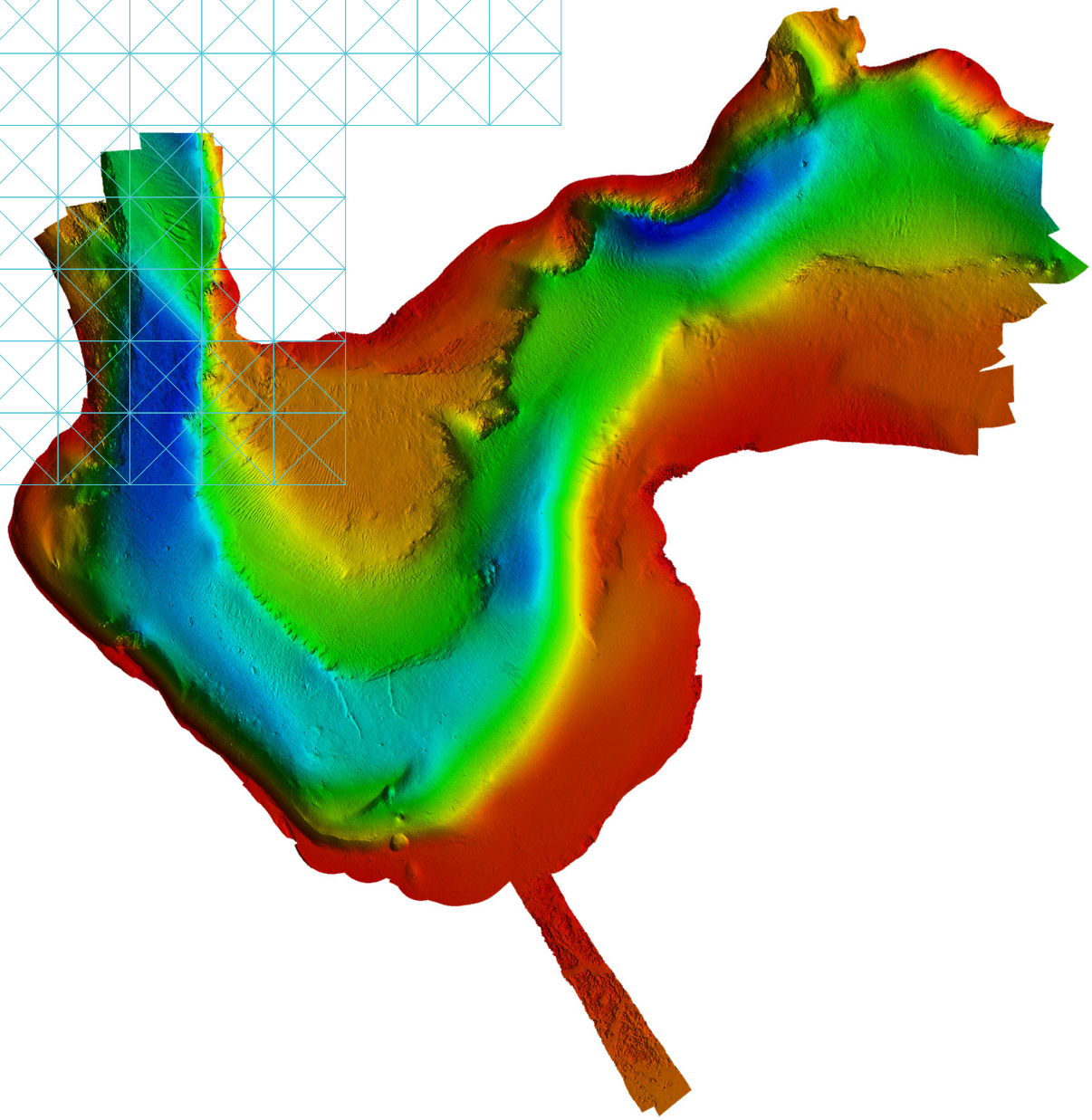
KONGSBERG

INSTALLATION MANUAL

EM 2040 MKII



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Kongsberg EM 2040 MKII
Multibeam echo sounder
Installation Manual

472405/B

Document information

- **Product**: Kongsberg EM 2040 MKII
- **Document**: Installation 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.

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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.

KM Support is also available in the KM-App.

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Table of contents

About this manual

The purpose of this manual is to present the descriptions and drawings required to install the EM 2040 MKII Multibeam echo sounder.

Target audience

The manual is intended for technical personnel; such as skilled shipyard workers, electricians, qualified engineers and naval architects. It is assumed that you understand the general principles of maritime electronic equipment. You must also be familiar with computer hardware, interface technology and installation of 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 and/or single beam echo sounders in hydrographic applications..

Online information

For information about the EM 2040 MKII and other products from Kongsberg Maritime, visit our website.

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

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Kongsberg EM 2040 MKII

Topics

System description

The EM 2040 MKII is a true wide band high resolution shallow water multibeam echo sounder. It is an ideal tool for any high resolution mapping and inspection application. EM 2040S MKII is a 50m rated version of EM 2040 MKII, that has the same dimensions, weight and performance as the 6000m rated EM 2040 MKII. If not specified, the specification also includes EM 2040S MKII.

Included features

- Frequency range: 200 to 400 kHz
- High resolution
- FM chirp allowing much longer range capability (depth and coverage) compared to CW pulses
- Complete roll, pitch and yaw stabilization
- Nearfield focusing on both transmit and receive
- Short pulse lengths, large bandwidth. Shortest pulse is 14 µs
- IHO S-44 exclusive order compliant
- Seabed image
- Swath coverage:
  - Single system: Up to 170 degrees
  - Dual RX: Up to 220 degrees
- Beam width:
  - EM 2040-04 MKII: 0.4x0.7 degrees at 400 kHz
  - EM 2040-07 MKII: 0.7x0.7 degrees at 400 kHz
- Displaying and logging of water column data is included for SIS users
- Depth rating
  - EM 2040 MKII Transducer depth rating: 6000 metres
  - EM 2040S MKII Transducer depth rating: 50 metres

Optional features

- 600 and 700 kHz modes (Single RX systems only. Dual Swath not available in these modes.)
- Dual swath option, allowing sufficient sound density alongtrack at reasonable survey speed
- 8 bit water column phase data logging

- EM® MultiFrequency Mode (Dual Swath not available in this mode.)
  - MultiFrequency Backscatter
  - MultiFrequency Inspection
  - MultiFrequency Bathymetry
  - MultiFrequency Pulse
- Extra detection

System diagram, single system

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

A *Hydrographic Work Station (HWS)*

B *Interfaces:*

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

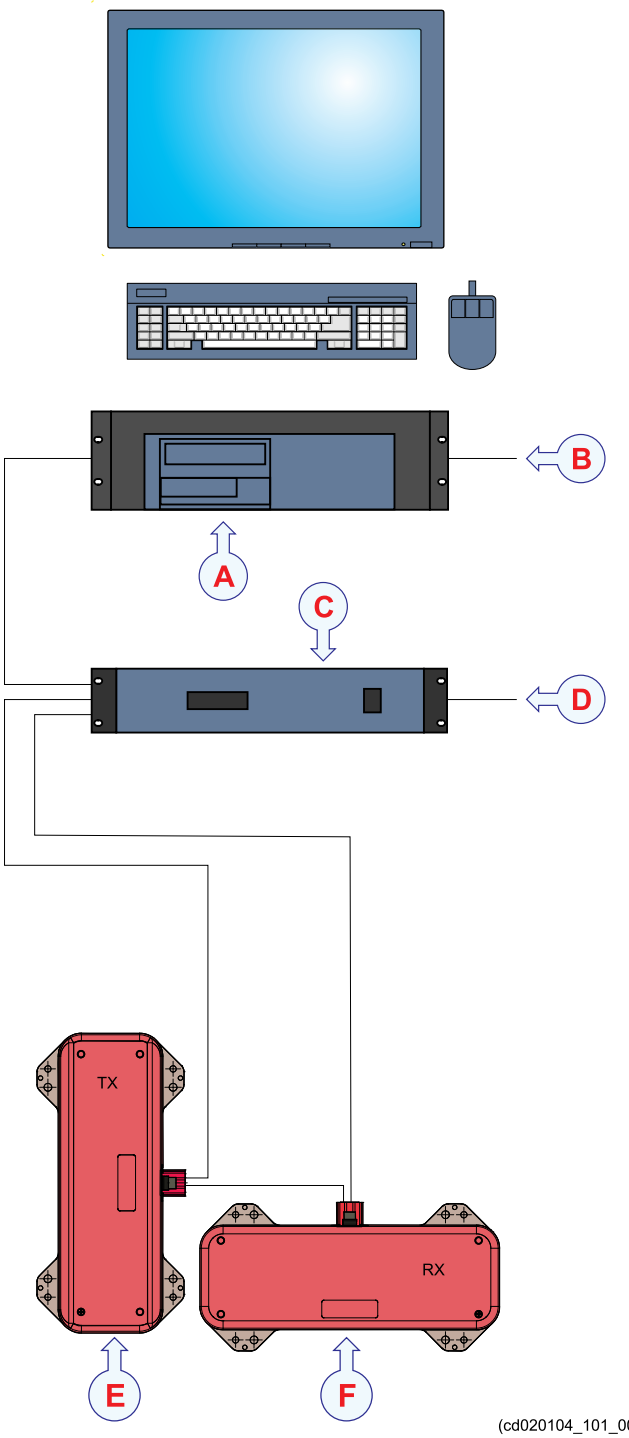
C *Processing Unit (PU)*

D *Interfaces:*

- *Positioning systems*
- *Attitude (roll, pitch and heave)*
- *Sound speed sensor*
- *Velocity*
- *Heading*
- *Clock*
- *Trigger input/output*
- *Clock synchronization (1PPS)*

E *Transmit transducer (TX)*

F *Receive transducer (RX)*



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System diagram, dual RX

The system diagram identifies the main components of a dual RX EM 2040 MKII system. Only the main connections between the units are shown. Detailed interface capabilities and power cables are not shown. One or two Processing Units may be required, depending on the system configuration.

A *Hydrographic Work Station (HWS)*

B *Interfaces:*

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

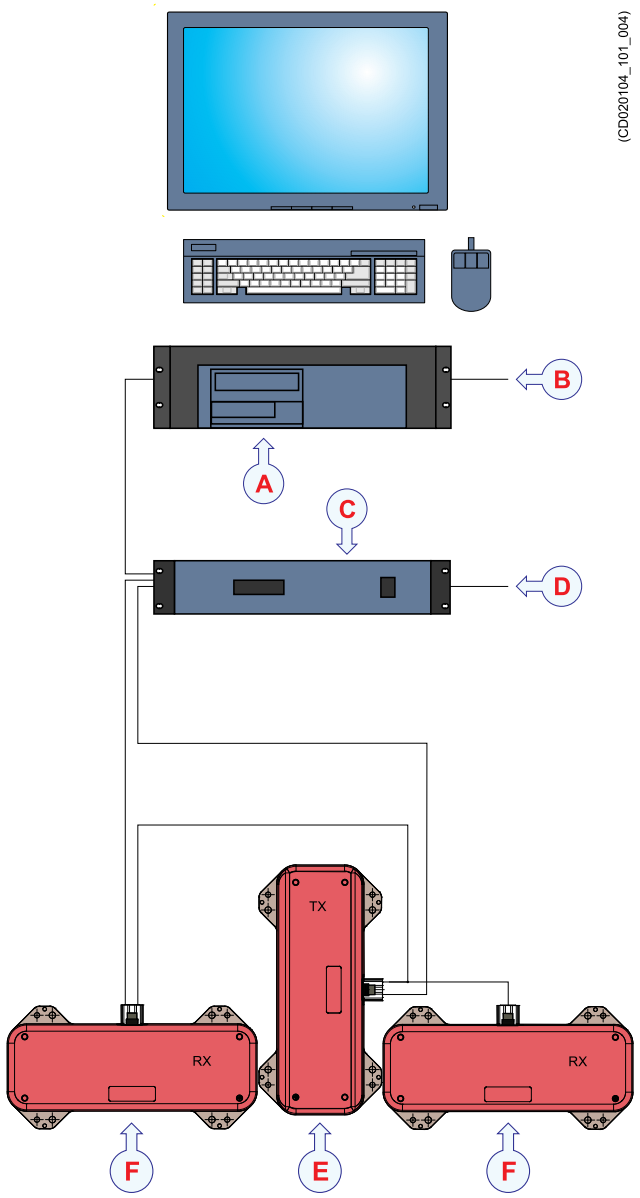
C *Processing Unit (PU)*

D *Interfaces:*

- *Positioning systems*
- *Attitude (roll, pitch and heave)*
- *Sound speed sensor*
- *Velocity*
- *Heading*
- *Clock*
- *Trigger input/output*
- *Clock synchronization (1PPS)*

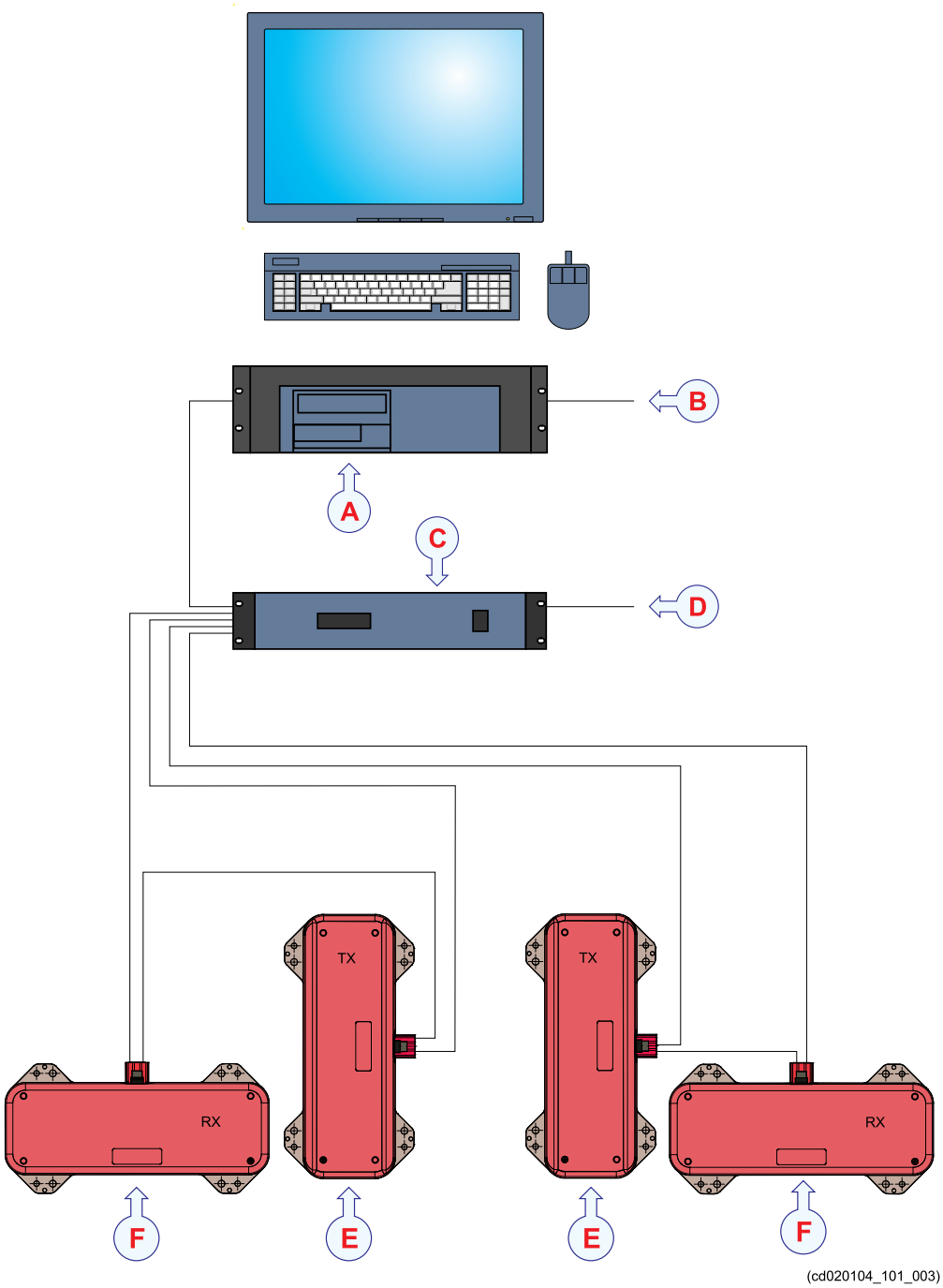
E *Transmit transducer (TX)*

F *Receive transducer (RX)*



System diagram, dual TX

The system diagram identifies the main components of a dual TX EM 2040 MKII system. Only the main connections between the units are shown. Detailed interface capabilities and power cables are not shown. One or two Processing Units may be required, depending on the system configuration.



A *Hydrographic Work Station (HWS)*

B *Interfaces:*

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

C *Processing Unit (PU)*

D *Interfaces:*

- *Positioning systems*
- *Attitude (roll, pitch and heave)*
- *Sound speed sensor*
- *Velocity*
- *Heading*
- *Clock*
- *Trigger input/output*
- *Clock synchronization (1PPS)*

E *Transmit transducer (TX)*

F *Receive transducer (RX)*

Portable System diagram, single system

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

A *Portable Hydrographic Work Station*

B *Interfaces:*

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

C *Portable Processing Unit*

D *Interfaces:*

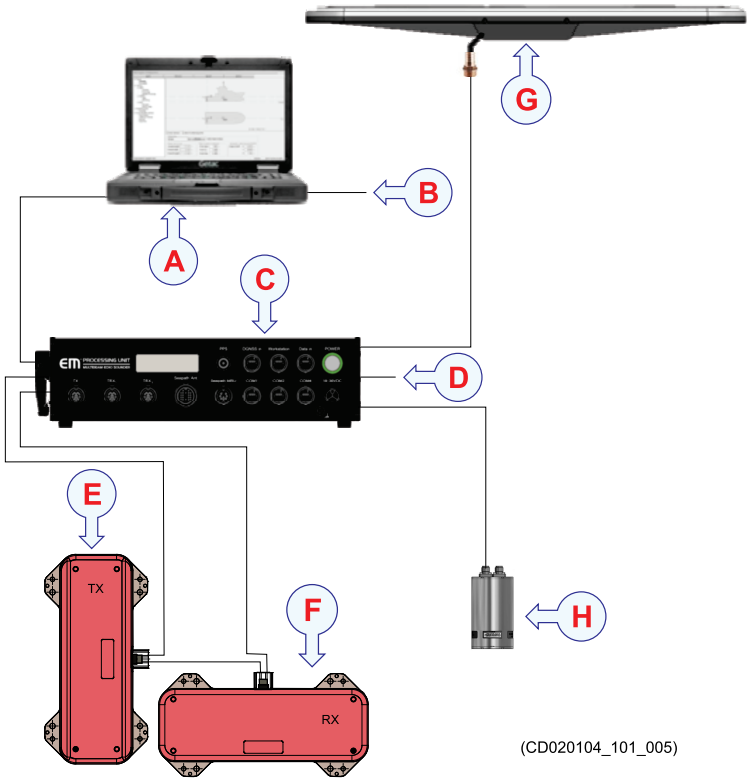
- *Positioning systems*
- *Attitude (roll, pitch and heave)*
- *Sound speed sensor*
- *Velocity*
- *Heading*
- *Clock*
- *Trigger input/output*
- *Clock synchronization (1PPS)*

E *Transmit transducer (TX)*

F *Receive transducer (RX)*

G *Seapath 130*

H *MRU H/5/5+*



Portable System diagram, dual system

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

A *Portable Hydrographic Work Station*

B *Interfaces:*

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

C *Portable Processing Unit*

D *Interfaces:*

- *Positioning systems*
- *Attitude (roll, pitch and heave)*
- *Sound speed sensor*
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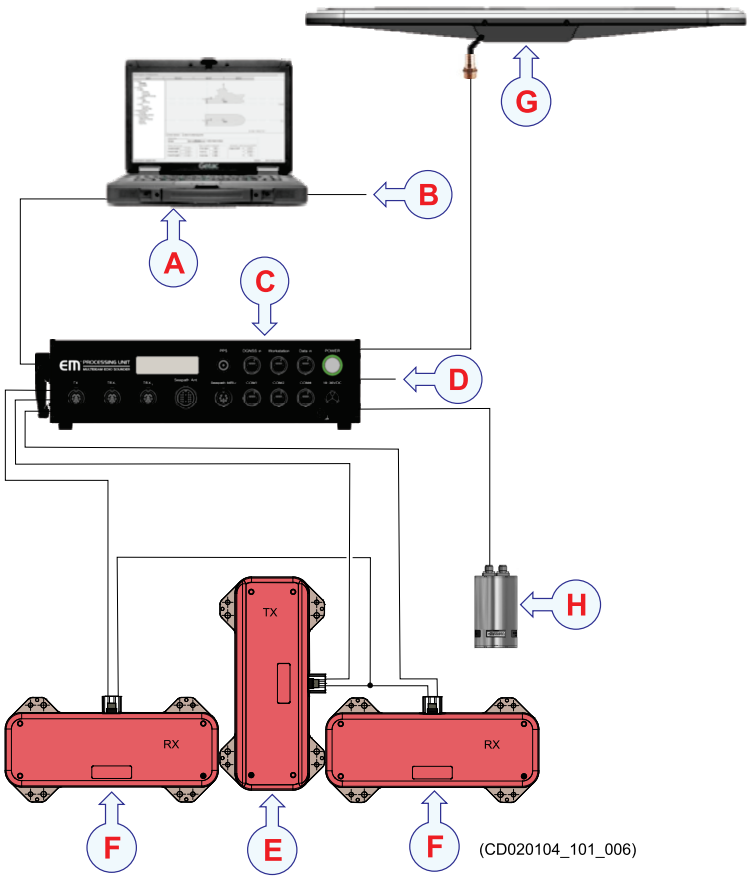


Main system units

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 2040 MKII uses separate transducer arrays for transmitting and receiving sound pulses.

The EM 2040 MKII system may be delivered in different versions with different transmission beam width.

- EM 2040-04 MKII (0.4 degrees at 400 kHz)
- EM 2040-07 MKII (0.7 degrees at 400 kHz)

The EM 2040 MKII has separate transducers for transmit and receive, mounted in a Mills cross configuration. The transmit transducer consists of three separate line arrays, one looking straight down and the two others pointing 55 degrees to each side. The transducer contains all analog electronics and digital control units with Ethernet interface to the Processing Unit. The transmitter is electronically steerable alongtrack while the receiver is steerable athwartship.

The transducers are made from composite ceramics which enables a wide bandwidth. The material in the transducer housing is Titanium.

Processing Unit description

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

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

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

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

Portable Processing Unit description

The Portable Processing Unit is a ruggedized IP67 (unmated and mated) version of the standard Processing unit that runs on 24VDC (18-36VDC).

The Portable Processing Unit can interface directly to the Seapath 130. The front plugs “Seapath” and “MRU” is powering and interfacing the Seapath 130 Antenna and MRU

The portable version has the same functionality as the standard EM Processing Unit in a splash proof enclosure, with the following exceptions:

- External trigger is not available
- Remote on/off is not available
- Portable version do not supports dual head and dual swath systems.

Hydrographic Work Station description

The Hydrographic Work Station is the operator station of the EM multibeam system.

A dedicated maritime computer is provided. It is set up with all necessary software.

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

The Hydrographic Work Station is based on a commercial design. Due to the constant development of new computer parts, older parts are no longer manufactured. This means that the computer type used with the EM 2040 MKII system changes from time to time.

For more detailed information about the different models of Hydrographic Work Station see the separate manual:

- *495770 - Hydrographic Work Station Instruction Manual*

Ethernet switch description

A high capacity Ethernet switch may be required.

If you use more than one Processing Unit, a high capacity Ethernet switch is required. The Ethernet switch is used to connect each transceiver and Processing Units together. A high capacity Ethernet switch is included in the EM 2040 MKII delivery.

Note

It is very important that a high-quality Ethernet cable is used. You must use Cat 5e STP (Shielded Twisted Pair) quality or better. Using cables with lower bandwidth capacity will reduce performance.

Remote Control Unit (K-Rem) description

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

Note

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

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

- One Sub-bottom profiler (SBP 27 or SBP 29)
- Two EM multibeam echo sounders
- One EA single beam echo sounder

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

Related topics

Interface to Remote Control Unit for external synchronisation, page 108
K-Sync interface to Remote Control Unit, page 109
Remote Control using K-Rem, page 112

Preparing the installation

Topics

Tools, equipment and consumables required for installation

To install the EM 2040 MKII system, all necessary tools and equipment for mechanical work, cabinet installation and electrical wiring must be available.

It is not practical to provide a detailed list of all necessary tools and equipment. 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.

However, you must make sure that the following specialized tools are available.

- All necessary tools and consumables required for welding
- All necessary tools and consumables required for physical installation of transducer frames and transducer modules
- All necessary tools and consumables required for electrical installations
- Torque wrench
- Unless a suitable lifting device is available, make sure that enough manpower is available to lift, hold and fasten the transducer.

Note

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

Personnel qualifications

The installation of the EM 2040 MKII system is a demanding task. Installation tasks must only be done by fully trained personnel.

As a minimum, the following certified personnel must be available:

- Service engineer from Kongsberg Maritime
- Welders
- Electricians

Note

The quality of the welding is critical to the safety of the vessel. Welding must only be done by a certified welder.

If applicable, the final installation welds must be approved by the vessel's national registry, the corresponding maritime authority and/or classification society. Observe the relevant rules and regulations related to welding.

Sonar room requirements

Topics

Environmental requirements

The EM 2040 MKII topside units must be installed in a dry and dust-free environment. The units are not fully protected against humidity, dust or moisture.

It is important that the sonar room is kept clean and dry. The system units must not be exposed to excessive temperatures, dust, moisture or humidity. Such conditions can cause corrosive attacks and subsequent failures to the electronic circuitry. Visit the sonar room at regular intervals to check for dust, high temperature and humidity. Take the necessary actions if the environmental conditions are poor.

Avoid running large power cables trough the sonar room.

Observe the environmental specifications related to each unit.

Size and access requirements

A well designed sonar room with a well fitted size and easy access reduces the risk of corrosion, and simplifies maintenance. This increases system reliability.

The sonar room must be large enough to house all the system units. The room must provide enough space to allow efficient maintenance. You must be able to keep all the cabinet doors fully open without undue restriction to your movements.

1 The room must not be used for any other heavy machinery.

2 The room must not be unnecessarily obstructed by girders, pipes etc, which may cause installation problems or impede maintenance.

3 The sonar room must be accessible under all conditions at sea or at a berth.

4 All doors or hatches must be designed so that the tools and equipment can be removed without being disassembled.

Requirements for insulation, heating and ventilation

The bulkheads in the sonar room should be insulated and provided with an interior wall to the deck. The room should be equipped with heater and connected to the vessel's ventilation system.

Heating requirements

Heating is an effective method for reducing humidity. The heater in the sonar room must be dimensioned to maintain the equipment within its environmental tolerances.

Observe the environmental specifications related to each unit.

Ventilation requirements

The sonar room should be connected to the vessel's ventilation system to ensure a supply of cooling air. If a ventilation system is not available, install two 3” pipes from the sonar room to a suitable fresh air location on deck.

The fresh air should enter the room as close to the floor as possible, and should be extracted from as high as possible. A funnel shaped drip-collector must be mounted below the vent pipes to divert moisture to the bilge. On the main deck, the best ventilation is provided when the outlet pipe is at least four meters higher than the inlet pipe. To keep out sea water, rain and spray, the ventilation pipes must be fitted with goosenecks or an equivalent design.

Note

If the vessel is likely to operate in tropical conditions, a suitable air conditioning system must be installed. The air conditioning system must be able to provide an ambient temperature that does not exceed the maximum operating temperatures of the EM 2040 MKII units that are installed in the room.

Requirements for electrical installations, cables and communication

The electrical installations in the sonar room must meet minimum requirements to provide suitable lights and supply power.

Light requirements

The sonar room must be equipped with suitable lighting to simplify the installation and to aid future maintenance.

Communication requirements

The sonar room should be equipped with a telephone, an intercom system, or any other means of oral communication between the sonar room and the bridge and/or control room(s).

Power requirements

Each unit in the sonar room should be provided with a separate circuit breaker on the mains supply.

Proper vessel ground must be provided.

A minimum number of additional electrical outlets must be provided for other equipment.

Cabling requirements

The sonar room units are connected to other EM 2040 MKII units located in different compartments on the vessel. The units may also be connected to peripheral devices. If these cables pass through hatches or areas where they may be damaged, they must be run in conduits. Minimum 2” conduit is recommended.

Make sure that all system cables are properly connected and secured, and installed with some slack. The slack is essential to withstand vibrations, and to facilitate future maintenance and replacements.

Where to install the transducer

Topics

Introduction to transducer location

A single answer to the question "where to install the transducer" cannot be given.

The physical location of the transducer depends on the vessel's design and construction, how the hull is shaped, and how the water runs along the hull. There are however a number of important guidelines, and some of these are even conflicting.

Note

The information here must be considered as general advice. Each system installation must be handled separately depending on the hull design and the other electrical and mechanical systems installed on the vessel.

Mount the transducer deep

In order to achieve the best possible performance, mount the transducer as deep as possible under the vessel’s hull.

There are several reasons for mounting the transducer as deep as possible.

Flow noise

Consider the situations when the vessel is unloaded, and pitching in heavy seas. The vessel is riding high, and the bow may even be lifted out of the water. This will cause a lot of air to follow the shape of the hull.

The upper water layers of the sea contain a myriad of small air bubbles created by the breaking waves. In heavy seas the upper 5 to 10 metres may be filled with air, and the highest concentrations will be near the surface. Air bubbles absorb and reflect the sound energy, and they may in worst cases block the sound transmission altogether.

Cavitation

Cavitation is the formation of small air bubbles close to the transducer face. The bubbles appear because the local pressure becomes negative during parts of the acoustic pressure cycles. The cavitation threshold increases with the hydrostatic pressure. The noise is made when the bubbles implode.

Transmitting in air

The transducer must never be lifted free of the water surface. If the transducer is activated when out of the water it may be damaged beyond repair. Mounting the transducer at a deep position on the hull will normally prevent this.

Slamming

Slamming happens if the vessel hull climbs out of the water in heavy seas. The force of the water when the hull falls down can push the transducer up, and this may cause damage both to the transducer and to its mounting. This is especially important for low frequency transducers with large faces. The effect of slamming can be reduced by mounting the transducer as deep as possible on the hull.

Note

Kongsberg Maritime AS takes no responsibility for any damages to the transducer, the cable or the mounting arrangement, caused by slamming.

Avoid protruding objects near the transducer

Objects protruding from the hull will generate turbulence and flow noise. This will reduce the overall performance of your system.

Protruding objects may be zinc anodes, transducers or even the vessel's keel. Holes and pipe outlets are also important noise sources, as well as rough surfaces caused by bad welding. Even traces of sealing compound, sharp edges, bolts or empty bolt holes will create noise. All these protruding objects may act as resonant cavities amplifying the flow noise at certain frequencies.

Do not place a transducer near protruding objects, and especially not close behind them. Make sure that the surface of the transducer face, the hull plating and putty around the transducer is as even and smooth as possible. Mounting screws or bolts must not be extruding from the transducer, the installation hardware or the hull plating. If necessary, grind and polish all surfaces.

Keep the transducer far away from the propellers

The propulsion propellers is the dominant noise source on most vessels. The noise is easily transmitted through the water. This noise may often reduce the overall performance of your EM 2040 MKII system.

The transducer must be installed as far away from the propellers as possible. The best positions are therefore on the fore part of the hull. Positions outside the direct line of sight from the propellers are best.

On small vessels we recommend mounting the transducer on that side of the keel where the propeller blades move *upwards*. This is because the propeller cavitation is weakest on that side. The cavitation starts when the water flows in the same direction as the propeller blades. This is where the propeller blades move downwards.

Mount the transducer at a safe distance from bow thruster(s)

Bow thruster propellers are extremely noisy. When you decide where to place the transducer, you must consider the noise created by most bow thrusters.

When in operation, the noise and cavitation bubbles created by the thruster may make your EM 2040 MKII transducer useless, almost no matter where it is installed. When the bow thrusters are *not* in operation, the tunnel creates turbulence. If your vessel is pitching, the tunnel may be filled with air or aerated water in the upper position and release this in the lower position.

In general, the transducer should therefore be placed well away from the bow thruster(s).

However, this is not an invariable rule. Certain thruster designs - combined with their physical locations on the hull - may still offer a suitable location for the transducer, even close to the thruster. If you are in doubt, consult a naval architect.

Summary and general recommendations

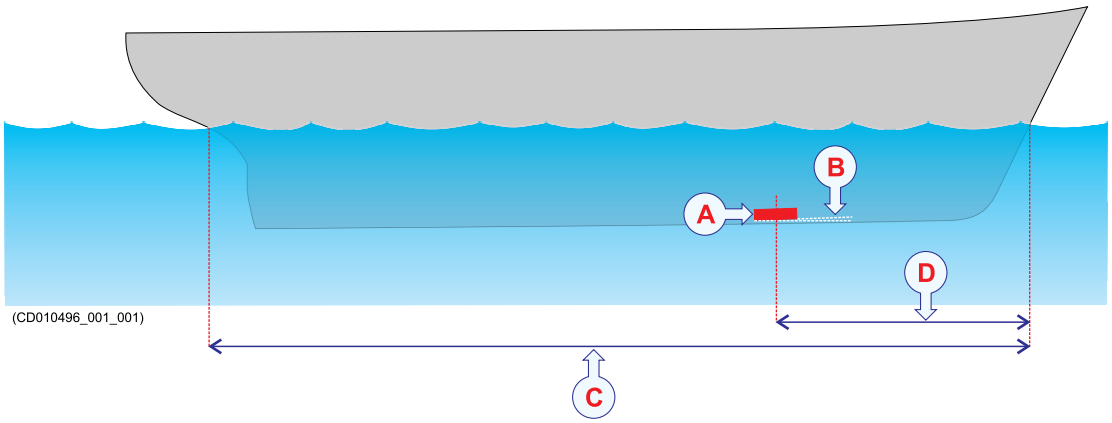
Some of the installation guidelines provided for transducer location may be conflicting. For this reason, each vessel must be treated individually in order to find the best compromise.

In general, the most important factor is to avoid air bubbles in front of the transducer face. For this reason, the recommended transducer location is normally in the fore part of the hull, well ahead of the noise created by the bow wave.

The maximum distance from the bow is normally equal to one third of the total water line length of the hull.

Note

Mounting the transducer more than 10–15 meters from the bow may cause problems with the turbulent flow.



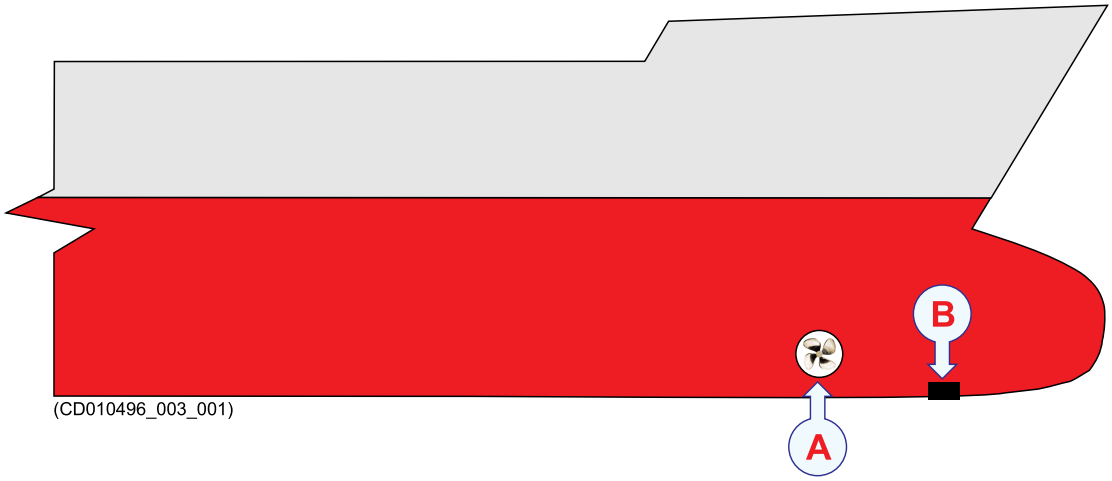
A *Transducer*

B *Inclination angle*

C *Hull length at water line*

D *Maximum 1/3 of the hull length at water line (C)*

If the vessel hull has a bulbous bow, this may well be a good transducer location, but also in this case the flow pattern of the aerated water must be taken into consideration. The foremost part of the bulb is often a good location.



A *Thruster*

B *Transducer location*

This applies to the vessel in normal trim and speed.

Important

The transducer must not have a negative inclination angle compared to water flow.

Do not place a transducer near protruding objects, and especially not close behind them.

Make sure that the surface of the resulting installation is as smooth and streamlined as possible.

Acoustic noise

As with any other hydroacoustic systems, the quality of the EM 2040 MKII echo data and presentations are subject to unwanted acoustic noise. The echoes from any large and small target must be detected inside the noise.

It is important that we keep the noise level as low as possible. This is necessary to obtain long range and dependable interpretations of the echoes. Even with the advanced noise filtering offered by the EM 2040 MKII system, we must address the noise challenge. This is important during the planning and preparations for the installation of the EM 2040 MKII system.

Topics

Contributing factors

Several factors are contributing to the performance of the hydroacoustic equipment used on board a vessel.

Such factors include:

- The quality and properties of the transmitted signal
- The quality of the receiving system
- The operational settings made during operation
- The properties of the target(s)
- The signal-to-noise ratio

The majority of these factors can neither be controlled nor improved by means of installation methods or transducer locations. The quality and properties of the transmitting and receiving systems are key factors during our product development, while our end user documentation aims to help you to make the right settings during operation. As for the target properties, there is nothing any of us can do with those.

The *signal-to-noise ratio*, however, can be improved by making the correct choices during installation.

The *signal* is the echo that we want to know something about, while the *noise* is any unwanted signals or disturbances. The echo must be detected in the noise and therefore it is necessary to keep the noise level as low as possible in order to obtain high echo interpretation.

The noise that contributes to the signal to noise ratio may be divided into the following types of noise:

- Self noise
- Ambient noise
- Electrical noise
- Reverberation
- Underwater noise

The transducer can pick up noise from:

- Biological disturbances
- Interference
- Cavitation
- Propeller noise
- Flow noise
- Acoustic noise from other hydroacoustic systems

The transducer cables are long. Electric noise from generators, pumps, cooling systems and other electric or electromechanical devices is easily picked up.

Self noise

Any vessel equipped with a hydroacoustic system (for example echo sounder or sonar) will produce more or less self noise.

There are many sources of such self noise. It is necessary to analyse the different sources of self-noise on a vessel, and find out how each source can affect the noise level of the hydroacoustic instruments.

Machinery noise

The main contributor to machinery noise is usually the main engine on board the vessel. The contribution from auxiliary machinery may, however, be considerable, especially if it is in poor shape. The machinery noise can be transmitted to the transducer as:

- Structure-borne noise through the ship structure and the transducer mountings.
- Water-borne noise through the hull into the water to the transducer.

Electrical noise

Modern vessels are normally equipped with a lot of electric instruments such as hydroacoustic systems, radars, navigation systems, and communication equipment. Any electric instruments may in some cases cause electrical interference and noise. International regulations and certifications are used to control and reduce this, but even these are limited if the electrical systems are poorly installed and/or maintained.

Propeller noise

Propeller noise is often the main source of noise at higher vessel speeds. Variable pitch propellers or fast moving propellers usually make more noise than fixed propellers or slow moving propellers.

Propeller noise is usually water-borne. In some cases, however, shaft vibrations or vibrations in the hull near the propeller may be structure-borne to the transducer. If a propeller blade is damaged, this may increase the noise considerably.

Propeller cavitation is a severe source of noise. "Singing" propellers might be a source of noise, which interferes at discrete frequencies. In some cases static discharge from the rotating propeller shaft may be quite disturbing.

Cavitation

Cavitation is the formation of small air bubbles close to the transducer face. The bubbles appear because the local pressure becomes negative during parts of the acoustic pressure cycles. The cavitation threshold increases with the hydrostatic pressure. The noise is made when the bubbles implode.

Cavitation noise may appear near extruding objects at higher speeds, but more often it is caused by the propellers. Propeller cavitation is a severe source of noise. The cavitation starts when the water flows in the same direction as the propeller blades. This is where the propeller blades move downwards.

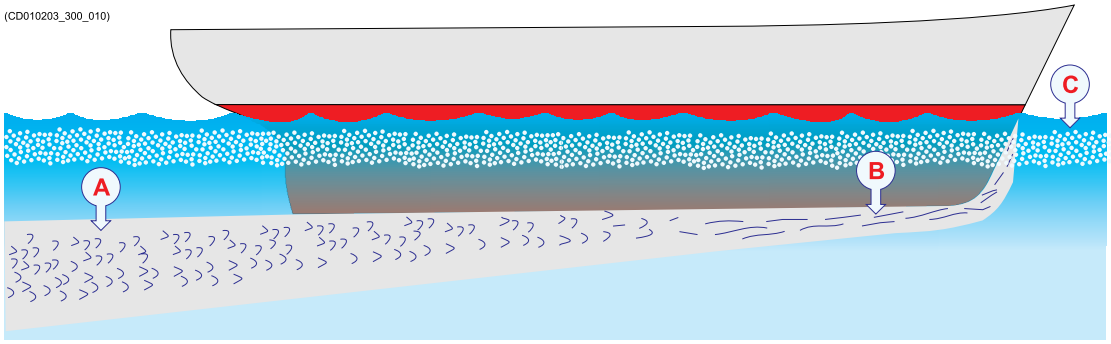
In some cases a resonant phenomenon is set up in a hole near the hull. This sound will have a discrete frequency, while all other flow noise will have a wide frequency spectrum.

(Image from U. S. Navy in the public domain.)

Flow noise

The upper water layers of the sea contain a myriad of small air bubbles created by the breaking waves. When the hull moves through water it will cause a disturbance, and this will generate friction. The friction zone is called the *flow boundary layer*. The water flow in this boundary layer may be *laminar* or *turbulent*.

- The *laminar* flow is a nicely ordered, parallel movement of the water.
- The *turbulent* flow is a disorderly flow pattern, full of eddies.



A *Turbulent flow*

B *Laminar flow*

C *Air bubbles*

Air bubbles absorb and reflect the sound energy, and they may in worst cases block the sound transmission altogether.

The boundary layer increases in thickness when it becomes turbulent. The boundary layer is thin in the forward part of the vessel hull, and increases as it moves aft. The thickness depends on ships speed and on the roughness of the hull. All objects sticking out from the hull, or dents in the hull, will disturb the flow and will increase the thickness of the boundary layer. When the flow speed is high, the turbulence can be violent enough to destroy the integrity of the water. Small voids or cavities in the water will occur and this is called cavitation.

Rattle noise

Rattle noise may be caused by loose objects in the vicinity of the transducer, like fixing bolts. The rattle may also come from loose objects inside the hull.

Interference

Interference from other hydroacoustic equipment on board the same vessel may be an annoying source of disturbance. Unless the same frequency is used for more than one piece of equipment only the transmitted pulse will contribute to the interference.

Ambient noise

Ambient noise is usually not a limiting factor to the performance of sonars and echo sounders.

The ambient noise may be split up as follows:

- **Sea noise**: Air bubbles, seismic disturbances, waves, boundary turbulence, etc.
- **Biological noise**: Fish, mammals
- **Man made noise**: Other vessels, interference
- **Precipitation noise**: Heavy rain or hail

In some areas, where many vessels operate together, the engine and propeller noise from other vessels may be disturbing. Interference from hydroacoustic instruments located in other vessels may also be a limiting factor. The sea noise depends on the weather conditions. In bad weather the sea noise can be quite high due to the waves.

Electrical self noise

Electrical or electronic self noise is picked up or generated in any other part of the equipment than the transducer.

The most common source of electrical self noise is hum. The hum is normally generated by a low quality power supply. It is then picked up by the transducer cables and/or sensitive electronic circuitry. At higher frequencies – where rather wide bandwidths are necessary – the noise from components, transistors or other analogue electronic may be a limiting factor.

Some means to reduce acoustic noise

Several factors are contributing to the performance of the hydroacoustic equipment used on board a vessel. Careful planning of the installation may reduce the acoustic noise.

Unfortunately, it is impossible to simply provide a number of specific procedures to reduce the noise.

An important factor is the physical location of the transducers. This depends on the vessel's design and construction, how the hull is shaped, and how the water runs along the hull. Other factors deal with other equipment mounted on board, and this will also be vessel dependant. At moderate ship speeds the machinery noise is usually dominant. At medium speeds the flow noise increases more rapidly and takes over, while at higher speed the propeller noise will be the main contributor.

Note

The information here must be considered as general advice. Each system installation must be handled separately depending on the hull design and the other electrical and mechanical systems installed on the vessel.

Reducing flow noise

- The hull plating in front of the transducer must be as smooth as possible.

  Important

  Be especially aware of bilge keels and sacrificial anodes. The keel must be rounded off without sharp edges. Neither extruding objects nor abrupt transitions must be present.

Reducing machinery noise

- Any hull structure that may vibrate must be damped or coated to reduce the vibrations.

Reducing propeller noise

- Sufficient clearance between the propellers and the hull, the rudder and the keel must be provided.
- Place the sacrificial anodes in places where the water flow is the least disturbed.
- Ensure that the propellers blades are correctly designed and without damages.

- The use of a baffle between the propellers and the transducer may reduce noise appreciably.
- Static discharges caused by the rotating propeller shaft may be removed by proper grounding or by mounting a coal brush from the shaft to vessel ground.

Reducing rattle noise

Ensure that no parts near the transducers can rattle as a result of water flow or vibrations.

Reducing interference

Interference from the transmission pulses from other hydroacoustic instruments on board the vessel is difficult to avoid. The problem may be reduced by choosing the working frequencies carefully and to some extent by separating the different transducers. On vessels with a large number of separate hydroacoustic systems installed and in simultaneous use, a separate synchronizing system (for example the K-Sync) should be considered.

Reducing electrical noise

- Make sure that all units are properly grounded. This is important to avoid electrical noise.
- Use shielded cables with correct grounding.
- Separate the cables used by the EM 2040 MKII system from other cables with high voltages, large currents or transients.
- Place all high voltage power cables in metal conduits.

Transducer installation principles

Topics

Introduction

The transducer can be installed using different installation principles.

The EM multibeam system is supplied with transducers and electronic units. While the electronic units are installed using normal tools, the transducers must be located and installed depending on the vessel's design.

The EM multibeam transducer arrays can be installed using one of the following principles.

- Gondola
- Blister
- Flush mounted
- Externally mounted with fairings
- Keel box
- Portable
- Hull unit
- Drop keel

Not all installation principles are possible for all EM models.

	EM 124	EM 304	EM 712	EM 2040 series
Gondola	X	X	X	X
Blister	X	X	X	X
Flush mounted	X	X	X	X
Exter-nally moun-ted with fair-ings	X	X	X	X
In a box keel	X	X	X	X
Portable mounting			X	X
Hull unit			X	X
Drop keel			X	X

Normally, in a permanent installation, the cables enter the hull through steel conduits which are fitted with standard ship type cable glands (Brattberg, Roxtec or equivalent) to provide water tightness. The cable glands should be of the type having a pressure rating of 4 bars or more. If the conduits end below the vessel's water-line, classification requirements may require a double set of approved glands. The conduits should be filled with water up to the waterline.

The installation of the transducer arrays must thus be planned together with the installation shipyard and/or the client.

Once the installation method is defined, the installation shipyard must provide the necessary drawings. These drawings must be approved by the vessel's classification authority.

If required, Kongsberg Maritime AS can assist with the required engineering.

Gondola

A gondola is a streamlined pod mounted under the hull of the ship. It can either be welded or bolted under the hull plates. It is well suited for refitting a vessel with an EM 2040 MKII system.

There is a gap between the gondola and the hull. Aerated water will pass through this gap, and thus not be pushed under the transducer.

This is often the preferred installation approach for Kongsberg Maritime and the method that gives the optimum weather window and system performance.

The gondola can be tailored to fit the ship and also the scope of supply.

Kongsberg Maritime recommends to place a "debris knife" in the forward end of the gondola.

The gondola will be water filled. To let the air escape, make suitable holes in the rear end close to the vessel's hull.

A gondola installation may help in avoiding air bubble blockage of the sound path under the transducers by aerated water. Gondolas may also contain additional transducers for other systems.

The transducers must be installed flush with the surrounding surface area to ensure best possible performance of the system.

Note

The inside surface of the gondola must be protected with appropriate protective paint and an adequate amount of sacrificial anodes.

The installation shipyard must provide all necessary installation drawings.

If required, all drawings and documents must be approved by the vessel's national registry and corresponding maritime authority and/or classification society.

Such approval must be obtained before the installation can begin. The shipowner and shipyard doing the installation are responsible for obtaining and paying for such approval.

Blister

A recommended method for transducer installation is by using a blister.

A blister is a mounting construction fully welded to the hull of the ship. The blister contains casings, which form the main part of the unit, housing the transducer frames and modules. The design of the blister is aimed at guiding the aerated water and air bubbles around both sides of the installation and create an environment around the transducer free of air bubbles.

Blisters of different sizes and shapes have been used from the early days of echo sounder installation, and this method of installation is a well known principle. A blister is well suited for refitting a vessel with an EM 2040 MKII system.

The blister can also be used for other sonar and echo sounder transducers.

The interior of the blister must be filled with water. Use drainage holes in the bottom and an air outlet on the top.

The transducers must be installed flush with the surrounding surface area to ensure best possible performance of the system.

Note

The inside surface of the blister must be protected with appropriate protective paint and an adequate amount of sacrificial anodes.

The installation shipyard must provide all necessary installation drawings.

If required, all drawings and documents must be approved by the vessel's national registry and corresponding maritime authority and/or classification society.

Such approval must be obtained before the installation can begin. The shipowner and shipyard doing the installation are responsible for obtaining and paying for such approval.

Flush mounted

With the flush mount method the transducers are installed inside the ship's hull.

This method exposes the transducers to passing air bubbles which might affect the system performance. The benefit of a flush mounted installation is that nothing protrudes from the keel. This solution is mainly used for deep water multibeams on ice classed vessels with additional Ice protection.

The transducer arrays may be mounted flush with the vessel’s hull. In order to do this, the shipyard must design a framework inside the hull to support the casings. The arrays must then be mounted so that their faces are flush with the outer hull.

Vents with sufficient capacity must be installed in the casings to prevent any air to be trapped and to avoid back pressure behind the transducers.

Note

This installation method may prove unsuccessful due to aerated water blocking the signal path to and from the transducers. Thorough research on the vessel’s hull design and the acoustic conditions must be made before attempting this installation method.

The transducers must be installed flush with the surrounding surface area to ensure best possible performance of the system.

Note

The installation shipyard must provide all necessary installation drawings.

If required, all drawings and documents must be approved by the vessel’s national registry and corresponding maritime authority and/or classification society.

Such approval must be obtained before the installation can begin. The shipowner and shipyard doing the installation are responsible for obtaining and paying for such approval.

Externally mounted with fairings

The transducer arrays can be mounted directly under the vessel's hull.

A fairing will usually be added around the transducers to ensure laminar water flow without any aeration problems.

Installation with fairings has proven successful in former multibeam echo sounder installations.

Note

The installation shipyard must provide all necessary installation drawings.

If required, all drawings and documents must be approved by the vessel's national registry and corresponding maritime authority and/or classification society.

Such approval must be obtained before the installation can begin. The shipowner and shipyard doing the installation are responsible for obtaining and paying for such approval.

Portable installation

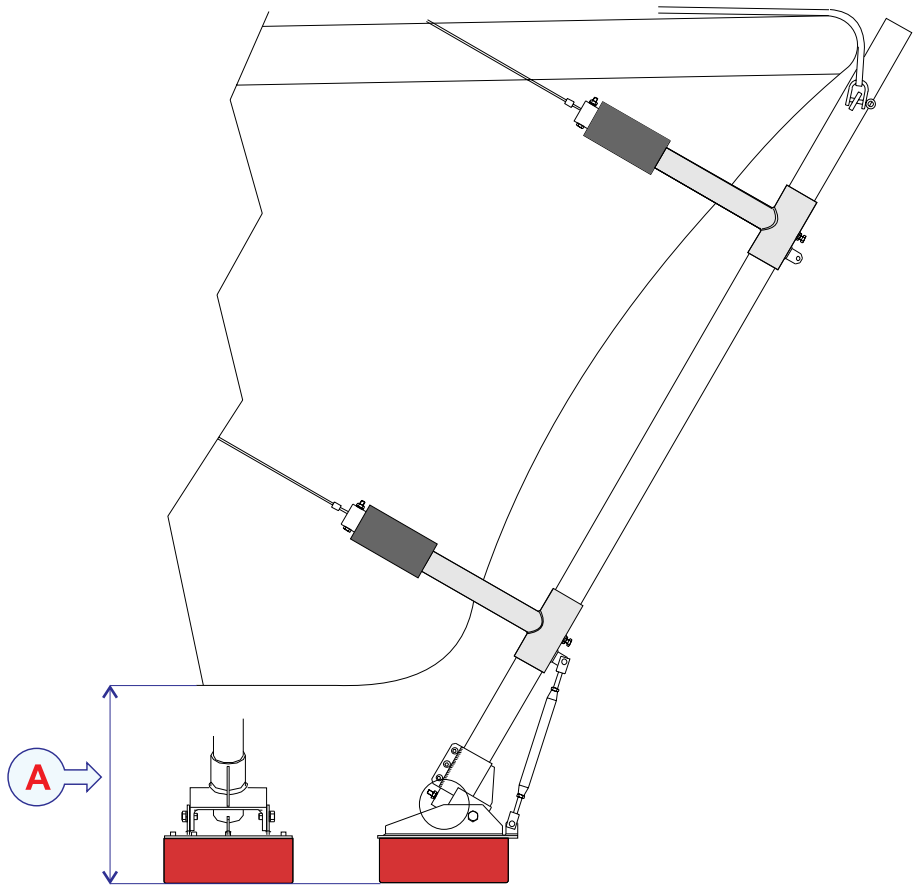
For temporary installations on a vessel the transducer might be deployed on a pole fixed to the bow or to the side, or in a moon pool.

Main considerations when using a non-permanent installation

- The mounting structure must be sufficiently rigid. Dynamic displacements of the transducer must be less than the installation accuracy requirements.

  The alignment specifications are found in the *Technical specifications*.
- The line of sight from the transducer to the bottom must not be blocked.
- Aerated water must be kept away from the transducer face.

An example of a mounting bracket that has been mounted to a pole over the bow is shown below.



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A *Distance from keel to transducer face is approximately 500 mm*

Transducer installation using a hull unit

A hull unit may be used to lower the EM 2040 MKII transducer into the water for use. When not in use, the transducer is retracted into a protective installation trunk. A hull unit is commonly used on sonars.

A *Transducer shaft sleeve*

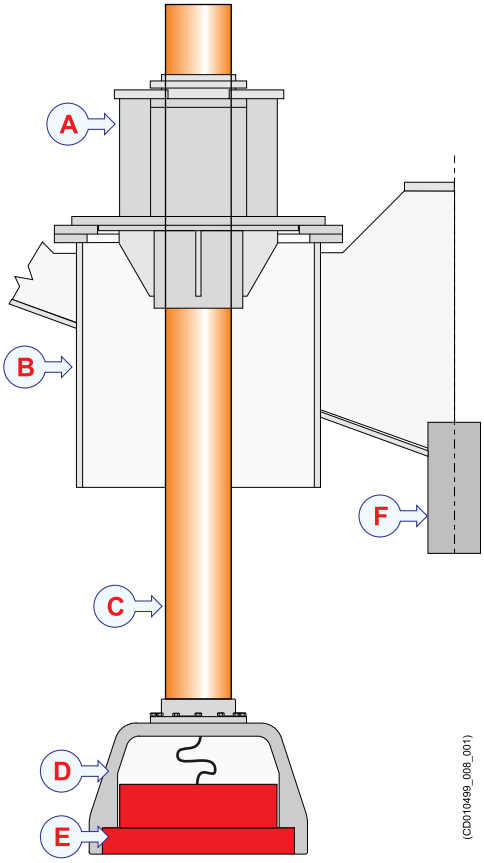
B *Installation trunk*

C *Transducer shaft*

D *Adapter*

E *Transducer*

F *Keel*



The retractable hull unit is more expensive than a blister, but on vessels with a hull where it is difficult or impossible to install a blister, it may still be a cost effective solution.

Vessels without a keel and with a wide, flat bottom is an example where a retractable transducer using a hull unit can be the only acceptable method for bringing the EM 2040 MKII transducer below the boundary layer.

Note

If a hull unit is a realistic option, call your dealer or Kongsberg Maritime for advice.

Installing the transducer

Topics

Installation summary

The installation of the EM 2040 MKII transducer requires careful planning and preparations. An overall installation procedure is provided. This procedure does not describe any detailed tasks. For more information, refer to the other descriptions and tasks in this chapter.

Prerequisites

In order to prepare the installation of the EM 2040 MKII transducer, the following prerequisites must be met:

- All relevant literature is available.
- All relevant vessel drawings are available.
- Detailed information is available about other systems on the vessel that may cause noise or interference.
- You have good knowledge about hydroacoustic systems and the challenges related to physical installation of these.

Context

The outline dimensions of the EM 2040 MKII transducer and the relevant installation items can be found in the *Drawing file* chapter in this manual.

Note

Sacrificial anodes must be mounted near the transducer to protect the connector(s).

Note

Preventive actions should be taken to avoid corrosion.

- *Sacrificial anodes are used to protect the connectors from corrosion.*
- *Kongsberg Maritime recommends to apply a lubricant to the bolts.We recommend the following lubricants:*
  - *AquaShield (Houghton International)*
  - *MOLYKOTE 1000 paste (DuPont)*

Procedure

1 Determine the physical location of the transducer.

The decision must be based on:

- The vessel drawings
- The shape and properties of the hull

Make sure that all possible considerations are made to reduce noise.

For more information, see:
Where to install the transducer, page 28

2 Determine the installation principle.

The decision must be based on:

- The vessel drawings
- The shape and properties of the hull

For more information, see:
Transducer installation principles, page 39

3 Design, manufacture and mount the equipment required for the transducer installation principle.We recommend using KM designed mounting plates or pods whenever possible. 353631 Transducer mounting plate - 0.7 x 0.7 degrees, page 173
355913 Transducer mounting plate - 0.4 x 0.7 degrees, page 174

Note

The risk of galvanic corrosion must be taken into account in the design of the mounting structure. Periodic inspection of the mounting screws and use of sacrificial anodes will be required in a permanent installation.

4 Mount the transducers.

5 Do a dimensional survey to determine the necessary position and angle measurements of the transducer and the relevant sensors.

The information provided by the dimensional survey is entered into the EM 2040 MKII software as installation parameters.

For more information, see:
Dimensional surveying and alignment, page 143

6 Lay the transducer cables from the transducers to the Processing Unit.

7 If your vessel will operate in waters with a lot of marine growth, consider applying a thin layer of anti-fouling paint to the transducer face.

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

For more information, see:

Painting the transducer face, page 68

The list of approved anti-fouling paints can be found on our website.

- https://www.kongsberg.com/anti-fouling-paints

Transducer description

The EM 2040 MKII system uses separate transducers for transmitting and receiving sound pulses.

The EM 2040 MKII system may be delivered in different versions with different transmission beam width.

- EM 2040-04 MKII (0.4 degrees at 400 kHz)
- EM 2040-07 MKII (0.7 degrees at 400 kHz)

The transducers are made from composite ceramics which enables a wide bandwidth. The material in the transducer housing is Titanium.

The EM 2040 MKII system is fully prepared for upgrading to cater for more demanding applications. Adding a second receive transducer increases the angular coverage.

The cables are connected to the transducers with underwater connectors. The standard length of the transducer cables is 15, 30 or 50 metres.

Caution

The transducers shall under no circumstances be opened or attempted repaired in field. Malfunctions reported by the Built-In Self Tests shall be reported to Kongsberg Maritime support for troubleshooting and/or replacement instructions. Any attempts to open the transducer may void the guarantee.

Related topics

338208 RX transducer outline dimensions - 0.7 degrees, page 170
338207 TX transducer outline dimensions - 0.7 degrees, page 171
337805 TX transducer outline dimensions - 0.4 degrees, page 172

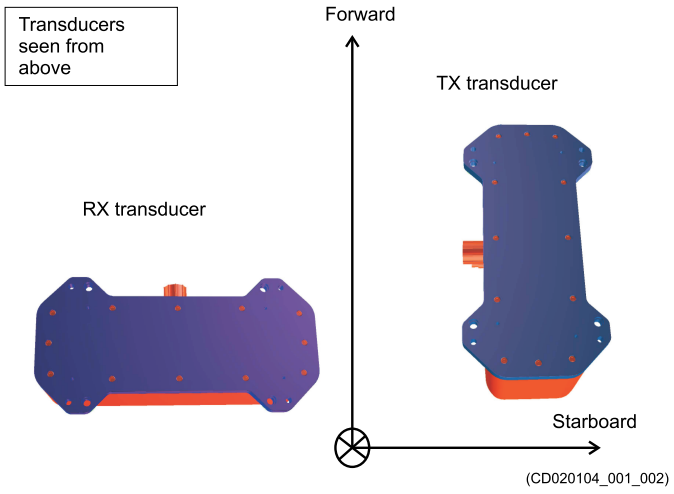
Transducer orientation

Correct location, orientation and alignment of the transducers is important for the performance of the system.

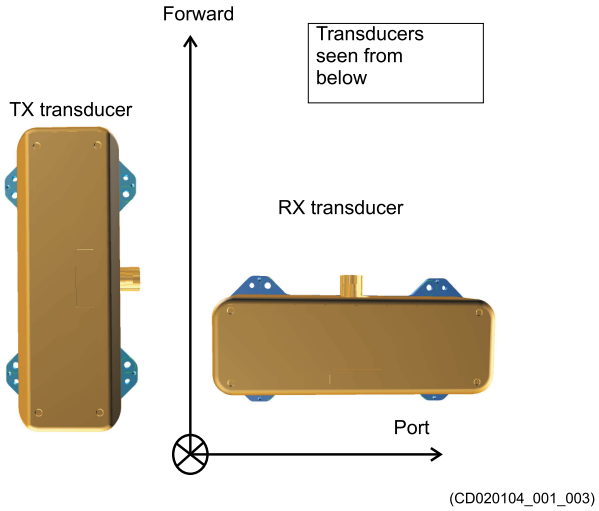
The two transducers are normally mounted as “T” or “L” configurations under the vessel’s hull (Mills Cross configuration). The transmit transducer should be aligned parallel to the vessel’s keel. The receive transducer should be aligned 90 degrees on the keel. Both transducers should be horizontal on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

Transducer default orientation

- Transmit transducer is mounted with cable connector on port side.
- Receive transducer is mounted with cable connector on forward side.



Transducer default orientation - Top view



Transducer default orientation - Bottom view

To ease the cabling, each transducer can be mounted 180 degrees rotated (back to front). The relative heading between the RX and the TX shall always be 90 degrees.

A transducer mounting plate is provided with the system to ensure accurate relative orientation of the transducers.

Transducer mounting plate, page 53

The transducer orientation is entered into the operator software (SIS).

Transducer mounting plate

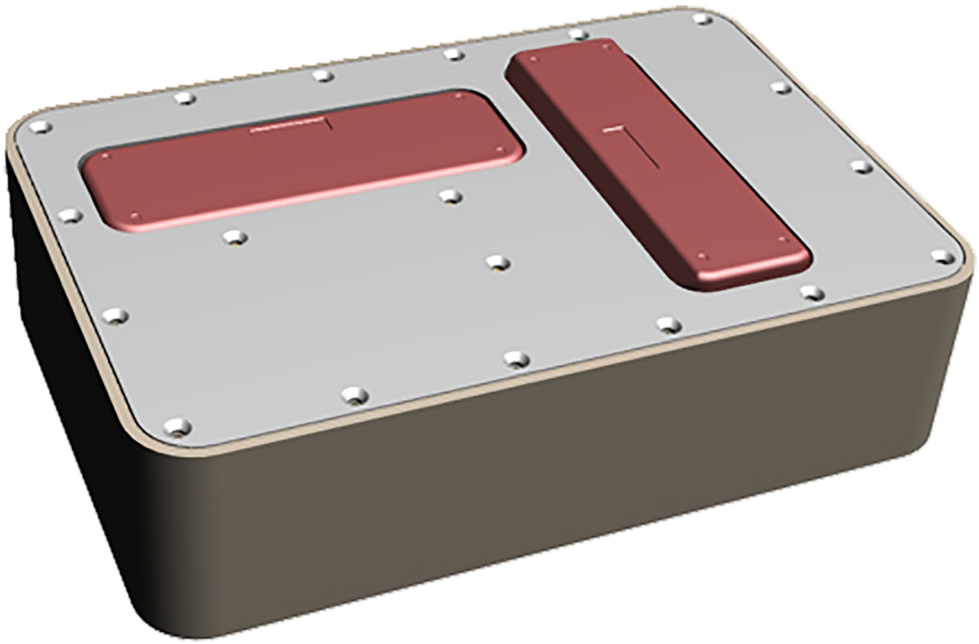
To ease installation, a mounting plate is delivered with the transducers. The mounting plate is fitted with a guidance system that ensures that the transducers are aligned within the required accuracy.

We strongly advise using the mounting plate that is provided. The mounting plate is delivered with wedge-locking washers, which should be used.

The requirements for knowing the relative heading between the RX and TX transducers are extremely strict. These requirements can only be met using the supplied mounting plate, or using a survey company/personnel with good experience in maritime dimensional surveying for verifying that the relative heading between the RX and TX transducers are within the specifications.

The mechanical mounting of the transducers must be carried out with this requirement in mind. The slightest slack will degrade the system performance.

We further recommend that the mounting plate is built into a steel casing and protected by a baffle for multipath reduction.



Flatness

The mounting structure must not deviate from a flat surface more than ± 0.2 mm. If the mounting plate is not used, the same requirement applies to the surface where the transducer is mounted.

Applicable torque values

The mounting plate must be bolted to the structure.

- Bolts: M12 A4-80
- Washers: Nord-lock
- Threadlocker: Loctite 243
- Torque: 68 Nm

The transducers must be bolted to the mounting plate.

- Bolts: M10 A4-80
- Washers: Nord-lock
- Threadlocker: Loctite 243
- Torque: 39 Nm

Related topics

353631 Transducer mounting plate - 0.7 x 0.7 degrees, page 173
355913 Transducer mounting plate - 0.4 x 0.7 degrees, page 174

Baffle for multipath reduction

To avoid multipath via surface or other objects, it can be useful to mount a “baffle” on each side of the transmit transducer.

The baffle must be made of POM (Polyoxymethylene) material.

Ready made baffle/cover plates for different transducer configurations are available from Kongsberg. For more information, contact Kongsberg Maritime.

Single system

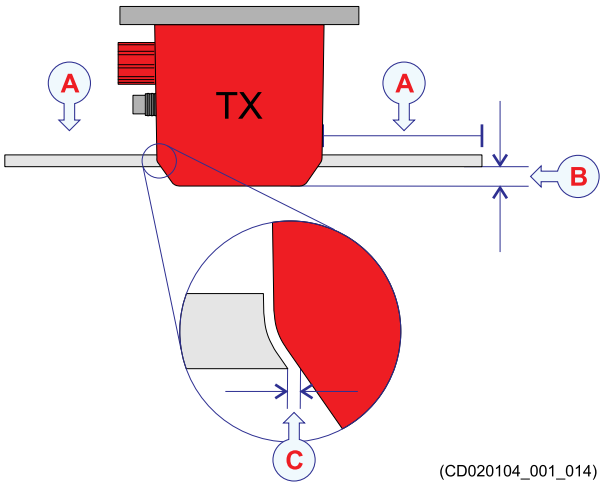
The baffle plate should be mounted horizontally 16 mm above the TX transducer face. The width of the baffle plate should be minimum 100 mm on all sides of the transducer. There should be a clearance of maximum 1 mm between the baffle and the cover plate.

With a single receive transducer, the transmit transducer beam pattern across is wider than the angular coverage of the receiver beams, especially for the lowest frequencies.

A *The width of the baffle plate should be minimum 100 mm on all sides of the transducer.*

B *The baffle plate should be mounted horizontally 16 mm above the TX transducer face.*

C *There should be a clearance of maximum 1 mm between the transducer and the baffle.*



Dual RX

For a dual RX system, the across coverage is up to 220 degrees. To avoid multipath via surface or other objects, the same type of baffle as for single RX should be used.

For TX angles > 80 degrees from the vertical, the baffle should be mounted with approximately 10 degrees larger angle.

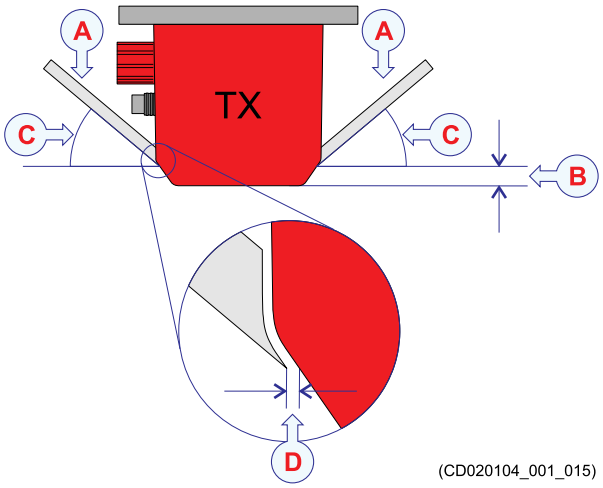
Example: If 100 degrees coverage is required to one side, the baffle should be mounted at 110 degrees (rotated 20 degrees up).

A *The width of the baffle plate should be minimum 100 mm on all sides of the transducer.*

B *The baffle plate should be mounted 16 mm above the TX transducer face.*

C *0 - 40 degrees*

D *There should be a clearance of maximum 1 mm between the transducer and the baffle.*



Dual TX

For a dual TX system, a baffle plate should be mounted on each transmit transducer.

The baffle plate should be mounted parallel to the TX transducer face. On a surface vessel the baffle can also be mounted horizontally to avoid multipath via the surface.

Related topics

479453 Cover plate - 0.7 x 0.7 degrees, page 175
110-0002161 Cover plate - 0.7 x 0.7 degrees, page 176
110-0002220 Cover plate - 0.4 x 0.7 degrees, page 177
110-0002273 Cover plate - 0.4 x 0.7 degrees, page 178

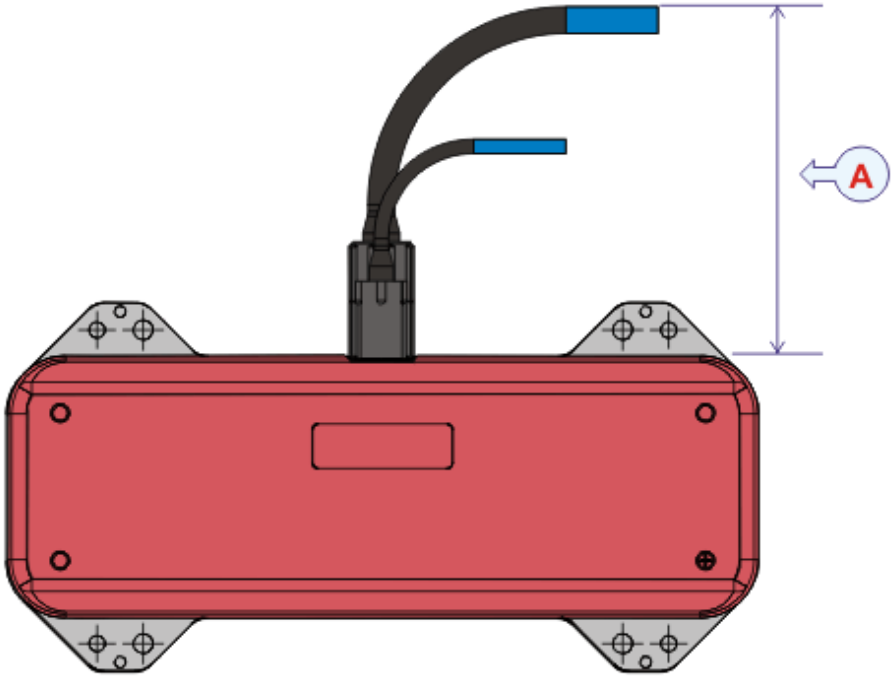
Transducer cables and space requirement

The transducer cables connect the transducers to the Processing Unit.

The transducer cables are Ethernet cables fit with underwater connectors at the transducer ends. In addition the TX cable provides power to the transmit transducer.

The receive transducer is powered from the transmit transducer via a The TX/RX synchronization/power cable.

The minimum bending radius is the minimum radius you can bend the transducer cable without damaging it.



A

- **Transmit Transducer cable**: Minimum bending radius: 125 mm

  The connector and cable will with minimum bending radius build 215 mm.
- **Receive Transducer cable**: Minimum bending radius: 100 mm

  The connector and cable will with minimum bending radius build 190 mm.

See *Cable layout and interconnections* for more cable details.

See *Handling of underwater connectors* for procedures for cleaning and lubrication of underwater connectors.

Related topics

Cable drawings and specifications, page 100
Handling of underwater connectors, page 134

Cable support

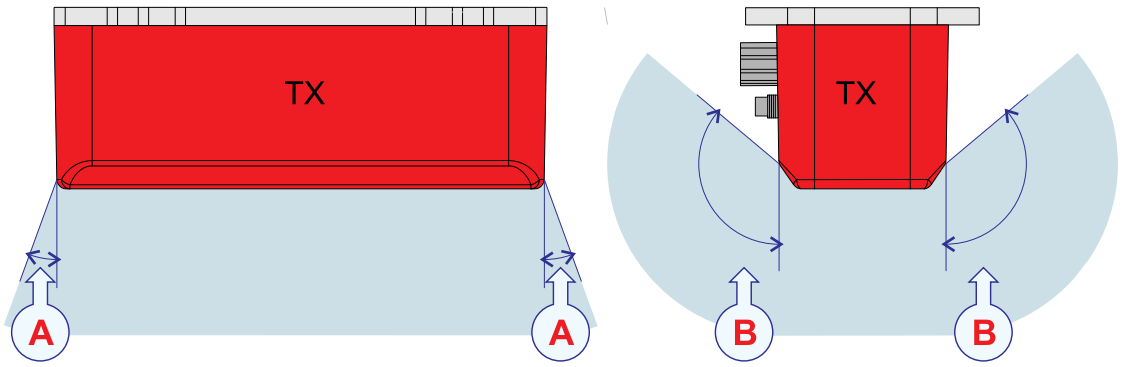
All cables must be supported and protected along their entire lengths using conduits and/or cable trays.

The only exception to this rule is over the final short distance (maximum 0.5 meters) as the cables run into the cabinets/units to which they are connected. These short service loops are to allow the cabinets to move on their shock mounts, and to allow maintenance and repair.

Free viewing sector

The transducer must be mounted so that it has a clear view of the bottom.

Transmit transducer (TX)



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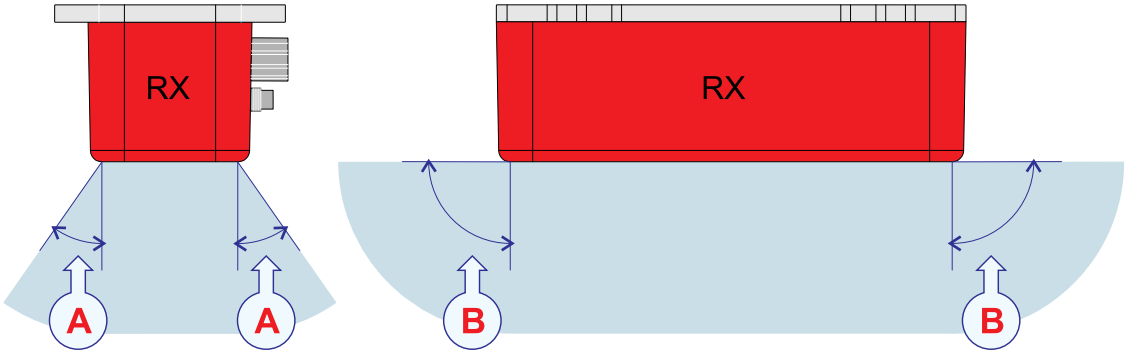
For EM 2040 MKII transmit transducer the optimal free viewing sectors relative to the transducer face are:

A 20 degrees in along direction

B 130 degrees in across direction

Receive transducer (RX)



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For EM 2040 MKII receive transducer the optimal free viewing sectors relative to the transducer face are:

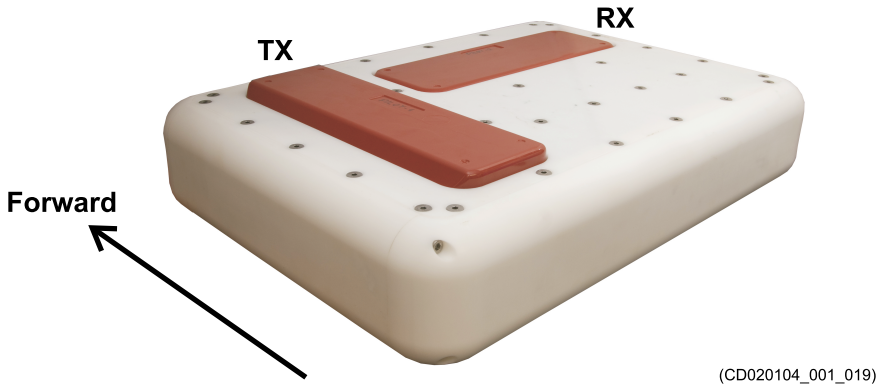
A 35 degrees in along direction

B 90 degrees in across direction

Portable installation

The small size and weight of the EM 2040 MKII transducer makes the system truly portable. For temporary installations on a vessel the transducer might be deployed on a pole fixed to the bow or to the side, or in a moon pool.

A prefabricated baffle, provided by Kongsberg Maritime, may be used to ensure a rigid, high accuracy installation and laminar water flow.



Example of 0.7 x 0.7 degree mounting in a prefabricated baffle.

An example of a Kongsberg Maritime fabricated baffle that has been mounted to a pole over the bow is shown below.

Installation of dual RX system

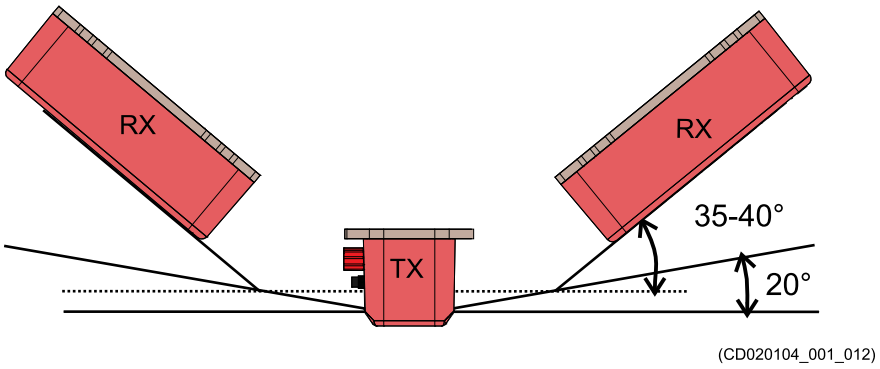
Adding a second receive transducer increases the angular coverage.

In a dual RX system, the transmit transducer must be connected to both receive transducers. This connection is for synchronization and power.

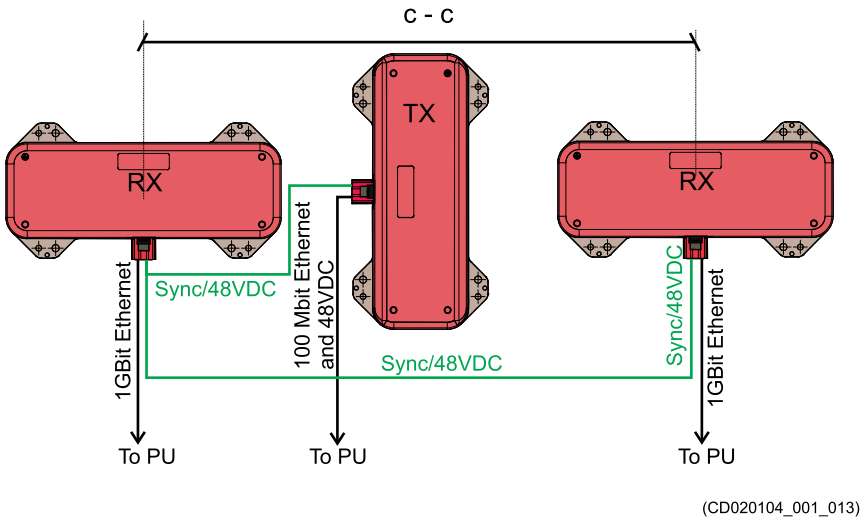
In a dual RX installation the two RX transducer arrays may be positioned on each side of the keel with a roll angle of 35 to 40 degrees. To be able to cover ± 100 degrees the roll installation angle should not be less than 35 degrees. To obtain overlap between the two RX arrays at shallow depths, the roll installation angle should not be more than 40 degrees, and the across distance between the two RX arrays should be as small as possible.

For specialist applications such as pipeline inspection, other configurations can be recommended depending on the application in question. Contact Kongsberg Maritime to get advice about your installation.

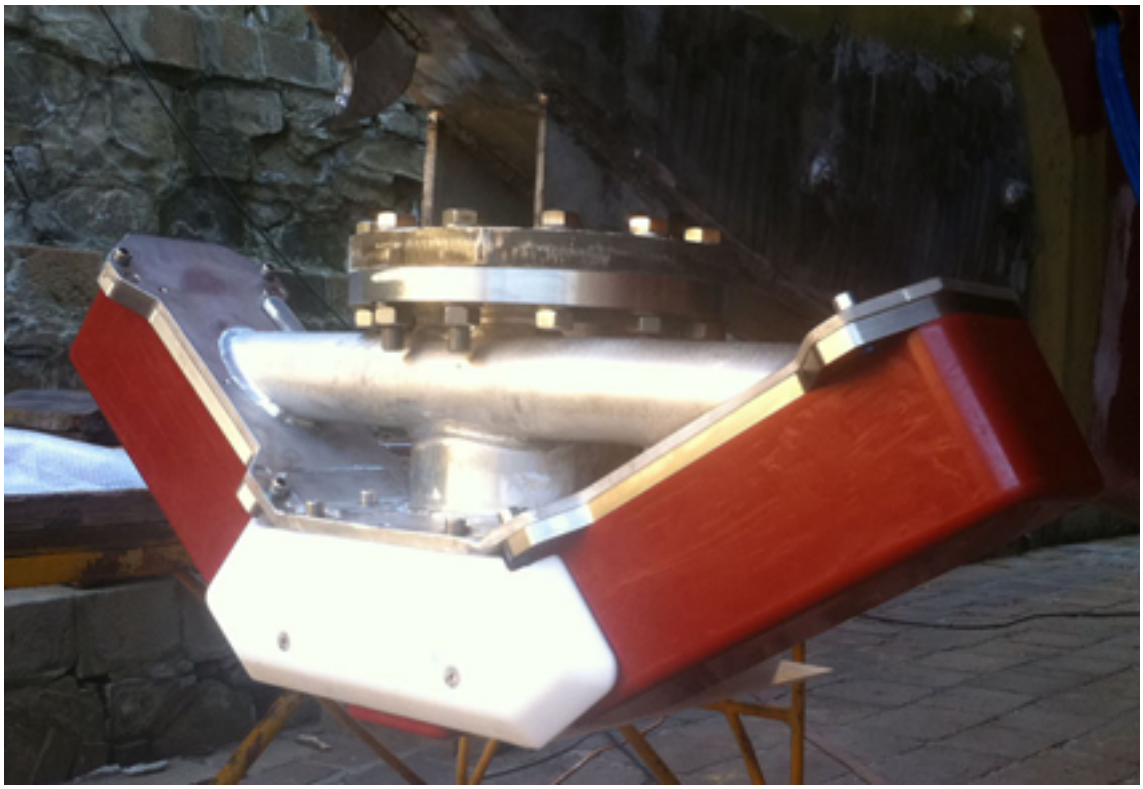
Example: With ± 40 degrees roll installation angle and across distance between the centre of the two RX transducers of 1 meter, the overlap between the two heads starts at about 1.4 metres depth below the RX transducers (with beams steered 60 degrees re array). With c-c of 2 meter the overlap starts at 2.8 metres.



Dual RX installation example



Dual RX, 0.7 x 0.7 degrees



All cables must be supported and protected along their entire lengths using conduits and/or cable trays. The dual RX mounting bracket is equipped with cable brackets for support of the transducer cables.

Rules for transducer handling

To secure long life and accurate results, the transducer must be handled correctly.

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

1 **Do not** activate the transducer when it is out of the water.

2 **Do not** handle the transducer roughly. Avoid impacts.

3 **Do not** expose the transducer to direct sunlight or excessive heat.

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

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

6 **Do not** lift the transducer by the cable.

7 **Do not** step on the transducer cable.

8 **Do not** damage the transducer cable. Avoid exposure to sharp objects.

Cleaning and painting the transducer face

During normal use, the transducer is subjected to biological fouling. If this marine growth is excessive, it will reduce the overall performance of your system.

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

Whenever opportunity arise, typically when the vessel is dry-docked, the transducer face must be cleaned for shells and other marine growth.

- Be careful so that you do not accidentally make cuts or inflict other physical damage to the transducer face.
- 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.
- **Do not** use high-pressure water, sandblasting, metal tools or strong solvents to clean the transducer.

Anti-fouling paint may be applied to the transducer face. To minimize the negative acoustical effects the layer of anti-fouling paint must be as thin as possible.

Recommended procedure for painting is found here: Painting the transducer face, page 68

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.

Approved anti-fouling paints

Because some paint types may be aggressive to the polyurethane in the transducer, consult our list of approved paints. Observe the relevant instructions and safety information provided by the paint manufacturer.

The list of approved anti-fouling paints can be found on our website.

- https://www.kongsberg.com/anti-fouling-paints

Non-permanent transducer installations

For non-permanent installations, rinse the transducer with fresh water every time you take it out of the water.

Painting the transducer face

Marine growth (biological fouling) on the transducer face reduces the 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
- Plastic brush
- Mild synthetic detergent
- Piece of wood or plastic without sharp corners
- 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. Approved anti-fouling paints for transducers are found on our website.

- https://www.kongsberg.com/anti-fouling-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 transducer 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.

Approved anti-fouling paints

The list of approved anti-fouling paints can be found on our website. Always refer to the manufacturer's documentation and data sheets for a complete procedure and for relevant safety information.

Online information

- https://www.kongsberg.com/anti-fouling-paints

Installing the EM 2040 MKII system hardware units

Topics

Installing the Processing Unit

Topics

Installing the Processing Unit

The Processing Unit is designed to be installed in a 19" rack. A suitable location for the Processing Unit must be defined prior to installation.

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

A suitable location for the Processing Unit must be defined prior to installation. The unit can in principle be mounted anywhere on board the ship provided that the location is dry and ventilated.

Due to the limitations caused by the cable lengths, we strongly recommend that the Processing Unit is located in the sonar room.

Make sure that ample ventilation is provided to avoid overheating.

Procedure

1 Prepare the location and the necessary tools.

2 Observe the installation requirements.

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

   b The position must be chosen to fit the available cable lengths between the Processing Unit and the other units it connects to.

   c Make sure that enough space is made available for maintenance purposes.

   d Make sure that adequate ventilation is available to avoid overheating.

   e Make sure that the installation method allows for the physical vibration, movements and forces normally experienced on a vessel.

   Note

   To allow future maintenance, you must mount the unit with its cables and connectors available for easy access.

3 Make sure that the chosen location meets the installation requirements.

4 Mount the Processing Unit using four bolts through the front panel. The mounting bolts and nuts are supplied with the unit.

Note

We strongly advise that you provide additional support for the Processing Unit, for example by using a standard component shelf suitable for the 19 " rack you are using.

5 Connect the cables.

Note

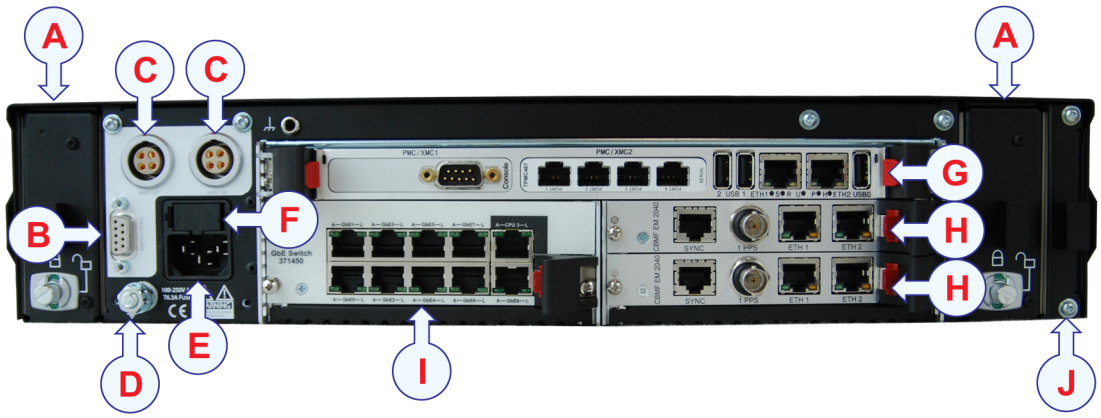
When you connect the cables, make sure that they are all properly secured, and able to withstand the vibration and movements of the vessel.

Related topics

385422 Processing Unit dimensions, page 179

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 depends on the system.

I *CP219 Ethernet switch*

J *Dust filter*

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 2040 MKII Processing Unit.

A ***CPU board***

Different CPU boards can be used in the EM 2040 MKII 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 depends on the system.

C ***VadaTech CP219 board***

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

D ***Fan unit***

The Processing Unit has two fan units for cooling purposes.

E *Dust filter*

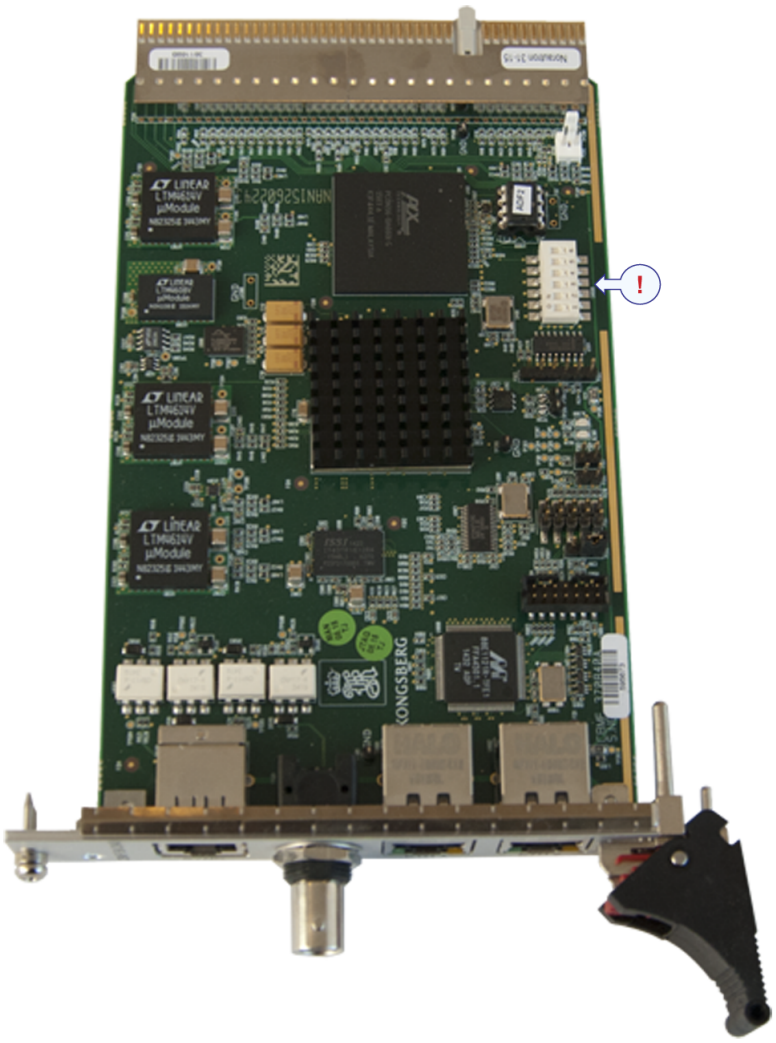
Power supply

One power supply unit is used in the EM 2040 MKII 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.

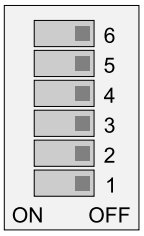
CBMF board - dip switch setting

The dip switch setting on the CBMF board has to be correct.



All the dip switches on all the CBMF boards in the Processing Unit should be set to OFF.

OFF is when they are pushed towards the edge of the circuit board.



(CD090306_001_001)

Installing the Portable Processing Unit

Topics

Portable Processing Unit description

The EM 2040 MKII Processing Unit is available in a portable splash proof IP67 rated version.

The portable version has the same functionality as the standard EM Processing Unit in a splash proof enclosure, with the following exceptions:

External trigger is not available

Remote on/off is not available

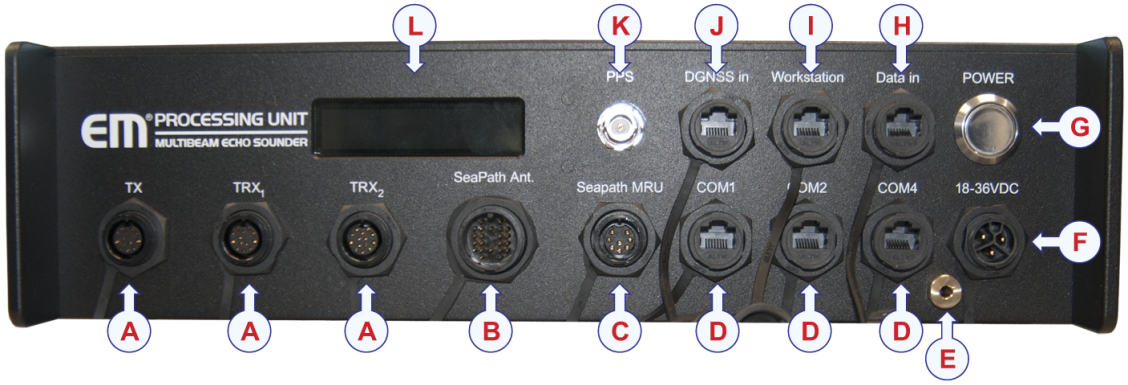
Portable version do not supports dual head and dual swath systems.

The Portable Processing Unit is designed for easy transportation and does not require a fixed installation. It is IP 67 rated, more shock resistant and has a handle for easy transportation.

If required, the Portable Processing Unit can be installed in a rack. Please contact Kongsberg Maritime for more information about the rack installation kit.

Portable Processing Unit front panel description

The front panel of the Portable Processing Unit holds all the connectors used to communicate with external devices and the power input socket.



A **TX, TRX_1, TRX_2**

Transducer cable input

B **SeaPath Ant.**

Seapath 130 Antenna interface cable input

C **Seapath MRU**

Seapath 130 MRU interface cable input

D **COM1, COM2, COM4**

PU Serial Com ports (COM3 is used by Seapath)

E *Ground connector*

F **18-36 VDC**

Power input

G **POWER**

Power On/Off - Correct direct current polarity indicated by green led

H **Data in**

External data input over Ethernet including attitude velocity

I **Workstation**

Hydrographic Work Station input

J **DGNSS in**

Input for GNSS corrections

K **PPS**

1PPS - one pulse per second input signal used to synchronise the internal clock in the Processing Unit

L *Information display*

Installing the Hydrographic Work Station

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

The Hydrographic Work Station is based on a commercial design. Due to the constant development of new computer parts, older parts are no longer manufactured. This means that the computer type used with the EM 2040 MKII system changes from time to time.

For more detailed information about the different models of Hydrographic Work Station see the separate manual:

- *495770 - Hydrographic Work Station Instruction Manual*

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 delivery.

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

System cables

System cables are provided by Kongsberg Maritime as a part of the delivery.

Shipyard cables

Shipyard cables must be provided by the shipyard doing the installation, or the shipowner. The cables must meet the minimum specifications provided in this publication.

Commercial cables

Commercial cables may be provided by Kongsberg Maritime as a part of the delivery. The cables may also be included with third party items that are used with the EM 2040 MKII system.

All electric 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 2040 MKII 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 system cables, make sure that the AC mains circuit breaker for the system is disconnected.

Cable plans

Topics

About the cable plans

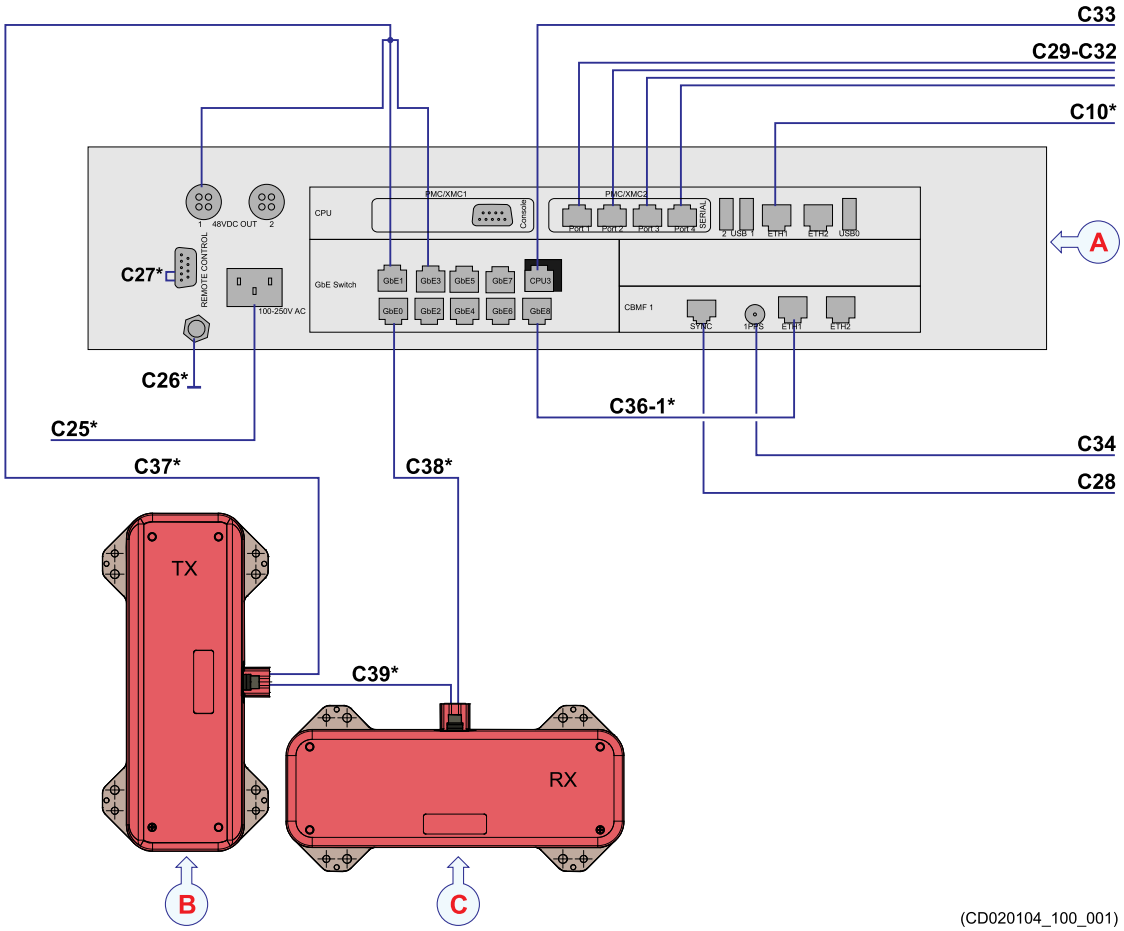
Due to its modular design, the EM 2040 MKII system can be set up in a variety of configurations.

To illustrate the variety of configurations, the following basic cable plans are provided.

- Processing Unit with single and dual transducer setup
- Portable Processing Unit with single and dual transducer setup
- Standard topside setup with the Hydrographic Work Station

Cable plan - Processing Unit - Single system - Single swath

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



A *Processing Unit (PU)*

B *Transmit Transducer (TX)*

C *Receive Transducer (RX)*

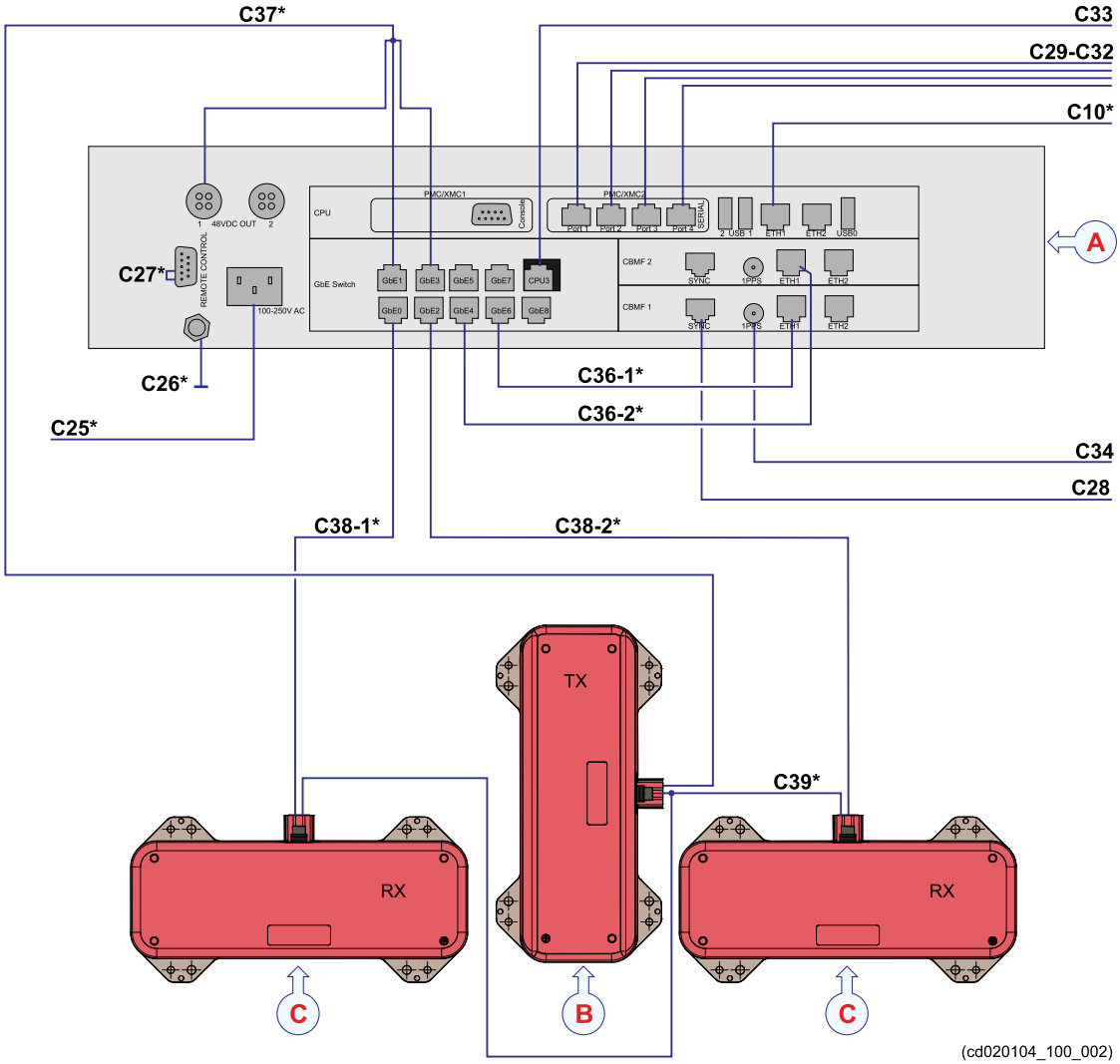
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040 MKII delivery.

Related topics

List of cables, page 96

Cable plan - Processing Unit - Dual RX- Single swath

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



A *Dual RX*

B *Transmit Transducer (TX)*

C *Receive Transducer (RX)*

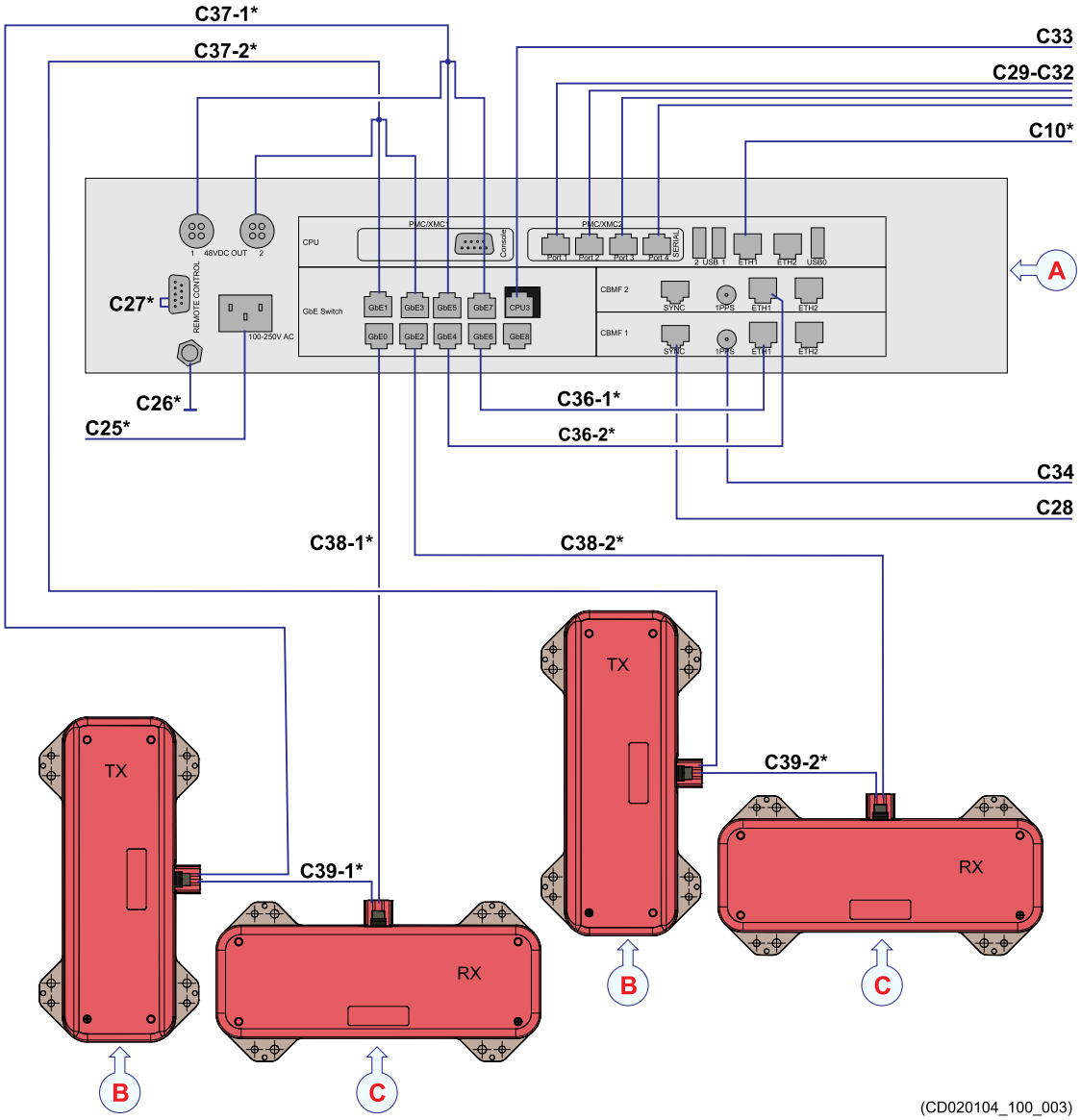
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040 MKII delivery.

Related topics

List of cables, page 96

Cable plan - Processing Unit - Dual TX - Single swath

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



A *Processing Unit (PU)*

B *Transmit Transducer (TX)*

C *Receive Transducer (RX)*

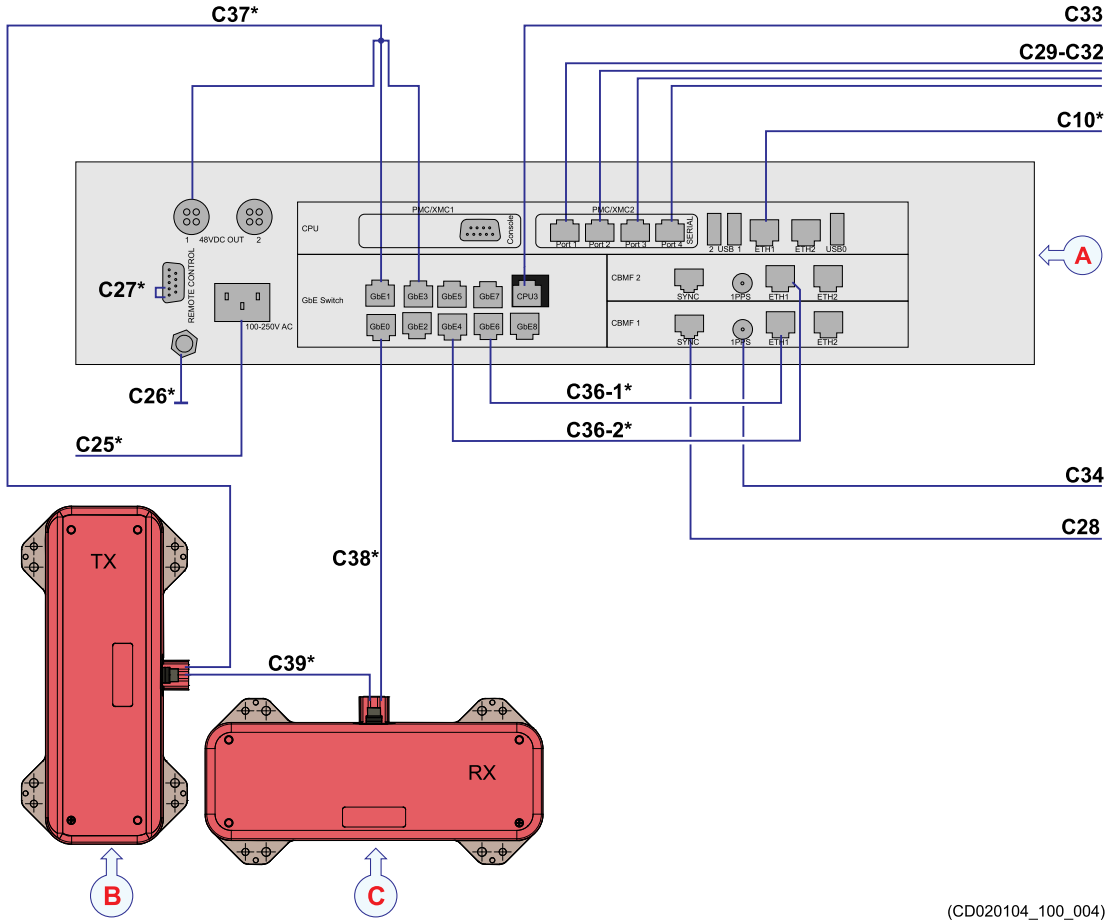
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040 MKII delivery.

Related topics

List of cables, page 96

Cable plan - Processing Unit - Single system - Dual swath

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



A *Processing Unit (PU)*

B *Transmit Transducer (TX)*

C *Receive Transducer (RX)*

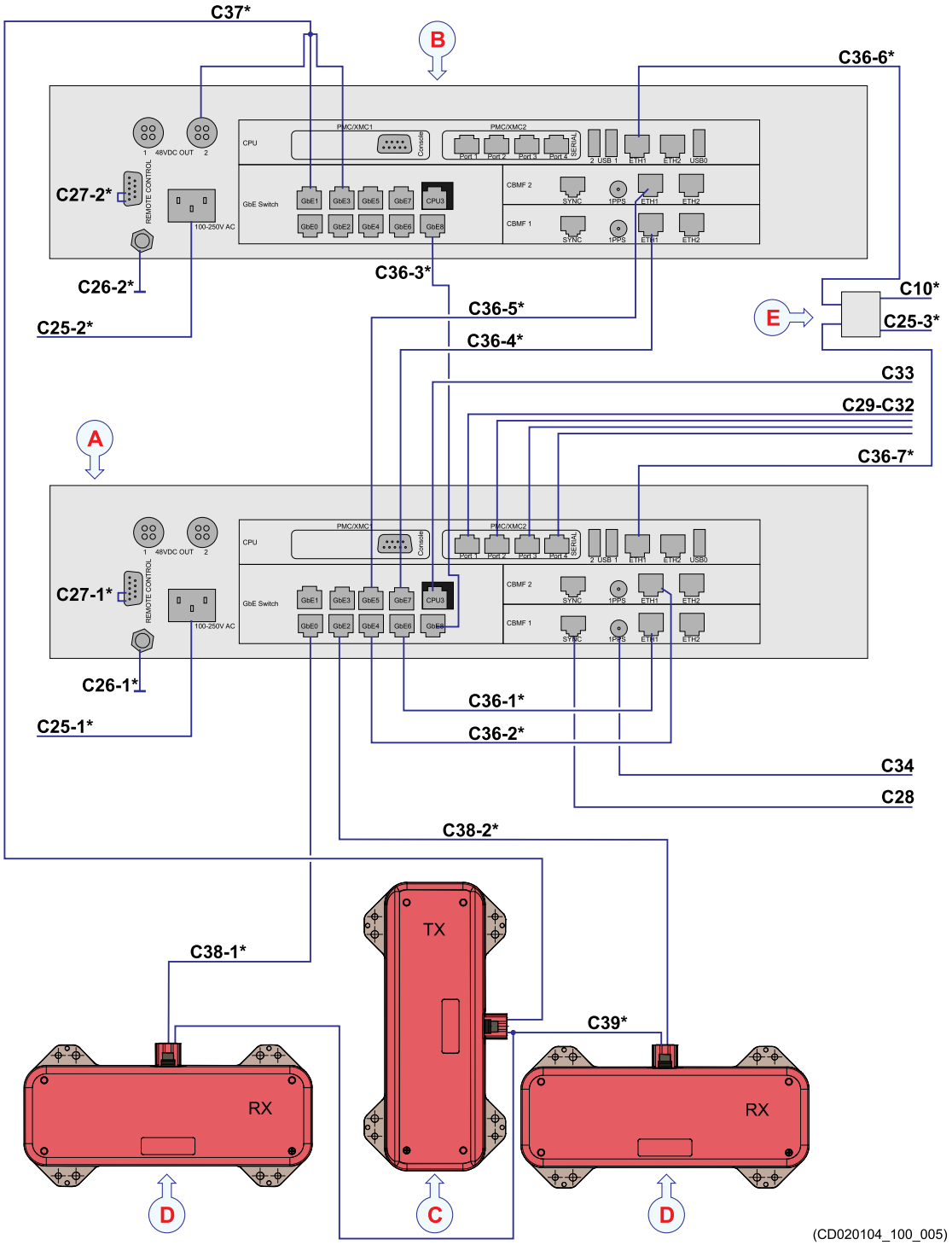
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040 MKII delivery.

Related topics

List of cables, page 96

Cable plan - Processing Unit - Dual RX - Dual swath

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



A *Processing Unit (PU) (Master)*

B *Processing Unit (PU) (Slave)*

C *Transmit Transducer (TX)*

D *Receive Transducer (RX)*

E *Ethernet switch*

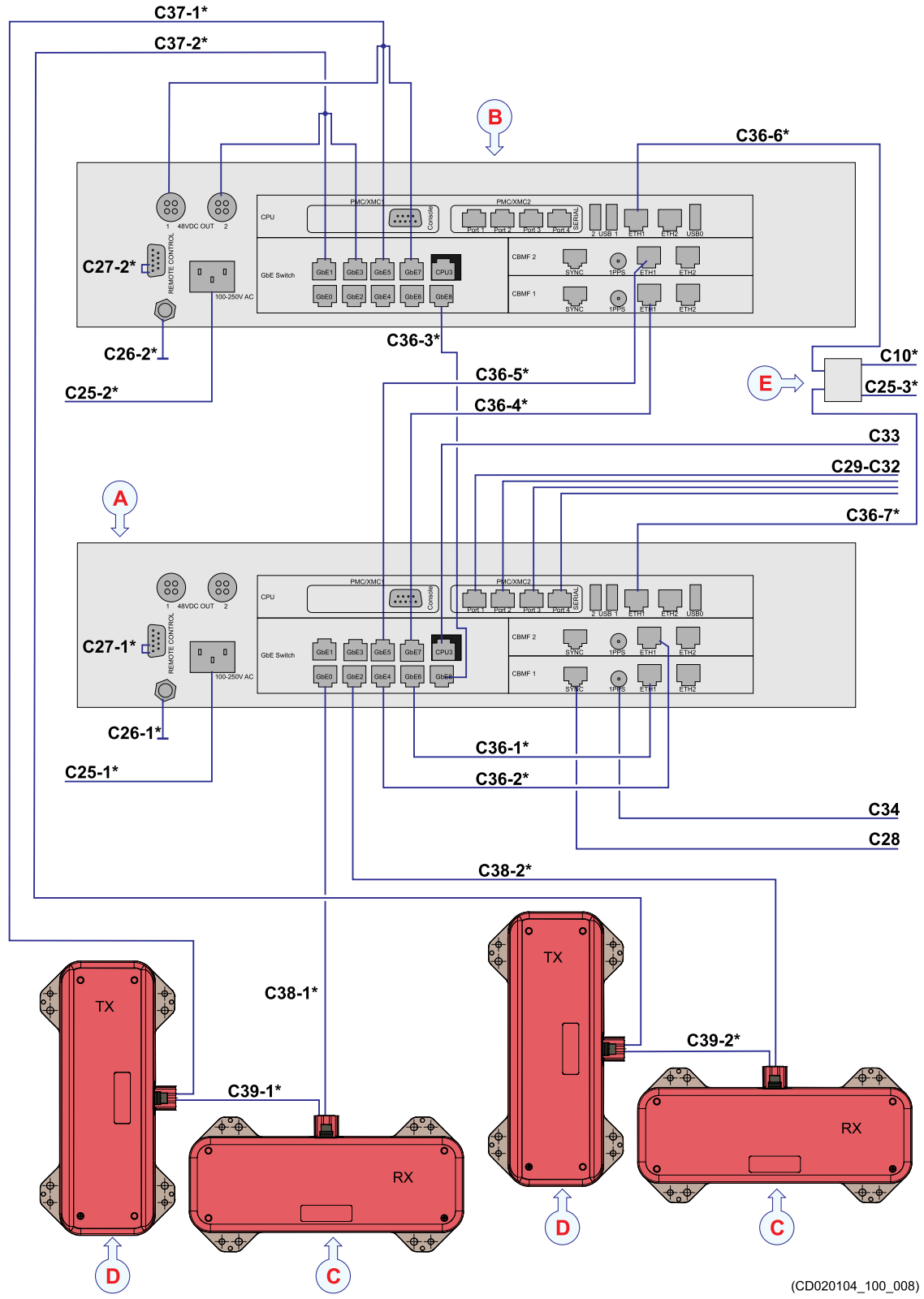
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040 MKII delivery.

Related topics

List of cables, page 96

Cable plan - Processing Unit - Dual TX - Dual swath

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



A *Processing Unit (PU) (Master)*

B *Processing Unit (PU) (Slave)*

C *Transmit Transducer (TX)*

D *Receive Transducer (RX)*

E *Ethernet switch*

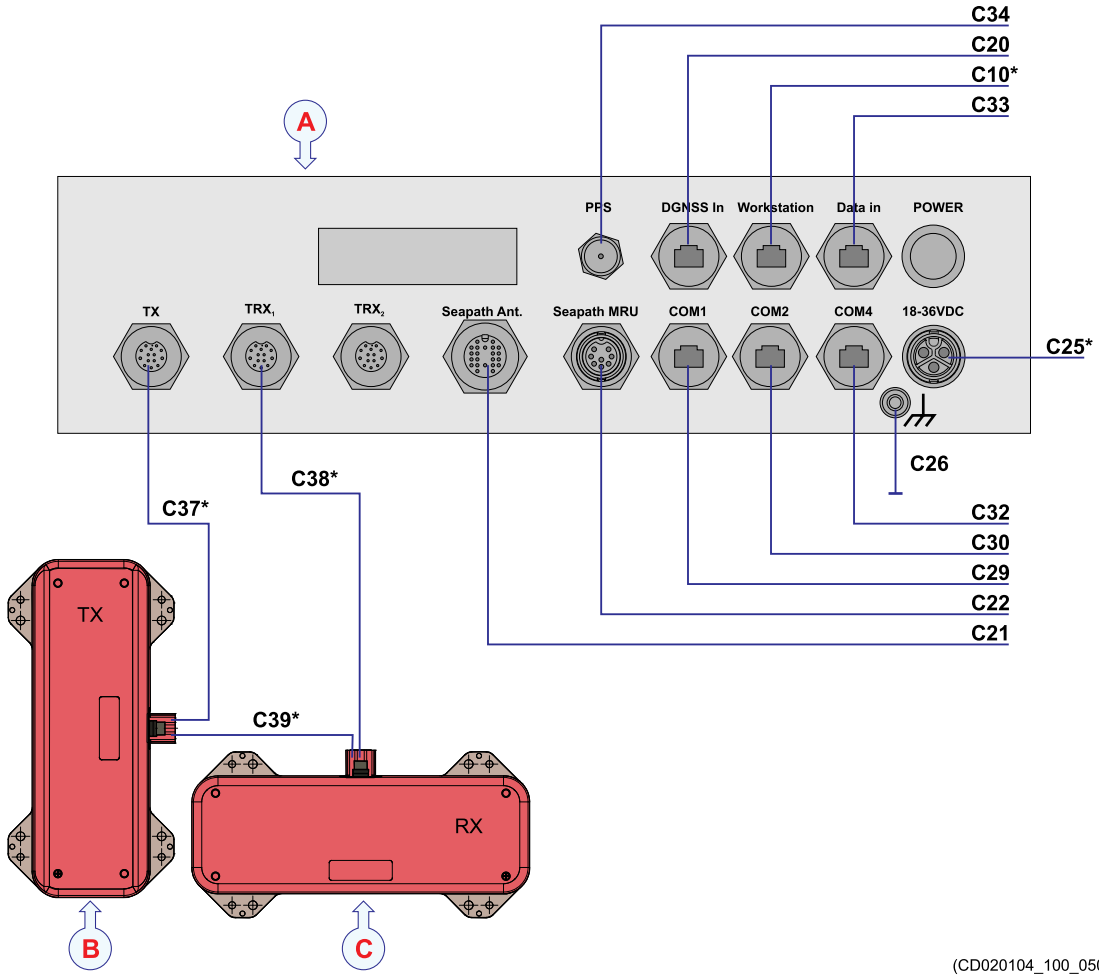
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040 MKII delivery.

Related topics

List of cables, page 96

Cable plan - Portable Processing Unit - Single system

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



A *Portable Processing Unit (PPU)*

B *Transmit Transducer (TX)*

C *Receive Transducer (RX)*

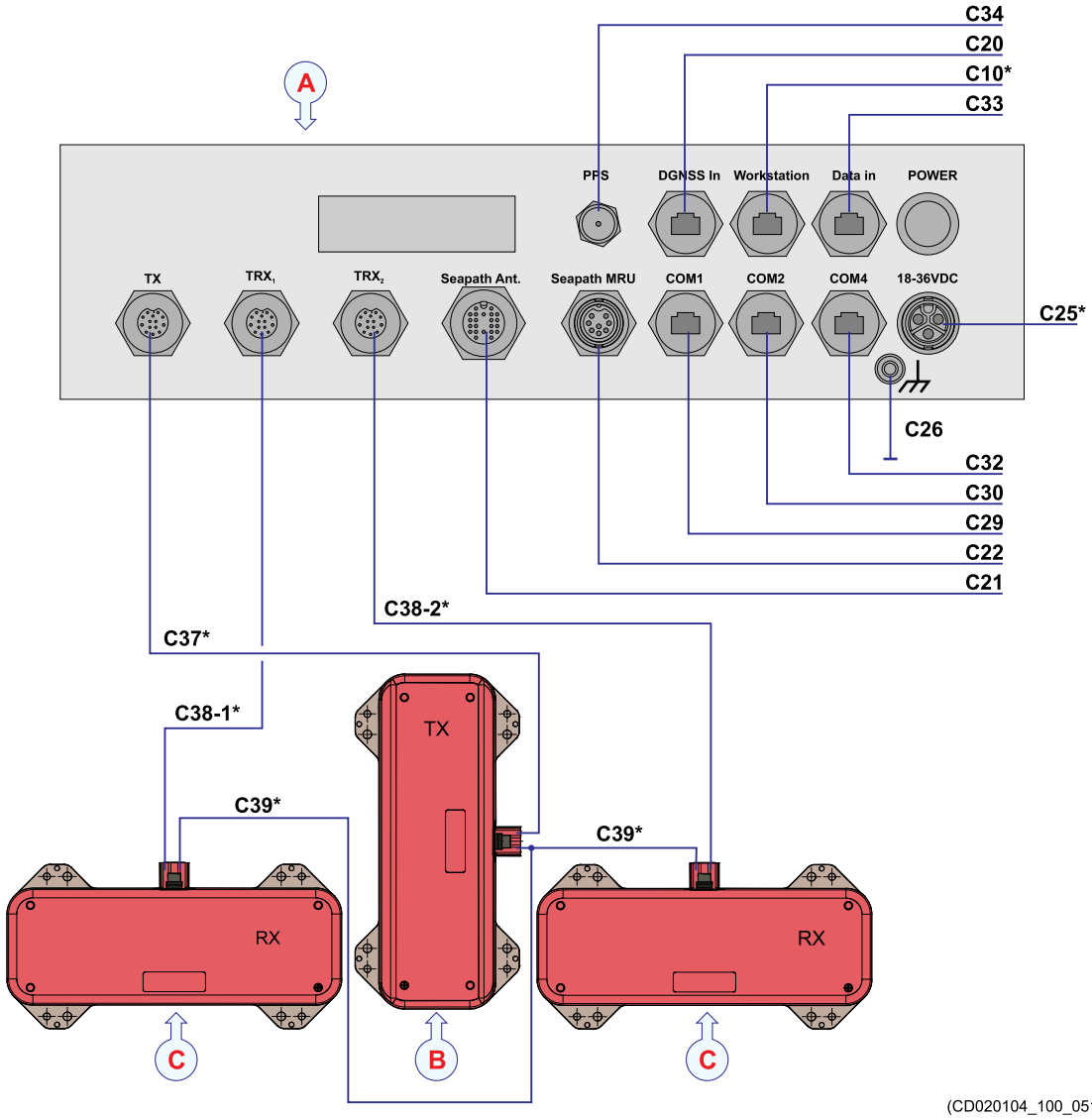
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040 MKII delivery.

Related topics

List of cables, page 96

Cable plan - Portable Processing Unit - Dual RX

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



A *Portable Processing Unit (PPU)*

B *Transmit Transducer (TX)*

C *Receive Transducer (RX)*

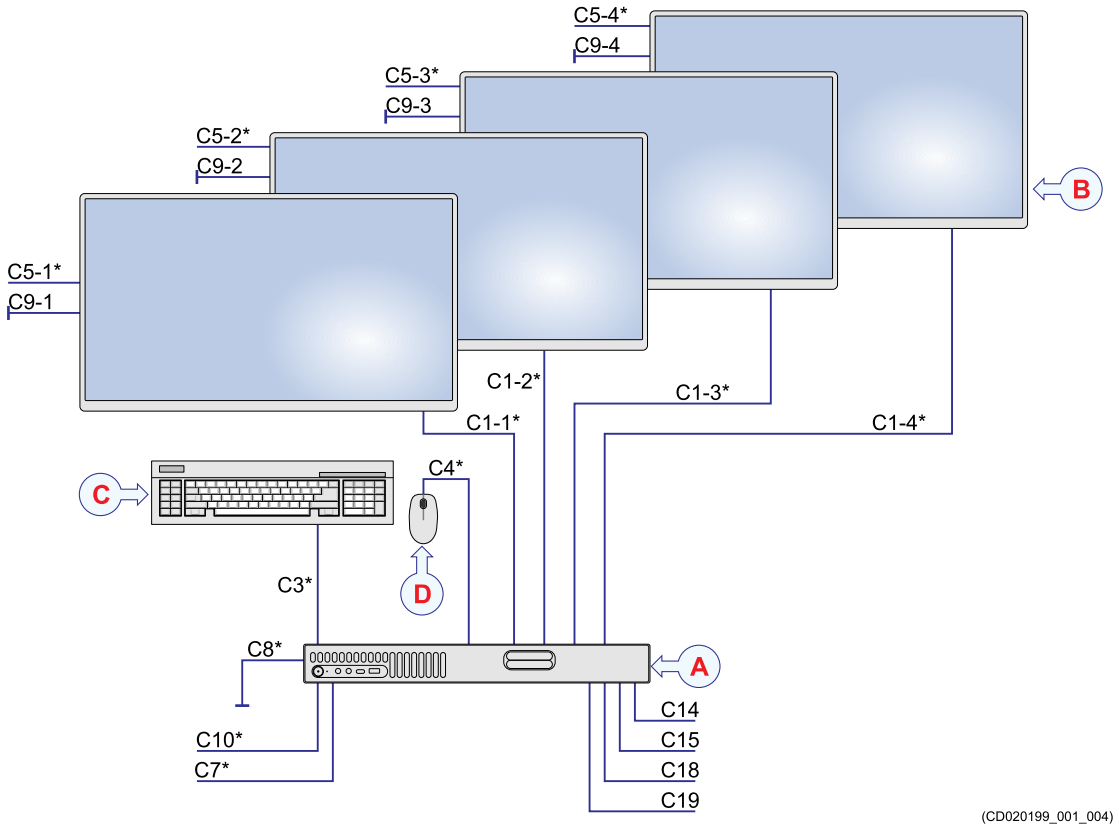
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040 MKII delivery.

Related topics

List of cables, page 96

Cable plan - Hydrographic Work Station

The topside/bridge cables include those used to connect the computer and the display to each other, to AC mains power, and to external devices.



A *Hydrographic Work Station (HWS)*

B *Display*

The Hydrographic Work Station supports three or four displays. The number of displays depend on the computer model used.

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 2040 MKII delivery.

Related topics

List of cables, page 96

List of cables

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

Cable	Signal	From/To	Minimum requirements
C1	Video cable	From Hydrographic Work Station to display	
	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.		
C3	Computer cable	From Hydrographic Work Station to keyboard	
C4	Computer cable	From Hydrographic Work Station to mouse (or another similar device)	
C5	AC Power cable	From display to uninterruptible power supply (UPS)	2 x 1.5 mm^2 + 1.5 mm^2 Ground
C7	AC Power cable	From Hydrographic Work Station to uninterruptible power supply (UPS)	2 x 1.5 mm^2 + 1.5 mm^2 Ground
C8	Ground cable	From Hydrographic Work Station to vessel ground	1 x 6 mm^2
C9	Ground cable	From display to vessel ground	1 x 6 mm^2
C10	Ethernet cable	From Processing Unit to Hydrographic Work Station	Cat 5e 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 computer to external device(s)	
C15	Serial cable	From computer to external device(s)	
C18	Ethernet cable	From Hydrographic Work Station to local area network (LAN)	Cat 5e STP (Shielded Twisted Pair)
C19	Ethernet cable	From Hydrographic Work Station to local area network (LAN)	Cat 5e STP (Shielded Twisted Pair)
C20	Serial cable	From DGNSS provider to Processing Unit. Input for correction services. See Seapath 130 manual for supported solutions. RS-232 serial line used for DGNSS input, page 127 RS-422 serial line used for DGNSS input, page 128	

Cable	Signal	From/To	Minimum requirements
C21	Seapath antenna interface cable	From Portable Processing Unit to Seapath antenna. Seapath antenna interface cable - with plug, page 129 Antenna interface cable, page 131	
C22	Seapath MRU interface cable	From Portable Processing Unit to Seapath MRU. Seapath MRU interface cable, page 132	
C25	AC Power cable	From Processing Unit to uninterruptible power supply (UPS)	2 x 1.5 mm^2 + 1.5 mm^2 Ground
C26	Ground cable	From Processing Unit to vessel ground	1 x 6 mm^2
C27	Control cable	From Processing Unit to remote control unit	3 x 0.5 mm^2
	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.		
C28	Control cable	From Processing Unit to external synchronization	2 x 5 x 0.5 mm^2
	The Processing Unit is equipped with a connection for interface to an external synchronization system.		
C29-C32	Serial cable	From Processing Unit to external devices	
C33	Ethernet cable	From Processing Unit to global positioning system (GPS) (Attitude velocity)	Cat 5e STP (Shielded Twisted Pair)
	The Processing Unit must be connected to the global positioning system (GPS) to receive the Attitude velocity datagram. The connection is made using an Ethernet cable. On the Processing Unit, this Ethernet cable is connected to the upper right socket (**A-CPU 3-L**) on the Ethernet switch.		
C34	Coax cable	From Processing Unit to the global positioning system (GPS) (1PPS (Pulse per second))	Coax cable
	The software clock can be synchronized to an external 1PPS (Pulse per second) signal. This signal is normally available from a global positioning system (GPS), and this is the preferred method to synchronise the echo sounder to an external clock.		
C36	Ethernet cable	Internal Ethernet connections on the Processing Unit	Cat 5e STP (Shielded Twisted Pair)
	Some of the circuit boards in the Processing Unit must be connected via Ethernet cables. The number of internal Ethernet connections depends on the chosen configuration. All the internal Ethernet connections are shown on the cable plans. The Ethernet cables for internal connections are delivered with the system.		

Cable	Signal	From/To	Minimum requirements
C37	Transducer cable	From Processing Unit to TX transducer Transmit Transducer cable, page 114 Transmit transducer cable - Portable Processing Unit, page 116	
C38	Transducer cable	From Processing Unit to RX transducer Receive Transducer cable, page 118 Receive transducer cable - Portable Processing Unit, page 120	
C39	Transducer cable	From TX transducer to RX transducer(s) TX to RX transducer cable, page 122 TX to dual RX transducer cable, page 124	

Comments

Note

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

The EM 2040 MKII system 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 2040 MKII system cables may be identified as **EM 2040 MKII/Cx**.

Related topics

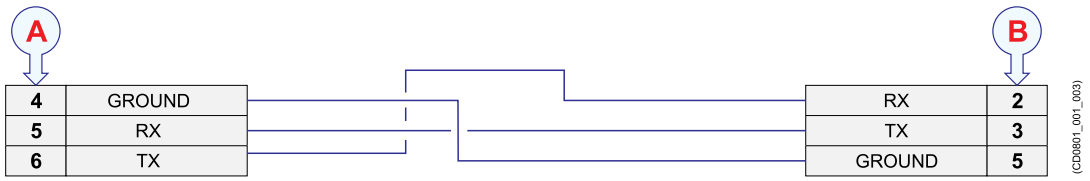
Cable plan - Processing Unit - Single system - Single swath, page 85
Cable plan - Processing Unit - Dual RX- Single swath, page 86
Cable plan - Processing Unit - Dual TX - Single swath, page 87
Cable plan - Processing Unit - Single system - Dual swath, page 88
Cable plan - Processing Unit - Dual RX - Dual swath, page 89
Cable plan - Processing Unit - Dual TX - Dual swath, page 91
Cable plan - Portable Processing Unit - Single system, page 93
Cable plan - Portable Processing Unit - Dual RX, page 94
Cable plan - Hydrographic Work Station, page 95

Cable drawings and specifications

Topics

RS-232 serial line using three wires and RJ45 connector

An RS-232 serial line connection is a common way to connect the EM 2040 MKII system to external devices.



A *Local connection*

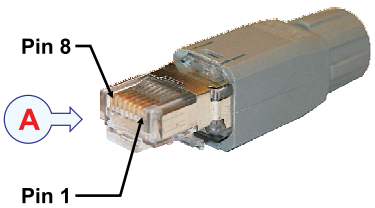
RJ45 connector

B *Connection on remote device*

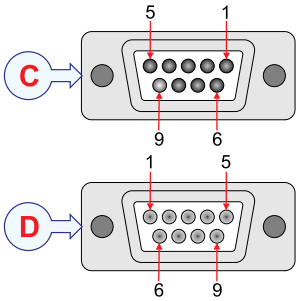
9-pin D-Subminiature connector

C *Female 9-pin D-Subminiature connector*

D *Male 9-pin D-Subminiature connector*



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



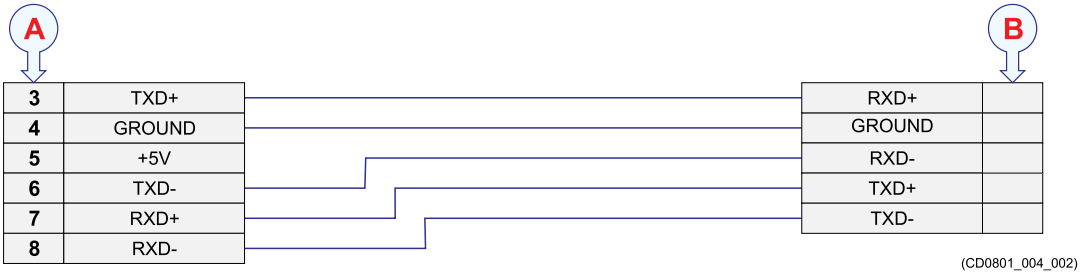
Minimum cable requirements

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

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

RS-422 serial line using five wires and RJ45 connector

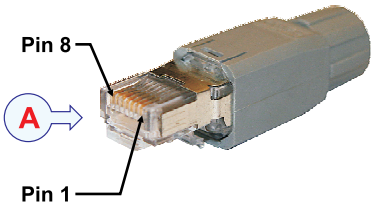
An RS-422 serial line connection is a common way to connect the EM 2040 MKII system to external devices. An RS-422 serial line connection can transmit data at rates as high as 10 million bits per second, and may be sent on cables as long as 1500 meters.



A *Local connection*

RJ45 connector

B *Connection on remote device*



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

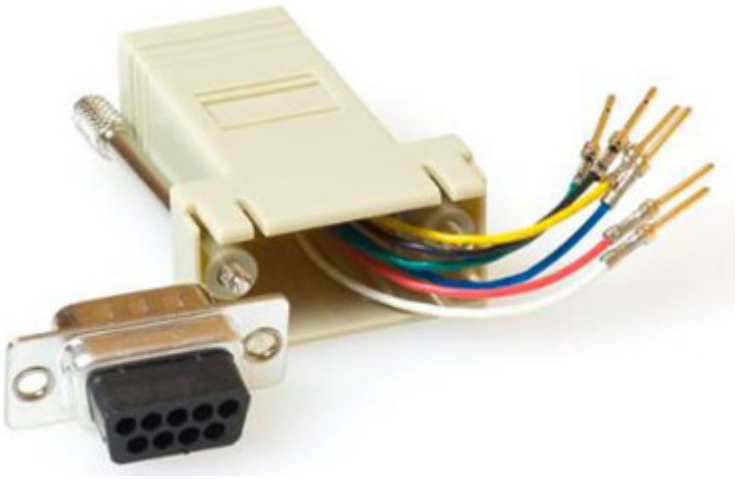
Minimum cable requirements

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

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

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

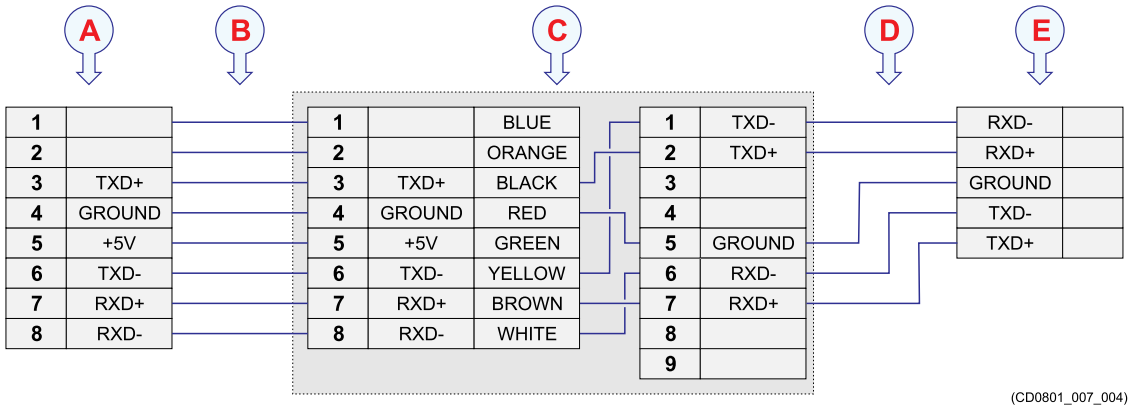
You can use an adapter if you need to connect a serial cable with a D-connector to the Processing Unit.



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

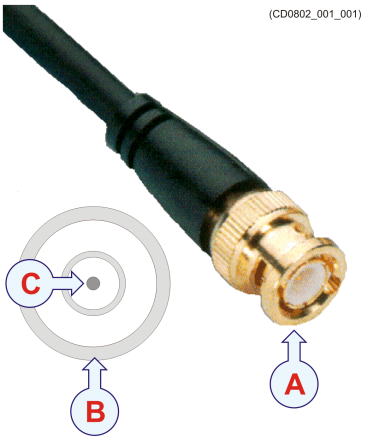
Clock synchronization (1PPS) using a coax cable

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

A *Male BNC connector*

B *Ground*

C *1PPS signal*



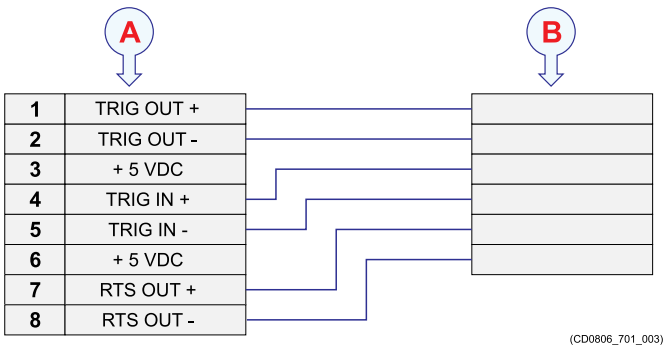
This cable must be provided by the installation shipyard.

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

External synchronization cable

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

This connection is used for interface to an external synchronization system (for example K-Sync) used when multiple echo sounders are employed on the same vessel. The external synchronization 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 mm^2
- **Screen**: Overall braided
- **Voltage**: 30 V
- **Maximum outer diameter**: Defined by the plugs and/or the gable gland

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

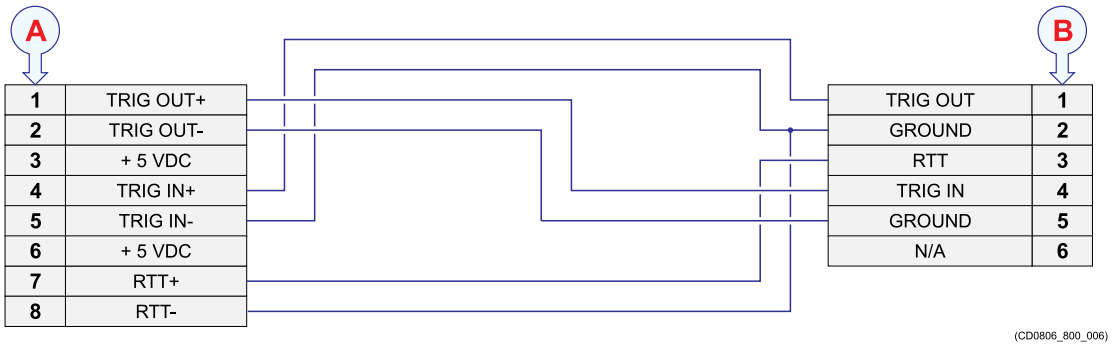
K-Sync interface to EM 2040 MKII Processing Unit

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

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

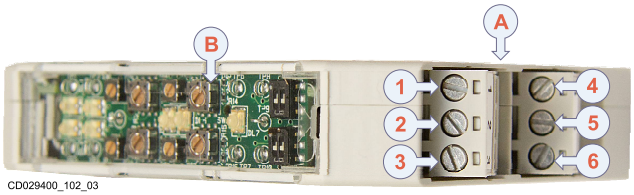
This is an optically isolated connection that requires ~10mA current. Input power and resistor value must be adjusted accordingly.

The connector is RJ45 type. This cable must be provided by the installation shipyard.



A *Connections on the Processing Unit The connector is RJ45 type.*

B *Connections on the K-Sync IO Module*



The pin configuration on the K-Sync IO Module follows:

Pin no.	Signal	Description
1	TRIG OUT	Trigger out – Signal to external device enabling it to transmit
2	GROUND	Mandatory – connected to pin 5 inside the module
3	RTT	Ready to transmit – Input from external device when it is ready for the next trigger pulse
4	TRIG IN	Trigger in – Input from external device, active while the device is transmitting
5	GROUND	Mandatory – connected to pin 2 inside the module
6	Not used	

Note

Pin 3 and 6 is used by Kongsberg Maritime only.

Each IO Module in the K-Sync Synchronizing Unit provides six connectors and a configuration board for physical adjustments of the communication parameters.

Connectors 1 through 6 as indicated by the arrows.

Note that each of the two connector elements can be pulled out of the IO Module for easy access.

Configuration board

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

Minimum cable requirements

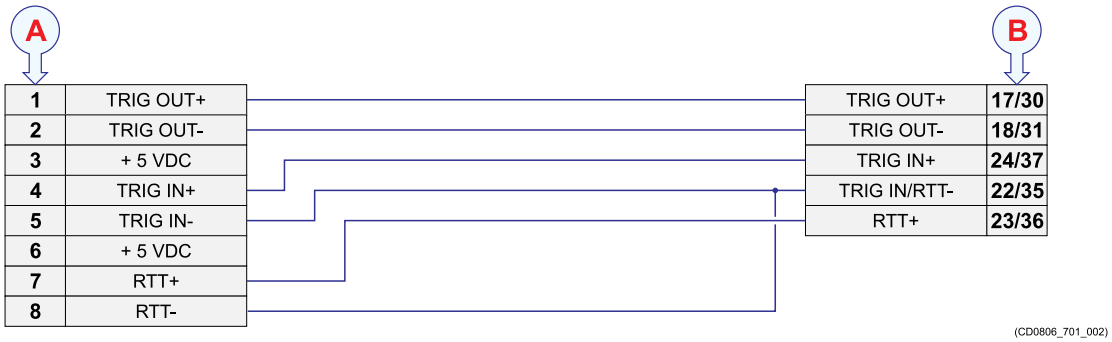
- **Conductors**: 2 x 3 x 0.2 mm^2
- **Screen**: Overall braided
- **Voltage**: 30 V
- **Maximum outer diameter**: Defined by the plugs and/or the gable gland

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

Interface to Remote Control Unit for external synchronisation

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

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



A *Connections on the Processing Unit*

The connector is RJ45 type.

Note

Pin 3 and 6 is used by Kongsberg Maritime only.

B *Connections in the Remote Control Unit (K-Rem)*

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

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

Minimum cable requirements

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

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

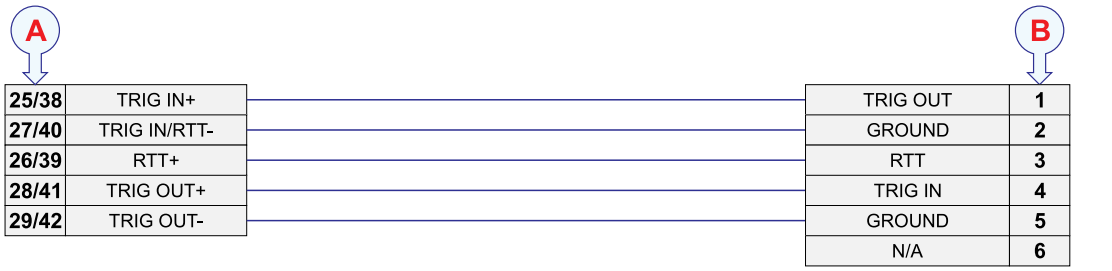
Related topics

Remote Control Unit (K-Rem) description, page 21
373962 Remote Control Unit (K-REM) wiring diagram, page 182

K-Sync interface to Remote Control Unit

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

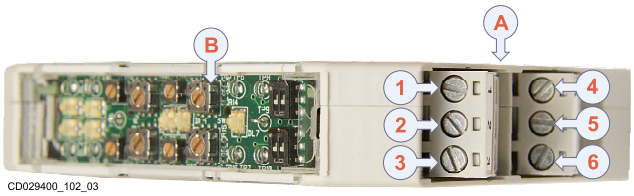
The Remote Control Unit is called K-Rem. It is prepared for remote control and interface to an external synchronization system up to four Kongsberg echo sounders.



A *Connections in the Remote Control Unit (K-Rem)*

B *Connections on the K-Sync IO Module*

The pin configuration on the K-Sync IO Module follows:



Pin no.	Signal	Description
1	TRIG OUT	Trigger out – Signal to external device enabling it to transmit
2	GROUND	Mandatory – connected to pin 5 inside the module
3	RTT	Ready to transmit – Input from external device when it is ready for the next trigger pulse
4	TRIG IN	Trigger in – Input from external device, active while the device is transmitting
5	GROUND	Mandatory – connected to pin 2 inside the module
6	Not used	

Each IO Module in the K-Sync Synchronizing Unit provides six connectors and a configuration board for physical adjustments of the communication parameters.

Connectors 1 through 6 as indicated by the arrows.

Note that each of the two connector elements can be pulled out of the IO Module for easy access.

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

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

Minimum cable requirements

- **Conductors**: 2 x 5 x 0.5 mm^2
- **Screen**: Overall braided
- **Voltage**: 60 V
- **Maximum outer diameter**: Defined by the plugs and/or the gable gland

Related topics

Remote Control Unit (K-Rem) description, page 21
373962 Remote Control Unit (K-REM) wiring diagram, page 182

Remote control

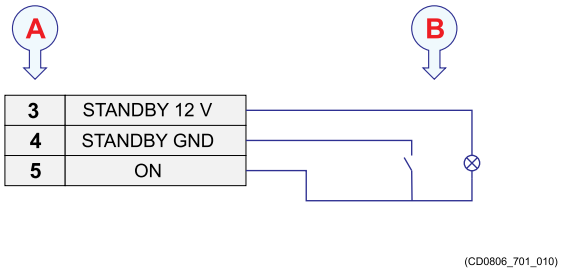
The Processing Unit can be switched on/off with a remote switch. This switch is connected to a 9–pin D-connector on the Processing Unit.

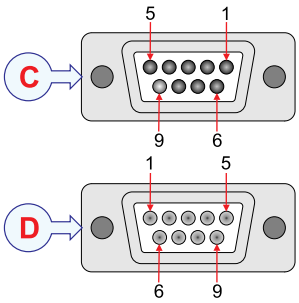
A *Local connection, male 9–pin D-connector*

B *Connection to remote lamp and on/off switch*

C *Female 9–pin D-connector*

D *Male 9–pin D-connector*





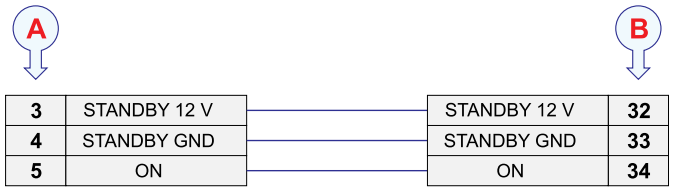
Minimum cable requirements

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

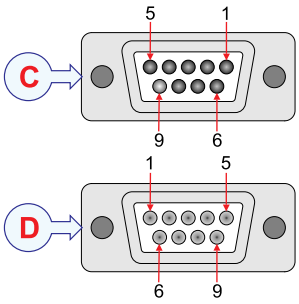


A *Local connection, male 9–pin D-connector*

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 gable gland

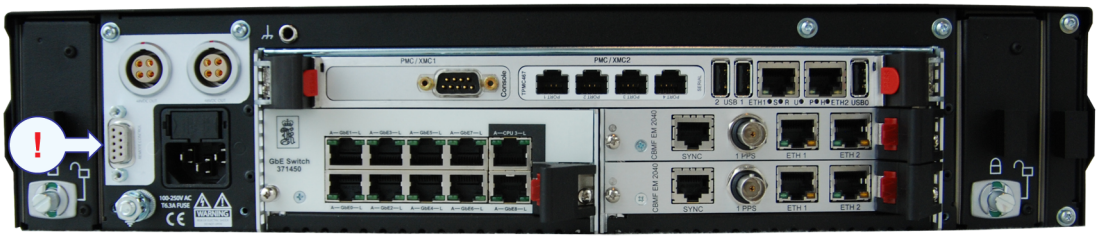
This cable must be provided by the installation shipyard.

Related topics

Remote Control Unit (K-Rem) description, page 21
373962 Remote Control Unit (K-REM) wiring diagram, page 182

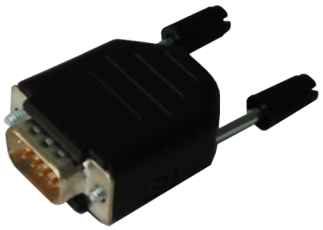
Dummy plug for not using remote control

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.



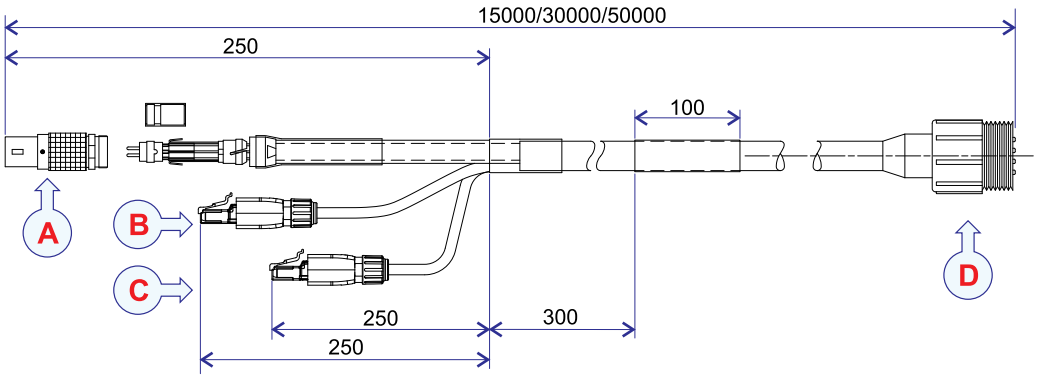
Note

*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.*



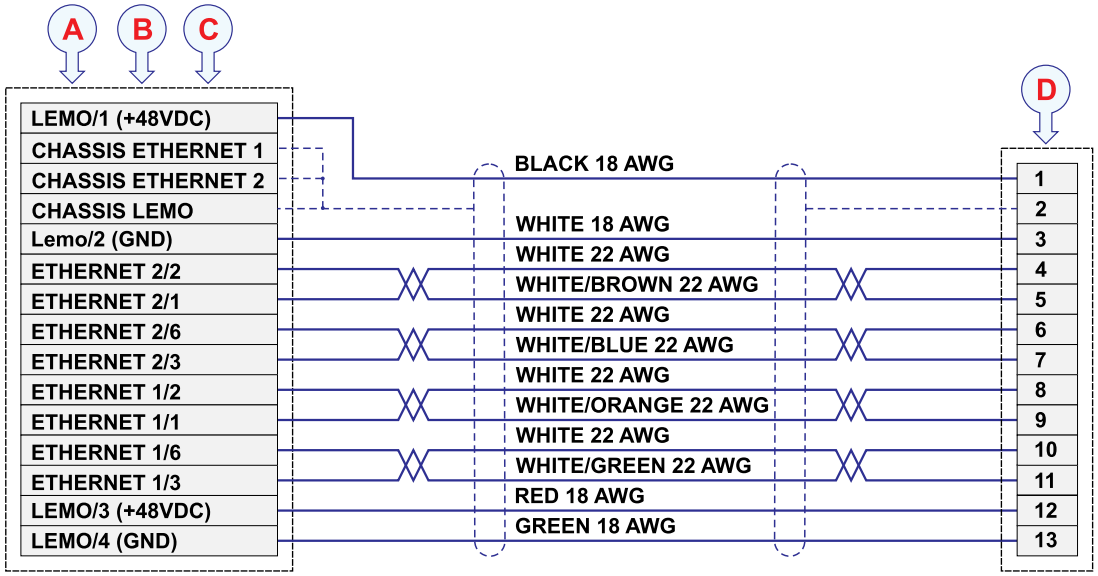
Transmit Transducer cable

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



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

(CD0808_100_002)



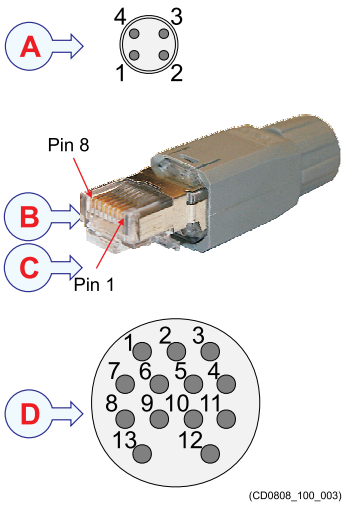
(CD0808_100_001)

A *Processing Unit end - LEMO Connector for power in Processing Unit end. Solder side view.*

B *Processing Unit end - RJ45 connector for signal in Processing Unit end.*

C *Processing Unit end - RJ45 connector for signal in Processing Unit end.*

D *Transducer end- Underwater connector- MacArtney SubConn DIL13M - Face view*



Cable specifications

- Cable length: 15, 30 or 50 meters
- Diameter DLSA locking sleeve (transducer end): 35.5 mm
- SubConn® Power/Ethernet Cable, Type D/P4TP22#/4C18#OS
- Minimum bending radius: 125 mm
- Maximum outer diameter: 13.2 mm nom.
- Weight in air: 209 kg/km nom.
- Weight in sea water: 69 kg/km nom.
- Depth rating: 6000 metres
- 4 Ethernet twisted pairs, 4 power conductors and 1 screen
- Screen: Overall braided
- Voltage:
  - Power conductor: 600V, max. 4 A
  - Twisted pairs: 250V, max. 1.5 A

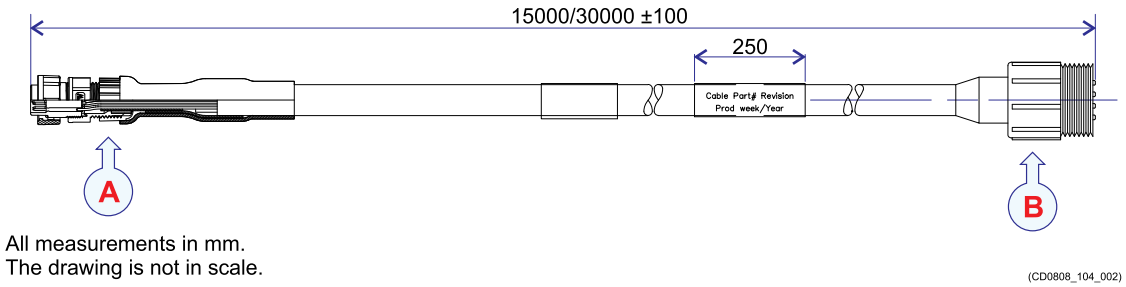
Important

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

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

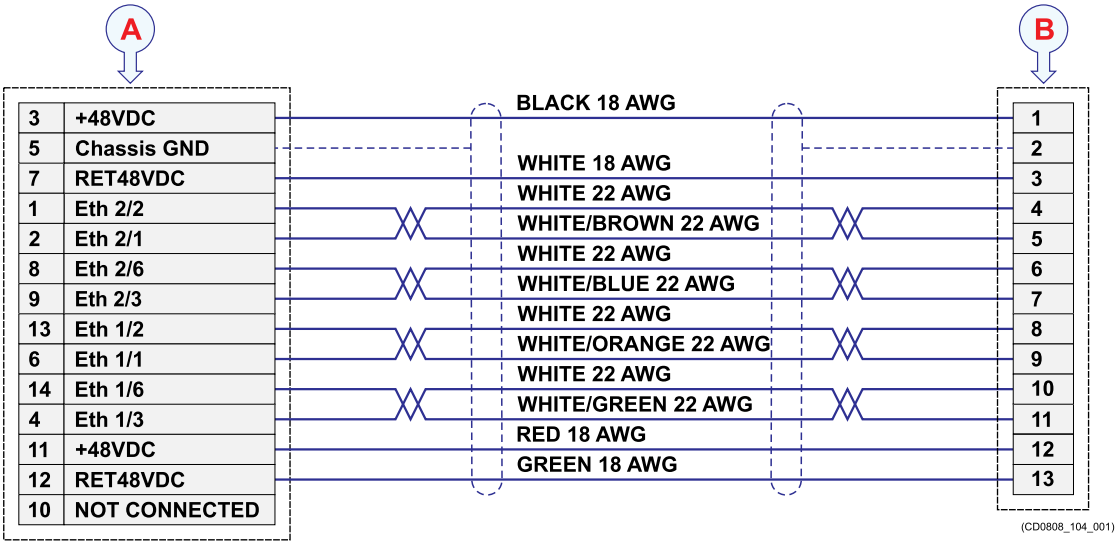
Transmit transducer cable - Portable Processing Unit

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



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

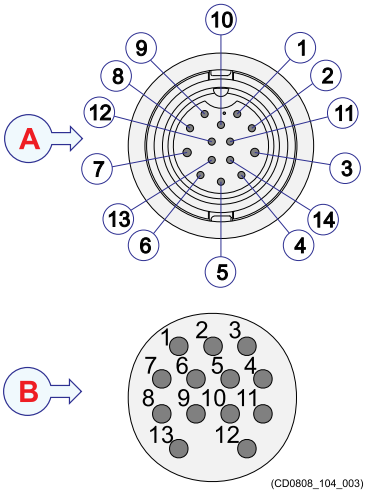
(CD0808_104_002)



(CD0808_104_001)

A *Processing Unit end - Amphenol connector - LTW CDU-14BFMA-LL7001 - Face view*

B *Transducer end- Underwater connector - MacArtney SubConn DIL13M - Face view*



(CD0808_104_003)

Cable specifications

- Cable length: 15 or 30 meters
- Diameter DLSA locking sleeve (transducer end): 35.5 mm
- SubConn® Power/Ethernet Cable, Type D/P4TP22#/4C18#OS
- Minimum bending radius: 125 mm
- Maximum outer diameter: 13.2 mm nom.
- Weight in air: 209 kg/km nom.
- Weight in sea water: 69 kg/km nom.

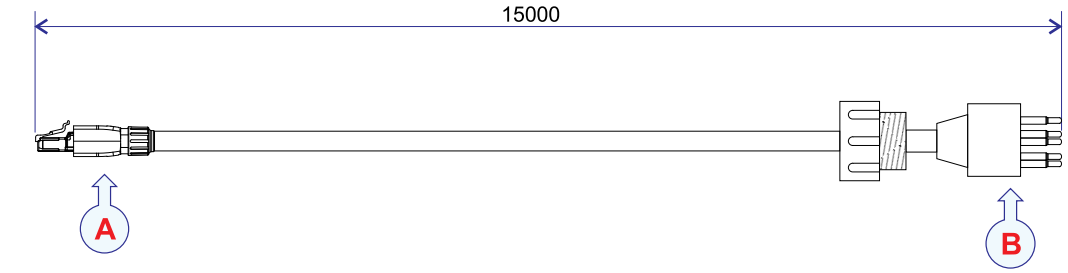
- Depth rating: 6000 metres
- 4 Ethernet twisted pairs, 4 power conductors and 1 screen
- Screen: Overall braided
- Voltage:
  - Power conductor: 600V, max. 4 A
  - Twisted pairs: 250V, max. 1.5 A

Important

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

Receive Transducer cable

The RX transducer must be connected to the Processing Unit.



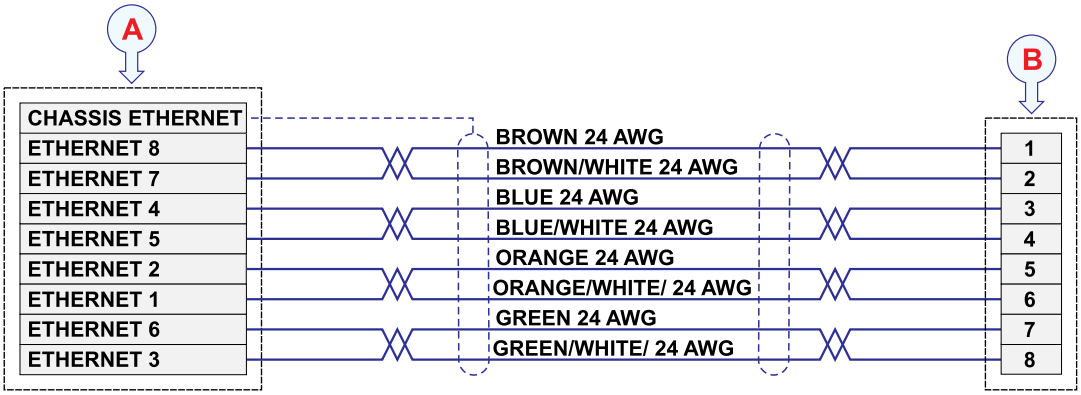
All measurements in mm.
The drawing is not in scale.

(CD0808_101_002)

Note

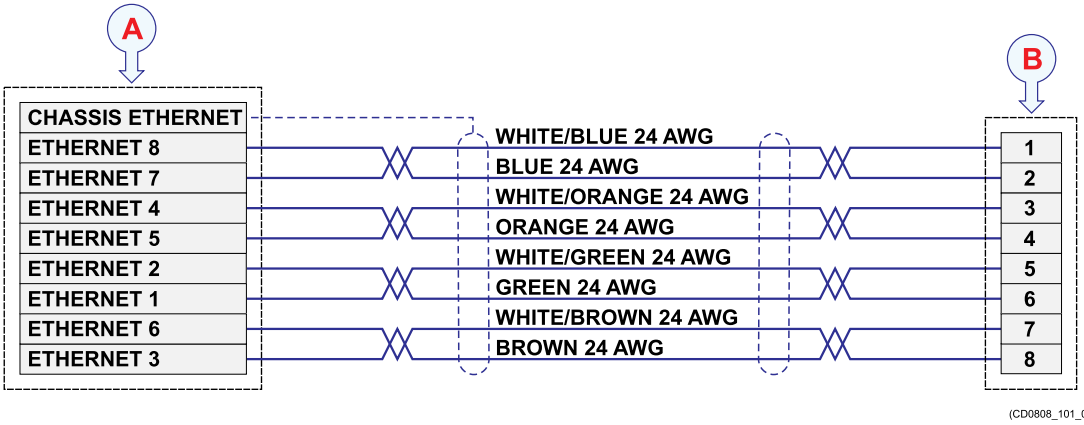
A change in the cable wiring was effectuated without Kongsberg being made aware. As a consequence there are currently two versions of the cable delivered that have the same part number. This change was introduced to the cable in Q2 2011. Please make sure to check the connections in your RJ45 connector against the drawings below before replacing it.

For deliveries after Q2 2011 the cable is connected according to this diagram, this is also according to EIA 568B:



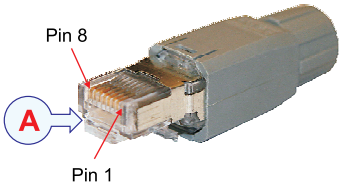
(CD0808_101_001)

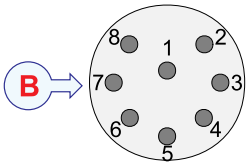
For deliveries before Q2 2011 the cable may be connected according to this diagram:



A *Processing Unit end - RJ45 connector*

B *Transducer end- Underwater connector - MacArtney SubConn DIL8M - Face view*





Cable specifications

- Cable length: 15, 30 or 50 metres
- Diameter DLSA locking sleeve (transducer end): 35.5 mm
- SubConn® Ethernet Cable, Type D-P4TP24#
- Minimum bending radius: 100 mm
- Maximum outer diameter: 10.4 mm nom.
- Conductors: 4 twisted pairs (Ethernet)
- Weight in air: 140 kg/km nom.
- Weight in sea water: 53 kg/km nom.
- Depth rating: 6000 metres
- Screen: Overall braided
- Voltage:
  - Twisted pairs: 250V, max. 1 A

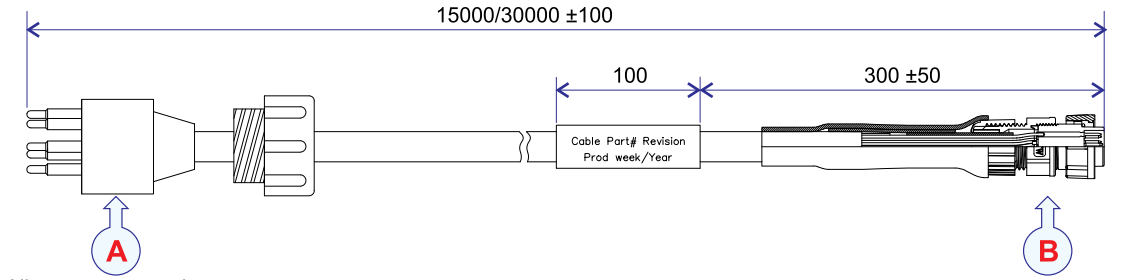
Important

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

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

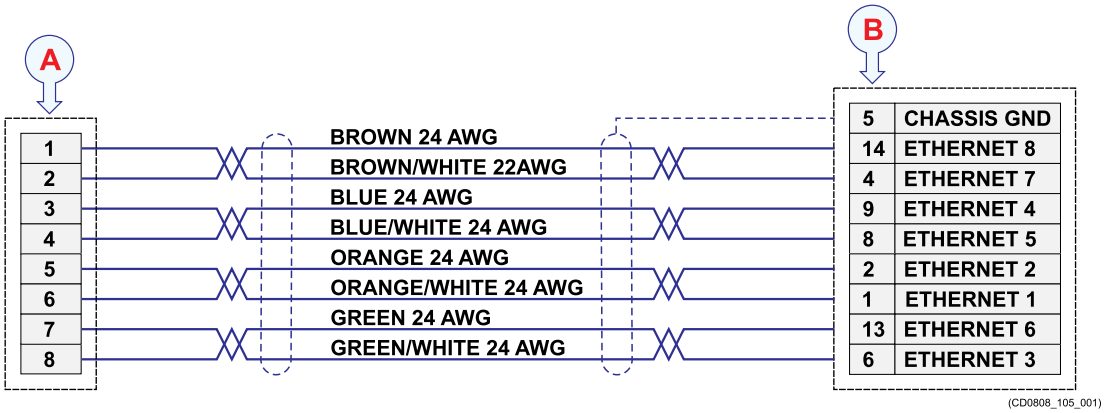
Receive transducer cable - Portable Processing Unit

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



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

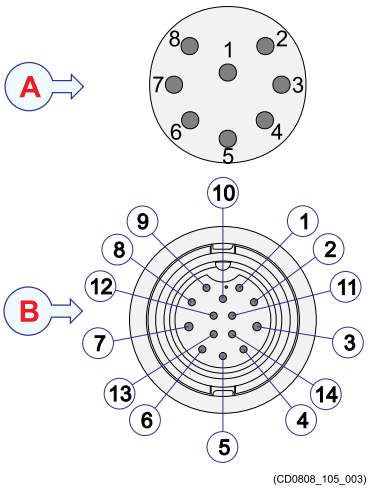
(CD0808_105_002)



(CD0808_105_001)

A *Transducer end- Underwater connector - MacArtney SubConn DIL8M - Face view*

B *Processing Unit end - Amphenol connector - LTW CDU-14BFMA-LL7001 - Face view*



Cable specifications

- Cable length: 15 or 30 meters
- Diameter DLSA locking sleeve (transducer end): 35.5 mm
- SubConn® Ethernet Cable, Type D-P4TP24#
- Minimum bending radius: 100 mm
- Maximum outer diameter: 10.4 mm nom.
- Conductors: 4 twisted pairs (Ethernet)
- Weight in air: 140 kg/km nom.
- Weight in sea water: 53 kg/km nom.
- Depth rating: 6000 metres
- Screen: Overall braided
- Voltage:
  - Twisted pairs: 250V, max. 1 A

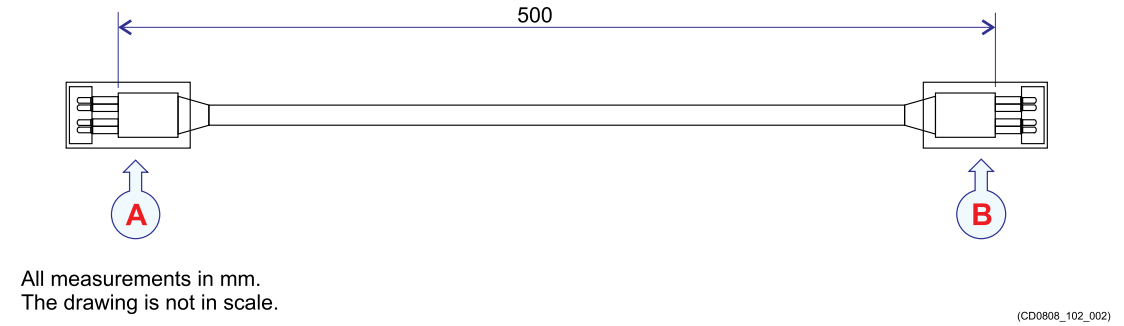
Important

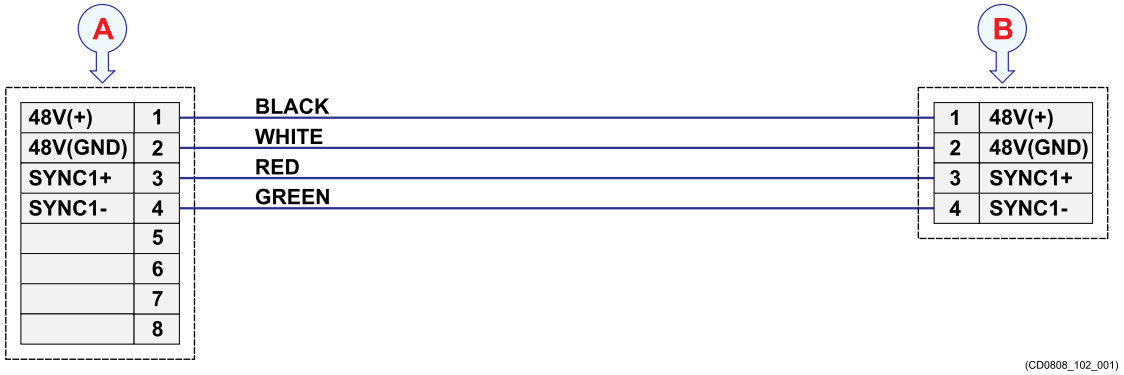
Sacrificial anodes must be mounted near the transducer to protect the connectors. Inspect the anodes regularly, and replace them if needed.

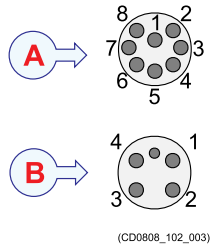
Correct handling of the underwater connectors is very important to avoid any leakage and corrosion problems to the EM 2040 MKII transducers.

TX to RX transducer cable

The transmit transducer must be connected to the receive transducer for synchronization and power.







A *Connector in TX end. Face view.*

B *Connector in RX end. Face view.*

Cable specifications

- Power/Sync Cable, Type SOOW 20/5
- Manufactured by MacArtney Underwter Technology
- MCIL8M, MCDLSF connector in TX end
- MCIL4M, MCDLSF connector in RX end
- Cable length: 0.5 or 1.5 meters
- Depth rating: 6000 metres
- Screen: Overall braided
- Voltage: 250V, max. 1 A

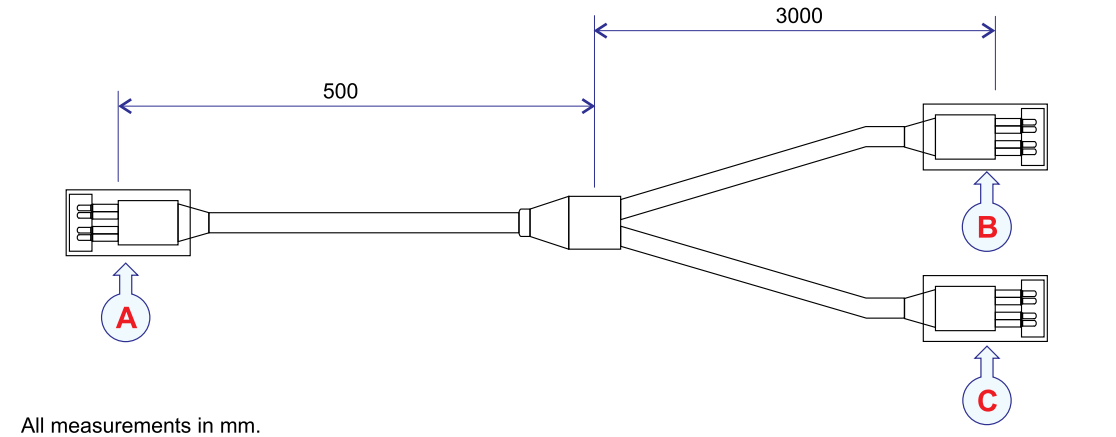
Important

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

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

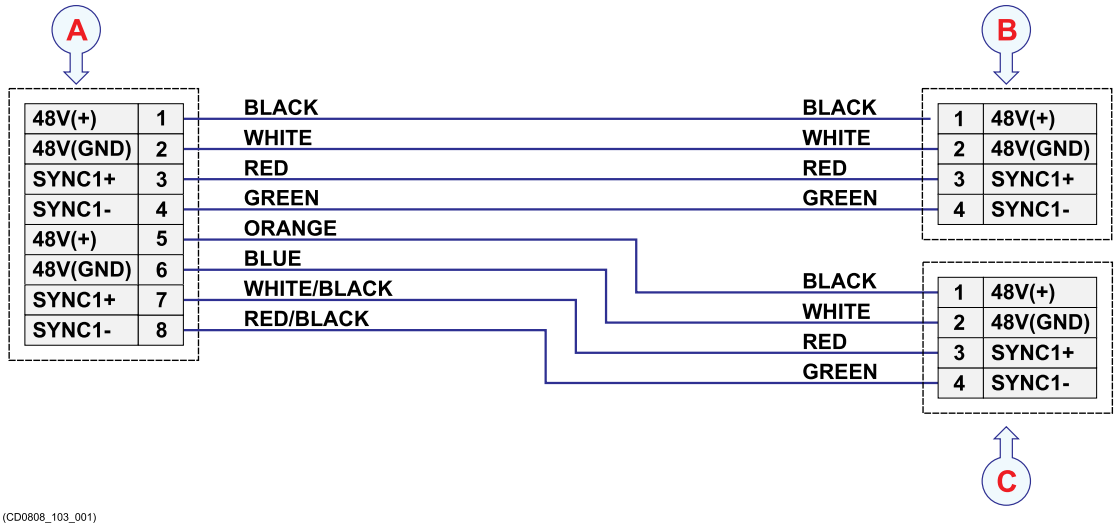
TX to dual RX transducer cable

In a dual RX system, the transmit transducer must be connected to both receive transducers. This connection is for synchronization and power.



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

(CD0808_103_002)

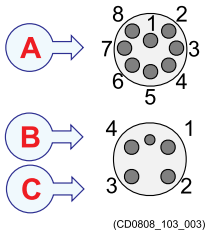


(CD0808_103_001)

A *Connector in TX end. Face view.*

B *Connector in RX end. Face view.*

C *Connector in RX end. Face view.*



Cable specifications

- Power and synchronization cable, type SOOW 20/8 and SOOW 18/4
- Manufactured by MacArtney Underwter Technology
- MCIL8M, MCDLSF connector in TX end
- MCIL4M, MCDLSF connector in RX end
- Cable length: 0.5 + 3.0 meters or 0.5 + 1.0 meters
- Depth rating: 6000 metres
- Screen: Overall braided
- Voltage: 250V, max. 1 A

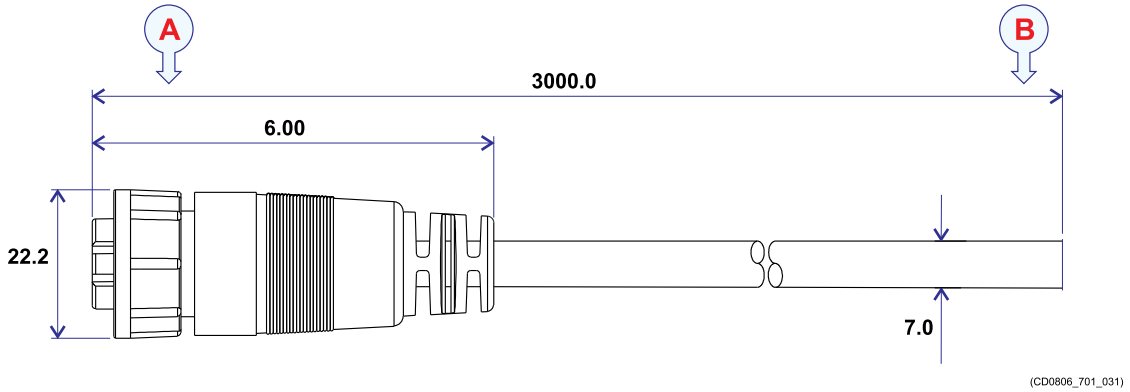
Important

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

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

DC Power cable

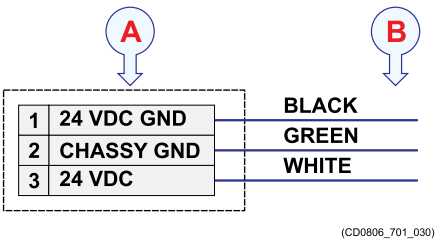
This cable is used to connect the Portable Processing Unit to DC power supply. The cable is delivered with the Portable Processing Unit.



A *Local connection*

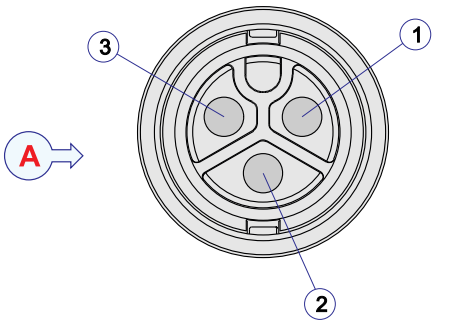
Amphenol LTW PWC-03AFFM-LL7A03

B *Remote connection*



Cable specifications

- Cable length: 3 m
- Maximum outer diameter: 7 mm
- Minimum bending radius: 10 x diameter
- Conductors: 3, 14 AWG
- Provided by Amphenol with soldered connectorUL2464 14AWG * 3 Conductors + Talcum, Black, PVC Jacket
- Voltage: 36V max, 20A



RS-232 serial line used for DGNSS input

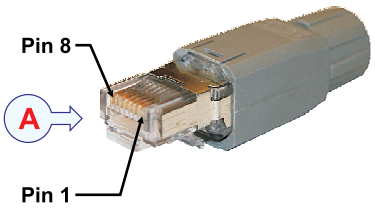
The EM 2040 MKII Portable Processing Unit has a dedicated interface for GNSS correction using RS-422 or RS-232 serial communication.

(CD0801_003_005)

A *Local connection*

RJ45 connector

B *Connection on remote device*



(CD0804_001_004)

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

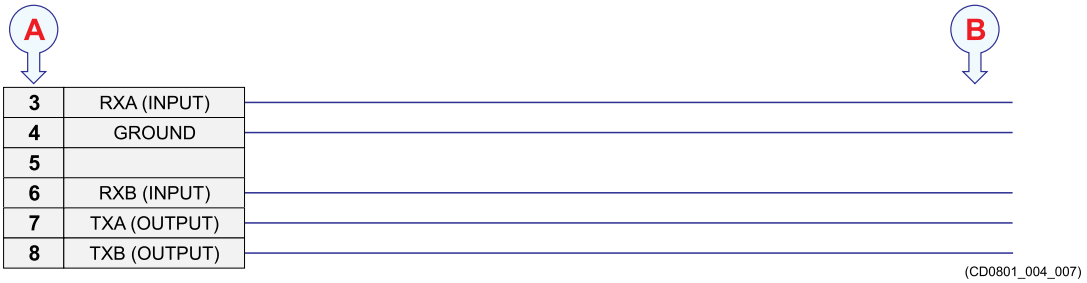
Minimum cable requirements

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

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

RS-422 serial line used for DGNSS input

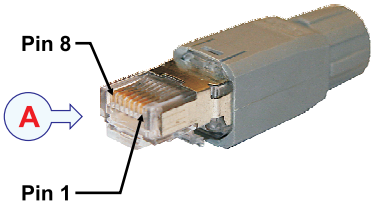
The EM 2040 MKII Portable Processing Unit has a dedicated interface for GNSS correction using RS-422 or RS-232 serial communication.



A *Local connection*

RJ45 connector

B *Connection on remote device*



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

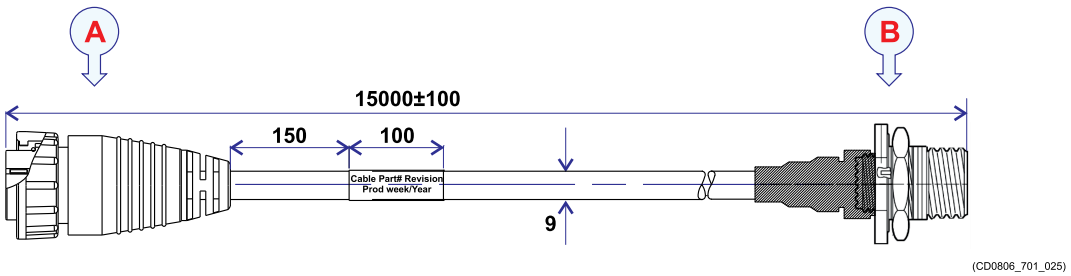
Minimum cable requirements

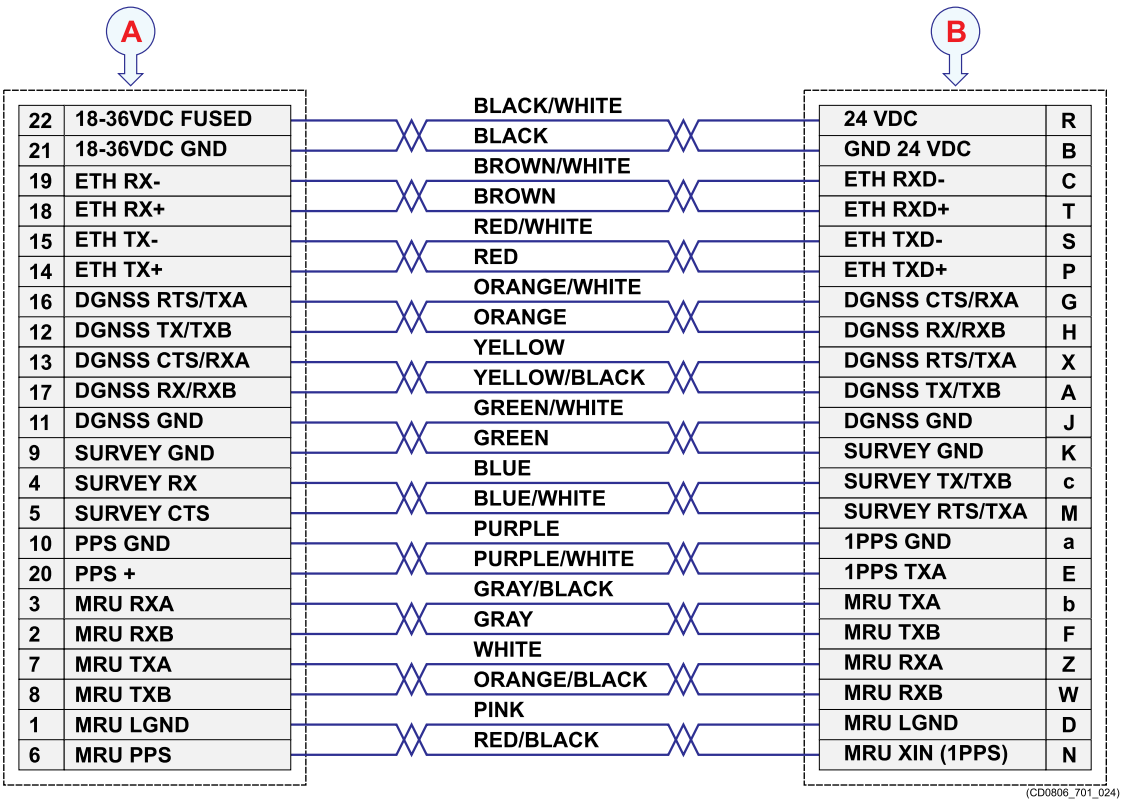
- **Conductors**: 2 x 3 x 0.2 mm^2
- **Screen**: Overall braided
- **Voltage**: 30 V
- **Maximum outer diameter**: Defined by the plugs and/or the gable gland

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

Seapath antenna interface cable - with plug

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



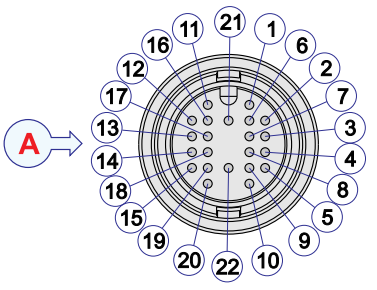


A *Local connection*

Amphenol LTW DU-22BFFA-SL7000

B *Connection to Seapath 130 antenna*

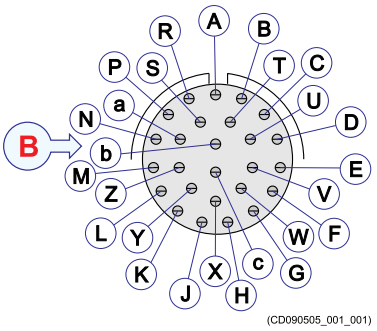
JVS07A1726SN



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

Relation between RS-232 and RS–422 pins

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



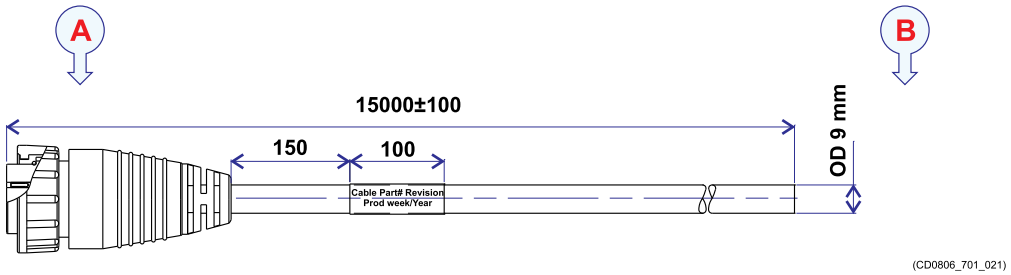
Cable specifications

- Cable length: 15 m
- Maximum outer diameter: 9 mm
- Minimum bending radius: 10 x diameter
- Conductors: 11 twisted pairs, 26 AWG
- Provided by Amphenol with soldered connector

  UL2464 26AWG * 11 Pairs+Drain+AL.Mylar PVC Jacket UV Resistant
- 22pin 2 ethernet TPs, 2 power conductors, 12 serial com leads (4xRS422), 4 1PPS leads and 1 screen
- +Drain+AP.Mylar PVC Jacket UV Resistant
- Screen: Aluminium Mylar
- Voltage: 300V
- Temperature: 80 °C

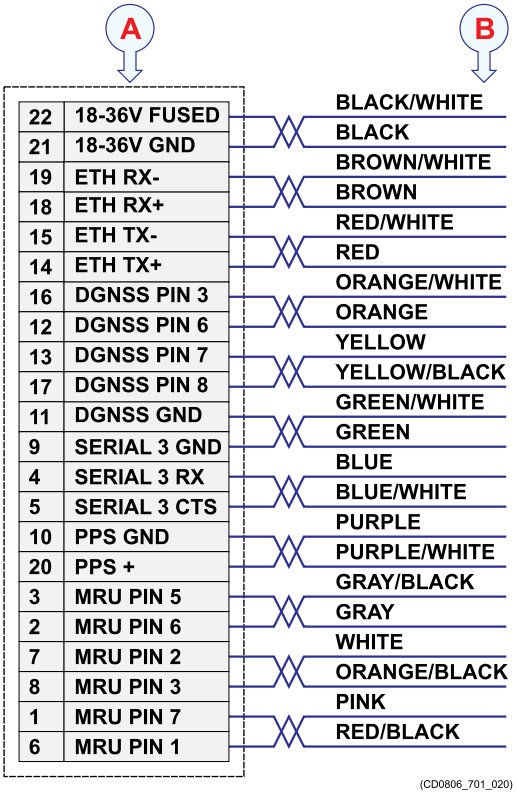
Antenna interface cable

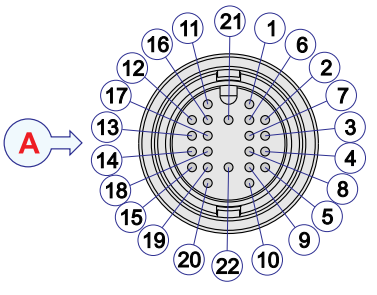
The Portable Processing Unit can be connected to a Seapath antenna with a dedicated cable. The cable is delivered with the Portable Processing Unit.



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

B *Connection Seapath antenna*





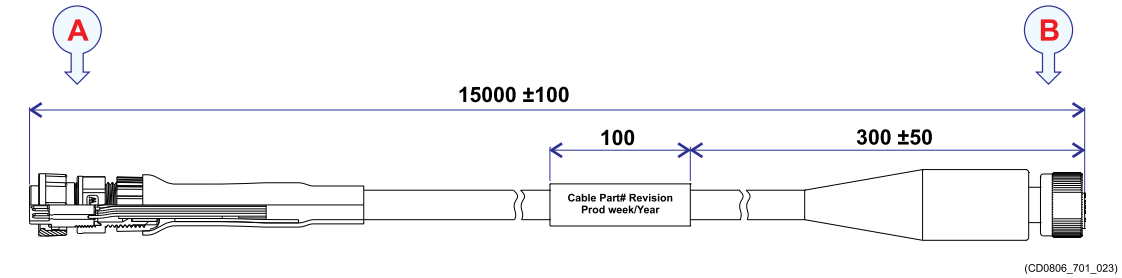
Cable specifications

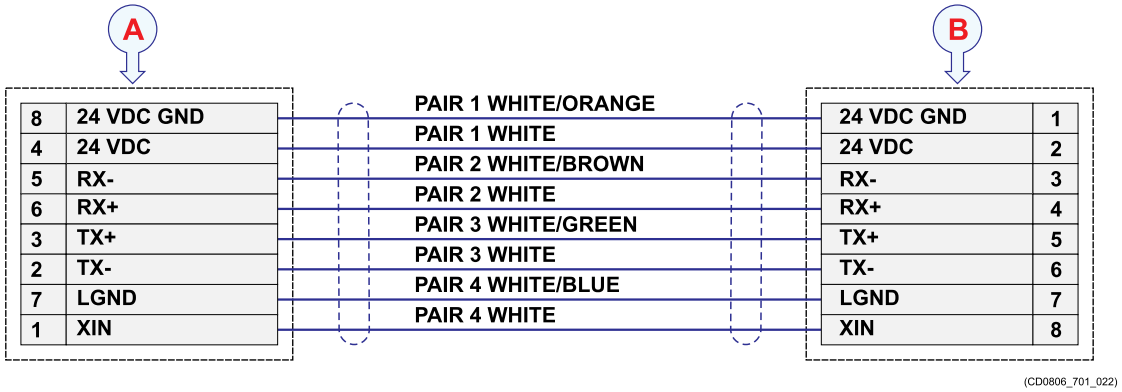
- Cable length: 15 m
- Maximum outer diameter: 9 mm
- Minimum bending radius: 10 x diameter
- Conductors: 11 twisted pairs, 26 AWG
- Provided by Amphenol with soldered connector

  UL2464 26AWG * 11 Pairs+Drain+AL.Mylar PVC Jacket UV Resistant
- 22pin 2 ethernet TPs, 2 power conductors, 12 serial com leads (4xRS422), 4 1PPS leads and 1 screen
- +Drain+AP.Mylar PVC Jacket UV Resistant
- Screen: Aluminium Mylar
- Voltage: 300 V
- Temperature: 80 °C

Seapath MRU interface cable

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



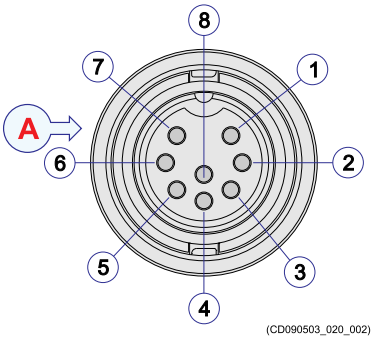


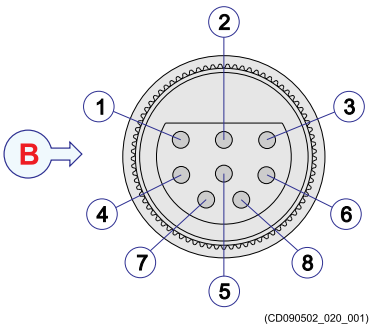
A *Local connection*

Amphenol LTW CD-08BFMA–LL7001

B *Connection Seapath MRU*

SEACON 5501–1508





Cable specifications

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

Steel conduits

In a permanent installation it is recommended to protect the transducer cables with steel conduits.

All cables must be supported and protected along their entire lengths using conduits and/or cable trays. The only exception to this rule is over the final short distance (maximum 0.5 meters) as the cables run into the cabinets/units to which they are connected. These short service loops are to allow the cabinets to move on their shock mounts, and to allow maintenance and repair.

The transducer cables are passed through the hull via a steel conduit. The steel conduit is normally extended until it reaches a minimum of 1000 mm above the waterline. The top of the conduit has to be sealed off with a watertight cable gland from e.g. Roxtec or MCT Brattberg.

All cables between the bridge, the various operation- and equipment rooms, must be supported and protected along their entire length using conduits or cable trays. Note that the cables must not be installed in the vicinity of high-power supplies and cables, antenna cables or other possible sources of interference. Kongsberg Maritime recommends that there are minimal bending of cables from transducers to operating room.

Cables containing insulation materials with different maximum-rated conductor temperatures should not be bunched together (that is, in a common clip, gland, conduit or duct). When this is impractical, the cables must be carefully arranged such that the maximum temperature expected in any cable in the group is within the specifications of the lowest-rated cable.

Metallic casings, pipes and conduits must be grounded, and when fitted with joints these must be mechanically and electrically grounded locally.

Handling of underwater connectors

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

Important

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

1 Disconnect the connector by pulling it straight out, not at an angle. Do not pull the cable, and avoid sharp cable bends.

2 The connectors must not be exposed to long periods of heat or direct sunlight. If a connector becomes very dry, it should be soaked in fresh water before use.

3 General cleaning and removal of any accumulated sand or mud on a connector should be performed using spray based contact cleaner (isopropyl alcohol). New grease must be applied again prior to mating.

4 Always apply grease before mating.

   Greasing and mating above water (dry mate):

   a Connectors must be greased with Molykote® 44 Medium before every mating.

   b A layer of grease corresponding to minimum 1/10 of socket depth should be applied to the female connector.

   c The inner edge of all sockets should be completely covered, and a thin transparent layer of grease left visible on the face of the connector.

   d After greasing, fully mate the male and female connector in order to secure optimal distribution of grease on pins and in sockets.

   e To confirm that grease has been sufficiently applied, de-mate and check for grease on every male pin. Then re-mate the connector.

   Greasing and mating under water (wet mate):

   a Connectors must be greased with Molykote® 44 Medium before every mating.

   b A layer of grease corresponding to approximately 1/3 of socket depth should be applied to the female connector.

   c All sockets should be completely sealed, and transparent layer of grease left visible on the face of the connector.

   d After greasing, fully mate the male and female connector and remove any excess grease from the connector joint.

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

- https://www.macartney.com/

Basic cable requirements

It is very important that all systems cables are installed correctly. All cables must be properly supported and protected, and all relevant precautions must be made to prevent unwanted noise.

Topics

Cable trays

All permanently installed cables associated with the system must be supported and protected along their entire lengths using conduits and/or cable trays.

The only exception to this rule is over the final short distance (maximum. 0.5 meters) as the cables run into the cabinets/units to which they are connected. These short service loops are to allow the cabinets to move on their shock mounts, and to allow maintenance and repair.

1 Wherever possible, cable trays must be straight, accessible and placed so as to avoid possible contamination by condensation and dripping liquids (oil, etc.). They must be installed away from sources of heat, and must be protected against physical damage. Suitable shields must be provided where cables are installed in the vicinity of heat sources.

2 Unless it is absolutely unavoidable, cables should not be installed across the vessel's expansion joints. If the situation is unavoidable, a loop of cable having a length proportional to the possible expansion of the joint must be provided. The minimum internal radius of the loop must be at least twelve times the external diameter of the cable.

3 Where a service requires duplicate supply lines, the cables must follow separate paths through the vessel whenever possible.

4 Signal cables must not be installed in the same cable tray or conduit as high-power cables.

5 Cables containing insulation materials with different maximum-rated conductor temperatures should not be bunched together (that is, in a common clip, gland,

conduit or duct). When this is impractical, the cables must be carefully arranged such that the maximum temperature expected in any cable in the group is within the specifications of the lowest-rated cable.

6 Cables with protective coverings which may damage other cables should not be grouped with other cables.

7 Cables having a copper sheath or braiding must be installed in such a way that galvanic corrosion by contact with other metals is prevented.

8 To allow for future expansion of the system, all cables should be allocated spare conductor pairs. Also, space within the vessel should be set aside for the installation of extra cables.

Radio frequency interference

All cables that are to be permanently installed within 9 m (30 ft) of any source of Radio Frequency (RF) interference such as a transmitter aerial system or radio transmitters, must, unless shielded by a metal deck or bulkhead, be adequately screened

Suitable screening can be established using sheathing, braiding or other suitable material. In such a situation flexible cables should be screened wherever possible.

It is important that cables, other than those supplying services to the equipment installed in a radio room, are not installed through a radio room, high power switch gear or other potential sources of interference. Cables which must pass through a radio room must be screened by a continuous metal conduit which must be bonded to the screening of the radio room at its points of entry and exit.

Physical protection of cables

Cables exposed to the risk of physical damage must be enclosed in a steel conduit or protected by a metal casing unless the cable's covering (for example armour or sheath) is sufficient to protect it from the damage risk.

Cables exposed to an exceptional risk of mechanical damage (for example in holds, storage-spaces and cargo-spaces) must be protected by a suitable casing or conduit, even when armoured, if the cable covering does not guarantee sufficient protection for the cables.

Metallic materials used for the physical protection of cables must be suitably protected against corrosion.

Grounding of system cables

All metallic cable coverings (armour, metallic sheathing and other protection) must be electrically connected to the vessel's hull at both ends except in the case of final sub-circuits where they should be connected at the supply end only.

Grounding connections should be made using a conductor which has a cross-sectional area appropriate for the current rating of the cable, or with a metal clamp which grips the metallic covering of the cable and is bonded to the hull of the vessel. These cable coverings may also be grounded by means of glands specially intended for this purpose and designed to ensure a good ground connection. The glands used must be firmly attached to, and in good electrical contact with, a metal structure grounded in accordance with these recommendations.

Electrical continuity must be ensured along the entire length of all cable coverings, particularly at joints and splices. In no case should the shielding of cables be used as the only means of grounding cables or units.

Metallic casings, pipes and conduits must be grounded, and when fitted with joints these must be mechanically and electrically grounded locally.

Cable connections and terminations

All cable connections are shown on the applicable cable plan and/or interconnection diagrams.

Where the cable plan shows cable connections outside an equipment box outline, the connections are to be made to a plug or socket which matches the plug or socket on that particular item of equipment.

Where two cables are connected in series via a junction box or terminal block, the screens of both cables must be connected together, but not grounded.

Care must be taken to ensure that the correct terminations are used for all cable conductors, especially those that are to be connected to terminal blocks. In this case, crimped sleeve-terminations must be fitted to prevent the conductor core from fraying and making a bad connection with the terminal block. It is also of the utmost importance that where crimped terminations are used, the correct size of crimp and crimping tool are used. In addition, each cable conductor must have a minimum of 15 cm slack (service loop) left before its termination is fitted.

Cable identification

Cable identification codes corresponding to the cable number shown in the cable plan must be attached to each of the external cables.

The identification codes should be positioned on the cable in such a way that they are readily visible after all panels have been fitted.

In addition, each cable conductor should be marked with the terminal board number or socket to which it is connected.

Cable glands and termination procedures

Cable glands are used to attach and secure the end of a cable to the equipment. Cable glands may also be used for sealing cables passing through bulkheads or gland plates.

About cable glands

Cable glands are used whenever a cable passes through a watertight bulkhead or into a cabinet, to seal the opening through which the cable passes and to protect the cable from abrasion on the edges of the hole.

There are many different types of cable gland on the market. The cable glands are not supplied with the system.

Note

Even though the cabinets from Kongsberg Maritime may be prepared for specific types of cable glands, the installation shipyard will be responsible for selecting cable gland types and installing them.

A cable gland (in the U.S. more often known as a cable connector or fitting) is a device designed to attach and secure the end of a cable to the equipment. A cable gland provides strain-relief and connects by a means suitable for the type and description of cable for which it is designed—including provision for making electrical connection to the armour or braid and lead or aluminium sheath of the cable, if any. Cable glands may also be used for sealing cables passing through bulkheads or gland plates.

Cable glands are mechanical cable entry devices and can be constructed from metallic or non-metallic materials. They are used throughout a number of industries in conjunction with cable and wiring used in electrical instrumentation and automation systems.

Cable glands may be used on all types of electrical power, control, instrumentation, data and telecommunications cables. They are used as a sealing and termination device to ensure that the characteristics of the enclosure which the cable enters can be maintained adequately.

http://en.wikipedia.org/wiki/Cable_gland (February 2014)

Preparing cables for termination

Whenever a cable shall penetrate a cabinet or a bulkhead using a cable gland, the termination of the cable must be prepared.

Prerequisites

Electrical installations can only be done by certified electricians. All necessary tools and instruments required must be available. The installation shipyard must prepare detailed drawings of the electrical system, and identify each cable.

Context

Cable glands are used whenever a cable passes through a watertight bulkhead or into a cabinet, to seal the opening through which the cable passes and to protect the cable from abrasion on the edges of the hole. The cable glands are not supplied with the EM 2040 MKII.

Note

There are many different types of cable gland on the market. This procedure describes the types used (now and previously) as standard in the units manufactured by Kongsberg Maritime. Even though the cabinets from Kongsberg Maritime may be prepared for specific types, the installation shipyard will be responsible for selecting cable gland types and installing them.

Procedure

1 Ensure all the cables to be connected are completely isolated from any power sources.

For safety reasons, switch off and remove the power supply fuses from any units or systems into which the cables are already connected.

2 Select the cable to be connected into the cabinet, and select the cable gland through which the cable is to pass.

Note

A minimum of 5 cm (recommended 5 to 10 cm) of cable slack must be allowed, both inside and outside the unity or cabinet, when you install cables. This is to allow for vibration damping, maintenance and measurement errors. Always double-check your measurements before taking any irreversible actions.

3 Measure the maximum length of cable.

a If the cable has already been installed in conduits: Measure the maximum length of cable required to reach from the final cable clip outside the cabinet to the terminal block(s) inside the cabinet. Add 20 cm, and remove the excess cable.

b If the cable has not been installed in conduits: Measure the maximum length of wire required to reach from the cable gland to the terminal block(s) inside the cabinet. Add 20 cm, and mark the cable.

Note

The outer insulation on the cable will extend into the cable gland to a point approximately 5 mm outside the outer surface of the cabinet wall.

4 Carefully remove the outer insulation from the required cable length.

Be careful! Do not damage the screen!

5 Leaving an appropriate length of the screen exposed from the insulation, cut off the remainder.

Securing and terminating cables

Once a cable has been prepared for termination, it must be connected to a unit or cabinet.

Prerequisites

Electrical installations can only be done by certified electricians. All necessary tools and instruments required must be available. The installation shipyard must prepare detailed drawings of the electrical system, and identify each cable.

Context

Observe the relevant cable plans, cable lists and/or interconnection drawings for the EM 2040 MKII.

Procedure

1 Referring to the wiring diagram and ensuring that there is 5 to 10 cm slack cable inside the cabinet, prepare and connect the cable cores to the appropriate terminals and/or plugs within or onto the cabinet.

2 Secure the cable using cable clips.

3 Check the terminal connections against the wiring diagram to ensure they are correct. Follow the same procedure for all the cables and cable glands.

4 Check the cabinet to ensure all tools and rubbish are removed, then close the cabinet door.

5 Take the appropriate safety measures, then replace the fuses and apply power to the system.

6 Perform a relevant system test to ensure the installation has been made successfully.

Using multi-diameter cable sealing

Cable sealing systems are available from several manufacturers, and multi-diameter types are becoming increasingly popular due to their ease of use.

Prerequisites

Electrical installations can only be done by certified electricians. All necessary tools and instruments required must be available. The installation shipyard must prepare detailed drawings of the electrical system, and identify each cable.

Illustration:

Sealing system example; the finished assembly

Context

Only a brief description of the sealing system will be presented here. Further information with relevant technical specifications and installation descriptions must be obtained from the manufacturer.

Roxtec modules (Image from Roxtec website)

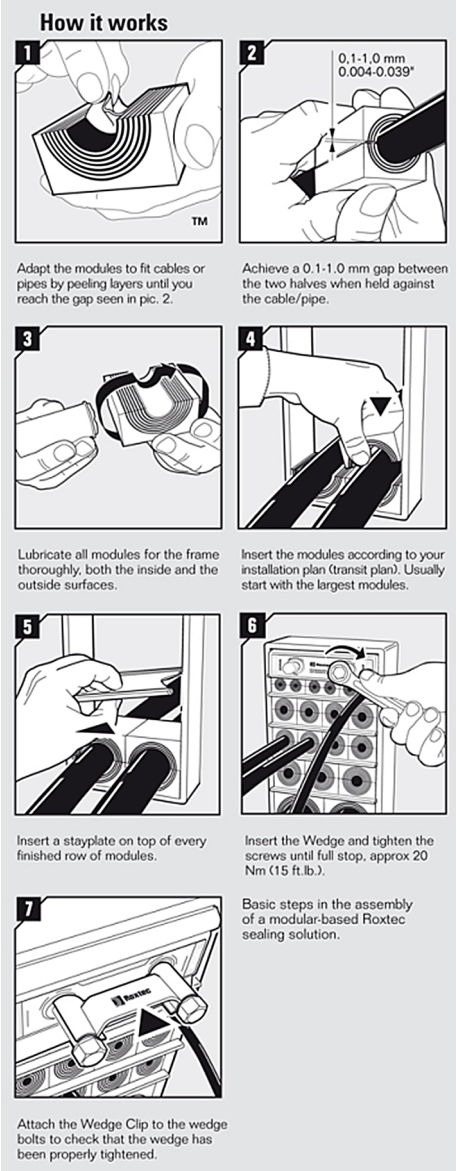
The illustrations and examples here are provided by the following manufacturer:

Roxtec International AB
Box 540
S-371 23 Karlskrona, SWEDEN

- http://www.roxtec.com

Illustration:

Roxtec steps (Image from Roxtec website)



Basic steps in the assembly of a modular-based Roxtec sealing solution.

The Roxtec system is available with a large number of various modules and compression units. The system complies with current screening and EMC requirements.

Procedure

1 Cut an opening in the structure (bulkhead, cabinet etc) you wish to penetrate.

The hole must be large enough to fit one of the standard rectangular or circular frames provided by the sealing system manufacturer.

Note

The chosen solution must comply with the fire and/or pressure demands for the vessel. If the sealing is to be used under water, both pressure and material requirements must be taken into consideration.

2 Mount the frame.

3 Pull the cable(s) through the frame.

In most cases the opening will be large enough to accept the plugs on the cables.

4 Secure each cable with a square sealing module.

5 Adjust the module to fit the cable's outer diameter.

6 When the required number of modules are installed, tighten the assembly with a compression unit.

Further requirements

For a complete installation procedure, refer to the relevant documentation provided by the manufacturer.

Dimensional surveying and alignment

Topics

About dimensional surveying and alignment

The EM 2040 MKII Multibeam echo sounder is a precision instrument for high quality data collection.

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 system prior to use. Modest accuracy requirements apply when your EM 2040 MKII system is only used to investigate objects in the water column.

The quality assurance tasks required for the EM 2040 MKII system include:

- Aligning the transducer during installation
- Dimensional surveying
- Calibration

The alignment and dimensional surveying must be done during the system 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 intervals, 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 the EM 2040 MKII system include:

1 Define the vessel coordinate system.

2 Define the location of the *origin* in the coordinate system.

3 Define the waterline with reference to the origin of the coordinate system.

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

5 Define the vessel's centre line.If required, identify the line with physical markings.

6 Measure the physical location and installation angle of all relevant sensors (or sensor antennas).

7 Measure the physical location and orientation of the transducer. Place it in the coordinate system.

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

The information provided by the dimensional survey is entered into the EM 2040 MKII software as installation parameters.

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.

The Dimensional survey measurement requirements are summarized in the chapter *Technical specifications*.

Alignment

To ensure a successful installation of the EM 2040 MKII system, all alignment and measurements must be done to the highest possible accuracy.

The alignment tasks required for the EM 2040 MKII transducer include:

- Measure and adjust the transducer mounting plate to ensure that it has been mounted within the given tolerances.
- Measure and adjust the external sensors to ensure that they have been mounted within the given tolerances.

Installation of the external sensors must be done according to the manufacturer's installation instructions.

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 do the dimensional surveying. They have no means of verifying the results until calibration at sea has been finalized.

Calibration

Calibration surveys are required during the sea trials. The calibration procedures are provided in the relevant end user documentation.

We strongly recommend that calibration surveys are done at regular intervals. As a minimum, calibration must be done prior to any large and/or important 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 system units 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.

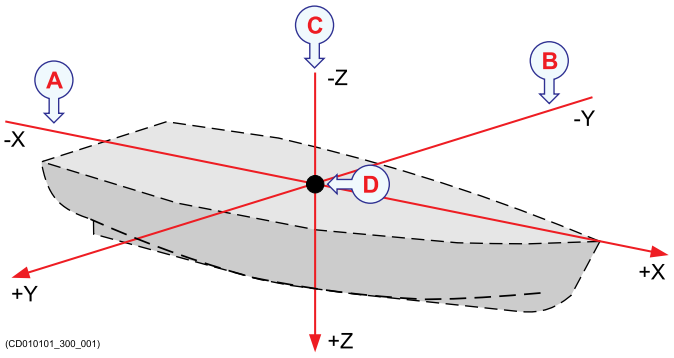
The antenna of a position sensor is typically mounted high above the superstructure, while a motion sensor is located close to the vessel's centre of gravity. Both of these are physically positioned far away from the transducer, which may be located closer to the bow.

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.

Example

If you wish to measure the actual water depth, you will need to know the vertical distance from the echo sounder transducer to the water line. Since the vessel's displacement changes with the amount of cargo, fuel etc, the physical location of the water line on the hull must either be measured at a regular basis, or measured with a second sensor.

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.



A *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).*

B *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).*

C *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).*

D *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 sensor

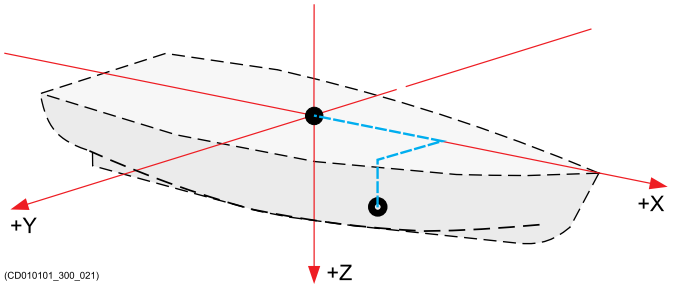
Coordinate system alternative origins

If necessary, other origin locations may be defined for specific products or purposes. One example is the *Navigation Reference Point* that is frequently used. Whenever a vessel is surveyed to establish accurate offset information, the surveyor may also establish an alternative origin location. Whenever relevant, any such alternative locations must be defined using offset values to the "official" origin established by the designer or shipyard. A commonly used alternative origin is the physical location of the vessel's motion sensor.

Defining the physical location of each sensor

By means of the vessel coordinate system, the physical location of every sensor can be defined using three numerical values for X, Y and Z. These values must define the vertical and horizontal distances from a single reference point; the origin. The physical location of the motion reference unit (MRU) is often the most important sensor to define. For many systems, the vessel heading is also a critical measurement.

In this example, a second reference point has been established. It is defined with three positive offset values for X, Y and Z. All values are positive because the new reference point is in front of and below the origin, and on the starboard side.



The accuracy of the three numerical values for X, Y and Z defines the accuracy of the sensor data.

Important

If you require a high accuracy, for example for underwater positioning, underwater mapping or scientific measurements, you must have each sensor positioned. 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.

Alignment report template

The template can be used to verify the alignment report provided by the survey contractor. Alternatively, the report template can be completed and serve as the final alignment report.

General information

Table 1 Scope of work

Sensor/system	Position	Heading	Roll	Pitch	Flatness

Table 2 Personnel

Name	Position and responsibilities

Table 3 Equipment

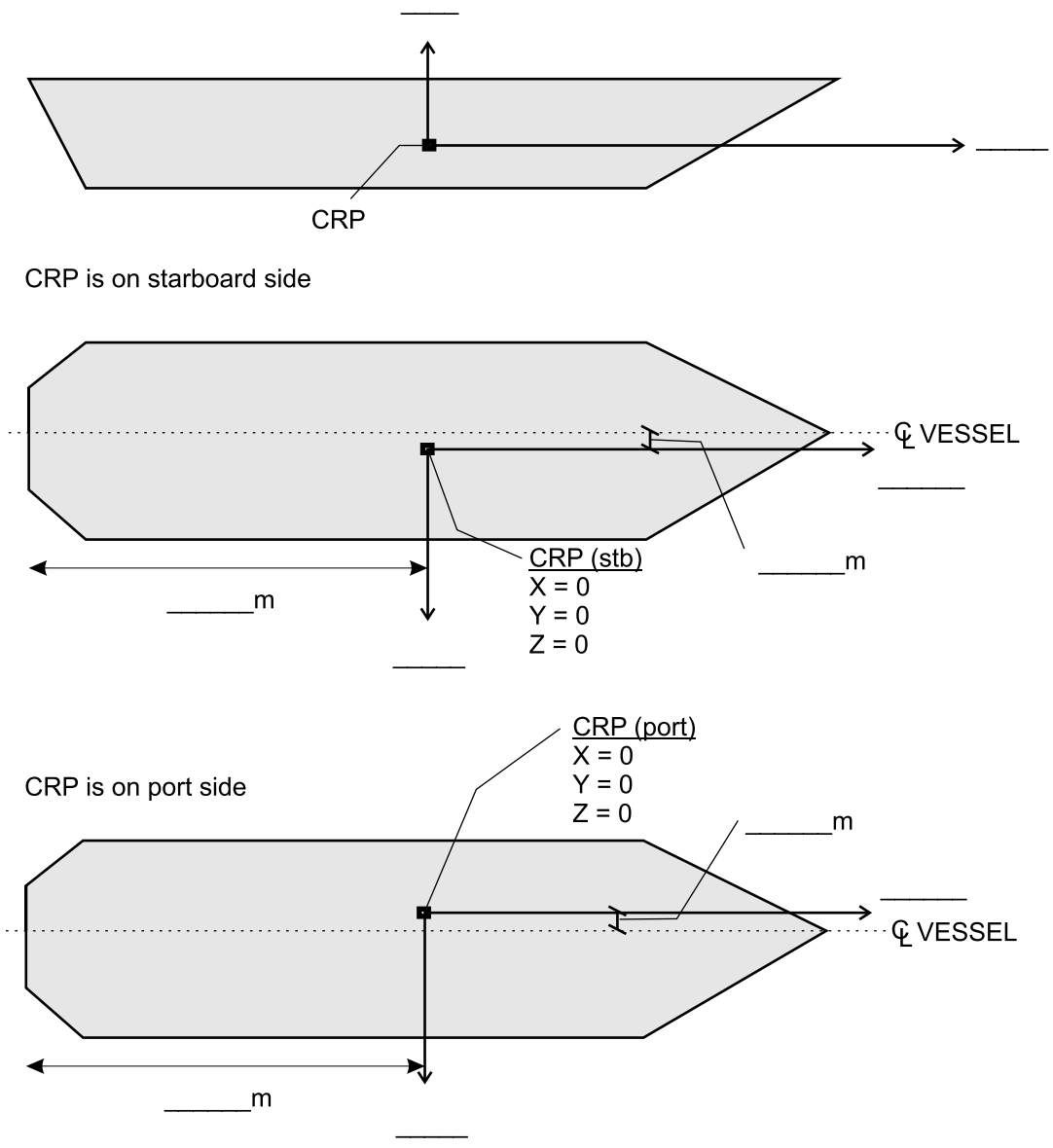
Make and model	Certificate expiry date

Vessel coordinate system

Table 4 Coordinate reference point system definition

	Definition/description
Origin point	
X-axis	
X-axis is positive	
Y-axis	
Y-axis is positive	
Z-axis	
Z-axis is positive	
Vessel reference plane	
Additional description of vessel coordinate system	

Figure 1 The vessel Coordinate Reference Point (CRP).



Instructions

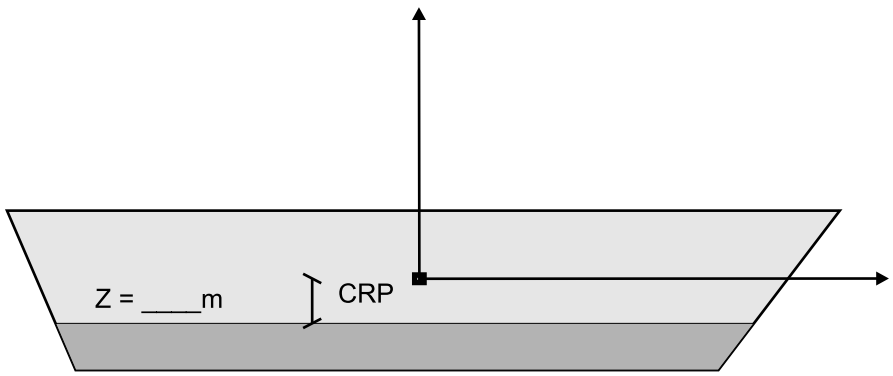
- Use only the sketch that applies to your CRP location, i.e. CRP on port or starboard side
- Enter definition of axes, i.e. which of the axes is X-axis, which is Y-axis and to what direction is the Z-axis pointing
- Enter distance to CRP from vessel centre line and from vessel stern, alternatively from other physical definable locations of the vessel

Waterline

Table 5 Waterline observations

Point no.	Z	Point description
Remarks		

Figure 2 Waterline



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Instructions

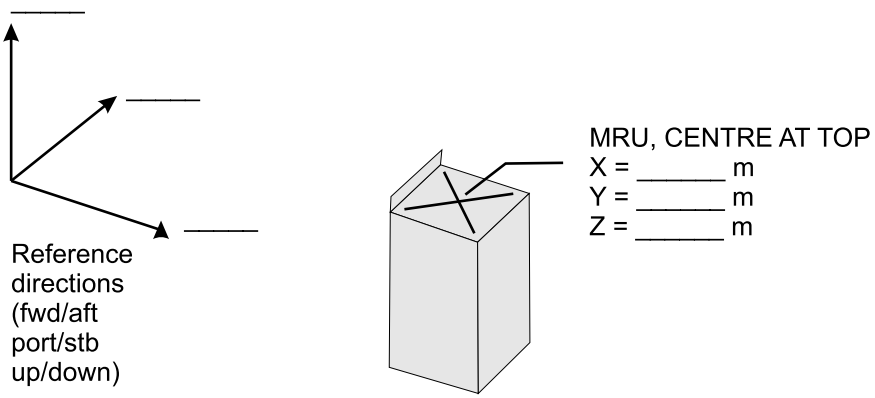
- Indicate all survey points used to define the waterline
- Enter Z value of waterline
- Enter definition of axes (forward and up)

Motion reference unit

Table 6 Motion sensor alignment

	MRU	Survey accuracy
x		
y		
z		
roll		
pitch		
yaw		
Remarks		

Figure 3 MRU position

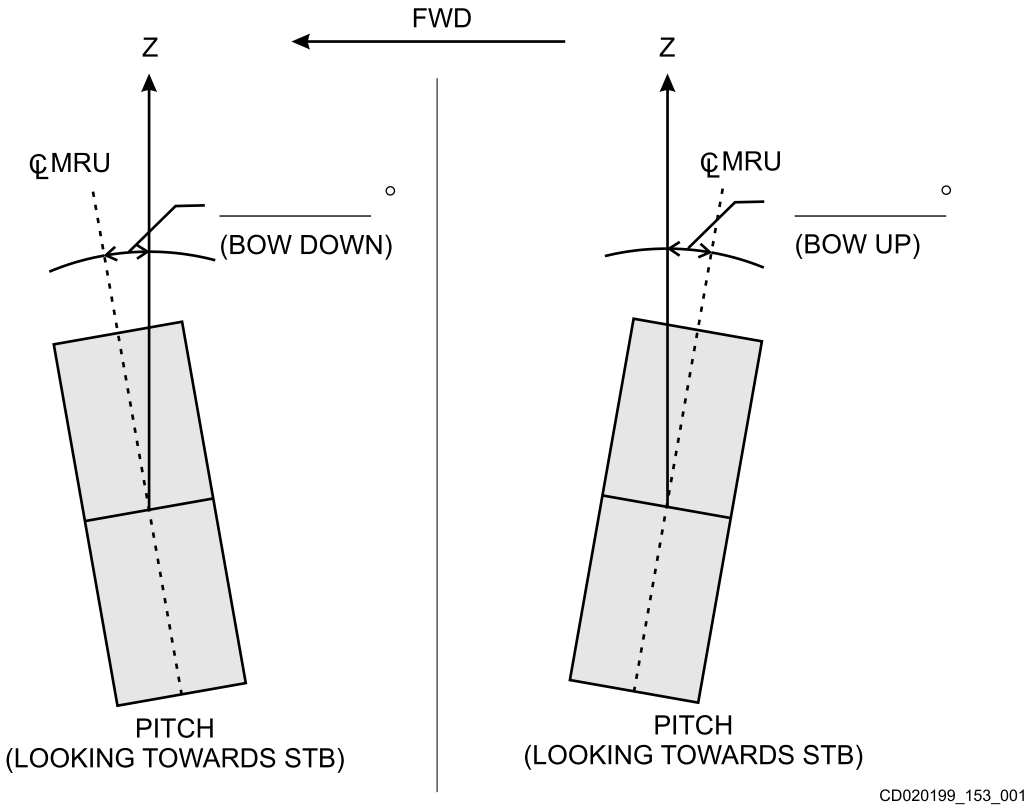


CD020199_151_001

Instructions

- Enter distances from CRP along the defined X-, Y- and Z-axes
- Indicate reference directions of the MRU installation that clarifies which way the unit is mounted

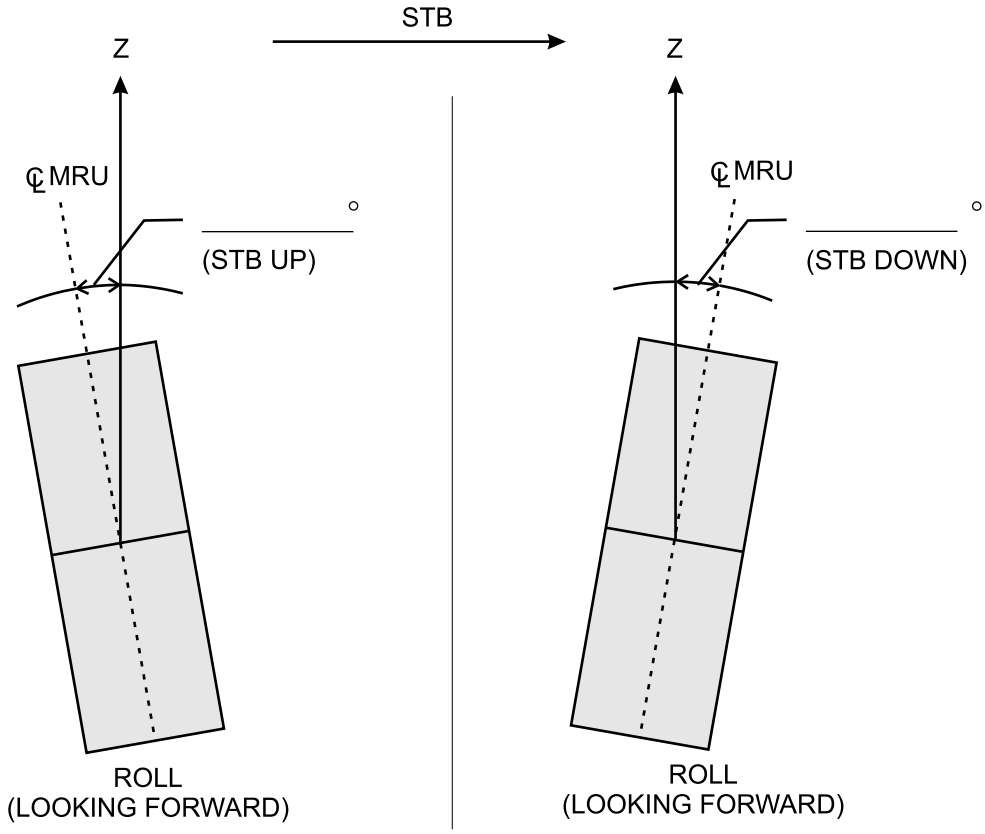
Figure 4 MRU pitch



Instructions

- Use only the sketch that applies to your MRU installation, i.e. pointing down in bow (fore) or aft direction
- Enter angle between MRU centre axis and vessel coordinate Z-axis along the fore-aft direction

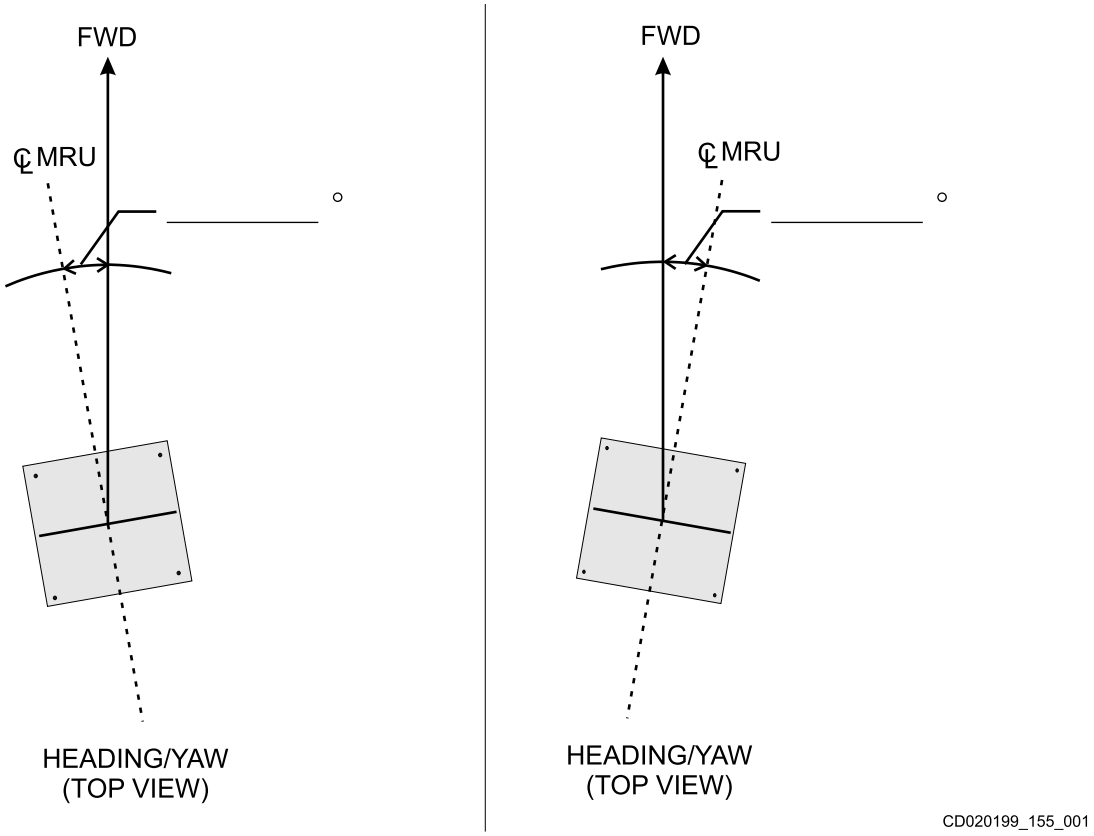
Figure 5 MRU roll



Instructions

- Use only the sketch that applies to your MRU installation, i.e. pointing down in port or starboard direction
- Enter angle between MRU centre axis and vessel coordinate Z-axis along the port-stb direction

Figure 6 MRU heading/yaw



Instructions

- Use only the sketch that applies to your MRU installation, i.e. pointing to port or starboard side of the vessel centre line
- Enter angle between MRU centre axis and vessel coordinate forward axis along as seen from above

GPS heading sensor

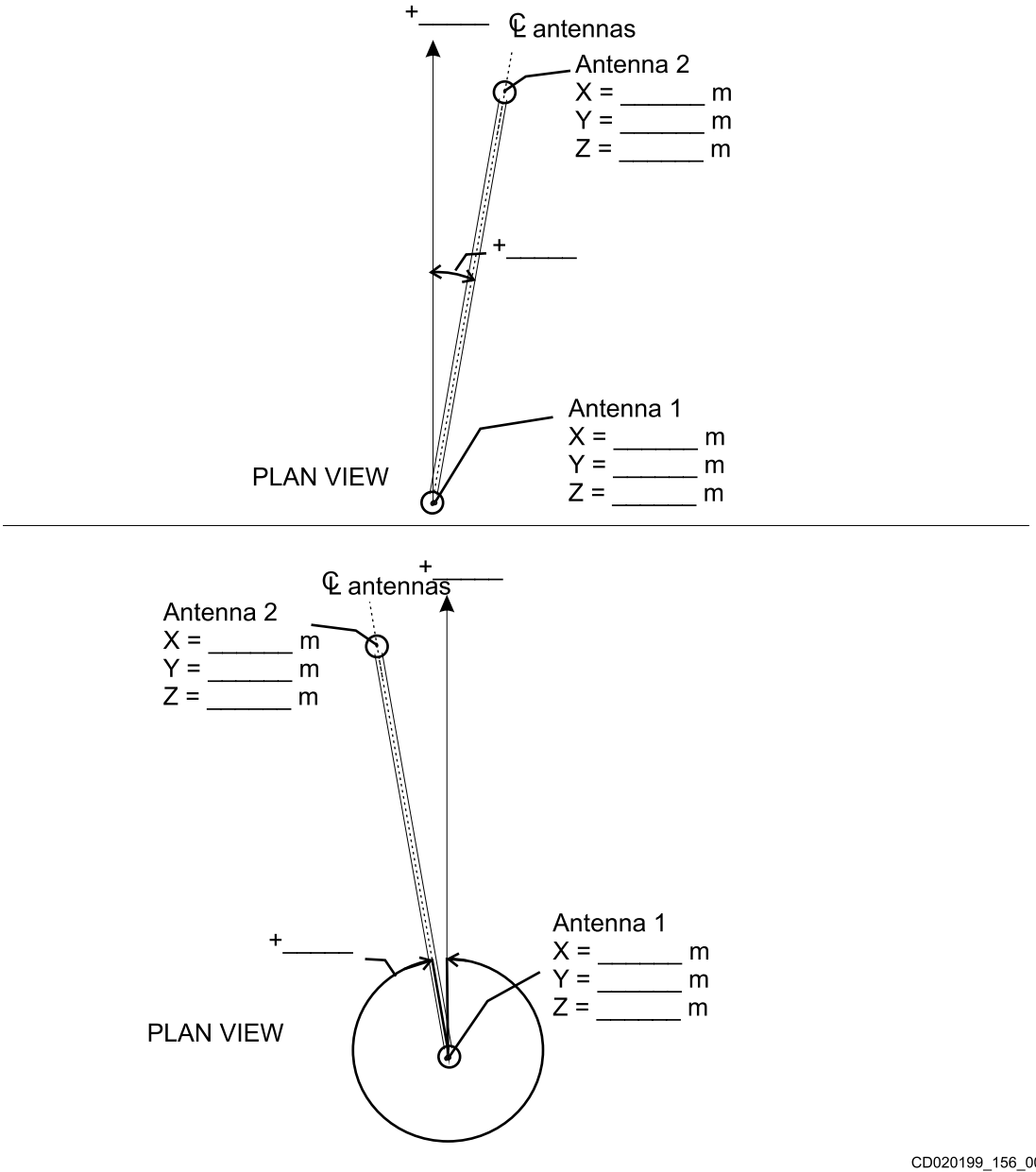
Note

Applies to any system that uses GPS/GNSS for heading determination, e.g. Seapath and POSMV.

Table 7 GPS heading alignment (Seapath, POSMV, etc.)

	Antenna 1	Survey accuracy
x		
y		
z		
	Antenna 2	Survey accuracy
x		
y		
z		
	Heading (1-2)	Survey accuracy
Heading rel. vessel ref. system		
Remarks		

Figure 7 GPS heading



Instructions

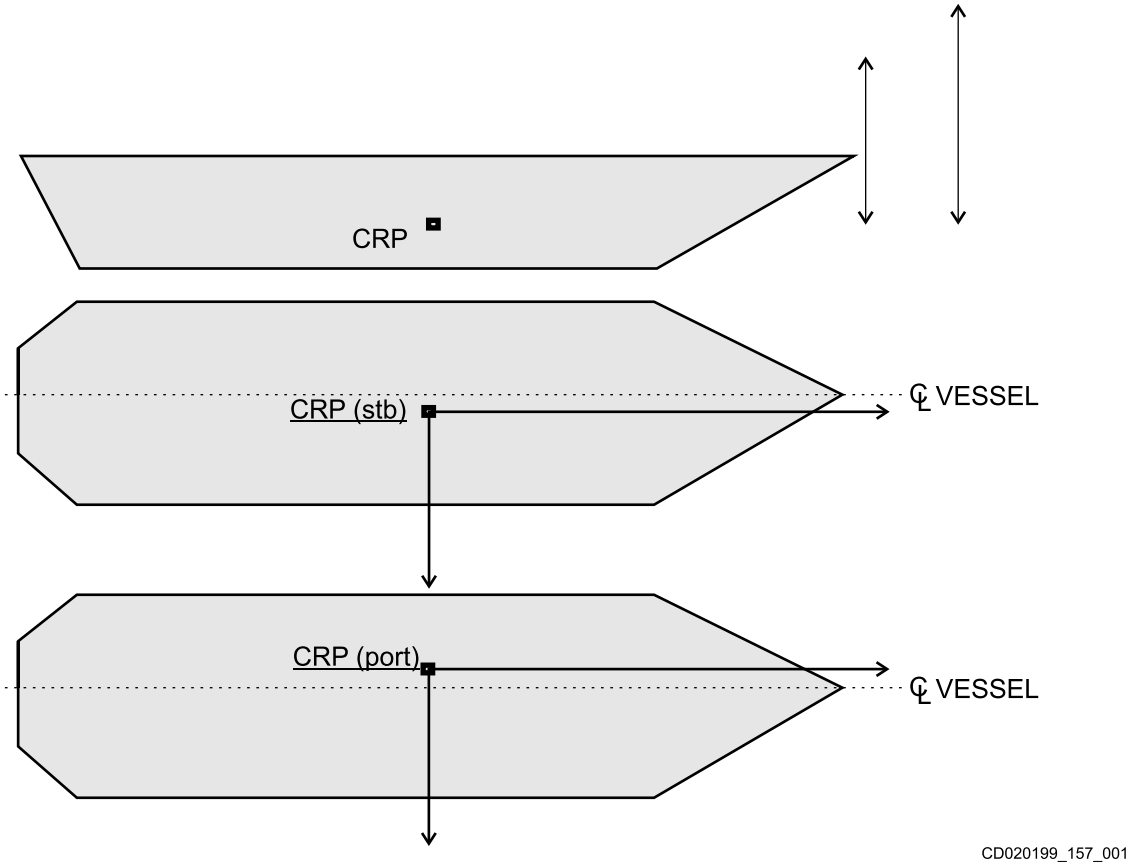
- Use only the sketch that applies to your installation, i.e. pointing port or starboard as seen from above
- Enter reference direction, i.e. whether antenna direction referred to X or Y direction (forward or sideways)
- Enter angle between antenna centre axis and reference axis
- Enter distances from CRP along the defined X-, Y- and Z-axes

Position sensor

Table 8 Position sensor alignment summary

	Antenna 1	Accuracy
x		
y		
z		
	Antenna 2	Accuracy
x		
y		
z		
	Antenna 3	Accuracy
x		
y		
z		
	Antenna 4	Accuracy
x		
y		
z		
	Antenna 5	Accuracy
x		
y		
z		

Figure 8 Position system



Instructions

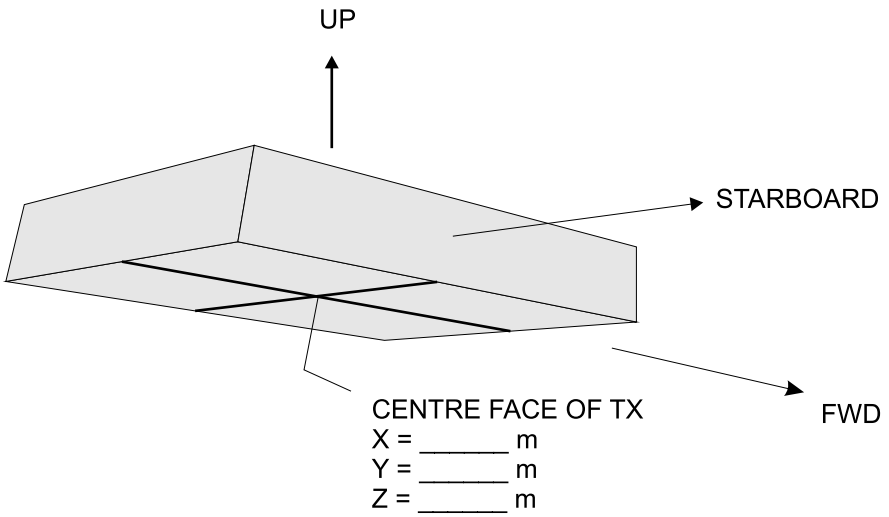
- Use only the sketch that applies to your installation, i.e. CRP on port or starboard side of vessel centre line
- Indicate all antenna locations on sketch, both height and as seen from above
- Enter definition of axes

Transmit transducer

Table 9 TX transducer

	TX Starboard side	TX Port side	Survey accuracy
x			
y			
z			
roll			
pitch			
yaw			
Remarks			

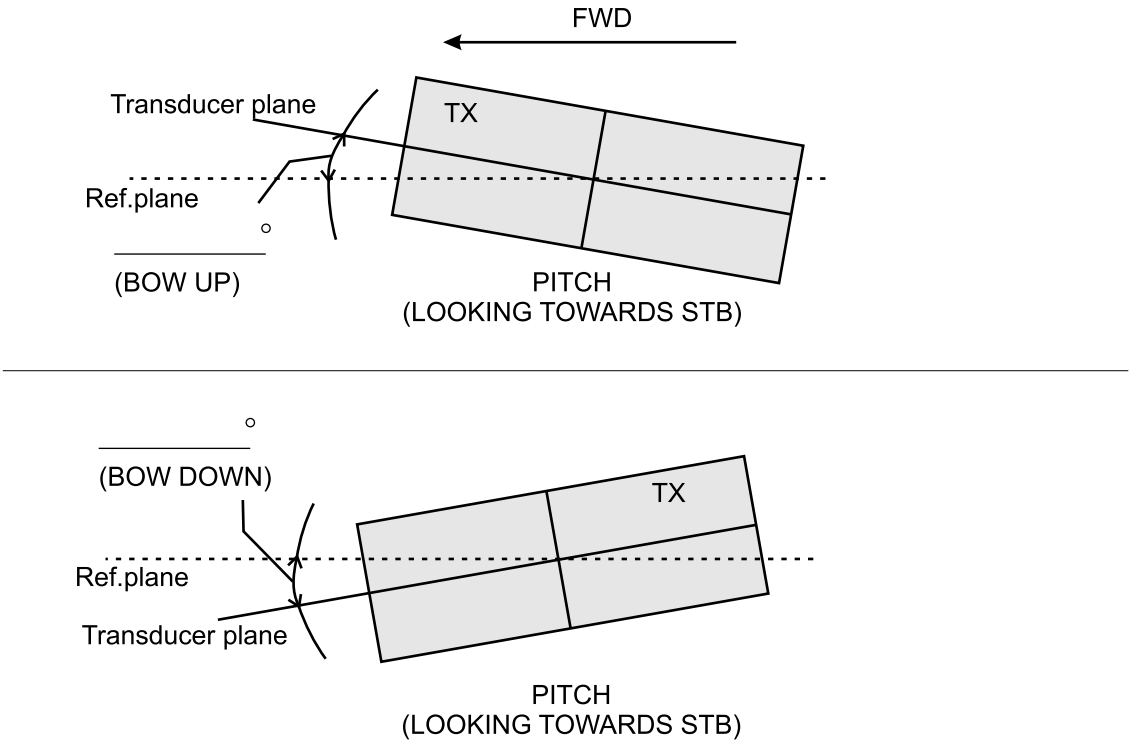
Figure 9 TX position



Instructions

- Enter distances from CRP along the defined X-, Y- and Z-axes

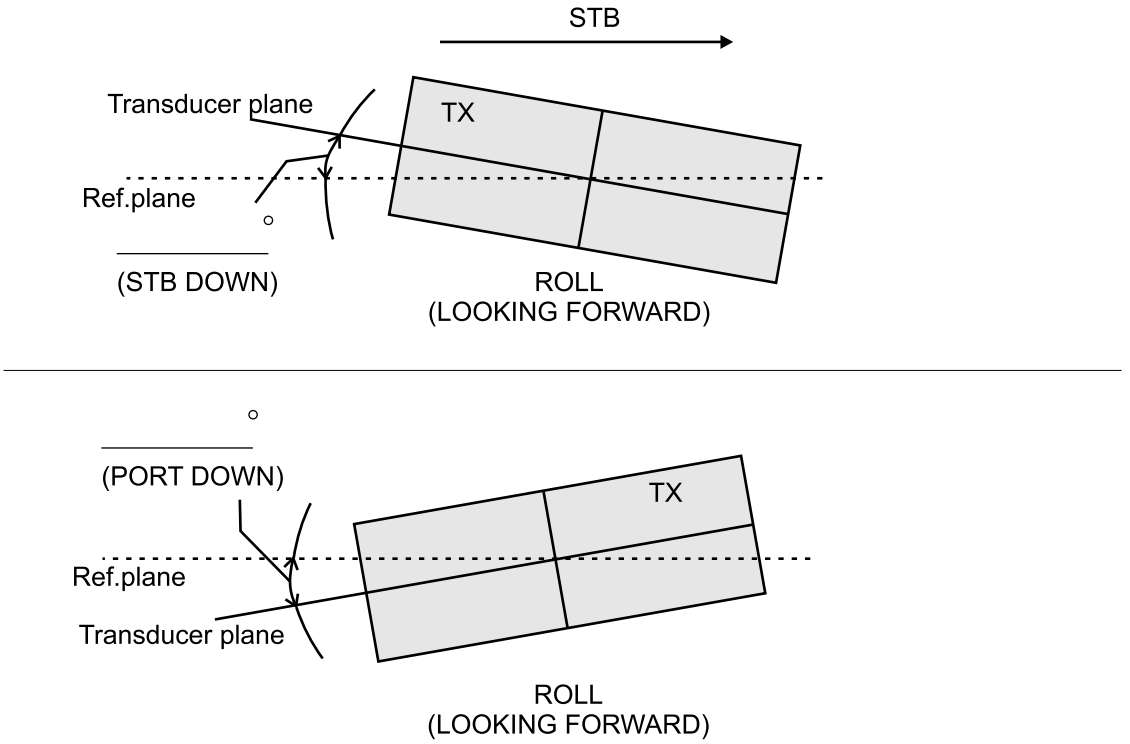
Figure 10 TX pitch



Instructions

- Use only the sketch that applies to your TX array installation, i.e. pointing down in bow (fore) or aft direction
- Enter angle between transducer plane and vessel reference axis along the fore-aft direction
- Enter definition of fore-aft direction (X or Y)

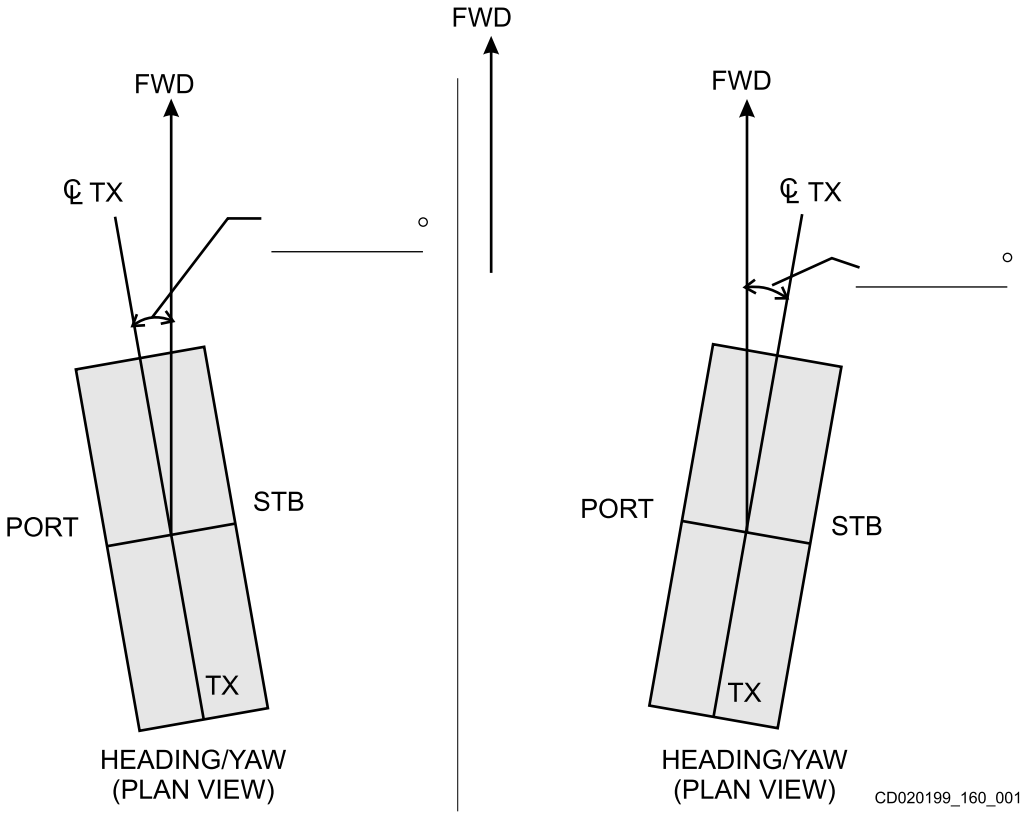
Figure 11 TX roll



Instructions

- Use only the sketch that applies to your TX array installation, i.e. pointing down on port or starboard side
- Enter angle between transducer plane and vessel reference axis along the port-stb direction
- Enter definition of port-stb direction (X or Y)

Figure 12 TX heading/yaw



Instructions

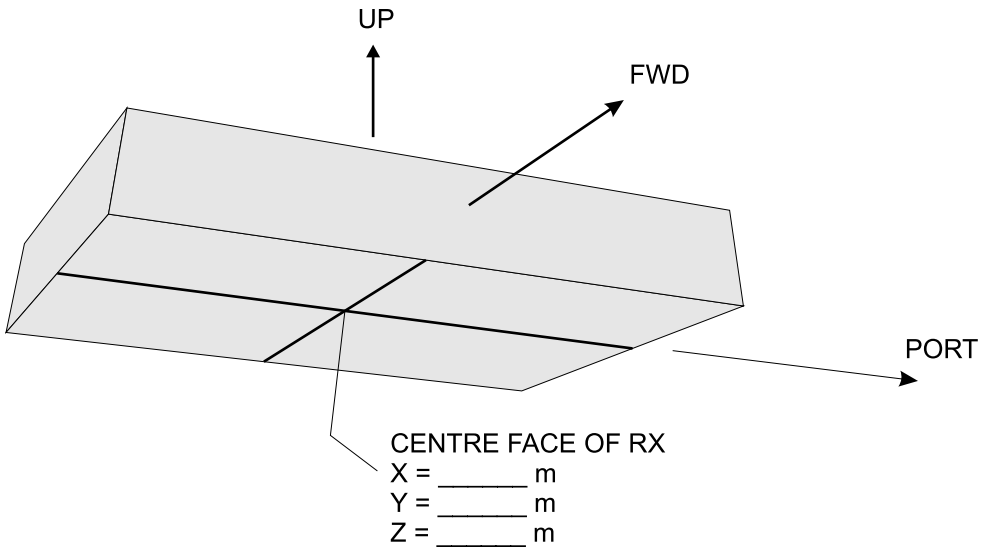
- Use only the sketch that applies to your TX array installation, i.e. heading to port or starboard side
- Enter angle between transducer centre line and vessel forward axis
- Enter definition of forward direction (X or Y)

Receive transducer

Table 10 RX transducer

	RX Starboard side	RX Port side	Survey accuracy
x			
y			
z			
roll			
pitch			
yaw			
Remarks			

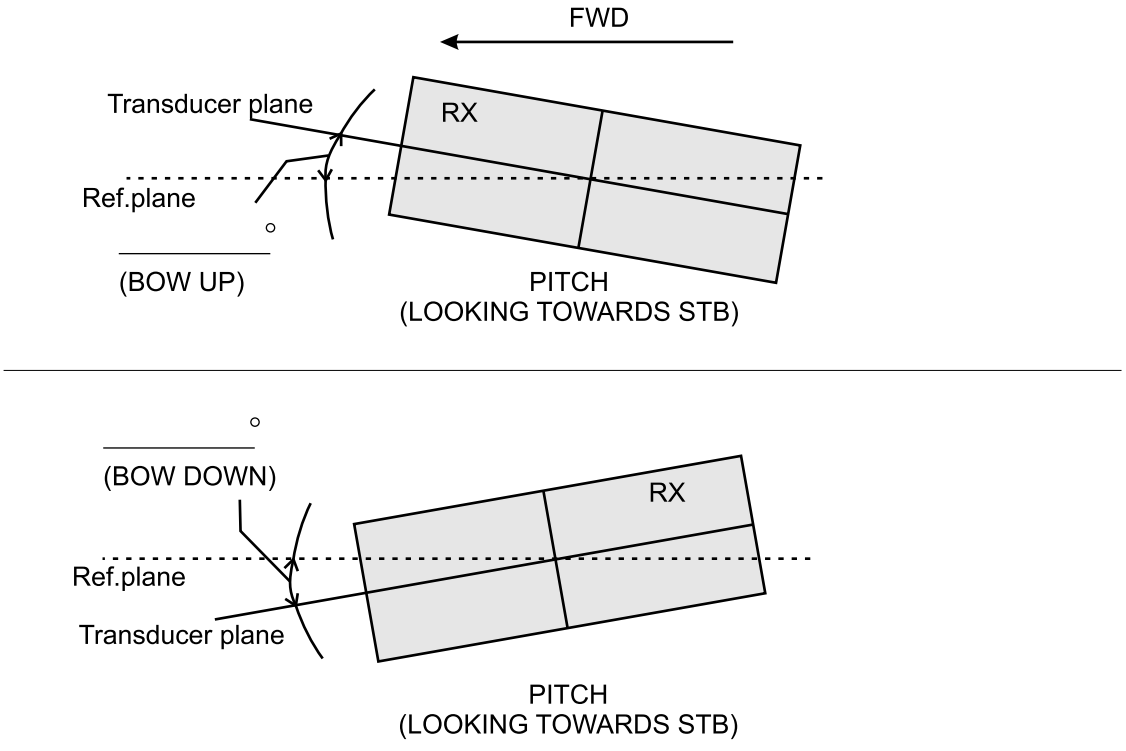
Figure 13 RX position



Instructions

- Enter distances from CRP along the defined X-, Y- and Z-axes

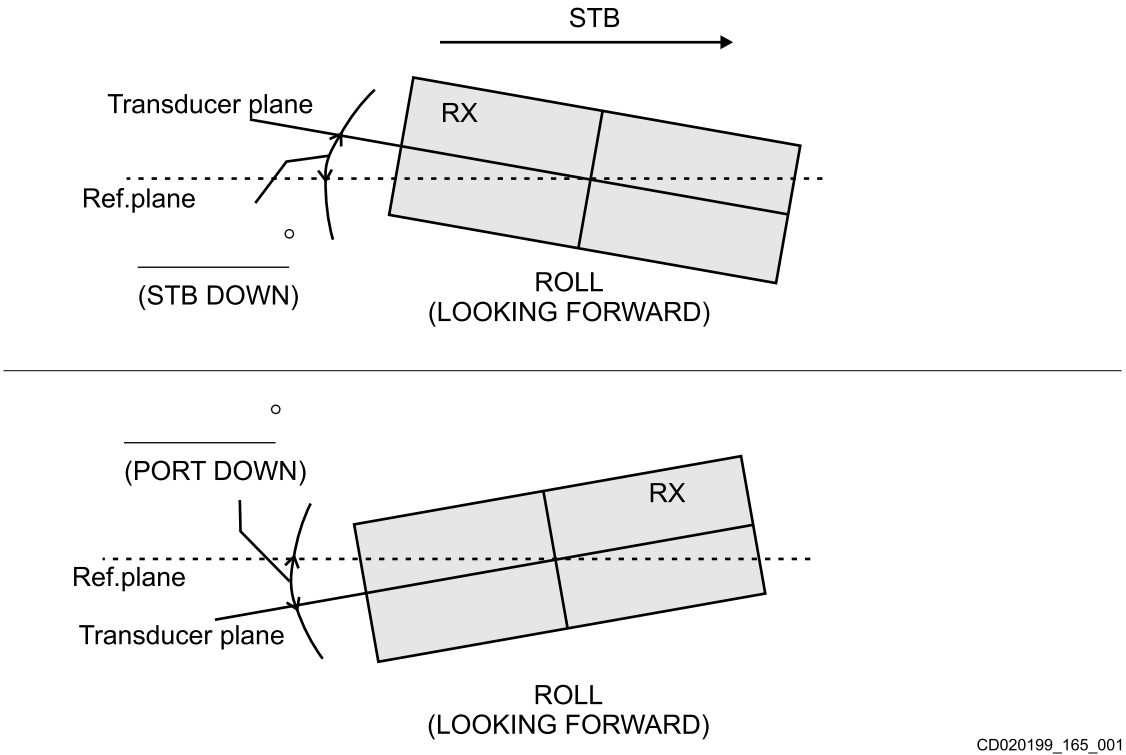
Figure 14 RX pitch



Instructions

- Use only the sketch that applies to your RX array installation, i.e. pointing down in bow (fore) or aft direction
- Enter angle between transducer plane and vessel reference axis along the fore-aft direction
- Enter definition of fore-aft direction (X or Y)

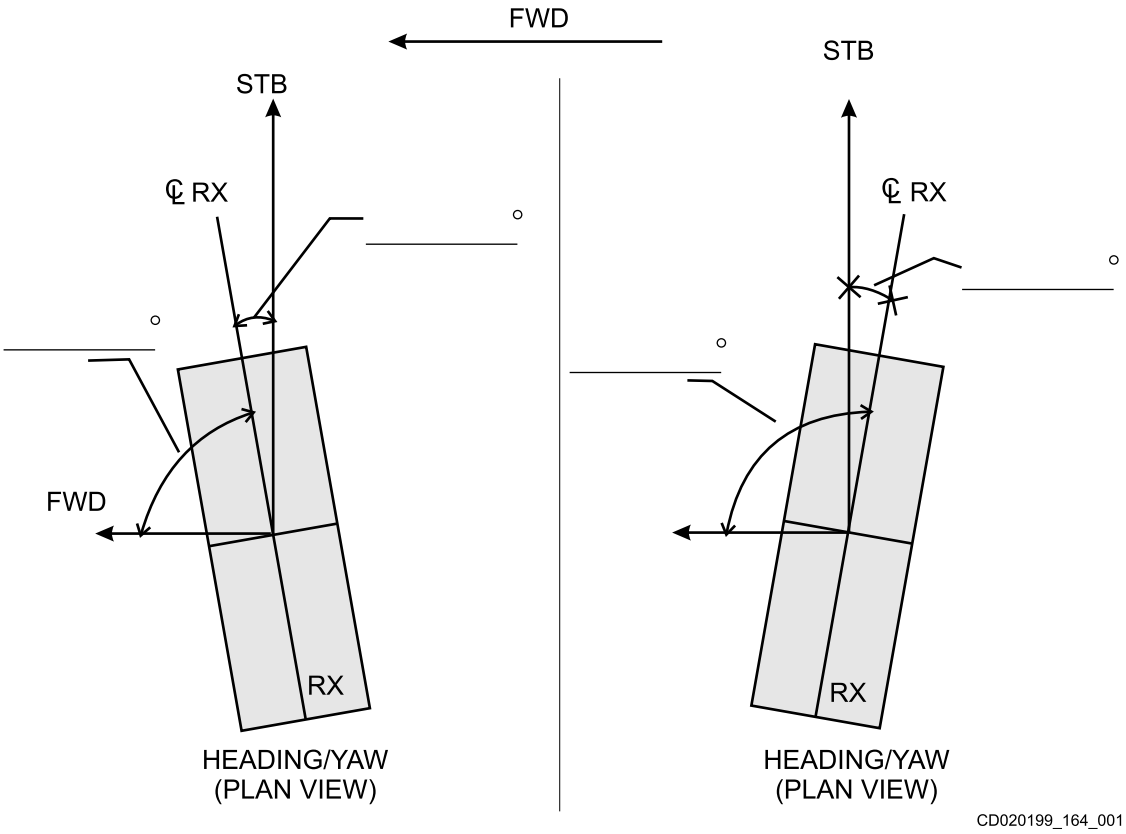
Figure 15 RX roll



Instructions

- Use only the sketch that applies to your RX array installation, i.e. pointing down on port or starboard side
- Enter angle between transducer plane and vessel reference axis along the port-stb direction
- Enter definition of port-stb direction (X or Y)

Figure 16 RX heading/yaw



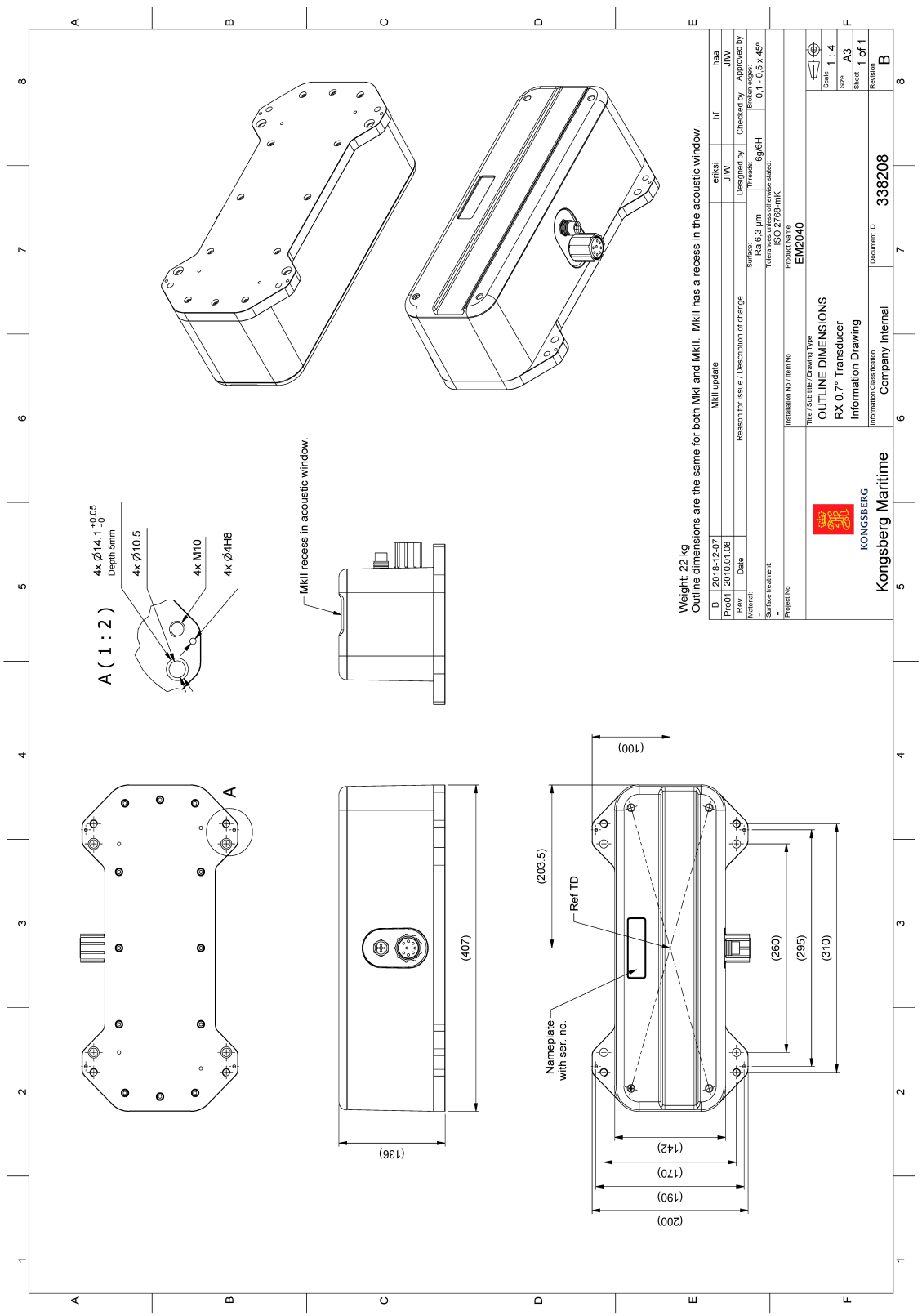
Instructions

- Use only the sketch that applies to your RX array installation, i.e. heading towards fore or aft side
- Enter angle between transducer centre line and vessel starboard axis
- Enter definition of starboard direction (X or Y)

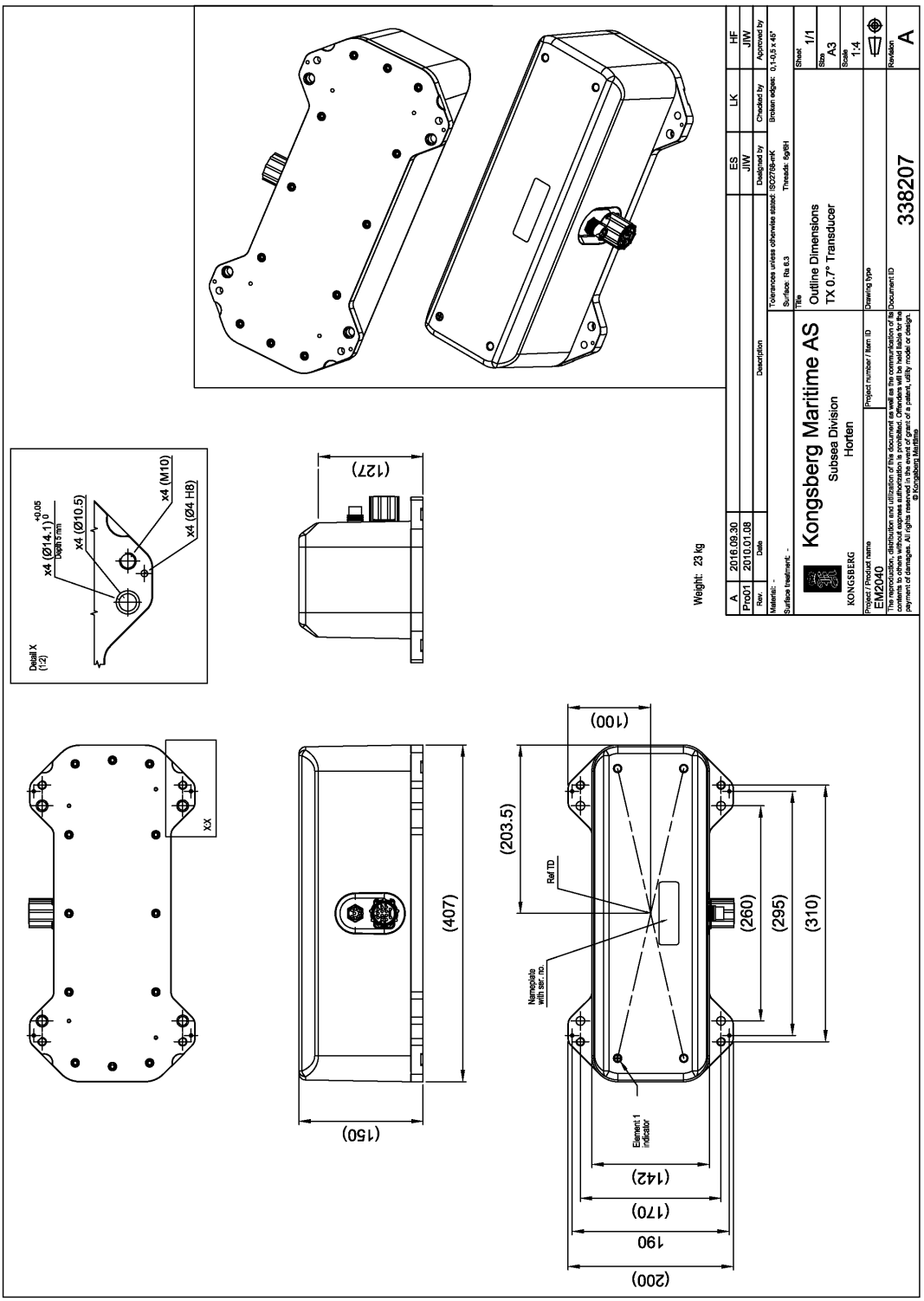
Drawing file

Topics

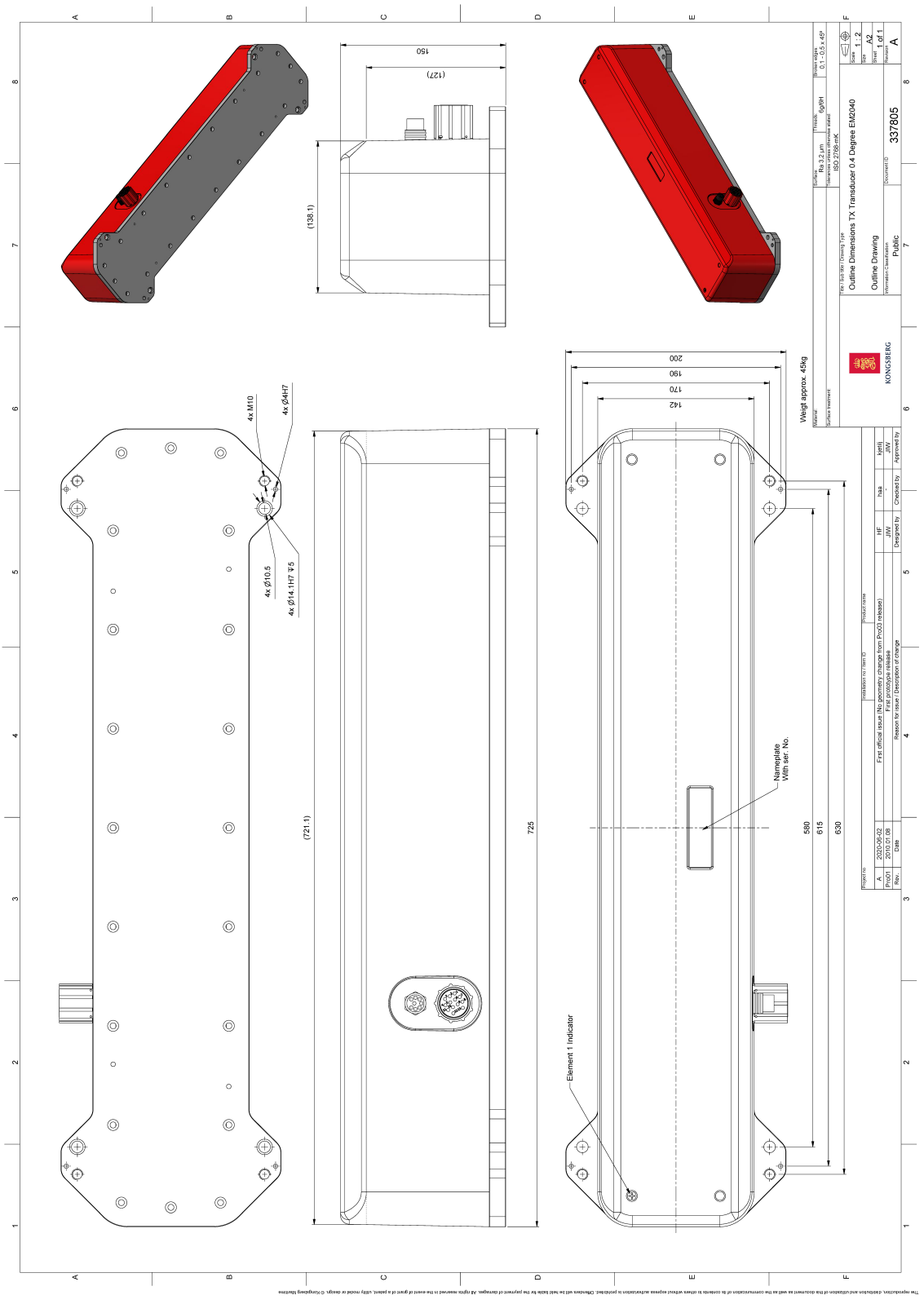
338208 RX transducer outline dimensions - 0.7 degrees



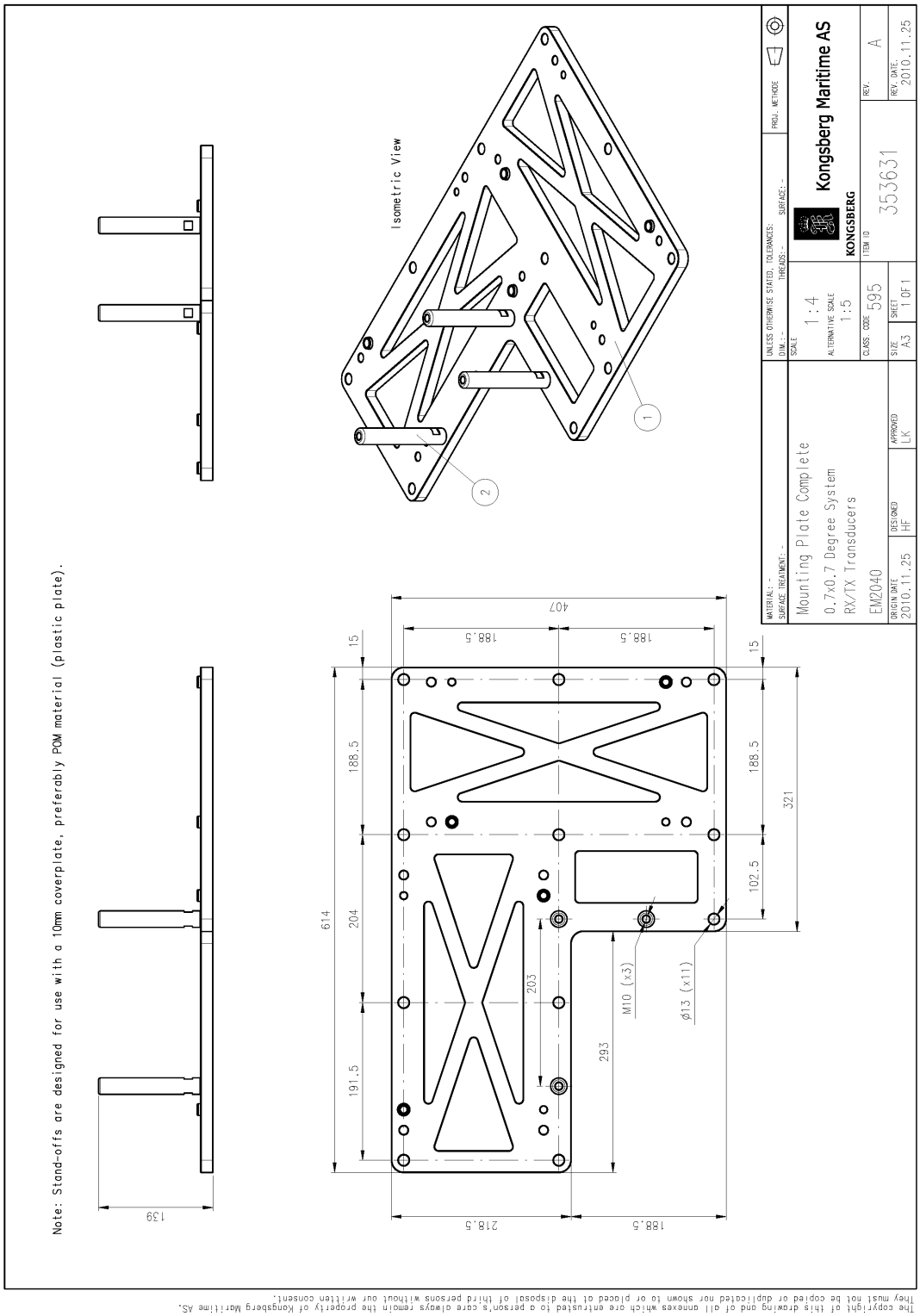
338207 TX transducer outline dimensions - 0.7 degrees



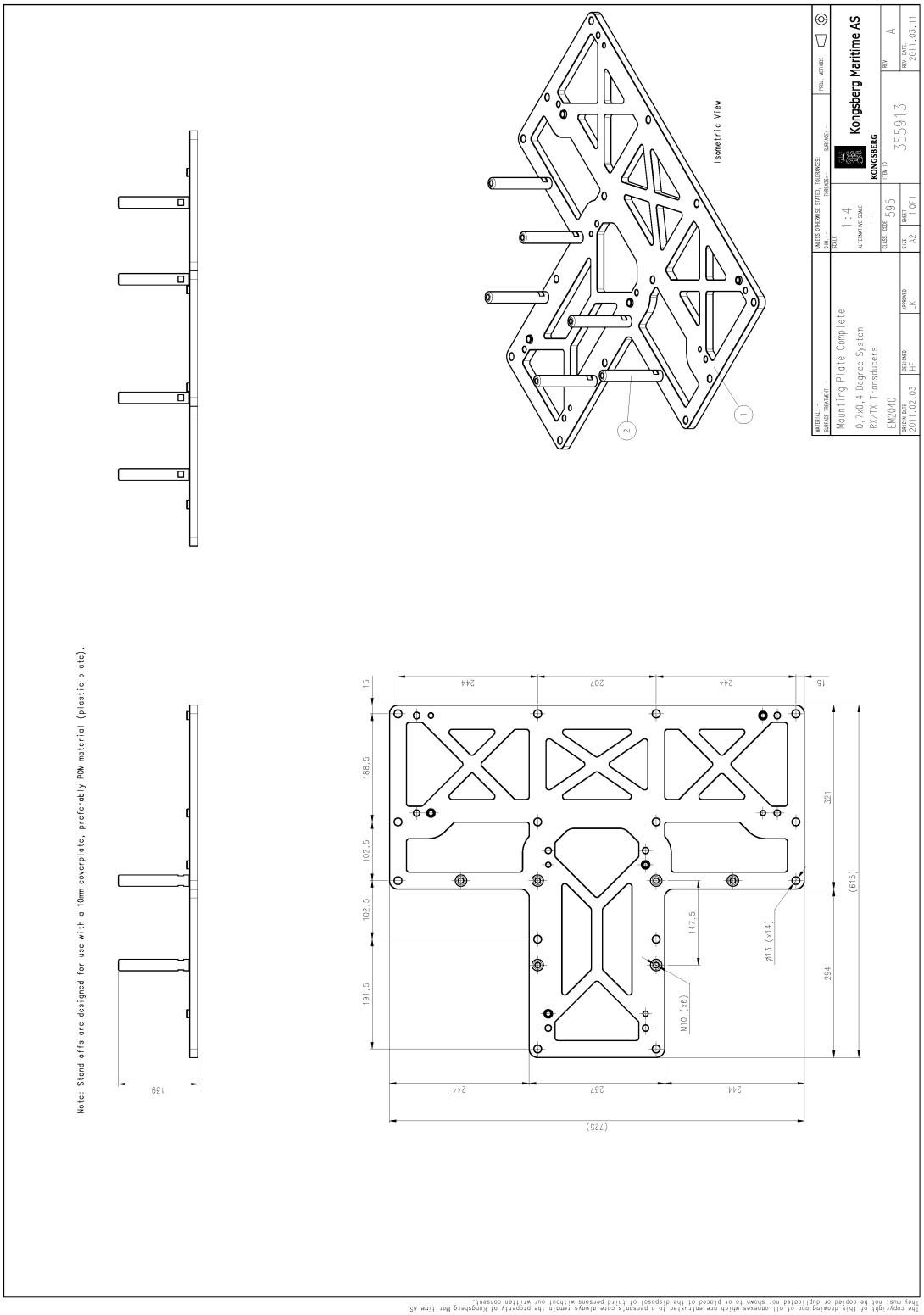
337805 TX transducer outline dimensions - 0.4 degrees



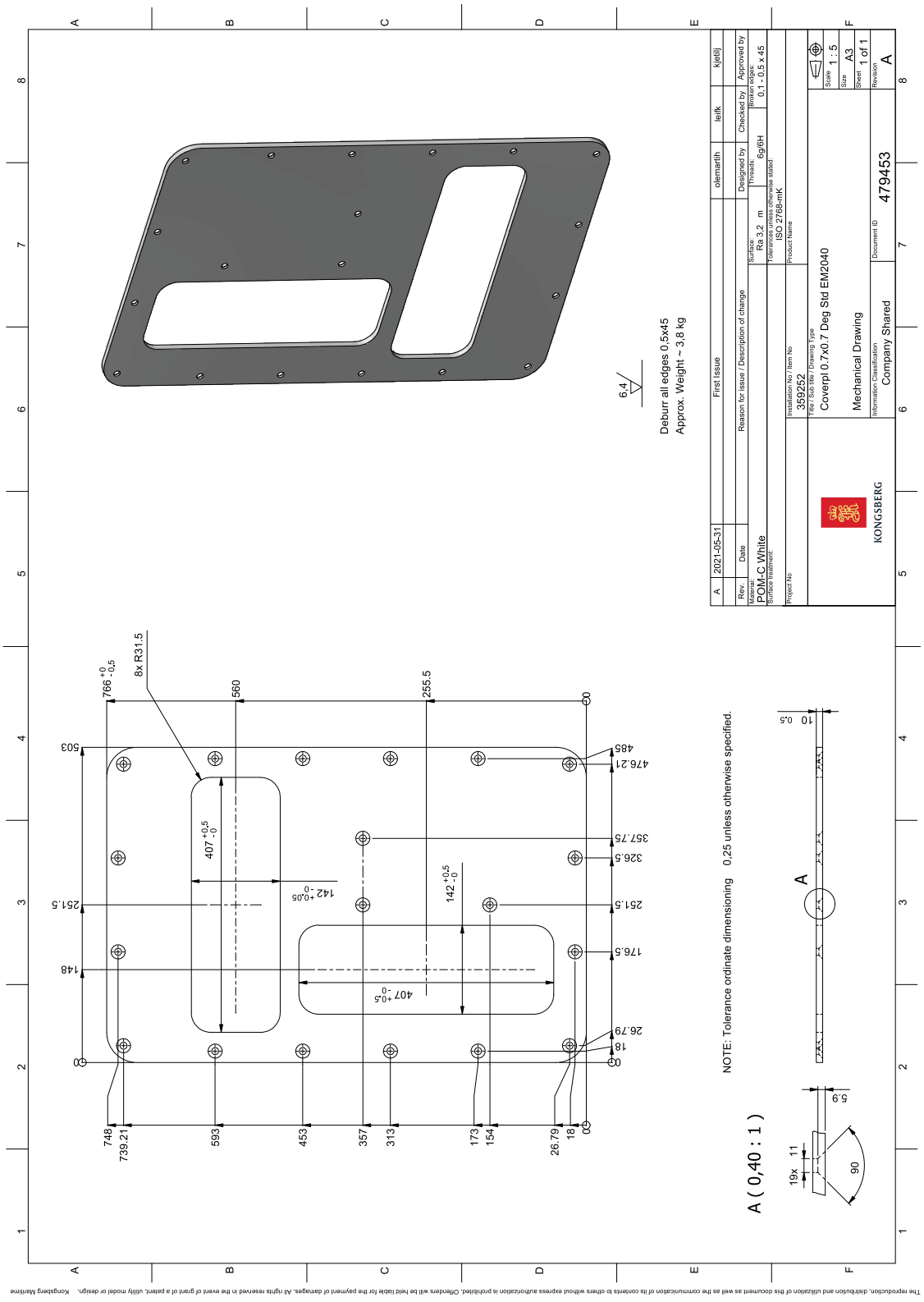
353631 Transducer mounting plate - 0.7 x 0.7 degrees



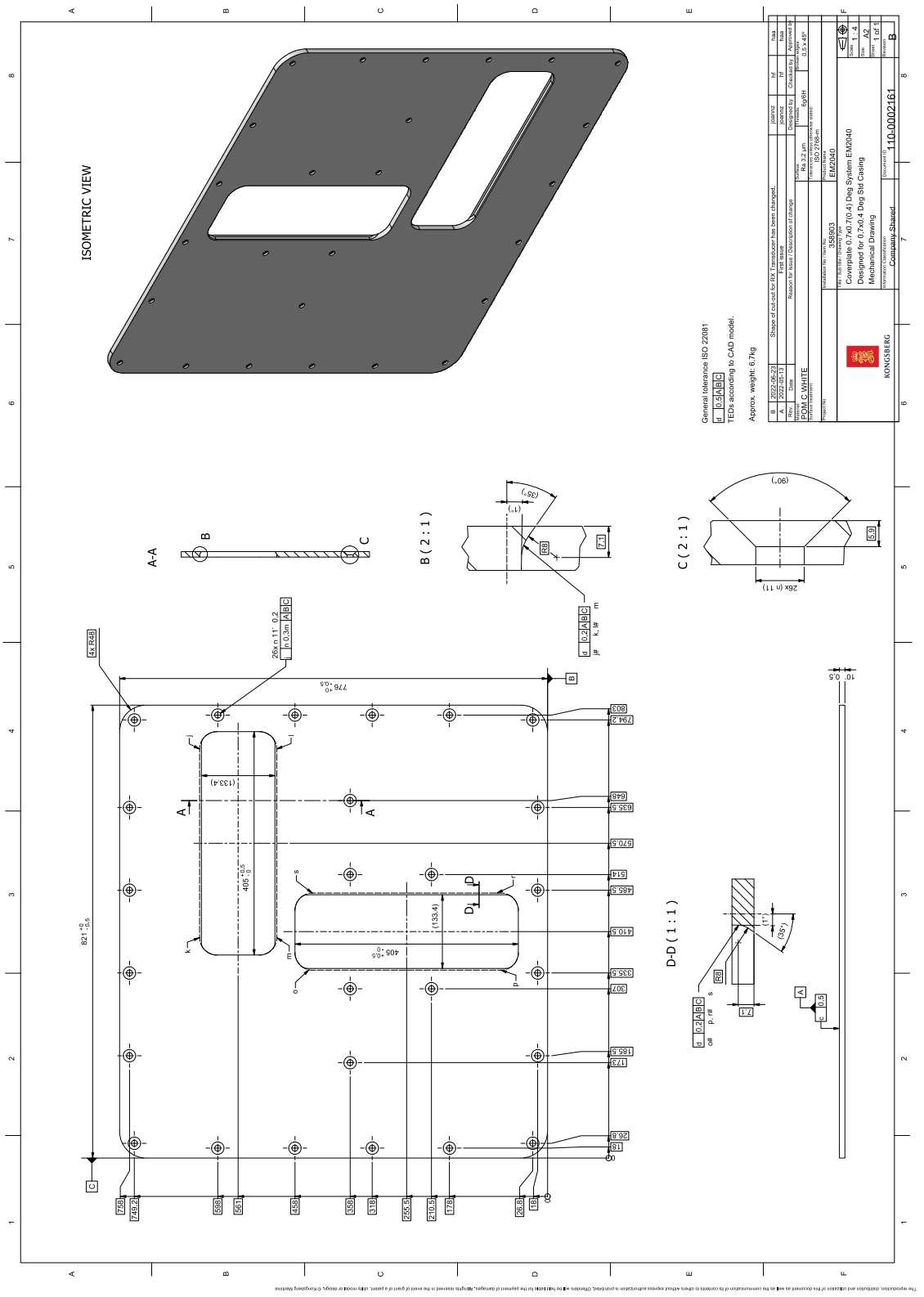
355913 Transducer mounting plate - 0.4 x 0.7 degrees



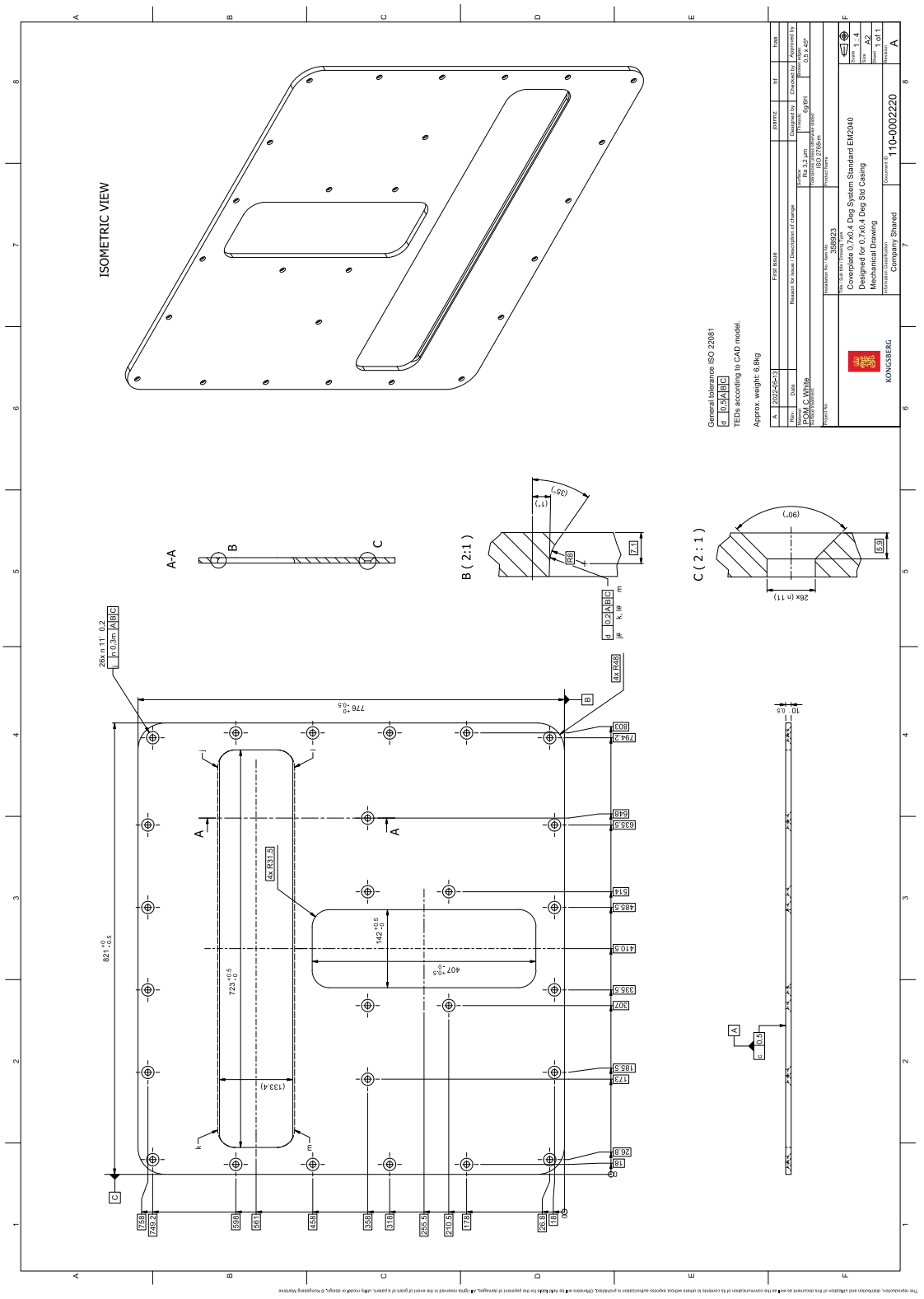
479453 Cover plate - 0.7 x 0.7 degrees



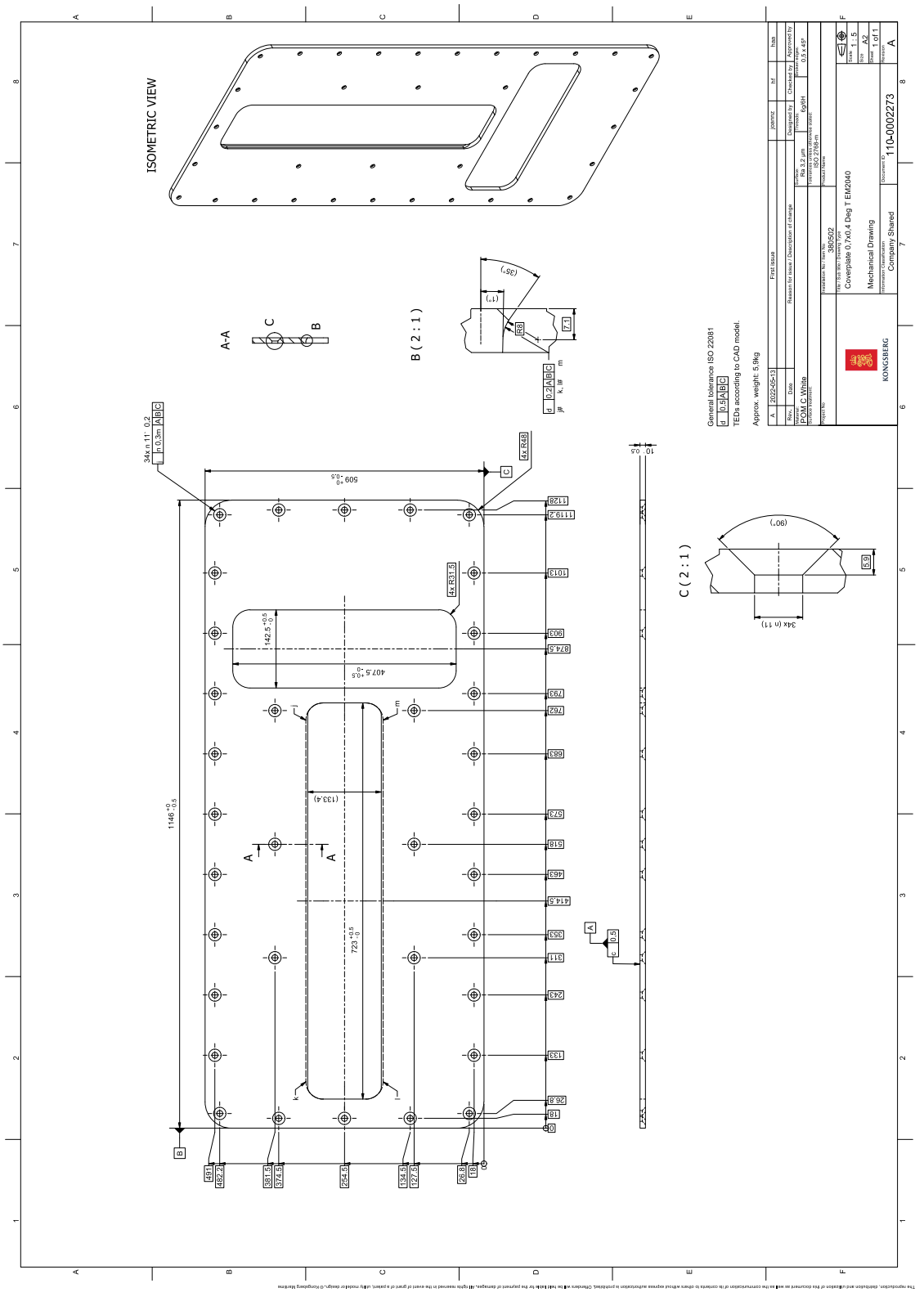
110-0002161 Cover plate - 0.7 x 0.7 degrees



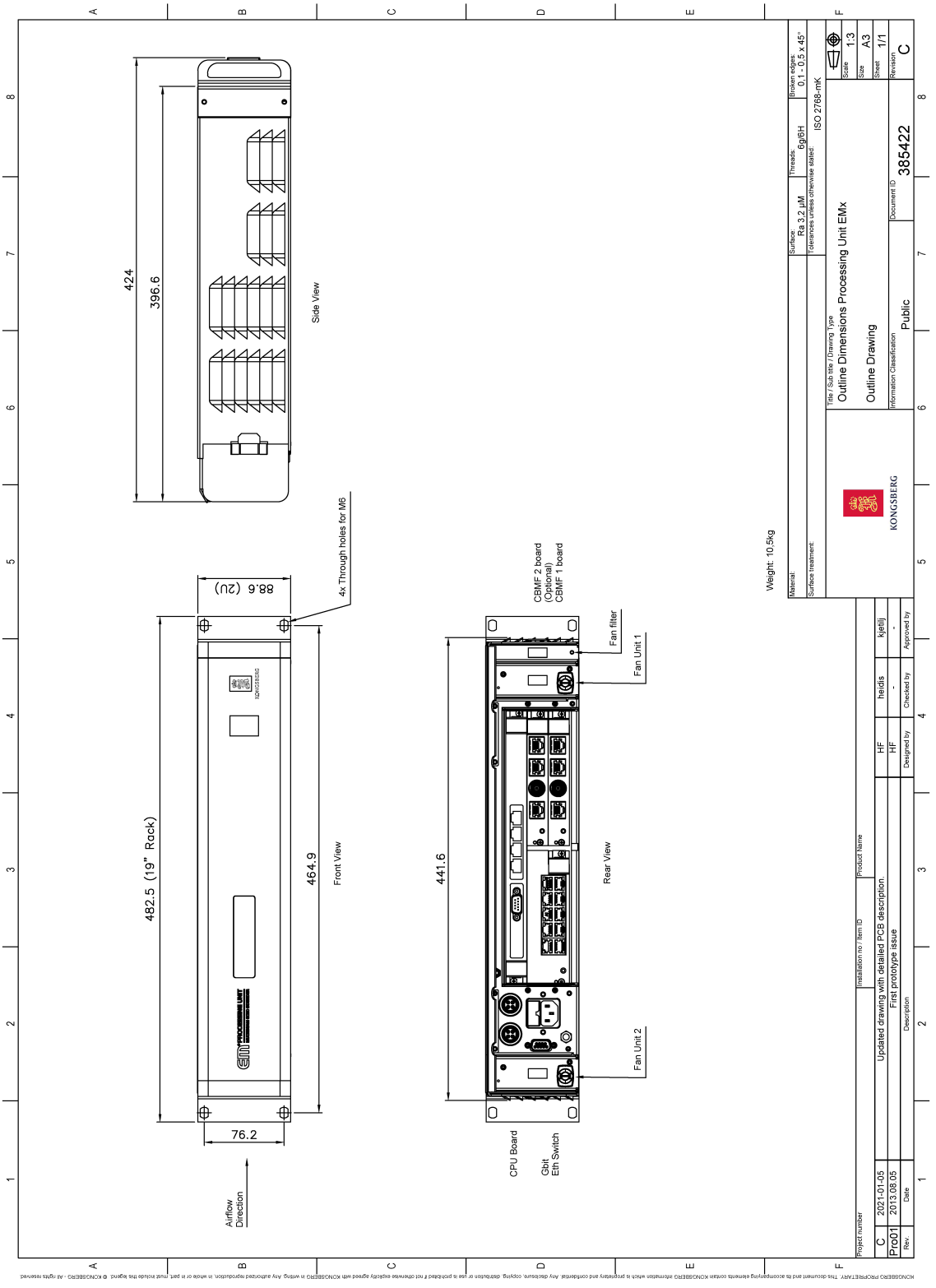
110-0002220 Cover plate - 0.4 x 0.7 degrees



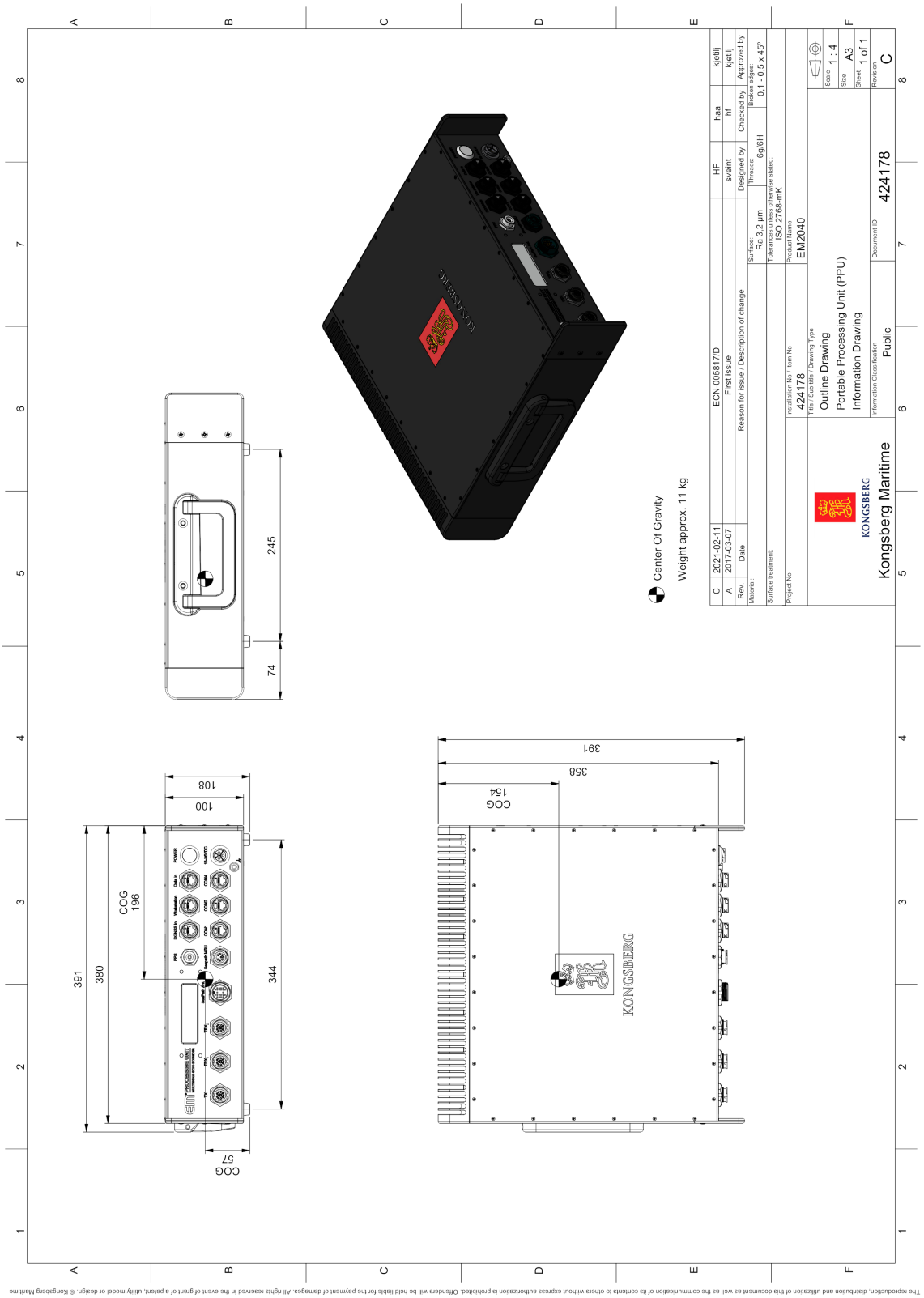
110-0002273 Cover plate - 0.4 x 0.7 degrees



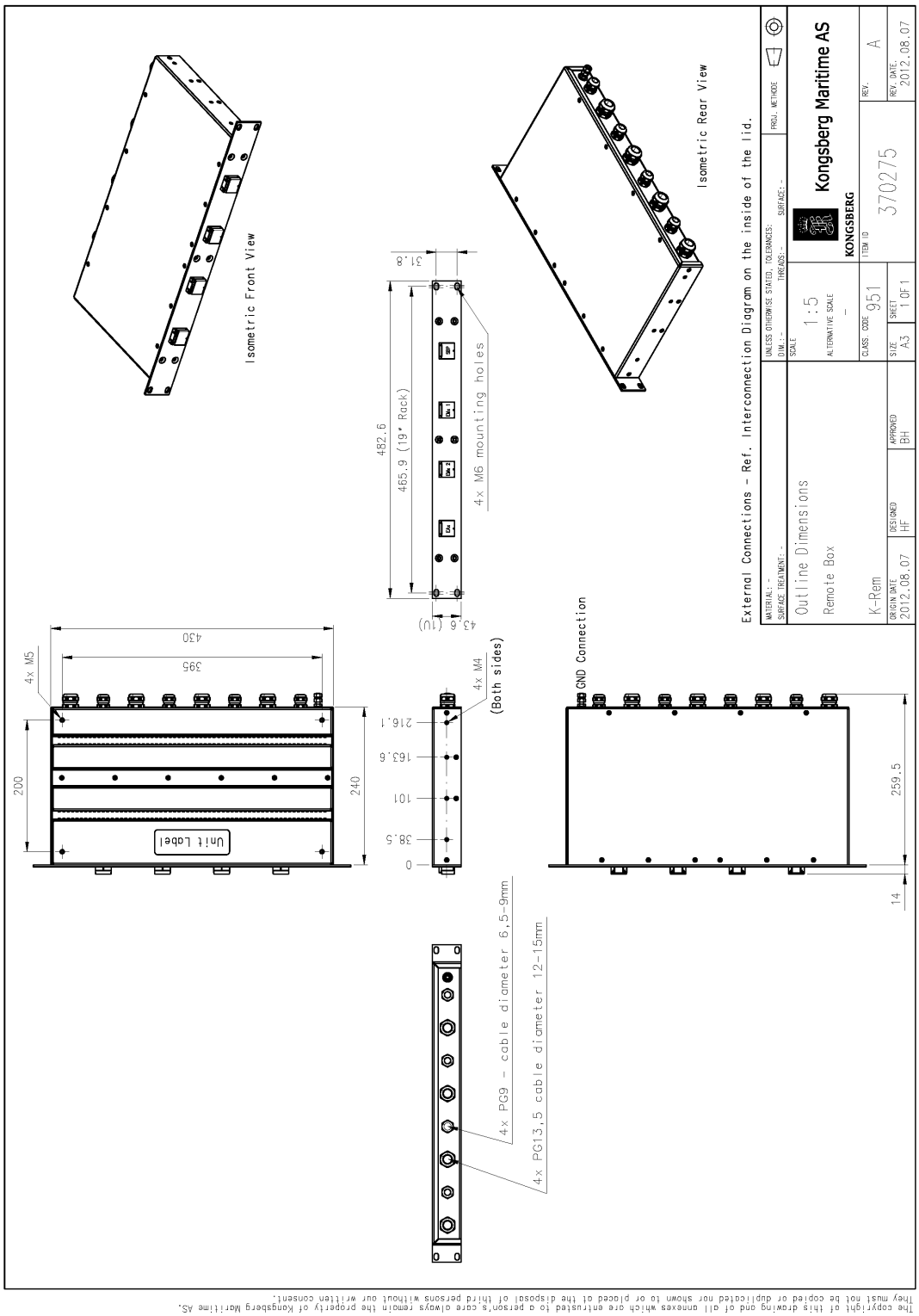
385422 Processing Unit dimensions



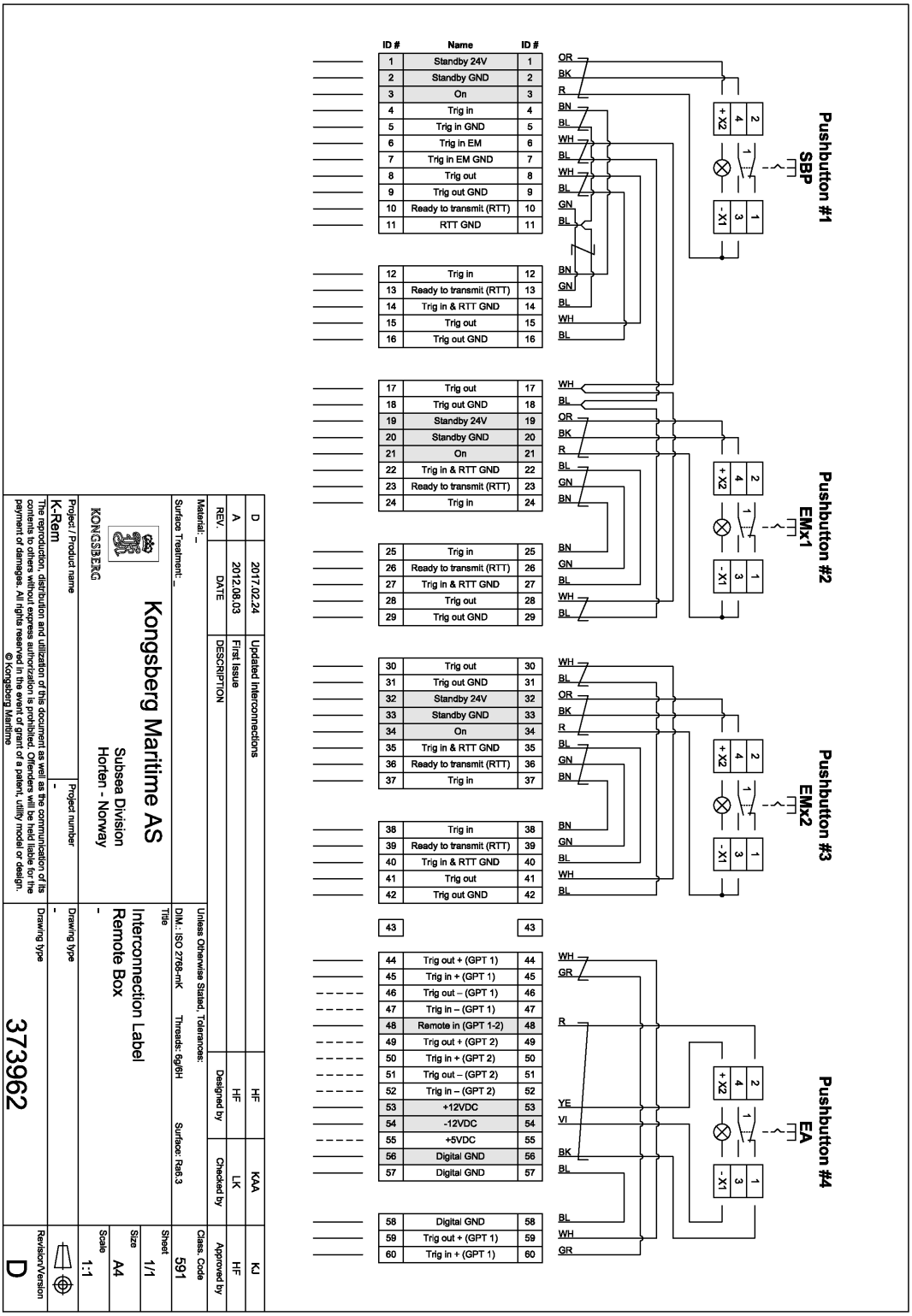
424178 Portable Processing Unit dimensions



370275 Remote Control Unit (K-REM) dimensions



373962 Remote Control Unit (K-REM) wiring diagram



Related topics

Interface to Remote Control Unit for external synchronisation, page 108
K-Sync interface to Remote Control Unit, page 109
Remote Control using K-Rem, page 112

Technical specifications

Topics

Interface specifications

Topics

Different datagram formats

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

Table 11 Data format supported by Multibeams

KMall format	all format	Both formats
EM 304	EM 710	EM 2040
EM 124	EM 302	EM 2040C
	EM 122	EM 2040P
		EM 712

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 data 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.

Newer generation multibeams will only have support for KMall format, and as such will require K-Controller and SIS 5.

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

all format

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

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

For multibeams that supports both formats, Kongsberg will continue to do maintenance and bug fixing for all and SIS 4. Any new feature development will only be available for KMall and SIS 5. Upgrading to the new format, K-Controller and SIS 5 is free, but new features might be licensed.

Change between data formats

How to change PU SW from SIS 4 with all format to SIS 5 with KMall format or from SIS 5 with KMall format to SIS 4 with all format.

From the installation medium, follow the instructions to install SIS on the work station and EM 2040 MKII.

From SIS 4 to SIS 5, start program `C:\Program Files\Kongsberg Maritime\EMSystem\K-Controller\PU\EMxxxx\Update\EMSWUpgrade.exe`

From SIS 5 to SIS 4, start program `C:\Program Files(86)\Kongsberg Maritime\SIS\PU\EMxxxx\Update\EMSWUpgrade.exe`

Do this steps to change PU SW to match SIS and data format.

1 Compare the SW versions. Difference will be marked.

2 Upgrade the selected SW items.

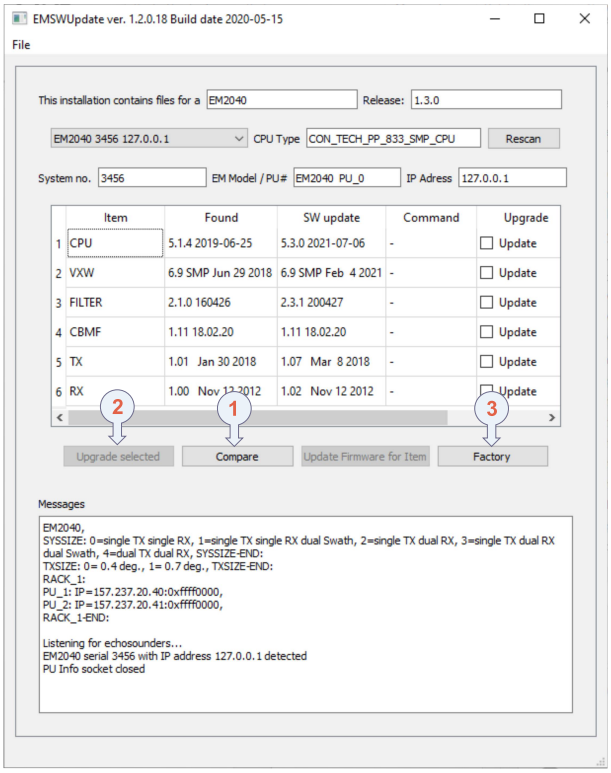
3 Set system to Factory setting.

Make sure all files are downloaded. Pay attention to the message window, no error messages should appear.

After upgrade reboot PU.

Note

Do not reboot PU until all files are successfully downloaded.



CD020104_400_001

In doubt contact KM.hydrographic.support@km.kongsberg.com for advice.

If it fails try to restart the program EMSWUpgrade.exe do the upgrade again.

Interface specifications - Processing Unit - all format

The EM 2040 MKII 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 the all format.

Supported datagram formats for GPS (position) information

The EM 2040 MKII system 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 2040 MKII 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 2040 MKII system 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 2040 MKII system 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 format.

- **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 2040 MKII system supports the following datagram format from a motion sensor:

These datagram formats are received using a serial communication line.

- **Kongsberg EM Attitude 3000**

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

Supported datagram formats for motion information including velocity

The EM 2040 MKII system supports the following datagram formats from a motion sensor:

These datagram formats are received using a serial communication line.

- **KM Binary**

  KM Binary is a generic 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 Maritime (https://www.kongsberg.com/maritime/), former Kongsberg Seatex, for position, attitude and velocity data from the Seapath sensor.

- **Seapath Binary 23**

  The Seapath 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 synchronization
- 1 pulse per second (1PPS) clock synchronization signal

Interface specifications - Processing Unit - KMall format

The EM 2040 MKII 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 the KMall format.

Supported datagram formats for GPS (position) information

The EM 2040 MKII system 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 2040 MKII 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 depth information

The EM 2040 MKII system supports the following datagram formats for depth information from an echo sounder:

These datagram formats are received using a serial or Ethernet (LAN) line.

- **NMEA DPT**

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

- **NMEA XDR**

  The NMEA XDR datagram provides measurement data from transducers that measure physical quantities such as temperature, force, pressure, frequency, angular or linear displacement, etc.

  In this context the XDR datagram is used as XDR-P to provide the depth from waterline.

- **Digiquartz pressure sensor**

  This datagram from Digiquartz contains depth from waterline and pressure.

Supported datagram formats for motion information

The EM 2040 MKII system supports the following datagram format from a motion sensor:

- **Kongsberg EM Attitude 3000**

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

Supported datagram formats for motion information including velocity

The EM 2040 MKII system supports the following datagram format from a motion sensor:

- **KM Binary**

  KM Binary is a generic 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.

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 synchronization
- 1 pulse per second (1PPS) clock synchronization signal

Output datagram formats

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

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 Hydrographic Work Station and configured in SIS 5. The EM 2040 MKII supports the following datagram format from a sound speed probe.

From SIS 5.9

From SIS 5.9 the SVPEditor accepts native formats from Valeport and AML, making it easy to use their native file formats.

Previous versions of SIS

The following datagram formats are supported from a sound speed probe.

- **AML Sound speed**

  AML is a third-party proprietary datagram format created by AML Oceanographic (http://www.amloceanographic.com) for use with their sound velocity probes. The file format is ASCII with a five-line header plus a variable number of data lines.

  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

External sensors requirements

The external sensors must fulfil these requirements to achieve the specified performance for the EM 2040 MKII system. Check with your sensor supplier if the sensor accuracy requirements are met and the required formats are supported.

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**: 0.2 degrees RMS
- **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.

Kongsberg supports a large range of sensor suppliers in addition to our own Kongsberg Seatex systems. The sensor must support datagram formats for motion information including velocity

Interface specifications - Hydrographic Work Station - all format

The EM 2040 MKII 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 the all format.

- Input of sound speed at transducer
- Output to Printer/plotter
- Input of sound speed profile (Ethernet or serial line)
- Input of tide input (Ethernet or serial line)
- Input of 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 2040 MKII 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 the KMall format.

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

Weights and outline dimensions

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

Transmit transducer - 0.4 degrees

- **Outline dimensions**:
  - **Length**: 725 mm
  - **Width**: 200 mm
  - **Height**: 150 mm
- **Weight**:
  - Weight (In air): 45 kg
  - Weight(In water): 30 kg
- **Volume**: 15 litres

Transmit transducer - 0.7 degrees

- **Outline dimensions**:
  - **Length**: 407 mm
  - **Width**: 200 mm
  - **Height**: 150 mm
- **Weight**:
  - Weight (In air): 23 kg
  - Weight(In water): 16 kg
- **Volume**: 8.6 litres

Receive transducer

- **Outline dimensions**:
  - **Length**: 407 mm
  - **Width**: 200 mm
  - **Height**: 136 mm
- **Weight**:
  - Weight (In air): 22 kg
  - Weight(In water): 16 kg
- **Volume**: 7.8 litres

Transducer mounting plate, 0.4 degrees

- **Outline dimensions**:
  - **Length**: 615 mm
  - **Width**: 725 mm
  - **Height**: 139 mm including support pillars
- **Weight**: 23 kg

Transducer mounting plate, 0.7 degrees

- **Outline dimensions**:
  - **Length**: 614 mm
  - **Width**: 407 mm
  - **Height**: 139 mm including support pillars
- **Weight**: 16 kg

Processing Unit

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

Portable Processing Unit

- **Make and model**: Kongsberg Maritime, EM PPU
- **Outline dimensions**:
  - **Depth**: 391 mm
  - **Width**: 391 mm
  - **Height**: 108 mm
- **Weight**: 10.5 kg

Hydrographic Work Station

For more detailed information about the different models of Hydrographic Work Station see the separate manual:

- *495770 - Hydrographic Work Station Instruction Manual*

Power requirements

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

Transducer

The power is normally supplied by the Processing Unit.

- **Voltage requirement**: 48 VDC
- **Maximum voltage deviation**: 10 %
- **Maximum power consumption**:
  - **Receive transducer**: 29 W (0.6 A)
  - **Transmit transducer 0.7 degrees**: 12 W (0.25 A) in CW mode, 24 W (0.5 A) in FM mode
  - **Transmit transducer 0.4 degrees**: 24 W (0.5 A) in CW mode, 48 W (1.0 A) in FM mode

Processing Unit

- **Make and model**: Kongsberg Maritime, EM PU
- **Voltage requirement**: 100 to 250 VAC, 47 to 63 Hz
- **Maximum power consumption**:
  - **With one CBMF board (without transducer)**: 115 W
  - **With two CBMF boards (without transducer)**: 125 W

Portable Processing Unit

- **Make and model**: Kongsberg Maritime, EM PPU
- **Voltage requirement**: 18 to 36 VDC, 24 VDC Nominal voltage
- **Maximum power consumption**:
  - **With one CBMF board (without transducer)**: 63 W
  - **With two CBMF boards (without transducer)**: 73 W

Dual Head Dual Swath systems are not available for the portable processing unit.

Processing Unit with Transducer

One CBMF card is required per swath. Consequently:

- Single RX Head systems require one CBMF card
- Dual RX Head systems require two CBMF cards

- Single RX Head Dual Swath systems require two CBMF cards
- Dual RX Head Dual Swath systems require two processing units with two CBMF cards in each processing unit

Dual Head Dual Swath systems are not available for the Portable Processing Unit.

System calculation examples:

EM 2040 MKII 0.7x0.7 degrees Single RX Single Swath in shallow waters	Maximum power consumption
Component	
AUV or Portable Processing unit with 1xCBMF	63
EM 2040 MKII 0.7 degrees Receiver	29
EM 2040 MKII 0.7 degrees Transmitter sending CW pulses	12
Total	104 W

EM 2040 MKII 0.7x0.7 degrees Single RX Dual Swath in deep waters	Maximum power consumption
Component	
AUV or Portable Processing unit with 2xCBMF	73
EM 2040 MKII 0.7 degrees Receiver	29
EM 2040 MKII 0.4 degrees Transmitter sending FM pulses	48
Total	150 W

EM 2040 MKII 0.7x0.7 degrees Dual RX Single Swath in shallow waters	Maximum power consumption
Component	
Standard Processing unit with 2xCBMF	125
EM 2040 MKII 0.7 degrees Receiver	29
EM 2040 MKII 0.7 degrees Receiver	29
EM 2040 MKII 0.7 degrees Transmitter sending CW pulses	12
Total	195 W

EM 2040 MKII 0.4x0.7 degrees Dual RX Dual Swath in deep waters	Maximum power consumption
Component	
Standard Processing unit with 2xCBMF	125
Standard Processing unit with 2xCBMF	125
EM 2040 MKII 0.7 degrees Receiver	29
EM 2040 MKII 0.7 degrees Receiver	29
EM 2040 MKII 0.4 degrees Transmitter sending FM pulses	48
Total	356 W

Hydrographic Work Station

For more detailed information about the different models of Hydrographic Work Station see the separate manual:

- *495770 - Hydrographic Work Station Instruction Manual*

Environmental requirements

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

Transducer

- **Operating temperature**: -5 to +40 °C
- **Storage temperature**: -20 to +60 °C
- **Depth rating**
  - EM 2040 MKII: 6000 m
  - EM 2040S MKII: 50 m

Processing Unit

- **Make and model**: Kongsberg Maritime, EM PU
- **Operating temperature**: 0 to +50 °C
- **Storage temperature**: -30 to +70 °C
- **Relative humidity**: 5 to 95% Non-condensing
- **Ingress protection (IP) code**: IP22
- **Certificates**:
  - IEC 60945:2002 and CORRIGENDUM 1:2008
  - IACS E10:2006

Portable Processing Unit

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

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

Hydrographic Work Station

For more detailed information about the different models of Hydrographic Work Station see the separate manual:

- *495770 - Hydrographic Work Station Instruction Manual*

Alignment specifications

These alignment specifications summarize the alignment accuracy requirements of the EM 2040 MKII 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

- **Position (x)**: ± 0.02 m
- **Position (y)**: ± 0.02 m
- **Position (z)**: ± 0.005 m
- **Pitch**:
  - TX transducer: ± 0.05 degrees
  - RX transducer: ± 0.20 degrees
- **Roll**:
  - TX transducer: ± 0.20 degrees
  - RX transducer: ± 0.02 degrees
- **Heading**: ± 0.05 degrees
- **Relative heading between RX and TX transducer**: ± 0.05 degrees

  Note

  ***Mounting angle between RX and TX transducer**: 90 degrees ± 1 degrees*

Motion sensor alignment accuracy

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

Heading sensor alignment accuracy

- **Heading**: ± 0.1 degrees

Position sensor alignment accuracy

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

Waterline determination accuracy

- **Position (z)**: ± 0.005 m

Equipment handling

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

Topics

Transporting Kongsberg Maritime equipment

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

Prerequisites

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

Context

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

Observe the packing instructions.

Note

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

Procedure

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

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

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

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

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

4 Handle all boxes and units with care.

Note

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

Related topics

Packing instructions for storage or shipping, page 217
Unpacking and handling printed circuit boards and electronic modules, page 221
Lifting units and transportation boxes, page 208

Lifting units and transportation boxes

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

Prerequisites

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

Context

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

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

Note

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

Procedure

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

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

3 If you need to use a crane:

   a Check the applicable weight certificate for the crane.

   b Check the security of the lifting lugs.

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

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

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

4 If you need to use a forklift truck:

   a Check the applicable weight certificate for the truck.

   b Check the limitations for lifting height and angles.

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

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

5 Handle all units and boxes with care.

Note

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

Related topics

Transporting Kongsberg Maritime equipment, page 207
Packing instructions for storage or shipping, page 217

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.

Related topics

Unpacking mechanical units, page 213
Unpacking electronic and electromechanical units, page 214

Unpacking mechanical units

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

Prerequisites

Observe the procedure for unpacking of standard parts and units.

Context

Mechanical and electromechanical units may be heavy.

Procedure

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

2 Lift the unit out of the transportation box.

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

4 Inspect the unit for visual damage.

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

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

Related topics

Unpacking standard parts and units, page 212

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.

Related topics
Unpacking standard parts and units, page 212

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. 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 assume that the unit has been used and 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.

Packing instructions for storage or shipping

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

Context

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

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

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

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

Procedure

1 Clean and protect the unit as described in the relevant procedures.

2 Place the unit in a suitable cardboard box or wooden crate.

3 Make sure that the unit is well be protected against physical damage by means of shock-absorbing insulation mats.

4 Take the necessary precautions if the unit must be protected against high or low temperatures, and mark the box accordingly.

5 Mark the box clearly to identify its contents.

6 Stored the box in a dry and dust-free area.

Related topics

Transporting Kongsberg Maritime equipment, page 207
Lifting units and transportation boxes, page 208
Unpacking and handling printed circuit boards and electronic modules, page 221
Returning a printed circuit board or an electronic module to Kongsberg Maritime, page 222
About Electrostatic Discharge (ESD), page 224

Storage after use

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

Topics

Cleaning an electronic cabinet or unit, page 218

Cleaning a mechanical or electromechanical unit, page 220

Cleaning an electronic cabinet or unit

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

Prerequisites

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

Procedure

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

Note

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

2 On completion, dry the unit thoroughly.

3 Inspect all surfaces for signs of corrosion, flaking, bubbling paint, stains etc.

4 Clean damaged or suspect areas, prepare and preserve these areas using the correct preservation mediums.

5 Open the unit.

6 Use a dedicated vacuum cleaner with an anti static nozzle to remove all dust from inside the unit.

Note

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

7 Wipe clean all exposed cables, and check for damage.

If a cable shows signs of wear or ageing, contact Kongsberg Maritime for advice.

8 Check if the unit contains batteries.

If the unit contains batteries, these may discharge slowly during storage. If the unit is to be stored for an extended period, disconnect or remove all internal batteries.

A suitable piece of insulating material can be placed between the battery and the electrical contacts to prevent electrical discharge. The battery can then remain in the unit, reducing the risk of it being misplaced during the storage period.

Caution

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

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

9 Place a suitably sized bag of desiccant material (silica gel or similar) into the unit to keep the electronic components as dry as possible.

10 Close the cabinet firmly before storage and/or shipment.

11 Secure and protect loose parts (shock absorbers, plug and sockets, protruding objects etc).

12 If the electronic cabinet shall be sent to storage or shipped, spray it externally using a corrosion inhibitor (for example a light oil) prior to packing.

Cleaning a mechanical or electromechanical unit

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

Prerequisites

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

Procedure

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

Note

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

2 On completion, dry the unit thoroughly.

3 Inspect all surfaces for signs of corrosion, flaking, bubbling paint, stains etc.

4 Clean damaged or suspect areas, prepare and preserve these areas using the correct preservation mediums.

5 Wipe clean all exposed cables, and check for damage.

If a cable shows signs of wear or ageing, contact Kongsberg Maritime for advice.

6 Secure and protect loose parts (shock absorbers, plug and sockets, protruding objects etc).

7 If the mechanical unit shall be sent to storage or shipped, spray it externally using a corrosion inhibitor (for example a light oil) prior to packing.

8 If relevant, place a suitably sized bag of desiccant material (silica gel or similar) into the to storage/transport box to keep the components as dry as possible.

Handling instructions for printed circuit boards and electronic modules

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

Topics

Unpacking and handling printed circuit boards and electronic modules

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 unpacked and handled, and then well protected during all handling.

Prerequisites

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. 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..

Sensitive printed circuit boards and electronic modules must always be transported and stored in protective antistatic packing bags. It as also important that they are not transported or stored close to strong electrostatic, electromagnetic or radioactive fields.

Context

Beware of Electrostatic Discharge (ESD)!

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

Note

Failure to follow these rules may result in an unserviceable circuit board or module.

Procedure

1 Prepare a suitable workbench with a conductive service mat.

Make sure that you wear a grounded wristband with direct contact with the skin.

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

far away from the bridge or any other rooms with wall-to-wall carpets! Whenever possible, always bring a wristband and ground yourself.

2 Lift the circuit board or module, in its protective antistatic packing bag, out of the transport box.

3 Place it in a stable position on the workbench.

4 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.

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

Note

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.

6 Take out and keep the documentation.

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

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

8 Keep the protective antistatic packing bag for future use.

Related topics

Transporting Kongsberg Maritime equipment, page 207
Packing instructions for storage or shipping, page 217
Returning a printed circuit board or an electronic module to Kongsberg Maritime, page 222
About Electrostatic Discharge (ESD), page 224

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

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

Prerequisites

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. 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..

Sensitive printed circuit boards and electronic modules must always be transported and stored in protective antistatic packing bags. It as also important that they are not transported or stored close to strong electrostatic, electromagnetic or radioactive fields.

Context

Beware of Electrostatic Discharge (ESD)!

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

Note

Failure to follow these rules may result in an unserviceable circuit board or module.

Procedure

1 Place the circuit board or module in the same protective antistatic packing bag as you originally received it in.

   If you do have this bag, use a protective bag of similar electrostatic discharge (ESD) protection quality.

   Note

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

2 Fill in all the necessary information on the applicable form, or provide relevant information in a document. Place the documentation inside the bag.

3 Seal the antistatic packing bag.

4 Place the circuit board or module in a suitable transport container, and secure it for shipping.

Related topics

Packing instructions for storage or shipping, page 217
Unpacking and handling printed circuit boards and electronic modules, page 221
About Electrostatic Discharge (ESD), page 224

About Electrostatic Discharge (ESD)

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

Beware of Electrostatic Discharge (ESD)!

Note

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

For correct and safe handling of printed circuit boards and electronic modules, you 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. 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.

What is Electrostatic Discharge (ESD)?

Electrostatic Discharge (ESD) is the transfer of an electrostatic charge between two bodies at different electrostatic levels, caused either by direct contact or induction by an electrostatic field. The passing of a charge through an electronic device can cause local overheating, and it can also "puncture" insulating layers within the structure of the device. This may deposit a conductive residue of the vaporized metal on the device, and thus create a short circuit. Electrostatic Discharge (ESD) may result in a failures or degraded performance of the device.

> ESD can create spectacular electric sparks (thunder and lightning is a large-scale ESD event), but also less dramatic forms which may be neither seen nor heard, yet still be large enough to cause damage to sensitive electronic devices. Electric sparks require a field strength above approximately 4 kV/cm in air, as notably occurs in lightning strikes. Other forms of ESD include corona discharge from sharp electrodes and brush discharge from blunt electrodes.
>
> ESD can cause a range of harmful effects of importance in industry, including gas, fuel vapour and coal dust explosions, as well as failure of solid state electronics components such as integrated circuits. These can suffer permanent damage when subjected to high voltages. Electronics manufacturers therefore establish electrostatic protective areas free of static, using measures to prevent charging, such as avoiding highly charging materials and measures to remove static such as grounding human workers, providing antistatic devices, and controlling humidity.
>
> *http://en.wikipedia.org/wiki/Electrostatic_discharge (January 2014)*

Precautions to prevent Electrostatic Discharge (ESD)

Sensitive printed circuit boards and electronic modules must always be transported and stored in protective antistatic packing bags. It as also important that they are not transported or stored close to strong electrostatic, electromagnetic or radioactive fields. If it is necessary to open and touch the printed circuit board or module inside the protective bag, the following precautions must be taken.

1 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.

Related topics

Packing instructions for storage or shipping, page 217
Unpacking and handling printed circuit boards and electronic modules, page 221
Returning a printed circuit board or an electronic module to Kongsberg Maritime, page 222

Disposal of old products and parts

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

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

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

Product recycling service

Kongsberg Maritime offers a product recycling service. See our website for more information.

- https://www.kongsberg.com/maritime/services/product-recycling

We accept all our products for recycling. The service is free of charge. The cost of having products removed, packed and delivered to one of our company locations is not covered by us. Contact us for information about return address and relevant procedures before sending anything.

Kongsberg Maritime has implemented and maintains an environmental management system in accordance with NS-EN ISO 14001:2015.

General safety rules

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

WARNING

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

1 You must always turn off all power before installation or maintenance work on the EM 2040 MKII system.

   Use the main circuit breaker, and label the breaker with a warning sign that informs others that maintenance or installation work is in progress on the system.

2 For safety reasons, two persons must always be present during troubleshooting with power turned ON.

3 Read and understand the applicable first aid instructions related to electric shock.

4 Whenever installation or maintenance work is in progress, it is essential that a first aid kit is available. All personnel must be familiar with the first aid instructions for electrical shock and other personal injuries.

5 The various parts of the system may be heavy.

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

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