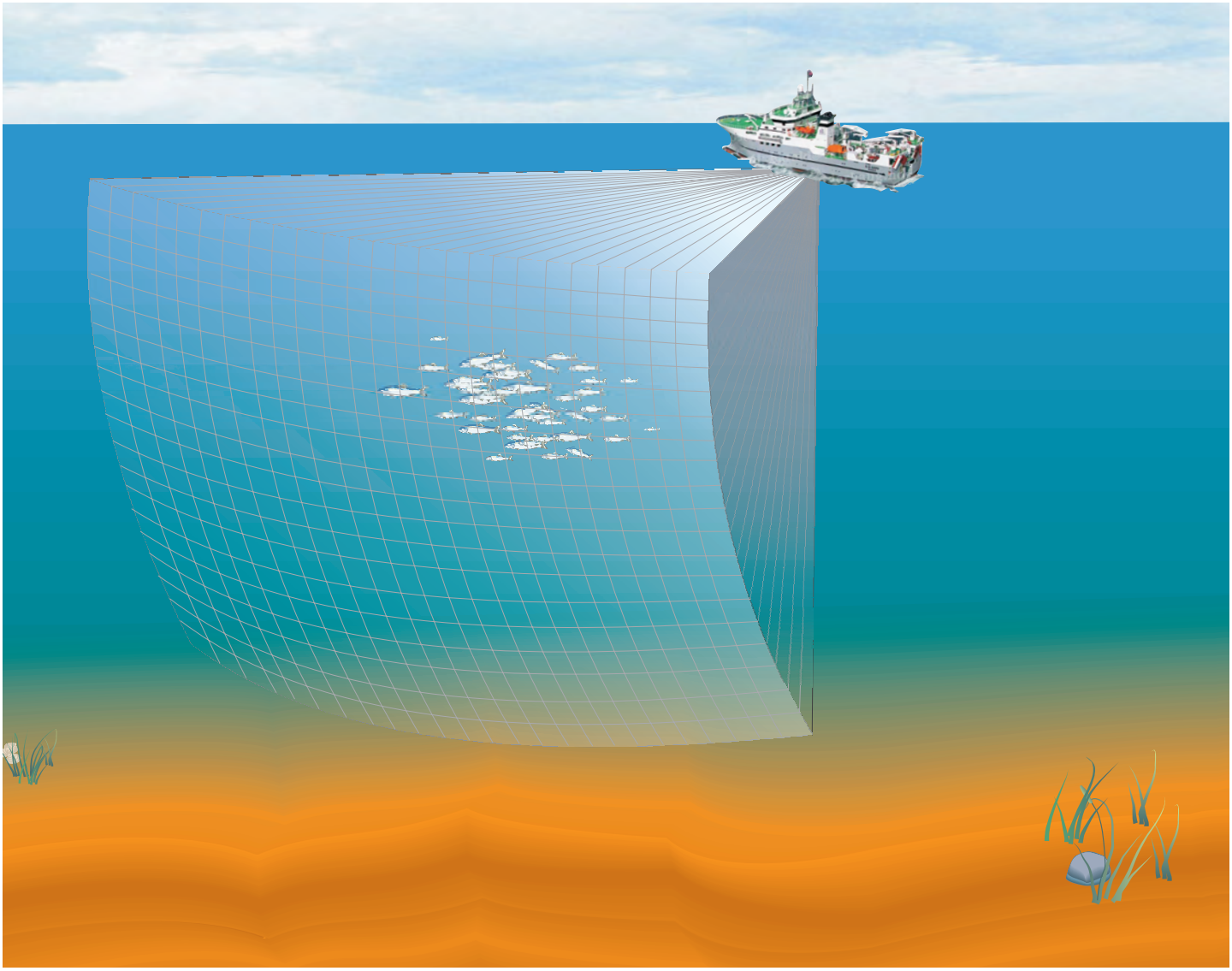
# Installation manual

## Simrad MS70
## Scientific multibeam sonar



KONGSBERG

# Simrad MS70

## Installation manual

This manual provides you with the basic information required to install the Simrad MS70. For more detailed information about the practical use of the product, refer to the *Simrad MS70 Operator manual*.

This manual has been prepared for **Generic delivery**.

### System configuration

This manual is configured for the following hardware items:

- System: **Simrad MS70 Scientific multibeam sonar**
- Ethernet switch: **HP Procurve 2910**
- Number of Ethernet switches: **1**
- TRC Beamforming computers: **Dell PowerEdge R610**
  - The TRC0 computer is fitted with an Intel PRO1000PT 4–port Ethernet adapter.
- Transceiver Unit: **Single cabinet**
- OS Computer: **Simrad APC12**
- Power supplies: **External Power Supply Units**

331549/B

## Revision status

| Simrad doc.no.: 331549 / Vessel: Generic / Current revision: B. | | |
|---|---|---|
| Rev.A | 04.03.2011 | First version |
| Rev.B | 24.03.2011 | Two chapters added. For details, see the record of changes in *About this manual* on page 9. |

## Copyright



## 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 information

If you require maintenance or repair, contact your local dealer. You can also contact us using the following address: simrad.support@simrad.com. If you need information about our other products, visit http://www.simrad.com. On this website you will also find a list of our dealers and distributors.

# Table of contents

# About this manual

## Purpose

The purpose of this manual is to provide the information and basic drawings required for installation of the Simrad MS70.

For more detailed information about the practical use of the product, refer to the *Simrad MS70 Operator manual*.

## About the technical descriptions and the target audience

This manual describes the installation of the Simrad MS70.

The manual is intended for technical personnel; qualified maintenance engineers and technicians. It is assumed that the personnel is conversant with the general principles of maritime electronic equipment, in particular sonar, echo sounder and catch monitoring systems. The personnel must also be familiar with computer hardware, signal processing, interface technology and traditional troubleshooting on electronic and mechanical products.

The instructions must be followed carefully to ensure optimal performance. As a guide, installation procedures are presented in the order they are to be performed. Successful completion of each procedure is to be confirmed by checking off the corresponding box.

Note

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

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

The equipment described in this manual includes the complete system with associated cabinets, but not system units provided locally by the customer, installation shipyard or local dealer. The manual also defines the equipment responsibility, and provides instructions for unpacking and storage.

After installation, this document must be stored on board the vessel for later reference when updating or servicing the equipment.

### Installation drawings

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, provide assistance to these drawings. Drawings must be approved by the appropriate vessel certification authority prior to installation of the system.

Applicable outline dimension and productions drawings are provided in the *Drawing file* chapter. Drawings may also be downloaded in PDF and/or DWG formats from http://www.simrad.com.

### System configuration

This manual is configured for the following hardware items:

- System: **Simrad MS70 Scientific multibeam sonar**
- Ethernet switch: **HP Procurve 2910**
- Number of Ethernet switches: **1**
- TRC Beamforming computers: **Dell PowerEdge R610**
  - The TRC0 computer is fitted with an Intel PRO1000PT 4–port Ethernet adapter.
- Transceiver Unit: **Single cabinet**
- OS Computer: **Simrad APC12**
- Power supplies: **External Power Supply Units**

### Record of changes

**A** **04.03.2011**: First release

**B** **24.03.2011**

**a** TRC Beamforming computers changed from Dell 1950 to Dell R610.

**b** Added two new chapters:

→ *Transceiver Unit assembly* on page 64

→ *Setting to work* on page 161

# Simrad MS70

Study this chapter to familiarize yourself with the Simrad MS70.

**Topics**



**Related topics**

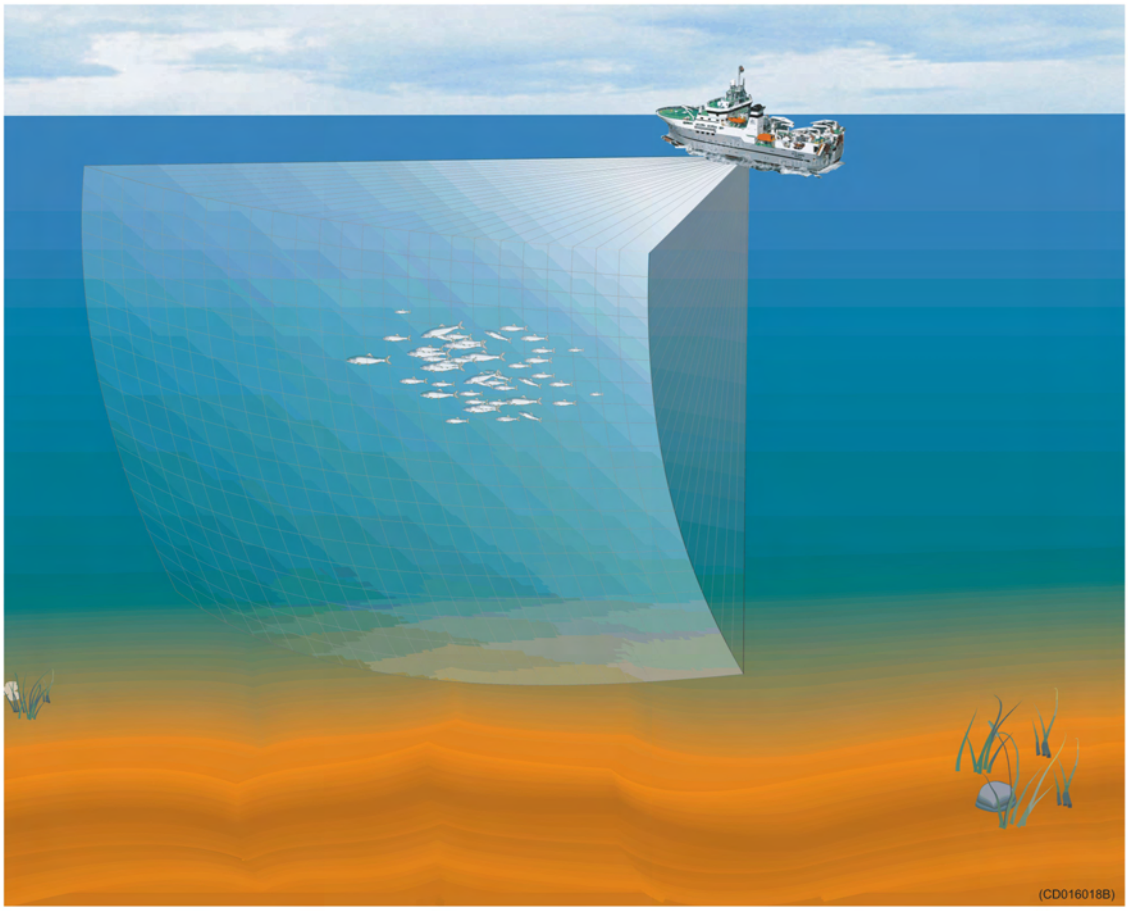


## Functional description

The Simrad MS70 is a Scientific multibeam sonar system. It is designed for fishery research applications, and incorporates the following primary features:

- Transceiver operation control
- Sensor input control
- Information display
- Data output and record control
- Replay of previously recorded data
- Remote control and data subscription
- Calibration utility

*Figure 1 Operational principle*




The Simrad MS70 Scientific multibeam sonar transducer is designed to be mounted on a drop keel. From this position, it will look horizontally athwartship, and provide a matrix of beams. This configuration allows for characterization and volume estimation of a school of fish using a single transmission. Schools of fish can be tracked, followed and studied using multiple transmissions. The MS70 also enables detection and characterization of schools close to surface.

The MS70 provides an acoustic matrix of 500 beams (25 horizontal and 20 vertical). This enables the MS70 to provide instantaneous 3D volume data. Where other systems need multiple pings to provide 3D volume data, the MS70 can provide this using a single ping. This allows the MS70 to provide more accurate data. For example, a school of fish can change its structure several times during the time other systems need to cover the school. Multiple consecutive pings enable the MS70 to provide true 4D data, where time is the fourth dimension. This allows for improved characterization of school structures that are changing over time.

# System description

The Simrad MS70 is the world's first quantitative multibeam sonar for fishery research applications The MS70 transducer array provides a matrix of acoustic beams. The array is normally mounted on a drop keel, which allows it to look horizontally. The MS70 allows you to perform characterization and volume estimation of a school of fish using a single transmission. Schools of fish can be tracked, followed and studied during multiple transmissions. The system also enables detection and characterization of schools close to surface.

The Simrad MS70 comprises the following units:

- Colour display
- Multibeam Operator Station
- Transceiver Unit
- Power Supply Units (3 ea)
- Transducer

# System diagram

A basic MS70 system diagram is provided.

### Hardware items

**A** *Multibeam Operator Station*

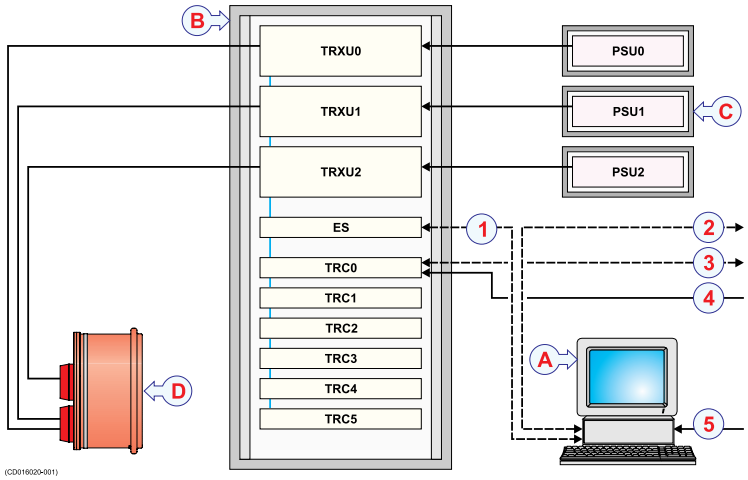
**B** *Transceiver Unit*

- ***TRXU*** *= three transceiver racks*
- ***ES*** *= Ethernet switch*
- ***TRC*** *= six beamforming computers*

**C** *Power Supply Units*

**D** *Transducer Array*

*Figure 2 Simplified system diagram*




### Interfaces

**1** Ethernet cable between the transceiver and the operator station

**2** Ethernet cable between the operator station and ship's local area network

**3** Ethernet cable to external data logger (optional)

**4** Serial line communication with a motion reference sensor

**5** Serial line communication with external sensors (Global positioning system, Course gyro and Sound velocity sensor)

The 25 cables from the transducer (D) are connected to the three transceiver shelves (TRXU) in the transceiver (B). An Ethernet switch controlling two local area networks within the transceiver distribute the processing tasks between the six beamforming computers (TRC). The operator station is connected to these networks by means of an Ethernet cable (1).

# System units

The Simrad MS70 comprises the following units:

- Colour display
- Multibeam Operator Station
- Transceiver Unit
- Power Supply Units (3 ea)
- Transducer

## Multibeam Operator Station

The MS70 Multibeam Operator Station is a high performance computer.

The computer software is based on the commercial Microsoft® Windows® XP® operating system.

The Multibeam Operator Station communicates with the Ethernet switch in the Transceiver Unit by means of an Ethernet cable.

The software on the operator station provides you with the following main functionality:

- Operational control of the Simrad MS70
- Communication with peripheral sensors and optional post-processing system(s)
- Sonar presentation
- Menu system
- Context sensitive on-line help

## Transceiver Unit

The transceiver performs the signal processing and digital beamforming of the transmitter and receiver channels.

The MS70 Transceiver Unit is housed in a 19” instrument rack.

In order to reduce the loss in the transducer cables, the transceiver is physically located as close as possible to the transducer array.

The main components in the transceiver are:

- 3 ea TRXU Transceiver subracks
- 6 ea TRC Beamforming computers
- 1 ea Ethernet switch
- Cabinet fan unit

## Power Supply Unit

The Simrad MS70 comprises three Power Supply Units. Each unit provides AC and DC power to one of the three transceiver racks in the transceiver. External analogue power supplies have been chosen to ensure minimum electric noise.

In order to reduce the voltage drop in the power cables between each Power Supply Unit and the Transceiver Unit, these cables must be kept as short as possible. The cables must also be run in steel conduits to minimize electric noise.

The main active components in each Power Supply Unit are:

- One Internet Power Switch
- One power supply, 6 Vdc
- One power supply, 12 Vdc
- One power supply, 75 Vdc

## Transducer

The MS70 Transducer is plane, and consists of a ceramic-polymer composite matrix.

The matching transformer for each transducer element is located in the transducer, this allows a low impedance connection to the Transceiver Unit. The array is connected to the rear side of the three TRXU Transceiver subracks using 25 cables.

*Figure 3 The Simrad MS70 transducer*

## Uninterrupted Power Supply (UPS)

In order to ensure continuous operation of the Simrad MS70 independent of varying quality of the vessel's mains supply, the use of uninterrupted power supplies (UPS) is important.

A UPS system must be fitted to supply to the TRC computers in the Transceiver Unit.

A UPS system is strongly recommended to power the Multibeam Operator Station and the Power Supply Units.

Normally, two UPS units are used:

- One is used to power the Multibeam Operator Station and other relevant units.

- One is used to power the Power Supply Units, and thus the Transceiver Unit.

Uninterrupted power supply (UPS) units are not included in the standard MS70 delivery.

Several commercial types are available. To choose the best UPS for the MS70 installation, consider environmental conditions, space available, the availability and duration of the batteries, and the power requirements of the MS70 units.

The minimum specifications for the Uninterrupted Power Supply (UPS) are:

- **Input voltage**: Must fit vessel supply voltage
- **Output voltage**: 230 Vac, 50 Hz
- **Output power**:

  The output power must correspond the power requirements of the MS70. If you wish to connect other computers and/or systems to the UPS, adjust the power rating accordingly.
- **Output requirement**: The AC output voltage must be a sine wave

### Related topics

- *Power requirements* on page 173

# General safety rules

***WARNING***

***The Simrad MS70 operates on 230 Vac 50/60 Hz. This voltage is 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 applicable 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 may be heavy. Make sure that the appropriate tools and certified lifting equipment are available, and that the personnel are trained in installation and maintenance work.

# General supply conditions

The following supply conditions are applicable to this Simrad MS70 delivery.

### Equipment responsibility

The shipyard performing the installation and/or equipment dealer becomes fully responsible for the equipment upon receipt unless otherwise stated in the contract.

The duration of responsibility includes:

- The period of time the equipment is stored locally before installation.
- During the entire installation process.
- While commissioning the equipment.
- The period of time between commissioning and the final acceptance of the equipment by the end user (normally the owner of the vessel which the equipment has been installed).

Unless other arrangements have been made in the contract, the Simrad MS70 guarantee period (as specified in the contract) begins when the acceptance documents have been signed

### Receipt, unpacking and storage

Upon accepting shipment of the equipment, the shipyard and/or the dealer should ensure that the delivery is complete and inspect each shipping container for evidence of physical damage. If this inspection reveals any indication of crushing, dropping, immersion in water or any other form of damage, the recipient should request that a representative from the company used to transport the equipment be present during unpacking.

All equipment should be inspected for physical damage, i.e. broken controls and indicators, dents, scratches etc. during unpacking. If any damage to the equipment is discovered, the recipient should notify both the transportation company and Kongsberg Maritime so that Kongsberg Maritime can arrange for replacement or repair of the damaged equipment.

Once unpacked, the equipment must be stored in a controlled environment with an atmosphere free of corrosive agents, excessive humidity or temperature extremes. The equipment must be covered to protect it from dust and other forms of contamination when stored.

For more information, see the appendix related to equipment handling.

→ *Equipment handling* on page 190

# General installation requirements

The following installation requirements are applicable to this Kongsberg Maritime delivery.

## Approval by classification society

The Simrad MS70 transducer installation must be approved by Det Norske Veritas (DNV) or another classification society.

The shipowner and shipyard performing the installation are responsible for obtaining the installation approval.

## Supply power

The supply voltage to the equipment is to be kept within ±10% of the installation's nominal voltage. Maximum transient voltage variations on the main switchboard's bus-bars are not to exceed -15% to +20% of the nominal voltage (except under fault conditions).

Kongsberg Maritime recommends that the Simrad MS70 is powered using an Uninterrupted Power Supply (UPS) with sine wave output.

The UPS must have the capacity to independently maintain power to the system for a minimum of 10 minutes. This ensures that the system can be switched off in a controlled manner in the event of a power failure.

## Compass deviation

Once the installation is complete, the vessel must be swung with the system in both the operative and inoperative modes. The shipowner and captain are responsible for updating the deviation table accordingly with regard to the vessel's national registry and corresponding maritime authority.

## 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 underwater 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

Make sure that ample clearance under the transducer and/or protection blister is provided when dry docking the vessel.

Avoid locating supporting blocks or structures in the vicinity of this equipment.

Note

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

Prior to dry docking, power down all hydroacoustic systems, and label each system accordingly to prevent accidental power on.

Remove circuit breakers if necessary.

### Wiring

All cables running between system cabinets located in different rooms and/or on different decks must be supported and protected along their entire lengths using conduits and/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.

For more detailed information about cables and wiring, refer to the basic cable requirements.

→ *Basic cable requirements* on page 200

## Support information

If you need additional technical support for your Simrad MS70 you must contact your local dealer, or one of our support departments. A list of all our dealers is provided on http://www.simrad.com.

**Norway (Main office)**

- **Address**: Strandpromenaden 50, 3190 Horten, Norway
- **Telephone**: +47 33 03 40 00
- **Telefax**: +47 33 04 29 87
- **E-mail address**: simrad.support@simrad.com
- **Website**: http://www.simrad.no

**Spain**

- **Address**: Poligono Partida Torres 38, 03570 Villajoyosa, Spain
- **Telephone**: +34 966 810 149
- **Telefax**: +34 966 852 304
- **E-mail address**: simrad.spain@simrad.com
- **Website**: http://www.simrad.es

### USA


- **Address**: 19210 33rd Ave W, Lynnwood, WA 98036, USA
- **Telephone**: +1 425 712 1136
- **Telefax**: +1 425 712 1193
- **E-mail address**: simrad.usa@simrad.com
- **Website**: http://www.simrad.com

# Installation planning

This chapter provides the marine engineers responsible for the installation the information necessary to plan the installation the Simrad MS70 according to Kongsberg Maritime's requirements.

Correct installation of the MS70 transducer is vital to the system's performance.

Several variables must be taken into consideration, the most important of which is the vessel's construction. This guide can be used to select the best location for the transducer, and includes a brief description of areas to be avoided.

**Topics**



## About installation drawings

All installation drawings must be supplied by the shipyard performing the installation.

Note

*The installation must be approved by the vessel's national registry and corresponding maritime authority and/or classification society. The shipowner and shipyard performing the installation are responsible for obtaining and paying for installation approval.*

Kongsberg Maritime offers free advice for installation planning. Proposed arrangements may be sent for commentary or suggestions supplied by Kongsberg Maritime. The following drawings should be submitted should assistance be requested:

- General arrangement
- Body plan and drawings of relevant bottom tanks and cofferdams
- Lines plan

# Where to mount the transducer

A single answer to the question where to locate the transducer cannot be given. It depends very much on the vessel's construction, how the hull is shaped and how the water runs along the hull. There are however a number of important guide lines, and some of these are even conflicting.

## Mount the transducer deep

Mount the transducer at a deep position on the hull. Consider the situations when the vessel is unloaded, and when it is pitching in heavy seas.

There are several reasons for this.

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

**2** Another reason to go deep is the cavitation in front of high power transducers. Cavitation is the formation of small bubbles in the water due to the resulting local pressure becoming negative during parts of the acoustic pressure cycles. The cavitation threshold increases with the hydrostatic pressure.

**3** The transducer must never be lifted free of the water surface. Transmitting into open air may damage the transducer beyond repair. Mounting the transducer at a deep position on the hull prevents this.

**4** If the transducer is lifted up from the water during heavy seas, it may be damaged when the hull strikes back at the sea surface. This is especially important for low frequency transducers with large faces.

## Mount the transducer midway

Mount the transducer midway between the bow and the stern to avoid heave effects

Heave is the vertical movement of the vessel. It disturbs the echo traces in the echogram, making a flat bottom appear as a wave. A transducer location in the middle of the vessel minimises the influence of the vessel's roll and pitch.

## Avoid protruding objects

Mount the transducer well away 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. Holes and pipe outlets are also important noise sources. They may act as resonant cavities amplifying the flow noise at certain frequencies.

Do not place an echo sounder transducer in the vicinity of such objects, and especially not close behind them.

For the same reason, it is very important that the hull area around the transducer face is as smooth and level as possible. Even traces of sealing compound, sharp edges, protruding bolts or bolt holes without filling compound will create noise.

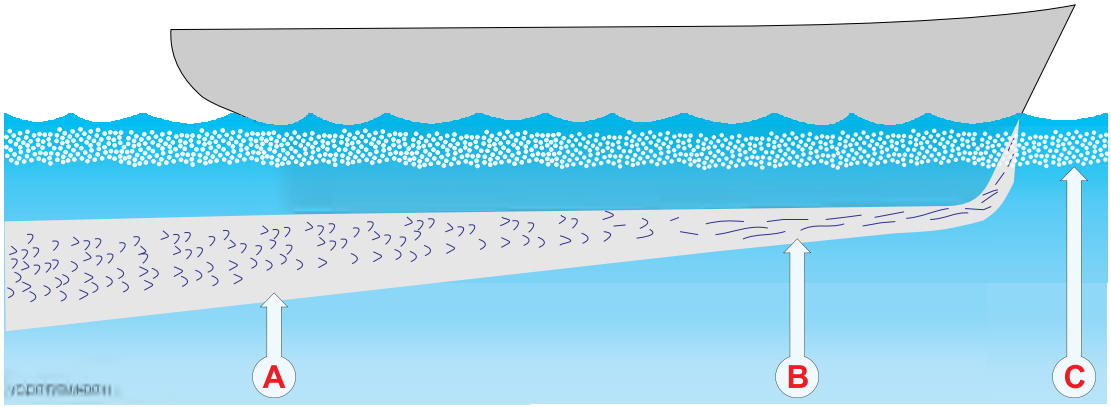
## Avoid the boundary water layer

Mount the transducer at the forward part of the hull to minimise the effects from the boundary water layer.

When the vessel forces its way through the sea, the friction between the hull and the water creates a boundary layer. The thickness of the boundary layer depends upon vessel speed and the roughness of the hull. Objects protruding from the hull, and dents in the hull, 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. The figure below illustrates the boundary layer of a vessel moving through the water.

*Figure 4 Boundary water layer*




**A** *Turbulent flow*

**B** *Laminar flow*

**C** *Air bubbles in the water*

Furthermore, air bubbles in the sea water are pressed 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 towards aft. 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 around 13 degrees, is prone to giving air problems for the transducer. In any case a transducer location in the forward part of the hull is preferred in order to minimise the influence of the boundary layer.

## Avoid all propellers

Mount the transducer far away from the propellers.

The propulsion propeller is the dominant noise source on most fishing vessels, research vessels, merchant vessels and pleasure crafts. The noise is transmitted through the sea water. For this reason, the transducer should be placed far away from the propeller, which means on the fore part of the hull. Positions outside the direct line of sight from the propeller are favourable.

On small vessels with short distances it is advised to mount the transducer on that side of the keel where the propeller blades move upwards, because the propeller cavitation is strongest on the other side. The cavitation starts most easily when the water flows in the same direction as the propeller blade, and that is to some degree the case at that side of the keel where the propeller blades move downwards.

## Avoid all bow thrusters

Mount the transducer far away from the bow thrusters.

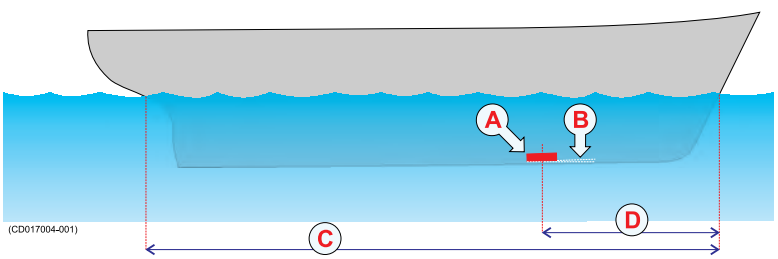
Bow thruster propellers are extremely noisy. When in operation, the noise and cavitation bubbles created by the thruster make the echo sounder useless, almost no matter where the transducer is installed. And when not in operation, the tunnel creates turbulence, and if the vessel is pitching, the tunnel may be filled with air or aerated water in the upper position and release this in the lower position.

In general, all transducers must be therefore placed well away from the bow thruster. However, this is not an invariable rule. Certain thruster designs combined with its physical location on the hull may still offer suitable transducer locations near the thruster. If you are in doubt, consult a naval architect.

## Summary and general recommendations

Some of the above guide lines are conflicting, and each case has to be treated individually in order to find the best compromise. Generally the propeller noise is the dominant factor, and a recommended transducer location is in the fore part of the hull, with maximum distance from the bow equal to one third of the total length of the hull at the water line.

*Figure 5 General recommendation for transducer location*




**A** *Transducer*

**B** *Inclination angle*

**C** *Hull length at water line*

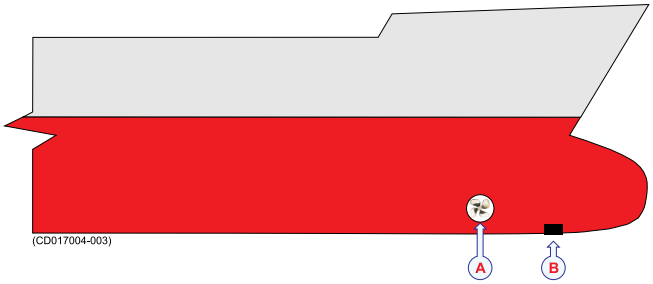
**D** *Maximum 1/3 of the hull length at water line (C)*

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

*Figure 6 Recommended location of the transducer on a bulbous hull*

**A** *Thruster*

**B** *Transducer location*




# Sonar room requirements

The “sonar room” is the compartment in which the Transceiver Unit and the Power Supply Units are installed.

Observe these minimum requirements to obtain suitable working conditions for MS70 installation, use and maintenance.

## Size and access

A well designed sonar room reduces the risk of corrosion and simplifies maintenance increasing system reliability.

- The sonar room must be dimensioned to house all the relevant cabinets that comprise the Simrad MS70.
- The physical distance between the transmitters and the transducer is limited due to the length of the transducer cables.
- The sonar room must not be unnecessarily obstructed by girders, pipes etc. which might cause installation problems or impede maintenance.
- The sonar room must be accessible under all conditions at sea or at a berth.
- All doors or hatches must be designed so that the equipment can be removed without being disassembled.

## Heating

The sonar room must be equipped with heater, dimensioned to maintain the equipment within its environmental tolerances (at least 1000 W), installed close to the deck. Heating is also an effective method for reducing humidity.

### Insulation

Bulkheads must be insulated and provided with an interior wall to the deck. The insulation should be the minimum equivalent of 50 mm of rock-wool. In addition, piping passing through the space prone to condensation must be insulated.

### Ventilation

The sonar room must be connected to the vessel's ventilation system. If this is not possible, two 3" vents must be provided from the sonar room to the main deck. In the room, the air inlet must whenever possible be located close to the deck and the outlet as high as possible. A funnel shaped drip-collector must be mounted below the vent pipes to divert moisture to the bilge. On the main deck, the best ventilation is provided when the outlet pipe is at least four meters higher than the inlet pipe. To keep out sea water, rain and spray, the ventilation pipes should be fitted with goosenecks or the equivalent. If the vessel is likely to operate in tropical conditions, a suitable air conditioning system must be installed. This system must be able to provide an ambient temperature not exceeding the maximum operating temperatures for the cabinets installed in the room.

### Cable protection

If the cables between the sonar room equipment and other system units located in different compartments on the vessel pass through hatches or areas where they may be damaged, they must be run through conduits (minimum 2" conduit is recommended).

### Electrical installations and lights

The sonar room must be equipped with suitable lighting to simplify the installation and to aid future maintenance. A minimum number of electrical outlets must be provided for the system units and other equipment.

### Bilge pump and decking

If the sonar room is located below the water line, it must be connected to the vessel's bilge pump system. If this is not possible, a separate bilge pump for the sonar room must be installed. Once the installation has been completed, the sonar room must be suitably decked without restricting access to the equipment and the cables.

## Cabling requirements

A detailed cable plan is provided for the installation of the Simrad MS70.

→ *Cable plans* on page 82

The cables fall into the following categories:

- Internal cables within the Transceiver Unit rack
- Ethernet cables between the Transceiver Unit rack and the Operator Station, and between the MS70 system and external network(s).
- Interface cables to external sensors

- Transducer cables

The power cables from the three Power Supply Unit cabinets must be run in steel conduits.

→ *Steel conduits for power cables* on page 56

The majority of the cables are provided by Kongsberg Maritime, but certain cables (in particular the cables to the external sensors) must be provided by the installation shipyard.

Note

*All electronic installations and corresponding wiring must be in accordance with the vessel's national registry and corresponding maritime authority and/or classification society. If no such guidelines exist, we recommend that Det Norske Veritas (DNV) Report No. 80-P008 «Guidelines for Installation and Proposal for Test of Equipment» is used as a guide. Observe Basic cable requirements on page 200.*

For more information about the cabling, see the *Cable layout* chapter and the basic cable requirements.

→ *Cable layout and interconnections* on page 80

→ *Basic cable requirements* on page 200

# Transducer installation

The purpose of this chapter is to provide generic descriptions and illustrations allowing the reader to understand the basic principles for echo sounder transducer installation.

This information must be regarded as general guidelines and recommendations only. The installation shipyard must design and manufacture installation hardware to fit each individual transducer and vessel. Whenever required, the installation shipyard must also have the installation approved by the applicable maritime authorities.

### Topics



### Related topics



Note

***Do not*** *expose the transducer to direct sunlight!*

***Do not*** *expose the transducer to excessive heat!*

***Do not*** *use high pressure water, sand blasting or metal tools to clean the transducer face!*

***Do not*** *use strong solvents to clean the transducer face!*

# Transducer description

The Simrad MS70 transducer is a short cylindrical container with the transducer array located at the bottom. The transducer cables penetrate the top of the cylinder.

The transducer is mounted with twelve -12- bolts with M12 thread.

A mounting ring must be welded to the blister plate. A clamping ring is then inserted sideways towards the mounting ring.

The twelve screws penetrate the clamping ring, and are fastened in the mounting ring. Both rings are supplied by Simrad.

*Figure 7 The Simrad MS70 transducer*

The transducer must be mounted so that it has a clear view within its coverage sector. It is also important that the transducer is mounted so that the water around it is not aerated.

Note

*An accurate measurement of the final position and angular orientation of the transducer is always required after installation.*

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

The transducer is provided with three sacrificial zinc anodes mounted to its top surface (lid). These anodes must be replaced when 1/3 of their bodies have been spent. If it is difficult to access the zinc anodes after the transducer has been installed, additional anodes must be mounted inside the blister. These additional anodes must be in electrical contact with the transducer, but not with the blister and/or hull.

Note

*The transducer - with the cables - is a delicate item. Great care must be shown during all handling.*

*Even minor damages to the transducer cable may cause water to penetrate both the cable and the transducer body. Further, a blow to the transducer face may easily damage one or more elements.*

# Transducer unpacking

The Simrad MS70 transducer is large and heavy. It is also a delicate precision instrument, and it must be handled with care during unpacking and installation. The following basic rules for transducer handling MUST be followed.

## Handling rules

Note

***Do not*** *expose the transducer to direct sunlight!*

***Do not*** *expose the transducer to excessive heat!*

***Do not*** *use high pressure water, sand blasting or metal tools to clean the transducer face!*

***Do not*** *use strong solvents to clean the transducer face!*

### Related topics

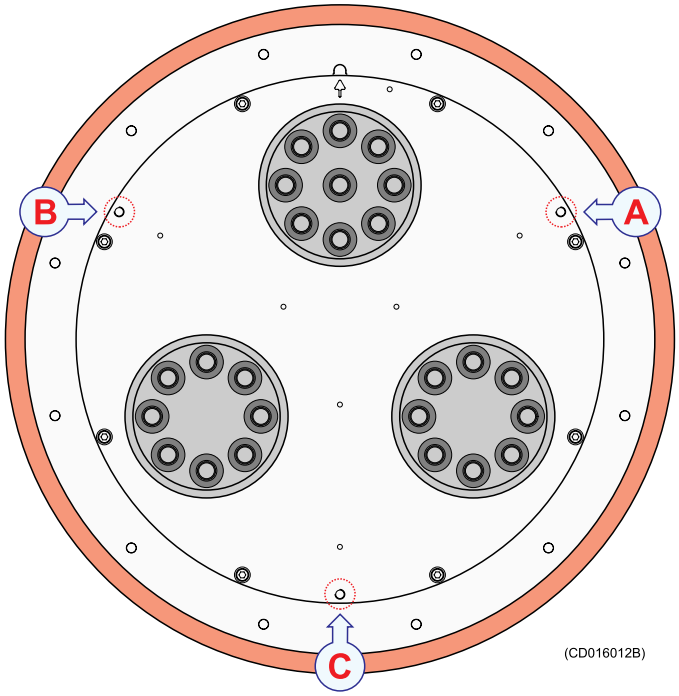
- *Rules for transducer handling* on page 44

## How to lift the transducer out of its transport crate

The Simrad MS70 transducer is shipped in a large wooden crate. The crate has two "rooms", one to house the transducer, and one to house the cables. The transducer is placed with its "face" downwards. It rests on a protective cushion shaped to fit the transducer. Across the top of the transducer body, a wooden beam secures that it stays in place during transportation.

**A** *The three M10 lifting eye bolts are inserted into these threaded holes.*

*Figure 8 The top side of the transducer array*




### Preparations

In order to lift the transducer out from its transportation crate, you will need a suitable crane. The crane must be able to carry the total weight of the transducer array and the cables. You will also need the necessary ropes and tackles, as well as three M10 lifting eye bolts. In order to protect the transducer face while handling the array, you will also need a circular wooden plate with diameter 522 mm. The weight of the transducer array is provided in the *Technical specifications* chapter.

### Procedure

**1** Open the crate. Do not use heavy tools, and make sure that you do not damage the transducer or any of the cables inside the crate.

2 Remove the transport beam across the top of the transducer body.

3 Mount the three 10 mm lifting eye bolts.

4 Lift the transducer straight up and out of the crate. Support the cables during the lift to keep the transducer body from tilting sideways.

5 Place the protective wooden plate under the transducer body to protect its face.

# Transducer installation procedure

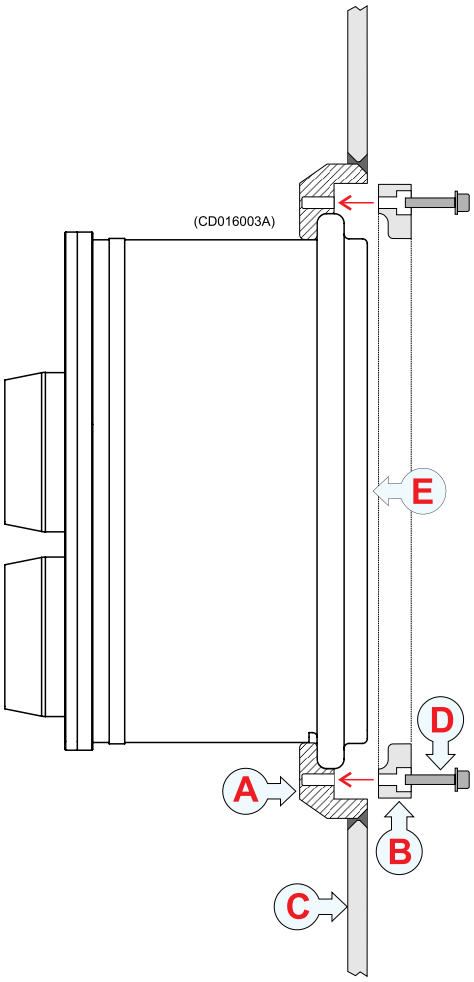
Observe the following procedures to install the Simrad MS70 transducer array.

## Installation principles

The Simrad MS70 transducer array is installed vertically in a retractable keel lowered below the vessel's hull. A mounting ring (B) is welded to the side wall of the retractable keel (C). The transducer is pushed in sideways, and fits into the mounting ring with the transducer face (E) facing towards port. A clamping ring (B) is mounted sideways, and holds the transducer in place by means of 12 bolts (D).

The lifting eyes on the transducer must be removed prior to final installation.

*Figure 9 Transducer installation principle*




**A** *Mounting ring (welded to the retractable keel's side wall)*

**B** *Clamping ring*

**C** *Side wall of retractable keel*

**D** *Bolts (12 x 12M)*

**E** *Transducer face*

The transducer is provided with three sacrificial zinc anodes mounted to its top surface (lid). These anodes must be replaced when 1/3 of their bodies have been spent. If it is difficult to access the zinc anodes after the transducer has been installed, additional anodes must be mounted inside the blister. These additional anodes must be in electrical contact with the transducer, but not with the blister and/or hull.

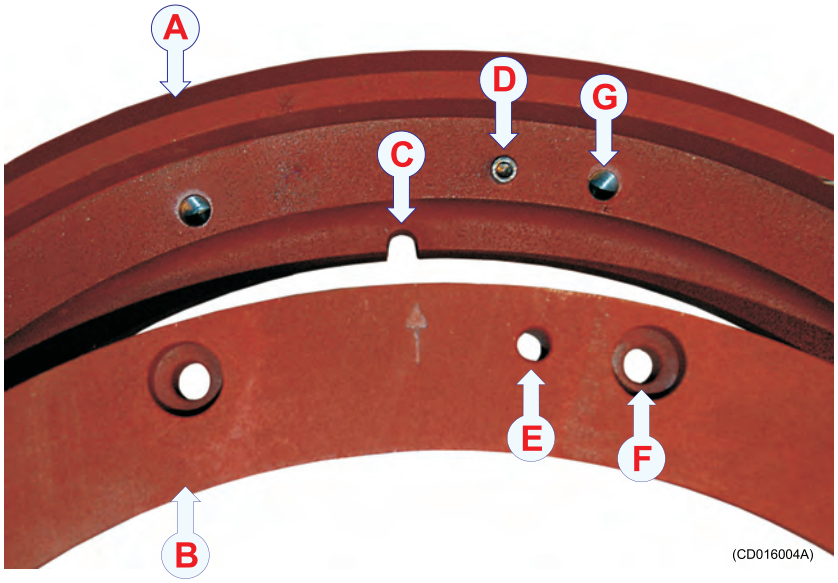
## Preparations

**1** Using available literature, experience and the ship drawings, decide the physical location of the transducer.

**2** Prepare the retractable keel to accept the transducer array.

- A suitable hole for the array must be provided, and you must ensure that enough space is available to accept the transducer and all the cables.
- Also, suitable cable ducts must be prepared.
- Refer to the mounting and clamping ring drawings.

*Figure 10 Mounting and clamping rings*




**A** *Mounting ring (to be welded to the retractable keel)*

**B** *Clamping ring*

**C** *Guidance notch in the mounting ring. This notch must be pointing UP!*

**D** *M6 guidance bolt on the mounting ring.*

**E** *M6 guidance hole on the clamping ring, will ensure that the clamping ring fits correctly on the mounting ring.*

**F** *Hole for one of the 12 mounting bolts.*

**G** *Self-locking thread to accept the mounting bolt.*

## Mounting the array

**1** Weld the mounting ring to the retractable keel. Ensure that the notch on the mounting ring points UP.

- Special care must be taken to ensure that the mounting ring is welded correctly in place.
- Check and verify that the mounting ring is vertical.
- Check and verify that the ring is not twisted out of shape as a result of the welding.

**2** Lift the transducer, and place it into the mounting ring. Ensure that the arrow on the transducer rim points UP.

**3** Fit the clamping ring, and mount the 12 bolts.

- Bolt type: M12 x 55 Stainless steel A4 Class 80
- Washer: Flat, Stainless steel A4 Class 80
- Torque: 76 Nm
- Apply Locktite 243

## Cables

**1** Place the cables in the cable ducts, and pull them through the applicable seals to the sonar room.

**2** Check and verify that cables are installed in such a way that they are protected from sharp edges, shock and vibration, as well as occasional work on the vessel.

→ *Transducer cables and conduit* on page 35

# Transducer cables and conduit

25 cables arranged in three groups are used to connect the MS70 transducer array to the 19” rack with the transceiver circuitry.

**A** *Steel conduit*

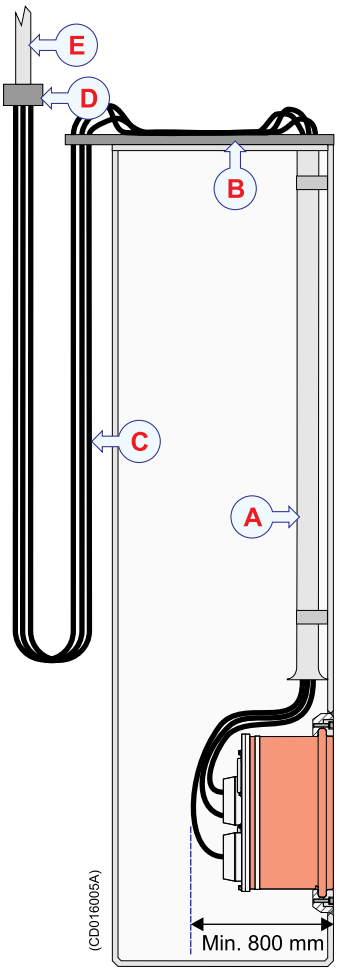
**B** *Watertight seal*

**C** *Allow the transducer cables to move freely up and down*

**D** *Secure the cables here*

**E** *Steel conduit*

*Figure 11 Designing the cable conduit*




By default, each cable is 25 meters long. The cables are cut to fit each individual installation.

The cable must be properly supported both inside and outside the retractable keel.

On the inside, design a steel cable duct from the top of the keel to just above the transducer (A). On the top of the ducts, place a watertight seal (B) which also supports the total weight of the cables, both inside and outside the keel.

Outside the retractable keel, allow the cable to run smoothly up and down (C) when the keel is lowered and hoisted. The top of the external cable run must be properly and permanently secured (D), and the seal must be able to take the entire weight of the cables. It is also important to ensure that the cable run can move undisturbed up and down outside the keel. There must be no obstructions to prevent the cables from moving freely!

A second steel conduit (E) is used between the external cable support and the electronic equipment in the sonar room.

## Design of cable conduit

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

If a watertight sealing is used, the design and quality of this sealing must be approved by the vessel’s classification society.

# Transducer alignment

The Simrad MS70 is a precision instrument for scientific use. In order to produce data that are both detailed and correct, it is necessary to calibrate the survey vessel more accurately than what may have been a standard practice earlier. The results, with all measurements taken in a common vessel coordinate system must be entered as MS70 operational parameters.

The calibration tasks include:

- measurement of where sensors are located
- measurement of how sensors 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

### Topics



Note

*Calibration must be taken seriously. It is recommended that this task and the continued control of the soundings' consistency is assigned to one motivated and qualified person in the organization. To achieve the best results, the calibration must be planned carefully, and monitored throughout the installation and the first sea trials. It is also recommended to repeat the calibration procedures with regular checks throughout the operation of the vessel.*

## Measurements

Observe this general introduction to the alignment task.

### Objectives

The following measurements must be made after installation:

- the horizontal and vertical positions of the transducer array.
- the angular orientation of the transducer array
- the horizontal and vertical positions of the motion sensor
- the horizontal and vertical positions of the positioning system (radio or GPS antenna)

It is easiest to perform these measurements with the vessel in dry dock, the others may be done with the vessel berthed. It is however recommended to perform these when in dry dock

During the sea trials (SAT), calibration surveys are required as described in the *MS70 Reference Manual*. Based on the calibration parameters determined from these surveys, proper values are entered into the MS70 as operational parameters.

In order to check and verify the performance of the MS70 system, we strongly recommend that calibration surveys are performed at regular intervals, or prior to any large survey. If existing sensors have been replaced, or new sensors have been installed, a new calibration is always required.

### Alignment of motion and heading sensors

The alignment of the motion sensor and the heading sensor must be adjusted so that they provide zero values for pitch, roll and heading with the vessel lying still with normal trim and a true North heading. It is recommended that this takes place in the dry dock. Alternatively, the offsets from zero must be determined. This is easiest to do with the vessel berthed. Follow the procedures in the applicable sensor manuals.

### Time delays

Any time delays of the motion sensor and positioning data from their time of validity to the time when they are available at the interface ports of the MS70 must be determined. The information may be available from the sensor manufacturer.

### Water line

Finally, the vertical position of the water line must be measured with the vessel in normal trim. This should preferably be done at normal survey speed, and must of course be repeated as the loading and hence the draft of the vessel changes.

## 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 are no restrictions to where the coordinate system's origo is located in the **X** and **Y** directions. In the **Z** direction however, the origo must be located on the water line.

Note

*The sea surface with the vessel in normal trim defines the horizontal (X-Y) plane. The water line must therefore be marked on the hull with the vessel in normal trim before any dry docking.*

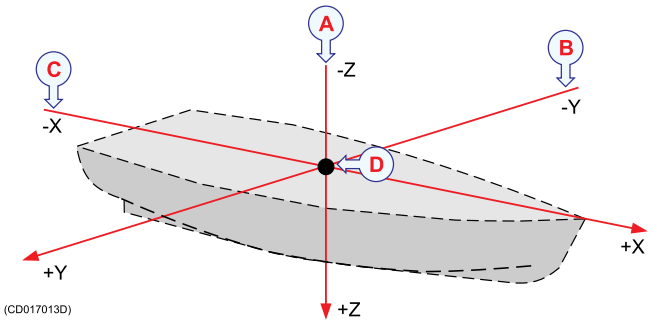
*Figure 12 Vessel coordinate system with the reference point on the water line*

**A** *Downward (Z-axis)*

**B** *Starboard (Y-azis)*

**C** *Forward (X-axis)*

**D** *Reference point (origo)*




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

## Sensor locations

The MS70 transducer array must be located according to the guidelines given elsewhere in this manual. With regard to the location of other sensors the following guidelines should be followed, but otherwise should be chosen according to the manufacturer's documentation.

### Motion sensor

The system motion sensor should normally be mounted on the centre line of the vessel, either close to the MS70 transducer array, or close to the vessel's centre of gravity.

The latter point is recommended if the sensor is used for other purposes than just with the MS70, or if its accuracy is sensitive to horizontal accelerations.

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, then this is the ideal location for the motion sensor. This will eliminate any errors from squat induced height changes which is not measured by current motion sensors.

Note

*If the fore-and-aft distance between the transducer array and the motion sensor is larger than 20 m, the system accuracy may be degraded.*

*The motion sensor must be aligned with the vessel centre line.*

### Heading sensor

The alignment of the motion sensor and the heading sensor must be adjusted so that they provide zero values for pitch, roll and heading with the vessel lying still with normal trim and a true North heading. It is recommended that this takes place in the dry dock. Alternatively, the offsets from zero must be determined. This is easiest to do with the vessel berthed. Follow the procedures in the applicable sensor manuals.

Note

*The heading sensor must be aligned with the vessel centre line.*

## Measurement accuracy

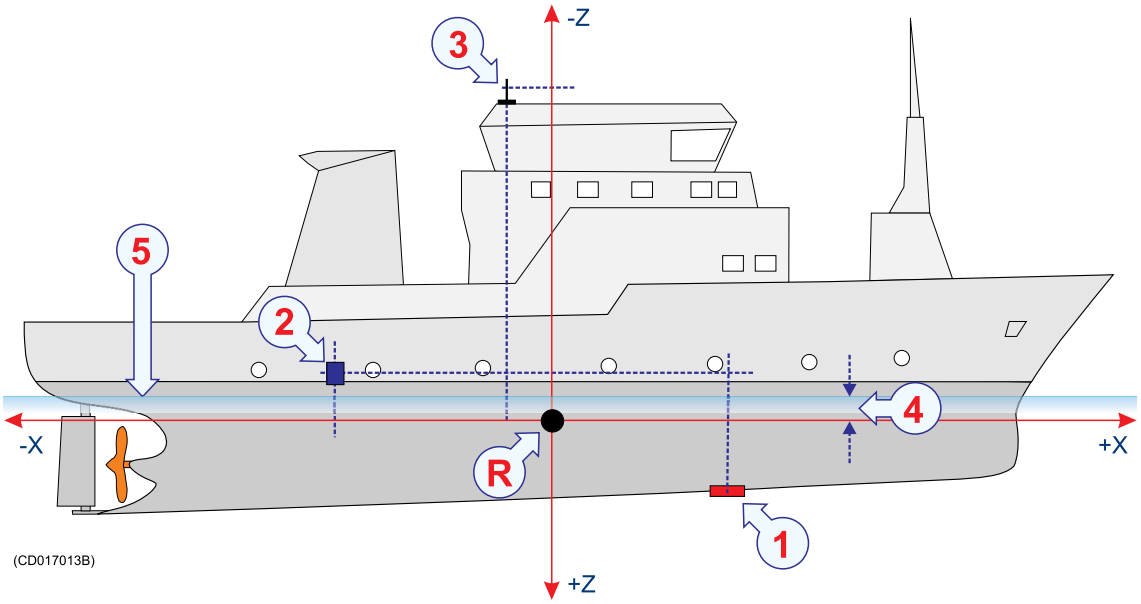
The required measurement accuracies given below have been determined from considerations on how they contribute to total system accuracy. Any errors in these measurements shall not significantly contribute to depth or position errors in the soundings.

The motion sensor must be aligned (set up). The indicated roll and pitch angles from the sensor when the vessel has a normal trim (i.e. the coordinate system's horizontal plane is horizontal) must be less than ±0.055° for both roll and pitch.

Note

*The given accuracies are maximum values, and if easily achievable, better accuracies should be obtained.*

*Figure 13 Typical location of sensors*




**1** *Location of the transducer array*

**2** *Motion sensor*

**3** *GPS Antenna*

**4** *Draft*

**5** *Water line*

***R** is the reference point (origo)*

## Transducer array

**1** Measure the vertical location of the transducer array with an accuracy of ±2 cm.

**2** Measure the horizontal location of the transducer array with an accuracy of ±5 cm.

**3** Measure the heading of the transducer to an accuracy of ±0.1°.

**4** Measure the roll (with respect to the horizontal plane) to an accuracy of ±0.025°.

**5** Measure the pitch (with respect to the vertical plane) to an accuracy of ±0.1°.

## Motion sensor

If the alongship distance between the transducer array and the Motion Sensor exceeds 5 m, its indicated pitch angle for vessel in normal trim must be less than 0.25°. If the distance is 20 m, the indicated pitch should be less than 0.05°. A linear interpolation for the other distance alternatives is recommended.

**1** Measure the vertical location of the motion sensor to an accuracy of ±10 cm.

**2** Measure the horizontal location of the motion sensor to an accuracy of ±5 cm.

Note

*If the Motion Sensor performs lever arm correction to give heave data valid for another location than where it is actually mounted, it is this location which must be measured.*

3 Set up the forward axis on the motion sensor with the X-axis of the vessel's coordinate system to an accuracy of ±0.1°.

4 Set up the motion sensor such that the indicated roll and pitch angles from the sensor when the vessel has a normal trim (the coordinate system's horizontal plane is horizontal) are less than ±0.05° for both roll and pitch.

### Heading sensor

The heading sensor must be aligned with the X-axis of the vessel's coordinate system to an accuracy of +0.255. If this is not possible, the resulting offset must be known to the same accuracy.

### Positioning system

1 Measure the vertical location of the positioning system antenna with an accuracy of ±2 cm.

This is only required if the positioning system measures position in the vertical axis. This will be usually only be the case for real-time kinematic GPS systems and some optical positioning systems.

2 Measure the horizontal location of the positioning system antenna's with an accuracy of ±5 cm or 20% of the positioning system's accuracy.

### Water line

Note

*With the vessel in normal trim, that is with an indicated pitch angle of zero from the motion sensor, the distance to the water line may be measured anywhere on the vessel, but 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.*

1 Measure the vertical distance to the water line with an accuracy of ±2 cm.

## Transducer orientation

The MS70 transducer array is equipped with index marks to be used for measuring its orientation. A ruler oriented with the face index marks can be used to give the heading and pitch of the array. By making the ruler as a right-angle cross the roll may be measured.

## Coordinate systems

The heading of the transducer array is measured as the heading of the projection of a line through the face index marks into the horizontal plane of the vessel coordinate system. If the array is mounted in such a way that the X-axis is vertical, the heading angle must be measured as the heading of the Y-axis with 90° subtracted. See the definition below.

The measurement of roll and pitch is done in a coordinate system which is the vessel coordinate system rotated about the Z-axis so that its X-axis is pointing in the transducer's heading direction.

- The pitch of the transducer array is measured as the angle in the vertical plane between the horizontal plane and the line through the index mark.

  The pitch installation angle is measured between the X axis and the horizontal plane. The angle is positive if the axis points upwards, and negative if it points down. The range is between -90° and +90°.

- The roll of the transducer array is measured as the angle in the vertical plane between the horizontal plane and a line on the face at right angle to the line through the index mark.

  The roll installation angle is measured between the Y axis and the horizontal plane. The angle is positive if the axis points downwards, and negative if it points up. The range is between -180° and +180°.

To determine if the roll installation angle is larger than +90° or smaller than -90°, consider how much roll was required to bring the transducer array into its final position. Use the standard definition for roll direction.

The MS70 software converts the measured roll angle to a rotation angle. This is made with an arc sine calculation, and erroneous measurements or data entry may make this impossible. However, if the measurements are done accurately, this will never be a problem.

## Making the measurements

The actual measurement of the installation angles may be done by two different methods:

**1** The most accurate method is to use land surveying techniques, establish a horizontal plane, and do distance measurements to and in this plane.

**2** The second method is to use an inclinometer to measure roll and pitch angles combined with distance measurements in the horizontal plane for heading. This method is easier, but it requires a sufficiently accurate inclinometer.

Which method is to be used must be determined by the facilities available. The use of land surveying techniques is the recommended method, and is especially appropriate on a new vessel where all sensor locations must be measured. The two other methods may be appropriate when installing an MS70 on a survey vessel where other sensor positions and orientations are already established. A prerequisite for using an inclinometer is of course that it is accurate enough.

## Heading sensor calibration

It may not be possible to calibrate the heading sensor accurately enough through sea trials, so the calibration is normally done with the vessel berthed.

On the quay the geographical coordinates of two points must be known or measured so that the heading of a line on the quay can be established to an accuracy of better than ±0.1°. The distance from two points on the centre line of the vessel (fore and aft) are then measured so that the vessel's heading can be calculated. The heading sensor is then aligned to this heading or its measured offset determined.

The vessel must be turned 180° as many times as necessary with the alignment or offset checked until the **mean error** is within the specifications of the heading sensor.

## Alignment summary

The table below give a summary of the requirements to the accuracy of the measurements.

*Table 1 Alignment summary*

| Sensor | Measurement | Accuracy |
|---|---|---|
| Transducer array | Position (x,y) [m] | ±0.05 |
| Transducer array | Position (z) [m] | ±0.02 |
| Transducer array | Pitch [deg] | ±0.10 |
| Transducer array | Roll [deg] | ±0.025 |
| Transducer array | Heading [deg] | ±0.50 |
| Motion sensor | Position (x,y) [m] | ±0.05 |
| Motion sensor | Position (z) [m] | ±0.10 |
| Motion sensor | Pitch [deg] | ±0.05 |
| Motion sensor | Roll [deg] | ±0.05 |
| Motion sensor | Heading [deg] | ±0.10 |
| Heading sensor | Heading [deg] | ±0.10 |
| Positioning system (antenna) | Position (x,y) [m] | ±0.05 |
| Positioning system (antenna) | Position (z) [m] | ±0.02 |
| Water line | Position (z) [m] | ±0.02 |

# Transducer handling and maintenance

You MUST observe the following rules for handling, cleaning, maintenance and painting.

**Topics**



## Rules for transducer handling

Note

***Do not*** *expose the transducer to direct sunlight!*

***Do not*** *expose the transducer to excessive heat!*

***Do not*** *use high pressure water, sand blasting or metal tools to clean the transducer face!*

***Do not*** *use strong solvents to clean the transducer face!*

### Transport protection

Some transducers are delivered with a cover plate on the face for protection during transport. Let this plate stay on as long as possible, but do not forget to remove it before the vessel goes into the sea.

### Painting the transducer face

An anti-fouling paint may be applied to the transducer face. Because some paint types may be aggressive to the polyurethane in the transducer face, consult Simrad's list of approved paints.

→ *Approved anti-fouling paints for transducers* on page 45

### Cleaning the transducer face

Whenever opportunity arise, for example when the vessel is dry docked, the transducer face may be cleaned for shells and other marine fouling.

Be careful not to make cuts in the transducer face.

Use a piece of soft wood or a very fine grade emery paper.

Do not use high pressure water or sand blasting.

### Special rules for acoustic windows

Arctic tanks have acoustic windows made of polycarbonate.

These must neither be painted nor cleaned with chemicals.

Acoustic windows must not be exposed to direct sunlight.

## Rules for transducer maintenance

Once installed, the transducer is maintenance free. However, when the vessel is docked, it is highly recommended to clean the transducer face to remove marine growth.

1 Perform a thorough visual check of the transducer.

2 If necessary, clean the transducer

- To clean the transducer, use normal synthetic soap and water.
- To remove marine growth, use fine-grade sandpaper or emery paper.

Note

***Do not*** *expose the transducer to direct sunlight!*

***Do not*** *expose the transducer to excessive heat!*

***Do not*** *use high pressure water, sand blasting or metal tools to clean the transducer face!*

***Do not*** *use strong solvents to clean the transducer face!*

3 If necessary, apply a new layer of anti-fouling paint to the transducer face.

Because some paint types may be aggressive to the polyurethane in the transducer face, please consult Simrad's list of approved paints.

→ *Approved anti-fouling paints for transducers* on page 45

## Approved anti-fouling paints for transducers

This is Simrad's list of approved antifouling paints on polyurethane transducer housing.

Please note that the products offered from these manufacturers are changed. Old products are removed, and new are offered. Consult the manufacturer's websites for up-to-date information. In case of doubt, contact Simrad for advice.

Refer to the manufacturer's documentation and data sheets for a complete product information and applicable procedures.

### Jotun

Head office address: P.O.Box 2021, N-3248 Sandefjord, Norway

Website: www.jotun.com.

1 Racing

2 Non-stop

3 Safeguard Universal primer (125 micron) with Antifouling SeaQuantum Ultra (125 micron)

4 Antifouling Seaguardian

### International Marine Coatings

Address: World-wide offices

Website: www.international-marine.com.

**1** Intersleek tie coat + 425 FCS

- BXA386/BXA390/BXA391 Grey
- HKA563/HKA570/HKA571 Yellow
- Mix BXA386, BXA390 and BXA391 first, then apply. When dry, mix HKA563, HKA570 and HKA571, apply.

**2** Intersmooth 360 Ecoloflex SPC

**3** Micron Extra

### Hempel IFA Coatings

Head office address: Hempel A/S, Lundtoftevej 150, Kgs. Lyngby, DK-2800 Copenhagen, Denmark

Website: www.hempel.com.

**1** Hempel A/F Classic 76550

# Transceiver Unit installation

This chapter explains how to install the Simrad MS70 Transceiver Unit.

The Transceiver is normally positioned in a dedicated room in the vicinity of the transducer. The physical length of the cables limit the physical distance between the transducer and the transceiver.

### Topics



### Related topics


- *Sonar room requirements* on page 25
- *Performance, Transceiver Unit* on page 168
- *Power requirements* on page 173
- *Environmental requirements* on page 174
- *Transceiver Unit outline (281020)* on page 177


## About the Transceiver Unit

The transceiver performs the signal processing and digital beamforming of the transmitter and receiver channels.

The MS70 Transceiver Unit is housed in a 19” instrument rack.

In order to reduce the loss in the transducer cables, the transceiver is physically located as close as possible to the transducer array.

The main components in the transceiver are:

- 3 ea TRXU Transceiver subracks
- 6 ea TRC Beamforming computers
- 1 ea Ethernet switch
- Cabinet fan unit

Note

*The Transceiver Unit is shipped as a "wired rack".*

*This means that the 19" instrument rack is empty.*

*The TRXU subracks, Ethernet switch and TRC computers are not mounted. However, all internal mounting material and wiring have been prepared to accept these units.*

*The physical installation of the electronic units, the internal wiring and the setting-to-work procedures are done by personnel from Kongsberg Maritime AS.*

# Transceiver Unit preparations

The instrument rack housing the Transceiver Unit is equipped with shock absorbers at the bottom of the cabinet and at the left hand side. This means that the cabinet is designed to be installed alongside a bulkhead.

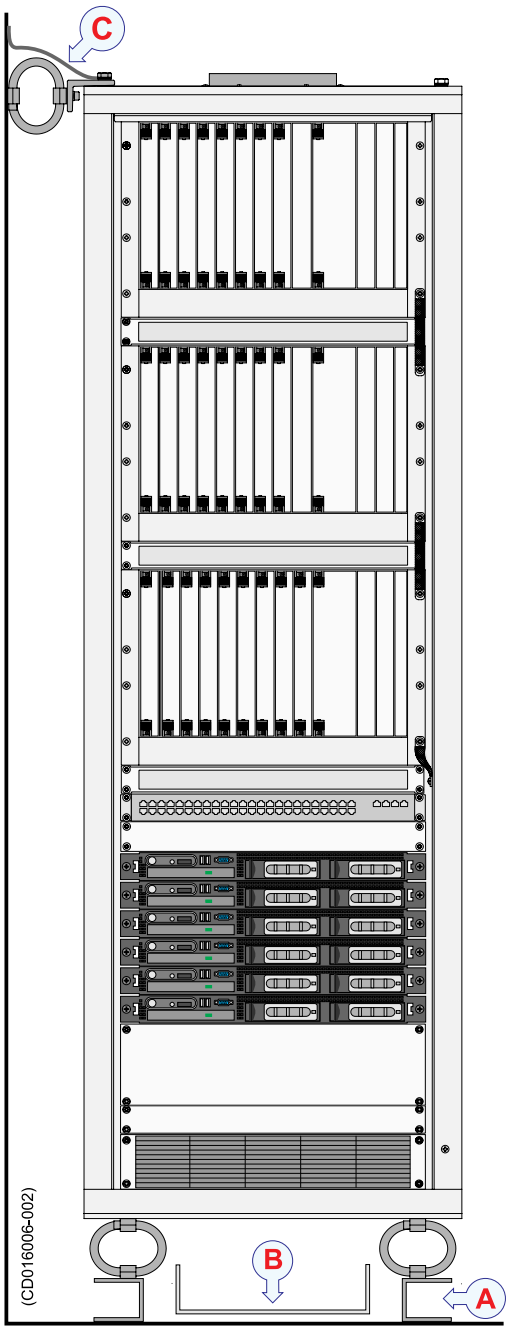
**A** *U-shaped steel profiles, must provide minimum 10 cm height*

**B** *Cable tray*

**C** *Grounding*

This procedure outlines the necessary tasks to prepare the transceiver for installation.

*Figure 14 Transceiver Unit positioning and grounding*




**1** Use U-shaped steel profiles (**A**) to add extra height for the cabinet. This allows room below the cabinet for transducer and interconnection cables.

**2** Use the space below the cabinet to install a cable tray (**B**) for the transducer cables.

All cables enter the cabinet through an opening in the bottom frame.

**3** Ensure that the Transceiver Unit can be properly grounded (**C**).

**4** Observe the outline dimensions drawing and the details regarding the cabinet's footprint.

→ *Transceiver Unit outline (281020)* on page 177

**5** Check and ensure that ample space is provided around the cabinet to allow for cables, maintenance and replacement of modules.

- Minimum space requirement, front: 100 cm
- Minimum space requirement, rear: 60 cm
- Minimum space requirement, below: Minimum 10 cm below the shock absorbers

**6** Check that the environmental requirements (temperature and humidity) for the sonar are met.

→ *Environmental requirements* on page 174

**7** Check that the sonar room requirements are met.

→ *Sonar room requirements* on page 25

# Transceiver Unit installation procedure

This procedure explains how to install the Transceiver Unit.

The Transceiver Unit is housed in a 19 inch commercial instrument rack.

The chosen method for mounting the cabinet must be determined by the installation shipyard and the customer. The cabinet may be welded to the deck and bulkhead brackets, or mounted using suitable bolts.

**1** Position the U-shaped profiles below the Transceiver Unit to provide the recommended height.

**2** Arrange the necessary brackets on the bulkhead to fit the shock absorbers.

Note that the outline dimension drawing shows the initial size of the shock absorbers. When the cabinet is complete with all electronics, the weight will compress the bottom shock absorbers slightly. You must take this into consideration when you arrange the mounting of the absorbers at the top of the cabinet.

**3** Mount the bulkhead brackets for the shock absorbers.

**4** Place the cabinet in its correct position, and mount it properly.

# Transceiver Unit parts identification

This section provides a generic overview of the Transceiver Unit.

Easy access to the front and rear part of the Transceiver Unit is essential, as this allows for easy replacement of parts.

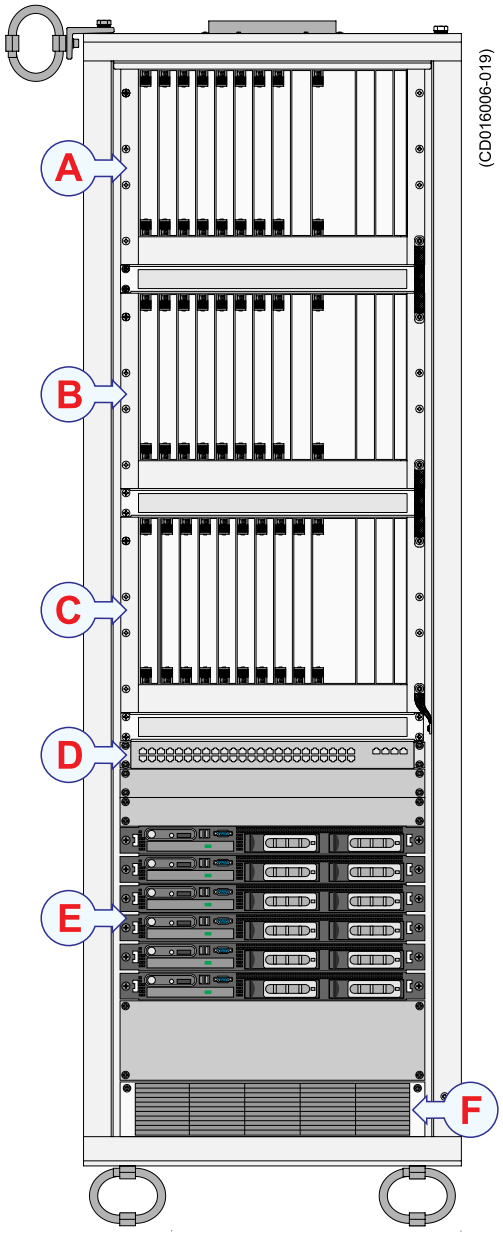
### Line replaceable units

The following units have been defined as line replaceable units in the Transceiver Unit.

- TRX32 Receiver boards
- SMS Driver boards
- TRX RIO boards
- Capacitor module
- Ethernet switch
- TRC Beamforming computer
- Cabinet fan unit

## Forward view

*Figure 15 Transceiver Unit, front view*




**A** *Transceiver rack TRXU0*
*Eight TRX32 boards are used.*

**B** *Transceiver rack TRXU1*
*Eight TRX32 boards are used.*

**C** *Transceiver rack TRXU2*
*Nine TRX32 boards are used.*

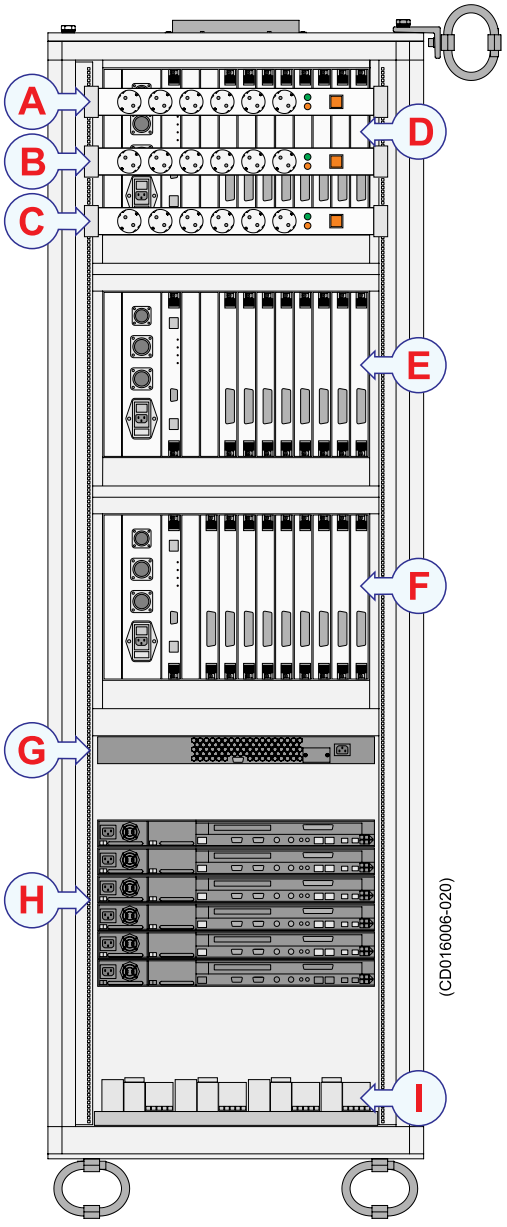
**D** *Ethernet switch*

**E** *TRC0–5 Beamforming computers*
*TRC0 (top) is the master.*

**F** *Fan unit*

## Rear view

*Figure 16 Transceiver Unit, rear view*




**A** *Power distributor PD2*

**B** *Power distributor PD1*

**C** *Power distributor PD1*

**D** *Rear side of Transceiver rack TRXU0*

**E** *Rear side of Transceiver rack TRXU1*

**F** *Rear side of Transceiver rack TRXU2*

**G** *Rear side of Ethernet switch*

**H** *Rear side of TRC Beamforming computers*

**I** *Circuit breakers (from left) CB0, CB1, CB2, CB3*

# Power Supply Unit installation

This chapter explains how to do the physical installation of the Power Supply Units.

The three units are installed in the sonar room within reasonable distance from the Transceiver Unit. The physical length of the power cables limit the physical distance between each Power Supply Unit and the Transceiver Unit.

### Topics



### Related topics

# About the Power Supply Unit

The Simrad MS70 comprises three Power Supply Units. Each unit provides AC and DC power to one of the three transceiver racks in the transceiver. External analogue power supplies have been chosen to ensure minimum electric noise.

In order to reduce the voltage drop in the power cables between each Power Supply Unit and the Transceiver Unit, these cables must be kept as short as possible. The cables must also be run in steel conduits to minimize electric noise.

The main active components in each Power Supply Unit are:

- One Internet Power Switch
- One power supply, 6 Vdc
- One power supply, 12 Vdc
- One power supply, 75 Vdc

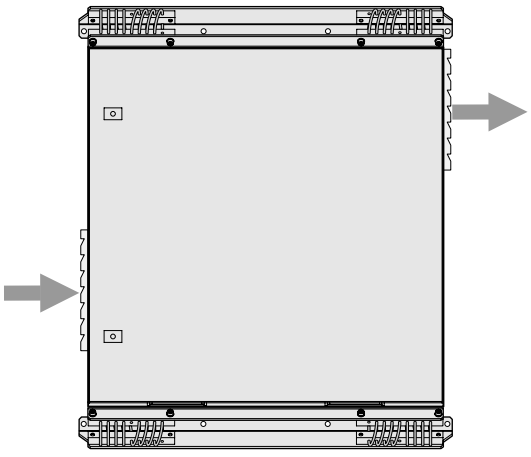
# Power Supply Unit preparations

Before the Power Supply Units are mounted, observe the following procedure.

### Installation methods

- Each cabinet can be installed "stand-alone", side by side or on top of each other. Make sure that enough space is provided between the cabinets to allow for ventilation, maintenance and parts replacements.
- The three cabinets can be installed together on a dedicated frame. This is an option, and the frame must be ordered separately. The frame is mounted vertically on the bulkhead by means of shock absorbers.

*Figure 17 Power supply Unit ventilation; air flow*



### Procedure

**1** Observe the outline dimensions drawing and the details regarding the Power Supply Unit's footprint.

→ *Power Supply Unit outline (311237)* on page 181

→ *Power Supply Unit mounting frame (308337)* on page 183

**2** Decide which of the two installation methods that will be used.

**3** Provide ample space around the cabinet to allow for ventilation, inspection, maintenance and parts replacement. Make sure that the cabinet door can be fully dismounted for unobstructed access to its internal parts.

- Minimum space requirement, front: 80 cm
- Minimum space requirement, rear: 0 cm
- Minimum space requirement, below: 0 cm (provided that the four feet are mounted)

**4** Check that the environmental requirements (temperature and humidity) for the sonar are met.

→ *Environmental requirements* on page 174

**5** Check that the sonar room requirements are met.

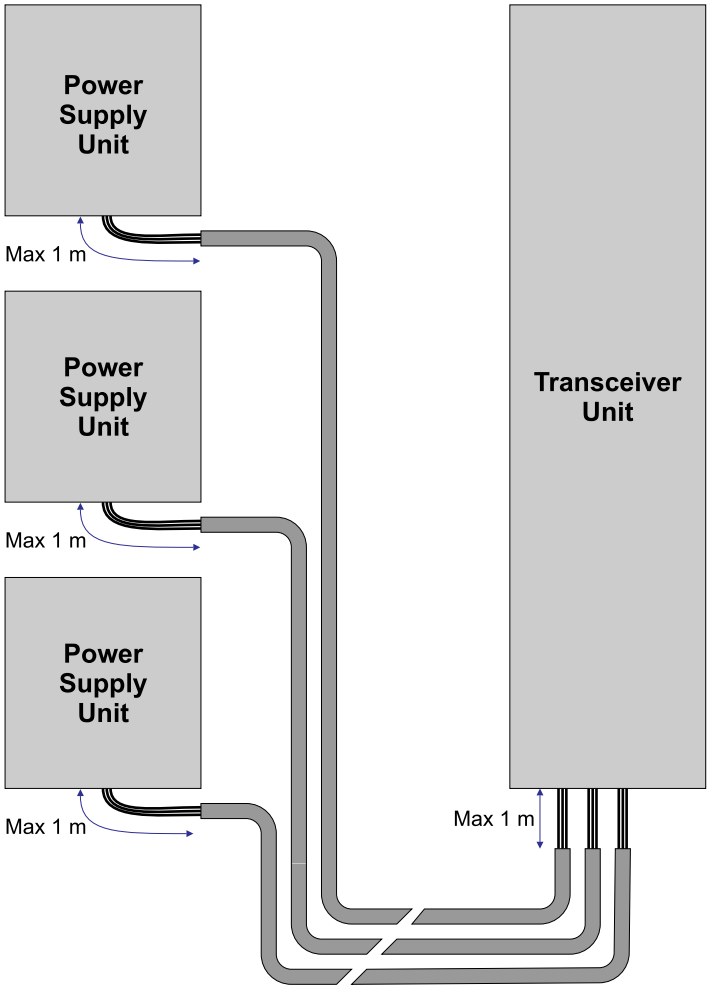
→ *Sonar room requirements* on page 25

# Steel conduits for power cables

Note

*Due to the voltages and currents provided by the power supplies, steel conduits are imperative.*

*Figure 18 Steel conduits principle*




The power cables from the three Power Supply Unit cabinets to the Transceiver Unit must be run in steel conduits. These conduits serve the following purposes:

- Noise and interference protection
- Physical protection

The minimum internal diameter of the steel conduits is 5 cm.

The maximum length of unprotected cable is 1 meter in each end of the conduit. For this reason, separate conduits for each Power Supply Unit is required.

If it is necessary to bend the steel conduits, make sure that the bending radius do not prevent the cable from being pulled through the conduit.

# Power Supply Unit installation procedure

Depending on the installation method provided, two procedures are provided.

### Cabinets mounted side by side, or above each other

1. Observe the eight 8.5 mm mounting holes through the rear side of the two shock absorbers.
2. Arrange the necessary brackets on the bulkhead to fit the cabinets.
3. Prepare the brackets to accept the eight bolts.
4. If necessary, mount a temporary shelf under the cabinet to support its weight.
5. Place the cabinet in its correct position (on the support shelf), and mount it properly using eight suitable bolts.

### Cabinets installed on the mounting frame

1. Observe the mounting holes on the mounting frame.
2. Arrange the necessary brackets on the bulkhead to fit shock absorbers.
3. Mount the bulkhead brackets for the shock absorbers.
4. Place the frame in its correct position, and mount it properly.
5. For each cabinet, place it on the support shelf on the frame, and mount it properly to the frame using four suitable bolts.

# Power Supply Unit population

***WARNING***

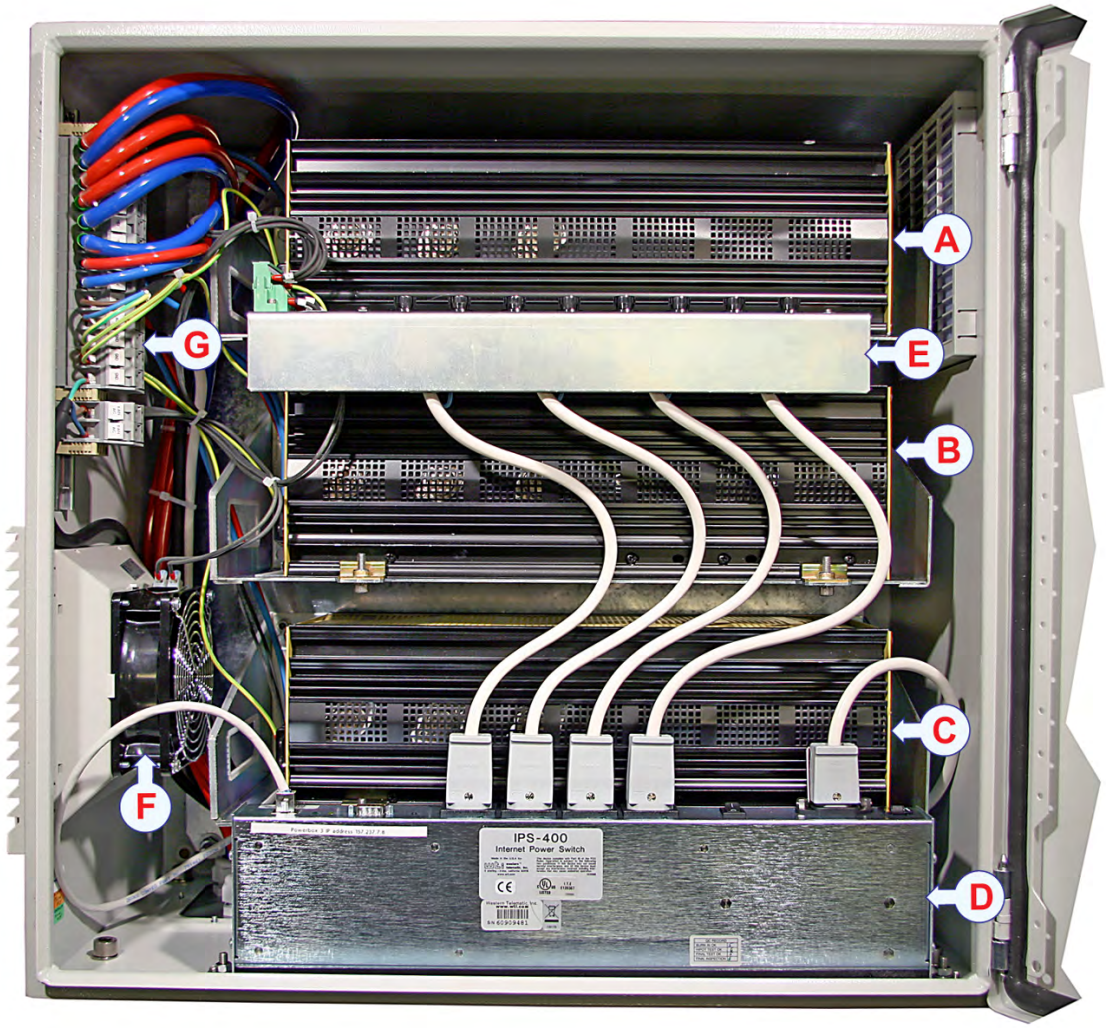
***This cabinet contains high voltages. You must disconnect the AC power connections before opening the cabinet.***

The following items are installed in the Power Supply Unit.

- Mounted on shelves on the back wall:
  - +75 Vdc power supply
  - +12 Vdc power supply
  - +6 Vdc power supply
  - Fuse bracket
- An Internet power switch is mounted at the bottom of the cabinet.
- A terminal block and a fan are mounted on the left side wall.

All cables in and out of the cabinet are fed through holes in the bottom.

*Figure 19 Power Supply Unit overview*




**A** *Power supply +6 Vdc*

**B** *Power supply +12 Vdc*

**C** *Power supply +75 Vdc*

**D** *Internet Power Switch*

**E** *Fuse panel*

**F** *Fan*

**G** *Terminal board for all interface and power cables*

# Multibeam Operator Station installation

This chapter describes the installation of the Simrad MS70 Multibeam Operator Station.

**Topics**



**Related topics**



## About the Multibeam Operator Station

The MS70 Multibeam Operator Station comprises a **Simrad APC12** Processor Unit manufactured by Kongsberg Maritime AS.

The necessary information required to install this computer is provided in this chapter.

# Operator station installation requirements

*Figure 20 Multibeam Operator Station*


Installation of the MS70 Multibeam Operator Station units must be performed by qualified and trained personnel. Observe the following general guidelines for installation.

- The safe navigation of the vessel.
- The “Compass safe distance” for each individual unit.
- Ergonomically correct operating and viewing heights.
- Maximum allowable cable distances between the various units.
- The installation areas are dry, well ventilated and free of excessive dust and vibration.
- Easy access to the cable connections on the back of the equipment is provided.
- Enough extra cable is allowed to facilitate maintenance and service by not having to disconnect the cables.

# Operator station computer installation

This section describes the installation of the MS70 Multibeam Operator Station computer.

## Preparations

Provide ample space around the computer. This is necessary to reach and use the front and rear mounted USB connectors, and the CD/DVD player. It is also important to allow for easy access to all the cables, and to provide for inspection, maintenance and parts replacement.

Make sure that the computer can be fully opened for unobstructed access to its internal parts.

- The computer can be installed inside a console, in a cabinet or 19” rack, or on a desk.
- Make sure that adequate ventilation is available to avoid overheating.
- The compass safe distance must be allowed for when planning the location of the unit.
- Ensure that the installation allows for the physical movements and forces normally experienced on a vessel.
- Ensure that enough space is provided for maintenance work.

## Installation procedure

**1** Prepare the mounting location.

→ *Multibeam Operator Station (341305)* on page 176

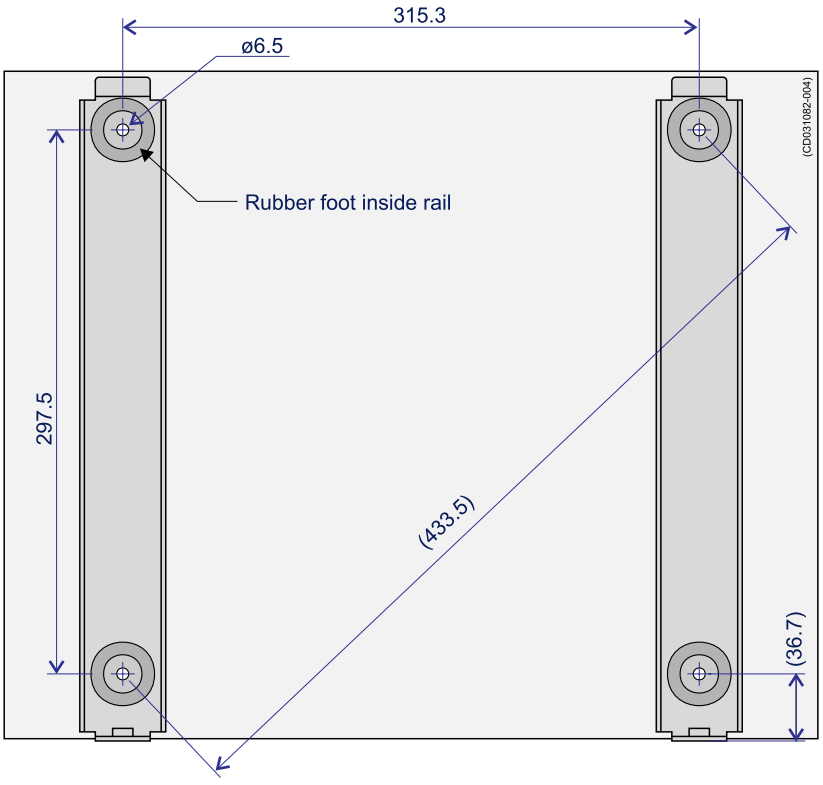
**2** Disassemble the base rails from the Processor Unit by removing the two front base rail screws.

**3** Attach the base rails as shown in the figure.

Note

*Note that the four rubber bushings must be mounted on top of the base rails. These are required to provide vibration and shock absorption between the base rails, and the rails mounted on the Processor Unit.*

*Figure 21 Installation of the Processor Unit*




**4** Mount the Processor Unit onto the base rails.

**a** Hook the unit onto the rails at the rear end.

**b** Press it down.

**c** Secure the Processor Unit with the two front base rail screws

# Operator station display monitor installation

This section describes the installation of the MS70 Operator Station display. The make and model of the this display is determined by the customer. For this reason, the information provided here is only for guidance. For a detailed specific installation procedure, refer to the applicable documentation provided with the display.

- The display must be located so that it is best protected from glare which reduces readability.
- The display may be mounted in a panel, on the desktop or bulkhead, or overhead.
- Make sure that adequate ventilation is available to avoid overheating.
- The compass safe distance must be allowed for when planning the unit's location.
- Make sure that the installation allows for the physical movements and forces normally experienced on a vessel.
- Make sure that enough space is provided for maintenance work.

# UPS installation

In order to ensure continuous operation of the Simrad MS70 independent of varying quality of the vessel's mains supply, the use of uninterrupted power supplies (UPS) is important.

A UPS system must be fitted to supply to the TRC computers in the Transceiver Unit.

A UPS system is strongly recommended to power the Multibeam Operator Station and the Power Supply Units.

Normally, two UPS units are used:

- One is used to power the Multibeam Operator Station and other relevant units.
- One is used to power the Power Supply Units, and thus the Transceiver Unit.

Uninterrupted power supply (UPS) units are not included in the standard MS70 delivery.

The installation of these units must be performed as described in the applicable documentation provided by the manufacturer. Ensure that you install the UPS unit in such a way that maintenance is easily carried out.

The minimum performance specifications for the UPS units are listed in chapter *Simrad MS70*.

### Related topics

- *Uninterrupted Power Supply (UPS)* on page 15

# Transceiver Unit assembly

When delivered, the MS70 Transceiver Unit is provided as a wired cabinet. This means that the cabinet is empty. None of the main modules are mounted. These are packed separately, and must thus be installed before the system can be set to work.

This chapter provides the necessary procedures to install the transceiver modules and cables.

Important

Do not connect any AC or DC power to the MS70 Transceiver or Power Supply Units until explicitly instructed to do so in the relevant procedure.

**Topics**

# About the Transceiver Unit

This section provides a general description of the Transceiver Unit.

**Topics**



## Transceiver Unit purpose

The transceiver performs the signal processing and digital beamforming of the transmitter and receiver channels.

The MS70 Transceiver Unit is housed in a 19” instrument rack.

In order to reduce the loss in the transducer cables, the transceiver is physically located as close as possible to the transducer array.

The main components in the transceiver are:

- 3 ea TRXU Transceiver subracks
- 6 ea TRC Beamforming computers
- 1 ea Ethernet switch
- Cabinet fan unit

The purpose of the Simrad MS70 Transceiver Unit is to:

- Transmission parameter distribution
- Transmission triggering
- Audio transmission
- Audio reception
- Analogue to digital conversion
- Beamforming
- Transmission and reception stabilizing

## Transceiver Unit parts identification

This section provides a generic overview of the Transceiver Unit.

Easy access to the front and rear part of the Transceiver Unit is essential, as this allows for easy replacement of parts.

**Line replaceable units**

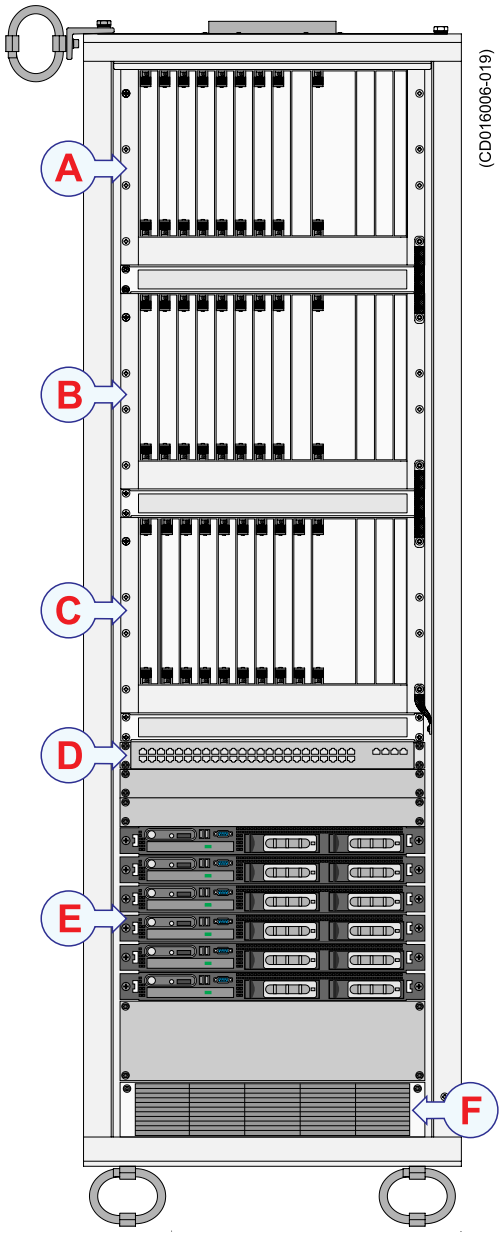
The following units have been defined as line replaceable units in the Transceiver Unit.

- TRX32 Receiver boards
- SMS Driver boards
- TRX RIO boards
- Capacitor module
- Ethernet switch

- TRC Beamforming computer
- Cabinet fan unit

## Forward view

*Figure 22 Transceiver Unit, front view*




**A** *Transceiver rack TRXU0*
*Eight TRX32 boards are used.*

**B** *Transceiver rack TRXU1*
*Eight TRX32 boards are used.*

**C** *Transceiver rack TRXU2*
*Nine TRX32 boards are used.*

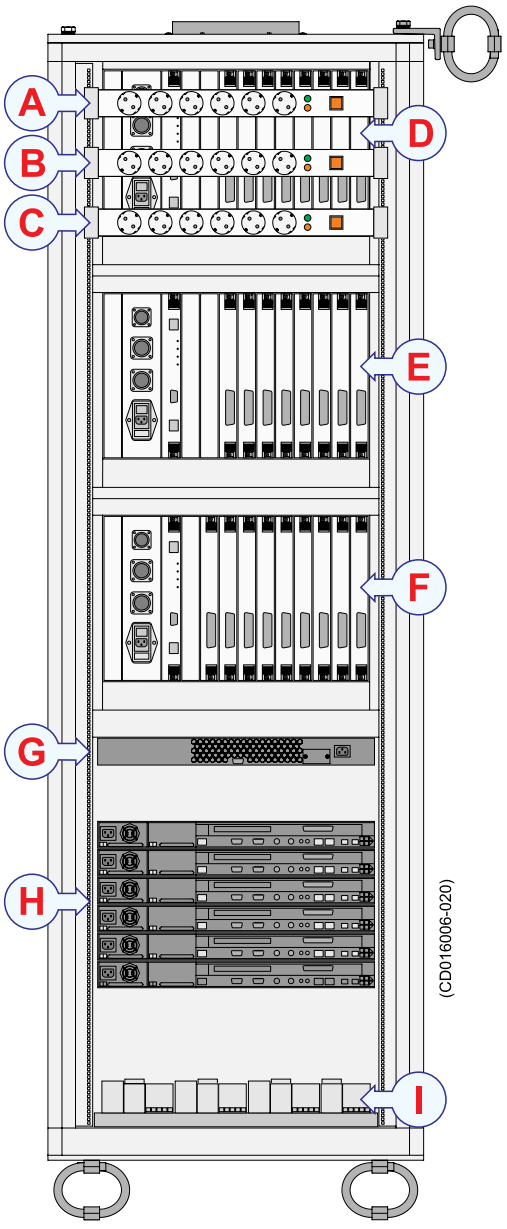
**D** *Ethernet switch*

**E** *TRC0–5 Beamforming computers*
*TRC0 (top) is the master.*

**F** *Fan unit*

## Rear view

*Figure 23 Transceiver Unit, rear view*




**A** *Power distributor PD2*

**B** *Power distributor PD1*

**C** *Power distributor PD1*

**D** *Rear side of Transceiver rack TRXU0*

**E** *Rear side of Transceiver rack TRXU1*

**F** *Rear side of Transceiver rack TRXU2*

**G** *Rear side of Ethernet switch*

**H** *Rear side of TRC Beamforming computers*

**I** *Circuit breakers (from left) CB0, CB1, CB2, CB3*

# Mounting the TRXU racks

This procedure explains how to install the three TRXU racks into the empty wired frame of the transceiver cabinet.

Note

*Due to the physical weight of the racks, minimum two persons must be allocated to do this task.*

Standard workshop tools are required, as well as a torque wrench for Allen bolts.

Important

Each of the three TRXU racks are provided complete with all circuit boards and modules readily mounted. They are positioned at the top of the transceiver rack, one above each of the three air ducts.

The racks must be installed in the following order:

**1** TRXU No.0 must be installed in the top position. There are eight TRX32 circuit boards in this rack, and they are identified with numbers 24 to 17.

**2** TRXU No.1 must be installed in the middle position. There are eight TRX32 circuit boards in this rack, and they are identified with numbers 16 to 9.

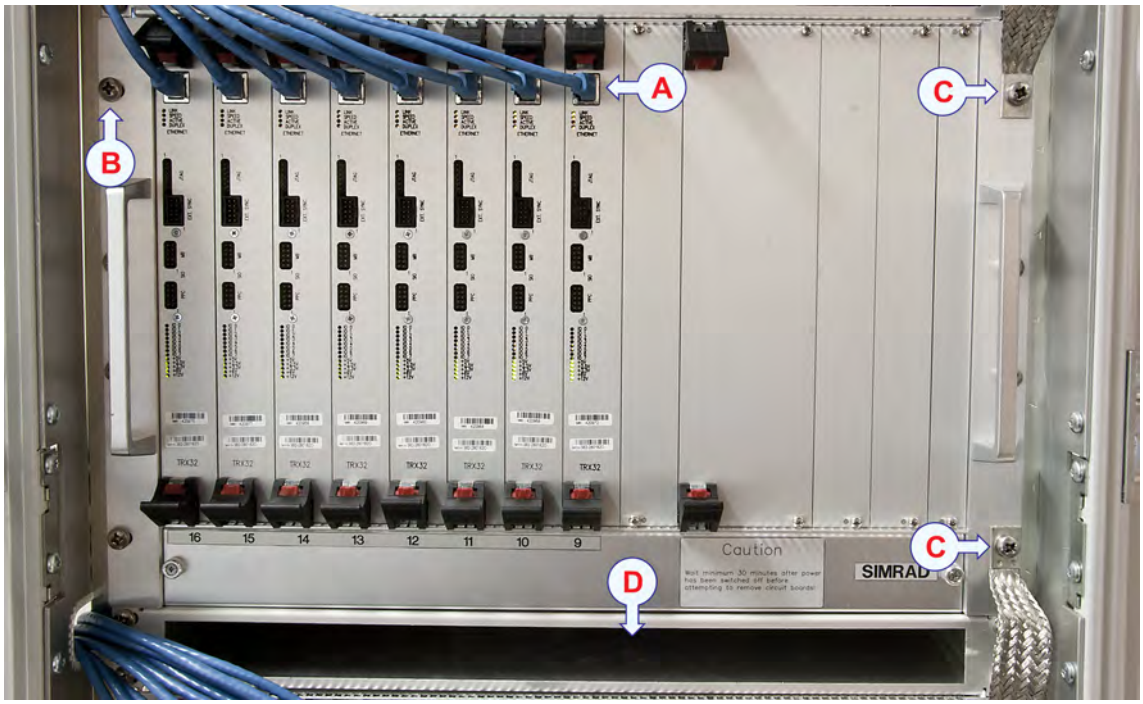
**3** TRXU No.2 must be installed in the bottom position. There are nine TRX32 circuit boards in this rack, and they are identified with numbers 8 to 0.

Each rack is mounted on a dedicated set of rails, and then secured with four front mounted racks bolts on each side of each TRXU rack.

The rails are already installed in the wired transceiver rack, and the bolts to be used are already placed in their holes. Each rail consists of two parts; one is mounted to the rack framework, and one is mounted to the side of the TRXU rack. During shipping, these side rails are however mounted inside the framework rails.

The bottom bolt on the right side of TRXU No.0 secures an earth strap to the top bolt on the right hand side of TRXU No.1. Similar, the bottom bolt on the right side of TRXU No.1 secures an earth strap to the top bolt on the right hand side of TRXU No.2. The bottom earth strap on TRXU No.2 is connected to the frame of the transceiver cabinet. These earth straps are all mounted on the empty transceiver cabinet frame during shipping.

*Figure 24 TRXU rack, front view*




*Note that the physical appearance of the TRX32 circuit boards and the various labels on the rack may differ from this photo.*

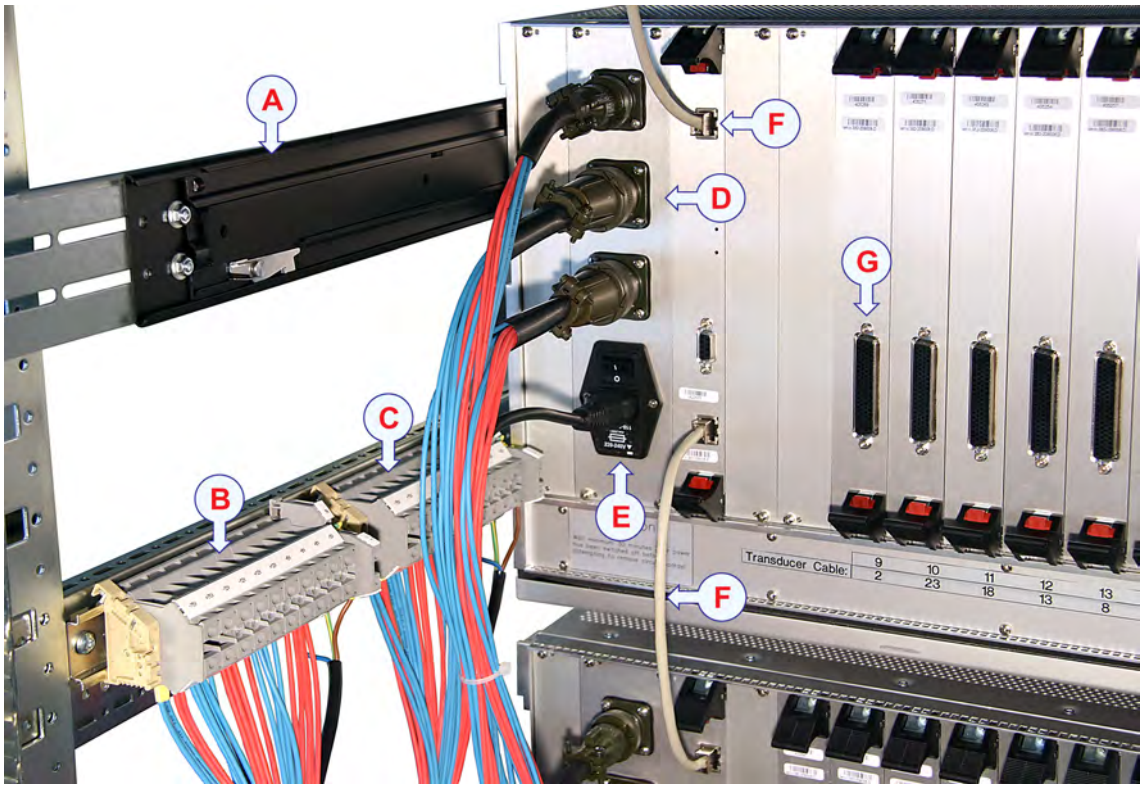
**A** *Ethernet cable, one is connected to each TRX32 circuit after the rack has been secured.*

**B** *Eight bolts are used to secure the rack. Two of these bolts also holds the earth straps.*

**C** *Earth straps*

**D** *Air duct. This air duct is mounted in the empty transceiver cabinet during shipping.*

*Figure 25 TRXU racks 1 and 2, rear view with cables*




*Note that the physical appearance of the various labels on the rack may differ from this photo.*

**A** *Mounting rail for TRSU rack*

**B** *Terminal board for power to TRXU No.1.*

**C** *Terminal board for power to TRXU No.2.*

**D** *Three Amphenol plugs connect the DC power cables to the rear side of the TRXU rack.*

**E** *AC input*

**F** *Synchronisation cables between the TRXU racks*

**G** *One of the sockets for the transducer cables.*

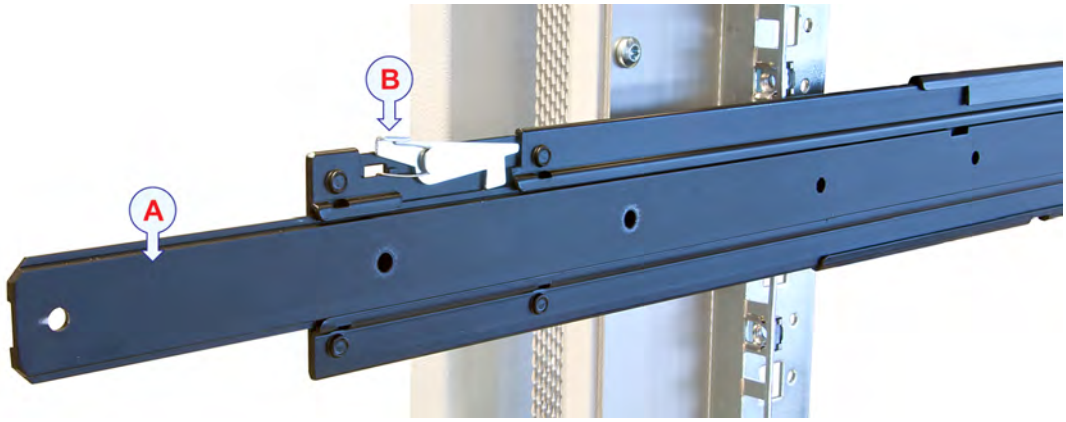
## Procedure

1 Remove the two earth straps on the right hand side of the transceiver cabinet.

2 Remove all the remaining 20 bolts that are temporarily mounted into their front holes.

3 On each of the six rails (three on each side), dismount the side rail that shall be mounted onto the TRXU racks.

*Figure 26 Remove the side rail (A) by unlocking it (B)*



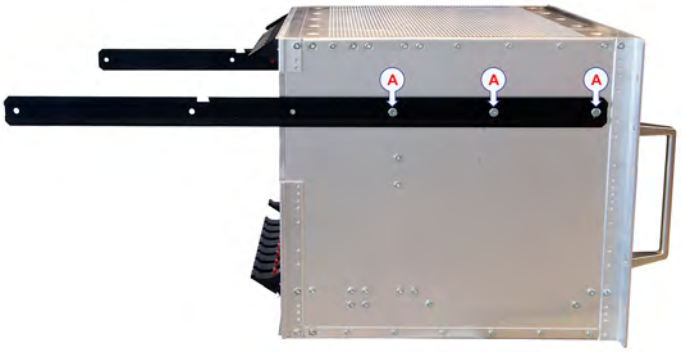

4 Remove the rail bolts from the two side panels on each TRXU rack.

5 Use the same bolts to mount the two side rails.

Note

*Do not use excessive force when you tighten the bolts for the side rails. Maximum torque is 130 Ncm. These bolts are inserted into nuts on the inside of the subracks, and if you tighten too hard, you may damage the threads.*

*Figure 27 Mount each side rails with three bolts (A)*




6 Push the rails mounted on the side of each rack into the rails on the cabinet, and push the rack carefully in.

You may find it useful to loosen the bolts on the fan drawers over and/or under the TRXU rack.

Note

*Make sure that you do not damage any of the Ethernet cables!*

7 Secure the subrack with the front bolts, four on each side.

8 Mount the two earth straps.

Note that the bolts used to mount the earths traps are slightly longer than the others.

**9** Connect the Ethernet cables to the corresponding sockets at the top of each TRX32 transceiver board.

The Ethernet cables are pre-installed, and the length of each cable is adjusted to reach the individual TRX32 transceiver boards.

**10** On the rear side of each TRXU rack, connect the four power plugs.

→ *Power Supply Units DC output wiring* on page 138

→ *TRXU racks DC input wiring* on page 139

→ *Power Connector Panel* on page 140

→ *+6 and +12 Vdc to the TRXU backplane* on page 141

→ *+75 Vdc to the TRXU backplane* on page 142

**11** On the rear side of the TRXU racks, connect the two synchronisation Ethernet cables.

→ *Transceiver Unit TRXU synchronization cable* on page 144

# Mounting the Ethernet switch

This procedure explains how to install the Ethernet switch into the empty wired frame of the transceiver cabinet.

Only standard workshop tools are required.

The Ethernet switch rests on a set of angular shelves on each side of the rack. It is secured in position using four bolts.

**1** Push the Ethernet switch in place on the shelves provided.

**2** Secure the switch in position using the four bolts, two on each side.

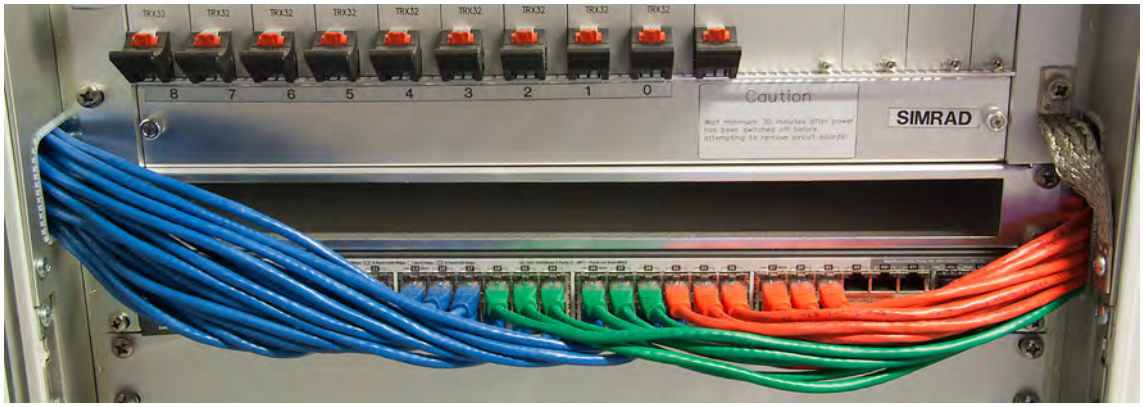
**3** Connect the front mounted Ethernet cables.

Observe the colour codes used on the cables.

→ *Ethernet cables; TRC computers* on page 85

→ *Ethernet cables; TRXU transceiver racks* on page 86

*Figure 28 Ethernet switch with all cables connected*




*Note that the Ethernet cables to the Power Supply Units and Multibeam Operator Station are not connected on this picture.*

*Note that the physical appearance of the various labels on the rack may differ from this photo.*

**4** Connect the AC power cables to the rear side of the switch.

Note

*Do not apply power!*

# Mounting the TRC Beamforming computers

This procedure explains how to install the six TRC Beamforming computers into the empty wired frame of the transceiver cabinet.

Note

*Due to the physical weight and the size of the computers, minimum two persons must be allocated to do this task.*

No tools are required.

Important

Each of the six TRC Beamforming computers are provided complete with all additional circuit boards and modules readily mounted. The software has been installed on all the computers. They are positioned at the bottom of the transceiver rack.

The TRC0 Beamforming computer must be mounted at the top. This computer is recognized by label, and the additional Ethernet interface boards that are mounted.

The order of the computers are:

**1** TRC0 (on top)

**2** TRC1

**3** TRC2

**4** TRC3

**5** TRC4

**6** TRC5 (at the bottom)

Each computer is identified with a name label.

Each computer is mounted on a dedicated set of rails. The rails are already installed in the wired transceiver rack.

*Figure 29 TRC Beamformer computer installation*


**A** *The two bolts on each side of the computer cabinet fit into these slots in the rail*

**B** *Press here (on each side) to push the computer into the rack.*

**C** *Locking device to release the computer from the rails*

## Procedure

**1** Pull out the rails.

**2** Lift the computer carefully, align the two bolts on each side so that they will fall into the corresponding slots on the rails.

**3** When the computer is properly aligned to the slots, release it.

**4** Push the computer into the transceiver rack.

It will lock in the withdrawn position.

**5** Connect the Ethernet cables to the rear side of the computer.

→ *Ethernet cables; TRC computers* on page 85

→ *[B] Ethernet cables to TRC Beamforming computers* on page 98

→ *RJ45 Ethernet, straight* on page 147

**6** Connect the AC power cables to the rear side of the computers.

Note

*Do not apply power!*

**7** Connect the interface cable to the rear side of the TRC0 Beamforming computer.

→ *Interface cables; Motion Reference Unit* on page 92

→ *[G] Motion Reference Unit interface* on page 103

→ *Generic RS-232 Serial line* on page 130

# Connecting the power cables from the Power Supply Units

This procedure explains how to connect the power cables from the three Power Supply Units.

The following cables must be connected:

**a** 230 Vac to TRXU fans

**b** +6 Vdc (one red and one blue cable)

**c** +6 Vdc (one red and one blue cable)

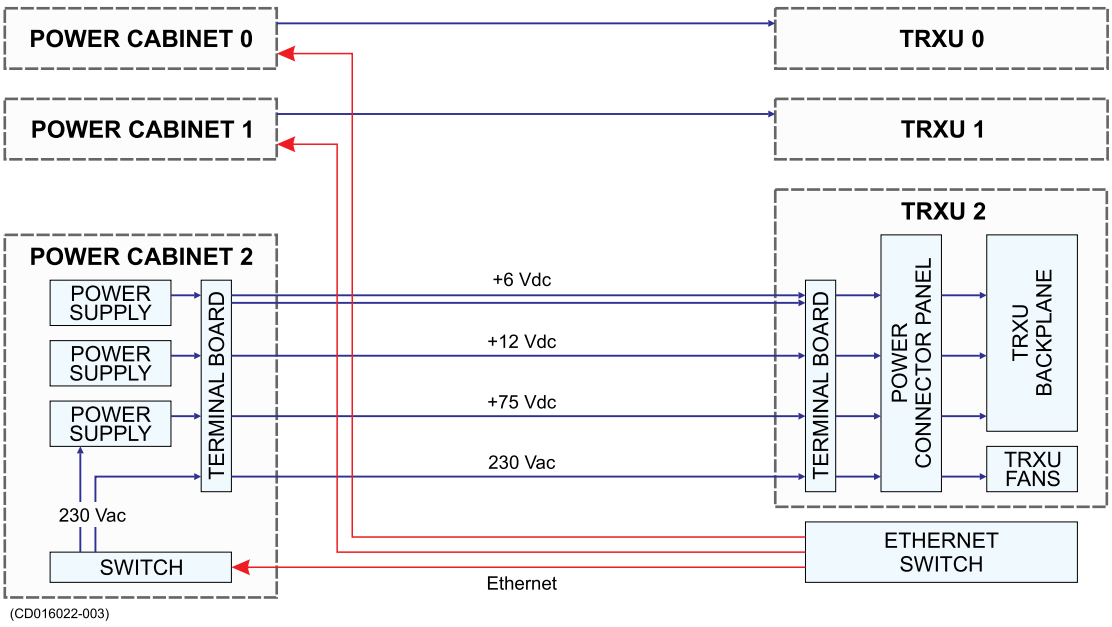
**d** +12 Vdc (one red and one blue cable)

**e** +75 Vdc (one red and one blue cable)

Important

Do not connect any AC or DC power to the MS70 Transceiver or Power Supply Units until explicitly instructed to do so in the relevant procedure.

*Figure 30 Block diagram, AC and DC distribution from Power Supply Units*

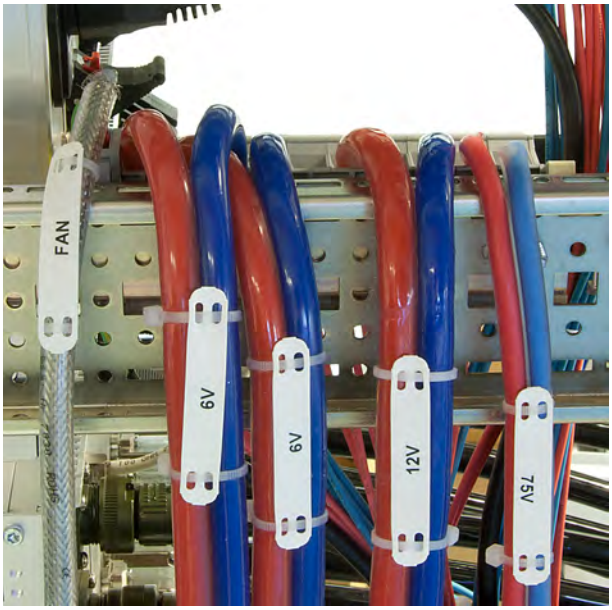


**1** Connect each of the power cables to the three terminal boards in the Transceiver Unit.

- The top terminal board is used to accept the power cables from Power Supply Unit no.0. The power is then connected to TRXU no.0.
- The bottom rear terminal board is used to accept the power cables from Power Supply Unit no.1. The power is then connected to TRXU no.1.
- The bottom forward terminal board is used to accept the power cables from Power Supply Unit no.2. The power is then connected to TRXU no.2.

→ *Power Supply Units DC output wiring* on page 138

*Figure 31 Power cables connected to the terminal board (example)*




*These cables are connected for test purposes when the side wall of the transceiver cabinet has been removed.*

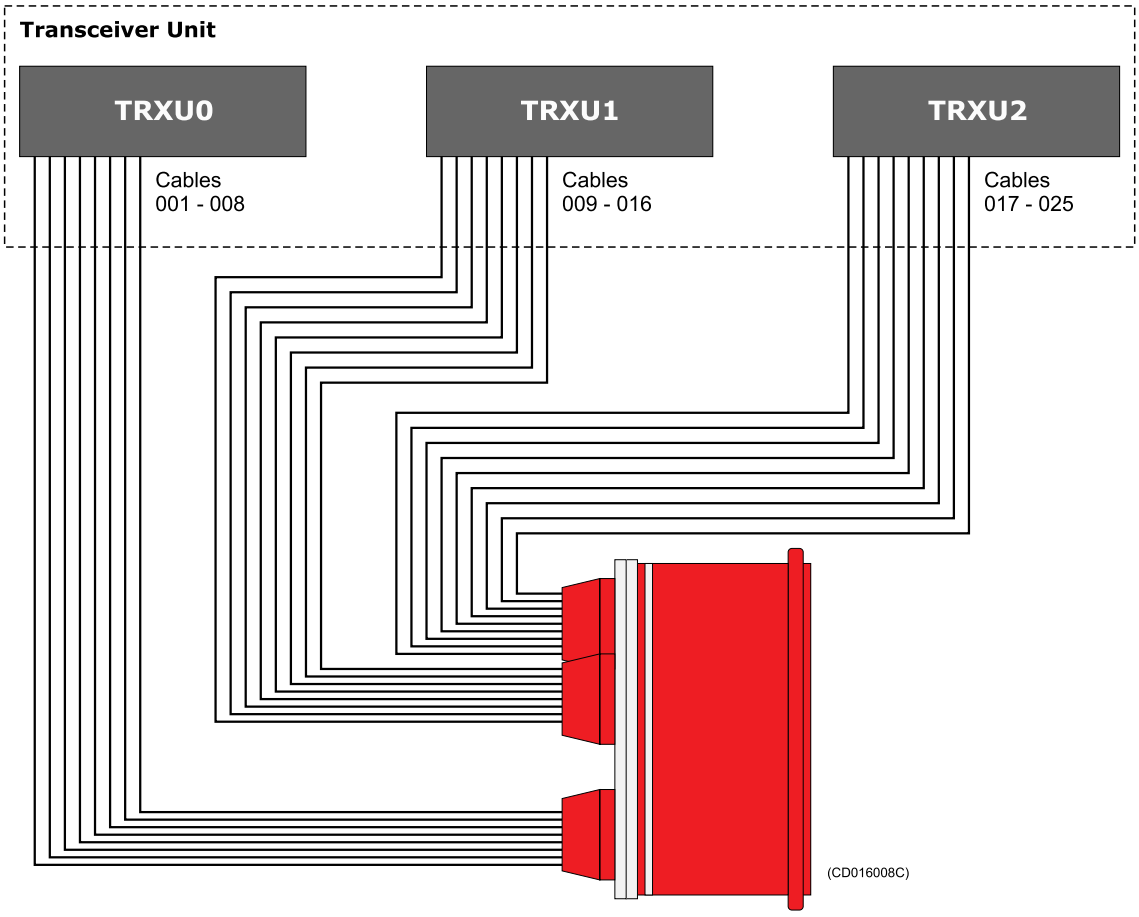
**2** Secure the cables to the frame in the cabinet using wire wraps.

# Connecting the transducer cables

This procedure explains how to connect the transducer cables to the rear side of the TRXU racks.

There are 25 transducer cables, and these are numbered 001 to 025.

*Figure 32 Cable plan, Transducer array*



**1** For each transducer cable, locate the identification number.

**2** Connect the plug to the correct socket on the correct TRXU, and tighten the bolts.

Observe the connection drawings provided.

→ *Transducer cables* on page 156

**3** Collect the transducer cables in bundles, and secure these to the wired frame in the transceiver cabinet with wire wraps.

*Figure 33 Transducer cables connected to the rear side of the TRXU rack*

# Cable layout and interconnections

This chapter provides the cable plan and cable installation requirements for the Simrad MS70.

**Topics**

# Read this first!

Detailed information about cable specifications, termination and connectors are provided. All cables are provided by Simrad unless otherwise specified. In order to provide for maintenance and to allow for vibration, make sure that some slack is provided for all cables.

A detailed drawing for each cable is provided. Each drawing provides additional specifications, and may, when applicable, include:

- Required minimum specifications
- Connections at each end (including reference to the corresponding: system unit, terminal board identification and plug/socket to be used)
- Corresponding terminations
- Number of cores

Cables fall into two categories.

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

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

For more information, see the generic cable requirements.

→ *Basic cable requirements* on page 200

Note

*Before you perform the MS70 cabling, ensure that the mains circuit breaker for the system is switched off.*

Note

*All electronic installations and corresponding wiring must be in accordance with the vessel's national registry and corresponding maritime authority and/or classification society. If no such guidelines exist, we recommend that Det Norske Veritas (DNV) Report No. 80-P008 «Guidelines for Installation and Proposal for Test of Equipment» is used as a guide. Observe Basic cable requirements on page 200.*

# Cable plans

A detailed cable plan is provided. Due to the large number of cables, they are organized in groups, each with different leading characters. The cable plan is organized with the following cable groups (indicated by [N]) and drawings:

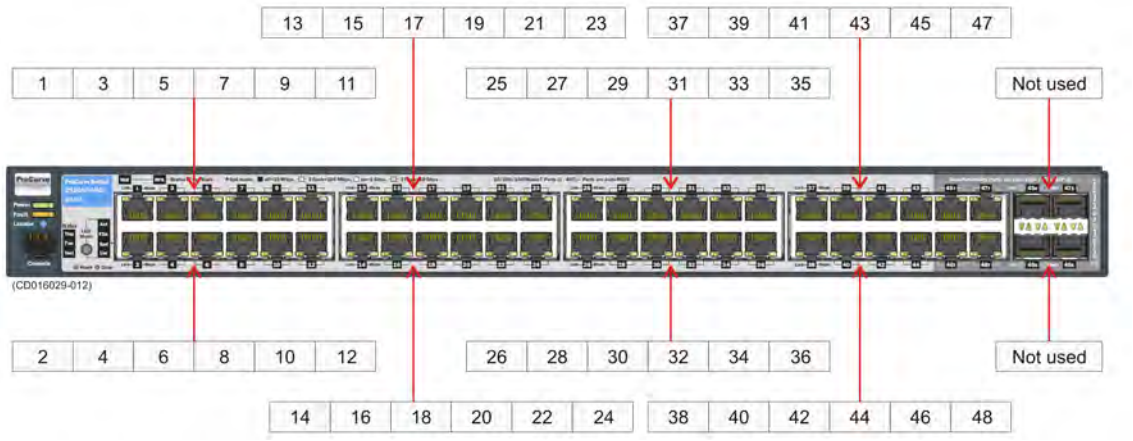
1. *Interconnection cables*: Overview of those cables that are used between the physical system units
2. *Ethernet cables*: Cables [A], [B], [C] and [D]
3. *Power cables*: Cables [B], [Q] and [R]
4. *Power Supply Unit cables*: Cables [A] and [Q]
5. *Transducer cables*: Cables 001 through 025
6. *Interface cables*: Cables [F]
7. *Multibeam Operator Station cables*: Cables [W]

### Topics

## Ethernet switch connectors

The **HP ProCurve 2910** Ethernet switch holds 48 front mounted connectors. The connectors are numbered 1 to 48 as shown in the illustration.

*Figure 34 HP ProCurve 2910 Ethernet switch connectors*




Note

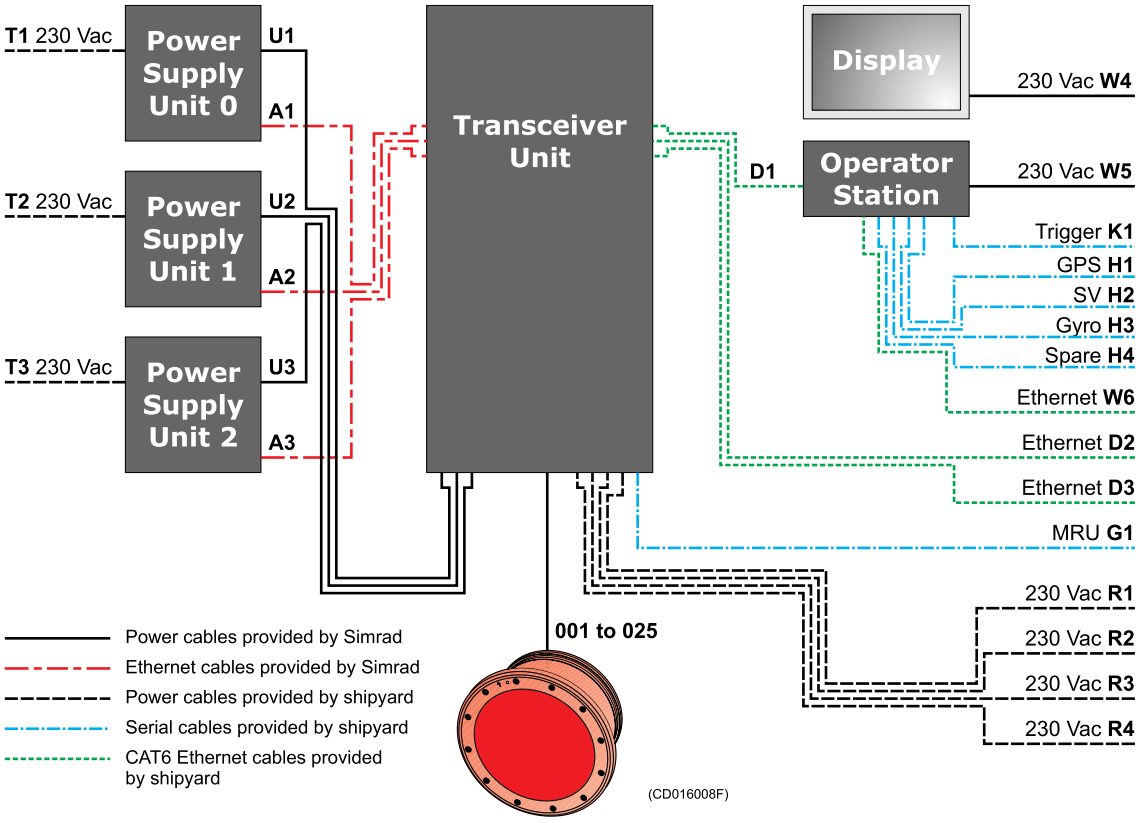
*Although the Ethernet connectors on the switch appear identical, they are organized in two different logical groups. The Ethernet switch thus operates as a "dual" unit providing two separate networks. For this reason, the connections between the switch and the peripheral devices are not random. Observe the ports that are identified on the cable plan, and use these.*

The two logical groups comprise the following ports:

- **TRU LAN**: Ports 1 through 32
- **OS LAN**: Ports 33 through 48

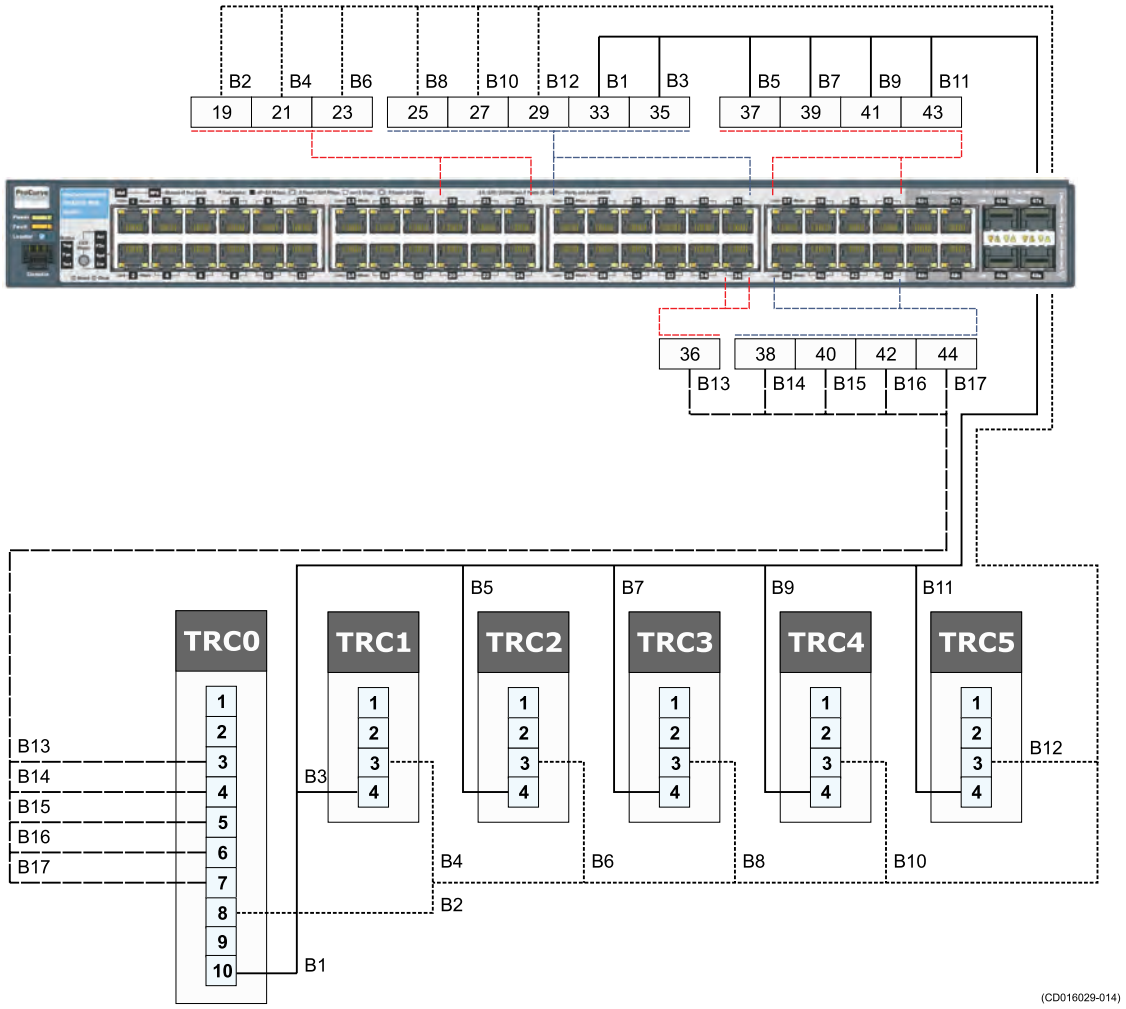
## System interconnection cables

*Figure 35 Cable plan, interconnection cables*



## Ethernet cables; TRC computers

*Figure 36 Cable plan, Ethernet cables; TRC computers*

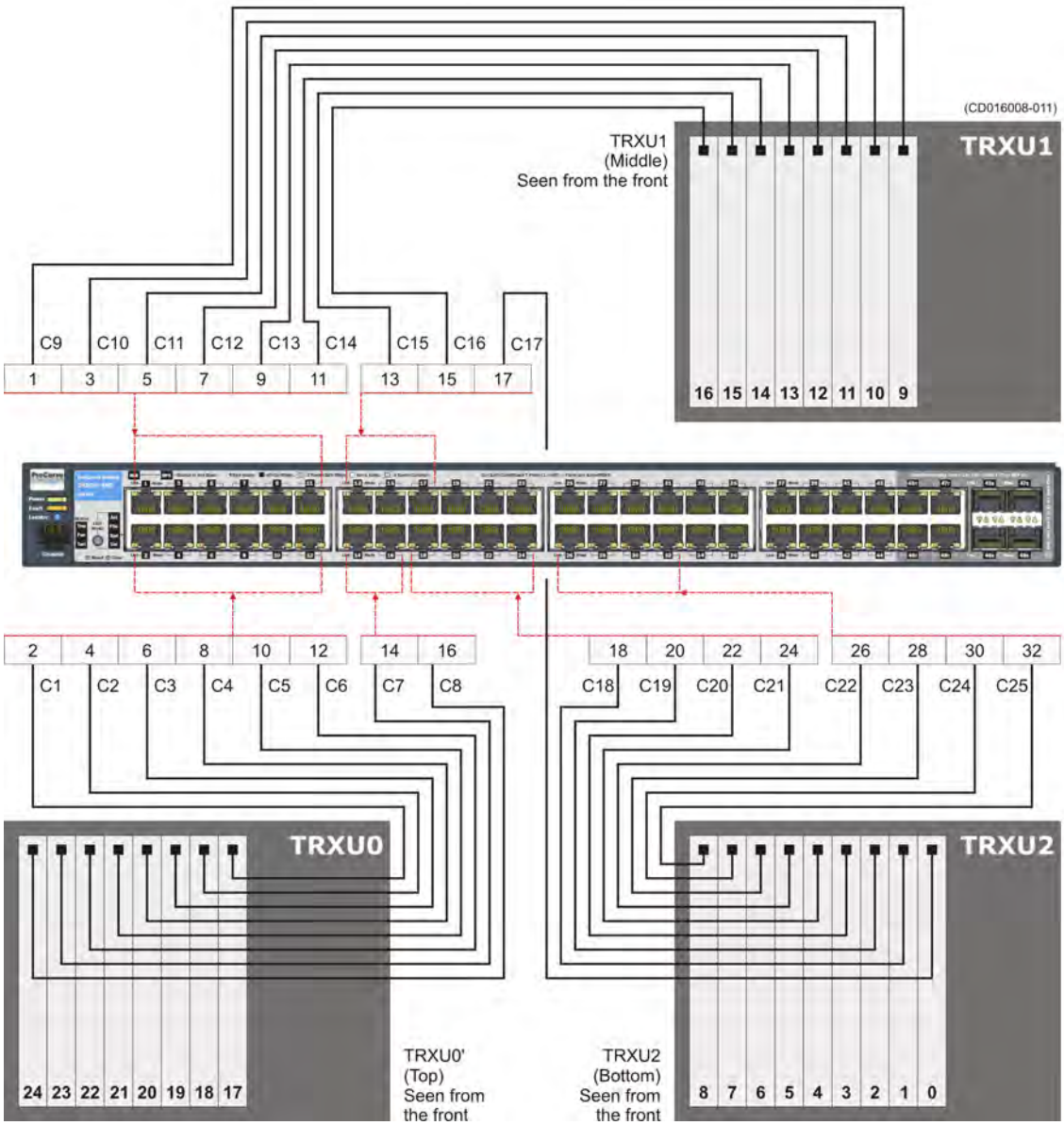



### Related topics

- *[B] Ethernet cables to TRC Beamforming computers* on page 98
- *RJ45 Ethernet, straight* on page 147

## Ethernet cables; TRXU transceiver racks

*Figure 37 Cable plan, TRXU Ethernet*

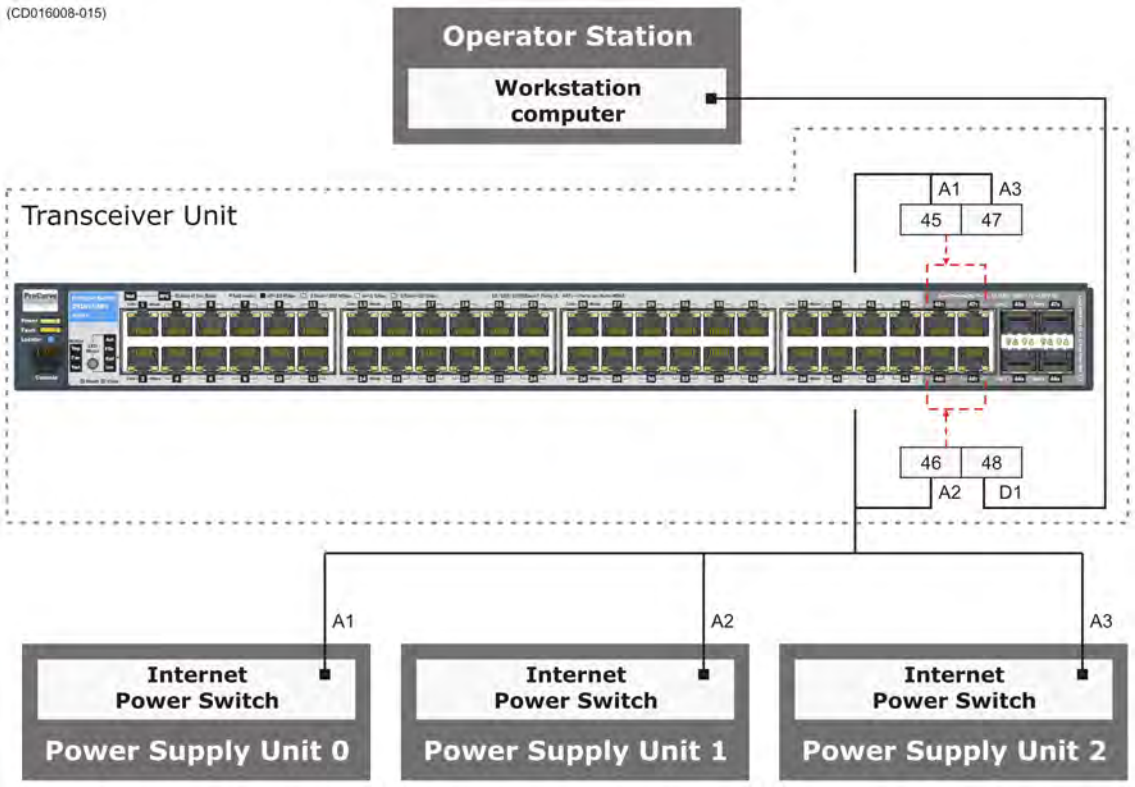



### Related topics

- *[C] Ethernet cables to TRXU transceiver racks* on page 100
- *RJ45 Ethernet, straight* on page 147

## Ethernet cables; Operator Station and Power Supply Units

*Figure 38 Cable plan, Power and Multibeam Operator Station Ethernet*

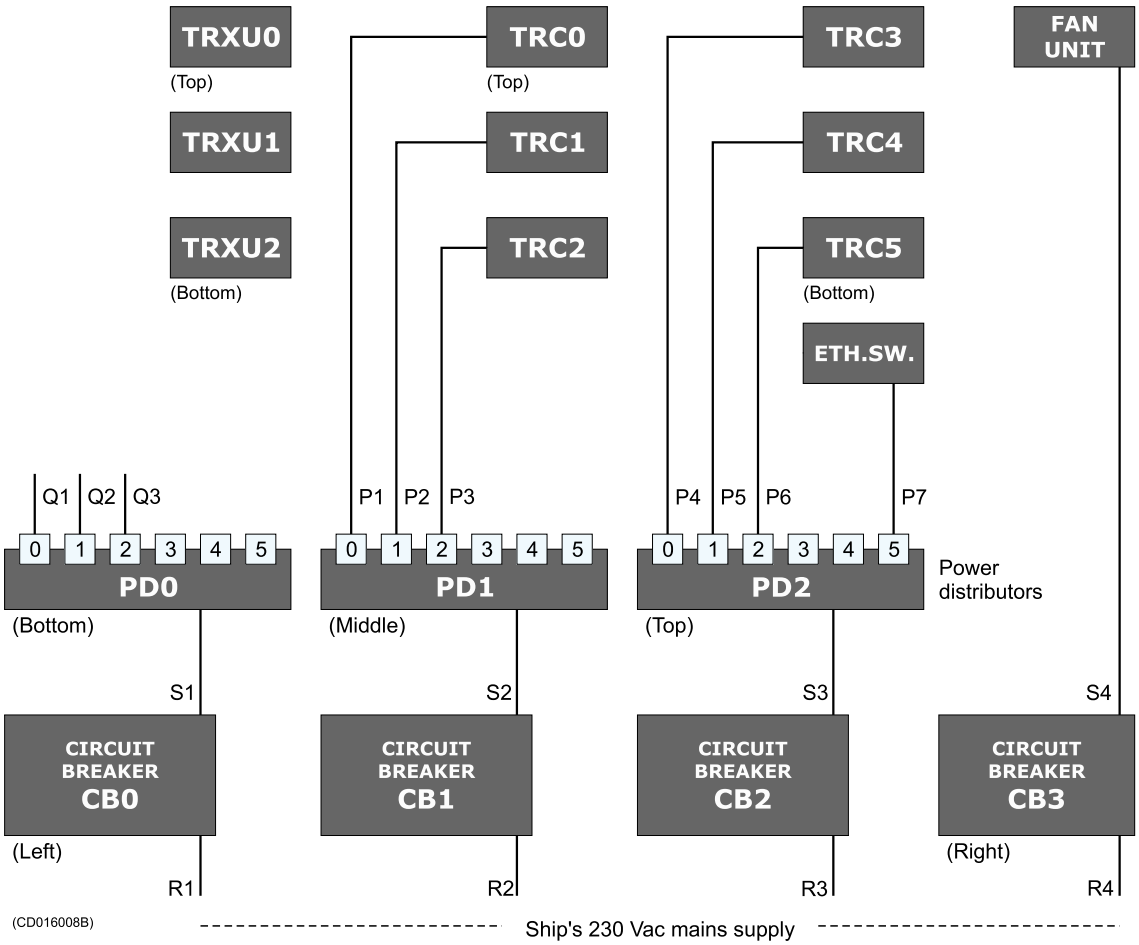



### Related topics

- *[A] Ethernet cables to Power Supply Units* on page 97
- *[D] Ethernet cables to external cabinets* on page 101
- *RJ45 Ethernet, straight* on page 147

## Power cables; Transceiver Unit

*Figure 39 Cable plan, AC mains, Transceiver Unit*

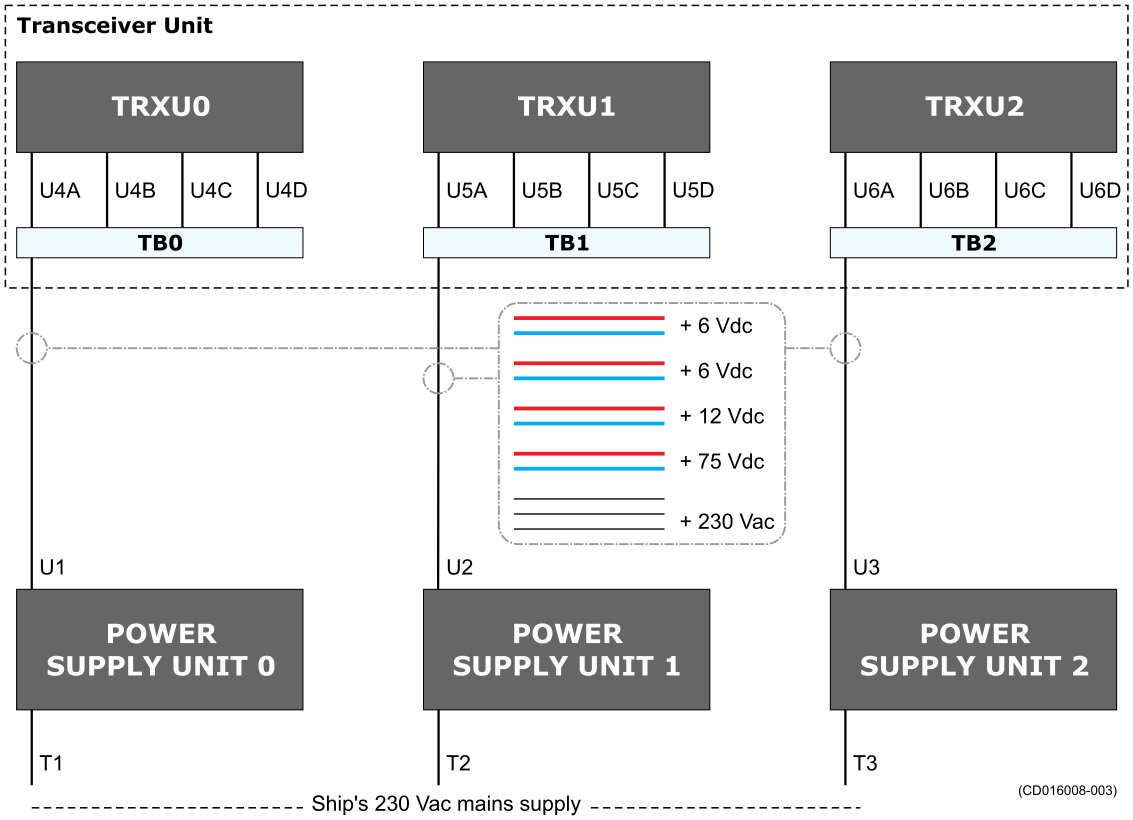



### Related topics

- *[P] Power cables to TRC Beamforming computers* on page 106
- *[Q] Power cables to TRXU transceiver racks* on page 107
- *[R] Power cables to ship's 230 Vac mains supply* on page 108
- *[S] Power cables from the four circuit breakers* on page 109
- *AC mains (IEC 60320)* on page 145
- *Circuit breaker* on page 146
- *Transceiver Unit Fan module wiring* on page 143

## Power cables; Power Supply Units

*Figure 40 Cable plan, Power Supply Units and DC supply power*

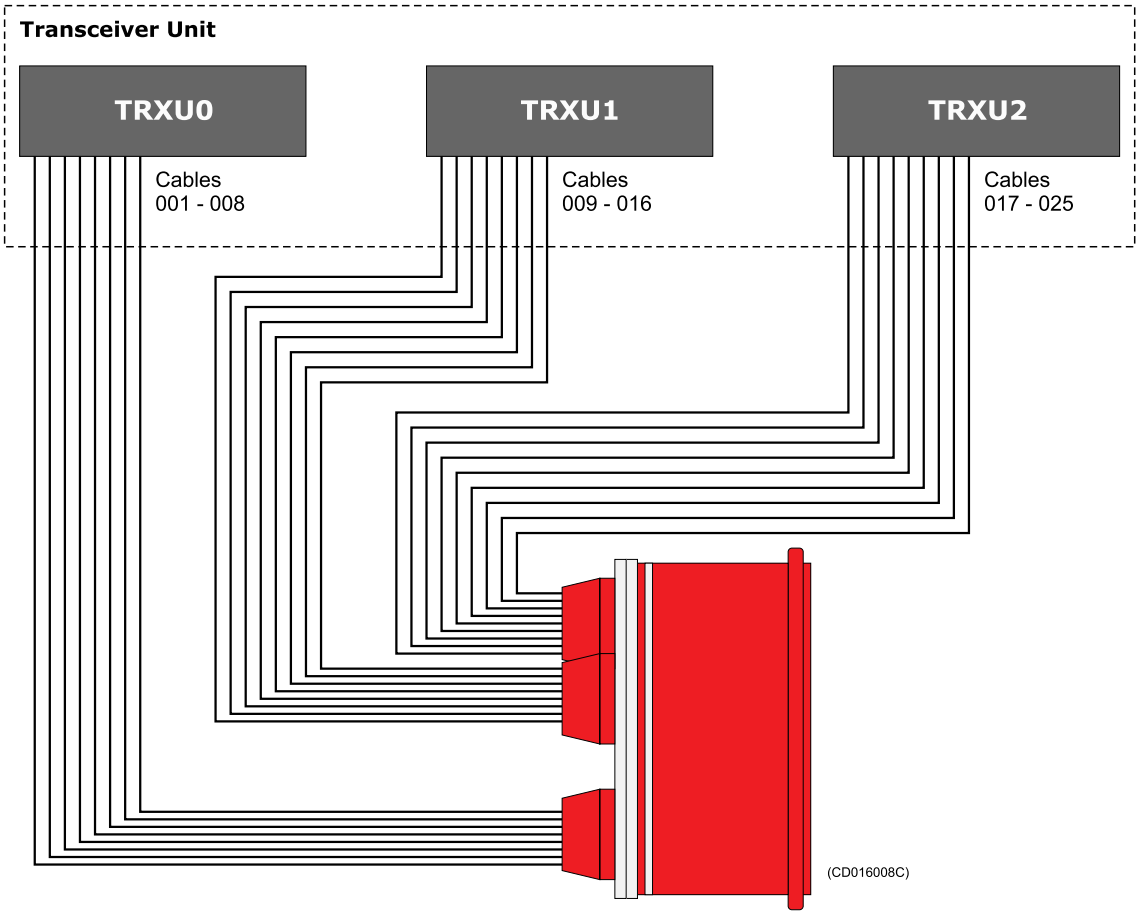



### Related topics

- *[T] AC mains supply to Power Supply Units* on page 110
- *[U] Power cables from Power Supply Units to Transceiver Unit* on page 111
- *Power Supply Units AC mains wiring* on page 137
- *Power Supply Units DC output wiring* on page 138
- *TRXU racks DC input wiring* on page 139

## Transducer cables

*Figure 41 Cable plan, Transducer array*

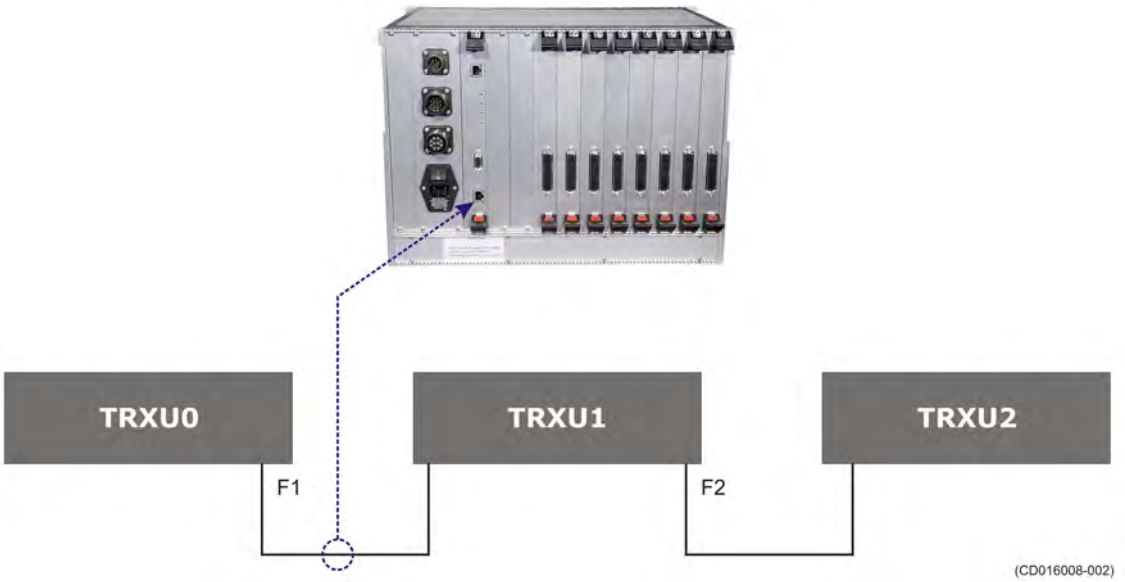



### Related topics

- *Transducer cables overview* on page 115
- *Transducer cables* on page 156
- *Terminations to TRXU0 (Top subrack)* on page 158
- *Terminations to TRXU1 (Middle subrack)* on page 159
- *Terminations to TRXU2 (Bottom subrack)* on page 160
- *Transducer cables* on page 115

## Interface cables; TRXU synchronization

*Figure 42 Cable plan, TRXU synchronization*

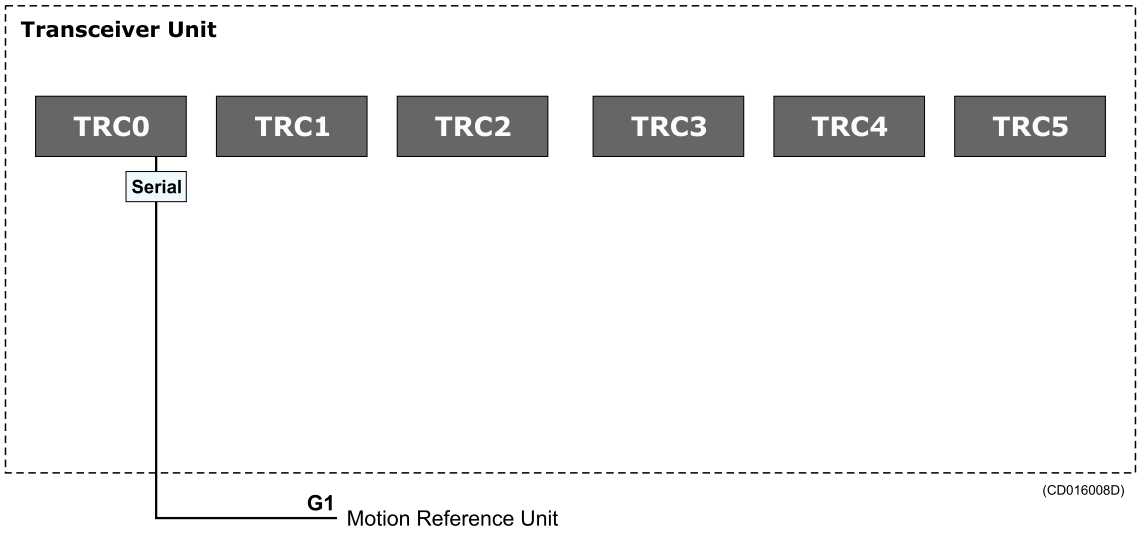



### Related topics

- *[F] Internal TRXU synchronisation* on page 102
- *Transceiver Unit TRXU synchronization cable* on page 144

## Interface cables; Motion Reference Unit

*Figure 43 Cable plan, Motion Reference Unit interface*

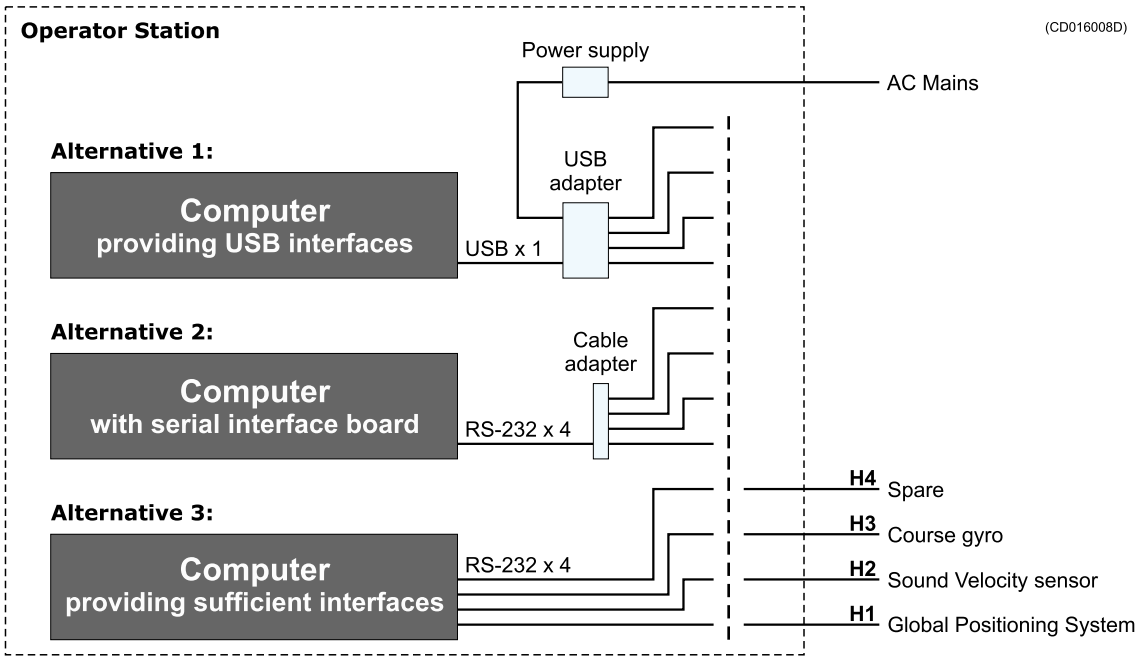



### Related topics

- *[G] Motion Reference Unit interface* on page 103
- *Generic RS-232 Serial line* on page 130

# Interface cables; GPS, sound velocity and gyro

*Figure 44 Cable plan, GPS, Sound velocity and Gyro interfaces*

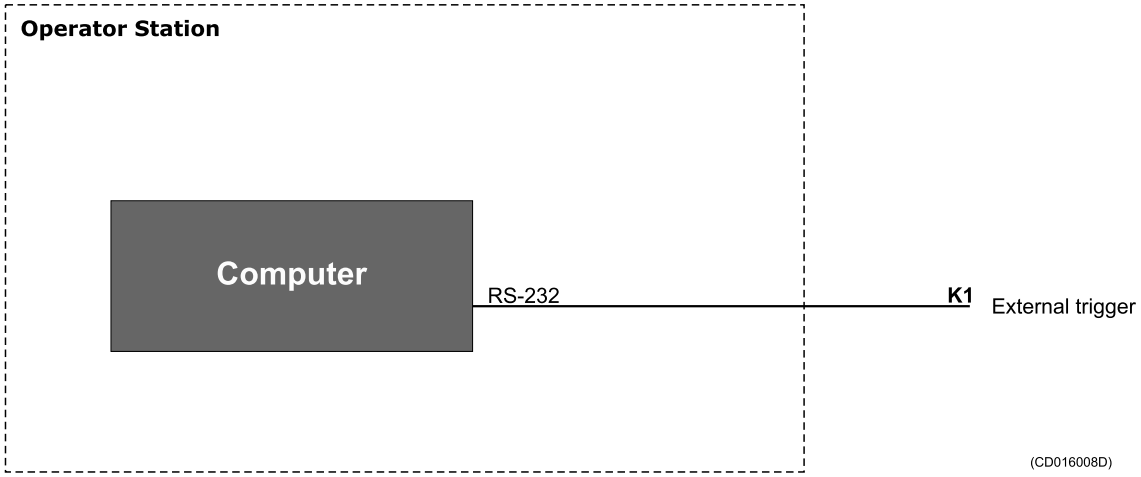



## Related topics

- *[H] GPS, Sound Velocity and Gyro interface* on page 104
- *Generic RS-232 Serial line* on page 130

# Interface cables; external trigger

*Figure 45 Cable plan, External trigger*

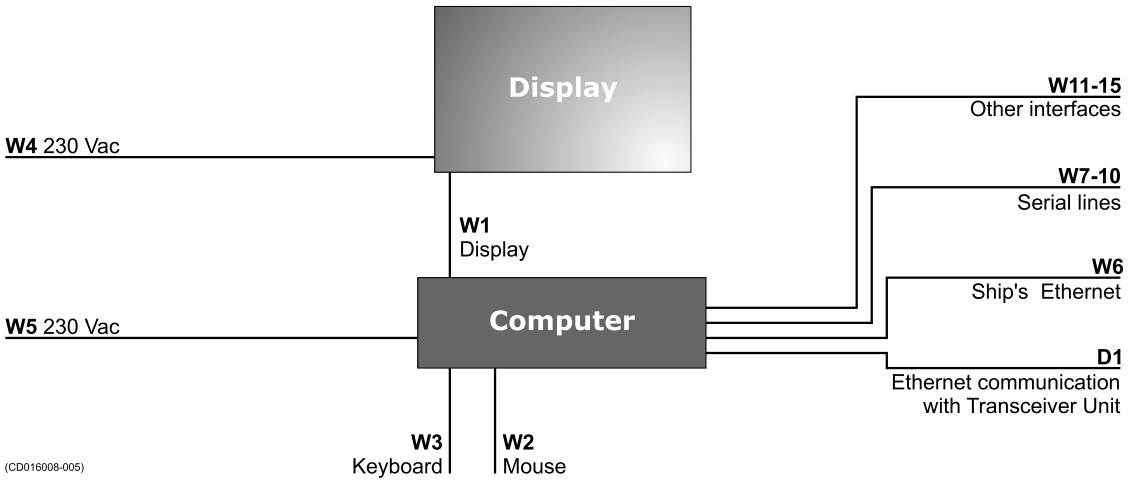



## Related topics

- *[K] External trigger* on page 105
- *RS-232 cable applied as external trigger (1:1)* on page 132

## Multibeam Operator Station cables

*Figure 46 Cable plan, Multibeam Operator Station*




### Related topics

- *[D] Ethernet cables to external cabinets* on page 101
- *[W] Operator Station cables* on page 113
- *Generic RS-232 Serial line* on page 130
- *Generic RS-422 Serial line* on page 134
- *VGA/SVGA Display* on page 150
- *Mouse cable* on page 152
- *Keyboard cable* on page 151
- *AC mains (IEC 60320)* on page 145
- *RJ45 Ethernet, straight* on page 147

# Detailed list of cables

The list below specifies each cable used by the Simrad MS70. References are made to the detailed cable drawings with applicable specifications.

**Topics**

## [A] Ethernet cables to Power Supply Units

**Cat.5** Ethernet cables are used, the default colour is grey. All are wired “straight“ (no crossovers).

The length of the cables are defined by the physical distance between the Transceiver Unit and the Power Supply Units. All cables are provided by Kongsberg Maritime.

*Table 2 Ethernet to Power Supply Units*

| Cable | From | To |
|---|---|---|
| A1 | Power Supply Unit 0 | Ethernet Switch [45] |
| A2 | Power Supply Unit 1 | Ethernet Switch [46] |
| A3 | Power Supply Unit 2 | Ethernet Switch [47] |

### Related topics

- *Ethernet cables; Operator Station and Power Supply Units* on page 87
- *RJ45 Ethernet, straight* on page 147

## [B] Ethernet cables to TRC Beamforming computers

**Cat.6** Ethernet cables are used. Neither of the Ethernet cables are screened, and all are wired “straight“ (no crossovers). Even numbered cables are normally green, and connect to port “1” on all the TRC Beamforming computers. Odd numbered cables are normally red, and connect to port “2” on the TRC Beamforming computers. Additional Ethernet cables are connected to the TRC0 Beamforming computer. All cables are 2 meters long.

*Figure 47 Ethernet connectors on the rear side of the TRC0 Beamforming computer*

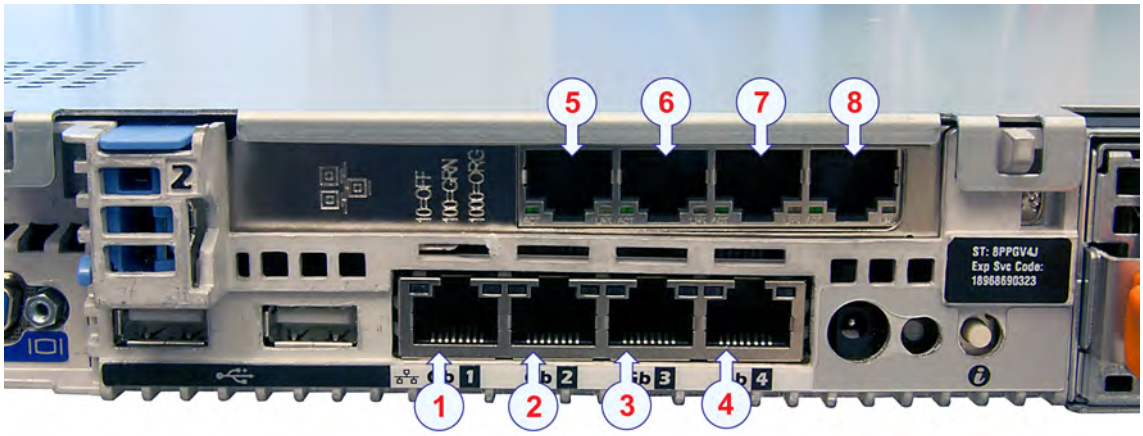



*Figure 48 Ethernet connectors on the rear side of the TRC1–5 computers*

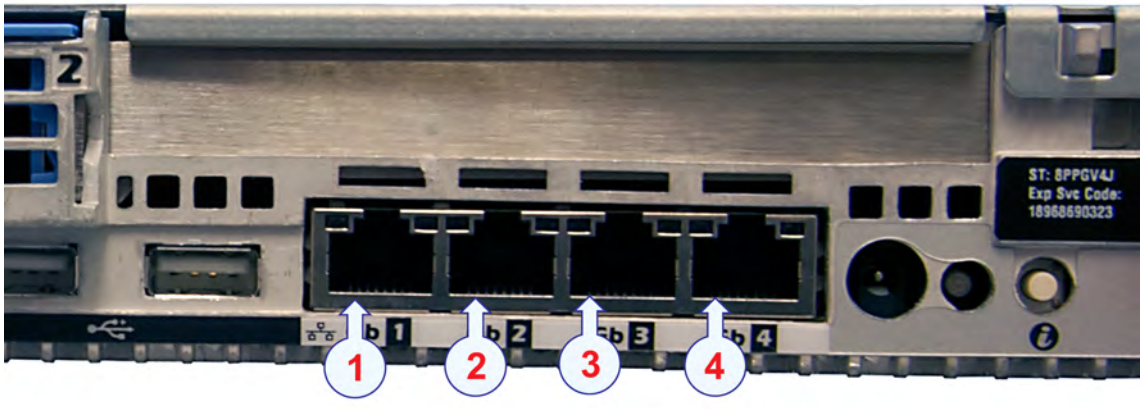



*Table 3 Ethernet TRC Beamforming computers*

| Cable | From | To |
|---|---|---|
| B1 | TRC0 port 1 | Ethernet Switch (OS LAN) |
| B2 | TRC0 port 2 | Ethernet Switch (TRU LAN) |
| B3 | TRC1 port 1 | Ethernet Switch (OS LAN) |
| B4 | TRC1 port 2 | Ethernet Switch (TRU LAN) |
| B5 | TRC2 port 1 | Ethernet Switch (OS LAN) |

*Table 3 Ethernet TRC Beamforming computers (cont'd.)*

| Cable | From | To |
|---|---|---|
| B6 | TRC2 port 2 | Ethernet Switch (TRU LAN) |
| B7 | TRC3 port 1 | Ethernet Switch (OS LAN) |
| B8 | TRC3 port 2 | Ethernet Switch (TRU LAN) |
| B9 | TRC4 port 1 | Ethernet Switch (OS LAN) |
| B10 | TRC4 port 2 | Ethernet Switch (TRU LAN) |
| B11 | TRC5 port 1 | Ethernet Switch (OS LAN) |
| B12 | TRC5 port 2 | Ethernet Switch (TRU LAN) |
| B13–17 | TRC0 ports 4 to 8 | Ethernet Switch (OS LAN) |

All cables are provided by Kongsberg Maritime.

## Related topics

- *Ethernet cables; TRC computers* on page 85
- *RJ45 Ethernet, straight* on page 147

## [C] Ethernet cables to TRXU transceiver racks

**Cat.6** Ethernet cables are used. Neither of the Ethernet cables are screened, and all are wired “straight“ (no crossovers). By default, all cables are blue. Those connected to TRXU0 are 2 meters long, the others are 1.5 meters long. All cables are provided by Kongsberg Maritime.

*Table 4 Ethernet to TRXU subracks*

| Cable | From | To |
|---|---|---|
| C1–8 | TRXU0 | Ethernet Switch (TRU) |
| C9–16 | TRXU1 | Ethernet Switch (TRU) |
| C17–25 | TRXU2 | Ethernet Switch (TRU) |

### Related topics

- *Ethernet cables; TRXU transceiver racks* on page 86
- *RJ45 Ethernet, straight* on page 147

## [D] Ethernet cables to external cabinets

**D1** is a standard **Cat 6** Ethernet cable used to connect the Ethernet Switch in the Transceiver Unit to the Multibeam Operator Station. The cable colour is grey. The cable is wired “straight“ (no crossovers). The length of the cable is defined by the physical distance between the Transceiver Unit and the Multibeam Operator Station. The cable must be provided by the installation shipyard. In order to handle the bandwidth of the Ethernet communication, a **Cat 6** Ethernet cable must be used.

Optional cables **D2** and **D3** may be used for external work stations (data loggers, post-processing stations etc.). If these cables are required, they must be provided by the installation shipyard. If an optional workstation is used for specific requirements, this is also connected to the Ethernet Switch in the Transceiver Unit. In order to handle the bandwidth of the Ethernet communication, **Cat 6** Ethernet cables must be used.

*Table 5 Ethernet cables for Multibeam Operator Station*

| Cable | From | To |
|---|---|---|
| D1 | Multibeam Operator Station | Ethernet Switch (OS) |
| D2 | Not used | |
| D3 | Not used | |

### Related topics

- *Ethernet cables; Operator Station and Power Supply Units* on page 87
- *Multibeam Operator Station cables* on page 95
- *RJ45 Ethernet, straight* on page 147

## [F] Internal TRXU synchronisation

Two special cables are used to synchronise the transmission in the Transceiver Unit. The two cables are connected from the TRXU2 rack (bottom) to TRXU1, and from TRXU1 to TRXU2 (top).

Both cables are provided by Kongsberg Maritime.

### Related topics

- *Interface cables; TRXU synchronization* on page 91

## [G] Motion Reference Unit interface

A single serial line cable is connected to the RS-232 port on the rear side of the TRC0 Beamforming computer.

*Figure 49 RS-232 connector on the rear side of the TRC0 Beamforming computer*


The cable must be provided by the installation shipyard.

### Related topics

- *Interface cables; Motion Reference Unit* on page 92
- *Generic RS-232 Serial line* on page 130

## [H] GPS, Sound Velocity and Gyro interface

Commercial RS-232 serial line cables are used to connect these inputs to the Multibeam Operator Station computer.

Several computers may not offer the required amount of serial lines. In order to provide the necessary serial interfaces, additional serial line adapters may be added to the computer. As an alternative, RS-232 to USB adapters can be used. In order to ensure that the necessary power is available, such adapters must - whenever possible - be used with dedicated external power supplies.

The Multibeam Operator Station computer must also facilitate interface for external trigger. Since the trigger only uses the CTS and DTS signals on a serial line (pins 5, 7 an8), it can be connected to a serial port otherwise used with an other peripheral device. See *[K] External trigger* on page 105.

These cables must be provided by the installation shipyard.

### Related topics


- *Interface cables; GPS, sound velocity and gyro* on page 93
- *[K] External trigger* on page 105
- *Generic RS-232 Serial line* on page 130
- *Serial line to USB adapter* on page 155

## [K] External trigger

Various trigger signals are required for the MS70. Some of these trigger signals are connected to or from external devices, while others are connected internally.

The following trigger signals are in use:

- **External trigger**: In order to allow for external triggering to or from other acoustic systems on the ship, a serial line on the Multibeam Operator Station computer is used. Whenever possible, a standard serial line interface should be used. If an RS-232 to USB adapter is used on the computer to facilitate the serial lines, one of these can also be used, provided that the CTS and RTS signals are available. This trigger cable must be provided by the installation shipyard.

### Related topics


- *[W] Operator Station cables* on page 113
- *Interface cables; external trigger* on page 94
- *RS-232 as external trigger* on page 131

## [P] Power cables to TRC Beamforming computers

Standard commercial 230 Vac power cables are used on all TRC Beamforming computers. The AC power distribution inside the rack is provided by four circuit breakers at the bottom of the cabinet, and three distribution rails at the top.

*Figure 50 AC distribution rail*

The units are powered from the three distribution rails as specified in the table.

*Table 6 Power cables to TRC Beamforming computers*

| Cable | From | To |
|---|---|---|
| P1 | Power Distribution 1 | TRC Beamforming computer 0 |
| P2 | Power Distribution 1 | TRC Beamforming computer 1 |
| P3 | Power Distribution 1 | TRC Beamforming computer 2 |
| P4 | Power Distribution 2 | TRC Beamforming computer 3 |
| P5 | Power Distribution 2 | TRC Beamforming computer 4 |
| P6 | Power Distribution 2 | TRC Beamforming computer 5 |

*Table 7 Power cable to Ethernet switch*

| Cable | From | To |
|---|---|---|
| P7 | Power Distribution 2 | Ethernet Switch 2 |

All cables are provided by Kongsberg Maritime.

### Related topics

- *Power cables; Transceiver Unit* on page 88
- *AC mains (IEC 60320)* on page 145

## [Q] Power cables to TRXU transceiver racks

When the Power Supply Units are used, all DC and AC voltages required by the TRXU racks are provided by these external supplies. **Distributor 0** and **Circuit Breaker 0** are then not in use. These devices are however installed for test purposes, and to provide power for potential future power modifications.

## [R] Power cables to ship’s 230 Vac mains supply

The power cables provided to supply the Transceiver Unit with 230 Vac mains are connected to the four circuit breakers in the bottom of the rack.

### Circuit breakers

- **Circuit Breaker 0** (left): Feeds **Distributor 0** (bottom), for future expansions
- **Circuit Breaker 1**: Feeds **Distributor 1** (middle), powers TRC beamforming computers 0, 1 and 2
- **Circuit Breaker 2**: Feeds **Distributor 2** (top), powers TRC beamforming computers 3, 4 and 5 and the Ethernet Switch
- **Circuit Breaker 3** (right): Feeds the main fan unit at the bottom of the rack

The other end of the mains cables are fitted with a standard mains plug.

*Table 8 Power cables to ship’s mains*

| Cable | From | To |
|---|---|---|
| R1 | Ship’s mains supply | Circuit breaker 0 |
| R2 | Ship’s mains supply | Circuit breaker 1 |
| R3 | Ship’s mains supply | Circuit breaker 2 |
| R4 | Ship’s mains supply | Circuit breaker 3 |

All cables are provided by Kongsberg Maritime.

### Related topics

- *Power cables; Transceiver Unit* on page 88
- *Circuit breaker* on page 146

## [S] Power cables from the four circuit breakers

Circuit breakers 0, 1 and 2 feed the three power distributors at the top of the rack, and cables **S1**, **S2** and **S3** are fitted to these distributor devices.

Cable **S4** powers the main fan at the bottom of the rack.

*Table 9 Power cables to ship's mains*

| Cable | From | To |
|---|---|---|
| S1 | Circuit breaker 0 | Power Distribution 0 |
| S2 | Circuit breaker 1 | Power Distribution 1 |
| S3 | Circuit breaker 2 | Power Distribution 2 |
| S4 | Circuit breaker 3 | Fan unit |

All cables are provided by Kongsberg Maritime.

### Related topics

- *Power cables; Transceiver Unit* on page 88
- *AC mains (IEC 60320)* on page 145
- *Transceiver Unit Fan module wiring* on page 143

## [T] AC mains supply to Power Supply Units

The three external Power Supply Units are powered by from a 230 Vac 16A mains outlet. The DC output is fed to the three TRXU transceiver subracks by means of three cable bundles.

*Table 10 AC mains to Power Supply Units*

| Cable | From | To |
|---|---|---|
| T1 | Ship's mains supply | Power Supply Unit 0 |
| T2 | Ship's mains supply | Power Supply Unit 1 |
| T3 | Ship's mains supply | Power Supply Unit 2 |

All cables are provided by Kongsberg Maritime.

### Supply requirements

Each of the two AC outlets for the instrument rack must provide minimum 10A. The AC outlet for the external power supply must provide 16A.

### Related topics

- *Power cables; Power Supply Units* on page 89
- *AC mains (IEC 60320)* on page 145
- *Power Supply Units AC mains wiring* on page 137

## [U] Power cables from Power Supply Units to Transceiver Unit

The DC power from the three Power Supply Units are connected to the Transceiver Unit using bundled cables. Each bundle holds the following cables:

**a** 230 Vac to TRXU fans

**b** +6 Vdc (one red and one blue cable)

**c** +6 Vdc (one red and one blue cable)

**d** +12 Vdc (one red and one blue cable)

**e** +75 Vdc (one red and one blue cable)

Observe the block diagram.

In addition to the three DC voltages, the bundled cables also provide 230 Vac power to the fan drawers in the TRXU racks.

Note

*The power cables must be installed in steel conduits to reduce noise.*

*Figure 51 Block diagram, AC and DC distribution from Power Supply Units*

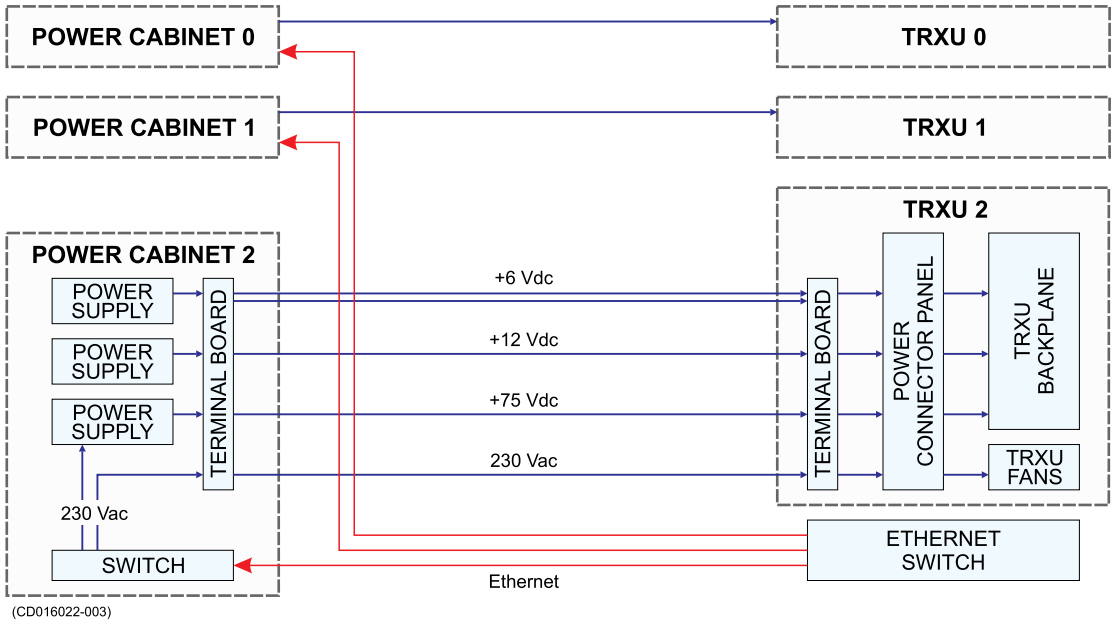



*Table 11 AC mains to Power Supply Units*

| Cable | From | To |
|---|---|---|
| U1 | Power Supply Unit 0 | TB0 on rear side of TRXU0 |
| U2 | Power Supply Unit 1 | TB1 on rear side of TRXU1 |
| U3 | Power Supply Unit 2 | TB2 on rear side of TRXU2 |

All cables are provided by Kongsberg Maritime.

### Related topics

- *Power cables; Power Supply Units* on page 89
- *Power Supply Units DC output wiring* on page 138
- *TRXU racks DC input wiring* on page 139
- *Power Connector Panel* on page 140
- *+6 and +12 Vdc to the TRXU backplane* on page 141
- *+75 Vdc to the TRXU backplane* on page 142

## [W] Operator Station cables

These cables are used on the Operator Station.

- **W1 / Display**: This is a commercial display cable. It provides the connection between the computer and the colour monitor. The type of cable used will depend on the video format required by the display (VGA/SVGA/DVI).
- **W2 / Mouse**: This is a commercial cable, and in most cases, it is fixed to the mouse. Ensure that the plug on the mouse cable is compatible with the computer (USB/PS2).
- **W3 / Keyboard**: This is a commercial cable, and in most cases, it is fixed to the keyboard. Ensure that the plug on the keyboard cable is compatible with the computer (USB/PS2).
- **W4 / AC mains to display**: This is a commercial power cable, and in most cases, it is provided with the display.
- **W5 / AC mains to computer**: This is a commercial power cable, and in most cases, it is provided with the computer.
- **W6 / Ship's ethernet**: A standard Ethernet cable with RJ45 connectors is used to connect the Operator Station to the ship's network. This cable must be provided by the installation shipyard. In order to handle the bandwidth of the Ethernet communication, we strongly recommend that a **Cat 6** Ethernet cable is used. This cable must be provided by the customer or the installation shipyard.
- **W7–10 / Serial line interfaces**: Standard serial line interfaces (RS232/RS422) may be used as required. One may be used as **K1** External trigger
- **W11–15 / Serial line interfaces**: Other interfaces (USB, Firewire etc) may be used as required.

Note

*Additional **Dx** Ethernet cable(s) are used to connect the Multibeam Operator Station to the Transceiver Unit. For these specifications. see [D] Ethernet cables to external cabinets on page 101.*

The Operator Station is equipped with a serial port adapter to provide multiple interfaces.

→ *Moxa CP134U-I Serial adapter setup* on page 125

→ *Moxa CP134U-I Serial line adapter* on page 135

*Table 12 Multibeam Operator Station*

| Cable | From | To |
|---|---|---|
| W1 | Operator Station computer | Colour display |
| W2 | Operator Station computer | Mouse |
| W3 | Operator Station computer | Keyboard |
| W4 | Display | Ship's mains supply |
| W5 | Operator Station computer | Ship's mains supply |
| W6 | Operator Station computer | Ship's local area network |

*Table 12 Multibeam Operator Station (cont'd.)*

| Cable | From | To |
|---|---|---|
| W7–10 | Operator Station computer | External equipment and/or peripherals (sensors) |
| W11–15 | Operator Station computer | External equipment |

### Related topics

- *[D] Ethernet cables to external cabinets* on page 101
- *[K] External trigger* on page 105
- *Multibeam Operator Station cables* on page 95
- *Moxa CP134U-I Serial line adapter* on page 135
- *VGA/SVGA Display* on page 150
- *Mouse cable* on page 152
- *Keyboard cable* on page 151
- *AC mains (IEC 60320)* on page 145
- *AC mains (IEC 60320)* on page 145
- *RJ45 Ethernet, straight* on page 147

## Transducer cables overview

A total of 25 transducer cables are brought up from the transducer array. Each cable is terminated in a large connector, and each connector plugs into its dedicated socket on the rear side of the **TRXU** transceiver subracks. The transducer cables are identified with numbers **001** through **025**

All transducer cables are provided by Kongsberg Maritime.

**Related topics**

- *Transducer cables* on page 156
- *Terminations to TRXU0 (Top subrack)* on page 158
- *Terminations to TRXU1 (Middle subrack)* on page 159
- *Terminations to TRXU2 (Bottom subrack)* on page 160
- *Transducer cables* on page 115

# Transducer cables

The MS70 transducer array is organised as follows:

- The array contains 25 quadrants
- Each quadrant contains 32 individual elements
- Each quadrant is connected by means of a separate cable to a dedicated **TRX32** circuit board handling the 32 channels

## Transducer cable pairs

There are 36 cable pairs in each transducer cable.

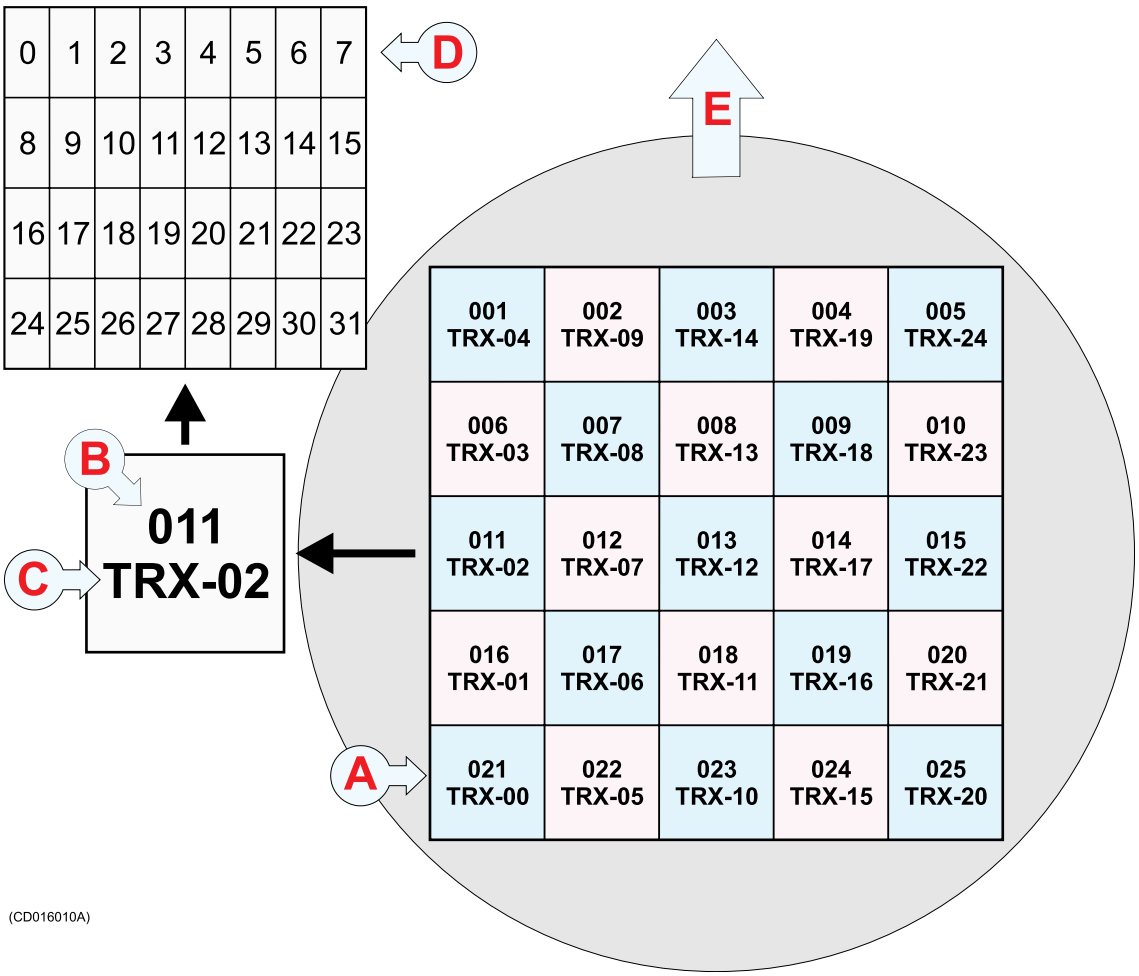
32 of these cable pairs are used for the elements in the module.

Cable pair 33 connects to a thermistor on the transformer circuit board in the transducer.

The last two cables pairs are not used, and these are cut.

## Element organisation

*Figure 52 Transducer element organisation*




*The transducer array is seen from behind.*

**A** *The transducer array contains 25 quadrants.*

**B** *Each quadrant is identified with the number of the transducer cable used for that specific quadrant.*

**C** *Each quadrant is identified with the **TRX32** circuit board used for that specific quadrant.*

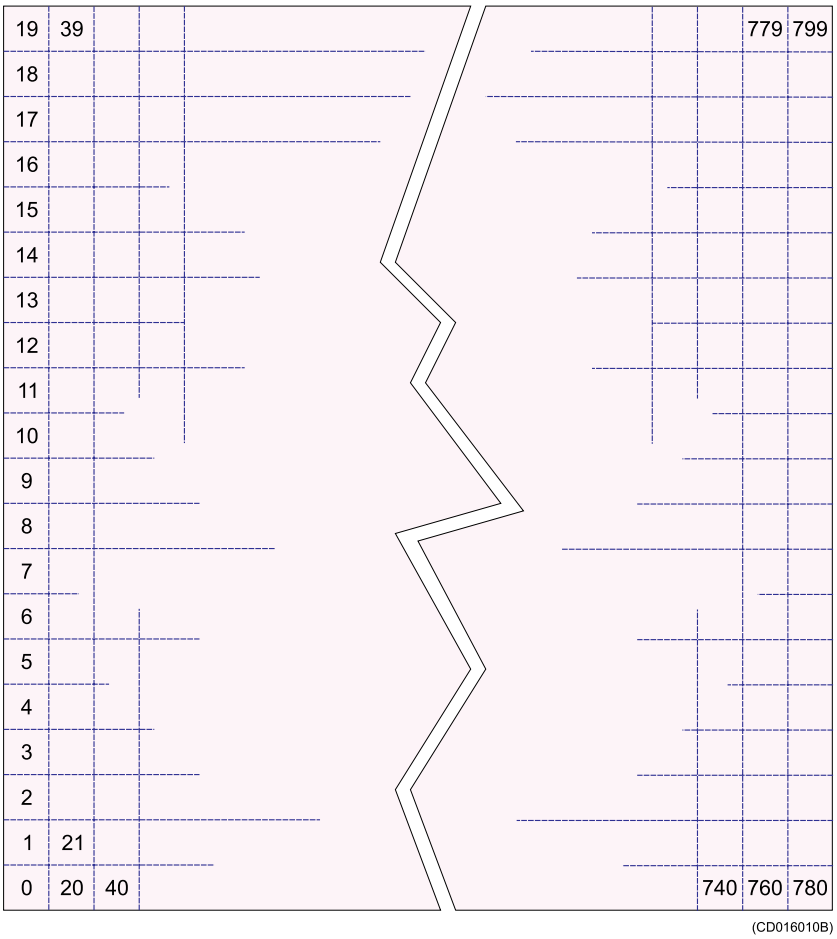
**D** *Each quadrant contains 32 elements, four rows with eight elements in each row. The number provided for each element specifies which **TRX32** channel on the specific circuit board that is used for the specific element.*

**E** *The arrow indicates direction UP.*

## Channel and element identification tables

The tables below defines the relationship between the elements and the individual channels. They also define which cable that is used, and to which TRX32 circuit board the element is physically connected.

*Figure 53 Transducer channel organisation*




*The transducer array is seen from behind. It contains a total of 800 channels organized as shown.*

*Table 13 Quadrant 001 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 19 | 8 | 18 | 16 | 17 | 24 | 16 |
| 1 | 39 | 9 | 38 | 17 | 37 | 25 | 36 |
| 2 | 59 | 10 | 58 | 18 | 57 | 26 | 56 |
| 3 | 79 | 11 | 78 | 19 | 77 | 27 | 76 |
| 4 | 99 | 12 | 98 | 20 | 97 | 28 | 96 |
| 5 | 119 | 13 | 118 | 21 | 117 | 29 | 116 |
| 6 | 139 | 14 | 138 | 22 | 137 | 30 | 136 |

*Table 13 Quadrant 001 element identification (cont'd.)*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 7 | 159 | 15 | 158 | 23 | 157 | 31 | 156 |
| Cable: **001** | | | | TRX32 circuit board: **4** | | | |

*Table 14 Quadrant 002 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 179 | 8 | 178 | 16 | 177 | 24 | 176 |
| 1 | 199 | 9 | 198 | 17 | 197 | 25 | 196 |
| 2 | 219 | 10 | 218 | 18 | 217 | 26 | 216 |
| 3 | 239 | 11 | 238 | 19 | 237 | 27 | 236 |
| 4 | 259 | 12 | 258 | 20 | 257 | 28 | 256 |
| 5 | 279 | 13 | 278 | 21 | 277 | 29 | 276 |
| 6 | 299 | 14 | 298 | 22 | 297 | 30 | 296 |
| 7 | 319 | 15 | 318 | 23 | 317 | 31 | 316 |
| Cable: **002** | | | | TRX32 circuit board: **9** | | | |

*Table 15 Quadrant 003 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 339 | 8 | 338 | 16 | 337 | 24 | 336 |
| 1 | 359 | 9 | 358 | 17 | 357 | 25 | 356 |
| 2 | 379 | 10 | 378 | 18 | 377 | 26 | 376 |
| 3 | 399 | 11 | 398 | 19 | 397 | 27 | 396 |
| 4 | 419 | 12 | 418 | 20 | 417 | 28 | 416 |
| 5 | 439 | 13 | 438 | 21 | 437 | 29 | 436 |
| 6 | 459 | 14 | 458 | 22 | 457 | 30 | 456 |
| 7 | 479 | 15 | 478 | 23 | 477 | 31 | 476 |
| Cable: **003** | | | | TRX32 circuit board: **14** | | | |

*Table 16 Quadrant 004 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 499 | 8 | 498 | 16 | 497 | 24 | 496 |
| 1 | 519 | 9 | 518 | 17 | 517 | 25 | 516 |
| 2 | 539 | 10 | 538 | 18 | 537 | 26 | 536 |
| 3 | 559 | 11 | 558 | 19 | 557 | 27 | 556 |
| 4 | 579 | 12 | 578 | 20 | 577 | 28 | 576 |
| 5 | 599 | 13 | 598 | 21 | 597 | 29 | 596 |
| 6 | 619 | 14 | 618 | 22 | 617 | 30 | 616 |
| 7 | 639 | 15 | 638 | 23 | 637 | 31 | 636 |
| Cable: **004** | | | | TRX32 circuit board: **19** | | | |

*Table 17 Quadrant 005 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 659 | 8 | 658 | 16 | 657 | 24 | 656 |
| 1 | 679 | 9 | 678 | 17 | 677 | 25 | 676 |
| 2 | 699 | 10 | 698 | 18 | 697 | 26 | 696 |
| 3 | 719 | 11 | 718 | 19 | 717 | 27 | 716 |
| 4 | 739 | 12 | 738 | 20 | 737 | 28 | 736 |
| 5 | 759 | 13 | 758 | 21 | 757 | 29 | 756 |
| 6 | 779 | 14 | 778 | 22 | 777 | 30 | 776 |
| 7 | 799 | 15 | 798 | 23 | 797 | 31 | 796 |
| Cable: **005** | | | | TRX32 circuit board: **24** | | | |

*Table 18 Quadrant 006 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 15 | 8 | 14 | 16 | 13 | 24 | 12 |
| 1 | 35 | 9 | 34 | 17 | 33 | 25 | 32 |
| 2 | 55 | 10 | 54 | 18 | 53 | 26 | 52 |
| 3 | 75 | 11 | 74 | 19 | 73 | 27 | 72 |
| 4 | 95 | 12 | 94 | 20 | 93 | 28 | 92 |
| 5 | 115 | 13 | 114 | 21 | 113 | 29 | 112 |
| 6 | 135 | 14 | 134 | 22 | 133 | 30 | 132 |
| 7 | 155 | 15 | 154 | 23 | 153 | 31 | 152 |
| Cable: **006** | | | | TRX32 circuit board: **3** | | | |

*Table 19 Quadrant 007 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 175 | 8 | 174 | 16 | 173 | 24 | 172 |
| 1 | 195 | 9 | 194 | 17 | 193 | 25 | 192 |
| 2 | 215 | 10 | 214 | 18 | 213 | 26 | 212 |
| 3 | 235 | 11 | 234 | 19 | 233 | 27 | 232 |
| 4 | 255 | 12 | 254 | 20 | 253 | 28 | 252 |
| 5 | 275 | 13 | 274 | 21 | 273 | 29 | 272 |
| 6 | 295 | 14 | 294 | 22 | 293 | 30 | 292 |
| 7 | 315 | 15 | 314 | 23 | 313 | 31 | 312 |
| Cable: **007** | | | | TRX32 circuit board: **8** | | | |

*Table 20 Quadrant 008 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 335 | 8 | 334 | 16 | 333 | 24 | 332 |
| 1 | 355 | 9 | 354 | 17 | 353 | 25 | 352 |

*Table 20 Quadrant 008 element identification (cont'd.)*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 2 | 375 | 10 | 374 | 18 | 373 | 26 | 372 |
| 3 | 395 | 11 | 394 | 19 | 393 | 27 | 392 |
| 4 | 415 | 12 | 414 | 20 | 413 | 28 | 412 |
| 5 | 435 | 13 | 434 | 21 | 433 | 29 | 432 |
| 6 | 455 | 14 | 454 | 22 | 453 | 30 | 452 |
| 7 | 475 | 15 | 474 | 23 | 473 | 31 | 472 |
| Cable: **008** | | | | TRX32 circuit board: **13** | | | |

*Table 21 Quadrant 009 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 495 | 8 | 494 | 16 | 493 | 24 | 492 |
| 1 | 515 | 9 | 514 | 17 | 513 | 25 | 512 |
| 2 | 535 | 10 | 534 | 18 | 533 | 26 | 532 |
| 3 | 555 | 11 | 554 | 19 | 553 | 27 | 552 |
| 4 | 575 | 12 | 574 | 20 | 573 | 28 | 572 |
| 5 | 595 | 13 | 594 | 21 | 593 | 29 | 592 |
| 6 | 615 | 14 | 614 | 22 | 613 | 30 | 612 |
| 7 | 635 | 15 | 634 | 23 | 633 | 31 | 632 |
| Cable: **009** | | | | TRX32 circuit board: **18** | | | |

*Table 22 Quadrant 010 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 655 | 8 | 654 | 16 | 653 | 24 | 652 |
| 1 | 675 | 9 | 674 | 17 | 673 | 25 | 672 |
| 2 | 695 | 10 | 694 | 18 | 693 | 26 | 692 |
| 3 | 715 | 11 | 714 | 19 | 713 | 27 | 712 |
| 4 | 735 | 12 | 734 | 20 | 733 | 28 | 732 |
| 5 | 755 | 13 | 754 | 21 | 753 | 29 | 752 |
| 6 | 775 | 14 | 774 | 22 | 773 | 30 | 772 |
| 7 | 795 | 15 | 794 | 23 | 793 | 31 | 792 |
| Cable: **010** | | | | TRX32 circuit board: **23** | | | |

*Table 23 Quadrant 011 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 11 | 8 | 10 | 16 | 9 | 24 | 8 |
| 1 | 31 | 9 | 30 | 17 | 29 | 25 | 28 |
| 2 | 51 | 10 | 50 | 18 | 49 | 26 | 48 |
| 3 | 71 | 11 | 70 | 19 | 69 | 27 | 68 |

*Table 23 Quadrant 011 element identification (cont'd.)*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 4 | 91 | 12 | 90 | 20 | 89 | 28 | 88 |
| 5 | 111 | 13 | 110 | 21 | 109 | 29 | 108 |
| 6 | 131 | 14 | 130 | 22 | 129 | 30 | 128 |
| 7 | 151 | 15 | 150 | 23 | 149 | 31 | 148 |
| Cable: **011** | | | | TRX32 circuit board: **2** | | | |

*Table 24 Quadrant 012 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 171 | 8 | 170 | 16 | 169 | 24 | 168 |
| 1 | 191 | 9 | 190 | 17 | 189 | 25 | 188 |
| 2 | 211 | 10 | 210 | 18 | 209 | 26 | 208 |
| 3 | 231 | 11 | 230 | 19 | 229 | 27 | 228 |
| 4 | 251 | 12 | 250 | 20 | 249 | 28 | 248 |
| 5 | 271 | 13 | 270 | 21 | 269 | 29 | 268 |
| 6 | 291 | 14 | 290 | 22 | 289 | 30 | 288 |
| 7 | 311 | 15 | 310 | 23 | 309 | 31 | 308 |
| Cable: **012** | | | | TRX32 circuit board: **7** | | | |

*Table 25 Quadrant 013 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 331 | 8 | 330 | 16 | 329 | 24 | 328 |
| 1 | 351 | 9 | 350 | 17 | 349 | 25 | 348 |
| 2 | 371 | 10 | 370 | 18 | 369 | 26 | 368 |
| 3 | 391 | 11 | 390 | 19 | 389 | 27 | 388 |
| 4 | 411 | 12 | 410 | 20 | 409 | 28 | 408 |
| 5 | 431 | 13 | 430 | 21 | 429 | 29 | 428 |
| 6 | 451 | 14 | 450 | 22 | 449 | 30 | 448 |
| 7 | 471 | 15 | 470 | 23 | 469 | 31 | 468 |
| Cable: **013** | | | | TRX32 circuit board: **12** | | | |

*Table 26 Quadrant 014 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 491 | 8 | 490 | 16 | 489 | 24 | 488 |
| 1 | 511 | 9 | 510 | 17 | 509 | 25 | 508 |
| 2 | 531 | 10 | 530 | 18 | 529 | 26 | 528 |
| 3 | 551 | 11 | 550 | 19 | 549 | 27 | 548 |
| 4 | 571 | 12 | 570 | 20 | 569 | 28 | 568 |
| 5 | 591 | 13 | 590 | 21 | 589 | 29 | 588 |

*Table 26 Quadrant 014 element identification (cont'd.)*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 6 | 611 | 14 | 610 | 22 | 609 | 30 | 608 |
| 7 | 631 | 15 | 630 | 23 | 629 | 31 | 628 |
| Cable: **014** | | | | TRX32 circuit board: **17** | | | |

*Table 27 Quadrant 015 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 651 | 8 | 650 | 16 | 649 | 24 | 648 |
| 1 | 671 | 9 | 670 | 17 | 669 | 25 | 668 |
| 2 | 691 | 10 | 690 | 18 | 689 | 26 | 688 |
| 3 | 711 | 11 | 710 | 19 | 709 | 27 | 708 |
| 4 | 731 | 12 | 730 | 20 | 729 | 28 | 828 |
| 5 | 751 | 13 | 750 | 21 | 749 | 29 | 748 |
| 6 | 771 | 14 | 770 | 22 | 769 | 30 | 768 |
| 7 | 791 | 15 | 790 | 23 | 789 | 31 | 788 |
| Cable: **015** | | | | TRX32 circuit board: **22** | | | |

*Table 28 Quadrant 016 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 7 | 8 | 6 | 16 | 5 | 24 | 4 |
| 1 | 27 | 9 | 26 | 17 | 25 | 25 | 24 |
| 2 | 47 | 10 | 46 | 18 | 45 | 26 | 44 |
| 3 | 67 | 11 | 66 | 19 | 65 | 27 | 64 |
| 4 | 87 | 12 | 86 | 20 | 85 | 28 | 84 |
| 5 | 107 | 13 | 106 | 21 | 105 | 29 | 104 |
| 6 | 127 | 14 | 126 | 22 | 125 | 30 | 124 |
| 7 | 147 | 15 | 146 | 23 | 145 | 31 | 144 |
| Cable: **016** | | | | TRX32 circuit board: **1** | | | |

*Table 29 Quadrant 017 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 167 | 8 | 166 | 16 | 165 | 24 | 164 |
| 1 | 187 | 9 | 186 | 17 | 185 | 25 | 184 |
| 2 | 207 | 10 | 206 | 18 | 205 | 26 | 204 |
| 3 | 227 | 11 | 226 | 19 | 225 | 27 | 224 |
| 4 | 247 | 12 | 246 | 20 | 245 | 28 | 244 |
| 5 | 267 | 13 | 266 | 21 | 265 | 29 | 264 |
| 6 | 287 | 14 | 286 | 22 | 285 | 30 | 284 |

*Table 29 Quadrant 017 element identification (cont'd.)*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 7 | 307 | 15 | 306 | 23 | 305 | 31 | 304 |
| Cable: **017** | | | | TRX32 circuit board: **6** | | | |

*Table 30 Quadrant 018 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 327 | 8 | 326 | 16 | 325 | 24 | 324 |
| 1 | 347 | 9 | 346 | 17 | 345 | 25 | 344 |
| 2 | 367 | 10 | 366 | 18 | 365 | 26 | 364 |
| 3 | 387 | 11 | 386 | 19 | 385 | 27 | 384 |
| 4 | 407 | 12 | 406 | 20 | 405 | 28 | 404 |
| 5 | 427 | 13 | 426 | 21 | 425 | 29 | 424 |
| 6 | 447 | 14 | 446 | 22 | 445 | 30 | 444 |
| 7 | 467 | 15 | 466 | 23 | 465 | 31 | 464 |
| Cable: **018** | | | | TRX32 circuit board: **11** | | | |

*Table 31 Quadrant 019 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 487 | 8 | 486 | 16 | 485 | 24 | 484 |
| 1 | 507 | 9 | 506 | 17 | 505 | 25 | 504 |
| 2 | 527 | 10 | 526 | 18 | 525 | 26 | 524 |
| 3 | 547 | 11 | 546 | 19 | 545 | 27 | 544 |
| 4 | 567 | 12 | 566 | 20 | 565 | 28 | 564 |
| 5 | 587 | 13 | 586 | 21 | 585 | 29 | 584 |
| 6 | 607 | 14 | 606 | 22 | 605 | 30 | 604 |
| 7 | 627 | 15 | 626 | 23 | 625 | 31 | 624 |
| Cable: **019** | | | | TRX32 circuit board: **16** | | | |

*Table 32 Quadrant 020 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 647 | 8 | 646 | 16 | 645 | 24 | 644 |
| 1 | 667 | 9 | 666 | 17 | 665 | 25 | 664 |
| 2 | 687 | 10 | 686 | 18 | 685 | 26 | 684 |
| 3 | 707 | 11 | 706 | 19 | 705 | 27 | 704 |
| 4 | 727 | 12 | 726 | 20 | 725 | 28 | 724 |
| 5 | 747 | 13 | 746 | 21 | 745 | 29 | 744 |
| 6 | 767 | 14 | 766 | 22 | 765 | 30 | 764 |
| 7 | 787 | 15 | 786 | 23 | 785 | 31 | 784 |
| Cable: **020** | | | | TRX32 circuit board: **21** | | | |

*Table 33 Quadrant 021 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 3 | 8 | 2 | 16 | 1 | 24 | 0 |
| 1 | 23 | 9 | 22 | 17 | 21 | 25 | 20 |
| 2 | 43 | 10 | 42 | 18 | 41 | 26 | 40 |
| 3 | 63 | 11 | 62 | 19 | 61 | 27 | 60 |
| 4 | 83 | 12 | 82 | 20 | 81 | 28 | 80 |
| 5 | 103 | 13 | 102 | 21 | 101 | 29 | 100 |
| 6 | 123 | 14 | 122 | 22 | 121 | 30 | 120 |
| 7 | 143 | 15 | 142 | 23 | 141 | 31 | 140 |
| Cable: **021** | | | | TRX32 circuit board: **0** | | | |

*Table 34 Quadrant 022 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 163 | 8 | 162 | 16 | 161 | 24 | 160 |
| 1 | 183 | 9 | 182 | 17 | 181 | 25 | 180 |
| 2 | 203 | 10 | 202 | 18 | 201 | 26 | 200 |
| 3 | 223 | 11 | 222 | 19 | 221 | 27 | 220 |
| 4 | 243 | 12 | 242 | 20 | 241 | 28 | 240 |
| 5 | 263 | 13 | 262 | 21 | 261 | 29 | 260 |
| 6 | 283 | 14 | 282 | 22 | 281 | 30 | 280 |
| 7 | 303 | 15 | 302 | 23 | 301 | 31 | 300 |
| Cable: **022** | | | | TRX32 circuit board: **5** | | | |

*Table 35 Quadrant 023 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 323 | 8 | 322 | 16 | 321 | 24 | 320 |
| 1 | 343 | 9 | 342 | 17 | 341 | 25 | 340 |
| 2 | 363 | 10 | 362 | 18 | 361 | 26 | 360 |
| 3 | 383 | 11 | 382 | 19 | 381 | 27 | 380 |
| 4 | 403 | 12 | 402 | 20 | 401 | 28 | 400 |
| 5 | 423 | 13 | 422 | 21 | 421 | 29 | 420 |
| 6 | 443 | 14 | 442 | 22 | 441 | 30 | 440 |
| 7 | 463 | 15 | 462 | 23 | 461 | 31 | 460 |
| Cable: **023** | | | | TRX32 circuit board: **10** | | | |

*Table 36 Quadrant 024 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 483 | 8 | 482 | 16 | 481 | 24 | 480 |
| 1 | 503 | 9 | 502 | 17 | 501 | 25 | 500 |

*Table 36 Quadrant 024 element identification (cont'd.)*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 2 | 523 | 10 | 522 | 18 | 521 | 26 | 520 |
| 3 | 543 | 11 | 542 | 19 | 541 | 27 | 540 |
| 4 | 563 | 12 | 562 | 20 | 561 | 28 | 560 |
| 5 | 583 | 13 | 582 | 21 | 581 | 29 | 580 |
| 6 | 603 | 14 | 602 | 22 | 601 | 30 | 600 |
| 7 | 623 | 15 | 622 | 23 | 621 | 31 | 620 |
| Cable: **024** | | | | TRX32 circuit board: **15** | | | |

*Table 37 Quadrant 025 element identification*

| Cha | Elmnt | Cha | Elmnt | Cha | Elmnt | Cha | Elmnt |
|---|---|---|---|---|---|---|---|
| 0 | 643 | 8 | 642 | 16 | 641 | 24 | 640 |
| 1 | 663 | 9 | 662 | 17 | 661 | 25 | 660 |
| 2 | 683 | 10 | 682 | 18 | 681 | 26 | 680 |
| 3 | 703 | 11 | 702 | 19 | 701 | 27 | 700 |
| 4 | 723 | 12 | 722 | 20 | 721 | 28 | 720 |
| 5 | 743 | 13 | 742 | 21 | 741 | 29 | 740 |
| 6 | 763 | 14 | 762 | 22 | 761 | 30 | 760 |
| 7 | 783 | 15 | 782 | 23 | 781 | 31 | 780 |
| Cable: **025** | | | | TRX32 circuit board: **20** | | | |

# Moxa CP134U-I Serial adapter setup

This section describes the **Moxa CP134U-I** 4–port optical isolated serial interface board.

This board is used on the Multibeam Operator Station to provide multiple serial line connections.

## Serial line support

The 4-port serial board supports the following serial line interface formats:

- **Port 1**: RS-232/422/485
- **Port 2**: RS-232/422/485
- **Port 3**: RS-422/485
- **Port 4**: RS-422/485

By manufacturer default, all these serial connections are set to **RS-422** format. In order to change this to RS-232 or RS-485 format, dedicated jumpers or DIP switches must be changed.

Note

*Note that only ports 1 and 2 support RS-232 format.*

## Jumper and DIP switch settings

Use the 10-pin jumper arrays and the two DIP switches to set ports 1 and 2 to RS-232, RS-422, or RS-485. Use the two DIP switches to set ports 3 and 4 to RS-422 or RS-485.

- **RS–232**: In order to use Port 1 (**COM2**) or Port 2 (**COM3**) as RS-232 interfaces, the relevant jumper arrays for Port 1 or Port 2 must be moved. Note that ports 3 and 4 do not support RS-232 format.
- **RS-422**: All four ports can be set to RS-422 using the two jumpers and the right-hand DIP switch S2.
- **RS-485**: All four ports can be set to RS-485 using the two jumpers and the right-hand DIP switch S2. Additionally, each port can be selected for a 2-wire or 4-wire connection type using the left-hand DIP switch S1.

*Figure 54 Location of the jumpers and DIP switches*

**A** *Jumper for Port 1 interface setup*

**B** *Jumper for Port 2 interface setup*

**C** *DIP-switch S1 for 2–wire or 4–wire setup (all ports)*

**D** *DIP-switch S2 for RS-422 or RS-485 selection (all ports)*

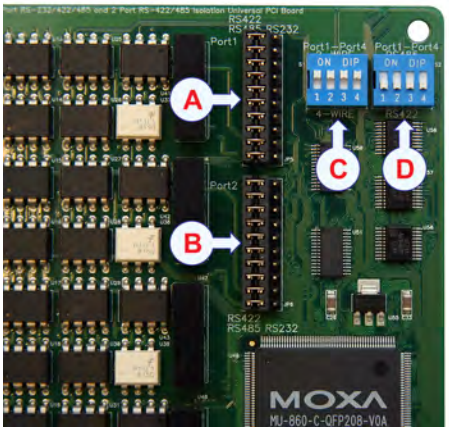


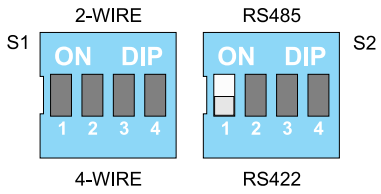
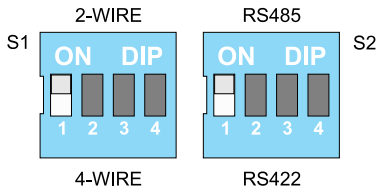
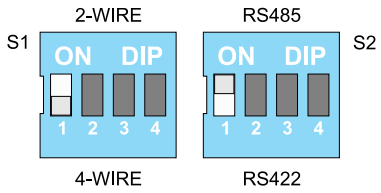

*Table 38 Serial lines jumper and DIP switch settings*

| Port | Interface | Jumper | S1 | S2 |
|---|---|---|---|---|
| Port 1 | RS-232 | Port 1 to right | | |
| | RS-422 | Port 1 to left | | 1 to OFF |
| | 2–wire RS-485 | Port 1 to left | 1 to ON | 1 to ON |
| | 4–wire RS-485 | Port 1 to left | 1 to OFF | 1 to ON |
| Port 2 | RS-232 | Port 2 to right | | |
| | RS-422 | Port 2 to left | | 2 to OFF |
| | 2–wire RS-485 | Port 2 to left | 2 to ON | 2 to ON |
| | 4–wire RS-485 | Port 2 to left | 2 to OFF | 2 to ON |

*Table 38 Serial lines jumper and DIP switch settings (cont'd.)*

| Port | Interface | Jumper | S1 | S2 |
|---|---|---|---|---|
| Port 3 | RS-422 | | | 3 to OFF |
| | 2–wire RS-485 | | 3 to ON | 3 to ON |
| | 4–wire RS-485 | | 3 to OFF | 3 to ON |
| Port 4 | RS-422 | | | 4 to OFF |
| | 2–wire RS-485 | | 4 to ON | 4 to ON |
| | 4–wire RS-485 | | 4 to OFF | 4 to ON |
| Note: [Blank] = Not active or not used. Ports 3 and 4 do not support RS-232. | | | | |

*Table 39 Serial lines DIP switch settings, examples*

| DIP switch | Setting |
|---|---|
|  | Port 1 set for RS-422 transmission. |
|  | Port 1 set for 2-wire RS-485 transmission. |
|  | Port 1 set for 4-wire RS-485 transmission. |

## Adapter cable

An adapter cable is included in the delivery. This allows for connection of four individual 9-pin D-sub connectors to the serial interface board.

*Table 40 Moxa CP134U-I 9–pin D-connector converter*

| Pin | RS-232 | RS-422 | RS485 (4–wire) | RS485 (2–wire) |
|---|---|---|---|---|
| 1 | DCD | TXD-(A) | TXD-(A) | — |
| 2 | RxD | TXD+(B) | TXD+(B) | — |
| 3 | TxD | RXD+(B) | RXD+(B) | Data-(B) |
| 4 | DTR | RXD-(A) | RXD-(A) | Data-(A) |
| 5 | GND | GND | GND | GND |
| 6 | DSR | — | — | — |
| 7 | RTS | — | — | — |
| 8 | CTS | — | — | — |
| 9 | — | — | — | — |

# Cable specifications

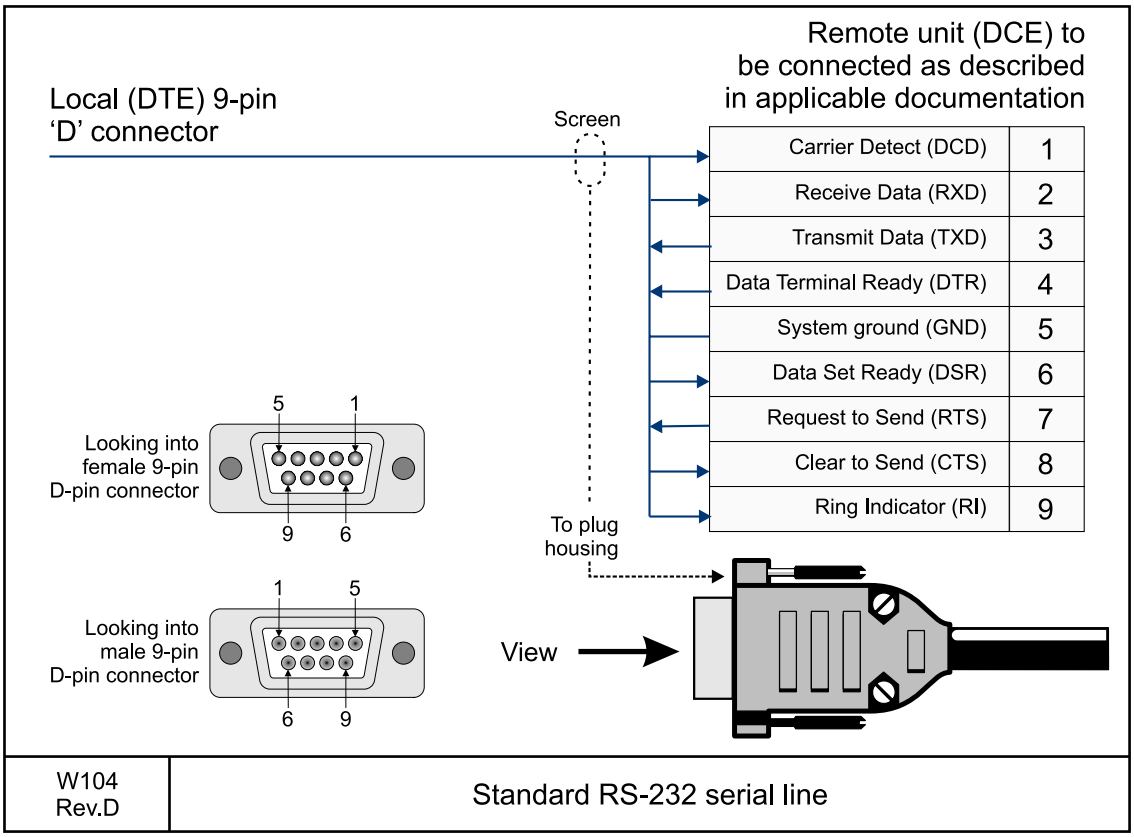
The drawings provided in this section specify in detail each cable used by the MS70 Scientific multibeam sonar.

**Topics**

## 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.

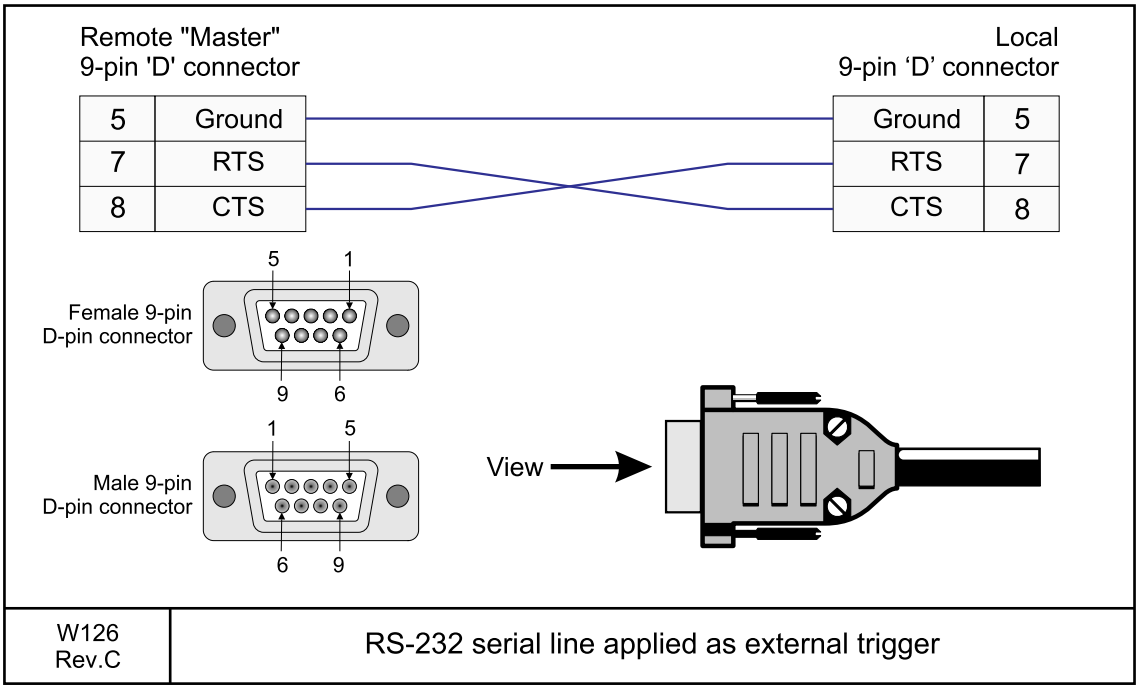



### Cable specifications

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

## RS-232 as external trigger

This cable comprises an RS-232 serial line applied as an external trigger. It provides interface with any peripheral unit that requires transmit/receive synchronization. One end of the cable connects to the local unit with a 9-pin D-connector, while the other connects to the peripheral system as described in the peripheral unit documentation.



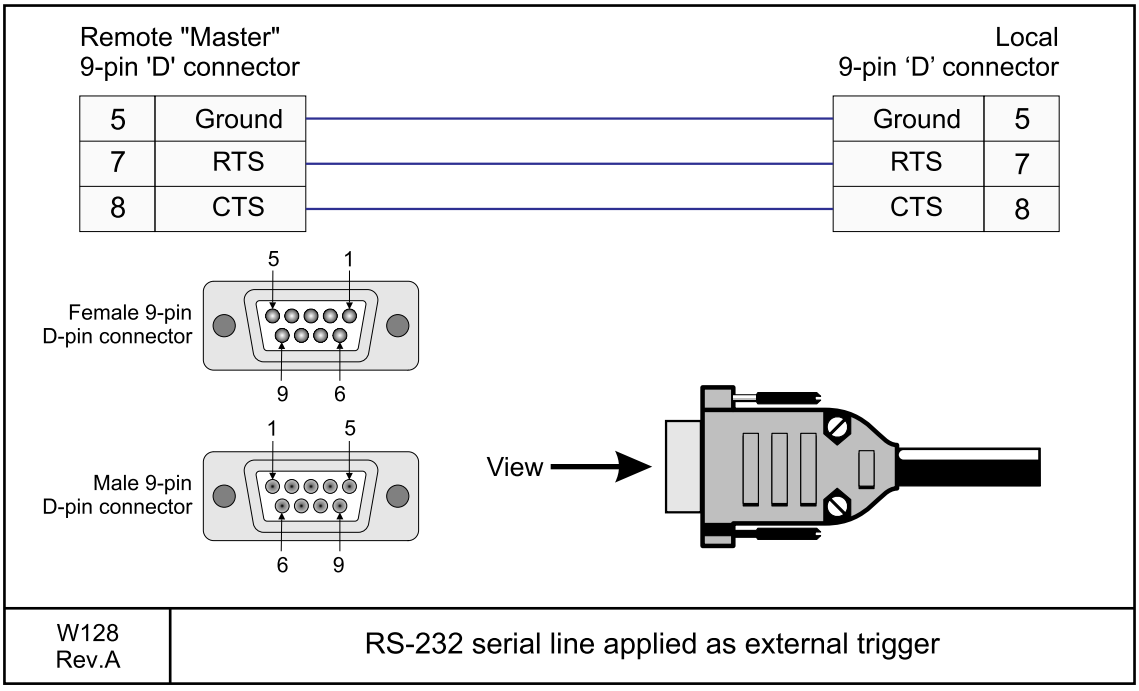

| W126 Rev.C | RS-232 serial line applied as external trigger |
|---|---|

### Cable specifications

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

## RS-232 cable applied as external trigger (1:1)

This cable comprises an RS-232 serial line applied as an external trigger. It provides interface with any peripheral unit that requires transmit/receive synchronization. One end of the cable connects to the local unit with a 9-pin D-sub connector, while the other connects to the peripheral system as described in the peripheral unit documentation.

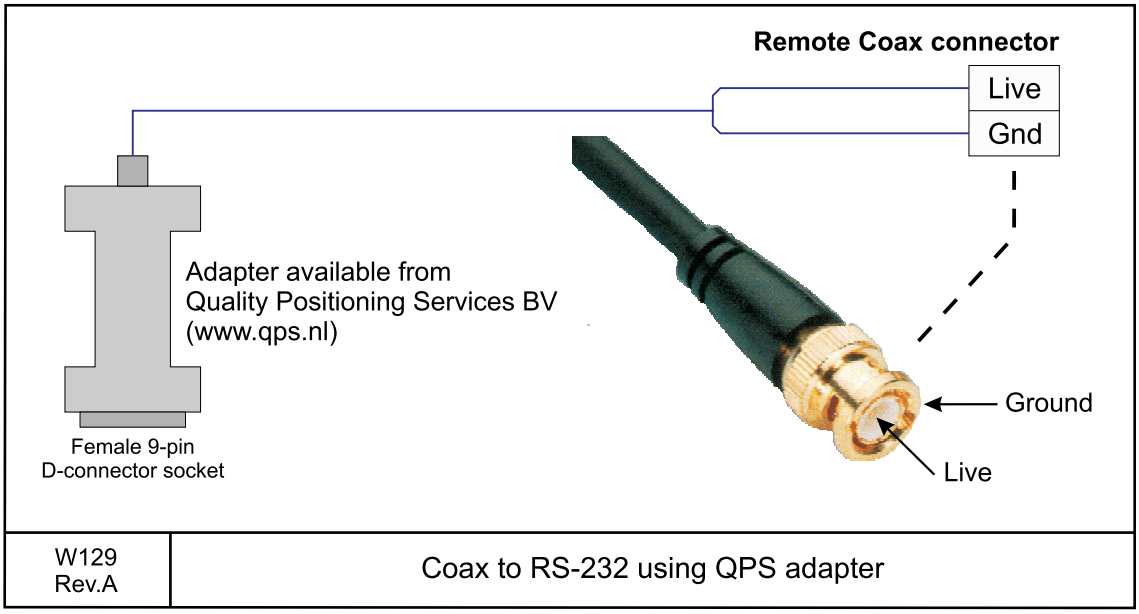



| W128 Rev.A | RS-232 serial line applied as external trigger |
|---|---|

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

## Coax to RS-232 cable and adapter

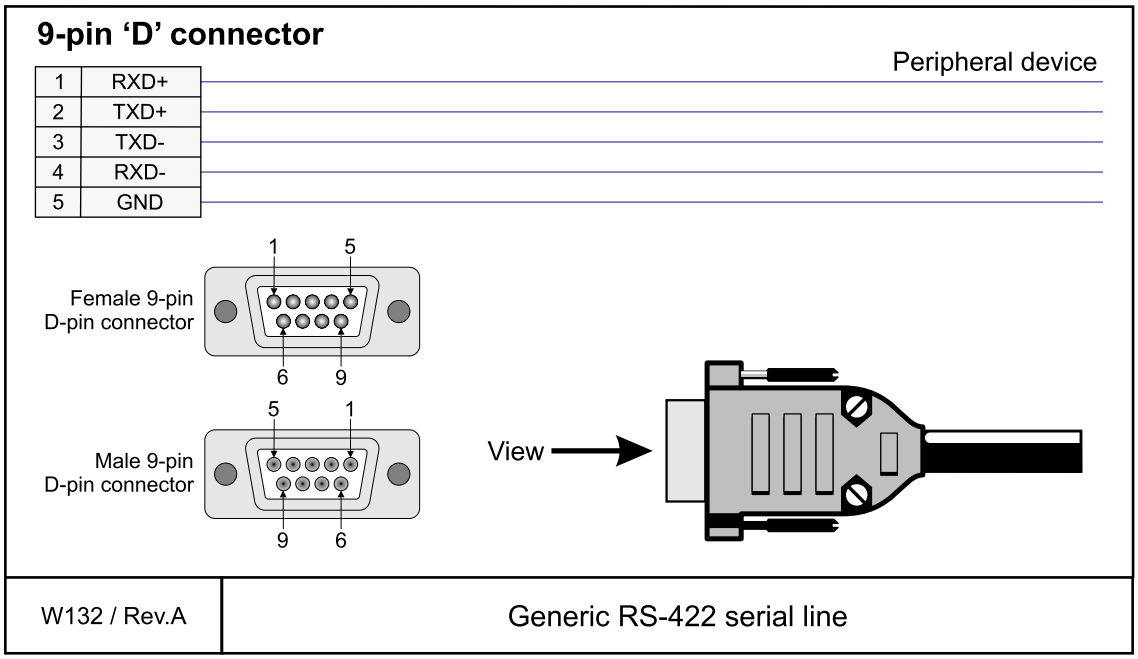
This cable with adapter is used to connect a coax connector to an RS-232 serial line.




| | |
|---|---|
| W129<br>Rev.A | Coax to RS-232 using QPS adapter |

## Generic RS-422 Serial line

This cable holds a multi purpose RS-422 balanced 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.




### More information

- http://en.wikipedia.org/wiki/Rs422

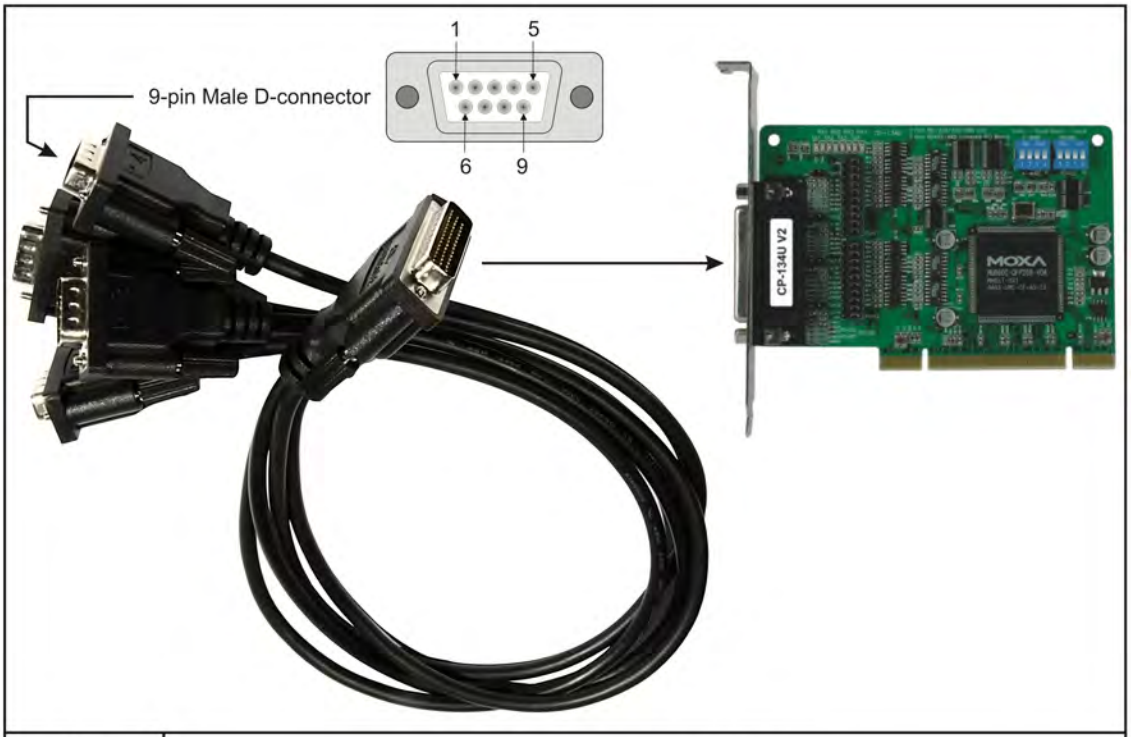
### Cable specifications

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

## Moxa CP134U-I Serial line adapter

The Multibeam Operator Station is equipped with a **Moxa CP-134U-I** serial interface board.

By default, each board provides four RS-422 serial lines. The connections to the board are made using four 9–pin D-connectors, and short converter cables with terminal boards are provided with the system.




| W144 Rev.B | Interface to Moxa CP134U-I |
|---|---|

### 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

### Pin assignments

This board supports RS-422 and RS-485 (both 2 and 4-wire). Ports 1 and 2 also support RS-232. The board is provided with a four way connector cable to offer four 9–pin male D-connectors.

*Table 41 Moxa CP134U-I 9–pin D-connector converter*

| Pin | RS-232 | RS-422 | RS485 (4–wire) | RS485 (2–wire) |
|---|---|---|---|---|
| 1 | DCD | TXD-(A) | TXD-(A) | — |
| 2 | RxD | TXD+(B) | TXD+(B) | — |
| 3 | TxD | RXD+(B) | RXD+(B) | Data-(B) |
| 4 | DTR | RXD-(A) | RXD-(A) | Data-(A) |
| 5 | GND | GND | GND | GND |
| 6 | DSR | — | — | — |
| 7 | RTS | — | — | — |
| 8 | CTS | — | — | — |
| 9 | — | — | — | — |

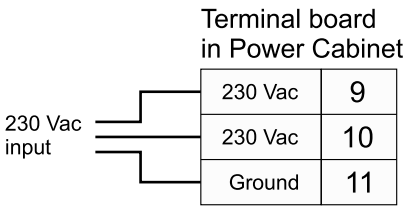
## Power Supply Unit wiring

Three Power Supply Units are used, one for each TRXU transceiver rack. The cables are terminated at terminal blocks; one inside each Power Supply Unit, and one of the rear side of each TRXU rack. From the terminal block on the rear side of each TRXU, three DC cable bundles are fed up to the rear side of the rack and terminated with plugs on the **Power Connector Panel**. The AC power provided by the Power Supply Units is also terminated on the **Power Connector Panel**, and it is only used to power the TRXU fans.

All power cables (AC and DC) are provided with the Power Supply Units. Maximum cable length between each Power Supply Unit and the Transceiver Unit is 10 meters.

### Power Supply Units AC mains wiring

The AC mains cables for the three Power Supply Units are connected to Terminal Board 1 inside each cabinet.




The Power Cabinets is provided with an AC mains cable readily connected to the terminal board.

| W246A Rev A | Power cabinets, AC input |
|---|---|

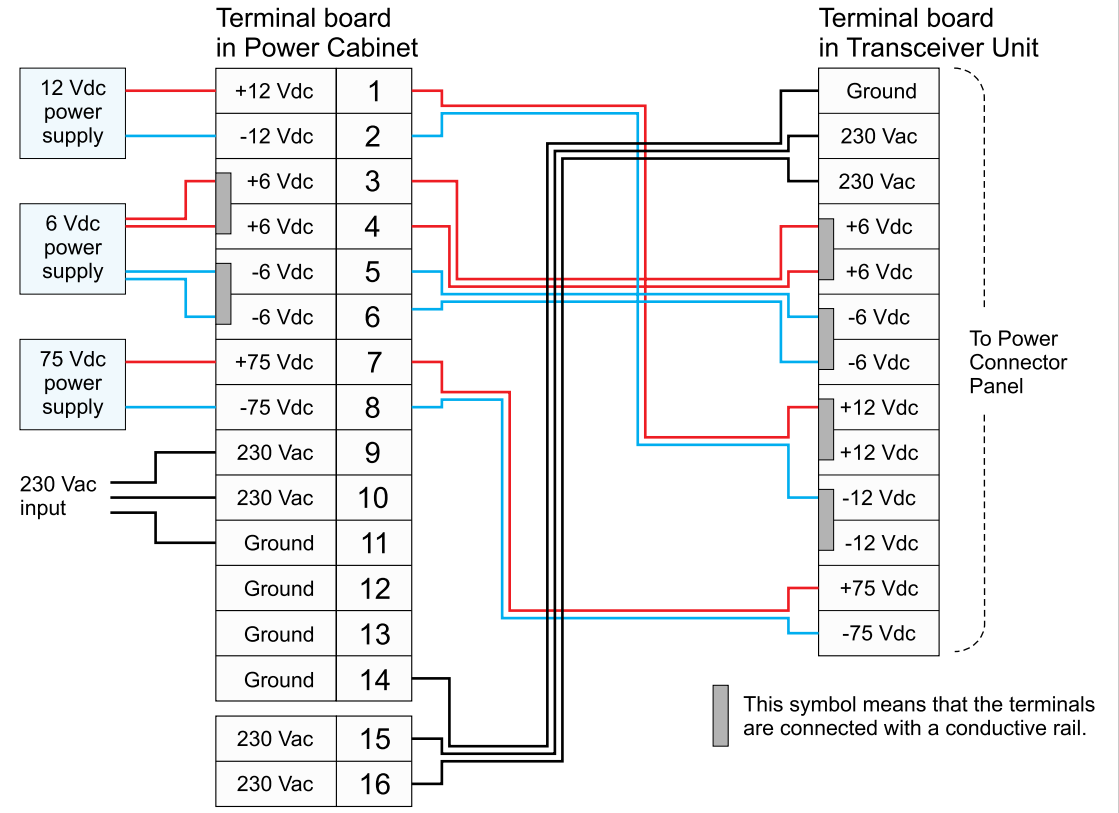
### Cable specifications

- **Conductors:** 2.5 mm²
- **Screen:** Separate conductor
- **Voltage:** 600 V
- **Maximum diameter:** Limited by the grommets on the cabinet

## Power Supply Units DC output wiring

The DC cables from the three Power Supply Units to the Transceiver Unit are all separate conductors.

Note that 230 Vac is also included in order to power the fans in each TRXU rack.




There are three Power Cabinets, and three terminal boards in the Transceiver Unit: One set for each TRXU rack.

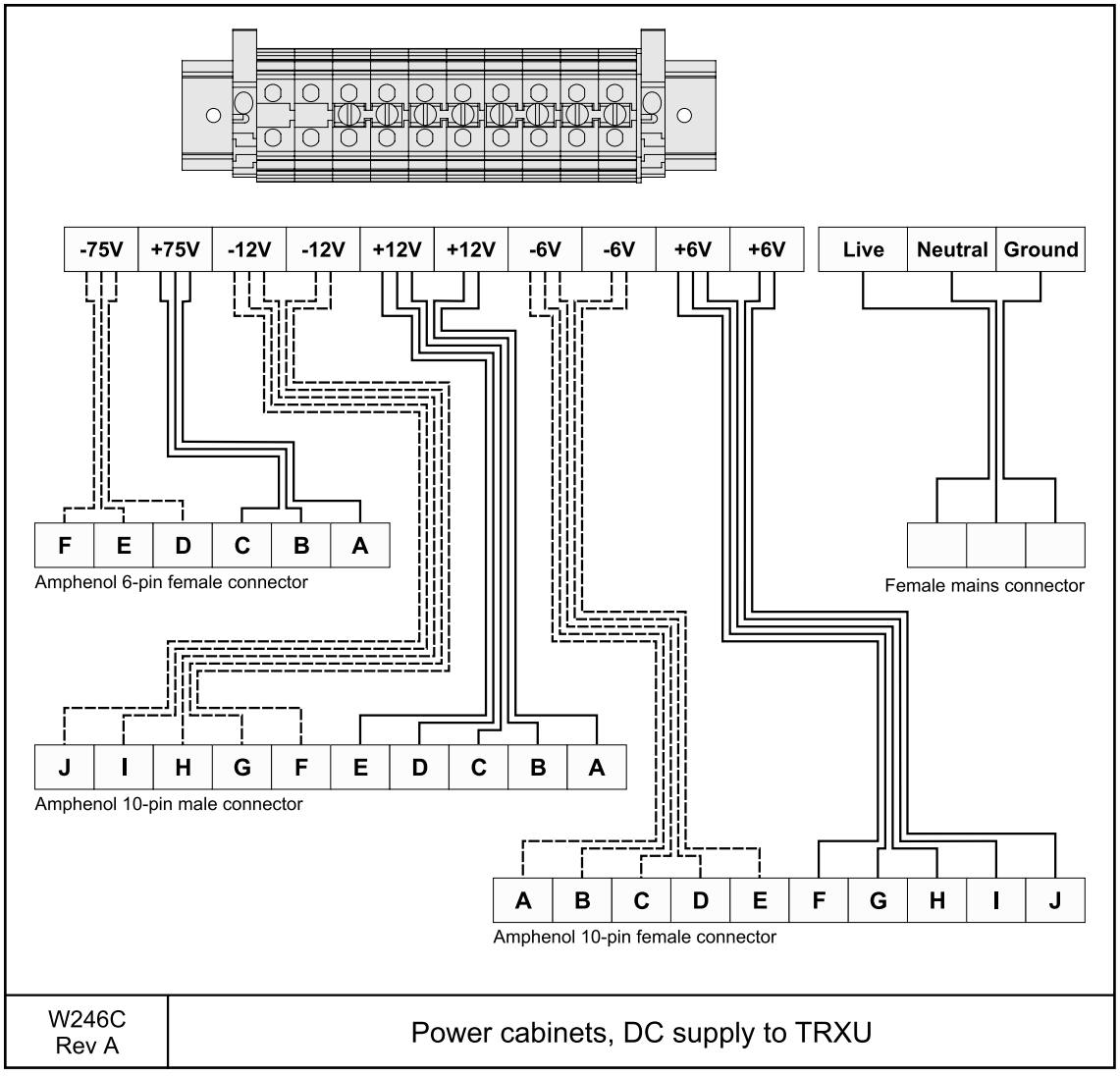
| W246B Rev B | Power cabinets, DC output |
|---|---|

## Cable specifications

- **Conductors:** 16 mm²
- **Screen:** Separate conductor
- **Voltage:** 600 V
- **Maximum diameter:** Limited by the grommets on the cabinet

## TRXU racks DC input wiring

These are the DC cables from the DC terminal boards at the rear of the three TRXU racks. Three Amphenol plugs connect these cables to the Power Connector Panel at rear side of the rack.



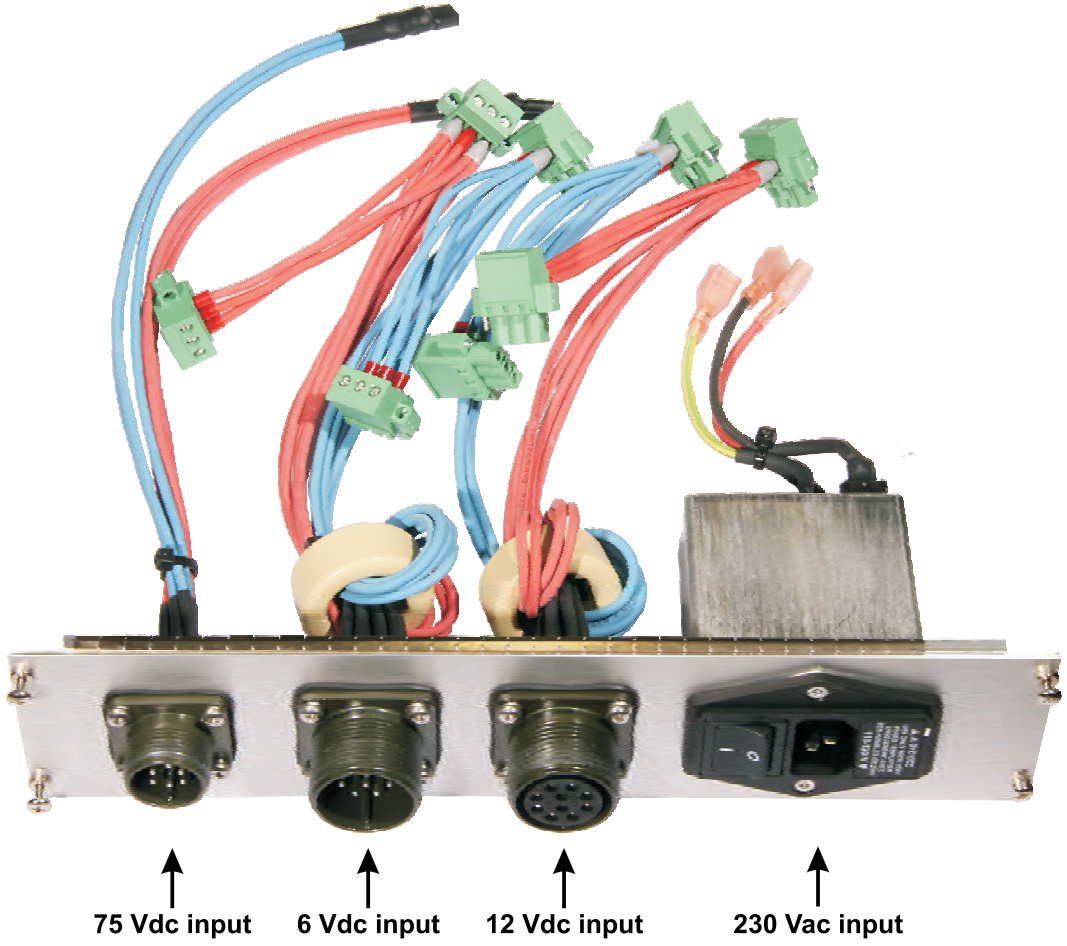

| W246C Rev A | Power cabinets, DC supply to TRXU |
|---|---|

## Cable specifications

- **Conductors**: 1.5 mm²
- **Screen**: Separate conductor
- **Voltage**: 600 V
- **Maximum diameter**: Limited by the mounting pins on the Amphenol connectors.

## Power Connector Panel

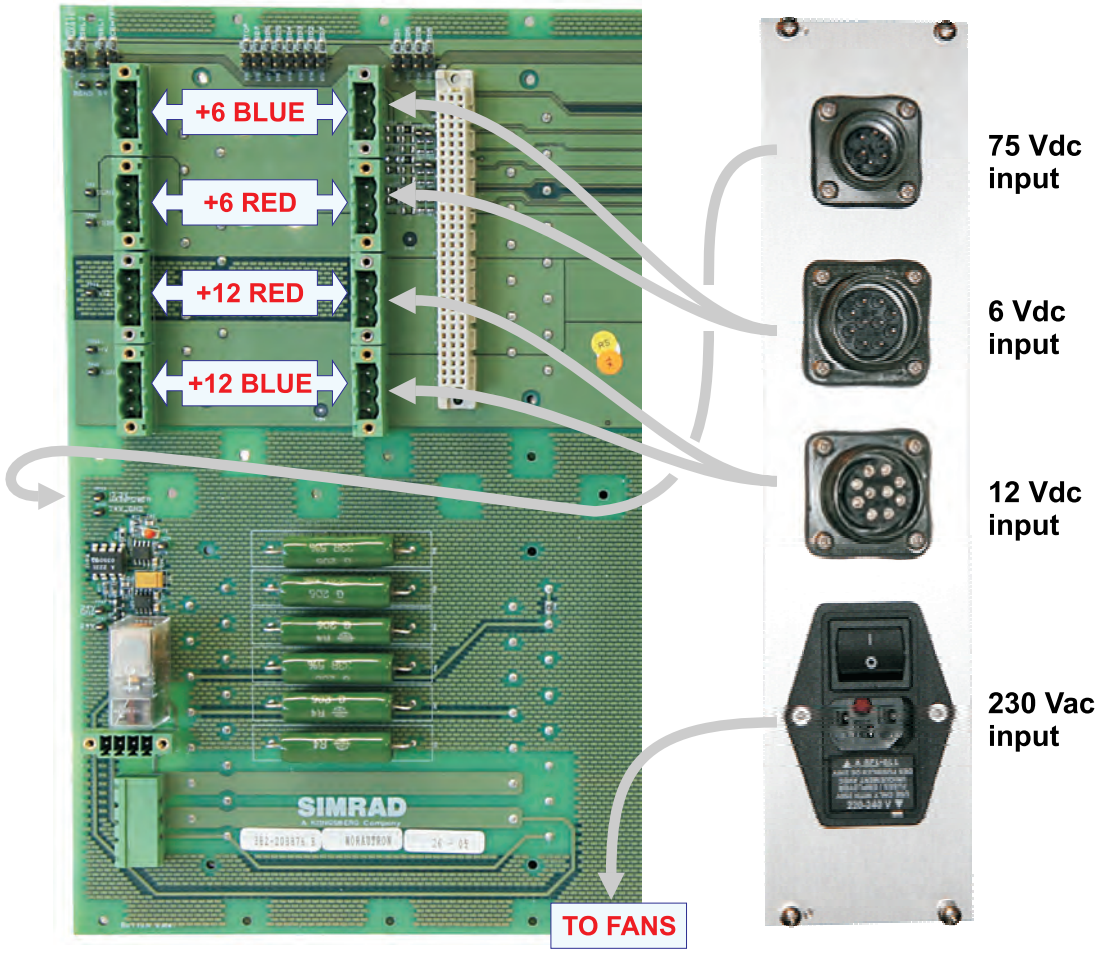
The DC and AC voltages are connected to the TRXU backplane and the fans through the Power Connector Panel.




| | |
|---|---|
| W246D Rev A | Power connector panel for TRXU subracks |

## +6 and +12 Vdc to the TRXU backplane

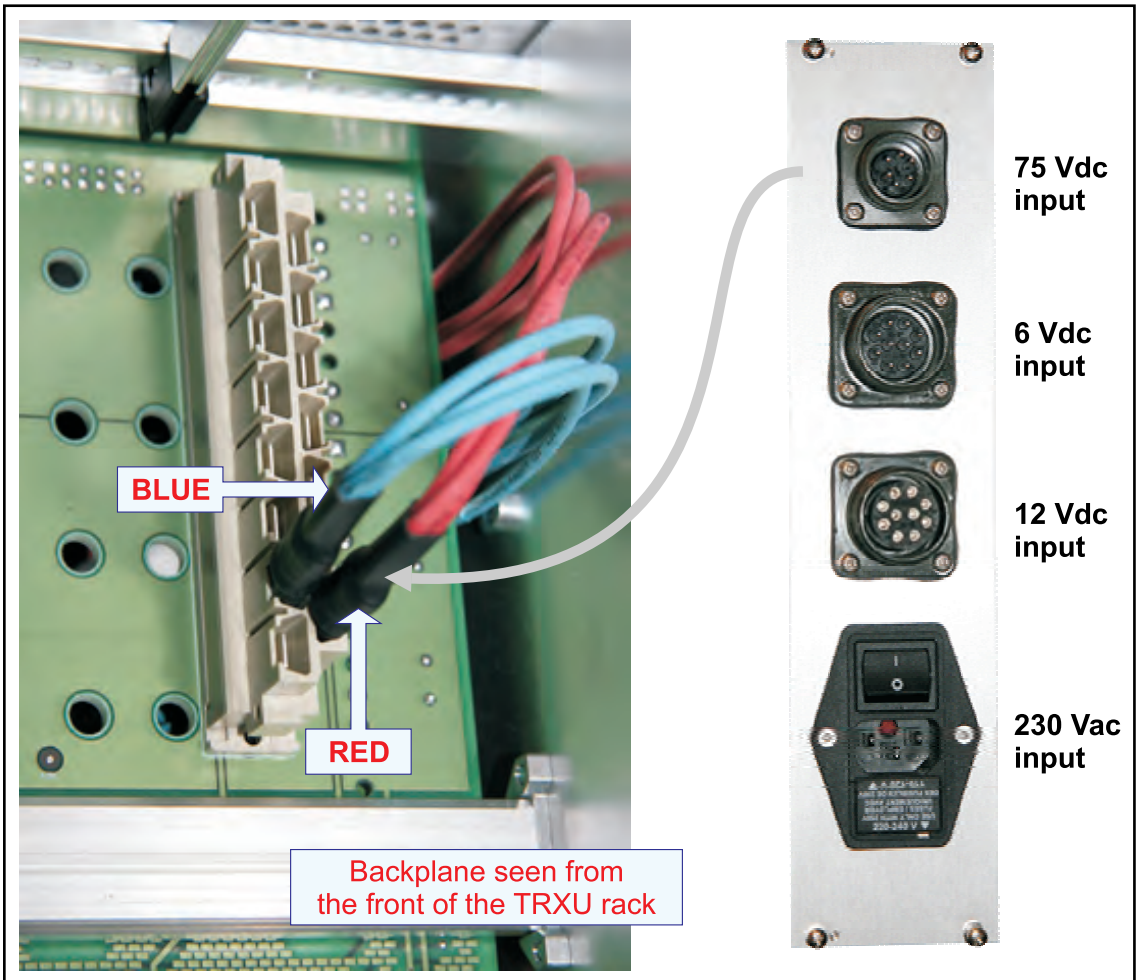
The +6 Vdc and the +12 Vdc voltages are connected to the TRXU backplane as shown below. The +75 Vdc cables are brought out to the front side of the backplane, while the 230 Vac voltage is connected to the fans at the bottom of the TRXU rack.




| | |
|---|---|
| W246E Rev A | Power cabinets, Power connector panel connects to TRXU backplane |

## +75 Vdc to the TRXU backplane

The +75 Vdc cables are brought out to the front side of the backplane, and connects as shown below. Use a cable strip to secure the rectangular plug into the socket.



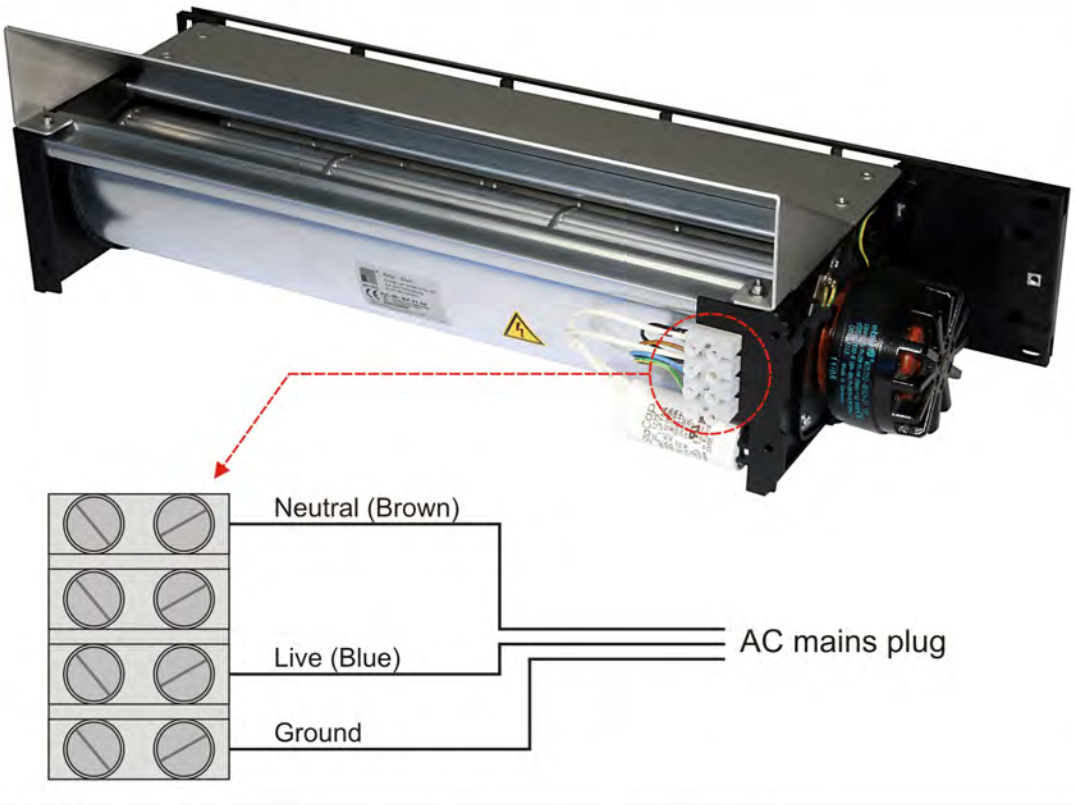

| | |
|---|---|
| W246F<br>Rev A | Power cabinets, 75 Vdc connects to TRXU backplane |

# Transceiver Unit wiring

## Transceiver Unit Fan module wiring

The Transceiver Unit fan module is located at the bottom of the Transceiver Unit rack. Its mains cable is connected to **Circuit Breaker 3**.

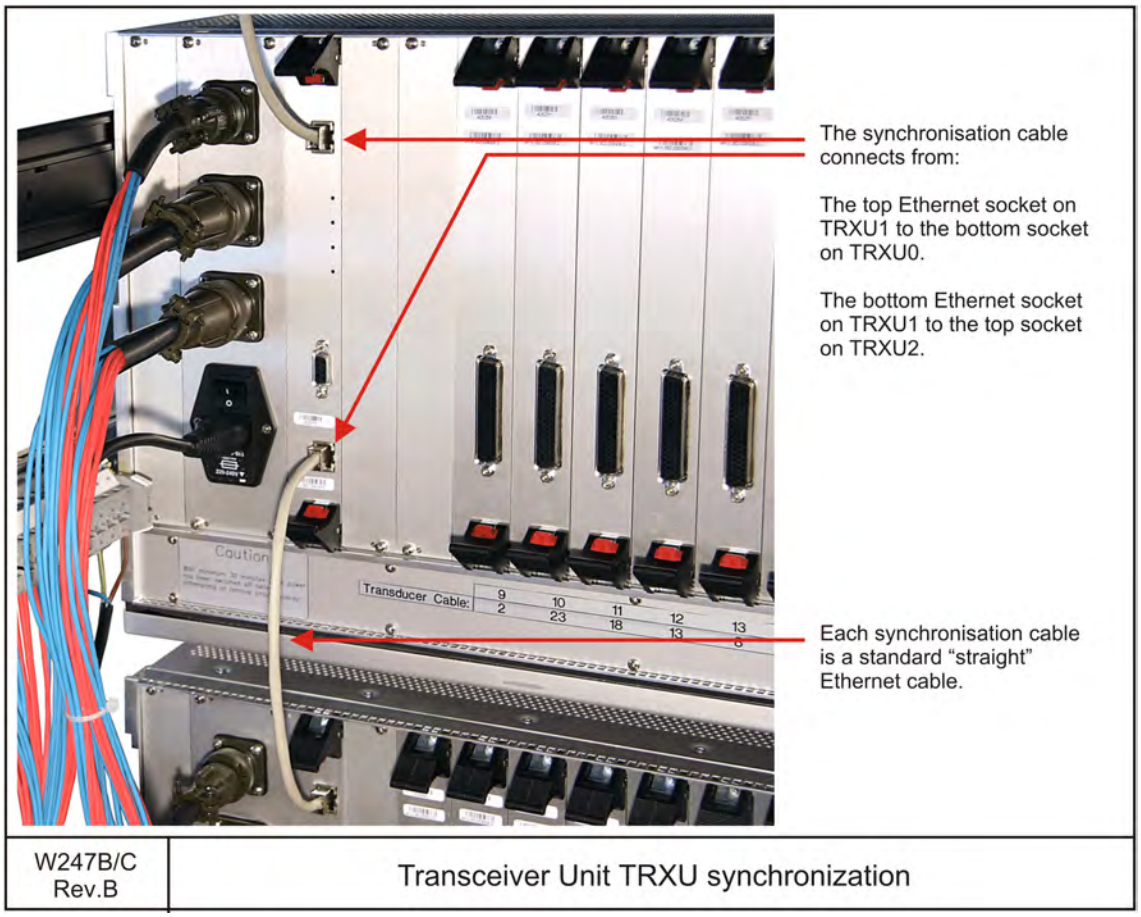
A standard AC mains cable is used. One end is open, the other is fitted with a standard mains plug.




| W247A Rev.A | Transceiver Unit fan module |
|---|---|

## Transceiver Unit TRXU synchronization cable

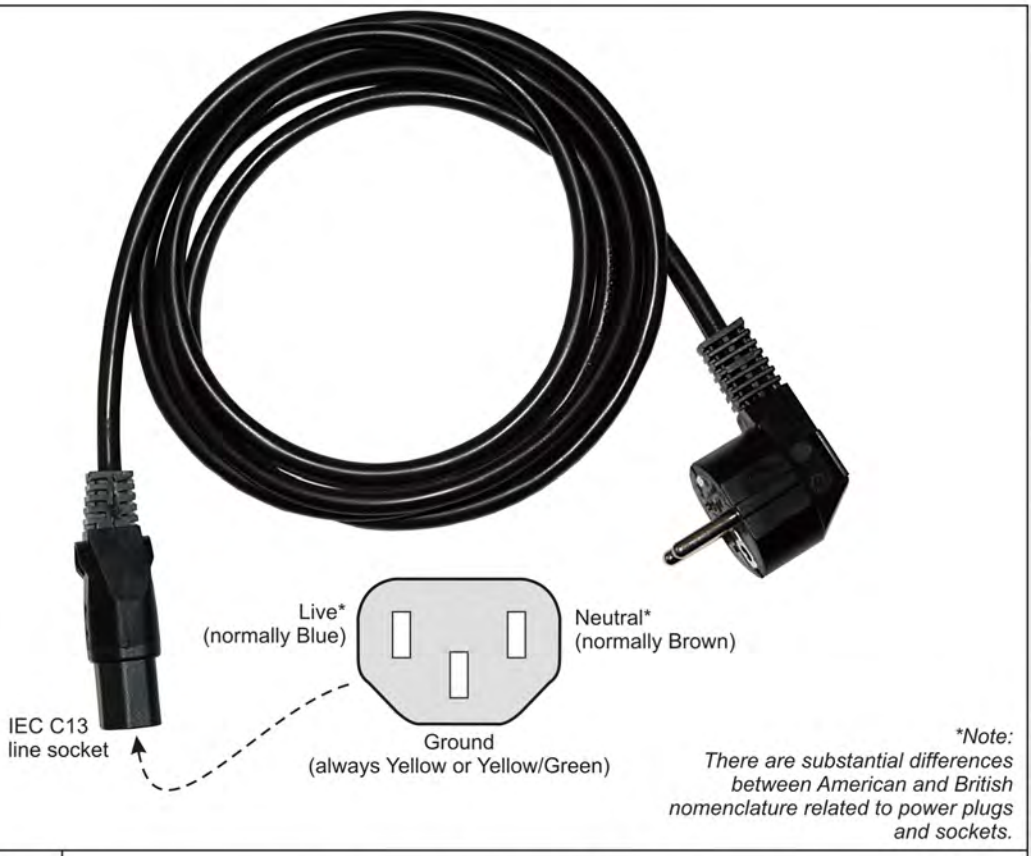
Two special cables are used to provide TRXU synchronization. These are connected to the rear side of the TRXU racks.




| W247B/C Rev.B | Transceiver Unit TRXU synchronization |
|---|---|

## AC mains (IEC 60320)

This is a commercial 230 Vac power cable for mains power. One end is fitted with an IEC plug, the other with a standard European mains plug. This is a standard cable type supplied in different lengths.




| W320 Rev.C | Commercial power cable for AC mains |
|---|---|

### Cable specifications

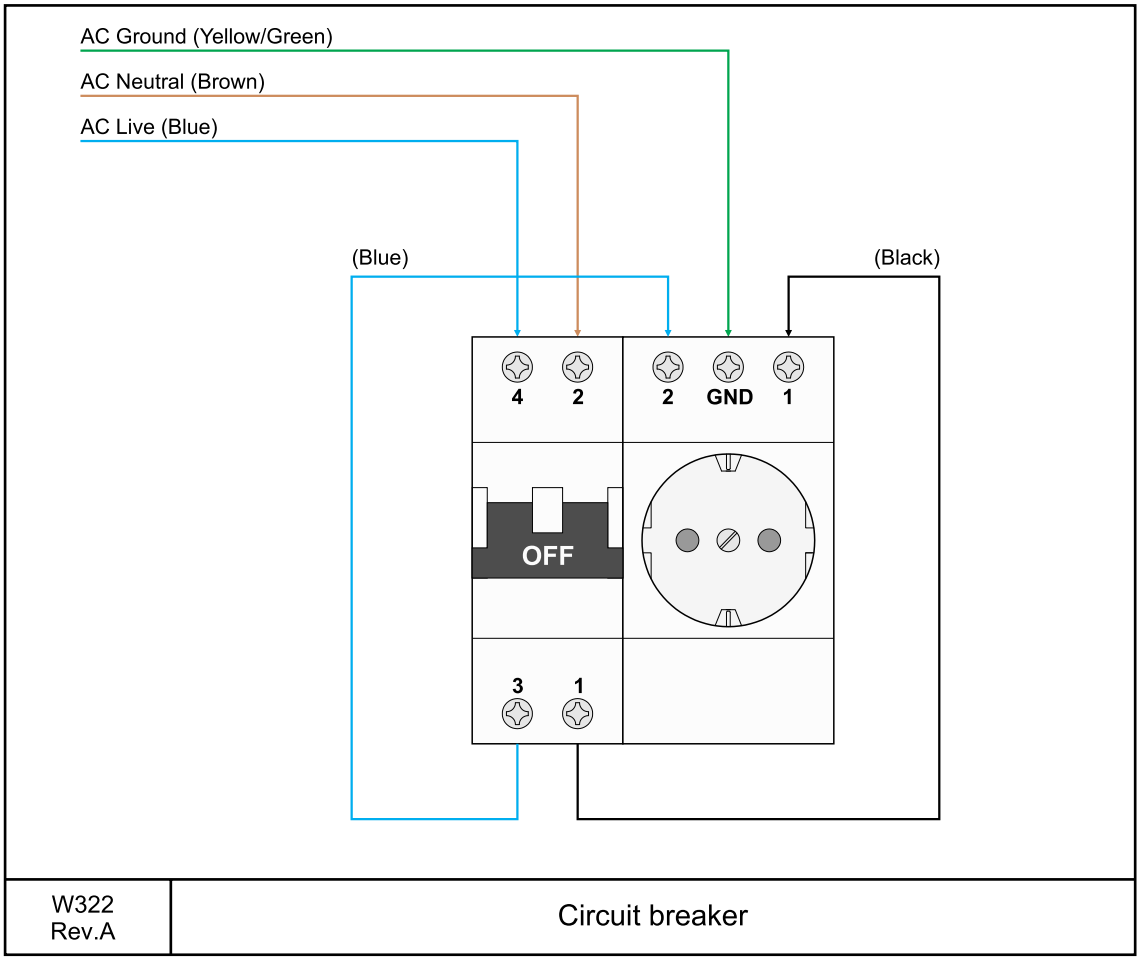
- **Conductors**: 2 x 1.5 mm² + GND
- **Screen**: None
- **Voltage**: 750 V
- **Maximum diameter**: Set by the plugs

### More information

- http://en.wikipedia.org/wiki/IEC_320

## Circuit breaker

This is a commercial circuit breaker providing overload protection. All cables used for the wiring are minimum 1.5 mm2.

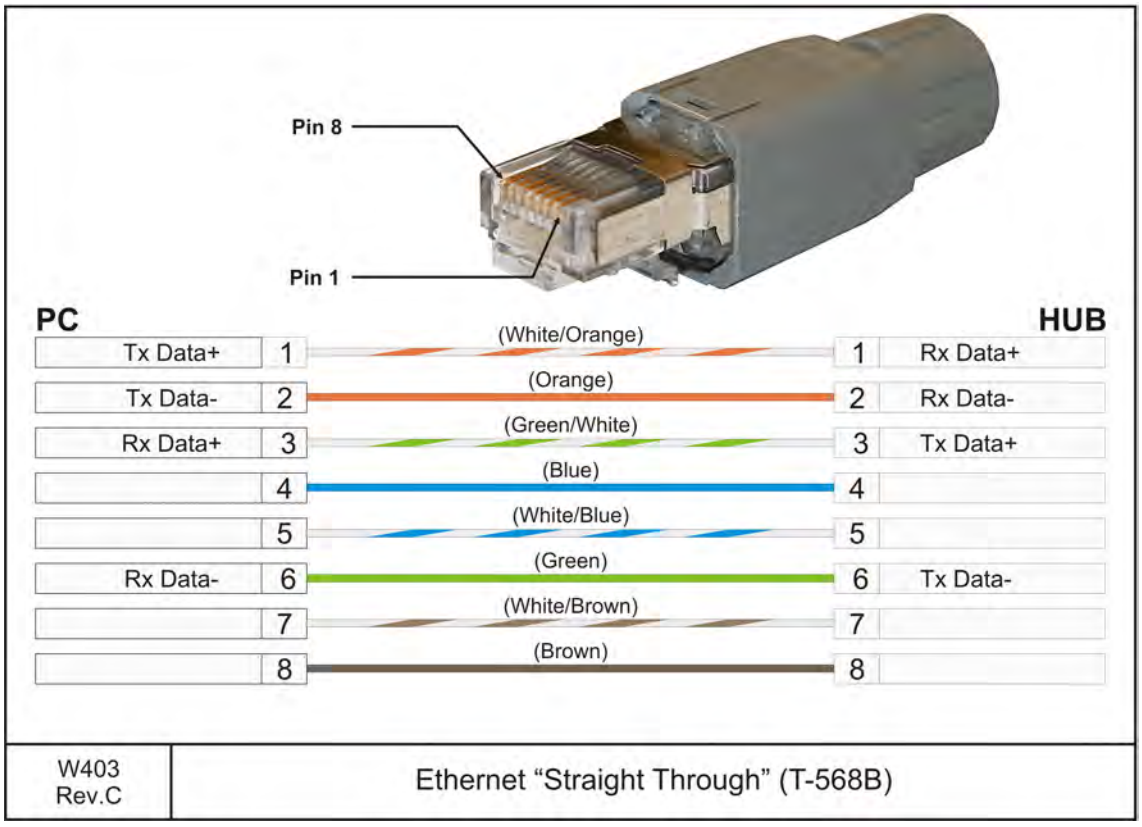


## RJ45 Ethernet, straight

This cable is used to provide standard Ethernet connections. Note that various categories exists. Normally, **CAT-5E** and **CAT-6** cables are used in local area networks with bandwidth exceeding 100 Mbit. Ethernet cables are available commercially in different lengths, colours and categories.

On the MS70, most of the local area networks cabling is for 1 Gbit bandwidth. We strongly recommend that **CAT-6** or **CAT-7** Ethernet cables are used.

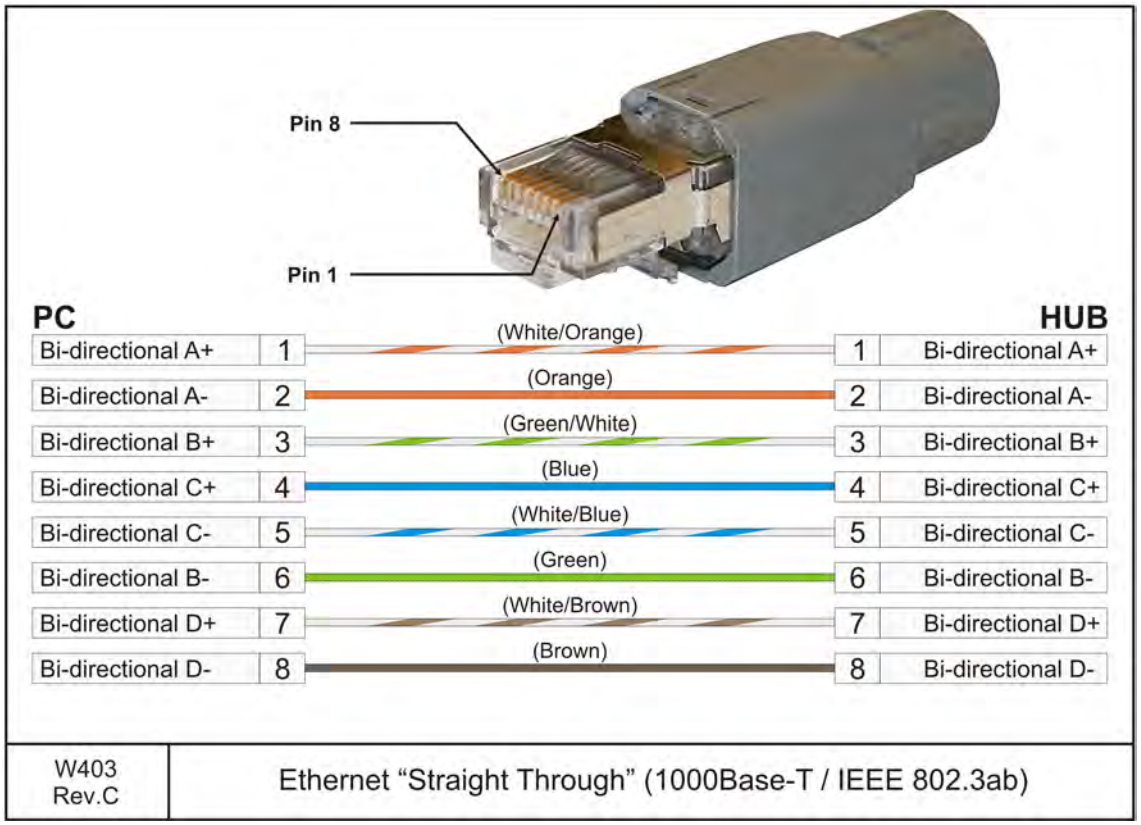
### 10Base-T Low-speed Ethernet connections




### Cable specifications

- Not applicable. This is a commercial cable.

### 1000Base-T High-speed Ethernet connections (CAT5E and faster)




### Cable specifications

- Not applicable. This is a commercial cable.

### More information

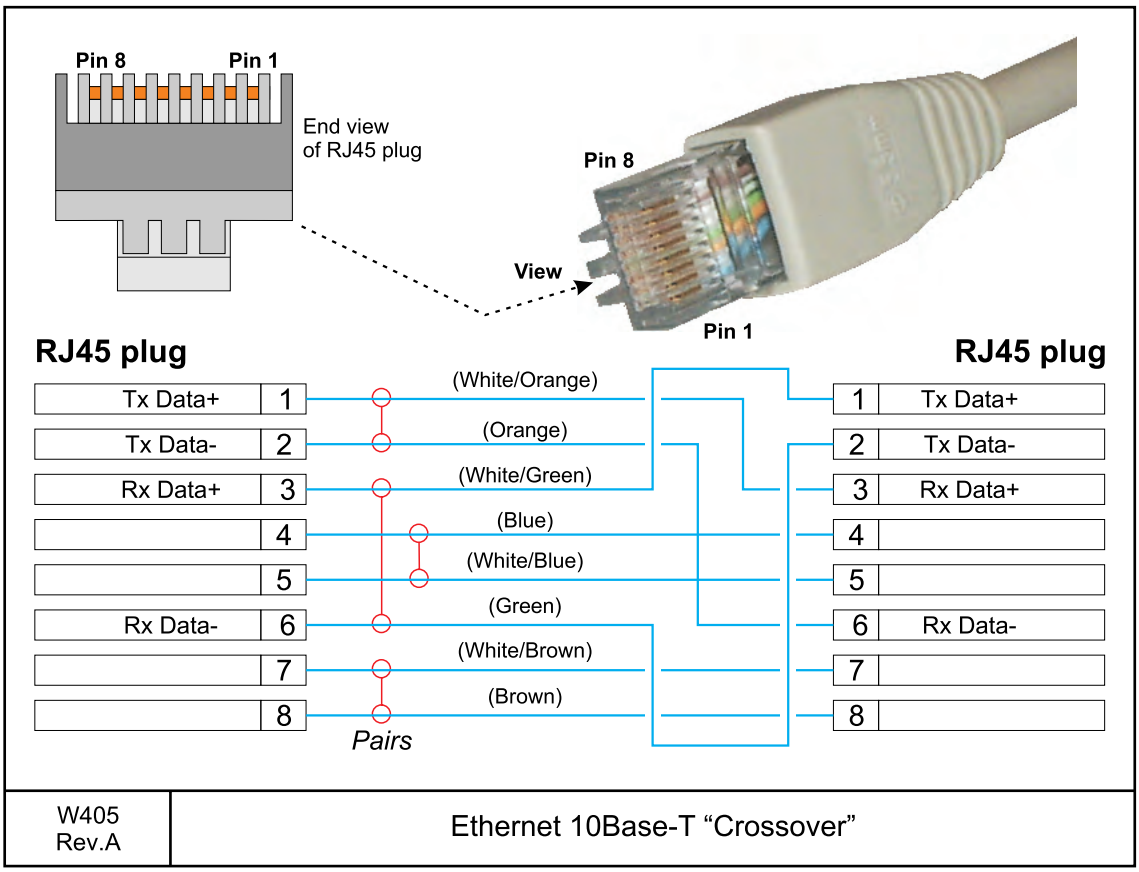
- http://en.wikipedia.org/wiki/TIA/EIA-568-B
- http://en.wikipedia.org/wiki/Category_5_cable

## RJ45 Ethernet, crossover

This cable is used to provide standard ethernet connections. Note that various categories exists. Normally, **Cat.5** and **Cat.6** cables are used in local area networks with bandwidth exceeding 100 Mbit

On the MS70 Scientific multibeam sonar however, most of the local area networks cabling is for 1 Gbit bandwidth, and we strongly recommend use of **Cat.6** or **Cat.7** cables.

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




| W405 Rev.A | Ethernet 10Base-T “Crossover” |
|---|---|

In order to prevent noise and crosstalk, you are strongly advised to use the cable pairs indicated in the drawing.

### Cable specifications

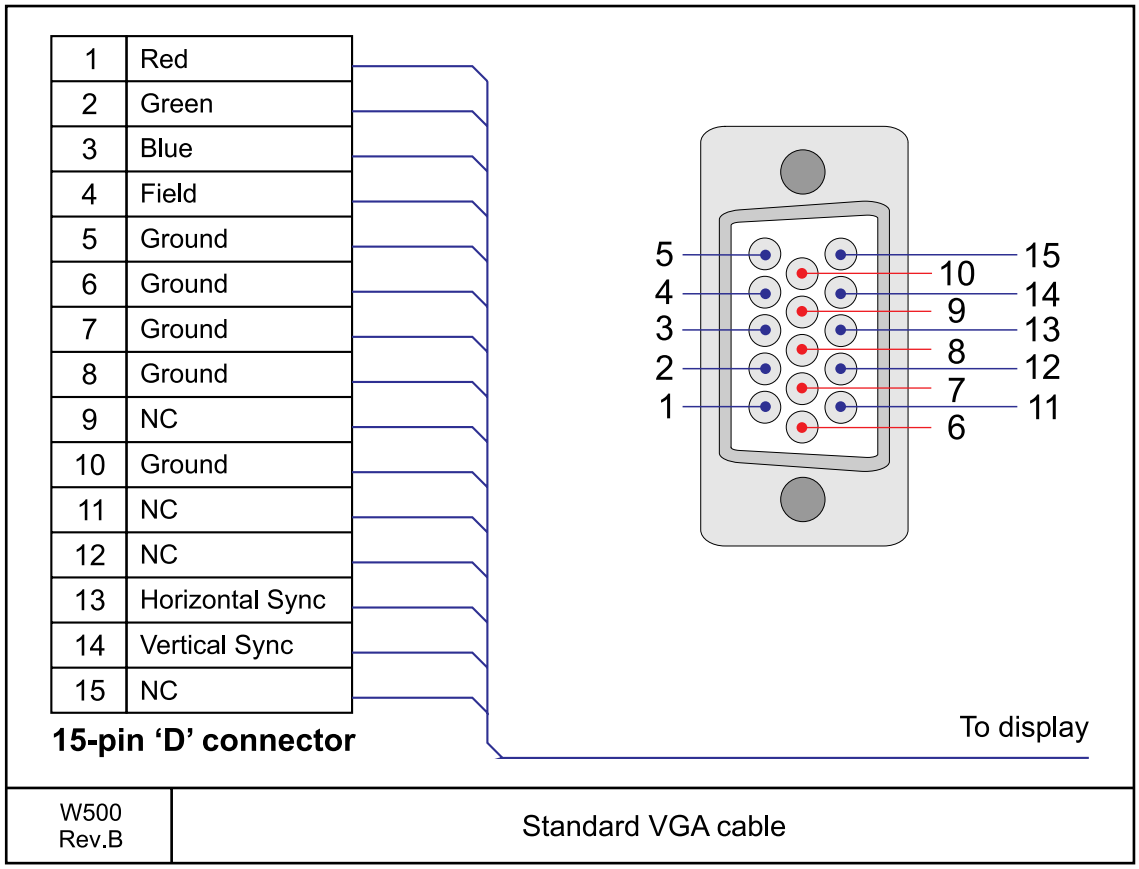
- Not applicable. This is a commercial cable.

### More information

- http://en.wikipedia.org

## VGA/SVGA Display

This is a standard VGA and SVGA video cable. One end is normally connected to the display, while the other end is terminated in a standard D-connector.



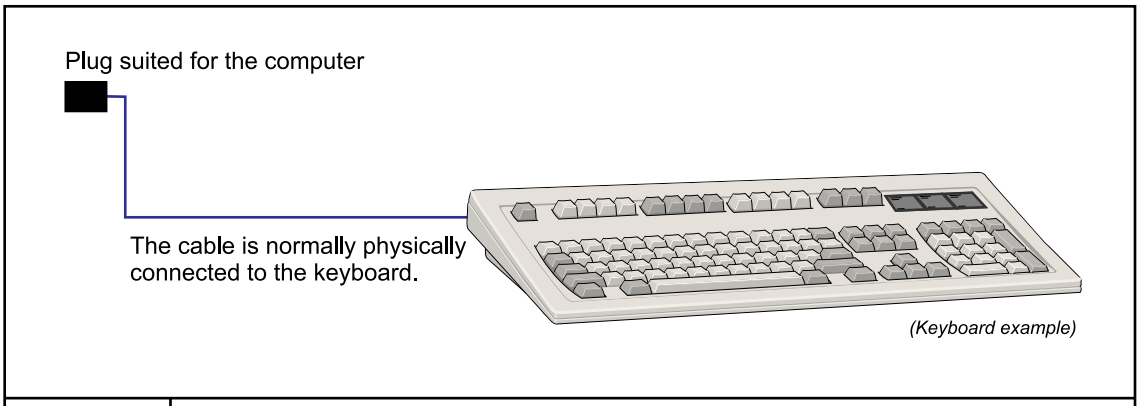

### Cable specifications

- Not applicable. This is a commercial cable.

## Keyboard cable

This is a standard keyboard cable. In most cases, the cable is physically connected to the keyboard. It is terminated in a plug suited to fit the computer.

Several keyboard types are available for different languages and hardware platforms. Both the keyboard and the attached cable are commercial items.

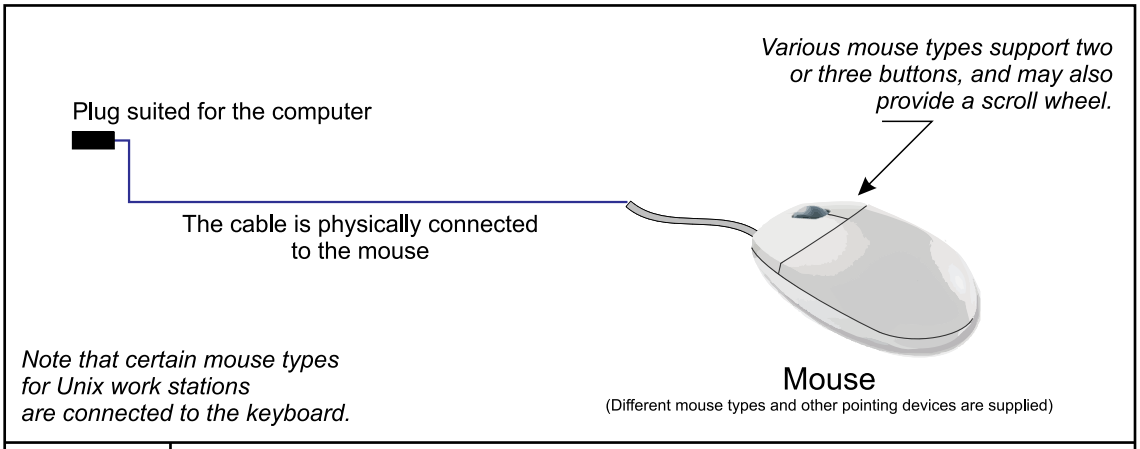



| | |
|---|---|
| W503 Rev.D | Computer keyboard |

## Mouse cable

This is a standard mouse (or other pointing device) cable. It is physically connected to the mouse, and terminated in a plug suited to fit the computer. Several mouse and pointing device types are available with two or three buttons, and with or without a scroll wheel. Both the mouse and the attached cable are commercial items.

On Unix work stations, the mouse is normally connected to the keyboard.

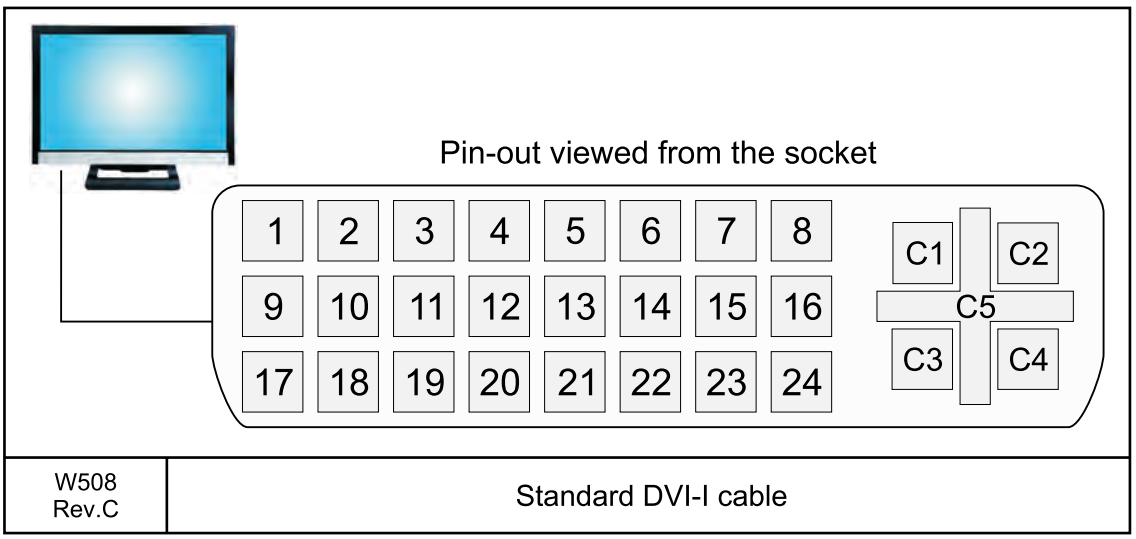



| | |
|---|---|
| W504 Rev.D | Mouse / Pointing device |

## DVI–I Display

This cable is a standard DVI-I cable. It is normally provided with the colour display.

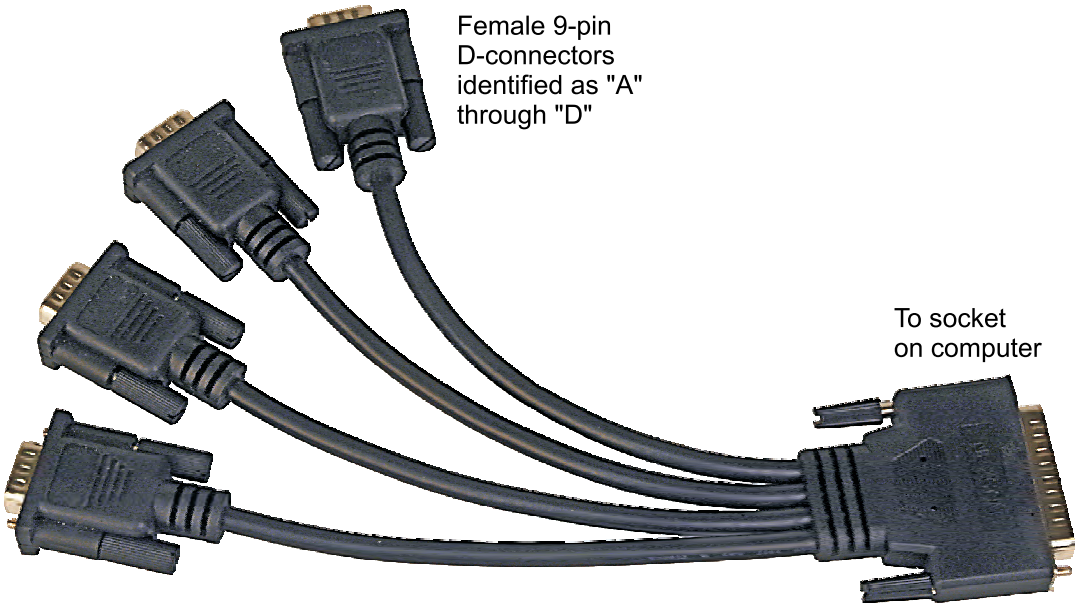
For more information about the DVI signals, see http://en.wikipedia.org.




| Pin | Signal | Pin | Signal |
|---|---|---|---|
| 1 | TMDS Data 2- (Digital red - (Link 1)) | 15 | Ground (Return for pin 14 and analog sync) |
| 2 | TMDS Data 2+ (Digital red + (Link 1)) | 16 | Hot plug detect |
| 3 | TMDS Data 2/4 shield | 17 | TMDS data 0- (Digital blue - (Link 1) and digital sync) |
| 4 | TMDS Data 4- (Digital green - (Link 2)) | 18 | TMDS data 0+ (Digital blue + (Link 1) and digital sync) |
| 5 | TMDS Data 4+ (Digital green + (Link 2)) | 19 | TMDS data 0/5 shield |
| 6 | DDC clock | 20 | TMDS data 5- (Digital red - (Link 2)) |
| 7 | DDC data | 21 | TMDS data 5+ (Digital red + (Link 2)) |
| 8 | Analog vertical sync | 22 | TMDS clock shield |
| 9 | TMDS Data 1- (Digital green - (Link 1)) | 23 | TMDS clock+ (Digital clock + (Links 1 & 2)) |
| 10 | TMDS Data 1+ (Digital green + (Link 1)) | 24 | TMDS clock- (Digital clock - (Links 1 & 2)) |
| 11 | TMDS Data 1/3 shield | C1 | Analog red |
| 12 | TMDS Data 3- (Digital blue - (Link 2)) | C2 | Analog green |
| 13 | TMDS Data 3+ (Digital blue + (Link 2)) | C3 | Analog blue |
| 14 | +5 Vdc (Power for monitor when in standby) | C4 | Analog horizontal sync |
| TMDS = Transition Minimized Differential Signaling | | C5 | Analog ground (Return for R, G and B signals) |

## Serial line adapter

This is a commercial adapter. It allows you to connect four RS-232 serial lines to a common socket on the computer.



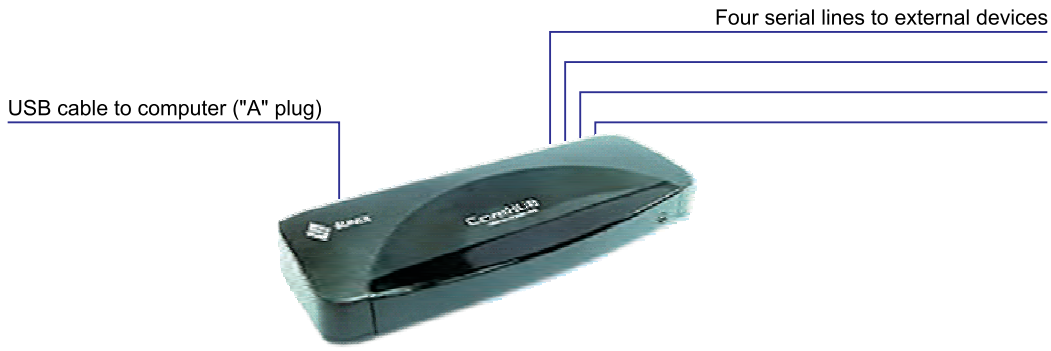

| | |
|---|---|
| W510<br>Rev.A | Serial line adapter |

### Cable specifications

- Not applicable

## Serial line to USB adapter

Commercial adapters providing conversion from RS-232 serial line to USB are available.




SUNIX ComHUB 4-port adapter shown as an example

| | |
|---|---|
| W512A<br>Rev. A | Serial line to USB adapter |

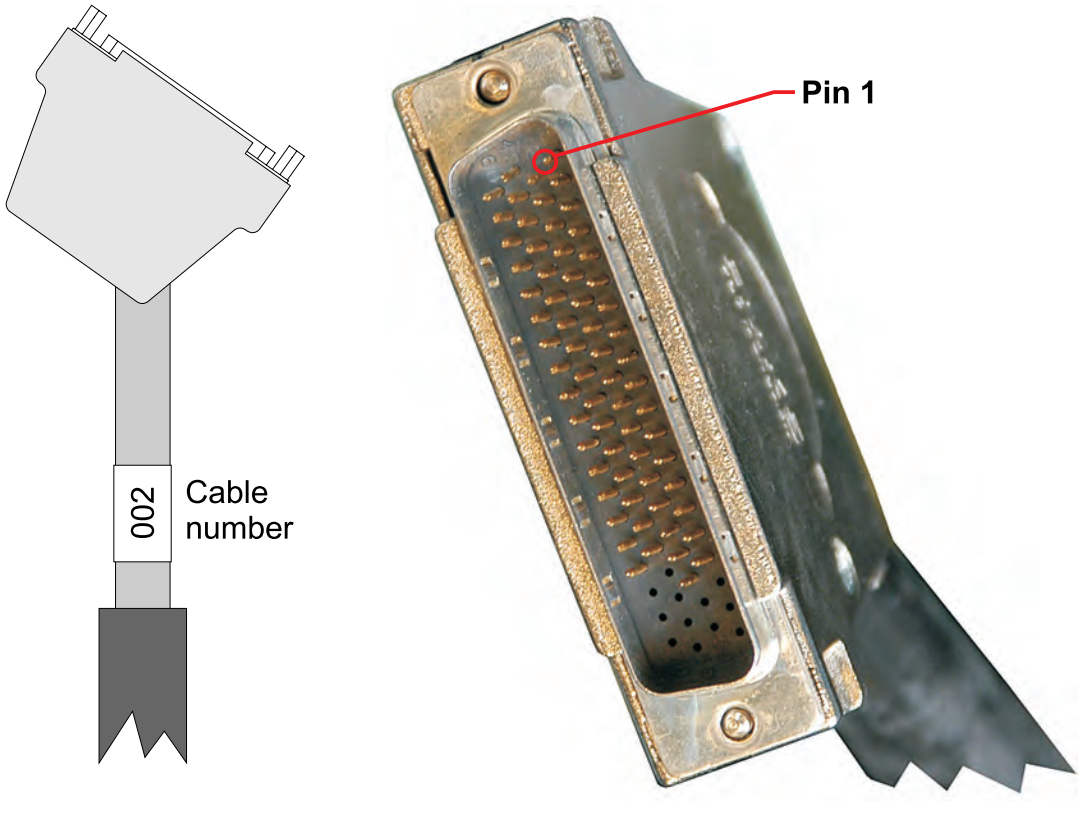
For information about cables and connections, observe the documentation provided with the adapter.

## Transducer cables

This is the termination of the transducer cable from the MS70 transducer array to the sockets on the rear side of the transceiver shelves. The other end of each cable is permanently fixed to the transducer array.

### Transducer connector

The drawing and table below show how the each transducer connector is wired.




| | |
|---|---|
| W808A Rev.B | Transducer cable termination |

- Minimum bending radius during installation: 95 mm
- Minimum bending radius, dynamic: 243 mm
- Tensile strength: 3000 N

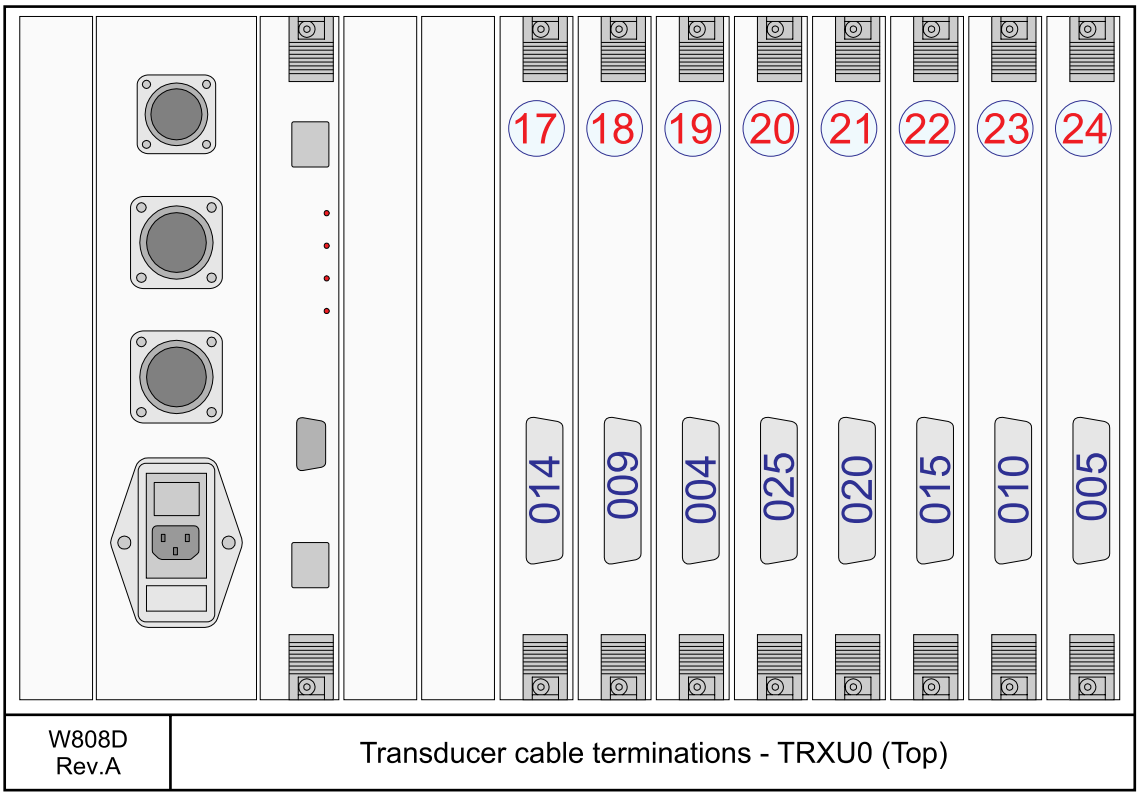
The connections made inside the D-connector are specified in the table below. Each pair in the cable contains the signal for the corresponding channel with the offset of 1 (pair 1 for channel 0 etc). Pair 33 is for the built-in thermistor. The cable contains three additional pairs, but these are cut.

*Table 42 Connections made inside the D-connector*

| Pair | Pin numbers | | Cable colour code | |
|---|---|---|---|---|
| 1 | 1 | 21 | White | Brown |
| 2 | 40 | 60 | Green | Yellow |
| 3 | 2 | 22 | Grey | Pink |
| 4 | 41 | 61 | Blue | Red |
| 5 | 3 | 23 | Black | Violet |
| 6 | 42 | 62 | Grey/Pink | Red/Blue |
| 7 | 4 | 24 | White/Green | Brown/Green |
| 8 | 43 | 63 | White/Yellow | Yellow/Brown |
| 9 | 5 | 25 | White/Grey | Grey/Brown |
| 10 | 44 | 64 | White/Pink | Pink/Brown |
| 11 | 6 | 26 | White/Blue | Brown/Blue |
| 12 | 45 | 65 | White/Red | Brown/Red |
| 13 | 7 | 27 | White/Black | Brown/Black |
| 14 | 46 | 66 | Grey/Green | Yellow/Green |
| 15 | 8 | 28 | Pink/Green | Yellow/Pink |
| 16 | 47 | 67 | Green/Blue | Yellow/Blue |
| 17 | 9 | 29 | Green/Red | Yellow/Red |
| 18 | 48 | 68 | Green/Black | Yellow/Black |
| 19 | 10 | 30 | Grey/Blue | Pink/Blue |
| 20 | 49 | 69 | Grey/Red | Pink/Red |
| 21 | 11 | 31 | Grey/Black | Pink/Black |
| 22 | 50 | 70 | Blue/Black | Red/Black |
| 23 | 12 | 32 | White | Brown |
| 24 | 51 | 71 | Green | Yellow |
| 25 | 13 | 33 | Grey | Pink |
| 26 | 52 | 72 | Blue | Red |
| 27 | 14 | 34 | Black | Violet |
| 28 | 53 | 73 | Grey/Pink | Red/Blue |
| 29 | 15 | 35 | White/Green | Brown/Green |
| 30 | 54 | 74 | White/Yellow | Yellow/Brown |
| 31 | 16 | 36 | White/Grey | Grey/Brown |
| 32 | 55 | 75 | White/Pink | Pink/Brown |
| 33 | 17 | 37 | White/Blue | Brown/Blue |

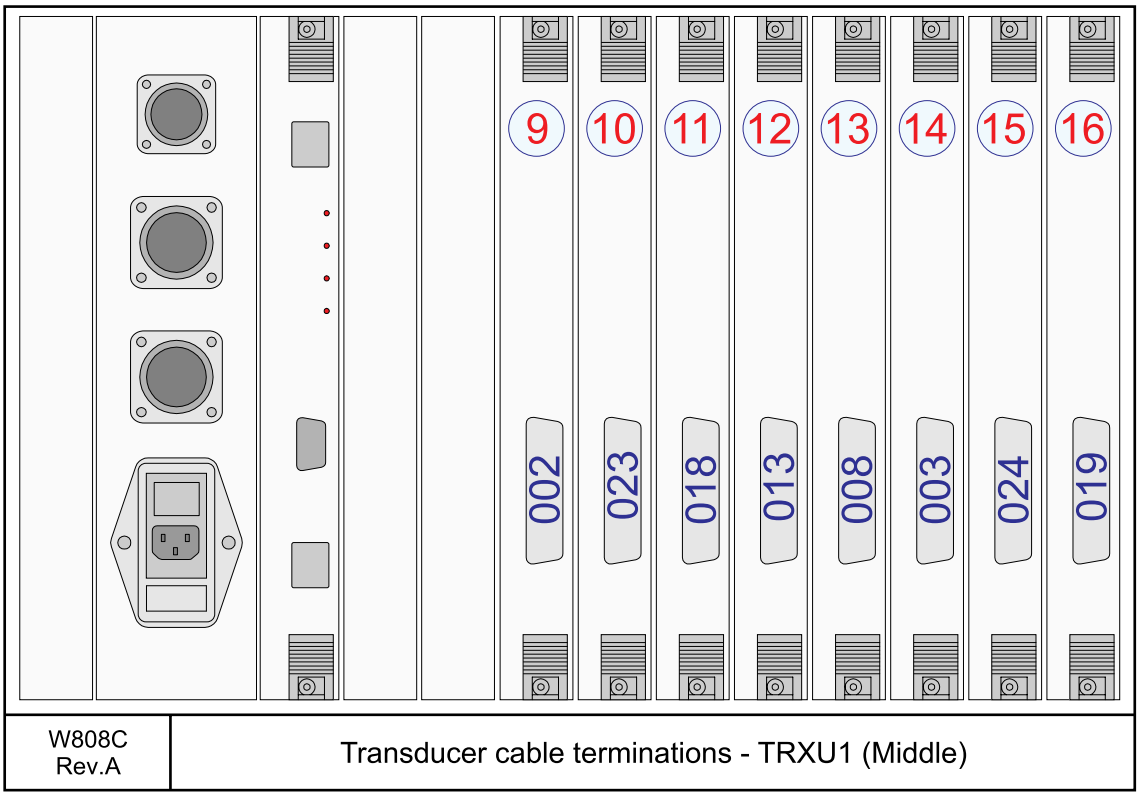
## Terminations to TRXU0 (Top subrack)

The drawing below shows which transducer cables that are connected to the eight connectors on the rear side of the **TRXU0** transceiver subrack.



## Terminations to TRXU1 (Middle subrack)

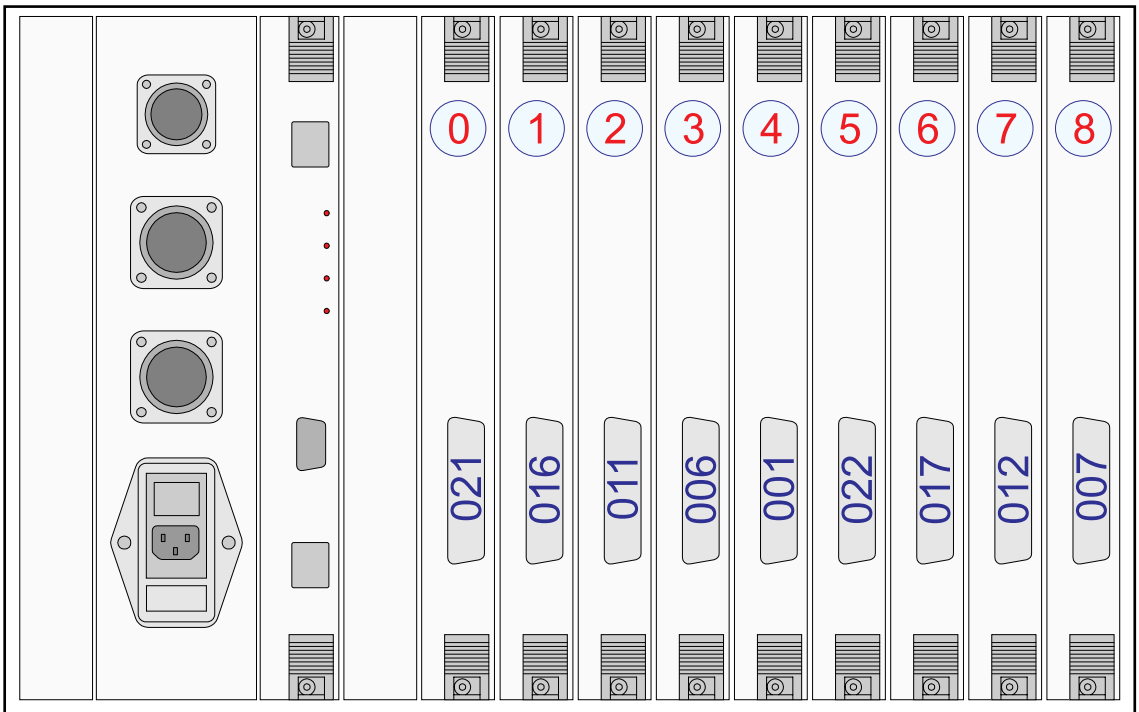
The drawing below shows which transducer cables that are connected to the eight connectors on the rear side of the **TRXU1** transceiver subrack.




| W808C Rev.A | Transducer cable terminations - TRXU1 (Middle) |
|---|---|

## Terminations to TRXU2 (Bottom subrack)

The drawing below shows which transducer cables that are connected to the nine connectors on the rear side of the **TRXU2** transceiver subrack.




| W808B Rev.A | Transducer cable terminations - TRXU2 (Bottom) |
|---|---|

# Setting to work

The procedures in this chapter shall be carried out once all the MS70 hardware units have been installed, and the cabling is finished.

When you carry out these procedures, make sure that you only perform those tasks described, and in the given order.

**Topics**



## Initial power-on

The initial power-on procedure is done by personnel from Kongsberg Maritime AS.

## Performance testing

The performance tests are described in the *Harbour Acceptance Test* and *Sea Acceptance Test* procedures.

# Technical specifications

This chapter provides the technical specifications and requirements related to the Simrad MS70.

In Kongsberg Maritime, we are continuously working to improve the quality and performance of our products. Technical specifications may therefore be changed without prior notice.

**Topics**

# System components

The Simrad MS70 comprises the following units.

### Basic system

- One Multibeam Operator Station
- One Transceiver Unit, including
  - Six beamforming computers
  - Three customised transceiver racks
  - One Ethernet switch
- Three Power Supply Units
- One Transducer Array

### Optional systems

- **Element Data Logger**
  - Element Data Logger Operator Station
  - One Ethernet switch (if required)

# Operation and performance

This section provides the performance specifications for the Simrad MS70.

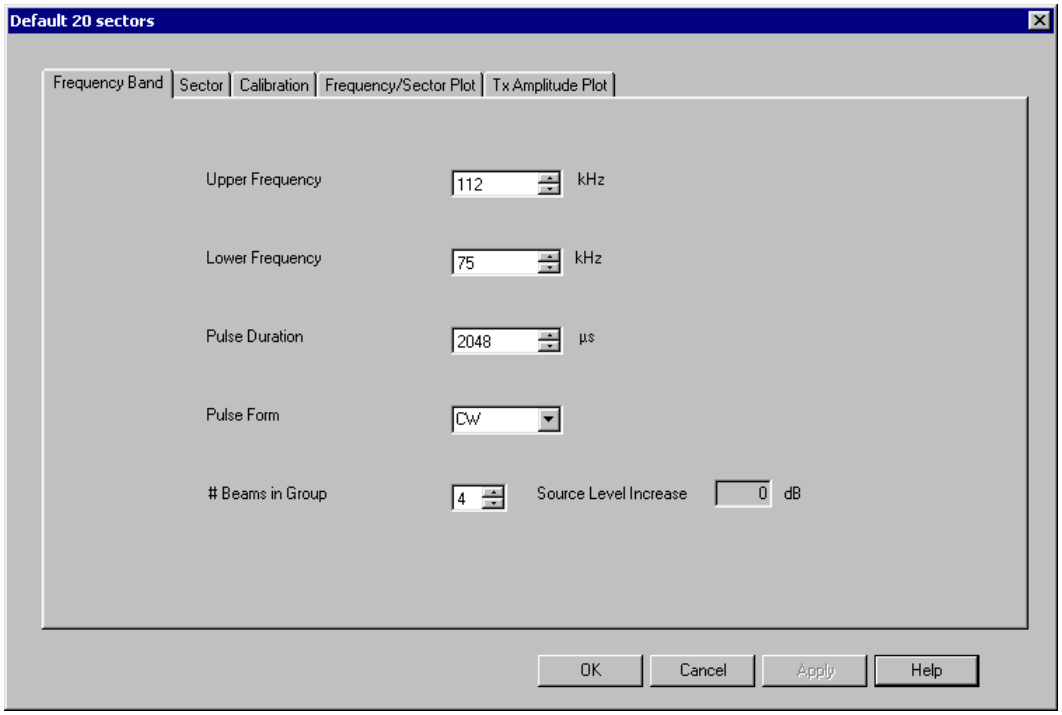
The Simrad MS70 is a flexible instrument allowing for a variety of different configurations optimized for different survey objectives. As many of the system parameters are mutually dependent the performance specification numbers will depend on the specific operation configuration. Please note that it will not be possible to obtain the limits for all performance parameters simultaneously as they are mutually dependent.

**Topics**

# Configuration settings

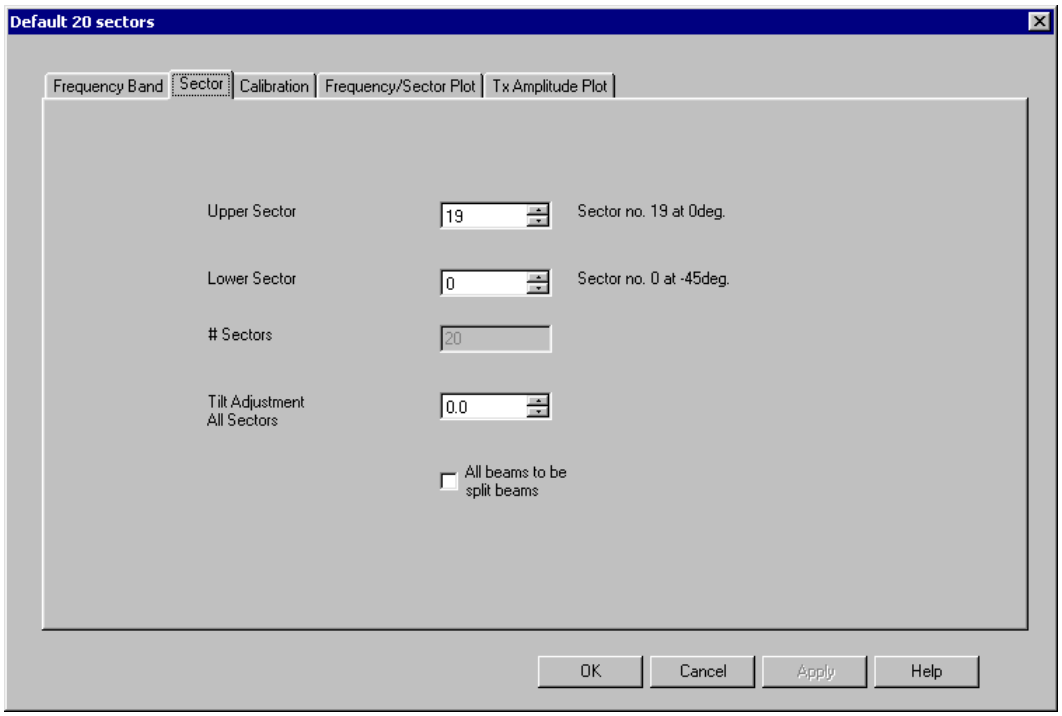
## Frequency band

- **Upper frequency:** 75 to 112 kHz
- **Lower frequency:** 75 to 112 kHz
- **Pulse duration:** 1024 to 10240 µsec
- **Pulse forms:** CW and LFM (Linear FM)
- **Number of sectors transmitted simultaneously:** 1 to 4



## Sectors

- **Number of sectors:** 1 to 20

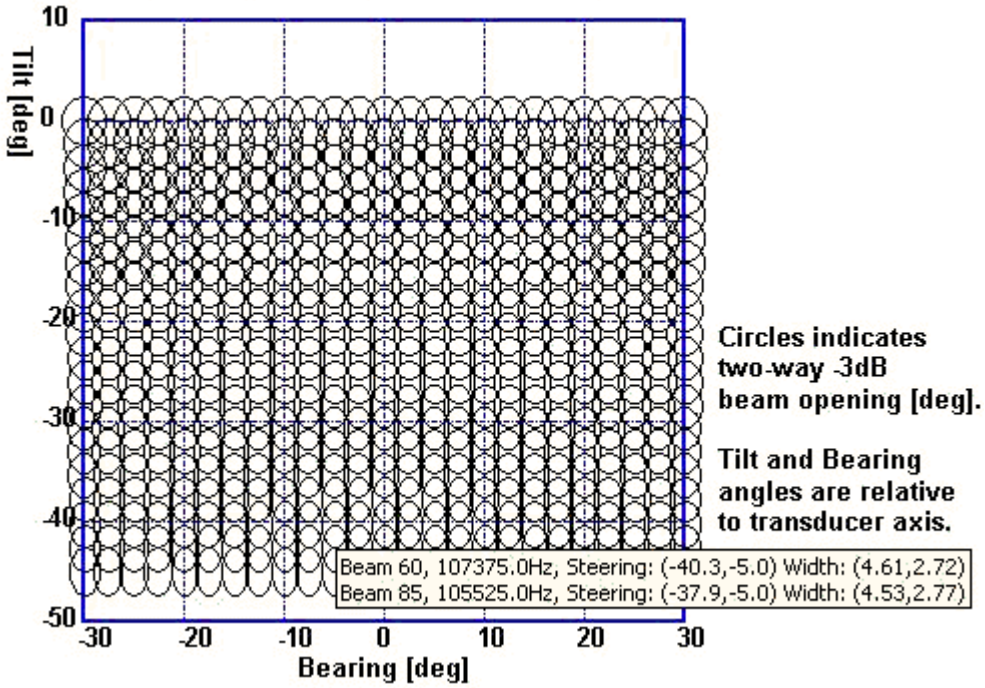


# Operational performance

## Coverage

- **Horizontal plane:** ±30 degrees
- **Vertical plane:** 0 to 45 degrees

*Figure 55 Frequency/Sector plot*




## Motion compensation

- **Roll compensation:** ≤ ±10º

## Sidelobe level

- -35 dB horizontal (alongship)
- -25 dB vertical

## Transmit and receive

- **Source level:** ≤ 225 dB
- **Receiver dynamic range:** 150 dB (instantaneous)
- **Individual transmitter channels:** 800
- **Individual receiver channels:** 800
- **Ping rate:** ≤ 2 Hz

## Sample rates

- **Output sample rate:** 62,5 kHz complex sampling (before decimation)
- **Output sample length:** Minimum 1,2 cm

## Performance, Multibeam Operator Station

### Hardware

- **Processor:** Pentium IV or later
- **Processor speed:** Minimum 3 GHz
- **Memory capacity:** Minimum 2 Gb
- **Hard-disk capacity:** Minimum 20 Gb
- **Type:** Simrad APC12 Processor Unit

### Software

- **Operating system:** Microsoft® Windows XP®
- **Scientific multibeam sonar application**: Custom Simrad software

## Performance, Transceiver Unit

- **TRC Beamforming computers:** Dell PowerEdge R610
- **TRXU Transceivers:** Custom MS70
- **Ethernet switch:** HP Procurve 2910

## Performance, Power Supply Unit

- **Output voltages:**
  - +6 Vdc, 20 A
  - +12 Vdc, 10 A
  - +75 Vdc, 4 A
- **Nominal power delivered to TRXU load:** 270 W
- **Ethernet cable:**
  - **Length:** 10 m
  - **Type:** CAT 5
- **DC voltage cables:**
  - **Maximum length:** 10 m
  - **Total weight, all power cables:** 14 kg

## Performance, Transducer array

- **Technology:** Ceramic polymer composite
- **Number of individual elements:** 800
- **Frequency range:** 70 to 120 kHz
- **Maximum transducer depth:** 15 m

# Interface specifications

This section provides the interface specifications for the Simrad MS70.

All serial lines are provided with adjustable baud rate, data bits, parity, and talker ID.

All Ethernet interfaces are provided with adjustable IP address and port number. The Ethernet interface may also be used to connect to the ship network to access file data.

## Serial lines

- **Inputs:**
  - **Position:** NMEA 0183 (GGA, GLL, or RMC)
  - **Speed:** NMEA 0183 (VBW, VTG, or RMC)
  - **Heading:** NMEA 0183 (HDM, HDT, HDG, or VHW)
  - **Distance:** NMEA 0183 (VLW) or 1/200 nmi contact pulses
  - **Sound speed at transducer face:** AML Smart Sensor Format
  - **Trawl:** Simrad ITI, Simrad PI, or Ifremer (Pacha and Scanmar)
  - **Motion:** Kongsberg EM Attitude
  - **Synchronization (Slave):** CTS and RTS
- **Outputs:**
  - **Depth:** NMEA 0183 (DBS, DBT, DPT, Simrad, and Atlas)
  - **Synchronization (Master):** CTS and RTS

## Ethernet

- **Inputs:**
  - **Position:** NMEA 0183 (GGA, GLL, or RMC)
  - **Speed:** NMEA 0183 (VBW, VTG, or RMC)
  - **Heading:** NMEA 0183 (HDM, HDT, HDG, or VHW)
  - **Distance:** NMEA 0183 (VLW)
  - **Trawl:** Simrad ITI, Simrad PI, or Ifremer (Pacha and Scanmar)
  - **Remote control:** MS70 Remote control commands (proprietary)
  - **Data subscription:** MS70 Data subscription commands (proprietary)
- **Outputs:**
  - **Depth:** NMEA 0183 (DBS, DBT, DPT, Simrad, and Atlas)
  - **Remote control:** MS70 Remote control responds (proprietary)
  - **Data subscription:** A wide variety of MS70 output data

### File

- **Inputs:**
  - Beam mode configuration parameters
  - Calibration data
  - User settings
  - Sound speed profile for the water column
  - Previously recorded data for replay
- **Outputs:**
  - Beam mode configuration parameters
  - Calibration data
  - User settings
  - Raw data for replay

### Other interfaces

Depending on the choice of Multibeam Operator Station model various interfaces are available such as Firewire, USB 2.0, and CD/DVD recorder.

# Weights and outline dimensions

This section provides the technical specifications and requirements related to weight and outline dimensions. For more detailed information about the dimensions, refer to *Drawing file* on page 175.

Note

*All weights are approximate.*

### Display Unit

- Not applicable. Refer to the documentation provided by the manufacturer.

### Multibeam Operator Station

- **Weight:** 20 kg
- **Width:** 445 mm
- **Height:** 185 mm
- **Depth:** 365 mm
- **Outline dimensions:**
  - *Multibeam Operator Station (341305)* on page 176

### Transceiver Unit

- **Weight:** 380 kg
- **Width:** 600 mm
- **Depth:** 900 mm
- **Height:** 1921 mm (excluding air outlet)
- **Outline dimensions:**
  - *Transceiver Unit outline (281020)* on page 177

### Power Supply Unit

- **Weight:** 82 kg
- **Width:** 600 mm
- **Depth:** 418 mm
- **Height:** 812 mm
- **Outline dimensions:**
  - *Power Supply Unit outline (311237)* on page 181

## Transducer array

- **Overall diameter:** 677 mm
- **Height, main body:** 313 mm
- **Maximum length of transducer cables:** 30 m
- **Weights:**
  - **Weight without cables:** 250 kg
  - **Weight of transducer cables:** 8,75 kg per meter
  - **Weight of transducer cables with protective hose:** 12,5 kg per meter
  - **Weight of transducer array with 15 m cables:** 382 kg
- **Minimum space required behind transducer:** 500 mm
- **Outline dimensions:**
  - *Transducer Array outline (208463)* on page 184
  - *Clamping ring (208465)* on page 186
  - *Mounting ring (208461)* on page 188

## Transducer cable

- **Minimum bending radius, static:** 95 mm
- **Minimum bending radius, dynamic:** 243 mm
- **Tensile strength:** 3000 N
- **Outer sheet:** Polyurethane

# Power requirements

This section provides the technical specifications and requirements related to the AC mains supply.

### Display Unit

- Not applicable. Refer to the documentation provided by the manufacturer.

### APC12 Processor Unit

- **Voltage requirement:** 115/230 Vac / 47–63 Hz / single phase, selectable (nominal)
- **Deviation:** 15%
- **Transient:** 20% of nominal voltage, recovery time 3 s
- **Power consumption:** Approximately 150 VA
- **Recommended circuit breaker:** 10 A, slow

### Transceiver Unit

- **Voltage requirement:** 230 Vac / 50–60 Hz / single phase (nominal)
- **Deviation:** 15%
- **Transient:** 20% of nominal voltage, recovery time 3 s
- **Power consumption:**
  - **TRC Computers:** 6 x 400 W = 2.400 W
  - **Ethernet switch:** 100 W
  - **Fan unit:** 100 W
- **Recommended circuit breaker:** 2 x 10 A, slow

### Power Supply Unit

- **Voltage requirement:** 230 Vac / 50–60 Hz / single phase (nominal)
- **Deviation:** 15%
- **Transient:** 20% of nominal voltage, recovery time 3 s
- **Power consumption:** Approximately 800 W (each cabinet)
- **Recommended circuit breaker:** 10 A, slow (each cabinet)

# Environmental requirements

This section provides the technical specifications and requirements related to the environmental conditions.

### Display Unit

- Not applicable. Refer to the documentation provided by the manufacturer.

### Multibeam Operator Station

- **Operational temperature:** 0 → +50°C
- **Storage temperature:** –40 → +70°C
- **Maximum ambient relative humidity, no condensation, operation:** 8 → 85%
- **Maximum ambient relative humidity, no condensation, storage:** 8 → 95%

### Transceiver Unit

- **Operational temperature:** 10 → +30°C with a maximum temperature gradation of 10°C per hour
- **Storage temperature:** –40 → +65°C
- **Maximum ambient relative humidity, no condensation, operation:** 20 → 80% with maximum humidity gradation of 10% per hour
- **Maximum ambient relative humidity, no condensation, storage:** 8 → 95%

### Power Supply Unit

- **Operational temperature:** 0 → +30°C
- **Storage temperature:** –40 → +65°C
- **Maximum ambient relative humidity, no condensation, operation:** 8 → 85%
- **Maximum ambient relative humidity, no condensation, storage:** 8 → 95%

# Drawing file

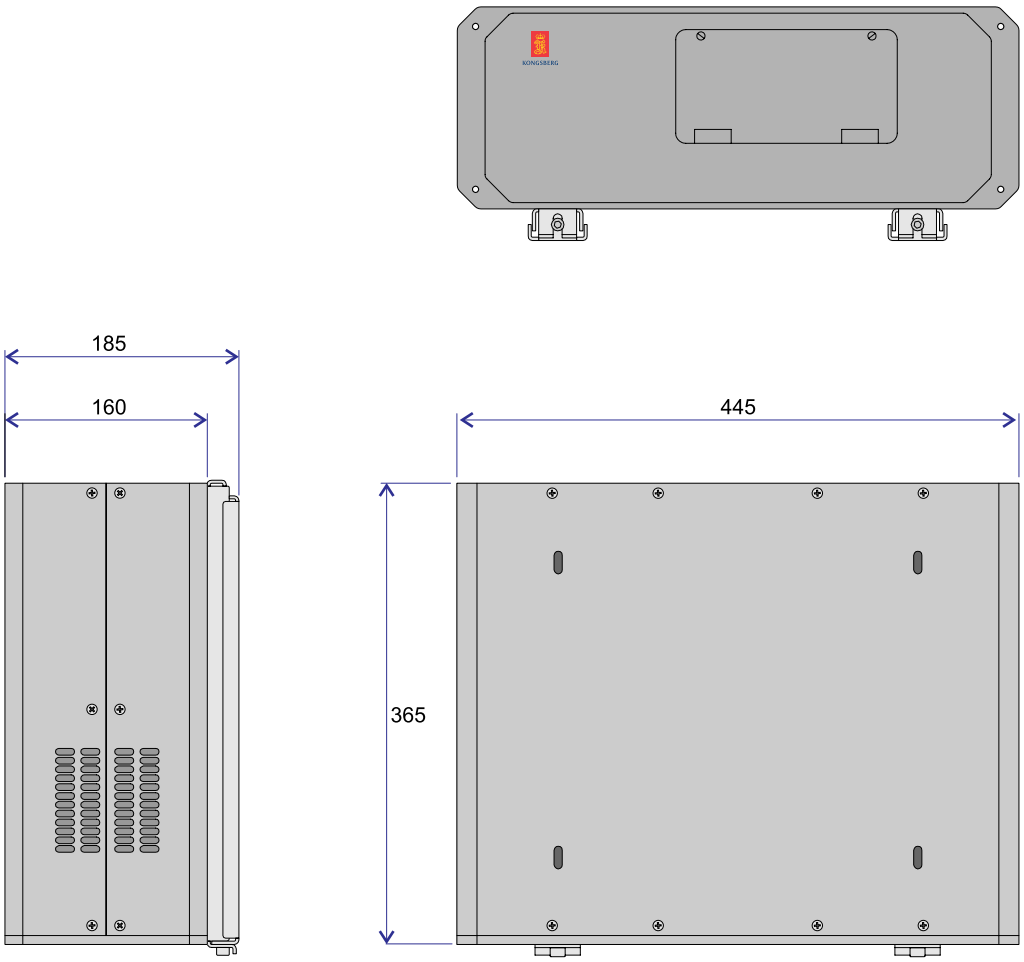
This chapter contains relevant drawings related to the installation and maintenance of the Simrad MS70.

Note

*The mechanical drawings are for information and guidance only. They are not in scale. All dimensions are in mm unless otherwise is noted. The original installation drawings are available on PDF and/or AutoCad's DWG format.*

**Topics**

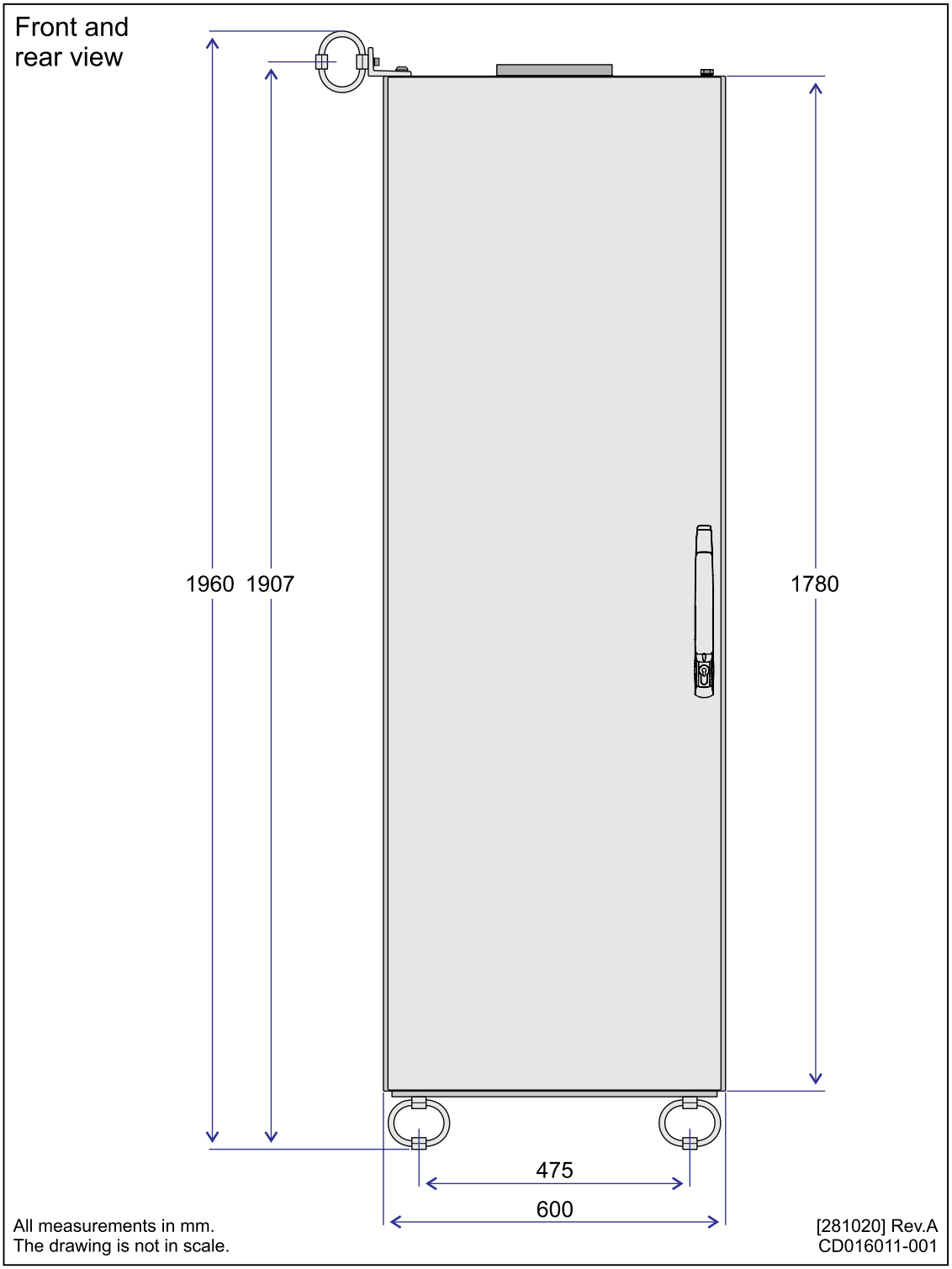
# Multibeam Operator Station (341305)

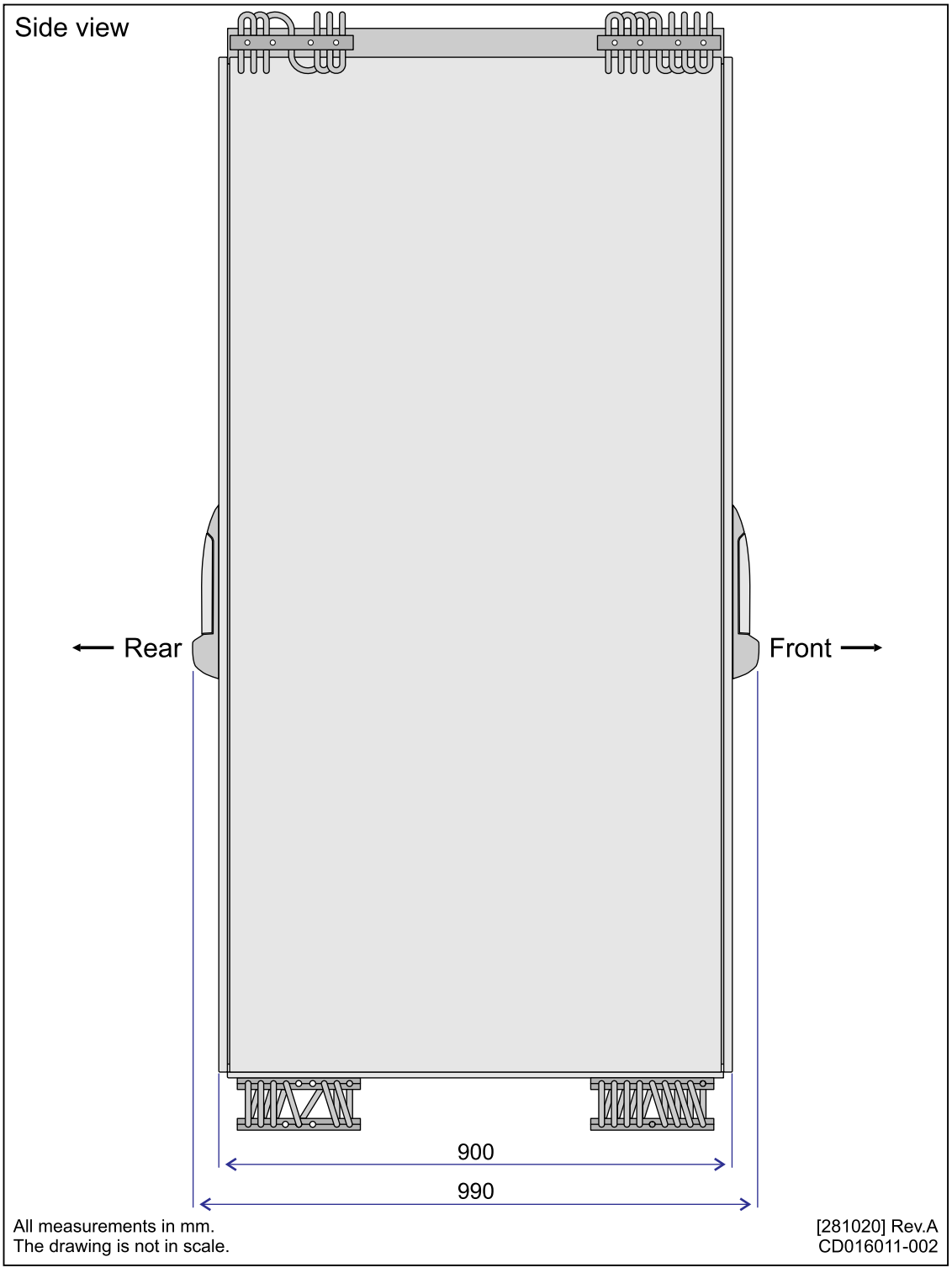


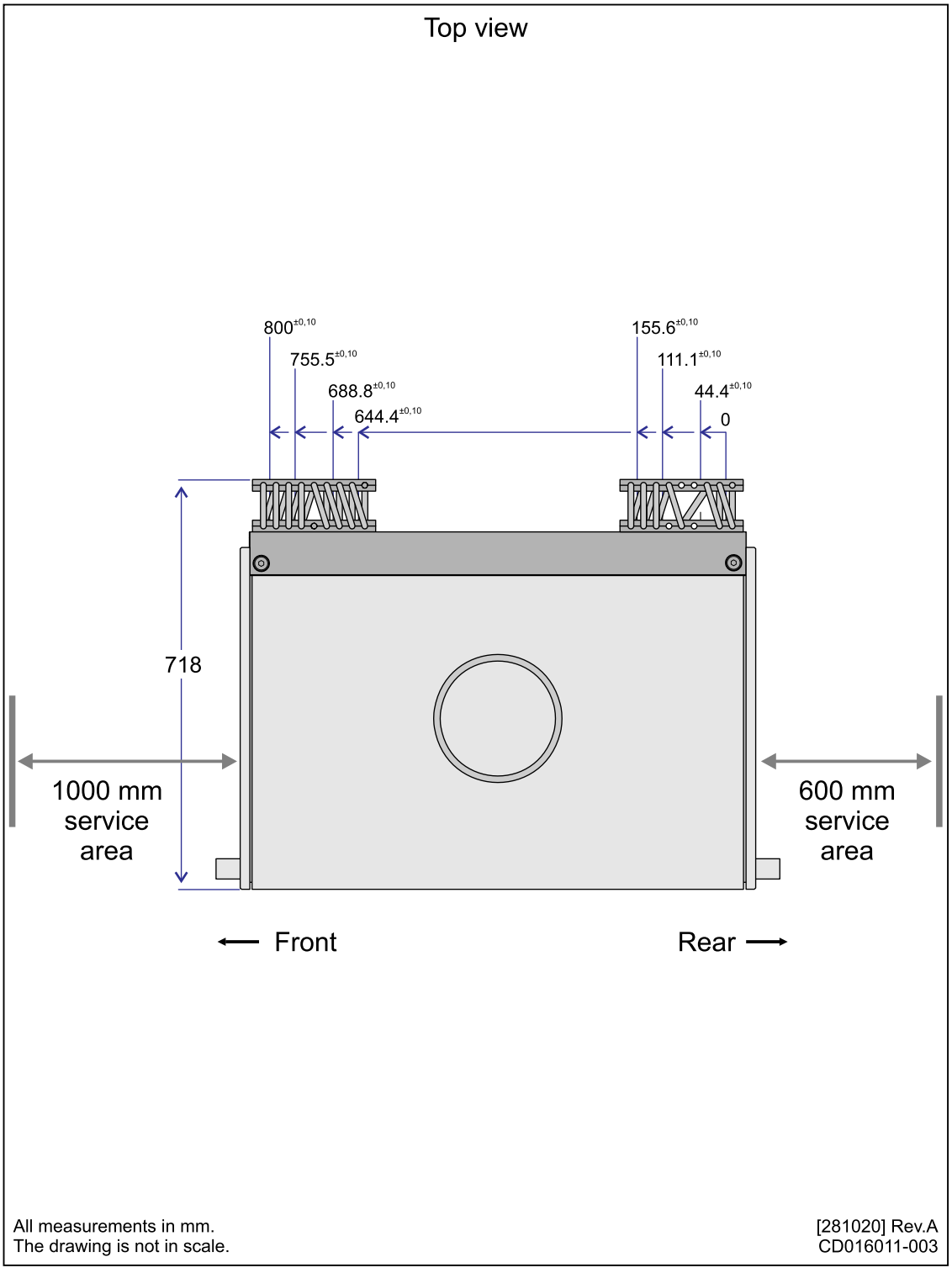

All measurements in mm.
The drawing is not in scale

341305 Rev.B
CD031082-005 Page 1 of 1

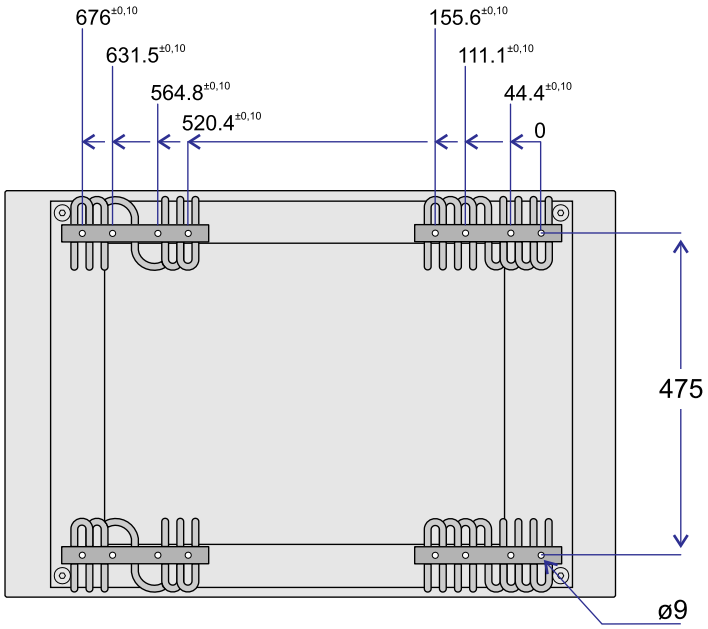
# Transceiver Unit outline (281020)




Side view
Rear
Front
900
990
All measurements in mm.
The drawing is not in scale.
[281020] Rev.A
CD016011-002


Top view
800±0,10
755.5±0,10
688.8±0,10
644.4±0,10
155.6±0,10
111.1±0,10
44.4±0,10
0
718
1000 mm service area
600 mm service area
Front
Rear
All measurements in mm.
The drawing is not in scale.
[281020] Rev.A
CD016011-003

Bottom view

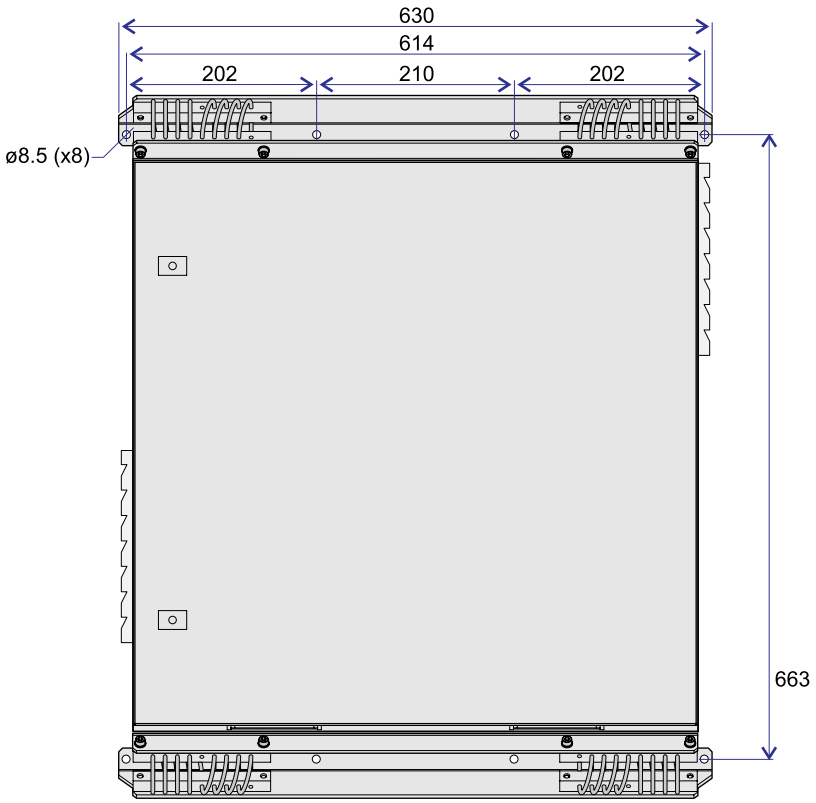



All measurements in mm.
The drawing is not in scale.

[281020] Rev.A
CD016011-004

# Power Supply Unit outline (311237)

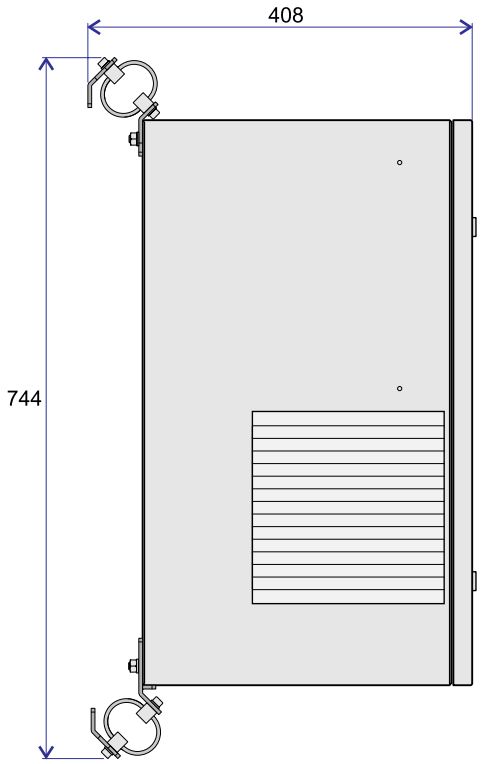
Front view




All measurements in mm.
The drawing is not in scale

311237 Rev.A
CD016022-006 Page 1

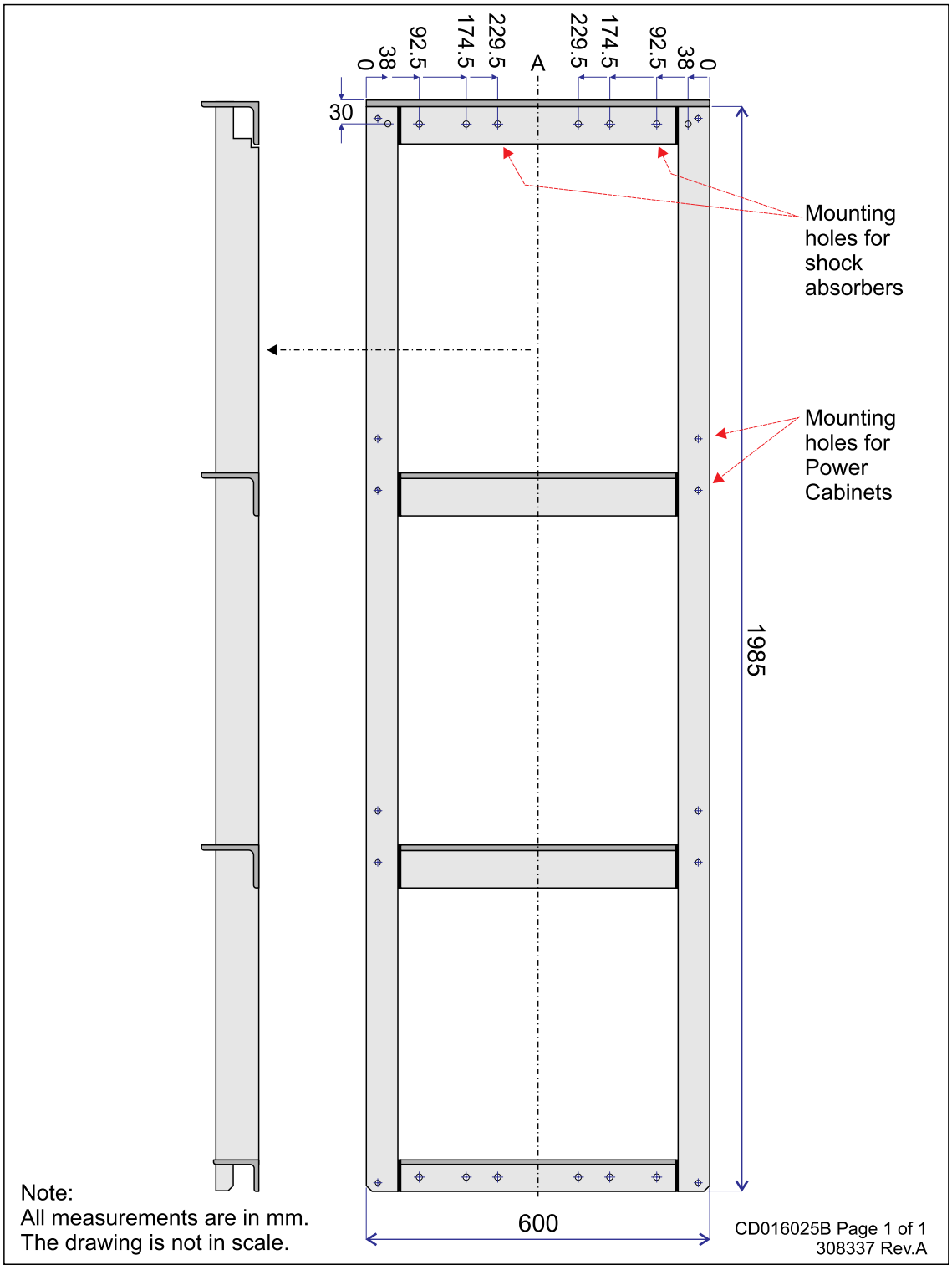
Side view



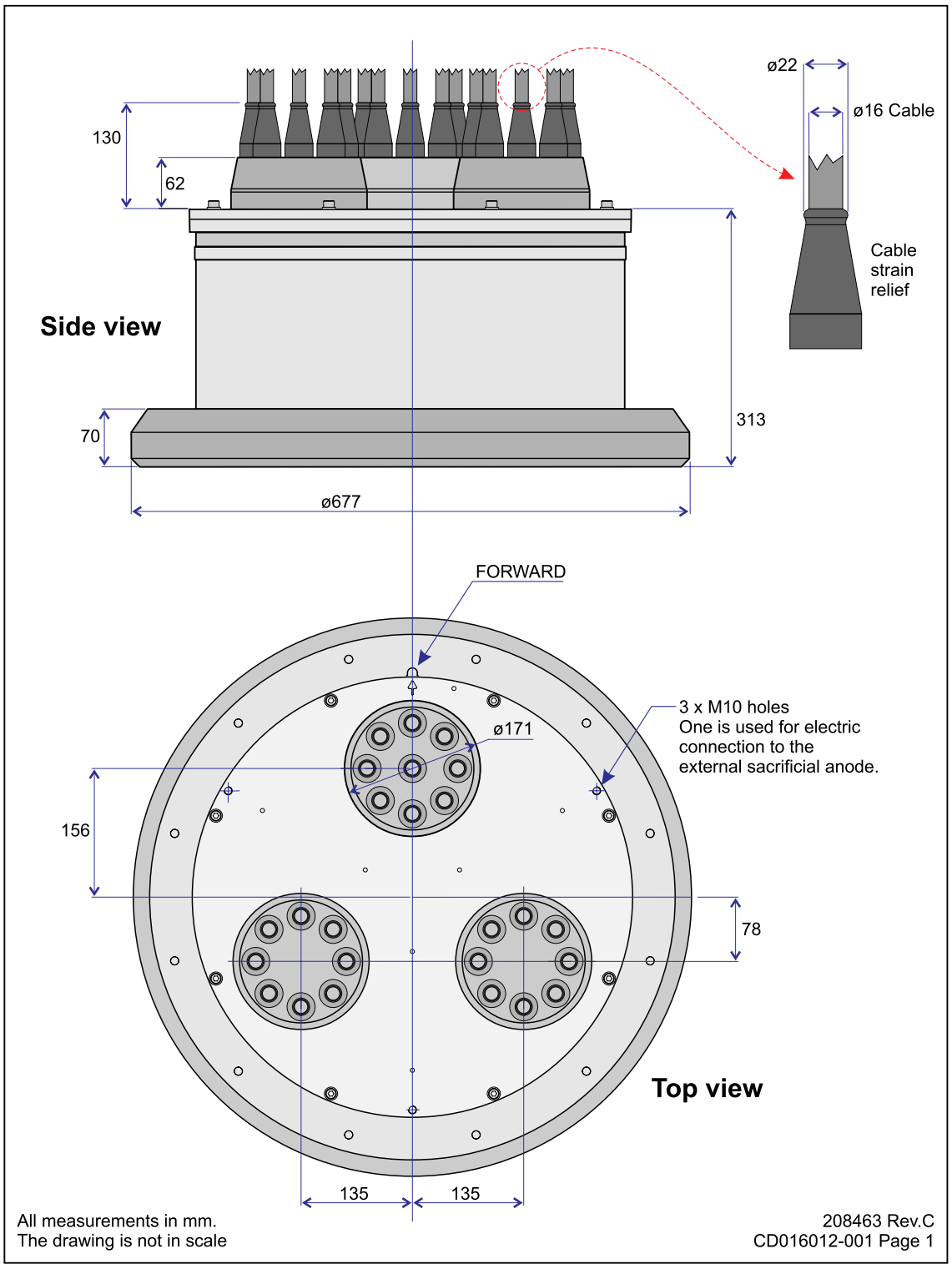

All measurements in mm.
The drawing is not in scale

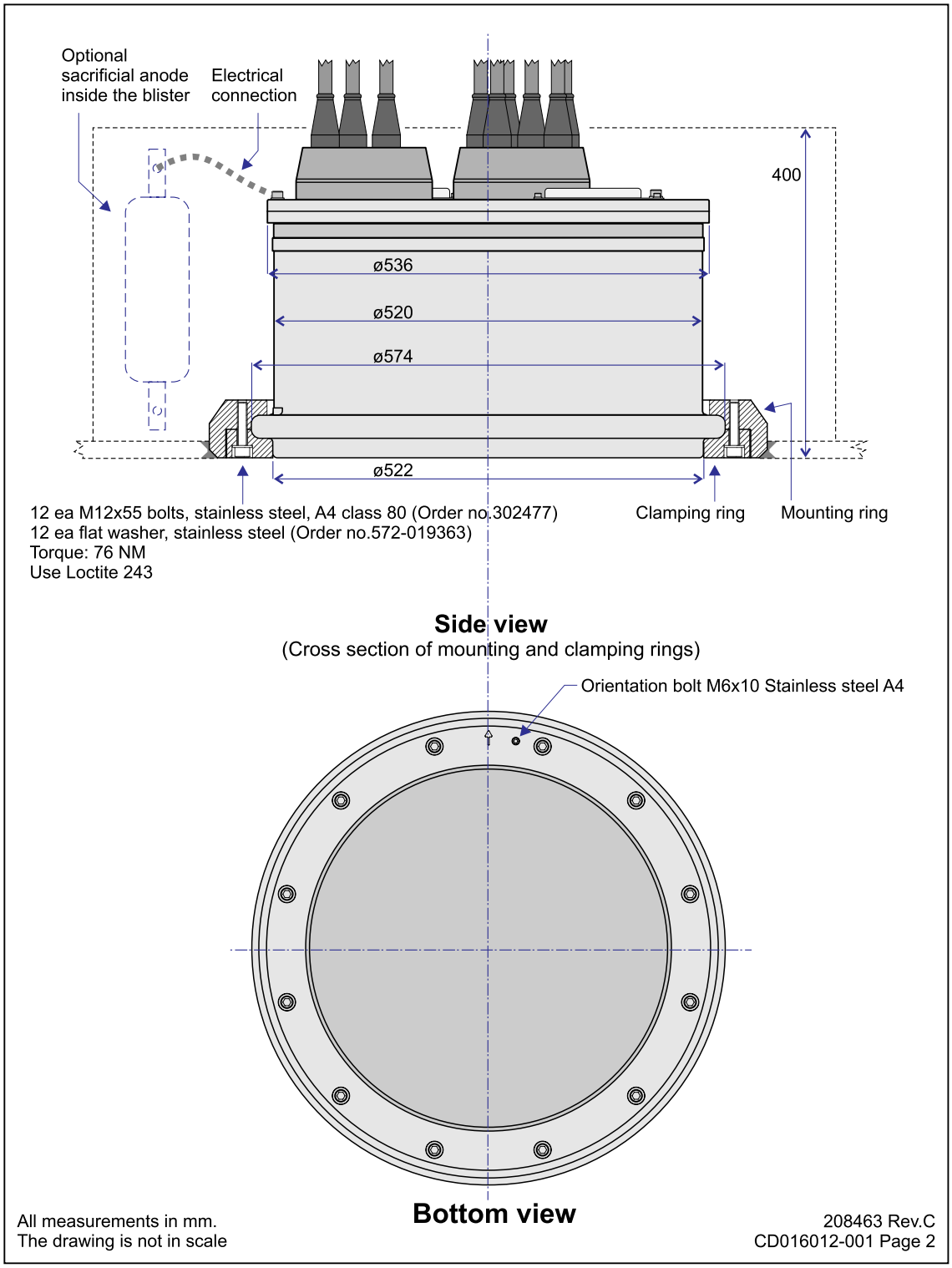
311237 Rev.A
CD016022-006 Page 2

# Power Supply Unit mounting frame (308337)

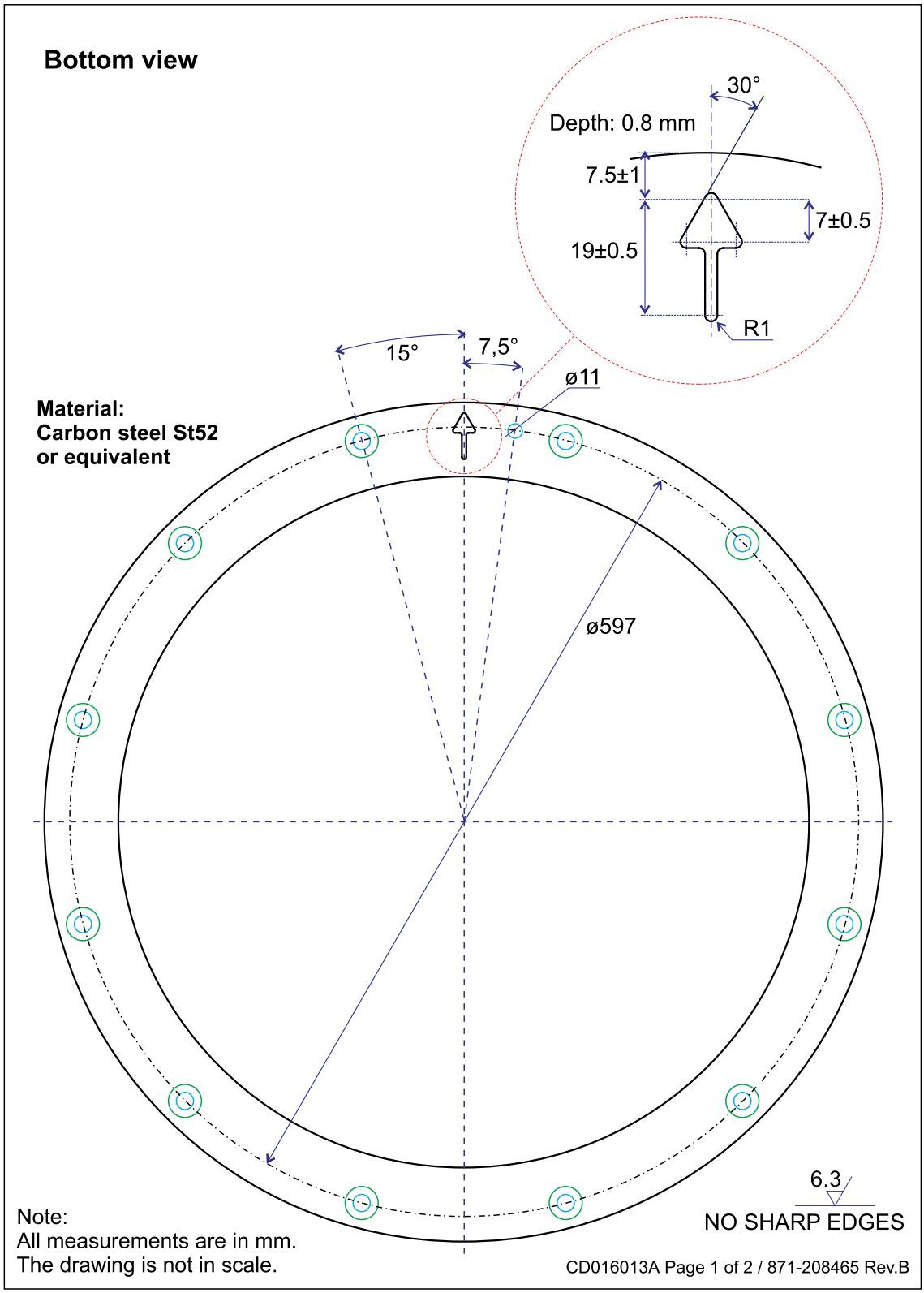


# Transducer Array outline (208463)

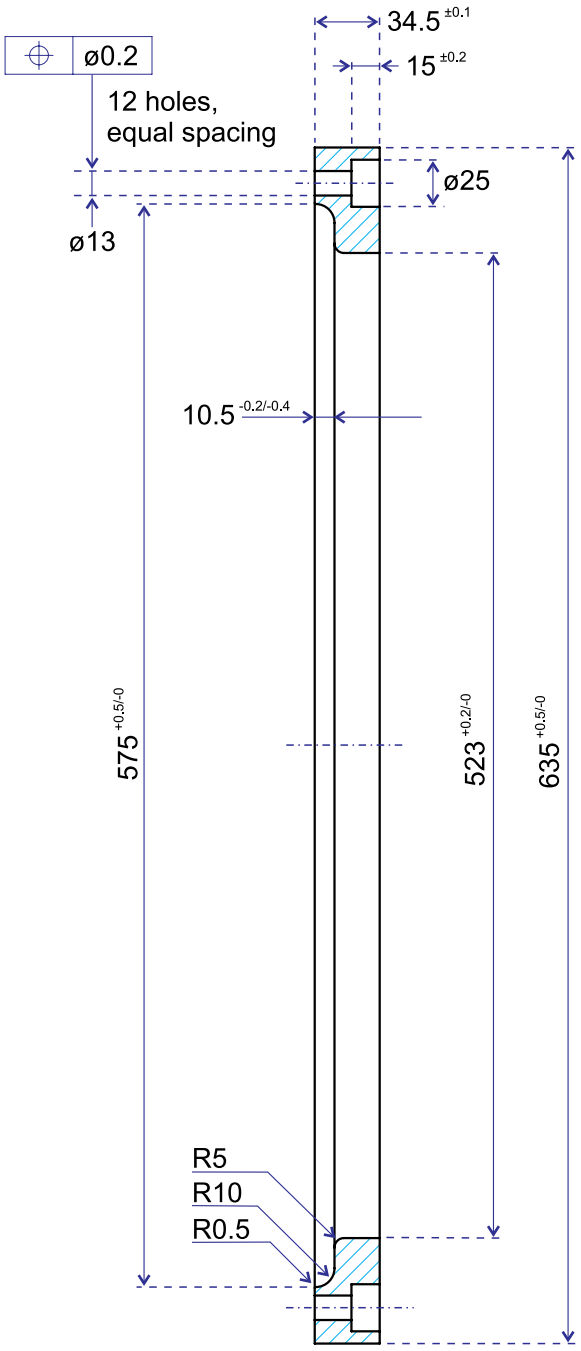



Optional
sacrificial anode
inside the blister
Electrical
connection
400
ø536
ø520
ø574
ø522
12 ea M12x55 bolts, stainless steel, A4 class 80 (Order no.302477)
12 ea flat washer, stainless steel (Order no.572-019363)
Torque: 76 NM
Use Loctite 243
Clamping ring
Mounting ring
Side view
(Cross section of mounting and clamping rings)
Orientation bolt M6x10 Stainless steel A4
Bottom view
All measurements in mm.
The drawing is not in scale
208463 Rev.C
CD016012-001 Page 2

# Clamping ring (208465)



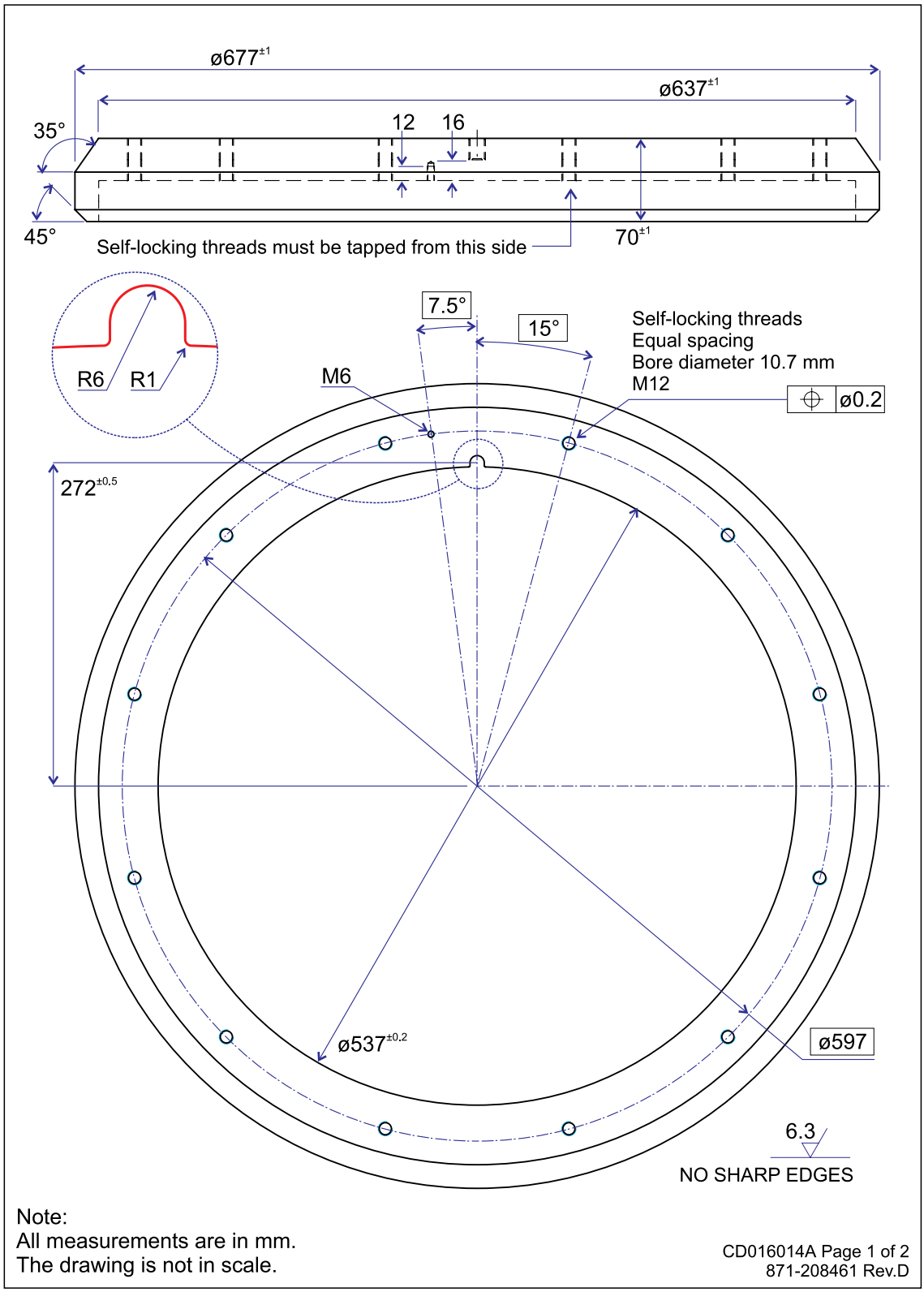
**Side view**




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

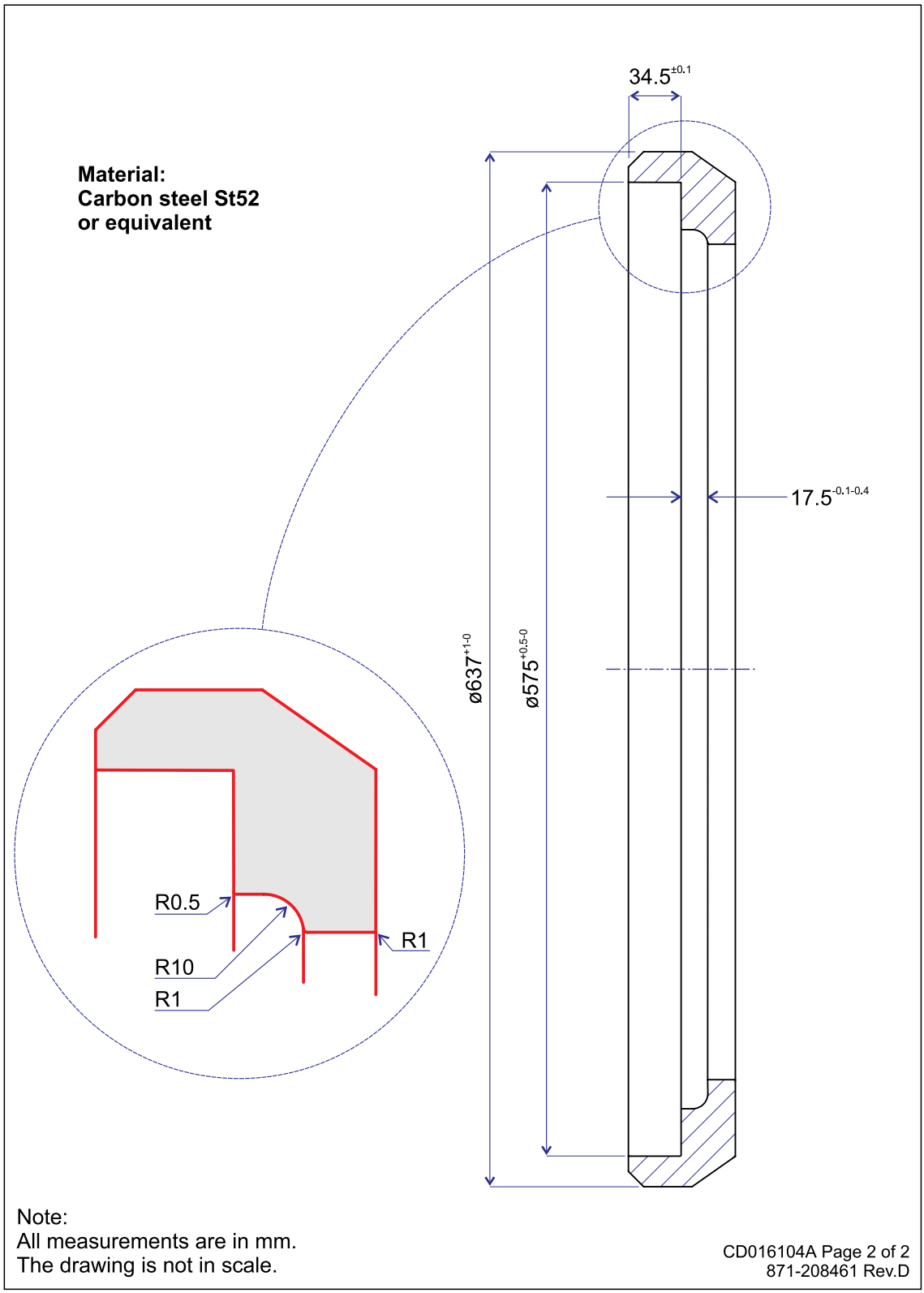
CD016013A Page 2 of 2 / 871-208465 Rev.B

# Mounting ring (208461)




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

CD016014A Page 1 of 2
871-208461 Rev.D


Material:
Carbon steel St52
or equivalent
34.5±0.1
17.5-0.1-0.4
ø637+1-0
ø575+0.5-0
R0.5
R10
R1
R1
Note:
All measurements are in mm.
The drawing is not in scale.
CD016104A Page 2 of 2
871-208461 Rev.D

# Appendix A Equipment handling

This section provides the basic rules for transportation, storage and handling of units. In this context, a unit may be any large or small part of the system. It can be supplied as part of the initial delivery, or as a spare part.

**Topics**

## Transportation

Unless otherwise stated in the accompanying documentation, electronic, electro-mechanical and mechanical units supplied by Kongsberg Maritime can be transported using all methods approved for delicate equipment; (by road, rail, air or sea). The units are to be transported in accordance with general or specific instructions for the appropriate unit(s), using pallets, transport cases, or carton boxes as appropriate.

Note

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

All local transportation must be carried out according to the same specifications as for the initial delivery. In general, all units must be handled with care.

The carton or case containing the unit must be kept dry at all times, and must be sheltered from the weather. It must not be subjected to shocks, excessive vibration or other rough handling. The carton or case will normally be marked with text or symbols indicating which way it is to be placed. Follow any instructions given, and ensure the case is always placed with its “top” uppermost.

The carton or case must not be used for any purpose for which it was not intended (step, table, etc.), and in the absence of other information, no other cartons or cases must be stacked on top of it.

# Lifting

A heavy crate will normally be marked with its weight, and the weights of other cartons or crates will normally be entered on the packing list.

- You must always check the weight of a crate before you attempt to lift it.
- You must always use lifting apparatus that is approved and certified for the load.

Heavy units may be equipped with lifting lugs for transportation by crane within the workshop or installation area. Before you use a crane:

- You must check the applicable weight certificate for the crane.
- You must check the security of the lifting lugs.

Ensure that all available lifting lugs are used. Ensure the unit remains under control during the operation to avoid damage to the unit, equipment or personnel.

Heavy units may be transported using a forklift truck. Special attention must then be paid to the position of the unit's centre of gravity. The units must be properly secured to the truck.

# Storage prior to installation or use

When a system, a unit or a spare part has been delivered to the customer, it may be subject to long time storage prior to installation and use. During this storage period, certain specifications must be met. The equipment must be preserved and stored in such a way that it does not constitute any danger to health, environment or personal injury.

**1** The equipment must be stored in its original transportation crate.

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

**3** The crate must not be used for any purpose for which it was not intended (eg. work platform etc.).

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

**5** The crates must not be placed directly on a dirt-floor.

**6** Do not open the crate for inspection unless special circumstances permit so.

- "Special circumstances" may be suspected damage to the crate and its content, or inspections by civil authorities.
- If any units are damaged, prepare an inspection report stating the condition of the unit and actions taken. Describe the damage and collect photographic evidence if possible. Re-preserve the equipment.
- If the units are not damaged, check the humidity absorbing material. If required, dry or replace the bags, then re-pack the unit(s) according to the packing instructions.

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

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

**9** The storage area's mean temperature must not be lower than -30° C, and not warmer than +70° C. If other limitations apply, the crates will be marked accordingly.

**10** The crate must not be exposed to moisture from fluid leakages.

**11** The crate must not be exposed to direct sunlight or excessive warmth from heaters.

**12** The crate must not be subjected to excessive shock and vibration.

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

*Caution*

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

# Inspection

An inspection must be carried out immediately after the unit(s) have arrived at their destination.

**1** Check all wooden or cardboard boxes, plastic bags and pallets for physical damage. Look for signs of dropping, immersion in water or other mishandling.

**2** If damage is detected externally, you will have to open the packaging to check the contents. Request a representative of the carrier to be present while the carton is opened, so any transportation damage can be identified.

**3** If any units are damaged, prepare an inspection report stating the condition of the unit and actions taken. Describe the damage and collect photographic evidence if possible. Send the inspection report to Kongsberg Maritime as soon as possible.

**4** If the units are not damaged, check the humidity absorbing material. If required, dry or replace the bags, then re-pack the unit(s) according to the packing instructions.

# Unpacking

## General unpacking procedure

Normal precautions for the handling, transportation and storage of fragile electronic equipment must be undertaken.

Note

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

*Do not use a knife to open cardboard cartons - the contents may lie close to the surface, and may be damaged by the blade.*

---

**1** Check the carton before opening it to ensure it shows no signs of dropping, immersion in water or other mishandling. If the carton shows signs of such damage, refer to the paragraph covering Inspection on receipt.

**2** Place the carton on a stable work bench or on the floor with the top of the carton uppermost.

**3** In the absence of other instructions, always open the top of the carton first. The contents will normally have been lowered into the carton from above, so this will usually be the easiest route to follow. Care must be used when opening the carton to ensure the contents are not damaged. Do not use a knife to open cardboard cartons

**4** If the carton has been closed using staples, remove the staples from the carton as you open it. This will reduce the possibilities of scratch injury to yourself and damage to the contents.

**5** If a wooden crate has been closed using screws, always remove them using a screwdriver. Do not attempt to prise the lid off with a crowbar or similar.

**6** Once the carton is open, carefully remove all loose packing and insulation material. Check for manuals and other documents that may have been added to the carton during packing, and put these to one side. Check also for special tools, door keys etc.

## Unpacking electronic and electromechanical units

Electronic and electromechanical units will normally be wrapped in a clear plastic bag. Lift the unit, in its bag, out of the carton and place it in a stable position on the floor/work bench.

Inspect the unit for damage before opening the plastic bag.

Note

*Beware of the dangers of Electro-Static Discharge (ESD) both to yourself and to the equipment, when handling electronic units and components.*

*Cables must **never** be used as carrying handles or lifting points.*

*Do not break the seal to open a circuit board package before the board is to be used. If the board package is returned to the manufacturer with the seal broken, the contents will be assumed to have been used and the customer will be billed accordingly.*

---

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

Open the unit and check inside. Remove any packing and desiccant material that may be inside.

## Unpacking mechanical units

Mechanical units may be heavy. Using a suitably certified lifting apparatus, lift the unit out of the crate and place it in a stable position on the floor/work bench.

Inspect the unit for damage and remove any packing material that may be inside the unit.

## Unpacking transducers

Transducers may be supplied mounted to a hull unit (if any), or packed separately. Crates are normally identified by the order number and the serial number.

The transducer face must be protected by a rigid, padded cover (e.g. a wooden box lined with foam rubber) all the time it is exposed to the risk of physical damage.

*Caution*

*Once transducer is unpacked, great care must be taken to ensure that transducer body and cabling is not exposed to any mechanical stress.*

# Storage after unpacking

The unit must whenever possible be stored in its original transportation crate until ready for installation. The crate must not be used for any purpose for which it was not intended (eg. work platform etc.).

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

Note

*Do not break the seal to open a circuit board package before the board is to be used. If the board package is returned to the manufacturers with the seal broken, the contents will be assumed to have been used and the customer will be billed accordingly.*

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

Note

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

# Storage after use

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

## Cleaning cabinets

If a cabinet has been exposed to salt atmosphere while it was in use, it must be thoroughly cleaned both internally and externally to prevent corrosion.

1. Wipe the cabinet externally using a damp cloth and a little detergent. Do not use excessive amounts of water as the unit may not be water tight. On completion, dry the unit thoroughly.
2. All surfaces must be inspected for signs of corrosion, flaking/bubbling paint, stains etc. Damaged or suspect areas must be cleaned, prepared and preserved using the correct preservation mediums for the unit. The mediums to be used will usually be defined in the units' maintenance manual.
3. Open the unit, and using a vacuum cleaner, remove all dust etc. from the unit. Great care must be taken to ensure the circuit boards and modules are not damaged in the process.

## Mechanical units

If a mechanical unit may has been exposed to a salt atmosphere while it was in use, it must be thoroughly cleaned both internally and externally to prevent corrosion.

1. If the construction materials and type of unit permits, wash the unit using a high-pressure hose and copious amounts of fresh water. Examples are the lower parts of hull units (outside the hull) or subsea units
2. Ensure that all traces of mud and marine growth are removed. Use a wooden or plastic scraper to remove persistent growth, barnacles etc. On completion, dry the unit thoroughly.

   *Caution*

   *Do not use a high pressure hose in the vicinity of cables or transducers. Do not use sharp or metal tools on a transducer face.*

3. If the materials or type of unit prevents the use of a high-pressure hose, wipe the unit using a cloth dampened with water containing a little detergent. Examples are the upper parts of hull units (inside the hull) and hydraulic systems
4. Do not use excessive amounts of water as some components on the unit may not be water tight. Wipe off the detergent with a damp cloth, then dry the unit thoroughly.
5. All surfaces must be inspected for signs of corrosion, flaking/bubbling paint, stains etc. Damaged or suspect areas must be cleaned, prepared and preserved using the correct preservation mediums. The mediums to be used will normally be defined in the unit's maintenance manual.

## Cables

Wipe clean all exposed cables, and check for damage. If a cable shows signs of wear or ageing, contact Kongsberg Maritime for advice.

## Internal batteries

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

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

*Caution*

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

## Dehumidifier

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

## Coatings

Spray the unit externally with a corrosion inhibitor (e.g. a light oil) before packing.

# Re-packaging

Whenever possible, the unit must be stored and transported in its original packing material and/or crate. In the event that this material is not available, proceed as follows:

- Small units must be protected from damp by being placed within a plastic bag at least 0.15 mm thick. An appropriate quantity of desiccant material should be placed inside this bag, and the bag sealed. The sealed unit must then be placed in an appropriate carton or crate, and supported in the container by appropriate shock-absorbing insulation (polystyrene foam chips etc.).
- Large units must be placed in a suitable cardboard box or wooden crate. The unit must be protected against physical damage by means of shock-absorbing insulation mats. The box must be clearly marked with its contents, and must be stored in a dry and dust-free area.

# Temperature protection

If the unit must be protected against extremes of temperature, the carton/crate must be lined on all walls, base and lid with 5 cm thick polyurethane or polystyrene foam. These units will be identified as delicate in the applicable documentation.

The package must then be clearly marked:

**Must not be transported or stored in temperatures below -5 degrees Celsius.**

Other units can normally be stored in temperatures between -30° C and +70° C, refer to the system's technical specifications for details.

Note

*Unless otherwise specified, transducers must not be stored in temperatures below -20° C and above +55° C.*

# Circuit board handling and packaging

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

### Beware of ESD!

When you handle electronic circuit boards, you must beware of the dangers of electrostatic discharge (ESD), both to yourself and to the equipment. In order to ensure safe transport and storage, circuit boards and other electronic units will always be wrapped in a clear plastic protective bag, and the bag will be sealed. See also section *Electro-Static Discharge (ESD)* on page 198.

### Unpacking and handling circuit boards

Observe the following steps to unpack a circuit board.

1. Wherever possible, prepare a suitable workbench. It must have an approved conductive service mat, and it must be connected directly to a reliable earth point via its earthing cord. You must wear a wristband in direct contact with the skin, and the wristband must be connected to the service mat.
2. Lift the circuit board, in its protective bag, out of the carton and place it in a stable position on the a floor/work bench.
3. Inspect the unit for damage before you open the plastic bag.
4. Do not break the seal to open a circuit board package before the board shall to be used. If the board package is returned with the seal broken, we will assume that the content has been used, and we will bill you accordingly.
5. Assuming all is well, open the bag and remove the unit.
6. Take out and keep the documentation. You will need it if the circuit board shall be returned to us. Also, remove any packing and desiccant material that may be inside.

7 Keep the protective plastic bag for future use.

### Unpacking on board the vessel

When you are working on board a vessel, an “approved conductive service mat” is often far away. As you still need to unpack circuit boards, make sure that you do it in the instrument room, or at another location where you have a steel deck. Keep far away from the bridge or any other rooms with wall-to-wall carpets! If possible, bring a wristband and ground yourself.

### Returning a circuit board

If you wish to return a circuit board to us, observe the following rules.

Note

*Failure to follow these rules may result in unserviceable circuit boards.*

1 Place the circuit board to be returned in the same protective plastic bag as you originally received it in - or a protective bag of similar ESD protection quality.

2 DO NOT use standard plastic bags, such as commercial bubble wrap.

3 Fill in all the necessary information on the applicable documentation and place it inside the bag.

4 Seal the bag.

5 Place the circuit board in a suitable carton, and secure it for shipping.

# Electro-Static Discharge (ESD)

### What is ESD?

Electro-Static Discharge (ESD) is the transfer of an electrostatic charge between two bodies at different electrostatic levels, caused either by direct contact or induction by an electrostatic field. The passing of a charge through an electronic device can cause localised overheating, and it can also “puncture” insulating layers within the structure of the device. This may deposit a conductive residue of the vaporised metal on the device, and thus create a short circuit. This may result in a catastrophic failure, or degraded performance of the device.

### ESD protection

Sensitive electronic circuit boards must be transported and stored in protective packing bags. The circuit boards must not be transported or stored close to strong electrostatic, electro-magnetic or radioactive fields.

If it is necessary to open and touch the circuit board inside the protective bag, then the following precautions must be taken:

1. The working area must be covered by an approved conductive service mat that has a resistance of between 50 kΩ and 2 MΩ, and is connected directly to a reliable earth point via its earthing cord.
2. The service personnel involved must wear a wristband in direct contact with the skin, connected to the service mat.
3. Printed circuit boards must be placed on the conductive service mat during installation, maintenance etc.
4. If, for any reason, it is necessary to move the circuit board from the conductive service mat, it must be placed in an approved antistatic transportation container (e.g. static shielding bag) before transportation.
5. During installation and servicing, all electrical equipment (soldering irons, test equipment etc.) must be earthed.

# Disposal

At the end of the product lifetime, all Kongsberg Maritime products must be disposed in an environmental friendly way.

All electrical and electronic components must be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or local authorities. The correct disposal and separate collection of your old appliance will help prevent potential negative consequences for the environment and human health. This is a precondition for reuse and recycling of used electrical and electronic equipment. For more detailed information about disposal of your old appliance, please contact your local authorities or waste disposal service.

All disposal of mechanical, electromechanical, electronic and chemical waste – including all types of batteries – must thus be disposed of according to national and international rules and regulations. Observe the relevant Waste Electronical and Electronic Equipment (WEEE) regulations.

Kongsberg Maritime offers a product recycling service. This is described on http://www.km.kongsberg.com →**Products** →**Services** →**Product recycling**.

# Appendix B Basic cable requirements

This chapter provides general information related to the installation of system cables.

**Topics**



## Cable trays

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

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

## Radio Frequency interference

All cables that are to be permanently installed within 9 m (30 ft) of any source of Radio Frequency (RF) interference such as a transmitter aerial system or radio transmitters, must, unless shielded by a metal deck or bulkhead, be adequately screened 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 must pass through a radio room must be screened by a continuous metal conduit or trunking which 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 an exceptional risk of mechanical damage (for example in holds, storage-spaces and cargo-spaces) must be protected by a suitable casing or conduit, even when armoured, if the cable covering does not guarantee sufficient protection for the cables.

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

# Grounding

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.

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

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

# Cable identification

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

# Index

**Simrad MS70 Scientific multibeam sonar**
**Installation manual**

**Simrad MS70 Scientific multibeam sonar**
**Installation manual**

**Simrad MS70 Scientific multibeam sonar**
**Installation manual**