KONGSBERG

EM 2040P

Multibeam echo sounder

Installation manual

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Document information

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Comments

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

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

Support information

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

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About this manual

The purpose of this manual is to present the descriptions and drawings required to install the EM 2040P 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 2040P and other products from Kongsberg Maritime, visit our website.

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

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EM 2040P

Topics

System description

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

Key features

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

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

System diagram

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

A *Hydrographic Work Station*

B *Interfaces:*

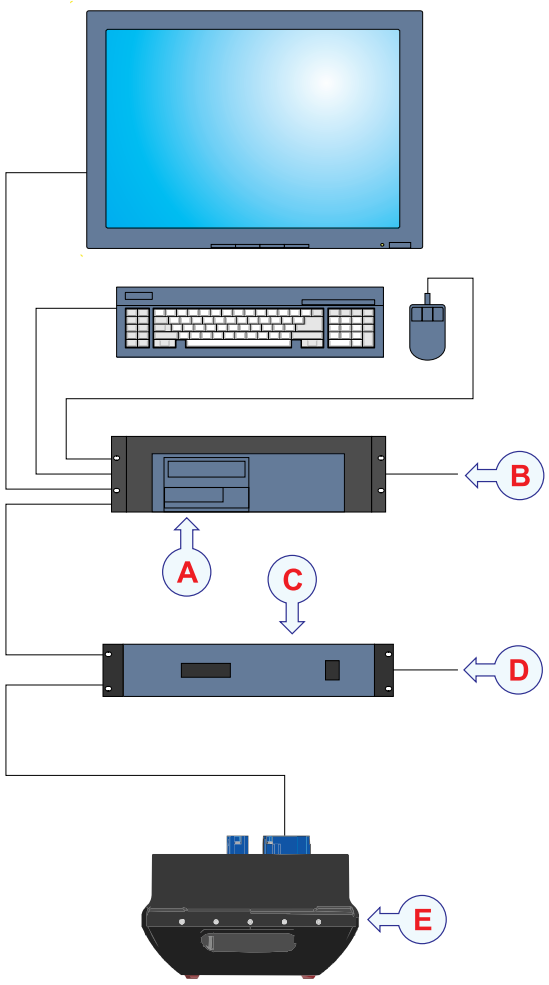
- *Sound speed sensor*
- *Tide*
- *Centre depth output*

C *Processing Unit*

D *Interfaces:*

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

E *Transducer*



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System units

Transducer description

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

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

The EM 2040P transducer has separate linear transducer arrays for transmit and receive in a Mills cross configuration. 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 transmit transducer consists of three separate line arrays, one looking straight down and the two others pointing 45 degrees to each side.

The transducers are made from composite ceramics which enables a wide bandwidth. The material in the part of the transducer housing which is exposed to sea water is hard anodised aluminium. The unit is delivered with a zink anode installed on the hard anodised aluminum for extra protection.

The transducer can be delivered with an integrated sound speed (SVT) probe from AML

Processing Unit description

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

Portable Processing Unit description

The EM 2040P 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:

- No external trigger available
- No Remote on/off available
- Not possible to interconnect two PU's to manage dual head and dual swath systems. Systems will either have to be dual head or dual swath.

Hydrographic Work Station description

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

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

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

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

Portable Hydrographic Work Station description

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

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

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

Remote Control Unit (K-Rem) description

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

Note

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

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

- One Sub-bottom profiler (SBP 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.

Preparations

Topics

Personnel qualifications

The installation of the EM 2040P is a demanding task. It is very important that the personnel involved in the installation tasks are competent and experienced craftsmen.

As a minimum, the following certified craftsmen must be available.

- Naval architects
- Welders
- Electricians
- Project manager

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 2040P units must be installed in a dry and dust-free environment. The units are not fully protected against humidity, dust or water.

It is important that the sonar room is kept dry. The EM 2040P units must not be exposed to excessive temperatures, 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 temperature and humidity, and take the necessary actions if the environmental conditions are poor.

Observe the environmental specifications related to the EM 2040P units.

Requirements for watertight integrity

The size, location and design of the sonar room must fulfil all the requirements to the vessel's watertight integrity.

In the event of a major leak, it must be possible to close all watertight hatches and/or doors to the room to maintain vessel stability and safety.

The physical size of the sonar room must be limited, so that in the event of a major leak, the flooding of the room will not induce instability, or cause the vessel to capsize or sink.

Inspect all watertight decks and bulkheads periodically. Make sure that there are no unprotected openings or improper penetrations that may allow progressive flooding from the compartment. Make sure that the watertight doors and hatches are in place and in good working order.

Install and activate bilge high level sensors to provide an early warning of abnormal accumulation of water. Position the sensors as low as possible along the centre area of the compartment, and/or in other locations where the water will gravitate to first. Inspect the bilge sensors periodically.

All cables leading in and out of the sonar room must be run in steel conduits. These steel conduits must reach up and above the freeboard deck.

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.

Note

The physical size of the sonar room must be limited, so that in the event of a major leak, the flooding of the room will not induce instability, or cause the vessel to capsize or sink.

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.

5 All cables leading in and out of the sonar room must be run in steel conduits. These steel conduits must reach up and above the freeboard deck.

6 In the event of a major leak, it must be possible to close all watertight hatches and/or doors to the room to maintain vessel stability and safety.

Requirements for insulation, heating and ventilation

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

Insulation requirements

The insulation in the sonar room should be the minimum equivalent of 50 mm of rock-wool. Piping passing through the space prone to condensation must be properly insulated.

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. Typical heating power is minimum 1000 W. The heater must be installed close to the deck.

Ventilation requirements

The sonar room must 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 2040P 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 must 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.

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

Proper vessel ground must be provided.

Cabling requirements

The sonar room units are connected to other EM 2040P 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.

Requirements for bilge pump and decking

If the sonar room is located below the water line, it must be connected to the vessel's bilge pump system.

Bilge pump requirement

If it is not possible to connect the sonar room to the vessel's bilge pump system, a separate bilge pump for the compartment must be installed.

Install and activate bilge high level sensors to provide an early warning of abnormal accumulation of water. Position the sensors as low as possible along the centre area of the compartment, and/or in other locations where the water will gravitate to first. Inspect the bilge sensors periodically.

Decking requirement

Once the installation has been completed, the sonar room must be suitably decked without restricting access to the equipment and the cables.

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 EM 2040P 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 EM 2040P performance, mount the transducer as deep as possible under the vessel’s hull.

There are several reasons for this recommendation.

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 in 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 may push the transducer up, and 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 EM 2040P performance.

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 in the vicinity of 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 2040P.

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 2040P Multibeam echo sounder useless, almost no matter where the transducer 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

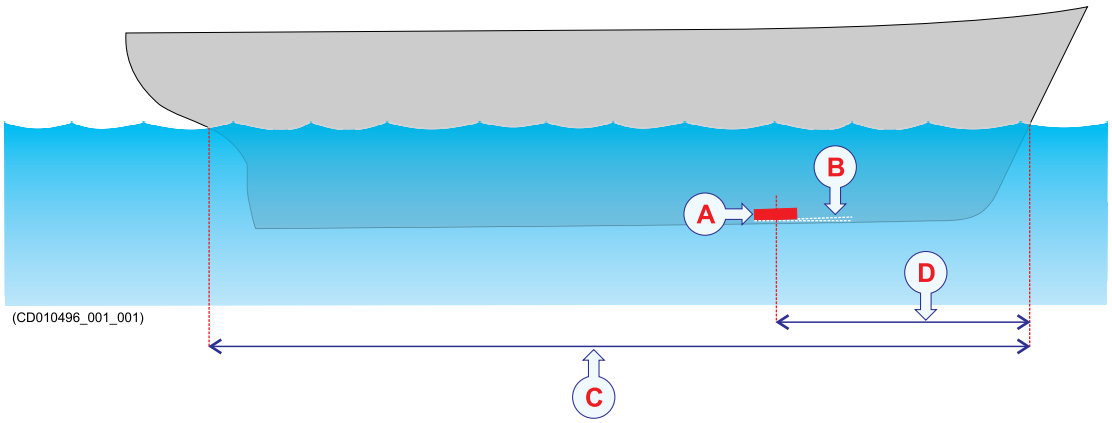
Some of the installation guidelines provided for transducer location may be conflicting. For this reason, each vessel must be treated individually in order to find the best compromise.

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.



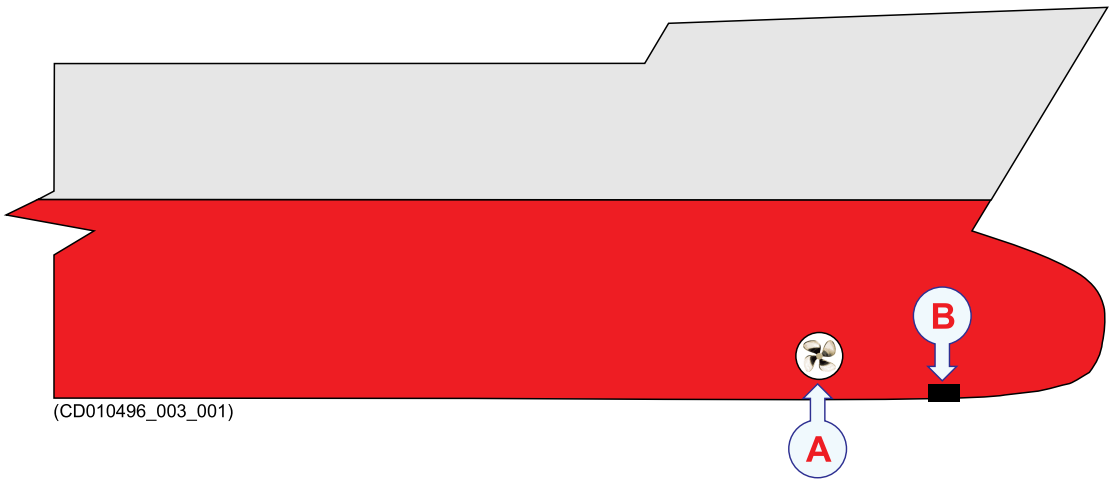
A *Transducer*

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 in the vicinity of 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 2040P 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 2040P, we must address the noise challenge. This is important during the planning and preparations for the EM 2040P installation.

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 the user to make the right filter 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.

> Signal-to-noise ratio (often abbreviated SNR or S/N) is a measure used in science and engineering that compares the level of a desired signal to the level of background noise. It is defined as the ratio of signal power to the noise power, often expressed in decibels. A ratio higher than 1:1 (greater than 0 dB) indicates more

signal than noise. While SNR is commonly quoted for electrical signals, it can be applied to any form of signal [...].

Wikipedia, Copied September 2013

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 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

A The transducer can pick up noise from

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

B The transducer cables are long, and may pick up electric noise from generators, pumps, cooling systems and other electric or electromechanical devices.

C The preamplifiers are very sensitive, and they can easily pick up electrical noise from internal and external power supplies. The preamplifiers are also vulnerable to analogue noise created by their own electronic circuitry. Digital noise created by the converter and processing circuitry can also create problems.

D Converters transform the analogue echoes to digital format.

E Signal processing circuitry can create digital noise.

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. We will here go into some details in order to analyse the different sources of self noise on a vessel and how they may influence upon 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.

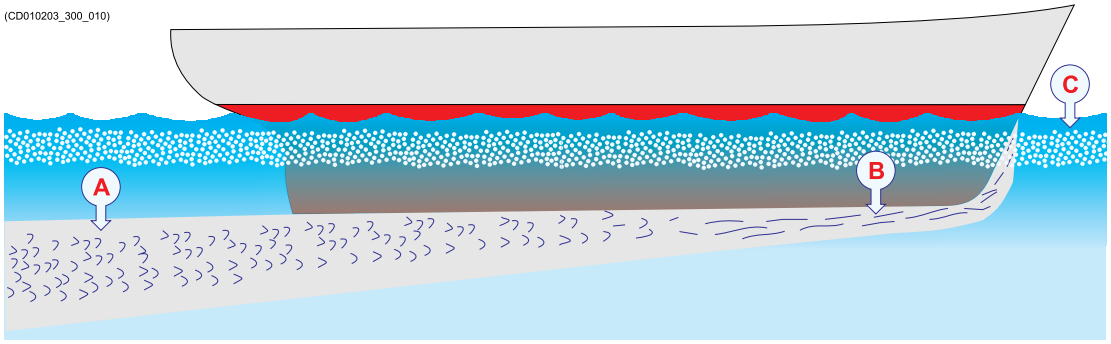
In some cases a resonant phenomenon is set up in a hole near the hull. This sound will have a discrete frequency, while all other flow noise will have a wide frequency spectrum.

(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 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.

> In physics, interference is the phenomenon in which two waves superpose each other to form a resultant wave of greater or lower amplitude. Interference usually refers to the interaction of waves that are correlated or coherent with each other, either because they come from the same source or because they have the same or

nearly the same frequency. Interference effects can be observed with all types of waves, for example, light, radio, acoustic, surface water waves or matter waves.

https://en.wikipedia.org/wiki/Wave_interference — April 2016

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 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 EM 2040P 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 EM 2040P 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 shape of the transducer (or dome around it) must be as streamlined as possible.
- The hull plating in front of the transducer must be as smooth as possible.

  Important

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

Reducing machinery noise

- The main engine and relevant auxiliary engines and equipment must be fixed to rigid foundations to avoid vibrations.
- Any hull structure that may vibrate should be damped or coated to reduce the vibrations.

The use of shock absorbers or floating rafts may sometimes reduce this noise. The structure-borne noise may be reduced by isolation, for example by providing vibration clamping between the transducer and the hull structure.

Reducing propeller noise

- Sufficient clearance between the propellers and the hull, the rudder and the keel must be provided.
- Place the zinc alloy 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 EM 2040P cables from other cables with high voltages, large currents or transients.
- Place all high voltage power cables in metal conduits.

Vessel coordinate system

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

When you have several different sensors and transducers on your vessel, and you wish each of them to provide accurate data, you need to know their relative physical positions.

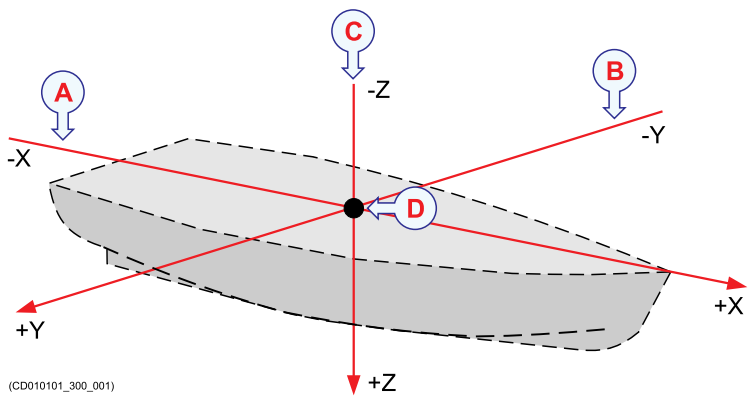
The antenna of a position sensor is typically mounted high above the superstructure, while a motion sensor is located close to the vessel's centre of gravity. Both of these are physically positioned far away from the transducer on a depth sensor, which may be located closer to the bow.

Very often, the information from one sensor depends on data from an other. It is then important that the relevant measurements are compensated for these relative distances.

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 reference unit (MRU)

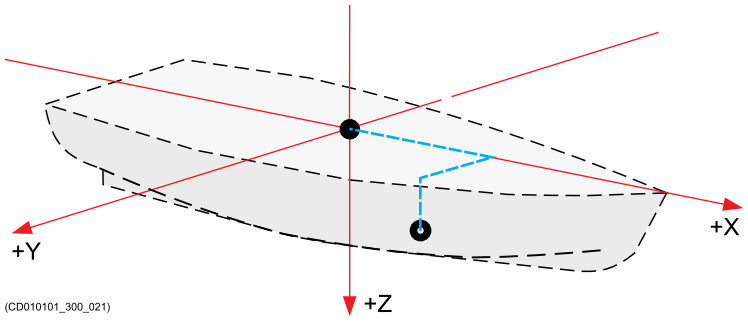
Coordinate system alternative origins

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 reference unit (MRU).

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.

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



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.

Important

If you require a high accuracy, for example for underwater positioning, underwater mapping or scientific measurements, you must have each sensor positioned using professional land surveying. For such use, a good alignment survey is critical for high quality results. Surveys are normally done by qualified and trained surveyors using proven survey equipment and methods.

Related topics

Alignment specifications, page 111

Installing the transducer

Topics

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 face.

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

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

8 **Do not** damage the transducer cable, and 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 performance of the EM 2040P.

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.

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.

Non-permanent transducer installations

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

Installation summary

Correct location, orientation and alignment of the transducer is vital for the performance of the EM 2040P system.

Prerequisites

To get a full overview of the installation, you need all relevant vessel drawings. You also need the drawings provided for the EM 2040P transducer.

Context

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

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.

2 Based on the shape of the transducer and the mounting devices available, determine the installation principle.

3 Design, manufacture and mount the equipment required for the transducer installation principle.

4 Unpack the transducer from its transport crate.

5 Cut the supplied rubber gasket so it fits the rear of the transducer.

A rubber gasket is delivered with the system. It should be used between the transducer and the structure it is bolted to.

6 Glue the gasket to the structure with **Araldite 2011**. Use sparingly and in such a way that the gasket is free of buckles.

7 Mount the transducer.

The transducer is fastened with six M8 bolts. If access to the rear of the transducer to fasten these bolts is not possible, a mounting ring must be used as part of the mounting structure to allow fastening of the bolts from the front.

Apply **Aquashield S1315** to the screw threads before the screws are inserted.

The transducer must be bolted to the structure with a torque of 10-12 Nm.

The bolts should have a depth of engagement of 10 +0.5/- 1 mm into the transducer.

Important

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

8 Connect the transducer cable to the transducer.

Refer to applicable procedure for cleaning and lubrication of underwater connectors.

9 Connect the transducer cable to the Processing Unit.

10 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.

Refer to applicable procedure for painting the transducer.

Related topics

Painting the transducer face, page 41
Drawing file, page 86
Alignment specifications, page 111

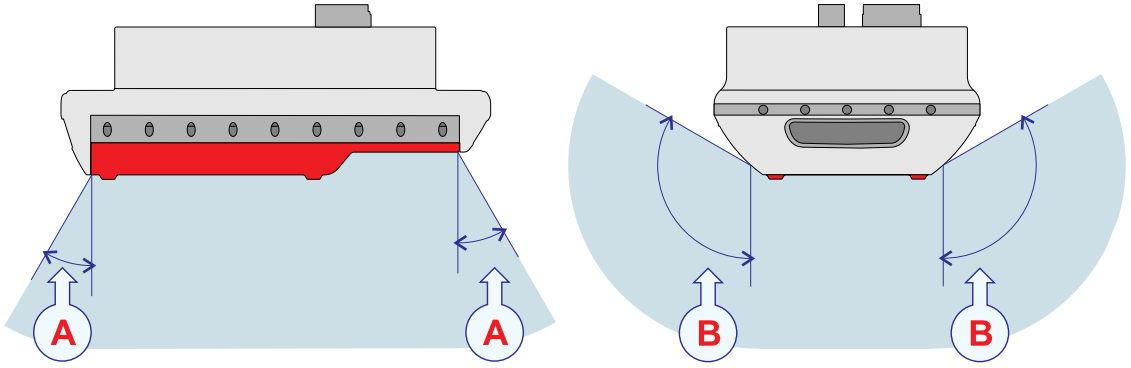
Installation requirements

Topics

Free viewing sector, page 36

Free viewing sector

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



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For EM 2040P the required free viewing sectors relative to the transducer face are:

A 30 degrees in along direction

B 120 degrees in across direction

Installation principles

Topics

Permanent transducer installation

The EM 2040P can be used in permanent installations if the transducer is properly protected against corrosion.

The EM 2040P system is designed for non permanent installations.

The material in the part of the transducer housing which is exposed to sea water is hard anodised aluminum. If the EM 2040P transducer is used in a permanent installation it has to be protected against corrosion.

Important

Sacrificial anodes must be mounted near the transducer to protect the connector(s) and the transducer housing. Inspect the anodes regularly, and replace them if needed.

The main considerations when using a permanent installation are:

- 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.
- 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.

Related topics

Technical specifications, page 96

Non permanent transducer installation

The small size and weight of the EM 2040P 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 moonpool.

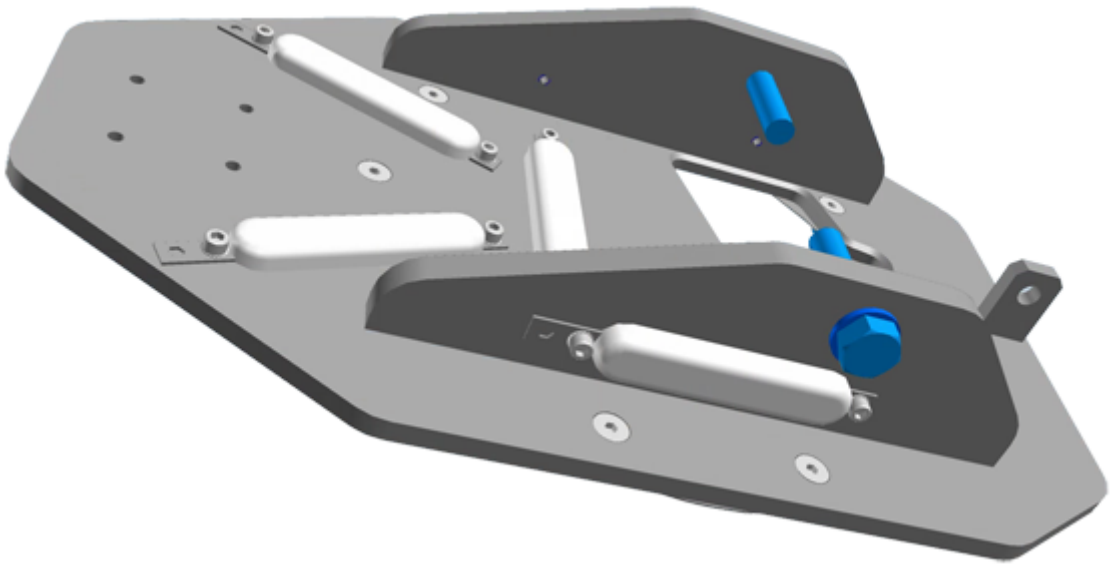
The main considerations when using a non permanent installation are:

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

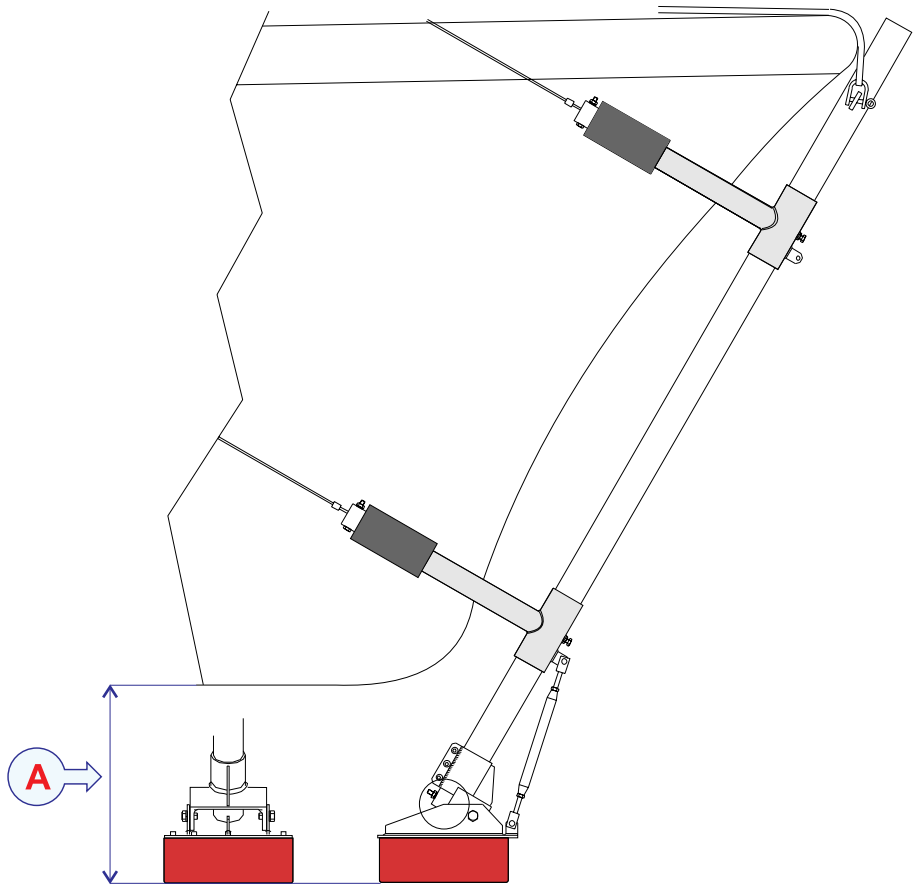
  The alignment specifications are found in the *Technical specifications*.
- The line of sight from the transducer to the bottom must not be blocked.
- Aerated water must be kept away from the transducer face.

A prefabricated mounting bracket provided by Kongsberg Maritime may be used to ensure a rigid, high accuracy installation and laminar water flow. The mounting bracket is equipped with sacrificial anodes and space for a motion reference unit (MRU).

Please contact Kongsberg Maritime AS for more information.



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



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 2040P 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.

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 2040P transducer below the boundary layer.

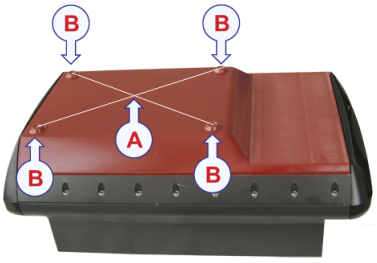
Note

Several Kongsberg sonars are provided with hull units of various sizes. Any one of these hull units can be redesigned for use with a EM 2040P transducer. If this is a realistic option, call your dealer or Kongsberg Maritime for advice.

Reference point on the EM 2040P transducer

The reference point on the face of the transducer has to be entered in K-Controller after installation.

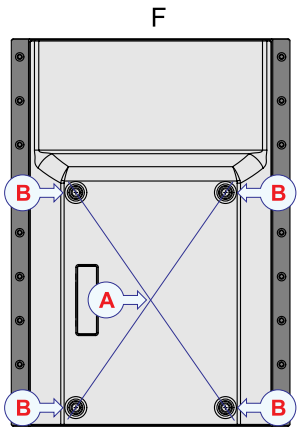
The physical location of the transducer has to be entered in K-Controller after installation. For EM 2040P the position entered by the operator is a reference point on the face of the transducer. This point is not marked on the transducer.



The reference point used is the intersection between two diagonal lines drawn between the bumpers on the transducer face.

A *Transducer reference point*

B *Bumpers*



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Painting the transducer face

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

Prerequisites

The following tools and consumables are required.

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

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

Context

The transducer has not been designed with any protection against biological fouling. Anti-fouling paint may therefore be applied to the transducer face. To minimize the negative acoustical effects the layer of anti-fouling paint must be as thin as possible.

Note

The anti-fouling paint will reduce the acoustical performance of the transducer. The surface roughness of the transducer substrate and the thickness of the paint may also influence the performance. Kongsberg Maritime cannot be held responsible for any negative consequences of the anti-fouling paint.

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

Procedure

1 Clean the transducer thoroughly.

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

2 Allow the transducer surface to dry.

3 Abrade the transducer surface using a sanding paper with 240 inch grit size.

   Do not exceed a surface roughness (R_{max}) of 35 microns as this can influence the EM 2040P performance.

4 Remove all dust.

5 Apply the primer, and let it dry.

6 Apply the paint.

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

   Note

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

7 Allow the paint to dry.

Further requirements

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

Related topics

Installation summary, page 34

Approved anti-fouling paints

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

Important

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

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

Jotun

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

Products:

- SeaQuantum Ultra S
  - **Primer**: Safeguard Universal ES

    Apply 80 µm wet film thickness (50 µm dry film thickness).
  - **Paint**: SeaQuantum Ultra S

    Apply 250 µm wet film thickness (125 µm dry film thickness).
- Seaforce 200 AV
  - **Primer**: Safeguard Universal ES AV

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

    Apply 140 µm wet film thickness (90 µm dry film thickness).

Data sheets and application guides can be downloaded from:

http://www.jotun.com/ww/en/b2b/technical-info/tds/index.aspx

International Marine Coatings

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

Products:

- Intersleek 1100SR

  - **Primer**: Intersleek 737

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

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

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

    Apply 100 µm dry film thickness.

The list can also be found on http://www.simrad.com.

Installing the EM 2040P 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.

The length of the transducer cables limits where the Processing Unit can be installed.

Make sure that adequate ventilation is available 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

In order to allow for future maintenance, we recommend to 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.

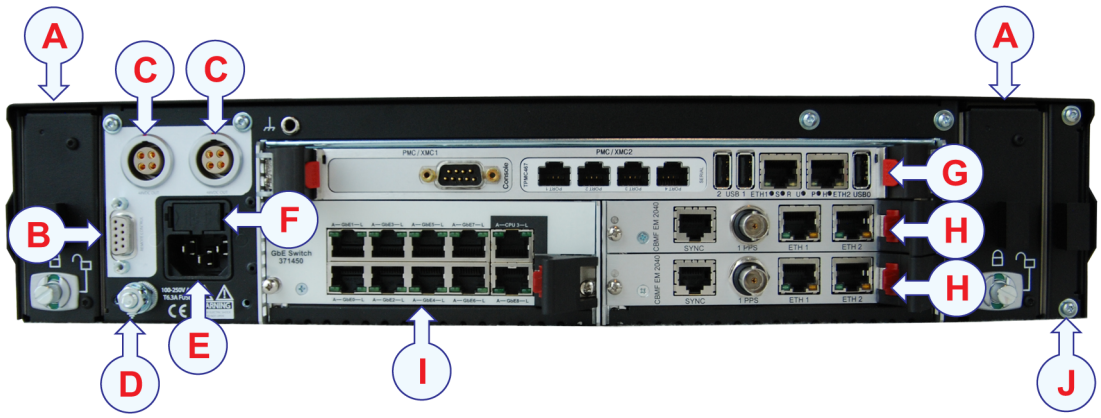
5 Connect the cables.

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.

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 *Air filter unit*

Related topics

Processing Unit, single swath, cable plan, page 61
Processing Unit, dual swath, cable plan, page 62

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 2040P Processing Unit.

A ***CPU board***

Different CPU boards can be used in the EM 2040P Processing Unit.

B ***CBMF board***

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

There are one or two Compact Beamformer (CBMF) boards in the Processing Unit. The number of CBMF boards depends on the system.

C ***VadaTech CP219 board***

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

D ***Fan unit***

The Processing Unit has two fan units for cooling purposes.

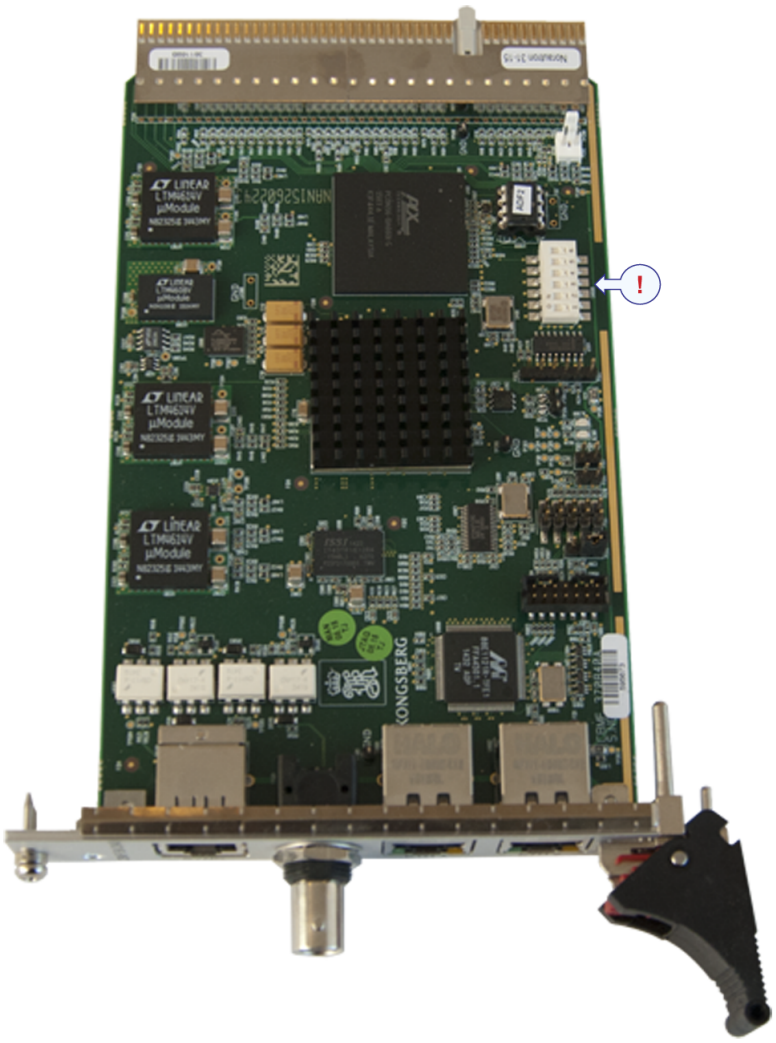
- ***Power supply***

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

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

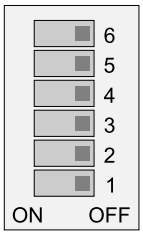
CBMF board - dip switch setting

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.



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Installing the Portable Processing Unit

Topics

Portable Processing Unit description

The EM 2040P 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:

No external trigger available

No Remote on/off available

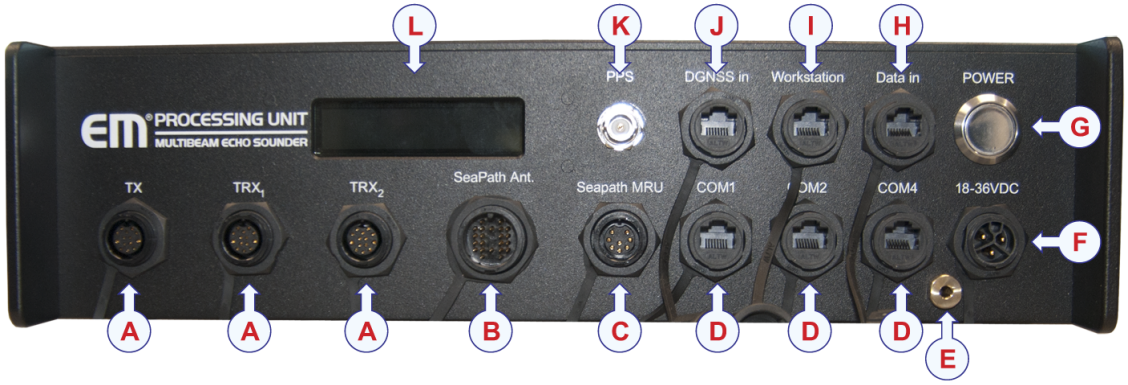
Not possible to interconnect two PU's to manage dual head and dual swath systems. Systems will either have to be dual head or dual swath.

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 Transducer cable input

B Seapath 130 Antenna interface cable input

C Seapath 130 MRU interface cable input

D PU Serial Com ports (COM3 available from Seapath)

E Ground connector

F 18-36Vdc power input socket

G Power on/off button. Correct direct current polarity indicated by green led.

H External data input over Ethernet including attitude velocity.

I Hydrographic Work Station input

J Input for GNSS corrections

K 1PPS input

L Processing Unit display

Related topics

Portable Processing Unit, cable plan, page 63

Installing the Hydrographic Work Station

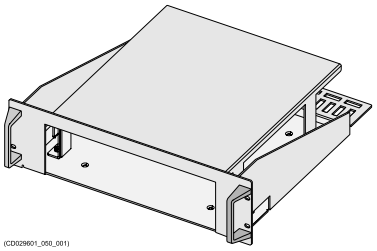
Topics

Installing the Hydrographic Work Station

The Hydrographic Work Station can be installed inside a console, inside a suitable cabinet, in a 19" rack or on a desk. Make sure that adequate ventilation is available to avoid overheating.

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.



A suitable location for the Hydrographic Work Station must be defined prior to installation.

Note

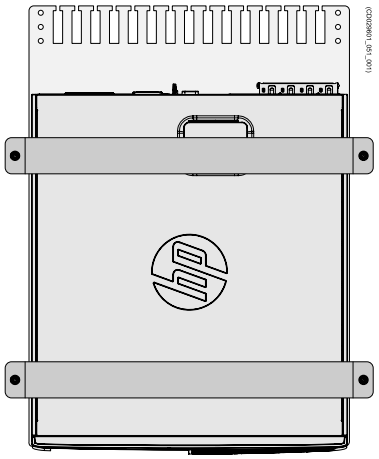
Observe the compass safe distance.

Context

The Hydrographic Work Station can be installed in several different ways using various installation kits.

- 19” rack mounting using kit (371931)
- Horizontal or vertical mounting kit (331385)
- Stand-alone desktop mounting (No installation kit)

Procedure



1 Prepare the location and the necessary tools.

2 Observe the installation requirements.

   a Depending on its physical properties, install the computer inside a console, in a cabinet or 19” rack, or on a desk.

   b Choose a position to fit the available cable lengths between the computer and the other units it connects to.

   c Observe the compass safe distance.

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

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

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

   Note

   In order to allow for future maintenance, we recommend to mount the unit with its cables and connectors available for easy access.

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

4 Provide ample space around the computer.

   You must be able to reach and use the front and rear mounted connectors and on/off switches. It is also important that you allow for easy access to all the cables, and enough space for inspection, maintenance and parts replacement. If relevant, make sure that the space allows you to open the computer for unobstructed access to its internal parts.

   Note

   Make sure that you can access both the rear and front side of the computer after it has been installed.

5 If you are mounting the computer using the 19” rack kit:

   a Remove the lid on the rack shelf.

   b Place the computer on the shelf.

   c Mount the lid, and secure it properly.

   d Place the shelf into the 19" rack.

   All necessary nuts and bolts are provided with the mounting kit.

6 If you are mounting the computer using the horizontal/vertical kit:

   a Prepare four holes – each M6 – for the bottom plate.

b Mount the bottom plate using M6x20 bolts, washers and nuts.

c Place the computer on the bottom plate.

d Mount the two brackets to the bottom plate using M5 locking nuts and washers.

7 If you are mounting the computer as a stand-alone desktop unit:

a Place the computer on the surface.

b Secure the computer using any means available.

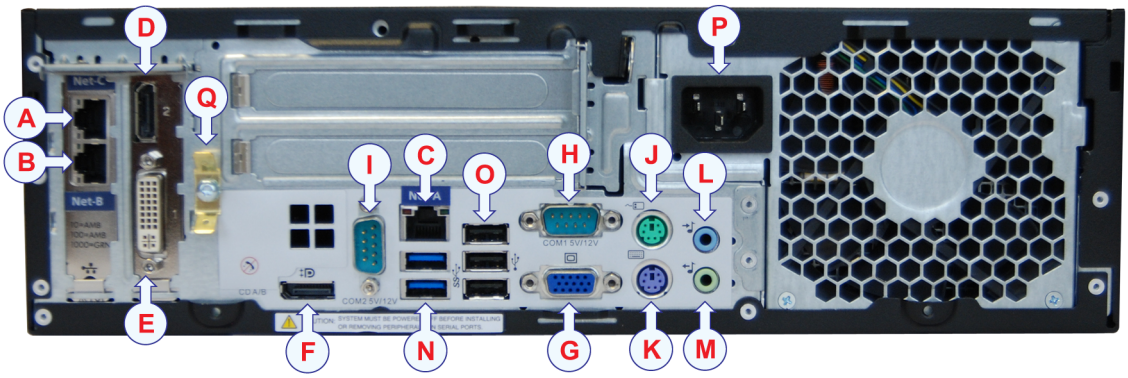
8 Connect the cables.

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.

Hydrographic Work Station rear connectors

The rear panel on the Hydrographic Work Station holds connectors for the various EM 2040P cables.



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

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

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

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

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

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

D *Display port*

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

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

E *Video port: DVI*

F *Display port*

G *Video port: VGA*

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

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

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

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

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

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

L *Audio cable: Not used*

M *Audio cable: Not used*

N *USB (Universal Serial Bus) sockets: USB 3.0 From Hydrographic Work Station to external device(s)*

O *USB (Universal Serial Bus) sockets: USB 2.0 From Hydrographic Work Station to external device(s)*

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

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

Related topics

Cable plan, Hydrographic Work Station, page 64

Cable layout and interconnections

Topics

Read this first

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

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

1 **System cables**: These cables are provided by Kongsberg Maritime as a part of the EM 2040P delivery.

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

3 **Commercial cables**: These cables may be provided by Kongsberg Maritime as a part of the EM 2040P delivery. They may also be included with third party items that are used with the EM 2040P.

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

Note

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

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

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

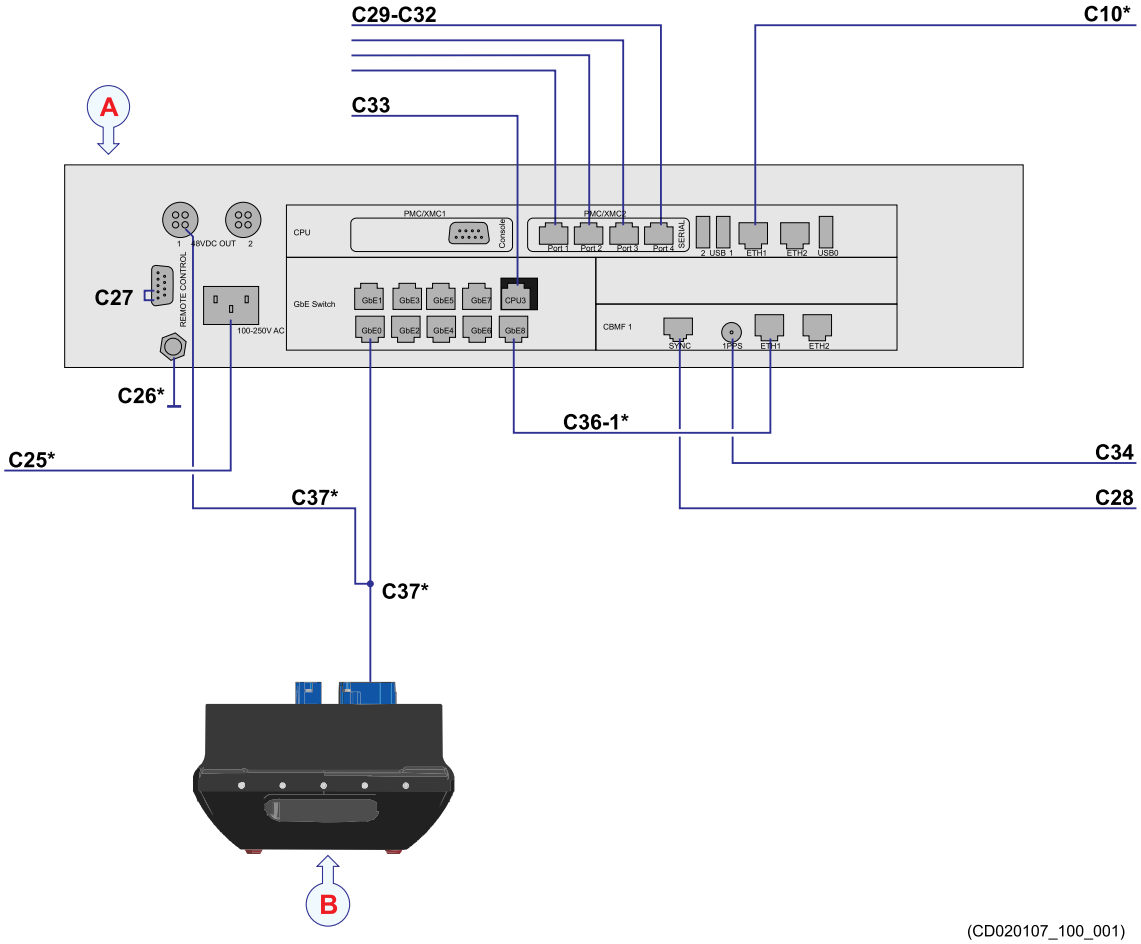
Before you install or maintain the EM 2040P cables, make sure that the AC mains circuit breaker for the system is switched off.

Cable plans

Topics

Processing Unit, single swath, cable plan

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



A *Processing Unit*

B *Transducer*

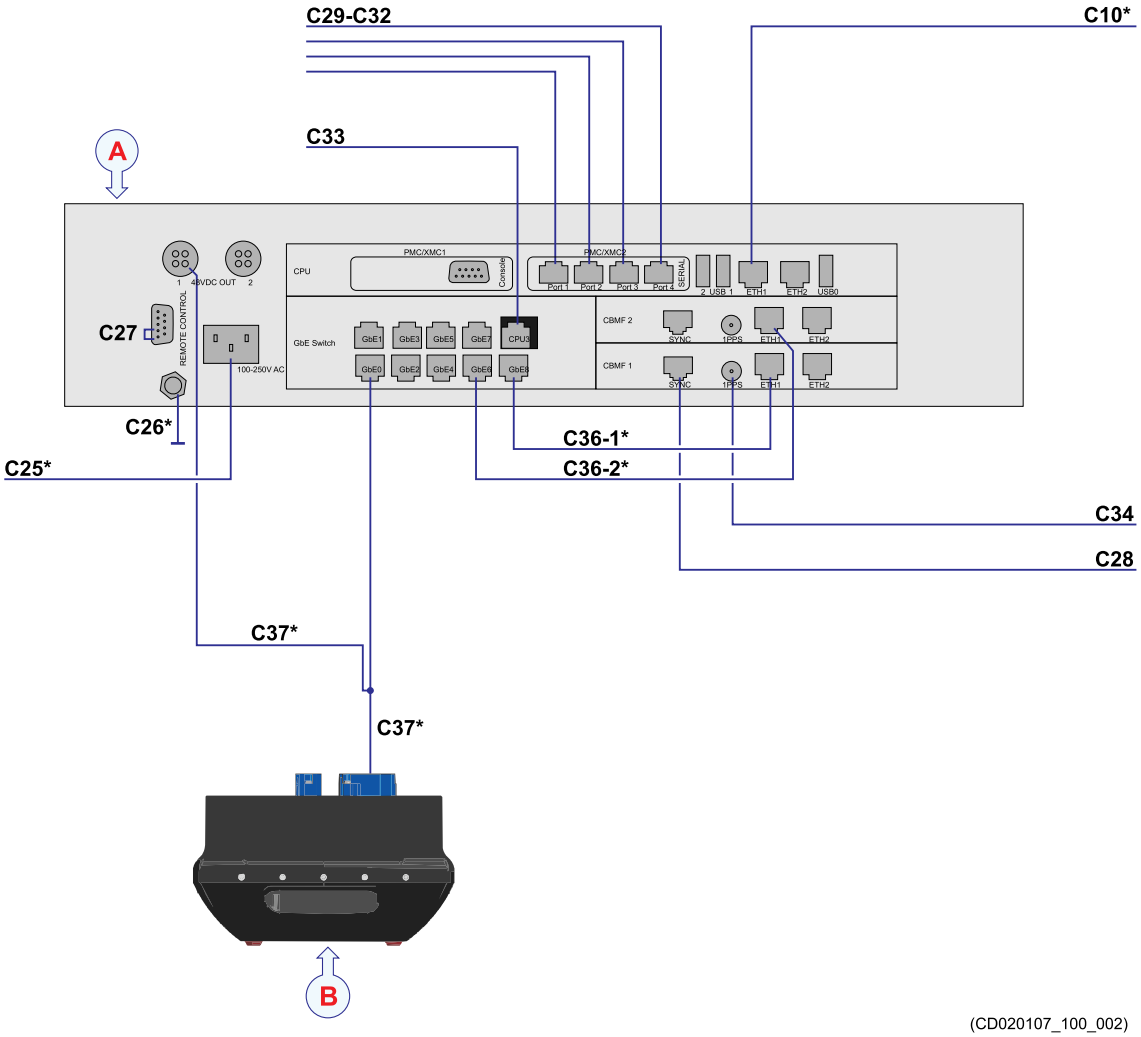
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040P delivery.

Related topics

Processing Unit rear panel description, page 48
List of EM 2040P cables, page 65

Processing Unit, dual swath, cable plan

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



A *Processing Unit*

B *Transducer*

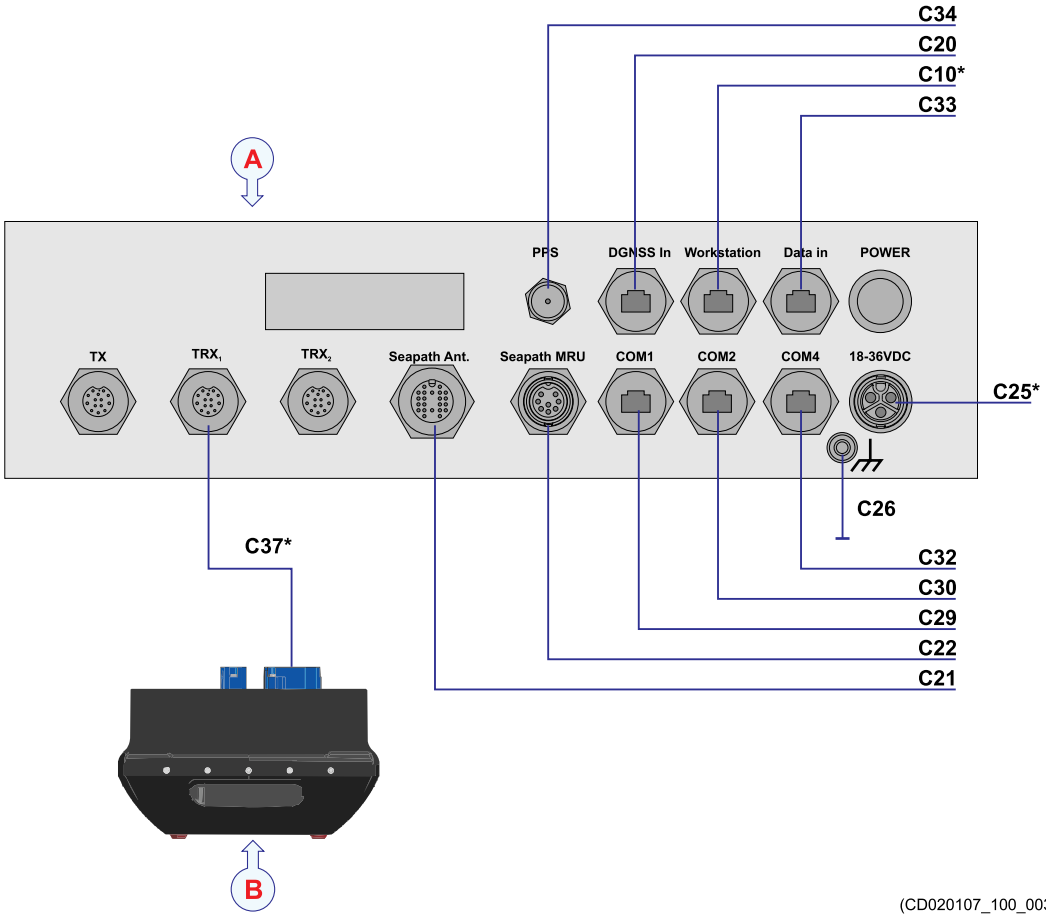
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040P delivery.

Related topics

Processing Unit rear panel description, page 48
List of EM 2040P cables, page 65

Portable Processing Unit, cable plan

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



A *Processing Unit*

B *Transducer*

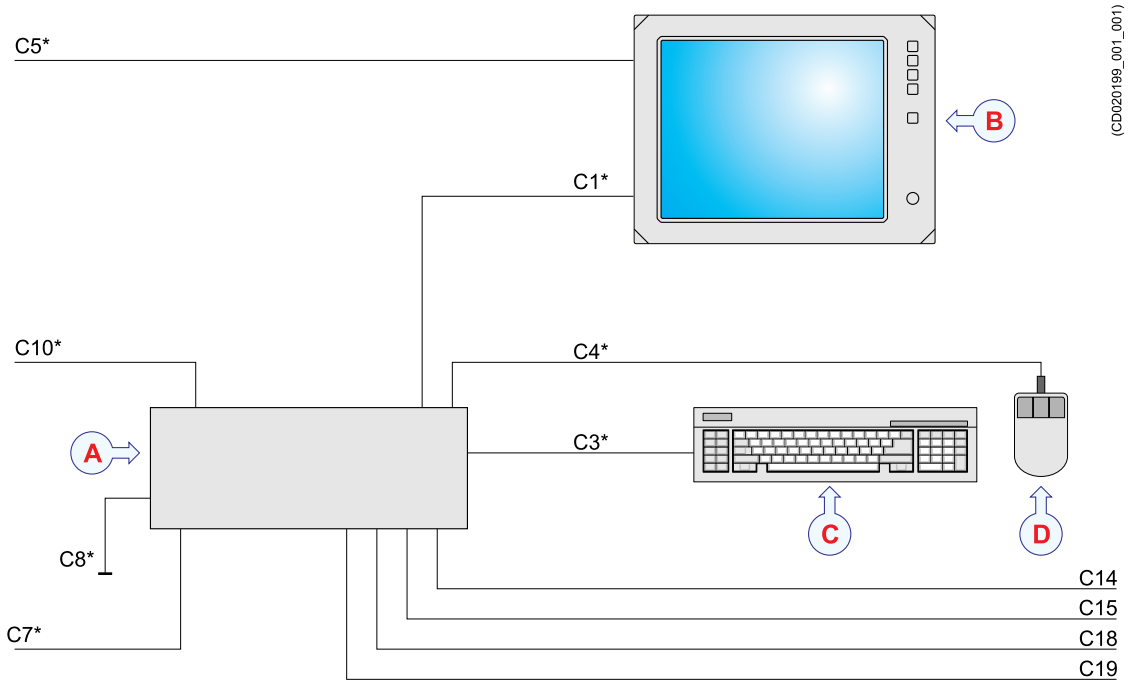
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040P delivery.

Related topics

Portable Processing Unit front panel description , page 52
List of EM 2040P cables, page 65

Cable plan, Hydrographic Work Station

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



A *Hydrographic Work Station*

B *Display*

The Hydrographic Work Station supports up to three displays.

C *Computer keyboard*

D *Computer mouse or trackball*

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

Related topics

Hydrographic Work Station rear connectors, page 56
List of EM 2040P cables, page 65

List of EM 2040P cables

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

Cable	Signal	From/To
C1	Video cable	From Hydrographic Work Station to display This is a commercial cable. It is normally provided with the display.
C3	Keyboard	From Hydrographic Work Station to keyboard This is a commercial cable. It is normally provided with the keyboard.
C4	Mouse	From Hydrographic Work Station to mouse (or another similar device) This is a commercial cable. It is normally provided with the mouse.
C5	AC power cable	From display to AC power outlet
C7	AC power cable	From Hydrographic Work Station to AC power outlet
C8	Ground cable	From Hydrographic Work Station to vessel ground
C10	Ethernet cable	From Hydrographic Work Station to Processing Unit
C14	Serial cable	From Hydrographic Work Station to external device(s)
C18	Serial cable	From Hydrographic Work Station to external device(s)
C19	Serial cable	From Hydrographic Work Station to external device(s)
C20	Serial cable	From DGNSS provider toProcessing Unit. Input for correction services. See Seapath 130 manual for supported solutions. RS-232 serial line used for DGNSS input, page 70 RS-422 serial line used for DGNSS input, page 71
C21	Special cable	From Portable Processing Unit to Seapath antenna. Seapath antenna interface cable - with plug, page 81 Antenna interface cable, page 83
C22	Special cable	From Portable Processing Unit to Seapath MRU. Seapath MRU interface cable, page 84
C25	Power cable	From Processing Unit to AC power outlet From Processing Unit to DC power outlet DC Power cable, page 85 Two versions, one for Portable Processing Unit and one for regular Processing Unit.
C26	Ground cable	From Processing Unit to vessel ground
C27	Control cable	From Processing Unit to remote control device Remote on/off switch If remote control is not used, a termination plug has to be inserted in the Remote control plug on the Processing Unit. This plug is a 9 pin D-SUB supplied with the Processing Unit. This function is not available for the Portable Processing Unit. Remote control, page 73 Remote Control using K-Rem, page 74 Dummy plug for not using remote control, page 75
C28	Control cable	From Processing Unit to synchronization device External synchronization This function is not available for the Portable Processing Unit. External synchronisation, page 76

Cable	Signal	From/To
C29	Serial cable	From Processing Unit to external device(s) RS-232 serial line using three wires and RJ45 connector, page 68 RS-422 serial line using five wires and RJ45 connector, page 69
C30		
C31		
C32		
C33	Ethernet cable	From Processing Unit to external device(s) Attitude Velocity sensor
C34	Coax cable	From Processing Unit to external device(s) 1 PPS (one pulse per second) clock synchronisation Clock synchronisation (1PPS) using a coax cable, page 72
C36	Ethernet cable	Processing Unit internal connection
C37	Transducer cable	From Processing Unit to transducer The transducer cable is provided with the transducer. Two versions, one for Portable Processing Unit and one for regular Processing Unit. Transducer cable, page 77 Transducer cable for Portable Processing Unit, page 79

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. If you use cables with lower bandwidth capacity you will reduce the EM 2040P performance.

Identifying EM 2040P cables on a project cable drawing

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

Related topics

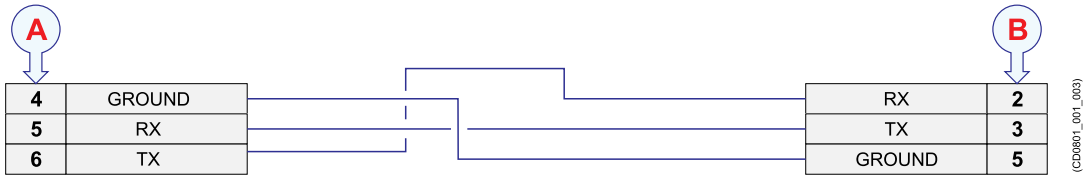
Processing Unit, single swath, cable plan, page 61
Processing Unit, dual swath, cable plan, page 62
Portable Processing Unit, cable plan, page 63
Cable plan, Hydrographic Work Station, page 64

Cable drawings and specifications

Topics

RS-232 serial line using three wires and RJ45 connector

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



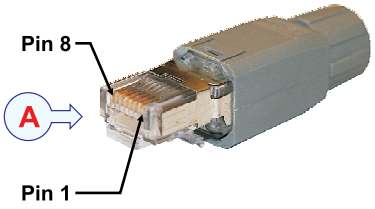
A *Local connection*

RJ45 connector

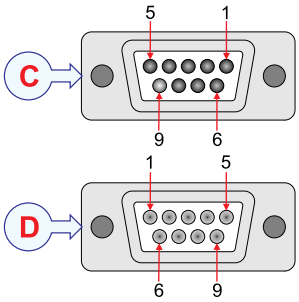
B *Connection on remote device*

C *Female 9-pin D-Subminiature connector*

D *Male 9-pin D-Subminiature connector*



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



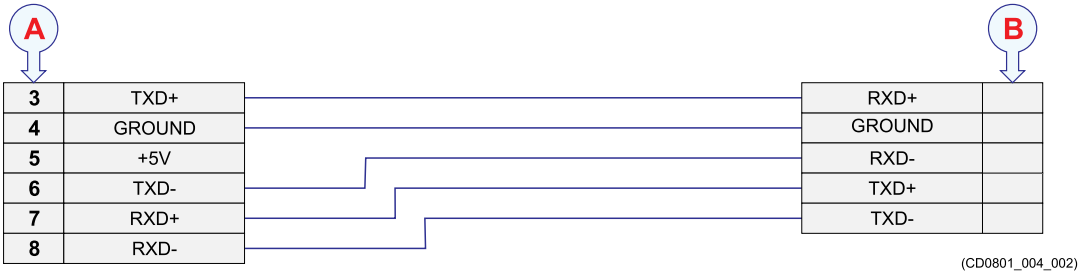
Minimum cable requirements

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

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

RS-422 serial line using five wires and RJ45 connector

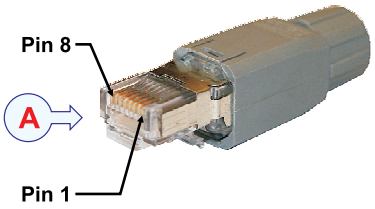
An RS-422 serial line connection is a common way to connect the EM 2040P to external devices. An RS-422 serial line connection can transmit data at rates as high as 10 million bits per second, and may be sent on cables as long as 1500 meters.



A *Local connection*

RJ45 connector

B *Connection on remote device*



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

Minimum cable requirements

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

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

RS-232 serial line used for DGNSS input

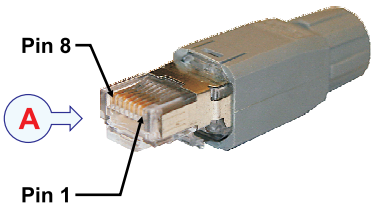
The EM 2040P Portable Processing Unit has a dedicated interface for GNSS correction using RS-422 or RS-232 serial communication.

(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.

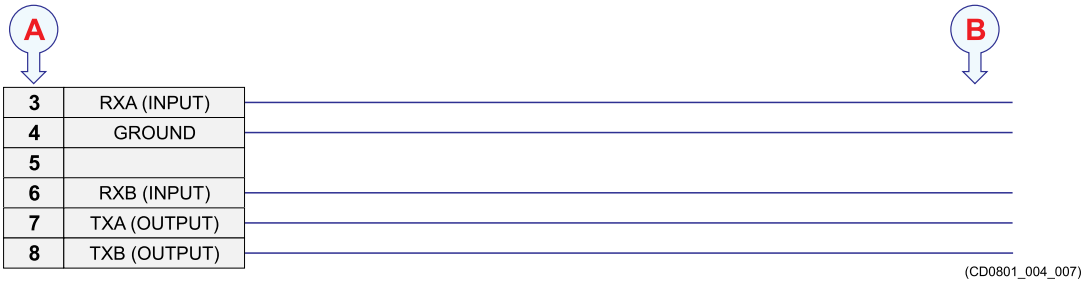
Minimum cable requirements

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

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

RS-422 serial line used for DGNSS input

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

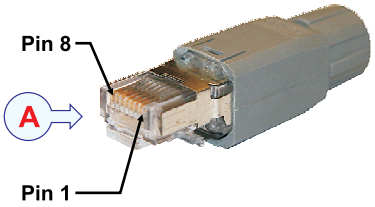


A *Local connection*

RJ45 connector

B *Connection on remote device*

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



Minimum cable requirements

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

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

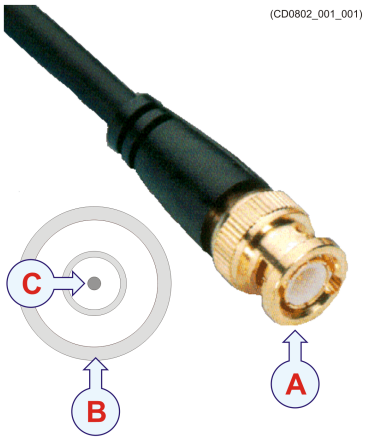
Clock synchronisation (1PPS) using a coax cable

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

A *Male BNC connector*

B *Ground*

C *1PPS signal*



This cable must be provided by the installation shipyard.

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

Remote control

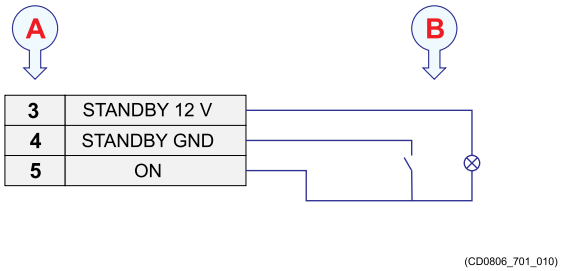
The Processing Unit can be switched on/off with a remote switch. This switch is connected to a 9–pin D-connector on the Processing Unit.

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

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

C *Female 9–pin D-connector*

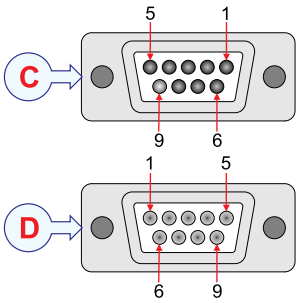
D *Male 9–pin D-connector*



Minimum cable requirements

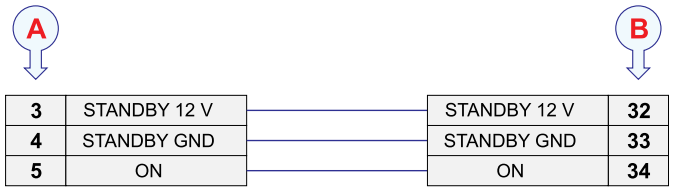
- **Conductors**: 3 x 0.5 mm²
- **Screen**: Overall braided
- **Voltage**: 60 V
- **Maximum outer diameter**: Defined by the plugs and/or the cable gland

This cable must be provided by the installation shipyard.



Remote Control using K-Rem

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

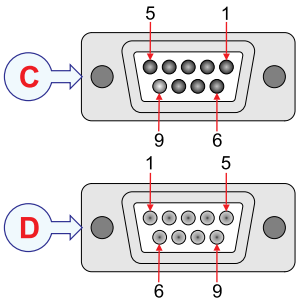


A *Local connection, male 9–pin D-connector*

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

C *Female 9–pin D-connector*

D *Male 9–pin D-connector*



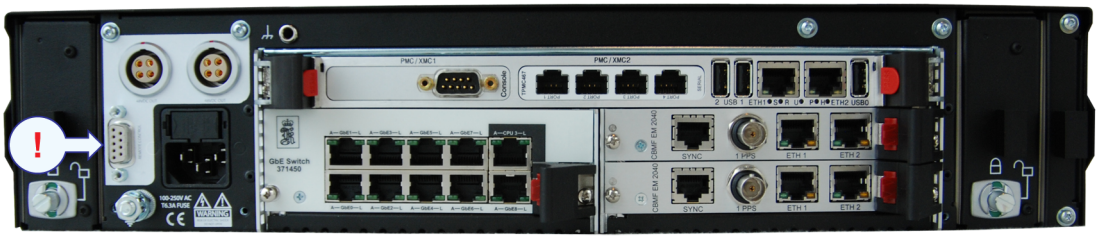
Minimum cable requirements

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

This cable must be provided by the installation shipyard.

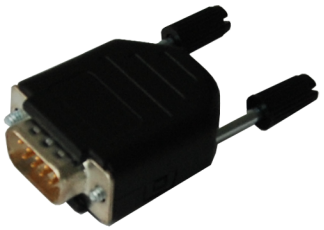
Dummy plug for not using remote control

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



Note

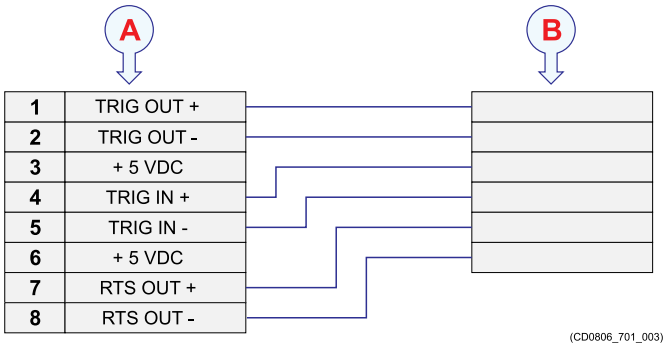
*If remote control is not used, the enclosed remote control dummy plug has to be inserted in the **Remote Control** connector in the Processing Unit. The Processing Unit will not work without this dummy plug.*



External synchronisation

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

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



A *Local connection The connector is RJ45 type.*

Note

Pin 3 and 6 is used by Kongsberg Maritime only.

B *Connection on remote device*

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

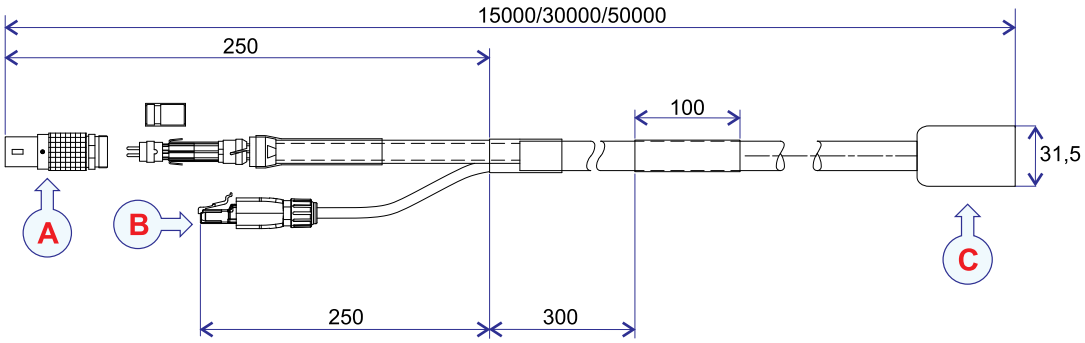
Minimum cable requirements

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

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

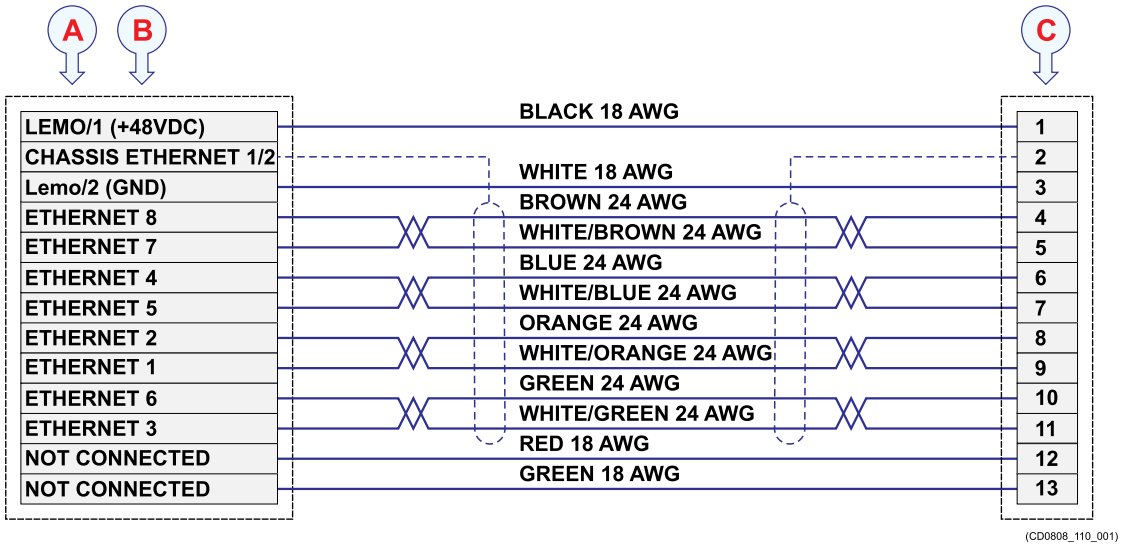
Transducer cable

The 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_110_002)

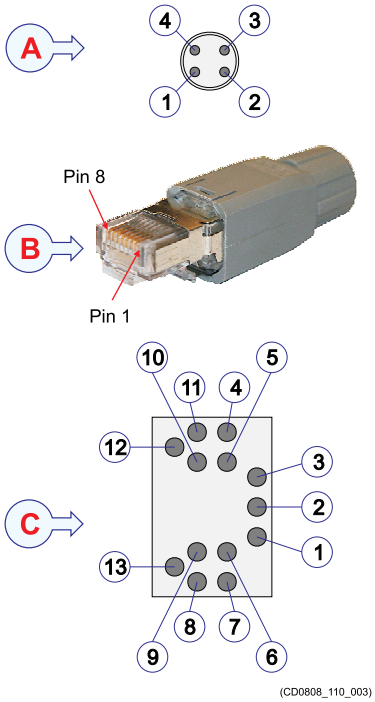


(CD0808_110_001)

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

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

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



Cable specifications

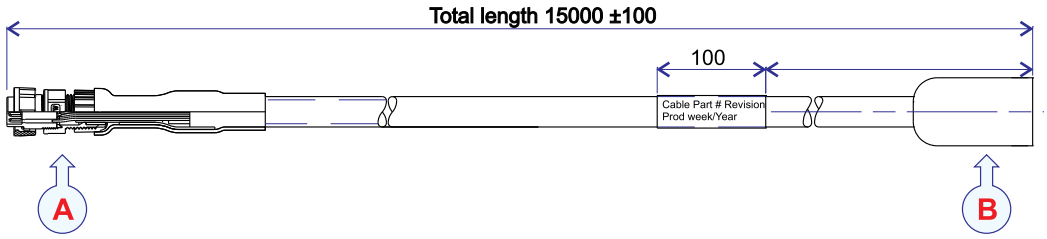
- Cable length: 15, 30 or 50 meters
- Maximum outer diameter: 13.97 mm nom.
- Minimum bending radius: 130 mm
- Conductors: 4 twisted pairs (Ethernet), 4 power conductors and 1 screen
- SubConn® Power/Ethernet Cable, Type D/P-P4TP24#/4C18#
- Connector width: 31.5 mm (transducer end)
- Weight in air: 246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

Important

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

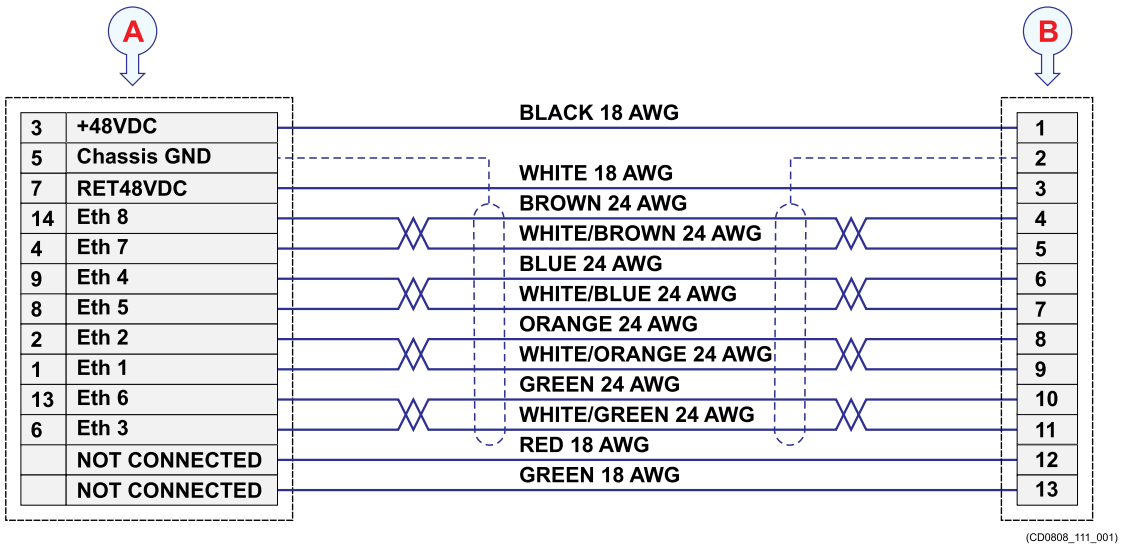
Transducer cable for Portable Processing Unit

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.

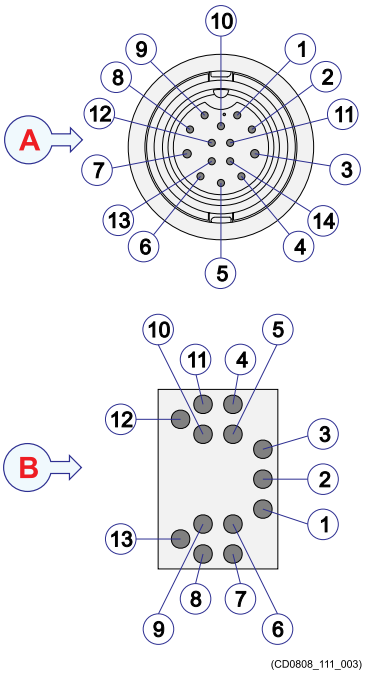
(CD0808_111_002)



(CD0808_111_001)

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

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



Cable specifications

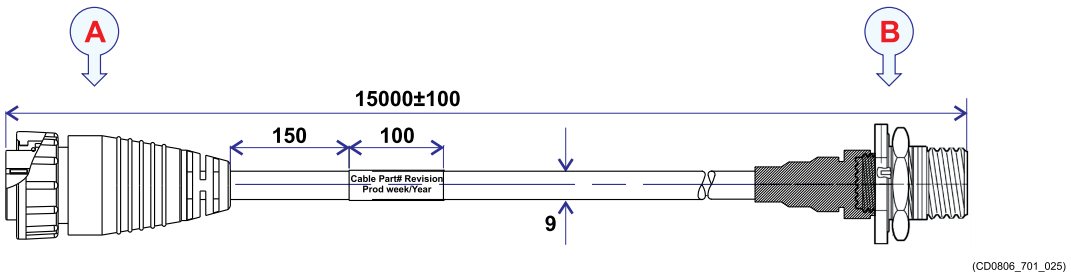
- Cable length: 15, 30 or 50 meters
- Maximum outer diameter: 13.97 mm nom.
- Minimum bending radius: 130 mm
- Conductors: 4 twisted pairs (Ethernet), 2 power conductors and 1 screen
- SubConn® Power/Ethernet Cable, Type D/P-P4TP24#/4C18#
- Connector width: 31.5 mm (transducer end)
- Weight in air: 246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

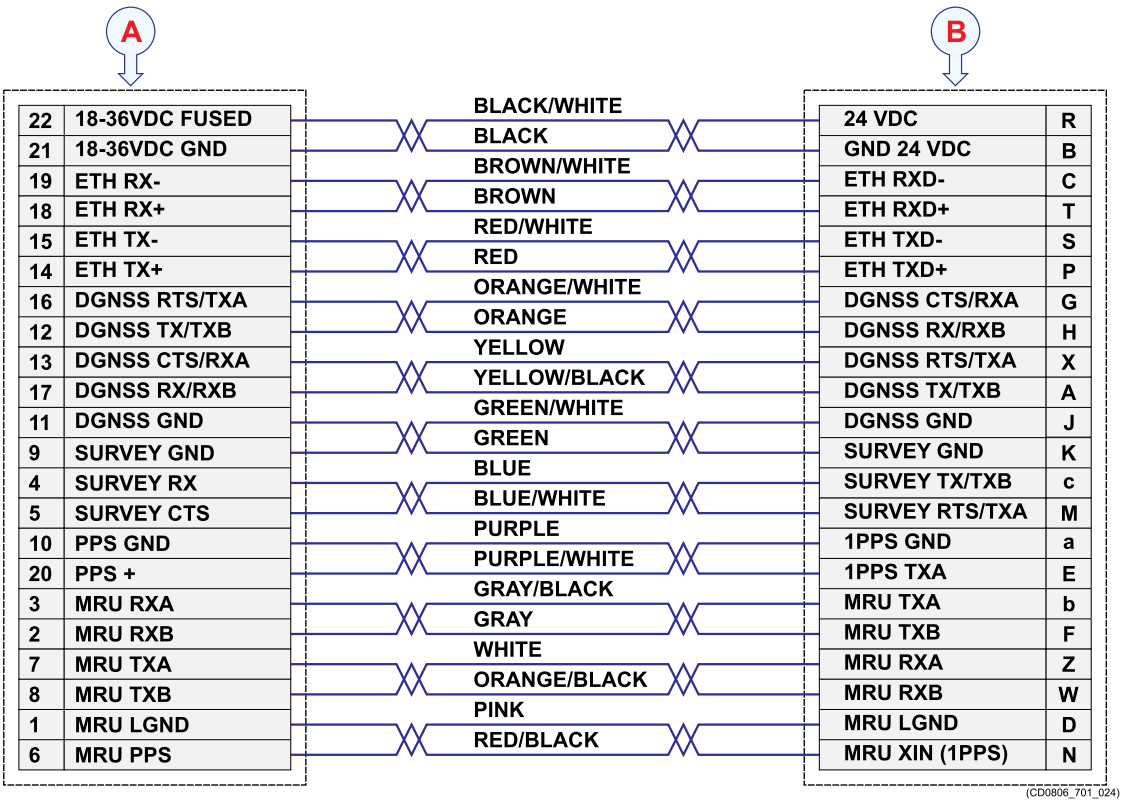
Important

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

Seapath antenna interface cable - with plug

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



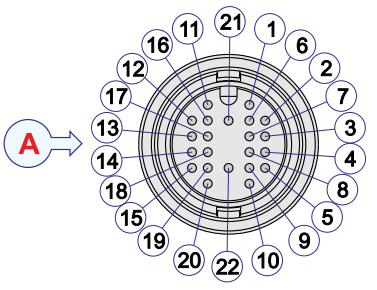


A *Local connection*

Amphenol LTW DU-22BFFA-SL7000

B *Connection to Seapath 130 antenna*

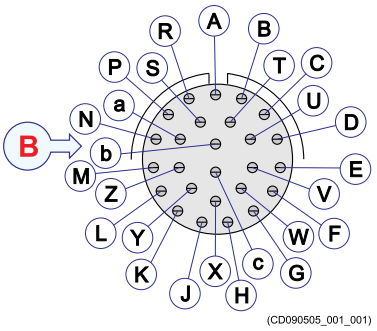
JVS07A1726SN



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

Relation between RS-232 and RS–422 pins

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



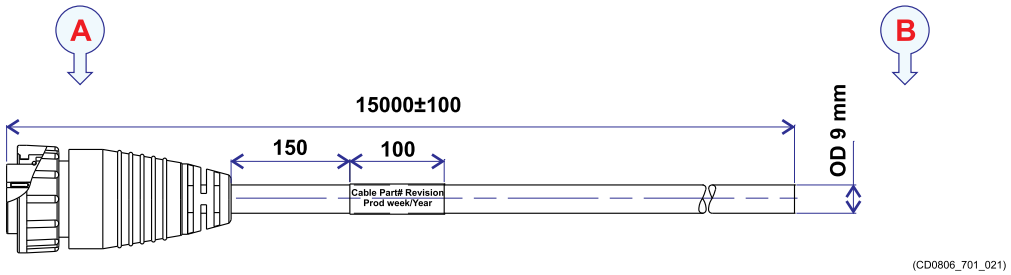
Cable specifications

- 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.



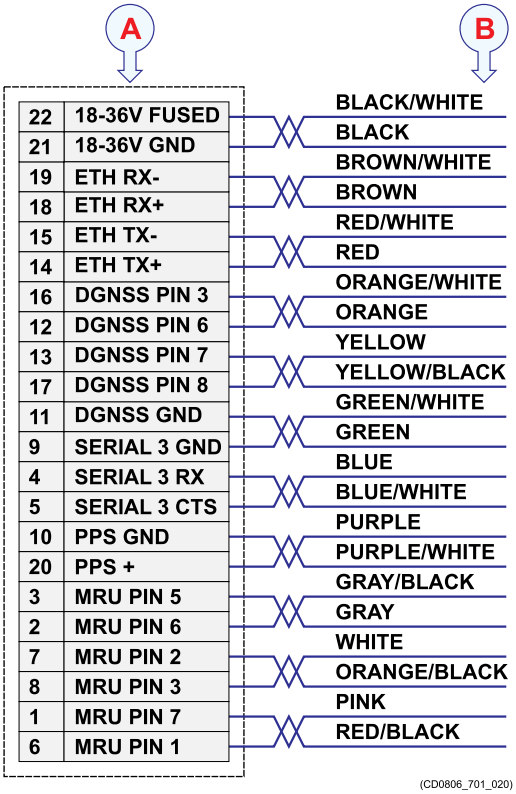
A *Local connection, Amphenol LTW DU-22BFFA-SL7000*

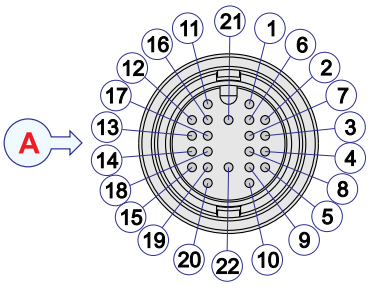
B *Connection Seapath antenna*

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

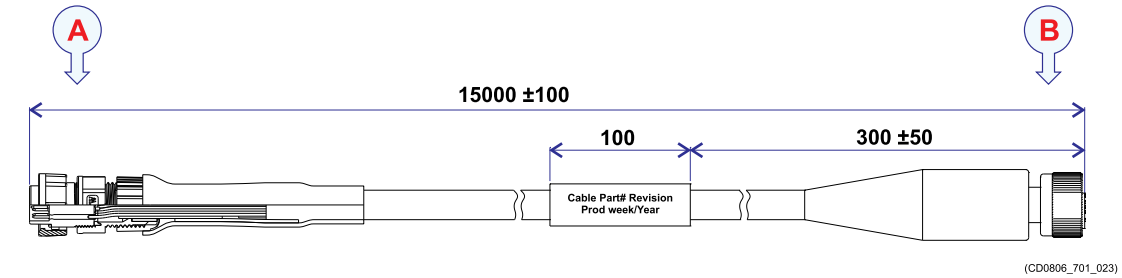
  UL2464 26AWG * 11 Pairs+Drain+AL.Mylar PVC Jacket UV Resistant
- 22pin 2 ethernet TPs, 2 power conductors, 12 serial com leads (4xRS422), 4 1PPS leads and 1 screen
- +Drain+AP.Mylar PVC Jacket UV Resistant
- Screen: Aluminium Mylar
- Voltage: 300 V
- Temperature: 80 °C

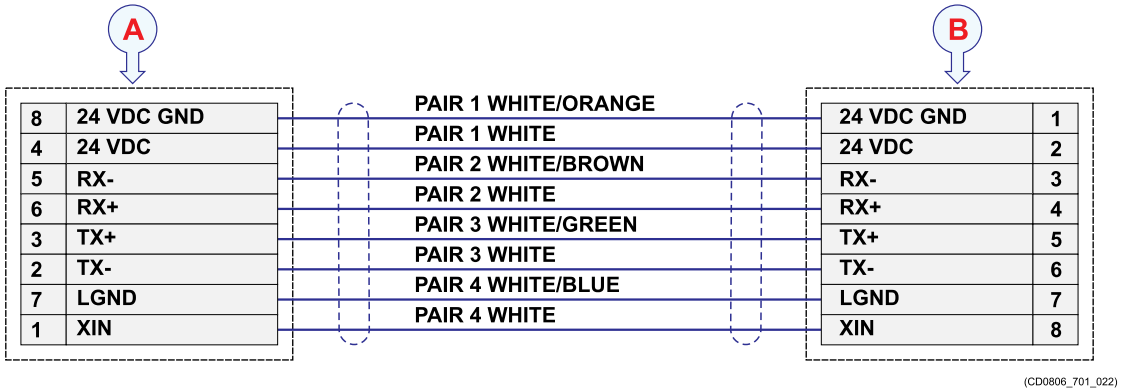




Seapath MRU interface cable

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.



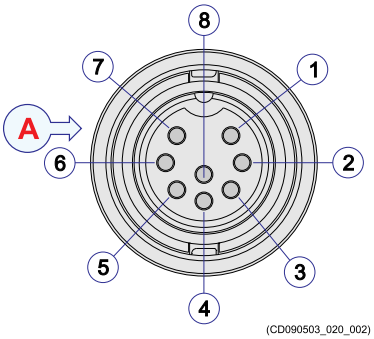


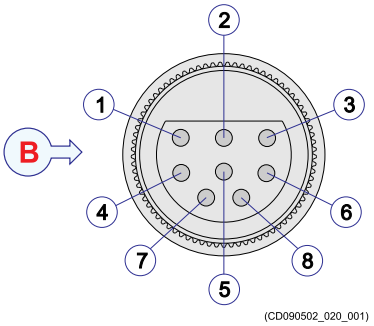
A *Local connection*

Amphenol LTW CD-08BFMA–LL7001

B *Connection Seapath MRU*

SEACON 5501–1508



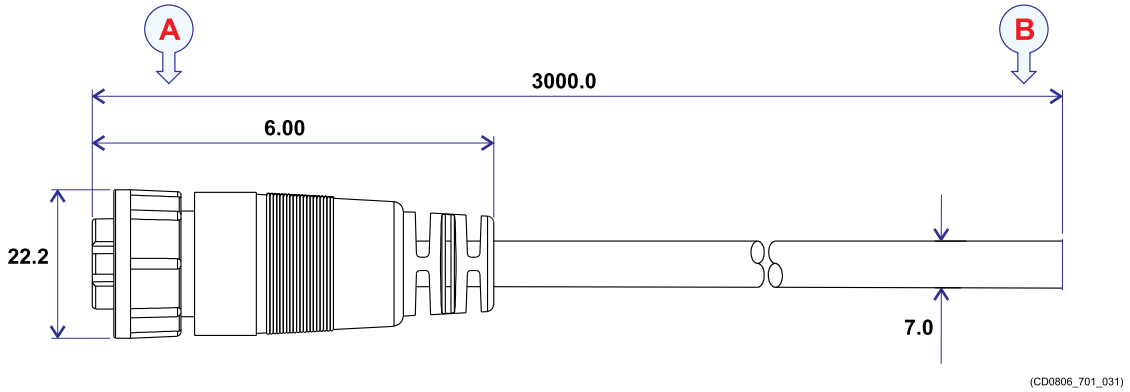


Cable specifications

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

DC Power cable

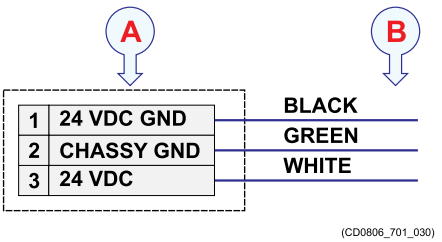
This cable is used to connect the Portable Processing Unit to DC power supply. The cable is delivered with the Portable Processing Unit.



A *Local connection*

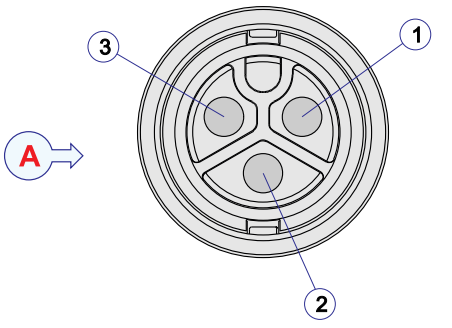
Amphenol LTW PWC-03AFFM-LL7A03

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

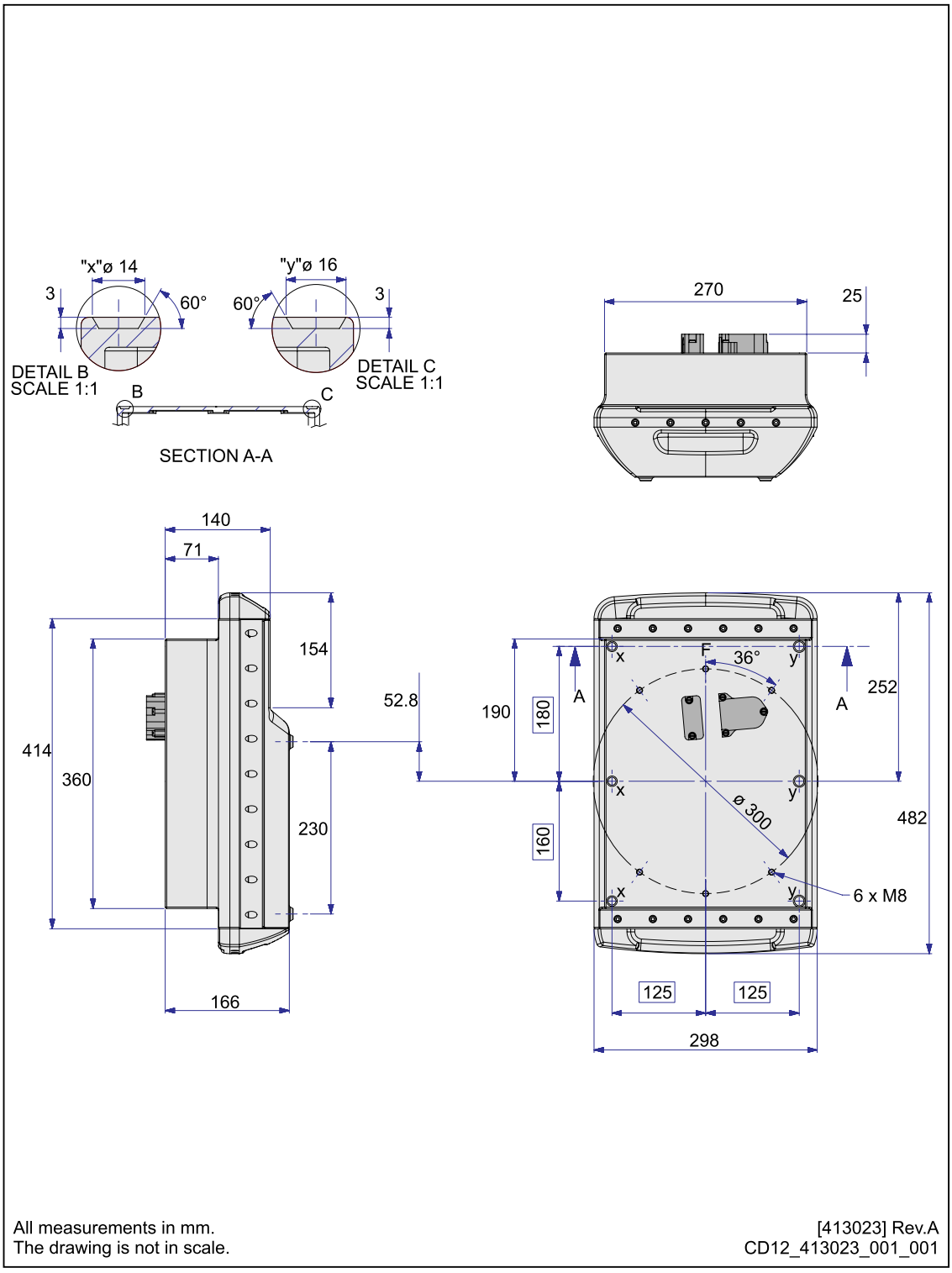


Drawing file

Topics

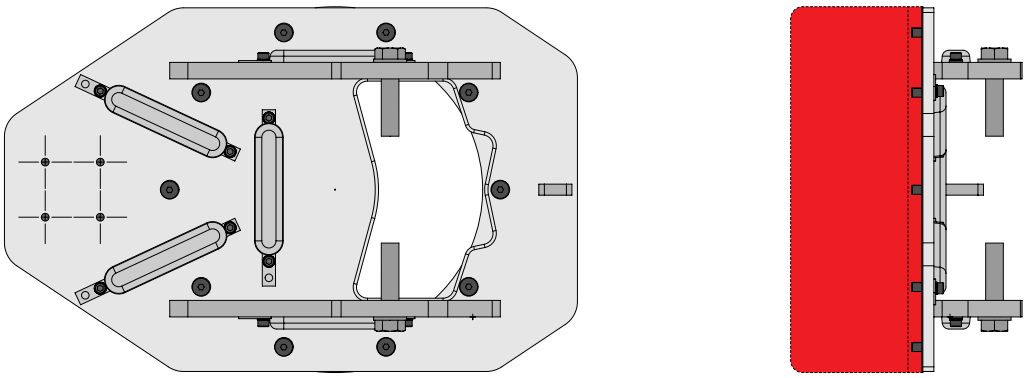
Transducer dimensions

Drawing 413023



Transducer mounting bracket

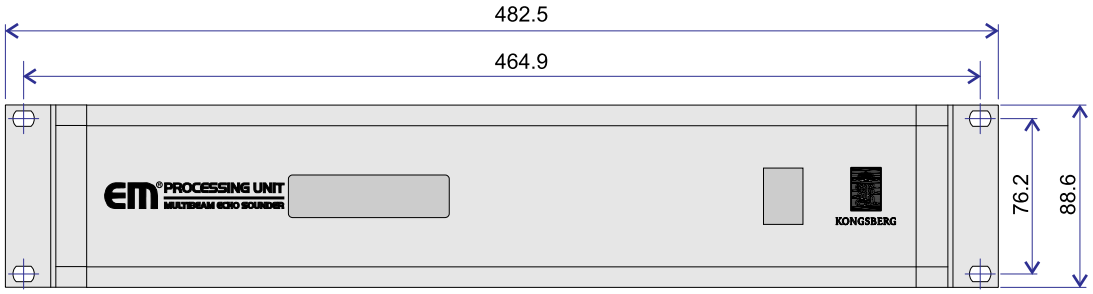
Drawing 499–218221



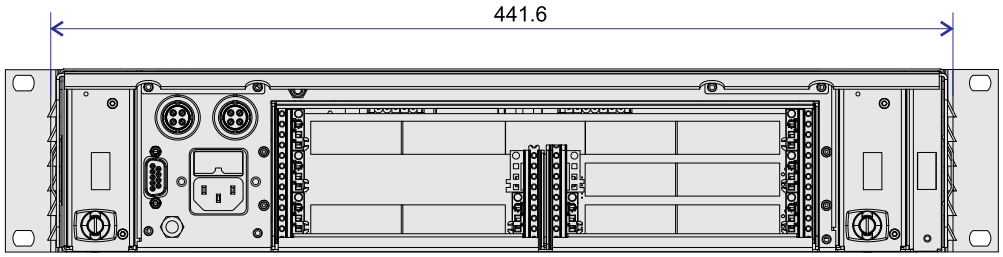
All measurements in mm.
The drawing is not in scale.

[218221] Rev.C
CD12_218221_001_001

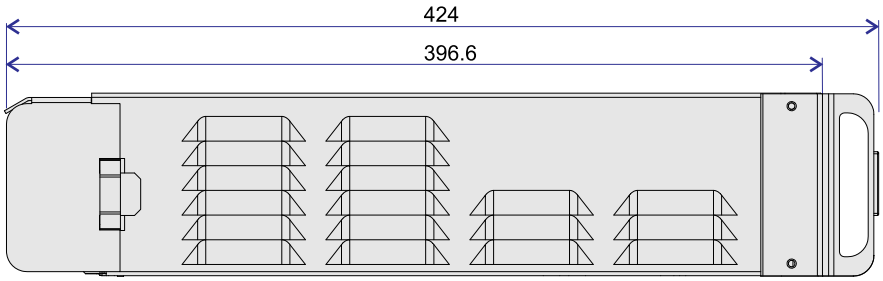
385422 Processing Unit dimensions



Front View



Rear View



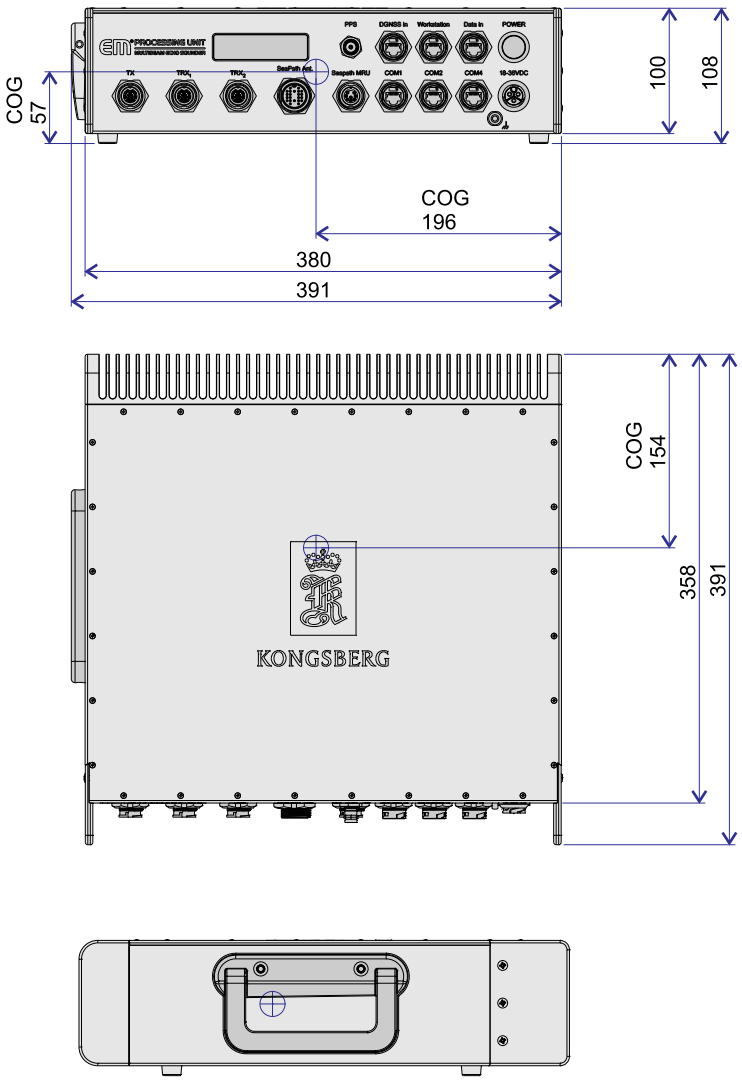
Side View

Weight: 10.5 kg

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

[385422] Rev.B
CD12_385422_001_001

424178 Portable Processing Unit dimensions

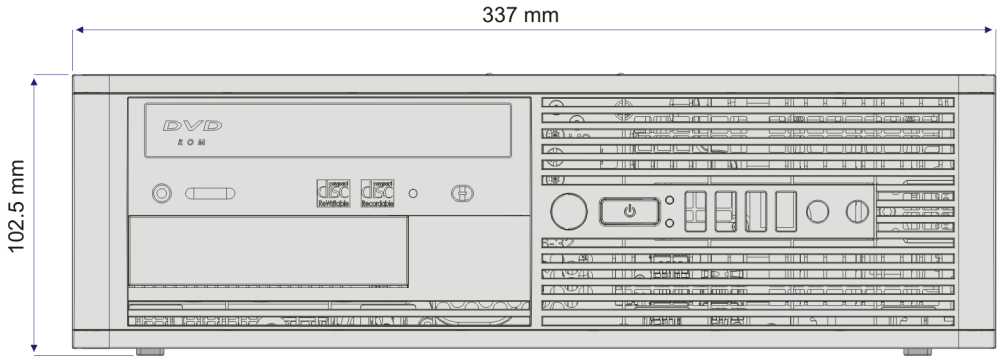


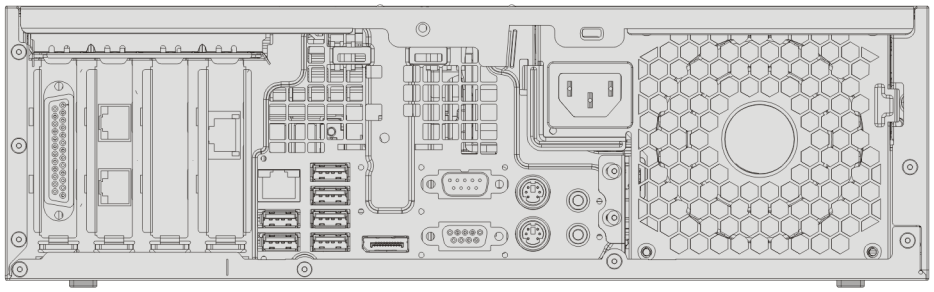
Weight: approximately 11 kg

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

[424178] Rev.A
CD12_424178_001_001

378828 Hydrographic Work Station dimensions

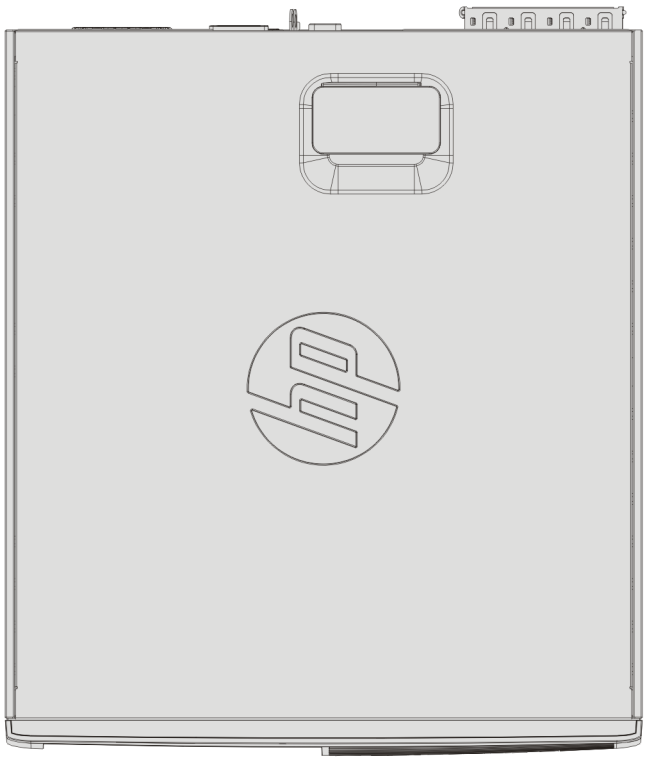




Note that this is a generic drawing. The physical presentation of the computer may not match specific product versions.

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

[378828] Rev.A
CD12_378828_001_001

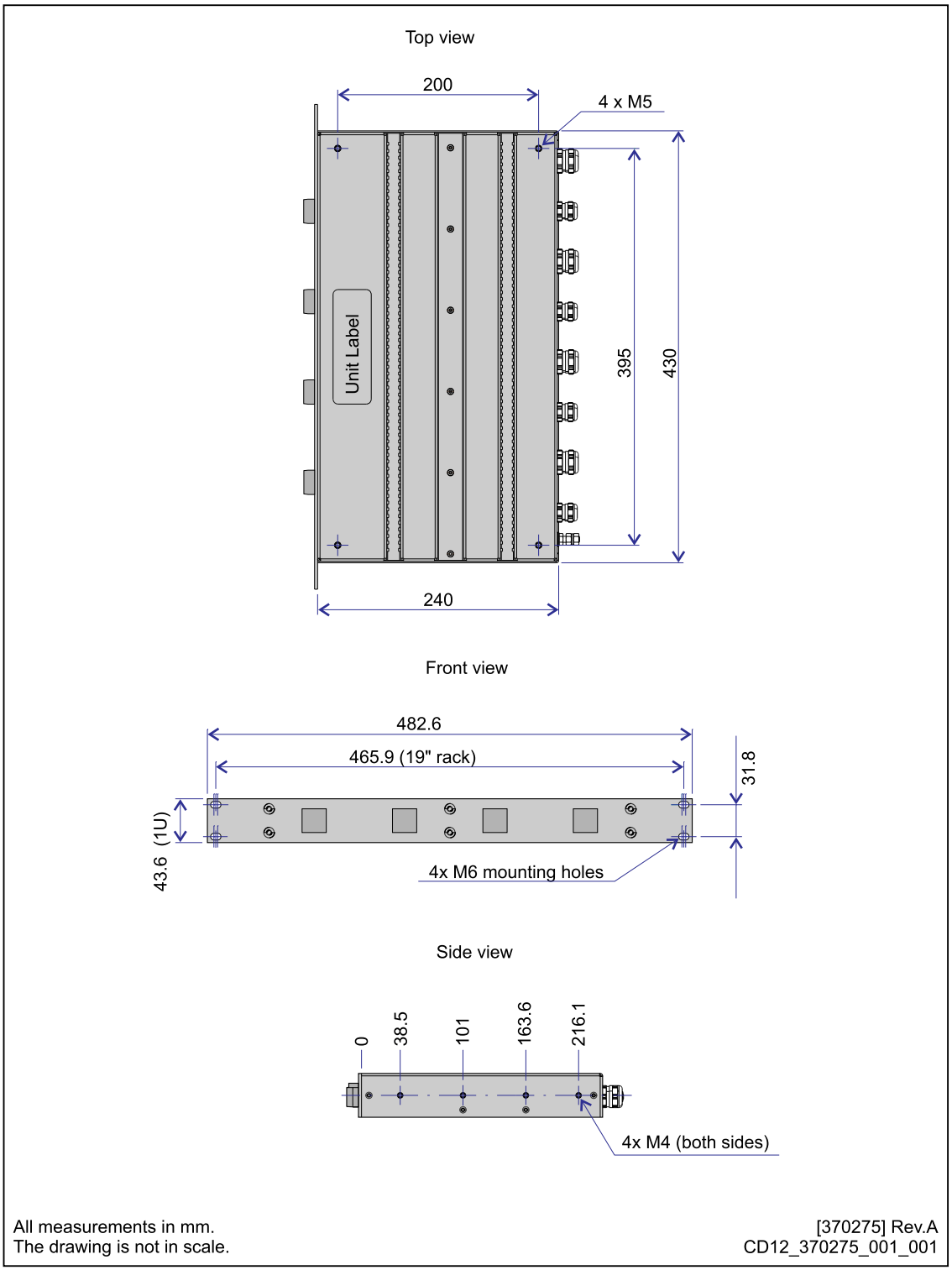


Note that this is a generic drawing. The physical presentation of the computer may not match specific product versions.

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

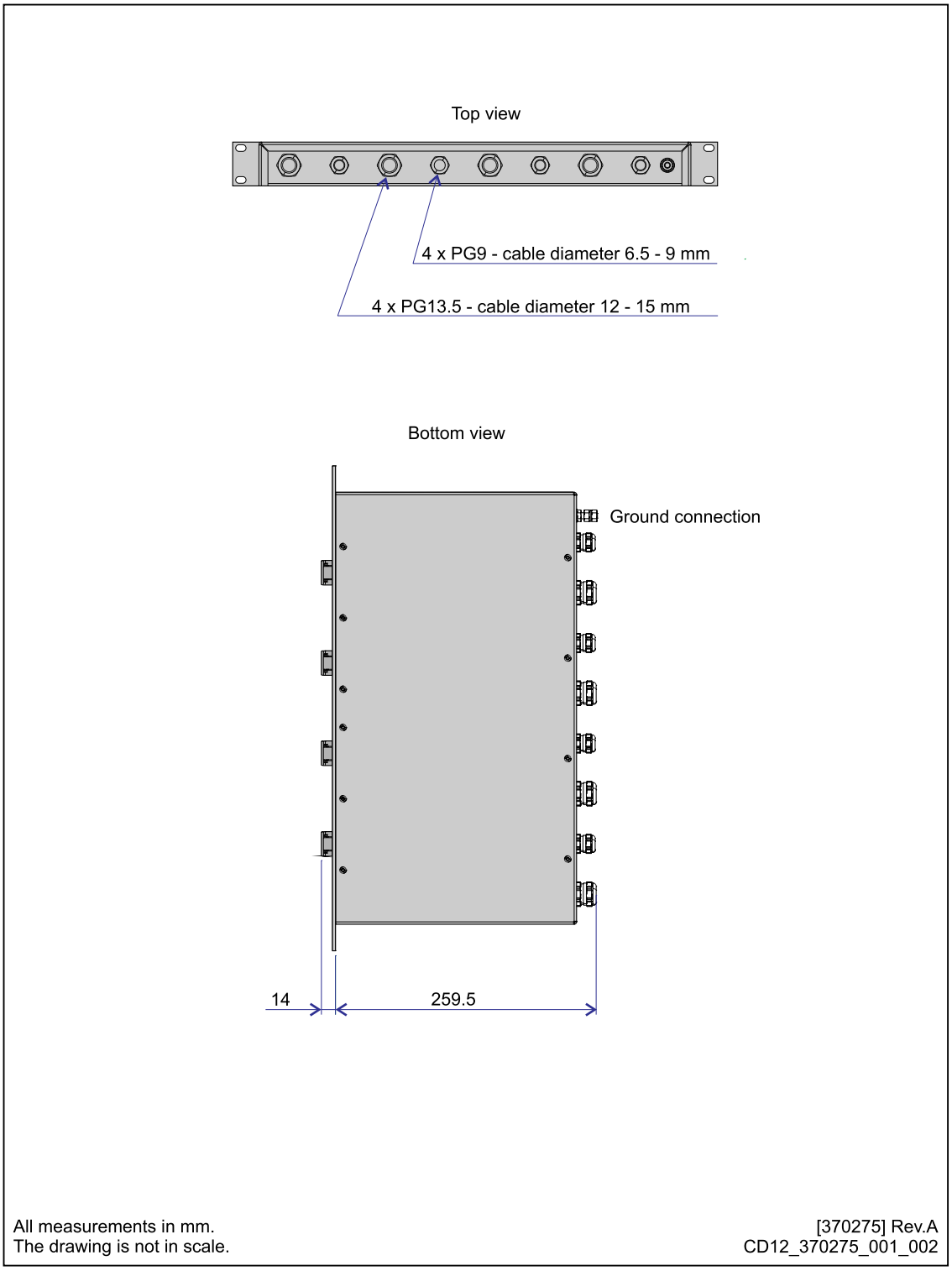
[378828] Rev.A
CD12_378828_001_002

370275 Remote Control Unit (K-REM) dimensions

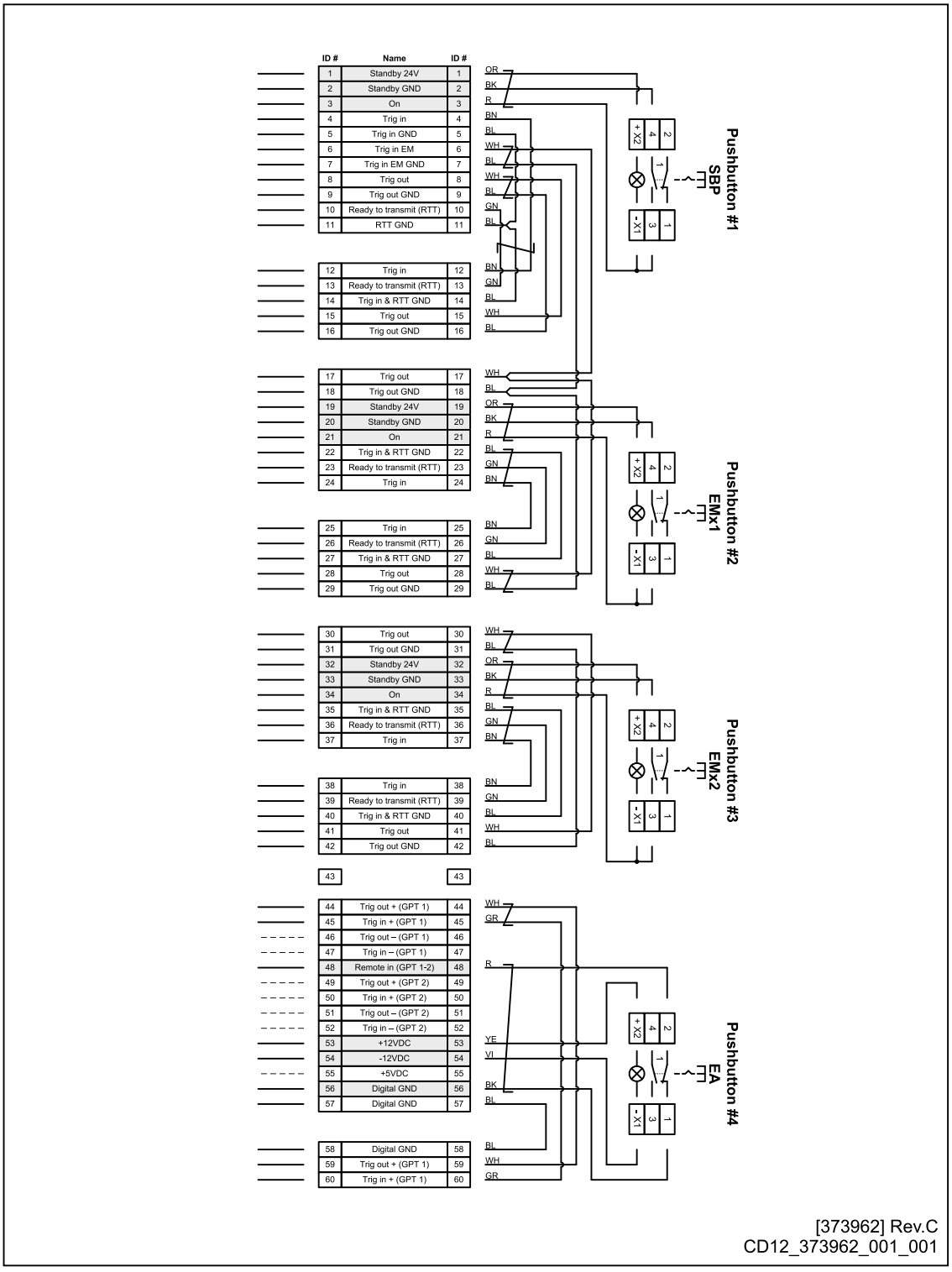


All measurements in mm.
The drawing is not in scale.

[370275] Rev.A
CD12_370275_001_001


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

373962 Remote Control Unit (K-REM) wiring diagram



Technical specifications

Topics

Performance specifications

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

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

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

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

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

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

- **Receive beam steering, across**: Stabilised for roll (±15 degrees)

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

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

Interface specifications

Topics

Interface specifications introduction

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

Different generations of datagram formats

SIS 5.x and newer versions use the new kmall format.

Older versions of SIS use the all format.

The available input datagram formats are different in these generations of SIS and are described in this chapter.

EM 2040P has been delivered with both generations of datagram formats.

The KMall format is described in it's own document. See the Software downloads page.

The datagram formats used with SIS 4.x and older are described in a separate document *EM Datagram formats* document number 160692.

Interface specifications - Processing Unit - all format

The EM 2040P 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 position information

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

This datagram format is received using a serial communication line.

- **NMEA ZDA**

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

Supported datagram formats for heading information

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

These datagram formats are received using a serial communication line.

- **NMEA HDT**

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

- **SKR82 Heading**

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

Supported datagram formats for depth information

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

These datagram formats are received using a serial communication line.

- **NMEA DBS**

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

- **NMEA DPT**

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

- **Simrad EK500 Depth**

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

Supported datagram formats for motion information

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

These datagram formats are received using a serial communication line.

- **Kongsberg EM Attitude 3000**

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

Supported datagram formats for motion information including velocity

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

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

- **Seapath Binary 11**

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

- **Seatex Binary 23**

  The Seatex Binary 23 is a proprietary datagram format created by Kongsberg Maritime (https://www.kongsberg.com/maritime/), former Kongsberg Seatex, to provide position, motion and heading data from a Seapath sensor system.

- **Seapath Binary 26**

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

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

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

- **Coda Octopus MCOM**

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

Special interfaces

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

Interface specifications - Processing Unit - KMall format

The EM 2040P 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 position information

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

- **NMEA ZDA**

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

Supported datagram formats for motion information

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

- **Kongsberg EM Attitude 3000**

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

Supported datagram formats for motion information including velocity

The EM 2040P supports the following datagram formats 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.

Supported datagram formats for sound speed probe

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

The EM 2040P supports the following datagram format from a sound speed probe.

- **AML**

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

  The supported AML Smart Sensor message formats are

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

- **Valeport**

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

  The supported Valeport message formats are

  – **MiniSVS SV**: Sound velocity

No longer supported

Some external sensors are no longer supported.

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

Special interfaces

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

Output datagram formats

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

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

External sensor requirements

The external sensors must fulfil these requirements to achieve the specified performance for the EM 2040P system.

Sensor accuracy

Velocitiy sensor accuracy requirements

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

Motion sensor accuracy requirements

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

- **Roll:** 0.02 degrees RMS
  - An accuracy of 0.05 degrees RMS can be accepted unless you have very long pulse length and large beam angles.
- **Pitch**: 0.05 degrees RMS
- **Heading**: 0.2 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.

Check with your sensor supplier if the sensor accuracy requirements are met and the required formats are supported.

Interface specifications - Hydrographic Work Station - all format

The EM 2040P 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)

Weight and outline dimensions

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

Transducer

- **Outline dimensions**:
  - **Length**: 482 mm
  - **Width**: 298 mm
  - **Height**: 166 mm
- **Weight**:
  - **In air**: 19.5 kg
  - **In water**: 1.7 kg

Processing Unit

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

Portable Processing Unit

Make and model: Kongsberg Maritime, EM PPU

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

Hydrographic Work Station

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

- **Make and model**: Hewlett Packard MP5810
- **Outline dimensions**:
  - **Depth**: 379 mm
  - **Width**: 338 mm
  - **Height**: 100 mm
- **Weight**: 7 kg (Approximately)

Display

- **Make and model**: Isic MD24 (DuraMON WS 24)
- **Manufacturer's website**: http://www.isic-systems.com
- **Outline dimensions**:
  - **Depth**: 68 mm
  - **Width**: 601 mm
  - **Height**: 408 mm
- **Weight**: 10 kg (Approximately)

Related topics

Drawing file, page 86

Power requirements

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

Under normal circumstances the external power is supplied to the Processing Unit, and the Processing Unit provides the transducers with 48 Vdc power.

Note

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

Transducer

The power is normally supplied by the Processing Unit.

- **Voltage requirement**: 48 VDC
- **Maximum voltage deviation**: 10 %

- **Maximum power consumption**:
  - **CW (Continuous Wave) mode**: 45 W (0.9 A)
  - **FM (Frequency Modulation) mode**: 60 W (1.25 A)

Processing Unit

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

Portable Processing Unit

- **Make and model**: Kongsberg Maritime, EM PPU
- **Voltage requirement**: 24 VDC Nominal voltage
- **Maximum power consumption**:
  - **With one CBMF board (without transducer)**: 115 W
  - **With two CBMF boards (without transducer)**: 125 W

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 2040P Single Swath System Component	Maximum power consumption
Processing unit with 1xCBMF	115
EM 2040P sonar head	60
Total	175 W

EM 2040P Dual Swath System Component	Maximum power consumption
Processing unit with 2xCBMF	125
EM 2040P sonar head	60
Total	185 W

Hydrographic Work Station

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

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

Display

- **Manufacturer**: Isic
- **Manufacturer's website**: http://www.isic-systems.com
- **Model**: MD22/24/27 (DuraMON WS 22/24/27)
- **Input voltage**: Standard: 90–264 VAC, Optional: 18–36 VDC, 50–60 Hz
- **Power consumption**: Max. 40 W

Environmental requirements

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

Transducer

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

Processing Unit

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

Portable Processing Unit

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

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

Hydrographic Work Station

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

  This IP rating is only applicable when the unit is mounted using the optional kit for 19-inch rack.
- **Certificates**:
  - IEC 60945
  - IACS E10

Display

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

Alignment specifications

These alignment specifications summarize the alignment accuracy requirements of the EM 2040P 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**: ± 0.05 deg
- **Roll**: ± 0.02 degrees
- **Heading**: ± 0.05 degrees
- **Flatness**: ± 0.5 mm
  - The mounting structure must not deviate from a flat surface more than ± 0.5 mm.

Motion sensor alignment accuracy

- **Position (x)**: ± 0.05 m

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

Heading sensor alignment accuracy

- **Heading**: ± 0.1 degrees

Position sensor alignment accuracy

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

Waterline determination accuracy

- **Position (z)**: ± 0.005 m

Related topics

Installation summary, page 34
Vessel coordinate system, page 29

Equipment handling

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

Topics

Transporting Kongsberg Maritime equipment

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

Prerequisites

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

Context

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

Observe the packing instructions.

Note

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

Procedure

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

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

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

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

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

4 Handle all boxes and units with care.

Note

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

Lifting units and transportation boxes

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

Prerequisites

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

Context

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

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

Note

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

Procedure

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

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

3 If you need to use a crane:

   a Check the applicable weight certificate for the crane.

   b Check the security of the lifting lugs.

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

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

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

4 If you need to use a forklift truck:

   a Check the applicable weight certificate for the truck.

   b Check the limitations for lifting height and angles.

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

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

5 Handle all units and boxes with care.

Note

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

Inspection of units and transportation boxes after arrival

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

Prerequisites

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

Procedure

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

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

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

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

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

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

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

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

Specifications for storage prior to installation or use

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

General specifications

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Caution

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

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

Temperature protection

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

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

Other temperature limits may be used if applicable.

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

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

Note

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

Unpacking instructions

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

Topics

Unpacking standard parts and units

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

Context

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

Note

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

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

Procedure

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

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

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

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

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

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

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

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

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

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

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

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

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

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

8 Check also for special tools, door keys etc.

Unpacking mechanical units

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

Prerequisites

Observe the procedure for unpacking of standard parts and units.

Context

Mechanical and electromechanical units may be heavy.

Procedure

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

2 Lift the unit out of the transportation box.

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

4 Inspect the unit for visual damage.

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

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

Unpacking electronic and electromechanical units

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

Context

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

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

Note

Beware of Electrostatic Discharge (ESD)!

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

Procedure

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

Note

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

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

3 Inspect the unit for damage.

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

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

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

5 Take out and keep the documentation.

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

6 If applicable, open the unit and check inside.

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

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

Unpacking transducers

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

Prerequisites

Observe the procedure for unpacking of standard parts and units.

Context

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

Note

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

Transducers may be heavy.

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

Observe these transducer handling rules:

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

Procedure

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

2 Lift the transducer, sonar head or hydrophone out of the transportation box.

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

4 Inspect the unit for visual damage.

5 Make sure that the relevant protection is kept in place until the final stages of the installation.

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

7 Observe the handling rules for transducers.

Specifications for storage after unpacking

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

General specifications

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

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

Note

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

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

Caution

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

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

Temperature protection

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

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

Other temperature limits may be used if applicable.

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

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

Note

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

General safety rules

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

1 You must always switch off all power before installation or maintenance work on the EM 2040P system.

   Use the main circuit breaker, and label the breaker with a warning sign that informs others that maintenance or installation work is in progress on the system.

2 For safety reasons, two persons must always be present during troubleshooting with power ON.

3 Read and understand the applicable first aid instructions related to electric shock.

4 Whenever maintenance is in progress, it is essential that a first aid kit is available, and that all personnel are familiar with the first aid instructions for electrical shock.

General safety rules

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

WARNING

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

1 You must always switch off all power before installation or maintenance work on the EM 2040P system.

   Use the main circuit breaker, and label the breaker with a warning sign that informs others that maintenance or installation work is in progress on the system.

2 For safety reasons, two persons must always be present during troubleshooting with power ON.

3 Read and understand the applicable first aid instructions related to electric shock.

4 Whenever maintenance is in progress, it is essential that a first aid kit is available, and that all personnel are familiar with the first aid instructions for electrical shock.

5 The various parts of the system may be heavy.

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

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