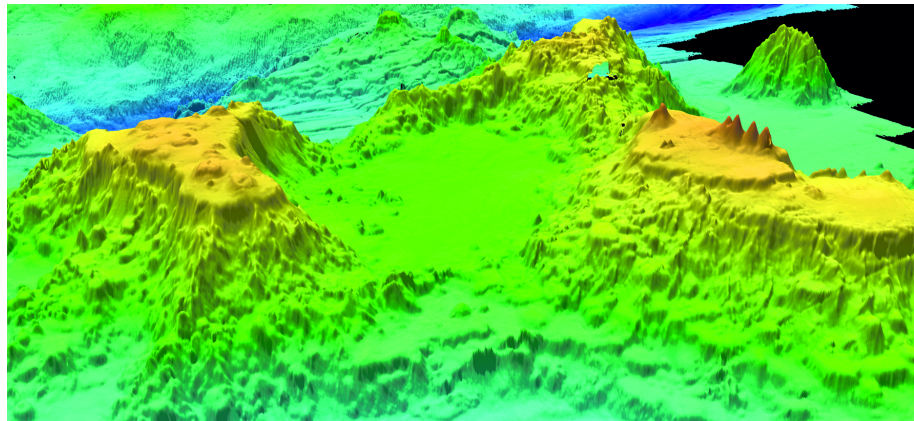




KONGSBERG

Kongsberg EM 124 Multibeam Echo Sounder Installation Manual



*Image: Bathymetry of the Northern Portion of the Mariana Trench.
Courtesy of Dr James V. Gardener, University of New Hampshire.*

443140/A

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Document information

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Warning

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

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

Disclaimer

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

Support information

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

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About this manual

Purpose of manual

The purpose of this manual is to provide the information, procedures and basic drawings required for the physical installation of the EM 124.

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..

Installation instructions

You must follow the instructions in this manual to ensure optimal performance. As a guide, installation procedures are presented in the order they must be done.

The equipment described in this manual includes the complete system with relevant cabinets. Units provided locally by the customer, installation shipyard or local representative are not described.

The manual also defines the equipment responsibility, and provides applicable instructions for unpacking and storage of units.

Note

You must follow the instructions given in this manual. If not it may affect the warranty.

Kongsberg Maritime AS will accept no responsibility for any damage or injury to the system, vessel or personnel caused by equipment that has been incorrectly installed or maintained, or by drawings, instructions or procedures that have not been prepared by us.

Installation drawings

The installation shipyard must provide all necessary installation drawings unless otherwise specified in the delivery contract.

Kongsberg Maritime AS may, on special order, provide assistance to these drawings.

Note

If required, all documents provided by the shipyard for the physical installation of the EM 124 must be approved by the vessel's national registry and corresponding maritime authority and/or classification society. Such approval must be obtained before the installation can begin. The shipowner and shipyard doing the installation are responsible for obtaining and paying for such approval.

The outline dimensions of the EM 124 units are found in the *Drawing file* chapter in this manual.

Online information

For information about the EM 124 and other products from Kongsberg Maritime, visit our website.

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

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Kongsberg EM 124

Topics

[System description, page 10](#)

[Technical details, page 11](#)

[System diagram, page 12](#)

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System description

EM 124 multibeam echo sounder is a high performance echo sounder for deep water mapping.

The EM 124 is designed to perform seabed mapping to full ocean depth with an unsurpassed resolution, coverage and accuracy. The system is cost effective, reliable, and easily operated. The design of the EM 124 is based on more than 50 years of hydrographic experience with echo sounders, sonars and underwater positioning for civilian and military use. It is the latest model in a series of deep sea multibeam echo sounders that started with the EM 12 in 1990.

The EM 124 consist of new state-of-the-art electronics and separate transmit and receive transducers in a Mills Cross configuration. It uses the same field-proven transducers as the EM 122, making it easy to upgrade. Care has been taken to design a highly, modular and flexible solution with compact electronics for easier and faster installation. Due to a flexible transducer design, the system can be tailored to almost any required size. The largest standard size, 0.5 x 1 degrees, gives the ultimate system performance in terms of resolution and range, while a smaller 4 x 4 degrees solution allowing full ocean depth surveys even on smaller vessels.

The EM 124 multibeam echo sounder consists of the following main units.

- Transducer arrays
- Transmitter Unit(s)
- Receiver Unit(s)
- Processing Unit
- Hydrographic Work Station

To form a complete system it is also required to have sensors providing vessel attitude, velocity, position, sound speed profile of the water column and speed of sound at the transducer depth.

Technical details

The EM 124 operates at sonar frequencies in the 10.5-13.5 kHz range. The transmit fan is divided into 4 sectors in shallow modes (8 sectors in deep modes) to maximize range capability but also to suppress interference from multiples of strong bottom echoes. The sectors are transmitted sequentially within each ping, and uses distinct frequencies or waveforms.

The nominal sonar frequency is 12 kHz with an angular coverage sector of up to 150 degrees and 1600 beams per ping. Achievable swath width on a flat bottom will normally be up to 6 times (143 degrees) the water depth. The angular coverage sector is operator controllable or may be set to a fixed range. It may also be set to vary automatically with depth according to achievable coverage. This maximizes the number of usable beams. The beam spacing is normally high density equidistant with equiangle available.

The transmit fan is split in several individual sectors with independent active steering according to vessel roll, pitch and yaw. This places all beams on a "best fit" to a line perpendicular to the survey line, thus ensuring a uniform sampling of the bottom and 100% coverage.

In dual swath mode the transmit fan is duplicated and transmitted with a small difference in alongtrack tilt. The applied tilt takes into account depth, coverage and vessel speed to give a constant beam separation alongtrack.

The sectors are frequency coded or have FM chirps, and they are transmitted sequentially at each ping. The sector steering is fully taken into account when the position and depth of each beam is calculated, as is the refraction due to the sound speed profile, vessel attitude and installation angles. The pulse length and range sampling rate are variable with depth (auto or manual) for best resolution.

In shallow waters due care is taken to the near field effects through nearfield focusing individually applied in the different sectors.

EM 124 applies one focus range for each of the transmit sectors which are used for shallow water environment. Dynamic beam focusing is used for the reception beams.

The ping rate is mainly limited by the round trip travel time in the water up to a ping rate of more than 5 Hz.

The number of individual TX and RX modules in the two arrays depends on the chosen configuration. The standard types identified by "transmission x reception" beamwidth are:

- **0.5 x 1 degree system:** 96 transmit transducer modules and 16 receive transducer modules
- **1 x 1 degree system:** 48 transmit transducer modules and 16 receive transducer modules
- **1 x 2 degrees system:** 48 transmit transducer modules and 8 receive transducer modules
- **2 x 2 degrees system:** 24 transmit transducer modules and 8 receive transducer modules
- **2 x 4 degrees system:** 24 transmit transducer modules and 4 receive transducer modules
- **4 x 4 degrees system:** 12 transmit transducer modules and 4 receive transducer modules

System diagram

The system diagram identifies the main components of a basic EM 124 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 sensors*
- *Tide*
- *Centre depth output*

C *Processing Unit*

D *Interfaces:*

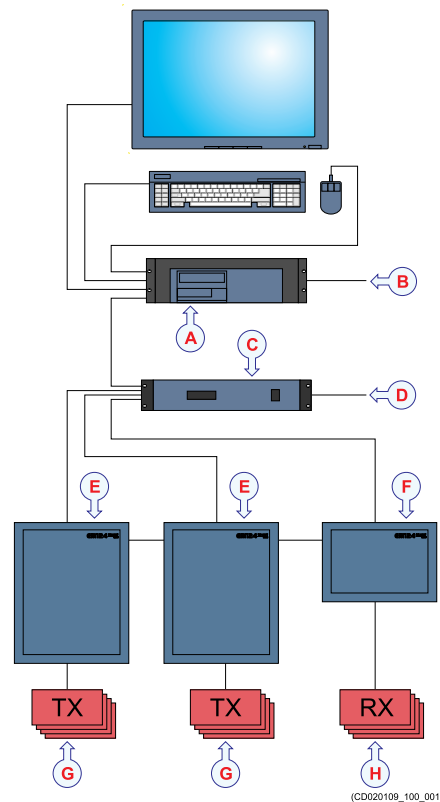
- *Positioning systems*
- *Attitude (roll, pitch and heave)*
- *Sound speed sensor*
- *Velocity*
- *Clock*
- *Trigger input/output*
- *Clock synchronisation (1PPS)*

E *Transmitter Unit (TXU)*

F *Receiver Unit (RXU)*

G *Transmit transducer modules*

H *Receive transducer modules*



System units

Topics

[Transducer description, page 13](#)

[Transmitter Unit description, page 14](#)

[Receiver Unit description, page 14](#)

[Processing Unit description, page 14](#)

[Hydrographic Work Station description, page 15](#)

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 124 uses separate transducer arrays for transmitting and receiving sound pulses. Both transducer arrays have several modules which are assembled in mounting frames.

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

The transmit transducer array contains up to 96 modules in accordance with the chosen beamwidth. Each module contains 18 elements arranged in rows of 6 elements. Each element is individually connected to its corresponding transmitter in the Transmitter Unit(s). It can thus be driven with an unique amplitude level and phase to allow forming of the required transmit sectors with individual steering.

The receive transducer contains up to 16 modules in accordance with the chosen beamwidth. Each module contains 8 transducer staves, and these have individual electrical connections to their corresponding preamplifiers in the Receiver Unit(s). Each staff can thus be given unique amplitude and phase control to allow forming of the required receive beams.



Receive transducer module

Transmitter Unit description

The EM 124 Transmitter Unit has all transmit electronics, like control processors, power amplifiers, power supply, capacitor battery and Ethernet interface.

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

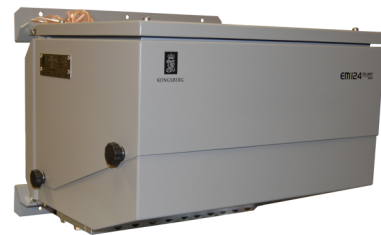
Twisted pair Ethernet is used for data communication with the Processing Unit.

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

Receiver Unit description

The EM 124 Receiver Unit has all receive electronics, like control processor, amplifiers, Analog-to-Digital Converters, power supply and Ethernet interface.

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



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

Processing Unit description

The EM 124 Processing Unit is provided to process the signals to and from the Transmitter and Receiver Units.

The EM 124 Processing Unit is an industrial computer using both COTS (commercial off-the-shelf) components and custom made components. The unit is designed and tested for rugged use.



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

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

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

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

Hydrographic Work Station description

The Hydrographic Work Station is the operator station for the EM 124.

A dedicated maritime computer is provided with the EM 124 Multibeam Echo Sounder. It is set up with all necessary software.

The Hydrographic Work Station is based on the Microsoft® Windows 10 operating system.

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



Support information

Should you need technical support for your EM 124 you must contact a Kongsberg Maritime office. A list of all our offices is provided on our website. You can also contact our main support office in Norway.

A 24 hour telephone support service may also be available depending of the level of SLA (Service Level Agreement).

- **Company name:** Kongsberg Maritime AS
- **Address:** Strandpromenaden 50, 3190 Horten, Norway
- **Website:** <https://www.km.kongsberg.com>
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Preparations

Topics

[Tools, equipment and consumables required for EM 124 installation, page 17](#)

[Personnel qualifications, page 18](#)

[Sonar room requirements, page 19](#)

[Where to install the transducer, page 22](#)

[Acoustic noise, page 27](#)

Tools, equipment and consumables required for EM 124 installation

In order to do the EM 124 installation, all necessary tools and equipment for mechanical work, cabinet installation and electrical wiring must be available.

It is not practical to provide a detailed list of all necessary tools and equipment. You must be equipped with a standard set of tools. This tool set must comprise the normal tools for electronic and electromechanical tasks. This includes different screwdriver types, pliers, spanners, a cable stripper, a soldering iron, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment.

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

- All necessary tools and consumables required for welding
- All necessary tools and consumables required for physical installation of transducer frames and transducer modules
- All necessary tools and consumables required for electrical installations
- An articulated jack or similar arrangement capable of lifting the individual EM 124 units
- Torque wrench

Note

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

Personnel qualifications

The installation of the EM 124 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.

- Service engineer from Kongsberg Maritime
- Welders
- Electricians

Note

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

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

Sonar room requirements

Topics

[Environmental requirements, page 19](#)

[Size and access requirements, page 19](#)

[Requirements for insulation, heating and ventilation, page 20](#)

[Requirements for electrical installations, cables and communication, page 20](#)

Environmental requirements

The EM 124 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 124 units must not be exposed to excessive temperatures, dust, moisture or humidity. Such conditions can cause corrosive attacks and subsequent failures to the electronic circuitry. Visit the sonar room at regular intervals to check temperature and humidity, and take the necessary actions if the environmental conditions are poor.

Avoid running large power cables through the sonar room.

Observe the environmental specifications related to the EM 124 units.

Size and access requirements

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

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

- 1 The room must not be used for any other heavy machinery.
- 2 The room must not be unnecessarily obstructed by girders, pipes etc, which may cause installation problems or impede maintenance.
- 3 The sonar room must be accessible under all conditions at sea or at a berth.
- 4 All doors or hatches must be designed so that the tools and equipment can be removed without being disassembled.

Requirements for insulation, heating and ventilation

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

Heating requirements

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

Observe the environmental specifications related to the EM 124 units.

Ventilation requirements

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

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

Note

If the vessel is likely to operate in tropical conditions, a suitable air conditioning system must be installed. The air conditioning system must be able to provide an ambient temperature that does not exceed the maximum operating temperatures of the EM 124 units that are installed in the room.

Requirements for electrical installations, cables and communication

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

Light requirements

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

Communication requirements

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

Power requirements

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

Proper vessel ground must be provided.

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

Cabling requirements

The sonar room units are connected to other EM 124 units located in different compartments on the vessel. The units may also be connected to peripheral devices. If these cables pass through hatches or areas where they may be damaged, they must be run in conduits. Minimum 2" conduit is recommended.

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

Where to install the transducer

Topics

[Introduction to transducer location, page 22](#)

[Mount the transducer deep, page 22](#)

[Avoid protruding objects near the transducer, page 23](#)

[Keep the transducer far away from the propellers, page 24](#)

[Mount the transducer at a safe distance from bow thruster\(s\), page 24](#)

[Summary and general recommendations, page 24](#)

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 124 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 124 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 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 124 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 124.

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 124 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

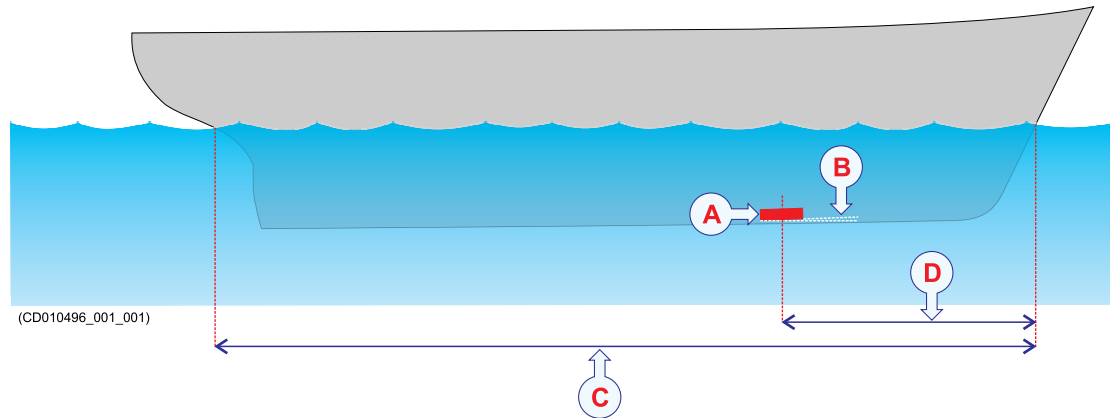
Some of the installation guidelines provided for transducer location may be conflicting. For this reason, each vessel must be treated individually in order to find the best compromise.

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.

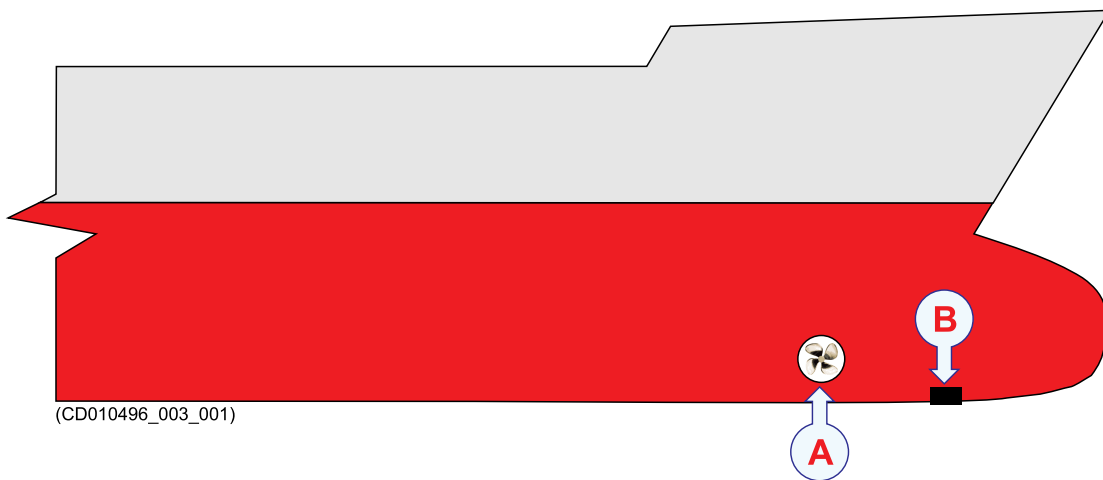
Note

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 124 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 124, we must address the noise challenge. This is important during the planning and preparations for the EM 124 installation.

Topics

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[Self noise, page 28](#)

[Ambient noise, page 31](#)

[Electrical self noise, page 31](#)

[Some means to reduce acoustic noise, page 31](#)

Contributing factors

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

Factors contributing to the performance of the hydroacoustic equipment used on board a vessel are:

- 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 [...].

http://en.wikipedia.org/wiki/Signal_to_noise_ratio (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 long range and dependable 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 cable is 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 for 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.

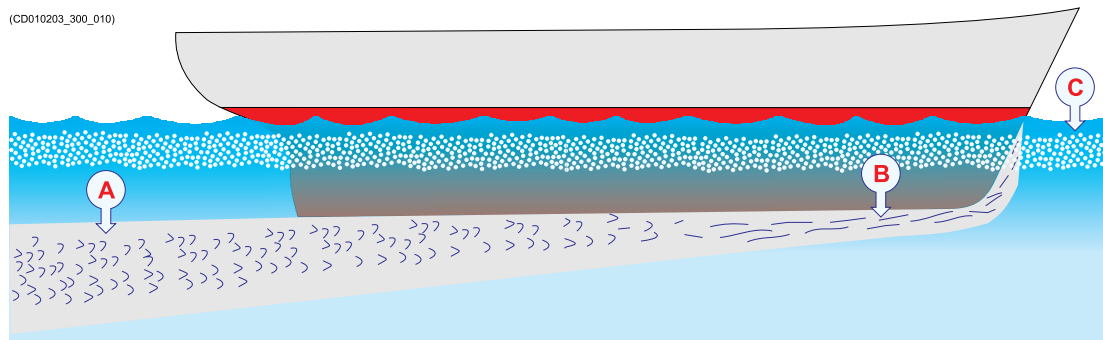
(Image from U. S. Navy in the public domain.)



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/Interference_\(wave_propagation\)](https://en.wikipedia.org/wiki/Interference_(wave_propagation)), 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.

Hum picked up by the transducer cables or picked up from the power supply is usually the most common source of electrical self noise. 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 124 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 124 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, as this is important to avoid electrical noise.
- Use shielded cables with correct grounding.
- Separate EM 124 cables from other cables with high voltages, large currents or transients.
- Place all high voltage power cables in metal conduits.

Installing the transducer

Topics

[Transducer description, page 35](#)

[Transducer installation principles, page 37](#)

[Transducer installation summary, page 43](#)

[Manufacturing and installing the casings, page 46](#)

[Designing, manufacturing and mounting the steel conduits, page 48](#)

[Installing the RX mounting frame, page 52](#)

[Installing the TX mounting frames, page 55](#)

[Installing the RX Transducers into the mounting frames, page 57](#)

[Installing the TX Transducers into the mounting frames, page 60](#)

[Rules for transducer handling, page 63](#)

[Painting the transducer face, page 65](#)

[Approved anti-fouling paints, page 67](#)

Transducer description

The EM 124 uses separate transducer arrays for transmitting and receiving sound pulses. Both transducer arrays have several modules which are assembled in mounting frames.

All TX modules are identical. Each TX module has one cable.

TX transducer module number 1 is always the most forward module.

All RX modules are identical. Each RX module has one cable.

RX transducer module number 1 is always the first on the port side.

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

The standard length of the transducer cables is 25 metres.

Note

Make sure that you do not damage the outer surface of the transducer cables. If water leaks into the cable, the transducer module has to be replaced.

The number of individual TX and RX modules in the two arrays depends on the chosen configuration. The standard types identified by "transmission x reception" beamwidth are:

- **0.5 x 1 degree system:** 96 transmit transducer modules and 16 receive transducer modules
- **1 x 1 degree system:** 48 transmit transducer modules and 16 receive transducer modules
- **1 x 2 degrees system:** 48 transmit transducer modules and 8 receive transducer modules
- **2 x 2 degrees system:** 24 transmit transducer modules and 8 receive transducer modules
- **2 x 4 degrees system:** 24 transmit transducer modules and 4 receive transducer modules
- **4 x 4 degrees system:** 12 transmit transducer modules and 4 receive transducer modules

Note

The red protective coating is an vital part of the transducer. It is very important that neither this coating nor the internal parts of the transducer are damaged during the handling, installation or cleaning. Any holes and/or scratches in the transducer surface will allow water to penetrate the transducer. If a leak occurs, the transducer must be replaced.



(CD020109_400_001)

Transmit transducer module

Transducer orientation

The two transducer arrays are normally mounted as "T" or "L" configurations under the vessel's hull (Mills Cross configuration). The transmit transducer array should be aligned

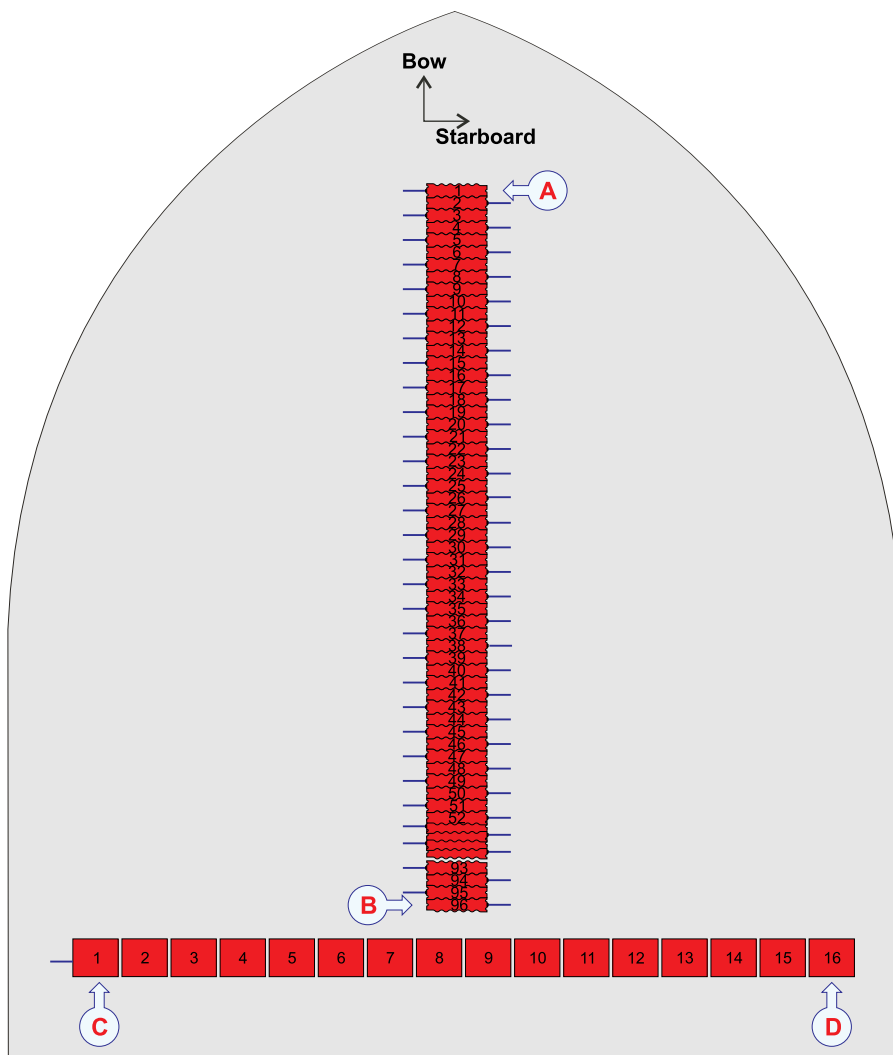
parallel to the vessel's keel. The receiver transducer array should be aligned 90 degrees on the keel. Both transducer arrays should be horizontal on a plane on the keel.

The transducer modules are assembled in the mounting frames especially designed for this purpose. The modules are secured with steel brackets, while the cables are pulled out trough the side of the frame.

The RX cables must point towards the starboard side.

The TX cables shall alternate between pointing towards starboard or port side. The cable on TX module number 1 must point towards the port side.

Orientation of transducer modules, top view, 0.5 x 1 degrees system.



(CD020109_150_001)

- A** Transmit transducer (TX) 1
- B** Transmit transducer (TX) 96
- C** Receive transducer (RX) 1
- D** Receive transducer (RX) 16

Transducer installation principles

Topics

[Introduction, page 37](#)

[Gondola, page 39](#)

[Blister, page 40](#)

[Flush mounted, page 41](#)

[External mounted with fairings, page 41](#)

Introduction

The transducer can be installed using different installation principles.

The EM multibeam system is supplied with transducers and electronic units. While the electronic units are installed using normal tools, the transducers must be located and installed depending on the vessel's design. A number of different factors related to the vessel's design must be taken into consideration during the installation planning.

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

- Gondola
- Blister
- Flush mounted
- Externally mounted with fairings
- Box keel
- Portable mounting
- Hull unit
- Drop keel

Not all installation principles are possible for all EM models.

	EM 124	EM 304	EM 712	EM 2040 series
Gondola	X	X	X	X
Blister	X	X	X	X
Flush mounted	X	X	X	X
Externally mounted with fairings	X	X	X	X
In a box keel	X	X	X	X
Portable mounting			X	X
Hull Unit			X	X
Drop keel	X	X	X	X

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

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

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

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

Gondola

A gondola is a streamlined pod mounted under the hull of the ship. It can either be welded or bolted under the hull plates. It is well suited for refitting a vessel with an EM 124 system.

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

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

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

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

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



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

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

Note

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

The installation shipyard must provide all necessary installation drawings.

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

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

Blister

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

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

Blisters of different sizes and shapes have been used from the early days of echo sounder installation, and this method of installation is a well known principle. A blister is well suited for refitting a vessel with an EM 124 system.

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

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

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

Note

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

The installation shipyard must provide all necessary installation drawings.

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

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

Flush mounted

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

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

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

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

Note

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

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

Note

The installation shipyard must provide all necessary installation drawings.

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

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

External mounted with fairings

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

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

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

Note

The installation shipyard must provide all necessary installation drawings.

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

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

Transducer installation summary

The installation of the EM 124 transducer requires careful planning and preparations. It is a key task for successful use of the EM 124 Multibeam Echo Sounder. An overall installation procedure is provided. This procedure does not describe any detailed tasks. Refer to the relevant tasks in this chapter.

Prerequisites

In order to prepare the installation of the EM 124 transducer, the following prerequisites must be met:

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

Context

The installation shipyard must provide all necessary design and installation drawings, as well as the relevant work standards and mounting procedures.

Note

In order to obtain maximum safety and EM 124 performance, it is very important that the installation procedures in this manual are complied to. You must do the tasks in the order they are described.

The vessel owner must make sure that the installation shipyard holds the applicable competence to perform the installation, and that the applicable maritime authorities are available to verify and certify the installation.

If required, all documents provided by the shipyard for the physical installation of the EM 124 must be approved by the vessel's national registry and corresponding maritime authority and/or classification society. Such approval must be obtained before the installation can begin. The shipowner and shipyard doing the installation are responsible for obtaining and paying for such approval.

The outline dimensions of the EM 124 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.

Note

It is important to minimize the alongship gap between the receiver and transceiver arrays to improve the performance at very shallow water (to get overlap between RX and TX footprints).

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

For more information, see:

[Where to install the transducer, page 22](#)

- 2 Determine the installation principle.

Several installation principles may be used. The principle must be chosen according to the vessel's hull design.

For more information, see:

[Transducer installation principles, page 37](#)

- 3 Prepare the transducer installation arrangement.

The installation arrangement must be capable of accepting the transducer frames. We recommend that the frames are mounted into steel casings.

For more information, see:

[Manufacturing and installing the casings, page 46](#)

- 4 Prepare and install the necessary cable conduit from the top of the casing to the sonar room.

For more information, see:

[Designing, manufacturing and mounting the steel conduits, page 48](#)

- 5 Install the mounting frames.

For more information, see:

[Installing the RX mounting frame, page 52](#)

[Installing the TX mounting frames, page 55](#)

- 6 Install the transducer modules.

For more information, see:

[Installing the TX Transducers into the mounting frames, page 60](#)

- 7 Lay the transducer cables from the transducer modules to the steel conduits.

Each cable is marked in both ends with the module's serial number and cable number.

- 8 Pull the transducer cables up through the steel conduit and strap them to protect against damage.

- 9 Seal the steel conduits.

- 10 Consider applying a thin layer of anti-fouling paint to the transducer face.

Marine growth (biological fouling) on the transducer face reduces the EM 124 performance. We recommend that you paint the transducer face immediately after installation, and then again as often as required to maintain the protection.

For more information, see:

[Painting the transducer face, page 65](#)

[Approved anti-fouling paints, page 67](#)

Further requirements

Connect the transducer cables to the Transmitter and Receiver Units.

Related topics

[Transducer array flatness, page 133](#)

[Checking the transducer array flatness and correcting deviations, page 134](#)

[Dimensional survey accuracy requirements, page 155](#)

[Alignment specifications, page 157](#)

[Drawing file, page 158](#)

Manufacturing and installing the casings

The transducer mounting frames needs to be mounted into a solid base construction also called casing. The casings can be integrated in different kind of installation types like a gondola, blister or flush in the hull.

Prerequisites

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

Observe the relevant rules and regulations related to welding. The quality of the welding is critical to the safety of the vessel. Welding must only be done by a certified welder. The final installation welds must be approved by the vessel's national registry, the corresponding maritime authority and/or classification society.

Before you can do this task, the following prerequisites must be met:

- All relevant vessel and transducer drawings must be available.
- All relevant drawings have been approved by the classification society.
- All relevant work instructions, procedures and standards must be available.
- The installation principle has been determined.
- The physical location of the transducer has been determined.
- The installation angles of the transducer have been defined.
- All relevant personnel (naval architects, designers) and tools must be available.

Context

The casings must be individually designed for each vessel, and it is not a part of the system delivery.

The casings must be provided (or manufactured) and installed by the installation shipyard. It is the shipyard's responsibility to get the installation approved by the classification society.

The installation must be carried out according to arrangement drawings designed for the specific vessel. Refer to the drawings included in the *Drawing File*, and the applicable drawings prepared by the installation shipyard.

Note

Follow the general safety procedures. This units are heavy.

Procedure

- 1 Manufacture the casings according the production drawings.
Alter the drawings and the design as required to fit the vessel and the chosen installation principle.
- 2 Install the casings under the hull in either the blister, the gondola or into the hull.

Designing, manufacturing and mounting the steel conduits

Steel conduits are used to protect the transducer cables. They should be filled with water up to the waterline.

Prerequisites

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

- All relevant vessel and transducer drawings must be available.
- All relevant work instructions, procedures and standards must be available.
- All relevant drawings have been approved by the classification society.
- The physical location of the transducer has been determined.
- The installation method has been determined.
- The installation angles of the transducer have been defined.
- All relevant personnel (naval architects, designers, skilled shipyard workers) and tools must be available.

Observe the relevant rules and regulations related to welding. The quality of the welding is critical to the safety of the vessel. Welding must only be done by a certified welder. The final installation welds must be approved by the vessel's national registry, the corresponding maritime authority and/or classification society.

Context

The transducer cables connect through the vessel's hull using steel conduits. The conduits are welded to the hull. The top of each conduit must be closed and sealed to preserve the watertightness. This can be done with a "Bratberger", "Roxtec" or a similar sort of sealing device.

The installation of the conduits must be properly planned. All plans and drawings must be approved by the classification authority. This is always the yard's responsibility.

The steel conduit must be designed to fit each individual ship. The quality of the materials used to manufacture the conduit, as well as the quality of the workmanship must be defined by the vessel owner and the installation shipyard.

The conduits are not included with the system delivery. They must therefore be both provided (or manufactured) and installed by the installation shipyard.

Note

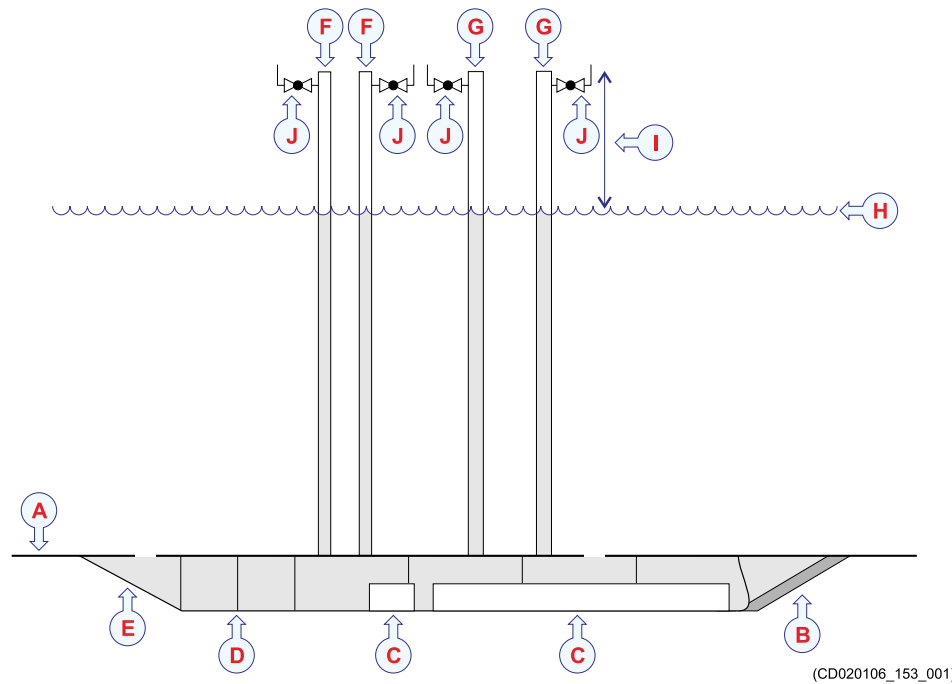
Make sure that there are no spatter, sharp edges or protruding objects that can damage the transducer cables.

All necessary precautions must be made to avoid damage to the cables while pulling them through the steel conduit. If water leaks into the cable, the transducer module has to be replaced.

The conduits should have a diameter of 6 inches (168 mm) or 8 inches (219 mm).

The number of conduits depends on the chosen system configuration and the internal diameter of the conduits.

- **0.5 x 1 degree system:**
 - 4 TX conduits, 8 inches
 - 2 RX conduits, 6 inches
- **1 x 1 degree system:**
 - 2 TX conduits, 8 inches
 - 2 RX conduits, 6 inches
- **1 x 2 degrees system:**
 - 2 TX conduits, 8 inches
 - 1 RX conduit, 6 inches
- **2 x 2 degrees system:**
 - 1 TX conduit, 8 inches
 - 1 RX conduit, 6 inches
- **2 x 4 degrees system:**
 - 1 TX conduit, 8 inches
 - 1 RX conduit, 6 inches
- **4 x 4 degrees system:**
 - 1 TX conduit, 6 inches
 - 1 RX conduit, 6 inches



- A** *Vessel's hull*
- B** *Ice and debris knife*
- C** *Casings for the transducer arrays frames and modules*
- D** *Support brackets inside the casing must not block for the transducer cables*
- E** *Water filled blister. With air outlet towards the hull*
- F** *One or more water filled steel conduit for the RX Transducer array*
- G** *One or more water filled steel conduit for the TX Transducer array*
- H** *Waterline*
- I** *Minimum 2 m above waterline. This must be verified by the classification society*
- J** *Separate air outlet pipes with ball valve, to above deck*

Procedure

- 1 Design the steel conduits with appropriate length and diameter to fit the transducer cables.
- 2 Manufacture the steel conduit according to the relevant production standards.

- 3 Mount the steel conduits from the casings and up towards the sonar room where the transmitter and receiver units are located.

The steel conduits are laid as required by the vessel structure and the location of the blister and sonar room. The conduits may be bent if required, but not more than 30 degrees. If a bend beyond 30 degrees is required a higher conduit diameter may be required. Please consult Kongsberg Maritime if this is the case.

The upper opening of the steel conduits should be minimum 2 metres above the vessel's waterline as specified by the classification society. If the openings of these conduits are under the water level, then special acceptances are needed from the classification society.

- 4 Each conduit should have an air outlet on top. This can be performed by a small ball valve and a 1 " pipe routed above the deck.

- 5 Close the top of the steel conduits with a cable sealing system.

Kongsberg Maritime recommends the use of sealing from Roxtec, Brattberg or similar.

- 6 If relevant, allow the maritime authority and/or classification society to inspect and approve the design and the installation of the steel conduit.

Installing the RX mounting frame

The mounting frames have been designed to offer a reliable and maintenance friendly installation method for the EM 124 Transducers.

Prerequisites

Note

Engineers from Kongsberg Maritime must be present to install the transducer mounting frames.

- The casings have been installed and machined according to the requirements.
- All relevant vessel and transducer drawings must be available.
- All relevant work instructions, procedures and standards must be available.
- All relevant personnel (skilled shipyard workers) and their tools must be available.

The following specific tools and items are required for this task:

- Torque wrench
- Loctite 242 (removable medium strength threadlocker)
- Lifting device
- Rope
- Tackles

Context

Mounting frames are designed to house the individual transducer modules. While the transducer modules are mounted into the frames, the frames require casings.

Additional baffle plates are required and part of the delivery. They need to be mounted during the installation.

The installation must be carried out according to arrangement drawings designed for the specific vessel. Refer to the drawings included in the Drawing File, and the applicable drawings prepared by the installation shipyard.

Note

The mounting frames must be handled with care. Please observe normal safety precautions for dockyard work and welding.

Drawings for EM 124 mounting frames

- RX mounting frame assy. 1 deg. drawing 860-213744
- RX mounting frame assy. 2 deg. drawing 860-213389
- RX mounting frame assy. 4 deg. drawing 860-213803

- Baffle plate 1, drawing 365207
- Baffle plate 2, drawing 365208
- Baffle plate 3, drawing 365209

Procedure

- 1 Mount the baffle plates to the mounting frames.

Use moderate torque, and secure with Loctite 242.

The number of baffle plates depends on the length of the array

Note

The baffle plates must be installed with correct orientation!

There is a text and an arrow mark on every baffle plate to show the correct orientation.

- 2 Mount the frames in the casings.

The mounting frames must be bolted onto the flat bars inside the casing. The number of flat bars depends on the length of the transducer array. There are two (2) holes in each flat bar. The frames are fastened by M16 socket cap screws. Use a torque of approximately 180 Nm.

Bolts of grade A4-80 should be used.

Note

The RX frame must be installed with the correct orientation!

The correct orientation can be found by comparing transducer module drawings with the frame drawings.

- 3 Check that each frame is mounted completely flat.

Important

No point on the frame may deviate from the ideal plane with more than 1.6 mm.

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

This can be checked by measuring the relative vertical positions of the module mounting bars on the frames. If the deviations are too large, this has to be corrected by applying shims.

The frame is installed completely flat.

- 4 Remove one bolt.
- 5 Apply Loctite 242 to the bolt.
- 6 Install the bolt using a torque of 180 Nm.
- 7 Repeat steps 4 - 6 for all the bolts.

Related topics

[Transducer array flatness, page 133](#)

[Checking the transducer array flatness and correcting deviations, page 134](#)

[Dimensional survey accuracy requirements, page 155](#)

[Alignment specifications, page 157](#)

[Drawing file, page 158](#)

Installing the TX mounting frames

The mounting frames have been designed to offer a reliable and maintenance friendly installation method for the EM 124 Transducers.

Prerequisites

Note

Engineers from Kongsberg Maritime must be present to install the transducer mounting frames.

- The casings have been installed and machined according to the requirements.
- All relevant vessel and transducer drawings must be available.
- All relevant work instructions, procedures and standards must be available.
- All relevant personnel (skilled shipyard workers) and their tools must be available.

The following specific tools and items are required for this task:

- Torque wrench
- Loctite 242 (removable medium strength threadlocker)
- Lifting device
- Rope
- Tackles

Context

Mounting frames are designed to house the individual transducer modules. While the transducer modules are mounted into the frames, the frames require casings.

The installation must be carried out according to arrangement drawings designed for the specific vessel. Refer to the drawings included in the Drawing File, and the applicable drawings prepared by the installation shipyard.

Note

The mounting frames must be handled with care. Please observe normal safety precautions for dockyard work and welding.

Drawings for EM 124 mounting frames

- 372053 - TX mounting frame assy. 0.5 deg. drawing
- 860-213433 - TX mounting frame assy. 1 deg. drawing
- 499-213370 - TX mounting frame assy. 2 deg. drawing
- 372981 - Arrangement drawing casing with frame TX 0.5 degrees

Procedure

- 1 If the TX mounting frame is for a 0.5 degree system, assemble the two parts.
The 0.5 degree mounting frame is a two-part type, that has to be assembled before bolting onto the flat bars inside the casing.
Refer to drawings 372053 and 372981 in the *Drawing file* for more information.

- 2 Mount the frame in the casings.
The mounting frames must be bolted onto the flat bars inside the casing. The number of flat bars depends on the length of the transducer array. There are three (3) holes in each flat bar. The frames are fastened by M16. Use a torque of approximately 187 Nm.

Bolts of grade A4-80 should be used.

- 3 Check that the each frame is mounted completely flat.

Important

No point on the frame may deviate from the ideal plane with more than 1.6 mm.

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

This can be checked by measuring the relative vertical positions of the module mounting bars on the frames. If the deviations are too large, this has to be corrected by applying shims.

When the frame is installed completely flat.

- 4 Remove one bolt.
- 5 Apply Loctite 242 to the bolt.
- 6 Install the bolt using a torque of 187 Nm.
- 7 Repeat steps 4 - 6 for all the bolts.

Related topics

[Transducer array flatness, page 133](#)

[Checking the transducer array flatness and correcting deviations, page 134](#)

[Dimensional survey accuracy requirements, page 155](#)

[Alignment specifications, page 157](#)

[Drawing file, page 158](#)

Installing the RX Transducers into the mounting frames

When all the preparations have been made, the Transducers must be installed into the mounting frames.

Prerequisites

Note

Engineers from Kongsberg Maritime must be present to supervise installation of the transducer modules.

- The mounting frames has been installed.
- The steel conduit is mounted with all installation work finalized.
- All relevant drawings have been approved by the classification society.
- All relevant personnel (skilled shipyard workers) and their tools must be available.

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

The following specific tools and items are required for this task:

- Torque wrench
- Loctite 242 (removable medium strength threadlocker)
- Lifting device
- Ropes and tackles

Context

Caution

Observe the physical size and weight of the transducer. Unless a suitable lifting device is available, make sure that enough manpower is available to lift, hold and fasten the transducer.

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

Do not lift the transducer by the cable.

The number of individual TX and RX modules in the two arrays depends on the chosen configuration. The standard types identified by "transmission x reception" beamwidth are:

- **0.5 x 1 degree system:** 96 transmit transducer modules and 16 receive transducer modules
- **1 x 1 degree system:** 48 transmit transducer modules and 16 receive transducer modules
- **1 x 2 degrees system:** 48 transmit transducer modules and 8 receive transducer modules
- **2 x 2 degrees system:** 24 transmit transducer modules and 8 receive transducer modules
- **2 x 4 degrees system:** 24 transmit transducer modules and 4 receive transducer modules
- **4 x 4 degrees system:** 12 transmit transducer modules and 4 receive transducer modules

Note

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

Procedure

- 1 Put the first transducer module into the frame.

Start with the transducer module on the starboard side.

Note

Observe the direction of the transducer.

The "BOW" marking must point towards the bow of the vessel!

- 2 Pull out the transducer cable, and guide it out through the cable penetration in the baffle plate on the bottom side of the mounting frame.

EM 124 transducer cables have a minimum bending radius of 78 mm.

Note

Ensure that minimum bending radius is not exceeded and that no damage is inflicted to the cables during the pull.

Damaged cables can only be replaced by replacing the entire transducer module and would require the vessel to be in dock.

- 3 Secure the transducer module in place with the brackets, one on each side.

Secure each bolt with Loctite 242, use torque 64 Nm.

- 4 Fill in the serial number in the cable identification table.

RX transducer module number 1 is always the first on the port side.

- 5 Mount the next transducer module close to the previous.

- 6 Repeat until all modules have been installed.

- 7 Check that the transducer cables pass through the casing in such a way that they are not exposed to wear and tear. Secure as required.

Related topics

[Cable plan, Receiver Unit, 1 degree, page 99](#)

[Weight and outline dimensions, page 147](#)

[Drawing file, page 158](#)

Installing the TX Transducers into the mounting frames

When all the preparations have been made, the Transducers must be installed into the mounting frames.

Prerequisites

Note

Engineers from Kongsberg Maritime must be present to supervise installation of the transducer modules.

- The mounting frames has been installed.
- The steel conduit is mounted with all installation work finalized.
- All relevant drawings have been approved by the classification society.
- All relevant personnel (skilled shipyard workers) and their tools must be available.

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

The following specific tools and items are required for this task:

- Torque wrench
- Loctite 242 (removable medium strength threadlocker)
- Lifting device
- Ropes and tackles

Context

Caution

Observe the physical size and weight of the transducer. Unless a suitable lifting device is available, make sure that enough manpower is available to lift, hold and fasten the transducer.

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

Do not lift the transducer by the cable.

The number of individual TX and RX modules in the two arrays depends on the chosen configuration. The standard types identified by "transmission x reception" beamwidth are:

- **0.5 x 1 degree system:** 96 transmit transducer modules and 16 receive transducer modules
- **1 x 1 degree system:** 48 transmit transducer modules and 16 receive transducer modules
- **1 x 2 degrees system:** 48 transmit transducer modules and 8 receive transducer modules
- **2 x 2 degrees system:** 24 transmit transducer modules and 8 receive transducer modules
- **2 x 4 degrees system:** 24 transmit transducer modules and 4 receive transducer modules
- **4 x 4 degrees system:** 12 transmit transducer modules and 4 receive transducer modules

Note

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

Procedure

- 1 Put the first transducer module into the frame.

TX transducer module number 1 is always the most forward module.

Note

Observe the direction of the transducer.

The TX cables shall alternate between pointing towards starboard or port side. The cable on TX module number 1 must point towards the port side.

- 2 Pull out the transducer cable, and guide it out through the side of the mounting frame.

EM 124 transducer cables have a minimum bending radius of 78 mm.

Note

Ensure that minimum bending radius is not exceeded and that no damage is inflicted to the cables during the pull.

Damaged cables can only be replaced by replacing the entire transducer module and would require the vessel to be in dock.

- 3 Secure the transducer module in place with the brackets, one on each side.
Secure each bolt with Loctite 242, use torque 64 Nm.
- 4 Fill in the serial number in the cable identification table.
TX transducer module number 1 is always the most forward module.
- 5 Mount the next transducer module next to the previous.

- 6 Repeat until all modules have been installed.
- 7 Check that the transducer cables pass through the casing in such a way that they are not exposed to wear and tear. Secure as required.

Related topics

[Cable plan, Transmitter Unit, page 91](#)

[Weight and outline dimensions, page 147](#)

[Drawing file, page 158](#)

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 and 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 124.

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.

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.

Rinse with fresh water

For non permanent installations, the transducer should be rinsed with fresh water every time it is taken out of the water.

Painting the transducer face

Marine growth (biological fouling) on the transducer face reduces the EM 124 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 124 performance.

- 4 Remove all dust.

- 5 Apply the primer, and let it dry.

- 6 Apply the paint.

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

Note

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

- 7 Allow the paint to dry.

Further requirements

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

Approved anti-fouling paints

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:

- **Primer:** Safeguard Universal ES
Apply 80 µm wet film thickness (50 µm dry film thickness).
- **Primer:** Safeguard Universal ES AV
Apply 70 µm wet film thickness (50 µm dry film thickness).
- **Paint:** SeaQuantum Ultra S
Apply 250 µm wet film thickness (125 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.km.kongsberg.com>.

Installing the EM 124 hardware units

Topics

[Transmitter Unit, page 70](#)

[Receiver Unit, page 74](#)

[Processing Unit, page 78](#)

[Installing the Hydrographic Work Station, page 83](#)

Transmitter Unit

Topics

[Installing the Transmitter Unit, page 71](#)

[RIO-P board - dip switch setting, page 73](#)

Installing the Transmitter Unit

The Transmitter Unit is normally located in a "sonar room" close to the transducer arrays. The physical length of the cables limit the distance between the transducers and the Transmitter Unit.

Prerequisites

The standard length of the transducer cables is 25 metres.

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

The Transmitter Unit is heavy. Make sure that the necessary manpower and lifting equipment are available before you start the installation work.

Free bulkhead space is required to mount the Transmitter Unit.

Note

The installation shipyard must provide all necessary installation drawings.

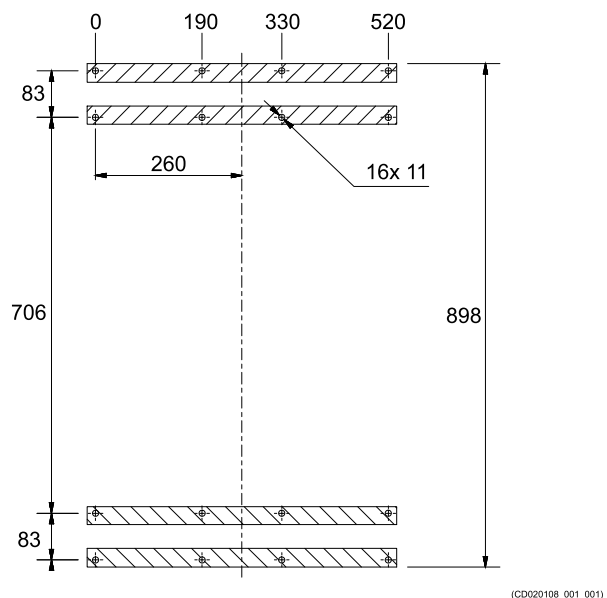
If required, all drawings and documents must be approved by the vessel's national registry and corresponding maritime authority and/or classification society.

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

The Transmitter Unit is delivered as a complete cabinet with shock absorbers.

Procedure

- 1 Prepare the installation site.
 - a Observe the general sonar room requirements.
 - b Provide ample space around the cabinet to allow for inspection, maintenance and parts replacement. Make sure that the space allows the cabinet door to be fully dismantled for unobstructed access to its internal parts.
 - c Verify that the installation does not cause problems with existing cabling, ventilation ducts, piping etc. Check both sides of the bulkhead.



Mounting hole pattern for the Transmitter Unit.

- 2 Mark the location of the holes for the upper and lower shock absorber on the bulkhead.
- 3 Drill eight (8) 11-mm holes for each shock absorber.

Note

Always check on the other side of the bulkhead before drilling holes.

- 4 Mount the cabinet to the bulkhead with sixteen (16) M10 bolts.
The bolts must be supplied by the shipyard. Bolts of grade A4-80 should be used.
As the cabinet is heavy, a lifting arrangement (articulated jack or similar) must be used.
The foundation onto which the cabinet is mounted will determine the correct torque to be applied to the bolts.
Alternatively, the shock absorbers can be mounted to a pair of specially designed support brackets.

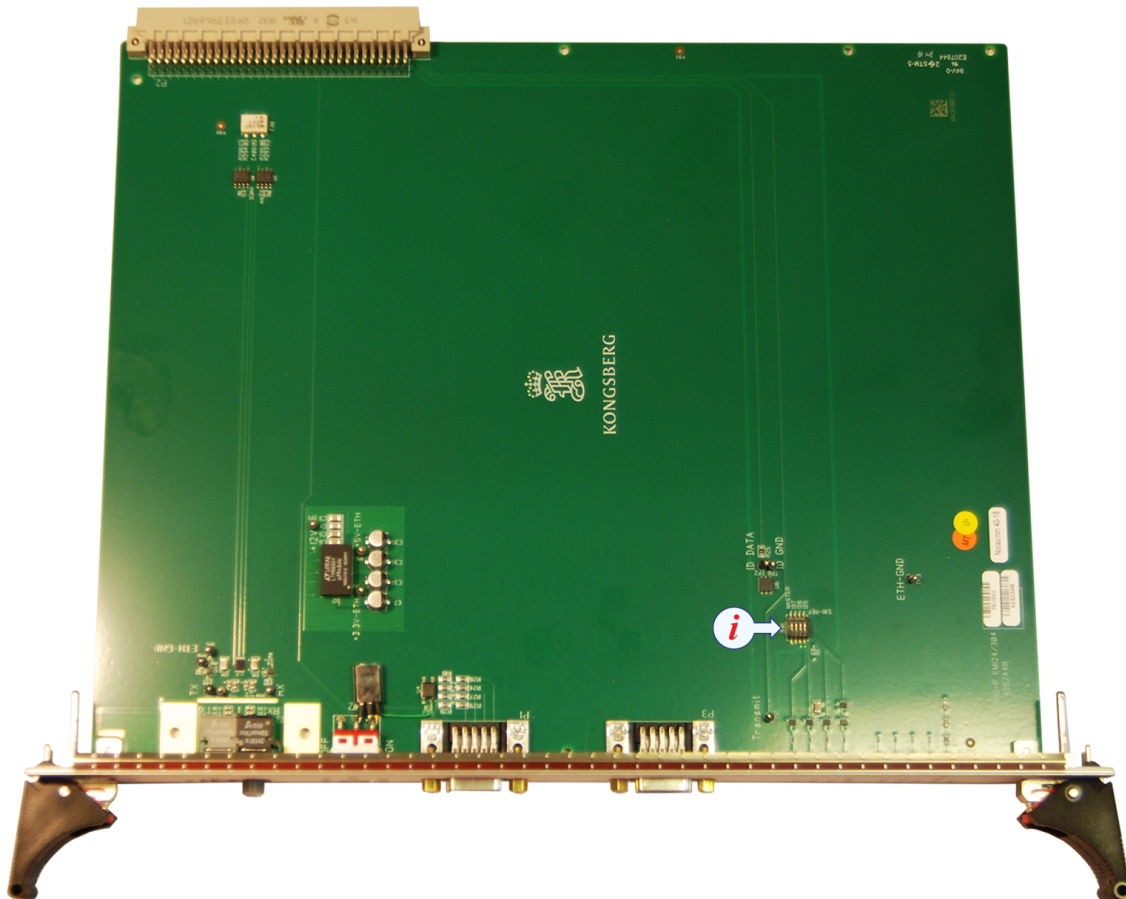
Related topics

[Weight and outline dimensions, page 147](#)

[Drawing file, page 158](#)

RIO-P board - dip switch setting

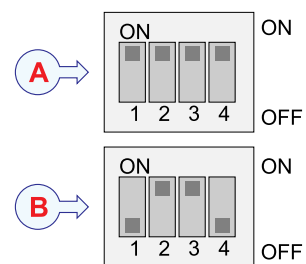
The dip switch setting on the RIO-P board has to be correct.



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

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

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



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

Note

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

Receiver Unit

Topics

[Installing the Receiver Unit, page 75](#)

[Receiver Unit - dip switch setting, page 77](#)

Installing the Receiver Unit

The EM 124 Receiver Unit is normally located in a "sonar room" close to the transducer arrays. The physical length of the cables limit the distance between the transducers and the Receiver Unit.

Prerequisites

The standard length of the transducer cables is 25 metres.

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

Free bulkhead space is required to mount the Receiver Unit.

Note

The installation shipyard must provide all necessary installation drawings.

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

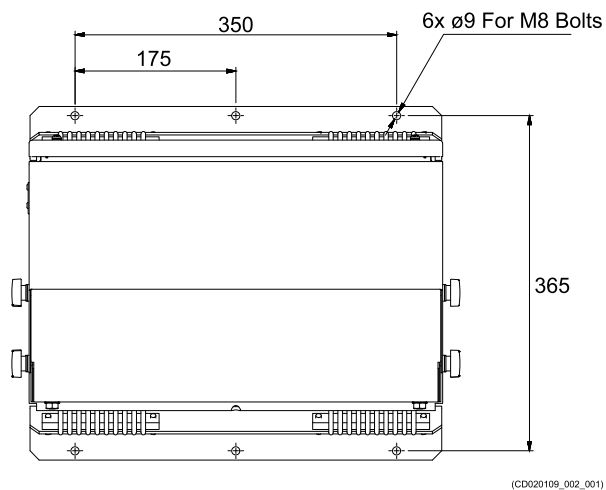
Such approval must be obtained before the installation can begin. The shipowner and shipyard doing the installation are responsible for obtaining and paying for such approval.

Context

The Receiver Unit is delivered as a complete cabinet with shock absorbers.

Procedure

- 1 Prepare the installation site.
 - a Observe the general sonar room requirements.
 - b Provide ample space around the cabinet to allow for inspection, maintenance and parts replacement. Make sure that the space allows the cabinet door to be fully dismantled for unobstructed access to its internal parts.
 - c Verify that the installation does not cause problems with existing cabling, ventilation ducts, piping etc. Check both sides of the bulkhead.
- 2 Mark the location of the holes for the upper and lower shock absorber on the bulkhead.



Mounting hole pattern for the Receiver Unit.

- 3 Drill three (3) 9-mm holes for each shock absorber.

Note _____

Always check on the other side of the bulkhead before drilling holes.

- 4 Mount the cabinet to the bulkhead with six (6) M8 bolts.

The bolts must be supplied by the shipyard. Bolts of grade A4-80 should be used.

The foundation onto which the cabinet is mounted will determine the correct torque to be applied to the bolts.

Related topics

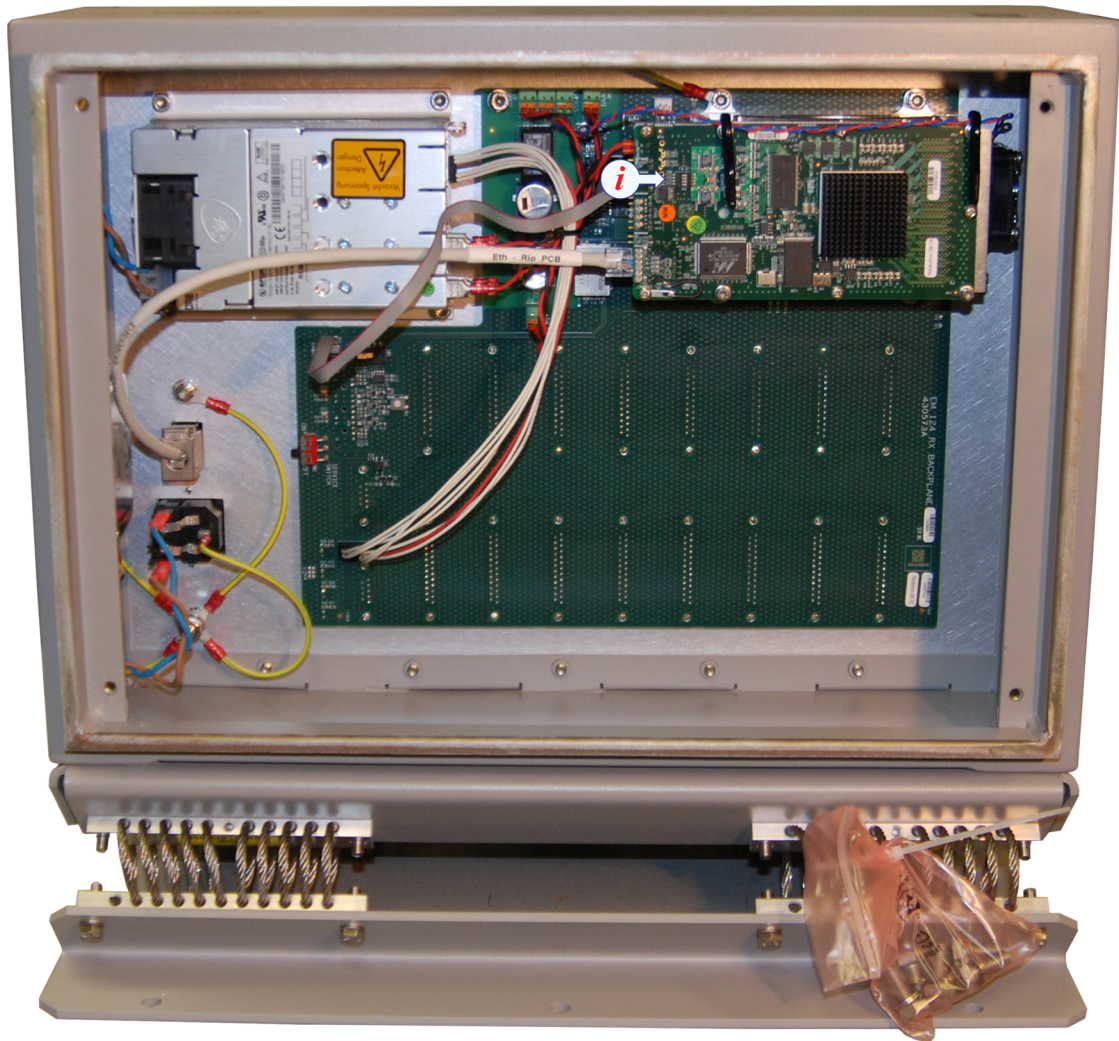
[Weight and outline dimensions, page 147](#)

[Drawing file, page 158](#)

Receiver Unit - dip switch setting

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

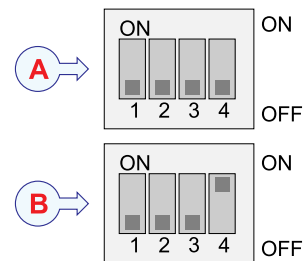
The software in the Processing Unit must know the identification of the Receiver Units. A switch on the processing board inside the Receiver Unit is used for this.



- A** Receiver Unit 1 (MASTER): all switches must be set to OFF.
- B** Receiver Unit 2 (SLAVE): switch 1, 2 and 3 must be set to OFF, switch 4 must be set to ON.

Note _____

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



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Processing Unit

Topics

[Installing the Processing Unit, page 78](#)

[Processing Unit rear panel description, page 80](#)

[Processing Unit circuit boards and modules, page 81](#)

[CBMF board - dip switch setting, page 82](#)

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.

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.

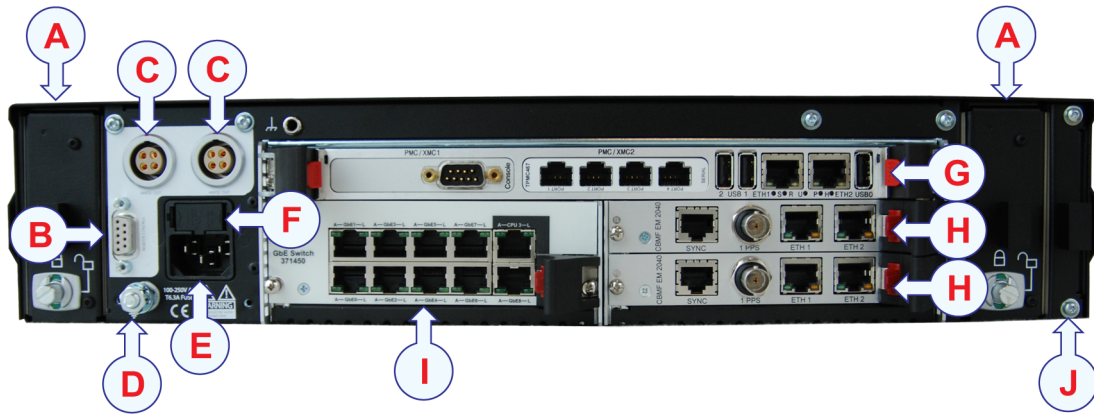
- 5 Connect the cables.

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 *Concurrent PP833 CPU board*

H *CBMF board*

There are one or two Compact Beamformer (CBMF) boards in the Processing Unit. The number of CBMF boards depend upon the configuration of the EM 124 system.

I *CP219 Ethernet switch*

J *Air filter unit*

Processing Unit circuit boards and modules

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



The following circuit boards and modules are used in the EM 124 Processing Unit.

A Concurrent PP833 CPU board

The Concurrent PP833 is the Central Processing Unit (CPU) of the EM 124 Processing Unit.

B CBMF board

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

There are one or two Compact Beamformer (CBMF) boards in the Processing Unit. The number of CBMF boards depend upon the configuration of the EM 124 system.

C VadaTech CP219 board

The VadaTech CP219 board is used as an Ethernet switch in the EM 124 Processing Unit.

D Fan unit

The Processing Unit has two fan units for cooling purposes.

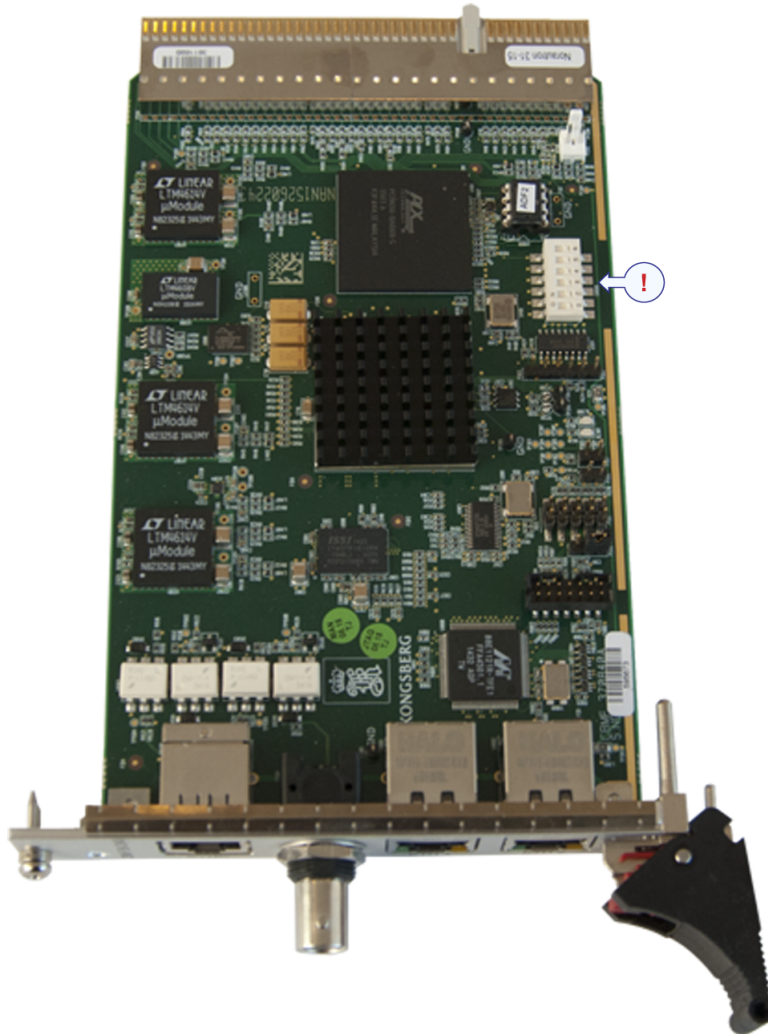
• Power supply

One power supply unit is used in the EM 124 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.

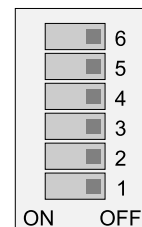
CBMF board - dip switch setting

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 Hydrographic Work Station

Topics

[Installing the Hydrographic Work Station, page 83](#)

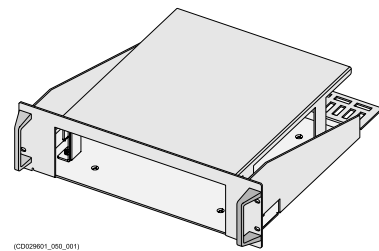
[Hydrographic Work Station rear connectors, page 86](#)

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.

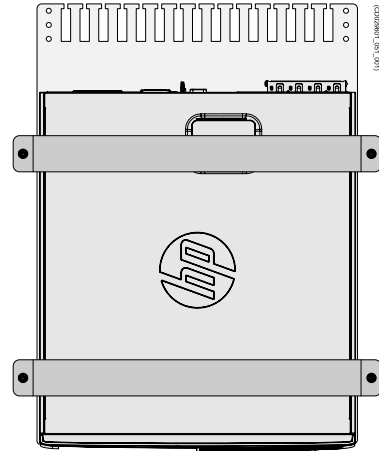
Context

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.

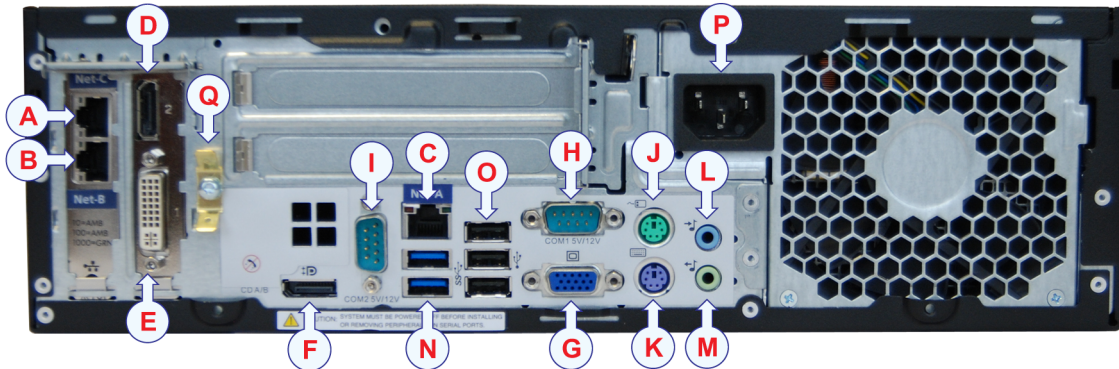
Related topics

[Weight and outline dimensions, page 147](#)

[Drawing file, page 158](#)

Hydrographic Work Station rear connectors

The rear panel on the Hydrographic Work Station holds connectors for the various EM 124 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 124 performance.
- D** Display Port
*Display cable: From Hydrographic Work Station to display (C1)
This is a commercial cable. The display cable is often physically attached to the display, and terminated in the “computer end” with a male connector. If the cable is not attached, it is normally provided with the display.*
- E** Video Port: DVI
- F** Display Port
- G** Video Port: VGA
- H** Serial cables: From Hydrographic Work Station to external device(s) (C14)
- I** Serial cables: From Hydrographic Work Station to external device(s) (C15)
- J** Computer cable: From Hydrographic Work Station to mouse (or another similar device) (C4)
The cable is often physically attached to the mouse, and terminated in the “computer end” with a male PS/2 or USB connector. Depending on the type of connector you must connect the mouse to the PS/2 connector or an USB connector on the computer.

- K** *Computer cable: From Hydrographic Work Station to keyboard (C3)*
The cable is often physically attached to the keyboard, and terminated in the “computer end” with a male PS/2 or USB connector. Depending on the type of connector you must connect the keyboard to the PS/2 connector or an USB connector on the computer.
- L** *Audio cable: Not used*
- M** *Audio cable: Not used*
- N** *USB interface connectors: USB 3.0 From Hydrographic Work Station to external device(s)*
- O** *USB interface connectors: USB 2.0 From Hydrographic Work Station to external device(s)*
- P** *AC power cable: From Hydrographic Work Station to uninterruptible power supply (UPS) (C7)*
- Q** *Ground cable: From Hydrographic Work Station to vessel ground (C8)*

Cable layout and interconnections

Correct cabling is essential for EM 124 operation. Cabling principles, cable plans and drawings, as well as relevant procedures, are provided.

Topics

[Cable plans, page 89](#)

[List of EM 124 cables, page 105](#)

[Clock synchronization \(1PPS\), page 109](#)

[External synchronization, page 111](#)

[Cable drawings and specifications, page 114](#)

Cable plans

Topics

[Cable plan, Processing Unit, page 90](#)

[Cable plan, Transmitter Unit, page 91](#)

[Cable plan, Receiver Unit, 1 degree, page 99](#)

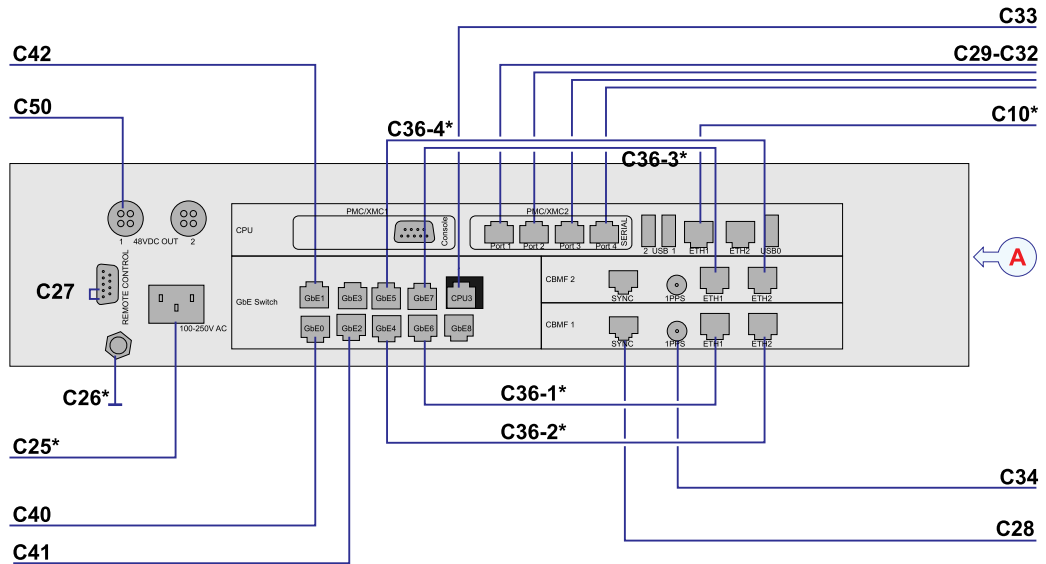
[Synchronization overview, 2 Transmitter Units 1 Receiver Unit, page 102](#)

[Remote on/off overview, 2 Transmitter Units 1 Receiver Unit, page 103](#)

[Hydrographic Work Station, page 104](#)

Cable plan, Processing Unit

The Processing Unit cables include those used to connect the EM 124 Processing Unit to AC mains power, and to the transmitter and receiver units. One Ethernet cable is used to connect the Processing Unit to the Hydrographic Work Station.



(CD020108_200_002)

Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 124 delivery.

A Processing Unit

Related topics

[List of EM 124 cables, page 105](#)

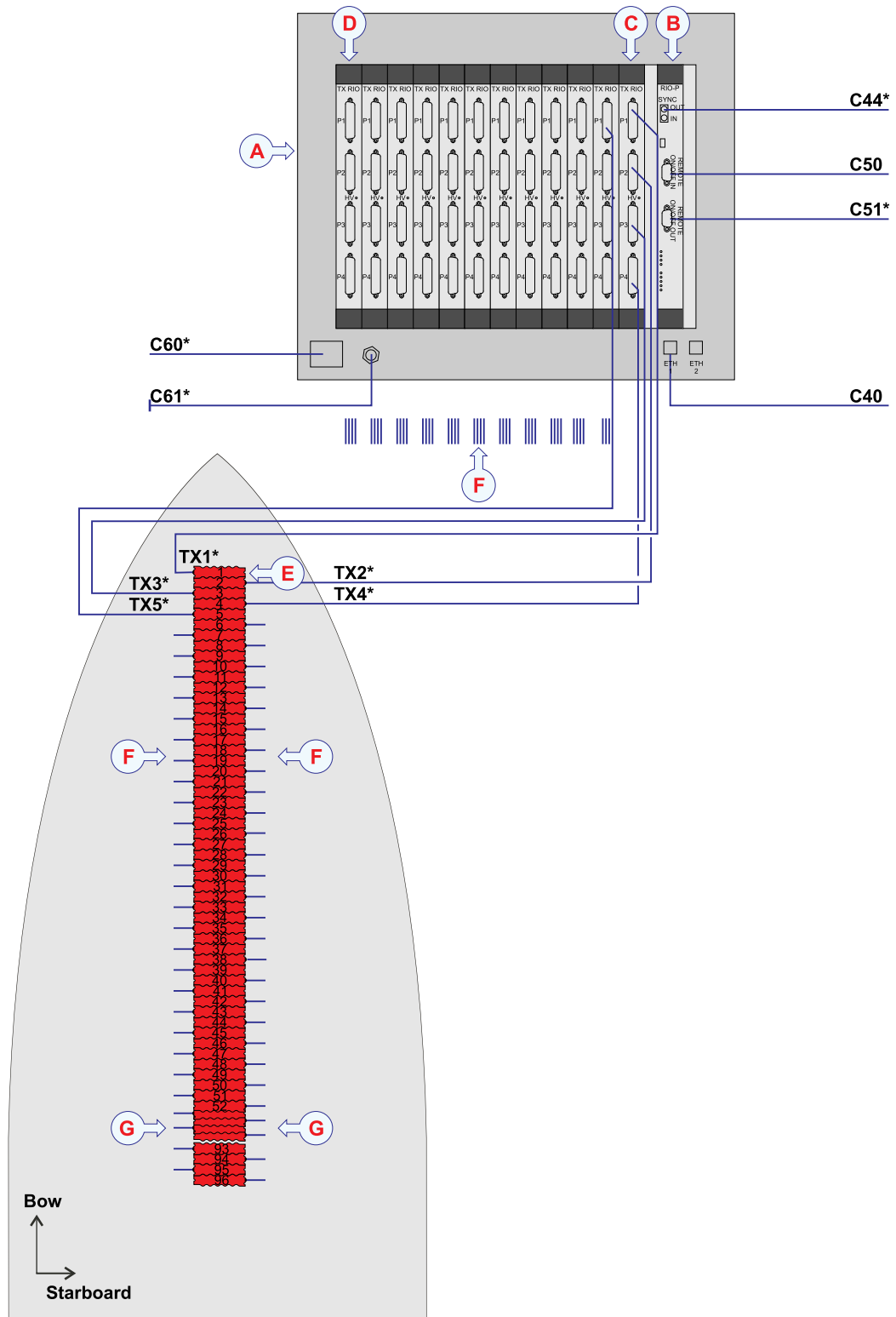
Cable plan, Transmitter Unit

The transmitter (TX) Unit cables include those used to connect the EM 124 TX Unit(s) to AC mains power, to the receiver (RX) Unit, to the Processing Unit and to the transducers. If there are more than one TX Unit they have to be connected to each other with a fibre optic cable.

The EM 124 system can have one or two Transmitter Units (TXUs), depending on the system configuration.

A system with 0.5 degrees transmitter array will need 96 transmit transducer modules and two Transmitter Units.

Transmitter Unit 1

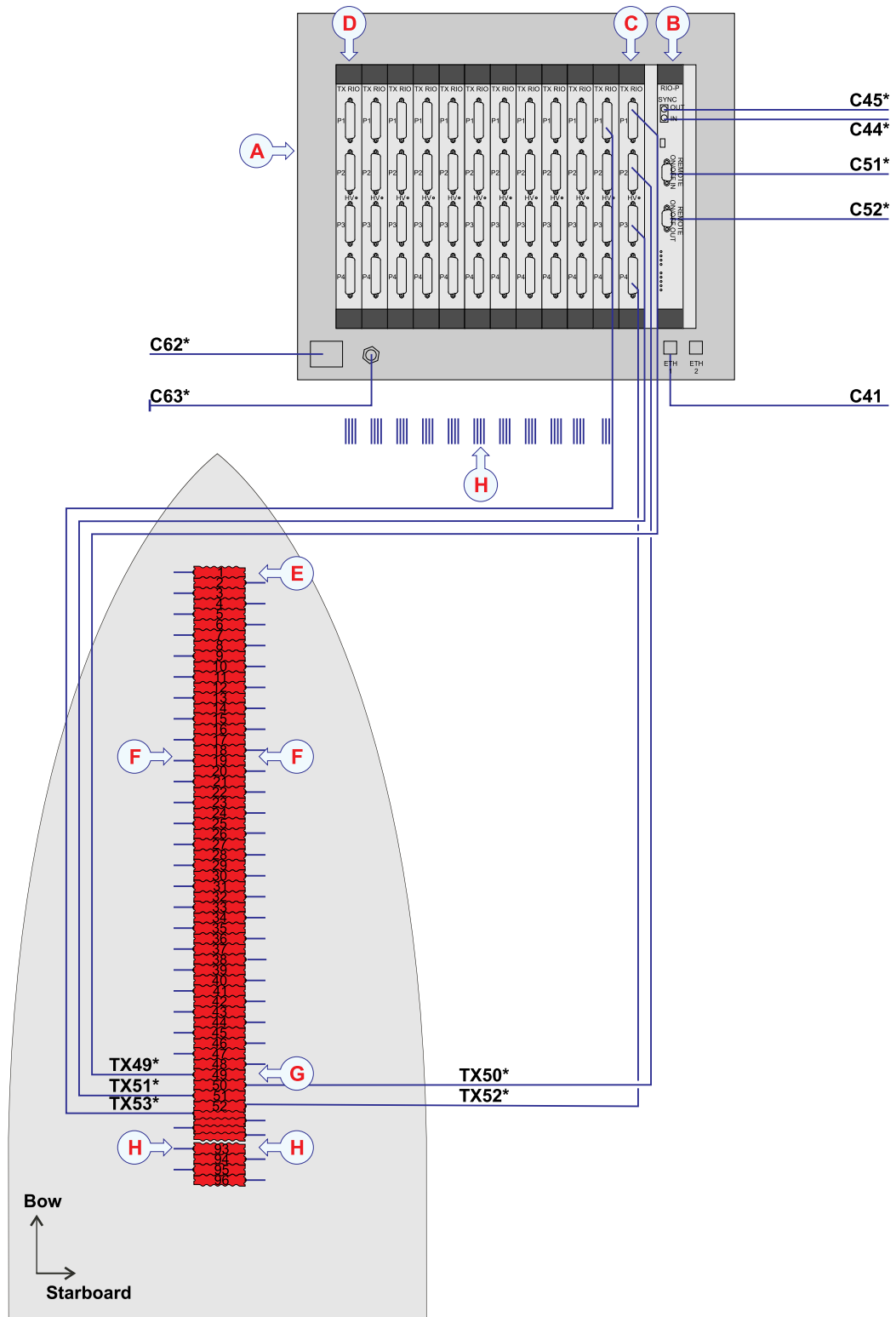


(CD020109_201_001)

Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 124 delivery.

- A *Transmitter Unit (TXU) 1*
- B *RIO-P board*
- C *TX RIO board 1*
- D *TX RIO board 12*
- E *Transmit transducer (TX) number 1*
- F *Cables from Transmit Transducer (TX) 1 to 48 are connected to Transmitter Unit (TXU) 1 according to table*
- G *Cables from Transmit Transducer (TX) 49 to 96 are connected to Transmitter Unit (TXU) 2 according to table*

Transmitter Unit 2



(CD020109_201_002)

Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 124 delivery.

- A *Transmitter Unit (TXU) 2*
- B *RIO-P board*
- C *TX RIO board 1*
- D *TX RIO board 12*
- E *Transmit transducer (TX) number 1*
- F *Cables from Transmit Transducer (TX) 1 to 48 are connected to Transmitter Unit (TXU) 1 according to table*
- G *Transmit Transducer (TX) number 49*
- H *Cables from Transmit Transducer (TX) 49 to 96 are connected to Transmitter Unit (TXU) 2 according to table*

Marking of TX transducer cables

Each transducer module and its cable is identified with a serial number as follows:

TX<nnnn>

Where <nnnn> is a numerical value.

Each transducer module is also identified by its physical location in the array (frame). This location number must be recorded during the installation of the transducer modules, and written down in the table provided in this chapter.

The TX transducer array is physically positioned in the fore-and-aft direction under the hull.

TX transducer module number 1 is always the most forward module.

Connection of TX transducer cables

The 0.5 degree system consists of 96 TX modules/cables.

The 1 degree system consists of 48 TX modules/cables.

The 2 degree system consists of 24 TX modules/cables.

The 4 degree system consists of 12 TX modules/cables.

Note _____

It is essential to connect all TX cables successively to the TX RIO boards in the Transmitter Unit(s).

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

Position	Transducer serial number (fill in)	Cable	Socket	TX RIO board	TX Unit	Size of system											
1	TX	TX 1	P1	1	TX Unit 1	4 deg											
2	TX	TX 2	P2														
3	TX	TX 3	P3														
4	TX	TX 4	P4														
5	TX	TX 5	P1	2		TX Unit 1	4 deg										
6	TX	TX 6	P2														
7	TX	TX 7	P3														
8	TX	TX 8	P4														
9	TX	TX 9	P1	3			TX Unit 1	4 deg									
10	TX	TX 10	P2														
11	TX	TX 11	P3														
12	TX	TX 12	P4														
13	TX	TX 13	P1	4				TX Unit 1	4 deg	2 deg							
14	TX	TX 14	P2														
15	TX	TX 15	P3														
16	TX	TX 16	P4														
17	TX	TX 17	P1	5					TX Unit 1	4 deg	2 deg	1 deg	0.5 deg				
18	TX	TX 18	P2														
19	TX	TX 19	P3														
20	TX	TX 20	P4														
21	TX	TX 21	P1	6						TX Unit 1	4 deg	2 deg	1 deg	0.5 deg			
22	TX	TX 22	P2														
23	TX	TX 23	P3														
24	TX	TX 24	P4														
25	TX	TX 25	P1	7							TX Unit 1	4 deg	2 deg	1 deg	0.5 deg		
25	TX	TX 26	P2														
27	TX	TX 27	P3														
28	TX	TX 28	P4														
29	TX	TX 29	P1	8								TX Unit 1	4 deg	2 deg	1 deg	0.5 deg	
30	TX	TX 30	P2														
31	TX	TX 31	P3														
32	TX	TX 32	P4														
33	TX	TX 33	P1	9									TX Unit 1	4 deg	2 deg	1 deg	0.5 deg
34	TX	TX 34	P2														
35	TX	TX 35	P3														
36	TX	TX 36	P4														

Position	Transducer serial number (fill in)	Cable	Socket	TX RIO board	TX Unit	Size of system			
37	TX	TX 37	P1	10	TX Unit 2				
38	TX	TX 38	P2						
39	TX	TX 39	P3						
40	TX	TX 40	P4						
41	TX	TX 41	P1	11					
42	TX	TX 42	P2						
43	TX	TX 43	P3						
44	TX	TX 44	P4						
45	TX	TX 45	P1	12					
46	TX	TX 46	P2						
47	TX	TX 47	P3						
48	TX	TX 48	P4						
49	TX	TX 49	P1	1					
50	TX	TX 50	P2						
51	TX	TX 51	P3						
52	TX	TX 52	P4						
53	TX	TX 53	P1	2					
54	TX	TX 54	P2						
55	TX	TX 55	P3						
56	TX	TX 56	P4						
57	TX	TX 57	P1	3					
58	TX	TX 58	P2						
59	TX	TX 59	P3						
60	TX	TX 60	P4						
61	TX	TX 61	P1	4					
62	TX	TX 62	P2						
63	TX	TX 63	P3						
64	TX	TX 64	P4						
65	TX	TX 65	P1	5					
66	TX	TX 66	P2						
67	TX	TX 67	P3						
68	TX	TX 68	P4						
69	TX	TX 69	P1	6					
70	TX	TX 70	P2						
71	TX	TX 71	P3						
72	TX	TX 72	P4						

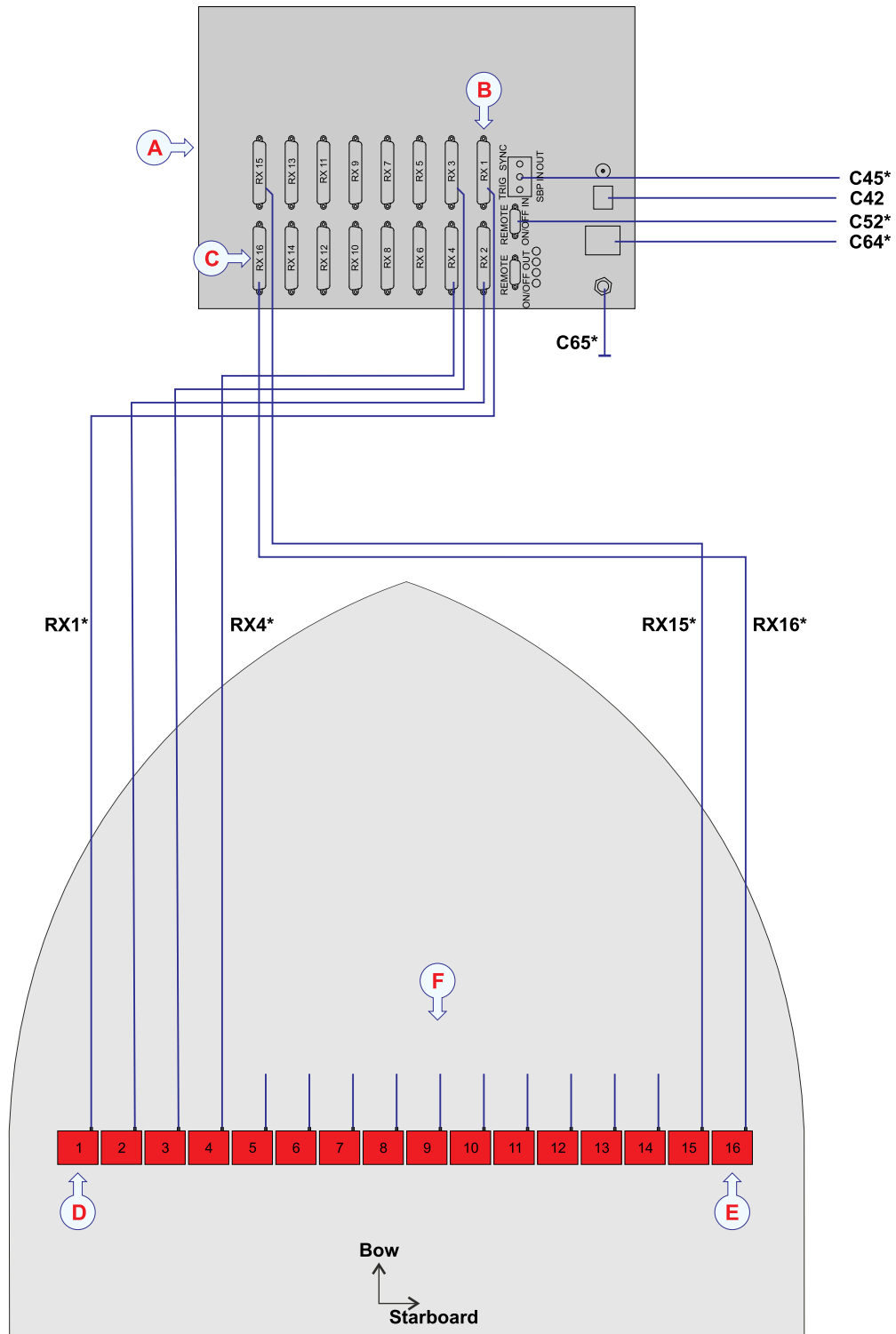
Position	Transducer serial number (fill in)	Cable	Socket	TX RIO board	TX Unit	Size of system			
73	TX	TX 73	P1	7					
74	TX	TX 74	P2						
75	TX	TX 75	P3						
76	TX	TX 76	P4						
77	TX	TX 77	P1	8					
78	TX	TX 78	P2						
79	TX	TX 79	P3						
80	TX	TX 80	P4						
81	TX	TX 81	P1	9					
82	TX	TX 82	P2						
83	TX	TX 83	P3						
84	TX	TX 84	P4						
85	TX	TX 85	P1	10					
86	TX	TX 86	P2						
87	TX	TX 87	P3						
88	TX	TX 88	P4						
89	TX	TX 89	P1	11					
90	TX	TX 90	P2						
91	TX	TX 91	P3						
92	TX	TX 92	P4						
93	TX	TX 93	P1	12					
94	TX	TX 94	P2						
95	TX	TX 95	P3						
96	TX	TX 96	P4						

Related topics

[List of EM 124 cables, page 105](#)

Cable plan, Receiver Unit, 1 degree

The receiver (RX) Unit cables include those used to connect the EM 124 RX Unit(s) to AC mains power, to the transmitter (TX) Unit, to the Processing Unit and to the transducers.



(CD020109_202_001)

- A Receiver Unit (RXU)
- B Socket RX 1
- C Socket RX 16
- D Receive transducer 1
- E Receive transducer 16
- F Receive transducer 5 to 14 connects to Socket RX 5 to RX 14 on Receiver Unit

Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 124 delivery.

Marking of RX transducer cables

Each transducer module and its cable is identified with a number as follows:

Transducer: RX<nnn>

Where <nnn> is a numerical value.

Each transducer module is also identified by its physical location in the array (frame). This location number must be recorded during the installation of the transducer modules, and written down in the table provided in this chapter.

Transducer module number 1 is always the first on the port side.

Connection of RX transducer cables

The 1 degree system consists of 16 RX modules/cables.

The 2 degree system consists of 8 RX modules/cables.

The 4 degree system consists of 4 RX modules/cables.

Note

It is essential to connect all RX cables successively to the sockets in the Receiver Unit(s).

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

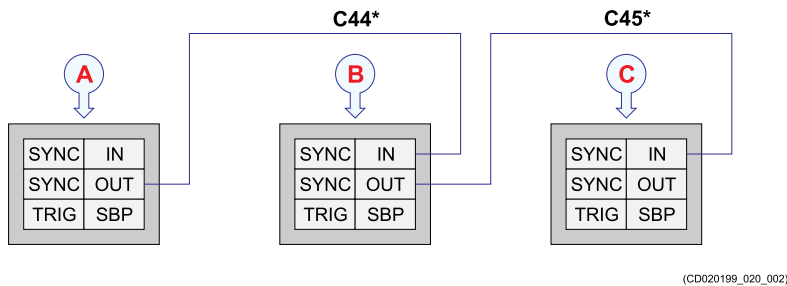
Position	Transducer serial number (fill in)	Cable	Socket	Size of system		
1	RX	RX1	RX 1	4 deg	2 deg	1 deg
2	RX	RX2	RX 2			
3	RX	RX3	RX 3			
4	RX	RX4	RX 4			
5	RX	RX5	RX 5			
6	RX	RX6	RX 6			
7	RX	RX7	RX 7			
8	RX	RX8	RX 8			
9	RX	RX9	RX 9			
10	RX	RX10	RX 10			
11	RX	RX11	RX 11			
12	RX	RX12	RX 12			
13	RX	RX13	RX 13			
14	RX	RX14	RX 14			
15	RX	RX15	RX 15			
16	RX	RX16	RX 16			

Related topics

[List of EM 124 cables, page 105](#)

Synchronization overview, 2 Transmitter Units 1 Receiver Unit

The transmitter and receiver unit(s) must be connected with a fibre optic synchronization signal.



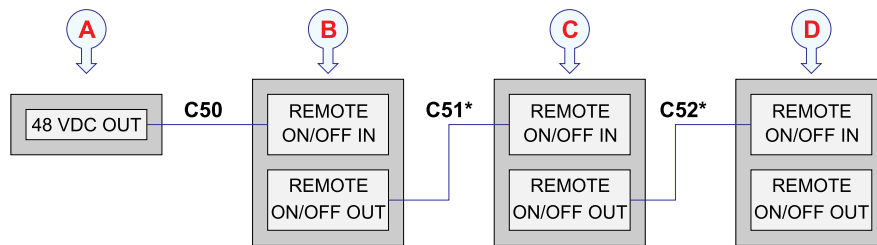
- A *Transmitter Unit (TXU) 1*
- B *Transmitter Unit (TXU) 2*
- C *Receiver Unit (RXU)*

Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 124 delivery.

The fibre optic cable and the cable for remote control between the Transmitter Units and Receiver Units are delivered as a kit. The standard cable length is 10 metres.

Remote on/off overview, 2 Transmitter Units 1 Receiver Unit

The EM 124 system can be switched on/off via the Processing Unit.



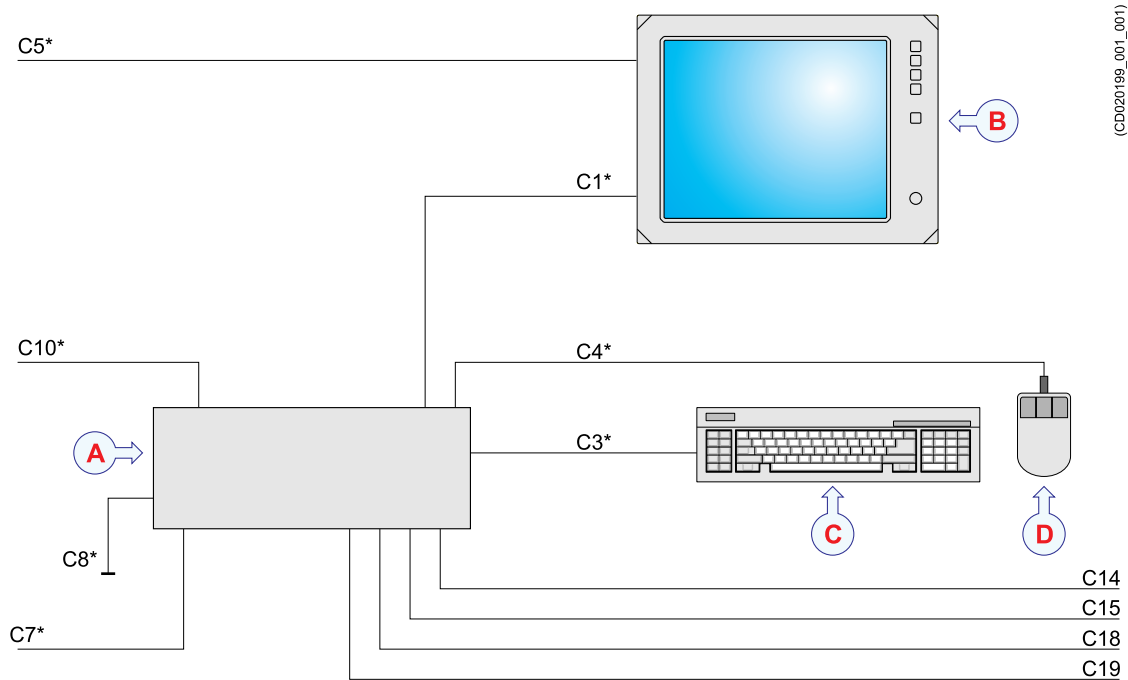
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- A *Processing Unit*
- B *Transmitter Unit (TXU) 1*
- C *Transmitter Unit (TXU) 2*
- D *Receiver Unit (RXU)*

Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 124 delivery.

Hydrographic Work Station

The topside/bridge cables include those used to connect the EM 124 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 cables. These cables are supplied with the EM 124 delivery.

Related topics

[List of EM 124 cables, page 105](#)

List of EM 124 cables

A set of cables is required to connect the EM 124 units to each other, and to the relevant power source(s).

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

Cable	Type	From/To	Minimum requirements
C27	Control cable	From Processing Unit to remote control device	
	Remote on/off switch If remote control is not used, a termination plug has to be inserted in the Remote control plug on the Processing Unit. This plug is a 9 pin D-SUB supplied with the Processing Unit. Remote control, page 119 Remote Control using K-Rem, page 120 Dummy plug for not using remote control, page 121		
C28	Control cable	From Processing Unit to synchronization device	
	External synchronization External synchronisation, page 118		
C29–C32	Serial cable	From Processing Unit to external device(s)	
	RS-232 serial line using three wires and RJ45 connector, page 115 RS-422 serial line using five wires and RJ45 connector, page 116		
C33	Ethernet cable	From Processing Unit to external device(s)	CAT5-E STP (Shielded Twisted Pair)
	Attitude Velocity sensor Attitude Velocity, Motion, Position and Time datagrams are supported via Ethernet.		
C34	Coax cable	From Processing Unit to the global positioning system (GPS)	
	The software clock can be synchronized to an external 1PPS (Pulse per second) signal. Clock synchronisation (1PPS) using a coax cable, page 117		
C36	Ethernet cable	Processing Unit internal connection	CAT5-E STP (Shielded Twisted Pair)
C40	Ethernet cable	From Processing Unit to Transmitter Unit 1	CAT5-E STP (Shielded Twisted Pair)
C41	Ethernet cable	From Processing Unit to Transmitter Unit 2	CAT5-E STP (Shielded Twisted Pair)
C42	Ethernet cable	From Processing Unit to Receiver Unit	CAT5-E STP (Shielded Twisted Pair)
C44	Fibre optic cable	From Transmitter Unit 1 to Transmitter Unit 2	
	The fibre optic cable and the cable for remote control between the Transmitter Units and Receiver Units are delivered as a kit. The standard cable length is 10 metres.		
C45	Fibre optic cable	From Transmitter Unit 2 to Receiver Unit	
	The fibre optic cable and the cable for remote control between the Transmitter Units and Receiver Units are delivered as a kit. The standard cable length is 10 metres.		
C50	Control cable	From Processing Unit to Transmitter Unit 1	
	Remote control of Transmitter Unit Remote control of Transmitter Unit, page 122		

Cable	Type	From/To	Minimum requirements
C51	Control cable	From Transmitter Unit 1 to Transmitter Unit 2	
	The fibre optic cable and the cable for remote control between the Transmitter Units and Receiver Units are delivered as a kit. The standard cable length is 10 metres.		
C52	Control cable	From Transmitter Unit 2 to Receiver Unit	
	The fibre optic cable and the cable for remote control between the Transmitter Units and Receiver Units are delivered as a kit. The standard cable length is 10 metres.		
C60	AC power cable	From Transmitter Unit to AC power outlet	
C61	Ground cable	From Transmitter Unit to vessel ground	
C62	AC power cable	From Transmitter Unit to AC power outlet	
C63	Ground cable	From Transmitter Unit to vessel ground	
C64	AC power cable	From Receiver Unit to AC power outlet	
C65	Ground cable	From Receiver Unit to vessel ground	
TX1-TX48	Transducer cable	From Transmitter Unit to transducer	
	The transducer cables are moulded to the transducer modules and connect in the other end to the Transmitter Unit (TXU) or Receiver Unit (RXU) with connectors. Transmit Transducer cable, page 128		
TX49-TX96	Transducer cable	From Transmitter Unit to transducer	
	The transducer cables are moulded to the transducer modules and connect in the other end to the Transmitter Unit (TXU) or Receiver Unit (RXU) with connectors. Transmit Transducer cable, page 128		
RX1-RX16	Transducer cable	From Receiver Unit to transducer	
	The transducer cables are moulded to the transducer modules and connect in the other end to the Transmitter Unit (TXU) or Receiver Unit (RXU) with connectors. Receive Transducer cable, page 129		

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 124 performance.

The EM 124 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 124 cables may be identified as **EM 124/Cx**.

Related topics

[Cable plan, Processing Unit, page 90](#)

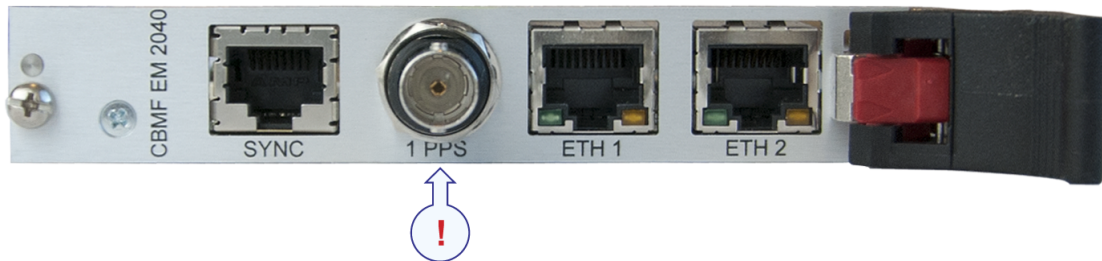
[Cable plan, Transmitter Unit, page 91](#)

[Cable plan, Receiver Unit, 1 degree, page 99](#)

[Hydrographic Work Station, page 104](#)

Clock synchronization (1PPS)

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



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

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

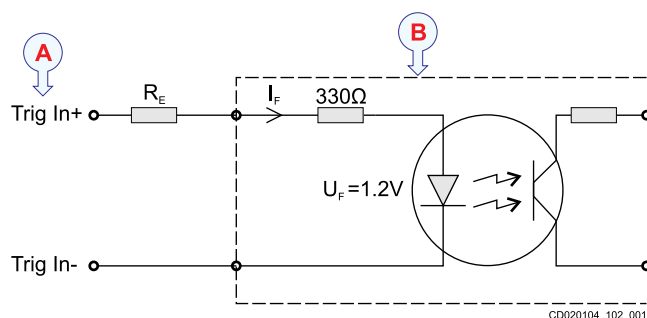
The CBMF board is equipped with an optocoupler at this input. The input series resistor is tuned for a TTL signal (Low level < 0.6 V, High level > 3.2 V).

Optically isolated input signals

Note

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

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



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

Two examples are shown to clarify.

•

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

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

•

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

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

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

External synchronization

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



This connection is used for interface to an external synchronization system (for example K-Sync) used when multiple echo sounders are employed on the same vessel. The external synchronization connector is located on the CBMF board in the processing unit. If the Processing Unit has two CBMF boards the lower one must be used for synchronization.

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

RJ45 connector pin layout

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

(CD0806_701_001)

Pin 3 and 6 is used by Kongsberg Maritime only.

External synchronization signal characteristics

Signal	Description	Type	Active
RTS	Ready To Send - Output from EM 124 when it is ready for the next trigger pulse	Open collector output from isolation unit	High
TRIG OUT	Trigger out - Output to external synchronization system, active while the EM 124 is transmitting	Open collector output from isolation unit	Low
TRIG IN	Trigger in - Input to EM 124 enabling it to transmit	Optical isolated input	High

Note

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

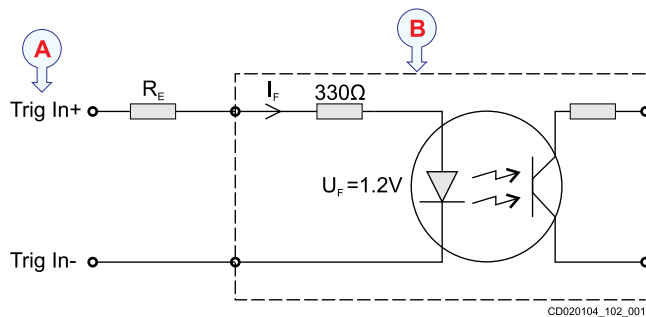
Optically isolated input signals

Note

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

A *Input from external system*

B *Processing Unit input circuitry*



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

Two examples are shown to clarify.

•

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

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

•

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

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

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

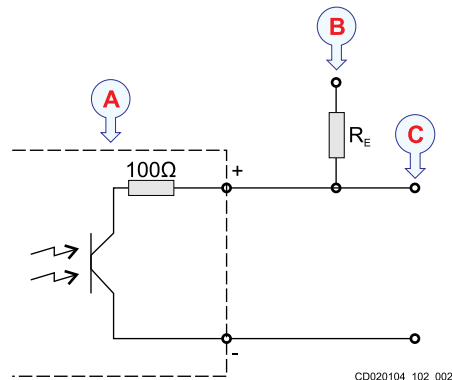
Optically isolated output signals

A Processing Unit output circuitry

B External power

C Input to external system

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



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

Cable drawings and specifications

Topics

[RS-232 serial line using three wires and RJ45 connector, page 115](#)

[RS-422 serial line using five wires and RJ45 connector, page 116](#)

[Clock synchronisation \(1PPS\) using a coax cable, page 117](#)

[External synchronisation, page 118](#)

[Remote control, page 119](#)

[Remote Control using K-Rem, page 120](#)

[Dummy plug for not using remote control, page 121](#)

[Remote control of Transmitter Unit, page 122](#)

[Remote control of Receiver Unit, page 124](#)

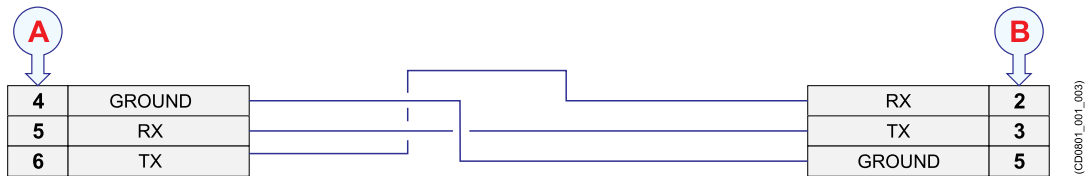
[Remote control overview, page 126](#)

[Transmit Transducer cable, page 128](#)

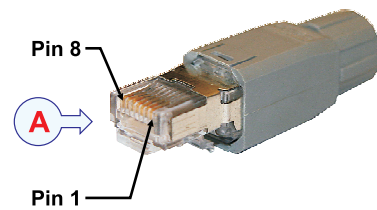
[Receive Transducer cable, page 129](#)

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 124 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

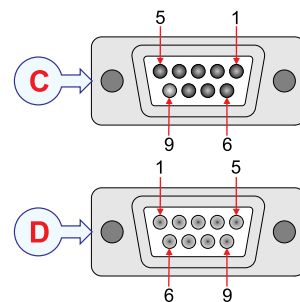


Unless otherwise specified, this cable must be provided by the installation shipyard. Note that this cable does not support all the signals in the standard RS-232 specification.

Minimum cable requirements

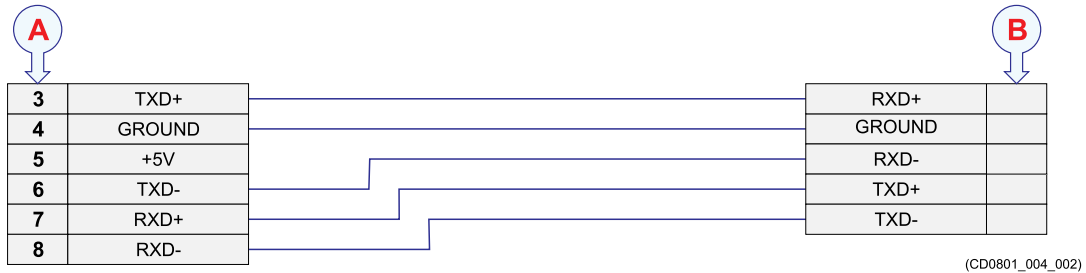
- **Conductors:** 2 x 2 x 0.2 mm²
- **Screen:** Overall braided
- **Voltage:** 30 V
- **Maximum outer diameter:** Defined by the plugs and/or the cable gland

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 124 to external devices. An RS-422 serial line connection can transmit data at rates as high as 10 million bits per second, and may be sent on cables as long as 1500 meters.

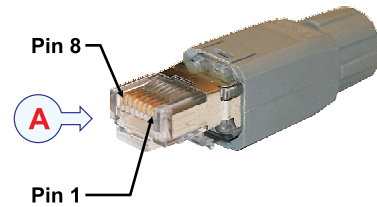


A Local connection

RJ45 connector

B Connection on remote device

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



(CD0804_001_004)

Minimum cable requirements

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

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

Clock synchronisation (1PPS) using a coax cable

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

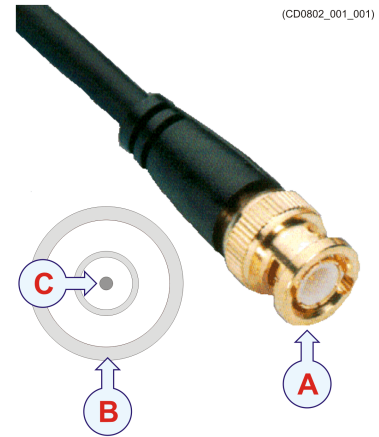
- A *Male BNC connector*
- B *Ground*
- C *1PPS signal*

This cable must be provided by the installation shipyard.

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

Related topics

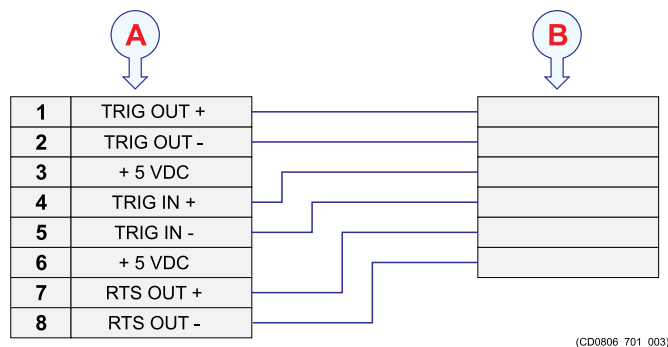
[Clock synchronization \(1PPS\), page 109](#)



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.

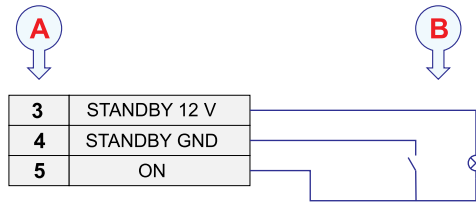
Related topics

[External synchronization, page 111](#)

Remote control

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

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

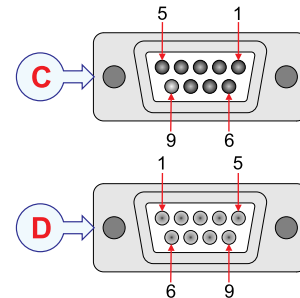


(CD0806_701_010)

Minimum cable requirements

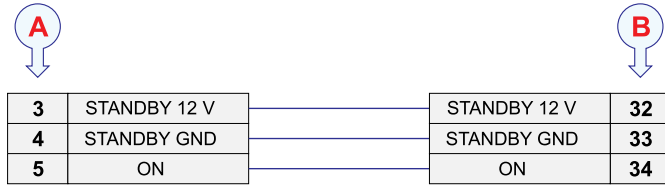
- **Conductors:** 3 x 0.5 mm²
- **Screen:** Overall braided
- **Voltage:** 60 V
- **Maximum outer diameter:** Defined by the plugs and/or the cable gland

This cable must be provided by the installation shipyard.



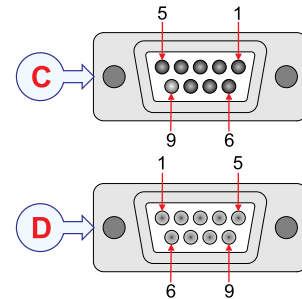
Remote Control using K-Rem

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



(CD0806_701_011)

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



Minimum cable requirements

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

This cable must be provided by the installation shipyard.

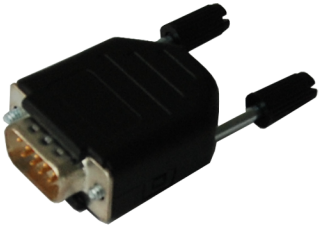
Dummy plug for not using remote control

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



Note

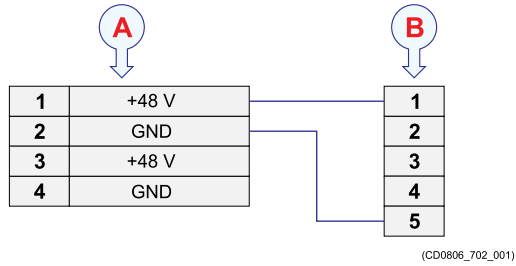
*If remote control is not used, the enclosed remote control dummy plug has to be inserted in the **Remote Control** connector in the Processing Unit. The Processing Unit will not work without this dummy plug.*



Remote control of Transmitter Unit

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

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



A Processing Unit end, male 4-pin Lemo connector.

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

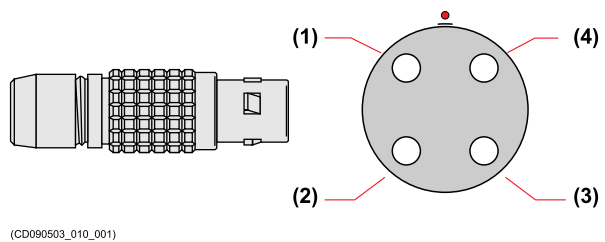
Kongsberg Maritime part number: 348015

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

Processing Unit end

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

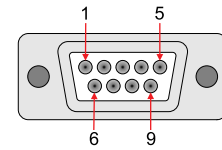
Connects to **48 VDC OUT** on the rear of the Processing Unit.



Transmitter Unit end

Pin layout male 9-pin D-connector.

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



(CD010504_002_001)



Minimum cable requirements

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

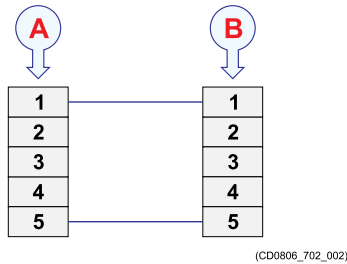
This cable must be provided by the installation shipyard.

Remote control of Receiver Unit

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

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

The fibre optic cable and the cable for remote control between the Transmitter Units and Receiver Units are delivered as a kit. The standard cable length is 10 metres.



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

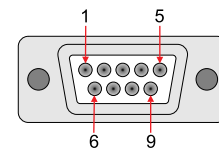
Connects to **REMOTE ON/OFF OUT** at the bottom of the Transmitter Unit.

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

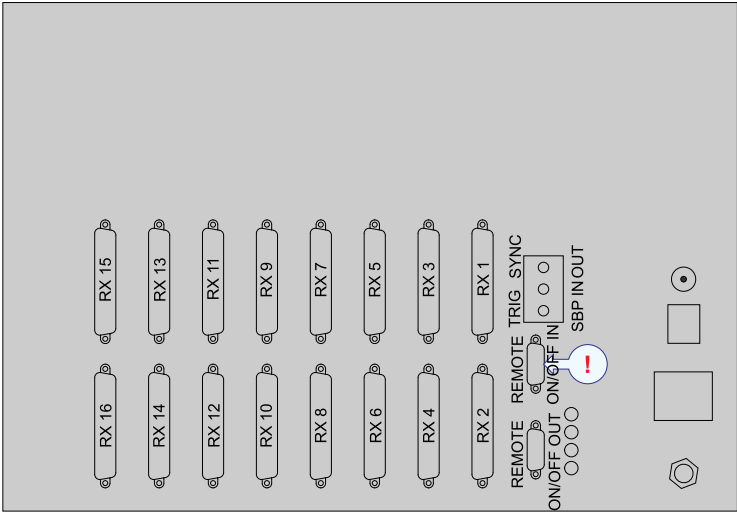
Connects to **REMOTE ON/OFF IN** at the Receiver Unit.

Pin layout male 9-pin D-connector.

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



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



(CD020109_260_001)

Minimum cable requirements

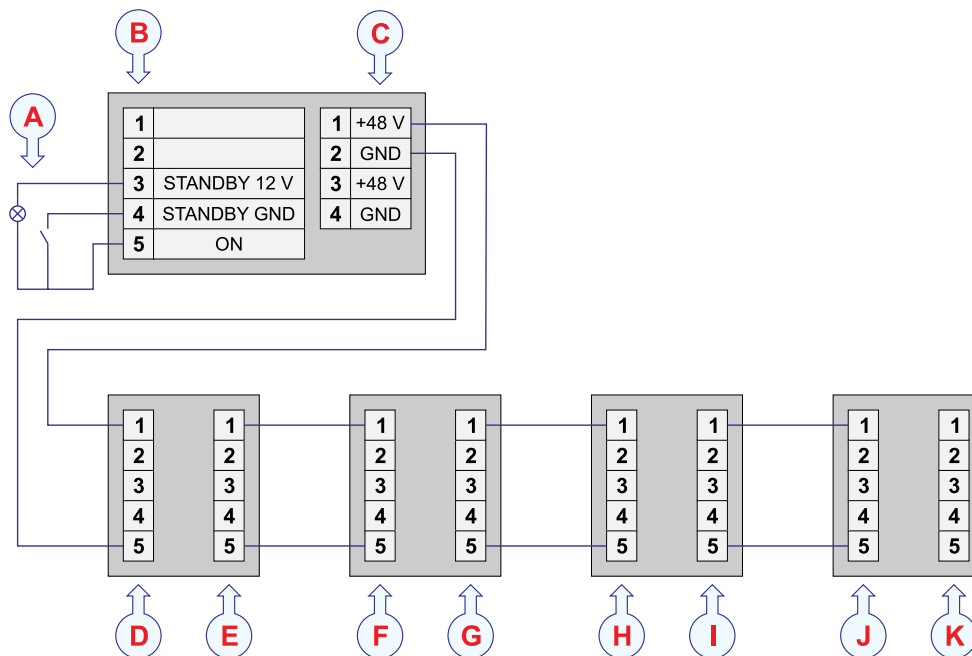
- **Conductors:** 2 x 0.5 mm²
- **Screen:** Overall braided
- **Voltage:** 60 V
- **Maximum outer diameter:** Defined by the plugs

Remote control overview

The EM 124 system can be switched on/off with a central control switch.

An EM 124 system has several hardware units, and to make it easier to switch on/off the system it is prepared for remote control. There are several methods to do this:

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



(CD0806_702_003)

- A** Remote switch and lamp (optional)
- B** Processing Unit, connector marked **REMOTE CONTROL**
- C** Processing Unit, connector marked **48VDC OUT**
- D** Transmitter Unit 1, connector marked **REMOTE ON/OFF IN**
- E** Transmitter Unit 1, connector marked **REMOTE ON/OFF OUT**
- F** Transmitter Unit 2, connector marked **REMOTE ON/OFF IN**
- G** Transmitter Unit 2, connector marked **REMOTE ON/OFF OUT**
- H** Receiver Unit 1, connector marked **REMOTE ON/OFF IN**
- I** Receiver Unit 1, connector marked **REMOTE ON/OFF OUT**
- J** Receiver Unit 2, connector marked **REMOTE ON/OFF IN**

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

Note

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

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

Transmit Transducer cable

The transducer cables are moulded to the transducer modules and connect in the other end to the Transmitter Unit (TXU) with connectors.

The standard length of the transducer cables is 25 metres.

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

Extended cables can be delivered upon request. Cables are extended by splicing onto existing standard 25m length cables.

Cable specifications

- Cable length: 25 m
- Maximum outer diameter: 13 mm
- Minimum bending radius: 78 mm

Receive Transducer cable

The transducer cables are moulded to the transducer modules and connect in the other end to the Receiver Unit (RXU) with connectors.

The standard length of the transducer cables is 25 metres.

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

Extended cables can be delivered upon request. Cables are extended by splicing onto existing standard 25m length cables.

Cable specifications

- Cable length: 25 m
- Maximum outer diameter: 13 mm
- Minimum bending radius: 78 mm

Dimensional surveying and alignment

Topics

[About dimensional surveying and alignment, page 131](#)

[Dimensional surveying, page 131](#)

[Alignment, page 132](#)

[Transducer array flatness, page 133](#)

[Checking the transducer array flatness and correcting deviations, page 134](#)

[Calibration, page 135](#)

[Vessel coordinate system, page 135](#)

About dimensional surveying and alignment

The EM 124 Multibeam Echo Sounder is a precision instrument for scientific measurements.

In order to obtain precision data that are both detailed and correct, it is necessary to align the transducer, measure the location and offset of each sensor in relation to the vessel's coordinate system, and calibrate the complete EM 124 prior to use. Modest accuracy requirements apply when your EM 124 system is only used to investigate objects in the water column.

The quality assurance tasks required for EM 124 include:

- Aligning the transducer during installation
- Dimensional surveying
- Calibration

The alignment and dimensional surveying must be done during the EM 124 installation with the vessel in dry dock. The first calibration is normally done at sea during the Sea Acceptance Test. This calibration may not be complete, and must then be repeated later. The calibration is then repeated at regular intervals, and prior to each survey.

Dimensional surveying

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

The dimensional surveying tasks required for EM 124 include:

- 1 Establishing the vessel coordinate system
- 2 Defining the location of the origin in the coordinate system
- 3 Establishing waterline with reference to the origin of the coordinate system
- 4 Setting out the required coordinate reference points throughout the vessel.
- 5 Defining the vessel's centre line, and if required — identify this line with physical markings
- 6 Measuring the necessary position and angles for all relevant sensors in the coordinate system.
- 7 Measuring the location and orientation of the EM 124 transducer in the coordinate system.

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

The information provided by the dimensional survey is entered into the EM 124 software as installation parameters.

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

Note

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

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

Related topics

[Dimensional survey accuracy requirements, page 155](#)

Alignment

To ensure a successful installation of the EM 124, all alignment and measurements must be done to the highest possible accuracy.

The alignment tasks required for EM 124 include:

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

Note

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

Related topics

[Alignment specifications, page 157](#)

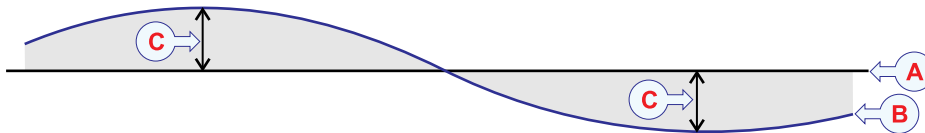
Transducer array flatness

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

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

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

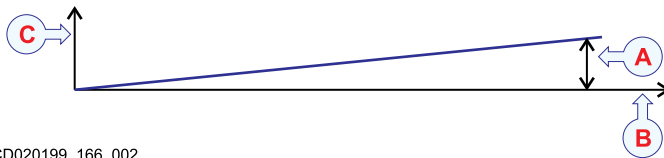
- No point on the frame may deviate from the ideal plane with more than the tolerance limit shown in *Technical specifications*. The limit will vary between the different multibeam echo sounders.



CD020199_166_001

- A** *Ideal plane*
- B** *Installed plane*
- C** *Deviation*

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



CD020199_166_002

- A** *Maximum gradient 0.1 % = 1 mm/m*
- B** *Distance between mounting points*
- C** *Difference in relative height between mounting points*

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

Related topics

[Dimensional survey accuracy requirements, page 155](#)

[Alignment specifications, page 157](#)

Checking the transducer array flatness and correcting deviations

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

Prerequisites

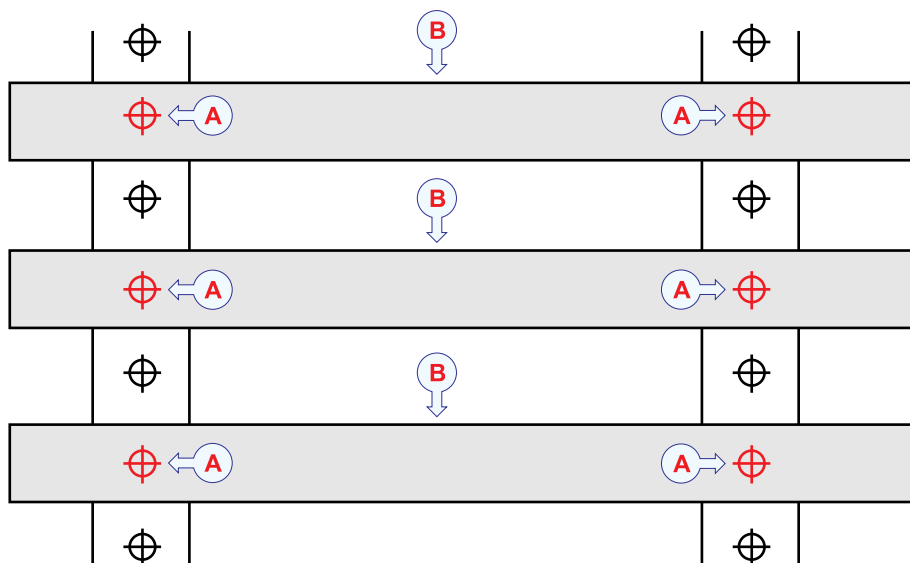
In some occasions a flatness survey of the frame mounting foundations can be recommended. This will give an indication of how much time and shims will be required.

Context

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

Procedure

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



CD020199_166_003

A Measure points

- 3 Determine the necessary adjustments to obey the given tolerances.

Note _____

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

- 4 Apply shims to level out the height differences.

- 5 Verify that the mounting frame is in plane within the given tolerances.
- 6 Repeat the procedure until the tolerances are met

Related topics

[Dimensional survey accuracy requirements, page 155](#)

[Alignment specifications, page 157](#)

Calibration

During the sea trials, calibration surveys are required as described in the EM 124 end user documentation.

In order to check and verify the performance of the EM 124 system, we strongly recommend that calibration surveys are done at regular intervals, or prior to any large survey.

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

Note

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

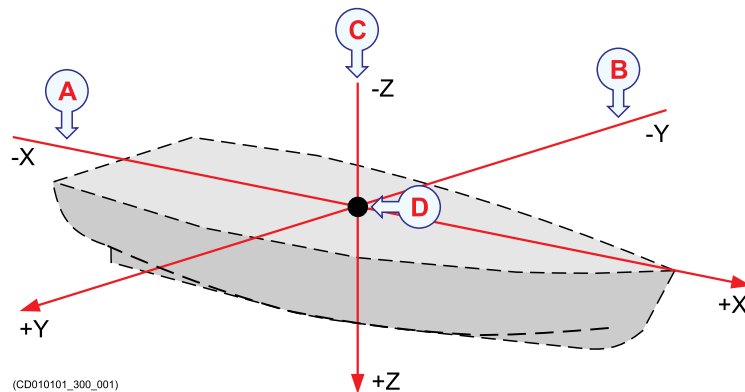
Vessel coordinate system

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

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

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

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



- 1 *The X-axis is the longitudinal direction of the vessel, and in parallel with the deck. A positive value for X means that a sensor or a reference point is located ahead of the reference point (origin).*
- 2 *The Y-axis is the transverse direction of the vessel, and in parallel with the deck. A positive value for Y means that a sensor or a reference point is located on the starboard side of the reference point (origin).*
- 3 *The Z-axis is vertical, and in parallel with the mast. A positive value for Z means that a sensor or a new reference point is located under the reference point (origin).*
- 4 *Reference point (Ship Origin)*

Coordinate system origin

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

Frequently used locations are:

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

Technical specifications

Topics

[Performance specifications, page 138](#)

[Interface specifications, page 140](#)

[Weight and outline dimensions, page 147](#)

[Power requirements, page 150](#)

[Environmental requirements, page 152](#)

[Dimensional survey accuracy requirements, page 155](#)

[Alignment specifications, page 157](#)

Performance specifications

These performance specifications summarize the main functional and operational characteristics of the EM 124 system.

- Maximum ping rate: More than 5 Hz
- Number of swaths per ping: 2
-

Model	Transmit beamwidth	Receive beamwidth	Transmit waveforms	Number of beams per ping
0.5 x 1 degree	0.5 degrees	1 degree	CW + FM	1024 *
1 x 1 degree	1 degree	1 degree	CW + FM	
1 x 2 degrees	1 degrees	2 degrees	CW + FM	1024
2 x 2 degrees	2 degrees	2 degrees	CW + FM	
2 x 4 degrees	2 degrees	4 degrees	CW + FM	512
4 x 4 degrees	4 degrees	4 degrees	CW + FM	

* 1024 beams, 1600 soundings in high density mode

- Standard beamwidths: 0.5 x 1, 1 x 1, 1 x 2, 2 x 2, 2 x 4 or 4 x 4 degrees
- Beam spacing: Equidistant, Equiangle, High density (only with 1 degrees RX array)
- Coverage sector: Up to 150 degrees
- Transmit beam steering: Stabilized for roll, pitch and yaw
- Receive beam steering: Stabilized for roll
- Depth range from transducers: 20 to 11000 metres
- Pulse lengths: 2 ms CW to 100 ms FM (nominal pulse length)
- Maximum range sampling rate: 2.6 kHz (28cm) at data output
- Source level:
 - 1 degree TX: Up to 240 dB re 1 μ Pa ref 1 m
 - 0.5 degrees TX: Up to 246 dB re 1 μ Pa ref 1 m

Dual swath restrictions

FM mode is used to extend the maximum range capability.

In Very Deep mode long FM pulses are prioritized. Dual swath is not available in this mode.

Reduced power output (Mammal protection)

Maximum intensity is encountered in a thin wedge extending below the ship with an angular coverage of about 140°. The intensity level may be lowered by 10 or 20 dB by the operator. The EM 124 may be set in a mode to begin pinging with a flexible soft-start as a possible means of inducing marine mammals to leave the area of high intensity sound.

Interface specifications

Topics

[Datagram formats, page 141](#)

[Processing Unit, page 142](#)

[External sensors requirements, page 145](#)

[Hydrographic Work Station, page 146](#)

Datagram formats

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

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

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

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

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

Newer generation multibeams will get support for both all and KMall format and will have full compatibility with SIS 4, K-Controller and SIS5. This includes:

- EM 2040 Series multibeams
- EM 712

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

- EM 124
- EM 304
- Any future EM multibeams

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

See the [Support EM 124](#) page.

Processing Unit

The EM 124 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 KMail format.

Supported datagram formats for position information

The EM 124 supports the following datagram format for position information.

- **NMEA GGA**

The NMEA GGA datagram transfers the 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 124 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 124 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 124 supports the following datagram formats from a motion sensor.

- **KM Binary**

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

- **Seapath Binary 11**

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

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

- **Seapath Binary 23**

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

- **Seapath Binary 26**

This is a proprietary format created by Kongsberg Seatex (<http://www.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 Hydrographic Work Station and configured in SIS 5.

The EM 124 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 KMail format is described in its own document.

See the [Product support A to Z](#) page.

External sensors requirements

The external sensors must fulfil these requirements to achieve the specified performance for the EM 124 system.

Sensor accuracy

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

- **Roll, pitch and yaw rate:** 0.03 deg/s RMS
- **Velocity:** 0.03 m/s RMS
- **Latency:** Maximum 5 ms
- **Update rate:** 100 Hz
- **Roll:** 0.02 degrees RMS
- **Pitch:** 0.05 degrees RMS
- **Heading:**
 - 0.5 degrees TX array: 0.1 degrees RMS
 - 1 degree TX array: 0.2 degrees RMS
 - 2 degrees TX array: 0.4 degrees RMS
- **Heave (real-time output):** 5 cm or 5 % whichever is highest

Doppler shifts

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

The following motion sensors have specifications that fulfils Kongsberg Maritime requirements for Doppler shift corrections.

- Kongsberg Maritime – Seapath series
- Applanix – Pos MV
- IXSEA – Phins

Hydrographic Work Station

The EM 124 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 multibeam using KMail format.

Hydrographic Work Station

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

Weight and outline dimensions

These weights and outline dimension characteristics summarize the physical properties of the EM 124 system.

Transmit transducer module

- **Outline dimensions:**
 - **Length:** 179 mm / 131.4 mm
 - **Width:** 760 mm
 - **Height:** 197 mm
- **Weight:** 58 kg

Transmit transducer frame

- **Outline dimensions:**
 - **Length:**
 - * **0.5 degree:** 15200 mm
 - * **1 degree:** 7770 mm
 - * **2 degrees:** 4020 mm
 - **Width:** 780 mm
 - **Height:**
 - * **1 degree:** 261.5 mm
 - * **2 degrees:** 249.5 mm

Receive transducer module

- **Outline dimensions:**
 - **Length:** 447 mm
 - **Width:** 342 mm
 - **Height:** 120 mm
- **Weight:** 24 kg

Receive transducer frame

- **Outline dimensions:**
 - **Length:**
 - * **1 degree:** 7200 mm
 - * **2 degrees:** 3600 mm
 - * **4 degrees:** 1808 mm
 - **Width:** 420 mm

- **Height:** 177 mm

Processing Unit

- **Outline dimensions:**
 - **Length:** 424mm
 - **Width:** 482.5 mm
 - **Height:** 88.6 mm
- **Weight:** 10.5 kg

Transmitter Unit

- **Outline dimensions:**
 - **Height:** 898 mm
 - **Width:** 606 mm
 - **Depth:** 612 mm
- **Weight:**
 - 1 degree: 96 kg
 - 2 degrees: 80 kg
 - 4 degrees: 72kg

Receiver Unit

- **Outline dimensions:**
 - **Height:** 285 mm
 - **Width:** 488 mm
 - **Depth:** 420 mm
- **Weight:** 21 kg

Hydrographic Work Station

Make and model: Hewlett Packard MP5810

The standard commercial computer has been configured to fit the operational requirements of the EM 124.

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

Display

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

Power requirements

These power characteristics summarize the supply power requirements for the EM 124 system.

TX Unit

- **Voltage requirement:** 230 VAC, 47 to 63 Hz
- **Maximum voltage deviation:** 15 %
- **Maximum power consumption:**
 - 1 deg: 1350 W
 - 2 deg: 750 W
 - 4 deg: 450 W

RX Unit

- **Voltage requirement:** 230 VAC, 47 to 63 Hz
- **Maximum voltage deviation:** 15 %
- **Maximum power consumption:** 50 W

Processing Unit

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

Hydrographic Work Station

- **Make and model:** Hewlett Packard MP5810
The standard commercial computer has been configured to fit the operational requirements of the EM 124.
- **Voltage requirement:** 100/240 VAC, 50 to 60 Hz, autosensing
- **Maximum power consumption:** 240 W (Approximately)

Note

The use of an Uninterruptible Power Supply (UPS) is highly recommended for the Hydrographic Work Station.

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 124 system.

Transducers

- **Operational temperature:** -5 to +50 °C
- **Storage temperature:** -30 to +70 °C
- **Depth rating:** 60 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

TX Unit

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

RX Unit

- **Operational temperature:** 0 to +50°C

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

Hydrographic Work Station

- **Make and model:** Hewlett Packard MP5810
- **Operational temperature:** 0 to +50 °C
- **Storage temperature:** -20 to 70 °C
- **Relative humidity:** 5 to 95% relative, non-condensing
- **Certificates:**
 - IEC 60945
 - IACS E10
- **Ingress protection (IP) rating: IP22**
 This IP rating is only applicable when the unit is mounted using the optional kit for 19-inch rack.

Display

- **Manufacturer:** Isic
- **Manufacturer's website:** <http://www.isic-systems.com>
- **Model:** MD22/24/27 (DuraMON WS 22/24/27)
- **Operational temperature:** -15 to 55 °C
- **Storage temperature:** -25 to 70 °C
- **Relative humidity:** 8 to 95% relative non-condensing

- **Ingress protection (IP) rating**
 - Front: IP65
 - Rear: IP20
- **Certificates**
 - IEC 60945
 - IACS E10

Dimensional survey accuracy requirements

Minimum accuracy requirements are defined for the dimensional survey.

Note

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

Transducer

- **Position (x):** ± 0.05 m
- **Position (y):** ± 0.05 m
- **Position (z):** ± 0.02 m
- **Pitch:**
 - TX transducer array: ± 0.05 degrees
 - RX transducer array: ± 0.20 degrees
- **Roll:**
 - TX transducer array: ± 0.20 degrees
 - RX transducer array: ± 0.02 degrees
- **Heading:** ± 0.1 degrees
- **Relative heading between RX and TX transducer :** ± 0.1 degrees

Motion Reference Unit (MRU)

Note

These specifications are minimum requirements. Consult the installation manual for each sensor for how it is to be aligned and how accurately the location needs to be measured.

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

Heading sensor

Note

These specifications are minimum requirements. Consult the installation manual for each sensor for how it is to be aligned and how accurately the location needs to be measured.

- **Heading:** ± 0.10 degrees

Global positioning system (GPS) (Antenna)

Note

These specifications are minimum requirements. Consult the installation manual for each sensor for how it is to be aligned and how accurately the location needs to be measured.

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

Waterline reference mark

- **Position (z):** ± 0.02 m

Related topics

[Dimensional surveying, page 131](#)

Alignment specifications

These alignment specifications summarize the alignment requirements of the EM 124 system.

Note

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

Transducer

- **Flatness:**
 - **Maximum deviation from ideal plane:** 1.6 mm
 - **Maximum gradient:** 0.1 %
The maximum allowed gradient between two adjacent mounting points on the frame is 0.1 % (1 mm/m)
- **Mounting angle between TX and RX transducer:** 90 degrees \pm 2 degrees

Related topics

[Alignment, page 132](#)

[Transducer array flatness, page 133](#)

[Checking the transducer array flatness and correcting deviations, page 134](#)

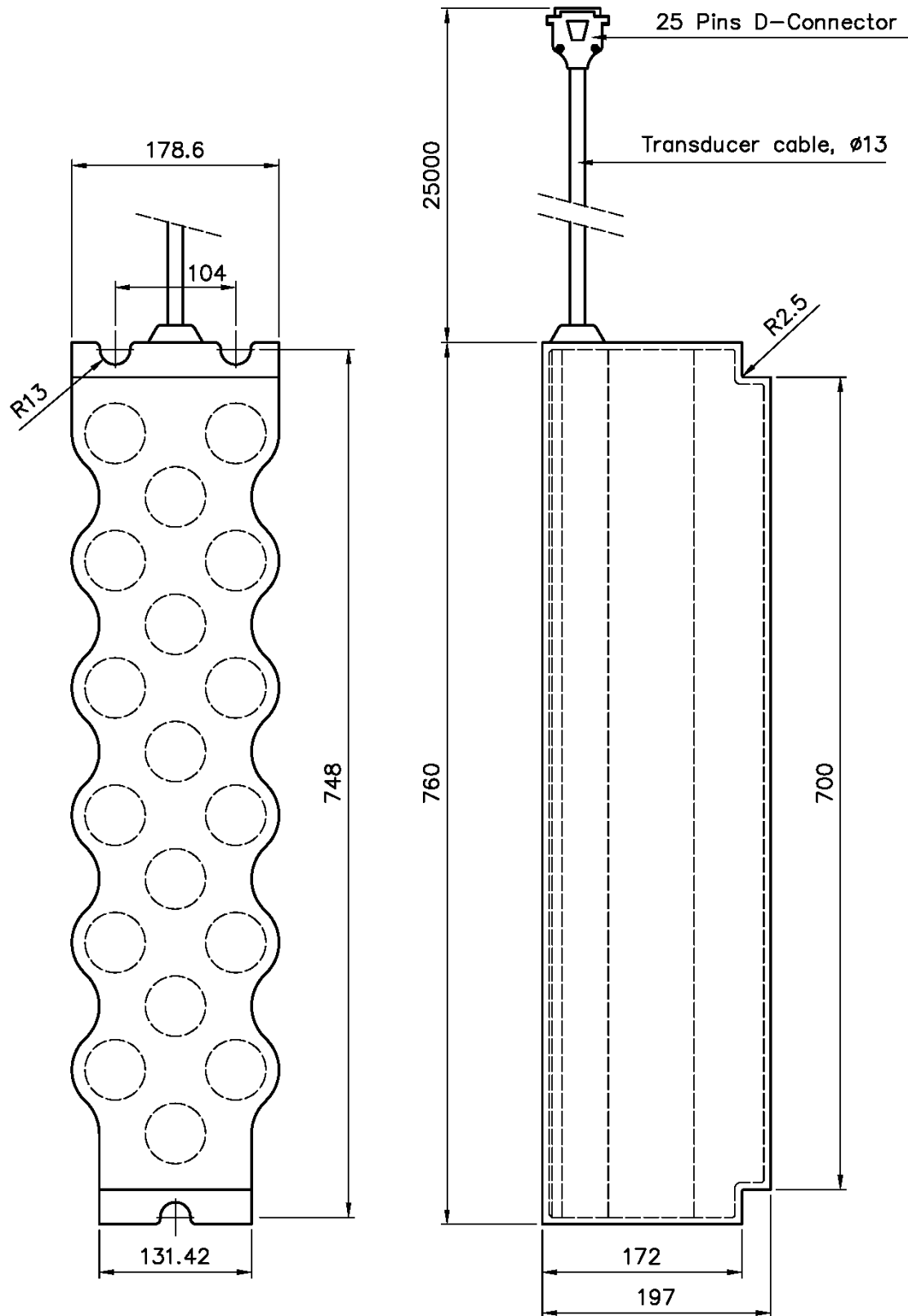
Drawing file

Drawing numbers referenced in this document

This chapter contains drawings referenced in this manual.

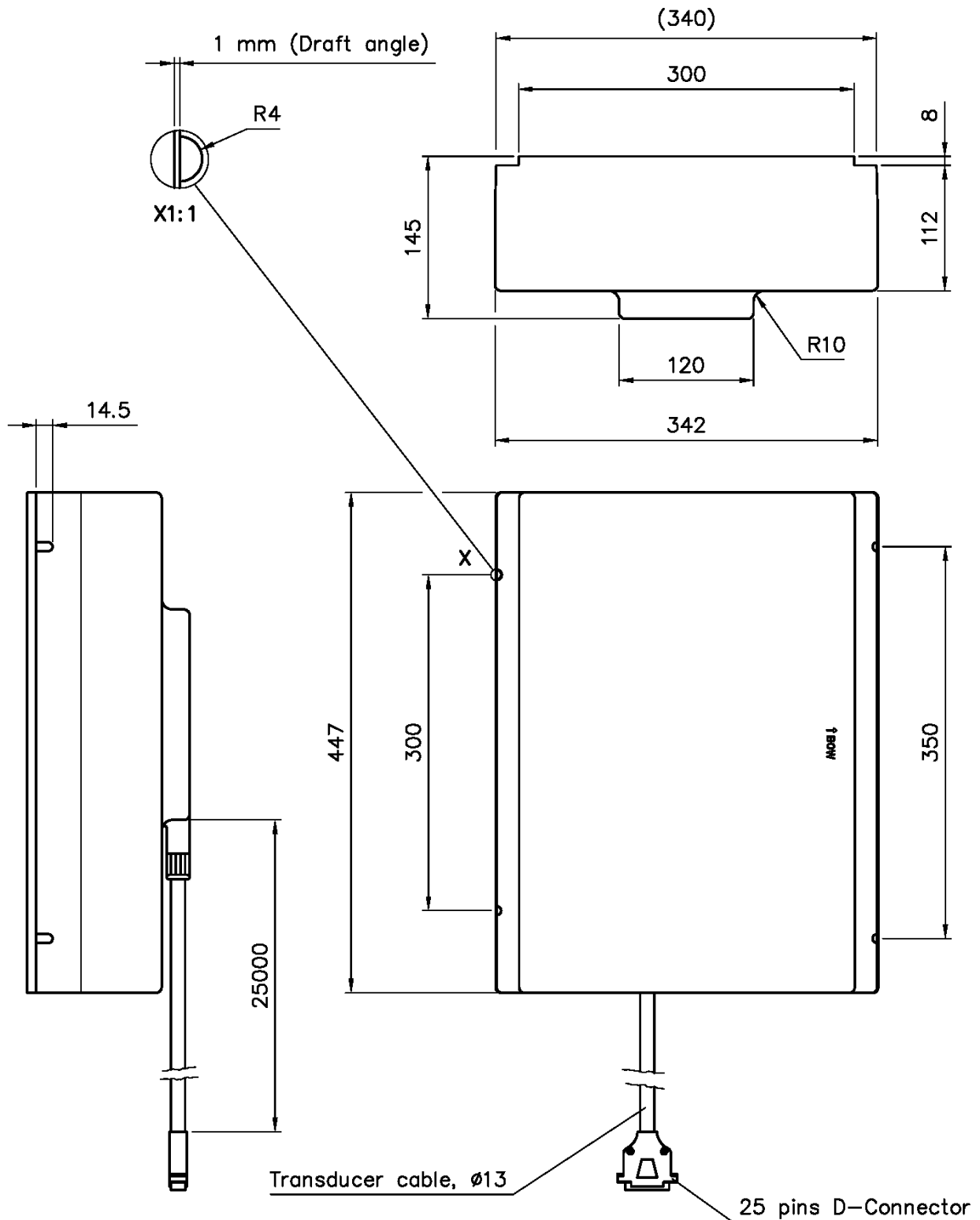
Drawing	Description
834-213673	TX module, outline dimensions
834-213217	RX module, outline dimensions
372053	TX mounting frame assembly 0.5 degrees
860-213433	TX mounting frame assembly 1 degrees.
499-213370 A	TX mounting frame assembly 2 degrees page 1
499-213370 B	TX mounting frame assembly 2 degrees page 2
860-213744	RX mounting frame assy. 1 degrees
860-213389	RX mounting frame assy. 2 degrees
860-213803	RX mounting frame assy. 4 degrees
372981	Arrangement drawing casing with frame TX 0.5 degrees
821-213754	Arrangement drawing casing with frame TX 1 degree
821-213755	Arrangement drawing casing with frame TX 2 degrees
821-213749	Arrangement drawing casing with frame RX 1 degree
821-213756	Arrangement drawing casing with frame RX 2 degrees
821-213819	Arrangement drawing casing with frame RX 4 degrees
365207	Baffle plate 1
365208	Baffle plate 2
365209	Baffle plate 3
426226	TX Unit, Outline dimension
435444	RX Unit, Outline dimension
385422	Processing Unit, outline dimensions

Drawing	Description
378828	Hydrographic Work Station, outline dimensions
445723	HWS MPxxxx Rack mount kit
365290	MPxxxx with KM 1000 mounting kit
409067	Signal/Fiber Cable Kit
370275	Remote Control Unit (K-REM), outline dimensions



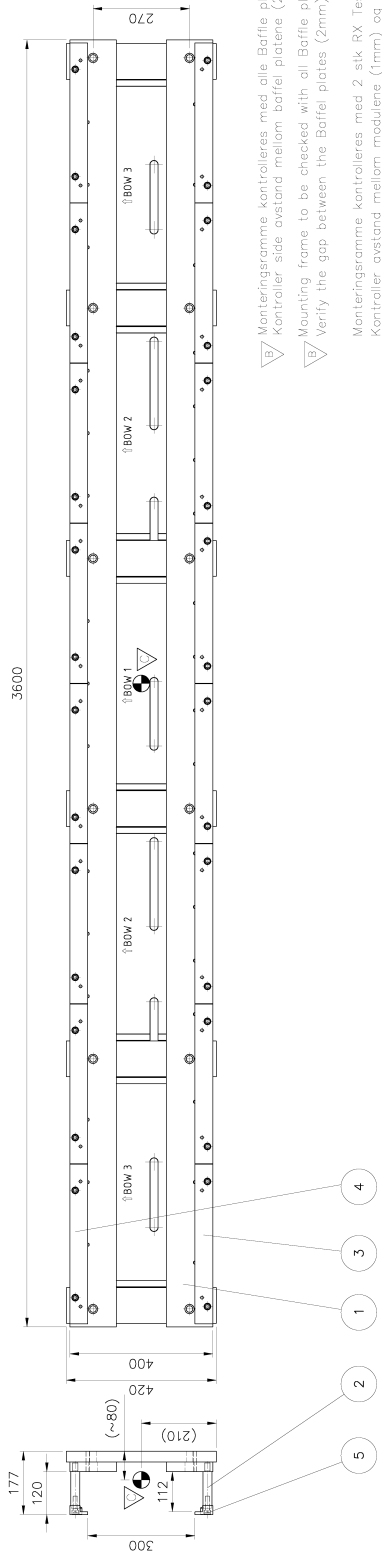
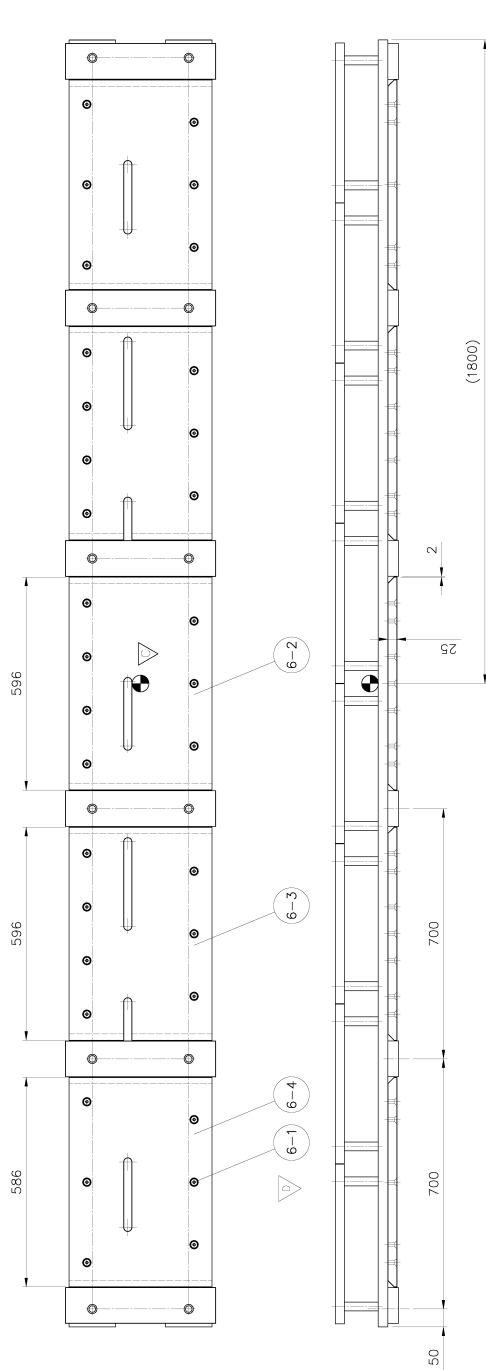
Weight: 58kg

REV./SIGN.	B	LK							
DATE	2012.03.06								
PROJ. METHOD			UNLESS OTHERWISE STATED, TOLERANCE: DIM.: ISO 2768-mK THREAD: 6g/6H			PARTS LIST: N.A.	KONGSBERG SIMRAD		
SCALE	1:5		OUTLINE DIMENSIONS			SHEET 1 OF 1	SH.SIZE: A4	REV.:	
DRAWN	98.09.07	EEn	TX MODULE			834-213673		B	
CHECKED	00.01.27	HF							
APPROVED	00.01.31	EEn	EM120			FILE NO.: 878-37			



Weight: 24 kg.

REV./SIGN.	B	KTP	C	LK						
DATE	99.11.03		12.03.06							
PROJ. METHOD			UNLESS OTHERWISE STATED, TOLERANCE: DIM.: THREAD:			PARTS LIST:		KONGSBERG SIMRAD		
SCALE	1:5		OUTLINE			SHEET 1 OF 1		SH.SIZE: A4		REV.:
DRAWN	99.09.14	KTP	HYDROPHONE UNIT			834-213217		C		
CHECKED	99.09.16	EEn	EM120 RX			FILE NO.: 876-99				
APPROVED	99.09.17	FT								



Note: All parts must be cleaned and mounted as dwg. shows.
 Stay bolts pos 2 to be locked/ greased with Loctite 242 . Stud torque 165Nm.
 Bolts Pos 5 to be mounted without torque.
 Mount all Baffle plates on site.
 Screws pos 6-1 to be locked/ greased with Loctite 242 . Moderate torque.

Note: Alle deler skal være rengjort og sammenskrudd som tegn. viser.
 Stågbolter Pos 2 løses/smøres med Loctite 242 og tiltrekkes med 165Nm.
 Bolter Pos 5 trekkes sturt uten moment.
 Monter alle baffle plater i dokk.
 Skrur Pos 6-1 løses/smøres med Loctite 242 og tiltrekkes med moderat moment!

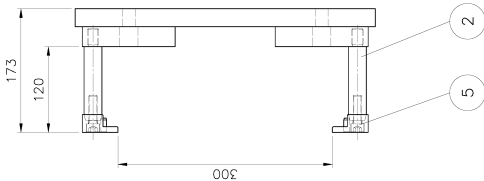
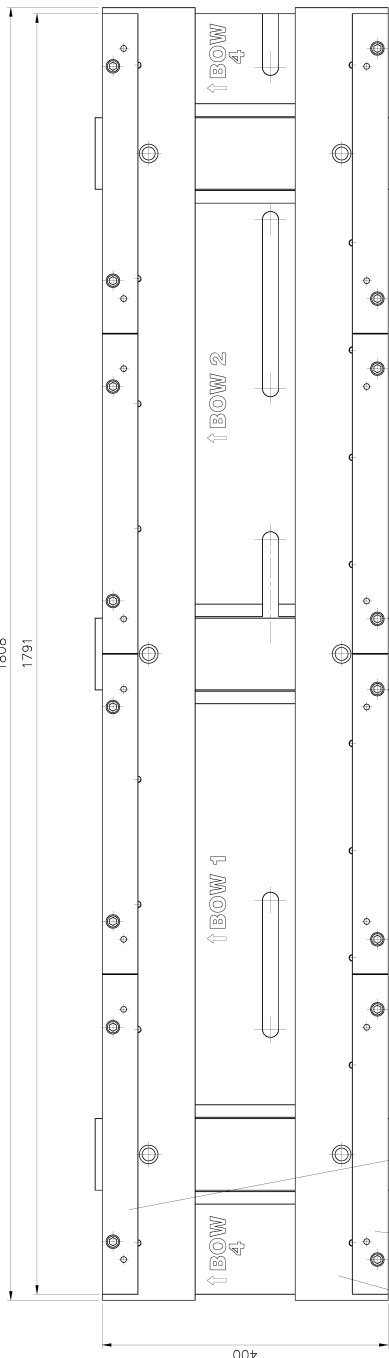
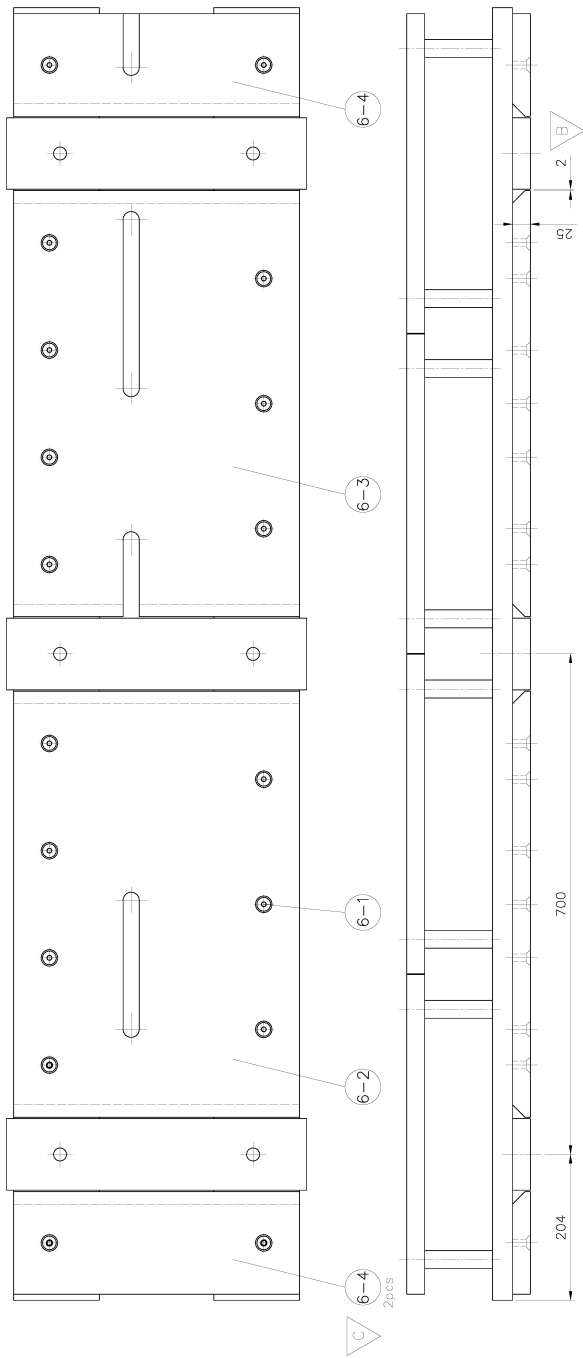
- ▽ B/ Monteringsstamme kontrolleres med alle Baffle platene.
 Kontroller avstand mellom Baffle platene (2mm) og at sveisen har kløring.
- ▽ B/ Mounting frame to be checked with all Baffle plates.
 Verify the gap between the Baffle plates (2mm) and that the weld has clearance.
- ▽ B/ Monteringsstamme kontrolleres med 2 stk RX Testmoduler.
 Kontroller avstand mellom modulene (1mm) og at kleinstykkene gir ca. 0.2mm press.
 RX Testmodul: 599-213993
- ▽ B/ Mounting frame to be checked with 2 pcs of RX Test module.
 Verify the gap between the modules (1mm) and that the clamps have approx. 0.2mm
 RX Test module: 599-213993

- ▽ B/ Note: Behandles forsiktig/ handle with care
- ▽ B/ Put the Baffleplates 6-2, 6-3, 6-4 unmounted into the wooden crate.
 Put the Countersink screws 6-1 into a pocket into wooden crate.
- ▽ B/ Sett baffle platene 6-2, 6-3, 6-4 umontert inn i kasse.
 Sett skruene 6-1 i en pappeske i kasse.
- ▽ B/ All external carrying must be done with wooden crate 356007

Weight: ~340kg

REV/SGN/B	LK	C	HF	D	LK	E	LK
2011.10.28	2013.09.08	2013.10.23	2016.8.23				
UNLESS OTHERWISE STATED TOLERANCE: DIM: ISO 2768-mk THREAD: 6g/6h							
MOUNTING FRAME ASSY							
RX MODULE							
2" SYSTEM							
EM120							

COG Centerpoint of Gravity	
PARTS LIST:	KONGSBERG
SHR SIZE: A2	SHRAD
SHEET 1 OF 1	860-213389
FILE NO:	685-54



Note: All parts must be cleaned and mounted as dwg. shows.
 Stay bolts pos 2 to be locked/ greased with Loctite 242 . Stud torque 165Nm.
 Bolts pos 5 to be mounted without torque.
 Mount all Baffle plates on site.
 Screws pos 6-1 to be locked/ greased with Loctite 242 . Moderate torque.

Note: Alle deler skal være rengjort og sammenskrudd som tegn. viser.
 Stågbolter Pos 2 låses/smøres med Loctite 242 og tiltrekkes med 165Nm.
 Bolter Pos 5 trekkes sturt uten moment.
 Monter alle baffel plater i dørk.
 Skrur Pos 6-1 låses/smøres med Loctite 242 og tiltrekkes med moderat moment.

B Monteringsramme kontrolleres med alle Baffle plattene.
 Kontroller side avstand mellom Baffle plattene (2mm) og at sveisen har klaring.
 B Mounting frame to be checked with all Baffle plates.
 Verify the gap between the Baffle plates (2mm) and that the weld has clearance.
 Monteringsramme kontrolleres med 2 stk RX Testmoduler.
 Kontroller avstand mellom modulene (1mm) og at klemstykke gir ca. 0.2mm press.
 RX Testmodul: 599-213993

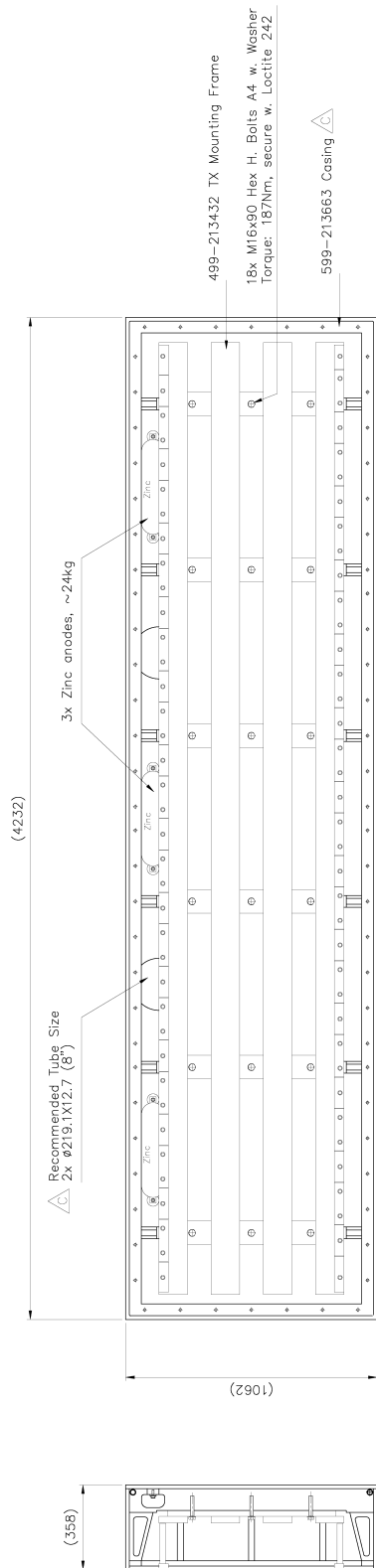
Mounting frame to be checked with 2 pcs of RX Test module.
 Verify the gap between the modules (1mm) and that the clamps have approx. 0.2mm pressure.
 RX Test module: 599-213993
 Note: Benardies forsikring/ handle with care
 Weight: ~150kg

REV/SGN/B	LK C	LK C			
DATE	12.02.29	2013.10.22			
PROJ.					
METHOD					
SCALE	1:5				
DRAWN	99.12.07	EE			
CHECKED	00.01.27	HF			
APPROVED	00.01.28	EE			

B Put the Baffleplates 6-2, 6-3, 6-4 unmounted into the wooden crate.
 Put the Countersink screws 6-1 into a pocket into wooden crate.
 B Sett baffel plattene 6-2, 6-3, 6-4 umontert inn i kasse.
 Sett skruene 6-1 i en poppeske i kasse.
 B All external carrying must be done with wooden crate 356015

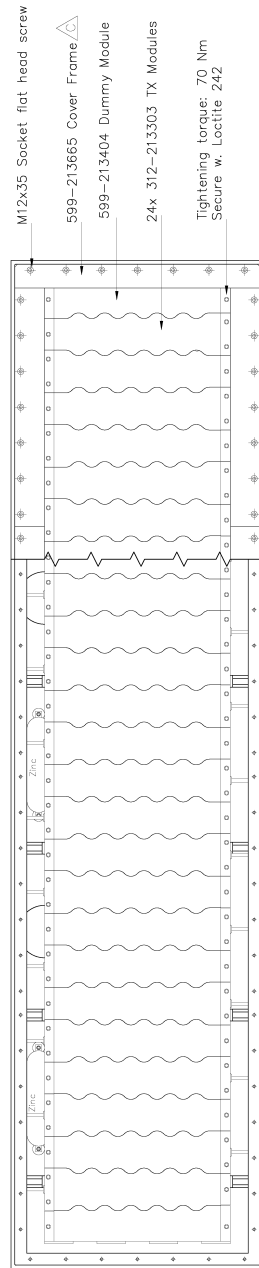
REV/SGN/B	LK C	LK C			
DATE	12.02.29	2013.10.22			
PROJ.					
METHOD					
SCALE	1:5				
DRAWN	99.12.07	EE			
CHECKED	00.01.27	HF			
APPROVED	00.01.28	EE			

B



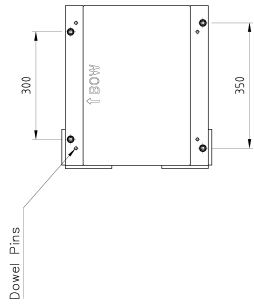
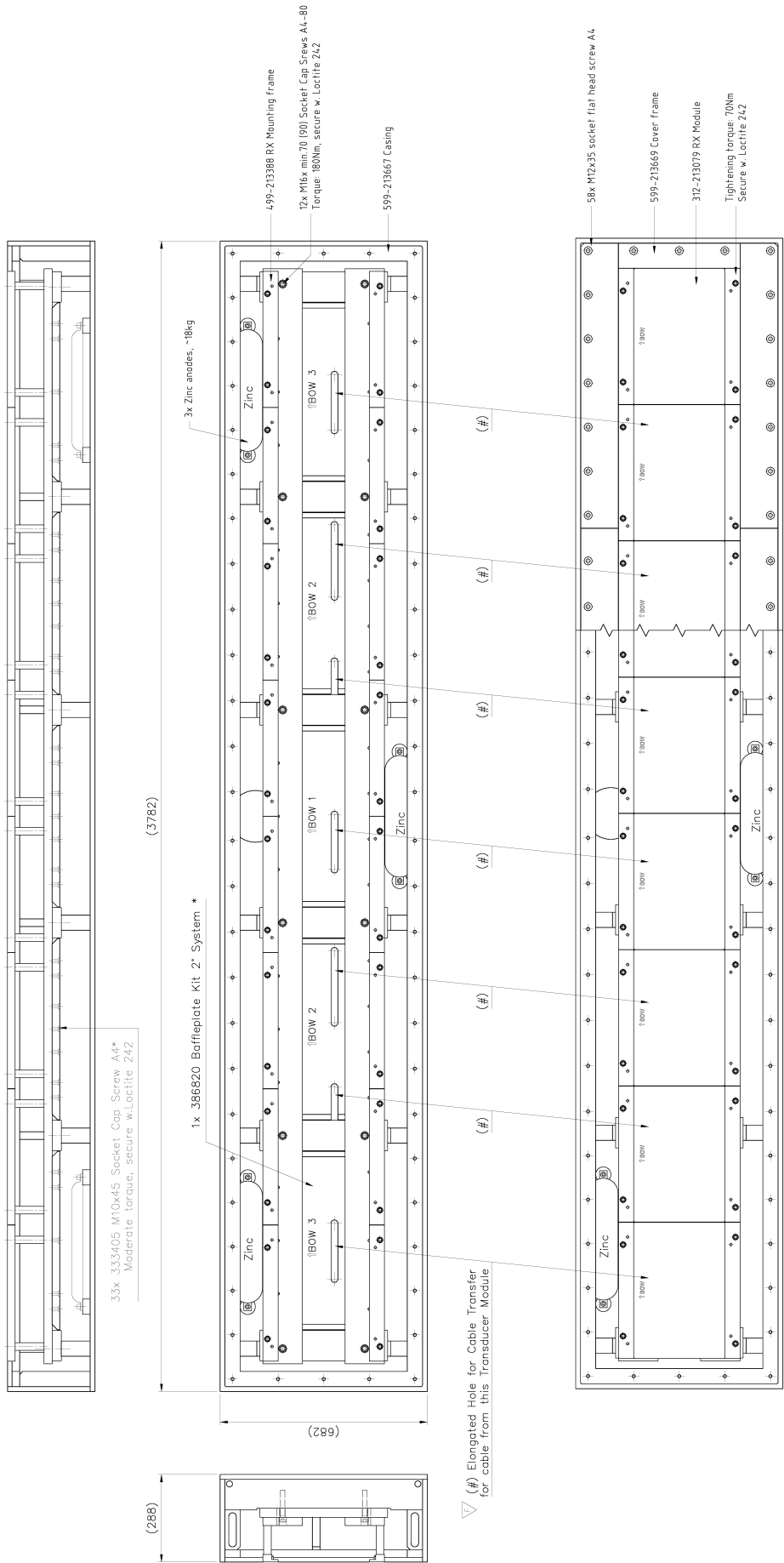
18x M16x90 Hex H. Bolts A4 w. Washer
Torque: 187Nm, secure w. Loctite 242

599-213663 Casing



Weights: TX Mounting Frame = 612.5kg, TX Modules = 1392kg, Casing = 1400kg
Cover Frame = 19kg, Total: ~34.30kg

REV./SIGN	HF	C	LK	DATE	03.11.05	2012.6.26	UNLESS OTHERWISE STATED TOLERANCE: DIM: ISO 2768-mk THREAD: 6g/6h	PARTS LIST: N.A.	SH: SIZE: A2	
PROJ. METHOD	⊙		ARRANGEMENT DRAWING						KONGSBERG SH: HEAD	
SCALE	1:1.15		2' TX ARRY w. CASING						SHEET 1 OF 1	
DRAWN	99.11.04		EE						821-213755	
CHECKED	00.01.27		HF						REV: C	
APPROVED	00.01.28		EE						FILE NO.: 685-72	

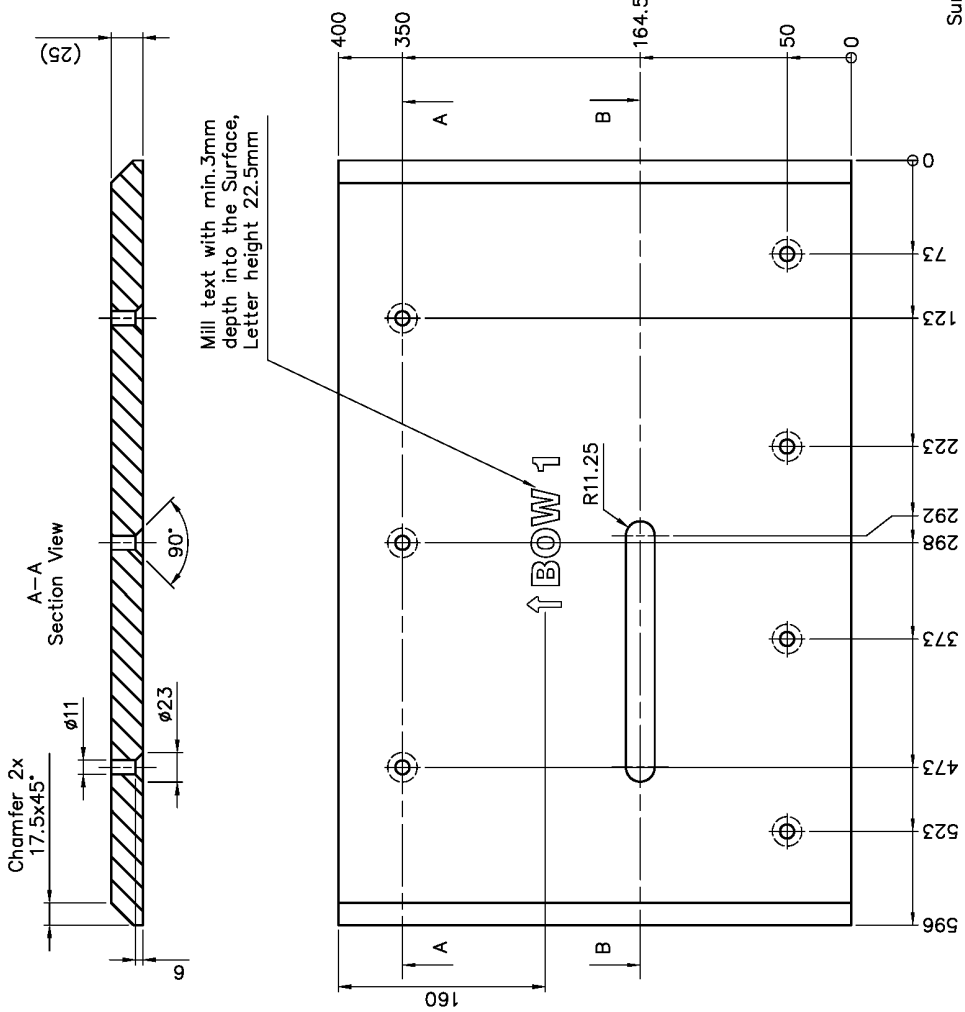


Note: observe the direction of the bow and the difference between the gaps of 6 ray bolts (300/350) when installing the Mounting Frame.

NOTE: *-* These components are part of 499-213388 Mounting Frame
 Weights: RX Mounting Frame = 340kg, RX Modules = 200kg, Casing = 830kg
 Baffle Plates = 90 kg, Cover Frame = 20.3kg, Total = 1400kg

REV	DATE	DESCRIPTION	UNLESS OTHERWISE SPECIFIED, TOLERANCES ARE:	DATE	BY	CHKD	APP'D
F	20131022	Changed from separate Baffleplates to Baffleplate kit	Form: 0.13 / 0.25 / 0.38 mm - Threads G5/B6	Surface: (Ref. 3)	LK	HF	BH
A	19991207	First Issue			ER	HF	ER

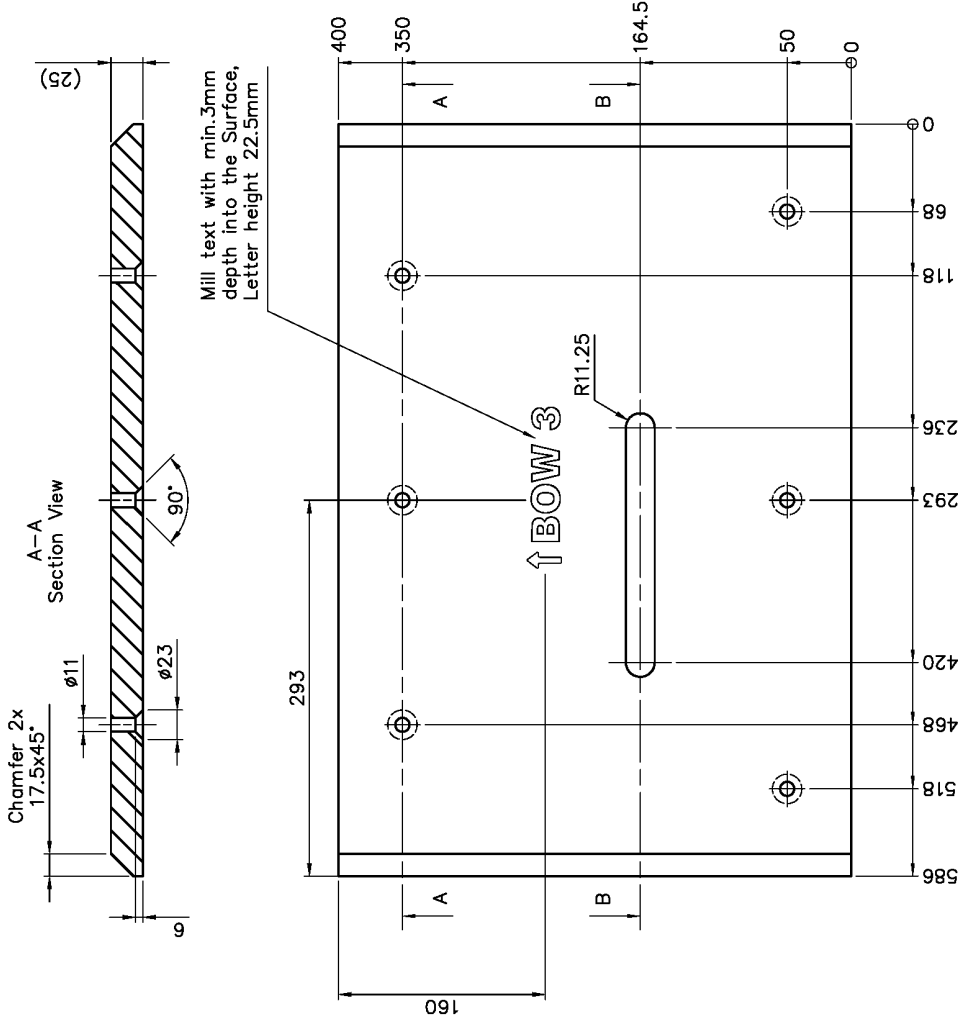
Material:	Surface treatment:	Project name:	Project number:
KONGSBERG		EM124	
Project / Product name:		Drawing type:	
Kongsberg Maritime AS		ARRANGEMENT DRAWING	
Subsea Division		2' RX ARRAY w. CASING	
Horten - Norway		Scale: 1:10	
Revision:		Revision/Version:	
		F	



Tolerances ordinate dimensioning: ±0.25

Surface treatment: 2 coats of Jotun Ploner Primer,color Grey, 50–100 micron
 Note: Before painting, the plate dimensions to be checked with the mounting frame.
 Chamfer all edges with 2.5 x45°.

REV.	A	DATE	2011.10.28	FIRST ISSUE	DESCRIPTION	LK	Desigined by	HF	Checked by	BH	Approved by
Material: Divinycell HCP80, 25mm											
Surface Treatment: -											
Unless Otherwise Stated, Tolerances: DIM: ISO 2768-mK Threads: Gg/6H Surface: Ra6.3											
Title Baffel Plate 1 Mounting Frame											
Sheet 1/1											
Size A3											
Scale 1:4											
Project / Product name EM122											
Project number -											
Drawing type -											
Document ID 365207											
Revision/Version A											
<p>KONGSBERG Kongsberg Maritime AS Subsea Division Horten - Norway</p> <p><small>The reproduction, distribution and utilization of this document as well as the communication of its contents to others without express authorization is prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of grant of a patent, utility model or design. © Kongsberg Maritime</small></p>											

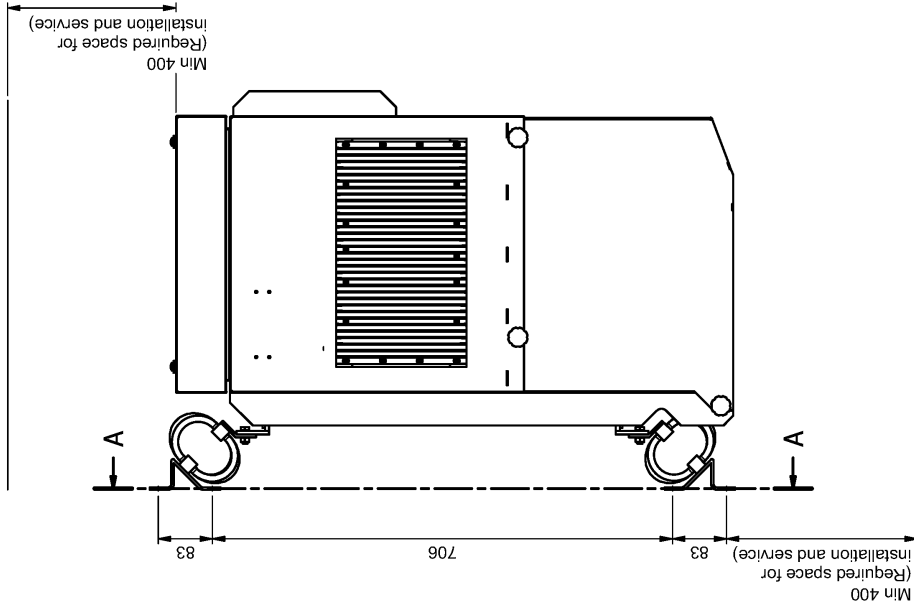
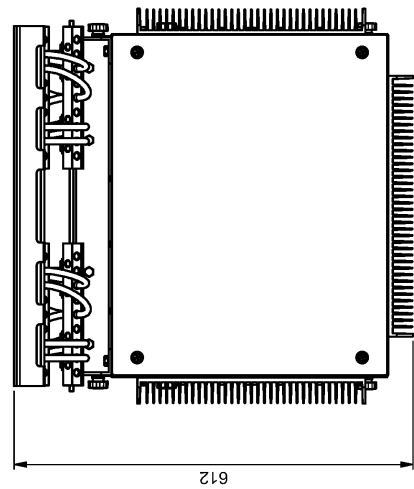
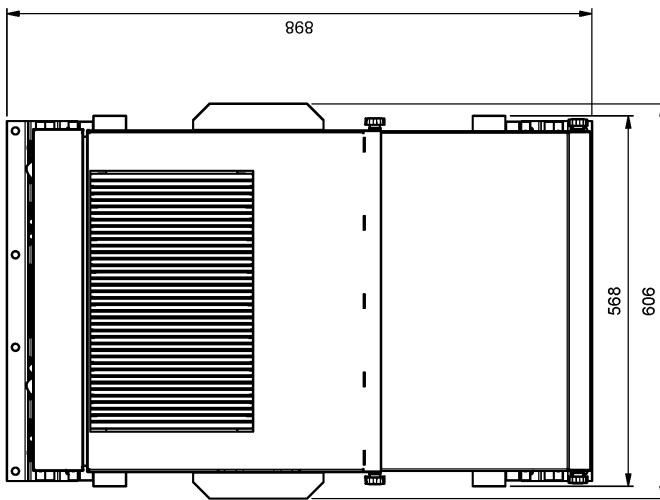
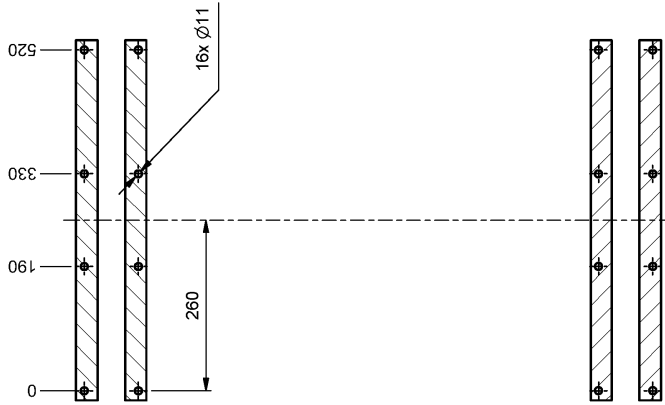


Surface treatment: 2 coats of Jotun Pioner Primer, color Grey, 50–100 micron
 Note: Before painting, the plate dimensions to be checked with the mounting frame.
 Chamfer all edges with 2.5 x45°:

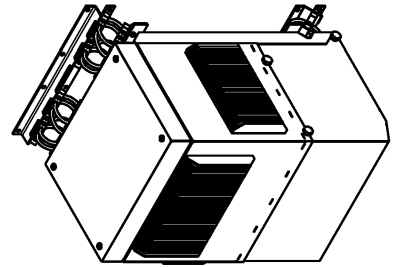
Tolerances ordinate dimensioning: ± 0.25

REV. A	DATE 2011.10.28	FIRST ISSUE	DESCRIPTION	LK	DESIGNED BY	HF	BH	
MATERIAL: Divinycell HCP80, 25mm			UNLESS OTHERWISE STATED, TOLERANCES:	APPROVED BY				
SURFACE TREATMENT: -			DIM: ISO 2768-mK - Threads: Gg/6H	CLASS. CODE				
PROJECT / PRODUCT NAME			TITLE	SHEET				
KONGSBERG			Baffle Plate 3	1/1				
Subsea Division			Mounting Frame	A3				
Horten - Norway				Scale				
Project / Product name			Drawing type	1:4				
EM122			Document ID	Revision/Version				
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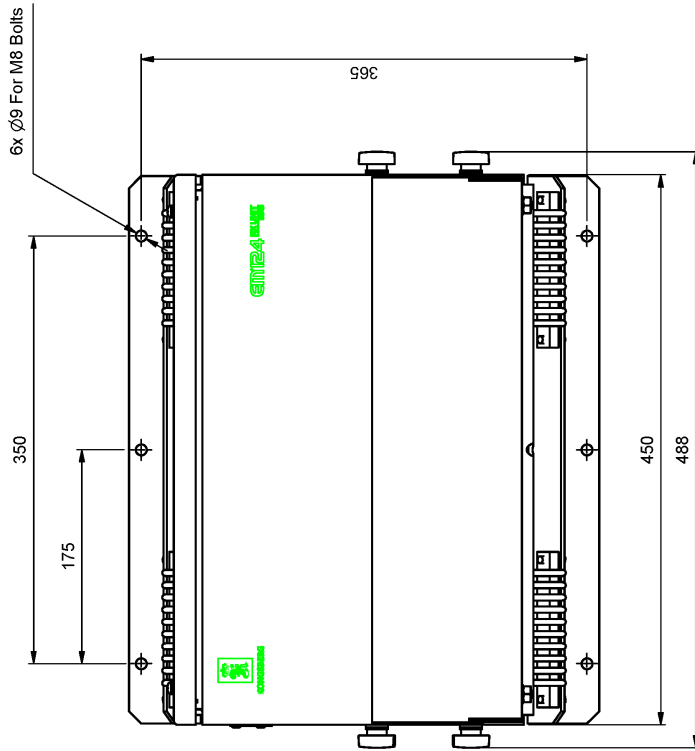
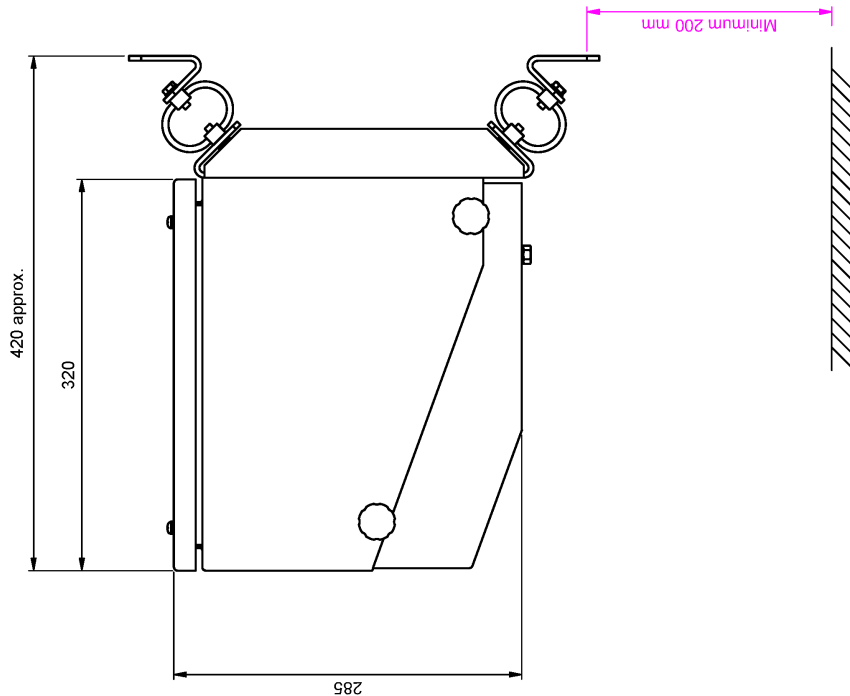
A-A (1:7.5)



Weight:
 1 Degree version ~96kg
 2 Degree version ~80kg
 4 Degree version ~72kg

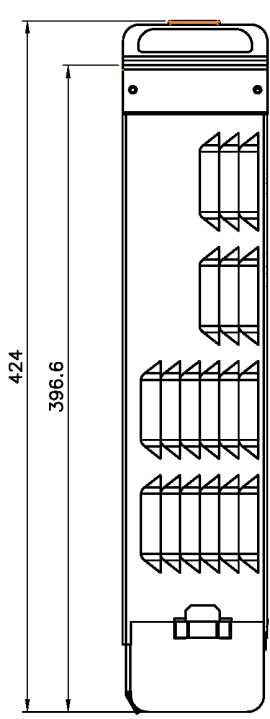


Rev.	Date	Description	Designed by	Checked by	Approved by
A	2018-06-29		eriksi	kn	
Material: -			Tolerances unless otherwise stated: ISO 2768-mK		
Surface treatment: -			Surface: Ra 3.2 µm		
			Threads: 6g/6H		
Project / Product name			Title		
KONGSBERG			OUTLINE DIMENSIONS		
Subsea Division			TX UNIT		
Horten			EM304/124		
Project number / Item ID			Drawing type		
436581			Outline Drawing (100416)		
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			A		

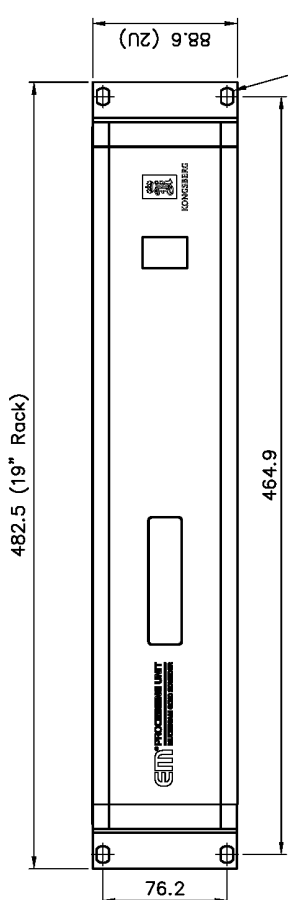


Weight complete unit approx.: 21 kg.

A	2018-01-15	First Issue	erikst	hf	kn
Rev.	Date	Description	Designed by	Checked by	Approved by
Material:		Tolerances unless otherwise stated: ISO 2768-mK			
Surface treatment:		Surface: Ra 3.2 µm			
Project / Product name		Title			
KONGSBERG		Outline Drawing			
Subsea Division		RX Unit			
Horthen		EM 124			
Project number / Item ID		Drawing type			
Underwater Mapping		Outline Drawing (100416)			
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Sheet		1 of 1			
Size		A3			
Scale		1 : 4			
Revision		A			

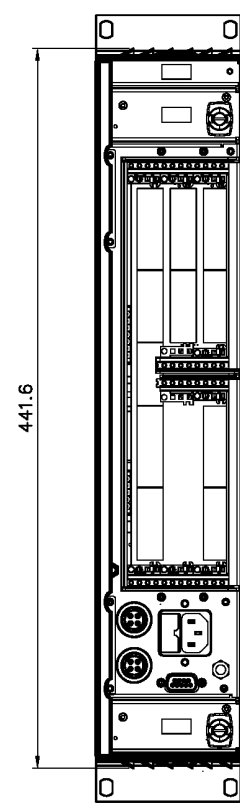


Side View



Front View

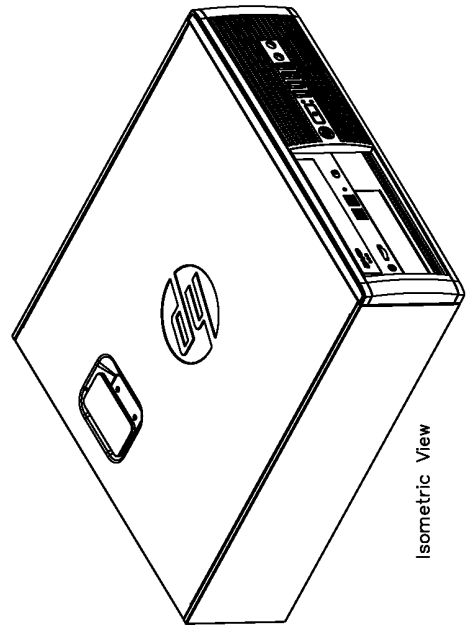
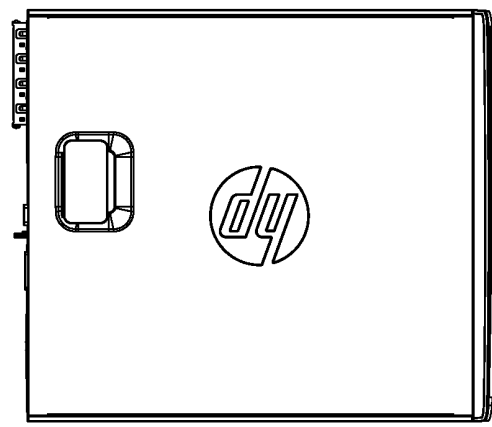
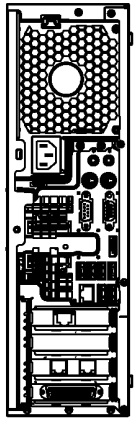
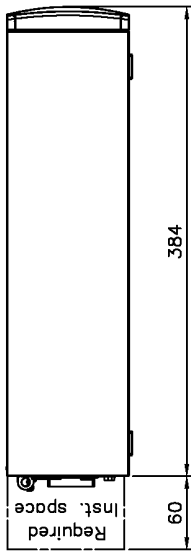
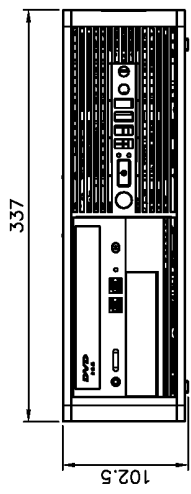
4x Through holes for M6



Rear View


Weight: 10,5kg

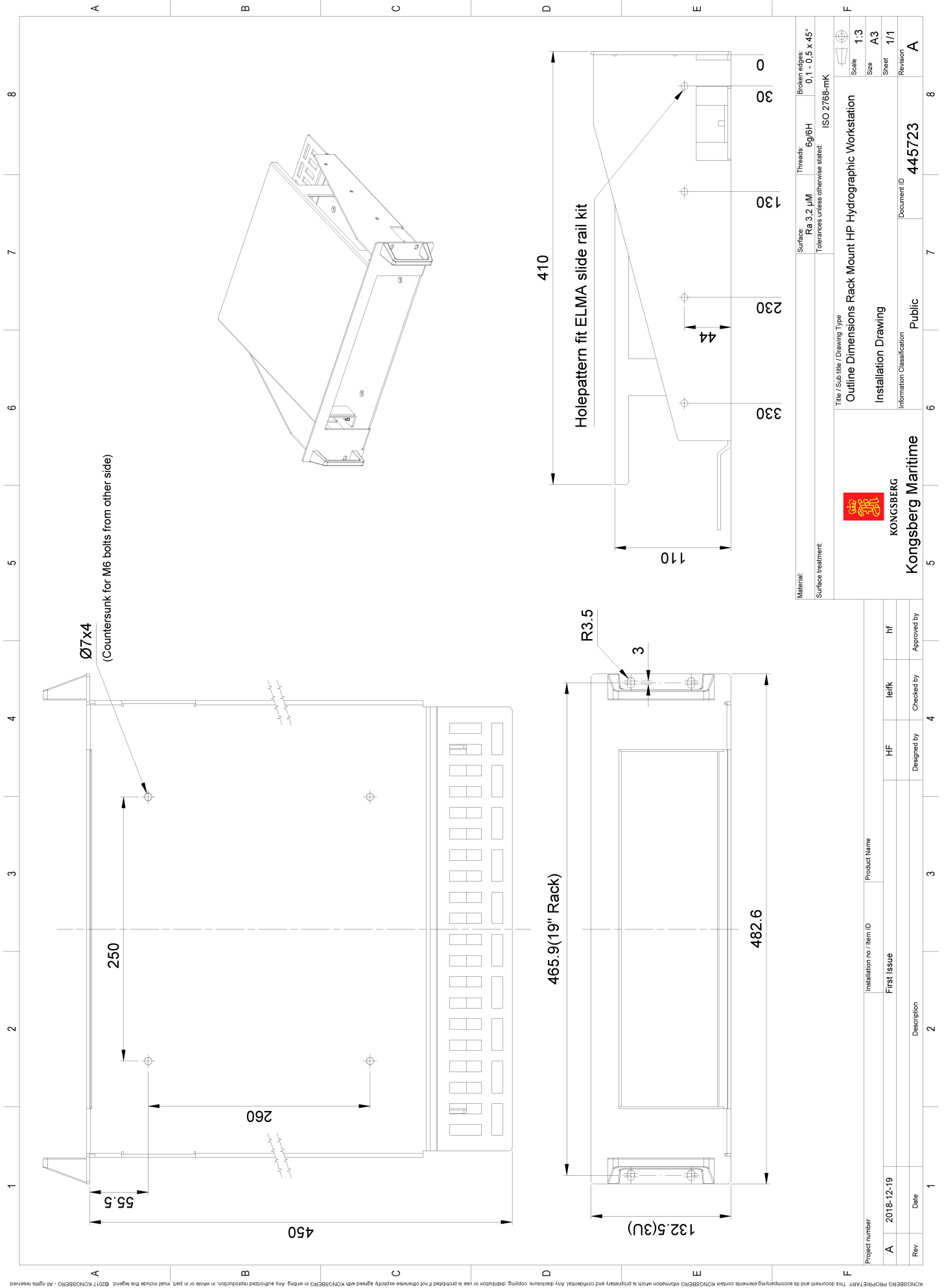
B	2017.06.09	Upd. holepattern acc. to 2U unit spec. Effective from Q3 2017	HF	BH	KJ
REV.	2013.08.05	First Prototype Release	HF		
DATE		DESIGNATION	Designed by	Checked by	Approved by
Surface Treatment: —		Unless Otherwise Stated, Tolerances:	Class. Code		
DIM.: ISO 2768-mK		Threads: G1/8H	Surface: Ra6.3		
Title		Sheet			
Kongsberg Maritime AS		1/1			
Subsea Division		Size			
Horten - Norway		A3			
Project / Product name		Scale			
EMX		1:3			
Project number		Drawing type			
—		—			
Title		Document ID			
Outline Dimensions		385422			
Processing Unit		Revision/Version			
—		B			

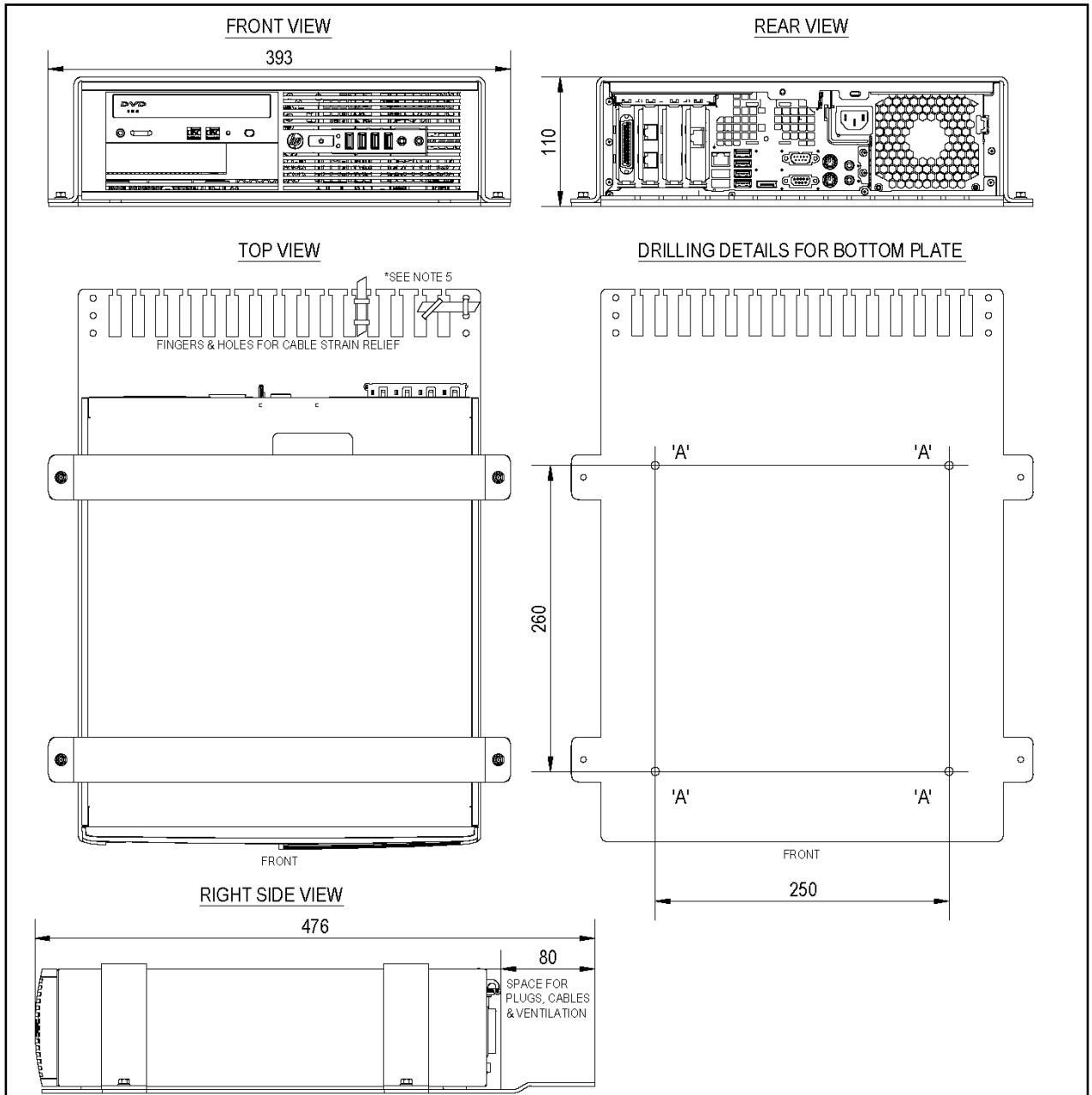


Weight approx. 8Kg

- Reference documentation: 366001
- Outline Desk Mounting: 371591
- Outline Rack Unit: 375288
- Rail Kit Rack Unit: 372140
- Instruction Manual Rack Unit: 372140
- Outline KM1000 Mounting Kit: 365290
- Outline Mariner Mounting Kit: 327993

REV.	DATE	First Issue	DESCRIPTION	HF	LK	TP
A	2012.12.19					
Unless otherwise stated, Tolerances: DIM.: ISO 2768-mK Threads: Gg/Wh Surface: Ra6.3						
Metadit: — Surface Treatment: —			Class Code 100416			
 KONGSBERG			Title Outline Dimensions			
Project / Product name EMX			Sheet 1/1			
Project number —			Size A3			
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Drawing type Outline			Document ID 378828			
Revision/Version A						






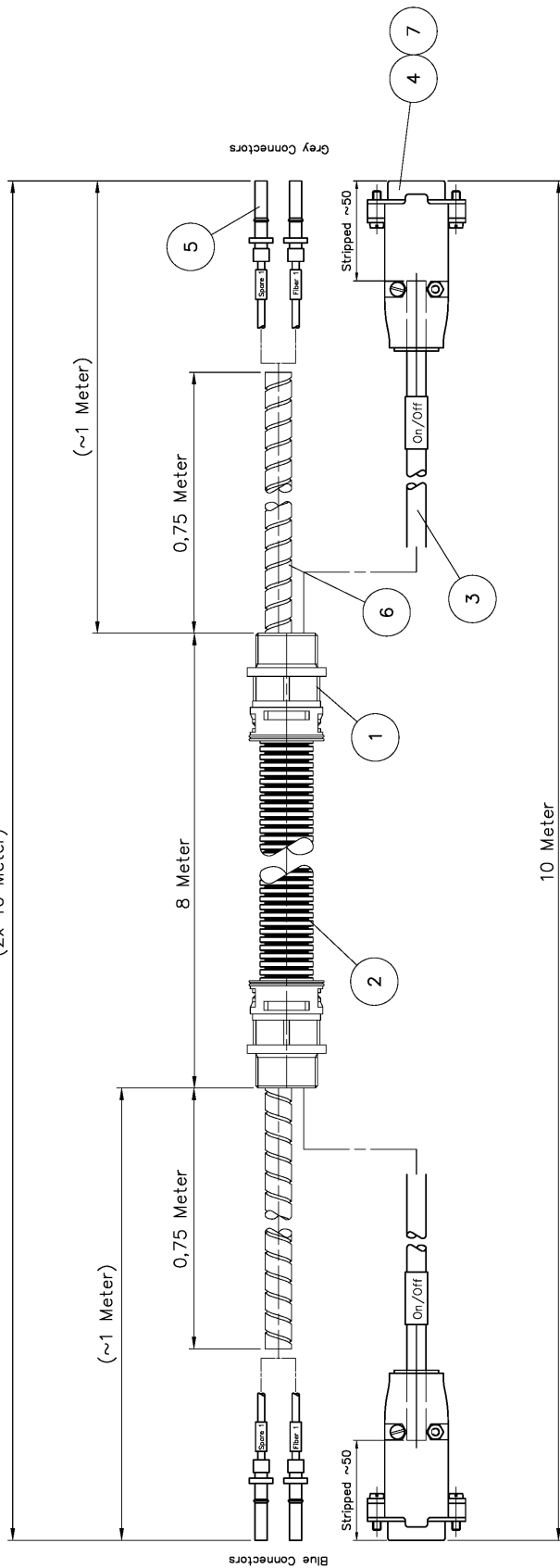
DIM. (WxHxD): 393x110x476 mm
 POWER SUPPLY: 100-240 VAC 50-60 Hz
 POWER CONSUMPTION, MAX: 120 Watt
 WEIGHT WITHOUT MOUNTING KIT: 7,6 kg
 WEIGHT WITH MOUNTING KIT: 8,6 kg

ASSEMBLY NOTES:

- 1) DRILL M6 HOLES IN MOUNTING SURFACE (4 OFF)
- 2) HOLE DETAILS: 'A': M6 CLERANCE
- 3) SECURE BOTTOM PLATE TO SURFACE USING M6 x 20 mm CSK SLT SCREW, WASHER & NUT (4 OFF)
- 4) SECURE THE CLAMPS (2 OFF) TO BOTTOM PLATE USING M5 LOCKING NUT AND WASHER (4 OFF)
- 5) SECURE ALL CABLES TO THE CABLE MANAGEMENT FINGERS AND HOLES USING TWO CABLE TIES PER CABLE
- 6 THE MOUNTING KIT CAN BE USED BOTH FOR HORIZONTAL AND VERTICAL MOUNTING

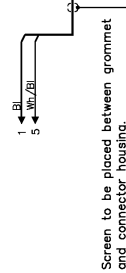
C	22.05.14	CO20712	FT	EB	ES
 Kongsberg Maritime AS Offshore Kongsberg		Title MPxxxx with KM1000 Mounting kit			Sheet 1/1
Project / Product name Basis		Project number -	Drawing type General Arrangement		
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(2x 10 Meter)

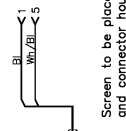


NOTE: TERMINATIONS AND SCREENS ARE INSULATED WITH HEAT-SHRINKABLE TUBES.

9 pin D-Sub, MALE



9 pin D-Sub, MALE

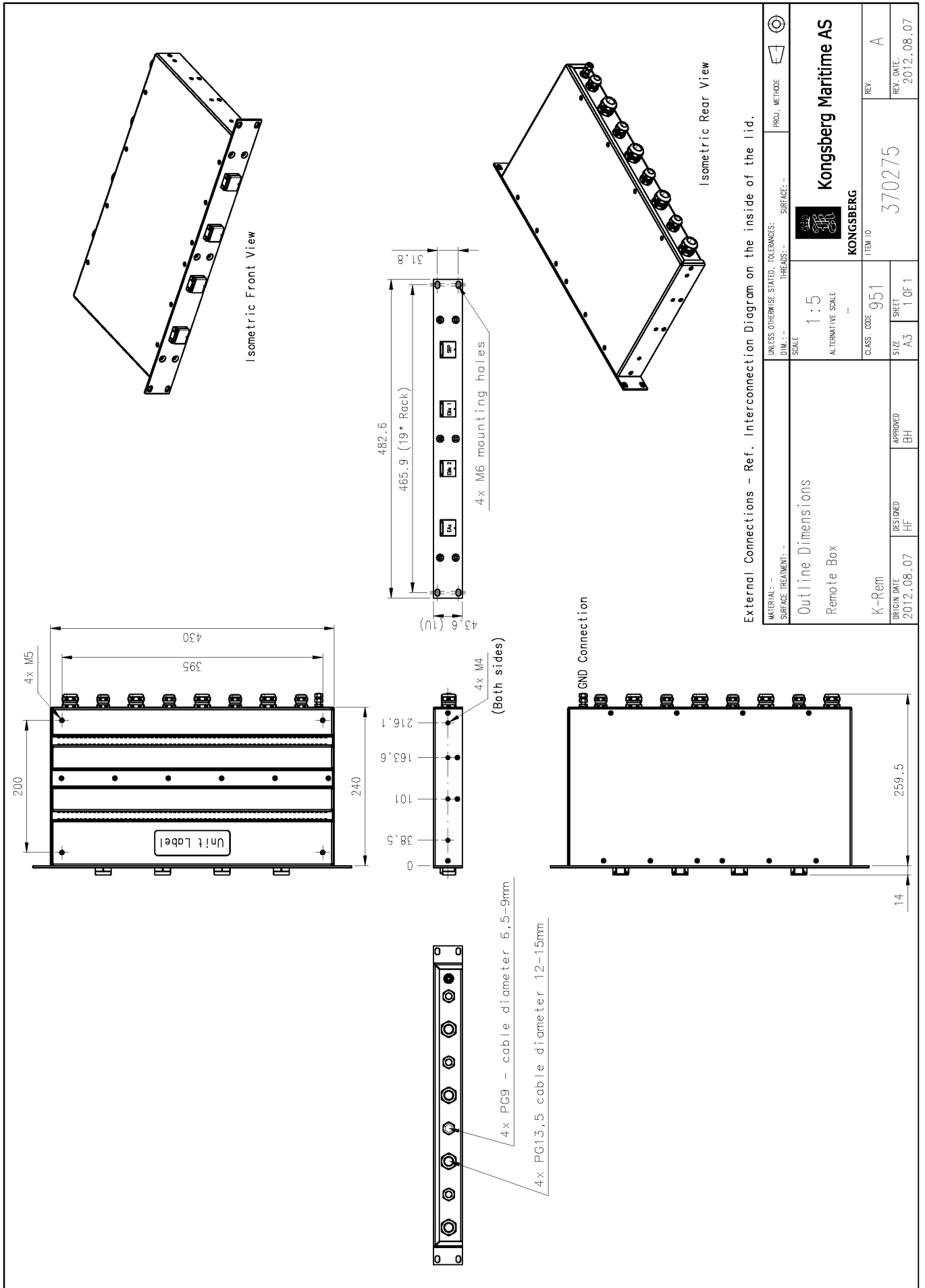


All cables to be labeled as shown with printable heatshrink-tubing.

All fiber connectors ends to be protected with suitable heatshrink-tubing. This is for extra protection, just a precaution while installing on sight, and must be easy to remove when needed.

Check:
Wire identification, check pin no. vs pin no.

REV.	A	2016.01.27	First Issue	DESCRIPTION	HF	ES	KEN
Material:	Unless Otherwise Stated, Tolerances: DIM.: ISO 2768-mK - Threads: Gg/6H - Surfaces: Ra6.3						
Surface Treatment:	-						
<p>Kongsberg Maritime AS Subsea Division Horten - Norway</p>				<p>On/Off and Fiber Cable Kit TX-RX / RX-RX</p>			
Project / Product name	EM712		Project number	-			
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<p>Revision / Version</p>				<p>A</p>			



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