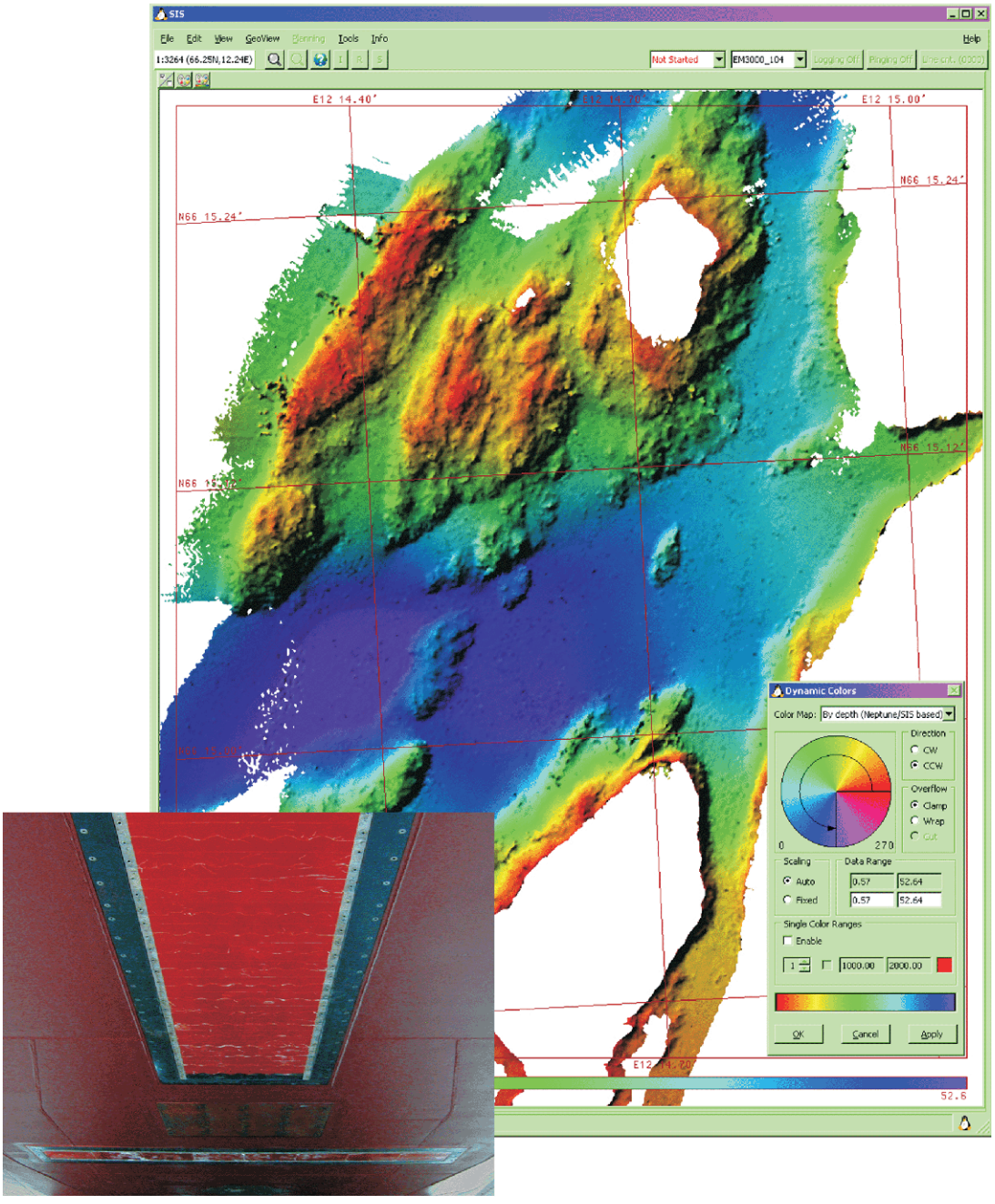
Installation Manual

KONGSBERG

EM 122
Multibeam echo sounder



KONGSBERG

EM 122

Installation Manual

This manual provides you with the basic information required to install the EM 122 Multibeam echo sounder system.

For more detailed information about the practical use of the product, refer to the *EM 122 Multibeam echo sounder Operator manual.*

317669/B

Document history

Document number: 317669		
Rev. A	May 2008	First version.
Rev. B	June 2013	General update, baffle plates and 0.5 deg. TX added.

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.

Warning

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

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

Support

If you require maintenance on your equipment, contact Kongsberg Maritime AS using the following address:km.hydrographic.support@kongsberg.com. If you need other information about this product, or any other Kongsberg Maritime AS products, visit http://www.km.kongsberg.com.

Table of contents

About this manual

The purpose of this manual

The purpose of this installation manual is to provide the descriptions and procedures required to install the Kongsberg EM 122 Multibeam echo sounder system units, and to perform the necessary cabling between the individual system units, and between the system and peripheral systems, sensors and devices.

Note

Detailed vessel specific mechanical drawings for the installation must be provided by the customer, or any shipyard contracted to perform the installation. Kongsberg Maritime AS may, on special order, supply these drawings. Drawings must be approved by the appropriate vessel certification authority prior to installation of the system and is outside Kongsberg Maritime responsibility.

The installation instructions given in this document must be adhered to. Failure to do so may render the guarantee void.

No special tools are generally required to perform installation, removal and replacement of modules and parts. When special tools are required, these are listed in the installation procedure.

EM 122

The purpose of this chapter is to provide an overall description of the EM 122 Multibeam echo sounder system and its main features.

Topics

Related topics

Brief system description

The EM 122 Multibeam echo sounder consists of these main units:

- Transducer Arrays
- Transceiver Unit(s)
- Preamplifier Unit
- TX Junction Box(es)
- Operator Station
- Remote Control

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

Installation of sensors are not treated in this manual.

Transducer arrays

Two transducer arrays must be mounted under the vessel's hull; one for transmission and one for reception.

The system may be delivered in several different versions identified by the “Transmission x Reception” beamwidth. The standard types are:

- 0.5° x 1° system: 96 TX modules and 16 RX modules
- 1° x 1° system: 48 TX modules and 16 RX modules
- 1° x 2° system: 48 TX modules and 8 RX modules
- 2° x 2° system: 24 TX modules and 8 RX modules
- 2° x 4° system: 24 TX modules and 4 RX modules

The various versions involve different numbers of Transmitter and Receiver boards in the Transceiver Unit, and different number of transducer modules in the TX and RX transducer arrays.

Due to Material change for the RX transducer modules, the RX frames are additionally equipped with baffle plates. The baffle plates are used to deaden noise attenuation on bottom side of the RX mounting frames.

Transceiver Unit – TRU

The EM 122 **Transceiver Unit** is a wall-mounted steel cabinet with integrated shock and vibration absorbers. It holds the circuit boards for transmission, reception and processing. It is normally located in a “sonar room” close to the transducer arrays. An Ethernet cable connects the Transceiver Unit to the Operator Station.

The cables from the transducer array's are connected to the Transceiver Unit via the TX Junction Box(es) and the Preamplifier Unit.

If the system has Sub Bottom Profiler 300, the RX cables are connected via Preamplifier Unit and up to TRU

Transceiver Unit on page 43

Preamplifier Unit

The EM 122 Preamplifier Unit is a wall-mounted steel cabinet with integrated shock and vibration absorbers. This unit amplifies and band pass filters the Receive signals from the RX transducer array. It is installed near the Transceiver unit in the “sonar room”.

The Preamplifier Unit is only used together with the Sub Bottom Profiler 300.

TX Junction Box(es)

TX Junction Box(es) are interface routing box(es) to facilitate the transducer cable installation.

Each box can handle 24 transducer modules.

Operator Station

The **Operator Station** will consist of a desktop computer, an LCD monitor, a mouse and a keyboard. Additional peripherals may be included. An optional kit for mounting the computer in a 19” rack is available.

Figure 1 System diagram

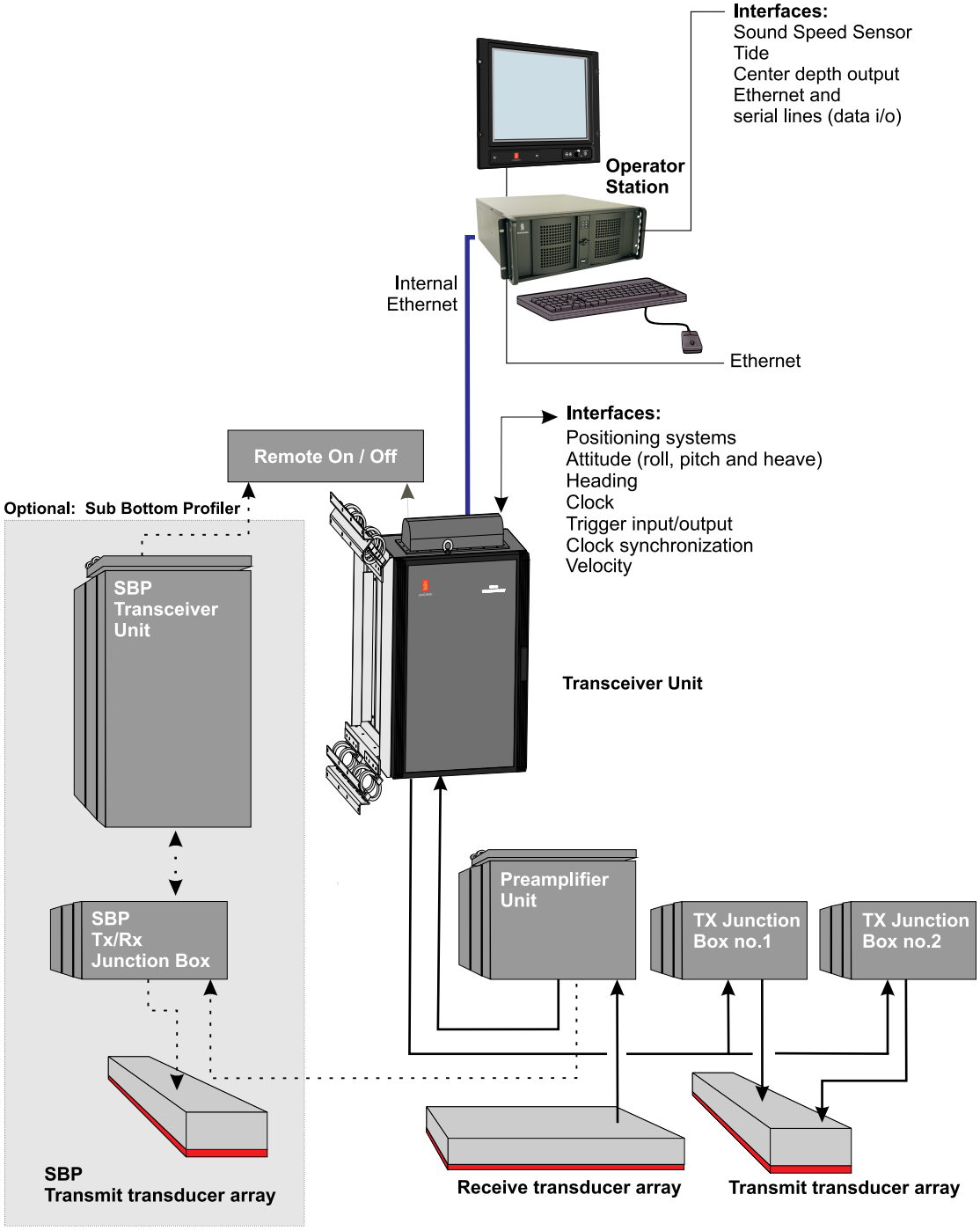


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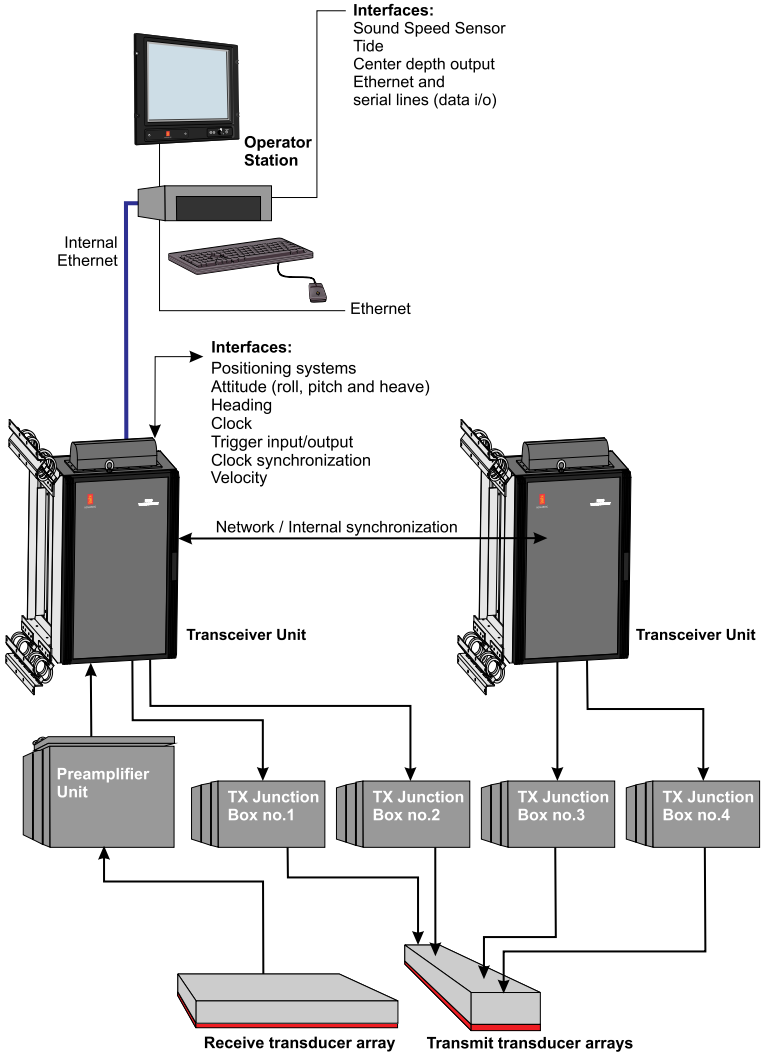
Figure 2 System diagram 0.5 degree TX



Scope of supply

Units

The EM 122 Multibeam echo sounder delivery comprises the following items

- EM 122 Operator Station
  - HWS work station with display, mouse, keyboard, hard disk and DVD recorder
- EM 122 Transceiver Unit
- EM 122 TX and RX Transducer Arrays
- TX Junction Box(es)
  - 0.5 degree – 4 Junction boxes
  - 1 degree – 2 Junction boxes
  - 2 degrees – 1 Junction box
- Preamplifier Unit (optional)
- Sub Bottom Profiler 300 (optional)
- Cabling
  - Transducer modules
  - Ethernet cable
  - Cabling between Transceiver Unit 1 and Transceiver Unit 2
  - Cabling between the Transceiver Unit and the Operator Station
  - Cabling between the Transceiver Unit and the TX Junction Box(es)
  - Cabling between the Transceiver Unit and the Preamplifier Unit (optional)
  - Cabling between the Preamplifier Unit and SBP 300 (optional)
  - Power cables (115 and/or 230Vac)

Services

Kongsberg Maritime AS may assist with the required engineering service for the installation. These services may include:

- Recommending the best location of the transducer arrays
- Assistance during the installation
- Testing
- Training

Assistance from Kongsberg Maritime AS must be ordered separately, and are charged according to the contract.

Supply conditions

Equipment responsibility

Upon receipt of the equipment the system owner or installation shipyard automatically becomes fully responsible for the equipment, unless otherwise stated in the contract. This responsibility covers the storage period before installation, the actual installation, commissioning, and the period between the completion of the commissioning and the acceptance of the equipment by the end user (normally the owner of the vessel or platform into which the equipment is to be installed).

Project management

Project manager

Kongsberg Maritime AS will normally appoint a dedicated project manager for the delivery project. The manager will follow up the installation and delivery, and will be the installation shipyard's and end user's point of contact.

Installation performed by Kongsberg Maritime

Kongsberg Maritime AS will assist during the installation if specified in the contract or requested by the installation shipyard or customer. Before any installation work by Kongsberg Maritime AS can begin, all cables (at least those which are in any way connected with the system) must be run and connected to their respective terminations. These cables together with the transducer installation will then be checked by the Kongsberg Maritime AS engineers before they are used.

Depending upon the availability of electrical power either from the generators on board or from ashore, the equipment related to the system, and the various parts of the system will be tested during the Setting to Work (STW) period. This requires that interfaces to equipment delivered by other subcontractors are ready for integration testing.

Delays may occur if any of the equipment related to the system is not available for Kongsberg Maritime AS for testing. During sea trials, the vessel must be at Kongsberg Maritime's disposal when required, even though we cannot be held responsible for expenses relating to the running costs of the vessel.

After completion of the commissioning, the equipment should be officially handed over to the end user and the appropriate documents signed in accordance with the contract. All defects or deviations from the contract must be specified in detail in these documents. It should be noted that if such defects or deviations are not specified, they cannot be used by any of the parties concerned as valid reason for not signing the documents.

Installation, supervision and commissioning

Electrical and mechanical installation

The installation shipyard is normally responsible for the installation of the entire system. In addition, the shipyard is responsible for providing and connecting all cables other than special cables supplied with the equipment. The actual installation and cable laying must comply with the vessel's classification rules and the recommendations given in this manual.

Base frames may be required for some units. If so, these must be manufactured in accordance with the drawings provided in the applicable sections in this manual.

During the installation period, the equipment must be covered in such a way that it is protected from dust, paint spray/splashes and welding/cutting sparks. Precautions must be taken to ensure that no part of the equipment is used as a work platform, or for any other purpose for which it was not designed.

Note

Any damage incurred during the installation period, even with a Kongsberg Maritime AS representative present, is the installation shipyard's responsibility unless it can be proven that the damage was due to production or material defects in the equipment delivered by Kongsberg Maritime AS, or irresponsibility by Kongsberg Maritime AS personnel.

Pre-commissioning and acceptance tests

Pre-commissioning and acceptance tests are conducted by Kongsberg Maritime AS personnel.

Installation tests

The Kongsberg Maritime installation period (after shipyard installation) is normally divided into three consecutive phases

- The initial start-up and dock-side testing period. This period is normally known as Setting-to-Work (STW).
- Dock-side commissioning under operational conditions. This commissioning period is normally ended with a Harbour Acceptance Test (HAT).
- Sea Acceptance Test (SAT) with final commissioning under operational conditions at sea.

The extent of the tests is normally defined in the contract.

If required during a contractual test period, the shipyard must provide assistance necessary for the rapid and efficient completion of the work even when the work is to be performed outside normal working hours. This requirement includes assistance from subcontractors when applicable. Excessive waiting time resulting from delays caused by the shipyard will be charged to the shipyard.

HAT and SAT are performed according to Kongsberg Maritime test procedures

Installation requirements

Power supply

The supply voltage to the equipment is to be kept within the specifications given in the chapter *Power requirements* on page 61.

Kongsberg Maritime strongly recommends that the EM 122 Operator Station is powered through an Uninterruptedly Power Supply (UPS). The UPS must be large enough to allow minimum 10 minutes operation. The system can then be switched off in a controlled manner in case of power failures.

Environmental requirements

Vibrations

The EM 122 Transceiver Unit and Preamplifier Unit are fitted with shock and vibration damping mounts.

If the vibration velocity amplitude at the base of the installed equipment is expected to exceed 1g in the range 5–50 Hz, constantly during operational life, special precautions are to be taken.

Consult the applicable manufacturer's documentation for shock and vibration damping of the EM 122 Operator Station and peripherals.

For more information about temperature and environment, see *Environmental and EMC specifications* on page 62

Noise sources

The vessel's hull, rudder(s) and propeller(s) should be thoroughly inspected in dry dock prior to installation. Roughness below the water-line, deformities in the shell plating and protruding obstacles can create acoustical noise. These sources of turbulence must be smoothed or removed as best as possible. It is especially important that the propeller(s) is not pitted or damaged.

Dry docking

The Transducer installation must be done when the vessel is in dry dock. Make sure there is sufficient working space under the hull for this installation work.

Note

The location of the gondola and/or protection blister must be noted on the vessel's docking plan for future reference.

Wiring

All cables between the bridge, the various operation- and equipment rooms, must be supported and protected along their entire length using conduits or cable trays. Note that the cables must not be installed in the vicinity of high-power supplies and cables, antenna cables or other possible sources of interference.

Warranty

The warranty on the scope of supply is 24 months from the date when the equipment is sent from the factory. Warranty does not cover damage or defects coming from improper storing of the equipment (i.e. cable damage by temperature oscillation, rusty components, physical damage etc.)

Transducer arrays

This chapter describes the installation of the EM 122 Transmit (TX) and Receive (RX) Transducer Arrays.

Drawings showing the installation principles and the physical dimensions are included in the text. Other drawings are included in the *Drawing File*.

Topics

Installation principles

Basic description

The EM 122 uses separate transducer arrays for transmitting and receiving sound pulses. Both transducer arrays comprise several modules which are assembled in mounting frames. These are normally fixed in a customized structure on the hull of the vessel. Note that the transmitter and receiver modules are of different types.

The two transducer arrays are normally mounted as “T” or “L”-configurations, or a similar variant under the vessel’s hull (Mills Cross configuration).

The transmit transducer array should be approximately aligned parallel to the vessel's keel. The receiver transducer array should be approximately aligned 90º on the keel. Both transducers should be horizontal, approximately on a plane on the keel. There is no need for the arrays to have the exact same heading, roll and pitch.

For best performance at very shallow depths, keep the alongship distance between RX and TX array as small as possible.

Installation philosophy

The EM 122 system is supplied as a basic echo sounder with two relatively large transducers. While the electronic units are installed using normal tools, the transducer arrays must be located and installed depending on the vessel's design. A number of different factors related to the ship's hull must be taken into consideration during the installation planning.

The basic installation structures are:

- Gondola
- Blister
- Flush-mounted integrated into the hull
- Externally mounted with fairing(s)

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 can assist with the required engineering.

Locating the transducer array

The location of the system's transducer is vital for the operational performance and there are some important guidelines which are generally applicable.

The boundary water layer

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

When a vessel moves through the sea, the friction between the hull and the water creates a boundary layer. The thickness of the boundary layer depends upon the vessel speed and the roughness of its hull. Any objects protruding from the hull, and any dents in the hull, will disturb the flow and increase the thickness of the boundary layer. The flow in this boundary layer may be laminar or turbulent. A laminar flow is a nicely ordered, parallel movement of the water. A turbulent flow has a disorderly pattern, full of eddies. The boundary layer increases in thickness when the flow goes from laminar to turbulent.

Furthermore, air bubbles in the sea water are pushed down below the hull and mixed into the boundary layer. The boundary layer is thin underneath the forward part of the vessel, and increases in thickness as it moves aftwards. If the sides of the hull are steep, some of the air bubbles in the boundary layer may escape to the sea surface along the vessel sides. It is our experience that a wide and flat bottom, with a rising angle less than about 13 degrees athwarthship, is prone to cause air problems for a transducer.

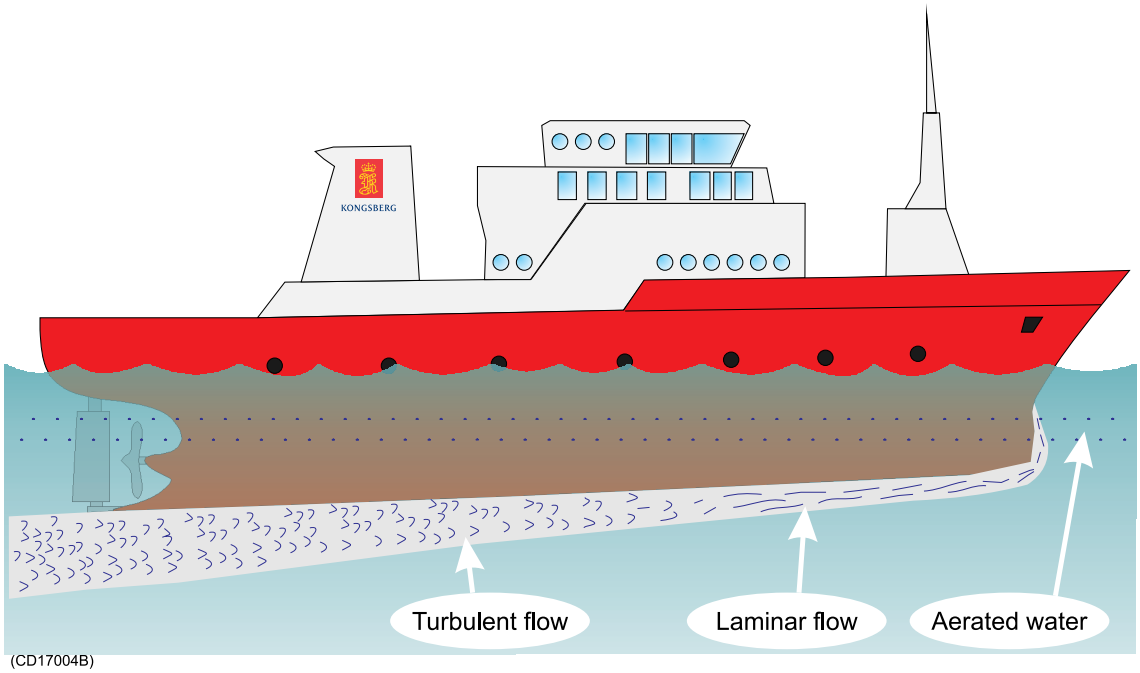
Sketch of boundary layer underneath the vessel on page 21 shows in principle the boundary layer of a vessel moving through the water.

The conclusion is that the transducer array should be mounted as deep as possible, and in the forward part of the hull.

Propeller noise

The propulsion propeller is the dominant noise source on most vessel types. The noise is transmitted through the sea water, and may in extreme cases reduce the maximum range capability of the EM 122.

Figure 3 Sketch of boundary layer underneath the vessel



The transducer arrays should therefore be placed far away from the propeller, which means on the forward part of the hull. Positions outside the direct line of sight from the propeller are favourable.

When a bow thruster operates, the noise and cavitation bubbles from its propellers may make an echo sounder useless. Even when the bow thruster is not in operation, its tunnel creates turbulence.

The tunnel may also drag air under the water, which escapes and make noise.

The transducer array should be placed with large distance from the bow thruster.

Noise from protruding objects on the hull

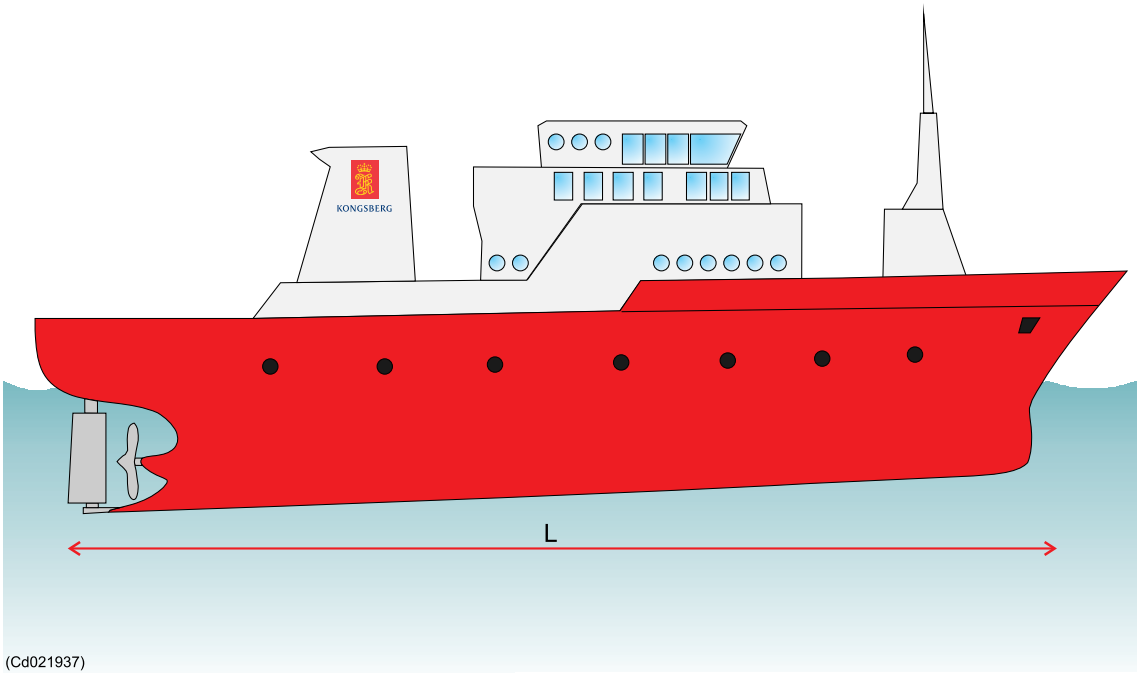
Objects protruding from the hull, such as zinc anodes, sonar transducers or even the vessel's keel, generate turbulence and flow noise. Also holes and pipe outlets are noise sources. They may act as resonant cavities amplifying the flow noise at certain frequencies.

Thus the transducer array should not be located in the vicinity of such objects, and especially not close behind them.

Summary

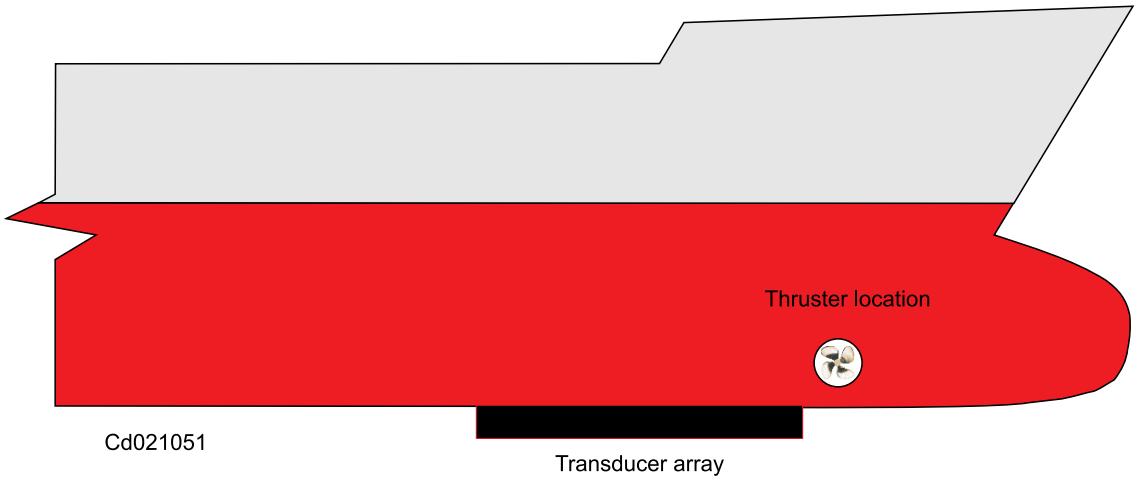
Some of the above guidelines may be conflicting, and each case has to be treated individually in order to find the best compromise.

Figure 4 Recommended location of the transducer array on the hull



The possibility of getting air bubbles in front of the transducer array is the most important factor.

Figure 5 Transducer array located on a bulbous bow



If a nominal horizontal mounting of the transducer array is desired, the transducers can be mounted parallel to the keel. Most ships have a positive design pitch of 0.5 to 2°. Backward tilt is not recommended, it may limit the operational weather window.

The recommended transducer array location is in the fore part of the hull, and normally follow the keel line with respect to tilt.

Installation steps

The following steps must be taken to install the EM 122 transducer arrays

1 Determine the physical location of the transducer arrays under the vessel's hull.

- This is briefly explained in the previous chapter.

Note

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

2 Design the transducer installation method.

- Several methods may be used: blister, gondola, flush mounting, external mounting with fairing(s). The method must be chosen according to the vessel's hull design.
- On an ice capable vessel or an icebreaker, the transducers will normally be incorporated into the hull. The transducers must be protected with ice windows.

EM 122 Gondola (example) on page 24.

EM 122 blister and steel pipe arrangements (example) on page 25.

3 Prepare the transducer array installation arrangement.

- The installation arrangement must be capable of accepting the two transducer frames.

4 Verify the alignment of the mounting frame foundation.

5 Install the steel conduit(s) that will take the transducer cables up inside the ship to the TRU.

Steel conduits on page 26

6 Mount the transducer frames.

Align the frames.

Mounting frames on page 28

7 Mount the transducer modules into the frames.

Transducer modules on page 32

8 Lay the transducer cables from the transducer modules to the steel conduits.

Each cable is marked in both ends with the module's serial no. and the cable no.

9 Pull the cables up through the steel conduits.

10 Seal the steel conduits on top. This is done by the shipyard. The transducer cables are designed to lay in water and the area around the transducers and the steel pipes shall be water filled.

Figure 6 EM 122 Gondola (example)

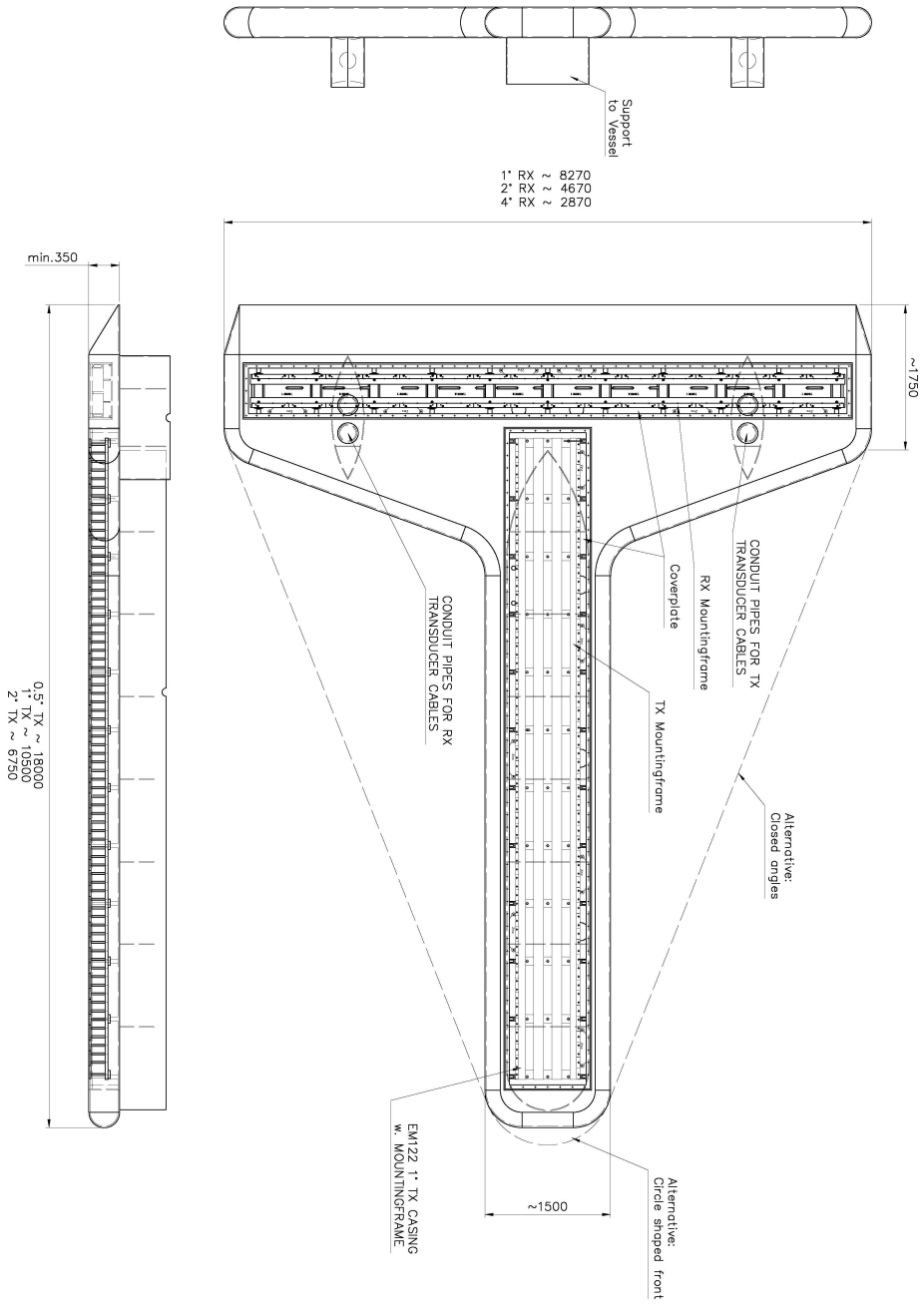


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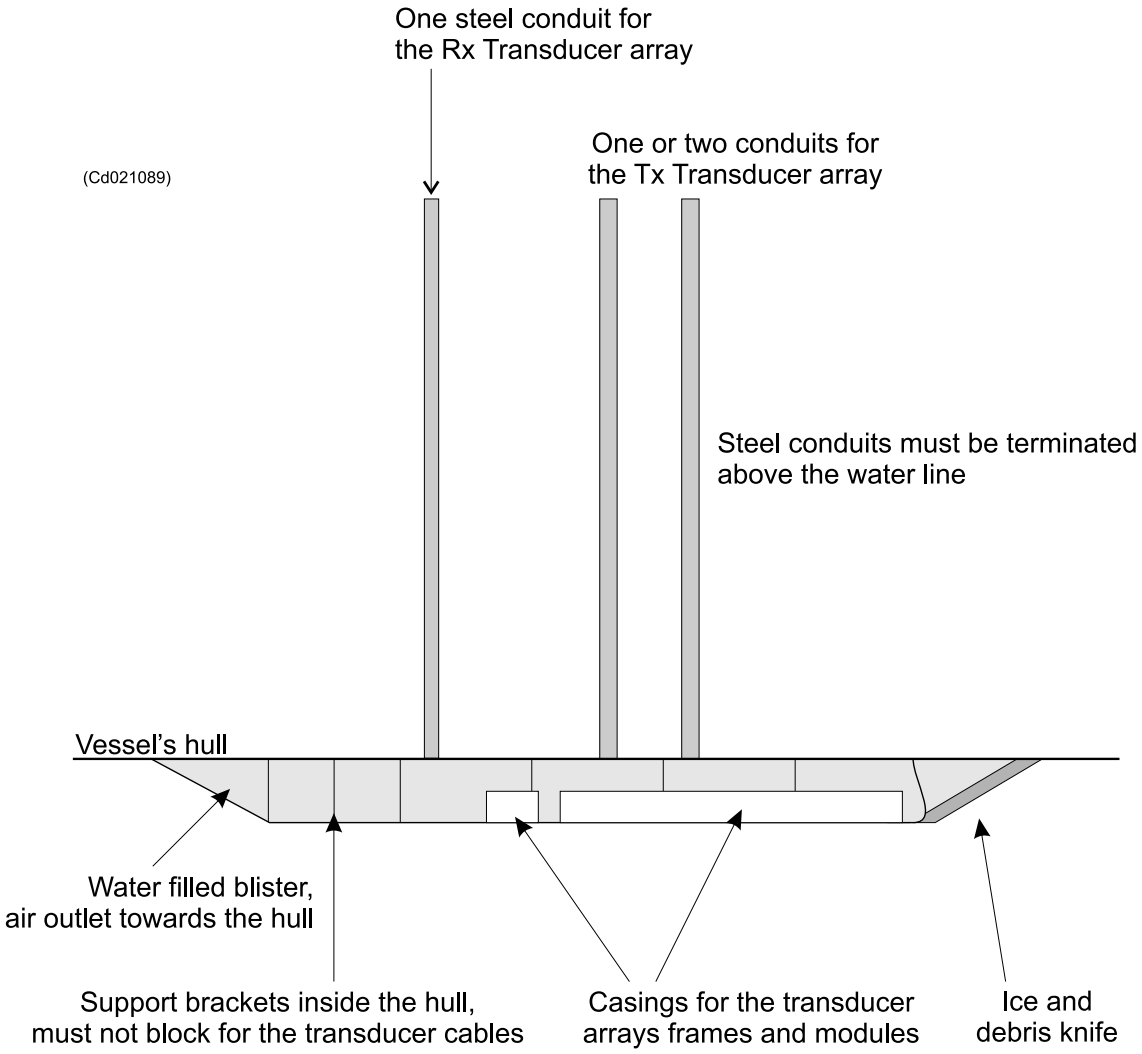
Figure 7 EM 122 blister and steel pipe arrangements (example)



Steel conduits

The transducer cables connect through the vessel's hull using steel conduits 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 steel conduits must be properly planned, and all plans and drawings must be approved by the vessel's classification authority.

For the principles, see *EM 122 blister and steel pipe arrangements (example)* on page 25

The steel conduits must be designed to fit each individual vessel. They are not included with the system delivery. The steel conduits must therefore be both provided (or manufactured) and installed by the installation shipyard. The number of steel conduits depends on the chosen system configuration and the internal diameter of the conduits.

- a 0.5° x 1° system (96 TX modules and 16 RX modules) requires four TX conduits and one RX conduit.
- a 1° x 1° system (48 TX modules and 16 RX modules) requires two TX conduits and one RX conduit.
- a 1° x 2° system (48 TX modules and 8 RX modules) requires two TX conduits and one RX conduit.
- a 2° x 2° system (24 TX modules and 8 RX modules) requires one TX conduit and one RX conduit.
- a 2° x 4° system (24 TX modules and 4 RX modules) requires one common TX and RX conduit.

Logistics and references

Safety - Refer to the general safety procedures.

Qualifications - Mechanical workers

Ship location - Dry dock

Special tools - None

Drawings *Drawing file* on page 109

Procedure

How to mount the steel conduits

1. Design the steel conduits with appropriate length and diameter to fit the echo sounder.
2. Mount the steel conduits from the vessel hull and up towards the sonar room and the EM 122 Transceiver Unit.
   - The RX steel conduit(s) should have an inner diameter of minimum 146 mm.
   - The TX steel conduit(s) should have an inner diameter of minimum 197.0 mm.

- 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. Note however that one or two sharp bends on the conduits may require a larger diameter.
- The upper opening of the steel conduits should be above the vessel's water line. If the openings of these conduits are under the water level, then special acceptances are needed from the classification.

3 Close the top of the steel conduits with a seal.

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

Casings

While the transducer elements are mounted into the frames, the frames require casings. One casing is required for each frame.

The casings are not a part of the system delivery. They must therefore both be provided (or manufactured) and installed by the installation shipyard.

Logistics and references

- **Logistics and references safety** - Refer to the general safety procedures. Note that the units are heavy!
- **Personnel** - Trained mechanical workers/welders
- **Ship location** - Dry dock
- **Special tools** - None
- **Drawings** - Refer to the following drawings in the *Drawing file* on page 109.

Procedure

How to mount the casings

1 Manufacture the casings according the production drawings.

2 Alter the drawings and the design as required to fit the vessel and the chosen installation method.

3 Install the casings under the hull in either the blister, the gondola or into the hull.

Mounting frames

The mounting frames are designed to house the individual transmit and receive transducer elements. The elements are mounted next to each other to make up the arrays.

The following mounting frames are available

- TX mounting frame for a 0.5 degree system
- TX mounting frame for a 1 degree system
- TX mounting frame for a 2 degrees system
  - These TX frames are basically identical, but they differ in physical length.
- RX mounting frame for a 1 degree system
- RX mounting frame for a 2 degrees system
- RX mounting frame for a 4 degrees system
  - These RX frames are also basically identical, but they differ in physical length

    The RX frames are additionally equipped with baffle plates. The baffle plates are used to deaden noise attenuation on bottom side of the RX mounting frames.

The mounting frames are installed into the casings prepared by the installation shipyard or directly into another mounting area.

Casings on page 28

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.

Logistics and references

- **Safety** - Refer to the general safety procedures. Note that the units are heavy !
- **Personnel** - Trained mechanical workers
- **Ship location** - Dry dock
- **Special tools** - Torque wrench
- **Drawings** - Refer to the previously mentioned drawings in the *Drawing file* on page 109

Important drawings for mounting frames and baffle plates:

- 365207 – Baffle plate 1
- 365208 – Baffle plate 2
- 365208 – Baffle plate 3
- 871–213391 – Mounting frame RX 2 degree
- 860–213389 – Mounting frame assembly 2 degree
- 821–213756 – Arrangement drawing 2 degree array

Procedures

Note

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

How to modify existing Rx frames for installation of baffle plates

1 Dismount the transducer modules from the mounting frame.

2 Dismount all clamps and stay rods from the mounting frame.

Note

All threaded holes on the Mounting Frame must be masked!

Note

Dismount the Mounting Frame and transport it to a locksmith shop and use a milling machine.

3 Transfer the hole-pattern according to the drawing. Drill and cut the thread.

4 Mounting frame to be checked with all baffle plates before re-installing.

5 Re-install the mounting frame according to the instructions in the procedure *How to mount the RX frames* on page 30.

How to mount the RX frames

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

1 Mount the baffle plates to the mounting frames. Use moderate torque. And secure with Loctite 242

Note

The baffle plates must be installed with correct orientation!

- The number of baffle plates depends on the length of the array
- For easier handling is a text and a arrow mark on every baffle plate.

2 The mounting frame must be bolted onto the flat bars inside the casing.

Note

The mounting frame must be installed with correct orientation!

- The number of flat bars depends on the length of the array
- There are two (2) holes in each flat bar

3 The frame must be bolted properly to the bars with torque of approximately 187 Nm.

4 Check that the frame is mounted completely flat.

- No point on the frame may deviate from the optimal plane with more than +-1.6mm

5 Repeat step 4 until the alignment procedure has been performed successfully.

- Refer to *alignment* on page 96 chapter for a proposed measuring method.

Refer to *Drawing file* on page 109 for mounting frame principles.

How to mount the TX frames

1 The mounting frame must be bolted onto the flat bars inside the casing.

- The number of flat bars depends on the length of the array.
- There are three (3) holes in each flat bar.
  - 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 drawing file on page xxx for 0.5 deg mounting frame

2 The frame must be bolted properly to the bars with torque approximately 187 Nm.

3 Check that the frame is mounted completely flat.

- No point on the frame may deviate from the horizontal plane with more than ± 0.5 mm.
- Refer to the *alignment* on page 96 chapter for a proposed measuring method.

4 Repeat step 3 until the alignment procedure has been performed successfully.

Transducer modules

To make the installation of the transducers easier, they are built with standard modules

- All RX modules are identical.
- All TX modules are identical.

  Each module has its unique serial number.

The two transducer module types are identified by their unique registration numbers, which are moulded into the rear of the element.

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 on the side of each array.

Logistics and references

- **Safety** - Refer to the general safety procedures. Note that the individual units are heavy !
- **Personnel** - Trained mechanical workers and installation engineers from Kongsberg Maritime AS.
- **Ship location** - Dry dock
- **Special tools** - Torque wrench
- **References** - Refer to the following drawings in the Drawing File:
  - *TX module* on page 111

References

- on page
- on page
- on page

Note

Note that engineers from Kongsberg Maritime must be present during the installation of the transducer modules.

Procedure

How to install the RX and TX transducer array modules

Observe normal safety precautions for dockyard work.

Caution

The transducer modules and the cables must be handled with care! The modules are heavy!

DO NOT LIFT THE MODULES BY THE CABLE!

For the mounting of TX array in the frames, there are no orientation limits. However, for the RX array there are some limitations.

RX array with casing – 2 degree on page 117

RX transducer modules

Note

When installing RX transducer modules, fill in the "Location of RX modules" table!

on page

1 Put the first transducer module into the frame.

- This module is mounted at either end of the array.

  Note

  Observe that you install the module so that it faces the correct way.

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.

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

- Use torque approximately 64 Nm.

4 Mount the next transducer module next to the previous.

5 Repeat until all modules have been installed.

6 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.

7 Check that all bolts are properly fastened.

TX transducer modules

Note

When installing TX transducer modules, fill in the "Location of TX modules"

on page

Installation examples

This chapter provides a number of examples for transducer array installation. Installation procedures are also defined.

Topics

Transducer blister

The transducer arrays should be mounted underneath the vessel. To achieve this, you can design and manufacture a streamlined transducer blister, and mount it under the vessel's hull. This is a well proven way, when refitting a vessel with a EM 122 system.

A blister is a mounting construction fully welded to the hull of the ship. I contains casings or boxes, which form the mail part of the unit, housing the transducer frames and modules. The design 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 principal.

Note

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

Logistics and references

Logistics and references Safety - Refer to the general safety procedures.

Personnel - Trained mechanical workers

Ship location - Dry dock

Special tools - Welding equipment

Protection - Protective paint, zinc anodes

References - Refer to the following drawings in the Drawing file

Procedure

How to mount the transducer blister

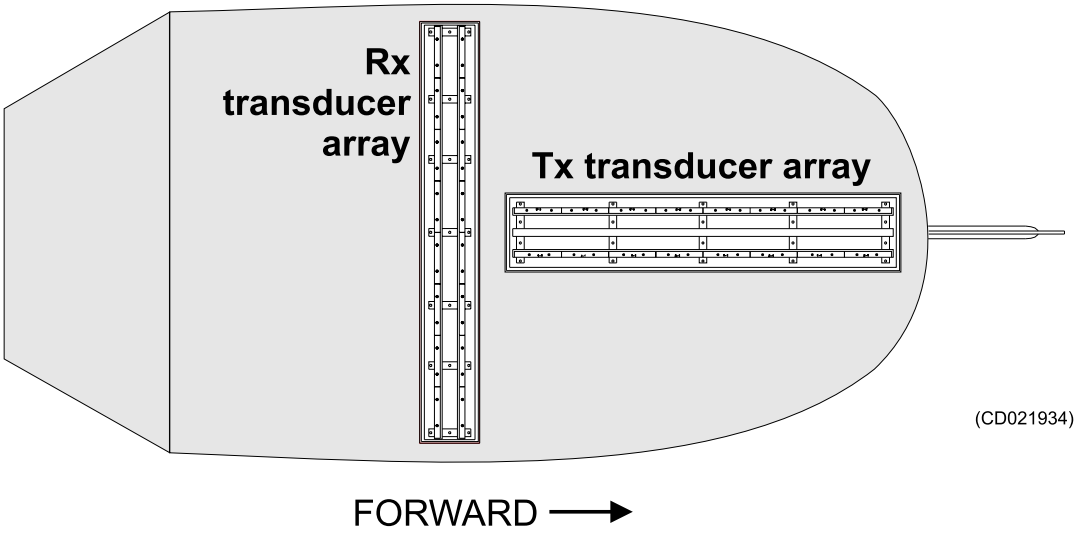
1 Design and manufacture the transducer blister.
   - The blister must hold the two casings; one for the TX and one for the RX transducer arrays. The appropriate drawings describing these casings are included in the Drawing File.
   - The blister will be water filled. To let the air escape, make a suitable hole in the rear end close to the vessel's hull.
   - Our recommendation is to place an "debris knife" in the forward end of the blister.

2 Prepare the inside surface protection of the blister. Paint with protective paint, and mount zinc anodes.

3 Mount the transducer blister under the vessel's hull.

4 Protect the outer surface of the blister.
   - It must have similar protective treatment as the rest of the vessel's hull.

Figure 8 Hatches for access to the steel conduits



Gondola

A gondola is like a pod hanging down from under the ship's keel and this pod is housing the transducers. There is a gap between the transducers and the ship's hull that will allow aerated water and air bubbles to pass trough this gap and not be pushed down and under the transducer faces. 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 have been involved in all sizes of gondolas, from the smallest wit only an EM 710 system to the largest one housing all transducers in an integrated acoustic outfit.

See *Gondola – 1 x 2 degree system* on page 37

Logistics and references

Logistics and references

Logistics and references Safety - Refer to the general safety procedures.

Personnel - Trained mechanical workers

Ship location - Dry dock

Special tools - Torque wrench

Protection - Protective paint, zinc anodes

References - None

Procedure

1 Design and manufacture the transducer gondola.

- The gondola must hold the two casings; one for the TX and one for the RX transducer arrays. The appropriate drawings describing these casings are included in the Drawing File.
- The gondola will be water filled. To let the air escape, make a suitable hole in the rear end close to the vessel's hull.
- Our recommendation is to place an "debris knife" in the forward end of the gondola.

2 Prepare the inside surface protection of the gondola. Paint with protective paint, and mount zinc anodes.

3 Mount the transducer gondola under the vessel's hull.

4 Check the inside surface protection of the gondola.

- Add paint or zinc as required.

5 Protect the outer surface of the gondola.

Figure 9 Gondola – 1 x 2 degree system

Flush mount

For a flush installation method, the transducers are installed inside the ship's hull. The transducer faces are then levelled with the surface of the hull. This method exposes the transducers to passing air bubbles which might affect the system performance. On ships

with sharp bows, deep drafts and ideal acoustic conditions this installation method might be acceptable. If this method is selected, great care must be taken during the planning solution to ensure best possible transducer location.

For ice breakers there is no other alternative than a flush installation, the transducer are then protected behind ice windows.

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.

Fairing

The transducer arrays may also be mounted directly under the vessel's hull and then "streamlined" with fairing. This installation method has proven successful in former multibeam echo sounder installations. The required installation drawings must be made by the installation shipyard or by third-party ship designers.

Protective acoustic window

Description of a acoustic window

Acoustic windows may be supplied for low frequency, 12 and 30 kHz multibeam echo sounders only, i.e. the EM 122 and the EM 122. For multibeam echo sounders with higher frequencies, such as the EM 710, acoustic windows will be too lossy, thus specially made ice strengthened transducers will be the solution.

An EM 122 multibeam system can be installed on ice going ships, from ice rand ships with the lightest ice class to a full ice breaker classified vessel.

Both the transmit and the receive transducers are then integrated into the ship's hull and are protected behind acoustic windows.

The ice window construction for the TX transducer and the RX transducer windows are different.

The TX window consists of several square windows bolted in front of the transducer. Each window is 840 mm wide and 640 mm long. The thickness is 70 mm. The amount of windows is given by the transducer size, from 2 to 8 units. The windows are bolted side by side inside a transducer casing with a minimum distance of 2 mm apart. The bolt size is M20x70 together with Nor Lock washers. Torch to be used is 280 Nm.

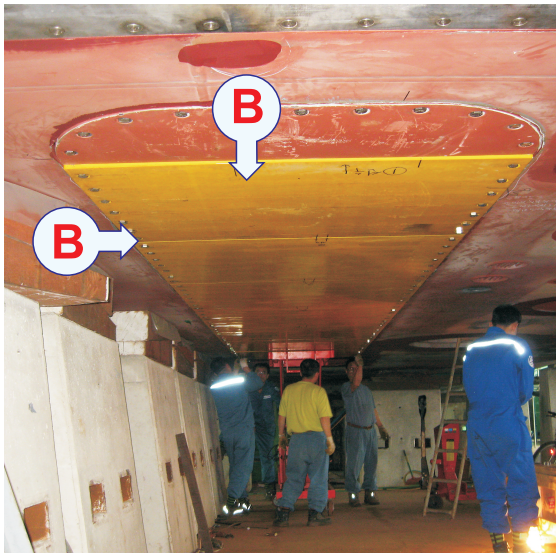
The construction is a metal frame of 6 beams which are molded in a plastic to allow the sound energy pass through and out into the water. Each beam has a hole in each end to allow bolting to the transducer casing. The mounting is with the beams sitting athwart ship and thus 90 degrees to the transducer length.

The RX window is produced as one window allowing protection of a 2 degree transducer only. It is bolted in front of the transducer with M16x60 and Nor Lock washers inside a transducer casing. Torch to be used is 160 Nm. The window is 2120 mm long and 610 mm wide

The construction has 4 longitudinal metal bars, 2 on each side of the window. Each beam has a hole in each end to allow bolting to the transducer casing. The beams are molded in plastic, as the TX window. The 2 inner beams have a distance apart wide enough to avoid obstructions to the return signal from the sea. They are installed parallel to the length of the RX transducer.

An ice window installation with a 1 degree RX system will have two windows attached. This has not been delivered yet and the practical splice will be solved in the project.

A – Titan RX protection window



B – Plastic TX protection window

System units

This chapter describes the installation of the EM 122 Transceiver Unit in the equipment or operation room, and the Operator Station in the operation room.

The Remote Control Junction Box installation for a 0.5 degree system is also described.

Drawings showing the system and the physical dimensions are included in the text.

Topics

Drawings showing the physical dimensions are included in the text.

Note

KM strongly recommends that an Uninterruptible Power Supply (UPS) is used to power the Operator Station.

Operator station

Description

The EM 122 Operator Station consists of a Kongsberg PC based workstation. Main units are computer chassis, display monitor, keyboard, mouse and units for external data storage.

Location

It is recommended to place the Operator Station in a room with environmental conditions similar to those required for extended human occupation. The Operator Station is usually mounted in the operation room, in a rack.

Installation

No specific installation procedures exist for the Operator Station. However, you must install the units so that they are properly physically supported and protected for shock and vibration due to sea conditions.

Transceiver Unit

Scope

This chapter presents the general installation procedures for the EM 122 Transceiver Unit.

Note

The guidelines for installation presented here must be regarded as a base for detailed vessel specific plans prepared by the installation shipyard. These plans should include drawings, instructions and procedures specific to the ship in which the equipment is to be installed.

Location

The EM 122 Transceiver Unit is normally installed in the vessel's "sonar room" close to the transducer arrays. This room must be dry and free from excessive dust and vibration. Maximum humidity of 80% is recommended. Good ventilation for the equipment cooling must be provided.

Kongsberg Maritime recommends that this room is chosen close enough to the transducer arrays so that you do not need to extend the transducer cables.

EM 122 have a standard length of 25 m.

The cabinet must be mounted on a bulkhead or on mounting brackets welded to the bulkhead. Ensure that sufficient space is provided around the unit to allow the unit's doors to open fully.

See figure *Transceiver unit seen from above.* on page 45

Figure 10 EM 122 Transceiver unit mounting

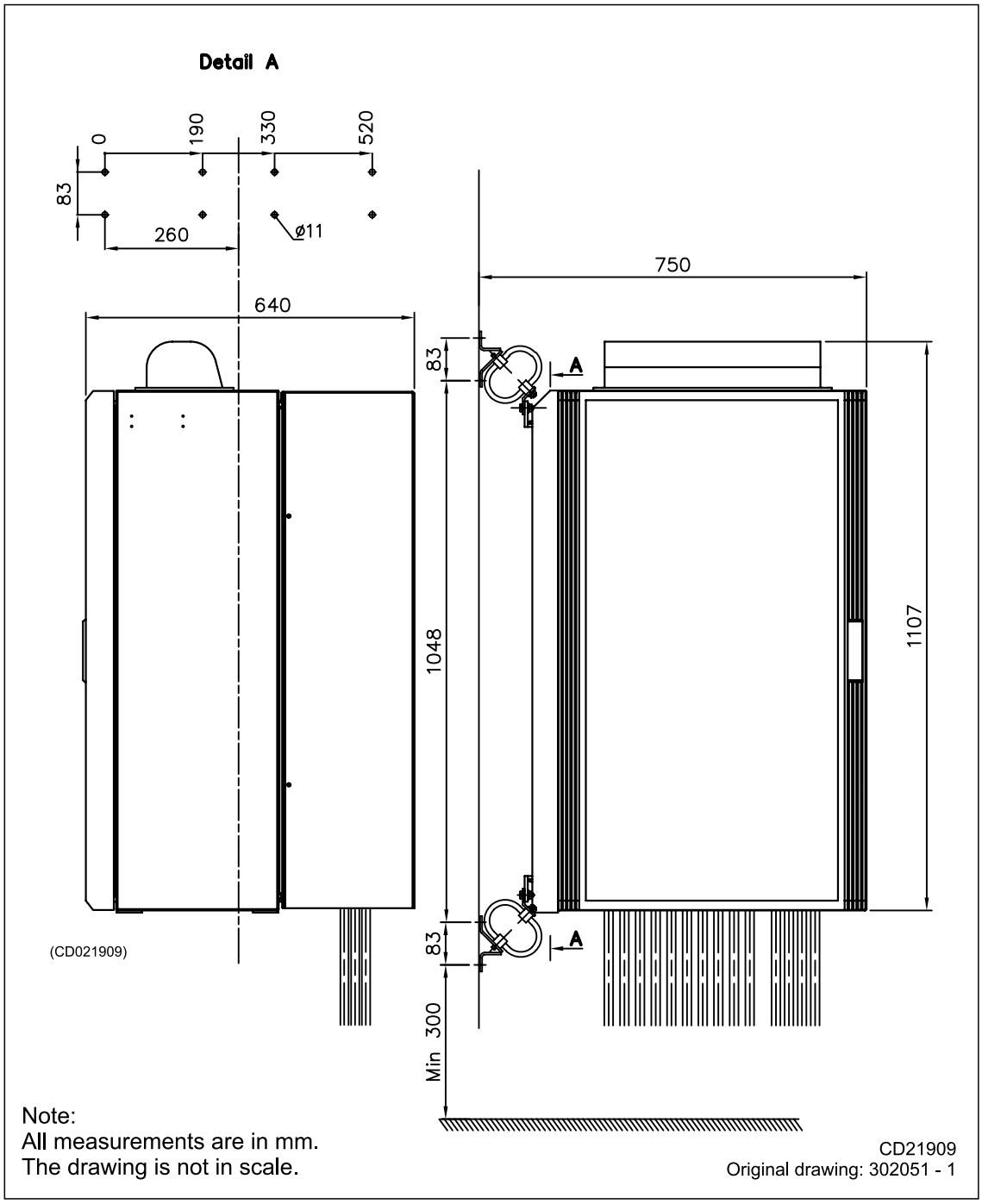
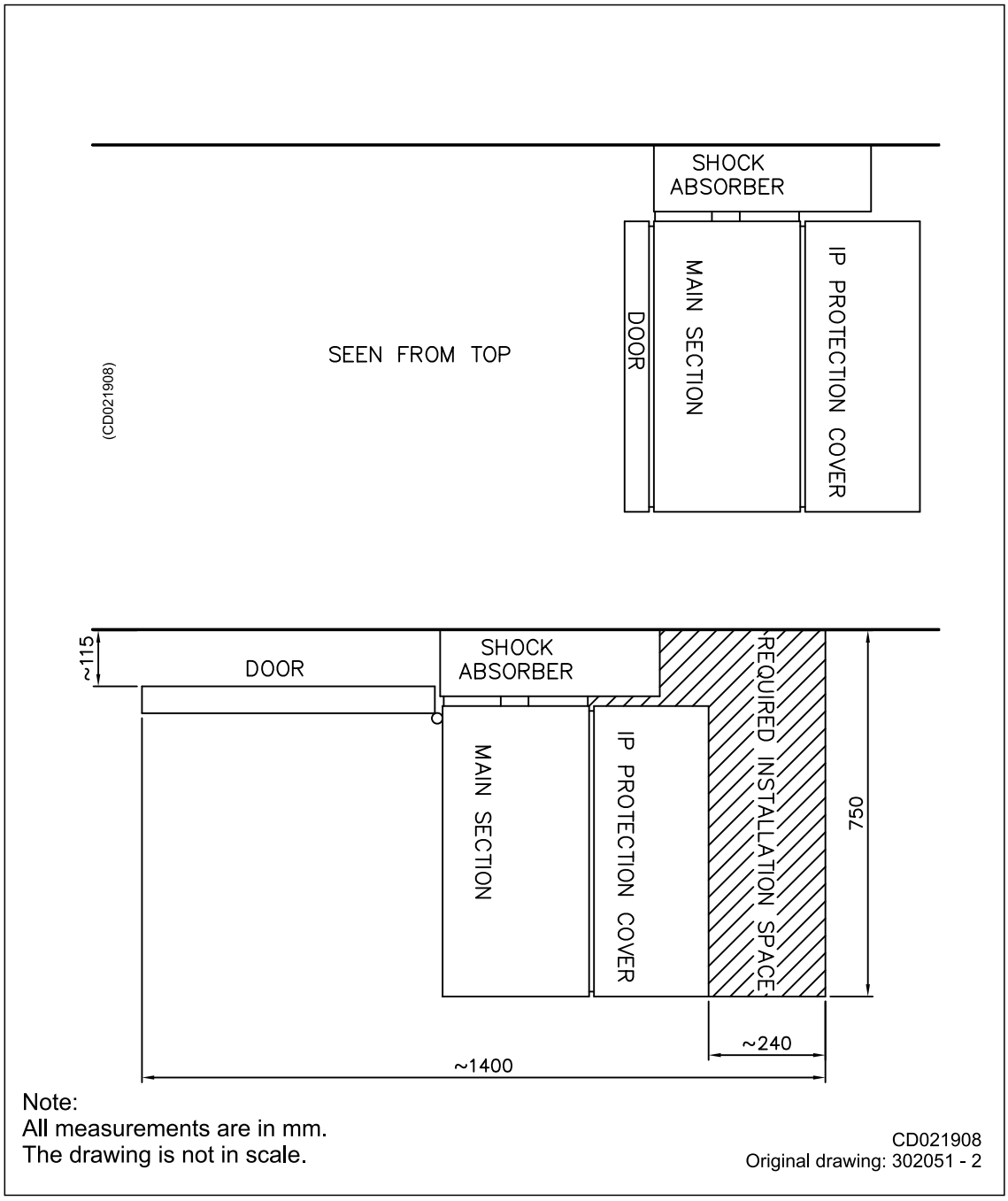


Figure 11 Transceiver unit seen from above.



General information

The Transceiver Unit cabinet has access to all the circuit boards on both the front and rear side.

The unit is mounted on a support frame at the factory. This frame is mounted on the bulkhead with four shock absorbers; two mounted on top of the frame and two at the bottom.

Note

The maximum distance between the EM 122 Transceiver Unit and the TX and RX Transducer Arrays is restricted by the length of TX Junction Box(es) and Preamplifier transducer cables. (5 m)

Logistics

- **Safety** – Refer to the general safety procedures. Note that the unit is heavy.
- **Personnel** – Trained mechanical/electrical workers
- **Ship location** – In dry dock or at quay. The watertight integrity of the ship will not be affected.
- **Special tools** – Special wrenches, lifting equipment
- **Reference** – None

Caution

The cabinet is heavy. Ensure that correct lifting equipment is available.

Procedure

How to mount the Transceiver unit

1 Mark the location of the holes for the first shock absorber on the bulkhead.

on page

2 Drill 11-mm holes, eight (8) for each shock absorber.

Caution

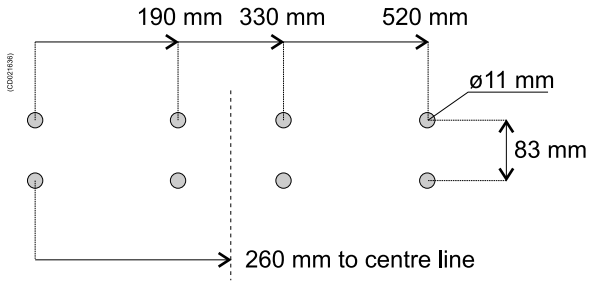
Always check on the other side of the bulkhead before drilling holes !

3 Mount the complete unit on the bulkhead.

- 10-mm bolts are enclosed. Use maximum torque 70 Nm.

4 Mount the Transceiver Unit cabinet.

Figure 12 Fixing holes for one shock absorber



How to perform the Transducer array cables and interfaces

1 Prepare the support brackets to receive the transducer array cables on the cabinet.

2 Mount the cables according to the cable plan.

- Make sure that the transducer cable tables are filled in correctly.

3 Close and secure cable bracket to secure the cables.

Surface preservation

All metal surfaces which are likely to corrode should be painted. This includes welds, base frames and support brackets. Make appropriate cautions to avoid spilling of paint on the cabinet

Preamplifier Unit

Scope

This chapter presents the general installation procedures for the Kongsberg Maritime EM 122 Preamplifier Unit.

Note

The guidelines for installation presented here must be regarded as a base for detailed vessel specific plans prepared by the installation shipyard. These plans should include drawings, instructions and procedures specific to the ship in which the equipment is to be installed. If necessary, these drawings must be approved by the relevant maritime classification society.

Location

The EM 122 Preamplifier Unit is normally installed in the vessel's "sonar room" close to the transducer arrays. This room must be dry and free from excessive dust and vibration. Maximum humidity of 80% is recommended. Good ventilation for the equipment cooling must be provided.

Kongsberg Maritime recommends that this room is chosen close enough to the RX transducer arrays so that you do not need to extend the transducer cables. These have a standard length of 25 meter.

The cabinet must be mounted on the bulkhead. Ensure that sufficient space is provided around the unit to allow the unit's doors to open fully. Space must be provided to allow the power and interface cables to be installed, and to allow the cabinet to move on its shock absorbers.

Note

Restrictions exist concerning the Sonar Room EMC screen.

General information

The Preamplifier Unit cabinet is fitted with hinges to allow the front to be opened, this gives access to both the front and rear sides of all the circuit boards.

The unit is designed to be mounted on a support frame. This frame is mounted on the bulkhead with four shock absorbers, two mounted on top of the frame and two at the bottom.

Logistics

- **Safety** – Refer to the general safety procedures. Note that the unit is heavy.
- **Personnel** – Trained mechanical/electrical workers
- **Ship location** – No recommendations. The watertight integrity of the vessel will not be effected.
- **Special tools** – Special wrenches, lifting equipment
- **Drawings** – see drawings files

Caution

The cabinet is heavy. Ensure that correct lifting equipment is available.

Procedures

How to mount the Preamplifier Unit cabinet

Caution

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

1. Mark the location of the holes for the first shock absorber on the bulkhead.
2. Drill 11– mm holes, eight (8) for each shock absorber
3. Mount the complete unit on the bulkhead.
   - Use 10– mm bolts, maximum torque 64 Nm.

How to mount the AC cable entry (supply voltage)

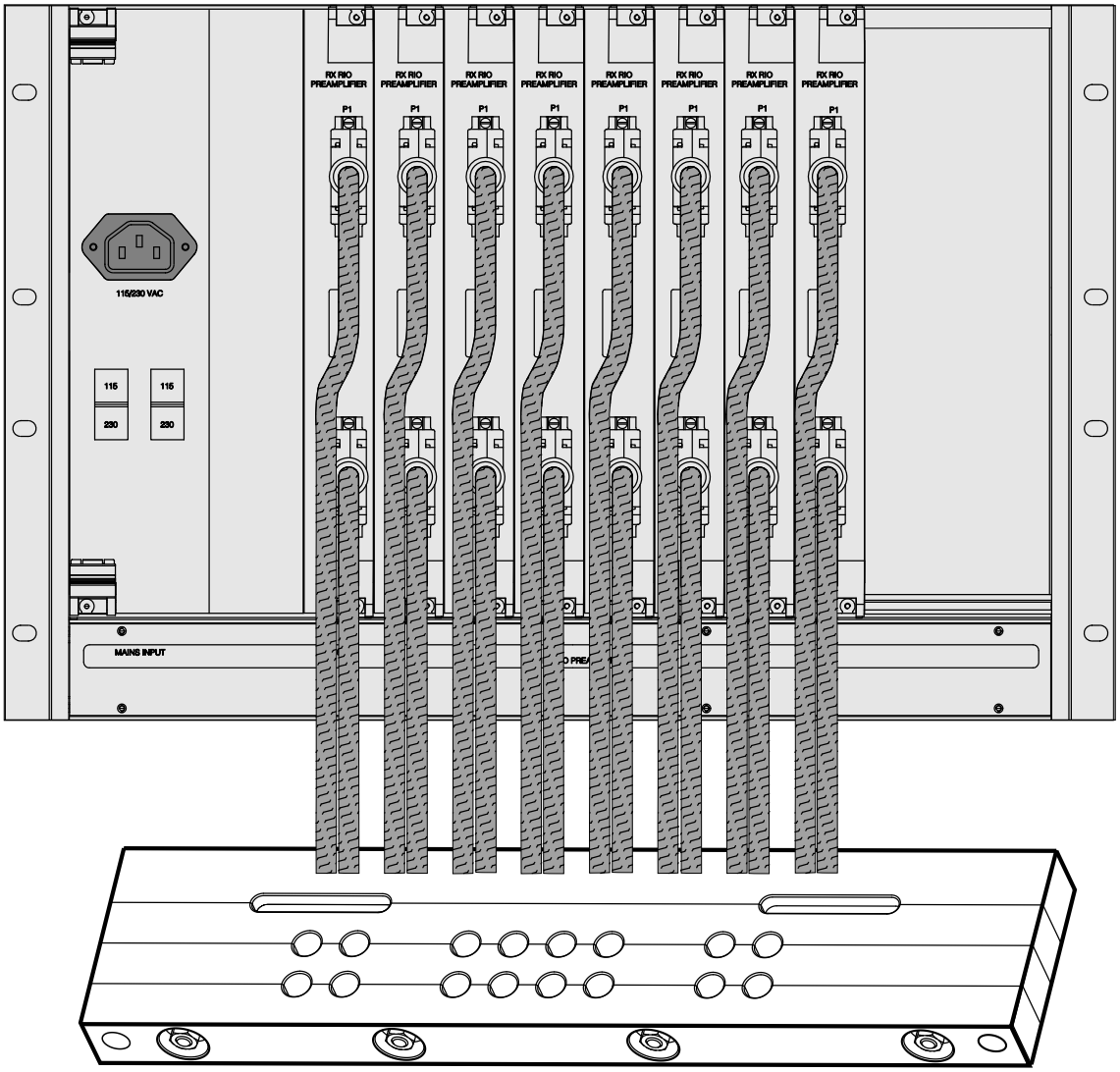
1. Insert the AC plug into the socket.

How to mount the Transducer array cables and interfaces

1. Prepare the support bracket to receive the transducer array cables on the lower frame on the rear side.
2. Mount the cables according to the cable plan.
3. Close and secure cable bracket to secure the cables.
4. Secure the interface cables by strapping them to the transducer cables.

Figure 13 Rear view

CD021949-009



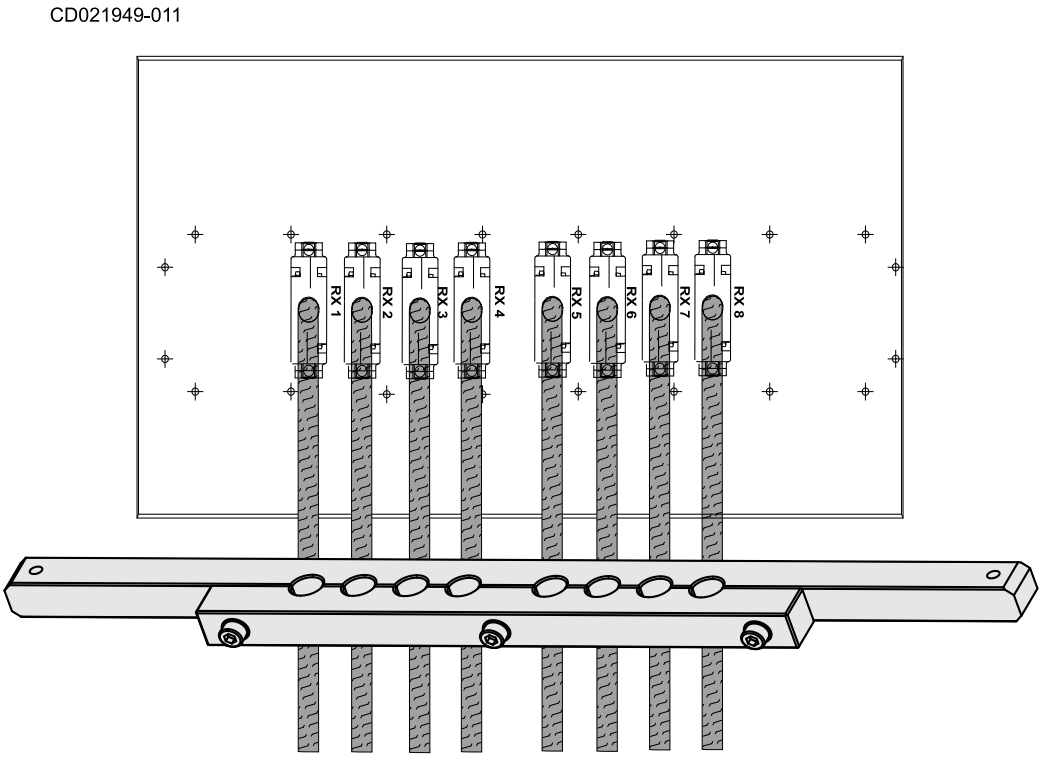
How to mount the Receiver cables underneath the cabinet

1 Prepare the support bracket to receive the receiver cables underneath the cabinet.

2 Mount the cables according to the cable plan.

3 Close and secure cable bracket to secure the cables.

Figure 14 Underneath view of the cabinet



Surface preservation

All exposed metal surfaces which are likely to corrode should be painted according to the appropriate preservation scheme. This includes welds, base frames and support brackets. Make appropriate cautions to avoid spilling of paint on the cabinet.

Figure 15 Preamplifier Unit mounting

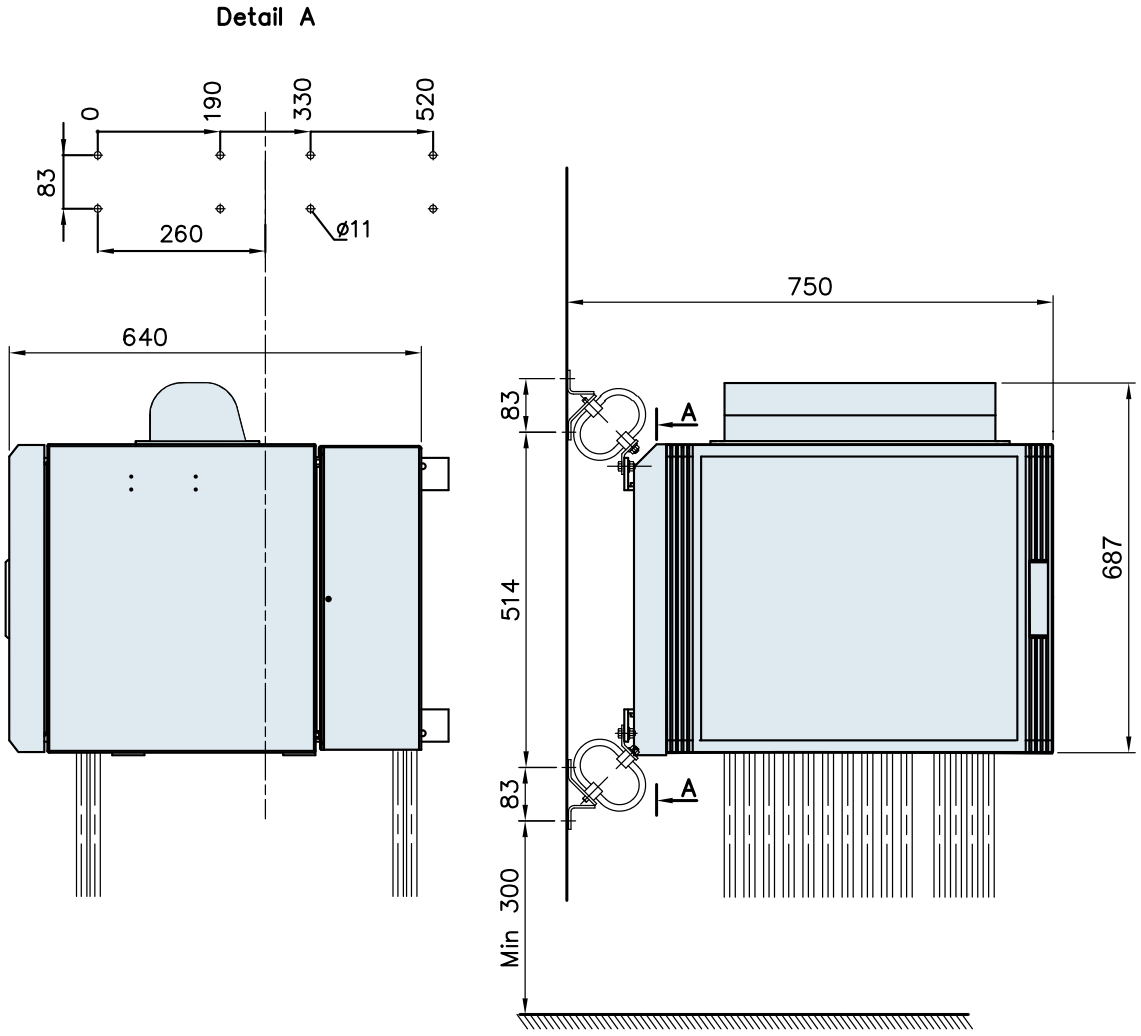
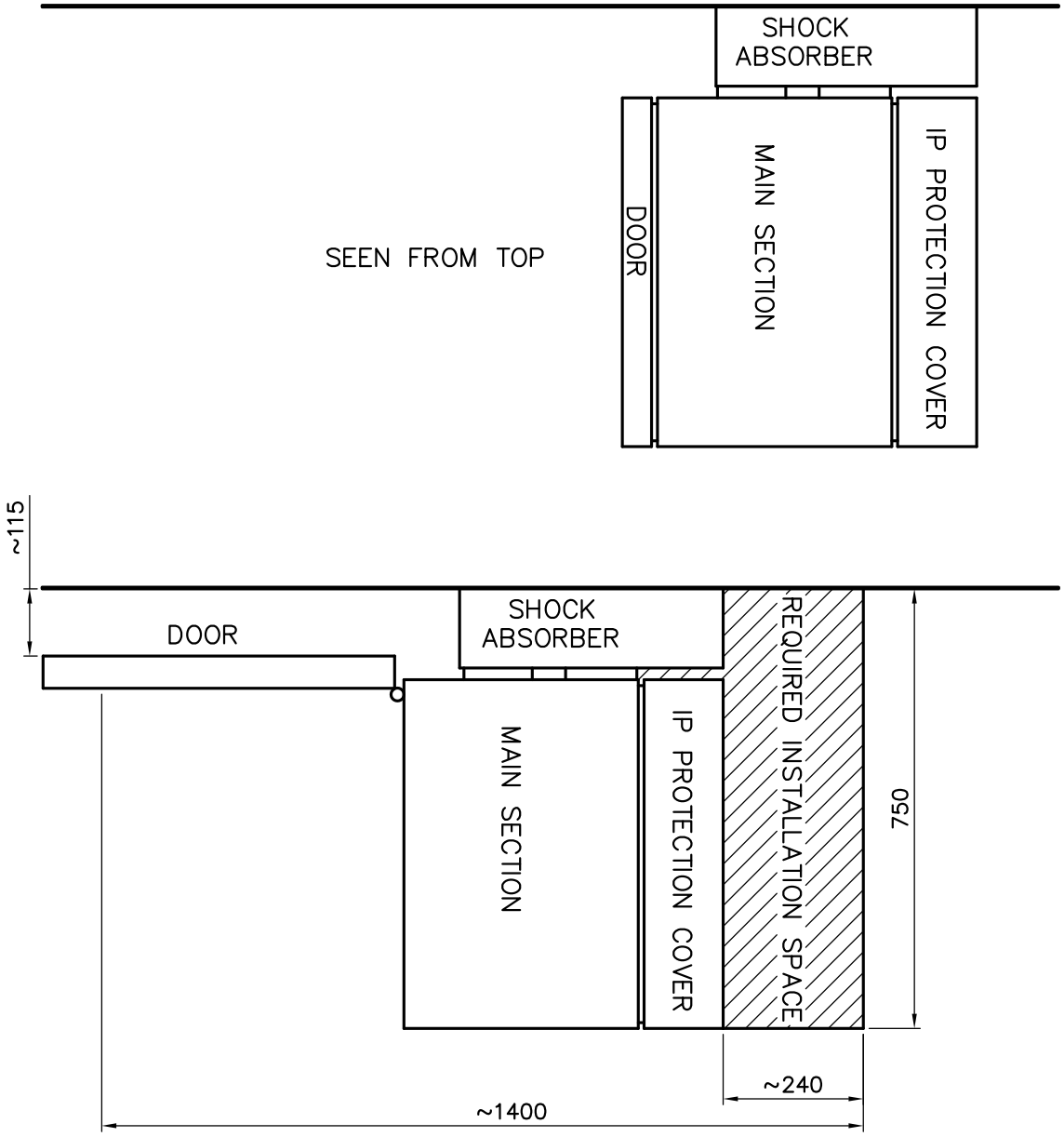


Figure 16 Preamplifier Unit seen from above



CD021949-010

TX Junction Box(es)

This section presents the general installation procedure for the EM 122 Junction Box(es).

Note

The guidelines for installation presented here must be regarded as a base for detailed vessel-specific plans prepared by the installation shipyard. These plans should include drawings, instructions and procedures specific to the ship in which the equipment is to be installed. If necessary, these drawings must be approved by the relevant maritime classification society.

Location

The EM 122 Junction Boxes (2 pcs) are normally installed in the vessel's "sonar room" close to the Transceiver Unit. This room must be dry and free from excessive dust and vibration. Maximum humidity of 80% is recommended. Good ventilation for the equipment cooling must be provided.

The cable length from this box to the Transceiver Unit is 5 meters.

The cabinet must be mounted on the bulkhead. Space must be provided to allow cables to be installed.

Logistics

Safety - Refer to the general safety procedures. Note that the unit is heavy!

Personnel - Trained mechanical/electrical workers

Ship location - In dry dock or at quay. The watertight integrity of the ship will not be affected.

Special tools - None

References - None

Procedures

How to mount the junction box cabinet

1. Mark the location of the holes for the four (4) bolts or make a foundation to be welded to the bulkhead.
2. Drill 11-mm holes.

   Caution

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

3. Mount the complete unit on the bulkhead.
   - 10-mm bolts are enclosed. Use maximum torque 70 Nm.

How to mount the transducer array cables and interfaces

1. Prepare the support bracket to receive the transducer array cables on the lower frame.
2. Mount the cables according to the cable plan.

3 Close and secure cable bracket to secure the cables.

4 Secure the interface cables by strapping them to the transducer cables.

Surface preservation

All exposed metal surfaces which are likely to corrode should be painted according to the appropriate preservation scheme. This includes welds, base frames and support brackets. Make appropriate cautions to avoid spilling of paint on the cabinet.

Remote Control Junction Box

This chapter presents the general installation procedures for the EM 122 Remote Control Junction Box.

Scope

A dedicated Junction Box has been designed to provide:

- Remote controlled system on/off with light indication
- System trigger output and input

These functions are all available through the Remote connector on the EM 122 Transceiver Unit. Cable *EM Remote synchronization and On/Off* on page 136 is used to connect the Junction Box to this connector.

Note

This Junction Box is optional, and may not be a part of your delivery. If only the system on/off switch is required, this can be placed almost anywhere, and connected to the Remote connector as described by cable EM Remote synchronization and On/Off on page 136.

Location

The Remote Control Junction Box will normally be installed on the bulkhead in the operations room, often close to the Operator Station.

General information

The Remote Control Junction Box is small, and has several cable glands in the bottom for easy cable access.

The standard version of this Junction Box only contains a terminal block and a switch with a lamp mounted on the door. Cable *EM Remote synchronization and On/Off* on page 136 must be connected to the terminal block. Other cables to external equipment are connected to the same terminal block. Cable *EM Remote synchronization and On/Off* on page 136 assumes that these cables are connected 1:1 compared to the 9–pin 'D' connector at the other end.

Logistics

- **Safety** - Refer to the general safety procedures.
- **Personnel** - Trained mechanical/electrical workers
- **Special tools** - None

Remote Control Junction Box – outline dimensions on page 58

Procedures

How to mount the remote control junction box cabinet

1 Mark the location of the holes for the cabinet.

- The size and location of these holes are shown on the outline drawings.

2 Drill the four 8.5–mm holes in the bulkhead

Caution

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

3 Mount the cabinet.

See *EM Remote synchronization and On/Off* on page 136

Figure 17 Junction Box – Standard circuit diagram

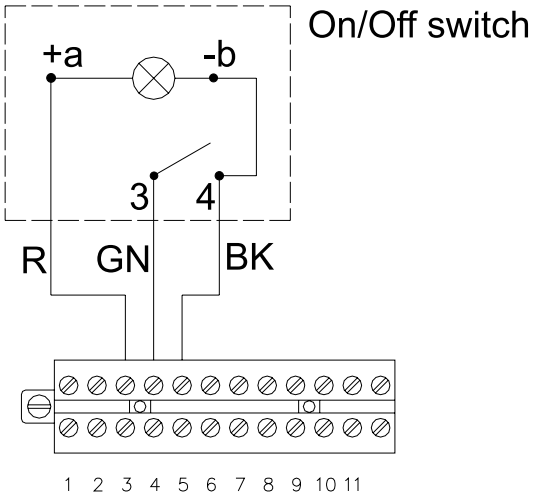
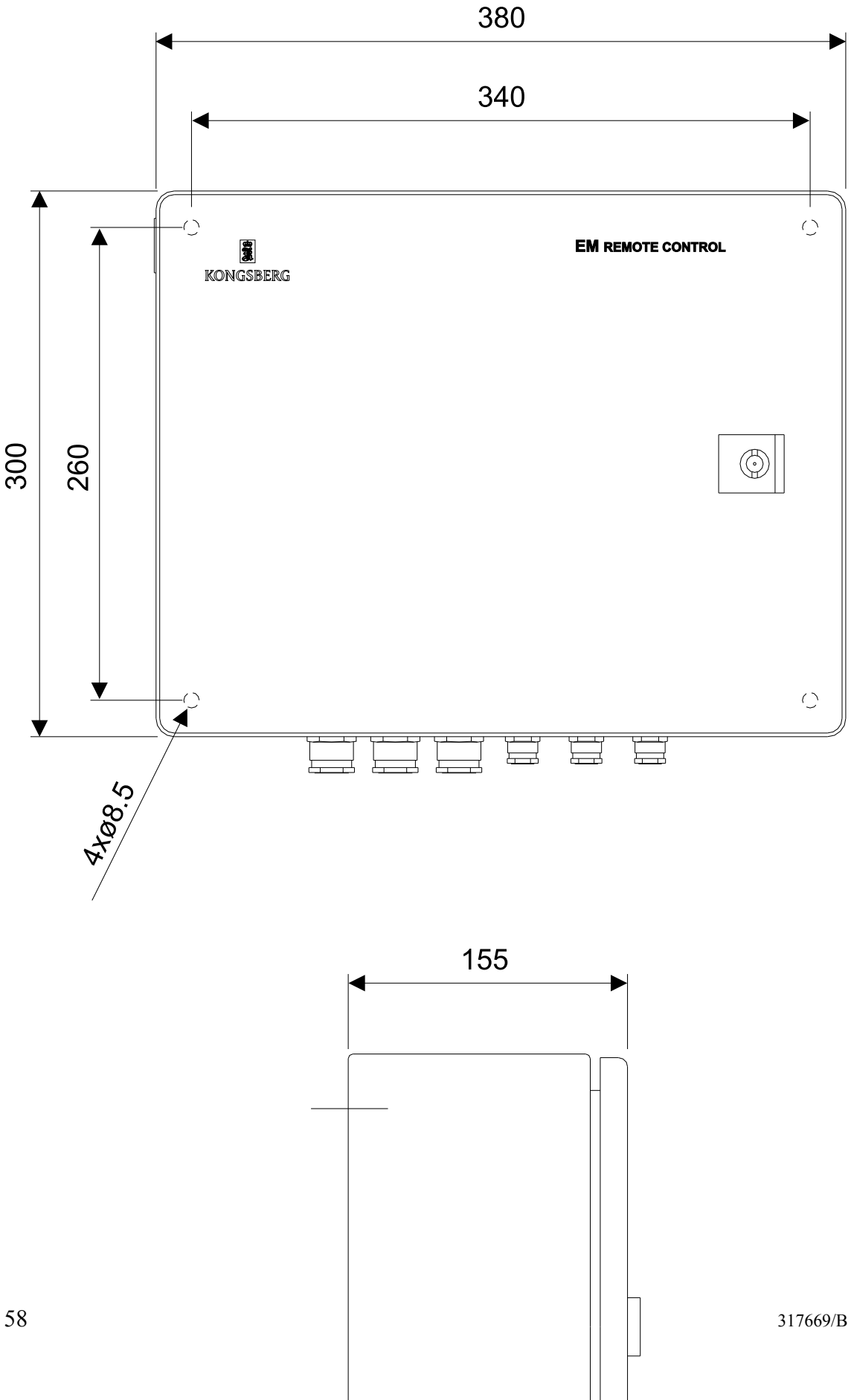


Figure 18 Remote Control Junction Box – outline dimensions



Technical specifications

This chapter presents the main technical specifications.

Note

Kongsberg Maritime AS is engaged in continuous development of its products and reserves the right to alter specifications without prior notice.

Topics

Interfaces

These interfaces are found on the Transceiver Unit and the Operator Station:

- Serial lines with operator adjustable baud rate, parity, data length and stop bit length for:
  - Motion sensor (roll, pitch, heave and optionally heading) in format supported by sensors from the main suppliers like Applanix , iXSEA, Coda, Kongsberg Maritime
  - Heading NMEA 0183 HDT or SKR82/LR60 or EM attitude format
  - Positions in either Simrad 90, NMEA 0183 GGA or GGK format
  - External clock in NMEA 0183 ZDA format / Trimble UTC
  - Sound speed at transducer
  - Sea level height (tide)
  - Single beam echo sounder depths
  - Output of depth straight down in NMEA 0183 DPT format
  - Depth pressure or high input
- Interface for 1PPS (pulse per second) clock synchronisation signal
- USB 2.0 interfaces for data storage, printing or plotting
- Parallel interface for Postscript colour graphics printer/plotter

- Ethernet interface for velocity input needed for Doppler compensation in chirp mode.
- Gigabit and Megabit Ethernet interface for input of sound speed profile, tide and echo sounder depths, and output of all data normally logged to disk

Physical specifications

Transmit transducer module – TX

- **Length:** 179 mm / 131.4 mm
- **Width:** 760 mm (780 mm with frame)
- **Height:** 197 mm (261.5 mm with 1 degree frame, 249.5 mm with 2 degrees frame)
- **Weight in air/water:** 58 kg / 46 kg

TX Frame length:

- 15261.5 mm (0.5 degree)
- 7770 mm (1 degree)
- 4020 mm (2 degrees)

TX mounting frame:

- **Weight in air/water:** 1635 kg / 1427 kg (1 degree)

Receive transducer module – RX

- **Length:** 447 mm
- **Width:** 342 mm (420 mm with frame)
- **Height:** 120 mm (177 mm with frame)
- **Weight in air/water:** 24 kg / 6 kg

RX Frame length

- 7200 mm (1 degree)
- 3600 mm (2 degrees)
- 1808 mm (4 degrees)

RX mounting frame:

- **Weight in air/water:** 700 kg / 611 kg (1 degree)
- **Weight in air/water:** 340 kg / 297 kg (2 degree)
- **Weight in air/water:** 150 kg / 131 kg (4 degree)

RX array weight

- **Weight in air/water:** 700 kg / 611 kg (1 degree)
- **Weight in air/water:** 340 kg / 297 kg (2 degree)

Transducer ice window

- **TX – Weight in air/water:** 200 kg / 55 kg
- **RX – Weight in air/water:** 530 kg / 412 kg (1 degree)
- **RX – Weight in air/water:** 310 kg / 241 kg (2 degree)

Transceiver Unit

- **Length:** 1107 mm
- **Width:** 540 mm
- **Height:** 750 mm
- **Weight:** Approximately 200 kg

RX Preamplifier Unit

- **Height:** 920 mm
- **Width:** 600 mm
- **Depth:** 630 mm
- **Weight:** Approximately 96 kg

TX Junction Box

- **Height:** 440 mm
- **Width:** 600 mm
- **Depth:** 303 mm
- **Weight:** Approximately 15 kg

Operator Station

- **Height:** 4U – 178 mm
- **Width:** 427 mm (excluding rack fixing brackets)
- **Depth:** 480 mm (excluding handles and connectors)
- **Weight:** Approximately 20 kg

19” inch LCD monitor

- **Height:** 440 mm (excluding mounting brackets)
- **Width:** 483 mm (excluding mounting brackets)
- **Depth:** 68 mm (excluding mounting brackets)
- **Weight:** 12 kg (approximately with bracket)

Power requirements

Operational voltage and frequency

AC voltage: 115/230 Vac ±10%, 47 – 63 Hz

Acceptable transients

- Short time (max. 2 sec) : ± 20%, 42 – 69 Hz
- Spikes (max. 50µs) : < 1000 V

Transceiver Unit:

- 0.5° x 1°: < 2000W
- 1° x 1°: < 2000W
- 1° x 2°: < 1900W
- 2° x 2°: < 1200W
- 2° x 4°: < 1200W
- The single phase supply must be protected with 16A (230 Vac supply) slow-blow fuses.

Operator Station: < 250W

LCD monitor: < 60W

Preamplifier Unit: < 200W

TX Junction Box: None

Note

For 115 Vac operation, please contact km.hydrographic.support@kongsberg.com

Power interrupts

Menu settings, all parameters and the sound speed profile are stored on the Operator Station's harddisk during operation, so operation can continue after power interruption. However, the file system may be damaged, so the use of an uninterruptable power supply (UPS) is highly recommended.

Environmental and EMC specifications

The system meets all requirements of the IACS E10 specification. The Transceiver and Preamplifier Unit meet the additional stronger requirements of the IEC 60945 specification.

The Operator Station and the LCD monitor are both IP22 rated. The Transceiver and Preamplifier Unit are IP54 rated.

Standards

EMC Noise emission: EN55022 (Class A)

EMC Noise immunity, voltage spikes: EN55101

IEC 60945 specification

Environment

- Operating temperature, sonar room: 0 to 50º C
- Operating temperature, operating room: +5 to 50º C
- Storage temperature: –30 to +70º C
- Humidity: 5 to 95% relative non-condensing

  Humidity requirements will depend on customer requirements. Normal specification is up to 80% non-condensing.

  Note

  To extend the lifetime of the equipment, the sonar room should be equipped with sufficient ventilation and the temperature should not be too high (i.e. not > 30ºC) for long periods of time.

Vibration

- Frequency Range: 2-13.2 Hz

  Excitation Level: +/- 1.0 mm
- Frequency Range: 13.2-100 Hz

  Excitation Level: 1 g

Shock

Cabinets w/shock absorbers: 15g half period sine

Duration: 11 ms

Cable layout and interconnections

This chapter presents the cable layout and interconnections between the systems.

Topics

The standard cables used between the EM 122 system units and between the units and their external devices are shown here. For larger installations where the EM 122 is a subsystem, the cables will also be shown in the cable layout plan and interconnection diagram specific for the vessel into which the system is installed.

Note

All cable connections may have to be made in accordance with the guidelines laid down by the vessel's classification society.

If no such guidelines exist, Kongsberg Maritime AS recommends that Det norske Veritas (DnV) Report No. 80-P008 «Guidelines for Installation and Proposal for Test of Equipment» should be used as a guide.

System cabling

Cable layout

The interconnection cables are identified on the cable layout drawings. Each cable is then listed in the corresponding list, which refer to the required cable specifications. On the following pages, each cable is identified with the appropriate terminations.

Shipyard and system cables

Each individual cable is identified on the cable plan. The cables fall into two categories

- Cables provided by the installation shipyard or owner
- System cables supplied with the delivery

Shipyard cables

The cables that must be provided by the shipyard or owner are identified as such in the descriptions. Note that the cable specifications given are the minimum specifications.

For each cable, the following information is provided

- Connection to be made on each end of the cable (including system unit, terminal board identification and plug/socket to be used)
- Number of cores
- Recommended cable type
- Minimum cable specifications

The necessary considerations must be taken to suit special requirements. Kongsberg Maritime accepts no responsibility for damage to the system or reduced operational performance if this is caused by improper cabling.

System cables

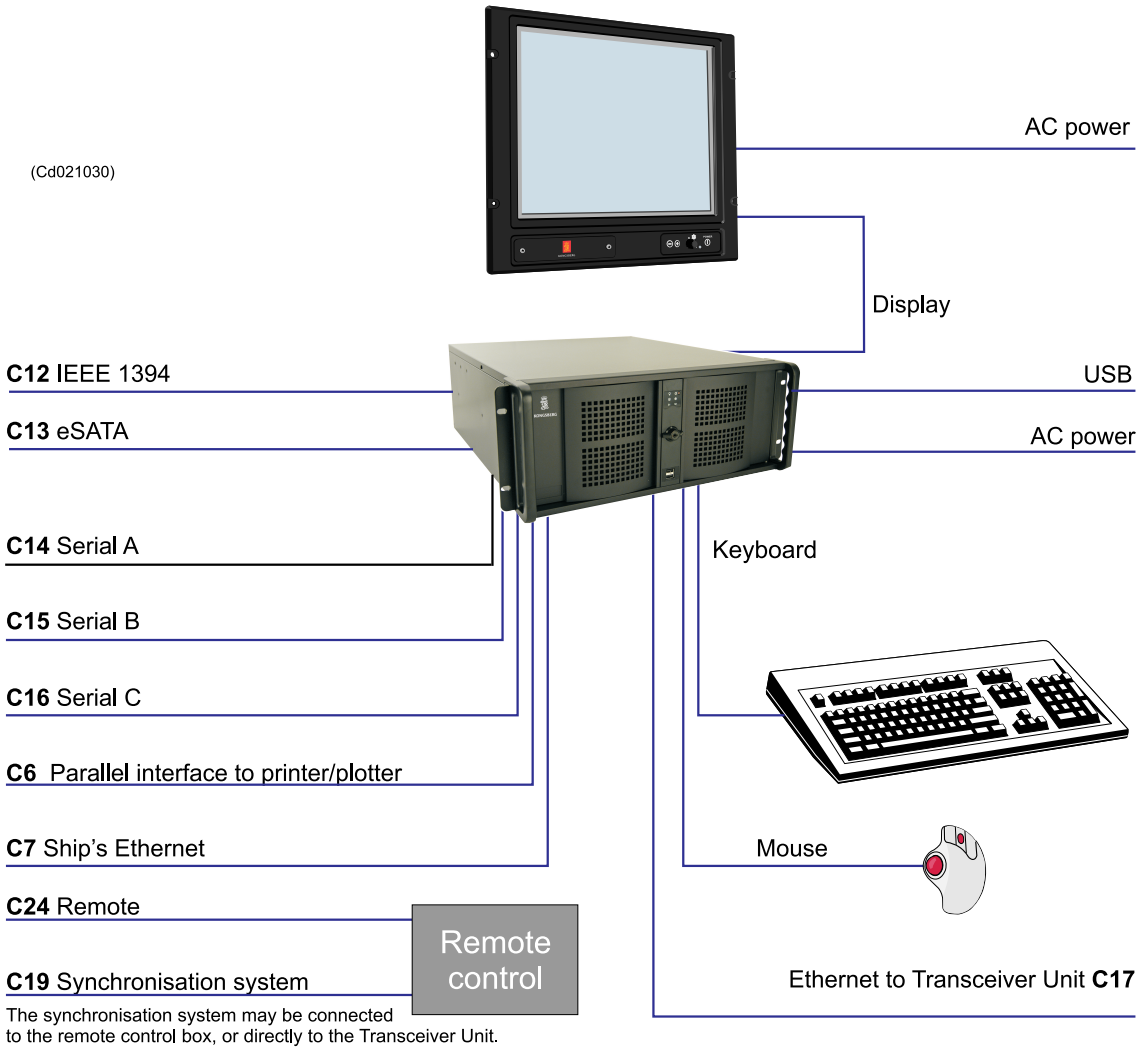
Several cables will be supplied with the system. Such cables normally comprise power cables for peripheral equipment, and interconnection cables for computers and/or work stations. These cables will normally be delivered with the units.

Operator Station cables

The illustration and the list below specifies each cable used on the EM 122 Operator Station. References are made to detailed cable drawings.

Note that this information includes several cables that may not be in use on all installations.

Figure 19 Operator Station cables



C6 - Printer or plotter

The Operator Station provides one parallel interface to a printer or plotter. In most cases, printers and plotters are connected directly to the ship's Ethernet network.

When applicable, the cable is provided by the manufacturer.

C7 - Ship's Ethernet

The Operator Station is equipped with two Ethernet ports interface boards, one is used to communicate with the ship's Ethernet while the other (C17) is used to communicate with the Transceiver Unit.

The Ethernet cables must be provided by the installation shipyard. For cable details, see *Ethernet cable with RJ45* on page 141

C8 / C9 - AC power

These are AC mains cables.

All AC mains cables are normally supplied by the manufacturer.

C14 - Serial A

This serial line is intended for a sound speed probe. If a sound speed probe is not used, the serial line may be used for other purposes.

See *Generic RS-232 Serial line* on page 134

The cables must be provided by the installation shipyard.

C15 - Serial B

This serial line is intended for a tide/depth sensor. If such a sensor is not used, the serial line may be used for other purposes.

See *Generic RS-232 Serial line* on page 134.

The cable must be provided by the installation shipyard.

C17 - Transceiver Unit RJ-45 interface

The Operator Station has two Ethernet outlets. One is used to communicate with the ship's Ethernet (C7) while the other C17 is used to communicate with the Transceiver Unit.

See *Ethernet cable with RJ45* on page 141.

The cable must be provided by the installation shipyard.

C19 - Synchronisation system

Refer to the Transceiver Unit cabling.

C24 - Remote

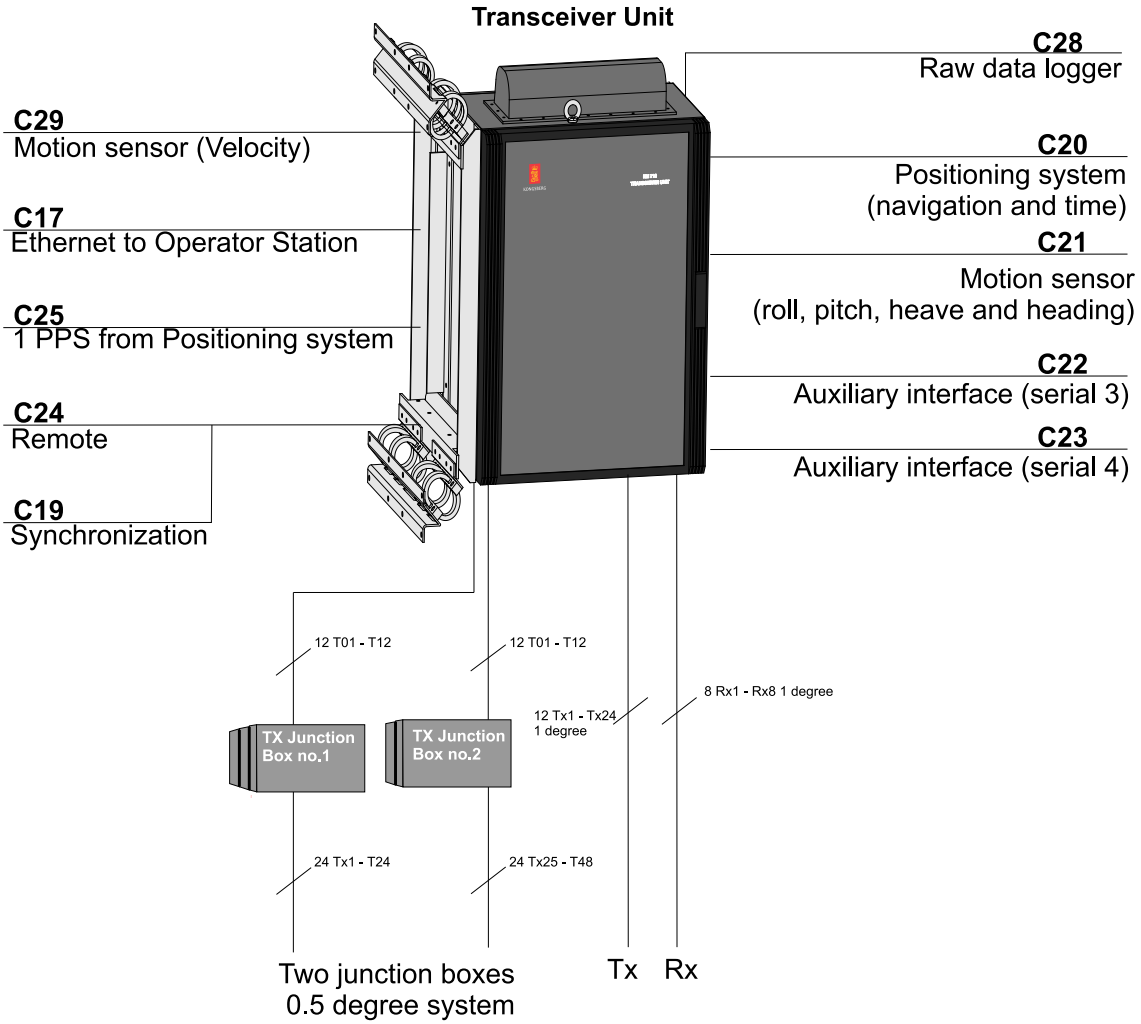
Refer to the Transceiver Unit cabling.

Transceiver Unit cables

The illustration specifies each cable used on the EM 122 Transceiver Unit. References are made to detailed cable drawings.

Note that this information includes several cables that may not be in use on all installations.

Figure 20 Transceiver Unit - Cable plan



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C17 - Transceiver Unit RJ-45 interface

Refer to the Operator Station cabling.

C19 - Synchronisation

An external system may be used to synchronise the echo sounder's transmissions. This system is connected to the Remote plug on the Transceiver Unit.

In most cases, an external junction box is located in the vicinity of the Operator Station to facilitate on/off control. The synchronisation system may then be connected to this junction box, or directly to the Remote plug.

The cable must be provided by the installation shipyard.

See *EM Remote synchronization and On/Off* on page 136

C20 / C21 / C22 / C23 - Serial lines 1 - 4

The Transceiver Unit is equipped with four serial lines. All connectors are 9-pin male D-sub connectors.

The serial lines are normally set up as follows:

- Serial Port 1 - Positioning systems
- Serial Port 2 - Motion sensor
- Serial Port 3 - Auxiliary 1
- Serial Port 4 - Auxiliary 2

The cables must be provided by the installation shipyard.

See *Generic RS-232 Serial line* on page 133

C24 - Remote

In most cases, an external junction box is located in the vicinity of the Operator Station to facilitate on/off control. The cable from this box is connected to the Remote plug on the Transceiver Unit.

The cable must be provided by the installation shipyard.

See *EM Remote synchronization and On/Off* on page 136

C25 - 1PPS

This is a timing signal terminated in a coax connector.

The cable must be provided by the installation shipyard.

C28 - Ethernet cable RJ-45

This interface RJ-45 ethernet cable are used for the raw data logger.

C29 - Ethernet RJ-45 interface

An ethernet RJ45 cable to motion sensor for velocity input needed for doppler compensation in FM mode.

Transducer cables

The transducer cables are supplied by the manufacturer. Note that the number of transducer cables depend on the chosen system resolution.

Transceiver Unit sub-racks – front view

The cabling at the front of the TRU is installed at the factory.

Internal cabling

Internal cabling made at the factory:

1 Front side:

- Ethernet cables that connects the different plug in boards.

2 Rear side:

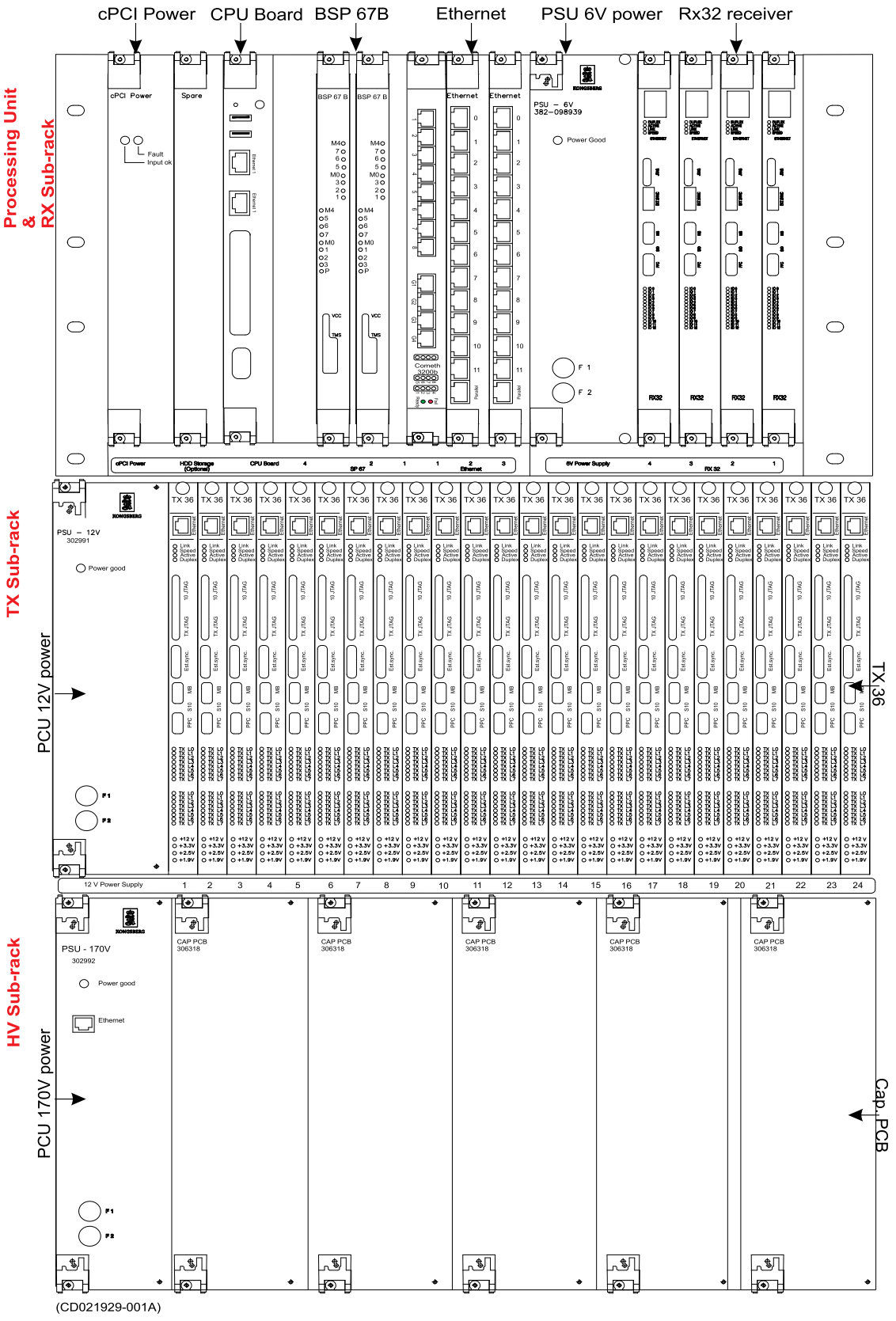
- Two control signal cable between sub-racks
- AC power cables between the sub-racks

During the installation the following cables must be mounted at the rear side:

- Serial cables to external sensors
- Ethernet cable to the Operator station
- Ethernet cable to external motion sensor
- Transducer cables
- AC input cables
- Remote control cable (if required)

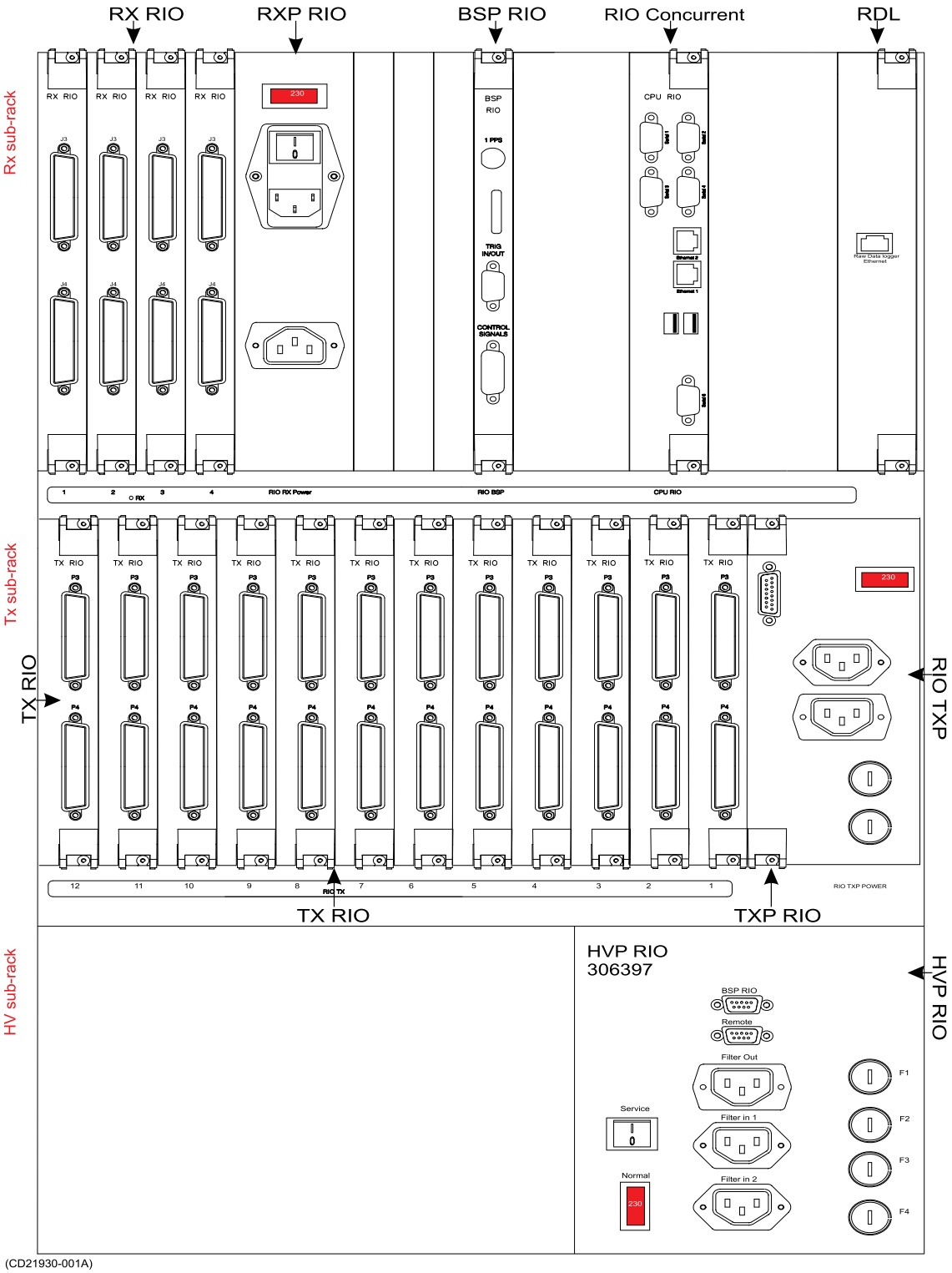
The cabling at the front of the TRU is installed at the factory.

Figure 21 Transceiver Unit sub-racks, front view



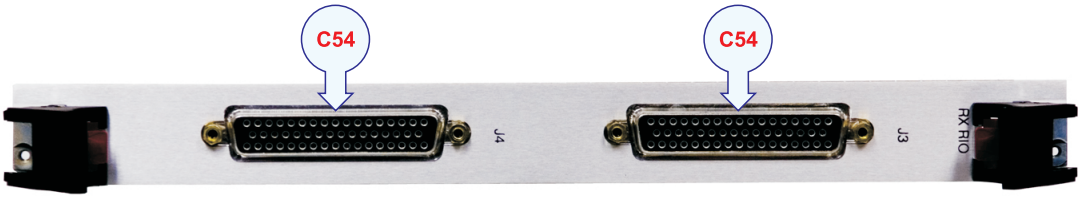
Transceiver unit sub-racks – rear view

Figure 22 Transceiver Unit sub-racks, rear view



RX RIO – Rear Interface Board

Figure 23 RX RIO



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External connections

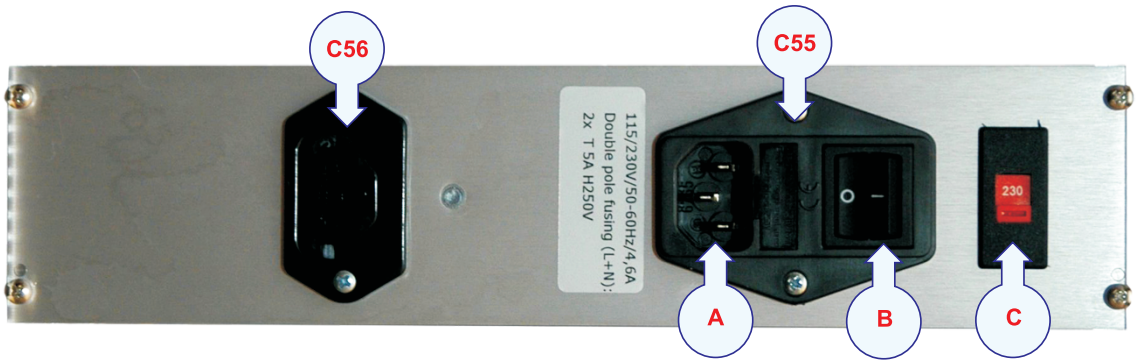
- **C54 - Preamplifier interconnection cables**

  This is a RX transducer cable terminated in a 50-pin D-sub connector.

  Each RX RIO board connects to the Preamplifier Unit.

RXP RIO – Rear Interface Board

Figure 24 RXP RIO



External connections

- **C55 – AC power**

  A AC power

  B Power On/off, normally set to on

  C Switch – 115/230 V for the fan unit

  This is a 115/230 Vac AC mains cable. Cable C55 is equipped with a 3-pin IEC female socket.

  C55 connects to the TXP RIO board and the cable are provided by the manufacturer.

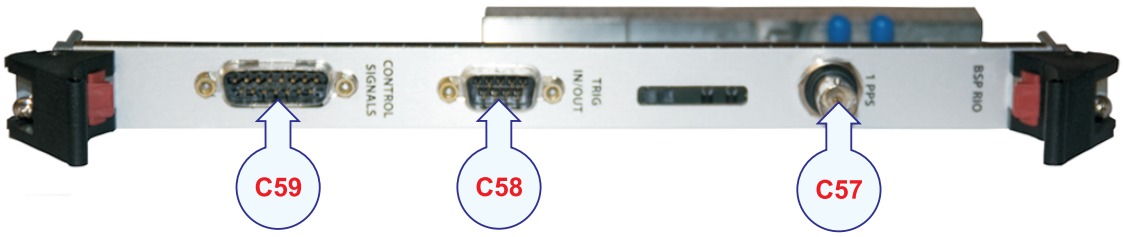
  For cable details, see *Standard AC power cable* on page 140

- **C56 – AC power**

  normally not used

BSP RIO – Rear Interface Board

Figure 25 BSP RIO



External connections

- **C57 - 1PPS from external sensor**

  This is a standard coaxial cable with a BNC plug. It is used to provide a 1PPS timing signal.

  For cable details, see *Generic coax cable* on page 135.

- **C58 - Trigger in/out to HVP RIO**

  This cable is equipped with a standard 9-pin D-sub connector. The interface is used to synchronize the echo sounder's transmissions with other acoustic instruments.

  This interface is connected to HVP-RIO C80 installed by the manufacture.

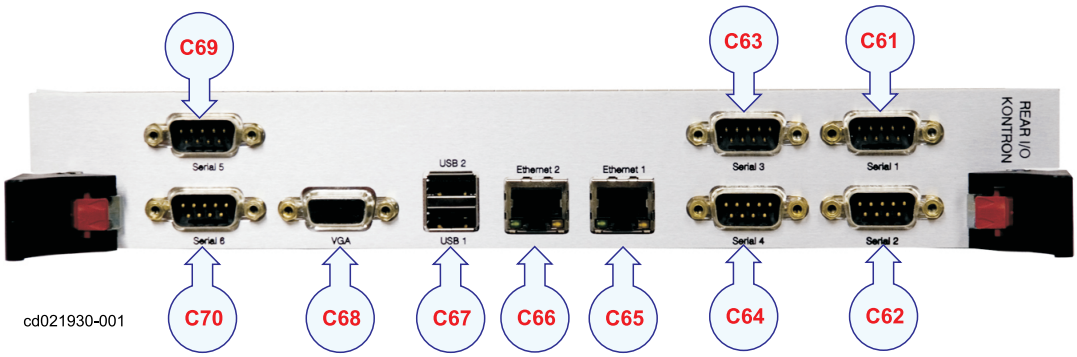
  For cable details, see *Trigger in/out* on page 137.

- **C59 - Control signals to TXP RIO**

  This cable is connected to TXP RIO (C71) and it is installed by the manufacturer.

Rear I/O Interface Board (Concurrent)

Figure 26 I/O Interface Board



External connections

- **C61 / C64 - Serial lines 1 - 4**, 9 pin D-sub, RS232

  These cables are equipped with 9-pin connectors. These interfaces are used for connection to external sensors (position, attitude etc.).

  The serial lines are normally set up as follows

  – **Serial Port 1** - Positioning systems

  – **Serial Port 2** - Motion sensor

  – **Serial Port 3** - Auxiliary 1

  – **Serial Port 4** - Auxiliary 2

- **C65 / C66 - Ethernet**, RJ45

  – **C65 – Ethernet 1** to operator station.

  – **C66 – Ethernet 2** is a velocity input from motion sensor. This input is needed for doppler compensation in FM mode.

- **C67 - USB**

  The USB cable is equipped with a standard USB2 connector and it is only used for system testing by Kongsberg Maritime personnel.

- **C68 - VGA**

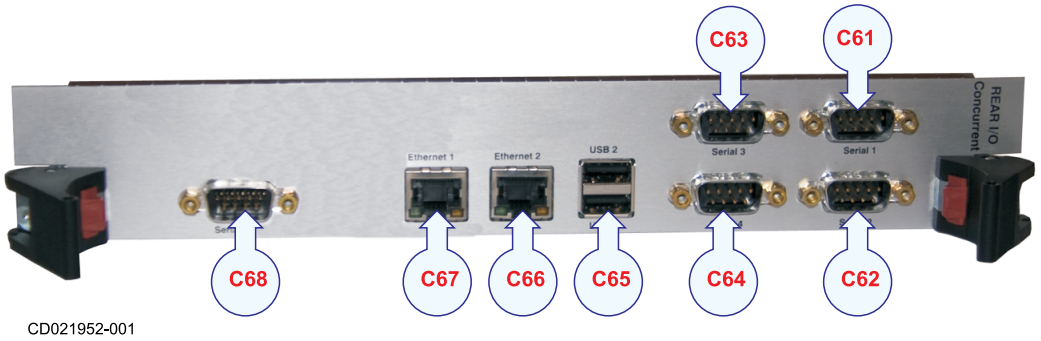
  This cable is equipped with a standard 15-pin D-sub connector. This interface is only used for system testing by Kongsberg Maritime personnel.

- **C69 / C70 - Serial lines 5 and 6**, not used.

  These cables are equipped with standard 9-pin D-sub connectors.

Rear I/O Interface Board Concurrent

Figure 27 I/O Interface Board



External connections

- **C61 / C64 - Serial lines 1 - 4**, 9 pin D-sub, RS232

  These cables are equipped with 9-pin connectors. These interfaces are used for connection to external sensors (position, attitude etc.).

  The serial lines are normally set up as follows

  – **Serial Port 1** - Positioning systems

  – **Serial Port 2** - Motion sensor

  – **Serial Port 3** - Auxiliary 1

  – **Serial Port 4** - Auxiliary 2

- **C65 - USB**

  The USB ports are equipped with two standard USB2 connectors and it is only used for system testing by Kongsberg Maritime personnel.

- **C66 / C67 - Ethernet**, RJ45

  – **C66 – Ethernet 1** to operator station.

  – **C67 – Ethernet 2** is currently used for velocity input from motion sensor. This input is needed for doppler compensation in FM mode.

- **C68 / - Serial line** , not used.

  This port is equipped with a standard 9-pin D-sub connector and it is only used for system testing by Kongsberg Maritime personnel.

Raw data logger interface (RDL)

Purpose and description

This is a Gigabit Ethernet output for a raw data logger option. This “unit” is connected internally to the TRU GBit switch board.

Figure 28 RDL board

External connections

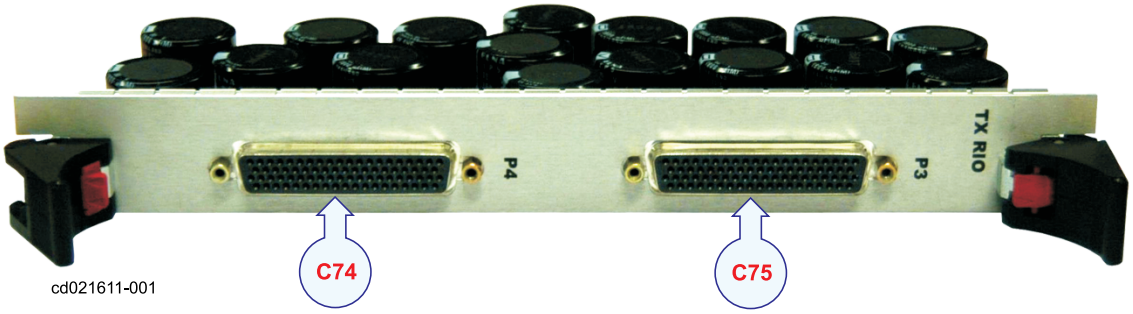
- **C85 - Ethernet**

  Ethernet cable to an optional Raw data logger.

  Ethernet cable with RJ45 on page 141

TX RIO – Rear Interface Board

Figure 29 TX RIO



External connections

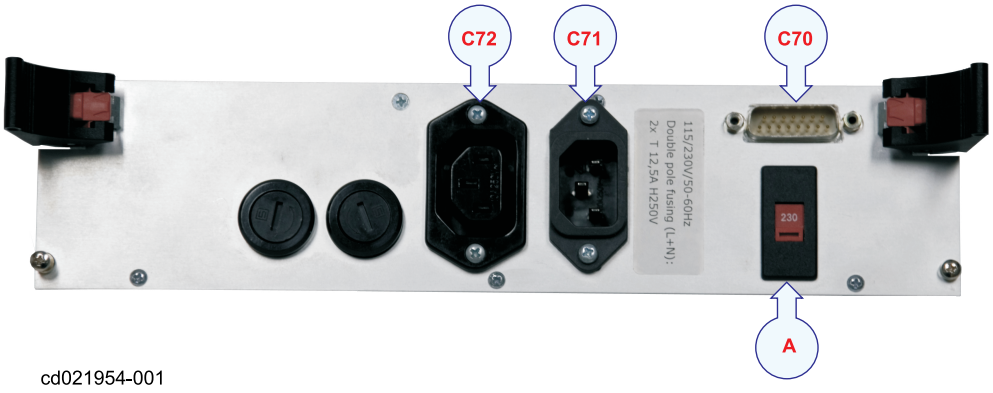
- **C74 / C75 - TX transducer**

  via junction box

  These are TX transducer cables terminated in 50-pin D-sub connectors. Each TX RIO board connects to two TX transducer cables.

TXP RIO – Rear Interface Board

Figure 30 TXP RIO



Power switch

- **A - AC power selector** for the fan unit

External connections

- **C70 - Control signals connected to the BSP RIO board**

  This cable is equipped with a standard 15-pin D-sub connector and is connected to the BSP RIO board. The interface is used for internal synchronization signals. This cable is provided by the manufacturer.

  For cable details, see *Internal control signals* on page 138.

- **C71 / 72 - AC power connected to the HVP RIO**

  These are 115/230 Vac AC mains cables. The cables are equipped with a 3-pin IEC socket. C72 connects to the RXP RIO board. C71 connects the HVP RIO in the HV sub-rack. The cables are installed by the manufacturer.

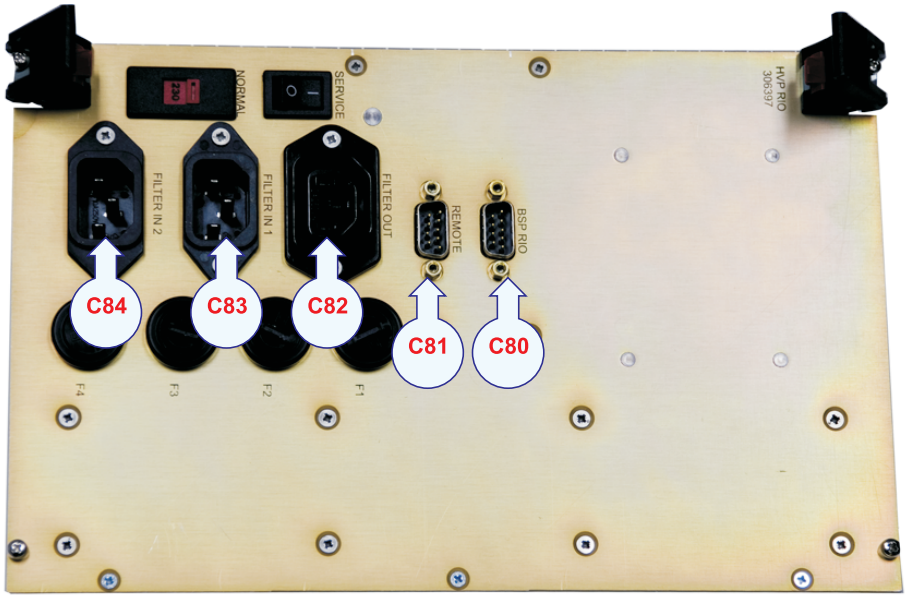
  For cable details, see *Standard AC power cable* on page 140

HVP RIO

Purpose and description

This is a rear I/O module with the following features

Figure 31 HVP RIO



The following cables can be connected to the circuit board.

External connections

- **C80 – BSP RIO (sync. signals)**

  This is a link signal to BSP RIO Trig in/out (C58) with a 9–pins connector.

  The cable is installed by the manufacturer.

- **C81 – Synchronisation and Remote Control**

  This cable is equipped with a standard 9-pin D-sub connector. The interface is used to connect to a remote On/Off power switch. It is also used for external trigger output and synchronization.

  An external system may be used to synchronise the echo sounder's transmissions. This system is connected to the Remote plug on the Transceiver Unit.

  In most cases, an external Remote Control junction box is located in the vicinity of the Operator Station to facilitate on/off control. The cable from this box is connected to the **Remote** plug on the Transceiver Unit.

  The cable must be provided by the installation shipyard.

- **C82 - Filtered AC power output connected to TXP-RIO**

  Power supply male equivalent socket connected to RIO TXP. The cable is installed by the manufacturer.

- **C83 / C84 - Mains AC power input**

  These are 115/230 Vac AC mains cables to the Transceiver Unit. Cable C83 and C84 must be equipped with a 3-pin IEC female socket.

  C83 and C84 must be connected to the ship's local power supply.

  The cables must be supplied by the installations shipyard.

  Note

  The TRU is normally used for 230V AC. For 115V AC, swithces on HVP RIO, TXP RIO and RXP RIO must be set to correct position.

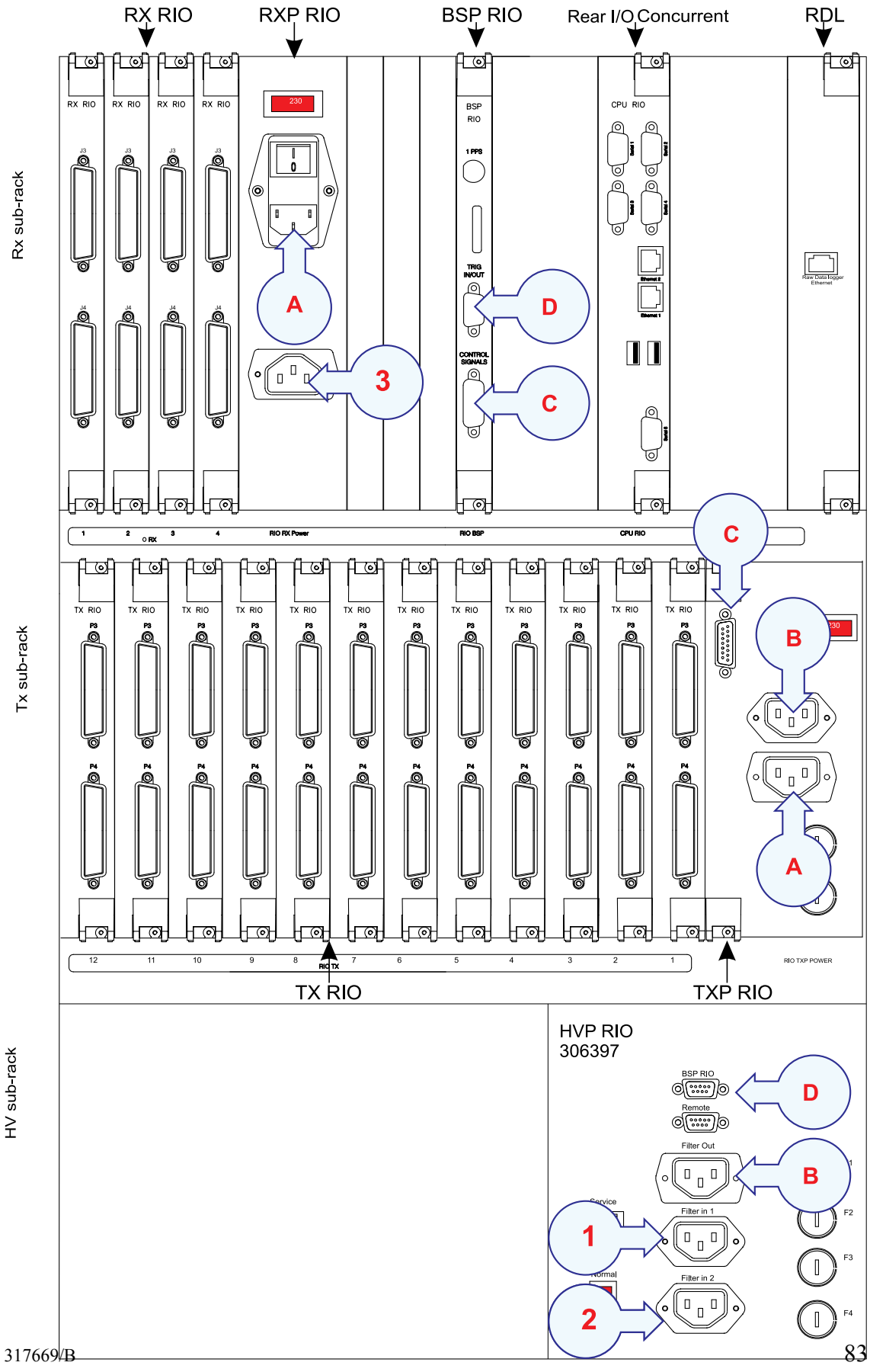
  Otherwise the equipment may be damaged.

Power and control cables between sub-racks - rear view

The *Transceiver Unit sub-racks, rear view* on page 83shows the power supply cable connection between the sub–racks, at the rear of the Transceiver Unit.

- Number 1 – 2 (see *Transceiver Unit sub-racks, rear view* on page 83) in the HV subrack must be connected to the ships main AC power supply.
- Number 3 is not used.

Figure 32 Transceiver Unit sub-racks, rear view



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- A Power cable between TxP Rio and RxP Rio

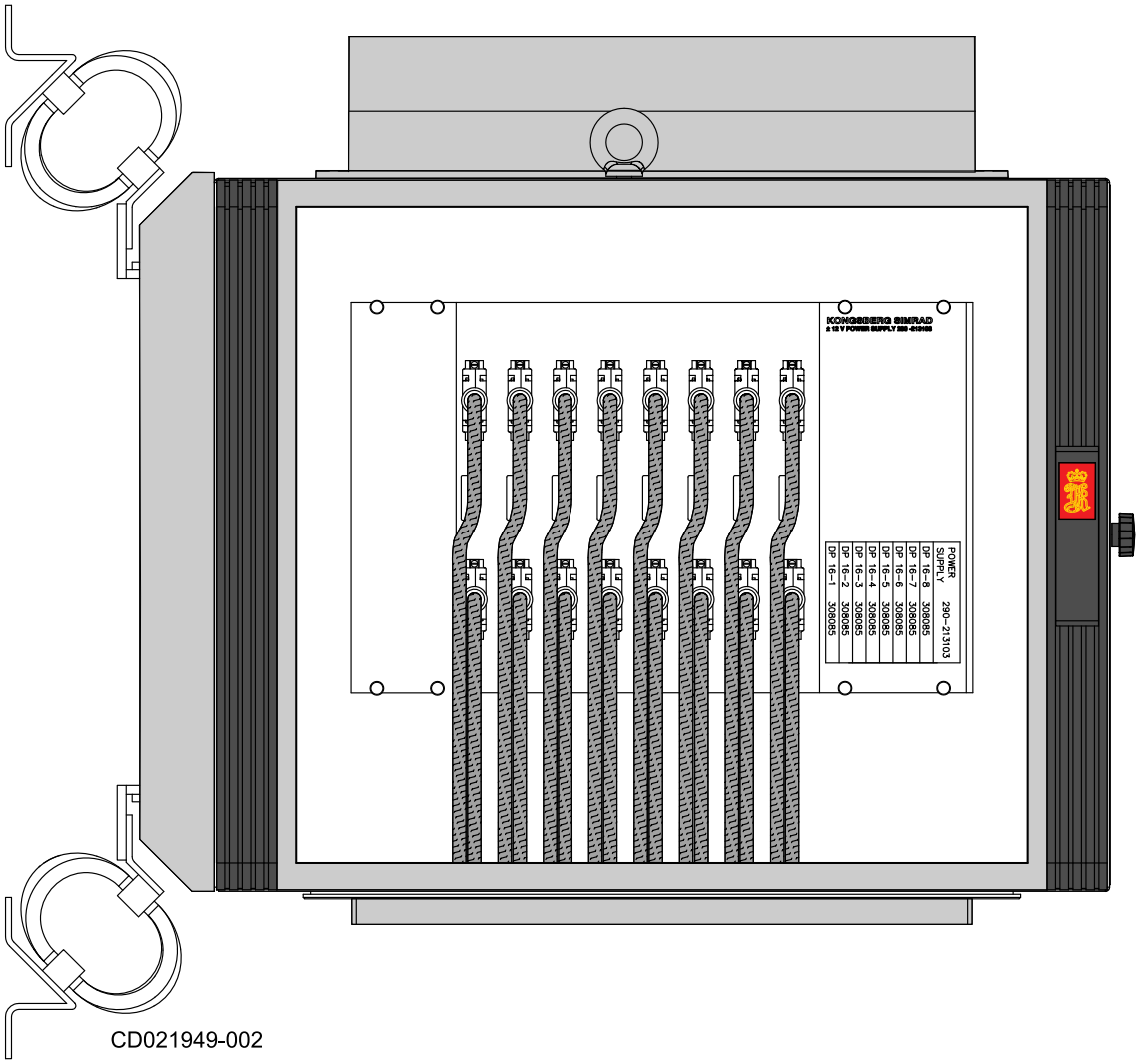
- B – Power cable between TxP Rio and HVP Rio
- C – Connection cable between TxP Rio and BSP RIO for control signals
- D – Connection cable between HVP Rio and BSP RIO for trig in/out signals

Preamplifier

Preamplifier – front view

The figure below shows the cable connection from underneath of the cabinet. Here will the receiver signal be transfer to the rear side of the Preamplifier Unit without cables to be connected.

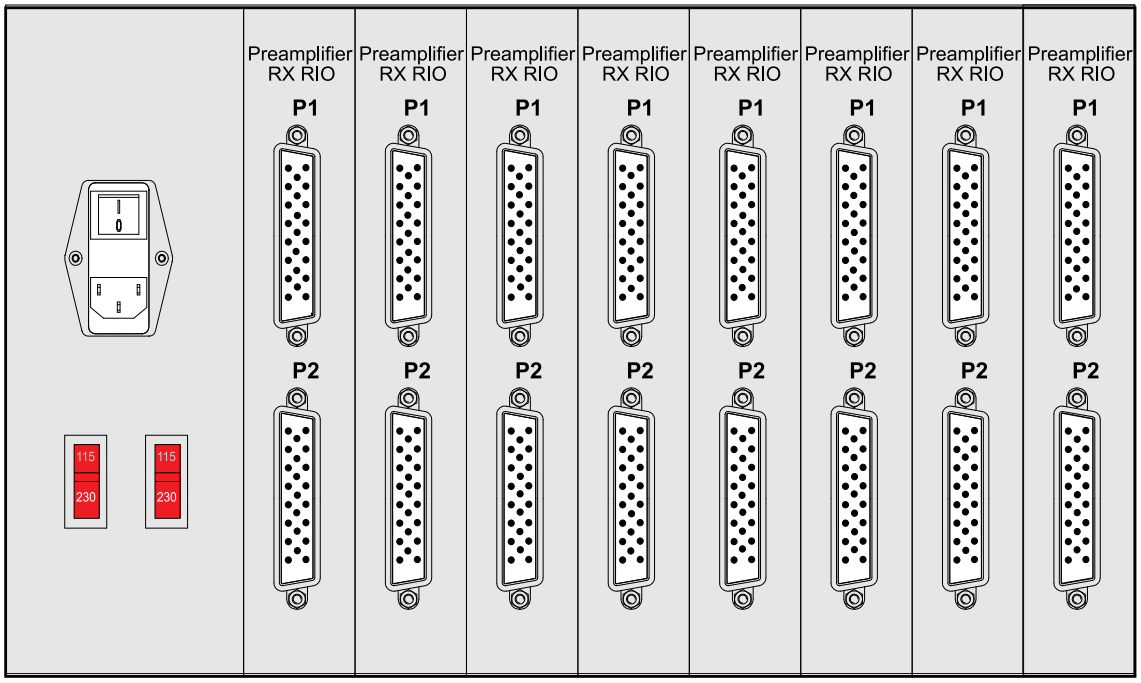
Figure 33 Preamplifier Unit - front view cabinet



The figure shows that the Preamplifier has 8 pcs of DP16 cards and 1 pc of Power supply 12 Volt.

Preamplifier – rear view

The figure shows where the receiver signal will be transferred to the SBP 300 through P1 connection. The P2 connection will transferred the receiver signal to the EM 302.



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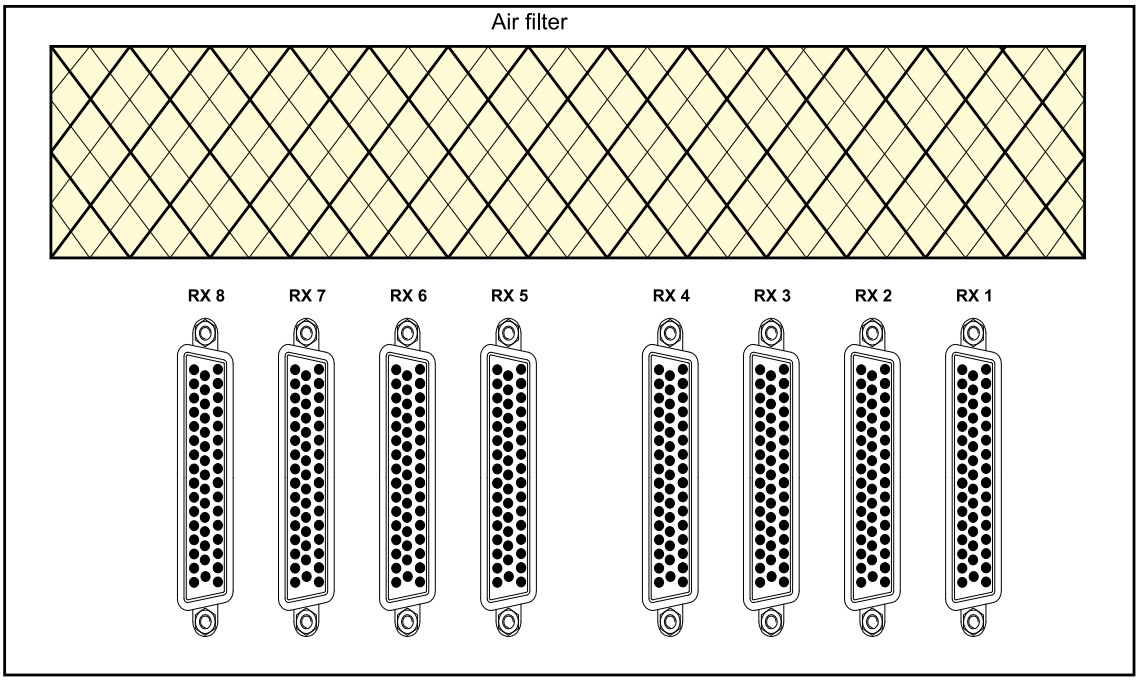
Preamplifier – underneath view

The figure shows where the cables from the receiver array (RX array) are connected to the Preamplifier Unit. The cable will be split from a 50 pins cable to a two 25 pins flat cables and will be connected in front of the Preamplifier Unit.

Figure 34 Preamplifier – underneath view



Transducer cables

The transducer cables between the TX Junction Boxes, Preamplifier Unit, Transceiver Unit and transducer arrays are all supplied by Kongsberg Maritime with the system.

For overview of the transducer cabling, see *Transducer cable layout* on page 122

The physical number of cables depends on the chosen system beamwidth as shown the following tables.

Table 1 TX Cables

TX Cables	
System beamwith	**Number of transducer modules = Number of cables from TX transducer array to TX Junction Box(es)**
0.5 degree	96
	Four TX Junction Boxes are used. Each of these are connected to the Transceiver Unit with 12 cables, making a total of 48 cables.
1 degree	48
	Two TX Junction Boxes are used. Each of these are connected to the Transceiver Unit with 12 cables, making a total of 24 cables.
2 degrees	24
	One TX Junction Box is used. This is connected to the Transceiver Unit with 12 cables.

Table 2 RX Cables

RX Cables	
System beamwith	**Number of transducer modules = Number of cables from RX transducer array to Preamplifier Unit**
1 degree	16
	The Preamplifier Unit is connected to the Transceiver Unit with 8 cables.
2 degrees	8
	The Preamplifier Unit is connected to the Transceiver Unit with 4 cables.
4 degrees	4
	The Preamplifier Unit is connected to the Transceiver Unit with 2 cables.

The following cable information is available both in the EM 122 installation and maintenance manuals. The cable markings are normally recorded in the installation manual first, and it is recommended to copy these records to the maintenance manual later.

Transmit array cables

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

TX<nnn>

where <nnn> is a numerical value.

The cables between the TX Junction Box(es) and the Transceiver Unit are identified as follows:

T<n>/<x>

where <n> is a number between 1 and 12 and <x> is a number between 13 and 24. In a 1–degree TX system, 12 cables are connected from each TX Junction Box to the Transceiver Unit. Two identical sets of cables are then provided, the first set (T1/13 to T12/24) are used from TX Junction Box no. 1 to sockets TX Rio 1 through TX Rio 6 on the Transceiver Unit. The second set is used from TX Junction Box no. 2 to sockets TX Rio 7 through TX Rio 12 on the Transceiver Unit.

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 tables provided in this chapter.

Note

In order to ensure proper operation by the EM 122 system, it is of vital importance that the physical location of the transducer modules fits the designated channel number in the transmit and receiver circuitry.

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

- Transducer module number 1 is always the most forward module.
- Module number 2 is the second forward, and so on.

During installation, you can select any TX module you wish and place them in random order in the frame. However, you **MUST** write down the serial number on each module in the order they have been positioned in the frame, so that you later can identify the modules in positions 1, 2, 3 and so on.

The connections to the TX Junction Box(es) are made with 25-pin “D-sub” connectors.

Note

During the installation of the transmit array, you must fill in the table below.

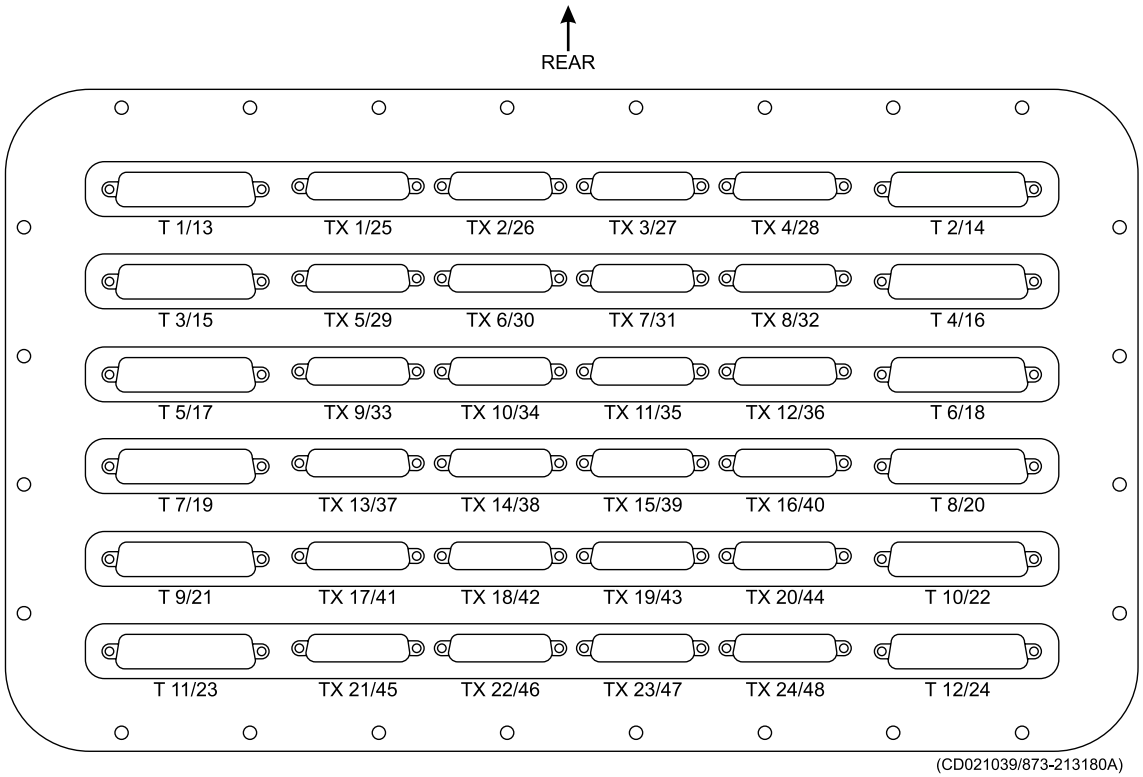
In a 2 degree system, you will only need the first 24 TX modules.

The cables from module 1 must point to port.

In a 0.5 degree system, you will need 96 TX modules and 4 junction boxes.

A “dummy” module shall be installed at each end of the TX transducer array.

Figure 35 Junction Box



Receive array cables

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

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 tables provided in this chapter.

Note

In order to ensure proper operation by the EM 122 system, it is of vital importance that the physical location of the transducer modules fits the designated module number in the transmit and receive circuitry.

R<n>

where **<n>** is a number between 1 and 8.

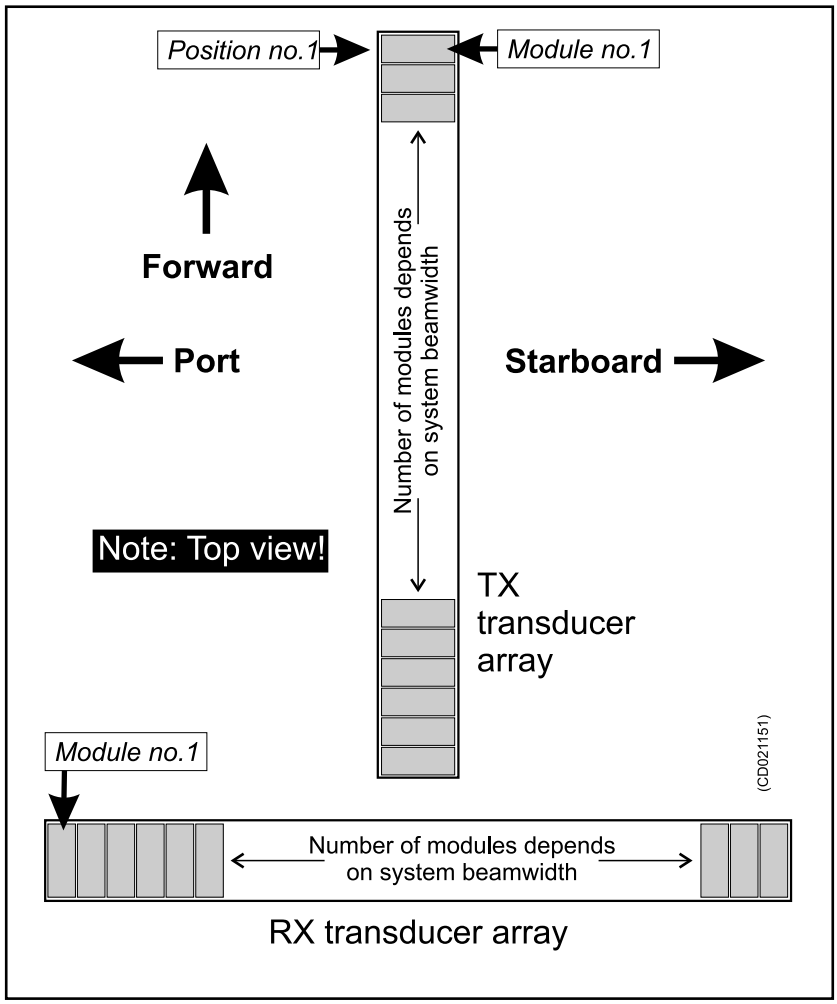
The RX transducer array is physically positioned in athwartship direction under the hull.

- Transducer module number **1** is always the first on the port side.
- Module number **2** is the second on the port side, and so on.

Location of the first module in each array (example) on page 90

During installation, you can select any RX module you wish and place them in random order in the frame. However, you **MUST** write down the serial number on each module in the order they have been positioned in the frame, so that you later can identify the modules in positions 1, 2, 3 and so on.

Figure 36 Location of the first module in each array (example)



Note

During the installation of the receiver array, you must fill in the table below.

Cables between TX Junction Box(es) and Transceiver Unit for 0.5 degree

The signal cabling between the TX Junction Box(es) and the Transceiver Unit is made with 24 individual cables.

The number of cables depends on the chosen TX system beamwidth.

For every two transducer cables connected to the Junction Box, one cable is passed on to the Transceiver Unit. The connections on both units are made with 50–pin “D-sub” connectors. The cables and corresponding sockets are identified as listed in the table.

Table 3 TX Junction Box(es) and Transceiver Unit Cabling

TX Junction Box(es) and Transceiver Unit Cabling			
Module	**TX Junction Box output socket and cable ID**	**Socket on Transceiver Unit**	**Input socket ID on TX Junction Box**
1	T1/13	TX Rio 1 – P3	TX 1/25
2			TX 2/26
3	T2/14	TX Rio 1 – P4	TX 3/27
4			TX 4/28
5	T3/15	TX Rio 2 – P3	TX 5/29
6			TX 6/30
7	T4/16	TX Rio 2 – P4	TX 7/31
8			TX 8/32
9	T5/17	TX Rio 3 – P3	TX 9/33
10			TX 10/34
11	T6/18	TX Rio 3 – P4	TX 11/35
12			TX 12/36
13	T7/19	TX Rio 4 – P3	TX 13/37
14			TX 14/38
15	T8/20	TX Rio 4 – P4	TX 15/39
16			TX 16/40
17	T9/21	TX Rio 5 – P3	TX 17/41
18			TX 18/42
19	T10/22	TX Rio 5 – P4	TX 19/43
20			TX 20/44
21	T11/23	TX Rio 6 – P3	TX 21/45
22			TX 22/46
23	T12/24	TX Rio 6 – P4	TX 23/47
24			TX 24/48
TX Junction Box no. 2 (1 degree only)			
25	T1/13	TX Rio 7 – P3	TX 1/25
26			TX 2/26
27	T2/14	TX Rio 7 – P4	TX 3/27
28			TX 4/28
29	T3/15	TX Rio 8 – P3	TX 5/29
30			TX 6/30
31	T4/16	TX Rio 8 – P4	TX 7/31
32			TX 8/32
33	T5/17	TX Rio 9 – P3	TX 9/33
34			TX 10/34

Table 3 TX Junction Box(es) and Transceiver Unit Cabling (cont'd.)

TX Junction Box(es) and Transceiver Unit Cabling			
Module	**TX Junction Box output socket and cable ID**	**Socket on Transceiver Unit**	**Input socket ID on TX Junction Box**
35	T6/18	TX Rio 9 – P4	TX 11/35
36			TX 12/36
37	T7/19	TX Rio 10 – P3	TX 13/37
38			TX 14/38
39	T8/20	TX Rio 10 – P4	TX 15/39
40			TX 16/40
41	T9/21	TX Rio 11 – P3	TX 17/41
42			TX 18/42
43	T10/22	TX Rio 11 – P4	TX 19/43
44			TX 20/44
45	T11/23	TX Rio 12 – P3	TX 21/45
46			TX 22/46
47	T12/24	TX Rio 12 – P4	TX 23/47
48			TX 24/48

Figure 37 Transceiver Unit's rear panel TX

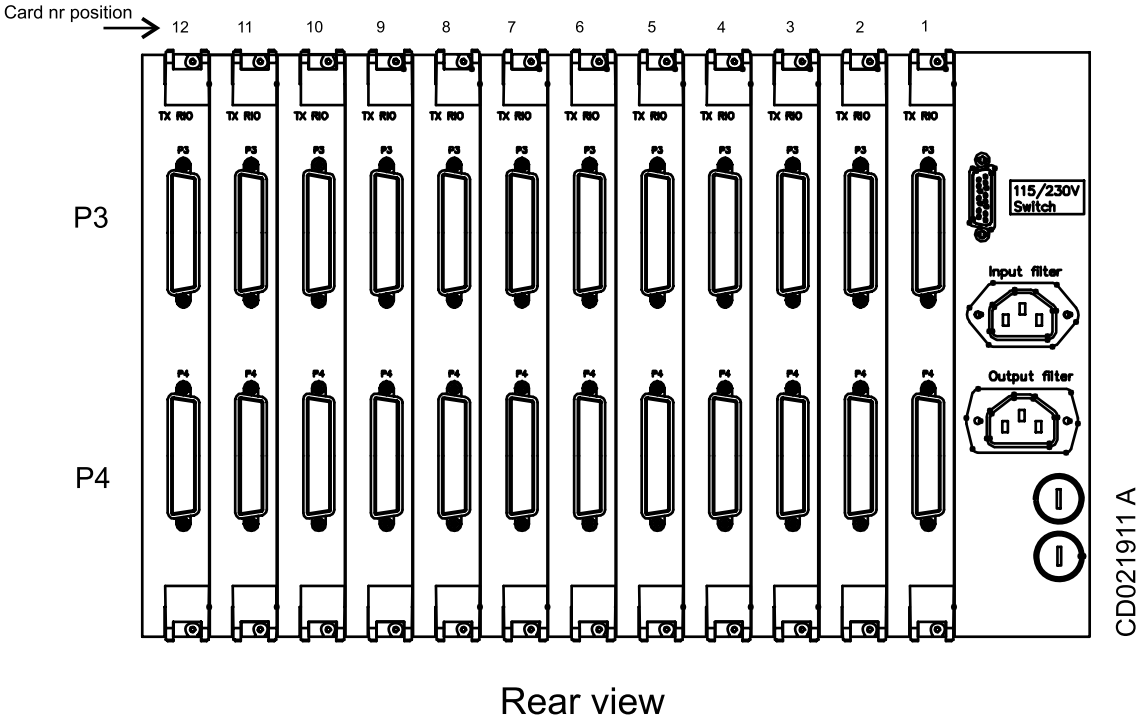
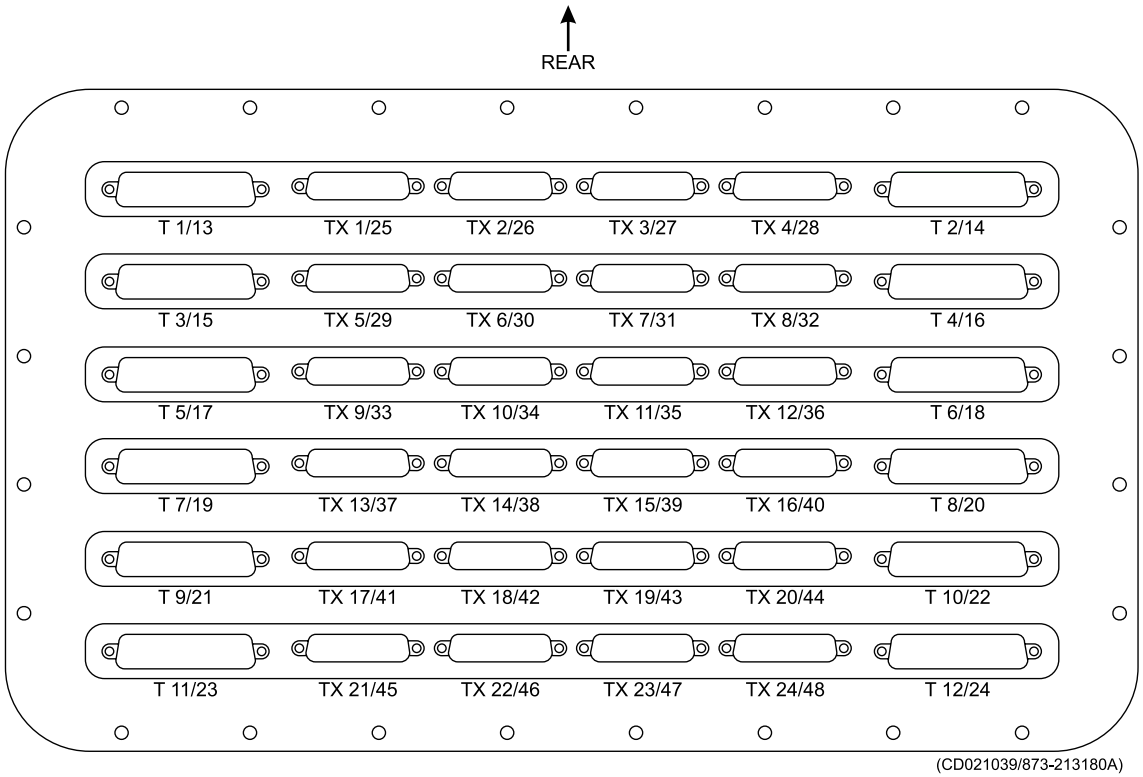


Figure 38 TX Junction Box



The signal cable between TX Junction box 1 and box 2 has to be connected from arrow A to B. The cable are supplied with the system.

Signal cable Junction box on page 146

Cables between Preamplifier Unit and Transceiver Unit

The signal cabling between the Preamplifier Unit and the Transceiver Unit is made with 8, 4 or 2 individual cables. The number of cables depends on the chosen RX system beamwidth.

For every two transducer cables connected to the Preamplifier Unit, one cable is passed on to the Transceiver Unit. The connections on both units are made with 50–pin “D-sub” connectors. The cables and corresponding sockets are identified as listed in the table.

Table 4 Preamplifier Unit and Transceiver Unit Cabling

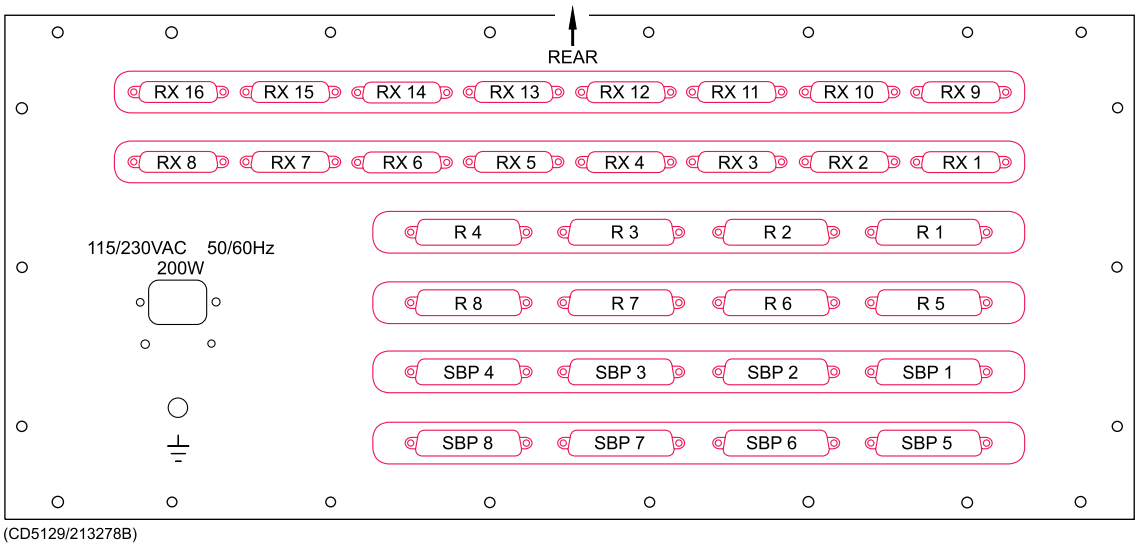
Preamplifier Unit to Transceiver Unit Cabling			
Module	**Input socket ID on Preamplifier Unit**	**Preamplifier Unit output socket and cable ID**	**Socket on Transceiver Unit**
1	RX 1	R1	RX Rio 1– J3
2	RX 2		
3	RX 3	R2	RX Rio 1 – J4
4	RX 4		

Table 4 Preamplifier Unit and Transceiver Unit Cabling (cont'd.)

Preamplifier Unit to Transceiver Unit Cabling			
Module	**Input socket ID on Preamplifier Unit**	**Preamplifier Unit output socket and cable ID**	**Socket on Transceiver Unit**
5	RX 5	R3	RX Rio 2 – J3
6	RX 6		
7	RX 7	R4	RX Rio 2 – J4
8	RX 8		
9	RX 9	R5	RX Rio 3– J3
10	RX 10		
11	RX 11	R6	RX Rio 3 – J4
12	RX 12		
13	RX 13	R7	RX Rio 4– J3
14	RX 14		
15	RX 15	R8	RX Rio 4 – J4
16	RX 16		

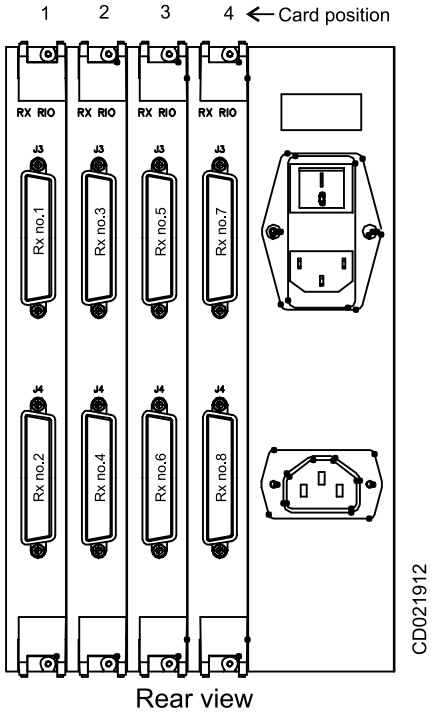
In a 1 degree RX system, all channels from 1 through 16 are used. In a 2 degree system, the first 8 channels are used, while the 4 degree system uses the first 4.

Figure 39 Preamplifier Unit



(CD5129/213278B)

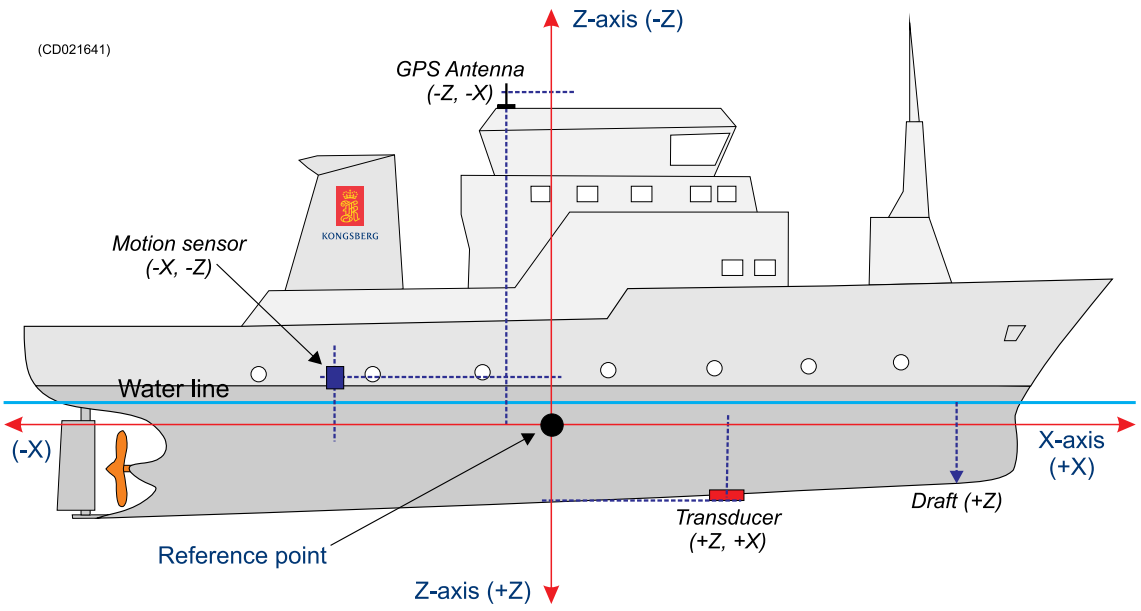
Figure 40 EM 122 Transceiver Unit's rear panel RX



alignment

Topics

Figure 41 Reference points



The EM 122 is a precision instrument for bathymetric swath mapping. To be able to produce data that are both detailed and correct, it is necessary to calibrate the survey vessel very well, and perhaps better than what may have been standard practice earlier.

The required calibration consists of:

- measurement of where sensors and transducers are located
- measurement of how sensors and transducers are oriented
- measurement of the water line vertical location
- alignment of angular measurement sensors
- determination of any offsets in sensor data
- determination of any time delays in sensor data

After the installation is completed in dock, a full set of alignment measurements must be carried out. This job has to be done by professional and experienced land surveyors, typically equipment is electronic total stations. Kongsberg Maritime can not be expected to have qualified personnel for such work.

The results, with all measurements taken in a common vessel coordinate system, are to be entered in the EM 122 Operator Station.

NB! Some external sensors may have been set up to output data referred to a location that differ from where it is physically mounted. It is the x, y, z values for this location that must be entered into the EM 122 Operator station.

Note

The given accuracies in the tables in this chapter, are maximum values, and if easily achievable, better accuracies should be obtained. The relative heading accuracy between Rx and Tx must be within ±0.1º.

All distance measurements are to done to an accuracy of 5 cm both horizontally and vertically.

The procedures and requirements made by the manufacturers of the external sensors connected to the EM 122 must also be taken into account.

Vessel coordinate system

A Cartesian coordinate system must be defined for the vessel. The following definition must be adhered to:

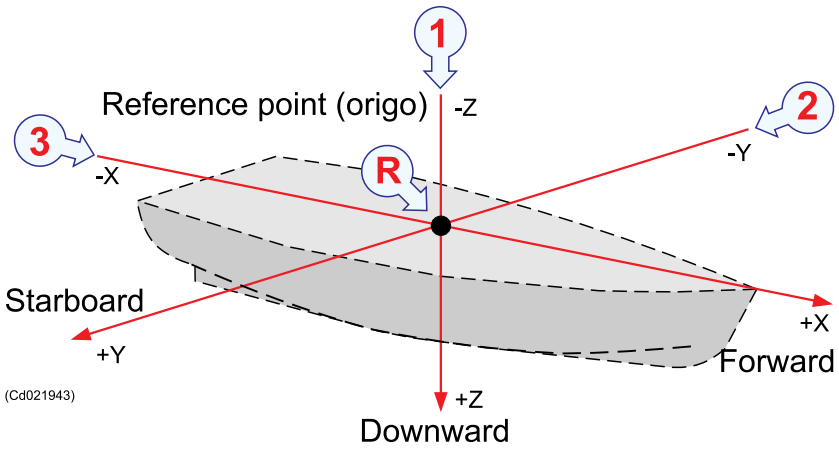
- X = forwards
- Y = to starboard
- Z = pointing downwards

There is no restriction on where the coordinate system's origo is located.

Note

The sea surface with the vessel in normal trim defines the horizontal (X-Y) plane. The water line should therefore be marked on the hull with the vessel in normal trim before dry docking for installation of transducers.

Figure 42 Reference points



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 XYZ coordinates in the vessel coordinate system.

Sensor location and alignment

Motion sensor

The system motion sensor is to provide the multibeam echo sounder with the angular orientation of the vessel coordinate system with respect to the gravity vector i.e. roll and pitch (usually the motion sensor also provides heave and sometimes heading). The motion sensor must thus know how it is oriented physically with respect to the vessel coordinate system. The motion sensor installation manual should be followed with respect to how this is to be achieved. If the sensor has input fields for how it is mounted, and the measurement of its orientation is feasible with an acceptable accuracy and effort, it is recommended that this done at the same time as the orientation measurements of the transducers is done. The final accuracy of the alignment of the sensor should in any case be evaluated and confirmed by examining the sensor measurement values when the vessel is in drydock with a known and accurately determined orientation. A calibration survey should afterwards be performed at sea to confirm correct performance.

The motion sensor must have a specified accuracy in roll and pitch of 0.02º or better. Any orientation measurements should be performed to this accuracy, as must the evaluation of the measurement data of the sensor. (Note that the most critical parameter is roll and a pitch accuracy of 0.05º is acceptable.)

The motion sensor must be aligned with the vessel centre line to an accuracy of 0.1º to avoid that crosscoupling between roll and pitch measurements degrades the accuracy.

The motion sensor should normally be mounted on the centre line of the vessel, either close of the multibeam transducers or close to the vessel's CG (Centre of Gravity).

The latter point is recommended if the sensor is used for other purposes than just the multibeam, or if its accuracy is sensitive to horizontal acceleration.

If there is any point in the fore-aft direction which does not change height with respect to the water line with changes in vessel speed, this will be the ideal location for the motion sensor as it will eliminate any errors from squat induced height changes which is not measured by current motion sensors.

Heading sensor

This sensor can either be based upon:

- GPS measurements like Seapath 300 or POS/MV
- Fibre optic gyro compass
- Standard gyro compass

The heading sensor dynamic accuracy should be in the order of one third of the transmit transducer beamwidth or better (i.e. 0.3º for a 1º beamwidth).

The sensor must be aligned to the vessel centre line to provide an accuracy better than a fifth of the transmit transducer beamwidth (i.e. 0.2º for a 1º beamwidth).

Compasses sensitive to acceleration should be mounted close to CG (Centre of Gravity)

Please see the sensor installation manual for any further instructions on installation and alignment.

The output of the sensor must be verified with the vessel having a known heading such as when it is in drydock. Alignment accuracy can also be evaluated with the vessel tied (in opposite directions) along a quay with known heading. A calibration survey should afterwards be performed at sea to confirm correct performance.

Positioning system

Most positioning systems are today based on Global Navigation Satellite System technology (GNSS) such as GPS, GLONASS and/or (later) GALILEO. The location of the positioning system, antenna must be measured, including its height (if geoide height is a measured and used parameter). It should be noted that some GNSS based systems use two (or more) antennas to provide vessel heading, if so the installation manual for the system should be consulted for how these antennae are to be aligned and how accurately the location of the antennae need to be measured.

Water line

With the vessel in normal trim, i.e with an indicated pitch angle of zero from the motion sensor, the distance to the waterline may be measured anywhere on the vessel. Otherwise it must be measured at the alongship physical location of the motion sensor. The measurement should be taken on both sides of the vessel and averaged to remove any roll effects. Simultaneous measurements are required if the vessel is moving.

Transducer Measurements

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. Note that it also necessary to ensure that the final transducer array face is flat with a maximum deviation from flatness of 5 mm peak to peak including any rotation.

Transducer heading

The heading of the transducers is measured as the average heading of the two fore-and-aft oriented sides of each transducer arrays. Thus, the heading of the transmit transducer is the heading of the long sides, while the heading of the receiver array is the heading of the short sides. For the receive transducer it may be better to measure the heading of the long sides, and then subtract 90º to achieve the correct value. The measurement accuracy is required to be within one fifth of the beamwidth of the transmit transducer. Note however that the measurement accuracy of the relative heading between the transmit and receive transducers must be better than 0.1º.

Transducer roll and pitch

Roll and pitch measurements are made according to standard conventions with positive pitch angle if the transmitter array's forward end is above the aft end (tilts up), and positive roll if the starboard side of the receiver array is lower than the port side.

Note that the roll and pitch angles to be measured are relative to the horizontal plane as defined by the vessel's coordinate system. i.e. for roll the angle that the transducer's y-axis have with respect to the horizontal and for pitch the angle that the transducers x-axis have with respect to the horizontal plane. The multibeam echo sounder converts the measured angles as entered into the installation menu to rotation angles before use i.e. do not do such a conversion before entering them into the system.

The measurement accuracy is given in the table

Table 5 Transducer roll and pitch

	Transmit transducer	Receive transducer
Roll	0.2º	0.02º
Pitch	0.05º	0.2º

Transducer position

The location of the centre of each transducer array face must be measured in the vessel coordinate system. This centre must be measured relative to the system reference point. Measurements must be done in the X, Y and Z directions on both transducers.

System calibration after final alignment

During the sea trials (SAT), calibration surveys are required as described in the EM 122 Operator Manual. Based on the calibration parameters determined from these surveys, together with the measurements done in the dry-dock, proper values are entered into the EM 122.

It is advisable to perform a calibration survey at regular intervals or prior to any large survey to check the performance of the sensors. If any sensor has been replaced or another navigation antenna is installed etc, a new calibration is required.

System test

Topics

After the installation has been performed and before the EM 122 system is brought into operation for the first time, a series of test procedures must be carried out to confirm a correct installation.

Some of the tests can be carried out on individual units once that particular unit has been installed. However, in the interests of safety and to avoid possible mistakes, it is recommended to set aside a period of time at the end of the installation phase specifically for the checks and tests. The entire set of tests can then be performed in sequence to ensure the entire system is comprehensively checked.

Note

If the test engineer is not satisfied with the quality of any part of the installation, he/she must contact the customer to have the work rectified and brought up to the required quality standards.

Which specific tests that are to be conducted are normally specified in the contract. In most cases, the following tests are performed

- Installation tests
  - These tests are performed during the installation work. The general procedures are given in this chapter. These tests take place before power is applied to the system.
- Setting To Work (STW)
  - This work is performed by the installation personnel from Kongsberg Maritime. All specific hardware and software units are checked, and the cabling is controlled.
- Harbour Acceptance Test (HAT)
  - This test is performed by the installation personnel from Kongsberg Maritime together with representatives from the customer and in some cases the installation shipyard.
- Sea Acceptance Test (SAT)

– This test takes place with the vessel in open sea. It is performed by the installation personnel from Kongsberg Maritime together with representatives from the customer and in some cases the installation shipyard. The purpose of the test is to check the functional specifications of the system during normal working conditions.

Visual inspection of units

Scope

WARNING

These checks must be completed before any power is switched onto the system.

After the physical installation has been carried out, all the system units must be visually checked to ensure that the EM 122 units have been installed correctly. You must ensure that the units have been mounted in the correct locations, correctly orientated (e.g. the right way up) and are correctly secured.

Operator Unit

Perform a close visual inspection of the unit according to the following procedure

1 Check that the unit is installed properly, secured, and that it is suitably orientated to enable easy operation.

2 Check that the unit is not damaged.

3 Make sure that appropriate slack has been applied to the cables.

4 Check that the air vents are not blocked.

5 Check the immediate environment around the unit. The operator should have easy access to a communication system, and it must be possible to dim and/or switch off the deckhead lights.

6 Checked (date/sign):_____

Transceiver Unit

Perform a close visual inspection of the EM 122 Transceiver Unit cabinet.

1 Check that the unit is installed in the correct location, and is suitably orientated to enable easy maintenance.

2 Check that the proper mounting bolts have been used, and that proper torque has been applied.

3 Check that the unit is not damaged.

4 Make sure that you have access to the internal part of the cabinet, from both sides, and that appropriate slack has been applied to the cables.

5 Check that the air vents are not blocked.

6 Check that the sonar room is equipped with proper light for maintenance work.

7 Check that the sonar room is equipped with the ventilation facilities required for continuous operation.

8 Checked (date/sign):_____

Preamplifier Unit

Perform a close visual inspection of the EM 122 Preamplifier Unit cabinet.

1 Check that the unit is installed in the correct location, and is suitably orientated to enable easy maintenance.

2 Check that the proper mounting bolts have been used, and that proper torque has been applied.

3 Check that the unit is not damaged.

4 Make sure that you have access to the internal part of the cabinet, from both sides, and that appropriate slack has been applied to the cables.

5 Check that the air vents are not blocked.

6 Check that the sonar room is equipped with proper light for maintenance work.

7 Check that the sonar room is equipped with the ventilation facilities required for continuous operation.

8 Check that the door and the forward part of the cabinet can open completely.

9 Checked (date/sign):_____

TX Junction Box 1

Perform a close visual inspection of the EM 122 TX Junction Box.

1 Check that the unit is installed in the correct location, and is suitably orientated to enable easy maintenance.

2 Check that the proper mounting bolts have been used, and that proper torque has been applied.

3 Check that the unit is not damaged.

4 Make sure that appropriate slack has been applied to the cables.

5 Check that the sonar room is equipped with proper light for maintenance work.

6 Check that the sonar room is equipped with the ventilation facilities required for continuous operation.

7 Checked (date/sign):_____

TX Junction Box 2

Perform a close visual inspection of the EM 122 TX Junction Box.

1 Check that the unit is installed in the correct location, and is suitably orientated to enable easy maintenance.

2 Check that the proper mounting bolts have been used, and that proper torque has been applied.

3 Check that the unit is not damaged.

4 Make sure that appropriate slack has been applied to the cables.

5 Check that the sonar room is equipped with proper light for maintenance work.

6 Check that the sonar room is equipped with the ventilation facilities required for continuous operation.

7 Checked (date/sign):_____

Electrical checks

Scope

This section of the manual contains the test procedures for the EM 122 system's power and signal interface cables.

WARNING

These checks must be completed before any power is switched onto the system.

Cabling

Visual cable inspection

Refer to the cable plans and interconnection diagrams, and check all power and interconnection cables. Any locally fitted plugs and connectors should also be checked to ensure that the correct types have been used for the specific locations. (Sealed or spark-proof connectors in areas where flammable gasses may accumulate, etc..)

Ensure that all cable connections have been made according to the cable plan, and that all connections are tight and secure. Ensure that all cables are correctly laid in conduits, or are otherwise protected according to the regulations and recommendations laid down by the vessel's registering authority. Ensure all protective covers are fastened correctly.

Cable connections and continuity

After the cable connections have been completed and the visual inspection has been carried out, all the cable cores must be checked for correct connection and continuity. Refer to the cable plans and interconnection diagrams, and check all interconnection cables. Any locally fitted plugs and connectors must be checked for shorts or open circuits. Ensure all cable connections have been made according to the cable plan, and that all connections are tight and secure.

The check procedure will require two engineers equipped with two-way communication devices; one will require continuity test equipment, while the other will require a suitable shorting strap.

Follow the check procedure below for each cable core

1. Position yourselves one at each end of the cable to be checked. Good communications must be established between you and your assistant.
2. Ensure that the cable to be tested is not connected to any power source.
   - If a cable terminates in a plug at the unit, the test will be more easily conducted if the plug is disconnected.
3. Select one pair of cable cores, and check that the cores are connected to the correct terminals in the unit.

4 Connect your continuity tester to the two terminals in question and check the continuity.
   - If a low resistance exists between the two cores, this may indicate the cores are connected to circuits or units with low internal resistance. If this is the case, disconnect the cores from the terminal block and test again.
   - The resistance should be nearing ∞ ohms.

5 Tell your assistant to short the two cores together. Repeat the previous test.
   - The resistance should be 0 (zero) ohms.

6 Tell your assistant to remove the shorting strap.
   - Check that the resistance reaches ∞ ohms again.

7 Check each core's resistance to ground, and each core's resistance to all the other cores in the cable.
   - All results should be close to ∞ ohms.

8 Assuming the test results are correct, the cores must be reconnected to the terminal block (if they had been removed), and the terminals checked to ensure they are tight.

9 On completion, move on to the next pair of cores and repeat the tests until the entire cable has been checked.

Operational voltage

Check that the operational voltages on the equipment match the power available on the vessel.

Final installation checks

After installation - but before un-docking - a number of verification must be done to check that the mechanical and electrical installation has been performed correctly.

Procedure

1. Check that the measured positions of the transducers, motion sensor and positioning system antenna are reasonable by comparing them with those estimated from the vessel drawings.
2. Check that the measured installation angles of the transducers is reasonable by comparing them with measurements done with a simple inclinometer.
3. Check that the specified sacrificial anodes have been mounted, and that any specified anti-fouling paint has been applied correctly.
4. Check that all system units have been fastened properly and that all nuts and bolts have been tightened properly.
5. Check that the data from the motion sensor, the heading sensor and the positioning system are correctly read by the EM 122 and that the values are reasonable before un-docing.

The steps in this procedure may be incorporated in the “Harbour Acceptance Test” carried out as a final check to test both the installation and the main functions of the system.

Drawing file

This chapter holds the drawings referenced to in the other sections of the manual.

- *System drawings* on page 109
- *Cable drawings* on page 131

Caution

The mechanical drawings/illustrations are for information and guidance only. They are not in scale.

DO NOT MANUFACTURE ANYTHING BASED ON THESE ILLUSTRATIONS – CONTACT OUR PROJECT DEPARTMENT FOR CORRECT DRAWINGS

All dimensions are in mm unless otherwise is noted.

Note that these drawings are not available in the electronic copy of this manual. The original installation drawings are available in PDF and/or AutoCad's DWG formats upon request.

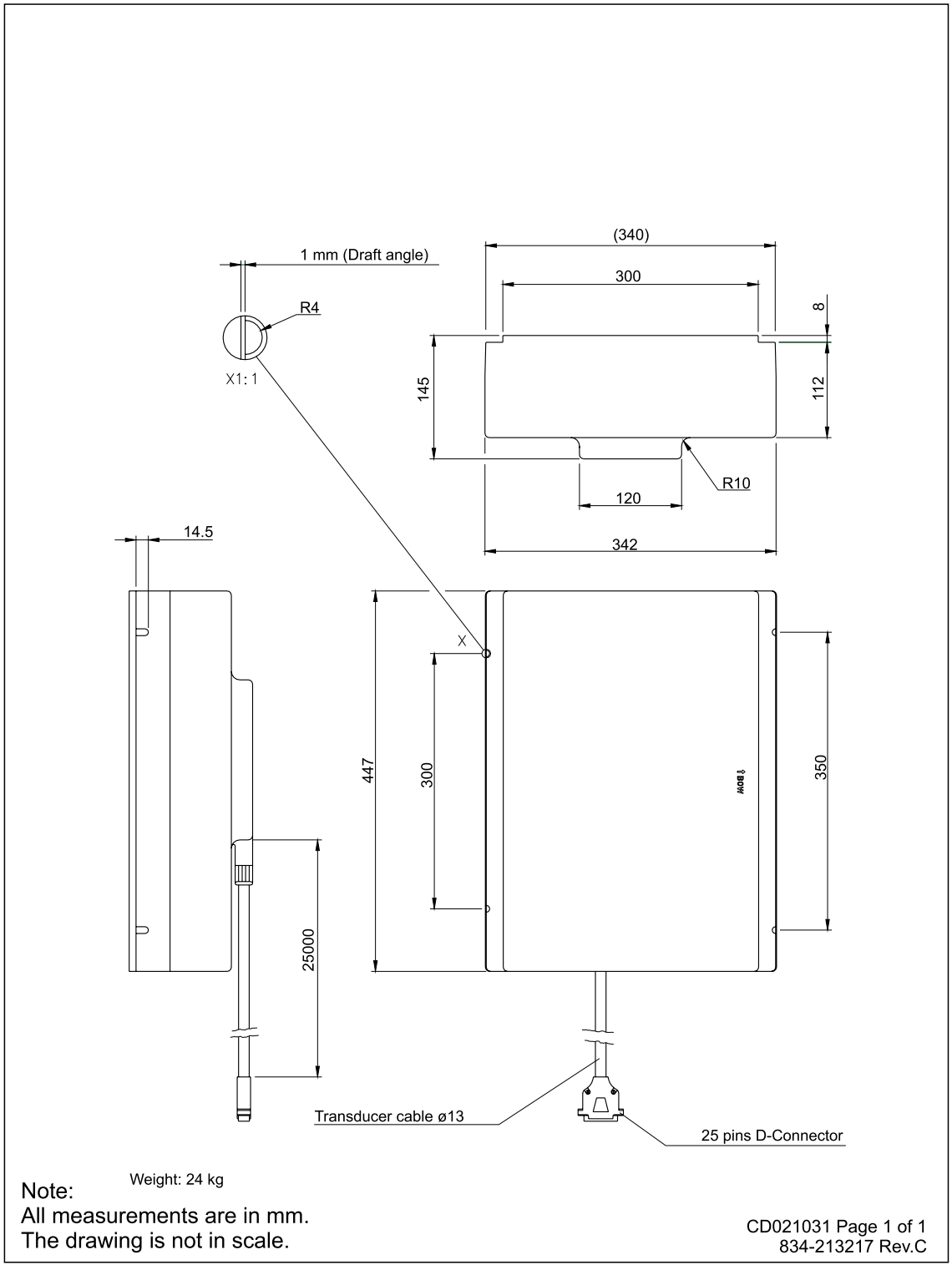
System drawings

System drawings

- *RX Module* on page 110
- *TX module* on page 111
- *TX array mounting frame assembly 0.5 degree* on page 112
- *TX array mounting frame assembly 1 degree* on page 113
- *TX array* on page 114
- *RX array* on page 116
- *RX array with casing – 2 degree* on page 117
- *Preamplifier* on page 119
- *TX Junction Box* on page 121
- *Transducer cable layout* on page 122
- *Operator station and display* on page 128

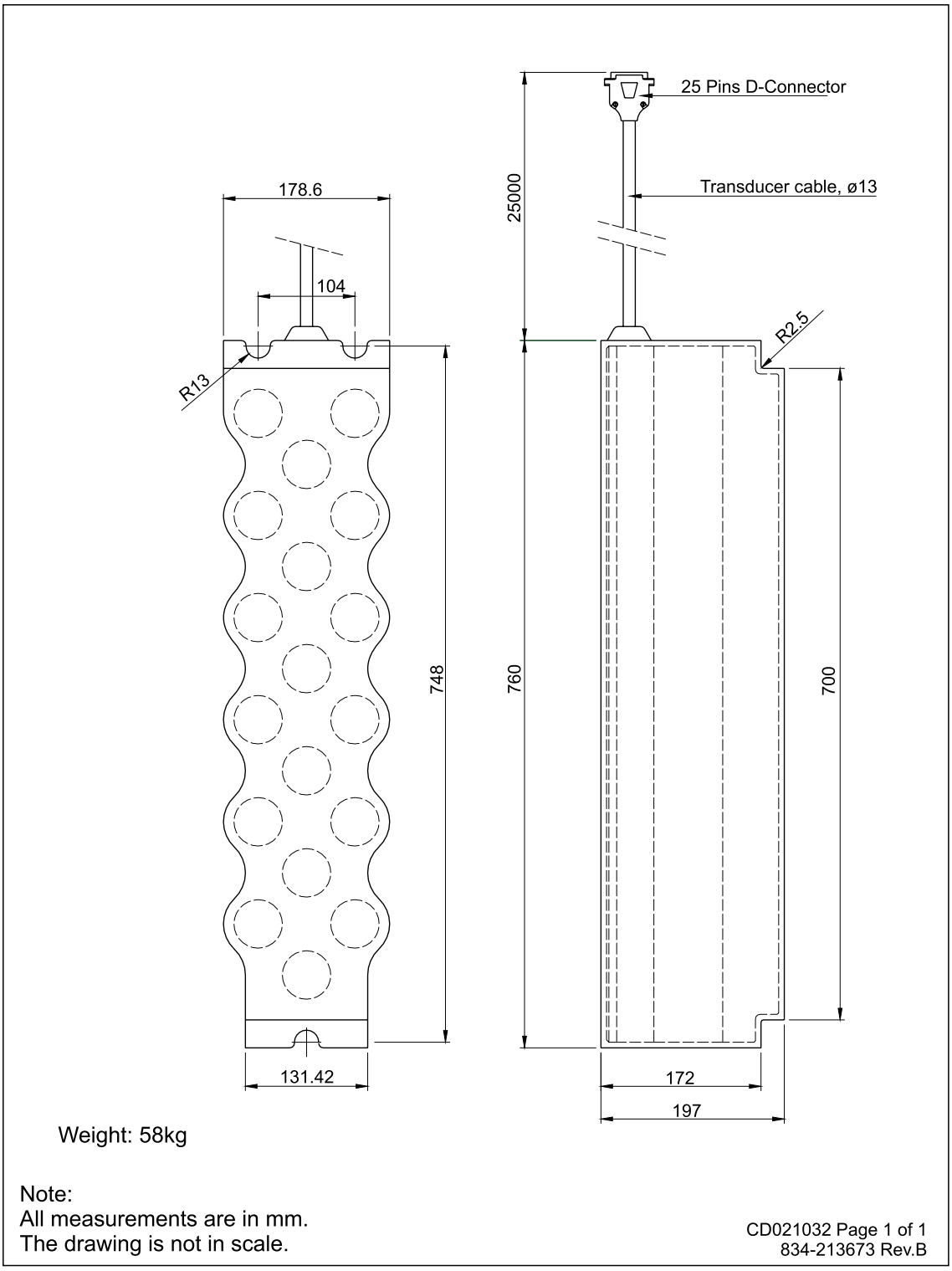
RX Module

Figure 43 RX Module, outline dimensions



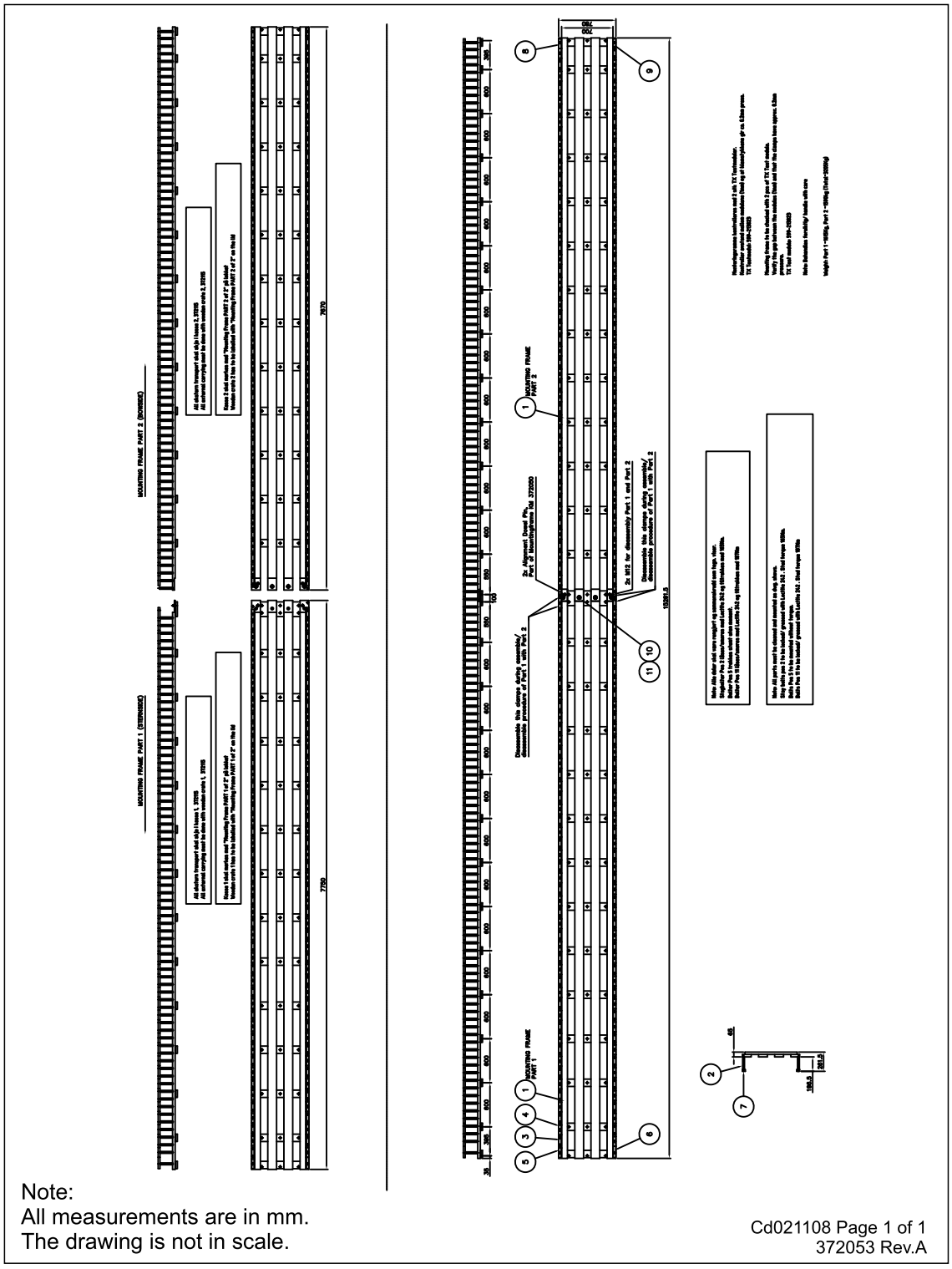
TX module

Figure 44 TX module – outline dimensions



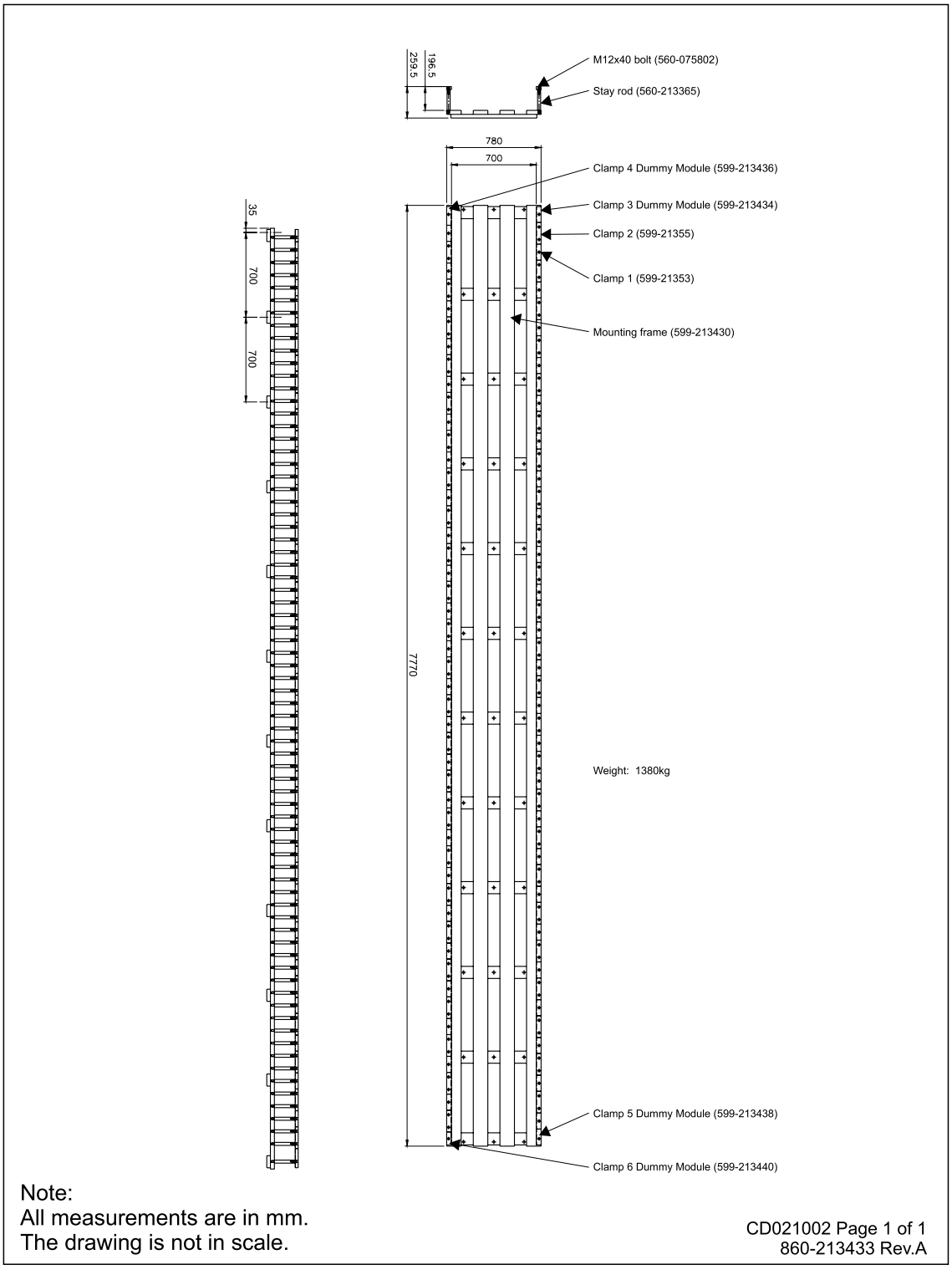
TX array mounting frame assembly 0.5 degree

Figure 45 TX array mounting frame assembly 0.5 degree



TX array mounting frame assembly 1 degree

Figure 46 TX array mounting frame assembly 1 degree



TX array

Figure 47 TX array with casing and modules – 1 degree

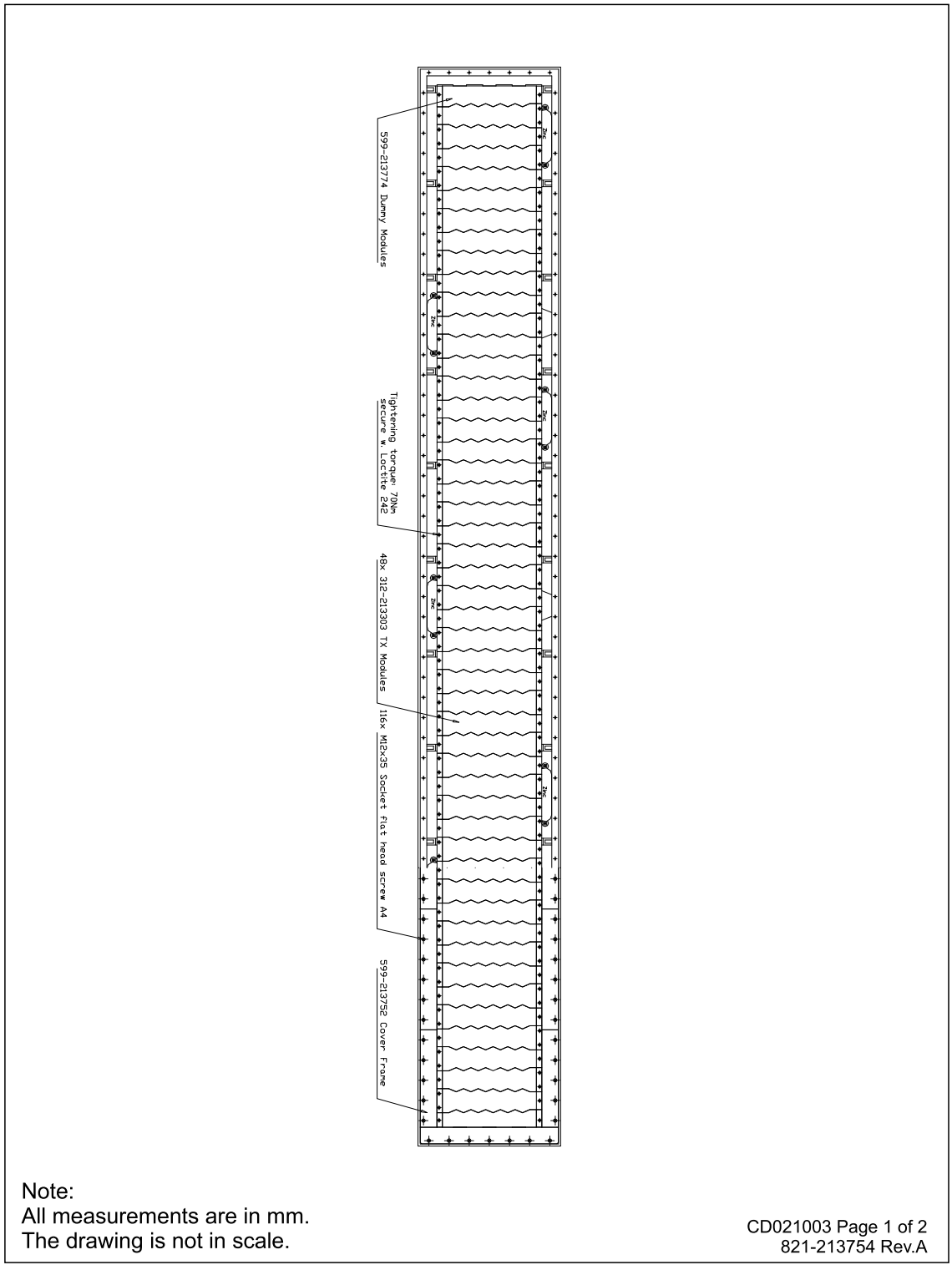
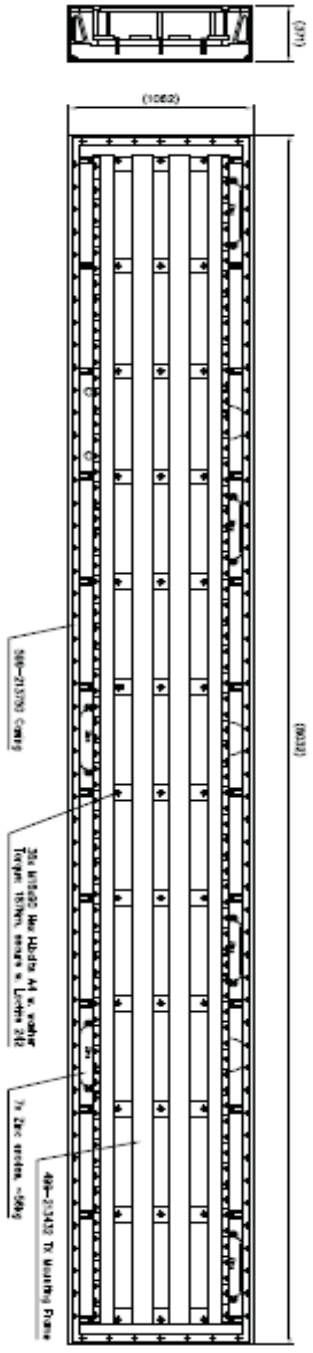


Figure 48 TX array with casing and mounting frame – 1 degree



Note:
All measurements are in mm.
The drawing is not in scale.

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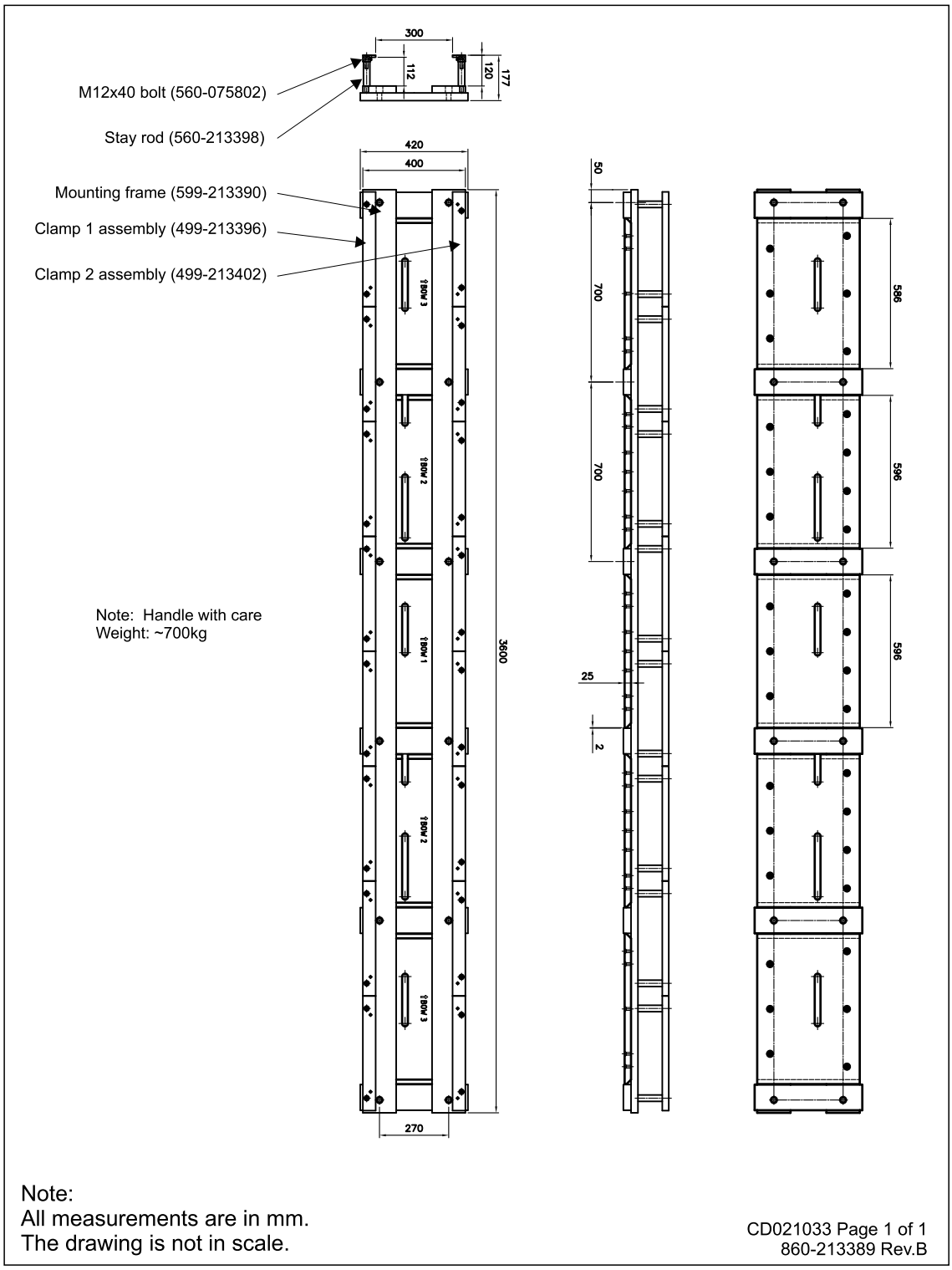
RX array

Figure 49 Mounting frame assembly with baffle plates – RX array 2 degree



RX array with casing – 2 degree

Figure 50 RX array with casing and modules – 2 degree

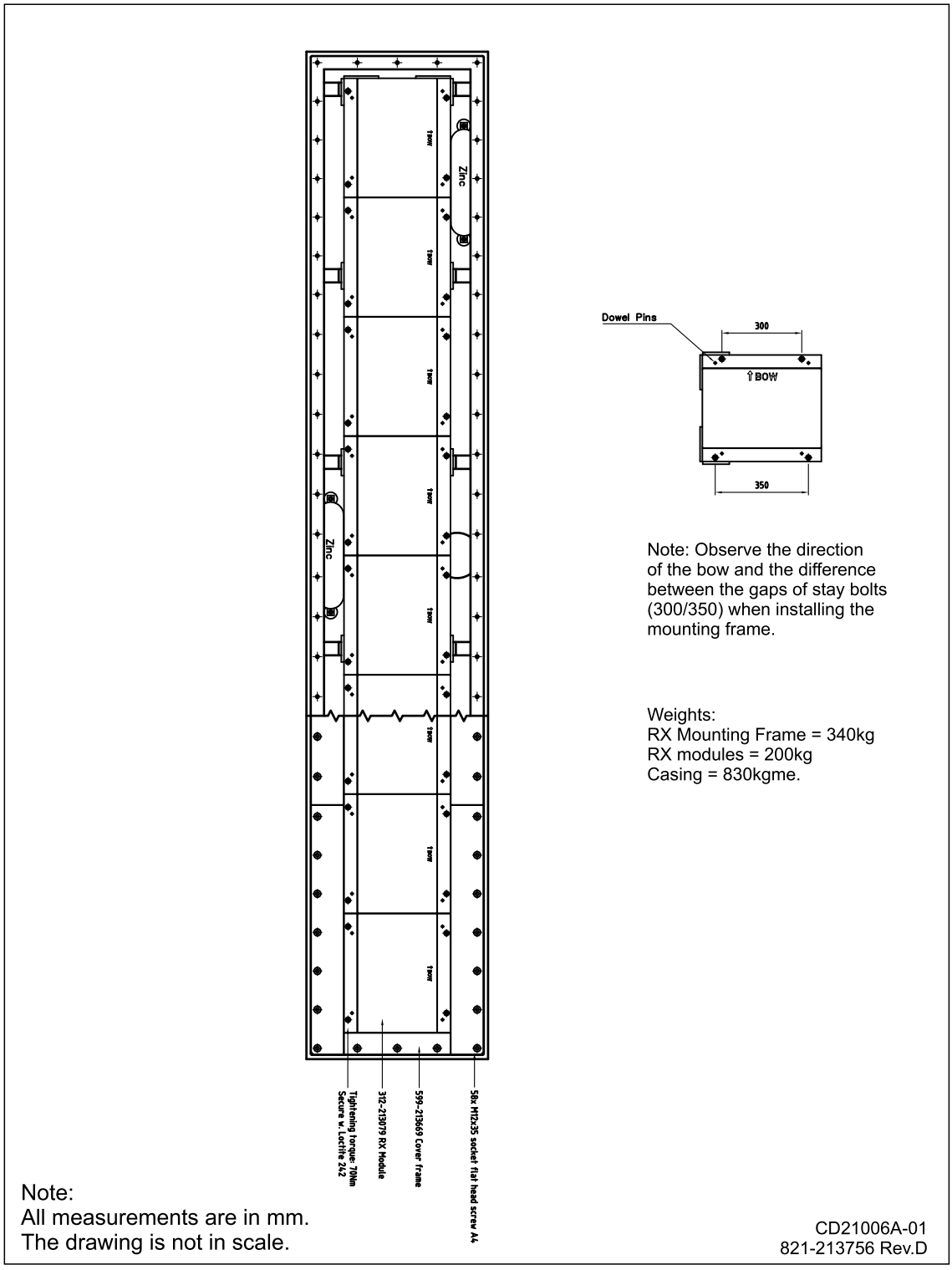
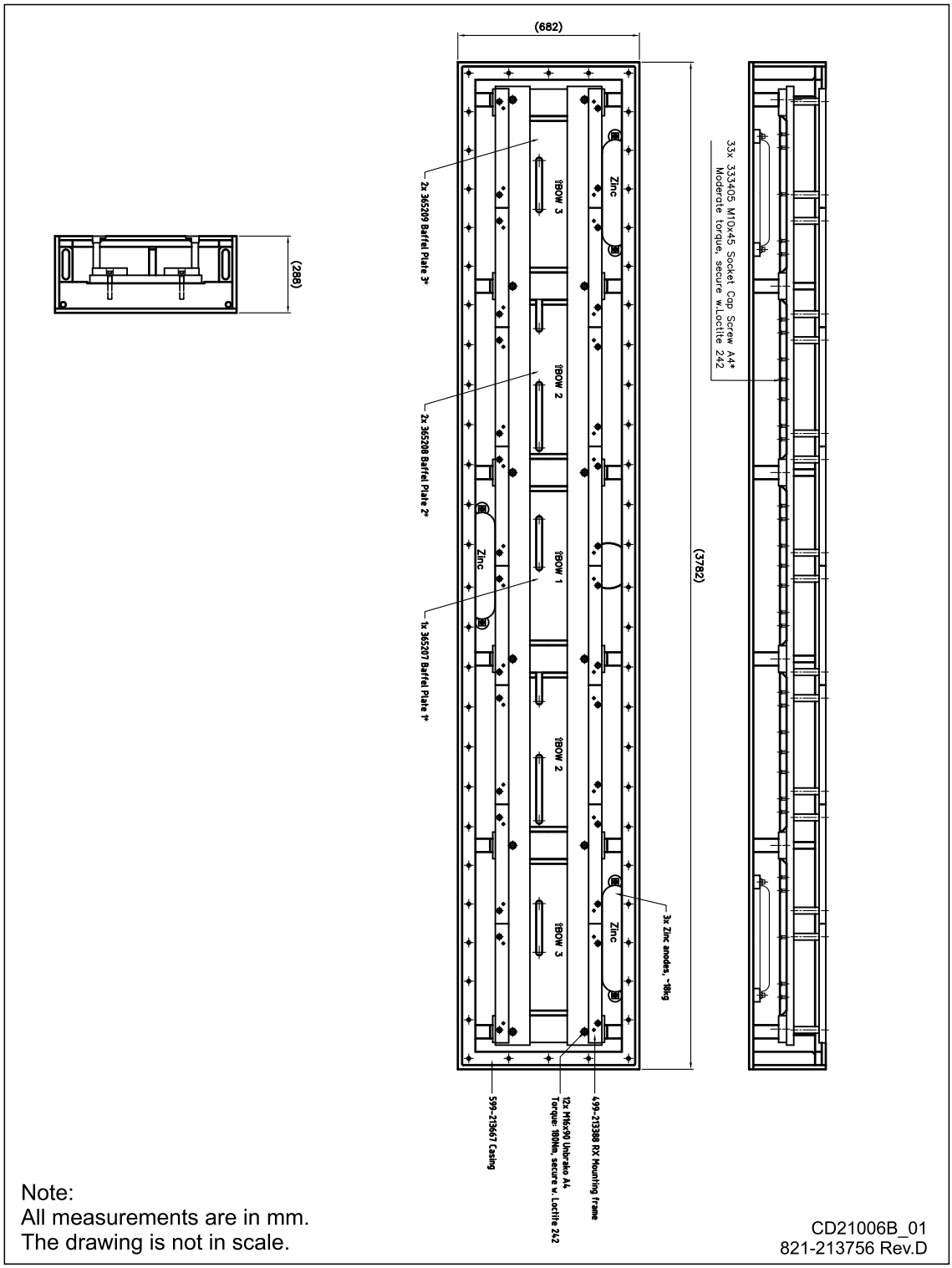
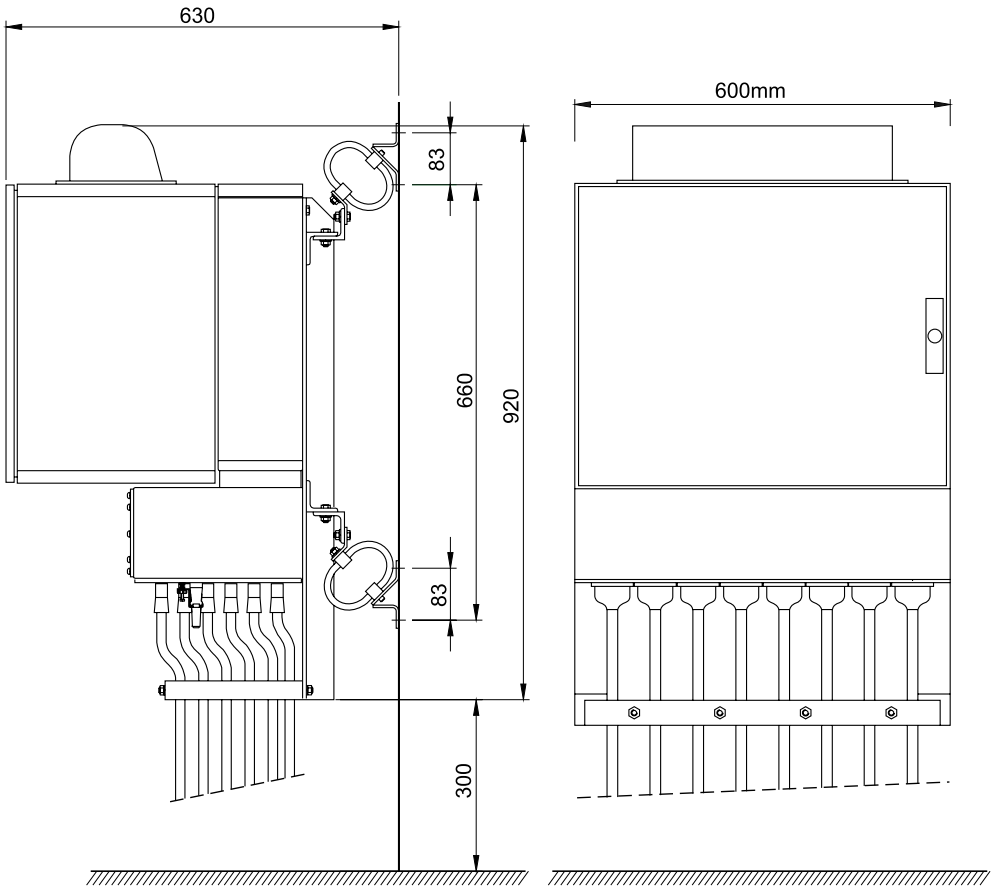


Figure 51 RX array with casing, mounting frame and baffle plates – 2 degree



Preamplifier

Figure 52 Preamplifier outline dimensions – EM 122



Note:
All measurements are in mm.
The drawing is not in scale.

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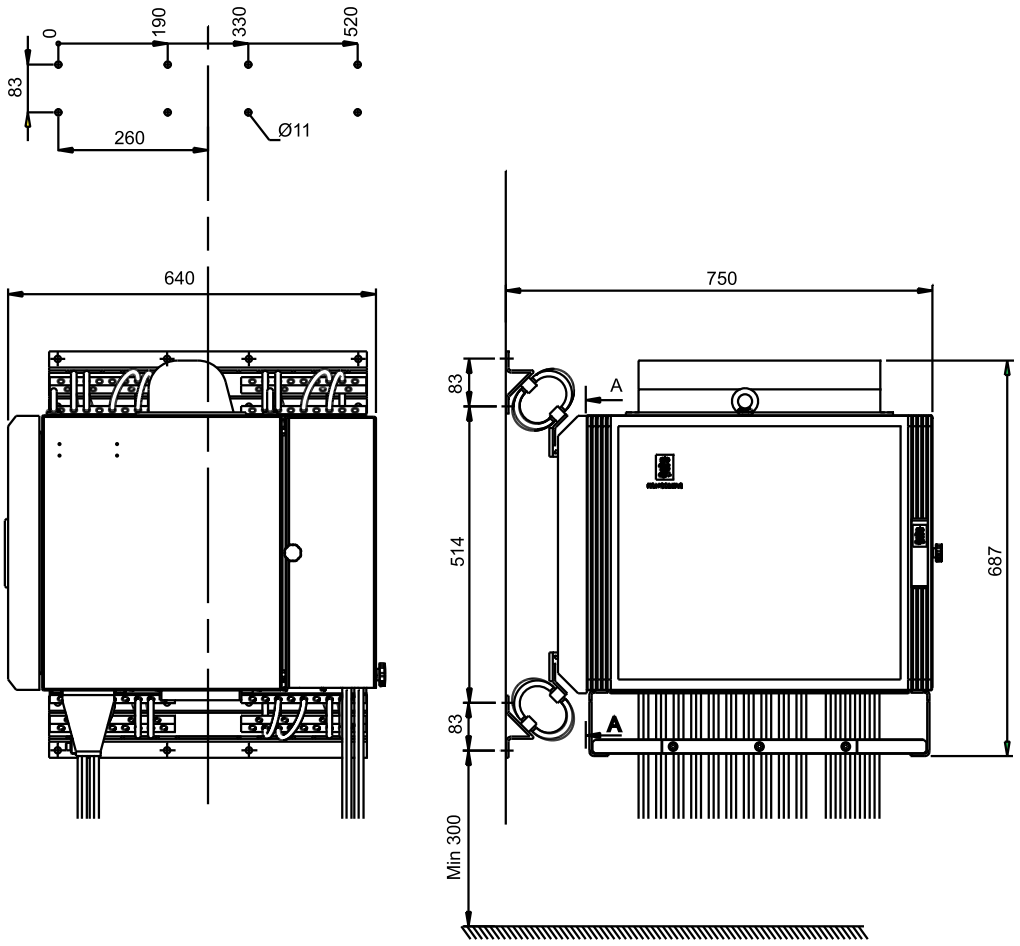
Figure 53 Preamplifier outline dimensions – EM 122/EM 302



Note:
All measurements are in mm.
The drawing is not in scale.

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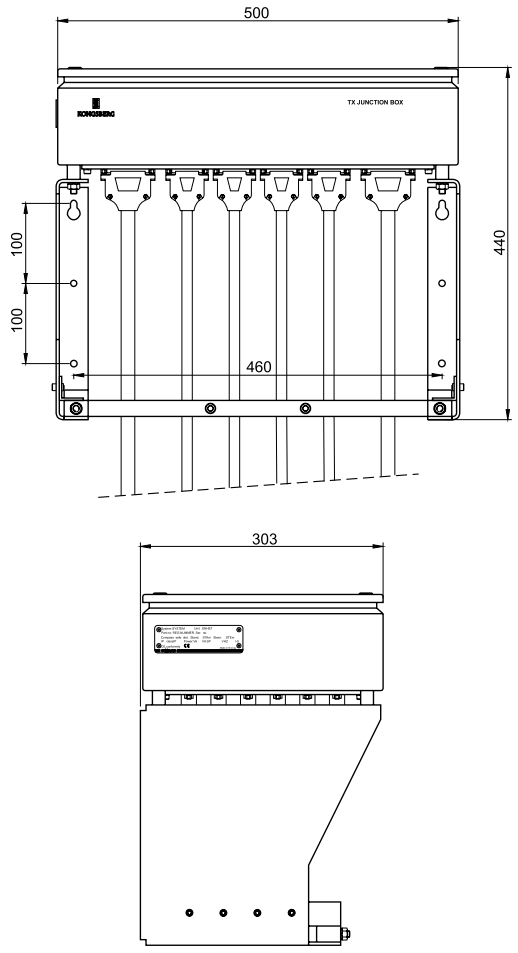
TX Junction Box

Figure 54 Outline dimensions



Note:
All measurements are in mm.
The drawing is not in scale

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Transducer cable layout

Figure 55 Cable layout – 1 degree TX (page 1 of 2)

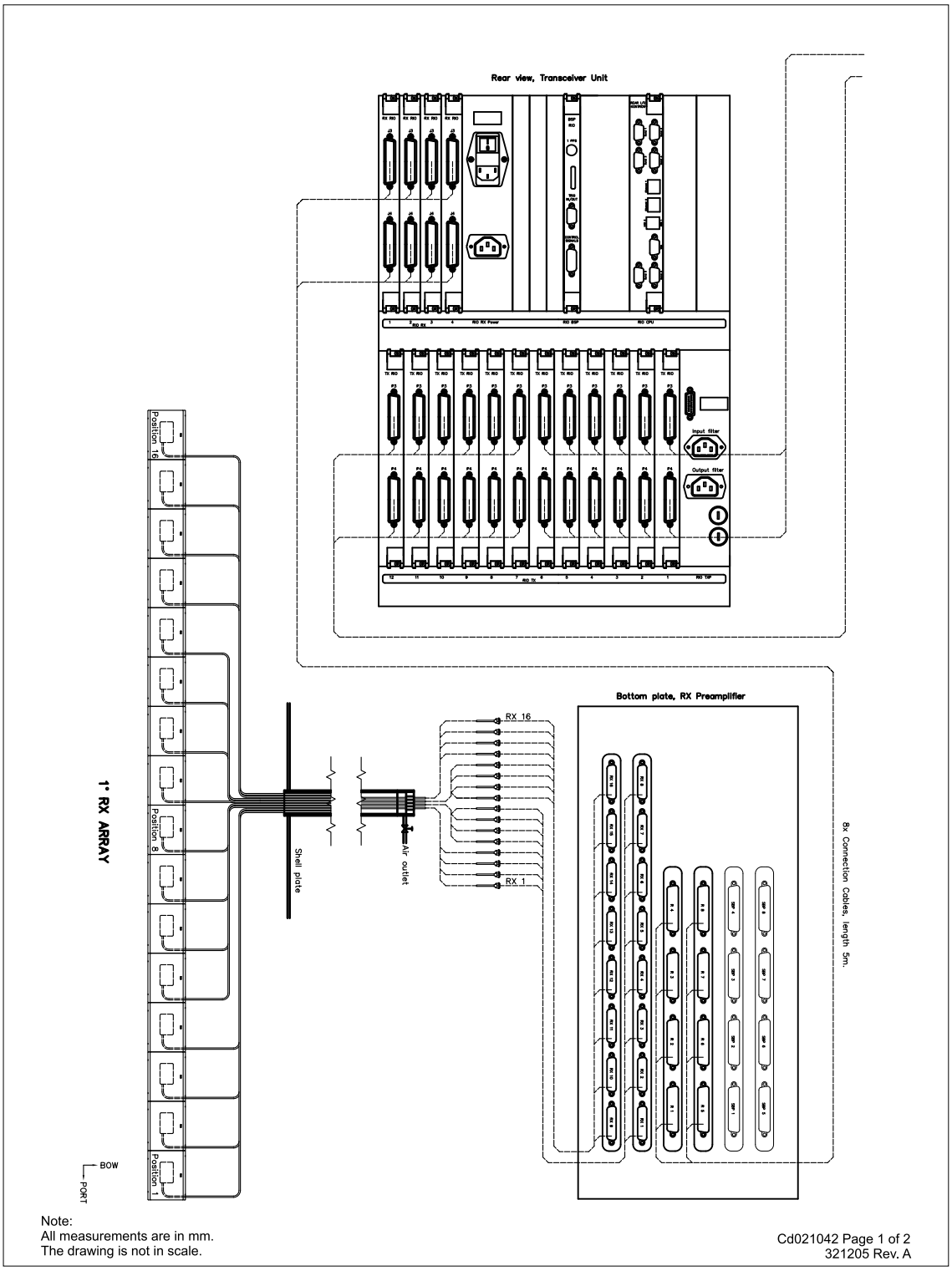


Figure 56 Cable layout – 1 degree TX (page 2 of 2)

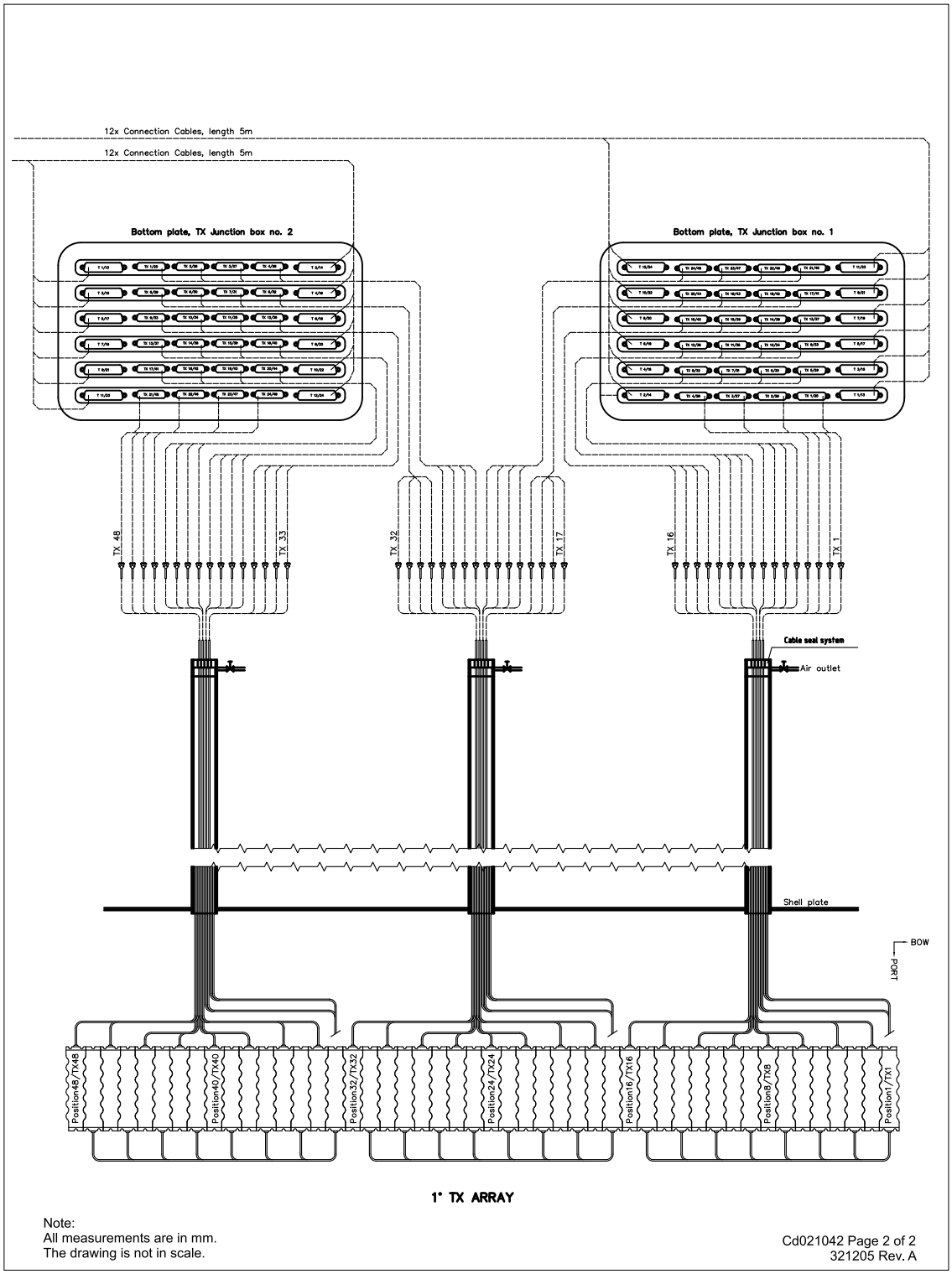


Figure 57 Cable layout – 0.5 degree TX (page 1 of 2)

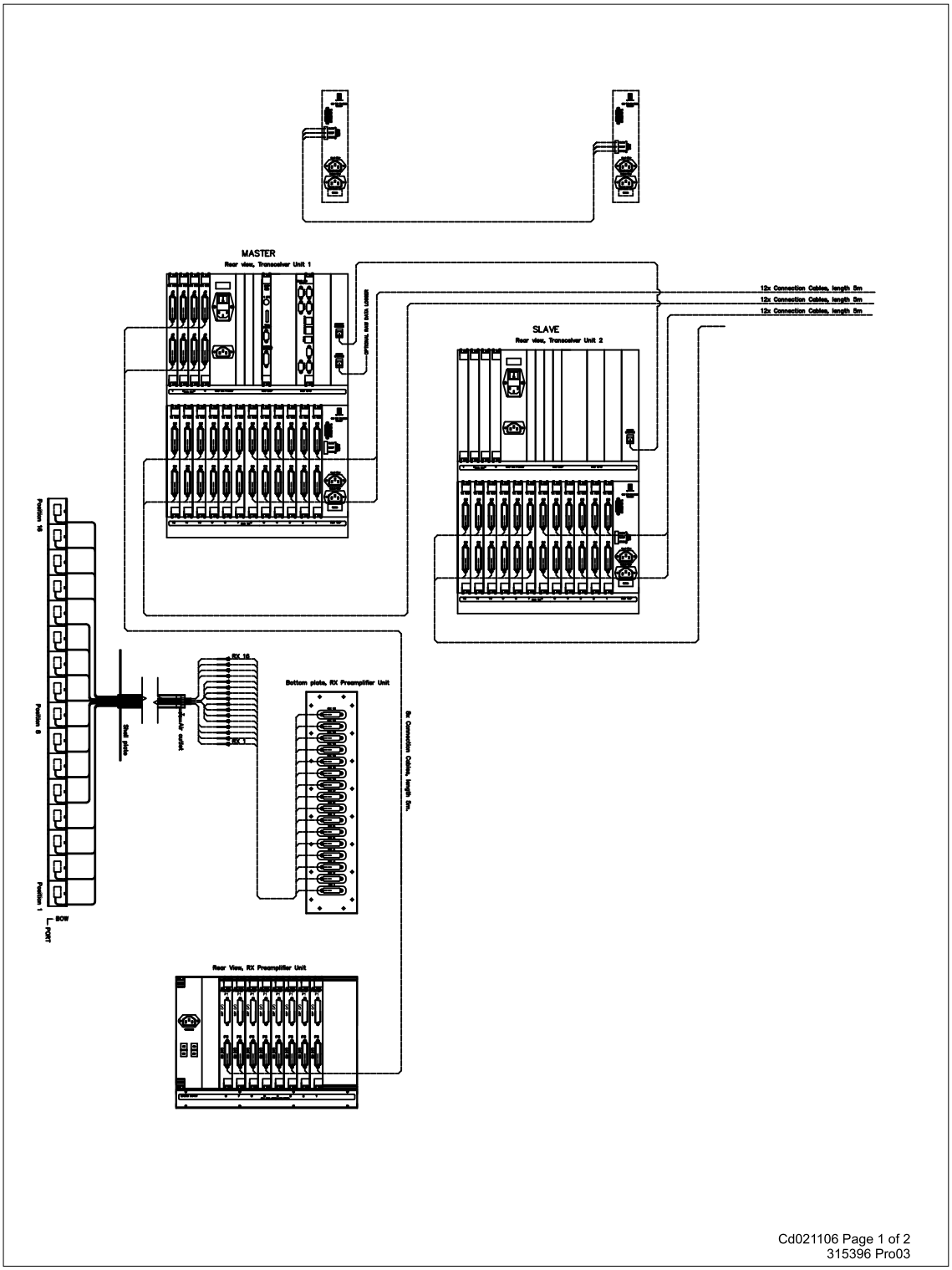
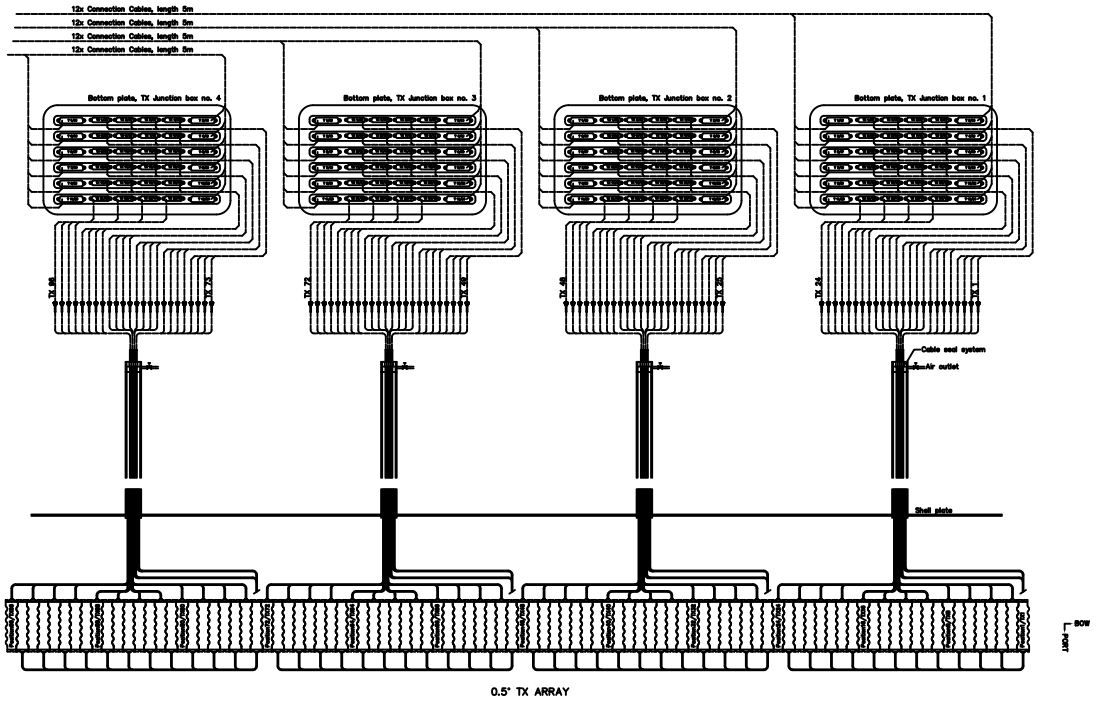


Figure 58 Cable layout – 0.5 degree TX (page 2 of 2)



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315396 Pro03

Ice window

Figure 59 TX Ice window

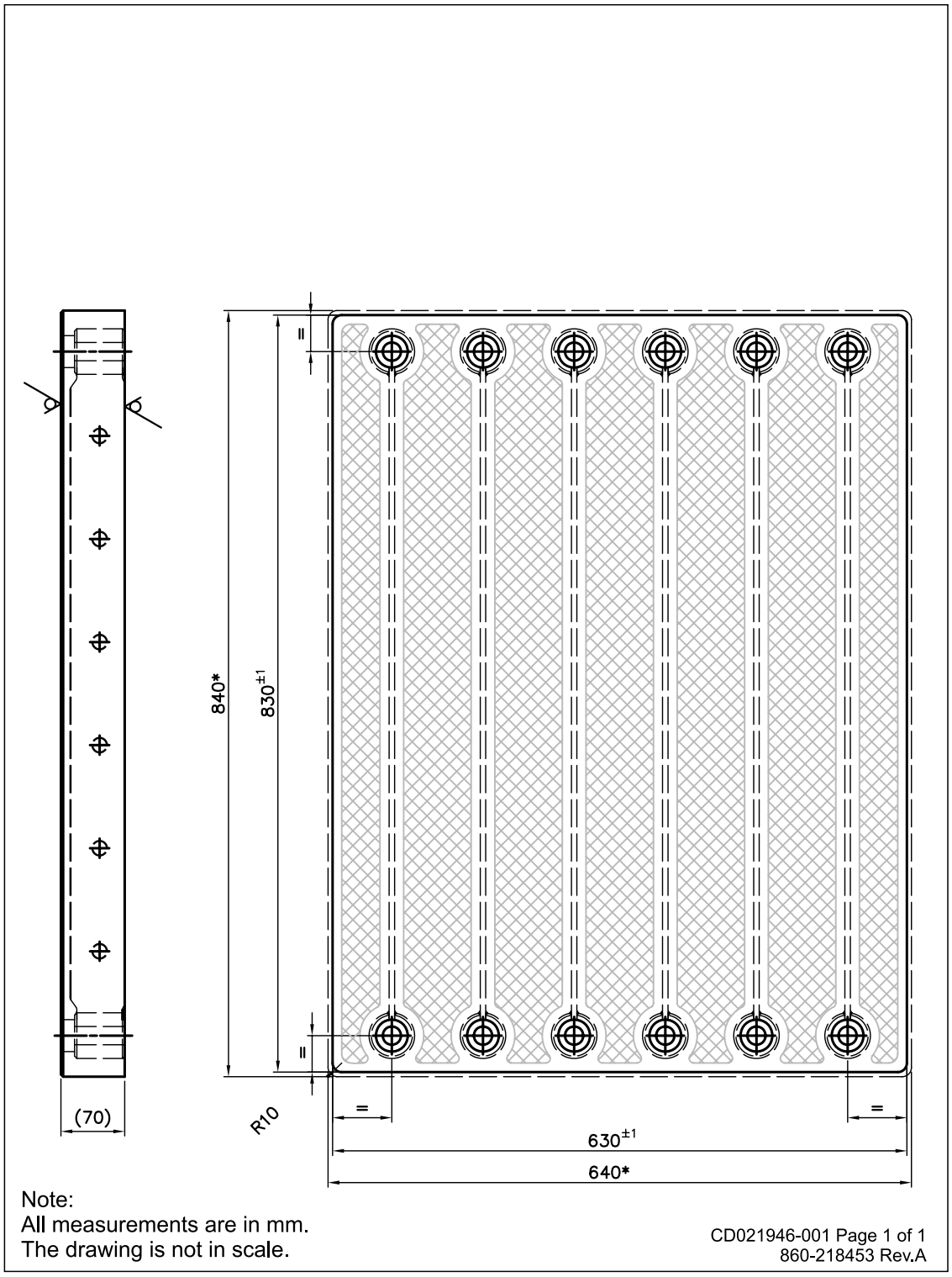
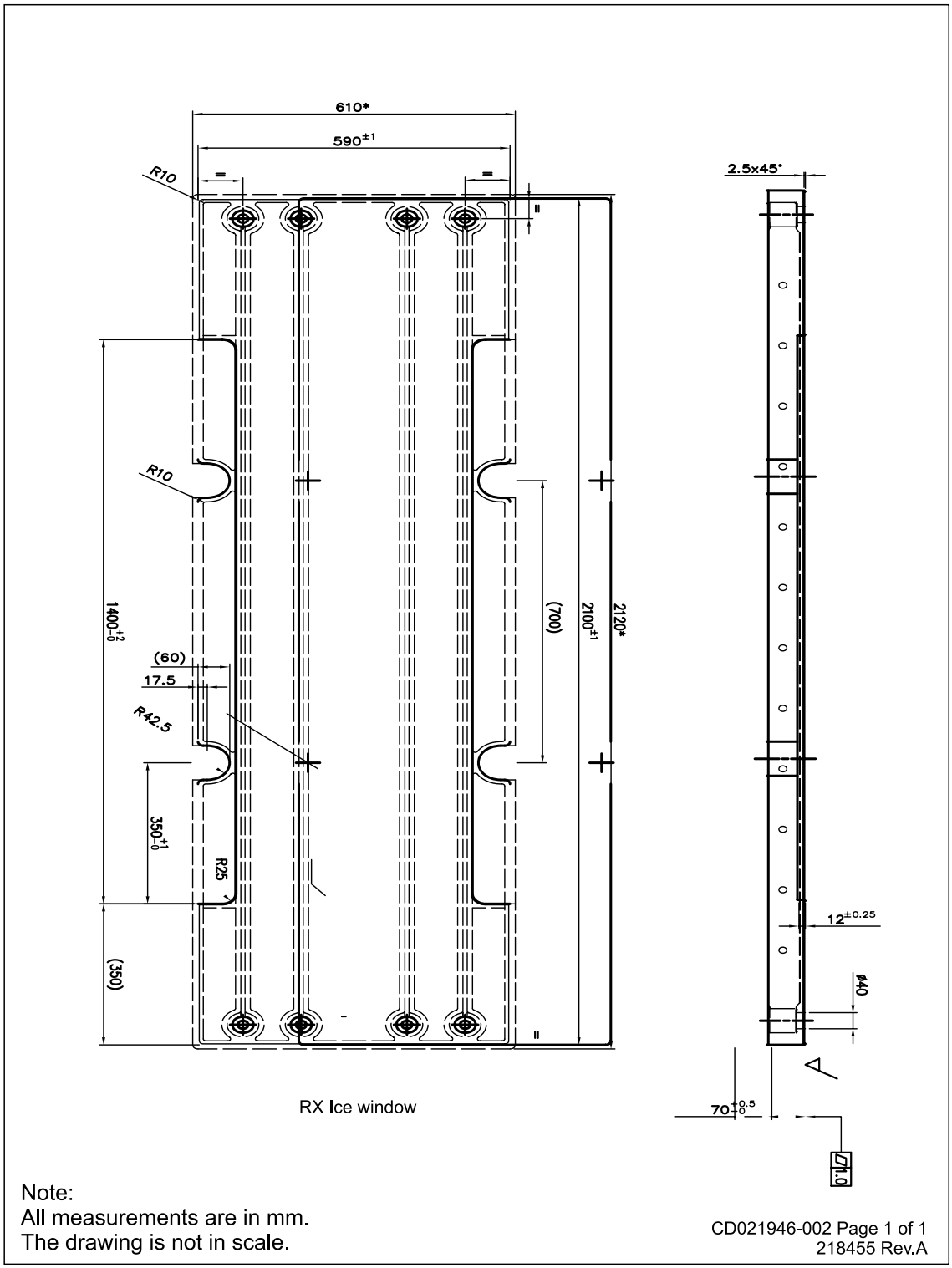


Figure 60 RX Ice window

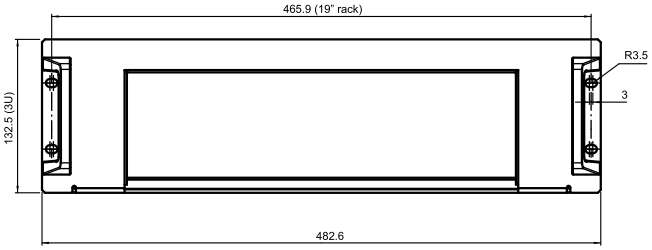


Operator station and display

Figure 61 Outline dimensions

24” LCD:
Width = 604 mm
Height = 408 mm
Depth = 68 mm
Weight = 10 kg

HWS:
Width = 338 mm
Height = 100 mm
Depth = 379 mm
Weight = 7.6 kg



19" rack mount kit for HWS:
Width = 482.6 mm
Height = 132.5 mm
Depth = 450 mm

Note:
All measurements are in mm.
The drawing is not in scale

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307181 Rev. F

Preamplifier Unit

Figure 62 RX Preamplifier Unit – internal cabling

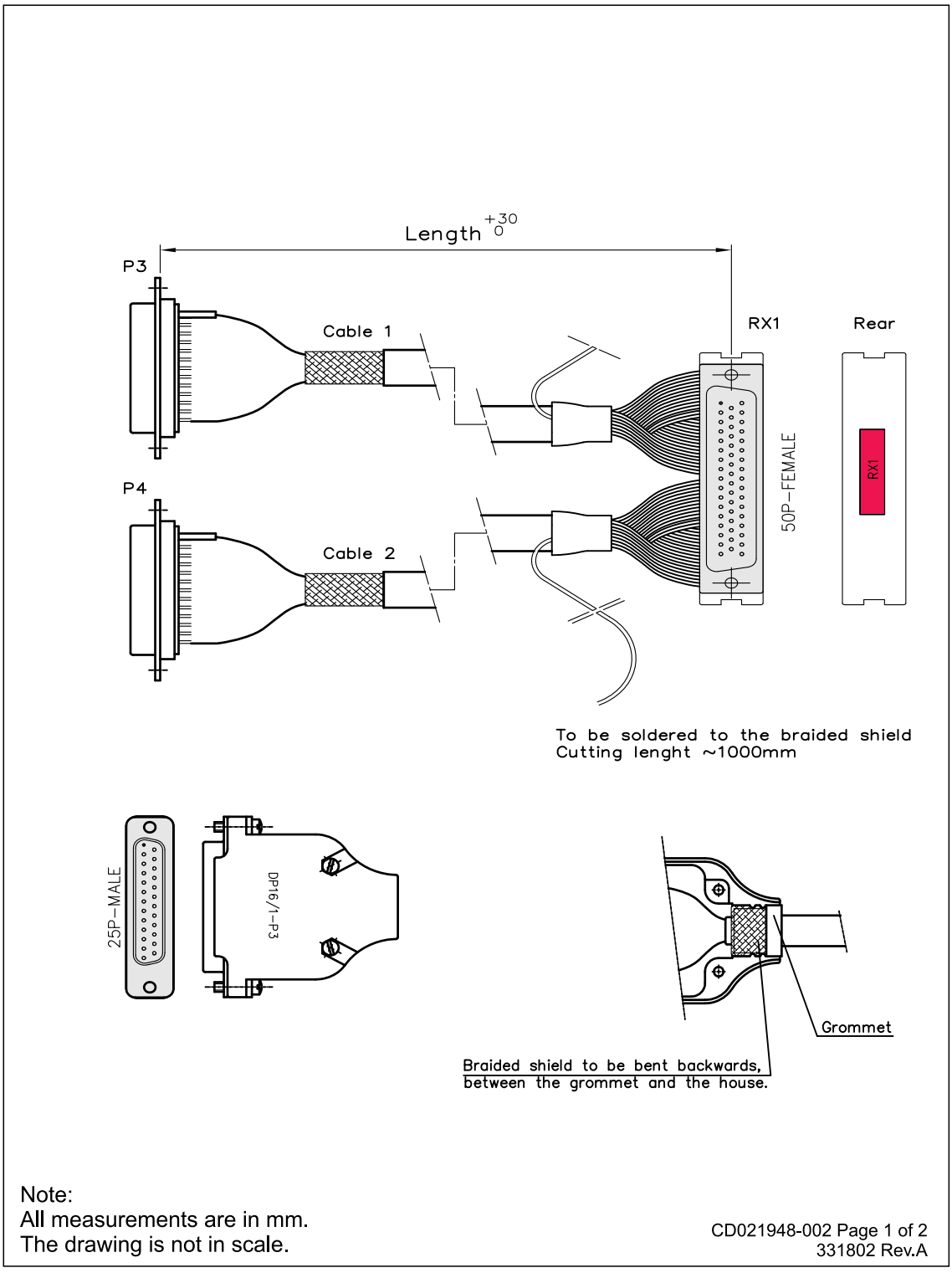
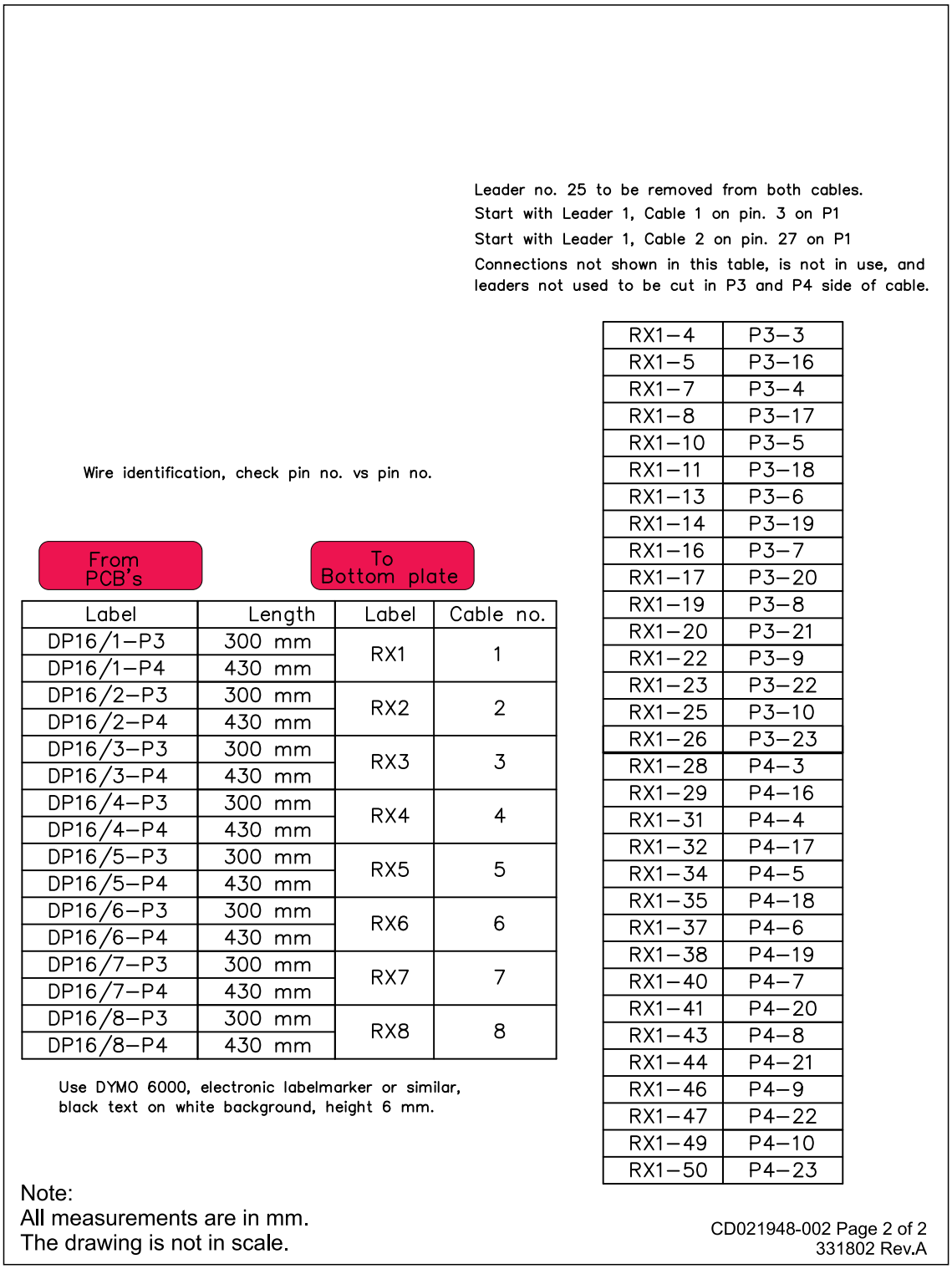


Figure 63 RX Preamplifier Unit – internal cabling



Label	Length	Label	Cable no.
DP16/1–P3	300 mm	RX1	1
DP16/1–P4	430 mm		
DP16/2–P3	300 mm	RX2	2
DP16/2–P4	430 mm		
DP16/3–P3	300 mm	RX3	3
DP16/3–P4	430 mm		
DP16/4–P3	300 mm	RX4	4
DP16/4–P4	430 mm		
DP16/5–P3	300 mm	RX5	5
DP16/5–P4	430 mm		
DP16/6–P3	300 mm	RX6	6
DP16/6–P4	430 mm		
DP16/7–P3	300 mm	RX7	7
DP16/7–P4	430 mm		
DP16/8–P3	300 mm	RX8	8
DP16/8–P4	430 mm		

RX1–4	P3–3
RX1–5	P3–16
RX1–7	P3–4
RX1–8	P3–17
RX1–10	P3–5
RX1–11	P3–18
RX1–13	P3–6
RX1–14	P3–19
RX1–16	P3–7
RX1–17	P3–20
RX1–19	P3–8
RX1–20	P3–21
RX1–22	P3–9
RX1–23	P3–22
RX1–25	P3–10
RX1–26	P3–23
RX1–28	P4–3
RX1–29	P4–16
RX1–31	P4–4
RX1–32	P4–17
RX1–34	P4–5
RX1–35	P4–18
RX1–37	P4–6
RX1–38	P4–19
RX1–40	P4–7
RX1–41	P4–20
RX1–43	P4–8
RX1–44	P4–21
RX1–46	P4–9
RX1–47	P4–22
RX1–49	P4–10
RX1–50	P4–23

Cable drawings

Note

w400 is a fixed length Ethernet cable supplied with the system. If required, the cable can be extended.

Table 6 Operator Station

Specifications	From/To
Ethernet cable with RJ45 on page 141	Operator Station —> Transceiver Unit
Ethernet cable with RJ45 on page 141	Operator Station —> Network (Ethernet)
Generic RS-232 Serial line on page 133	Operator Station —> Depth/Tide sensor
Generic RS-232 Serial line on page 133	Operator Station —> Sound Speed Sensor or probe

Remark

1 The cables are commercial computer cables, and they are all supplied with the Operator Station

Table 7 Transceiver Unit

Specifications	From/To
Generic RS-232 Serial line on page 133	Transceiver Unit —> Positioning system
Generic RS-232 Serial line on page 133	Transceiver Unit —> Motion sensor
Generic RS-232 Serial line on page 133	Transceiver Unit —> Auxiliary 1
Generic RS-232 Serial line on page 133	Transceiver Unit —> Auxiliary 2
Remote control and external trig on page 139	Transceiver Unit —> Remote control unit
Ethernet cable with RJ45 on page 141	Transceiver Unit —> Operator Station
Ethernet cable with RJ45 on page 141	Transceiver Unit —> Motion Sensor (velocity)

Table 8 Preamplifier Unit

Specifications	From/To
RX transducer cable from Preamplifier to TRU on page 144	Preamplifier Unit —> Transceiver Unit
Preamplifier Unit cable from array on page 145	RX Transducer —> Preamplifier Unit

Table 9 TX Junction Box 1

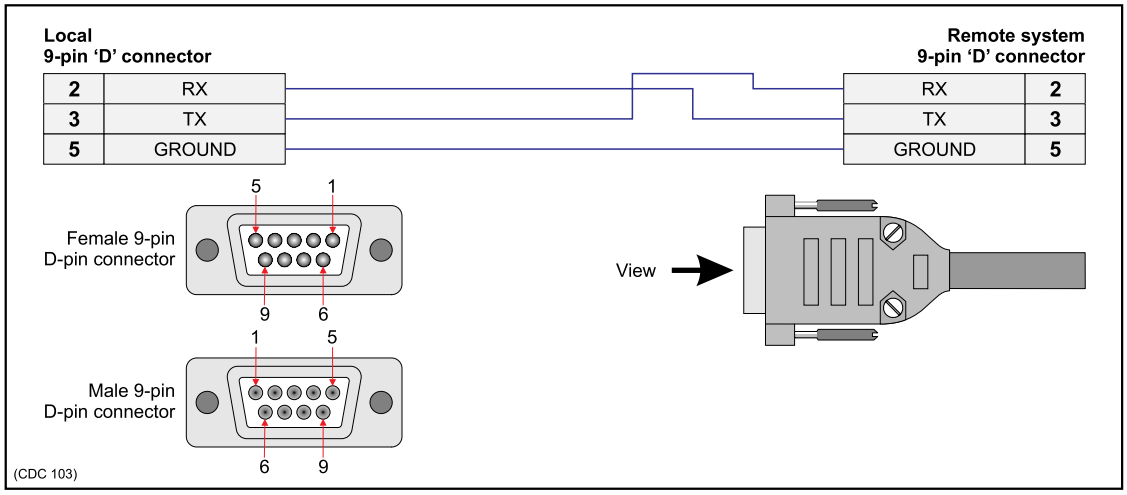
Specifications	From/To
TX transducer cables from junction boxes or transducer to TRU on page 142	Transceiver Unit —> TX Junction Box 1
on page	TX Junction Box 1 —> Transducer array

Table 10 TX Junction Box 2

Specifications	From/To
TX transducer cables from junction boxes or transducer to TRU on page 142	Transceiver Unit —> TX Junction Box 2
on page	TX Junction Box 2 —> Transducer array

Generic RS-232 Serial line

This cable holds a multi purpose serial line. It provides interface with any peripheral unit. One end of the cable connects to the local unit (DTE) with a 9-pin D-connector, while the other connects to the peripheral (DCE) as described in the peripheral unit's documentation. Note that this cable does not support all the signals in the standard RS-232 specification.



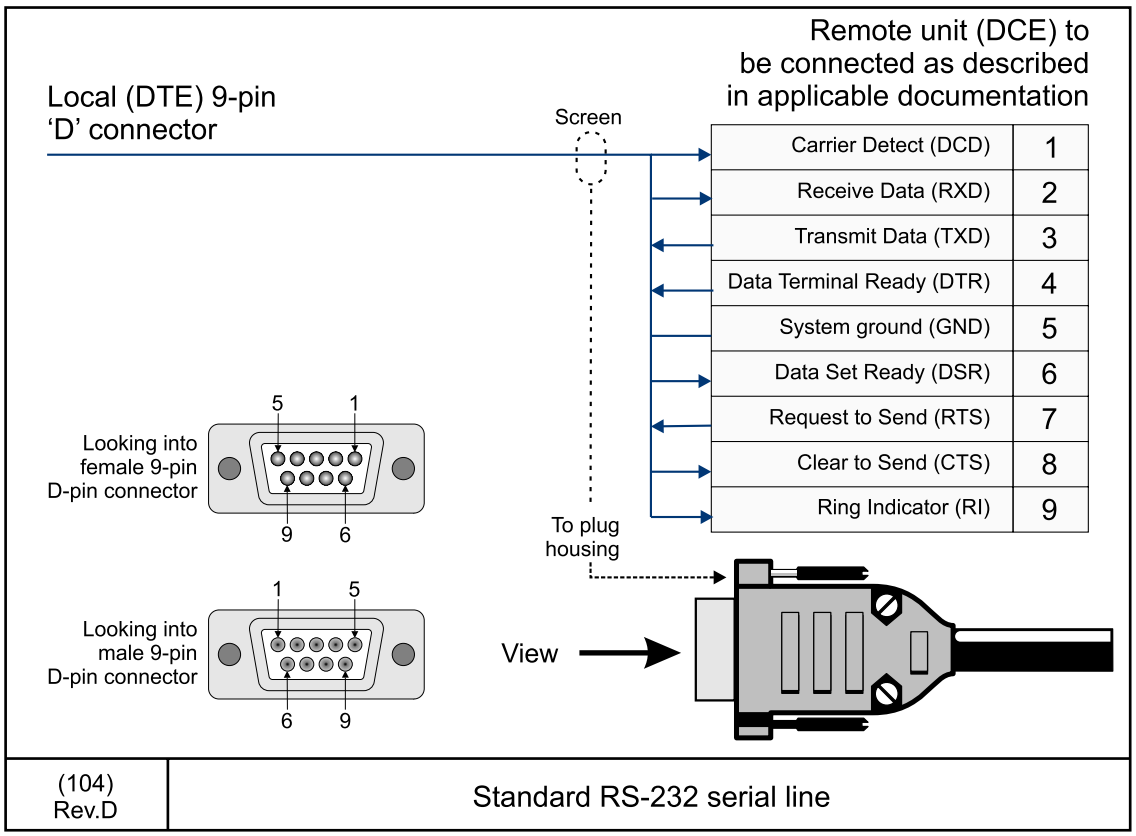
Cable specifications

- Conductors: 2 x 2 x 0.5 mm²
- Screen: Screened twisted pairs and overall braided
- Voltage: 60 V
- Maximum diameter: Limited by the plugs

Generic RS-232 Serial line

This cable comprises a multi purpose serial line. It provides interface with any peripheral unit. One end of the cable connects to the local unit **(DTE)** with a 9-pin D-connector, while the other connects to the peripheral **(DCE)** as described in the peripheral unit's documentation.

In many cases, only the **RxD**, **TxT** and **GND** pins are used. Twisted pairs are sufficient in the cable.

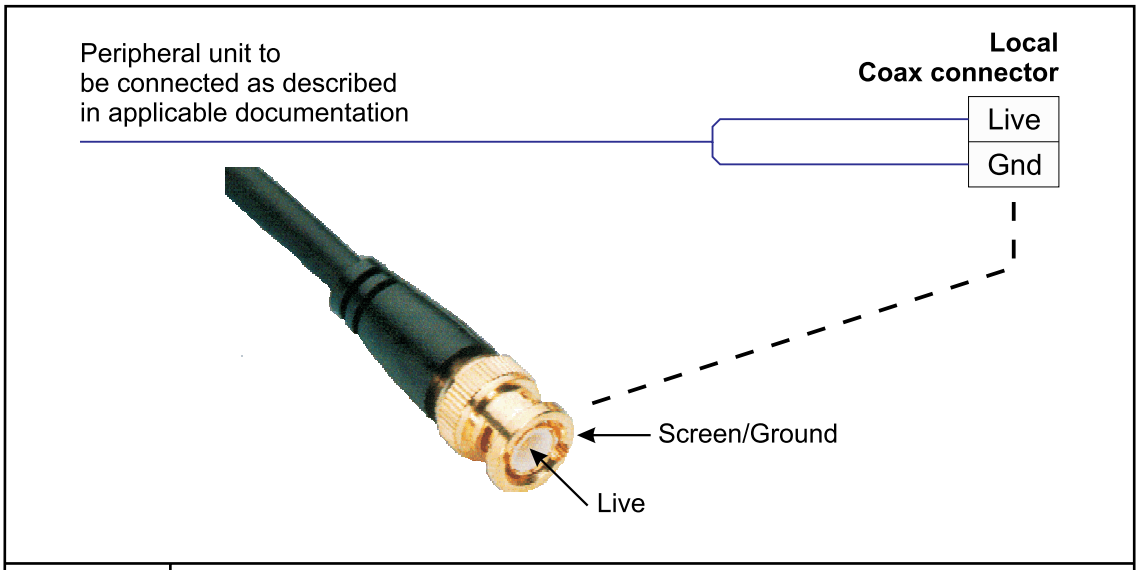


Cable specifications

- Conductors: 5 x 2 x 0.5 mm²
- Screen: Screened twisted pairs and overall braided
- Voltage: 60 V
- Maximum diameter: Limited by the plugs

Generic coax cable

This cable is used for connections to peripheral units or networks.

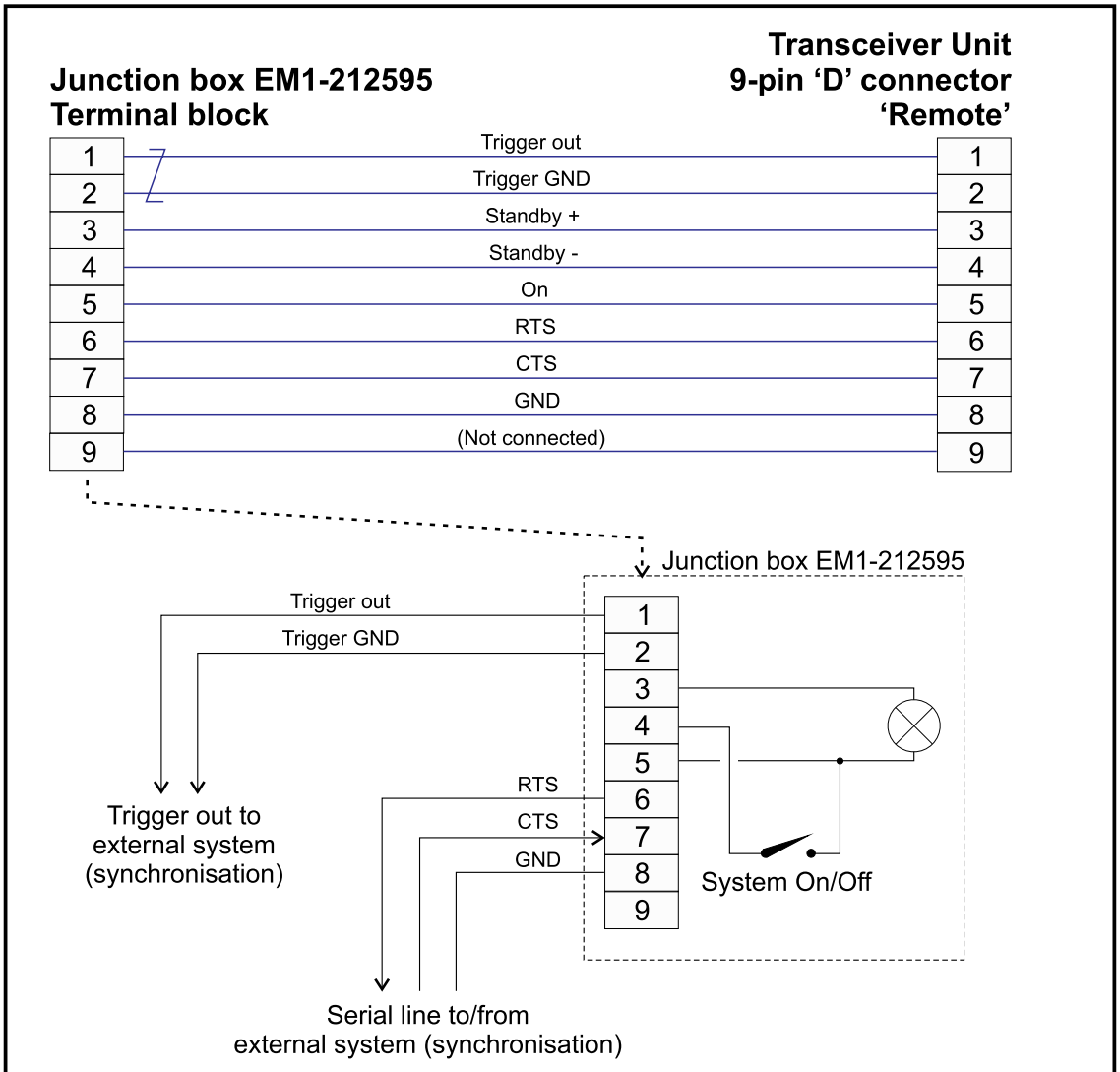


W105 Rev.E	Coax connection to peripheral unit or network

EM Remote synchronization and On/Off

Control signals

This cable connects the Transceiver Unit to a remote On/Off switch located in a Remote Control junction box. The same connection allows trigger output and remote control (synchronization) with a serial line.

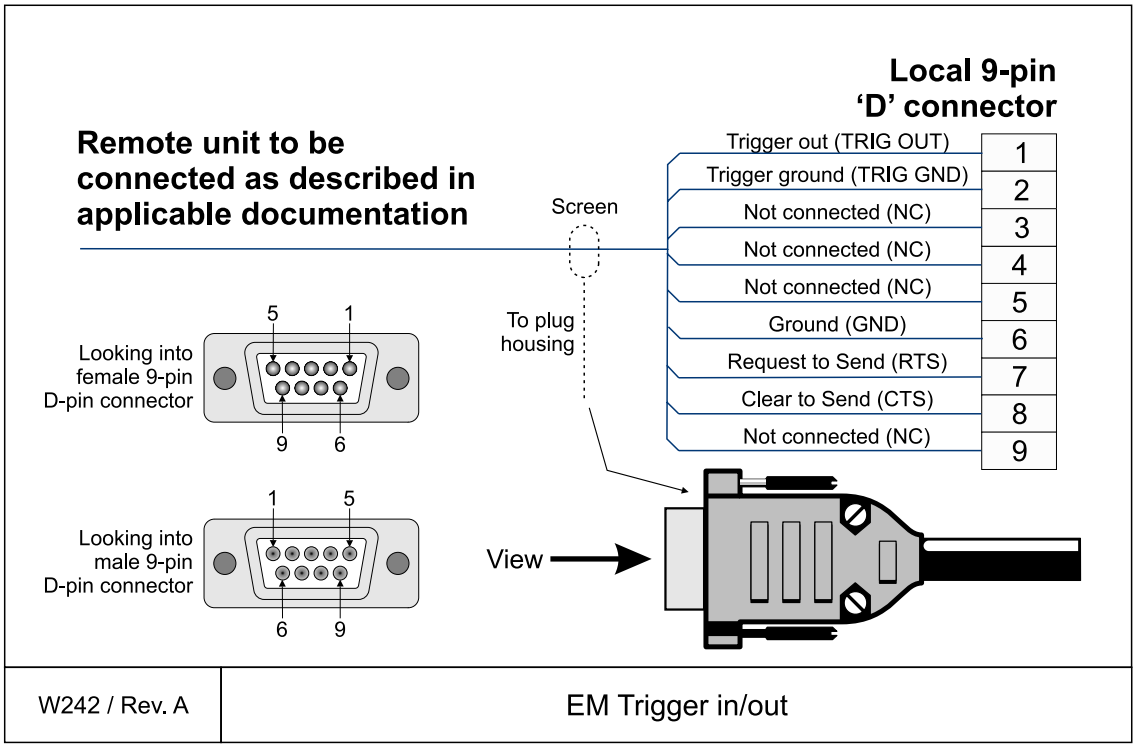


W202 Rev.C	Transceiver Unit - Junction Box

- Conductors: 5 x 2 x 0.5 mm²
- Screen: Overall braided
- Voltage: 60 V
- Maximum diameter: Limited by the plugs

Trigger in/out

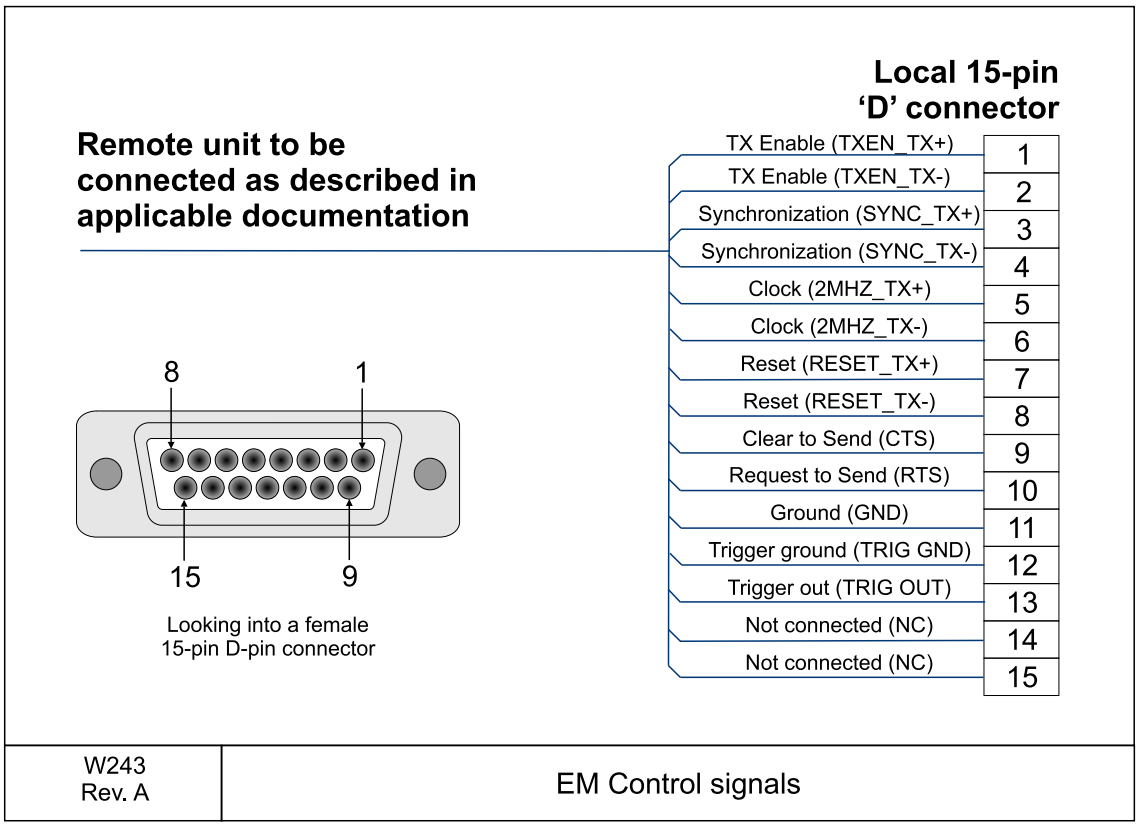
This cable is used to synchronize the echo sounder's transmissions with other acoustic instruments. It is terminated in a standard 9–pin D-sub connector at the Transceiver Unit end.



- Conductors: 5 x 2 x 0.5 mm²
- Screen: Screened twisted pairs and overall braided
- Voltage: 60 V
- Maximum diameter: Limited by the plugs

Internal control signals

This cable is used to transmit synchronization signals and TX enable signals. It is terminated in a standard 15–pin D-sub connector.

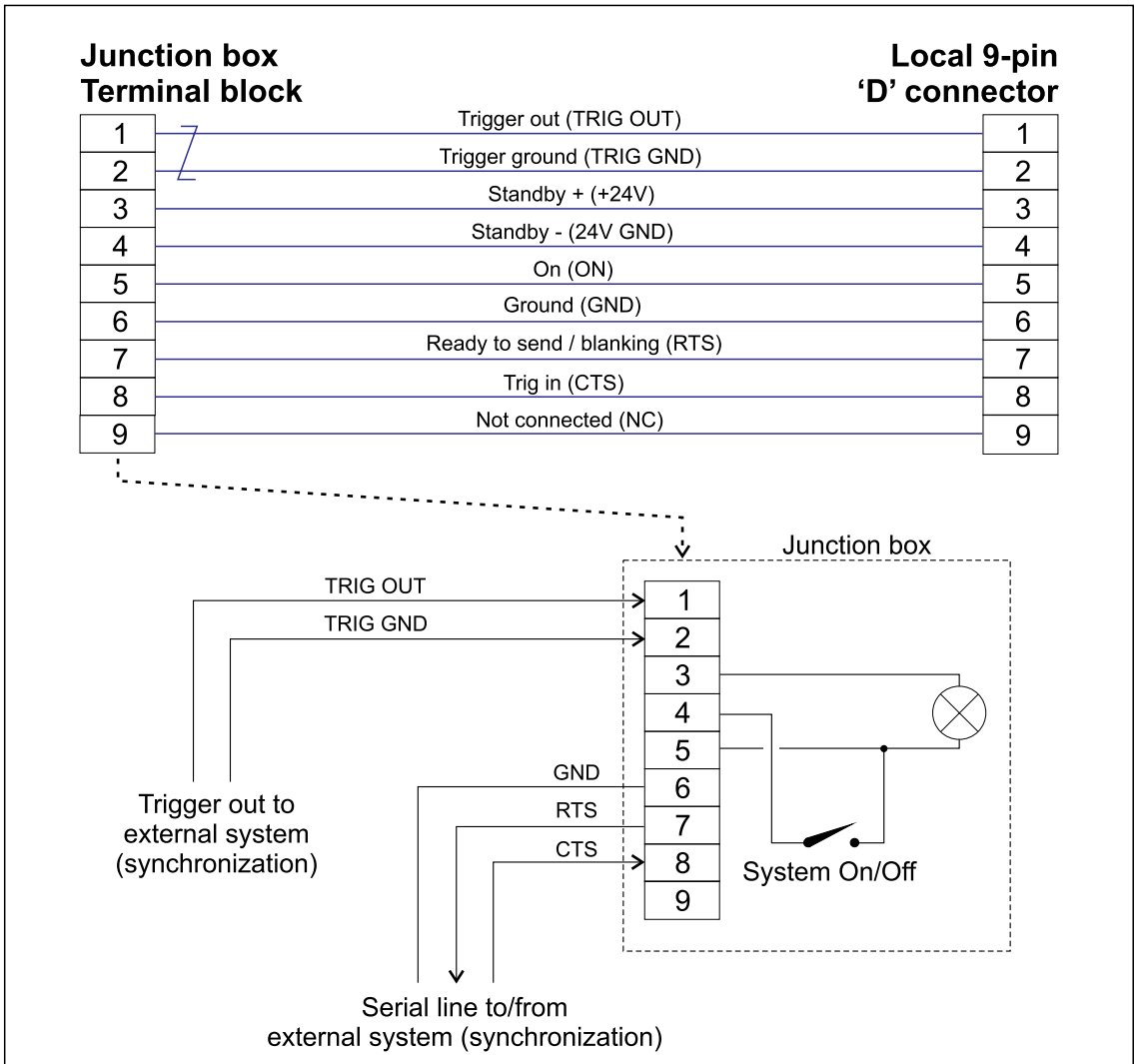


- Conductors: 9 x 2 x 0.5 mm²
- Screen: Screened twisted pairs and overall braided
- Voltage: 60 V
- Maximum diameter: Limited by the plugs

Remote control and external trig

This cable connects the EM 122 Transceiver Unit (HVP RIO) to a remote On/Off switch, normally located in a Remote Control junction box.

The same connection allows trigger output and remote control (synchronization) with a serial line.

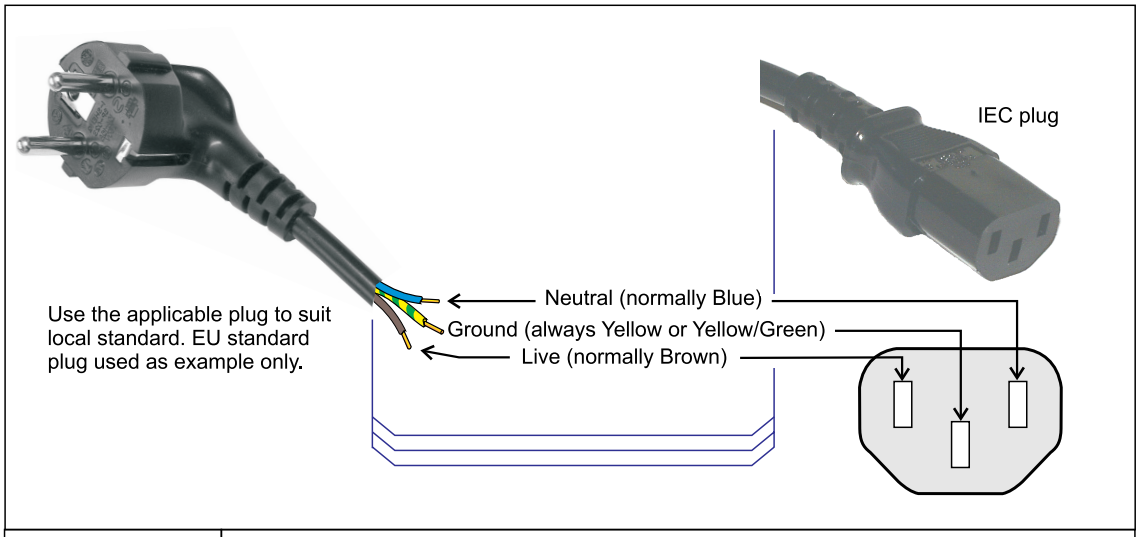


W245 / Rev. A	NSEM Remote On/Off control and synchronization

- Conductors: 5 x 2 x 0.5 mm²
- Screen: Overall braided
- Voltage: 60 V
- Maximum diameter: Limited by the plugs

Standard AC power cable

This cable is a standard three-wire power cable. The instrument end is terminated in a standard IEC female socket, while the other end is terminated in a plug suitable for the local standard.



W301eu/Rev A	Standard power cable for 115/230 Vac 2-phase

Note

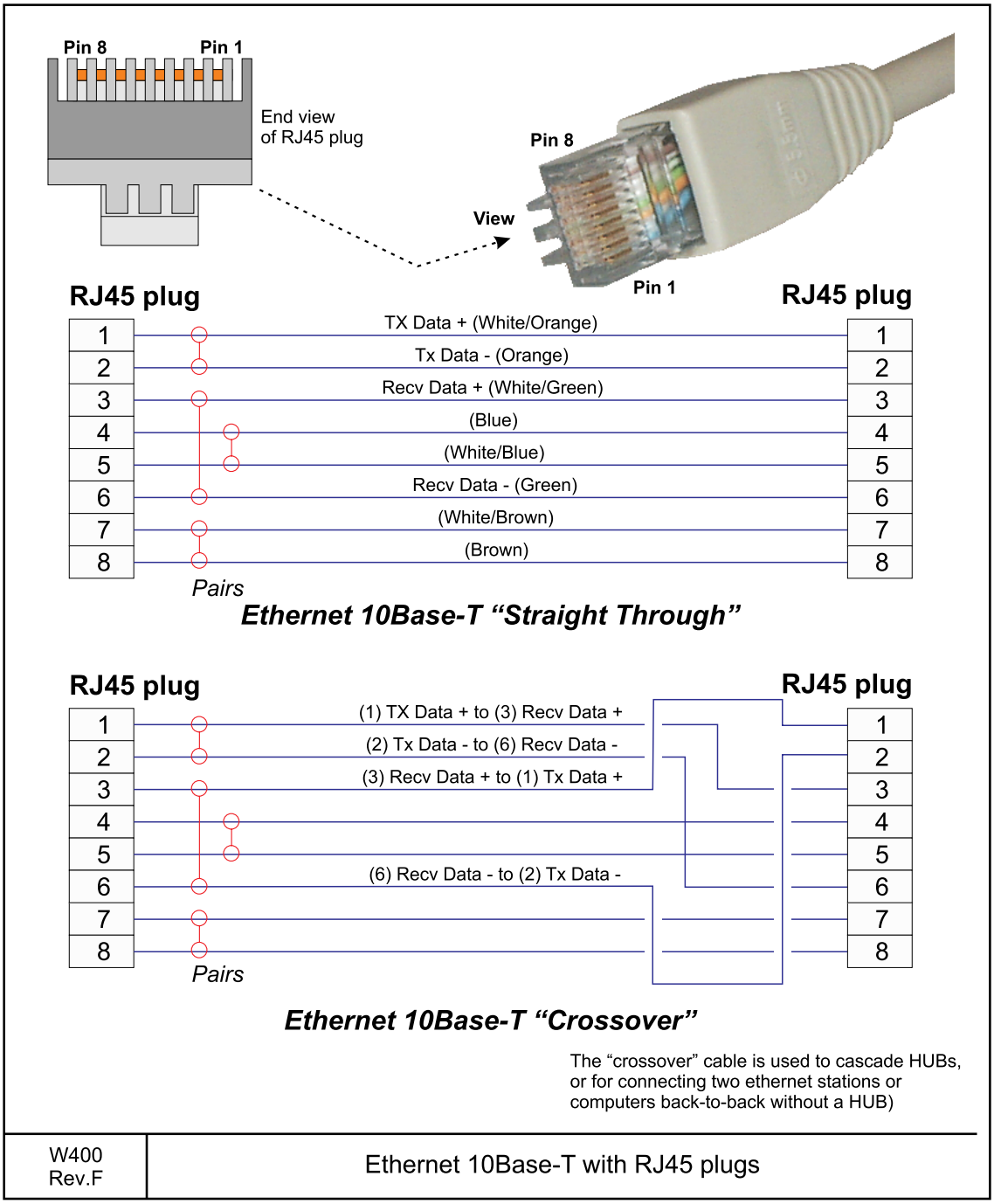
*Different cable colours may be used for the **live** and **neutral** wires. Ground is however always on green/yellow.*

- Conductors: 3 x 1.5 mm²
- Screen: None
- Voltage: 750 V
- Maximum diameter: Defined by the manufacturer

Ethernet cable with RJ45

This cable is used to provide standard Ethernet connections. Note that various categories exists. **Cat.5 E** and **Cat.6** cables are used in local area networks with date rate exceeding 100 Mbit/s.

Ethernet cables are available commercially in different lengths, colours and categories.

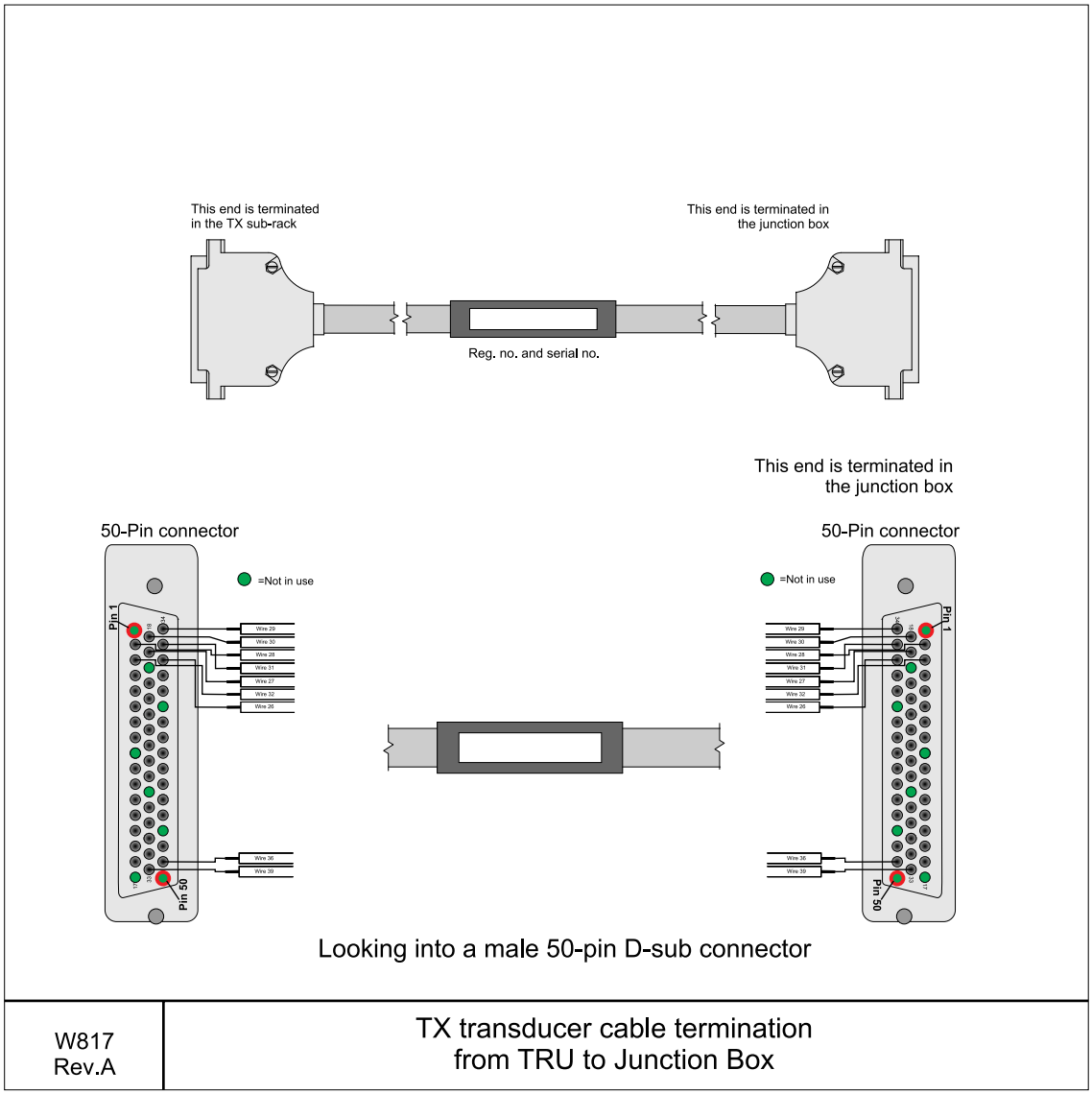


W400 Rev.F	Ethernet 10Base-T with RJ45 plugs

Screened category 6 (or 5 E) twisted pair cable to fit the specific RJ45 connectors used. AWG 23 and 24 size conductors are recommended.

TX transducer cables from junction boxes or transducer to TRU

These are one to one cables from the EM 122 Transceiver Unit to the TX Junction Boxes. Each cable is terminated at the cabinet's rear through a 50–pins “D-sub” connector. The cables are supplied by manufacturer.



W817 Rev.A	TX transducer cable termination from TRU to Junction Box

TX transducer cables to transducer array

These are the cables from the EM 122 Junction Boxes to the TX transducer arrays. Each cable is terminated at the junction box through a 25–pins “D-sub” connector. At the transducer end, the cables is moulded to their respective modules. The cables are supplied by manufacturer.

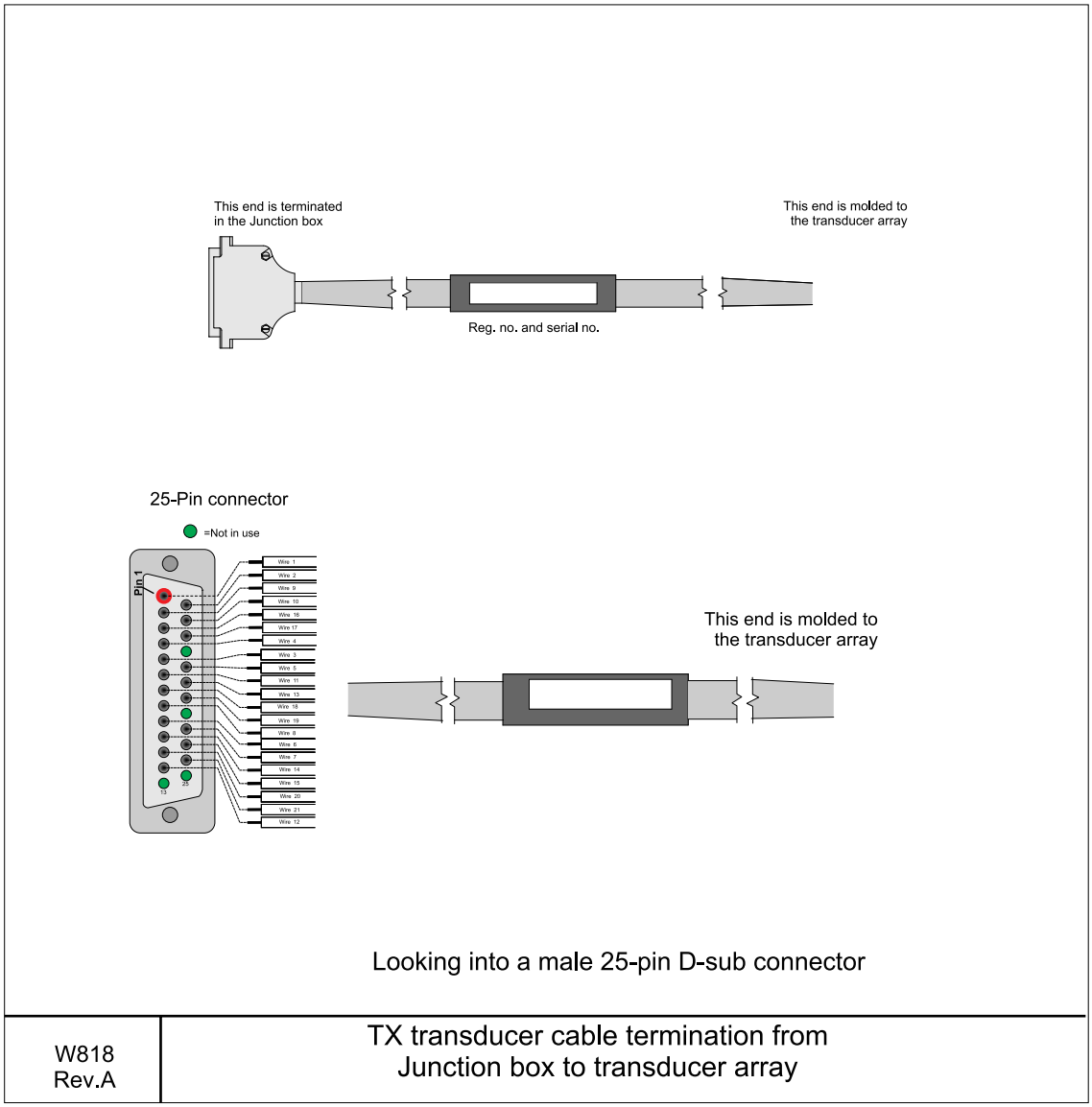
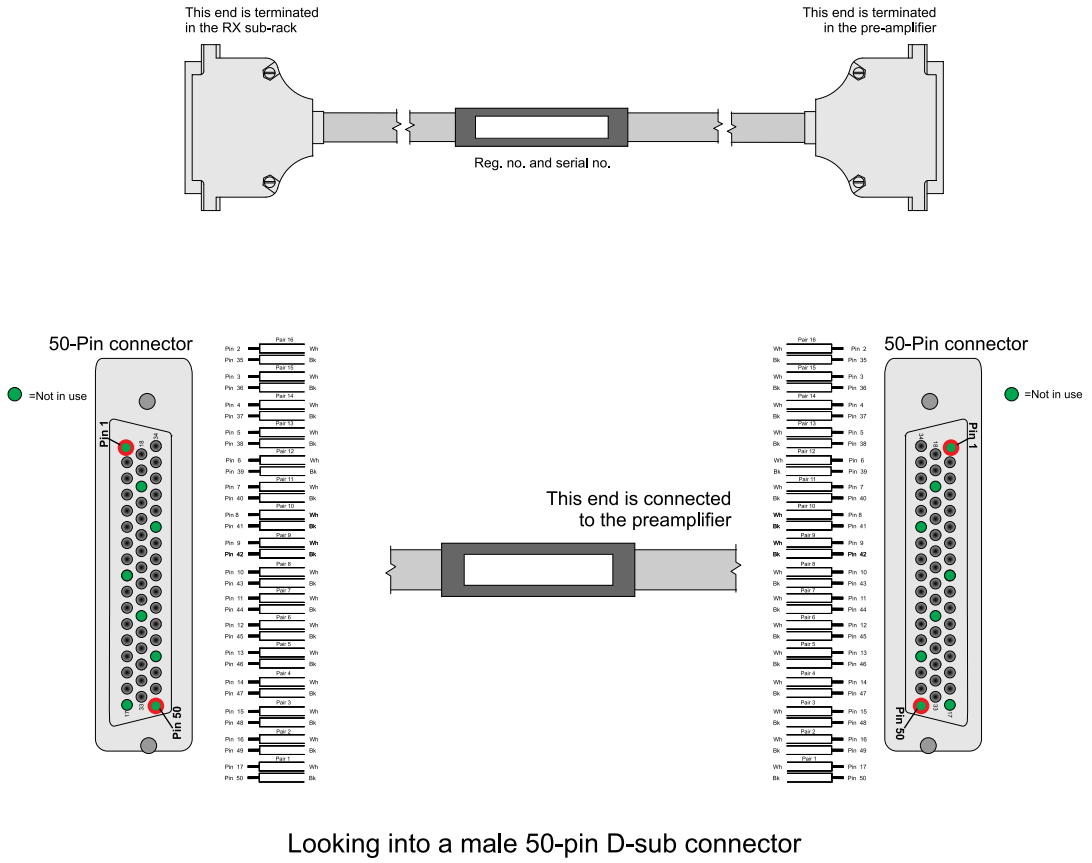


Table 11 25–pin “D-sub” connector

Pin number	Wire number
6, 7, 8, 19, 20	8, 11, 13, 18, 19
5, 9, 18, 22	3, 5, 6, 7
3, 4, 10, 11, 16, 23	4, 14, 15, 16, 17, 20
1, 2, 12, 14, 15, 24	1 ,2, 9, 10, 12, 21

RX transducer cable from Preamplifier to TRU

This one to one cable is used from the EM 122 Preamplifier to the Transceiver Unit. Each cable is terminated at the cabinet's rear through a 50–pins “D-sub” connector. The cables are supplied by manufacturer.



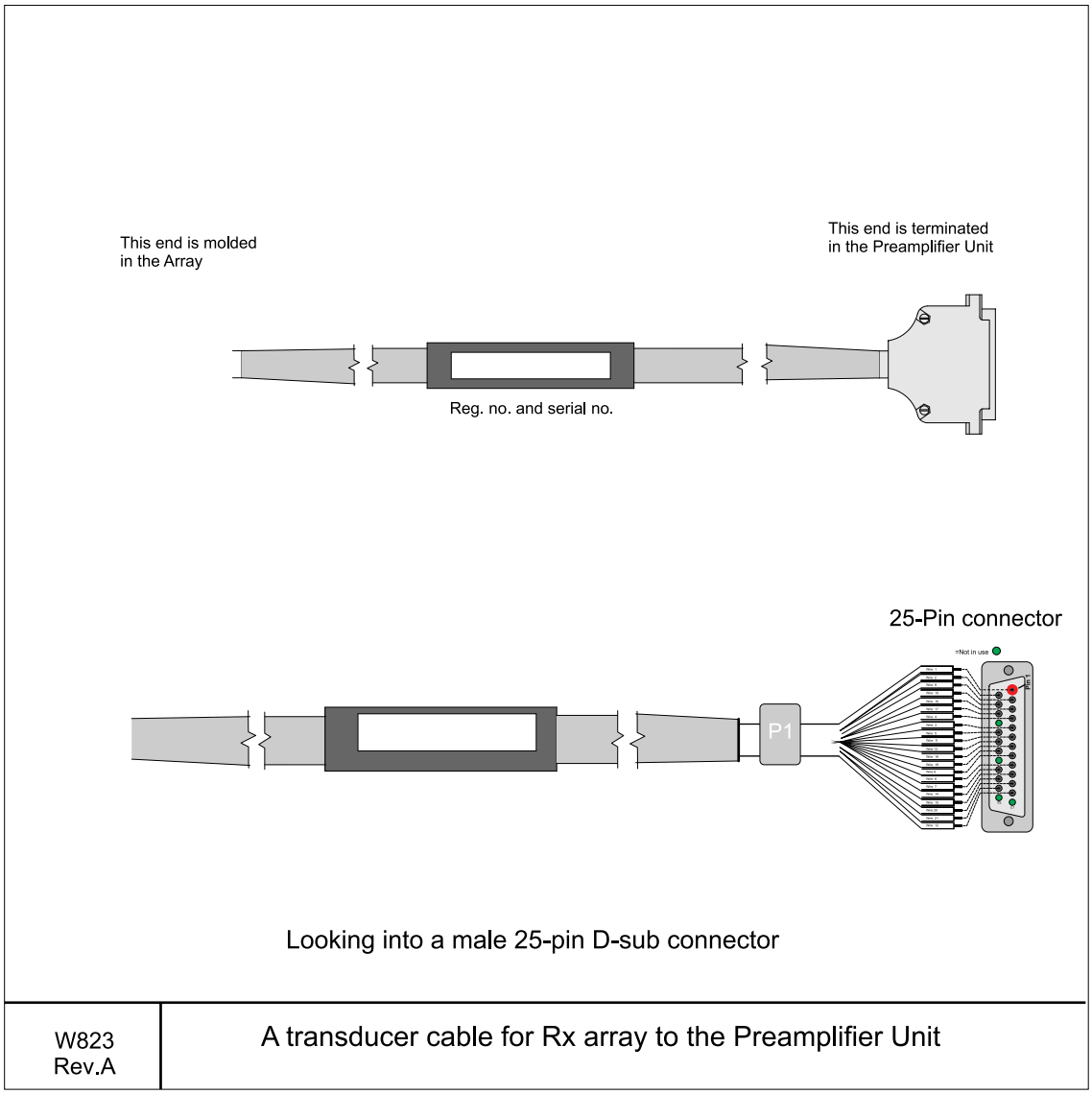
Looking into a male 50-pin D-sub connector

W821 Rev.A	RX transducer cable termination from Preamplifier to TRU - EM120/122

Apply a label to the cable marked with module type (RX) and the cable registration number (both ends).

Preamplifier Unit cable from array

This cable is used from the array to the EM 122 Preamplifier Unit. The cable is terminated at the Preamplifier Unit bottom side through a 25–pin “D-sub” connector. The cables are supplied by manufacturer.



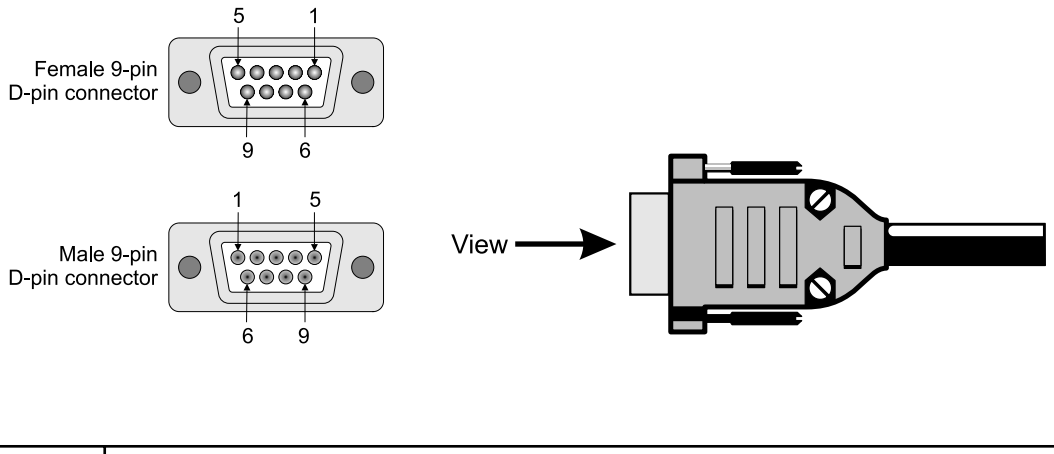
W823 Rev.A	A transducer cable for Rx array to the Preamplifier Unit

Apply a label to the cable marked with module type (RX) and the cable registration number (both ends).

Table 12 25–pin “D-sub” connector

Pin number	Wire number
6, 7, 8, 19, 20	8, 11, 13, 18, 19
5, 9, 18, 22	3, 5, 6, 7
3, 4, 10, 11, 16, 23	4, 14, 15, 16, 17, 20
1, 2, 12, 14, 15, 24	1 ,2, 9, 10, 12, 21

Signal cable Junction box



W143 Rev A	Signal cable connection Junction box

This signal cable are used to provides interface between junction box 1 and junction box 2.

Cable specifications

- Conductors: 8 x 0.5 mm²
- Screen: Screened
- Maximum diameter: Φ8.8 mm

Appendix A
General safety rules

The Kongsberg EM 122 Multibeam echo sounder system operates on 230 Vac 50/60 Hz.

Note

*The EM 122 is by **default wired to 230 Vac**.*

For 115 Vac operation, please contact km.hs@kongsberg.com.

WARNING

This voltage may be lethal!

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

- Always switch off all power before installation or maintenance. Use the main circuit breaker, and label the breaker with a warning sign that informs others that maintenance or installation work is being carried out on the system.
- Do not open the rack or cabinet doors while in rough seas. It may swing open suddenly and cause damage or injury.
- For safety reasons during troubleshooting on the equipment with power ON, two persons must always be present.
- Read and understand the first aid instructions for electric shock.
- Whenever maintenance is carried out, it is essential that a first aid kit is available, and that the maintenance personnel are familiar with the first aid instructions for electrical shock.
- The various parts of the system are heavy. Make sure that the appropriate tools and certified lifting equipment are available, and that the personnel are trained in installation and maintenance work.

Appendix B Basic cable requirements

This appendix provides general information related to the installation and maintenance of system cables.

Cable trays

All permanently installed cables associated with the system must be supported and protected along their entire lengths using conduits and/or cable trays. The only exception to this rule is over the final short distance (maximum. 0,5 meters) as the cables run into the cabinets/units to which they are connected. These short service loops are to allow the cabinets to move on their shock mounts, and to allow maintenance and repair.

- Wherever possible, cable trays must be straight, accessible and placed so as to avoid possible contamination by condensation and dripping liquids (oil, etc.). They must be installed away from sources of heat, and must be protected against physical damage. Suitable shields must be provided where cables are installed in the vicinity of heat sources.
- Unless it is absolutely unavoidable, cables should not be installed across the vessel's expansion joints. If the situation is unavoidable, a loop of cable having a length proportional to the possible expansion of the joint must be provided. The minimum internal radius of the loop must be at least twelve times the external diameter of the cable.
- Where a service requires duplicate supply lines, the cables must follow separate paths through the vessel whenever possible.
- Signal cables must not be installed in the same cable tray or conduit as high-power cables.
- Cables containing insulation materials with different maximum-rated conductor temperatures should not be bunched together (that is, in a common clip, gland, conduit or duct). When this is impractical, the cables must be carefully arranged such that the maximum temperature expected in any cable in the group is within the specifications of the lowest-rated cable.
- Cables with protective coverings which may damage other cables should not be grouped with other cables.

- Cables having a copper sheath or braiding must be installed in such a way that galvanic corrosion by contact with other metals is prevented.
- For service purpose of the system, all cables should be allocated spare conductor pairs. Also, space within the vessel should be set aside for the installation of extra cables.

Radio Frequency interference

All cables that are to be permanently installed within 9 m (30 ft) of any source of Radio Frequency (RF) interference such as a transmitter aerial system or radio transmitters, must, unless shielded by a metal deck or bulkhead, be adequately screened by sheathing, braiding or other suitable material. In such a situation flexible cables should be screened wherever possible.

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

Physical protection

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

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

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

Grounding

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

Grounding connections should be made using a conductor which has a cross-sectional area appropriate for the current rating of the cable, or with a metal clamp which grips the metallic covering of the cable and is bonded to the hull of the vessel. These cable coverings may also be grounded by means of glands specially intended for this purpose

and designed to ensure a good ground connection. The glands used must be firmly attached to, and in good electrical contact with, a metal structure grounded in accordance with these recommendations.

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

Cable connections

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

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

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

Cable terminations

Care must be taken to ensure that the correct terminations are used for all cable conductors. All cable work has to be done according to IPC 620 standard or similar standards.

Cable identification

Cable identification codes corresponding to the cable number shown in the cable plan must be attached to each of the external cables. These identification codes should be positioned on the cable in such a way that they are readily visible after all panels have been fitted. In addition, each cable conductor should be marked with the terminal board number or socket to which it is connected.