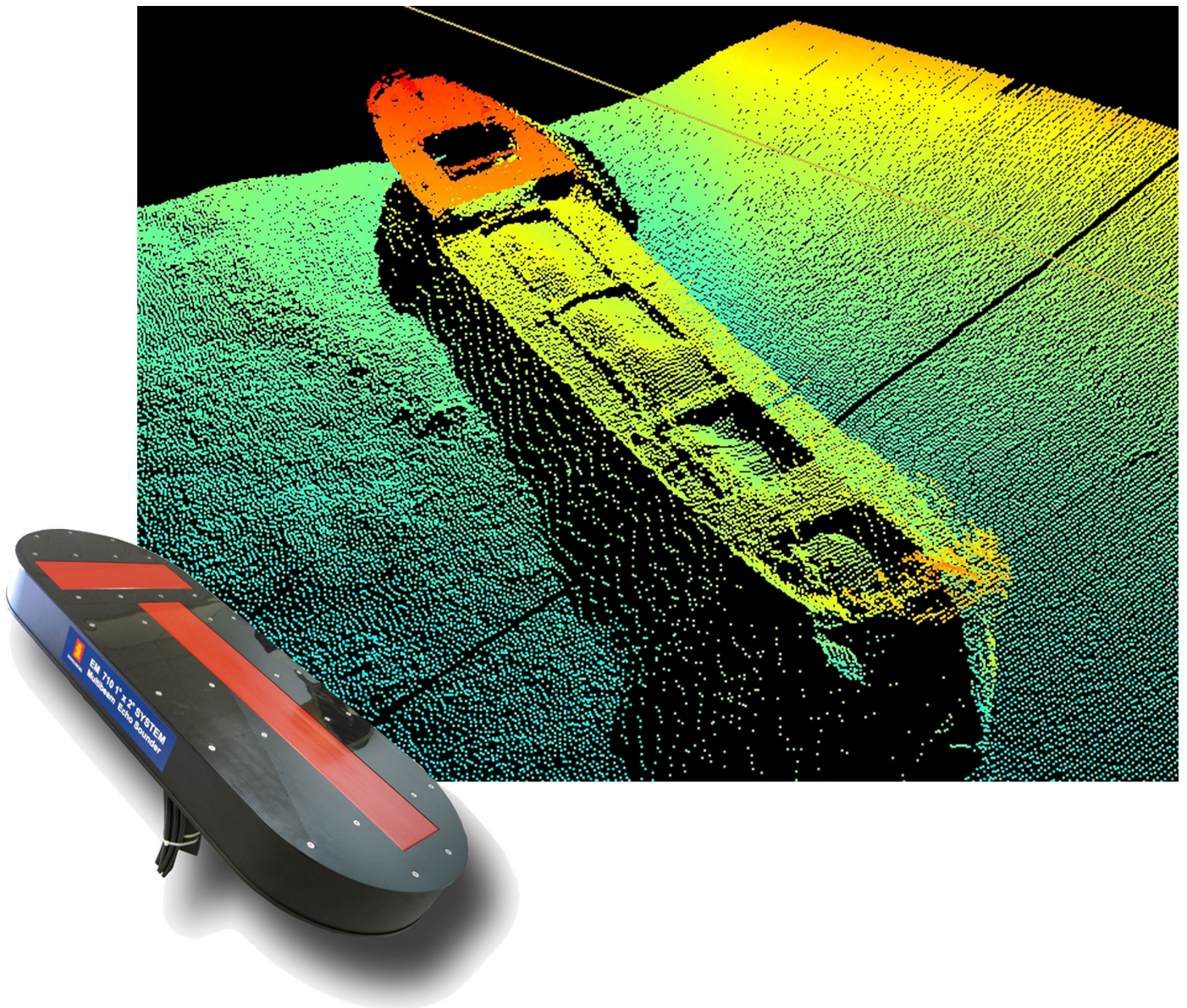# Maintenance Manual

EM 710
Multibeam echo sounder

Kongsberg EM 710
Multibeam echo sounder

Maintenance manual

Kongsberg Maritime

Document history

Note

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

Comments

To assist us in making improvements to the product and to this manual, we welcome comments and constructive criticism.
e-mail: km.documentation@kongsberg.com

Table of contents

1 ABOUT THIS MANUAL

1.1 General

This is the maintenance manual for the EM 710 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. The manual will also list the unique boards in the different system delivered.

1.2 Maintenance philosophy

Kongsberg Maritime defines three levels for maintenance.

1 **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.

2 **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.

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

Note

This manual is prepared for the intermediate level.

1.3 System overview

Key facts

The EM 710 multibeam echo sounder is a high to very high resolution seabed mapping system capable of meeting all relevant survey standards. The system configuration can be tailored to the user requirements, allowing for choice of beamwidths as well as transmission modes. The minimum acquisition depth is from less than 3 m below its transducers, and the maximum acquisition depth is up to 2000 m.

Acrosstrack coverage (swath width) is up to 5.5 times water depth to a maximum of more than 2000 m. The sounding density is very high, allowing even the very demanding LINZ special order survey specification for object detection to be met in full.

There are three basic versions of the EM 710:

• EM 710 - Full performance version.

• EM 710S - CW pulse forms only.

• EM 710RD - Short CW pulse only.

The reduced performance versions EM 710S and EM 710RD are upgradable to full performance.

Innovative acoustic principles

The EM 710 operates at sonar frequencies in the 70 to 100 kHz range. The transmit fan is divided into three sectors to maximize range capability but also to suppress interference from multiples of strong bottom echoes. The sectors are transmitted sequentially within each ping, and uses distinct frequencies or waveforms.

Both CW pulses of different lengths and even longer, compressible waveforms (chirps) are utilized. The alongtrack beamwidth depends upon the chosen transducer configuration with 0.5, 1 and 2 degrees available as standard. Focusing is applied individually to each transmit sector to retain the angular resolution inside the near field. A ping rate of up to 25 per second is possible. The transmit fan is electronically stabilized for roll, pitch and yaw.

The EM 710 has a receive beamwidth of either 1 or 2 degrees depending on the chosen receive transducer. The number of beams is 256 or 128 respectively, with dynamic focusing employed in the near field.

A high density beam processing mode provides up to 400 or 200 soundings per swath by using a limited range window for the detections, which in practice is equivalent to synthetically sharpening the beamwidth.

The system will be able to generate two separate alongtrack swaths per ping. The system produces up to 800 (with 1 degree receive transducer) soundings per ping in this mode.

The beamspacing may be set to be either equiangular or equidistant. The receive beams are electronically roll stabilized. This can be used to increase the resolution beyond what is achievable in normal operation. In high density mode, the size of each acoustic footprint is reduced to fit the higher sounding density. The coverage may be limited by the operator either in angle or in swath width without reducing the number of beams. A combination of phase and amplitude bottom detection algorithm is used, in order to provide soundings with the best possible accuracy.

Acoustical seabed imaging

Integrated seabed acoustical imaging capability is included as standard. Software to use this data for automatic seabed classification is available.

Water column display

A real time display window for water column backscatter is available. Logging of water column data and of raw stave data (before beamforming) is a system option.

Choice of operator software

The EM 710 is delivered as a complete stand-alone seabed mapping system. The Operator Station, a high-performance PC work station, includes the necessary operator controls for setting up and running the system, data logging and system testing. The Seafloor Information System (SIS) by Kongsberg Maritime also includes an extensive set of graphical displays for data quality control, as well as system calibration and other tools which are required. SIS supports on-line real-time data cleaning to improve the overall survey efficiency.

Post-processing software for the EM 710 is available from both Kongsberg Maritime and third-party suppliers.

System drawing

Figure 1   EM 710 system units and interfaces

Operator Station

Interfaces (serial and Ethernet):
Sound Speed probe
Tide
Single beam echo sounder depths

Remote Control
(Optional)

Transceiver Unit

Serial interfaces:
Positioning systems
Attitude (roll, pitch and heave)
Heading
Clock
Velocity

Special interfaces:
Trigger input/output
Clock synchronization

Supply voltage:
115 or 230 Vac 50/60 Hz

2 or 4   5, 10 or 20

Receive transducer array

Transmit transducer array

(Cd021601-002)

System configuration with desktop operator station, transceiver unit and transducer arrays.

1.4 System characteristics

Main units

The basic EM 710 multibeam echo sounder consists four units

- Transmit Transducer
- Receive Transducer
- Transceiver Unit
- Operator Station

A complete mapping system will in addition include a vessel motion sensor, heading sensor, sound velocity sensor(s) and a positioning system.

Transducers

The EM 710 transducers are fully water tight units intended for many years of trouble-free operation in rough seas. The transmit and receive transducers both have a width of 224 mm and a height of 118 mm. Their length depends upon the chosen beamwidth, either 970 mm for a 1 degree unit or 490 mm for a 2 degrees unit. The weights are respectively 35 and 18 kg (excluding cables).

The weight of a 0.5º x 1º system are 70 and 18 kg (excluding cables).

The transducers have a maximum depth rating of 250 m.

A transmit beamwidth of 0.5 degree is achieved by mounting two 970 mm transmit transducers together alongship. Such a beamwidth reduction is not possible with the receive transducer.

The transducers are supplied as standard with 15 m long underwater cables terminated with a surface connector directly pluggable into the Transceiver Unit. On special order underwater connectors or longer cables may be supplied. Five, ten or twenty cables are used on the transmit transducer, two or four on the receive transducer, in accordance with the transducer length.

Transceiver Unit

The EM 710 Transceiver Unit contains all transmit and receive electronics, and the Processing Unit which performs the beamforming, bottom detection, and motion and sound speed corrections. It contains all interfaces for time-critical external sensors such as vessel attitude (roll, pitch, heading and heave), vessel position and external clock. More than one sensor of each type may be connected simultaneously, with one in use but all logged.

The Transceiver Unit comprises two 19" sub-racks contained in a cabinet designed for bulkhead or deck mounting.

For the 2° x 2° system, the TRU are compressed in one 19" sub-rack.

The number of circuit boards will depend upon the chosen transducer configuration. Twisted pair Ethernet is used for data communication with the Operator Station.

Operator Station

The Operator Station of the EM 710 is the HWS high performance dual-processor PC workstation. The operator software is the Seafloor Information System (SIS). The HWS dual bootable to either Linux® or Windows XP®.

SIS, as a minimum, allows setting the EM 710 installation and runtime parameters, data logging and running self-test on the system without restrictions.

The SIS software also includes functionality for survey planning, 2D and 3D geographical display of the survey results, seabed image and water column displays, plus real-time data cleaning algorithms.

Alternatively, third-party software solutions can be used for the operator interface and real-time processing.

The HWS is normally supplied with a 19" industrialized LCD monitor with a resolution of 1280 x 1024 pixels. Support for a second monitor is included. A spill-proof US keyboard and a standard optical mouse is normally supplied, but optionally a small IP 65 rated keyboard with integrated track stick can be delivered.

1.5 Optional

For an optional dual system a maximum swath width of 10 x water depth in shallow water can be achieved. (200 degrees, 3000 m) In deeper water a maximum of 3 x water depth.

A dual system will generate twice as many beams/sounding. 512/800 per ping for a 0.5° and 1° system and 256/400 per ping for a 2° system.

1.6 General safety rules

The system operates on 115 and/or 230 Vac, 50/60 Hz with a switch in the Transceiver Unit.

WARNING

This voltage can be lethal.

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

- Always switch off all power before installation or maintenance. Use the main circuit breaker, and label the breaker with a warning sign that informs others that maintenance or installation work is being carried out on the system.

- Read and understand the first aid instructions for electric shock.

- For safety reasons during troubleshooting on the equipment with power ON, two persons should always be present.

- Whenever maintenance is carried out, it is essential that a first aid kit is available, and that the maintenance personnel are familiar with the first aid instructions for electrical shock.

- The various parts of the system are heavy. Make sure that the appropriate tools and certified lifting equipment are available, and that the personnel are trained in installation and maintenance work.

2 TECHNICAL SPECIFICATIONS

Note _____

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

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Topics

2.1 Interfaces

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

- Serial lines with operator adjustable baud rate, parity, data length and stop bit length for:
  - Motion sensor (roll, pitch, heave and optionally heading) in format supported by sensors from the main suppliers like Applanix , iXSEA, Coda, Kongsberg Maritime
  - Heading NMEA 0183 HDT, SKR82/LR60 or EM attitude format or Sperry Mk39 format
  - Positions in either Simrad 90, NMEA 0183 GGA or GGK format
  - External clock in NMEA 0183 ZDA format / Trimble UTC
  - Sound speed at transducer
  - Sea level height (tide)
  - Single beam echo sounder depths
  - Output of depth straight down in NMEA 0183 DPT format
- Interface for 1PPS (pulse per second) clock synchronisation signal
- SATA and Firewire interface for external data storage devices
- USB 2.0 interfaces for data storage, printing or plotting
- Parallel interface for Postscript colour graphics printer/plotter
- Ethernet interface for velocity input needed for Doppler compensation in chirp mode.
- Gigabit and Megabit Ethernet interface for input of sound speed profile, tide and echo sounder depths, and output of all data normally logged to disk.

2.2 Physical specifications

Transducer – 2 degrees

- **Length:** 490 mm
- **Width:** 224 mm
- **Height:** 118 mm
- **Weight:** 18 kg (nominal without cables)

Transducer – 1 degree

- **Length:** 970 mm
- **Width:** 224 mm
- **Height:** 118 mm
- **Weight:** 35 kg (nominal without cables)

Transducer – 0.5 degree (two 1 degree modules)

- **Length:** 1940 mm
- **Width:** 224 mm
- **Height:** 118 mm
- **Weight:** 70 kg (nominal without cables and mounting frame)

Transceiver Unit (version for bulkhead mounting)

- **Height:** 841 mm
- **Width:** 540 mm
- **Depth:** 750 mm (nominal including shock absorbers)
- **Weight:**
    - 106 kg (2 by 2 degrees)
    - 111 kg (1 by 2 degrees)
    - 116 kg (1 by 1 degree)
    - 127 kg (0.5 by 1 degree)

Note

A smaller Transceiver Unit is normally used for the 2 by 2 degrees model. See below

Transceiver Unit – 2 x 2 degree system (version for bulkhead mounting)

- **Height:** 573 mm
- **Width:** 540 mm
- **Depth:** 750 mm (nominal including shock absorbers)
- **Weight:** 83 kg

Operator Station

- **Height:** 127 mm
- **Width:** 427 mm (excluding rack fixing brackets)
- **Depth:** 480 mm (excluding handles and connectors)
- **Weight:** Approximately 20 kg

19" inch LCD monitor

- **Height:** 444 mm (excluding mounting brackets)
- **Width:** 483 mm (excluding mounting brackets)
- **Depth:** 68 mm (excluding mounting brackets)
- **Weight:** 12 kg (approximately with bracket)

2.3 Power requirements

Operational voltage and frequency

- AC voltage: 115 (60 Hz) or 230 (50 Hz) Vac

  Voltage ± 10%

  Frequency ± 5%

Acceptable transients

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

Transceiver Unit

- 0.5° x 1°: < 800W
- 1° x 1°: < 600W
- 1° x 2°: < 500W
- 2° x 2°: < 400W
- The single phase supply must be protected with 16A (230 Vac supply) slow-blow fuses.
- **Operator Station:** < 250 W
- **LCD monitor:** < 60 W (max)
- **Remote Control:** None

Note ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

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

Power interrupts

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

2.4 Environmental and EMC specifications

The system meets all requirements of the IACS E10 specification.

The Transceiver Unit meet the additional stronger requirements of the IEC 60945 specification.

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

Environment

- Operating temperature, sonar room: −5 to 50º C for TRU and TD
- Operating temperature, operating room: +5 to 50º C for HWS
- Storage temperature: −30 to +70º C
- Humidity: 95% RH at 55°C , non-condensing

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

Note ────────────────────────────────

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

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Vibration

- 5 – 150 Hz, 1.23g rms

  2 hours duration

Shock

- Cabinets w/shock absorbers: 15g half period sine pulse
- Duration: 11 ms

2.5 System performance data

- **Frequency range:** 70 to 100 kHz
- **Maximum ping rate:** 30 Hz

- **Number of beams and soundings for each ping:**
  - 1 x 2 and 2 x 2 degrees: 128 beams with 200 soundings in High Density mode per swath
  - 0.5 x 1 and 1 x 1 degree: 256 beams with 400 soundings in High Density mode per swath
  - With Dual swath the number of beams and soundings are doubled
- **Beamwidths:** 0.5 x 1,1 x 2, 1 x 2 or 2 x 2 degrees
- **Beam spacing:** Equidistant, Equiangle, High Density
- **Coverage sector:** Up to 140 degrees
- **Transmit beam steering:** Stabilized for roll, pitch and yaw
- **Receive beam steering:** Stabilized for roll
- **Depth range from transducers**: 3 to approximately 2.000 metres
- **Depth resolution:** 1 cm
- **Pulse lengths:** 0.15, 0.5 and 2 ms CW and up to 120 ms FM
- **Range sampling rate:** 14 kHz (5 cm) at data output

3 CABLE LAYOUT

Note

For more detailed information about this chapter – see our installation manual for EM 710

Topics

- *System cabling* on page 20
- *Operator Station cables* on page 21
- *Transceiver Unit cables* on page 22
- *Transducer cables* on page 29
- *Cable specifications* on page 32

The standard cables used between the EM 710 system units and between the units and their external devices are shown here. For larger installations where the EM 710 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.

Contact information:

DNV

Corporate Headquarters

Veritasveien 1

1322 Høvik Norway

http://www.dnv.com

3.1 System cabling

Cable layout

The interconnection cables are identified on the cable plan drawings. The following pages give a brief description of each cable. In the Drawing file, each cable is identified with the appropriate terminations and required specifications.

Shipyard and system cables

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

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

Shipyard cables

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

For each cable, the following information is provided:

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

The appropriate 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 hardware.

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

3.2 Operator Station cables

The illustration and the list below specifies each cable used on the EM 710 Operator Station. References are made to detailed cable drawings in the EM 710 installation manual.

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

Figure 2   Operator Station cables
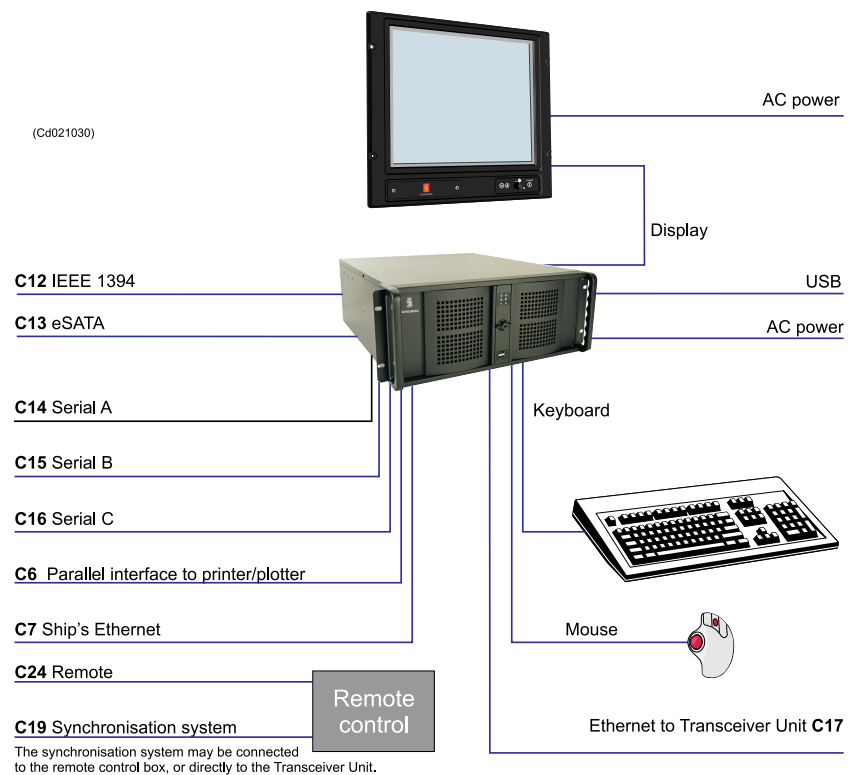
3.3 Transceiver Unit cables

The illustrations and the cable lists below specify each cable used on the EM 710 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 3   Transceiver Unit - overview of interfaces
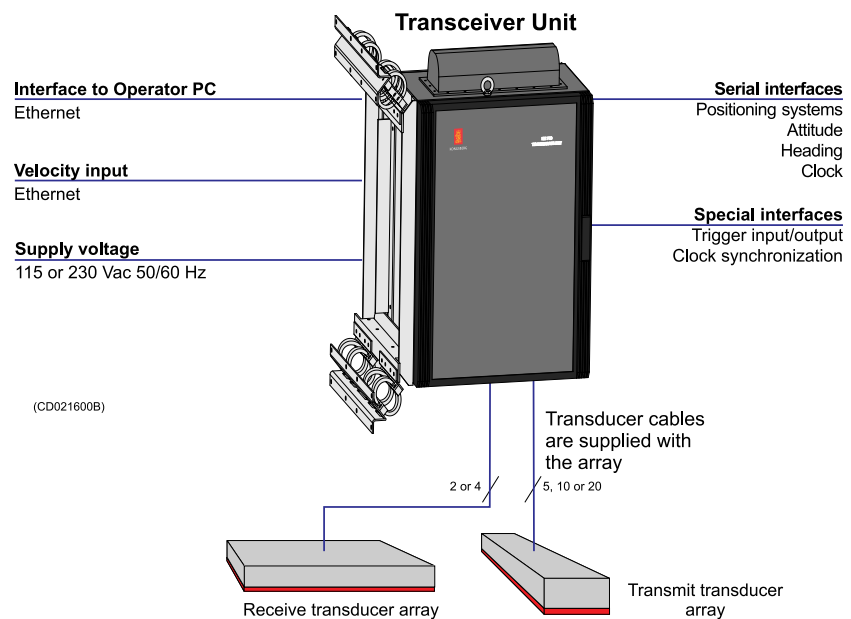
Internal cabling made at the factory:

1   Front side:

- Ethernet cables that connects the different plug in boards.

2   Rear side:

- One control signal cable between sub-racks

- AC power cables between the sub-racks

3.3.1 Transceiver Unit – front view

Figure 4   0.5 x 1 degree

(CD021610A)
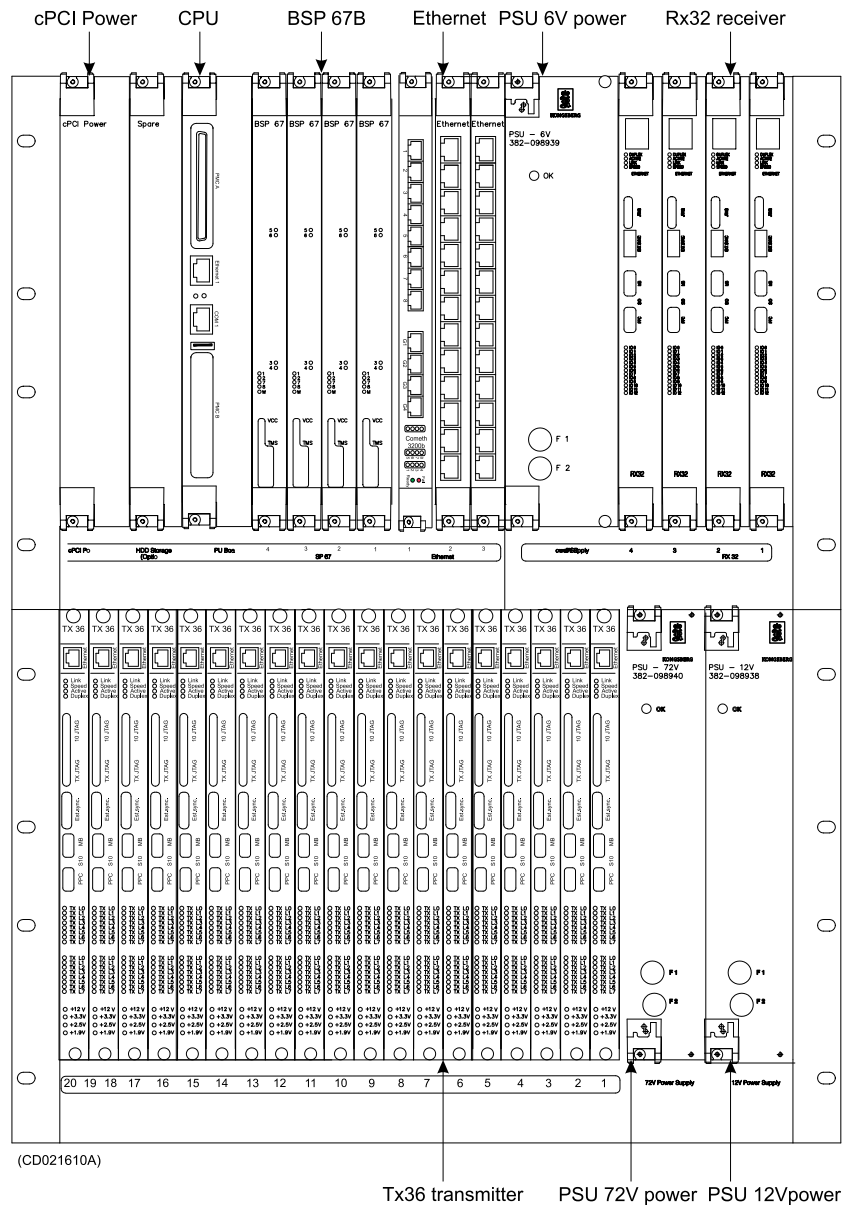
3.3.2 Transceiver Unit – rear view

Figure 5   0.5 x 1 degree
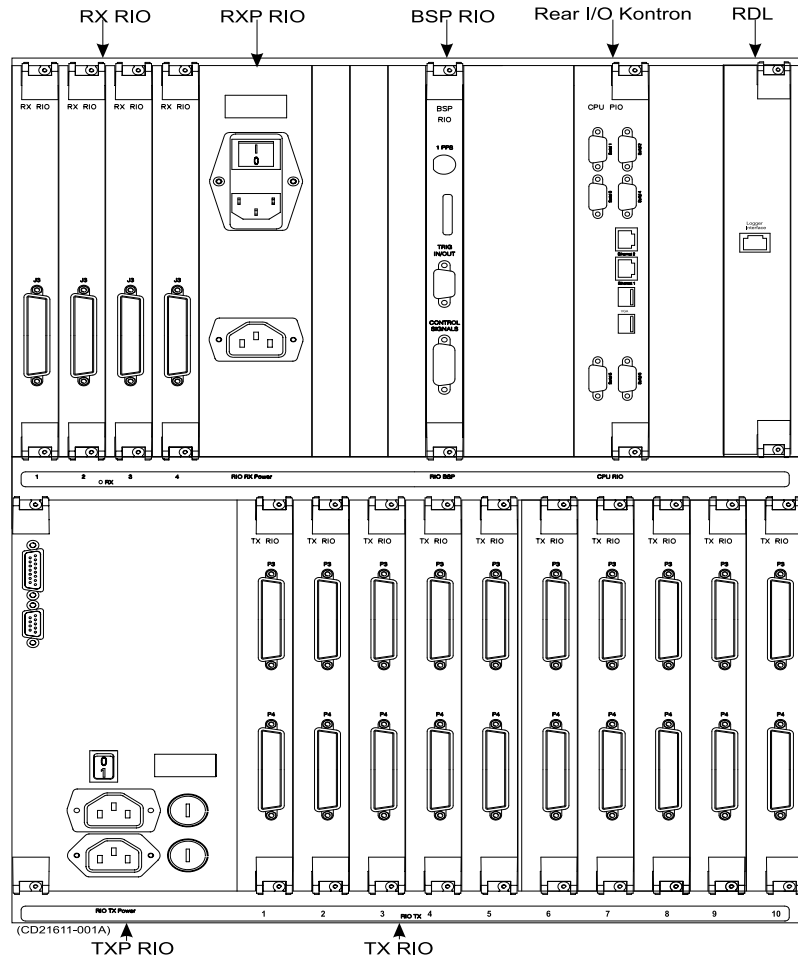
3.3.3 TRU compact – 2 x 2 degree system

Note _____

All cards used in 2 x 2 degree system are the same as shown in 0.5 x 1 degree system.

_____

Figure 6   Transceiver Unit front view – 2 x 2 degree
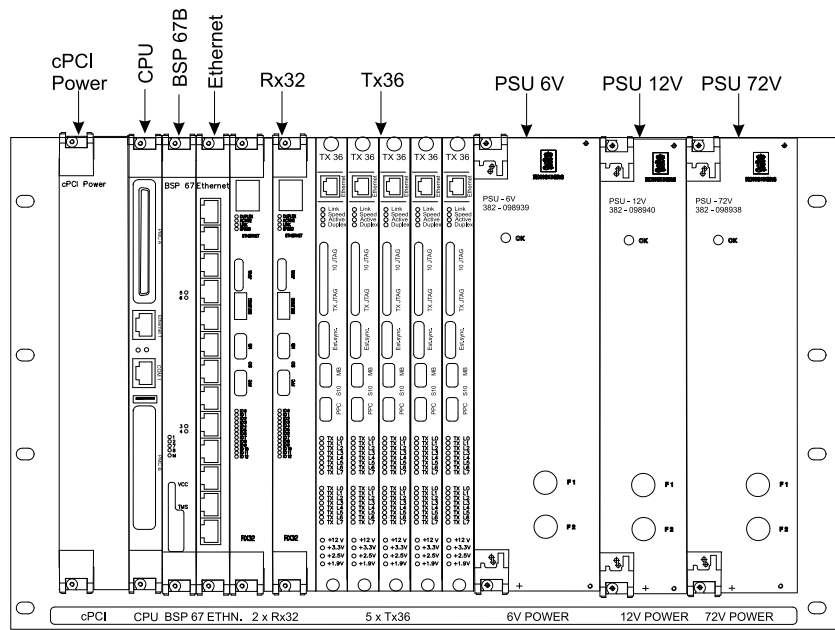
(cd021661-001)

Figure 7   Transceiver Unit rear view – 2 x 2 degree
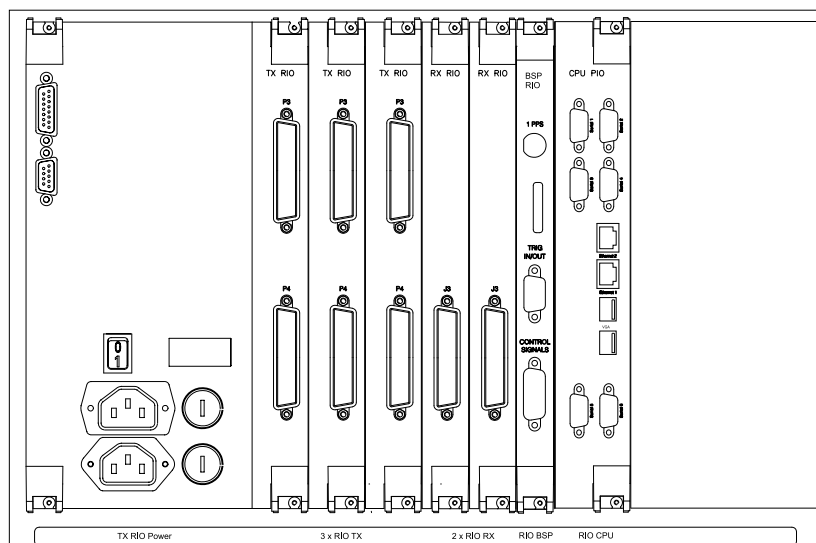
(CD021661-002)

Figure 8   Cable configuration for 2 x 2 degrees system
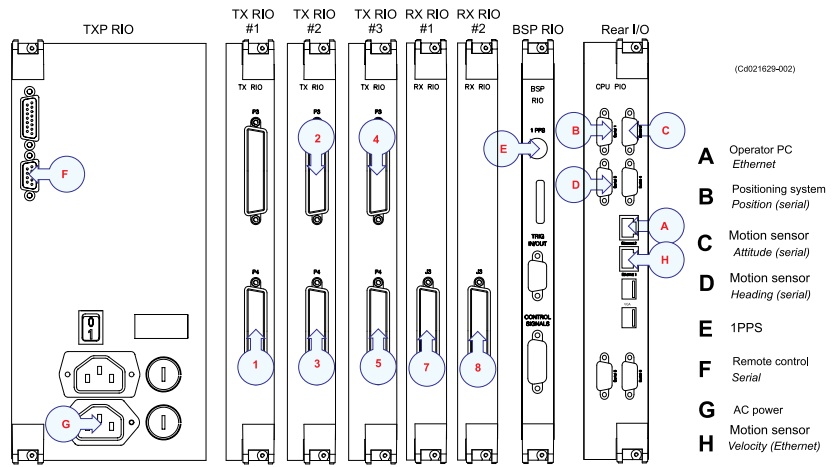
- **1 - 5** – Connection between TRU and TX array
- **7 - 8** – Connection between TRU and RX array

3.3.4 Transceiver Unit – Cable configuration

This chapter presents a standard cable configuration for a complete EM 710 echo sounder system. The following illustrations describe a 0.5 x 1 degrees model, but note that the actual cable layout will be different for every system, depending on the EM 710 model, the number of external sensors and other interfacing systems.

Figure 9   0.5 x 1 degree system cabling between TRU and other system units and external systems
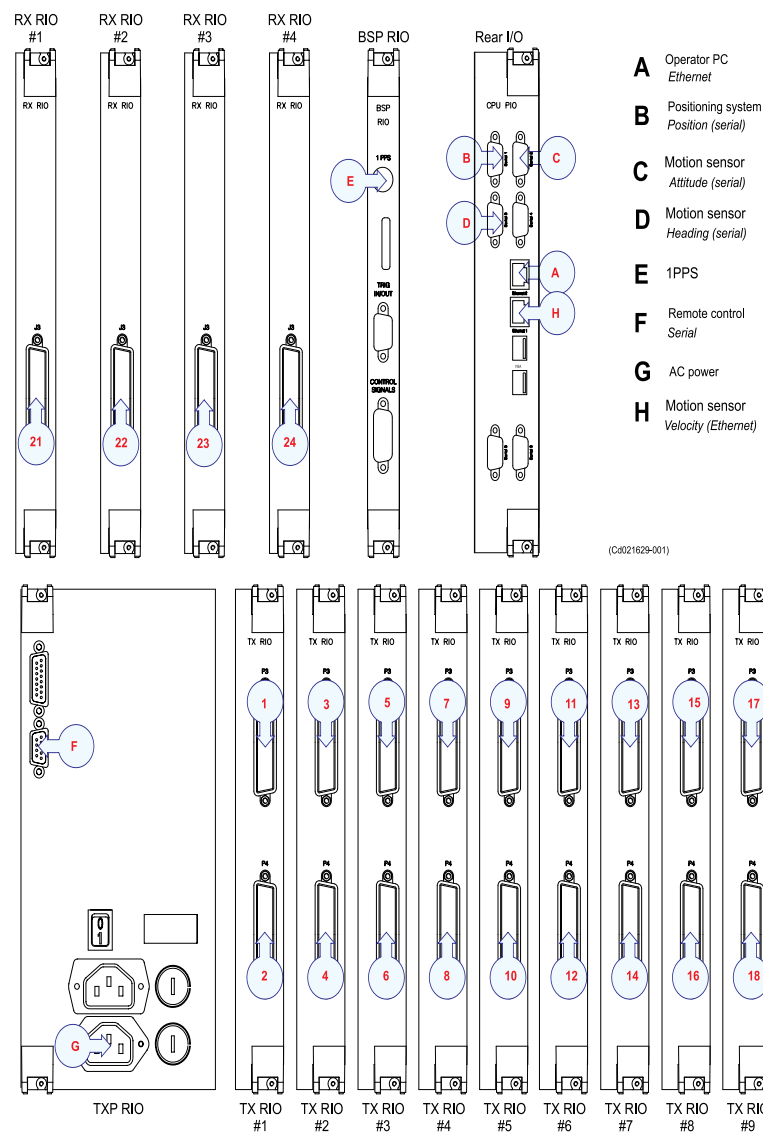
- **1 - 20** – Connection between TRU and TX array
- **21 - 24** – Connection between TRU and RX array

Figure 10   Internal cabling in the Transceiver Unit (power and control cables)
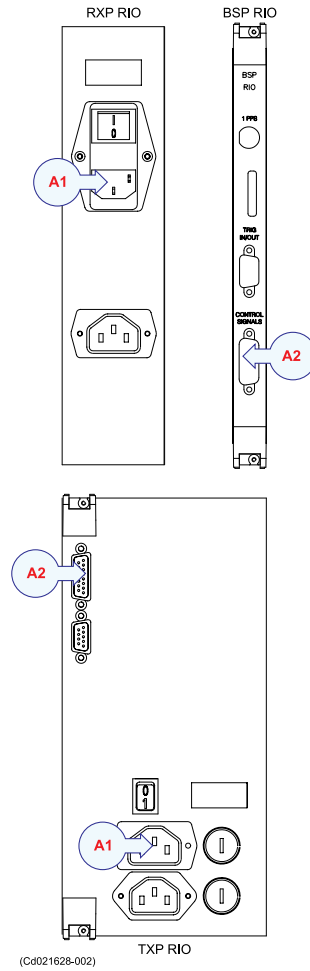
- **A1** – Connection between RXP RIO and TXP RIO (AC power)
- **A2** – Connection between BSP RIO and TXP RIO (control signals)

3.4 Transducer cables

The transducer cables between the transducer arrays and the Transceiver Unit are all supplied by Kongsberg Maritime with the EM 710 system. The physical number of cables depends on the chosen system beamwidth as shown the following tables.

System beamwidth (TX x RX)	Number and type of TX transducer modules	Number and type of RX transducer modules
	Number of cables from TX transducer array to Transceiver Unit	Number of cables from RX transducer array to Transceiver Unit
0.5 x 1 degree	2 x TX1	1 x RX1
	20	4
1 x 1 degree	1 x TX1	1 x RX1
	10	4
1 x 2 degrees	1 x TX1	1 x RX2
	10	2
2 x 2 degrees	1 x TX2	1 x RX2
	5	2

The following cable information is available both in the EM 710 installation and maintenance manuals. The cable markings are normally recorded in the installation manual first, and it is recommended to copy these records to the maintenance manual later.

Note that performance data about each element and it's serial number are recorded in the Factory Acceptance Test documentation provided with each system.

3.4.1 Transmit array cable markings

The TX transducer module(s) and its cable is identified as follows:

TX1<m>/<n> or TX2<m>/<n> where <m> is the cable number (a number between 1 and 10) and <nnn> is the module's serial number (a numerical value).

The transducer cables are moulded to the TX array, but connect in the other end to the Transceiver Unit (TRU) with 76–pin D-sub connectors.

During the installation of the TX array, you <u>must</u> fill in the cable identification table(s) below.

For a 0.5 x 1 degree system, you will need all cables listed in the tables. With a 1 x 1 or 1 x 2 degrees system, you only need the first 10, while the 2 x 2 degrees system only requires the first 5 cables.

The 0.5 x 1 degree system consists of two TX modules. It is essential to connect all 20 TX cables successively to the TX RIO boards in the Transceiver Unit. Where to start is determined by the physical orientation of the transducer cable outlet (port or starboard). Both options are shown in the figure below.

Figure 11   Connection of TX transducer cables, 0.5 x 1 degree system
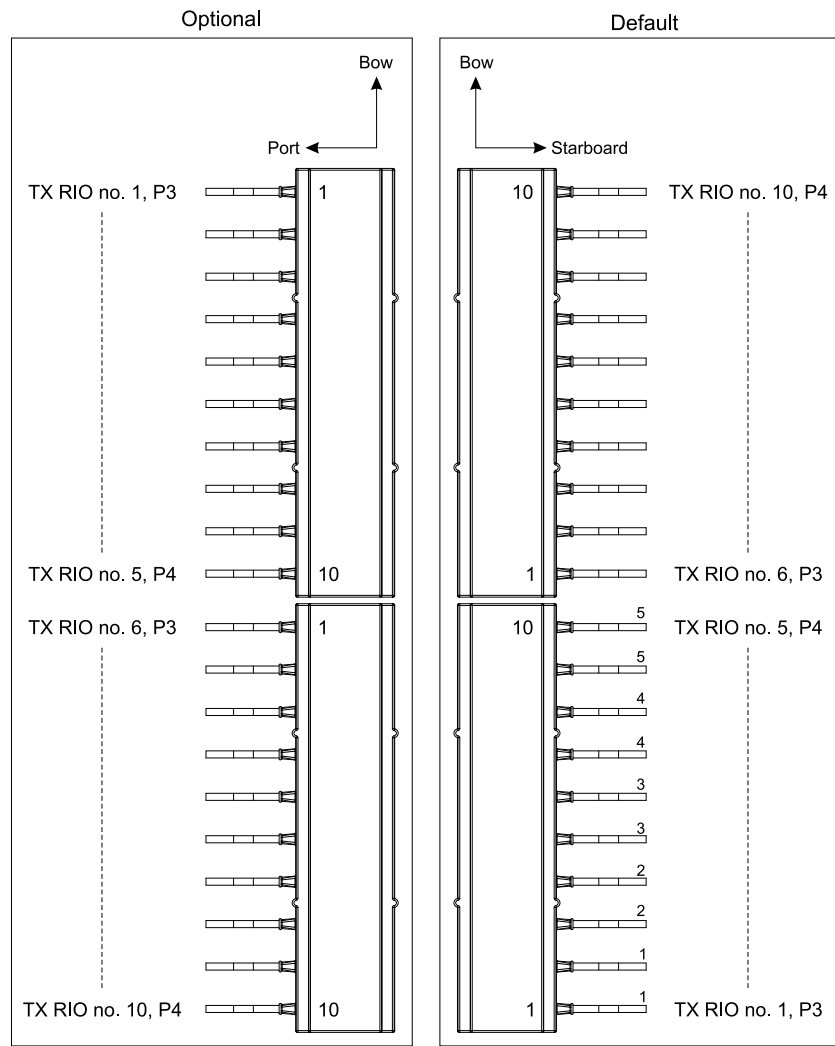
(CD021627B)

Table 1   Connection of TX transducer cables

TX array identification		TRU identification	
Cable no.	Serial no.	TX RIO no.	Socket no.
1		1	P3
2		1	P4
3		2	P3
4		2	P4
5		3	P3
6		3	P4
7		4	P3
8		4	P4
9		5	P3
10		5	P4

Table 2   Connection of TX transducer cables

TX array identification (second 0.5 degree array)		TRU identification	
Cable no.	Serial no.	TX RIO no.	Socket no.
1		6	P3
2		6	P4
3		7	P3
4		7	P4
5		8	P3
6		8	P4
7		9	P3
8		9	P4
9		10	P3
10		10	P4

Table 3   Connection of TX transducer cables with TRU compact – 2 x 2 degree system

TX array identification		TRU identification	
Cable no.	Serial no.	TX RIO no.	Socket no.
			P3
1		1	P4
2		2	P3
3		2	P4
4		3	P3
5		3	P4

3.4.2 Receive array cable markings

The RX transducer module(s) and its cable is identified as follows:

RX1<m>/<n> or **RX2<m>/<n>** where <m> is the cable number (a number between 1 and 10) and <nnn> is the module's serial number (a numerical value).

The transducer cables are moulded to the RX array, but connect in the other end to the Transceiver Unit (TRU) with 76–pin D-sub connectors.

Note

During the installation of the RX array, you <u>must</u> fill in the cable identification table below.

In a 0.5 x 1 or 1 x 1 degree system, you will need all cables listed in the table, With a 1 x 2 or 2 x 2 degrees system, you only need the first 2 cables.

RX array identification		TRU identification
Cable no.	**Serial no.**	**RX RIO no.**
1		1
2		2
3		3
4		4

3.5 Cable specifications

The Drawing file chapter provides detailed information about the cables used in 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 performance degradation or damage caused to system, vessel or personnel if the cables used during installation do not meet these specifications.

4 OPERATOR STATION

The HWS Hydrographic Work Station is the operator station normally used with the EM 710 Multibeam echo sounder.

This is a basically a PC work station, but it has been specially designed for rugged maritime use, and it is prepared for mounting in a standard 19" rack. In the rack it will require four rack height units. The HWS is by default supplied with at 19" industrial LCD monitor, a keyboard and an optical mouse. The display monitor can be mounted in a 19" rack, however a bracket for table, bulkhead or roof mounting is provided.

Figure 12   HWS Hydrographic Work Station

All components making up the HWS Hydrographic Work Station are standard commercial computer parts.

4.1 HWS overview

The primary task of the HWS Hydrographic Work Station is to safeguard the collected data and to visualize it for quality control. The computer is equipped to handle the heavy processing requirements and the high speed, large volume data storage demands of hydrographic systems. It has been specifically designed as the optimal platform for running the Seafloor Information System (SIS) real-time operating software used on the Kongsberg Maritime EM multibeam echo sounders.

The special features of SIS include real-time:

- Gridding of sounding data
- Filtering of sounding data
- 3-D visualization of sounding data
- Storage and visualization of high resolution backscatter data from the seabed and the water column

The partitioned system disk is by default provided with two operating systems; Linux and Microsoft Windows XP®. During the computer's boot sequence up you can decide which operating system to use. The Seafloor Information System (SIS) software is factory installed and tested on both operating systems.

4.2 Technical description

The primary task of the HWS Hydrographic Work Station is to safeguard the collected data. All data are thus initially stored on a pair of high performance SATA disks. These disks are run in a RAID1 configuration, thus ensuring against loss of data even if one disk should fail. They are mounted in "hot swappable" enclosures, so that the collected data may be transported on the disk.

A DVD recorder is the standard means for permanent archiving of the collected data.

If you wish to use other storage devices or media, the HWS provides USB 2.0, Firewire (IEEE 1394) and SCSI interfaces. Gigabit Ethernet interface is available for transfer of the data to another network computer. For temporary storage data may also be backed up to the system drive.

4.3 HWS circuit boards and modules

The HWS Hydrographic Work Station comprises commercial circuit boards and modules.

5 TRANSCEIVER UNIT

The EM 710 Transceiver Unit contains all transmit and receive electronics. It comprises one or two 19" sub-racks contained in a cabinet designed for bulkhead or deck mounting.

1   The upper **Receiver rack** holds the receiver boards, circuit boards for processing, beam forming and communication and two power supplies

    •   The lower **Transmitter rack** holds the transmitter boards and two power supplies

2   For a 2° x 2° system there is two ways to compose this system:

    One as described above or one using a single 19" sub-rack containing both **Receiver** and **Transmitter** system units.

Both sub-racks are equipped with high efficiency fans. The filtered air inlet is at the bottom of the Transceiver Unit, and the outlet is at the top.

The Transceiver Unit is mounted on shock and vibration dampers. This chapter provides the following information:

5.1 Theory of operation

Overview

This chapter presents a functional description of the EM 710 Transceiver Unit.

Simplified block diagram

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

- Processing
- Transmission
- Reception

The commands and parameters from the SIS operator station are sent via the Ethernet connection to the Control processor (CPU) in the TRU.

The CPU contains a DiskOnModule where the software is stored. New releases of the software can be downloaded from the Operator Station.

For control of the transmitters the commands and parameters are interpreted and passed on through an Ethernet interface to the transmitter boards (TX36). The control processor at each TX36 board uses the received parameters to calculate the individual steering of each transmitter. The boards have power amplifiers used for the analog output signals. These signals are sent via the rear I/O module (TX RIO) and a junction box to the TX array. The high voltage is made by a high voltage power supply. A capacitor bank on the TX RIO boards is used to store the energy needed for the TX pulses.

The RX array is connected directly to the TRU rear I/O modules (RX RIO).

The CPU downloads parameters through an Ethernet interface to the receiver boards (RX32). The RX32 processors control the data acquisition. The stave data are amplified, digitized and bandpass filtered. The stave data are then passed to the BSP 67B board via the backplane.

The BSP 67B boards perform band the pass filtering needed for the different TX sectors, and the beam forming of all the receiver beams. The beam data are transferred to the CPU board via the cPCI bus.

The CPU board performs the bottom detection and produces the output datagrams. It also reads the sensor data (time, position, attitude etc.) input from the RS-232 serial lines. The serial lines are connected via the rear I/O board and a serial PMC module mounted on the CPU board. The velocity data is read via a separate Ethernet line. The sound speed profile and the sound

speed at transducer depth are received from the operator station. The CPU puts a timestamp on all datagrams. The datagrams are sent via Ethernet to the operator station.

An Ethernet output is available for raw hydrophone data. A raw data logger can be connected to this output.

Figure 13   Transceiver Unit – simplified block diagram
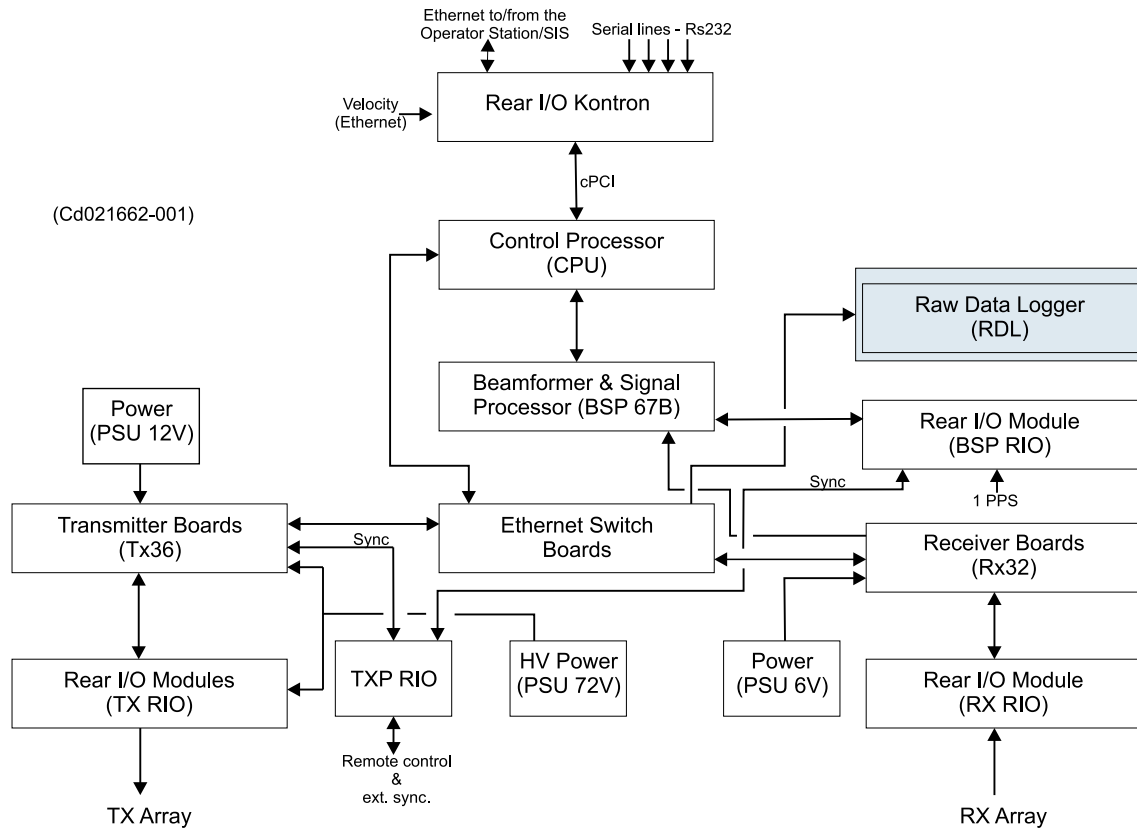
5.1.1 External synchronisation and remote on/off

The RS 232 serial line type RTS and CTS signals are used for external synchronisation. In addition a trig out signal is issued by the TRU.

The signals are available on the plug marked remote on the TXP RIO.

Table 4

Signal	Levels	Function	TRU remote plug
CTS (TRU input)	H=high= +3 to +15 V L=low = -3 to -15 V	H: Ping command to TRU L: Wait	Pin 8
RTS (TRU output)	H=high= +3 to +15 V L=low = -3 to -15 V	H: TRU is ready for a new ping L: TRU is busy	Pin 7
CTS/RTS gnd			Pin 6
Trig out (TRU output)	TTL Level	H: TX is off L: TX is active	Pin 1
Trig gnd			Pin 2

For cable details, see *Remote control and external trig* on page 129

Figure 14   Typical sequence
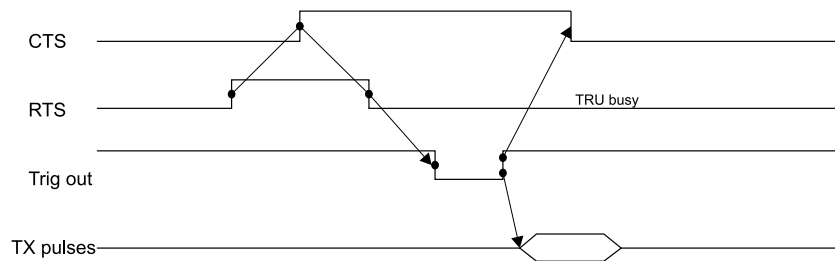
(cd021101-005)

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 CTS must be high for minimum 100 microseconds. The TRU will then change RTS to L (busy), issue a Trig out signal (will be low for 1 millisecond) to indicate the start of the transmit pulses, and then transmit the TX pulses. After the Trig out is received, the external device should turn CTS back to L. When the receive 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 a 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.

Remote on/off

The TRU on/off function can be remotely controlled. The TRU is turned on by connecting pin 4 and 5 in the TRU remote plug together.

Trigger in/out (not used) on page 127

5.1.2 Clock sync 1 PPS

The 1 PPS (on pulse per second) signal is connected to the coax connector on the BSP RIO board. The BSP RIO is equipped with an optocoupler at this input. The input series resistor is tuned for a TTL signal (Low level<0.6 V, High level>3.2 V). The falling edge of the signal is used by the TRU to synchronize the internal clock. The 1 PPS signal must be minimum 1 microsecond long.

5.2 Receiver rack (large TRU)

The Receiver rack is the upper sub-rack of the Transceiver Unit.
It holds several circuit boards and power supplies. All the units
are accessed either from the front or the rear of the rack.

The Receiver rack contains an 84 HP backplane allowing circuit
boards and modules to be inserted from both sides. Two different
sizes of 6U boards are used (depths 160 and 220 mm). All circuit
boards are supported by guide rails. The rack also contains two
high efficiency fan units.

Figure 15   Receiver rack front view – 0.5 x 1 degree
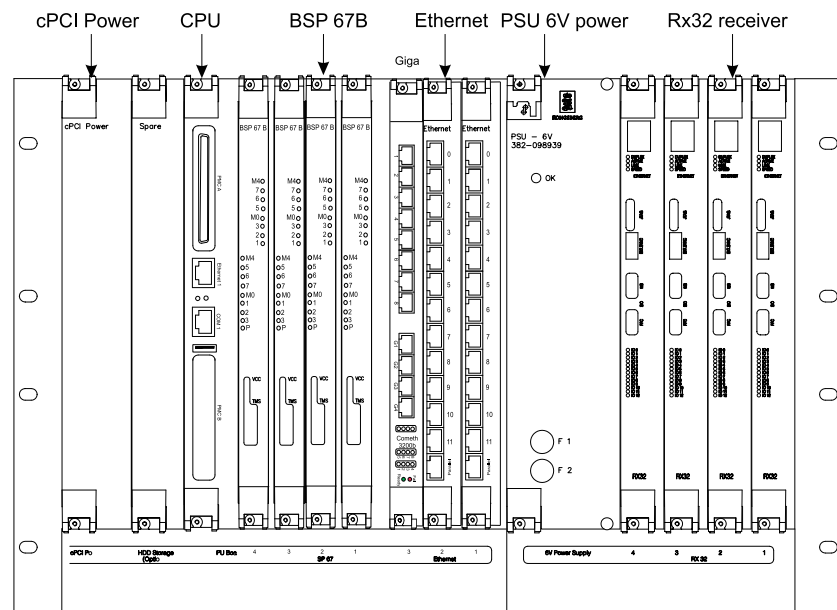
(cd021610-001)

The Receiver rack holds the following <u>front</u> mounted circuit
boards and modules (from left) :

- cPCI Power Supply
- CPU Board
- BSP 67B Boards
- Ethernet Switch Boards
- Power Supply PSU 6V
- RX32 Receiver Boards

Figure 16   Receiver rack rear view – 0.5 x 1 degree
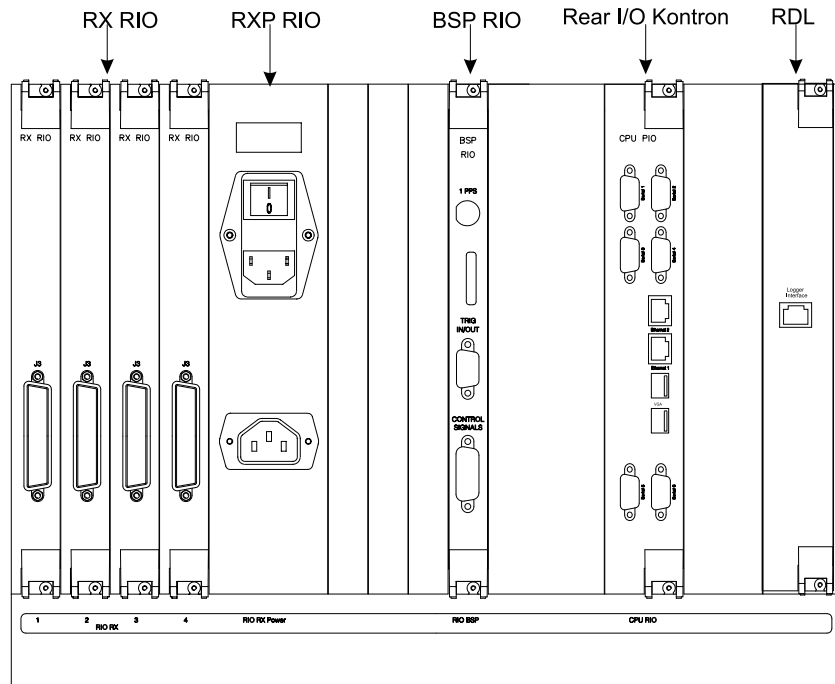
The following circuit boards and modules are rear mounted (from left) :

* RX RIO Rear Interface Boards

* RXP RIO Rear Interface Module

* BSP RIO Rear Interface Board

* Rear I/O Interface Board

* RDL

The illustrations above display the typical circuit board configuration for a 0.5 x 1 degree system. The number of boards used in the Transceiver Unit is different for each EM 710 model. For the Receiver rack, this is indicated by the table below.

Table 5   RX rack

RX rack	No. of items			
Circuit boards	0.5 x 1	1 x 1	1 x 2	2 x 2
cPCI Power Supply	1	1	1	1
CPU Board	1	1	1	1
BSP 67B Board	4	4	2	2
Ethernet Switch Board Giga	1	1	1	0
Ethernet Switch Board Mega	2	1	1	1
Power Supply PSU 6V	1	1	1	1
RX32 Receiver Board	4	4	2	2
RX RIO Rear Interface Board	4	4	2	2

Table 5   RX rack (cont'd.)

RX rack	No. of items			
Circuit boards	**0.5 x 1**	**1 x 1**	**1 x 2**	**2 x 2**
RXP RIO Rear Interface Module	1	1	1	1
BSP RIO Rear Interface Board	1	1	1	1
Rear I/O Interface Board	1	1	1	1
RDL	1	1	1	0

5.3 Transmitter rack

The Transmitter rack is the lower sub-rack of the Transceiver Unit. It holds several circuit boards and power supplies. All the units are accessed either from the front or the rear of the rack.

The Transmitter rack contains an 84 HP backplane allowing circuit boards and modules to be inserted from both sides. The front mounted modules are all 6U deep (220 mm) and the rear modules have a standard depth of 80 mm. All circuit boards are supported by guide rails. The rack also contains a high efficiency fan unit.

*Figure 17   Transmitter rack front view – 0.5 x 1 degree model*

(CD021610-002)

Tx36 transmitter   PSU 72V power   PSU 12Vpower
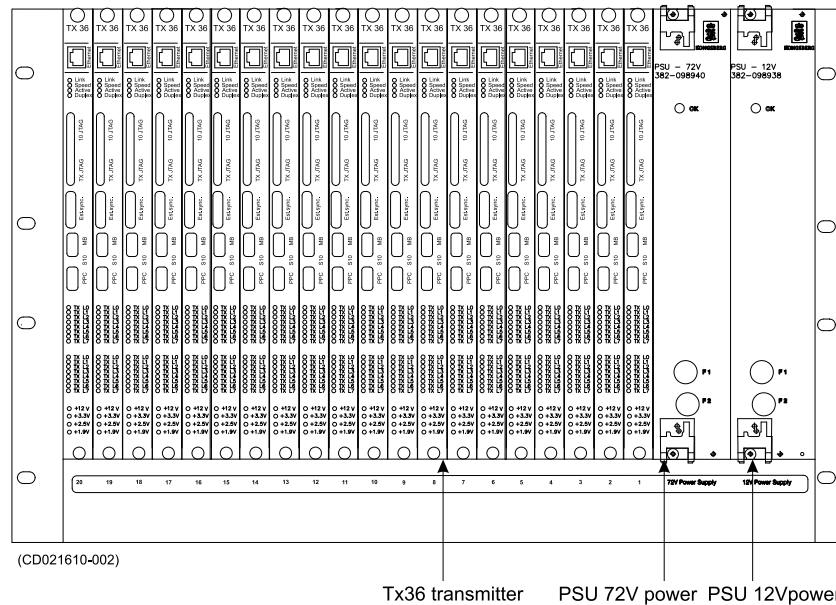
The Transmitter rack holds the following <u>front</u> mounted circuit boards and modules (from left) :

• TX36 Transmitter Board
• Power Supply PSU 72V
• Power Supply PSU 12V

Figure 18   Transmitter rack rear view – 0.5 x 1 degree model

(CD21623b)   TXP RIO   TX RIO
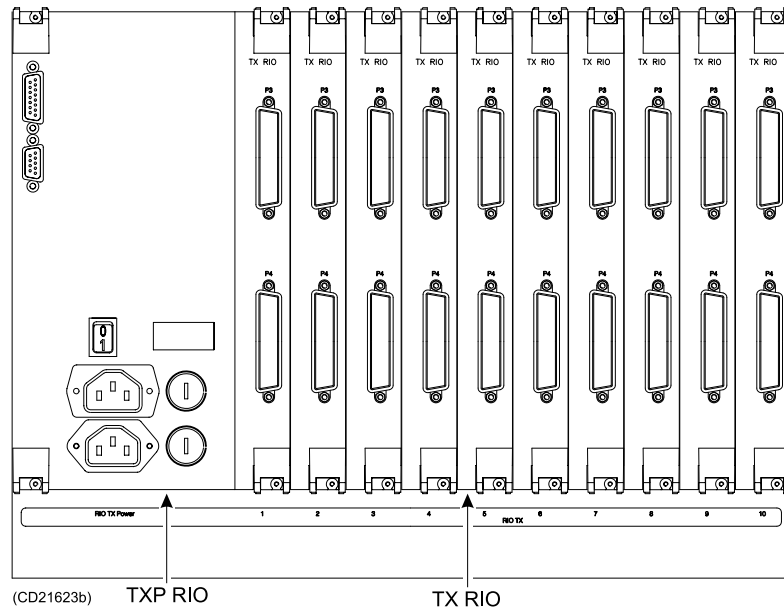
The following circuit boards and modules are rear mounted (from left) :

• TXP RIO Rear Interface Board

• TX RIO Rear Interface Boards

The illustrations above display the typical circuit board configuration for a 0.5 x 1 degree system. The number of boards used in the Transceiver Unit is different for each EM 710 model. For the Receiver rack, this is indicated by the table below.

Table 6   TX rack

TX rack	No. of items			
Circuit boards	0.5 x 1	1 x 1	1 x 2	2 x 2
TX36 Transmitter Board	20	10	10	5
Power Supply PSU 72V	1	1	1	1
Power Supply PSU 12V	1	1	1	1
TXP RIO Rear interface board	1	1	1	1
TX RIO Rear interface board	10	5	5	3

5.4 TRU compact 2 x 2 degree system

This system contains one sub-rack with Processing, Receiver and Transmitter in one. It holds several circuit boards and power supplies. All the units are accessed either from the front or the rear of the rack.

Please note that the Giga ethernet switch board is not in use here.

Figure 19   Transceiver Unit front view – 2 x 2 degree
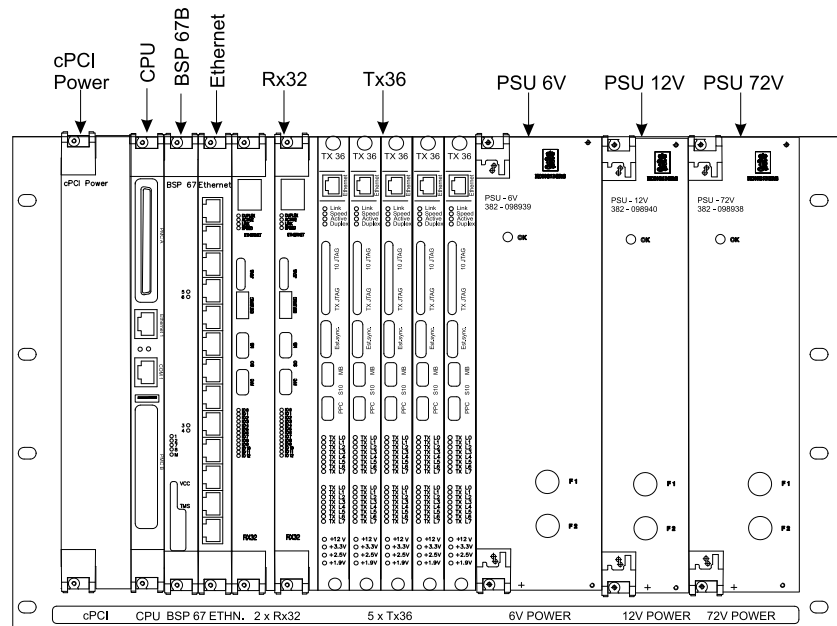
(cd021661-001)

Figure 20   Transceiver Unit rear view – 2 x 2 degree
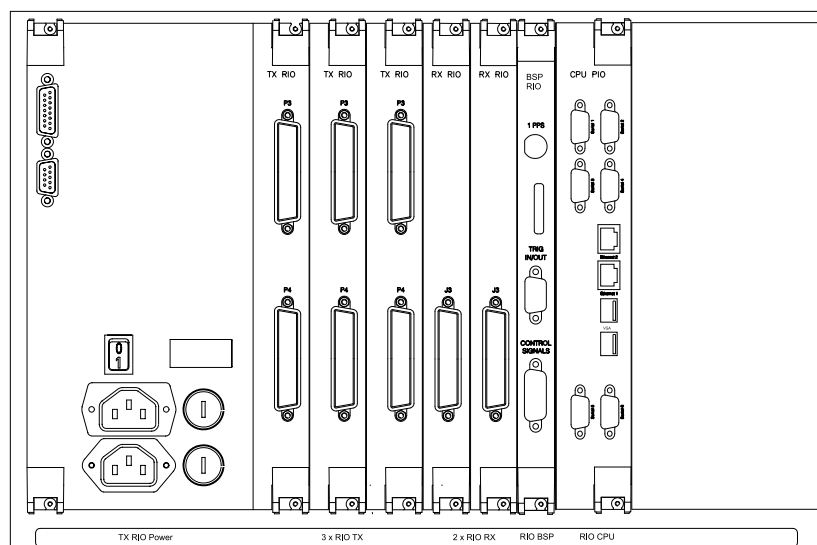
(CD021661-002)

5.5 Circuit board descriptions

In the following all the circuit boards and modules in the EM 710 Transceiver Unit are described. All facilities useful for maintenance personnel are provided.

5.5.1 cPCI Power Supply

Purpose and description

This is a standard 500 W cPCI Power Supply. Its main purpose is to supply DC output to the CPU, BSP 67B, RX32 and Ethernet Switch circuit boards.

Figure 21   Power One

Key features

- PICMG 2.11 compatible
- AC input
- Industry standard
- Power factor corrected
- Active current share
- International safety approvals

Specifications

Input:

- Input voltage: 90 to 264 Vac, 47 to 63 Hz
- Maximum input current: 7.1 A /90 Volt
- Inrush current: 30 A at 120 Vac, 20 A at 240 Vac
- Power factor: 0.95

Output:

- Output voltage and current ratings

Table 7

Output voltage (Vdc)	Maximum output current (A)
3.3	60.0
5.0	50.0
12.0	12.0
-12.0	4.0

- Line regulation: ± 10mV

- Load regulation: ± 10mV

General

- Efficiency: 80% minimum at 110 Vac
- Isolation: Input to ground 500 Vac, input to output 1500 Vac

Facilities

There are two front panel LEDs

LEDs:

- Green: Power good
- Amber: Power fail

External connections

- None.

5.5.2 CPU Board with PMC Module

Purpose and description

The Kontron CP6011 cPCI Single Board Computer is a fully IBM-AT compatible stand-alone PC. It is used by the Transceiver Unit as the Central Processing Unit (CPU). The TPMC866 is a standard single-width 32 bit PMC module. It has eight channels of high performance RS-232 serial ports with front I/O and back I/O. It is mounted on the CPU Board.

Figure 22   CPU Board

cd021929-001
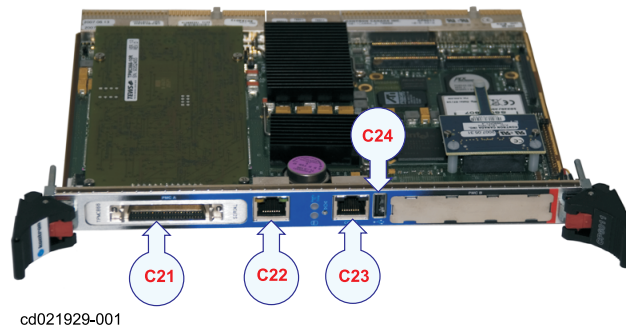
Key features

- Intel® Pentium M processor, 1.8 GHz
- FlashDrive, 512 Mb
- PCI Mezzanine Card (PMC) Interface

Specifications

Input

- Supply voltage : +3.3 Vdc, +5 Vdc, +12 Vdc, -12 Vdc
- Current (max): 6.1 A at 3.3 Vdc, 5.6 A at 5 Vdc, 0.3 A at 12 Vdc, <10 mA at -12

Vdc

- Power consumption: 43 W maximum

Capability

- DRAM: 512 MB SDRAM with ECC. Running at 200 MHz
- Chipset: Intel E7501 and Intel ICH3-S south bridge

- CMOS RAM: 114 byte non-volatile RTC, MC146818 compatible

- RTC with on-board Lithium battery

Facilities

There are two front panel LEDs

LEDs

- Blue: Hot swap Green: Power OK

- Green: Flash disk activity

External connections

- **C21 - PMC I/O Interface (TPMC866–10) – not used**

  The TPMC866–10 cable is equipped with a 50-pin connector.

- **C22 - Ethernet**

  The Ethernet cables are equipped with standard RJ-45 connectors. The CPU board has one Ethernet port (ETH1) in the front.

  C22 connects to ETH1 for communication with one of the Ethernet Switch Boards. The cable C22 is provided by the manufacturer, and it is a part of the internal cabling

  For cable details, see *Ethernet cable with RJ45* on page 131

- **C23 - Serial line (COM1) — not used**

  This is a serial line terminated in a RJ 45 connector. COM1 is software selectable for RS-232 or RS-422/485 operation.

- **C24 - USB — not used**

  The USB cable is equipped with a standard USB2 connector. One USB channel is available at the front panel of the CPU board. This cable is normally not used.

5.5.3 Kontron CP 6011 pentium CPU BOARD

Bios settings

Date

Time

- Legacy diskette A: Disabled

- Primary Master: Auto Shown as 261 MB

- Primary Slave: None

- Secondary Master: None

- Secondary Slave: None

- POST Errors Disabled

- System Memory 624 KB

- Extended Memory 511 MB

Advanced

Boot Settings Configuration

- Installed O/S Other

- Enable ACPI No

- Reset Configuration Data No

- Boot-time Diagnostic Screen Enabled

- Extended Memory Testing None

- Summary Screen Delay None

- Save CMOS in FLASH Enabled

- Retry Boot Sequence Disabled

- PS/2 Mouse Disabled

- SMART Device Monitoring Disabled

- Floppy Check Disabled

PCI Configuration – On-board Ethernet Controller

- On-board Ethernet Controller 1 Enabled
  - Option ROM Scan Disabled
- On-board Ethernet Controller 2 Enabled
  - Option ROM Scan Disabled
- On-board Ethernet Controller 3 Enabled
  - Option ROM Scan Disabled

PCI Configuration – On-board PMC Expansion

- On-board PMC A Expansion Slot
  - Option ROM Scan Enabled
  - Latency Timer Default
- On-board PMC B Expansion Slot
  - Option ROM Scan Enabled
  - Latency Timer Default

PCI Configuration – PCI Performance Settings

- PCI Cache Line Size 16
- On-board HB8 PCI-X Bridge Settings
  - Force 64 bit Control Both
  - Smart Prefetch Mechanism Enabled
  - Smart Prefetch Timeout 256 PCICLK
  - Prefetch scheme Aggressive
  - PCIX Pimary Initial Prefetch Count 8
  - PCI Sec. Initial Prefetch count 8
  - PCI Sec. Incremental Prefetch count None
  - PCI Sec. Maximum Prefetch count 32
- Default Primary Video Adapter On-board
- Delay before PCI Initialization 0
- IDE - Device 31, Function 1 Enabled
- Legacy USB Support Enabled

On-board Device Configuration

- Serial port A Enabled
  - Base I/O address 3F8
  - Interrupt IRQ 4
- Serial port B Enabled
  - Base I/O address 2F8
  - Interrupt IRQ 3
  - Mode RS-232
- Floppy Disk Controller Disabled

Advanced Chipset Control

- ECC Config ECC

Console Redirection

- Console Redirection Disabled
- N/A

Advanced Processor Options
- Speed Step Support POM

Monitoring

Intelligent System Monitor
- Interrupt Generation Disabled
- Hardware Monitor Temperature **Read Temperature**
- Hardware Monitor Voltage Inputs **Read Voltages**

Control Temperature Events
- CPU Temperature Interrupt Disabled
- N/A

Control Voltage Events
- XXXX Interrupt **Disable All**

IPMI System Management
- N/A
- IDE Activity LED IDE Activity
- Watchdog After POST Disabled
- FPGA IRQ Disabled
- Automatic TCC Disabled
- Delay Prior to enabling the TCC N/A

Boot
- CD-ROM Drive
- Hard Drive
- Removable Devices

5.5.4 BSP 67B Board

Purpose and description

The Beamforming & Signal Processing Board (BSP 67B) is a double cPCI board. The BSP67B Board is used by the Transceiver Unit for beamforming and signal processing purposes. The processing power in the BSP 67B Board is based on sixteen Texas C6713B digital signal processors (DSP) working in parallel.

Figure 23   BSP 67B Board

cd021610-003
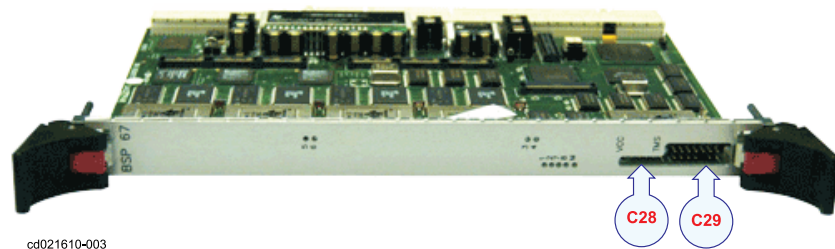
Specifications

Power consumption: 40W at 3.3 Vdc / 5Vdc

Facilities

LEDs

There is one LED for each of the sixteen DSPs. The LEDs are marked M4, 5, 6, 7, M0, 1, 2, 3 on both Base board and Mezzanine Board. The upper row is for Mezzanine Board. When BSP 67B is loaded, the LEDs will normally flash with a frequency at 1 Hz. LEDs marked B and P are for test purpose only.

External connections

The following cables can be connected to the circuit board

- **C28 - VCC to TMS** For FPGA programming and test purpose

  This cable is connected to the VCC slot to provide a JTAG interface to the FGPA modules on the BSP 67B board. The signals of the VCC slot are available at a 36-pin single line header.

  Note _____

  This interface is only to be used by Kongsberg Maritime personnel.

- **C29 - TMS** For test purposes only

  This cable is connected to the TMS Emulator slot for programming and development purposes. The signals of the TMS slot are available at a 14-pin double line header.

  Note

  This interface is only to be used by Kongsberg Maritime personnel.

5.5.5 Ethernet Switch Board – Gigabit

Purpose and description

This is a 12 channel cPCI Ethernet Switch Board. It is used to interconnect the RX32 Receiver Boards and TX36 Transmitter Boards with the CPU Board.

Figure 24   Ethernet Switch Board
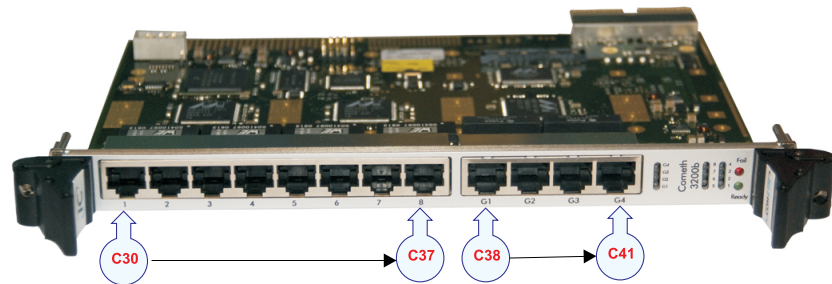
CD021098-006

Key features

- 8 ports of fast and 4 Giga Ethernet ports, auto-negotiating, front panel

- Full wire speed layer 2/3 switching on all ports

- Auto address learning

- Auto address aging

Specifications

- Power consumption: 3.3 Vdc or 5 Vdc Power supply up to 18 Watts according to the configuration

- 1 – 8 Ethernet ports: 10/100TX

- G1 – G4 Ethernet ports: 10/100/1000BT

- Port routing: RJ-45 10/100/1000 BaseTX (at front)

Facilities

Front panel LEDs

- Power supply and CPU Status

- Switched ports : activity/link

External connections: The following cables can be connected to the circuit board

- **C30 to C37 – 100 Megabit Ethernet ports**

  The Ethernet cables are equipped with standard RJ-45 connectors. The Ethernet board has 12 Ethernet ports. 8 fast ports * 10/100TX (FB) and 4 giga ports * 10/100/1000BT (FB)

  The Ethernet interface of each RX32 receiver board and some of the TX36 transmitter boards are connected to fast ports from C30 to C37.

  C31 to C34 – Here must RX32 be connected.

  One Ethernet port must be used to communicate with the CPU board.

  These cables are provided by the manufacturer. Each cable is cut to a suitable length for connection to dedicated ports. The cable ends are labelled accordingly.

  For cable details see *Ethernet cable with RJ45* on page 131.

- **C38 to C41 – Giga ports**

  The output data to the Raw data logger must be connected to port number C40.

  C41 connects to next switch board.

  These cables are provided by the manufacturer. Each cable is cut to a suitable length for connection to dedicated ports. The cable ends are labelled accordingly.

  For cable details see *Ethernet cable with RJ45* on page 131.

Connection for Gigabit card – 0.5x1, 1x1, 1x2 and 2x2 degree system

- **C30** – 1 connected to CPU/LAN label ETH1–1
- **C31** – 2 connected to RX32 – 1 / label ETH1–2
- **C32** – 3 connected to RX32 – 2 / label ETH1–3
- **C33** – 4 connected to RX32 – 3 / label ETH1–4

  Not used on 1x2 and 2x2 degree system

- **C34** – 5 connected to RX32 – 4 / label ETH1–5

  Not used on 1x2 and 2x2 degree system

- **C35** – 6 connected to TX36 – 1 / label ETH1–6
- **C36** – 7 connected to TX36 – 2 / label ETH1–7
- **C37** – 8 connected to TX36 – 3 / label ETH1–8
- **C38** – G1 connected to TX36 – 4 / label ETH1–G1
- **C39** – G2 connected to TX36 – 5 / label ETH1–G2
- **C40** – G3 connected to RDL / label ETH1–G3
- **C41** – G4 connected to ETH2–10 / label ETH1–G4

5.5.6 Ethernet Switch Board – Megabit

Purpose and description

This is a 12 channel cPCI Ethernet Switch Board. It is used to interconnect the RX32 Receiver Boards and TX36 Transmitter Boards with the CPU Board.

Figure 25   Ethernet Switch Board with arrows
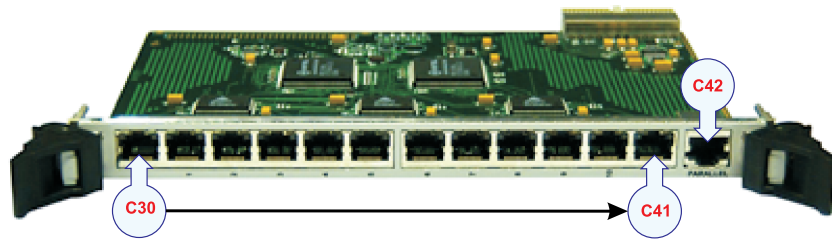
Key features

• 12 ports of 10/100BaseTX, auto-negotiating, front panel

• Full wire speed layer 2 switching on all ports

• 1k MAC address table

• Auto address learning

• Auto address aging

Specifications

Power consumption: 1.2 A at 3.3 Vdc

Ports: 10/100 BaseTX: 12

Parallel port: 1

Port routing: RJ-45 10/100 BaseTX (at front)

Facilities

LEDs: None

External connections: The following cables can be connected to the circuit board

• **C30 to C41 - Ethernet ports**

The Ethernet cables are equipped with standard RJ-45 connectors. The Ethernet board has 12 Ethernet ports (0 to 11). The Ethernet interface on the TX36 transmitter boards must be connected to an Ethernet board.

These cables are provided by the manufacturer. Each cable is cut to a suitable length for connection to dedicated ports. The cable ends are labelled accordingly.

- **C42 - Parallel port – not used**

  The parallel port has a standard Ethernet RJ-45 interface. This interface is not used.

Connection for Megabit card no 2 – 0.5x1, 1x1 and 1x2 degree system

- **C30** – 0 connected to TX36 – 6 / label ETH2–0
- **C31** – 1 connected to TX36 – 7 / label ETH2–1
- **C32** – 2 connected to TX36 – 8 / label ETH2–2
- **C33** – 3 connected to TX36 – 9 / label ETH2–3
- **C34** – 4 connected to TX36 – 10 / label ETH2–4
- **C35** – 5 connected to TX36 – 11 / label ETH2–5
- **C36** – 6 connected to TX36 – 12 / label ETH2–6
- **C37** – 7 connected to TX36 – 13 / label ETH2–7
- **C38** – 8 connected to TX36 – 14 / label ETH2–8
- **C39** – 9 connected to TX36 – 15 / label ETH2–9
- **C40** – 10 connected to ETH1–G4 / label ETH2–10
- **C41** – 11 connected to ETH3–10 / label ETH2–11
- **C42** – not in use

Connection for Megabit card no 3 – 0.5x1, 1x1 and 1x2degree system

- **C30** – 0 connected to TX36 – 16 / label ETH3–0
- **C31** – 1 connected to TX36 – 17 / label ETH3–1
- **C32** – 2 connected to TX36 – 18 / label ETH3–2
- **C33** – 3 connected to TX36 – 19 / label ETH3–3
- **C34** – 4 connected to TX36 – 20 / label ETH3–4
- **C35** – 5 Not used
- **C36** – 6 Not used
- **C37** – 7 Not used
- **C38** – 8 Not used
- **C39** – 9 Not used
- **C40** – 10 connected to ETH2–11 / label ETH3–10
- **C41** – not in use
- **C42** – not in use

5.5.7 Power Supply PSU 6V

Purpose and description

This is a 6 V / 25 A power supply. It is used to supply DC power to the analog part of the RX32 Receiver Boards.

Figure 26   Power Supply PSU 6V

Specifications

Input:
- Maximum operating range: 90 to 264 Vac
- Nominal input voltage range: 110 to 240 Vac, 47 to 64 Hz
- Inrush current: < 10 A in 10 ms
- Power factor: > 90 %

Output:
- Output voltage: 6 Vdc ± 2 %
- Switching frequency: 166.667 kHz
- Output current limit: < 28 A
- Minimum load: 1 A
- Maximum load: 25 A continuously
- Line regulation: < ± 0.2 %
- Load regulation: < ± 1 %
- Ripple and noise: < 60 mV (peak-to-peak)

Facilities
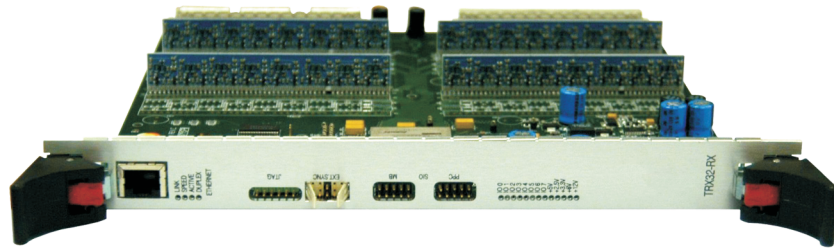
LEDs:
- Green: Power good

External connections:
- None

5.5.8 RX32 receiver board

The RX32 Receiver Board is designed for reception and processing of transducer data.

Figure 27   RX32 Receiver Board

Note ────────────────────────────

Circuit boards are delicate items. They may work year after year in an advanced product, but then fail due to a small spark of static electricity. For this reason, it is very important that they are properly handled and protected during handling.

─────────────────────────────────

- Power supplies
- Network FPGA and surrounding components
- Receiver part, 32 identical FPA receiver channels

The RX32 Receiver Board includes 32 independent FPA (Floating Point Amplifier) receivers. The operating frequency is programmable within the range 10 to 500 kHz. All command input and sample data output are communicated via a 100 Mbit/s Ethernet interface.

The receivers generate band pass filtered complex sample data at a programmable output rate. The sample values from all 32 receivers can be output via the Ethernet interface without further processing. Onboard power circuitry generates all internal voltage from a +12 Vdc and a +6 Vdc input.

The receiver is based upon the FPA ASIC (Application-Specific Integrated Circuit). The FPA ASIC is a complete one-channel frontend, including all the signal-processing from the transducer input to a digital serial interface to a signal processor. The RX data is collected by a FPGA (Field Programmable Gate Array).

A 4 bit nibble link in the backplane is used to transfer the sample values from the RX32 board to the BSP 67B board(s).

Figure 28   RX32 simplified block diagram
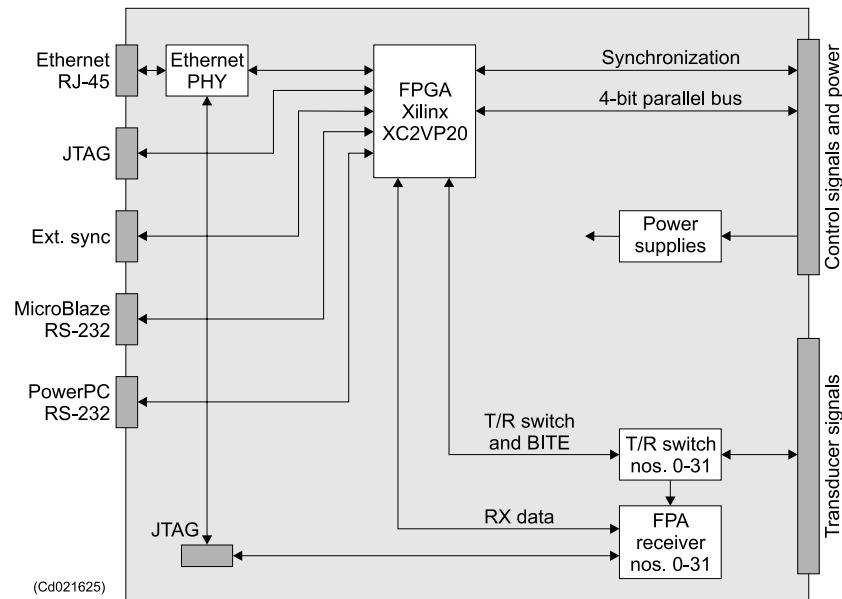
Technical specifications

These are the main technical specifications for the RX32 Receiver circuit board. Please note that technical specifications can be altered without prior warning.

Power supply specifications

- Main supply voltages: +6 V, +12 V
- Current consumption: 2.5 A (6 V), 0.75 A (12 V)

Transducer interface

- Number of channels: 32
- Receiver input impedance: 75 ohms or 1000 ohms, software selectable
- Transducer connections: Differential
- Transducer connector: 96–pin Euro connector

Interface specifications

- Ethernet: 10/100Mb/s
- Nibble Bus: Special 4–bit interface
- ID0 to ID4: Active high identification bits 0 to 4 (maximum 32 board addresses)
- ID5 to ID7: Active high identification bits 5 to 7 (maximum 8 rack addresses)
- CLK20MHZ: Differential system master clock, 20 MHz
- RESET: Differential active low reset, synchronized to negative edge of CLK20MHZ

- MASTER: Active low, enables master signal source
- PS_SYNC: Switching power supply synchronization

Receiver specifications

- Input termination: Fully differential input
- Input impedance: Matched to transducer (75 ohms) or high impedance (1 kohm)
- Frequency range: 10 to 500 kHz
- Low pass filter: Anti-aliasing, 62.5, 125, 250 and 500 kHz
- Gain: 0 to 90 dB in 6 dB steps
- Noise figure:
  - Impedance matching: 5 dB
  - High impedance: 2 dB
- Sampling: Simultaneous sampling of all channels, 2 MHz
- Automatic Gain Selection (AGS): Implemented for each channel, selects optimum gain setting to make best use of analogue to digital input range
- Analogue to digital conversion: 12 bit resolution
- Dynamic range: > 140 dB
- Signal processing: Digital demodulation, filtering and decimation (ratio 7 – 256)

  The receiver technology is based on the **Floating Point Amplifier (FPA)** ASIC. Eight of these ASICs in die form are used on the eight channel **FPA8** hybrid circuit. This hybrid circuit also includes necessary surrounding components, such as power supply decoupling.

Facilities

LEDs

- Ethernet: Four LEDs display Ethernet operating mode and activity
- LINK: The connection to the external device is OK (green)
- SPEED: The detected bit rate is 100 Mbit/s (yellow)
- ACTIVITY: Flashing light indicates transmit and receive activity (green)
- DUPLEX: The interface operates in full duplex mode (yellow)

I/O

- I/O: Eight yellow LEDs display processor activity and error conditions.

- IO 0: The PowerPC embedded program broadcasts a BOOTP/DHCP (Boot Strap Protocol / Dynamic Host Configuration Protocol) request via the Ethernet interface.

- IO 1: A BOOTP/DHCP reply message has been received from an external boot server.

- IO 2: The PowerPC sends a TFTP (Trivial File Transfer Protocol) request to the boot server asking for its application program.

- IO 3: The PowerPC embedded program is up and running. The PowerPC embedded program is included in the FPGA firmware as initialized block RAM.

- IO 4: This LED flashes when the receivers are running and generating sample data. The flash speed is proportional to the receiver decimation clock.

- IO 5: This LED is reserved for product maintenance tasks.

- IO 6: This LED flashes every time TXENABLE goes active.

- IO 7: The MicroBlaze embedded program is up and running. The MicroBlaze embedded program is included in the FPGA firmware as initialized block RAM.

Power

- Power: Five green LEDs indicate that the internal supply voltages are OK.

- +5 V

- +2.5 V

- +3.3 V

- +6 V

- +12 V

Figure 29   RX32 Receiver Board with arrows
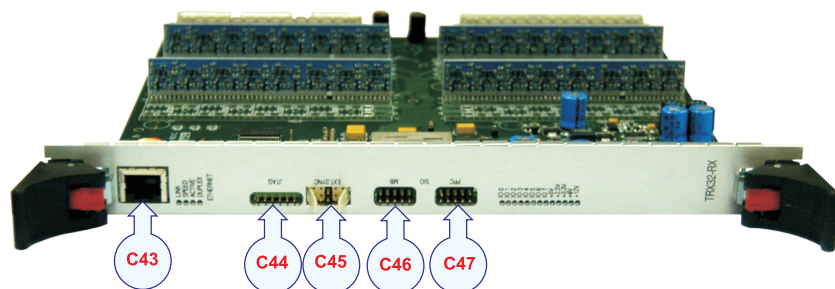
External connections

- **C43 - Connected to Ethernet switch board**

  The Ethernet cable is equipped with a standard RJ-45 connector. The Ethernet interface of the RX32 receiver board must be connected to an Ethernet switch board. This interface is used for all command input and sample data output. This is normally the only cable connected to the RX32 receiver board. It is provided by the manufacturer. *Ethernet cable with RJ45* on page 131.

- **C44 - JTAG / For internal use only**

  This cable is connected to the JTAG slot to provide a JTAG interface to the FGPA modules on the RX32 receiver board. The signals of the JTAG slot are available at a 6-pin single line header.

  Note ———————————————————————

  This interface is only to be used by Kongsberg Maritime personnel.

  ————————————————————————————

- **C45 - External synchronization (EXT SYNC) / For internal use only**

  This cable is connected to the EXT SYNC slot for accurate transmit synchronization with external equipment. The signals of the EXT SYNC slot are available at a 10-pin double line header.

  Note ———————————————————————

  This interface is only to be used by Kongsberg Maritime personnel.

  ————————————————————————————

- **C46 - MicroBlaze (MB) / For internal use only**

  This cable is connected to the MB slot for debugging the MicroBlaze (FPGA soft-core processor) program software. The signals of the MB slot are available at a 10-pin double line header.

  Note ———————————————————————

  This interface is only to be used by Kongsberg Maritime personnel.

  ————————————————————————————

- **C47 - PowerPC (PPC) / For internal use only**

  This cable is connected to the PPC slot for debugging the PowerPC (FPGA hard-core processor) program software. The signals of the PPC slot are available at a 10-pin double line header.

  Note

  This interface is only to be used by Kongsberg Maritime personnel.

5.5.9 RX RIO – Rear Interface Board

Purpose and description

This is the rear I/O module for the RX32 Receiver Board. It holds transformers and band pass filters. It also connects the 32 receiver channels to the 78-pin connector. The signals are low level ac signals, < 5 V and < 0.1 A.

Figure 30   RX RIO
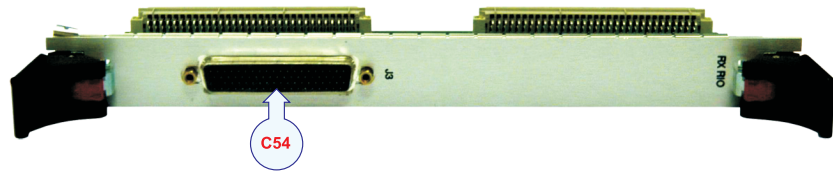
Facilities

LEDs

- None

External connections

- **C54 - RX transducer**

5.5.10 RXP RIO – Rear Interface Board

Purpose and description

This is a rear I/O module with AC input filter. It connects the 115/230 Vac input to the backplane. One AC output plug with filter is also available for the possibility to connect an extra fan module (not used).

Figure 31   RXP RIO
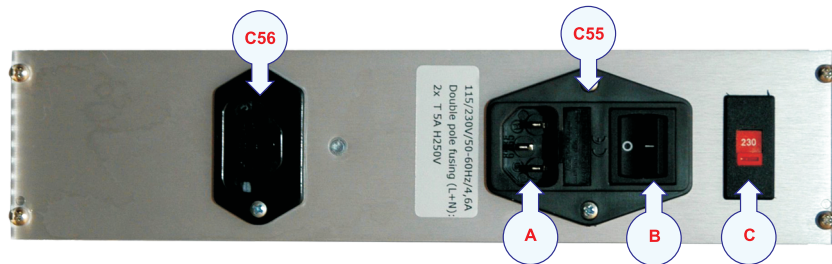
Facilities

LEDs

- None

External connections

- **C55 – AC power**

    A   AC power

    B   Power On/off, normally set to on

    C   Switch – 115/230 V for the fan unit

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

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

    For cable details, see *Standard AC power cable* on page 130

- **C56 – AC power**

    normally not used

5.5.11 BSP RIO – Rear Interface Board

Purpose and description

This is the rear I/O module for the master BSP. It holds control signals from the TX sub-rack (power sync), external trig interface (TX pulse output, RX ready output, trig input) and 1PPS input.

Figure 32   BSP RIO

Facilities

LEDs:

• None

External connections

• **C57 - 1PPS**

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

External synchronisation and remote on/off on page 38

Generic coax cable on page 124

• **C58 - Trigger in/out**

This is cable is equipped with a standard 9-pin D-sub connector.

The interface is used to synchronize the echo sounder's transmissions with other acoustic instruments.

This interface is normally not used (see cable C71).

Trigger in/out (not used) on page 127

• **C59 - Control signals**

This cable is equipped with a standard 15-pin D-sub connector and is connected to the TXP RIO board.

The interface is used to transmit internal synchronization signals and TX enable signals (time stamp of TX pulses).
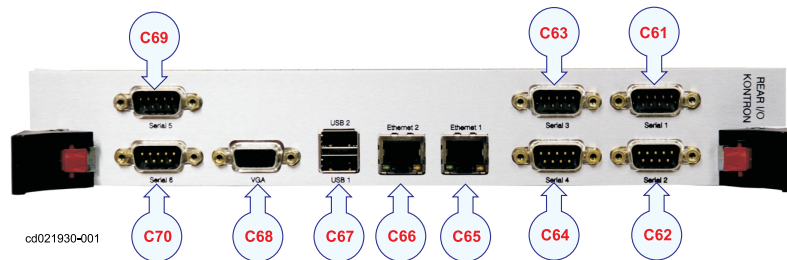
This cable is provided by the manufacturer.

Internal control signals on page 128

5.5.12 Rear I/O Interface Board (Kontron)

Purpose and description

This is the rear I/O module for external sensors. For this purpose, it is equipped with four serial lines and two Gbit ethernet links.

Figure 33   I/O Interface Board

Facilities

LEDs:

None

External connections

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

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

    The serial lines are normally set up as follows

    – **Serial Port 1** - Positioning systems

    – **Serial Port 2** - Motion sensor

    – **Serial Port 3** - Auxiliary 1

    – **Serial Port 4** - Auxiliary 2

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

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

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

- **C67 - USB**

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

- **C68 - VGA**

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

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

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

5.5.13 Raw data logger interface (RDL)

Purpose and description

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

The RDL is a real time software application that provides the capability to log raw hydrophone data from hydrographic instruments produced by Kongsberg Maritime.

The communication between the RDL and the transceiver unit uses a 1 Gbit Ethernet line.

Figure 34   RDL board

Facilities

LEDs:

• None

External connections

• **C85 - Ethernet**

  Ethernet cable to an optional Raw data logger.

 *Ethernet cable with RJ45* on page 131

5.5.14 TX36 transmitter board

The TX36 Transmitter Board is designed for processing and transmission of transducer data.

Note _____

Circuit boards are delicate items. They may work year after year in an advanced product, but then fail due to a small spark of static electricity. For this reason, it is very important that they are properly handled and protected during handling.

Figure 35   TX36 Receiver Board
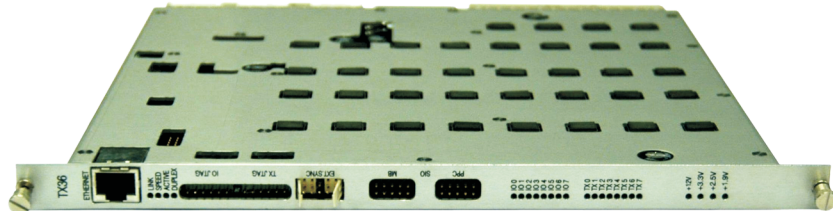
- Power supplies

- Network FPGA

- TX FPGA

- Transmitter part, 36 identical PWM transmitter channels

The TX36 Transmitter Board includes 36 independent PWM (Pulse Width Modulation) transmitters. The operating frequency is programmable within the range 10 to 500 kHz. All command input and sample data output are communicated via a 100 Mbit/s Ethernet interface.

The board includes software for synthesizing the transmit signal at runtime. A variety of different beam shapes and time signals can be generated by entering a few high level input parameters. Onboard power circuitry generates all internal voltages from a +12 Vdc input. A separate high voltage input is provided for feeding the output stage of the transmitters.

The transmitters are based on a PWM (Pulse Width Modulation) technique, with a switching frequency of 2 MHz. This makes it possible to generate arbitrary signals in the whole frequency band 10 to 500 kHz. Traditional CW pulses at any frequency or amplitude can be generated, as well as more complex waveforms, and several simultaneous signals. These signals are specified by the user and generated in the TX FPGA.

Figure 36   TX36 simplified block diagram
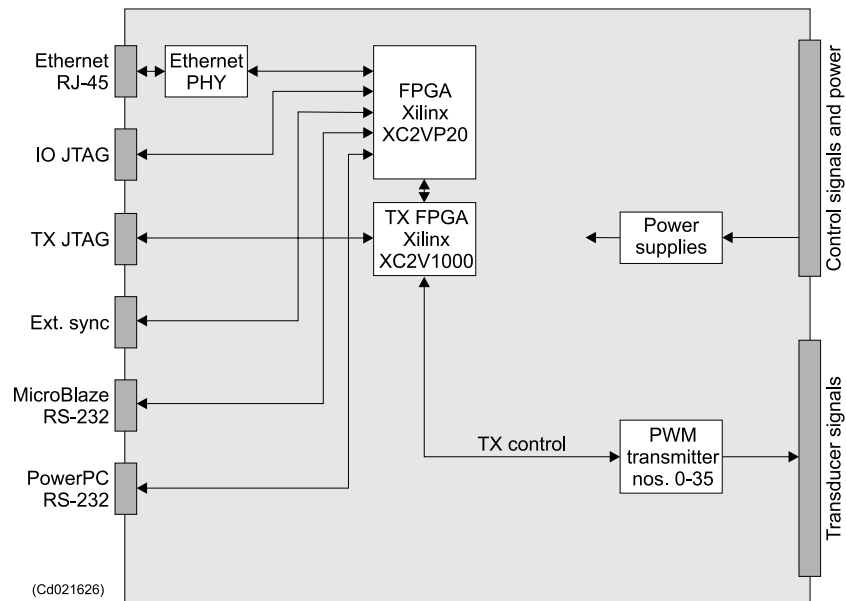
Technical specifications

These are the main technical specifications for the TX36 Receiver circuit board. Please note that technical specifications can be altered without prior warning.

Mechanical characteristics

- Type: Double "eurocard", extended board format
- Length: 220 mm
- Height: 233.4 mm
- Width: 25.4 mm (5U)
- Weight: Approximately 950 grams

Power supply specifications

- Main supply voltages: +12 Vdc (used for the TX driver circuits) and HV (high voltage supply for the transmitter output stage)
- Maximum mean current consumption: <1 A (12V)
- Internal current consumption: 2.0 A (5 Vdc), 0.6 A (3.3 Vdc), 1.2 A (1.8 Vdc)

    These are the external power supply requirements, excluding current from 12 V supply for transmission drivers (approximately 0.1 A per channel during the transmission pulse).

Transducer interface

- Number of channels: 36

- Transducer impedance: 75 ohm
- Transducer connections: Single-ended
- Transducer connector: 96-pin Euro connector

Interface specifications

- Ethernet: 10/100Mb/s
- ID0 - 4: Active high Identification Bit 0-4 (maximum 32 board address)
- CLK20MHZ: Master clock in system, 20 MHz
- RESET~: Active low, synchronized to negative edge of CLK20MHZ
- TXENABLE~: Active low, synchronized to negative edge of CLK20MHZ
- MASTER~: Active low, enables master signal source

Transmitter

- Output signal frequency range: 10 to 500 kHz
- PWM switching frequency: 20 MHz
- Output signal waveform: Arbitrary waveform, described by "Nyquist samples"
- Max. output power: 50 W
- Max. pulse length: 400 ms
- Max. duty cycle: 10 % (frequency dependant)
- High voltage supply: 0 to 170 Vdc.

Facilities

LEDs

- LINK: The connection to the external device is OK (green)
- SPEED: The detected bit rate is 100 Mbit/s (yellow)
- ACTIVITY: Flashing light indicates transmit and receive activity (green)
- DUPLEX: The interface operates in full duplex mode (yellow)

  Ethernet: Four LEDs display Ethernet operating mode and activity
- TX: Eight yellow LEDs display transmission activity.

I/O

- IO 0: The PowerPC embedded program broadcasts a BOOTP/DHCP (Boot Strap Protocol / Dynamic Host Configuration Protocol) request via the Ethernet interface.
- IO 1: A BOOTP/DHCP reply message has been received from an external boot server.

- IO 2: The PowerPC sends a TFTP (Trivial File Transfer Protocol) request to the boot server asking for its application program.
- IO 3: The PowerPC embedded program is up and running. The PowerPC embedded program is included in the FPGA firmware as initialized block RAM.
- IO 4: This LED flashes when the receivers are running and generating sample data. The flash speed is proportional to the receiver decimation clock.
- IO 5: This LED is reserved for product maintenance tasks.
- IO 6: This LED flashes every time TXENABLE goes active.
- IO 7: The MicroBlaze embedded program is up and running. The MicroBlaze embedded program is included in the FPGA firmware as initialized block RAM.

  I/O: Eight yellow LEDs display processor activity and error conditions.

Power

- Power: Five green LEDs indicate that the internal supply voltages are OK.
- +5 V
- +2.5 V
- +3.3 V
- +6 V
- +12 V

Figure 37   TX36
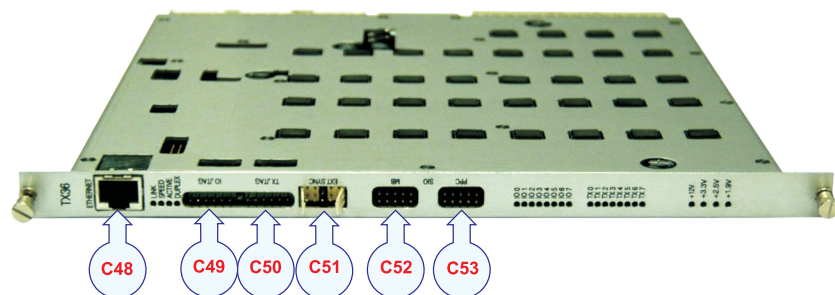
External connections

- **C48 - Connected to Ethernet switch board**

  The Ethernet cable is equipped with a standard RJ-45 connector. The Ethernet interface of the TX36 transmitter board must be connected to an Ethernet switch board. This interface is used for all command input and sample data output. This is normally the only cable connected to the TX36 transmitter board. It is provided by the manufacturer.

  For cable details see *Ethernet cable with RJ45* on page 131.

- **C49 - IO JTAG / For internal use only**

  This cable is connected to the IO JTAG slot to provide a JTAG interface to the FGPA modules on the TX36 transmitter board. The signals of the IO JTAG slot are available at a 6-pin single line header.

  Note

  This interface is only to be used by Kongsberg Maritime personnel.

- **C50 - TX JTAG / For internal use only**

  This cable is connected to the TX JTAG slot to provide a JTAG interface to the FGPA modules on the TX36 transmitter board. The signals of the TX JTAG slot are available at a 6-pin single line header.

  Note

  This interface is only to be used by Kongsberg Maritime personnel.

- **C51 - External synchronization / For internal use only**

  This cable is connected to the EXT SYNC slot for accurate transmit synchronization with external equipment. The signals of the EXT SYNC slot are available at a 10-pin double line header.

  Note

  This interface is only to be used by Kongsberg Maritime personnel.

- **C52 - MicroBlaze (MB) / For internal use only**

  This cable is connected to the MB slot for debugging the MicroBlaze (FPGA soft-core processor) program software. The signals of the MB slot are available at a 10-pin double line header.

  Note

  This interface is only to be used by Kongsberg Maritime personnel.

- **C53 - PowerPC (PPC) / For internal use only**

  This cable is connected to the PPC slot for debugging the PowerPC (FPGA hard-core processor) program software. The signals of the PPC slot are available at a 10-pin double line header.

  Note

  This interface is only to be used by Kongsberg Maritime personnel.

5.5.15 Power Supply PSU 12V

Purpose and description

This is a 12 V / 24 A power supply. It is used to supply DC power to the TX36 Transmitter Boards. It can also deliver 72 A extra during transmit (with maximum 10 % TX duty cycle).

Figure 38   Power Supply PSU 12V
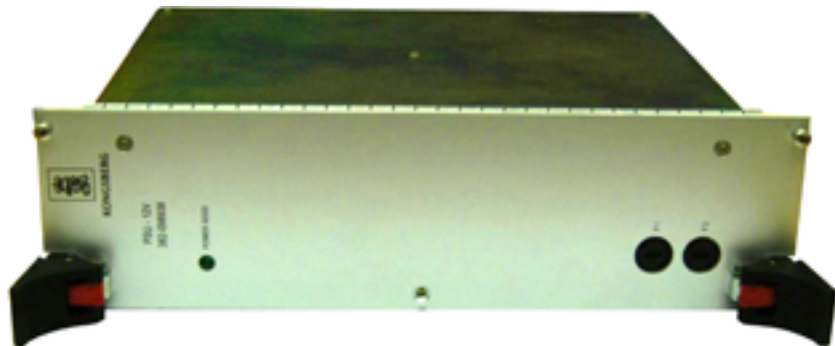
Specifications

Input:

- Maximum operating range: 90 to 264 Vac
- Nominal input voltage range: 110 to 240 Vac, 47 to 64 Hz
- Inrush current: < 10 A in 10 ms
- Power factor: > 90 %

Output:

- Output voltage: 12 Vdc ± 2 %
- Switching frequency: 166.667 kHz
- Output current limit: < 27 A, approx. 500 ms delay
- Minimum load: 1 A
- Maximum load: 24 A continuously (dependent on number of TX36 boards)
- Maximum load: 100 A, < 400 ms
- Line regulation: <± 0.2 %
- Load regulation: < ±1 %
- Ripple and noise: < 100 mV (peak-to-peak)

Facilities

LEDs:

- Green: Power good

External connections

- None

5.5.16 TXP RIO – Rear Interface Board

Purpose and description

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

- AC input with filter and fuse
- AC output for RX sub-rack
- Buffer for LVDS control signal
- Bleeder for TX power
- Remote on/off and synchronisation interface
- Relay for remote control
- Heater element

    The heater element is turned on when the TRU is turned off.

- Fuses
- 115 / 230 Voltage switch

Figure 39   TXP RIO
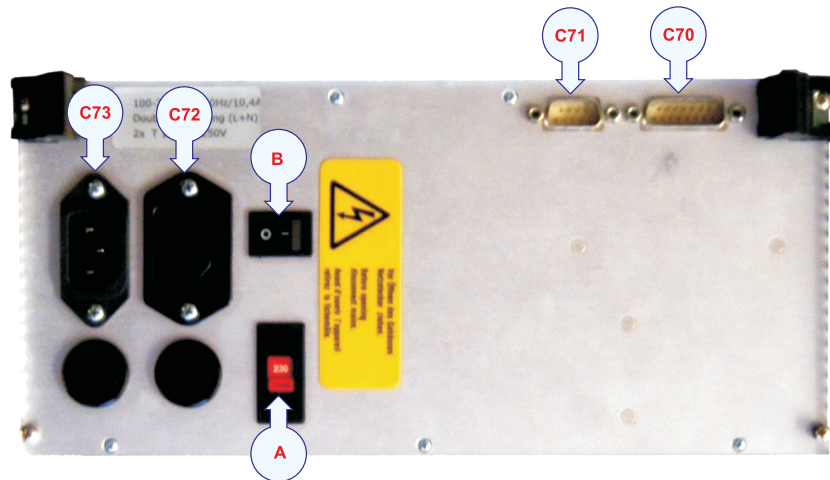
Facilities

LEDs

- None

Power switch

- **A - AC power switch** for the fan unit
- **B - On/off switch** – set to off if remote on/off control is used

    WARNING

    Set to off if remote control is used

External connections

- **C70 - Control signals**

  This cable is equipped with a standard 15-pin D-sub connector and is connected to the BSP RIO board.

  The interface is used for synchronization signals and TX enable signals (time stamp of TX pulses).

  This cable is provided by the manufacturer.

  Internal control signals on page 128

- **C71 - Remote On/Off control and synchronization**

  This cable is equipped with a standard 9-pin D-sub connector.

  The interface is used to connect to a remote On/Off power switch. It is also used for external trigger output and synchronization. For more information, see *External synchronisation and remote on/off* on page 38

  Remote control and external trig on page 129

- **C72 / C73 - AC power**

  These are 115/230 Vac AC mains cables. Cable C72 must be equipped with a 3-pin IEC male socket and C73 in a female equivalent.

  C72 connects AC power to the RXP RIO board. C73 is connected to the ship's mains power.

  The cable C72 is provided by the manufacturer.

  Standard AC power cable on page 130

5.5.17 TX RIO – Rear Interface Board

Purpose and description

This is the rear I/O module for two TX36 Transmitter Boards. It contains a capacitor bank connected to the HV Power Supply. It also connects the 72 transmitter channels to two 78-pin D-sub connectors. The transmitters have common ground.

These are TX transducer cables terminated in 78-pin D-sub connectors.

Figure 40   TX RIO

Facilities

LEDs:

• None

External connections

• **C74 / C75 - TX transducer**

These are TX transducer cables terminated in 78-pin D-sub connectors. Each TX RIO board connects to two TX transducer cables.

5.5.18 Power Supply PSU 72V

Purpose and description

This is a 72 V / 5 A power supply. It is used to charge the capacitor battery located on the TX RIO boards.

Figure 41
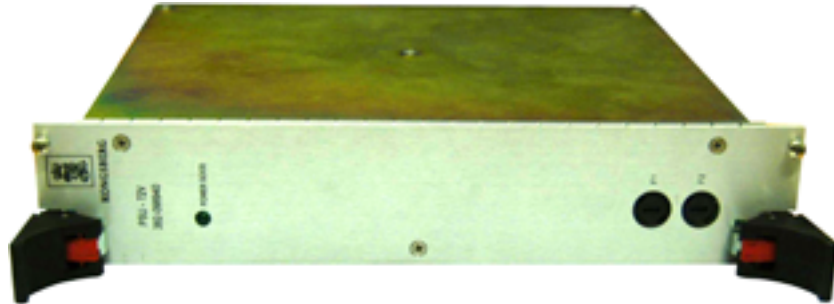
Specifications

Input

- Maximum operating range: 90 to 264 Vac
- Nominal input voltage range: 110 to 240 Vac, 47 to 64 Hz
- Inrush current: < 10 A in 10 ms
- Power factor: > 90 %

Output

- Output voltage: 72 Vdc ± 0.5V
- Switching frequency: 167.667 kHz
- Output current limit: < 5.5 A
- Maximum load: 3.5 A continuously
- Maximum load: 5.0 A, < 400 ms
- Line regulation: < ± 0.2 %
- Load regulation: N/A
- Ripple and noise: < 400 mV (peak-to-peak)

Facilities

LEDs:

- Green: Power good

External connections

- None.

6 TROUBLESHOOTING

6.1 Messages

Introduction

The EM 710 provides numerous messages to inform you of major and minor hardware and software errors.

The messages, if they occur, will be displayed in SIS' Message service window and/or in the Status bar.

The different utilities operating on the EM 710 Operator Station each issue several messages. These messages can be sorted in three categories:

- Information
- Warnings
- Errors

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

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

→ Refer to the Seafloor Information System (SIS) Operator manual for further information.

6.2 BIST tests

BSP - Beamformer and Signal Processing

This test checks all Beamformer and Signal Processing circuit boards in the EM 710 Transceiver Unit.

TX36 - Transmitter board

This test checks all TX36 transmitter circuit boards in the EM 710 Transceiver Unit (voltage, current and temperature).

RX32 - Receiver board

This test checks all RX32 receiver circuit boards in the EM 710 Transceiver Unit (voltage, current and temperature).

TRU Power - Transceiver unit

This test checks the 6 V, 12 V and 72 V power supplies in the EM 710 Transceiver Unit. The power level are tested on all RX and TX boards.

RX 32 / BSP link

This test checks the nibble bus interface between the RX 32 receiver circuit boards and the BSP circuit boards. A large set of known data is transferred from each of the RX 32 receiver boards to the BSP boards. The data received by the BSP is verified.

RX channels

This test checks all RX channels (including the transducers). The BIST report lists phase and amplitude response of all RX channels, and also the impedance of the transducers.

TX channels

This test checks all TX channels (including the transducers). This is done by transmitting at one by one TX amplifier. The output voltage and current is measured. This data is used to calculate the transducer element impedance. BIST report lists channels outside the limits.

RX noise level (broadband)

This test measures the average isotropic spectral noise level for each receiver channel (in dB rel 1 μPa/Hz). Wide RX bandwidth (70 to 100 kHz) is used.

The receiver directivity index, the transducer sensitivity and the bandwidth is used to convert to isotropic spectral noise level.

RX noise spectrum

This test measures the average isotropic spectral noise level for each board (in dB rel 1 μPa/Hz). It is displayed with 700 Hz steps from 70 to 100 kHz.

TRU software date / version

This test presents the software date and versions for the CPU, BSP, RX32 and TX36 circuit boards.

CPU

This test presents the CPU type, the CPU clock frequency, the current and maximum temperatures for the CPU die and for the CPU board. In addition some key voltages are reported, and finally the network addresses for the board's interfaces.

7 REPLACEMENT PROCEDURES

Topics

Safety precautions

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

WARNING

This voltage can be lethal.

System power must be switched off before any replacement is carried out. Failure to do so may lead to personal injury, and/or serious damage to the system.

ESD precautions

The replacement procedures presented in this chapter allows you to replace circuit boards. These are delicate devices, and special attention must be made to the handling of these.

The following precautions are therefore very important:

- The working area must be covered by an approved conductive service mat that has a resistance of between 50 kΩ and 2 MΩ, and is connected directly to a reliable ground point via its grounding cord.
- The maintenance technician or engineer must use a grounding bracelet, firmly connected to an ESD grounding point.

  - The bracket in the upper left corner of the EMU serves as ESD grounding point when working in front of the cabinet.

  - The two profile beams mounted on each side wall of the cabinet serves as ESD grounding points when working at the back of the cabinet.
- All circuit boardsmust be stored in anti-static bags while not in use.

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

Overview

This chapter presents the basic procedures for disassembly and reassembly of the replaceable parts in the EM 710 system.

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

Tools required

- 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
- Adjustable spanners
- Socket set
- Wire straps in different sizes

7.1 Procedures for Transceiver Unit

The replaceable units in the EM 710 Transceiver Unit are:

Processing and receiver rack

- cPCI Power Supply
- CPU Board
- BSP 67B Boards
- Ethernet Switch Boards
- Power Supply PSU 6V
- RX32 Receiver Boards
- RX RIO Rear Interface Boards
- RXP RIO Rear interface Module
- BSP RIO Rear Interface Board
- Rear I/O Interface Board
- Raw Data Logger (RDL)
- Fuses
- Fan drawers (2 pcs)

Transmitter rack

- Power Supply PSU 12V
- TX36 Transmitter Boards

- TX RIO Rear Interface Boards
- TXP RIO Rear Interface Board
- Fuses
- Fan drawer

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

Circuit boards and power supplies

The Transceiver Unit holds three sub–racks. All the sub–racks hold plug-in circuit boards.

The replacement of these modules is described in this procedure.

The system must be switched off prior to disassembly. Access is gained to the sub–racks by opening the front door of the Transceiver Unit with a special tool for the cabinet doors. Before removing any modules, be sure that the led in the HV Power supply has no green light on.

Disassembly procedure

- Remove the front mounted cables from the applicable circuit boards
- Release the thumb-screws and other screws if required
- Pull the board/unit carefully out

Replacement procedure

1 Insert new circuit boards and modules in reverse order. Mount the front mounted ethernet cable connectors.

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

7.2 Power Supply

The are two power supply is located in the Processing and Receiver Rack. CPCI Power on the left side and one 6 Volt power supply between the Ethernet cards and RX 32 receiver cards.

In the Transmitter sub-rack there are one 12 Volt power supply on the left side.

Disassembly procedure

1 Open the front door of the Transceiver Unit.

2 Switch off the circuit breaker on the rear side at the transmitter sub-rack.

3 Unbolt the unit. It is mounted with four screws so they cannot fall out.

4 Release the screws

5 Pull out the unit carefully

Reassembly procedure

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

7.3 Fuse replacement

The Transceiver Unit holds several power supplies. Three of these are equipped with primary fuses marked with F1 and F2.

These fuses are mounted in the front on:

- 6 V Power supply
- 12 V Power supply
- 72 V Power supply

Disassembly procedure

- Release the fuse with a screwdriver

Reassembly procedure

- Replace with the same type of fuse by reversing above procedure

7.4 Fan drawers

There are four fan drawers in the Transceiver Unit. Two fan drawers are located underneath the Processing and Receiver sub-rack, one underneath the Transmitter sub-rack.

Access is gained to the sub–racks by opening the front protective cover of the Transceiver Unit.

WARNING

The system must be switched off prior to disassembly.

How to disassembly fan drawers

1 Gain access to the wired rack.

2 Twist the right and left screw on the fan drawer a few turns.

3 Pull the fan drawer carefully out.

How to reassembly fan drawers

1 Reverse the above procedure.

7.5 New BSP RIO card and Jumper Link

Before installing the jumper link, check that system are shout down

This procedure is not for TRU compact 2 x 2 degree system.

Procedure for how to mount a new BSP RIO card with registration number: 316694 in a TRU that has the old BSP RIO card with registration number: 382–219683

How to install the jumper link

1 The system has to be turned off – no power

2 Remove the RX32 card number 1 and number 2 in the front of the TRU

3 Insert the component – see figure *Overview of the installing place of Jumper Link* on page 92

   Since the component is very small – it would be useful to use a pliers for holding the component and for installation for the component.

4 Insert the RX32 cards

5 Change from the old BSP RIO card to the new BSP RIO card

6 Power up the system

   If the installation of the component is wrong – the system will not work.

Figure 42   Overview of the installing place of Jumper Link
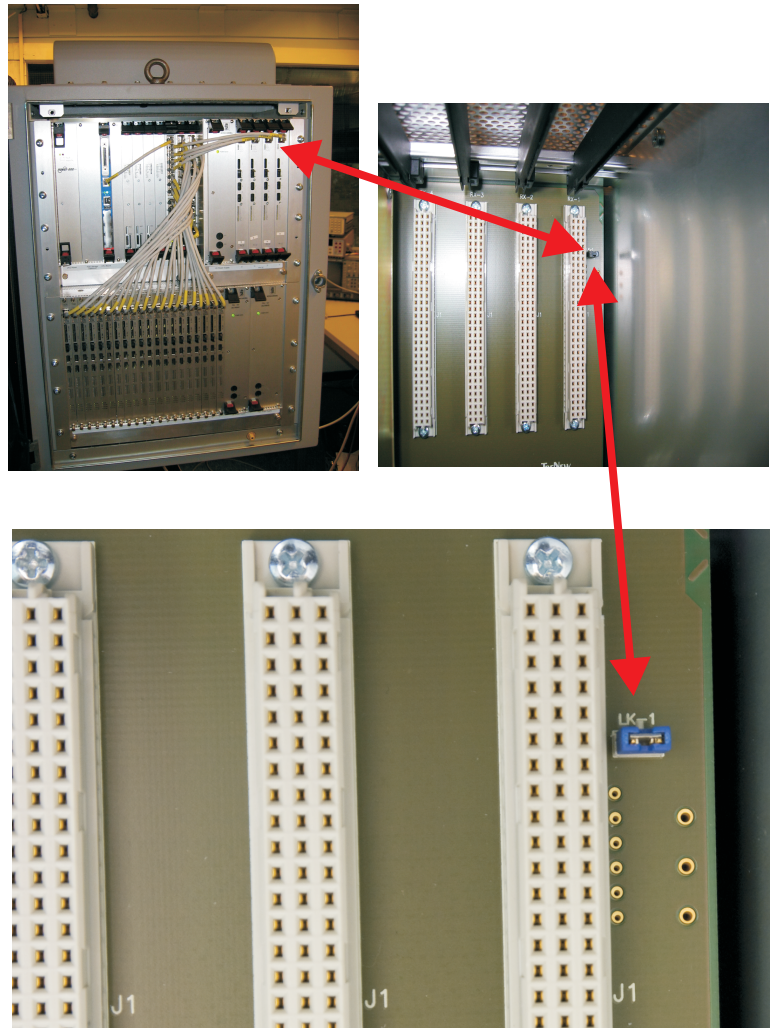
8 SPARE PARTS

This chapter contains an illustrated presentation of the spare parts available for the EM 710 multibeam echo sounder. All parts are minimum of what we recommend onboard and at site.

Table 8   Power Supplies

Pc	TRU ompact 2 x 2degree system	Normal system	Parts
1	382-099656	382-099656	Power Supply cPCI
1	382-098939	382–098939	Power Supply PSU-6 V
1	302991	382–098938	Power Supply PCU-12 V
1	382–098940	382–098940	Power Supply PSU-HV

Table 9   Receiver Unit

Pc	TRU ompact 2 x 2degree system	Normal system	Parts
1	311806	311806	CPU Board Kontron KIT, Following two items:
1	323771	323771	PCB BSP 67B
1	309057	309057	PCB RX 32
1	382–219486	382–219486	Interface card RX RIO
1	302124	302124	CPU Inteface card RIO
1	313255	316694	BSP RIO
1		328545	Gigabit Ethernet Switch
1	719-098950	719–098950	Megabit Ethernet Switch
1		322096	RDL Board

Table 10   Transmitter Unit

Pc	TRU ompact 2 x 2degree system	Normal system	Parts
2	382–206644	382–206644	PCB TX 36
1	382–219483	382–219483	Interface Card TX RIO
1	382–098822	382–098822	RIO TXP

Note ─────────────────────────────────

With regard to "PCB TX 36", it is recommended to include

• 3 x PCB's for 0,5 and 1 degree systems

• 2 x PCB's for 2 degree system

───────────────────────────────────

With regard to "Interface card TX RIO", it is recommended to include

- 2 x PCB's for 1 degree system

- 1 x PCB for 2 degree system

Table 11   Hydrographic Worksstation

Pc	Our part number	Parts
1	324098	HWS
1	301942	Hard disk

9 MAINTENANCE PROGRAM

The purpose of this document is to provide guidance to operators and maintainers on recommended maintenance procedures for multi beam echo sounders and ancillary equipment. The guidelines will assist in keeping the equipment fully operational and in detecting problems and malfunctions as early as possible.

9.1 Before every survey (alongside)

The following systems shall be maintained:

Remove old surveys.

If possible, delete all surveys from the hard disks on the EM Operator stations. This will ensure that different surveys are not mixed together and that all data disks are empty at survey start.

Defragment all survey disks.

At survey start, and during the survey (if time allows), defragment the data disk(s). This is performed to optimise the disk capacity.

Run all BISTS.

The system has several BIST incorporated in the system software. Run all these to verify correct system operation or take corrective action if any alarms appears.

Verify operation of all external sensors.

The various multi beam echo sounders are part of an integrated system with several external sensors. Verify operation of each ancillary system using the relevant technical and operational manuals. Perform corrective actions if necessary.

9.2 Before every survey (offshore)

Roll calibration check

Perform a Roll calibration as described in the operator manual and verify if any roll offset values have changed. If different from the last check, update and verify.

Pitch calibration check

Perform a Pitch calibration as described in the operator manual and verify if any pitch offset values have changed. If different from the last check, update and verify.

Cross line verification check

To check the sound speed corrections, run two lines perpendicular to each other and verify the swath versus the centre beam.

9.3 Every time used

Clean the SVP probe in fresh water.

Each time the SVP unit is used, it shall be cleaned in fresh water and stored in a dry and safe place. Verify that no physical damage is done to the unit and that the sacrificial anodes (if any) are all intact.

9.4 Every 6 months

Check all external cables

All interface cables are connected to the various electronic units by delta connectors or similar. Verify that all connectors are securely fastened and that all cables are free from physical damage.

Clean all air filters

Wherever there are air filters, they shall be cleaned at least every 6 months. If the units are installed in a dirty environment, then shorter intervals between cleaning may be required.

Hoover the inside of every cabinet.

Each cabinet should be cleared of dust and other particles at least every 6 months. A suitable Hoover should be used for this work, ensuring that no metallic parts are used inside the cabinets. System power must be isolated prior to cleaning.

WARNING

UTMOST CARE MUST BE TAKEN DURING THIS OPERATION

9.5 Every dry-docking

Docking

WARNING

For cleaning – do not use high pressure cleaner or simular.

All transducers should be checked when the ship is in dry-dock. Remove very carefully all marine growth with only a **wood** or **plastic** ice scraper. Then renew the anti fouling paint on the transducer faces. Great care must be taken when performing this.

How to do replace the anti fouling paint

- The transducer has to be rubbed softly with hand with a very fine sand paper.

- A thin layer of primer dependent of the frequency of the system
- Antifouling type SeaQuantum Ultra, Layer thickness 125 micron

Primer on 300 kHz and 200 kHz systems: Penguin primer, 75 micron layer thickness.

Primer on all other systems: Safeguard Universal ES, 125 micron layer thickness.

Note _____

The last primer is giving the best protection but contains micro sized aluminium grains and has yet not been tested for 200 and 300 kHz systems.

_____

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

From Jotun Paints, Sandefjord Norway

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

From International Paints

- Intersleek tie coat +425 FCS
    - BXA386/BXA390BXA391 grey
    - HKA563/HKA570/HKA571 Yellow

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

From Hempel IFA Coatings AS

- Hempel A/F Classic 76550

From Jotun-Henry Clark Ltd

- Anti-fouling Seaguardian

Note _____

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

_____

Diver

There is also one opportunity for a diver to the gently scrap of the arrays with a **wood** or **plastic**ice scraper.

10 INSTALLATION DRAWINGS

This chapter contains installation drawings and cable details.

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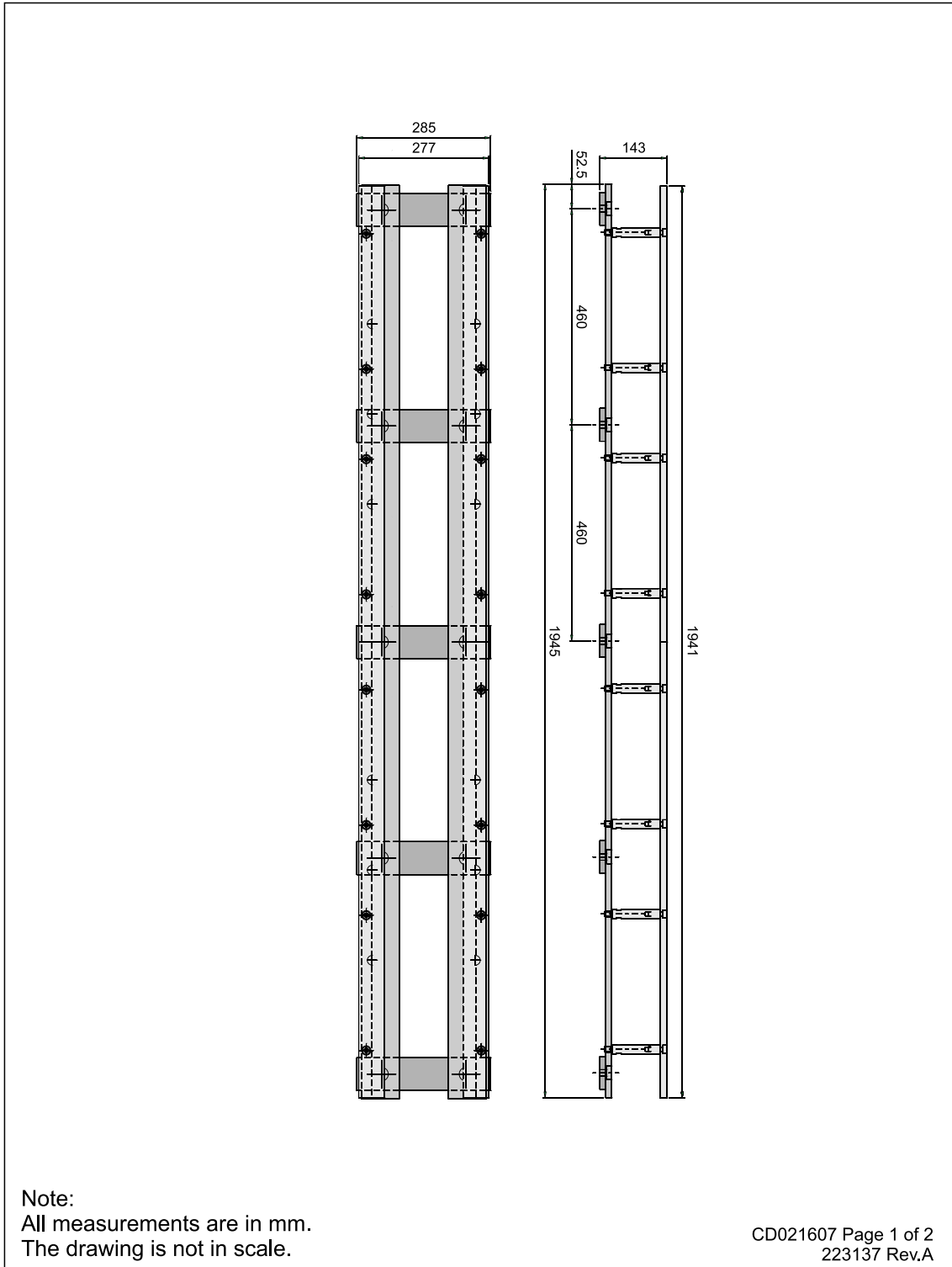
Installation drawings

- *0.5° mounting frame assembly TX module* on page 99
- *1° mounting frame assembly RX module* on page 101
- *2° mounting frame assembly TX/RX module* on page 103
- *0.5 x 1° gondola* on page 105
- *Transducer TX1 Outline dimensions* on page 107
- *Transducer TX2 Outline dimensions* on page 109
- *Transducer RX1 Outline dimensions* on page 111
- *Transducer RX2 Outline dimensions* on page 113
- *HWS Operator Station Outline dimensions* on page 115
- *Transceiver Unit Outline dimensions* on page 116
- *Transceiver Unit 2 x 2 degree system – Outline dimensions* on page 118
- *Transceiver Unit mounting bracket* on page 120
- *Junction Box – outline dimensions* on page 121
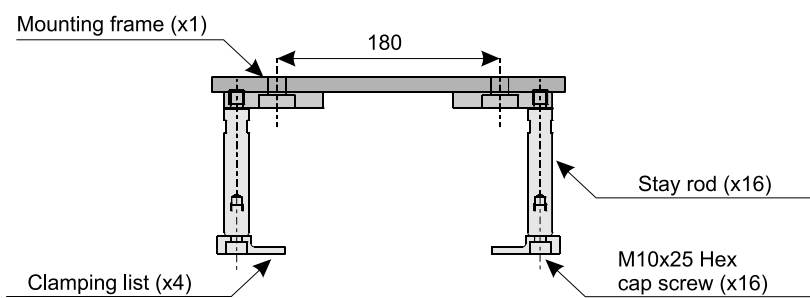- *Transceiver Unit cable clamp* on page 122

Cable details

- *Generic RS-232 Serial line* on page 123
- *Generic coax cable* on page 124
- *Sound speed probe interface* on page 125
- *RS-232 or RS-422/485 serial line* on page 126
- *Trigger in/out (not used)* on page 127
- *Internal control signals* on page 128
- *Remote control and external trig* on page 129
- *Standard AC power cable* on page 130
- *Ethernet cable with RJ45* on page 131
- *VGA/SVGA Display cable* on page 132
- *USB cable* on page 133
- *Keyboard cable* on page 134
- *Mouse cable* on page 135
- *Parallel printer* on page 136
- *RX/TX transducer cables* on page 137

10.1 Installation Drawings

10.1.1 0.5º mounting frame assembly TX module

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

CD021607 Page 1 of 2
223137 Rev.A

Mounting frame (x1)

180

Stay rod (x16)

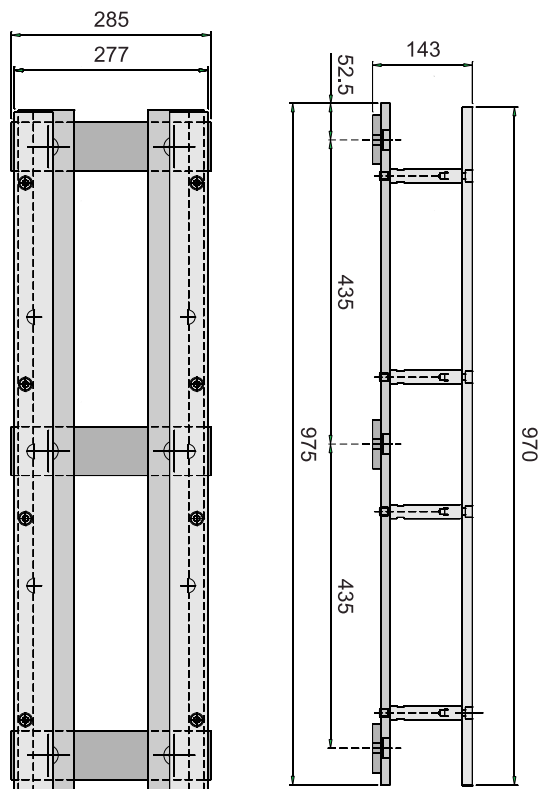Clamping list (x4)

M10x25 Hex
cap screw (x16)

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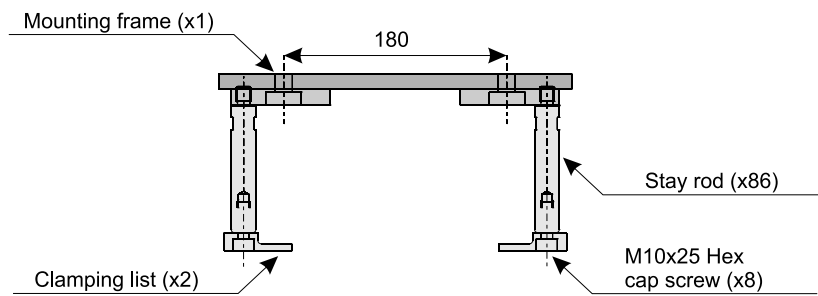All measurements are in mm.
The drawing is not in scale.

Cd021607 Page 2 of 2
223137 Rev.A

10.1.2 1° mounting frame assembly RX module

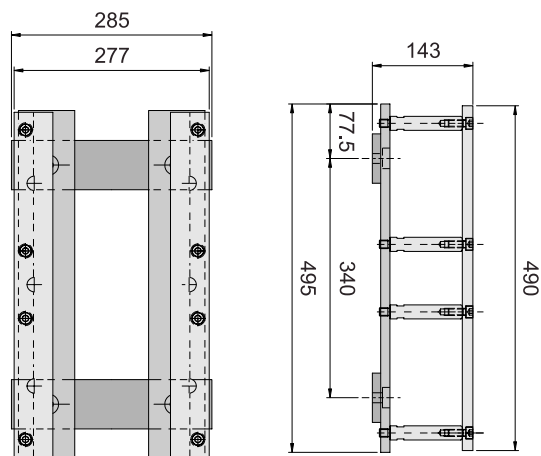Note:
All measurements are in mm.
The drawing is not in scale.

Cd021608 Page 1 of 2
223139 Rev.B

Mounting frame (x1)

180

Stay rod (x86)

Clamping list (x2)

M10x25 Hex
cap screw (x8)

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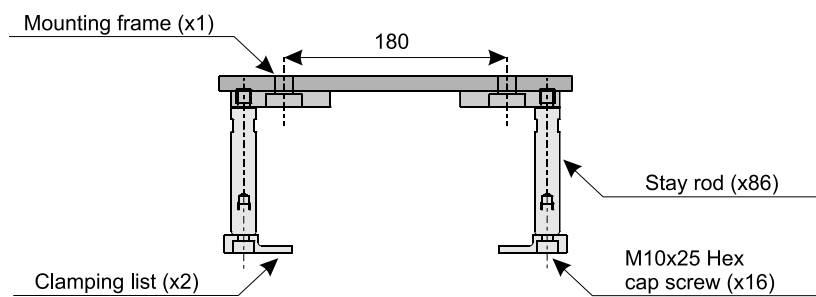All measurements are in mm.
The drawing is not in scale.

Cd021608 Page 2 of 2
223139 Rev.B

10.1.3 2° mounting frame assembly TX/RX module

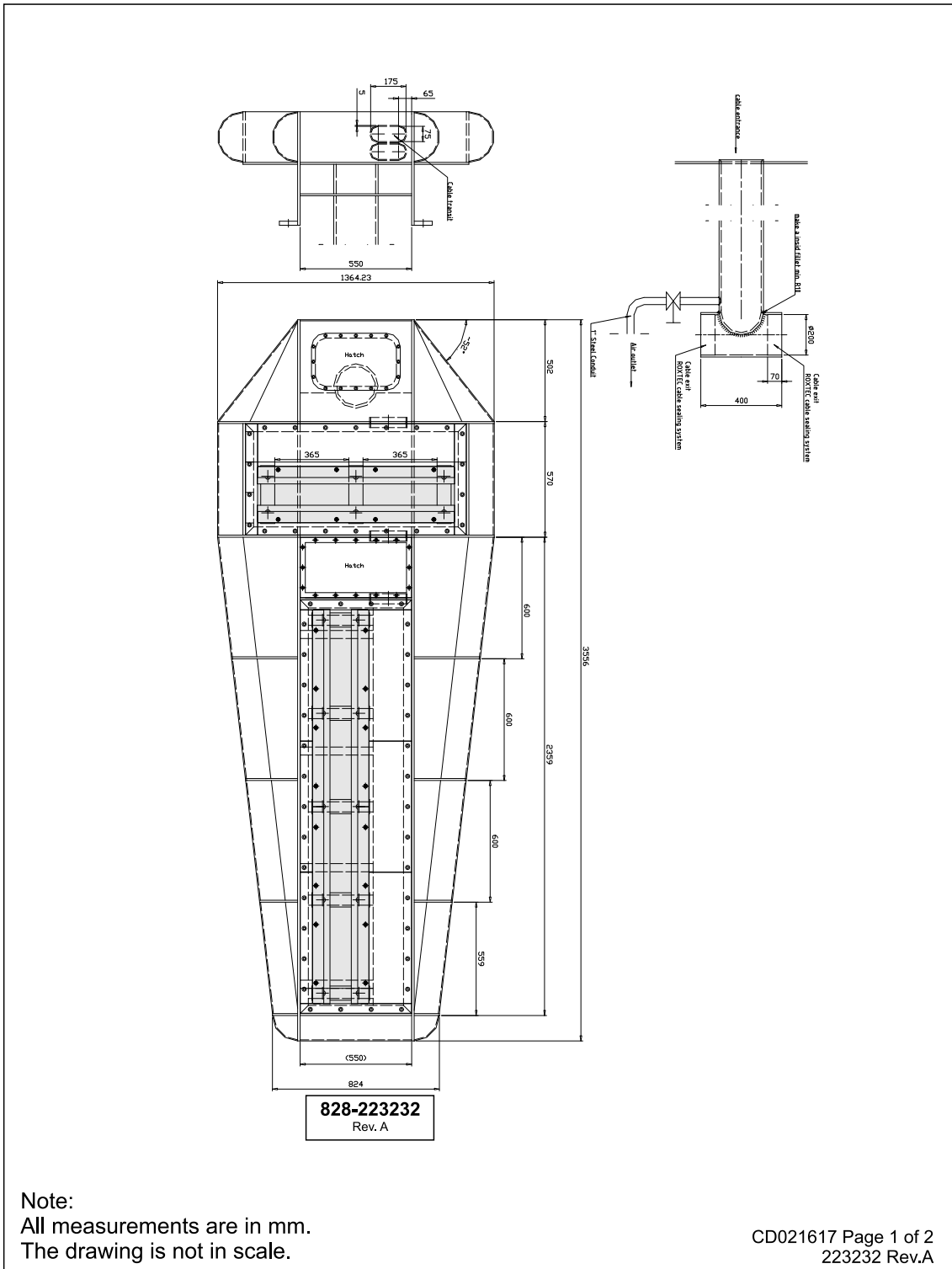Note:
All measurements are in mm.
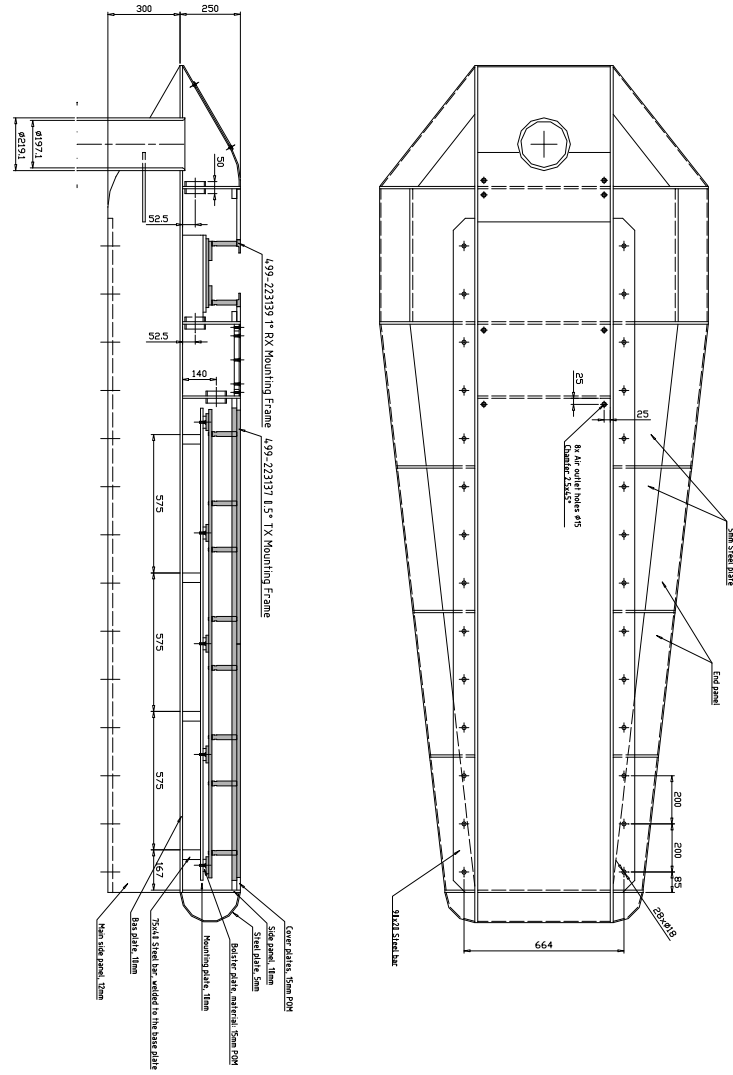The drawing is not in scale.

CD021612 Page 1 of 2
223273 Rev.B

Mounting frame (x1)

180

Stay rod (x86)

M10x25 Hex
cap screw (x16)

Clamping list (x2)

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

CD021612 Page 2 of 2
223273 Rev.B

10.1.4 0.5 x 1° gondola

828-223232
Rev. A

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

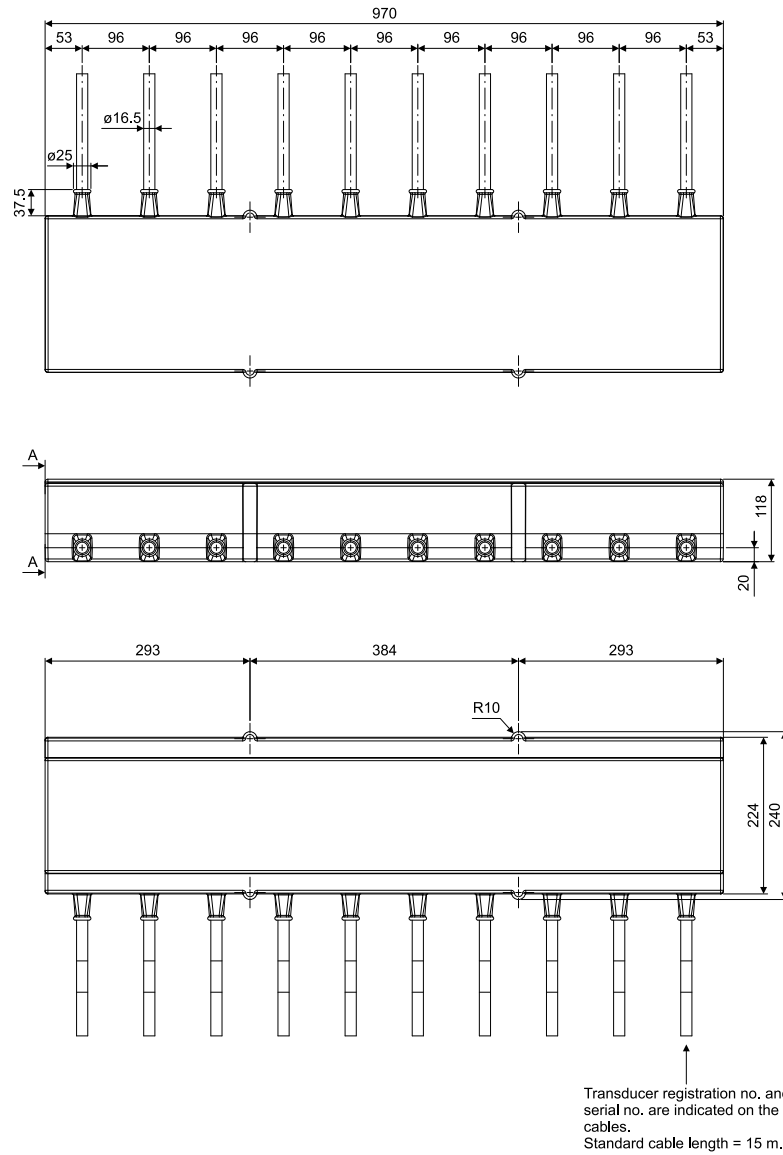CD021617 Page 1 of 2
223232 Rev.A

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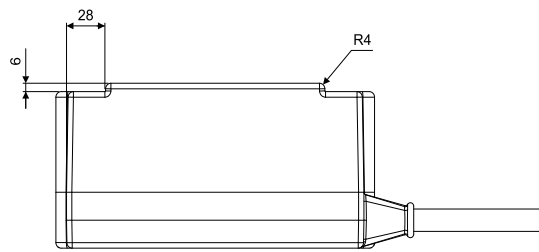The drawing is not in scale.

Cd021617 Page 2 of 2
223232 Rev.A

10.1.5 Transducer TX1 Outline dimensions

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

Cd021603 Page 1 of 2
216148 Rev.A

28

6

R4

Section A-A

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

Cd021603 Page 2 of 2
216148 Rev.A

10.1.6 Transducer TX2 Outline dimensions

490

53 96 96 96 96 53

ø16.5

ø25

37.5

A

A

118

20

101 288 101

R10

224 240

Transducer registration no. and
serial no. are indicated on the
cables.
Standard cable length = 15 m.

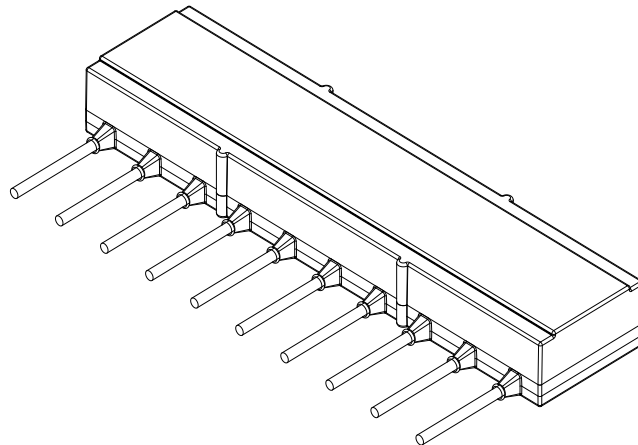Note:
All measurements are in mm.
The drawing is not in scale.
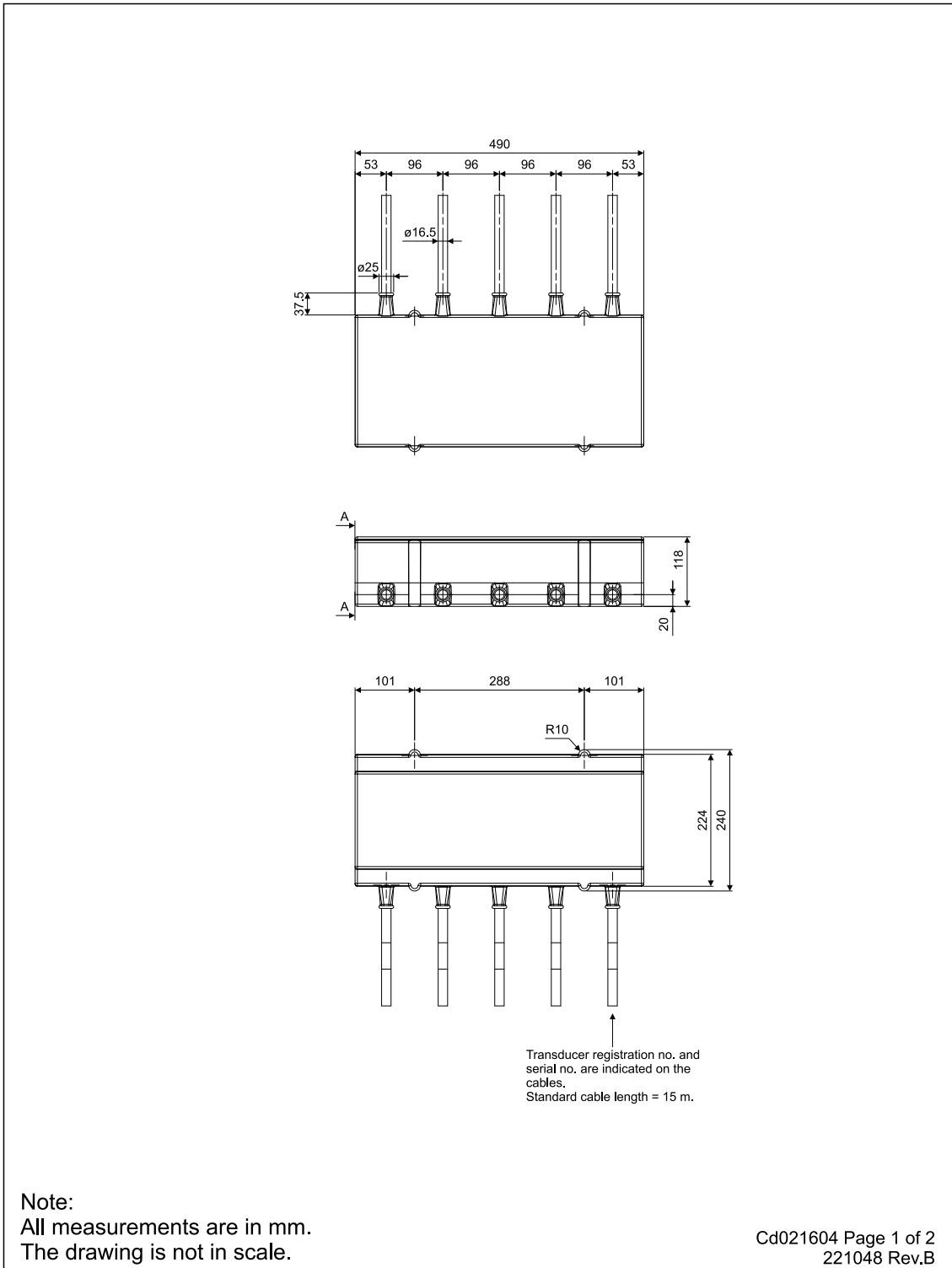
Cd021604 Page 1 of 2
221048 Rev.B

28

6

R4
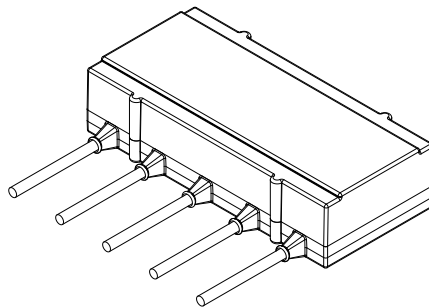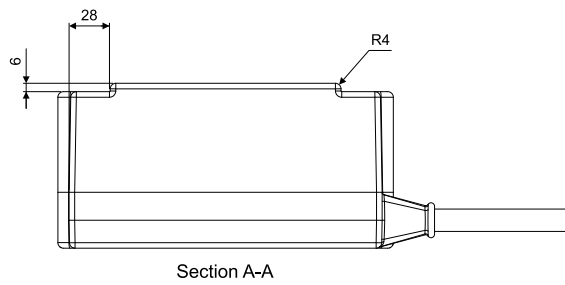
Section A-A

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

Cd021604 Page 2 of 2
221048 Rev.B

10.1.7 Transducer RX1 Outline dimensions

Transducer registration no. and serial no. are indicated on the cables.
Standard cable length = 15 m.

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

Cd021605 Page 1 of 2
219621 Rev.A

28

6

R4

Section A-A

Cd021605 Page 2 of 2
219621 Rev.A

10.1.8 Transducer RX2 Outline dimensions

Transducer registration no. and serial no. are indicated on the cables.
Standard cable length = 15 m.

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

Cd021606 Page 1 of 2
216146 Rev.A

28

6

R4

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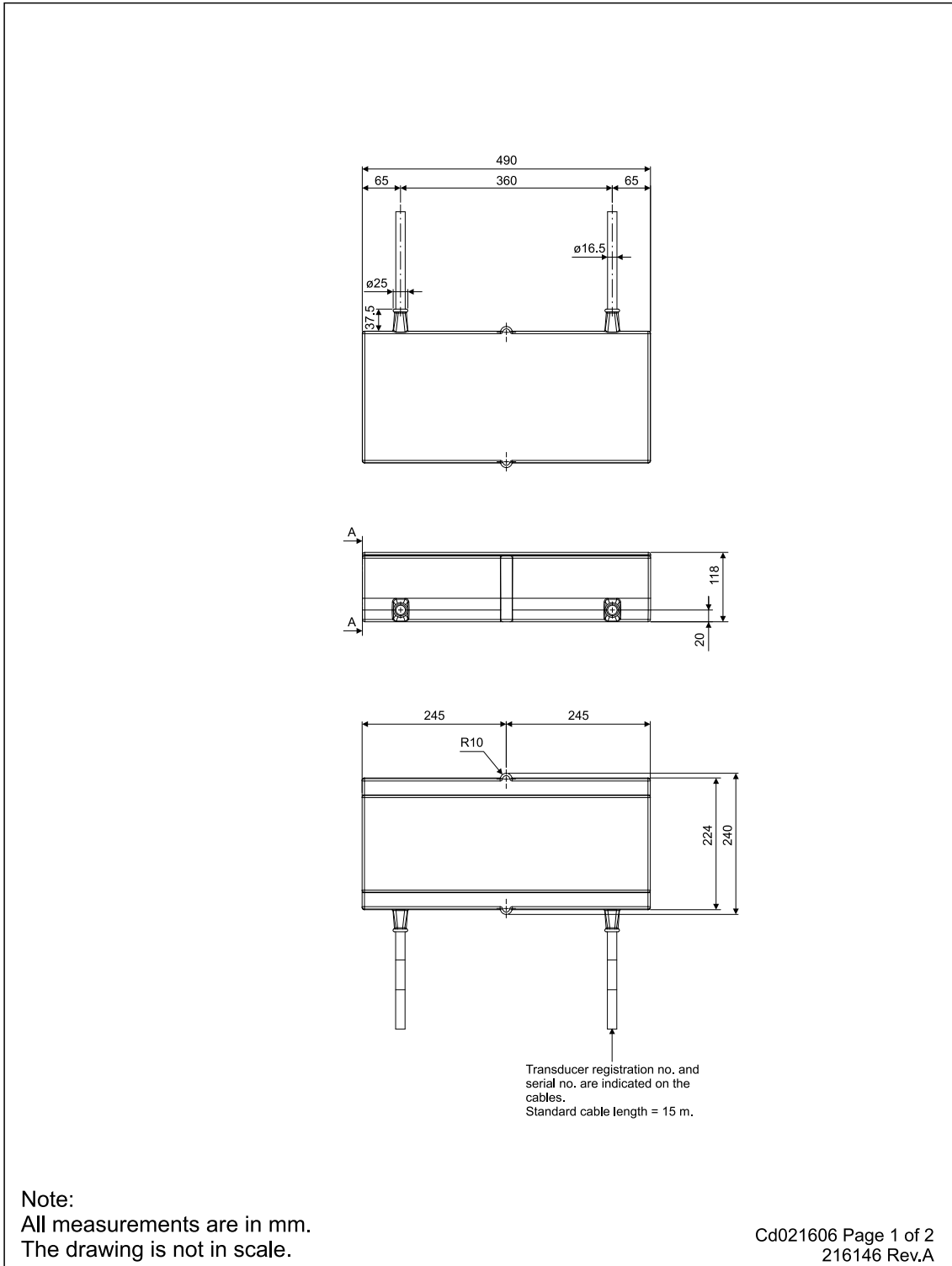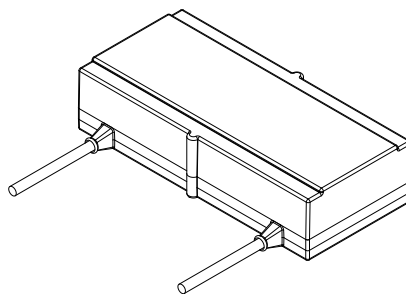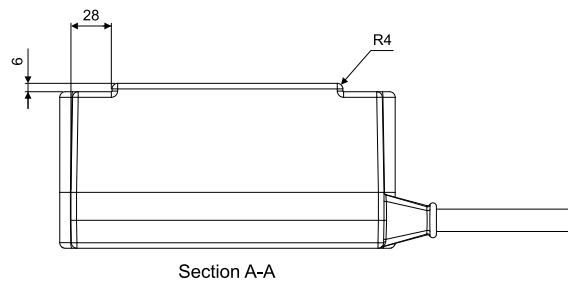
Note:
All measurements are in mm.
The drawing is not in scale.

CD021606 Page 2 of 2
216146 Rev.A

10.1.9 HWS Operator Station Outline dimensions
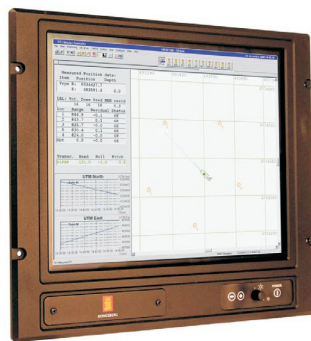
19" LCD:
Width = 483 mm
Height = 444 mm
Depth = 68 mm
Weight = 12 kg

HWS 19" Rack:
Width   = 427 mm
Height = 180 mm/4U
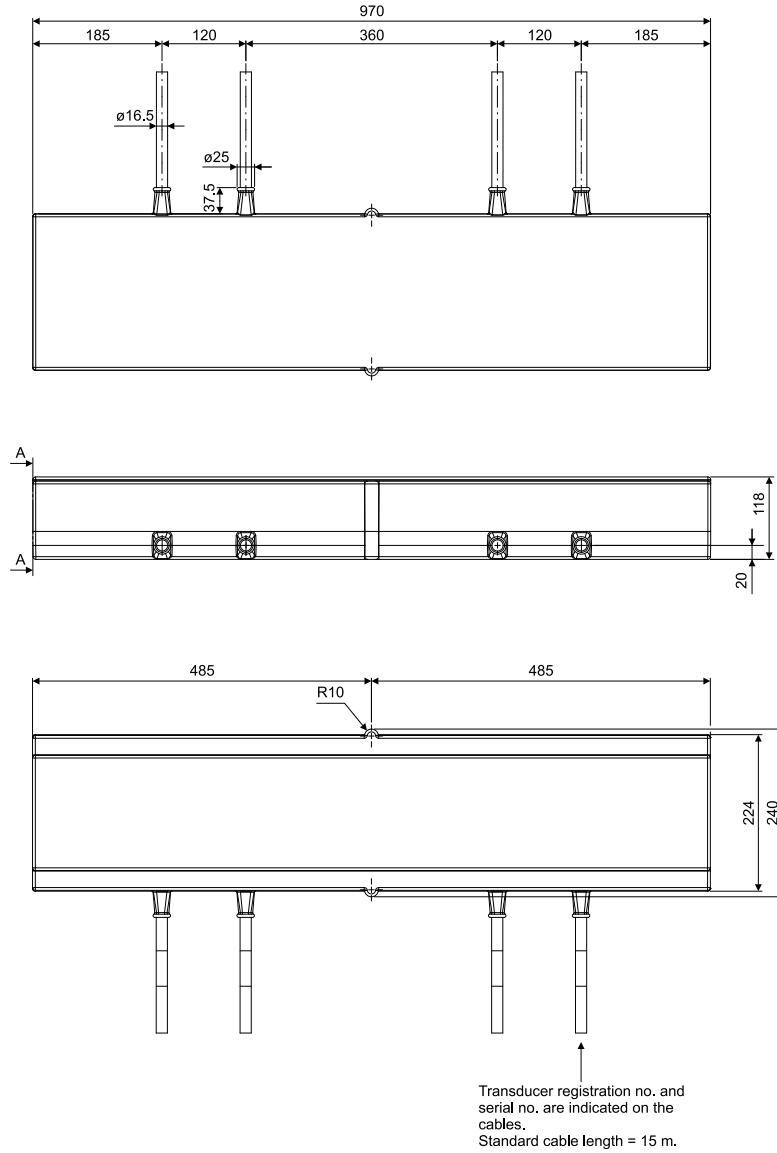Depth   = 480 mm
Weight = 20 kg

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

Cd021046 Page 1 of 1
307181 Rev. A

10.1.10 Transceiver Unit Outline dimensions

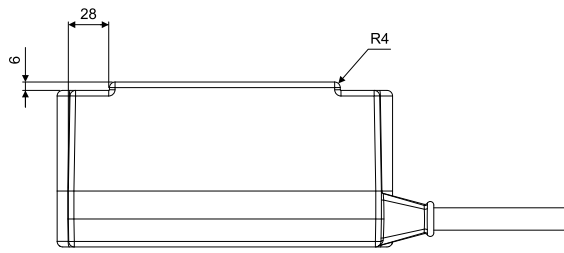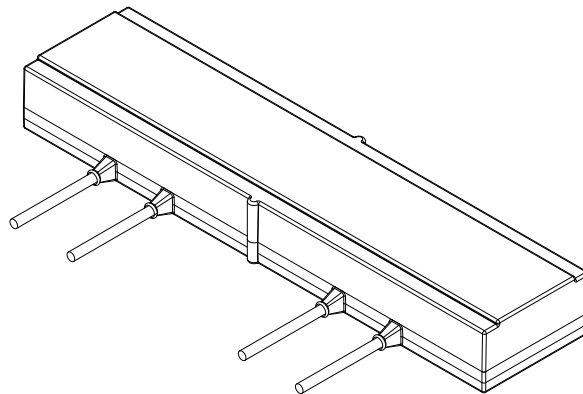Note:
All measurements are in mm.
The drawing is not in scale.

Cd021602 Page 1 of 2
223122 Rev.A

SEEN FROM TOP

SHOCK ABSORBER

DOOR

MAIN SECTION

IP PROTECTION COVER

~115

DOOR

SHOCK ABSORBER

MAIN SECTION

IP PROTECTION COVER

REQUIRED INSTALLATION SPACE

750

~1200

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

Cd021602 Page 2 of 2
223122 Rev.A

10.1.11 Transceiver Unit 2 x 2 degree system – Outline dimensions

Detail A

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

Cd021664-001 Page 1 of 2
318712 Rev.A

SEEN FROM TOP

SHOCK
ABSORBER

DOOR

MAIN SECTION

IP PROTECTION COVER

~115

DOOR

SHOCK
ABSORBER

MAIN SECTION

IP PROTECTION COVER

REQUIRED INSTALLATION SPACE

750

~240

~1300

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

Cd021664-001 Page 2 of 2
318712 Rev.A

10.1.12 Transceiver Unit mounting bracket

M10x30 Hex
cap screw (x8)

M10 (x8)
To be threaded after
surface treatment

(140)
111.5
28.5
0
0
40
230
370
560
600 ±2.5

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

Cd021613 Page 1 of 1
212984 Rev.A

10.1.13 Junction Box – outline dimensions

Junction Box EM1-212595 (108-212591)

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

CD021645 Page 1 of 1
212593 Rev.B

10.1.14 Transceiver Unit cable clamp

Other external cables
(power, serial lines, Ethernet etc.)

RX cables

TX cables

M10x100 Hex cap screw
with spring washer and
6K locking nut (x4)

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

Cd021614 Page 1 of 1
223163 Rev.A

10.2 Cable Drawings

10.2.1 Generic RS-232 Serial line

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

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

W104 Rev.D	Standard RS-232 serial line
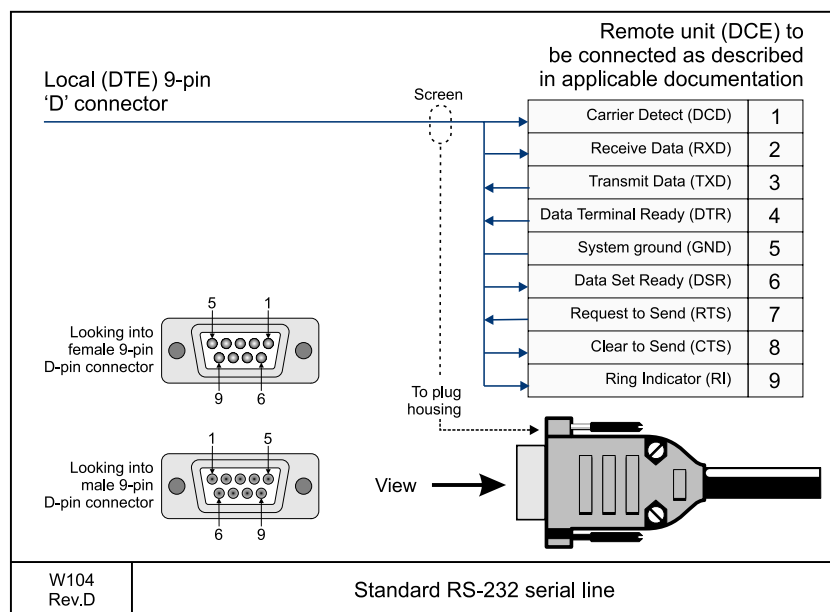
Cable specifications

- Conductors: 5 x 2 x 0.5 mm²

- Screen: Screened twisted pairs and overall braided

- Voltage: 60 V

- Maximum diameter: Limited by the plugs

10.2.2 Generic coax cable

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

Peripheral unit to be connected as described in applicable documentation	**Local Coax connector** Live Gnd Screen/Ground Live
W105 Rev.E	Coax connection to peripheral unit or network

10.2.3 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.
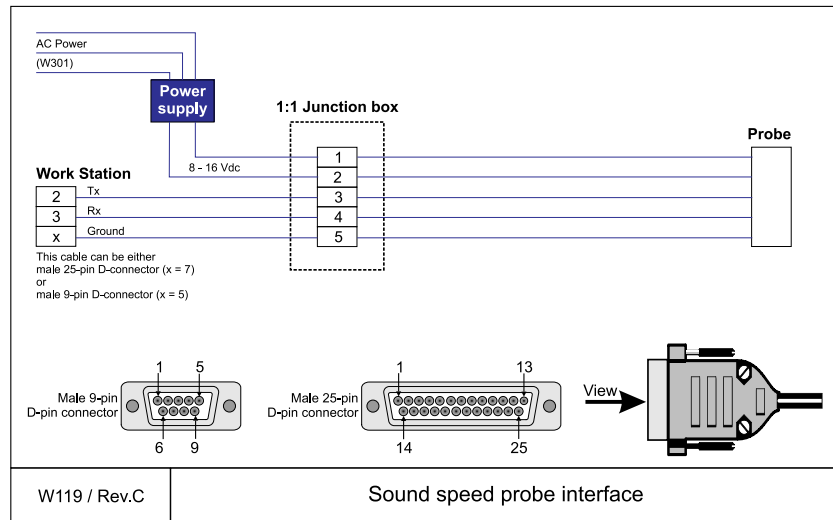
The cable between the junction box and the probe is supplied by the probe manufacturer.

- Conductors: 2 x 2 x 0.5 mm²

- Screen: Screened twisted pairs and overall braided

- Voltage: 60 V

- Maximum diameter: Limited by the plugs

10.2.4 RS-232 or RS-422/485 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.

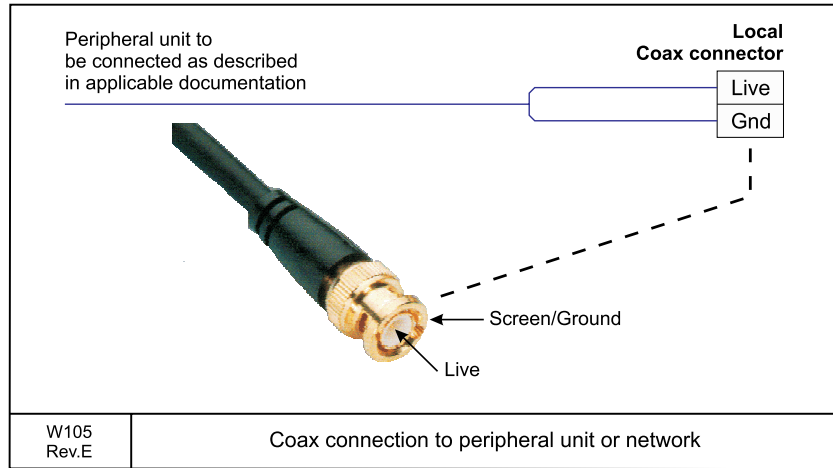| W127 Rev. A | Standard RS-232 or RS-422/485 serial line |
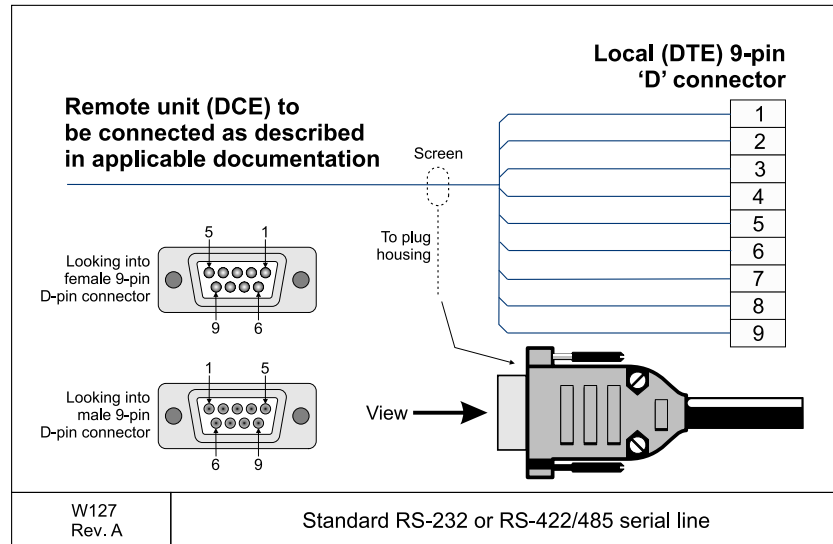
- Conductors: 6 x 2 x 0.5 mm²

- Screen: Screened twisted pairs and overall braided

- Voltage: 60 V

- Maximum diameter: Limited by the plugs

10.2.5 Trigger in/out (not used)

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

The cable is normally not used.

| W242 / Rev. A | EM Trigger in/out |

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

## 10.2.6 Internal control signals

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

W243 Rev. A	EM Control signals
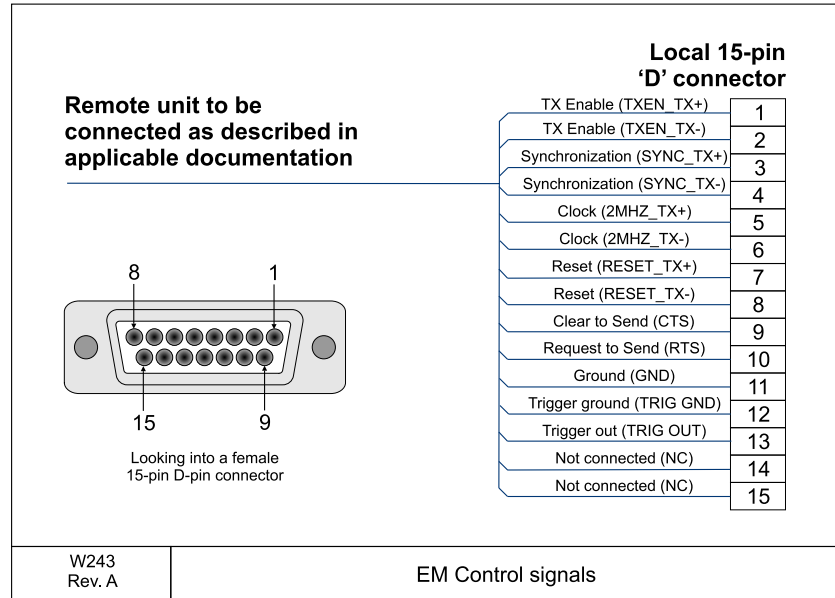
- Conductors: 9 x 2 x 0.5 mm²
- Screen: Screened twisted pairs and overall braided
- Voltage: 60 V
- Maximum diameter: Limited by the plugs

10.2.7 Remote control and external trig

This cable connects the EM 710 Transceiver Unit to a remote On/Off switch, normally located in a Remote Control junction box.

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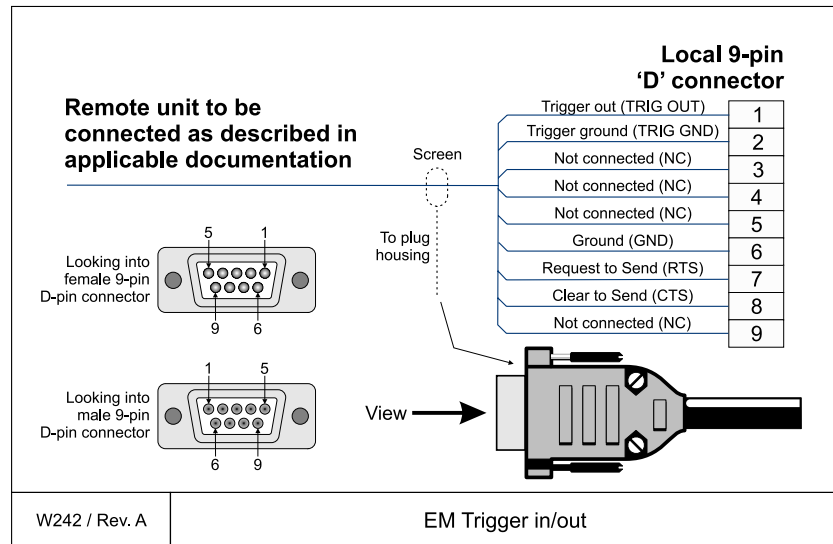

| W245 / Rev. A | NSEM Remote On/Off control and synchronization |
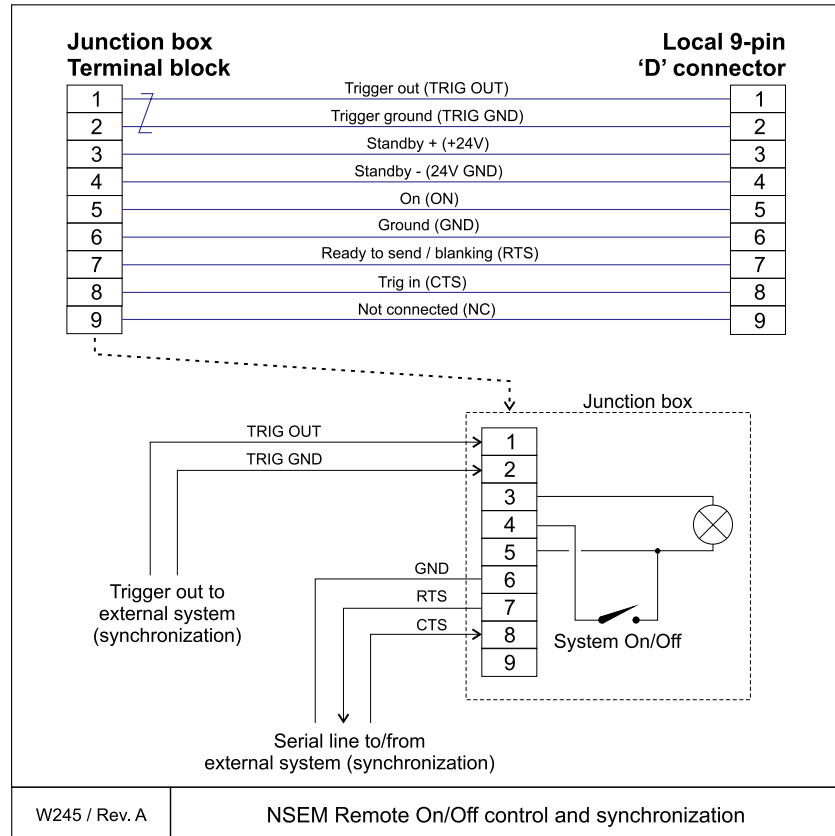
- Conductors: 5 x 2 x 0.5 mm²
- Screen: Overall braided
- Voltage: 60 V
- Maximum diameter: Limited by the plugs

10.2.8 Standard AC power cable

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

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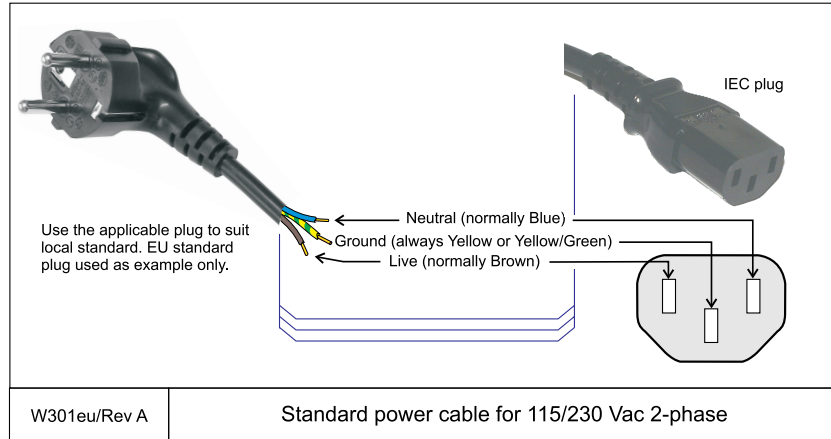
Note

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

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

10.2.9 Ethernet cable with RJ45

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

Ethernet cables are available commercially in different lengths, colours and categories.
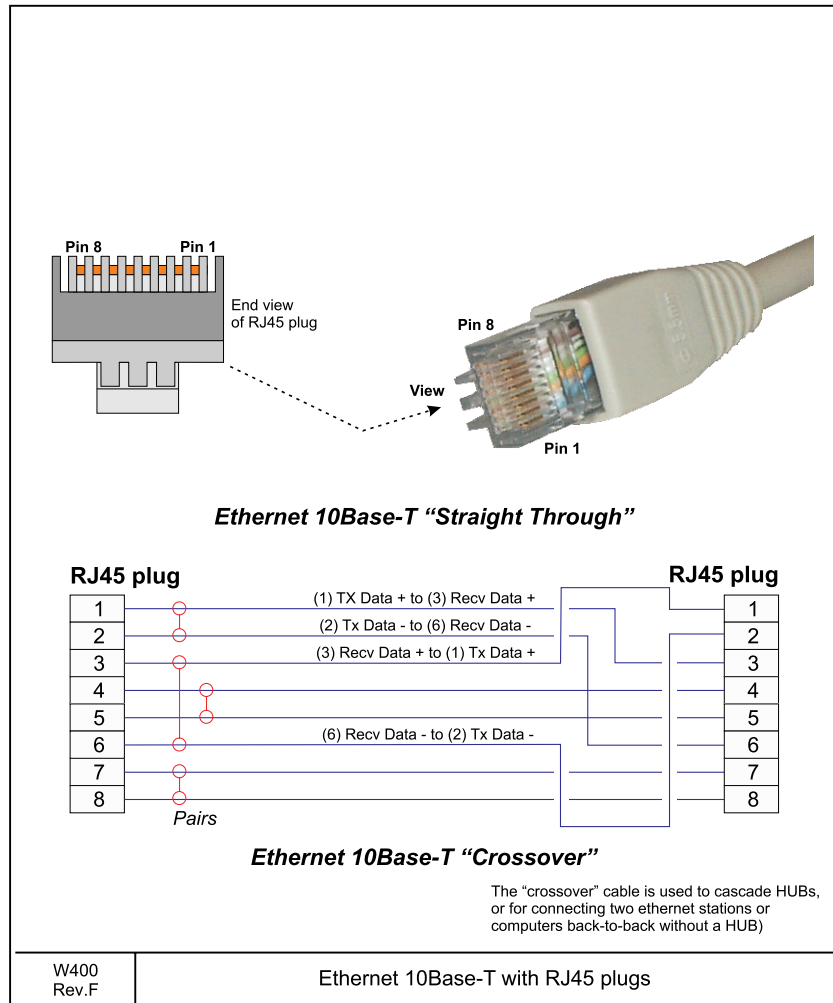
Screened category 6 (or 5 E) twisted pair cable to fit the specific RJ45 connectors used. AWG 23 and 24 size conductors are recommended.

10.2.10 VGA/SVGA Display cable

This is a standard commercial SVGA/VGA display cable used to connect the video signals. The cable is normally physically attached to the display monitor, and it is provided with the plug readily attached. If it is supplied as a separate cable, it is fitted with plugs on either end.
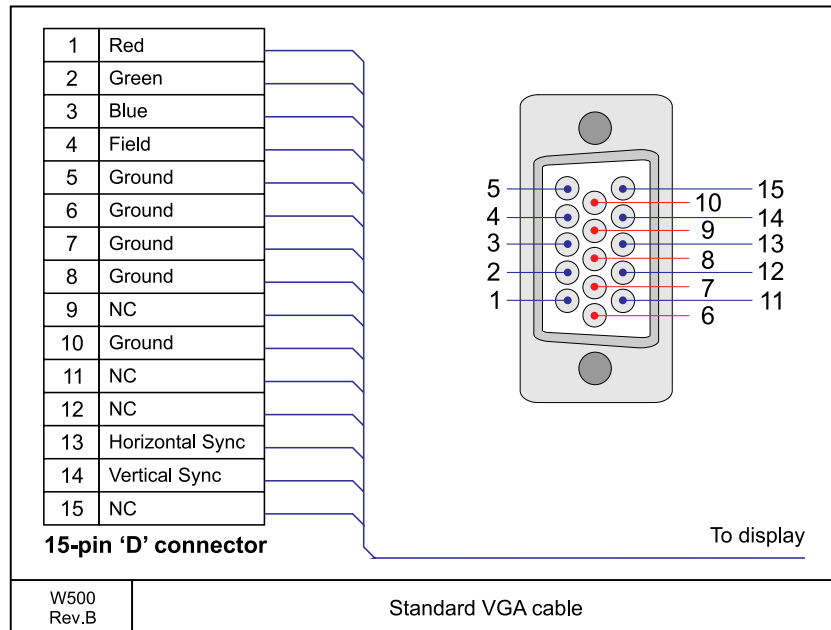
1	Red
2	Green
3	Blue
4	Field
5	Ground
6	Ground
7	Ground
8	Ground
9	NC
10	Ground
11	NC
12	NC
13	Horizontal Sync
14	Vertical Sync
15	NC

15-pin 'D' connector

To display

W500 Rev.B	Standard VGA cable

- Conductors: Defined by the manufacturer
- Screen: Defined by the manufacturer
- Voltage: Defined by the manufacturer
- Maximum diameter: Defined by the manufacturer
- Termination: Normally 15–pin D-connector(s)

10.2.11 USB cable

Just about any computer that you buy today comes with one or more Universal Serial Bus (USB) connectors on the back. These connectors let you attach everything from mouse to printers to your computer quickly and easily. Since the operating system supports USB, installation of device drivers is also easy.

In most cases, the USB cable is commercial, and they are normally supplied with the external devices, However, USB cables are also available commercially in different fixed lengths.

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

W501 Rev.B	Commercial USB cable

10.2.12 Keyboard cable

This is a standard keyboard cable. The cable is normally 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.
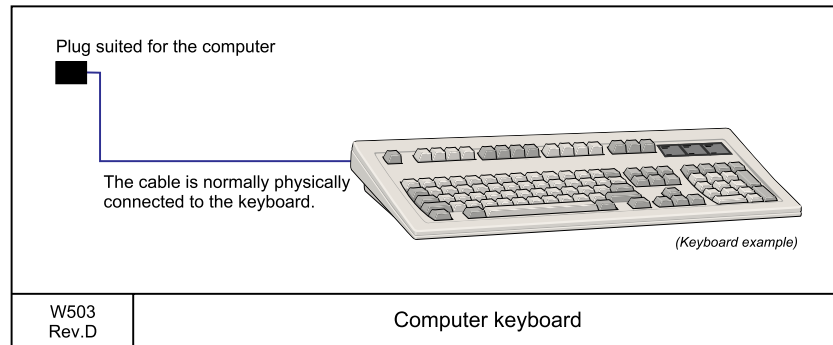
Plug suited for the computer

The cable is normally physically connected to the keyboard.

(Keyboard example)

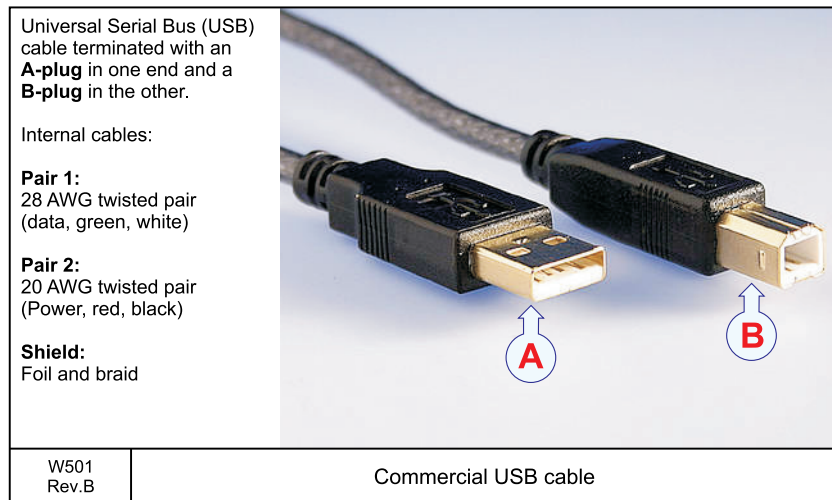| W503 Rev.D	Computer keyboard

- Conductors: Defined by the manufacturer
- Screen: Defined by the manufacturer
- Voltage: Defined by the manufacturer
- Maximum diameter: Defined by the manufacturer
- Termination: USB, DIN or similar

10.2.13 Mouse cable

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

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

Various mouse types support two or three buttons, and may also provide a scroll wheel.

Plug suited for the computer

The cable is physically connected to the mouse

Note that certain mouse types for Unix work stations are connected to the keyboard.

Mouse
(Different mouse types and other pointing devices are supplied)

W504 Rev.D	Mouse / Pointing device

- Conductors: Defined by the manufacturer
- Screen: Defined by the manufacturer
- Voltage: Defined by the manufacturer
- Maximum diameter: Defined by the manufacturer
- Termination: USB, PS2 or similar

10.2.14 Parallel printer
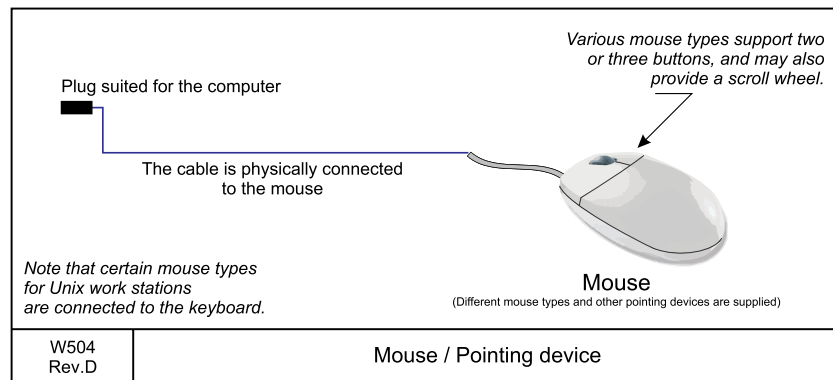
This is a standard "Centronics" parallel printer cable. It is provided ready-made with printers, and also obtainable from commercial retailers.

25-pin D-connector		Parallel port connector (IEEE 1284-A)
1	Strobe	
2	Data 0	
3	Data 1	
4	Data 2	
5	Data 3	
6	Data 4	
7	Data 5	
8	Data 6	
9	Data 7	
10	Acknowledge	
11	Busy	
15	Error	
18-24	Ground	

The socket on the rear side of the computer is normally a 25-pin female D-connector.

13   1
25   14

W505 Rev.E	Centronics parallel printer cable
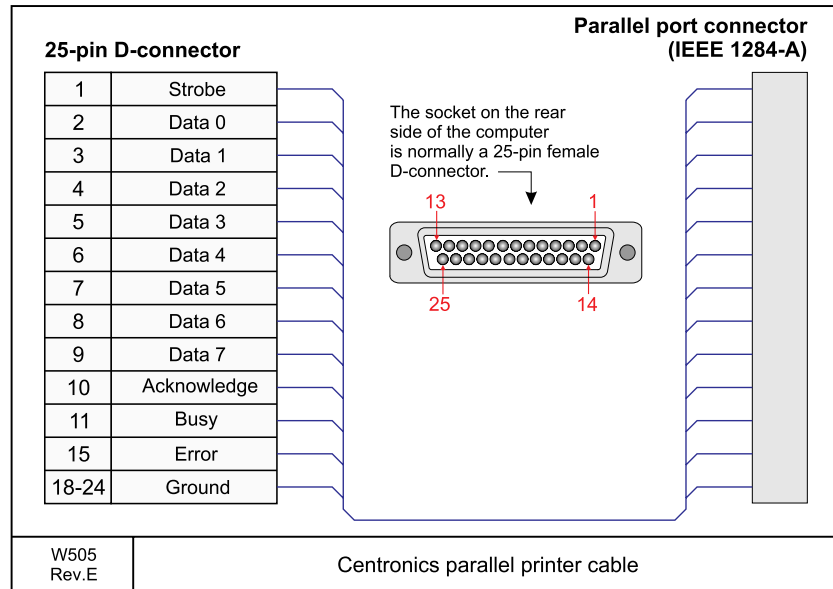
Cable specifications

- Conductors: Defined by the standard

- Screen: Defined by the cable manufacturer, normally overall braided

- Voltage: 60V

- Maximum diameter: Defined by the cable manufacturer

- Termination: 25–pin "D-sub" connector in one end, parallel port connector in the other end (IEEE 1284–A)

10.2.15 RX/TX transducer cables

These are the cables from the EM 710 Transceiver Unit to the RX/TX transducer arrays. Each cable is terminated at the cabinet's rear through a 78–p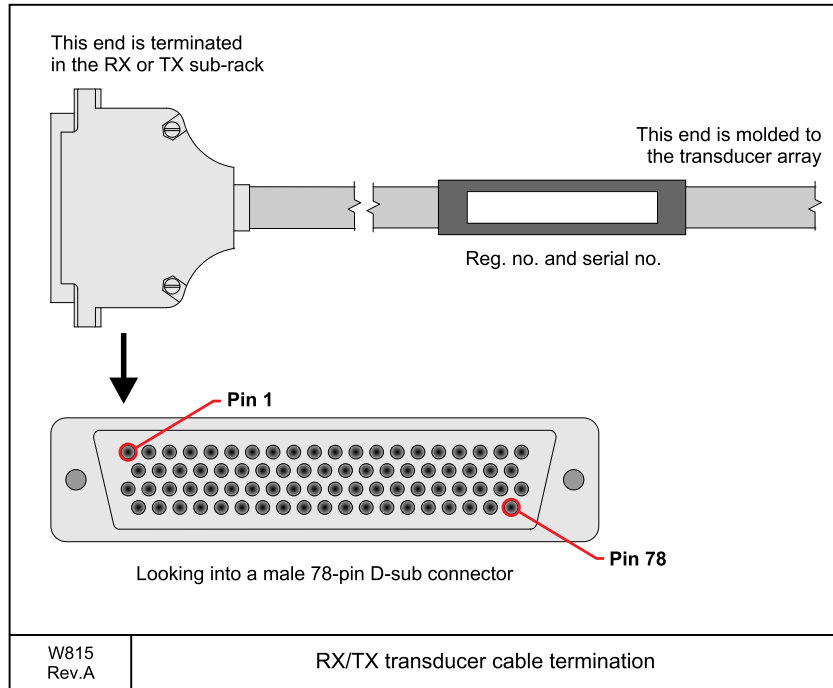in D-sub connector. At the transducer end, the cables are moulded to their respective arrays. The cables are supplied by manufacturer.

This end is terminated in the RX or TX sub-rack

This end is molded to the transducer array

Reg. no. and serial no.

Pin 1

Pin 78

Looking into a male 78-pin D-sub connector

W815 Rev.A	RX/TX transducer cable termination

The following table displays the pin assignment in the transducer cable from the RX RIO board in the Transceiver Unit to the RX transducer

Table 12   RX transducer cable pin assignment

Module no.	Element no.	Pin no.		Wire colour code	
1	1	1	21	White	Brown
1	2	40	60	Green	Yellow
1	3	2	22	Grey	Pink
1	4	41	61	Blue	Red
1	5	3	23	Black	Violet
1	6	42	62	Grey/pink	Red/blue
1	7	4	24	White/green	Brown/green
1	8	43	63	White/yellow	Yellow/brown
1	9	5	25	White/grey	Grey/brown
1	10	44	64	White/pink	Pink/brown
1	11	6	26	White/blue	Brown/blue
1	12	45	65	White/red	Brown/red

Table 12   RX transducer cable pin assignment (cont'd.)

Module no.	Element no.	Pin no.		Wire colour code	
1	13	7	27	White/black	Brown/black
1	14	46	66	Grey/green	Yellow/grey
1	15	8	28	Pink/green	Yellow/pink
1	16	47	67	Green/blue	Yellow/blue
2	1	9	29	Grey/blue	Pink/blue
2	2	48	68	Grey/red	Pink/red
2	3	10	30	Grey/black	Pink/black
2	4	49	69	Blue/black	Red/black
2	5	11	31	White	Brown
2	6	50	70	Green	Yellow
2	7	12	32	Grey	Pink
2	8	51	71	Blue	Red
2	9	13	33	Black	Violet
2	10	52	72	Grey/pink	Red/blue
2	11	14	34	White/green	Brown/green
2	12	53	73	White/yellow	Yellow/brown
2	13	15	35	White/grey	Grey/brown
2	14	54	74	White/pink	Pink/brown
2	15	16	36	White/blue	Brown/blue
2	16	55	75	White/red	Brown/red

The following table displays the pin assignment in the transducer cable from the TX RIO board in the Transceiver Unit to the TX transducer.

Table 13   TX transducer cable pin assignment

Element no.	Pin no.		Wire colour code	
1	1	21	White	Brown
2	2	22	Green	Yellow
3	3	23	Grey	Pink
4	4	24	Blue	Red
5	5	25	Black	Violet
6	6	26	Grey/pink	Red/blue
7	7	27	White/green	Brown/green
8	8	28	White/Yellow	Yellow/brown
9	9	29	White/grey	Grey/brown
10	10	30	White/pink	Pink/brown
11	11	31	White/blue	Brown/blue
12	12	32	White/red	Brown/red

Table 13   TX transducer cable pin assignment (cont'd.)

Element no.	Pin no.		Wire colour code	
13	13	33	White/black	Brown/black
14	14	34	Grey/green	Yellow/grey
15	15	35	Pink/green	Yellow/pink
16	16	36	Green/blue	Yellow/blue
17	17	37	Green/red	Yellow/red
18	18	38	Green/black	Yellow/black
19	40	60	Grey/blue	Pink/blue
20	41	61	Grey/red	Pink/red
21	42	62	Grey/black	Pink/black
22	43	63	Blue/black	Red/black
23	44	64	White	Brown
24	45	65	Green	Yellow
25	46	66	Grey	Pink
26	47	67	Blue	Red
27	48	68	Black	Violet
28	49	69	Grey/pink	Red/blue
29	50	70	White/green	Brown/green
30	51	71	White/yellow	Yellow/brown
31	52	72	White/grey	Grey/brown
32	53	73	White/pink	Pink/brown
33	54	74	White/blue	Brown/blue
34	55	75	White/red	Brown/red
35	56	76	White/black	Brown/black
36	57	77	Grey/green	Yellow/grey

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