Installation manual

KONGSBERG

EM 1002

Multibeam echo sounder

Hull mounted transducer array

EM 1002

Multibeam echo sounder

Installation manual

851-160978 / Rev.E

Note

Kongsberg Maritime AS makes every effort to ensure that the information contained within this document is correct. However, our equipment is continuously being improved and updated, so we cannot assume liability for any errors which may occur.

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 or injury to personnel. The user must be familiar with the contents of the appropriate manuals before attempting to install, operate or maintain the equipment.

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

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Sections

This book is the Installation manual for the EM 1002 multibeam echo sounder. It describes how to install the various units used by the EM 1002 system.

1 Purpose and description

This chapter presents a brief description of the system, lists the scope of supply, and defines the supply conditions. Refer to page 1.

2 Technical specifications

This chapter gives some of the technical specifications. Refer to page 57.

3 System units

This chapter explains how to install the Operator Station and the Transceiver Unit. Refer to page 22.

4 Transducer array

This chapter explains how to install the transducer array. Refer to page 40.

5 Transducer cabling

This chapter present a description on how to terminate the transducer cables. Refer to page 52.

6 Cable layout and interconnections

This chapter describes the cabling required to connect the system units together, and to interface with the peripherals. Refer to page 58.

7 Alignment

This chapter explains how to perform the required alignemnets of the sensors and the transducer array. Refer to page 99.

8 Installation checks

This chapter presents the checks required before the system is switched on. Refer to page 108.

9 Drawing file

Remarks

References

Further information about the EM 1002 system may be found in the following manuals:

- EM 1002 Operator manual (850-160977)
- EM 1002 Maintenance manual (852-160979)

The reader

This installation manual is intended for the design and installation engineers at the shipyard performing the installation. The information is supplied as the basis for the shipyard's own installation drawings applicable to the vessel. On completion of the installation, this manual must be kept on the vessel for reference purposes during system maintenance.

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Document logistics

Rev	Date	Written	Checked	Approved
A	22.10.98	RBr	BHL	EHa
B	28.10.98	RBr	BHL	EHa
C	27.10.99	RBr	BHL	EHa
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(The original signatures are recorded in the company's logistic database.)

Rev	Comments
A	First edition.
B	Only minor changes to the text. Refer to EM 160978B.
C	All cable information changed. Remote Control Junction Box implemented. Drawing file reorganised. Refer to EM 160978C.
D	Individual cable identification implemented, as well as minor changes to the text. Refer to EM 160978D.
E	Cable information revised. New layout. New chapter (Trasducer cabling). Minor changes to the text. Updated drawings. Revised Technical Specifications.

To assist us in making improvements to the product and to this manual, we would welcome comments and constructive criticism. Please send all such - in writing or by e-mail - to:

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High voltage safety warning

Precautionary measures

The voltages used to power this equipment are potentially lethal. Even 110 volts can kill. Whenever possible, the following precautionary measures must be taken before any work is carried out inside the equipment:

- Switch off all high-voltage power supplies.
- Check the operation of any door interlocks and any other safety devices.
- Completely discharge all high-voltage capacitors.

It should be noted that interlocks and safety devices are normally located only at regular access points, and high voltages may be exposed during dismantling.

Never work alone on high-voltage equipment!

First aid in the event of electric shock

Normally, even a high voltage electric shock will not kill instantly. The victim can still be revived even when his breathing and heart-beat have ceased.

Could YOU save someone's life?

In the event of electric shock, the correct actions, performed quickly may well save the victim's life. Make sure you know what to do!

Immediate action

While shouting for help, remove the source of power from the victim. Switch off the supply if possible, or using a dry, non-conductive material (rubber gloves, broom handle etc.) to insulate yourself, separate the victim from the source. If the voltage exceeds 1000 volts, switch off the supply and be ready to catch the victim. Take care- do not become a victim yourself.

Commence first aid on the spot. Continue to shout for assistance till someone arrives.

1 Lay the victim flat on his back and loosen any tight clothing (collar, tie, belt etc.).

2 Open his mouth and check for and remove any false teeth, chewing gum etc.

3 Check if the victim is breathing. If not, check if his heart is beating. The pulse is normally easily found in the main arteries of the neck, either side of the throat, up under the chin.

If his heart is beating but he is not breathing, commence artificial respiration. If the victim's heart is not beating, commence external cardiac massage (ECM). Continue to shout for assistance till someone arrives.

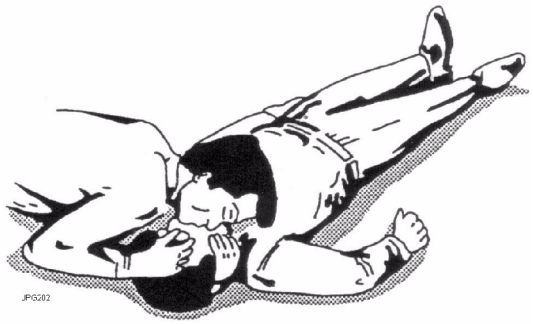
External cardiac massage

1 Kneel beside the victim. Place the heel of one hand in the centre of his chest, at a position half way between the notch between the collar-bones at the top of his chest, and the dip in the breast-bone at the base of his rib cage. Place the other hand on top of the first.

2 Keeping the arms straight and using your entire weight, press down rapidly so that the breast bone is depressed four- five cm, then release the pressure. Repeat rhythmically at a rate of one cycle per second. This will be hard work, but keep going. His life depends on YOU. Do not worry about breaking his ribs - these will heal if he survives.

Artificial respiration

1 Kneel besides the victim's head. Place one hand under his neck and lift, allowing his head to fall back. This will lift his tongue and open the air passage in his throat.
2 Place the palm of the hand on his forehead to maintain the "chin-up" position.
3 Using the index finger and thumb of the same hand, pinch the victim's nostrils closed. Open his mouth.
4 Take a deep breath and cover his mouth with yours. Blow steadily into his lungs to expand his chest. Remove your mouth from his to allow the air to escape from his chest. You should be able to see his chest deflate.
5 Repeat the "inflation-deflation" cycle at a rate of about 12 cycles per minute till the victim begins to breath normally again.



Combining EMC and artificial respiration

If you are alone, perform **one** cycle of artificial respiration for every **five** cycles of EMC. This will be hard work, but keep going. His life depends on you!

If there are other people available to help, one should perform the EMC while one performs the artificial respiration for every five cycles of EMC. It will be much more efficient with two people.

Once the victim's heart is beating and he is breathing, roll him onto his side and support him in that position. As consciousness returns he may vomit, and this will allow any liquid to drain out of his mouth.

Remove the victim to a hospital as soon as possible, but do not interrupt the artificial respiration and EMC cycles till his heart beat and breathing returns.

If started quickly and performed correctly, the resuscitation methods described will keep a sufficient volume of oxygenated blood flowing trough the victims body to allow full recovery.

Proficiency in the resuscitation methods can only be achieved trough training. All personnel concerned should attend courses on a regular basis. Remember, someone's life could depend on you.

Do you know what to do?

1 PURPOSE AND DESCRIPTION

1.1 General

The purpose of this installation manual is to present the descriptions and drawings required to install the EM 1002 multibeam echo sounder system.

Note

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

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

Note

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

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

Overview

The EM 1002 multibeam echo sounder consists of these main units:

- Operator Station
- Transceiver Unit
- Transducer Junction Box
- Transducer Array
- Hull Unit (optional)
- Hull Unit Controller (if Hull Unit)

→ *The EM 1002 system units are shown on page 4.*

Transducer array

The EM 1002 Transducer Array is used both for transmit and receive. It is semicircular with a radius of 45 cm and 160° angular extent. Its weight in water is approximately 90 kg. Eight 12.5 m long underwater cables connect the transducer to the Transducer Junctioin Box. The cables are fitted with connectors on the “dry” end. The cables from the Transducer Junction Box to the Transceiver Unit are 5 meters long.

The curved transducer of the EM 1002 makes the accuracy dependent upon variation in sound speed at the transducer depth. It is therefore recommended to install a sensor which allows real-time measurement of sound speed variation if this is expected. The system will take into account the sensor measurements in its calculations of beam pointing angles and raybending. The system is prepared for using an AML Smart Probe directly. Due to possible marine growth, and to ease of cleaning or servicing of the sensor, it would be advisable to mount the sensor in a tank inside the hull, and pump water taken from the transducer depth through the tank on permanent installations.

Transceiver Unit

The EM 1002 Transceiver Unit contains the transmit and receive electronics and processors for beamforming, bottom detection, and control of all parameters with respect to gain, ping rate and transmit angles. It has serial interfaces for all time-critical external sensors such as vessel attitude (roll, pitch, heading and heave), vessel position, and external clock. The Transceiver Unit is a wall mounted cabinet with integrated shock and vibration absorbers. An Ethernet cable connects the Transceiver Unit to the Operator Station.

Operator Station

The Operator Station is a high-performance workstation or PC. It contains the operator interface, displays the collected data, and logs them to disk and tape.

Hull Unit Controller (if Hull Unit)

The EM 1002 Hull Unit Controller controls the pitch stabilistation system. It is only delivered when the system has a Hull Unit.

Hull Unit (optional)

The EM 1002 Hull Unit is a electromechanical device designed to physically lower the transducer array from a safe storage position down into the water. The array may be lowered to a maximum depth of 82 centimeters under its storage position within the hull.

The Hull Unit will also mechanically stabilize the transducer array to compensate for the vessel's pitch movements during the survey.

The EM 1002 Hull Unit is a electromechanical device designed to physically lower the transducer array from a safe storage position down into the water. The array may be lowered to a maximum depth of x meters under the vessel's hull. The Hull Unit is large and heavy, and will only be fitted to relatively large vessels.

→ *For more information about the Hull Unit, refer to the Hull Unit Instruction manual.*

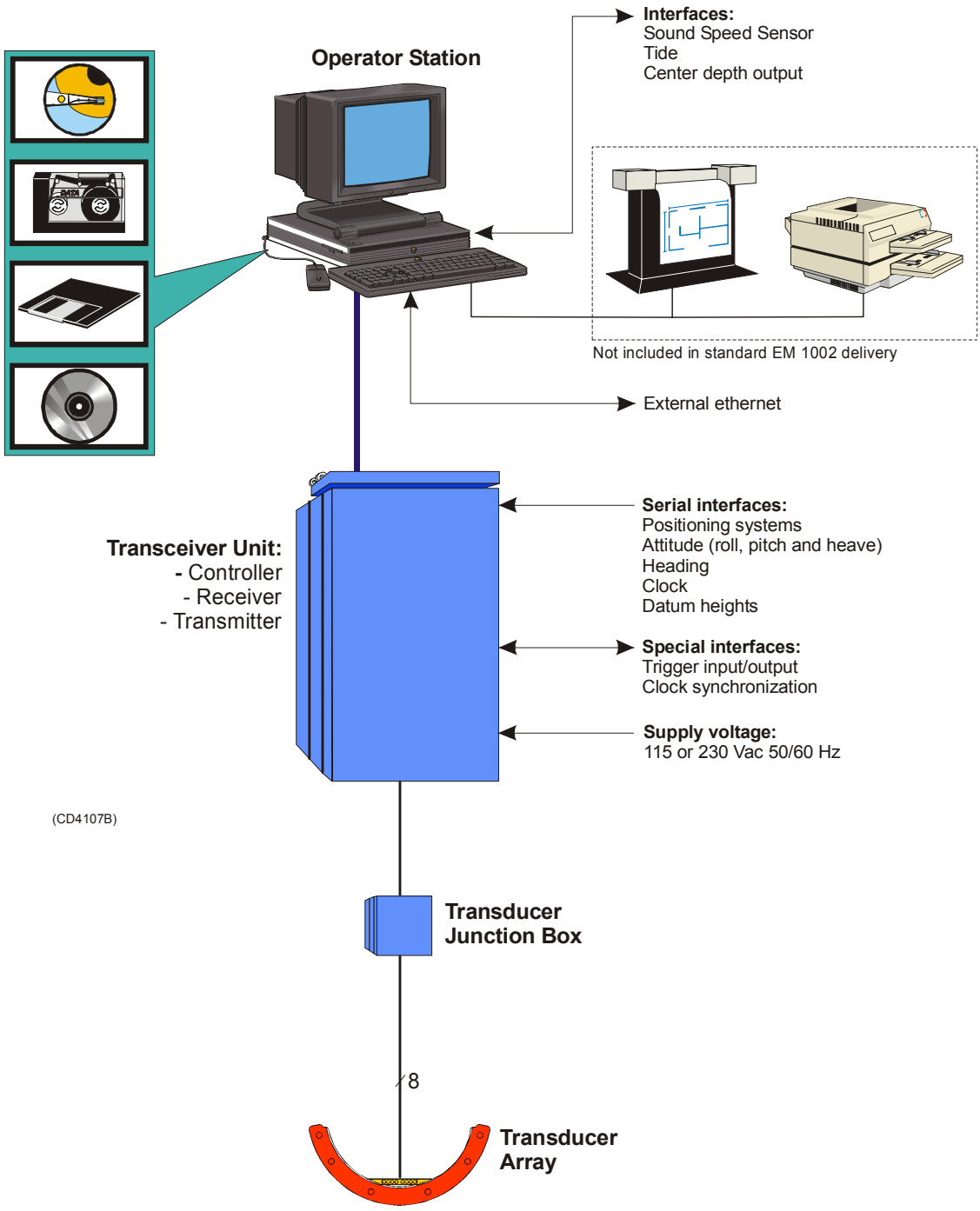


Figure 1 EM 1002 system diagram

1.2 Scope of supply

Units

The EM 1002 delivery comprises the following items:

- EM 1002 Operator Station
  - Commercial Unix Workstation or PC with display, mouse and keyboard
  - Storage units (CD-rom, tape and harddisk)
- EM 1002 Transceiver Unit
- EM 1002 Transducer Array
  - If the vessel is already fitted with an EM 1000 transducer array, this can be used.
- Remote Control Junction Box (optional)
- Transducer Junction Box
- Cabling
  - Transducer cables
  - Workstation's internal cabling
  - Cabling to and from peripherals
  - Cabling between the Transceiver Unit and the Operator Station
  - Power cables (115 and/or 230 Vac)

Services

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

- Recommending a good location of the transducer array
- Installation outline drawings to fit the specific vessel
- Assistance during the installation
- Testing
- Training

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

1.3 General safety rules

The system operates on 115 and/or 230 Vac, 50/60 Hz.

Warning ***This voltage can be lethal.***

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

- Always switch off all power before installation or maintenance. Use the main circuit breaker, and label the breaker with a warning sign that informs others that maintenance or installation work is being carried out on the system.
- Read and understand the first aid instructions for electric shock.
- For safety reasons during troubleshooting on the equipment with power ON, two persons should always be present.
- Whenever maintenance is carried out, it is essential that a first aid kit is available, and that the maintenance personnel are familiar with the first aid instructions for electrical shock.
- The various parts of the system are heavy. Make sure that the appropriate tools and certified lifting equipment are available, and that the personnel are trained in installation and maintenance work.

1.4 Supply conditions

Equipment responsibility

Upon receipt of the EM 1002 system units the installation shipyard automatically becomes fully responsible for the equipment. This responsibility covers the storage period before installation, the actual installation, and the period between the completion of the installation and the acceptance of the equipment by the end user or owner.

Reception, unpacking and storage

A special chapter is provided for this information.

→ *Refer to page 11.*

Installation guidelines

Unless otherwise stated, the installation shipyard is responsible for the installation of the entire EM 1002 system. In addition, the shipyard is responsible for providing and connecting all cables. The actual installation and cable laying must comply with the vessel's classification rules and the recommendations given in this manual.

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

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

Assistance from Kongsberg Maritime

Kongsberg Maritime AS may assist during the installation if specified in the contract or requested by the installation shipyard or customer. Kongsberg Maritime AS may also assist with installation drawings. All such assistance is charged to the customer at the current rates.

If required during a contractual test period, the shipyard must provide assistance necessary for the rapid and efficient completion of the work even when the work is to be performed

outside normal working hours. This requirement includes assistance from subcontractors when applicable. Excessive waiting time resulting from delays caused by the shipyard will be charged to the shipyard.

Guarantee

The guarantee period for the system (as specified in the contract) normally begins as soon as acceptance documents have been signed.

1.5 Installation requirements

Supply power

The supply voltage to the equipment is to be kept within ±15% 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 strongly recommends that the EM 1002 Operator Station is powered through an Uninterruptible Power Supply (UPS). The UPS should have the capacity to independently maintain power 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.

Environmental requirements

Vibrations

If the equipment is expected to be exposed to excessive vibration for extended periods, special dampening precautions must be taken.

Temperature and humidity

All equipment, unless otherwise specified, must be protected from temperature extremes and excessive humidity.

→ *Refer to "Ambient temperature and humidity" on page 13 for more information.*

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 sonar trunk 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 sonar trunk and/or protection blister must be noted on the vessel's docking plan for future reference.

Wiring

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

1.6 Equipment handling

Introduction

This chapter describes how to transport, pack and unpack, clean, preserve and store electronic, electro-mechanical and mechanical units supplied by Kongsberg Maritime AS.

The units may be supplied as spare parts, or as parts of a delivery.

Transportation

General specifications

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; e.g. 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. The units should be checked and the regulations investigated by the packer/shipper before the unit is dispatched.

Local transportation

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 equipment 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 up 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 (e.g. 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.

- Always check the weight of a crate before attempting to lift it.
- Always use lifting apparatus that is certified for the load.

Heavy units may be equipped with lifting lugs for transportation by crane within the workshop or installation area. Before a crane is used, check:

- The applicable weight certificate for the crane.
- 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 fork-lift 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.

Initial preservation

Introduction

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.

Specific specifications are presented below.

→ *For further information about storage, refer to page 17.*

→ *For further information about re-packing, refer to page 19.*

→ *For further information about temperature protection, refer to page 21.*

Original packing crate

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 repack 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.

→ *Refer to the information on page 19.*

Ambient temperature and humidity

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

2 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.

Note

Transducers must not be stored in temperatures below -20°C.

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3 The crate must not be exposed to moisture from fluid leakages.

4 The crate must not be exposed to direct sunlight or excessive warmth from heaters.

Shock and vibration

1 The crate must not be subjected to excessive shock and vibration.

- Normal vibrations from vehicle, vessel or other transportation movements are permitted.

ESD precautions

→ *Refer to the information on page 20.*

Batteries

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 and unpacking

Inspection

An inspection must be carried out immediately after the unit(s) have arrived at their destination.

- Check all wooden or cardboard boxes, plastic bags and pallets for physical damage. Look for signs of dropping, immersion in water or other mishandling.
- 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.
- 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.
- If the units are not damaged, check the humidity absorbing material. If required, dry or replace the bags, then repack the unit(s) according to the packing instructions.

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.

- 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.
- Place the carton on a stable work bench or on the floor with the top of the carton uppermost.
- 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.

Caution

Do not use a knife to open cardboard cartons - the contents may lie close to the surface, and may be damaged by the blade.

- 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.
- If a wooden crate has been closed using screws, always remove them using a screw-driver. Do not attempt to prise the lid off with a crow-bar or similar.
- 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.

Electronic and electro-mechanical units

Caution

Beware of the dangers of Electro-Static Discharge (ESD) both to yourself and to the equipment, when handling electronic units and components. Refer to the precautions starting on page 20.

Electronic and electro-mechanical 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 *Cables must **never** be used as carrying handles or lifting points.*

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.*

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.

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.

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.

Note *Once the units are unpacked, great care must be taken to ensure that transducers and cabling are not exposed to any mechanical stress.*

Re-packing

If the unit is not to be installed immediately, re-pack it in its original packing material to prevent damage in the intervening period.

→ *Refer to the information on page 19.*

Storage

Pre-installation storage

The equipment should 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.

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.

After use storage

Introduction

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 the unit may have been exposed to salt atmosphere while it was in use, it must be thoroughly cleaned both internally and externally to prevent corrosion.

- 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.
- All surfaces must be inspected for signs of corrosion, eg. 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.
- 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 the mechanical unit may have been exposed to a salt atmosphere while it was in use, it must be thoroughly cleaned both internally and externally to prevent corrosion.

- If the construction materials and type of unit permits, wash the unit using a high-pressure hose and copious amounts of fresh water.

  Examples:

  - The lower parts of hull units (outside the hull)
  - Subsea units
- 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.*

- 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.

  Example:

  - The upper parts of hull units (inside the hull)
  - Hydraulic systems
- 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.

- All surfaces must be inspected for signs of corrosion, eg. 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-packing

The unit should 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.
- Ensure that the resulting unit is weather proof as required by the current and expected environment.

ESD precautions

Electrostatic Discharge (ESD)

Electro-Static Discharge (ESD) is the transfer of an electrostatic charge between two bodies at different electrostatic potentials, 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 during transport and storage

Sensitive electronic equipment must be transported and stored in protective packing bags, boxes and cabinets. The equipment must NOT be transported or stored close to strong electrostatic, electro-magnetic or radioactive fields.

Unpacking and servicing ESD sensitive equipment

If it is necessary to open and touch the electronics inside the boxes/cabinets, then the following precautions MUST be taken:

- The working area must be covered by an approved conductive service mat that has a resistance of between 50kΩ and 2 MΩ, and is connected directly to a reliable earth point via its earthing cord.
- The service personnel involved must wear a wrist-band in direct contact with the skin, connected to the service mat.

- Printed circuit boards and other components should be placed on the conductive service mat during installation, maintenance etc.

Caution

If, for any reason, it is necessary to move the circuit board or components from the conductive service mat, they must be placed in an approved anti-static transportation container (e.g. static shielding bag) before transportation.

- During installation and servicing, all electrical equipment (soldering irons, test equipment etc.) must be earthed.

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, though refer to the system's Technical Specifications document for details.

Transducers must not be stored in temperatures below -20°C.

2 SYSTEM UNITS

2.1 Introduction

This chapter describes the installation of the EM 1002 Transceiver Unit in the equipment or operation room, and the Operator Station in the operation room.

In addition, the junction box between the transducer array and the Transceiver Unit is described as well as the optional Remote Control Junction Box.

Drawings showing the system and the Transceiver Unit shape and outline dimensions are included in the text.

There are no detailed drawings of the Operator Station. This is because the shape and outline dimensions can vary. Most Operator Stations use standard PC (personal computer) cabinets.

Note

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

2.2 Operator Station

Description

The EM 1002 Operator Station consists of a commercial workstation, either a PC or a Unix based computer. Main units are computer chassis, display monitor, keyboard, mouse or trackball, and one or two units for external data storage (tape and/or hard disk).

Location

It is recommended to place the Operator Station in a room with environmental conditions similar to those required for extended human occupation.

The Operator Station is usually mounted on a desk in the operation room, and suitably tied down.

Installation

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

2.3 Transceiver Unit

Scope

This chapter presents the general installation procedures for the EM 1002 Transceiver Unit.

Note

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

Location

The EM 1002 Transceiver Unit is normally installed in the vessel's "sonar room" close to the transducer arrays. This room must be dry and free from excessive dust and vibration. Maximum humidity of 80% is recommended. Good ventilation for the equipment cooling must be provided.

Kongsberg Maritime recommends that this room is chosen close enough to the transducer array so that you do not need to extend the transducer cables. These have a standard length of 12.5 m.

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

General information

The Transceiver Unit cabinet is fitted with hinges to allow the front and middle parts to swing open, this gives you access to both the front and rear side of all the circuit boards.

The EM 1002 Transceiver Unit cabinet's total height (including cable support) is 1110 mm.

Note

The maximum distance between the EM 1002 Transceiver Unit and the Transducer Array is restricted by the length of the transducer cables.

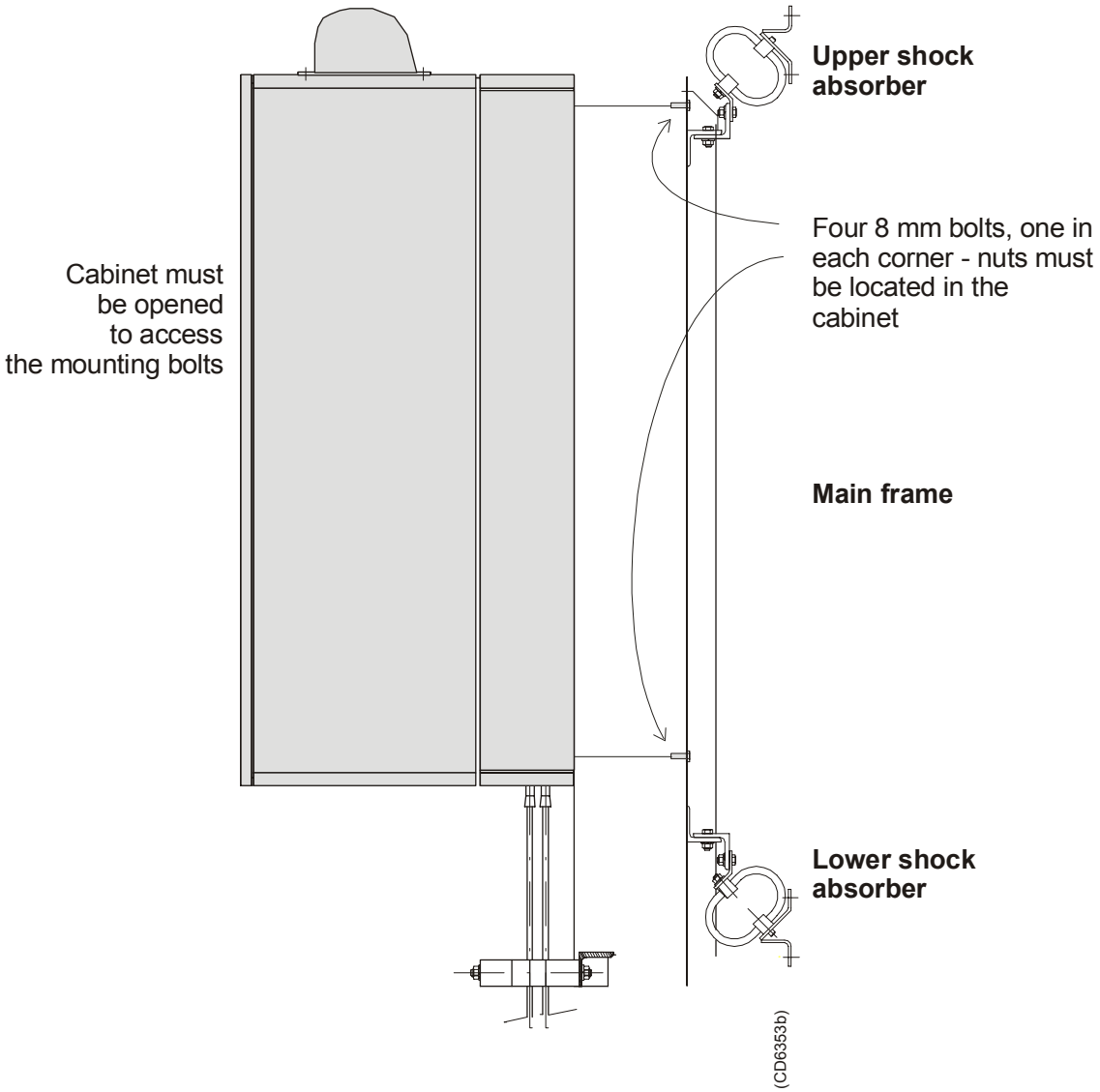


Figure 2 Standard EM 1002 Transceiver Unit mounting

Logistics

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

Personnel - Minimum two trained mechanical/electrical workers

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

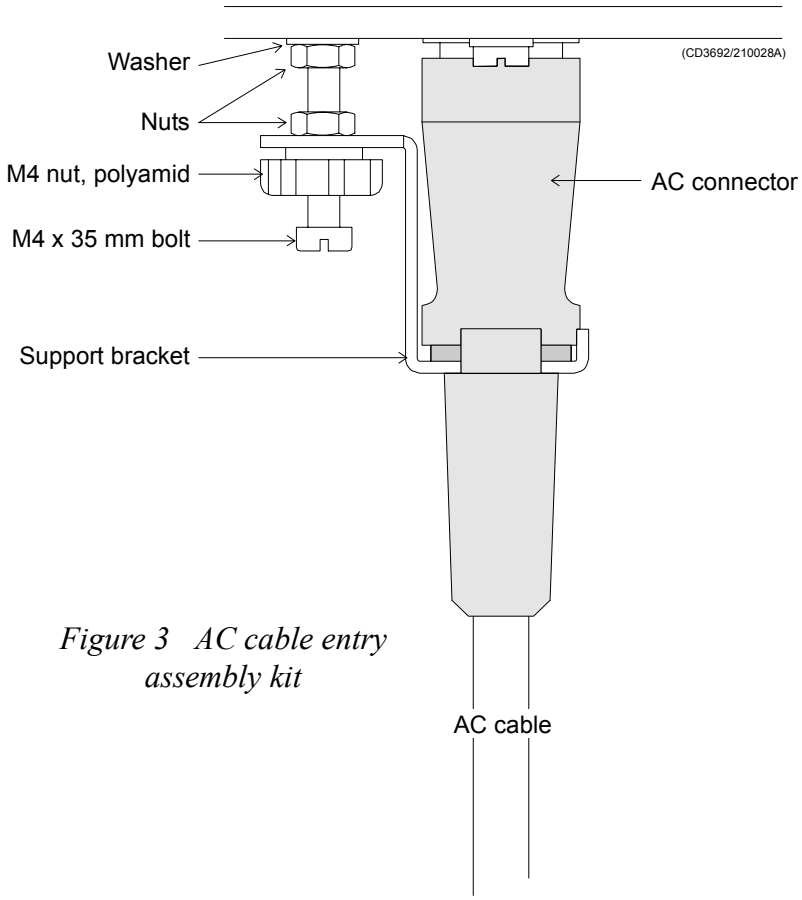


Figure 3 AC cable entry assembly kit

Special tools - Special wrenches (included with the cabinet), lifting equipment

References - None

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

Procedures

Note *Some systems are equipped with an optional Raw Data Logger. When installing a Transceiver Unit with this logger, remember to check the outline dimensions.*

Cabinet

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

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

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

3 Mount the main (upper) part of the Transceiver Unit cabinet.

- Four 8-mm bolts are used, one in each corner of the cabinet. The bolts and nuts are included with the delivery. You need to open the cabinet door to access the mounting holes. Use maximum torque 22 Nm.

4 Mount the lower part of the Transceiver Unit cabinet.

- Four 8-mm bolts are used, one in each corner of the cabinet. The bolts and nuts are included with the delivery. You need to open the cabinet door to access the mounting holes. Use maximum torque 22 Nm.

5 Mount the complete unit on the bulkhead.

- 10-mm bolts are enclosed. Use maximum torque 64 Nm.

AC cable entry (supply voltage)

The AC cable entry is supplied as an assembly kit.

→ *Refer to figure 3 on page 26.*

All parts required to assemble this connection are included with the delivery in a small plastic bag.

1 Insert the AC plug into the socket.

2 Assemble the support bracket, position it to support the AC plug, and tighten the nuts.

Transducer array cables and interfaces

1 Prepare the support bracket to receive the transducer array cables on the lower frame.

→ *Refer to figure 4 on page 28 for the cable entries.*

→ *The cable layout is described on page 52.*

2 Mount the cables according to the cable plan.

3 Close and secure cable bracket to secure the cables.

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

Surface preservation

All exposed metal surfaces which are likely to corrode should be painted according to the appropriate preservation scheme. This includes welds, base frames and support brackets. Care must be exercised to ensure the cabinet is not splashed with paint.

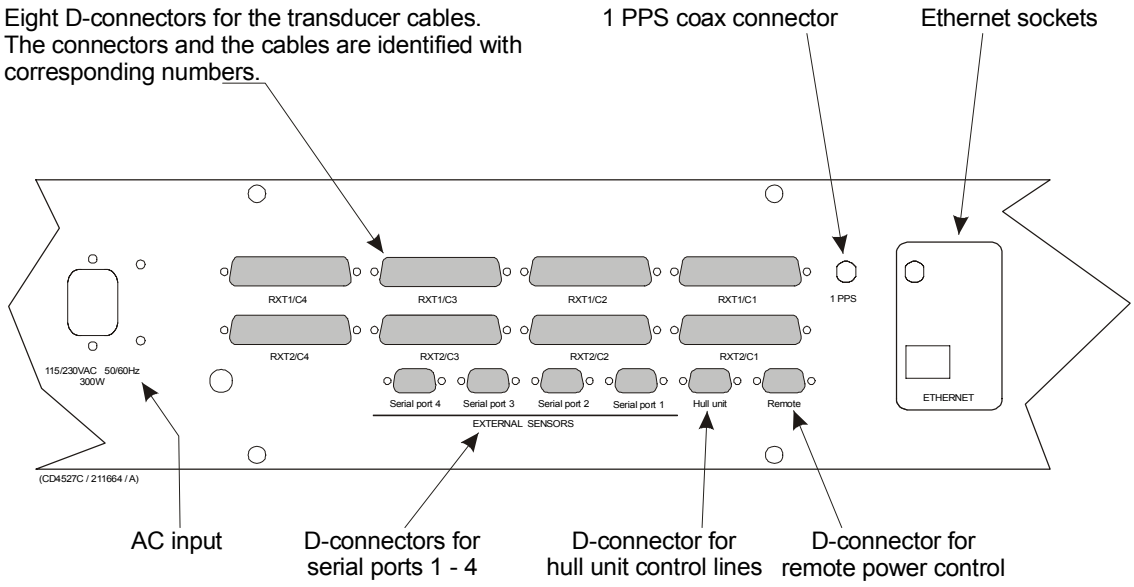


Figure 4 Cable entries under the EM 1002 Transceiver Unit

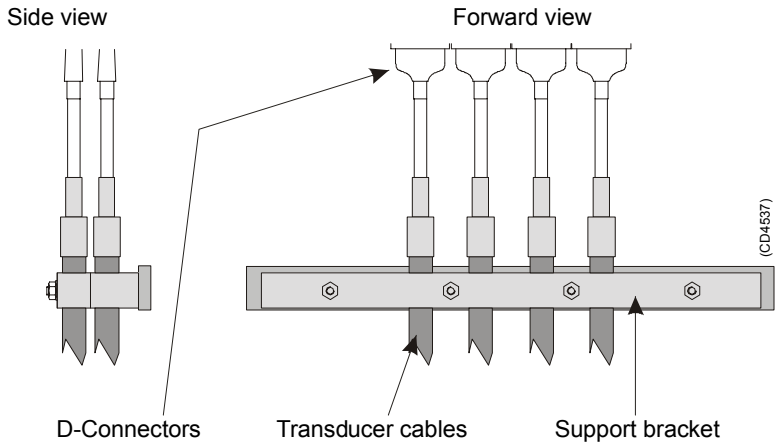


Figure 5 Transducer cable support

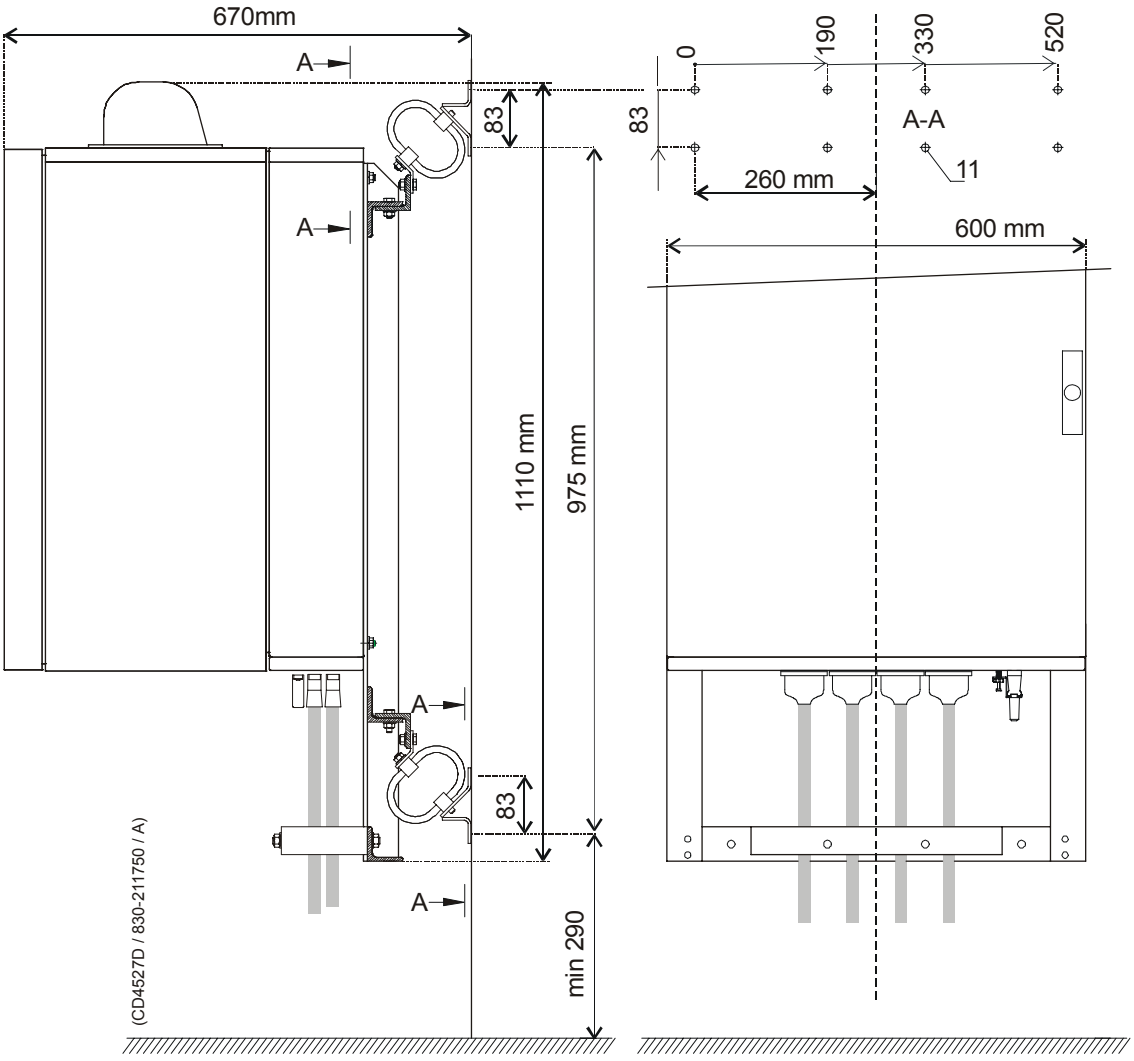


Figure 6 Transceiver Unit, dimensions

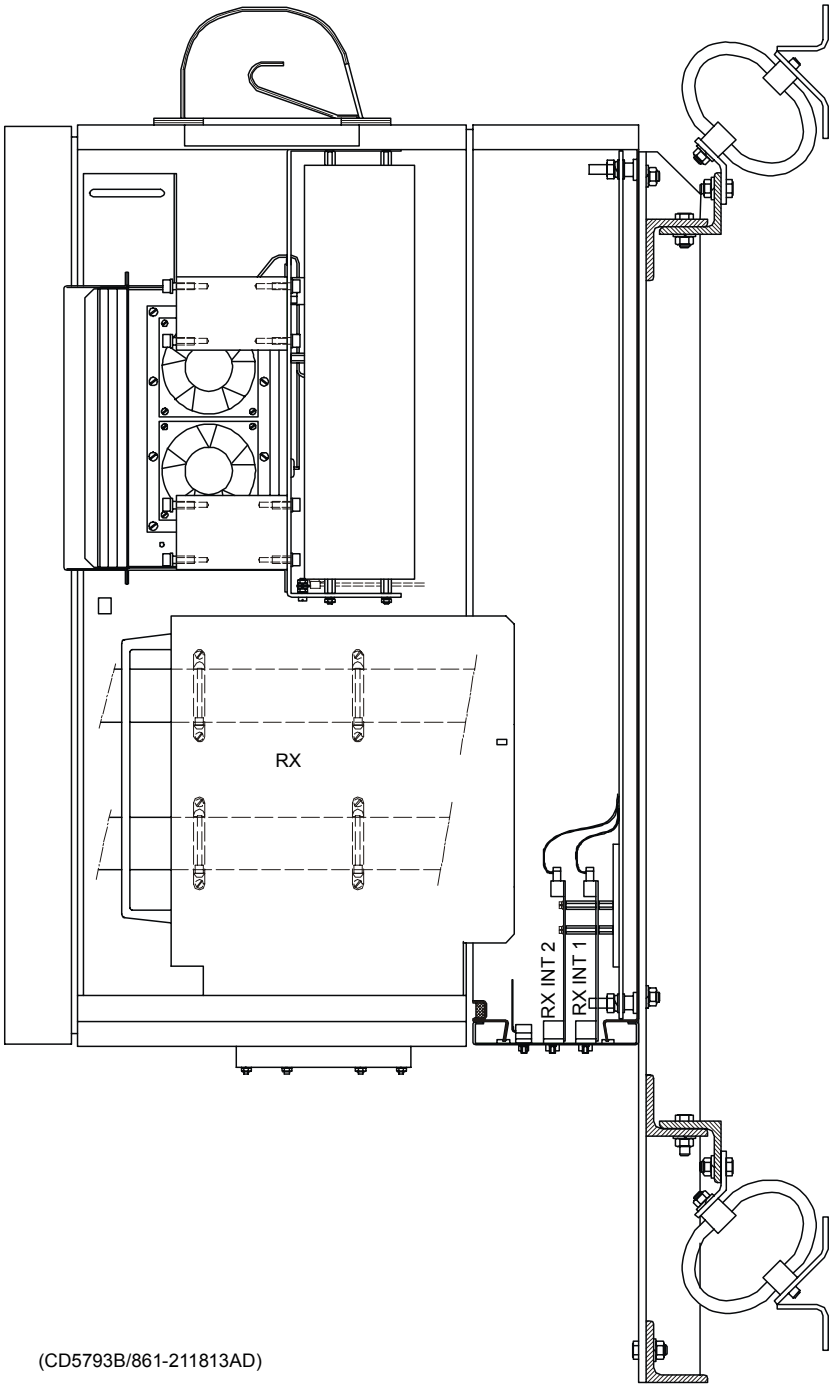


Figure 7 Wired Cabinet. Subassembly, Transceiver Unit

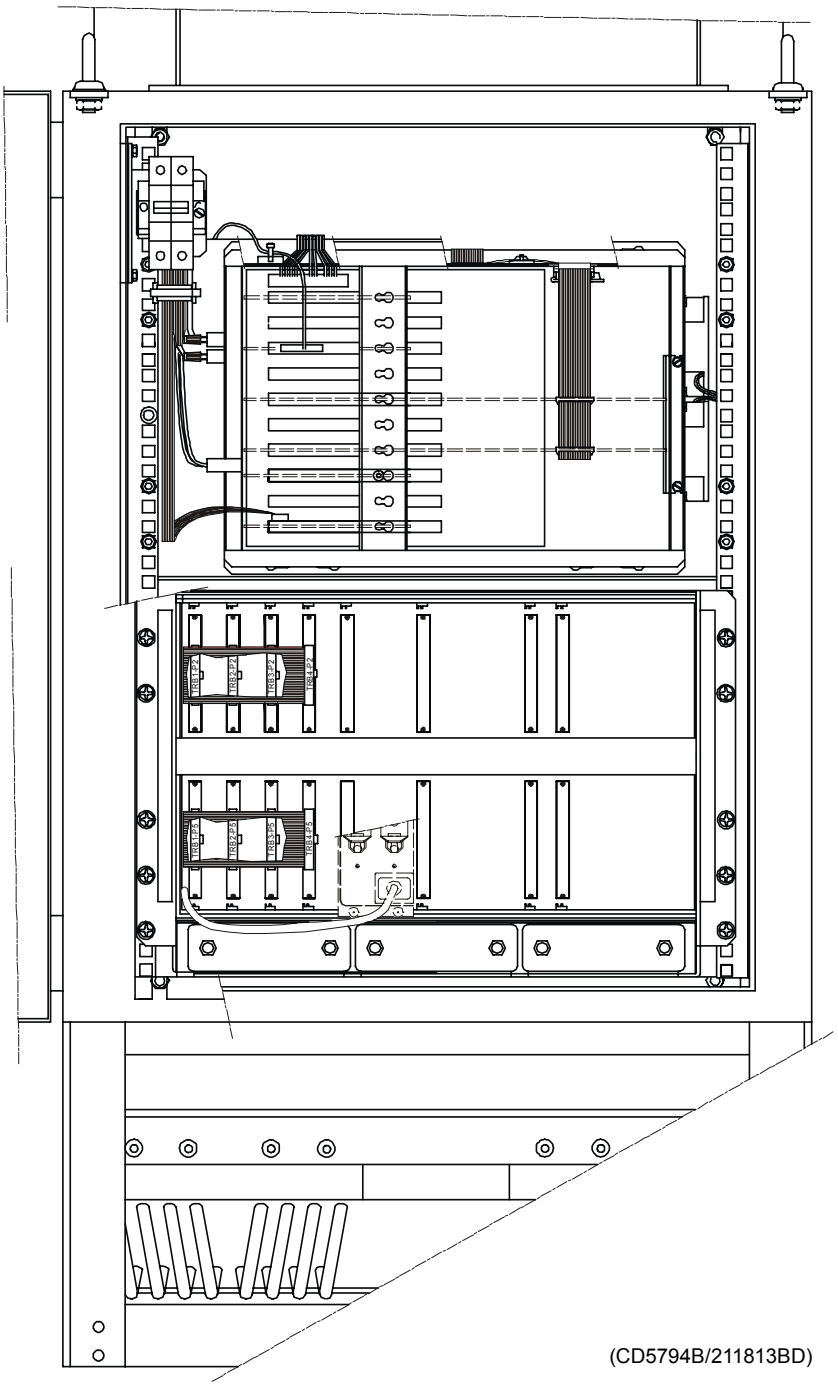


Figure 8 Wired rack, Transceiver Unit

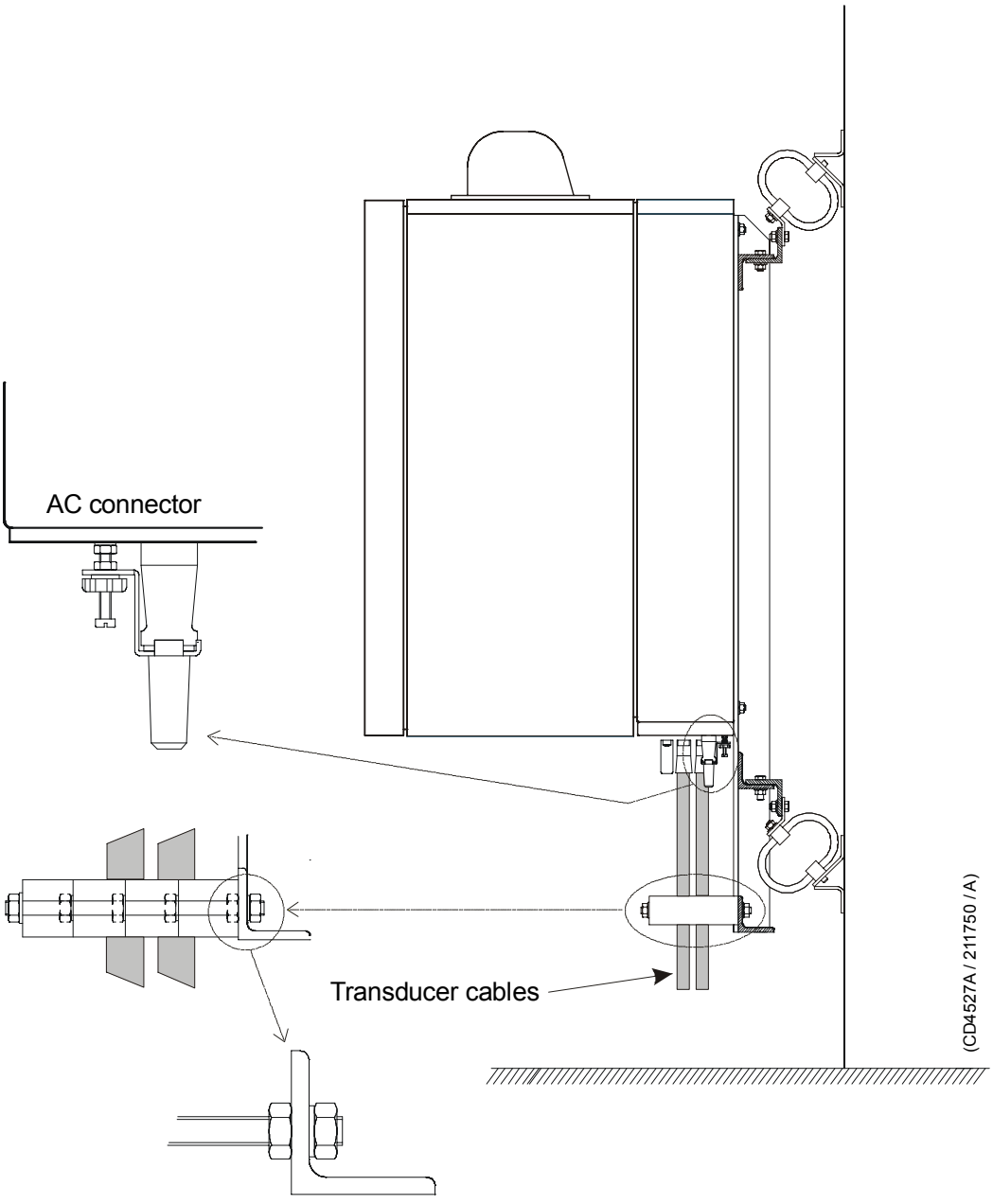


Figure 9 Transceiver Unit, side view

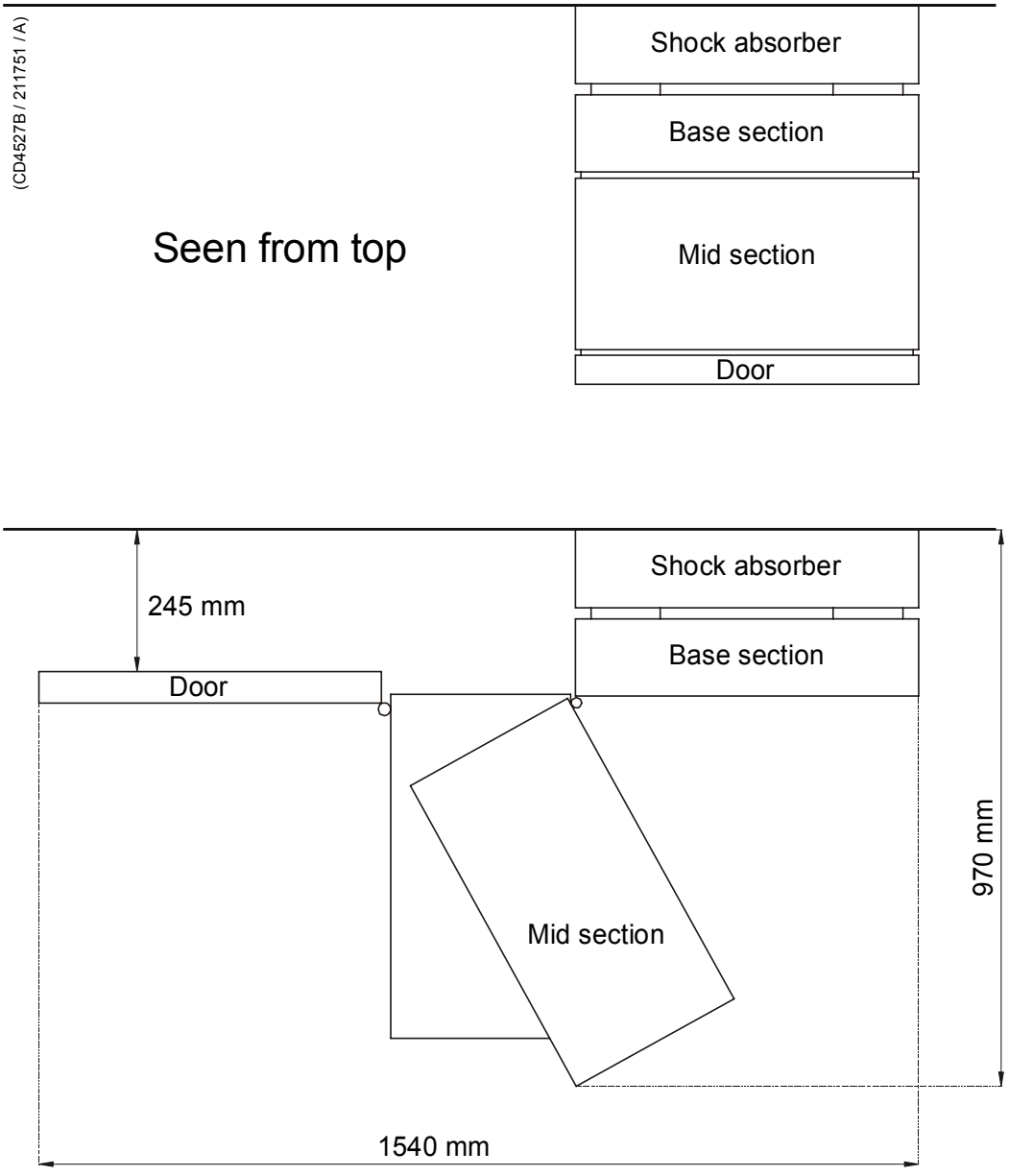


Figure 10 Transceiver Unit, space requirements

2.4 Remote Control Junction Box

Scope

A dedicated Junction Box has been designed to provide:

- Remote controlled system on/off with light indication
- System trigger output
- External trigger in via RS 232 serial line

These functions are all available through the **Remote** connector on the EM 1002 Transceiver Unit. Cable W202 is used to connect the Junction Box to this connector.

→ *Refer to page 87 for a description of the W202 cable.*

Note that this Junction Box is optional, and may not be a part of your delivery. If only the system on/off switch is required, this can be placed almost anywhere, and connected to the **Remote** connector as described by cable W202.

Location

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

General information

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

→ *Refer to page 36 for the outline dimensions.*

The standard version of this Junction Box only contains a terminal block and a switch with a lamp mounted on the door. Cable W202 must be connected to the terminal block. Other cables to external equipment are connected to the same terminal block. Cable W202 assumes that these cables are connected 1:1 compared to the 9-pin ’D’ connector at the other end.

Logistics

Safety - Refer to the general safety procedures.

Personnel - 1 trained mechanical/electrical worker

Special tools - None

References:

→ *Refer to page 36 for the outline dimensions.*

Procedures

1 Mark the location of the holes for the cabinet.

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

2 Drill the four 8.5-mm holes in the bulkhead.

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

3 Mount the cabinet.

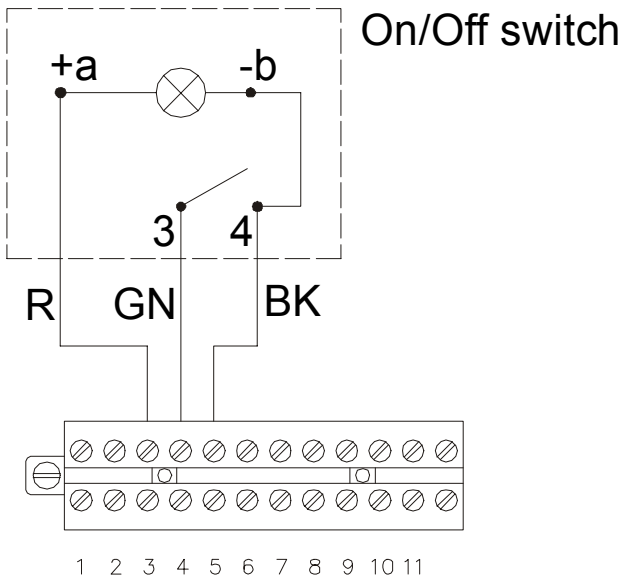


Figure 11 Junction Box - Standard circuit diagram

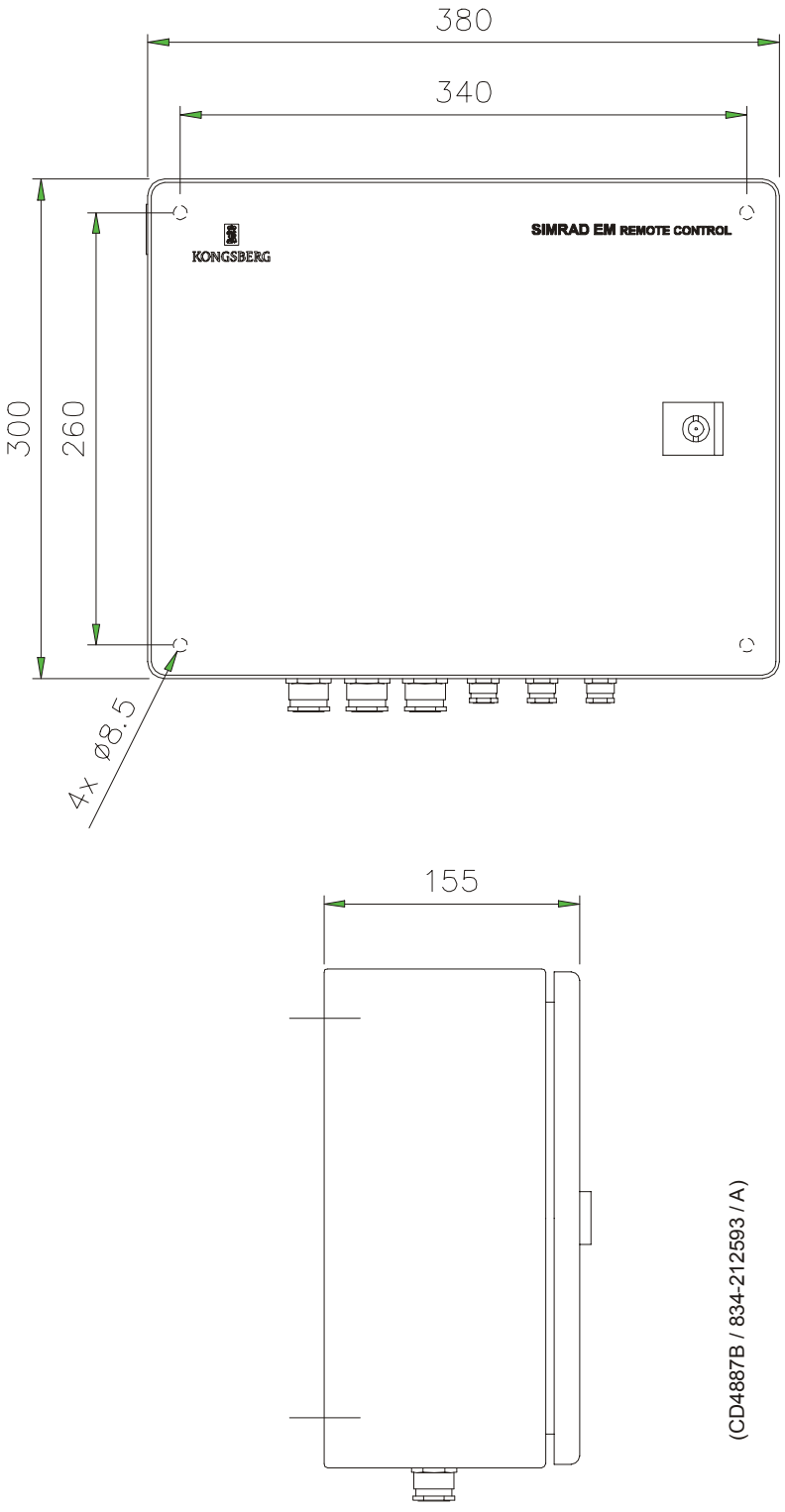


Figure 12 Remote Control Junction Box - outline dimensions

2.5 Junction Box

Description

The Junction Box is used to terminate the transducer cables. It must therefore be mounted as close to the gantry as possible. The length of the transducer cables (approximately 12.5 meters) limit the distance between the box and the gantry, while the distance between the Junction Box and the Transceiver Unit is limited by these cables (approximately 5 meters).

Logistics

Safety - Refer to the general safety precautions

Personnel - Trained mechanical workers

Number of workers - To be decided by installation shipyard

Ship location - No recommendations

Special tools - None

References:

→ *210960 Junction Box, outline on page 117.*

Installation

1 Drill 4 holes in the bulkhead, each capable of taking an M8 bolt.
- The bolts are NOT included with the unit.
- The location of the holes with reference to each other is shown in the outline drawing.

2 When the preparations for the bolts have been completed, open the front of the unit from the box. Hold the box in place while the bolts are mounted. Tighten to a torque of approximately 8 Nm.

3 Replace the front onto the box, and secure all the securing screws to prevent the ingress of water or other contamination.

Cabling

The transducer cables are connected to the termination boards in the junction box.

Observe the following procedure:

1 Open the junction box.

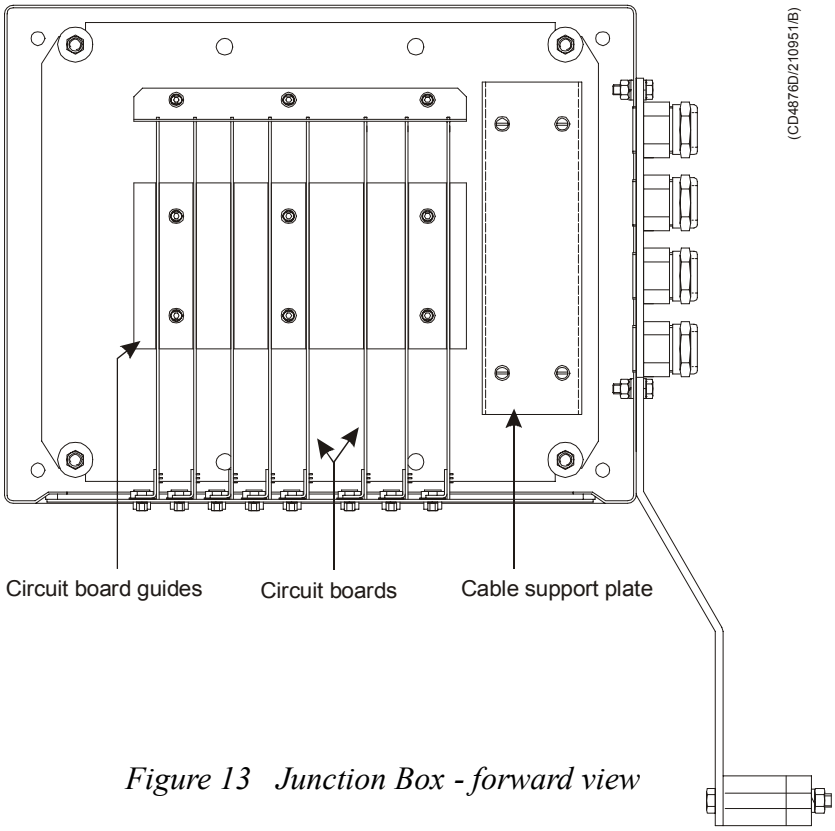


Figure 13 Junction Box - forward view

2 Dismantle the relevant cable gland and thread the various parts onto the cable in the correct order.

3 Pass the cable into the junction box.

4 Connect the cable plugs onto the circuit board connectors.

5 Ensure all connections are made firmly.

6 Reassemble the cable gland and tighten it to ensure a water proof seal, ensuring enough slack is left in the cable so none of the wires is under tension.

When all cables have been connected, check the entire assembly to ensure all the connections are correct and tight. Close the junction box, using a thin film of silicon grease on the seal to ensure the box will be water proof.

Terminating the transducer cables

The transducer cables are terminated on the sockets on the front edge of the circuit boards.

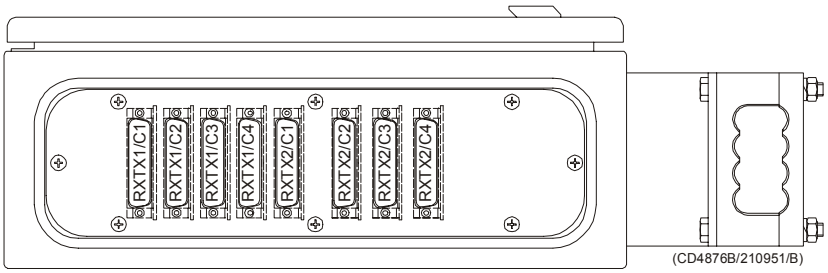


Figure 14 Junction Box - bottom view with the 'D' connectors for the Transceiver Unit cables

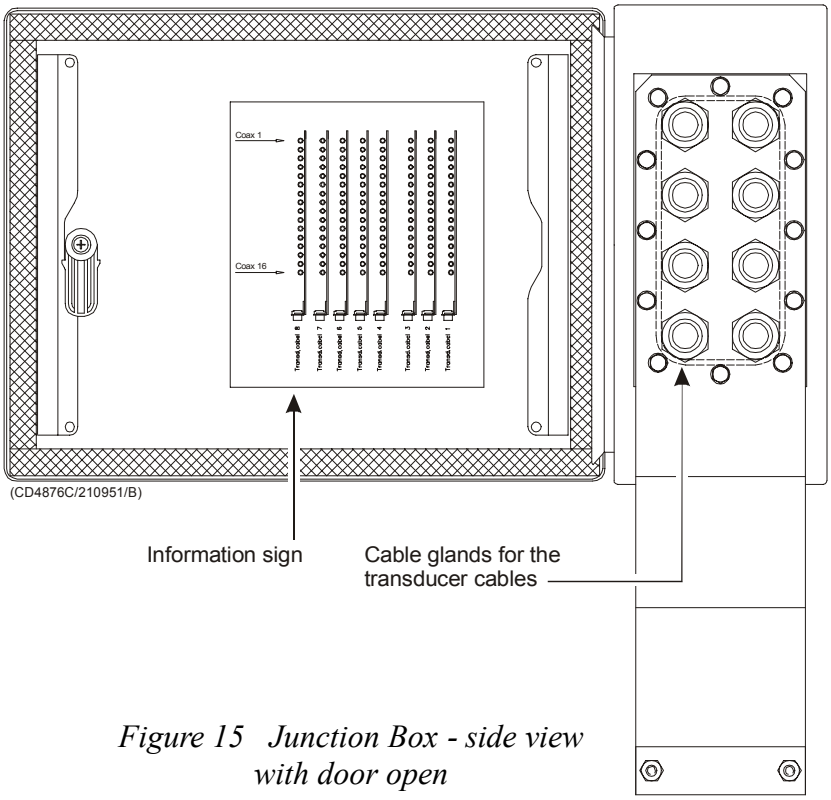


Figure 15 Junction Box - side view with door open

3 TRANSDUCER ARRAY

3.1 Introduction

This chapter describes the installation of the EM 1002 Transducer Array.

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

→ *Refer to page 113.*

The transducer array for the EM 1002 is fitted directly to the hull of the vessel.

The optional sound speed sensor must be installed close to the transducer array.

Note *This installation description applies only to the fitting of a transducer directly to the vessel's hull.*

3.2 Basic description

The EM 1002 transducer array consists of 128 transducer elements fitted into an array shaped as a segment of a cylinder. The array is mounted on the vessel's hull using a bed-plate and a bracket.

The installation of the transducer depends on the vessel's keel design. If the vessel's keel is prominent the transducer supporting bracket can be integrated into it. If the vessel's bottom is flat, the bracket and strengthening plate can be mounted directly onto it. It is important that the transducer is fitted to the vessel such that the bottom face of the array is below the keel of the vessel.

→ *Refer to drawing 830-088454 on page 115 for the outline dimensions.*

The transducer cables are passed up into the hull through a steel tube. This steel tube should reach above normal water level, and it should be terminated with a watertight cable gland.

→ *Cable glands are described on page 67.*

The vessel's hull must be strengthened with a steel plate 30 mm thick at the position where the transducer is to be installed. The support bracket is welded to the plate, and the transducer array is then bolted to the bracket. A fairing must be built around the array in order to stream-line it to reduce noise and drag, and to prevent objects, ropes etc. from becoming snagged on the bracket.

3.3 Locating the transducer array

General

Correct location of the system's tranducer is vital for the operational performance.

A single answer to the question of where to locate the blister with the transducer arrays cannot be given. It depends very much on the vessel's construction. However, there are some important guidelines which are generally applicable.

The boundary water layer

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

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

→ *Figure 16 shows in principle the boundary layer of a vessel moving through the water.*

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

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

Propeller noise

The propulsion propeller is the dominant noise source on most vessel types. The noise is transmitted through the sea water, and may in extreme cases reduce the maximum range capability of the EM 1002, despite its high sonar frequency.

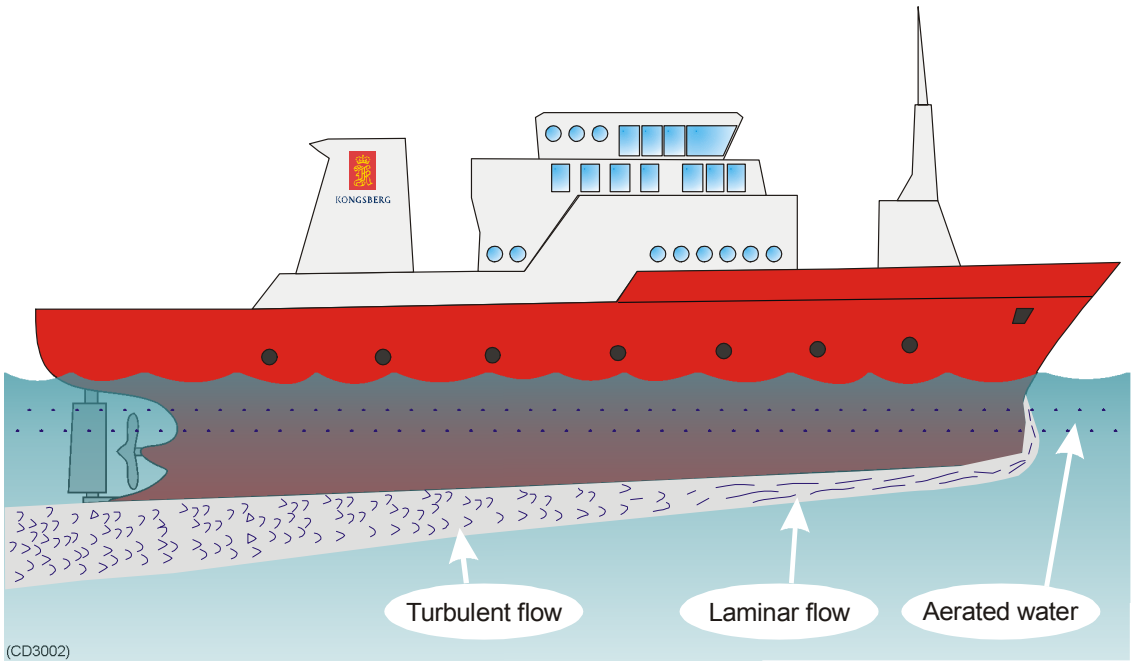


Figure 16 Sketch of boundary layer underneath the vessel

The transducer arrays should therefore 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.

When a bow thruster operates, the noise and cavitation bubbles from its propellors may make an echo sounder useless, almost no matter where its transducer is installed. And even when it is not in operation, its tunnel creates turbulence, and if the vessel pitches much, the tunnel may be filled with air or aerated water in the upper position which is then released in the lower position.

Therefore, the transducer array should be placed well away from the bow thruster.

Noise from protruding objects on the hull

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

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

Summary

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

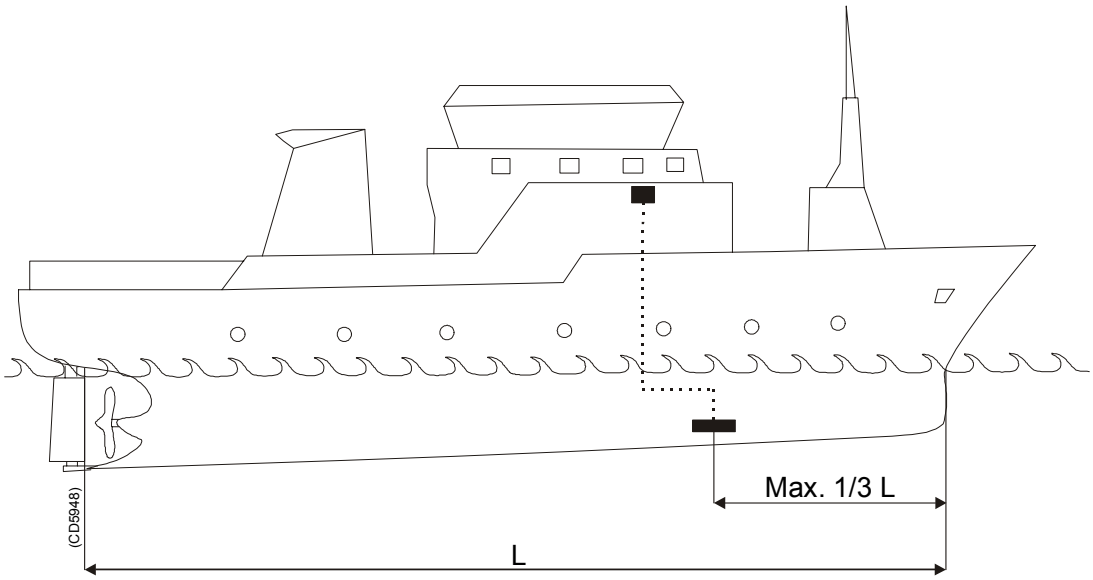


Figure 17 Recommended location of the transducer array on the hull

Generally the possibility of getting air bubbles in front of the transducer array is the most important factor, and thus the recommended transducer array location is in the fore part of the hull, with a maximum distance from the bow equal to one third of the total water line length of the hull, see the figure.

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

If a nominal horizontal mounting of the transducer array is desired, its face should be in parallel with the keel.

This applies to the vessel in normal trim and speed. Under no circumstances should the array be tilted backwards when the vessel is moving at an appreciable speed.

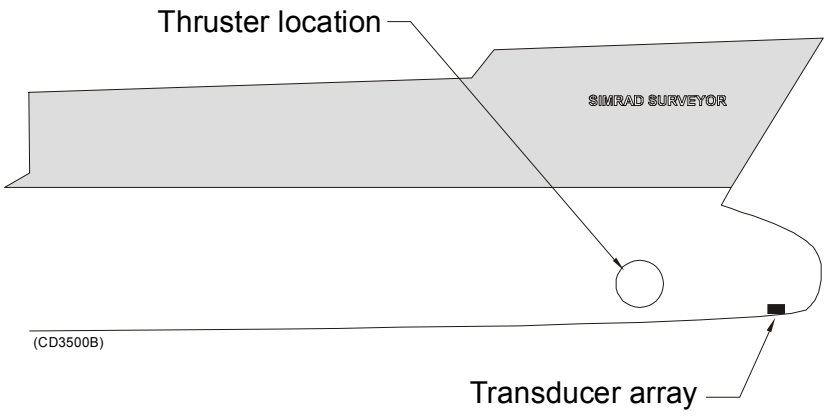


Figure 18 Transducer array located on a bulbous bow

3.4 Transducer array installation

Introduction

The installation of the transducer array includes as follows:

- Installation of the **base plate** for hull strengthening.
- Installation of the **mounting bracket**.
- Mounting of the **transducer array**.
- Manufacturing and fitting of the **stream-line fairing**.

On completion of the installation the entire system must be checked to ensure that the units and cabling are installed correctly. The transducer must then be aligned to ensure it is orientated correctly relative to the vessel.

After the fairing, steel pipe, and mounting bracket are fitted into position and painted, the transducer array can be installed. The sound speed probe (if applicable) should also be mounted at this time.

Refer to the installation drawings, cable plans, main interconnection diagrams and the drawings showing the outline dimensions of the unit located at the back of this section of the manual.

Note

The ship must be in dry dock for the transducer array installation.

Safety - Refer to the general safety procedures

Personnel - Two trained mechanical workers from the shipyard and 1 or 2 representatives from Kongsberg Maritime.

Ship location - Dry dock

Special tools - None

References - None

Location

→ *More information on how to select the location of the transducer array is found on page 41.*

The actual installation must be carried out according to the arrangement drawings designed specifically for the vessel. Deviations from this specification should not be made without consulting Kongsberg Maritime. In all cases, it is imperative that the transducer array has a free view under the keel.

Reinforcing braces must be added where the installation causes weakening of the hull construction.

If there is any chance of damage caused by welding or other work during the installation period, the array must be protected with heat resistant material.

Tolerances

There are three tolerance angles to take into consideration:

Roll angle

The upper edges of the array should be horizontal in the athwartships direction to about ± 2 degrees when the ship is floating at its normal trim.

Pitch angle

The upper edges of the array should be horizontal in the fore-and-aft direction to within 0 to +4 degrees when the ship is floating at its normal trim.

Azimuth angle

The array must be installed such that the short sides of the unit are parallel to the keel of the vessel to within ± 2 degrees.

Procedure

1 Disassemble the cable glands, and thread the cables up into the hull of the vessel.

2 Lift the transducer up into position and secure it.

Note *Once the securing bolts are tight, they should be locked in position (using wire threaded through holes drilled in their heads or some other approved method).*

3 Pull the transducer cables up through the steel pipe and into the vessel.

4 Ensure that enough slack is left to allow the unit to be removed if necessary

5 Ensure that the cable's radius of curvature around corners is within the specifications.

6 Bind the cables together using cable ties, and protect them from damage by a rubber sheath wrapping where they pass through pipe openings and bends.

7 Check the fairing and transducer, any irregularities must be removed.

- If necessary, hollows in the fairing must be filled, and rough edges and bumps must be removed. Protect the transducer during the smoothing operations. Any gaps between the transducer and the fairing over 4 mm wide must be filled using a silicon filler compound.

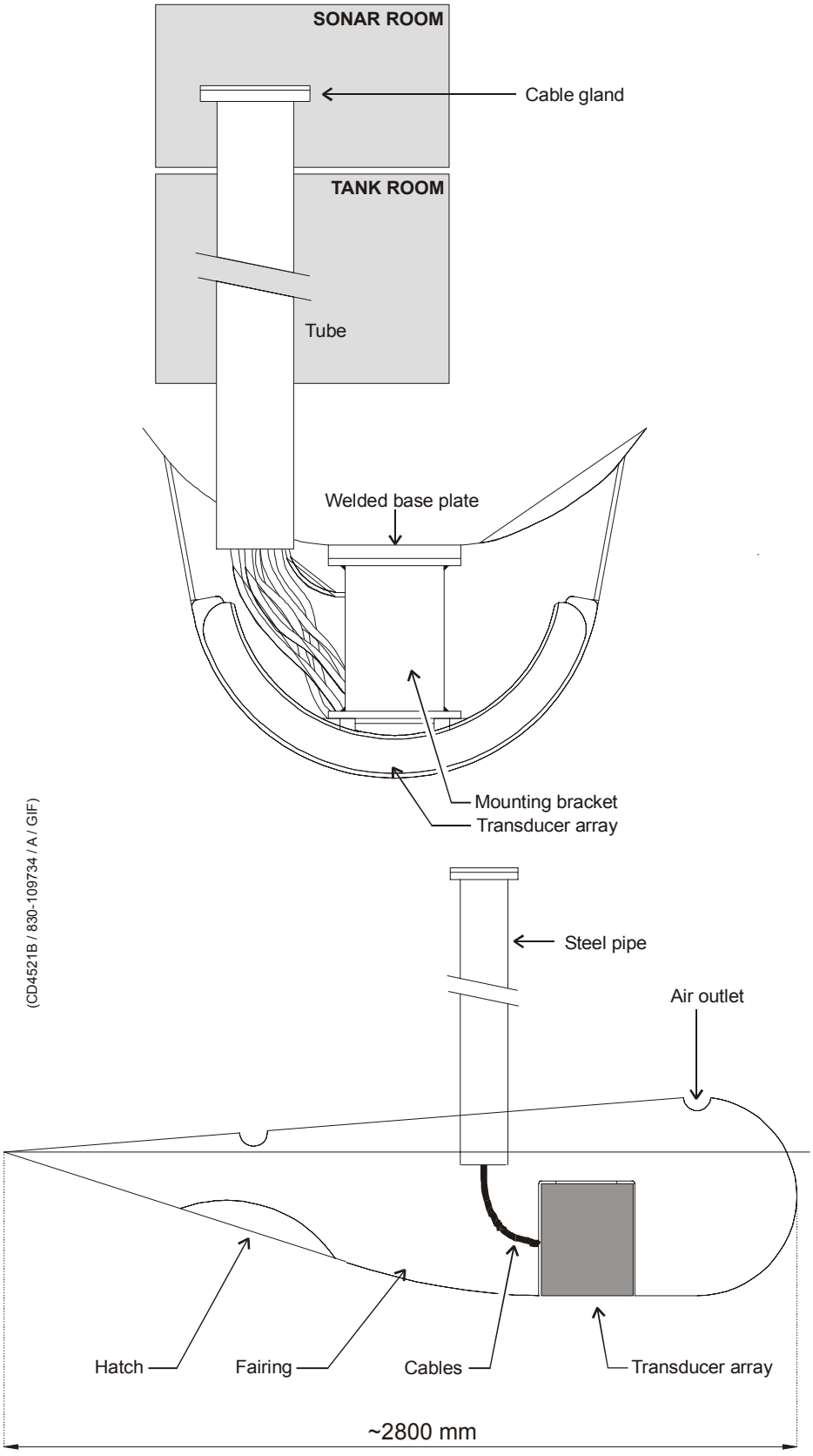


Figure 19 Arrangement drawing, example

Steel pipe

General

The cable pipe should be fitted behind and close to the transducer. Its exact location must be determined by the installastion shipyard, who will designe it into the installation drawings for the vessel. The top flange of the steel pipe must be equipped with a water-tight cable gland.

The installation must be approved by the vessel's classification society.

Logistics

Safety - Refer to the general safety procedures

Personnel - 2 trained mechanical workers

Ship location - Dry dock

Special tools - None

References - None

Procedure

No standard installation procedure is given as the procedure will depend on the type of hull, the intended location on the hull, and the actual design of the transducer support and fairing arrangement being fitted.

Base plate and mounting bracket

General

A base plate is required to strengthen the vessel's hull. It must be made by the installation shipyard, and designed to interface the top flange in the mounting bracket. The physical location of the base plate thus defines the location of the transducer array.

The location of the base plate and the mounting bracket must be calculated by personnel experienced in the installation of transducers. Its exact location must be designed into the installation drawings for the vessel.

The installation drawings may need approval from the vessel's classification society.

Logistics

Safety - Refer to the general safety procedures

Personnel - 2 trained mechanical workers

Ship location - Dry dock

Special tools - None

References:

→ *599-109711 Transducer mounting bracket, page 116*

Procedure

The base plate must be manufactured from a steel plate with the following minimum specifications:

- 30 mm thick
- Size 320 x 290 mm
- Six M16 holes placed to fit the top flange in the mounting bracket

No standard installation procedure is given as the procedure will depend on the type of hull, the intended location on the hull, and the actual design of the transducer support and fairing arrangement being fitted.

3.5 Surface protection

General

The transducer and support bracket must be protected against corrosion. Parts of the unit must be protected against galvanic corrosion by installing zinc anodes in appropriate areas. However, painting all exposed surfaces with a primer and topcoat/antifouling paint is a necessity. Paint also any exposed surfaces inside the vessel, the cable pipe and all welds.

Logistics

Safety - Refer to the general safety procedures

Personnel - 1 trained mechanical worker or painter

Ship location - Dry dock

Special tools - Primer, antifouling paint and paint tools

References - None

Procedure

1 Wash the transducer face carefully with hot water and soap.

- Do not use a metal brush!

2 Rinse the array with fresh water and let it dry.

3 Paint the transducer face with anti-fouling paint, max thickness must not exceed 60-80 micron.

- Recommended anti-fouling paint for the transducer face is:

  JOTUN SEAMATE HB-66
  - Racing (tin free)
  - Non-Stop (tin free)

  INTERNATIONAL
  - Hisol 900
  - Intersmooth Tin Free SPC (BGA 535 Dark Red or BGA 537 Red)

4 Paint all steel plates exposed to sea water. Use polyester primer and the same anti-fouling paint as for the rest of the ship's hull.

3.6 Fairing

General

The stream-lined fairing is intended to reduce drag and turbulence around the transducer and support bracket, and prevent ropes etc. from becoming snagged on the unit.

After the fairing has been installed, it must be protected against corrosion. Parts of the unit may be protected against galvanic corrosion by installing zinc anodes in appropriate areas. However, painting all exposed surfaces with a primer and topcoat/antifouling paint is a necessity.

Logistics

Safety - Refer to the general safety procedures

Personnel - Trained mechanical workers

Number of workers - Depends on installation complexity

Ship location - Dry dock

Special tools - Primer, antifouling paint and paint tools

References:

→ *Arrangement drawing, figure 19 on page 47.*

Procedure

Each system will require a special set of drawings for the production and installation of the fairing. These drawings must be made by the installing dockyard. It is very important that the fairing and the transducer fit correctly together and to the hull. To simplify the designing and building of the fairing, it is recommended to manufacture a dummy transducer.

4 TRANSDUCER CABLING

4.1 Introduction

This chapter explains how to terminate the transducer cables.

There are two different ways to mount the transducer array. Therefore there are two different “versions” of the EM 1002 system, the 1002 and the 1003 (see below).

In addition to this, the systems use a junction box.

→ *Refer to page 37 for information about the junction box.*

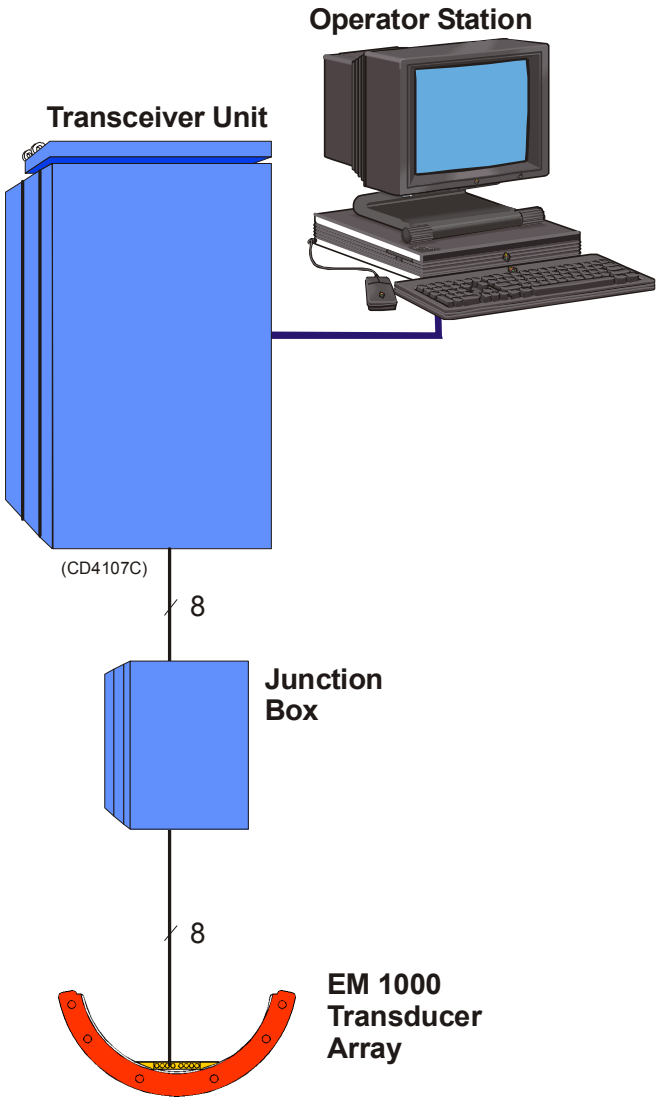
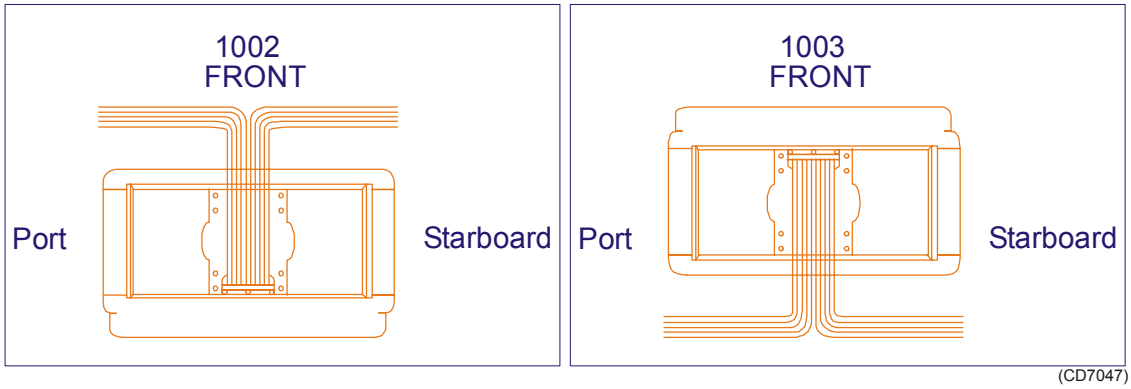


Figure 20 System diagram

Find out which way your transducer array is mounted:

Note *Even if one of these versions are called 1002, the 1003 is also an EM 1002 system.*

	1002	1003
Cover is pointing forewards (as seen on drawing below)		x
Cover is pointing backwards (as seen on drawing below)	x	



(CD7047)

1002 installation

If you have a 1002 installation (see the table above), channel 128 on the transducer will be on the port side. Inside the junction box this will be cross connected, so that channel 128 goes into the beamformer as channel 1. (Beamforming is done directly).

1003 installation

If you have a 1003 installation (see the table above), connect the transducer in the same way as for 1002. The starboard element (channel 128), will go into the beamformer as element number 1.

You also have to use a file called **calib** when installing the 1003. Set the model name to be 1003. The software will then cross connect the channels.

This file follows the transducer's orientation. As an example, on a 1003 installation, adjustments of "beam" 1 will affect starboard side, while for the 1002, it will affect the port side.

For the Raw Data Logger display, the port side transducer element will be on the left side for the 1002 and on the right side for 1003 installations.

Note *BIST test output: Channel 1 is on the port side for 1002 and on the starboard side for 1003 installations (RX channels).*

Cabling

Transducer array

The transducer array is connected with eight cables. Each cable contains 16 indivdual coax cables, and each coax is terminated in a small coax connector.

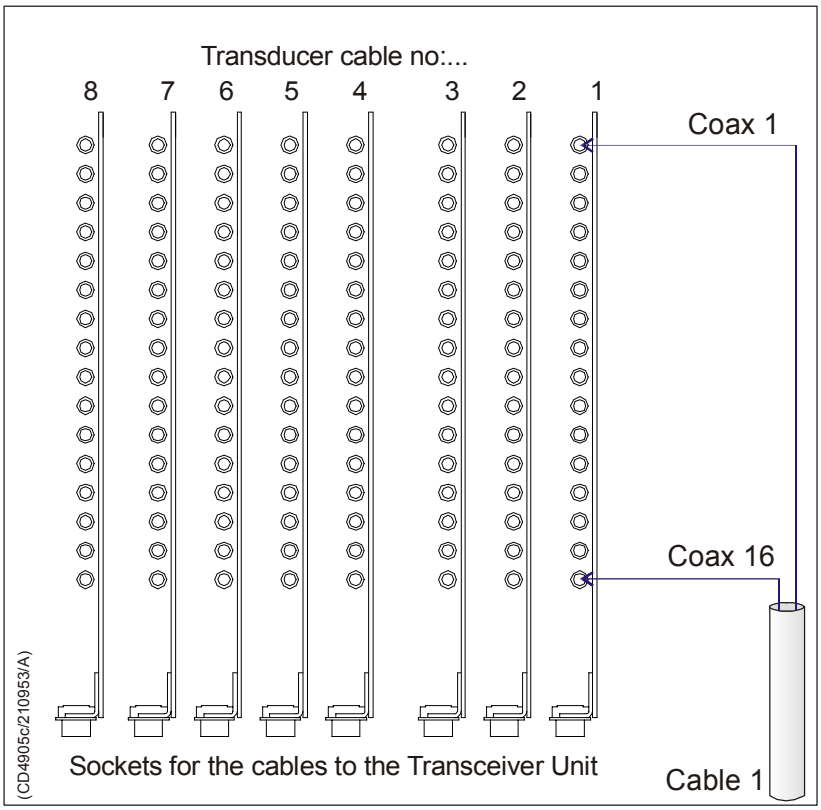


Figure 21 Junction Box terminations

The cable identified as **RXT2/C4** (Cable 1) is connected to the right-most circuit board in the Junction Box (board 1). The cable's coax 1 (= Channel 1) is connected to socket 16 (= Channel 16 on the top socket) on the board. The channels are thus connected in the reverse order on each board.

The remaining coax connectors are terminated according to the following pattern:

Cable 1:

Cable	Coax	Board	Board Ch	SW Ch
1	1	1	16	128
1	2	1	15	127
1	3	1	14	126
1	4	1	13	125
etc				

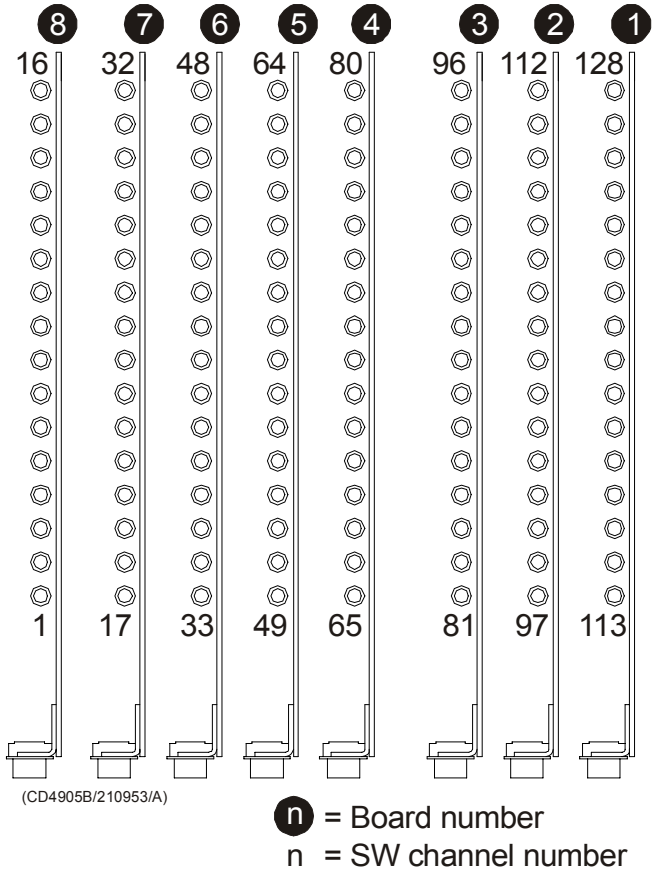


Figure 22 Physical connectors related to software channels

Cable 2:

Cable	Coax	Board	Board Ch	SW Ch
2	1	2	16	112
2	2	2	15	111
2	3	2	14	110
2	4	2	13	109
etc				

Cable 3:

Cable	Coax	Board	Board Ch	SW Ch
3	1	3	16	96
3	2	3	15	95
3	3	3	14	94
3	4	3	13	93
etc				

Cable 4:

Cable	Coax	Board	Board Ch	SW Ch
4	1	4	16	80
4	2	4	15	79
4	3	4	14	78
4	4	4	13	77
etc				

Cable 5:

Cable	Coax	Board	Board Ch	SW Ch
5	1	5	16	64
5	2	5	15	63
5	3	5	14	62
5	4	5	13	61
etc				

Cable 6:

Cable	Coax	Board	Board Ch	SW Ch
6	1	6	16	48
6	2	6	15	47
6	3	6	14	46
6	4	6	13	45
etc				

Cable 7:

Cable	Coax	Board	Board Ch	SW Ch
7	1	7	16	32
7	2	7	15	31
7	3	7	14	30
7	4	7	13	29
etc				

Cable 8:

Cable	Coax	Board	Board Ch	SW Ch
8	1	8	16	16
8	2	8	15	15
8	3	8	14	14
8	4	8	13	13
etc				

5 TECHNICAL SPECIFICATIONS

Notice

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

Physical specifications

Transducer Array

Length	398 mm
Depth	887 mm
Width	473 mm
Weight	130 kg (90 kg in water)
Cable length	12.5 m

Transceiver Unit

Length	746 mm
Depth	630 mm
Width	600 mm
Weight	60 kg

Dimensions and weights will depend on your choice of workstation model and peripherals.

Power requirements

Operational voltage and frequency

Transceiver Unit	115 / 230 Vac, < 1000 W, 47 to 63 Hz *(The cabinet is wired for 230 Vac from the factory).*
Operator Station	100 to 240 Vac, < 100 W, 47 to 63 Hz
	– The single phase supply must be protected with 16A slow–blow fuses

6 CABLE LAYOUT

6.1 Introduction

The standard cables used between the EM 1002 system units and between the units and their external devices are shown here. For larger installations where the EM 1002 is a subsystem, the cables will also be shown in the cable layout plan and interconnection diagram specific for the vessel into which the system is installed.

Note

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

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

6.2 System cabling

Cable layout

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

Shipyard and system cables

General

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

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

Shipyard cables

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

For each cable, the following information is provided:

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

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

System cables

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

Operator Station cables

The illustration and the list below specifies each cable used on the EM 1002 Operator Station. References are made to detailed cable drawings.

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

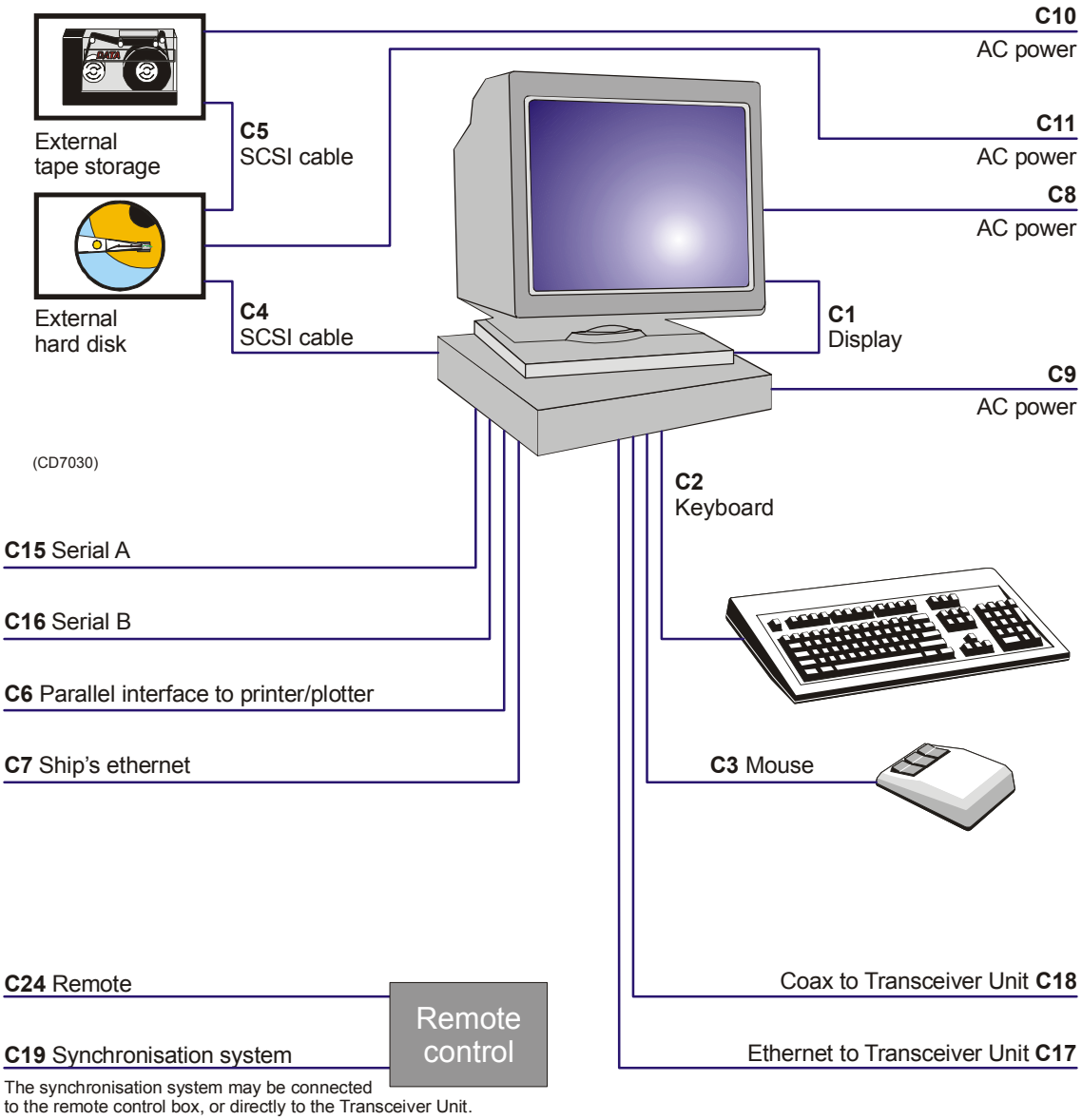


Figure 23 EM 1002 Operator Station - Cable plan

C1 - Display

This is a standard VGA cable. It is supplied with the display unit.

→ *Cable details on page 91.*

C2 - Keyboard

This is a standard keyboard cable. It is normally supplied with the keyboard.

→ *Cable details on page 92.*

C3 - Mouse or pointing device

This is a standard mouse cable. It is normally supplied with the keyboard. Note that different workstation types allow for different mouse connections. On Unix workstations, the mouse is often connected to the keyboard, while most PCs provide a socket on the computer assembly.

→ *Cable details on page 93.*

C4 / C5 - SCSI cables

These cables are used only if the Operator Station is supplied with external SCSI storage devices. The cables are then supplied by the manufacturer.

C6 - Centronics printer

The Operator Station only provides one parallel interface to plotter or printer. In most cases, plotters and printers are connected directly to the ship's ethernet network. If a parallel printer is used, this cable is provided with the printer.

→ *Cable details on page 94.*

C7 - Ship's ethernet

The Operator Station may be equipped with one or two ethernet interface boards. When two -2- boards are provided, one is used to communicate with the ship's ethernet while the other (C17) is used to communicate with the Transceiver Unit.

This cable must be provided by the installation shipyard.

→ *Cable details on page 90.*

C8 / C9 / C10 / C11 - AC power

These are AC mains cables. Note that C10 and C11 are only required if external SCSI storage devices are implemented. All AC mains cables are provided by the manufacturer.

→ *Cable details on page 89.*

C12 / C13 / C14 - Not used

For future expansion.

C15 - Serial A

This serial line is intended for a sound speed probe, which is normally interfaced by means of a small junction box and a power supply.

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

This cable must be provided by the installation shipyard.

→ *Sound speed probe cable details on page 86.*

→ *Standard 9-pin RS-232 serial line details on page 84.*

C16 - Serial B

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

This cable must be provided by the installation shipyard.

→ *Standard 25-pin RS-232 serial line details on page 82.*

→ *Standard 9-pin RS-232 serial line details on page 84.*

C17 - Transceiver Unit RJ-45 interface

The Operator Station may be equipped with one or two ethernet interface boards. When two -2- boards are provided, one is used to communicate with the ship's ethernet (C7) while the other (C17) is used to communicate with the Transceiver Unit.

The interface between the Operator Station and the Transceiver Unit is made with either C17 or C18. In some cases two parallel ethernet cables may be used. These are then identified as C17A and C17B.

This cable must be provided by the installation shipyard.

→ *Cable details on page 90.*

C18 - Transceiver Unit Coax interface

The interface between the Operator Station and the Transceiver Unit is made with either C17 or C18.

If applicable, this cable must be provided by the installation shipyard.

→ *Cable details on page 85.*

C19 - Synchronisation system

Refer to the Transceiver Unit cabling.

C24 - Remote

Refer to the Transceiver Unit cabling.

Transceiver Unit cables

The illustration and the list below specifies each cable used on the EM 1002 Transceiver Unit. References are made to detailed cable drawings.

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

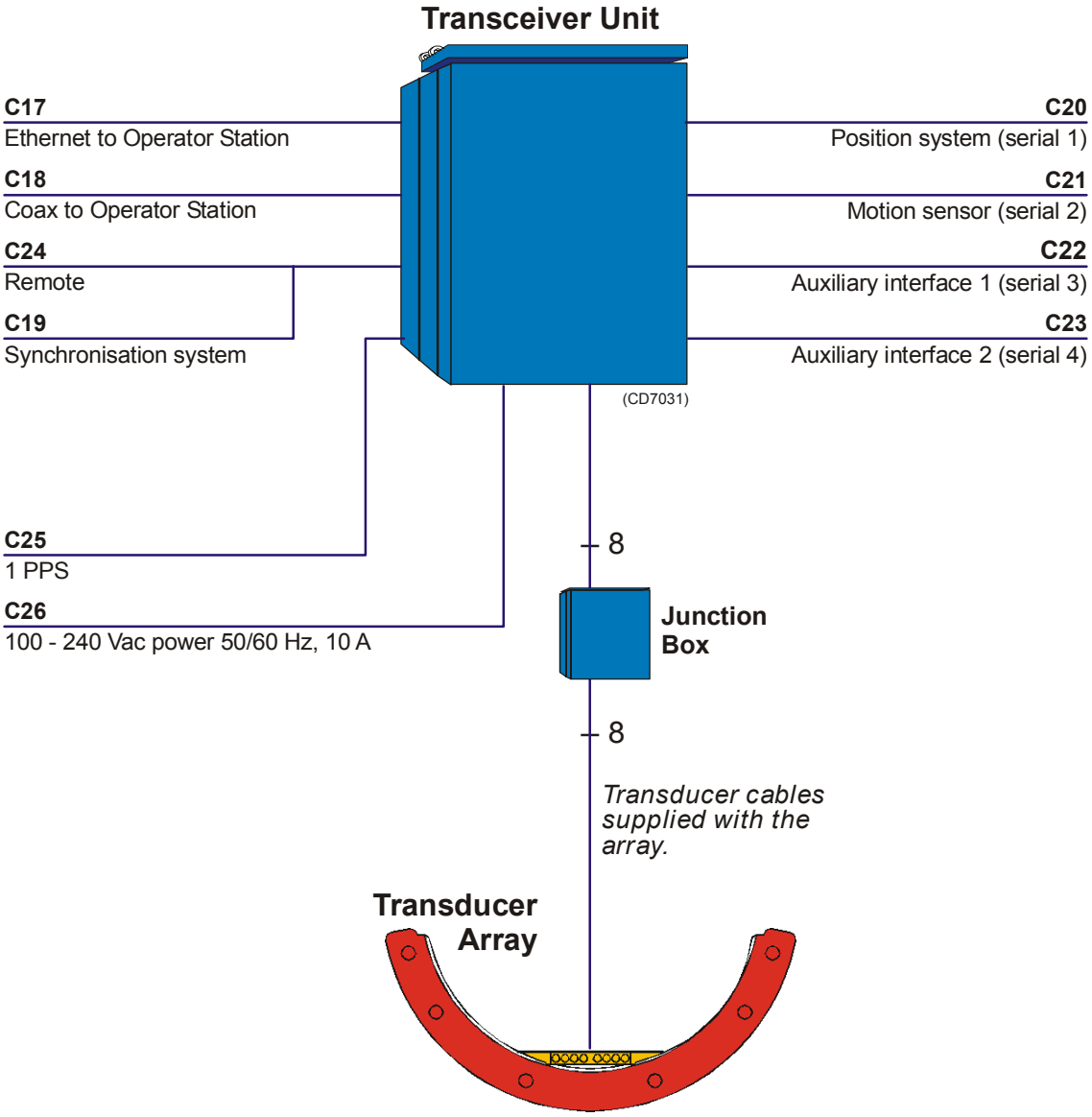


Figure 24 EM 1002 Transceiver Unit - Cable plan

C17 - Transceiver Unit RJ-45 interface

Refer to the Operator Station cabling.

C18 - Transceiver Unit Coax interface

Refer to the Operator Station cabling.

C19 - Synchronisation

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

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

→ *Cable details on page 87.*

The cable must be provided by the installation shipyard.

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

The Transceiver Unit is equipped with four serial lines. All connectors are 9-pin male D-connectors. The serial lines are normally set up as follows:

Serial Port 1 - Positioning systems

Serial Port 2 - Motion sensor

Serial Port 3 - Auxiliary 1

Serial Port 4 - Auxiliary 2

→ *Cable details on page 83.*

The cables must be provided by the installation shipyard.

C24 - Remote

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

→ *Cable details on page 87.*

The cable must be provided by the installation shipyard.

C25 - 1PPS

This is a timing signal terminated in a coax connector.

→ *Cable details on page 85.*

The cable must be provided by the installation shipyard.

C26 - AC power

These is the AC mains cable to the Transceiver Unit.

→ *Cable details on page 89.*

The AC cables are supplied by the manufacturer.

Transducer cables

The transducer cables are supplied by the manufacturer.

EM 1002 Transducer array

When the transducer array is mounted under the hull, the eight transducer cables are terminated into the eight D-sub connectors under the Transceiver Unit.

The cables on the transducer array are identified as follows:

`RXT1/Cn`

where n=1 through 4, and

`RXT2/Cn`

where n=1 through 4.

The cables are also identified with a number between 1 and 8, as follows:

- RXT1/C1 - Cable 8
- RXT1/C2 - Cable 7
- RXT1/C3 - Cable 6
- RXT1/C4 - Cable 5
- RXT2/C1 - Cable 4
- RXT2/C2 - Cable 3
- RXT2/C3 - Cable 2
- RXT2/C4 - Cable 1

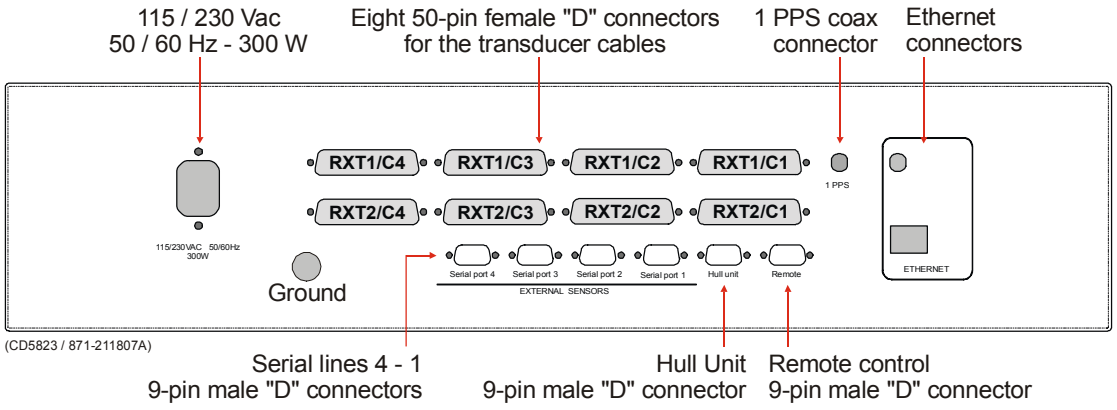


Figure 25 The connector panel under the Transceiver Unit

6.3 Cable gland assembly procedure

Purpose

Cable glands are used whenever a cable passes through a water-tight bulkhead or into a cabinet, to seal the opening through which the cable passes and to protect the cable from abrasion on the edges of the hole. Follow the guidelines detailed here when installing cables through cable glands.

Note *There are many different types of cable gland on the market. This procedure describes the types used (now and previously) as standard in the units manufactured by Kongsberg Maritime. The cable glands are not supplied with the system.*

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

Note *The screen in transducer cables must never be connected to ship's ground in the cable glands!*

General procedure

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

- I.e. Switch off and remove the supply fuses from any units or systems into which the cables are already connected.

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

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

3 Depending on whether the cable has already been installed in conduits, either.

a (installed) measure the maximum length of cable required to reach from the final cable clip outside the cabinet to the terminal blocks inside the cabinet, add 20 cm, then remove the excess cable,

or:

b (loose cable) measure the maximum length of wire required to reach from the cable gland to the terminal blocks inside the cabinet, add 20 cm. and mark the cable.

Note

*The cable's outer insulation will extend into the cable gland to a point approximately 5 mm **outside** the outer surface of the cabinet wall into which the cable gland is secured.*

4 Taking care not to damage the screening, carefully remove the outer insulation from the required cable length.

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

Securing and terminating the cables

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

2 Secure the cable within the cabinet using cable clips.

3 Check the terminal connections against the wiring diagram to ensure they are correct.

Follow the same procedure for all the cables and cable glands. Once all the cables have been fitted:

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

Once all the system cables are connected and checked:

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

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

Multi-diameter modules

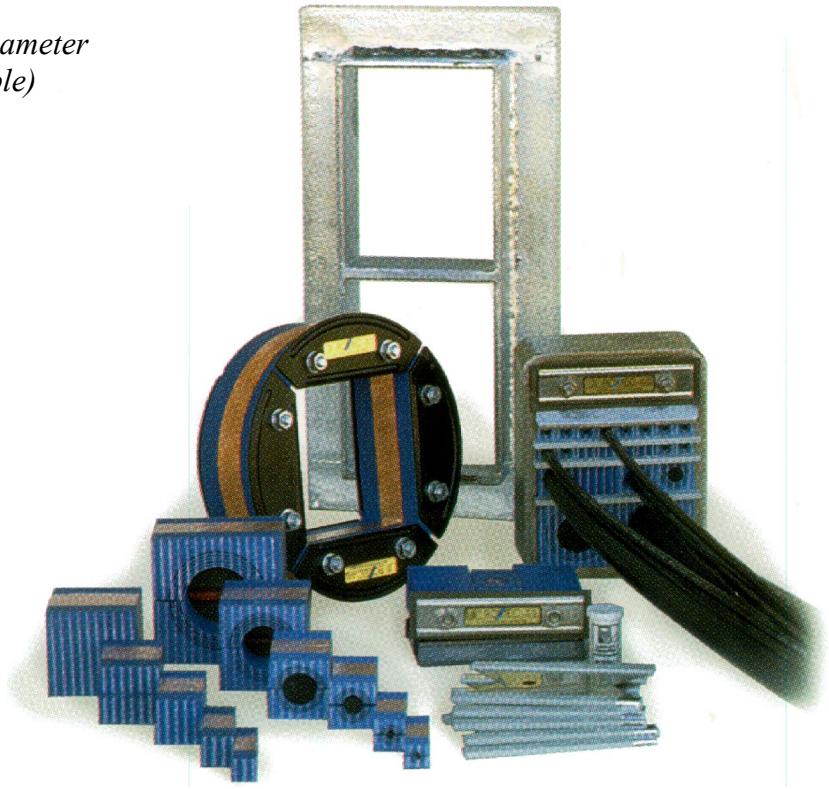
Multi-diameter cable glands are now available from several sources, and these types are becoming increasingly popular due to ease of use. Only a brief description of the system will be presented her, further information with technical specifications and installation descriptions must be obtained from the manufacturer(s).

The illustrations and examples here are from the following manufacturer:

```
Roxtec AB
Bx 540
S-371 23 Karlskrona, SWEDEN
http://www.roxtec.se
```

To use this sealing system, you first need to cut an opening in the wall (bulkhead, cabinet etc) you wish to penetrate, and this hole must be sized to fit one of the standard rectangular or circular frames provided by the manufacturer.

Figure 26 Multi-diameter modules (example)



After the frame has been mounted, the cables can be pulled through, and in most cases the opening will be large enough even to accept the plugs on the cables.

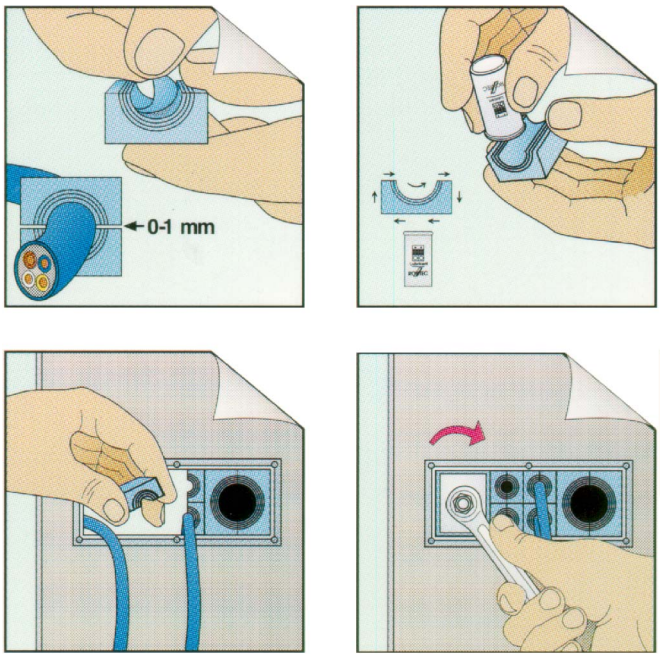


Figure 27 Multi-diameter system - Principal procedure

Once the cables are through, each cable is secured with a square module, which is adjusted to fit the cable's outer diameter.

When the required number of modules are installed, the assembly is tightened with a compression unit.

This system is available with a large number of various modules and compression units, and it will also comply to screening and EMC requirements.

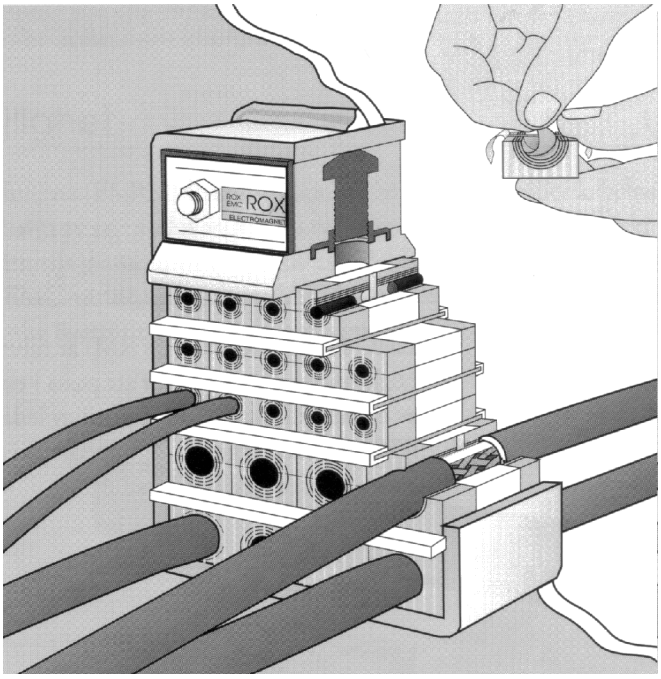


Figure 28 Multi-diameter system - The finishied assembly

Standard type

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

- Switch off and remove the supply fuses from any units or systems into which the cables are already connected.

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

3 Slacken and remove the compression nut from the cable gland, and extract the compression seal and the screen collar from the body of the gland.

Note

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

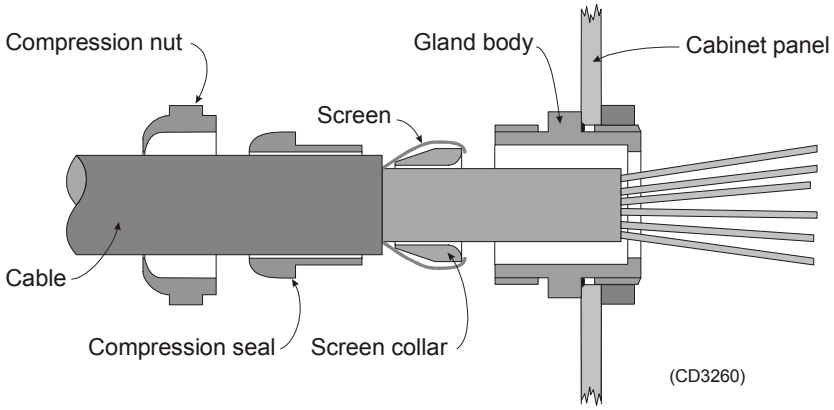


Figure 29 Standard cable gland assembly

4 Depending on whether the cable has already been installed in conduits, either:

c (installed) measure the maximum length of cable required to reach from the final cable clip outside the cabinet to the terminal blocks inside the cabinet, add 20 cm, then remove the excess cable,

or:

d (loose cable) measure the maximum length of wire required to reach from the cable gland to the terminal blocks inside the cabinet, add 20 cm. and mark the cable.

Note

*The cable's outer insulation will extend into the cable gland to a point approximately 5 mm **outside** the outer surface of the cabinet wall into which the cable gland is secured.*

5 Taking care not to damage the screening, carefully remove the outer insulation from the required cable length.

6 Leaving 12 mm of the screen exposed from the insulation, cut off the remainder.

7 Taking care not to damage the screening, slide the compression nut (smallest diameter first) over the cable and onto the intact insulation.

8 Taking care not to damage the screening, slide the compression seal (rounded end first) over the cable and onto the intact insulation.

9 Slide the screen collar (narrow end first) onto the cable and fit it underneath the screen. Slide it as close to the intact outer insulation as possible.

10 If the screen extends beyond the "flat" end of the screen collar, fold any excess length over the end of the collar such that the screen will be gripped between the collar and the gland body when the parts are assembled.

11 Carefully thread the cable through the gland body till the screen collar is tight into the gland body.

12 Slide the compression seal into the gland body till the shoulder is hard up against the gland body.

13 Slide the compression nut over the compression seal and engage the threads.

14 While holding the gland body to prevent it turning, and pressing the cable into the gland, tighten the compression nut onto the gland body.

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

16 Secure the cable within the cabinet using cable clips.

17 Check the terminal connections against the wiring diagram to ensure they are correct.

Follow the same procedure for all the cables and cable glands. Once all the cables have been fitted:

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

Once all the system cables are connected and checked:

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

20 Perform a system test to ensure the installation has been conducted successfully.

Additional type 1 (842-093878)

1 Mount the cable gland body, and tighten it with the nuts on each side of the cabinet wall.

2 Slide the metal washers, the rubber gasket and the compression nut onto the cable in the order indicated in the figure.

→ *Refer to figure 30.*

3 Bend the screen over the rubber gasket.

4 Push the rubber gasket and the two metal washers carefully into the cable gland body.

5 While holding the gland body to prevent it turning, and pressing the cable into the gland, tighten the compression nut onto the gland body.

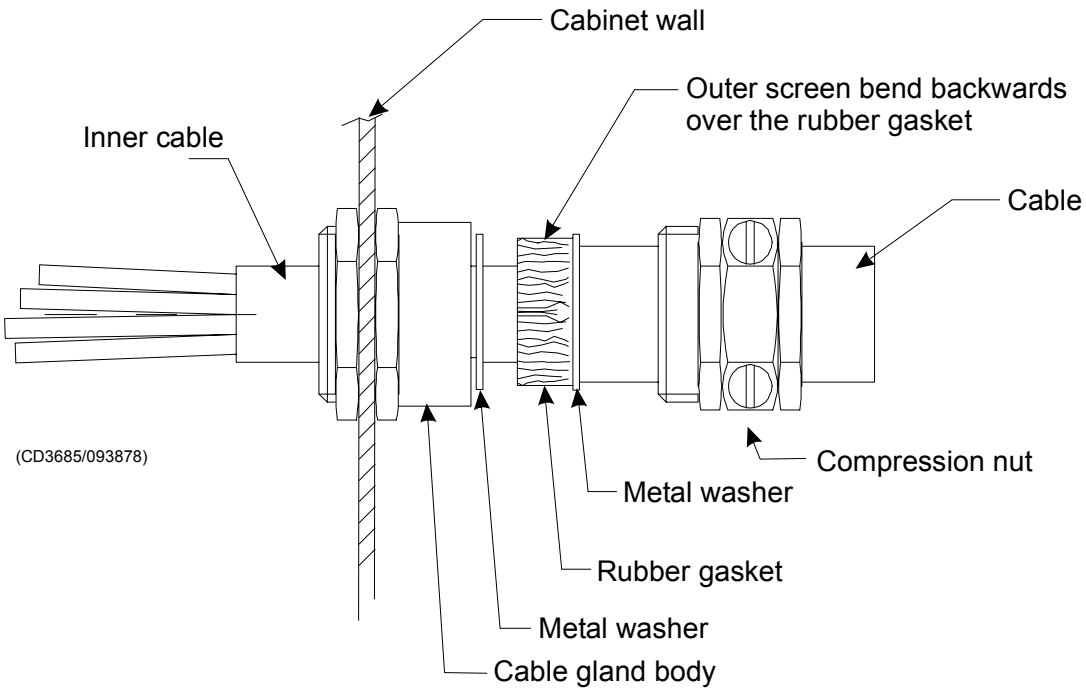


Figure 30 Cable gland, type 1 (842-093878)

Additional type 2 (541-093642)

1 Mount the cable gland body, and tighten it with the nuts on each side of the cabinet wall.

2 Slide the metal washers, the rubber gasket and the compression nut onto the cable in the order indicated in the figure.

→ *Refer to figure 31.*

3 Bend the screen over the compression cone.

4 Push the compression conne, the washers and the rubber sealing washer into the cable gland body.

5 Close the mounting nut.

6 Close and tighten the compression nut on the other side of the cabinet wall.

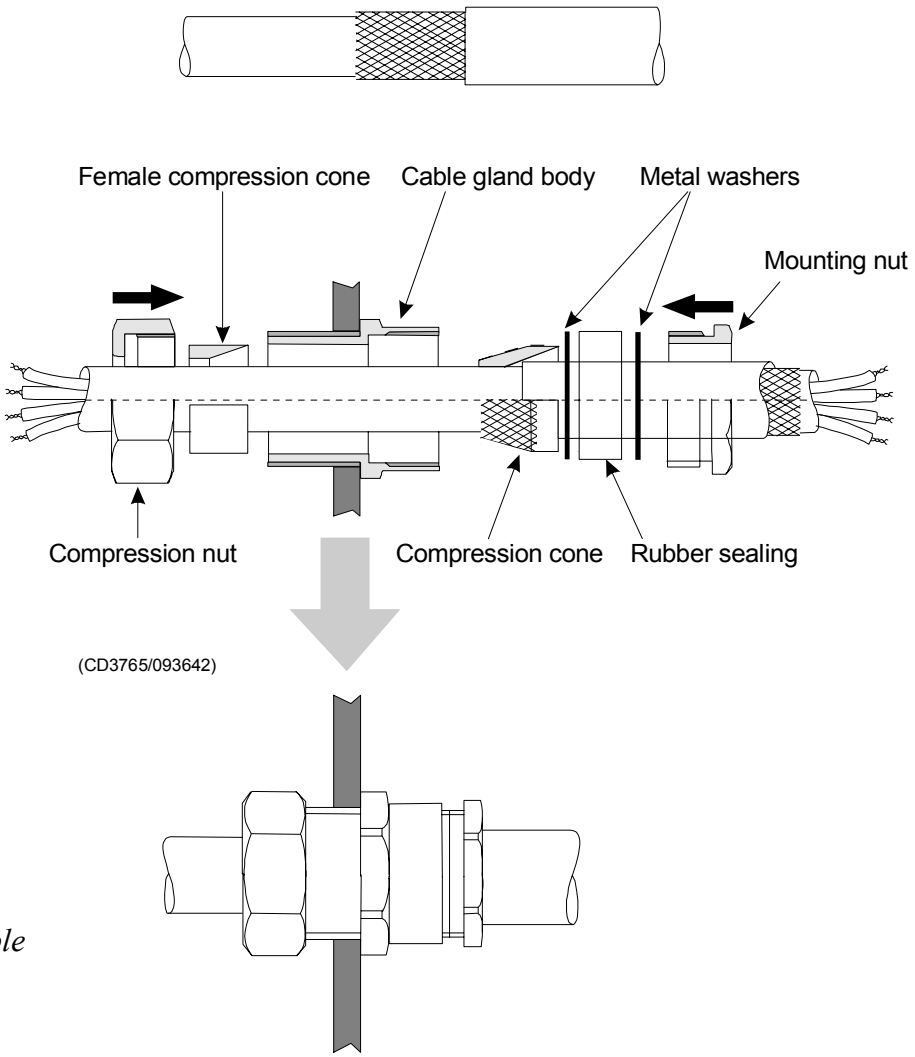


Figure 31 Cable gland, type 2 (541-093642)

4-Ports Serial Line Board (C114P)

Purpose and description

This is a commercial circuit board designed and produced by Moxa Technologies. It is identified as C114P, and is located in the Processing Rack.

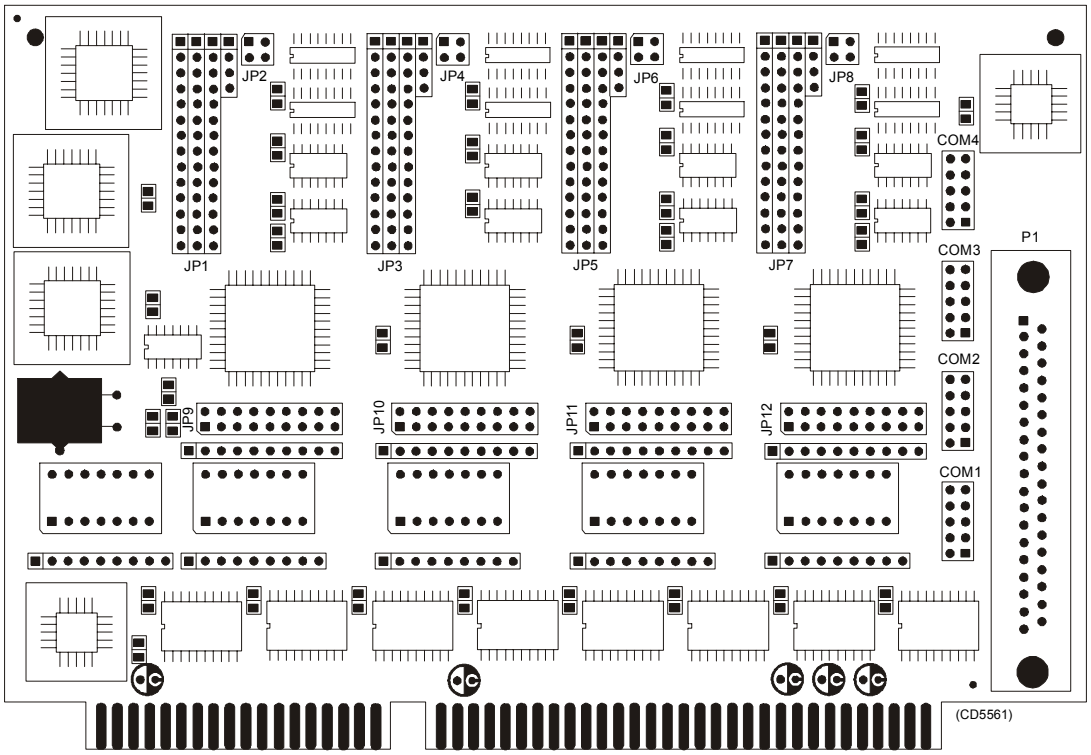


Figure 32 The C114P layout

How it works

Each of the 4 ports can be configured to RS-232, RS-422, or RS-485 interface individually, but only RS-232 will work on the EM 1002 system.

Facilities

LEDs

None.

Jumpers

The C114 is set up with IRQ 11 on the jumpers JP9, JP10, JP11 and JP12.

Links

Note

The following settings are only valid for new boards. For boards older than spring 2001 the settings will be inverted. The settings that are OFF on these drawings will be ON and vice versa.

The settings of the C114P DIP switches for use in the EM 1002 are listed in the table below:

Switch	**1**	**2**	**3**	**4**	**5**	**6**	**7**
SW 5	ON	ON	OFF	OFF	OFF	ON	ON
SW 1	ON	ON	ON	ON	OFF	OFF	ON
SW 2	OFF	ON	ON	ON	OFF	OFF	ON
SW 3	ON	OFF	ON	ON	OFF	OFF	ON
SW 4	OFF	OFF	ON	ON	OFF	OFF	ON

Connections

The C114P contains one DB-37 female connector on the rear side of the circuit board. It comes with a cable; one terminal is a 37-pin male D-type and the other terminal is a four 9-pin male D-type connectors. This is not used.

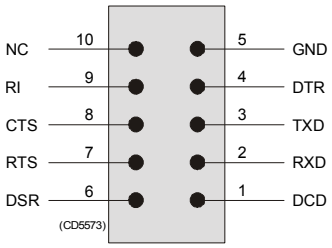


Figure 33 10-pin header connector pin assignment

In addition, four 10-pin pin-head connectors corresponds to the DB-37 connector on the board of C114P. These four connectors are called COM1, COM2, COM3 and COM4, and are connected directly to the Transceiver Unit bottom plate.

→ *Refer to figure 33 for pin assignment.*

Serial Line Board (CI-104JS)

If more information is needed, refer to webpage *www.moxa.com*.

Purpose and description

This is a commercial circuit board designed and produced by Moxa Technologies. It is located in the Processing Unit.

The board is a cabling space saver that features a built-in RJ45 bracket to save cable layout space and reduce cost.

It has surge protection and ISA bus.

Note

A software setup has been done at Kongsberg Maritime to configure the board.

How it works

The Smartio CI-104JS Series provides 4 RJ-45 sockets for connection, which save a lot of cable space.

Surge Protection

To prevent the board from damage caused by lighting or high potential voltage, TVSS (Transient Voltage Surge Suppressor) technology is introduced in Smartio CI-104JS to protect the board. This is critical to harsh environment such as factory.

Specifications

Connector type	RJ–45
Bus	ISA (16 bit)
Serial	RS–232
Ports (interface)	4
Power requirements	83 mA max. (–12V), 57 mA max. (+12V), 100 mA max. (+5V)
Operating temperature	0° – 55°C
Dimesions	157 x 83 mm (width x depth)
Surge protection	25 KV ESD 2 KV EFT

Facilities

No switches.

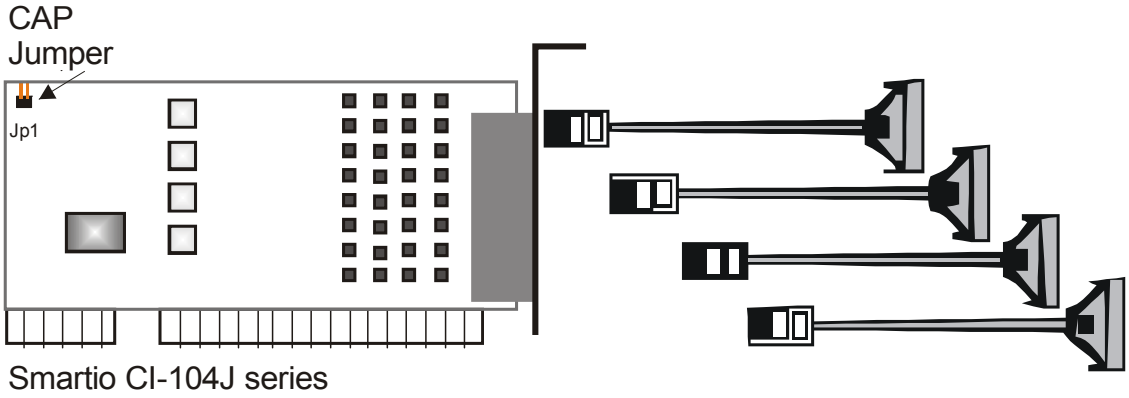


Figure 34 Illustration of the Serial Line Board.

6.4 Remote power switch

Introduction

If required, a separate power switch may be installed to provide remote on/off for the Transceiver Unit.

Connection

Refer to cable drawing W202. This drawing explains how a small switch and a 12 Vdc lamp can be connected to the 9-pin **Remote** D-Connector on the Transceiver Unit.

The switch can be installed to suit local needs, wither in a separate box, or in a console.

→ *Refer to drawing W202 on page 87.*

6.5 Cable specifications

Introduction

The next pages provide detailed information about the cables used on the system. Note that several cables may share identical specifications.

The technical parameters provided for the cables are the minimum specifications. Also, in most cases, it may be useful to install extra pairs in selected cables for future expansions.

Note

The cables specified may not meet the standards provided by the vessel's classifiaction society. Consult the applicable guidelines.

Kongsberg Maritime as takes no responsibility for damage caused to system, vessel or personnel if the cables used during installation do not meet these specifications.

Generic RS-232 serial line (DTE)

This cable described the pin configuration for an RS-232 interface. The Data Terminal Equipment (DTE) end is shown.

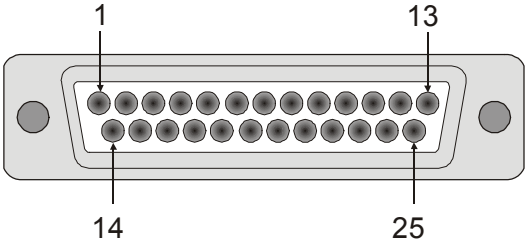
The DTE end is shown on page 82.

1	Shield
2	**Transmitted data (Tx)**
3	**Received data (Rx)**
4	**Request to send (RTS)**
5	**Clear to send (CTS)**
6	**DCE Ready**
7	**Signal ground**
8	Rx line signal detect
9	*Reserved for testing*
10	*Reserved for testing*
11	*Unassigned*
12	Sec. Rx line signal detect
13	Sec. Clear to send
14	Sec. Tx data
15	Transmitter signal timing
16	Sec. Rx data
17	Rx signal timing (DCE source)
18	Local loopback
19	Sec. Request to send
20	**DTE Ready**
21	Remote loopback
22	Ring indicator
23	Data signal rate selector
24	Tx signal timing (DCE Source)
25	Test mode

25-pin D-sub connector

Original and complete RS-232 signal definition shown. The most commonly used signals are shown in bold.

(DTE = Data Terminal Equipment)



Looking into a male 25-pin D-pin connector

W101 / Rev. B	RS-232 serial line (DTE)

Conductors	XX x 2 x 0.5 mm2
Screen	Overall braided
Voltage	60 V
Max.diameter	Set by the plugs

Generic RS-232 serial line (DCE)

This cable described the pin configuration for an RS-232 interface. The Data Circuit terminating Equipment (DCE) end is shown.

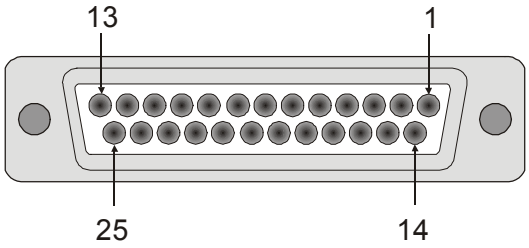
The DTE end is shown on page 81.

1	Shield
2	**Received data (Rx)**
3	**Transmitted data (Tx)**
4	**Clear to send (CTS)**
5	**Request to send (RTS)**
6	**DCE Ready**
7	**Signal ground**
8	Received line signal detect
9	*Reserved for testing*
10	*Reserved for testing*
11	*Unassigned*
12	Sec. Rx line signal detect
13	Sec. Request to send
14	Sec. Rx data
15	Transmitter signal timing
16	Sec. Tx data
17	Rx signal timing (DCE source)
18	Local loopback
19	Sec. Clear to send
20	**DTE Ready**
21	Remote loopback
22	Ring indicator
23	Data signal rate selector
24	Tx signal timing (DTE Source)
25	Test mode

25-pin D-sub connector

Original and complete RS-232 signal definition shown. The most commonly used signals are shown in bold.

(DCE = Data Circuit terminating equipment)



Looking into a female 25-pin D-pin connector

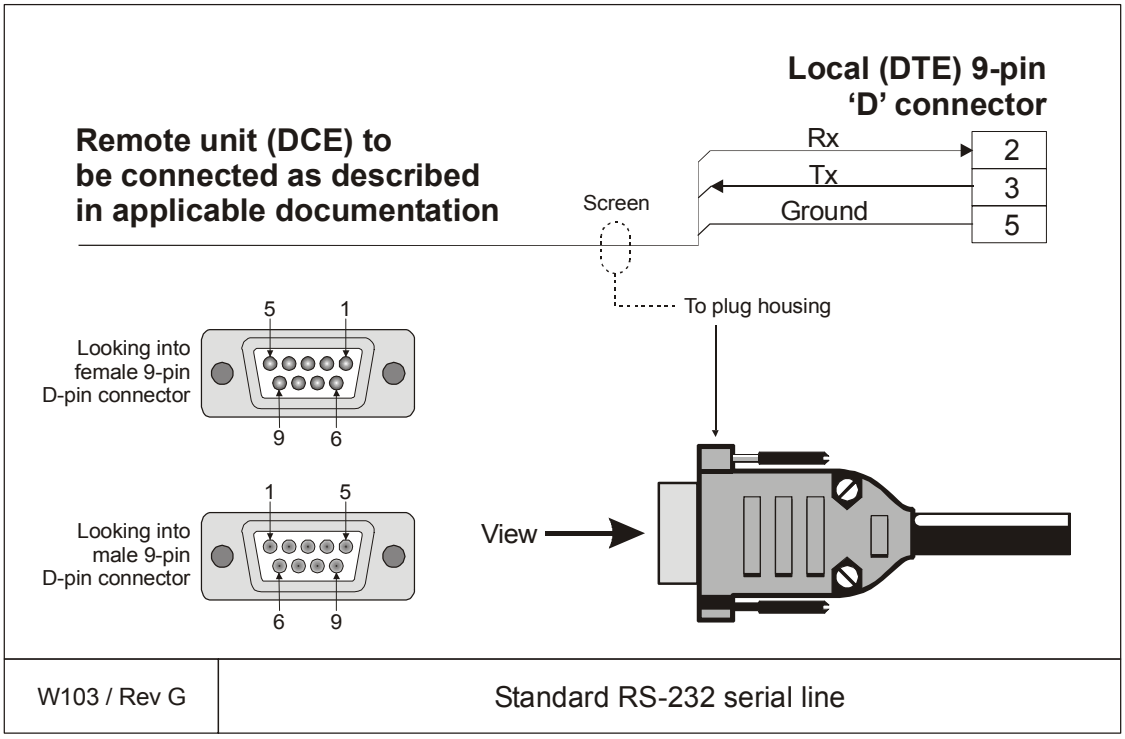
W102 / Rev. B	RS-232 serial line (DCE)

Conductors	XX x 2 x 0.5 mm2
Screen	Overall braided
Voltage	60V
Max.diameter	Set by the plugs

Generic RS-232 Serial line

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

Note that this cable does not support all the signals in the standard RS-232 specification.

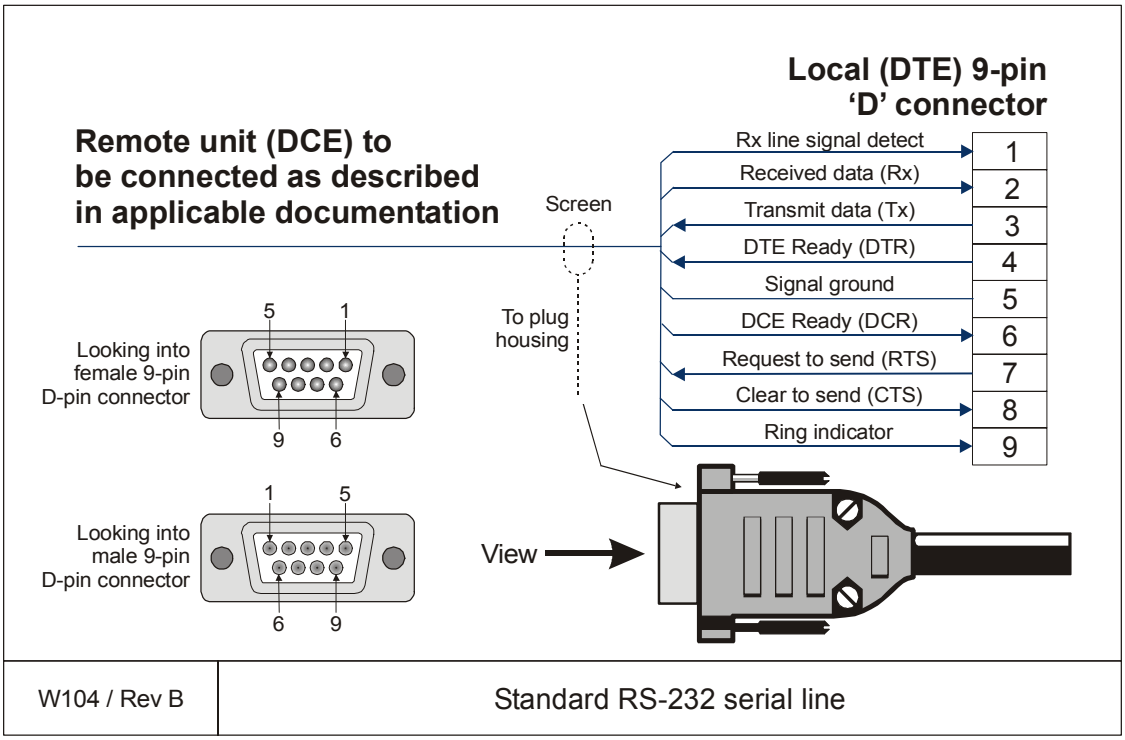


W103 / Rev G	Standard RS-232 serial line

Conductors	3 x 2 x 0.5 mm2
Screen	Overall braided
Voltage	60V
Max.diameter	Set by the plugs

Generic RS-232 Serial line

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



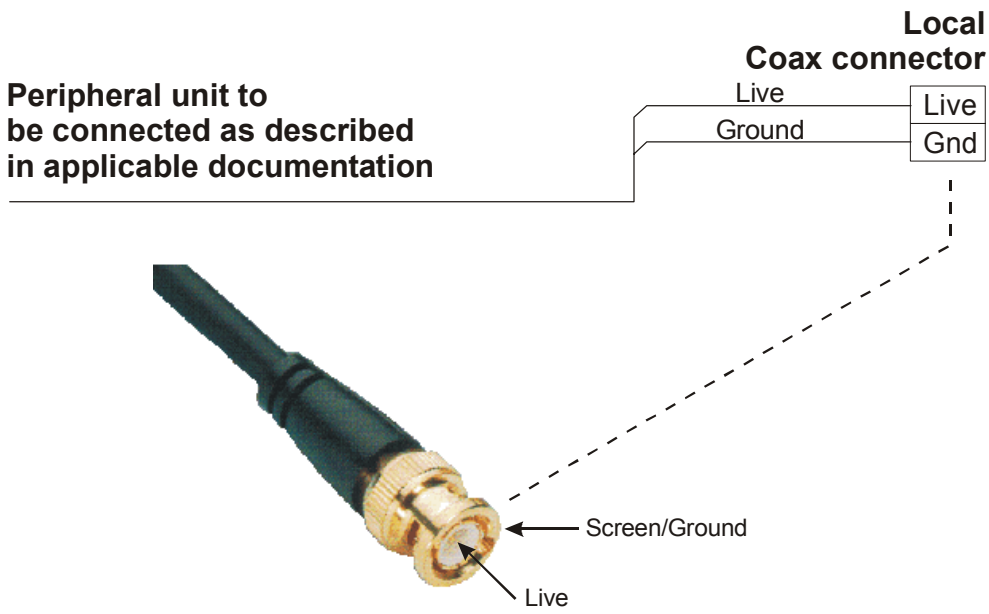
W104 / Rev B	Standard RS-232 serial line

Conductors	6 x 2 x 0.5 mm2
Screen	Screened twisted pairs and overall braided
Voltage	60V
Max.diameter	Set by the plugs

Generic coax cable

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

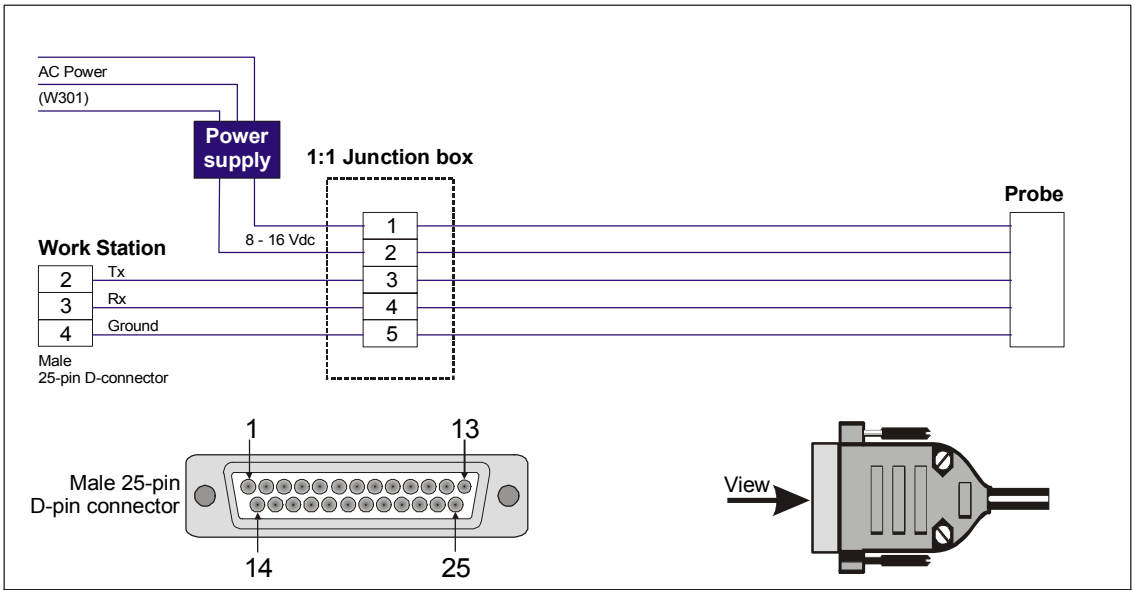
In the EM 1002, EM 120 and EM 300 systems, this cable connects the 1 PPS timing signal to the Transceiver Unit. It is also possible to use a coax connection between the Transceiver Unit and the Operator Station.



W105 / Rev.D	Coax connection to peripheral unit or network

Sound speed probe interface

This cable provides the interconnection between the Processor Unit work station and the sound speed probe. This connection is normally made through a small junction box and with a power supply as indicated in the drawing.



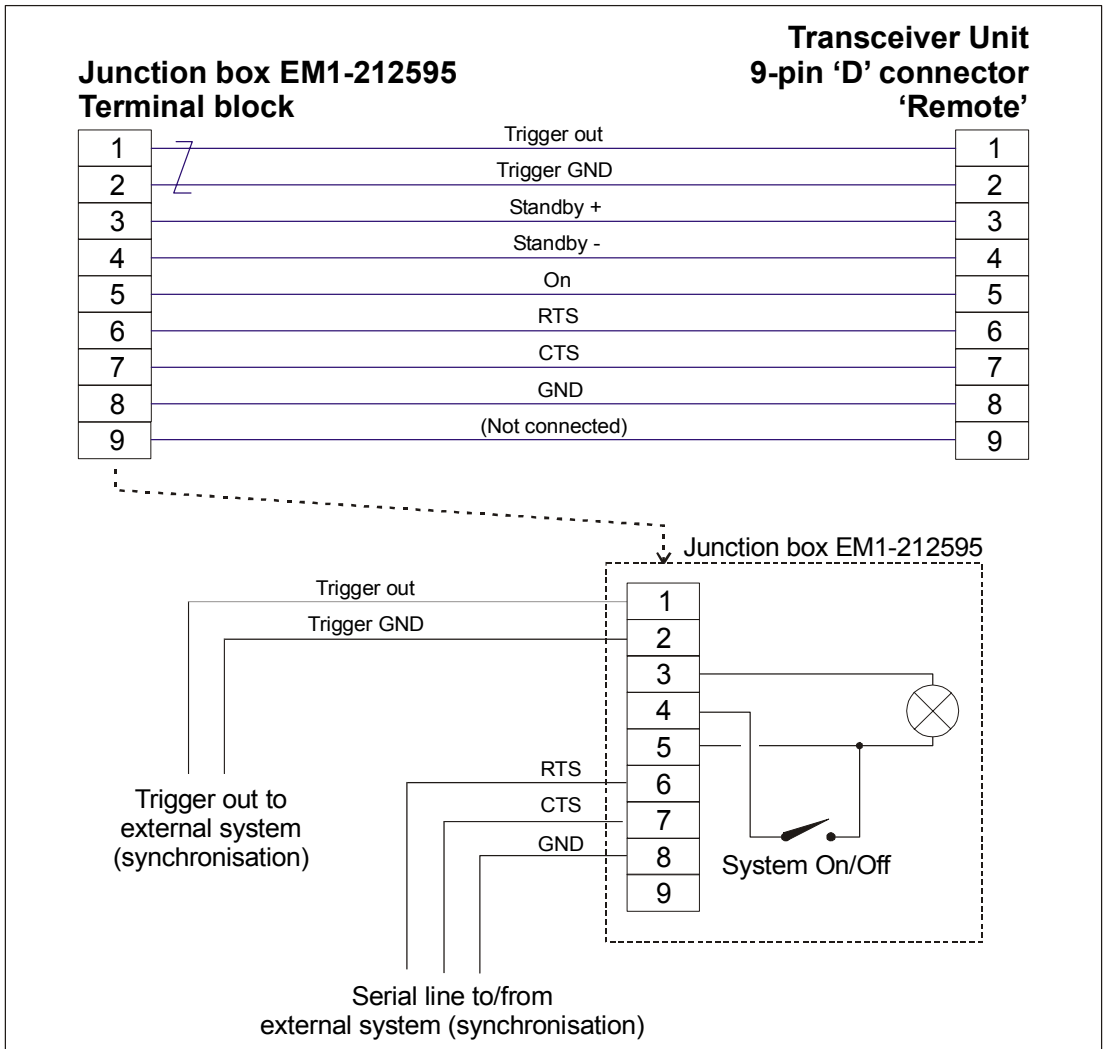
W119 / Rev.B	Sound speed probe interface

The cable between the junction box and the probe is supplied by the probe manufacturer.

Conductors	2 x 2 x 0.5 mm2
Screen	Overall braided
Voltage	60V
Max.diameter	Set by the plugs

EM Remote synchronisation and On/Off

This cable connects the Transceiver Unit to a remote On/Off switch located in a Junction Box (type EM1-212595). The same connection allows trigger output and remote control (synchronisation) with a serial line.

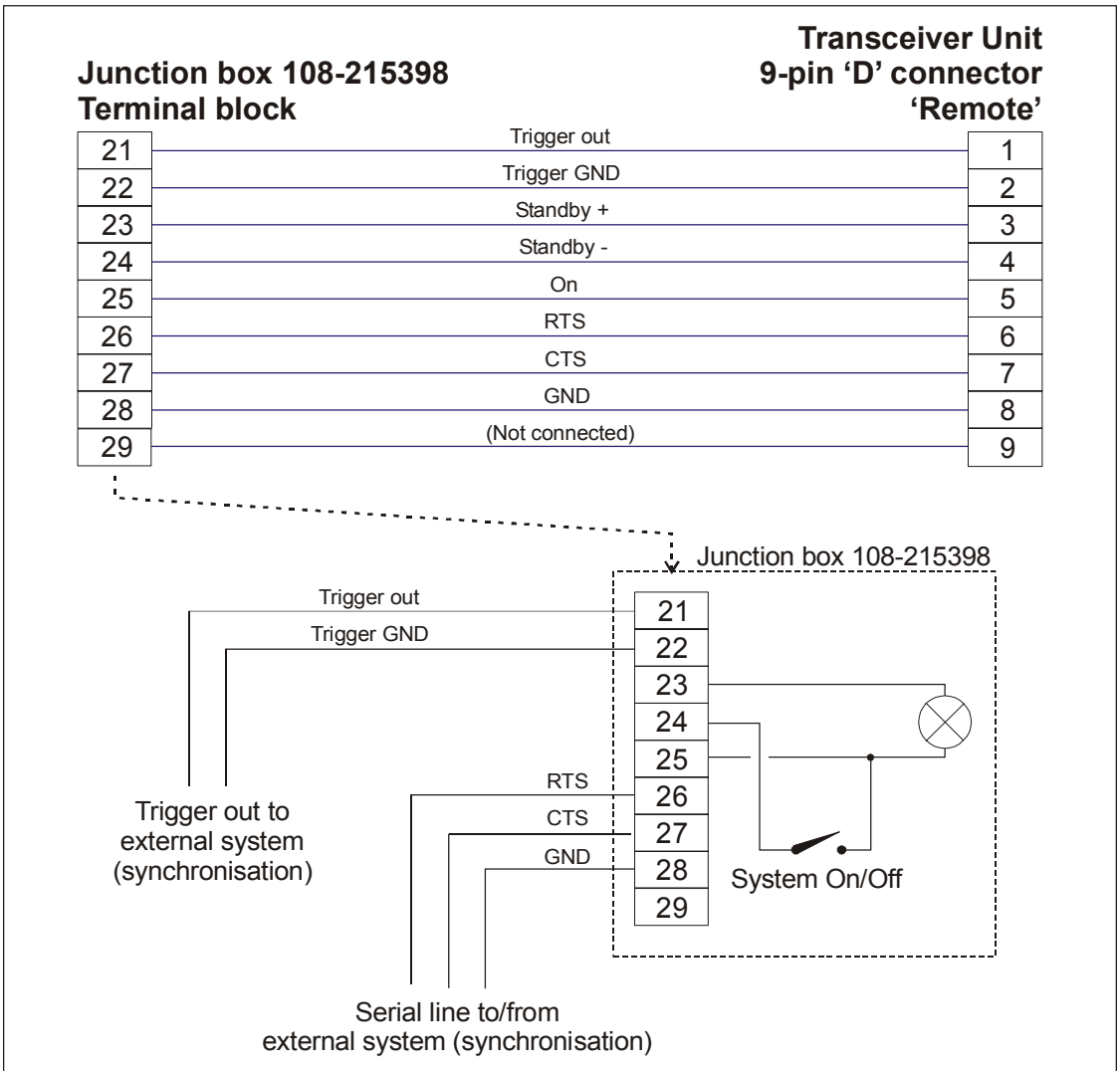


W202 / Rev C	Transceiver Unit - Junction Box

Conductors	5 x 2 x 0.5 mm2
Screen	Overall braided
Voltage	60V
Max.diameter	Set by the plugs

EM Remote Control with 3 switches

This cable connects the Transceiver Unit to a remote On/Off switch located in a Junction Box (type 108-215397). The same connection allows trigger output and remote control (synchronization) with a serial line.

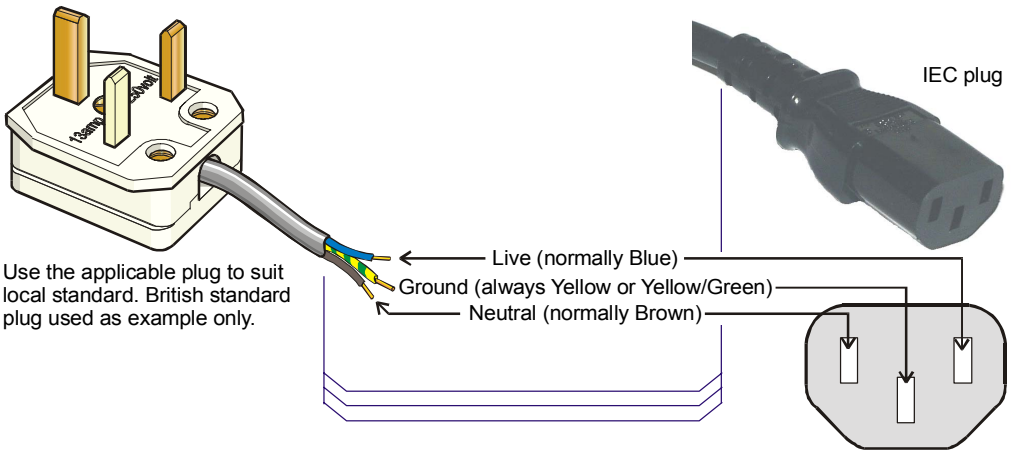


W238 / Rev A	Transceiver Unit - Junction Box

Conductors	5 x 2 x 0.5 mm2
Screen	Overall braided
Voltage	60V
Max.diameter	Set by the plugs

Standard AC power cable

This cable is a standard three-wire power cable. It is commercially available in standard lengths, or may be produced locally to suit the specific installation needs. The instrument end is terminated in a standard IEC female socket, while the other end is terminated in a plug suitable for the local standard.



W301 / Rev B	Standard power cable for 115/230 Vac 2-phase

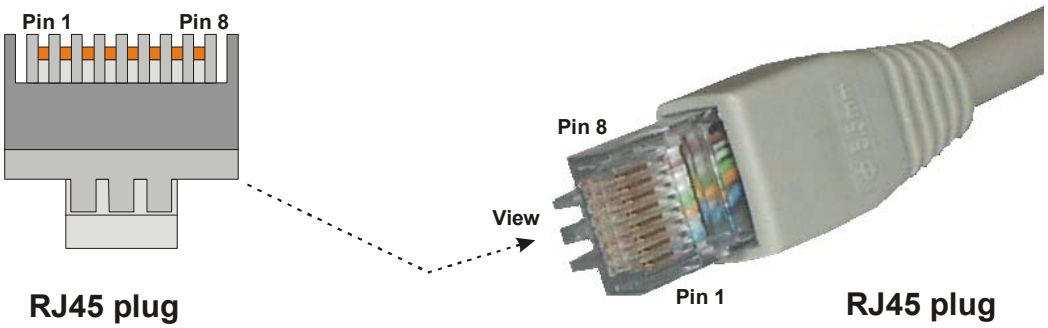
Note

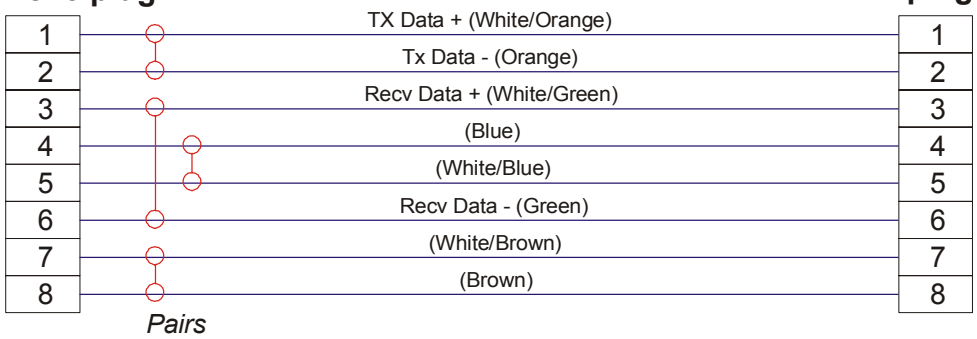
Different cable colours may be used for the "live" and "neutral" wires. Ground is however always on green/yellow.

Conductors	2 x 1.5 mm^2 + GND
Screen	None
Voltage	750 V
Max. diameter	Set by the plugs

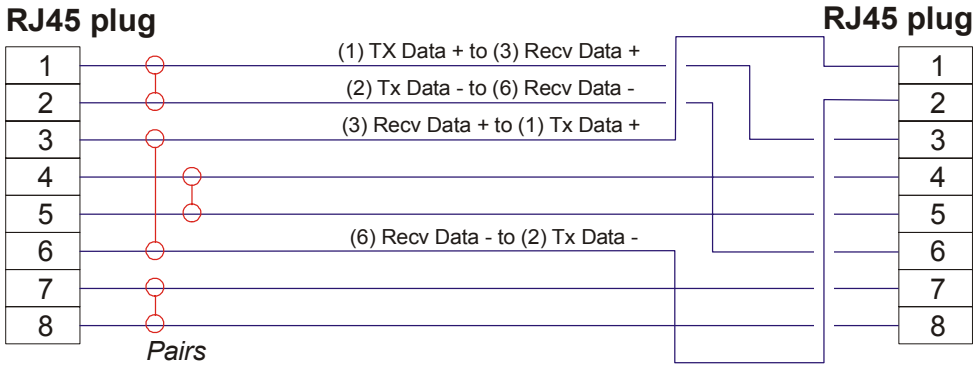
Ethernet with RJ45

This cable contains the Ethernet connection. RJ45 plugs are used to terminate the cable. Note that these plugs must be screened to comply to EC rules.





Ethernet 10Base-T "Straight Through"



Ethernet 10Base-T "Crossover"

NOTE: In order to prevent noise and crossover, you are strongly adviced to use the cable pairs indicated above.

The "crossover" cable is used to cascade HUBs, or for connecting two ethernet stations or computers back-to-back without a HUB)

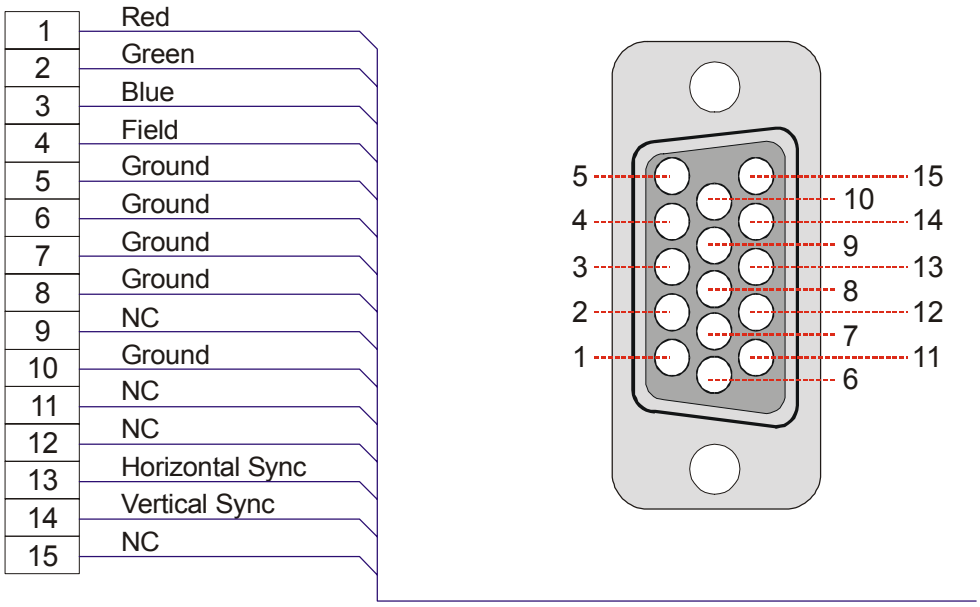
W400 / Rev E	Ethernet 10Base-T with RJ45 plugs

Standard VGA cable

This is a standard display cable used to connect the video signals.

The cable is normally physically fastened to the display unit, and it is provided with the plug(s) readily attached.

15-pin 'D' connector (VGA type)

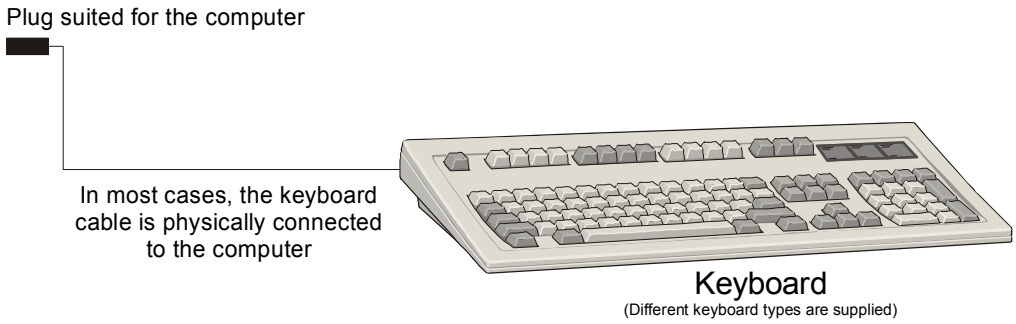


W500 / Rev.A	Standard VGA cable

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 C	Keyboard

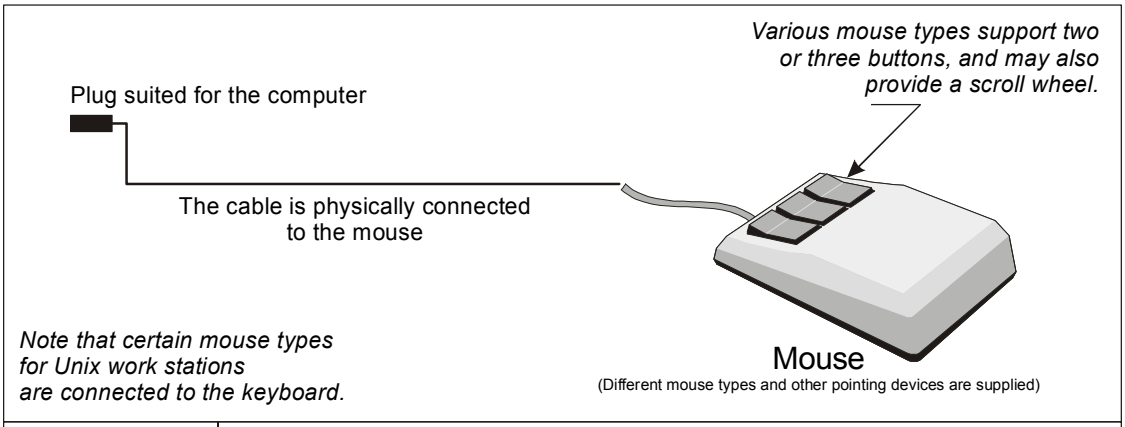
Mouse or pointing device cable

This is a standard mouse cable. It is physically connected to the mouse. It is terminated in a plug suited to fit the computer.

Note

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

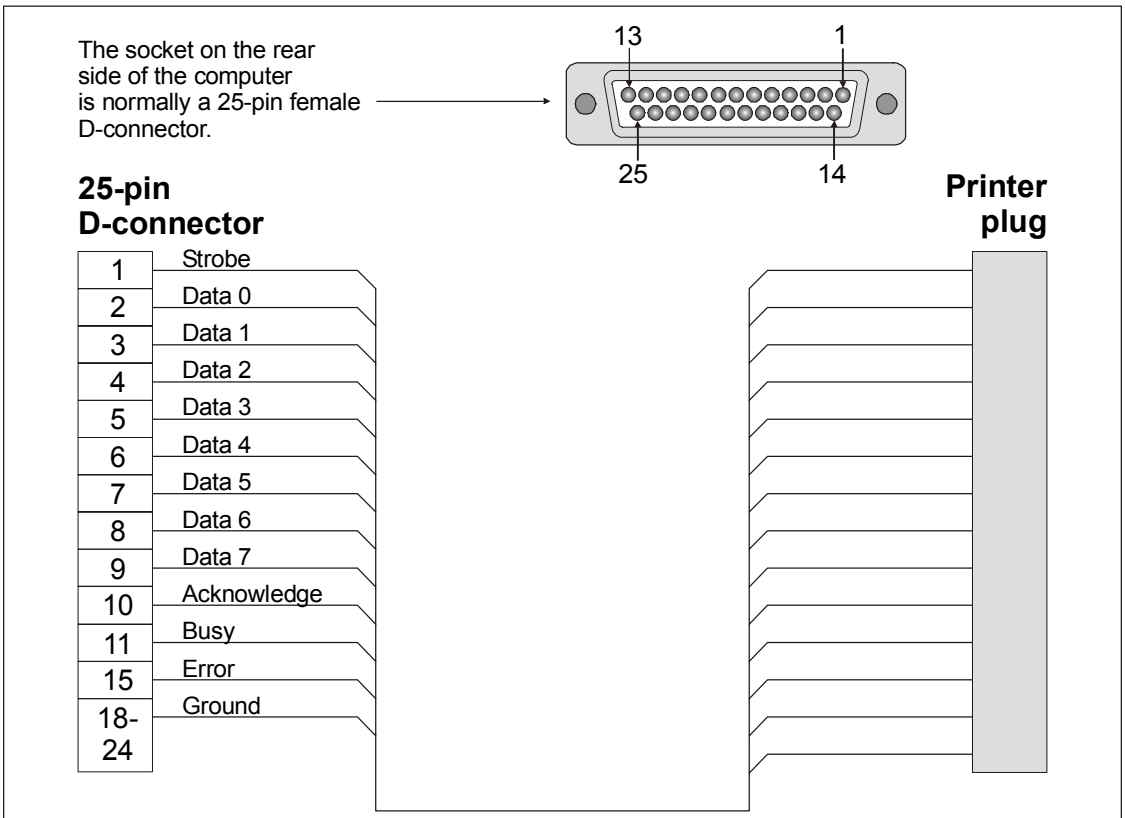
Several mouse and pointing device types are available with two or three buttons, and with or without a scroll wheel. Both the mouse and the attached cable are commercial items.



W504 / Rev B	Mouse / Pointing device

Centronics printer cable

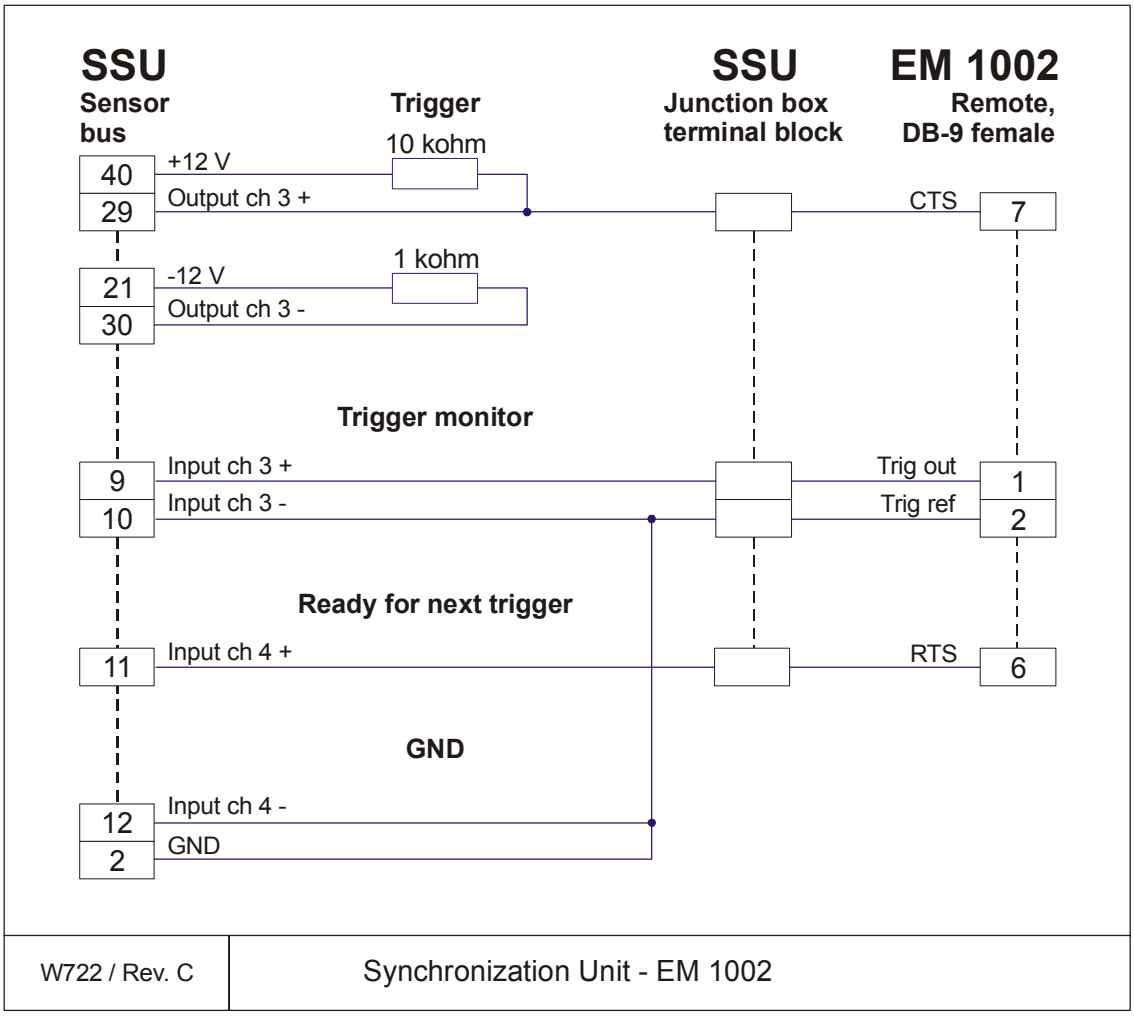
This is a standard Centronics printer cable.



W505 / Rev C	Centronics printer cable

EM 1002 synchronization

This cable provides the control signals between the EM 1002 Multibeam Echo Sounder and the Synchronization Unit.



Conductors	6 x 2 x 0.25 mm^2
Screen	Overall braided
Voltage	60V
Max. diameter	Set by the plugs

6.6 Basic cabling requirements

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 (max. 0.5 metre) as the cables run into the cabinets/units to which they are connected. These short unsupported lengths are to allow the cabinets to move on their shock mounts, and to allow maintenance and replacements.

- 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 remote 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 bunched such that the maximum temperature expected in any cable in the bunch is within the specifications of the lowest-rated cable.
- Cables with protective coverings which may damage other cables should not be bunched together 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 cabin, 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. 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, lead sheath 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 related to 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 earth 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 tappings. In no case should the lead-sheathing 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.

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 suits 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.

7 ALIGNMENT

7.1 Introduction

The EM 1002 is a precision instrument for bathymetric swath mapping. To be able to produce data that are both detailed and correct, it is necessary to calibrate the survey vessel more accurately than what may have been standard practice earlier. The required calibration consists of:

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

The results, with all measurements taken in a common vessel coordinate system, are to be entered in the EM 1002 Operator Station.

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.

7.2 The measurements

Objectives

Overview

The measurements to be made after installation are:

- the horizontal and vertical positions of the EM 1002 transducer array.
- the angular orientation of the transducer array
- the angular orientation of the motion sensor
- the horizontal and vertical positions of the motion sensor.

- the horizontal and vertical positions of the positioning system (radio or GPS antenna).

The measurements on the transducer array must be made with the vessel in dry dock, the others may be done with the vessel berthed.

During the first sea trials calibration surveys should be run as described in the EM 1002 operator manual. From these surveys any inaccuracies in the determination of the above parameters may be identified and the values entered in the EM 1002 Operator Station setup corrected accordingly.

It is advisable to perform a calibration survey at regular intervals or before large surveys to ensure against any changes in the determined offsets. Alternatively any changes should be looked for in the data from regular surveys as these make possible. At the very least calibration surveys should be performed if any sensor is replaced.

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. 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.

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

Note

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

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

Sensor location

Overview

The EM 1002 transducer array must be located according to the guidelines given elsewhere in this installation 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 vessel motion sensor (giving heave, roll and pitch) should normally be mounted on the centerline of the vessel, either close to the EM 1002 transducer array or close to the vessel's heave-roll-pitch center.

The latter point is recommended if the sensor is used for other purposes than just with the EM 1002, 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 waterline 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 alongship distance between the transducer array and the motion sensor is larger than 30 m, the system accuracy may be degraded.

Note that the motion sensor must be aligned with the vessel centerline.

Heading sensor

The accuracy of the heading sensor may be sensitive to accelerations and should therefore be mounted close to the heave-roll-pitch center.

Note that the heading sensor must be aligned with the vessel centerline.

Measurement accuracy

Overview

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

Transducer array

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

2 Measure the horizontal location to an accuracy of ±10 cm.

These measurements must be made from the center of the transducer's "face".

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

4 Measure the roll to an accuracy of ±0.025°.

5 Measure the pitch to an accuracy of ±0.1°.

Motion sensor

6 Measure the horizontal location of the motion sensor to an accuracy of ±10 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.

7 Align (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°.

The motion sensor must be aligned (set up) such that 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, should be 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 ±0.1°. If this is not possible, the resulting offset must be known to the same accuracy.

Positioning system

1 The vertical location of the positioning system antenna must be measured to 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 The positioning system antenna's horizontal location must be measured to an accuracy of ±10 cm.

Water line

1 The vertical distance to the waterline should be measured with an accuracy of ±2 cm.

Note

Note that with the vessel in normal trim, i.e with an indicated pitch angle of zero from the motion sensor, the distance to the waterline may be measured anywhere on the vessel, 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.

7.3 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 centerline 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.

7.4 Transducer measurements

General

The most important variables in the installation procedure with respect to the system accuracy, are the heading of the transducer with respect to the vessel's fore-and-aft centre line, and the horizontal plane of the transducer with respect to the trim-plane of the vessel. These variables must be checked on completion of the installation, and any discrepancies compensated for.

To obtain the best possible results for the transducer alignment calibration, the vessel must be in a dry dock and a theodolite must be used. Using a theodolite will give a high degree of accuracy, but will take some time and requires experience and specialized equipment.

Heading measurements

Scope

After the installation, the heading of the transducer must be measured relative to a given reference line, normally the centre line of the vessel. Any offset between the transducer heading and the centre line of the vessel will be compensated for by the system software.

If the vessel is in dry dock, the fore-and-aft centerline of the vessel can easily be defined by using the keel itself as the reference line.

Bench-marks should have been located in the transducer room to simplify the alignment procedure.

Tools required

- Theodolite
- Straight edge
- Finely incremented ruler
- Laser pointer

The transducer must be fully lowered and in its normal operating position before any measurements are taken. The fore-and-aft and athwart-ships centre lines of the transducer must be defined.

Procedure

→ *Refer to figure 35 on page 105.*

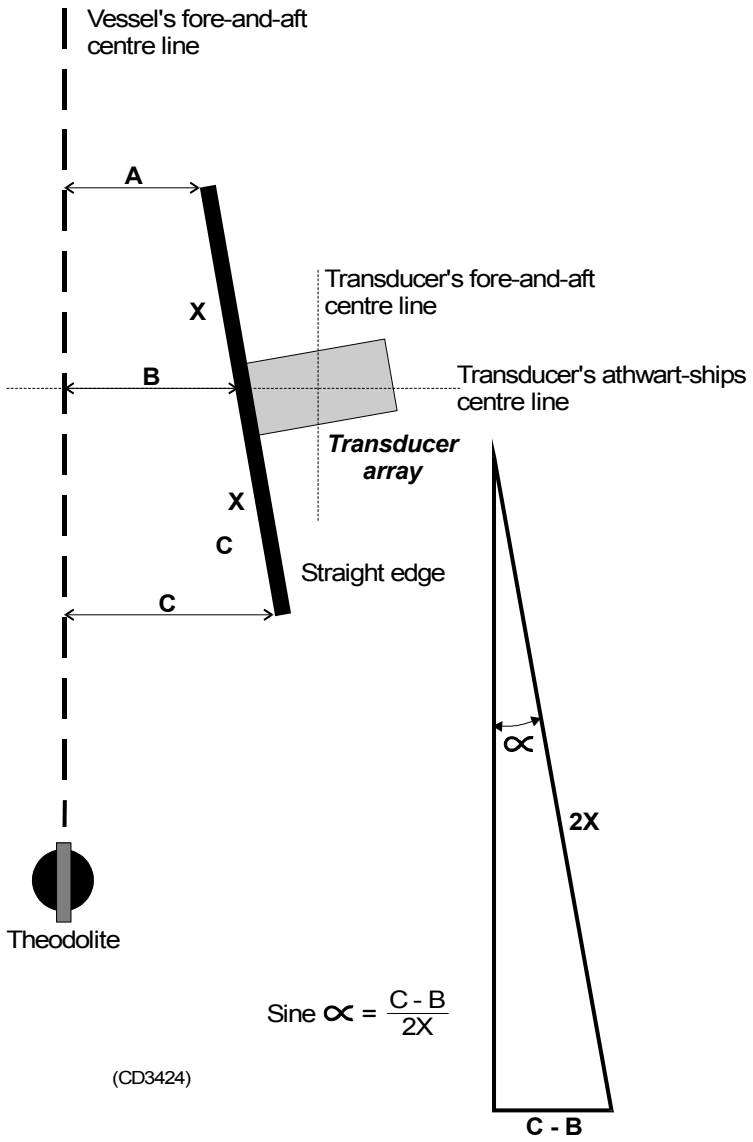


Figure 35 EM 1002 Transducer measurements

The following method describes the establishment of the EM 1002 transducer heading offset:

1 Transfer the vessel's centerline to the dock bottom.

- This is easily accomplished using a plumbline.
- Hold the plumbline on a selected spot on the vessel's centerline, and when the bob is steady, mark the dock bottom at the place where the bob indicates.
- Repeat several times at different places along the vessel's keel.

2 Establish the centerline in the dock bottom by carefully joining up the marks.

3 Place the theodolite on the dock-bottom centre line at a reasonable distance from the transducer, and align it exactly to the line.

- Check the alignment by elevating and depressing the scope and ensuring the cross-hairs follow the centre line.

4 Mark the centre of the long straight-edge.

5 Hold the straight-edge against one side of the transducer, parallel to the fore-and-aft centre line of the vessel, such that the centre of the straight-edge is positioned on the athwart-ships centre line of the transducer.

- This will effectively extend the side of the transducer in the fore-and-aft direction. The further the transducer edge can be extended, the more accurate will be the final result.
- Laser pointers are available to simplify this even more.

6 Position a finely incremented ruler horizontally against the centre and both ends of the straight-edge in turn.

7 Use the theodolite, measure the distances from the straight edge to the vessel's centre line.

- If there is an error in the alignment of the transducer, this will be noted as a difference between the measurements.

The difference between the measurement at the centre of the straight-edge and that at one end, should be equal to the difference between the measurement at the centre and the other end. This check will ensure the measurements are accurate.

Take the difference between the measurements at the ends of the straight-edge. ("C-B" on the diagram). The length of the straight-edge can then be measured ("2X" on the diagram), and the following formula applied to the results:

$$Sin\varrho = \frac{C - B}{2x}$$

The direction of any error will be obvious from the measurements. Generally, if the value of the aft measurement is smaller than that of the fore measurement, the transducer is facing to port of the centre line. It must therefore be adjusted to starboard.

If the transducer fore-and-aft angular offset is within 2 degrees of the centerline, it is possible to compensate for the discrepancy in the EM 1002 software. Otherwise the transducer has to be adjusted manually by turning the transducer shaft. The whole procedure must then be repeated once more to check the correction.

Note

It is essential that the measurements are as accurate as possible since the transducer offset will directly influence the accuracy of the EM 1002 readings.

Roll and pitch measurements

The same arrangement as used for the heading mesurments can be used for the roll and pitch measurements.

Align the teodolite to the same trim level as the vessel. Measure to the four corners of the mounting bracket of the transducer. If it is difficult to use the corners of this bracket, then use the machined area on both sides of the transducer as targets. It can often be a help to use a ruler on to this areas to get good readings.

With ”height” measurements from all four corners of the transducer it is easy to calculate the roll and pitch offset between the transducer and the ships trim level.

8 INSTALLATION CHECKS

8.1 Visual inspection of units

Scope

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

After the physical installation has been carried out, all the system units must be visually checked to ensure that the EM 1002 units have been installed correctly. You must ensure that the units have been mounted in the correct locations, correctly orientated (e.g. the right way up) and are correctly secured.

Transceiver Unit

Perform a close visual inspection of the EM 1002 Transceiver Unit cabinet.

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

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

10 Check that the unit is not damaged.

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

12 Check that the air vents are not blocked.

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

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

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

16 Checked (date/sign):_____

Vertical Reference Unit

Perform a close visual inspection of the EM 1002 Vertical Reference Unit cabinet.

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

2 Make sure that the positioning of the unit conforms to the specifications presented in the installation description.

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

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

5 Checked (date/sign): _____

Operator Unit (Work station)

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

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

2 Check that the unit is not damaged.

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

4 Check that the air vents are not blocked.

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

6 Checked (date/sign): _____

8.2 Electrical checks

Scope

This section of the manual contains the test procedures for the EM 1002 system's power and signal interface cables.

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

Cabling

Visual cable inspection

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

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

Cable connections and continuity

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

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

Follow the check procedure below for each cable core:

1 Position yourselves one at each end of the cable to be checked. Good communications must be established between you and your assistant.

2 Ensure that the cable to be tested is not connected to any power source.

- If a cable terminates in a plug at the unit, the test will be more easily conducted if the plug is disconnected.

3 Select one pair of cable cores, and check that the cores are connected to the correct terminals in the unit.

4 Connect your continuity tester to the two terminals in question and check the continuity.

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

5 Tell your assistant to short the two cores together. Repeat the previous test.

- The resistance should be 0 (zero) ohms.

6 Tell your assistant to remove the shorting strap.

- Check that the resistance reaches ∞ ohms again.

7 Check each core's resistance to ground, and each core's resistance to all the other cores in the cable.

- All results should be close to ∞ ohms.

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

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

Operational voltages

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

8.3 Final checks

After installation, but before leaving port for the sea trials, the following checks must be done:

10 Check that the specified sacrificial anodes have been mounted, and that any specified anti-fouling paint has been applied correctly.

11 Check that all system units have been fastened properly and that all nuts and bolts have been tightened properly.

12 Check that the data from the motion sensor, the heading sensor and the positioning system are correctly read by the EM 1002 and that the values are reasonable.

13 Check that the echo sounder is acquiring reasonable sounding values.

9 DRAWING FILE

9.1 Overview

This chapter contains cable details and installation drawings.

Cable details

→ *Refer to page 58.*

Installation drawings

If required, certain drawings may be supplied on AutoCad format. To order, contact Kongsberg Maritime and refer to the drawing number in the bottom right corner of the frame.

→ *Transducer array, Outline dimensions, page 118.*

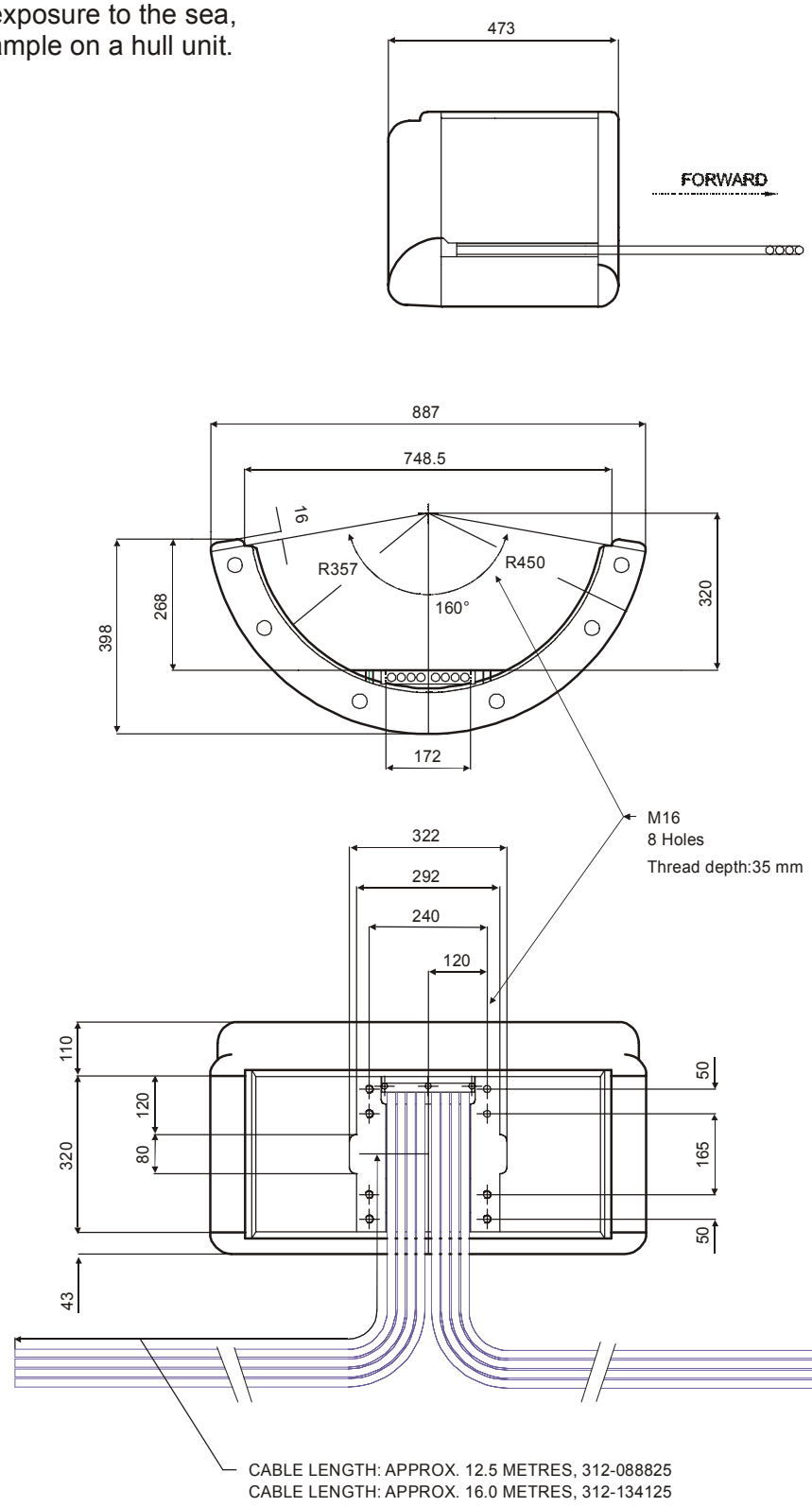
→ *Transducer array, Outline dimensions, page 119.*

→ *Mounting bracket, **transducer,** page 120.*

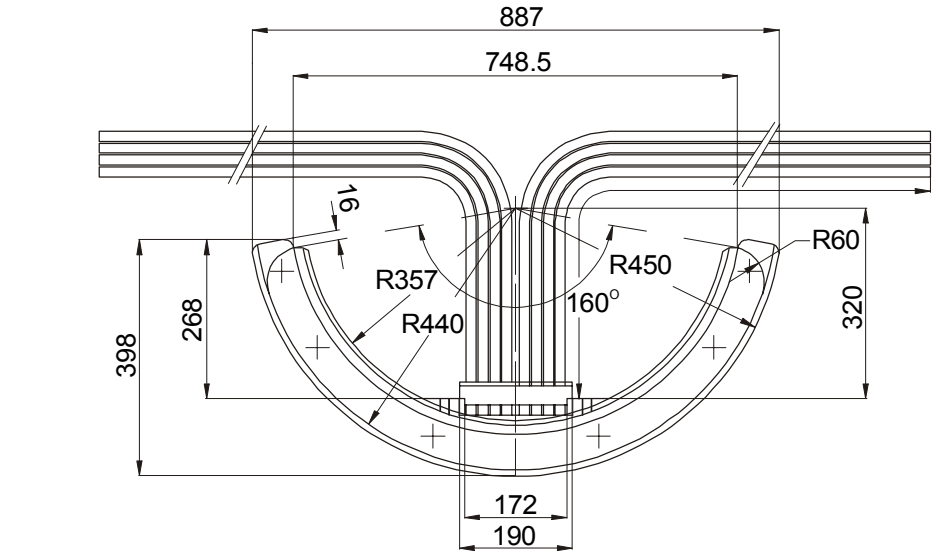
→ *Junction Box for transducer cables, outline, page 121.*

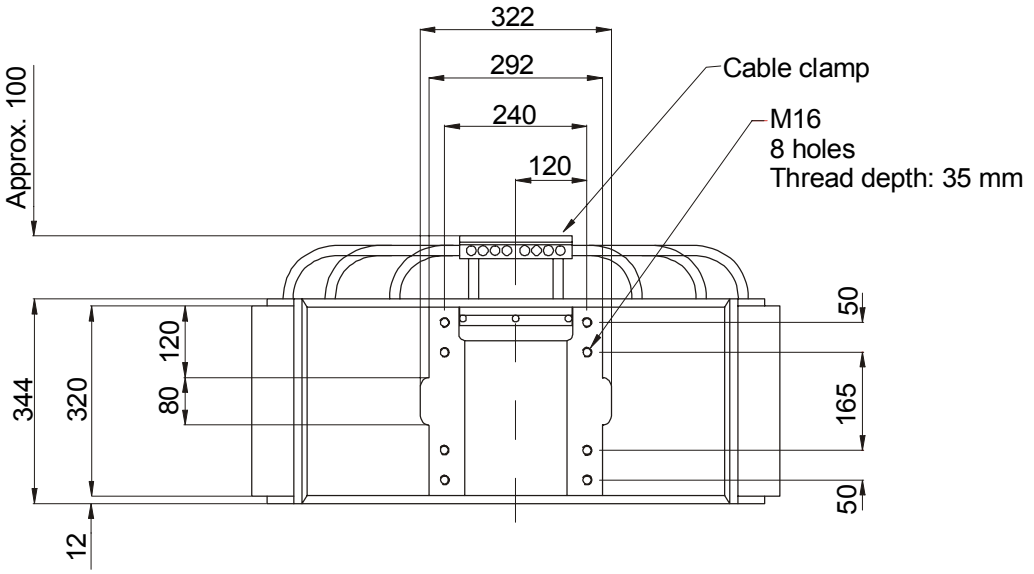
→ *Junction Box assembly, page 122.*

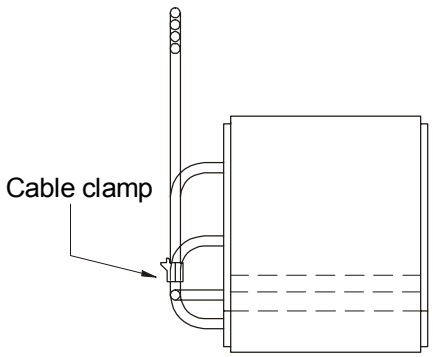
This drawing presents the transducer array prepared for open exposure to the sea, for example on a hull unit.



Revision: D CD4871 (&488)	Transducer array, Outline dimensions	**830-088179** Rev.D



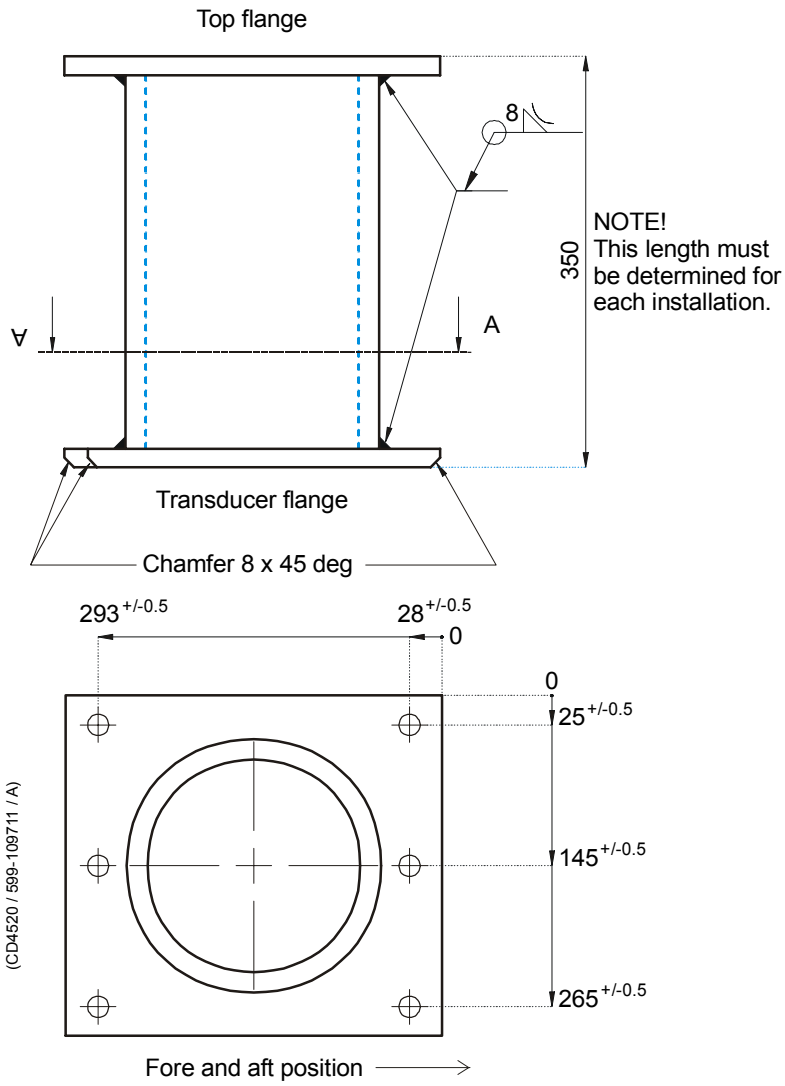


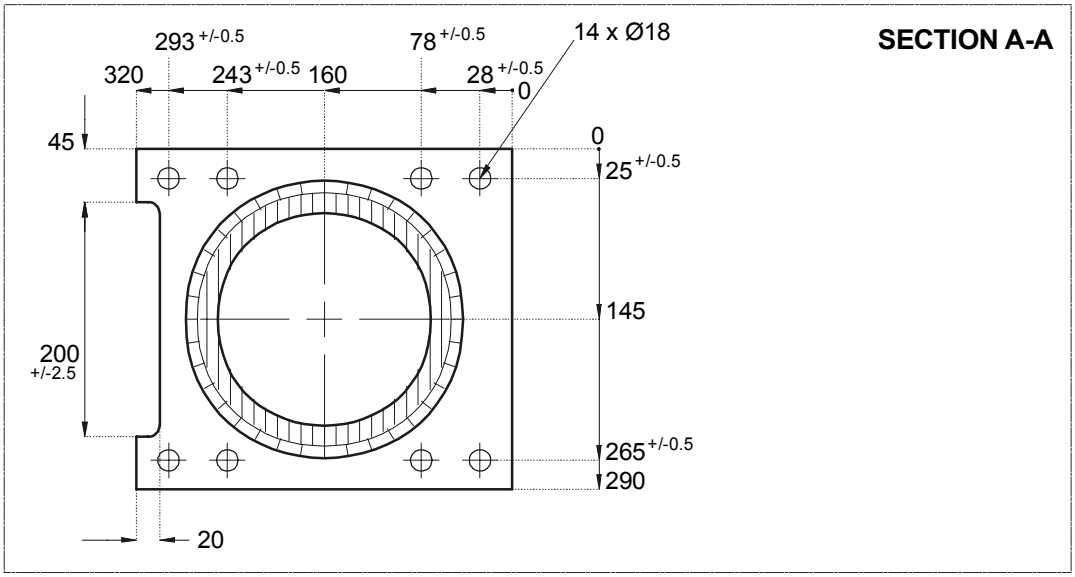


FORWARD

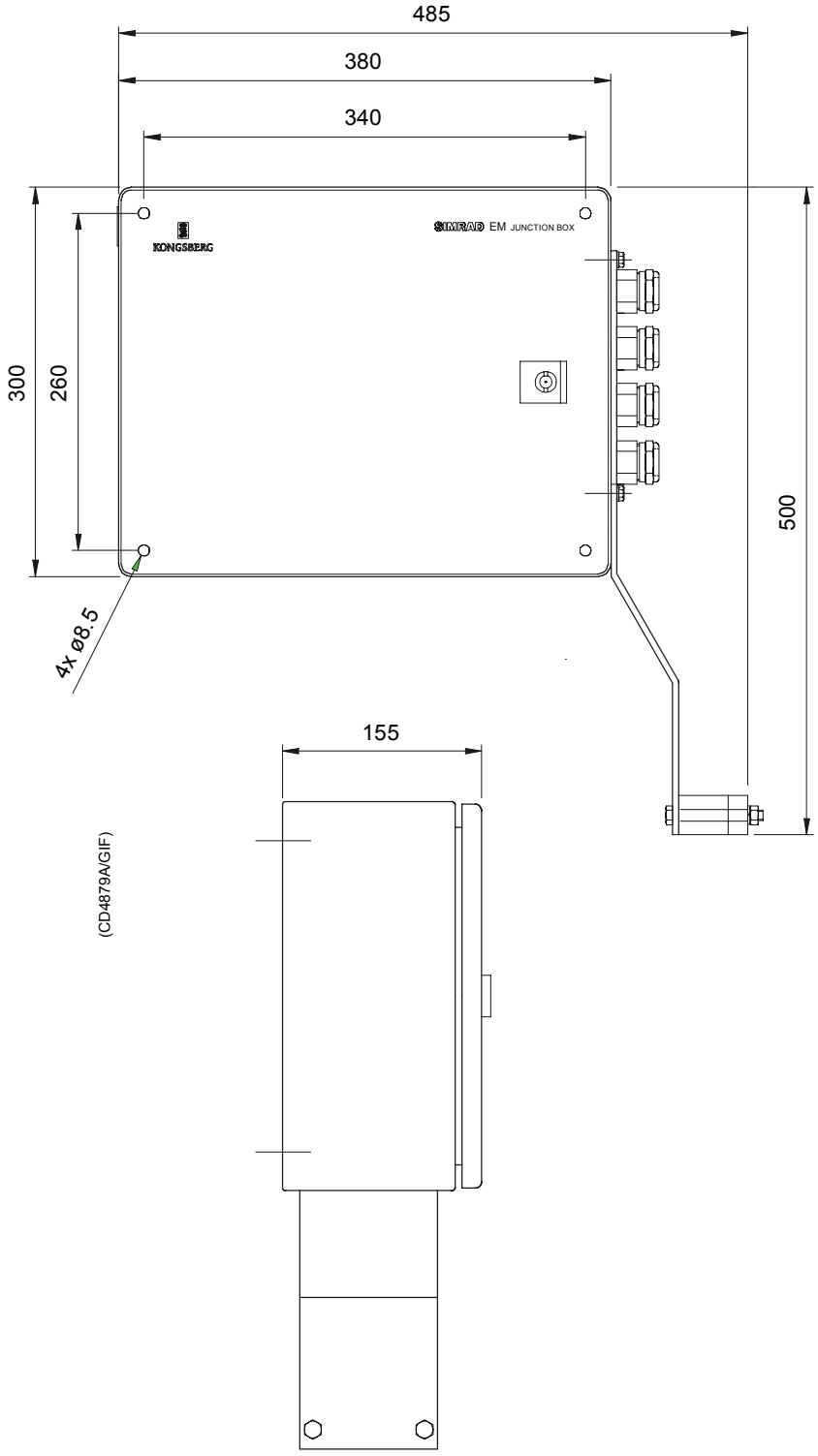
This drawings presents
the transducer array
prepared to fit into a blister.

Revision: C CD4942	Transducer array - Outline dimensions	**830-088454** Page 1 of 1



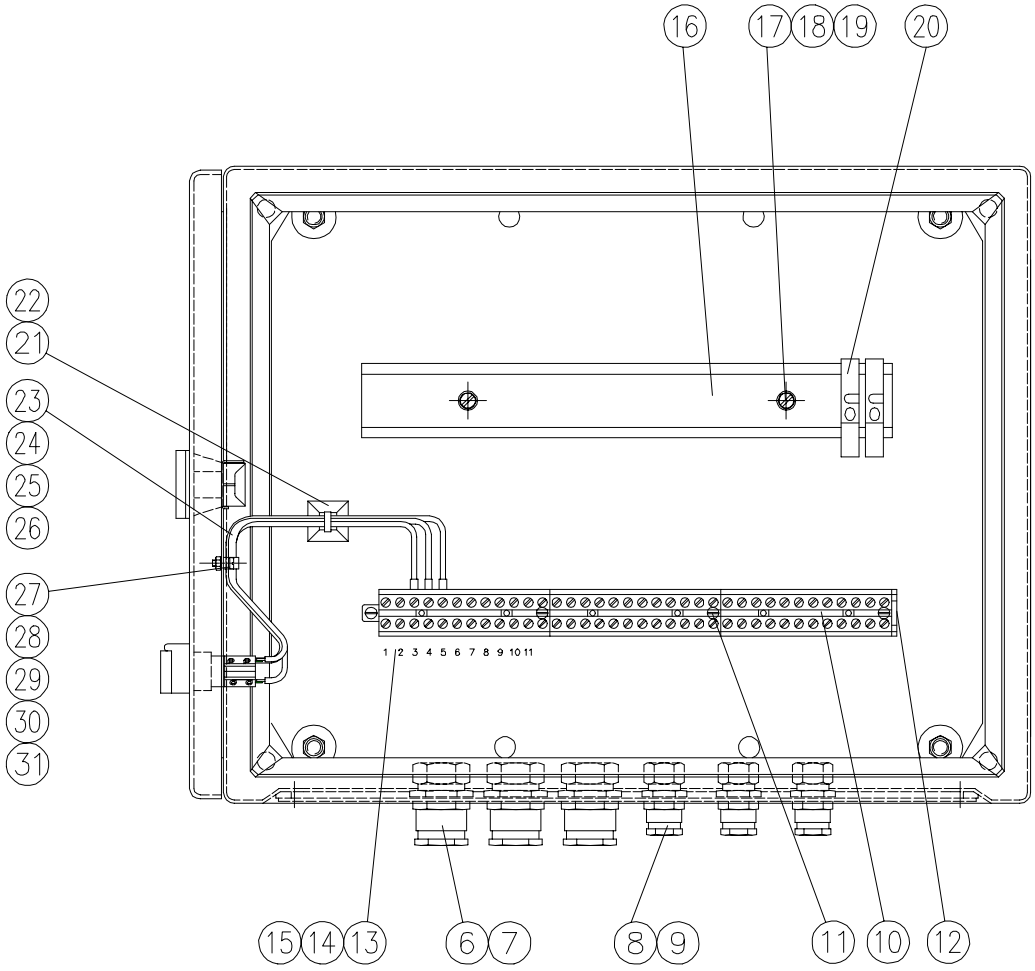


Page 1 of 1 (CD4520)	Mounting bracket, transducer	**599-109711** Rev.A



Revision: A CD4879	Junction Box for transducer cables - Outline	**210960** Page 1 of 1

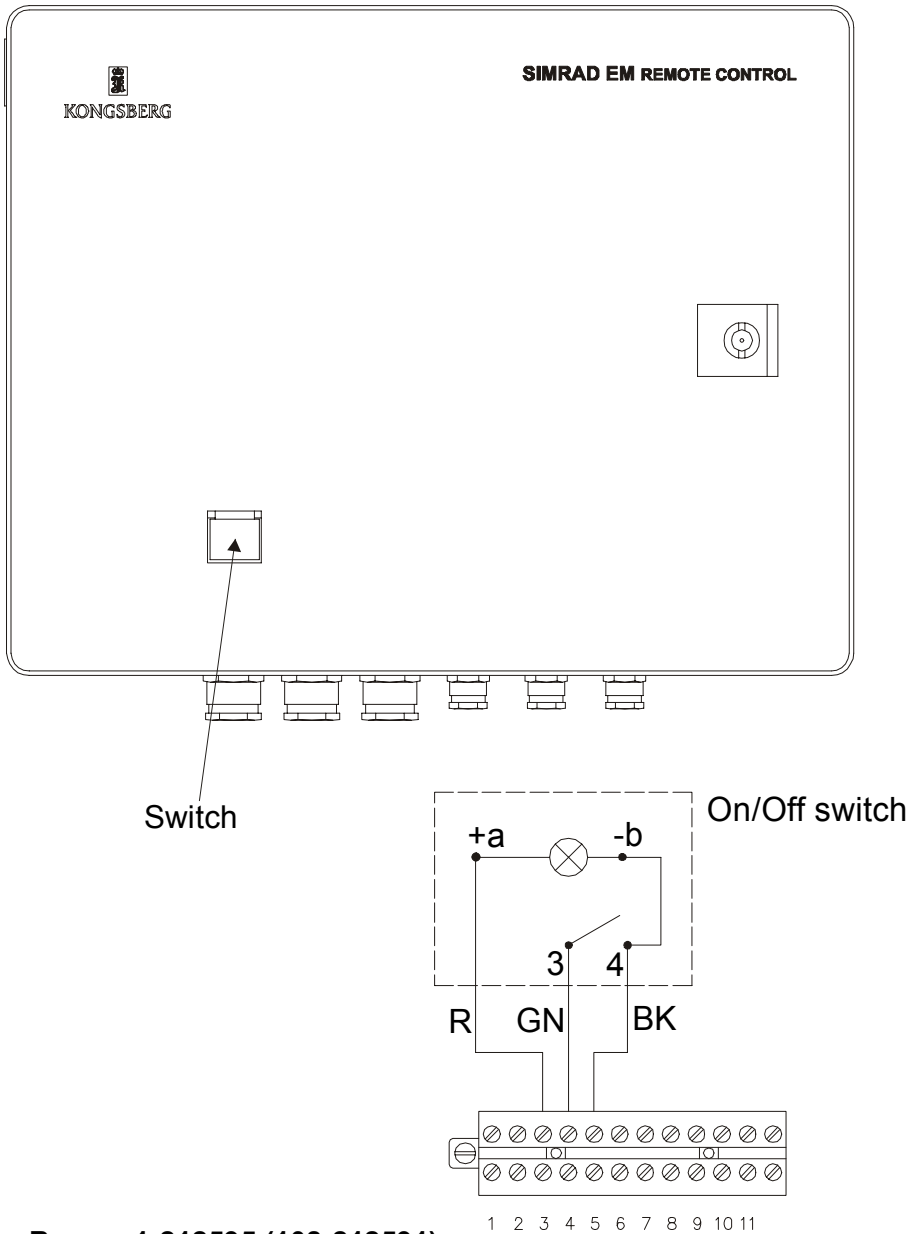
6-7	Screened cable gland
8-9	Screened cable gland
10	Terminal block
11	M3x6 bolt
12	End piece for terminal block
13-15	Marking tape
16	Mounting rail
17-19	M4x8 bolt with nut and washer
20	End piece
21-22	Mounting plate
23-26	Mounting strip
27-31	Mounting material (bolts, strips etc)



Junction Box em1-212595 (108-212591)

Revision: A CD4886A/PDF	Junction Box, assembly	860-212592 Page 1 of 2

2-5 On/Off switch with built-in lamp



Junction Box em1-212595 (108-212591)

CD4886B Page 2 of 2	Junction Box, assembly	**860-212592** Rev B

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EM 1002 Multibeam echo sounder
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