separately. Sonar heads and hydrophones are normally packed and shipped in separate boxes. Boxes are identified by the order number and the serial number of the unit inside.

Note

Once a transducer, sonar head or hydrophone is unpacked, make sure that the body and the cabling are not exposed to any mechanical stress. Protect the transducer face with a padded cover plate to prevent damage.

Transducers may be heavy.

A sonar head must always be handled as a delicate item. Wrongful actions may damage the sonar head beyond repair.

Observe these sonar head handling rules:

- **Do not** activate the sonar head when it is out of the water.
- **Do not** lift the sonar head by the cable.
- **Do not** step on the sonar head cable.
- **Do not** handle the sonar head roughly, avoid impacts.
- **Do not** expose the sonar head to direct sunlight or excessive heat.
- **Do not** use high pressure water, sand blasting, metal tools or strong solvents to clean the sonar head face.

Procedure

- 1 Obtain the necessary lifting equipment, and make sure that the equipment is certified for the weight.
- 2 Lift the transducer, sonar head or hydrophone out of the transportation box.
- 3 Place it in a stable position on the floor/work bench.
- 4 Inspect the unit for visual damage.
- 5 Make sure that the relevant protection is kept in place until the final stages of the installation.
- 6 Collect and keep the relevant user manuals and/or documents provided with the unit.

- 7 Observe the handling rules for transducers.

Specifications for storage after unpacking

The unit must whenever possible be stored in its original transportation crate until ready for installation.

General specifications

During storage, each box must not be used for any purpose for which it was not intended (work platform, table, steps etc.).

Once unpacked, all equipment must be kept in a dry, non condensing atmosphere, free from corrosive agents and isolated from sources of vibration.

Note

Do not break the seal to open a circuit board package before the board is to be used. If the board package is returned to Kongsberg Maritime with the seal broken, we will assumed that the unit has been used, and then you will be billed accordingly.

Each unit must be installed in its intended operating position as soon as possible after unpacking. If the unit contains normal batteries, these may have been disconnected/isolated before the unit was packed. These must then be reconnected during the installation procedure. Units containing batteries are marked.

Caution

Units containing lithium or alkaline batteries must be handled separately and with care. Such units are marked accordingly. Do not attempt to recharge such batteries, open them, or dispose of them by incineration.

Refer to the applicable product data sheets or battery handling procedures for further details.

Temperature protection

Any units that requires protection against extreme temperatures are identified as such in the applicable documentation. The box used to transport and store such units are clearly marked, for example:

Must not be transported or stored in temperatures below -5 °C.

Other temperature limits may be used if applicable.

If a unit needs temperature protection, the box to be used for storage and transportation must be lined on all walls, base and lid, using minimum 5 cm thick polyurethane or polystyrene foam.

Most system units can normally be stored in temperatures between -30° C and +70° C. Refer to the relevant technical specifications for details.

Note

Unless otherwise specified, transducers and hydrophones must not be stored in temperatures below -10°C and above $+50^{\circ}\text{C}$.

General safety rules

The following safety precautions must be followed at all times during installation and maintenance work.

- 1 You must always switch off all power before installation or maintenance work on the EM 2040P system.
Use the main circuit breaker, and label the breaker with a warning sign that informs others that maintenance or installation work is in progress on the system.
- 2 For safety reasons, two persons must always be present during troubleshooting with power ON.
- 3 Read and understand the applicable first aid instructions related to electric shock.
- 4 Whenever maintenance is in progress, it is essential that a first aid kit is available, and that all personnel are familiar with the first aid instructions for electrical shock.

General safety rules

The following safety precautions must be followed at all times during installation and maintenance work.

WARNING

The EM 2040P operates on 230 VAC 50/60 Hz. This voltage is lethal! You must never work alone on high-voltage equipment!

- 1 You must always switch off all power before installation or maintenance work on the EM 2040P system.
Use the main circuit breaker, and label the breaker with a warning sign that informs others that maintenance or installation work is in progress on the system.
- 2 For safety reasons, two persons must always be present during troubleshooting with power ON.
- 3 Read and understand the applicable first aid instructions related to electric shock.
- 4 Whenever maintenance is in progress, it is essential that a first aid kit is available, and that all personnel are familiar with the first aid instructions for electrical shock.

5 The various parts of the system may be heavy.

Make sure that the appropriate tools and certified lifting equipment are available.
The personnel must be trained in relevant installation and maintenance work.

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