



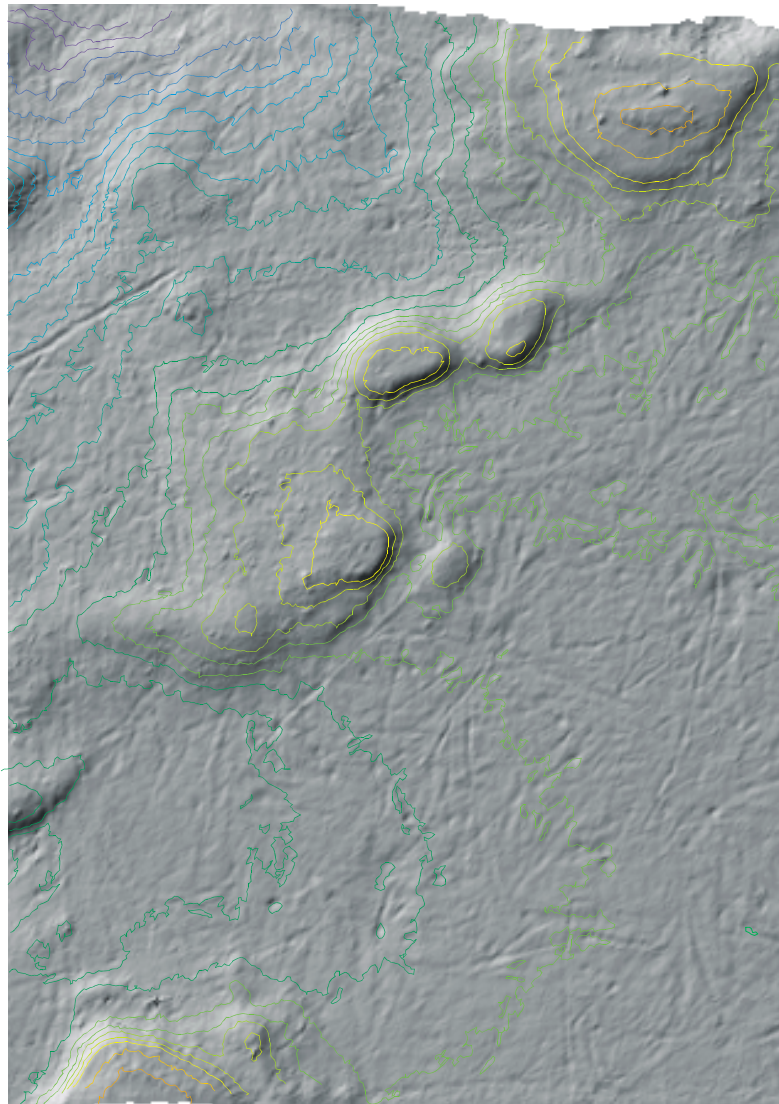
KONGSBERG

Maintenance manual

EM 1002

Multibeam echo sounder

Complete version & Hull Unit



EM 1002

Multibeam echo sounder

Maintenance manual – Complete version

Note

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

Warning

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

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Sections

This book is the maintenance manual for the EM 1002 multibeam echo sounder. It describes how to perform intermediate maintenance on the system.

1 Introduction

This section presents a general introduction to the echo sounder system, and defines the maintenance philosophy. Refer to page 1.

2 Technical specifications

This chapter presents the main technical specifications. Refer to page 9.

3 Cable layout and interconnections

This chapter describes the cabling, and details the necessary cable specifications. Refer to page 23.

4 Transceiver Unit 125-211814

This chapter describes the design and operation of the Transceiver Unit with registration number 125-211814. Each circuit board is explained, as well as overall block diagrams and the theory of operation. Refer to page 87.

5 Transceiver Unit 125-218141

This chapter describes the design and operation of the Transceiver Unit with registration number 125-218141. Each circuit board is explained, as well as overall block diagrams and the theory of operation. Refer to page 136.

6 Raw Data Logger

This chapter describes the design and operation of the Raw Data Logger. Each circuit board is explained, as well as overall block diagrams and the theory of operation. Refer to page 173.

7 Hull Unit Controller

This chapter describes the Hull Unit Controller. Each circuit board is explained, as well as overall block diagrams and the theory of operation. Refer to page 175.

8 Remote Control Junction box

This chapter describes the Remote Control Junction Box. Refer to page 193.

9 Troubleshooting

This chapter provides basic procedures for automatic and traditional troubleshooting. Refer to page 197.

10 Replacement procedures

This chapter explains how to perform replacement of the line replaceable units (LRU). Refer to page 251.

11 Datagram formats

The formats for data input and output to and from the EM Series multibeam echo sounders are described here. Refer to page 267.

12 System administration

This chapter provides basic information useful for the EM 1002 system supervisor. Refer to page 311.

13 Spare parts

This chapter provides a listing of the line replaceable units with illustrations and order numbers. Refer to page 347.

14 Drawing file

Remarks

References

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

- EM 1002 Operator manual
- EM 1002 Installation manual

The reader

This maintenance 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 Kongsberg Maritime'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.

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Document logistics

Rev	Date	Written	Checked	Approved
A	09.01.2004	EGj	GFS	KN
B				
C				
D				
E				
F				
G				

(The original signatures are recorded in the company's logistic database.)

Rev	Comments
A	Original issue. Contains information about all versions of the Transceiver Unit.
B	
C	

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

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High voltage safety warning

Precautionary measures

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

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

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

Never work alone on high-voltage equipment!

First aid in the event of electric shock

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

Could YOU save someone's life?

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

Immediate action

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

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

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

- 2 Open his mouth and check for and remove any false teeth, chewing gum etc.
- 3 Check if the victim is breathing. If not, check if his heart is beating. The pulse is normally easily found in the main arteries of the neck, either side of the throat, up under the chin.

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

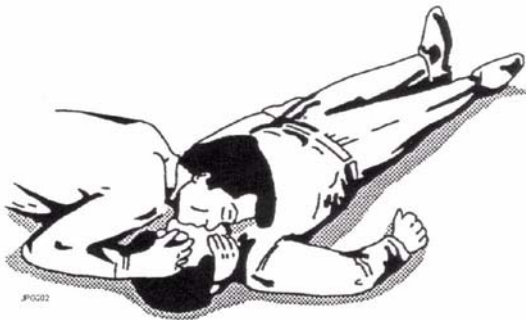
External cardiac massage

- 1 Kneel beside the victim. Place the heel of one hand in the centre of his chest, at a position half way between the notch between the collar-bones at the top of his chest, and the dip in the breast-bone at the base of his rib cage. Place the other hand on top of the first.
- 2 Keeping the arms straight and using your entire weight, press down rapidly so that the breast bone is depressed four- five cm, then release the pressure. Repeat rhythmically at a rate of one cycle per second. This will be hard work, but keep going. His life depends on YOU. Do not worry about breaking his ribs - these will heal if he survives.



Artificial respiration

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



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

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

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



Do you know what to do?

Combining ECM and artificial respiration

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

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

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

1 INTRODUCTION

1.1 Overview

This is the maintenance manual for the EM 1002 multibeam echo sounder system.

The manual contains detailed descriptions of each of the units in the system. Each circuit board and mechanical assembly is described. The manual also describes the troubleshooting process based on the Built-In Self test (BIST) software, and it includes procedures for disassembly and reassembly of the replaceable items.

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

Note

The EM 1002 system can be delivered with a Hull Unit optionally. If you do not have a Hull Unit, disregard the information about the Hull Unit and the Hull Unit Controller.

1.2 Maintenance philosophy

Kongsberg Maritime AS defines three levels for maintenance manuals:

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 maintenance manual is prepared for the intermediate level.

1.3 System units

Overview

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

- Operator Station
- Transceiver Unit
- Transducer Array
- Remote Control Junction Box (this is optional if you have a Hull Unit)
- Hull Unit (optional)
- Hull Unit Controller (if Hull Unit)

→ *The EM 1002 system units are shown on page 5.*

→ *The EM 1002 Hull Unit system units are shown on page 6.*

Operator Station

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

Transceiver Unit

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

Transducer array

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

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

Raw Data Logger

The Raw Data Logger is an option that can be mounted on the EM 1002 Transceiver Unit. The main purpose is to log the samples throughout the water column for all 128 staves. The sample data can also be presented on the display.

Hull Unit Controller (if Hull Unit)

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

Hull Unit (optional)

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

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

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

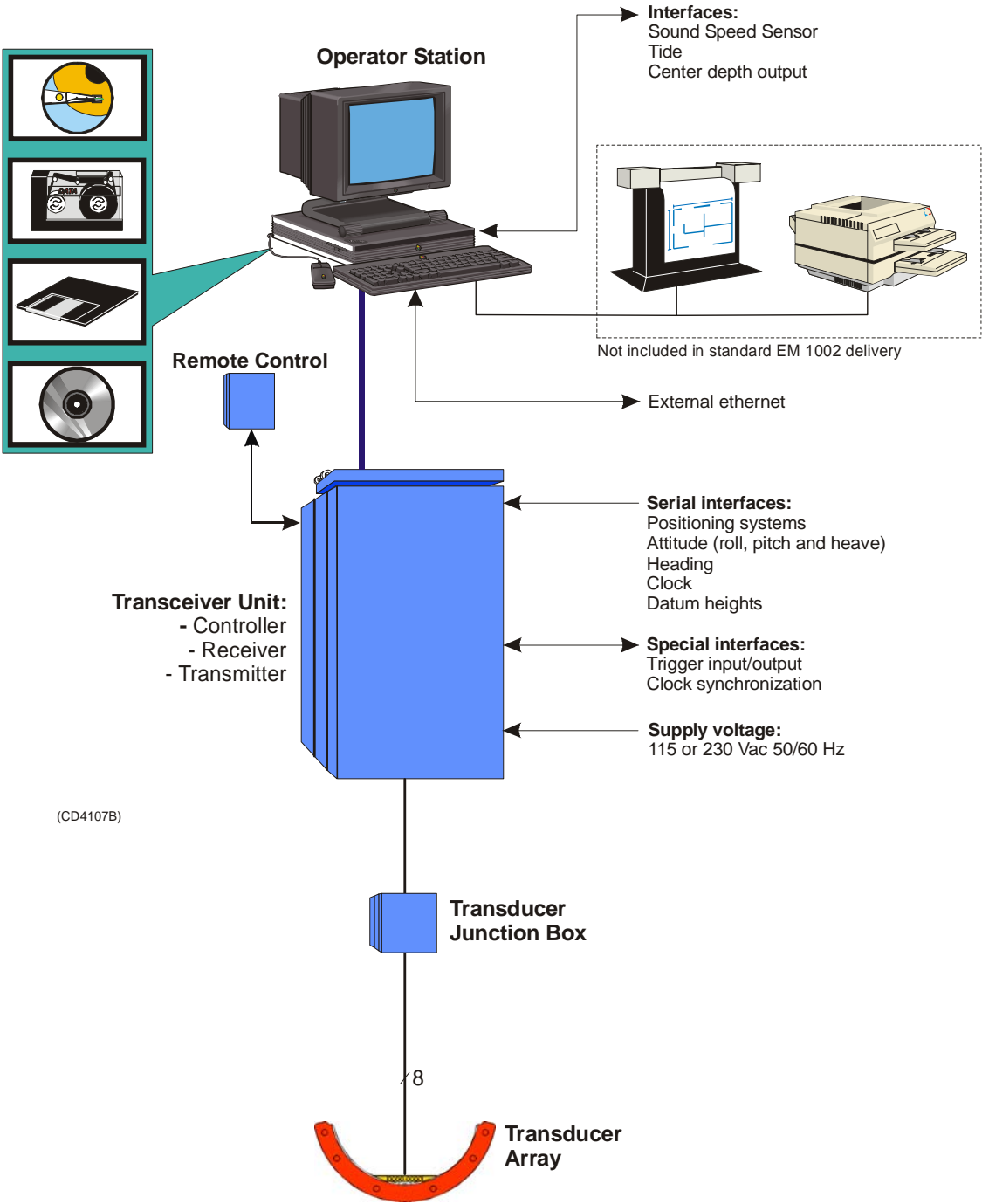


Figure 1 EM 1002 system diagram

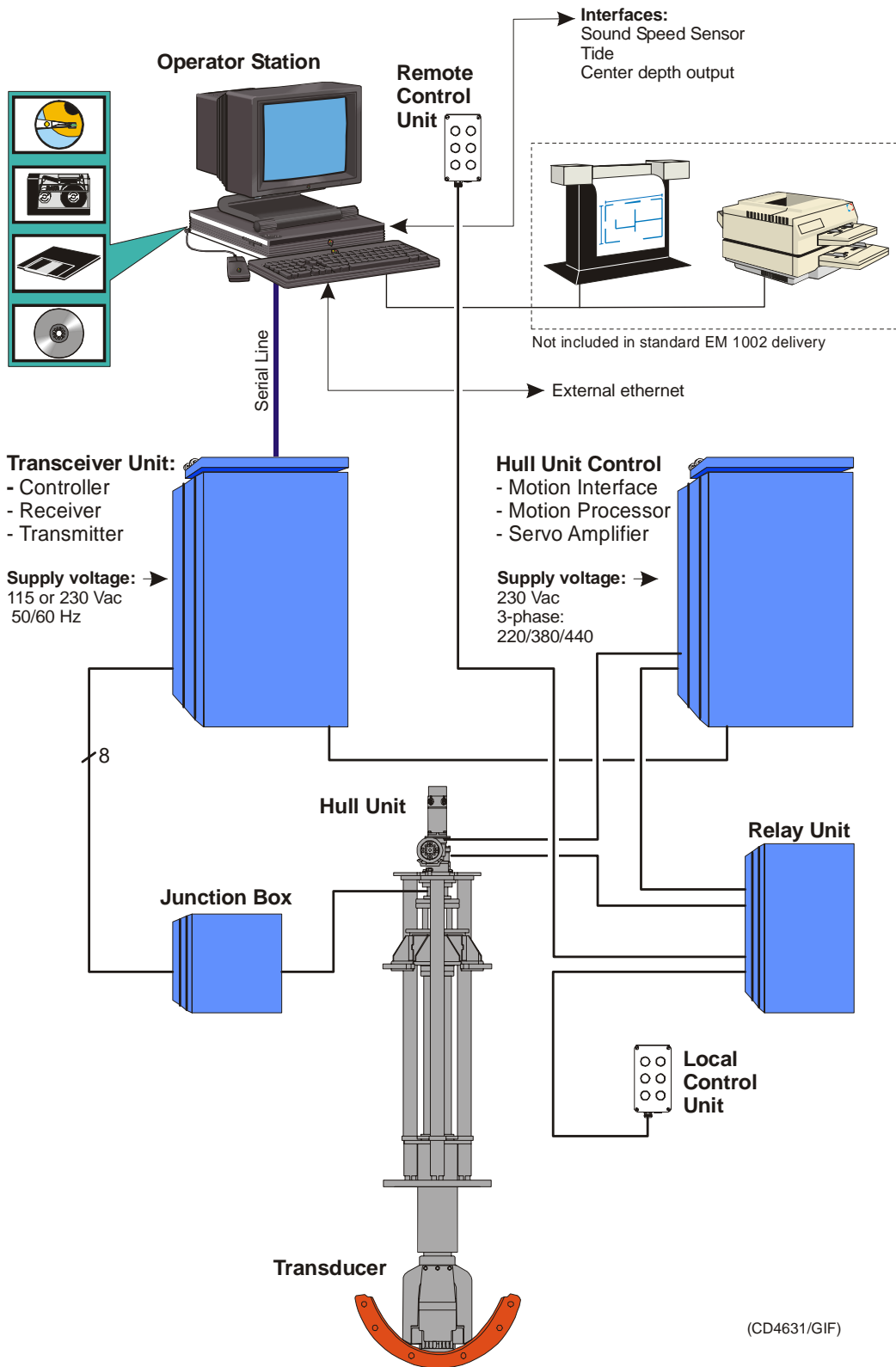


Figure 2 EM 1002 system diagram (with Hull Unit)

1.4 Note about changing AC supply voltage

The EM 1002 is wired for 230 Vac when it comes from the factory. If it is desirable to change to 115 Vac, do the following:

- The Processing Rack power must be rewired.
- Switch LVPS (Low Voltage Power Supply) to 115 Vac.
- Switch HVPS (High Voltage Power Supply) to 115 Vac.
- The 220 Vac fans must be changed to 115 Vac type.

→ *Refer to page 264.*

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2 TECHNICAL SPECIFICATIONS

Notice

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

→ *The technical specifications for the Hull Unit and the associated items are presented on page 11.*

Interfaces

- Serial lines with operator adjustable baud rate, parity, data and stop bit length for:
 - Motion sensor (roll, pitch, heave and optionally heading) in format supported by sensors from Applied Analytics, Seatex and TSS
 - Gyrocompass in NMEA 0183 HDT format.
 - Positions in either Simrad 90, NMEA 0183 GGA or GGK format
 - External clock in NMEA 0183 ZDA format
 - Sound speed profile
 - Sound speed at transducer
 - Sea level height (tide)
 - Datum height(s)
 - Output of depth straight down in NMEA 0183 DPT format
- Interface for 1 PPS (pulse per second) clock signal
- Parallel interface for Postscript colour graphics printer/plotter
- Ethernet interface for input of sound speed profile data and output of all data normally logged to disk and/or tape

Physical specifications

Transducer Array

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

Transceiver Unit

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

Operator station

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

Power requirements

Operational voltage and frequency

Transceiver Unit	115 / 230 Vac, < 300 W, 47 to 63 Hz <i>(The cabinet is wired for 230 Vac from the factory).</i>
	<i>10A slow-blow fuses</i>
Operator Station	100 to 240 Vac, < 300 W, 47 to 63 Hz, 16 A slow blow fuse input.
	<i>- The single phase supply must be protected with 16A slow-blow fuses</i>

Acceptable transients

Short time (max. 2 sec) $\pm 25\%$, 42 - 69 Hz
 Spikes (max. 50 μ s) < 1000 V

Power interrupts

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

2.1 Hull Unit technical and physical specifications

Note *The Hull Unit is optional.*

Hull unit

Height (above flange)	2150 mm
Weight (Including transducer)	Approx. 1000 kg
Distance of raise / lower travel	820 mm
Power supply	220/380/440 Vac, 3 phase, 50 Hz
Power consumption	370 W (hoisting)

Environmental specifications

<i>Standards</i>	
EMC Noise Emission	EN55022 (Class A)
EMC Noise Immunity	EN55101
Vibration	MIL.STD 167-1
Shock	MIL.STD 4141, 4142
Temperature, sonar room	0°C to 55°C
Humidity, sonar room	Up to 96% (non-condensing)

Raise/lower motor

Motor type	WEGS ODGS 712
Part number	11CX4E
Input voltage	230 / 380 / 440 Vac
Frequency	50 Hz
Phase	3 Phase
Rated power	370 W
Speed	2800 RPM
Water resistance	IP 44
Gear ratio	30:1

Pitch servo motor

Motor type	RX 520
Part number	499-108416
Input voltage	118 Vdc

Normal current	7 A
Max. current (at start-up)	max. 30 A
Speed	3600 rpm
Gearbox type	MRC 610
Gear ratio	5:1
Dimensions (Complete)	Length - 443 mm
Diameter (Max)	136 mm
Weight	16 kg

Synchro Transmitter

Motor type	11 CX 4e
Part number	
Input voltage	115 Vdc
Frequency	400 Hz
Normal current	
Max. current (at start-up)	max. 31 A
Transformation ratio	0.783 ± 0.016
Phase shift	4.5°
Total Null voltage	75 V
Output voltage	90 V
Error from E.Z.	Max. 7 minutes

Limit switches

Type, Hoist limits	1LS3-4PG
Type, Pitch limits	914 CE2-3G

Lubrication

Oil	SAE 30 motor oil
Bearing grease	Esso Cazar K1

Relay Unit

Height	500 mm
Width	400 mm
Depth	250 mm
Weight	15.5 kg

Remote & Local Control Units

Height	241 mm
Width	151 mm

Depth	114 mm max
Weight	1.5 kg
Power supply	24 Vdc

Hull Unit Controller

Height	1110 mm
Width	600 mm
Depth	670 mm max
Weight	Approx. 50 kg
Power supply	230 Vac

Transducer array

Weight	130 kg
Cable length	12.5 m

2.2 Environmental specifications

Introduction

This document contains the standard environmental requirements for Kongsberg Maritime AS main product families.

The purpose is to have common environmental requirements for all equipment used in Kongsberg Maritime systems installed in seagoing vessels, fixed and floating offshore rigs and industrial installations.

Referenced documents

- IEC Publication 68 - 2 - 1
- IEC Publication 68 - 2 - 2
- IEC Publication 68 - 2 - 6
- IEC Publication 68 - 2 - 27
- IEC Publication 68 - 2 - 30
- IEC Publication 68 - 2 - 32
- IEC Publication 68 - 2 - 52
- IEC Publication 92 - 504 Sec. 3
- IEC Publication 157 - 1
- IEC Publication 529
- IMO resolution A468 (XII) 1981
- European Norm EN 60945
- European Norm EN 50081 part 2
- European Norm EN 50082 part 2

Definitions and abbreviations

IEC - International Electrotechnical Commission

IMO - International Maritime Organisation

EN - European Norm

Requirements

The Kongsberg Maritime products shall as a minimum fulfil these requirements which are based on national and international authority requirements. The requirements are valid the following locations:

- 1 Inside cubicle and desks.
- 2 Machinery spaces, control rooms, accommodation, bridge and similar marine environments.
- 3 Open deck, mast and similar industrial environments.
- 4 Submerged.

The requirement for storage and transport are for products in its shipping configuration. If additional requirements is actual for specific deliveries or projects, these shall be stated in contracts.

Vibration and shock

Vibration during storage and transport	
Frequency range	5 to 500 Hz
Excitation level	+/- 0.7 g
Reference document: IEC publication 68-2-6	
Vibration during operation (locations 1, 2, 3 and 4)	
Frequency range	5 to 500 Hz
Excitation level	5 to 13.2 Hz: +/- 1.5 mm 13.2 to 100 Hz: 1 g
Sweep rate	1 oct/min
Duration	10 sweeps 5 - 100 - 5 Hz
Reference document: IEC publication 68-2-6 (Test Fc)	
Shock during storage and transport, free fall	
> 500 kg gross weight	max 25 mm fall
< 500 kg gross weight	max 50 mm fall
< 200 kg gross weight	max 100 mm fall
< 100 kg gross weight	max 250 mm fall
< 50 kg gross weight	max 500 mm fall
< 21 kg gross weight	max 1000 mm fall
Reference document: IEC publication 68-2-32	

Shock during operation			
<i>Location</i>	<i>Shock type I</i>	<i>Shock type II</i>	<i>Shock type III</i>
General	50 m/s ²	100 m/s ²	-
Bottom sections of the hull	100 m/s ²	300 m/s ²	-
Ice-going vessel	100 m/s ²	300 m/s ²	-
Steeringmachine room	50 m/s ²	100 m/s ²	-
Crane and load equipment	100 m/s ²	300 m/s ²	500 m/s ²
<i>Shock type I:</i> Long duration (11 ms), low acceleration amplitude <i>Shock type II:</i> Medium duration (6 ms), medium acceleration amplitude <i>Shock type III:</i> Short duration (1 ms), high acceleration amplitude			
Reference document: IEC publication 68-2-27, test Ea: Shock			

Dry heat

Storage and transport	
Ambient temperature range	-40 to +70 degrees C
Reference documents: IEC publication 68-2-1 (Test Ab and Ad) IEC publication 68-2-2 (Test Bb and Bd)	
Operation, ambient temperature range	
Location 1	0 to +70 degrees C
Location 2	0 to +55 degrees C
Location 3	-25 to +70 degrees C
Bridge equipment shall not fail when powered up at -10 degrees C	
Reference documents: IEC publication 68-2-1 (Test Ab and Ad) IEC publication 68-2-2 (Test Bb and Bd)	

Cyclic humidity

Specifications for locations 1, 2, 3 and 4.	
Low temperature	+20 degrees C
High temperature	+55 degrees C
Humidity	95% Relative
Reference documents: IEC publication 68-2-30 (Test Db)	

High voltage

Specifications for locations 1, 2, 3 and 4.		
All components that may be subject to damage can be removed prior to this test.		
<i>DC voltage</i>	<i>AC voltage</i>	<i>Test voltage (AC)</i>
0 to 75	0 to 60	500
76 to 150	61 to 125	1250
151 to 300	126 to 250	1500
301 to 450	251 to 380	1800
451 to 600	381 to 500	2000
601 to 800	501 to 660	2300
Reference documents: IEC publication 157-1		

Insulation resistance

Specifications for locations 1, 2, 3 and 4.			
All components that may be subject to damage can be removed prior to this test. The test shall be carried out before and after the humidity test, low temperature test and salt mist test.			
<i>Rated supply (V)</i>	<i>Test voltage (DC)</i>	<i>Before</i>	<i>After</i>
Under 65 V	2x supply voltage; min. 24 V	10 Mohm	1 Mohm
Over 65 V	500 V	100 Mohm	10 Mohm
Reference documents: IEC publication 92-504, Section 3			

Power supply offsets from nominal value

Specifications for locations 1, 2 and 3.	
Frequency deviation	+/- 5%
Frequency transient	+/- 15%
Voltage deviation	+10 to -15%
Voltage transient	+/- 20%
Reference documents: IEC publication 92-504, Section 3	

Power supply failure

Specifications for locations 1, 2 and 3.
Three interruptions to the supply with a minimum of break time of 10 mil.seconds with repetition rate of 10 seconds. After restart there shall be no corruption of programme, data or operation.
Reference documents: IEC publication 92-504 Section 3

Salt mist

Specifications for locations 3 and 4.
The chosen items shall functioning after test.
Reference documents: IEC publication 68-2-52 (Test Kb)

Enclosure

Equipment mounted inside cubicles and desks:	IP00
Bridge, etc. equipment:	IP22
Machine- and steering machine room equipment:	IP44
Open deck and mast equipment:	IP56
Underwater equipment: (transducers etc.)	IP68
Reference documents: IEC publication 259	

Dynamic inclination

Specifications for locations 1, 2 and 3.
The equipment is rolled to an angle of 22.5 degrees either way within a time period of 10 seconds. The test in each direction must be carried out for minimum 15 minutes.
Reference documents: IEC publication 62-504 Section 3

Acoustic noise

Specifications for locations 2, Bridge equipment	
Maximum noise level	55 dB (A) / 1 m
Reference documents: IMO resolution A 468 (XII) 1981	

Electromagnetic compatibility (EMC)

Emission requirements	
<i>Location</i>	<i>European Norm</i>

2 and 3 (All electronic and electric equipment above water)	EN50081-2 Generic emission standard, Part 2: Industrial environ- ment
2 and 3 (Bridge, open deck and mast equipment)	EN60945 General requirements, methods of testing and re- quired test results Marine Na- vigational Equipment.
Immunity requirements	
<i>Location</i>	<i>European Norm</i>
2 and 3 (All electronic and electric equipment above water)	EN50082-2 Generic immunity standard Part 2: Industrial environ- ment
2 and 3 (Bridge, open deck and mast equipment)	EN60945 General requirements, methods of testing and re- quired test results for Marine Navigational Equipment

Note

Specifications for commercial equipment, such as computers delivered with the system, are in accordance with those of the respective equipment.

Conditions relating to guarantee

Warranty

The Customer's right to warranty only covers damage due to faults in fabrication or components used. The warranty is valid for 12 months from installation, and maximum 18 months from delivery.

Kongsberg Simrad AS will perform warranty repairs or change faulty components in their workshop during normal working hours. Transport to and from Kongsberg Simrad AS take place at the customers risk and cost. Any other costs such as customs duty, fees and insurance will also be covered by the customer. If the repair takes place outside the Kongsberg Simrad AS workshop, travel expenses, per diem, lodging and 50% of travel time (based on rates for repair work) will be charged.

The warranty is void in the following cases:

- A) Connections to the equipment or other work has taken place without permission from Kongsberg Simrad AS.
- B) Damage has occurred as a consequence of unskilled or erroneous work on the equipment or neglectful maintenance.
- C) If the terms of payment has not been satisfied. Parts such as packing, fuses, lamps and simple electronic components are regarded as consumables and are as such wholly or partly exempt from the warranty.

Repairs

The customer shall cover repairs performed after the validity time of the warranty, in full. Customer shall also cover transport to and from Kongsberg Simrad AS' workshop. If the repair-work takes place outside Kongsberg Simrad AS' workshop, the customer will cover travel costs, per diem, lodging and travel time in addition to the time spent on the actual repair.

The warranty on repair work-limited to 3 months after time of repair-is limited to the fault which was sought repaired. The customer shall point out faults of the repair-work performed. Other faults occurring will not be covered by the warranty. If Kongsberg Simrad AS can offer replacement equipment during the period of repair, the customer shall cover transport and insurance of this.

Validity

This warranty is effective only when a warranty certificate or other proof of purchase and equipment serial number are presented. Furthermore, the installation and the operation of the equipment must have been carried out as instructed in the product manual(s). Warranty liability does not apply to any equipment which has become inoperative due to misuse, accident, neglect, sea water damage or unauthorised repair.

Kongsberg Simrad AS will not be liable for any loss, incidental or consequential damages whether based upon warranty, contract or negligence, or arising in connection with the sale, installation, use or repair of the product. Consequential damages include, but are not limited to, any loss of profit, property damage or personal injury.

The terms of warranty as described do not affect your statutory rights.

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3 CABLE LAYOUT

3.1 Introduction

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

Note

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

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

3.2 System cabling

Cable layout

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

Shipyard and system cables

General

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

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

Shipyard cables

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

For each cable, the following information is provided:

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

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

System cables

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

Operator Station (Unix workstation)

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

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

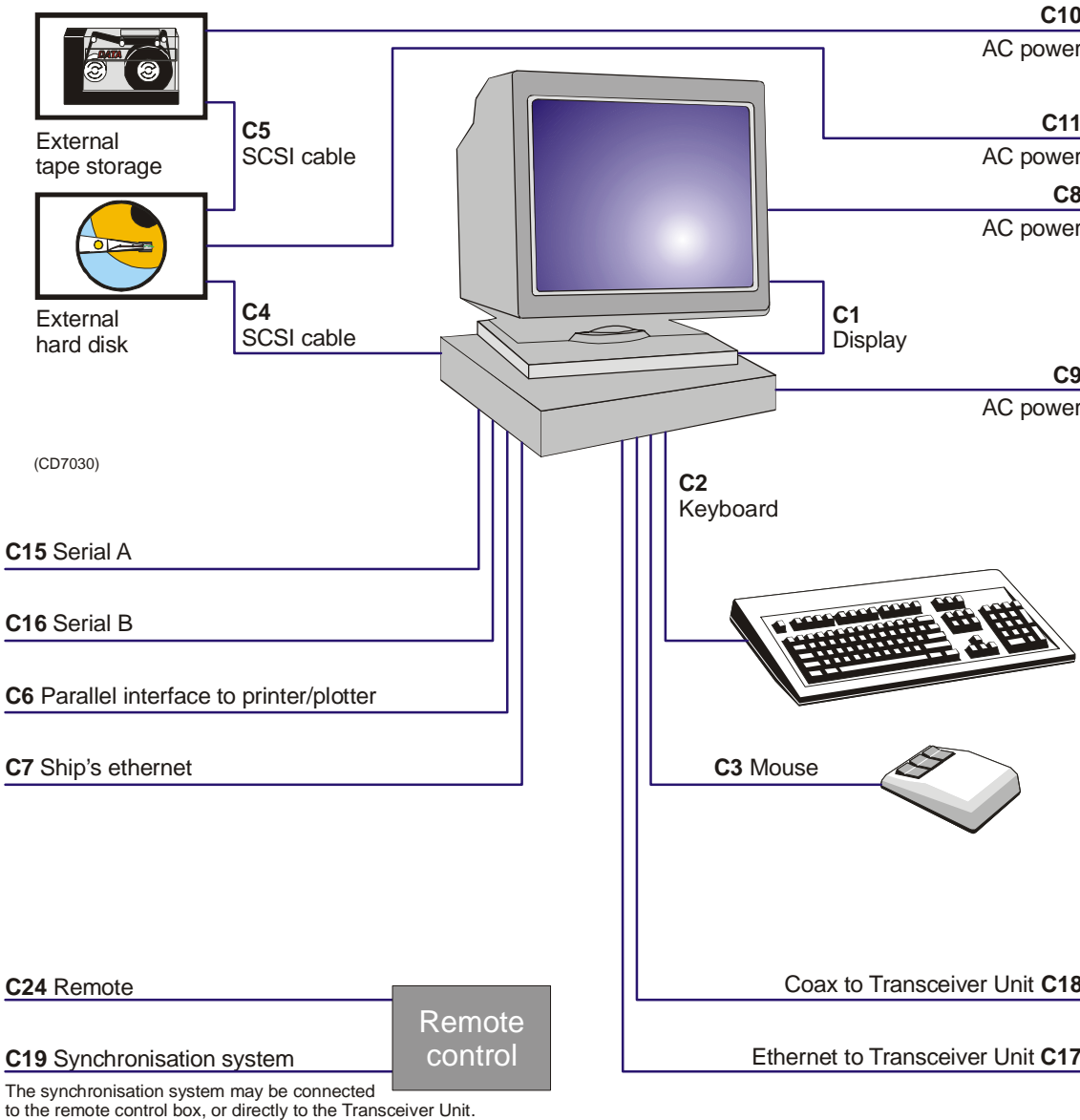


Figure 3 EM 1002 Operator Station - Cable plan

C1 - Display

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

→ *Cable details on page 72.*

C2 - Keyboard

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

→ *Cable details on page 74.*

C3 - Mouse or pointing device

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

→ *Cable details on page 75.*

C4 / C5 - SCSI cables

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

C6 - Centronics printer

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

→ *Cable details on page 76.*

C7 - Ship's ethernet

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

This cable must be provided by the installation shipyard.

→ *Cable details on page 71.*

C8 / C9 / C10 / C11 - AC power

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

→ *Cable details on page 66.*

C12 / C13 / C14 - Not used

For future expansion.

C15 - Serial A

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

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

This cable must be provided by the installation shipyard.

→ *Sound speed probe cable details on page 63.*

→ *Standard 9-pin RS-232 serial line details on page 59.*

C16 - Serial B

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

This cable must be provided by the installation shipyard.

→ *Standard 25-pin RS-232 serial line details on page 57.*

→ *Standard 9-pin RS-232 serial line details on page 59.*

C17 - Transceiver Unit RJ-45 interface

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

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

This cable must be provided by the installation shipyard.

→ *Cable details on page 71.*

C18 - Transceiver Unit Coax interface

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

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

→ *Cable details on page 60.*

C19 - Synchronisation system

Refer to the Transceiver Unit cabling.

C24 - Remote

Refer to the Transceiver Unit cabling.

Operator Station

Specifications

The cables shown and specified here are those used when the EM 1002 is implemented with a standard personal computer as Operator Station.

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. Various commercial computers will also allow for different interface possibilities.

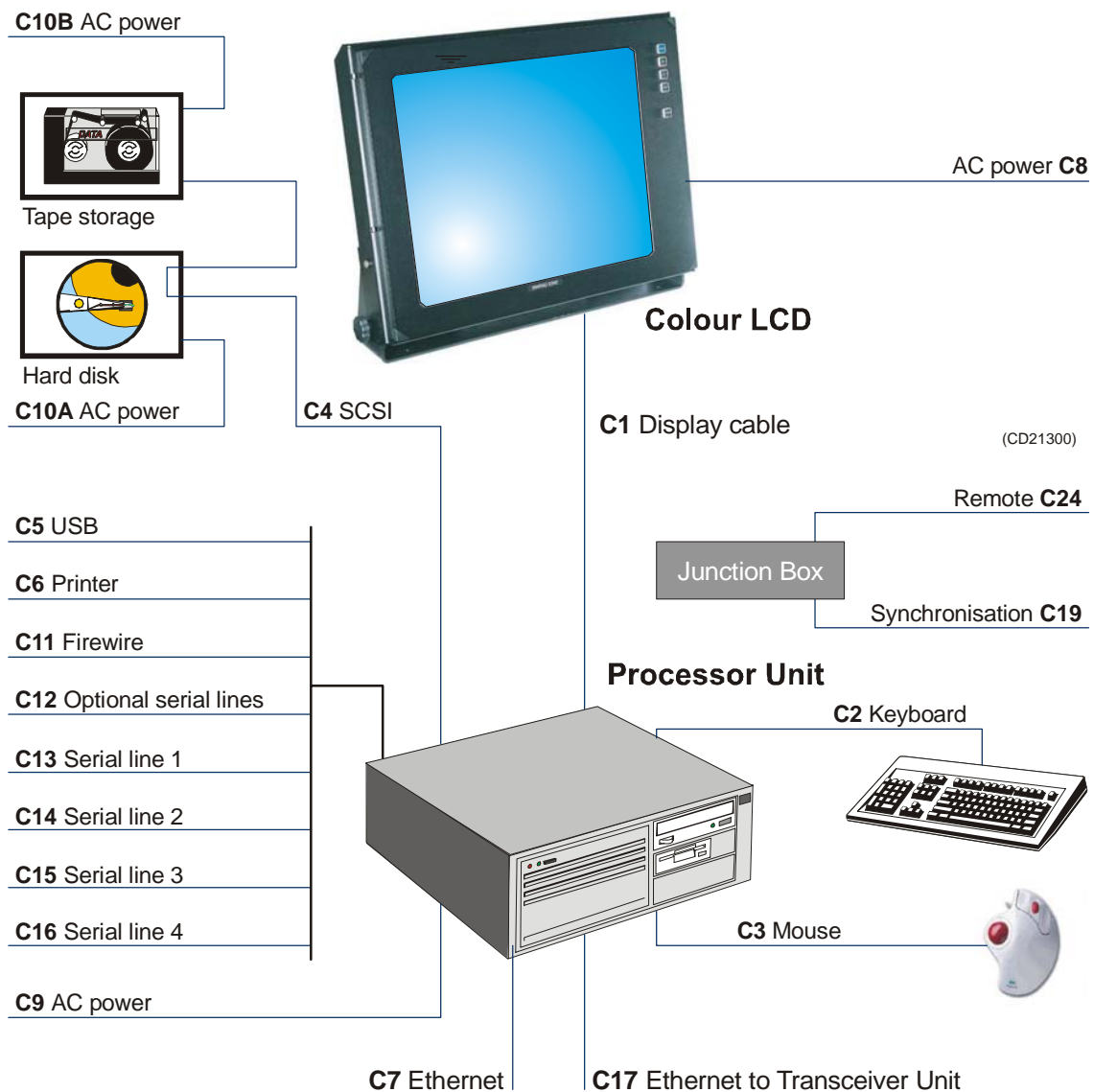


Figure 4 EM 1002 cable plan - Computer

C1 - 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 display monitor.

→ *Cable details, page 72.*

C2 - Keyboard

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

→ *Cable details, page 74.*

C3 - Mouse (or other pointing device)

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

→ *Cable details, page 75.*

C5 - USB

This is a standard USB interface cable. It is optional, and when required, it is supplied by the manufacturer.

→ *Cable details, page 73.*

Most commercial computers have more than one USB interface. If more than one is used, the cables are identified as C5A, C5B etc.

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

C6 - 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 76.*

C7 - Ethernet

The computer is normally equipped with only one ethernet interface board, and only **C17** is then supported. The communication between the computer and the Transceiver Unit is then made on **C17**.

However, an additional ethernet board may be installed. With both **C7** available, one ethernet line is used to communicate directly with the transceiver, while the other connects the multibeam echo sounder to the ship’s ethernet network. Both cables are terminated with RJ45 plugs, and both must be supplied by the installation shipyard.

→ *Cable details, page 71.*

C8 / C9 / C10 - AC power

These are standard mains cables. The cable is supplied by the manufacturer.

→ *Cable details, page 66.*

Cables **C10A** and **C10B** are optional, and will only be used with an external storage device is implemented.

C11 - Firewire

This is a standard Firewire interface cable. It is optional, and when required, it is supplied by the manufacturer.

Commercial computers may have more than one Firewire interface. If more than one is used, the cables are identified as C11A, C11B etc.

C12 - Optional serial lines

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

→ *9-pin connector, cable details, page 59.*

C13 / C14 / C15 / C16 - Serial lines

The number of serial lines available depends on the computer make and model. Standard RS-232 serial lines with 9-pin or 12-pin D-connectors are default.

→ *9-pin connector, cable details, page 59.*

→ *25-pin connector, cable details, page 57.*

C17 - Ethernet

The ethernet communication between the computer and the Transceiver Unit is then made on **C17**.

→ *Cable details, page 71.*

C18 - Not used

This cable is not used. On older EM 1002 systems **C18** was a coax interface cable between the Operator Unit and the Transceiver Unit.

C19 - Synchronisation

The transmission of the EM 1002 may be externally controlled and synchronised with other acoustic systems on the vessel. The interface to a synchronisation system may be done directly on the Remote connector on the Transceiver Unit, or through the Junction Box.

→ *Cable details, page 64.*

C24 - Remote control

Refer to the Transceiver Unit cables.

Transceiver Unit cables

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

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

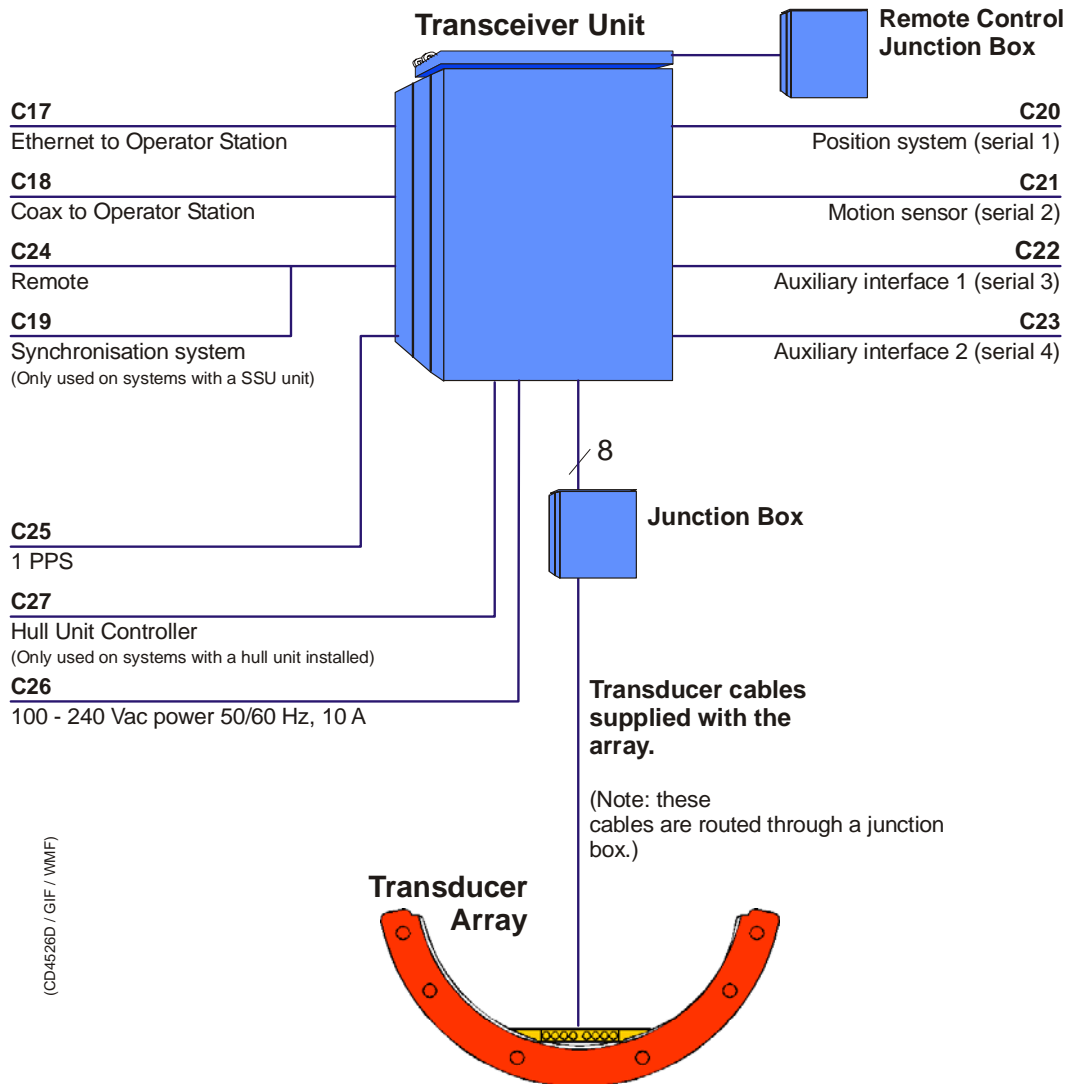


Figure 5 EM 1002 Transceiver Unit - Cable plan

C17 - Ethernet interface to Operator Station

Refer to the Operator Station cabling.

C18 - Coax interface to Operator Station

This cable was used on older systems with Unix workstations.

C19 - Synchronisation

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

In most cases, a junction box is located in the vicinity of the Operator Station to facilitate on/off control. The synchronisation system may then be connected to this junction box, or directly to the **Remote** plug. See **C24** for additional information.

→ *Cable details on page 64.*

The cable must be provided by the installation shipyard.

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

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

Serial Port 1 - Positioning systems

Serial Port 2 - Motion sensor

Serial Port 3 - Auxiliary 1

Serial Port 4 - Auxiliary 2

→ *Cable details on page 58.*

The cables must be provided by the installation shipyard.

C24 - Remote

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

→ *Cable details on page 64.*

The cable must be provided by the installation shipyard.

Whenever a synchronisation system is used, the control lines from this system is often connected to the on/off junction box. Cable C24 will then be common for on/off and synchronisation between the junction box and the **Remote** plug on the Transceiver Unit.

C25 - 1PPS

This is a timing signal terminated in a coax connector.

→ *Cable details on page 60.*

The cable must be provided by the installation shipyard.

C26 - AC power

This is the AC mains cable to the Transceiver Unit.

→ *Cable details on page 66.*

The AC cables are supplied by the manufacturer.

Transducer cables

The transducer cables are supplied by the manufacturer. There are eight cables with maximum length 12.5 meters.

Hull Unit Controller cables

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

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

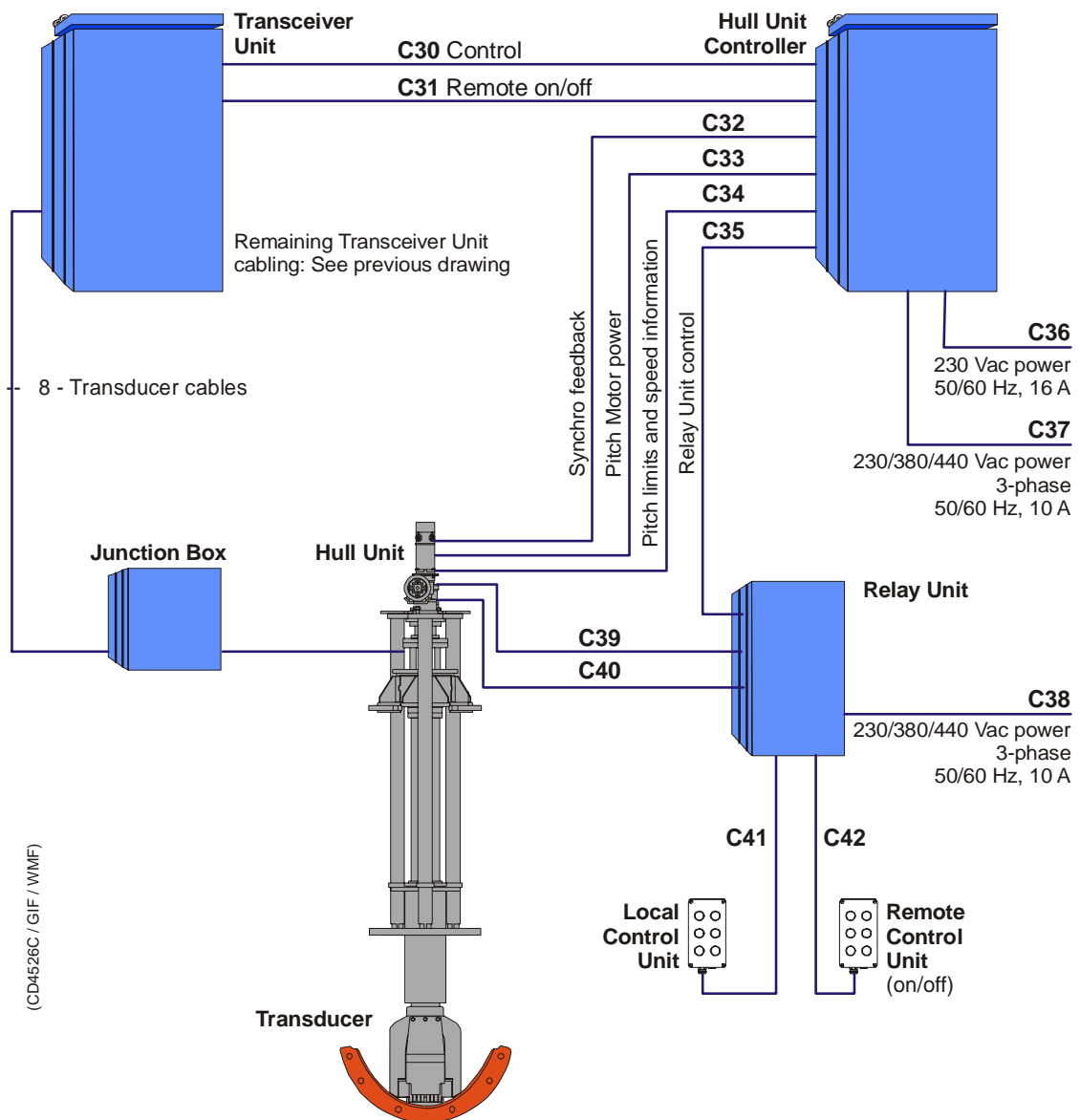


Figure 6 EM 1002 Cable plan - Hull Unit

C30 - Control signals

This serial line provides the control signals between the Transceiver Unit and the Hull Unit Controller.

→ *Cable details on page 61.*

The cable must be provided by the installation shipyard.

C31 - Remote on/off

This cable provides remote control of the Transceiver Unit power to the Hull Unit.

→ *Cable details on page 62.*

The cable must be provided by the installation shipyard.

C32 - Synchro feedback

This cable provides feedback from the synchro monitoring the pitch motor.

→ *Cable details on page 81.*

The cable must be provided by the installation shipyard.

C33 - Pitch motor power

This cable provides the power lines for the pitch motor. The motor is controlled by a DC voltage with a duty cycle controlling both motor speed and direction. 50% duty cycle brings the motor to full stop.

→ *Cable details on page 82.*

The AC cables are supplied by the manufacturer.

C34 - Pitch limits and speed information

This cable provides the control signals from the pitch limit switches (positive and negative) as well as the speed information from the pitch motor.

→ *Cable details on page 83.*

The AC cables are supplied by the manufacturer.

C35 - Relay Unit control

This cable supplies control signals between the Relay Unit and the Hull Unit Controller.

→ *Cable details on page 79.*

The AC cables are supplied by the manufacturer.

Power kabel C36 må sjekkes!

C36 - AC power

This is the 230 AC mains cable to the Hull Unit Controller.

→ *Cable details on page 66.*

The AC cables are supplied by the manufacturer.

C37 - 3-phase AC power

This is the 230/380/440 AC mains cable to the Hull Unit Controller.

→ *Cable details on page 70.*

The AC cables are supplied by the manufacturer.

C38 - 3-phase AC power

This is the 230/380/440 mains cable to the Relay Unit.

→ *Cable details on page 67.*

The AC cables are supplied by the manufacturer.

C39 - 3-phase AC power

This is the 230/380/440 mains cable to the hoist motor.

→ *Cable details on page 68.*

The AC cables are supplied by the manufacturer.

C40 - Limit switches and hoist motor brake

This cable supplies control signals from the upper and lower limit switches between the Hull Unit termination block E401 and the Relay Unit.

→ *Cable details on page 80.*

C41 - Local Control Unit

This is a cable connects the Relay Unit to the Local Control Unit.

→ *Cable details on page 77.*

C42 - Remote Control Unit

This is a cable connects the Relay Unit to the Remote Control Unit (on/off).

→ *Cable details on page 78.*

3.3 Terminating the transducer cables

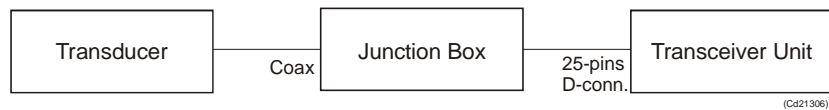
Overview

The transducer cables are supplied with the transducer array, and they are not identified with an Wxxx number on the cable plan.

When the transducer is installed on a hull unit two transducer models have been used. Both are described in this manual.

The cables are normally terminated to the Transceiver Unit through a Junction Box. However, some installations use D-connectors. Depending on the array and installation used, the following different plug types and terminations are used:

- The transducer cables are terminated in the junction box with small coax connectors.
- Another cable is connecting the junction box and the Transceiver Unit.



For systems installed before 2002 (serial number 500-52x):

- A transducer array mounted directly under the hull uses 50-pin D-sub connectors. These connect directly to the Transceiver Unit.

Calib.txt file

In addition a **calib.txt** file is used to supply the transducer characteristics to the Processing Rack software.

Cabling

Transducer array

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

The coax connectors are standard for transducer arrays. To make these fitted to the Transducer Unit, a junction box is used. The Transducer cables are terminated in the junction box, and eight other cables with 50-pins D-sub connectors in each are used between the junction box and the Transceiver Unit.

The connections inside the junction box are identical for both hull mounted transducer arrays and transducer arrays mounted on a Hull Unit.

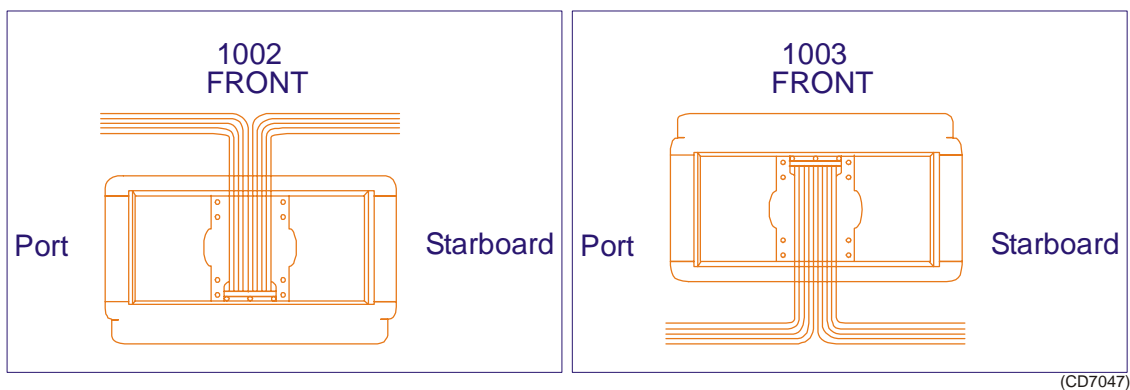


Figure 7 Transducer array mounting.

Note

The 1003 on figure 7 is also an EM 1002 system.

For both mounting directions (see drawing above) the connections inside the junction box are identical. The calib.txt file will handle this.

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

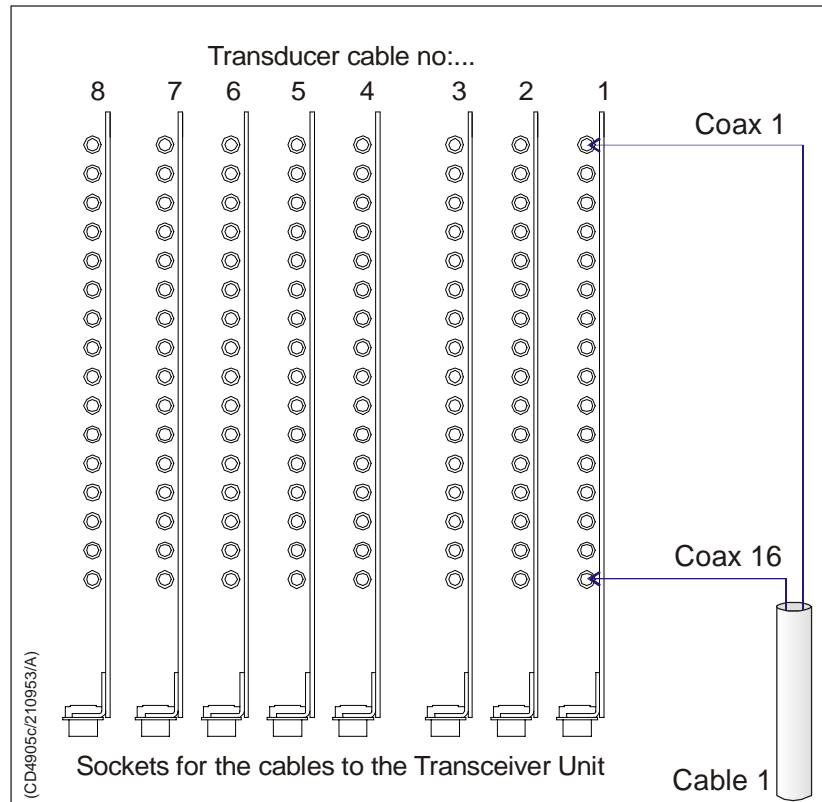


Figure 8 Junction Box terminations

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

Cable 1:

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

Cable 2:

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

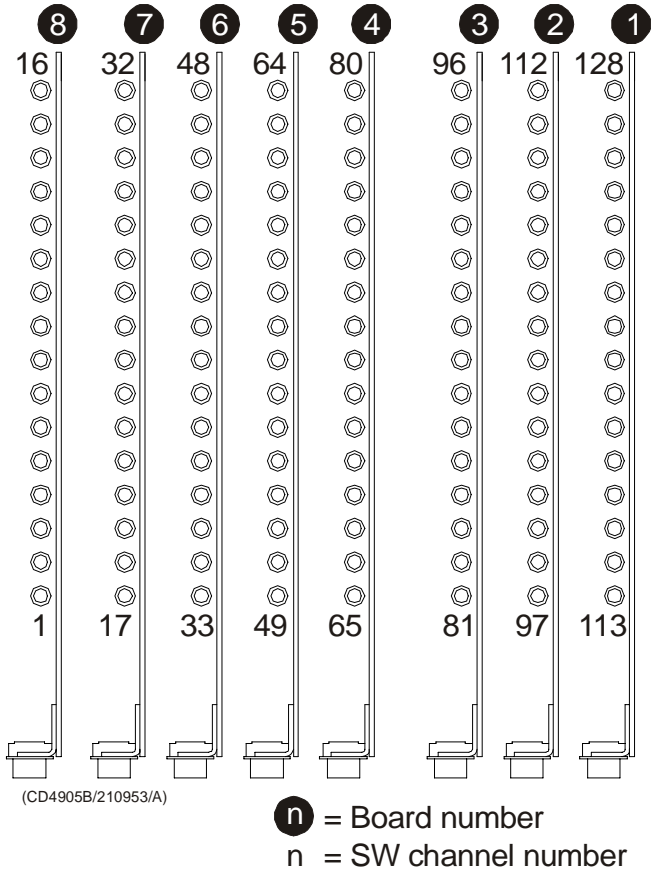


Figure 9 Physical connectors related to software channels

Cable 3:

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

Cable 4:

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

Cable 5:

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

Cable 6:

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

Cable 7:

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

Cable 8:

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

Transducer array connection in the Transceiver Unit

The cables from the junction box are identified as follows:

RXT1/Cn

where n=1 through 4, and

RXT2/Cn

where n=1 through 4.

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

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

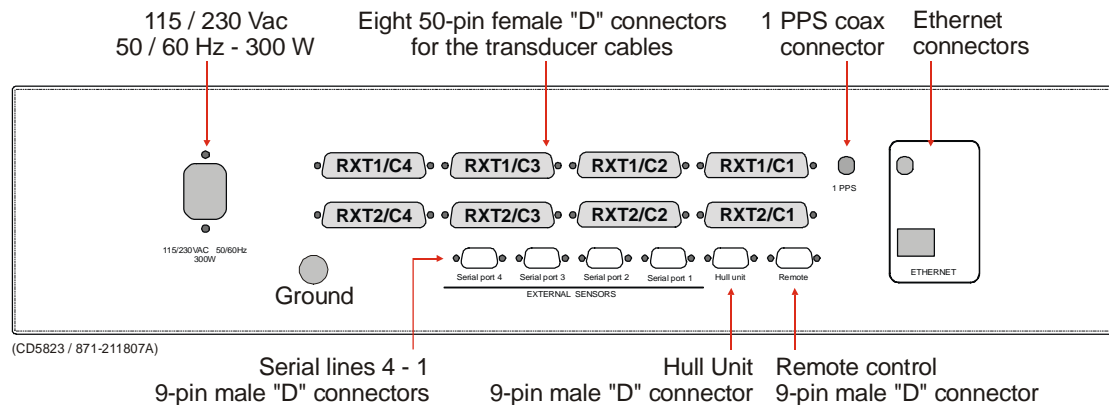


Figure 10 The connector panel under the Transceiver Unit

3.4 Cable gland assembly procedure

Purpose

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

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

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

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

General procedure

- 1 Ensure all the cables to be connected are completely isolated from any power sources.
 - I.e. Switch off and remove the supply fuses from any units or systems into which the cables are already connected.
- 2 Select the cable to be connected into the cabinet, and select the cable gland through which the cable is to pass.

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

- 3 Depending on whether the cable has already been installed in conduits, either.
 - a (installed) measure the maximum length of cable required to reach from the final cable clip outside the cabinet to the terminal blocks inside the cabinet, add 20 cm, then remove the excess cable,or:
 - b (loose cable) measure the maximum length of wire required to reach from the cable gland to the terminal blocks inside the cabinet, add 20 cm. and mark the cable.

Note

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

- 4 Taking care not to damage the screening, carefully remove the outer insulation from the required cable length.
- 5 Leaving an appropriate length of the screen exposed from the insulation, cut off the remainder.

Securing and terminating the cables

- 1 Referring to the wiring diagram and ensuring that there is 5 to 10 cm. slack cable inside the cabinet, prepare and connect the cable cores to the appropriate terminals within the cabinet.
- 2 Secure the cable within the cabinet using cable clips.
- 3 Check the terminal connections against the wiring diagram to ensure they are correct.

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

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

Once all the system cables are connected and checked:

- 5 Take the appropriate safety measures, then replace the fuses and apply power to the system.
- 6 Perform a system test to ensure the installation has been conducted successfully.

Multi-diameter modules

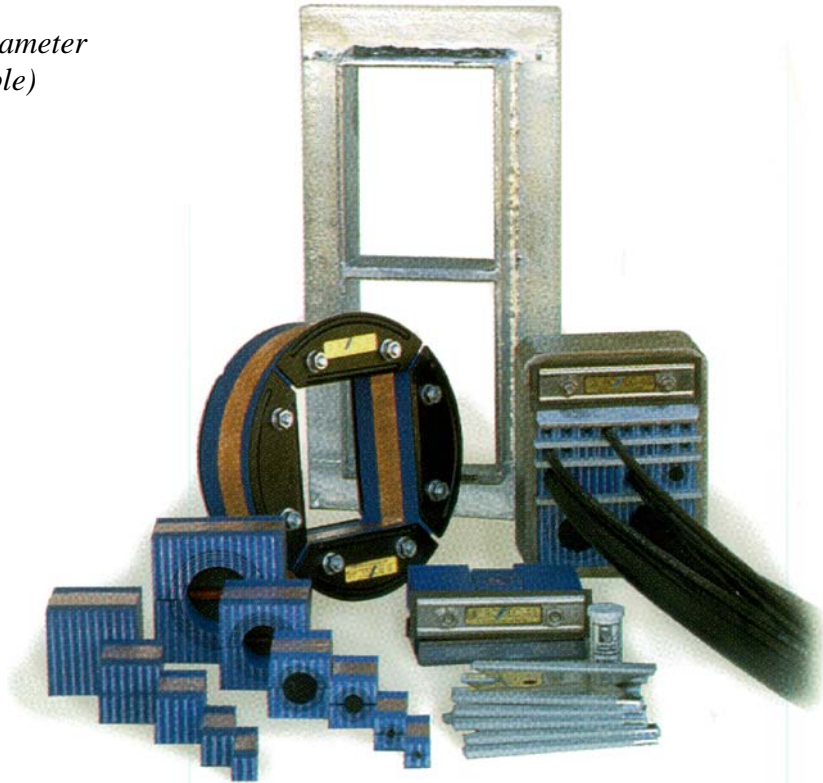
Multi-diameter cable glands are now available from several sources, and these types are becoming increasingly popular due to ease of use. Only a brief description of the system will be presented here, further information with technical specifications and installation descriptions must be obtained from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

The illustrations and examples here are from the following manufacturer:

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

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

Figure 11 Multi-diameter modules (example)



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

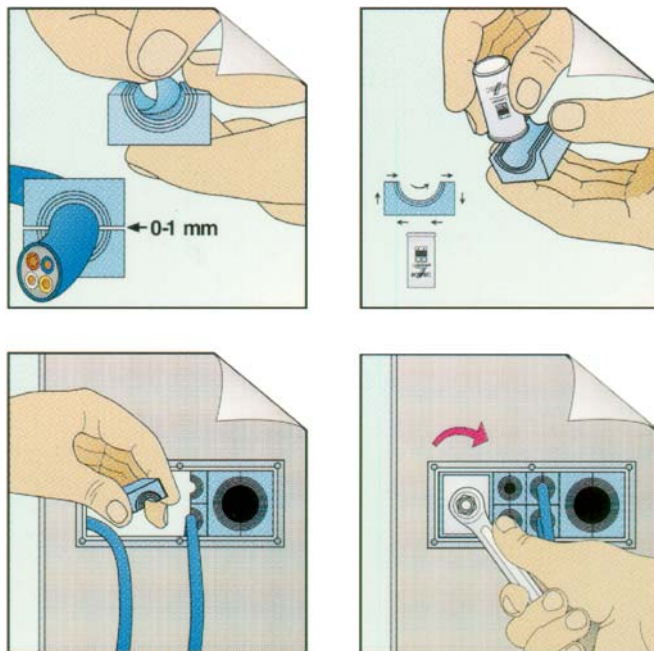


Figure 12 Multi-diameter system - Principal procedure

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

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

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

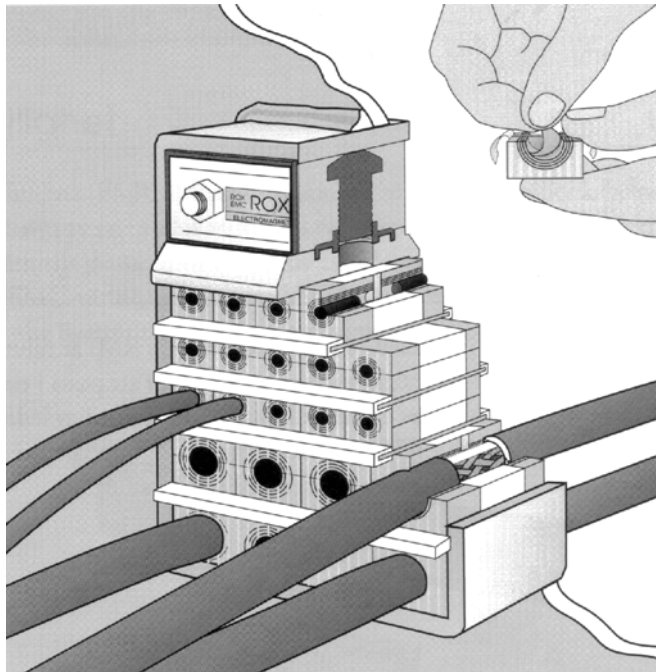


Figure 13 Multi-diameter system - The finished assembly

Standard type

- 1 Ensure that all the cables to be connected, are completely isolated from any power sources.
 - Switch off and remove the supply fuses from any units or systems into which the cables are already connected.
- 2 Select the cable to be connected into the cabinet, and select the cable gland through which the cable is to pass.
- 3 Slacken and remove the compression nut from the cable gland, and extract the compression seal and the screen collar from the body of the gland.

Note

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

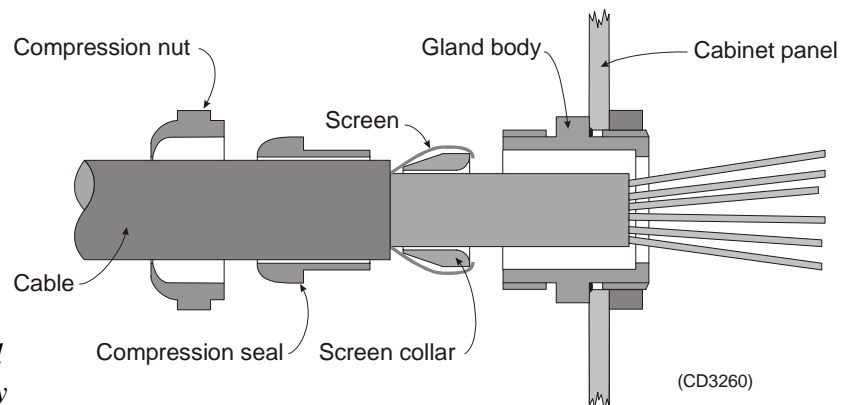


Figure 14 Standard cable gland assembly

- 4** Depending on whether the cable has already been installed in conduits, either:
- c** (installed) measure the maximum length of cable required to reach from the final cable clip outside the cabinet to the terminal blocks inside the cabinet, add 20 cm, then remove the excess cable,
- or:
- d** (loose cable) measure the maximum length of wire required to reach from the cable gland to the terminal blocks inside the cabinet, add 20 cm. and mark the cable.

Note

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

- 5** Taking care not to damage the screening, carefully remove the outer insulation from the required cable length.
- 6** Leaving 12 mm of the screen exposed from the insulation, cut off the remainder.
- 7** Taking care not to damage the screening, slide the compression nut (smallest diameter first) over the cable and onto the intact insulation.
- 8** Taking care not to damage the screening, slide the compression seal (rounded end first) over the cable and onto the intact insulation.
- 9** Slide the screen collar (narrow end first) onto the cable and fit it underneath the screen. Slide it as close to the intact outer insulation as possible.
- 10** If the screen extends beyond the "flat" end of the screen collar, fold any excess length over the end of the collar such that the screen will be gripped between the collar and the gland body when the parts are assembled.

- 11 Carefully thread the cable through the gland body till the screen collar is tight into the gland body.
- 12 Slide the compression seal into the gland body till the shoulder is hard up against the gland body.
- 13 Slide the compression nut over the compression seal and engage the threads.
- 14 While holding the gland body to prevent it turning, and pressing the cable into the gland, tighten the compression nut onto the gland body.
- 15 Referring to the wiring diagram and ensuring that there is 5 to 10 cm. slack cable inside the cabinet, prepare and connect the cable cores to the appropriate terminals within the cabinet.
- 16 Secure the cable within the cabinet using cable clips.
- 17 Check the terminal connections against the wiring diagram to ensure they are correct.

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

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

Once all the system cables are connected and checked:

- 19 Take the appropriate safety measures, then replace the fuses and apply power to the system.
- 20 Perform a system test to ensure the installation has been conducted successfully.

Additional type 1 (842-093878)

- 1 Mount the cable gland body, and tighten it with the nuts on each side of the cabinet wall.
- 2 Slide the metal washers, the rubber gasket and the compression nut onto the cable in the order indicated in the figure.
→ *Refer to figure 15.*
- 3 Bend the screen over the rubber gasket.
- 4 Push the rubber gasket and the two metal washers carefully into the cable gland body.
- 5 While holding the gland body to prevent it turning, and pressing the cable into the gland, tighten the compression nut onto the gland body.

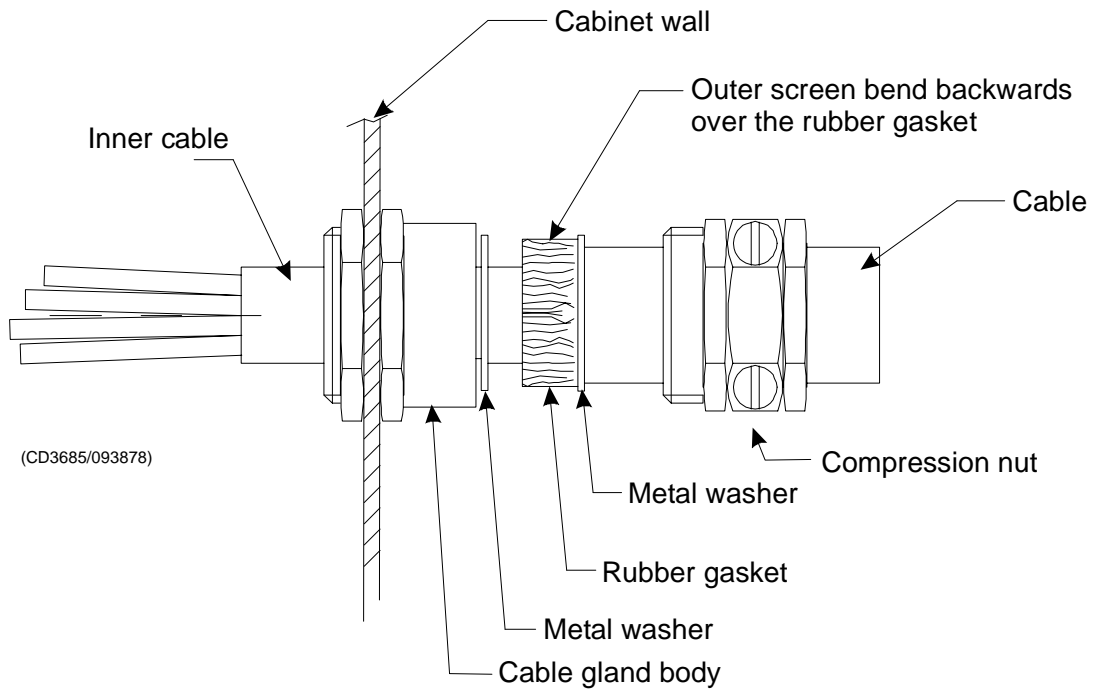


Figure 15 Cable gland, type 1 (842-093878)

Additional type 2 (541-093642)

- 1 Mount the cable gland body, and tighten it with the nuts on each side of the cabinet wall.
- 2 Slide the metal washers, the rubber gasket and the compression nut onto the cable in the order indicated in the figure.
- Refer to figure 16.
- 3 Bend the screen over the compression cone.
- 4 Push the compression cone, 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.

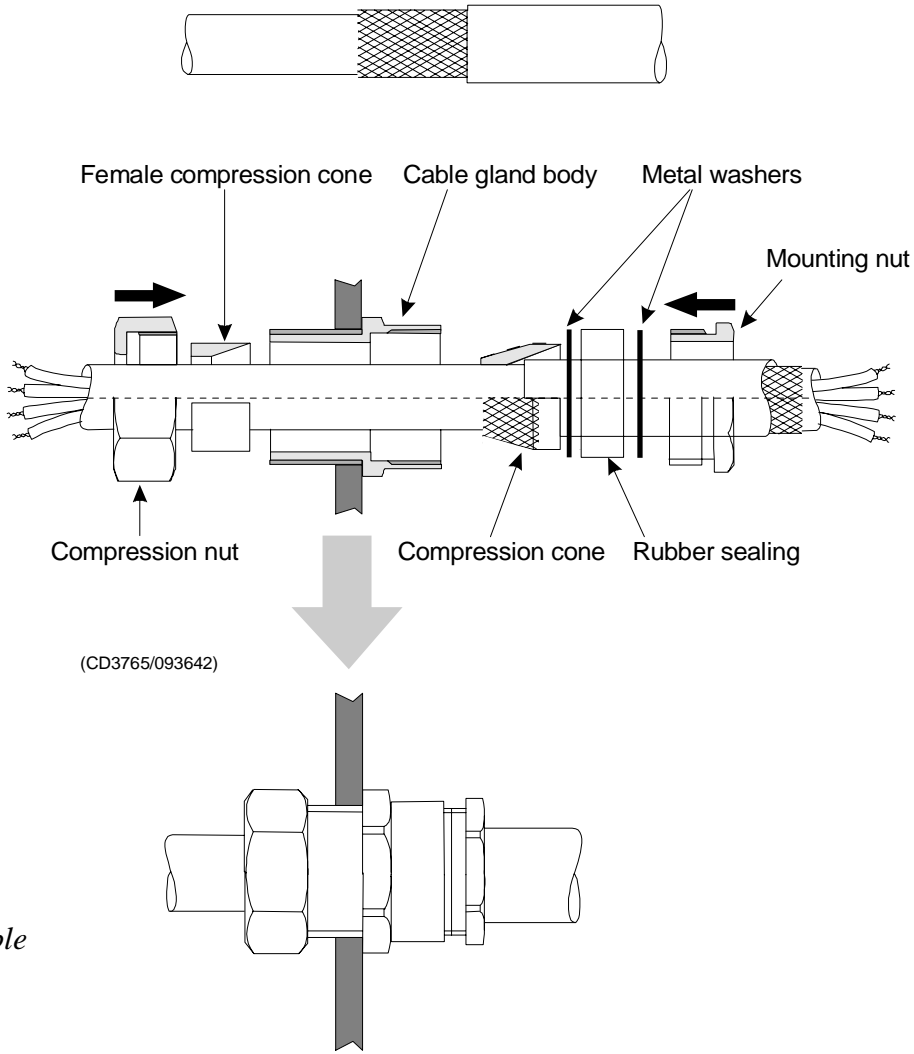


Figure 16 Cable gland, type 2 (541-093642)

3.5 Cable specifications

Introduction

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

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

Note

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

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

3.6 Basic cabling requirements

Cable trays

All permanently installed cables associated with the system must be supported and protected along their entire lengths using conduits and/or cable trays. The only exception to this rule is over the final short distance (max. 0.5 metre) as the cables run into the cabinets/units to which they are connected. These short unsupported lengths are to allow the cabinets to move on their shock mounts, and to allow maintenance and replacements.

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

Radio Frequency interference

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

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

Physical protection

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

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

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

Grounding

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

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

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

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

Cable connections

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

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

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

Cable terminations

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

Cable identification

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

Generic RS-232 serial line (DTE)

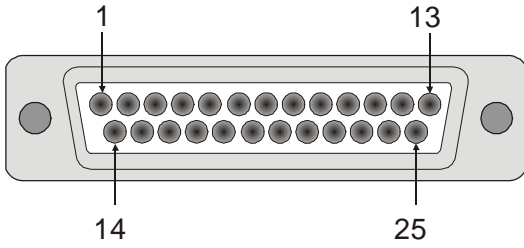
This cable described the pin configuration for an RS-232 interface. The Data Terminal Equipment (DTE) end is shown.

The DTE end is shown on page 57.

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

25-pin D-sub connector
Original and complete RS-232 signal definition shown. The most commonly used signals are shown in bold.

(DTE = Data Terminal Equipment)



Looking into a male 25-pin D-pin connector

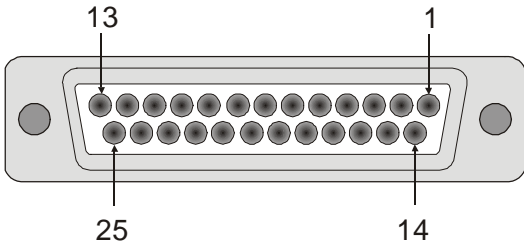
W101 / Rev. B	RS-232 serial line (DTE)
---------------	--------------------------

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

Generic RS-232 serial line (DCE)

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

The DTE end is shown on page 56.

1	Shield	<p>25-pin D-sub connector</p> <p>Original and complete RS-232 signal definition shown. The most commonly used signals are shown in bold.</p> <p>(DCE = Data Circuit terminating equipment)</p>  <p style="text-align: center;">Looking into a female 25-pin D-pin connector</p>
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	<i>Reserved for testing</i>	
10	<i>Reserved for testing</i>	
11	<i>Unassigned</i>	
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	

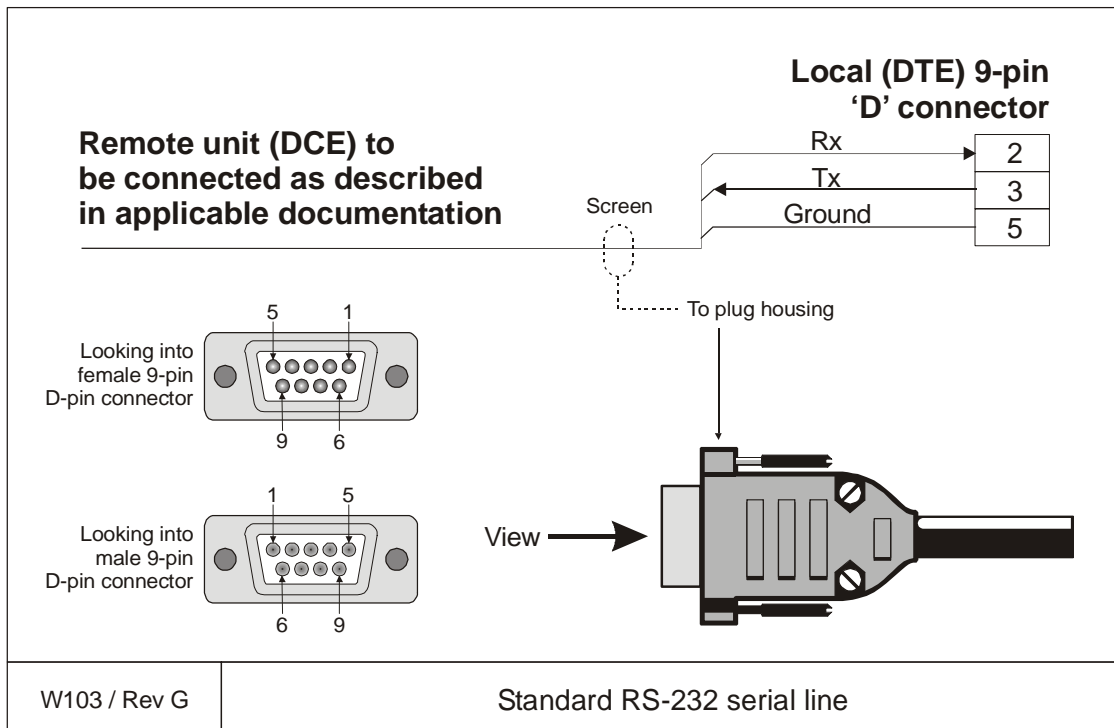
W102 / Rev. B	RS-232 serial line (DCE)
---------------	---------------------------

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

Generic RS-232 Serial line

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

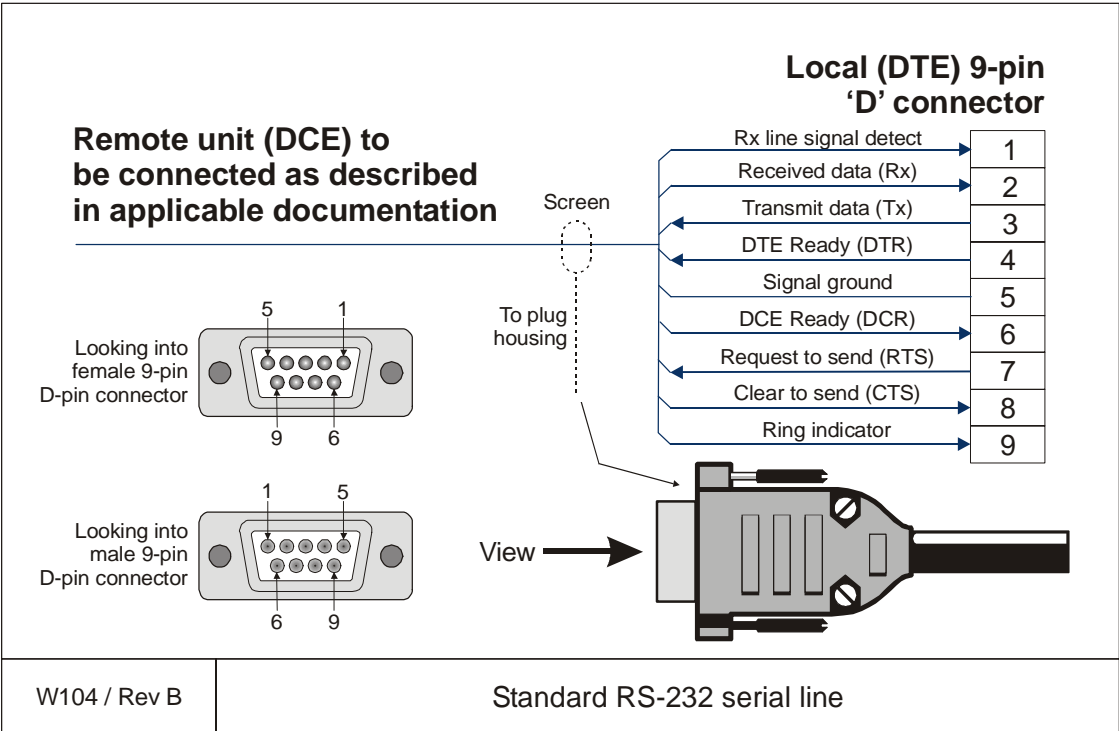
Note that this cable does not support all the signals in the standard RS-232 specification.



Conductors	3 x 2 x 0.5 mm ²
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.

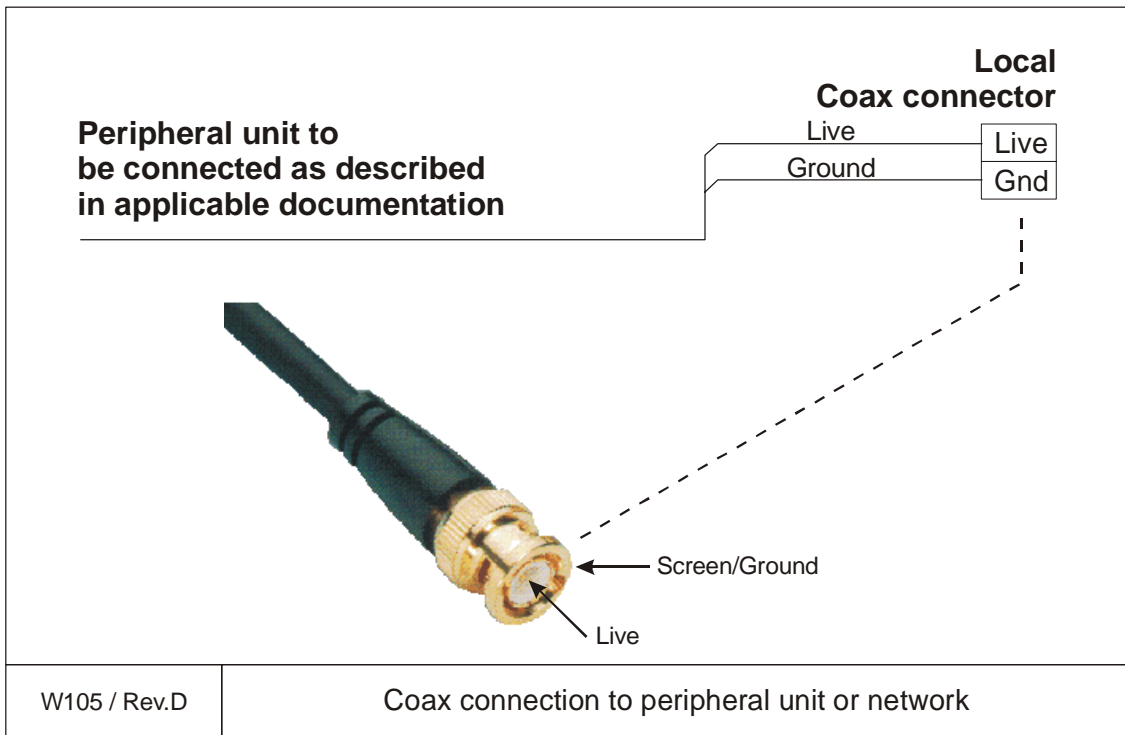


Conductors	6 x 2 x 0.5 mm2
Screen	Screened twisted pairs and overall braided
Voltage	60V
Max.diameter	Set by the plugs

Generic coax cable

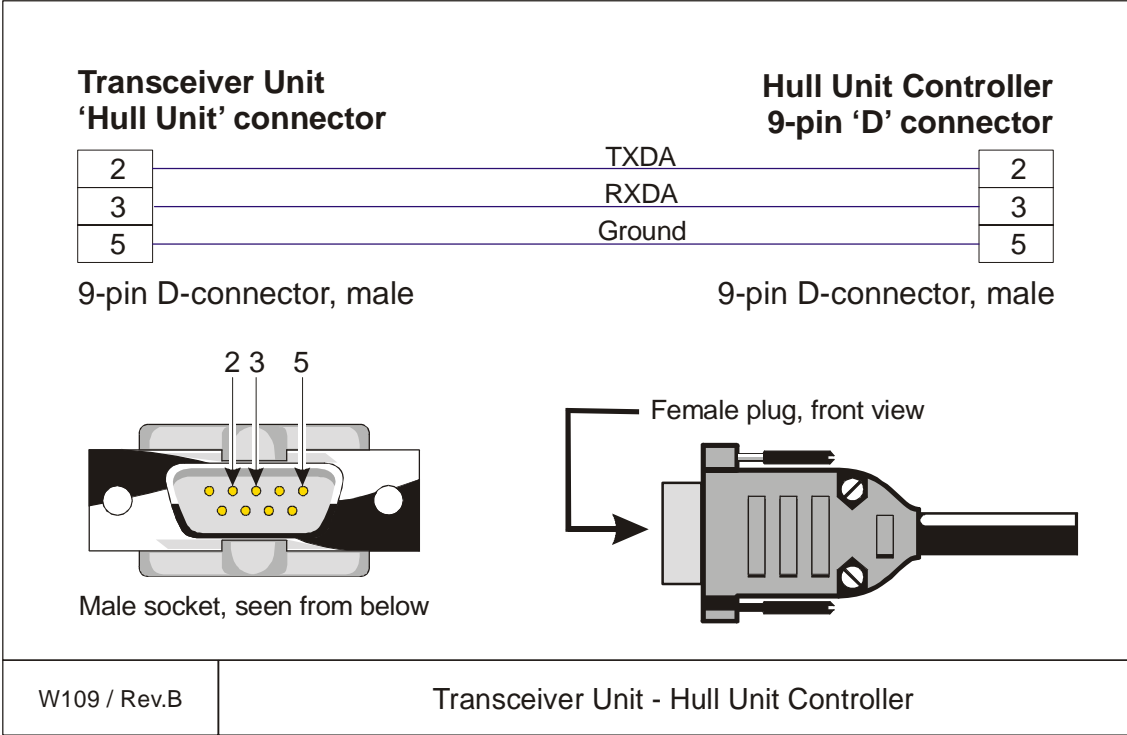
This cable is used for connections to peripheral units or networks.

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



Serial line to Hull Unit Controller

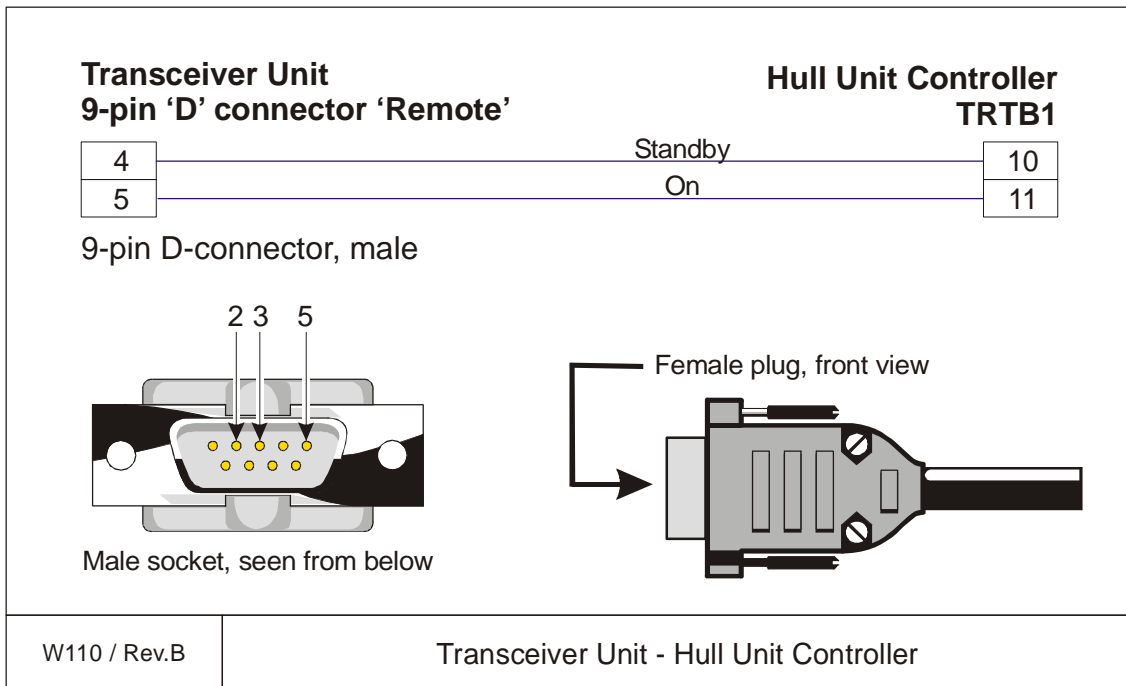
This serial line provides the control signals between the Transceiver Unit and the Hull Unit Controller. Each end of the cable is terminated in a standard female 9-pin 'D' connector.



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

On/off from Hull Unit Controller

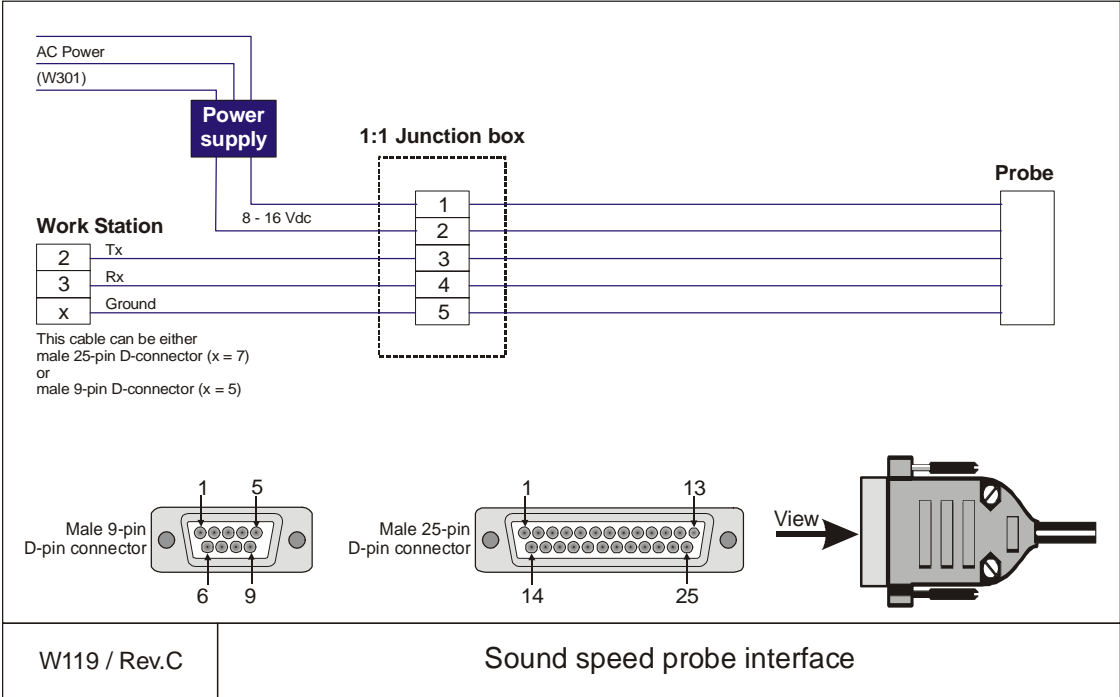
This cable provides remote control of the Transceiver Unit power. A female 9-pin 'D' connector is used on the cable's Transceiver Unit end, while the other end is connected to the Hull Unit Controller's terminal block. When the "On" switch on the Remote Control Unit is pushed, power is applied to the Hull Unit Controller and to the Transceiver Unit through this cable.



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

Sound speed probe interface

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



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

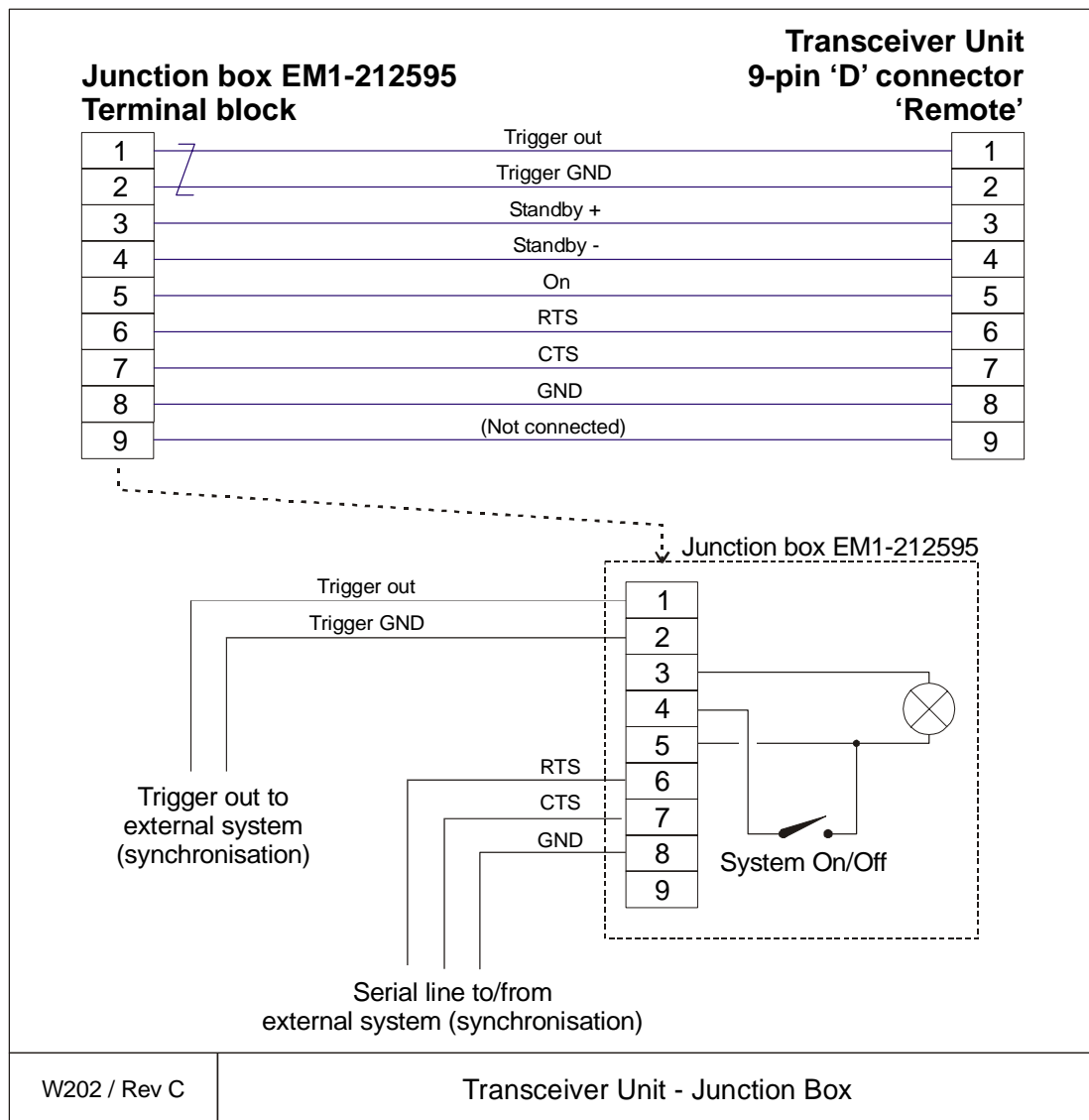
Conductors	2 x 2 x 0.5 mm2
Screen	Overall braided
Voltage	60V
Max.diameter	Set by the plugs

EM Remote synchronisation and On/Off

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

Note *This information is also valid for Remote Control junction box 108-212591.*

Note *This is not valid for Hull Unit.*



W202 / Rev C

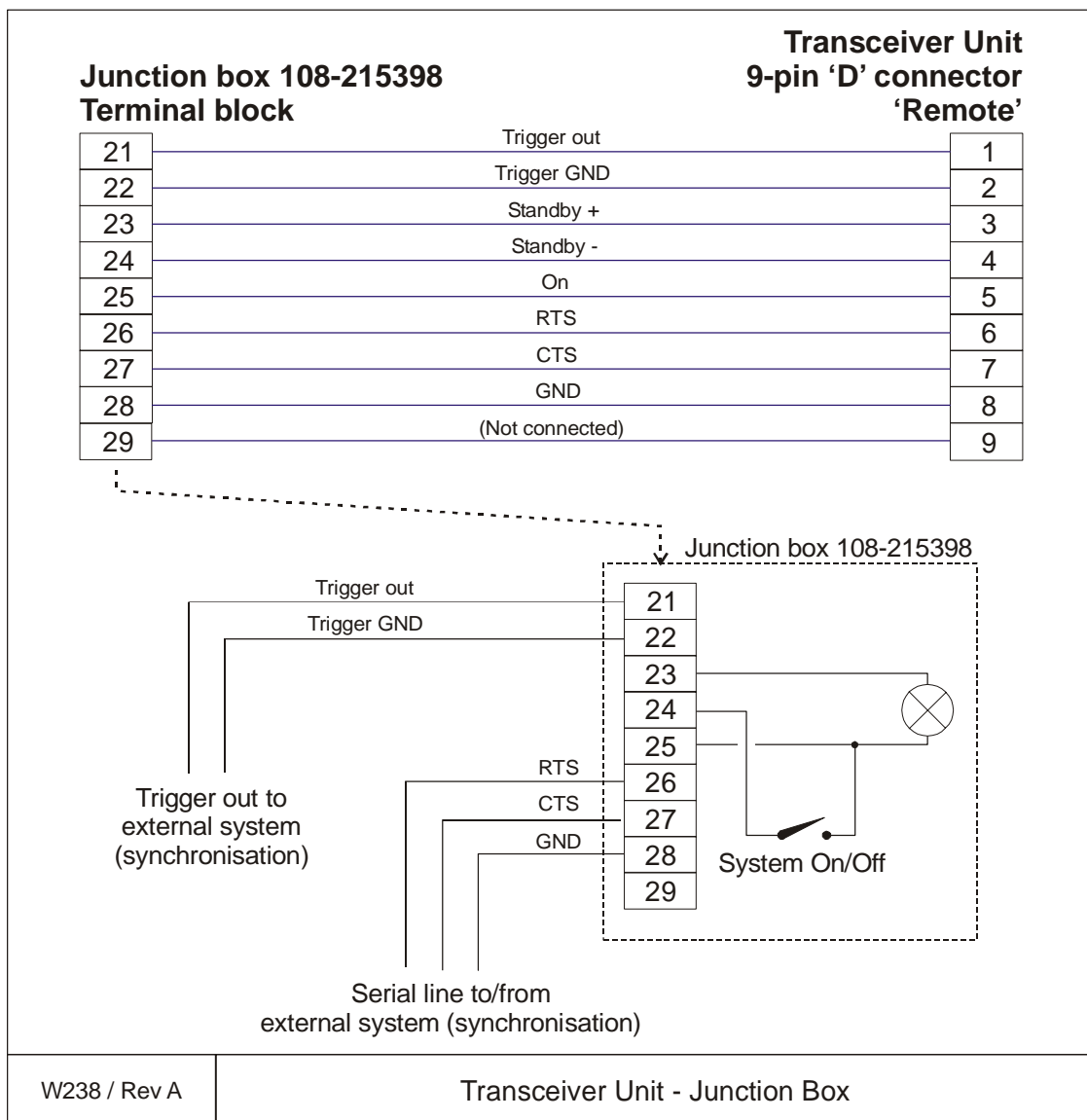
Transceiver Unit - Junction Box

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

EM Remote Control with 3 switches

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

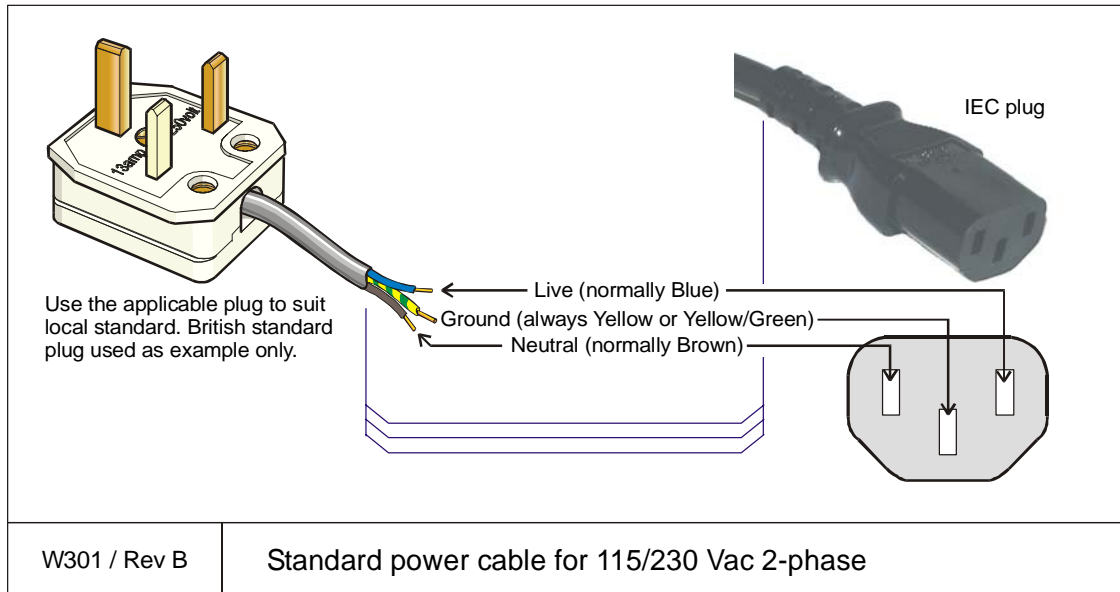
Note *This is not valid for Hull Unit.*



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

Standard AC power cable

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



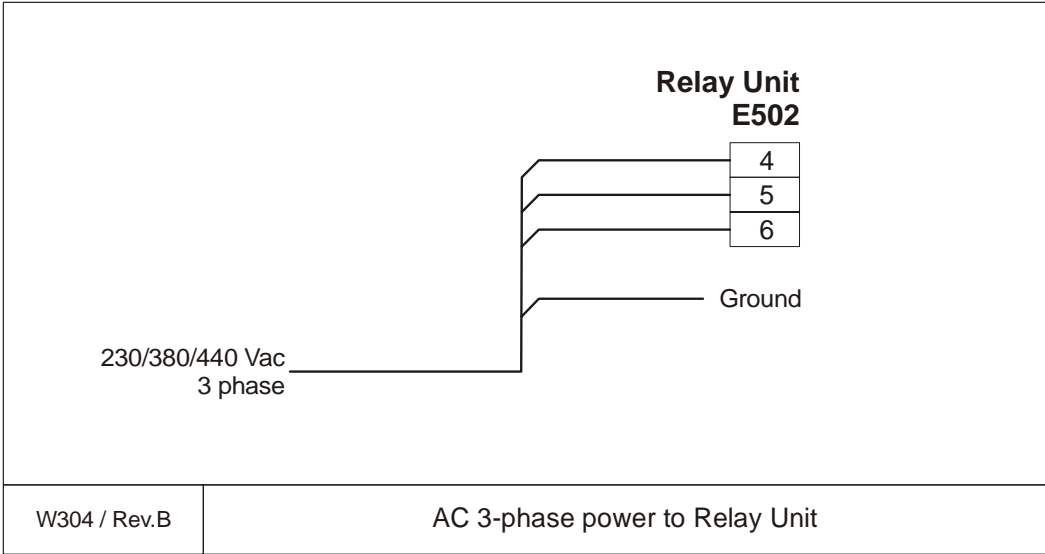
Note

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

3-phase AC power to Relay Unit

This cable connects 230, 380 or 440 Vac 3-phase to the EM 1002 Relay Unit.



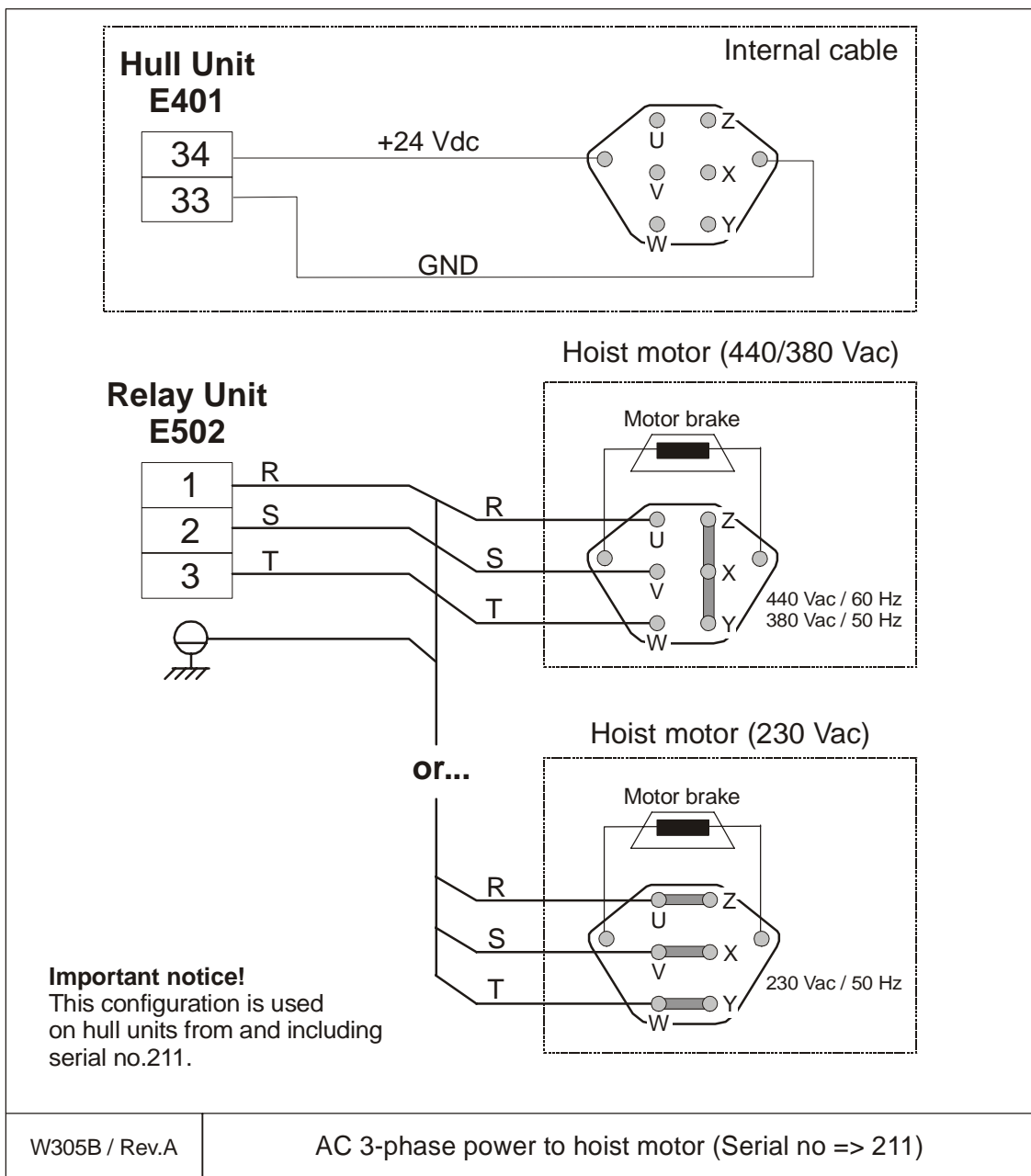
Conductors	3 x 1.5 mm ² + Gnd
Screen	Seperate conductor
Voltage	750V
Max.diameter	20 mm

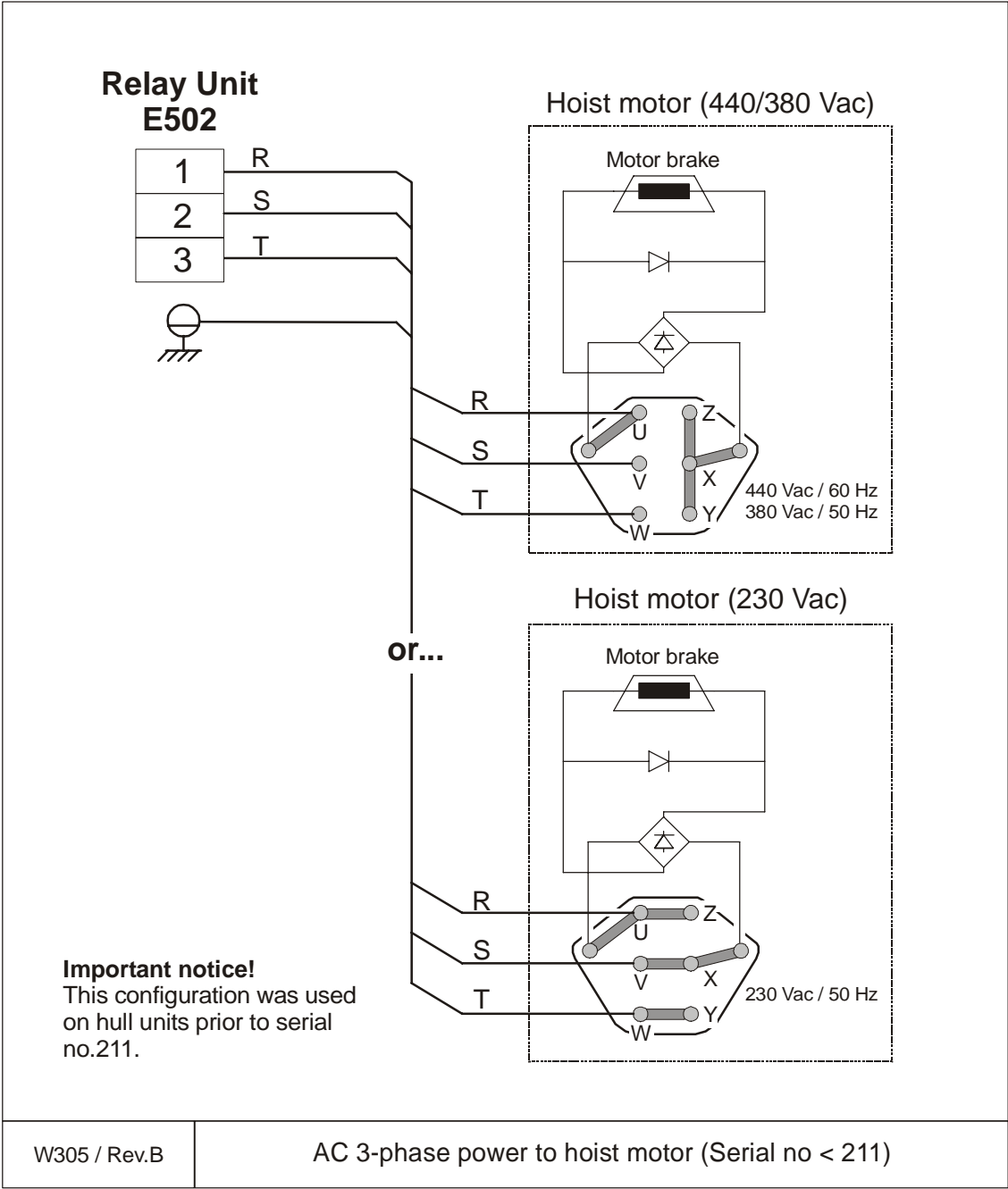
3-phase AC power to hoist motor

This cable connects the 3-phase power from the Relay Unit and to the hull unit's hoist motor. Note that the cable can be connected in two ways, depending on the motor's voltage requirements.

Note

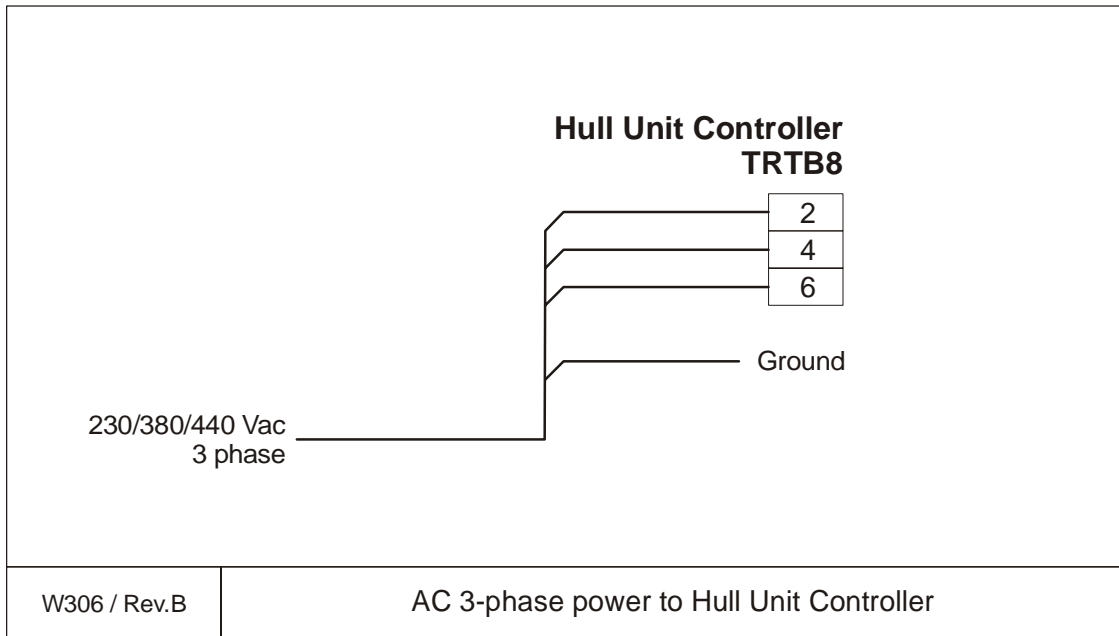
The hoist motor used after June 1999 requires an external +24 Vdc to operate. This change is implemented from hull unit with serial number 211.





3-phase AC power to Hull Unit Controller

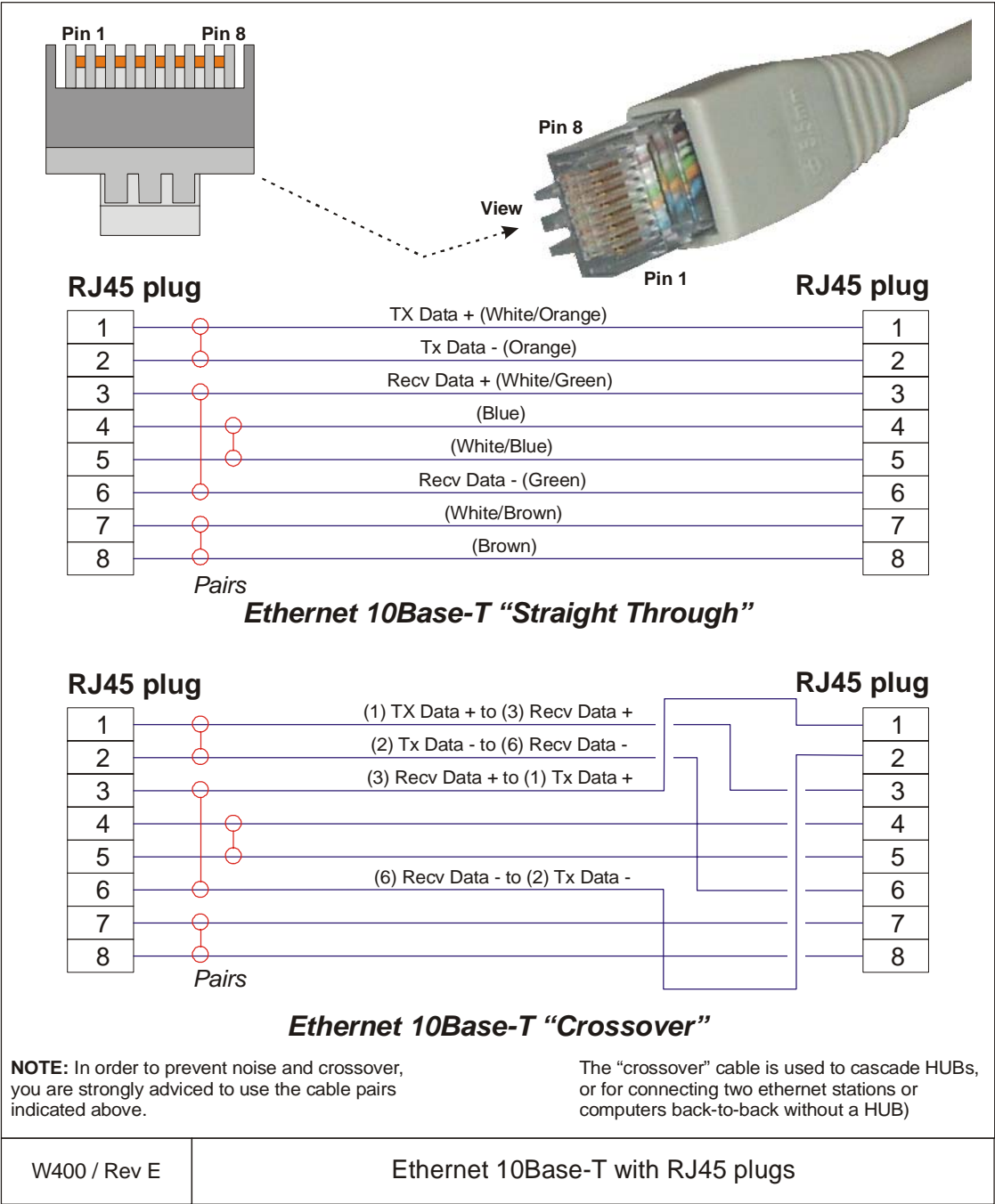
This cable connects 230, 380 or 440 Vac 3-phase to the Hull Unit Controller.



Conductors	3 x 1.5 mm ² + Gnd
Screen	Seperate conductor
Voltage	750V
Max.diameter	20 mm

Ethernet with RJ45

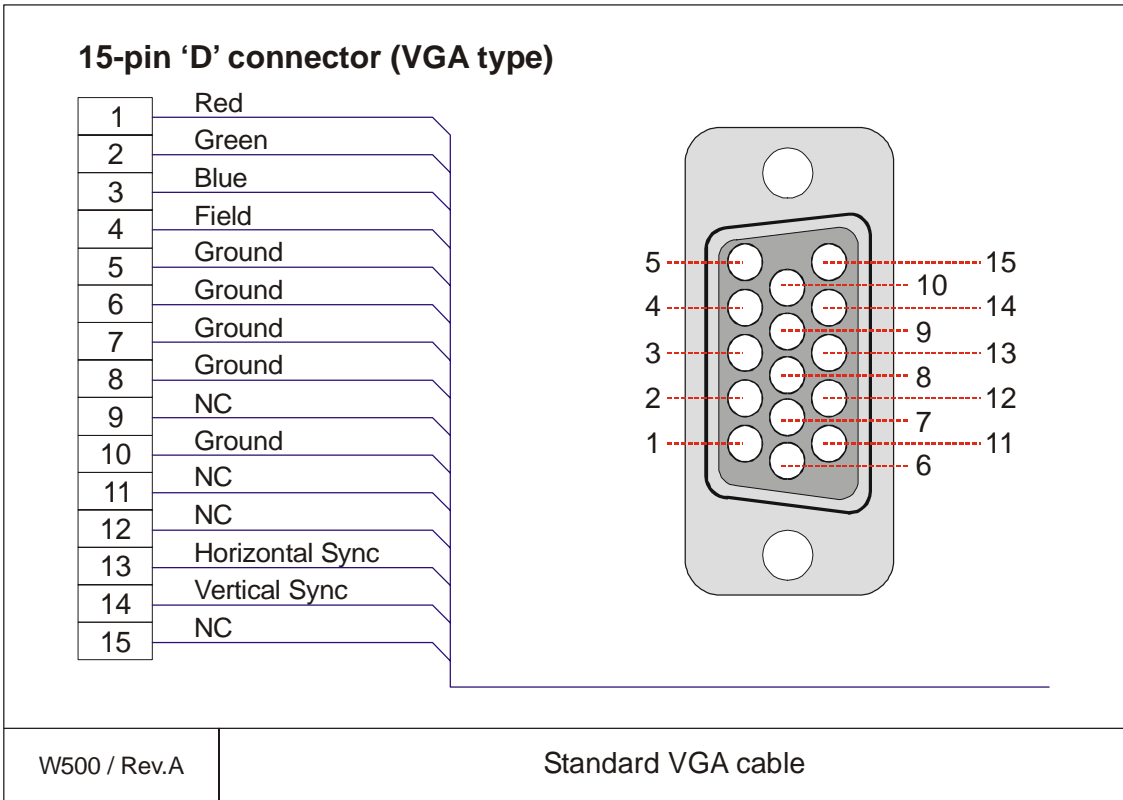
This cable contains the Ethernet connection. RJ45 plugs are used to terminate the cable. Note that these plugs must be screened to comply to EC rules.



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 most kind 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:

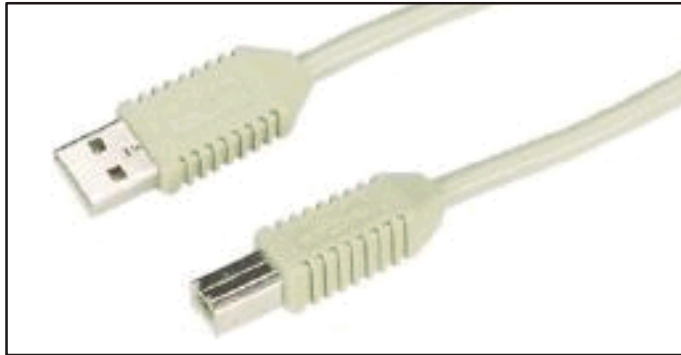
20 AWG twisted pair
(Power, red, black)

Shield:

Foil and braid

Length: 4.5 m

Order no: 719-078524



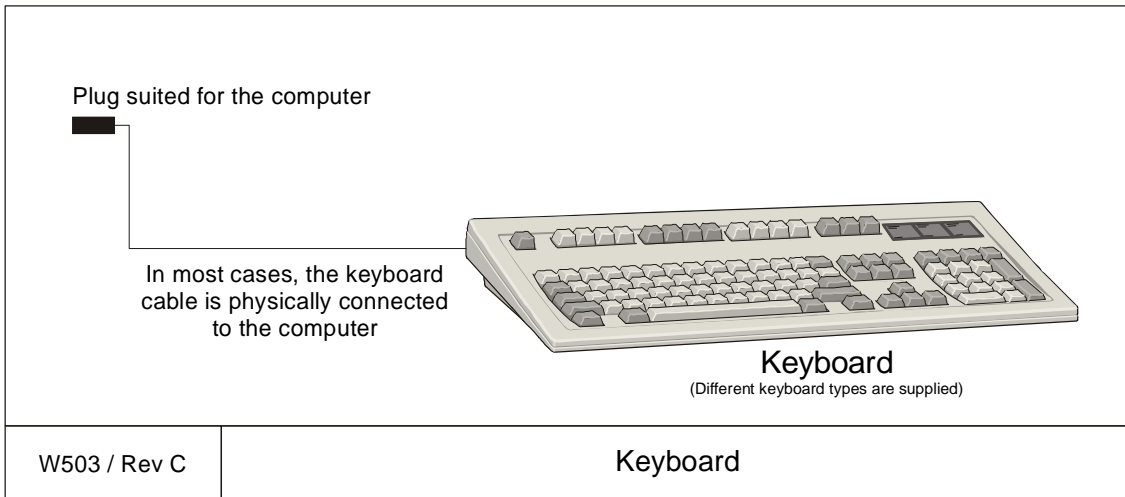
W501 / Rev.A

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.



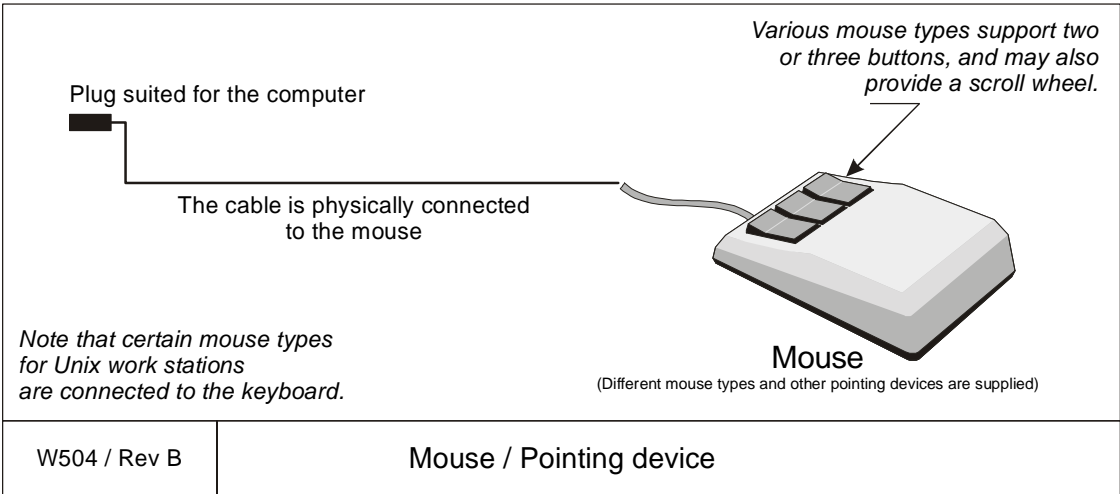
Mouse or pointing device cable

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

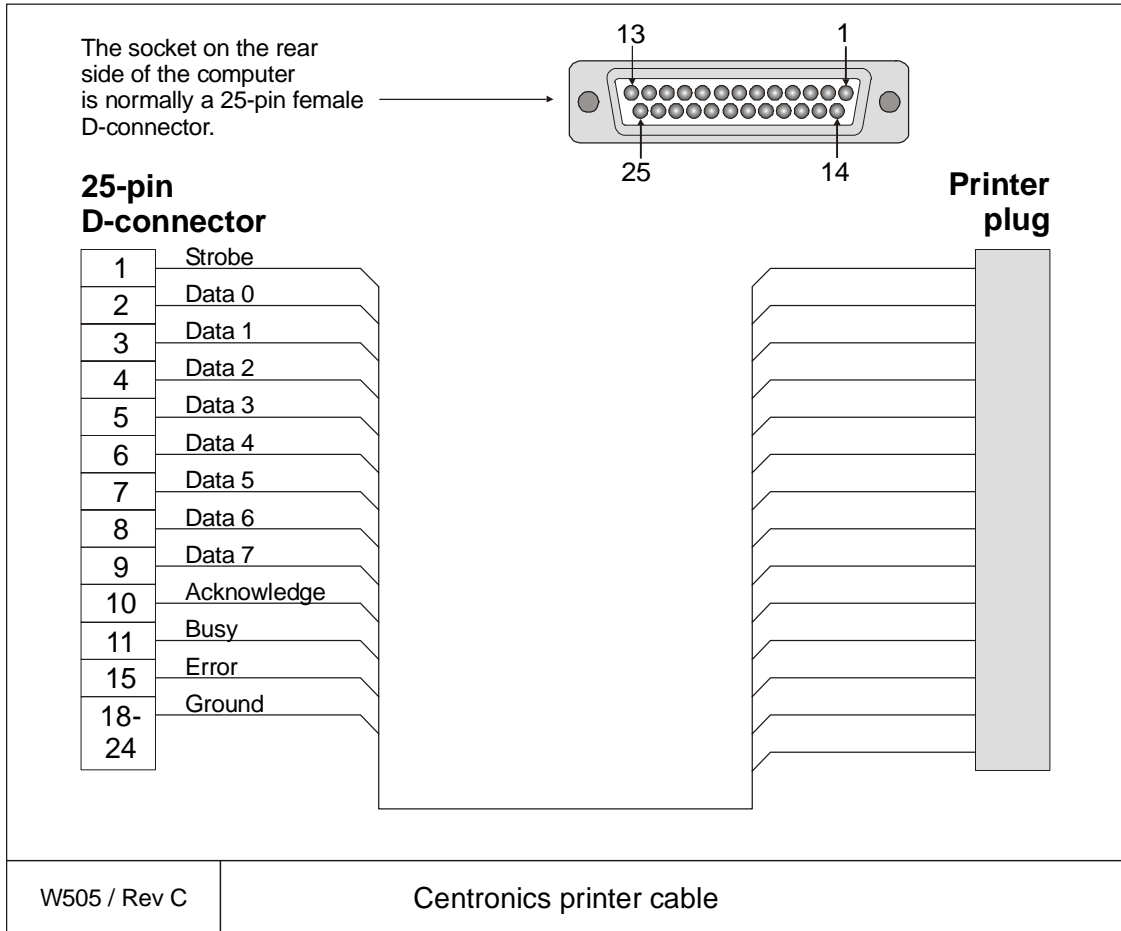
On Unix work stations, the mouse is normally connected to the keyboard.

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.



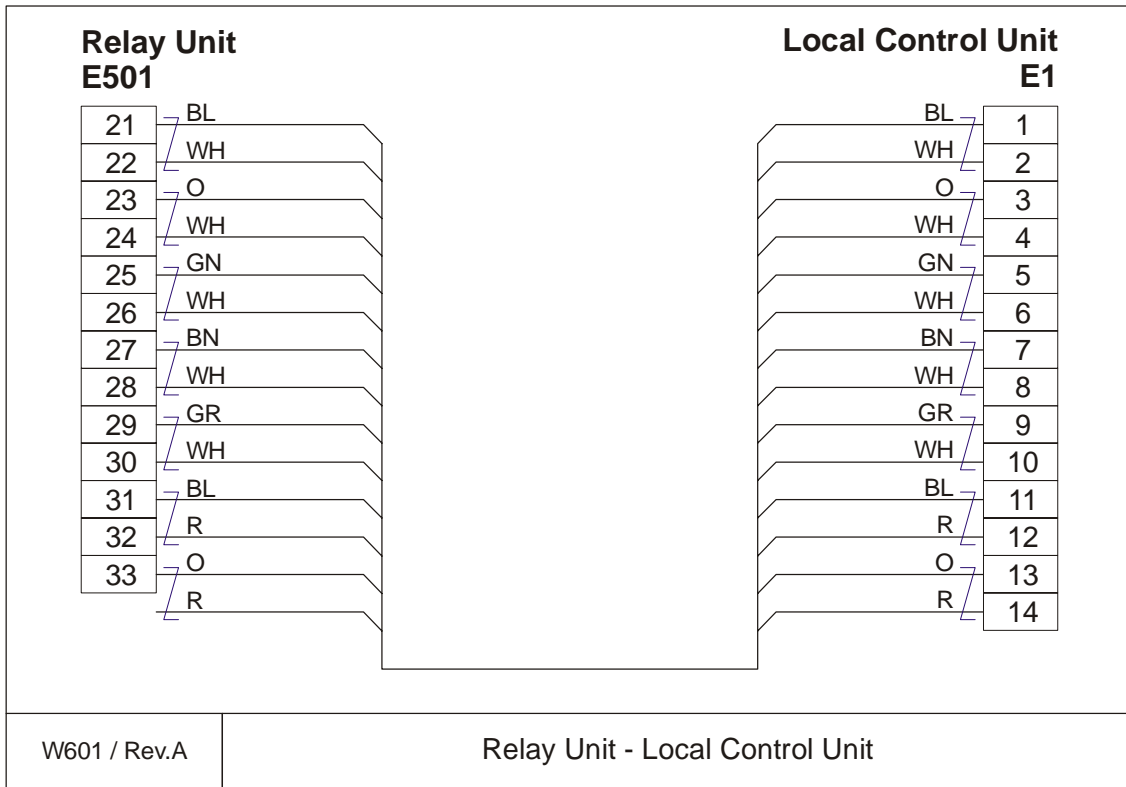
Centronics printer cable

This is a standard Centronics printer cable.



Local Control Unit

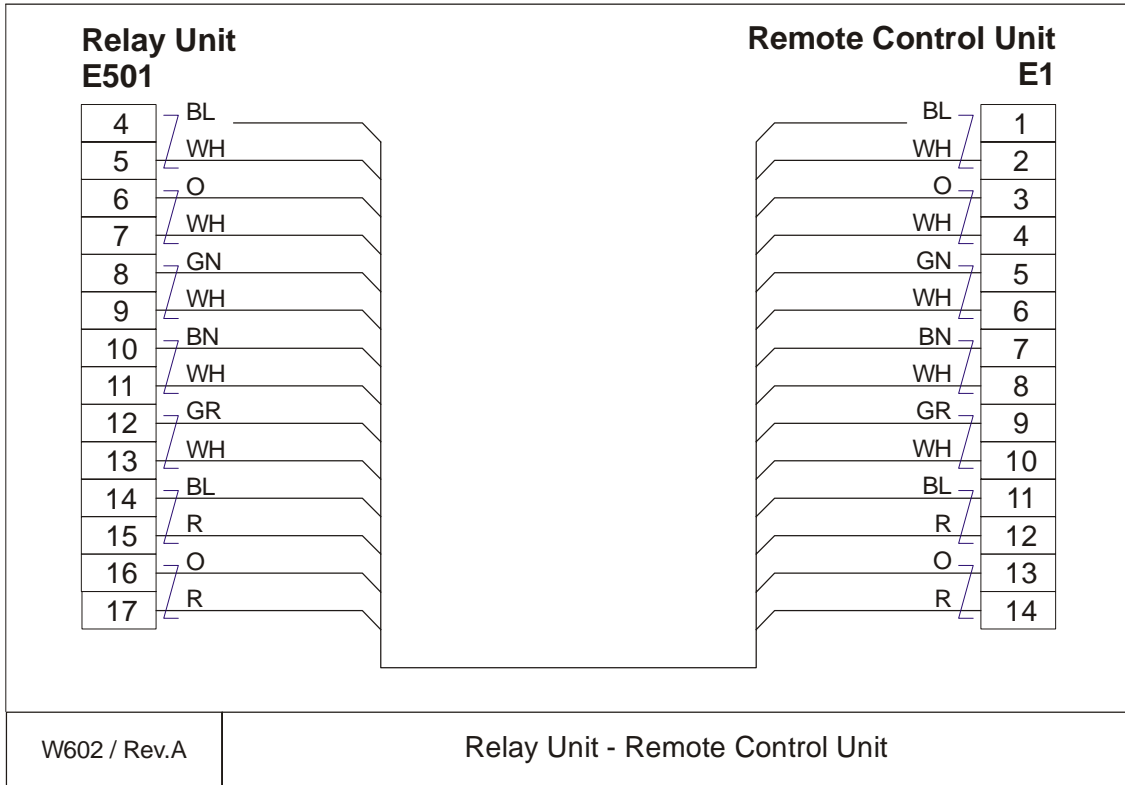
This cable connects the EM 1002 Relay Unit to the Local Control Unit.



Conductors	2 x 7 x 0.5 mm ²
Screen	Overall braided
Voltage	60V
Max.diameter	20 mm

Remote Control Unit

This cable connects the Relay Unit to the Remote Control Unit.



Conductors	2 x 7 x 0.5 mm ²
Screen	Overall braided
Voltage	60V
Max.diameter	20 mm

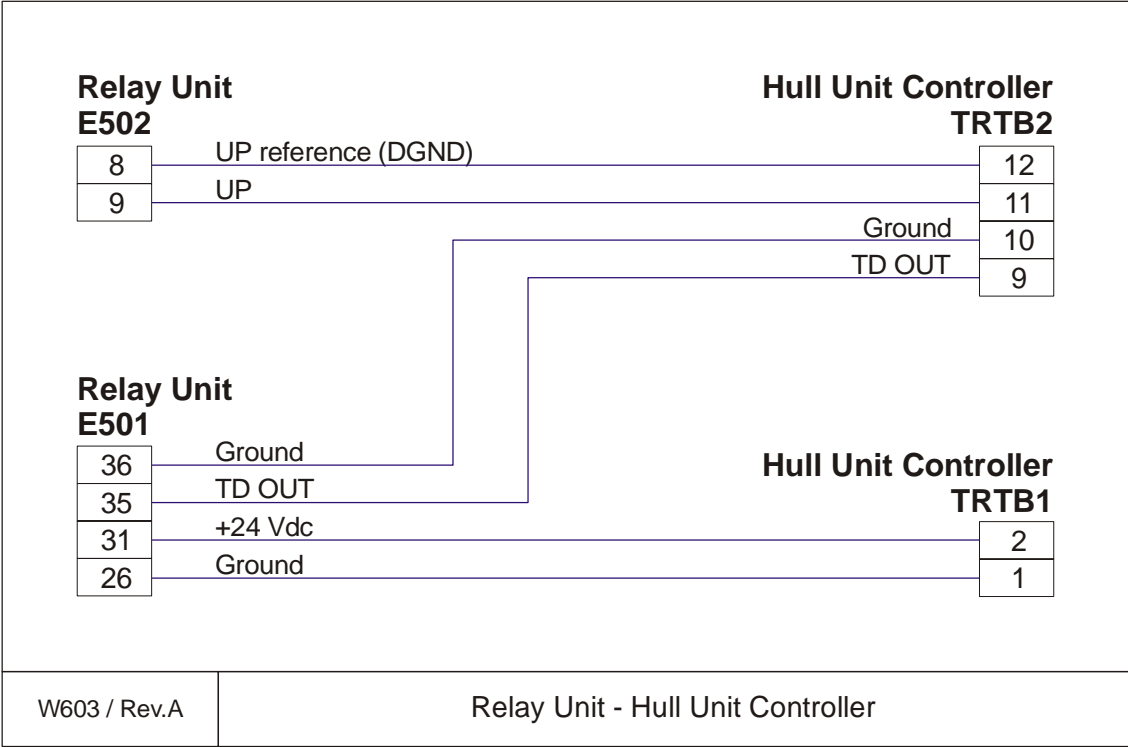
Relay Unit control

This cable supplies control signals between the Relay Unit and the Hull Unit Controller.

UP - this signal is active low when you have pressed the **Up** button on the Remote or Local Control Unit.

TD OUT - this signal is active high when the lower limit switch reports the transducer array to be fully lowered.

+24 Vdc - This voltage is supplied by the Relay Unit when the “On” switch on the Remote Control Unit has been pushed. The control voltage powers up the Hull Unit Controller.



Conductors	4 x 2 x 0.5 mm ²
Screen	Overall braided
Voltage	60V
Max.diameter	15 mm

Limit switches and hoist motor brake

This cable supplies control signals from the upper and lower limit switches between the EM 1002 Hull Unit termination block E401 and the Relay Unit. The drawing also shows how the various switches are connected to termination block E401.

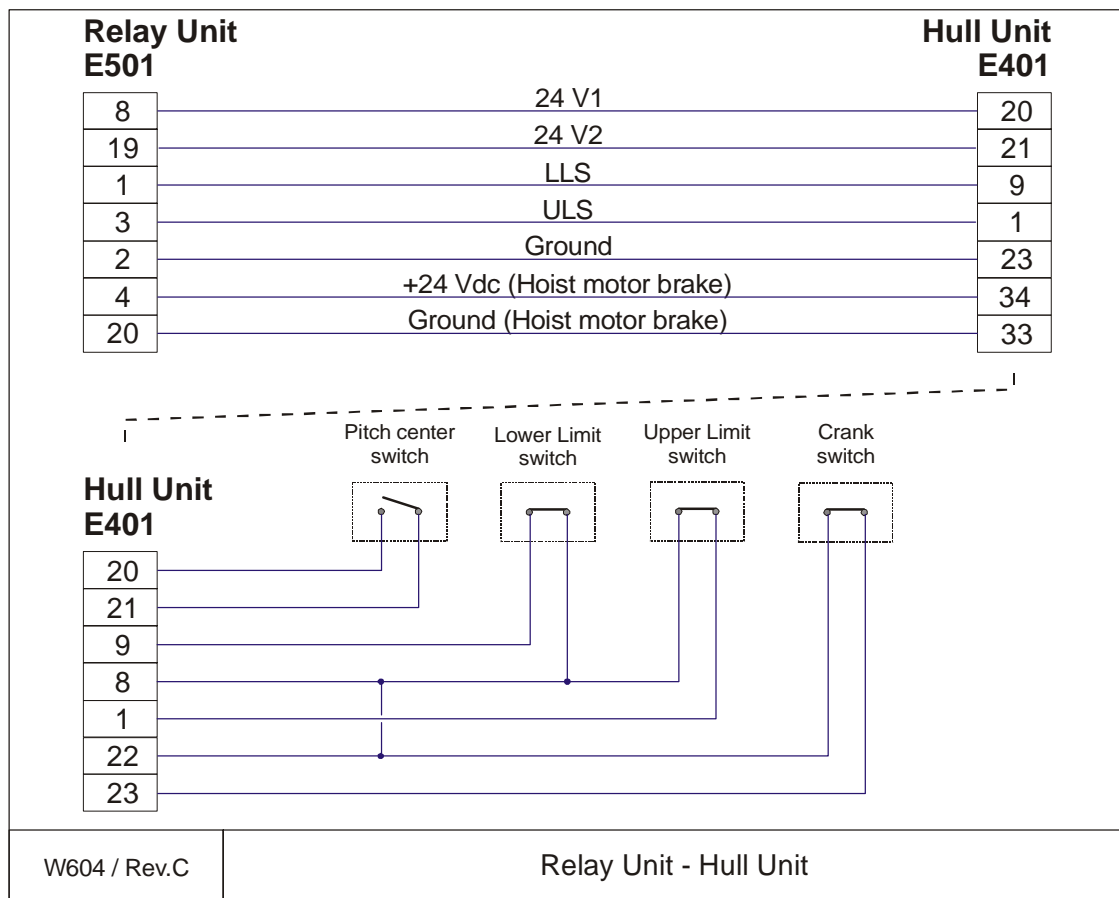
LLS - Lower Limit Switch. The control line is active low when the switch is closed (transducer array lowered to maximum position).

ULS - Upper Limit Switch. The control line is active low when the switch is closed (transducer array hoisted to maximum position).

24 Vx - The Pitch Center Switch is only closed when the transducer array is level. The 24 Vdc line is then closed, and hoisting can take place.

+24 Vdc (Hoist motor brake) - The voltage on this line releases the hoist motor brake. Note that this connection is only used on hull units with serial number 211 or higher.

Conductors	Screen	Voltage	Max.diameter
2 x 7 x 0.5 mm ²	Overall braided	60V	20 mm



Synchro feedback

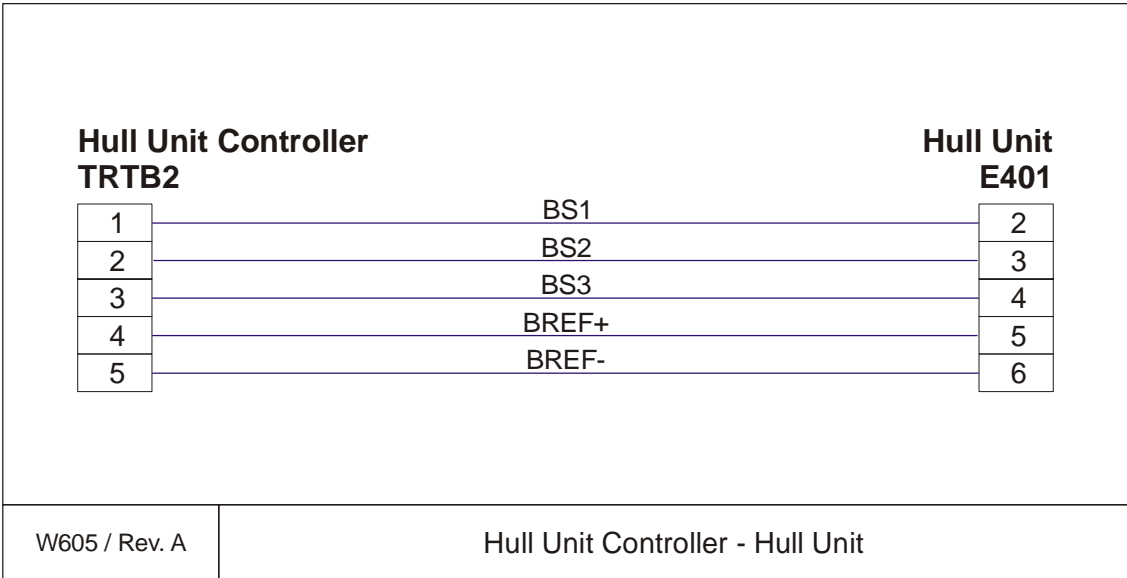
This cable provides feedback from the synchro monitoring the pitch motor.

BS1 - Synchro signal phase 1

BS2 -Synchro signal phase 2

BS3 -Synchro signal phase 3

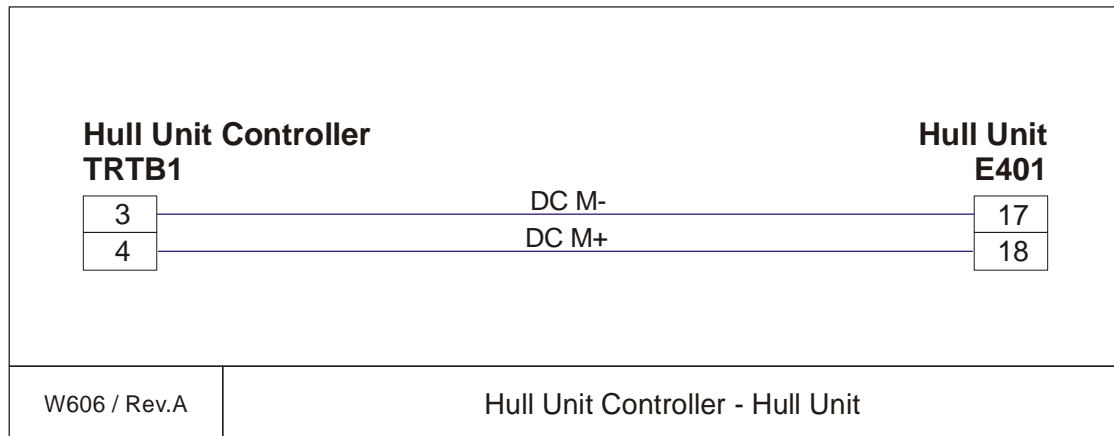
BREF - Synchro reference



Conductors	5 x 1.5 mm ²
Screen	Overall braided
Voltage	750V
Max.diameter	20 mm

Pitch motor power

This cable provides the power lines for the pitch motor. The motor is controlled by a DC voltage with a duty cycle controlling both motor speed and direction. 50% duty cycle brings the motor to full stop.



Conductors	3 x 2.5 mm ²
Screen	Overall braided
Voltage	750V
Max.diameter	20 mm

The feedback from the pitch motor are identified as **Tacho+** and **Tacho-** on a different cable.

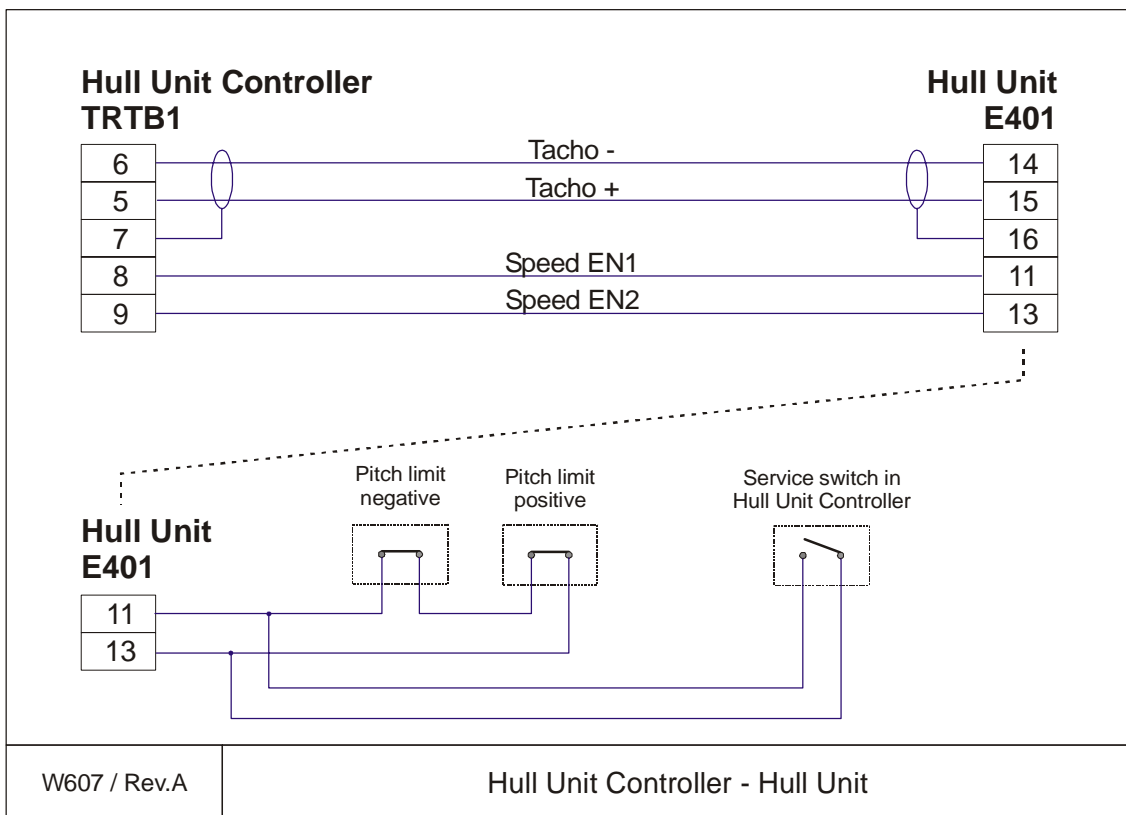
→ Refer to page 83.

Pitch limit and speed information

This cable provides the control signals from the pitch limit switches (positive and negative) as well as the speed information from the pitch motor.

Speed EN - Two switches are implemented to stop the pitch movement if it exceeds the outer limits defined by the software. If one of the two switches is opened, the pitch movement will stop altogether, and you need to use the service switch in the Hull Unit Controller to restart it.

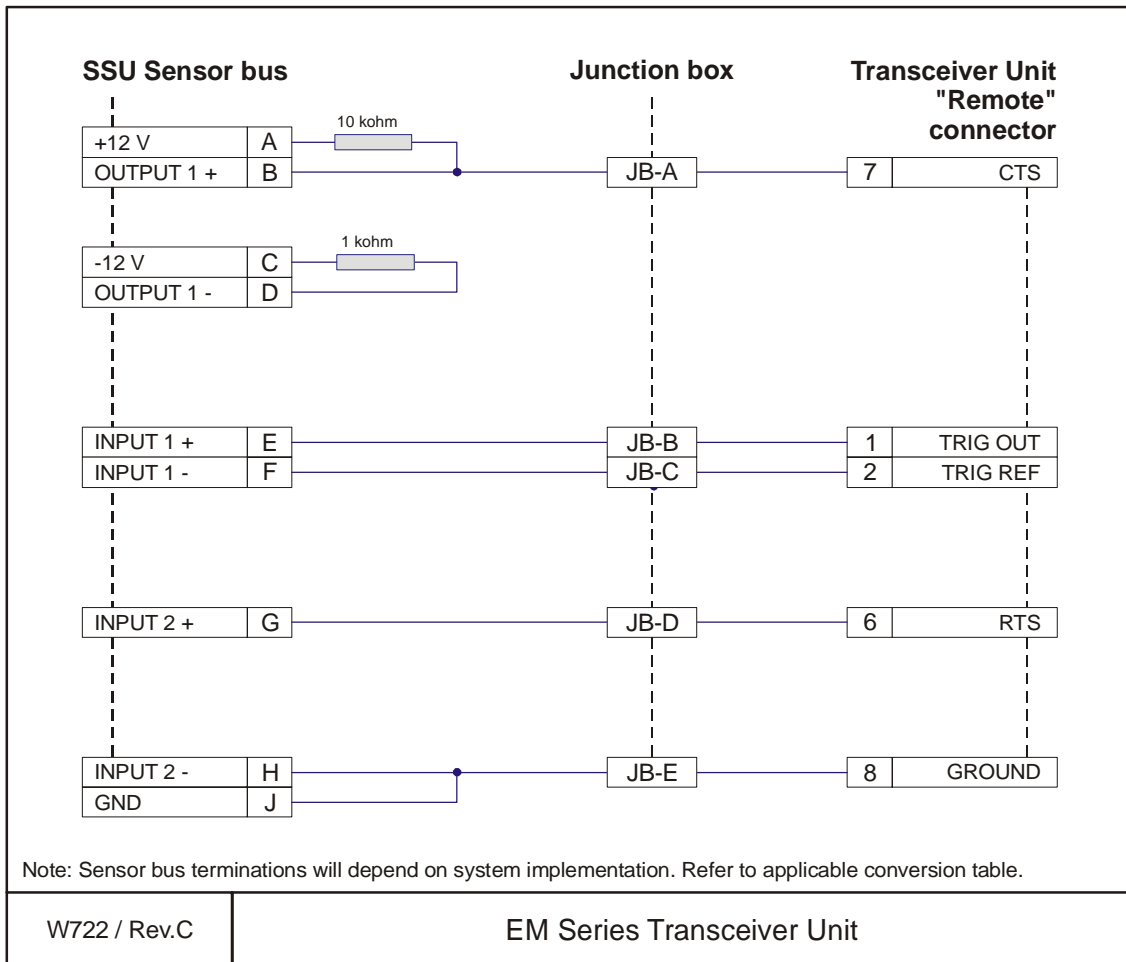
Tacho - Speed information from the pitch motor.



Conductors	2 x 2 x 0.5 mm ²
Screen	Overall braided
Voltage	60V
Max.diameter	15 mm

Synchronisation: EM Series transceiver

This cable provides the control signals between the Synchronisation System and any of the EM Series transceivers; EM 120, EM 300 and EM 1002.



The terminations on the sensor bus and in the junction box will be different for every system implementation. Refer to the applicable conversion table(s) for further details.

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

3.7 System cabling

Cable layout

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

Shipyard and system cables

General

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

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

Shipyard cables

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

For each cable, the following information is provided:

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

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

System cables

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

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4 TRANSCEIVER UNIT 125-211814

4.1 Description and main functions

Overview

The EM 1002 Transceiver Unit performs the reception, data acquisition, received signal processing and transmission for the multibeam echo sounder system. The cabinet holds two wired racks containing the system circuit boards.

- The top **Processing Rack** holds the complete Processing Unit with its own power supply. This unit provides data acquisition, signal processing and function control.
- The bottom **Receiver Rack** holds the receiver and transmitter boards, a controller, two power supplies and a large capacitor bank.

Two different versions of the Transceiver Unit have been delivered. The registration number of the Transceiver Unit will determine which version you have:

125-211814, *more information on page 88.*

125-218141, *more information on page 136.*

This number is to be found on the Transceiver Unit chassis.

All versions are described in this manual. Please check your Transceiver Unit to find out which version you have.

4.2 Transceiver Unit 125-211814

- *Description and main functions, page 87.*
- *Transceiver Unit outline, page 89.*
- *Theory of operation, page 94.*
- *Processing rack, details, page 97*
- *Receiver rack, details, page 98.*
- *Circuit board descriptions, page 99.*

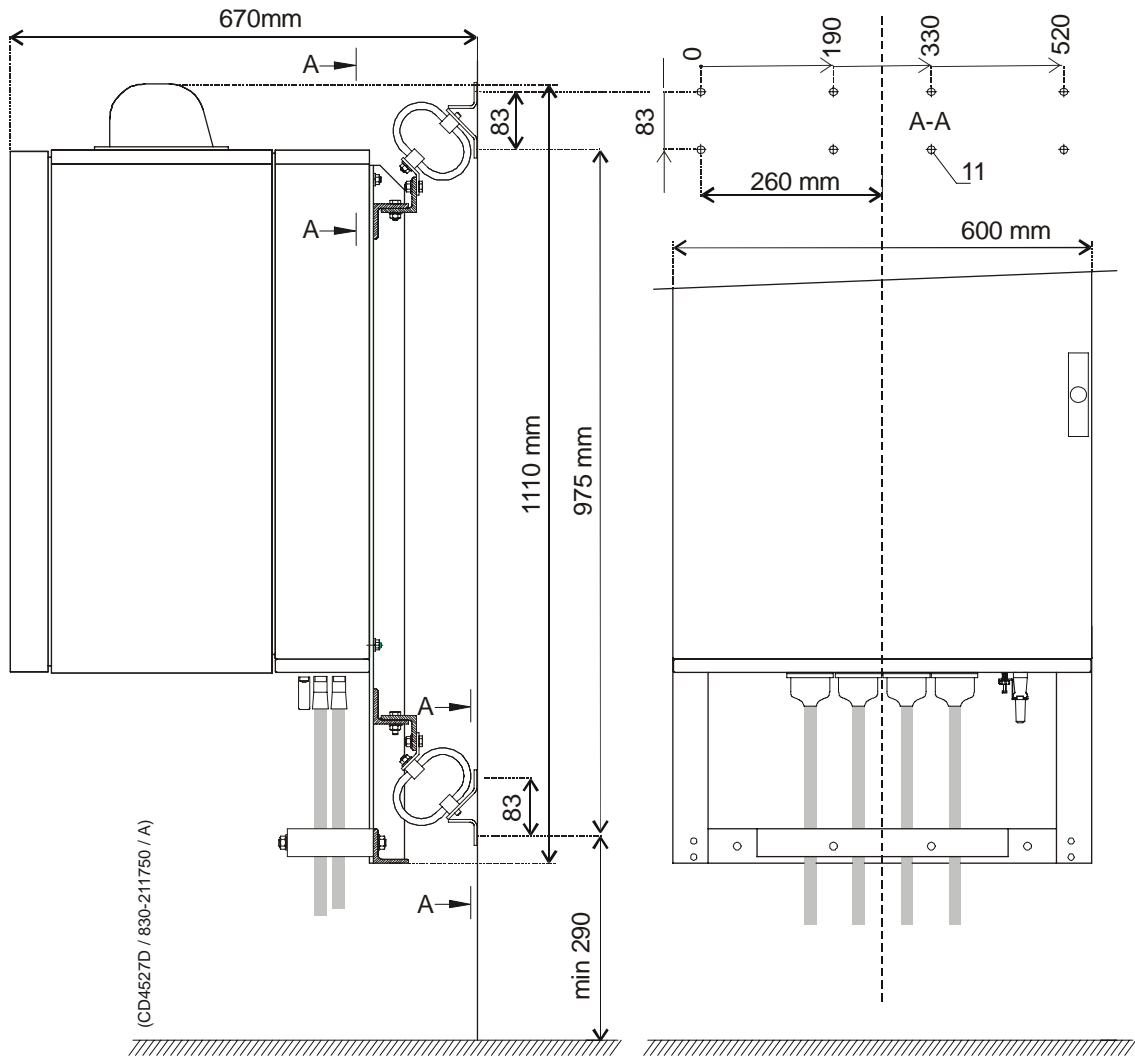
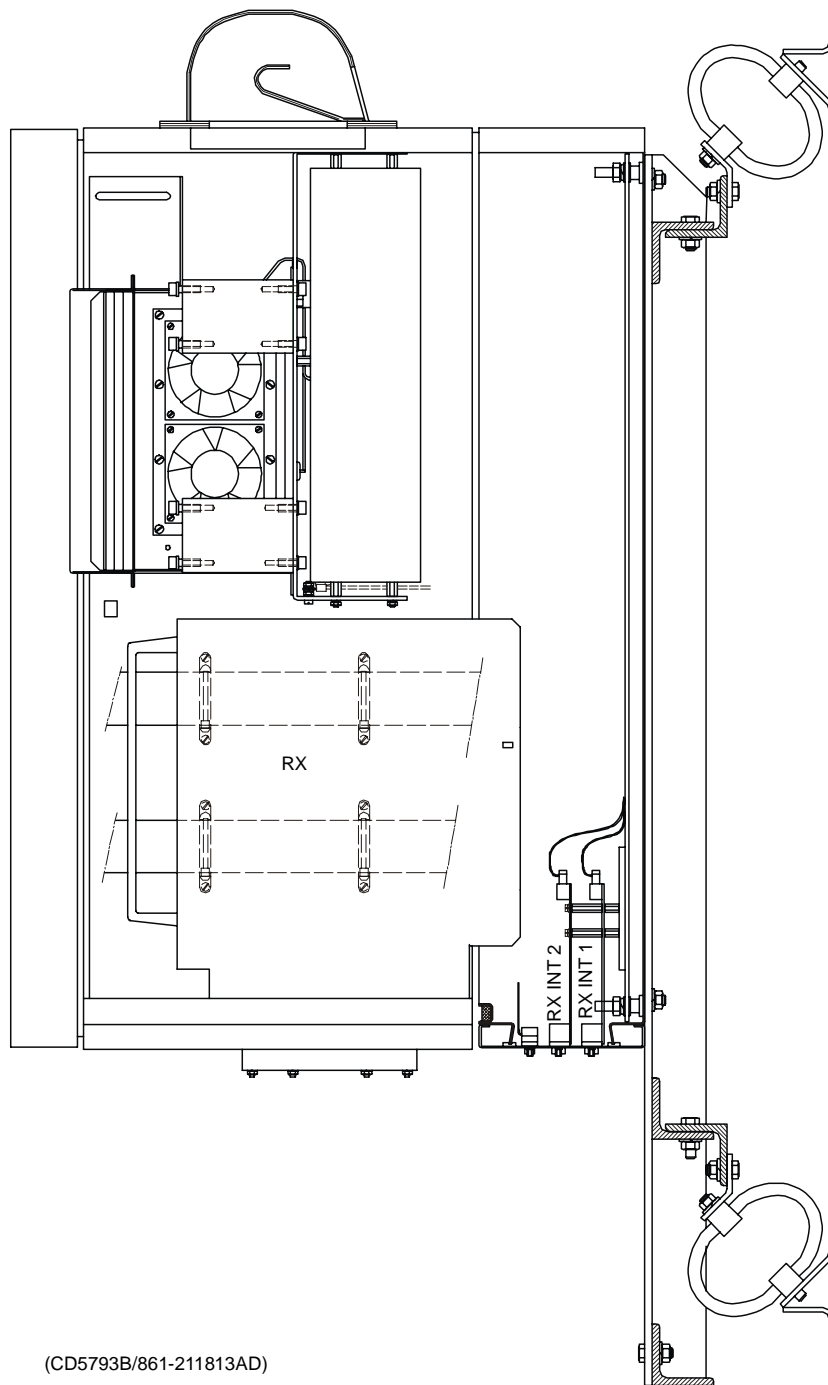


Figure 17 Transceiver Unit, dimensions



(CD5793B/861-211813AD)

Figure 18 Wired Cabinet. Subassembly, Transceiver Unit

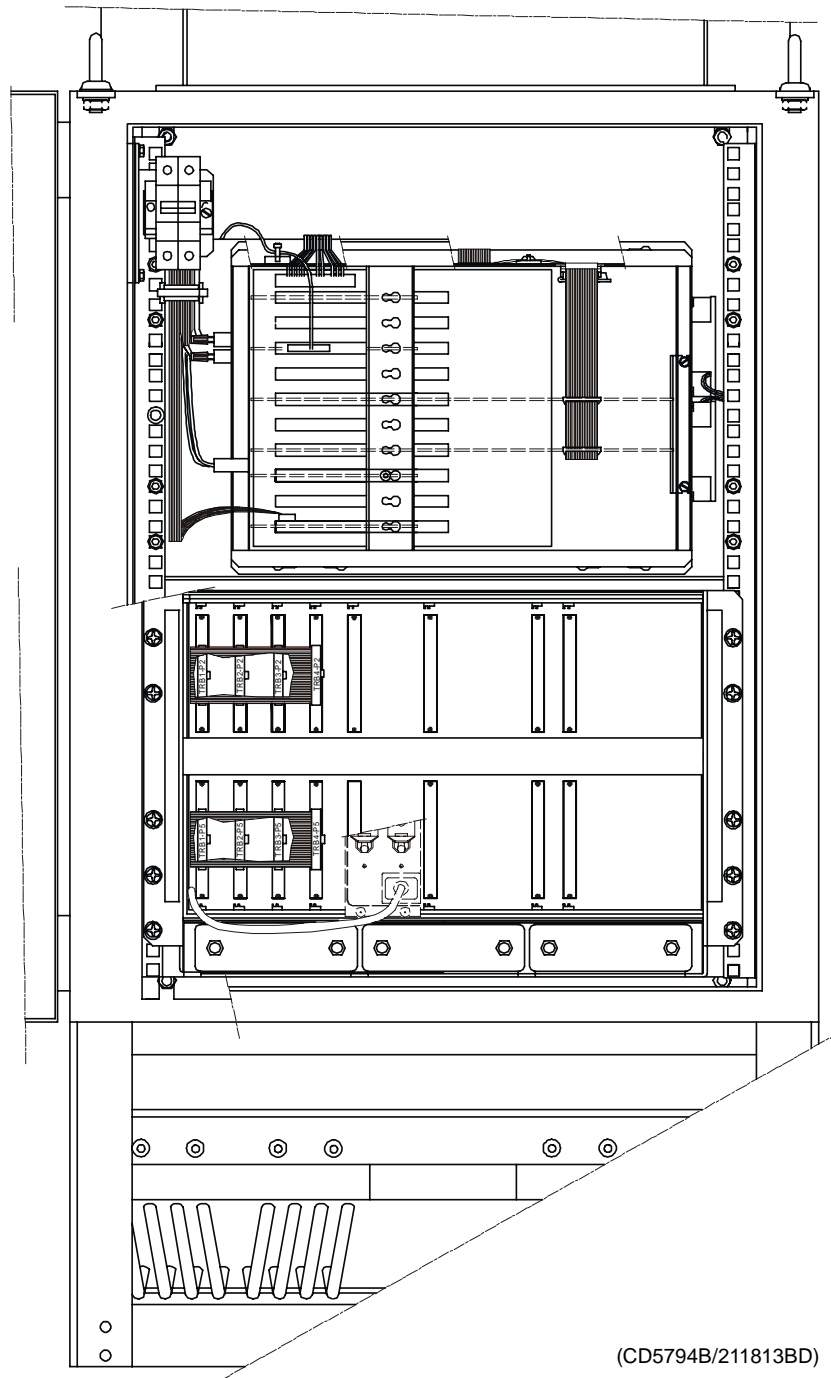


Figure 19 Wired rack, Transceiver Unit

The Processing Rack

The Processing Rack is located at the top of the Transceiver Unit. It holds a chassis with several circuit boards, fans and a power supply. A ground strap and a circuit breaker for the power supply is also available, but these are mounted on the main rack, and not on the shelf.

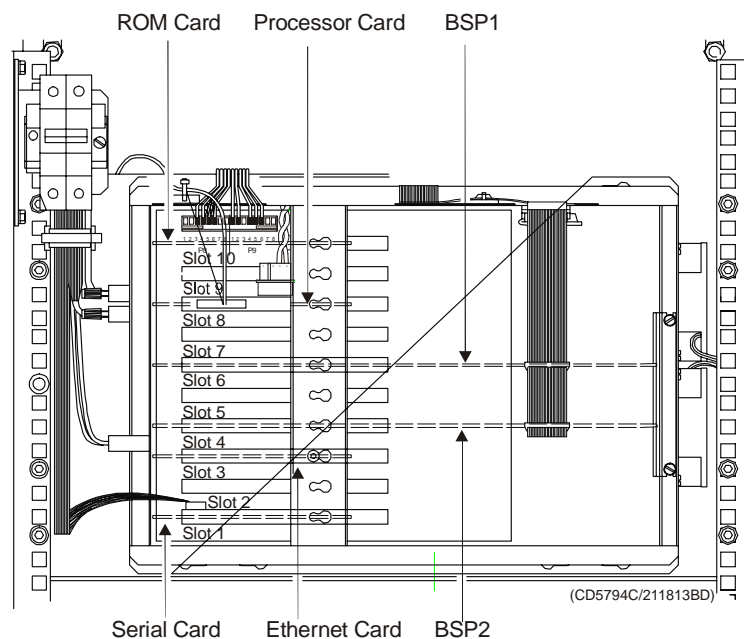
The Processing Rack holds the following circuit boards and modules:

- 4-Ports Serial Line board
- Beamformer & Signal Processor (BSP1 and BSP2)
- Ethernet Adapter
- ROM board

On newer systems, made after summer 2001, the ROM board has been replaced with a DiskOnModule flash disk / DiskOnFlash module mounted on the Control Processing Unit board. The ROM board will be replaced on older systems too.

- Control Processing Unit board
- Power supply
- Fan
- Motherboard

→ *A more detailed description of all the circuit boards and modules is found on page 97.*



The Receiver Rack

The Receiver Rack is located at the bottom of the Transceiver Unit. It holds several circuit boards, power supplies and a capacitor bank. All the units are accessed from the front of the rack.

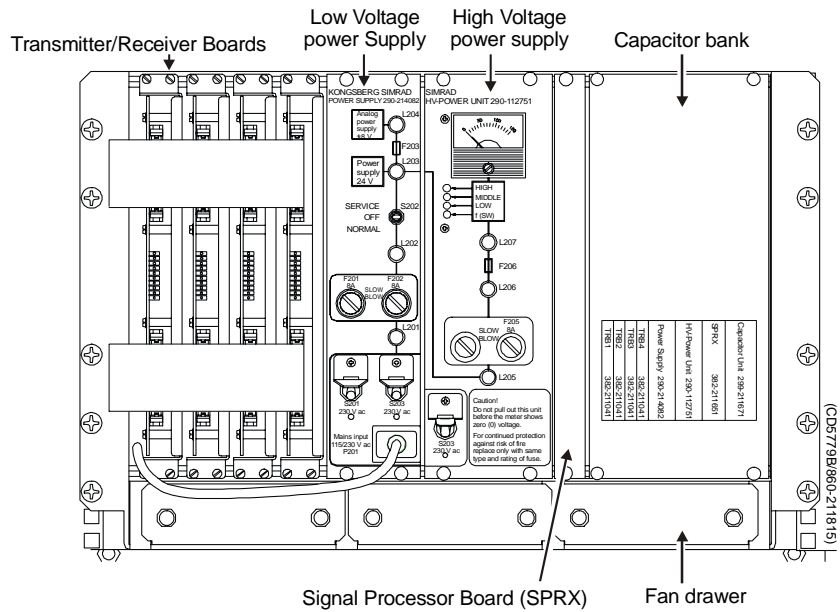


Figure 20 The Receiver Rack

The Receiver Rack holds the following circuit boards and modules (from left):

- TRB 32/Receiver/Transmitter board (max 4)
- Low Voltage Power Supply
- High Voltage Power Supply
- Signal Processor Board RX (SPRX)
- Capacitor bank

→ A more detailed description is found on page 98.

4.3 Theory of operation

Overview

This chapter presents a functional description of the Transceiver Unit.

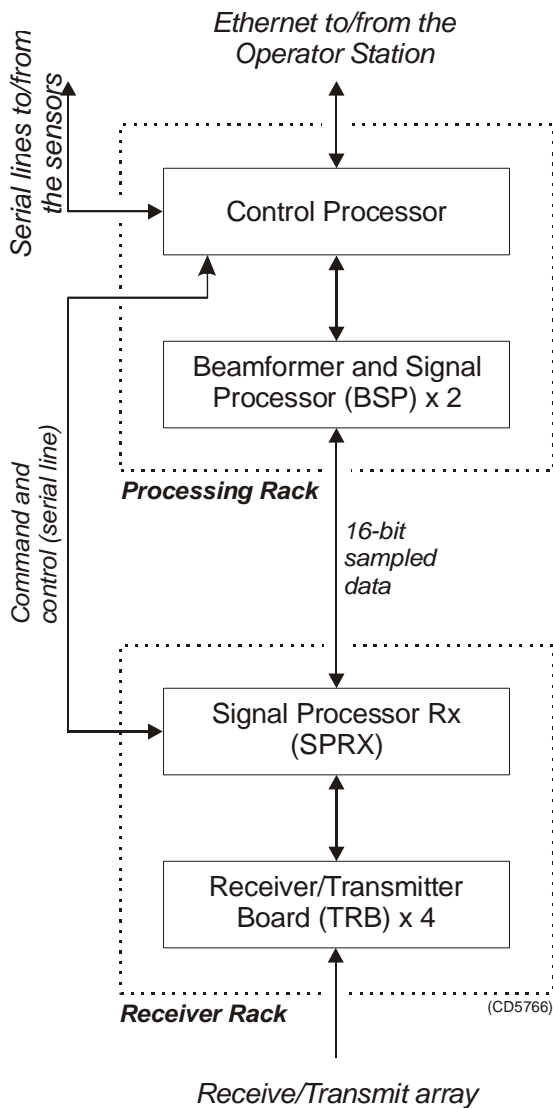


Figure 21 Transceiver Unit, simplified block diagram

Simplified block diagram

The simplified block diagram for the Transceiver Unit presents the following main functions:

- Transmission
- Reception
- Processing

The various parameter settings made on the Operator Station are sent to the Control Processor in the Processing Rack. The information is interpreted, and passed on to the Signal Processor RX (SPRX) in the Receiver Rack.

After the transmission, the Signal Processor RX (SPRX) receive the echoes, and pass them to the two Beamformer and Signal Processors (BSP) in the Processing Rack.

Control functions

The control functions in the Transceiver Unit are mainly handled by the two processor boards, but additional peripheral boards are also used. The majority of the control boards are contained in the Processing Rack.

Reg.no. 125-211814 (with PROM)

The Control Processor in the Processing Unit is not equipped with interface capabilities, and thus requires external boards to handle ethernet and serial lines interface. It also relies on an external memory board for the software contained in the ROM device. All the peripheral boards used here are commercial.

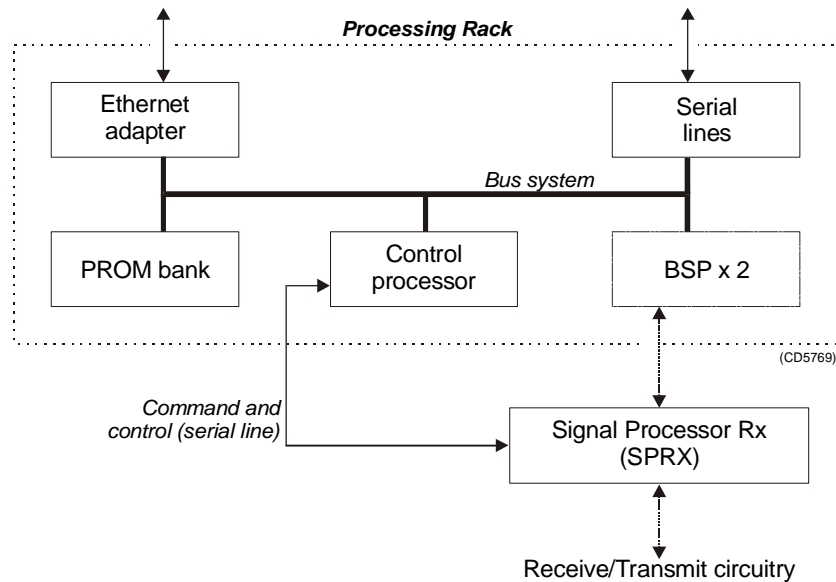


Figure 22 The control functions for 125-211814 with PROM

Reg.no. 125-211814 (without PROM)

The Control Processor in the Processing Unit is not equipped with interface capabilities, and thus requires external boards to handle ethernet and serial lines interface.

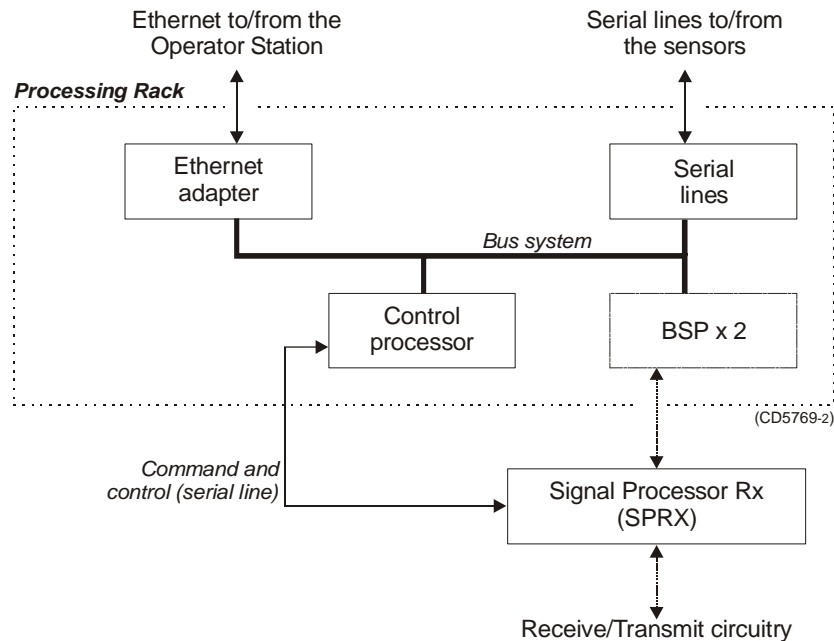


Figure 23 The control functions for 125-211814 without PROM

External synchronisation

The serial line RTS and CTS signals are used for external synchronisation. In addition a trig out signal is issued by the TRU.

Levels:

RTS, CTS:

H=high= +3 to +15 V

L=low= -3 to -15 V

Trig out:

TTL Level

Outputs from TRU:

Trig out=1 TX is off(High TTL level)

Trig out=0 TX is active(Low TTL level)

RTS=H TRU is ready for a new ping

RTS=L TRU is not ready

RTS is pin 7 on the CPU card D connector. (Pin 6 on EM120 and EM300 "remote" plug).

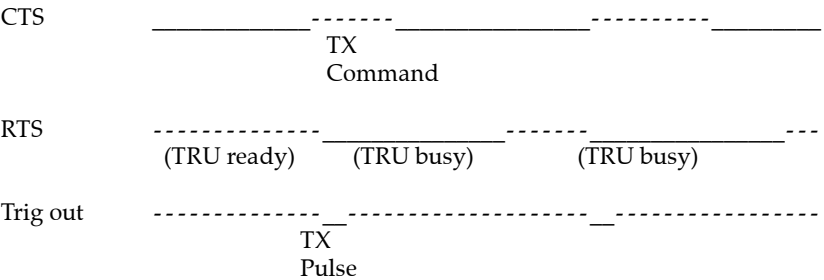
Inputs to TRU:

CTS=H Ping command
CTS=L Wait

CTS is pin 8 on the CPU card D connector. (Pin 7 on the EM120 and EM300 “remote” plug). The CTS pulse length must be minimum 30 milliseconds.

Gnd is pin 5 on the CPU card D connector. (Pin 8 on EM120 and EM300 “remote” plug).

Typical sequence:



When the TRU is ready for a new ping, RTS is set to H. When the external device is ready for a new ping, CTS shall be changed to H. The TRU will then start a ping, change RTS to L (busy), and the Trig out will be low during the transmit pulse. After the Trig out is received, the external device should turn CTS to L. (Or at least keep it high for 35 milliseconds).

When the received period is finished and the TRU is ready for a new ping, the RTS will be changed to H, and the TRU will wait for new trigger (a high level on CTS).

If CTS is H all the time, or if external sync in the installation menu is switched off, the TRU will ping at its maximum rate.

One serial line is used to interface the command and control signals to and from the RX controller.

4.4 Processing rack details

Location

The Processing Rack is located at the top of the the Transceiver Unit. It holds a chassis with several circuit boards, fans and a power supply. A ground strap and a circuit breaker for the power supply is also available, but these are mounted on the main rack, and not on the shelf.

Circuit boards and modules

4-ports Serial Line Board

This is a commercial circuit board. It provides the Transceiver Unit with four serial lines.

→ *The interface board C114P is explained on page 101.*

Beamformer & Signal Processor (BSP)

These are the main processing boards in the Transceiver Unit.

→ *The circuit board is explained on page 113.*

Ethernet Adapter

This is a commercial circuit board. It provides the Transceiver Unit with the ethernet communication to the Operator Station.

→ *The circuit board is explained on page 104.*

ROM board

This is a commercial ROM (Read Only Memory) board.

→ *The circuit board is explained on page 103.*

Control Processor Unit board (CPU)

This processor board acts as a function controller. It might hold a DiskOnModule flash disk.

→ *The circuit board is explained on page 108.*

Power supply

It contains four analogue power supplies. They are all located on the rear of the Processing Rack.

→ *The power supply is explained on page 116.*

Motherboard

This is a commercial circuit board.

→ *The circuit board is explained on page 117*

Fan

The fan is located on the right side of the Processing Rack, when seen from the front.

4.5 Receiver rack details

Location

The Receiver Rack is located at the bottom of the the Transceiver Unit. It holds several circuit boards, power supplies and a capacitor bank.

Circuit boards and modules

Transmitter/Receiver board

These four boards hold the amplifiers for all the individual RX channels and all the individual TX channels.

→ *The circuit board is explained on page 118.*

Low Voltage Power Supply

This is a commercial linear power supply mounted on a chassis for easy replacement. It also contains linear supplies for the TRB's.

→ *The Low Voltage Power Supply is explained on page 120.*

High Voltage Power Supply

This is a switching power supply. It provides the high output voltage for the transmitters, and uses the Capacitor bank to store the energy between the pings.

→ *The High Voltage Power Supply HVPU is explained on page 123.*

Signal Processor Board RX (SPRX)

The processor board is used as a function controller. This is a common circuit board whose name is SPB31.

→ *The Signal Processor Board is explained on page 124.*

Backplane (RXBP)

The Receiver Rack uses a passive backplane. All connections to the circuit boards (except transmission signals) are made on this backplane.

→ *The RX Backplane is explained on page 130.*

Capacitor bank

This unit stores transmission energy temporarily.

4.6 Circuit board descriptions

Overview

This chapter describes all the circuit boards and modules in the EM 1002 Transceiver Unit. A functional description with a block diagram is provided, as well as the facilities provided for maintenance.

Remember that all versions of the Transceiver Unit is in this manual. Different boards and power supplies are therefore described for the EM 1002 system. Check the reg.no. on your Transceiver Unit to find out which version you have.

4-Ports Serial Line Board (C114P)

Purpose and description

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

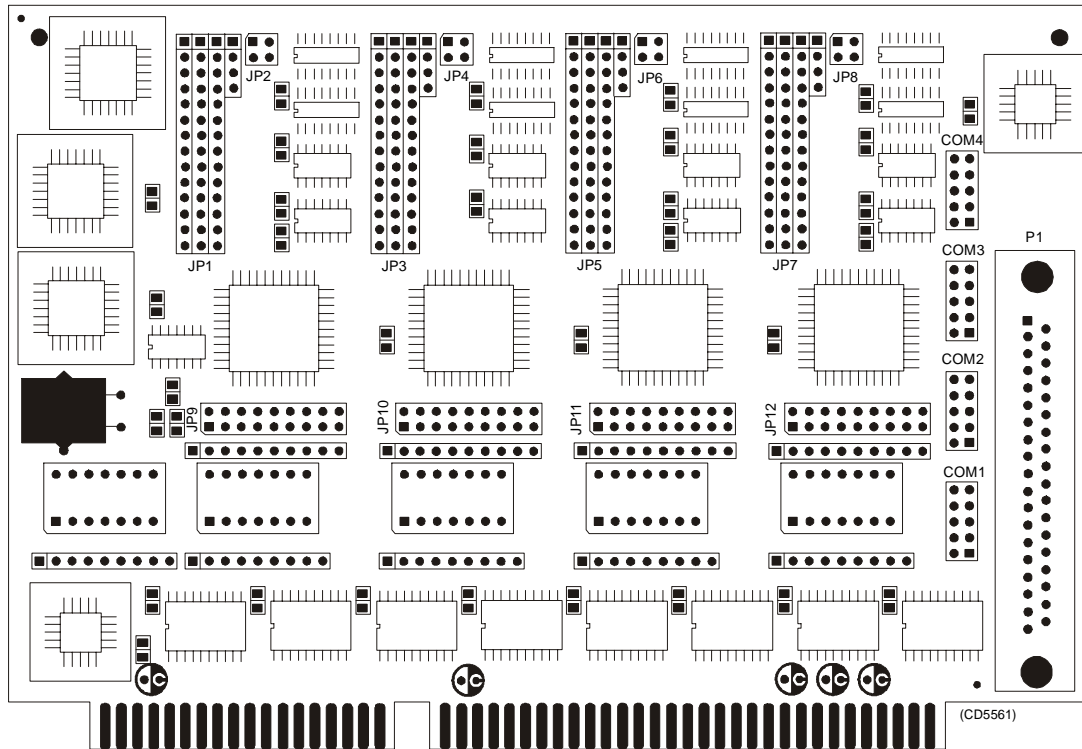


Figure 24 The C114P layout

How it works

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

Facilities

LEDs

None.

Jumpers

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

Links**Note**

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

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

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

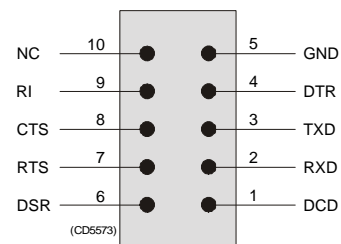
Connections

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

→ Refer to figure 25 for pin assignments.

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

Figure 25 10-pin header connector pin assignment



ROM board

Purpose and description

The ROM (Read Only Memory) board is an ISA bus card that adds an EPROM socket to a PC motherboard. This is a commercial circuit board designed and produced by Blunk Microsystems. The ROM board is located in the processing rack.

It provides a means of auto-starting embedded applications. If a properly formatted EPROM is installed, the BIOS will recognize the EPROM during its ROM scan and pass control to it after completing the power-up tests. The ROM board uses one 27010, 27020 or 27040, booting applications as large as 128K, 256K or 512K, respectively.

Facilities

LEDs

None

Test points

None

Links

Jumper	Base Address
1-8	CE000
2-7	CE800
3-6	CF000
4-5	CF800

When used in EM 1002, the default settings for the ROM board are jumpers 2-7, and base address CE800.

Ethernet Adapter

Purpose and description

This is a 16-bit ISA adapter designed and produced by 3Com, identified as 3C509B-COMBO. The purpose of the adapter is to connect the transceiver unit to the operator unit. The circuit board is located in the Processing Rack.

The Etherlink III adapter has the following features:

- Hardware Plug and Play support, which automatically configures ISA bus resources without user intervention.
- AutoLink auto installation software, which installs all “Novell NetWare DOS ODI” client software into your operating system.
- Auto Select Media Type capability, which enables certain drivers to automatically detect the type of media connector that connects the adapter to the network.
- Backward compability with existing (3C509B) EtherLink III ISA adapter drivers.
- Network management support through “Transcend Etherlink SmartAgent” software, which is auto-installed with the drivers.

How it works

The cable types and connector specifications in the Ethernet Adapter are:

- 10BASE5 thick Ethernet coaxial, 10BASE2, fibre etc. with an AUI connector.
- 10BASE2 thin Ethernet coaxial with a BNC connector.
- 10BASE-T, twisted-pair cable with a RJ-45 connector.

→ *The 3C509B-COMBO edge connectors is shown in figure 26.*

The 3C509B-COMBO has a LED for the link beat. This LED confirms that there is an active connection between the adapter and the hub. The thin ethernet segment is terminated at both ends with a 50 Ω terminator.

The maximum bus speed supported by the Ethernet Adapter is 10 MHz.

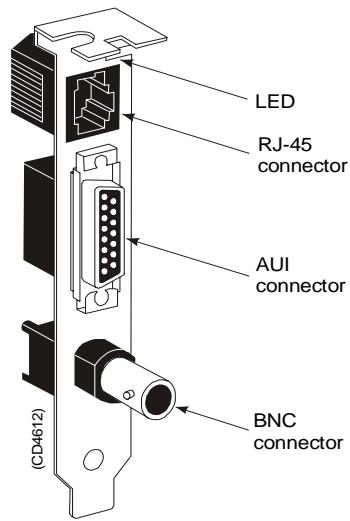


Figure 26 The 3C509B-COMBO backplate with its connectors

Facilities

LEDs

Confirms that there is an active connection between the adapter and the hub.

- If the LED is on, the link beat is working. (The connection is correct).
- If the LED is off, the link beat has not been established or there is a problem with the connection between the adapter and the hub.
- If the LED is blinking, the cable polarity is reversed.

→ *See figure 26*

Connections

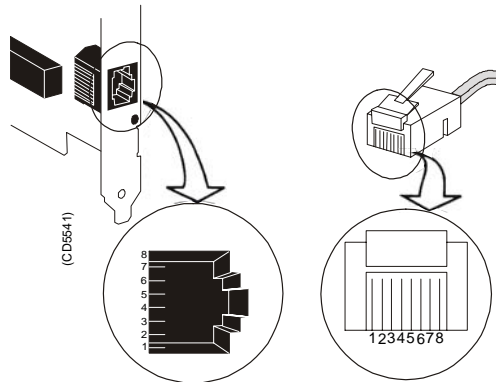
The internal wiring gives access to the BNC and RJ45 connections at the bottom plate of the Transceiver Unit.

Setup of the board

If the type of ethernet cable is known at delivery time, the board is set up accordingly. If not, the board is set up for 10BASE-T (RJ-45).

It is difficult to reconfigure the board on site. (A PC with ISA-bus and special software is needed).

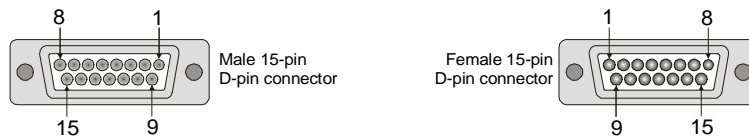
→ *Refer to figure 27 og and figure 28 for detailed description.*



RJ45 plug			RJ45 plug	
1		TX Data + (White/Orange)		1
2		Tx Data - (Orange)		2
3		Recv Data + (White/Green)		3
4		(Blue)		4
5		(White/Blue)		5
6		Recv Data - (Green)		6
7		(White/Brown)		7
8		(Brown)		8

Ethernet 10Base-T "Straight Through"

Figure 27 RJ-45 Connector pin assignments



Ethernet socket			Remote system	
1		Collision shield		
2		Collision (+)		
3		Transmit (+)		
4		Receive shield		
5		Receive (+)		
6		Power return		
7		Not used		
8		Not used		
9		Collision (-)		
10		Transmit (-)		
11		Transmit shield		
12		Receive (-)		
13		+12 V		
14		Voltage shield		
15		Not used		

(CD5542) Connect to connector housing

Figure 28 The AUI connector pin assignment

Control Processor Unit board

Purpose and description

This circuit board is an ISA Half-sized Single Board Computer delivered by ICP. It is equipped with a 486 CPU and advanced high performance multi-mode I/O. There are two variants of the circuit board that might be placed in the system. These are identified as:

- SSC-486H

or

- SSC-5x86H

Both of them are explained in this chapter. The Control Processor Board is located in the Processing rack.

Specifications

The Half-sized Single Board Computers SSC-486H and SSC-5x86H provides the following specifications:

	SSC-486H	SSC-5x86H
CPU	486SX/DX/DX2 or DX4	486SX/DX/DX2/DX4 or Cyrix/AMD 5x86
Bus	PC/104 bus	ISA bus and PC/104 bus
DMA channels	7	7
Interrupt levels	15	15
Chipset	UM8498F and UM8496	M1489 and M1487
Real-time clock/calendar	DS-12887 chip and quartz oscillator, 128B CMOS memory, powered by lithium battery for over 10 years of data retention.	DS-12887 chip and quartz oscillator, 128B CMOS memory, powered by lithium battery for over 10 years of data retention.
RAM memory	1MB to 64MB	1MB to 64MB, EDO and standard DRAM supported.
IDE hard disk drive interface	Up to two IDE hard drives.	Up to two PCI Enhance IDE hard drives.
Floppy disk drive interface	Two 2.88MB, 1.44MB, 1.2MB, 720KB or 360KB floppy disk drives.	Two 2.88MB, 1.44MB, 1.2MB, 720KB or 360KB floppy disk drives.
High speed serial ports	Two NS16C550 compatible UARTs	Two NS16C550 compatible UARTs
Bi-directional Parallel Port	Yes	Yes

	SSC-486H	SSC-5x86H
Watch-dog timer	Can be set by 1, 2, 10, 20, 110 or 220 seconds period. Reset or NMI was generated when CPU did not periodically trigger the timer. Your program use hex 043 and 443 to control the watch-dog and generate a system reset.	Can be set by 1, 2, 10, 20, 110 or 220 seconds period. Reset or NMI was generated when CPU did not periodically trigger the timer. Your program use hex 043 and 443 to control the watch-dog and generate a system reset.
External power connector	Yes	Yes
Keyboard connector	Yes	Yes
Mouse	PS/2 Mouse Port on-board	PS/2 Mouse Port on-board
Power Consumption	+5V @ 2.5A (486DX2-66, 4MB RAM) +/- 12V @ 20mA (for RS-232 only)	+5V @ 1.75A (5x86-133, 4MB RAM)
Operating temperature	0° ~ 60°C (CPU needs cooler)	0° ~ 60°C (CPU needs cooler)

→ *The set-up procedures for SSC-486H and SSC-5x86H are described on page 238*

Facilities

Jumpers

All the SSC-5x86H- and SSC-486H circuit board's jumpers are preset at the factory. The default settings are listed in the tables.

→ *Refer to figure 29 for different jumper settings.*

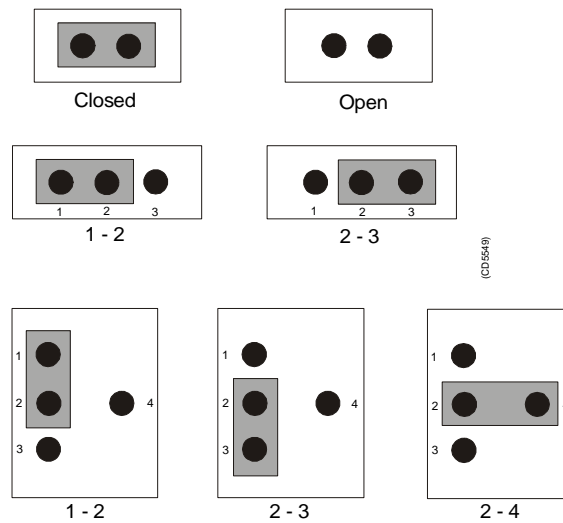


Figure 29 Different applicable jumper settings

The SSC-486H circuit board:

	Jumpers	Settings	Description
SSC-486H CPU	JP1	2 - 3	-
	JP2	1 - 2 3 - 4	-
	JP3	Open	-
	JP4	Open	-
	JP5	1 - 2	-
	JP6	Open	-
	JP7	Open	-
CPU Clock Generator Speed (33 MHz)	JP8	1 - 2 Closed 3 - 4 Closed 5 - 6 Open 7 - 8 Open	-
CPU Voltage (+3.3 V)	JP12	2 - 3	-
	JP24	Open	-
Upgrade the External Cache (128KB, 32K x 8)	JP13	2 - 3	-
	JP14	1 - 2 3 - 4	-
Watch-Dog Timer, Active Type	JP18	1 - 2	Open when WDT time-out
WDT Time-out period (10 sec.)	JP17	1 - 2 Open 3 - 4 Closed 5 - 6 Open 7 - 8 Open	-

	Jumpers	Settings	Description
Parallel Port Interface, Parallel Port Interrupt Setting (IRQ7)	JP22	1 - 2	-
Parallel Port Data Request Setting (DRQ3)	JP20	2 - 3	-
Parallel Data Acknowledge (DACK3)	JP19	2 - 3	-
Serial Port Interface, COM1 Serial Port Interrupt Setting (IRQ4)	JP21	1 - 2	-
COM2 Serial Port Interrupt Setting (IRQ3)	JP23	1 - 2	-
IDE Host Adapter Interface	JP11	Open	IDE IOCHDRY Non-Connected
FDC47C665 Multi-I/O Chipset	JP16	Open	Enable FDC37C665
PS/2 Mouse IRQ Selection (IRQ12)	JP15	Closed	-

The SSC-5x86H circuit board:

	Jumpers	Settings	Description
SSC-5x86H CPU	JP1	2 - 3	-
	JP2	2 - 3	-
	JP3	3 - 4	-
	JP4	3 - 4	-
	JP5	3 - 4	-
	JP6	5 - 6	-
	JP7	2 - 3	-
	JP8	2 - 3	-
	JP9	Closed	-
	JP10	Open	-
CPU Clock (33MHz)	JP11	1 - 2 Closed 3 - 4 Closed	-
	JP12	Open	-
	JP14	1 - 2	-
CPU Voltage (+3.3V)	JP13	2 - 3	-
Watch-Dog Timer, Active Type	JP15	1 - 2	Open when WDT time-out

	Jumpers	Settings	Description
WDT Time-out period (10 sec.)	JP16	1 - 2 Open 3 - 4 Closed 5 - 6 Open 7 - 8 Open	-
DiskOnChip Memory Address	JP17	5 - 6	Address E000
PS/2 Mouse	JP18	Closed	Enable PS/2 Mouse, IRQ12

Connections

COM1 is used for external sync (RTS, CTS). COM1, pin RX/TX, is also connected to the test connector at the Transceiver Unit bottom plate, for debug purposes and factory production testing.

→ Refer to description page 96.

1PPS signal is connected from the parallel port (signal on pin 10, GND (ground) on pin 23) to the bottom plate in the Transceiver Unit.

Beamformer & Signal Processor (BSP)

Purpose and description

The Beamforming & Signal Processing (BSP) board is a multi digital signal processor (DSP) board. It is designed to perform the beamforming and signal processing in sonars and multibeam echo sounders. It is controlled from a host processor.

The processing power in the Beamforming & Signal Processing (BSP) board is based on eight Texas TMS320C50 fixed point digital signal processors working in parallel while beamforming the data. Next, there are four Texas TMS320C44 floating point digital signal processors interconnected to use both parallel and sequential processing of the beamformed data from the fixed point processors.

The Beamforming & Signal Processing (BSP) board is a single slot full length standard ISA format circuit board made to fit into a personal computer.

How it works

The Beamforming & Signal Processing (BSP) board contains four main sections:

- Sonar Input Data
- Beamforming
- Signal Processing
- Host Interface

The **Sonar Input Data** interfaces an 18-bit wide and 1k deep Input FIFO (First-In-First-Out) register. This input FIFO holds the data received from the transducer array through the receiver processing circuitry. A dedicated digital signal processor reads the input FIFO.

There are two identical **Beamforming** digital signal processing branches. Each consists of four digital signal processors and a 16-bit wide and 8k deep dual port memory (DPRAM). The two branches are exchanging data by means of this DPRAM.

The **Signal Processing** section comprises three digital signal processors dedicated to do further processing of the beamformed data.

The **Host Interface** function is maintained by the master processor on the Beamforming & Signal Processing (BSP) board. It exchanges data with the host processor via a 16-bit wide and 8k deep dual port memory (DPRAM) on the ISA bus.

Facilities

LEDs

D1 (LED): C44 D

Test points

There is one test point for each C50 digital signal processor (eight total). These testpoints are all connected to the XF/ signal which is active while that particular C50 access the shared DPRAM.

There is also one test point for each C44 digital signal processor (four total). These test points are connected to the IIOF2/ signal, which is a general purpose I/O port bit that can be controlled by the software.

The C44-D testpoint is also connected to a light emitting diode (D1) for visual observation. The LED will be activated during each ping.

TP1	C50 E0
TP2	C50 E1
TP3	C50 E2
TP4	C50 E3
TP5	C50 F0
TP6	C50 F1
TP7	C50 F2
TP8	C50 F3
TP11	C44 A
TP12	C44 B
TP13	C44 C
TP14 (& D1)	C44 D

The testpoints will be active when the corresponding processor is working.

Links

A number of links are implemented on the board to allow for several different applications. Links LK1, LK2 and LK3 are used to identify the board as one out of maximum eight boards in one system.

LK3	LK2	LK1	BSP ID
0	0	0	BSP 0
0	0	1	BSP 1
0	1	0	BSP 2
0	1	1	BSP 3
1	0	0	BSP 4
1	0	1	BSP 5
1	1	0	BSP 6
1	1	1	BSP 7

Link applications

The following links are ON (closed) in this application:

- BSP0 is the master processor (no links).
- BSP1 is the slave processor (link LK1).

Switches

There are no switches on the board.

Connections

The Beamforming & Signal Processing (BSP) holds the following plugs and sockets:

P1	Sonar input data
P2	ISA bus component
P3	Emulator
P4	Direct memory access
P5	External communication port
P6	Test access port
P7	External communication port

The P1, sonar input data, is connected to BIFB via a flat cable plug.

Processing Unit Power Supply

Purpose and description

The purpose of the power supply is to feed 5 Vdc and 12 Vdc to the Processing Rack. It is located on the rear side of the Processing Rack, hidden behind a cover plate.

The Processing Rack contains four analogue power supplies (OLS-24C, OLD-12/15BB and two OLS-5NV). The purpose of those is to feed power to the circuit boards in the Processing Rack, respectively 5 Vdc and 12 Vdc.

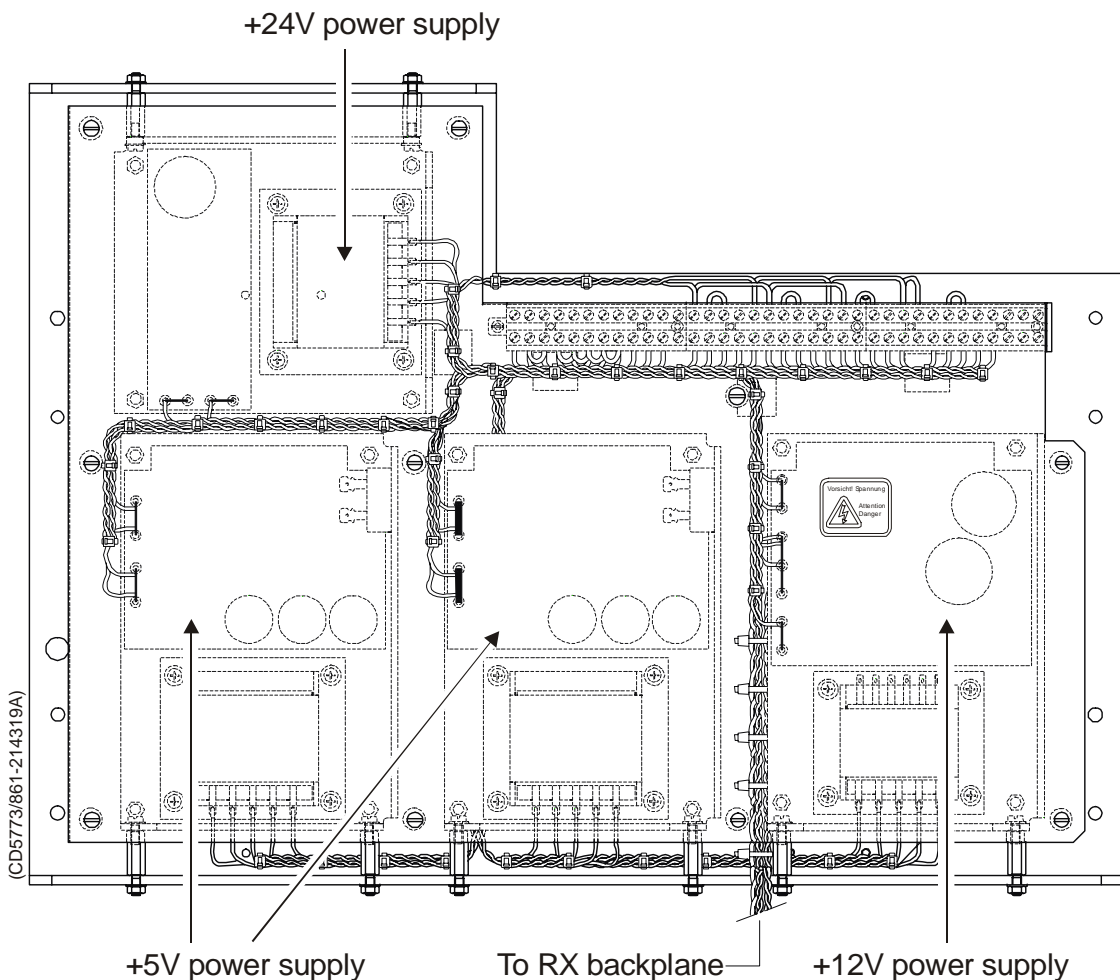


Figure 30 Power supplies on the rear panel.

How it works

This is a commercial linear power supply that feeds 5 Vdc and 12 Vdc to the Processing Rack. It also feeds 5 Vdc, 12 Vdc and 24 Vdc to the Receiver Backplane.

Motherboard

How it works

This is a passive backplane with standard ISA-bus.

Facilities

LEDs

The board has four LEDs:

- + 5V
- - 5V
- + 12V
- - 12V

- 5V is not used and is not lit. The three others should be lit at all times.

Test points

None

Links

None

Connections

+ 5V, + 12V and - 12V.

Transmitter/Receiver Board (TRB)

Purpose and description

The purpose of the Transmitter/Receiver Board (TRB) is to transmit and receive to and from 32 individual channels.

The TRB is fastened to a combined strengthening plate and heat sink which covers the entire component side of the board and also forms a “front panel” to the board. The board is located in tracks within the Transceiver Unit to ensure correct location, and is held in position by four screws.

The TRB has two 34-pin connectors on its front edge which carry the signals to and from the transducer.

How it works

Transmission

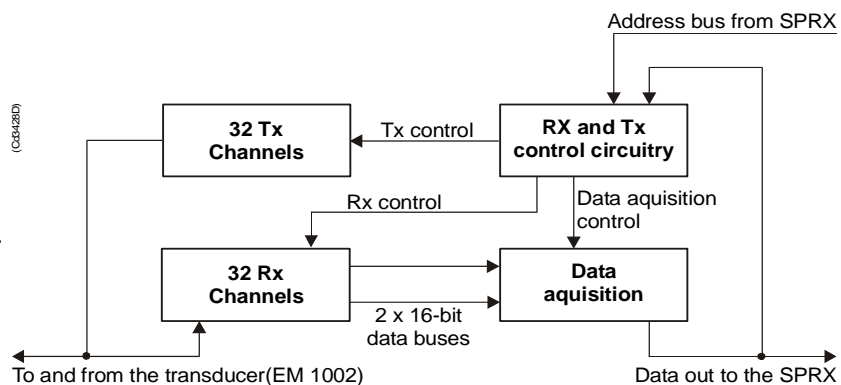
The TRB contains a control interface that controls the 32 transmitters on the board.

Technical details

Dimensions (Width x Height x Depth)	220 x 233.35 x 0.32 mm
Analogue input/output	32 channels, 60W, + T/R switch
Connectors	Two 96-pin euro on back edge of board Two 34-pin flat cables on front edge
Analogue to digital	12-bits resolution I/Q simultaneously converted to 32-bit latched bus
Power requirements	+ 5 Vdc, 8 Vdc, + 24 Vdc

The ± 8 Vdc and 24 Vdc is supplied by the Low Voltage Power Supply (LVPS). The + 5 Vdc is supplied by the Processing Unit (PU) Power Supply.

Figure 31
Transmitter/Receiver
(TRB)
block diagram



Facilities

Test points

The test points listed below are available to assist the maintenance engineer. They are located on the front edge of the board between the two connectors, in front of the corresponding LED.

AVCC4	+ 5 V
AVCC analogue voltage	+ 5 V
AVDD analogue voltage	+ 15 V
VCC digital voltage	+ 5 V
AVEE analogue voltage	- 5 V
HV1 high voltage transmitter	+ 13 - + 130 V
HV2 high voltage transmitter	+ 13 - + 130 V
HV3 high voltage transmitter	+ 13 - + 130 V
HV4 high voltage transmitter	+ 13 - + 130 V
TX transmitter indicator	TX pulse

Links

The TRB holds no links that can be set by the maintenance engineer.

Switches

The TRB holds no switches that can be adjusted by the maintenance engineer.

LEDs

The TRB holds ten red LEDs on its front edge, mounted in a vertical line between the connectors. When these LEDs are lit, they indicate the presence of the corresponding voltage levels.

Connectors

The TRB carries four connectors, two located at each end of the board. P1 is a 96-pin, male right-angled euro-connector, located on the rear edge of the board, carrying power. P2 is a 96-pin, male, right-angled euro-connector, also located on the rear edge of the board, carrying power and digital control signals. P3 and P4 are 34-pin, male, right-angled connectors with ejector/latch, located on the front edge of the board. Each connector carries 16 input/outputs to the transducer/preamplifier.

Low Voltage Power Unit (LVPU)

Purpose and description

The purpose of the Low Voltage Power Unit (LVPU) is to supply power to all the modules in the Transceiver Unit, except the high voltage power for the transmission, power to PU and $\pm 12\text{Vdc}$.

The Low Voltage Power Unit is located between the Transmitter/Receiver Boards and the High Voltage Power Supply in the Receiver Rack. The power supply is a plug-in module. It has two front mounted fuses, one service switch, and one switch to select 115 or 230 Vac mains input.

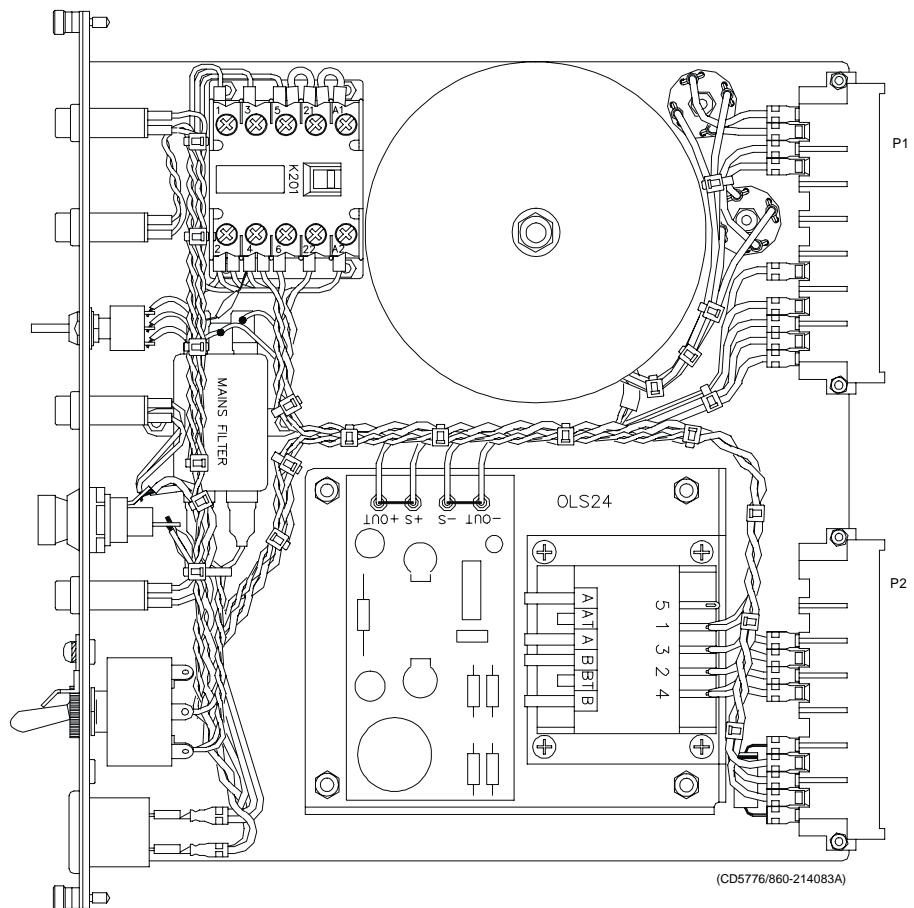


Figure 32 The Low Voltage Power Supply

How it works

The power unit contains two separate power supplies. The output of the stand-by power supply is 24 Vdc.

The power unit has a service switch. When this is set to normal, the power supply is controlled by the on/off relay. This relay is remote controlled from a switch in the operator room. When you disengage the relay, you can control the power supply manually from the Transceiver Rack using the service switch. It is then possible to activate parts of the system (service mode).

The transformers and rectifiers function is to provide 8 Vdc output for the receivers either we have 115 Vac or 230 Vac input.

The LVPU also supplies + 5 V to several boards. See figure below.

→ Refer to the block diagram in figure 33.

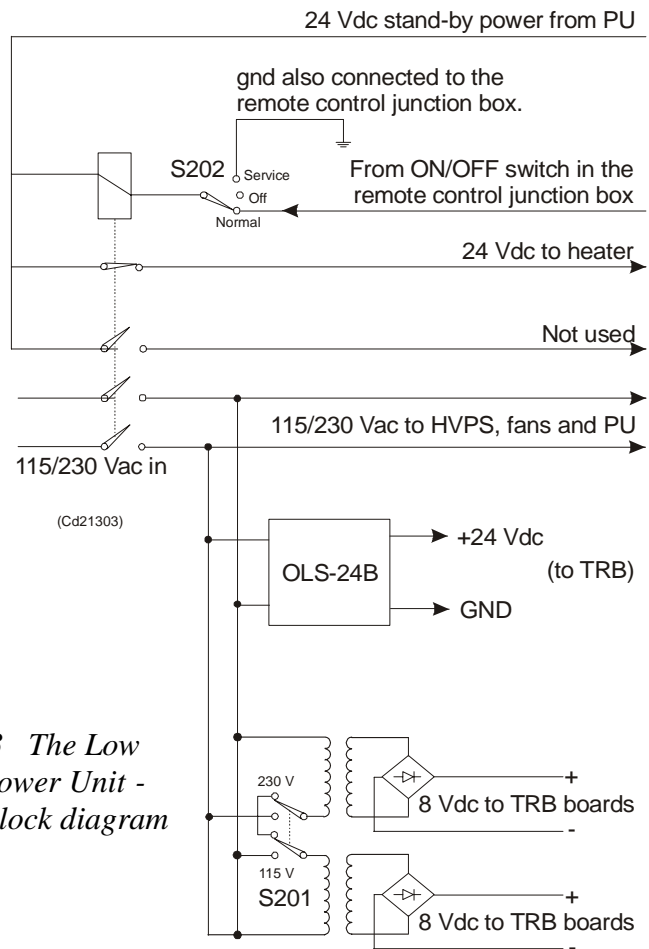
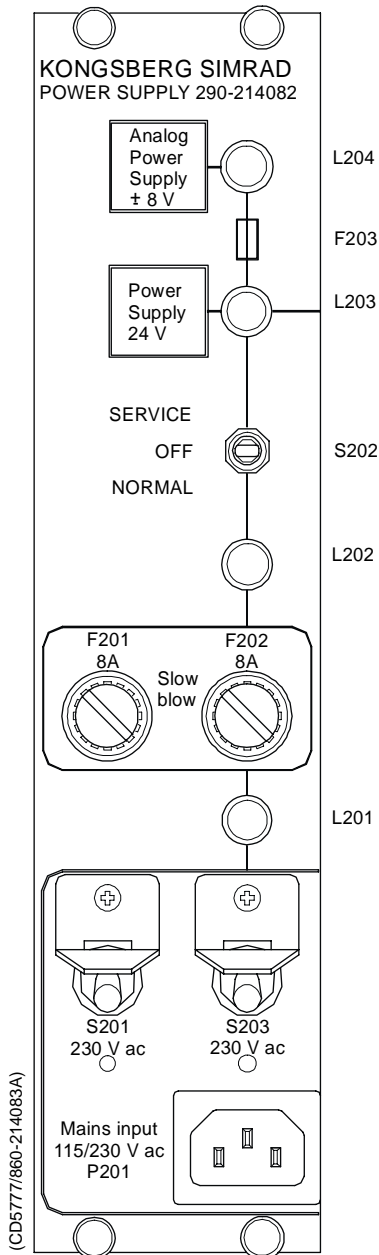


Figure 33 The Low Voltage Power Unit - simplified block diagram



Facilities

LEDs

- L201: Indicator for mains input
- L202: Indicator for 24 Vdc stand by mode
- L203: Lit to indicate AC supply to switched and analogue
- L204: Lit to indicate AC supply to analogue power.

Test points

None

Links

None

Switches

- S201: Switch for mains input 115/230 Vac
- S202: Service/Off/Normal switch

Connections

- P1
- P2

Fuses

- F201: Primary fuse
- F202: Primary fuse
- F203: Thermostat fuse inside the torodial transformer

High Voltage Power Unit (HVPU)

Purpose and description

The purpose of the High Voltage Power Unit (HVPU) is to provide the power for the output amplifiers.

The input to the system is 85 to 265 Vac. The output is 130 Vdc. The output voltage can be reduced to -10 dB (41 Vdc) or -20dB (13 Vdc). The values can be adjusted.

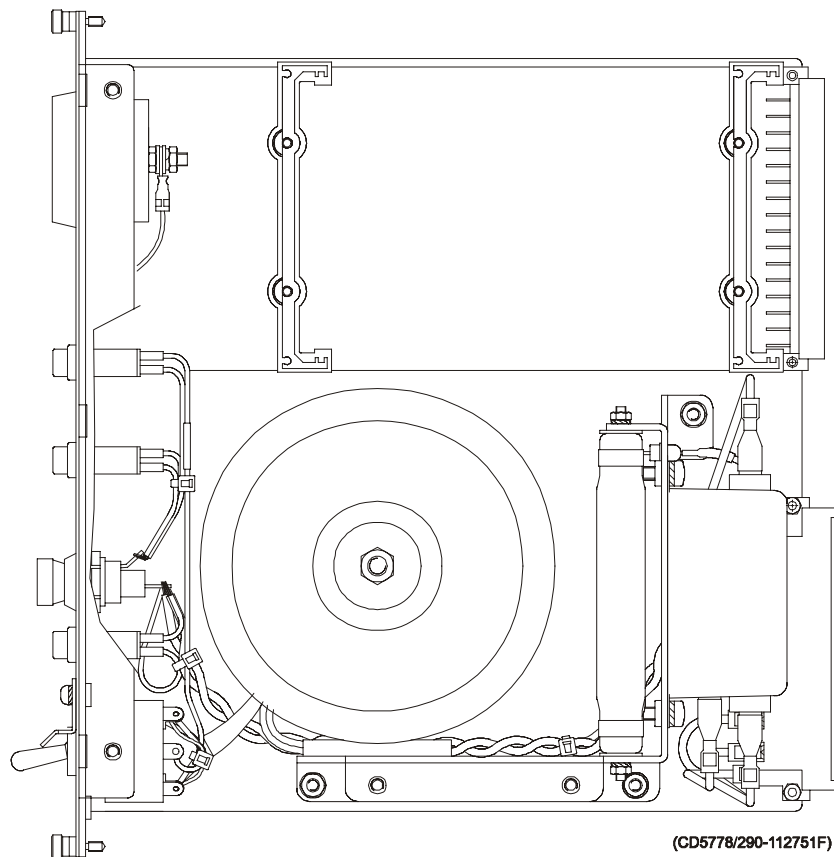


Figure 34 The High Voltage Power Supply

Signal Processor Board (SPB31)

Purpose and description

The Signal Processor Board (SPB31) is designed for high speed beamforming and sonar signal processing. The board design is based on the TMS 320C31 floating point DSP (Digital Signal Processor) from Texas Instruments.

The Signal Processor Board is designed as a "double Europe" standard sized printed circuit board. It is equipped with a number of front mounted LEDs, test points, potentiometers and coax connectors.

How it works

The main components of the Signal Processor Board are:

- 1** TMS 320C31 Digital Signal Processor
 - Clock frequency 33.33 or 40 MHz
 - 32-bit data bus
 - 24-bit address bus
 - 40/32-bit floating point unit
 - 1 internal serial line
 - 2 pc 32-bit timers
 - 4 interrupt inputs
 - DMA controller
 - Programmable in C and assembly
 - Emulator and symbolic de-bugger available
- 2** 256k x 32 bit PROM.
- 3** 512 x 32 bit SRAM 25 ns
- 4** Complex multiplier.
- 5** 4 serial lines RS422/RS232.
- 6** Programmable counter for TX clock, 64 CHTX.
- 7** Dual port interface to P1 bus (Multibus I type).
- 8** Bus interface to P2 bus.
- 9** Control bus for control outputs compatible with SPB29.

The Signal Processor Board works very similar to other microprocessor boards. The TMS 320C31 Digital Signal Processor operates with standard peripheral circuitry such as RAM, PROM (with software) and the interface controllers. Devices for disk drive control are omitted, but Dual Port RAM and a complex multiplier is implemented instead. Refer to the block diagram.

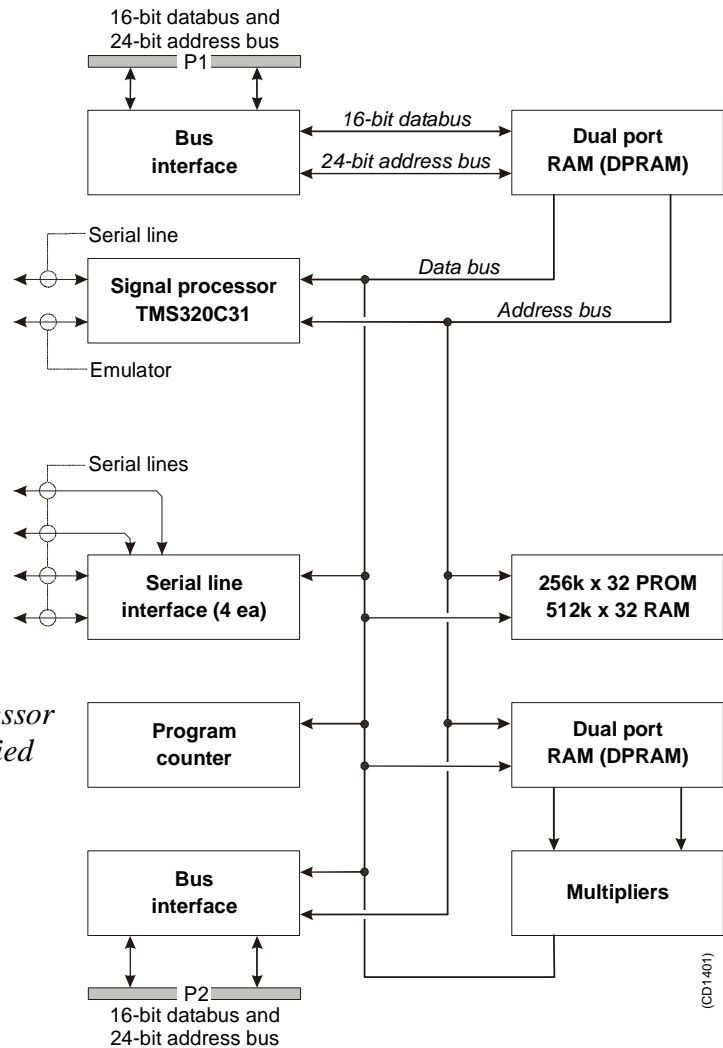


Figure 35 Signal Processor Board SPB31 - simplified block diagram

An emulator for the TMS 320C31 processor is developed. It consists of a controller board in a PC and an active pod which is connected to the target board by a 12 pin plug.

Facilities

Unmounted devices

Links

A large number of links are implemented on the processor board to allow for several different applications. The links are used as follows:

LK 1	2BI422 to RXDB on U15
LK 2	RXDB2 input to RXDB on U15
LK 3	2AI422 to RXDA on U15
LK 4	RXDA2 input to RXDA on U15

LK 5	CLKIN to U64
LK 6	FSRO and DRO to set frame sync for sercom on U32
LK 7	RDRO to DRO when sercom in U32 is used on RS232
LK 8	Clock to U36
LK 9	RXDA input to RXDA on U63
LK 10	RXDB input to RXDB on U63
LK 11	BI422 input to RXDB on U63
LK 12	AI422 input to RXDA on U63
LK 13	CLQ to P2A25, U60 must not be mounted
LK 14	TXCLK to P2B24, U60 must not be mounted
LK 15	CLI to P2A24, U60 must not be mounted
LK 16	TSTSIG to P2C23, U60 must not be mounted
LK 17	TXEN~ to P2A22, U60 must no be mounted
LK 18	MEM3 to P2C3, LK30 must be OFF
LK 19A	XF0~ as output
LK 19B	XF0 as input
LK 20A	XF0 as output
LK 20B	XF0~ as input
LK 23A	XF1~ as output
LK 23B	XF1 as input
LK 24A	XF1 as output
LK 24B	XF1~ as input
LK 25A	TCLK0~ as output
LK 25B	TCLK0 as input
LK 26A	TCLK0 as output
LK 26B	TCLK0~ as input
LK 27A	TCLK1~ as output
LK 27B	TCLK1 as input
LK 28A	TCKL1 as output
LK 28B	TCLK1~ as input
LK 29	External reset, INIT1, when ON
LK 30	IACK~ to P2C3, LK18 must be OFF
LK 31	U40 to CLKIN on DSP U32

Note that this list is for reference only.

Link applications

When using the Signal Processor Board in the EM 1002 Transceiver Unit, the following links must be **ON** (closed):

- LK 4
- LK 5
- LK 8
- LK 9
- LK10
- LK 19
- LK 20
- LK 23
- LK 24
- LK 31

When using the Signal Processor Board in the EM 1002 Hull Unit Controller, the following links must be **ON** (closed):

- LK 4
- LK 5
- LK 8
- LK 9
- LK 10
- LK 31

LED's

LED's used:

D1: program initialized OK

D2: BIST active

D3: aquisition of reciever data

D4: aquisition of reciever data

D5: simulator active

D6: not used

D7: not used

D8: not used

Test points

TP 1: GND

TP 2: General purpose test output no.1

TP 3: General purpose test output no.2

TP 4: General purpose test output no.3

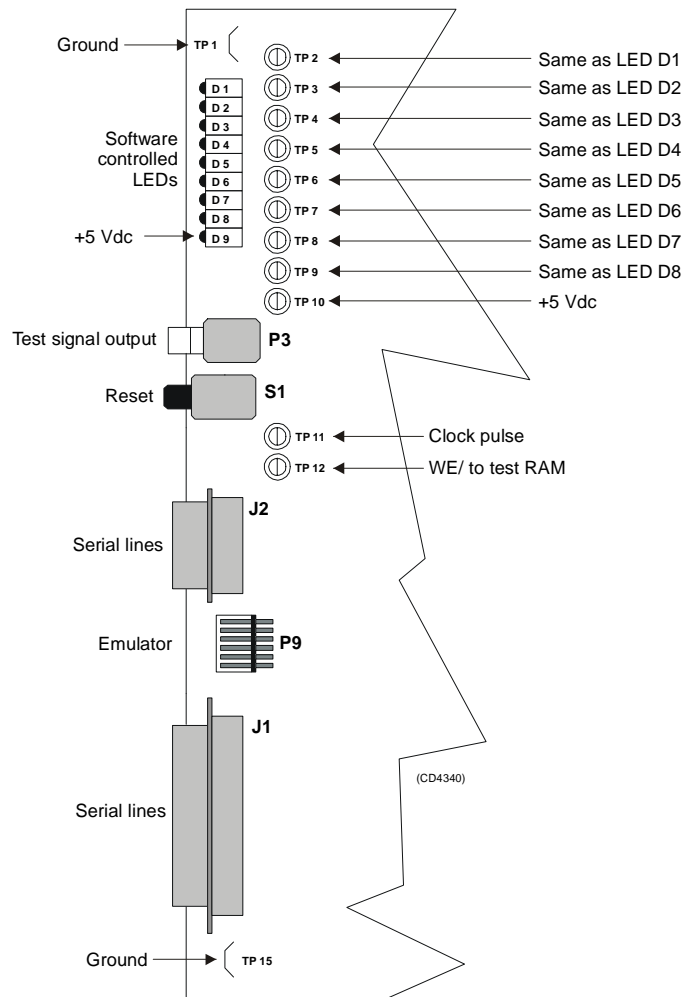


Figure 36 Signal Processor Board SPB31, front mounted devices

- TP 5: General purpose test output no.4
- TP 6: General purpose test output no.5
- TP 7: General purpose test output no.6
- TP 8: General purpose test output no.7
- TP 9: General purpose test output no.8
- TP 10: +5 Vdc
- TP 11: Clock pulse, CP, monitor
- TP 12: WE~ for testing RAM loading
- TP 13: GND
- TP 14: GND
- TP 15: GND

Connections

The following connections are made to the Signal Processor Board:

P1	Multibus
P2	Signal processor external bus
P3	Test signal output
J1	Serial lines
J2	Serial lines

The trig out puls is active during transmit, and generated by SPRX. This is a TTL level pulse and is active when low.

- *The connections are explained in the figure on page 96.*
- *The Receiver Backplane connections(PXB-P3) are explained on page 131.*

Receiver Backplane (RXBP)

Purpose and description

The purpose of the Receiver Backplane is to enable communication between the circuit boards plugged into it, and between these circuit boards and the external circuitry in the cabinet. The RXBP is located behind the bottom wired rack in the Transceiver Unit, and holds the following circuit boards:

- Transmitter/Receiver Board 1
- Transmitter/Receiver Board 2
- Transmitter/Receiver Board 3
- Transmitter/Receiver Board 4
- Low Voltage Power Supply
- High Voltage Power Supply
- Signal Processor Board RX
- Capacitor Bank

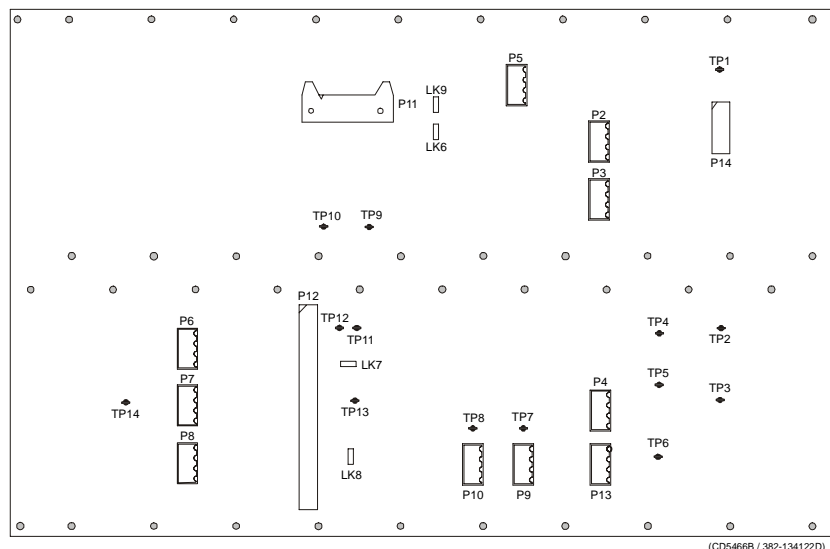
How it works

There are no active components on this backplane.

Facilities

LEDs

None



(CD5466B / 382-134122D)

Figure 37 Receiver Backplane, rear side

Links

There are four links on this backplane:

LK6: ON

LK7: ON, HVCLK to HVCKR

LK8: ON, DA0 to DB0

LK9: OFF

Test points

All the test points listed below are only used during development and debugging:

TP 1: GND

TP 2: Read pulse to the TRB

TP 3: Filter clk. to PDH's on the TRB

TP 4: Write pulse to the TRB

TP 5: Sample and hold to PDH's on the TRB

TP 6: Four times demodulator frequency to PDH's on the TRB

TP 7: TX enable to the TRB

TP 8: GND

TP 9: GND

TP 10: Write pulse to fifo on the BSP

TP 11: Read pulse to 2 port RAM on the SPTX

TP 12: Write pulse to 2 port RAM on the SPTX

TP 13: Test signal input to PDH's on the TRB

Connections

The sockets on the rear side of the backplane and their connections in the EM 1002 Transceiver Unit are described in the tables below.

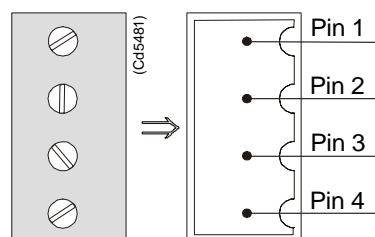


Figure 38 Pin configuration

The EM 1002 do not use P6, P7, P8, or P12.

RXB-P2	Signal	Connection
1	STBY+	Bottom plate-Remote pin 3
2	STBY-	Bottom plate-Remote pin 4
3	ON	Bottom plate-Remote pin 5
4		

RXB-P3	Signal	Connection
1	HEAT	Wall sect.-Resistor pin 1
1	HEAT	Heater-Terminal pin 2
2	STBY-	Wall sect.-Resistor pin 2
2	STBY-	Heater-Terminal pin 1
3	TRIG	Bottom plate-Remote pin 1
4	DGND	Bottom plate-Remote pin 2

RXB-P4	Signal	Connection
1	+12VH	
2	HGND	
3	HGND	
4		

RXB-P5	Signal	Connection
1	+12VH	TXB-P3 pin 4
2	HGND	TXB-P3 pin 2
3	HGND	TXB-P3 pin 3
4	+5VH	TXB-P3 pin 1

RXB-P9	Signal	Connection
1	POW1	TX/RX Fan pin 1
2	POW2	TX/RX Fan pin 3
3	POW1	PU Fuse pin 3
4	POW2	PU Fuse pin 4

RXB-P10	Signal	Connection
4	GND	chassis

RXB-P11	Signal	Connection
1		flat cable to PSB card
2		flat cable to PSB card

RXB-P13	Signal	Connection
1	+5 Vdc	TXB-P2 pin 1
2	+5Vdc	TBX-P2 pin 2
3	DGND	TBX-P2 pin 3
4	DGND	TBX-P2 pin 4

RXB-P14	Signal	Connection
1	+5 Vdc	TXB-P2 pin 1
2	+5Vdc	TBX-P2 pin 2
3	DGND	TBX-P2 pin 3
4	DGND	TBX-P2 pin 4

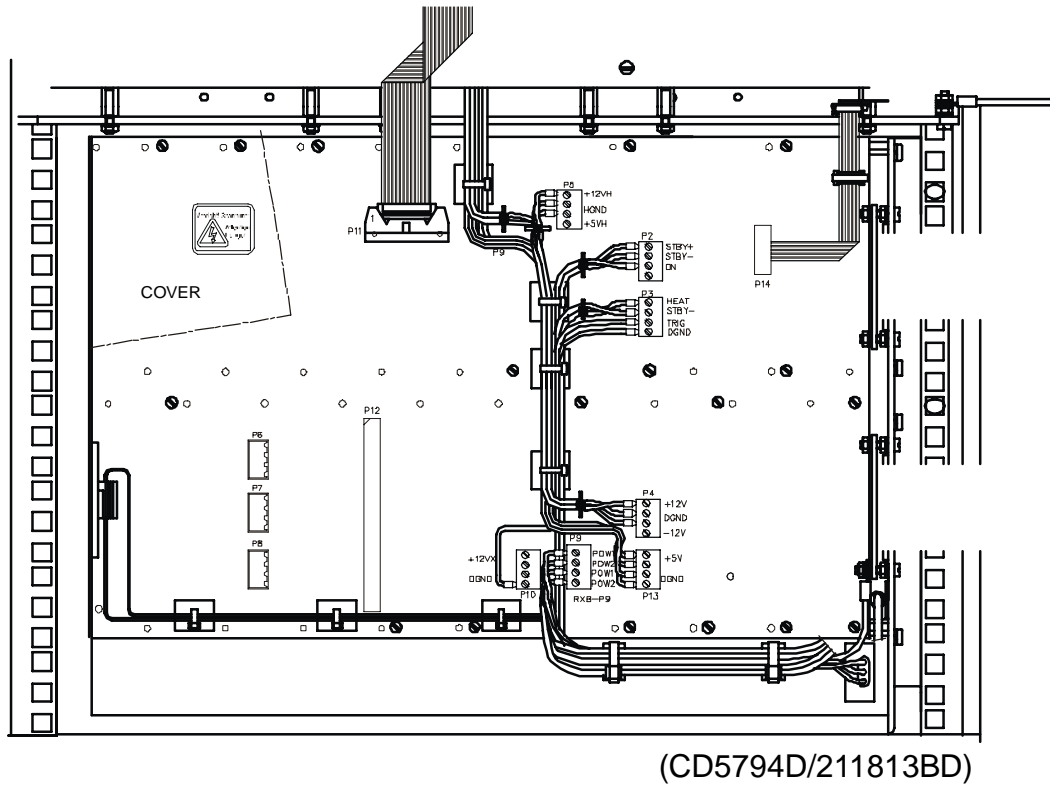


Figure 39 The Receiver Backplane

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5 TRANSCEIVER UNIT 125-218141

5.1 Description and main functions

Overview

The EM 1002 Transceiver Unit performs the reception, data acquisition, received signal processing and transmission for the multibeam echo sounder system. The cabinet holds two wired racks containing the system circuit boards.

- The top **Processing Rack** holds the complete Processing Unit with its own power supply. This unit provides data acquisition, signal processing and function control.
- The bottom **Receiver Rack** holds the receiver and transmitter boards, a controller, two power supplies and a large capacitor bank.

Two different versions of the Transceiver Unit have been delivered. The registration number of the Transceiver Unit will determine which version you have:

125-211814, *more information on page 88.*

125-218141, *more information on page 136.*

All versions are described in this manual. Please check your Transceiver Unit to find out which version you have.

5.2 Transceiver Unit 125-218141

- *Description and main functions, page 135.*
- *Transceiver Unit outline, page 137.*
- *Theory of operation, page 142.*
- *Processing rack, details, page 145*
- *Receiver rack, details, page 146.*
- *Circuit board descriptions, page 147.*

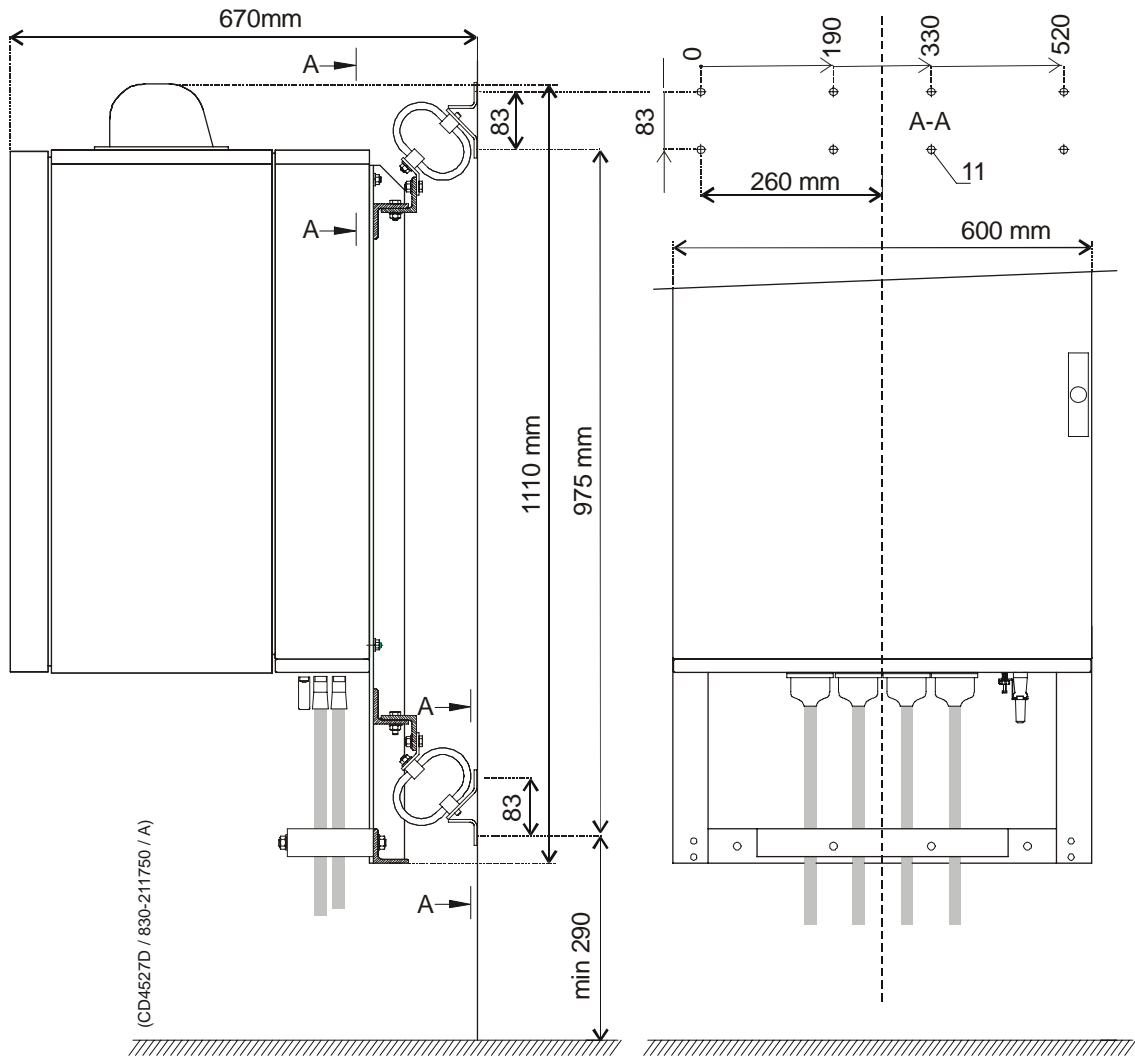
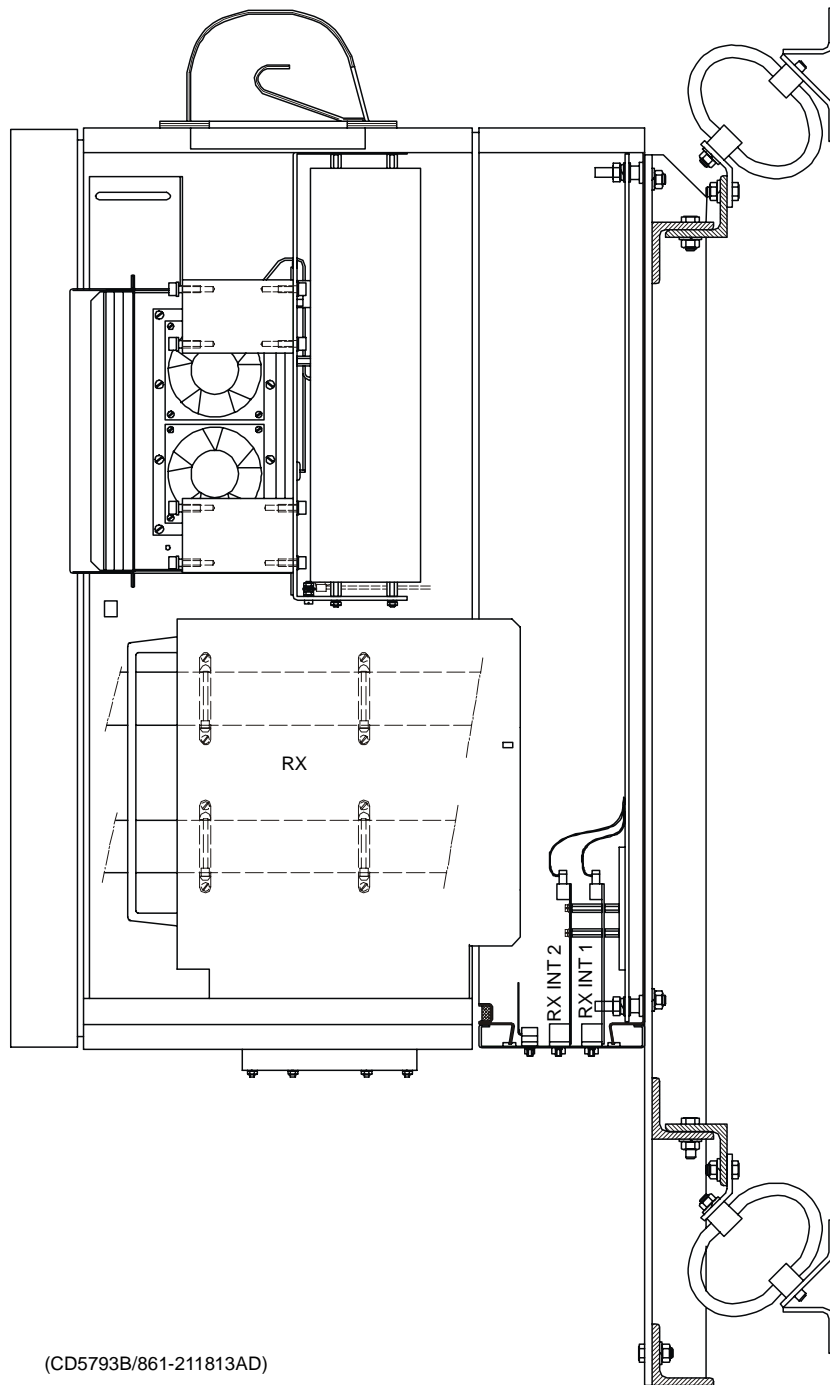


Figure 40 Transceiver Unit, dimensions



(CD5793B/861-211813AD)

Figure 41 Wired Cabinet. Subassembly, Transceiver Unit

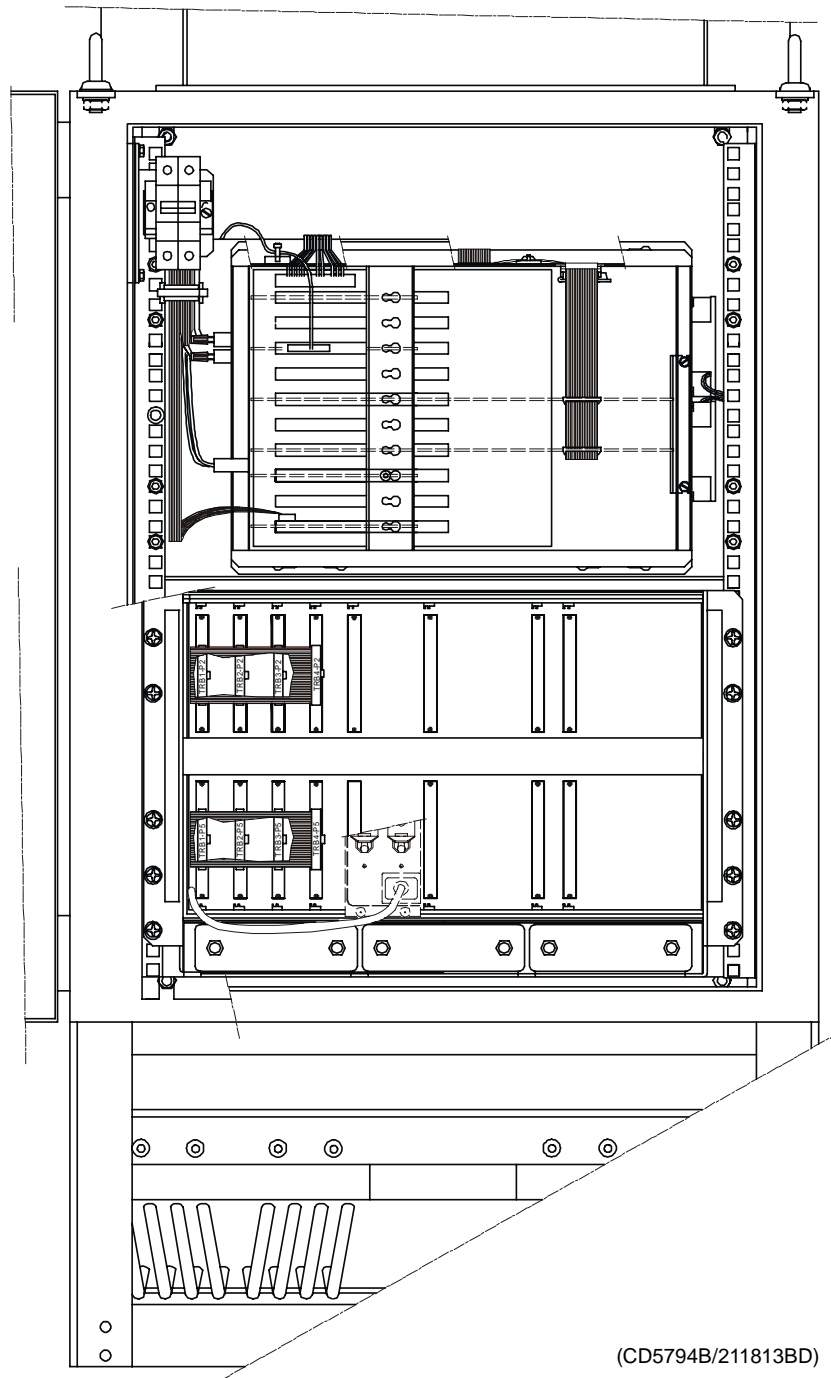


Figure 42 Wired rack, Transceiver Unit

The Processing Rack

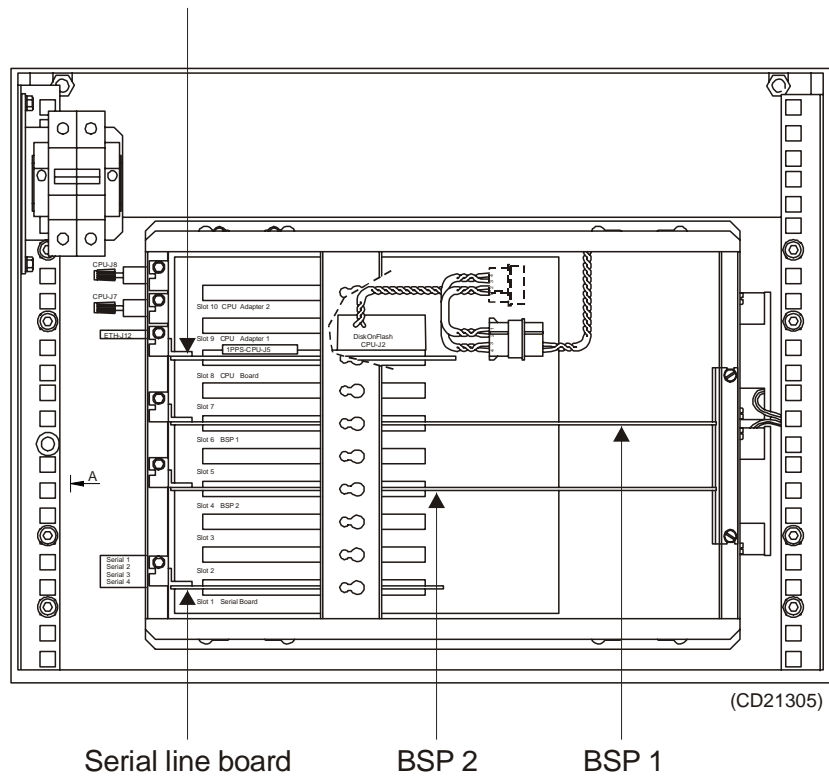
The Processing Rack is located at the top of the Transceiver Unit. It holds a chassis with several circuit boards, fans and a power supply. A ground strap and a circuit breaker for the power supply is also available, but these are mounted on the main rack, and not on the shelf.

The Processing Rack holds the following circuit boards and modules:

- 4-Ports Serial Line board
- Beamformer & Signal Processor (BSP1 and BSP2)
- DiskOnFlash module (mounted on the CPU board)
- Control Processing Unit (CPU) board
- Power supply
- Fan
- Motherboard

→ *A more detailed description of all the circuit boards and modules is found on page 145.*

CPU board (with DOF)



The Receiver Rack

The Receiver Rack is located at the bottom of the Transceiver Unit. It holds several circuit boards, power supplies and a capacitor bank. All the units are accessed from the front of the rack.

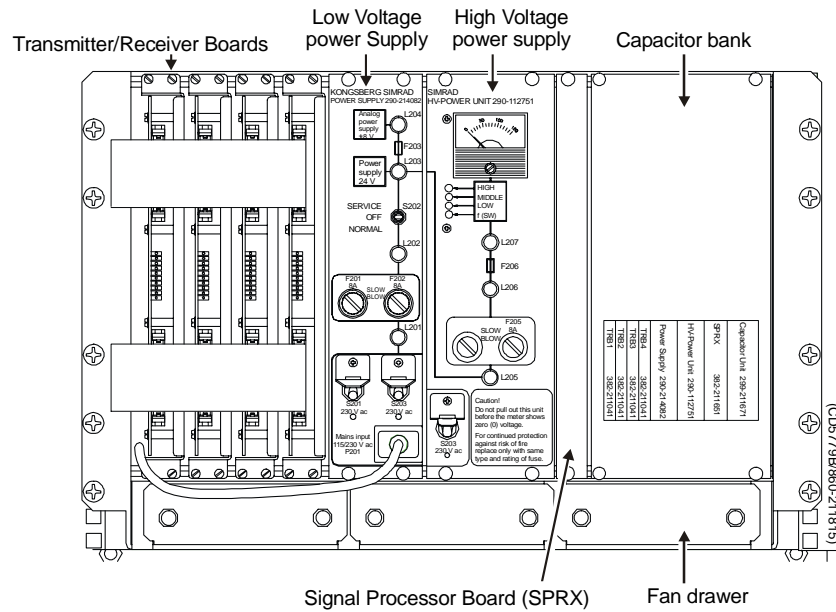


Figure 43 The Receiver Rack

The Receiver Rack holds the following circuit boards and modules (from left):

- TRB 32/Receiver/Transmitter board (max 4)
- Low Voltage Power Supply
- High Voltage Power Supply
- Signal Processor Board RX (SPRX)
- Capacitor bank

→ A more detailed description is found on page 146.

5.3 Theory of operation

Overview

This chapter presents a functional description of the Transceiver Unit.

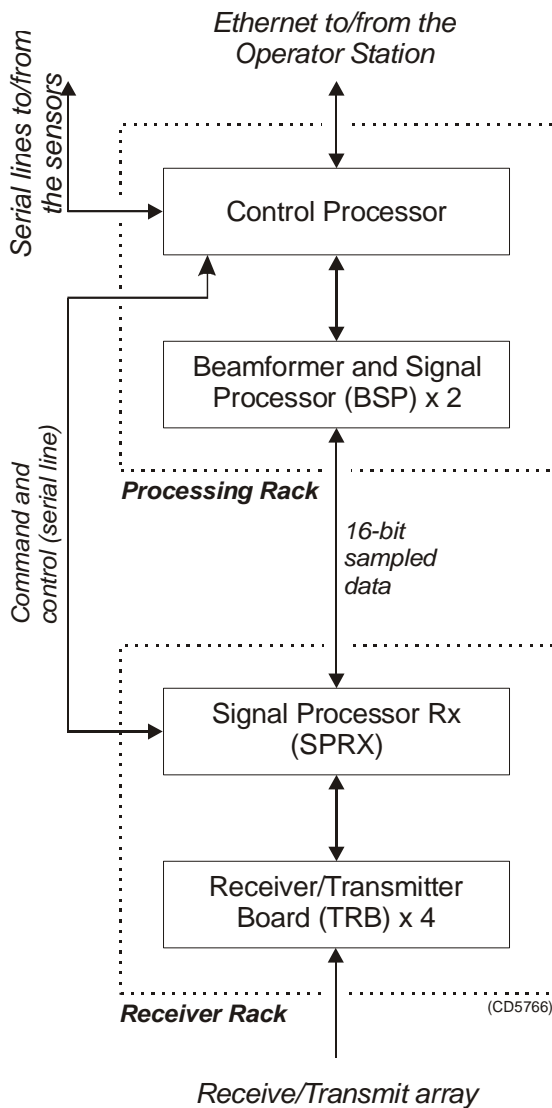


Figure 44 Transceiver Unit, simplified block diagram

Simplified block diagram

The simplified block diagram for the Transceiver Unit presents the following main functions:

- Transmission
- Reception
- Processing

The various parameter settings made on the Operator Station are sent to the Control Processor in the Processing Rack. The information is interpreted, and passed on to the Signal Processor RX (SPRX) in the Receiver Rack.

After the transmission, the Signal Processor RX (SPRX) receive the echoes, and pass them to the two Beamformer and Signal Processors (BSP) in the Processing Rack.

Control functions

The control functions in the Transceiver Unit are mainly handled by the two processor boards, but additional peripheral boards are also used. The majority of the control boards are contained in the Processing Rack.

The Control Processor in the Processing Unit is equipped with interface capabilities and a DOF (DiskOnFlash) module flash disk.

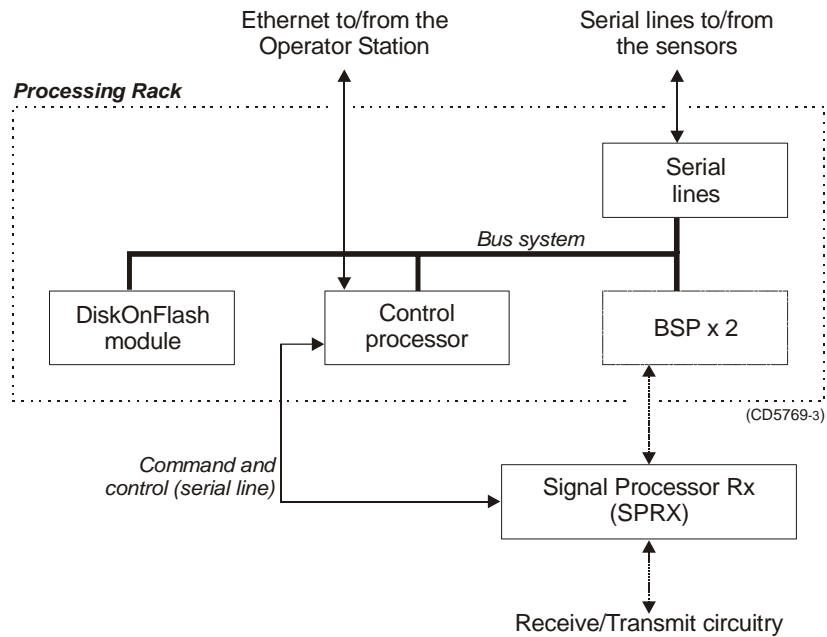


Figure 45 The control functions for 125-218141

External synchronisation

The serial line RTS and CTS signals are used for external synchronisation. In addition a trig out signal is issued by the TRU.

Levels:

RTS, CTS:

H=high= +3 to +15 V

L=low= -3 to -15 V

Trig out:

TTL Level

Outputs from TRU:

Trig out=1 TX is off(High TTL level)

Trig out=0 TX is active(Low TTL level)

RTS=H TRU is ready for a new ping

RTS=L TRU is not ready

RTS is pin 7 on the CPU card D connector. (Pin 6 on EM120 and EM300 “remote” plug).

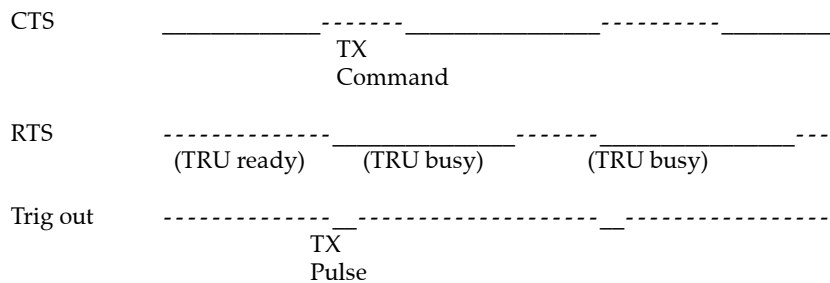
Inputs to TRU:

CTS=H Ping command
 CTS=L Wait

CTS is pin 8 on the CPU card D connector. (Pin 7 on the EM120 and EM300 “remote” plug). The CTS pulse length must be minimum 30 milliseconds.

Gnd is pin 5 on the CPU card D connector. (Pin 8 on EM120 and EM300 “remote” plug).

Typical sequence:



When the TRU is ready for a new ping, RTS is set to H. When the external device is ready for a new ping, CTS shall be changed to H. The TRU will then start a ping, change RTS to L (busy), and the Trig out will be low during the transmit pulse. After the Trig out is received, the external device should turn CTS to L. (Or at least keep it high for 35 milliseconds).

When the received period is finished and the TRU is ready for a new ping, the RTS will be changed to H, and the TRU will wait for new trigger (a high level on CTS).

If CTS is H all the time, or if external sync in the installation menu is switched off, the TRU will ping at its maximum rate.

One serial line is used to interface the command and control signals to and from the RX controller.

5.4 Processing rack details

Location

The Processing Rack is located at the top of the the Transceiver Unit. It holds a chassis with several circuit boards, fans and a power supply. A ground strap and a circuit breaker for the power supply is also available, but these are mounted on the main rack, and not on the shelf.

Circuit boards and modules

4-ports Serial Line Board

This is a commercial circuit board. It provides the Transceiver Unit with four serial lines.

→ *The interface board, CI-104JS, is explained on page 148.*

Beamformer & Signal Processor (BSP)

These are the main processing boards in the Transceiver Unit.

→ *The circuit board is explained on page 151.*

DiskOnModule (DOM) or DiskOnFlash (DOF) module

This flash disk is mounted on the Control Processor Unit board.

Control Processor Unit board (CPU)

This processor board acts as a function controller. It holds a DiskOnModule flash disk.

→ *The circuit board is explained on page 150.*

Power supply

It contains three analogue power supplies. They are all located on the rear of the Processing Rack.

→ *The power supply is explained on page 154.*

Motherboard

This is a commercial circuit board.

→ *The circuit board is explained on page 155*

Fan

The fan is located on the right side of the Processing Rack, when seen from the front.

5.5 Receiver rack details

Location

The Receiver Rack is located at the bottom of the the Transceiver Unit. It holds several circuit boards, power supplies and a capacitor bank.

Circuit boards and modules

Transmitter/Receiver board

These four boards hold the amplifiers for all the individual RX channels and all the individual TX channels.

→ *The circuit board is explained on page 156.*

Low Voltage Power Supply

This is a commercial linear power supply mounted on a chassis for easy replacement. It also contains linear supplies for the TRB's.

→ *The Low Voltage Power Supply is explained on page 158.*

High Voltage Power Supply

This is a switching power supply. It provides the high output voltage for the transmitters, and uses the Capacitor bank to store the energy between the pings.

→ *The High Voltage Power Supply HVPU is explained on page 161.*

Signal Processor Board RX (SPRX)

The processor board is used as a function controller. This is a common circuit board whose name is SPB31.

→ *The Signal Processor Board is explained on page 162.*

Backplane (RXBP)

The Receiver Rack uses a passive backplane. All connections to the circuit boards (except transmission signals) are made on this backplane.

→ *The RX Backplane is explained on page 168.*

Capacitor bank

This unit stores transmission energy temporarily.

5.6 Circuit board descriptions

Overview

This chapter describes all the circuit boards and modules in the EM 1002 Transceiver Unit. A functional description with a block diagram is provided, as well as the facilities provided for maintenance.

Remember that all versions of the Transceiver Unit is in this manual. Different boards and power supplies are therefore described for the EM 1002 system. Check the reg.no. on your Transceiver Unit to find out which version you have.

Serial Line Board (CI-104JS)

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

Purpose and description

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

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

It has surge protection and ISA bus.

Note

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

How it works

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

Surge Protection

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

Specifications

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

Facilities

No switches.

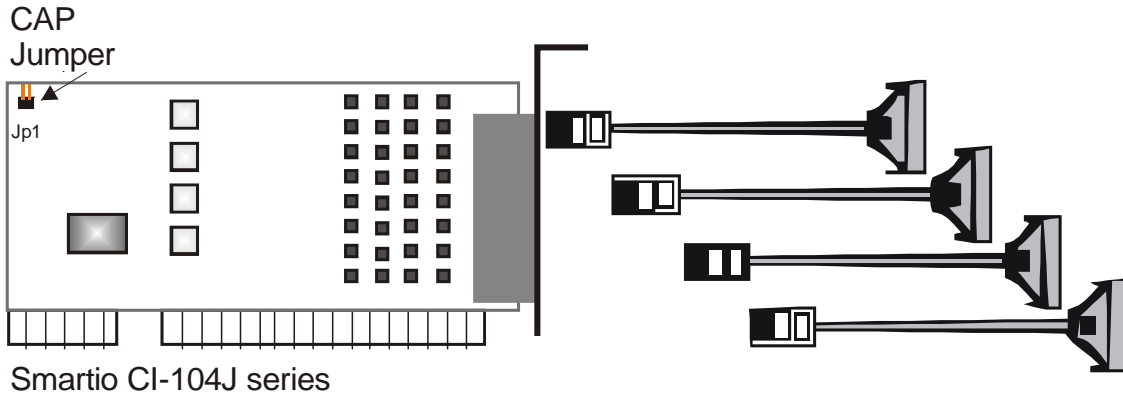


Figure 46 Illustration of the Serial Line Board.

VIPer 629 Control Processor Board

Purpose and description

This is a commercial circuit board designed and produced by Kontron.

→ Refer to webpage www.kontron.com for more information.

A DiskOnModule (DOM) or a DiskOnFlash (DOF) module is mounted on this board. This module contains the software needed for this CPU board, and for the BSP boards. It can be upgraded from the release CD.

The LAN / Ethernet to and from the Operator Station is connected here.



Figure 47 VIPer 629

Beamformer & Signal Processor (BSP)

Purpose and description

The Beamforming & Signal Processing (BSP) board is a multi digital signal processor (DSP) board. It is designed to perform the beamforming and signal processing in sonars and multibeam echo sounders. It is controlled from a host processor.

The processing power in the Beamforming & Signal Processing (BSP) board is based on eight Texas TMS320C50 fixed point digital signal processors working in parallel while beamforming the data. Next, there are four Texas TMS320C44 floating point digital signal processors interconnected to use both parallel and sequential processing of the beamformed data from the fixed point processors.

The Beamforming & Signal Processing (BSP) board is a single slot full length standard ISA format circuit board made to fit into a personal computer.

How it works

The Beamforming & Signal Processing (BSP) board contains four main sections:

- Sonar Input Data
- Beamforming
- Signal Processing
- Host Interface

The **Sonar Input Data** interfaces an 18-bit wide and 1k deep Input FIFO (First-In-First-Out) register. This input FIFO holds the data received from the transducer array through the receiver processing circuitry. A dedicated digital signal processor reads the input FIFO.

There are two identical **Beamforming** digital signal processing branches. Each consists of four digital signal processors and a 16-bit wide and 8k deep dual port memory (DPRAM). The two branches are exchanging data by means of this DPRAM.

The **Signal Processing** section comprises three digital signal processors dedicated to do further processing of the beamformed data.

The **Host Interface** function is maintained by the master processor on the Beamforming & Signal Processing (BSP) board. It exchanges data with the host processor via a 16-bit wide and 8k deep dual port memory (DPRAM) on the ISA bus.

Facilities

LEDs

D1 (LED): C44 D

Test points

There is one test point for each C50 digital signal processor (eight total). These testpoints are all connected to the XF/ signal which is active while that particular C50 access the shared DPRAM.

There is also one test point for each C44 digital signal processor (four total). These test points are connected to the IIOF2/ signal, which is a general purpose I/O port bit that can be controlled by the software.

The C44-D testpoint is also connected to a light emitting diode (D1) for visual observation. The LED will be activated during each ping.

TP1	C50 E0
TP2	C50 E1
TP3	C50 E2
TP4	C50 E3
TP5	C50 F0
TP6	C50 F1
TP7	C50 F2
TP8	C50 F3
TP11	C44 A
TP12	C44 B
TP13	C44 C
TP14 (& D1)	C44 D

The testpoints will be active when the corresponding processor is working.

Links

A number of links are implemented on the board to allow for several different applications. Links LK1, LK2 and LK3 are used to identify the board as one out of maximum eight boards in one system.

LK3	LK2	LK1	BSP ID
0	0	0	BSP 0
0	0	1	BSP 1
0	1	0	BSP 2
0	1	1	BSP 3
1	0	0	BSP 4
1	0	1	BSP 5
1	1	0	BSP 6
1	1	1	BSP 7

Link applications

The following links are ON (closed) in this application:

- BSP0 is the master processor (no links).
- BSP1 is the slave processor (link LK1).

Switches

There are no switches on the board.

Connections

The Beamforming & Signal Processing (BSP) holds the following plugs and sockets:

P1	Sonar input data
P2	ISA bus component
P3	Emulator
P4	Direct memory access
P5	External communication port
P6	Test access port
P7	External communication port

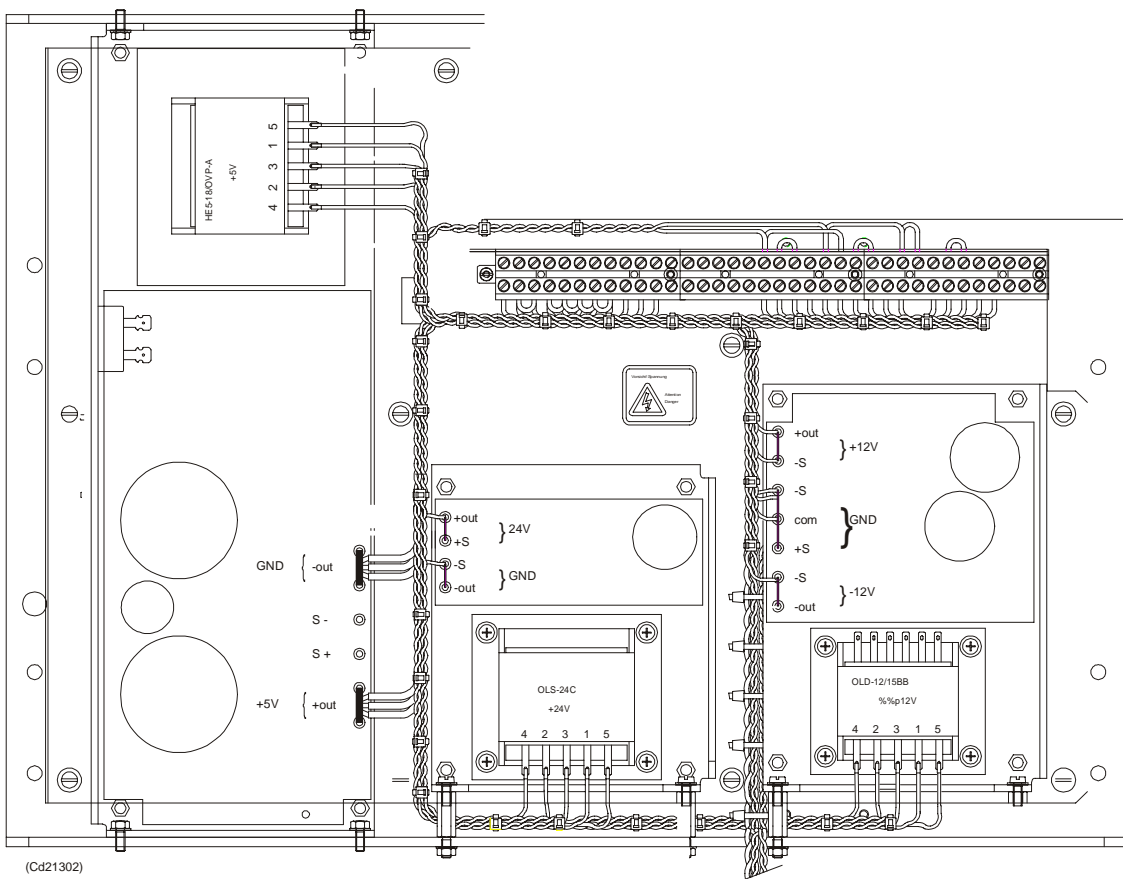
The P1, sonar input data, is connected to BIFB via a flat cable plug.

Processing Unit Power Supply

Purpose and description

The purpose of the power supply is to feed 5 Vdc and 12 Vdc to the Processing Rack. It is located on the rear side of the Processing Rack, hidden behind a cover plate.

The Processing Rack contains three analogue power supplies (OLS-24C, OLD-12/15BB and one HE5-18/OVP). The purpose of those is to feed power to the circuit boards in the Processing Rack, respectively 5 Vdc and 12 Vdc.



How it works

This is a commercial linear power supply that feeds 5 Vdc and 12 Vdc to the Processing Rack. It also feeds 5 Vdc, 12 Vdc and 24 Vdc to the Receiver Backplane.

Motherboard

How it works

This is a passive backplane with standard ISA-bus.

Facilities

LEDs

The board has four LEDs:

- + 5V
- - 5V
- + 12V
- - 12V

- 5V is not used and is not lit. The three others should be lit at all times.

Test points

None

Links

None

Connections

+ 5V, + 12V and - 12V.

Transmitter/Receiver Board (TRB)

Purpose and description

The purpose of the Transmitter/Receiver Board (TRB) is to transmit and receive to and from 32 individual channels.

The TRB is fastened to a combined strengthening plate and heat sink which covers the entire component side of the board and also forms a “front panel” to the board. The board is located in tracks within the Transceiver Unit to ensure correct location, and is held in position by four screws.

The TRB has two 34-pin connectors on its front edge which carry the signals to and from the transducer.

How it works

Transmission

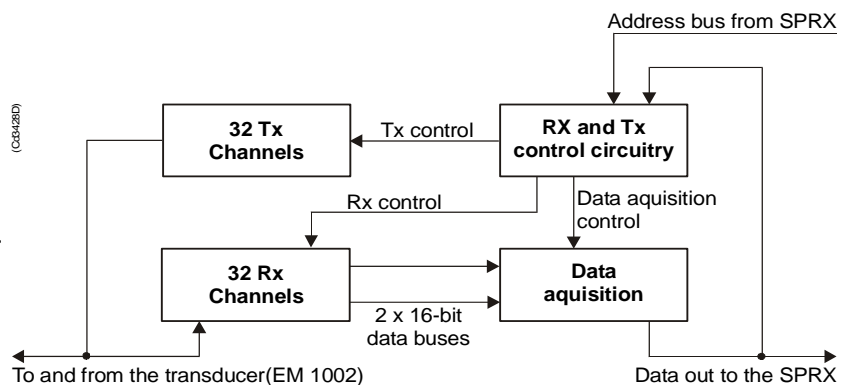
The TRB contains a control interface that controls the 32 transmitters on the board.

Technical details

Dimensions (Width x Height x Depth)	220 x 233.35 x 0.32 mm
Analogue input/output	32 channels, 60W, + T/R switch
Connectors	Two 96-pin euro on back edge of board Two 34-pin flat cables on front edge
Analogue to digital	12-bits resolution I/Q simultaneously converted to 32-bit latched bus
Power requirements	+ 5 Vdc, 8 Vdc, + 24 Vdc

The ± 8 Vdc and 24 Vdc is supplied by the Low Voltage Power Supply (LVPS). The + 5 Vdc is supplied by the Processing Unit (PU) Power Supply.

Figure 48
Transmitter/Receiver
(TRB)
block diagram



Facilities

Test points

The test points listed below are available to assist the maintenance engineer. They are located on the front edge of the board between the two connectors, in front of the corresponding LED.

AVCC4	+ 5 V
AVCC analogue voltage	+ 5 V
AVDD analogue voltage	+ 15 V
VCC digital voltage	+ 5 V
AVEE analogue voltage	- 5 V
HV1 high voltage transmitter	+ 13 - + 130 V
HV2 high voltage transmitter	+ 13 - + 130 V
HV3 high voltage transmitter	+ 13 - + 130 V
HV4 high voltage transmitter	+ 13 - + 130 V
TX transmitter indicator	TX pulse

Links

The TRB holds no links that can be set by the maintenance engineer.

Switches

The TRB holds no switches that can be adjusted by the maintenance engineer.

LEDs

The TRB holds ten red LEDs on its front edge, mounted in a vertical line between the connectors. When these LEDs are lit, they indicate the presence of the corresponding voltage levels.

Connectors

The TRB carries four connectors, two located at each end of the board. P1 is a 96-pin, male right-angled euro-connector, located on the rear edge of the board, carrying power. P2 is a 96-pin, male, right-angled euro-connector, also located on the rear edge of the board, carrying power and digital control signals. P3 and P4 are 34-pin, male, right-angled connectors with ejector/latch, located on the front edge of the board. Each connector carries 16 input/outputs to the transducer/preamplifier.

Low Voltage Power Unit (LVPU)

Purpose and description

The purpose of the Low Voltage Power Unit (LVPU) is to supply power to all the modules in the Transceiver Unit, except the high voltage power for the transmission, power to PU and $\pm 12\text{Vdc}$.

The Low Voltage Power Unit is located between the Transmitter/Receiver Boards and the High Voltage Power Supply in the Receiver Rack. The power supply is a plug-in module. It has two front mounted fuses, one service switch, and one switch to select 115 or 230 Vac mains input.

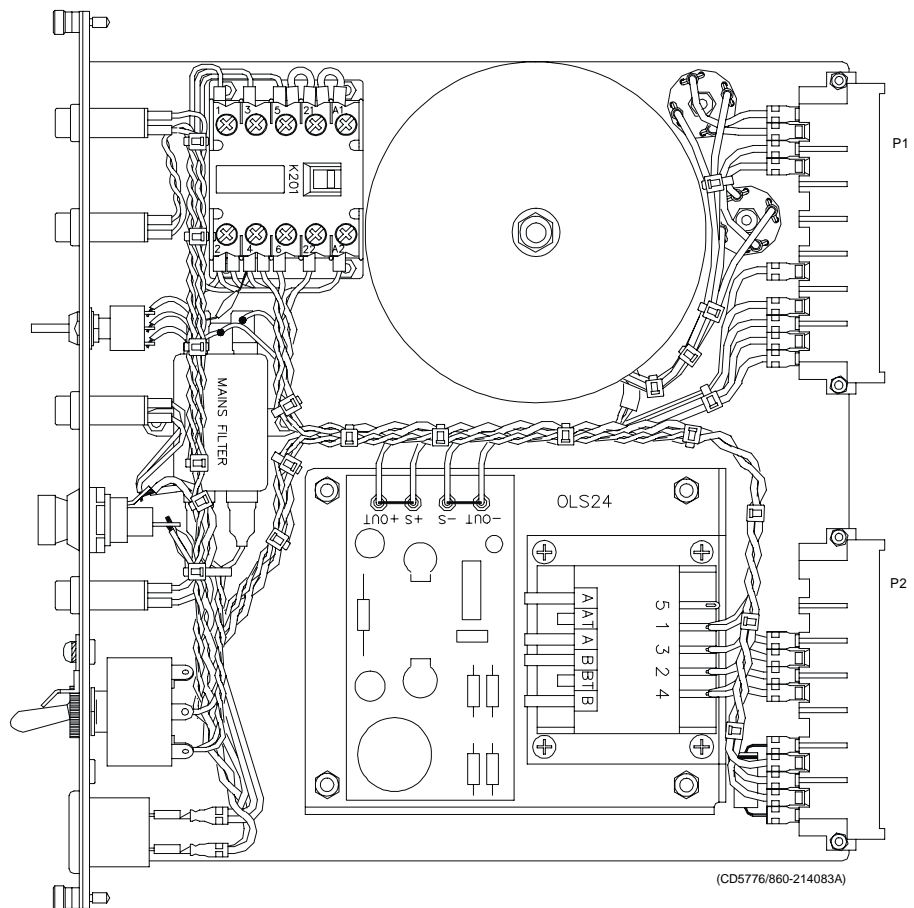


Figure 49 The Low Voltage Power Supply

How it works

The power unit contains two separate power supplies. The output of the stand-by power supply is 24 Vdc.

The power unit has a service switch. When this is set to normal, the power supply is controlled by the on/off relay. This relay is remote controlled from a switch in the operator room. When you disengage the relay, you can control the power supply manually from the Transceiver Rack using the service switch. It is then possible to activate parts of the system (service mode).

The transformers and rectifiers function is to provide 8 Vdc output for the receivers either we have 115 Vac or 230 Vac input.

The LVPU also supplies + 5 V to several boards. See figure below.

→ Refer to the block diagram in figure 50.

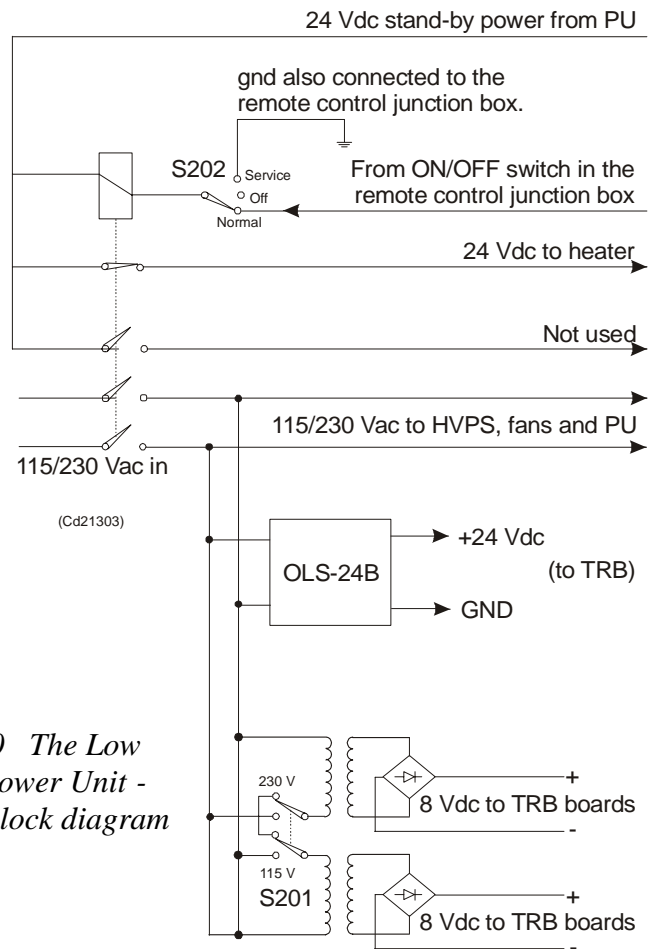
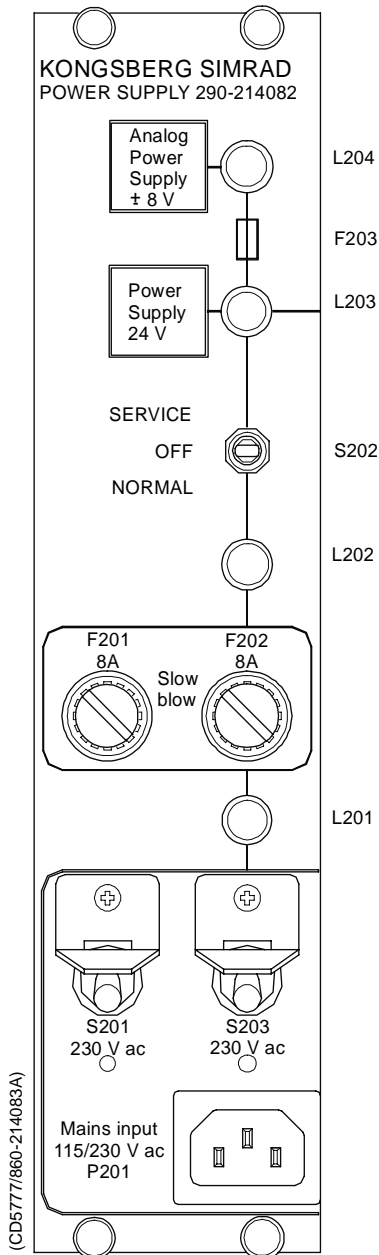


Figure 50 The Low Voltage Power Unit - simplified block diagram



Facilities

LEDs

- L201: Indicator for mains input
- L202: Indicator for 24 Vdc stand by mode
- L203: Lit to indicate AC supply to switched and analogue
- L204: Lit to indicate AC supply to analogue power.

Test points

None

Links

None

Switches

- S201: Switch for mains input 115/230 Vac
- S202: Service/Off/Normal switch

Connections

- P1
- P2

Fuses

- F201: Primary fuse
- F202: Primary fuse
- F203: Thermostat fuse inside the torodial transformer

High Voltage Power Unit (HVPU)

Purpose and description

The purpose of the High Voltage Power Unit (HVPU) is to provide the power for the output amplifiers.

The input to the system is 85 to 265 Vac. The output is 130 Vdc. The output voltage can be reduced to -10 dB (41 Vdc) or -20dB (13 Vdc). The values can be adjusted.

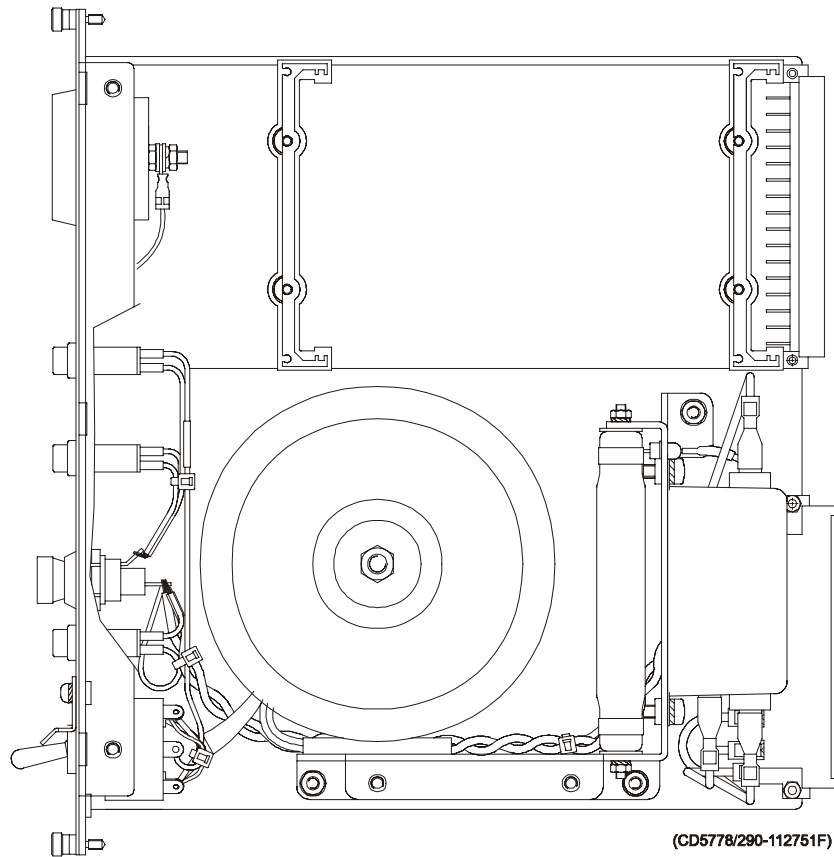


Figure 51 The High Voltage Power Supply

Signal Processor Board (SPB31)

Purpose and description

The Signal Processor Board (SPB31) is designed for high speed beamforming and sonar signal processing. The board design is based on the TMS 320C31 floating point DSP (Digital Signal Processor) from Texas Instruments.

The Signal Processor Board is designed as a "double Europe" standard sized printed circuit board. It is equipped with a number of front mounted LEDs, test points, potentiometers and coax connectors.

How it works

The main components of the Signal Processor Board are:

- 1** TMS 320C31 Digital Signal Processor
 - Clock frequency 33.33 or 40 MHz
 - 32-bit data bus
 - 24-bit address bus
 - 40/32-bit floating point unit
 - 1 internal serial line
 - 2 pc 32-bit timers
 - 4 interrupt inputs
 - DMA controller
 - Programmable in C and assembly
 - Emulator and symbolic de-bugger available
- 2** 256k x 32 bit PROM.
- 3** 512 x 32 bit SRAM 25 ns
- 4** Complex multiplier.
- 5** 4 serial lines RS422/RS232.
- 6** Programmable counter for TX clock, 64 CHTX.
- 7** Dual port interface to P1 bus (Multibus I type).
- 8** Bus interface to P2 bus.
- 9** Control bus for control outputs compatible with SPB29.

The Signal Processor Board works very similar to other microprocessor boards. The TMS 320C31 Digital Signal Processor operates with standard peripheral circuitry such as RAM, PROM (with software) and the interface controllers. Devices for disk drive control are omitted, but Dual Port RAM and a complex multiplier is implemented instead. Refer to the block diagram.

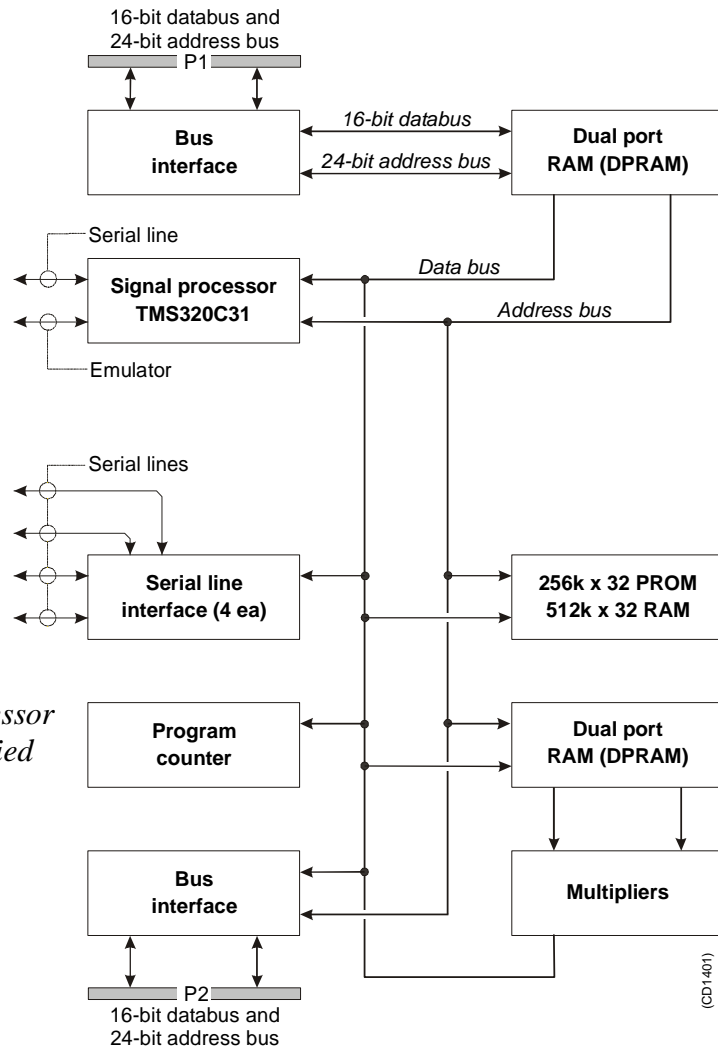


Figure 52 Signal Processor Board SPB31 - simplified block diagram

An emulator for the TMS 320C31 processor is developed. It consists of a controller board in a PC and an active pod which is connected to the target board by a 12 pin plug.

Facilities

Unmounted devices

Links

A large number of links are implemented on the processor board to allow for several different applications. The links are used as follows:

LK 1	2BI422 to RXDB on U15
LK 2	RXDB2 input to RXDB on U15
LK 3	2AI422 to RXDA on U15
LK 4	RXDA2 input to RXDA on U15

LK 5	CLKIN to U64
LK 6	FSRO and DRO to set frame sync for sercom on U32
LK 7	RDRO to DRO when sercom in U32 is used on RS232
LK 8	Clock to U36
LK 9	RXDA input to RXDA on U63
LK 10	RXDB input to RXDB on U63
LK 11	BI422 input to RXDB on U63
LK 12	AI422 input to RXDA on U63
LK 13	CLQ to P2A25, U60 must not be mounted
LK 14	TXCLK to P2B24, U60 must not be mounted
LK 15	CLI to P2A24, U60 must not be mounted
LK 16	TSTSIG to P2C23, U60 must not be mounted
LK 17	TXEN~ to P2A22, U60 must no be mounted
LK 18	MEM3 to P2C3, LK30 must be OFF
LK 19A	XF0~ as output
LK 19B	XF0 as input
LK 20A	XF0 as output
LK 20B	XF0~ as input
LK 23A	XF1~ as output
LK 23B	XF1 as input
LK 24A	XF1 as output
LK 24B	XF1~ as input
LK 25A	TCLK0~ as output
LK 25B	TCLK0 as input
LK 26A	TCLK0 as output
LK 26B	TCLK0~ as input
LK 27A	TCLK1~ as output
LK 27B	TCLK1 as input
LK 28A	TCKL1 as output
LK 28B	TCLK1~ as input
LK 29	External reset, INIT1, when ON
LK 30	IACK~ to P2C3, LK18 must be OFF
LK 31	U40 to CLKIN on DSP U32

Note that this list is for reference only.

Link applications

When using the Signal Processor Board in the EM 1002 Transceiver Unit, the following links must be **ON** (closed):

- LK 4
- LK 5
- LK 8
- LK 9
- LK10
- LK 19
- LK 20
- LK 23
- LK 24
- LK 31

When using the Signal Processor Board in the EM 1002 Hull Unit Controller, the following links must be **ON** (closed):

- LK 4
- LK 5
- LK 8
- LK 9
- LK 10
- LK 31

LED's

LED's used:

D1: program initialized OK

D2: BIST active

D3: aquisition of reciever data

D4: aquisition of reciever data

D5: simulator active

D6: not used

D7: not used

D8: not used

Test points

TP 1: GND

TP 2: General purpose test output no.1

TP 3: General purpose test output no.2

TP 4: General purpose test output no.3

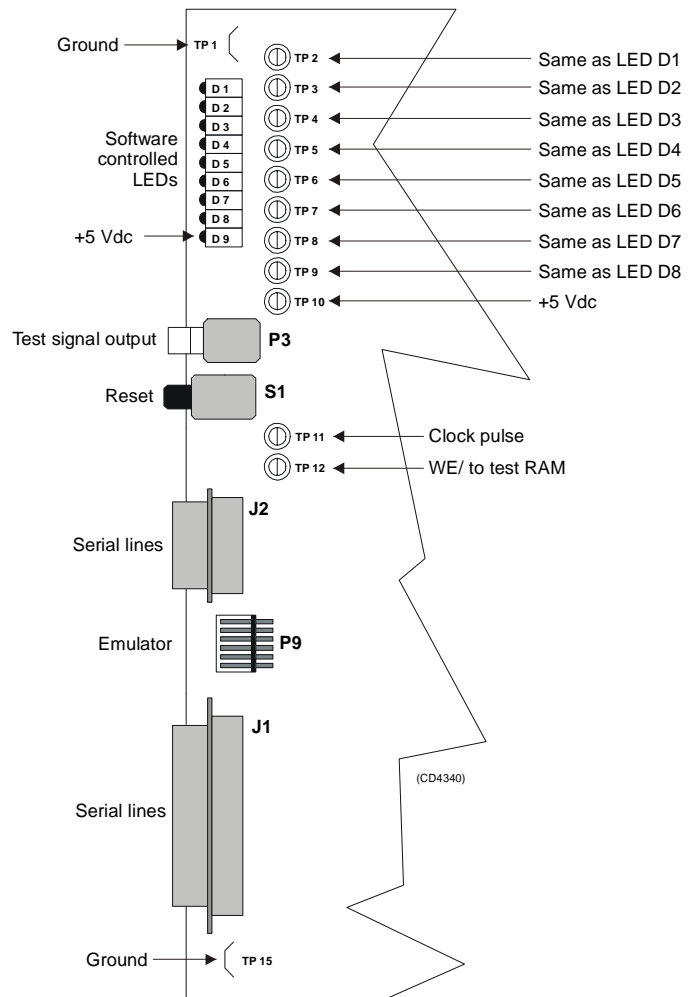


Figure 53 Signal Processor Board SPB31, front mounted devices

- TP 5: General purpose test output no.4
- TP 6: General purpose test output no.5
- TP 7: General purpose test output no.6
- TP 8: General purpose test output no.7
- TP 9: General purpose test output no.8
- TP 10: +5 Vdc
- TP 11: Clock pulse, CP, monitor
- TP 12: WE~ for testing RAM loading
- TP 13: GND
- TP 14: GND
- TP 15: GND

Connections

The following connections are made to the Signal Processor Board:

P1	Multibus
P2	Signal processor external bus
P3	Test signal output
J1	Serial lines
J2	Serial lines

The trig out puls is active during transmit, and generated by SPRX. This is a TTL level pulse and is active when low.

- *The connections are explained in the figure on page 143.*
- *The Receiver Backplane connections(PXB-P3) are explained on page 169.*

Receiver Backplane (RXBP)

Purpose and description

The purpose of the Receiver Backplane is to enable communication between the circuit boards plugged into it, and between these circuit boards and the external circuitry in the cabinet. The RXBP is located behind the bottom wired rack in the Transceiver Unit, and holds the following circuit boards:

- Transmitter/Receiver Board 1
- Transmitter/Receiver Board 2
- Transmitter/Receiver Board 3
- Transmitter/Receiver Board 4
- Low Voltage Power Supply
- High Voltage Power Supply
- Signal Processor Board RX
- Capacitor Bank

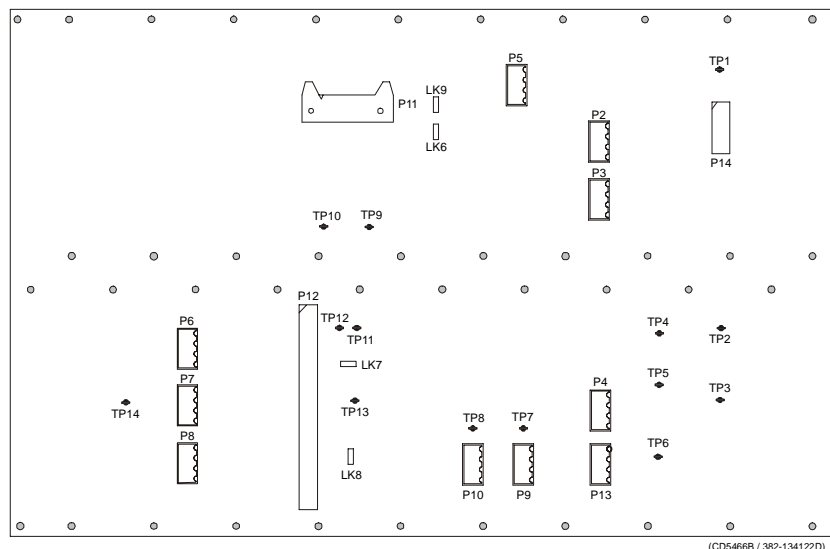
How it works

There are no active components on this backplane.

Facilities

LEDs

None



(CD5466B / 382-134122D)

Figure 54 Receiver Backplane, rear side

Links

There are four links on this backplane:

LK6: ON

LK7: ON, HVCLK to HVCKR

LK8: ON, DA0 to DB0

LK9: OFF

Test points

All the test points listed below are only used during development and debugging:

TP 1: GND

TP 2: Read pulse to the TRB

TP 3: Filter clk. to PDH's on the TRB

TP 4: Write pulse to the TRB

TP 5: Sample and hold to PDH's on the TRB

TP 6: Four times demodulator frequency to PDH's on the TRB

TP 7: TX enable to the TRB

TP 8: GND

TP 9: GND

TP 10: Write pulse to fifo on the BSP

TP 11: Read pulse to 2 port RAM on the SPTX

TP 12: Write pulse to 2 port RAM on the SPTX

TP 13: Test signal input to PDH's on the TRB

Connections

The sockets on the rear side of the backplane and their connections in the EM 1002 Transceiver Unit are described in the tables below.

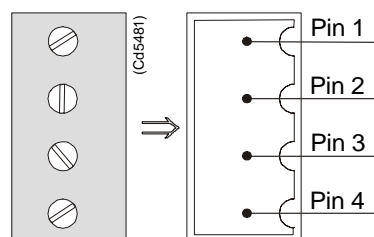


Figure 55 Pin configuration

The EM 1002 do not use P6, P7, P8, or P12.

RXB-P2	Signal	Connection
1	STBY+	Bottom plate-Remote pin 3
2	STBY-	Bottom plate-Remote pin 4
3	ON	Bottom plate-Remote pin 5
4		

RXB-P3	Signal	Connection
1	HEAT	Wall sect.-Resistor pin 1
1	HEAT	Heater-Terminal pin 2
2	STBY-	Wall sect.-Resistor pin 2
2	STBY-	Heater-Terminal pin 1
3	TRIG	Bottom plate-Remote pin 1
4	DGND	Bottom plate-Remote pin 2

RXB-P4	Signal	Connection
1	+12VH	
2	HGND	
3	HGND	
4		

RXB-P5	Signal	Connection
1	+12VH	TXB-P3 pin 4
2	HGND	TXB-P3 pin 2
3	HGND	TXB-P3 pin 3
4	+5VH	TXB-P3 pin 1

RXB-P9	Signal	Connection
1	POW1	TX/RX Fan pin 1
2	POW2	TX/RX Fan pin 3
3	POW1	PU Fuse pin 3
4	POW2	PU Fuse pin 4

RXB-P10	Signal	Connection
4	GND	chassis

RXB-P11	Signal	Connection
1		flat cable to PSB card
2		flat cable to PSB card

RXB-P13	Signal	Connection
1	+5 Vdc	TXB-P2 pin 1
2	+5Vdc	TBX-P2 pin 2
3	DGND	TBX-P2 pin 3
4	DGND	TBX-P2 pin 4

RXB-P14	Signal	Connection
1	+5 Vdc	TXB-P2 pin 1
2	+5Vdc	TBX-P2 pin 2
3	DGND	TBX-P2 pin 3
4	DGND	TBX-P2 pin 4

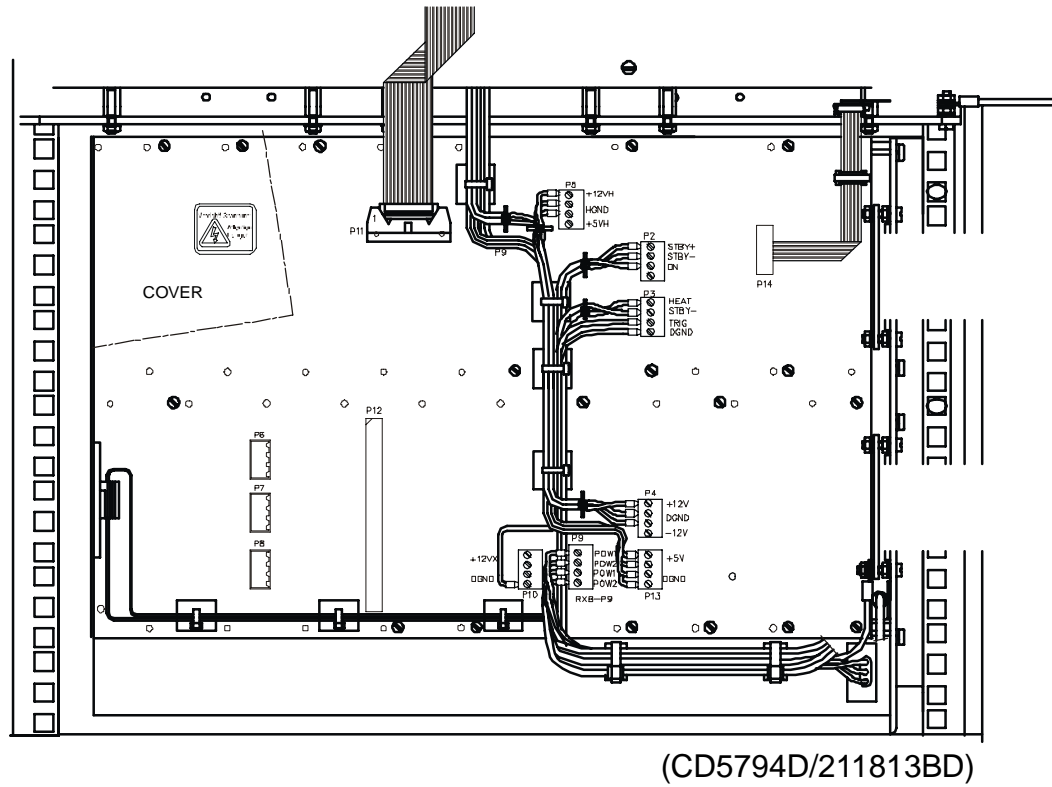


Figure 56 The Receiver Backplane

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6 RAW DATA LOGGER

6.1 Description and main functions

Overview

The Raw Data Logger is an option that can be mounted on the EM 1002 Transceiver Unit. The main purpose is to log the samples through out the water column for all 128 staves. The sample data can also be presented on the display.

The data logger contains:

- CD-writer
- harddisk
- Beamformer Signal Processing (BSP) board
- Control Processing Unit (CPU) board

A ribbon cable is connecting the EM 1002 Transceiver Unit and the Raw Data Logger.

The CD-writer is used to load the Kongsberg Maritime software and to backup sample data to a CD-disk.

Software is installed on the BSP board and on the harddisk.

This chapter provides the following information:

- *Description and main functions, page 173.*
- *Raw Data Logger outline, page 174.*

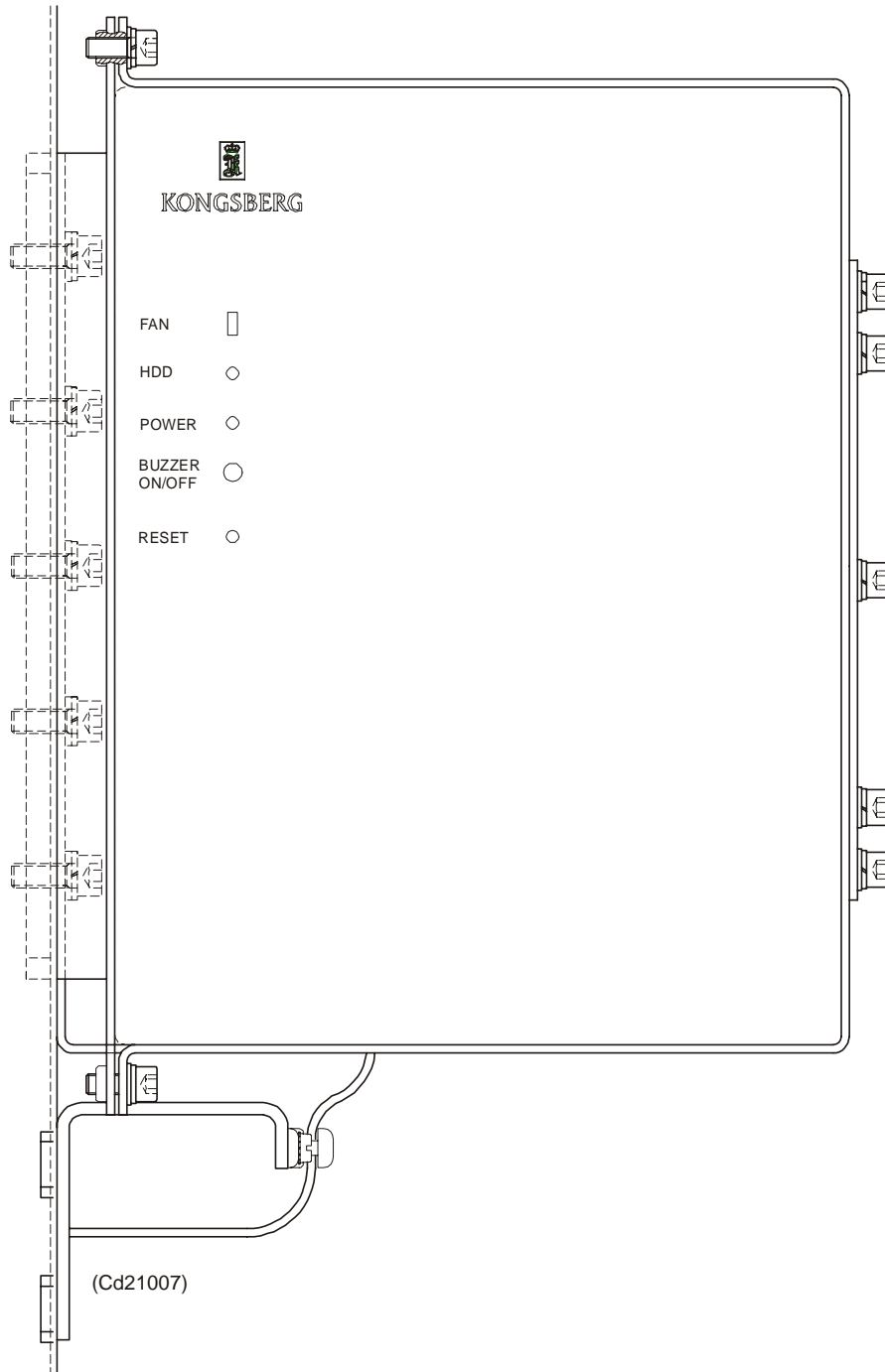


Figure 57 Raw Data Logger - Outline dimensions

7 HULL UNIT CONTROLLER

Note

The Hull Unit is an optional part of the EM 1002 system. If you do not have a Hull Unit, disregard this chapter.

For more information about the Hull Unit, refer to the Hull Unit Instruction Manual (852-164697).

7.1 Description and main functions

Overview

The EM 1002 Hull Unit Controller controls the pitch stabilisation system. The cabinet holds one subrack containing circuit boards and modules, and the back plate holds a MSP-10 Reference power supply.

This chapter provides the following information:

- *Description and main functions, page 175.*
- *Hull Unit Controller assembly outline, page 176.*
- *Theory of operation, page 178.*
- *Subrack, details, page 180*
- *Circuit board descriptions, page 181.*

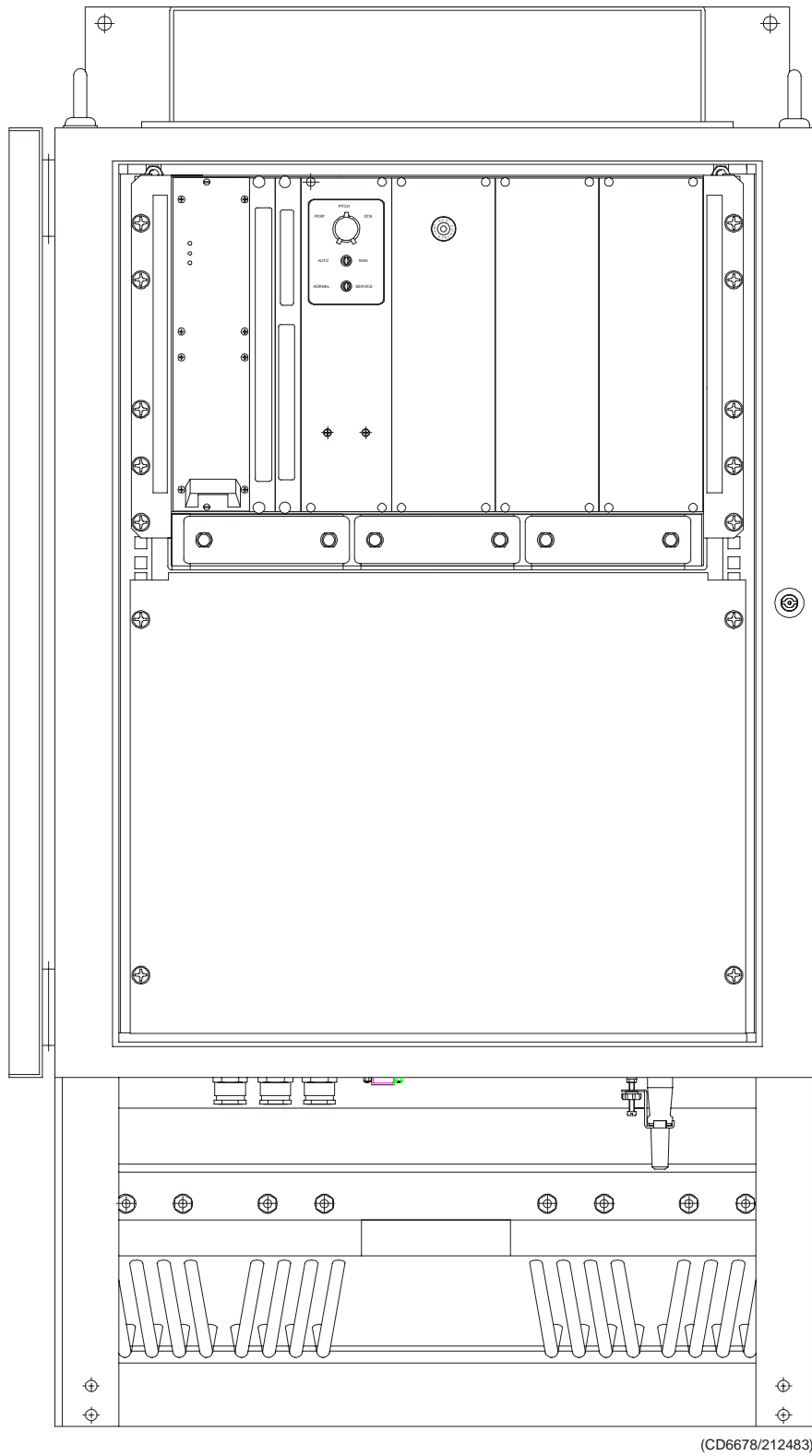
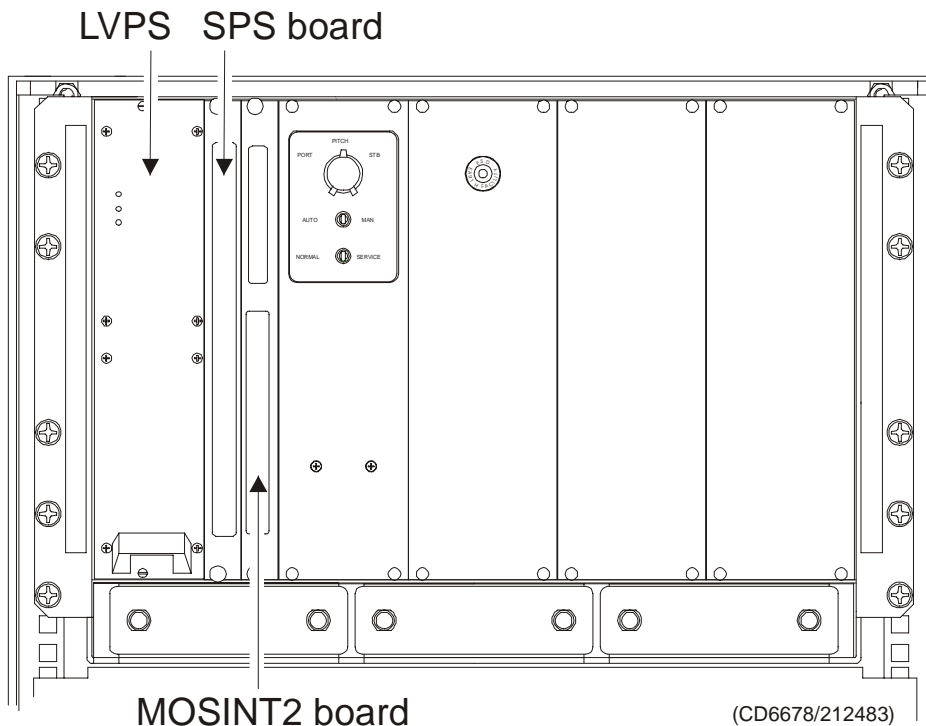


Figure 58 Hull Unit Controller, wired

Circuit boards and modules

The subrack is located at the top of the Hull Unit Controller. It holds 2 circuit boards, a power supply and a servo amplifier.



The subrack holds the following circuit boards and modules:

- Signal Processor board (SPS)
- Motor and Sensor Interface board (MOSINT2)
- Passive Servo Backplane
- Low Voltage Power Supply (LVPS)
- Fan

→ *A more detailed description of all the circuit boards and modules is found on page 181.*

7.2 Theory of operation

Overview

This chapter presents a functional description of the Hull Unit Controller.

Simplified block diagram

The simplified block diagram for the Hull Unit Controller presents the following main functions:

- Transmission
- Reception
- Processing

→ *Refer to figure 59.*

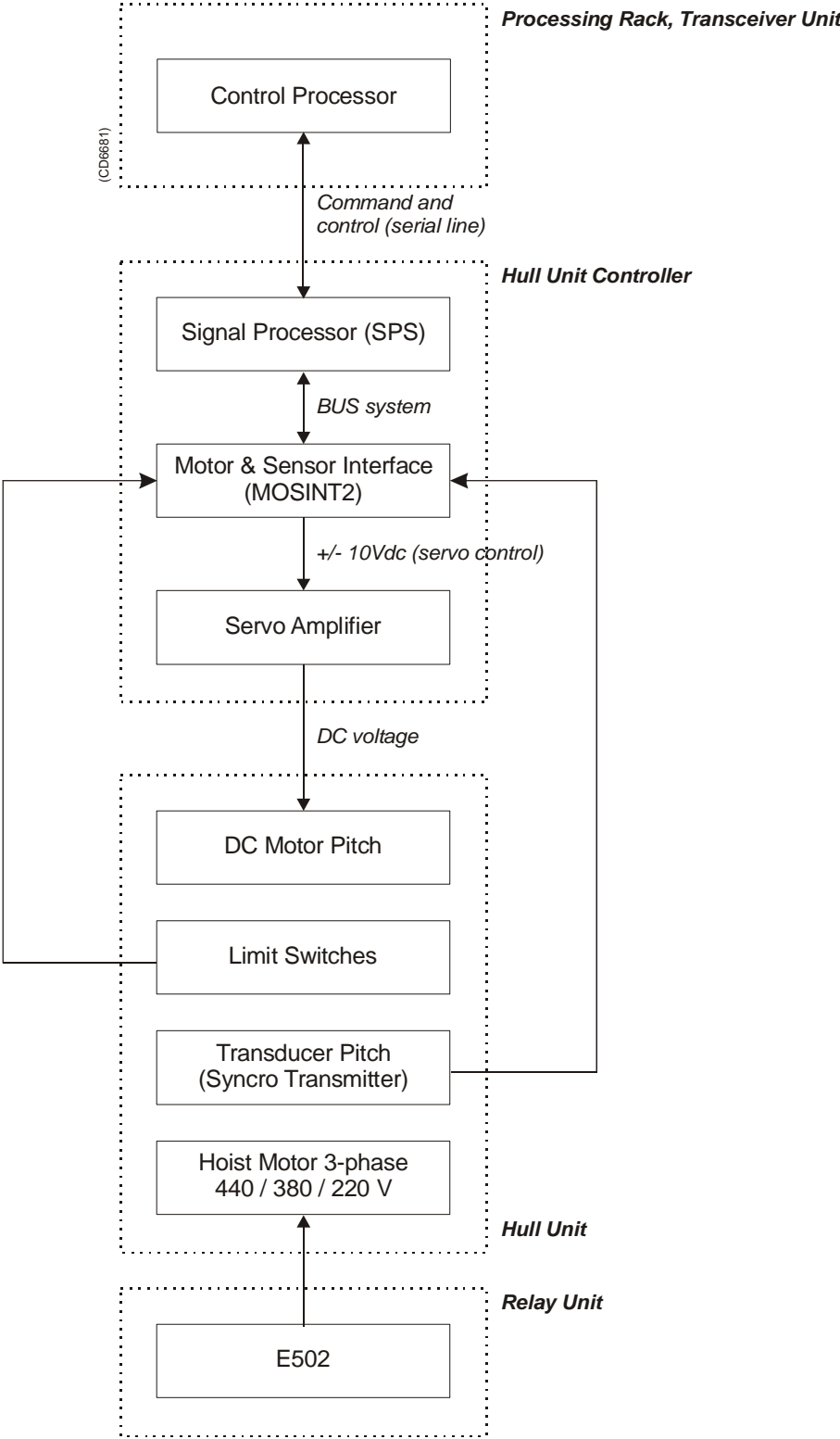


Figure 59 EM 1002, simplified block diagram

7.3 Hull Unit Controller subrack details

Location

The EM 1002 Hull Unit Controller controls the pitch stabilisation system. The cabinet holds one subrack containing circuit boards and modules, and the back plate holds a MSP-10 Reference power supply.

The subrack is located at the top of the Hull Unit Controller. It holds 2 circuit boards, a power supply and a servo amplifier.

Circuit boards and modules

Signal Processor Board (SPS)

The SPS is used as a function controller.

→ *The board is explained on page 182.*

Motor and Sensor interface board (MOSINT2)

The MOSINT2 contains several analogue and digital inputs and outputs. MOSINT2 is controlled by signal Processor board (SPS).

→ *The circuit board is explained on page 183.*

Passive Servo Backplane

The subrack uses a passive backplane. All the connections to the power supply and circuit boards are made on this backplane.

→ *The circuit board is explained on page 189.*

Low Voltage Power Supply (LVPS)

The low voltage power supply is a plug-in module on the left side of the subrack. It supplies + 5 Vdc, + 15 Vdc and - 15 Vdc. This is a commercial item.

→ *The power supply is explained on page 191.*

Reference Power Supply (MSP-10)

The reference power supply is a commercial item.

→ *The power supply is explained on page 192.*

Fans

Two of the fans are located at the bottom of the Processing Unit. One is located next to the power supply.

7.4 Circuit board descriptions

Overview

This chapter describes all the circuit boards and modules in the EM 1002 Hull Unit Controller. A functional description with a block diagram is provided, as well as the facilities provided for maintenance.

Signal Processor board (SPS)

→ *Refer to page 124 for a closer description.*

Motor and Sensor interfaces board (MOSINT2)

Purpose and description

The MOSINT2 contains several analogue and digital inputs and outputs. It is controlled by the Signal Processor board (SPS).

It performs the vital interface function for the synchro gyro input. The board is equipped with several LEDs for voltage and performance monitoring.

How it works

The MOSINT2 circuit board functions are contained on a double extended Europa board with standard Kongsberg Maritime interface. The board is equipped with a multiple of input/output (I/O) line facilities which can be selected to operate as input or output lines through software control.

A general course gyro interface for gear ratios other than 1:1 is implemented. Also available is a 12-bit Analogue-to-Digital (A/D) converter (AD7874) with a programmable amplifier with four individual inputs. A Digital-to-Analogue (D/A) converter with four outputs is included. One output is used for a signal to the servo amplifier, and one for other purposes. One Synchro-to-Digital (S/D) converters take care of transducer position.

The Motor & Sensor Interface (MOSINT) consists of the following modules:

- Stepper/Synchro Gyro Interface
- Four 12-bits Analogue-to-Digital (A/D) converter inputs
- Four 12-bits Digital-to-Analogue (D/A) converter outputs
- Six Synchro-to-Digital (S/D) converters
- Parallel Interface

The number of A/D, D/A and S/D converters will reflect the unique application for each customer.

The Motor & Sensor Interface (MOSINT) board has eight LEDs and six test points mounted on its front edge. Most of these are used to check the supply voltages:

- TP1 and D1 monitor the -5 Vdc
- TP2 and D2 monitor the +5 Vdc (analogue supply voltage)
- TP3 and D3 monitor the +5 Vdc (digital supply voltage)
- TP4 is ground

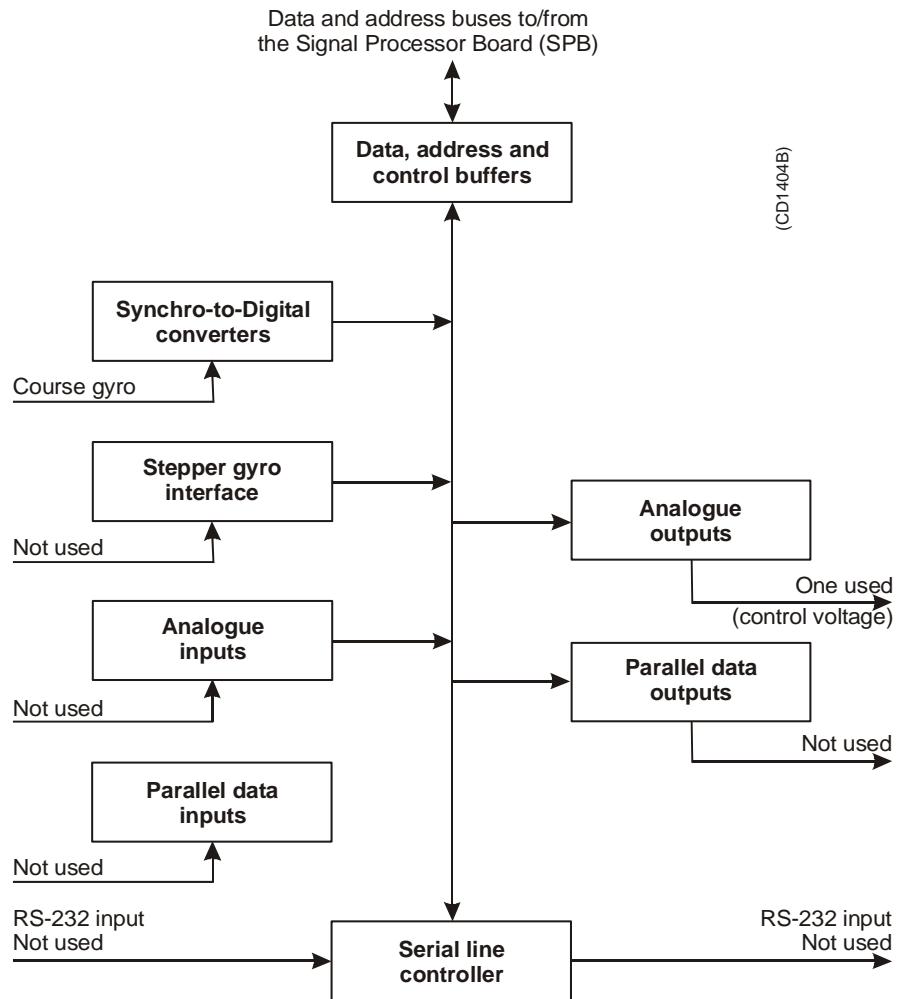


Figure 60 Motor & Sensor Interface 2 (MOSINT2) block diagram

- TP5 monitors the +15 Vdc
- TP6 monitors the -15 Vdc
- D4 is not used.
- D5 indicates that the board is enabled.
- D6, D7 and D8 indicate the stepper synchro inputs.

Stepper/Synchro Gyro Interface

This is a standard Kongsberg Maritime Gyro Interface used to convert the analogue three phase signal into a digital six phase signal. The interface is intended for gyros with gears of these reductions: 1:360, 1:180 and 1:90, or a stepper gyro with the same gear reductions. This input is not used.

Four 12-bits Analogue-to-Digital (A/D) converter inputs

One A/D converter is intended for a possible heave input reading, and one A/D converter is for space or offset calculations. All have 12 bits. These inputs are not used. The A/D converters are not used on systems delivered today, but can be found on some older EM 1002 systems.

Four 12-bits Digital-to-Analogue (D/A) converter outputs

One D/A converter is used to supply control voltage to the Servo Amplifier adjusting to speed.

Six Synchro-to-Digital (S/D) converters

One S/D converter is used to read the Transducer pitch. The other inputs are available for special customer applications, or are not used. All have 12 bits \pm 1 bit accuracy.

Parallel Interface

12 TTL level outputs are provided for input or output applications. These are controlled by the software, and are used to control both external and internal devices. Four outputs are buffered by a transistor array, one of these is used to control a relay.

FacilitiesLEDs

D1	- 5 Vdc (for A / D converter)
D2	+ 5 Vdc (for A / D converter)
D3	+ 5 Vdc
D4	Indicates activation of relay K1
D5	BE => ON when the MOSINT2 is enabled
D6	S3 => ON when phase 3 synchro i/f is high
D7	S2 => ON when phase 2 synchro i/f is high
D8	S1 => ON when phase 1 synchro i/f is high

Test points

TP 1	- 5 Vdc (for A / D converter)
TP 2	+ 5 Vdc (for A / D converter)
TP 3	3 + 5 Vdc
TP 4	GND
TP 5	+ 15 Vdc
TP 6	- 15 Vdc
TP 7	AD_RD~ (Low while reading A / D converter)

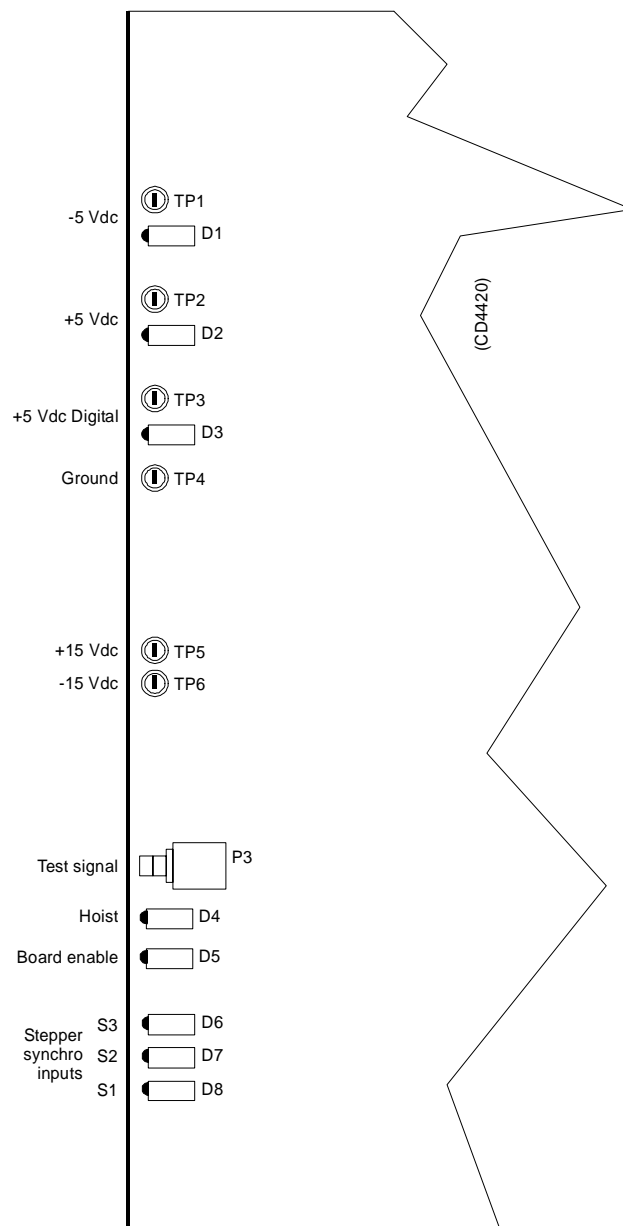


Figure 61 Motor & Sensor Interface 2 (MOSINT2) front mounted devices

TP 8	A / D input signal, channel 4
TP 9	A / D input signal, channel 3
TP 10	CONV~ (Low when start convert to A / D converter is issued)
TP 11	A / D input signal, channel 2
TP 12	A / D input signal, channel 1

Links

LK 01	Open	S / D converter 5, control bit "B"
LK 02	Closed	S / D converter 6, bypass Twin-T network
LK 03	Open	S / D converter 5, bandwidth low
LK 04	Open	S / D converter 3, bandwidth low
LK 05	Open	S / D converter 3, control bit "A"
LK 06	Open	S / D converter 3, control bit "B"
LK 07	Open	S / D converter 5, bypass Twin-T network
LK 08	Open	S / D converter 5, bypass Twin-T network
LK 09	Open	S / D converter 5, bypass Twin-T network
LK 10	Closed	S / D converter 6, bandwidth low
LK 11	Open	S / D converter 6, control bit "A"
LK 12	Open	S / D converter 4, control bit "B"
LK 13	Open	S / D converter 4, control bit "A"
LK 14	Open	S / D converter 4, bandwidth low
LK 15	Closed	S / D converter 6, control bit "B"
LK 16	Open	S / D converter 5, control bit "A"
LK 17	Closed	S / D converter 6, bypass Twin-T network
LK 18	Closed	S / D converter 6, bypass Twin-T network
LK 19	Open	S / D converter 4, bypass Twin-T network
LK 20	Open	S / D converter 4, bypass Twin-T network
LK 21	Open	S / D converter 4, bypass Twin-T network
LK 22	Open	S / D converter 1, bandwidth low
LK 23	Open	S / D converter 1, control bit "A"
LK 24	Open	S / D converter 1, control bit "B"
LK 25	Open	S / D converter 3, bypass Twin-T network
LK 26	Open	S / D converter 3, bypass Twin-T network
LK 27	Open	S / D converter 3, bypass Twin-T network
LK 28	Open	S / D converter 2, bandwidth low
LK 29	Open	S / D converter 2, control bit "A"
LK 30	Open	S / D converter 2, control bit "B"
LK 31	Open	S / D converter 2, bypass Twin-T network
LK 32	Open	S / D converter 2, bypass Twin-T network
LK 33	Open	S / D converter 2, bypass Twin-T network
LK 34	Open	S / D converter 1, bypass Twin-T network
LK 35	Open	S / D converter 1, bypass Twin-T network
LK 36	Open	S / D converter 1, bypass Twin-T network
LK 37	Closed	A / D converter uses internal interface
LK 38	Open	A / D converter uses external interface

Note

*The link settings may vary for different customer applications.
The settings shown are the normal configuration.*

Links 28, 30, 31, 32 and 33 are closed for Transducer pitch.

Link 37 is always closed.

Switches

Gyro			DIL switch S1							
			8	7	6	5	4	3	2	1
Gyro not connected			0	0	0	0	0	0	0	0
Synchro signal	1:360	50/60 Hz	1	0	0	1	1	0	0	0
		400 Hz	0	1	0	1	1	0	0	0
	1:180	50/60 Hz	1	0	0	1	0	1	0	0
		400 Hz	0	1	0	1	0	1	0	0
	1:90	50/60 Hz	1	0	0	1	0	0	1	0
		400 Hz	0	1	0	1	0	0	1	0
Stepper signal	1:360		0	0	1	0	1	0	0	1
	1:180		0	0	1	0	0	1	0	1
	1:90		0	0	1	0	0	0	1	1

Table 1 DIL switch S1 setting

Socket mounted components

U 01	R / D Converter RDC19202-303 (not mounted)
U 03	R / D Converter RDC19202-303 (not mounted)
U 05	R / D Converter RDC19202-303 (not mounted)
U 07	R / D Converter RDC19202-303 (not mounted)
U 10	R / D Converter RDC19202-303 (not mounted)
U 13	R / D Converter RDC19202-303
U 15	PAL
U 16	PAL
U 17	PAL
U 19	Parallel output port 8255A
U 22	Programmable communication interface 8251A (not mounted)
U 43	D / A Converter AD664BD-BIP

Servo backplane

Purpose and description

The purpose of the servo Backplane is to enable communication between the circuit boards plugged into it, and between these circuit boards and the external circuitry in the cabinet.

The Hull Unit Controller holds the following circuit boards:

- Signal Processing board
- Motor and Sensor Interface board
- Low Voltage Power Supply

How it works

There are no active components on this backplane.

Facilities

LEDs

None.

Test points

All the test points listed below are only used during development and debugging.

TP1: GND

TP2: Read pulse to the MOSINT2

TP3: Reset to the MOSINT2

TP4: Write pulse to the MOSINT2

TP5: GND

TP6: + 5V

TP7: + 15V

TP8: - 15V

TP9: Serial line input

TP10: Serial line output

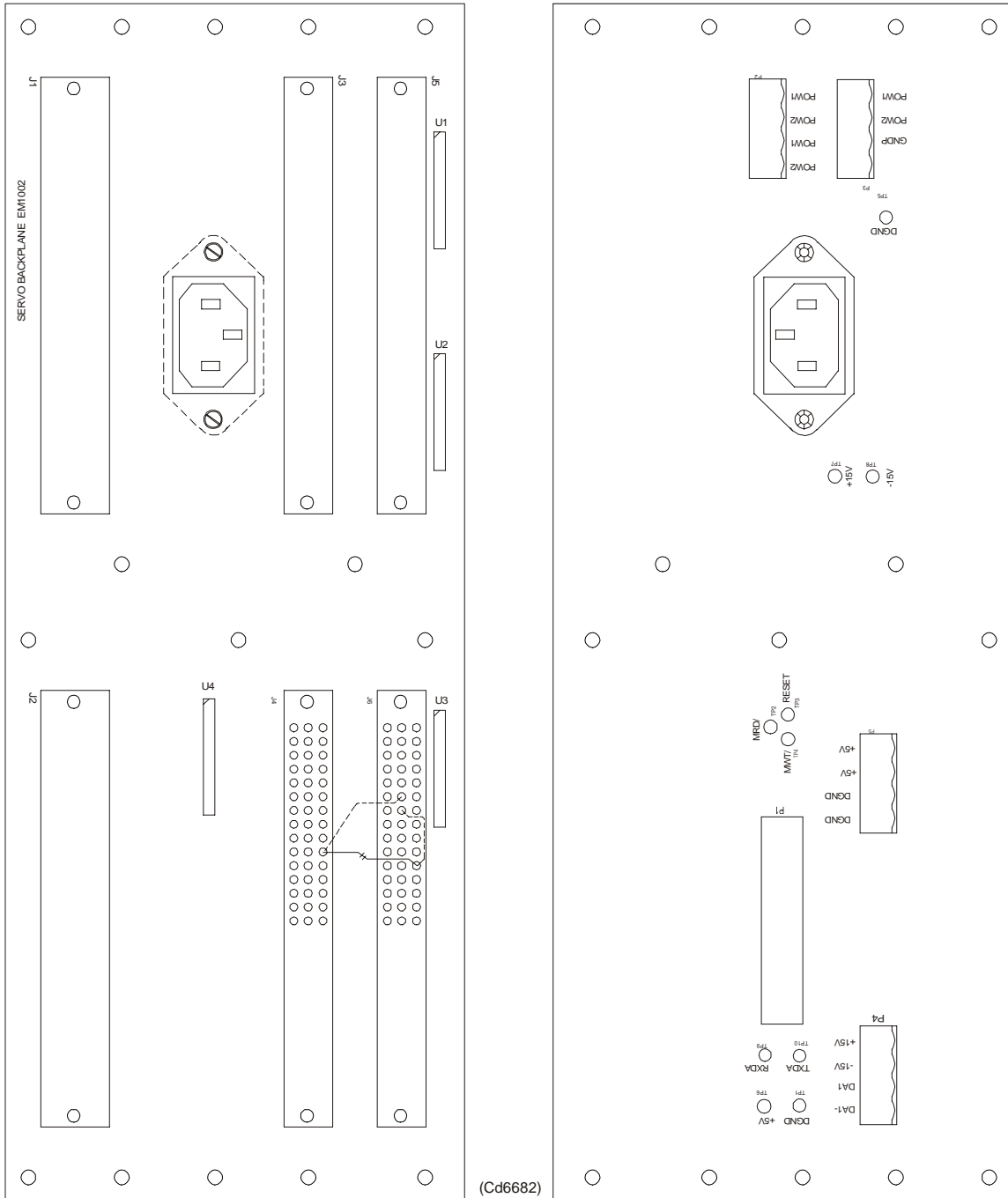


Figure 62 The servo backplane

Low Voltage Power Supply (LVPS)

Purpose and description

The power supply is a commercial item. It is manufactured by Powec. The type identification is PMP 4M02 SIC.

Note

The power supply includes internal fuses. The rating is 3.15 A.

It supplies:

- + 5 Vdc
- + 15 Vdc
- - 15 Vdc

Facilities

Fault alarms/indicators

There are three LEDs on the LVPS:

- One green for **power ON**
- One red for over-voltage - shutdown, **OV - shutdown**
 - If there is an over-voltage from the module or if an error in the over-voltage detection circuit occurs, the OV-shutdown LED is lit. The module will then be shut down.
- One red for **Alarm**
 - Lit if other faults or if the module stops working.

Reference Power Supply (MSP10)

Purpose and description

The reference power supply is required in order to operate the Hull Unit synchro transmitters. This is 115Vac, 400Hz, and it is produced by a small power supply located on the back plate.

Note

*The reference power supply has an externally mounted fuse.
Fuse rating is 200mA.*

The reference power supply is a commercial item. It is supplied by the Norwegian company Joseph Eide AS. The type identification is MSP-10.

How it works

The reference power supply supplies 115 V - 400 Hz to the synchro transmitter on the Hull Unit and to the synchro/digital converter on MOSINT2.

8 REMOTE CONTROL JUNCTION BOX

8.1 Description

The standard version of the EM 1002 system has a Remote Control Junction Box.

On systems with a hull unit, the on/off function is by default handled by the Remote Control Unit. If access to the trigger output and/or the serial line is required, this Remote Control Junction Box may be used.

→ *For information about the Remote Control Unit and the Local Control Unit, refer to the Hull Unit Instruction manual.*

This chapter includes information about the Remote Control Junction Box.

→ *Remote Control Junction Box, refer to page 194.*

→ *Remote Control Junction Box outline, refer to page 195.*

8.2 Remote Control Junction Box

Scope

A dedicated Remote Control Junction Box has been designed to provide:

- System trigger output
- External trigger in via RS 232 serial line

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

→ Refer to page 64 for a description of the W202 cable.

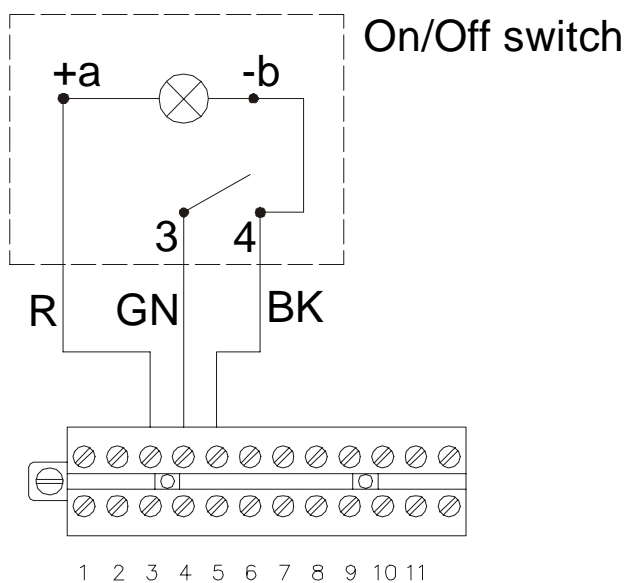
Note

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

Location

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

General information



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

→ Refer to page 195 for the outline dimensions.

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

Figure 63 Remote Control Junction Box - Standard circuit diagram

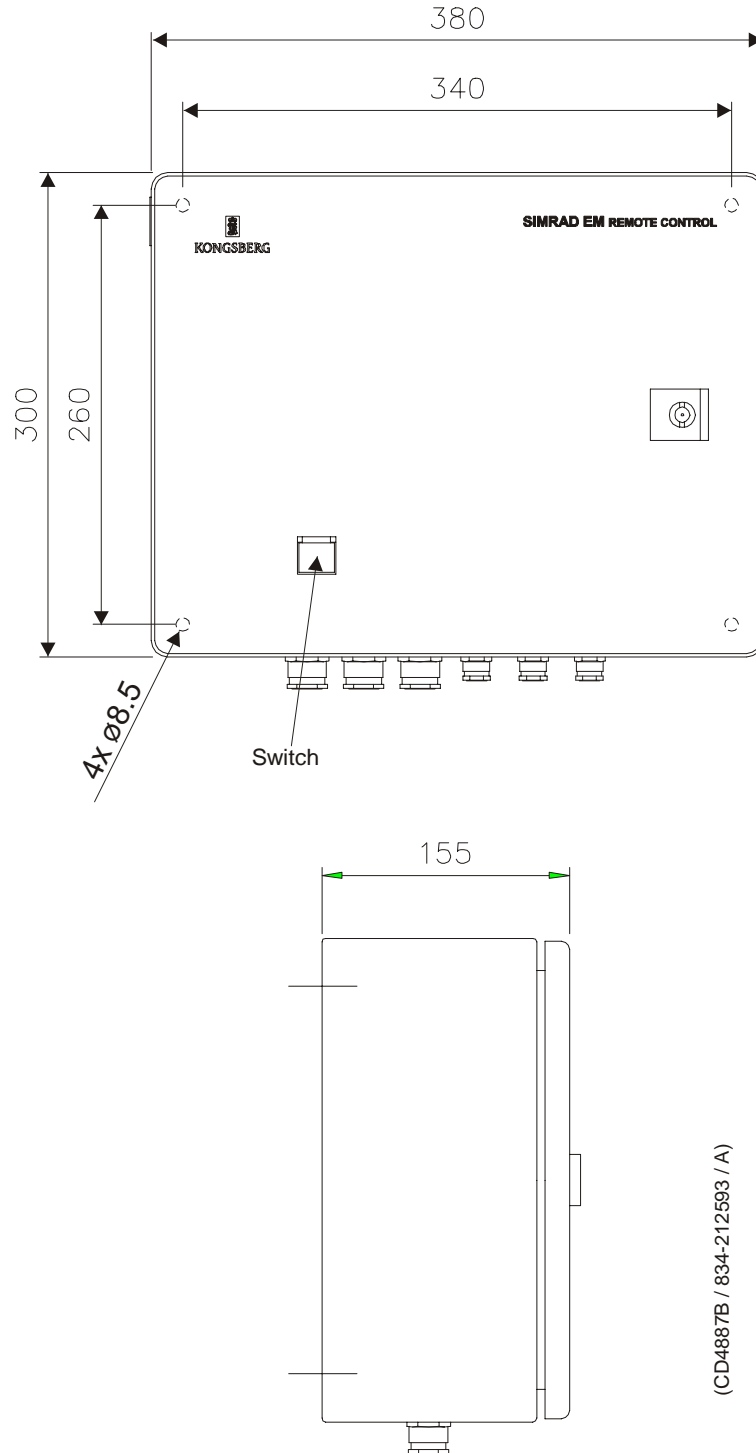


Figure 64 Remote Control Junction Box - outline dimensions

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9 TROUBLESHOOTING

9.1 Messages

Introduction

The EM 1002 provides numerous messages to inform you of major and minor hardware and software errors.

The messages, if they occur, will be displayed in the Status Display in the Message field.

The different utilities operating on the EM 1002 Operator Station each issue several messages. These messages can be sorted in four categories:

- display warnings
- display errors
- warnings
- errors

The messages presented as **display warnings** and **warnings** merely point out small inaccuracies, and must be regarded as guidelines to the normal operation of the system.

The **display errors** and operational **errors** reflect major and minor hardware and software errors, some of which must be acted upon to ensure the normal operational capability.

The following chapters present all the possible messages, and briefly explain the proper action to be taken.

The information is provided as follows:

<Nxxx>: - <Message text>

Necessary action with applicable references.

<Nxxx> is the message identifier. The number will allow you to find the message easier in this document, and it tells you which utility issued it.

N - *module/utility identifier.*

xxx - *message identifier*

In the list below you will find one letter representing each module. Each module is described in its own chapter. The number **xxx** is only an identifier.

S: setup messages

W: ESO/workstation messages

L: launchpad messages

E: sound speed profile editor messages

P: Ping Display messages

The **Hardware** and **CPU CMOS setup** messages are presented with the exact same layout. The Hardware messages also start with a message identifier <Nxxx>, and have a following message text.

The message text contains an error code which has to be decoded to get the exact error condition.

Most display errors are equipped with a help-textfunction, giving additional help on the errors. This text will, in most cases, be identical to the action text found in this manual.

9.2 Setup messages

Setup messages

The following messages are presented by the **Setup** utility.

Display Warning

S10: - Remember to set correct Gain parameters when using Manual bottom detection!

Normal mode should be Range And Gain, which uses Automatic bottom detection!

This mode should only be used when automatic bottom detection doesn't work. Make sure that the Depth To Normal Incidence depth indicator has a sensible value - it should have a value fairly close to the expected depth.

Display Error

S15: - Unable to write BIST output buffer to printfile <filename>.

An attempt was made to open the printfile in the system defaults directory for writing, but the operation failed. You should have full read and write access to the directory and all files in the directory.

Display Error

S17: - Unable to write BIST output buffer to file <filename>.

An attempt was made to open the savefile in the system defaults directory for writing, but the operation failed. You should have full read and write access to the directory and all files in the directory.

Display Error

S18: - No reply to the current BIST test!

Each of the Built In Self Test (BIST) commands is required to give a response within a fixed period of time. The length of this period varies with the type of test. The Processing Units has sub-units that may not respond in time, but this should be reported back to the operator as part of the reply to the current BIST test.

If the Processing Unit does not respond within the allocated time period, you should try one of the other tests to see if this is a general problem. If this is the case, or if the problem persists, you should try rebooting the Processing Unit.

Display Warning

S21: - The profile is not deep enough, and should be extended. When you select the OK button, the profile will be sent to the profile editor for automatic extension.

All profiles used by the system require a maximum depth of 12000 meters. Profiles less deep will be extended by the system, starting from the original maximum depth. The extension is based on standard table values, with two points interpolated between last value pair in profile and first table value pair.

Error

S25: - The Profile contains errors and will not be used. Errors detected:

The same message is used for several types of warnings:

1. Out-of-bounds depth values. Legal interval is 0 - 12000m.
2. Out-of-bounds sound speed values. Legal interval is 1400 - 1700 m/s.
3. Fewer actual samples than stated in profile header, using actual no. of samples in profile.
4. Gradient anomalies checking two neighbouring value pairs.

Even though you are given the choice to use the profile, it is recommended that you use the profile editor to verify and correct it. Otherwise, the echo sounder soundings may suffer quality degradation.

Error

S28: - Too step gradients...

If one or more of the samples are spike values, they should be removed from the profile.

Display Warning

S32: - The sound velocity profile <name> contains too few samples.

The profile header says that the profile contains less than two entries. At least two entries are required, and for any real life sounding that is really too few entries.

Display Warning

S33: - The sound velocity profile <name> contains more than 1000 samples!

The system is not designed to handle profiles exceeding 1000 depth/speed pairs. You should use the profile, or download again, using 1000 depth/speed pairs as a maximum.

Display Error

S37: - Sound Velocity Profile <name> was not found!

The specified profile was not located in the directory containing the sound speed profiles (\$SHAREDHOME). You could have misspelt the profile name, or the profile has been removed from this directory after it was selected. Try selecting the profile from the pull-down menu. This menu is updated every time it is opened, and should give you the exact list of available profiles.

Display Error

S50: - The file <filename> is not found in the \$HOME/<directory>, or in the \$NEPTUNEHOME/defaults directory.

Error

S61: - The following entries in the set-up-file are missing or contain an error in value specification:

All set-up parameters are checked when a set-up file is opened. Any parameters that are not within legal range or missing from the file will be listed in this message. By following the instructions, it is possible to get around the problem and recreate the set-up file. You may instead check if you have a backup version of the installation file in the system directory by selecting the 'File->Read...' option. You will probably find some older version of the file, because any modification of the installation parameters followed by a 'File-Save' creates a backup version of the file to be modified.

Display Error

S64: - Profile <name> has an error in line 1. The line should contain a space after the opening parenthesis and one space before the closing parenthesis. Correct the profile before reselecting...

According to the Simrad ASCII profile format, this space is required. You can fix the problem using a text editor. If you have downloaded the profile from an external source, please verify that your profile source or download programs adheres to the file syntax.

Display Error

S65: - Profile <name> has an error in line 1. It seems that the header does not contain the correct no. of elements. Create the profile before retrying.

The profile header should start with "(" and close with ")". One or both of these elements could not be located in the header line. You can fix the problem using a text editor. If you have downloaded the profiles from an external source, please verify that your profile source or download programs adheres to the file syntax.

Display Error

S66: - Sound Velocity Profile directory <name> not found!

The missing directory (\$SHAREDHOME) is created during installation, and should always be present. If not, it means that someone has modified the file system. You should reinstall the system to recreate the proper operating environment.

Display Warning

S69: - Profiles in Simrad Survey Format cannot be downloaded...

The system cannot use this format for sound speed profiles. These profiles are produced when logging data, based on a Simrad ASCII format profile selected by the user. If this ASCII profile is no longer available, and you would like to use it again, you could use the Profile Editor to convert the profile into the Simrad ASCII profile format.

Display Error

S70: - The BIST for SW version returned an empty string!

Each of the Built In Self Test commands will return with the result being displayed in the BIST output area. This message informs you that a reply arrived, but that the reply contained no text to be displayed. This is clearly an error. Please repeat BIST command to check if the problem is repeatable. Errors like this should not occur, and if the problem persists, you are advised to reboot the Processing Unit and restart the operation station software.

Error

S71: - The Set-up-file is empty. Do you want to reinstall the default Simrad file?

The file containing installation parameter set-up values was empty. When this happens, the system can automatically install the default version of the file. The file may have been corrupted during a program crash. Confirming installation of default file allows you to continue. Otherwise, the system cannot be operated...

Display Error

S73: - Format error in BIST return for SW version request!

Each of the Built In Self Test commands will return with the result being displayed in the BIST output area. This message informs you that a reply arrived, but that the reply did not match the expected format. This is clearly an error. Please repeat BIST command to check if the problem is repeatable. Errors like this should not occur, and if the problem persists, you are advised to reboot the Processing Unit and restart the operation station software.

Display Error

S74: - 'BSP Test' failed - do you want to reboot the BSP unit?

The BSP sub-unit may occasionally lock up, with no pings being produced from the echo sounder. When that happens, the BSP BIST command will fail with this message. It is, however, possible to restart the BSP without rebooting the Processing Unit. This will happen when you confirm that a reboot is wanted. When the boot is completed, you should run the BSP BIST command again to verify that the unit responds correctly.

Display Error

S96: - Environment 'MODULE_ADDRESSES' undefined!

The program cannot operate without the specified environment. Please verify that the correct start-up procedure is used.

Display Error

S97: - Network Configuration File not found! File: <filename>

The program cannot operate without the specified file. Please verify that the file specified by the environment 'MODULE_ADDRESSES' with hostname as extension is present in your home directory, and that you at least have 'Read' permission.

Error

S98: - Error in connecting to input socket for program <program name>.

The set-up program tries to open an input socket, but the operation failed. The most likely explanation, is that the port no. specified for the set-up program already is in use. Check if any of the programs started from a previous session of the system are still running. If so, terminate these programs. If you do not know how to do this, it will in most cases be sufficient to log out and then back in. This will terminate any running programs and free up resources. Then restart the operator station software...

Display Error

S147: - Error sending datagrams to Ping Display!

Communication with the Ping Display uses IP socket communication, where the Ping Display has opened a specific port for data input. This error occurs when the set-up program tries to send to that port. The most likely explanation is that the port no. specified for the Ping Display is in use by another program.

Display Error

S148: - No profile name entered!

You have not specified a profile name - the input field is empty. Enter a profile name to proceed...

Display Warning

S150: - The file <filename> was empty, and factory defaults was read. Please verify all settings and save all settings using the 'File->Save' menu option.

The specified file containing set-up parameters (runtime or installation) was empty. When this happens, the system automatically installs the default version of the file. The file may have been corrupted during a program crash.

Display Error

S151: - The file <filename> is not found in the \$HOME directory, or in the \$NEPTUNEHOME/defaults directory. After verifying the settings, you may create the file by using the 'File->Save' menu option. The program terminates when you select the OK button.

The specified file containing set-up parameters (runtime or installation) is missing from the system directory, and was not located in any of the predefined locations for the file. The error indicates that the system somehow has been corrupted, possible due to manual operations in the file system. It is advisable to reinstall the system to re-establish system integrity.

Display Error

S152: - Not able to copy the file <filename> to \$HOME/<filename>. The program terminates when you select the OK button.

The specified file containing set-up parameters (runtime or installation) was missing from the system directory, and could not be copied to this directory. Due to problems with the directory access. The error indicates that the system somehow has been corrupted, possible due to manual operations in the file system. It is advisable to reinstall the system to re-establish system integrity.

Display Error

S206: - Min. Depth must be less than Max. Depth!

It should be fairly easy to fix - just enter a minimum value less than the maximum value...

Display Error

S207: - Max. Depth must be greater than Min. Depth!

It should be fairly easy to fix - just enter a maximum value greater than the minimum value...

Display Error

S208: - Legal interval: [<value>, <value>]

The input value is outside the specified interval - re-enter value to proceed...

Display Error

S211: - Couldn't locate Workspace of Main Program!

If this error occurs, it means that certain workspace functions will be disabled, but that the overall functionality will be present. It has been observed that restarting the Operator Station software may remove the problem.

Display Error

S212: - Couldn't connect to SMS Server!

Occurs when the program is started independent of the rest of the system, or when the operating environment is insufficiently defined. It means that none of the functionality based on running an integrated system will be present, thereby rendering the system inoperable. If restarting the system does not remove the problem, it is likely, that the easiest way to fix it is to reinstall the software.

Display Error

S213: - Illegal Window Configuration Command received: <command>

An unknown workspace or window command was received. Should not affect the main functionality of the program.

Display Error

S214: - Couldn't send status to SMS Server!

This is a serious error, which should not occur. It reflects internal corruption in the communication link with the rest of the system. It means that none of the functionality based on running an integrated system will be present, thereby rendering the system inoperable. If restarting the system does not remove the problem, it is likely, that the easiest way to fix it is to reinstall the software.

Display Error

S215: - Server Connection Broken!

This is a serious error, which should not occur. It reflects internal corruption in the communication link with the rest of the system. It means that none of the functionality based on running an integrated system will be present, thereby rendering the system inoperable. If restarting the system does not remove the problem, it is likely, that the easiest way to fix it is to reinstall the software.

Display Warning

S237: - No profile downloaded...

The system has not received any download profiles. When downloading takes place, the set-up program is notified of the profile name. So far, it seems that nothing has arrived.

Display Warning

S238: - Profile not located in profile directory!

When downloading takes place, the set-up program is notified of the profile name. The system has received a download profile, but it could not be located in the directory used for sound speed profiles.

Display Error

S239: - Sensor Offset + current sound speed exceeds maximum speed of 1700.0 m/s.

The system does not recognise sound speeds in water exceeding 1700 m/s. To correct, enter an offset value, which keeps the sum of sound speed and offset value below or equal to 1700 m/s.

Launchpad messages

The following messages are presented by the **Launchpad** utility.

Display Error

L12: - The following Program(s) should always run, but is still NOT running:

The Operator Station software is an integrated system, and is based on having a predefined set of programs running. If not, the echo sounder cannot be operated.

You may look for any messages related to the offending program in the 'Messages' area of the 'Status Display', or use the 'File->Print / View' menu item to bring up the 'Message Viewer'.

Select the icon for the offending program(s) to check for any messages that could help you locate and fix the problem.

Display Error

L13: - Echo Sounder Not Ready!

The Initial 'Power Up' Built In Self Test (BIST) has failed. Details may be found in the ESO Set-up BIST Self Test (Show->Testing) menu.

The Echo Sounder has a range of Built In Self Test (BIST) commands, testing various parts of the Sounder.

Every time the Operator Station software is started, a link to the Processing Unit is established and the Initial Power-Up-Test is performed. If this fails, the Echo Sounder is inoperable, and the operator should examine the error messages in the BIST test window in the Set-up-program.

Additional status information may be obtained using the other BIST tests available.

Display Error

L15: - Error in Runtime or Installation set-up values!

Must be corrected before activating!

All parameters go through verification checks. First while reading from the Set-up-file, and second while entering parameters manually. The reported error is detected while reading from a Set-up-file, and will block Echo Sounder operation until corrected.

Set the correct value for the offending parameter(s) in the set-up program, and use the 'File' menu 'Read' command to read the set-up back in.

This will automatically verify the new set-up.

Display Warning

L16: - No reply from PU on 'Time Request'. Logging NOT started!

When activating logging of data, the system timestamps some of the datagrams used in the process.

The time to use was requested from the Processing Unit, but the reply did not arrive within a fixed period of time. This may be due to a Processing Unit running at full capacity, or - if the situation continues, while having a normal load on the system - that you may have network problems.

Display Warning

L39: - The <program name> program has not yet registered.
Do you still want to wait for the program to come up?

When starting one of the programs used by the system, it will try to hook up to enable the necessary communication and supervision. If a program does not succeed with this initial registration or hook up, it may have problems in the initial phase of starting up.

Please refer to the 'Status Display, Messages Section' for possible error messages that may help sorting out the problems.

Display Error

L40: - The following Program(s) has not yet registered:

All programs started and supervised by the Launchpad establishes a communication link with the system when they are launched. The listed program(s) did not succeed in establishing this link. It could be that the program (s) crashed before the linkup was attempted. If so, the program(s) has no possibility to communicate with the rest of the system. You may try a manual start of the system in a window, to see if you can find any useful messages written in the window.

Warning

L45: - Error reading input datagram...

Reading from the communication input socket failed. This is a low-level error, and should not occur if the system managed to start properly. If the error persist, try terminating the system and restart the software again.

Display Error

L47: - The Initial Power Up Self Test failed.
Do you want to repeat the test?

Please refer to the test menus in the Echo Sounder Set-up program for details.

Warning

L52: - Sound Speed At Transducer deviates more than X m/s from the corresponding value defined by the current Sound Speed Profile!

The sound speed at transducer depth received from the probe exceeded the selected alarm offset 5 times in a row. You should verify that you are using the correct sound speed profile, and also verify the size of the alarm offset.

Warning

L54: - Current Center Depth exceeds original maximum depth from the current Sound Speed Profile!

Center Beam Depth = <depth>
 Profile Max. Depth = <depth>.

The original profile had a maximum depth before the automatic profile extension extended the profile down to 12000 m. The depth you now are registering exceeds this depth. This could mean that your original profile isn't deep enough for this area.

Display Error

L59: - Echo Sounder Not Ready!
 Error in Sound Speed Profile!

There are no samples in the current Sound Speed Profile! Verify & correct current profile, or select a new one! After doing this, you should run the Power Up Built In Self Test (BIST) to enable the system.

Display Error

L60: - Echo Sounder Not Ready!
 Error in echo sounder set-up parameters!

All parameters go through verification checks. First while reading from set-up-file and second when entering parameters manually. The reported error is detected while reading from the set-up-file, and must be corrected before continuing! After doing this, you should run the Power Up Built In Self Test (BIST) to enable the system.

Display Error

L62: - No Processing Unit has been detected while scanning the Network.
 Do you want to terminate the Launchpad?

The Operator Station is not receiving broadcast datagrams from the Processing Unit. The continuing flow of broadcast datagrams tells the rest of the system that the PU is still alive. To prevent gaps in the line and possible data corruption, logging was stopped. Possible reasons for loss of contact:

- . Processing Unit is not Powered On
- . Network Cable Problems
- . Configuration Errors
- . Processing Unit Hardware / Software malfunction

Error

L64: - Connection timeout - Logging switched Off!

The Operator Station stopped receiving broadcast datagrams from the Processing Unit. The continuing flow of broadcast datagrams tells the rest of the system that the PU is still alive. To prevent gaps in the line and possible data corruption, logging was stopped. Possible reasons for loss of contact:

- .Processing Unit is not Powered On
- .Network Cable Problems
- .Configuration Errors
- .Processing Unit Hardware / Software malfunction

Error

L65: - Connection timeout - Pinging switched Off!

The Operator Station stopped receiving broadcast datagrams from the Processing Unit. The continuing flow of broadcast datagrams tells the rest of the system that the PU is still alive. The system status was set to No Pinging. Possible reasons for loss of contact:

- .Processing Unit is not Powered On
- .Network Cable Problems
- .Configuration Errors
- .Processing Unit Hardware / Software malfunction

Error

L66: - Timeout in Processing Unit <-> Launchpad Connection!

The Operator Station stopped receiving broadcasts from the Processing Unit. The continuing flow of broadcasts tells the rest of the system that the PU is still alive. Possible reasons for loss of contact:

- .Processing Unit is not Powered On
- .Network Cable Problems
- .Configuration Errors
- .Processing Unit Hardware / Software malfunction

Display Error

L67: - Format Error in Processing Unit Broadcast!

The Processing Units broadcast their presence on the Network. Such a broadcast message was received, but did not meet the format specification.

Display Error

L76: - No reply to the Initial Power-Up BIST.
Do you want to Retry?

The network connection is OK, but the Processing Unit is not responding. Cancel the current attempt. Power the Processing Unit 'Off' and then 'On' again. Then try restarting the operating software.

Display Error

L83: - Could not create Config-file!

An attempt was made to store the current layout configuration onto the system defaults directory, but the operation failed. You should have full read & write access to this directory.

Display Error

L84: - Error in retrieving 'All Workspaces' info!

This is an internal error in the Launchpad, and should never happen. If it does occur, it will be during saving of the layout configuration to file. You should then restart the Operator Station software, and try the same command once again. This error may indicate internal problems for the Launchpad program, and should be reported.

Display Error

L85: - Program <name> contains an error in the configuration-file start-string!

This is a serious error. An attempt was made to update the main configuration file from data in memory. The attempt failed because the internal information did not adhere to the syntax for this type of information. You should exit and restart the system to avoid loss of operational control.

Display Error

L89: - Could not create Log-file Backup!

An attempt was made to open the log- file in the system defaults directory, but the operation failed. You should have full read & write access to this directory.

Display Error

L99: - Not able to change to Raw Data Directory <name> when generating Survey Parameters file.

An attempt was made to change the internal working directory to the one used for raw data (\$RAWDATAHOME), but the operation failed. Please verify that you have full read, write & execute access to this directory.

Display Warning

L111: - Tape Operation Aborted!

Reason:

The reason for an aborted tape operation may vary. With the exception of a user-triggered abort, the reason stated in the message body originates from the operating system, but should be fairly easy to understand. Examples of this could be a message stating that the tape drive is offline or that no data cartridge is loaded.

Display Warning

L112: - You cannot delete the current survey!

The current survey could be active, meaning that the associated directories and files are in use for data storage and processing. Removal of the current survey is therefore prohibited.

Display Warning

L113: - The Log-file is quite large: size X Mb - reset recommended!

The messages in the log-file may be viewed using the 'File->Print / View' command. If the file contains too many messages, it may be prove too 'crowded' for practical purposes. It is recommended that you pay heed to the suggestions of reset offered by the system. Use the 'File->Reset Log-file' option. If you are afraid of loosing useful information, please note that any errors reported while logging data, is logged in a separate log-file along with the survey data. Also remember, that you are offered the option of backing up your log-file before resetting.

Display Warning

L114: - You cannot alter logging set-up while logging is Active!

Due to the programmed functionality of the system, some parameters (logging set-up & installation parameters) may not be modified, because that would disrupt proper functionality and data integrity.

Display Warning

L117: - The root partition of this system now has less than 2Mb space left...

If the disk space on the root partition falls to zero, you may experience various types of problems while operating the system. It is advisable to increase this space to a minimum of 10 - 20 Mb.

Display Warning

Display Warning

Display Error

L120: - The main configuration file <filename> was not found. Since this is a vital file for the system, the Launchpad will terminate when you select the OK button...

This file contains the overall configuration of the operator station software. The system can't operate without this file. The file was copied to the system directory during installation, and may have been accidentally removed.

Display Error

L121: - Error(s) found in the Launchpad Configuration File!

When you select the 'OK' button, the file will be deleted and this program will terminate.

When restarting the system, the Factory Default Configuration File will be installed.

The Launchpad program uses a text-file to define which programs are included in the system. Quite a few bits of information are stored here, using a fixed syntax. This error occurs because the line for this program does not adhere to the syntax. An erroneous modification may have been done using a text editor. A new default version of the file will automatically be installed when restarting the system.

Error

L122: - There are too many entries in setup-file! Max = 18.

The configuration file contains all programs included in the integrated system, but may also contain programs added by the user. These programs may be started from the Launchpad, but are not supervised as the other programs.

The total number of entries has exceeded the maximum limit, probably due to manual modifications of this configuration file.

To restore the default file supplied by the system, remove the \$HOME/.eso_system/esoEmX_config file, and restart the system.

Error

L123: - Not able to obtain the icon for <this utility>!

Each of the programs integrated into the system has a button in the rightmost part of the Launchpad, and each of these buttons should have a symbol / icon for identification purposes.

The symbol name specified in the external configuration file was not found, indicating an error in the file, or a mismatch between the configuration file and the file containing the icon descriptions.

If this error occurs, a capital 'X' is drawn instead of the proper icon.

Error

L124: - Not able to obtain default icon!

Each of the programs integrated into the system has a button in the rightmost part of the Launchpad, and each of these buttons should have a symbol / icon for identification purposes.

The symbol name specified in the external configuration file was not found, indicating an error in the file, or a mismatch between the configuration file and the file containing the icon descriptions.

If this error occurs, a capital 'X' is drawn instead of the proper icon. This message indicates that the 'X' icon was not found.

Display Error

L137: - A survey name must be provided before this program can start!

Fill in or select a survey name to continue!

Display Error

L140: - Illegal character(s) in the Survey Name!

The characters ('>' or '<') are illegal as part of all file-names, survey-names and operator names. Space (' ') will be substituted with '_ '.

Display Error

L141: - Illegal character(s) in the Operator Name!

The characters ('>' or '<') are illegal as part of all file-names, survey-names and operator names. Space (' ') will be substituted with '_ '.

Error

L142: - Environment 'MODULES_ICON_FILE' not found, or empty! Fix and restart!

The file containing the icon descriptions used by the system cannot be located, because the environment variable, giving the name of this file, was undefined. All environment variables used by the system are defined when installing the system, so this message indicates a system installation error.

Error

L143: - Unable to open module icon description file <name> specified in environment 'MODULES_ICON_FILE'. Fix and restart!

The file containing the icon descriptions could not be opened. The file may be missing, or you do not have the proper file access.

Display Error

L144: - Program <name> (possibly specified by the environment symbol <symbol name> in the start-up script) was not found in the Network Configuration File.

File: DPC.addresses.<hostname>

The system cannot work until the problem is fixed, and will terminate when you select the 'OK' button.

The specified file contains network addresses and port no.'s for all programs attached to the system. The error occurs when the program listed in the error message does not have an appropriate entry in the file.

Display Error

L145: - Error opening Network Configuration File!

File: DPC.addresses.<hostname>

The system cannot work until the problem is fixed, and will terminate when you select the 'OK' button.

The specified file contains network addresses and port no.'s for all programs attached to the system. The error occurs when your program tries to access this file, but is denied access. Several possible reasons:

1. The file does not exist. Removed? Wrong Name?
2. You have no file system access.

Display Error

L146: - Error in connecting to socket given by <entry name> in the file: DPC.addresses.<hostname>.

The system cannot work until the problem is fixed, and will terminate when you select the 'OK' button.

All programs in this system have an entry in the specified file. The most likely reason for this problem is that this entry is in use by a process (program) running on the system now. If you cannot find and terminate such a process, then try logging out and logging on before restarting the system.

Display Error

L147: - The following environment variables are undefined:
<variable list>

Part of the system uses external definition of various elements used within the programs. One such type of external definition is Environment Variables. One or more of these are undefined, leaving the system without all information needed to function properly. The environment variables should be defined as part of the installation process, and these error points to either an error in the installation, or manual interference in the files defining these variables.

Display Error

L149: - Active Pos. Sys.: No Input...

The system does not receive any input from the positioning system defined as Active. This could be due to the wrong system being selected as Active. You should also check input port parameters in the set-up program, and finally, check that the cabling is OK and that the positioning system unit generates the correct datagrams.

Display Error

L150: - Heading Sensor: No Input...

The system does not receive any input from the system generating the Heading. This could be due to the wrong system being selected for Active Heading. You should also check input port parameters in the set-up program, and finally, check that the cabling is OK and that the unit from which heading is used, generates the correct datagrams.

Display Error

L151: - Attitude Sensor: No Input...

The system does not receive any input from the attitude sensor. You should check input port parameters in the set-up program, and that the cabling is OK. Also check that the attitude sensor generates the correct datagrams.

Error

L152: - Clock: No Input...

The system does not receive any clock input from the positioning system. You should check input port parameters in the set-up program, and that the cabling is OK. Also check that the positioning system generates the correct datagram.

Error

L154: - Logging of Survey Data to Disk was switched Off due to an error in the <name> program!

Refer to messages in the Status Display for further details.

Error

L155: - Logging of Raw Data to Disk was switched Off due to an error in the <name> program!

Refer to messages in the Status Display for further details.

Display Error

L163: - Quit Signal Received! System will shut down when you select the 'OK' button!

The system uses built-in mechanisms to handle signals (interrupts) originating both internally and externally. The type of signal is described in the message. All, except the external Terminate Signal, is caused by errors in the program.

Display Error

L164: - Floating Point Exception! System will shut down when you select the 'OK' button!

The system uses built-in mechanisms to handle signals (interrupts) originating both internally and externally. The type of signal is described in the message. All, except the external Terminate Signal, is caused by errors in the program.

Display Error

L165: - Bus Error! System will shut down when you select the 'OK' button!

The system uses built-in mechanisms to handle signals (interrupts) originating both internally and externally. The type of signal is described in the message. All, except the external Terminate Signal, is caused by errors in the program.

Display Error

L166: - Segmentation Violation! System will shut down when you select the 'OK' button!

The system uses built-in mechanisms to handle signals (interrupts) originating both internally and externally. The type of signal is described in the message. All, except the external Terminate Signal, is caused by errors in the program.

Display Error

L167: - Terminate Signal Received! System will shut down when you select the 'OK' button!

The system uses built-in mechanisms to handle signals (interrupts) originating both internally and externally. The type of signal is described in the message. All except the external Terminate Signal, is caused by errors in the program.

Display Error

L168: - Illegal Instruction Signal Received! System will shut down when you select the 'OK' button!

The system uses built-in mechanisms to handle signals (interrupts) originating both internally and externally. The type of signal is described in the message. All, except the external Terminate Signal is caused by errors in the program.

Display Error

L169: - SIGNAL <signal no.> received! System will shut down when you select the 'OK' button!

The system uses built-in mechanisms to handle signals (interrupts) originating both internally and externally. The type of signal is described in the message. All, except the external Terminate Signal, is caused by errors in the program.

Error

L170: - Unable to create Process List!

An attempt was made to open the process id log-file in the system directory for writing, but the operation failed. You should have full read & write access to the specified file and directory.

Error

L171: - Unable to open Process List!

An attempt was made to open the process id log-file in the system directory for reading, but the operation failed. You should have full read & write access to the specified file and directory.

Display Error

L172: - The following Programs are still running, and must be terminated before continuing:

The operating software uses several programs in an integrated system. Each running program is represented internally as a process. It has been observed, mostly after a crash, that these processes may continue to be active when they should not have been. The system detects these processes when it is restarted, and will, on users confirmation, issue termination commands before the system continues initialisation. But on rare occasions, the termination signal sent to these processes fails, and manual intervention is required as instructed in the error message.

Display Error

L173: - The following Programs could not be terminated:

The operating software uses several programs in an integrated system. Each running program is represented internally as a process. It has been observed, mostly after a crash, that these processes continue to be active when they should not have been. The system detects these processes when it is restarted, and will, on user confirmation, issue termination commands before the system continues initialisation. But on rare occasions, the termination signal sent to these processes fails, and manual intervention is required as instructed in the error message.

Display Error

L176: - The following Program(s) should always run, but is still NOT running:

All programs started and supervised by the Launchpad establishes a communication link with the system when they are launched. The listed program(s) did not succeed in establishing this link. It could be that the program (s) crashed before the linkup was attempted. In that case, the program(s) has no possibility to communicate with the rest of the system. You may try to start the system manually in a window, to see if you can find any useful messages written in the window. These programs are so called system programs, and it will be impossible to run the system when they are not running as intended.

Display Error

L177: - Could not read Raw Data directory for survey <name>.

You do not have the correct access to the specified directory. Correct ownership of directories and files are defined when the system is installed, so this problem could be the result of a manual operation in the file system. Please verify that you have read, write & execute access to the storage directories for raw data (\$RAWDATAHOME).

Display Error

L178: - Not able to change to Survey Directory <name> when fetching Line Statistics file!

The system could not perform an internal change of directory to the specified directory due to error in directory access. You should have read, write & execute access to all directories and files in the data storage locations. Please verify and correct.

Display Error

L179: - Not able to change to Home Directory when fetching Line Statistics file!

The system could not perform an internal change of directory back to your login directory due to error in directory access. You should have read, write & execute access to all directories and files in the data storage locations. Please verify and correct.

Display Error

L181: - Not able to copy the file <filename> to \$HOME/<filename>. Program terminates when you select the OK button!

This is the file setting up the configuration of the status filed in the Launchpad. An attempt was made to copy this file from the system defaults directory, but failed. You should have read & write access to all files in the system directory and to the directory itself. Please verify and correct.

Display Error

L182: - Could not open Operators File!

Open a terminal window, and go to the \$HOME/.eso_system directory. Verify that you have both Read and Write access to the file 'esoSetup.operators'.

Display Error

L183: - Not able to copy the Status Config file to <directory name>. Using default values...

This is the file setting up the configuration of the status fields in the Launchpad. An attempt was made to copy the file from the system defaults directory, but failed. You should have read & write access to all files in the system directory and to the directory itself. Please verify and correct.

Display Error

L184: - Status Config file not found. Using default values...

This is the file setting up the configuration of the status fields in the Launchpad. It was not located in any of the predefined locations. This is an error by itself - but the system uses a default set-up, and will be operable. If you define a new status set-up, remember to save the set-up for later use.

Display Error

L186: - Could not init log-file!

It was not possible to create the file due to error in permissions. You should have read & write access to all files in the system directory and to the directory itself. Please verify and correct.

Display Error

L187: - Could not open log-file for append!

It was not possible to open the file for append due to error in file access. You should have read & write access to all files in the system directory. Please verify and correct.

Display Error

L189: - Line Statistics File could not be opened!

Survey: <survey name>
File: <line name>.linestat

The line statistics file for the specified line exists, but it could not be opened due to error in file access. You should have read, write & execute access to all files in the data storage directories. Please verify and correct.

Display Error

L190: - Statistics File for Survey <survey name>, line <line name> is empty!

The line statistics file for the specified line exists, but it was empty. It is difficult to state the reason for this, because all lines, no matter how small, should have something in this type of file. The file should be removed.

Display Error

L193: - Raw Data Parameters File for Survey <survey name> could not be opened!

The line parameters file for the specified line exists, but it could not be opened due to error in file access. You should have read, write and execute access to all data storage files and directories. Please verify and correct.

Display Error

L194: - Survey Parameters File for Survey <survey name>, line <line name> is empty!

The line parameters file for the specified line exists, but it was empty. It is difficult to state the reason for this, because all lines, no matter how small, should have something in this type of file. The file should be removed.

Display Error

L198: - Not able to change to Survey Directory <directory name> when fetching Line Statistics file!

There can be several reasons for this error, the most probable is that you don't have the correct access to the specified survey directory. Please verify that you have read, write & execute access to all directories in the \$PROCHOME location. '\$PROCHOME' is an environment variable defining the top location of your storage area for processed data (not raw data).

Display Error

L209: - You do not have WRITE access to file <name>.

You do not have the correct access to the specified file. Correct ownership of directories and files are defined when the system is installed, so this problem could be the result of a manual operation in the file system. Please verify that you have read, write & execute access to the shared system directory (\$SHAREDHOME) and all files and subdirectories.

Display Error

L212: - Operation cancelled!
Echo Sounder not ready!

The system was interrupted while performing a Power Up test. One of the main criteria for initiating the system is that the Power Up test is completed without error. When this test is cancelled, the system is defined to be inoperable. It will remain so until the test is completed successfully.

Display Error

L222: - Line Statistics File not found.

Survey: <survey name>
File: <line name>.linestat

The specified Line Statistics File does not exist. When terminating logging to a line, such a file is produced automatically. This error indicates that the file system has been manually modified.

Display Error

L228: - The file <filename> is not found on \$HOME/<name> directory, or on \$NEPTUNEHOME/defaults directory. Since this is a vital file for the system, the Launchpad will terminate when you select the OK button...

The main configuration file is not located in any of the predefined locations. The system cannot be operated without this file. You should check if you have any backups of the system directory - one is made during every upgrade / reinstall of the system. If that fails, reinstall the system.

Display Error

L229: - The file <filename> is not found on \$HOME/<name> directory, or on \$NEPTUNEHOME/defaults directory. Using default set-up...

The main configuration file is not located in any of the predefined locations. The system cannot be operated without this file. You should check if you have any backups of the system directory - one is made during every upgrade / reinstall of the system. If that fails, reinstall the system.

Display Warning

L230: - Operator <name> has no Config-file...

Use the 'Update Operator's 'Config-file' popup menu option on the 'All Programs' icon in the 'Programs' section of the Launchpad. This will generate a default file for the current operator.

Display Error

L231: - The file <filename> is not found on \$HOME/<name> directory, or on \$NEPTUNEHOME/defaults directory.

The specified file is not located in any of the predefined locations. The system cannot be operated without this file. You should check if you have any backups of the system directory - there is made one during every upgrade / reinstall of the system. If that fails, reinstall the system.

Display Error

L232: - Not able to remove the file <file name>.

Check access and owner of the file. Program terminates when you select the OK button.

You do not have the correct access to the specified file. Correct ownership of directories and files are defined when the system is installed, so this problem could be the result of a manual operation in the file system. Please verify that you have read, write & execute access to the system directory and all files in this directory (\$HOME/.eso_system).

Display Error

L233: - Unable to open Table Of Contents!

You do not have the correct access to the selected file. Correct ownership of directories and files are defined when the system is installed, so this problem could be the result of a manual operation in the file system. Please verify that you have read, write & execute access to the system directory and all files in this directory (\$HOME/.eso_system).

Display Error

L234: - Unable to open temporary copy of the log-file!

It was not possible to open the file, due to an error in file access. You should have read & write access to all files in the system directory (\$HOME/.eso_system). Please verify and correct.

Display Error

L235: - Cannot allocate enough memory for viewing the log-file. You should reset the file using the 'File->Reset Log-file' option.

The log-file was too big for the available memory resources. If it is important to view the log-file, you could try terminating as many of the programs as possible before retrying. If the problem persists, you should reset the log-file. When resetting, it is possible to take a backup copy of the log-file.

Display Error

L297: - Raw Data Parameters File for
Survey <survey name>
Line <line name>
could not be opened!

The parameter file for the specified survey exists, but it could not be opened due to error in file access. You should have read, write and execute access to all data storage files and directories. Please verify and correct. Due to the sequence of events producing this file, this error is not likely to occur.

Display Error

L298: - Survey Parameters File for Survey <name> does not exist!

The survey parameter file is based on the parameters for each line, and presents information regarding changes in line parameter set-up. For some reason, this file could not be produced. It may be, that there are no lines in the survey, or that the logged lines are corrupted.

Display Error

L299: - Raw Data Parameters File for
Survey <survey name>
Line <line name>
does not exist!

The file contains the parameter set-up being used when logging the line. For some reason, this file could not be produced. It may be that the logged line is corrupted.

Display Error

L300: - Environment variable for Network Configuration File not defined!

Some of the information required to have the system running properly, is set outside of the actual programs, using environment variables. The specified variable is not defined, and probably means an installation error, or manual modification in the definition of variables.

Display Error

L301: - Could not open Network Configuration File!
File: <filename>

It was not possible to open the file due to error in file access. You should have read & write access to all files in the system directory. Please verify and correct.

Display Error

L302: - Unable to open Serial Datagram Set-up-file

It was not possible to open the file due to error in file access. You should have read & write access to all files in the system directory. Please verify and correct.

Display Error

L303: - Unable to open Datagram Set-up-file!

File: <filename>

This file contains the datagrams available for subscription. It will not be possible to use the subscription facility without this file. You should have read & write access to all files in the system directory. Please verify and correct.

Display Error

L304: - Format error on input from Datagram Set-up-file!

File: <filename>

Datagrams available for user-defined distribution are defined using a fixed format. One or more of the entries in this file does not fit this format. The safest way to fix the problem is to remove the file, and restart the system. The file will then be copied to the system directory, using the default version supplied with the installation.

Display Error

L318: - Illegal format on IP address!

Format: ddd.ddd.ddd.ddd, where 'd' is a digit.

Leading zeros may be omitted.

The networking addresses used by the system must follow the specified syntax. Normally, if you have subscribers running on the same computer as the operating software, you should use the IP address of this computer.

Display Warning

L321: -This is the system's broadcast IP address, and cannot be deleted. If you were thinking of defining a new broadcast address, this one will be automatically adjusted whenever the system's IP address is modified.

When removing an IP address, all programs having the selected address will be modified. Since the selected address is of vital importance for the system, deletion or modification is not allowed. The address is used to establish and maintain the connection with the echo sounder.

Display Warning

L325: - You cannot change the datagram set-up of the system's reserved programs!

Currently, only user-defined datagram subscriptions may be modified. Allowing the user to modify the flow of datagrams needed for proper operation of the system could result in operational problems.

Display Warning

L326: - You cannot modify the IP address of the system's reserved programs!

Currently, only user-defined datagram subscription set-up may be modified. Allowing the user to modify the networking set-up, needed for proper operation of the system, could result in operational problems.

Display Warning

L327: - The specified IP Port no. is outside bounds!
Legal interval: [2000, 6000]

The interval is limited to avoid interfering with the internal port no. usage of the system. Using port no.'s already in use will give operational problems, both for the system programs and for user programs.

Display Warning

L328: - IP Port no. <port no.> is already in use by the <subscriber name> subscriber!
Legal IP Port interval: [2000, 6000]

Opening and using the same port no. for reading is not allowed. You may send datagrams to the same port no. from several programs, but since you are defining datagram distribution, you cannot use the same port as another program.

Display Warning

L333: - Logging cannot be started when Edit Mode is enabled in the Set-up menu!

The reason for this restriction is that when logging to a line is started, all current values of the installation parameters are logged with the data. And since only one such representation is possible per line, editing of these parameters is prohibited when already logging.

Display Error

L334: - PPS not received!

The system does not receive any input from the system generating the 1PPS. This could be due to the wrong system being selected for 1PPS. You should also check input port parameters in the set-up program, and finally, check that the cabling is OK and that the unit from which heading is used, generates the correct datagrams.

Display Warning

L335: - Initial Power-Up Test was interrupted!
Echo Sounder Not Ready!

The initial power-up test was interrupted by the user. And since it is an absolute requirement that this test is successfully completed, this test should be performed (with no errors reported).

Display Warning

L336: - No Sound Speed Probe values received!

The system is supposed to receive Sound Speed Probe values, but does not receive any. Verify probe connections, set-up and power.

Display Error

L337: - Depth/Height Sensor: No Input...

The system is supposed to receive sensor input, but does not receive any. Verify sensor connections, set-up and power.

Warning

L355: - Unknown NMEA Telegram received...

The datagram received were not uniquely recognised. It seems to be a NMEA datagram, but one not supported by the system. The datagram may also contain format errors. Please refer to separate documentation on datagram definitions.

Error

L356: - Format Error in Remote Control Telegram!

The datagram received was recognised as a Remote Control datagram, but the content does not adhere to the datagram syntax. Please refer to separate documentation on datagram definitions.

Display Warning

L357: - Datagram subscriber 'remoteLogging' not defined!
Use 'Options->DatagramSubscriptions...' to enter 'remoteLogging' as a subscriber. Remember to supply IP address and port.no. to receive datagrams on!

The system has received a Remote Control datagram, but vital information is missing from the datagram distribution set-up. Without this, none of the remote control functionality will be available. The rest of the sounder will operate as normal.

Display Warning

L358: - No datagrams are selected for the 'remoteLogging' subscriber! Use 'Options->DatagramSubscriptions...' and select datagrams for subscription for the 'remoteLogging' subscriber.

When using the Remote Control functionality, you must define a selection of datagrams that you want distributed to the 'remoteLogging' subscriber. Otherwise, nothing will flow to this subscriber, even though it is properly defined with an IP address and port number.

Display Error

L364: - The system is currently configured NOT to launch the Survey Display automatically. Changing this mode requires changing the configuration file...

Some installations have their own Survey Control software. The message indicates that the current configuration of the system has disabled this particular feature. Please refer to the documentation for information on how to enable this software.

Display Warning

L372: - Could not verify incoming profile!

The Profile Editor is already running, and profile verification is currently suspended. Terminating the current editor session will automatically bring up the received profile for verification.

Display Error

L400: - Could not open print tmp-file.

You do not have the correct access to a work-file in your own home directory. Correct ownership of directories and files are defined when the system is installed, so this problem could be the result of a manual operation in the file system. Please verify that you have read, write & execute access to your login directory and the files in this directory.

Display Error

L401: - Error in Launchpad Message Server Initialize!

Some system resources could not be allocated, because some other program is holding these resources. Check if any of the programs started from a previous session of the system are still running. If so, terminate these programs. If you do not know how to do this, it will in most cases be sufficient to log out and then back in. This will terminate any running programs and free up resources. Then restart the operator station software...

ESO messages

The following messages are presented by the **ESO** utility.

Display error

W5: - Serial Set-up-file <filename> missing. Install Default file?

The specified file is either removed or renamed. However, the default file provided will enable all functions on a system not extended with a serial port expansion card.

Display error

W9: - No Serial input device is open! Select the 'Smart Probe Profile Inputs' as the current serial I/O function in the 'Workstation I/O Interfaces' menu.

The serial port specified for this function could not be opened as expected probably due to error in read/write permission, or that a non-existing device is specified in the set-up-file.

Display error

W12: - Unable to open temporary file <filename>!

The error occurs because of inaccurate read/write permissions to the system directory. This is either an installation error, or an error introduced after installation.

Display error

W17: - Input Error. To enable new input, you must reselect the current input function.

The input format was not recognised. Reading from the serial port was disabled to avoid further input, and must be reactivated by reselecting the input function.

Display warning

W22: - No probe samples logged!

The sampling of probe values was terminated, but no values were actually received. Check probe connections and serial port set-up.

Display warning

W26: - The file <name> was empty. Factory Defaults was used instead. Please verify settings and use the 'File -> Save' command to make settings permanent.

This means that the set-up-file somehow has been corrupted. (E.g. system crash, text editor). A workaround is to set all parameters in the menus as required, and recreate the set-up-file using the 'File->Save' command. If this is followed by the 'File->Read' command, full functionality should be restored. Alternatively, you could exit the program - remove the empty file - and then restart the program. This will enable you to install the default set-up-file delivered with the system.

Display error

W27: - The file <filename> is not found in the \$HOME directory, or on \$NEPTUNEHOME/defaults directory.

The set-up-file should be present in both the indicated locations. If you at any point have done a system upgrade, you should check for backup copies in any of the system directory backups in the login directory. Backup file syntax: ".eso_system<date_time>/ .esoSetup.serial". If no such files are found, search for the file on the CD-ROM containing the installation.

Display error

W28: - Not able to copy the file <filename> to \$HOME/.eso_system. Program terminates when you select the OK button.

The error occurs because of inaccurate read/write permissions to the system directory. This is either an installation error, or an error introduced after installation.

Display error

W29: -Not able to remove the file <filename>. Check access and owner of the file. Program terminates when you select the OK button.

The error occurs because of inaccurate read/write permissions to the system directory. This is either an installation error, or an error introduced after installation.

Display error

W30: - Unable to open device <device-name>! You may have a permission problem.

The error occurs because of inaccurate read/write permissions to the specified serial port device. This is either an installation error, or an error introduced after installation.

Display error

W40: - The set-up file is incomplete. Verify all parameters. Then save your configuration using the 'File->Save Set-up' menu option. Then read the set-up using the 'File->Read Set-up' to reinitiate the system!

The file could be corrupted (system crash), or modified outside the program (text editor), accidentally removing parts of the file.

Display error

W41: - Incomplete SVP CALC profile received on the network...

When receiving from the network, AML CALC files are supposed to be received in one go, i.e. complete with both profile identifier and termination sequence. In this case, no termination sequence was found in input.

Warning

W43: - The device associated with this function is in active use by the following function:

<function>.

To use the selected function:

1. Switch OFF the other function
or
2. Change device associated with one of the two functions.

Warning

W44: - You must terminate any active functions before reading set-up file!

Warning

W45: - Could not open tide output file: <filename>. You may have a permission problem...

An attempt was made to open the tide file in the current survey directory, but the operation failed. You should have full read & write access to the directory and all files in the directory.

Correct the directory & file access and activate the tide input function again.

Warning

W46: - The <name> function cannot share device with the <name> function. Per definition, only the following functions may share device:

<list of functions>

These functions may all be active at the same time.

Warning

W53: - Serial Port input not recognised! To enable new input, you must reselect the last selected input function

The input received was not recognized. This could be due to errors in the format used for transmitted data, or, if a serial line is used, errors in setting up serial line characteristics.

Warning

W54: - Input buffer overrun - function disabled! To enable new input, you must reselect the currently disabled input function.

Error

W60: - The last command sequence to the probe failed. Repeat your latest action to retransmit sequence. If this message was issued when bringing up this window, select the 'Apply Settings' button in the 'Sampling Parameters' section to repeat sequence.

The probe did not recognize the last command issued. This could be caused by garbled serial line transfer. Verify your serial line settings and retry the command once again.

Error

W61: - No reply to last SV Plus command! Probe may be disconnected or without power...

Error

W62: Format Error in SV Plus Input!

The input from the probe was not recognized. This could be caused by garbled serial line transfer. Verify your serial line settings and retry the command once again.

Sound Speed Profile Editor messages

The following messages are presented by the **SSP Editor** utility.

Warning

E10: - Profile contains fewer points than specified in Profile Header. Using number of points read from file!

The profile may have been edited manually, creating a mismatch between header no. of entries and actual no. of entries. The profile was automatically corrected.

Warning

E11: - Profile contains more points than specified in Profile Header. Using number of points read from file!

The profile may have been edited manually, creating a mismatch between header no. of entries and actual no. of entries. The profile was automatically corrected.

Warning

E13: - You have no WRITE access to profile directory <directory name>.

The profile directory is created with full Read and Write access when installing the system. This problem may be caused by manual modifications of the file system. Set the correct directory access before retransmitting.

Warning

E33: - The file <filename> containing the selected Sound Profile was not found.

Someone has deleted the selected Sound Velocity Profile from the disk after the list was created! The list was produced using only actual and existing profiles. If you have no idea how this could have happened, get in touch with the System Administrator.

Warning

E38: - You have no WRITE access to the selected Sound Velocity Profile directory!

The File Selection Box enables traversal of the file system directory structure, which means that you may select any directory as a storage area for the SV Profile - even those you do not have WRITE access to. If you are denied access to a directory that you would like to have access to, check the System Manager to see if this is permissible.

Warning

E42: - You have no DELETE access to the selected Sound Velocity Profile!

The profile directory is created with full Read and Write access when installing the system. This problem may be caused by manual modification of the file system. Set the correct directory & file access before retrying.

Error

E46: -

Environment 'SVP_EDITOR_MODULE_NO' not defined or empty!
Environment 'SVP_EDITOR_MODULE_NAME' not defined or empty!
These errors results in a program that does not work properly. Fix and restart!

Most of the variable elements of the system configuration can be configured outside the programs. This is done by quite a few 'environment variables', which is set to an initial value when installing the system, and then fetched by the programs when needed. The environment variables listed in the error message must be set to match the initial values.

Warning

E54: - Please use the 'Save As...' command to give the profile a name.

Warning

E56: - No points in Profile...

The editable buffer is empty. Create a profile using the New Profile command in the File menu. You may also use the Copy SV Profile or the Combine SV Profiles in the Edit menu.

Warning

E60: - Illegal Survey Format File Name: <filename>

The survey format profile name does not match the syntax, which is as follows:

<line_no_yyyymmdd_hhmmss_sensor_version>.sfsvp

The only way to correct this is to do a manual profile rename. Since the survey profiles are named automatically, this is an error that should not have occurred.

Warning

E61: - Empty file: <filename>

The file does not contain any samples, and cannot be used. It is not possible to state any reasons for this. The file should be removed from the profiles directory.

Warning

E62: - Currently no editable profiles in work area to save!

Ping Display messages

The following messages are presented by the **Ping Display** utility.

P32: - No information received from the ESO! Ignore this message if used in stand-alone mode.

When starting up, the program tries to get some information from the ESO system. But when running in a standalone mode, it does not receive any answer. The requested information is not important in the standalone mode.

If you get this message when running as part of the complete system, try restarting the operator software.

9.3 Hardware messages

Hardware messages

The following messages are reported by the software monitoring the hardware circuitry in the Transceiver Unit.

- 402:** High voltage power supply too low.
This is a failure reported by the SPRX.
Action: Run the BIST program for more details.
- 403:** High Voltage power supply too high.
This is a failure reported by the SPRX.
Action: Run the BIST program for more details.
- 404:** Low Voltage power supply failure.
This is a failure reported by the SPRX.
Action: Run the BIST program for more details.
- 420:** Illegal parameter value in command from PU.
This is a warning reported by the BSP.
Action: Run BSP BIST. If this does not help, restart the echo sounder.
- 422:** Internal synchronisation problem on BSP.
This is a warning reported by the BSP.
Action: Run BSP BIST.
- 460:** No valid heading input.
This is a failure reported by the PU.
Action: Check heading input from sensor and installation parameters on the Operator Station.
- 461:** No valid attitude input.
This is a warning reported by the PU.
Action: Check heading input from sensor and installation parameters on the Operator Station.
- 462:** No valid position input.
This is a failure reported by the PU.
Action: Check heading input from sensor and installation parameters on the Operator Station.
- 463:** No valid 1 PPS input.
This is a failure reported by the PU.
Action: Check heading input from sensor and installation parameters on the Operator Station.

- 464:** Error in communication with TRU.
This is a failure reported by the PU.
Action: Check SPRX, LV power BIST. Check power in TRU RX.
- 465:** Error in communication with BSP.
This is a failure reported by the PU.
Action:
- 466:** Illegal parameter value in command from OS to PU.
This is a warning reported by the PU.
Action:
- 467:** No external trigger received.
This is a warning reported by the PU.
Action: Check heading input from sensor and installation parameters on the Operator Station.

9.4 CPU CMOS SETUP

Setup for SSC-486H

To change the setup you must mount a standard VGA card and connect a VGA monitor and a keyboard.

This setup is based on BIOS:KU26C-03B. Hit "DEL" key after power on and confirm/change to following settings in CMOS:

Advanced setup

Typematic rate (char/sec): 30

System keyboard: Absent

Primary display: Absent

Mouse support: Disable

Above 1MB memory test: Enable

Memory test tick sound: Enable

Parity error check: Enable

Hit "DEL" message display: Enable

Extended Bios RAM area: 0:300

Wait for "F1" if any error: Enable

System boot up num-lock: On

Numeric processor test: Enable

Wietek processor: Absent

Floppy drive seek at boot: Disable

System boot up sequence: A:,C:

System boot up CPU speed: High

External cache: Enable

Internal cache: Enable

Internal cache WB or WT: WR-thru

Turbo switch function: Enable

Password checking: Setup

Video shadow, C000, 16k: Enable

Video shadow, C400, 16k: Enable

Shadow, C800, 16k: Disable

Shadow, CC00, 16k: Disable

Shadow, D000, 16k: Disable

Shadow, D400, 16k: Disable
Shadow, D800, 16k: Disable
Shadow, DC00, 16k: Disable
Shadow, E000, 64k: Disable
IDE multi-sector transfer: Auto
Primary IDE 32-bit transfer: Disable
Primary IDE block mode: Master
Primary IDE LBA mode: Mas/Sla
Secondary IDE present: None
Secondary IDE 32 bit transfer: Disable
Secondary IDE Block mode: Disable
Secondary IDE LBA mode: Mas/sla

Peripheral setup

Onboard FDC: Enable
Onboard IDE: Enb-pri
Serial port 1: 3F8h
Serial port 2: 2F8h
Parallel port: 378h
Parallel port mode: Normal
Parallel extended mode: ECP

Chipset setup

Auto config function: Enable
Cache read: 3-2-2-2
Cache write: 1 ws
DRAM wait: 1 ws
DRAM page: Fast
Keyboard clock: 9.5 MHz
AT clock select: PCLK/4
Local ready: Delay 1T
CPU ADS# delay: No delay
Alt bit in tag SRAM: 7+1 bit
Signal LDEV# sample time: in T3
HW DRAM parity check: Disable

ISA bus refresh disable bit: Fast
DRAM refresh method: Ras only
Devicer for refresh: Reserved (1/1)
Video ROM cache C000, 16k: Disable
Video ROM cache C400, 16k: Disable
Adapter ROM cache: Disable
System memory remap or not: Enable
LOWA20# select: Chipset
RC reset select: Chipset
IO recovery time select: 5 BCLK
Hold CPU percentage: Disable
Software flush 80486: Disable
Enable force read miss: Disable

Setup for SSC-5x86H

This setup is based on Award Bios v4.51G. ICP version KU35-LSV3.2. Hit "DEL" key after poweron and confirm/change to following settings in CMOS:

Standard setup

Primary Master: None
Primary Slave: None
Drive A: None
Drive B: None
Video: EGA/VGA
Halt on: All, but keyboard

BIOS features setup

Virus Warning: Disabled
CPU internal cache: Enabled
External cache: Enabled
Quick power on self test: Disabled
Boot sequence: A,C
Swap floppy drive: Disabled
Boot up floppy seek: Disabled
Boot up Numlock status: On

Boot up system speed: High
Gate A20 option: Fast
Memory parity check: Disabled
Typematic rate setting: Disabled
Typematic rate (chars/sec): 6
Typematic delay (msec): 250
Security option: Setup
PS/2 mouse functional ctrl: Disabled
PCI/VGA Palette snoop: Disabled
OS selector for DRAM>64Mb: Non OS2
Video bios shadow: Enabled
C8000-CFFFF Shadow: Disabled
D0000-D7FFF Shadow: Disabled
D8000-DFFF Shadow: Disabled

Chipset features

Auto configuration: Enabled
AT-BUS CLK: CLK/4
DRAM read timing: Normal
DRAM write timing: Normal
SRAM read timing: 3-1-1-1
SRAM write timing: 0 Wait
Hidden refresh: Disabled
Memory hole (15M-16M): Disabled
ISA I/O recovery: Enabled
Fast back to back: Enabled

Power managment setup

Power Management: Disable
PM control by APM: Yes
Video Off Option: Susp/stby -> OFF
Video Off Method: V/H Sync+Blank
MODEM use IRQ: 3

PM TIMERS

HDD power down: Disabled

Doze mode: Disabled

Standby mode: Disabled

Suspend mode: Disabled

PM EVENTS

VGA: Off

FDD (3FxD): On

LPT & COM: LPT/COM

HDD (1FXH): On

NMI: OFF

IRQ3 (COM2): On

IRQ4 (COM1): On

IRQ5 (LPT2): On

IRQ6 Floppy disk: On

IRQ7 LPT1: On

IRQ8 RTC Alarm: Off

IRQ9 IRQ2 redir: On

IRQ10 Reserved: Off

IRQ11 Reserved: Off

IRQ12 PS/2 Mouse: On

IRQ13 Coprocessor: Off

IRQ14 Hard disk: On

IRQ15 Reserved: Off

Integrated peripherals

On-chip Local Bus IDE: Disabled

Onboard FDC control: Enabled

Onboard UART1: 3F8/IRQ4

Onboard UART2: 2F8/IRQ3

Onboard parallel port: 378

Parallel port mode: Normal

9.5 CMOS SETUP - standard Processing Unit

Setup for VI Per

Standard CMOS Setup

Date

Time

HARD DISKS	type	Mode
Primary Master	Auto	Auto
Primary Slave	Auto	Auto
Secondary Master	Auto	Auto
Secondary Master	Auto	Auto

Drive A: 1.44M, 3.5 in.

Drive B: None

Video: EGA/VGA

Halt On: All, But Disk/Key

BIOS Feature Setup

Note *While setting up the DiskOnModule or DiskOnFlash module, the CPU has to boot on the floppy drive!*

Boot Sequence: **A,C,SCSI**

Note *Remember to put back before booting from DiskOnModule!*

Boot Sequence: **C,A,SCSI**

Virus Warning: Disabled

CPU Internal Cache: Enabled

External Cache: Enabled

CPU L2 Cache ECC Checking: Enabled

Processor Number Feature: Enabled

Quick Power On Self Test: Enabled

Boot Sequence: C,A,SCSI

Swap Floppy Drive: Disabled

Boot Up Floppy Seek: Disabled

Boot Up NumLock:	On
Gate A20 Option:	Fast
Typematic Rate Setting:	Disabled
Typematic Rate (Char/Sec):	6
Typematic Delay (Msec):	250
Security Option:	Setup
PCI/VGA Palette Snoop:	Disabled
OS Select For DRAM > 64MB:	Non-OS2
Report No FDD Fpr WIN 95:	Yes

Video BIOS Shadow:	Disabled
C8000-CBFFF Shadow:	Disabled
CC000-CFFFF Shadow:	Disabled
D0000-D3FFF Shadow:	Disabled
D4000-D7FFF Shadow:	Disabled
D8000-DBFFF Shadow:	Disabled
DC000-DFFFF Shadow:	Disabled

Chipset Features Setup

SDRAM RAS-to-CAS Delay:	3
SDRAM RAS Precharge Time:	3
SDRAM CAS latency Time:	3
SDRAM Precharge Control:	Disabled
DRAM Data Integrity Mode:	Non-ECC
System BIOS Cacheable:	Disabled
Video BIOS Cacheable:	Disabled
Video RAM Cacheable:	Disabled
8 Bit I/O Recovery Time:	3
16 Bit I/O Recovery Time:	2
Memory Hole at 15M-16M:	Enabled
Passive Release:	Enabled
Delayed Transaction:	Disabled
AGP Aperture Size (MB):	64

CPU Warning Temperature: 66°C/151°F

Current System Temp:

Current CPU Temperature

CPU FAN Speed

VCCP: VTT:

VCC3: + 5 V:

+12 V: -12 V:

- 5 V:

Shutdown Temperature: 70°C/158°F

Power Management Setup

ACPI function: Disabled

Power Management: User Define

PM Control by APM: No

Video Off Method: V/H SYNC+Blank

Video Off After: NA

MODEM Use IRQ: NA

Doze Mode: Disable

Standby Mode: Disable

Suspend Mode: Disable

HDD Power Down: Disable

Throttle Duty Cycle: 62.5%

PCI/VGA Act-Monitor: Disabled

Soft-Off by PWR-BTTN: Instant-Off

PowerOn by Ring: Enabled

Resume by Alarm: Disabled

IRQ 8 Break Suspend: Disabled

** Reload Global Timer Events **

IRQ[3-7,9-15],NMI: Disabled

Primary IDE 0:	Disabled
Primary IDE 1:	Disabled
Secondary IDE 0:	Disabled
Secondary IDE 1:	Disabled
Floppy Disk:	Disabled
Serial Port:	Enabled
Parallel Port:	Disabled

PNP/PCI Configuration

PNP OS Installed:	No
Resource Controlled By:	Manual
Reset Configuration:	Disabled

IRQ-3 assigned to:	Legacy ISA
IRQ-4 assigned to:	Legacy ISA
IRQ-5 assigned to:	PCI/ISA PnP
IRQ-7 assigned to:	Legacy ISA
IRQ-9 assigned to:	Legacy ISA
IRQ-10 assigned to:	Legacy ISA
IRQ-11 assigned to:	Legacy ISA
IRQ-12 assigned to:	Legacy ISA
IRQ-14 assigned to:	PCI/ISA PnP
IRQ-15 assigned to:	PCI/ISA PnP
DMA-0 assigned to:	PCI/ISA PnP
DMA-1 assigned to:	PCI/ISA PnP
DMA-3 assigned to:	PCI/ISA PnP
DMA-5 assigned to:	PCI/ISA PnP
DMA-6 assigned to:	PCI/ISA PnP
DMA-7 assigned to:	PCI/ISA PnP

Used MEM base addr: N/A

Load BIOS Defaults

NO

Load Setup Defaults

NO

Integrated peripherals

IDE HDD Block Mode:	Enabled
IDE Primary Master PIO:	Auto
IDE Primary Slave PIO:	Auto
IDE Secondary Master PIO:	Auto
IDE Secondary Slave PIO:	Auto
IDE Primary Master UDMA:	Auto
IDE Primary Slave UDMA:	Auto
IDE Secondary Master UDMA:	Auto
IDE Secondary Slave UDMA:	Auto
On-Chip Primary PCI IDE:	Enabled
On-Chip Secondary PCI IDE:	Enabled
USB Keyboard Support:	Disabled
Init Display first:	PCI Slot
KBC input clock:	8 MHz
Onboard FDC Controller:	Enabled
Onboard Serial Port 1:	3F8/IRQ4
Onboard Serial Port 2:	2F8/IRQ3
UART Mode Select:	Normal
Onboard Parallel Port:	378/IRQ7
Parallel Port Mode:	SPP

Supervisor password

PASSWORD DISABLED

User password

PASSWORD DISABLED

IDE HDD Auto detection

Do not choose Disk On Module here, it should be set to auto:

Primary Master: No

Primary Slave: No

Secondary Master: No

Secondary Slave: No

Save and Exit Setup

YES

9.6 CMOS SETUP - Processing Unit

Setup for Smartio CI-104JS

Installation - jumper settings

Three serial cards are being used in the EMx Processing Rack. These cards must be set up in a slightly different manner. The Version 1 and 2 of the old card had jumper settings, while the new one must use software to program the flash on the card.

Programming of the serial-card - Smartio CI-104JS

The card is to be re-programmed for the use of correct ports and interrupts. This applies to both using the card with existing equipment, and with newer versions of the EM series that are to be produced in the future.

Note

This card is for RS232 only!

The card is programmed with the program IO_IRQ.EXE. This is on the accompanying CD, and a copy is also available on a floppy disc.

Before programming JP-1 must be set on the card. JP-1 can be found in the upper left-hand corner of the card.

Insert the card in a PC running MS-DOS, boot the PC and start the program IO-IRQ.EXE. Please use online help to configure the card to the following set-up:

Resource	PU with SSC-4x86H and SSC-5x86H	PU with Viper CPU
IRQ	15	11
Interrupt vector	0x2C0	0x1C0
I/O address, port 1	0x280	0x180
I/O address, port 2	0x288	0x188
I/O address, port 3	0x290	0x190
I/O address, port 4	0x298	0x198

Save this configuration in the card, exit and turn the power off. **Remove the jumper JP-1 before the card is to be used.**

SmartIO serial card and SSC-5x86H AND SCC-4x86H

Serial-card is set up with IRQ 11 on the jumpers JP9, JP10, JP11, and JP12.

DIP Switches for SmartIO C114 Rev. 1.0:

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

DIP Switches for SmartIO C114 Rev. 2.0:

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

SmartIO serial card and VIPER CPU card

Serial-card is set up with IRQ 15 on the jumpers JP9, JP10, JP11 and JP12.

DIP Switches for SmartIO C114 Rev.1.0:

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

DIP Switches for SmartIO C114 Rev.2.0:

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

10 REPLACEMENT PROCEDURES

10.1 Introduction

Overview

This chapter presents the basic procedures for disassembly and reassembly of the replaceable parts in the EM 1002 sonar 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
- 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
- Soldering iron
- Open ended and ring spanners in metric sizes
- Adjustable spanners
- Socket set

The following expendables are recommended:

- Solder
- Wire straps in different sizes

10.2 Common procedures

The next pages hold common replacement procedures.

10.3 Transceiver Unit procedures

Overview for Transceiver Unit 125-211814

The Line Replaceable Units (LRUs) in the EM 1002 Transceiver Unit are:

- Processing rack:
 - 4-Ports Serial Line Board
 - Beamformer & Signal Processor 1/2 (BSP1 and BSP2)
 - Ethernet Adapter
 - ROM bank *
 - * After 2001 the EM 1002 system has a DiskOnModule mounted on the CPU board instead of the ROM bank.
 - Control Processor Board (486)
 - Fan
 - Motherboard
- Other devices:
 - AC mains fuse and filters
 - Fuses
 - Fan drawers

Overview for Transceiver Unit 125-218141

The Line Replaceable Units (LRUs) in the EM 1002 Transceiver Unit are:

- Processing rack:
 - 4-Ports Serial Line board
 - Beamformer & Signal Processor 1/2 (BSP1 and BSP2)
 - SDRAM (mounted on the CPU board)
 - Control Processor Unit (CPU) board
 - Fan
 - Motherboard
- Other devices:
 - AC mains fuse and filters
 - Fuses
 - Fan drawers

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

Circuit boards and modules

Introduction

The Transceiver Unit holds two wired racks. All the wired racks hold plug-in circuit boards and modules. The replacement of these modules is described in this procedure.

The system must be switched off prior to disassembly. Access is gained to the wired racks by opening the front door of the Transceiver Unit. To open the front door, use the special tool for the cabinet doors. Before removing any modules, be sure that voltmeter on front of the High Voltage Supply shows zero (0) voltage.

- Processing rack

→ *The circuit boards and modules in the Processing rack are shown on page 98.*

- Receiver rack

→ *The circuit boards and modules in the Receiver rack are shown on page 99.*

Disassembly procedure

- 1 Remove the front mounted cables from the applicable circuit boards.
- 2 Release the thumb-screws if required.
- 3 Pull the board/unit carefully out.

Software replacement

→ *Refer to page 263.*

Replacement of all the circuit boards

In some cases, it might be necessary to replace all the circuit boards in the Transceiver Unit. The following procedure is then suggested:

- 1 Open the front door of the Transceiver Unit as previously described.
- 2 Switch off the circuit breaker on the left side of the Processor rack, and pull out the contact on the Low Voltage Power Unit. Wait until voltmeter on the High Voltage Supply shows “zero” volts.
- 3 Unplug the front mounted flat ribbon cable connectors on the Transmitter/Receiver boards. Use care; do not pull by the cables !
- 4 Remove the circuit boards and modules carefully.
- 5 Insert new circuit boards and modules in reverse order. Mount the front mounted flat ribbon cable connectors and the front covers.
- 6 Check that the circuit boards and modules have been installed in their correct locations! Refer to the applicable pictures and drawings.

Fan drawers

→ Refer to page 265.

Heater element

Introduction

A heater element is mounted on the right wall in the bottom wired rack. The heater is included to ensure the temperature inside the cabinet remains stable when the system is switched off, thus preventing condensation forming inside the cabinet. The heater is a commercial item.

Disassembly procedure

- 1 Open the front door of the Transceiver Unit.
- 2 Switch off the front mounted circuit breaker located on the left side of the Processor rack
- 3 Open up the middle section of the cabinet

Caution

Do not open the middle cabinet while in rough sea. The cabinet is heavy, and sudden movements may cause damage or injury to personnel.

- 4 Note down the location of the wires prior to removal !
- 5 Locate the heater. Follow the heater cables to the terminal block, and disconnect the wires.
- 6 Loosen the rail support holding the heater in place, and allow the heater to slide out (forward).

Reassembly procedure

The new heater is replaced reversing the above procedure.

The power supply is located in the Receiver Rack, between the Low Voltage Power Supply and the Capacitor bank.

+ 24V Power Supply

The power supply is located on the rear side of the Processing Unit.

Disassembly procedure

- 1 Open the front door of the Transceiver Unit.
- 2 Switch off the circuit breaker on the left side of the Processing rack, and pull out the contact on the Low Voltage Power Unit.

- 3 Remove the cover on the rear side of the Processing Unit.
- 4 Locate the power supply.
→ *Refer to drawing on page 116.*
- 5 Note down the location of the wires prior to removal !
- 6 Disconnect the wires.
- 7 Unbolt the screws that holds the power supply.
- 8 Remove the power supply.

Reassembly procedure

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

AC mains circuit breaker

Introduction

The circuit breaker is located on the left side of the Processing rack.

Disassembly procedure

- 1 Switch off the AC input to the cabinet.
- 2 Open the front door of the Transceiver Unit. Open up the middle part of the cabinet and swing the middle section towards the left.

Caution

Do not open the middle cabinet while in rough sea. The cabinet is heavy, and sudden movements may cause damage or injury to personnel.

Caution

Make sure that the input AC voltage is switched off prior to commencing the disassembly.

- 3 Unbolt the 4 screws on each side of the Processor rack to loosen the entire rack. Push the rack carefully backwards until the screws that hold the circuit breaker are available with a screwdriver. It might be necessary to loosen some straps that holds the cables.
- 4 Note down the location of the wires prior to removal !
- 5 Disconnect the wires on the faulty circuit breaker.
- 6 Unbolt the screws that holds the circuit breaker
- 7 Remove the circuit breaker carefully.

Reassembly procedure

Replace by reversing the above procedure.

AC mains filter

Introduction

The mains AC filter is located on the bottom plate of the Transceiver Unit.

Disassembly procedure

- 1 Switch off the AC input to the cabinet.
- 2 Open the front door of the Transceiver Unit. Open up the middle part of the cabinet and swing the middle section towards the left.

Caution Do not open the middle cabinet while in rough sea. The cabinet is heavy, and sudden movements may cause damage or injury to personnel.

Caution Make sure that the input AC voltage is switched off prior to commencing the disassembly.

- 3 Note down the location of the wires prior to removal !
- 4 Disconnect the wires on the faulty AC filter.
- 5 Unbolt the 2 screws that holds the AC filter from the underside of the bottom plate and remove the filter.

Reassembly procedure

Replace by reversing the above procedure.

Fuse replacement

Introduction

The Transceiver Unit holds several power supplies. Two of these are equipped with primary fuses.

- Low Voltage Power Unit
- High Voltage Power Supply

Disassembly procedure

The fuses on these power supplies are front mounted. No disassembly is required.

Reassembly procedure

Replace with the same type of fuse.

10.4 Hull Unit Controller procedures

Overview

The Line Replaceable Units (LRUs) in the EM 1002 Hull Unit Controller are:

- Subrack:
 - Signal Processor board (SPS)
 - Motor and Sensor Interface board (MOSINT2)
 - Low Voltage Power Supply (LVPS)
- Other devices:
 - AC mains fuse and filters
 - Fuses
 - Fan drawers

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

Circuit boards and modules

Introduction

The Hull Unit Controller holds one wired rack. The wired rack holds plug-in circuit boards and modules. The replacement of these modules is described in this procedure.

The system must be switched off prior to disassembly. Access is gained to the wired rack by opening the front door of the Hull Unit Controller. To open the front door, use the special tool for the cabinet doors.

The following modules are accessible in the Hull Unit Controller:

- Signal Processor board (SPS)
- Motor and Sensor Interface board (MOSINT2)
- Low Voltage Power Supply (LVPS)

→ *The circuit boards and modules are shown on page 181.*

Disassembly procedure

- 1 Release the thumb-screws if required.
- 2 Pull the board/unit carefully out.

Reassembly procedure

The new board is replaced reversing the above procedure.

Software replacement

→ *Refer to page 263.*

Replacement of all the circuit boards

In some cases, it might be necessary to replace all the circuit boards in the Hull Unit Controller. The following procedure is then suggested:

- 1 Open the front door of the Hull Unit Controller as previously described.
- 2 Open the middle section of the cabinet and switch off the circuit breaker.
- 3 Remove the circuit boards and modules carefully.
- 4 Insert new circuit boards and modules in reverse order.
- 5 Check that the circuit boards and modules have been installed in their correct locations! Refer to the applicable pictures and drawings.

Fan drawers

→ *Refer to page 265.*

Heater element

Introduction

A heater element is mounted to ensure the temperature inside the cabinet remains stable when the system is switched off, thus preventing condensation forming inside the cabinet. The heater is a commercial item.

It is mounted on the right side of the cabinet.

Disassembly procedure

Caution

Do not open the middle cabinet while in rough sea. The cabinet is heavy, and sudden movements may cause damage or injury to personnel.

- 1 Open the front door and the middle section of the Hull Unit Controller.
- 2 Switch off the front mounted circuit breakers located on the left side of the backplate.
- 3 Open up the middle section of the cabinet
- 4 Note down the location of the wires prior to removal!
- 5 Locate the heater. Follow the heater cables to the terminal block, and disconnect the wires.

- 6 Loosen the rail support holding the heater in place, and allow the heater to slide out (forward).

Reassembly procedure

The new heater is replaced reversing the above procedure.

220 Vac mains circuit breaker

Introduction

The circuit breaker is located on the left side of the backplate.

Disassembly procedure

- 1 Switch off the AC input to the cabinet.
- 2 Open the front door of the Hull Unit Controller. Open up the middle part of the cabinet and swing the middle section towards the left.

Caution

Do not open the middle cabinet while in rough sea. The cabinet is heavy, and sudden movements may cause damage or injury to personnel.

Caution

Make sure that the input AC voltage is switched off prior to commencing the disassembly.

- 3 It might be necessary to loosen some straps that holds the cables.
- 4 Note down the location of the wires prior to removal!
- 5 Disconnect the wires on the faulty circuit breaker.
- 6 Loosen the rail support holding the circuit breaker in place, and allow the circuit breaker to slide out.
- 7 Remove the circuit breaker carefully.

Reassembly procedure

Replace by reversing the above procedure.

220 Vac mains filter

Introduction

The mains AC filter is located on the bottom plate of the Hull Unit Controller.

Disassembly procedure

- 1 Switch off the AC input to the cabinet.

- 2 Open the front door of the Hull Unit Controller. Open up the middle part of the cabinet and swing the middle section towards the left.

Caution Do not open the middle cabinet while in rough sea. The cabinet is heavy, and sudden movements may cause damage or injury to personnel.

Caution Make sure that the input AC voltage is switched off prior to commencing the disassembly.

- 3 Note down the location of the wires prior to removal !
- 4 Disconnect the wires on the faulty AC filter.
- 5 Unbolt the 2 screws that holds the AC filter from the underside of the bottom plate and remove the filter.

Reassembly procedure

Replace by reversing the above procedure.

Software replacement

Overview

Normally the spare boards are fully equipped with software. If this is not the case, follow the instructions below.

Several of the circuit boards in the wired racks hold software on onboard PROMs and PALs. These devices must be moved from a faulty circuit board to a new spare. This is a delicate job, and the circuit board and the memory devices must be handled with great care.

The following precautions must be taken:

- The software replacement operation must be performed on a stable workbench or table.
- The table must be covered with an antistatic mat connected to the ship's ground
- The maintenance technician or engineer must wear a grounding bracelet, firmly connected to the ship's ground.
- All circuit boards must be stored in anti-static bags while not in use.

Each software device is identified with a white label. This label holds the following information:

- | | |
|-----------------------------|---------------|
| - Circuit board | E.g. SPB |
| - Device number | E.g. U15 |
| - Software version | E.g. V1.1 |
| - Date | E.g. 90.09.15 |
| - Checksum (in hexadecimal) | E.g. 05A3 |

Disassembly

- 1 Identify the device to be removed and write down the location of pin 1.
- 2 Use a small screwdriver or a special extraction tool and remove the device carefully from its socket on the source circuit board.
- 3 Ensure that the device is lifted as vertically as possible to prevent damage to the pins.

Caution

Once the device has been removed, handle it with care !

Insertion

- 1 Identify the socket where the device is to be located, place the device carefully into the socket, and ensure that it is orientated correctly.

- 2 Press the device gently but firmly into the socket using even pressure over the whole surface area.
- 3 After insertion, check that all the pins are properly inserted into the socket, and that no pins are bent.

Resassembly procedure

Note

Several circuit boards contain software mounted in PROMs, or other hardware devices. In the event of board replacement, ensure that the correct firmware devices are mounted and that correct links are fitted.

- 1 Locate the new module in the rack ensuring that module is correctly positioned in the guide rails.
- 2 Slide the board gently into the rack ensuring that the rear connectors mate correctly. Secure the thumb-screws.
- 3 Reconnect the flat ribbon cables (if any) onto the front of the board. Ensure that no pins are bent or broken, and that the plugs connect properly. Clip the locks onto the connectors to ensure the board is held securely in position.
- 4 Close the cabinet door.

Fan drawers

Introduction

There are several fan drawers in the sonar system. Three fans are located in the bottom of the Receiver Rack and the Transmitter Rack. They are either 230 Vac or 110 Vac. The two fans in the Processing Rack are 12 Vdc.

The Hull Unit Controller has one fan drawer. It is located under the subrack.

The sonar system must be switched off. Access is gained to the wired racks by opening the front door of the Transceiver Unit.

Disassembly procedure

The fan drawers located underneath the wired racks:

- 1 Gain access to the wired rack.
- 2 Twist the right thumb-screw on the fan drawer anti-clockwise a few turns, and the left thumb-screw clockwise a few turns.
- 3 Pull out the fan drawer.

The two fan drawers located in the Processing Rack:

- 1 Gain access to the Processing Rack by opening the front door.
- 2 Loosen the ribbon cable connected to RXB-P11.
- 3 Unscrew the eight screws holding the Processing Rack (in the front) and carefully pull it out. The screws are located on top and bottom of the rack.

Note

Some cables might have to be loosened.

- 4 The fans are located on the right hand side.

Reassembly procedure

The fan drawers located underneath the wired racks:

- 1 Push the drawer in. Make sure that the unit connects properly to the rear socket.
- 2 Secure the unit with the thumbscrews.
- 3 Close the cabinet door.

The two fan drawers located in the Processing Rack:

- 1 Replace the fan back on the chassis.
- 2 Put the chassis back into the rack.

3 Close the front door.

11 DATAGRAM FORMATS

11.1 Introduction

Note *The information herein is common for the EM 3000, EM 2000, EM 1002, EM 300 and EM 120 multibeam echo sounders. Some of the information may not be relevant for your specific system. Please disregard this.*

Note *The information in this document is not valid for the EM 12, EM 100, EM 950 and EM 1000 multibeam echo sounders.*

The formats for data input and output to and from the EM Series multibeam echo sounders are described here. The information given here is valid for the Kongsberg Maritime multibeam echo sounders introduced after 1995.

Note *In order to meet special customer requirements, Kongsberg Maritime may have to change the datagram formats described here. The formats presented in this document may therefore be altered without prior notice, although backward compatibility will be maintained as far as possible. Before software is written in accordance with this document, it is strongly recommended to contact Kongsberg Maritime to ensure that the latest version is used, and that any planned changes are taken into account.*

11.2 Presentation format

The format description is according to the NMEA 0183 standard for ASCII fields, with the ASCII character(s) given as follows:

- “x.x” defines a variable length numerical field, with optionally included decimal point and sign.
- “c--c” defines a variable length field of printable characters.
- “x--x” defines a variable length field of numeric characters.
- “a_ _” defines a fixed length field of alphabetical characters (for example “aa”= two character long field.
- “x_ _” defines a fixed length field of numeric characters.

For binary fields, the length is given in number of bytes plus “U” for unsigned and “S” for signed data.

11.3 Input datagrams

Introduction

Only a limited number of input formats from external sensors are accepted. These are primarily in accordance with the NMEA 0183 specification, or based upon the principles of that specification.

Note

The majority of these formats have not been defined by Kongsberg Maritime. Thus, these formats are not controlled by Kongsberg Maritime.

Almost all input formats are ASCII. Serial line input on the multibeam echo sounder's Processing Unit is most common, but some datagrams - which are not time critical - are interfaced on serial line(s) or Ethernet to the Operator Station.

Position

Overview

The EM Series accepts position data in the following formats:

- NMEA 0183 GGA
- GGK
- SIMRAD 90
- With the GGA and GGK datagrams, information contained in NMEA 0183 VGST and VTG datagrams will also be accepted and used.
- A datagram format for Sonar Head depth is provided for the EM 3000 and the EM 2000. Note that the format is the same as that used by the Paroscientific Digiquartz pressure sensor. This format may also be used for input of for example varying datum heights or other special height information on all models.
- A datagram format for input of tidal height is provided.

The **GGA format** is given below according to the NMEA 0183 version 2.30 description. Additional data at the end of the datagram is accepted to cater for users who need to log additional information than what is provided in the standard format. This is also supported with the GGK format. The total datagram length must be limited to less than 128 bytes if additional data is included.

Note

While such additional data will be logged, it is up to the user to extract the data to whatever use is required in postprocessing. Anyone using this possibility must also be aware that any future changes to the GGA or GGK format may require modifications in the datagrams and hence data decoding.

The **GGK format** was originally defined by the US Army Corps of Engineers for their tests with kinematic GPS. Trimble's proprietary version of the format is supported. If any changes to the format are made if it becomes part of the NMEA standard, this will be implemented.

To preserve the inherent accuracy of the kinematic GPS data it is necessary to correct the data for vessel motion. This requires accurate timing synchronisation between the motion sensor and the GPS receiver. It is therefore imperative that:

- the position datagram has a constant and known time delay
- or
- the time stamp in the datagram is actually the time of the position fix, that synchronisation to the 1 PPS signal of the GPS receiver is enabled, and that the system clock has been set correctly

As neither of these conditions may not be possible to achieve with a sufficient accuracy, the application of motion correction is operator selectable. Motion compensation may be applied to any position input, not only kinematic GPS.

In addition to position data from the GGA or GGK datagrams, speed and course over ground from **NMEA VTG** datagrams may also be copied into the position output datagram. These values may be useful in filtering of the positioning during postprocessing. If a VTG datagram does not follow the GGA or GGK datagram the course and speed fields of the output datagrams will be set to their invalid values.

The "Standard deviation of semi-major axis of error ellipse" field in a **NMEA GST** datagram may also be copied to the position output datagram as its "Measure of position fix quality". It will then replace the use of the HDOP or DOP field in the GGA or GGK datagram respectively to derive this field. This must be enabled by the operator however, and then if the GST datagram does not follow the GGA or GGK the quality measure field of the output datagram will be set to its invalid value.

As an alternative to GGA, the **SIMRAD 90 format** position datagram may be used. The SIMRAD 90 format is intended to be the format of choice when the positioning system is not a stand-alone GPS receiver supplying GGA or GGK format datagrams. The SIMRAD 90 format can in addition to global longitude latitude coordinates also be used for Northing Easting type projection coordinates (e.g. UTM).

To cater for applications where the EM 2000 or EM 3000 Sonar Head is mounted on a subsea vehicle, the original SIMRAD 90 format has been expanded to allow inclusion of the depth of the vehicle in addition to its horizontal position in longitude latitude or Northing Easting coordinates.

Also for EM 2000 and EM 3000 applications with separate surface and underwater positioning systems, the SIMRAD 90 format will allow the underwater position to be provided relative to the vessel, with the vessel surface position given in a separate GGA, G GK or SIMRAD 90 datagram.

GGA Datagram

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	–	–
Talker identifier	aa	Capital letters	–
Sentence formatter	Always GGA,	–	–
UTC of position	hhmmss.ss,	000000 to 235959.9...	–
Latitude in degrees and minutes, plus optional decimal minutes	llll.ll,	0000 to 9000.0...	–
Latitude – N/S	a,	N or S	–
Longitude in degrees and minutes, plus optional decimal minutes	yyyyy.yy,	00000 to 18000.0...	–
Longitude – E/W	a,	E or W	–
GPS quality indicator	x,	0 to 8	1
Number of satellites in use	xx,	00 to 12	–
HDOP	x.x,	0 to	1
Antenna altitude re mean sea level (geoid)	x.x,	–	2
Units of antenna altitude	M,	–	–
Geoidal separation (sea level re WGS–84)	x.x,	–	2
Units of geoidal separation	M,	–	–
Age of differential GPS data	x.x,	–	–
Differential reference station id	xxxx,	0000 to 1023	–
Possible extension of datagram with user defined data (addition to NMEA format)	c–c	–	3
Checksum	*hh	–	–
End of sentence delimiter = CRLF	Always 0Dh 0Ah	–	–

Note 1

The HDOP (Horizontal Dilution Of Precision) value will be scaled and copied to the "Measure of position fix quality" field in the position output datagram. The scale factor depends upon the GPS quality indicator's value:

- 1 - (SPS or standard GPS) => 1000
- 2 - (differential GPS) => 100

- 3 - (PPS or precise GPS) => 200, but 10 if GGA is treated as RTK. (See Note 2)
- 4 - (kinematic GPS with fixed integers) => 10
- 5 - (kinematic GPS with floating integers) => 50
- 6 - (estimated or dead reckoning mode) => 1000
- 7 - (manual input mode) => 1000
- 8 - (test mode) => 1000, but 10 if GGA is treated as RTK. (See Note 2)
- The "Measure of position fix quality" field will be set to 65534 (largest valid number) if the indicator is zero (non-valid position).

This scaling is used to give at least a relatively correct position fix quality change (in the order of cm) if there are dropouts in differential, precise or kinematic measurements, although HDOP is not a meter value.

Note 2

When the quality factor is 4 or 5 a height output datagram is automatically generated, and also if the quality factor is 3 or 8 and the operator has set the GGA position to be an RTK position. The height is the sum of these two fields which are assumed positive upwards (antenna above geoid).

Note 3

The maximum length of this field should be restricted so that the total datagram length is not more than 127 bytes.

GGK Datagram

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	–	–
Talker identifier	aa	Capital letters	–
Sentence formatter	Always GGK,	–	–
UTC time of position	hhmmss.ss,	000000 to 235959.99...	–
UTC date of position	MMDDYY,	010100 to 123199	–
Latitude in degrees and minutes, plus optional decimal minutes	llll.lllll,	0000 to 9000.0...	–
Latitude – N/S	a,	N or S	–
Longitude in degrees and minutes, plus optional decimal minutes	yyyyy.yyyyyy,	00000 to 18000.0...	–
Longitude – E/W	a,	E or W	–
GPS quality indicator	x,	0 to 3	1
Number of satellites in use	xx,	00 to 12	–
DOP	x.x,	0 –	1
Antenna ellipsoidal height	x.x,	–	–
Units of antenna ellipsoidal height	M,	–	–
Possible extension of datagram with user defined data	c--c	–	2
Checksum	*hh	–	–
End of sentence delimiter = CRLF	Always 0Dh 0Ah	–	–

Note 1

The DOP (Dilution Of Precision) value will be scaled and copied to the "Measure of position fix quality" field in the position output datagram. The scale factor depends upon the GPS quality indicator's value:

- 1 (SPS or standard GPS) => 1000
- 2 (differential GPS) => 100
- 3 (kinematic GPS) => 10

The "Measure of position fix quality" field will be set to 65534 (largest valid number) if the indicator is zero (non-valid position).

This scaling is used to give at least a relatively correct position fix quality change (in cm) if there are dropouts in differential, precise or kinematic measurements, although DOP is not a meter value.

Note 2

The maximum length of this field should be restricted so that the total datagram length is not more than 127 bytes.

GST Datagram

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	–	–
Talker identifier	aa	Capital letters	–
Sentence formatter	Always GST,	–	–
UTC time of the GGA or GGK associated with this sentence	hhmmss.ss,	000000 to 235959.9...	–
RMS value of the standard deviation of the range inputs to the navigation process	x.x,	0 –	–
Standard deviation of semi–major axis of error ellipse in meters	x.x,	0 –	1
Standard deviation of semi–minor axis of error ellipse in meters	x.x,	0 –	–
Orientation of semi–major axis of error ellipse in degrees from true North	x.x,	0 –	–
Standard deviation of latitude error in meters	x.x,	0 –	–
Standard deviation of longitude error in meters	x.x,	0 –	–
Standard deviation of altitude error in meters	x.x,	0 –	–
Checksum	*hh	–	–
End of sentence delimiter = CRLF	Always 0Dh 0Ah	–	–

Note 1

The term "standard deviation of error" in the format description implies that the GST datagram was originally intended to contain statistics. Such a use may invalidate the intended use here, namely to derive a better quality measure than the HDOP in the GGA or DOP in the GGK datagram. Thus, the GST datagram should only be used if one is certain that this field contains the semi-major axis of the error ellipse for the latest fix, and not a statistical measure calculated over a number of fixes.

VTG Datagram

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	–	–
Talker identifier	aa	Capital letters	–
Sentence formatter	Always VTG,	–	–
Course over ground, degrees true	x.x,T,	0 to 359.9...	1
Course over ground, degrees magnetic	x.x,M,	0 to 359.9..	1
Speed over ground, knots	x.x,N,	0 –	1
Speed over ground, km/h	x.x,K,	0 –	1
Mode indicator	a	A,D,E,M,S or N	–
Checksum	*hh	–	–
End of sentence delimiter = CRLF	Always 0Dh 0Ah	–	–

Note 1

Only true course and the first valid speed field will be used.

Simrad 90 Datagram

Data Description	Format	Length	Valid range	Note
Start identifier = \$	Always 24h	1	–	–
Talker identifier	aa	2	Capital letters	–
Sentence formatter	Always S90,	4	–	–
Date of position	DDMMYY,	7	010100 to 311299	–
UTC of position as hour, minute, second, hundredth of second	hhmmssss,	9	00000000 to 23595999	–
Latitude in degrees, minutes and decimal minutes	xxxx.xxxx	9	0000.0000 to 9999.9999	A
Hemisphere identifier	a,	2	N or S	A
Longitude in degrees, minutes and decimal minutes, or depth in meters	xxxxx.xxxx	10	00000.0000 to 18000.0000	A
Hemisphere or depth identifier	a,	2	E, W or D	A
Northing or range in meters	xxxxxxxx.x,	12	000000000.0 to 999999999.9	B
Easting or depth in meters	xxxxxxxx.x,	10	0000000.0 to 9999999.9	B
UTM zone number	xx,	3	01 to 60	–
User defined central meridian longitude or bearing	xxxxx.xxxx	10	00000.0000 to 35999.9999	C
Hemisphere or bearing identifier	a,	2	E, W, or B	C
System descriptor	x,	2	0 to 7	1
Position fix quality indicator	x,	2	0 to 9 and A to F	2
Speed over ground in m/s	xx.x,	5	00.0 to 99.9	3
Course over ground in degrees	xxx.x	5	000.0 to 359.9	3
End of sentence delimiter = ,CRLF	Always 2Ch 0Dh 0Ah	3	–	–

Note 1

Value of system descriptor defines content of datagram as follows. (Note that the Kongsberg Maritime EM 12, the EM 950 and the EM 1000 multibeam echo sounders will only accept values less than 3):

- **0** - The position is longitude latitude in global coordinates given in the fields noted A.

- **1** - The position is Northing Easting on the Northern hemisphere given in the fields noted B. If the projection is defined to be UTM the UTM zone number or a user definable central meridian longitude may be given in the field noted C.
- **2** - As for system descriptor equal to 1, but the position is on the Southern Hemisphere.
- **3** - As for system descriptor equal to 0, but in addition the depth is given in the Easting field noted B.
- **4** - As for system descriptor equal to 1, but in addition the depth is given in the longitude field noted A.
- **5** - As for system descriptor equal to 2, but in addition the depth is given in the longitude field noted A.
- **6** - The position is given relative to the vessel in a polar coordinate system with horizontal range and depth provided in the fields noted B and bearing re true North in the field noted C.
- **7** - As for system descriptor 6, but the bearing is re the vessel centerline.

Note 2

The position fix quality given in the position output datagram will be derived from the quality indicator (this differs from the original definition of the format) as follows (in m):

F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
0.01	0.02	0.05	0.1	0.2	0.5	1	2	5	10	20	50	100	200	500	1000

Note 3

If these fields have valid values they will be copied to equivalent fields in the position output datagram. They may be used in filtering of the positioning during postprocessing. (The original definition of the format had line heading in the course field and its use was to orient real-time displays).

Tide input

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	–	–
Talker identifier	a	Capital letter	–
Sentence formatter	Always TIDE,	–	–
Date and time of prediction / measurement	YYYYMMDDhhmm,	199601010000 to 999912312359	–
Tide offset in meters and decimal meters	x.x	±327.66	1
Optional checksum	*hh	–	–
End of sentence delimiter = CRLF	Always 0Dh 0Ah	–	–

Note 1

A negative number will be assumed to indicate an increase in sea level.

Depth or height input

Data Description	Format	Valid range	Note
Start identifier = *	Always 2Ah	–	–
Sentence identifier	ii	00 to 09	1
Talker identifier	ii	00 to 99	–
Depth or height in meters and decimal meters	x.x	–	2
End of sentence delimiter = CRLF	Always 0Dh 0Ah	–	–

Note 1

A sentence identifier equal to 00 is used for underwater vehicle depth, all other identifiers are customer specific (usually a datum height).

Note 2

If input is depth, it will be used in the depth output datagram to offset the transmit transducer depth. If input is height, which will usually imply a time or position variable datum height, its use will depend on the sentence identifier and will be implemented as required by a specific customer. Depth is positive downwards. Depths may be scaled and offset by operator settable constants:

$$\text{output_depth [m]} = \text{scale_factor} * (\text{input_depth} - \text{offset})$$

Attitude data**Overview**

Attitude data is generally accepted on one or more serial input port(s) as:

- roll, pitch, heave and heading on one port,

or

- roll, pitch and heave on one port and heading separately on another port.

The data update rate should be commensurate with the expected dynamics of the vessel (typically up to 100 Hz).

The acceptable format for roll, pitch, heave and optionally also heading is a 10 byte long message originally defined in the EM 1000 for use with digital motion sensors. It is supported by the following sensors:

- Applied Analytics POS/MV
- Photokinetics Octans
- Seatex MRU
- Seatex SeaPath
- TSS DMS-05

Heading will be accepted in the NMEA 0183 HDT format or in the format used by the Simrad Robertson SKR80(82) gyrocompass. A current loop to RS-232 converter may then be required. The Lemkuhl LR40(60) Scan Repeater format is also accepted, as it is the same as that of the SKR80 with the exception of an extra status byte. Note that if the attitude sensor is capable of reading the gyrocompass and transfer the heading to the attitude sensor datagram (if it does not measure heading itself), this is preferable to interfacing the gyrocompass directly to the system.

Roll, pitch and heading in the Sperry Marine MK-39 MOD2 Attitude and Heading Reference System format is also accepted. A second motion sensor must then be used to supply heave.

Attitude data may be supplied from more than one sensor. All data may be logged, but only one set as chosen by the operator will be used in real time.

EM Attitude input format

The EM attitude format is a 10-bytes long message defined as follows:

- Byte 1: Sync byte 1 = 00h, or Sensor status = 90h-AFh
- Byte 2: Sync byte 2 = 90h
- Byte 3: Roll LSB
- Byte 4: Roll MSB
- Byte 5: Pitch LSB
- Byte 6: Pitch MSB
- Byte 7: Heave LSB
- Byte 8: Heave MSB
- Byte 9: Heading LSB
- Byte 10: Heading MSB

where **LSB** = least significant byte, **MSB** = most significant byte.

All data are in 2's complement binary, with 0.01° resolution for roll, pitch and heading, and 1 cm resolution for heave.

- Roll is positive with port side up with $\pm 179.99^\circ$ valid range
- Pitch is positive with bow up with $\pm 179.99^\circ$ valid range
- Heave is positive up with ± 9.99 m valid range
- Heading is positive clockwise with 0 to 359.99° valid range.

Non-valid data are assumed when a value is outside the valid range.

How roll is assumed to be measured is operator selectable, either with respect to the horizontal plane (the Hippy 120 or TSS convention) or to the plane tilted by the given pitch angle (i.e. as a rotation angle around the pitch tilted forward pointing x-axis). The latter convention (called Tate-Bryant in the POS/MV documentation) is used inside the system in all data displays and in logged data (a transformation is applied if the roll is given with respect to the horizontal).

Note that heave is displayed and logged as positive downwards (the sign is changed) including roll and pitch induced lever arm translation to the system's transmit transducer.

This format has previously been used with the EM 950 and the EM 1000 with the first synchronisation byte always assumed to be zero. The sensor manufacturers have been requested to include sensor status in the format using the first synchronisation byte for this purpose. It is thus assumed that:

- 90h in the first byte indicates a valid measurements with full accuracy
- any value from **91h to 99h** indicates valid data with reduced accuracy (decreasing accuracy with increasing number)
- any value from **9Ah to 9Fh** indicates non-valid data but normal operation (for example configuration or calibration mode)
- and any value from **A0h to AFh** indicates a sensor error status

Sperry Mk.39 Attitude input format

The format is 18 bytes long, and it is organised as 9 words. The most significant byte of a word is transmitted first.

- Word 1 AA55h
- Word 2 Status and time
- Word 3 Heading
- Word 4 Roll
- Word 5 Pitch

- Word 6 Heading rate
- Word 7 Roll rate
- Word 8 Pitch rate
- Word 9 Checksum (MSB) and 1's complement of checksum (LSB)

All data are in 2's complement binary. Heading is given within $\pm 180^\circ$, roll and pitch within $\pm 90^\circ$. (Note however that the values $+180^\circ$ and $+90^\circ$ are not permitted, as these are one bit too high.)

Heading is measured with reference to true North, and positive when the bow points eastwards. Roll is per definition a rotation angle (Tate-Bryant) and positive when the starboard side goes up. Pitch is positive when the bow goes down.

HDT format

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	–	–
Talker identifier	aa	Capital letters	–
Sentence formatter	Always HDT,	–	–
Heading, degrees true	x.x,T	0 to 359.9...	–
Checksum	*hh	–	–
End of sentence delimiter = CRLF	Always 0Dh 0Ah	–	–

SKR80 format

The SKR80 sends out a stream of data with four bytes for each measurement. There is one byte for each digit:

- The first byte for the decimal degree (Example: xxx.X)
- The second for the degree (Example: xxX.x)
- The third for the 10's degree (Example: xXx.x)
- The fourth for the 100's degree (Example: Xxx.x)

The two uppermost bits of a byte are always zero, the next two bits give the digit, 00 for the decimal, 01 for the degree, 10 for the 10's degree, and 11 for the 100's degree. The lowest four bits give the digit value in 4-bit BCD format. As an example a heading of 234.5° will give the four bytes 05h 14h 23h 32h. The LR40 adds a fifth byte at the end for status with the two upper bits of the status byte set to 11 (11000000 for OK, 11001010 for alarm). This status byte is ignored.

Clock

The system clock is used to time stamp all data output. The clock may be set upon start of new survey or power-up on the Processing Unit (recommended source is a NMEA ZDA format datagram). The clock will drift, typically some seconds per day, unless it is synchronised to a 1 PPS (pulse per second) input signal (the clock millisecond counter will be set to zero whenever a pulse is received). A fully correct clock is only necessary if the output data are later to be combined with other time critical data logged or created by other systems, for example an accuracy of up to one minute would be necessary to apply tidal changes. If the timestamp supplied in the position input datagrams is to be used, it is imperative that the system clock is correctly set and that 1 PPS synchronisation is used.

ZDA format

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	–	–
Talker identifier	aa	Capital letters	–
Sentence formatter	Always ZDA,	–	–
UTC	hhmmss.ss,	000000 to 235959.9...	–
Day	xx,	01 to +31	–
Month	xx,	01 to +12	–
Year	xxxx,	0000 to 9999	–
Local zone hours	xx,	–13 to +13	1
Local zone minutes	xx	00 to +59	1
Optional checksum	*hh	–	–
End of sentence delimiter = CRLF	Always 0Dh 0Ah	–	–

Note 1

Local zone time is not used. An offset time may be entered by the operator to get the system clock to show a different time than UTC.

Sound Speed

Overview

A sound speed profile may be loaded into the Operator Station either on a serial line or on Ethernet. Formats previously used with existing Kongsberg Maritime echo sounders (Kongsberg Maritime ASCII and Binary Sound Velocity Profile input datagrams) will be accepted, but since their resolution in depth is limited to 1 m and the number of entries to 100, a new format given below without these limitations is recommended. This format is also accepted by the Kongsberg Maritime HIPAP and HPR underwater positioning systems (but not necessarily vice-versa). Note that a complete profile may be pieced together from several datagrams and edited with the Operator Station's Sound Speed Editor.

The new format is completely in ASCII and allows 9998 entries without limitations in resolution. In addition to depth and sound speed, it allows input of absorption coefficient, pressure, temperature and salinity or conductivity. The latter parameters may be used to calculate depth, sound speed and absorption coefficient. Use of a depth dependent absorption coefficient allows a more accurate determination of bottom backscatter strength.

Note that this datagram may also be logged as output, retaining information not included in the standard sound speed profile output datagram, such as where and when the profile has been taken.

Kongsberg Maritime SSP format

Data Description	Format	Length	Valid range	Note
Start identifier = \$	Always 24h	1	–	–
Talker identifier	aa	2	Capital letters	–
Datagram identifier	Always Sxx,	4	S00to S53	1,2
Data set identifier	xxxxx,	6	00000 to 65535	–
Number of measurements = N	xxxx,	5	0001 to 9999	–
UTC time of data acquisition	hhmmss,	7	000000 to 235959	3
Day of data acquisition	xx,	3	00 to 31	3
Month of data acquisition	xx,	3	00 to 12	3
Year of data acquisition	xxxx,	5	0000 to 9999	3
<i>N entries of the next 5 fields – See note 4</i>				
– Depth in m from water level or Pressure in MPa	x.x,	2 –	0 to 12000.00 0 to 1.0000	–
– Sound velocity in m/s	x.x,	1 –	1400 to 1700.00	–
– Temperature in °C	x.x,	1 –	–5 to 45.00	–

Data Description	Format	Length	Valid range	Note
– Salinity in parts per thousand or Conductivity in S/m	x.x,	1 –	0 to 45.00 0 to 7.000	–
Absorption coefficient in dB/km	x.x	0 –	0 to 200.00	–
Data set delimiter	CRLF	2	0Dh 0Ah	–
End of repeat cycle				
Latitude in degrees and minutes, plus optional decimal minutes	III.II,	Variable 5–	0000 to 9000.0...	5
Latitude – N/S	a,	2	N or S	5
Longitude in degrees and minutes, plus optional decimal minutes	yyyyy.yy,	Variable 6–	00000 to 18000.0...	5
Longitude – E/W	a,	2	E or W	5
Atmospheric pressure in MPa	x.x,	1 –	0 to 1.0000	5
User given comments	c– –c	Variable	–	5
Optional checksum	*hh	–	–	6
End of datagram delimiter = \CRLF	5Ch 0Dh 0Ah	3	–	–

Note 1

The datagram identifier identifies what type of data is included. This is shown in the following table where D is depth, P is pressure, S is salinity, C is conductivity, c is sound speed, α is absorption coefficients, and L is latitude. The notation c(T,S) indicates for example that the sound speed is to be calculated from the temperature and salinity input data. When pressure is used, the atmospheric pressure must be given if the pressure is absolute, otherwise the pressure must be given re the sea level and the atmospheric pressure must be zero.

Identifier	Input data	Data to be used
S00	D, c	D, c
S10	D, c	D, c
S11	D, c, α	D, c, α
S12	D, c, T, S	D, c, α (D,T,S,L)
S20	D, T, S	D, c(D,T,S,L)
S21	D, T, S, α	D, c(D,T,S,L), α
S22	D, T, S	D, c(D,T,S,L), α (D,T,S,L)
S30	D, T, C	D, c(D,T,C,L)
S31	D, T, C, α	D, c(D,T,C,L), α
S32	D, T, C	D, c(D,T,C,L), α (D,T,C,L)
S40	P, T, S	D(P,T,S,L), c(P,T,S,L)
S41	P, T, S, α	D(P,T,S,L), c(P,T,S,L), α

Identifier	Input data	Data to be used
S42	P, T, S	D(P,T,S,L), c(P,T,S,L), α (P,T,S,L)
S50	P, T, C	D(P,T,C,L), c(P,T,C,L)
S51	P, T, C, α	D(P,T,C,L), c(P,T,C,L), α
S52	P, T, C	D(P,T,C,L), c(P,T,C,L), α (P,T,C,L)

Note 2

S00 is a special case because then the sound speed profile will be taken into use immediately without further operator intervention. The checksum is then mandatory and must be correct. Furthermore entries for zero depth and a deeper depth than expected during the survey must be included.

Note 3

Note that these fields have fixed length and leading zeros must be used.

Note 4

The depth or pressure field is always required while the other fields are optional except for those required by the datagram identifier. The field-delimiting commas must always be included even if the fields are empty.

Note 5

The positions, atmospheric pressure and comment fields are optional. Note that the option field must not include a \. It is recommended to include sensor type in the comment field.

Note 6

The checksum field is calculated between the \$ and the * delimiters by exclusive OR'ing of all bytes. The checksum is required for datagram S00, but is optional for the others.

AML CALC format

Sound speed profile data input in the CALC format is used by the Applied Microsystems Ltd. (AML) Total System Software package to support AML's complete range of sensors is also accepted.

This format is an ASCII format with a five line header plus a variable number of lines with data as follows:

Line 1: CALC, sn, date, depth increment, depth display

- sn is the sensor serial number
- date is current date taken from computer
- depth increment is logging depth increment

- depth display is depth units (meters or decibars)

Line 2: AML SOUND VELOCITY PROFILER S/N: xxxxx

Line 3: DATE:xxxxx TIME:xxxxx

- This line gives the Julian date and time at start of sensor logging

Line 4: DEPTH OFFSET(M): xxxx.x

- This line gives the pressure offset at sea level.

Each line of data contains three numbers:

- depth (in meters)
- sound velocity (in m/s)
- temperature (in degrees Celsius)

Line 5: DEPTH(M) VELOCITY (M/S) TEMPERATURE (_C)

The numbers are separated by a space, and each line is terminated with a linefeed (LF). The numbers shall all include a decimal point (xxx.x xxxx.x xx.xLF). The data are terminated by a line with three zeros with two spaces between the zeros (0 0 0).

AML Smart Sensor format

The **AML Smart SV&P** sensor and later the **SVPlus** sensor may be used directly for sound speed profile input on serial line to the Operator Station. Both these sensors may also be used to measure the sound speed at the transducer depth continuously during the surveying.

A measurement is requested from a smart sensor by issuing the word 'scan' as four ASCII characters terminated by CR. The reply from the SV sensor is a string of ASCII characters:

'S'CRLF xxxx.x CRLF>

where xxxx.x is the measured sound speed in m/s (in bytes 5-11). From the SV&P sensor the received string is:

'S'CRLF ±xxx.xx xxxx.x CRLF>

where the first number is the pressure in decibars relative to the surface and the second sound speed in m/s (in bytes 13-19).

Smart sensors with autonomous output may also be used, both P&SV (sound speed with pressure) and T&SP (sound speed with temperature).

The P&SV format is:

±xxx.xx xxxx.x CRLF

The T&SP format is:

±xx.xxx xxxx.x CRLF

The last field in both of these formats give the sound speed and the first field either pressure in decibars or temperature in degrees Celsius.

Depth input from single beam echo sounder

Overview

Depth datagrams from a single beam echo sounder are accepted for display and logging on the system. The following formats are supported:

- NMEA 0183 DBS
- NMEA 0183 DPT
- binary datagrams from the Kongsberg Maritime EA 500 echo sounder series.

DBS format

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	–	–
Talker identifier	aa	Capital letters	–
Sentence formatter	Always DBS,	–	–
Depth in feet	x.x,f,	0.1 –	1
Depth in meters	x.x,M,	0.1 –	1
Depth in fathoms	x.x,F	0.1 –	1
Checksum	*hh	–	–
End of sentence delimiter = CRLF	Always 0Dh 0Ah	–	–

Note 1

The decoding priority will be meter field, feet field and fathom field with the depth value extracted from the first field with valid data.

DPT format

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	–	–
Talker identifier	aa	Capital letters	–
Sentence formatter	Always DPT,	–	–
Depth in meters from the transducer	x.x,	0.1 –	–
Offset of transducer from waterline in meters	x.x,	0 –	1
Maximum range scale in use	x.x	–	–

Data Description	Format	Valid range	Note
Checksum	*hh	–	–
End of sentence delimiter = CRLF	Always 0Dh 0Ah	–	–

Note 1

A negative value implying that the offset is from the keel should not be used.

EA 500 format

Data Description	Format	Valid range	Note
Start identifier = D	Always 34h	–	–
Channel identifier	x,	1 to 3	1
Time as HHMMSShh	xxxxxxx,	00000000 to 23595999	1
Depth in meters from the transducer	32 bit IEEE 754 floating point	0.1 –	1
Bottom backscattering strength in dB	32 bit IEEE 754 floating point	–	–
Transducer number	32 bit integer	–	–
Athwartship slope in degrees	32 bit IEEE 754 floating point	–	–

Note 1

Only the channel identifier, depth and time will be decoded by the system. The least significant byte is transmitted first (the Intel convention).

Note

The datagram must be sent on Ethernet to UDP port number 2200 on the Operator Station.

Remote control**Overview**

A Remote Control datagram has been implemented to allow:

- the multibeam echo sounder to start logging on remote command.
- the multibeam echo sounder to send out parameter and sound speed profile datagrams as a response to the remote command.
- the survey line numbers to be set from a remote location.

Note that the parameter and sound speed profile datagrams are always sent out when logging is started or any changes are made to the parameters or sound speed. They may also be sent out regularly at operator specified intervals.

The datagram currently only allows survey related parameters to be transferred to the system. It will later be expanded to allow remote setting of all installation parameters, and then basically as a copy of the standard start/stop datagram with identical conventions with regard to order (which is not important), but requiring only the parameters actually to be set.

Data Description	Format	Valid range	Note
Start identifier = \$	Always 24h	–	–
Talker identifier	aa	Capital letters	–
Datagram identifier	Rxx,	R00 to R20	1
EM model number	EMX=dddd,	–	2
Responsible operator	ROP=a--a,	–	–
Survey identifier	SID=a--a,	–	–
Survey line number	PLN=d..d,	–	–
Survey line identifier (planned line no)	PLL=d--d,	–	–
Comment	COM=a--a	–	–
Optional checksum	*hh	–	–
End of datagram delimiter = \CRLF	5Ch 0Dh 0Ah	–	–

Note 1

Rxx defines what action the system is to take with respect to pinging and logging of data in addition to changes in the parameters. Note that logging of survey data on local storage is not affected, this is determined by operator control from the menu only.

- R00 - System to stop pinging (and logging if on)
- R10 - System to stop all logging (but continue or start pinging).
- R11 - System to start logging on new line to both local and remote
- R12 - System to star logging on new line but only to local storage
- R13 - System to start logging on new line but only to remote
- R20 - System to send installation parameter datagram and sound speed profile datagrams to remote

Note 2

The EM model number will be required when parameter changes are made with respect to transducer location or system gain settings.

11.4 Output datagrams

Introduction

Output datagrams are usually logged to disk or tape on the EM Series Operator Station. The output datagrams may also be exported to user provided programs on the Operator Station or on an external Ethernet network using UDP protocol (remote logging). An NMEA DPT depth datagram may be exported on a serial line.

The output datagrams are mostly in binary format using signed or unsigned integer numbers with lengths of 1, 2 or 4 bytes. All binary data will presently be big endian.

Note

As this is subject to modifications, we recommend that software written to decode EM Series data includes a check for the byte ordering with a provision for byte swapping. Suitable data fields to check on are the length field at the start of the datagram, the EM Series model number field and possibly the date and time fields.

The basic output datagram structure established with the EM 100 echo sounder is retained.

- All datagrams (except the NMEA DPT datagram) start with STX, datagram type and time tag, and end with ETX and checksum (sum of bytes between STX and ETX). In addition the total length of the datagram (*not including the length field*) will precede the STX byte, given as a four byte binary number.
- The length field is only included when logging to tape and/or disk, but not for datagrams logged to a remote location. The length can then be derived from the network software. Systems logging data remotely should add this length at the start of each datagram. This length is required if the data are to be used with Kongsberg Maritime post-processing systems.
- The time stamp resolution has been increased to 1 millisecond and now includes the century, but as a consequence the time stamp is now binary and not ASCII as implemented previously. The date is given as 10000*year(4 digits) + 100*month + day, for example 19950226 for February 26, 1995. All date fields in the output datagrams use this format. A time is usually given (in milliseconds) from midnight.

- The datagrams identify the multibeam echo sounder model and its serial number. The system model number is 120 for the EM 120, 300 for the EM 300, etc. For the EM 3000D (the dual head system) the model number was originally given as 3002 and the serial number is that of Sonar Head number 1. However in the depth datagram model numbers 3003-3008 are now used to also identify the actual transmit and sampling frequencies of the two heads. If only one head is activate on the EM 3000D, it is coded as a single head system.
- Due care has been taken to include all parameters needed in postprocessing in the relevant datagrams, with a minimum of data duplication. Where resolution of a data field is variable, a resolution descriptor is included.
- Invalid data are always identified by the highest positive number allowed in a field unless otherwise noted.
- A real-time parameter datagram has been added to enable logging of parameters not used in postprocessing, but which may be important in checking the quality of the logged data, or to allow tracing of reasons for possible malfunctions.
- Attitude data as time continuous records and raw ranges and beam pointing angles are logged to allow eventual postprocessing corrections. The logged attitudes are valid at the transmit transducer, and are corrected for any sensor offsets.

Depth

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	–	–
Start identifier = STX (Always 02h)	1U	–	–
Type of datagram = D(epth data) (Always 44h)	1U	–	–
EM model number (Example: EM 3000 = 3000)	2U	–	4
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
Ping counter (sequential counter)	2U	0 to 65535	–
System serial number	2U	100 –	–
Heading of vessel in 0.01°	2U	0 to 35999	–
Sound speed at transducer in dm/s	2U	14000 to 16000	–
Transmit transducer depth re water level at time of ping in cm	2U	0 to 65536	1

Data Description	Format	Valid range	Note
Maximum number of beams possible	1U	48 –	–
Number of valid beams = N	1U	1 to 254	–
z resolution in cm	1U	1 to 254	–
x and y resolution in cm	1U	1 to 254	–
Sampling rate (f) in Hz or Depth difference between sonar heads in the EM 3000D	2U 2S	300 to 30000 –32768 to 32766	3 4
Repeat cycle – N entries of :	16*N	–	–
– Depth (z) from transmit transducer (unsigned for EM 120 and EM 300)	2S or 2U	–32768 to +32766 or 1 to 65534	2
– Acrosstrack distance (y)	2S	–32768 to 32766	2
– Alongtrack distance (x)	2S	–32768 to 32766	2
– Beam depression angle in 0.01°	2S	–11000 to 11000	3
– Beam azimuth angle in 0.01°	2U	0 to 56999	3
– Range (one-way travel time)	2U	0 to 65534	3
– Quality factor	1U	0 to 254	5
– Length of detection window (samples/4)	1U	1 to 254	–
– Reflectivity (BS) in 0.5 dB resolution (Example: –20 dB = 216)	1S	–128 to +126	–
– Beam number	1U	1 to 254	6
End of repeat cycle			
Transducer depth offset multiplier	1S	–1 to +17	1
End identifier = ETX (Always 03h)	1U	–	–
Check sum of data between STX and ETX	2U	–	–

Note 1

The transmit transducer depth plus the depth offset multiplier times 65536 cm should be added to the beam depths to derive the depths re the water line. The depth offset multiplier will usually be zero, except when the EM 2000/3000 Sonar Head is on an underwater vehicle at a depth larger than 655.36 m. Note that the offset multiplier will be negative (-1) if the actual heave is large enough to bring the transmit transducer above the water line. This may represent a valid situation, but may also be due to an erroneously set installation depth of either the transducer or the water line.

Note 2

The beam data are given re the transmit transducer or sonar head depth and the horizontal location of the active positioning system's antenna. Heave, roll, pitch, sound speed at the transducer depth and ray bending through the water column

have been applied. On the EM 1002/2000/3000 the beam depths must be regarded as signed values to take into account beams which may be going upwards. On the EM 120/300 the beam depths are always positive and the values are therefore unsigned.

Note 3

The range, beam depression angle (positive downwards and 90° for a vertical beam) and beam azimuth angle (re vessel centerline) are given relative to the transducer (sonar head) at the ping transmit time. Heave, roll, pitch and sound speed at the transducer depth have been applied, but not ray bending. These values may thus be directly used for a new ray bending calculation with a revised sound speed profile to generate new sounding depths and positions without any need for using attitude data. The range resolution in time is the inverse of the range sampling rate (i.e. nominally equivalent to about $70 \mu\text{s}$ for the EM 3000).

Note that if the data need to be reprocessed with a new sound speed at the transducer depth or new roll, pitch or heave values, full reprocessing starting with the raw range and beam angle data is required. Attitude data is also required in this reprocessing, and both these data types will in the future be logged as standard.

If the beam azimuth angle has a value larger than 35999, the beam pointing angle has replaced the beam depression angle, and the raw two-way travel time has replaced the one-way heave and beam angle corrected travel time. The transmit tilt angle plus 54000 is given in the beam azimuth angle field. The use of this data definition is available on remote output to a port named as "RawDepth..." for use by other systems which do their own attitude and sound speed processing.

Note 4

In an EM 3000D the transmit transducer depth is that of Sonar Head number 1, taking into account the depth offset multiplier as described in note 1. The range multiplier is replaced by the difference in depth between Sonar Head number 1 and 2, i.e. head 2 depth is equal to head 1 depth (possibly modified with depth offset multiplier) plus the depth difference. The range sampling rates in Hz of the two heads is given through the EM model number according to the following table:

EM model number	3003	3004	3005	3006	3007	3008
Sonar Head 1	13956	14293	13956	14621	14293	14621
Sonar Head 2	14621	14621	14293	14293	13956	13956

Previously the model number of the EM 3000D was given as 3002 with head sample rates of 13956 and 14621 Hz respectively. The head depths in this case should be assumed to be equal, and although the mathematical derivation of final beam depths would otherwise be the same as described above, the transmit transducer depth was not actually exactly that of the sonar heads.

Note 5

The quality number's upper bit signifies whether amplitude (0) or phase (1) detection has been used. If amplitude the 7 lowest bits give the number of samples used in the centre of gravity calculation. If phase the second highest bit signifies whether a second (0) or first (1) order curve fit has been applied to determine the zero phase range, and the 6 lowest bits indicates the quality of the fit (actually the normalized variance of the fit re the maximum allowed, i.e. with a lower number the better the fit).

Note 6

Beam 128 is the first beam on the second sonar head in an EM 3000D dual head system.

Raw range and beam angle

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	–	–
Start identifier = STX (Always 02h)	1U	–	–
Type of datagram = F (Always 46h)	1U	–	–
EM model number (Example: EM 3000 = 3000)	2U	–	–
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
Ping counter (sequential counter)	2U	0 to 65535	–
System serial number	2U	100 –	–
Maximum number of beams possible	1U	48 –	–
Number of valid beams = N	1U	1 to 254	–
Sound speed at transducer in dm/s	2U	14000 to 16000	–
Repeat cycle – N entries of :	8*N	–	
– Beam pointing angle in 0.01°	2S	–11000 to 11000	1
– Transmit tilt angle in 0.01°	2U	–2999 to 2999	1
– Range (two-way travel time)	2U	0 to 65534	1
– Reflectivity (BS) in 0.5 dB resolution	1S	–128 to 126	–
– Beam number	1U	1 to 254	–

Data Description	Format	Valid range	Note
End of repeat cycle			
Spare (Always 0)	1U	–	–
End identifier = ETX (Always 03h)	1U	–	–
Check sum of data between STX and ETX	2U	–	–

Note 1

The beam pointing angle is positive to port and the transmit tilt angle is positive forwards for a normally mounted system looking downwards. The range resolution in time is the inverse of the range sampling rate given in the depth datagrams.

Seabed image

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	–	–
Start identifier = STX (Always 02h)	1U	–	–
Type of datagram = S(eabed image data) (Always 53h)	1U	–	–
EM model number (Example: EM 3000 = 3000)	2U	–	–
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
Ping counter (sequential counter)	2U	0 to 65535	–
System serial number	2U	100 –	–
Mean absorption coefficient in 0.01 dB/km	2U	1 to 20000	1
Pulse length in μ s	2U	50 –	1
Range to normal incidence used to correct sample amplitudes in no. of samples	2U	1 to 16384	–
Start range sample of TVG ramp if not enough dynamic range (0 else)	2U	0 to 16384	–
Stop range sample of TVG ramp if not enough dynamic range (0 else)	2U	0 to 16384	–
Normal incidence BS in dB (BSN) (Example: –20 dB = 236)	1S	–50 to 10	–
Oblique BS in dB (BSO) (Example: –1 dB = 255)	1S	–60 to 0	–
Tx beamwidth in 0.1°	2U	1 to 300	–
TVG law crossover angle in 0.1°	1U	20 to 300	–
Number of valid beams (N)	1U	1 to 254	–
Repeat cycle – N entries of :	6*N	–	
– beam index number	1U	0 to 253	2
– sorting direction	1S	–1 or 1	3
– number of samples per beam = Ns	2U	1 –	–

Data Description	Format	Valid range	Note
– centre sample number	2U	1 –	4
End of repeat cycle			
Repeat cycle – ΣNs entries of:	Σ Ns	–	
– Sample amplitudes in 0.5 dB (Example: –30 dB = 196)	1S	–128 to 126	–
End of repeat cycle			
Spare byte if required to get even length (Always 0 if used)	0–1U	–	–
End identifier = ETX (Always 03h)	1U	–	–
Check sum of data between STX and ETX	2U	–	–

Note 1

These fields have earlier had other definitions.

Note 2

The beam index number is the beam number - 1.

Note 3

The first sample in a beam has lowest range if 1, highest if -1.
Note that the range sampling rate is defined by the sampling rate in the depth output datagram and that the ranges in the seabed image datagram are all two-way from time of transmit to time of receive

Note 4

The centre sample number is the detection point of a beam.

Position

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	–	–
Start identifier = STX (Always 02h)	1U	–	–
Type of datagram = P(osition data) (Always 050h)	1U	–	–
EM model number (Example: EM 3000 = 3000)	2U	–	–
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
Position counter (sequential counter)	2U	0 to 65535	–
System / serial number	2U	100 –	–
Latitude in decimal degrees*20000000 (negative if southern hemisphere) (Example: 32°34' S = –65133333)	4S	–	–
Longitude in decimal degrees*10000000 (negative if western hemisphere) (Example: 110.25° E = 110250000)	4S	–	–

Data Description	Format	Valid range	Note
Measure of position fix quality in cm	2U	–	1
Speed of vessel over ground in cm/s	2U	0 –	1
Course of vessel over ground in 0.01°	2U	0 to 35999	1
Heading of vessel in 0.01°	2U	0 to 35999	–
Position system descriptor	1U	1 to 254	2
Number of bytes in input datagram	1U	– 254	–
Position input datagram as received	Variable	–	3
Spare byte if required to get even length (Always 0 if used)	0–1U	–	–
End identifier = ETX (Always 03h)	1U	–	–
Check sum of data between STX and ETX	2U	–	–

Note 1

These data will be valid only if available as input.

Note 2

The position system descriptor shows which source this data is from and its real-time use by bit coding:

- xxxx xx01 - position system no 1
- xxxx xx10 – position system no 2
- xxxx xx11 – position system no 3
- 10xx xxxx – the position system is active, system time has been used
- 11xx xxxx - the position system is active, input datagram time has been used
- xxxx 1xxx – the position may have to be derived from the input datagram which is then in SIMRAD 90 format.

Note 3

Complete input datagram except header and tail (such as NMEA 0183 \$ and CRLF).

Height

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	–	–
Start identifier = STX (Always 02h)	1U	–	–
Type of datagram = h(eight data) (Always 068h)	1U	–	–
EM model number (Example: EM 3000 = 3000)	2U	–	–
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (EXample: 08:12:51.234 = 29570234)	4U	0 to 86399999	–

Data Description	Format	Valid range	Note
Height counter (sequential counter)	2U	0 to 65535	–
System serial number	2U	100 –	–
Height in cm	4S	–4294967296 to 4294967295	–
Height type	1U	0 to 99	1
End identifier = ETX (Always 03h)	1U	–	–
Check sum of data between STX and ETX	2U	–	–

Note 1

The height type is as given in the height input datagram unless it is zero. Then the height is derived from the GGK or GGA datagram and is the height of the water level re the vertical datum (possibly motion corrected).

Tide

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	-	-
Start identifier = STX (Always 02h)	1U	-	-
Type of datagram = T(ide data) (Always 054h)	1U	–	–
EM model number (Example: EM 3000 = 3000)	2U	-	-
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	-	-
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	-
Tide counter (sequential counter)	2U	0 to 65535	-
System serial number	2U	100 -	-
Date = year*10000 + month*100 + day (from input datagram) (Example: Feb 26, 1995 = 19950226)	4U	-	-
Time since midnight in milliseconds (from input datagram) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	-
Tidal offset in cm	2S	-32768 to 32766	-
Spare (Always 0)	1U	-	-
End identifier = ETX (Always 03h)	1U	-	-
Check sum of data between STX and ETX	2U	-	-

Attitude

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	–	–
Start identifier = STX (Always 02h)	1U	–	–
Type of datagram = A(ttitude data) (Always 041h)	1U	–	–
EM model number (Example: EM 3000 = 3000)	2U	–	–
Date = year*10000 + month*100 + day (at start of data record) (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (at start of data record) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
Attitude counter (sequential counter)	2U	0 to 65535	–
System serial number	2U	100 –	–
Number of entries = N	2U	1 –	–
Repeat cycle – N entries of:	12*N	–	–
– Time in milliseconds since record start	2U	0 to 65534	–
– Sensor status	2U	–	1
– Roll in 0.01°	2S	–18000 to 18000	–
– Pitch in 0.01°	2S	–18000 to 18000	–
– Heave in cm	2S	–1000 to 10000	–
– Heading in 0.01°	2U	0 to 35999	–
End of repeat cycle			
Sensor system descriptor	1U	–	2
End identifier = ETX (Always 03h)	1U	–	–
Check sum of data between STX and ETX	2U	–	–

Note 1

The sensor status will be copied from the input datagram's two sync bytes if the sensor uses the EM format, and from the sensor's status word if it is a Sperry Mk39. See the input format description for further details.

Note 2

The sensor system descriptor will show which sensor the data is derived from, and which of the sensor's data have been used in real time by bit coding:

- xx01 xxxx – motion sensor number 1
- xx10 xxxx – motion sensor number 2
- xxxx xxx1 – heading from the sensor is active
- xxxx xx0x – roll from the sensor is active
- xxxx x0xx – pitch from the sensor is active
- xxxx 0xxx – heave from the sensor is active

Heading

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	–	–
Start identifier = STX (Always 02h)	1U	–	–
Type of datagram = H(heading data) (Always 048h)	1U	–	–
EM model number (Example: EM 3000 = 3000)	2U	–	–
Date = year*10000 + month*100 + day (at start of data record) (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (at start of data record) (System: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
Heading counter (sequential counter)	2U	0 to 65535	–
System serial number	2U	100 –	–
Number of entries = N	2U	1 –	–
Repeat cycle – N entries of:	4*N	–	–
– Time in milliseconds since record start	2U	0 to 65534	–
– Heading in 0.01°	2U	0 to 35999	–
End of repeat cycle			
Heading indicator (active or not) (0 = inactive)	1U	–	–
End identifier = ETX (Always 03h)	1U	–	–
Check sum of data between STX and ETX	2U	–	–

Mechanical transducer tilt

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	–	
Start identifier = STX (Always 02h)	1U	–	
Type of datagram = J (Always 4Ah)	1U	–	
EM model number (Example: EM 1002 = 1002)	2U	–	
Date = year*10000 + month*100 + day (at start of data record) (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (at start of data record) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
Tilt counter (sequential counter)	2U	0 to 65535	–
System serial number	2U	100 –	–
Number of entries = N	2U	1 –	–
Repeat cycle – N entries of:	4*N	–	
– Time in milliseconds since record start	2U	0 to 65534	–
– Tilt in 0.01 degrees	2S	–1499 to +1499	1

Data Description	Format	Valid range	Note
End of repeat cycle			
Spare (Always zero)	1U	–	–
End identifier = ETX (Always 03h)	1U	–	–
Check sum of data between STX and ETX	2U	–	–

Note 1

This tilt angle is the measured mechanical tilt of a hull unit such as that often supplied with the EM 1002. It is positive when the transducer is tilted forwards.

Clock

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	–	–
Start identifier = STX (Always 02h)	1U	–	–
Type of datagram = C(lock data) (Always 043h)	1U	–	–
EM model number (Example: EM 3000 = 3000)	2U	–	–
Date = year*10000 + month*100 + day (of EM clock) (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (of EM clock) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
Clock counter (sequential counter)	2U	0 to 65535	–
System serial number	2U	100 –	–
Date = year*10000 + month*100 + day (from external clock input) (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (from external clock datagram) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
1 PPS use (active or not) (0 = inactive)	1U	–	1
End identifier = ETX (Always 03h)	1U	–	–
Check sum of data between STX and ETX	2U	–	–

Note 1

Shows if the system clock is synchronised to an external 1 PPS signal or not.

Surface sound speed

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	–	–
Start identifier = STX (Always 02h)	1U	–	–
Type of datagram = G (Always 047h)	1U	–	–

Data Description	Format	Valid range	Note
EM model number (Example: EM 3000 = 3000)	2U	–	–
Date = year*10000 + month*100 + day (at start of data record) (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (at start of data record) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
Sound speed counter (sequential counter)	2U	0 to 65535	–
System serial number	2U	100 –	–
Number of entries = N	2U	1 –	–
Repeat cycle – N entries of:	4*N	–	–
– Time in seconds since record start	2U	0 to 65534	–
– Sound speed in dm/s (including offset)	2U	14000 to 15999	–
End of repeat cycle			
Spare (Always 0)	1U	–	–
End identifier = ETX (Always 03h)	1U	–	–
Check sum of data between STX and ETX	2U	–	–

Sound speed profile

This datagram will contain the profile actually used in the real time raybending calculations to convert range and angle to xyz data. It will usually be issued together with the installation parameter datagram.

Note

The format as given below has been changed from previous editions of this manual. The former format is identified by its type which was “V” (056h). The previous format had 2 byte long fields for depth and sound speed, this is now 4 bytes.

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	–	–
Start identifier = STX (Always 02h)	1U	–	–
Type of datagram = U (Always 055h)	1U	–	–
EM model number (Example: EM 3000 = 3000)	2U	–	–
Date = year*10000 + month*100 + day (at start of use) (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (at start of use) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
Profile counter (sequential counter)	2U	0 to 65535	–
System serial number	2U	100 –	–

Data Description	Format	Valid range	Note
Date = year*10000 + month*100 + day (when profile was made) (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (when profile was made) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
Number of entries = N	2U	1 –	–
Depth resolution in cm	2U	1 to 254	–
Repeat cycle – N entries of:	8*N	–	–
- Depth	4U	0 to 1200000	–
– Sound speed in dm/s	4U	14000 to 17000	–
End of repeat cycle			
Spare byte to get even length (Always 0)	1U	–	–
End identifier = ETX (Always 03h)	1U	–	–
Check sum of data between STX and ETX	2U	–	–

Kongsberg Maritime SSP output

This datagram will contain the profile as received as input, and is logged as is to enable use of its data in postprocessing. The real time use of its data is decided by the operator, the sound speed profile actually being used is given by the sound speed profile output datagram (see above).

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	–	–
Start identifier = STX (Always 02h)	1U	–	–
Type of datagram = W (Always 057h)	1U	–	–
EM model number (Example: EM 3000 = 3000)	2U	–	–
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
SSP counter (sequential counter)	2U	0 to 65535	–
System serial number	2U	100 –	–
Input datagram starting with Sentence formatter and ending with Comment	Variable	–	–
Spare byte if required to get even length (Always 0 if used)	0 – 1U	–	–
End identifier = ETX (Always 03h)	1U	–	–
Check sum of data between STX and ETX	2U	–	–

Single beam echo sounder depth

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	–	–
Start identifier = STX (Always 02h)	1U	–	–
Type of datagram = E(cho sounder data) (Always 045h)	1U	–	–
EM model number (Example: EM 3000 = 3000)	2U	–	–
Date = year*10000 + month*100 + day (of EM clock) (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (of EM clock) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
Echo sounder counter (sequential counter)	2U	0 to 65535	–
System serial number	2U	100 –	–
Date = year*10000 + month*100 + day (from input datagram if available) (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (from input datagram if available) (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
Echo sounder depth from waterline in cm	4U	0 to 1200000	–
Source identifier (S, T, 1, 2 or 3)	ASCII	–	1
End identifier = ETX (Always 03h)	1U	–	–
Check sum of data between STX and ETX	2U	–	–

Note 1

Identifies the source datagram type, i.e. NMEA DBS, NMEA DPT or EA 500 series channel 1-3 respectively.

Runtime parameter

Data Description	Format	Valid range	Note
Number of bytes in datagram	4U	–	–
Start identifier = STX (Always 02h)	1U	–	–
Type of datagram = R(untime parameter) (Always 052h)	1U	–	–
EM model number (Example: EM 3000 = 3000)	2U	–	–
Date = year*10000 + month*100 + day (Example: Feb 26, 1995 = 19950226)	4U	–	–
Time since midnight in milliseconds (Example: 08:12:51.234 = 29570234)	4U	0 to 86399999	–
Ping counter	2U	0 to 65535	–
System serial number	2U	100 –	–
Operator Station status	1U	–	1
Processing Unit status	1U	–	1
BSP status	1U	–	1

Data Description	Format	Valid range	Note
Sonar Head or Transceiver status	1U	–	1
Mode	1U	1 –	2
Filter identifier	1U	0 to 254	3
Minimum depth in m	2U	0 to 10000	–
Maximum depth in m	2U	1 to 12000	–
Absorption coefficient in 0.01 dB/km	2U	1 to 20000	4
Transmit pulse length in μ s	2U	1 to 50000	–
Transmit beamwidth in 0.1 degrees	2U	1 to 300	–
Transmit power re maximum in dB	1S	0 to –50	–
Receive beamwidth in 0.1 degrees	1U	5 to 80	–
Receive bandwidth in 50 Hz resolution	1U	1 to 254	–
Receiver fixed gain setting in dB	1U	0 to 50	–
TVG law crossover angle in degrees	1U	2 to 30	–
Source of sound speed at transducer	1U	0 to 3	5
Maximum port swath width in m	2U	10 to 20000	8
Beam spacing	1U	0 to 3	6
Maximum port coverage in degrees	1U	10 to 110	8
Yaw and pitch stabilization mode	1U	–	7
Maximum starboard coverage in degrees	1U	10 to 110	–
Maximum starboard swath width in m	2U	10 to 20000	–
Spare (Always 0)	2U	–	–
HiLo frequency absorption coefficient ratio	1U	00 to 120	–
End identifier = ETX (Always 03h)	1U	–	–
Check sum of data between STX and ETX	2U	–	–

Note 1

The system status will by set bits indicate system faults by bit coding (a fault may not necessarily be detrimental to system performance).

The Operator Station status byte is used as follows:

- 1xxx xxxx - No reply from the Processing Unit.

The Processing Unit status byte is used as follows:

- xxxx xxx1 - Communication error with BSP
- xxxx xx1x - Communication error with Transceiver or Sonar Head
- xxxx x1xx - Attitude not valid for this ping
- xxxx 1xxx - Heading not valid for this ping
- xxx1 xxxx - System clock has not been set since power on
- xx1x xxxx - External trigger signal not detected

- x1xx xxxx - Hull unit not responding

A set bit in the BSP status byte indicates an internal communication problem. On the EM 2000 and EM 3000 problems with the high speed data uplink are specifically indicated as follows:

- xxxx xxx1 - EM 2000, EM 3000 and Sonar Head no 1 on the EM 3000D
- xxx1 xxxx - Sonar Head no 2 on the EM 3000D

The BSP status byte is used as follows by the EM 3000:

- xxxx xxx1 - Ping rejected due to errors in received data on BSP1
- xxxx xx1x - Too much seabed image data on BSP1
- xxxx x1xx - Invalid command received by BSP1
- xxx1 xxxx - Ping rejected due to errors in received data on BSP2
- xx1x xxxx - Too much seabed image data on BSP2
- x1xx xxxx - Invalid command received by BSP2

The Sonar Head status byte is used as follows by the EM 2000 and EM 3000:

- xxxx xxx1 - Temperature too high on Sonar Head 1
- xxxx xx1x - Data link failure on Sonar Head 1
- xxxx x1xx - Voltages out of range on Sonar Head 1
- xxx1 xxxx - Temperature too high on Sonar Head 2 of EM 3000D
- xx1x xxxx - Data link failure on Sonar Head 2 of EM 3000D
- x1xx xxxx - Voltages out of range on Sonar Head 2 of EM 3000D

The Transceiver status byte is used as follows by the EM 120, EM 300 and EM 1002:

- xxxx xxx1 - Transmit (HV) voltage out of range
- xxxx xx1x - PSU voltage out of range
- xxxx x1xx - Internal communication error
- xxxx 1xxx - Receive channel DC offset(s) out of range
- xxx1 xxxx - Internal communication error
- x1xx xxxx - Internal communication error
- 1xxx xxxx - Defective fuse(s) in transmitter

Note 2

The mode identifier byte is used as follows:

- 0000 0000 - Nearfield (EM 3000) or Very Shallow
- 0000 0001 - Normal (EM 3000) or Shallow (default for EM 2000)
- 0000 0010 - Target detect (EM 3000) or Medium
- 0000 0011 - Deep
- 0000 0100 - Very deep
- 0000 0101 - Extra deep (EM 300)

Note 3

The filter identifier byte is used as follows:

- xxxx xx00 - Spike filter set to Off
- xxxx xx01 - Spike filter is set to Weak
- xxxx xx10 - Spike filter is set to Medium
- xxxx xx11 - Spike filter is set to Strong
- xxxx x1xx - Slope filter is on
- xxxx 1xxx - Sector tracking or Robust Bottom Detection (EM 3000) is on
- 0xx0 xxxx - Range gates have Normal size
- 0xx1 xxxx - Range gates are Large
- 1xx0 xxxx - Range gates are Small
- xx1x xxxx - Aeration filter is on
- x1xx xxxx - Interference filter is on

Note 4

The used absorption coefficient should be derived from the seabed image or central beams echogram datagram if it is automatically updated with changing depth.

Note 5

The sound speed (at the transducer depth) source identifier is used as follows :

- 0000 0000 - From real time sensor
- 0000 0001 - Manually entered by operator
- 0000 0010 - Interpolated from currently used sound speed profile

Note 6

The beamspace identifier is used as follows:

- 0000 0000 - Determined by beamwidth (FFT beamformer of EM 3000)
- 0000 0001 - Equidistant
- 0000 0010 - Equiangle
- 0000 0011 - Equiangle around nadir, equidistant in between

Note 7

The yaw and pitch stabilization identifier is set as follows:

- xxxx xx00 - No yaw stabilization
- xxxx xx01 - Yaw stabilization to survey line heading (Not used)
- xxxx xx10 - Yaw stabilization to mean vessel heading
- xxxx xx11 - Yaw stabilization to manually entered heading
- 1xxx xxxx - Pitch stabilization is on.

Note 8

Port swath width and coverage was in earlier versions the sum of port and starboard

Installation parameters

This datagram is an ASCII datagram except for the header which is formed as in all other output datagrams. The datagram is issued as a start datagram when logging is switched on and as a stop datagram when logging is turned off, i.e. at the start and end of a survey line. It may also be sent to a remote port as an information datagram. It is usually followed by a sound speed profile datagram.

In the datagram all ASCII fields start with a unique three character identifier followed by “=”. This should be used when searching for a specific field as the position of a field within the datagram is not guaranteed. The number or character part following is in a variable format with a minus sign and decimal point if needed, and with “,” as the field delimiter. The format may at any time later be expanded with the addition of new fields at any place in the datagram.

For the EM 3000 the transducer 1 data are for the Sonar Head and the transducer 2 data are for the second Sonar Head of an EM 3000D. For other new EM systems with separate transmit and receive transducers, transducer 1 refers to the transmit transducer, and transducer 2 refers to the receive transducer.

Data Description	Example	Format	Valid range	Note
Number of bytes in datagram	–	4U	–	1
Start identifier = STX	Always 02h	1U	–	–

Data Description	Example	Format	Valid range	Note
Type of datagram = l or i(nstallation parameters) or r(emote information)	Start = 049h Stop = 069h Remote info = 70h	1U	–	–
EM model number	EM 3000 = 3000	2U	–	–
Date = year*10000 + month*100 + day	Feb 26, 1995 = 19950226	4U	–	–
Time since midnight in milliseconds	08:12:51.234 = 29570234	4U	0 to 86399999	–
Survey line number	–	2U	0 to 65534	–
System serial number	–	2U	100 –	–
Serial number of second sonar head	–	2U	100 –	–
Water line vertical location in m	WLZ=x.x,	ASCII	–	–
System main head serial number	SMH=x.x,	ASCII	100 –	1
Hull Unit	HUN=x	ASCII	0 or 1	–
Hull Unit tilt offset	HUT=x.x	ASCII	–	–
Transducer 1 vertical location in m	S1Z=x.x,	ASCII	–	–
Transducer 1 along location in m	S1X=x.x,	ASCII	–	–
Transducer 1 athwart location in m	S1Y=x.x,	ASCII	–	–
Transducer 1 heading in degrees	S1H=x.x,	ASCII	–	–
Transducer 1 roll in degrees re horizontal	S1R=x.x,	ASCII	–	–
Transducer 1 pitch in degrees	S1P=x.x,	ASCII	–	–
Transducer 1 no of modules	S1N=x--x,	ASCII	–	–
Transducer 2 vertical location in m	S2Z=x.x,	ASCII	–	–
Transducer 2 along location in m	S2X=x.x,	ASCII	–	–
Transducer 2 athwart location in m	S2Y=x.x,	ASCII	–	–
Transducer 2 heading in degrees	S2H=x.x,	ASCII	–	–
Transducer 2 roll in degrees re horizontal	S2R=x.x,	ASCII	–	–
Transducer 2 pitch in degrees	S2P=x.x,	ASCII	–	–
Transducer 2 no of modules	S2N=x--x,	ASCII	–	–
System (sonar head 1) gain offset	GO1=x.x,	ASCII	–	–
Sonar head 2 gain offset	GO2=x.x,	ASCII	–	–
Outer beam offset	OBO=x.x	ASCII	–	–
High/Low Frequency Gain Difference	FGD=x.x	ASCII	–	–
Transmitter (sonar head no1) software version	TSV=c--c,	ASCII	–	2
Receiver (sonar head 2) software version	RSV=c--c,	ASCII	–	2
BSP software version	BSV=c--c,	ASCII	–	2
Processing unit software version	PSV=c--c,	ASCII	–	2
Operator station software version	OSV=c--c,	ASCII	–	2
Datagram format version	DSV=c--c,	ASCII	–	2

Data Description	Example	Format	Valid range	Note
Depth sensor time delay in millisec	DSD=x--x,	ASCII	--	--
Depth sensor offset	DSO=x.x,	ASCII	--	--
Depth sensor scale factor	DSF=x.x,	ASCII	--	--
Depth sensor heave	DSH=aa,	ASCII	IN or NI	3
Active position system number	APS=x,	ASCII	0 to 2	7
Position system 1 motion compensation	P1M=x,	ASCII	0 or 1	4
Position system 1 time stamp used	P1T=x,	ASCII	0 or 1	5
Position system 1 vertical location in m	P1Z=x.x,	ASCII	--	--
Position system 1 along location in m	P1X=x.x,	ASCII	--	--
Position system 1 athwart location in m	P1Y=x.x,	ASCII	--	--
Position system 1 time delay in seconds	P1D=x.x,	ASCII	--	--
Position system 1 geodetic datum	P1G=c--c,	ASCII	--	--
Position system 2 motion compensation	P2M=x,	ASCII	0 or 1	4
Position system 2 time stamp use	P2T=x,	ASCII	0 or 1	5
Position system 2 vertical location in m	P2Z=x.x,	ASCII	--	--
Position system 2 along location in m	P2X=x.x,	ASCII	--	--
Position system 2 athwart location in m	P2Y=x.x,	ASCII	--	--
Position system 2 time delay in seconds	P2D=x.x,	ASCII	--	--
Position system 2 geodetic datum	P2G=c--c,	ASCII	--	--
Position system 3 motion compensation	P3M=x,	ASCII	0 or 1	4
Position system 3 time stamp use	P3T=x,	ASCII	0 or 1	5
Position system 3 vertical location in m	P3Z=x.x,	ASCII	--	--
Position system 3 along location in m	P3X=x.x,	ASCII	--	--
Position system 3 athwart location in m	P3Y=x.x,	ASCII	--	--
Position system 3 time delay in seconds	P3D=x.x,	ASCII	--	--
Position system 3 geodetic datum	P3G=c--c,	ASCII	--	--
Position system 3 on serial line or Ethernet	P3S= x,	ASCII	0 for Ethernet	--
Motion sensor 1 vertical location in m	MSZ=x.x,	ASCII	--	--
Motion sensor 1 along location in m	MSX=x.x,	ASCII	--	--
Motion sensor 1 athwart location in m	MSY=x.x,	ASCII	--	--
Motion sensor 1 roll reference plane	MRP=aa,	ASCII	HO or RP	--
Motion sensor 1 time delay in milliseconds	MSD=x--x,	ASCII	--	--
Motion sensor 1 roll offset in degrees	MSR=x.x,	ASCII	--	--
Motion sensor 1 pitch offset in degrees	MSP=x.x,	ASCII	--	--
Motion sensor 1 heading offset in degrees	MSG=x.x,	ASCII	--	--
Motion sensor 2 vertical location in m	NSZ=x.x,	ASCII	--	6
Motion sensor 2 along location in m	NSX=x.x,	ASCII	--	6
Motion sensor 2 athwart location in m	NSY=x.x,	ASCII	--	6
Motion sensor 2 roll reference plane	NRP=aa,	ASCII	HO or RP	6
Motion sensor 2 time delay in milliseconds	NSD=x--x,	ASCII	--	6

Data Description	Example	Format	Valid range	Note
Motion sensor 2 roll offset in degrees	NSR=x.x,	ASCII	–	6
Motion sensor 2 pitch offset in degrees	NSP=x.x,	ASCII	–	6
Motion sensor 2 heading offset in degrees	NSG=x.x,	ASCII	–	6
Gyrocompass heading offset in degrees	GCG=x.x,	ASCII	–	–
Roll scaling factor	MAS=x.x,	ASCII	–	–
Transducer depth sound speed source	SHC=x	ASCII	0 or 1	8
Active heading sensor	AHS=x,	ASCII	1 to 4	–
Active roll sensor	ARO=x,	ASCII	1 to 4	–
Active pitch sensor port no	API=x,	ASCII	1 to 4	–
Active heave sensor port no	AHE=x,	ASCII	1 to 4	–
Cartographic projection	CPR=aaa,	ASCII	–	–
Responsible operator	ROP=c--c,	ASCII	–	–
Survey identifier	SID=c--c,	ASCII	–	–
Survey line identifier (planned line no)	PLL=x--x,	ASCII	–	–
Comment	COM=c--c,	ASCII	–	–
Spare byte if required to get even length	Always 0 if used	0–1U	–	–
End identifier = ETX	Always 03h	1U	–	–
Check sum of data between STX and ETX		2U	–	–

Note 1

Serial number of head no 2 if that head is the only one in use with the EM 3000D, otherwise the serial number of head no 1 in the EM 3000D or the only head in the EM 3000.

Note 2

A version number is given as 3 alphanumerical fields separated by decimal points, plus date as yymmdd (for example 3.02.11 991124).

Note 3

IN = the heave of an underwater vehicle is presumed to be measured by the vehicle's depth sensor and the heave sensor input is not used by system.

Note 4

1 = the positions are motion compensated

0 = the positions are not motion compensated

Note 5

0 = the system has used its own time stamp for the valid time of the positions

1 = the system has used the time stamp of the position input datagram (external time).

Note 6

If entries for a second motion sensor are not included although two sensors are being used, they are presumed to have the same parameters.

Note 7

Position system number -1.

Note 8

0 = Transducer depth sound speed is used as the initial entry the sound speed profile used in the raytracing calculations.

1 = Transducer depth sound speed is NOT used for raytracing calculations.

Note that the source of the sound speed at the transducer depth (and this sound speed is always used to calculate beam pointing angles if required) is logged in the runtime datagram.

12 SYSTEM ADMINISTRATION

12.1 Introduction

This chapter provides basic reference information useful for the EM 1002 system supervisor. In order to make the most of the information provided, you may need some basic knowledge of the Unix operating system.

12.2 Passwords

EM 1002 Installation setup

In order to change the installation parameters on the EM 1002 system, you need to enter a password. This password is common for all the operators of the EM 1002 system. You will automatically be prompted to enter the password once you select **Edit enable** in the **Edit** menu.

By default the user ID is “em1002” and the password is “simrad”.

If a password has not been identified, the first attempt to modify the installation parameters will prompt you to enter a new password.

If the password is lost, the current password can be deleted by deleting the following file:

```
$HOME/.eso_system/.esoEM 1002_protection
```

No special privileges are required to delete this file. Once it is gone, the system will prompt you for a new password next time you choose **Edit enable**.

12.3 EM 1002 File system

Introduction

The EM 1002 requires a large number of individual files. Some are used for data storage, others for system setup, while some are used to store operator and system configurations. This chapter lists the various file types and provides brief explanations.

The notation \$<name> is an “environment variable”, usually specifying a filesystem directory.

Survey files

During a survey, the EM 1002 system will record and store the following file types:

- Raw data
- Survey data

The information is stored on the Operator Station harddisk on dedicated data formats defined by Kongsberg Maritime..

Survey data

These are the data files generated by the system. Note that files will only be stored if the **Survey Format To Disk** option is checked in the window opened by **Options -> Logging**.

These files are used by the post-processing software, and by the Survey Display program.

Note

Unless this data is stored, the Survey Display application will not work.

Raw data

These are the files containing the raw data retrieved during the survey. These files are the most important files collected during a survey. If you accidentally lose your survey data format files (required by the post-processing software), you can recreate these files based on the raw data files. Care should be taken to backup raw data files on a regular basis, using the backup facilities supplied as an integral part of the system.

Sound speed profiles

All the sound speed profiles are stored as separate files in directory specified by the environment variable.

\$\$SHAREDHOME

The files have extension ***.asvp**

Absorption coefficient file

The absorption coefficient file contains number pairs of absorption coefficients and corresponding depths. The coefficients are integrated during loading to the echo sounder and the integrated value is used. The file is named **absorption.coef** and is stored in directory:

\$\$SHAREDHOME

Workstation I/O

When you define the use of the Operator Station's serial lines, the setup information is stored in the following file:

\$HOME/.eso_system/esoSetup.serial

Echo sounder parameters

These are the files determining how the current echo sounder system is set up. The system uses separate files for runtime and installation parameters.

Installation setup

The installation setup information is saved in the following file:

\$HOME/.eso_system/esoEM1002Setup.installation

Every time you save this file, a backup file is generated automatically. This file is named:

esoEM1002Setup.installation.yyyy_mmdd_hhmm

where:

yyyy=year

mm=month

dd=day

hh=hour

mm=minute.

You can also save the setup files with other names you choose yourself. You can then pick any name, but you must keep the extension as ".installation". The extension is added automatically if you only specify the file name.

Runtime setup

The runtime setup information is saved in the following file:

esoEM1002Setup.runtime

Every time you save this file, a backup file is generated automatically. This file is named:

`$HOME/.eso_system/esoEM1002Setup.runtime.yyyy_mmdd_hhmm`

where:

yyyy=year

mm=month

dd=day

hh=hour

mm=minute.

You can also save the runtime files with other names you choose yourself. You can then pick any name, but you must keep the extension as “.runtime”. The extension is added automatically if you only specify the file name.

Echo sounder status

The information in the Status Field in the Launchpad is stored in the following file:

`$HOME/.eso_system/esoSetup.status`

IP addresses, ports and datagrams

The IP addresses for the various items in the system, the ports used for the various applications, and the datagram distribution are collected in the following file:

`$HOME/DPC.addresses.<host>`

where <host> is the name of the Operator Station.

You may modify the contents of this file by using the **Options** -> **Datagram subscriptions** choices on the Launchpad.

The datagrams available are listed in the following file:

`$HOME/.eso_system/esoSetup.datagrams`

This is a static file, and will only be used by the system.

NMEA 0183

The information for the NMEA 0183 depth serial line is stored in the following file:

`$HOME/.eso_system/esoSetup.serial`

BIST files

When you run the built-in test applications, the results displayed in the output area in the BIST window may be saved to disk.

The file is created with the following location and file name:

\$HOME/.eso_system/BISToutput

Every time you save the information, the old file will be replaced. The information is stored in ASCII format.

Logfiles

Each application in the EM 1002 system issues report and error messages when required. These messages are collected in logfiles.

The size of the current logfile is monitored by the system. If it exceeds 8Mb, a warning dialogue pops up recommending a reset of the file. The actual reset is done using the **File->Reset Logfile** option, as instructed in the popup dialogue.

When you reset the logfile using the **File -> Reset logfile** command on the Launchpad, you may create a backup copy of the logfile. The backup is named:

\$HOME/.eso_system/esoLogfile.yyyy_mmdd_hhmm

where:

yyyy=year

mm=month

dd=day

hh=hour

mm=minute.

In most cases you do not need to create backup copies of the logfile, since errors and warnings are logged to the survey logfiles during active surveying.

In addition to this logfile, the errors and warnings issued during a survey are saved on a separate file for the active survey. This file is only created while logging takes place. The file is:

\$PROCHOM/<survey>/esoLogfile

where <survey> is the chosen name for the active survey.

Operator configuration files

These are the individual files containing the operator specified window layouts and desktop workspaces for the programs supervised by the EM 1002 Launchpad.

Default window layout

Each operator can define a preferred window and workspace layout, and then use the **Window Layout -> Save Operator's Layout** command on the launchpad's main menu to save this information. The name of the file will be:

`$HOME/.eso_system/esoEmX_config.<operator>`

where <operator> is the current operator of the system, as defined in the Launchpad's Survey field (below the program icons).

The default window layout is:

`$HOME/.eso_system/esoEmX_config`

List of known operators

The list of the operators known to the system is stored in the following file:

`$HOME/.eso_system/esoSetup.operators`

User preferences

All the preferences you define during the survey are stored in a separate file.

`$HOME/.eso_system/esoSetup.launchpad`

This file is created using the **Options -> User preferences** command on the Launchpad's main menu.

Survey jobs

These are the files generated by the Survey Display's Planning module. All these plans are located in the following directory:

`$SHAREDHOME/<job name>.asciiplan`

TOC files

The TOC (Table of Contents) files are created automatically when you select the Generate Tape TOC operation in the File Admin window.

Each TOC file contains a list of all the files on the tape. This is normally all the files used for a specific survey, but in general it can be any file types recognized by the File Admin utility.

The TOC files can be named manually, or they can be assigned a name automatically. This name is then defined based on the current date and time with extension *.TOC.

The files are stored in the following directory:

`$HOME/.eso_system/`

12.4 File formats

Introduction

The main files are described in this chapter, but the header files that follow the system are only referred to and must be inspected by listing the header file of current interest or by checking the computer display.

Survey format and I/O library

The **Survey Format (SF)** files are the key files of the Kongsberg Maritime workstation systems. The files are located in the **\$PROCHOME** directory. An I/O library from Kongsberg Maritime is supplied to the users who wish to access the data themselves. You can then install the I/O library wherever it fits for your development. Header files and libraries are available.

The **SF** is a Kongsberg Maritime defined format that fits for all Kongsberg multibeam echo sounder data, and for the EA 500 and EK 500 single beam echo sounders. The data is converted directly to this format if a Kongsberg Maritime logging system is used. As the lines are run, the raw data is fed into the **handleMessage** or **handleEmX** filter and stored correctly on the **\$PROCHOME/<SurveyName>** directory, while the **survey.lines** file on the same directory is updated with information about the same line.

The survey format

Introduction

This is the Kongsberg Maritime workstation processing format that applies to all multibeam echo sounders and also to some single beam echo sounders. The format is used in other workstation products in addition to *Neptune*, such as *Merlin*, *Poseidon* and *Triton*.

The format is based on indexed files. For each line there is an index file which holds some common index data for each ping. The files handled by the index file are:

- 1 Depth file
- 2 Sonar Image file
- 3 Classification file

The following files have been defined as system administration files:

- 4 Parameter file
- 5 sound speed file

These files contain parameter settings and information about the sound speed that has been used during the data collection. The information about the used sound speed is vital for reprocessing old data with new sound speed profiles.

The position files (there might be several due to more than one positioning system) are treated separately. After position processing, a new valid position file is generated and will be used for further processing (Sensor 00), version 02.

A representation of the file structure is described by the following:

Index file	Depth file	Position file
FileHeadrec	FileHeadRec	FileHeadrec
PingHeadRed	DepthFileRec 1	PosHeadRec
IndexFileRec 1	DepthFileRec 2	PositionFileRec
1		
IndexFileRec 2	.....	PositionFileRec
2		
.....
.....	DepthFileRec i	.....
IndexFileRec i	.....	PositionFileR
ec i		
.....	DepthFileRec n	.....
IndexFileRec n	.....	PositionFileRec
n		
Raw sidescan file	Parameter file	sound speed file
FileHeadRec	FileHeadRec	FileheadRec
SideHeadRec	ParameterRec 1	SndVelFileRec 1
SideRawFileRec 1	ParameterRec 2	SndVelFileRec 2
SideRawFileRec 2	.....	.....
.....
.....	ParameterRec i	SndVelFileRec i
SideRawFileRec i	.....	.....
.....	ParameterRec n	SndVelFileRec n
SideRawFileRec n		

Survey format I/O library

The I/O sub-routine library can be used by a company or institution who have bought a license for a Kongsberg Maritime workstation product. It can also be distributed by the Kongsberg Maritime customer to others after agreement between Kongsberg Maritime and the institution or company. Maintenance and help with the library and files are given to those who have maintenance contract with Kongsberg Maritime.

The Survey format coordinate system

The coordinate system of the vessel has an x-axis along the ships keel pointing forwards from the origin of the ship. The y-axis points to starboard, and the z-axis points straight down giving the depths as positive values increasing with depth.

This generates the *right-hand coordinate system* on board the ship. Positive rotation around the axis is defined by the right-hand rule, giving a positive rotation of angles in the horizontal plane in the same way as the gyro rotates positively (Clockwise as seen from above the ship).

The data that is logged on files is in latitude/longitude coordinates. The data is represented by a 4-byte integer that has the following resolutions:

Latitude :

2*10E7 decimal degrees per number unit (+90 to -90 degrees).

Longitude:

1*10E7 decimal degrees per number unit (+180 to -180 degrees).

Depths are treated with centimetre resolution in the EM 1002 system, and represented in this resolution on the XYZ files.

Use of the Kongsberg Maritime I/O library

Introduction

The Kongsberg Maritime I/O library consists of two different parts. One part is intended to be used by those who want to fit their own data into Kongsberg Maritime's *Survey Format* (SF) file format. The modules supported for this use are *msgSim* and *handleMessage*. The *handleMessage* takes its input data from the logging program (Mermaid/Merlin) or from *msgSim*. The other part is intended to be used by those who want to use Survey Format data. This part of the library is called RWlib (Read and Write library). All routines in the library return an integer as return parameter. This parameter is negative if something went wrong or the data returned are not valid.

Message simulator

The message simulator (**msgSim**) simulates messages from the logging system by reading one or more raw data files, putting the message length in front of each message and writing it to *stdout*. If the messages are separated on different data files, the files containing the depth data message must end with **.dpt**, position data with **.pos**, sidescan data with **.rss** and start/stop/parameter data with **.inf**. The module also handles the situation when all messages are collected in one file. All of these data files must only contain valid, complete messages and nothing else.

Message handling

Messages from Mermaid/Merlin or msgSim may be 'piped' into **handleMessage**. This module reads the messages from **stdin**, decodes them into survey format and writes them to file. The files written are:

- position files (.pos)
- depth files (.depth)
- sidescan files (.sidescan)
- parameter files (.para)
- sound speed files (.svel)
- index files (.ind).

The name of the new file starts with the line number, an underscore, the date of the start telegram, an underscore, the time, an underscore, sensor number, an underscore, version number and the extension.

Example:

```
0183_19921031_155630_00_01.depth
```

The module starts decoding and writing when a start telegram arrives and stops when a stop telegram arrives. If sidescan data is to be handled, depth data must be present, and if the data is to be used with "near real time" visualization (i.e. Merlin), position data must also be present. For information on how to run **handleMessage**, see the section "Command references".

Library calls

Introduction

The library is written in the ANSI "C" programming language. The definition and prototyping is done in the ***.h** files:

- readWriteFile.h

- SurveyLines.h
- newFormat.h

The return structures that you need to know about are found in the **newFormat.h** file. This file is documented internally in the file, while the other *.h files not are intended to be read, just included to supply you with the structures required for some of the calls. These calls are described here, and the prototyping is found in the above listed header files.

Writing new files

For writing new files in SF the library **libRW** is supported. With this library you can open, write and close new files in SF.

Before a file (of any type) can be written, it must be opened by the appropriate open routine for this file type. The input parameters for these routines are:

- file directory,
- generic file name,
- sensor number (set to 0->zero)
- type specific header,
- a comment and a description of the process which created the file.

In addition file handler **newFilePnt** must be supported for each file (except for opening the index file) and one common write handler. E.g. this write handler is used for writing indices to files. To write new records to file, a set of writing routines are supported. All those writing routines have their specific record format, their file handler (except for writing pings) and the common write handler as parameters. When depth data or sidescan data is written, it must be specified which sounder (port or starboard for dual system or single for single system) the data comes from. To close the file (except the index file which is closed with a specific routine) the routine *closeNewFile* is called with the file handler as input.

All data are written to file in the native format (little or big Endian) in which the program is running. The index file (with ping data) is written every time the ping number changes. This is done automatically in **writeDepth** or **writePing**, which means that these routines must be called in order to let the index and ping records be written (ping number must be supplied and properly changed if not present in the raw datagram). Date and time must also be supplied for each record (ping and position) so that it will be possible to index a ping from position through data and time. When the index file is written, all indices are written including those for sidescan and position. As sidescan data only are accessible through the index file, all calls to either **writeDepth** or *writePing* must be made. Position data, on the other hand, may either be accessed via index (for "near real time") or via time. But in order to make indices for the position data correct, all data must be written in time sequence. The positions are also filtered for coarse jumps (i.e. more than one degree) and flagged accordingly before they are written. Available routines are described in the following paragraphs.

Open files

newIndexFile: Open and init index file

(IN: writeHandler, directory, fileName, sensor, pingHeader, comment, process)

newPosFile: Open and init position file

(IN: fileHandler, writeHandler, directory, fileName, sensor, posHeader, comment, process)

newDepthFile: Open and init depth file

(IN: fileHandler, writeHandler, directory, fileName, sensor, comment, process)

newSideFile: Open and init sidescan file

(IN: fileHandler, writeHandler, directory, fileName, sensor, sideHeader, comment, process)

newSvelFile: Open sound speed file

(IN: fileHandler, writeHandler, directory, fileName, sensor, comment, process)

newParaFile: Open parameter (start/stop/parameter) file

(IN: fileHandler, writeHandler, directory, fileName, sensor, comment, process)

Write files

writePos: - Write position data to file

(IN: fileHandler, writeHandler, positionRecord)

writeDepth: Write depth data to file (and possible also index and ping)

(IN: fileHandler, writeHandler, sounder, depthRecord)

writeSidescan: Write sidescan data to file

(IN: fileHandler, writeHandler, sounder, sidescanRecord)

writePing: Set current ping data, write ping and index data to file

(IN: writeHandler, sounder, pingRecord)

writeSvel: Write sound speed data to file

(IN: fileHandler, writeHandler, soundVelRecord)

writePara: Write parameter data to file

(IN: fileHandler, writeHandler, parameterRecord)

Close files

closeNewFile: Close a file

(IN: fileHandler)

closeIndexFile: Write last index/ping to file (if necessary), close index file

(IN: writeHandler)

Reading and updating survey data

For those who only want to read or update data on SF, the library *libRW* is supplied. With this library you can open, read, copy, update and close the files containing SF data.

Before anything can be done with a file, it must be opened by the appropriate opening routine. These routines have the parameters:

- 1 file mode (r or r+)
- 2 directory
- 3 file name
- 4 sensor number (set to 0)
- 5 file version number as input

In addition a file handler must be supported for each file. For the index file an index handler must also be supported. It is through this index handler that depth, sidescan and (for "near real time") position data are accessible. The different opening routines then return some type specific data (e.g. a file header and number of record). To open a file for reading, set file mode to **r** and for updating set file mode to **r+**.

If the data is written on a machine with little Endian and read on a machine with big Endian format (or vice versa), it is automatically swapped when read, or updated. If the file is copied, then it is always copied to the native format of the machine the program is running on.

Note

Compressed data can not be transferred between little Endian and big Endian machines.

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The data can be accessed in several different ways. Ping data, position data, sound speed data and parameter data are accessed via an index number which starts at 0 (zero) and goes up to the number of records (minus one) for each file. Depth data and sidescan data are accessed via the file index. This index is set with the **setFileIndexno** routine. If the depth and sidescan data were produced by a dual echo sounder system, the port and starboard can be accessed via the *port* and *stb* parameters; for single echo sounder system, the *sing* parameter is used.

To get an interpolated position for a ping, one must first call the routine **initPosInter**. This routine includes an index to the first position and number of positions as input parameters. This is because all indexing on a file within a region is based on the indices from the position file. The routine uses a handler **posSearchPnt** and returns the first valid ping index and number of indices within the positions. These parameters should then be used in the loop to access the ping, depth and sidescan data.

To get a ping with its position the routine **getPingPos** is used. This uses the parameter **indexHandler** set by **setFileIndexno**. You may also specify the maximum legal difference in time and in distance from the ping to the two nearest positions. If you only want ping data at a specific delta distance, this may also be set. If the routine returns with a negative number, no valid position exists for this ping. When finished, **freePosInter** is called.

To update a file, the file must be opened with file mode = r+. Then all the update routines can be used. Access through the index handler to depth and sidescan files must still be used. When the updating is finished, **updateHeader** must be called to set the right time and process for file updated. If you want to change other data in the files than flags, the file should be copied (with **copyFile**) before it is updated. The routine **copyFile** has as input parameter the file handler and the new directory, and it returns the new file version number.

To make a new position file from several position files (combine), the general file header must be copied with **copyHeader**. Then the copied file (header) must be opened with **openPosFileAppend** and position can be written (in sequence) with **updatePostion**.

There are also some convenience routines to update flags for position, ping and depth data. These routines read the data, check if some flags are changed and if so, write the changed data back. Modules that keep original survey data structures in memory, should use the ordinary update routines instead. It is however strongly recommended that you keep track of what flags (e.g. one variable that tells whether some of the depth flags for a ping are changed) that are changed, in order to minimize input/output. When depth flags are updated only those flags which are not equal NaN (Not a Number) are updated.

The module does also (for the time being) contain some routines to transform across- and along-data for each beam to either latitude and longitude or to UTM and to calculate the distance between two positions. Supplied routines are described in the following paragraphs.

Open files

openIndexFile Open index file

IN: fileHandler, indexHandler, fileMode, directory,
fileName, sensor, versionNumber,

OUT: pingHeader, sounderSystem, numbOfPing

openPosFile Open position file

IN: fileHandler, fileMode, directory, fileName, sensor,
versionNumber,

OUT: posHeader, numbOfPos

openDepthFile Open depth file

IN: fileHandler, fileMode, directory, fileName, sensor,
versionNumber

openSideFile Open sidescan file

IN: fileHandler, fileMode, directory, fileName, sensor,
versionNumber,

OUT: sideHeader

openSvelFile Open sound speed file

IN: fileHandler, fileMode, directory, fileName, sensor,
versionNumber,

OUT: numbOfSvel

openParaFile Open parameter file

IN: fileHandler, fileMode, directory, fileName, sensor,
versionNumber,

OUT: numbOfPara

openPosFileAppend Open position file for append

IN: fileHandler, directory, fileName, sensor,
versionNumber, posHeader)

Reading data

setFileIndexno Set index and get ping data

IN: fileHandler, indexHandler, pingIndex,
OUT: pingRecord

getDepth Get depth data

IN: fileHandler, indexHandler,
OUT: singDepthRecord, stbDepthRecord,
portDepthRecord

getSidescan Get sidescan data

IN: fileHandler, indexHandler,
OUT: singSidescanRecord, stbSidescanRecord, portSide-
scanRecord

getPosition Get position data

IN: fileHandler, posIndex,
OUT: positionRecord

getManyPos Convenience routine to get many
positions

IN: fileHandler, fromPosIndex, numbofPos,
OUT: positionRecords

getSvel Get sound speed data

IN: fileHandler, svelIndex,
OUT: soundVelRecord

getPara Get parameter data

IN: fileHandler, paraIndex,
OUT: parameterRecord

getPosIndDateTime Get position indexes from date and time

IN: fileHandler, totNumbOfPos, fromDate, fromTime,
toDate, toTime
OUT: fromPosIndex, numbofPos

initPosInter Initiate for accessing interpolated
positions for ping

IN: positionFileHandler, indexFileHandler, posSearchPnt,
posHeader, fromPosIndex, numbofPos, totalNumbofPing,

OUT: fromPingIndex, numbOfPing

getPingPos Get ping with interpolated position
IN: indexFileHandler, indexHandler, posSearchPnt,
pingIndex, deltaDistance, maximumDistance, maximumTimeDifference,
OUT: pingRecord, positionRecord

freePosInter Free data for position interpolation
IN: posSearchPnt

getManyIndex- Get noPing pings from fromPing
IN: indexFileHandler, fromPing, noPing,
OUT: indexes

getNoPing- Get number of ping in file
IN: indexFileHandler,
OUT: noPing

getInterPos Interpolate position from time and date
IN: positionFileHandler, indexFileHandler, posHead,
maxDist, maxTimeDiff,
OUT: newPos

getPosList Get position data into position list
IN: positionFileHandler, posHead, fromPos, noPos,
deltaDist, maxDist,
OUT: pingPosList

getPingList Get position data into ping list
IN: pingHead, posSearch, fromPing, noPing, deltaDist,
maxDist, maxTimeDiff,
OUT: pingPosList

getFromNoOfPing Get fromping and no of pings for pings
that are between two valid positions
IN: positionFileHandler, indexFileHandler, fromPos,
noPos, totPing,
OUT: fromPing, noPing

flagPosJump Mark all position with pos_jump_flag
which are outside a given range from the
median of the surrounding positions
IN: posHead, noPos, pos, medianFilterType, maxDist

Copy file

copyFile Copy file
IN: fileHandler, directory,

OUT: versionNumber

copyHeader Copy general file header

IN: fileHandler, directory,

OUT: versionNumber

Update file

updatePing Update ping data and set index

IN: fileHandler, indexhandler, pingIndex, pingRecord

updateDepth Update depth data

IN: fileHandler, indexHandler, singDepthRecord,
stbDepthRecord, portDepthRecord

updateSidescan Update sidescan data

IN: fileHandler, indexHandler, singSidescanRecord, stbSi
descanRecord, portSidescanRecord

updatePosition Update position

IN: fileHandler, posIndex, positionRecord

updateHeader Update file header after updating file

IN: fileHandler, process, comment

Update flags

updatePosFlag Update position flag

IN: fileHandler, posIndex, positionFlag

updatePingFlag Update ping flag and set index

IN: fileHandler, indexHandler, pingIndex, pingFlag

updateDepthFlag Update depth flag for current index

IN: fileHandler, indexHandler, singDepthFlagList,
stbDepthFlagList, portDepthFlagList

Close file

closeFile Close a file

IN: fileHandler

Convenience routines

Some routines has been developed to make life easier for the programmers. These functions are listed below.

Transform

toLL Transform each beam to latitude and longitude

IN: positionRecord, posHeader, gyroHeading,
depthRecord,

OUT: latLongPositions

toUTM	Transform each beam to UTM IN: utmSone, positionRecord, posHeader, gyroHeading, depthRecord, OUT: utmPositions
getDiffDist	Calculate distance between to positions (in centimetres) IN: fromPositionRecord, toPositionRecord, posHeader OUT: distance
calcDirection	Calculate the direction from one position to another (in milli-degrees) IN: fromPositionRecord, toPositionRecord, posHeader OUT: direction

Header files

For each file there is a description on what it contains. The documentation is on the header file itself, and the user should consult this file. It is found in the IO library distribution.

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readWriteFile.h	Handlers and prototypes for readWriteFile.c
newFormat.h	Definition of survey format.
process.h	Process id. description
datum.h	List of datums
cdefine.h	Definitions of some C programming definitions used in the programs.
general.h	Definition of some general structures that are used several places in the code.

SurveyLines library

This file is important for all the processing. It includes all the lines of the survey, and identifies which versions are the most recent. The file is binary and is located on the \$PROCHOME/<SurveyName> directory.

The file **survey.lines** is an index of all existing SF data files on current directory. The file **current.line** identifies the line currently being processed. These two files must be updated by the modules writing or updating SF files. All modules reading SF files get a list of existing survey format files by reading the **survey.lines** file. The sensors that exists for the different lines are also listed on a specific file. This is the **line.sensors** file. In addition a file called **adm.data** contains the sensors of the survey with their name and their id numbers.

Writing and updating

The following routines are supplied:

```
int SIAdd (
s110FileType ioFileType      /* IN:  SL_SURVEY_L or SL_CURRENT_L */
char *dir,                  /* IN:  Directory name */
char *prefix,               /* IN:  File name prefix */
SlSurveyFileType survFileType /* IN:  SL_POS, SL_INDEX, SL_DEPTH, or
                               SL_SIDESCAN */
int version,                /* IN:  File version */
ProDescType lastProc        /* IN:  Process identification */
)
```

This function adds a new record to the **survey.lines** file. If a record for the directory/file name prefix combination of current interest already exists, this record is updated and no new record is added. For **current.line** SIAdd has the same functionality as for **survey.lines**, except that when a new record is added, the previous record is deleted.

```
int SIUpdate (
SIloFileType ioFileType,    /* IN:  SL_SURVEY_L or SL_CURRENT_L */
char *dir,                  /* IN:  Directory name */
char *prefix,               /* IN:  File name prefix */
SlSurveyFileType survFileType /* IN:  SL_POS, SL_INDEX, SL_DEPTH, or
                               SL_SIDESCAN */
int version,                /* IN:  File version */
ProDescType lastProc        /* IN:  Process identification */
)
```

This function is equal to the SIAdd function, except that the current directory/file name prefix combination must exist. If the new version number is lower than the version number on the **survey.lines** file, then the datafiles (.pos, .ind, .depth, or .sidescan) with version number higher than the new version number will be deleted.

```
int SIDelete(
```

```
SIioFileType ioFileType,      /* IN:  SL_SURVEY_L or SL_CURRENT_L */
char *dir,                    /* IN:  Directory name */
char *prefix,                 /* IN:  File name prefix */
SISurveyFileType survFileType, /* IN:  SL_POS,SL_INDEX,SL_DEPTH, or
                               SL_SIDESCAN */
ProDescType lastPro          /* IN:  Process identification */
)
```

Delete a survey format file by setting the version equal to 0. The record is deleted in the **survey.lines** file. The datafile (.pos, .ind, .depth, or .sidescan) will be deleted.

```
int SIDeleteLine(
  SIioFileType ioFileType,      /* IN:  SL_SURVEY_L or SL_CURRENT_L */
  char *dir,                    /* IN:  Directory name */
  char *prefix,                 /* IN:  File name prefix */
  ProDescType lastPro          /* IN:  Process identification */
)
```

Deletes all survey format files for a line by setting the versions equal to 0. The datafiles (.pos, .ind, .depth, and .sidescan) will be deleted and the file [<dir>/]<prefix>_00_01.para will be deleted

Reading

The following functions return information in a SIList structure (See the SurveyLines.h file for information about the structure). The following routines are supplied:

```
SISList *SICreateList (
  SIioFileType ioFileType,      /* IN:  SL_SURVEY_L or SL_CURRENT_L */
)
```

Function for reading **survey.lines** and **current.line**. SICreateList returns a SIList structure.

```

int SIUpdateList (
    SIioFileType ioFileType,      /* IN:  SL_SURVEY_L or SL_CURRENT_L */
    SIList *ioList                /* IN:  Pointer to structure from the
                                   SICreateList function */
)

```

SIUpdateList updates an existing SIList structure. Use SICreateList once to create the list. Then call SIUpdateList repeatedly to get information on changes made to the survey.lines or current.line.

Header files

This is where the programmers can find the definitions of the structures of this library. The actual header files are:

SurveyLines.h Survey line and current line structures.
lineSensors.h Structures and routines for the
line.sensors file.

Administration file I/O

File format

The **adm.data** file contains the names of the different sensors. The file is an ASCII file named where for each sensor the following data are written:

sensor <sensorType1> <N1> <name1>

sensor <sensorType2> <N2> <name2>

sensor <sensorType1> <N3> <name3>

where **N_x** is the sensor number on the Survey Format files, and **namex** is the name of the sensor. The **sensorTypex** is position or depth. This is when more than the usual EM sensor exists. The Merlin logging system will build this file and the **survey.lines** file automatically, and the default EM sensor is given by:

sensor position 0 undefined

Reading

To read the file, the following routine is called:

AdReadAdm (EvHandler *evHand)

And to fetch the sensors read:

AdGetSensors (int *noSensors, SensorPnt *snrPnt)

Structures and files

The structures are defined in the **adm.h** file.

12.5 Survey Predefined Files

Introduction

When you define and run a survey, you will always need information describing basic data or set-up, such as:

- projection data
- user defined colours
- user defined show/hide settings
- coastline contours
- course deviation

The **Survey Predefined Files** function allows you to build a set of templates to hold this kind of information.

File locations

The Survey Predefined Files are located in the `$$SHAREDHOME` directory. In this directory, you can create subdirectories defining specific survey types, where the type can be defined by your own choice. You can for example create sets of files to match specific bottom conditions or geographical locations.

The result may be (for example):

```
$$SHAREDHOME/Oslofjord/*.*
```

```
$$SHAREDHOME/Mercator_30_degrees/*.*
```

In order to create the file structure, and to copy in the files you wish to use, you need to open a terminal window on your Operator Station and use the standard Unix commands.

→ *Refer to the applicable instruction manual(s) for a description of the terminal window and the Unix commands.*

Using the Survey Predefined Files

When you define a new survey using the options on the EM 1002 launchpad, you are asked which of the Survey Predefined Files you will use. When you select any of the templates on the list, the files in that directory are copied over to the survey directory on `$PROCHOME`.

12.6 Projection data

Scope and purpose

This document defines the interfaces and use of the component **Projection**. The purpose with the document is to describe how the component interfaces with other components, and how the component is to be used.

Projection overview

Each and every survey should have a well defined projection. The Kongsberg Maritime Software will use the defined projection in all geographic displays and in many other programs where a projection is needed.

There are three major different ways to define a projection in the Kongsberg Maritime Software:

- 1 You have full access to the library PROJ.4 from USGS.
- 2 You can give Kongsberg Maritime the source code (in “C”) to his preferred projection, and make that projection a permanent part of all Kongsberg Maritime Software.
- 3 You can program your own projections into the shared library (libsharedProj.so) which is used in all Kongsberg Maritime Software. A template of the source code is supplied by Kongsberg Maritime.

It should be noted that Kongsberg Maritime knows nothing about what goes on inside your projection routines. Some of these routines may contain datum transformations which should be known to the system operator.

Projection protocol

You should for each and every survey define your preferred projection. The projection used in a survey is defined in the file \$PROCHOME/<survey>/projection.data

The first word in the first line defines which projection to use. The file may look like this:

- 1 If the first word is “RijksDriehoksnet”, the preferred projection for the Netherlands is used.
- 2 If the first word is “utm”, a UTM-projection is used. Setting the UTM zone is however a little tricky:

```
utm  
0 3
```

0 3

If the file looks like the above, UTM zone 31 is selected. The number 3 is the longitude.

- 3 If the first word is “sharedlib”, the projection from the shared library libsharedProj.so is used

- 4 If the first word is “user_defined”, a user defined projection from the USGS PROJ.4 library is used.

The file \$PROCHOME/<survey>/projection.data may then look like this:

```
user_defined      defaultProjections:proj1
```

This means that the user defined projection using PROJ.4 is found in the file \$PROJ_LIB/defaultsProjections and that the setup for the projection is taken from <proj1>.

The file \$PROJ_LIB/defaultsProjections may look like this:

(which is standard PROJ.4, ref. [1], [2] and [3]):

```
<proj1>
proj=stere
x_0=155000
y_0=463000
k=0.9996
lat_0=52.156160556
lon_0=5.387638889
<proj2>
proj=utm
zone=31
```

- 5 If the first word is “GK_AUSTRIA”, the preferred projection for Austria is selected. There are 16 parameters which controls this projection and they are all kept in the same file. These 16 parameters must be in the specified order in the file, the rest of the file is comments. As we can see this projection performs a datum transformation from WGS 84 to Bessel (Europe) prior to the projection. The projection itself is a Gauss-Krüger.

\$PROCHOME/<survey>/projection.data may look like this:

```
GK_AUSTRIA
-563.9
-82.3
-463.4
4.47
4.85
```

```
1.88
4.46
6377397.155
299.15281285
16.3333333333333
6378137.0
298.257223563
0
-5000000
500
! Line1: GK_AUSTRIA tells Simrad Software
! to use Gauss-Kruger for Austria.
! Transformationsparameter
! für die Umwandlung von WGS84-Koordinaten
! nach Gauss-Krüger-Koordinaten bezogen
! auf das Datum MGI
! Zeile 1: Translation in x [m]
! Zeile 2: Translation in y [m]
! Zeile 3: Translation in z [m]
! Zeile 4: Maßstab
! Zeile 5: Rotation in x ["]
! Zeile 6: Rotation in y ["]
! Zeile 7: Rotation in z ["]
! Zeile 8: große Halbachse [m]
! Nutzersystem (z.B. Bessel)
! Zeile 9: Abplattung Nutzersystem
! (z.B. Bessel)
! Zeile 10: Zentralmeridian Nutzersystem
! (z.B. Bessel)
! Zeile 11: große Halbachse [m] WGS84
! Zeile 12: Abplattung WGS84
! Zeile 13: Zuschlag Rechtswert
! Zeile 14: Zuschlag Hochwert
! Last line: Fixed height used in
! projections.
```

Notes

The setup of the projection is quite important to do right which means that this should be done by qualified persons only. In the Neptune/Survey Display system it is possible to set up default surveys that you can use as templates for new surveys. These default surveys can then be set up with the correct projections and given names which makes it easy for the operator to choose a default survey of the correct type.

There is already a file \$PROJ_LIB/defaultsProjections which is in use if some of the standard default surveys are used.

12.7 Dynamic Projection Library

Introduction

The purpose is to describe how the component interfaces with other components and how the component is to be used.

Overview

There need to be defined a shared library where the customer can implement his own projection routines to use with Kongsberg Maritime's Graphic System. This shared library will then be a permanent part of all graphic windows.

Dynamic projection library definitions

In the graphic system today you can set projection and some projection parameters in the file

`$PROCHOME/<survey>/projection.data`.

This file will also be used when you specify that projections shall be taken from the shared library **libsharedProj.so**. The shared library for customer defined projections, **libsharedProj.so**, must be put somewhere where the loader will find it at startup, `/usr/lib/libsharedProj.so`.

Dynamic projection library protocol

When you wish to use a projection defined in the shared library, the first line in the file

`$PROCHOME/<survey>/projection.data` must look like this:

`sharedlib 5`

The number (here: 5) is defined by you.

When the program (i.e. Survey, Merlin, GridDisplay) starts, it will look for the file

`$PROCHOME/<survey>/projection.data`. When it finds the word **sharedlib** as the first word in the file, the next word is read as an integer which identifies which projection will be used.

The **initUserProjection** routine is then called with this number as a parameter. This enables you to do additional initialisation to the projection. Since only the first line in `$PROCHOME/<survey>/projection.data` is used by the system, you can freely use the rest of this file for additional parameters to be read at startup time.

Each and every projection should be associated with a name. This name will appear when you wish to plot something on a plotter. For Kongsberg Maritime's Graphic System to get this name, you must supply a routine **getUserProjectionName** which also has the number as an input parameter and returns a string with the name to be used for the projection.

When Kongsberg Maritime's Graphic System is set up to use projection routines from the shared **library libsharedProj.so**, it will do so by calling two routines. The routine used for projection is **userProjectionLatLongToNorthEast**, and the routine used for the reverse projection is **userProjectionNorthEastToLatLong**.

Example

This is an example of how the codes for

- `initUserProjection`
- `getUserProjectionName`
- `userProjectionLatLongToNorthEast`
- `userProjectionNorthEastToLatLong`

should look like:

```
/* **FILEHEADER**
** $Id: dummyRoutines.c,v 1.1.1.1
** 1997/01/23 08:45:44 tp Exp $
**
** Filename: dummyRoutines.c
** Date of creation: 23 Jan 1997
** Creator: Terje Pedersen
** Purpose: Dummy-routines for the shared
** library libsharedProj.so
** which can be changed by the customer.
** Copyright: Kongsberg Simrad AS
** **_FILEHEADER */
#include <stdlib.h> /*calloc-function*/
#include <string.h> /*memcpy-function*/
/* **S*****
* Routine:
*   initUserProjection
* Purpose:
*   Initialize the user's preferred
```

```
*      projection. The programmer has access to
*      the file projection.data in current
*      directory which the user controls.
* Parameters:
*      int userProjectionNumber (input)
*      This is the number found in
*      projection.data
*      where the first line looks like this:
*      sharedlib 4
*      In this case userProjectionNumber will be
*      4.
* Return values:
*      0 on success, -1 on error.
* References:
*      The Component Interface
*      Document: Neptune/UserProjections.
* Changes:
* **_S** *****/
int initUserProjection(int
userProjectionNumber)
{
    switch (userProjectionNumber){
    case 1:
        break;
    default:
        return -1;
    }/*switch*/
    return 0;
}/*initUserProjection*/
/* **S*****/
* Routine:
*      getUserProjectionName
* Purpose:
*      Get the name to display in the
*      menus for this user projection.
* Parameters:
* int userProjectionNumber (input):
*      This is the number found in
*      projection.data
*      where the first line looks like this:
*      sharedlib 4
*      In this case userProjectionNumber will
```



```

*     be 4.
* Return values:
*     A dynamically allocated character array
*     containing the name of the projection to
*     use. On error NULL is returned.
* References:
*     The Component Interface Document:
*     Neptune/UserProjections.
* Changes:
* **_S** *****/
char *getUserProjectionName(int
userProjectionNumber)
{
    char *p;
    if ((p = calloc(20,sizeof(char)))==NULL)
return NULL;
    switch (userProjectionNumber){
    case 1:
        memcpy(p,"User Projection 1",18);
        break;
    default:
        free(p);
        return NULL;
    }/*switch*/
    return p;
}/*getUserProjectionName*/
/* **S** *****/
* Routine:
*     userProjectionLatLongToNorthEast
* Purpose:
*     This routine is called to get the
*     projection coordinates from the
*     geographic coordinates.
* Parameters:
* int userProjectionNumber (input):
*     See initUserProjection.
* double latitude, double longitude (input):
*     latitude and longitude in decimal
*     degrees.
* double *north, double *east (input/output):
*     pointers to doubles where to store the
*     projection coordinates north and east

```

```
*      (in meters).
* Return values:
*      0 on success, -1 on error.
* References:
*      The Component Interface Document:
*      Neptune/UserProjections.
* Changes:
* **_S** *****/
int userProjectionLatLongToNorthEast(int
userProjectionNumber,
    double latitude, double longitude,
    double *north, double *east)
{
    if (north == NULL || east == NULL) return
-1;
    switch (userProjectionNumber){
    case 1:
        break;
    default:
        return -1;
    }/*switch*/
    return 0;
}/*userProjectionLatLongToNorthEast*/
/* **S** *****/
* Routine:
*      userProjectionNorthEastToLatLong
* Purpose:
*      This routine is called to get the
*      geographic coordinates from the
*      projection coordinates.
* Parameters:
* int userProjectionNumber (input):
*      See initUserProjection.
* double north, double east (input):
*      Projection coordinates (meters)
* double *latitude, double *longitude
* (input/output):
*      Pointers to doubles where to store the
*      geographic coordinates latitude and
*      longitude (desimal degrees).
* Return values:
*      0 on success, -1 on error.
```

```

* References:
*   The Component Interface Document:
*   Neptune/UserProjections.
* Changes:
* **_S** *****/
int userProjectionNorthEastToLatLong(int
userProjectionNumber,
    double north, double east,
    double *latitude, double *longitude)
{
    if (latitude == NULL || longitude == NULL)
return -1;
    switch (userProjectionNumber){
    case 1:
        break;
    default:
        return -1;
    }/*switch*/
    return 0;
}/*userProjectionNorthEastToLatLong*/

```

The makefile on a DEC OSF1 UNIX workstation looks like this:

```

# $Id: Makefile,v 1.1 1997/01/23 11:12:07 tp
Exp $
# Makefile to create libsharedProj.so.
#
# 23 Jan 1997, Terje Pedersen
#
# Copyright: Kongsberg Simrad AS
#
#
.PHONY:install lib clean
CC=cc
LD=ld
LDFLAGS=-shared -no_archive
INSTALL=/usr/local/lib
dummyRoutines.o: dummyRoutines.c
@$(CC) -c $<
lib: dummyRoutines.o

```

```
@$(LD) $(LDFLAGS) -o libsharedProj.so
dummyRoutines.o -lc

install: lib
@cp libsharedProj.so
$(INSTALL)/libsharedProj.so
@cp dummyRoutines.h
$(NEPTUNEHOME)/include/simrad/.
@ls -l $(INSTALL)/libsharedProj.so
@ls -l
$(NEPTUNEHOME)/include/simrad/dummyRoutines.h

clean:
@rm dummyRoutines.o libsharedProj.so
```

The makefile is probably very similar on other platforms.

Notes

There are some restrictions on shared libraries on every platform. You should be aware of this. When upgrading Kongsberg Maritime Software the customer's shared library should be reinstalled to make sure it is the one being used. You are encouraged to use the initialisation routine to test that the projection is working.

Heights are not used in Kongsberg Maritime's Graphic system. It is not necessary in the projections since the height varies very little within one survey that a fixed height will suffice. This can be a parameter in \$PROCHOME/<survey>/projection.data that you can read at startup time and use in the projections internally.

13 SPARE PARTS

13.1 Overview

This chapter contains an illustrated presentation of the spare parts available for the EM 1002 multibeam 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.

13.2 Spares data presentation

Spares table

The parts are presented in a table format ("5008") specified by the Royal Norwegian Navy.

An example is shown below.

10 SNo	11 Drawing ref	13 Prod.p.no	15 Article name	18 Price	21 Unit	22 Quantity
	12 Other ref.	14 TM part.no	16 Technical data	19 TM code	26 User-spares	27 Base spares
	24 Date	17 NATO No		23 Status	20 Comp	25 Ser.no.
1	Fig.1 - 05.03.97	290-085827 - -	Powec Power Supply PMP 4M.02	- - -	EA 0 C	1 0 N/A
2	Fig.1 05.03.97	299-049179 - -	Fan Drawer Assembly	- - -	EA 0 C	3 0 N/A

The parts information in this table also conforms to the civilian standard **NS 5820** specified by the Norwegian Standardisation Society (Norges Standardiserings Forbund).

Parts list codes

These are the code descriptions for the information in the table.

Key codes to the parts list		
No	Caption	Description
10	Serial no.	Row number in list.
11	Drawing no. & item no.	The number of the drawing, and the position on that drawing, of the part.
12	Other references	Any other applicable references are included here.
13	Producer's part no.	The part number to be used when ordering spares from Kongsberg Maritime AS.
14	True manufacturer's part no.	Part number designated by manufacturer of part. Will be same as (13) if part is manufactured or assembled by Kongsberg Maritime AS.
15	Article name	The name of the unit or part.
16	Technical data	Any additional technical information which may be relevant.
17	NATO catalogue no.	The NATO stock number will be added where appropriate.
18	Currency/unit price	Price of the part, and the applicable currency
19	True manufacturer's code	This is a code number to identify the suppliers of the parts to enable you to order directly from the suppliers in an emergency.
20	Component	Component definition. C = a component which cannot be broken down into smaller units. P = a part which may contain separately replaceable components. S = a set of parts.
21	Unit	The SI units applicable to the component. E.G. m = metric units for bolts etc.
22	Quantity	The total number of that particular part included in the system.
23	Status	Code for use by the Navy. Will be completed by the Navy
24	Date	This is the date the row was last updated.
25	Serial number	The component serial number where applicable.
26	User spares	The suggested number of spares to be held by the user.
27	Spares at base	The suggested number of spares to be held at the user's home base.

13.3 Transceiver Unit

Overview

The line replaceable units in the EM 1002 Transceiver Unit are:

- Circuit boards
- Capacitor battery
- Power supplies
- Fan drawers

The Transceiver Unit has been delivered in two versions with different reg.numbers. Please check your cabinet to find the right reg.no. and use the dedicated list below.

Processing Rack - Reg.no 125-211814

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

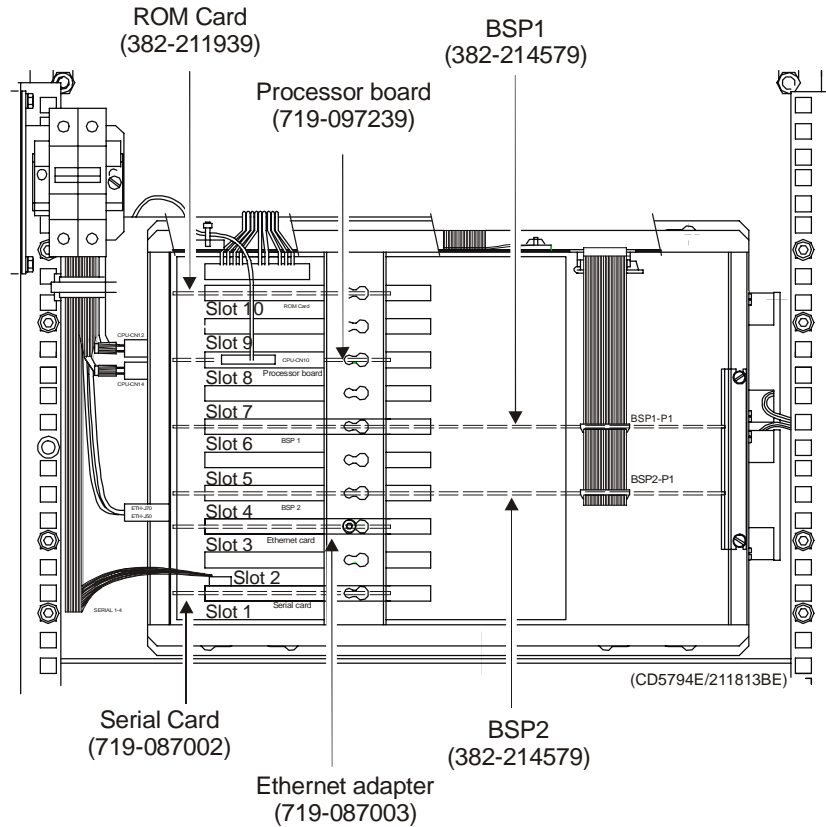


Figure 65 Processing Rack spares for Transceiver Unit with reg.no. 125-211814

SNo	Drawing ref	Prod.p.no	Article name	Price	Unit	Quantity
	Other ref.	TM part.no	Technical data	TM code	User-spares	Base spares
	Date	NATO No	Other information	Status	Comp	Ser.no.
1	Fig.65	382-211939	ROM card	-	EA	1
	-	-		-	1	0
	01.12.03	-		-	C	N/A
2	Fig.65	719-097239	Processor board	-	EA	1
	-	-	Commercial item	-	0	0
	01.12.03	-		-	C	N/A
3	Fig.65	382-214579	Beamformer & Signal Processor	-	EA	2
	-	-		-	0	1
	01.12.03	-		-	C	N/A
4	Fig.65	719-087002	Serial card	-	EA	1
	-	-	Commercial item	-	0	1
	01.12.03	-		-	C	N/A
5	Fig.65	719-097597	DiskOnModule	-	EA	1
	-	-	(Mounted on the processor board. This is NOT for systems with a ROM card).	-	0	0
	01.12.03	-	Commercial item	-	C	N/A
6	Fig.65	719-087003	Ethernet Adapter	-	EA	1
	-	-	Commercial item	-	0	1
	01.12.03	-		-	C	N/A
7	Fig.65	129-096870	Fan, axial, 12 Vdc	-	EA	2
	-	-	Commercial item	-	0	1
	01.12.03	-		-	C	N/A

SNo	Drawing ref	Prod.p.no	Article name	Price	Unit	Quantity
	Other ref.	TM part.no	Technical data	TM code	User-spares	Base spares
	Date	NATO No	Other information	Status	Comp	Ser.no.
1	-	290-097126	Power supply +24 V	-	EA	1
	-	-		-	1	0
	01.12.03	-		-	C	N/A
2	-	290-086216	Power supply 5V	-	EA	1
	-	-		-	0	0
	01.12.03	-		-	C	N/A
3	-	290-087850	Power supply \pm 12V	-	EA	1
	-	-		-	0	0
	01.12.03	-		-	C	N/A

Processing Rack - Reg.no 125-218141

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

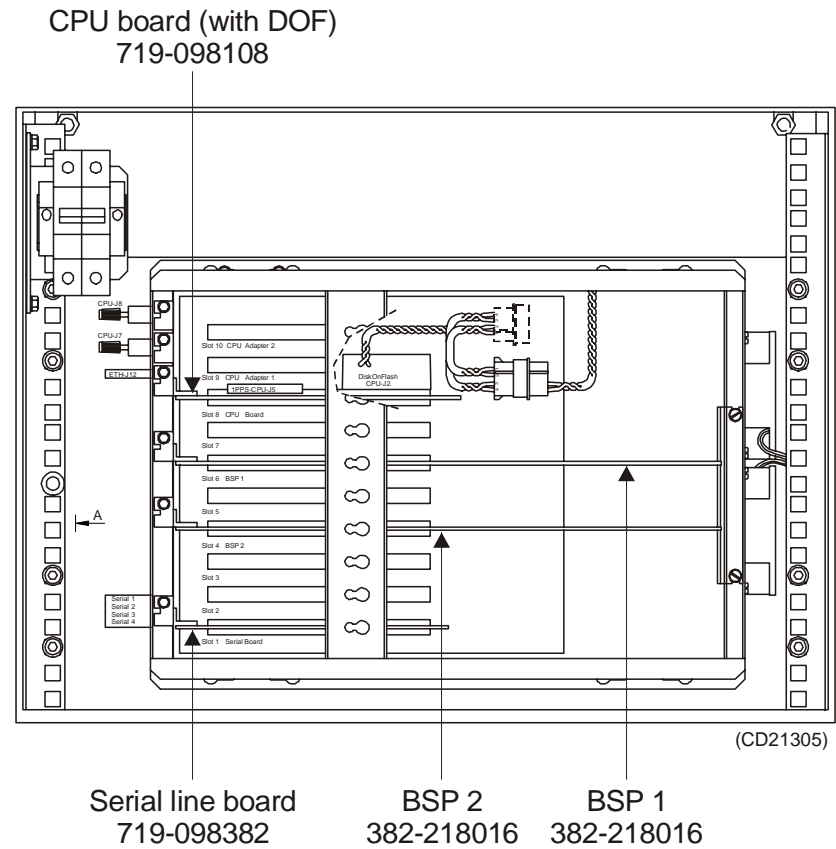


Figure 66 Processing Rack spares for Transceiver Unit with reg.no. 125-218141

SNo	Drawing ref	Prod.p.no	Article name	Price	Unit	Quantity
	Other ref.	TM part.no	Technical data	TM code	User-spares	Base spares
	Date	NATO No	Other information	Status	Comp	Ser.no.
1	Fig.66	719-098108	Control Processor Unit (CPU) board	-	EA	1
	-	-	Commercial item	-	1	0
	01.12.03	-		-	C	N/A
2	Fig.66	382-218016	Beamformer & Signal Processor	-	EA	2
	-	-		-	0	0
	01.12.03	-		-	C	N/A
3	Fig.66	719-098382	Communication board (serial line)	-	EA	1
	-	-	Commercial item	-	0	0
	01.12.03	-		-	C	N/A
4	Fig.66	719-087748	SDRAM (mounted on the CPU board)	-	EA	1
	-	-	Commercial item	-	0	0
	01.12.03	-		-	C	N/A

5	Fig.66 01.12.03	719-098387 - -	DiskOnFlash (DOM) module (mounted on the CPU board) Commercial item	- - -	EA 0 C	1 0 N/A
6	Fig.66 01.12.03	129-096870 - -	Fan, axial, 12 Vdc Commercial item	- - -	EA 0 C	2 1 N/A

SNo	Drawing ref	Prod.p.no	Article name	Price	Unit	Quantity
	Other ref.	TM part.no	Technical data	TM code	User-spares	Base spares
	Date	NATO No	Other information	Status	Comp	Ser.no.
1	- - 01.12.03	290-097126 - -	Power supply +24V	- - -	EA 1 C	1 0 N/A
2	- 01.12.03	290-098674 - -	Power supply +5V	- - -	EA 0 C	2 0 N/A
3	- 01.12.03	290-087850 - -	Power supply \pm 12V	- - -	EA 0 C	2 0 N/A

Receiver Rack

The following spare parts are those circuit boards and power supplies used in the Receiver Rack.

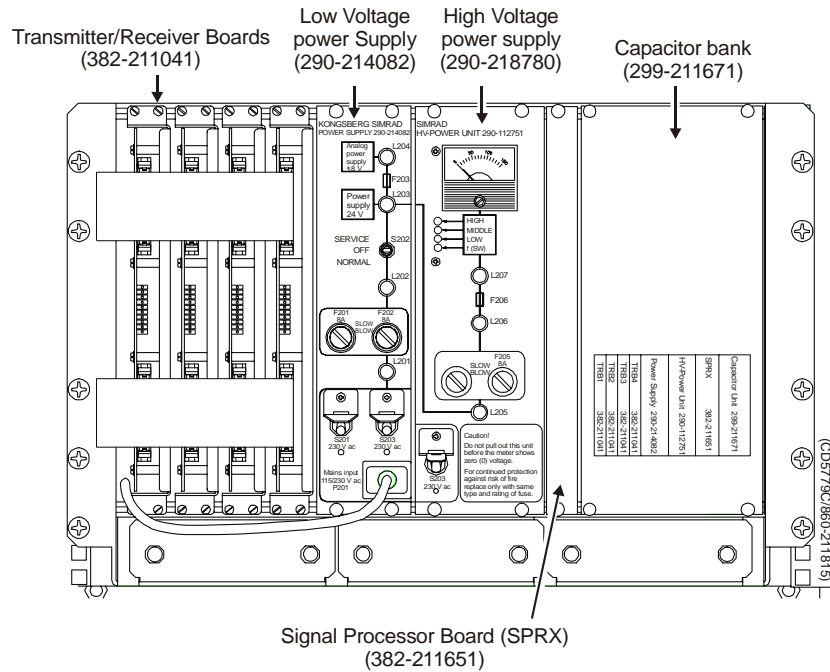


Figure 67 Receiver Rack spares

SNo	Drawing ref	Prod.p.no	Article name	Price	Unit	Quantity
	Other ref.	TM part.no	Technical data	TM code	User-spares	Base spares
	Date	NATO No	Other information	Status	Comp	Ser.no.
1	Fig.67	382-211041	Transmitter / Receiver Board	-	EA	4
	-	-		-	0	1
	06.01.04	-		-	C	N/A
2	Fig.67	290-214082	Low Voltage Power Supply	-	EA	1
	-	-		-	0	1
	06.01.04	-		-	C	N/A
3	Fig.67	290-218780	High Voltage Power Supply	-	EA	1
	-	-		-	0	1
	06.01.04	-		-	C	N/A
4	Fig.67	382-211651	Signal Processor Board RX	-	EA	1
	-	-		-	0	1
	06.01.04	-		-	C	N/A
5	Fig.67	299-211671	Capacitor Bank	-	EA	1
	-	-		-	0	1
	06.01.04	-		-	C	N/A

13.4 Hull Unit Controller

Overview

The line replaceable units in the EM 1002 Transceiver Unit are:

- Circuit boards
- Capacitor battery
- Power supplies
- Fan drawers

Subrack

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

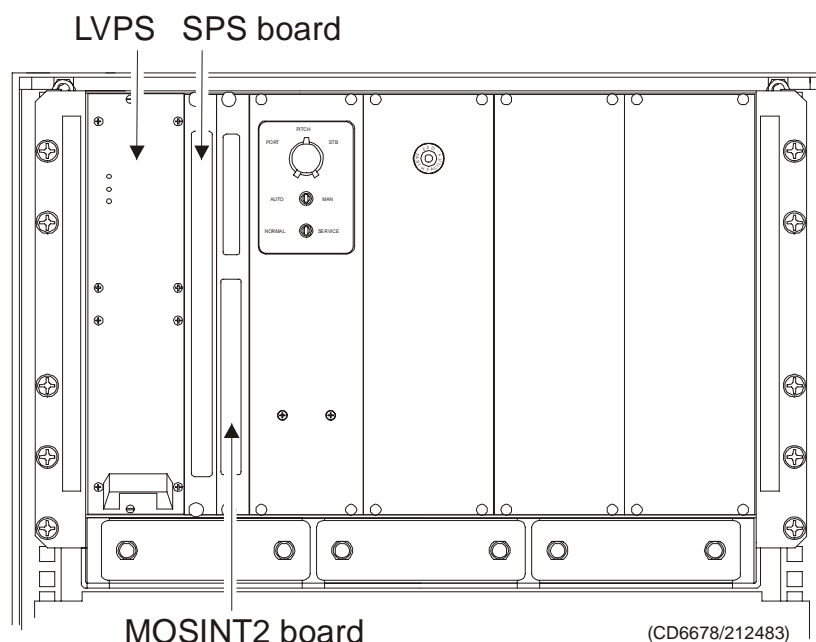


Figure 68 Hull Unit Controller, spares

SNo	Drawing ref	Prod.p.no	Article name	Price	Unit	Quantity
	Other ref.	TM part.no	Technical data	TM code	User-spares	Base spares
	Date	NATO No	Other information	Status	Comp	Ser.no.
1	Fig.68 - 12.09.02	382-212021 - -	Signal Processor board (SPS)	- - -	EA 1 C	1 0 N/A
2	Fig.68 - 12.09.02	382-212026 - -	Motor & Sensor Interface board (MOSINT2)	- - -	EA 0 C	1 0 N/A
3	Fig.68 - 12.09.02	290-085827 - -	Low Voltage Power Supply Commercial item	- - -	EA 0 C	1 0 N/A

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14 DRAWING FILE

14.1 Overview

This chapter contains cable details and installation drawings.

Cable details

→ *Refer to page 23.*

Installation drawings

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

→ *Transducer array, Outline dimensions, page 362.*

→ *Transducer array, Outline dimensions, page 363.*

→ *Hull Unit, Outline dimensions, page 360.*

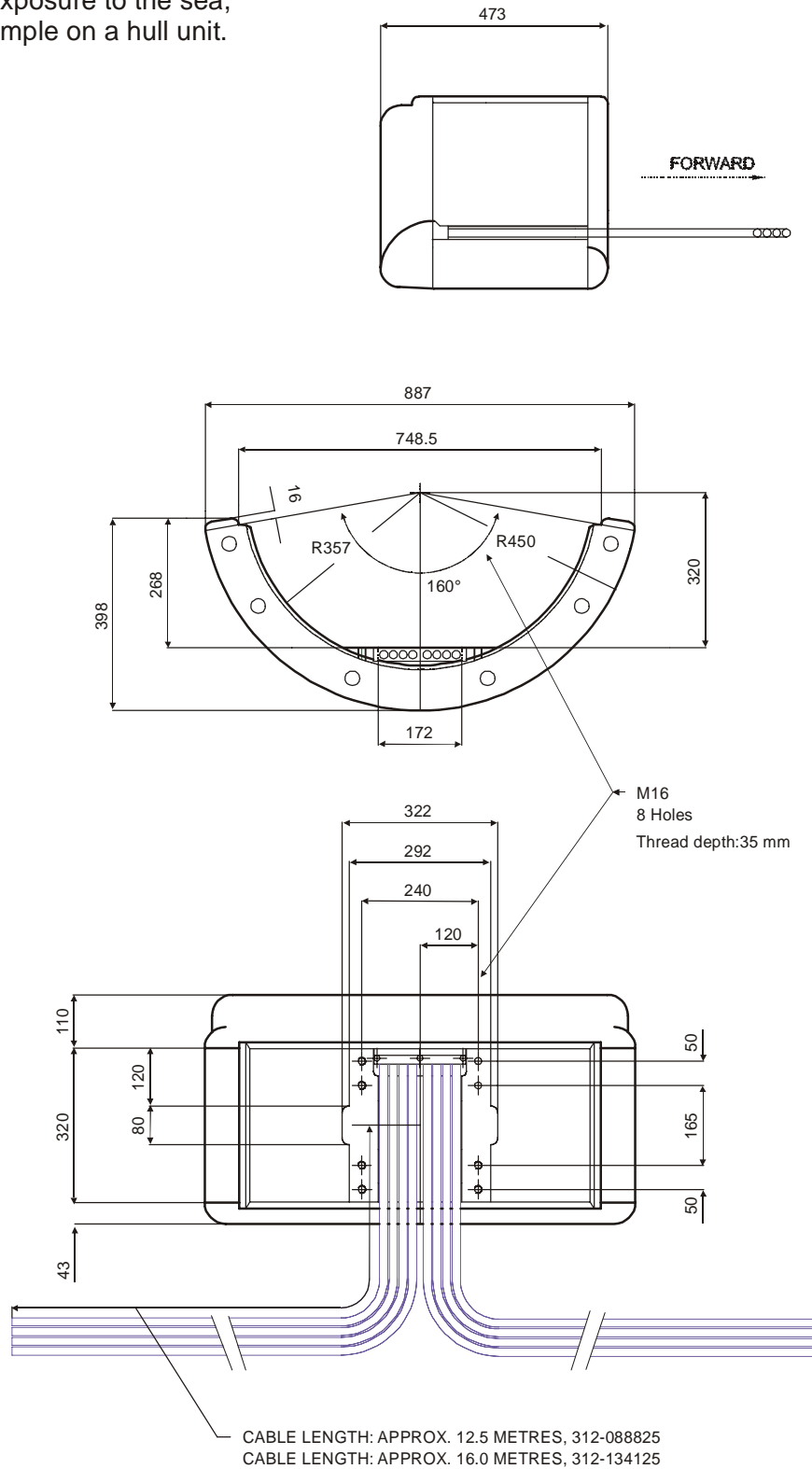
→ *Hull Unit cabling, page 361.*

→ *Junction Box for transducer cables, outline, page 369.*

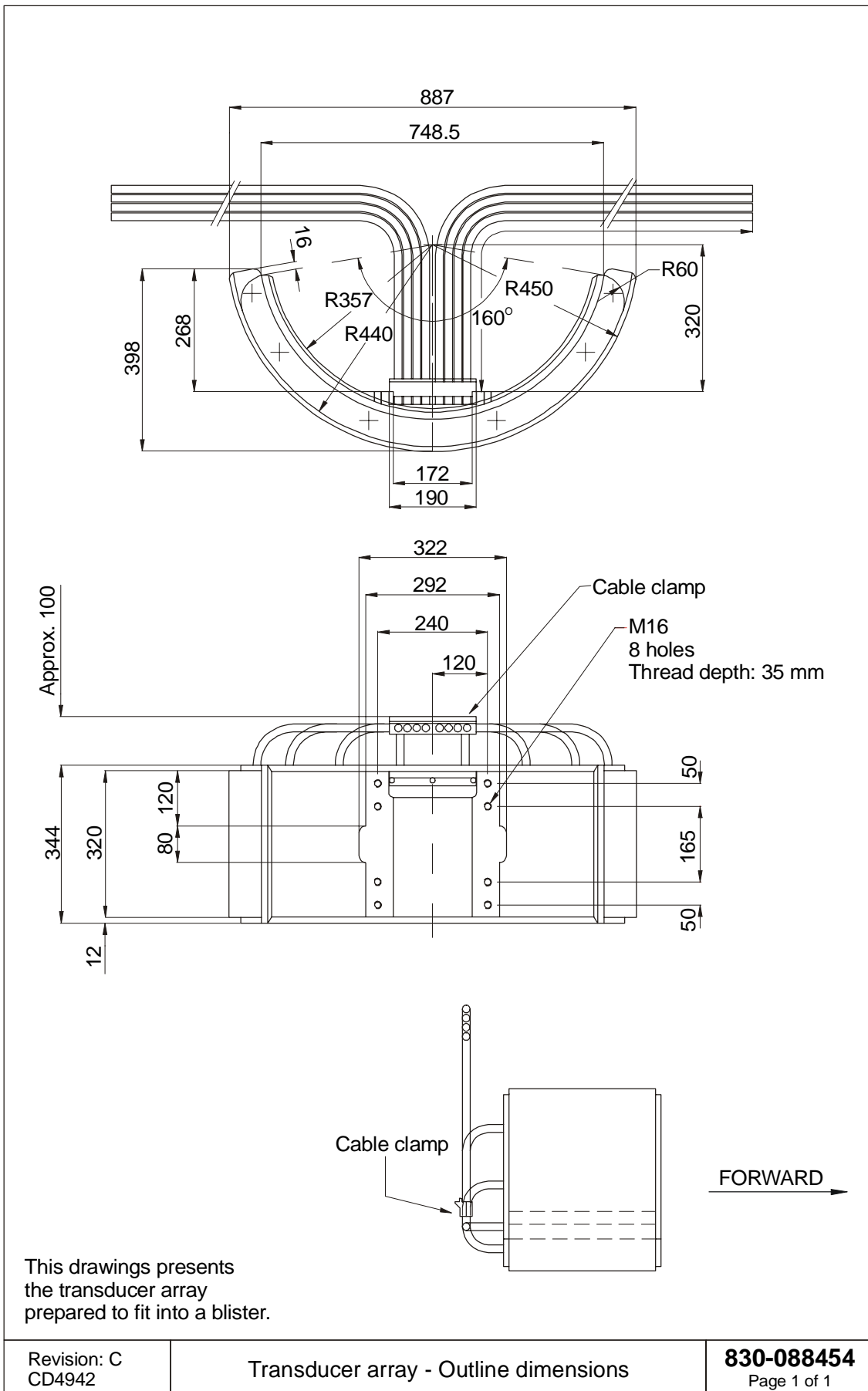
→ *Interconnection diagram, page 377.*

→ *Hull Unit Controller, wired cabinet, page 370.*

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



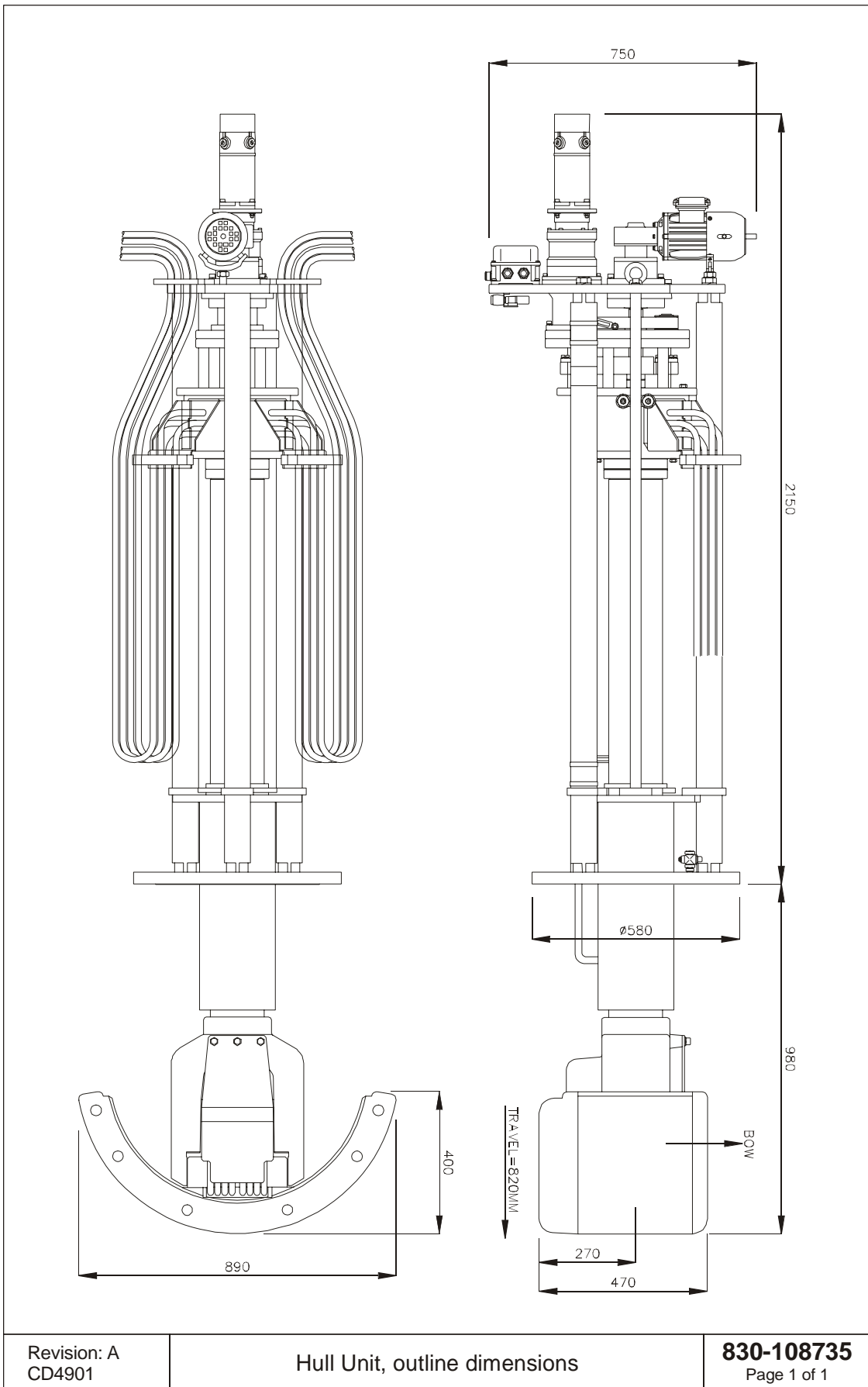
<p>Revision: D CD4871 (&488)</p>	<p>Transducer array, Outline dimensions</p>	<p>830-088179 Rev.D</p>
--	---	------------------------------------

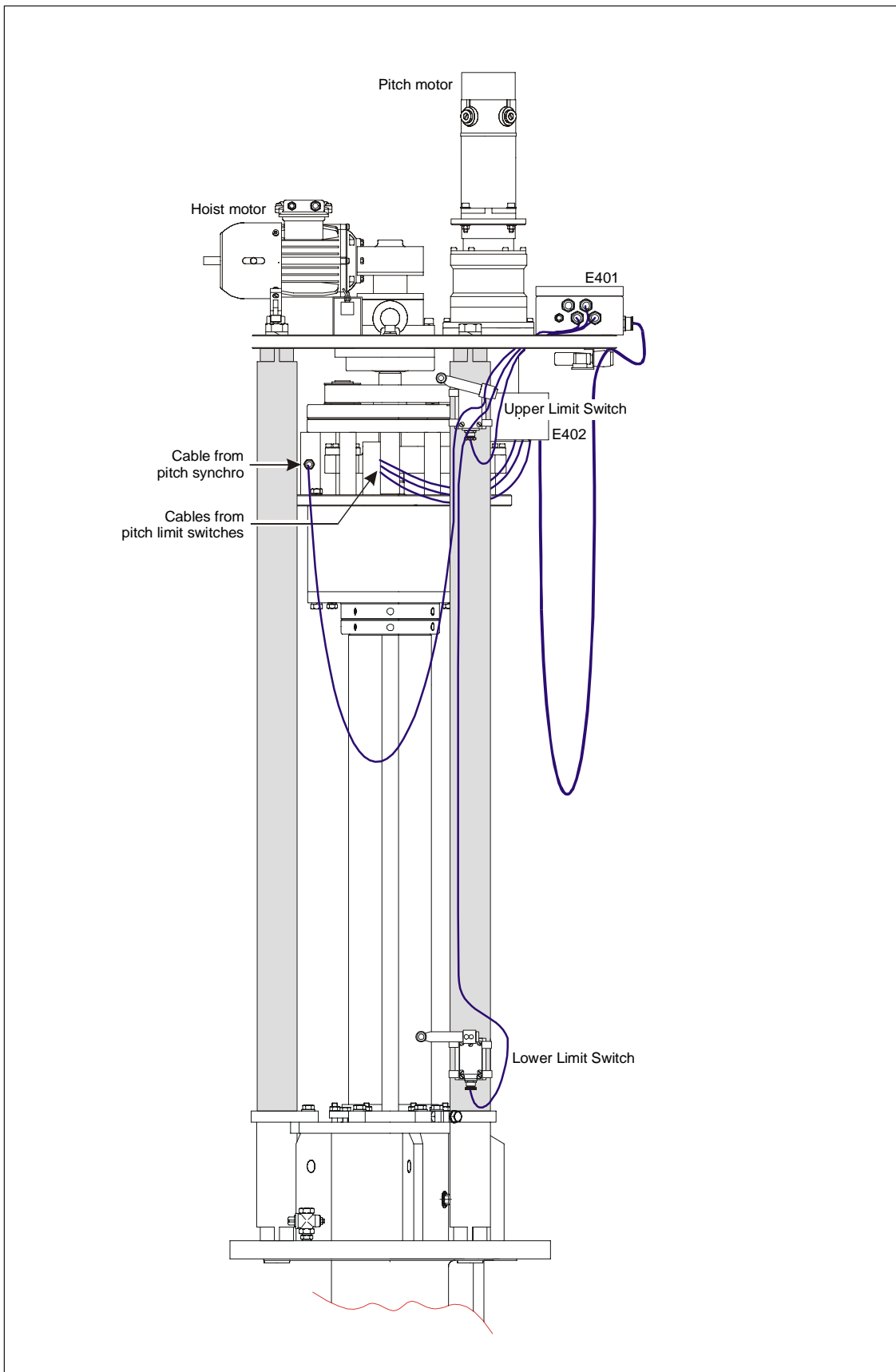


Revision: C
CD4942

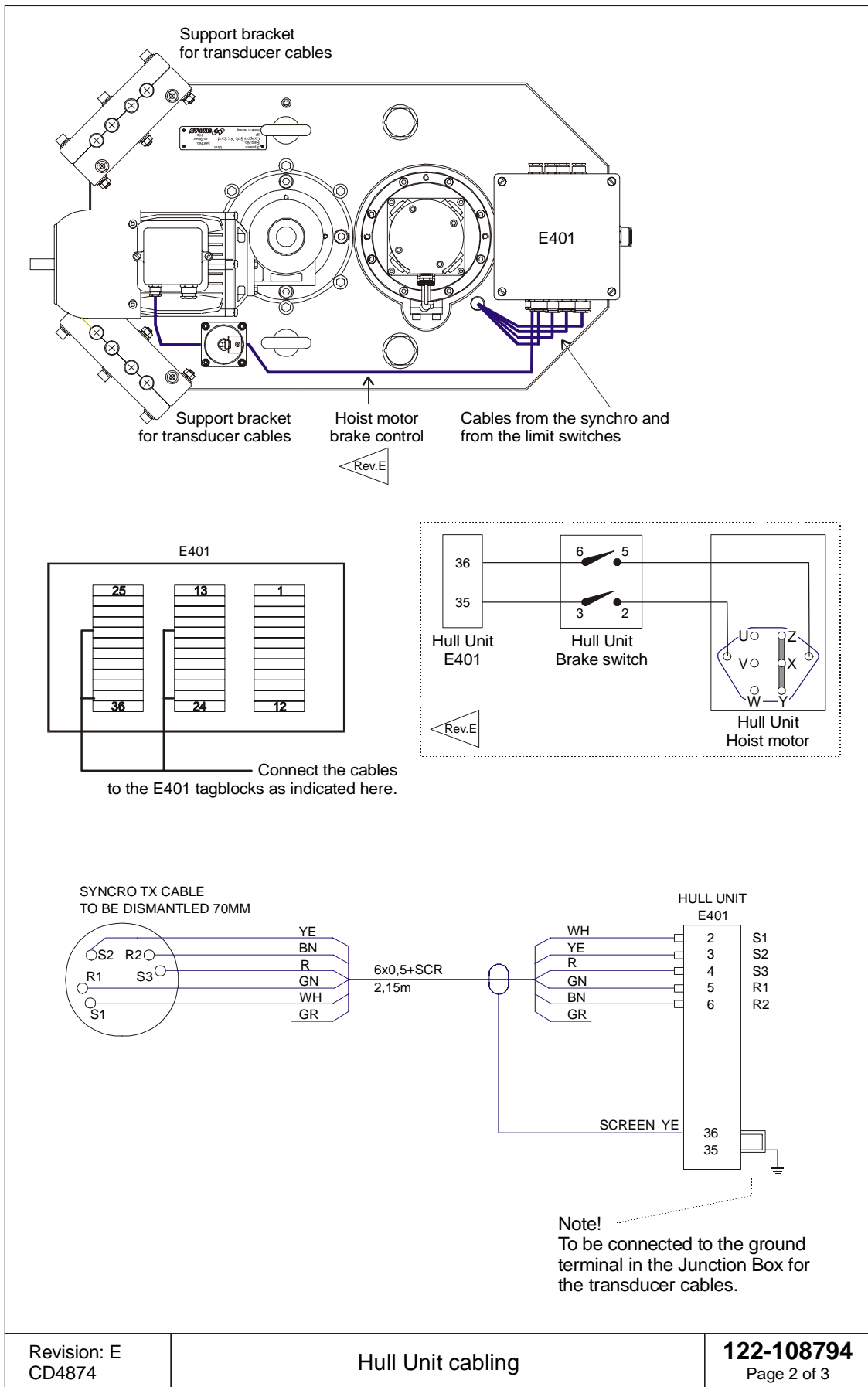
Transducer array - Outline dimensions

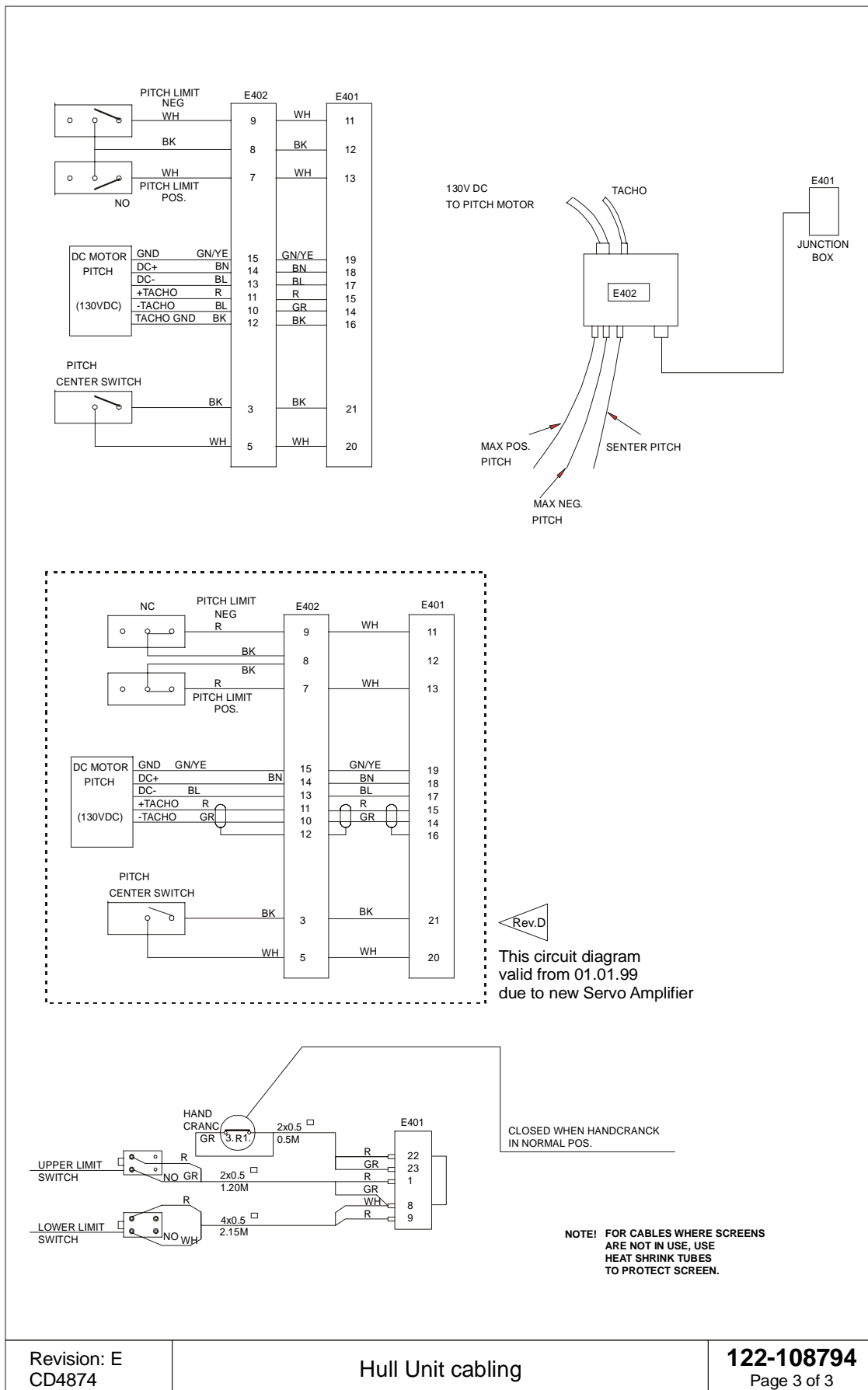
830-088454
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Revision: E CD4874A	Hull Unit cabling	122-108794 Page 1 of 3
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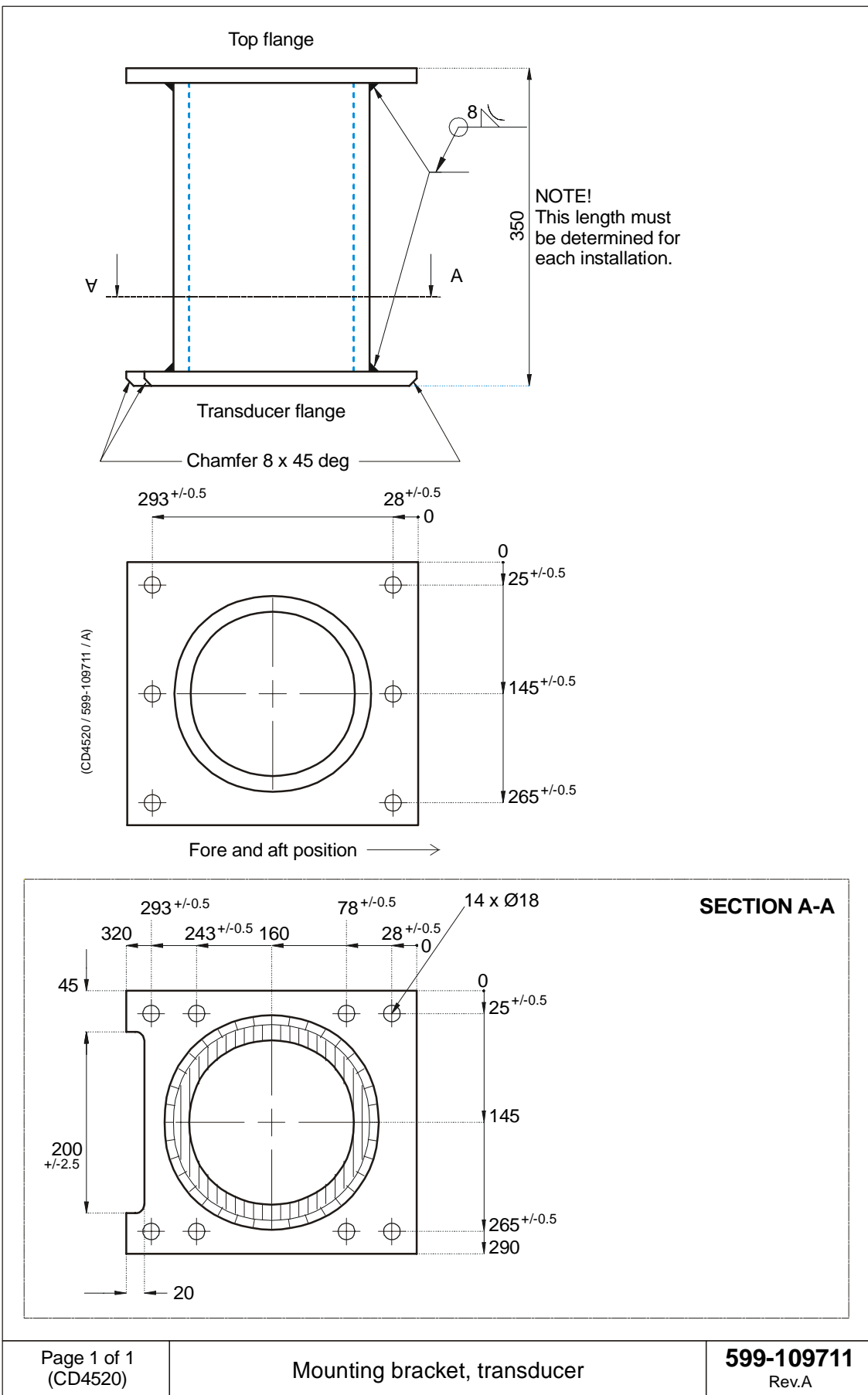


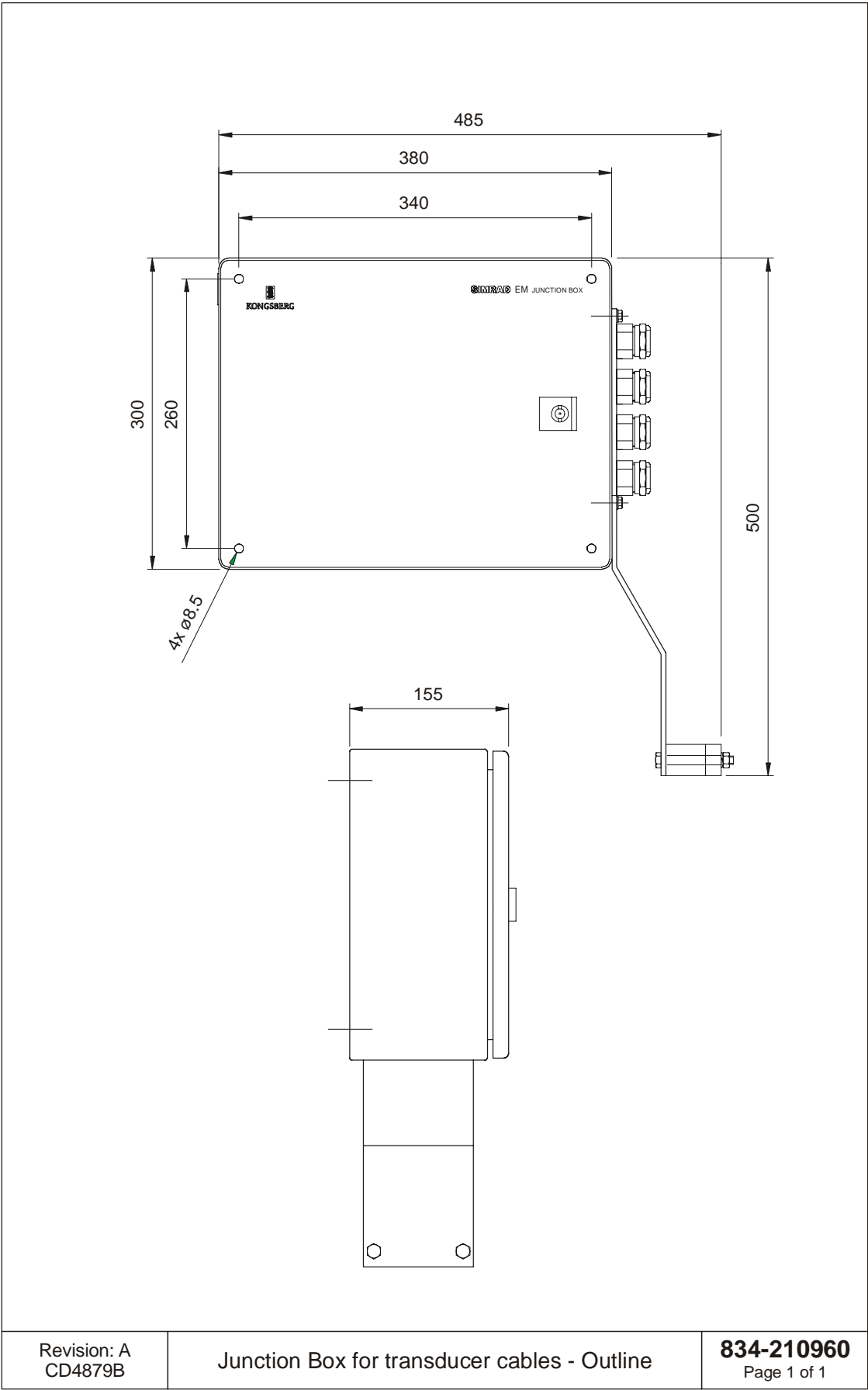


Revision: E
CD4874

Hull Unit cabling

122-108794
Page 3 of 3



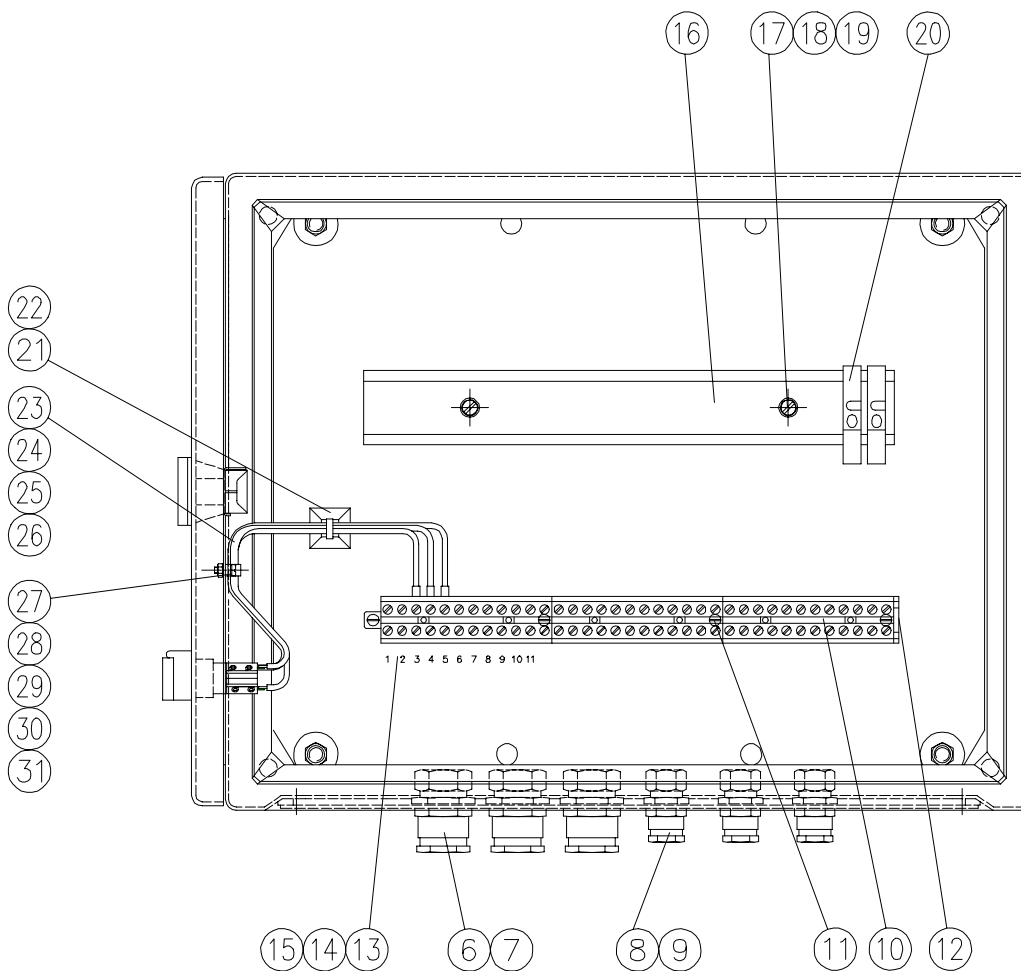


Revision: A
CD4879B

Junction Box for transducer cables - Outline

834-210960
Page 1 of 1

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



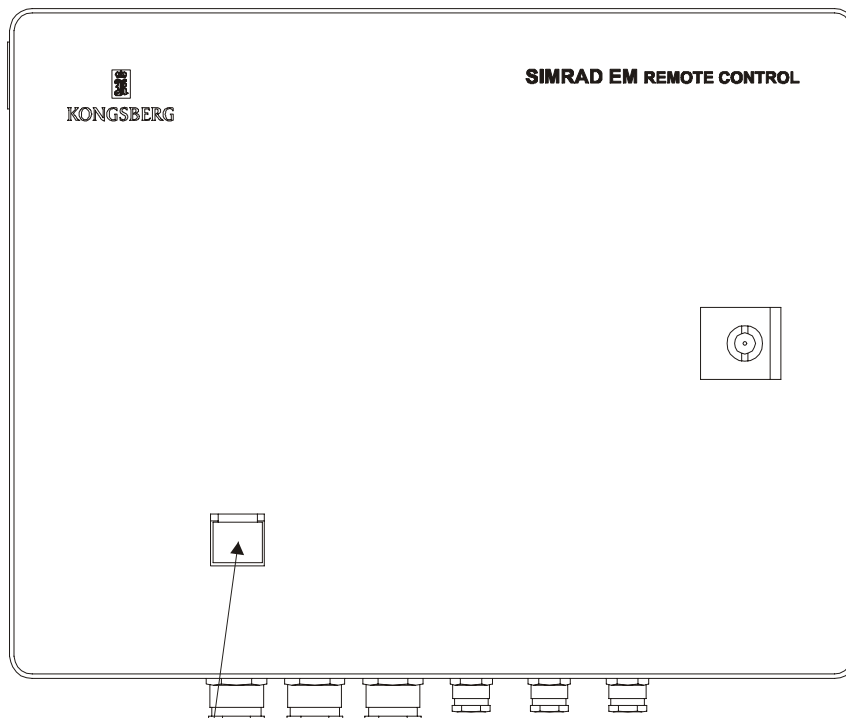
Junction Box em1-212595 (108-212591)

Revision: A
CD4886A/PDF

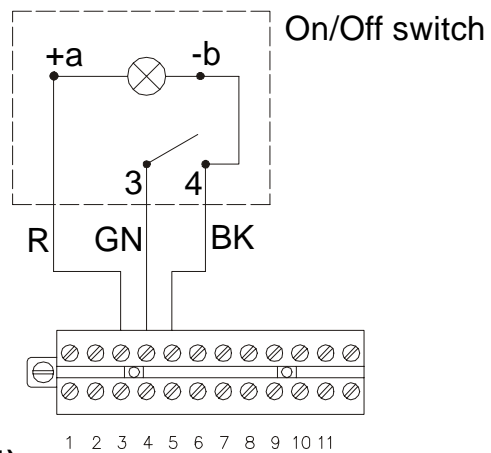
Junction Box, assembly

860-212592
Page 1 of 2

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



Switch



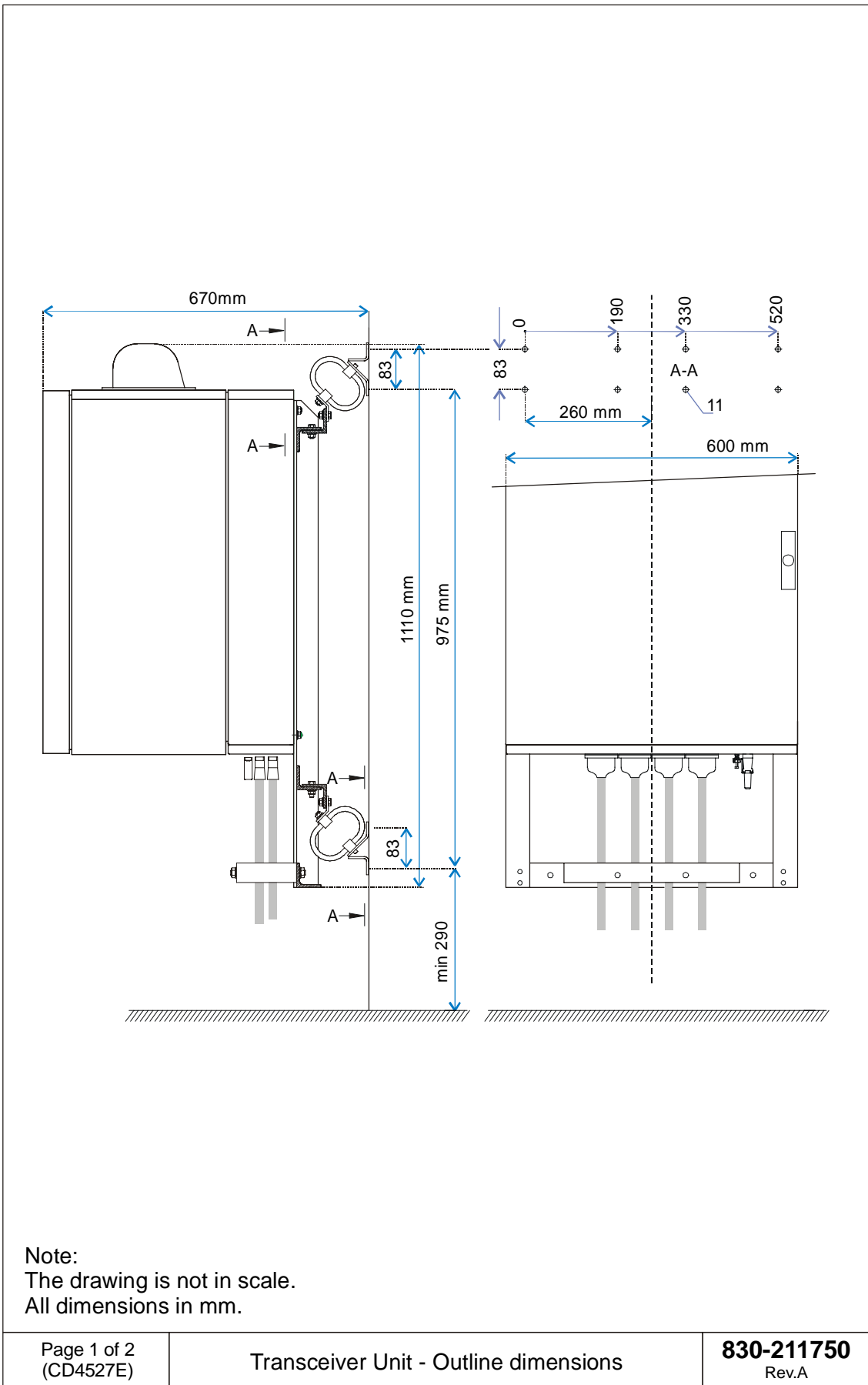
On/Off switch

Junction Box em1-212595 (108-212591)

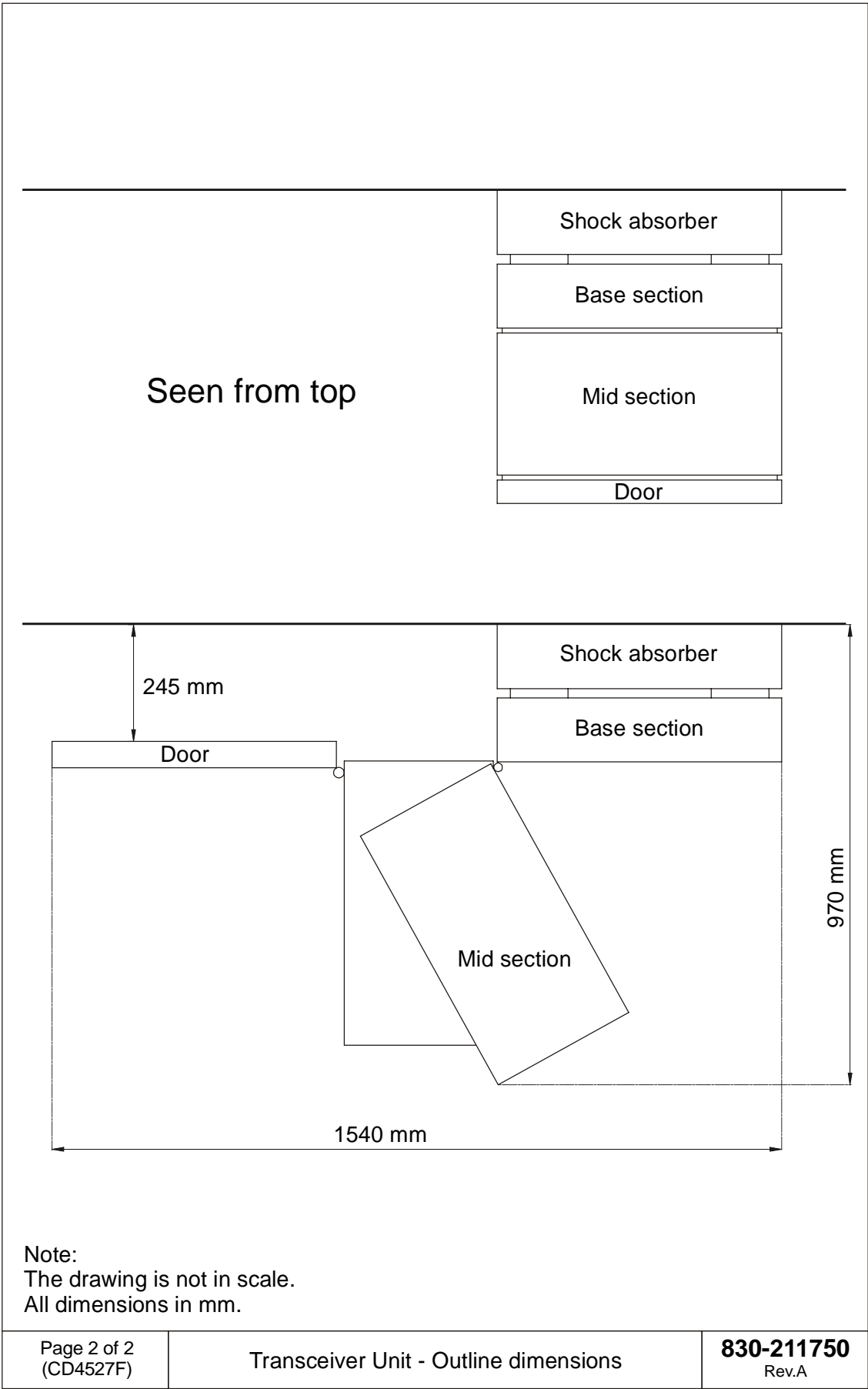
CD4886B
Page 2 of 2

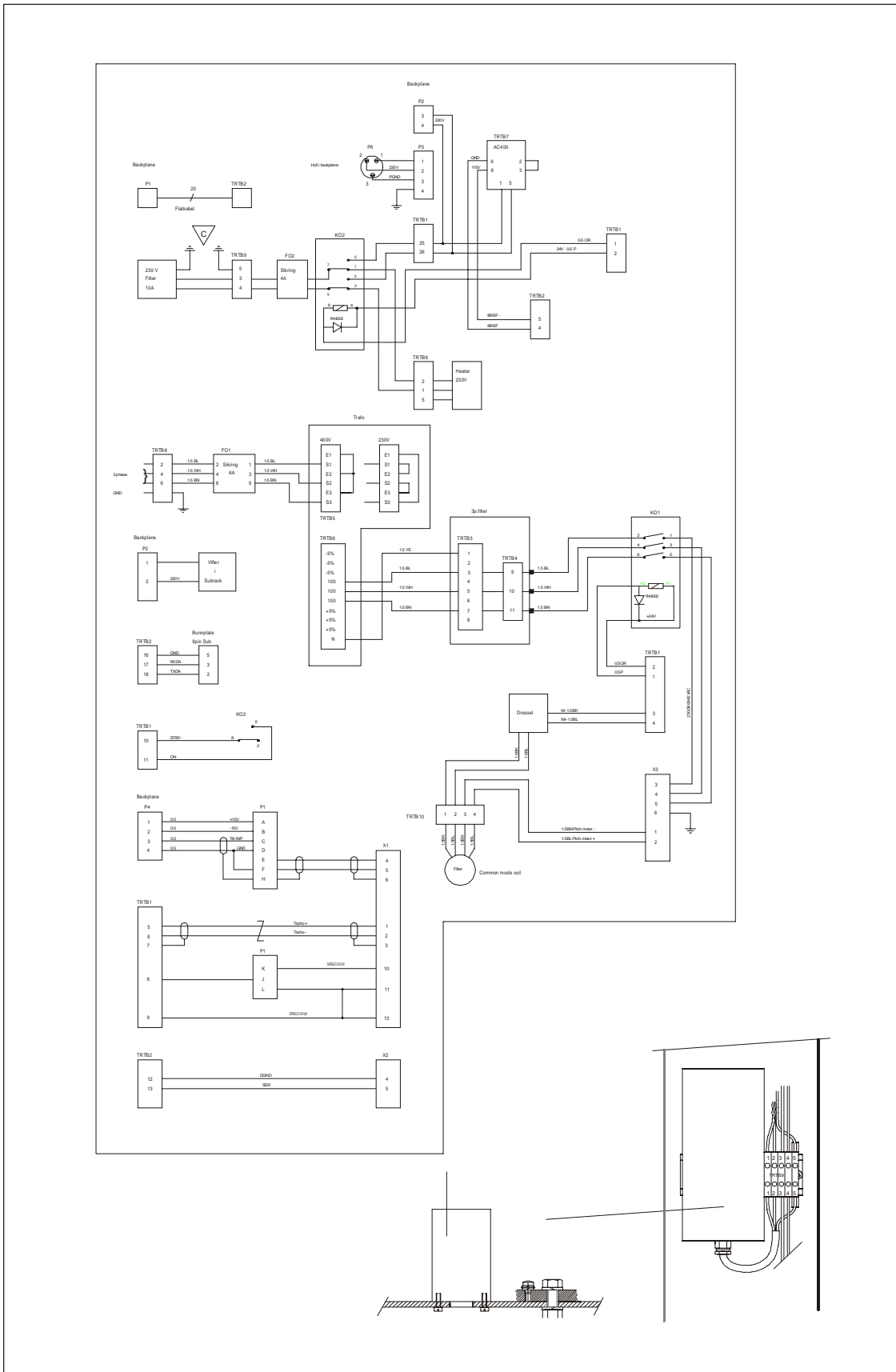
Junction Box, assembly

860-212592
Rev B



Note:
 The drawing is not in scale.
 All dimensions in mm.

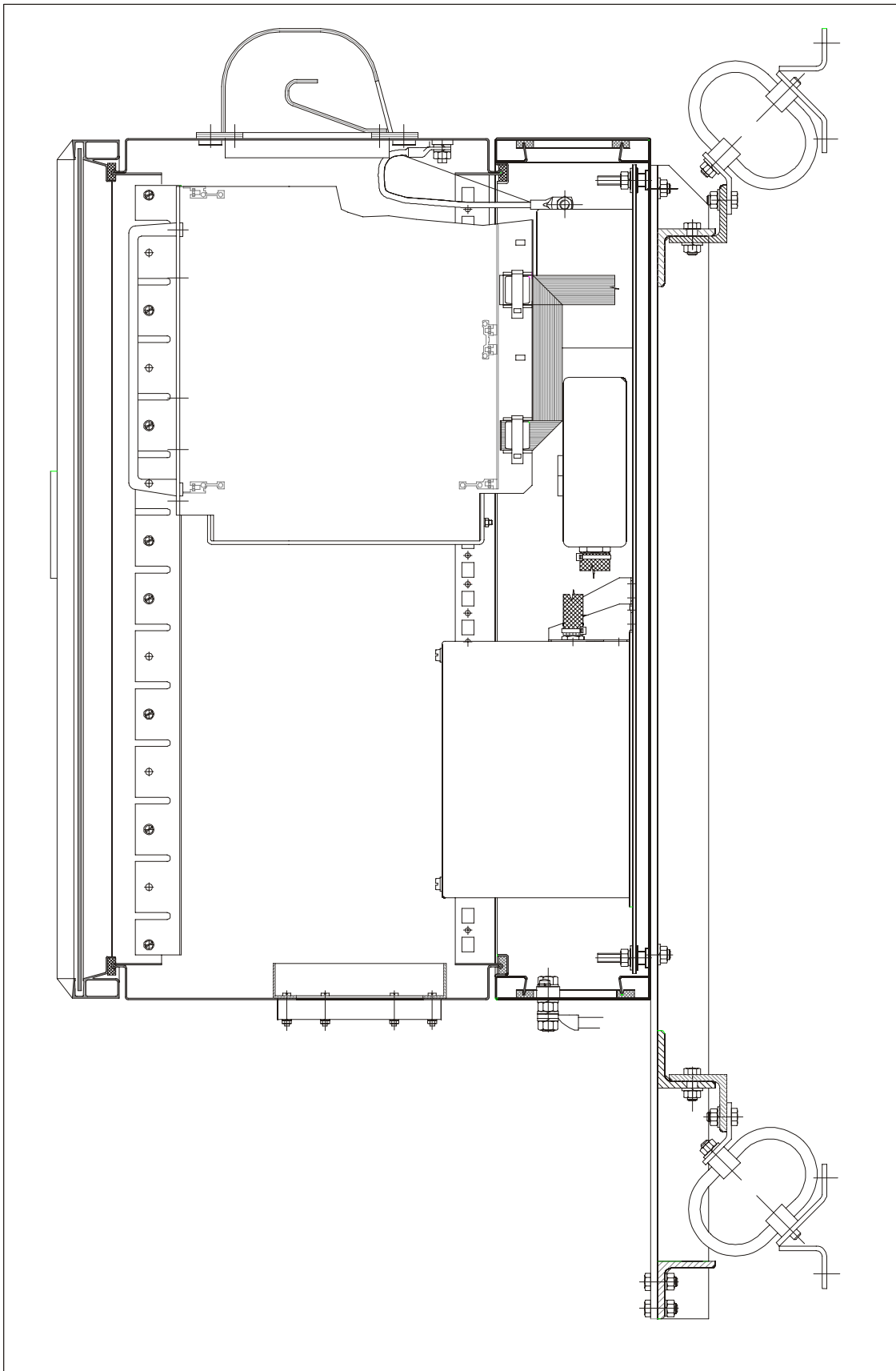




Revision: C
Cd6703

EM 1002 w / Hull Unit, wired cabinet

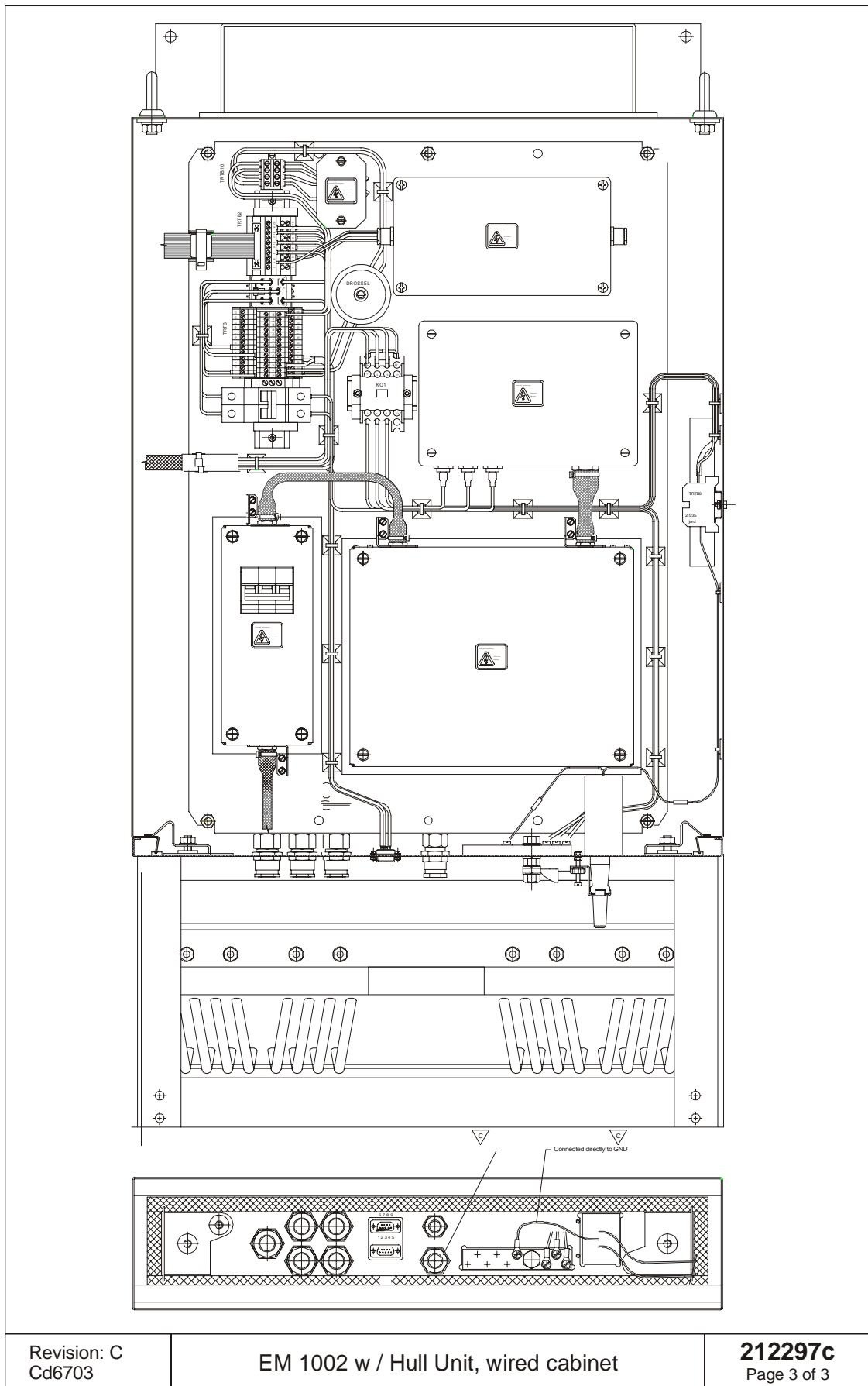
212297c
Page 1 of 3



Revision: C
Cd6703

EM 1002 w / Hull Unit, wired cabinet

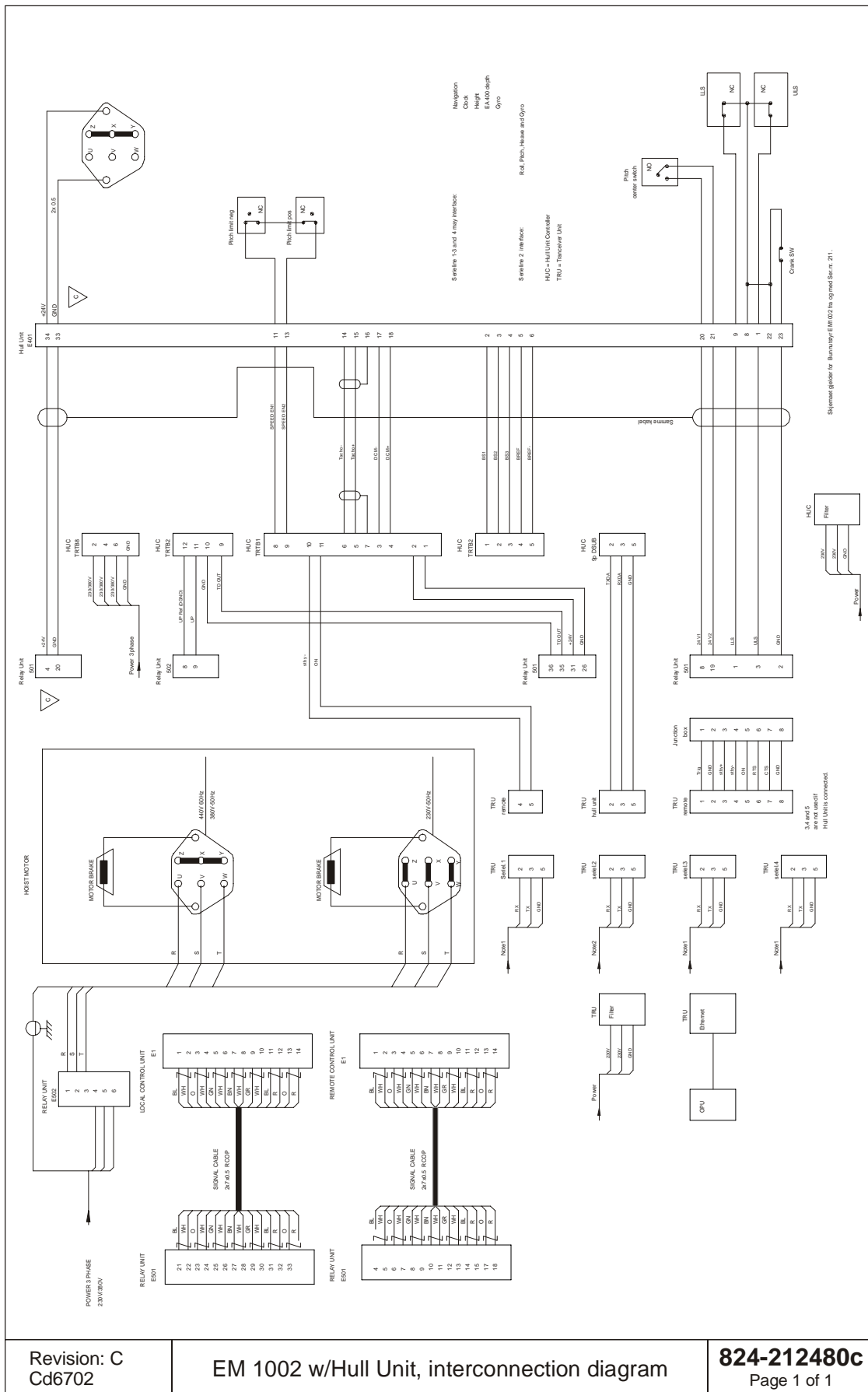
212297c
Page 2 of 3



Revision: C
Cd6703

EM 1002 w / Hull Unit, wired cabinet

212297c
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Maintenance manual Complete version

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