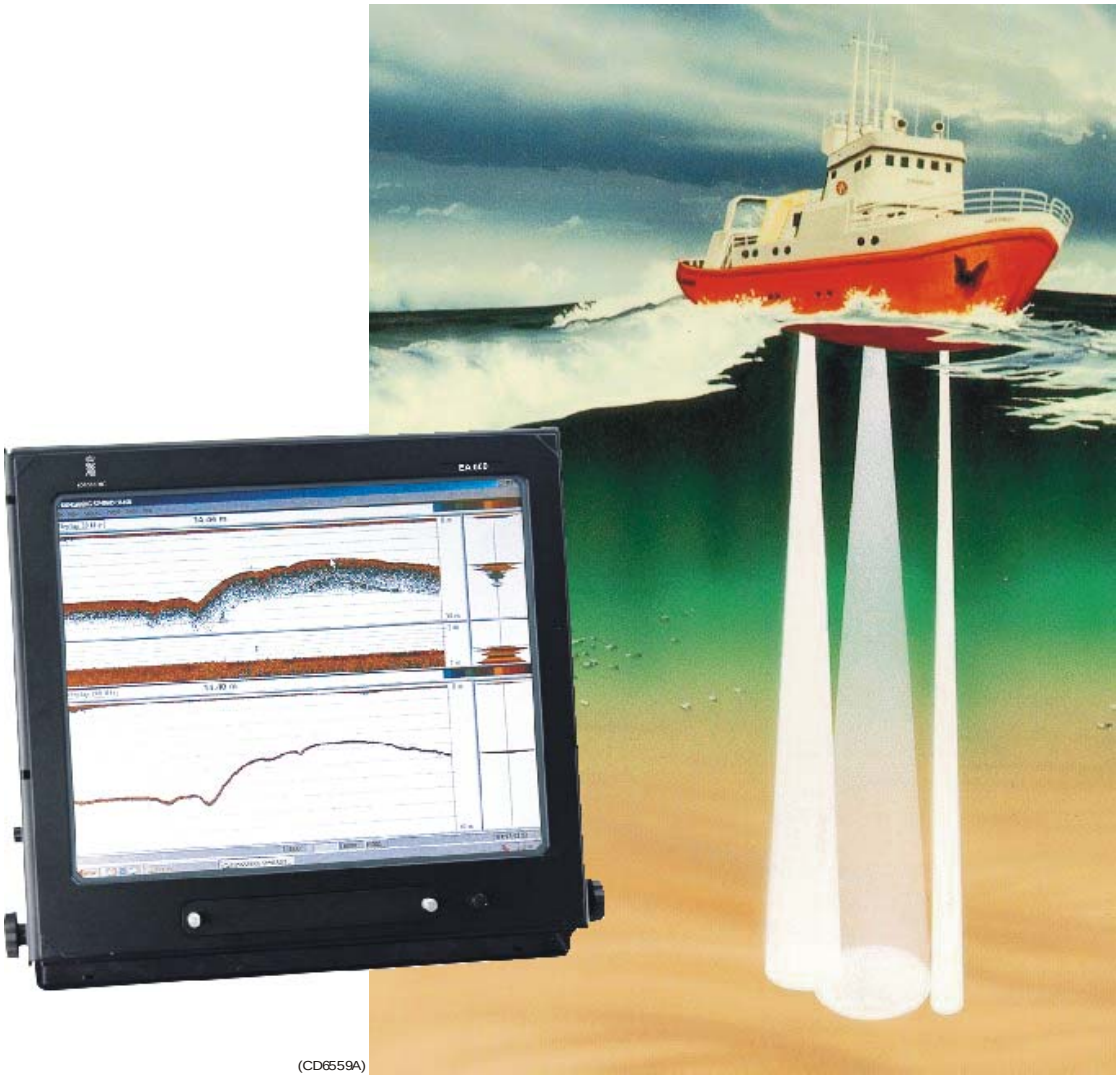
Instruction Manual

KONGSBERG

EA 600

Single beam hydrographic echo sounder

Base version, installation and maintenance information



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Single beam echo sounder

Instruction manual

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Chapters

This book is the installation manual for the EA 600. It describes how to install and maintain the various units used by the EA 600 system.

Remarks

References

Further information about the EA 600 system supplied, may be found in the following manuals:

- EA 600 Operator manual

The reader

This manual is intended to be used by a trained maintenance technician or engineer, with experience of electronic and digital circuitry, computers and electromechanical design. The level of information is based on Simrad's maintenance philosophy: The onboard technical personnel shall, with the help of the documentation and the system's built-in test functions, be able to identify malfunctions, locate the fault, and replace major parts, modules and components on the "Line Replaceable Unit" (LRU) level. He/she will however not attempt to repair the LRUs.

1 INTRODUCTION

1.1 Overview

This is the instruction manual for the EA 600 single beam hydrographic echo sounder system.

The chapters Hardware installation and Transducer installation contains information about how to install the system, while the chapters GPT maintenance, Replacement procedures and Spare parts contains maintenance information.

All cables are described in the chapter Cable layout.

The manual also defines the equipment responsibility, and provides instructions for unpacking and storage. This is found in the appendices.

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.

The manual contains detailed descriptions of each of the units in the system. Each circuit board and mechanical assembly is described. The manual includes procedures for disassembly and reassembly of the replaceable items.

This manual also presents drawings required to install the EA 600 hydrographic 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.

1.2 Maintenance philosophy

Kongsberg Maritime AS defines three levels for maintenance:

Organizational - You will only perform limited preventive and corrective maintenance on the system. There is no need for technical education or training, and no need for any instruments. Typical tasks are exterior cleaning, or changing fuses.

Intermediate - You will perform overall preventive and corrective maintenance on the system. It is recommended that you are an educated engineer with experience from computerized design and mechanical systems. It is further expected that you can use standard electronic instruments, such as an oscilloscope. You should be trained by Kongsberg Maritime to perform maintenance on the system. Typical tasks may include troubleshooting, testing and circuit board replacement.

Depot - You will perform detailed maintenance on the system and on the circuit boards and modules. You must be an educated engineer with experience of computerized design and mechanical systems. It is further expected that you can use standard electronic instruments, such as an oscilloscope. You should be trained by Kongsberg Maritime to perform maintenance on the system. Typical tasks are circuit board repair.

Note

This manual is prepared for the intermediate level.

This manual does not describe the maintenance of the computer and the peripheral devices (printers, plotters and sensors). For information about these items, refer to the applicable manufacturer’s documentation.

1.3 General safety rules

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

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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.
- 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 System overview

Key facts

The EA 600 is a single or multi frequency echo sounder designed for the professional hydrography community. It can operate with maximum four frequency channels simultanously.

- The EA 600 system is flexible and easy to configure due to the modular design.
- The EA 600 is available in several versions. The standard EA 600 system uses a Hydrographic Operator Station (HOS) (combined display and computer). A system using a desktop computer is optionally available. For IP55 protection of the transceiver unit(s) a dedicated steel cabinet may be supplied.
- Echo sounders ranging from relatively low-cost single beam to large multi-frequency systems can be realised.
- Menus and dialogue boxes are operated with a standard computer mouse and keyboard.
- Large colour liquid crystal displays (LCD) are used. A standard computer mouse may be used.
- The EA 600 uses the Microsoft Windows® display interface. Operation is to a large extent self-explanatory. Getting started is easy if you are familiar with standard Microsoft Windows® programs.
- A store/replay function reduces the need for echogram printout on paper. The unprocessed transducer signal is recorded on the internal harddisk. During replay, this signal is injected into the EA 600 processing software as if it arrived directly from the transceiver.

Main units

The standard EA 600 hydrographic echo sounder consists of one or more transducers, a General Purpose Transceiver (GPT) and a Hydrographic Operator Station (HOS). When required for enhanced protection, the GPT unit(s) may be installed in a dedicated steel cabinet.

- Transducers are available at frequencies ranging from 12 to 710 kHz.
- The General Purpose Transceiver (GPT) contains transmitter and receiver electronics. It can be configured for single beam operation. The receivers are designed for low noise, and they can handle input signals spanning a very large instantaneous dynamic amplitude range of 160 dB. All targets are correctly measured and displayed. Output transmit power per frequency channel is maximum 2 kW per channel.

- A twisted pair Ethernet cable connects the General Purpose Transceiver (GPT) with the computer. The distance between the computer and the GPT can be extended up to 100 meters.
- If more than one transceiver is used, a small ethernet HUB or switch is used to connect the General Purpose Transceivers to the computer.
- Most of the echo sounder functions are implemented in software. The bottom detection algorithm is implemented solely in software with separate computation for each frequency channel.
- Interfaces are provided for depth telegram output as well as navigation data, temperature sensor and motion sensor inputs. An external push button may be connected for manually start and stop of the survey lines.
- An external push button may be added for manual control of the event triggering.
- Socket interface is included. To run the EA 600 software and other software (for example survey- or classification software) on the same computer, this socket interface is required for data transmission between the software packages.

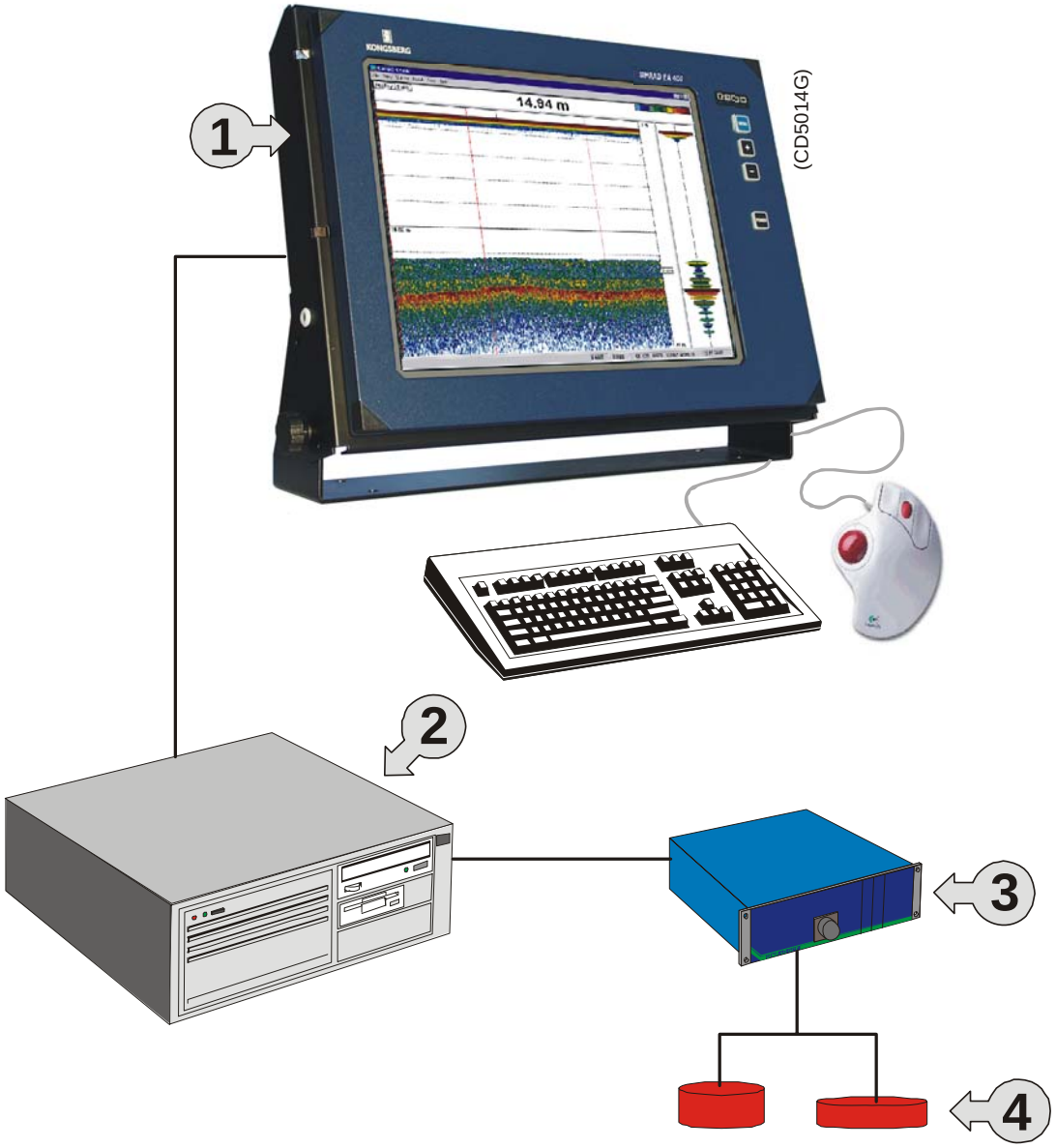
1.5 System diagrams

The following system diagrams are provided:

- EA 600 with one transceiver
- EA 600 with two transceivers
- EA 600 with Hydrographic Operator Station (HOS) and two transceivers
- EA 600 with a Hydrographic Operator Station (HOS) and the GPT Cabinet.

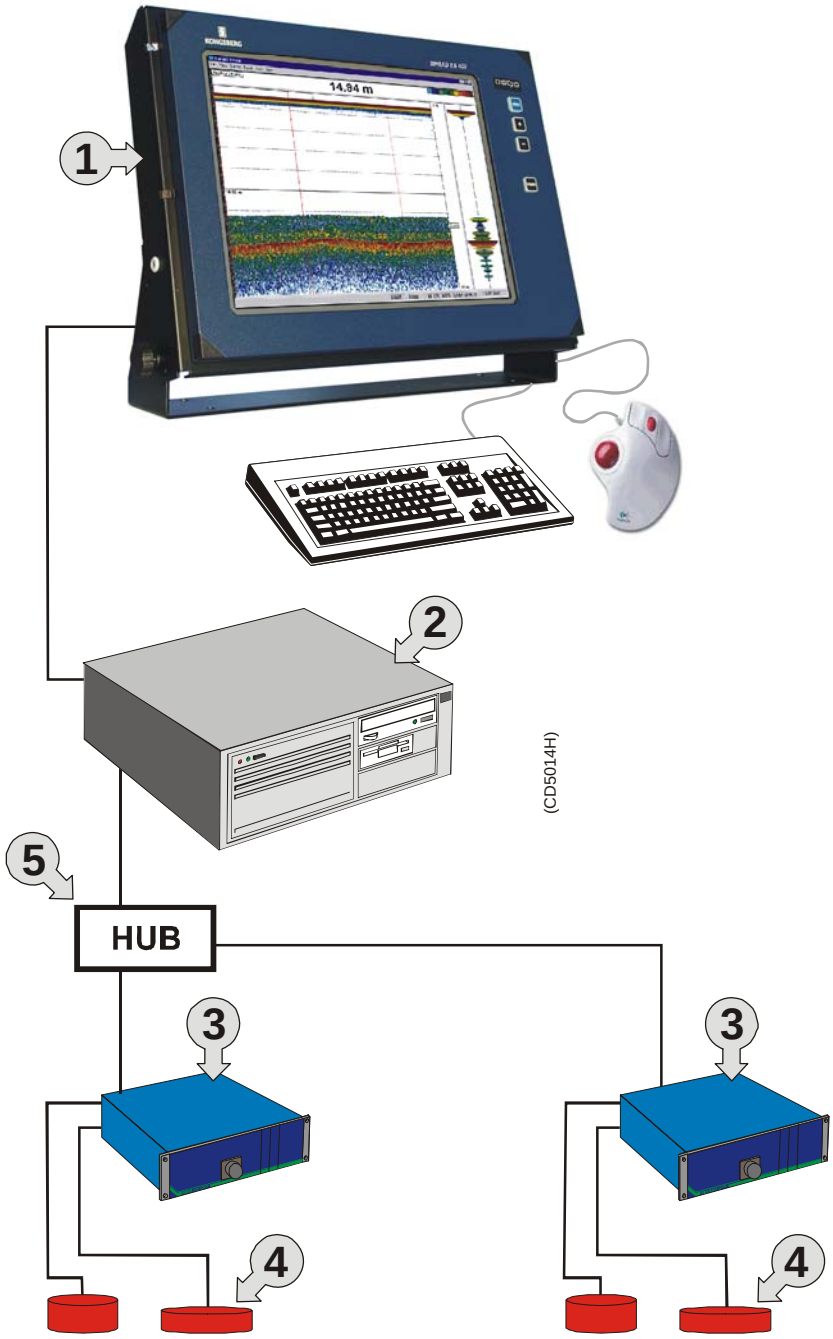
System diagram with one transceiver

1) Display unit 2) Processor unit 3) General Purpose Transceiver (GPT) 4) Transducers



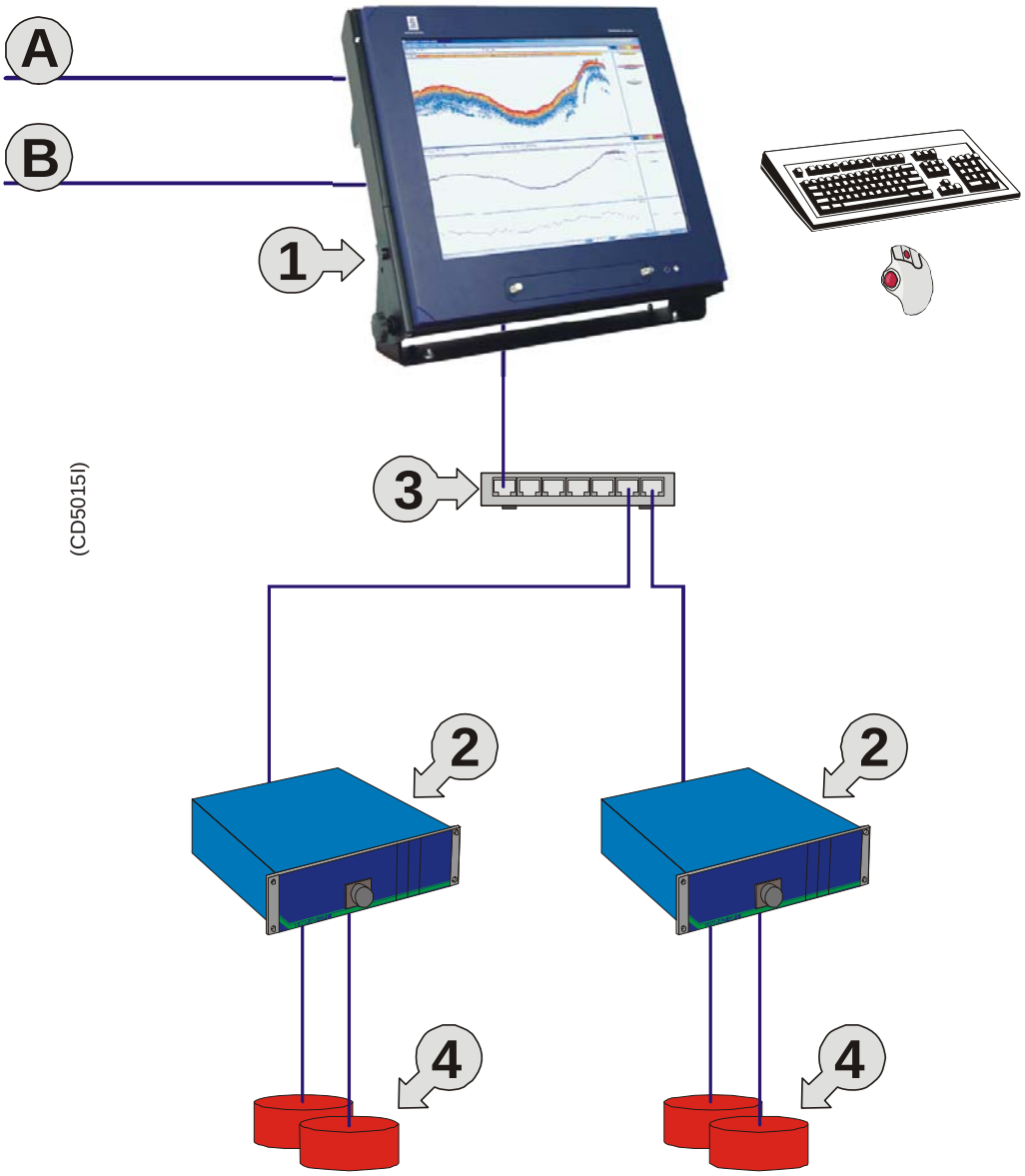
System diagram with two transceivers

1) Display unit 2) Processor unit 3) General Purpose Transceiver (GPT)
4) Transducers 5) Ethernet HUB or switch



System diagram with Hydrographic Operator Station (HOS) and two transceivers

1) Hydrographic Operator Station (HOS) 2) General Purpose Transceiver (GPT)
3) Ethernet HUB or switch 4) Transducers A) Navigational data B) Motion sensor data



System diagram with Hydrographic Operator Station (HOS) and a GPT Cabinet

1) Hydrographic Operator Station (HOS) 2) GPT Cabinet with one or two General Purpose Transceivers (GPT) 3) Transducers

1.6 Technical specifications

The following is a summary of the technical specifications for the EA 600 echo sounder. Note that the specifications may be changed without prior warning.

Topics

Echosounder system

- **Frequency channels:** 1, 2, 3 or 4 channels
- **Operating frequencies:** 12, 18, 33, 38, 50, 120, 200, 210 and 710 kHz
- **Echogram types:**
  - Surface echogram
  - Bottom expansion
  - Alongtrack slope
  - Pinger mode
- **Gain function:** 20 log TVG, 30 log TVG, 40 log, TVG or None.
- **Ping rate:** Adjustable, maximum 20 pings per second.
- **Start depth and range:** 5 to 15,000 meters in Manual, Auto range or Auto start modes.
- **Scope presentation:** Displays the echo strength of the most recent ping.
- **Colour scale:** 12 colours (3 dB pr colour)
- **Bottom detector:** Software tracking algorithm, adjustable minimum and maximum depth

External interfaces

Numerous external interfaces are provided for the EA 600 echo sounder system.

Outputs

- Echogram printer (Centronics parallel)
- Depth data (NMEA, Simrad or Atlas)
- Echogram (only on Ethernet)
- Navigation
- Relay navigation
- Motion sensor
- Status messages
- Annotation
- Sound Velocity Profile applied
- Temperature sensor
- Remote display
- Raw data (only Ethernet) (Classification)
- GeoRef data (only network)

Inputs

- Navigation receiver (NMEA)
- Heading (NMEA)
- Motion sensor (Heave, roll and pitch)
- Analogue heave, roll and pitch (+/- 10 V)
- Annotation
- Sound Velocity Profile
- Real time SVP smart sensor
- Transmit synchronization
- Temperature sensor
- Remote On/Off logging
- Remote On/Off pinging
- Remote On/Off history

Remote control toggle switches

- Survey Line
- Event
- Remote power
- Transmit synchronization

General Purpose Transceiver (GPT)

- **Transmit power:** Max 2 kW (Single or Dual frequency transceiver)
- **Receiver noise figure:** 3 dB
- **Transducer impedance:** 60 ohms
- **Output protection:** Short circuit and open circuit protection
- **Receiver input range:** Instantaneous dynamic amplitude range -160 dBW to -20 dBW (dB relative to 1W)
- **Connectors**
  - **Transducer**: 12-pin female Amphenol, Shell MS3102A-24, Insert 24-19S
  - **AUI**: 15-pin female Delta
  - **Network**: 8-pin RJ-45 socket
  - **Auxiliary**: 25-pin female Delta
- **Physical dimensions**
  - **Width:** 284 mm
  - **Height:** 112 mm
  - **Depth:** 246 mm
- **Weights**
  - **With one TX board:** 2.7 kg
  - **With two TX boards:** 3.3 kg
- **Supply power and fuses**
  - **AC**: 95 to 265 Vac, 50-60 Hz, 50-100 W
  - **DC:** 11 to 15 Vdc, 50-100 W
- **Fuses**
  - **AC fuse:** Ø5x20 mm, 2 A slow
  - **DC fuse:** Ø5x20 mm, 10 A slow or fast
- **Operational temperature:** 0 to +55 deg C
- **Storage temperature:** -40 to +70 deg C
- **Humidity:** 5 to 95% relative non-condensing

GPT Cabinet (IP55)

- **Contents**
  - One or two General Purpose Transceivers (GPT)
  - Ethernet HUB
- **Physical dimensions**
  - **Width:** 400 mm
  - **Height:** 425 mm
  - **Depth:** 420 mm
- **Weights**
  - **With one GPT:** Approximately 30.5 kg
  - **With two GPTs:** Approximately 34.5 kg
- **Supply power and fuses**
  - The GPT Cabinet holds one or two General Purpose Transceivers, and one ethernet switch.
- **Operational temperature:** 0 to +55 deg C
- **Storage temperature:** -40 to +70 deg C
- **Humidity:** 5 to 95% relative non-condensing

Processor Unit

The Processor Unit comprises a standard personal computer. It may be provided locally, but the following specifications are recommended:

- **Processor:** Pentium 400 MHz
  - Minimum requirement: Pentium 1 GHz
- **Memory capacity:**
  - Minimum requirement: 256 Mb
- **Hard disk capacity:**
  - Minimum requirment: 40 GB
- **Disk drives**
  - 1.44 Mb floppy
  - CD-ROM Read/Write
- **External interfaces**
  - Minimum 2 x RS-232 serial lines, recommended 4 x RS-232 serial lines
  - Parallel/USB port
  - 2x ethernet RJ-45
- **Operating systems**: MS Windows 2000 or XP
- **Additional software required:** Internet Explorer 5.0 (or later)
- **Operational temperature:** 0 to +40 deg C
- **Storage temperature:** -40 to +70 deg C
- **Humidity:** 5 to 95% relative non-condensing

Note

Observe that the maximum total cable length used between the Processor Unit and the General Purpose Transceiver (GPT) is 100 meters using CAT5 STP 10 Mbit cable.

Operator Station

The EA 600 is supplied with the HOS 192 Operator Station This is a 19-inch display with a built-in computer. Optionally, the smaller HOS 152 can be supplied.

Earlier systems included the HOS 181 or HOS 151.

Refer to the applicable documentation provided with the unit for more information.

Ethernet HUB

When more than one General Purpose Transceiver is supplied, the EA 600 will be supplied with an Ethernet HUB. Several different switches are available. A standard commercial is HUB supplied with the echo sounder, unless a specific type is specified by the customer. Further specifications may be found in the documentation supplied with the unit.

Standard HUB/switch:

- **No. of ports:** 5
- **Network speed:** 10 Mbps
- **Interfaces**: RJ-45 Ethernet and BNC (optional)
- **External power supply:** 230 Vac
- **Power consumption:** Max 10 W
- **Power frequency:** 50 to 60 Hz
- **Operational temperature:** 0 to +40 deg C
- **Storage temperature:** -20 to +80 deg C
- **Humidity:** 5 to 80% relative non-condensing

2 HARDWARE INSTALLATION

2.1 Introduction

This chapter contains the necessary information for installation of the various units comprising the EA 600 echo sounder.

Hardware items

→ *Basic installation procedure (overview), page 20*

→ *General Purpose Transceiver (GPT) installation, page 25*

→ *Printer installation, page 27*

Transducers

→ *Transducer installation, page 30*

Cables and interfaces

→ *Cable layout, page 69*

2.2 Basic procedure

Purpose

The basic installation procedure is presented here. Detailed technical information can be found in the next chapters. The applicable page references are made in the procedure.

Parts configuration

Check that you have received all parts required for the installation; cables, connectors, brackets etc.

Transducer(s)

Install the transducer(s) and the transducer cables according to the guide-lines in this manual and the drawings provided with the transducer.

Install the two-wire cable for the temperature sensing thermistor if applicable.

Operator Station, keyboard and display

Mount the Operator Station using the appropriate brackets. Connect the keyboard and the pointing device.

The Operator Station is 19” as standard and 15” as optional.

Note

Make sure that there is a reliable ground connection between the computer and the ship’s ground.

Connect the computer and display power cables, and the display’s VGA cable.

General Purpose Transceiver

Mount the General Purpose Transceiver using the appropriate brackets.

Connect the transducer cable and the power cable.

Connect the cable from the temperature sensor (if applicable).

Install a two-wire cable for remote on/off of the GPT’s, if available.

Interfaces

Ethernet

An Ethernet cable must be used between the transceiver and the computer if your system includes a General Purpose Transceiver (GPT).

If only one GPT is used, you need a twisted pair cable with swapped receive and transmit wires. The cable is connected between the GPT and the echo sounder's Operator Station.

An Ethernet Hub is required if your system includes more than one General Purpose Transceiver.

Note

Straight through Ethernet cable must be used.

Serial lines

Connect navigation receiver and heave sensor with serial line output to the rear of the echo sounder computer using RS-232 cables. Heave sensors with an analog output are connected directly to the Auxiliary connector of the nearest transceiver.

Synchronization

Synchronous transmission is desirable if there are several echo sounders onboard the vessel. For every echo sounder and every transceiver onboard the ship, connect the appropriate pins at the Auxiliary connectors together using a two-wire cable.

Related topics

→ *Transducer installation, page 30*

→ *Transducer cables wiring, page 126*

→ *Remote control connection, page 122*

2.3 Parts and configurations

Overview

The EA 600 echo sounder is designed as a modular system. It supports a variety of configurations and frequency options.

The EA 600 echo sounder is provided in several configurations. The basic configurations are:

- The **GPT Cabinet** configuration uses a dedicated steel cabinet to house the transceivers. This configurations provides IP55 protection. It includes the following items:
  - GPT cabinet with one or two General Purpose Transceivers and an ethernet HUB (if required)
  - 1-4 transducers
  - Display Unit with built-in Processor Unit (computer)
  - Pointing device (mouse or rollerball)
  - Keyboard
- The **Transceiver** configuration includes a number of transceivers installed as seperate units. This configurations provides IP40 protection. It includes the following items:
  - 1-4 General Purpose Transceivers (GPT)
  - 1-4 transducers
  - Ethernet HUB (if the system comprises more than one General Purpose Transceiver (GPT))
  - Display Unit with built-in Processor Unit (computer)
  - Pointing device (mouse or rollerball)
  - Keyboard

Transducer

One or more **transducers** are included.

A single frequency General Purpose Transceiver (GPT) accepts one transducer, and a dual frequency GPT accepts two transducers.

The GPT cabinet is equipped with one or two General Purpose Transceivers, and can thus facilitate maximum four transducers.

A large number of transducers are available from Kongsberg Maritime. There are several transducer alternatives for each operating frequency with different beam widths, power rating and mounting arrangements.

All transducers are rated 60 or 75 ohms. Each has an efficiency of approximately 50%.

Transceiver

One or more **General Purpose Transceivers (GPT)** are included.

The transceiver(s) may be installed inside the GPT cabinet., or otherwise as described in the *Overview* above.

The General Purpose Transceiver (GPT) is a small self-contained unit containing its own power supply. It operates from +12 Vdc or 115-230 Vac. The unit can be mounted anywhere on board the ship, provided that the location is dry and ventilated. Power cable and mounting brackets are enclosed.

We recommend that the GPT is mounted as close to the transducer(s) as possible.

The GPT is available in single beam configuration. Possible operating frequencies are 12, 18, 33, 38, 50, 70, 120, 200, 210 and 710 kHz.

The GPT is available in single and dual frequency configurations. A dual frequency single beam configuration is also provided. Possible operating frequencies are listed in the technical specifications. Typical single frequency configurations include:

Identification	Frequency and power
GPT-S12(x)-H	12 kHz (x kW)
GPT-S18(x)-H	18 kHz (x kW)
GPT-S33(x)-H	33 kHz (x kW)
GPT-S38(x)-H	38 kHz (x kW)
GPT-S50(x)-H	50 kHz (x kW)
GPT-S70(x)-H	70 kHz (x kW)
GPT-S120(x)-H	120 kHz (x kW)
GPT-S200(x)-H	200 kHz (x kW)
GPT-S210(x)-H	210 kHz (x kW)
GPT-S710(x)-H	710 kHz (x kW)

...where **x** identifies the output power:

- EA 600: 1 to 2 (= 1 to 2 kW)

Typical dual frequency configurations include:

Identification	Frequency and power
GPT-S38(x)/S200(x)-H	38 kHz (x kW) & 200 kHz (x kW)
GPT-S50(x)/S200(x)-H	50 kHz (x kW) & 200 kHz (x kW)
GPT-S120(x)/S200(x)-H	120 kHz (x kW) and 200 kHz (x kW)

...where **x** identifies the output power:

- EA 600: 1 to 2 (= 1 to 2 kW)
- Other dual frequency combinations are available.

- Other 3. party frequencies as 15 kHz, 33 kHz and 210 kHz are available and can be configured as single or dual combinations.

Note

Frequencies below 33 kHz for EA 400 has a max bottom range at 200 m.

Display Unit

In a standard delivery, 15” or 19” LCD units are supplied. All units have an integrated processor Unit (computer) mounted on the rear side. The display units operate from 230 Vdc.

The compact configuration uses a display unit with one or two General Purpose Transivers (GPT) units mounted on the rear side.

Software

All echo sounder configurations run identical software. The software automatically adapts to the number and type of installed transceivers during power-on. Upon delivery, the software is pre-installed on the computer, as well as supplied on a CD-ROM. Software updates are distributed on a CD-ROM.

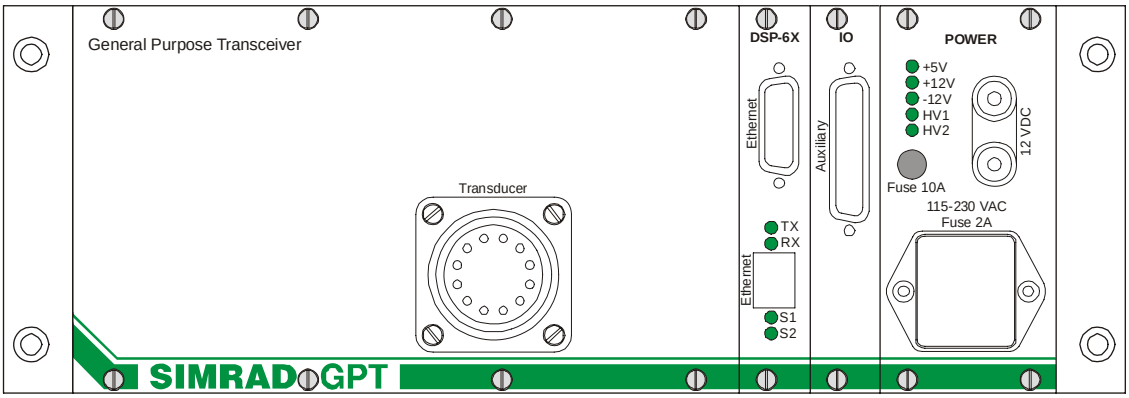
Printer

A printer can be supplied. Most standard off-the-shelf colour printers can be used. A standard Windows® driver is required.

2.4 General Purpose Transceiver (GPT)

Overview

The GPT transceiver is a self-contained unit. It can be mounted anywhere onboard the vessel. It is recommended to mount the GPT as close to the transducer(s) as possible in order to minimise the electrical interference into the transducer cable.



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The General Purpose Transceiver is easily mounted with the brackets supplied with the unit.

Procedure

Two brackets and four pan head screws are enclosed. The side walls of the unit each hold six screws; three screws along the bottom edge and three screws along the top edge.

The brackets can be vertically mounted in three different positions;

- Use the two rear holes, or
- Use the two centre holes, or
- Use the two front holes.

The brackets can be horizontally mounted in four different ways using either the bottom edge holes or the top edge holes.

1 Unscrew two screws from each side wall.

2 Mount the brackets using the pan head screws.

3 Position the unit on the surface and mark the four mounting holes.

4 Remove the unit, and drill mounting holes.

5 Mount the unit to the surface using 5 mm bolts.

2.5 Operator Station

A standard personal computer is used.

Depending on the computer type (desktop integrated with LCD, tower or laptop), install the unit so that it is secure and able to withstand the shock, vibrations and movements experienced on a ship.

Perform the cabling on the rear side of the unit.

2.6 Printer

Introduction

Any Microsoft Windows® compatible printer may be connected to the EA 600 Processor Unit. The connection is made with a standard Centronics type parallel cable.

Hardware installation

Refer to the applicable printer documentation for hardware installation. Make sure that the printer is securely mounted to withstand the shock, vibrations and movements experienced on a ship.

Software installation

In order to use the printer, you must install the necessary driver(s) and set up the EA 600 Processor Unit so that the presence of the printer is known. To do this, you will need to use the standard Microsoft Windows® tools on the computer.

In this procedure, a Hewlett Packard 970C colour printer is used as an example.

Note

You need to access the underlying operating system directly to perform this maintenance task. Take care when proceeding. With full access you can severely damage the operating system if you are not careful.

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1 Terminate the echo sounder program without shutting down the computer.

- Verify that the echo sounder presents a standard Microsoft Windows® computer display.

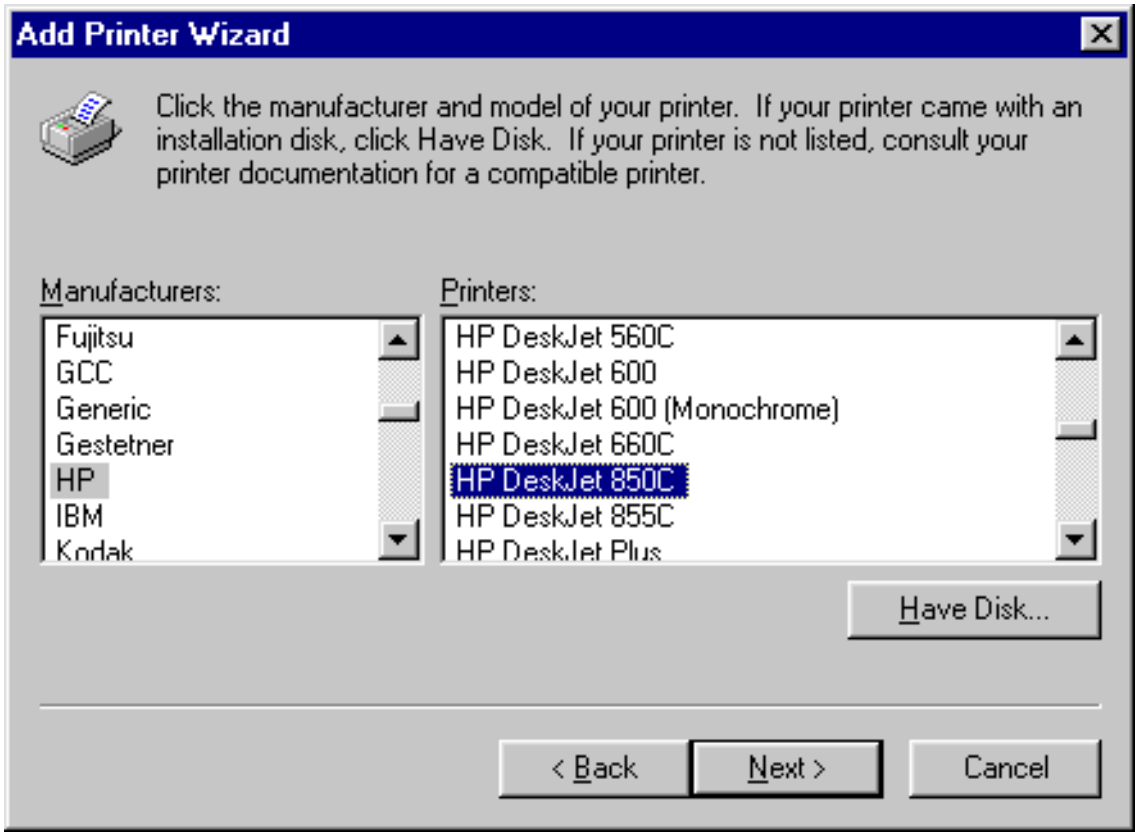
2 Press the **Start** button in the lower left corner, and activate the **Settings** option on the menu.

3 On the **Settings** sub-menu select **Printers**.

4 Double-click the **Add Printer** icon to start the printer installation software.

5 On the first page, select **My Computer**. Then, click the **Next** button to move to the next page.

6 On the second page, click the check box next to the **LPT1** port. Again, click the **Next** button to move to the next page.



7 On the third page, select **HP** in the manufacturers list, and **HP DeskJet 970C** in the printers list. Click **Next** to continue.

- If a different printer make is installed, select the appropriate manufacturer and model. If the printer you have is not listed, refer to *Software installation of unlisted printer.*

8 On the fourth page, the logical name of the printer becomes **HP DeskJet 970C**. You can select a different name by modifying the printer name entry. Make this printer your default printer by selecting **Yes**. Click **Next** to continue.

9 On the fifth page, select **Not Shared**. Click **Next** to continue.

10 On the sixth page, print a test page. Then, press **Finish** to complete the installation.

11 Restart the computer.

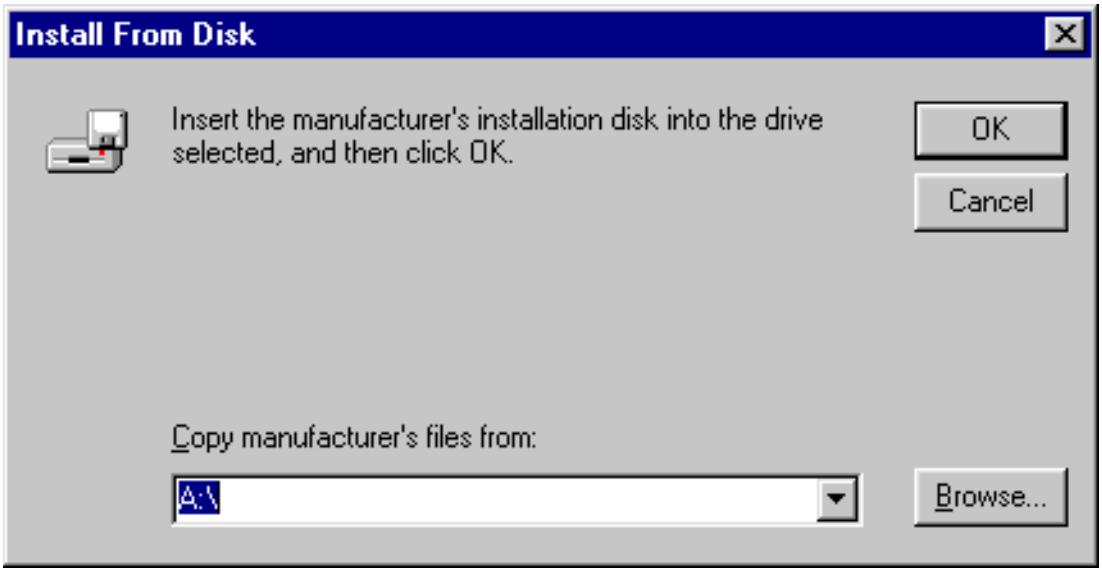
Note that menus and dialogues used during printer installation are part of the operating system. These follow the language setting of the operating system. They do not comply to the language setting of the echo sounder program.

Software installation of unlisted printer

If your new printer is not listed on the second installation page, observe the following procedure:

1 On the second page, press the **Have disk** button.

2 Insert the disk or CD ROM supplied with you printer, and identify the drive name for the installation program.



3 Allow the software to locate the necessary drivers.

4 Return to the standard procedure.

Several printer manufacturers supply their printers with all the necessary drivers and installation software on a CD ROM. To use this facility, simply insert the CD ROM, and allow the installation software to start automatically. Follow the instruction presented by the installation software.

3 TRANSDUCER INSTALLATION

3.1 Transducer location

General

A single answer to the question where to locate the transducer cannot be given. It depends very much on the vessel's construction. However, there are some important guide lines.

Go deep

The upper water layers of the sea contain a myriad of small air bubbles created by the breaking waves. In heavy seas the uppermost 5 to 10 metres may be air-filled, with the highest concentrations near the surface. Air bubbles absorb and reflect the sound energy, and may in worst cases block the sound transmission totally. Therefore, mount the transducer at a deep position on the hull.

Consider the situation when the vessel is unloaded, and when it is pitching in heavy seas. The transducer must never be lifted free of the water surface. Not only will the sound transmission be blocked, but the transducer may be damaged by slamming against the sea surface.

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

Boundary water layer

When the vessel forces its way through the sea, the friction between the hull and the water creates a boundary layer. The thickness of the boundary layer depends upon vessel speed and the roughness of the hull. Objects protruding from the hull, and dents in the hull, disturb the flow and increase the thickness of the boundary layer. The flow in this boundary layer may be laminar or turbulent. A laminar flow is a nicely ordered, parallel movement of the water. A turbulent flow has a disorderly pattern, full of eddies. The boundary layer increases in thickness when the flow goes from laminar to turbulent. Figure 1 (next page) sketches the boundary layer of a vessel moving through the water.

Furthermore, air bubbles in the sea water are pressed down below the hull and mixed into the boundary layer. The boundary

layer is thin underneath the forward part of the vessel, and increases in thickness as it moves towards aft. If the sides of the hull are steep, some of the air bubbles in the boundary layer may escape to the sea surface along the vessel sides. It is our experience that a wide and flat bottom, with a rising angle less than around 13 degrees, is prone to giving air problems for the transducer. In any case a transducer location in the forward part of the hull is preferred in order to minimise the influence of the boundary layer.

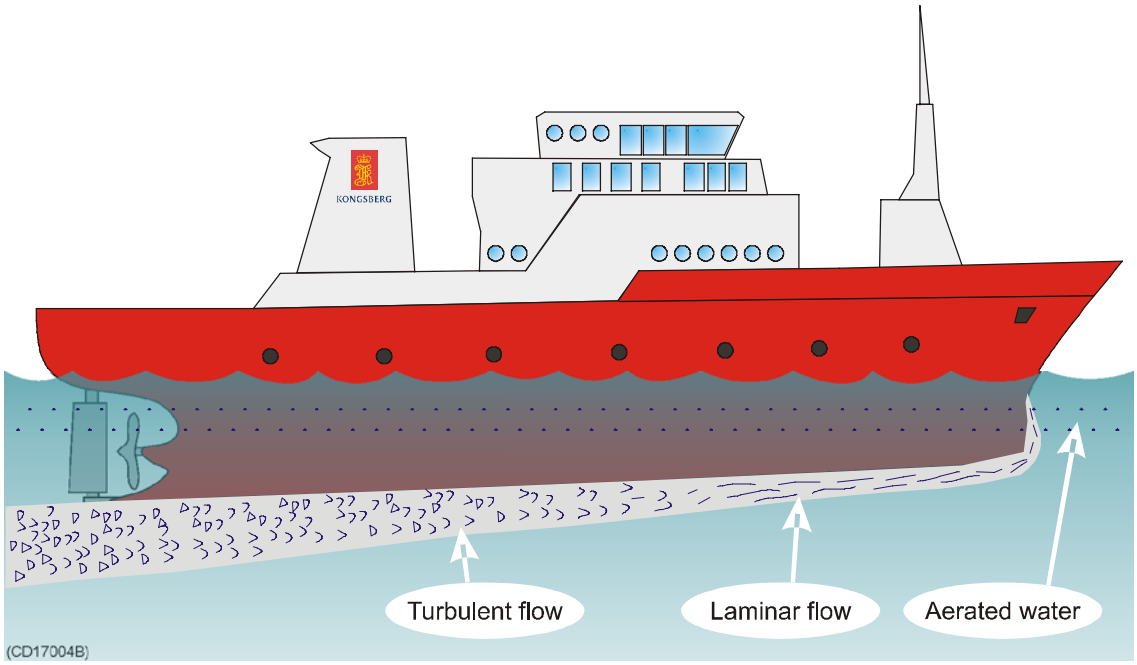


Figure 1 Sketch of the boundary layer underneath the vessel.

Propeller noise

The propulsion propeller is the dominant noise source on most fishing vessels, research vessels, merchant vessels and pleasure crafts. The noise is transmitted through the sea water. Therefore the transducer should be placed far away from the propeller, which means on the fore part of the hull. Positions outside the direct line of sight from the propeller are favourable. On small vessels with short distances it is advised to mount the transducer on that side of the keel where the propeller blades move upwards, because the propeller cavitation is strongest on the other side. The cavitation starts most easily when the water flows in the same direction as the propeller blade, and that is to some degree the case at that side of the keel where the propeller blades move downwards.

Bow thruster propellers are awful machines. When they are in operation, the noise and cavitation bubbles make the echo sounder useless, almost no matter where the transducer is installed. And when not in operation, the tunnel creates turbulence, and if the vessel is pitching, the tunnel may be filled with air or aerated water in the upper position and release this in the lower position. Therefore, an echo sounder transducer should be placed well away from the bow thruster.

Vessel heave

Heave is the up and down movement of the vessel. It disturbs the echo traces in the echogram, so that a flat bottom is displayed as a wave. A transducer location in the middle of the vessel minimises the influence of vessel roll and pitch.

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

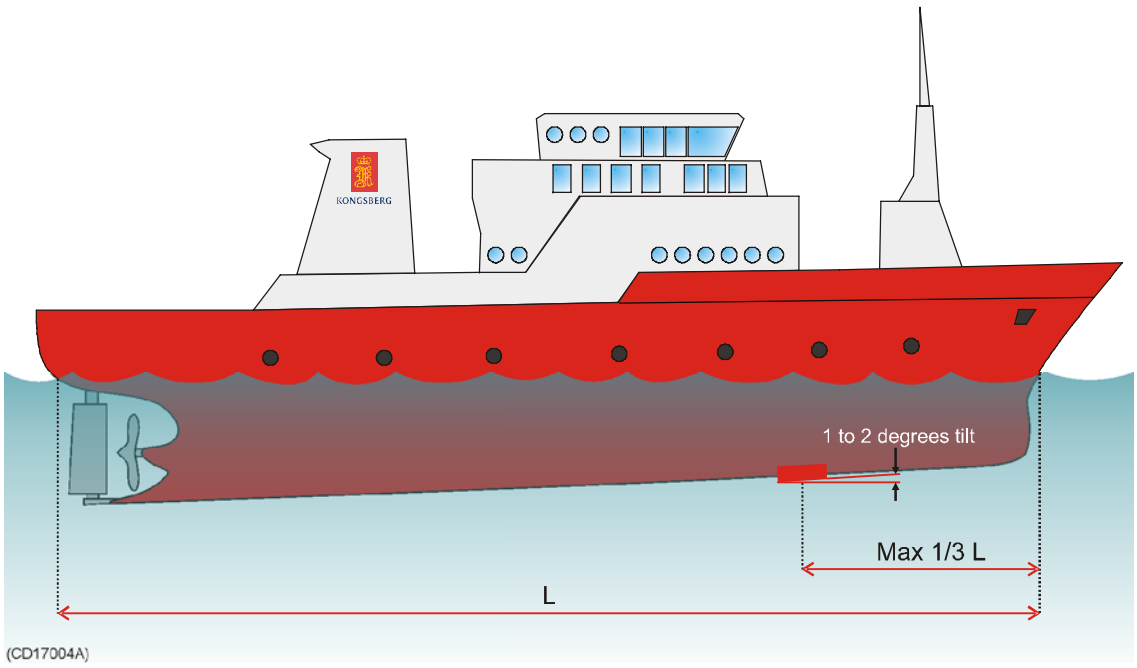


Figure 2 Recommended location of the transducer on the hull

Summary

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

→ *See figure 2.*

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

→ *See figure 3.*

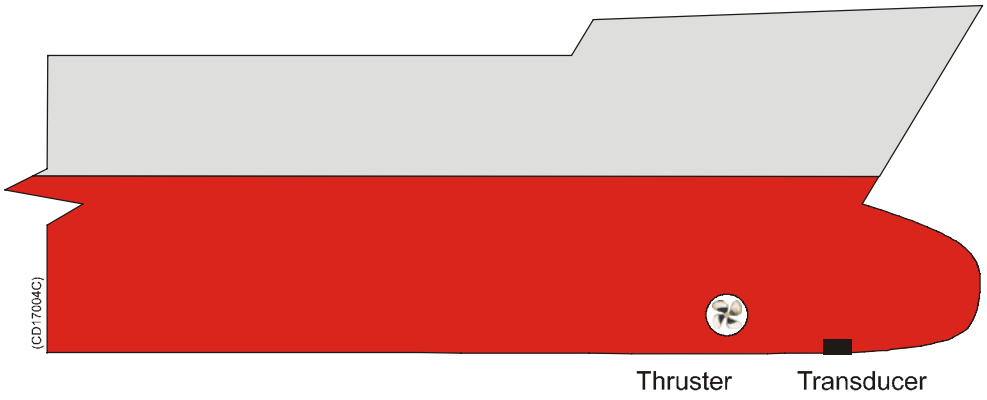


Figure 3 Transducer location on a bulbous bow

3.2 Ways of mounting the transducer

Inclination of the transducer face

Incline the transducer face approximately 2 degrees, so that the flowing water meets it directly. This assures laminar water flow. Mounting screws should not be extruding from the transducer, and the space around the screws could be filled with a compound or a locking ring.

External mount

Some transducers have a streamlined housing, designed for installation outside the hull.

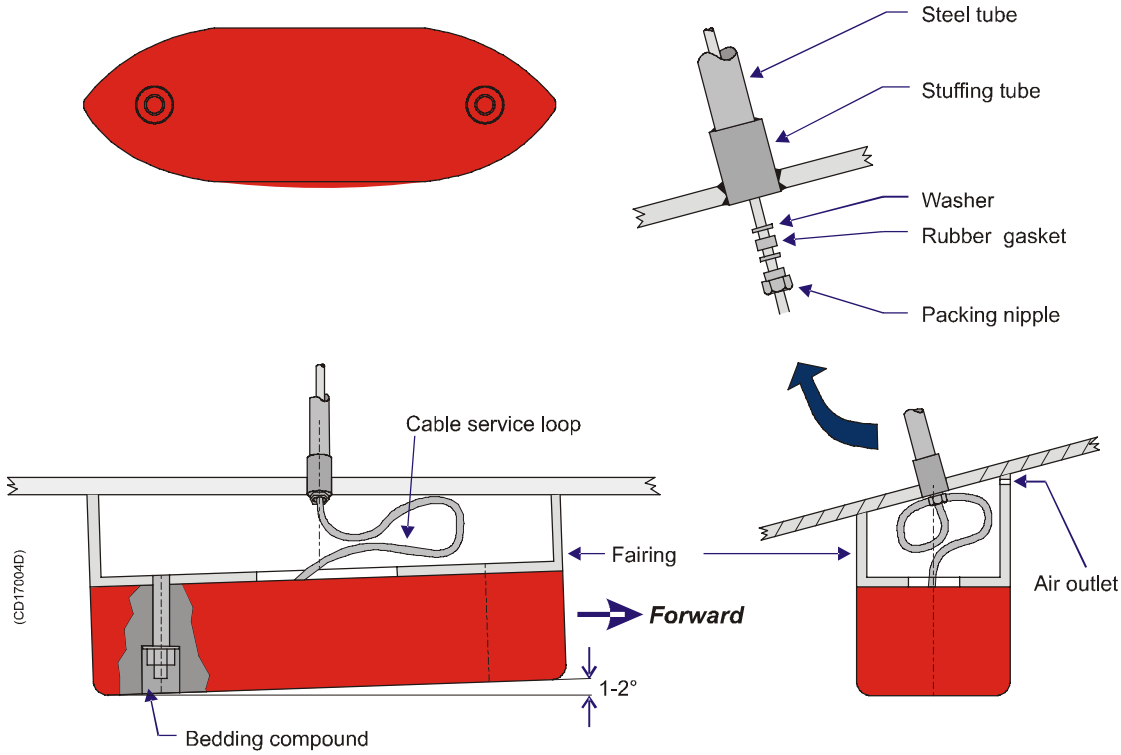


Figure 4 External mounting on steel hulls

A fairing, made by the shipyard, is placed between the transducer and the hull, to adapt for the deadrise angle of the hull. The fairing can be made of wood or steel, and should have the same outline dimensions as the transducer.

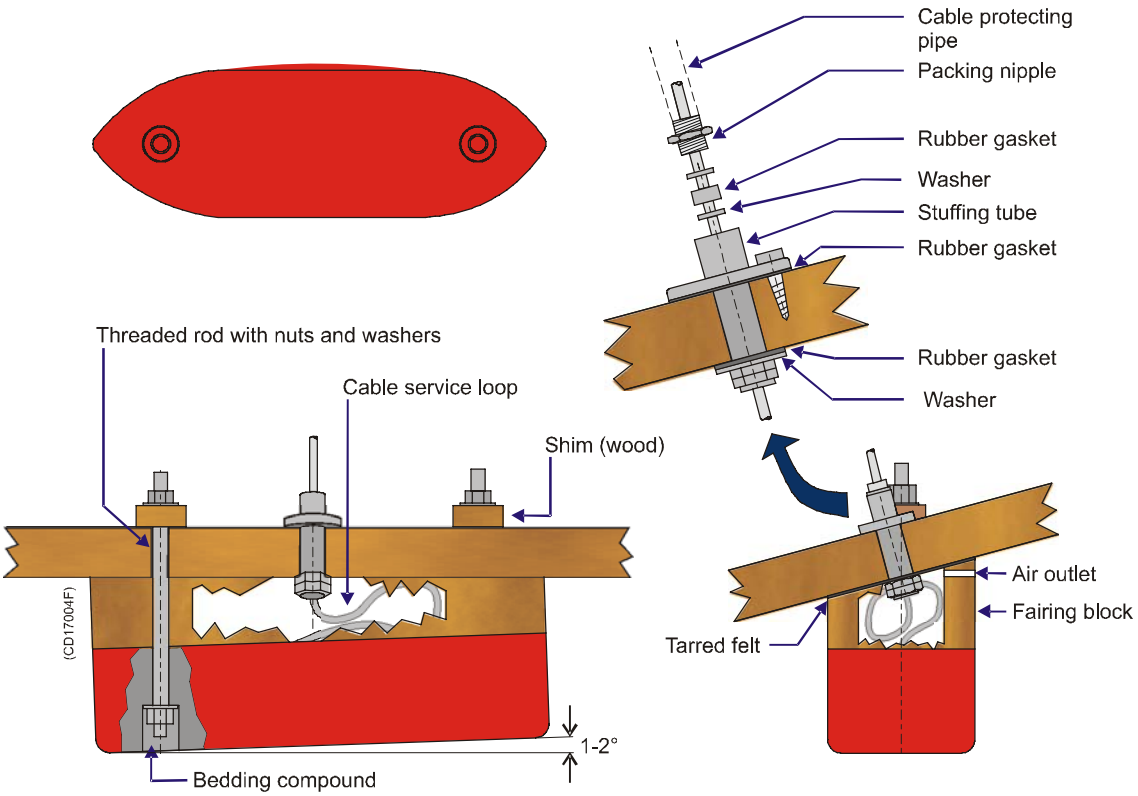


Figure 5 External mounting on wood or polyester hulls

These transducers are mainly used on smaller vessels. A location approximately 0.5 m aside from the keel may be adequate for the passage of water between the keel and the transducer. The figures illustrate external mounting of transducers on steel hulls and on wood or polyester hulls respectively.

→ *Refer to figures 4 and 5.*

Transducer blister

Other transducers are designed for installation into the hull or in a blister. In general, a blister installation is the recommended method. It brings the transducer below the boundary layer. A blister is illustrated below.

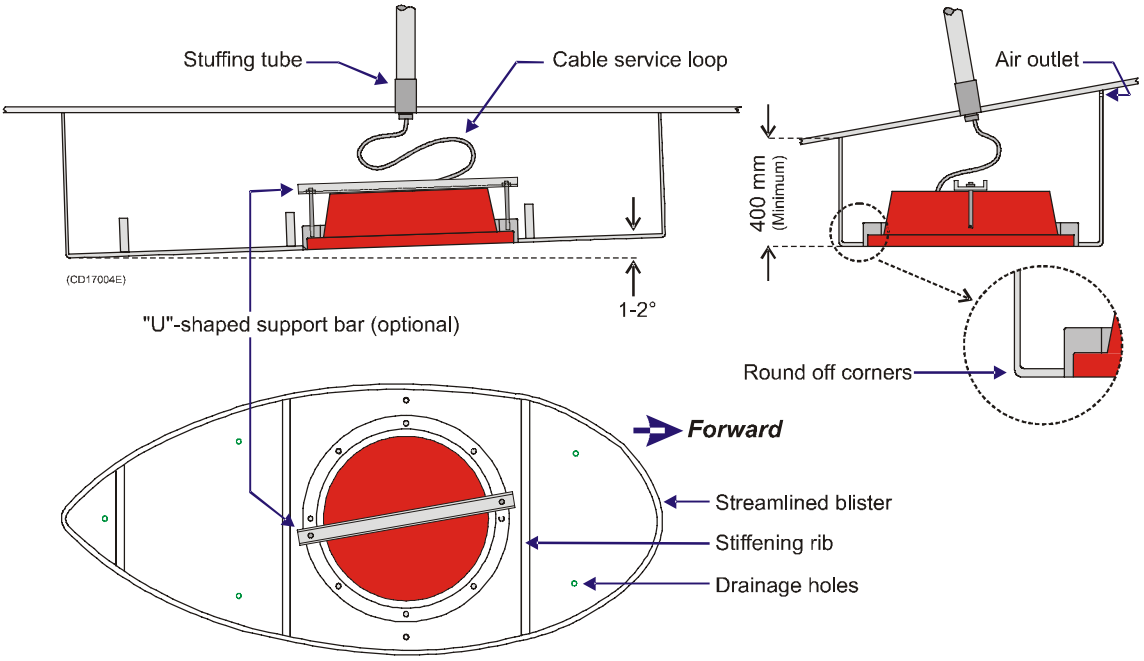


Figure 6 Transducer blister

The best performance is obtained with a blister height of 40 cm or more. A streamlined shape and rounded edges reduce the flow noise. A vertical leading edge or front will guide the aerated water to the sides of the blister. The orientation of the blister should follow the water flow. On a conventional hull shape, without a bulb, the front of the blister should have a few degrees toe-in towards the bow.

→ *See figure 7.*

The blister is placed on one of the sides of the hull, and the distance from the keel is a trade off between a close distance giving a turbulent flow of water in a narrow passage, and a large distance bringing the transducer higher up and also more affected by vessel roll. Normally a distance of approximately 1 m is a good compromise.

→ *See figure 8.*

The interior of the blister must be filled with sea water. Use drainage holes in the bottom and an air outlet on the top. The water pressure behind the transducer will then compensate for the outside pressure during vessel movements in rough sea.

Large diameter transducers must be fitted with a horizontal support bar. This bar can then be secured to the mounting ring using threaded rods.

→ *Refer to figure 6.*

The transducer cable penetrates the hull in a stuffing tube. Leave an adequate loop of the cable behind the transducer for easy mounting or removal of the transducer.

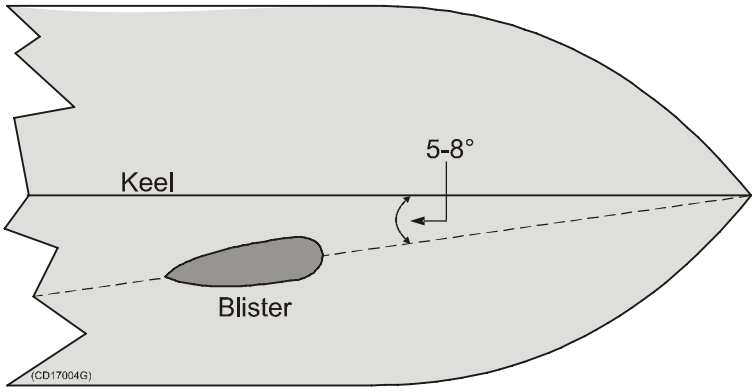


Figure 7 Blister toe-in towards the keel

Observe the horizontal and vertical distances (X and Y) between the keel and the transducer blister. On a medium sized vessel, the horizontal distance (X) should be approximately 1 meter. The vertical distance (Y) must in general be as small as possible. This is important to prevent the keel from shadowing the transducer beam in shallow waters.

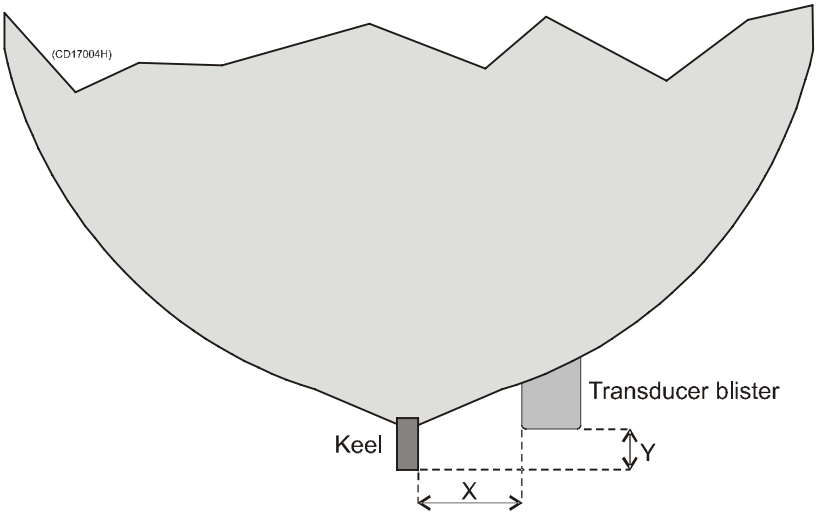
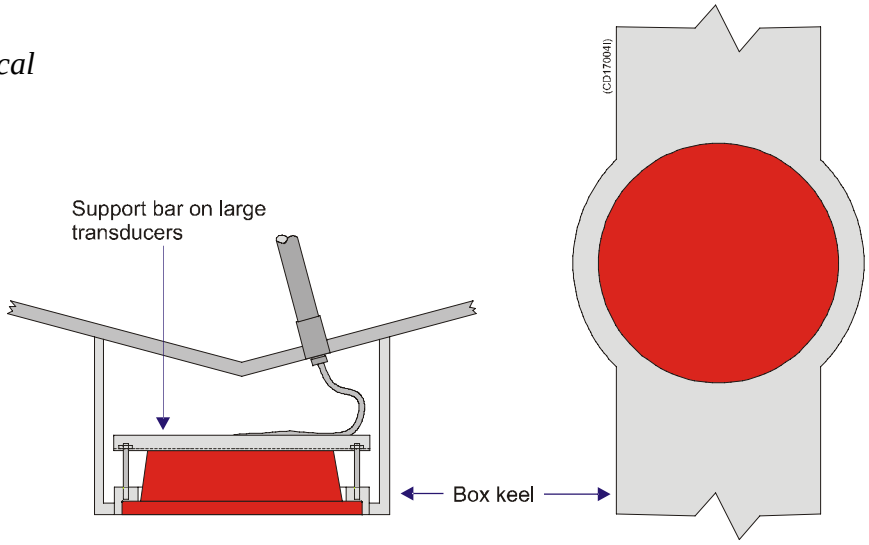


Figure 8 Location of blister relative to the keel

In a box keel

Vessels with a box keel may use this for transducer installation. The box keel is already the deepest part of the vessel. If the box keel is too narrow to accommodate the transducer, it can be widened, either symmetrically or to one side only. In the last case the installation could also be described as a blister merged into the keel. The figure below illustrates a symmetrical box keel installation.

Figure 9 Symmetrical box keel installation



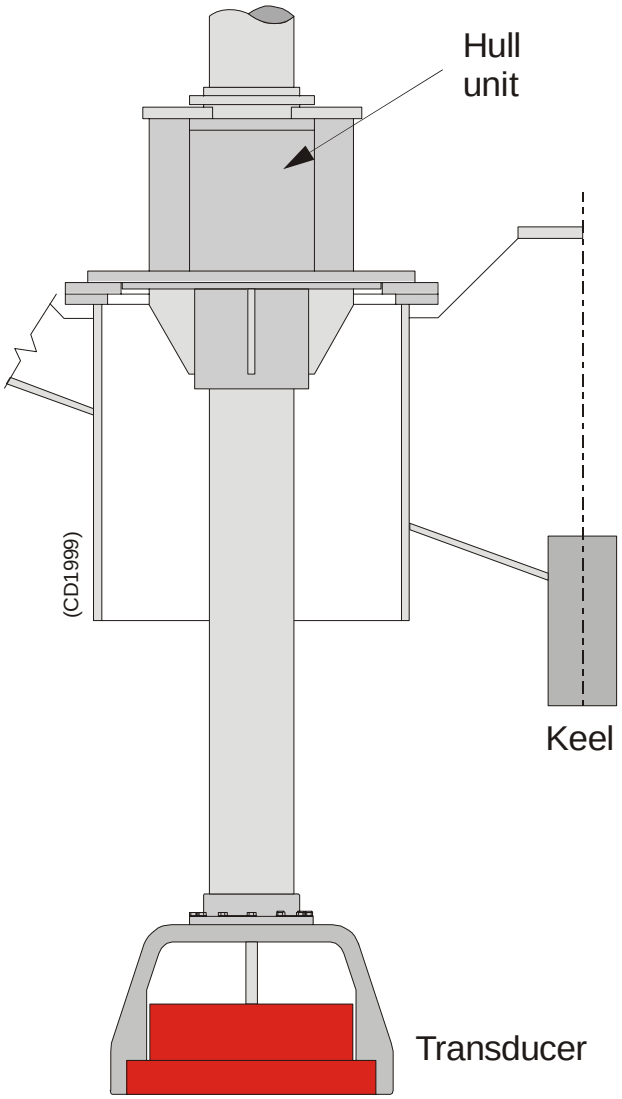
Large diameter transducers must be fitted with a horizontal support bar. This bar can be secured to the mounting ring using threaded rods.

Retractable transducer

Retractable hull units are commonly used for horizontal looking sonars. When not in use, the transducer is retracted into a trunk. The retractable hull unit is more expensive than a blister, but on vessels having a hull where it is difficult or impossible to install a blister, it may be worth-while. A retractable hull unit with transducer is shown below.

Vessels without a keel and with a wide, flat bottom is an example where a retractable hull unit can be the only acceptable method for bringing the echo sounder transducer below the boundary layer.

Figure 10 Retractable hull unit with transducer



Centre board

The use of a centre board with the purpose of stabilising the vessel is well known. A centre board is also a superior platform for transducers. Such instrument keels have been built, mainly on research vessels, with a length of 3 m, protruding also 3 m below the hull, see the figure below. At that depth, the water is free of air bubbles up to very high sea states. The vessel is then able to perform reliable acoustic measurements in open sea a larger part of the year.

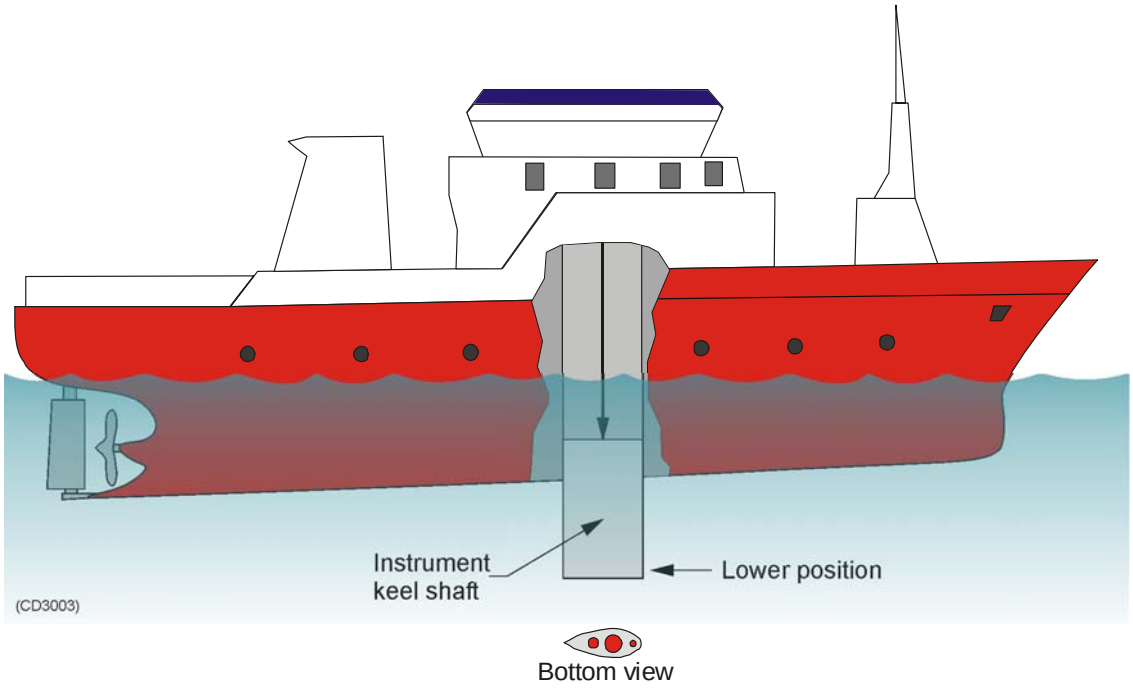


Figure 11 Deep centre board/instrument keel

Flush mounting in a steel tank

Flush mounting is used on very large vessels with a hull so deep that no air bubbles are found below the hull, and on vessels operating in shallow harbours or waters, where a protruding blister can not be accepted.

The standard procedure for flush mounting on a steel vessel is to weld a steel tank inside the hull, and mount the transducer into this tank. As for a blister, the interior of the tank must be filled with water. This can be accomplished by air release through a steel tube, which is extended either to open air 1.5 m above the water line or to the water outside the hull at a point higher than the tank interior. If the tube is extended to open air, drainage must be provided with leakage at the transducer flange or a separate hole in the tank bottom. Transducer mounting in a steel tank is shown in the figure below.

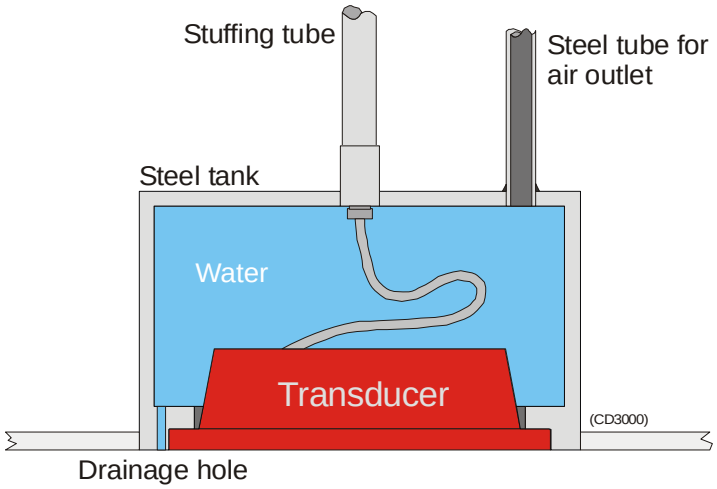


Figure 12 Flush mounting of transducer in steel tank

Behind a protective acoustic window

Vessels operating in arctic waters need special attention on transducer installation. Floating blocks of ice may damage even a flush mounted transducer face. For this situation Kongsberg Maritime offers ‘’arctic tanks’’ in different sizes.

The transducer shown in the figure below is mounted inside the tank behind a strong acoustic window which could be made of polycarbonate. The tank is oil filled.

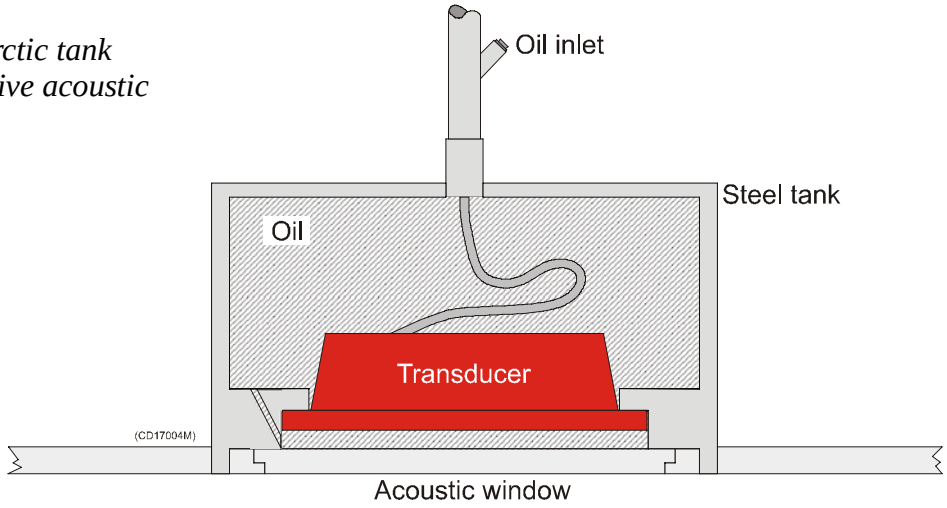


Figure 13 Arctic tank with a protective acoustic window

Inside the hull

An installation of the transducer inside the hull, and sounding through the hull, requires a good acoustic contact between the transducer face and the hull. Build a tank around the transducer and fill it with a liquid. Oil used in hydraulic systems is a well suited liquid for this purpose. It contains no gas bubbles and is non-corrosive.

The tarnsducer can be mounted inside the hull. A substantial loss must be expected when the sound passes through the hull.

→ *Refer to figure 14.*

Typical values of the two way loss are 3 dB for polyester, 6 dB for aluminium and 10 dB for steel. Hulls made of wood or a sandwich type with foam in the middle, attenuate the sound so much that through hull sounding must be regarded as impossible. The loss varies with the distance between transducer face and the hull. The best result is obtained when the distance is half a wavelength. Consult Kongsberg Maritime for advice. In addition to the loss, the beam pattern is degraded, because a larger area of the hull is set into vibrations.

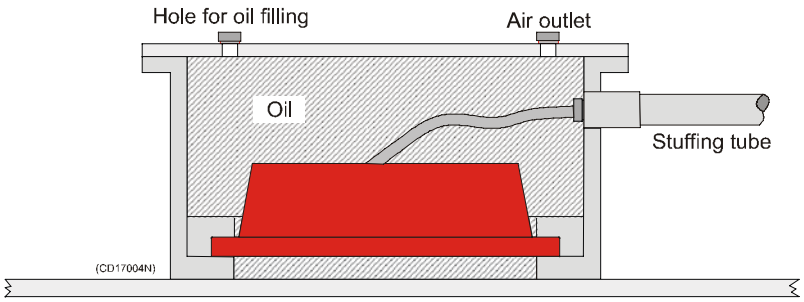


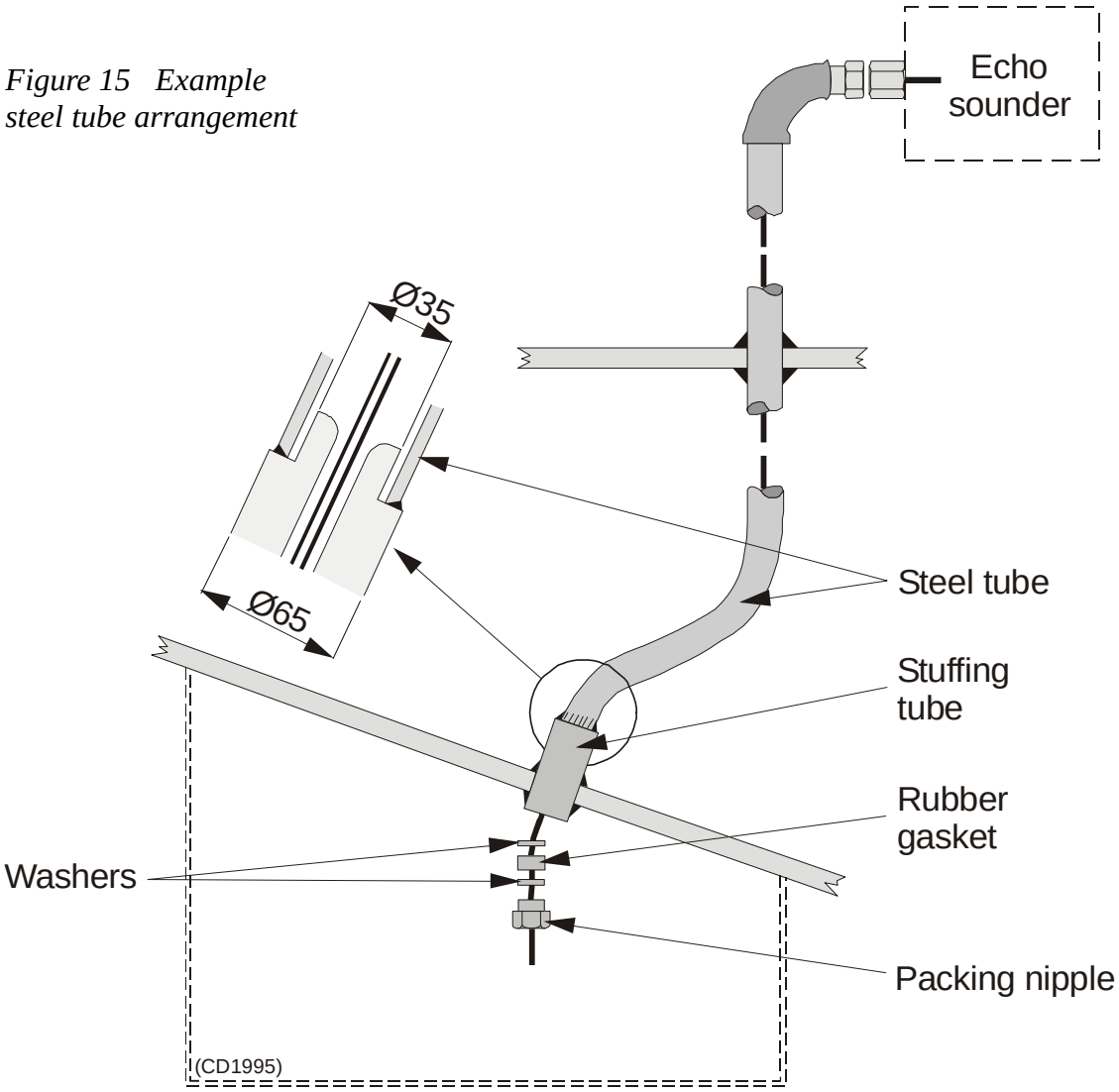
Figure 14 Transducer mounting inside the hull

It is strongly recommended to lay a steel conduit from the transducer to the echo sounder transceiver, and draw the transducer cable through the conduit. There are two reasons for this procedure.

- First, it will make it easier at a later stage to replace the transducer.
- Second, noise and interference from other electrical equipment is greatly reduced.

With a steel conduit the installation satisfies the EU regulations for EMC interference. Without a steel conduit, there is a risk of reduced echo sounder performance.

Figure 15 Example steel tube arrangement



The tube should be unbroken and watertight from the transducer to above the water line. From there, openings or a junction box can be installed to facilitate drawing of the cable, or to add a cable extension. However, the tube should act as a continuous electrical screen all the way and be connected to the transceiver chassis.

Tube dimensions:

- Minimum 35 mm inner diameter
- Minimum 6 mm wall thickness (4.5 mm if galvanised).

If two or more transducers are installed close to each other it is possible to pull their cables in the same steel tube, provided the tube diameter is increased accordingly. However, for easy replacement it is recommended that each transducer has its own steel tube.

Most Kongsberg Maritime transducers are delivered with 20 m cable. Excess cable can be cut off, or an extension cable can be added. This is possible because all Kongsberg Maritime transducers have a built-in transformer for tuning and matching to the cable impedance of 75 Ohms.

Do not lift the transducer by the cable.

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

An anti-fouling paint may be applied to the transducer face. Because some paint types may be aggressive to the polyurethane in the transducer face, please consult Kongsberg Maritime's list of approved paints on the next page.

Note

Arctic tanks have acoustic windows made of polycarbonate. These must neither be painted nor cleaned with chemicals.

During dry docking of the vessel, the transducer face may be cleaned for shells and other marine fouling. Be careful not to make cuts in the transducer face. Use a piece of wood or a very fine grade emery paper.

3.3 Approved anti-fouling paints

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

From Jotun Paints, Sandefjord Norway:

- Antifouling Seamate HB 33
- Antifouling Seamate HB 66
- Antifouling Seamate HB 99
- Racing
- Non-stop

From International Paints:

- Intersleek tie coat + 425 FCS
  - BXA386/BXA390/BXA391 Grey
  - HKA563/HKA570/HKA571 Yellow

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

From Hempel IFA Coatings AS:

- Hempel A/F Classic 76550

From Jotun-Henry Clark Ltd:

- Anti-fouling Seaguardian

Note

Refer to the manufacturer's documentation and data sheets for a complete procedure.

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4 GENERAL PURPOSE TRANSCEIVER (GPT) DESCRIPTION AND MAINTENANCE

4.1 Description and main functions

Overview

The GPT contains transmitter and receiver electronics.

This chapter provides the following information:

→ *Description and main functions, page 47.*
→ *GPT outline, page 48.*
→ *GPT theory of operation, page 50.*
→ *GPT circuit board descriptions, page 52.*
→ *GPT maintenance, page 59.*

4.2 GPT drawing

The basic GPT outline dimensions are shown in the diagram below, note that the illustration is not draw to scale.

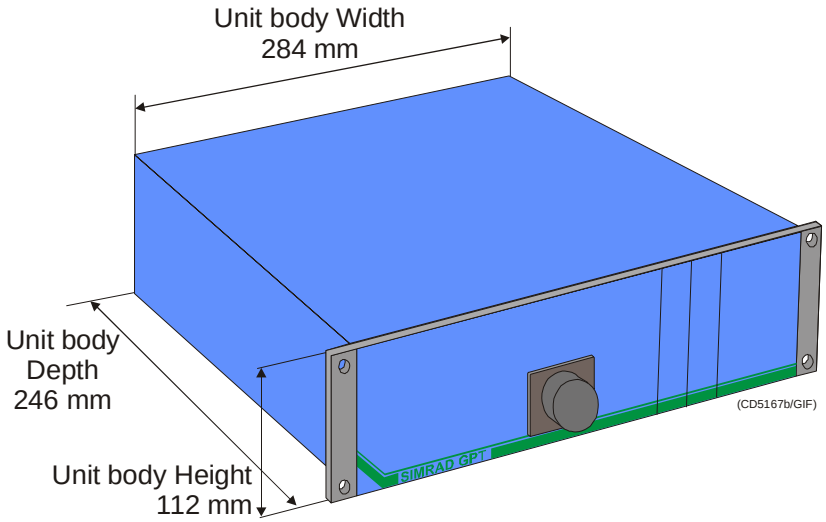


Figure 16 GPT - Outline dimensions

Circuit boards and modules

GPT

The GPT holds several circuit boards and two power supplies. All connections are made on the front panel.

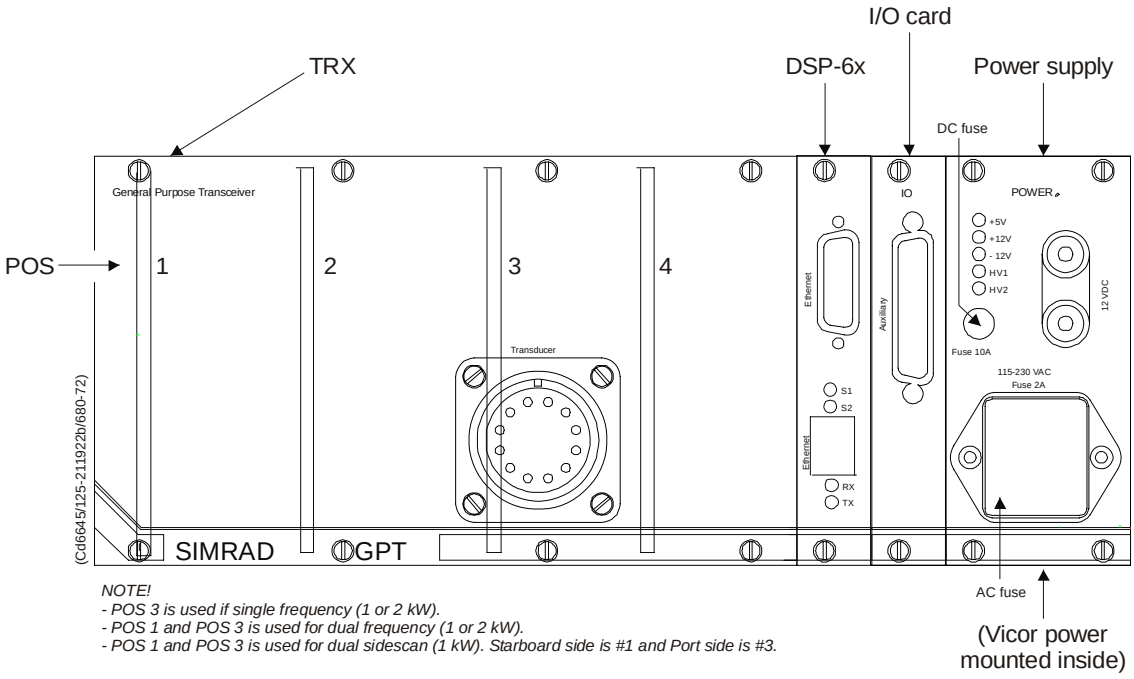


Figure 17 GPT, wired

The unit holds the following circuit boards and modules:

- DSP-6x
- TRX board, 12- 710 kHz, one or two
- I/O card
- Power supply / Vicor power

4.3 GPT - Theory of operation

Overview

This chapter presents a functional description of the GPT.

The GPT transceiver cabinet houses one or two TRX transmitter/receiver boards, a DSP signal processor board, an IO board handling various interface signals and a Power board. Both configurations of the transceiver use the same rugged female connector for the transducer signals. An Ethernet link connects the GPT with the computer unit; TP (Twisted Pair) or AUI (Attachment Unit Interface). Transceiver commands are communicated from the computer to the GPT, and receiver data is communicated in the opposite direction.

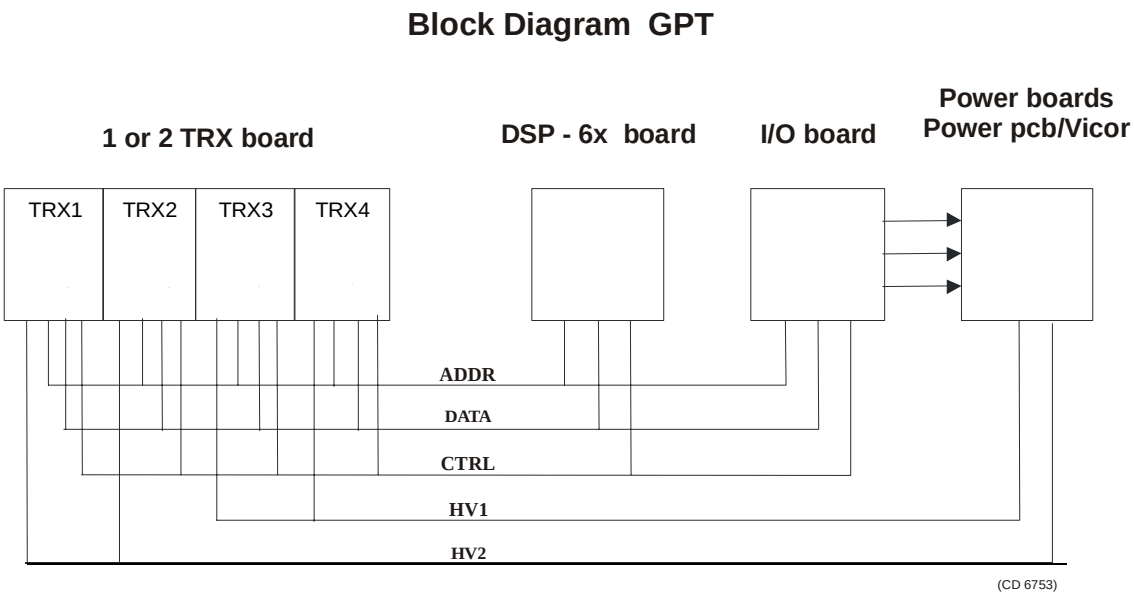
The DSP processor handles Ethernet communication and digital filtering of the received signals. The DSP board contains the Ethernet interface electronics and four indicator lamps. The RX lamp flashes every time a data block arrives at the Ethernet interface, and the TX lamp flashes every time a block is transmitted. The S1 and S2 lamps are used to indicate various error states. Different signal sequences are described below. The IO board contains analog inputs for motion sensor and temperature, digital signals for transmit synchronisation with external equipment and a digital input signal for remote on/off of the complete transceiver. The GPT operates from any input voltage in the range 115 to 230 VAC. No selector switch is included.

The mains socket contains two 2 A fuses. Standard slow-acting types should be used. The Power board converts the 115-230 VAC input to a +12 VDC which is available via connectors at the front of the board. All other internal voltages inside the GPT are generated from this +12 VDC. Consequently, the GPT can also be powered from a 12 V car battery. A UPS (Uninterrupted Power Supply) arrangement is realised by operating the transceiver from the 115-230 VAC mains with a car battery connected.

The transceiver can also be used as a 7 A battery charger. The +12 VDC connector is protected by a 10 A fuse. Standard slow-acting types can be used. Three red lamps at the front of the POWER board indicate that +5 V to the processor electronics and ±12 V to the receiver circuitry are generated. The POWER board includes two independent supplies for charging the high voltage transmit capacitors. The HV1 lamp (green) lights while the TRX channel 3 capacitor is charged, and the HV2 lamp (green) lights while the TRX channel 2 capacitor is charged.

Simplified block diagram

The GPT holds several circuit boards and two power supplies.



One frequency TRX3 (1 or 2kW)

Two frequency TRX3 low and TRX1 high (1 or 2 kW)

Figure 18 GPT block diagram

4.4 Circuit board descriptions

Overview

This chapter describes all the circuit boards and modules in the EA 600 GPT. A functional description with a block diagram is provided, as well as the facilities provided for maintenance.

Digital Signal Processing board, DSP-6x

Purpose and description

The DSP-6X is a general-purpose data acquisition, control and signal processing microcomputer board. It is targeted for high performance echo sounder applications. The board is remote controlled by a host via Ethernet under the TCP/IP/UDP protocol.

The DSP-6X is based on a signal processing microcomputer from Analog Devices named ADSP-21062, also known as the SHARC (Super Harvard Architecture Computer).

How it works

There are two Ethernet interfaces on the board. Both the DB-15 AUI connector and the RJ-45 UTP plug is accessed at the front of the board. The DSP-6X communicate with an external host via the TCP/IP/UDP Protocol.

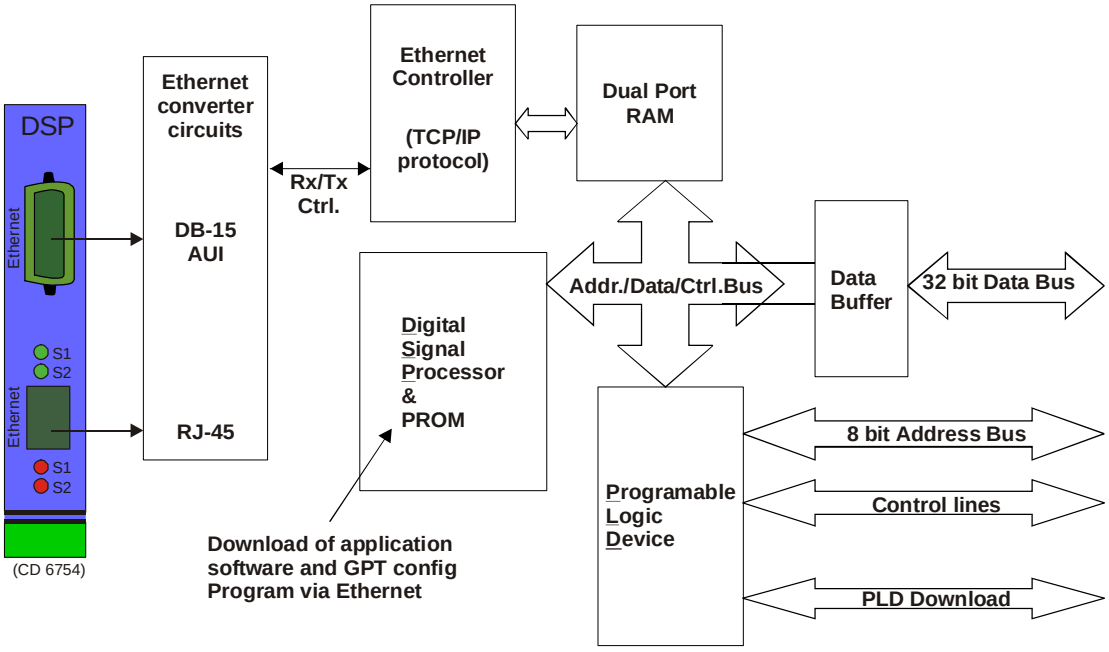


Figure 19 DSP-6x block diagram

Facilities

LEDs

On the front panel of DSP-6X there are 4 LED indicators:

TX: Flashes when data is transmitted via Ethernet.

RX: Flashes when data is received via Ethernet (even if the data is not for my Ethernet address).

S1: indicate various error states

S2: indicate various error states

Below is a list of the different settings:

- At power up or reset a flash sequence of 0,1,2,3,0 (S2 MSB, S1 LSB) means OK
- After download of new application software via Ethernet a flash sequence of 0,3,2,1,0 means OK. If SI, S2 flashing simultaneous a number of times, it means download error.
- After power up or reset, a Dual port RAM test failure is indicated by S1 static on.
- After power up or reset, a Ethernet initialisation or loopback test failure is indicated by S2 static on.
- When the GPT is in operational mode, S2 is flashing at a high rate (low light intensity) when connected to a host. S1 is flashing synchronous to the ping rate (low light intensity).

TRX board

Purpose and description

The transmitter/receiver (TRX) board contains a full bridge 1 or 2 kW transmitter, a high precision receiver, a 12 bit AD converter and digital control circuitry. The transducer connector is located at the top of the board. Transmitter commands and sample data are digitally communicated via the address/data-bus at the bottom of the board.

How it works

Below is a simplified block diagram.

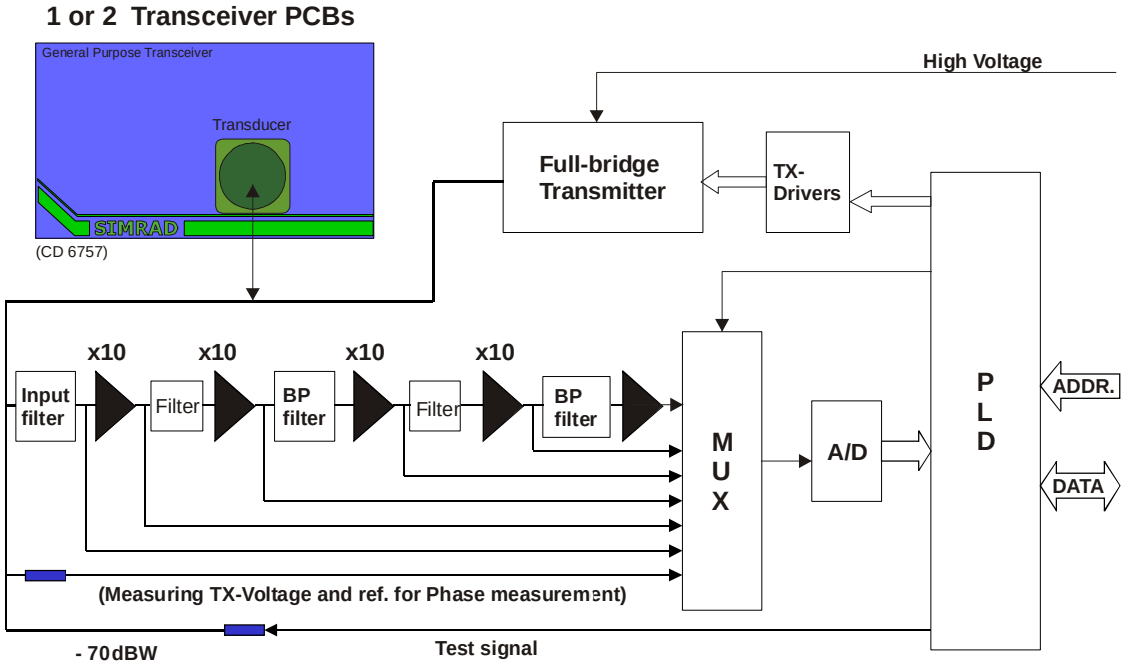


Figure 20 TRX board block diagram

I/O board

Purpose and description

The I/O board is used to control the dual high voltage power supply residing on the POWER board. In addition it provides the external interface to sensors and input output signals. A PLD (Programable Logic Device) contains the logic interface functions for host control from the DSP-6X board and support functions for the other interfaces.

The XC95108 Programmable Logic Device (PLD) U6 contains the following functions.

- Bus interface
- Sensor input control
- Digital input/ output
- High voltage power control

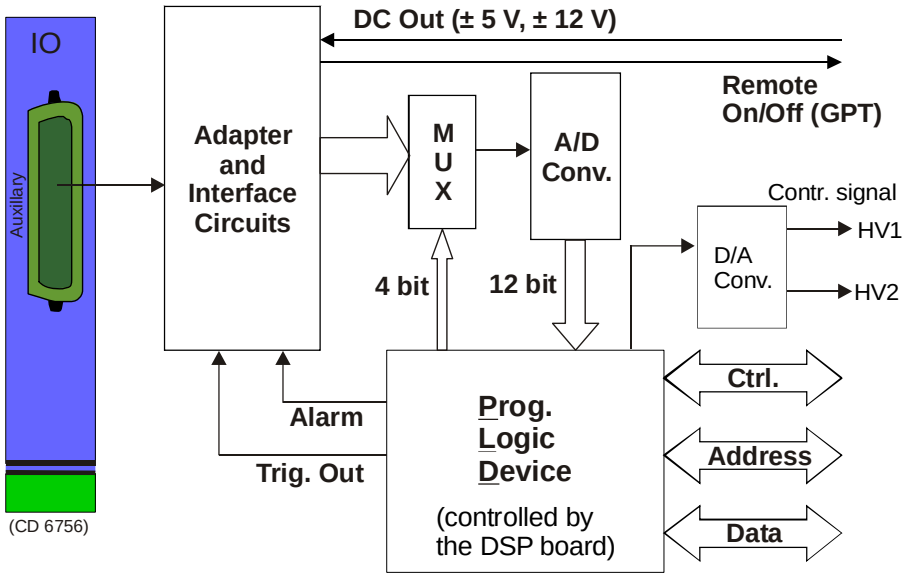


Figure 21 I/O board block diagram

GPT Power supply

Purpose and description

The GPT power module generates all internal voltages needed by the GPT transceiver. The power module consists of a printed circuit board with front plate and an external DC-DC switching converter. The converter (Vicor VI-272-EW) is mounted directly on the inner wall of the GPT cabinet using the cabinet as heat sink.

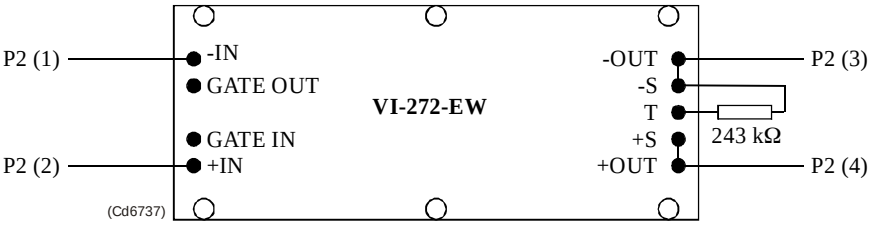


Figure 22 Vicor converter

A four-wire cable connects the external converter with connector P2 on the printed circuit board.

The power module converts the 115-230 VAC mains to a approximately 12 VDC which is available via a connector at the front plate. All other voltages are generated from this internal 12 VDC. Consequently, the GPT can also be powered from a standard 12 V car battery. A UPS (Uninterrupted Power Supply) arrangement is realised by operating the GPT from the 115-230 VAC mains with a car battery connected. The power module can also be used as a 7 A battery charger. The remote ON/OFF input signal switches the internal 12 VDC on/off. The remote ON/OFF circuit also implements undervoltage protection.

The mains converter section consists of mains noise filter, bridge rectifier, hold-up capacitor, DC-DC switching converter and a protection power diode. The mains noise filter is mounted at the front plate.

How it works

The converter operates at a switching frequency near 1 MHz, and its efficiency is approximately 80%. The mains converter section accepts input voltages from 95 to 265 Vac and alternation frequencies from 50 to 400 Hz.

The internal 12 VDC is available at the 12 VDC connector at the front plate. This connector is used for either powering the GPT from a standard car battery or for charging the battery from the mains. Protection against reverse battery polarity has been included.

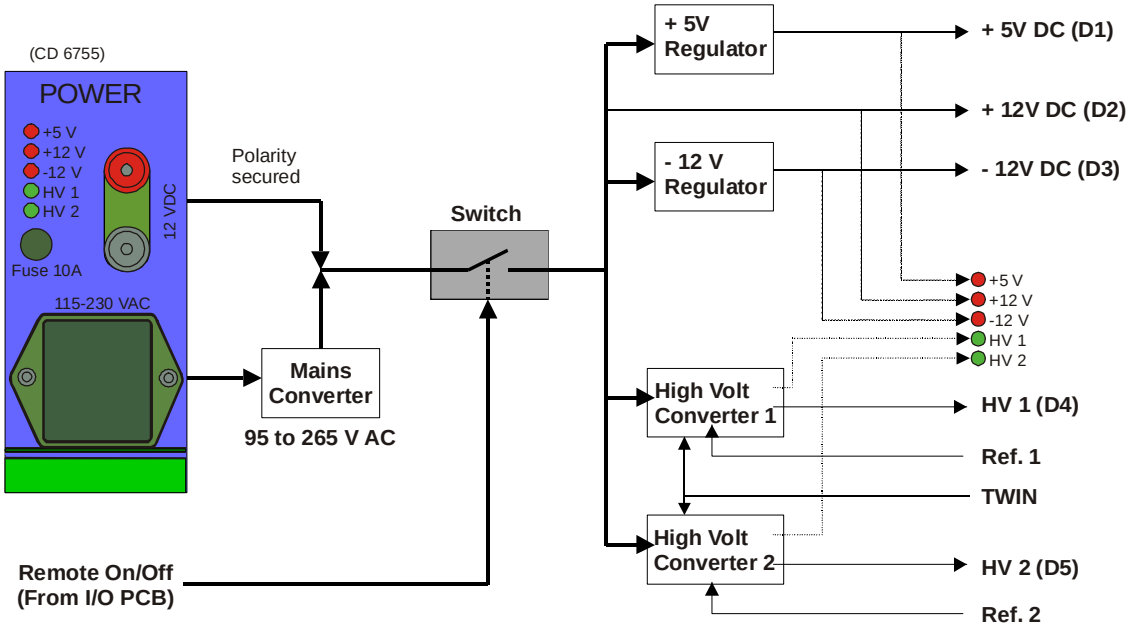


Figure 23 Block diagram - power supply

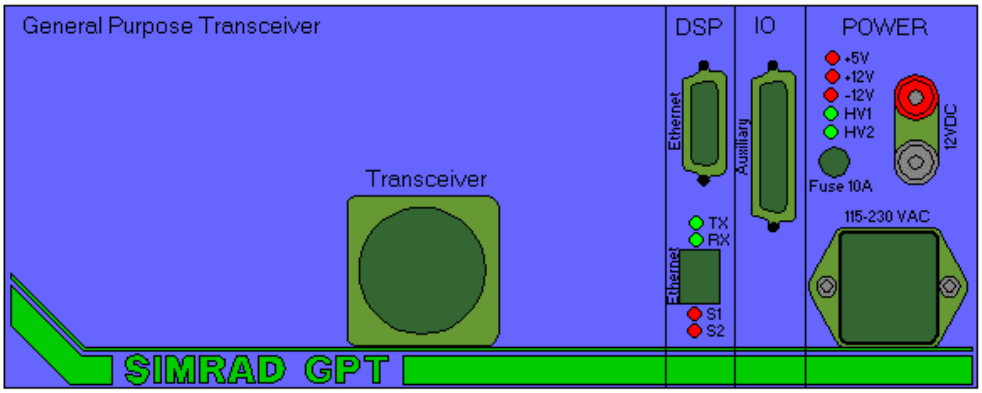
Facilities

LEDs

There are several diodes:

- **D1:** + 5V OK
- **D2:** + 12V OK
- **D3:** - 12V OK
- **D4:** HV1 is transmitting (TRX 3)
- **D5:** HV2 is transmitting (TRX 1)

4.5 Maintenance on the GPT

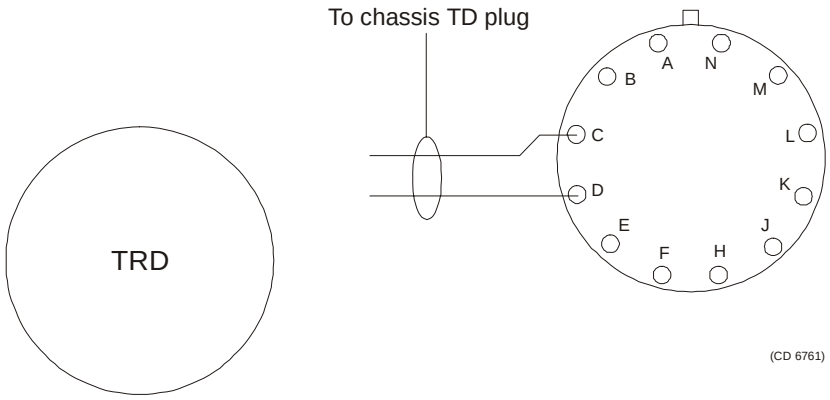


The GPT transceiver is a small multi-configuration self-contained unit that can be mounted anywhere on board the vessel. Typically, it is mounted near the transducer in order to minimise electrical interference into the transducer cable. The GPT transceiver cabinet houses one or two TRX transmitter/receiver boards, a DSP signal processor board, an IO board handling various interface signals and a Power board. Both configurations of the transceiver use the same rugged female connector for the transducer signals. An Ethernet link connects the GPT with the computer unit; TP (Twisted Pair) or AUI (Attachment Unit Interface). Transceiver commands are communicated from the computer to the GPT, and receiver data is communicated in the opposite direction.

The DSP processor handles Ethernet communication and digital filtering of the received signals. The DSP board contains the Ethernet interface electronics and four indicator lamps. The RX lamp flashes every time a data block arrives at the Ethernet interface, and the TX lamp flashes every time a block is transmitted. The S1 and S2 lamps are used to indicate various error states. Different signal sequences are described below. The IO board contains analog inputs for heave and temperature, digital signals for transmit synchronisation with external equipment and a digital input signal for remote on/off of the complete transceiver. The GPT operates from any input voltage in the range 115 to 230 VAC. No selector switch is included.

The mains socket contains two 2 A fuses. Standard slow-acting types should be used. The Power board converts the 115-230 VAC input to a +12 VDC which is available via connectors at the front of the board. All other internal voltages inside the GPT are generated from this +12 VDC. Consequently, the GPT can also be powered from a 12 V car battery. A UPS (Uninterrupted Power Supply) arrangement is realised by operating the transceiver from the 115-230 VAC mains with a car battery connected.

The transceiver can also be used as a 7 A battery charger. The +12 VDC connector is protected by a 10 A fuse. Standard slow-acting types can be used. Three red lamps at the front of the POWER board indicate that +5 V to the processor electronics and ±12 V to the receiver circuitry are generated. The POWER board includes two independent supplies for charging the high voltage transmit capacitors. The HV1 lamp (green) lights while the TRX channel 3 and 4 capacitors are charged, and the HV2 lamp (green) lights while the TRX channel 1 and 2 capacitors are charged.

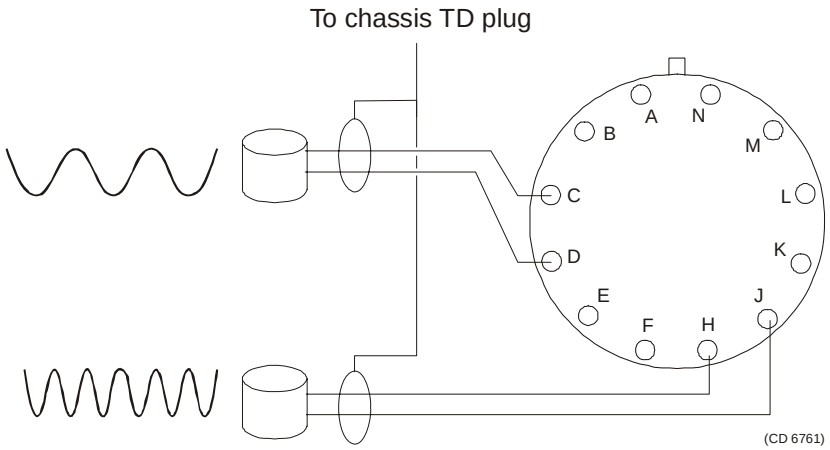


Single Frequency Single Beam 1 or 2 kW. This GPT configuration includes only one transmitter/receiver board. The transducer signal wires are connected to pin C and D at the transducer connector. The cable screen is connected to chassis TD plug.

Dual Frequency Single Beam 1 or 2 kW. This GPT configuration includes two transmitter/receiver boards. The two boards are independently operated at two different frequencies. The high frequency transducer is connected to pin H and J (channel 1), and the low frequency transducer is connected to pin C and D (channel 3). The cable screen is connected to chassis TD plug.

Note

In order to prevent electrical noise pickup along the transducer cable the screens must only be connected to chassis transducer plug!



Dual Frequency Side Scan 1+1 kW. This GPT configuration includes two transmitter/receiver boards. The two boards are operated at the same frequency. The transducer for the port side is connected to pin C and D, and the transducer for the starboard side is connected to pin H and F. The cable screen is connected to chassis TD plug.

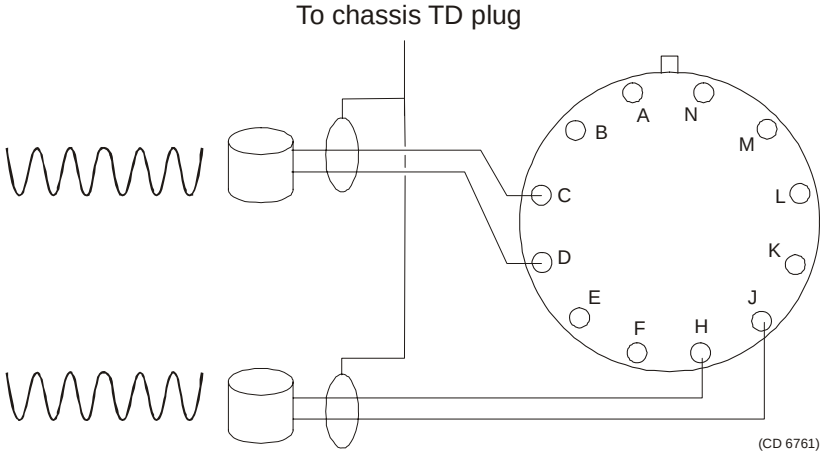
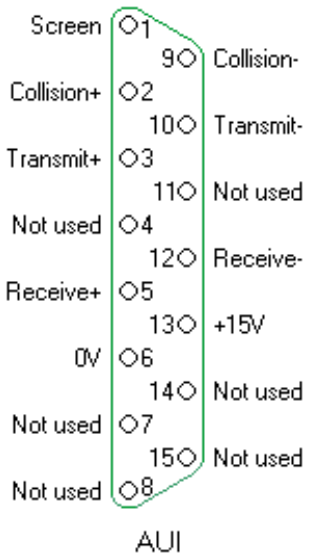
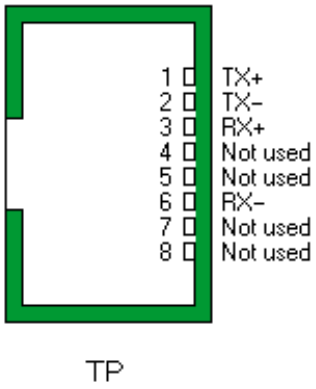
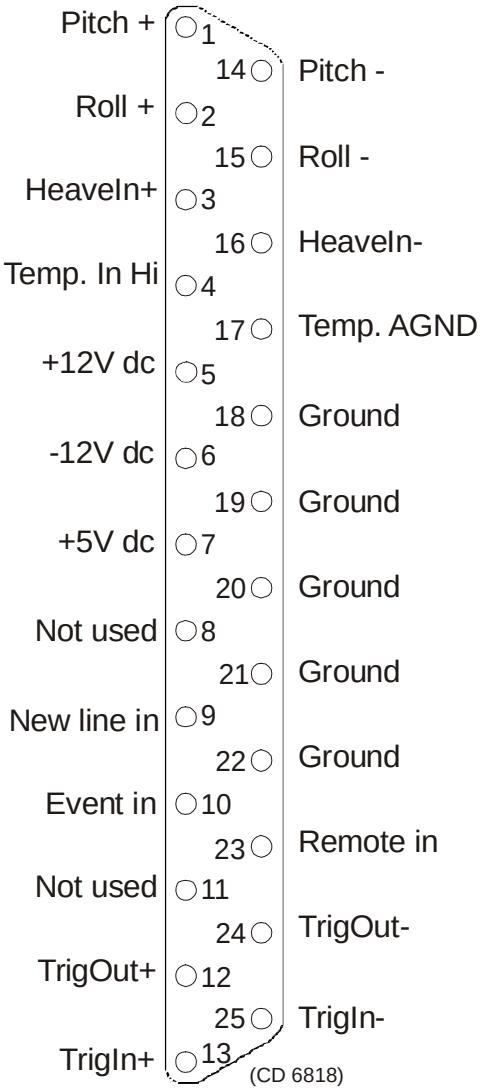


Figure 24 Parallel connections

Ethernet AUI Connector. The original Attachment Unit Interface for attachment to a thick Ethernet network is provided; IEEE 802.3 compliant 10 Mbit/s Ethernet. This interface includes power and differential signals for transmit, receive and collision presence.


Screen 1
9 Collision-
Collision+ 2
10 Transmit-
Transmit+ 3
11 Not used
Not used 4
12 Receive-
Receive+ 5
13 +15V
0V 6
14 Not used
Not used 7
15 Not used
Not used 8
AUI


1 TX+
2 TX–
3 RX+
4 Not used
5 Not used
6 RX–
7 Not used
8 Not used
TP


Pitch + 1
14 Pitch -
Roll + 2
15 Roll -
HeaveIn+ 3
16 HeaveIn-
Temp. In Hi 4
17 Temp. AGND
+12V dc 5
18 Ground
-12V dc 6
19 Ground
+5V dc 7
20 Ground
Not used 8
21 Ground
New line in 9
22 Ground
Event in 10
23 Remote in
Not used 11
24 TrigOut-
TrigOut+ 12
25 TrigIn-
TrigIn+ 13
(CD 6818)

Ethernet TP Connector. The newer Twisted Pair interface is also provided; IEEE 802.3 compliant 10 Mbit/s Ethernet. This interface includes differential signals for transmit and receive.

Auxiliary Connector. The I/O board contains a 25-pin female Delta connector handling various external interface signals. An analogue heave sensor can be connected to pins 3 and 16, 1 and 14 is for pitch and 2 and 15 is for roll. One differential input is connected to the sensor output terminal, and the other input is grounded at the sensor in order to prevent ground potential offsets between the sensor and the transceiver from adding to the sensed signal. The differential input range is ±10 V.

Fixed input scaling factor for heave is 1 V/m. For roll and pitch it is possible to select 1 V/degree or Volt = 10 sin(angle).

Some transducers contain a built-in thermistor (temperature sensitive resistor, 10 kohm at 25°C) for measuring the water temperature. The thermistor wires are connected to pins 4 and 17.

Pins 5, 6, 7 and 8 contain supply voltages sufficient for small external adapter and conversion modules.

TrigIn and TrigOut are digital signals provided for transmit synchronisation with external equipment of various makes. The two TrigOut signals are open collector outputs (max 100 mA) containing a 100 kohm pull-up resistor to +5 V. TrigOut+ is normally low (output transistor is conducting), and TrigOut- is the logical inverse of TrigOut+.

In internal trigger mode the sounder starts transmitting as soon as it is ready for the next ping. TrigOut+ goes high (output transistor is not conducting) when the transmit pulse starts, and it goes low again when all frequency channels within the transceiver have finished transmitting. The TrigIn signals are totally disregarded. In external trigger mode the behaviour of these signals is slightly different. Transmission is delayed until a pulse is detected at one of the TrigIn inputs; a low-to-high transition at the TrigIn+ input or a high-to-low transition at the TrigIn- input. TrigOut+ goes high when the transceiver is ready to transmit, and it goes low again when all frequency channels within the transceiver have finished transmitting.

The RemoteIn signal at pin 23 switches the transceiver on/off. Left open the transceiver is on. If grounded (< +2.5 V) the transceiver is off.

DSP6x board Status Lamps. S1 and S2 displays a two bit binary number; S2 displays bit 1 and S1 displays bit 0. Hence, S2 on and S1 off corresponds to the quantity 10 binary or 2 decimal.

- The flash sequence 0, 1, 2, 3, 0 during power on or reset indicates that everything is OK.
- Downloading new software to the GPT via Ethernet the correct flash sequence is 0, 3, 2, 1, 0. A download error is indicated by S1 and S2 flashing simultaneously a number of times.
- S1 static on indicates a Dual port RAM error.
- S2 static on indicates an Ethernet loopback test failure.

- S1 generates short duration flashes when the GPT is pinging.
- S2 is flashing at high rate when the GPT is connected to a top side computer.

The GPT is a self-contained unit that can be mounted on virtually any surface:

- Two brackets and four pan head screws are enclosed. The GPT side walls contains six screws; three screws along the bottom edge and three screws along the top edge. Unscrew two screws from each side wall, and mount the brackets using the pan head screws. The brackets can be vertically mounted in three different positions; use the two rear holes, use the two centre holes, use the two front holes. The brackets can be horizontally mounted in four different ways using either the bottom edge holes or the top edge holes.
- Position the GPT on the surface and mark the four mounting holes.
- Remove the GPT, and drill mounting holes.
- Mount the GPT to the surface using 5 mm bolts.

5 REPLACEMENT PROCEDURES

5.1 Introduction

Overview

This chapter presents the basic procedures for disassembly and reassembly of the replaceable parts in the EA 600 system.

Tools required

A standard tool set is required to perform the removal and replacement of the modules. This tool set should contain the following tools:

- Cabinet key (IP 55 cabinet)
- Standard screwdrivers in different widths and lengths
- Standard cross-slot screwdrivers in different widths and lengths
- Allen keys in metric sizes
- Philips screwdrivers in different sizes
- Pozidrive screwdrivers in different sizes
- Flat nosed pliers
- Lap jointed pliers
- Wire cutters

5.2 General Purpose Transceiver (GPT) procedures

Overview

The Line Replaceable Units (LRUs) in the GPT are:

- TRX transmitter and transceiver board(s)
- DSP-6x
- I/O card
- Power supply
- Vicor power

Other devices:

- AC mains fuse, 2A slow
- DC fuse, 10A slow or fast

The replacement procedures for these parts are described in the following disassembly and reassembly procedures.

The modules that are accessible, are described in this chapter.

Circuit boards and modules

Introduction

The system must be switched off prior to disassembly. Access is gained by opening the top panel of the GPT. How to open the GPT is described under the Disassembly procedure.

Disassembly procedure

1 Remove the mounted cables from the applicable circuit boards.

2 Release the thumb-screws if required. (TRX boards are mounted behind the front cover).

3 Pull the board/unit carefully out.

Reassembly procedure

1 Check links and switches on the new board and compare to the old board.

2 Insert new circuit boards and modules in reverse order. Mount the removed cables and the front covers.

3 Check that the circuit boards and modules have been installed in their correct locations! (Refer to the applicable pictures and drawings).

Power Supply

Introduction

How to open the GPT is described under the Disassembly procedures of the Circuit boards and modules.

Disassembly procedure

1 Switch off the circuit breaker.

2 Unbolt the unit. It is mounted with four captive-bolts so they cannot fall out. The nuts and spring washers are accessible.

Reassembly procedure

The new power supply is replaced by reversing the above procedure.

6 CABLE LAYOUT

6.1 Introduction

This chapter describes the general installation requirements for the EA 600 system cables. These instructions must be used together with the applicable cable plan(s).

Note

All cable connections and installation must be made in accordance with the guidelines laid down by the vessel's classification society.

6.2 Cable plans and specifications

Configurations

The system cables are identified in following cable plans. Each cable is identified with a cable number (Cx). Further information about the cable (connections and specifications) may be found on the referenced page(s).

The following main configurations are available:

- Basic
- Hydrographic Operator Station
- GPT Cabinet

Several variations may be built based on these main configurations.

Basic

The basic configuration comprises a single General Purpose Transceiver (GPT), a Processor Unit and a display. An optional Ethernet HUB or switch is added for interface purposes.

If two GPT units are required, the Ethernet switch must be installed.

Hydrographic Operator Station (HOS)

This configuration comprises a 15- or 18-inch display with a built-in Processor Unit. It is otherwise identical to the basic configuration.

GPT Cabinet

The GPT Cabinet configuration uses a steel cabinet to provide IP55 protection. One or two GPT units may be installed in the cabinet, as well as an Ethernet switch if required.

Processing Unit

Specifications

The cables shown and specified here are those used when the EA 600 is implemented with a separate Processing Unit.

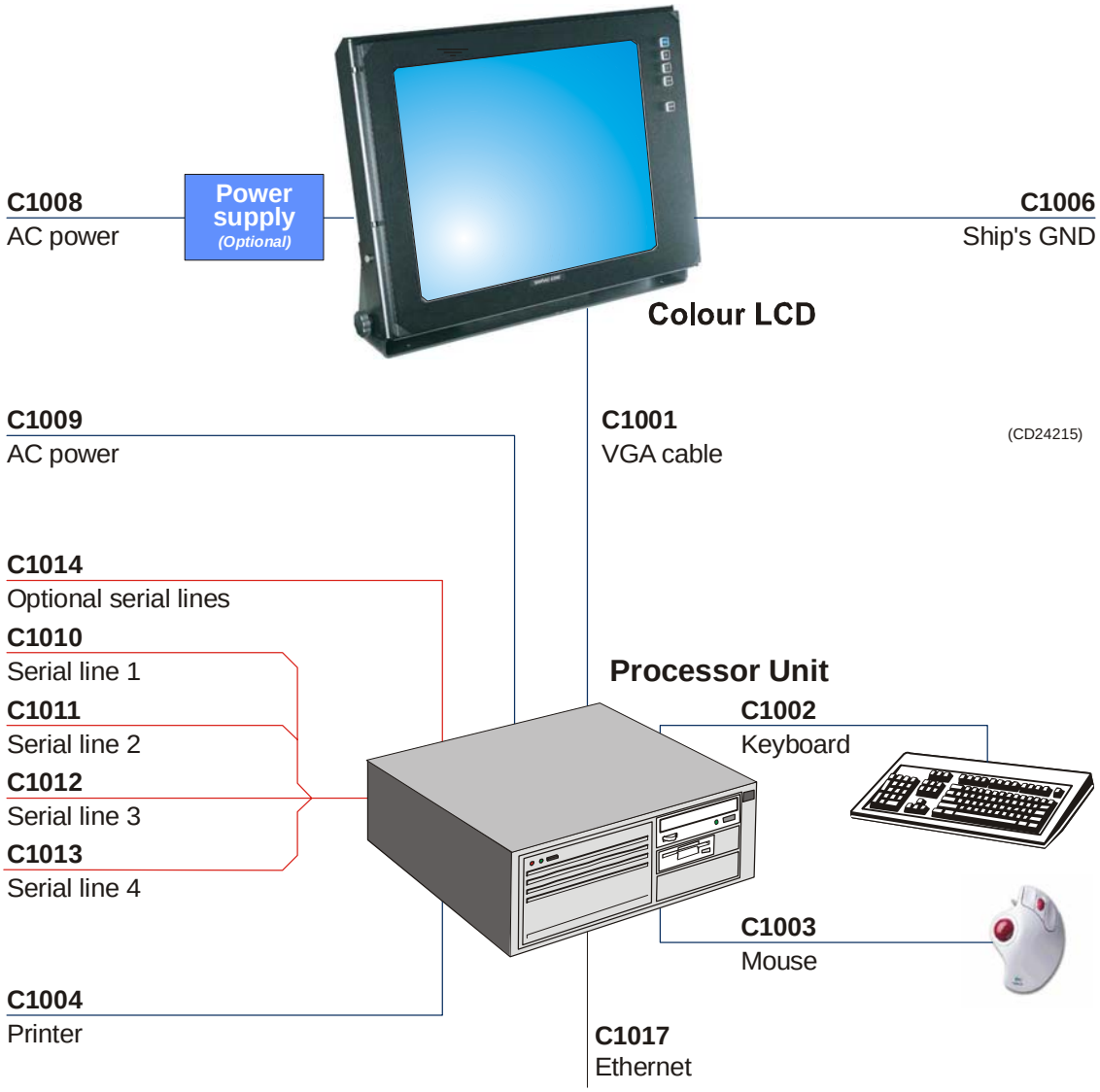


Figure 25 EA 600 cable plan - Computer

C1001 - Display (VGA)

This is a standard computer cable, and it is only used if a secondary display is connected to the operator station. It is normally supplied with the extra display monitor.

→ *Cable details, page 115.*

C1002 - Keyboard

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

→ *Cable details, page 117.*

C1003 - Mouse (or other pointing device)

This is a standard computer cable. It is supplied with the mouse.

→ *Cable details, page 118.*

C1004 - Printer (Parallel Centronics)

This is a standard computer cable. It is supplied with the printer. Note that this is an optional item.

→ *Cable details, page 119.*

C1006 - Ship's ground

This is a single core ground cable. It must be supplied by the installation shipyard.

→ *Cable details, page 112.*

C1007 / C1017 - Ethernet

The computer is normally equipped with one Ethernet plug, and only **C1017** is then supported. The communication between the computer and the General Purpose Transceiver (GPT).EA 600 can then be connected through a switch.

However, an additional Ethernet board may be installed. With both **C1007** and **C1017** available, one Ethernet line is used to communicate directly with the GPT, while the other connects the EA 600 to the computer. Both cables are terminated with RJ45 plugs, and can be supplied by the installation shipyard.

If a single Ethernet cable is used between the computer and the General Purpose Transceiver (GPT) unit, this must be twisted (”cross-over” connection). If an Ethernet hub is implemented, straight cables are used.

→ *Cable details, page 114.*

C1008 / C1009 - AC power

This is a standard AC mains cable. The cable is supplied by Kongsberg Maritime.

→ *Cable details, page 111.*

C1010 / C1011 / C1012 / C1013 - Serial lines

The number of serial lines available depends on the computer make and model. Standard RS-232 serial lines with 9-pin D-connectors are default.

C1014 - Serial lines

If required for special interface requirements, the computer may have an optional interface board installed to allow for additional serial lines.

C1015 / C1016 - USB

These are two standard USB cables. Both are optional, and the cables are supplied by Kongsberg Maritime when applicable.

→ *Cable details, page 116.*

Note that commercial “RS-232 to USB” converters may also be put to use if the number of available serial lines is too small.

C1028 - Remote control

Refer to the General Purpose Transceiver (GPT) cables.

Connectors

All connectors are normally located on the rear side of the computer unit. The physical location of these will depend on the actual computer model chosen for the installation.

Hydrographic Operator Station

Specifications

The cables shown and specified here are those used when the EA 600 Operator Station is implemented with a HOS 152 or HOS 192 Hydrographic Operator Station.

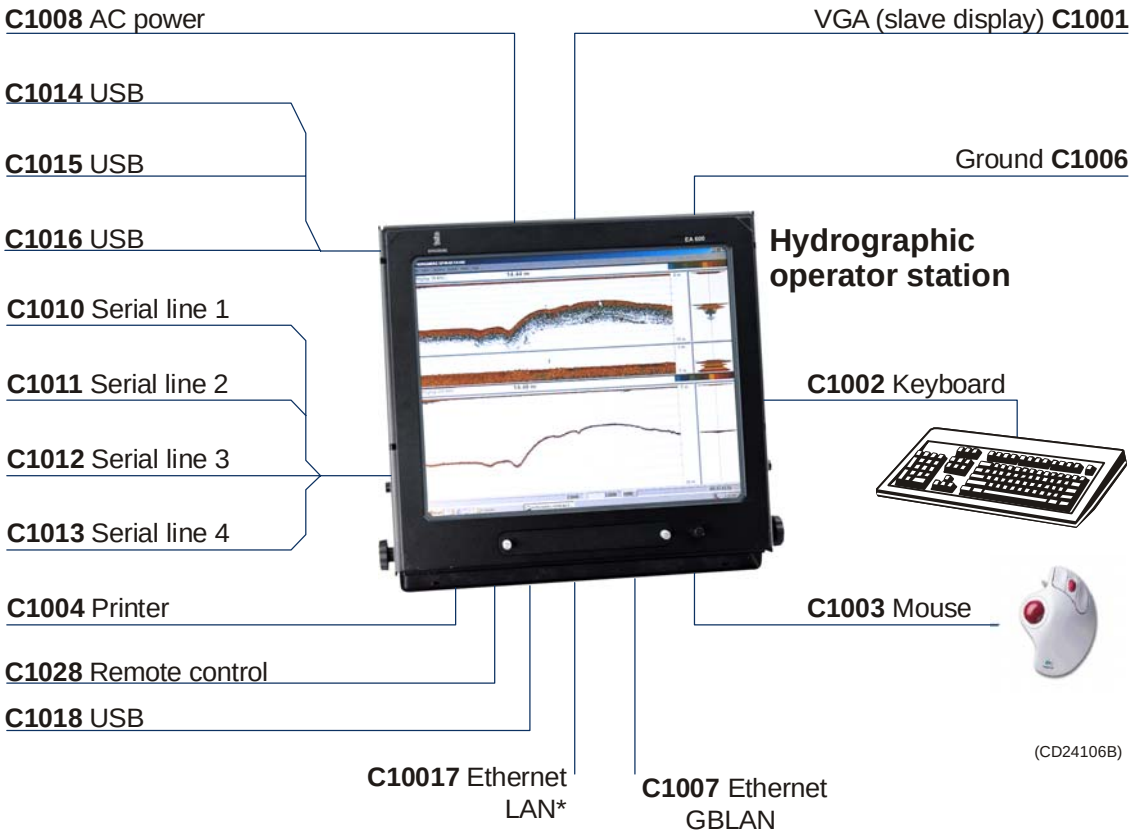


Figure 26 EA 600 cable plan - Hydrographic operator station

C1001 - Display (VGA)

This is a standard computer cable, and it is only used if a secondary display is connected to the operator station. It is normally supplied with the extra display monitor.

→ *Cable details, page 115.*

C1002 - Keyboard

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

→ *Cable details, page 117.*

C1003 - Mouse (or other pointing device)

This is a standard computer cable. It is supplied with the mouse.

→ *Cable details, page 118.*

C1004 - Printer (Parallel Centronics)

This is a standard computer cable. It is supplied with the printer. Note thast this is an optional item.

→ *Cable details, page 119.*

C1005 - Not used

This cable is not implemented.

C1006 - Ship's ground

This is a single core ground cable. It must be supplied by the installation shipyard.

→ *Cable details, page 112.*

C1007 / C1017 - Ethernet

The computer is normally equipped with two Ethernet interface connectors. The communication between the operator station and the general Purpose Transceiver (GPT) is normally connected directly (recommended) and LAN* connector is used, **C1017**.

With both **C1007** and **C1017** available, one Ethernet line is used to communicate directly with the GPT, while the other connects the echo sounder to the ship's Ethernet network GLAN. Both cables are terminated with RJ45 plugs, and both must be supplied by the installation shipyard. One short LAN cable is supplied by Kongsberg Maritime for connection computer and GPT.

Failure to use separate network adapters will cause a heavy traffic load on the common network. This may inhibit normal traffic on this network, and degrade the operational capabilities of the EA 600 system.

If a single Ethernet cable is used between the Operator Station and the General Purpose Transceiver (GPT) unit, this must be twisted ("cross-over" connection). If an Ethernet hub or a switch is implemented, straight cables are used.

→ *Cable details, page 114.*

C1008 - AC power

This is a standard AC mains cable. The cable is supplied by Kongsberg Maritime.

→ *Cable details, page 111.*

C1010, C1011, C1012 and C1013 - Serial lines

The number of serial lines available depends on the computer make and model. Standard RS-232 serial lines with 9-pin D-connectors are default.

→ *9-pin connector, cable details, page 110.*

→ *25-pin connector, cable details, page 109.*

C1014, C1015, C1016 and C1018 - USB

These are four standard USB cables. Both are optional, and the cables are supplied by Kongsberg Maritime when applicable.

→ *Cable details, page 116.*

Note that commercial “RS-232 to USB” convertes may be put to use if the number of available serial lines is too small.

C1028 - Remote control

Refer to the General Purpose Transceiver (GPT) cables.

Connectors

The following connectors are located on the side panel of the operator station.

Remote Control (male)	Power AC
USB: 1, 2 and 3	Mouse
Keyboard (PS2)	Parallel printer (female)
Slave display (female)	Ethernet LAN* (RJ45)
Ethernet GLAN (RJ45)	COM 1, 2, 3 and 4 (male)

Figure 27 Connectors on the operator station’s panel

The following connector and switch are located on the front of the operator station.

On/Off switch	USB

Figure 28 Connector and switch on the operator station's front

General Purpose Transceiver (GPT)

Specifications

The cables shown and specified here are those used when the EA 600 is implemented with one or two stand-alone General Purpose Transceiver (GPT) units.

The cable plan is shown on the next pages. Note that the 15-pin network connector on the GPT is not used.

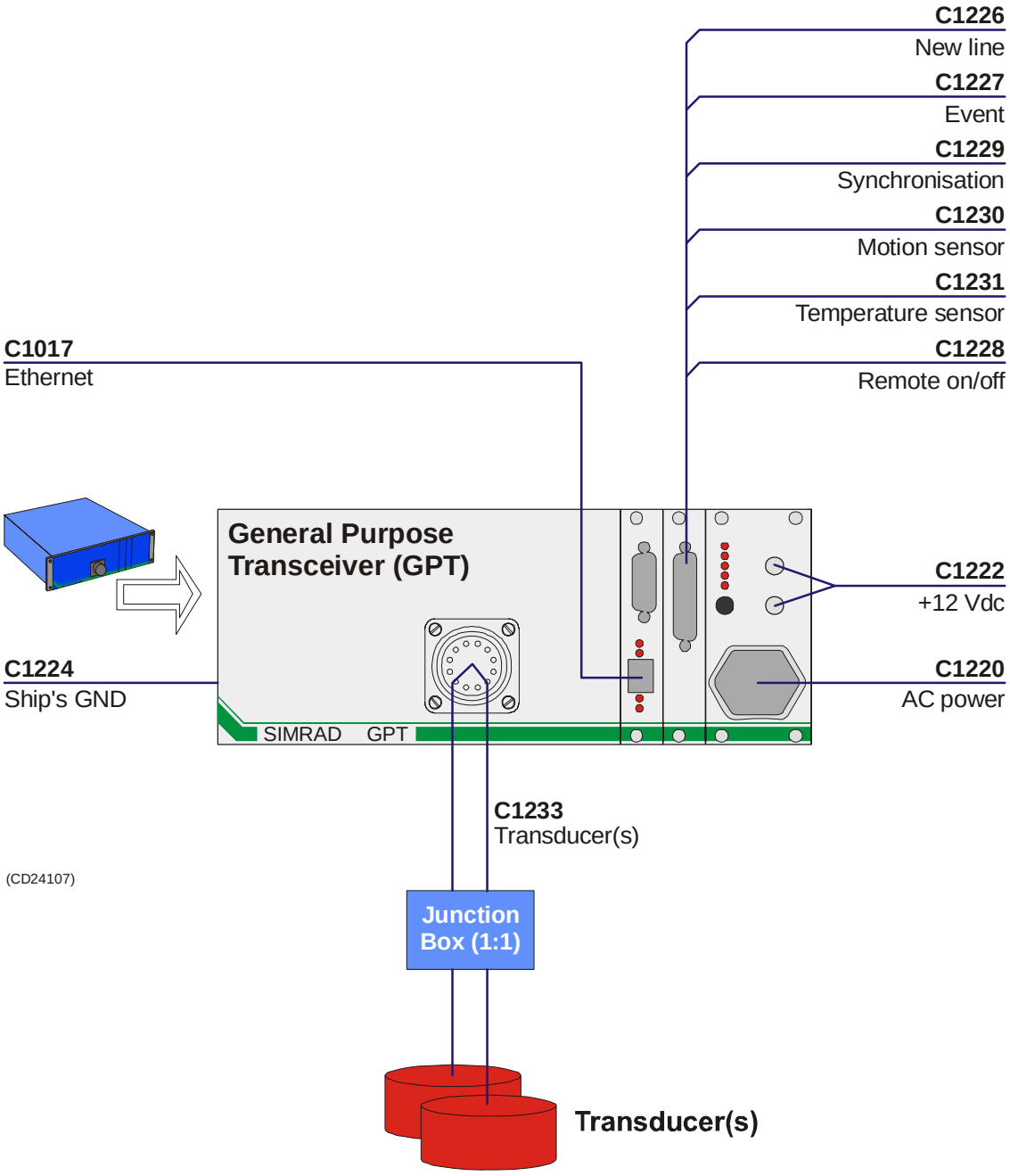


Figure 29 EA 600 cable plan - Single GPT

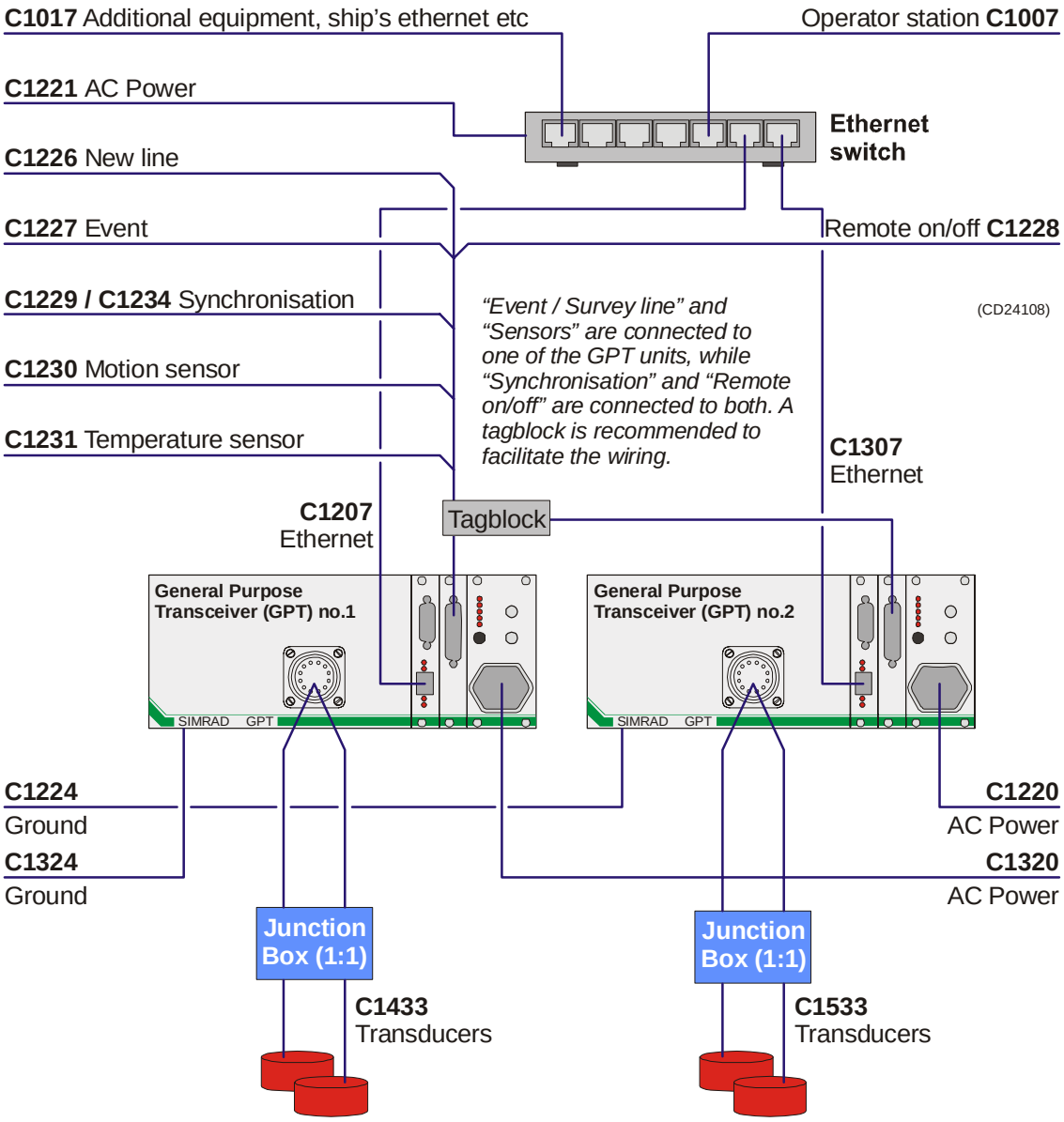


Figure 30 EA 600 cable plan - Dual GPT

Connectors

The following connectors are located on the rear side of the General Purpose Transceiver (GPT) unit.

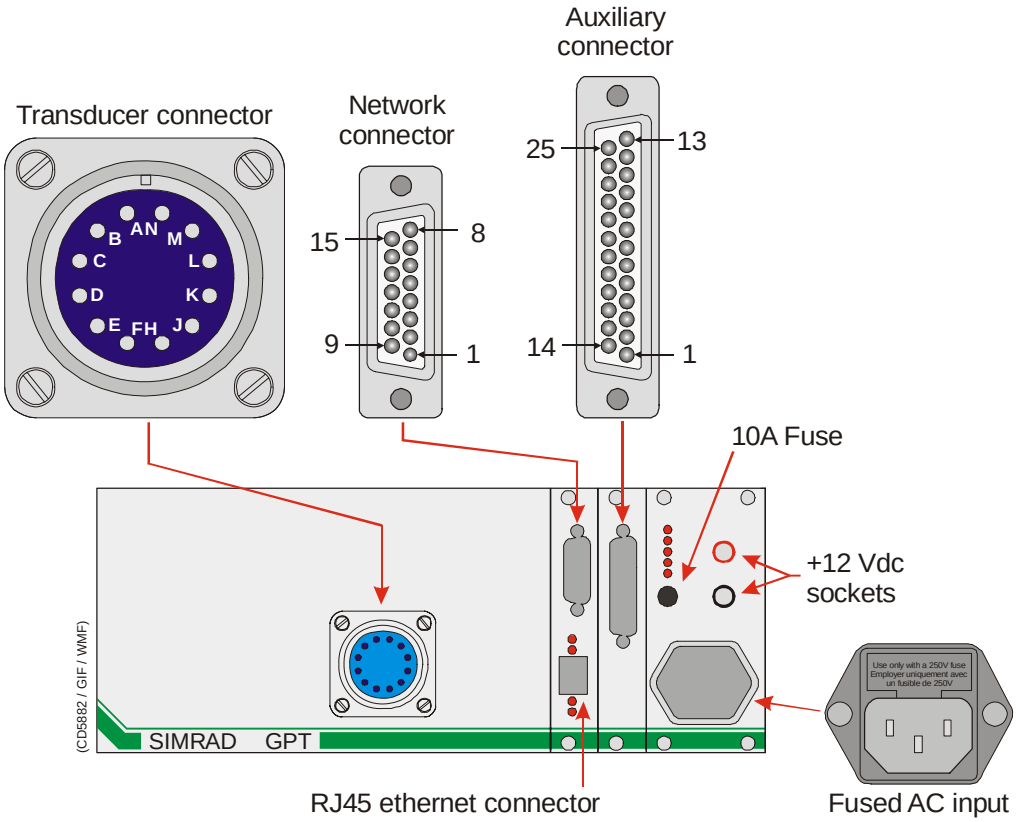


Figure 31 GPT connectors

C1007 / C1017 / C1207 / C1307 - Ethernet

This is a standard RJ45 terminated Ethernet cable. The communication between the computer and the General Purpose Transceiver (GPT) can then be made directly, or via the ship's network.

If only a single Ethernet cable is used between the operating station and the General Purpose Transceiver (GPT) unit, this must be twisted ("cross-over" connection). If an Ethernet Hub or a switch is implemented, straight cables are used.

→ *Cable details, page 114.*

C1220 - AC Power to GPT

This is a standard AC mains cable. The cable is supplied by Kongsberg Maritime.

→ *Cable details, page 111.*

C1221 - AC Power to Ethernet Hub/switch

An Ethernet Hub or switch is required if you need to use more than one General Purpose Transceiver (GPT), or if you wish to connect the echo sounder system to an existing network. Any commercial 100 MHz Hub/switch may be used.

→ *Cable details, page 111.*

C1222 - Battery

This cable is used to connect a battery to the GPT.

The +12 Vdc input/output connectors can be used in the following ways:

- Operate the transceiver from a +12 Vdc power supply.
- Operate the transceiver from mains power, but leave a battery connected to the DC connectors. The battery will then provide you with an uninterruptable power supply facility. It will automatically be charged when the mains power is present.
- Use the +12 Vdc power from the transceiver to power external units.

→ *Cable details, page 81.*

C1224 - Ship's ground

This is a single core ground cable. It must be supplied by the installation shipyard.

→ *Cable details, page 112.*

C1226 - New line annotation (trigger input)

This input is referenced to digital ground. The cable must be provided by the shipyard.

→ *Cable details, page 125.*

C1227 - Event annotation (trigger input)

This input is referenced to digital ground. The cable must be provided by the shipyard.

→ *Cable details, page 125.*

C1228 - Remote on/off control

This input is referenced to digital ground. The cable must be provided by the shipyard.

→ *Cable details, page 122.*

If an Hydrographic Operator Station is used, the on/off function is supported on a dedicated connector.

If a standard computer is used, you must assemble a small switch box to hold the necessary on/off switch.

C1229 / C1234 - Synchronization of GPT 1 and GPT 2

This cable is used to connect the GPT to an external system for synchronization purposes. The cable must be provided by the shipyard.

→ *Cable details, page 123.*

C1230 - Motion sensor (input)

This cable is used to connect the GPT to an external motion sensor. The cable must be provided by the shipyard.

→ *Cable details, page 124.*

C1231 - Temperature sensor (input)

This cable is used to connect the GPT to an external temperature sensor. The cable must be provided by the shipyard.

→ *Cable details, page 124.*

C1233 - Transducer(s)

The transducer cable is fixed to the transducer. If the distance between the transducer and the transceiver exceeds the length of the transducer cable, a 1:1 junction box must be used. The standard transducer cable supplied is 15 to 20 meters long.

Note

The transducer cable between the transducer element and the junction box or GPT must be run in steel conduits. Use flexible conduit close to the plug on the transceiver.

→ *Cable details, page 126.*

GPT Cabinet

Specifications

The cables shown and specified here are those used when the EA 600 is implemented with a GPT Cabinet for IP55 protection. The cabinet may contain one or two General Purpose Transceiver (GPT) units and an Ethernet switch. All internal cabling in the cabinet is made by the manufacturer.

Note that all cables connect to the main tagblock with the exception of the ethernet cable(s) and the transducer cables(s).

C1207 / 1307 - Ethernet

This is a standard RJ45 terminated Ethernet cable. It will normally be terminated directly onto the Ethernet switch inside the GPT cabinet. It can then either connect directly to the operator station, or to the ship's network.

If only one General Purpose Transceiver (GPT) is mounted in the GPT Cabinet, the Ethernet switch may not be fitted.

If a single Ethernet cable is used between the Operator Station and a single GPT unit, this must be twisted ("cross-over" connection). If an Ethernet switch is installed, straight cables are used. With two GPT units in use, the switch is always present.

For additional information, refer to the **C1007** description with the operator station cables.

All Ethernet cables must be provided by the shipyard.

→ *Cable details, page 114.*

C1220 - AC Power

This is a standard AC mains cable. It must be provided by the shipyard.

→ *Cable details, page 120.*

C22 - DC output/input

This connection may be used to power the GPT cabinet from an external +12 Vdc supply. This will however only work if the cabinet only houses one transceiver, since the ethernet switch relies on AC power to operate.

The connection also provides a +12 Vdc output.

→ *Cable details, page 120.*

C1224 - Ship's ground

Standard grounding cable, must be provided by the shipyard.

→ *Cable details, page 120.*

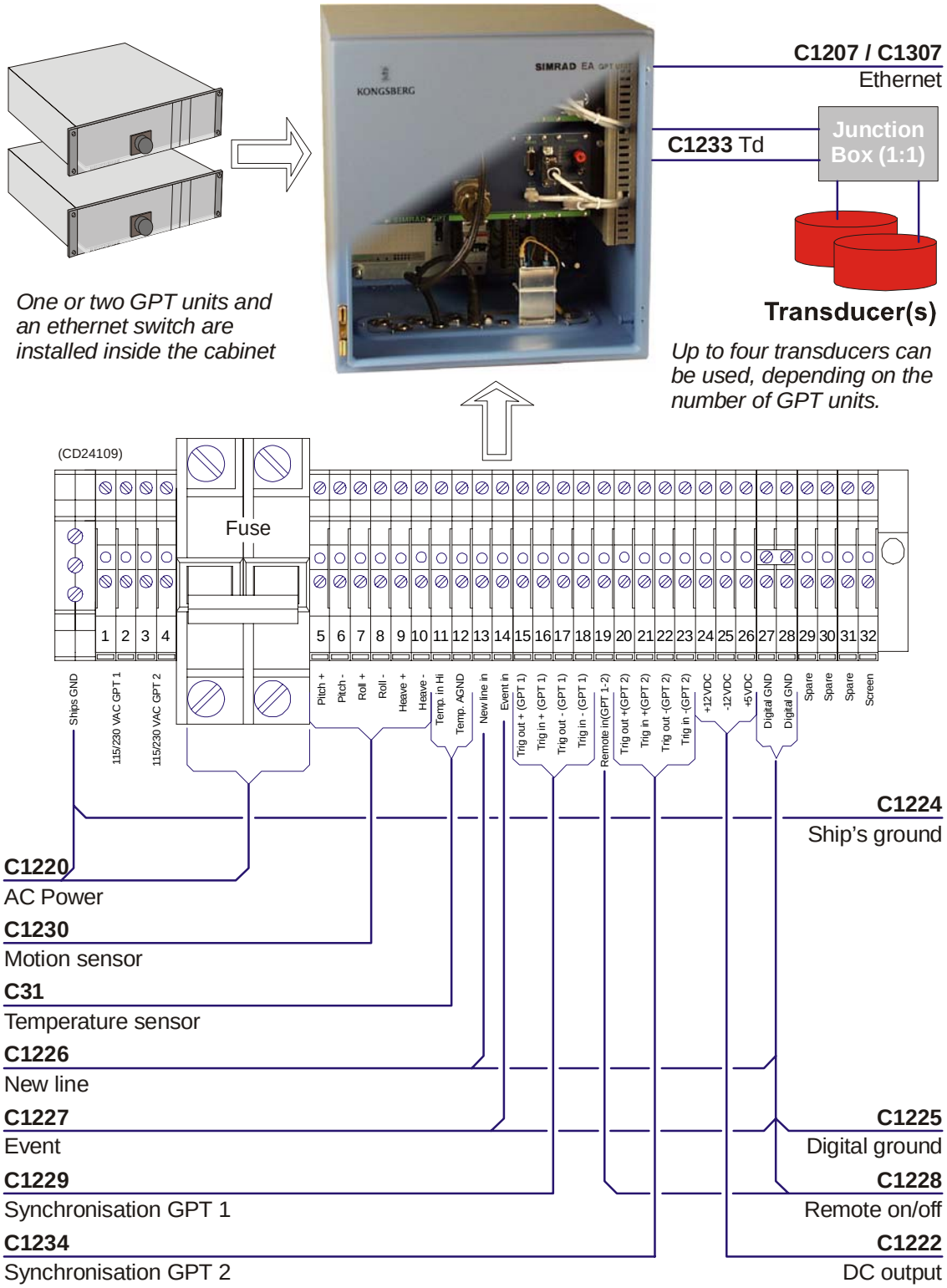


Figure 32 EA 600 cable plan - GPT Cabinet

C1225 - Digital ground

Standard grounding cable, must be provided by the shipyard.

→ *Cable details, page 120.*

C1226 - New line annotation (trigger input)

This input is referenced to digital ground. The cable must be provided by the shipyard.

→ *Cable details, page 120.*

C1227 - Event annotation (trigger input)

This input is referenced to digital ground. The cable must be provided by the shipyard.

→ *Cable details, page 120.*

C1228 - Remote on/off control

This input is referenced to digital ground. The cable must be provided by the shipyard.

→ *Cable details, page 120.*

If an Hydrographic Operator Station is used, the on/off function is supported on a dedicated connector.

If a standard computer is used, you must assemble a small switch box to hold the necessary on/off switch.

C1229 - Synchronisation of GPT1

This cable is used to connect the GPT to an external system for synchronization purposes. The cable must be provided by the shipyard.

→ *Cable details, page 120.*

C1230 - Motion sensor (input)

This cable is used to connect the GPT to an external motion sensor. The cable must be provided by the shipyard.

→ *Cable details, page 120.*

C1231 - Temperature sensor (input)

This cable is used to connect the GPT to an external temperature sensor. The cable must be provided by the shipyard.

→ *Cable details, page 120.*

C1433 / C1533 - Transducer(s)

The transducer cable is fixed to the transducer. If the distance between the transducer and the transceiver exceeds the length of the transducer cable, a 1:1 junction box must be used.

Note

The transducer cable between the transducer element and the junction box or GPT must be run in steel conduits. Use flexible conduit close to the GPT cabinet and the plug on the transceiver.

The transducer cables are provided by the manufacturer. The standard transducer cable supplied is 15 to 20 meters long.

→ *Cable details, page 126.*

C1234 - Synchronisation of GPT2

This cable must be provided by the shipyard.

→ *Cable details, page 120.*

Using more than one GPT Cabinet

If more than one GPT Cabinet is used remember the following:

- Seperate synchronisation to each cabinet.
- Remote is normally connected in parallell, but that is eligible.
- The motion sensor is connected to one GPT Cabinet only.
- The temperature sensor is connected to one GPT Cabinet only.
- The “New line in” is connected to one GPT Cabinet only.
- The “Event in” is connected to one GPT Cabinet only.

6.3 External interfaces

Overview

- Navigation (GPS) interface (NMEA)
- Annotation text input (NMEA)
- Depth telegram output (NMEA)
- Heave sensor input

Navigation (GPS)

GPS (Global Positioning System) receivers output NMEA 0183 telegrams containing geographical latitude and longitude. The defined communication parameters are:

- 4800 bits per second
- 8 data bits
- no parity
- one stop bit

Most navigation receivers also allow different parameters to be entered.

Connect the navigation receiver to a free RS-232 port. Only the signal (Rx, pin 2) and ground wires (pin 5) need to be connected. Connect only the signal wire (Tx, pin 3) and the ground wire (pin 5) to the GPS system's output. Maximum cable length is approximately 50 meters.

The connection must be established in the software as well. Observe the following procedure:

1 Open the **Navigation Interface** dialogue box.

2 Enter the name of the selected RS-232 port and the communication parameters.

Depth output

The current depth from a defined transceiver channel can be sent out on a chosen serial line. One or more of the following serial lines can be used:

- Heave Sensor
- Navigation Interface

The dialogue boxes used to control these interfaces also include a button to open the **Depth Output** dialogue box. From this dialogue, you can select from three different types of NMEA depth telegrams.

- The **$SDDBS** telegram contains the depth below the surface.
- The **$SDDBT** telegram contains the depth below the transducer.
- The **$SDDPT** telegram contains the depth below the transducer and the distance between the transducer and the waterline.

The EA 600 can also output the **EA 500/EK500** compatible depth telegrams; D1, D2 etc. Output for Atlas echo sounders are also provided.

Only one telegram type at a time can be generated, and the same serial line parameters as for the main sensor must be used.

Heave sensor

A heave sensor with an analogue output is connected directly to the **Auxiliary** connector.

The positive heave input signal (pin 3) is connected to the sensor output terminal. The negative heave input signal (pin 16) is grounded at the sensor in order to prevent ground potential offsets between the sensor and the transceiver from adding to the sensed signal.

Maximum cable length is virtually unlimited.

The connection must be established in the software as well. Observe the following procedure:

1 Open the **Heave Sensor** dialogue box.

2 Select the appropriate transceiver.

Heave sensors with a serial line output are connected to a free RS-232 port at the rear of the computer. Maximum cable length is approximately 50 meters. In these cases, use the **Heave Sensor** dialogue box to enter the required communication parameters and the name of the selected port.

Temperature sensor

Connect the temperature sensing thermistor to the **Auxiliary** connector (pins 4 and pin 17).

Colour printer

Connect the printer to the parallel port, use a standard printer cable with all wires connected. Maximum cable length for parallel cable is approximately 10 meters.

The connection must be established in the software as well. Observe the following procedure:

1 Open the **Printer Setup** dialogue box.

2 Enter the selected printer.

External “Event” triggering

An external switch may be connected to the General Purpose Transceiver (GPT) to trigger Events manually. Alternatively, the trigger can be a negative pulse.

External “New line number” triggering

An external switch may be connected to the General Purpose Transceiver (GPT) to trigger “New line number” manually. Alternatively, the trigger can be a negative pulse.

6.4 External triggering

Overview

Whenever more than one hydroacoustic system (echo sounder or sonar) is installed on a vessel, interference may occur. To avoid this, the systems may either be connected to a common synchronization system, or one of the acoustic systems may be defined as a “master”.

The EA 600 echo sounder include interface for remote transmit synchronisation. The system can be set up to operate in either **Master** or **Slave** mode in relation to an external synchronization or hydroacoustic system.

The EA 600 system may comprise more than one General Purpose Transceiver (GPT). If the EA 600 operates as a Master, the synchronization between these are controlled by the echo sounder software. If the echo sounder operates as a Slave system, the GPT units must be individually controlled by the Master system.

Note

In its default configuration, the EA 600 is set up to operate as a Master. Special action must be taken to reconfigure the echo sounder for Slave operation.

Master system

When the EA 600 system is set up to operate as a Master in a system, the **TrigOut** signal from the GPT **Auxiliary** connector must be connected to the external trigger input on the other hydroacoustic system(s). If more than one GPT us used by the Master system, the **TrigOut** signal must be taken from the active GPT. Two **TrigOut** signals are available for either positive or negative triggering. When activated. the trigger signal will allow all the systems to transmit simultaneously.

Note

Simultaneous transmission of more than one system can only take place if the systems operate with different frequencies!

→ *The cable and connections to the GPT is shown on page 123.*

The **TrigOut+** signal is an open collector output (max 100 mA) containing a 100-kohm pullup resistor to +5 Vdc. This signal is normally low. The **TrigOut+** signal goes high when the transceiver is ready to transmit, and it goes low again when all frequency channels of the transceiver have finished transmitting.

TrigOut- is the inverse of **TrigOut+**.

Connect the ground wire to one of the **Ground** pins (18-22).

Slave system

If an external system is used to provide the transmit trigger, the trigger signal must be connected to one of the **TrigIn** inputs on the GPT **Auxiliary** connector. When activated. the trigger signal from the external system will allow the EA 600 system to transmit.

If more than one GPT is used by the Slave system, the input trigger must be connected to all the GPT units in parallel.

Two **TrigIn** inputs are available for either positive or negative triggering. The **TrigIn-** input is sensitive to a high-to-low transition.

Connect the ground wire to one of the **Ground** pins (18-22).

Note

If the EA 600 system comprises more than one GPT unit, the external trigger must be connected in parallel to every GPT.

→ *The cable and connections to the GPT is shown on page 123.*

7 SPARE PARTS

7.1 Overview

This chapter contains an illustrated presentation of the spare parts available for the EA 600 single beam echo sounder. All the parts are not listed her, only those defined as Line Replaceable Units (LRU) to be changed by the on-board maintenance personnel.

7.2 GPT spare parts

The line replaceable units in the EA 600 GPT are:

- Circuit boards
- Power supply

The spare parts in the GPT are those circuit boards used in the chassis.

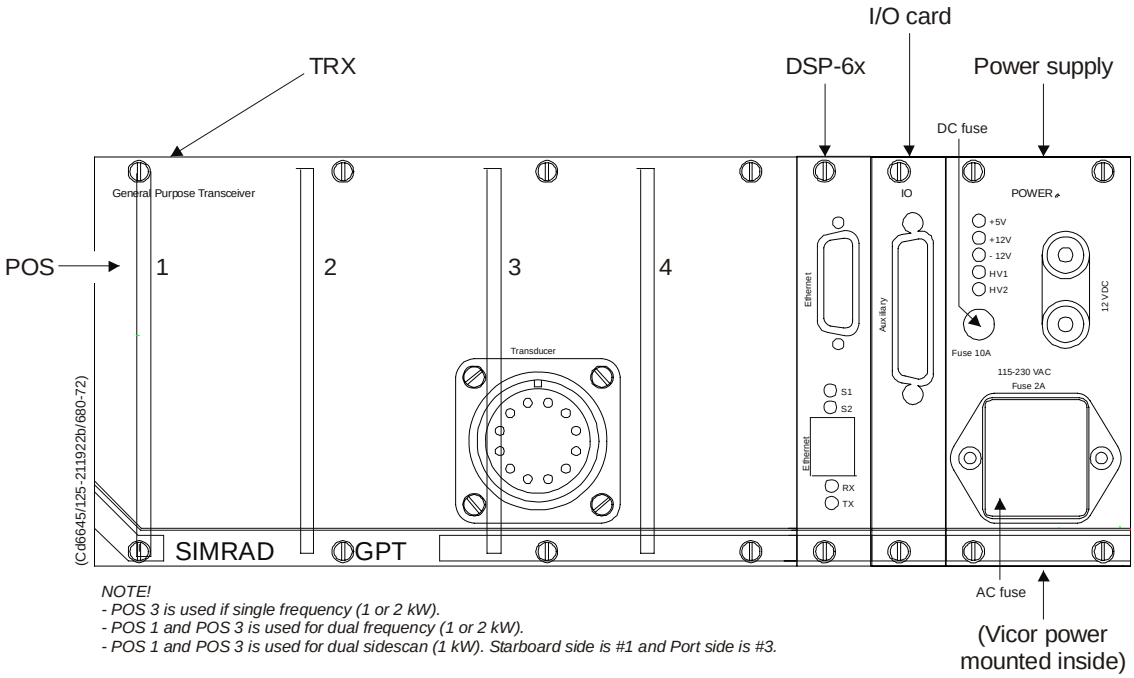


Figure 33 GPT, wired

GPT spare parts (example)

SNo	Drawing ref	Prod.p.no	Article name	Price	Unit	Quan-tity
	Other ref.	TM part.no	Technical data	TM code	User-spares	Base spares
	Date	NATO No	Other information	Status	Comp	Ser.no.
1	Fig.33 26.09.02	382-201216 - -	TRX board, 120 kHz	- - -	EA 0 C	1 0 N/A
2	Fig.33 26.09.02	382-201217 - -	TRX board, 200 kHz	- - -	EA 0 C	1 0 N/A
3	Fig.33 26.09.02	382-211782 - -	DSP-6x	- - -	EA 0 C	1 0 N/A
4	Fig.33 26.09.02	382-200459 - -	I / O card	- - -	EA 0 C	1 0 N/A

5	Fig.33 26.09.02	382-200002 - -	Power supply	- - -	EA 0 C	1 0 N/A
6	Fig.33 26.09.02	382-200889 - -	Vicor power supply Commercial item	- - -	EA 0 C	1 0 N/A

8 DRAWING FILE

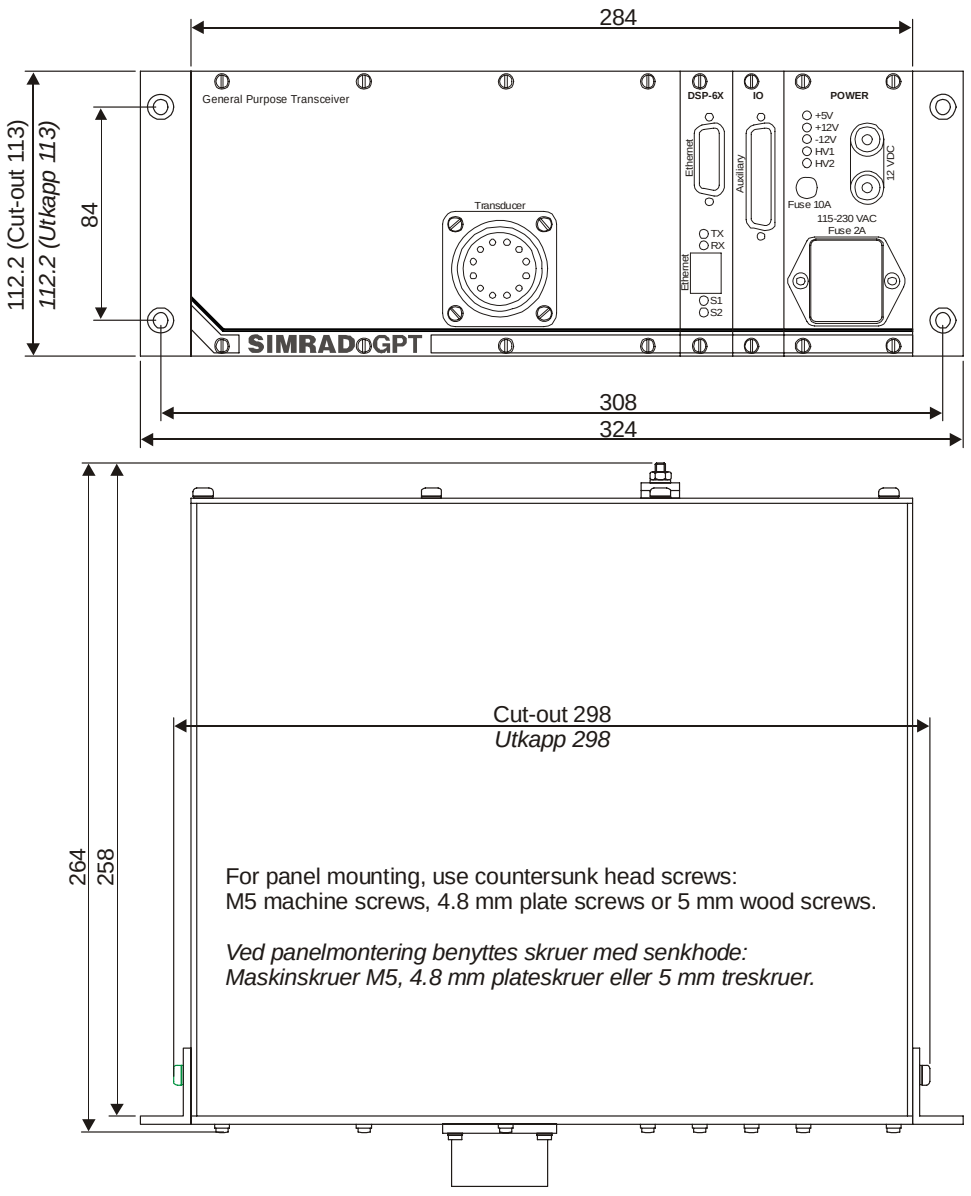
8.1 Overview

This chapter contains cable details and installation drawings.

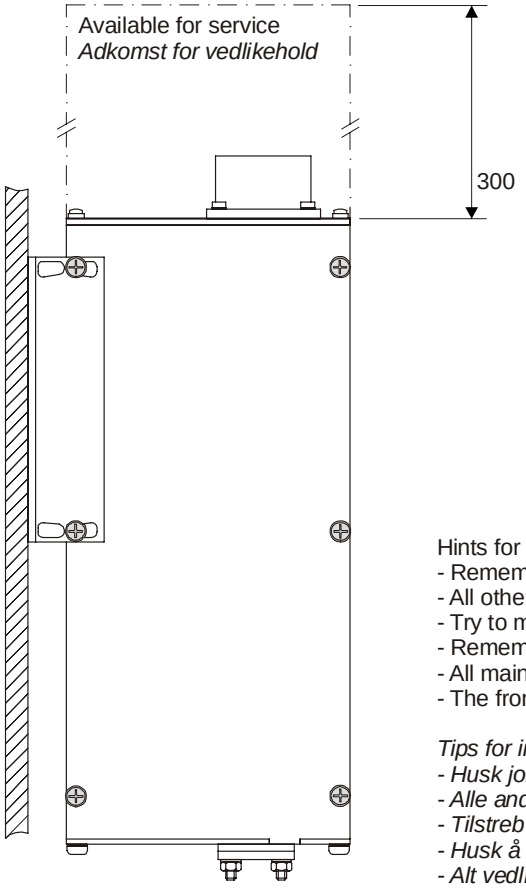
Installation drawings

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.

Cable details



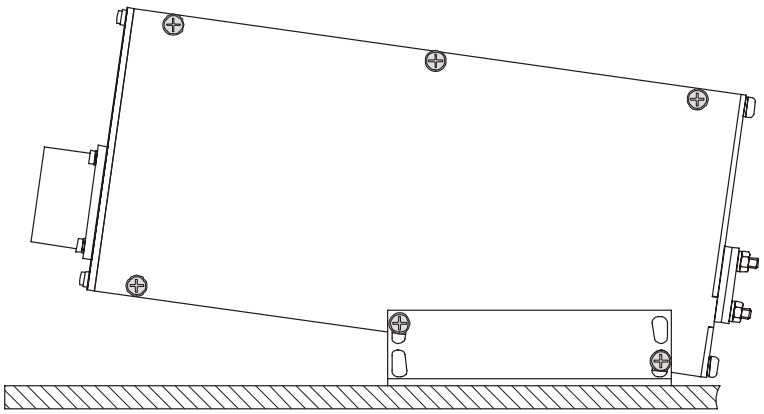
Page 1 of 2 (CD5467A)	GPT Dimensions and installation	**820-201035** Rev.C



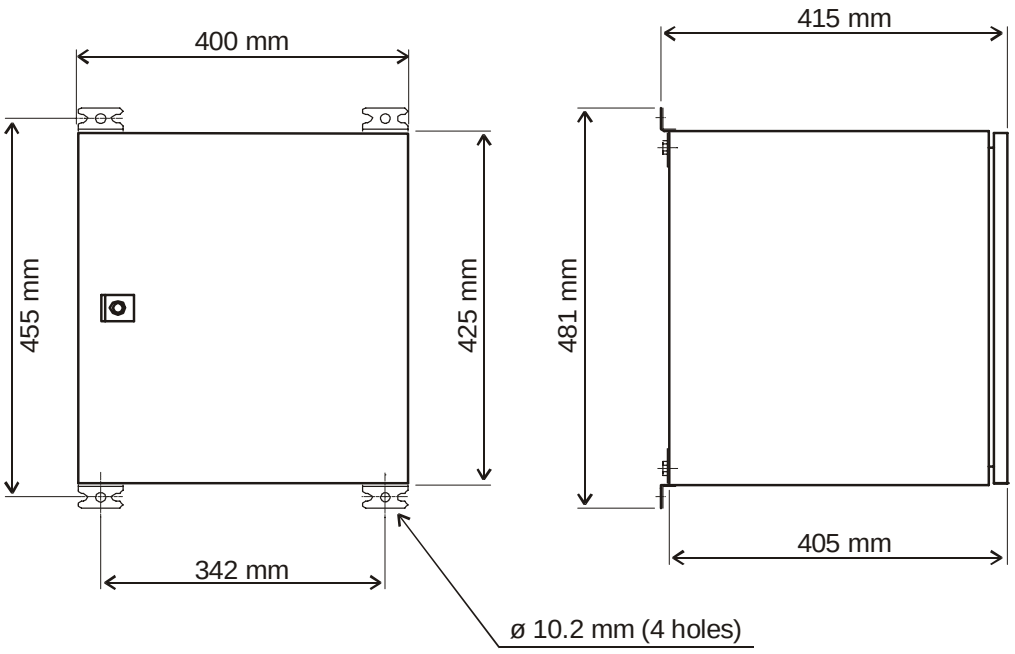
Mounting examples
Monteringseksempler

Hints for installation:
- Remember the earth connection on the rear panel.
- All other connections are made on the front panel.
- Try to make the wiring simple.
- Remember to make room for maintenance.
- All maintenance is made from the front.
- The front panel should be visible.

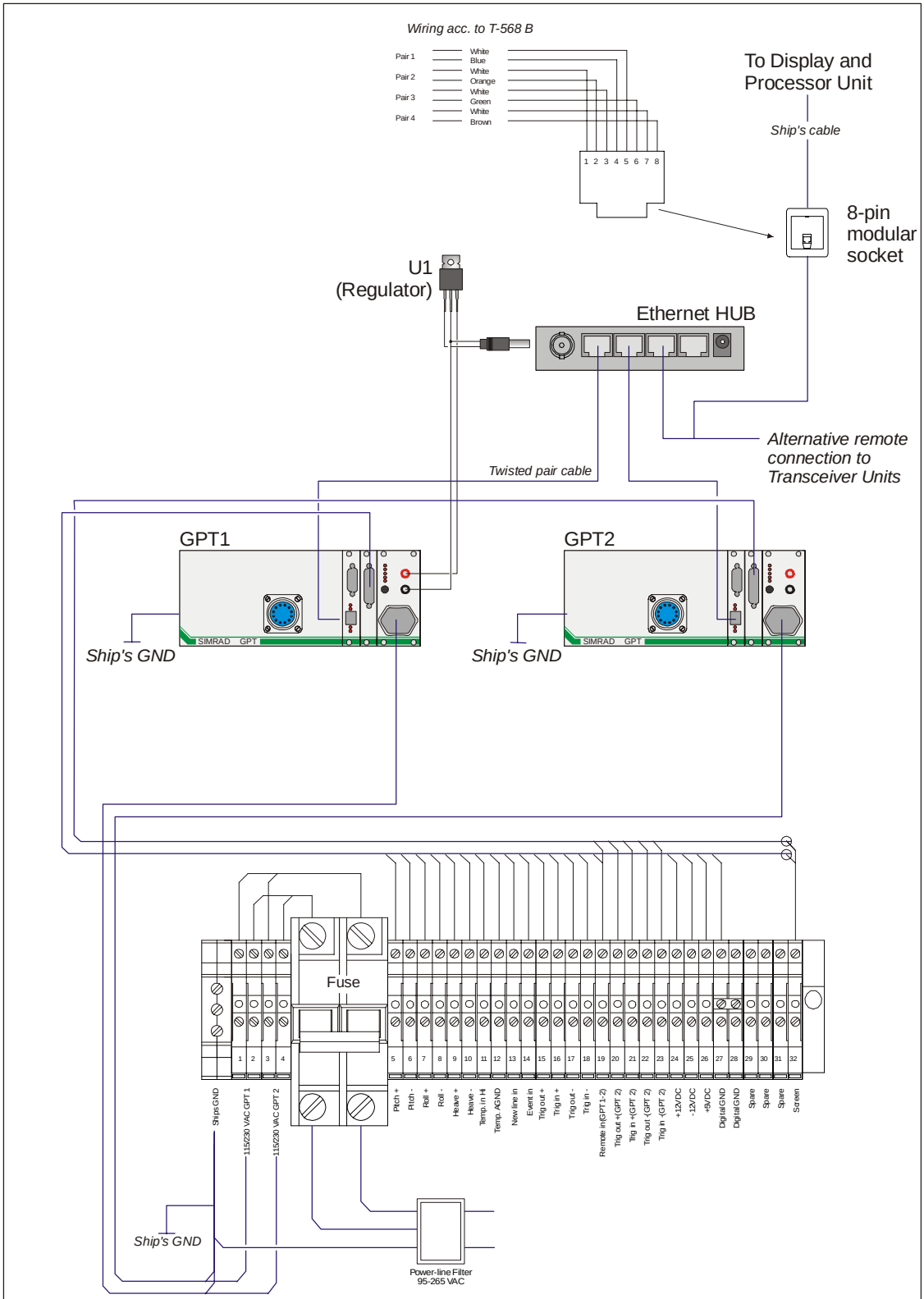
Tips for installasjon:
- Husk jordtilkopling på bakpanelet.
- Alle andre tilkopling gjøres på frontpanelet.
- Tilstreb enkel kabling.
- Husk å lage adkomst for vedlikehold.
- Alt vedlikehold skjer fra fronten.
- La frontplaten være synlig.



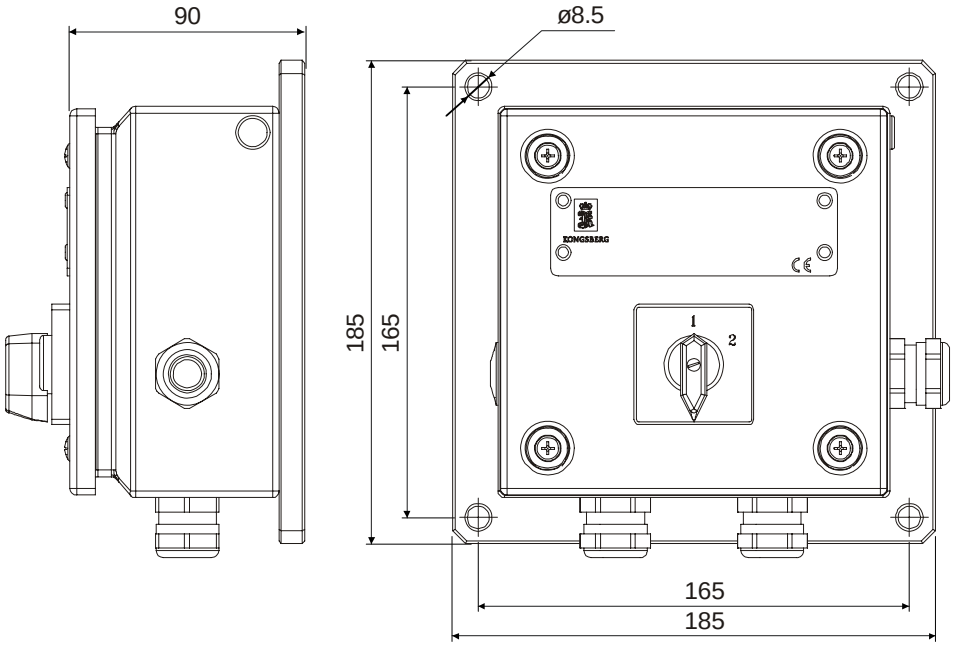
Page 2 of 2 (CD5467B)	GPT Dimensions and installation	**820-201035** Rev.C

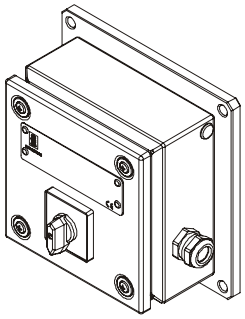


Page 1 of 1 (CD5979)	GPT Cabinet, Outline dimensions	**834-215556** Rev.A



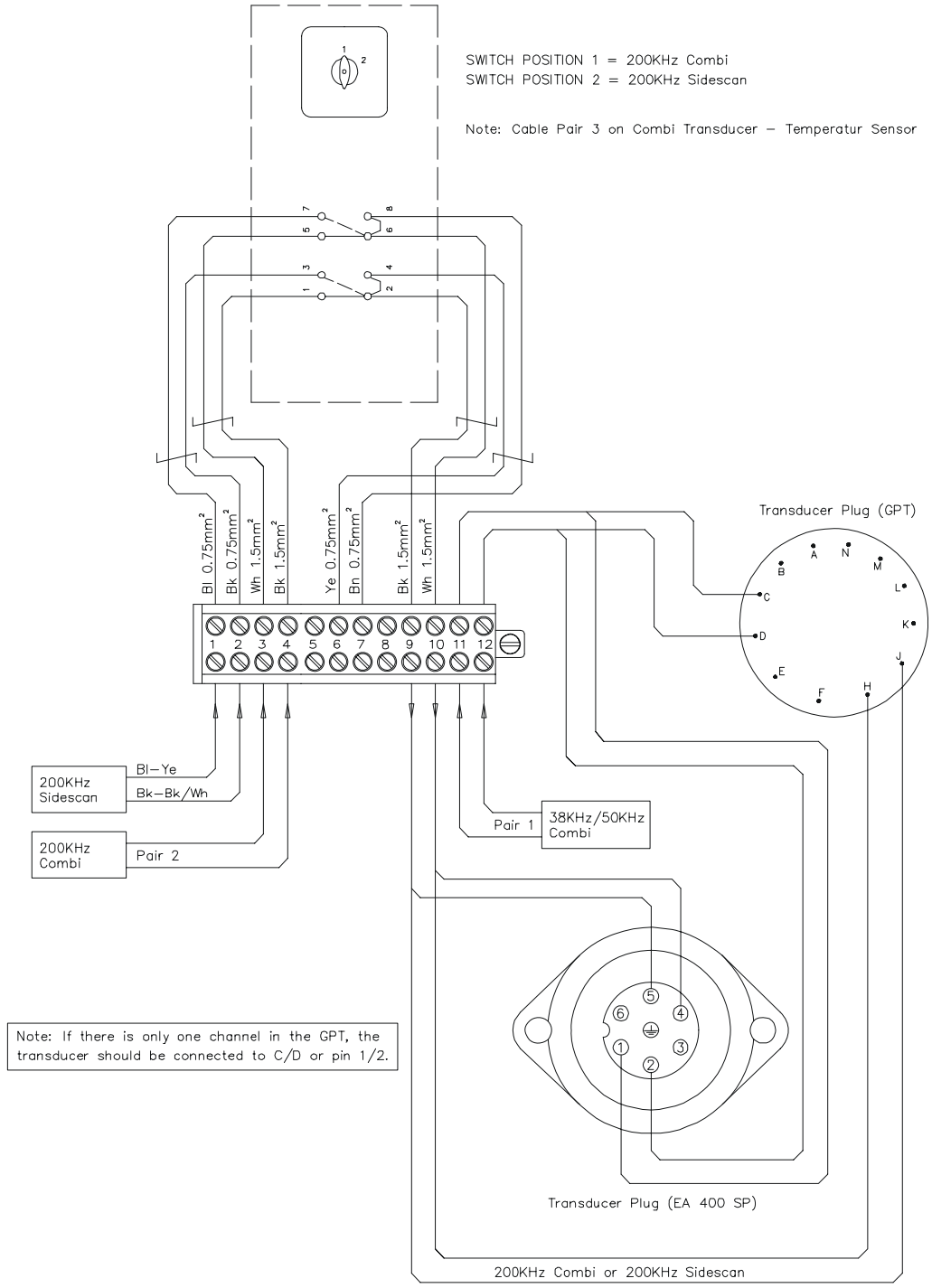
Page 1 of 1 (CD5980A)	GPT Cabinet - Internal wiring	**824-214945** Rev.C





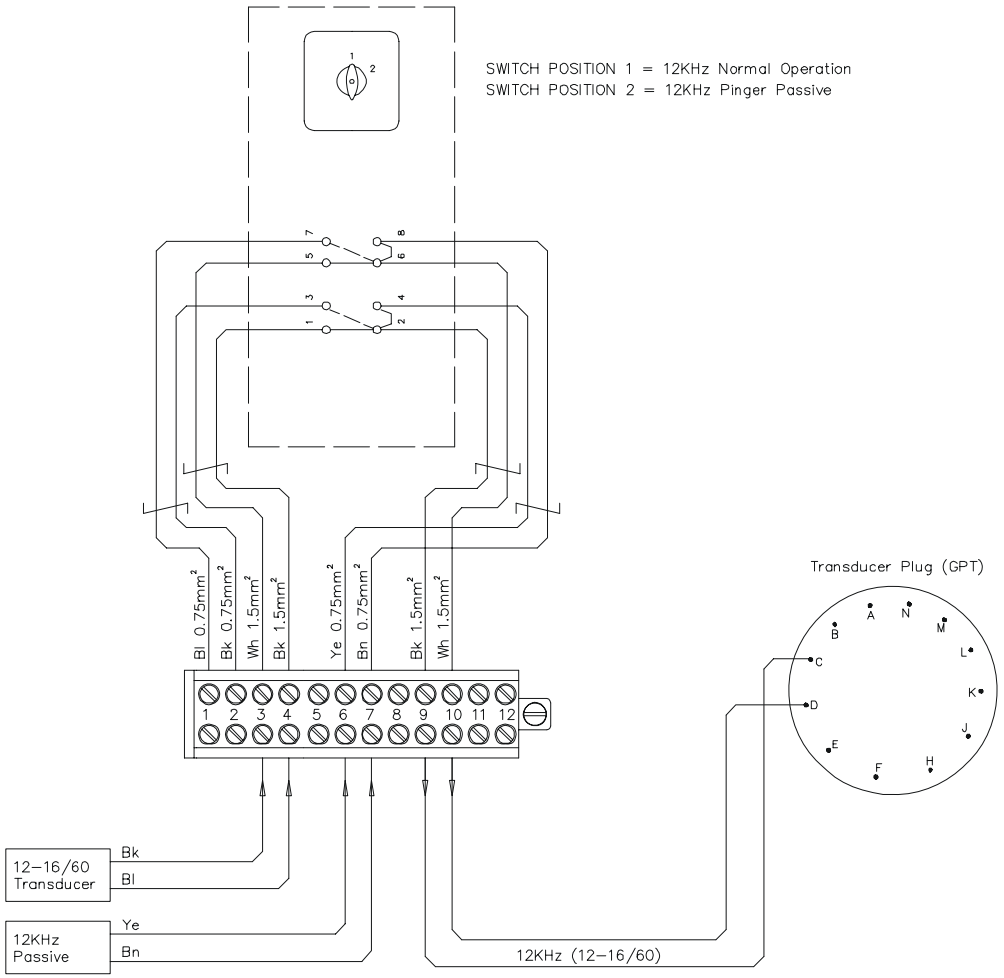
Page 1 of 1 CD24104	EA Transducer Switch Unit outline dimensions	**834-223074** Rev.A

COMBI/SIDESCAN TRANSDUCER

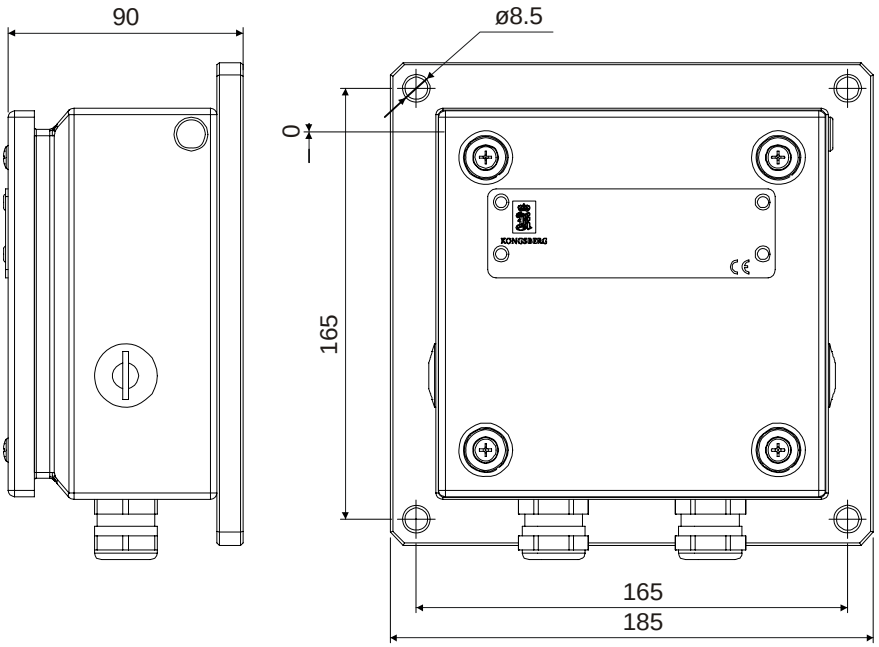


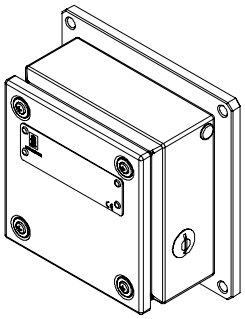
Page 1 of 2 CD24105	EA Transducer Connection Unit interconnection diagram	**834-223080** Rev.B

12KHz ACTIVE/PASSIVE PINGER TRANSDUCER



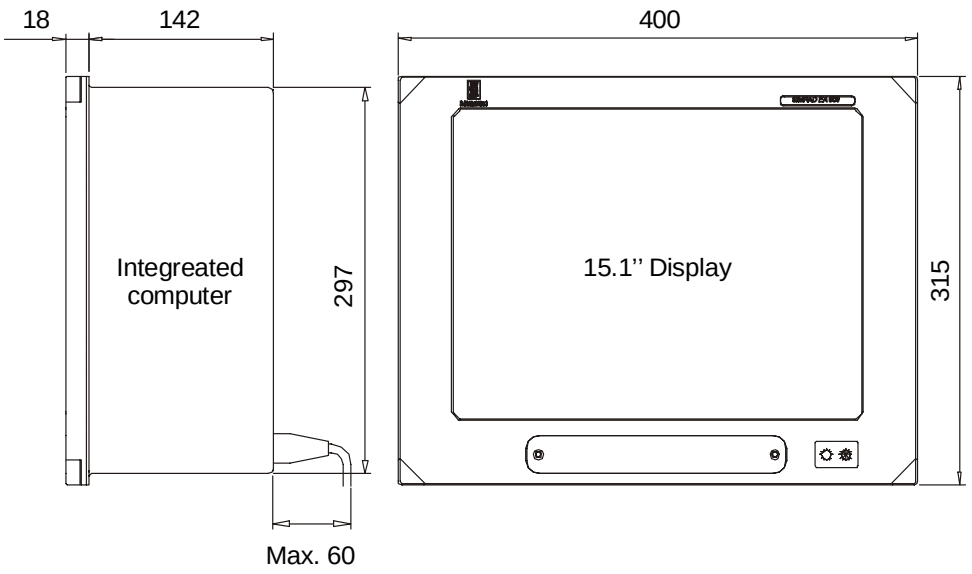
Page 2 of 2 CD24105	EA Transducer Connection Unit interconnection diagram	**834-223080** Rev.B

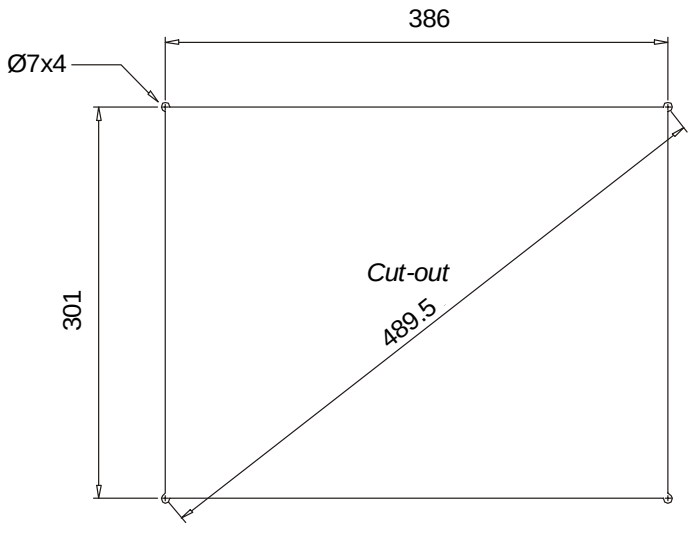




Page 1 of 1 CD24103	EA Transducer Connection Unit outline dimensions	**834-223046** Rev.A

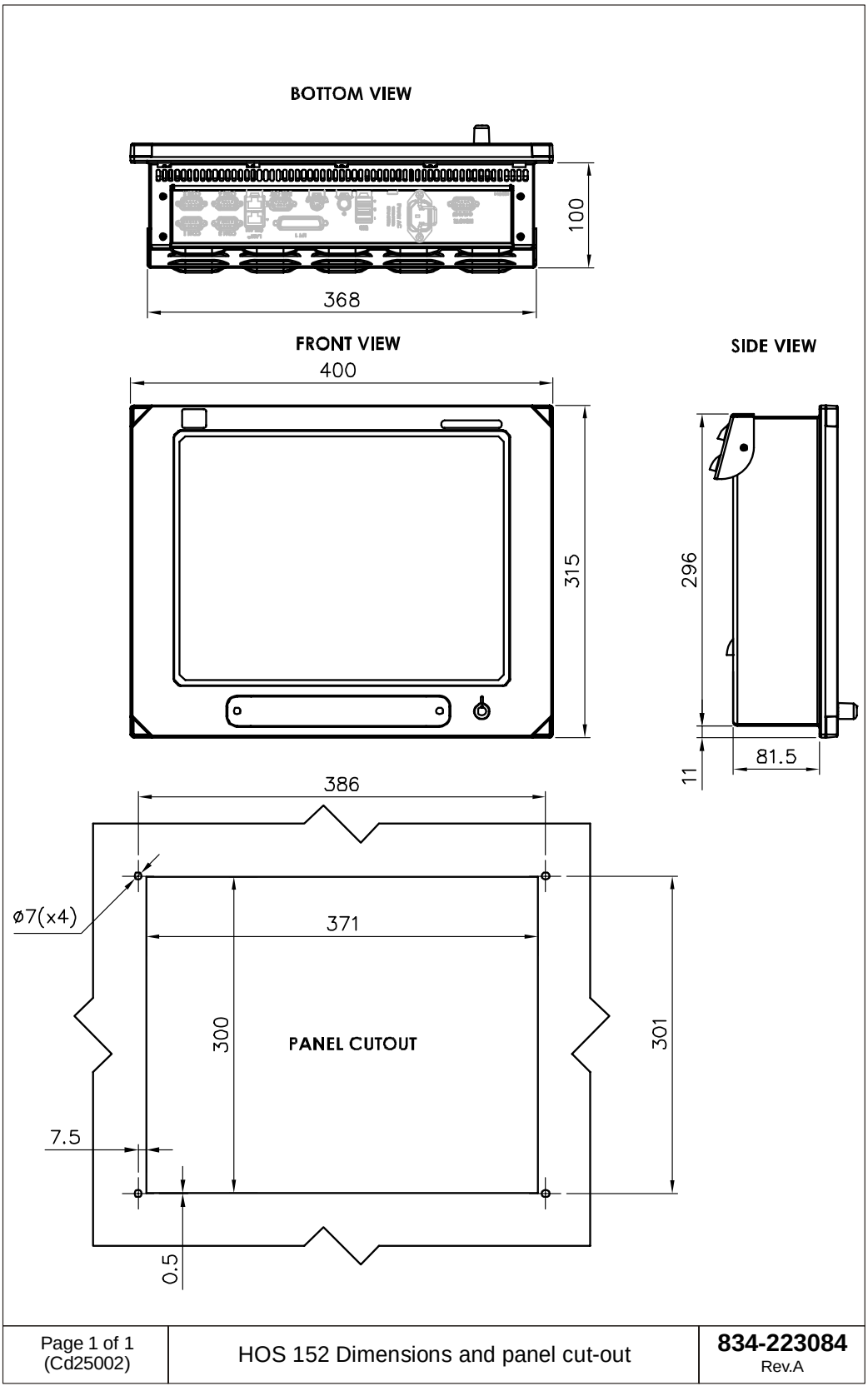
Not to scale





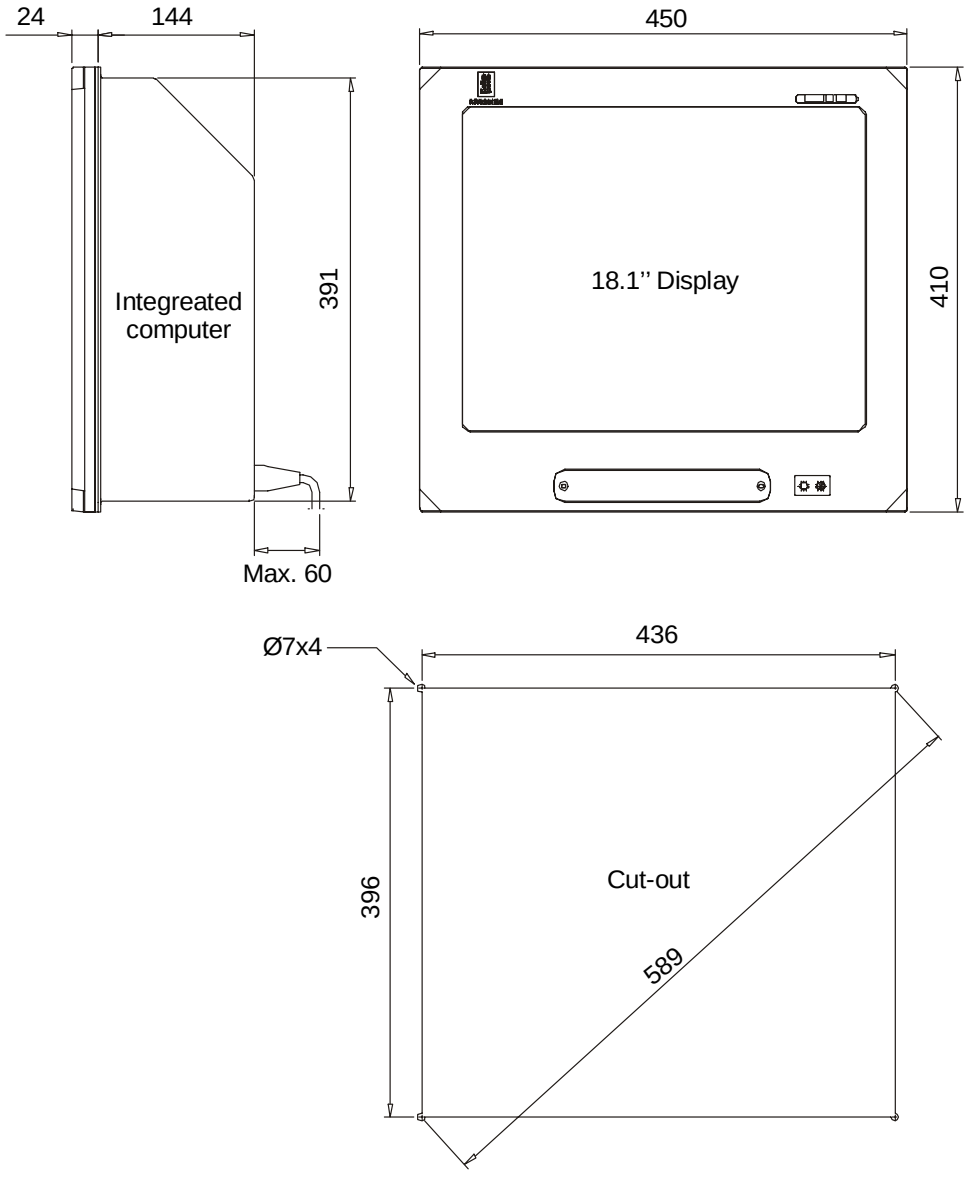
For best results use four screws (order number: 599-200984) and four nuts (order number: 599-200986) when mounting the unit in panels with a thickness of 22 mm or less.

Page 1 of 1 (CD6418)	HOS 151 Dimensions and panel cut-out	**834-215648** Rev.A



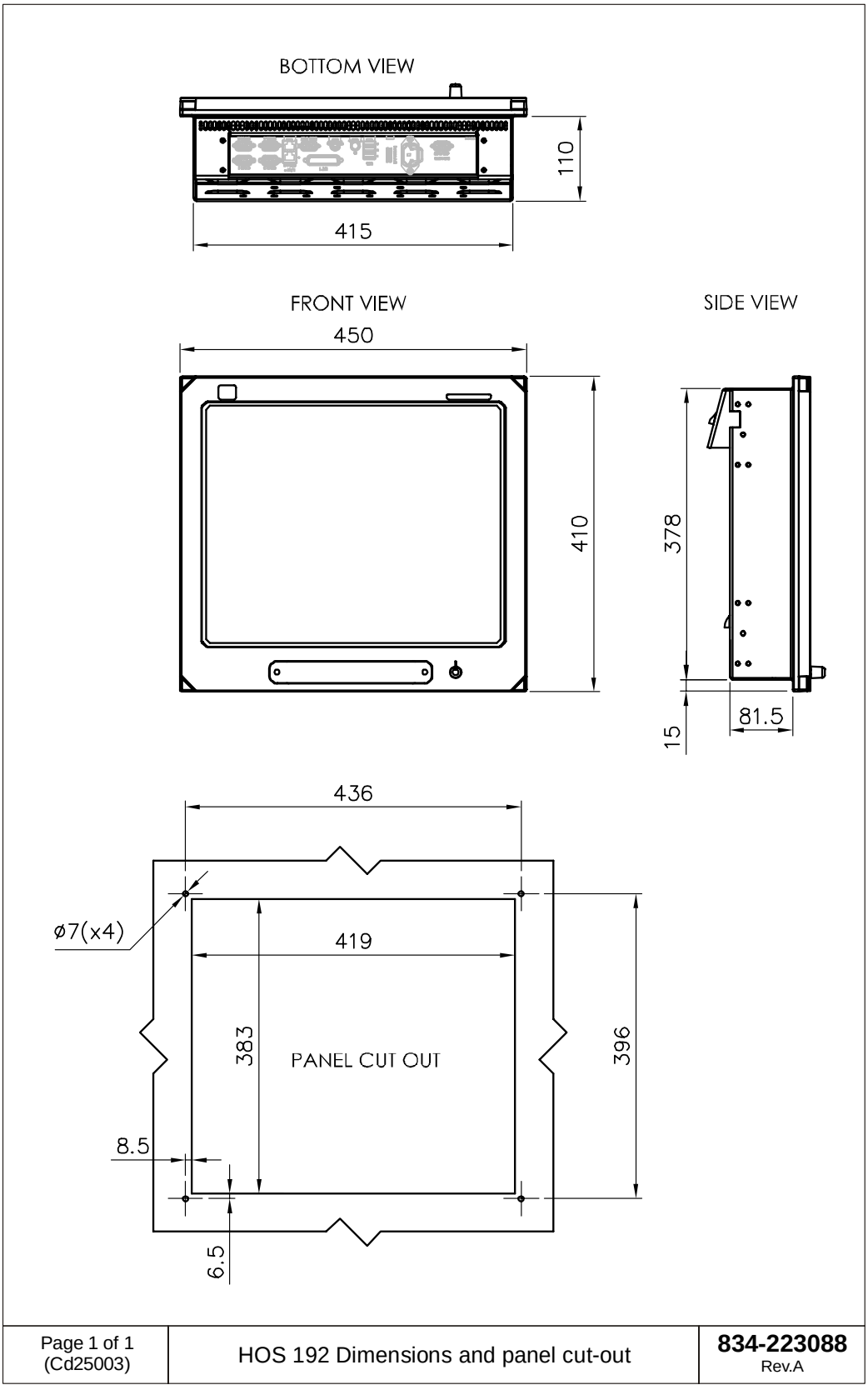
Page 1 of 1 (Cd25002)	HOS 152 Dimensions and panel cut-out	**834-223084** Rev.A

Not to scale

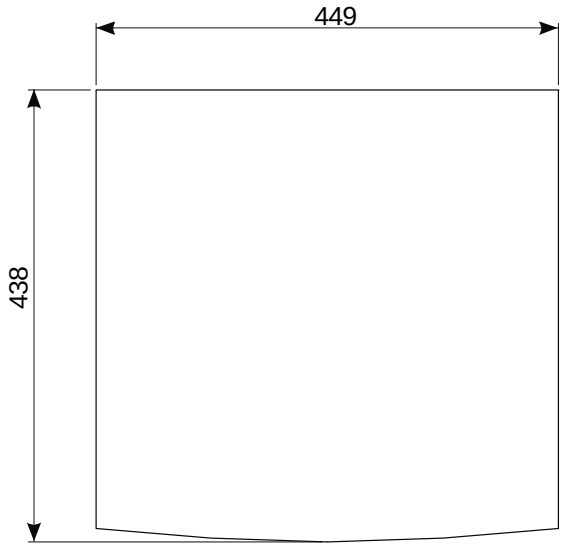


For best results use four screws (order number: 599-200984) and four nuts (order number: 599-200986) when mounting the unit in panels with a thickness of 16 mm or less.

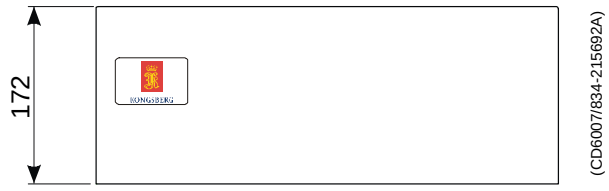
Page 1 of 1 (CD6419)	HOS 181 Dimensions and panel cut-out	**834-215649** Rev.A



Page 1 of 1 (Cd25003)	HOS 192 Dimensions and panel cut-out	**834-223088** Rev.A



Top view
HP KAYAK



Front view
HP KAYAK

Page 1 of 1 (CD6007)	HP Kayak outline	**834-215692** Rev.A

Generic RS-232 serial line (DCE)

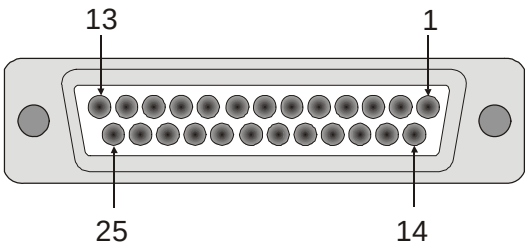
This cable described the pin configuration for an RS-232 interface. The Data Circuit terminating Equipment (DCE) end is shown.

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)



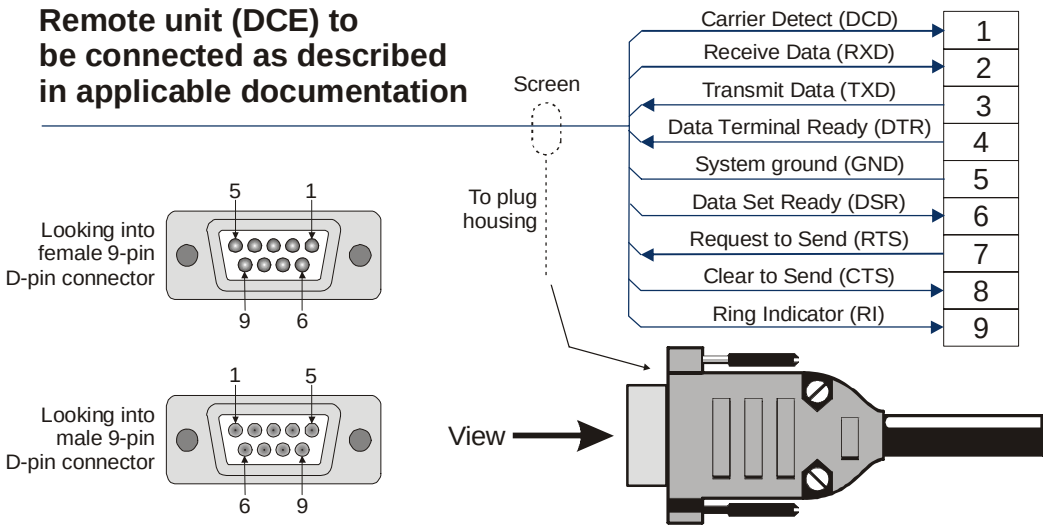
Looking into a female 25-pin D-pin connector

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

Conductors	25 x 1 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.

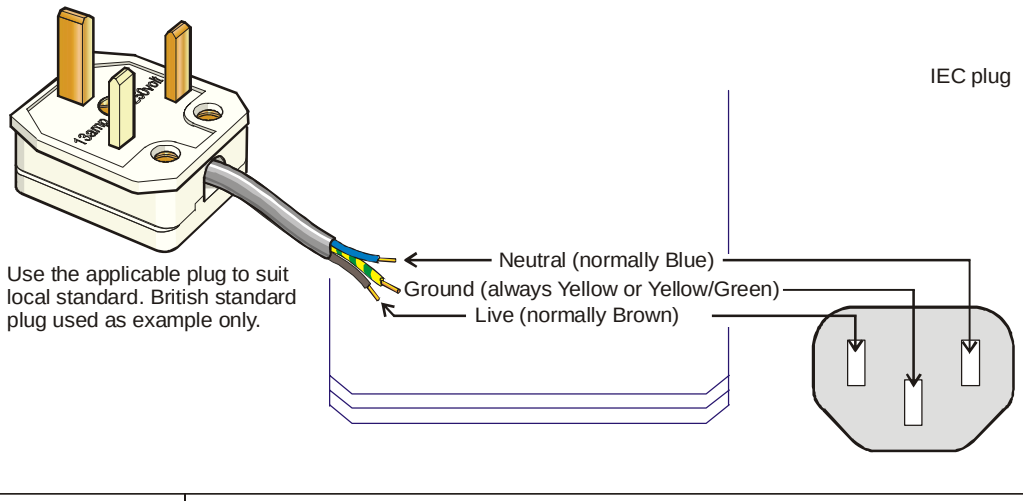


W104 / Rev C	Standard RS-232 serial line

Conductors	9 x 2 x 0.5 mm2
Screen	Screened twisted pairs and 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

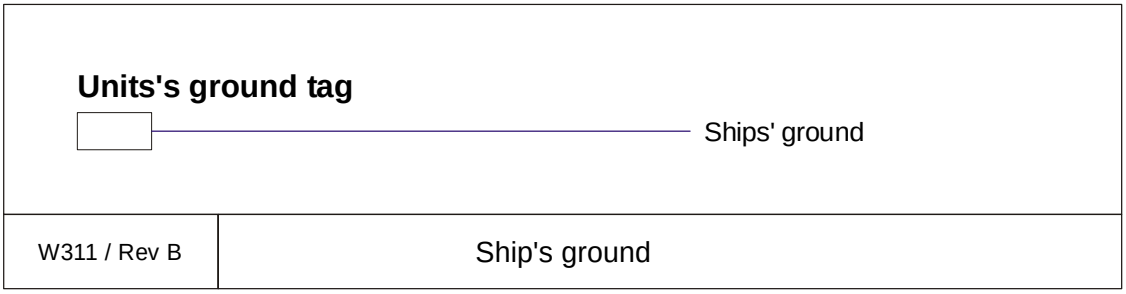
Different cable colours may be used for the “live” and “neutral” wires. Ground is however always on green/yellow.

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

EMC ground

This cable is used to connect the system unit to the ship’s ground.

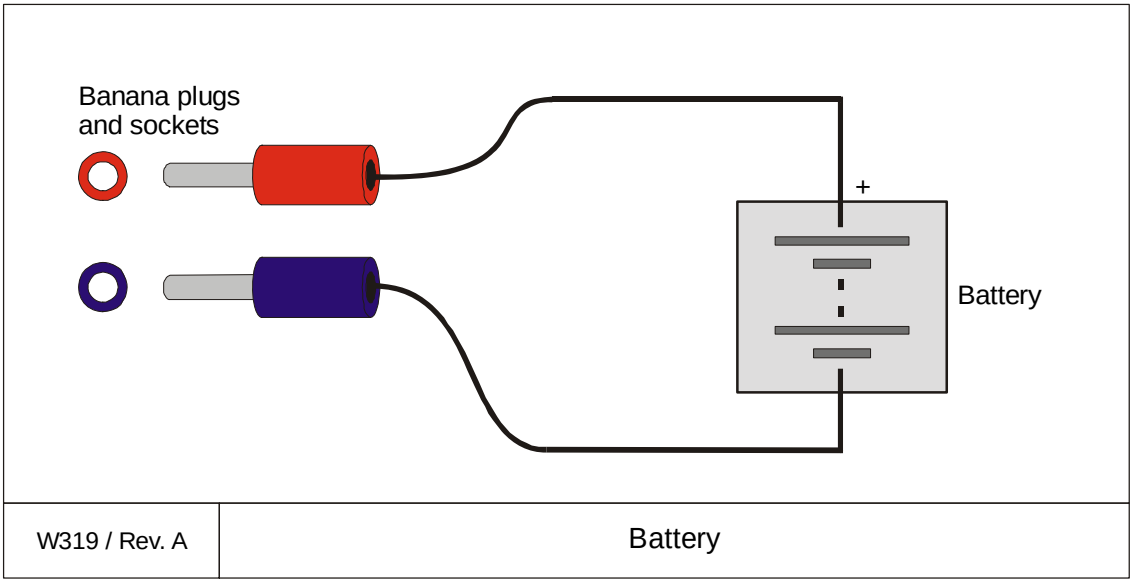
Note that this cable must be as short as possible.



Minimum cable specifications	
Conductors	1 x 6 mm2
Screen	None
Voltage	60 V
Max.diameter	N/A

Battery

This cable is used to connect a battery to the system. Red plug and red socket is normally used for positive (+). Black plug and black socket is normally used for negative (-).

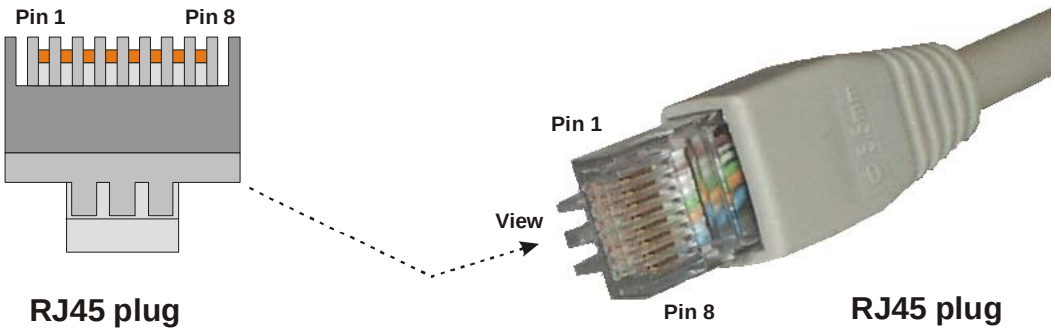


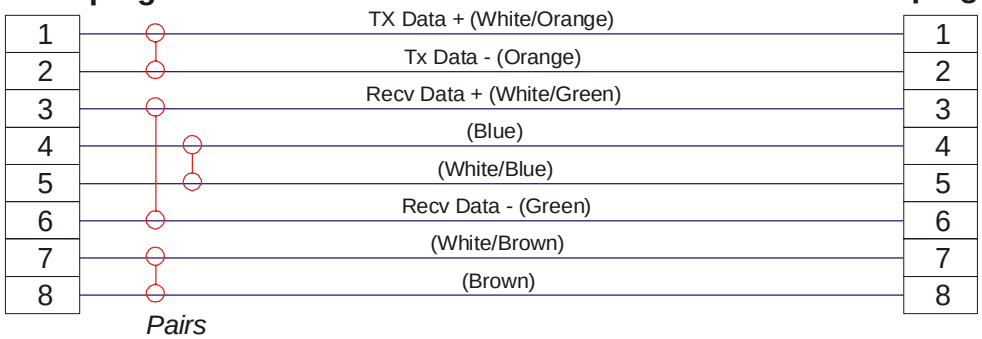
W319 / Rev. A	Battery

Conductors	2 x 1.5 mm2
Screen	None
Voltage	Selected to fit the battery voltage and the expected current
Max.diameter	N/A

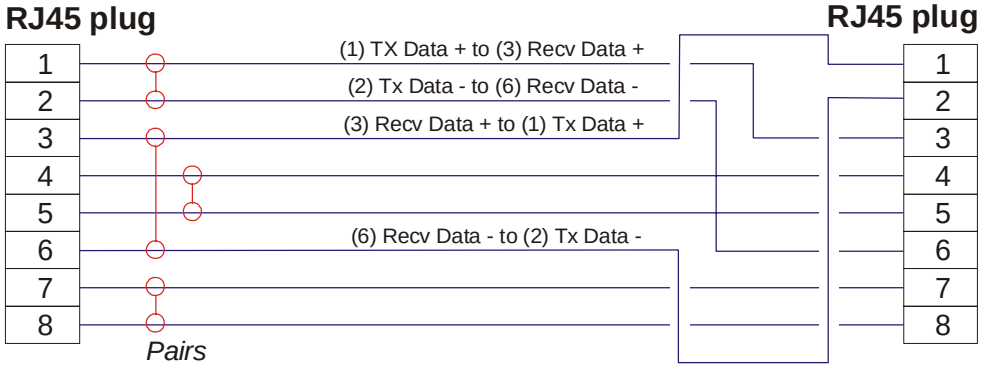
Ethernet with RJ45 plugs (screened)

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"

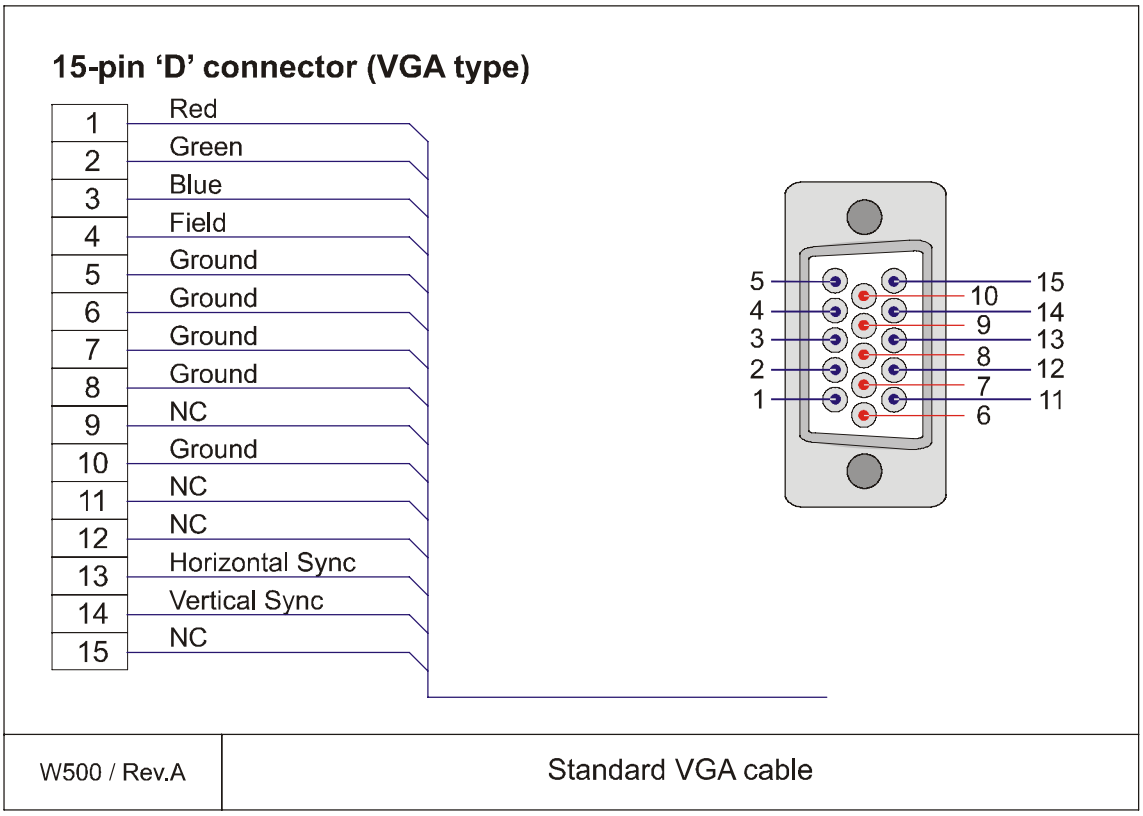
NOTE: In order to prevent noise and crosstalk, you are strongly adviced to use the cable pairs indicated above.

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

W400 / Rev G	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.



Standard USB cable

This is a standard commercial USB cable terminated with **A** and **B** plugs in either ends. The cable can be used for a variety of external devices. The order number provided is for a 4.5 m cable.

Universal Serial Bus (USB) cable
terminated with an **A-plug** in one end
and a **B-plug** in the other.

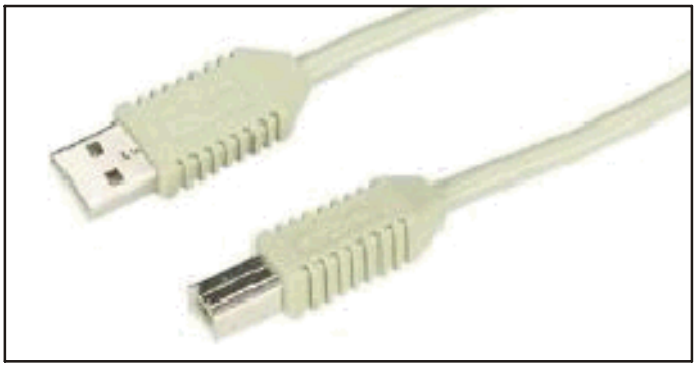
Internal cables:

Pair 1:
28 AWG twisted pair
(data, green, white)

Pair 2:
20 AWG twisted pair
(Power, red, black)

Shield:
Foil and braid

Length: 4.5 m
Order no: 719-078524

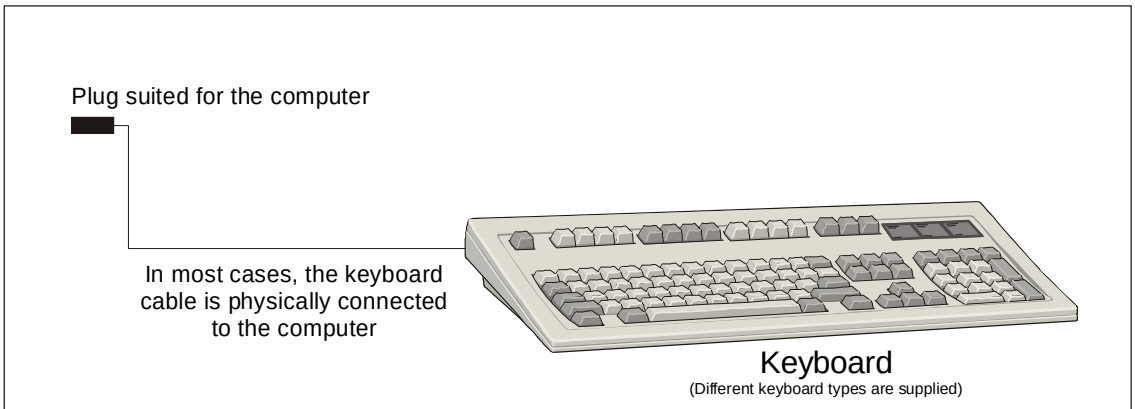


W501 / Rev.A	Commercial USB cable

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

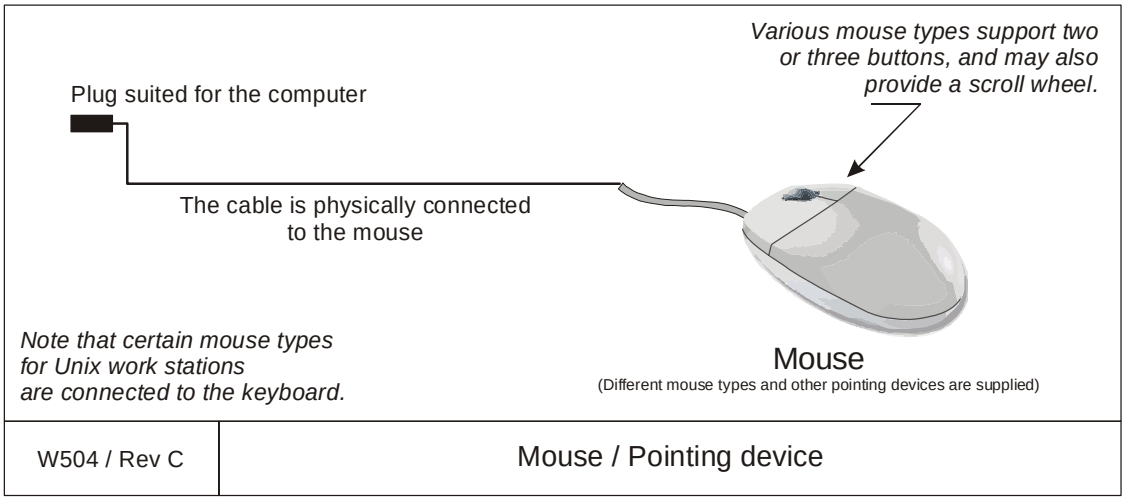
Mouse or pointing device cable

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.

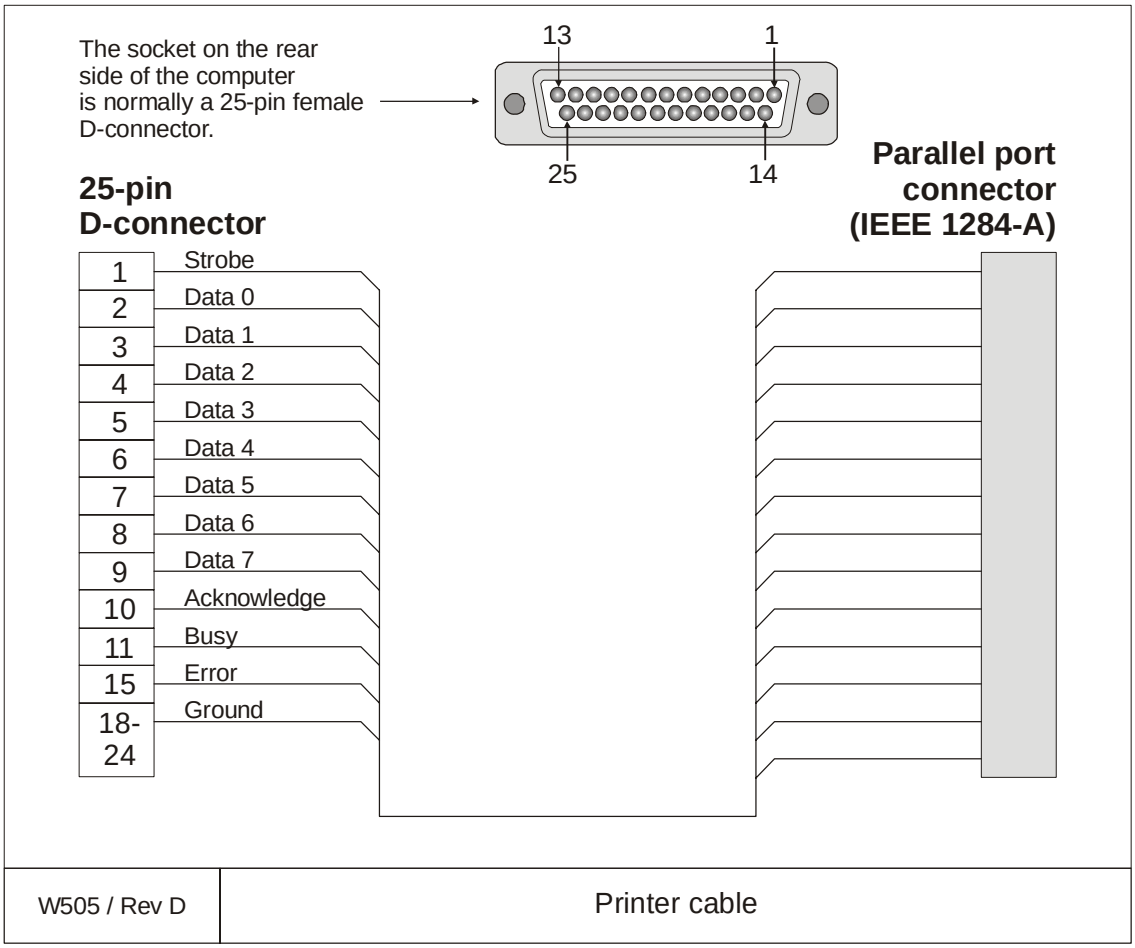
Several mouse and pointing device types are available with two or three buttons, and with or without a scroll wheel. Both the mouse and the attached cable are commercial items.



W504 / Rev C	Mouse / Pointing device

Printer cable

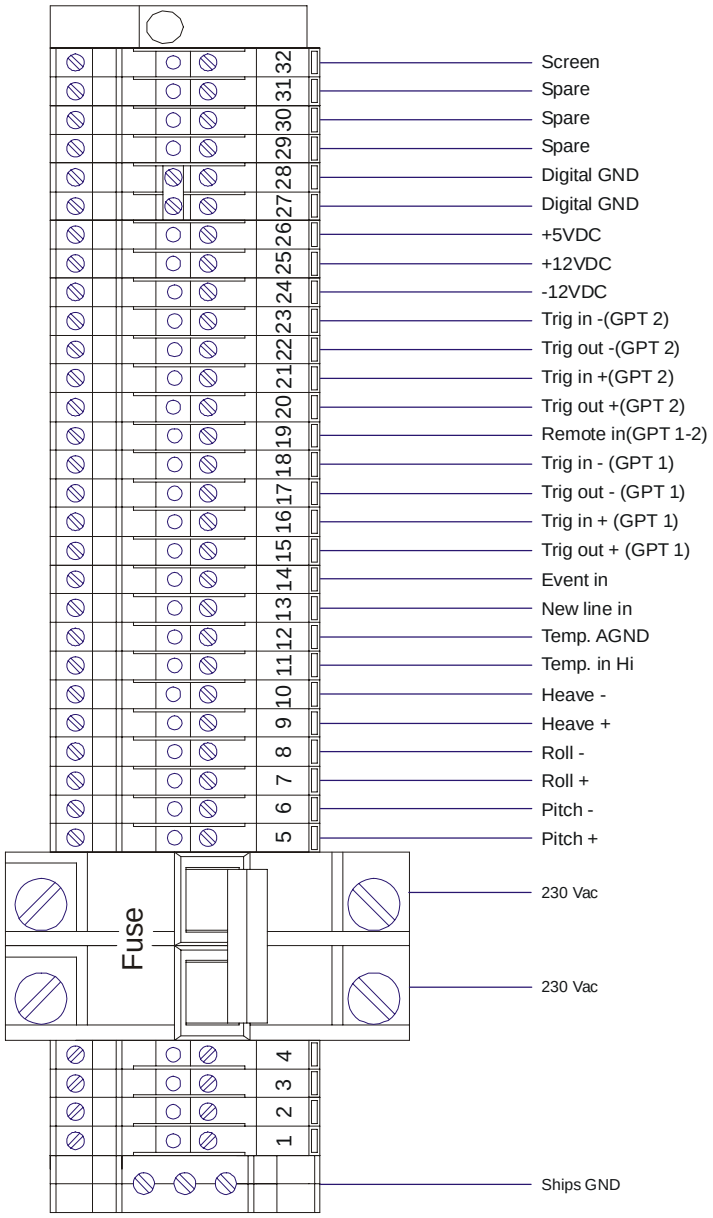
This is a standard printer cable. It is terminated in the computer's parallel port.



W505 / Rev D	Printer cable

GPT Cabinet interface cables

These are the cables used to interface the GPT Cabinet. Note that Ethernet and transducer cables are described separately.



For internal cabinet wiring, refer to 824-214954 (CD5980A)

W619 / Rev.A	GPT Cabinet cables

Specifications for each of the cables (except AC power cables):

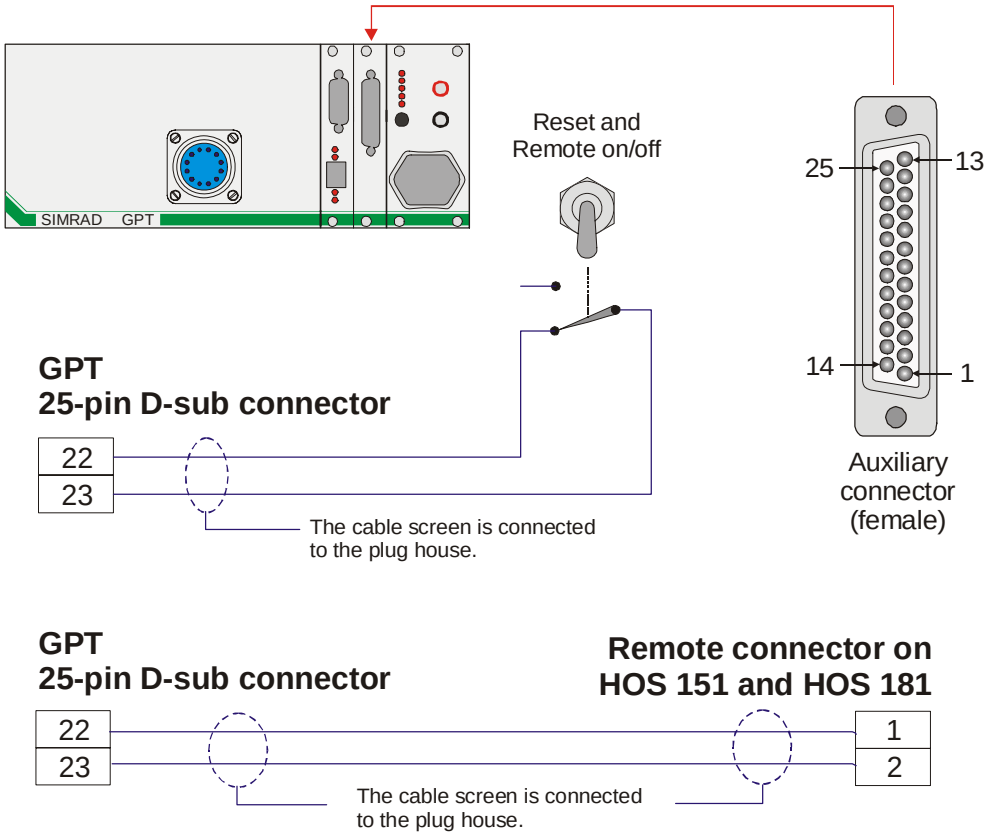
Conductors	N x 0.5 mm2
Screen	Overall braided
Voltage	60 V
Max.diameter	Set by the plugs

Specifications for AC power cable:

Conductors	3 x 2.5 mm2
Screen	Separate conductor
Voltage	750 V
Max.diameter	Set by the plugs

Remote on / off

This cable is used to connect a remote on/off switch to the General Purpose Transceiver (GPT). The switch can be located in a separate box, or incorporated on a common switch panel.

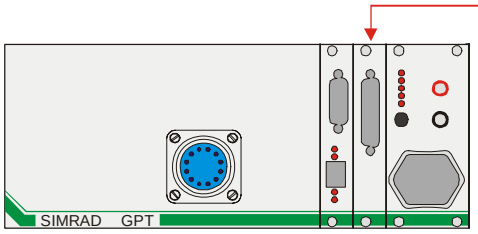


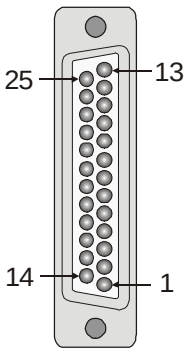
W620a / Rev C	Remote on/off

Conductors	2 x 0.22 mm2
Screen	Overall braided
Voltage	60 V
Max.diameter	Set by the plugs

GPT Remote synchronisation

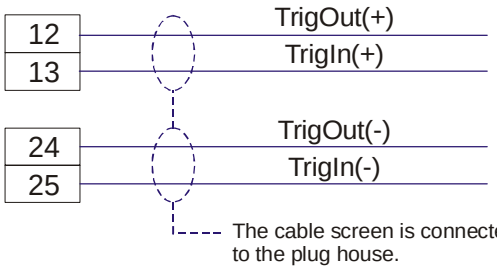
This cable is used to connect the General Purpose Transceiver (GPT) to an external system for synchronisation purposes.





Auxiliary connector (female)

GPT
25-pin D-sub connector



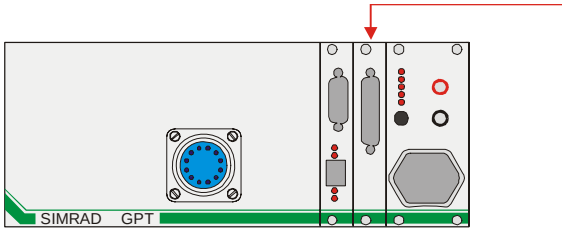
Several transceivers may be triggered from an external system by connecting the TrigIn pins in parallel.

W620b / Rev C	External trigger in/out

Conductors	2 x 2 x 0.22 mm2
Screen	Braided pairs and overall braided
Voltage	60 V
Max.diameter	Set by the plugs

Motion and temperature sensors

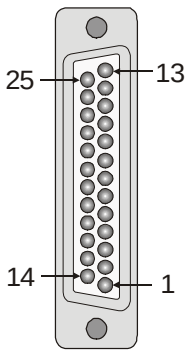
This cable is used to connect the General Purpose Transceiver (GPT) to external motion and temperature sensors.



GPT 25-pin D-sub connector

1	Pitch(+)
2	Roll(+)
3	Heave(+)
14	Pitch(-)
15	Roll(-)
16	Heave(-)
4	Temp(+)
17	Temp(AGND)

The cable screen is connected to the plug house.



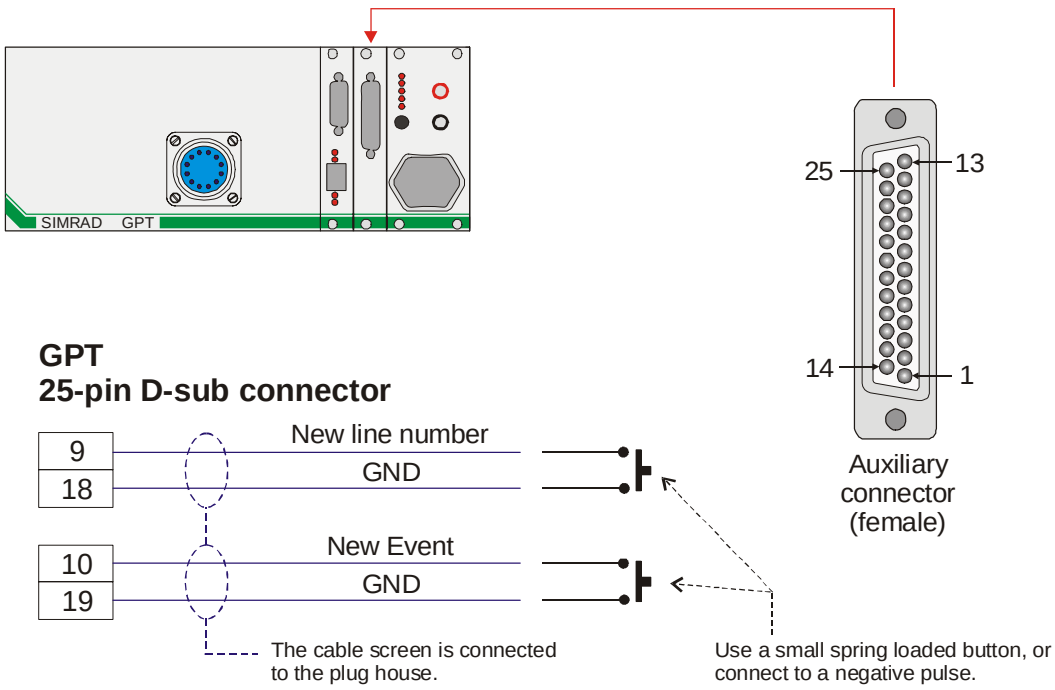
Auxiliary connector (female)

W620c / Rev C	Heave, Roll, Pitch and Temperature sensors

Conductors	2 x 0.22 mm2
Screen	Overall braided
Voltage	60 V
Max.diameter	Set by the plugs

New Event and Line number

This cable is used to connect the General Purpose Transceiver (GPT) to two external buttons for generation of new “Events” and “Line numbers”.



W620d / Rev C	“Event” and “New line number” buttons

Conductors	2 x 0.22 mm2 (for each button)
Screen	Overall braided
Voltage	60 V
Max.diameter	Set by the plugs

Transducer(s)

The cables described in this chapter are used to connect the General Purpose Transceiver (GPT) to one or more transducers.

The following transducer types may be used:

- Single frequency, single beam
- Single frequency, dual beam (wide and narrow)
- Dual frequency, single beam (combi)

For the majority of the transducers, the cables are supplied from the manufacturer. These are normally physically fastened to the transducer.

Note

The distance between the General Purpose Transceiver (GPT) and the transducer(s) must be as short as possible to avoid interference and noise.

If the distance between the transducer and the transceiver exceeds the length of the cable, a junction box must be used. The cable between the junction box and the transceiver must then be supplied by Kongsberg Maritime, and this must be the same type as used on the transducer(s).

Note

All transducer cables must be run in steel conduits. Use flexible conduit close to the transceiver.

Note

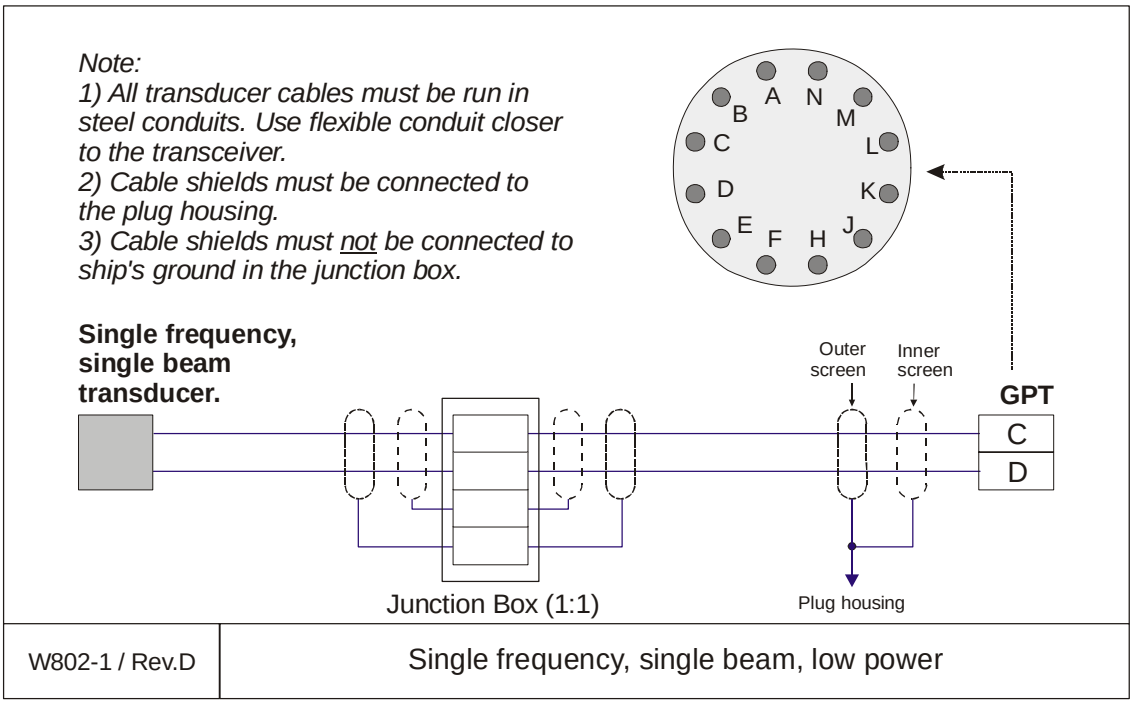
Cable shields must be connected to the plug housing. The shields must not be connected to ship's ground anywhere between the transducer and the plug on the transceiver.

Observe the cabling diagrams.

Single frequency, single beam

The next two drawings show how to connect a single frequency, single beam transducer to the system. Note that two different connections are made, depending on the rated power output.

Low power output is achieved when the GPT is equipped with a single transmitter board. In most systems, this will result in a 2 kW output power, but older GPTs may only be capable of supplying 1 kW.



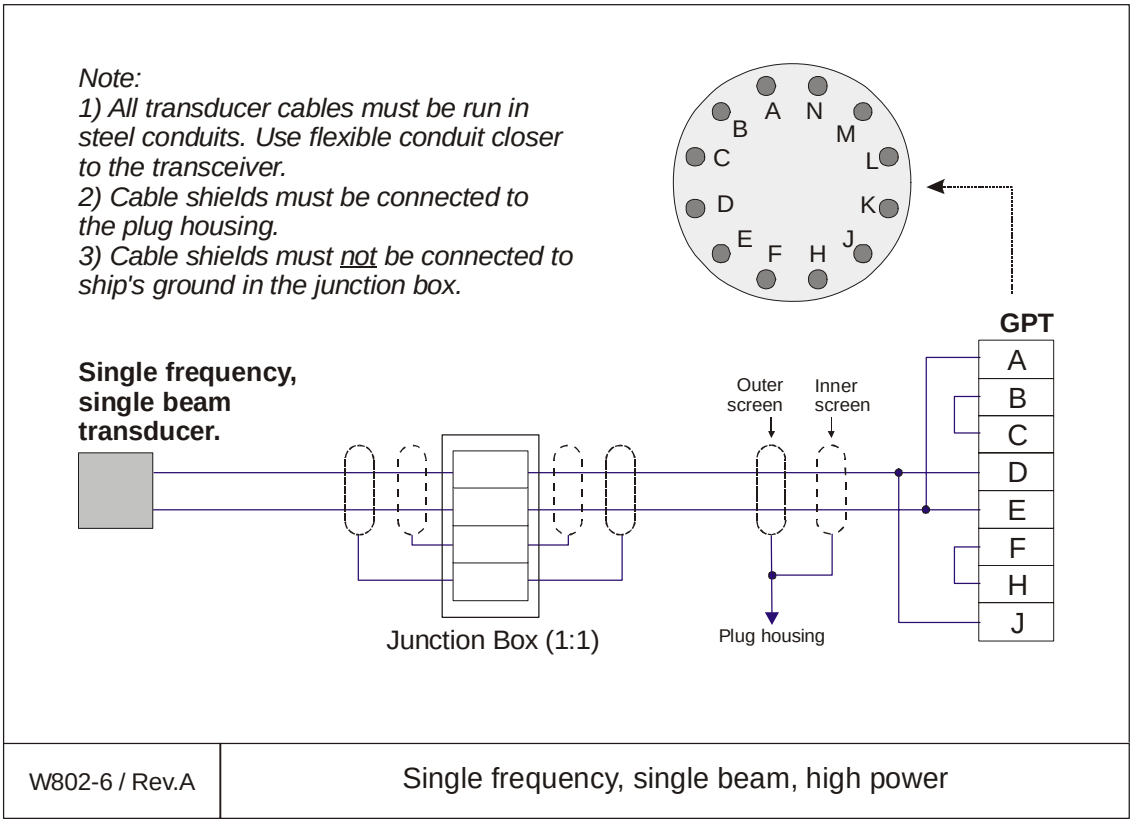
W802-1 / Rev.D	Single frequency, single beam, low power

Conductors	2 x N mm2
Screen	Overall braided
Voltage	600 V
Max.diameter	N/A

The conductor diameter “N” depends on the chosen transducer. Normal value for single beam transducers is 1.5 mm^2. Special transducer cable is available from Kongsberg Maritime.

High power output is achieved when the GPT is equipped with four transmitter boards. In most systems, this will result in a 4 kW output power, but older GPTs may only be capable of supplying 2 kW.

The 4 kW high power output is not a standard feature on EA 600.



W802-6 / Rev.A	Single frequency, single beam, high power

Conductors	2 x N mm2
Screen	Overall braided
Voltage	600 V
Max.diameter	N/A

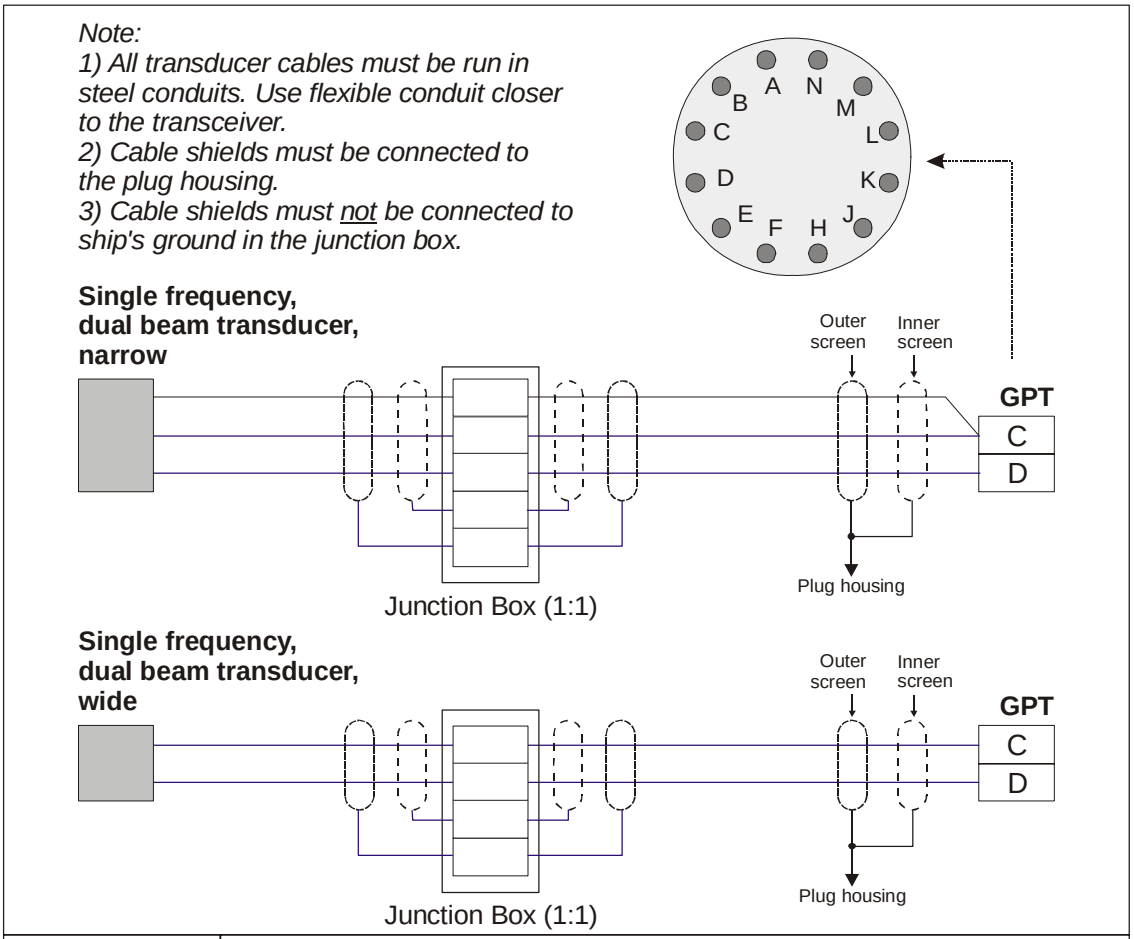
The conductor diameter “N” depends on the chosen transducer. Normal value for single beam transducers is 1.5 mm^2. Special transducer cable is available from Kongsberg Maritime.

Single frequency, dual beam

The drawing shows how to connect a single frequency, dual beam transducer to the system.

Note

Check the transmit power if wide beam is selected in order not to exceed the power capacity on the transducer.



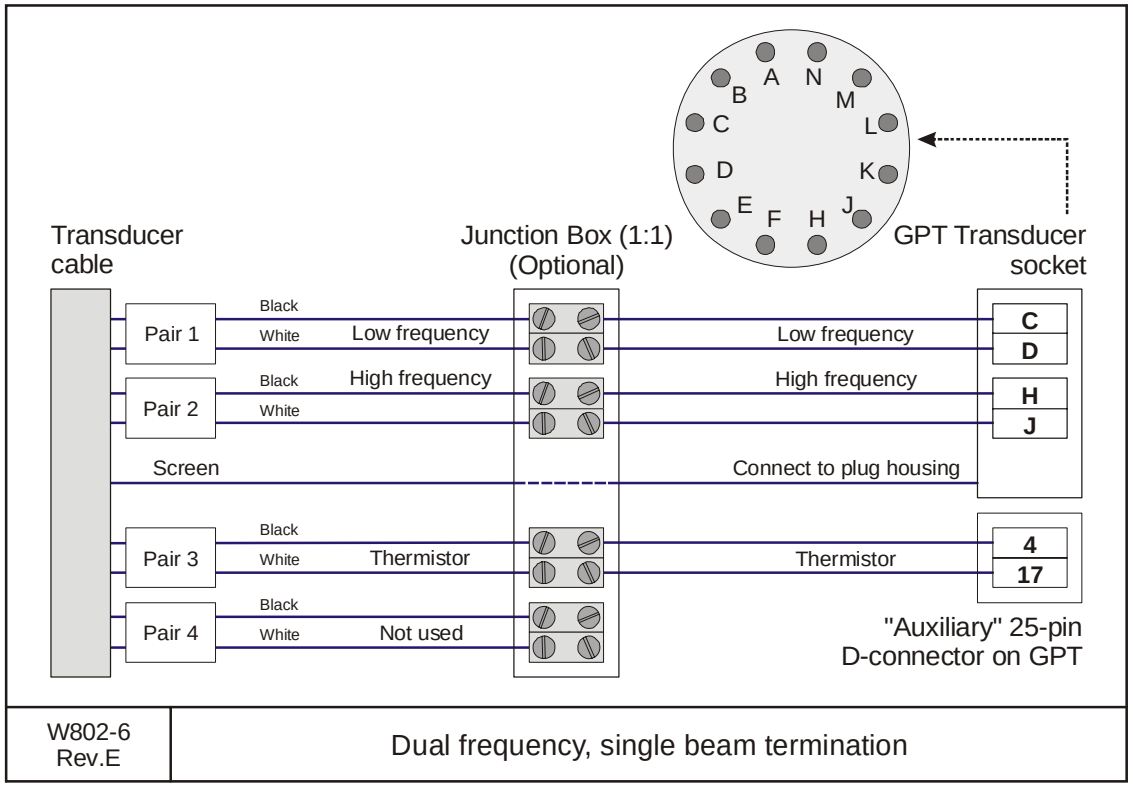
W802-2 / Rev B	Single frequency, dual beam

Conductors	3 x N mm2 or 2 x N mm2
Screen	Overall braided
Voltage	600 V
Max.diameter	N/A

The conductor diameter “N” depends on the chosen transducer. Normal value for single beam transducers is 1.5 mm^2. Special transducer cable is available from Kongsberg Maritime.

Dual frequency, single beam

The drawing shows how to connect a dual frequency, single beam transducer to the system.



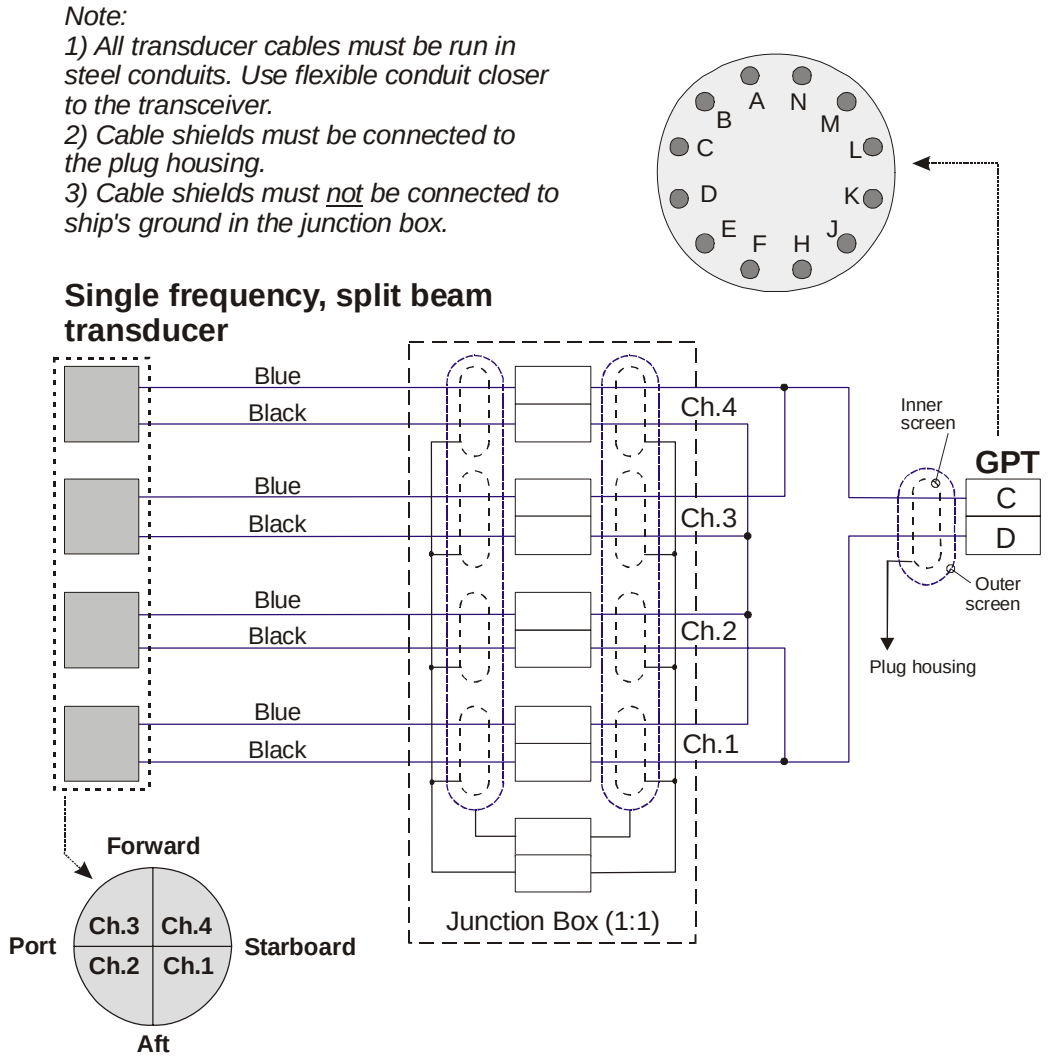
W802-6 Rev.E	Dual frequency, single beam termination

Conductors	2 x 2 x N mm2
Screen	Overall braided
Voltage	60 V
Max.diameter	N/A

The conductor diameter “N” depends on the chosen transducer. Normal value for single beam transducers is 1.5 mm^2. Special transducer cable is available from Kongsberg Maritime.

Split beam transducer connected as single beam

The drawing shows how to connect a split beam transducer to a single beam system.



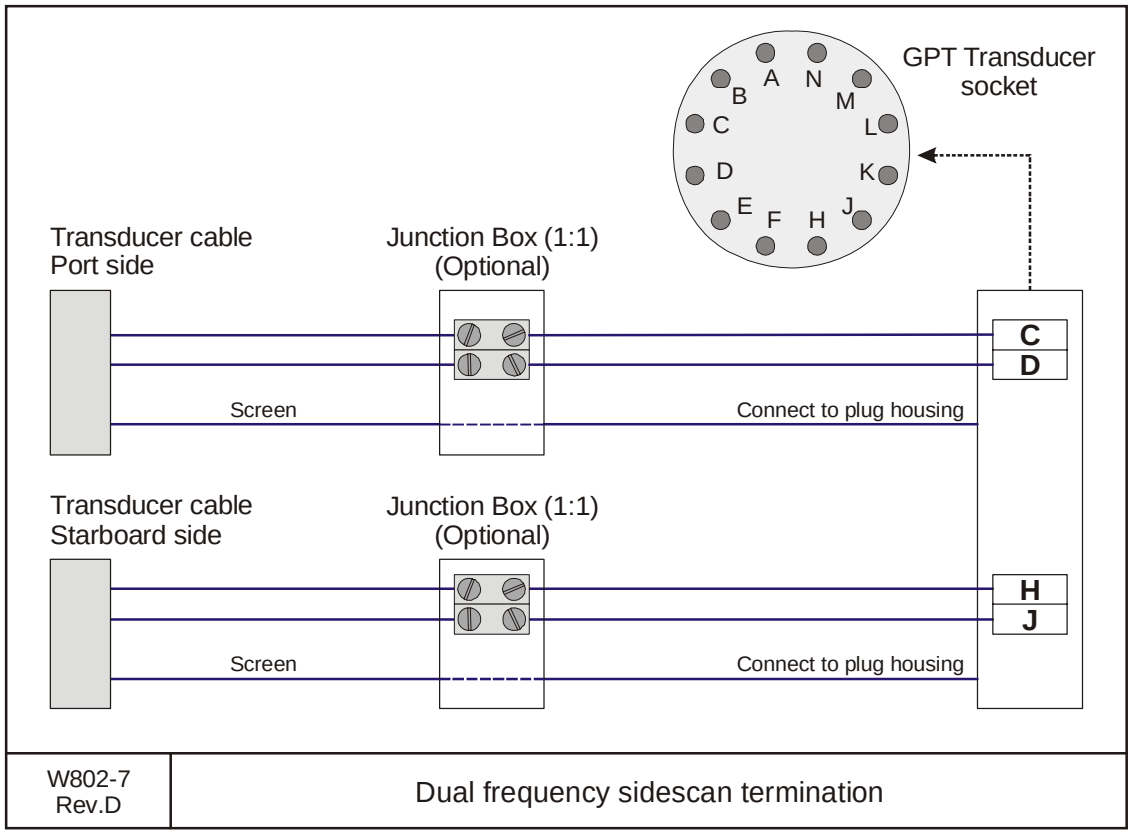
W802-5 / Rev.C	Split beam transducer connected as single beam

Conductors	4 x 2 x N mm2
Screen	Overall braided
Voltage	600 V
Max.diameter	N/A

The conductor diameter “N” depends on the chosen transducer. Normal value for single beam transducers is 1.5 mm^2. Special transducer cable is available from Kongsberg Maritime.

Dual frequency, side scan

The drawing shows how to connect a dual frequency, side scan transducers to the system.



W802-7 Rev.D	Dual frequency sidescan termination

Conductors	2 x 2 x N mm2
Screen	Overall braided
Voltage	60 V
Max.diameter	N/A

The conductor diameter “N” depends on the chosen transducer. Normal value for single beam transducers is 1.5 mm^2. Special transducer cable is available from Kongsberg Maritime.

Cable colours on split beam transducers

Note that the cables from the transducer may be supplied in different colours. The following colours may be used:

Channel	Shown in W802-3	Alt.A	Alt B
4	BL	BK	BN
4	BK	WH	WH
3	BL	BK	GN
3	BK	WH	WH
2	BL	BK	O
2	BK	WH	WH
1	BL	BK	BL
1	BK	WH	WH

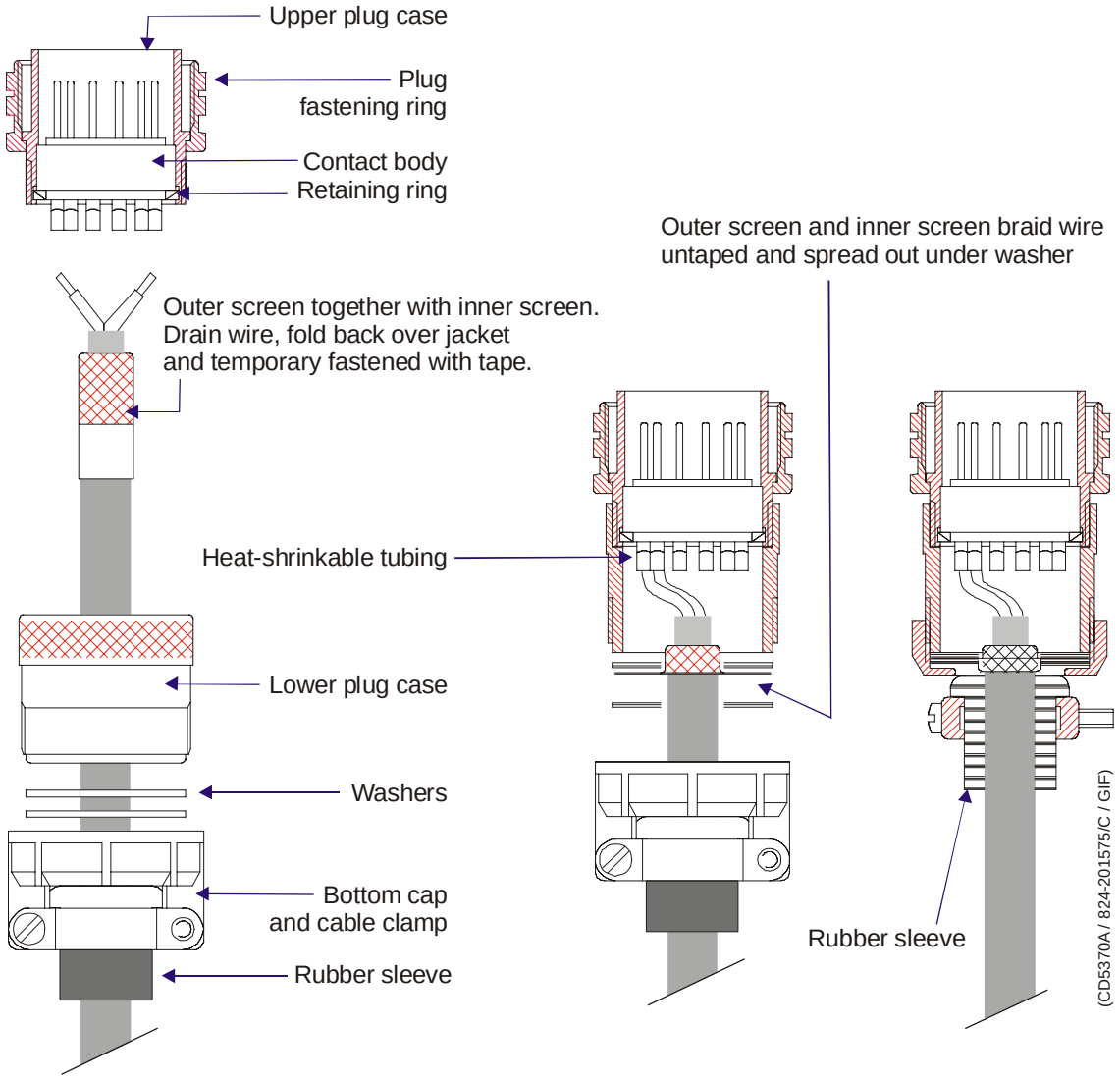


Figure 34 GPT Plug connection, transducer

9 APPENDICES

9.1 Overview

This chapter holds the following appendices:

9.2 Equipment handling

Introduction

This section 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; (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 (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 142.*

→ *For further information about re-packing, refer to page 144.*

→ *For further information about temperature protection, refer to page 146.*

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 information on page 144.*

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, or higher than +60° 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.

ESD precautions

→ *Refer to the information on page 145.*

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 145.*

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. Never lift the transducers by the transducer cable.*

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 144.*

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 a cabinet has been exposed to salt atmosphere while it was in use, it must be thoroughly cleaned both internally and externally to prevent corrosion.

- 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 a 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.

  Examples:

  - 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.

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:

Note

Must not be transported or stored in temperatures below -5 degrees Celsius.

Other units can normally be stored in temperatures between -30° C and +70° C, refer to the system's technical specifications for details.

Transducers must not be stored in temperatures below -20° C and above +60° C.

9.3 Warranty

The warranty on the slope of supply in 365 days from the acceptance of the installation on board. Warranty does non cover damage or defects coming from improper storing of the equipment (i.e. cable damage by temperature oscillation, rusty components, physical damage etc.)

9.4 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 service loops are to allow the cabinets to move on their shock mounts, and to allow maintenance and repair.

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

Radio Frequency interference

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

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

Physical protection

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

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

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

Grounding

Grounding connections should be made using a conductor which has a cross-sectional area appropriate for the current rating of the cable, or with a metal clamp which grips the metallic covering of the cable and is bonded to the hull of the vessel. These cable coverings may also be grounded by means of glands specially intended for this purpose and designed to ensure a good ground connection. The glands used must be firmly attached to, and in good electrical contact with, a metal structure grounded in accordance with these recommendations.

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

Metallic casings, pipes and conduits must be grounded, and when fitted with joints these must be mechanically and electrically grounded locally.

Cable connections

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

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

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

Cable terminations

Care must be taken to ensure that the correct terminations are used for all cable conductors, especially those that are to be connected to terminal blocks. In this case, crimped sleeve-terminations must be fitted to prevent the conductor core from fraying and making a bad connection with the terminal block. It is also of the utmost importance that where crimped terminations are used, the correct size of crimp and crimping tool are used. In addition, each cable conductor must have a minimum of 15 cm slack (service loop) left before its termination is fitted.

Cable identification

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

9.5 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.

- That is 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 to 10 cm of slack cable must be allowed (depending on the cable diameter and arrangement), 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 Take care not to damage the screening, carefully remove the outer insulation from the required cable length.

5 Leave 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 here, further information with technical specifications and installation descriptions must be obtained from the manufacturer(s).

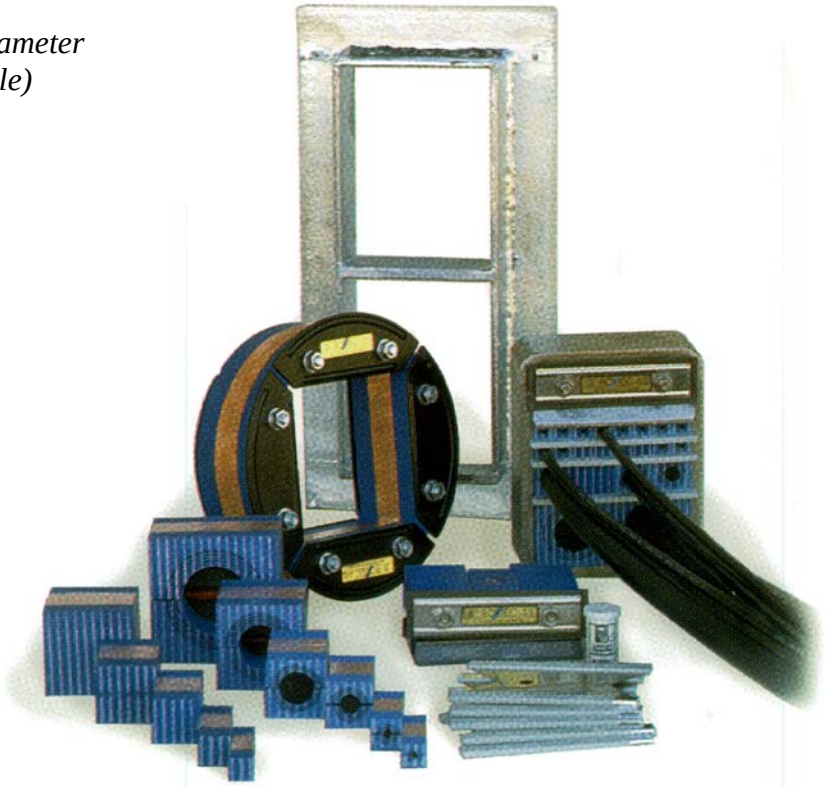

Figure 35 Multi-diameter modules (example)

The illustrations and examples here are from the following manufacturer:

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

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.

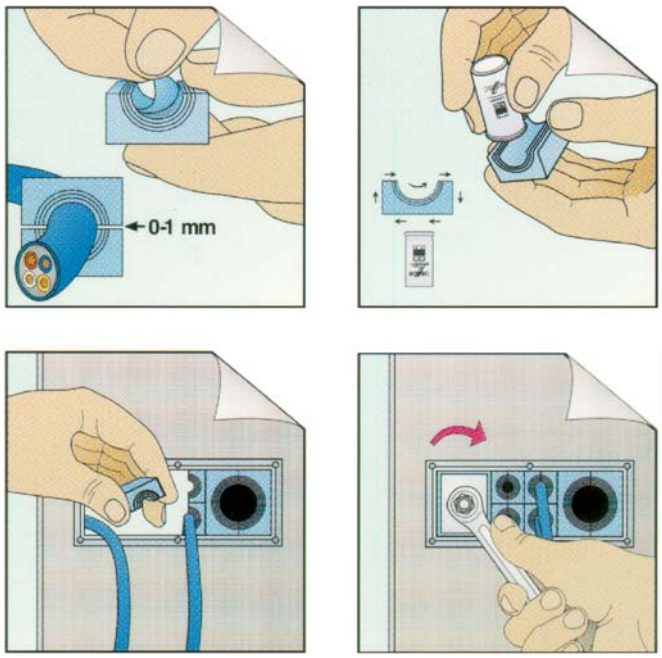

Figure 36 Multi-diameter system - general procedure

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 with screening and EMC requirements.

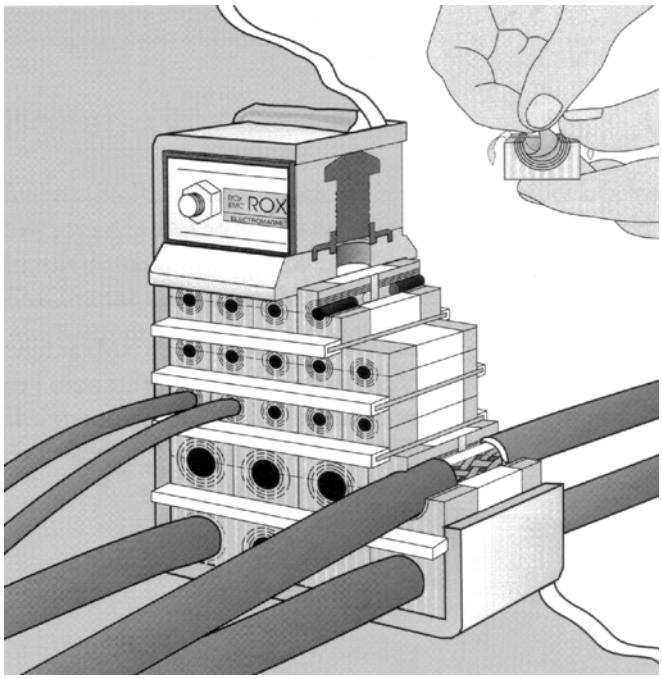

Figure 37 Multi-diameter system - the finishied assembly

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. Verify that no safety interlocks have been bypassed. Tag out the system properly.

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.

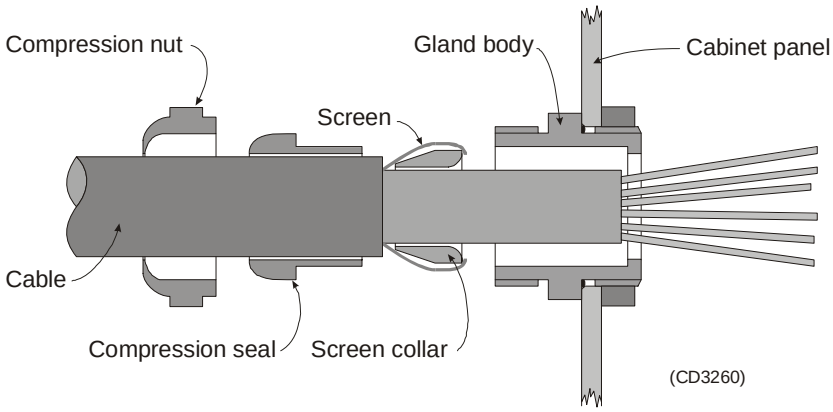

Figure 38 Standard cable gland assembly

Note

*A **minimum** of 5 to 10 cm of slack cable must be allowed (depending on the cable diameter and arrangement), 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.*

4 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.*

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

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

7 Take 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 39.*

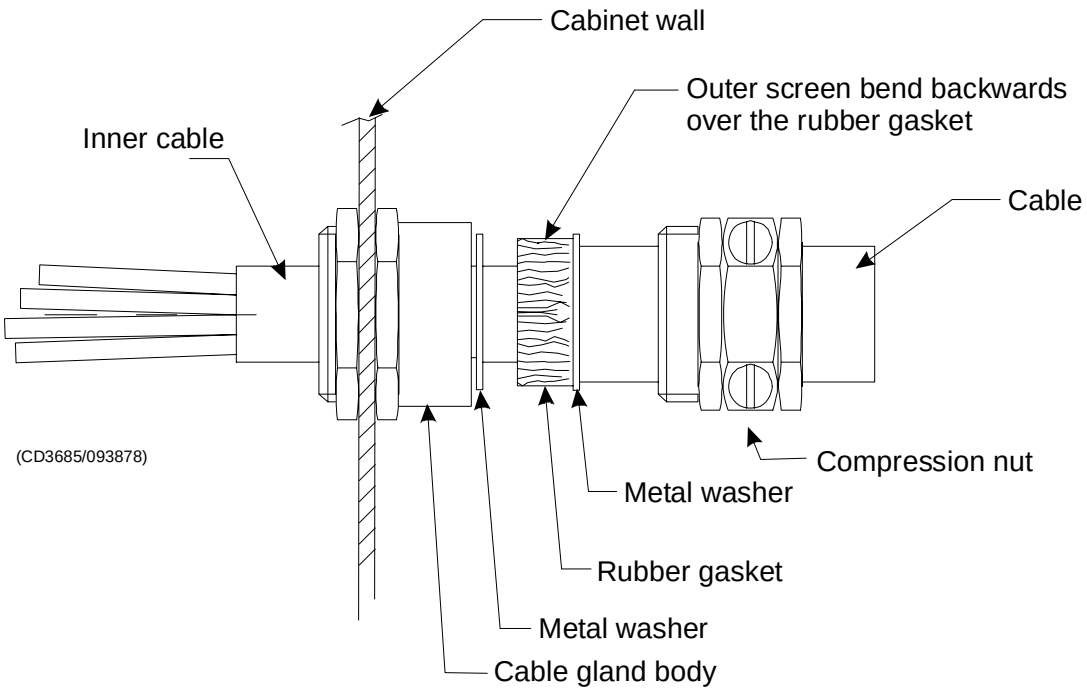

Figure 39 Cable gland, type 1 (842-093878)

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.

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 40.*

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.

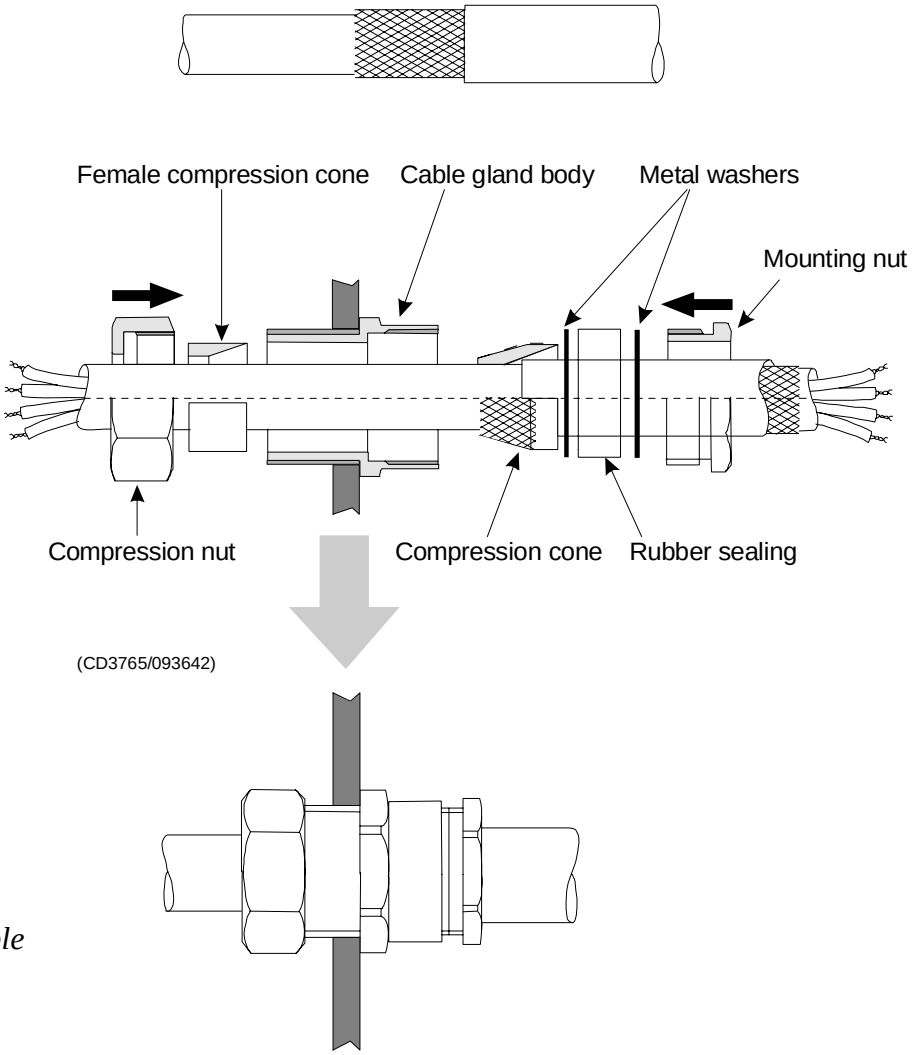

Figure 40 Cable gland, type 2 (541-093642)

KONGSBERG

EA 600
Instruction manual / Base version

EA 600
Instruction manual / Base version

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