



EM 2040C

Multibeam echo sounder





KONGSBERG

EM 2040C
Multibeam echo sounder
Maintenance manual

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Document information

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- **Document:** Maintenance manual
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Warning

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

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

Comments

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

e-mail: km.documentation@kongsberg.com

For technical support issues, please contact km.support@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 2040C 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, and 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 Kongsberg EM 2040C can be downloaded from our website.

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

Our website will also give you information about other Kongsberg products.

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

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EM 2040C

Topics

[System description, page 9](#)

[System diagram, page 11](#)

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System description

The EM 2040C is a shallow water multibeam echo sounder based on the EM 2040 technology, an ideal tool for any high resolution mapping and inspection application.

Key facts

- High resolution
- Wide frequency range
- Short pulse lengths, large bandwidth
- FM chirp
- Complete roll and pitch stabilization
- Nearfield focusing both on transmit and receive
- Water column
- Seabed image
- Swath coverage:
 - Single head: 130 degrees
 - Dual head: 200 degrees
- Depth rating:
 - EM 2040C: 50 m
 - EM 2040CX: 1500 m
- Easy to install
- Dual swath as option

The receiver and transmitter are integrated in a common sonar head, with the same dimensions as the EM 3002. The system fulfils the IHO-S44 special order and the more stringent LINZ specification.

The EM 2040C is available in a CX version where the subsea part has a depth rating of 1500 m for operation on ROV or AUV

Yaw stabilization is available in dual head configuration. Each head uses one sector, and by independently steering each sector the system can stabilize for the yaw movement of the vessel.

The operating frequency range is from 200 to 400 kHz with frequency selection in step of 10 kHz, enabling the user to choose on the fly the best operating frequency for the application. Due to the very large operating bandwidth available the system will have an output sample rate of more than 60 kHz. The system will thus effectively operate with very short pulse lengths, less than 25 microseconds, which gives a raw range resolution ($c\tau/2$) of 18 mm and an accuracy of less than 10mm ($c\tau/4$).

In dual head mode, both heads are operated independently creating one swath from each head simultaneously. This is due to a very flexible solution by using two different frequencies for each head.

By utilizing both CW and FM chirp pulses, the system can achieve a much longer range capability with a higher resolution. The maximum depth range is 520 m at 200 kHz and a swath with up to 690 m with dual head.

The angular coverage for 200 to 300 kHz is up to 130 degrees with one sonar head, allowing coverage of 4.3 times water depth. With two sonar heads, tilted 35-40 degrees to each side, 200 degrees can be covered. This allows surveying to the water surface or up to 10 times water depth on flat bottoms. For frequencies above 320 kHz the angular coverage per head is gradually decreasing to 70 degrees at 400 kHz.

As an option the EM 2040C can be delivered with the dual swath capability, allowing a sufficient sounding density along track at a high vessel speed.

System diagram

The system diagram identifies the main components of a basic EM 2040C system, as well as the connections between the units. Interface capabilities and power cables are not shown.

A *Hydrographic Work Station*

B *Hydrographic Work Station interfaces:*

- *Sound speed sensor*
- *Tide*
- *Center depth output*

C *Processing Unit*

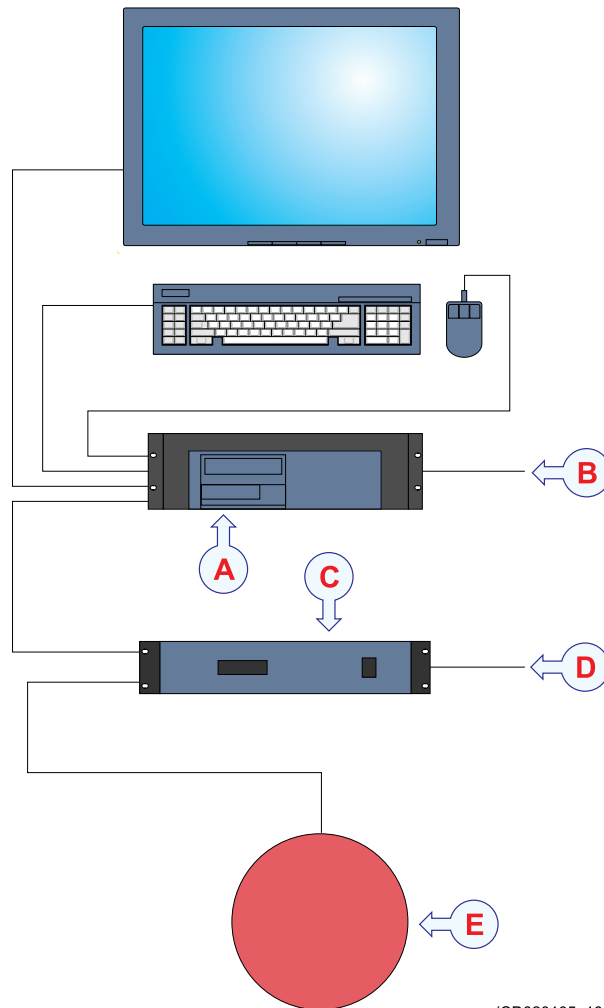
D *Processing Unit interfaces:*

- *Positioning systems*
- *Attitude (roll, pitch and heave)*
- *Velocity*
- *Heading*
- *Clock*

Processing Unit special interfaces:

- *Trigger input/output*
- *Clock synchronisation (1PPS)*

E *Sonar Head*



(CD020105_101_001)

System units

Sonar head 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 2040C has transducers for transmit and receive in one housing, and we call it a "sonar head".

The EM 2040C sonar head is a short cylindrical container with the transducers located on one end, and with cable connector and fastening holes on the other.

The end with the transducers is the sonar head's "face".

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



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).

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



Hydrographic Work Station description

The Hydrographic Work Station is the operator station of the EM 2040C.

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

The Hydrographic Work Station is based on the Microsoft® Windows® 7 operating system.

The Hydrographic Work Station is normally mounted on the bridge.



Ethernet switch

A high capacity Ethernet switch may be required.

If you use more than one Processing Unit, an Ethernet switch is required. This is used to connect each Processing Unit to the Hydrographic Work Station. A high capacity Ethernet switch (1000BASE-T) is included in the EM 2040C delivery.

Note

It is very important that a high quality Ethernet cable is used. You must use CAT-5E quality or better. Using cables with lower bandwidth capacity will reduce the EM 2040C performance.

1000BASE-T (also known as IEEE 802.3ab) is a standard for gigabit Ethernet over copper wiring. Each 1000BASE-T network segment can be a maximum length of 100 meters (330 feet), and must use Category 5 cable or better (including Cat 5e and Cat 6).

https://en.wikipedia.org/wiki/Gigabit_Ethernet (January 2016)

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 2040C delivery.



The Remote Control Unit is called K-Rem. It is prepared for remote control and interface to an external synchronization system for the following 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

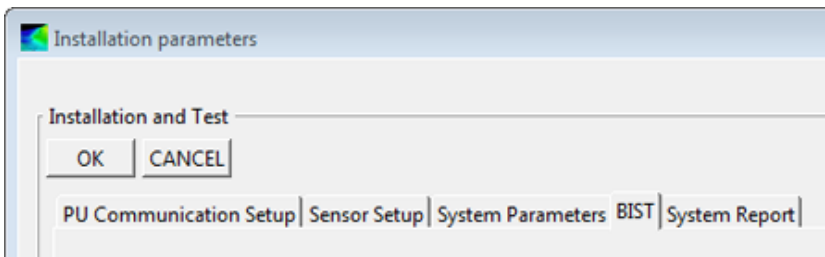
[BIST \(Built-In Self Test\) dialog box, page 15](#)

BIST (Built-In Self Test) dialog box

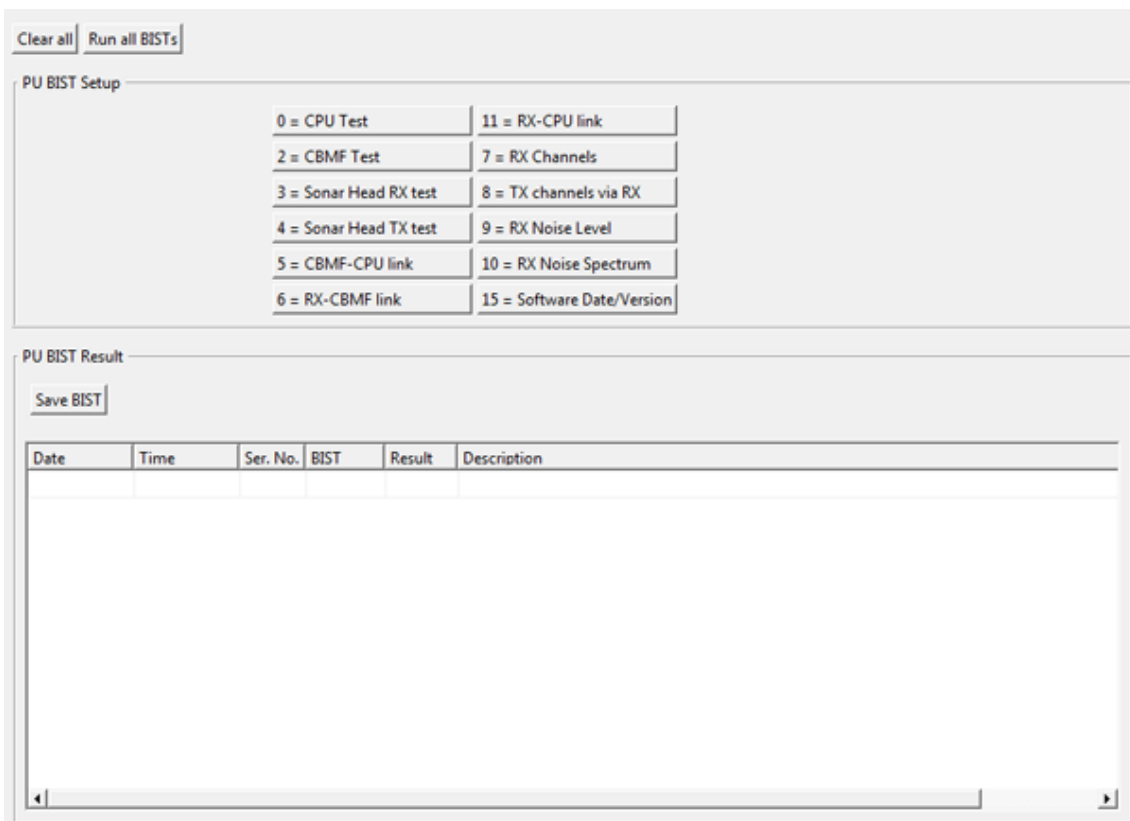
The **BIST** (Built-In System Test) dialog box controls the test and diagnose program that checks the performance of the EM 2040C.

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 CBFM board. A large set of known data is transferred from the CBFM board and the data received is checked by the CPU board.
- 6 RX-CBFM link
- This test checks the GBit Ethernet interface between the RX transducer unit and the CBFM board. A large set of known data is transferred from the RX transducer unit to the CBFM board. The data received is checked by the CBFM 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 2040C 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

[Inspecting and cleaning the sonar head face, page 20](#)

[Painting the sonar head face, page 22](#)

[Approved anti-fouling paints, page 23](#)

Inspecting and cleaning the sonar head face

Marine growth (biological fouling) on the sonar head face reduces the EM 2040C 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 2040C. 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 Inspect the sonar head closely for any sign of dents, cracks, fractures or holes.
If you find suspicious damage, take high resolution pictures that show the damage, and contact Kongsberg support 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.

Related topics

[Painting the sonar head face, page 22](#)

[Approved anti-fouling paints, page 23](#)

Painting the sonar head face

In order to reduce the marine growth (biological fouling) on the sonar head face, it may be covered with a thin film of suitable anti-fouling paint. The sonar head must be painted 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 2040C 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.

Related topics

[Inspecting and cleaning the sonar head face, page 20](#)

[Approved anti-fouling paints, page 23](#)

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 tie coat + 425 FCS
 - A BXA386/BXA390/BXA391 Grey (equal parts)
 - B HKA563/HKA570/HKA571 Yellow (equal parts)Mix "A" and apply. Once dry, mix "B" and apply.
- Intersmooth 360 Ecoloflex SPC
- Micron Extra

Related topics

[Inspecting and cleaning the sonar head face, page 20](#)

[Painting the sonar head face, page 22](#)

Illustrated spare parts catalogue

Topics

[Ordering spare parts, page 26](#)

[List of spare parts, page 27](#)

Ordering spare parts

To make the order process as short and as effective as possible, please include the following details:

- Part name and/or description
- Our part number
- Number of units 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

Processing Unit spare part - single version - one CBMF board, page 27

Processing Unit spare part - dual version - two CBMF boards, page 27

CBMF board spare part, page 28

Concurrent PP833 CPU board spare part, page 28

Ethernet switch spare part, page 29

Fan unit spare part, page 30

Power supply spare part, page 30

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 2040C 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:** 385402
- **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 2040C 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:** 385405
- **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 2040C system.

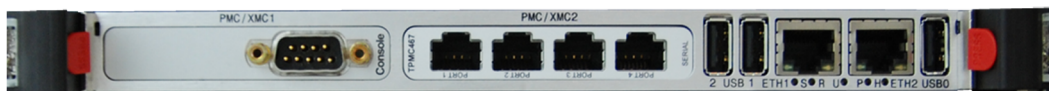
This is a generic photo. The CBMF board used by the EM 2040C may look slightly different due to minor design changes on the protective lid and/or the front panel.

- **Part name:** CBMF board
- **Part number:** 384585
- **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.



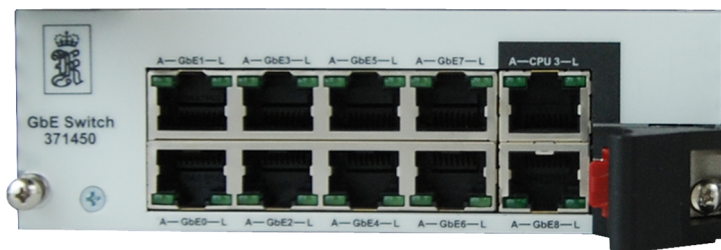
This is a generic photo. The Concurrent CP833 CPU board used by the EM 2040C may look slightly different due to minor design changes on the protective lid and/or the front panel.

- **Part name:** Concurrent PP833 CPU board
- **Part number:** 385385
- **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
2040C 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 2040C 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 2040C Processing Unit for supply of 5, 24 and 48 VDC.

- **Part name:** Power supply, Excesys 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

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[Processing Unit familiarization, page 32](#)

[Processing Unit front panel description, page 33](#)

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[Processing Unit circuit boards and modules, page 35](#)

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[CP219 Ethernet switch, page 38](#)

[CBMF board, page 39](#)

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.

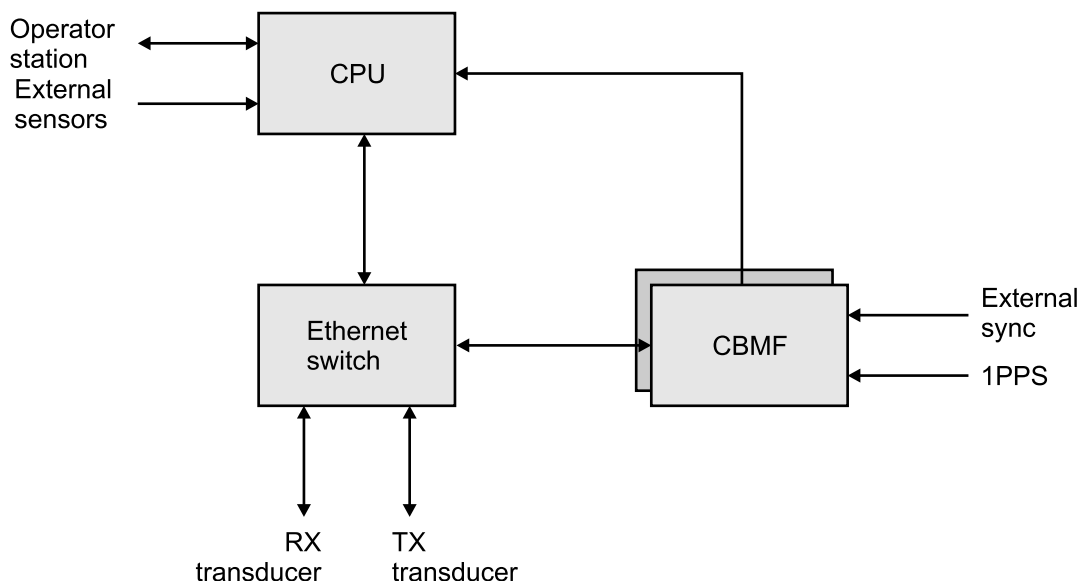
It uses both COTS (commercial off-the-shelf) components and custom made components. Ventilation is provided through slits located on the sides. The front panel of the Processing Unit holds a mains power switch and an information display.

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

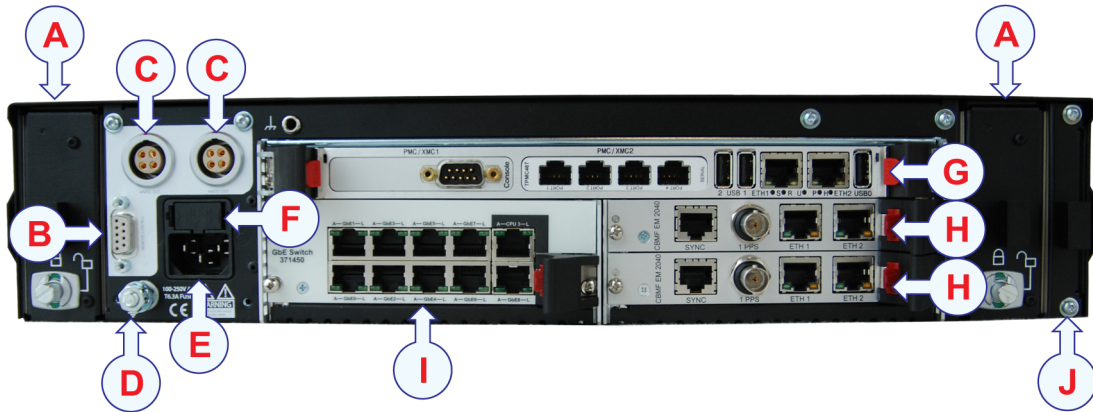
The front panel of the Processing Unit holds a mains power switch and an information display.



- 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 2040C 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 EM 2040C 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 2040C Processing Unit. All are line replaceable units.

A *Concurrent PP833 CPU board*

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

C *VadaTech CP219 board*

The VadaTech CP219 board is used as an Ethernet switch in the EM 2040C 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 2040C 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 36](#)

[Concurrent PP833 CPU board connectors, page 37](#)

Concurrent PP833 CPU board overview

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

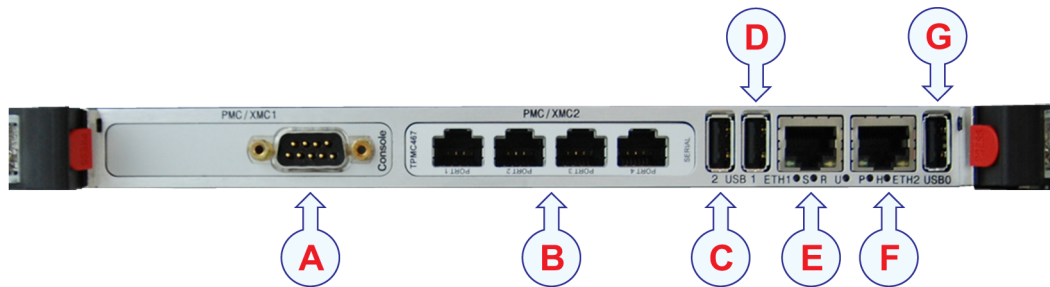


The Concurrent PP833 is a PC-compatible high functionality Compact PCI (cPCI) board used by the EM 2040C Processing Unit as the Central Processing Unit (CPU).

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 2040C.



- 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

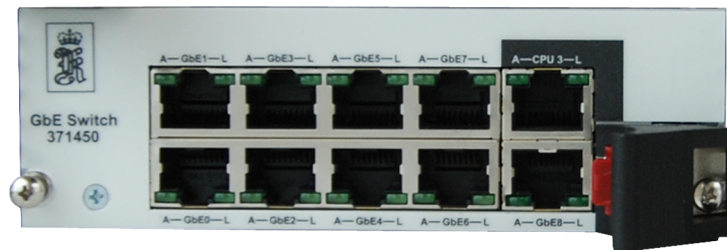
[Ethernet switch overview, page 38](#)

[Ethernet switch connectors, page 38](#)

Ethernet switch overview

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

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

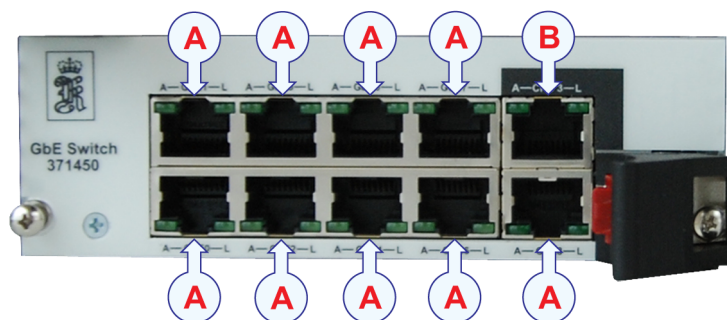


The VadaTech CP219 is a compact PCI module that provides 10 Gigabit Ethernet ports on the front panel.

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 2040C 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 39](#)

[CBMF board configuration, page 40](#)

[CBMF board connectors, page 41](#)

CBMF board overview

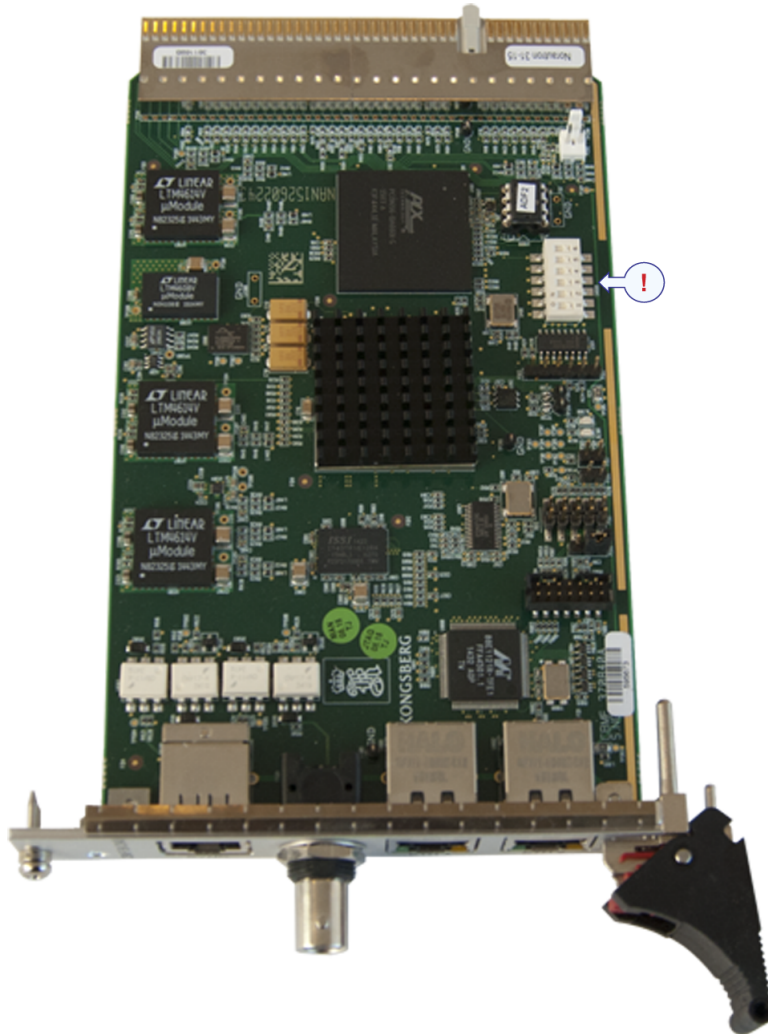
The Compact Beamformer (CBMF) board is used by the Processing Unit for beamforming and signal processing purposes.



This is a generic photo. The CBMF board used by the EM 2040C 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.

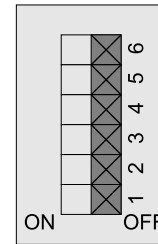


This is a generic photo. The CBMF board used by the EM 2040C may look slightly different due to minor design changes on the protective lid and/or the front panel.

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.



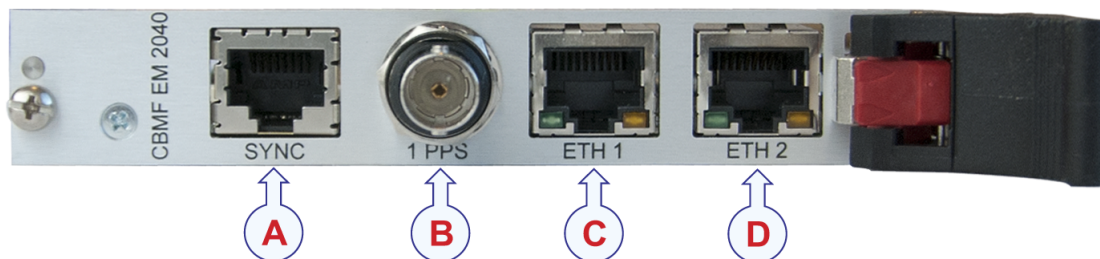
(CD090306_001_001)

Do not touch other switches or link settings.

The CBMF board is configured by Kongsberg Maritime for use in the EM 2040C. 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 2040C 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 2040C

Cable layout and interconnections

Topics

[Read this first, page 43](#)

[Cable plans, page 44](#)

[List of EM 2040C cables, page 51](#)

[Cable drawings and specifications, page 53](#)

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 2040C delivery.

Note

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.

Only trained and authorized personnel can install the EM 2040C cables.

Kongsberg Maritime will not accept any responsibility for errors, malfunctions or damage to system or personnel caused by improper wiring.

A detailed drawing for each specific cable is provided. 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 two categories.

1 **System cables**

These cables are provided by Kongsberg Maritime as a part of the EM 2040C 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.

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.

Cable plans

Topics

[Single head, single swath cable plan, Processing Unit, page 45](#)

[Single head, dual swath cable plan, Processing Unit, page 46](#)

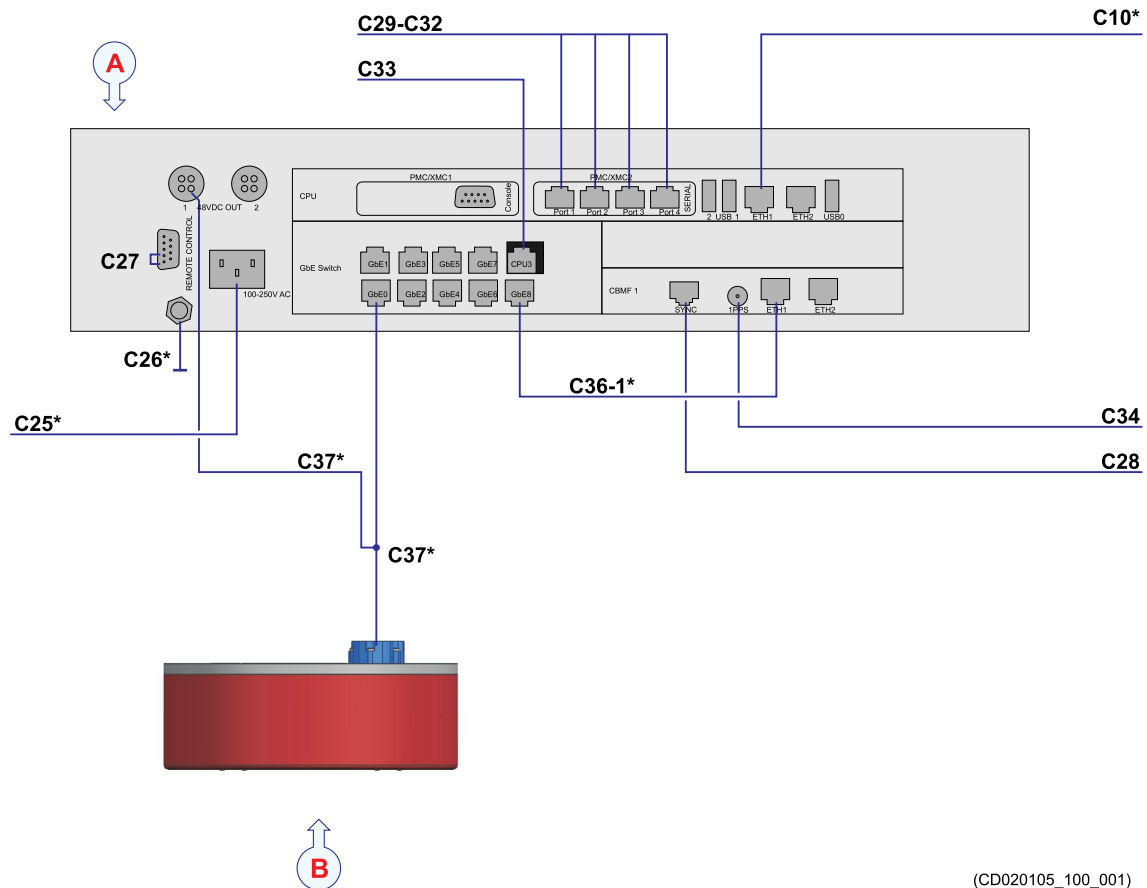
[Dual head, single swath cable plan, Processing Unit, page 47](#)

[Dual head, dual swath cable plan, Processing Unit, page 48](#)

[Topside cable plan, page 50](#)

Single head, single swath cable plan, Processing Unit

The Processing Unit cables include those used to connect the EM 2040C 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.



(CD020105_100_001)

A Processing Unit

B Sonar Head

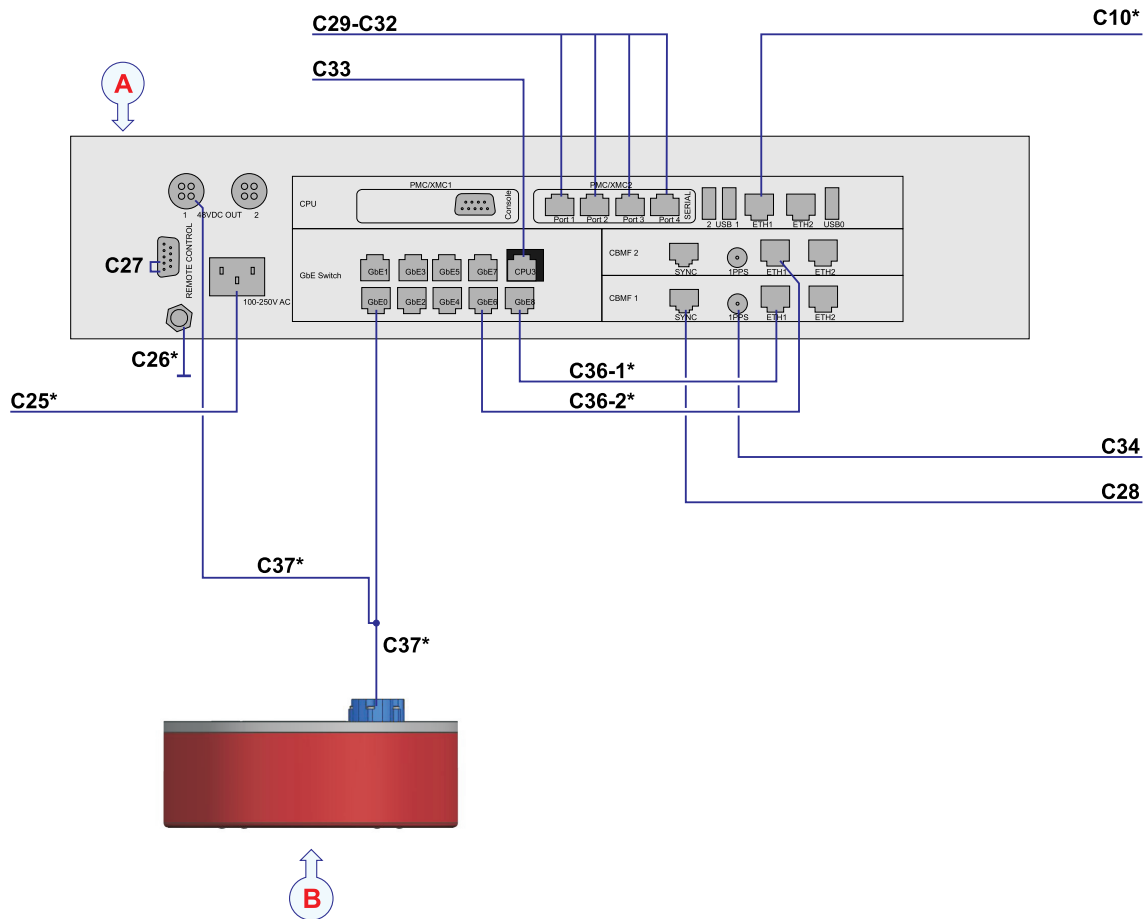
Cables identified with an asterisk (*) are system cables. These are provided with the standard EM 2040C delivery.

Related topics

[List of EM 2040C cables, page 51](#)

Single head, dual swath cable plan, Processing Unit

The Processing Unit cables include those used to connect the EM 2040C 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.



A Processing Unit

B Sonar Head

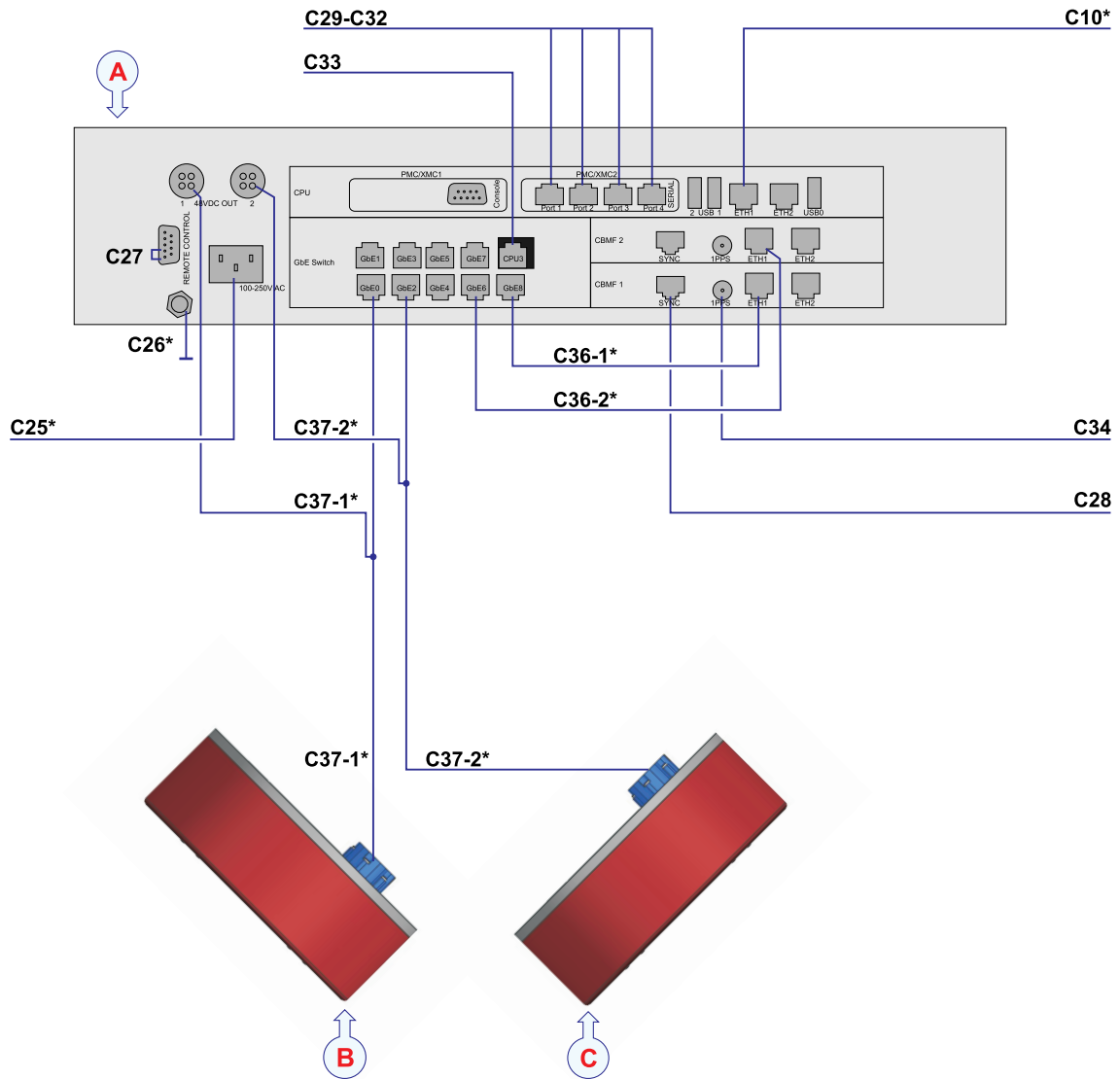
Cables identified with an asterisk (*) are system cables. These are provided with the standard EM 2040C delivery.

Related topics

[List of EM 2040C cables, page 51](#)

Dual head, single swath cable plan, Processing Unit

The Processing Unit cables include those used to connect the EM 2040C 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.



(CD020105_100_003)

A *Processing Unit*

B *Sonar Head*

C *Sonar Head*

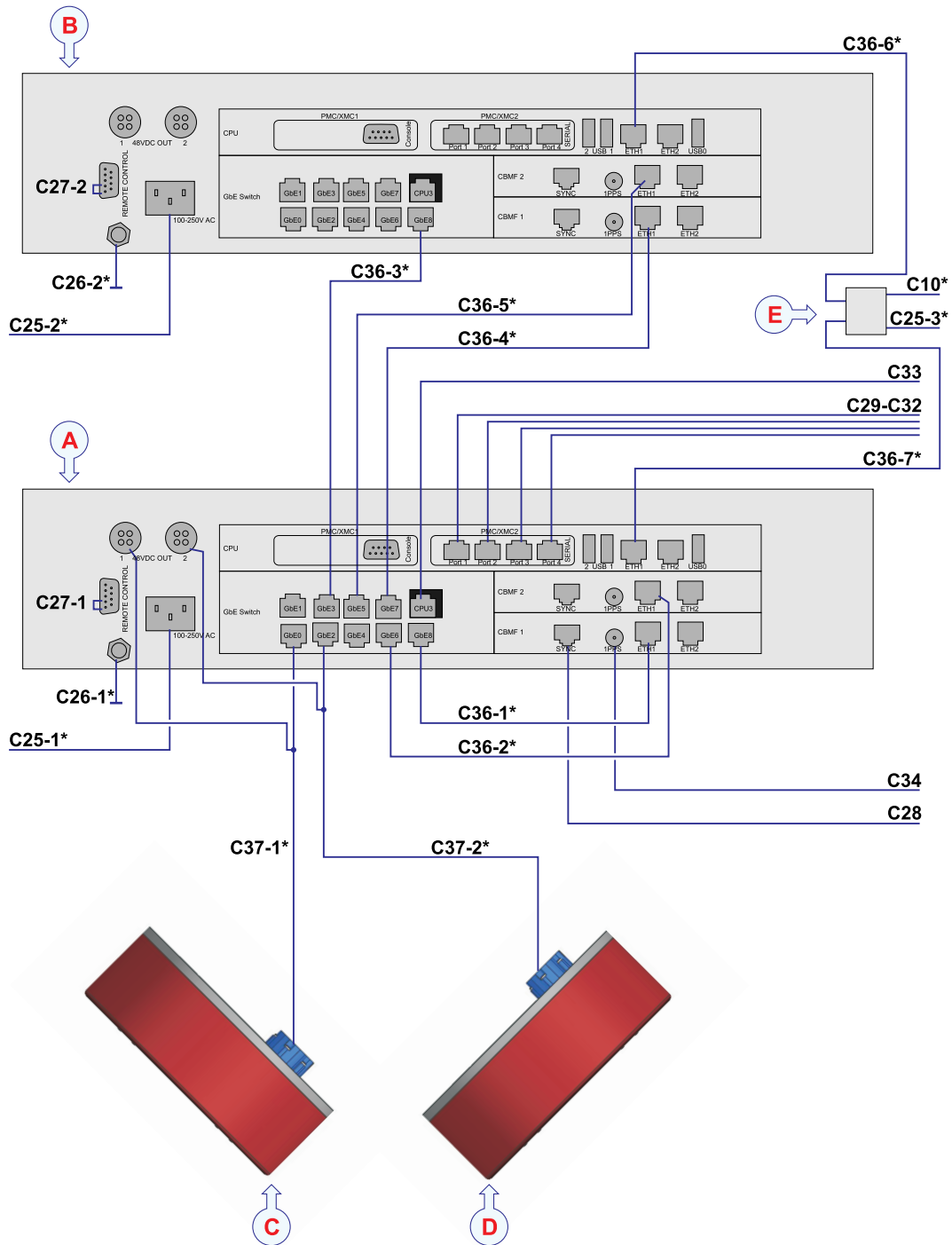
Cables identified with an asterisk (*) are system cables. These are provided with the standard EM 2040C delivery.

Related topics

[List of EM 2040C cables, page 51](#)

Dual head, dual swath cable plan, Processing Unit

The Processing Unit cables include those used to connect the EM 2040C Processing Units to AC mains power, and to the sonar head. Ethernet cables are used to connect the Processing Units to the Hydrographic Work Station.



(CD020105_100_004)

A *Processing Unit*

B *Processing Unit*

C *Sonar Head*

D *Sonar Head*

E *Ethernet switch*

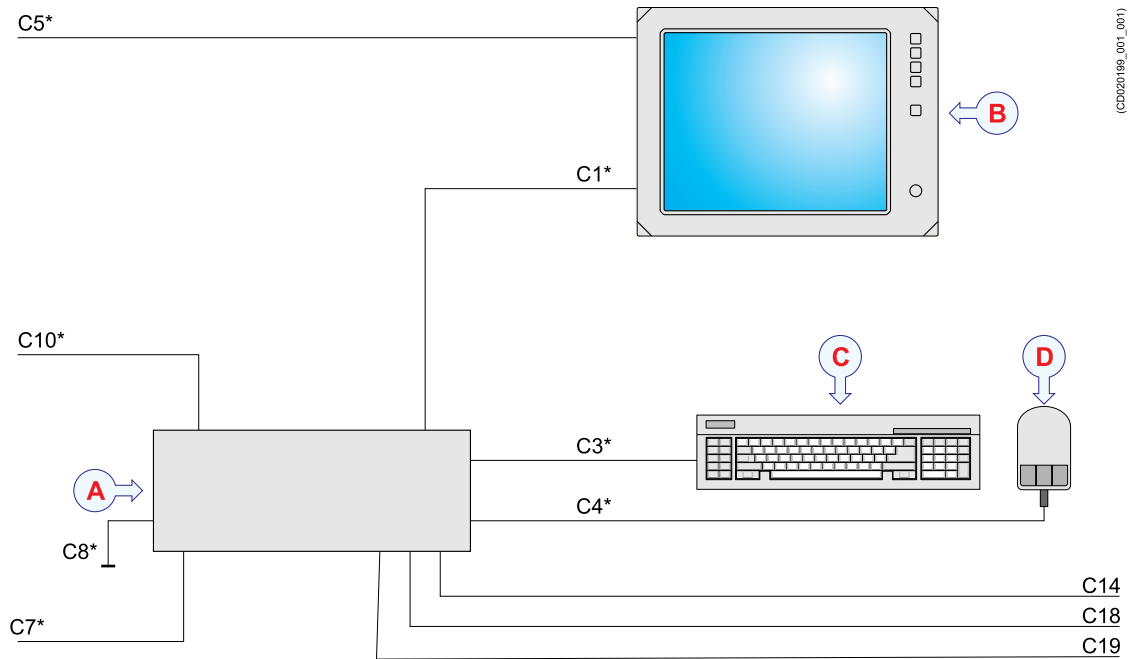
Cables identified with an asterisk (*) are system cables. These are provided with the standard EM 2040C delivery.

Related topics

[List of EM 2040C cables, page 51](#)

Topside cable plan

The topside/bridge cables include those used to connect the EM 2040C 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 are provided with the standard EM 2040C delivery.

Related topics

[List of EM 2040C cables, page 51](#)

List of EM 2040C cables

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

Cable	Signal	From/To	Minimum requirements
C1	Video	Hydrographic Work Station / Display	See comment 1
C3	Keyboard	Hydrographic Work Station / Keyboard	See comment 2
C4	Mouse	Hydrographic Work Station / Mouse	See comment 3
C7	AC power	Hydrographic Work Station / Vessel mains supply	
C8	Ground	Hydrographic Work Station / Vessel ground	
C10	Ethernet	Hydrographic Work Station / Processing Unit	
C14	Serial	Hydrographic Work Station / External device	
C18	Serial	Hydrographic Work Station / External device	
C19	Serial	Hydrographic Work Station / External device	
C25	AC power	Processing Unit / Vessel mains supply	
C26	Ground	Processing Unit / Vessel ground	
C27	Control	Processing Unit / External device Remote control to local on/off switch in junction box (Optional) 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.	
C28	Control	Processing Unit / External device External synchronisation	
C29	Serial	Processing Unit / External device	
C30	Serial	Processing Unit / External device	
C31	Serial	Processing Unit / External device	
C32	Serial	Processing Unit / External device	

Cable	Signal	From/To	Minimum requirements
C33	Ethernet	Processing Unit / External device Attitude Velocity sensor	
C34	Ethernet	Processing Unit / External device 1 PPS (one pulse per second) clock synchronisation	
C36	Ethernet	Processing Unit internal connection	
C37	Transducer	Processing Unit / Sonar head	See comment 4

Comments

- 1 This is a commercial cable. It is normally provided with the display.
- 2 This is a commercial cable. It is normally provided with the keyboard.
- 3 This is a commercial cable. It is normally provided with the mouse.
- 4 The transducer cable is provided with the transducer.

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 2040C performance.

Identifying EM 2040C cables on a project cable drawing

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

Related topics

- [Single head, single swath cable plan, Processing Unit, page 45](#)
- [Single head, dual swath cable plan, Processing Unit, page 46](#)
- [Dual head, single swath cable plan, Processing Unit, page 47](#)
- [Dual head, dual swath cable plan, Processing Unit, page 48](#)
- [Topside cable plan, page 50](#)
- [Cable drawings and specifications, page 53](#)

Cable drawings and specifications

Relevant cables and connections required for the EM 2040C are described in detail.

Topics

[RS-232 serial line using three 3 wires and RJ45 connector, page 54](#)

[RS-422 serial line using five wires and RJ45 connector, page 55](#)

[1PPS \(One pulse per second\) using a coax cable, page 56](#)

[Remote control, page 58](#)

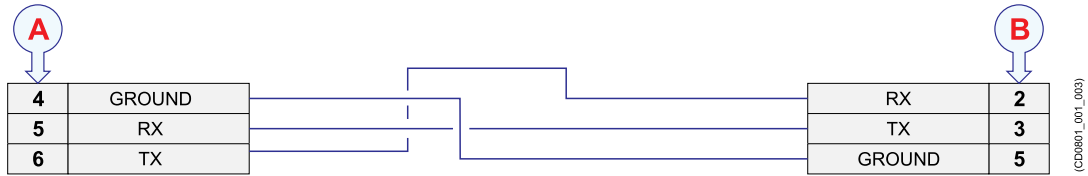
[Remote Control using K-Rem, page 59](#)

[Dummy plug for not using remote control, page 60](#)

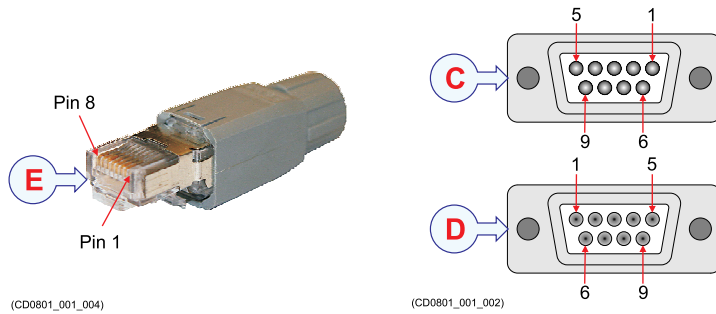
[External Synchronisation, page 61](#)

RS-232 serial line using three 3 wires and RJ45 connector

An RS-232 serial line connection using three –3– wires and NMEA telegrams is probably the most common way to connect the EM 2040C to external devices.



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

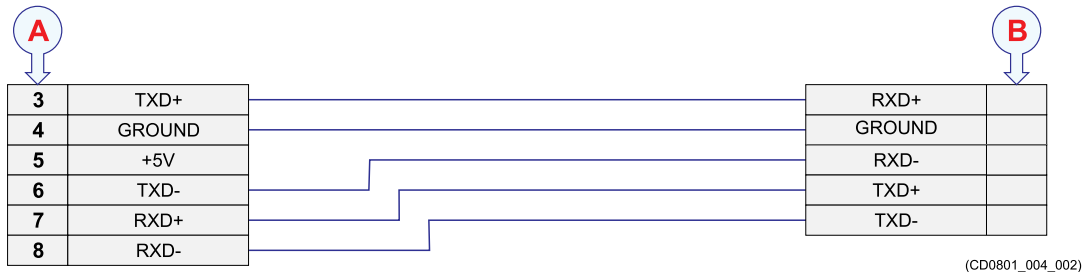


Unless otherwise specified, the serial line cable must be provided by the installation shipyard.

Note that this cable does not support all the signals in the standard RS-232 specification.

RS-422 serial line using five wires and RJ45 connector

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.



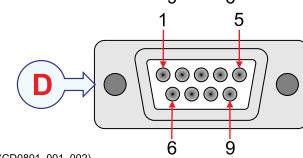
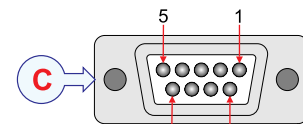
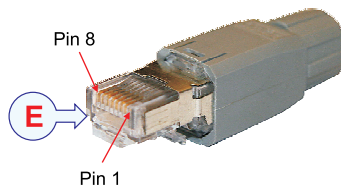
A *Local connection*

B *Connection on peripheral device*

C *Female 9-pin D-connector*

D *Male 9-pin D-connector*

E *RJ45 connector*



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

Minimum cable requirements

- **Conductors:** 2 x 4 x 0.5 mm²
- **Screen:** Overall braided
- **Voltage:** 60 V
- **Maximum outer diameter:** Defined by the plugs

If you need to install a very long serial line cable, increase the cross section.

1PPS (One pulse per second) 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.

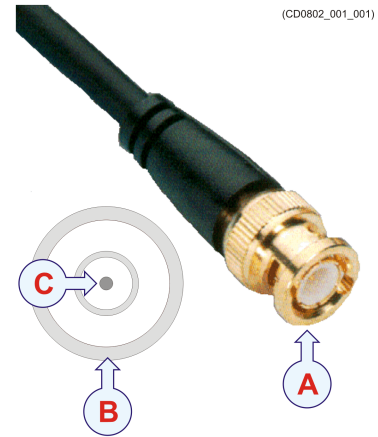
The 1PPS (one pulse per second) signal is normally provided by a positioning system.

This is an optically isolated connection that requires approximately 10 mA current. The input power and the resistor value must be adjusted accordingly.

The 1PPS (one pulse per second) signal is connected to the coax connector on the CBMF board.

The CBMF board is equipped with an optocoupler at this input. The input series resistor is tuned for a TTL signal (Low level < 0.6 V, High level > 3.2V). It can be selected in SIS whether the falling edge or the rising edge of the signal is used by the Processing Unit to synchronise the internal clock.

The 1PPS signal must be minimum 1 microsecond long.



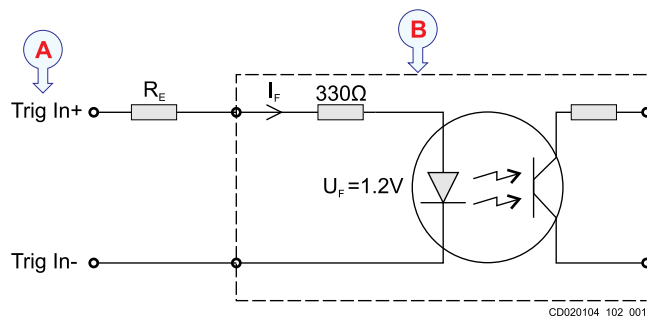
Optical isolated input signals

- A *Input from external system*
- B *Processing Unit input circuitry*

The input current must be approximately 10 mA. Depending on your input signal additional resistance must be applied to achieve the required input current. Two examples are shown to clarify.

Example:

$$I_F = \frac{4.5V - 1.2V(U_F)}{330} \quad 10mA$$



Using +4.5V input signal the input current will be as required (~10mA). No additional resistance required.

Example:

$$R_{TOT} = \frac{12V - 1.2V(U_F)}{10mA} = \frac{10.8}{0.010} = 1080$$

$$R_E = 1080 - 330 = 750$$

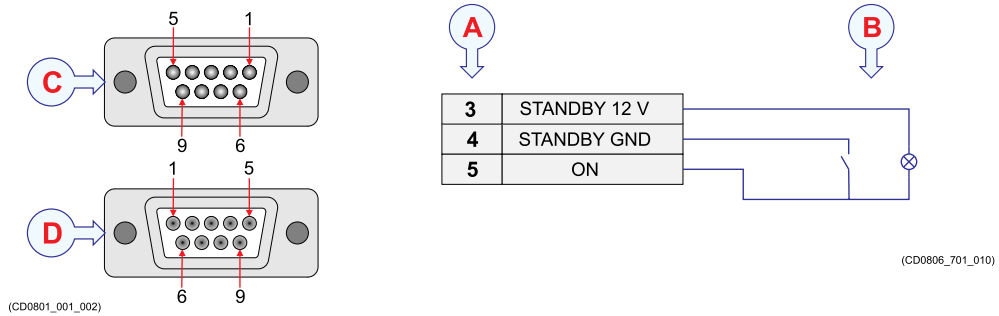
An added resistor of 750Ω and minimum 0.1 Watt must be used.

Note

The input signals must not be negative, i.e. no RS-232 signals can be used for these inputs.

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

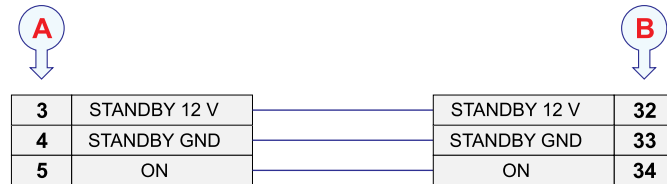
Minimum cable requirements

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

This cable must be provided by the installation shipyard.

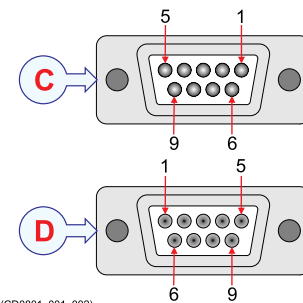
Remote Control using K-Rem

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



(CD0801_001_002)

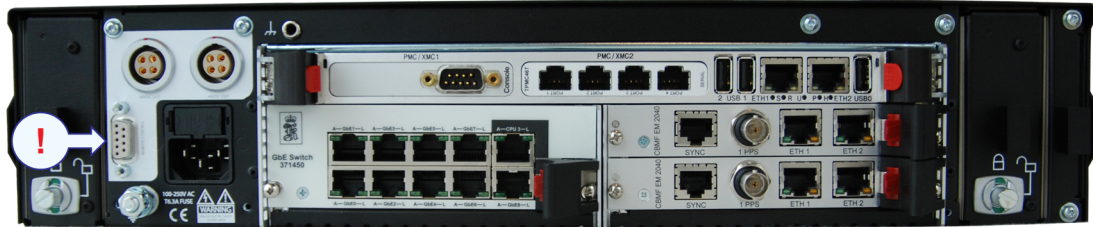
Minimum cable requirements

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

This cable must be provided by the installation shipyard.

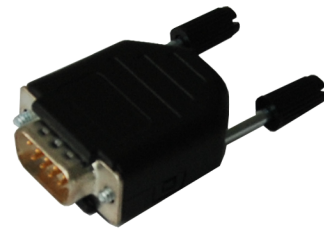
Dummy plug for not using remote control

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.

External synchronisation input/output

When multiple echo sounders are employed on a vessel it is essential to optimize the timing of the transmitting of each system. The Kongsberg Maritime K-Sync Synchronising Unit provides highly configurable timing.

The EM 2040C provides the following synchronisation signals:

EM 2040C external synchronisation signal characteristics		
Signal	Type	Active
Ready To Transmit (output)	Open collector output from isolation unit	High
Trig out (output)	Open collector output from isolation unit	Low
Trig in (input)	Optical isolated input	High

- **Ready To Transmit:** This is an output signal from the EM 2040C to the synchronisation system that goes active when the EM is ready to transmit. The signal is inactive when the echo sounder is transmitting, receiving or processing samples.
- **Trig out:** The EM 2040C issues a trig out signal. The trig out signal starts before the first transmit pulse and is terminated after the end of the last transmit pulse. For EM 2040C all pulses in one swath are transmitted simultaneously. With dual swath, two pulses are transmitted in sequence. The length of this trig signal is 0.7 ms plus the total TX signal length. For CW pulses the actual TX pulse is 1.5 times the nominal pulse length (because of amplitude tapering).

Reference to the Raw range and angle 78 datagram:

The transmit time for the TX pulse is referred to the centre of the pulse.

The total length of the TX pulse is given in the datagram (Signal length).

The time delay from the leading edge of the trig out pulse to the centre of the first TX pulse is:

– $506 \text{ us} + 0.5 * \text{signal length}$.

Example of signal length (200 kHz, Normal sector):

- Short CW: 101 μs
- Medium CW: 288 μs
- Long CW: 865 μs
- Short FM: 3 ms
- Long FM: 12 ms

- **Trig in:** The EM 2040C can be triggered by an external signal that will cause the echo sounder to ping. The **CBMF** board is equipped with an optocoupler at this input. The input series resistor is tuned for a TTL signal (Low level < 0.6 V, High level > 3.2 V). There is a delay from the external trig signal is received to the start of the transmit pulse (Trig out). This is caused by signal processing in the TX transducer (pitch stabilization, focus range etc).

The delay is minimum 1.5 ms and depends on the number of transmit pulses per ping (to optimize pitch stabilization). This means that the delay depends on ping mode (frequency), sector mode and swath mode (single/dual).

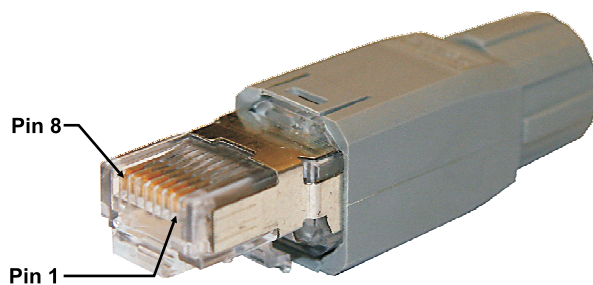
External Synchronisation cable

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.

This is an optically isolated connection that requires ~10mA current. Input power and resistor value must be adjusted accordingly.

The connector is RJ45 type.

This cable must be provided by the installation shipyard.



1	Trig out +
2	Trig out -
3	DGND
4	Trig in +
5	Trig in -
6	DGND
7	RTT +
8	RTT -

(CD0806_701_001)

Pin 3 and 6 is used by Kongsberg Maritime only.

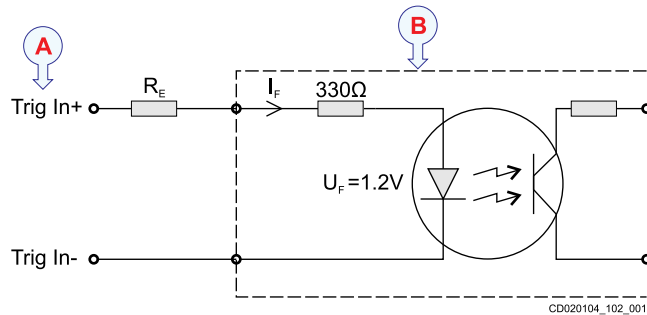
Minimum cable requirements

- **Conductors:** 1
- **Screen:**
- **Voltage:**
- **Maximum outer diameter:**

Optical isolated input signals

- A *Input from external system*
- B *Processing Unit input circuitry*

The input current must be approximately 10 mA. Depending on your input signal additional resistance must be applied to achieve the required input current. Two examples are shown to clarify.



Example:

$$I_F = \frac{4.5V - 1.2V(U_F)}{330} = 10mA$$

Using +4.5V input signal the input current will be as required (~10mA). No additional resistance required.

Example:

$$R_{TOT} = \frac{12V - 1.2V(U_F)}{10mA} = \frac{10.8}{0.010} = 1080$$

$$R_E = 1080 - 330 = 750$$

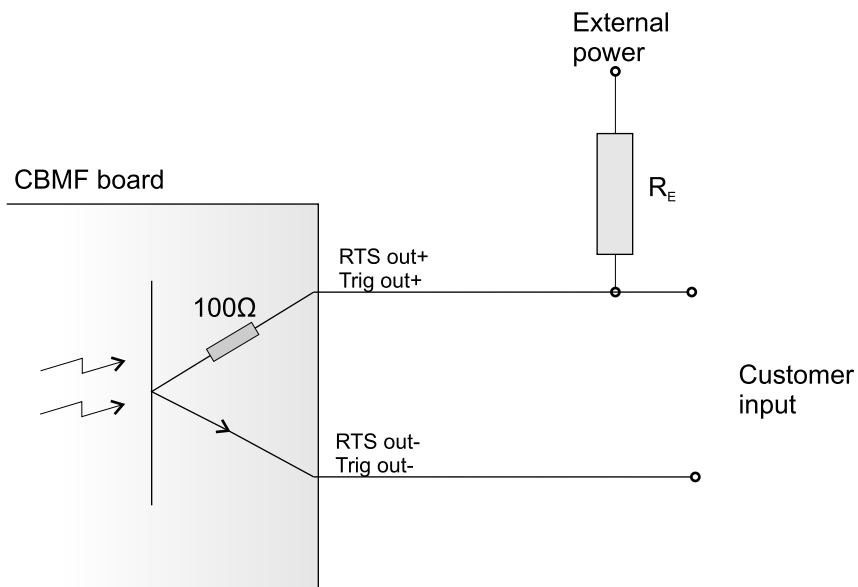
An added resistor of 750Ω and minimum 0.1 Watt must be used.

Note

The input signals must not be negative, i.e. no RS-232 signals can be used for these inputs.

Optical isolated output signals

The collector current must be approximately 10 mA. A resistor must be used to tune the collector current depending on your voltage.



cd020104_102_002

Power	Resistor value	Minimum effect
5 V	0.38 kΩ	0.1 W
12 V	1.08 kΩ	0.15 W
24 V	2.28 kΩ	0.25 W

Note

To avoid ground loops and damage of the EM 2040 electronics caused by external connections, all connections are optically isolated.

Drawing file

Topics

[Sonar head dimensions \(low profile connector\), page 66](#)

[Sonar head dimensions \(round connector\), page 67](#)

[Processing Unit dimensions, page 68](#)

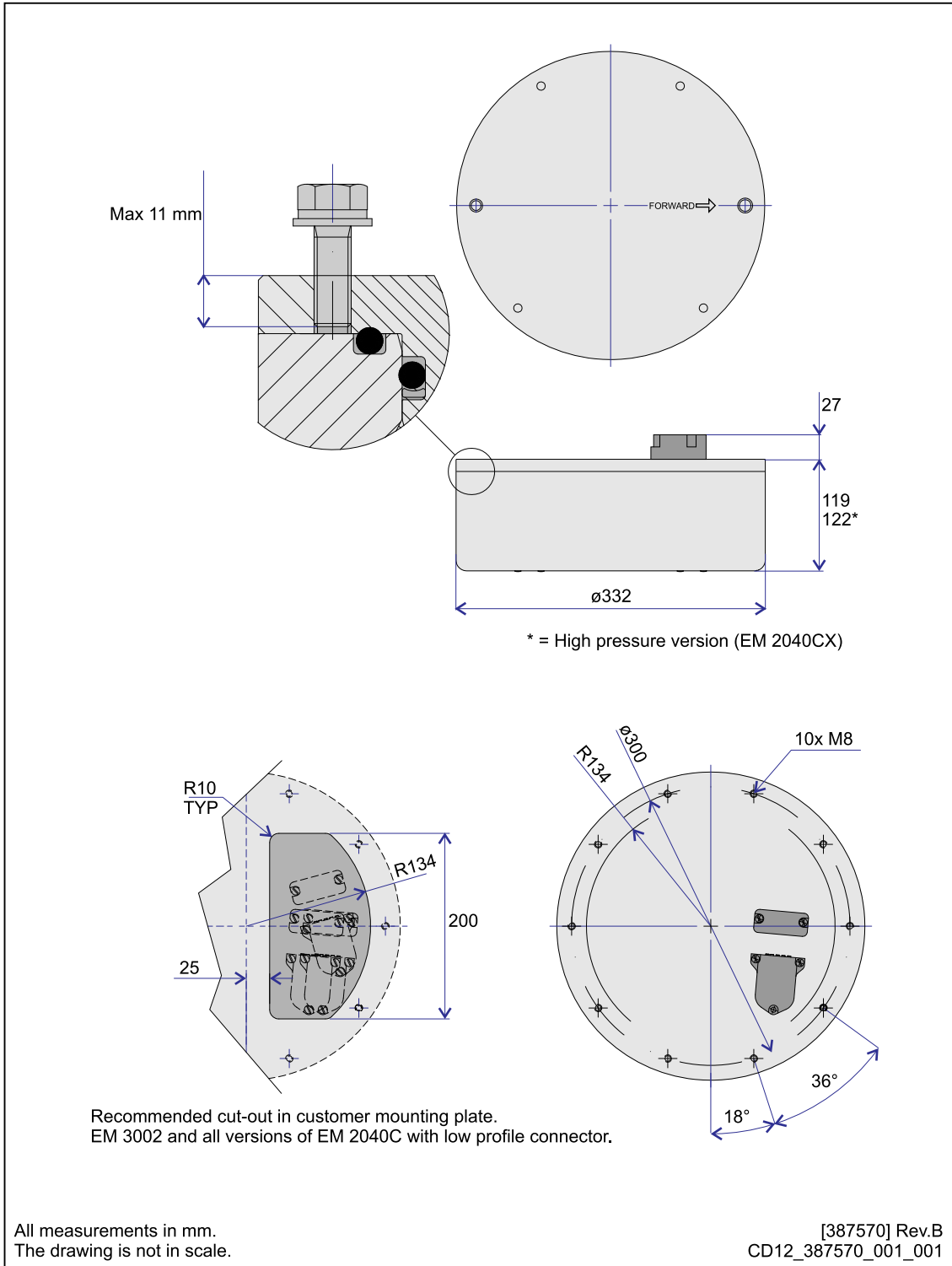
[Hydrographic Work Station outline dimensions, page 69](#)

[Remote Control Unit \(K-REM\) outline dimensions, page 71](#)

[Remote Control Unit \(K-REM\) wiring diagram, page 73](#)

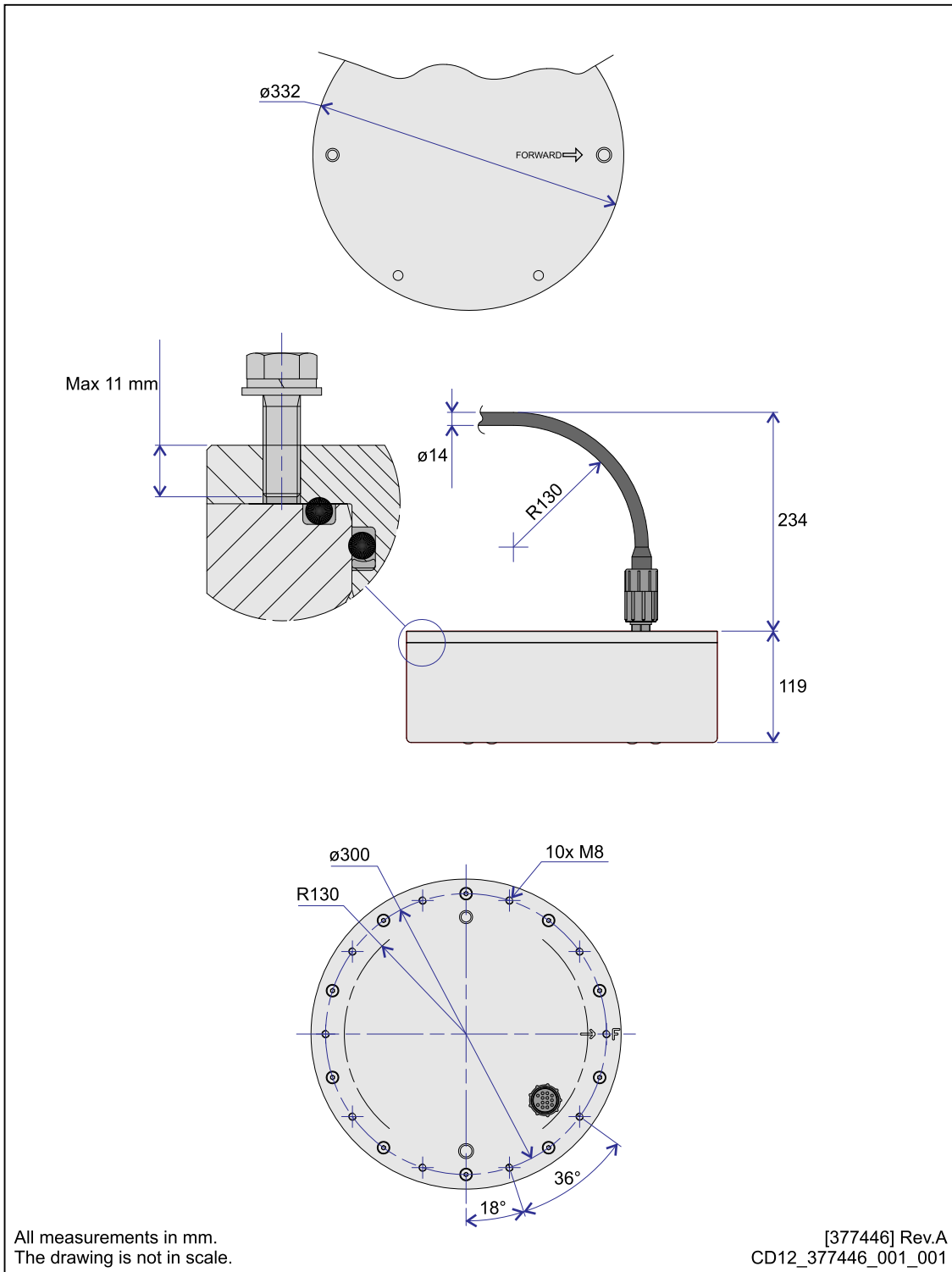
Sonar head dimensions (low profile connector)

Drawing 387570



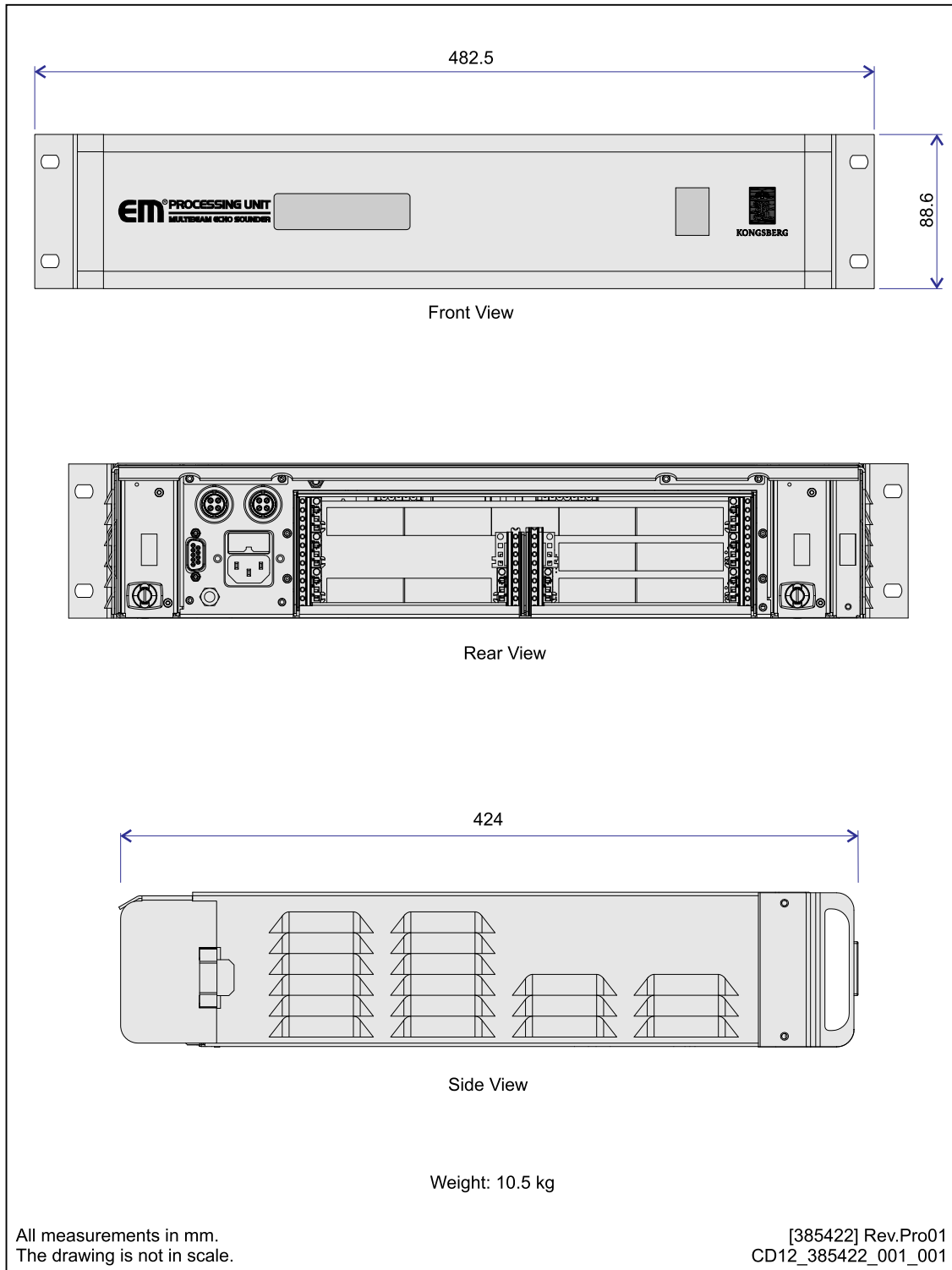
Sonar head dimensions (round connector)

Drawing 377446



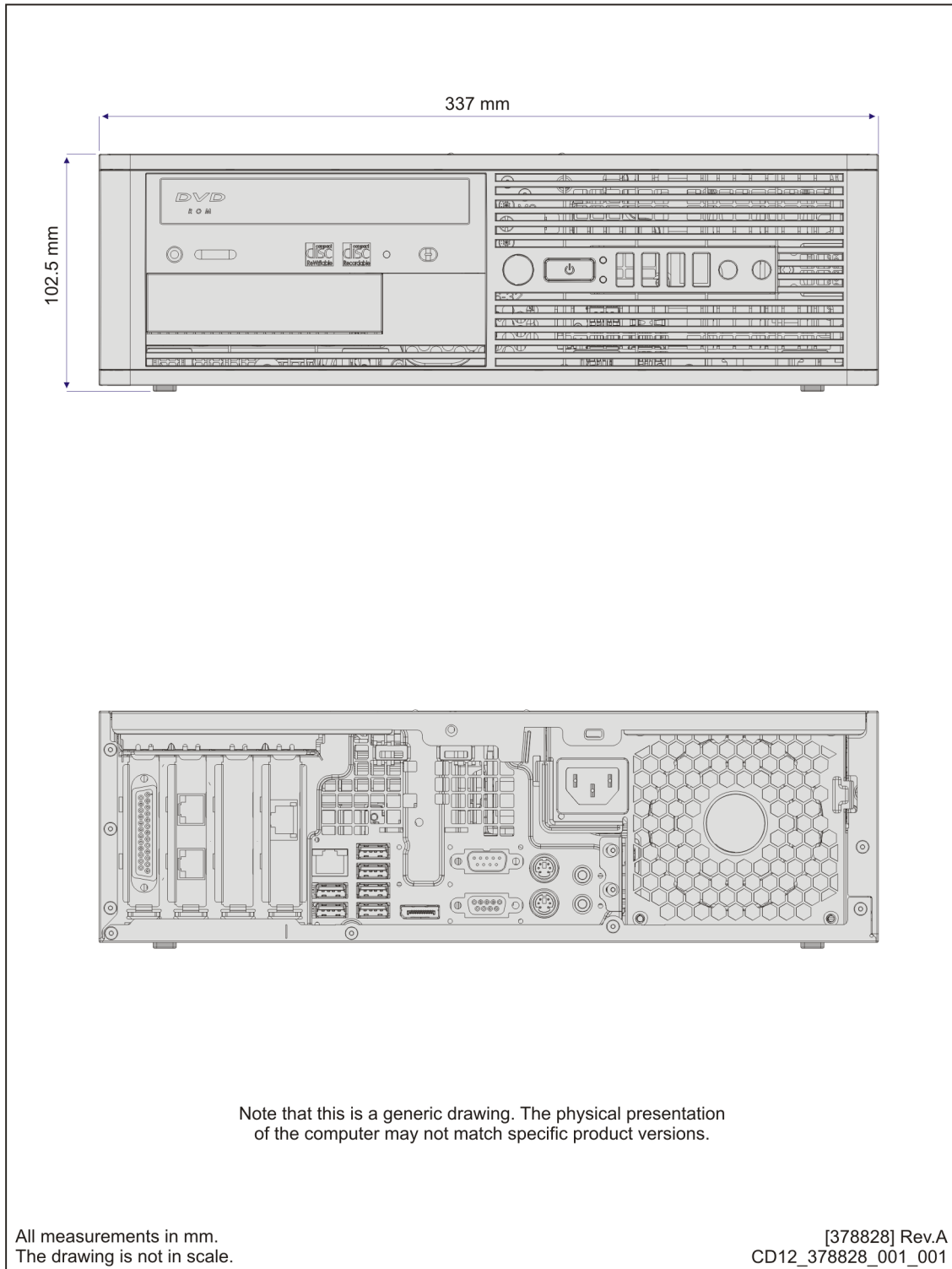
Processing Unit dimensions

Drawing 385422



Hydrographic Work Station outline dimensions

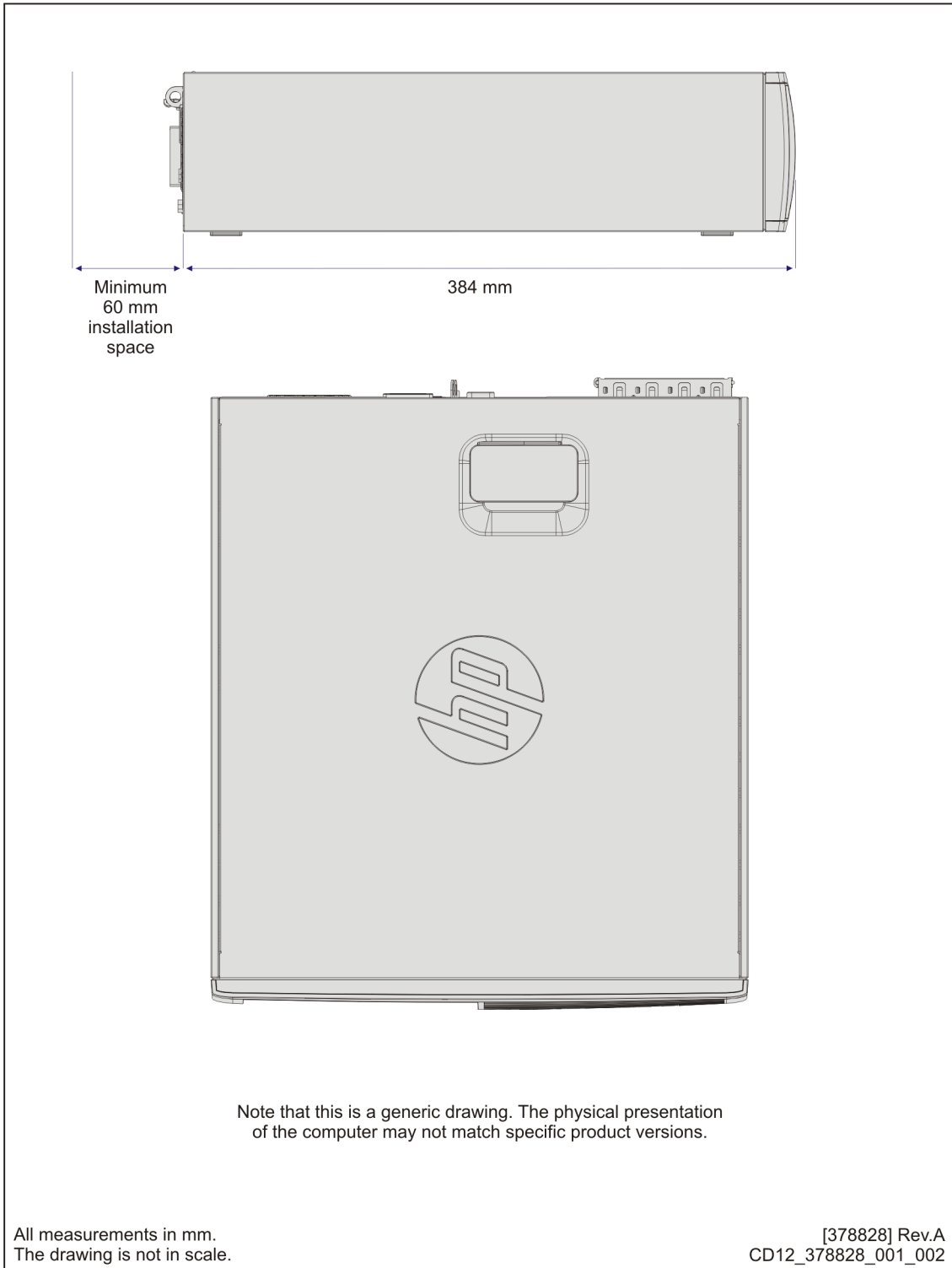
Drawing 378828 (2 pages)



Note that this is a generic drawing. The physical presentation of the computer may not match specific product versions.

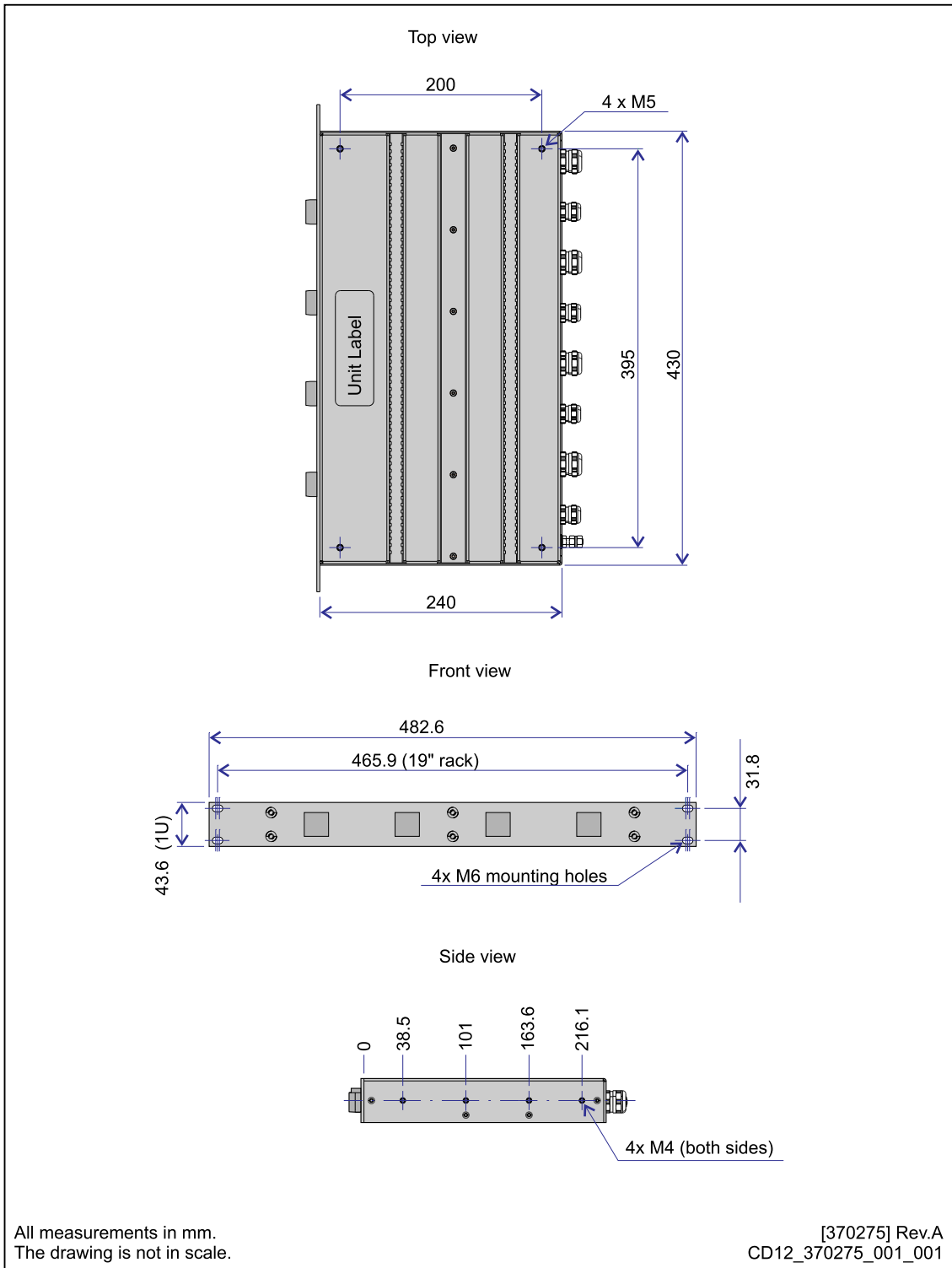
All measurements in mm.
The drawing is not in scale.

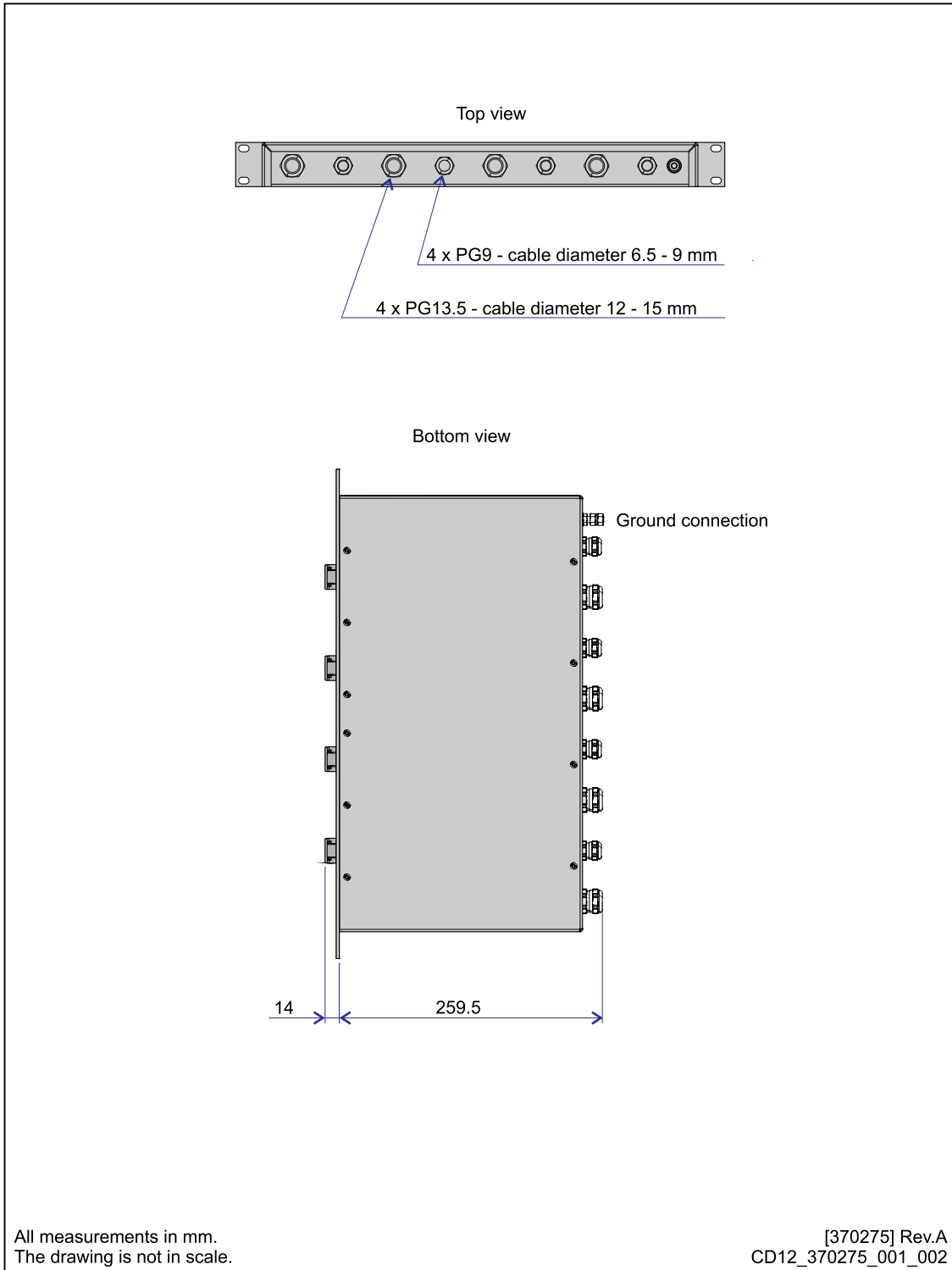
[378828] Rev.A
CD12_378828_001_001



Remote Control Unit (K-REM) outline dimensions

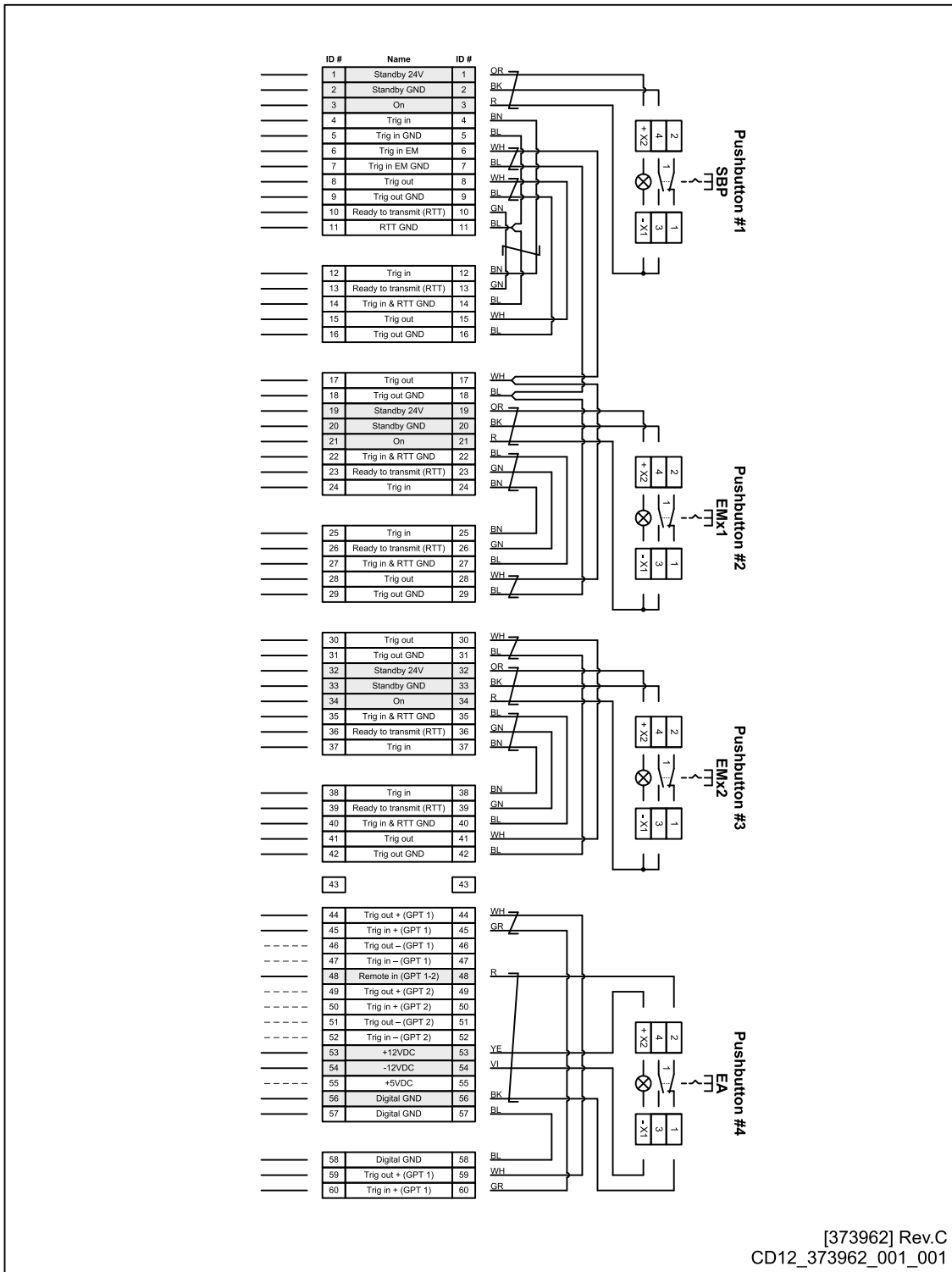
Drawing 370275 (2 pages)





Remote Control Unit (K-REM) wiring diagram

Drawing 373962



[373962] Rev.C
CD12_373962_001_001

Technical specifications

Topics

[Performance specifications, page 75](#)

[Interface specifications, page 77](#)

[Weights and outline dimensions, page 81](#)

[Power requirements, page 83](#)

[Environmental requirements, page 84](#)

Performance specifications

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

- **Frequency range:** 200 to 400 kHz
- **Operator selectable frequencies:** 200 to 400 kHz in 10 kHz steps
- **Maximum detected depth:**
 - EM 2040C: Limited to 600 m relative to the surface
 - EM 2040CX: Limited to 600 m relative to Sonar Head face.
- **Minimum detected depth:** 0.5 m
- **Maximum ping rate:** 50 Hz
- **Number of soundings per ping:**
 - Single head: Up to 800 (400 per swath)
 - Dual head: Up to 1600 (400 per swath)
- **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 at 300 kHz:** 204.5 dB re 1 μ Pa at 1 m
- **RX beam spacing:**
 - Equiangular
 - Equidistant
 - High density
- **Coverage sector, single head:**
 - **200 to 320 kHz:** up to 130 degrees
 - **350 kHz:** 100 degrees
 - **400 kHz:** 70 degrees
- **Coverage sector, dual head:**
 - **200 to 320 kHz:** 200 degrees
 - **350 kHz:** 170 degrees
 - **400 kHz:** 140 degrees
- **Transmit beam steering:** Stabilised for pitch (+/- 10 degrees)
- **Receive beam steering:** Stabilised for roll (+/- 15 degrees)
- **Yaw stabilized beams:** +/- 10 degrees, for dual head only

- **Range resolution (defined as $cT/2$):** 18.8 mm at 25 μ s pulse
- **Pulse length (CW):** 25 – 600 μ s (1700 μ s with FM disable)
- **Pulse length (FM):** Up to 12 ms
- **Output sampling rate:** Up to 61 kHz (15 mm)

Table 1 Max depth and coverage, EM 2040C, cold ocean water

Operating frequency	Max depth	Max coverage across	
		Single head	Dual head
200 kHz	520 m	570 m	690 m
300 kHz	450 m	525 m	625 m
350 kHz	400 m	475 m	570 m
400 kHz	350 m	350 m	500 m

Note _____

The calculated coverage (in FM mode) is based on $NL=45$ dB. Backscatter strength used is $BS=-10$ dB.

Interface specifications

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

These datagram formats are 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

The EM 2040C supports the following datagram formats for vessel heading information.

These datagram formats are received using a serial communication line.

- **NMEA HDT**

The NMEA HDT datagram provides the true vessel heading. This is normally information from 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

The EM 2040C 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.

This datagram format is received using an Ethernet (LAN) line.

- **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

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

These datagram formats are received using a serial communication line.

- **Kongsberg EM Attitude 3000**

Kongsberg 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. The datagram contains a 10-bytes long message.

- **MK-39 MOD2**

This is a third party proprietary datagram format for roll, pitch and heading. It was created by Sperry Marine (<http://www.sperrymarine.com>). This format does not include heave.

Supported datagram formats for motion with velocity

The EM 2040C 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.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 2040C system.

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

Sonar head EM 2040C

- **Outline dimensions:**
 - **Diameter:** 332 mm
 - **Height:** 119 mm
 - **Volume:** 10.3 litres
- **Weight:**
 - **In air:** 18.8 kg
 - **In water:** 8.4 kg

Sonar head EM 2040CX

- **Outline dimensions:**
 - **Diameter:** 332 mm
 - **Height:** 122 mm
 - **Volume:** 10.6 litres
- **Weight:**
 - **In air:** 26.1 kg
 - **In water:** 15.5 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

Hydrographic Work Station

- **Manufacturer:** Hewlett Packard
(<http://www.hp.com>)

- **Model:** HP8300H

The standard computer from Hewlett Packard has been configured to fit the operational requirements of the EM 2040C.

- **Outline dimensions:**

- **Depth:** 384 mm
- **Width:** 337 mm
- **Height:** 102.5 mm

- **Weight:** approximately 8 kg

Display

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

Power requirements

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

Note

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

Sonar head EM2040C

- **Supply voltage:** 48 VDC \pm 10%, normally supplied by the Processing Unit
- **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:**
 - PU with one CBMF board, without sonar head: 115 W
 - PU with two CBMF boards, without sonar head: 125 W
 - PU with one sonar head (pinging): 160 W
 - PU with one sonar head (pinging with long FM pulse): 175 W

Hydrographic Work Station

- **Manufacturer:** Hewlett Packard
(<http://www.hp.com>)
- **Model:** HP8300H
The standard computer from Hewlett Packard has been configured to fit the operational requirements of the EM 2040C.
- **Voltage requirement:** 110/220 Vac, 40/60 Hz, autosensing
- **Power consumption:** Approximately 150 W

Display

- **Manufacturer:** ISIC A/S
(<http://www.isic-systems.com>)
- **Model:** DuraMON WS 24
- **Voltage requirement:** 90 to 264 Vac / 50 to 60 Hz
- **Power consumption:** Approximately 25 W

Environmental requirements

The environmental specifications summarize the temperature and humidity requirements for the Kongsberg EM 2040C system.

Sonar head EM2040C

- **Operational temperature:** -5 to +40 °C
- **Storage temperature:** -10 to +60 °C
- **Depth rating:**
 - EM2040C: 50 m
 - EM2040CX: 1500 m

Processing Unit

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

Hydrographic Work Station

- **Manufacturer:** Hewlett Packard
(<http://www.hp.com>)
- **Model:** HP8300H
The standard computer from Hewlett Packard has been configured to fit the operational requirements of the EM 2040C.
- **Operational temperature :** 0 to +50 degrees Celcius
- **Storage temperature :** -20 to +70 degrees Celcius
- **Relative humidity :** 5 to 95% relative non-condensing
- **IP rating :** IP22 when mounted with the optional kit for 19 inch rack mount
- **Certificates :**
 - IEC 60945
 - IACS E10

Display

- **Manufacturer:** ISIC A/S
(<http://www.isic-systems.com>)
- **Model:** DuraMON WS 24
- **Operational temperature:** –15 to +55°C
- **Storage temperature:** –25 to +70°C
- **Relative humidity:** 8 to 90% relative non-condensing
- **IP rating**
 - Front: IP65
 - Rear: IP20
- **Certificates:**
 - IEC 60945
 - IACS E10

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 87](#)

[Lifting units and transportation boxes, page 89](#)

[Inspection of units and transportation boxes after arrival, page 91](#)

[Specifications for storage prior to installation or use, page 92](#)

[Unpacking instructions, page 94](#)

[Specifications for storage after unpacking, page 99](#)

[Packing instructions for storage or shipping, page 101](#)

[Storage after use, page 103](#)

[Handling instructions for printed circuit boards and electronic modules, page 106](#)

[Disposal of old products, page 111](#)

[Handling of underwater connectors, page 112](#)

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.

Related topics

[Packing instructions for storage or shipping, page 101](#)

[Circuit board unpacking and handling, page 106](#)

[Lifting units and transportation boxes, page 89](#)

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.

Related topics

[Transporting Kongsberg Maritime equipment, page 87](#)

[Packing instructions for storage or shipping, page 101](#)

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 °Celsius.

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 94](#)

[Unpacking mechanical units, page 95](#)

[Unpacking electronic and electromechanical units, page 96](#)

[Unpacking transducers, page 97](#)

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.

Related topics

[Unpacking mechanical units, page 95](#)

[Unpacking electronic and electromechanical units, page 96](#)

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.

Related topics

[Unpacking standard parts and units, page 94](#)

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.

Related topics

[Unpacking standard parts and units, page 94](#)

Unpacking transducers

Prior to installation or use, 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 °Celsius.

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 $+50^{\circ}\text{C}$.

Packing instructions for storage or shipping

If a unit needs to be packed for storage or shipment, you must whenever possible use its original packing material and/or crate.

Context

In the event that the original packing material is unavailable, observe this basic procedure. It applies to all cabinets, large or small units, and mechanical items.

Note that a dedicated procedure applies for circuit board handling and packaging.

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 °Celsius.

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.

Procedure

- 1 Clean and protect the unit as described in the relevant procedures.
- 2 Place the unit in a suitable cardboard box or wooden crate.
- 3 Make sure that the unit is well be protected against physical damage by means of shock-absorbing insulation mats.
- 4 Take the necessary precautions if the unit must be protected against high or low temperatures, and mark the box accordingly.
- 5 Mark the box clearly to identify its contents.
- 6 Stored the box in a dry and dust-free area.

Related topics

[Transporting Kongsberg Maritime equipment, page 87](#)

[Lifting units and transportation boxes, page 89](#)

[Circuit board unpacking and handling, page 106](#)

[Returning a printed circuit board or an electronic module to Kongsberg Maritime, page 108](#)

[About Electrostatic Discharge \(ESD\), page 109](#)

Storage after use

If a unit is removed from its operating location and placed into storage, it must be properly cleaned and prepared before packing.

Topics

[Cleaning an electronic cabinet or unit, page 103](#)

[Cleaning a mechanical or electromechanical unit, page 104](#)

Cleaning an electronic cabinet or unit

If an electronic cabinet has been exposed to salt atmosphere, it must be thoroughly cleaned both internally and externally to prevent corrosion.

Prerequisites

In order to clean an electronic cabinet or unit, you will need relevant tools and detergents. You will also need some amount of desiccant material.

Procedure

- 1 Wipe off the external surfaces of the unit using a damp lint free cloth and a mild detergent.

Note

Do not use excessive amounts of water. The unit may not be water tight.

- 2 On completion, dry the unit thoroughly.
- 3 Inspect all surfaces for signs of corrosion, flaking, bubbling paint, stains etc.
- 4 Clean damaged or suspect areas, prepare and preserve these areas using the correct preservation mediums.
- 5 Open the unit.
- 6 Use a dedicated vacuum cleaner with an anti static nozzle to remove all dust from inside the unit.

Note

Use extreme care with delicate circuit boards and units. Make sure that these are not damaged in the process.

- 7 Wipe clean all exposed cables, and check for damage.
If a cable shows signs of wear or ageing, contact Kongsberg Maritime for advice.
- 8 Check if the unit contains batteries.
If the unit contains batteries, these may discharge slowly during storage. If the unit is to be stored for an extended period, disconnect or remove all internal batteries.
A suitable piece of insulating material can be placed between the battery and the electrical contacts to prevent electrical discharge. The battery can then remain in the unit, reducing the risk of it being misplaced during the storage period.

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.

- 9 Place a suitably sized bag of desiccant material (silica gel or similar) into the unit to keep the electronic components as dry as possible.
- 10 Close the cabinet firmly before storage and/or shipment.
- 11 Secure and protect loose parts (shock absorbers, plug and sockets, protruding objects etc).
- 12 If the electronic cabinet shall be sent to storage or shipped, spray it externally using a corrosion inhibitor (for example a light oil) prior to packing.

Cleaning a mechanical or electromechanical unit

If an mechanical unit has been exposed to a salt atmosphere, it must be thoroughly cleaned to prevent corrosion.

Prerequisites

In order to clean a mechanical or electromechanical unit, you will need relevant tools and detergents.

Procedure

- 1 Wipe off the external surfaces of the mechanical unit using a damp lint free cloth and a mild detergent.

Note

Do not use excessive amounts of water. The unit may include parts that are not water tight.

- 2 On completion, dry the unit thoroughly.
- 3 Inspect all surfaces for signs of corrosion, flaking, bubbling paint, stains etc.
- 4 Clean damaged or suspect areas, prepare and preserve these areas using the correct preservation mediums.
- 5 Wipe clean all exposed cables, and check for damage.
If a cable shows signs of wear or ageing, contact Kongsberg Maritime for advice.
- 6 Secure and protect loose parts (shock absorbers, plug and sockets, protruding objects etc).
- 7 If the mechanical unit shall be sent to storage or shipped, spray it externally using a corrosion inhibitor (for example a light oil) prior to packing.
- 8 If relevant, place a suitably sized bag of desiccant material (silica gel or similar) into the to storage/transport box to keep the components as dry as possible.

Handling instructions for printed circuit boards and electronic modules

Printed circuit boards and electronic modules are delicate items. They may work year after year in an advanced product, but then fail due to a small spark of static electricity. For this reason, it is very important that they are properly handled and protected during shipping.

Topics

[Circuit board unpacking and handling, page 106](#)

[Returning a printed circuit board or an electronic module to Kongsberg Maritime, page 108](#)

[About Electrostatic Discharge \(ESD\), page 109](#)

Circuit board unpacking and handling

It is very important that printed circuit boards and other electronic modules are handled correctly.

Prerequisites

For correct and safe handling of printed circuit boards and electronic modules, you will need a suitable workbench with an approved conductive service mat. This service mat must be connected directly to a reliable earth point via its earthing cord. You must wear a wristband in direct contact with the skin, and the wristband must be connected to the service mat.

Sensitive printed circuit boards and electronic modules must always be transported and stored in protective antistatic packing bags. The circuit boards and modules must not be transported or stored close to strong electrostatic, electromagnetic or radioactive fields.

Context

Beware of electrostatic discharge (ESD)!

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 Prepare a suitable workbench with a conductive service mat.
- 2 Make sure that you wear a grounded wristband with direct contact with the skin

When you are working on board a vessel, an “approved conductive service mat” is often far away. As you still need to unpack circuit boards, make sure that you do it in the instrument room, or at another location where you have a steel deck.

Note

Keep far away from the bridge or any other rooms with wall-to-wall carpets!

If possible, bring a wristband and ground yourself.

- 3 Lift the circuit board, in its protective antistatic packing bag, out of the transport box.
- 4 Place it in a stable position on the workbench.
- 5 Inspect the unit for damage before you open the plastic bag.
- 6 Do not break the seal to open a printed circuit board or electronics module package before the item shall to be used.

Important

If the package is returned with the seal broken, we will assume that the content has been used. You will then be billed accordingly.

- 7 Assuming all is well, open the bag and remove the unit.
- 8 Take out and keep the documentation.
You will need the documentation if the circuit board or module shall be returned to us.
- 9 Remove any packing and desiccant material that may be inside.
- 10 Keep the protective antistatic packing bag for future use.

Related topics

[Transporting Kongsberg Maritime equipment, page 87](#)

[Packing instructions for storage or shipping, page 101](#)

[Returning a printed circuit board or an electronic module to Kongsberg Maritime, page 108](#)

[About Electrostatic Discharge \(ESD\), page 109](#)

Returning a printed circuit board or an electronic module to Kongsberg Maritime

If you wish to return a printed circuit board or an electronic module to us – either operational or defective – certain rules apply.

Prerequisites

For correct and safe handling of printed circuit boards and electronic modules, you will need a suitable workbench with an approved conductive service mat. This service mat must be connected directly to a reliable earth point via its earthing cord. You must wear a wristband in direct contact with the skin, and the wristband must be connected to the service mat.

Sensitive printed circuit boards and electronic modules must always be transported and stored in protective antistatic packing bags. The circuit boards and modules must not be transported or stored close to strong electrostatic, electromagnetic or radioactive fields.

Context

Beware of electrostatic discharge (ESD)!

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.

Note

Failure to follow these rules may result in unserviceable circuit boards.

Procedure

- 1 Place the circuit board to be returned in the same protective antistatic packing bag as you originally received it in - or in a protective bag of similar electrostatic discharge (ESD) protection quality.

Note

DO NOT use standard plastic bags, such as commercial bubble wrap.

- 2 Fill in all the necessary information on the applicable documentation and place it inside the bag.
- 3 Seal the bag.
- 4 Place the circuit board in a suitable carton, and secure it for shipping.

Related topics

[Packing instructions for storage or shipping, page 101](#)

[Circuit board unpacking and handling, page 106](#)

[About Electrostatic Discharge \(ESD\), page 109](#)

About Electrostatic Discharge (ESD)

Electrostatic discharge (ESD) is the sudden flow of electricity between two electrically charged objects. Such flow can be caused by contact, an electrical short, or dielectric breakdown. ESD can cause serious damage to printed circuit boards and electronic modules.

Beware of Electrostatic Discharge (ESD)!

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.

For correct and safe handling of printed circuit boards and electronic modules, you will need a suitable workbench with an approved conductive service mat. This service mat must be connected directly to a reliable earth point via its earthing cord. You must wear a wristband in direct contact with the skin, and the wristband must be connected to the service mat.

What is Electrostatic Discharge (ESD)?

Electrostatic Discharge (ESD) is the transfer of an electrostatic charge between two bodies at different electrostatic levels, caused either by direct contact or induction by an electrostatic field.

The passing of a charge through an electronic device can cause local overheating, and it can also “puncture” insulating layers within the structure of the device. This may deposit a conductive residue of the vaporized metal on the device, and thus create a short circuit.

This may result in a failures or degraded performance of the device.

ESD can create spectacular electric sparks (thunder and lightning is a large-scale ESD event), but also less dramatic forms which may be neither seen nor heard, yet still be large enough to cause damage to sensitive electronic devices. Electric sparks require a field strength above approximately 4 kV/cm in air, as notably occurs in lightning strikes. Other forms of ESD include corona discharge from sharp electrodes and brush discharge from blunt electrodes.

ESD can cause a range of harmful effects of importance in industry, including gas, fuel vapour and coal dust explosions, as well as failure of solid state electronics components such as integrated circuits. These can suffer permanent damage

when subjected to high voltages. Electronics manufacturers therefore establish electrostatic protective areas free of static, using measures to prevent charging, such as avoiding highly charging materials and measures to remove static such as grounding human workers, providing antistatic devices, and controlling humidity.

http://en.wikipedia.org/wiki/Electrostatic_discharge (January 2014)

Precautions to prevent Electrostatic Discharge (ESD)

Sensitive printed circuit boards and electronic modules must always be transported and stored in protective antistatic packing bags. The circuit boards and modules must not be transported or stored close to strong electrostatic, electromagnetic or radioactive fields.

If it is necessary to open and touch the printed circuit board or module inside the protective bag, the following precautions must be taken:

- 1 The working area must be covered by an approved conductive service mat that has a resistance of between 50 k Ω and 2 M Ω , and is connected directly to a reliable earth point via its earthing cord.
- 2 You - and all other service personnel involved - must wear a wristband in direct contact with the skin. The wristband must be electrically connected to the service mat.
- 3 Printed circuit boards and electronic modules must be placed on the conductive service mat during installation and maintenance operations.
- 4 If, for any reason, it is necessary to move the circuit board from the conductive service mat, it must be placed in an approved antistatic transportation container (for example a static shielding bag) before transportation.
- 5 During installation and servicing, all electrical equipment (for example soldering irons and test equipment) must be earthed.

Related topics

[Packing instructions for storage or shipping, page 101](#)

[Circuit board unpacking and handling, page 106](#)

[Returning a printed circuit board or an electronic module to Kongsberg Maritime, page 108](#)

Disposal of old products

At the end of the product lifetime, all Kongsberg Maritime products must be disposed of in an environmentally-friendly way.

All electrical and electronic components must be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or local authorities. The correct disposal and separate collection of your old appliance will help prevent potential negative consequences for the environment and human health. This is a precondition for reuse and recycling of used electrical and electronic equipment. For more detailed information about disposal of your old appliance, please contact your local authorities or waste disposal service.

All disposal of mechanical, electromechanical, electronic and chemical waste - including all types of batteries - must take place according to national and international rules and regulations. Observe the relevant Waste Electrical and Electronic Equipment (WEEE) regulations.

Product recycling service

Kongsberg Maritime offers a product recycling service. The service is described on our website.

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

Observe the following path: **Products**→**Services**→**Product recycling**.

We accept all Kongsberg Maritime products for recycling free of charge. The cost of having products removed, packed and delivered to a Kongsberg Maritime registered company location is, however, not covered by us. Prior to returning any material please contact us for information about a relevant return address and procedure for your product.

Kongsberg Maritime has implemented and maintains an environmental management system in accordance with NS-EN ISO 14001:2004.

Handling of underwater connectors

Correct handling of the underwater connectors is very important to avoid any leakage and corrosion problems to the EM 2040C transducers.

Important

You must follow these instructions carefully to ensure correct use of your SubConn® underwater connectors.

- 1 Disconnect the connector by pulling it straight out, not at an angle. Do not pull the cable, and avoid sharp cable bends.
- 2 The connectors must not be exposed to long periods of heat or direct sunlight. If a connector becomes very dry, it should be soaked in fresh water before use.
- 3 General cleaning and removal of any accumulated sand or mud on a connector should be performed using spray based contact cleaner (isopropyl alcohol). New grease must be applied again prior to mating.
- 4 Always apply grease before mating.

Greasing and mating above water (dry mate):

- a Connectors must be greased with Molykote® 44 Medium before every mating.
- b A layer of grease corresponding to minimum 1/10 of socket depth should be applied to the female connector.
- c The inner edge of all sockets should be completely covered, and a thin transparent layer of grease left visible on the face of the connector.
- d After greasing, fully mate the male and female connector in order to secure optimal distribution of grease on pins and in sockets.
- e To confirm that grease has been sufficiently applied, de-mate and check for grease on every male pin. Then re-mate the connector.

Greasing and mating under water (wet mate):

- a Connectors must be greased with Molykote® 44 Medium before every mating.
- b A layer of grease corresponding to approximately 1/3 of socket depth should be applied to the female connector.
- c All sockets should be completely sealed, and transparent layer of grease left visible on the face of the connector.
- d After greasing, fully mate the male and female connector and remove any excess grease from the connector joint.

The recommendations from the manufacturer of the underwater connectors may be subject to change without prior notice. Please refer to the manufacturers website for updated information.

- <http://www.macartney.com>

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 2040C 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 2040C 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 2040C 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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