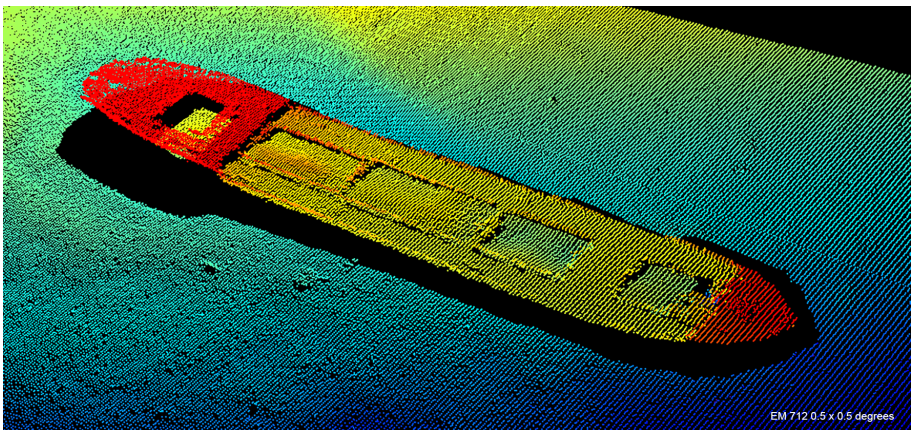
KONGSBERG

Kongsberg EM 712
Multibeam echo sounder
Maintenance Manual



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- **Document**: Maintenance Manual
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- **Revision**: B
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Warning

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

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

Disclaimer

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

Support information

If you require maintenance or repair, contact Kongsberg Maritime's support organisation. You can also contact us using the following address: km.hydrographic.support@kongsberg.com. If you need information about our other products, visit https://www.kongsberg.com/maritime.

Table of contents

About this manual

The purpose of this manual is to present the descriptions and drawings required to do basic maintenance tasks on the EM 712 Multibeam echo sounder . The equipment described in this manual includes the complete system with associated cabinets, but not those system units provided locally by the customer, installation shipyard or local dealer.

Target audience

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

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

Online information

All relevant end-user documentation provided for your EM 712 can be downloaded from our website.

- https://www.kongsberg.com/maritime/

Our website also provides information about other Kongsberg products.

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

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Kongsberg EM 712

Topics

System description

The EM 712 multibeam echo sounder is a high to very high resolution seabed mapping system.

The EM 712 multibeam echo sounder is capable of meeting all relevant survey standards. The system configuration can be tailored to the user requirements, allowing for choice of beamwidths as well as transmission modes. The minimum acquisition depth is from less than 3 m below its transducers, and the maximum acquisition depth is up to 3600 m.

The EM 712 replaces the EM 710. EM 712 is built with new, state of the art technology.

By increasing the frequency range from 70-100 kHz to 40-100 kHz, the range performance is greatly improved. The transmit transducer arrays are the same, while the receive arrays has got a built in preamplifier. The preamplifier reduces the electronic self noise and this gives extended range capability as long as the external noise (ships noise, flow noise , sea-state) is low. The EM 712 receiver can be configured for 0.5°, using two receiver modules. For upgrade from EM 710 to EM 712, the TX and RX frames plus the transmit array(s) can be reused.

Acrosstrack coverage (swath width) is up to 5.5 times water depth and the maximum achievable depth is 3600 m. The sounding density is very high, allowing even the very demanding LINZ special order survey specification for object detection to be met in full.

There are three basic versions of the EM 712:

- EM 712 - Full performance version
- EM 712S (shallow) - Continuous wave (CW) pulse forms only
- EM 712RD (reduced depth) - Short CW pulse only, restricted to 600 m water depth.

The reduced performance versions EM 712S and EM 712RD can be upgraded to full performance.

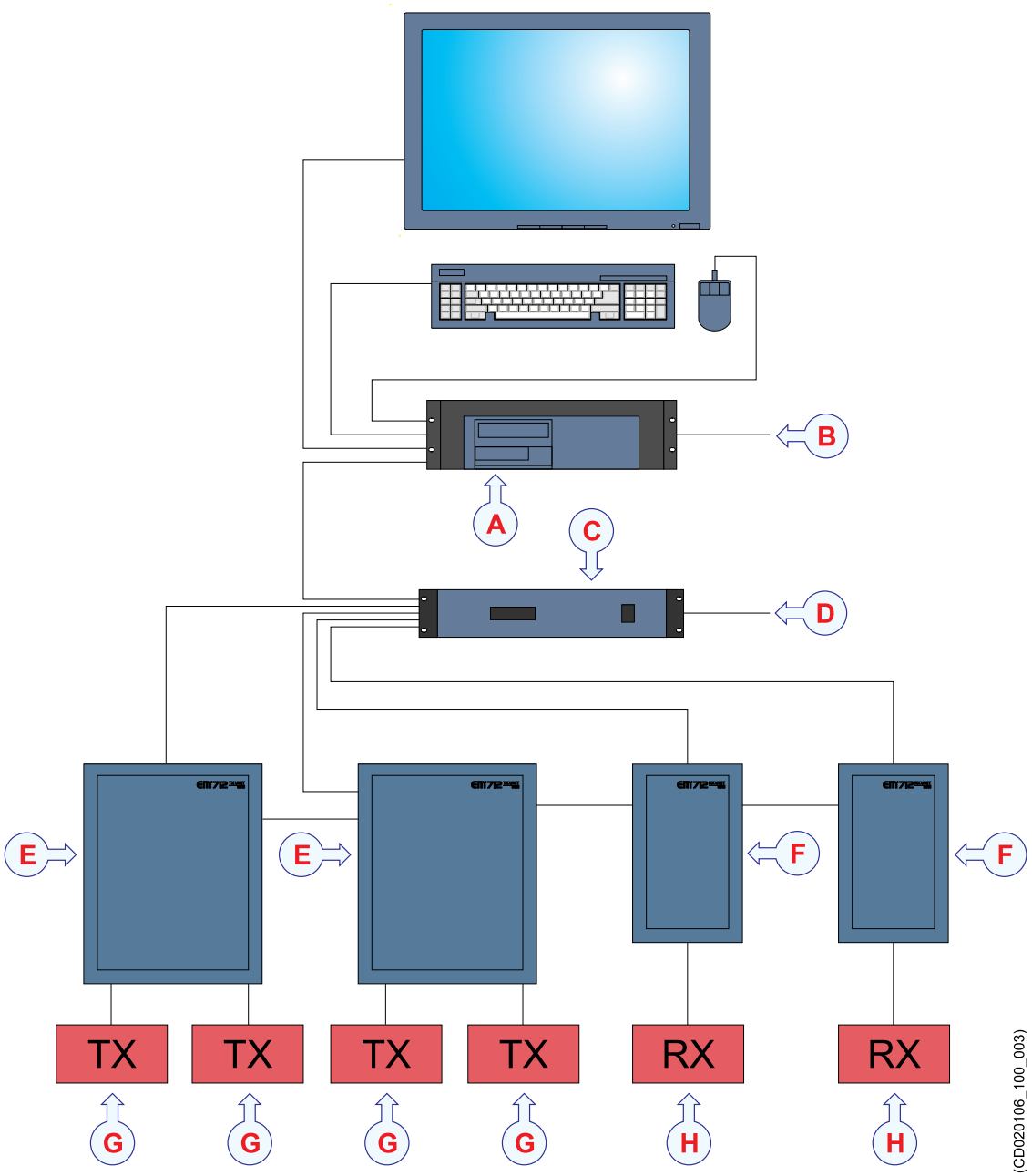
EM 712B, upgrade from EM 710

With EM 712B it is possible to upgrade EM 710 to EM 712 without replacing the transducer modules.

To achieve this we have made a separate Receiver Unit scientifically tailored for use with the EM 710 receive transducers. The EM 712B Receiver Unit has the same measurements and weight as the regular Receiver Unit, but performs the preamplification in the Receiver Unit instead of in the receive transducer.

System diagram - 0.25° x 0.5° system

The system diagram identifies the main components of a basic EM 712 system. Only the main connections between the units are shown. Detailed interface capabilities and power cables are not shown.



A *Hydrographic Work Station*

B *Interfaces:*
- *Sound speed sensor*
- *Tide*
- *Centre depth output*

C *Processing Unit*

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

E *Transmitter Unit*

F *Receiver Unit*

G *Transmit transducer module*

H *Receive transducer module*

System units

Topics

Transducer description

A transducer is a device that converts one form of energy to another. In an echo sounder system the transducer converts between electric energy and sound.

The EM 712 uses separate transducer arrays for transmitting and receiving sound pulses. Both transducer arrays can have one or more modules which are assembled in mounting frames.

The EM 712 transducer modules are available in an ice reinforced version. For more information, contact Kongsberg Maritime.

The two transducer arrays are normally mounted as “T” or “L” configurations under the vessel’s hull (Mills Cross configuration). The transmit transducer array should be aligned parallel to the vessel’s keel. The receiver transducer array should be aligned 90 ° on the keel. Both transducer arrays should be horizontal on a plane on the keel.

Processing Unit description

The EM 712 Processing Unit is provided to process the signals to and from the Transmitter and Receiver Units.

The EM 712 Processing Unit is an industrial computer using both COTS (commercial off-the-shelf) components and custom made components. The unit is designed and tested for rugged use.

The Processing Unit performs the receiver beamforming, bottom detection, and motion and sound speed corrections. It contains all interfaces for time-critical external sensors such as vessel attitude (roll, pitch, heading and heave), vessel position and external clock. More than one sensor of each type may be connected simultaneously, with one in use and all of them logged.

The Processing Unit controls the Transmitter and Receiver units via Ethernet communication, and is also interfaced to the Operator station via Ethernet.

The 48 V output from the Processing Unit can be used for remote on/off control of the Transmitter and Receiver Units.

The Processing Unit is normally located in a "sonar room" close to the transducer arrays. The unit can also be placed in the "survey room" or on the bridge.

Transmitter Unit description

The EM 712 Transmitter Unit has all transmit electronics, like control processors, power amplifiers, power supply, capacitor battery and Ethernet interface.

The Transmitter Unit is a wall-mounted steel cabinet with integrated shock and vibration absorbers, designed for bulkhead mounting. One 19 inch sub-rack is contained in the cabinet. The number of circuit boards in the sub-rack will depend on the chosen transducer configuration.

Twisted pair Ethernet is used for data communication with the Processing Unit.

The Transmitter Unit is normally located in a "sonar room" close to the transducer arrays.

For a 0.25° transducer array, two Transmitter Units are used.

Receiver Unit description

The EM 712 Receiver Unit has all receive electronics, like control processor, amplifiers, Analog-to-Digital Converters, power supply and Ethernet interface.

The Receiver Unit is a small wall-mounted steel cabinet with integrated shock and vibration absorbers, designed for bulkhead mounting. The number of circuit boards in the Receiver Unit will depend on the chosen transducer configuration. Twisted pair Ethernet is used for data communication with the Processing Unit.

The Receiver Unit is normally located in a "sonar room" close to the transducer arrays.

For a 0.5° transducer array, two Receiver Units are used.

With EM 712B it is possible to upgrade EM 710 to EM 712 without replacing the transducer modules. To achieve this we have made a separate Receiver Unit scientifically tailored for use with the EM 710 receive transducers. The EM 712B Receiver Unit has the same measurements and weight as the regular Receiver Unit.

Hydrographic Work Station description

The Hydrographic Work Station is the operator station for the EM 712.

A dedicated maritime computer is provided with the EM 712 Multibeam echo sounder . It is set up with all necessary software.

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

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

Troubleshooting

Topics

Tools for troubleshooting

Efficient EM 712 troubleshooting requires a good knowledge of its functionality and design. Specific tools may also be required for certain tasks.

The following tools are relevant for troubleshooting the Kongsberg EM 712 Multibeam echo sounder .

- Built-In Self Test (BIST)
- Analysis of the data presentations made by the EM 712
- Messages
- Visual checks
- Relevant measurements with applicable test instruments
- Test and verification procedures
- Your own knowledge of how the system works

We assume that you are equipped with a standard set of tools. This tool set must comprise the normal tools for electronic and electromechanical tasks. This includes different screwdriver types, pliers, spanners, a cable stripper, a soldering iron, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment.

Note

If one or more special tools are required for a task, these are specified in the relevant procedure.

It is impossible to create a detailed list of all possible errors and error symptoms in the EM 712.

However, key components that fail will in most cases be detected by the tools you have available.

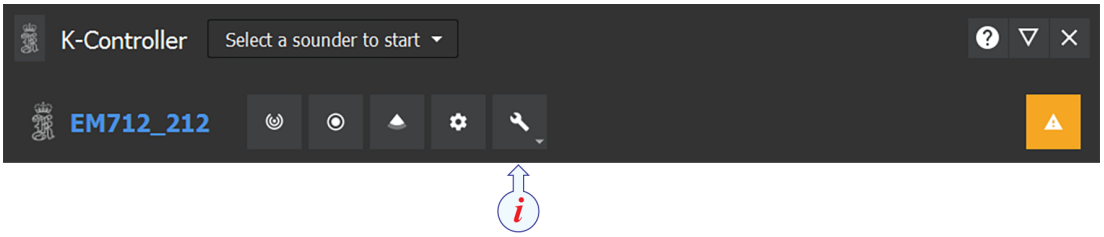
The most important tool is your own knowledge about the EM 712. Based on a list of the main components in the system, brief descriptions of what they do and how they work, including suggested certain symptoms, you may work out the possible solutions.

BIST (Built-In Self Test) dialog box

The **BIST** dialog box provides several automatic tests to check the operation of the echo sounder system.

How to open

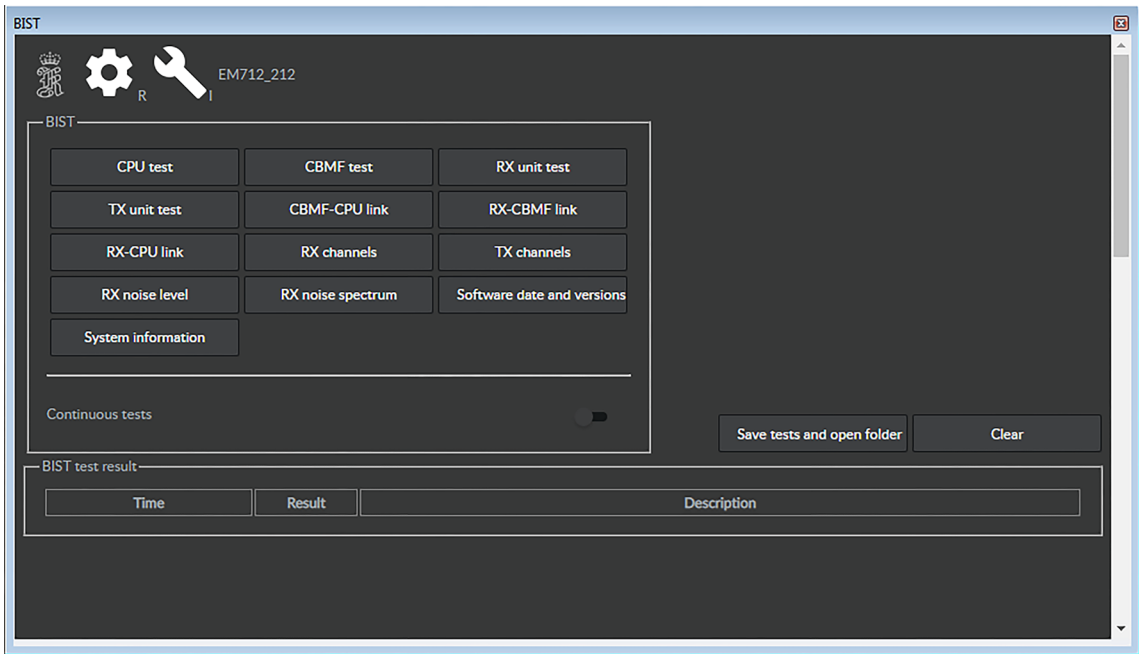
- **SIS**: Select **Installation Parameters** on the **View** menu. Select the **Installation Parameters** icon and select **BIST**.
- **K-Controller**: Select the **Installation Parameters** icon and select **BIST**.



Description

The BIST (Built-In Self Test) options provide a number of automatic tests that may be started to check the operation of the echo sounder system.

Various test are available, depending on what system you have.



Details

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.

CBMF test

This test presents the CBMF board temperature, the internal power supply voltages. In addition software and firmware versions are displayed.

RX unit test

This test presents the internal temperatures and voltages in the receiver electronics. In addition software and firmware versions are displayed.

TX unit test

This test presents the internal temperatures and voltages in the transmitter electronics. In addition software and firmware versions are displayed.

CBMF-CPU link

This test checks CBMF board(s), Ethernet connection and the parallel bus interface between the CBMF board(s) and the CPU circuit board. A large set of known data is transferred from the CPU unit on Ethernet via CBMF back to the CPU board. The data received is checked by the CPU board.

RX-CBMF link

This test checks the GBit interface between the RX unit and the CBMF boards. A large set of known data is transferred from RX unit via CBMF to the CPU board on parallel bus. The data received is checked by the CPU board.

RX-CPU link

This test is not implemented yet.

RX channels

The Receiver Unit has a programmable signal generator board that is used to inject a test signal at the preamplifier inputs in the RX arrays. The BIST report displays the measured RX transducer impedance for all RX channels. This test may fail at very high noise levels.

TX channels

This test checks the impedance of all TX elements. This is done by measuring the voltage and current used by all individual transmitters. This test may fail at very high noise levels.

RX noise level

This test measures the average isotropic spectral noise level for each receiver channel (in dB rel 1 μPa/Hz) for different frequency bands. The receiver directivity index, the transducer sensitivity and the filter bandwidth is used to convert to isotropic spectral noise level. On a quiet ship away from noise sources, the noise level should normally be below 45 dB.

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 small frequency 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.

Software date and versions

This test presents the software date and versions for the system components.

System information

This test acquires information needed (serial numbers, software versions, BIST results etc.) for a status report.

Save tests and open folder

Select **Save tests and open folder** to save the test results as a text file.

Clear

Select **Clear** to delete the tests already run.

PU System test result

All the tests will be listed as they are done.

Time

The time the test was run showing as yyyymmdd-hhmmss.

Result

The result showing as Passed or Failed.

Description

A short description of the test. Select the description or the text file to get more details.

BIST (Built-In Self Test) theory

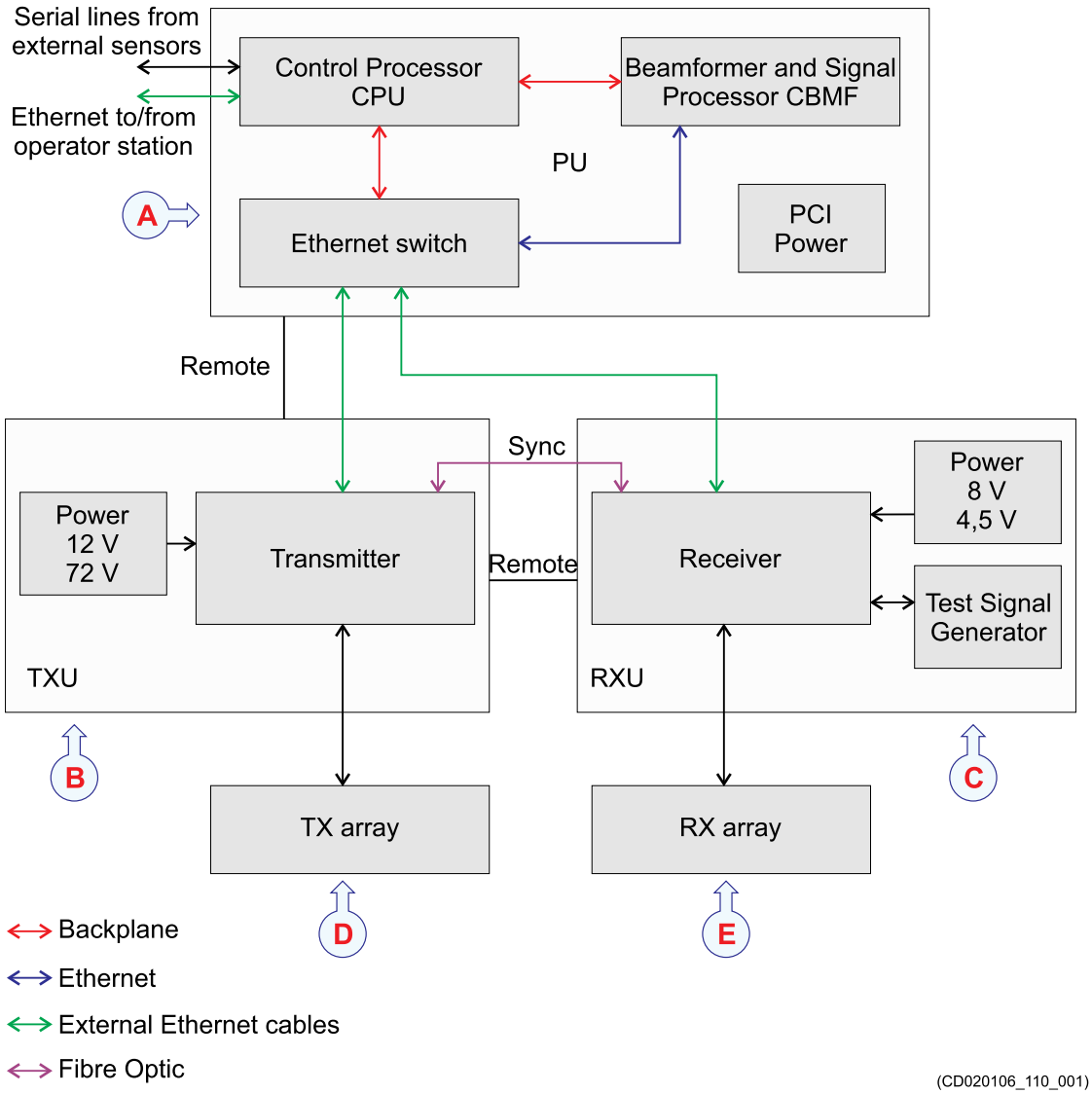
Topics

BIST Introduction

The purpose of the offline BIST system is to detect errors and locate the failed module.

The BIST tests are organized in a sequence, and tests module by module. The CPU executes the BISTs and sends the BIST reply to the operator station.

Temperature, voltage, communication and firmware versions of each board and module are tested.



A *Processing Unit*

B *Transmitter Unit (TXU)*

C *Receiver Unit*

D *Transmit transducer array*

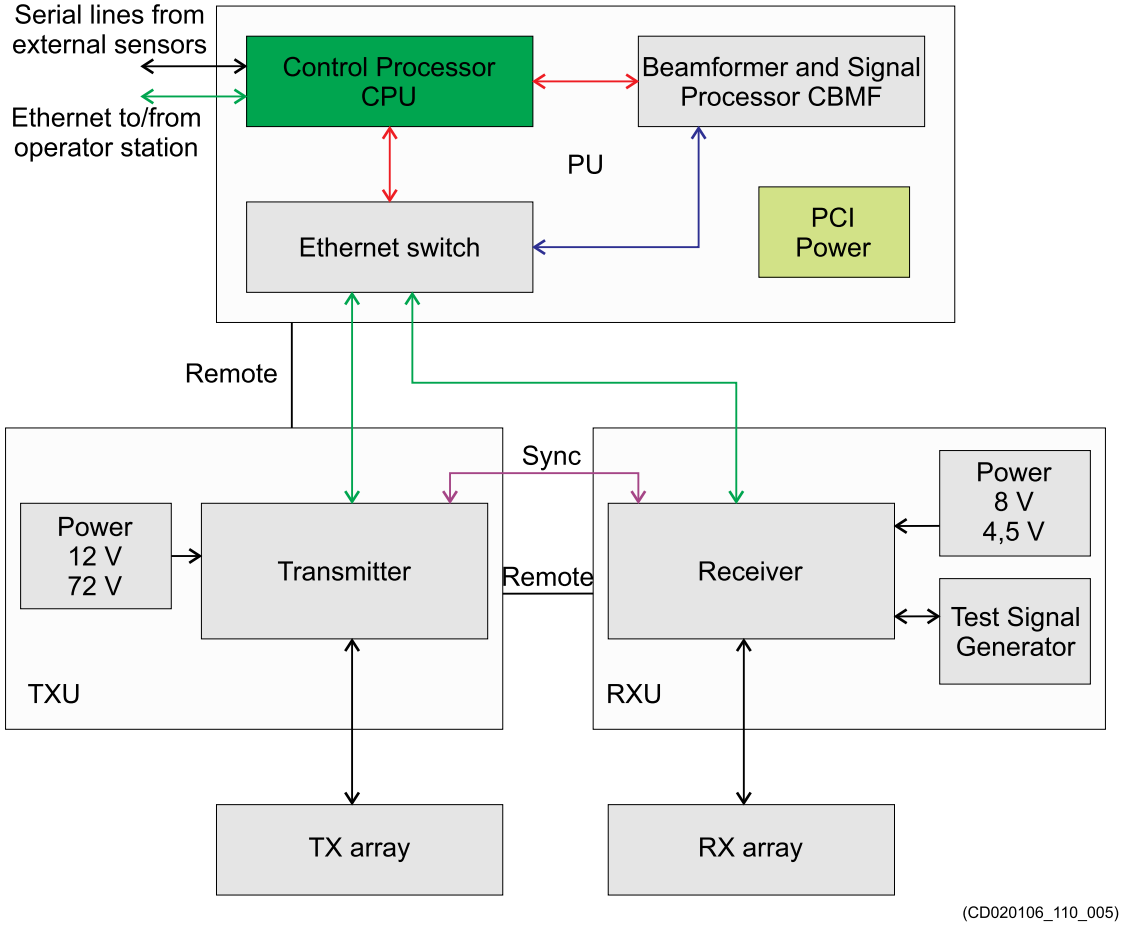
E *Receive transducer array*

CPU Test

Checks the CPU board in the in the EM 712 Processing Unit.

This test presents the CPU type, the CPU clock frequency, the current and maximum temperatures for the CPU die and for the CPU board. Checks all beamformer and signal processing boards (CBMF) in the EM 712 Processing Unit.

In addition some key voltages are reported, and finally the network addresses for the board's interfaces.

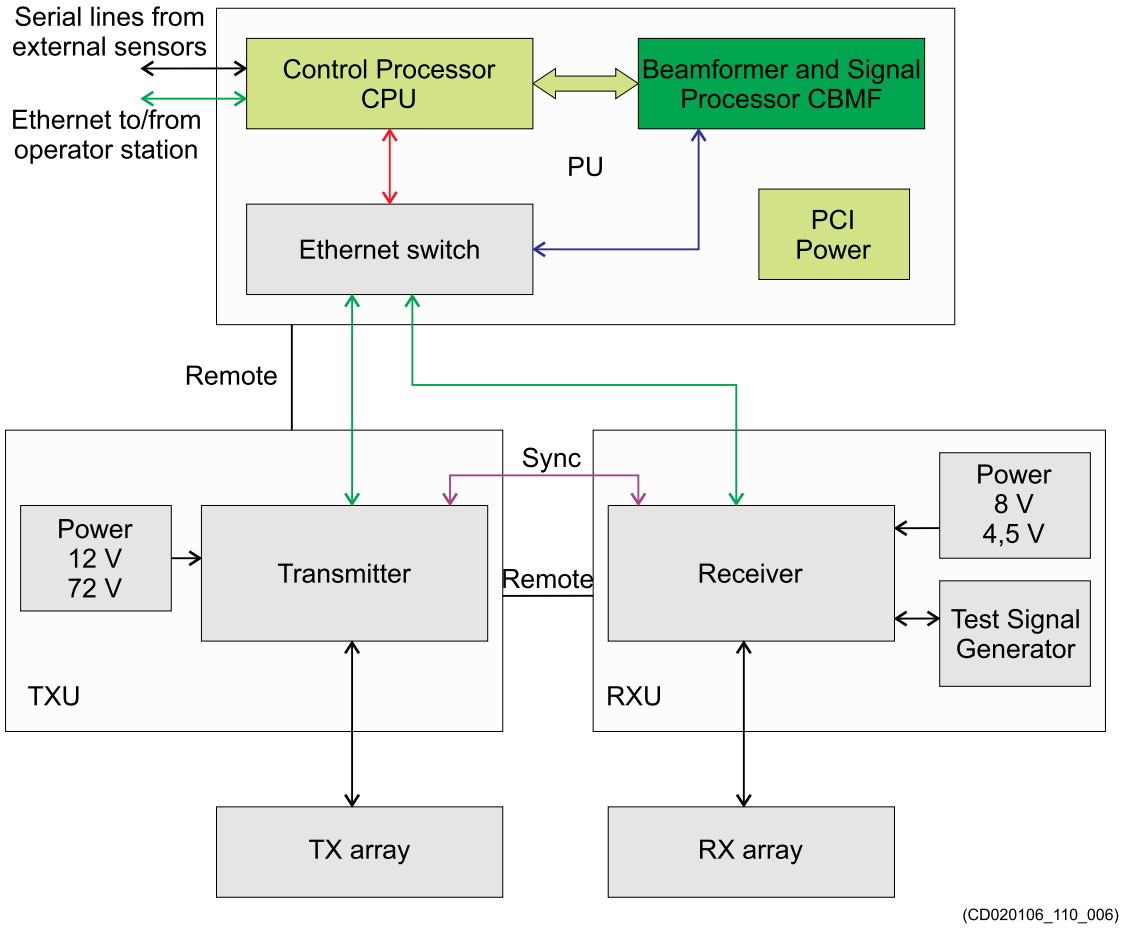


Dark green modules are to be tested. Light green modules have to function to be able to perform current test.

CBMF test

Checks all beamformer and signal processing boards (CBMF) in the EM 712 Processing Unit.

This test presents the CBMF board temperature, the internal power supply voltages. In addition software and firmware versions are displayed.

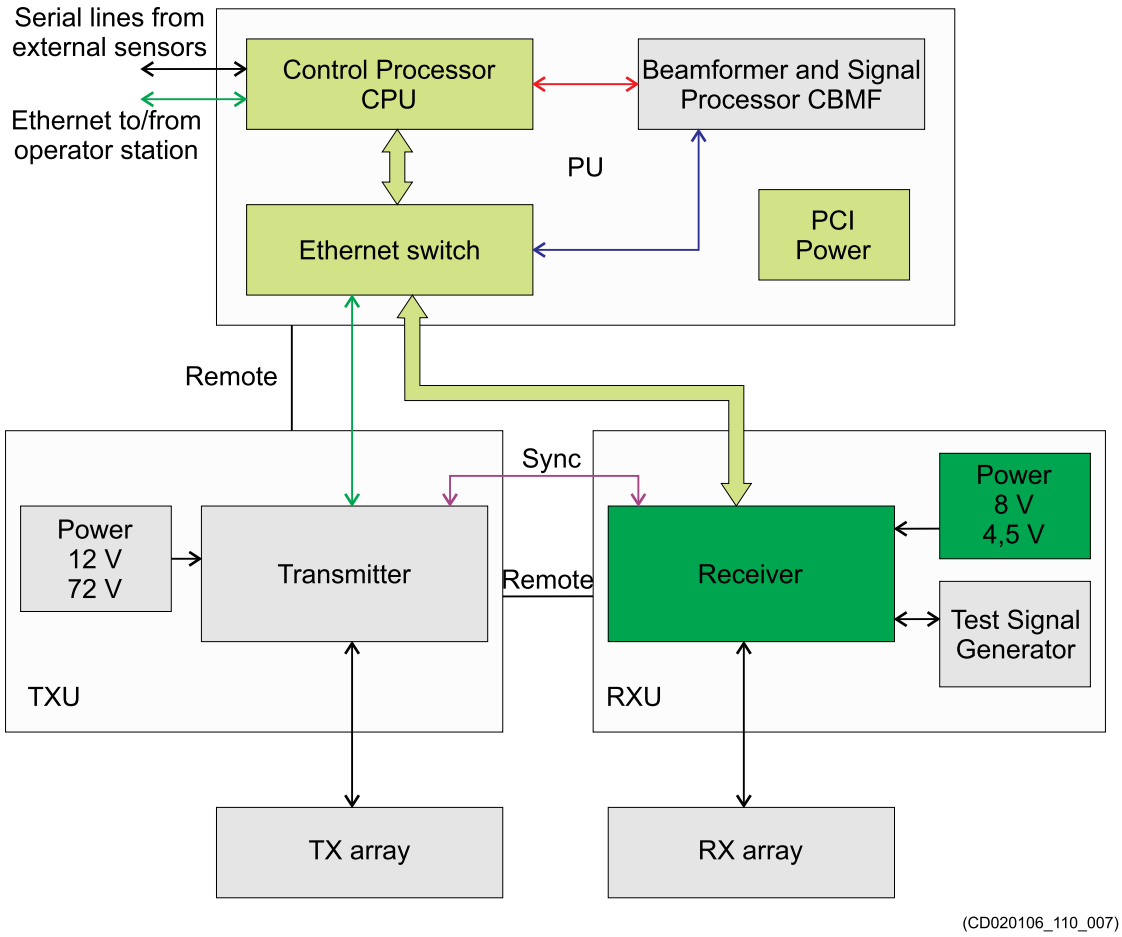


Dark green modules are to be tested. Light green modules have to function to be able to perform current test.

RX unit test

Checks the receiver electronics in the EM 712 Receiver Unit.

This test presents the internal temperatures and voltages in the receiver electronics. In addition software and firmware versions are displayed.

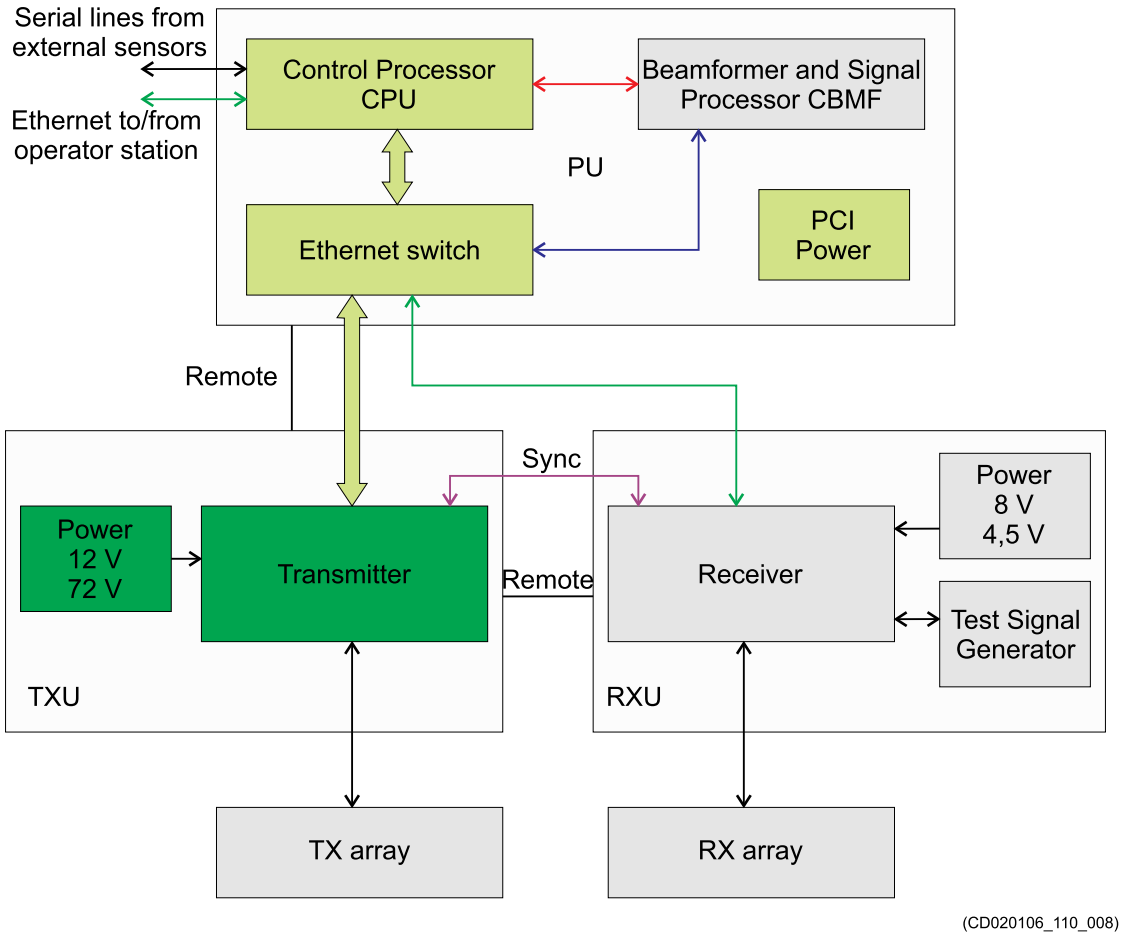


Dark green modules are to be tested. Light green modules have to function to be able to perform current test.

TX unit test

Checks the transmitter electronics in the EM 712 Transmitter Unit.

This test presents the internal temperatures and voltages in the transmitter electronics. In addition software and firmware versions are displayed.

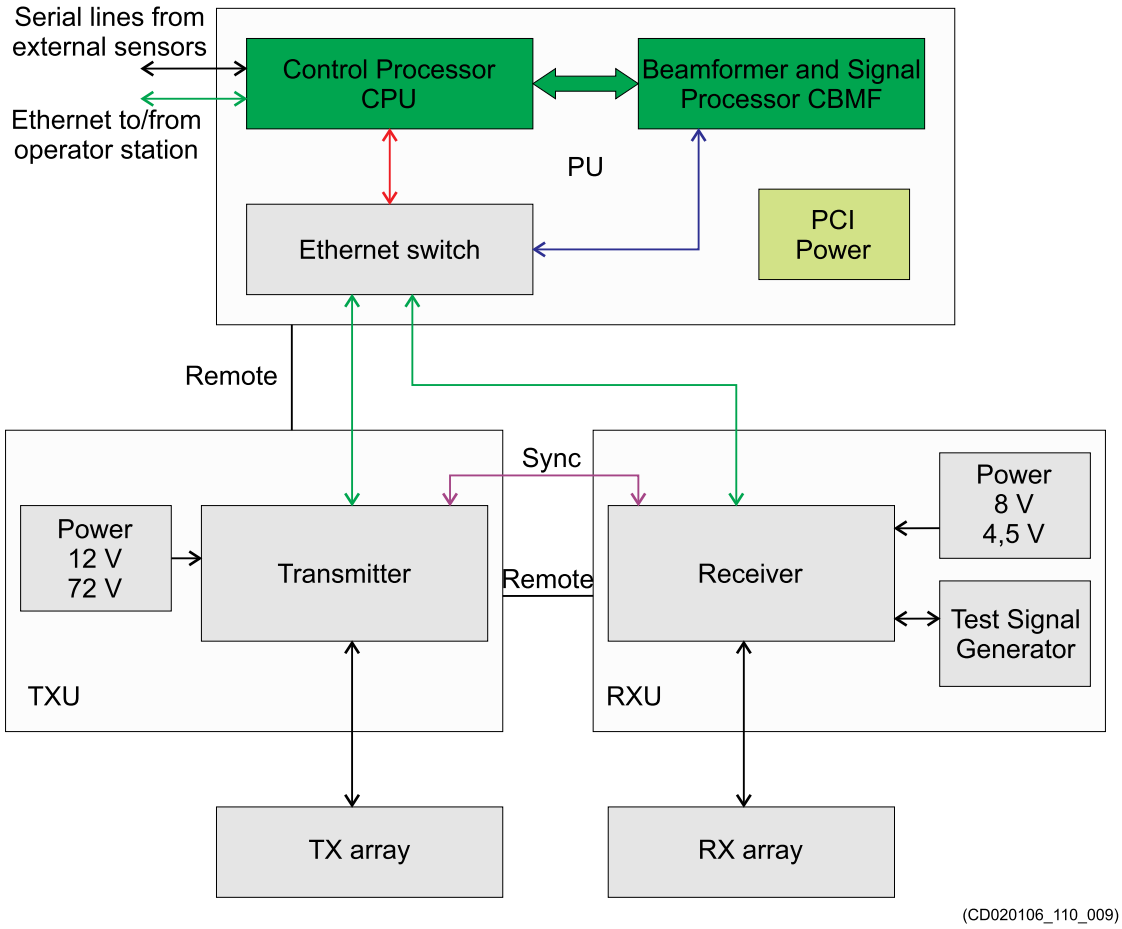


Dark green modules are to be tested. Light green modules have to function to be able to perform current test.

CBMF-CPU link

Checks the parallel bus interface between the CBMF board and the CPU board.

This test checks CBMF board(s), Ethernet connection and the parallel bus interface between the CBMF board(s) and the CPU circuit board. A large set of known data is transferred from the CPU unit on Ethernet via CBMF back to the CPU board. The data received is checked by the CPU board.

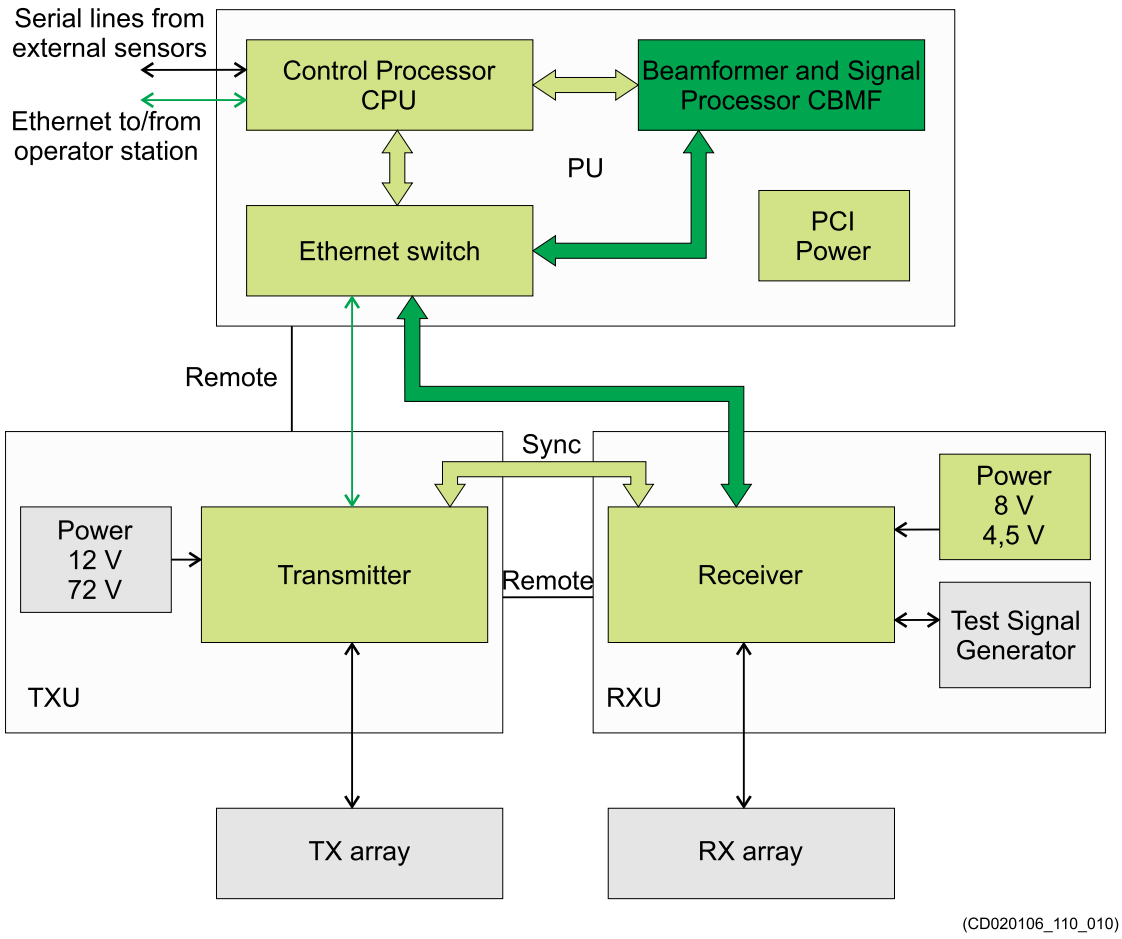


Dark green modules are to be tested. Light green modules have to function to be able to perform current test.

RX-CBMF link

This test checks the GBit interface between the RX unit and the CBMF boards.

A large set of known data is transferred from RX unit via CBMF to the CPU board on parallel bus. The data received is checked by the CPU board.



Dark green modules are to be tested. Light green modules have to function to be able to perform current test.

RX channels

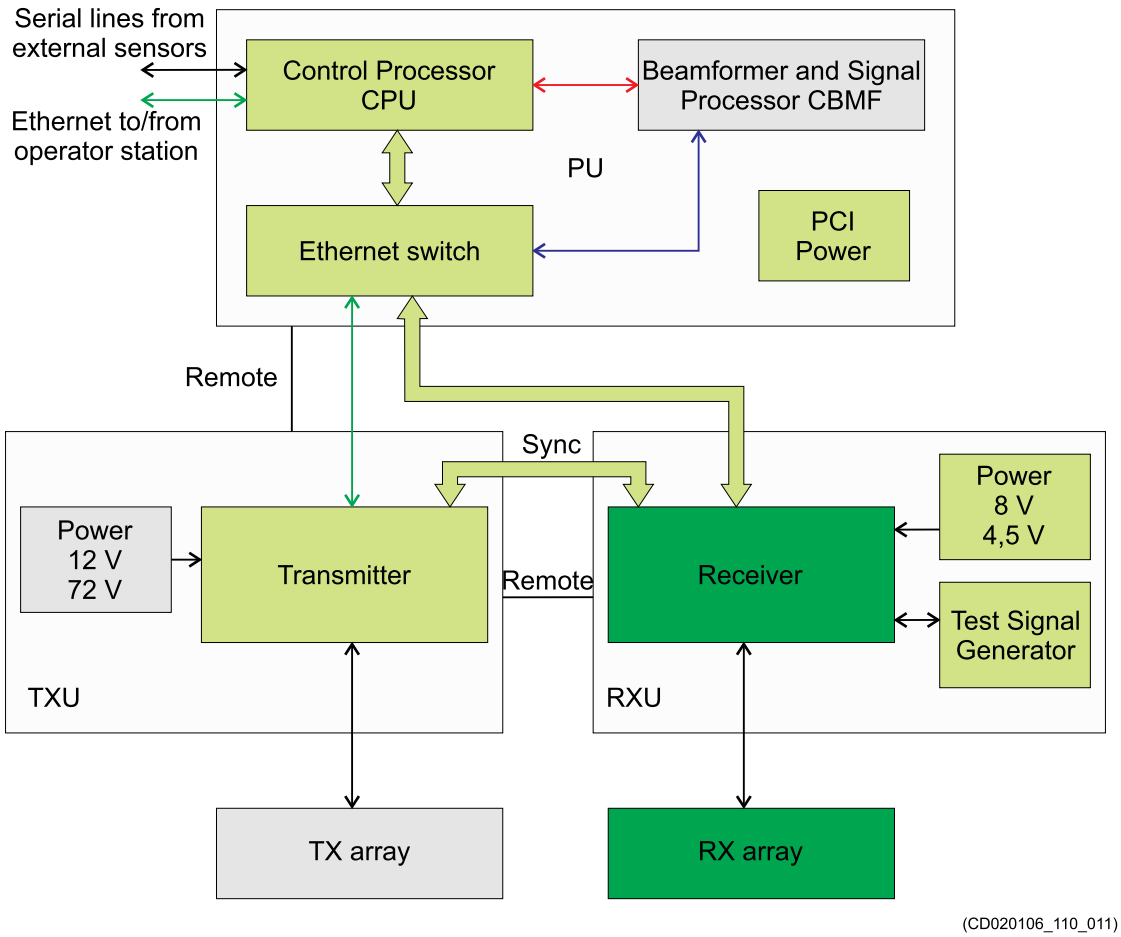
Checks the RX channels including transducers by injecting a test signal at receiver input.

- **EM 712**

  The Receiver Unit has a programmable signal generator board that is used to inject a test signal at the preamplifier inputs in the RX arrays. The BIST report displays the measured RX transducer impedance for all RX channels.

- **EM 712B**

  The Receiver Unit has a programmable signal generator board that is used to inject a test signal at the preamplifier inputs in the Receiver Unit. The BIST report displays the measured RX transducer impedance for all RX channels.

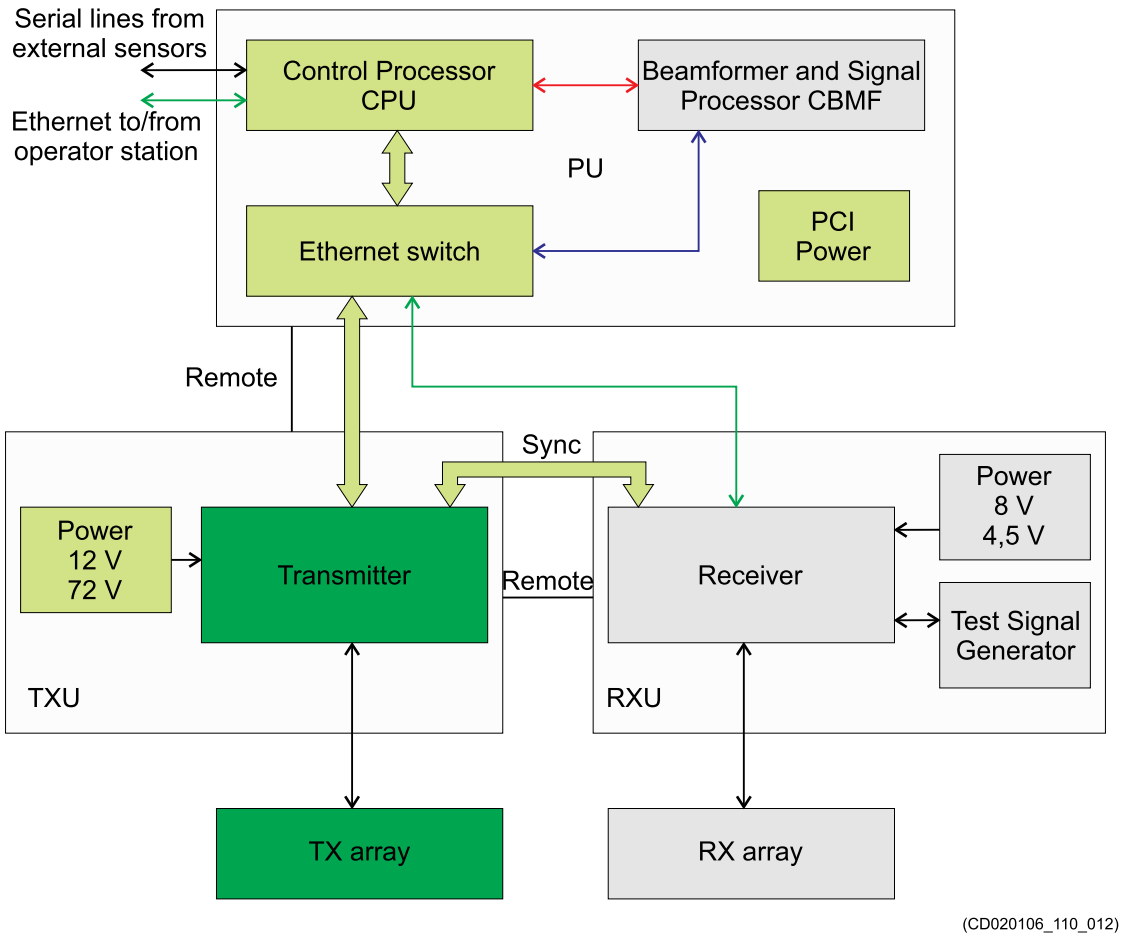


Dark green modules are to be tested. Light green modules have to function to be able to perform current test.

TX channels

Checks all TX channels including the transducers.

This test checks the impedance of all TX elements. This is done by measuring the voltage and current used by all individual transmitters.

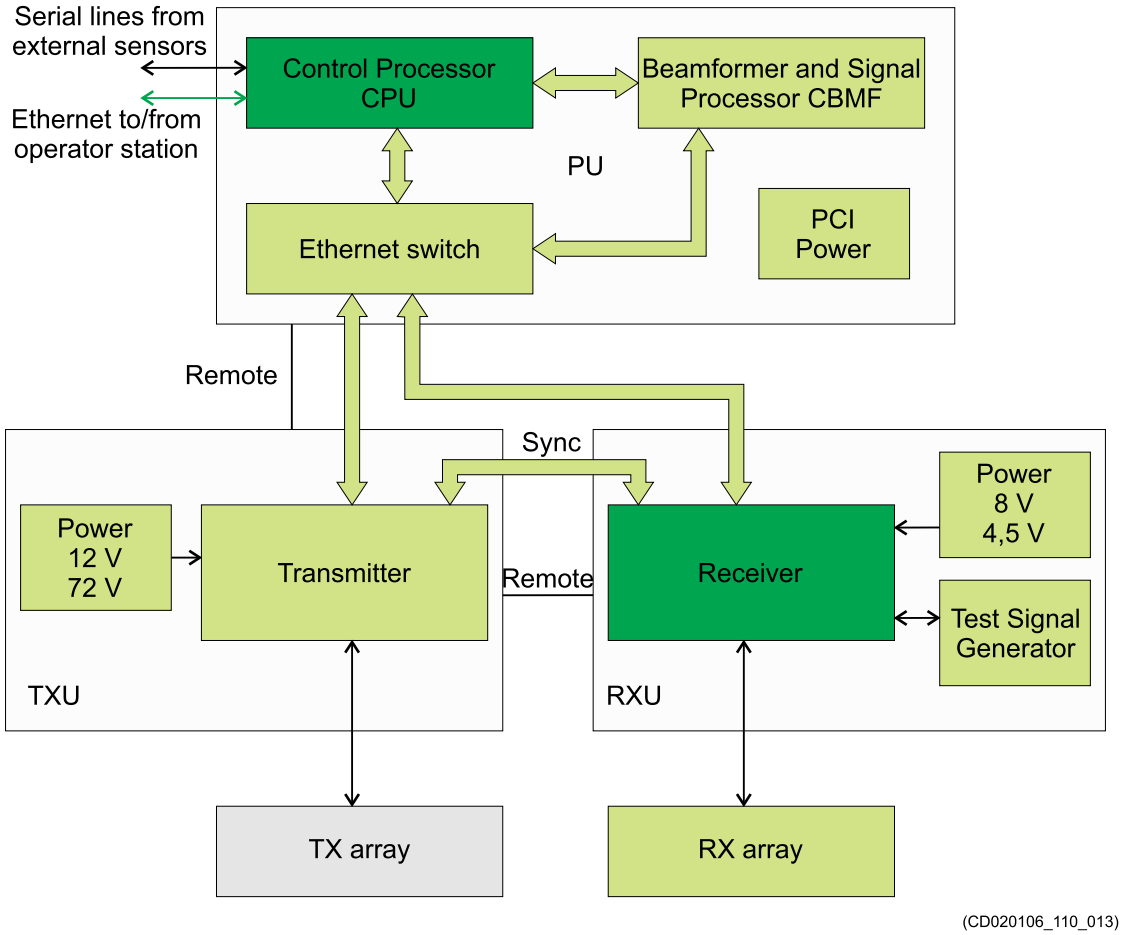


Dark green modules are to be tested. Light green modules have to function to be able to perform current test.

RX noise level

Checks the isotropic spectral noise level.

This test measures the average isotropic spectral noise level for each receiver channel (in dB rel 1 µPa/Hz) for different frequency bands. The receiver directivity index, the transducer sensitivity and the filter bandwidth is used to convert to isotropic spectral noise level.



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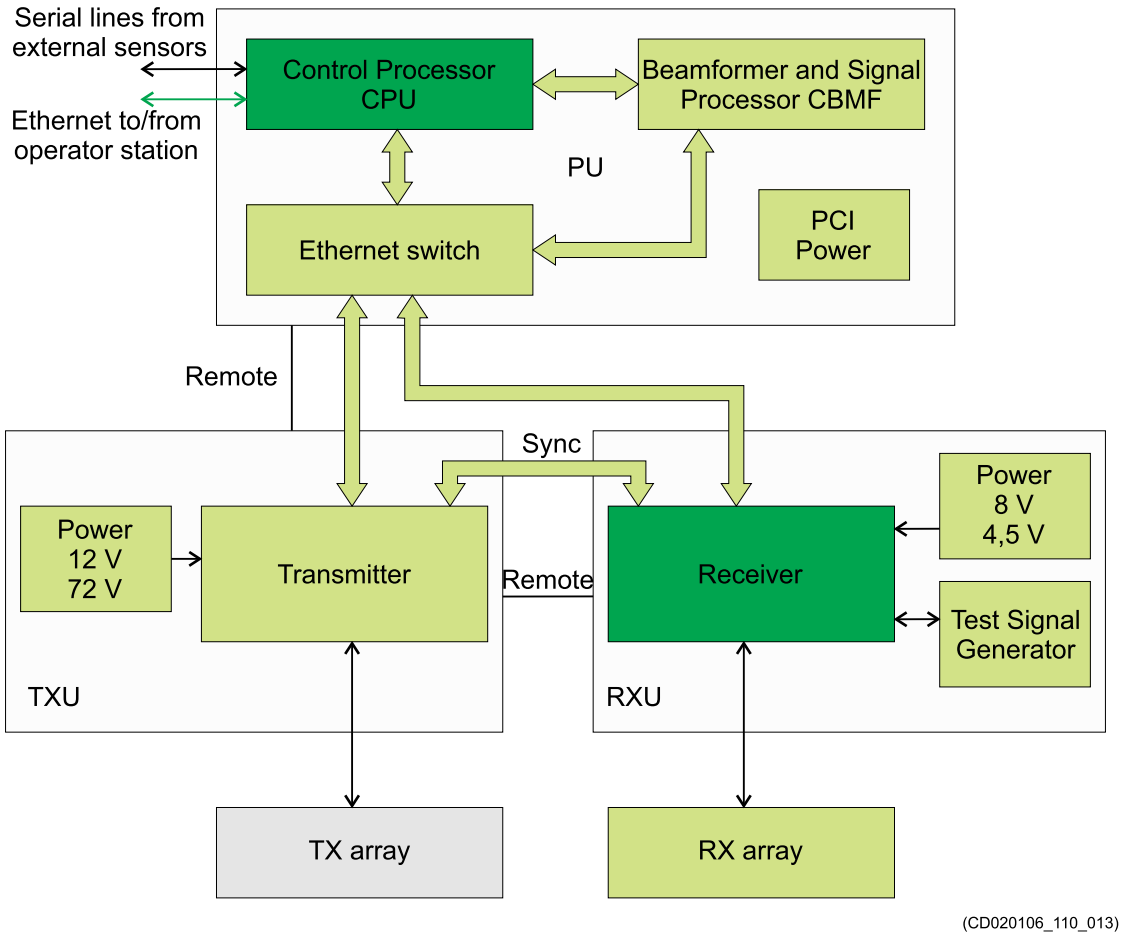
RX noise spectrum

Checks the isotropic spectral noise level.

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 small frequency 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.

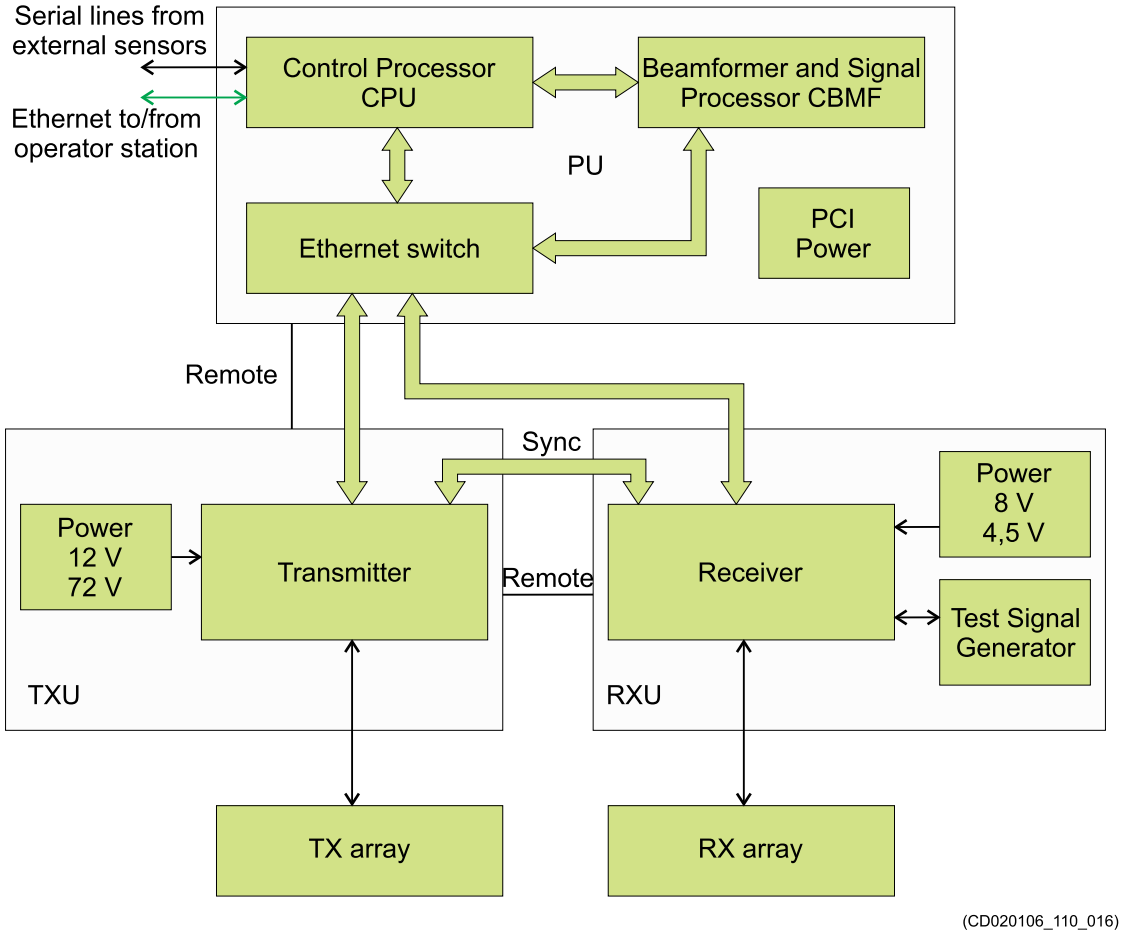


Dark green modules are to be tested. Light green modules have to function to be able to perform current test.

Software date and versions

Checks the software date and versions.

This test presents the software date and versions for the system components.



Dark green modules are to be tested. Light green modules have to function to be able to perform current test.

System information

Generates a status report for the EM 712 system.

This test acquires information needed (serial numbers, software versions, BIST results etc.) for a status report. This report can be sent to the factory to update the EM 712 product database.

Preventive maintenance

Topics

Inspecting and cleaning the transducer face

Marine growth (biological fouling) on the transducer face reduces the EM 712 performance. For this reason, it is important to keep the transducer face clean. Every time your vessel is in dry dock, you must remove the marine growth. At the same time, you must inspect the transducer 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 transducer is subjected to biological fouling. If this marine growth is excessive, it will reduce the performance of the EM 712. Whenever opportunity arise, typically when the vessel is dry-docked, the transducer face must be cleaned for shells and other marine growth.

It is important to check the transducer 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 transducer.

A transducer must always be handled as a delicate instrument. Incorrect actions may damage the transducer beyond repair. Observe these transducer handling rules:

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

Procedure

1 Allow for sufficient access to clean and inspect the entire surface of the transducer.

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, sandblasting, metal tools or strong solvents to clean the transducer face.*

Do not *damage the outer protective skin of the transducer face.*

3 Allow the transducer surface to dry.

4 Do a thorough visual inspection of the transducer. Check for dents, scratches, holes or other damage to the surface.

If you suspect damage, take a high resolution photo. Contact your dealer or the Kongsberg support organization for advice.

5 Apply anti-fouling paint as described in the dedicated procedure.

Note

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

The list can also be found on Kongsberg Maritime (https://www.kongsberg.com/maritime/).

Painting the transducer face

Marine growth (biological fouling) on the transducer face reduces the EM 712 performance. We recommend that you paint the transducer face immediately after installation, and then again as often as required to maintain the protection.

Prerequisites

The following tools and consumables are required.

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

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

Context

The transducer has not been designed with any protection against biological fouling. Anti-fouling paint may therefore be applied to the transducer 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 transducer. The surface roughness of the transducer substrate and the thickness of the paint may also influence the performance. Kongsberg Maritime cannot 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 transducer thoroughly.

   Make sure that you remove all oil grease residues, as well as salt and other contamination.

2 Allow the transducer surface to dry.

3 Abrade the transducer 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 712 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 transducer 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

Approved anti-fouling paints, page 41

Inspecting and replacing sacrificial anodes

Anodes are used on various units to prevent metals from corroding in salt water.

Context

Anodes are constructed of a metal alloy with an active voltage that is greater than the metal of the structure; thus, the anode corrodes before the material it is protecting. The three main alloys used are magnesium, aluminum, and zinc.

The sacrificial anodes must be inspected every time the vessel is in dry dock. Replace the anodes if they are damaged or severely corroded.

Procedure

1 Inspect all anodes for damage and corrosion.

2 Loosen the mounting screws and remove the anode.

3 Clean the new anode and mounting surface using Isopropyl alcohol on a soft cloth or paper wipe.

4 Grease the mounting screws and threads with Aqua Shield or Molykote P-40 paste.

5 Mount the new anode using the same screws. Make sure there is good electrical contact with the unit.

Approved anti-fouling paints

This is our list of approved antifouling paints for all transducer 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 transducer with traditional hull plating paint. Use only the correct type of approved paint specified.

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

Jotun

- **Manufacturer**: Jotun
- **Address:** P.O.Box 2021, N-3248 Sandefjord, Norway
- **Manufacturer's website**: http://www.jotun.com

Products:

- SeaQuantum Ultra S
  - **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).
- Seaforce 200 AV
  - **Primer**: Safeguard Universal ES AV

    Apply 70 µm wet film thickness (50 µm dry film thickness).
  - **Paint**: Seaforce 200 AV

    Apply 140 µm wet film thickness (90 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

- **Manufacturer**: International Marine Coatings
- **Address:** Stoneygate Lane, Felling, Gateshead, Tyne & Wear, NE10 0JY United Kingdom
- **Manufacturer's website**: www.international-marine.com

Products:

- Intersleek 1100SR
  - **Primer**: Intersleek 737

    Apply 50 µm dry film thickness.
  - **Paint**: Intersleek 1100SR

    Apply 150 µm dry film thickness.
- Intersmooth 7465Si SPC
  - **Primer**: Intergard 269

    Apply 40 µm dry film thickness.
  - **Paint**: Intersmooth 7465Si SPC

    Apply 100 µm dry film thickness.

The list can also be found on Kongsberg Maritime (https://www.kongsberg.com/maritime/).

Parts replacement

Topics

Tools and equipment required for parts replacement

In order to safely remove and replace printed circuit boards modules, generic and specific tools are required.

You must be equipped with a standard set of tools. This tool set must comprise the normal tools for electronic and electromechanical tasks. This includes different screwdriver types, pliers, spanners, a cable stripper, a soldering iron, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment.

- Screwdriver (various types and sizes)
- Allen keys (various sizes)
- Cable cutter, knife and/or scissors
- Wire stripper
- Pliers (various types and sizes)
- Spanner (various sizes) (US: Wrench)
- Tweezers

Note

If you need specific consumables, or if special tools and/or test instruments are required, these are identified in the relevant procedure(s).

Note

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 handling. You must be familiar with the applicable handling precautions. Take all necessary steps to avoid Electrostatic Discharge (ESD).

As a minimum, the following precautions must be taken:

1 For correct and safe handling of printed circuit boards and electronic modules, you need a suitable working area. The working area must be covered by an approved conductive service mat that has a resistance of between 50 kΩ and 2 MΩ, 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.

WARNING

Personell must check that all the equipment is earthed before power is connected or switched on.

Processing Unit replacement

If a Processing Unit fails to operate, it must be replaced with a new unit. All replacement tasks must be done according to the specified procedures, and you must follow the relevant safety instructions.

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

Note

These procedures will instruct you to handle electronic circuit boards and/or modules. Before doing so, make sure that you are familiar with the applicable handling precautions. Follow the relevant handling procedures for circuit boards and electronic modules.

Topics

Removing the Processing Unit, page 47

Installing the Processing Unit, page 48

Removing the Processing Unit

One or two Processing Units are used in the EM 712 system. The complete Processing Unit can be supplied as a spare part.

Prerequisites

You must be equipped with a standard set of tools. This tool set must comprise the normal tools for mechanical tasks. This includes different screwdriver types, pliers, adjustable spanners, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment.

Context

Refer to the detailed information in the *Cable layout and interconnections* chapter.

Procedure

1 Locate the unit you wish to remove.

The Processing Unit is normally mounted in a cabinet, in a rack or placed on a table.

2 Turn off the EM 712.

3 Disconnect the power cable on the rear side of the unit.

4 Disconnect the cables.

5 Loosen the unit by removing the mounting bolts on both sides.

6 Grab a firm hold of the unit, and pull it straight out.

7 Place the unit on a conductive service mat on your work table.

Further requirements

To return the unit for repair or replacement, follow the relevant handling instructions.

Installing the Processing Unit

The Processing Unit is designed to be installed in a 19" rack.

Prerequisites

You must be equipped with a standard set of tools. This tool set must comprise the normal tools for electronic and electromechanical tasks. This includes different screwdriver types, pliers, spanners, a cable stripper, a soldering iron, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment.

Context

Refer to the detailed information in the *Cable layout and interconnections* chapter.

Procedure

1 Grab a firm hold of the unit, and push it straight in.

2 Fasten the unit by securing the mounting bolts on both sides.

3 Connect the power cable on the rear side of the unit.

4 Connect the cables.

Note

When you connect the cables, make sure that they are all properly secured, and able to withstand the vibration and movements of the vessel.

Further requirements

Once the unit has been installed, follow the normal procedure to turn on the EM 712.

CPU board replacement

If a CPU board fails to operate, it must be replaced with a new circuit board. All replacement tasks must be done according to the specified procedures, and you must follow the relevant safety instructions.

This is a generic photo. The CPU board used by the EM 712 may look slightly different due to minor design changes on the protective lid and/or the front panel.

There is one CPU board in the Processing Unit.

Note

These procedures will instruct you to handle electronic circuit boards and/or modules. Before doing so, make sure that you are familiar with the applicable handling precautions. Follow the relevant handling procedures for circuit boards and electronic modules.

Topics

Removing the CPU board, page 50

Installing the CPU board, page 51

Removing the CPU board

If a CPU board fails to operate, it must be replaced with a new circuit board. All replacement tasks must be done according to the specified procedures, and you must follow the relevant safety instructions.

Prerequisites

This is a generic photo. The CPU board used by the EM 712 may look slightly different due to minor design changes on the protective lid and/or the front panel.

You must be equipped with a standard set of tools. This tool set must comprise the normal tools for electromechanical tasks. This includes different screwdriver types, pliers, adjustable spanners, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment.

Context

Removal is done by pulling the board straight out of the Processing Unit.

Procedure

1 Turn off the Processing Unit.

2 Disconnect the power cable on the rear side of the unit.

3 Identify the circuit board you wish to remove.

4 Disconnect all relevant cables.

5 Loosen the screws. **(A)**

6 Loosen the circuit board by pushing the two red locking devices on the handles. **(B)**

7 Push the handles outward. **(C)**

8 Grab the handles and pull the circuit board straight out.

9 Place the circuit board on a conductive service mat on your workbench.

Further requirements

To return the circuit board for repair or replacement, follow the relevant handling instructions.

Installing the CPU board

If a CPU board fails to operate, it must be replaced with a new circuit board. All replacement tasks must be done according to the specified procedures, and you must follow the relevant safety instructions.

Prerequisites

This is a generic photo. The CPU board used by the EM 712 may look slightly different due to minor design changes on the protective lid and/or the front panel.

A new circuit board must be available.

You must be equipped with a standard set of tools. This tool set must comprise the normal tools for electromechanical tasks. This includes different screwdriver types, pliers, adjustable spanners, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment. Depending on the chosen installation method, additional tools may be required.

Procedure

1 Make sure that all AC mains power has been disconnected.

2 Grab the handles and push the circuit board straight in.

3 Push the handles inward. **(C)**

4 Tighten the screws. **(A)**

5 Connect the cables.

6 Connect AC mains power.

Further requirements

Once the circuit board has been installed, follow the normal procedure to turn on the EM 712.

VadaTech CP219 Ethernet switch replacement

If a VadaTech CP219 Ethernet switch fails to operate, it must be replaced with a new switch. All replacement tasks must be done according to the specified procedures, and you must follow the relevant safety instructions.

The VadaTech CP219 board is used as an Ethernet switch in the EM 712 Processing Unit.

Note

These procedures will instruct you to handle electronic circuit boards and/or modules. Before doing so, make sure that you are familiar with the applicable handling precautions. Follow the relevant handling procedures for circuit boards and electronic modules.

Topics

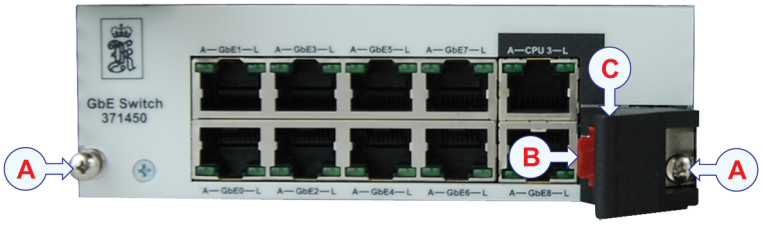
Removing the VadaTech CP219 Ethernet switch , page 53

Installing the VadaTech CP219 Ethernet switch, page 54

Removing the VadaTech CP219 Ethernet switch

If a VadaTech CP219 Ethernet switch fails to operate, it must be replaced with a new switch. All replacement tasks must be done according to the specified procedures, and you must follow the relevant safety instructions.

Prerequisites



You must be equipped with a standard set of tools. This tool set must comprise the normal tools for electromechanical tasks. This includes different screwdriver types, pliers, adjustable spanners, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment.

Context

Removal is done by pulling the board straight out of the Processing Unit.

Procedure

1 Turn off the Processing Unit.

2 Disconnect the power cable on the rear side of the unit.

3 Identify the circuit board you wish to remove.

4 Disconnect all relevant cables.

5 Loosen the screws. **(A)**

6 Loosen the circuit board by pushing the red locking device on the handle. **(B)**

7 Push the handle to the right. **(C)**

8 Grab the handle and pull the circuit board straight out.

9 Place the circuit board on a conductive service mat on your workbench.

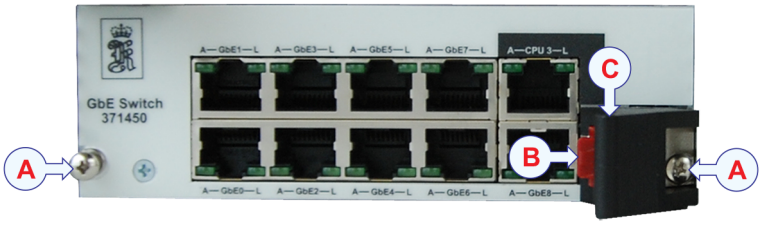
Further requirements

To return the circuit board for repair or replacement, follow the relevant handling instructions.

Installing the VadaTech CP219 Ethernet switch

If a VadaTech CP219 Ethernet switch fails to operate, it must be replaced with a new switch. All replacement tasks must be done according to the specified procedures, and you must follow the relevant safety instructions.

Prerequisites



A new circuit board must be available.

You must be equipped with a standard set of tools. This tool set must comprise the normal tools for electromechanical tasks. This includes different screwdriver types, pliers, adjustable spanners, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment.

Procedure

1 Make sure that all AC mains power has been disconnected.

2 Grab the handle and push the circuit board straight in.

3 Push the handle to the left. **(C)**

4 Tighten the screws. **(A)**

5 Connect the cables.

6 Connect AC mains power.

Further requirements

Once the circuit board has been installed, follow the normal procedure to turn on the EM 712.

CBMF board replacement

If a CBMF board fails to operate, it must be replaced with a new circuit board. All replacement tasks must be done according to the specified procedures, and you must follow the relevant safety instructions.

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

Note

These procedures will instruct you to handle electronic circuit boards and/or modules. Before doing so, make sure that you are familiar with the applicable handling precautions. Follow the relevant handling procedures for circuit boards and electronic modules.

Topics

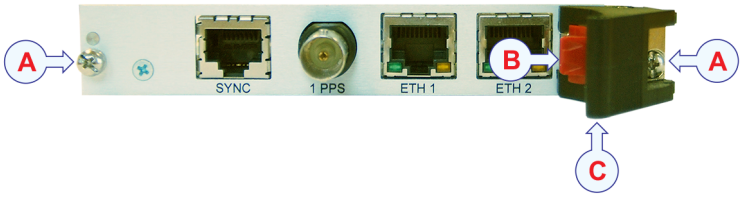
Removing the CBMF board, page 56

Installing the CBMF board, page 57

Removing the CBMF board

If a CBMF board fails to operate, it must be replaced with a new circuit board. All replacement tasks must be done according to the specified procedures, and you must follow the relevant safety instructions.

Prerequisites



This is a generic photo. The CBMF board used by the EM 712 may look slightly different due to minor design changes on the protective lid and/or the front panel.

You must be equipped with a standard set of tools. This tool set must comprise the normal tools for electromechanical tasks. This includes different screwdriver types, pliers, adjustable spanners, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment.

Context

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 712 system. Removal is done by pulling the board straight out of the Processing Unit.

Procedure

1 Turn off the Processing Unit.

2 Disconnect the power cable on the rear side of the unit.

3 Identify the circuit board you wish to remove.

4 Disconnect all relevant cables.

5 Loosen the screws. **(A)**

6 Loosen the circuit board by pushing the red locking device on the handle. **(B)**

7 Push the handle to the right. **(C)**

8 Grab the handle and pull the circuit board straight out.

9 Place the circuit board on a conductive service mat on your workbench.

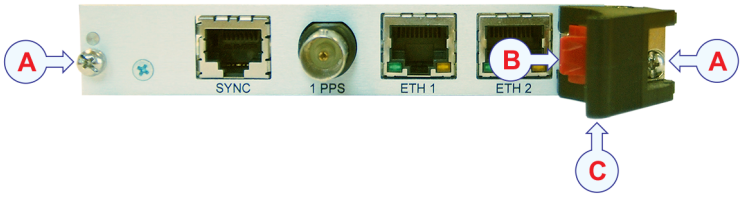
Further requirements

To return the circuit board for repair or replacement, follow the relevant handling instructions.

Installing the CBMF board

If a CBMF board fails to operate, it must be replaced with a new circuit board. All replacement tasks must be done according to the specified procedures, and you must follow the relevant safety instructions.

Prerequisites



This is a generic photo. The CBMF board used by the EM 712 may look slightly different due to minor design changes on the protective lid and/or the front panel.

You must be equipped with a standard set of tools. This tool set must comprise the normal tools for electromechanical tasks. This includes different screwdriver types, pliers, adjustable spanners, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment.

Context

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 712 system.

Procedure

1 Make sure that all AC mains power has been disconnected.

2 Grab the handle and push the circuit board straight in.

3 Push the handle to the left. **(C)**

4 Tighten the screws. **(A)**

5 Connect the cables.

6 Connect AC mains power.

Further requirements

Once the circuit board has been installed, follow the normal procedure to turn on the EM 712.

Fan unit replacement

If a fan unit fails to operate, it must be replaced with a new module. All replacement tasks must be done according to the specified procedures, and you must follow the relevant safety instructions.

The Processing Unit has two fan units for cooling purposes.

Note

These procedures will instruct you to handle electronic circuit boards and/or modules. Before doing so, make sure that you are familiar with the applicable handling precautions. Follow the relevant handling procedures for circuit boards and electronic modules.

Topics

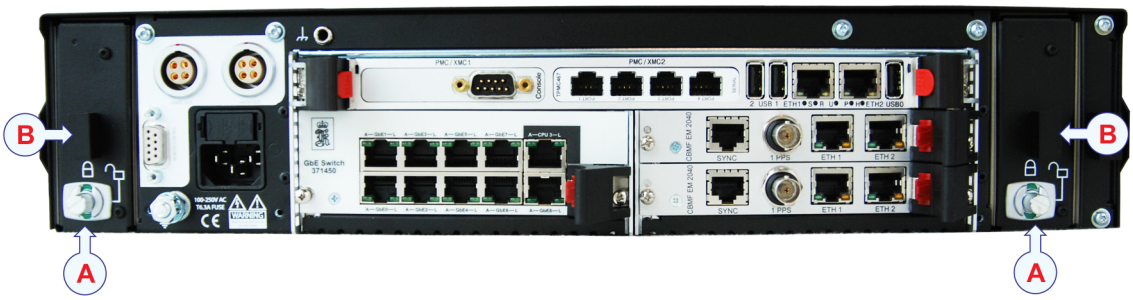
Removing the fan unit, page 59

Installing the fan unit, page 60

Removing the fan unit

If a fan unit fails to operate, it must be replaced with a new module. All replacement tasks must be done according to the specified procedures, and you must follow the relevant safety instructions.

Prerequisites



You must be equipped with a standard set of tools. This tool set must comprise the normal tools for electromechanical tasks. This includes different screwdriver types, pliers, adjustable spanners, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment.

Context

The Processing Unit has two fan units for cooling purposes.

Procedure

1 Turn off the Processing Unit.

2 Disconnect the power cable on the rear side of the unit.

3 Locate the unit you wish to remove.

4 Loosen the screw. **(A)**

5 Grab the handle and pull the unit straight out. **(B)**

6 Place the unit on a conductive service mat on your workbench.

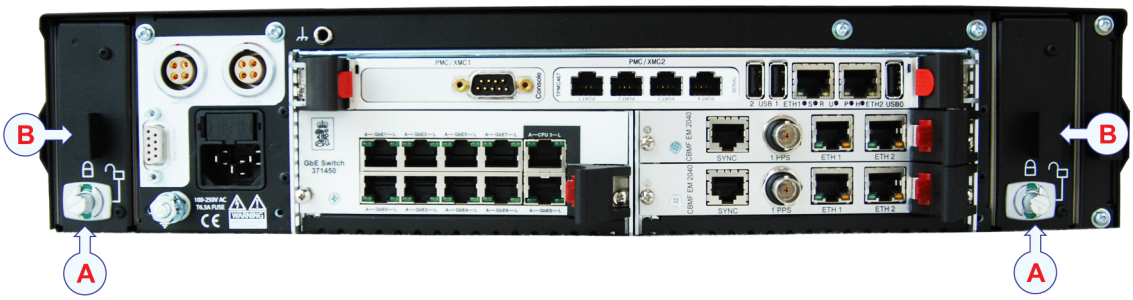
Further requirements

To return the unit for repair or replacement, follow the relevant handling instructions.

Installing the fan unit

If a fan unit fails to operate, it must be replaced with a new module. All replacement tasks must be done according to the specified procedures, and you must follow the relevant safety instructions.

Prerequisites



You must be equipped with a standard set of tools. This tool set must comprise the normal tools for electromechanical tasks. This includes different screwdriver types, pliers, adjustable spanners, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment.

Context

The Processing Unit has two fan units for cooling purposes.

Procedure

1 Make sure that all AC mains power has been disconnected.

2 Grab the handle and push the unit straight in. **(B)**

3 Tighten the screw. **(A)**

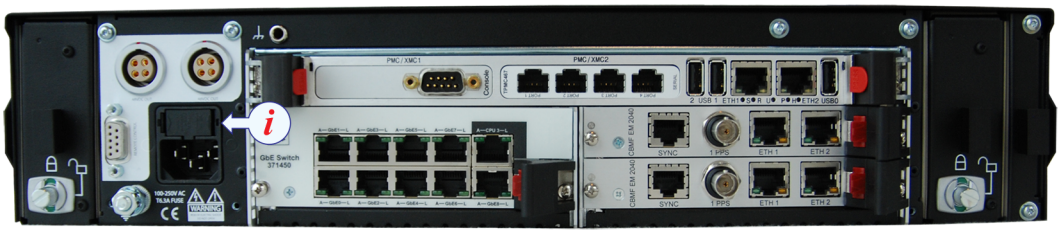
4 Connect AC mains power.

Further requirements

Once the unit has been installed, follow the normal procedure to turn on the EM 712.

Processing Unit fuse replacement

The Processing Unit is protected with two ceramic body cartridge fuses on the power inlet. The fuses are replaced if blown.



Note

These procedures will instruct you to handle electronic circuit boards and/or modules. Before doing so, make sure that you are familiar with the applicable handling precautions. Follow the relevant handling procedures for circuit boards and electronic modules.

Topics

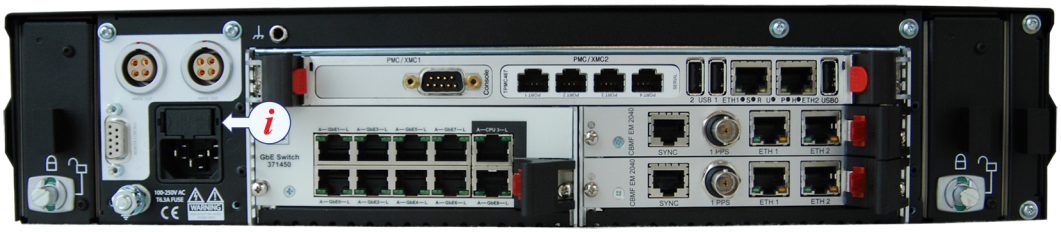
Removing the fuse in the Processing Unit, page 62

Installing the fuse in the Processing Unit, page 63

Removing the fuse in the Processing Unit

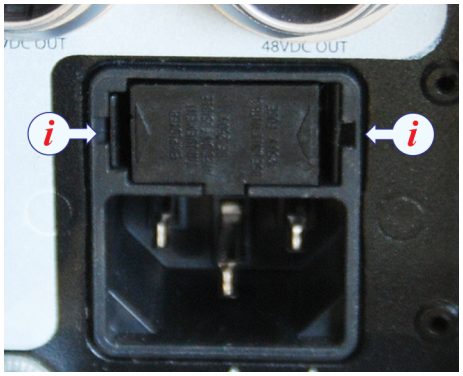
The Processing Unit is protected with two ceramic body cartridge fuses on the power inlet. The fuses are replaced if blown. Follow this procedure to remove the fuses.

Prerequisites



You must be equipped with a standard set of tools. This tool set must comprise the normal tools for electromechanical tasks. This includes different screwdriver types, pliers, adjustable spanners, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment.

Procedure



1 Turn off the Processing Unit.

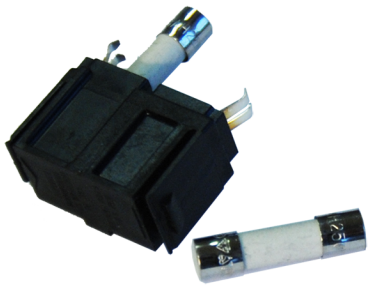
2 Disconnect the power cable on the rear side of the unit.

3 Locate the fuse holder.

4 Insert a small-blade screwdriver into the side of the fuse holder to release the lid catch.

5 Gently pull the fuse holder out.

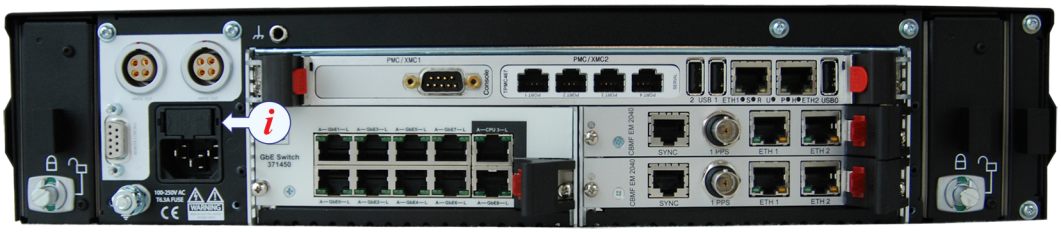
6 Remove the blown fuse from the fuse holder.



Installing the fuse in the Processing Unit

The Processing Unit is protected with two ceramic body cartridge fuses on the power inlet. The fuses are replaced if blown. Follow theis procedure to install the fuses.

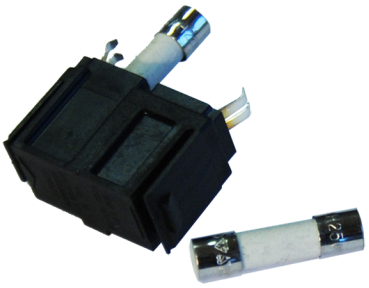
Prerequisites



A new fuse must be available.

You must be equipped with a standard set of tools. This tool set must comprise the normal tools for electromechanical tasks. This includes different screwdriver types, pliers, adjustable spanners, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment.

Procedure



1 Make sure that all AC mains power has been disconnected.

2 Insert a new fuse into the fuse holder.

3 Push the fuse holder in.

4 Connect the power cable on the rear side of the unit.

5 Turn on the Processing Unit.

Further requirements

Once the unit has been installed, follow the normal procedure to turn on the EM 712.

Spare parts and consumables

Topics

Ordering spare parts

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

The following information must be provided with your order:

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

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

List of spare parts - Processing Unit

Topics

Processing Unit spare part 401290

The complete Processing Unit can be supplied as a spare part.

- **Part name:** Processing Unit
- **Part number:** 401290
- **Number in use:** 1
- **Recommended number in spare:** 1
- **True manufacturer:** Kongsberg Maritime (https://www.kongsberg.com/maritime/)

Related topics

Processing Unit replacement, page 46

CBMF board spare part 404291

There are two Compact Beamformer (CBMF) boards in the Processing Unit.

This is a generic photo. The CBMF board used by the EM 712 may look slightly different due to minor design changes on the protective lid and/or the front panel.

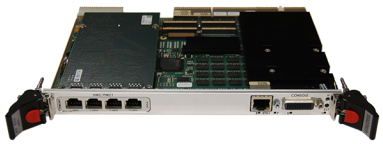
- **Part name:** CBMF board
- **Part number:** 404291
- **Number in use:** 2
- **Recommended number in spare:** 1
- **True manufacturer:** Kongsberg Maritime (https://www.kongsberg.com/maritime/)

Related topics

CBMF board replacement, page 55

CPU board spare part 456983

There is one CPU board in the Processing Unit.



- **Part name:** Concurrent PP B12/033 CPU board
- **Part number:** 456983
- **Number in use:** 1
- **Recommended number in spare:** 1
- **True manufacturer:** Concurrent Technologies Plc.

  Concurrent Technologies (http://www.gocct.com)

Related topics

CPU board replacement, page 49

Power supply spare part 373897

One power supply unit is used in the EM 712 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)

Fan unit spare part 385387

Two fan units are used in the EM 712 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

Related topics

Fan unit replacement, page 58

List of spare parts - Transmitter Unit

Topics

LPTX36 Transmitter board spare part 390018

There are up to 20 LPTX36 Transmitter boards in each Transmitter Unit.

- **Part name:** LPTX36 Transmitter board
- **Part number:** 390018
- **Number in use:** 20
- **Recommended number in spare:** 1
- **True manufacturer:** Kongsberg Maritime (https://www.kongsberg.com/maritime/)

TX RIO board spare part 399431

There are up to 10 TX RIO boards in each Transmitter Unit.

- **Part name:** TX RIO board
- **Part number:** 399431
- **Number in use:** 10
- **Recommended number in spare:** 1
- **True manufacturer:** Kongsberg Maritime (https://www.kongsberg.com/maritime/)

RIO-P board spare part 322623

There is one RIO-P board in each Transmitter Unit.

- **Part name:** RIO-P board
- **Part number:** 322623
- **Number in use:** 1
- **Recommended number in spare:** 1
- **True manufacturer:** Kongsberg Maritime (https://www.kongsberg.com/maritime/)

Ethernet switch spare part 338124

There is one VadaTech CP218 Ethernet switch in each Transmitter Unit.

- **Part name:** VadaTech CP218 Ethernet switch board
- **Part number:** 338124
- **Number in use:** 1
- **Recommended number in spare:** 1
- **True manufacturer:** VadaTech Incorporated
  VadaTech (http://www.vadatech.com)

TXU Fan unit spare part 397740

There is one fan unit in each Transmitter Unit.

- **Part name:** TXU Fan unit
- **Part number:** 397740
- **Number in use:** 1
- **Recommended number in spare:** 1
- **True manufacturer:** Elma (https://www.elma.com)

TXU Power supply spare part 422238

There is one power supply unit in each Transmitter Unit.

- **Part name:** Power supply Excesys XLD
- **Part number:** 422238
- **Number in use:** 1
- **Recommended number in spare:** 1
- **True manufacturer:** Excelsys Technologies (http://www.excelsys.com)

List of spare parts - Receiver Unit

Topics

Receiver Unit 1° - spare part 403302

The complete receiver Unit can be supplied as a spare part. The number of Receiver Units used will depend on the system configuration.

The number of circuit boards in the Receiver Unit will depend on the chosen transducer configuration.

- **Part name:** Receiver Unit 1°
- **Part number:** 403302
- **Number in use:** 1
- **Recommended number in spare:** 1
- **True manufacturer:** Kongsberg Maritime (https://www.kongsberg.com/maritime/)

Receiver Unit 2° - spare part - 403303

The complete receiver Unit can be supplied as a spare part. The number of Receiver Units used will depend on the system configuration.

The number of circuit boards in the Receiver Unit will depend on the chosen transducer configuration.

- **Part name:** Receiver Unit 2°
- **Part number:** 403303
- **Number in use:** 1
- **Recommended number in spare:** 1
- **True manufacturer:** Kongsberg Maritime (https://www.kongsberg.com/maritime/)

Receiver Unit 1° - spare part - EM 712B 447972

The complete receiver Unit can be supplied as a spare part. The number of Receiver Units used will depend on the system configuration.

The number of circuit boards in the Receiver Unit will depend on the chosen transducer configuration.

EM 712B is an upgrade kit for EM 710 that allows you to upgrade to EM 712 without changing the transducers.

- **Part name:** Receiver Unit 1° EM 712B
- **Part number:** 447972
- **Number in use:** 1
- **Recommended number in spare:** 1
- **True manufacturer:** Kongsberg Maritime (https://www.kongsberg.com/maritime/)

EM 712B Receiver Unit 2° - spare part 448220

The complete receiver Unit can be supplied as a spare part. The number of Receiver Units used will depend on the system configuration.

The number of circuit boards in the Receiver Unit will depend on the chosen transducer configuration.

EM 712B is an upgrade kit for EM 710 that allows you to upgrade to EM 712 without changing the transducers.

- **Part name:** Receiver Unit 2° EM 712B
- **Part number:** 448220
- **Number in use:** 1
- **Recommended number in spare:** 1
- **True manufacturer:** Kongsberg Maritime (https://www.kongsberg.com/maritime/)

RXU Power supply spare part 399824

There is one power supply unit in each Receiver Unit.

- **Part name:** Power supply Roal RCB600-AB00
- **Part number:** 399824
- **Number in use:** 1
- **Recommended number in spare:** 1
- **True manufacturer:** Roal/Efore (https://www.efore.com)

Processing Unit

Topics

Processing Unit description

The EM 712 Processing Unit is provided to process the signals to and from the Transmitter and Receiver Units.

The EM 712 Processing Unit is an industrial computer using both COTS (commercial off-the-shelf) components and custom made components. The unit is designed and tested for rugged use.

The Processing Unit performs the receiver beamforming, bottom detection, and motion and sound speed corrections. It contains all interfaces for time-critical external sensors such as vessel attitude (roll, pitch, heading and heave), vessel position and external clock. More than one sensor of each type may be connected simultaneously, with one in use and all of them logged.

The Processing Unit controls the Transmitter and Receiver units via Ethernet communication, and is also interfaced to the Operator station via Ethernet.

The 48 V output from the Processing Unit can be used for remote on/off control of the Transmitter and Receiver Units.

The Processing Unit is normally located in a "sonar room" close to the transducer arrays. The unit can also be placed in the "survey room" or on the bridge.

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.

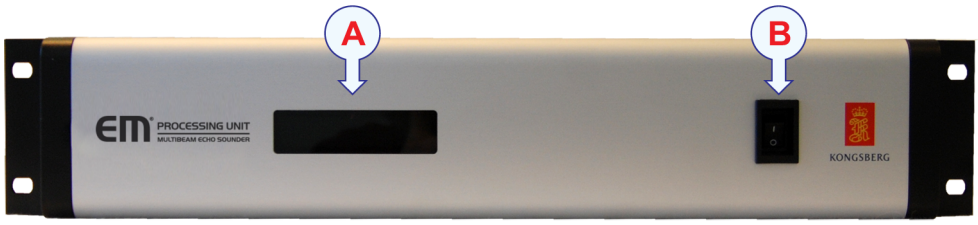
The Processing Unit can be switched on/off with a remote switch.

The 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.

The Transmitter Unit(s) and Receiver Unit(s) are connected to the Ethernet switch in the Processing Unit.

Processing Unit front panel description

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

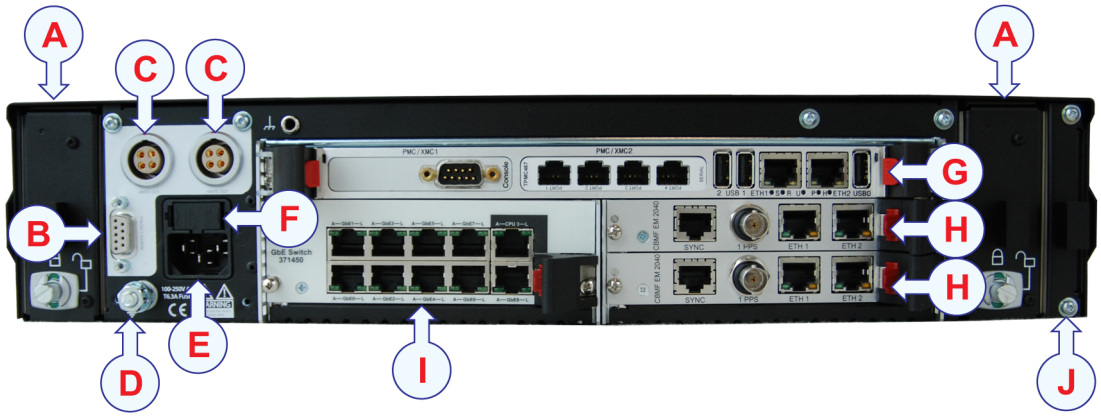


A *Information display*

B *Power On/Off*

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 mains power socket*

F *Fuse for the AC mains supply*

G *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 712 system.

I *CP219 Ethernet switch*

J *Air filter unit*

Processing Unit circuit boards and modules

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

The following circuit boards and modules are used in the EM 712 Processing Unit.

A ***CPU board***

Different CPU boards can be used in the EM 712 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 712 system.

C ***VadaTech CP219 board***

The VadaTech CP219 board is used as an Ethernet switch in the EM 712 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 712 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.

CPU board

Topics

Concurrent PP B12 CPU board overview

Concurrent PP B12 is one version of CPU board used in the EM 712 Processing Unit.

The Concurrent PP B12 is a PC-compatible high functionality Compact PCI (cPCI) board used by the EM 712 Processing Unit as the Central Processing Unit (CPU).

The circuit board is manufactured by Concurrent Technologies and configured by Kongsberg Maritime AS. Different CPU boards can be used in the EM 712 Processing Unit.

Concurrent PP B12 CPU board connectors

The Concurrent PP B12 CPU board holds two large connectors for the backplane, as well as several front mounted connectors.

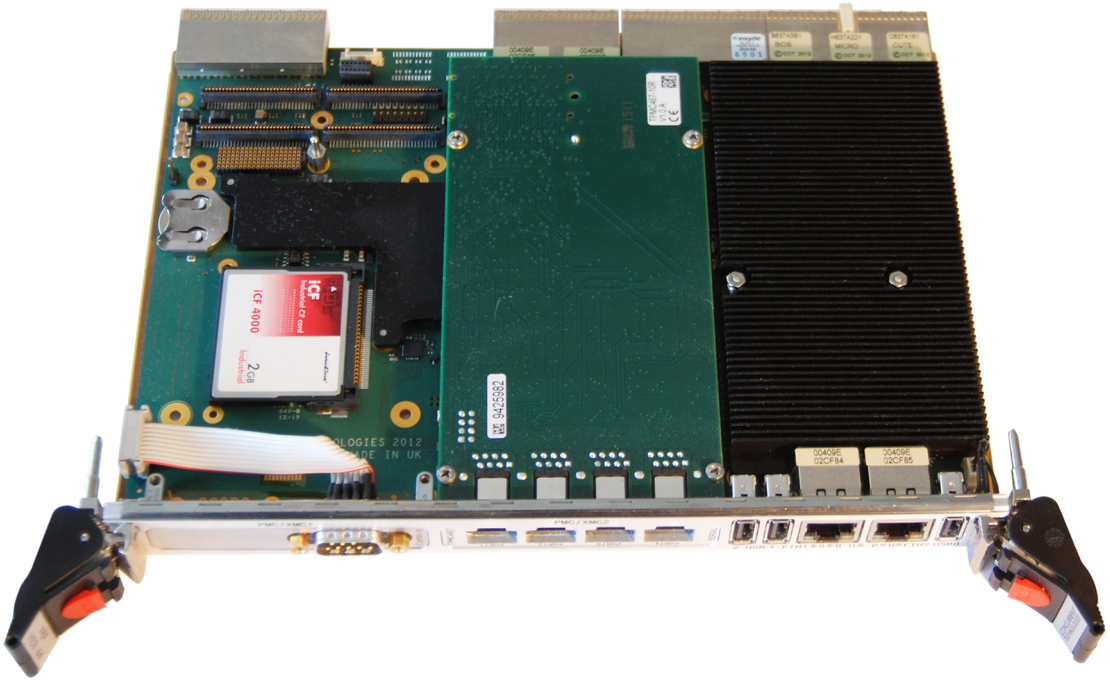
A *Console - for Kongsberg Maritime use only*

B *COM1 to COM4 - Four serial ports with RJ45 connectors. The ports can be configured to be RS-232 or RS-422*

C *Ethernet 1 - used for communication to the Operator Station (Hydrographic Work Station)*

Concurrent PP833 CPU board overview

Concurrent PP833 is one version of CPU board used in the EM 712 Processing Unit.

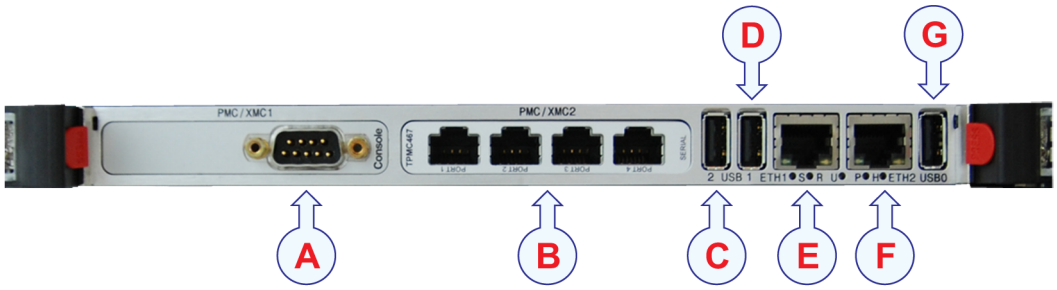


The Concurrent PP833 is a PC-compatible high functionality Compact PCI (cPCI) board used by the EM 712 Processing Unit as the Central Processing Unit (CPU).

The circuit board is manufactured by Concurrent Technologies and configured by Kongsberg Maritime AS. Different CPU boards can be used in the EM 712 Processing Unit.

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 712.



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

The VadaTech CP219 board is used as an Ethernet switch in the EM 712 Processing Unit.

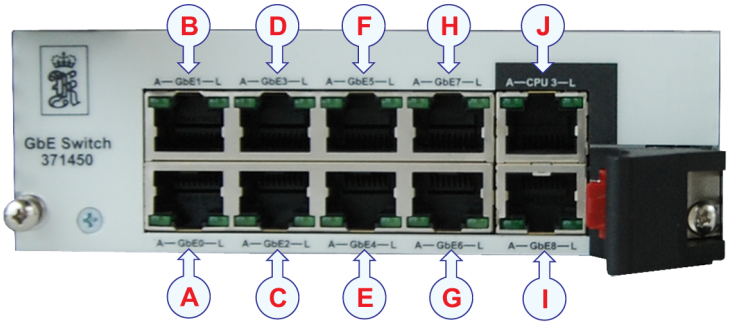
This is a generic photo. The Vadatech CP219 board used by the EM 712 may look slightly different due to minor design changes on the protective lid and/or the front panel.

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 712 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 *Port 1, GbE0*
Regular Gigabit Ethernet port

B *Port 2, GbE1*
Regular Gigabit Ethernet port

C *Port 3, GbE2*
Regular Gigabit Ethernet port

D *Port 4, GbE3*
Regular Gigabit Ethernet port

E *Port 5, GbE4*
Regular Gigabit Ethernet port

F *Port 6, GbE5*
Regular Gigabit Ethernet port

G *Port 7, GbE6*
Regular Gigabit Ethernet port

H *Port 8, GbE7*
Regular Gigabit Ethernet port

I *Port 9, GbE8*
Regular Gigabit Ethernet port

J *Port 10, CPU3*
Gigabit Ethernet port reserved for Attitude Velocity sensor

CBMF board

Topics

CBMF board overview

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

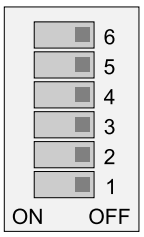
This is a generic photo. The CBMF board used by the EM 712 may look slightly different due to minor design changes on the protective lid and/or the front panel.

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 712 may look slightly different due to minor design changes on the protective lid and/or the front panel.

Switches and links



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

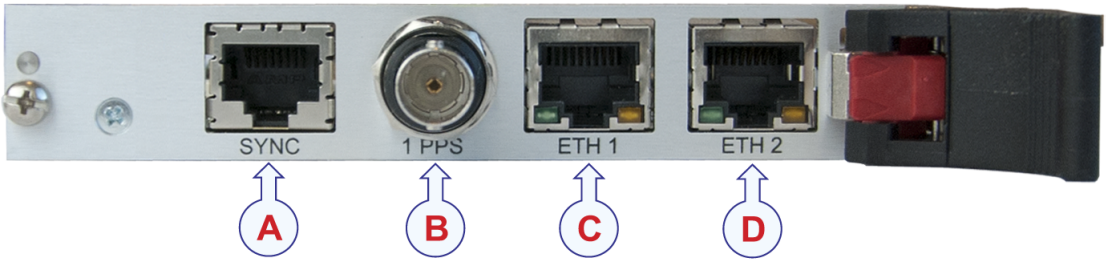
The switch setting on the CBMF board has to be correct. All the switches on all the CBMF boards in the Processing Unit should be set to OFF. OFF is when they are pushed towards the edge of the circuit board.

Do not touch other switches or link settings.

The CBMF board is configured by Kongsberg Maritime for use in the EM 712. 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 712 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 712*

Transmitter Unit

Topics

Transmitter Unit description

The EM 712 Transmitter Unit has all transmit electronics, like control processors, power amplifiers, power supply, capacitor battery and Ethernet interface.

The Transmitter Unit is a wall-mounted steel cabinet with integrated shock and vibration absorbers, designed for bulkhead mounting. One 19 inch sub-rack is contained in the cabinet. The number of circuit boards in the sub-rack will depend on the chosen transducer configuration.

Twisted pair Ethernet is used for data communication with the Processing Unit.

The Transmitter Unit is normally located in a "sonar room" close to the transducer arrays.

For a 0.25° transducer array, two Transmitter Units are used.

Transmitter Unit bottom panel description

The Transmitter Unit holds several circuit boards and a power supply. All the circuit boards are accessed either from the top or the bottom of the unit.

TX RIO board

There are up to 10 TX RIO boards in each Transmitter Unit. The transducer cables connect to the TX RIO boards.

The number of TX RIO boards depends on the configuration of the EM 712 system.

- 0.25° TX array: 20 (2x10)
- 0.5° TX array: 10
- 1° TX array: 5
- 2° TX array: 3

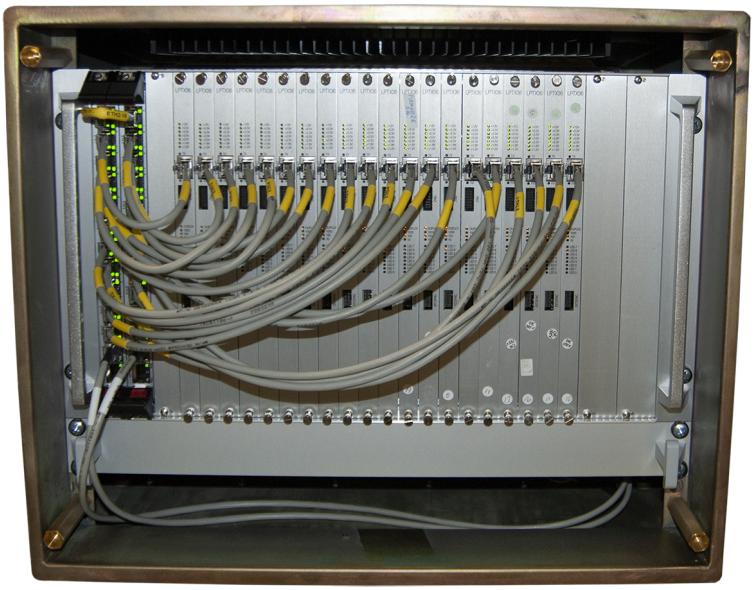
RIO-P board

There is one RIO-P board in each Transmitter Unit. The signals for remote on/off control and synchronization is connected to the RIO-P board.

In addition there are two Ethernet connectors and connection for power at the bottom of the Transmitter Unit.

Transmitter Unit top panel description

The Transmitter Unit holds several circuit boards and a power supply. All the circuit boards are accessed either from the top or the bottom of the unit.



LPTX36 Transmitter board

There are up to 20 LPTX36 Transmitter boards in each Transmitter Unit. Each LPTX36 board is connected to the Ethernet switch in the Transmitter Unit.

The number of LPTX36 boards depends on the configuration of the EM 712 system.

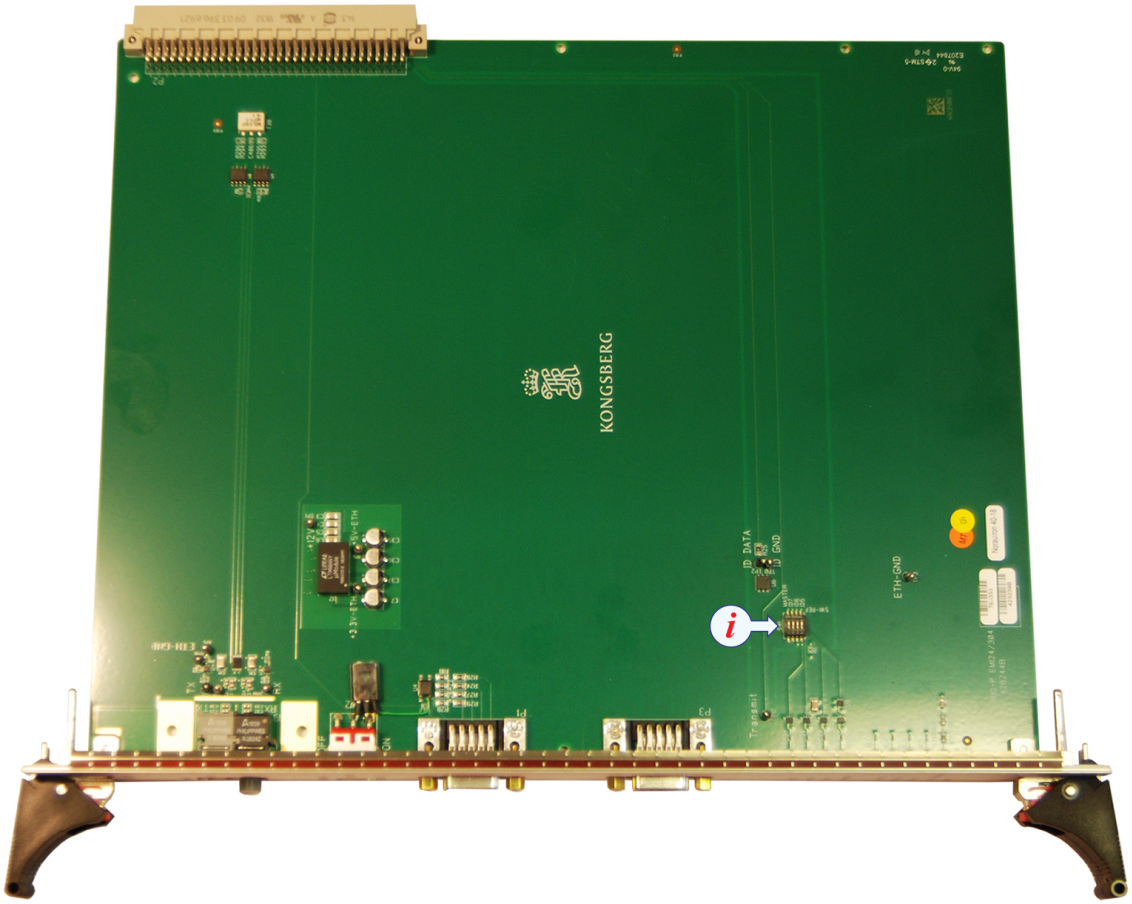
- 0.25° TX array: 40 (2x20)
- 0.5° TX array: 20
- 1° TX array: 10
- 2° TX array: 5

VadaTech CP218 Ethernet switch

There is one VadaTech CP218 Ethernet switch in each Transmitter Unit. Each LPTX36 board is connected to the Ethernet switch in the Transmitter Unit.

RIO-P board - dip switch setting

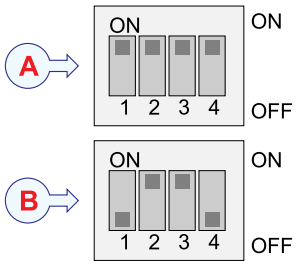
The dip switch setting on the RIO–P board has to be correct.



A Transmitter Unit 1 (MASTER): All switches must be set to ON.

The position of the dip switches are shown with the LED lights on the front of the RIO-P board when the board is installed and the Transmitter Unit is powered up.

- MASTER should be lit.
- ID5, ID6 and ID7 should not be lit.



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B Transmitter Unit 2 (SLAVE): Switch 1 and 4 must be set to OFF, switch 2 and 3 must be set to ON.

Note

If there is only one Transmitter Unit in the system, it has to be set to Transmitter Unit 1 (MASTER).

Receiver Unit

Topics

Receiver Unit description

The EM 712 Receiver Unit has all receive electronics, like control processor, amplifiers, Analog-to-Digital Converters, power supply and Ethernet interface.

The Receiver Unit is a small wall-mounted steel cabinet with integrated shock and vibration absorbers, designed for bulkhead mounting. The number of circuit boards in the Receiver Unit will depend on the chosen transducer configuration. Twisted pair Ethernet is used for data communication with the Processing Unit.

The Receiver Unit is normally located in a "sonar room" close to the transducer arrays.

For a 0.5° transducer array, two Receiver Units are used.

With EM 712B it is possible to upgrade EM 710 to EM 712 without replacing the transducer modules. To achieve this we have made a separate Receiver Unit scientifically tailored for use with the EM 710 receive transducers. The EM 712B Receiver Unit has the same measurements and weight as the regular Receiver Unit.

Receiver Unit front panel description

The connectors and circuit boards of the Receiver Unit are accessed from the front.

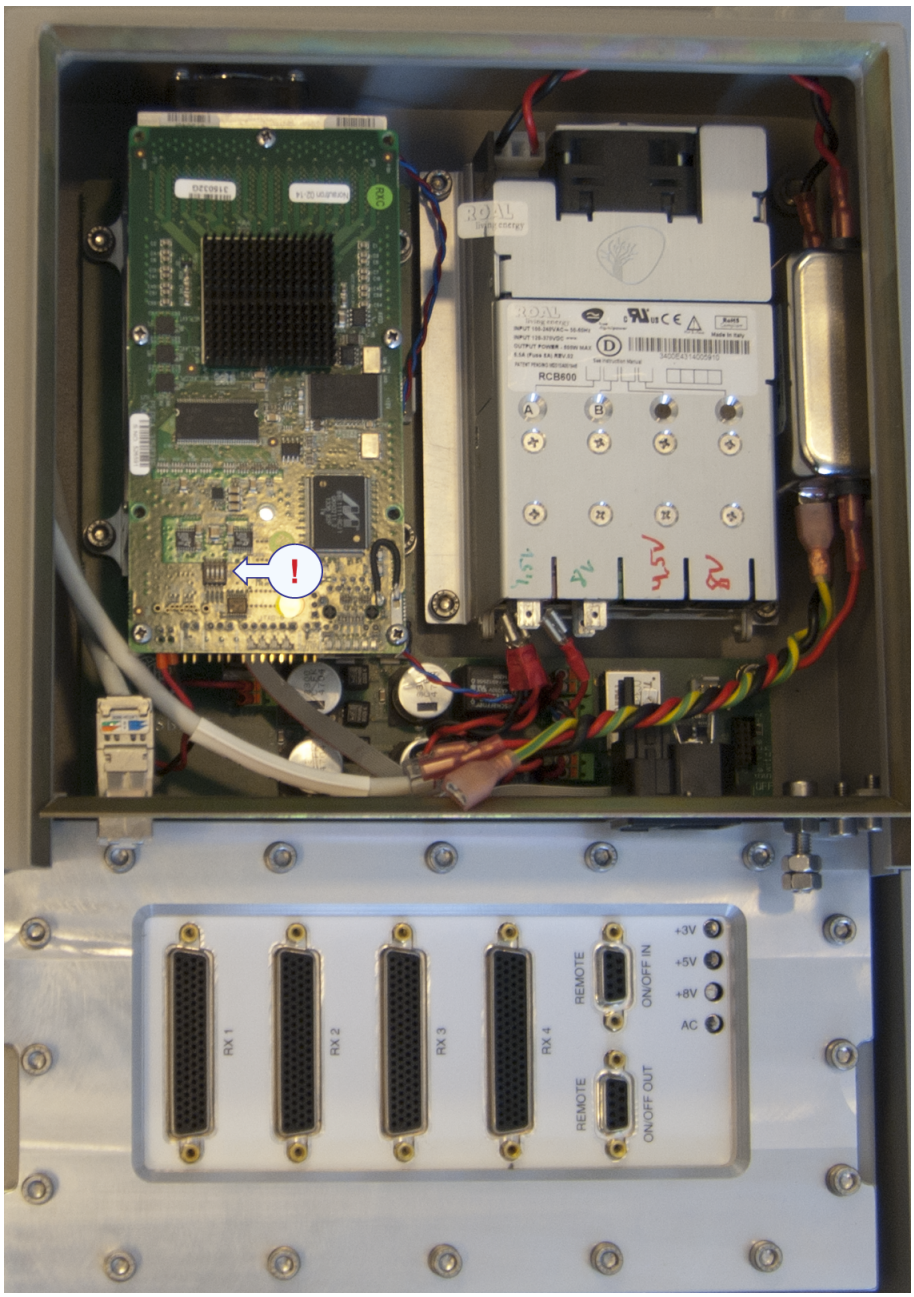
The transducer cables connect to the receiver Unit. The number of cables will depend on the chosen transducer configuration.

Receiver Unit - dip switch setting

The dip switch setting in the Receiver Unit has to be correct.

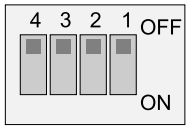
For a 0.5° transducer array, two Receiver Units are used.

The software in the Processing Unit must know the identification of the Receiver Units. A switch on the processing board inside the Receiver Unit is used for this.



One Receiver Unit

All switches must be set to OFF. OFF is when they are pushed up.



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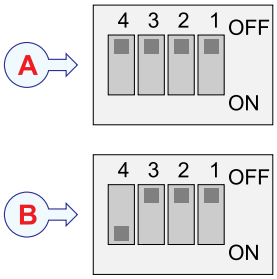
Two Receiver Units

A Receiver Unit 1: all switches must be set to OFF. OFF is when they are pushed up.

Receiver Unit 1 is connected to RX transducer 1.

B Receiver Unit 2: switch 1, 2 and 3 must be set to OFF, switch 4 must be set to ON.

Receiver Unit 2 is connected to RX transducer 2.



(CD020106_020_001)

Hydrographic Work Station

Topics

Hydrographic Work Station description

The Hydrographic Work Station is the operator station for the EM 712.

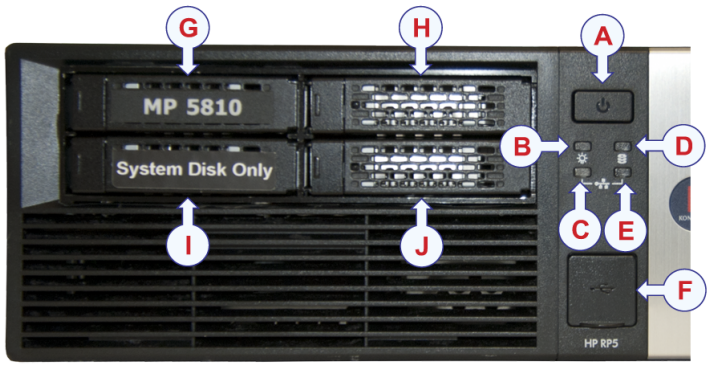
A dedicated maritime computer is provided with the EM 712 Multibeam echo sounder . It is set up with all necessary software.

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

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

Hydrographic Work Station front panel description

The front panel of the Hydrographic Work Station holds a mains power switch, LED indicators, USB sockets and hard disk drives.



A *Power On/Off*

B *Power connection indicator*

C *Network connection indicator*

D *Hard disk indicator*

E *Network activity indicator*

F *USB 2.0*
2 USB connectors behind lid

G *Hard disk drive*
Raw data

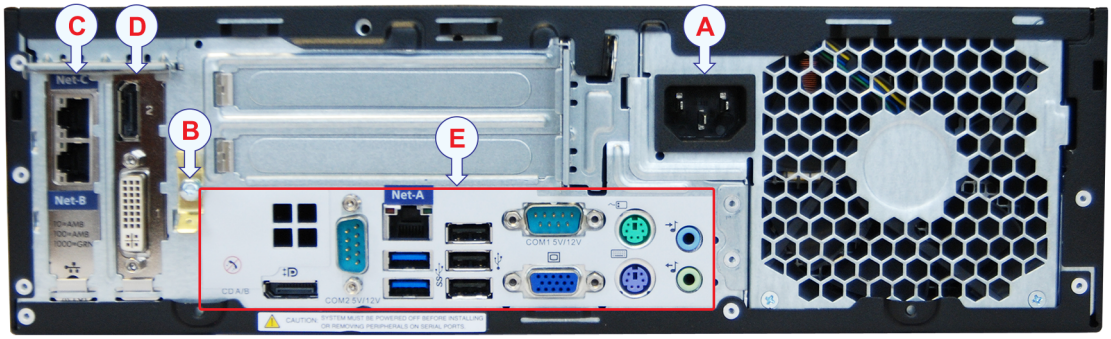
H *Hard disk drive*
Gridded data

I *Hard disk drive*
System disk

J *Not used*

Hydrographic Work Station rear panel description

The rear panel of the Hydrographic Work Station holds all the connectors used by the computer to communicate with external devices. It also holds the power input socket and a mains power switch.



The image shows the MP5810 Fishery SIS5 model. Part number: 438803

If another model is used, the connections can be different.

A *AC power socket*

B *Ground connector*

C *Slot 1: Dual Ethernet adapter*

D *Slot 2: Graphic adapter*

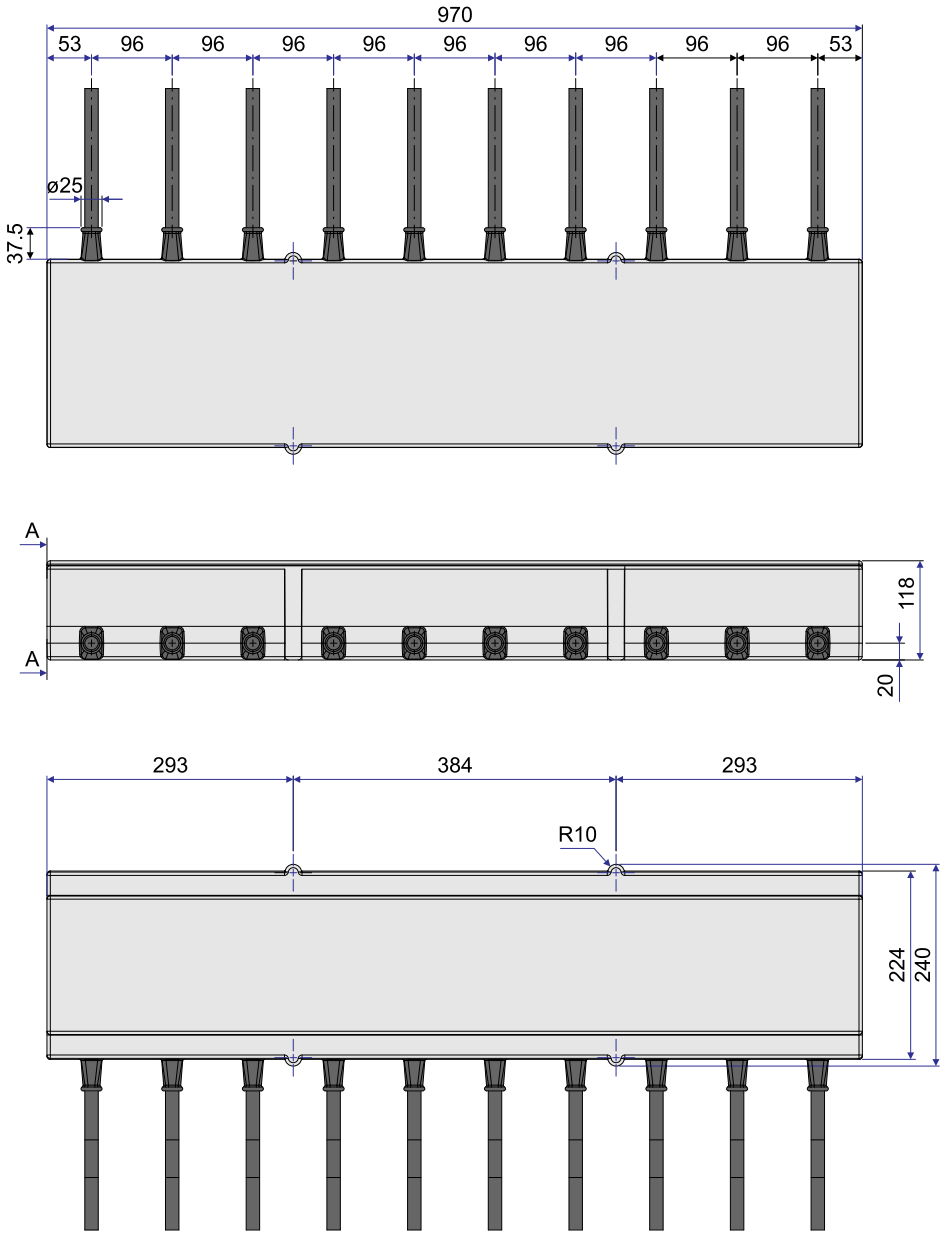
If another model is used, the graphic adapter can be different.

E *Computer rear panel interfaces*

Drawing file

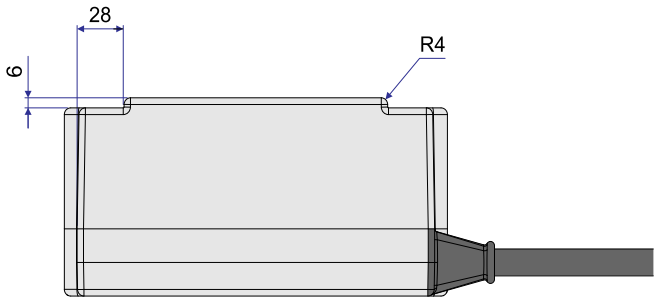
Topics

216148 Transducer TX1 dimensions

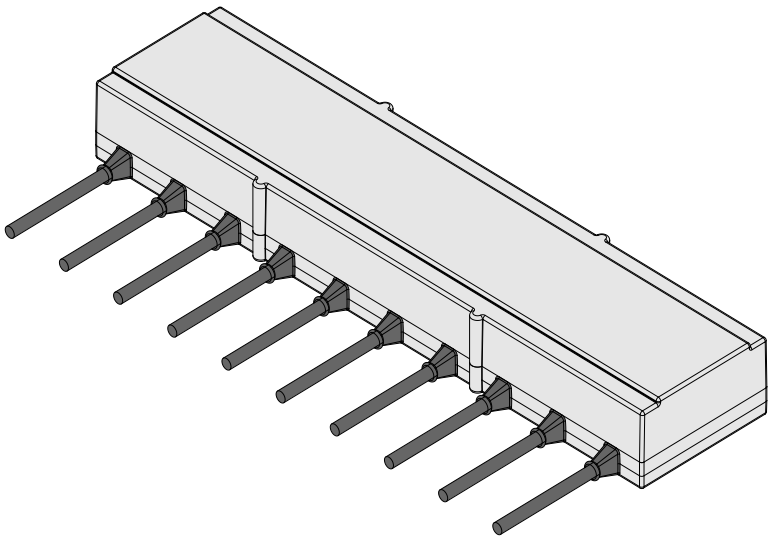


All measurements in mm.
The drawing is not in scale.
Information may be omitted. Observe the source drawing for additional details.

[216148] Rev.A
CD12_216148_001_001



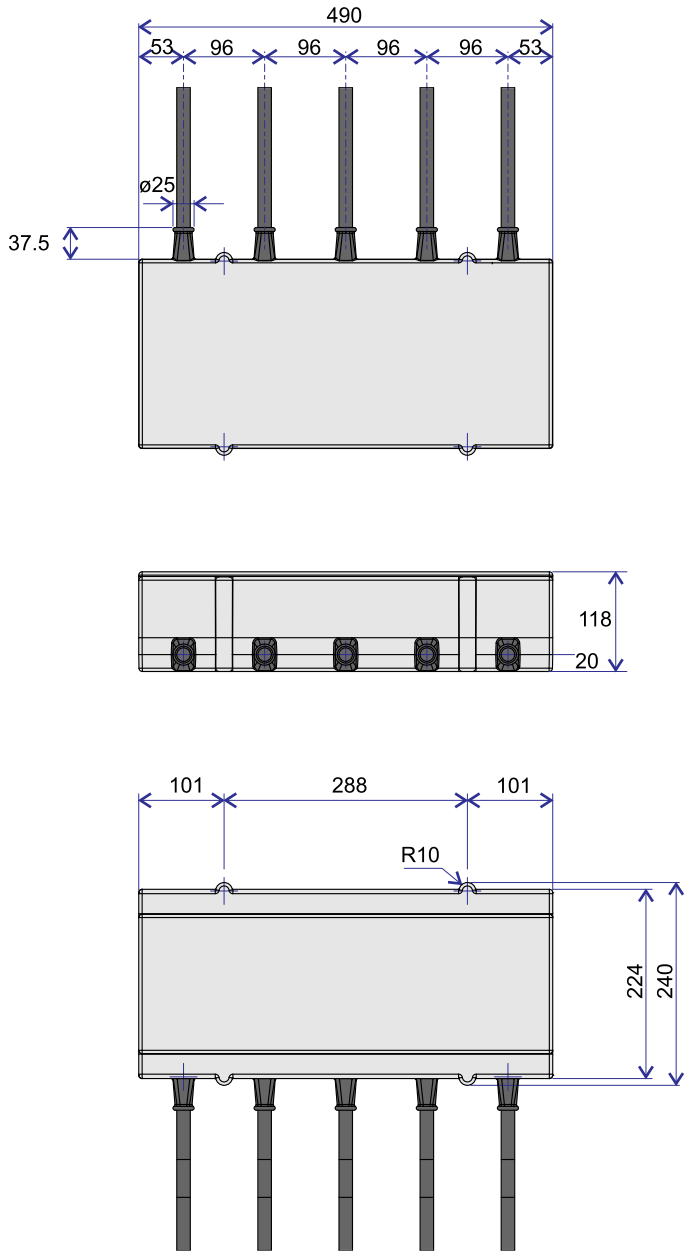
Section A-A



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

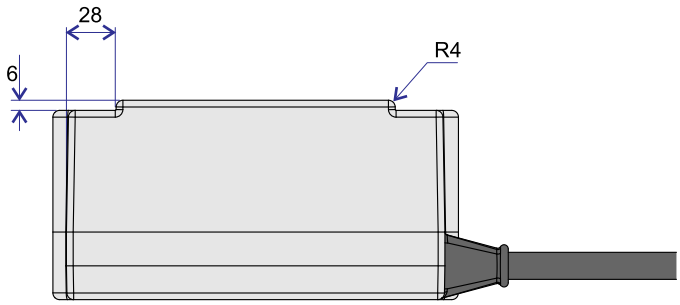
[216148] Rev.A
CD12_216148_002_001

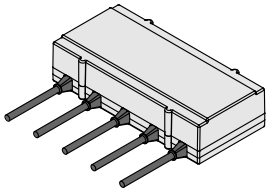
221048 Transducer TX2 dimensions



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

[221048] Rev.B
CD12_221048_001_001

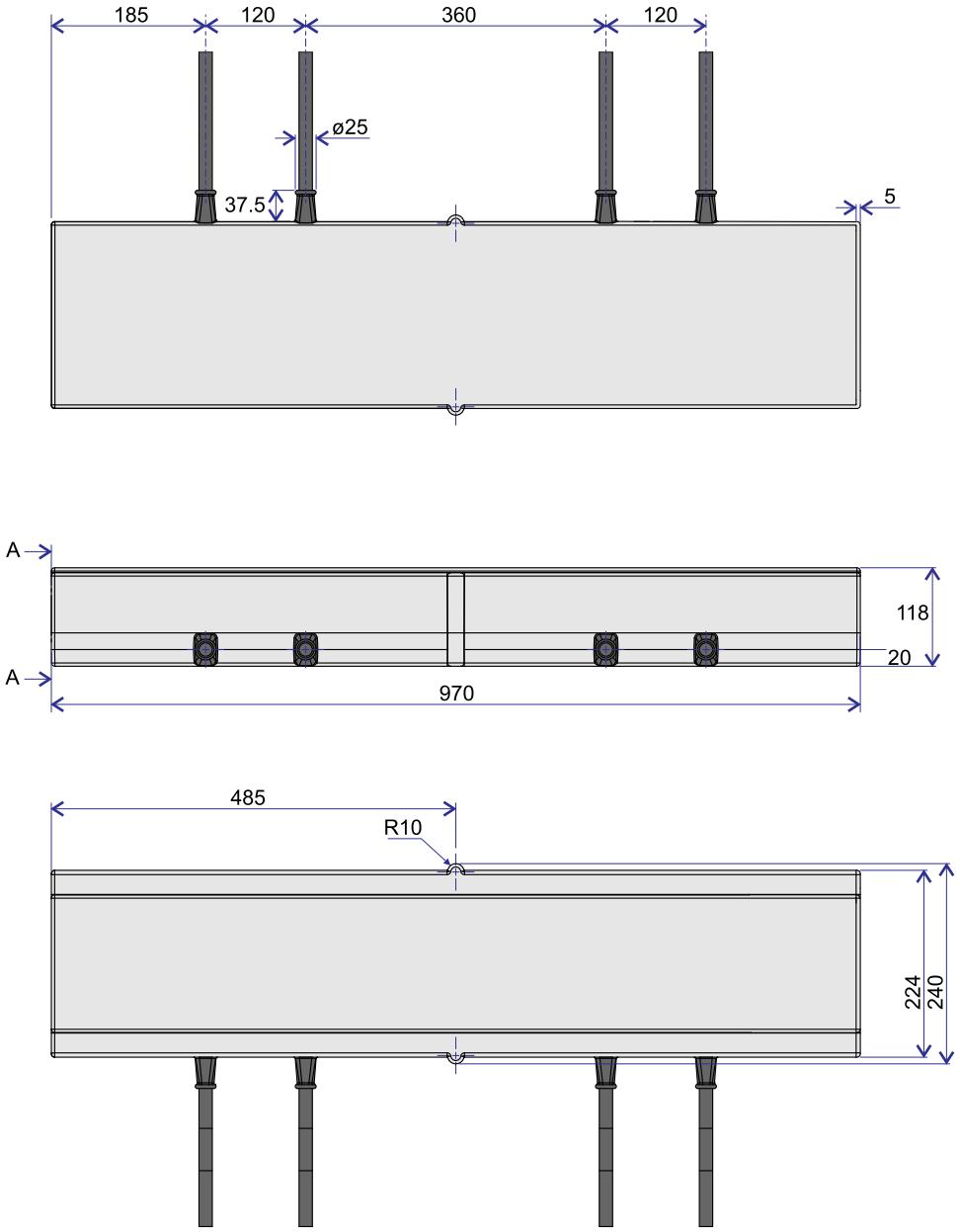




All measurements in mm.
The drawing is not in scale.
Information may be omitted. Observe the source drawing for additional details.

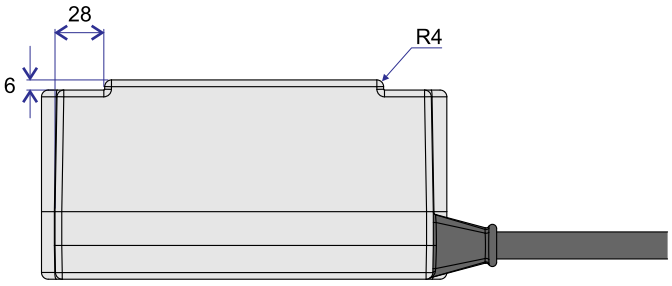
[221048] Rev.B
CD12_221048_002_001

219621 Transducer RX1 dimensions

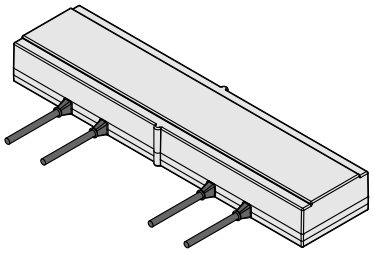


All measurements in mm.
The drawing is not in scale.
Information may be omitted. Observe the source drawing for additional details.

[219621] Rev.A
CD12_219621_001_001



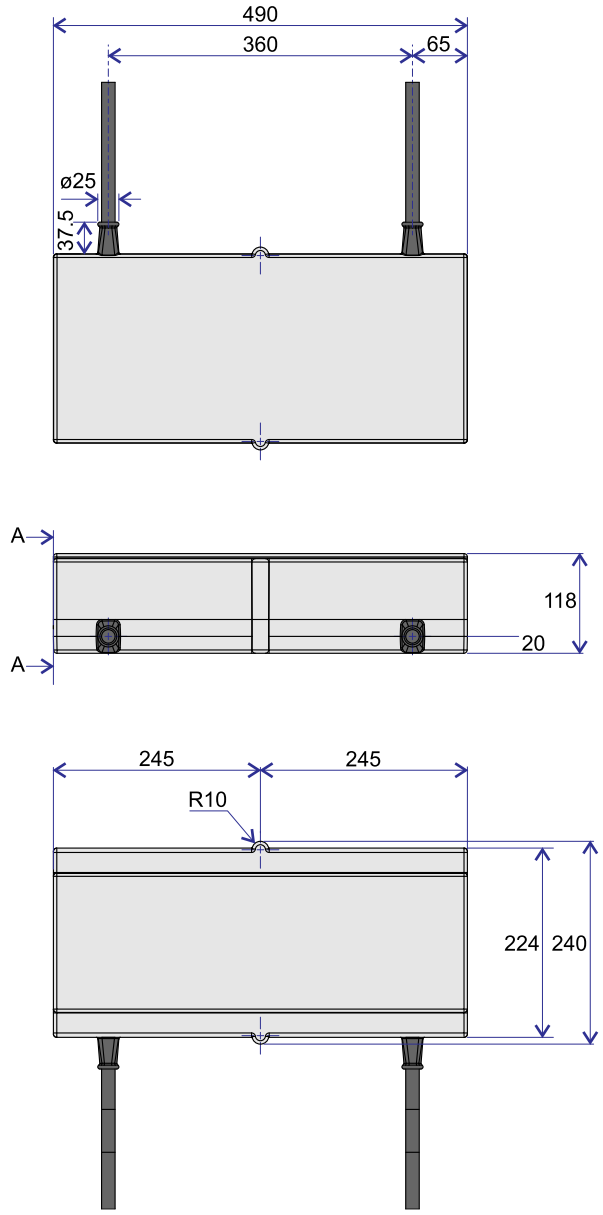
Section A-A



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

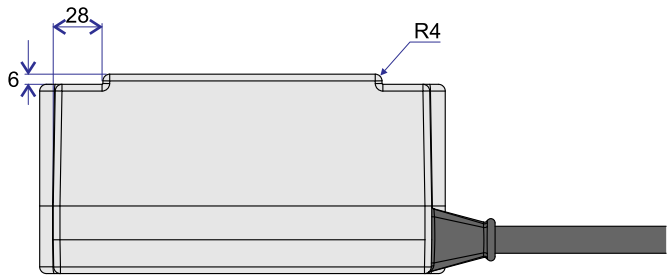
[219621] Rev.A
CD12_219621_002_001

216146 Transducer RX2 dimensions

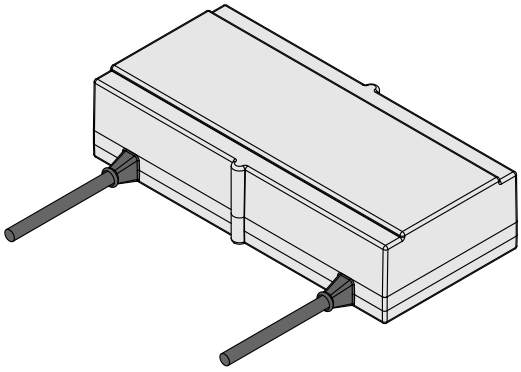


All measurements in mm.
The drawing is not in scale.
Information may be omitted. Observe the source drawing for additional details.

[216146] Rev.A
CD12_216146_001_001



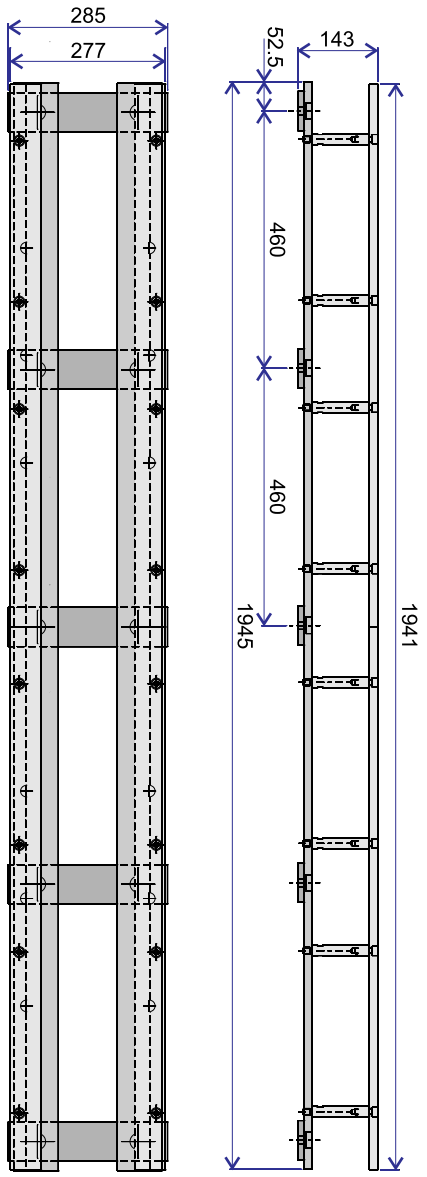
Section A-A



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

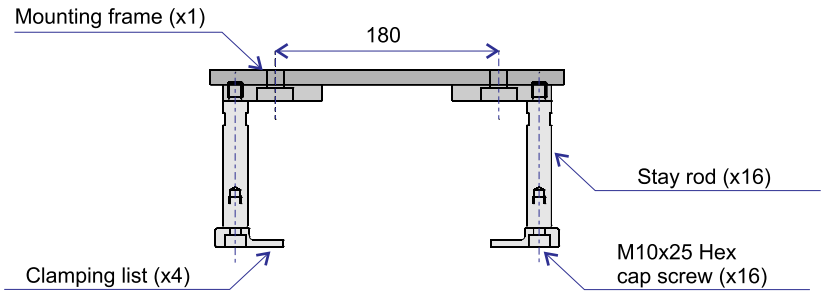
[216146] Rev.A
CD12_216146_002_001

223137 Transducer mounting frame - 0.5°



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

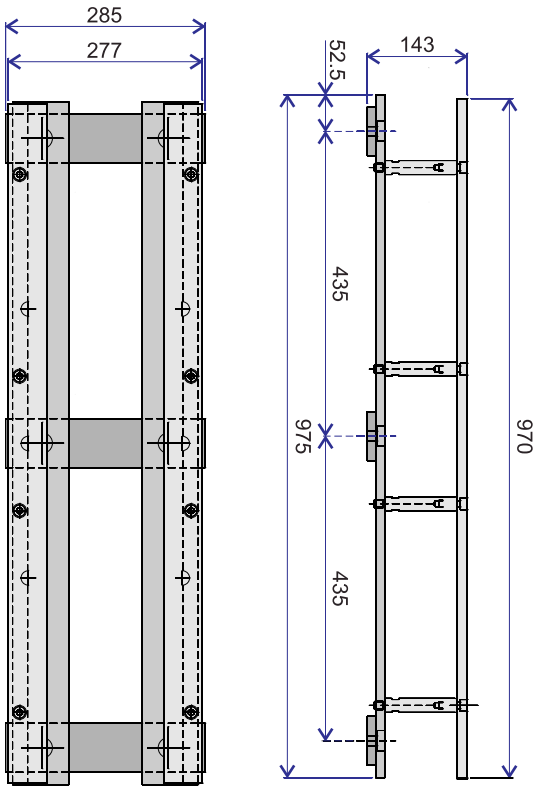
[223137] Rev.A
CD12_223137_001_001



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

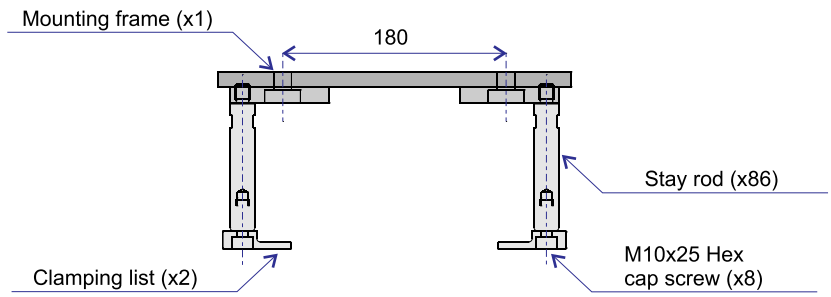
[223137] Rev.A
CD12_223137_002_001

223139 Transducer mounting frame - 1°



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

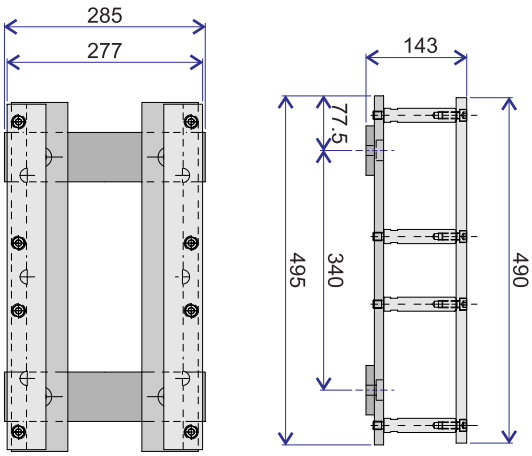
[223139] Rev.B
CD12_223139_001_001



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

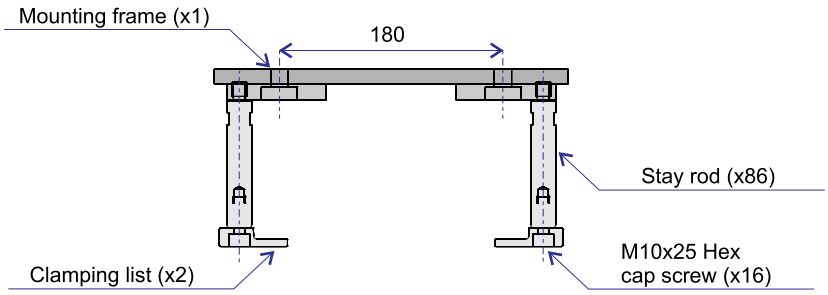
[223139] Rev.A
CD12_223139_002_001

223273 Transducer mounting frame - 2°



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

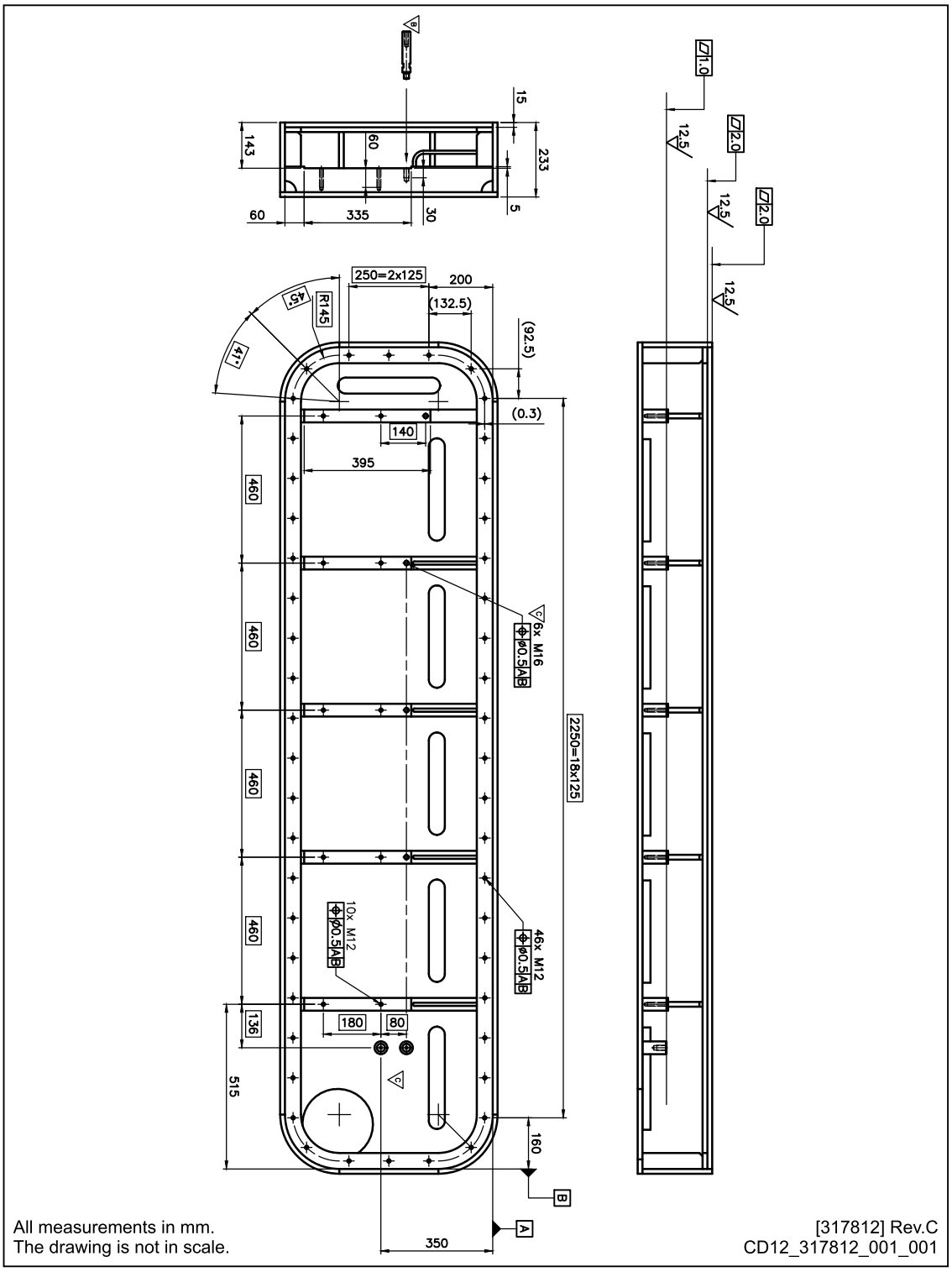
[223273] Rev.B
CD12_223273_001_001



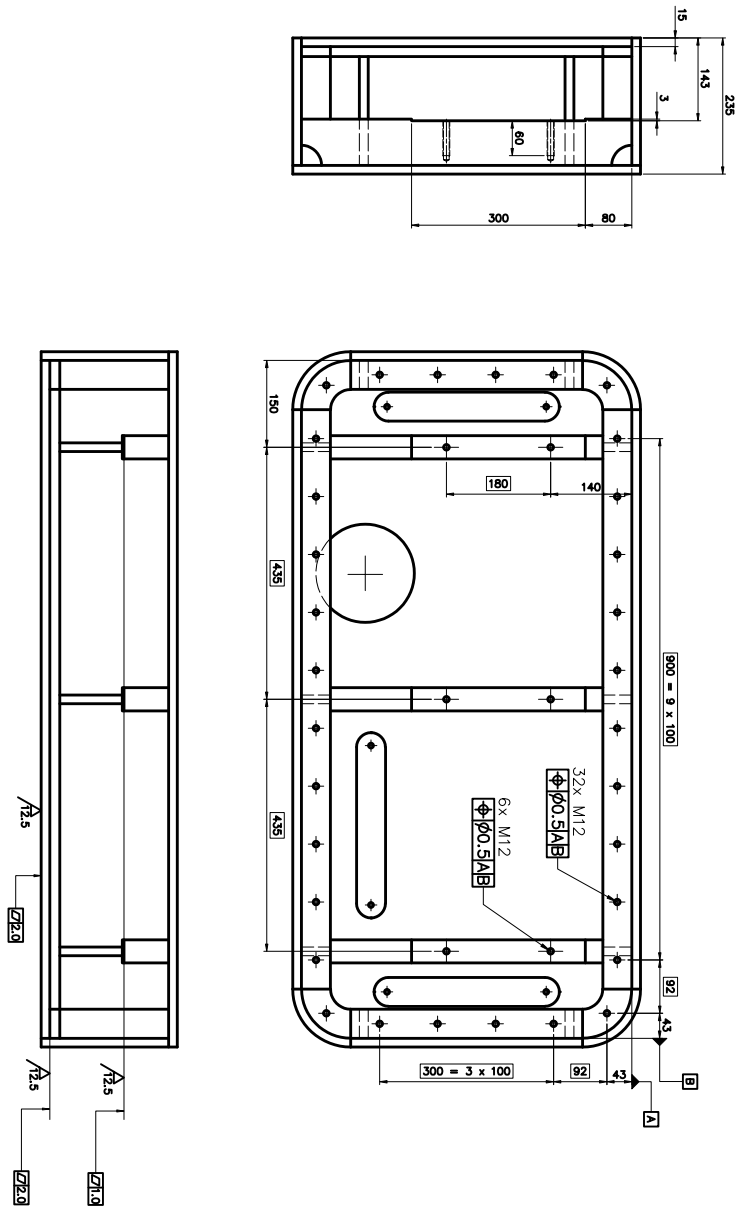
All measurements in mm.
The drawing is not in scale.
Information may be omitted. Observe the source drawing for additional details.

[223273] Rev.A
CD12_223273_002_001

317812 Casing w/mounting frame - 0.5°



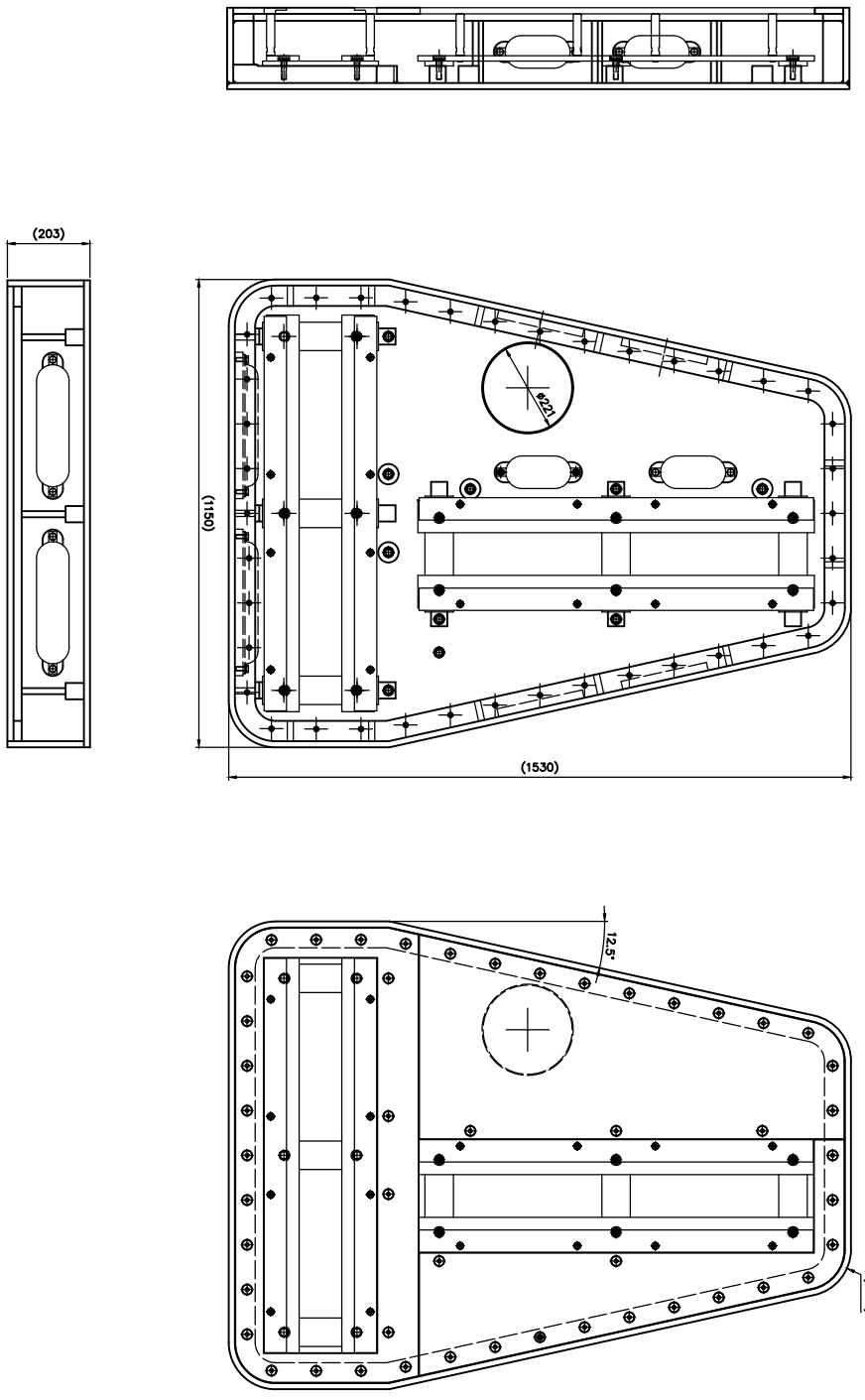
320320 Casing w/mounting frame - 1°



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

[320320] Rev.A
CD12_320320_001_001

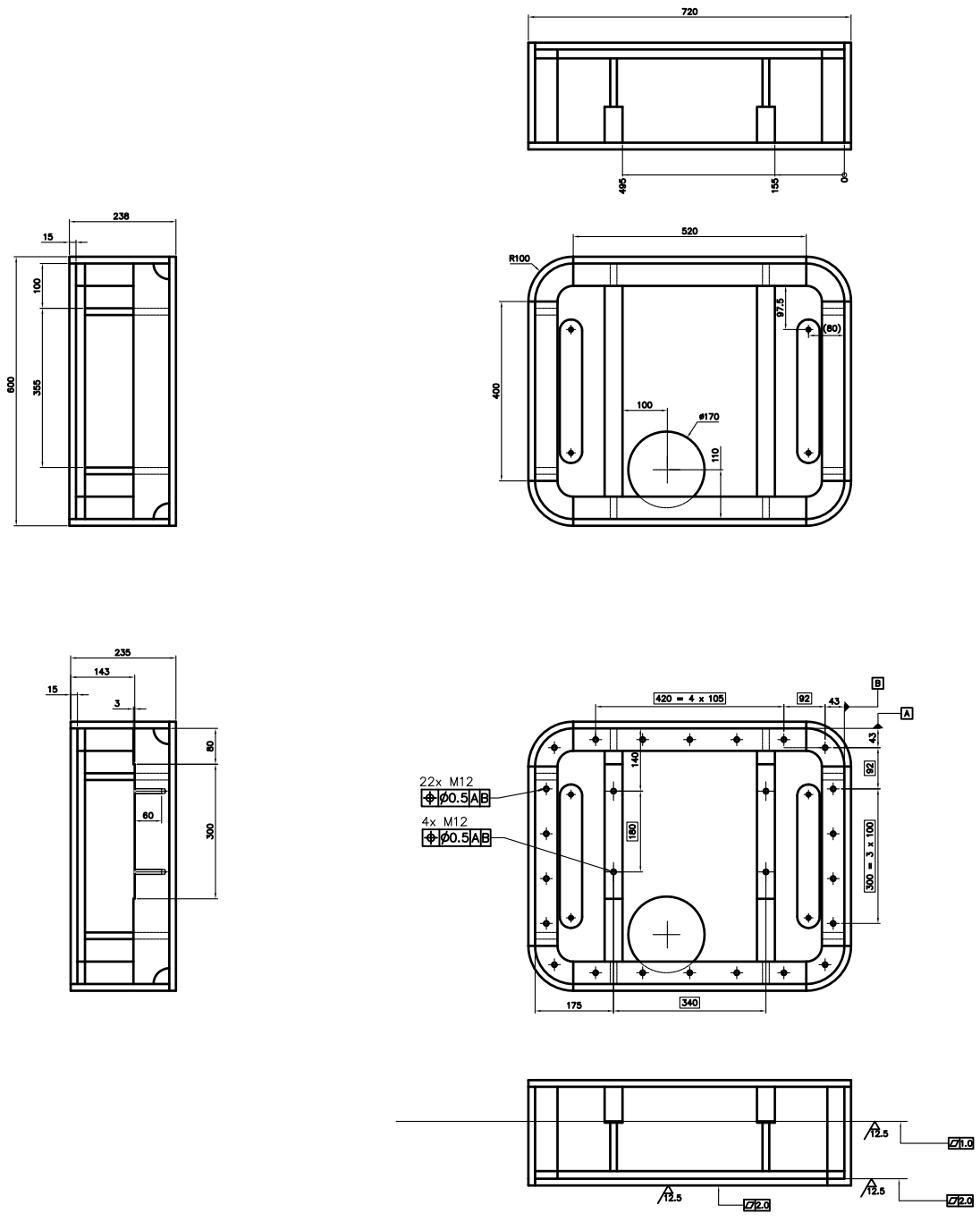
375817 Combined casing w/mounting frame - 1°



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

[375817] Rev.A
CD12_375817_001_001

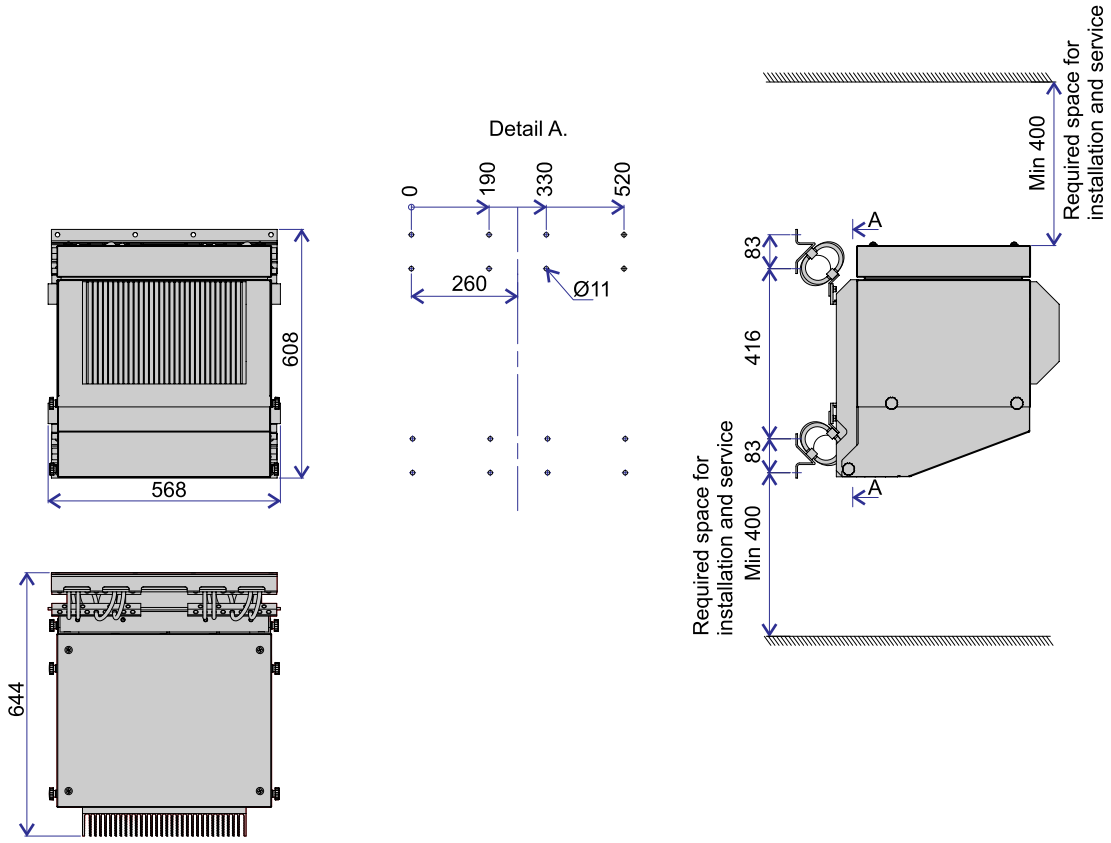
331369 Casing w/mounting frame - 2°



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

[331369] Rev.A
CD12_331369_001_001

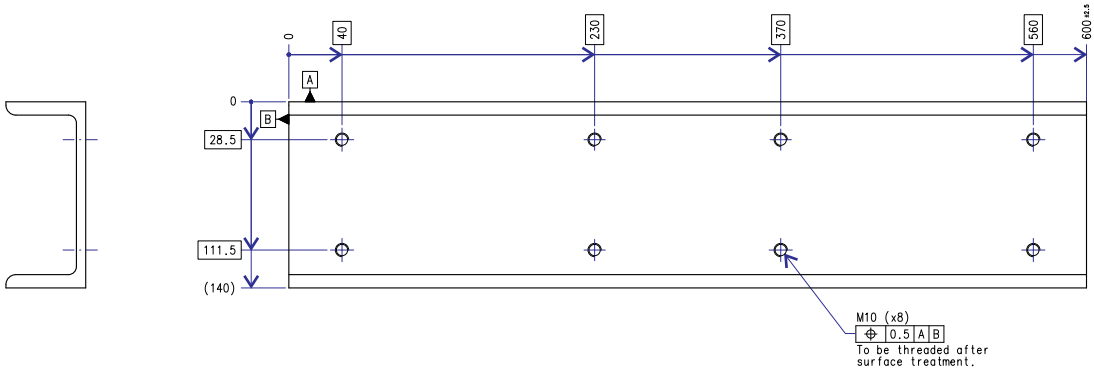
396402 EM 712 Transmitter Unit dimensions

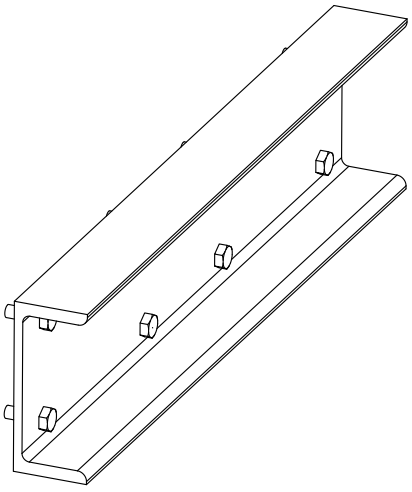


All measurements in mm.
The drawing is not in scale.

[396402] Rev.A
CD12_396402_001_001

212984 EM 712 Transmitter Unit mounting bracket

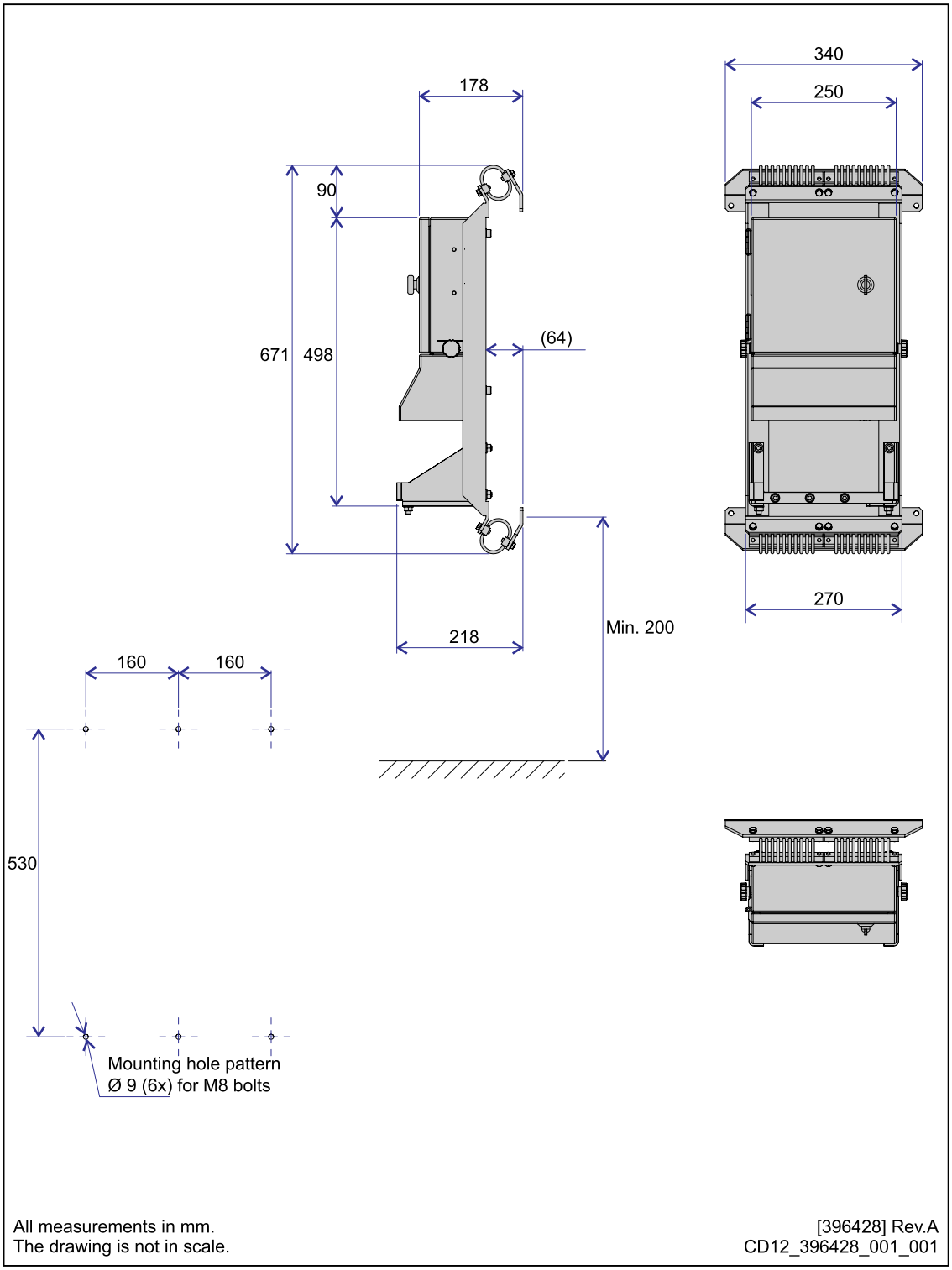




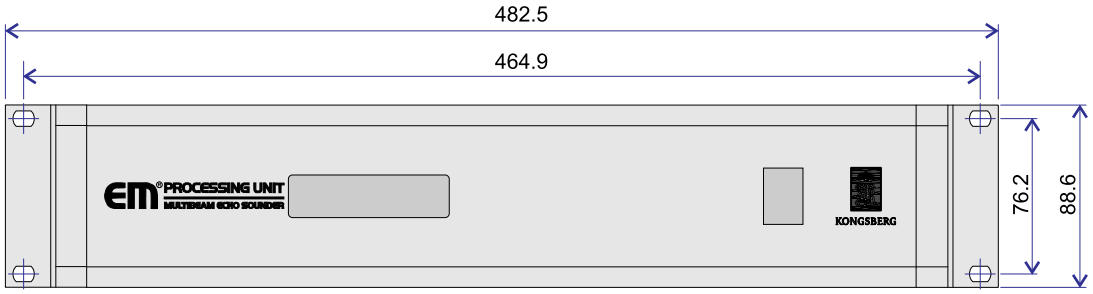
All measurements in mm.
The drawing is not in scale.
Information may be omitted. Observe the source drawing for additional details.

[212984] Rev.A
CD12_212984_001_001

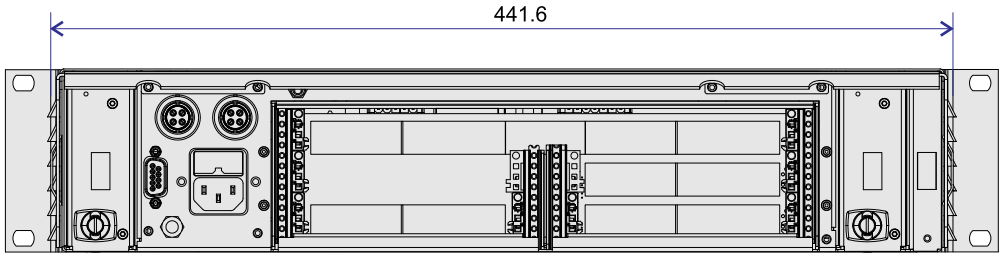
396428 EM 712 Receiver Unit dimensions



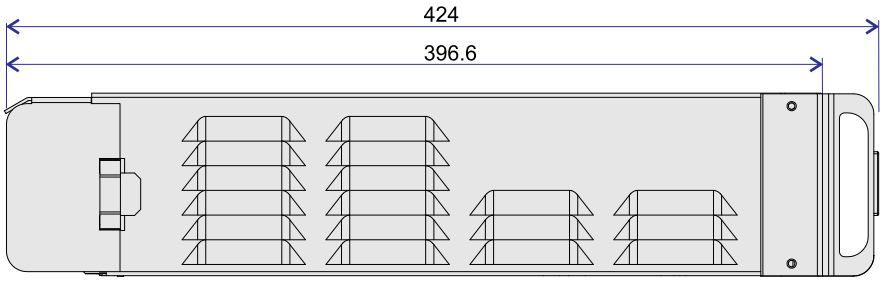
385422 Processing Unit dimensions



Front View



Rear View



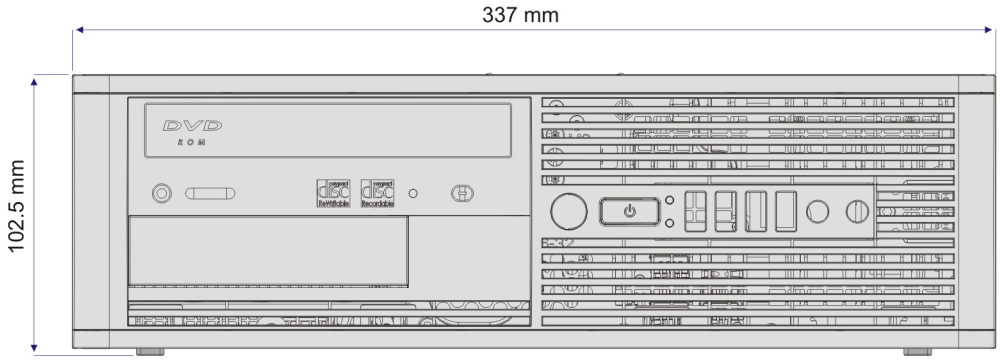
Side View

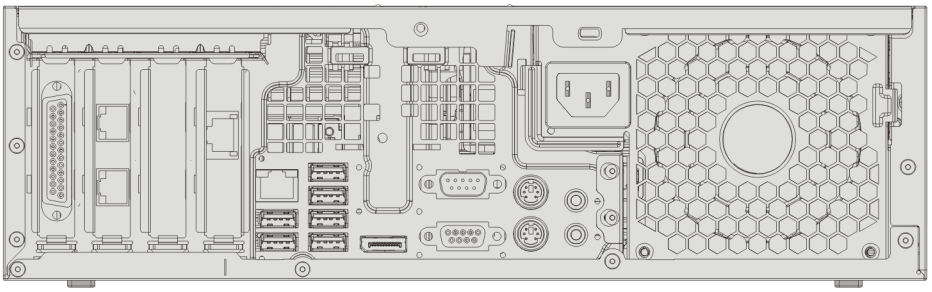
Weight: 10.5 kg

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

[385422] Rev.B
CD12_385422_001_001

378828 Hydrographic Work Station dimensions

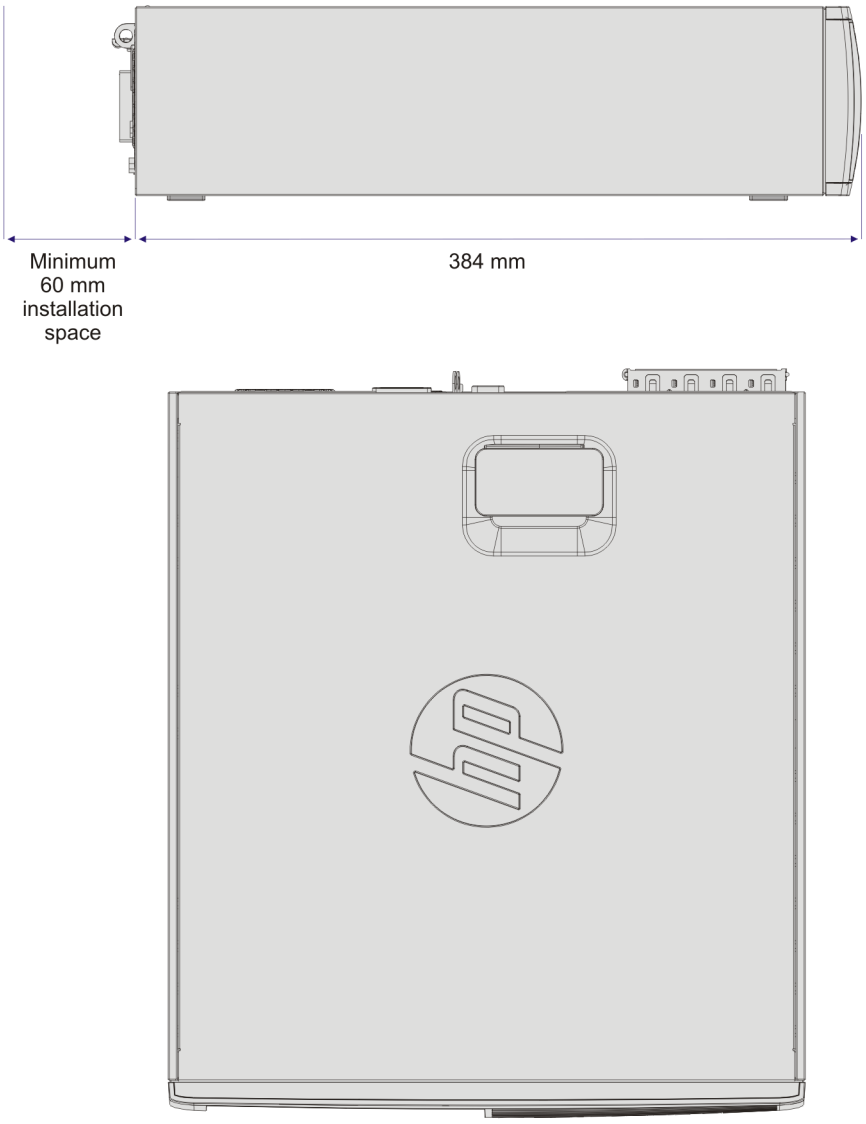




Note that this is a generic drawing. The physical presentation of the computer may not match specific product versions.

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

[378828] Rev.A
CD12_378828_001_001

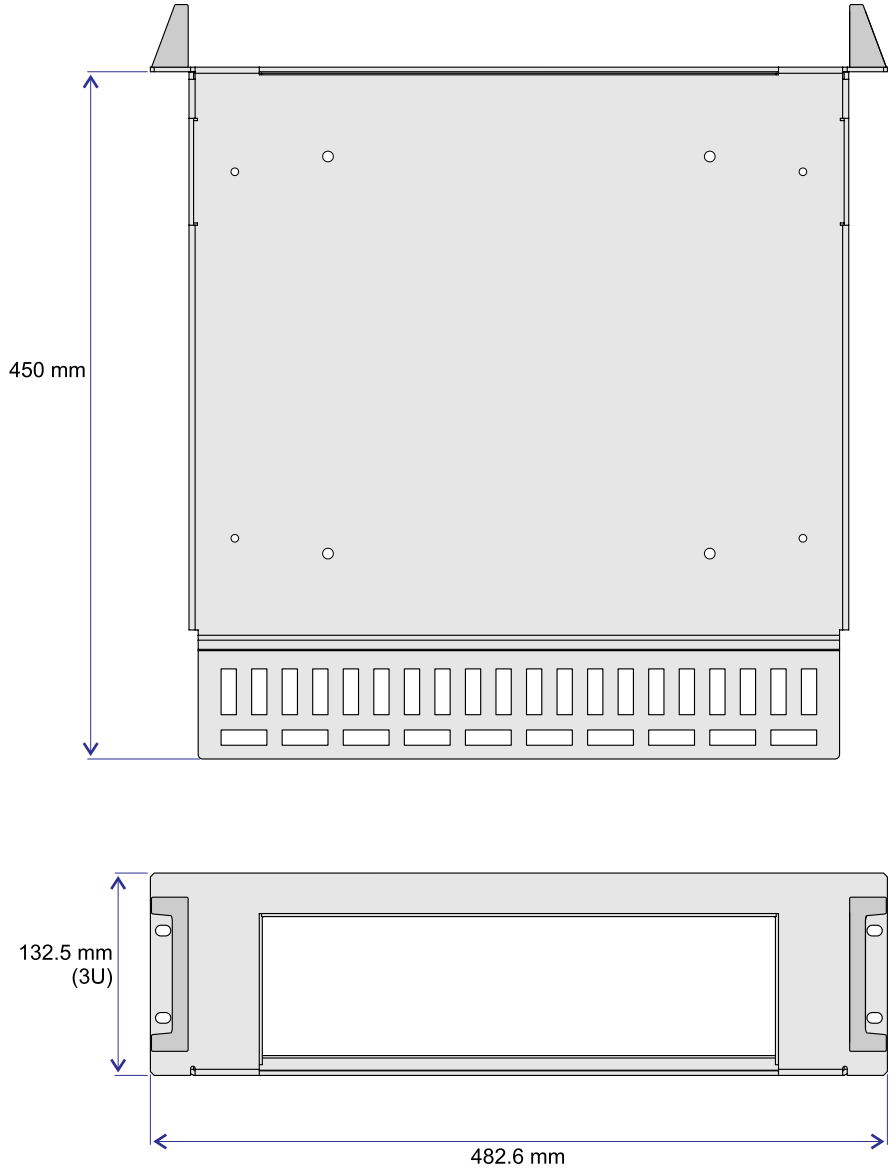


Note that this is a generic drawing. The physical presentation of the computer may not match specific product versions.

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

[378828] Rev.A
CD12_378828_001_002

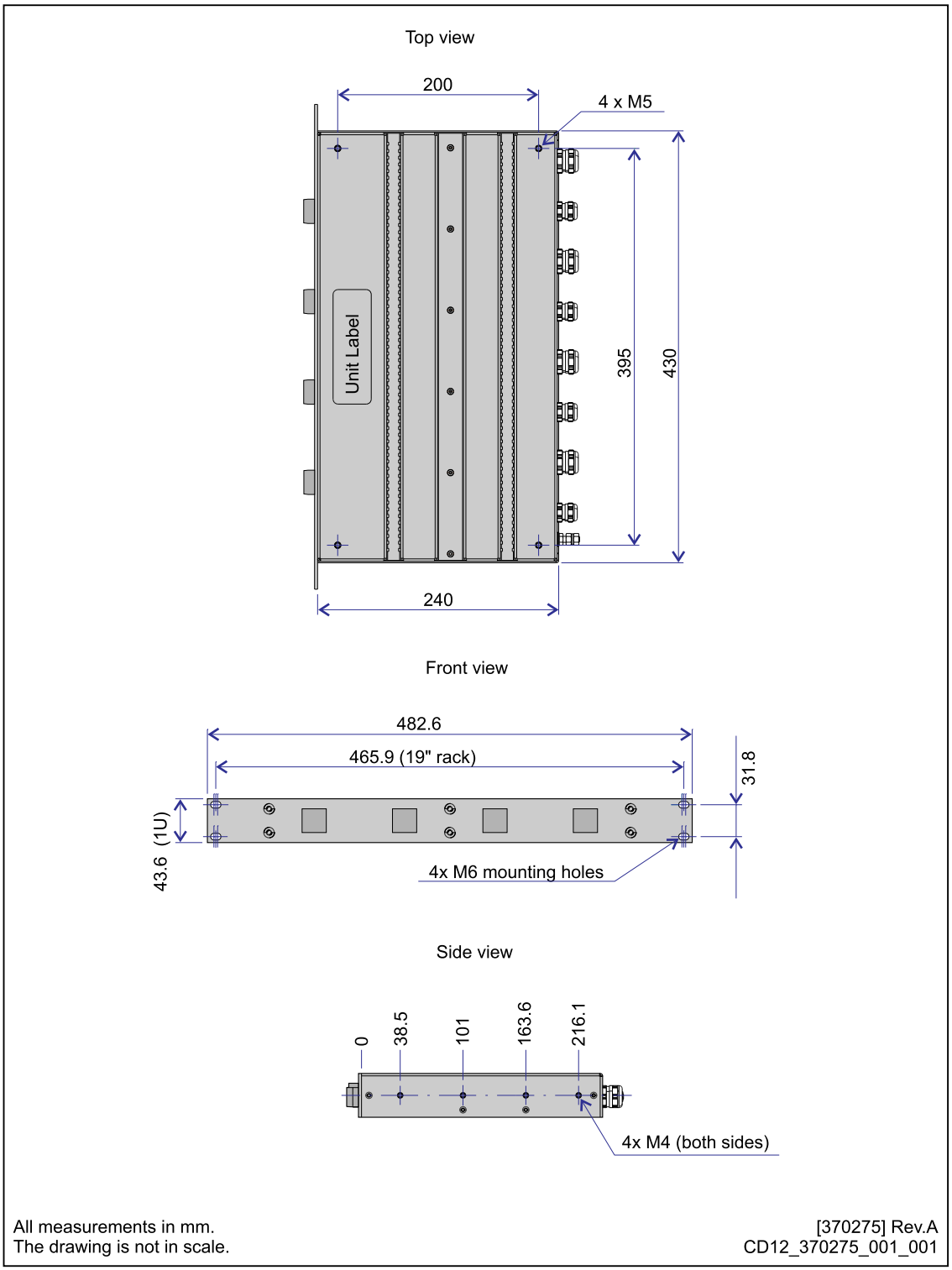
371591 Rack installation kit dimenisons

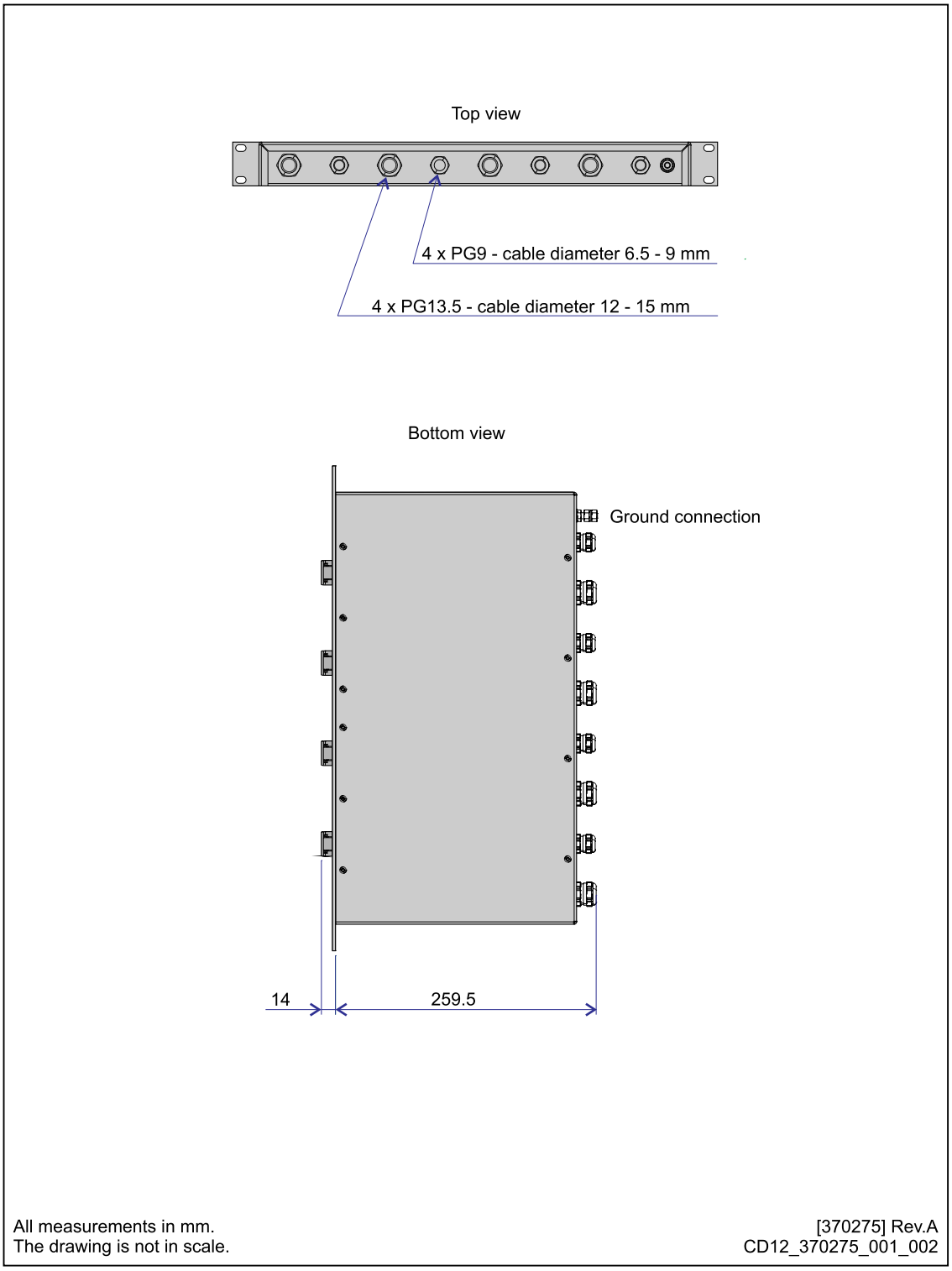


All measurements in mm.
The drawing is not in scale.

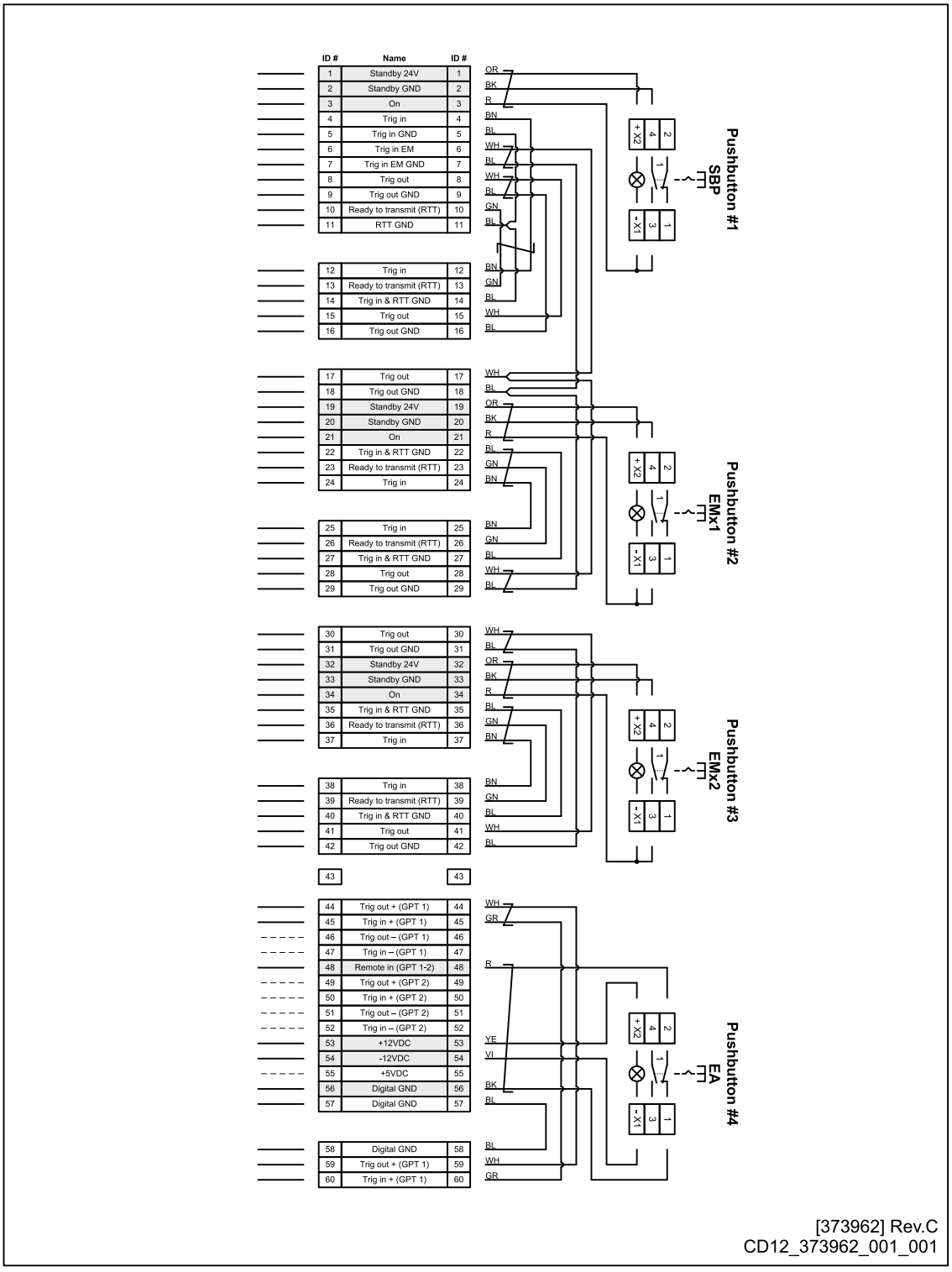
[371591] Rev.B
CD12_371591_001_001

370275 Remote Control Unit (K-REM) dimensions

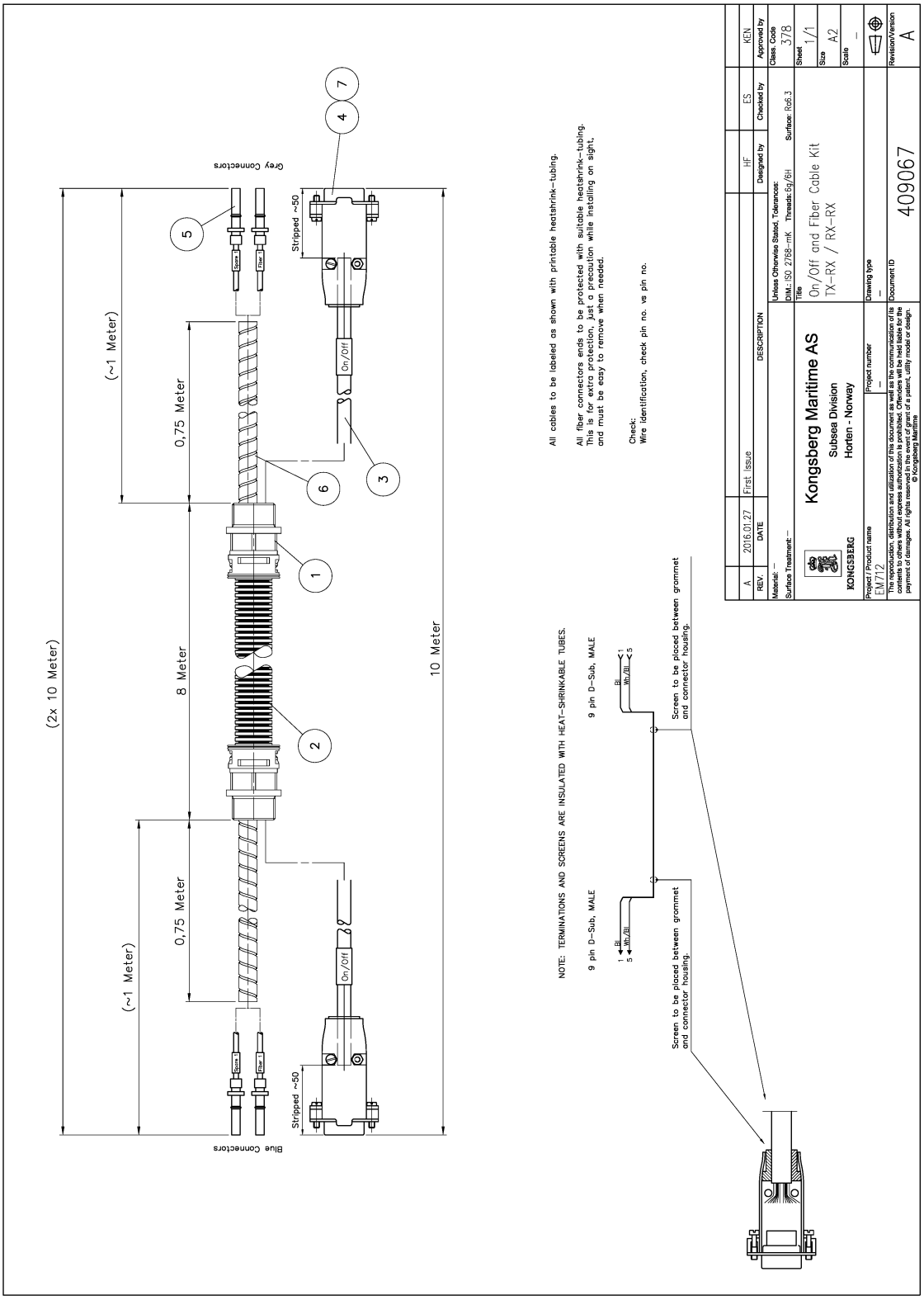



Top view
4 x PG9 - cable diameter 6.5 - 9 mm
4 x PG13.5 - cable diameter 12 - 15 mm
Bottom view
Ground connection
14
259.5
All measurements in mm.
The drawing is not in scale.
[370275] Rev.A
CD12_370275_001_002

373962 Remote Control Unit (K-REM) wiring diagram



409067 Fibre cable kit



Technical specifications

Topics

Performance specifications

These performance specifications summarize the main functional and operational characteristics of the EM 712 system.

- Maximum ping rate: More than 30 Hz
- Number of swaths per ping: 2
-

Number of beams and soundings				
System version	**0.25 x 0.5**	**0.5 x 0.5**	**0.5 x 1 and 1 x 1**	**1 x 2 and 2 x 2**
Number of soundings/ping	1600	1600	800	400
Number of soundings/swath	800	800	400	200

- Beamwidths: 0.25 x 0.5, 0.5 x 0.5, 0.5 x 1, 1 x 1, 1 x 2 or 2 x 2 degrees
- Beam spacing: Equidistant, Equiangle, High Density
- Coverage sector: Up to 140°
- Transmit beam steering: Stabilized for roll, pitch and yaw
- Receive beam steering: Stabilized for roll
- Depth range from transducers: 3 to approximately 3600 metres
- Pulse lengths: 0.2, 0.5 and 2 ms CW and FM (chirp) up to 120 ms
- Range sampling rate: 15 kHz (5 cm) at data output
- Source level:
  - 1° TX: Up to 225 dB re 1 µPa ref 1 m
  - 0.5° TX: Up to 231 dB re 1 µPa ref 1 m
  - 0.25° TX: Up to 237 dB re 1 µPa ref 1 m

Available beamwidths at the given frequencies

	40 kHz	**50 kHz**	**70 kHz**	**100 kHz**
0.25° TX	0.6	0.5	0.35	0.24
0.5° TX/RX	1.2	1.0	0.7	0.5
1.0° TX/RX	2.4	2.0	1.4	1.0
2.0° TX/RX	4.8	4.0	2.8	2.0

Maximum coverage and depth

Beamwidth	0.25 x 0.5	0.5 x 0.5	0.5 x 1	1 x 1	1 x 2	2 x 2
Maximum coverage						
Winter *	3800	3600	3450	3250	3050	2850
Summer *	4400	4200	3950	3700	3550	3250
Maximum depth						
Winter *	3400	3200	3000	2900	2700	2600
Summer *	3600	3400	3200	3100	2900	2800

Estimated depth and coverage for EM 712, based on BS= -20dB, NL= 35 dB, f = 40 kHz

Dual swath restrictions

FM mode is used to extend the maximum range capability.

Since the relative ping rate increases at large depths (caused by reduced angular coverage), the need for dual swath decreases with depth. In the Very Deep and Extra Deep modes long FM pulses are prioritized, so dual swath is not available in these modes.

Reduced power output (Mammal protect)

Maximum intensity is encountered in a thin wedge extending below the ship with an angular coverage of about 140°. The intensity level may be lowered by 10 or 20 dB by the operator. The EM 712 may be set in a mode to begin pinging with a flexible soft-start as a possible means of inducing marine mammals to leave the area of high intensity sound.

Interface specifications

Topics

Different datagram formats

Different EM multibeams will use and log data on different formats.

KMall format

The KMall format is the successor of the all format, and uses the file extension kmall. Water column data can be logged in a separate file with extension kmwcd. The format is a generic format with high resolution data and the structure of the datagram is designed to make updates easier.

EM multibeams using KMall will be controlled and configured using the K-Controller and can acquire and log data using SIS 5 or other third party acquisition software.

Next generation multibeams will only have support for KMall format, and as such will require K-Controller and SIS5. This includes:

- EM 124
- EM 304
- Any future EM multibeams

The KM multibeam output datagram format is described in a Doxygen document, a documentation generator writing software reference documentation, and can be downloaded from the Kongsberg websites.

See this page to download the Doxygen document: https://www.kongsberg.com/maritime/support/document-and-downloads/software-downloads/ page.

all format

Older generation EM multibeams will not have support for the new datagram format or use the K-Controller and SIS 5. This includes:

- EM 120/122
- EM 300/302
- EM 3000/3002
- EM 710

The all output datagram format is described in a separate document *EM Datagram formats* document number 160692, and can be downloaded from the Kongsberg websites.

See this page and select the relevant product to download the document: Product support A to Z.

Both formats

Support for both all and KMall format and will be available for:

- EM 2040 Series multibeams
- EM 712

For these we will continue to do maintenance and bug fixing for all and SIS4. Any new feature development will only be available for KMall and SIS5. Upgrading to the new format, K-Controller and SIS5 is free, but new features might be licensed.

Contact our customer support line for assistance in upgrading existing systems.

Interface specifications - Processing Unit - all format

The EM 712 system will interface with peripheral systems and sensors using standard and/or proprietary datagram formats. This is a description of available datagram formats for EM multibeams using all format.

Supported datagram formats for position information

The EM 712 supports the following datagram format for position information.

These datagram formats are received using a serial communication line.

- **PTNL GGK**

  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 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 712 supports the following datagram format from an external clock.

This datagram format is received using a serial communication line.

- **NMEA ZDA**

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

Supported datagram formats for heading information

The EM 712 supports the following datagram formats for vessel heading and/or gyro information.

These datagram formats are received using a serial communication line.

- **NMEA HDT**

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

- **SKR82 Heading**

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

Supported datagram formats for depth information

The EM 712 supports the following datagram formats for depth information from an echo sounder.

These datagram formats are received using a serial communication line.

- **NMEA DBS**

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

- **NMEA DPT**

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

- **Simrad EK500 Depth**

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

Supported datagram formats for motion information

The EM 712 supports the following datagram format from a motion sensor.

These datagram formats are received using a serial communication line.

- **Kongsberg EM Attitude 3000**

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

Supported datagram formats for motion information including velocity

The EM 712 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 Maritime (https://www.kongsberg.com/maritime/), former Kongsberg 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 Maritime (https://www.kongsberg.com/maritime/), former Kongsberg Seatex, to provide position, motion and heading data from a Seapath sensor system.

- **Seapath Binary 26**

  This is a proprietary format created by Kongsberg Maritime (https://www.kongsberg.com/maritime/), former Kongsberg 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

Interface specifications - Processing Unit - KMall format

The EM 712 system will interface with peripheral systems and sensors using standard and/or proprietary datagram formats. This is a description of available datagram formats for EM multibeams using KMall format.

Supported datagram formats for position information

The EM 712 supports the following datagram format for position information.

- **NMEA GGA**

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

- **PTNL GGK**

  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).

Supported datagram formats for external clock

The EM 712 supports the following datagram format from an external clock.

- **NMEA ZDA**

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

Supported datagram formats for motion information

The EM 712 supports the following datagram format from a motion sensor.

- **Kongsberg EM Attitude 3000**

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

Supported datagram formats for motion information including velocity

The EM 712 supports the following datagram formats from a motion sensor.

- **KM Binary**

  KM Binary is a general datagram format defined by Kongsberg Maritime. This format has very high resolution on timing and sensor parameters.

- **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.

  Seapath Binary 11 is an old format with low resolution that Kongsberg does not recommend.

- **Seapath Binary 23**

  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.

- **Seapath Binary 26**

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

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

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

Supported datagram formats for sound speed probe

Sound speed probe can be interfaced directly to the Processing Unit and configured in K-Controller or interfaced to the Hydrograpic Work Station and configured in SIS 5.

The EM 712 supports the following datagram format from a sound speed probe.

- **AML**

  This is a third-party proprietary datagram format created by AML Oceanographic for use with their sound speed sensors. The file format is ASCII with a five-line header plus a variable number of data lines. For more information, see http://www.amloceanographic.com.

  The supported AML Smart Sensor message formats are

  – **AML NMEA**: NMEA like format
  – **AML SV**: Sound Velocity
  – **AML SVT**: Sound Velocity and Temperature
  – **AML SVP**: Sound Velocity and Pressure
  – **Micro SV**: Sound Velocity
  – **Micro SVT**: Sound Velocity and Temperature
  – **Micro SVP**: Sound Velocity and Pressure

- **Valeport**

  This is a third-party proprietary datagram format created by Valeport Ltd. for use with their sound velocity sensors.

  The supported Valeport message formats are

  – **MiniSVS SV**: Sound velocity

No longer supported

Some external sensors are no longer supported.

- Position sensor format Simrad 90
- Attitude sensor format Sperry MK-39
- Heading sensor format NMEA HDT, SKR 82

Special interfaces

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

Output datagram formats

The KMall format is described in it's own document.

See the Product support A to Z page.

External sensor requirements

The external sensors must fulfil these requirements to achieve the specified performance for the EM 712 system.

Sensor accuracy

Velocitiy 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 fulfil (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**:
  - 0.1 degrees RMS for 0.5 ° TX transducer
  - 0.2 degrees RMS for 1° TX transducer
  - 0.4 degreesRMS for 2° TX transducer
- **Heave**: 5 cm or 5% whichever is highest (real-time output)

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 fulfils Kongsberg Maritime requirements for Doppler shift corrections.

- Kongsberg Maritime – Seapath series
- Applanix – Pos MV

- IXSEA – Phins

Interface specifications - Hydrographic Work Station - all format

The EM 712 system will interface with peripheral systems and sensors using standard and/or proprietary datagram formats. This is a description of available datagram formats for EM multibeams using all format.

- 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)

Interface specifications - Hydrographic Work Station - KMall format

The EM 712 system will interface with peripheral systems and sensors using standard and/or proprietary datagram formats. This is a description of available datagram formats for EM multibeams using KMall format.

- 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)

Weight and outline dimensions

These weights and outline dimension characteristics summarize the physical properties of the EM 712 system.

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

Transmit transducer module – TX1 – 1°

- **Outline dimensions**:
  - **Length**: 970 mm
  - **Width**: 224 mm
  - **Height**: 118 mm
- **Weight**: 98 kg (with 10 cables)

Transmit transducer module – TX2 – 2°

- **Outline dimensions**:
  - **Length**: 490 mm
  - **Width**: 224 mm
  - **Height**: 118 mm
- **Weight**: 50 kg (with 5 cables)

Receive transducer module – RX1 – 1°

- **Outline dimensions**:
  - **Length**: 970 mm
  - **Width**: 224 mm
  - **Height**: 118 mm
- **Weight**: 56 kg (with 4 cables)

Receive transducer module – RX2 – 2°

- **Outline dimensions**:
  - **Length**: 490 mm
  - **Width**: 224 mm
  - **Height**: 118 mm
- **Weight**: 28.5 kg (with 2 cables)

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

Transmitter Unit

- **Physical dimensions**:
  - **Height**: 380 mm
  - **Width**: 600 mm
  - **Depth**: 600 mm
- **Weight**: 71 kg (for 0.5° TX array)

Receiver Unit

- **Physical dimensions**:
  - **Height**: 350 mm
  - **Width**: 250 mm
  - **Depth**: 260 mm
- **Weight**: 11 kg

Hydrographic Work Station

Make and model: Hewlett Packard MP5810

The standard commercial computer has been configured to fit the operational requirements of the EM 712.

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

Display

- **Manufacturer**: Isic
- **Manufacturer’s website**: http://www.isic-systems.com
- **Make and model**: MD24 (DuraMON WS 24)
- **Outline dimensions**:
  - **Depth**: 68 mm
  - **Width**: 601 mm

  - **Height**: 408 mm
- **Weight**: 10 kg (Approximately)

Power requirements

These power characteristics summarize the supply power requirements for the EM 712 system.

Note

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

TX Unit

- **Voltage requirement**: 230 Vac, 47 to 63 Hz
- **Maximum voltage deviation** : 15%
- **Power consumption**: Less than 300 W

RX Unit

- **Voltage requirement**: 230 Vac, 47 to 63 Hz
- **Maximum voltage deviation** : 15%
- **Power consumption**: Less than 50 W

Processing Unit

- **Make and model**: Kongsberg Maritime, EM PU
- **Voltage requirement**: 100 to 250 Vac, 47 to 63 Hz
- **Maximum power consumption**:
  - **With two CBMF boards** : 125 W

Hydrographic Work Station

- **Make and model**: Hewlett Packard MP5810

  The standard commercial computer has been configured to fit the operational requirements of the EM 712.
- **Voltage requirement**: 100/240 VAC, 50 to 60 Hz, autosensing
- **Maximum power consumption**: 240 W (Approximately)

Display

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

Environmental requirements

These specifications summarize the temperature requirements and other environmental standards for the EM 712 system.

Transducer

- **Operational temperature**: -5 to +50 °C
- **Storage temperature**: -30 to +70 °C
- **Depth rating** : 250 m

Processing Unit

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

Transmitter Unit

- **Operational temperature**: 0 to 40 °C
- **Storage temperature**: –30 to 70 °C
- **Relative humidity**: 5 to 93% relative non-condensing
- **Ingress protection**: IP23
- **Vibration**:
  - **Frequency range**: 5 to 100 Hz
  - **Excitation level**: 0.7 g
- **Shock**:
  - **Peak acceleration**: 15 g
  - **Duration**: 11 ms
  - Half sine pulse
- **Reference standards**:
  - IEC 60945:2002 and CORRIGENDUM 1:2008
  - IACS E10:2006

Receiver Unit

- **Operational temperature**: 0 to 50 °C
- **Storage temperature**: –30 to 70 °C
- **Relative humidity**: 5 to 93% relative non-condensing
- **Ingress protection**: IP23
- **Vibration**:
  - **Frequency range**: 5 to 100 Hz
  - **Excitation level**: 0.7 g
- **Shock**:
  - **Peak acceleration**: 15 g
  - **Duration**: 11 ms
  - Half sine pulse
- **Reference standards**:
  - IEC 60945:2002 and CORRIGENDUM 1:2008
  - IACS E10:2006

Hydrographic Work Station

- **Make and model**: Hewlett Packard MP5810
- **Operating temperature**: 0 to +50 °C
- **Storage temperature**: -20 to 70 °C
- **Relative humidity**: 5 to 95% relative, non-condensing
- **Certificates**:
  - IEC 60945
  - IACS E10
- **Ingress protection (IP) rating: IP22**

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

Display

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

Alignment specifications

These alignment specifications summarize the alignment accuracy requirements of the EM 712 system.

Note

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

Transducer alignment accuracy

TX array

- **Position (x)**: ± 0.05 m
- **Position (y)**: ± 0.05 m
- **Position (z)**: ± 0.02 m
- **Pitch**:
  - TX transducer: ± 0.05 degrees
  - RX transducer: ± 0.20 degrees
- **Roll**:
  - TX transducer: ± 0.20 degrees
  - RX transducer: ± 0.02 degrees
- **Heading**: ± 0.10 degrees
- **Relative heading between RX and TX transducer**: ± 0.05 degrees
- **Flatness**: ± 0.2 mm
  - The mounting structure must not deviate from a flat surface more than ± 0.2 mm.

Motion sensor alignment accuracy

- **Position (x)**: ± 0.05 m
- **Position (y)**: ± 0.05 m
- **Position (z)**: ± 0.05 m
- **Pitch**: ± 0.05 degrees
- **Roll**: ± 0.02 degrees
- **Heading**: ± 0.10 degrees

Heading sensor alignment accuracy

- **Heading**: ± 0.10 degrees

Position sensor alignment accuracy

- **Position (x)**: ± 0.05 m
- **Position (y)**: ± 0.05 m
- **Position (z)**: ± 0.02 m

Waterline determination accuracy

- **Position (z)**: ± 0.02 m

Cable layout and interconnections

Topics

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 712 delivery.

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

1 **System cables**: These cables are provided by Kongsberg Maritime as a part of the EM 712 delivery.

2 **Shipyard cables**: These cables must be provided by the shipyard performing the installation, or the shipowner. It is very important that the cables used meet the minimum specifications provided in this manual.

3 **Commercial cables**: These cables may be provided by Kongsberg Maritime as a part of the EM 712 delivery. They may also be included with third party items that are used with the EM 712.

All electronic installations and corresponding wiring must be in accordance with the vessel's national registry and corresponding maritime authority and/or classification society.

Note

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

Only skilled and authorized personnel can install the EM 712 cables.

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

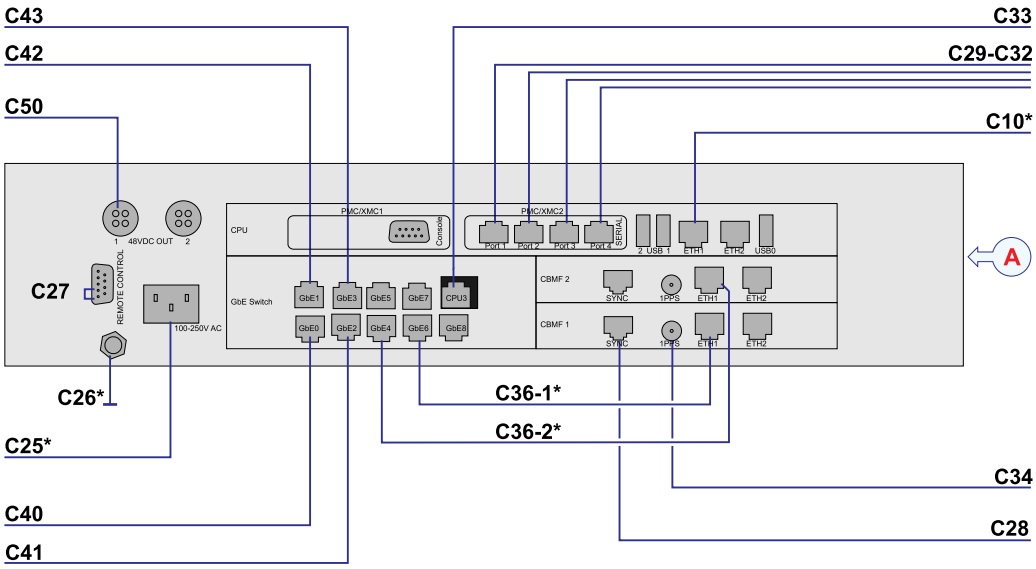
Before you install or maintain the EM 712 cables, make sure that the AC mains circuit breaker for the system is switched off.

Cable plans

Topics

Cable plan - Processing Unit

The Processing Unit cables include those used to connect the EM 712 Processing Unit to AC mains power, and to the transmitter and receiver units. One Ethernet cable is used to connect the Processing Unit to the Hydrographic Work Station.



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Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 712 delivery.

A Processing Unit

Related topics

Processing Unit rear panel description, page 78
List of EM 712 cables, page 164

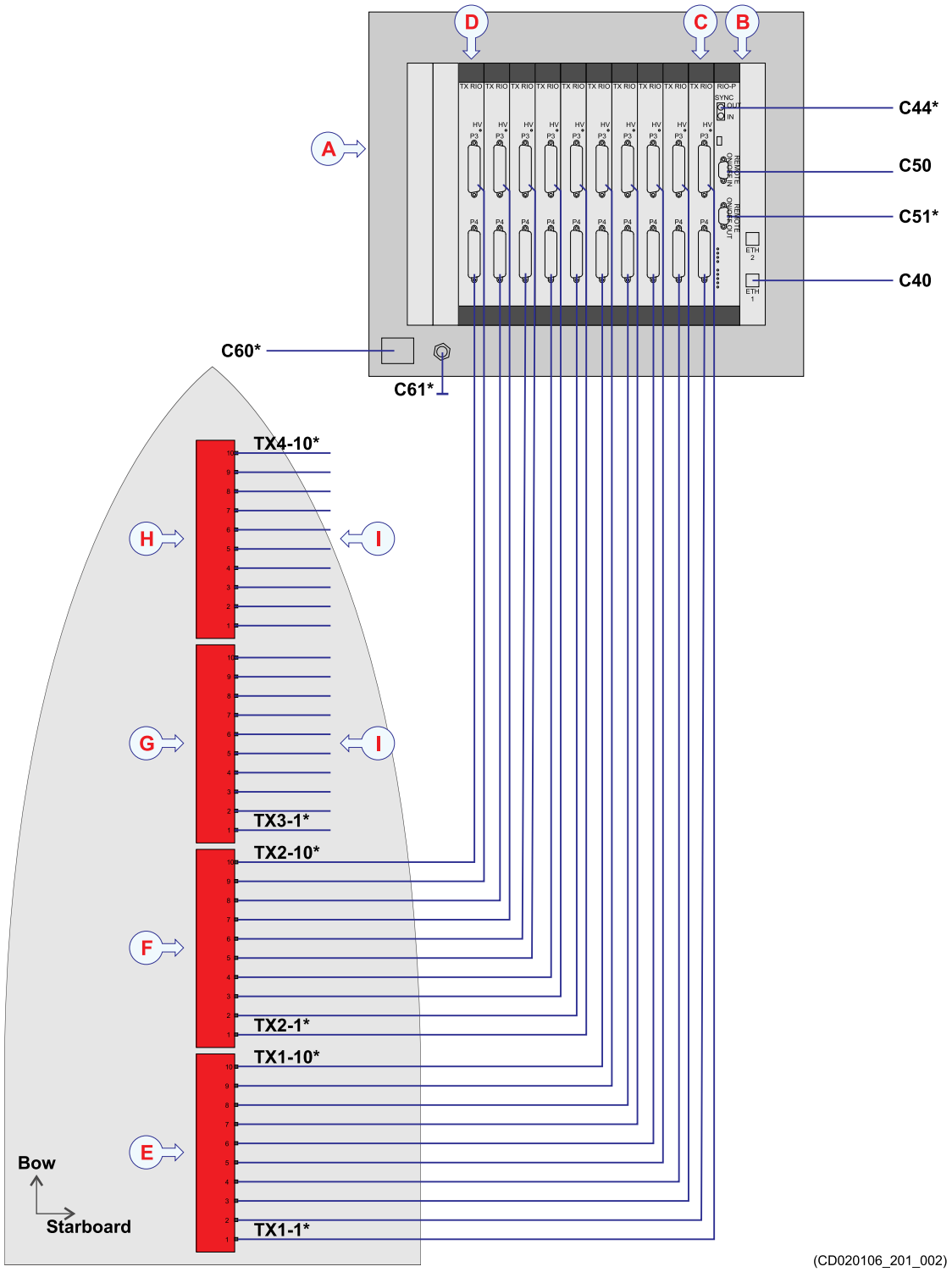
Cable plan - Transmitter Unit

The transmitter (TX) Unit cables include those used to connect the EM 712 TX Unit(s) to AC mains power, to the receiver (RX) Unit, to the Processing Unit and to the transducers. If there are more than one TX Unit they have to be connected to each other with a fibre optic cable.

The EM 712 system can have one or two Transmitter Units (TXUs), depending on the system configuration. A system with 0.25° transmitter array will need 4 Transmit Transducer modules and two Transmitter Units.

The illustrations show the Transmit Transducer array mounted in the default orientation, with the cables pointing towards starboard.

Transmitter Unit 1



Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 712 delivery.

A *Transmitter Unit 1*

B *RIO-P board*

C *TX RIO board 1*

D *TX RIO board 10*

E *Transmit transducer module number 1*

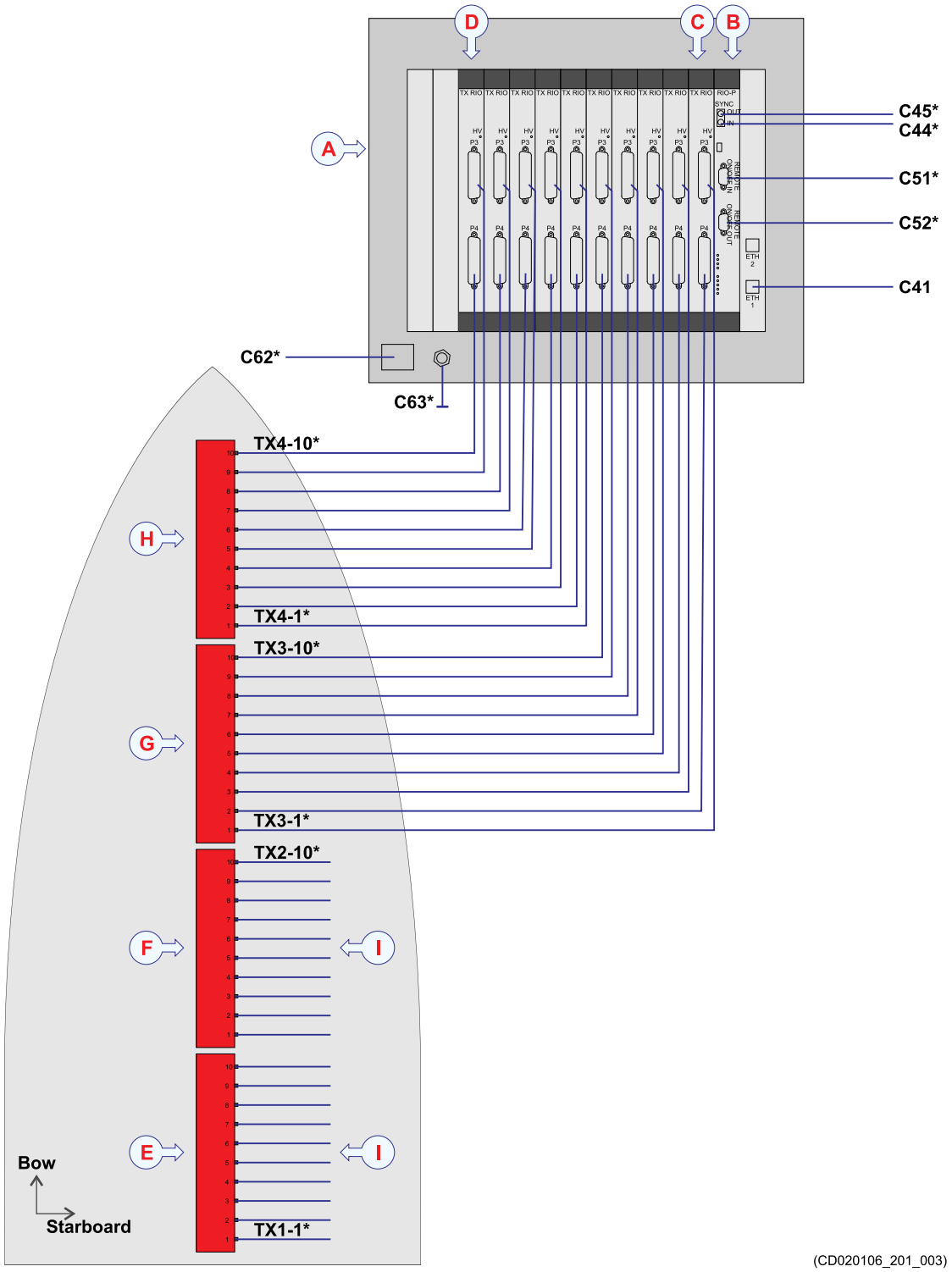
F *Transmit transducer module number 2*

G *Transmit transducer module number 3*

H *Transmit transducer module number 4*

I *Cables from Transmit Transducer 3 and 4 are connected to Transmitter Unit 2 according to the cable identification table*

Transmitter Unit 2



Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 712 delivery.

A *Transmitter Unit 2*

B *RIO-P board*

C *TX RIO board 1*

D *TX RIO board 10*

E *Transmit transducer module number 1*

F *Transmit transducer module number 2*

G *Transmit transducer module number 3*

H *Transmit transducer module number 4*

I *Cables from Transmit Transducer 1 and 2 are connected to Transmitter Unit 1 according to the cable identification table*

Related topics

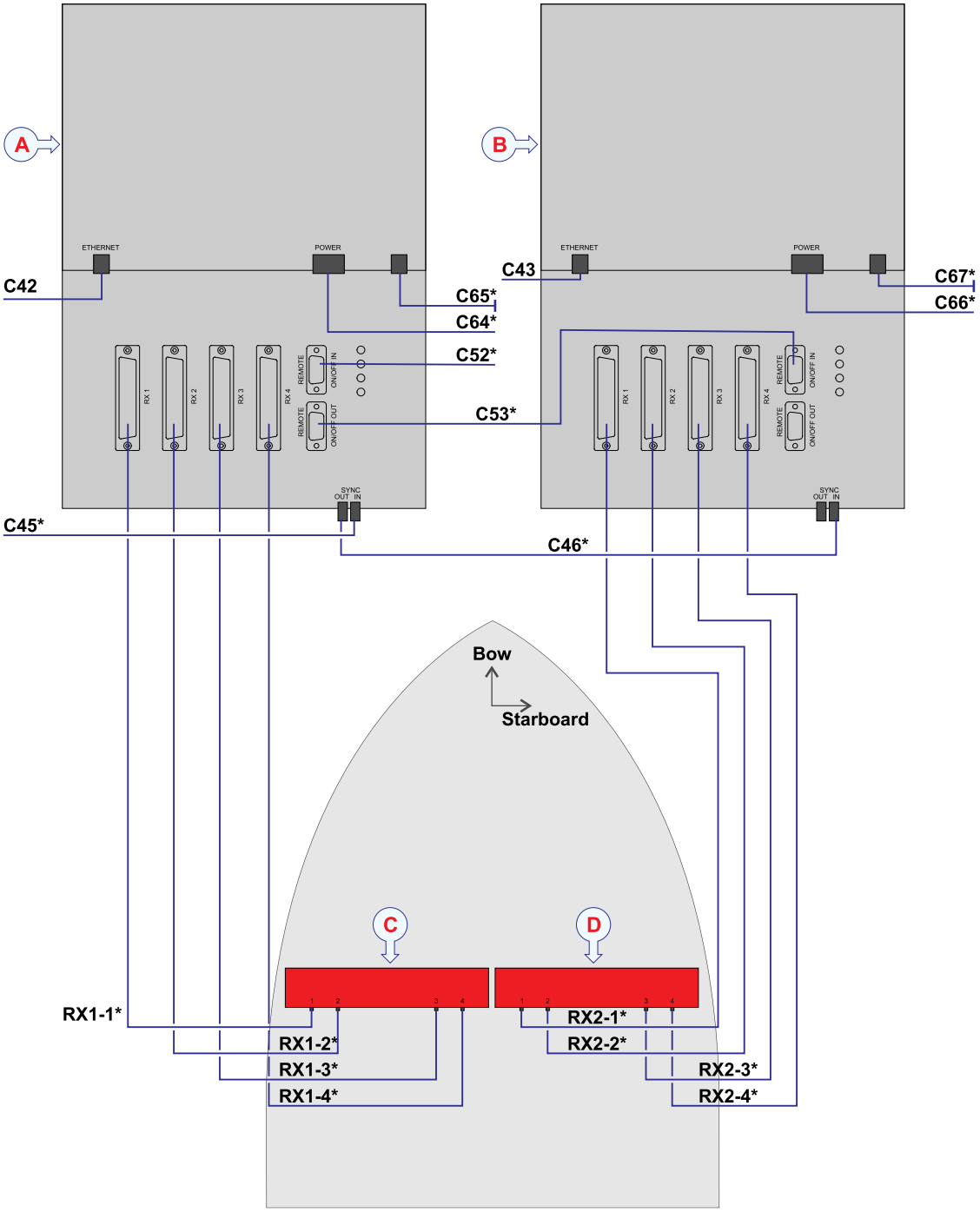
List of EM 712 cables, page 164

Cable plan - Receiver Unit

The receiver (RX) Unit cables include those used to connect the EM 712 RX Unit(s) to AC mains power, to the transmitter (TX) Unit, to the Processing Unit and to the transducers. If there are more than one RX Unit they have to be connected to each other with a fibre optic cable.

The EM 712 system can have one or two Receiver Units (RXUs), depending on the system configuration. A system with 0.5° receiver array will need two Receive Transducer modules and two Receiver Units.

The illustrations show the Receive Transducer array mounted in the default orientation, with the cables pointing towards stern.



Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 712 delivery.

A *Receiver Unit 1*

B *Receiver Unit 2*

C *Receive transducer module number 1*

Cables from Receive Transducer module 1 are connected to Receiver Unit 1 according to the cable identification table

D *Receive transducer module number 2*

Cables from Receive Transducer module 2 are connected to Receiver Unit 2 according to the cable identification table

Note

During the installation of the transducer array, you must fill in the cable identification table.

The number of cables depends on the chosen system configuration.

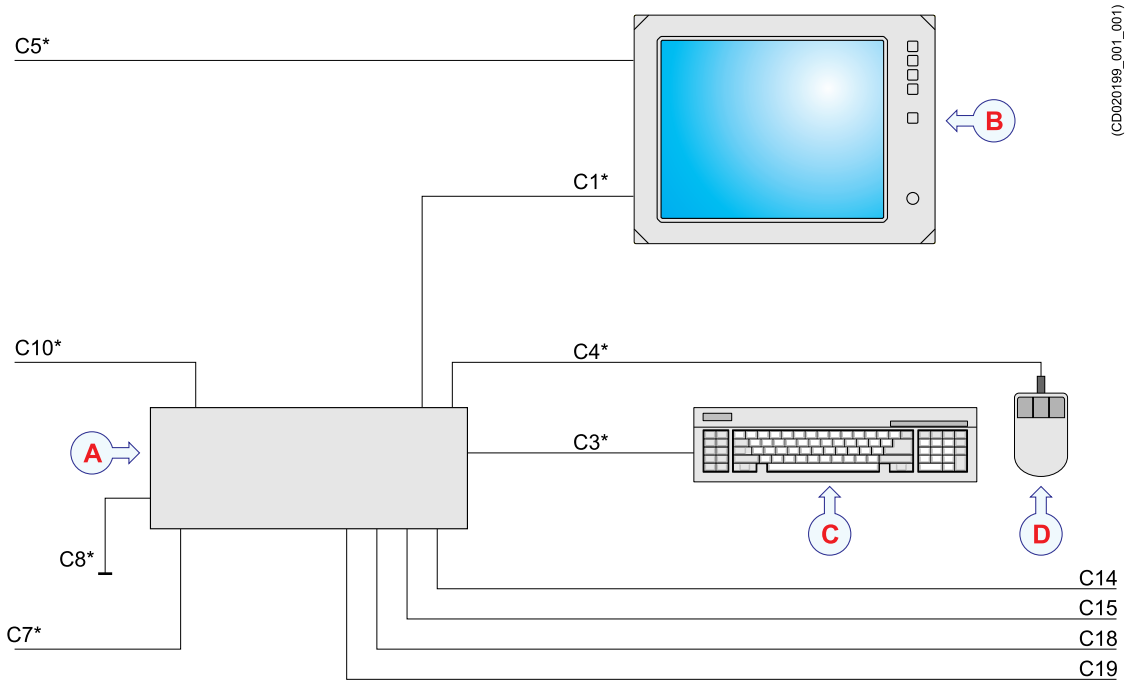
- *0.5° receive transducer: 8 cables*
- *1° receive transducer: 4 cables*
- *2° receive transducer: 2 cables*

Related topics

List of EM 712 cables, page 164

Cable plan, Hydrographic Work Station

The topside/bridge cables include those used to connect the EM 712 Hydrographic Work Station and the display to each other, to AC mains power, and to external devices.



A *Hydrographic Work Station*

B *Display*

The Hydrographic Work Station supports up to three displays.

C *Computer keyboard*

D *Computer mouse or trackball*

Cables identified with an asterisk (*) are system or commercial cables. These cables are supplied with the EM 712 delivery.

Related topics

Hydrographic Work Station rear panel description, page 100
List of EM 712 cables, page 164
Hydrographic Work Station rear connectors, page 182

List of EM 712 cables

A set of cables is required to connect the EM 712 units to each other, and to the relevant power source(s).

The following cables are used when the EM 712 is set up.

Cable	Signal	From/To	Minimum requirements
C1	Display cable	From Hydrographic Work Station to display	
	This is a commercial cable. It is normally provided with the display.		
C3	Computer cable	From Hydrographic Work Station to keyboard	
	This is a commercial cable. It is normally provided with the keyboard.		
C4	Computer cable	From Hydrographic Work Station to mouse (or another similar device) This is a commercial cable. It is normally provided with the mouse.	
C5	AC power cable	From display to AC power outlet	
C7	AC power cable	From Hydrographic Work Station to AC power outlet	
C8	Ground cable	From Hydrographic Work Station to vessel ground	
C10	Ethernet cable	From Hydrographic Work Station to Processing Unit	CAT5-E STP (Shielded Twisted Pair)
	A 4.5 meter long Ethernet cable is provided with the Processing Unit. If a longer cable is required, this must be provided by the installation shipyard.		
C14	Serial cable	From Hydrographic Work Station to external device(s)	
C15	Serial cable	From Hydrographic Work Station to external device(s)	
C18	Ethernet cable	From Hydrographic Work Station to external device(s)	
C19	Ethernet cable	From Hydrographic Work Station to external device(s)	
C25	AC power cable	From Processing Unit to AC power outlet	
C26	Ground cable	From Processing Unit to vessel ground	

Cable	Signal	From/To	Minimum requirements
C27	Control cable	From Processing Unit to remote control device	
	Remote on/off switch If remote control is not used, a termination plug has to be inserted in the Remote control plug on the Processing Unit. This plug is a 9 pin D-SUB supplied with the Processing Unit. Remote control, page 192 Remote Control using K-Rem, page 193 Dummy plug for not using remote control, page 194		
C28	Control cable	From Processing Unit to synchronization device	
	External synchronization External synchronisation, page 189		
C29–C32	Serial cable	From Processing Unit to external device(s)	
	RS-232 serial line using three wires and RJ45 connector, page 185 RS-422 serial line using five wires and RJ45 connector, page 186		
C33	Ethernet cable	From Processing Unit to external device(s)	CAT5-E STP (Shielded Twisted Pair)
	Attitude Velocity sensor		
C34	Coax cable	From Processing Unit to the global positioning system (GPS)	
	The software clock can be synchronized to an external 1PPS (Pulse per second) signal. Clock synchronisation (1PPS) using a coax cable, page 188		
C36	Ethernet cable	Processing Unit internal connection	CAT5-E STP (Shielded Twisted Pair)
C40	Ethernet cable	From Processing Unit to Transmitter Unit 1	CAT5-E STP (Shielded Twisted Pair)
C41	Ethernet cable	From Processing Unit to Transmitter Unit 2	CAT5-E STP (Shielded Twisted Pair)
C42	Ethernet cable	From Processing Unit to Receiver Unit 1	CAT5-E STP (Shielded Twisted Pair)
C43	Ethernet cable	From Processing Unit to Receiver Unit 2	CAT5-E STP (Shielded Twisted Pair)
C44	Fibre optic cable	From Transmitter Unit 1 to Transmitter Unit 2	
	The fibre optic cable and the cable for remote control between the Transmitter Units and Receiver Units are delivered as a kit.The standard cable length is 10 metres.		

Cable	Signal	From/To	Minimum requirements
C45	Fibre optic cable	From Transmitter Unit 2 to Receiver Unit 1	
	The fibre optic cable and the cable for remote control between the Transmitter Units and Receiver Units are delivered as a kit.The standard cable length is 10 metres.		
C46	Fibre optic cable	From Receiver Unit 1 to Receiver Unit 2	
	The fibre optic cable and the cable for remote control between the Transmitter Units and Receiver Units are delivered as a kit.The standard cable length is 10 metres.		
C50	Control cable	From Processing Unit to Transmitter Unit 1	
	Remote control of Transmitter Unit		
C51	Control cable	From Transmitter Unit 1 to Transmitter Unit 2	
	The fibre optic cable and the cable for remote control between the Transmitter Units and Receiver Units are delivered as a kit.The standard cable length is 10 metres.		
C52	Control cable	From Transmitter Unit 2 to Receiver Unit 1	
	The fibre optic cable and the cable for remote control between the Transmitter Units and Receiver Units are delivered as a kit.The standard cable length is 10 metres.		
C53	Control cable	From Receiver Unit 1 to Receiver Unit 2	
	The fibre optic cable and the cable for remote control between the Transmitter Units and Receiver Units are delivered as a kit.The standard cable length is 10 metres.		
C60	AC power cable	From Transmitter Unit to AC power outlet	
C61	Ground cable	From Transmitter Unit to vessel ground	
C62	AC power cable	From Transmitter Unit to AC power outlet	
C63	Ground cable	From Transmitter Unit to vessel ground	
C64	AC power cable	From Receiver Unit to AC power outlet	
C65	Ground cable	From Receiver Unit to vessel ground	
C66	AC power cable	From Receiver Unit to AC power outlet	
C67	Ground cable	From Receiver Unit to vessel ground	
TX1-1 - - - TX1-10	Transducer cable	From Transmitter Unit to transducer	
	The transducer cables are moulded to the transducer modules and connect in the other end to the Transmitter Unit (TXU) or Receiver Unit (RXU) with connectors.		

Cable	Signal	From/To	Minimum requirements
TX2-1 - - - TX2-10	Transducer cable	From Transmitter Unit to transducer	
	The transducer cables are moulded to the transducer modules and connect in the other end to the Transmitter Unit (TXU) or Receiver Unit (RXU) with connectors.		
TX3-1 - - - TX3-10	Transducer cable	From Transmitter Unit to transducer	
	The transducer cables are moulded to the transducer modules and connect in the other end to the Transmitter Unit (TXU) or Receiver Unit (RXU) with connectors.		
TX4-1 - - - TX4-10	Transducer cable	From Transmitter Unit to transducer	
	The transducer cables are moulded to the transducer modules and connect in the other end to the Transmitter Unit (TXU) or Receiver Unit (RXU) with connectors.		
RX1–1 RX1–2 RX1–3 RX1–4	Transducer cable	From Receiver Unit to transducer	
	The transducer cables are moulded to the transducer modules and connect in the other end to the Transmitter Unit (TXU) or Receiver Unit (RXU) with connectors.		
RX2–1 RX2–2 RX2–3 RX2–4	Transducer cable	From Receiver Unit to transducer	
	The transducer cables are moulded to the transducer modules and connect in the other end to the Transmitter Unit (TXU) or Receiver Unit (RXU) with connectors.		

The standard length of the transducer cables is 15 metres. There is an option for cable length of 25 metres.

The length of the cables are fixed. The cables can not be extended or shortened during installation.

Identifying EM 712 cables on a project cable drawing

The EM 712 is often a part of a project delivery. For such deliveries, specific project cable drawings are established to show all the main cables, and how the various products are connected. In such project cable drawings, the EM 712 cables may be identified as **EM 712/Cx**.

Transmit transducer cables

The cables between the EM 712 transmit transducer array and the Transmitter Unit are supplied by Kongsberg Maritime. The number of cables depends on the chosen system configuration.

The cables are moulded to the transducers and connect to the Transmitter Unit with connectors.

The length of the cables are fixed. The cables can not be extended or shortened during installation.

Note

Kongsberg Maritime recommends not to dismount the connector during the installation.

- Cable length: 15 or 25 metres
- Maximum outer diameter: 16.2 mm
- Minimum bending radius: 95 mm

Marking of transmit transducer cables

Each transducer cable is identified with transducer type, transducer part number, cable number and transducer serial number.

It is possible to mount the transmit transducers with the cables pointing to the port or to the starboard side. The default orientation is to the starboard side, this should be used if possible.

It is essential to connect the transducer cables successively to the TX RIO boards in the Transmitter Unit, see the cable identification table for details.

Default orientation of transducer modules, top view, 0.5° x 0.5° system.

Each transducer module is identified by its physical location in the array. If mounting is in accordance with the default orientation, the most aft module is transmit transducer number 1 The location of the transducer modules must be recorded during installation and written down in the cable identification table.

A Transmit transducer (TX) number 1

B Transmit transducer (TX) number 2

C Receive transducer (RX) number 1

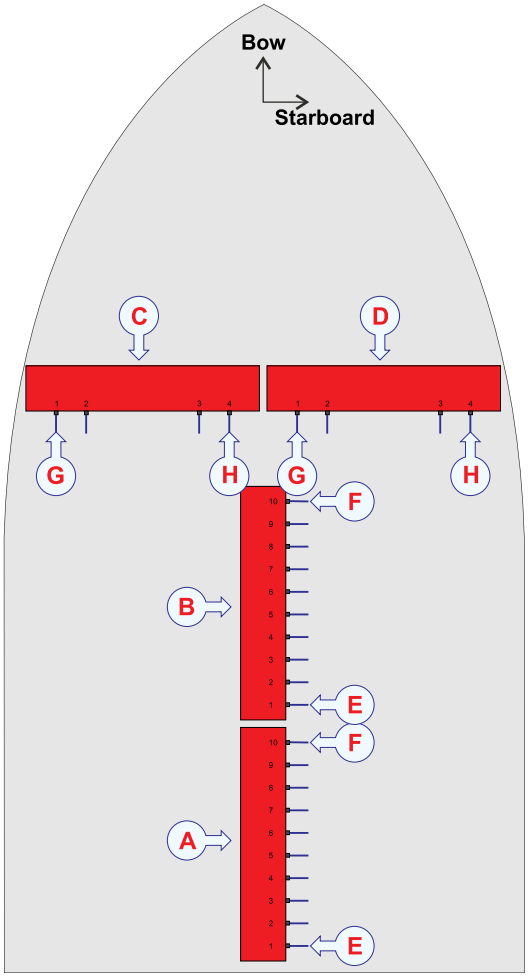
D Receive transducer (RX) number 2

E TX cable number 1

F TX cable number 10

G RX cable number 1

H RX cable number 4



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Optional orientation of transducer modules, top view, 0.5° x 0.5° system.

Each transducer module is identified by its physical location in the array. If optional orientation is used, the most forward module is transmit transducer number 1. The location of the transducer modules must be recorded during installation and written down in the cable identification table.

A Transmit transducer (TX) number 1

B Transmit transducer (TX) number 2

C Receive transducer (RX) number 1

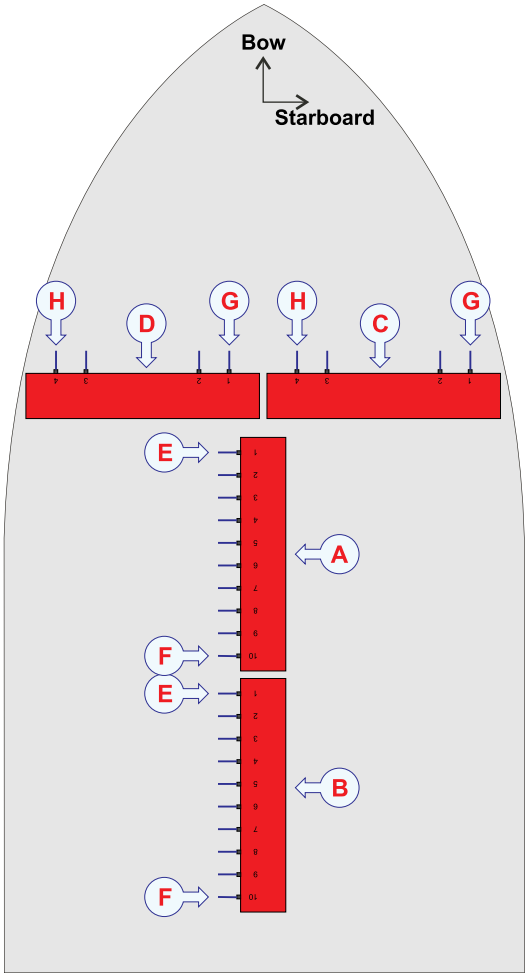
D Receive transducer (RX) number 2

E TX cable number 1

F TX cable number 10

G RX cable number 1

H RX cable number 4



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Connection of transmit transducer cables

The number of cables depends on the chosen system configuration.

- 0.25° transmit transducer: 40 cables
- 0.5° transmit transducer: 20 cables
- 1° transmit transducer: 10 cables
- 2° transmit transducer: 5 cables

Note

During the installation of the transducer array, you must fill in the cable identification table.

Table 1 Cable identification table

TX module			TX Unit			Size of system			
Position	Transducer serial number (fill in)	Cable	Unit	TX RIO board	Socket				
1		1	1	1	P3	2°	1°	0.5°	0.25°
		2	1	1	P4				
		3	1	2	P3				
		4	1	2	P4				
		5	1	3	P3				
		6	1	3	P4				
		7	1	4	P3				
		8	1	4	P4				
		9	1	5	P3				
		10	1	5	P4				
2		1	1	6	P3				
		2	1	6	P4				
		3	1	7	P3				
		4	1	7	P4				
		5	1	8	P3				
		6	1	8	P4				
		7	1	9	P3				
		8	1	9	P4				
		9	1	10	P3				
		10	1	10	P4				
3		1	2	1	P3				
		2	2	1	P4				
		3	2	2	P3				
		4	2	2	P4				
		5	2	3	P3				
		6	2	3	P4				
		7	2	4	P3				
		8	2	4	P4				
		9	2	5	P3				
		10	2	5	P4				
4		1	2	6	P3				
		2	2	6	P4				
		3	2	7	P3				
		4	2	7	P4				

TX module			TX Unit			Size of system			
		5	2	8	P3				
		6	2	8	P4				
		7	2	9	P3				
		8	2	9	P4				
		9	2	10	P3				
		10	2	10	P4				

Receive transducer cables

The cables between the EM 712 receive transducer array and the Receiver Unit are supplied by Kongsberg Maritime. The number of cables depends on the chosen system configuration.

The cables are moulded to the transducers and connect to the Receiver Unit with connectors.

The length of the cables are fixed. The cables can not be extended or shortened during installation.

Note

Kongsberg Maritime recommends not to dismount the connector during the installation.

- Cable length: 15 or 25 metres
- Maximum outer diameter: 16.2 mm
- Minimum bending radius: 95 mm

Marking of receive transducer cables

Each transducer cable is identified with transducer type, transducer part number, cable number and transducer serial number.

It is possible to mount the receive transducers with the cables pointing to the stern or to the bow. The default orientation is astern, this should be used if possible.

It is essential to connect the transducer cables successively to the Receiver Unit, see the cable identification table for details.

Default orientation of transducer modules, top view, 0.5° x 0.5° system.

Each transducer module is identified by its physical location in the array. If mounting is in accordance with the default orientation, the port side module is receive transducer number 1. The location of the transducer modules must be recorded during installation and written down in the cable identification table.

A Transmit transducer (TX) number 1

B Transmit transducer (TX) number 2

C Receive transducer (RX) number 1

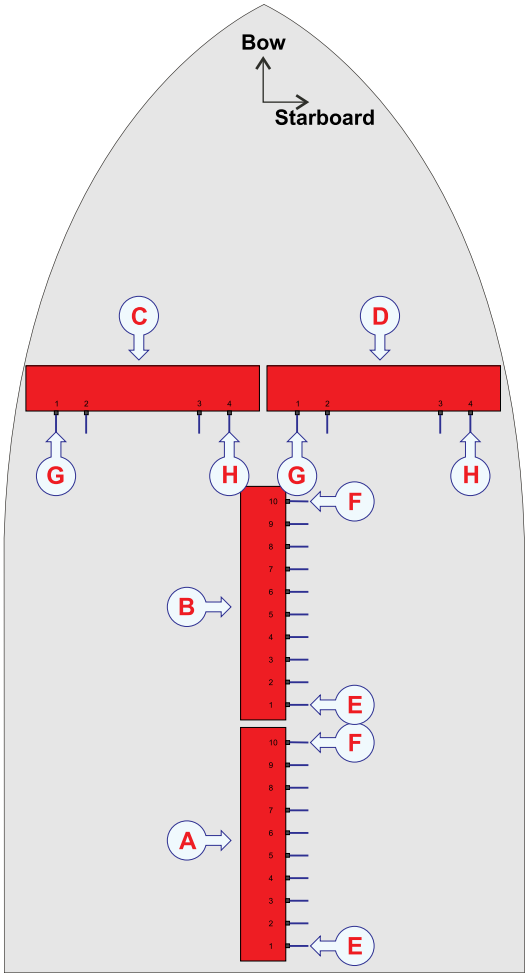
D Receive transducer (RX) number 2

E TX cable number 1

F TX cable number 10

G RX cable number 1

H RX cable number 4



(CD020106_150_001)

Optional orientation of transducer modules, top view, 0.5° x 0.5° system.

Each transducer module is identified by its physical location in the array. If optional orientation is used, the most starboard fide module is receive transducer number 1. The location of the transducer modules must be recorded during installation and written down in the cable identification table.

A Transmit transducer (TX) number 1

B Transmit transducer (TX) number 2

C Receive transducer (RX) number 1

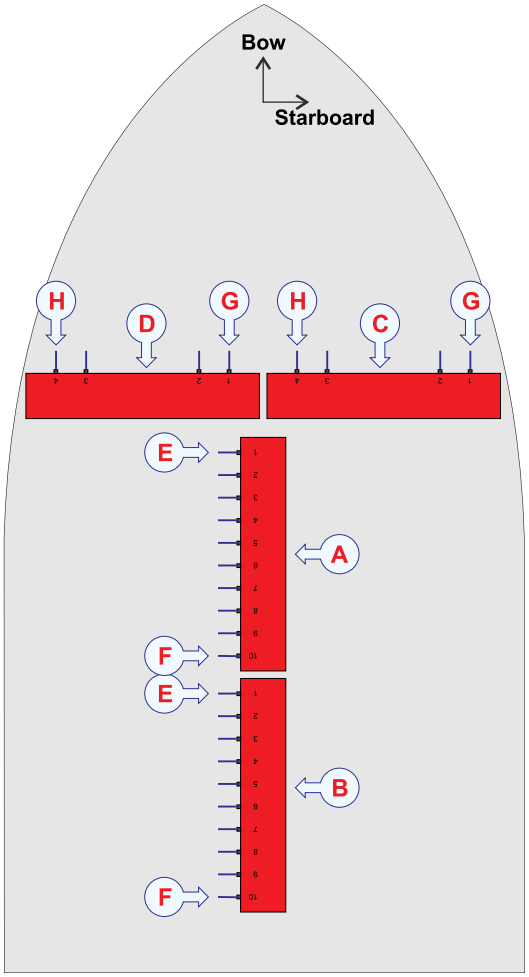
D Receive transducer (RX) number 2

E TX cable number 1

F TX cable number 10

G RX cable number 1

H RX cable number 4



(CD020106_151_001)

Connection of receive transducer cables

Note

During the installation of the transducer array, you must fill in the cable identification table.

The number of cables depends on the chosen system configuration.

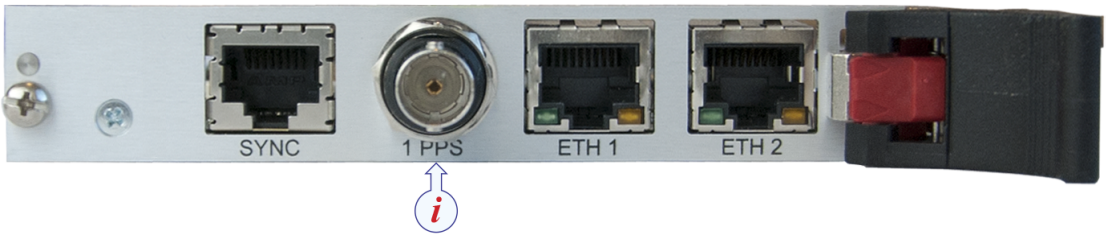
- *0.5° receive transducer: 8 cables*
- *1° receive transducer: 4 cables*
- *2° receive transducer: 2 cables*

Table 2 Cable identification table

Position	RX module number identification		RX Unit		Size of system		
	Transducer serial number (fill in)	Cable	Receiver Unit	Socket			
1		1	1	RX 1	2°	1°	0.5°
		2	1	RX 2			
		3	1	RX 3			
		4	1	RX 4			
2		1	2	RX 1			
		2	2	RX 2			
		3	2	RX 3			
		4	2	RX 4			

Clock synchronization (1PPS)

The Processing Unit has a 1PPS (one pulse per second) input for clock synchronization.



This is a generic photo. The CBMF board used by the EM 712 may look slightly different due to minor design changes on the protective lid and/or the front panel.

It can be selected in the operator software SIS wether the falling edge or the rising edge of the 1PPS signal is used by the Processing Unit to synchronize the internal clock. The 1PPS signal must be minimum 1 microsecond long.

The 1PPS signal is connected to the coax connector on the CBMF board. This connection is marked **1PPS**. If the Processing Unit has two CBMF boards the lower one must be used for **1PPS**.

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).

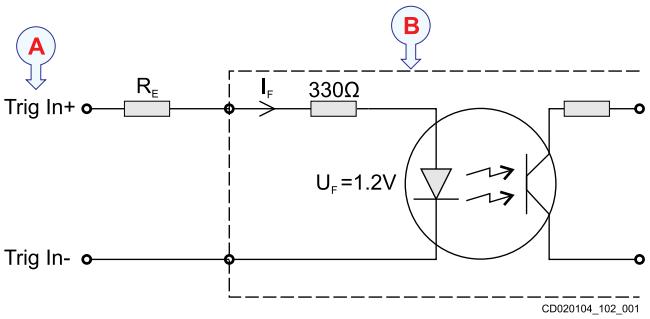
Optically isolated input signals

Note

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

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.

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

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

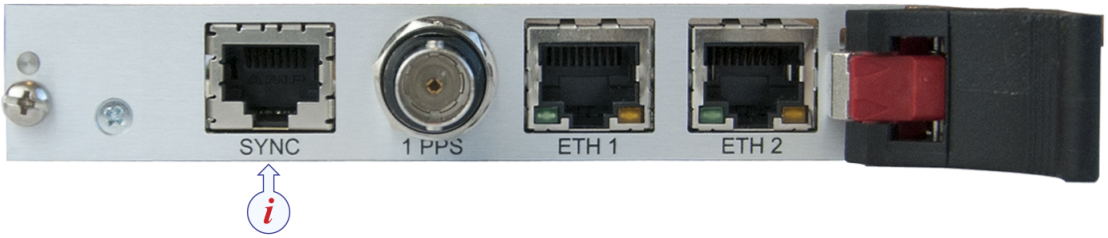
- $$R_{TOT} = \frac{12V - 1.2V(U_F)}{10mA} = \frac{10.8}{0.010} = 1080\Omega$$

  $$R_E = 1080 - 330 = 750\Omega$$

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

External synchronization

The Processing Unit is has a connection for interface to an external synchronization system.



This is a generic photo. The CBMF board used by the EM 712 may look slightly different due to minor design changes on the protective lid and/or the front panel.

This connection is for interface to an external synchronization system, for example K-Sync. An external synchronization system is used when multiple echo sounders are employed on the same vessel.

The external synchronization connector is located on the CBMF board in the processing unit. If the Processing Unit has two CBMF boards the lower one must be used for synchronization.

This is an optically isolated connection that requires ~10mA current. Input power and resistor value must be adjusted accordingly. The connector is RJ45 type.

RJ45 connector pin layout

1	TRIG OUT +
2	TRIG OUT -
3	+ 5 VDC
4	TRIG IN +
5	TRIG IN -
6	+ 5 VDC
7	RTS OUT +
8	RTS OUT -

(CD0806_701_001)

Pin 3 and 6 is used by Kongsberg Maritime only.

External synchronization signal characteristics

Signal	Description	Type	Active
RTS	Ready To Send - Output from EM 712 when it is ready for the next trigger pulse	Open collector output from isolation unit	High
TRIG OUT	Trigger out - Output to external synchronization system, active while the EM 712 is transmitting	Open collector output from isolation unit	Low
TRIG IN	Trigger in - Input to EM 712 enabling it to transmit	Optical isolated input	High

Note

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

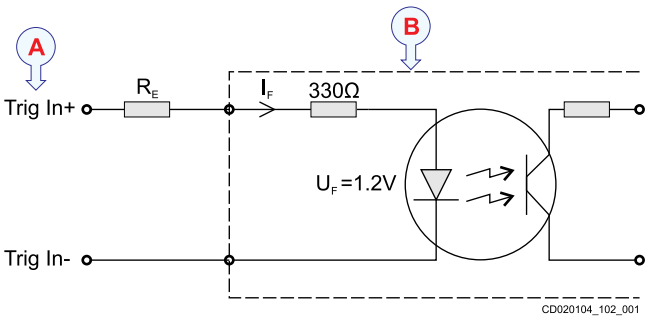
Optically isolated input signals

Note

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

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.

•

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

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

•

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

$$R_E = 1080 - 330 = 750\Omega$$

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

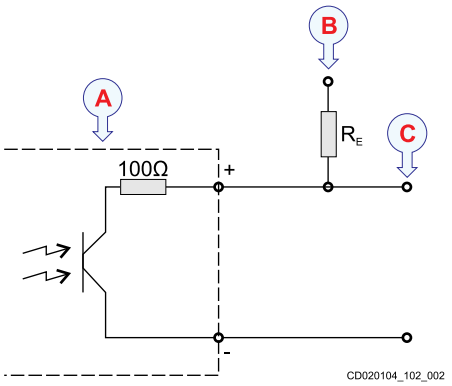
Optically isolated output signals

A *Processing Unit output circuitry*

B *External power*

C *Input to external system*

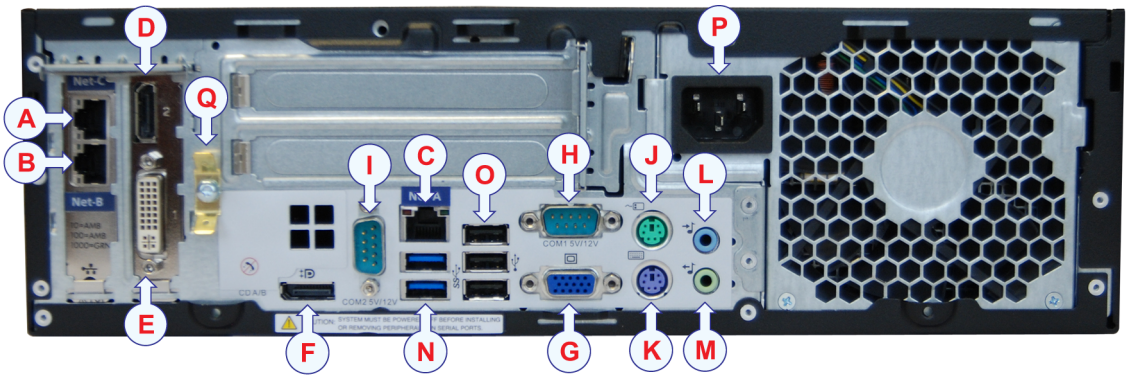
The collector current must be approximately 10 mA. A resistor must be used to tune the collector current depending on your voltage.



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

Hydrographic Work Station rear connectors

The rear panel on the Hydrographic Work Station holds connectors for the various EM 712 cables.



The image shows the MP5810 Fishery SIS5 model. Part number: 438803

If another model is used, the connections can be different.

A *Ethernet cable: From Hydrographic Work Station to local area network (LAN) (C18)*

B *Ethernet cable: From Hydrographic Work Station to local area network (LAN) (C19)*

C *Ethernet cable: From Hydrographic Work Station to Processing Unit (C10)*

It is very important that high-quality Ethernet cables are used. You must use CAT-5E STP (Shielded Twisted Pair) quality or better. If you use cables with lower bandwidth capacity you will reduce the EM 712 performance.

D *Display Port*

Display cable: From Hydrographic Work Station to display (C1)

This is a commercial cable. The display cable is often physically attached to the display, and terminated in the "computer end" with a male connector. If the cable is not attached, it is normally provided with the display.

E *Video Port: DVI*

F *Display Port*

G *Video Port: VGA*

H *Serial cables: From Hydrographic Work Station to external device(s) (C14)*

I *Serial cables: From Hydrographic Work Station to external device(s) (C15)*

J *Computer cable: From Hydrographic Work Station to mouse (or another similar device) (C4)*

The cable is often physically attached to the mouse, and terminated in the "computer end" with a male PS/2 or USB connector. Depending on the type of connector you must connect the mouse to the PS/2 connector or an USB connector on the computer.

K *Computer cable: From Hydrographic Work Station to keyboard (C3)*

The cable is often physically attached to the keyboard, and terminated in the "computer end" with a male PS/2 or USB connector. Depending on the type of connector you must connect the keyboard to the PS/2 connector or an USB connector on the computer.

L *Audio cable: Not used*

M *Audio cable: Not used*

N *USB interface connectors: USB 3.0 From Hydrographic Work Station to external device(s)*

O *USB interface connectors: USB 2.0 From Hydrographic Work Station to external device(s)*

P *AC power cable: From Hydrographic Work Station to uninterruptible power supply (UPS) (C7)*

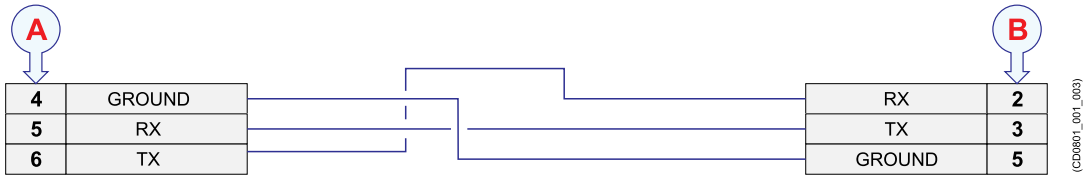
Q *Ground cable: From Hydrographic Work Station to vessel ground (C8)*

Cable drawings and specifications

Topics

RS-232 serial line using three wires and RJ45 connector

An RS-232 serial line connection using three (3) wires is a common way to connect the EM 712 to external devices.



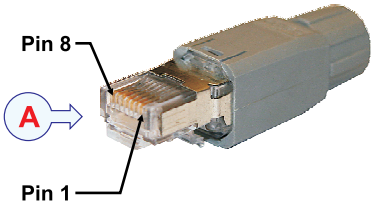
A *Local connection*

RJ45 connector

B *Connection on remote device*

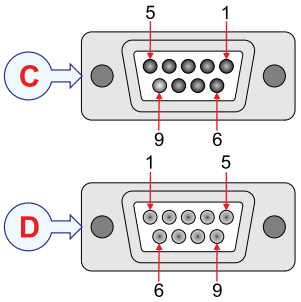
C *Female 9-pin D-Subminiature connector*

D *Male 9-pin D-Subminiature connector*



(CD0804_001_004)

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



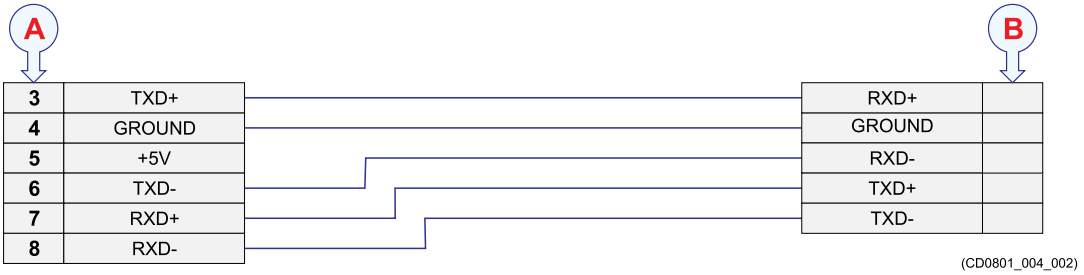
Minimum cable requirements

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

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

RS-422 serial line using five wires and RJ45 connector

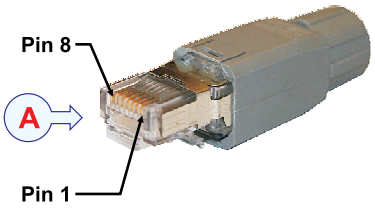
An RS-422 serial line connection is a common way to connect the EM 712 to external devices. An RS-422 serial line connection can transmit data at rates as high as 10 million bits per second, and may be sent on cables as long as 1500 meters.



A *Local connection*

RJ45 connector

B *Connection on remote device*



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

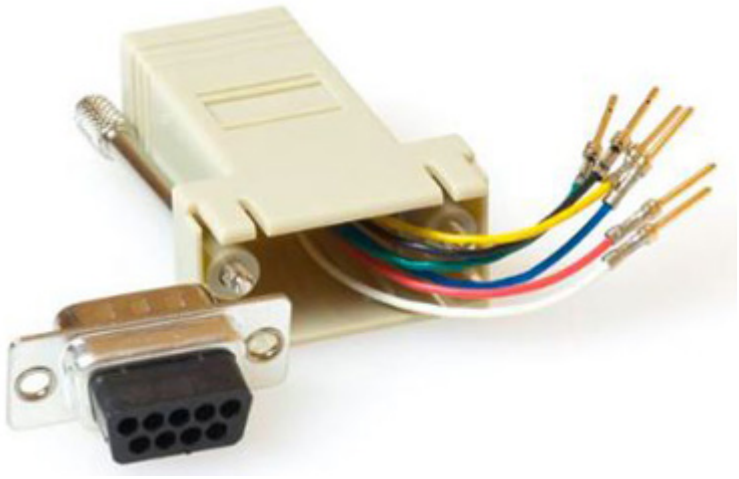
Minimum cable requirements

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

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

Adapter for D-connector to RJ45 connector for RS-422

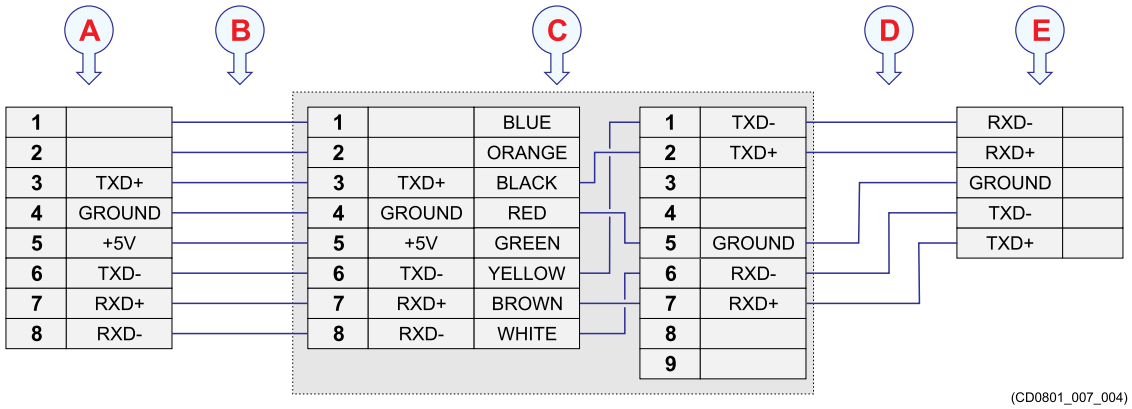
You can use an adapter if you need to connect a serial cable with a D-connector to the Processing Unit.



The Processing Unit has four serial ports with RJ45 connectors. The ports can be configured to be RS-232 or RS-422.

You can use an adapter if you need to connect a serial cable with a D-connector to the Processing Unit. Two adapters and two standard Cat6 patch cables are provided with a standard delivery.

The adapter has RJ45 female connector at one end and 9-pin male D-connector at the other end. The wiring at the RJ45 side is fixed, and the wire ends have crimp contacts to be placed in the desired position of the D-connector without any tools.



A Local connection (Processing Unit)

RJ45 connector

B Standard patch cable

C Adapter Part number 357235

Wired for RS-422

D Standard RS-422 cable

E Connection on remote device

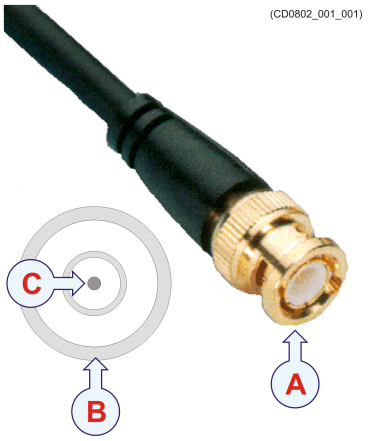
Clock synchronisation (1PPS) using a coax cable

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

A *Male BNC connector*

B *Ground*

C *1PPS signal*



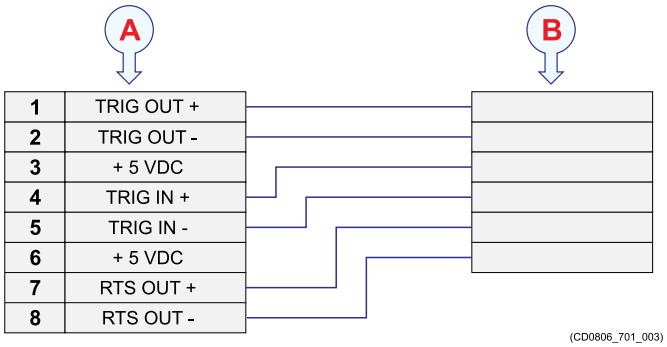
This cable must be provided by the installation shipyard.

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

External synchronisation

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

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



A *Local connection The connector is RJ45 type.*

Note

Pin 3 and 6 is used by Kongsberg Maritime only.

B *Connection on remote device*

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

Minimum cable requirements

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

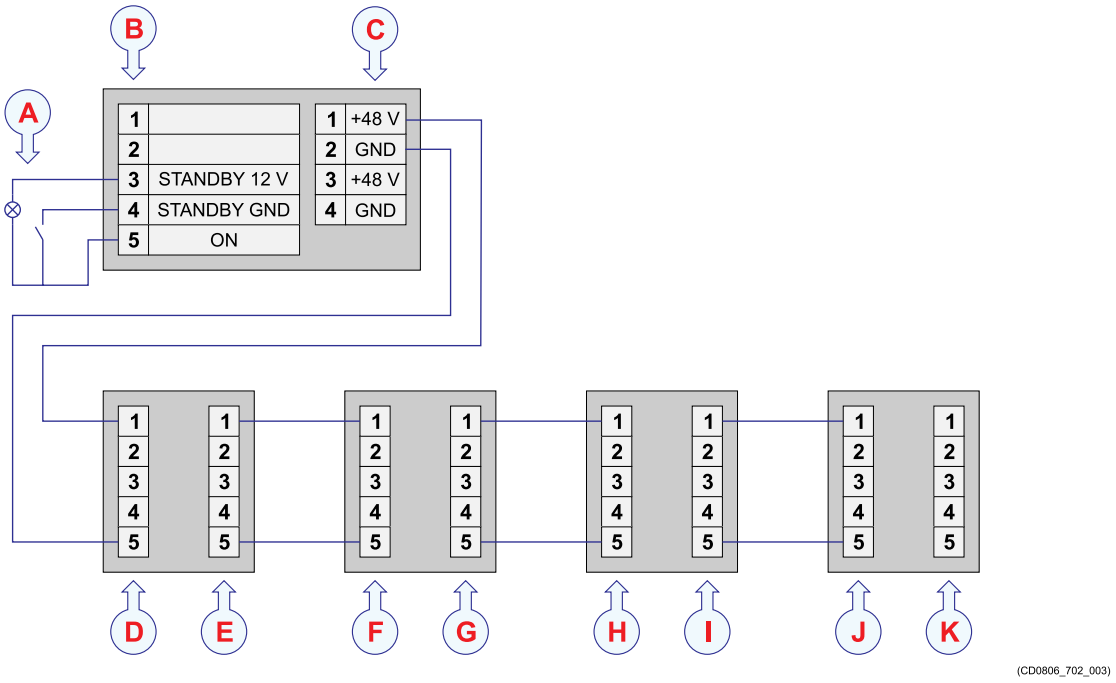
We recommend using a shielded CAT-6A quality or better cable.

Remote control overview

The EM 712 system can be switched on/off with a central control switch.

An EM 712 system has several hardware units, and to make it easier to switch on/off the system it is prepared for remote control. There are several methods to do this:

- Using a remote switch to turn on/off the entire system. The remote switch can either be the K-Rem Remote Control Unit ordered from Kongsberg Maritime or a switch and lamp provided by the installation shipyard.
- Using the Processing Unit to switch on/off the entire system. The on/off switch on the Processing Unit can be used to switch on/off the Transmitter and Receiver Units in addition to the Processing Unit itself. In this case the enclosed remote control dummy plug has to be inserted in the Remote Control connector in the Processing Unit.



A Remote switch and lamp (optional)

B Processing Unit, connector marked **REMOTE CONTROL**

C Processing Unit, connector marked **48VDC OUT**

D Transmitter Unit 1, connector marked **REMOTE ON/OFF IN**

E Transmitter Unit 1, connector marked **REMOTE ON/OFF OUT**

F Transmitter Unit 2, connector marked **REMOTE ON/OFF IN**

G Transmitter Unit 2, connector marked **REMOTE ON/OFF OUT**

H Receiver Unit 1, connector marked **REMOTE ON/OFF IN**

I Receiver Unit 1, connector marked **REMOTE ON/OFF OUT**

J Receiver Unit 2, connector marked **REMOTE ON/OFF IN**

K Receiver Unit 2, connector marked **REMOTE ON/OFF OUT**

Note

The number of Transmitter Units and Receiver Units depends upon the chosen system configuration.

The diagram shows the principle for a maximum possible solution, with two Transmitter Units and two Receiver Units.

Remote control

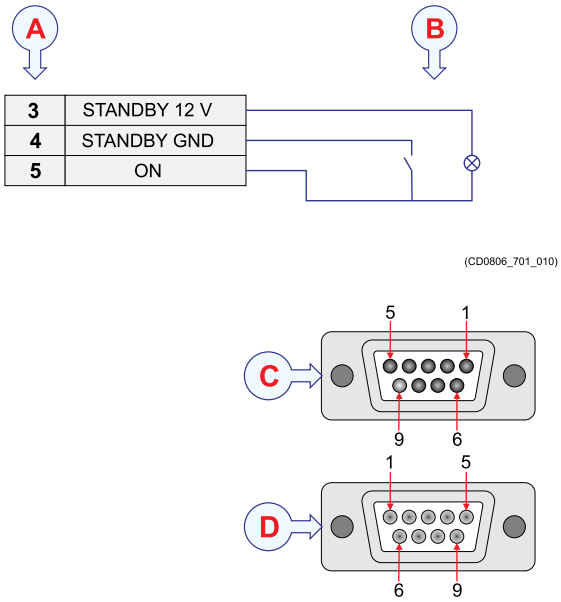
The Processing Unit can be switched on/off with a remote switch. This switch is connected to a 9–pin D-connector on the Processing Unit.

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*



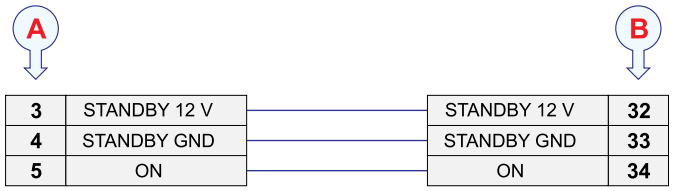
Minimum cable requirements

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

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).

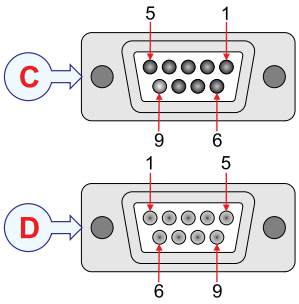


A *Local connection, male 9–pin D-connector*

B *Connection at the terminal strip in Remote Control Unit (K-Rem)*

C *Female 9–pin D-connector*

D *Male 9–pin D-connector*



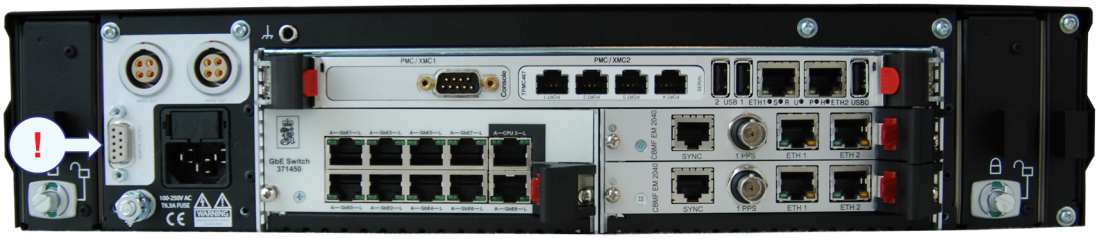
Minimum cable requirements

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

This cable must be provided by the installation shipyard.

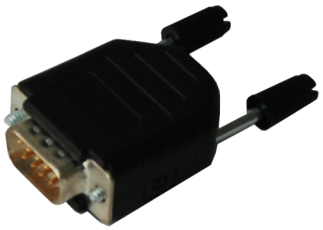
Dummy plug for not using remote control

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

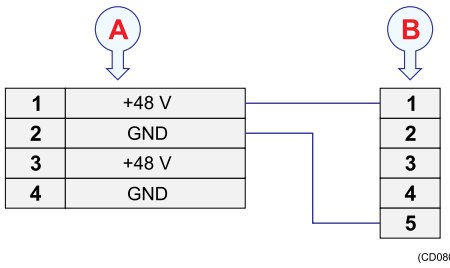
*If remote control is not used, the enclosed remote control dummy plug has to be inserted in the **Remote Control** connector in the Processing Unit. The Processing Unit will not work without this dummy plug.*



Remote control of Transmitter Unit

Cable for switching on/off the Transmitter Unit from the Processing Unit.

This cable between the Transmitter Unit and the Processing Unit is required if you want to switch on and off the Transmitter Unit from the Processing Unit.



A *Processing Unit end, male 4–pin Lemo connector.*

Lemo part number: FGG.3B.304.CLAD62Z .

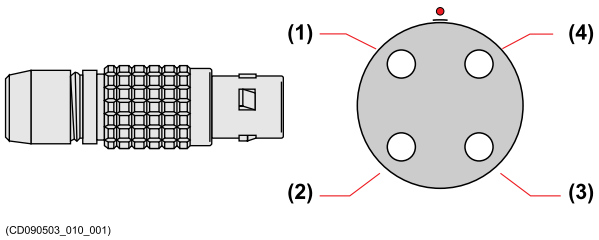
Kongsberg Maritime part number: 348015

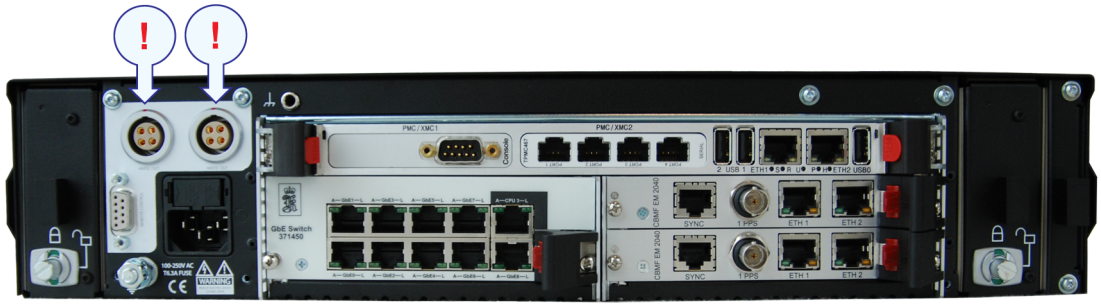
B *Transmitter Unit end, male 9–pin D-connector*

Processing Unit end

Pin layout male 4–pin Lemo connector. Solder side view.

Connects to **48 VDC OUT** on the rear of the Processing Unit.

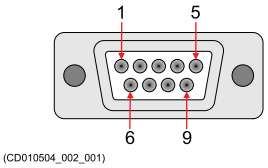




Transmitter Unit end

Pin layout male 9–pin D-connector.

Connects to **REMOTE ON/OFF IN** on the RIO-P board at the bottom of the Transmitter Unit.



Minimum cable requirements

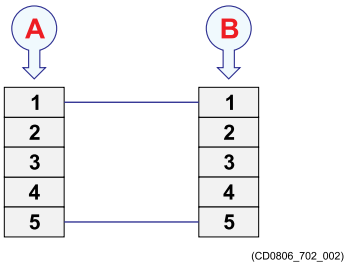
- **Conductors**: 2 x 0.5 mm²
- **Screen**: Overall braided
- **Voltage**: 60 V
- **Maximum outer diameter**: Defined by the plugs

This cable must be provided by the installation shipyard.

Remote control of Receiver Unit

Cable for switching on/off the Receiver Unit from the Processing Unit.

This cable between the Transmitter Unit and the Receiver Unit is required if you want to switch on and off the Receiver Unit from the Processing Unit.



A *Transmitter Unit end, male 9–pin D-connector*

Connects to **REMOTE ON/OFF OUT** at the bottom of the Transmitter Unit.

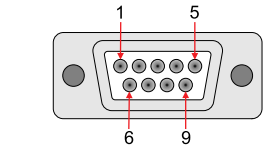
B *Receiver Unit end, male 9–pin D-connector*

Connects to **REMOTE ON/OFF IN** at the Receiver Unit.

Transmitter Unit end

Pin layout male 9–pin D-connector.

Connects to **REMOTE ON/OFF OUT** on the RIO-P board at the bottom of the Transmitter Unit.

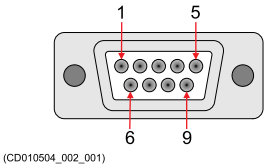


(CD010504_002_001)

Receiver Unit end

Pin layout male 9–pin D-connector.

Connects to **REMOTE ON/OFF IN** at the Receiver Unit.



Minimum cable requirements

- **Conductors**: 2 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.

Dimensional surveying and alignment

Topics

About dimensional surveying and alignment

The EM 712 Multibeam echo sounder is a precision instrument for high quality data collection.

In order to obtain precision data that are both detailed and correct, it is necessary to align the transducer, measure the location and offset of each sensor in relation to the vessel's coordinate system, and calibrate the complete EM 712 prior to use. Modest accuracy requirements apply when your EM 712 system is only used to investigate objects in the water column.

The quality assurance tasks required for EM 712 include:

- Aligning the transducer during installation
- Dimensional surveying
- Calibration

The alignment and dimensional surveying must be done during the EM 712 installation with the vessel in dry dock. The first calibration is normally done at sea during the Sea Acceptance Test. This calibration may not be complete, and must then be repeated later. The calibration is then repeated at regular interfaces, and prior to each survey.

Dimensional surveying

Determining the relative positions and orientations of the sensors and the transducer with high accuracy is important. This can only be met using a survey company/personnel with good experience in maritime dimensional surveying.

The dimensional surveying tasks required for EM 712 include:

1 Establishing the vessel coordinate system

2 Defining the location of the origin in the coordinate system

3 Establishing waterline with reference to the origin of the coordinate system

4 Setting out the required coordinate reference points throughout the vessel.

5 Defining the vessel's centre line, and if required — identify this line with physical markings

6 Measuring the necessary position and angles for all relevant sensors in the coordinate system.

7 Measuring the location and orientation of the EM 712 transducer in the coordinate system.

All results from the dimensional survey measurements must be summarized in a report by the consultants doing the work.

The information provided by the dimensional survey is entered into the EM 712 software as installation parameters.

More detailed information of Kongsberg Maritime's requirements are found in the chapter *Technical specifications.*

Note

Determining the relative positions and orientations of the sensors and the transducer with high accuracy is important. This requires professional surveying done by qualified and trained personnel using proven equipment and methods for maritime dimensional surveying. We recommend that you use third-party consultants with well proven experience with vessel dimensional control. Sufficient time and satisfactory work conditions must be given to the survey work. The installation engineers from Kongsberg Maritime are neither equipped nor trained to do dimensional surveying.

If the accuracy requirements are not met, and this is found to be the reason for a malfunctioning system, the vessel will most likely need to be dry docked in order to repeat the dimensional survey.

Alignment

To ensure a successful installation of the EM 712, all alignment and measurements must be done to the highest possible accuracy.

The alignment tasks required for EM 712 include:

- Measure and adjust the transducer frames to ensure that they have been mounted within the given tolerances.

Note

Aligning the transducer for correct installation within the given tolerances requires professional skills. The installation engineers from Kongsberg Maritime are neither equipped nor trained to perform the dimensional surveying, and they have no means of verifying the results until calibration at sea has been done.

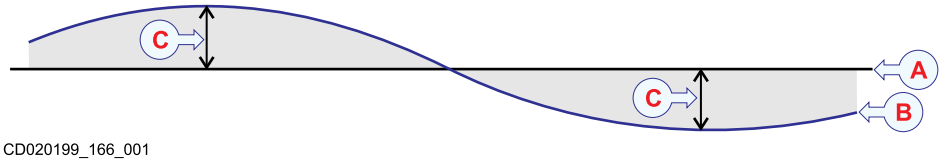
Transducer array flatness

To avoid unwanted acoustic effects caused by misalignment of the transducer elements the transducer array must be installed with a flat surface.

It may be most practical to perform these measurements on the transducer mounting frames before installation of the transducer modules. A final verification after module installation is then required.

The installed transducer array shall form a plane, the following requirements apply:

- No point on the frame may deviate from the ideal plane with more than the tolerance limit shown in *Technical specifications*. The limit will vary between the different multibeam echo sounders.



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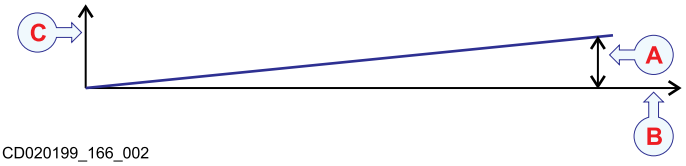
A *Ideal plane*

B *Installed plane*

C *Deviation*

- The maximum allowed gradient between two adjacent mounting points is 0.1 %.



CD020199_166_002

A *Maximum gradient 0.1 % = 1 mm/m*

B *Distance between mounting points*

C *Difference in relative height between mounting points*

The flatness must be controlled by land survey methods, to the highest possible accuracy. The survey of the flatness can be carried out independently from the survey of the vessel coordinate system and alignment of the sensors.

Checking the transducer array flatness and correcting deviations

An overall procedure specifying the main tasks is provided. The detailed knowledge about how to do the measurements is offered by the consultants doing the work.

Prerequisites

In some occasions a flatness survey of the frame mounting foundations can be recommended. This will give an indication of how much time and shims will be required.

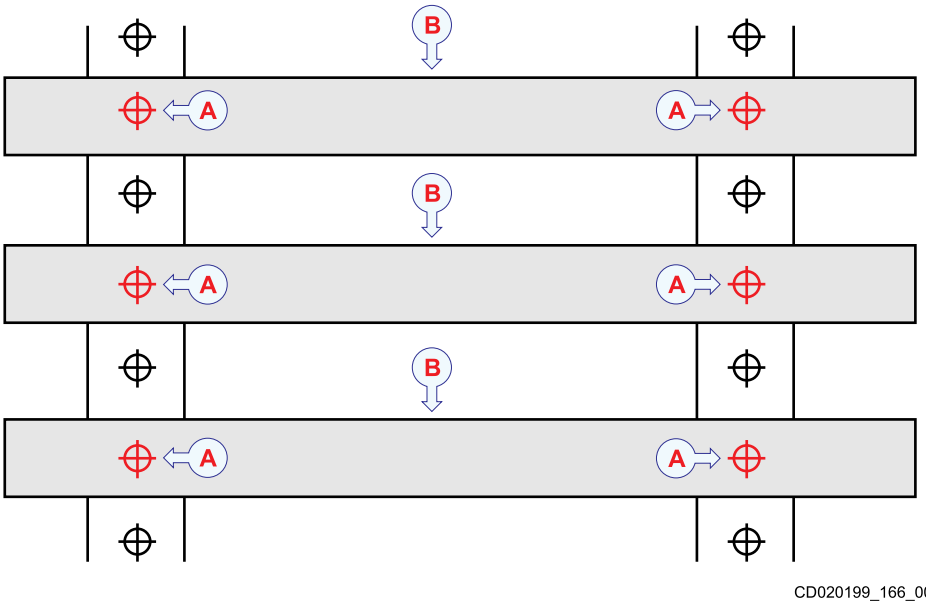
Context

The maximum allowed gradient between two adjacent mounting points is 0.1 %.

Procedure

1 Mount the mounting frame.

2 Measure the relative height of all mounting points on the closest available module foundation inside the frame.



A *Measure points*

3 Determine the necessary adjustments to obey the given tolerances.

Note

There is one requirement applicable to the gradient between two adjacent mounting points and one that applies to the whole array.

4 Apply shims to level out the height differences.

5 Verify that the mounting frame is in plane within the given tolerances.

6 Repeat the procedure until the tolerances are met

Calibration

During the sea trials, calibration surveys are required as described in the EM 712 end user documentation.

In order to check and verify the performance of the EM 712 system, we strongly recommend that calibration surveys are done at regular intervals, or prior to any large survey.

The calibration process is described in detail in the *Seafloor Information System (SIS) Operator Manual.*

Note

Calibration must be taken seriously. The final verification of correct installation can only be done during calibration at sea. Installation and operational parameters that do not meet the accuracy requirements may lead to incorrect data. To achieve the best results, the calibration must be planned and done carefully.

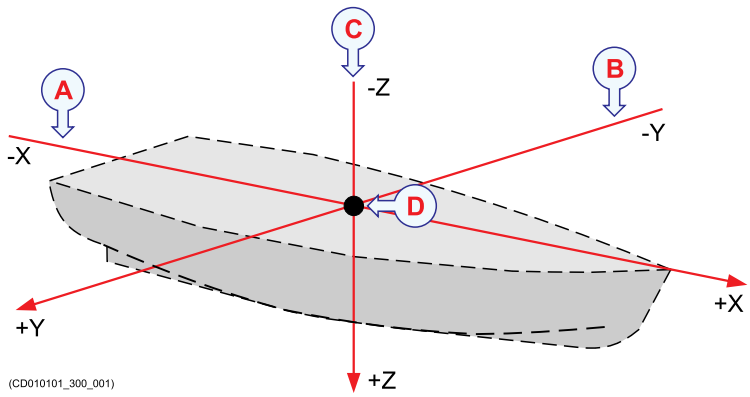
Vessel coordinate system

The vessel coordinate system is established to define the relative physical locations of systems and sensors.

When you have several different sensors and transducers on your vessel, and you wish each of them to provide accurate data, you need to know their relative physical positions. The antenna of a position sensor is typically mounted high above the superstructure, while a motion sensor is often located close to the vessel's centre of gravity. Both of these are physically positioned far away from the transducer on a depth sensor, which may be located closer to the bow. Very often, the information from one sensor depends on data from an other. It is then important that the relevant measurements are compensated for these relative distances.

Reference points must be established on the vessel at selected positions. These are needed during measurements of the sensor positions. Visual markings at these positions should be prepared and noted on the vessel drawings with **X**, **Y** and **Z** coordinates in the vessel coordinate system.

In order to establish a system to measure the relative distance between sensors, a virtual coordinate system is established. This coordinate system uses three vectors; X, Y and Z.



1 *The X-axis is the longitudinal direction of the vessel, and in parallel with the deck. A positive value for X means that a sensor or a reference point is located ahead of the reference point (origin).*

2 *The Y-axis is the transverse direction of the vessel, and in parallel with the deck. A positive value for Y means that a sensor or a reference point is located on the starboard side of the reference point (origin).*

3 *The Z-axis is vertical, and in parallel with the mast. A positive value for Z means that a sensor or a new reference point is located under the reference point (origin).*

4 *Reference point (Ship Origin)*

Coordinate system origin

The *origin* is the common reference point where all three axis in the vessel coordinate system meet. All physical locations of the vessel's sensors (radar and positioning system antennas, echo sounder and sonar transducers, motion reference units, etc.) are referenced to the origin. In most cases, the location of the vessel's "official" origin has been defined by the designer or shipyard. This origin is normally identified with a physical marking, and also shown on the vessel drawings.

Frequently used locations are:

- Aft immediately over the rudder (frame 0)
- Vessel's centre of gravity
- The physical location of the motion reference unit (MRU)

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

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

Prerequisites

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

Context

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

Observe the packing instructions.

Note

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

Procedure

1 Ensure that all local transportation is done according to the same specifications as for the initial delivery.

2 Make sure that the box containing the unit is kept dry at all times, and sheltered from the weather.

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

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

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

4 Handle all boxes and units with care.

Note

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

Lifting units and transportation boxes

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

Prerequisites

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

Context

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

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

Note

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

Procedure

1 Check the weight of the box or unit before you attempt to lift it.

2 Make sure that you have the relevant lifting apparatus required, and that this equipment is approved and certified for the load.

3 If you need to use a crane:

   a Check the applicable weight certificate for the crane.

   b Check the security of the lifting lugs.

   c If the unit to be lifted is provided with dedicated lifting lugs, make sure that all available lugs are used.

   d Make sure that the unit remains under full control during the lifting operation.

   This is important to avoid damage to the unit, equipment or personnel.

4 If you need to use a forklift truck:

   a Check the applicable weight certificate for the truck.

   b Check the limitations for lifting height and angles.

   c Pay special attention to the position of the unit's centre of gravity.

   d Make sure that the unit is properly secured to the truck during the lifting and transportation operations.

5 Handle all units and boxes with care.

Note

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

Inspection of units and transportation boxes after arrival

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

Prerequisites

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

Procedure

1 Check all boxes (wooden or cardboard boxes, plastic bags and/or pallets) for physical damage.

Look for signs of dropping, immersion in water or other mishandling.

2 If external damage is detected, open the box to check its contents.

Request that a representative of the carrier to be present while the box is opened, so any transportation damage can be identified and documented.

3 If a unit has been damaged, prepare an inspection report stating the condition of the unit and actions taken.

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

4 If units are not damaged, check the humidity absorbing material.

If required, dry or replace the bags, then re-pack the unit(s) according to the packing instructions.

Specifications for storage prior to installation or use

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

General specifications

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

1 The equipment must be stored in its original transportation box.

2 Ensure that the units are clearly separated in the shelves and that each unit is easily identifiable.

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

4 Boxes must not be placed on top of each other, unless specific markings permit this.

5 Boxes must not be placed directly on a dirt floor.

6 Do not open a box for inspection unless special circumstances permit so.

"Special circumstances" may be suspected damage to the box and its content, or inspections by civil authorities.

a If a unit is damaged, prepare an inspection report stating the condition of the unit and the actions taken. Describe the damage and collect photographic evidence if possible. Re-preserve the equipment.

b If the unit is not damaged, check the humidity absorbing material. If required, dry or replace the bags, then re-pack the unit according to the packing instructions.

7 If a box has been opened, make sure that is it closed and sealed after the inspection. Use the original packing material as far as possible.

8 The storage room/area must be dry with a non-condensing atmosphere. It must be free from corrosive agents.

9 The storage room/area's mean temperature must not be lower than -10° C, and not warmer than +50° C. If other limitations apply, the crates will be marked accordingly.

10 Boxes must not be exposed to moisture from fluid leakages.

11 Boxes must not be exposed to direct sunlight or excessive warmth from heaters.

12 Boxes must not be subjected to excessive shock and vibration.

13 If the unit contained in a box holds normal batteries, these may have been disconnected/isolated before the unit was packed. These must only be reconnected before the installation starts. Units containing batteries are marked.

Caution

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

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

Temperature protection

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

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

Other temperature limits may be used if applicable.

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

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

Note

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

Unpacking instructions

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

Topics

Unpacking standard parts and units

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

Context

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

Note

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

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

Procedure

1 Check the carton before opening it to ensure it shows no signs of dropping, immersion in water or other mishandling.

   1 If external damage is detected, open the box to check its contents.

   2 Request that a representative of the carrier to be present while the box is opened, so any transportation damage can be identified and documented.

   3 If a unit has been damaged, prepare an inspection report stating the condition of the unit and actions taken.

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

2 Place the box on a stable work bench or on the floor with the top of the box facing upwards.

3 In the absence of other instructions, always open the top of the carton first.

   The contents of the box will normally have been lowered into the carton from above, so this will usually be the easiest route to follow. Be careful when you open the box, and make sure that the contents are not damaged. Do not use a knife to open cardboard boxes.

4 If the box has been closed using staples, remove the staples from the carton as you open it.

   This will reduce the possibilities of scratch injury to yourself and damage to the contents.

5 If a wooden box has been closed using screws, always remove them using a screwdriver.

   Do not attempt to force the lid open with a crowbar or similar tool.

6 Once the carton is open, carefully remove all loose packing and insulation material.

7 Check for user manuals and other documents that may have been added to the carton during packing.

8 Check also for special tools, door keys etc.

Unpacking mechanical units

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

Prerequisites

Observe the procedure for unpacking of standard parts and units.

Context

Mechanical and electromechanical units may be heavy.

Procedure

1 Obtain the necessary lifting equipment, and make sure that the equipment is certified for the weight.

2 Lift the unit out of the transportation box.

3 Place it in a stable position on the floor/work bench.

4 Inspect the unit for visual damage.

5 Remove any packing material that may be inside the unit.

6 Collect and keep the relevant user manuals and/or documents provided with the unit.

Unpacking electronic and electromechanical units

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

Context

Electronic and electromechanical units are normally wrapped in clear antistatic plastic bags.

Do not break the seal to open a printed circuit board, an electronic module or a unit before it shall be used. If the unit is returned with a broken seal we will assume that it has been used. You will then be billed accordingly.

Note

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.

Procedure

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

Note

You must never use the cables to lift or carry a unit.

2 Place it in a stable position on the floor or on the workbench.

3 Inspect the unit for damage.

a If a unit has been damaged, prepare an inspection report stating the condition of the unit and actions taken.

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

4 Assuming all is well, open the bag and remove the unit.

5 Take out and keep the documentation.

You will need the documentation if the item shall be returned to us.

6 If applicable, open the unit and check inside.

7 Remove any packing and desiccant material that may be found inside the shipping container or bag.

8 Collect and keep the relevant user manuals and/or installation documents provided with the unit.

Unpacking transducers

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

Prerequisites

Observe the procedure for unpacking of standard parts and units.

Context

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

Note

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

Transducers may be heavy.

A transducer must always be handled as a delicate instrument. Incorrect actions may damage the transducer beyond repair.

Observe these transducer handling rules:

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

Procedure

1 Obtain the necessary lifting equipment, and make sure that the equipment is certified for the weight.

2 Lift the transducer, sonar head or hydrophone out of the transportation box.

3 Place it in a stable position on the floor/work bench.

4 Inspect the unit for visual damage.

5 Make sure that the relevant protection is kept in place until the final stages of the installation.

6 Collect and keep the relevant user manuals and/or documents provided with the unit.

7 Observe the handling rules for transducers.

Specifications for storage after unpacking

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

General specifications

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

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

Note

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

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

Caution

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

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

Temperature protection

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

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

Other temperature limits may be used if applicable.

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

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

Note

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

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