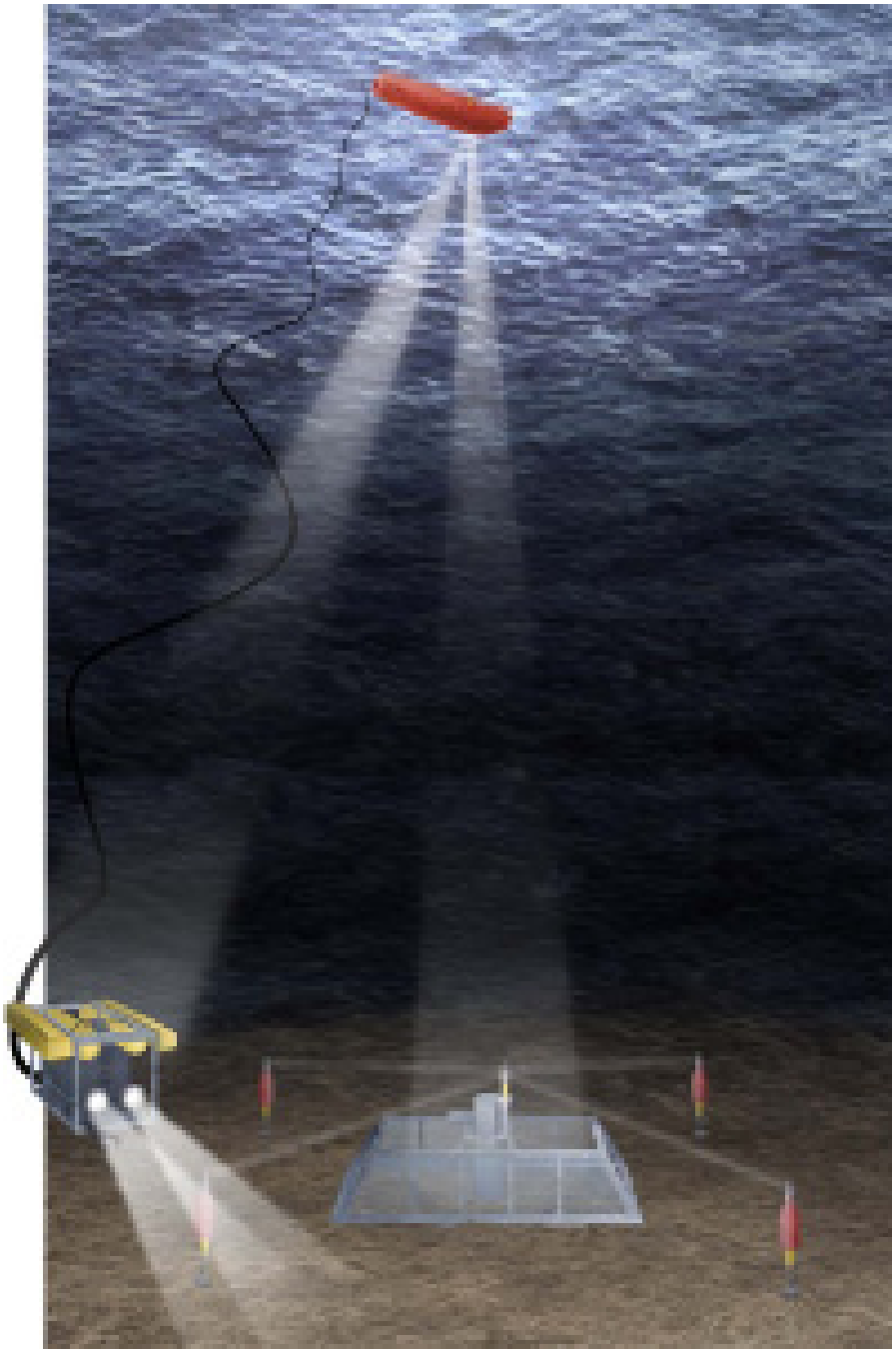
Instruction Manual

KONGSBERG

HiPAP®

High Precision Acoustic Positioning

Model 501/451/351/101



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Instruction Manual

Document history

Rev	Date	Written by	Checked by	Approved by
H	07.03.2013	AJ	AD	JEF
	Replaced APC12 with MP8200 8 channel serial line model P/N: 364602. General updates.			

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Disclaimer

Kongsberg Maritime endeavours to ensure that all information in this document is correct and fairly stated, but does not accept liability for any errors or omission.

Warning

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

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Additional documents

Display manual

Separate manual supplied with the display. Not a Kongsberg Maritime document.

Keyboard manual

Separate manual supplied with the keyboard. Not a Kongsberg Maritime document.

Trackball

Separate document supplied with the trackball. Not a Kongsberg Maritime document.

Air to air heat exchange unit for Transceiver Unit x81

Not a Kongsberg Maritime document.

Air to air heat exchange unit for Transceiver Unit x21

Not a Kongsberg Maritime document.

Remarks

The reader

The installation information in this manual is intended for the design and installation engineers at the yard performing the installation. The information is supplied as the basis for the yard's own installation drawings applicable to the vessel. On completion of the installation, this section may be used for reference purposes during system maintenance.

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

High voltage safety warning

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

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

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

Caution *Never work alone on high-voltage equipment! Refer to general safety procedures.*

Table of contents

1 ABOUT THIS MANUAL

This document is the Instruction manual for the (High Precision Acoustic Positioning) HiPAP® Model 501/451/351/101 systems (named HiPAP® systems in rest of the manual).

The manual contains descriptions, specifications, procedures and illustrations required to install and maintain the HiPAP® system units.

The manual also defines the equipment responsibility, and provides general information about preservation, packing and storage of the units, and provides the Factory Acceptance Tests and the HiPAP® test and alignment procedures.

The system is described down to circuit board level, named as the Line Replaceable Units (LRUs). Block diagrams and drawings are used to simplify the descriptions.

Conversion kits for upgrading of old HiPAP® systems are also included.

References

→ *319957 - APOS for HiPAP® 501/451/351/101 Instruction Manual*

→ *311046 - HiPAP® hull units Model 501/451/351/101 Instruction Manual*

→ *331070 - HiPAP® Commissioning check and verification*

→ *859-216300 - Backup files document*

Abbreviations

Abbreviations used in this manual:

APOS	Acoustic Positioning Operator Station
BOP	Blow Out Preventer
CG	Centre of Gravity
DP	Dynamic Positioning
DVI	Digital Visual Interface
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HiPAP®	High Precision Acoustic Positioning
HPR	Hydroacoustic Position Reference
LBL	Long Base Line
LRU	Line Replaceable Unit
MULBL	Multi-User Long Base Line
PCB	Printed Circuit Board
ROV	Remotely Operated Vehicle
RTB	Responder Terminal Block
SSBL	Super Short Base Line
SSLBL	Super Short and Long Base Line

Backup

You are advised to take a backup of all operator stations at regular intervals (1-3 months), and every time major changes have been performed in configuration and /or user settings.

Software upgrade

Caution ***A system backup must be performed when the software has been upgraded.***

→ *The backup procedures are included in a separate document, the* ***Backup files document****, doc no 859-216300.*
This document is supplied with every system delivered.

2 SYSTEM DESCRIPTION

This chapter provides a brief description of the HiPAP® systems and configurations. It also gives a short description of each unit.

Topics

Related topics

HiPAP® systems – short overview

The HiPAP® systems are designed for optimal positioning of subsea objects in both shallow and deep water.

All HiPAP® systems; HiPAP® 501, HiPAP® 451, HiPAP® 351 and HiPAP® 101 have common software and hardware platforms, and thereby offer the same kind of additional functionality and options.

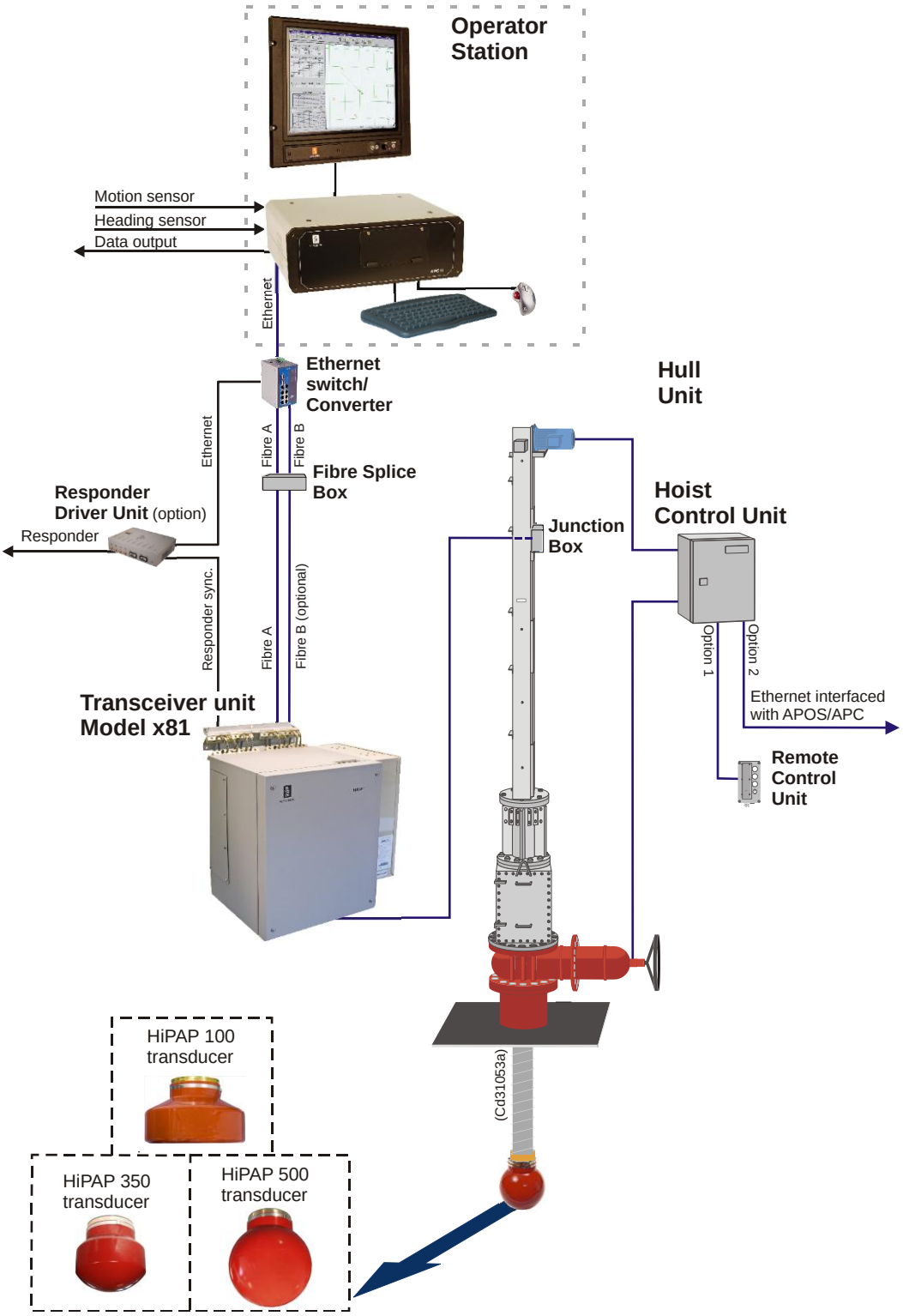
- The HiPAP® 501, HiPAP® 451, HiPAP® 351 systems are medium frequency systems operating from 21 kHz to 31 kHz.
- The HiPAP® 101 system is a low frequency systems operating from 10 kHz to 15.5 kHz.

HiPAP® system configuration

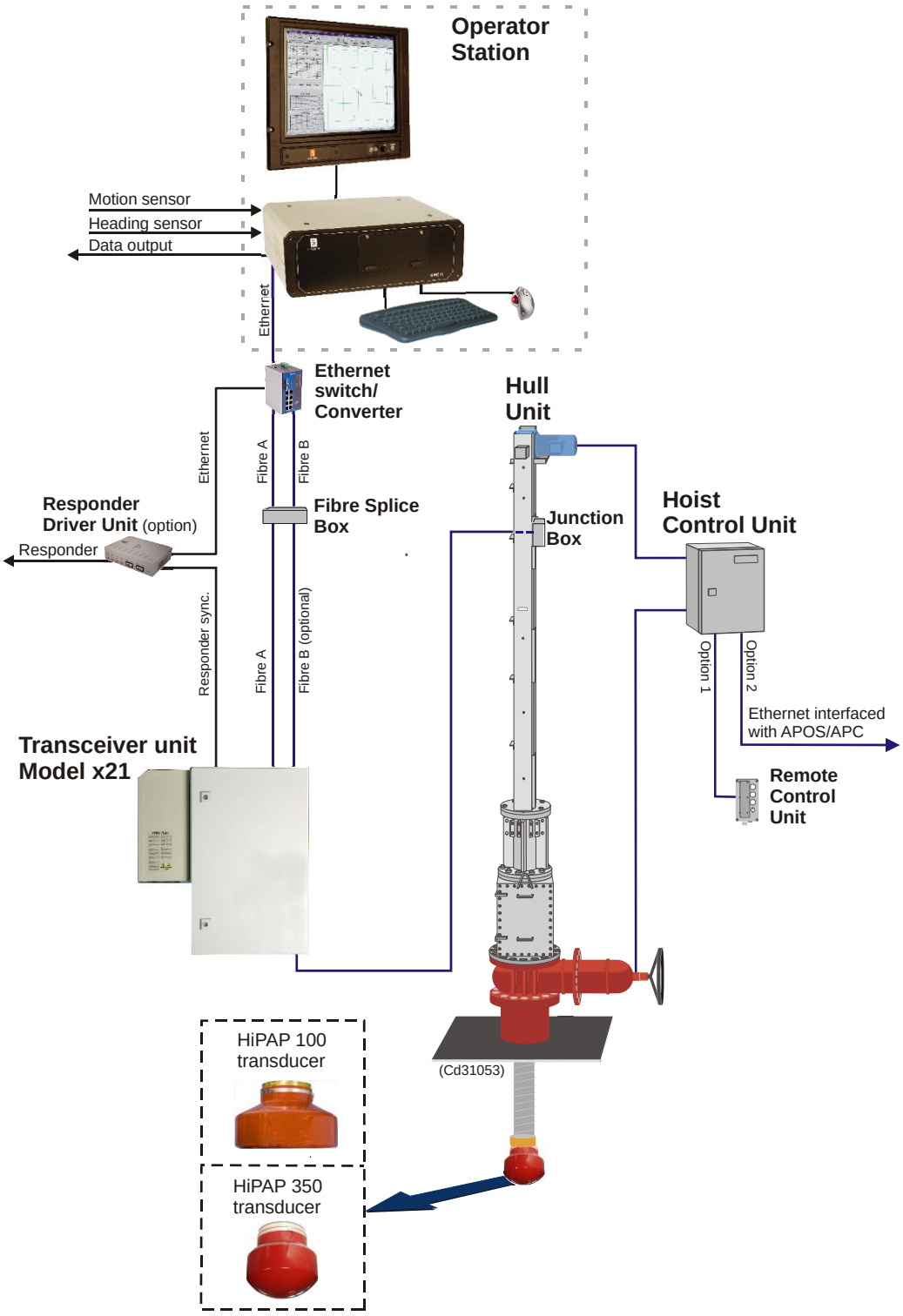
A HiPAP® system may be configured as:

- **Standard HiPAP® systems**:
  - HiPAP® systems used with Transceiver unit Model x81, *see figures on page 5*
  - HiPAP® systems used with Transceiver unit Model x21, *see figure on pages* 6
- **HiPAP® Dual Net system**:
  - HiPAP® systems used with Transceiver unit Model x81, *see figure on page 7*

HiPAP® system with Transceiver unit Model x81

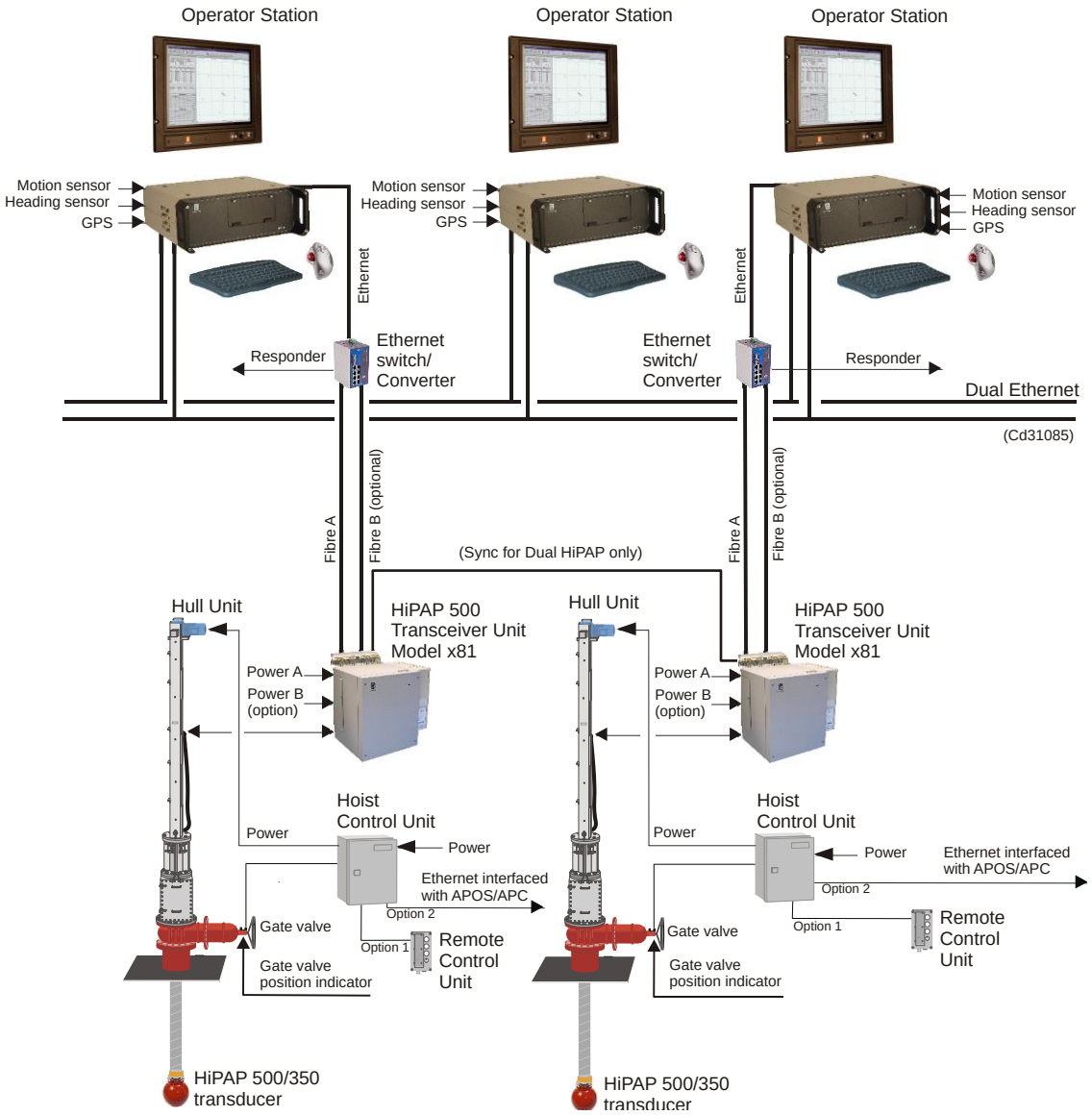


HiPAP® system with Transceiver unit Model x21



HiPAP® redundant system

Example of a HiPAP® redundant system:



Operator station

The operator station may be configured in two ways:

1. Stand alone

- Computer
- Display
- Keyboard
- Trackball

The stand alone configuration can be fitted as:

- **Contained in a standard 19" rack**
  - The display and the computer are fitted into a standard 19" rack unit. The keyboard and the trackball may be placed on a desk, or on a suitable shelf. The transceiver unit is installed close to the hull unit.
  - The display, the computer and the keyboard are fitted into drawers in a standard 19" rack unit.
- **Desktop system**
  - The display, the computer, the keyboard and the trackball sit on a desk top or a purpose-built shelf.

2. Operator console

If the HiPAP® system is delivered together with a Kongsberg DP system the operator station may be installed in a standard Kongsberg DP console.

Transceiver unit (system-specific)

Two types of transceiver units are available:

- HiPAP® Transceiver unit Model x81are used for the systems 501, 451 and 351.
  - HiPAP® systems used with Transceiver unit Model x81, *see figures on pages 5 and 7.*
- HiPAP® Transceiver unit Model x21 are used for the systems 351 and 101.

– HiPAP® systems used with Transceiver unit Model x21, *see figure on page* 6.

Hull unit (system-specific)

Hull units w/transducer, gate valves, Hoist Control Unit with Ethernet interface are described in the *HiPAP® hull units Model 501/451/351/101 Instruction Manual.*

APOS

The HiPAP® system is operated from APOS, a Windows based software system. The system can be operated from one single APOS station or from a wide number of APOS operator stations connected on a network.

Sensors

The HiPAP® system has a wide range of interfaces to sensors from different manufacturers.

The HiPAP® system needs high accuracy heading, roll and pitch sensors to be interfaced.

The accuracy of the sensors has direct impact on the position.

Conversion kits for upgrading of an "old" HiPAP® system

- Transceiver unit Model x81 to be used with a transducer cable with plug.

→ *See information on page 59*

- Transceiver unit Model x21 to be used with a transducer cable with plug.

→ *See information on page 63*

For more information, contact Kongsberg Maritime.

System units - short description

Topics

Operator Station

The HiPAP® System is operated through either one or several Operator Stations.

The Operator Station consists of the following main units:

- A Windows™ based personal computer
- A display for presentation of information
- Keyboard and mouse

The same computer is used for all types of installation, desktop or rack with additional mounting brackets or rails as required.

Power

The computer can be powered from either a 115 VAC or 230 VAC supply.

USB disk

An USB disk containing programs for backup and restore is delivered at the system setup. These programs can only be used when the system boots from the USB disk.

Keyboard

The keyboard is a PS/2 keyboard. It is a QWERTY keyboard with US layout and includes back-lighting.

Trackball

The trackball is a standard trackball with a scroll wheel and three buttons.

Display

→ *Refer to the separate manual supplied with the display.*

1PPS converter (option)

The 1PPS converter is an option to a standard HiPAP® system.

1PPS; One Pulse per Second.

The signal is normally taken from a GPS receiver or a time synchronize unit.

This pulse is used to synchronize the clock on the APOS/HiPAP system with a reference clock.

In addition to the pulse, a message with correct time must be transmitted on the same serial line as used for the 1PPS input.

A 1PPS converter passes the RS-232 GPS Position Data through but shapes the 1PPS pulse to a fixed pulse length and converts it from TTL level to RS-232 level.

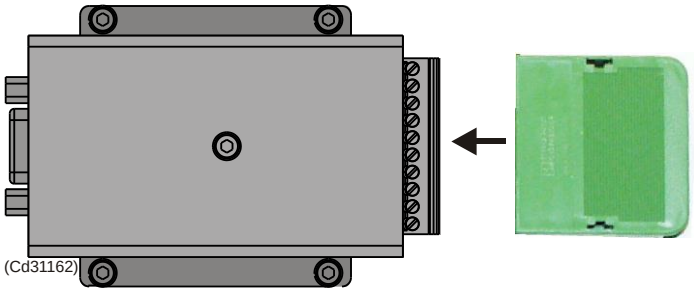


Figure 1 1PPS converter

Ethernet switch/Converter

The Ethernet switch/Converter is used for:

- Interface Optical fibre cable to transceiver

- Responder Driver Unit
- Hoist Control Unit with Ethernet
- Gate Valve Main Control Unit with Ethernet

Fibre Splice Box

The Fibre Splice Box has eight (8) ports. This box is used to splice the system fibre-optic cables.

Transceiver units

The HiPAP® transceiver units are steel cabinets, containing a rack holding the system electronics modules. The units are fitted with an air to air heat exchange unit.

The transceiver units are designed to be mounted on a suitable bulkhead and are fitted with vibration/shock absorbers to reduce the effects of transceiver unit vibrations.

Topics

→ *Transceiver unit Model x81 on page 13*

→ *Transceiver unit Model x21 on page 14*

Transceiver unit Model x81

- Transceiver unit x81 may be delivered with:
  - With the air to air heat exchange unit mounted on the right side as standard.
    or
  - With the air to air heat exchange unit mounted on the unit door (optional).

An access door for plugging connectors and service is located on the left side of the unit.

Figure 2 Standard Transceiver unit Model x81 w/air to air heat exchange unit mounted on the right side

- Used for the HiPAP® 501 with eight (8) TRX32 boards
- Used for the HiPAP® 451 with two (2) TRX32 boards
- Used for the HiPAP® 351 with two (2) TRX32 boards
- Used for the HiPAP® 101 with one (1) TRX32 board

System upgrade

The HiPAP® 451 can be upgraded to full HiPAP® 501 performance. This is done by:

- Installation of 6 additional transmitter/receiver boards (TRX32) in the transceiver unit.
- APOS software upgrade.

Connections

All cables to and from the transceiver unit enter the unit through the base of the unit.

Power

The transceiver unit is powered from a 230 Vac supply. The power switch (Main switch) is located inside the transceiver unit.

→ *Refer to figure on page 80*

If you only have 110 Vac power available, you must use a 110 Vac to 230 Vac transformer - see page 15.

Transceiver unit Model x21

Transceiver unit x21 are delivered with the air to air heat exchange unit mounted on the left side.

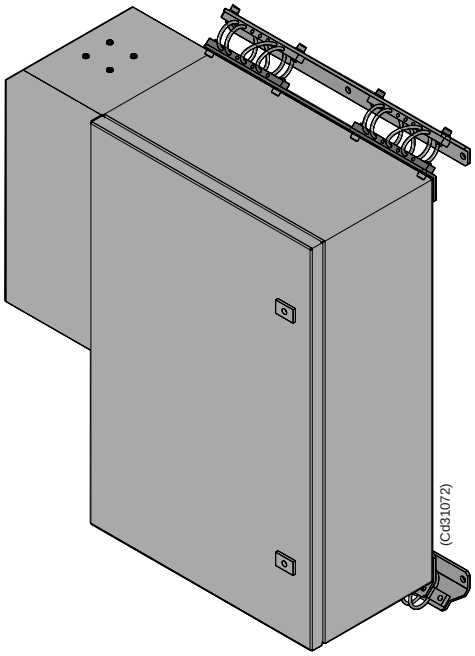


Figure 3 Transceiver unit Model x21

- Used for the HiPAP® 351 with two (2) TRX32 boards
- Used for the HiPAP® 101 with one (1) TRX32 board

Connections

All cables to and from the transceiver unit enter the unit through the base of the unit.

Power

The transceiver unit is powered from a 230 Vac supply. The power switch (Main switch) is located inside the transceiver unit.

→ *Refer to figure on page 91*

If you only have 110 Vac power available, you must use a 110 Vac to 230 Vac transformer - see page 15.

110 Vac to 230 Vac transformer - option for both transceiver units

If your only have 110 Vac power available, an external transformer from 110 Vac to 220 Vac must be installed on the main power line to both the Transceiver unit Model x81 and the Transceiver unit Model x21

→ *Order no see page 20*

3 TECHNICAL SPECIFICATIONS

This chapter gives the technical specifications of the HiPAP® system units.

Topics

Related topics

Operator Station

Weight:	7.6 kg
Dimensions (WxDxH):	338 x 379 x 100 mm

→ *Outline dimensions - see drawing in the Drawing file chapter from page 157*

Power specifications

Voltage:	110/220 VAC
	50/60 Hz autosensing
	240 W 85+ autosensing power

Connections

Parallel port:	1 x HP Parallel Port Adapter
Serial port:	COM1
	8 port Bluestorm card
USB:	8 x USB 2.0
VGA:	1 x VGA – implemented on motherboard
Display port:	1 x Display port – implemented on motherboard
	Display port adapter (HP Display port to DVI-D Adapter)
Audio:	1 x Audio in
	1 x Audio out
	Integrated High Definition audio with AD1884 codec
Others:	2 x PS2
	1 x Headphone/line-out
	1 x Microphone in

Fibre Splice Box

Eight (8) ports MX-WFR-00024-02.

→ *For more information, refer to the supplier*

Ethernet switch/Converter

The converter requires a power supply. The DR-4524 DIN-rail 24 Vdc Power Supply is used.

Transceiver units

Common data

This data is the same for x81 and x21 transceiver units.

Degree of protection:	IP 44

Power

Voltage:	230 Vac
– The power supply to a HiPAP® transceiver unit must be kept within ±10% of the unit's nominal voltage. – The maximum transient voltage variations on the main switch- board's bus-bars which could occur (except under fault conditions), are not to exceed -15% to +20% of the nominal voltage. – Using 110 Vac to 230 Vac transformer (option) - see page 20	
Inrush max:	35 A Ac
Maximum current drawn:	2.5 A
Nominal:	1.6 A Ac
Frequency:	50 - 60 Hz
Nominal power consumption:	370 W

Environment

Operating temperature:	0° C to +55° C
Storage temperature:	-20 to +65° C
Humidity:	15% - 95% (non condensing)

Vibration

Range:	5-100 Hz

Excitation level:	5-13.2 Hz ±1.5 mm, 13.2-100 Hz 1 g

The HiPAP transceiver accepts the following input formats:

Gyro:

- NMEA $**HDT
- NMEA $**VHW
- Yokogawa $**HRC
- SKR
- STL

VRU / Attitude:

- EM 3000
- $SPSXN,10
- $SPSXN,23
- IxSea Octans TAH ($PHOCT) R-P-H (UTC)
- IxSea Octans $PHTRO (roll and pitch)
- Ixsea *Octans $PHLIN (Heave only)*

Data input can be either serial line RS-232 / RS-422 or Ethernet UDP.

Serial line speeds can be from 1200 baud up to 115200 baud, 1 or 2 stop bits, 7/8 bit data and parity none, even or odd.

Note

For attitude data, the data rate should be at least 25 Hz, 100 Hz is recommended.

Model x81

Weight:	approximately 80 kg (depending on number of PCBs fitted)

→ *Outline dimensions - see drawing in the Drawing file chapter from page 157*

Main power supply

Input:	230 Vac

Output:	24 Vdc, 12 Vdc, 6 Vdc, 5 Vdc, 3.2 Vdc
Input:	230 Vac
Output:	48 Vdc

Model x21

Weight:	approximately 35 kg (depending on number of PCBs fitted)

→ *Outline dimensions - see drawing in the Drawing file chapter from page 157*

Main power supply

Input:	230 Vac
Output:	48 Vdc, 24 Vdc12 Vdc, 5.4 Vdc

110 Vac to 230 Vac transformer (option)

For installations where only 110 Vac power is available, an external transformer from 110 Vac to 220 Vac must be installed on the main power line to the transceiver units.

Order no.:	319618
Weight:	7. 8 kg
Outline dimensions:	(300 x 250 x 155) mm

SSBL accuracy

The angular figures are errors in both axis, elevation and orthogonal.

The specification is based on:

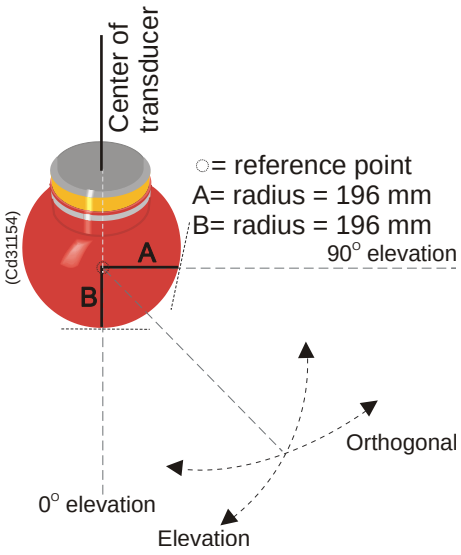
- Free line of sight from transducer to transponder.
- No influence from ray-bending.
- Signal to Noise ratio in water in the 250 Hz receiver band.
- No error from heading and roll / pitch sensors.

Transducer reference point

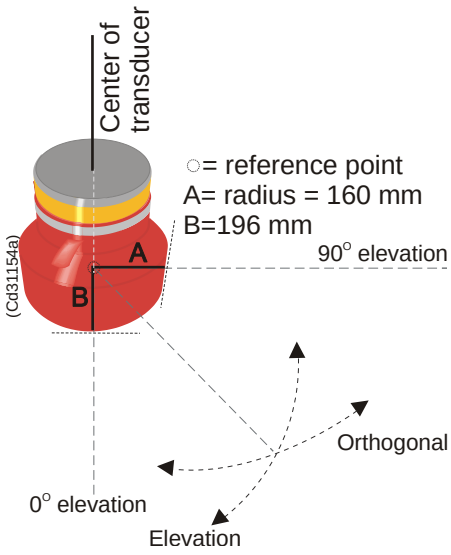
The reference points shown below are the origin for the position measurements.

The elevation and orthogonal angles are used in the accuracy curves.

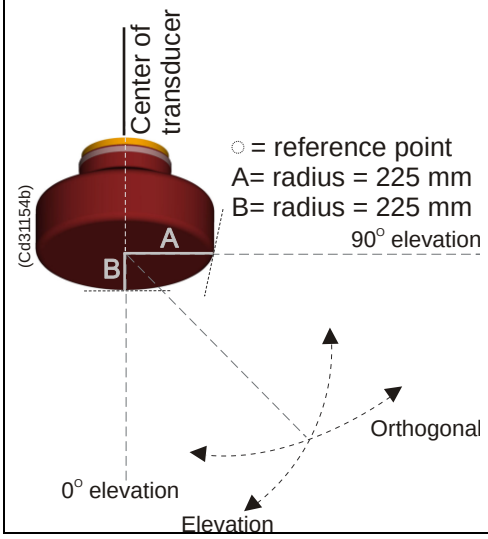
HiPAP® 500 transducer



HiPAP® 350 transducer



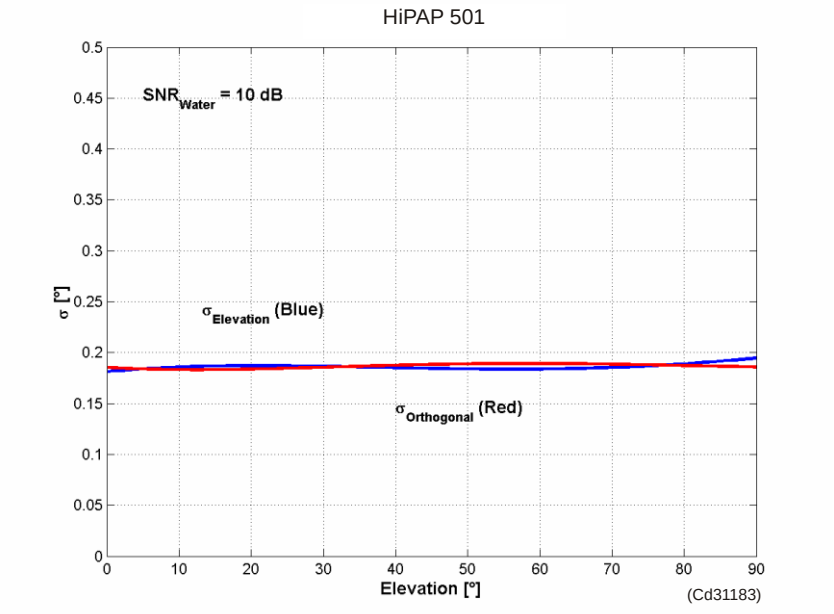
HiPAP® 100 transducer



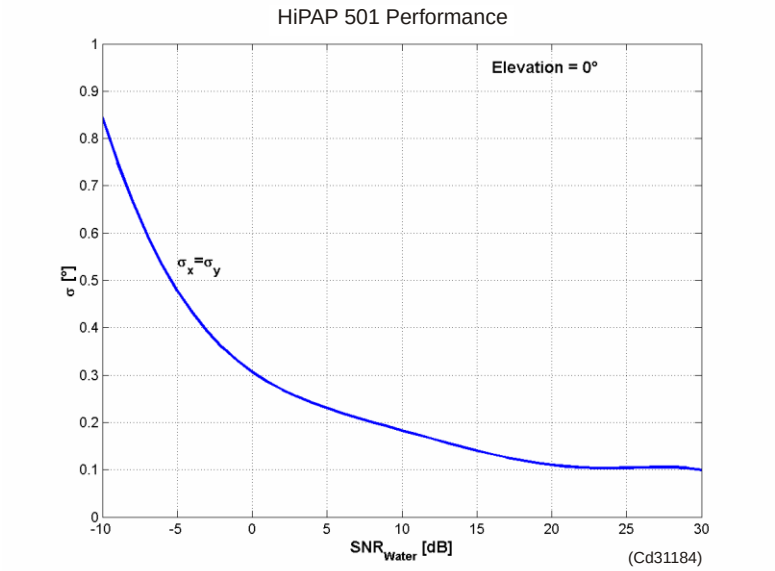
HiPAP® 501

	HiPAP® 501 Single system			HiPAP® 501 Dual system		
	S/N [dB rel. 1µPa]			S/N [dB rel. 1µPa]		
	20	10	0	20	10	0
Angular Accuracy [°] (At 0° elevation)	0.12	0.18	0.3	0.085	0.13	0.21
Range Accuracy [m]	0.1	0.1	0.15	0.1	0.15	0.15
Cymbal Range Accuracy [m]	0.02	0.02	0.02	0.02	0.02	0.02
Receiver beam [°]	10			10		
Coverage [°]	±100			±100		

Accuracy curves – HiPAP® 501



The figure above shows the accuracy as a function of elevation angle. The signal to noise ratio of 10 dB is in the bandwidth.



The figure above shows the accuracy as a function of signal to noise ratio. The elevation and the orthogonal angles are 0° (at vertical).

HiPAP® 451

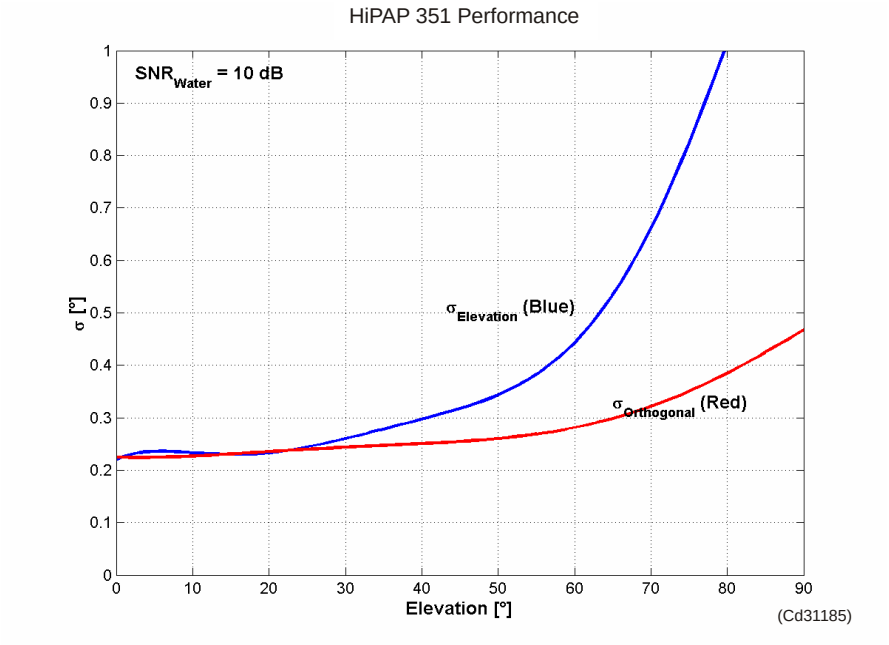
The HiPAP® 500 transducer is used. HiPAP® 451 has the same technical performance as HiPAP® 351.

HiPAP® 351

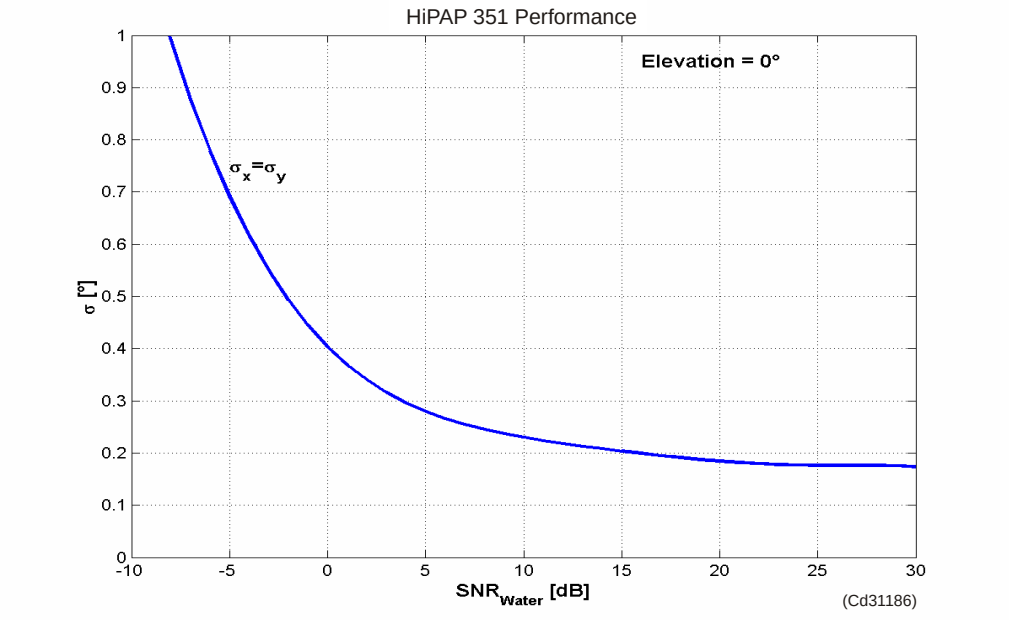
HiPAP® 351/451 Single system	**S/N [dB rel. 1µPa]**		
	20	10	0
Angular Accuracy, 1σ [°] (At 0° elevation)	0.18	0.23	0.4
Range Accuracy, 1σ [m]	0.1	0.15	0.2
Cymbal Range Accuracy, 1σ [m]	0.02	0.02	0.02
Receiver beam [°]	15		
Coverage [°]	+/-80		

The elevation and orthogonal angles are used in the accuracy curves.

Accuracy curves – HiPAP® 351



The figure above shows the accuracy as a function of elevation angle. The signal to noise ratio 10 dB is in the bandwidth.



The figure above shows the accuracy as a function of signal to noise ratio. The elevation and the orthogonal angles are 0° (at vertical).

HiPAP® 101

HiPAP® 101 system	S/N [dB rel. 1µPa]
	20
Angular Accuracy, 1σ [°] (At 0° elevation)	0.14
Range Accuracy, 1σ [m]	0.2
Cymbal, Range Accuracy, 1σ [m]	0.02
Receiver beam [°]	15
Coverage [°]	+/-60

LBL accuracy

The position accuracy for LBL operation depends on the transponder array geometry, sound velocity errors and signal to noise ratio. Range accuracy's down to a few centimetres can be obtained, while ROV and vessel positions can be calculated to within a few decimetres.

Table 1 and Figure 4 show acoustic parameters and position accuracies that are achieved in deep waters when using an array with four transponders at water depth 3000m.

Source of random error	1-sigma FSK	1-sigma Cymbal
Range reception with 20 dB S/N	0.15 m	0.02 m
Range reception in the transponder	0.15 m	0.02 m
Range error due to transponder movements	0.01 m	
Range error due to rig movements	0.05 m	
HiPAP® Angle accuracy	0.15°	

Table 1 Sources of random errors on the acoustic measurements

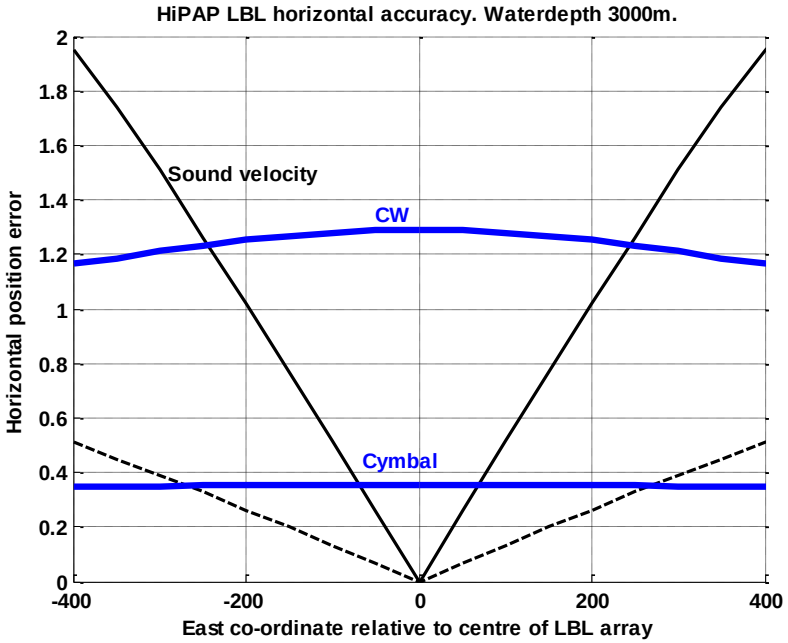


Figure 4 LBL position error in the horizontal plane as a function of the East co-ordinate. The North co-ordinate is zero. The blue lines show random error due to acoustics. Black line is systematic error due to 1 m/s wrong sound velocity settings.

The blue lines in Figure 4 show the random error in the horizontal position when the rig moves within a transponder array with 4 transponders placed on a circle with 500 m radius at water depth 3000 m. The lower line shows the expected error when the Cymbal acoustics is used and the upper line when the old CW acoustics is used.

The black line shows the systematic error when the sound velocity is set 1 m/s incorrectly in APOS. This error is zero in the centre of the array due to the symmetry. The LBL run time calibration should be done when the rig is in the centre of the array. Then the effect of a wrong sound velocity setting in APOS is strongly reduced, as shown with the dotted black line.

Range capabilities

The range capabilities of an acoustic system are dependent of the vessels noise level and attenuation of the transponder signal level due to ray bending. The transponder source level and the signal to noise ratio are crucial factors for calculating maximum range capability. The below figures are recommended guideline for maximum operating range.

Please also be aware of:

- The figures are valid for HiPAP® 501/351/451
- Figures for cNODE® are when used in Cymbal mode (Wideband)
- The HiPAP® system will in many cases have longer range capabilities that specified below due to its narrow receiving beam.
- The figures are approximate values for guidance.
- Ray bending can limit the maximum range
- Ray bending normally not a problem for vertical positioning operation

Transponder	**Transponder source level** (dB rel.1µPa ref. 1 m)	**Max Range (Typical, m)**
cNODE®, 180º transducer	190	2000
cNODE®, 40º transducer	203	3000
cNODE®, 30º transducer	206	4000
Standard MPT/SPT 319	188	1500
High power SPT 324	195	2000
High power SPT 331	206	3000

The specification is based on:

- Free line of sight from transducer to transponder
- No influence from ray bending
- Signal to Noise ratio ≥ 12 dB. rel. 1µPa

Fibre-optic cable

The following table shows recommended cable for use in Kongsberg Maritime networks.

Supplier part no.	KM part no.	Cable type	Configuration
507-UB04-080U-ALT/900	324994	Multimode OM 3 Fibre 50/125 µm	4 fibres, free length without connectors, flame retardant, halogen free

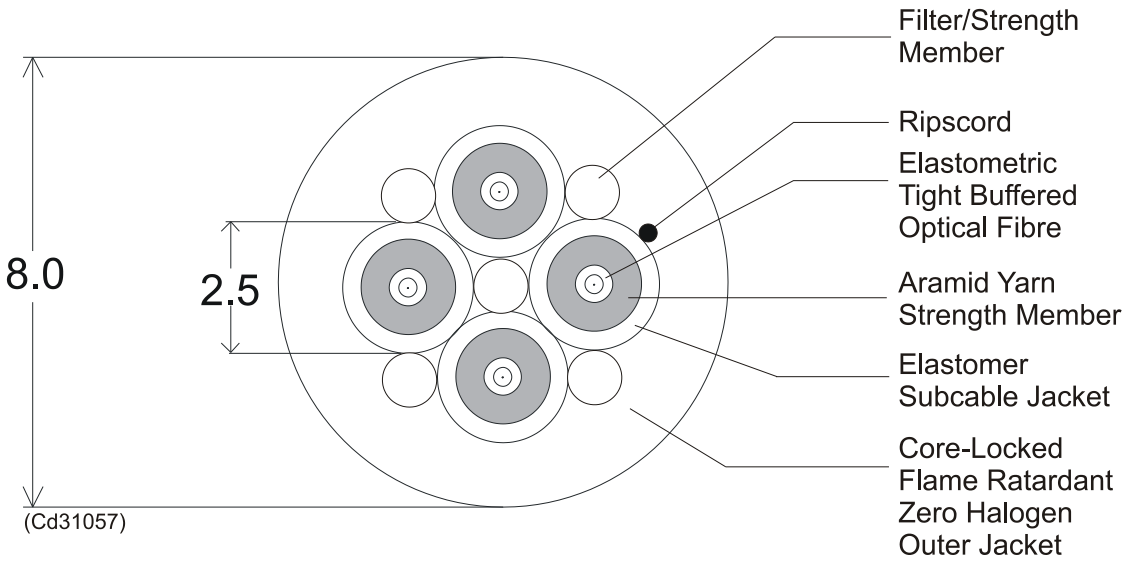


Figure 5 Fibre-optic cable details

Cable data

Cable diameter:	8.0 mm
Total cable weight:	65 kg/km
Operating temperature:	-40° C to +85° C
Installation temperature:	-10° C to +60° C
Storage temperature:	-55° C to +85° C

Installation

Minimum bend radius:	180 mm
Maximum tensile load:	2000 N

Operating

Minimum bend radius:	180 mm
Maximum tensile load:	800 N

Cord data

Cord diameter:	2.5 mm
Minimum bend diameter:	80 mm

Fibre data

Core diameter:		50 µm
Cladding diameter:		125 µm
Primary coating diameter:		250 µm
Secondary buffer diameter:		900 µm
Proof test level:		100 kpsi
* Wavelength:	**850 nm**	**1310 nm**
Bandwidth:	600 MHz	1000 MHz

***** Wavelength in the cable depends on the Ethernet switch used. KM normally uses 1300 nm with bandwidth 1000 MHz.

Patch cables

Patch cable used in the transceiver units

Fibre-optic cable:	310688
Type:	Multimode OM2 50/125 µm
Patch Cable:	EFNT010-001M-STLC
Length:	1 m
Connection:	ST-LC
Bandwidth:	10 Gb

Patch cable used for optic isolated responder

- Supplied by kit:
  Patch cable dupl. fiber-optic cable FC-2/2-2 metre (reg. no 719-097260), part of kit, see page 129
- Other lengths on request
- Connector type ST

Connector type ST

Figure 6 Connector type ST

4 INSTALLATION

This chapter provides the descriptions and drawing references required to install the HiPAP® systems.

The guidelines for installation presented in this manual must be regarded as a base for detailed plans prepared by the installation yard. These plans must include drawings, instructions and procedures specific to the ship in which the equipment is to be installed. These drawings must be approved by the local maritime classification society.

Note — *The display and computer should always be secured down to the surface on which they sit to avoid damage in the event of rough weather.*

Warning — ***The installation instructions given in this manual must be followed. Failure to do so may render the guarantee void.***

Warning — ***Kongsberg Maritime AS accepts no responsibility for any damage or injury to the system, ship or personnel caused by drawings, instructions and procedures not prepared by Kongsberg Maritime.***

Topics

→ *Transceiver unit Model x21 installation on page 41*

Related topics

→ *Cables on page 46*

→ *Drawings in the Drawing file chapter from page 157*

Supply conditions

Equipment responsibility

Upon receipt of the equipment the system owner or installation yard automatically becomes fully responsible for the equipment, unless otherwise stated in the contract. This responsibility covers the storage period before installation, the actual installation, commissioning, and the period between the completion of the commissioning and the acceptance of the equipment by the end user (normally the owner of the vessel or platform into which the equipment is to be installed).

- Reception, unpacking and storage. A separate chapter, *Equipment handling* is provided for this information – on page 139.

Installation guidelines

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

Assistance from Kongsberg Maritime

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

If required during a contractual test period, the yard must provide assistance necessary for the rapid and efficient completion of the work even when the work is to be performed outside normal working hours. This requirement includes assistance from subcontractors when applicable. Excessive waiting time resulting from delays caused by the yard will be charged to the yard.

Before you start

Precautions and requirements

Before you start the installation, you must take the following actions:

- Inform the supervisor / coordinator that the work is about to be carried out.
- Collect the required documentation and read the applicable procedures ***before*** commencing work.
- Collect the required tools. Normally only a standard tool set will be required. If special tools are necessary to perform a task, the procedure will list those required.
- Ensure that all power is switched off to the system, and remove the fuses. If power is required to perform a task, the procedure will state so.
- Label the on / off switches, circuit breakers and fuses with notes clearly stating that work is being carried out on the system.

Caution *Do not attempt to run the system before the checks listed in the* HiPAP check and verification procedure *have been completed.*

Standard tools

A standard mechanical tool set will be required for:

- Perform the installation, removal and replacement of modules and parts described in this manual.
- Perform the majority of the maintenance described in this manual.

A standard electrical tool set may be required to perform repairs to cables etc.

In addition, the normal heavy tools designed for installation work is required.

The following expendables are recommended:

- Isolating plastic tape
- Solders
- Wire straps in different sizes

Special tools

If special tools are required for a particular procedure, they will be listed at the beginning of that procedure.

Computer

The computer can be mounted either in a standard 19” rack, or on a desk. The type of installation must be stated when you order the unit, to ensure that rails or mounting brackets are supplied as appropriate.

- The computer supplied for desktop installation must be mounted as “best fit” for the user.
- If the computer is to be mounted in a 19” rack, an appropriate rack must be provided by the customer.

Handling

Care should be taken when unpacking and handling the equipment. A visual inspection should be made to check that the equipment has not been damaged during shipment and that all components and parts are present according to the packing list.

Unit location

The computer must be easily accessible during operation of the system.

Logistics

Safety - Refer to the safety warning in the front of this manual.

Personnel - 1 trained mechanical fitter.

Special tools - None.

Drawings – Computer mounting drawing in the Drawing file chapter from page 157.

Mechanical installation

The computer is mounted with a kit.

→ *See Mounting kit drawing in Drawing file on page 161.*

19” rack installation

The computer is supplied with a kit for rack mounting.

Procedure

1 Place the computer on the bottom plate.

2 Mount the housing onto the computer. Use the bolts and washers provided.

3 Follow the procedure provided by the rack manufacturer and mount the computer into the rack.

4 Place the keyboard and trackball on a suitable desk or shelf close to the computer.

5 Connect the cables.

Desktop installation

The computer, keyboard and trackball must be placed on a suitable desk or shelf and secured in position using the mounting brackets provided.

- Ensure that the desk/shelf is strong enough to support the weight of the units.
- Check that you can operate the system comfortably before securing the units in position.

Note

Refer to technical specifications starting on page 16 for the weights of the unit, and check the strength of the desk/shelf before placing the units. Remember that vertical accelerations due to vessel pitch, roll and slamming in heavy seas will increase the instantaneous weights of the units considerably.

Cabling

Ensure that enough excess cable is provided to allow the units to be moved around during maintenance.

1 Connect the standard cables between the various units.

2 Perform the remaining cable interconnections.

3 Check the supply voltages and all cable connections before applying power to the system.

Note *Several of the cables are delivered with the units. Connectors and pin allocations for these cables are given in this document for reference only.*

1PPS converter (option)

The 1PPS converter is mounted on the cable between the GPS receiver and the COM port used on the computer.

The box may be mounted wherever suitable. (Mounting screws, two on each side).

The 1PPS converter requires a power supply.

→ *1PPS layout, see illustration on page 11*

Ethernet switch/Converter

The Ethernet switch/Converter must be placed in the vicinity of the Operator Station.

Mounting

The converter requires a power supply.

→ *See Spare Parts chapter for information on page 110.*

Fibre Splice Box

Fibre Splice Box must be placed in the vincinity of the Ethernet switch/Converter.

Transceiver units

Basic installation instructions

The transceiver unit (cabinet) must be mounted on to a bulkhead.

The mounting of the Model x81 and Model x21 are basically the same.

Note

The guidelines for installation presented here must be regarded as a base for detailed plans to be prepared by the installation yard. These plans must include drawings, instructions and procedures specific to the ship in which the equipment is to be installed. These drawings must be approved by the local maritime classification society before use.

Note

The maximum distance between the transceiver unit and the hull unit is restricted by the length of the transducer cable.

Vibrations

The HiPAP® transceiver unit is fitted with shock and vibration damping devices.

If the vibration velocity amplitude at the base of the installed equipment is expected to exceed 10 mm/s in the range 5-50 Hz, constantly during operational life, special precautions may have to be taken.

Important information about ventilation and maintenance

- There must be a clear space between the transceiver unit and the next unit or bulkhead horizontally.
- Below the unit there must be a space for cable routing.

- **For Model x81**:

→ *Refer to drawing on page 161*

- **For Model x21:**

→ *Refer to drawing on page 167*

Transceiver unit Model x81 installation

Unit location

The transceiver unit (cabinet) must be located close to the hull unit, either in the same compartment or in a compartment in the close vicinity.

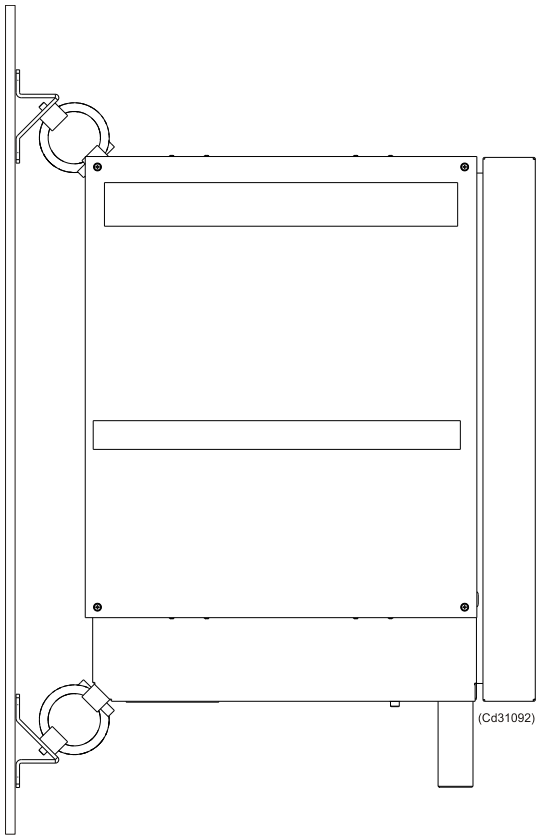


Figure 7 Cabinet mounting - side view

Logistics

Safety - Refer to the general safety procedures in the front of this manual.

Personnel - Minimum 3 trained mechanical/electrical fitters.

Special tools - None.

Drawings - Transceiver unit Model x81 mounting drawing in the Drawing file chapter from page 157.

Procedure

→ *See the procedure for installing the x81 transceiver unit with an adapter kit on page 41.*

Note

You do not need to remove the circuit boards and modules from the cabinet during the installation process. Keep the cabinet door closed. Ensure that the cabinet is not exposed to dust, moisture, vibration or physical damage during the installation process.

Caution

Check the other side of the bulkhead and decks before welding to make sure it is safe to weld the brackets to the bulkhead.

The anchor bolts for the shock absorbers are screwed on to the brackets.

1 Select a suitable bulkhead.

2 Measure and mark the locations where the shock absorber brackets (with bolts) are to be mounted.

3 Remove the brackets from the shock absorbers by removing the 16 nuts (four for each shock absorber).

- There is no need to remove the shock absorbers from the cabinet.

4 Weld the brackets to the bulkhead.

5 Clean the welds and brackets, and paint them with the appropriate preservation mediums.

6 Once the paint is dry, lift the cabinet into position and align the shock absorbers onto the bracket bolts.

7 Start with the upper shock absorber, and bolt the shock absorbers to the brackets.

Warning

Ensure that all the power supplies are switched off and the fuses removed before you connect the cables.

Power

If you only have 110 Vac power available, an external transformer from 110 Vac to 230 Vac must be installed on the main power line to the transceiver unit.

Mounting

1 Open the unit.
- Inside the unit there are four through holes for the mounting screws, one in each corner.
- Mounting screws w/nuts are not included.

2 Mount the unit where suitable.

3 Fasten the four mounting screws.

4 Close the unit.

Cabling

Ensure that enough excess cable is provided to allow the units to be moved around during maintenance.

1 Open the door

→ *How to open/close the door on page 83.*

2 Connect the cables

→ *See drawings in the Drawing file chapter from page 157.*

→ *Cables - see Cables starting on page 46.*

3 Once all the cables have been connected and the installation has been checked, remove all “foreign” matter from the cabinet and close the door.

4 Check the supply voltages and all cable connections before applying power to the system.

Note

Several of the cables are delivered with the units. Connectors and pin allocations for these cables are given in this document for reference only.

Adapter Kit for x81 Transceiver

The adapter kit is used to install the x81 transceiver cabinet in the same place where the old HiPAP® 500 transceiver cabinet was previously installed.

→ *See drawing in the Drawing file chapter on page 185.*

Procedure

1 Remove the HiPAP® 500 transceiver cabinet from the brackets.

- The parts where the adapter kit is installed onto are welded into the wall.

2 Fasten the top bracket with three (3) mounting screws to the bracket where the shock absorbers are.

3 The place the plates/brackets onto the welded parts and fasten six (6) mounting screws on the top bracket and six (6) mounting screws on the bottom bracket.

- Make sure all the screws are fastened properly and the transceiver unit is safely mounted.

Transceiver unit Model x21 installation

Unit location

The transceiver unit cabinet must be located close to the hull unit, either in the same compartment or in a compartment in the close vicinity.

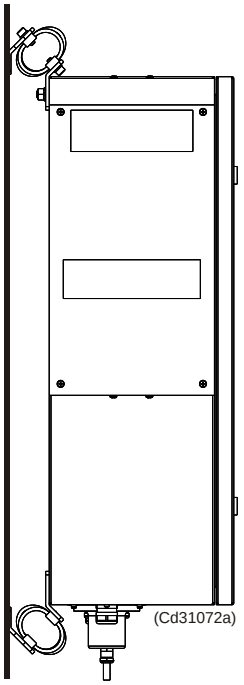


Figure 8 Cabinet mounting - side view

Logistics

Safety - Refer to the general safety procedures in the front of this manual.

Personnel - Minimum 3 trained mechanical/electrical fitters.

Special tools - None.

Drawings - Transceiver unit Model x21 mounting drawing in the Drawing file chapter from page 157.

Procedure

Note

You do not need to remove the circuit boards and modules from the cabinet during the installation process. Keep the cabinet door firmly shut. Ensure that the cabinet is not exposed to dust, moisture, vibration or physical damage during the installation process.

Caution

Check the other side of the bulkhead and decks before welding to make sure it is safe to weld the brackets to the bulkhead.

The anchor bolts for the shock absorbers are screwed on to the brackets.

1 Select a suitable bulkhead.

2 Measure and mark the locations where the shock absorber brackets (with bolts) are to be mounted.

3 Remove the brackets from the shock absorbers by removing the nuts and bolts, four for each shock absorber.

- There is no need to remove the shock absorbers from the cabinet.

4 Weld the brackets to the bulkhead.

5 Clean the welds and brackets, and paint them with the appropriate preservation mediums.

6 Once the paint is dry, lift the cabinet into position and align the shock absorbers onto the bracket bolts.

7 Start with the upper shock absorber, and bolt the shock absorbers to the brackets.

- Use shake-proof washers, and tighten the nuts to an appropriate torque.
- Ensure the correct nuts and washers are used.

Warning ***Ensure that all the power supplies are switched off and the fuses removed before attempting to connect the cables.***

Power

If you only have 110 Vac power available, an external transformer from 110 Vac to 230 Vac must be installed on the main power line to the transceiver unit.

Mounting

1 Open the unit.
- Inside the unit there are four through holes for the mounting screws, one in each corner.
- Mounting screws w/nuts are not included.

2 Mount the unit where suitable.

3 Fasten the four mounting screws.

4 Close the unit.

Cabling

Ensure that enough excess cable is provided to allow the units to be moved around during maintenance.

1 Connect the cables.

→ *See drawings in the Drawing file chapter from page 157.*

→ *Cables - see Cables starting on page 46.*

2 Once all the cables have been connected and the installation has been checked, remove all “foreign” matter from the cabinet and close the door.

3 Connect the standard cables between the various internal units.

4 Perform the remaining cable interconnections.

5 Check the supply voltages and all cable connections before applying power to the system.

Note *Cables are delivered with the units. Connectors and pin allocations for these cables are given in this document for reference only.*

5 CABLES

This chapter provides basic information and general installation requirements for cables. It also includes information about transceiver units internal cabling.

For more information about all cables see separate document Cable plan and interconnections KM Doc No. 325840.

Note

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

If no such guidelines exist, Kongsberg Maritime recommends that the *Det Norske Veritas (DNV) Report No. 80-P008, "Guidelines for Installation and Proposal for Test of Equipment"* be used as a guide.

Topics

→ *Cable gland assembly procedure on page 47*

→ *Basic cable requirements on page 49*

→ *Cable planning on page 52*

→ *Computer on page 52*

→ *GPS input signals connections on page 54*

→ *1PPS converter (option) on page 54*

→ *Transceiver unit Model x81 on page 56*

→ *Transceiver unit Model x21 on page 61*

→ *Transducer to transceiver unit cables installation on page 64*

→ *Fibre-optic cable installation on page 66*

Related topics

→ *Cable plan and interconnections on page 189*

→ *Drawings in the Drawing file chapter from page 158*

Cable gland assembly procedure

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

Note

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

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

General procedure

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

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

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

Note

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

---

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

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

or:

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

Note

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

---

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

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

Securing and terminating the cables

1 Ensure that there is 5 to 10 cm slack cable inside the cabinet - see wiring diagram.

2 Prepare and connect the cable cores to the appropriate terminals within the cabinet.

3 Secure the cable within the cabinet using cable clips.

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

5 Follow the same procedure for all the cables and cable glands.

Once all the cables have been fitted and checked:

6 Check the cabinet to ensure all tools and rubbish are removed.

7 Close the cabinet door.

8 Once all the system cables are connected and checked:

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

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

Basic cable requirements

Cable trays

All permanently installed cables associated with the system must be supported and protected along their entire lengths using conduits and/or cable trays.

Fibre-optic cables are described in a separate section.

→ *Fibre-optic cable installation information on page 66*

The only exception to this rule is over the final short distance (max. 0.5 m) as the cables run into the cabinets/units to which they are connected. These short service loops are to allow the cabinets to move on their shock mounts, and to allow maintenance and repair.

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

- Cables having a copper sheath or braiding must be installed in such a way that galvanic corrosion by contact with other metals is prevented.
- To allow for future expansion of the system, all cables should be allocated spare conductor pairs. Also, space within the vessel should be set aside for the installation of extra cables.

Radio Frequency interference

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

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

Physical protection

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

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

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

Grounding

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

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

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

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

Cable connections

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

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

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

Cable terminations

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

Cable identification

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

Cable planning

All cables must be available at the units, properly installed in cable ducting.

Note — *Special system requirements, adaptations or components may introduce special drawings and cables.*

Caution — *All power must be switched off prior to the cable installation.*

Caution — *Do not to exceed the physical limitations of the cables.*

Note — *In order to meet the EMC requirements, dedicated grounding cables have been used to connect the various system units to the vessel's ground. These cables are identified as "X" on the cable plan drawings. The braided grounding cable required is supplied with the system. These cables must not be longer than 1 metre.*

Computer

Computer connections

All connections to and from the computer are made on the rear of the unit.

- A: VHDC1-68 connector, PORT 1 to 8 for serial line cable (split cable; W-U010a,… W-U010h).

→ *The split cable on page 171*

- Ethernet connectors for NET A and Net B
- Ethernet connector - connection to the transceiver unit
- USB ports
- B: HDMI connector to display
- D: VGA connector for display
- Trackball (mouse)
- Keyboard PS/2 style connector
- C: Power input

The computer rear panel may look like the following figure:

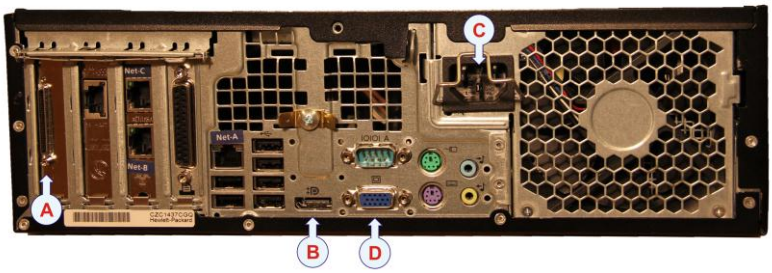


Figure 9 Computer rear panel

Computer Dual Net connection

The computer connections for Dual Net are done via two connectors as follows:

- NET A
  - The RJ45 connector from NET A is connected to the Main Net A.
- NET B
  - If dual net is used, the RJ45 connector from NET B is connected to the Main Net B.

→ *Cable details see Drawing file chapter on page 157.*

Depending on the Main Net implementation, the RJ45 connector could be connected directly to a HUB or a Patch panel.

GPS input signals connections

The signal from the GPS is normally a RS-232 serial line transmitting NMEA serial data, and a TTL pulse once pr. second to synchronise the computer internal timing clock to the GPS clock.

This connection is normally done as follows:

RS-232 Data	Pin 2 PORT computer
I PPS Pulse*	Pin 8 PORT computer
Ground ref.	Pin 5 PORT computer any PORT for RS-232 may be used.

Note

**The 1PPS pulse can have different pulse length and polarity from different suppliers of GPS receivers, so the connection described above will not always work. A 1PPS converter can be used to handle the problem.*

1PPS converter (option)

This converter passes the RS-232 Data through but shapes the 1PPS pulse to a fixed pulse length and converts it from TTL level to RS-232 level.

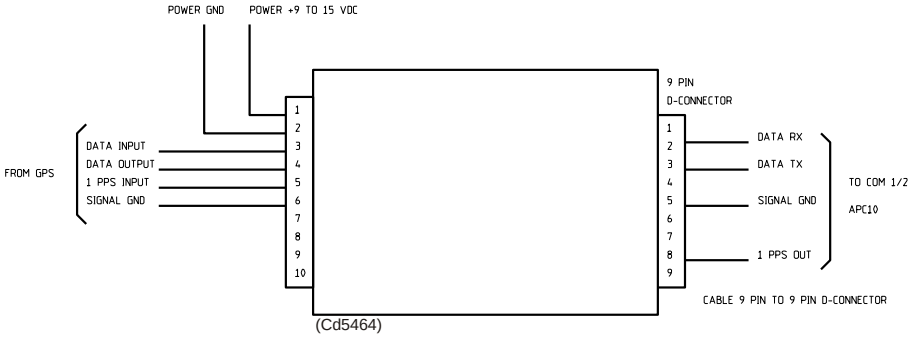


Figure 10 1PPS converter connections

A 9-pin D-connector extension cable is delivered with the converter so it can be mounted where the computer is mounted.

The converter needs an external power of 9-15VDC 100 mA.

If the distance between the GPS receiver and the computer is more than 10 m, we advice you to mount the 1PPS converter close to the GPS receiver.

1PPS converter internal

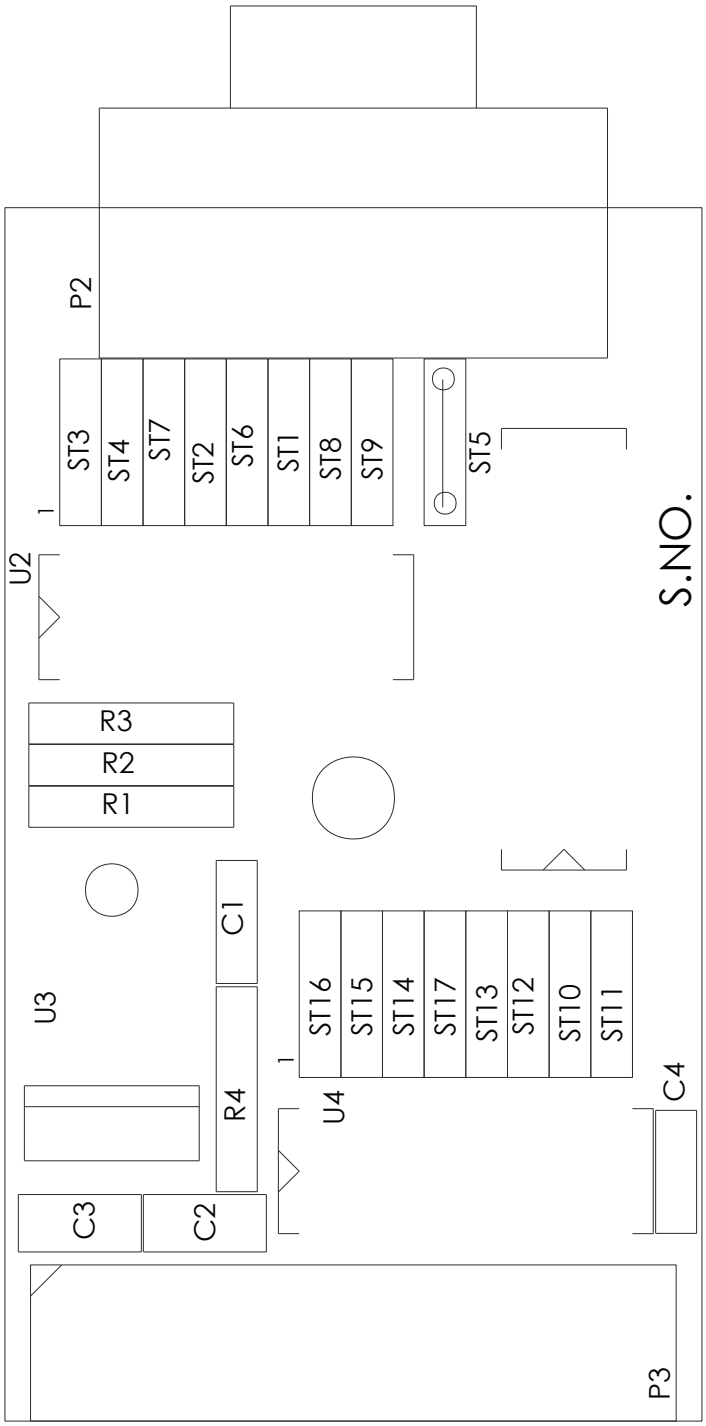
The 1PPS converter contains 2 DIP switch blocks.

ST14, ST15, ST16, ST17 controls the edge triggering of the 1PPS pulse.

Pos Edge trig	**Neg Edge trig**
ST16 ON	ST16 OFF
ST15 OFF	ST15 ON
ST14 ON	ST14 OFF
ST17 OFF	ST17 ON

ST13 = NEG RS-232 PULSE TERMINAL 9
ST12 = POS RS-232 PULSE TERMINAL 9
ST10 = NEG RS-232 PULSE 9 Pin D-SUB Pin 8
ST11 = POS RS-232 PULSE 9 Pin D-SUB Pin 8

ST3 = Connect	Data RX (Normally connected)	to 9 Pin D-SUB Pin 2
ST4 = Connect	Data TX (Normally connected)	to 9 Pin D-SUB Pin 3
ST7 = Connect	422A+ (Normally open)	to 9 Pin D-SUB Pin 9
ST2 = Connect	422A (Normally open)	to 9 Pin D-SUB Pin 6
ST6 = Connect	422B (Normally open)	to 9 Pin D-SUB Pin 4
ST1 = Connect	422B+ (Normally open)	to 9 Pin D-SUB Pin 1
ST8 = Select	Length A pulse (Normally open)	to RS-422 Converter
ST9 = Select	Length B pulse (Normally open)	to RS-422 Converter
ST5 = Connect	1PPS (Normally connected)	to 9 Pin D-SUB Pin 8



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

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Transceiver unit Model x81

→ *Wiring diagram on page 181*

Caution *Ensure that 10 cm of slack cable is provided outside the cabinet to allow the cabinet to move on its shock absorbers without damaging the cable.*

Model x81 internal cabling

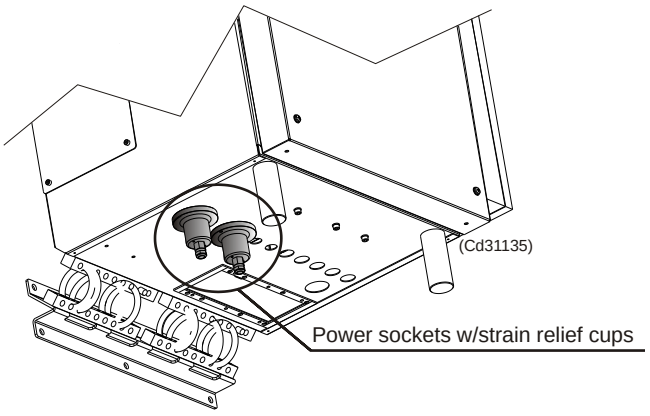
System cables From the computer patch cable - see figure on page 58.

Transducer cables The cables pass through the base of the unit.
See drawings in the *Drawing file* chapter on page 157 and description in section *Transducer patch cable* on page 59.

Model x81 power cable

Power cable The power cable connects to the power socket at the base of the unit.

Use the strain relief cup(s) supplied with the unit.



Note! For redundant power input, both power sockets must be used. (Use power from different power sources.)

Model x81, fibre-optic cables

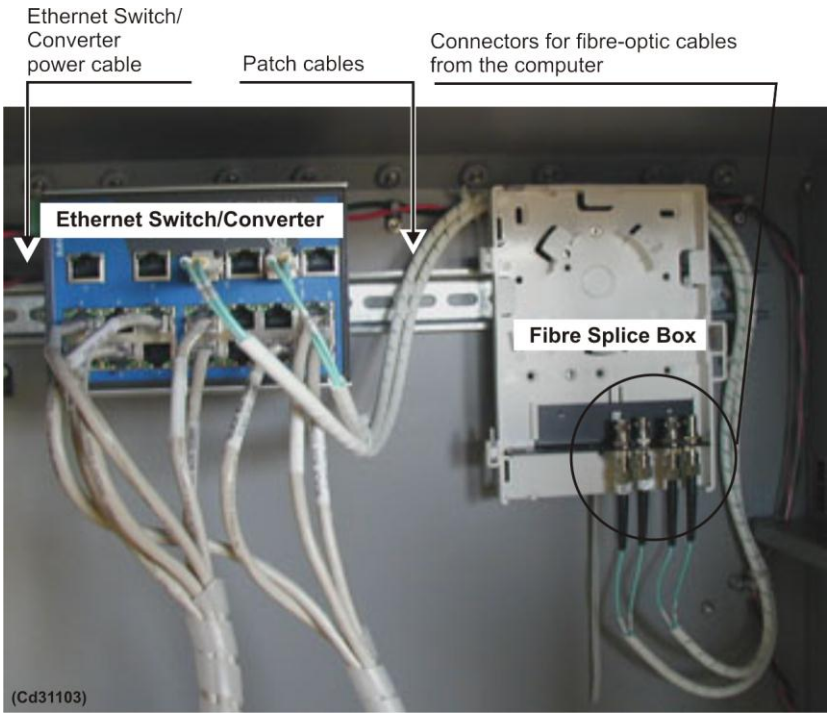


Figure 11 Transceiver unit Model x81 - internal

The figure shows the fibre patch cables going from the fibre splice box to the Etherenet switch/Converter. The system fibre cables (not shown) are termineated on the inside of the fibre splice box.

Model x81 - transducer cable connection

This unit can connect to the transducer with two different types of cable.

- Transducer patch cable
- Transducer cable with plug.

Related topics

→ *Fibre-optic cables installation on page 66*

→ *Cable plan and interconnections on page 189*

Transducer patch cable

The transceiver end of the cable has a gland plate approximately 60 cm from the connectors. This plate is mounted onto the outside lower right rear corner of the transceiver cabinet with six (6) mounting screws.

→ *See cable drawings in the Drawing file chapter from page 157.*

Once the gland plate has been fastened to the cabinet, the 2-8 cables (depending on configuration) should be strapped to the double row of cable tie mounting-plates at the lower left back wall of the cabinet, as shown in the figure on page 60. This will provide strain relief and positioning for the cables.

It is important to fasten the cables in the correct order, to avoid confusion when connecting the individual cables to the electronics (filter boards).

Transducer cable with plug

This is to be used if your installations have transducer cable with plug - typically if you are replacing the transceiver cabinet in an existing installation. In this case, you need a TD plug conversion kit.

→ *TD plug conversion kit on page 112*

The transducer cable attaches to the x81 cabinet, in exactly the same way as it was attached to the “old style”, but at the bottom of the cabinet.

Cables connection to filter boards

Connect the cables to the Filter boards in the correct order. The cables are labelled as shown in the following figure on page 60. Cable 0 to Filter board 0, Cable 1 to Filter board 1, ... Cable 7 to Filter board 7.

→ *The correct order is indicated in the figure on page 82.*

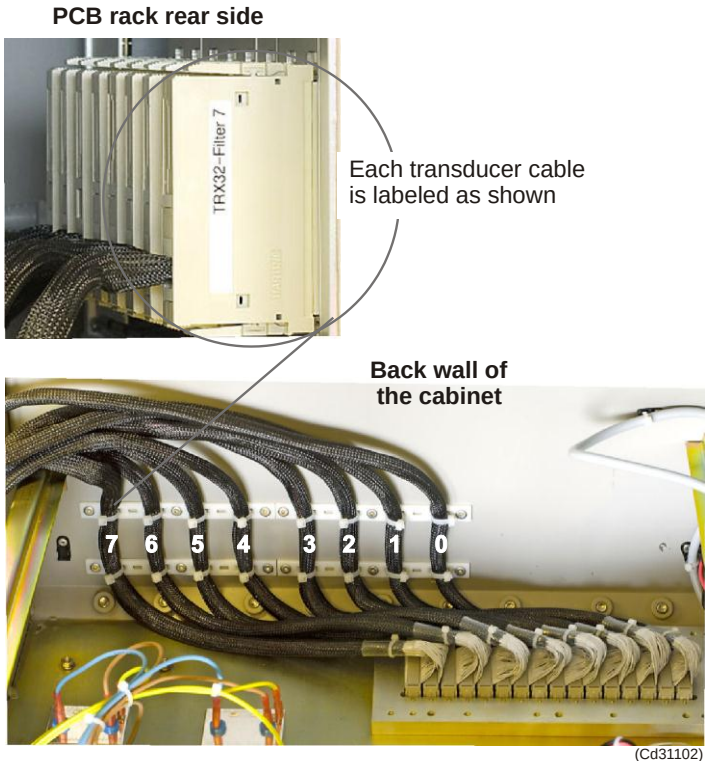


Figure 12 Transducer cable with plug inside the cabinet

→ *Inside the cabinet - fasten the cables as described on page 58.*

Transceiver unit Model x21

→ *Wiring diagram on pages 182 and 183*

Caution *Ensure that 10 cm of slack cable is provided outside the cabinet to allow the cabinet to move on its shock absorbers without damaging the cable.*

Model x21 internal cabling

System cables From the computer patch cable - see figure on page 62

Transducer cables See cable drawings in the *Drawing file* chapter from page 157.

Model x21 power cable

Power cable The power cable connects to the power socket w/ strain relief cup at the base of the unit - *see figure on page 93.*

Model x21, fibre-optic cables

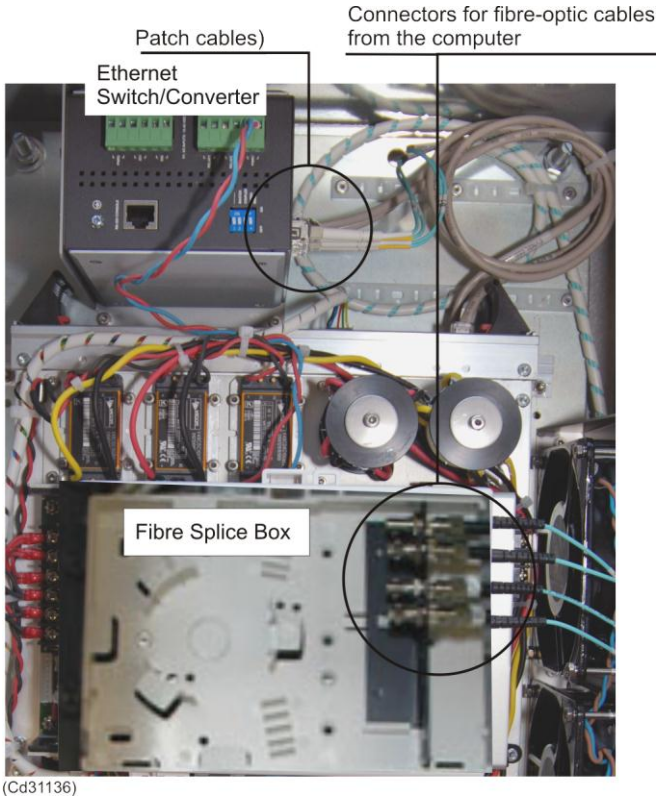


Figure 13 Transceiver unit Model x21, fibre-optical cables

The figure shows the fibre patch cables going from the fibre splice box to the Etherenet switch/Converter. The system fibre cables (not shown) are termineated on the inside of the fibre splice box.

Related topics

→ *Fibre-optic cables installation on page 66*

→ *Cable plan and interconnections on page 189*

Model x21 - transducer cable connection

This unit can connect to the transducer with two different types of cable.

- Transducer patch cable
- Transducer cable with plug.

Transducer patch cable

The transceiver end of the cable has a gland plate approximately 60 cm from the connectors. This plate is mounted onto the lower right rear corner on the outside of the transceiver cabinet with six (6) mounting screws.

→ *See cable drawings in the Drawing file chapter from page 157.*

Transducer cable with plug

This cable is used if your installation has a transducer cable with plug - typically if you are replacing the transceiver cabinet in an existing installation.

A junction box is available for connecting old hull units to HiPAP® 351/101 Transceiver unit Model x21.

→ *Junction box kit on page 113*

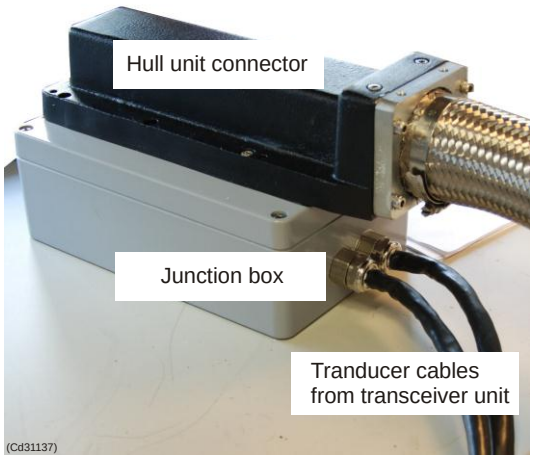


Figure 14 Junction box for connecting an old hull unit to Model x21

How to connect the junction box

→ *This is shown on drawing 304969 on pages 185 and 187*

This junction box can receive the hull unit connector from either:

- a HiPAP® 501 system; sixteen (16) 37 pin D-sub connectors
  - this option may be used if you want to change a HiPAP® 501 system to a 351 system, by replacing the 500 transducer with a 350 transducer, and keeping the existing hull unit.

or

- a HiPAP® 351 system; three (3) 37 pin D-sub connectors.

Two cables are going out of the junction box through nipples at the bottom, to the bottom plate of the Transceiver unit and to the two (2) connectors connected to the filter boards inside the Transceiver unit Model x21.

Transducer to transceiver unit cables installation

Cable information

Cabling from transducer to transceiver is separated in two parts .

- One part is protected inside the hull unit and goes **from the transducer to the junction box.**
- The other part goes **from the junction box to the transceiver**, and is the moving part of the transducer cable. Then it is possible to replace this part if damaged, or when connecting to another transceiver type.

The cabling from the **transducer to the junction box** is standard for all transceiver types. It is made bye eight (8) round flat cables placed and protected inside the hull unit.

→ *See drawing on page 179 and 180*

Page 1 (on page 179) shows the 8 cables and the location in the hull unit.

The cable used is a 64 conductor round flat cable with a common shield and insulated protection. The cable diameter is 13 mm.

Each cable is split in 2 at the transducer end. Each half goes to a 37 pin D-sub connector (not all pins are used). The other end of the cable goes into the junction box and is terminated in a 64 pin flat cable connector.

Page 2 (on page 180) shows one of the cables inside the hull unit in more detail.

Example:

P501 and P502 is connected at the transducer end and to J1 in the junction box.

P503 and P504 goes to J2 ……

HiPAP® 501/451

→ *Cable details see drawing on page 173 and 174.*

All 8 cables going into the junction box are connected to the transceiver with the same type of cable as inside the hull unit.

Page 1 (on page 173) gives an overview of all 8 cables.
Page 2 (on page 174) shows the internal connection for every individual cable.

HiPAP® 351/101 (x81)

→ *Cable details see drawing on pages 175 and 176.*

Just 2 cables are used from the junction box to the transceiver unit with the same type of cable as inside the hull unit.

Page 1 (on page 175) gives an overview of the 2 cables.

Page 2 (on page 176) shows the internal connection for every individual cable.

Note that one of the cables is split into 2 connectors in the junction box.

HiPAP® 351/101 (x21)

→ *Cable details see drawing on pages 177 and 178.*

Just 2 cables are used from the junction box to the transceiver with the same type of cable as inside the hull unit.

Page 1 (on page 177) gives an overview of the 2 cables.

Page 2 (on page 178) shows the internal connection for every individual cable. Note that one of the cables is split into 2 connectors in the junction box.

Fibre-optic cable installation

This section describes how to install fibre-optic cables and connectors for Kongsberg Maritime computer network onboard vessels and rigs.

Warning

During transport, cable laying and pulling into the protective conduit, the cables must not be sharply bent with a radius lower than the recommended values or twisted in any way. The cable must only be pushed/pulled by hand and not by machine. See technical specifications for minimum allowed bending radius.

Related topics

→ *Fibre-optic cable description on page 28*

→ *Cable plan and interconnections on page 189*

Installation

Each fibre cable contains (4-6) fibres. A fibre link uses two fibres, one for transmitting and one for receiving data. The remaining fibres are spare.

The signals from a field cable source (TX) is connected to (RX) input of Fibre-optic Converter and vice versa.

Maximum cable length

The maximum Gigabyte Ethernet distance for point-to-point links is 1000 m (850 nm) or 600 m (1310 nm) cable length when using a standard multi mode cable.

Note

Single mode cables should be used if a longer distance is required. If this is the case then the receiver and the transmitter in the switches in both ends have to be changed to single mode type. Maximum distance for point-to-point links with single mode cables depends on cable type used.

Cable routing and protection recommendations

The fibre-optic cable can be laid together with all types of other cables.

- For mechanical protection in harsh environments the network cables should be laid in a protective conduit, e.g. aluminium conduit, galvanised-steel conduit or flexible metallic conduit Pg-21.
- Where cables are laid on the floor, e.g. just before entry into a cabinet, cable trays must be used in order to prevent the possibility of physical damage being caused by personnel accidentally stepping on the cables.
- The fibre-optic cable should have a sufficient slack in both ends to allow installation and termination inside the network distribution unit.

Cable termination

ST connectors are used for connecting fibre-optic network cables to the fibre splice box (in the transceiver unit).

Terminating fibre-optic cables

Fibre-optic cables should ideally be delivered in required length ready with ST connectors in both ends.

Note — *The termination of fibre connector's work must be done by experienced personnel only.*

A patch cable (ST to LC) is used from the fibre splice box to the switch/converter.

Each fibre has to be tested for reflections and damping (loss). The test results must be documented.

Cable screen

If the fibre-cable is screened/armoured the screen/armour must be terminated in EMC cable glands. If the cable has no screen/armour, standard cable glands can be used.

The outer cable screen, if applicable, is to be grounded in both ends. Grounding is done by means of shielded cable glands or EMC Mats at the point of entry into the console/cabinet. Inner cable screen(s), if applicable, is to be terminated together with the outer screen.

6 OPERATION

HiPAP® operation

Operation of the HiPAP® system:

→ *See the APOS for HiPAP® 501/451/351/101 Instruction Manual and the APOS online help.*

7 MAINTENANCE

→ *See the MP8200 Maintenance Manual, doc no. 366813.*

This chapter contains information on how to perform all normal preventive and corrective maintenance on the standard HiPAP® system units.

- The procedures are identical for all HiPAP® systems.
- The technical descriptions included in this manual are intended to be used by maintenance technician and/or engineer, with experience of computer-based electronic circuitry. It is also strongly recommended that the personnel are familiar with the basic principles of hydro-acoustic technology, and in particular, positioning systems.
- The maintenance personnel are expected to replace faulty Line Replaceable Units (LRUs) (circuit boards or modules), but not to perform circuit board repairs. In order to find the faulty component, it is also expected that the maintenance personnel have access to standard electronic instruments, such as oscilloscopes and MultiMate's.

Note

If your organization (or vessel/rig) does not have the appropriate personnel available, you are strongly advised to contact either Kongsberg Maritime or your dealer for assistance.

Warning

Kongsberg Maritime accepts no responsibility for any damage or injury to the system, ship or personnel caused by drawings, instructions and procedures not prepared by Kongsberg Maritime.

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

Topics

Related topics

→ *Backup on page 2*

→ *Software upgrade on page 2*

→ *Tools on page 34*

→ *Spare parts on page 110*

→ *Drawings in the Drawing file chapter from page 157*

Safety

Refer to standard company/vessel safety procedures before commencing maintenance work.

→ *See also High voltage safety warning on page II in this manual.*

Note

After any maintenance work, the system must be checked to ensure it works correctly. Refer to the procedure in the Test and alignment procedures.

Before you start

Before you start performing any maintenance, the power must be switched off, and it must be kept off while the maintenance is being carried out.

Warning ***The maintenance engineer MUST wear a grounding bracelet, which is securely connected to the vessel's ground, at all times when performing maintenance on the units.***

---

1 Switch off all power to the HiPAP® system, and to other systems connected to the HiPAP® (Motion sensor, Heading sensor etc.).

2 Remove the fuses if possible (for the other systems) and label the fuse panels with tags stating that maintenance is being carried out on the system.

Maintenance philosophy

The maintenance philosophy recommended by Kongsberg Maritime is:

- On-board maintenance should be carried out by a maintenance engineer, with the assistance of the operator. The maintenance should include the following:
  - Calibrations
  - Simulations
  - Functional tests
  - Traditional troubleshooting based on a good knowledge of the system.
- Replacement of faulty parts should be limited to the line replaceable units (LRUs) recommended in the spare parts list.

Note

To reduce the number of spare boards required, standard circuit boards without software may be provided. In the event of a replacement becoming necessary, the software on the faulty circuit board must then be transferred to the new board. Any links and switches on the new circuit board must also be set as on the old board.

Whenever a faulty unit has been replaced, the unserviceable unit should be sent to Kongsberg Maritime, or an appointed dealer, for repair.

Error detection

If a fault is detected, the operator should call the maintenance engineer at the earliest opportunity. The operator should be issued with a standard procedure detailing how he/she is to respond to system errors or faults. This procedure should contain the following (as a minimum):

Whenever an error message appears:

- Write down any Alarm message.
- Write down the parameters currently set in the system.
- Write down a brief description of the actions currently being carried out.
- Write down the commands being executed (if any) when the error appeared.
- Write down the controls carried out (if any) when the error message appeared.
- Write down any other information that might be valuable to the maintenance engineer during troubleshooting. This also includes events not directly connected to the system (for example bad weather, excessive temperature in operations room etc.).

Verification

The first action to be performed by the maintenance engineer on receipt of a fault message must be fault verification. If the system has been closed down, it should be powered up again (unless the fault has caused serious damage to the system), and an attempt made to make the fault reappear.

- Verify the fault during continued operation.

Maintenance schedule

Maintenance routines must be performed regularly and effectively to ensure that the equipment is kept in top condition.

The chart below states the **maximum** recommended intervals at which the various routines should be performed - the intervals should be decreased if the system is used excessively.

Maintenance chart

Unit	Weekly	1-3 Month	6 Months	Reference
All units - exterior	Clean	-	Check	
All cable connections	-	-	Check	

Preventive maintenance

The preventive maintenance consists of keeping the units clean.

Use:

- Soft lint-free cloth
- Bucket
- Mild liquid detergent

Wet the cloth, then wring as much of the water out as possible.

Note — *Use only a damp cloth - so there is no possibility of water dripping into the unit.*

8 CABLE PLAN AND INTERCONNECTIONS

Separate document; ***Cable plan and interconnections***
doc. No 325840.

9 SYSTEM UNITS - DETAILED DESCRIPTION

This chapter gives a detailed description of the HiPAP® system units.

Topics

Computer

This section describes the internal layout and connections of the computer parts.

Topics

→ *See the MP8200 Maintenance Manual, doc no. 366813.*

Before you start

Note — *Before you start, please read the general maintenance information on page 72.*

Computer internal

The following units and circuit boards in the computer are defined as *Line Replaceable Units* (LRUs):

- Computer
- Bluestorm serial interface card
- Power supply unit
- Hard disk
- DVD Recorder

The computer is based on a commercially available motherboard, and the additional boards are standard plug-in circuit boards.

The placement of boards and units are shown in the figure below. The boards (not the motherboard) and units can be replaced separately.

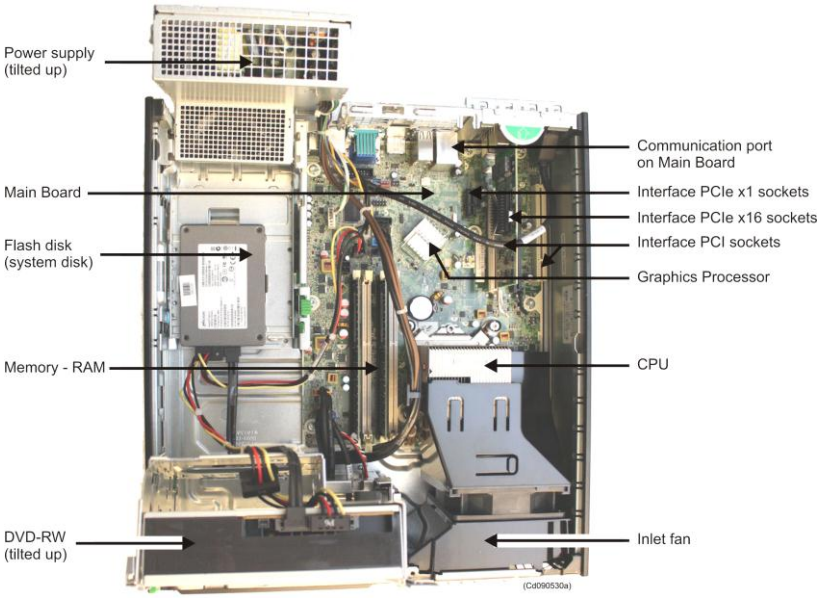


Figure 15 Computer - internal layout

How to open the computer

1 Switch off the power.

2 Remove the power connector from the back of the unit.

3 Switch off power to all other units connected to the computer (display, transceiver, motion sensor, etc).

4 Unscrew the computer from the bracket.

5 Lift the top cover by using the lever on the top.

Keyboard

Under normal conditions, maintenance is not required, apart from keeping the unit clean. If the keyboard is not functioning properly, the unit must be replaced.

Trackball

Under normal conditions, maintenance is not required, apart from keeping the unit clean. If the trackball is not functioning properly, the unit must be replaced.

1PPS converter (option)

Maintenance is not required under normal conditions apart from keeping the unit clean. If the 1PPS converter is not functioning properly the unit must be replaced.

→ *1PPS converter information, see page 11*

Ethernet switch/Converter

Maintenance is not required under normal conditions apart from keeping the unit clean. If the Ethernet switch/Converter is not functioning properly, the unit must be replaced.

→ *Ethernet switch / Converter information, see page 11*

Replacement

1 Remove all cables.

2 Replace the unit.

→ *Replacement, see page 87*

3 Reconnect all cables.

Configuration

The new Ethernet switch/Converter must be configured. You will find the configuration information on the Operator Station. Ref:

C:\Install\moxa\moxaconfig.rtf

Fibre Splice Box

Maintenance is not required under normal conditions apart from keeping the unit clean.

Transceiver unit Model x81

This section describes the internal layout, connections and replacement of the Transceiver unit Model x81 parts.

Topics

→ *Transceiver unit Model x81 internal layout on page 80.*

→ *Replacement of parts on page 82*

If more information is required, contact Kongsberg Maritime for service.

Before you start

Note

Before you start, please read the general maintenance information on page 72

Model x81 internal layout

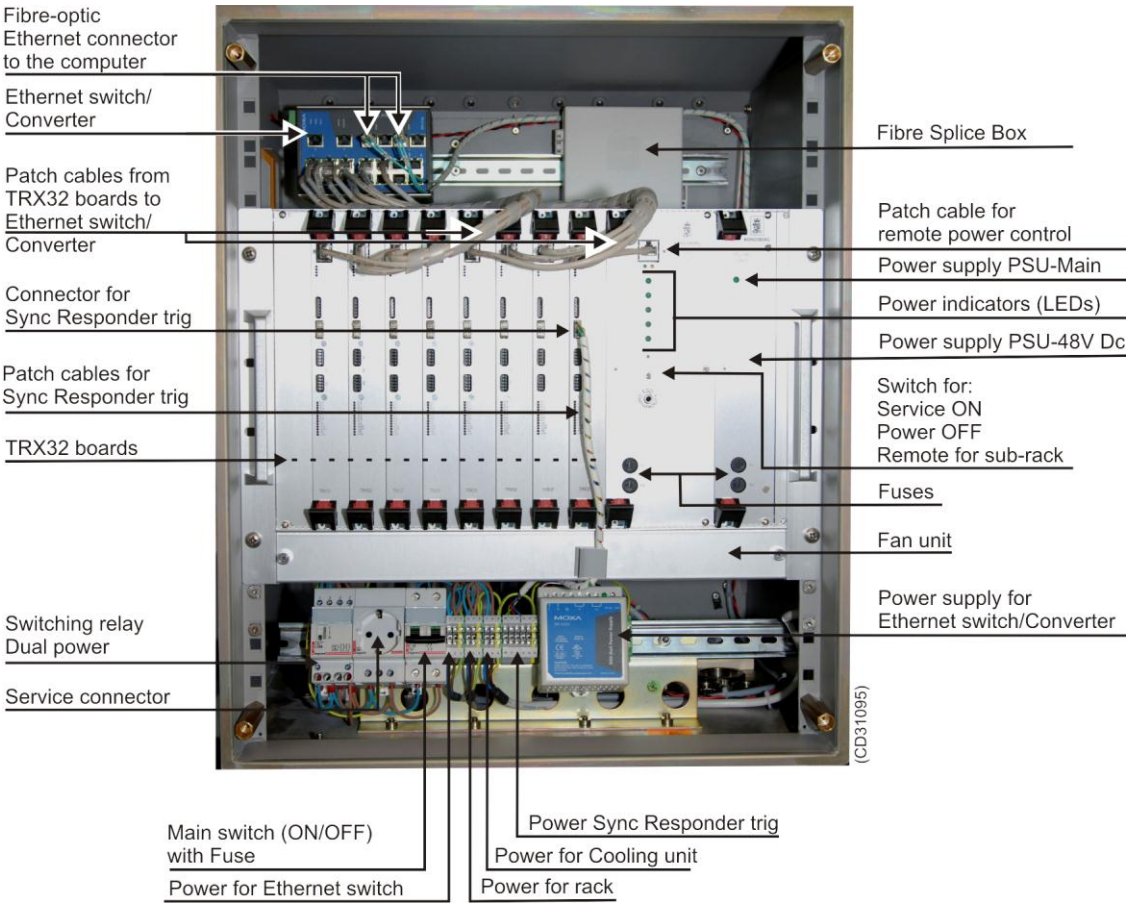


Figure 16 Transceiver unit Model x81 - internal layout

The following parts contained within this transceiver unit are defined as *Line Replaceable Units* (LRUs):

TRX32 boards - Transmitter/Receiver board - up to eight (8) boards, depending on the system configuration. This is a plug-in unit.

TRX32 Filter boards - Transmitter/Receiver filter board - up to eight (8) boards, depending on the system configuration. This is a plug-in unit.

Ethernet switch / Converter - Ethernet to Fibre-optic converter. Dual Ethernet possibility. Used LC fibre-optic connectors.

Fibre Splice Box - Fibre splice Box with up to eight (8) ports MX-WFR-00024-02. This box is used to terminating the system Ethernet fibre-optic cable. A patch cable is used from

this box to the Ethernet switch / Converter.

Power supply PSU-Main - Provides the voltages required by the TRX32 boards, and carries a “power on” indicator. This is a plug-in unit.

Power supply PSU-48 V Dc - Provides power to the transmitters and carries a “power on” indicator. This is a plug-in unit.

Fan unit - For air circulation inside the transceiver unit.

Terminal blocks - Used for connecting externally supplied signals.

Ethernet switch / Converter power supply - The DR-4524 DIN-rail 24 Vdc Power Supply is used.

Cooling unit - This unit is mounted on the outside, on the transceiver unit right side. It cools the air inside the transceiver unit. “Air to air” principle.

→ *Separate manual is supplied with the unit. This is not a Kongsberg Maritime document.*

Model x81 power sockets

The transceiver model x81 is equipped with two power sockets for redundant power input. These should be connected to different power sources. If redundant power is not used, only one of the sockets needs to be connected. Two strain relief cup(s) are supplied with the unit (with mounting screws).

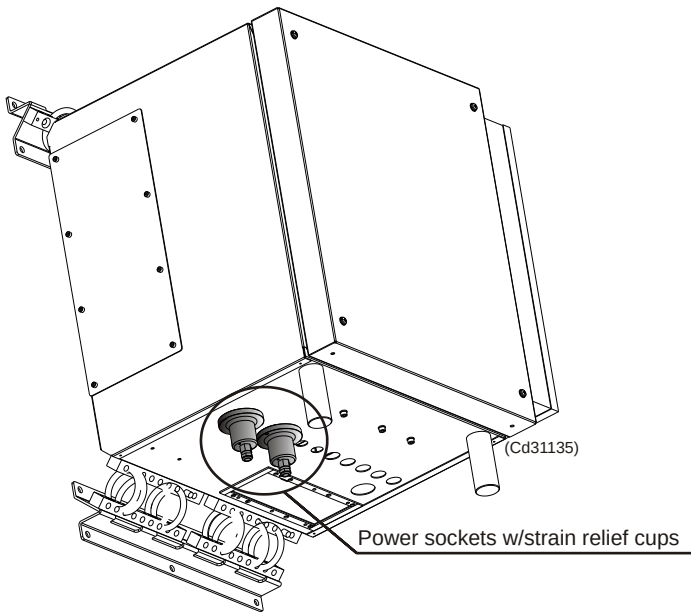


Figure 17 Transceiver Unit Model x81 power sockets

Transceiver unit Model x81, PCB rack

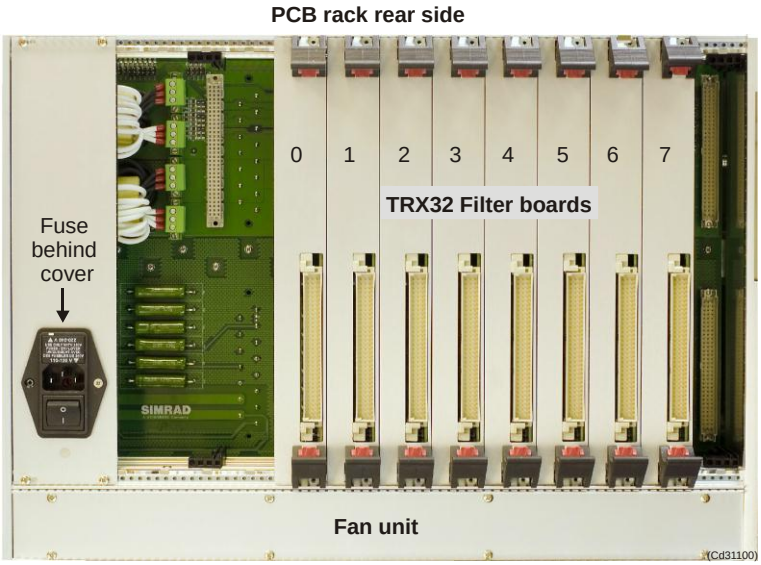


Figure 18 Transceiver unit Model x81, PCB rack

Replacement of Model x81 parts

Topics

→ *How to open / close the door on page 83*

→ *Replacement of the TRX32 boards on page 83*

→ *Replacement of the TRX32 filter boards on page 85*

→ *Replacement of the power modules on page 87*

→ *Replacement of the Ethernet switch / Converter on page 87*

→ *Replacement of the power unit for Ethernet switch / Converter on page 88*

→ *Replacement of the Fibre Splice Box on page 88*

→ *Replacement of the terminal blocks on page 88*

→ *Replacement of the fans on page 87*

→ *Replacement of the fuses on page 89*

If more information is required, contact Kongsberg Maritime for service.

Before you start

Note

Before you start, please read the general maintenance information on page 72.

How to open / close the door

Before performing any replacements, you must open the transceiver unit front door. To do this:

1 Loosen the four captive screws in the corners of the door.

2 Lift the door off.

To close the door, proceed in reverse order!

Circuit boards basics

→ *TRX32 boards location, see the figure on page 80.*

→ *TRX32 filter boards location, see the figure on page 82.*

The circuit boards in the transceiver unit rack are all plug-in modules. The boards are locked into position by two ejectors.

TRX32 Transceiver board visual inspection

→ *Refer to page 107*

Replacement of a TRX32 Transceiver board

Before you start, read the following:

- Before you start removing any board/unit on page 71.
- How to open/close the Transceiver unit door on page 83.

Removal

1 Switch off the transceiver unit using the Main switch.

2 Locate the faulty board.

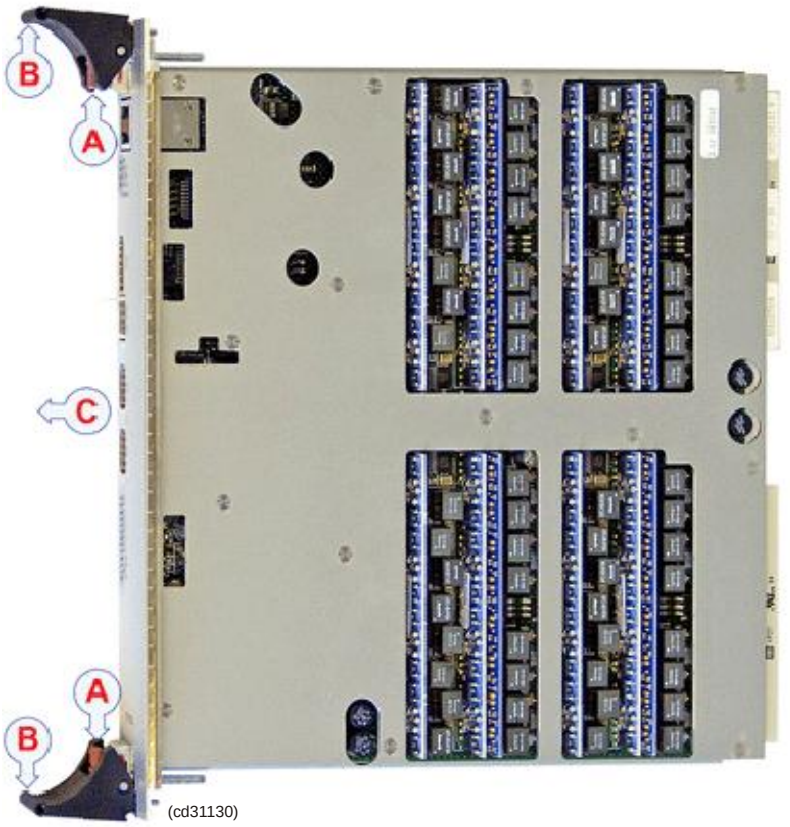


Figure 19 TRX32 Transceiver board

3 Note the locations of, and remove, any cable connected to the front of the board.

4 Press down the red knob (**A**) on the board ejectors. The ejectors are now free.

5 To loosen the board, push the top ejectors (**B**) up, and the bottom ejector (**B**) down.

6 Then pull the board straight out (**C**).

7 Place the board into an anti-static plastic bag and place it on a clean, stable work-bench where it cannot be damaged.

Replacement

In principle, replacing a board is to perform the steps in *Removal a TRX32 board* in reverse order.

1 Grab the board ejectors with both hands, and push the board straight in.

2 Lock the board in place by pulling the top locking handle down, and the bottom locking handle up.

3 Insert the front mounted Ethernet cable and other front mounted cables.

4 Once all the boards are in position, re-apply power as required.

5 Close the transceiver unit front door.

Replacement of a TRX32 filter board

Before you start, read the following:

- Before you start removing any board/unit on page 71.
- How to open/close the Transceiver unit door on page 83.

Removal

1 Switch off the transceiver unit using the Main switch.

2 To access the filter boards:

a Open the access door to remove a filter board.

→ *Access door on page 13*

→ *Same principle as removing a TRX32 board, see procedure on page 83.*

or

b Removing the PCB rack.

→ *How to remove the PCB rack, see procedure on page 86.*

Replacement

In principle, replacing a power unit is to perform the steps in paragraph *Removal* in reverse order.

Replacement of units

Before you start, read the following:

- Before you start removing any board/unit on page 71.
- How to open/close the Transceiver unit door on page 83.

→ *Units location, see the figure on page 80.*

PCB rack

Removal

The unit is mounted with four (4) screws.

Remove the module as follows:

1 Switch off the transceiver unit using the Main switch.

2 Remove the cables (**C**) at the front of the rack.

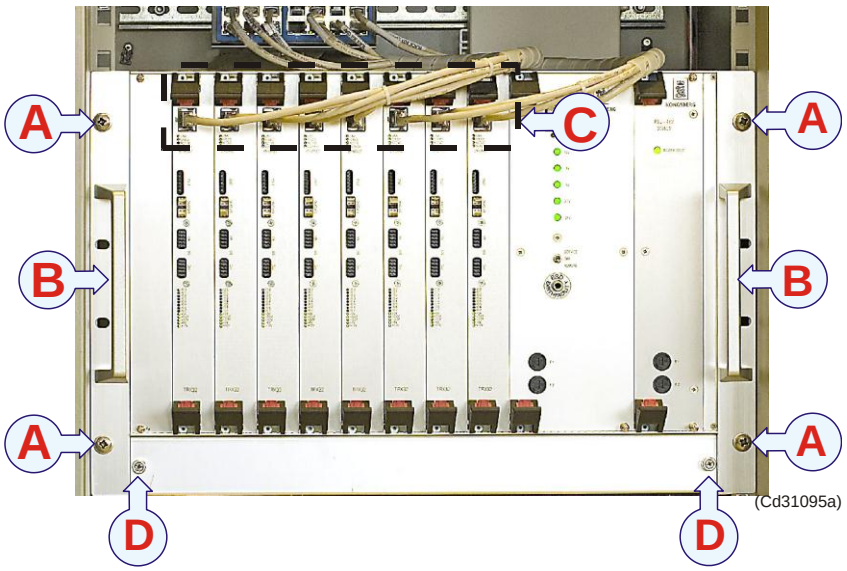


Figure 20 Model x81 PCB rack

3 Open the access door on the left side and disconnect the transducer cables from the filter boards.

4 Remove the four screws (A).

5 Grab the two handles (B) and pull the rack gently out.

6 When the rack is almost pulled out, support the rack and lift it out.

7 Place the rack on a suitable workbench.

Replacement

In principle, replacing the rack is to perform the steps in paragraph *Removal* in reverse order.

Power modules

Removal/ Replacement

→ *Same principle as removing/ replacing a TRX32 board, see procedures starting on page 83.*

Fan unit

Removal

1 Switch off the transceiver unit using the Main switch.

2 Remove the two screws (**D**) in the front.

→ *See figure on page 86*

3 Pull the lower edge down and out.

Replacement

In principle, replacing the fan unit is to perform the steps in paragraph *Removal* in reverse order.

Ethernet switch / Converter

Removal

The Ethernet switch / Converter is located on the support rail at the top of the transceiver unit.

1 Switch off the transceiver unit using the Main switch.

2 Remove all cables.

3 The module is snapped on. To remove it, pull down the lock-tab at the lower end (use a screwdriver to press it down), and pull it directly out from the support rail.

Replacement

1 Align the module on the support rail.

2 Press the module, and pull down the lock-tab until it snaps into place.

3 Connect the cables.

4 Switch on the transceiver unit using the Main switch.

Note *The new Ethernet switch / Converter must be configured.*

---

5 Configure the unit - see information on page 78.

Power unit for Ethernet switch / Converter

Removal

The Ethernet switch / Converter power unit is located on the support rail at the bottom of the transceiver unit. To remove/replace the unit:

→ *Same principle as for the Ethernet switch / Converter.*

Replacement

→ *Same principle as for the Ethernet switch / Converter.*

Fibre splice Box

Removal

The Fibre splice Box is located on the support rail at the top of the transceiver unit. To remove/replace the unit:

→ *Same principle as for the Ethernet switch / Converter.*

Replacement

→ *Same principle as for the Ethernet switch / Converter.*

Terminal block

Removal

The terminal block modules are located on the support rail at the bottom of the transceiver unit. Remove the module as follows:

1 Switch off the transceiver unit using the Main switch.

2 Remove the power cables in to the cabinet.

3 Disconnect the terminal block module.

4 The module is snapped on. To remove it, pull down the lock-tab in the lower end, and pull it directly out from the support rail.

Replacement

To replace a terminal block module, proceed as follows:

1 Align the module on the support rail.

2 Press the module, and pull down the lock-tab until it snaps into place.

Fuses

The transceiver unit is powered via a Main switch mounted on the support rail at the bottom of the transceiver unit.

Fuse replacement

1 Switch off all external units and systems connected to the HiPAP® system.

2 Open the transceiver unit front door.

3 Switch off power to the unit using the Main switch.

4 Replace the blown fuse(s) with a fuse with correct size and type.

→ *See above for more information.*

5 If the Main switch has tripped, remake the switch.

Caution *Release the switch immediately. It is made so it can trip again if necessary.*

---

6 First, return power to the HiPAP® system, then to the other external units.

Caution *If, when a fuse is replaced, it blows or trips again when power is switched on to the system, a more serious fault exists. Do not replace the fuse(s) a second time until the fault has been found and corrected.*

---

7 Close the transceiver unit front door.

Fuses

Unit	Fuse location	Fuse replacement	Fuse description
Main switch	*Location, see figure on page 80.*	N/A	The fuse is a circuit breaker, and it trips at 10 A.
TRX32 Filter board power connector with ON / OFF switch.	*Located at the rear side of the PCB rack, see figure on page 82.*	To access the fuse, open the access door. The fuse is placed behind a cover, on top of the power connector.	**Fuse** - 250 V, 6.3 A, slow-blow.
Power PSU-Main 48 Vdc	*Location, see figure on page 80.*	The fuse is contained in a fuse holder. To replace the fuse: Use a screwdriver, press down and turn the holder half a turn. Take the holder out and remove the fuse. Replace the fuse in reverse order!	F1 and F2. **F1** - 250 V, 6.3 A, slow-blow. **F2** - 250 V, 6.3 A, slow-blow.
Power unit for transmitters PSV-Main	*Location, see figure on page 80.*	The fuse is contained in a fuse holder. To replace the fuse: Use a screwdriver, press down and turn the holder half a turn. Take the holder out and remove the fuse. Replace the fuse in reverse order!	F1 and F2. **F1** - 250 V, 8 A, slow-blow. **F2** - 250 V, 8 A, slow-blow.

Caution *Always use the correct size and type of fuse. Irreparable damage may be caused to the transceiver unit if the wrong fuse (or anything else) is used.*

Transceiver unit Model x21

This section describes the internal layout, connections and replacement of the Transceiver unit Model x21 parts.

Topics

→ *Transceiver unit model x21 internal layout on page 91*

→ *Replacement of parts on page 93*

Before you start

Note

Before you start, please read the general maintenance information on page 72.

Model x21 internal layout

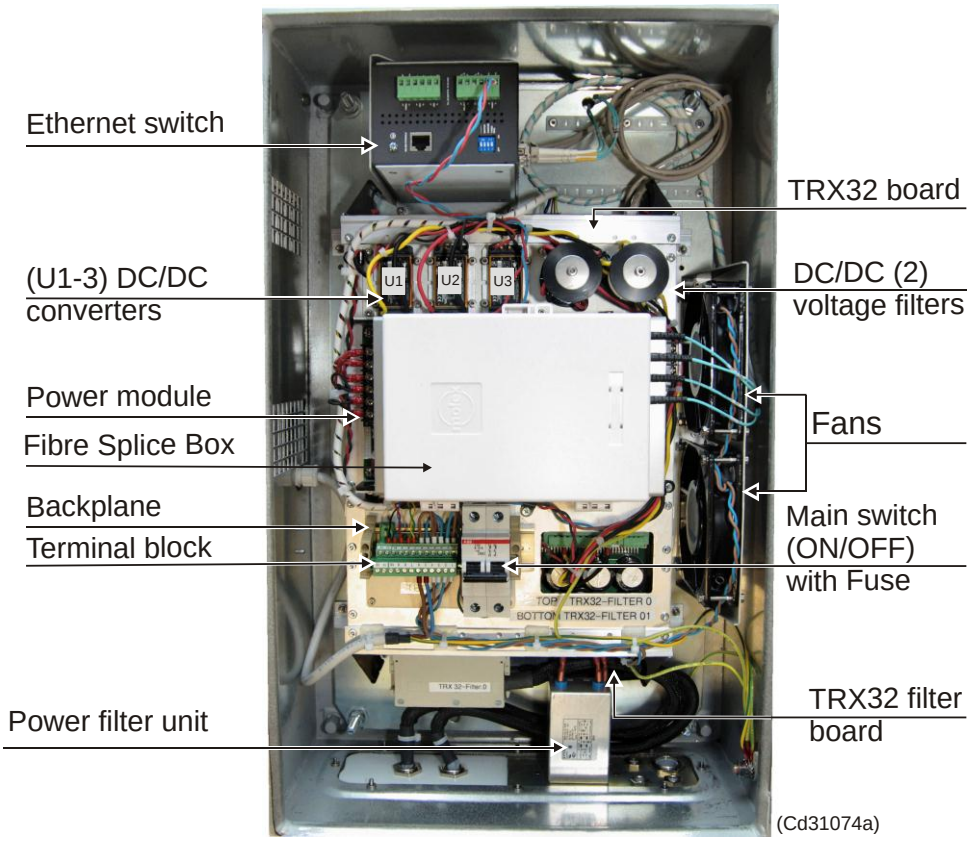


Figure 21 Transceiver unit Model x21 - internal layout

The following parts contained within this transceiver unit are defined as *Line Replaceable Units*

TRX32 board - The boards are located in the PCB rack, behind the Power module, and are to be inserted from the top of the "rack".

TRX32 filter board - The board is located in the PCB rack, behind the Power module, and is to be inserted from the base of the "rack".

Power module - This unit provides voltage for the transmitter and the DC/DC converters, and carries a "power on" indicator on the input and output side.

Ethernet switch / Converter - Ethernet to Fibre-optic converter. Dual Ethernet possibility. Used LC fibre-optic connectors.

DC/DC converters - The DC/DC converters provide the voltage required by the TRX32 boards and the Ethernet switch.

DC/DC voltage filters - Filters the DC/DC power before the power enters the TRX32 boards.

Cooling unit - The unit is mounted on the outside, on the transducer unit left side. It cools the air inside the transceiver unit.

→ *Separate manual is supplied with the unit. This is not a Kongsberg Maritime document.*

Model x21 power socket

The transceiver model x21 is equipped with one power socket with strain relief cup.

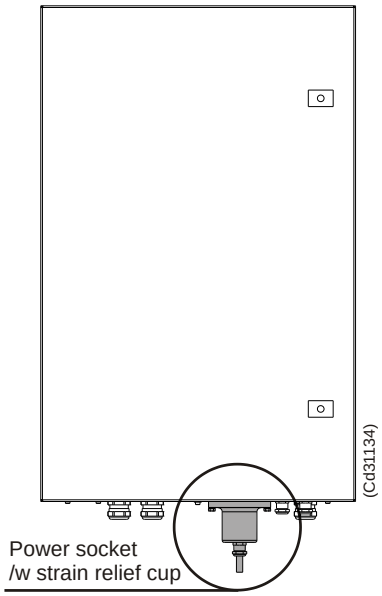


Figure 22 Transceiver Unit Model x21 power socket w/strain relief cup

Replacement of Model x21 parts

Topics

→ *How to open/close the door on page 94*

→ *Replacement of the circuit boards on page 94*

→ *Replacement of units on page 96*

→ *Replacement of the fuses on page 97*

If more information is required, contact Kongsberg Maritime for service.

Before you start

Note — *Before you start, please read the general maintenance information on page 72.*

How to open/close the door

Before performing any replacements, you must open the transceiver unit front door.

1 Use the door key to turn the two door screws clockwise to open position.

2 Open the door.

To close the door, proceed in reverse order!

Replacement of circuit boards

To replace a circuit board, the rack has to be removed from the bottom plate.

The circuit boards in the transceiver unit are all plug-in modules. The boards are locked into position by two ejectors. All boards are replaced using the same procedure.

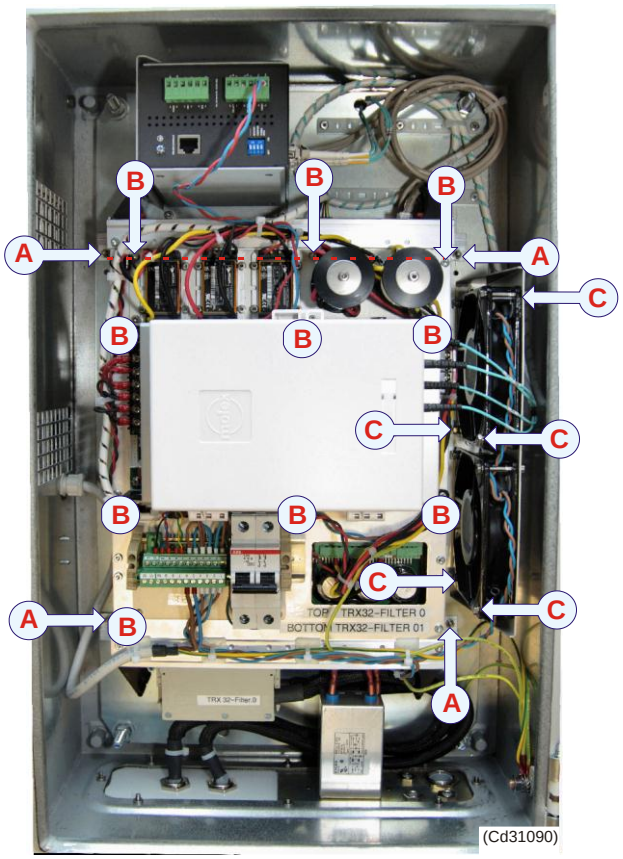


Figure 23 Model x21 internal screws

Removing a circuit board

1 Switch off the transceiver unit using the Main breaker.

→ *Circuit boards placement, refer to figure on page 91.*

2 Locate the faulty board.

3 Remove the rack from the cabinet, by removing the four (4) screws in the corners of the rack (**A**).

→ *Refer to figure on page 94*

4 Grab the board ejectors with both hands, and press down the red knob on the board ejectors, and then remove the board.

5 Put the board into an anti-static plastic bag and place it on a clean, stable work-bench where it cannot come to any harm.

Replacing a circuit board

In principle, replacing a board is to perform the steps in *Removing a circuit board* in reverse order.

When you replace a board, ensure that the board is correctly located in the rails before any pressure is applied to the board!

1 Locate the board in the slots and carefully slide the board into position.

- Ensure that the board does not interfere with any components as it is pushed in.

2 When the connectors on the back of the board begin to mate with the connectors on the back plane, (approximately 5 mm before the board is fully home) check that the board is correctly located then apply even pressure over the front of the board and push it firmly home.

3 Once all the boards are in position, reassemble the unit and re-apply power.

4 Close the transceiver unit front door.

Replacement of units

→ *Refer to figure on page 94*

Power module

Removal

1 Switch off the transceiver unit using the Main breaker.

2 Unscrew the top plate on which the power module is mounted on. Nine (9) screws on the top plate (**B**).

3 Disconnect all cables.

4 Remove the power unit.

Replacement

In principle, replacing the power unit is to perform the steps in procedure Removal in reverse order.

1 Replace the power supply.

2 Reconnect all cables.

DC/DC voltage filters

→ *Refer to "Removing the power module" procedure above.*

1 Remove / replace the faulty filter.

- Mounted with four (4) screws.

Replacement of DC/DC converters

→ *Refer to "Removing the power module" procedure above.*

1 Remove /replace the faulty converter.

- Mounted with four (4) screws.

Fan units

Removal

Note

The fans must be checked every 6 month, and replaced when required.

---

1 Open the transceiver unit door.

2 Identify the defective fan unit.

3 Slacken the screws four (4) securing the fan unit (**C**).

→ *Refer to figure on page 94*

4 Disconnect the cable from the terminal block.

5 Remove the defect fan.

Replacement

In principle, replacing the fan unit is to perform the steps in procedure *Removing a fan* in reverse order.

1 Replace the fan unit.

2 Reconnect all cables in the terminal block.

Fuse

The transceiver unit is powered via the Main switch in the bottom of the transceiver unit.

Unit	Fuse location	Fuse description
Main switch	*See figure in section on page 80.*	The fuse is a circuit breaker. It trips at 10 A.

Circuit boards and units

This section provides information on the circuit boards and power units. Switch settings and links are described where necessary.

Topics

→ *Computer on page 97*

→ *Transceiver units on page 99*

Computer circuit boards and power unit

Topics

→ *See the MP8200 Maintenance Manual, doc no. 366813.*

This section only describes the Bluestorm circuit board, for the rest of the boards, see the MP8200 maintenance manual.

BlueStorm/PCI serial adapter board

Manufacturer; http://www.connecttech.com

This serial adapter board is a commercially available board. It is equipped with:

- four RS-232
- four RS-422

Several cards can be used in the computer to increase the number of outputs available.

BlueStorm/PCI installation for Windows XP

The BlueStorm/PCI board uses a specific driver on Windows XP. This device driver provides an interface between the Windows XP operating environment and a BlueStorm/PCI adapter. Under Windows XP you can install a maximum of 256 serial ports.

- Install the driver
- Test the board

Refer to the BlueStorm/PCI User Manual.

Switches

The BlueStorm/PCI board holds no switches.

Links

The BlueStorm/PCI board holds no links.

Connectors

- One PCI connector
- One VHDC1-68 female connector for the serial lines.

→ *Cable details on page 171*

Transceiver units

This section provides a short description of the circuit boards and power supply units contained within the transceiver units.

The following circuit boards and units are described:

Common circuit boards

Topics

→ *TRX32 transceiver board on page 100*

→ *TRX32 filter board on page 108*

Model x81

→ *Location of modules, see figure on page 80*

Topics

→ *Power supplies - contact Kongsberg Maritime*

→ *Ethernet switch - contact Kongsberg Maritime*

→ *Fan unit - contact Kongsberg Maritime*

→ *Cooling unit - refer to separate manual supplied with the unit*

Model x21

→ *Location of modules, see figure on page 91*

Topics

→ *Power module - contact Kongsberg Maritime*

→ *Ethernet switch - contact Kongsberg Maritime*

→ *Fans - contact Kongsberg Maritime*

→ *Cooling unit - refer to separate manual supplied with the unit*

TRX32 Transceiver board

The TRX32 board is a 32 channels multi-frequency transmitter and receiver circuit board.

The board is normally covered by a protection, screening and strengthening plate, which covers most of the component side of the board.

The board is locked in position by two board ejectors.

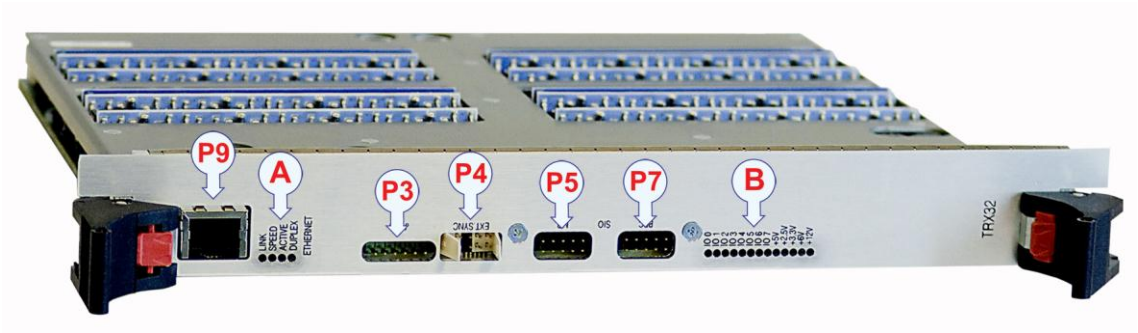
Function

The TRX32 board holds a total of 32 transmitters and 32 receivers, and each transmitter/receiver pair is connected via the cable to a specific element in the transducer. The board also contains computing power.

Configuration

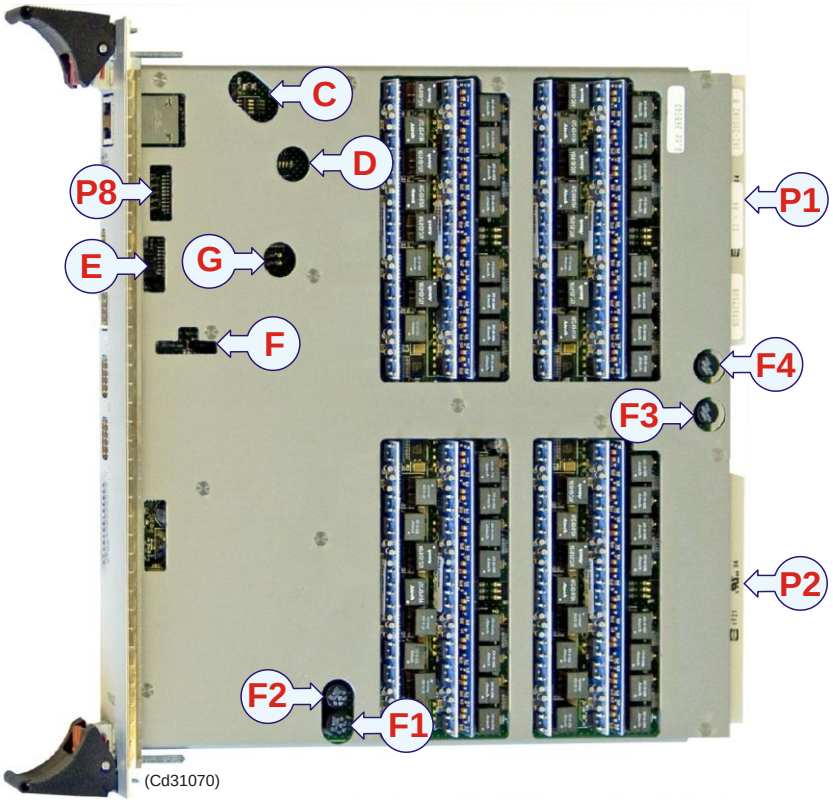
The TRX32 board is fitted with LEDs to monitor its operational status, as well as links and switches to set it up for various applications.

TRX32 front panel



- **A** - LEDs to monitor Ethernet activity
- **B** - LEDs to monitor input/output activity and power supplies
- **P9** - Ethernet connector
- **P3** - JTAG connector
- **P4** - External synchronisation
- **P5** - Serial input/output for development and debugging purposes
- **P7** - Serial input/output for development and debugging purposes

TRX32 top view



- **C** - Switch SW1
- **D** - Switch SW2
- **E** - Links ST1, ST2, ST3 and ST4
- **F** - Links ST5, ST6, ST7 and ST8
- **G** - Links ST9 and ST10
- **P1** - Backplane connector power and signals
- **P2** - Backplane connector to transducer element
- **P8** - JTAG connector

Fuses:

- **F1** - 12 V fuse 4 A 250 V
- **F2** - 6 V fuse 4 A 250 V
- **F3** - High voltage fuse 6.3 A 250 V
- **F4** - High voltage fuse 6.3 A 250 V

LEDs

→ *LEDs location, see the figure on page 100.*

Ethernet LEDs (pos A)

Four LED's display Ethernet operating mode and activity as follows:

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

Processor activity and error conditions LEDs (pos B)

The front panel includes 8 yellow LEDs (IO0-IO7) displaying processor activity and various error conditions, and 5 LEDs indication power supply status.

LED	Function
IO0-IO3 (yellow)	Show the PowerPC boot sequence
IO7 (yellow)	Indicates that the MicroBlaze program has successfully started
5 (green)	The 5 green LEDs indicate that the internal supply voltages are OK

- **IO 0** - The PowerPC embedded program broadcasts a BOOTP/DHCP (Boot Strap Protocol / Dynamic Host.
- **IO 1** - A BOOTP/DHCP reply message has been received from an external boot server containing:
  - IP address of the server providing the PowerPC application program
  - name of the file containing the PowerPC application program
  - IP address assigned to the transceiver board
  - subnet-mask to be used for receiving limited broadcast messages.

- **IO 2** - The PowerPC sends a TFTP (Trivial File Transfer Protocol) request to the boot server asking for its application program. The application program has been successfully down-loaded and is up and running.
- **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 at Kongsberg Maritime.
- **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.

Switches

The TRX32 board holds two switches, SW1 and SW2.

→ *Switches location - see figure on page 101*

SW1

Board ID upper bits switch. SW1 1 ON require TRX32 rev H and system backplane support for 8 ID bits. The Version Acknowledge reports which method is selected.

SW1 - 1	Rack ID select: P1 A1 - A3 (ID5 - ID7) / SW1 Rack ID bit 0 - 2	ON/ OFF
SW1 - 2	Rack ID bit 0	ON = 0
SW1 - 3	Rack ID bit 1	ON = 0
SW1 - 4	Rack ID bit 2	ON = 0

SW2

The PROM revision select is for future expansion, current PROM only holds one configuration.

SW2 - 1	Firmware configuration PROM revision select mode software / hardware OPEN / CLOSED	OPEN
SW2 - 2	Firmware configuration PROM revision bit 0	OPEN
SW2 - 3	Firmware configuration PROM revision bit 1	OPEN
SW2 - 4	Not connected	

Links

The TRX32 board holds the following links:

→ *Links location - see figure on page 101*

ST1 - ST4	Used for Ethernet field upgrade of FPGA configuration firmware	CLOSED
ST5	No function	OPEN
ST6 HALT	Alternative use of LED's and test points for debugging purpose	OPEN
ST7 TRST	No function	OPEN
ST8	Legacy PPC software control of start FPGA configuration from firmware PROM	CLOSED
ST9 PROG	Manual control of start FPGA configuration from firmware PROM	OPEN
ST10 INIT	Manual reset of the firmware PROM internal address counter	OPEN

Connectors

- **P1** - a 96-pin, male right-angled euro-connector, located on the rear edge of the board. It carries power and digital control signals.
- **P2** - a 96-pin, male, right-angled euro-connector, located on the rear edge of the board. Connector for the transducer elements cables (two wires per element).
- **P3, P4, P5, P7, P8, P9**, male, right-angled connectors, located on the front edge of the board.

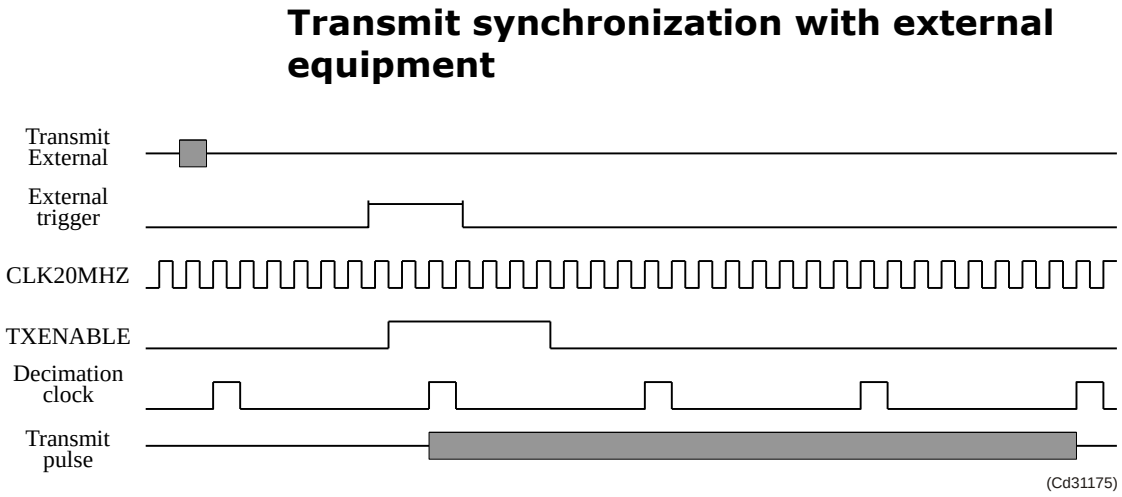


Figure 24 Transmit synchronization with external triggering

In some applications the transmit cycle is triggered by an external hardware signal:

1 The host computer downloads a sequence of Ethernet commands (broadcast or individually addressed) into the transceiver boards containing a high level description of the transmit pulse.

2 The host broadcasts a Transmit External command to the transceiver boards.

3 All boards (master and slaves) toggle their TR-switch (Transmit/Receive-switch) from receive to transmit position when receiving the Transmit External command.

4 The master board generates a TXENABLE pulse when a positive edge on the SYNC_IN signal (front panel connector P4) is detected. The TXENABLE transitions are aligned with the negative edge of CLK20MHZ.

5 All boards (master and slaves) start transmitting on the first receiver decimation tick (positive edge of decimation clock) after TXENABLE has gone high. The positive edge of the decimation clock is aligned with the positive edge of CLK20MHZ. The decimation clock is not available as an external signal.

On the board

The P4 connector can be used for accurate transmit synchronization with external equipment.

The differential output signal **goes high** (+SYNC_OUT = +3.3V, -SYNC_OUT = 0V) when the transceiver board starts transmitting and **goes low** (+SYNC_OUT = 0V, -SYNC_OUT = +3.3V) when the transmit pulse finishes.

The two outputs are short circuit protected. Their output impedance is approximately 30 k. The differential input signal is used for controlling start of transmission of the transceiver board. Transmission is delayed until a pulse arrives at this input when the board operates in external trigger mode, positive edge of the differential voltage (+SYNC_IN) - (-SYNC_IN).

The maximum voltage range of both inputs is -7 V to +12 V. The differential input impedance is >12 k.

Fuses

→ *Fuses location - see figure on page 101*

Removal

1 Remove the TRX32 circuit board.

→ *Refer to page 83*

2 Use a pair of flat nosed pliers, and grab the fuse carefully on each side. Pull it straight up.

The following fuses are used:

- F1/F2 Kongsberg Maritime order no. 251-086584
- F3/F4 Kongsberg Maritime order no. 251-097722

Replacement

Note

The new fuse MUST be the same rating as the old.
DO NOT replace with a larger fuse.

---

3 Push the fuse straight down into its socket.

4 Replace the TRX32 circuit board.

→ *Refer to page 83*

TRX32 Transceiver board visual inspection

The TRX32 Transceiver board is provided with several front mounted LED indicators. Observe the following procedure to check these.

LED group (A):

Link - Check that this LED flashes green. This means that the communication with the Ethernet switch is operational

Speed - Check that this LED is lit yellow. This means that the communication speed is 100 Mbit/s

Activity - Check that this LED flashes green. This means that the communication is active

Duplex - Check that this LED is lit yellow. This means that the communication is running in full duplex mode.

LED group (B):

Check that the lower five LEDs are lit green. This means that the respective supply voltages are present

The TRX32 Transceiver board is provided with several front mounted LED indicators. Observe the following procedure to check these.

- If a power indicator LED is switched off on only one single TRX32 board, this may be caused by a blown fuse on the board.
- If a power indicator LED is switched off on all the TRX32 boards in the rack, you have a common power problem, and need to check the Power Supply Unit for the relevant rack.
- If one of the communication LEDs (Group A) are suspicious;
  - Check the Ethernet cable between the TRX32 board and the Ethernet switch.
  - Then, check the Ethernet switch.

Related topics

→ *TRX32 Transceiver board on page 100*

→ *Replacement of the TRX32 Transceiver board on page 83.*

TRX32 filter board

The TRX32 filter board is a special made board containing 32 band pass filters and a capacitor battery.

The board is normally used as a front end module for a TRX32 board.

The board is locked in position by two board ejectors.

Function

Signals coming from the transducer are filtered before they are supplied into the TRX32 board.

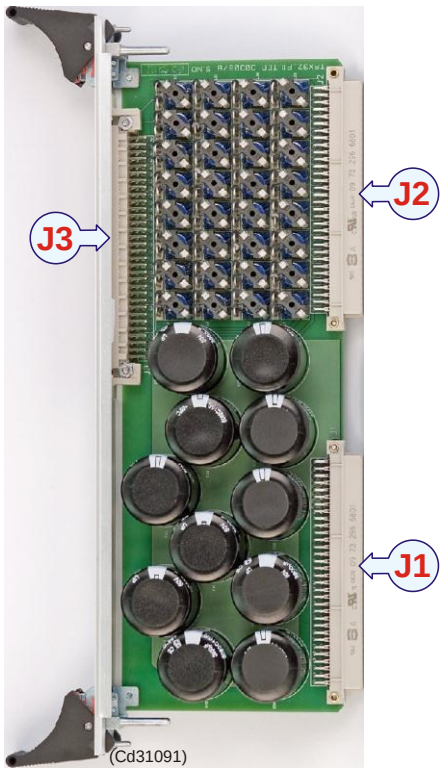
The capacitor battery supplies preloaded energy to the transmitters on a TRX32 board.

In a HiPAP® transceiver unit, the TRX32 Filter boards are mounted on the rear side of the TRX32 boards and the backplane. One TRX32 Filter board is connected directly through the backplane to a TRX32 board.

The 32 band pass filters, filters the input signals coming from 32 transducer elements into J3, before the 32 input signals are supplied out to J2. When the TRX32 board transmits into J2, the filters will pass the transmitted pulse directly to the transducer without any filtering out from J3.

The capacitor battery is connected to J1 and is made of 11 capacitors in parallel giving totally 11 X 3900 uF = 42 900 uF.

Connectors



The TRX32 filter board carries three connectors as follows:

- **J1 -** connector for capacitor battery
- **J2 -** connector for filtered signals to the TRX32 board
- **J3** - connector for the transducer elements

10 SPARE PARTS

This chapter lists the parts and modules defined by Kongsberg Maritime as *Line Replaceable Units (LRUs)*. The unit name and order number are given.

Mounting components (such as nuts, bolts, washers etc.) have not been allocated order numbers as we regard these items as standard commercial parts available from retail outlets around the world.

Topics

Operator station

Part No	Item name	Recommended spares:
364602	Computer	1
337533	Bluestorm serial interface card	1
368464	Power supply unit	1
367360	Hard disk	1
368465	DVD-Recorder	1

Transceiver Model x81

HiPAP® 501/451/351 system

Part no.	Item name	Recommended spares
-	**Technical data**	
303088	PCB TRX32, 501	1
304337	PCB TRX32 Filter	
304605	PCB POWER SUPPLY PSU-48V DC	1
382-079671	PCB POWER SUPPLY PSU-MAIN	1
318101	DS-518A Ethernet Switch Industrial Gigabit Managed Redundant Ethernet Switch with 16 10/100BaseT(X) ports, 2 combo 10/100/1000BaseT(X)/SFP (mini-GBIC) port	
310177	SFP-1GSXLC Small form factor pluggable transceiver with 1000BaseSX, LC, 0.5 km	1
310181	DR-4524, 45W/2A DIN-Rail 24 VDC Power Supply Universal 85 to 264 VAC input	1

HiPAP® 101 system

Part no.	Item name	Recommended spares
-	**Technical data**	
303088	PCB TRX32, 501	1
306273	PCB TRX32 Filter	
304605	PCB POWER SUPPLY PSU-48V DC	1
382-079671	PCB POWER SUPPLY PSU-MAIN	1
318101	DS-518A Ethernet Switch Industrial Gigabit Managed Redundant Ethernet Switch with 16 10/100BaseT(X) ports, 2 combo 10/100/1000BaseT(X) / SFP (mini-GBIC) port	
310177	SFP-1GSXLC Small form factor pluggable transceiver with 1000BaseSX, LC, 0.5 km	1
310181	DR-4524, 45W/2A DIN-Rail 24 VDC Power Supply with universal 85 to 264 VAC input	1

Transducer cable with plug

Using transducer cable with plug; typically when replacing the transceiver.

Part no.	Item name
305230	TD plug conversion kit

→ *Drawing - see cable conversion kit drawing on page 184*

Transceiver unit Model x21

HiPAP® 351 system

Part no.	Item name	Recommended spares
-	**Technical data**	
303088	PCB TRX32, 501	1
304337	PCB TRX32 Filter	
302504	Power module TRU HiPAP® 351 with DC/DC units	1
303331	Data switch assembly TRU HiPAP® 351	1

HiPAP® 101 system

Part no.	Item name	Recommended spares
-	**Technical data**	
303088	PCB TRX32, 501	1
306273	PCB TRX32 Filter	
302504	Power module TRU HiPAP® 350 with DC/DC units	1
303331	Data switch assembly TRU HiPAP® 351	1

Transducer cable with plug

Using transducer cable with plug; typically when replacing the transceiver.

Part no.	Item name
304969	Junction box

→ *Drawing - see junction box conversion kit drawing on pages 185 and 187*

11 HIPAP® MODELS AND POSITIONING PRINCIPLES

The HiPAP® systems are designed to provide accurate positions of subsea objects such as Remotely Operated Vehicles (ROVs), autonomous underwater vehicles (AUVs), towed bodies or fixed seabed transponders. To achieve the accuracy, the HiPAP® system uses unique signal processing techniques. This technique enables narrow transmitter and receiver beams to be generated in all directions within the lower half of the transducer using electronic beam control.

The HiPAP® 501/451/351/101 systems are the second generation HiPAP® systems. These models have a new transceiver unit and a new signal processing algorithms for Cymbal processing.

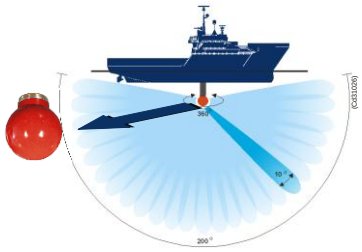
Cymbal is KM's new acoustic protocol for positioning and communication.

All HiPAP® systems; HiPAP® 501, HiPAP® 451, HiPAP® 351 and HiPAP® 101 have common software and hardware platforms, and thereby offer the same kind of additional functionality and options.

- The HiPAP® 501, HiPAP® 451, HiPAP® 351 systems are medium frequency systems operating from 21 kHz to 31 kHz.
- The HiPAP® 101 system is a low frequency system operating from 10 kHz to 15.5 kHz.

Topics

HiPAP® 501



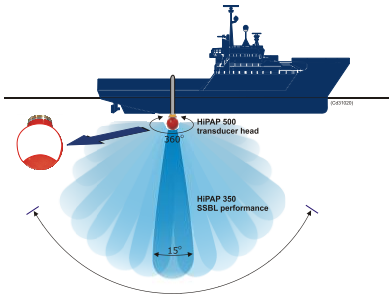
The HiPAP® 501 has a full spherical transducer body including 241 transducer elements. This model has close to full accuracy in the half sphere sector and is the preferred system where the best possible performance is required. The HiPAP® 501 can also track targets above the half sphere sector.

The use of *very narrow beams* provides:

- High accuracy
- Long range capabilities
- Good noise reduction capabilities
- Good multipath suppression

The HiPAP® 500 transducer has a diameter of 392 mm and will be installed with the 500 mm gate valve.

HiPAP® 451



The HiPAP® 450 transducer is the same unit as the HiPAP® 500 transducer. The system has Transmitter/Receiver boards for only 46 elements, similar to the HiPAP® 351 system.

The HiPAP® 451 system has the same operational and technical performance as the HiPAP® 351 system.

→ *Refer to HiPAP® 351 system description on page 116.*

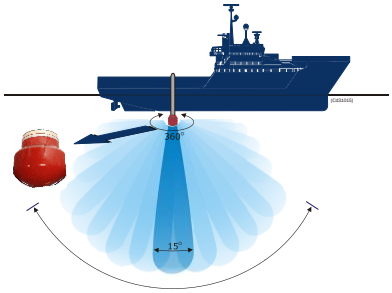
The HiPAP® 451 uses the same hull units as the HiPAP® 501.

Upgrade to HiPAP® 501

The HiPAP® 451 can be upgraded to full HiPAP® 501 performance. This is done by:

- Insert 6 additional Transmitter / Receiver Boards in the transceiver unit which is fully prepared for this.
- APOS software upgrade.

HiPAP® 351



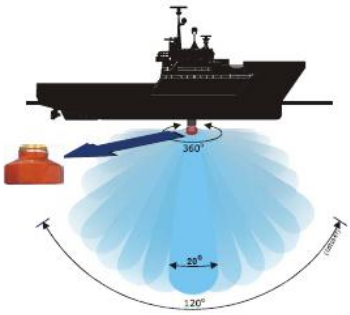
The HiPAP® 351 has a spherical transducer with a cylindrical body including 46 transducer elements. This model has good accuracy in the ± 60° sector and is suited for operations where the major positioning objects are within this sector.

The use of *narrow beams* provides:

- High accuracy
- Long range capabilities
- Good noise reduction capabilities
- Good multipath suppression

The HiPAP® 350 transducer has a diameter of 320 mm and it will be installed with a 350 mm gate valve. Installing the system with a 500 mm gate valve, will enable an easy upgrade to a HiPAP® 501 system.

HiPAP® 101



The HiPAP® 101 has a planar transducer array with a cylindrical body including 31 transducer elements. This model has good accuracy in the ± 60º coverage sector and is suited for operations where the major positioning targets are within this sector.

The HiPAP® 100 transducer has a diameter of 452 mm and will be installed with the 500 mm gate valve.

Positioning principles and processing

The HiPAP® system uses two different principles for positioning; the SSBL and the LBL. These two principles have different properties that make the system flexible for different applications.

- The SSBL principle is based on range and direction measurement to one transponder, while the LBL principle is based on range measurements to minimum three transponders on the seabed.

- The SSBL principle, due to its simple operation, is the obvious choice if the accuracy is good enough for the application performed. The LBL principle is the obvious choice if the SSBL accuracy is not good enough for the application performed, though it requires a more complex operation.
- Cymbal is a signal processing technique used for all positioning modes. Cymbal utilizes Direct Sequence Spread Spectrum (DSSS) signals for positioning and data communication. DSSS is a wide band signal. The Cymbal protocol provides new characteristics for both positioning and data communication.

SSBL positioning

In SSBL, the system calculates a three-dimensional subsea position of a transponder relative to a vessel-mounted transducer. The position calculation is based on range and direction measurements to one transponder. The onboard transducer transmits an interrogation pulse to a subsea transponder, which then answers with a reply pulse. When using a responder the interrogation is replaced by a hard wire trigger connection.

- The onboard system will measure the time from the interrogation to the reply pulse is detected and use the sound velocity to compute the range.
- The transponder position is presented both numerical and graphically on the operator station. Only one onboard SSBL type transducer is necessary to establish this position.

Using a pressure sensor in the subsea transponder can increase position and depth accuracy. The pressure is measured and transmitted to the surface HiPAP® system using acoustic telemetry. The depth is then used in the algorithms for establishing the 3D position. The system can also read the depth via a serial line input from a pressure sensor. Simultaneous use of many transponders is made possible by using individual interrogation and reply frequencies.

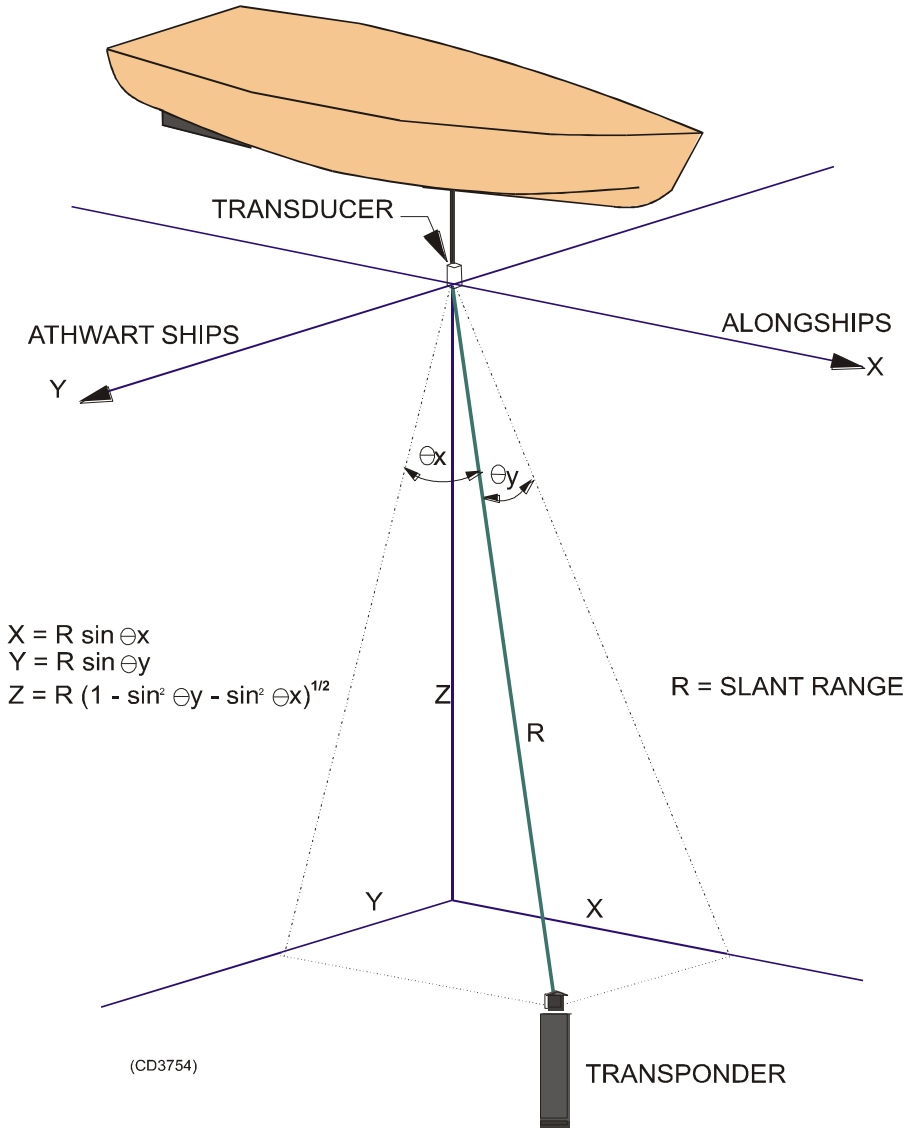


Figure 25 SSBL principle

LBL positioning

Calibration

The LBL principle is based on one vessel-mounted transducer, and normally 4 - 6 transponders on the seabed. This seabed transponder array must be calibrated before LBL positioning operations can begin. The calibration shall determine the transponder's positions in a local geographical co-ordinate frame.

The HiPAP® system supports two calibration techniques:

1. Baseline measurements

This technique uses automatic calibration functions in the HiPAP® system. This allows all the ranges to be measured and made available by acoustic telemetry communication between the transponders and the vessel's system. Based on the baseline measurements and initial positions of the transponders, the calibrated transponder positions are computed.

2. Runtime calibration

To use this technique, the system is run in LBL positioning mode, using the SSBL positions of the seabed transponders for the vessel LBL position calculation. The runtime calibration function logs the measurements. Based on this, new optimised seabed transponder positions will be computed. This technique makes the baseline measurements redundant. If the baselines measurements are done, they are also used in the calculations.

The calibration is performed only once prior to positioning operation, since the transponders will remain in the same location during the operation.

Positioning

When the transponder positions are known, positioning of the surface vessel can begin. All the seabed transponders will be interrogated simultaneously, and each will respond with its specific reply signal. The LBL system will then calculate the ranges from the individual transponders. By using the calibration data together with the calculated ranges in software algorithms, the vessel or an ROV can be positioned. ROV positioning requires an subsea transceiver to be mounted on the ROV.

- The system can take the depth from an ROV-mounted pressure sensor via a serial line. By using this depth in the computation, it will increase the position accuracy of the ROV.
- The range capabilities of a medium frequency LBL system will be approximately the same as those of an SSBL system.
- LBL positioning will give better position accuracy at greater water depths, but is more complex to operate, and it needs more transponders than the SSBL.

- LBL TP positioning method uses one transponder to measure the ranges to the transponders in the array and telemetry the data to the surface vessel, which computes the position of the transponder.

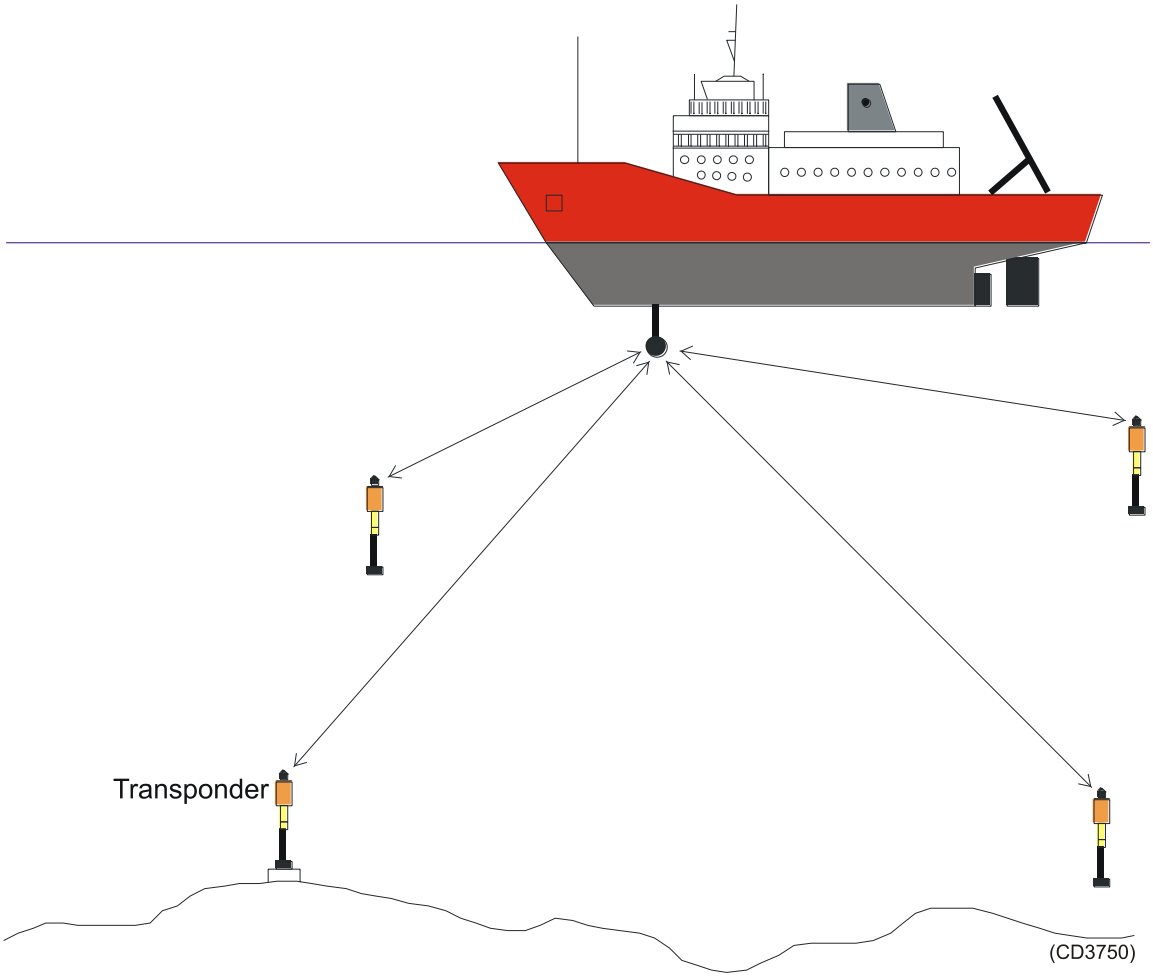


Figure 26 LBL principle

Multi-User LBL positioning

Several individual vessels and ROV units can now position themselves using the same seabed transponder array. The system and principle has the following main advantages:

- Provides high position accuracy (comparable to standard LBL).
- A small number of transponders serve all vessels and ROVs.
- Secures high position update rate (down to approx. 2 seconds), which is essential in DP operations.
- Avoids transponder frequency collisions when vessels are working in the same area (all vessels are "listening" only).

A transponder array is deployed and calibrated by use of subsea baseline measurements. One transponder is used as the Master in the positioning phase. The other transponders are called the Slaves.

The Master transponder acts as a beacon. It starts a positioning sequence by doing the steps described below. This is done regularly with an interval set by telemetry from one of the vessels.

- The Master interrogates the Slaves.
- The Master transmits its individual transponder channel to be received by the vessels/ROVs positioning in the array.
- Each Slave transponder receives the interrogation from the Master and transmits its individual reply channels after a turnaround delay.

A MULBL system positioning in the array listens for the individual channels transmitted by the master beacon, and by the Slave transponders. When they are received, the system uses its knowledge about their positions in the TP array to calculate the differences in range to the transponders in the TP array. The time difference between the Master interrogation and the start of the reception of the pulses at the system is unknown. It has to be calculated together with the position of the vessel or ROV.

All vessels to use the MULBL array need the coordinates of the transponders and the channel numbers, which will be distributed on a file.

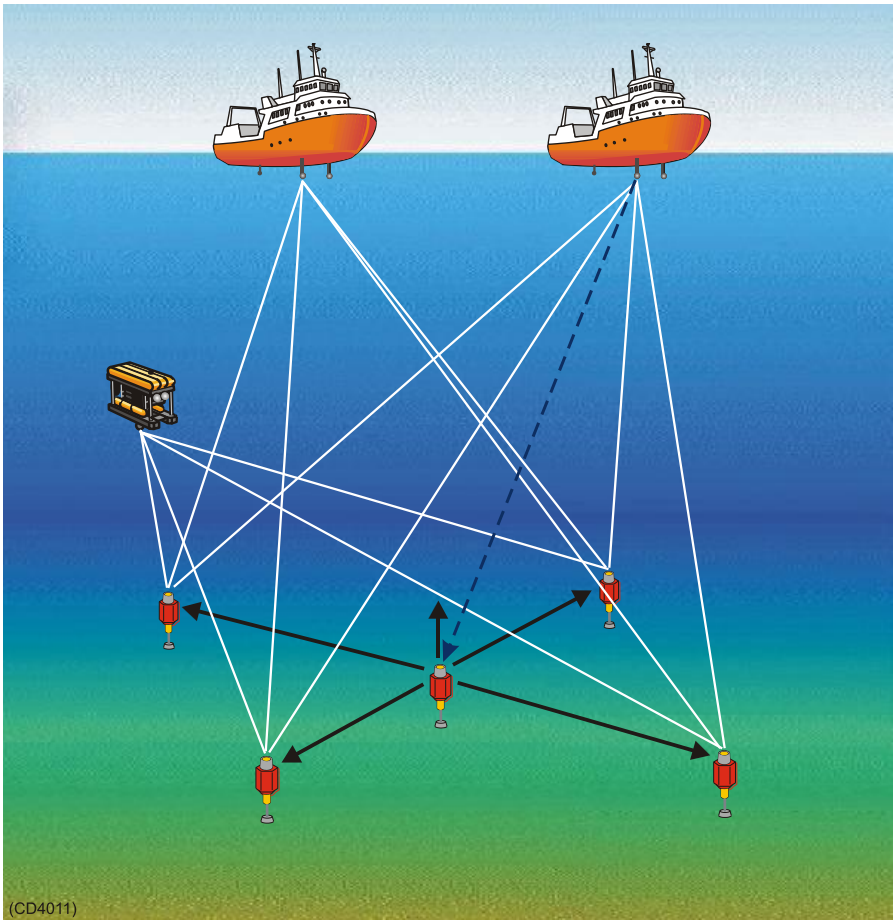


Figure 27 Multi-User LBL positioning

Combined SSBL and LBL positioning

The combined SSBL/LBL system uses an onboard multi-element transducer. The system may operate as an SSBL system and as an LBL system simultaneously.

As an example, the vessel may be positioned relative to the seabed using LBL while an SSBL transponder/responder on an ROV is positioned relative to the vessel. The vessel is displayed relative to the array origin and the ROV relative to the vessel.

The combined system will also use the measured directions in 2D together with the measured ranges in the LBL positioning. The combined measurement gives a robust system with increased accuracy. An LBL solution is achievable when only two transponder replies are detected.

HiPAP® processing

HiPAP® SSBL processing

- The HiPAP® system determines the position of a subsea target (transponder or responder) by controlling a narrow reception beam towards its location. The system uses a digital beam-former, which takes its input from all the transducer elements.
- The system uses a number of wide fixed beams to generate an approximate position for the target. Once this is achieved, it uses data from all the elements on the hemisphere facing the target to compute the narrow reception beam and optimise the directional measurement.
- The range is measured by noting the time delay between interrogation and reception. The system will control the beam dynamically so it is always pointing towards the target. The target may be moving, and the vessel itself is affected by pitch, roll and yaw. Data from a roll/pitch sensor is used to stabilise the beam for roll and pitch, while directional data from a compass is input to the tracking algorithm to direct the beam in the correct horizontal direction.
- The HiPAP® transceiver can operate with up to 56 transponders simultaneously. The data is sent to the computer.

HiPAP® LBL processing

- This mode is similar to the HiPAP® SSBL processing, but the transceiver positions up to 8 LBL transponders for each single LBL interrogation. Both ranges and directions to the transponders are measured.

HiPAP® MULBL processing

- This mode is similar to the HiPAP® LBL processing, but the transceiver does not interrogate the MULBL transponder array, it only listen for the replies from the array. The transceiver can listen for up to 8 LBL transponders. The direction to the transponders and the time difference between the received replies is transmitted to the computer.

HiPAP® Telemetry processing

- The unit transmits acoustic telemetry messages, and receives and decodes the acoustic telemetry message from the transponder. The data is sent to the computer.

Cymbal acoustic protocol

Cymbal is the new acoustic protocol used for both positioning of subsea transponder in SSBL/LBL mode and data communication to and from transponders.

The technology

Cymbal utilizes Direct Sequence Spread Spectrum (DSSS) signals for positioning and data communication. The data communication speed is variable and can be adapted to the acoustic communication conditions; noise and multi-path.

DSSS is a wide band signal.

The Cymbal protocol provides new characteristics for both positioning and data communication.

Range capability and reduced impact from noise

Cymbal protocol can transmit more energy in each positioning pulse. Compared to the current HiPAP® 500 this extra energy will provide higher position accuracy at low signal to noise ratio. It will also provide longer range capabilities. This improvement in energy is 5dB.

Range accuracy

The Cymbal signal gives range accuracy in the order of 0.01m, error contribution from sound velocity and ray bending not included.

Directional measurements

In SSBL operation, the accuracy of directional measurement is the main contributor to the position accuracy. The HiPAP® 501 has new and improved algorithms for directional computation when using Cymbal. At low signal to noise ratio the system will be more robust.

Number of channels

The Cymbal protocol has increased number of unique codes for transponder channels compared to the current system. At present there are 50 unique transponder channels.

Multi-path capability

The Cymbal protocol is designed to have good multi path properties. The processing technique allows signals to and from the transponder to overlap and still be able to have a correct detection.

Power management – lifetime

The Cymbal protocol has a power management function that can command the transponder to adjust transmit power to save batteries.

Data Link with variable data rate – adaptable

The Cymbal protocol supports variable data rate and high reliability level. The obtainable data rate is defined by the signal to noise level and multi-path conditions. By default the system uses data rates that will secure long range and high reliable communication.

Integrated navigation and data link

Data that needs to be sent to and from a transponder will be interleaved between the positioning signals. The cNODE® transponder can any time send status and data to the HiPAP® and visa versa.

cNODE® - Modeless transponder

The Cymbal protocol is able to use transponders in SSBL and LBL mode without changing the mode of the transponder. A transponder in an LBL array can by the operator be deselected from the LBL positioning and directly be used in SSBL mode. No data telemetry is required.

12 RESPONDER OPTION

This chapter describes the Responder option for HiPAP® systems.

Topics

Related topics

Basic responder information

The responder option provides drive signals to responders from the HiPAP® system. For this function a Responder Driver Unit (RDU) is used. The software is included in the APOS.

- The Responder Driver Unit is controlled from the operator station through the Ethernet connection, selecting the output to be activated. A sync signal from the transceiver controls the timing of the output drive signal.
- The Responder Driver Unit has:
  - **4 individual electrical outputs -** the electrical outputs can be connected directly to a Responder.
    and
  - **4 individual fibre optic outputs -** the fibre-optic outputs have to be converted to an electrical pulse before connected to a Responder. We have a special kit for this purpose.

→ *Kit: part no: 330965 – drawing on page 138*

The outputs can be used when you transmit the Responder drive signals as fibre-optic signals in an umbilical, and convert the signal to an electrical signal in front of the Responder. This gives a good insulation of the driver signal from other voltages in an umbilical.

Responder Driver Unit

The Responder Driver Unit is a stand-alone unit. The unit is protected against dust and water.

Figure 28 Responder Driver Unit

Inputs to the unit:

- Power
- Ethernet
- Sync signal

Outputs of the unit:

- Four electrical responder drive signals
- Four fibre optic responder drive signals

POWER

The RDU unit is powered from a 85 - 264 Vac supply. The power switch is located back at the right side of the unit.

Technical specifications

Responder Driver Unit kit

Part no.:	317925

Includes:

- RDU unit
- Power cable
- Ethernet cable
- D-sub connectors
- Mounting screws w/nuts (4)

Responder Driver Unit

Weight:	2.8 kg
Degree of protection:	IP 44

→ *Outline dimensions - see drawing on page 134*

Power

Power:	230 Vac, 150 mA
Frequency:	40 - 440 Hz
Inrush max:	5 A Ac
Maximum current drawn:	0.4 A
Normal current drawn:	0.06 A
Nominal power consumption:	15 W

Environmental conditions

Operating temperature:	0 to 55° C
Storage temperature:	-30 to 70° C
Humidity:	15% - 95% (non condensing)

Vibration

Range:	5-100 Hz
Excitation level:	5-13.2 Hz ±1.5 mm, 13.2-100 Hz 1 g

Fibre to responder drive converter kit

Part no.:	330965

→ *Drawing on page 138*

Installation

Responder Driver Unit

The Responder Driver Unit is a stand-alone unit and can be mounted with 4 off screws horizontally or vertically.

Unit location

The unit should be located where it is most suitable for connecting the cables to the responders. This can be close to Remote Operating Vehicle (ROV) operation room.

There is normally one cable connected to the Responder Driver Unit for **each responder** to be operated. The unit must be installed so it is easy accessible for operators to check the working condition of the responder trig status diodes.

Logistics

Safety - Refer to the general safety procedures.

Special tools - None.

Drawings - Outline dimensions - see drawing on page 134

Mounting

1 Open the unit.
- Remove the four (4) screws which secure the lid (one in each corner).

2 Lift off the lid.
- There are four (4) through holes for the mounting screws inside the unit (one in each corner).

3 The mounting screws w/nuts are a part of the RDU kit (delivered with the unit).

→ *RDU kit on page 128*

4 Mount the RDU where suitable.

5 Fasten the four (4) mounting screws.

6 Close the unit.

Fibre to responder drive converter

The unit has a DIN rail mounting.

Cable layout and interconnections

→ *Cable plan and interconnections on page 189*

Maintenance

Note — *Before you start, read the general maintenance information on page 72.*

Responder Driver Unit

Under normal conditions, maintenance is not required, apart from keeping the unit clean. If the unit is not functioning properly, the unit must be replaced.

The unit is interfaced to the HiPAP® system via an Ethernet connection and hard wired to the HiPAP® transceiver unit to get the sync pulse for correct timing. The APOS controls which drive is being active while the sync is received from the HiPAP® Transceiver.

Figure 29 Responder Driver Unit

Connections

Caution *When not mounted/used - keep the protecting caps on the fibre-optic connectors.*

Four electrical outputs (**C**) and four fibre optical outputs (**B**) are available. Totally 8 outputs can be used. There is a green LED indicator for every responder drive output (**A**) showing the activity on the output. There is also a power on LED indicating power is on (**D**).

- The 4 electrical outputs can separately be connected directly to separately responders. Output drive signal to responders is a +24V electrical pulse of 4.5 ms or a fibre-optic pulse.
- The 4 optical outputs are normally connected with a fibre-optic cable to 4 separately converters with their own separate power. One converter for every responder. The fibre-optic output pulse is 4.5 ms as the electrical pulse.

→ *Fibre to responder drive converter on page 129*

- The converter power is normally the same power as the responder is powered from.
- The converter converts the optical signal back to an electrical signal before supplied to a responder.
  - Converter to be used: 326494 is a part of kit 330965
  - Fibre optic patch cable that can be used: 719-097260 FC-2/2-2M.

→ *Responder Driver Unit replacement, see installation on page 129*

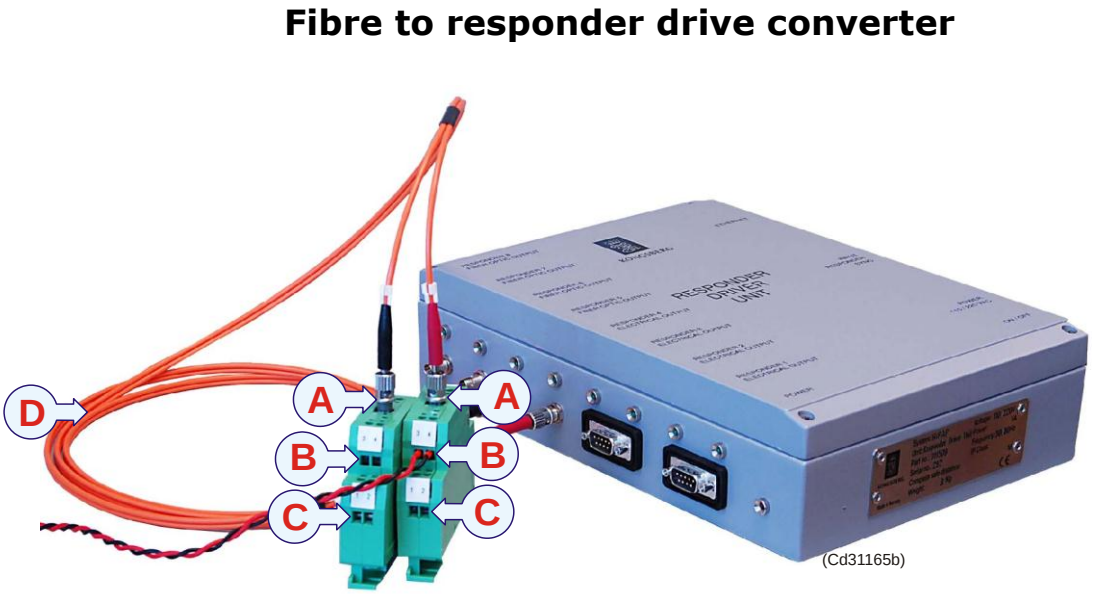


Figure 30 Illustrating a system using two optic responder converter kit - electrical connection to the responder is not shown

A: *Fibre-optic connector*
B: *Power supply cable (Local power cable is shown here)*
C: *Electrical connector*
D: *Fibre-optic patch cables*

→ *Kit see page 129*

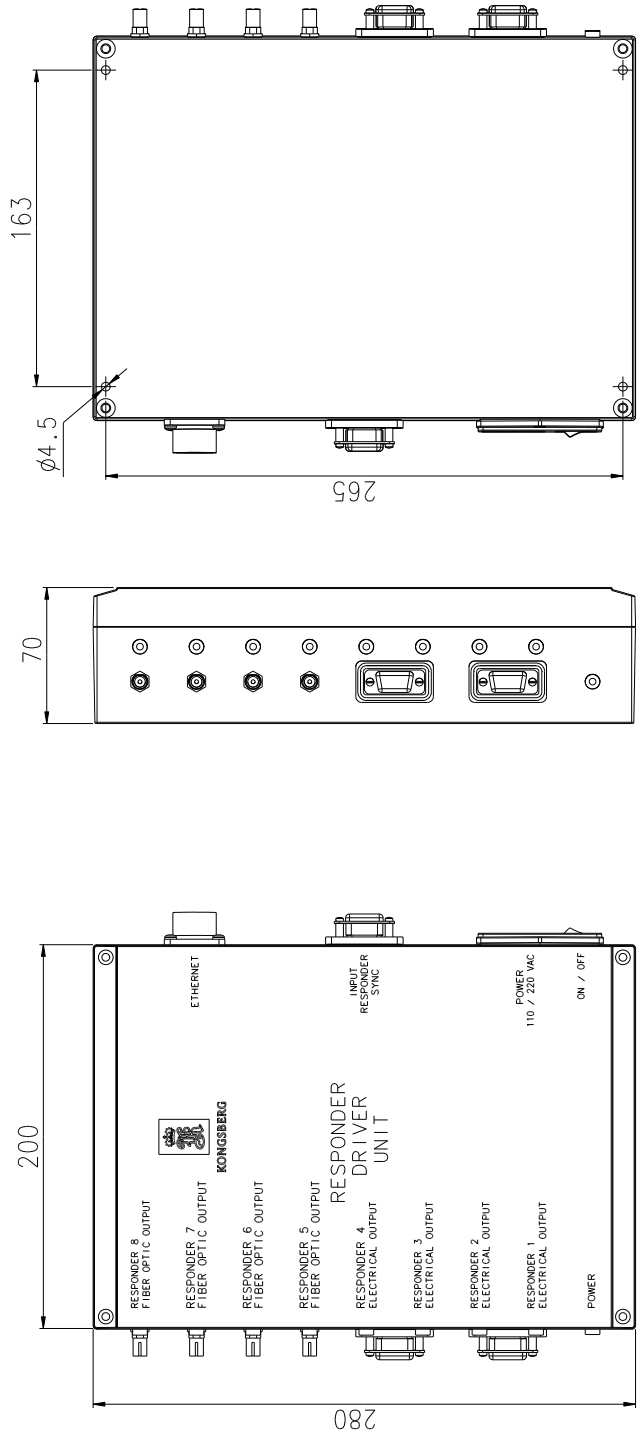
Spare parts

Part no.	Item name
-	**Technical data**
319173	Responder Driver Unit
336494	Power 24 Vdc, 25 mA
317925	Responder Driver Unit, kit
330965	Fibre to responder drive converter, kit

Drawings

Part No.	Rev.	Description	Ref.
316067	A	Responder Driver Unit (option) - outline dimensions	on page 134
313697	E	Responder Driver Unit - wiring diagram	on page 137
W250A	N/A	Responder Driver Unit - Pinout responder sync.	on page 135
W251A	N/A	Responder Driver Unit - Electrical drive signal Responder 1-4 pinout	on page 135
W249D	N/A	Pinout Responder sync, Responder Driver Unit for Model x21	on page 136
W249B	N/A	Pinout Responder sync, Responder Driver Unit for Model x81	on page 136
330965	A	Fibre to responder drive converter - wiring diagram	on page 138

Responder Driver Unit - outline dimension



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

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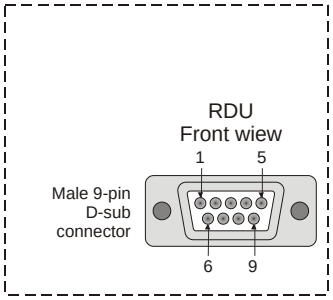
316067 Rev.A

Responder Driver Unit

→ *Refer to Responder Driver Unit - wiring diagram on page 137*

Pinout responder sync. input

Responder	9p D-sub
+Sync	1
-Sync	2



W250 Rev.A	Pinout Responder sync for Responder Drive Unit

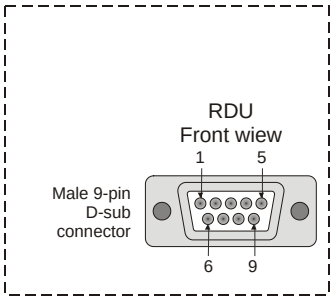
Electrical drive signal Responder 1-4 pinout

Responder 1	9p D-sub
Power 1 +24V	1
Drive signal 1	2
Ground	3

Responder 2	9p D-sub
Power 2 +24V	6
Drive signal 2	7
Ground	8

Responder 3	9p D-sub
Power 3 +24V	1
Drive signal 1	2
Ground	3

Responder 4	9p D-sub
Power 4 +24V	6
Drive signal 2	7
Ground	8



W251 Rev.A	Pinout Responder drive signal 1 to 4 for Responder Drive Unit

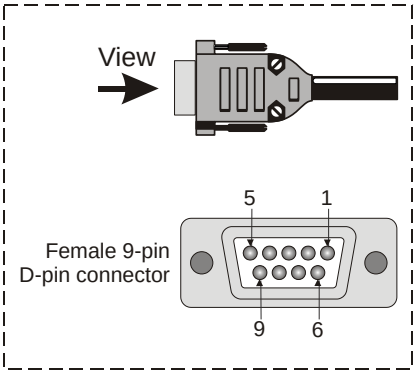
Optical drive signal responder 5-8:

Connector: Industry standard ST fibre connector 850 nm, optical drive signal pulse 5 ms.

→ *Connector on page 29*

Responder sync cable, Transceiver unit Model x21

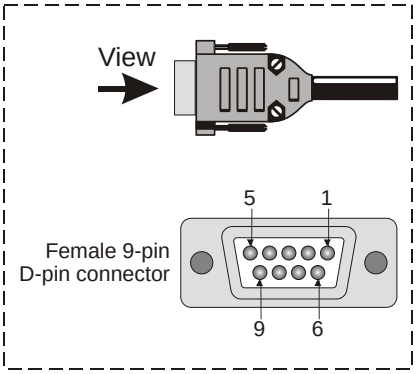
Responder	TB1	9p Dsub
+Sync out	9	1
-Sync out	10	2
Ground	11	



W249D Rev.A	Responder sync cable for HiPAP Transceiver unit Model x21

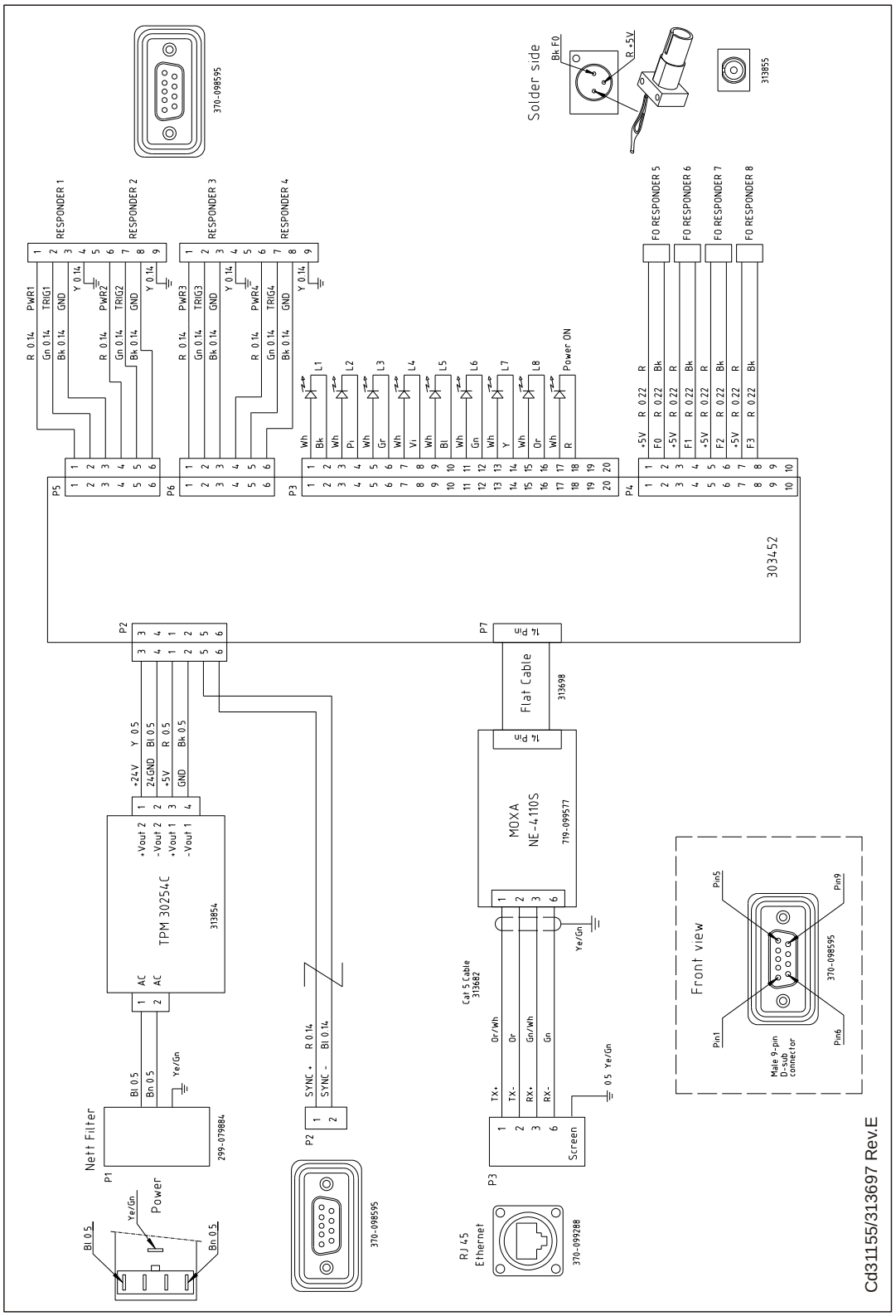
Responder sync cable, Transceiver unit Model x81

Responder	Terminal block	9p Dsub
+Sync out	12	1
-Sync out	13	2
Ground	14	

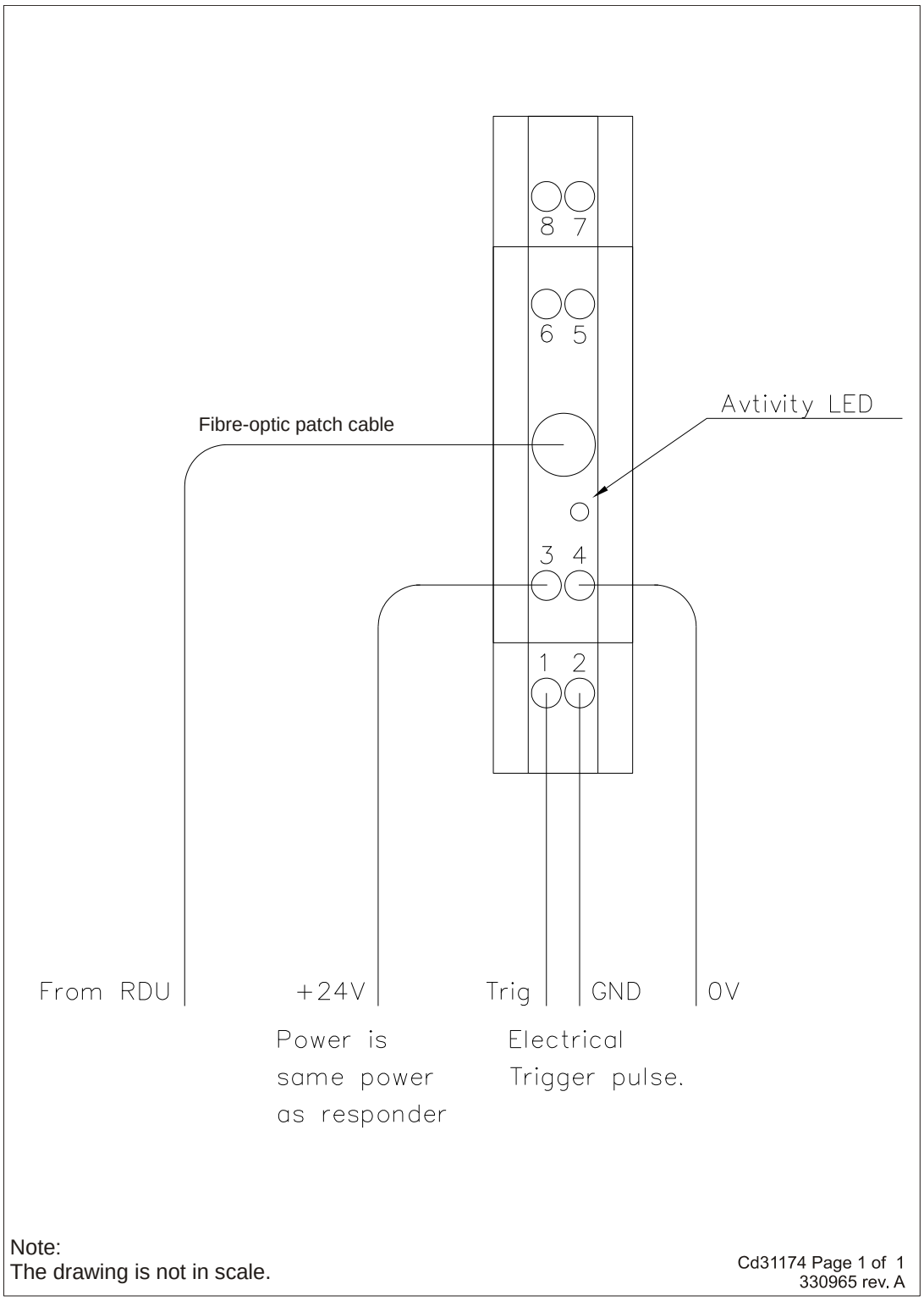


W249B Rev.A	Responder sync cable for HiPAP Transceiver unit Model x81

Responder Driver Unit - wiring diagram



Fibre to responder drive converter - wiring diagram



Note:
The drawing is not in scale.

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330965 rev. A

13 LASER OPTION

This chapter describes the laser option for HiPAP® systems used with the Transceiver Unit Model x81.

Topics

Related topics

→ *Technical specifications - See documentation delivered with the Laser. This is not a Kongsberg Maritime document.*

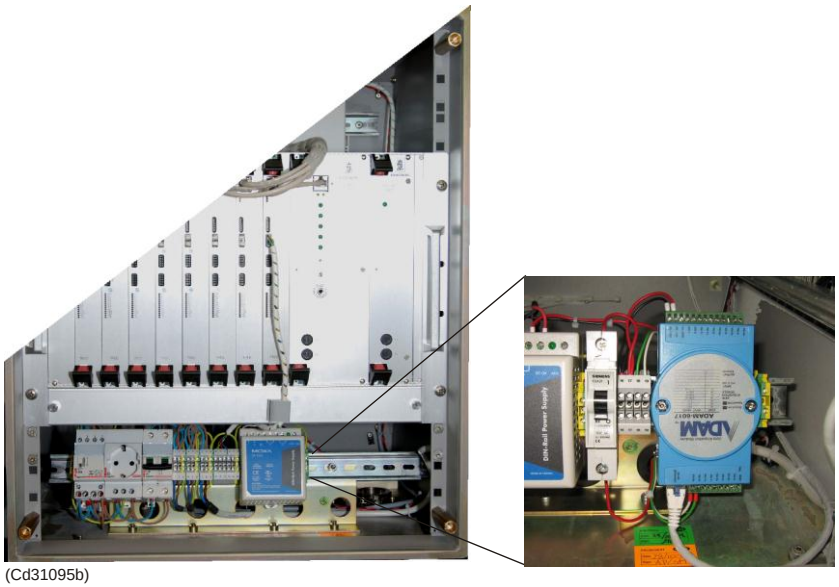
Basic laser information

The laser can be used to measure the transducer depth. The readings are integrated in the APOS, and can be presented on the Operator Station. The laser is to be used with the Transceiver unit Model x81 only. The laser is mounted on the hull unit.

The laser system includes:

- **Laser** - to be mounted on the hull unit at the top.
- **Hoist indicator ADAM 6017** - to be mounted in the TU Model x81.
- **Laser switch** - (power switch for laser/circuit breaker) to be mounted in the TU Model x81.
- **Reflector plate** - to be mounted on the transducer shaft.
- **Cable** - between the TU Model x81 and the hull unit.

TU Model x81:



Hull unit:

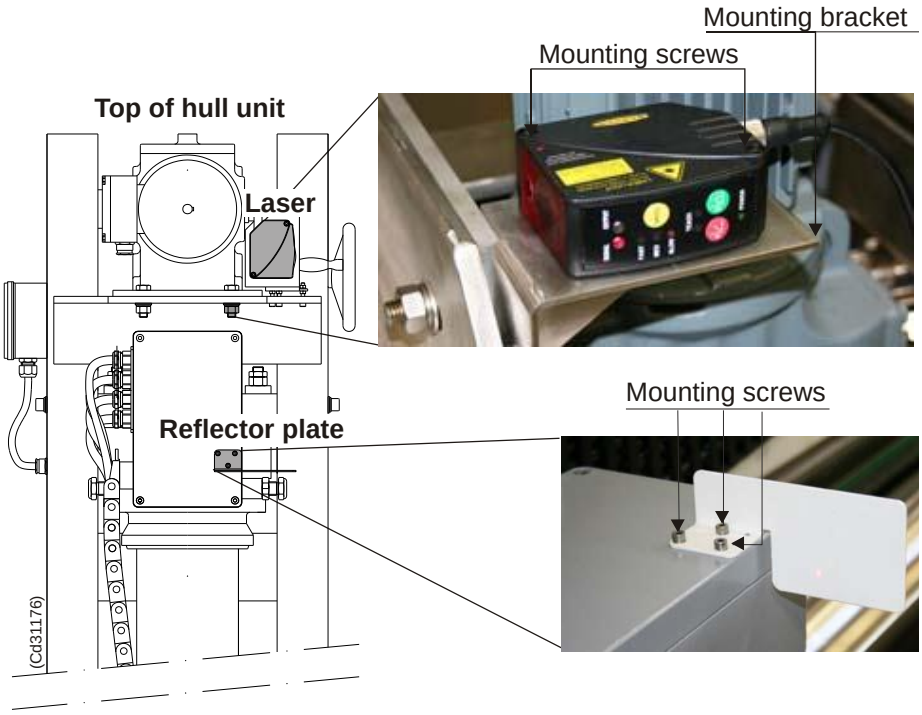


Figure 31 Laser system parts location

Installation

Logistics

Safety - Refer to the general safety procedures.

Vessel location - N/A.

Special tools - None.

Drawings -

- Laser location and mounting screws, see figure on page 140
- Hoist indicator/Hull unit - wiring diagram on page 145

Laser

The laser is mounted on the hull unit. See figure above.

Connect the laser cable to the ICP-CON and TB4 in the transceiver unit.

The laser may be switched ON/OFF when required, but the unit requires about 30 minutes warm up time before use. The laser power switch is located in the base of the transceiver unit.

→ *Refer to the figure on page 144*

Hoist indicator (ADAM 6017)

Drawings - Hoist indicator ADAM 617 – wiring diagram on page 145

→ *Same principle as for the RTB module, on page 87*

Laser switch

→ *Same principle as for the RTB module, on page 87*

Cable layout and interconnections

→ *Cable plan and interconnections on page 189*

Maintenance

Note — *Before you start, read the general maintenance information on page 72.*

Laser inspection

1 Inspect the laser and connections.

2 Clean the laser and reflector plate (every 2 months).

How to replace the Laser

Removal/ Replacement

1 Switch off power to the system.

2 Disconnect the unit cable.

3 Unscrew the two (2) mounting screws holding the Laser.

4 Lift the laser out.

5 Fit the new laser into place, and secure it with the two screws.

6 Reconnect the cable.

7 Adjust the new laser as required.

ADAM converter

Removal/ Replacement

→ *Same principle as for the RTB module, on page 90*

Laser switch

Removal/ Replacement

→ *Same principle as for the RTB module, on page 36.*

Spare parts

- Laser LT3PIQ: 298-099692
- Hoist indicator ADAM 6017: 719-097234
- Reflector plate for laser: 317459
- Laser cable: 719-078595
- Laser switch: 251-096603

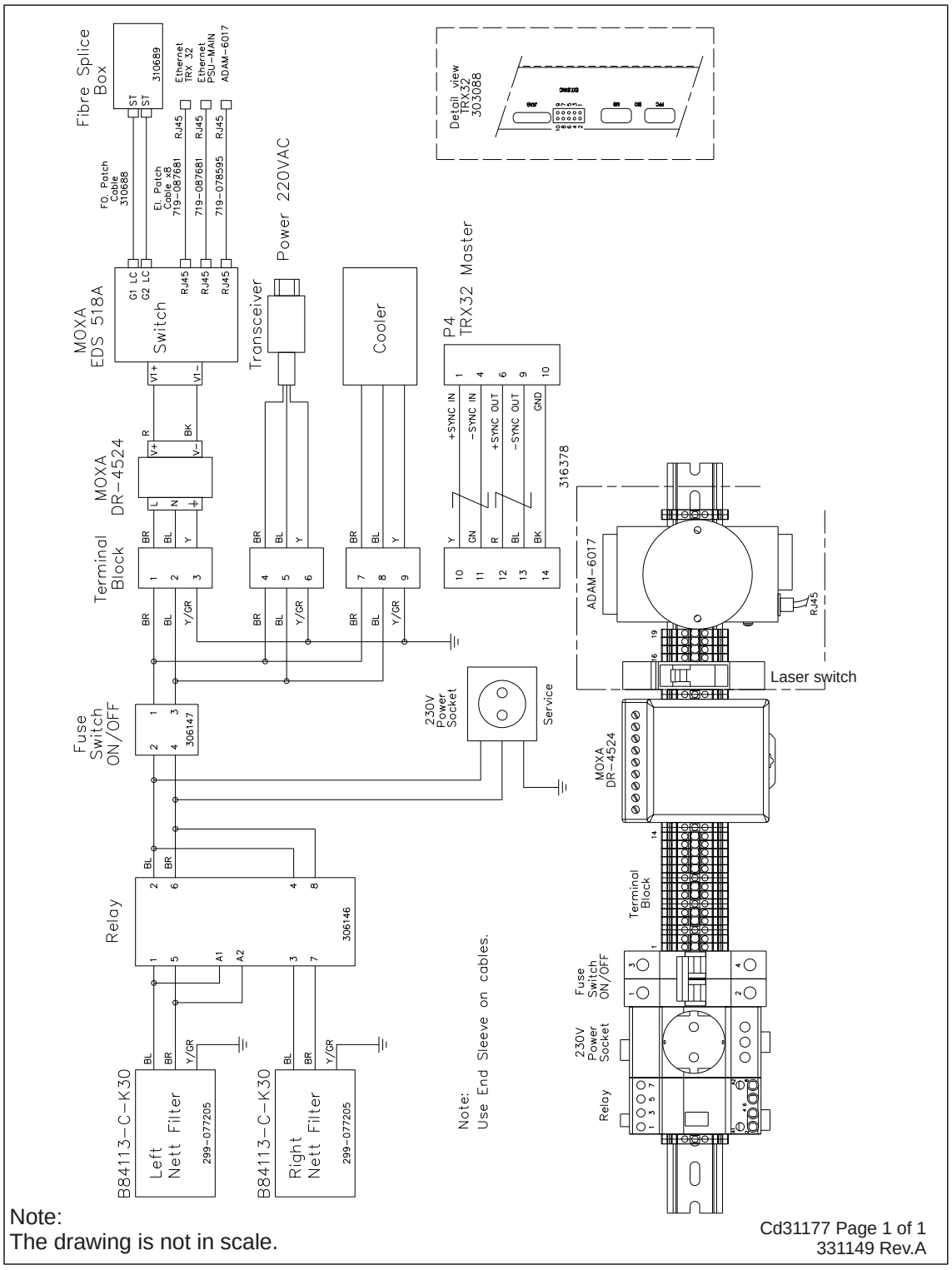
Laser kit for TU Model x81

- Part no.: 331158

Drawings

Part No.	Rev.	Description	Ref.
331149	A	TU Model x81 - wiring diagram w/laser	on page 144
329779	A	Hoist indicator / hull unit - wiring diagram	on page 145

TU Model x81 – wiring diagram w/laser



Note:
The drawing is not in scale.

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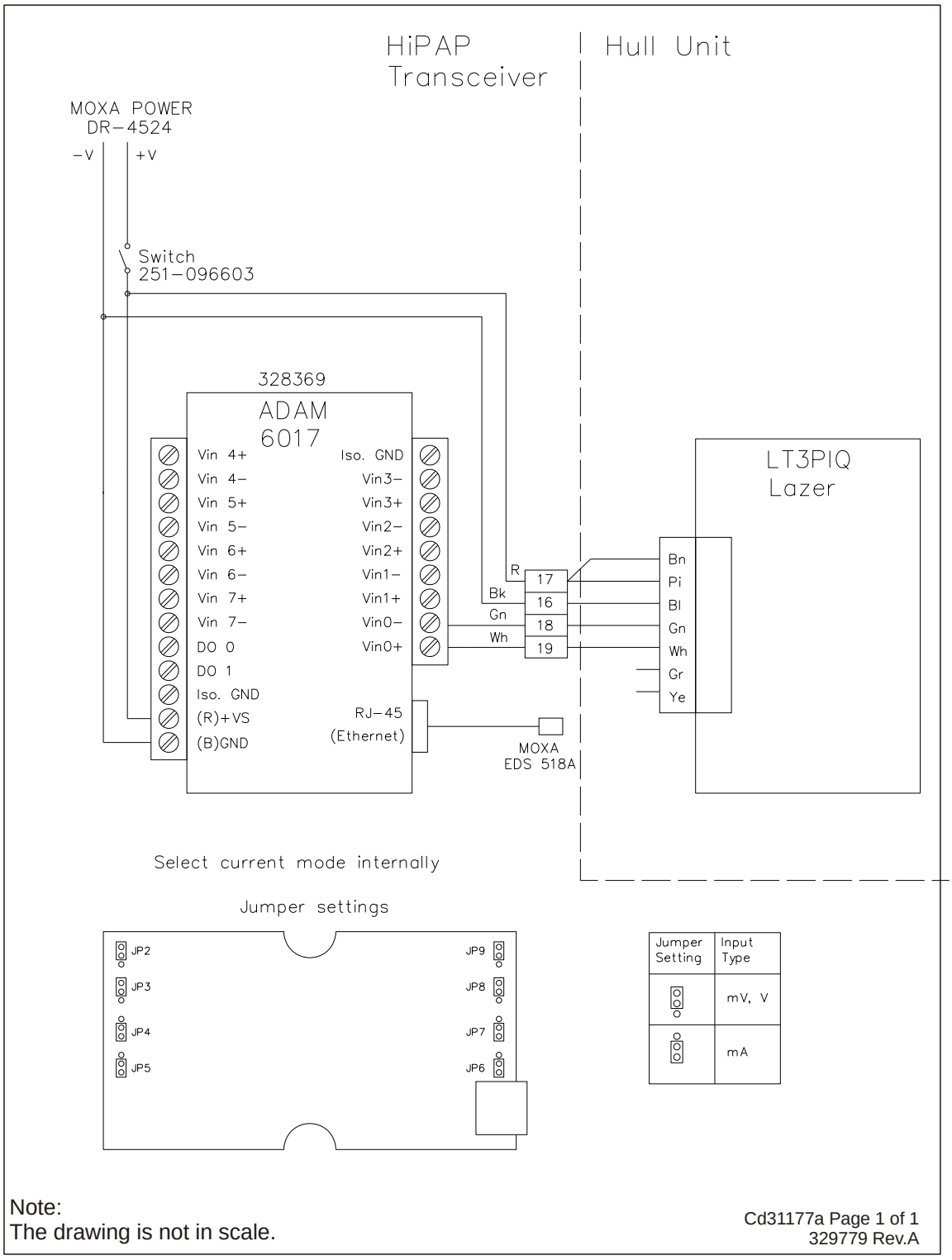
331149 Rev.A

Hoist indicator ADAM 617 – wiring diagram



14 EQUIPMENT HANDLING

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

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

Topics

Transportation

Unless otherwise stated in the accompanying documentation, electronic, electro-mechanical and mechanical units supplied by Kongsberg Maritime can be transported using all methods approved for delicate equipment; (by road, rail, air or sea). The units are to be transported in accordance with general or specific instructions for the appropriate unit(s), using pallets, transport cases, or carton boxes as appropriate.

Note

Special local restrictions concerning air transportation may be applied to units containing certain types of batteries. The units should be checked and the regulations investigated by the packer/shipper before the unit is dispatched.

Local transportation

All local transportation must be carried out according to the same specifications as for the initial delivery. In general, all units must be handled with care. The carton/case containing the equipment must be kept dry at all times, and must be sheltered from the weather. It must not be subjected to shocks, excessive vibration or other rough handling.

The carton /case will normally be marked with text or symbols, indicating which way it is to be placed. You must follow the instructions given, and ensure that the carton /case is always placed with its “top” uppermost.

The carton/case must not be used for any purpose for which it was not intended (step, table, etc.), and in the absence of other information, no other cartons/cases must be stacked on top of it.

Lifting

A heavy crate will normally be marked with its weight, and the weights of other cartons or crates will normally be entered on the packing list.

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

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

- You must check the applicable weight certificate for the crane.
- You must check the security of the lifting lugs.

Ensure that all available lifting lugs are used. Ensure the unit remains under control during the operation to avoid damage to the unit, equipment or personnel.

Heavy units may be transported using a fork-lift truck. Special attention must then be paid to the position of the unit’s centre of gravity. The units must be properly secured to the truck.

Storage prior to installation or use

When a system, a unit or a spare part has been delivered to the customer, it may be subject to long-time storage prior to installation and use. During this storage period, certain specifications must be met. The equipment must be preserved and stored in such a way that it does not constitute any danger to health, environment or personal injury.

1 The equipment must be stored in its original transportation crate.

2 Ensure that the units are clearly separated in the shelves and that each unit is easily identifiable.

3 The crate must not be used for any purpose for which it was not intended (e.g. work platform etc.).

4 The crates must not be placed on top of each other, unless specific markings permit this.

5 The crates must not be placed directly on a dirt-floor.

6 Do not open the crate for inspection unless special circumstances permit so.

- "Special circumstances" may be suspected damage to the crate and its content, or inspections by civil authorities.
- If any units are damaged, prepare an inspection report stating the condition of the unit and actions taken. Describe the damage and collect photographic evidence if possible. Re-preserve the equipment.
- If the units are not damaged, check the humidity absorbing material. If required, dry or replace the bags, then repack the unit(s) according to the packing instructions.

7 If the crate has been opened, make sure that is it closed and sealed after the inspection.

- Use the original packing material as far as possible.

→ *Refer to information on page 154.*

Ambient temperature and humidity

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

2 The storage area's mean temperature must not be lower than -30° C, and not warmer than +70° C.

- If other limitations apply, the crates will be marked accordingly.

Note *Transducers must not be stored in temperatures below -30° C, or higher than +55° C.*

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

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

Shock and vibration

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

ESD precautions

→ *Refer to the information on page 154.*

Batteries

If the unit contains normal batteries, these may have been disconnected/isolated before the unit was packed. These must only be reconnected before the installation starts. Units containing batteries are marked.

Caution *Units containing lithium or alkaline batteries must be handled separately and with care. Such units are marked accordingly. Do not attempt to recharge such batteries, open them or dispose of them by incineration. Refer to the applicable product data sheets.*

Inspection

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

- Check all wooden or cardboard boxes, plastic bags and pallets for physical damage. Look for signs of dropping, immersion in water or other mishandling.
- If damage is detected externally, you will have to open the packaging to check the contents.
  - Request a representative of the carrier to be present while the carton is opened, so any transportation damage can be identified.
- If any units are damaged, prepare an inspection report stating the condition of the unit and actions taken. Describe the damage and collect photographic evidence if possible. Send the inspection report to Kongsberg Maritime as soon as possible.

- If the units are not damaged, check the humidity absorbing material. If required, dry or replace the bags, then repack the unit(s) according to the packing instructions.

Unpacking

Normal precautions for the handling, transportation and storage of fragile electronic equipment must be undertaken.

Note

If the unit is not to be prepared for immediate use, you may consider storing it unopened in its original packing material. However, it may be useful to open the case to check its contents for damage and retrieve any accompanying documentation.

- Check the carton before opening it to ensure it shows no signs of dropping, immersion in water or other mishandling.
  - If the carton shows signs of such damage, refer to the paragraph covering Inspection on receipt.
- Place the carton on a stable work bench or on the floor with the top of the carton uppermost.
- In the absence of other instructions, always open the top of the carton first. The contents will normally have been lowered into the carton from above, so this will usually be the easiest route to follow.
  - Care must be used when opening the carton to ensure the contents are not damaged.

Caution

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

- If the carton has been closed using staples, remove the staples from the carton as you open it. This will reduce the possibilities of scratch injury to yourself and damage to the contents.
- If a wooden crate has been closed using screws, always remove them using a screw-driver. Do not attempt to prise the lid off with a crow-bar or similar.

- Once the carton is open, carefully remove all loose packing and insulation material. Check for manuals and other documents that may have been added to the carton during packing, and put these to one side. Check also for special tools, door keys etc.

Electronic and electro-mechanical units

Caution — *Beware of the dangers of Electro-Static Discharge (ESD) both to yourself and to the equipment, when handling electronic units and components. Refer to the ESD precautions starting on page 154.*

Electronic and electro-mechanical units will normally be wrapped in a clear plastic bag. Lift the unit, in its bag, out of the carton and place it in a stable position on the floor/work bench.

Inspect the unit for damage before opening the plastic bag.

Note — *Cables must **never** be used as carrying handles or lifting points.*

Note — *Do not break the seal to open a circuit board package before the board is to be used. If the board package is returned to the manufacturers with the seal broken, the contents will be assumed to have been used and the customer will be billed accordingly.*

Assuming all is well, open the bag and remove the unit.

Open the unit and check inside. Remove any packing and desiccant material that may be inside.

Mechanical units

Mechanical units may be heavy. Using a suitably certified lifting apparatus, lift the unit out of the crate and place it in a stable position on the floor/work bench.

Inspect the unit for damage and remove any packing material that may be inside the unit.

Re-packing

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

→ *Refer to the information on page 154.*

Storage after unpacking

The unit must whenever possible be stored in its original transportation crate until ready for installation. The crate must not be used for any purpose for which it was not intended (e.g. work platform etc.).

Once unpacked, the equipment must be kept in a dry, non condensing atmosphere, free from corrosive agents and isolated from sources of vibration.

Note

Do not break the seal to open a circuit board package before the board is to be used. If the board package is returned to the manufacturers with the seal broken, the contents will be assumed to have been used and the customer will be billed accordingly.

The unit must be installed in its intended operating position as soon as possible after unpacking.

If the unit contains normal batteries, these may have been disconnected/isolated before the unit was packed. These must then be reconnected during the installation procedure. Units containing batteries are marked.

Caution

Units containing lithium or alkaline batteries must be handled separately and with care. Such units are marked accordingly. Do not attempt to recharge such batteries, open them or dispose of them by incineration. Refer to the applicable product data sheets.

After use storage

If a unit is removed from its operating location and placed into storage, it must be properly cleaned and prepared before packing.

Cleaning cabinets

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

- Wipe the cabinet externally using a damp cloth and a little detergent. Do not use excessive amounts of water as the unit may not be water tight. On completion, dry the unit thoroughly.
- All surfaces must be inspected for signs of corrosion, e.g. flaking/bubbling paint, stains etc. Damaged or suspect areas must be cleaned, prepared and preserved using the correct preservation mediums for the unit. The mediums to be used will usually be defined in the units' maintenance manual.
- Open the unit, and using a vacuum cleaner, remove all dust etc. from the unit. Great care must be taken to ensure the circuit boards and modules are not damaged in the process.

Cables

Wipe clean all exposed cables, and check for damage. If a cable shows signs of wear or ageing, contact Kongsberg Maritime for advice.

Dehumidifier

Place a suitably sized bag of desiccant material (silica gel or similar) into the unit to keep the electronic components as dry as possible.

Coatings

Spray the unit externally with a corrosion inhibitor (e.g. light oil) before packing.

Re-packing

The unit should be stored and transported in its original packing material and/or crate. In the event that this material is not available, proceed as follows:

- Small units must be protected from damp by being placed within a plastic bag at least 0.15 mm thick. An appropriate quantity of desiccant material should be placed inside this bag, and the bag sealed. The sealed unit must then be placed in an appropriate carton or crate, and supported in the container by appropriate shock-absorbing insulation (polystyrene foam chips etc.).
- Large units must be placed in a suitable cardboard box or wooden crate. The unit must be protected against physical damage by means of shock-absorbing insulation mats. The box must be clearly marked with its contents, and must be stored in a dry and dust-free area.

ESD precautions

What is ESD?

Electro-Static Discharge (ESD) is the transfer of an electrostatic charge between two bodies at different electrostatic potentials, caused either by direct contact or induction by an electrostatic field.

The passing of a charge through an electronic device can cause localised overheating, and it can also “puncture” insulating layers within the structure of the device. This may deposit a conductive residue of the vaporised metal on the device, and thus create a short circuit. This may result in a catastrophic failure, or degraded performance of the device.

ESD Protection during transport and storage

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

If it is necessary to open and touch the circuit board inside the protective bag, then the following precautions must be taken:

- The working area must be covered by an approved conductive service mat that has a resistance of between 50 kW and 2 MW, and is connected directly to a reliable earth point via its earthling cord
- The service personnel involved must wear a wrist-band in direct contact with the skin, connected to the service mat.
- Printed circuit boards and other components should be placed on the conductive service mat during installation, maintenance etc.

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

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

Temperature protection

If the unit must be protected against extremes of temperature, the carton/crate must be lined on all walls, base and lid with 5 cm thick polyurethane or polystyrene foam.

These units will be identified as delicate in the applicable documentation.

The package must then be clearly marked:

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

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

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

15 HIPAP® COMMISSIONING CHECK AND VERIFICATION

Separate document; ***HiPAP® Commisioning check and verification*** doc. No. 331070.

This procedure shall be used to check and verify the HiPAP® system during or after commissioning/installation.

16 DRAWING FILE

This chapter holds illustrations referred to in this manual. The illustrations are based on the original system drawings and wiring diagrams.

- Unless otherwise noted, all measurements are in millimetres.
- The illustrations are not in scale.
- The original drawings are available in electronic format upon request.

Drawings

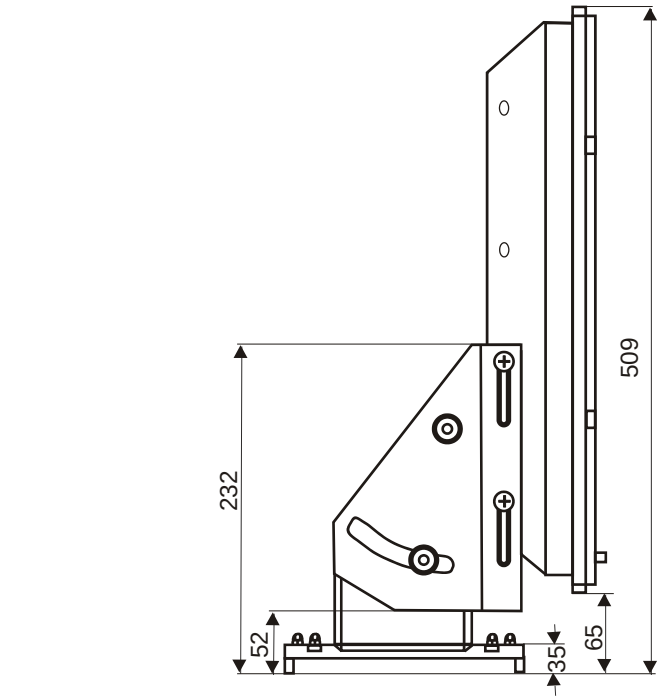
Part No.	Rev.	Description	Ref.
Outline dimensions/mounting			
365290	B	Computer	on page 161
N/A	N/A	Keyboard	on page 159
N/A	N/A	Display	on page 160
365290	B	Computer desktop	on page 161
371591	B	Computer rack	on page 162
308630	B	Transceiver unit Model x81 - with air to air heat exchanger unit mounted on the right side	on pages 161 and 164
308630	B	Transceiver unit Model x81 - with air to air heat exchanger unit mounted on the front door	on pages 165 and 166
304659	C	Transceiver unit Model x21	on pages 167 and 168
Cables (miscellaneous)			
W301	A	Standard AC power cable	on page 169
W311	C	EMC ground cable	on page 170
W126	C	External trigger cable	on page 170
Computer cables			
W127	B	RS-232 / RS-422 Serial line	on page 171
Transceiver unit Model x81 cables/wiring diagrams			
306009	A	Transducer cable for HiPAP® 501/451 Transceiver unit Model x81 end	on pages 173 and 174
306577	C	Transducer cable for HiPAP® 351/101 Transceiver unit Model x81 end	on pages 175 and 176
305393	B	Model x81 - Wiring diagram	on page 181
305230	A	Cable conversion kit drawing	on page 184
359740	A	Adapter Kit for Transceiver Unit x81	on page 185
Transceiver unit Model x21 cables/wiring diagrams			
306580	C	Transducer cable	on pages 177 and 178
303407	E	Model x21 - Wiring diagram	on pages 182 and 183
304969	E	Junction box conversion kit drawing	on pages 185 and 187
Hull unit transducer cable for all HiPAP® systems			
305992	B	Transducer hull unit cable, for all HiPAP® systems	on pages 179 and 180
Option cables			
Responder, all cables			from page 133
Laser, all cables			from page 143
Miscellaneous			
213346	B	1PPS converter - assembly drawing	on page 188

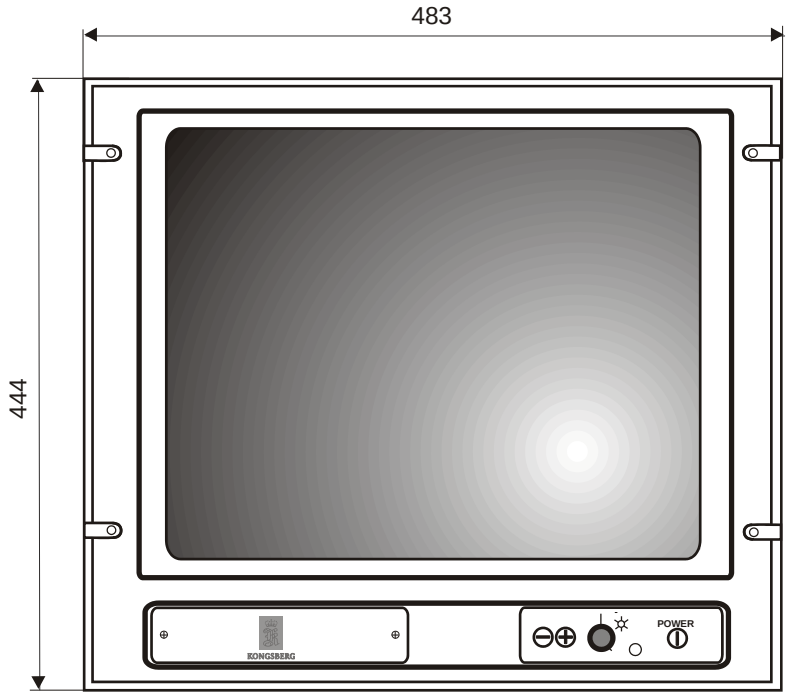
Keyboard - outline dimensions

(Cd31406)

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

19" display - outline dimensions

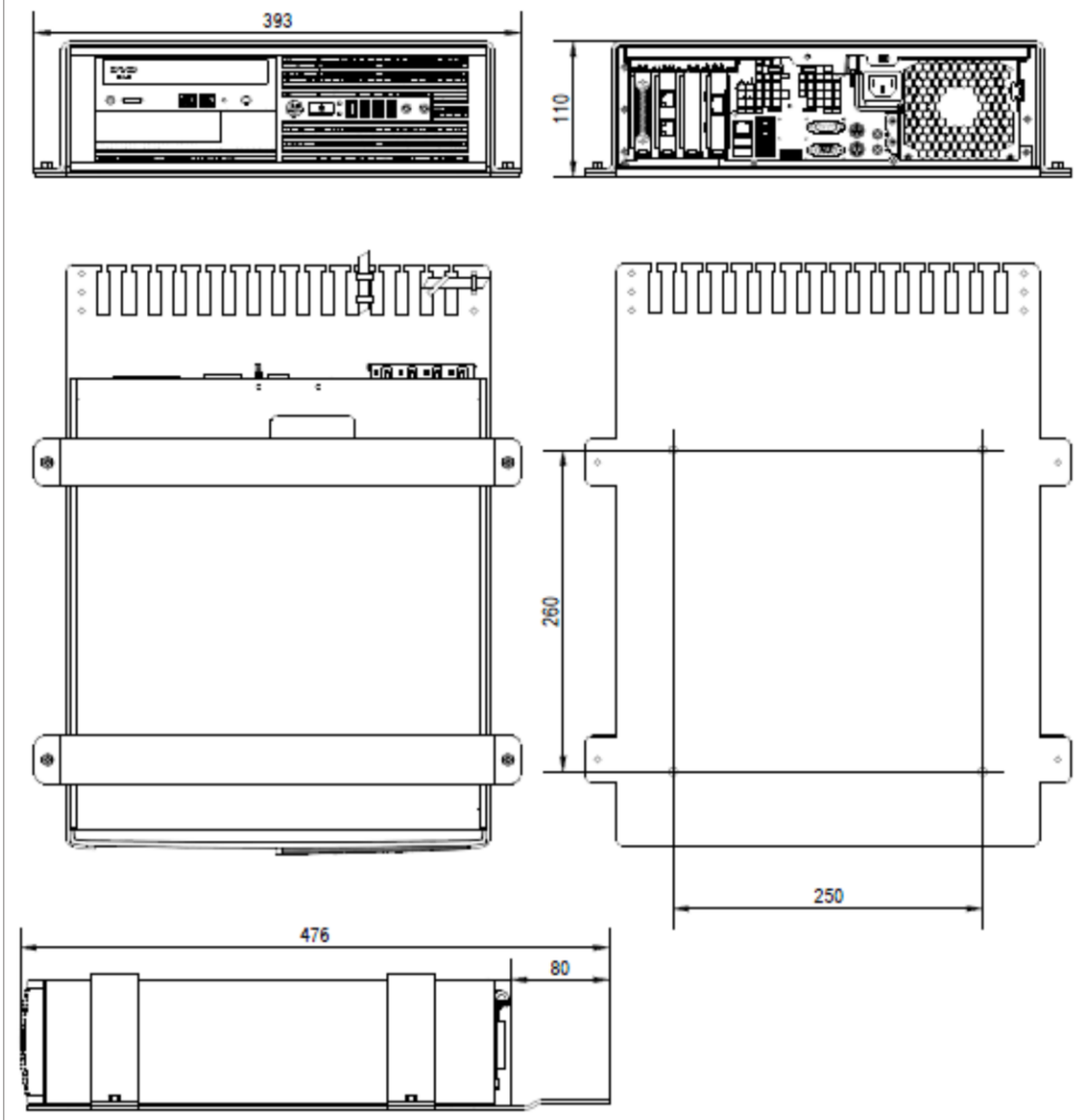




Note:
All measurements are in mm.
The drawing is not in scale.

Cd31022x Page 1 of 1

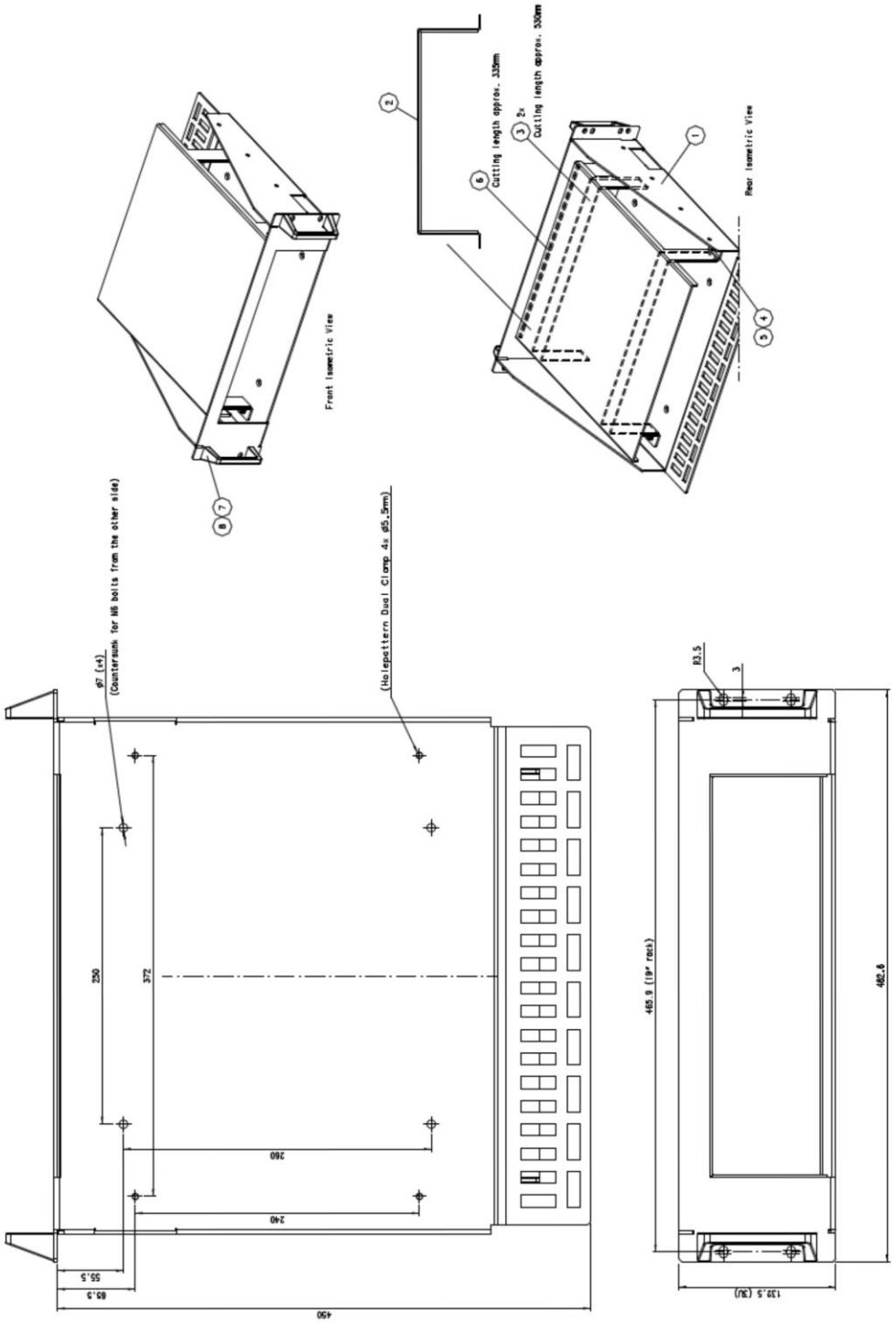
Computer - desktop mounting and outline dimensions



Note:
The drawing is not in scale.

Cd31249 Page 1
365290 Rev. B

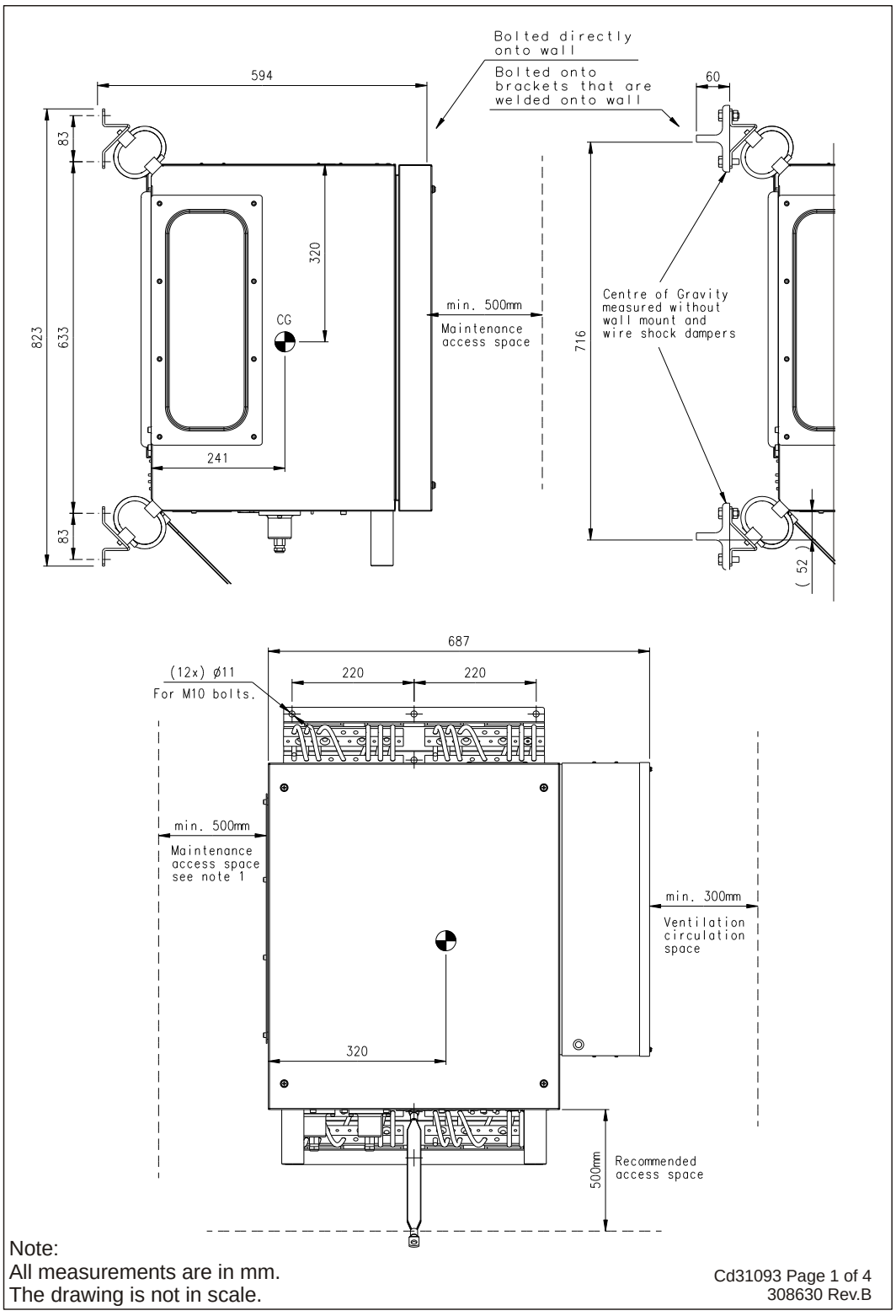
Computer – rack mounting and outline dimensions



Note:
The drawing is not in scale.

Cd31250 Page 1
371591 Rev. B

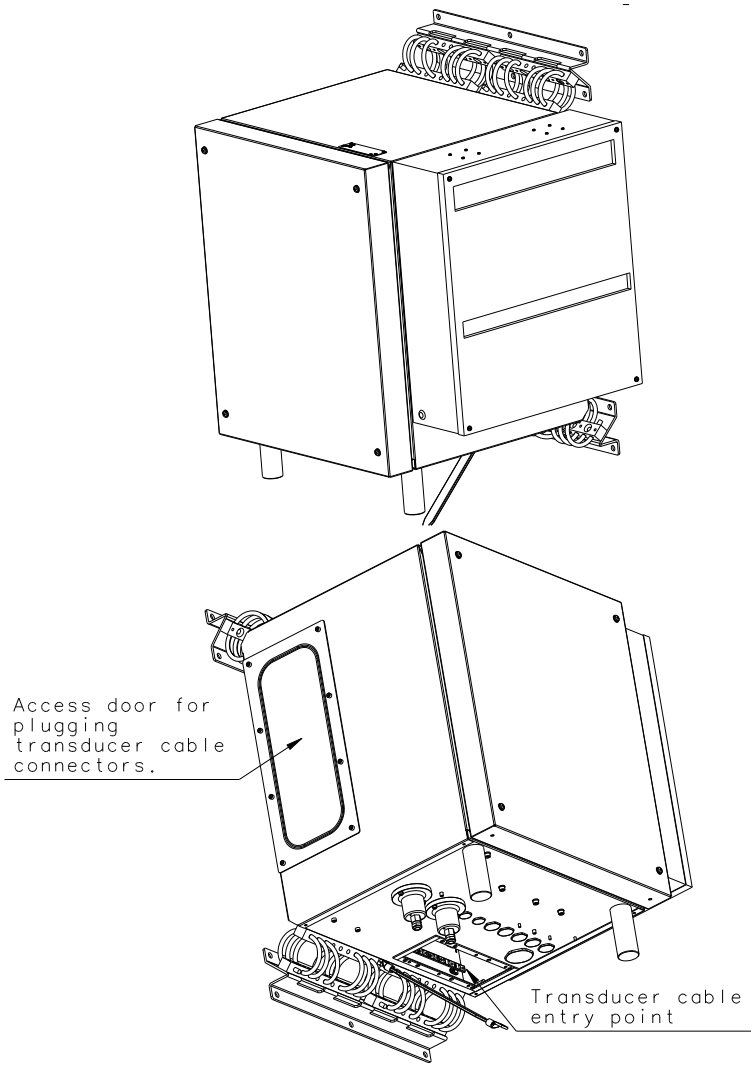
Transceiver unit Model x81, with cooling unit mounted on the right side - outline dimensions/mounting, page 1



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

Cd31093 Page 1 of 4
308630 Rev.B

Transceiver unit Model x81, with cooling unit mounted on the right side - outline dimensions/mounting, page 2



Dimensions are nominal.
The shock mounts are flexible,
and dimensions may vary slightly.

Pre-drilling of 12 mounting holes
or wleding of brackets
should be done according to this drawing.

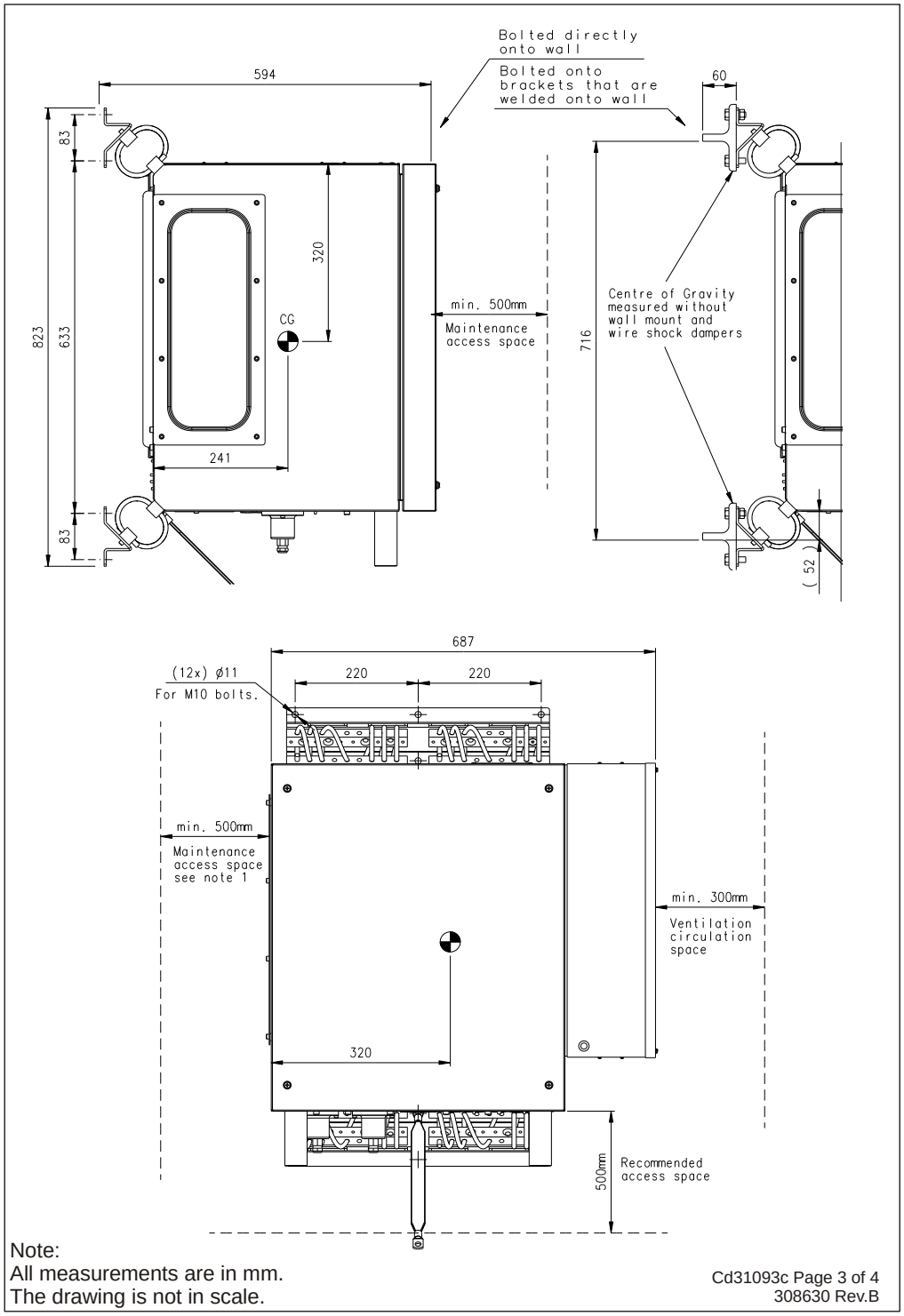
Note 1
Access from left hand side is recommended.
Access can, in exeptional cases,
be done from the front.
However, this is cumbersome and not recommended.

Weight: Approx 79Kg.

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

Cd31093a Page 2 of 4
308630 Rev.B

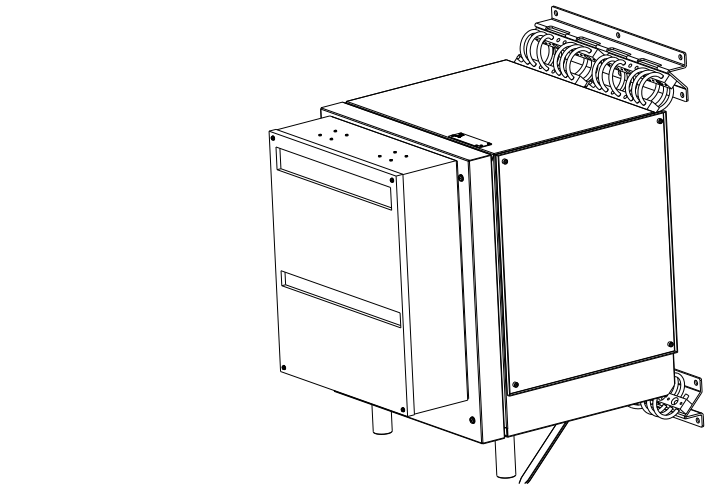
Transceiver unit Model x81, with cooling unit mounted on the front door (option) - outline dimensions/mounting, page 1

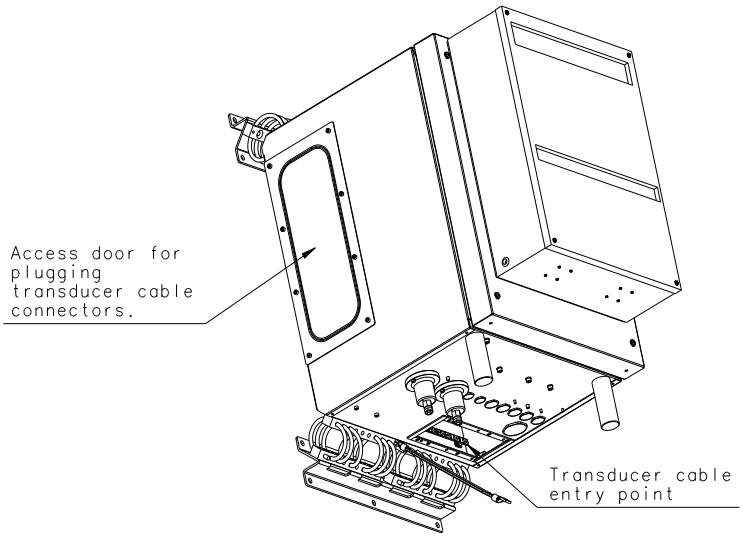


Note:
All measurements are in mm.
The drawing is not in scale.

Cd31093c Page 3 of 4
308630 Rev.B

Transceiver unit Model x81, with cooling unit mounted on the front door (option) - outline dimensions/mounting, page2





Dimensions are nominal.
The shock mounts are flexible,
and dimensions may vary slightly.

Pre-drilling of 12 mounting holes
or wleding of brackets
should be done according to this drawing.

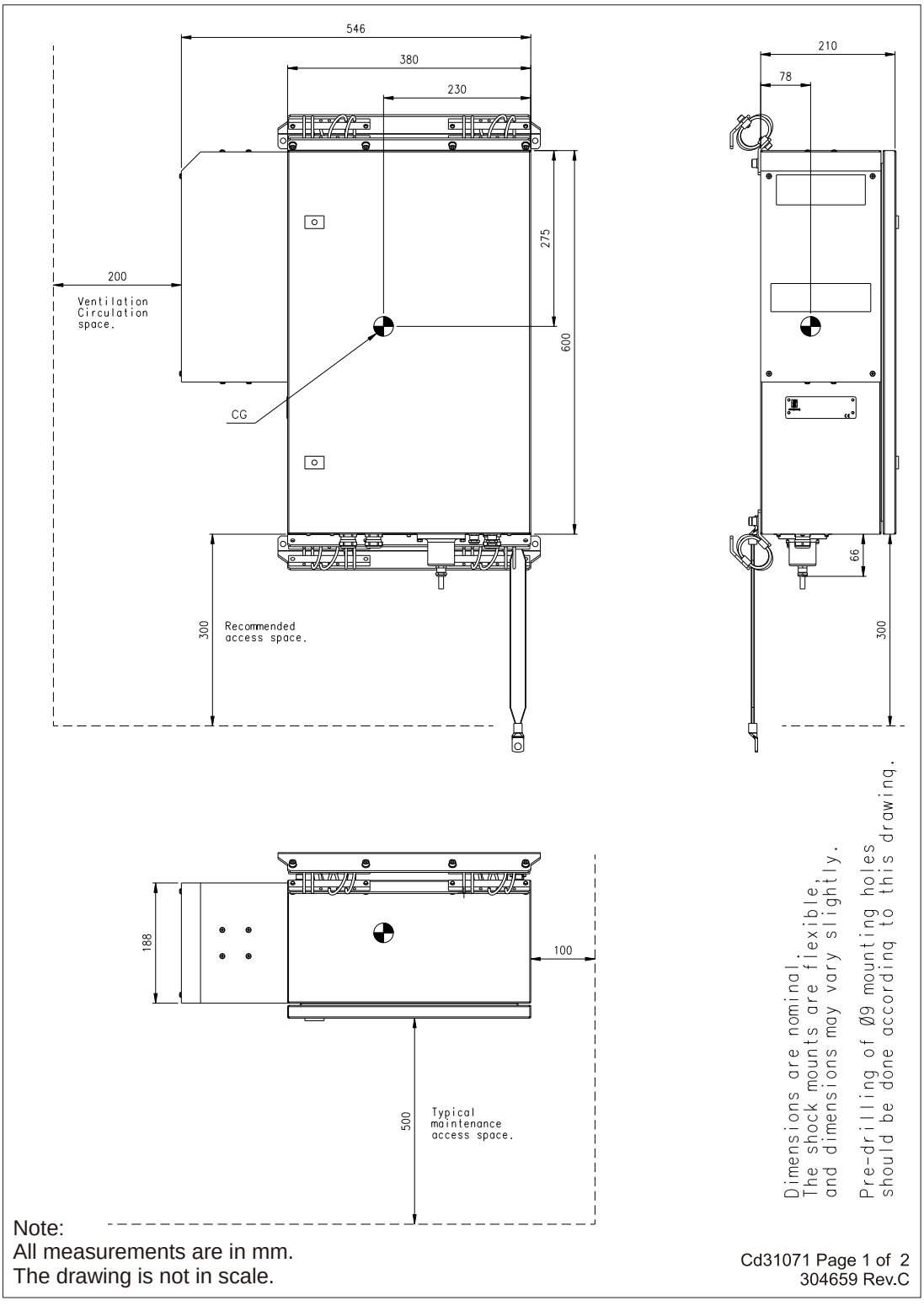
Note 1
Access from left hand side is recommended.
Access can, in exeptional cases,
be done from the front.
However, this is cumbersome and not recommended.

Weight: Approx 79Kg.

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

Cd31093d Page 4 of 4
308630 Rev.B

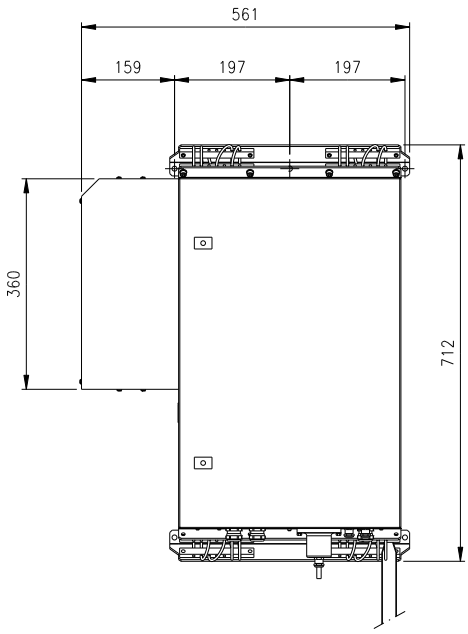
Transceiver unit Model x21 - outline dimensions/mounting, page 1

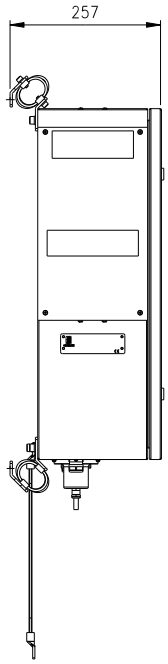


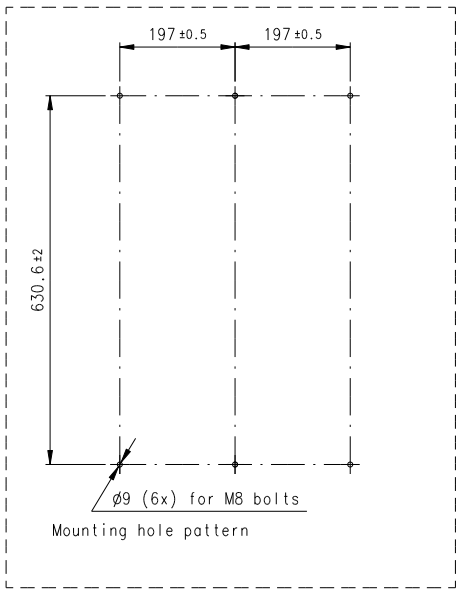
Note:
All measurements are in mm.
The drawing is not in scale.

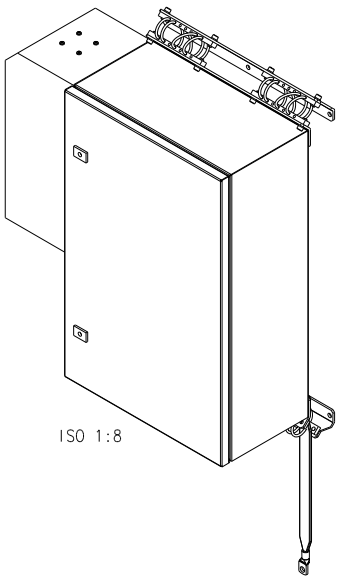
Cd31071 Page 1 of 2
304659 Rev.C

Transceiver unit Model x21 – outline dimensions/mounting, page 2









Dimensions are nominal.
The shock mounts are flexible,
and dimensions may vary slightly.

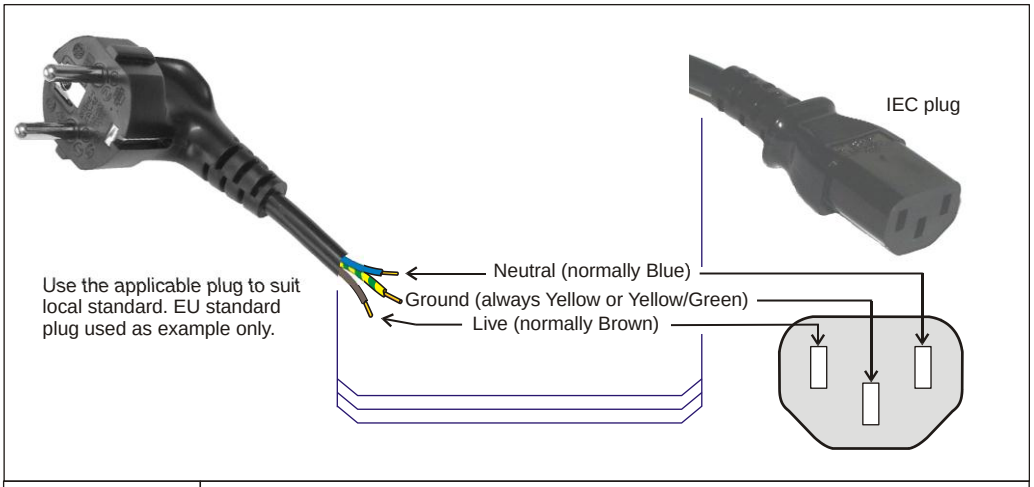
Pre-drilling of Ø9 mounting holes
should be done according to this drawing.

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

Cd31071 Page 2 of 2
304659 Rev.C

Standard AC power cable

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



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

Note

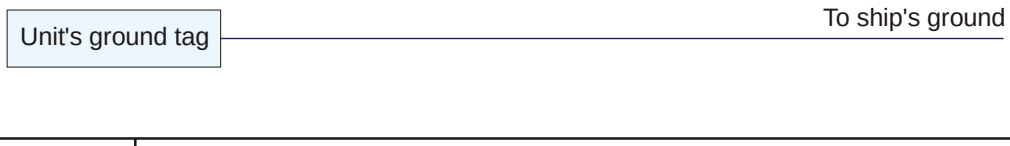
Different cable colours may be used for the "live" and "neutral" wires. Ground is however always on green/yellow.

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

EMC ground cable

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

Note that this cable must be as short as possible.

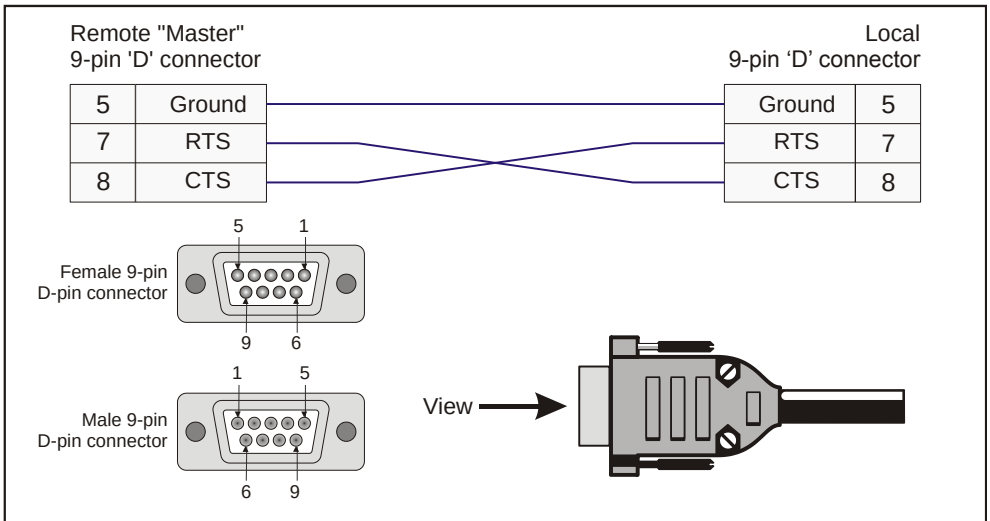


W311 Rev.C	Ship's ground

Minimum specifications

- Conductors. 1 x 6 mm^2
- Screen: None
- Voltage: 60V
- Max. diameter: N/A

External trigger cable



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

- Conductors: 6 x 0.5 mm^2
- Screen: Overall braided
- Voltage: 60V
- Max. diameter: Limited by the plugs

Computer RS-232 / RS-422 serial line cable

This cable comprises a multi-purpose serial line. It provides interface with any peripheral unit. One end of the serial line cable connects to the computer with a 9-pin ’D’ connector.

The serial line cable is a split cable, with eight cables, one for each of the com port connectors. The com port connectors are labelled.

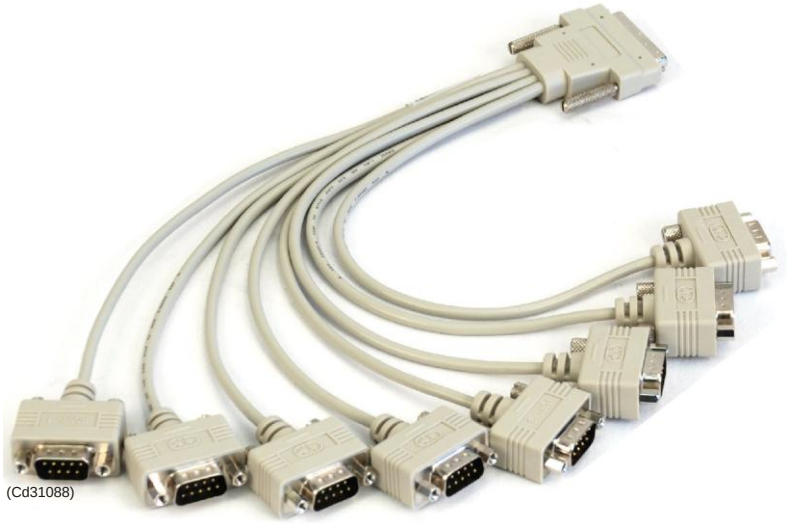
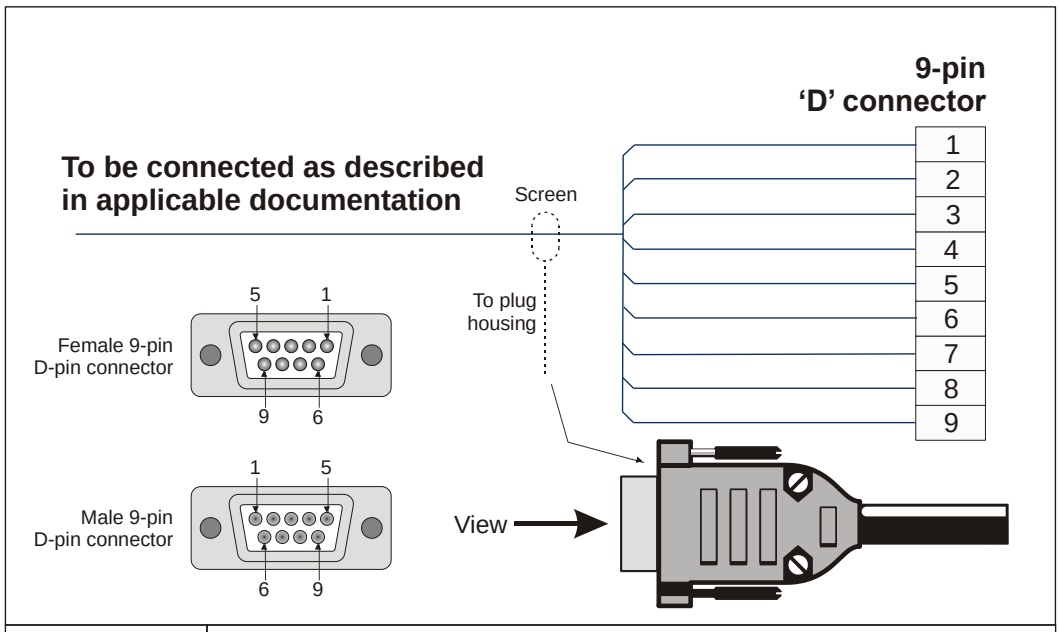


Figure 32 Serial lines cable

- PORT 1, PORT 2, PORT 3 and PORT 4 are RS-232
- PORT 5, PORT 6, PORT 7 and PORT 8 are RS-422

The other end (eight connectors) connects to the peripheral (DCE) as described in the peripheral unit’s documentation.



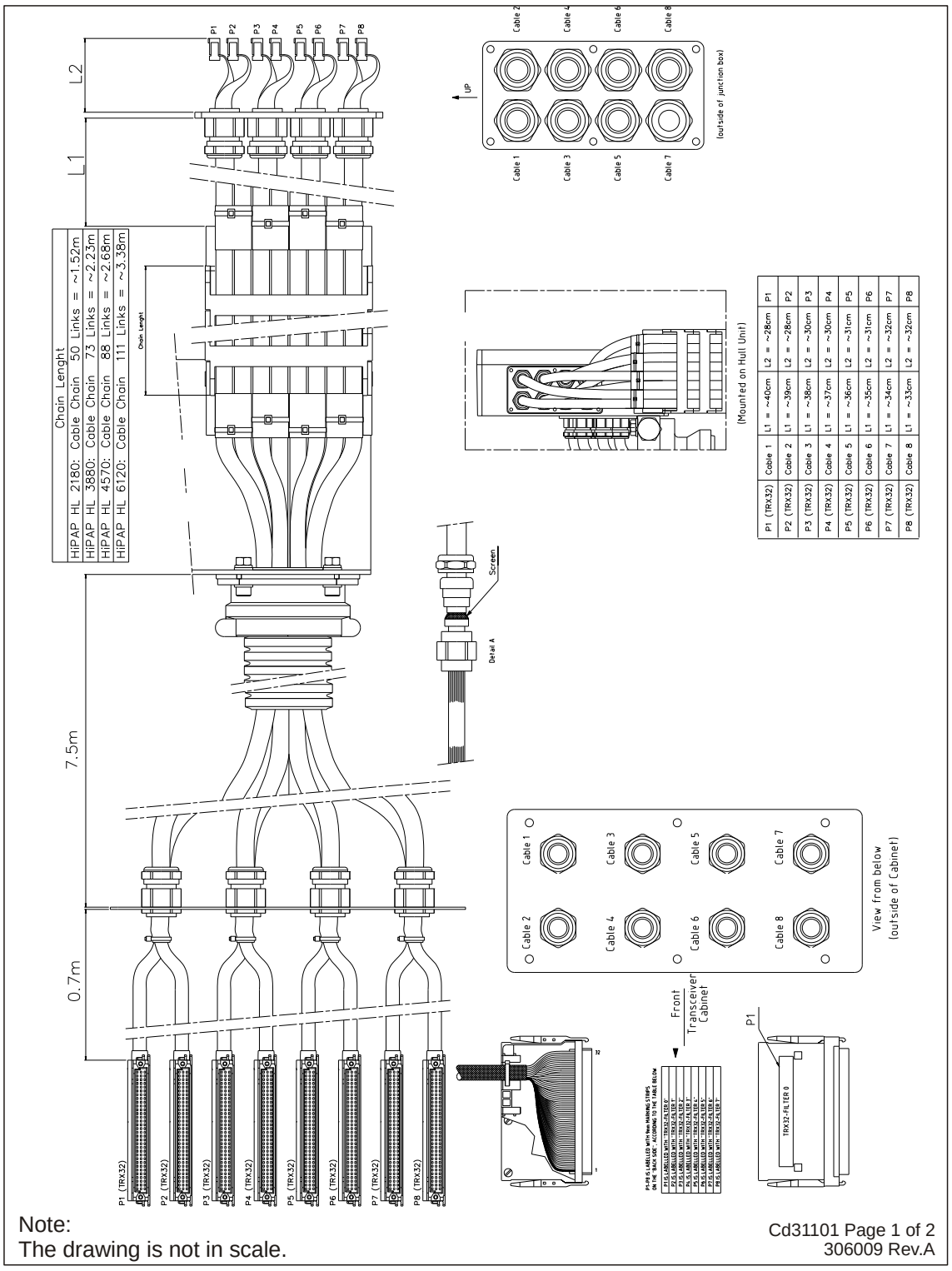
W127 Rev. B	Standard RS-232 or RS-422/-485 serial line

The pins are allocated as follows:

Pin no.	Signal RS-232	Signal RS-422	Pin no.	Signal RS-232	Signal RS-422
1	Carrier detect	Reception data +	2	Receive data	Transmission data +
3	Transmit data	Transmission data -	4	Data terminal ready	Reception data -
5	GND	GND	6	Data set ready	
7	Ready to send		8	Clear to send	
9	Ring indicator				

- Conductors: 6 x 2 x 0.5 mm^2
- Screen: Screened twisted pairs and overall braided
- Voltage: 60V
- Max. diameter: Set by plugs

Transducer cable for HiPAP® 501/451 system, page 1



P1 (TRX32)	Cable 1	L1 = ~40cm	L2 = ~28cm	P1
P2 (TRX32)	Cable 2	L1 = ~39cm	L2 = ~28cm	P2
P3 (TRX32)	Cable 3	L1 = ~38cm	L2 = ~30cm	P3
P4 (TRX32)	Cable 4	L1 = ~37cm	L2 = ~30cm	P4
P5 (TRX32)	Cable 5	L1 = ~36cm	L2 = ~31cm	P5
P6 (TRX32)	Cable 6	L1 = ~35cm	L2 = ~31cm	P6
P7 (TRX32)	Cable 7	L1 = ~34cm	L2 = ~32cm	P7
P8 (TRX32)	Cable 8	L1 = ~33cm	L2 = ~32cm	P8

Note:
The drawing is not in scale.

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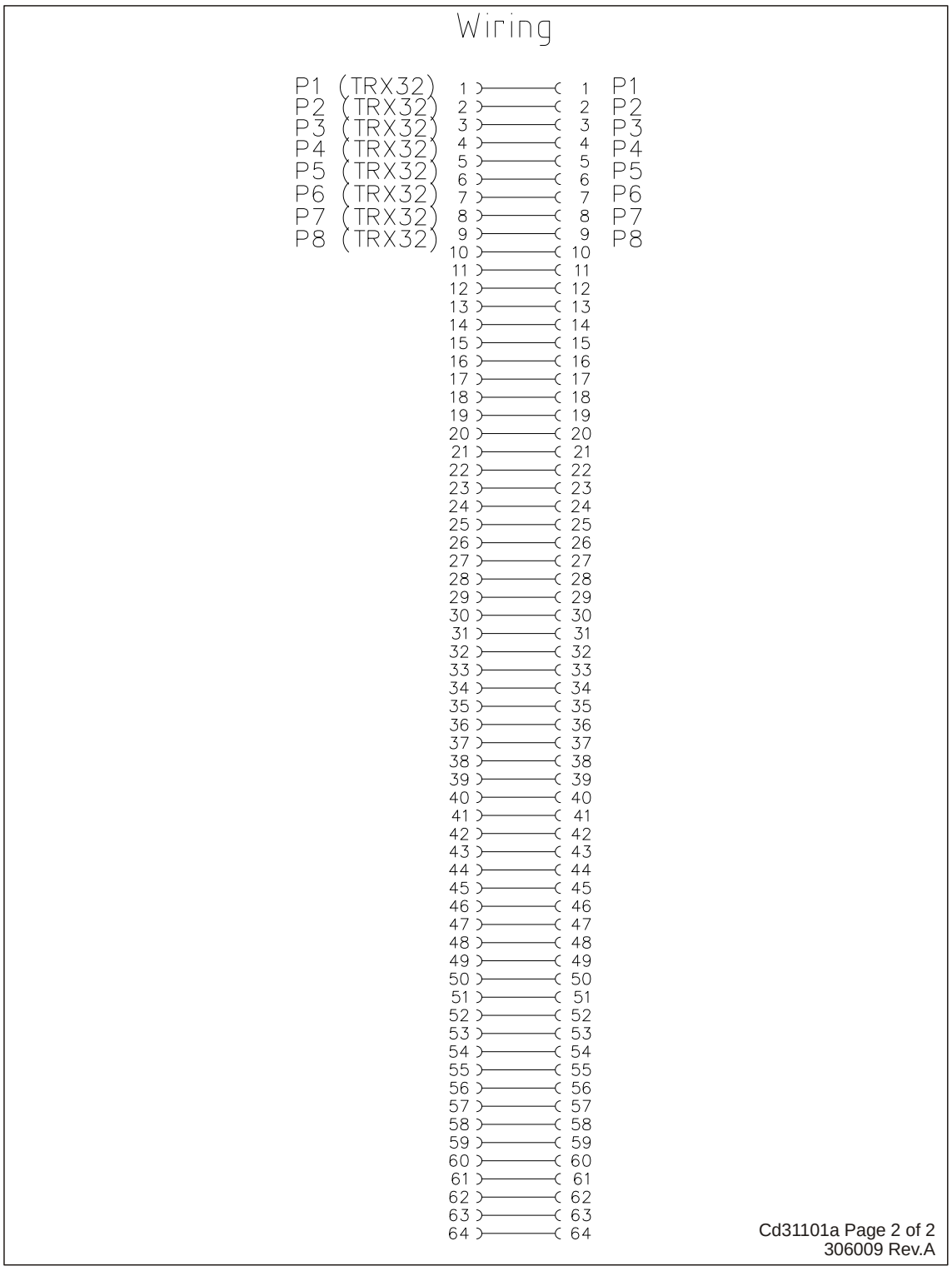
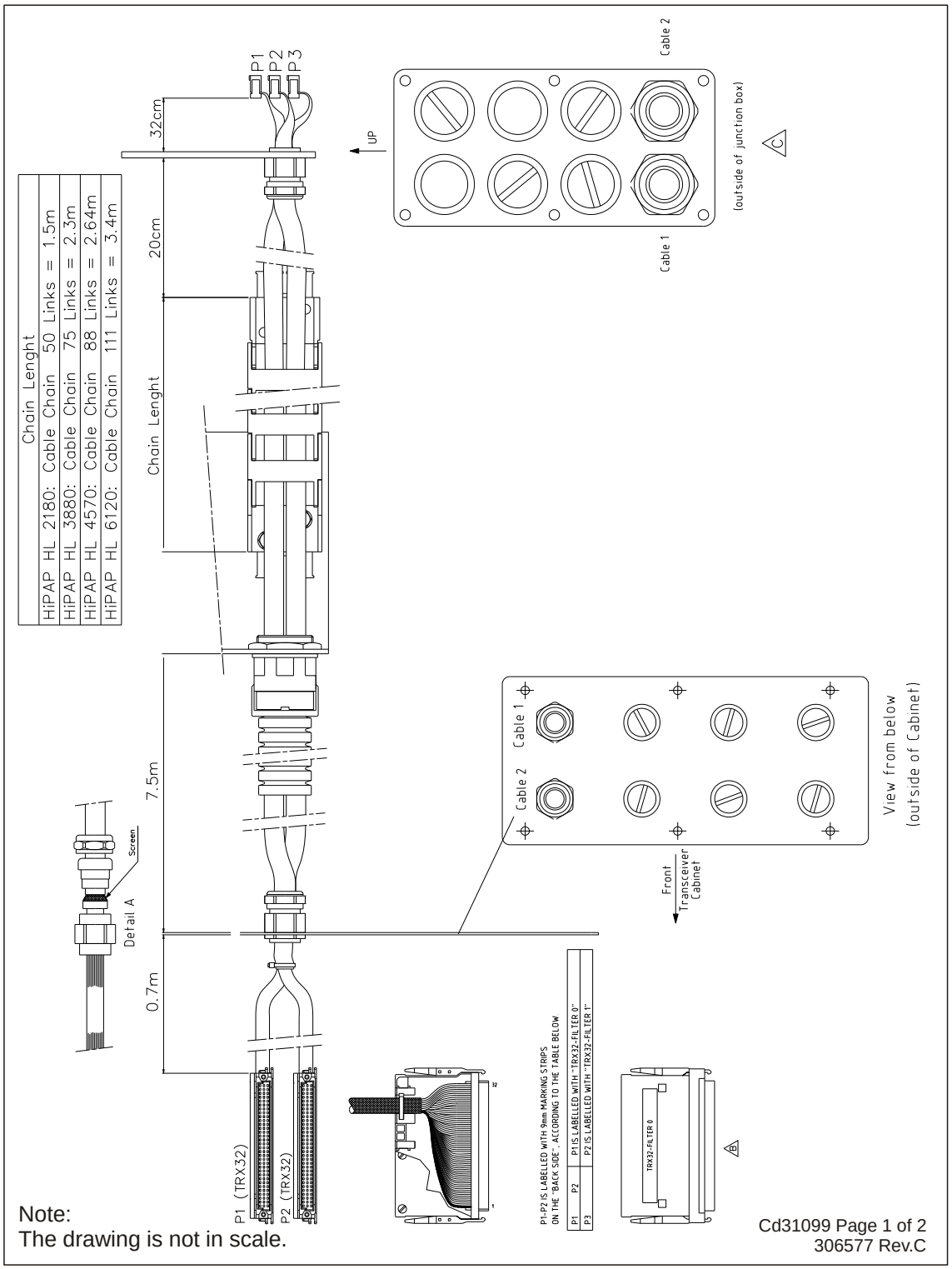
306009 Rev.A

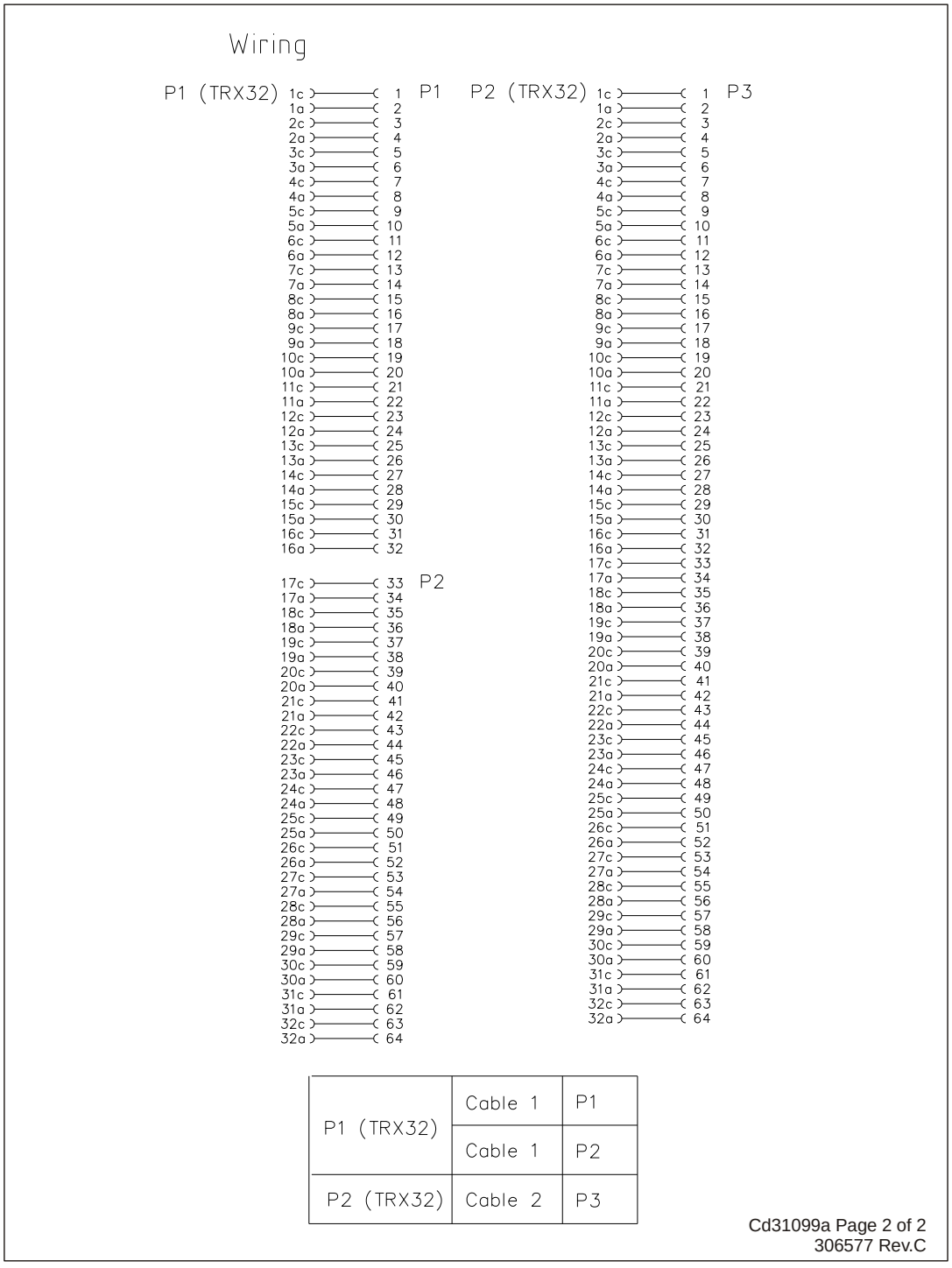
Transducer cable for HiPAP® 501/451 system , page 2



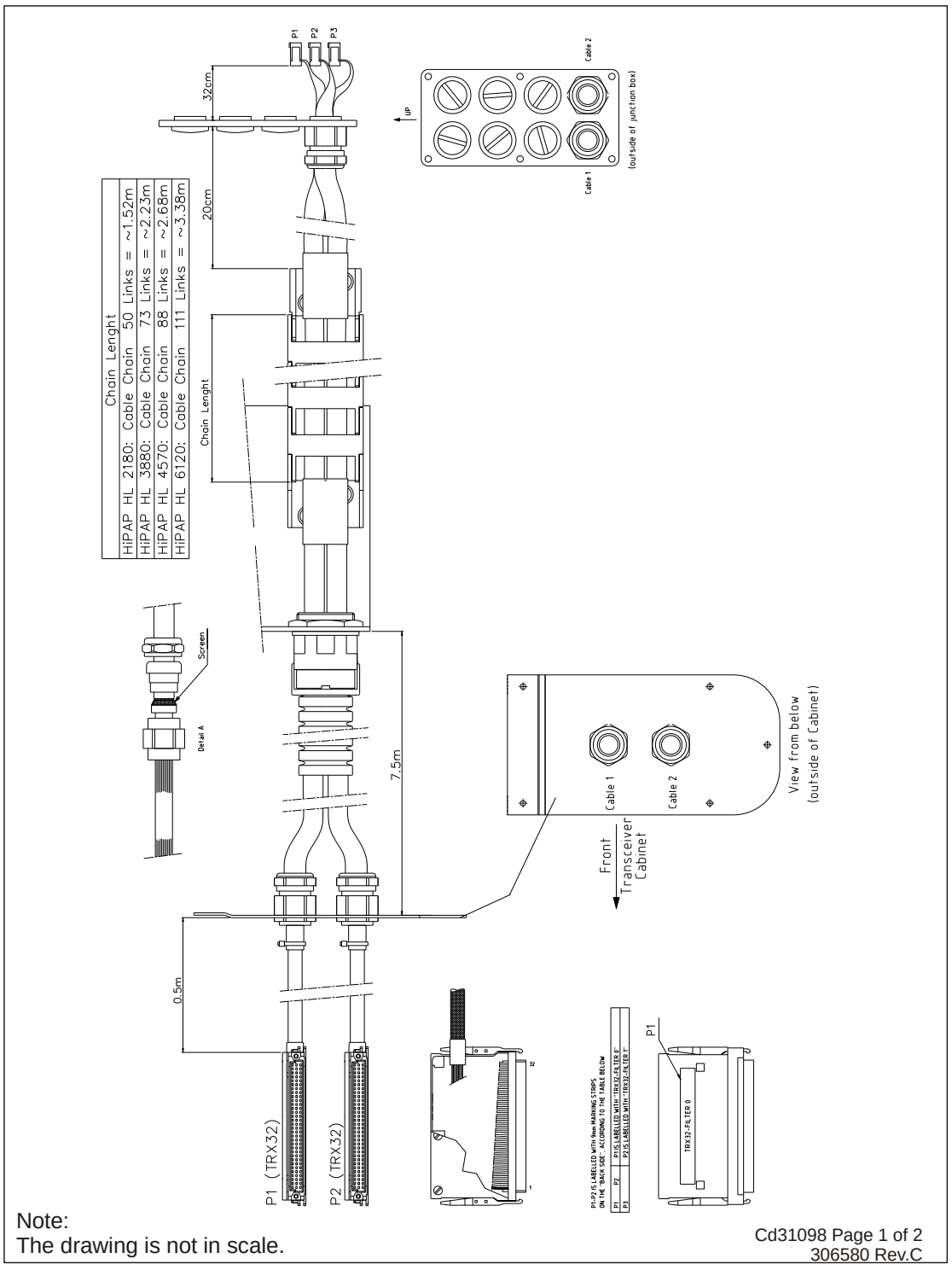
Transducer cable for HiPAP® 351/101 system, w/Transceiver unit Model x81, page 1



Transducer cable for HiPAP® 351/101 system, w/Transceiver unit Model x81, page 2



Transducer cable for Transceiver unit Model x21, page 1



Note:
The drawing is not in scale.

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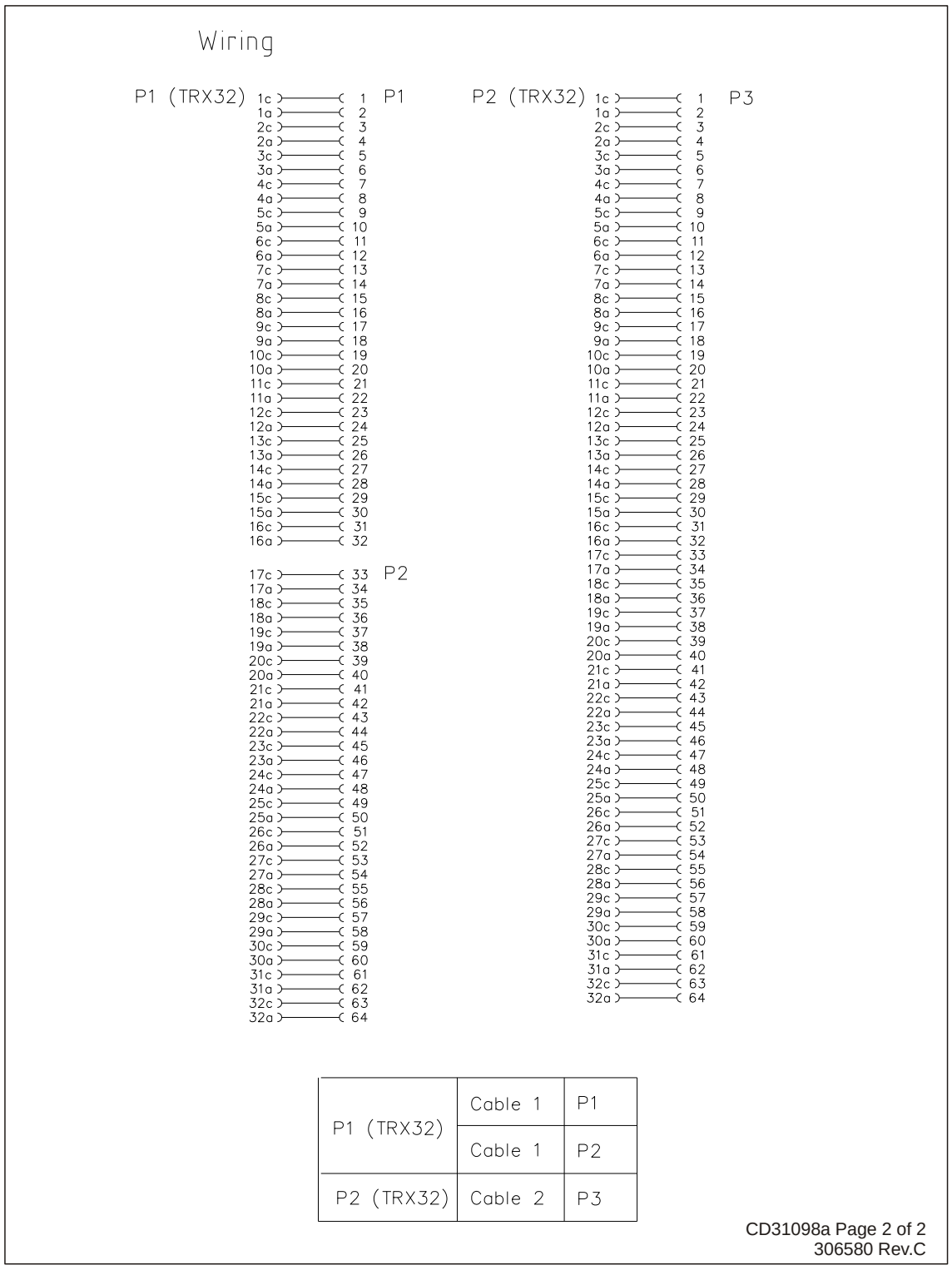
306580 Rev.C

Transducer cable for Transceiver unit Model x21, page 2



P1 (TRX32)	Cable 1	P1
	Cable 1	P2
P2 (TRX32)	Cable 2	P3

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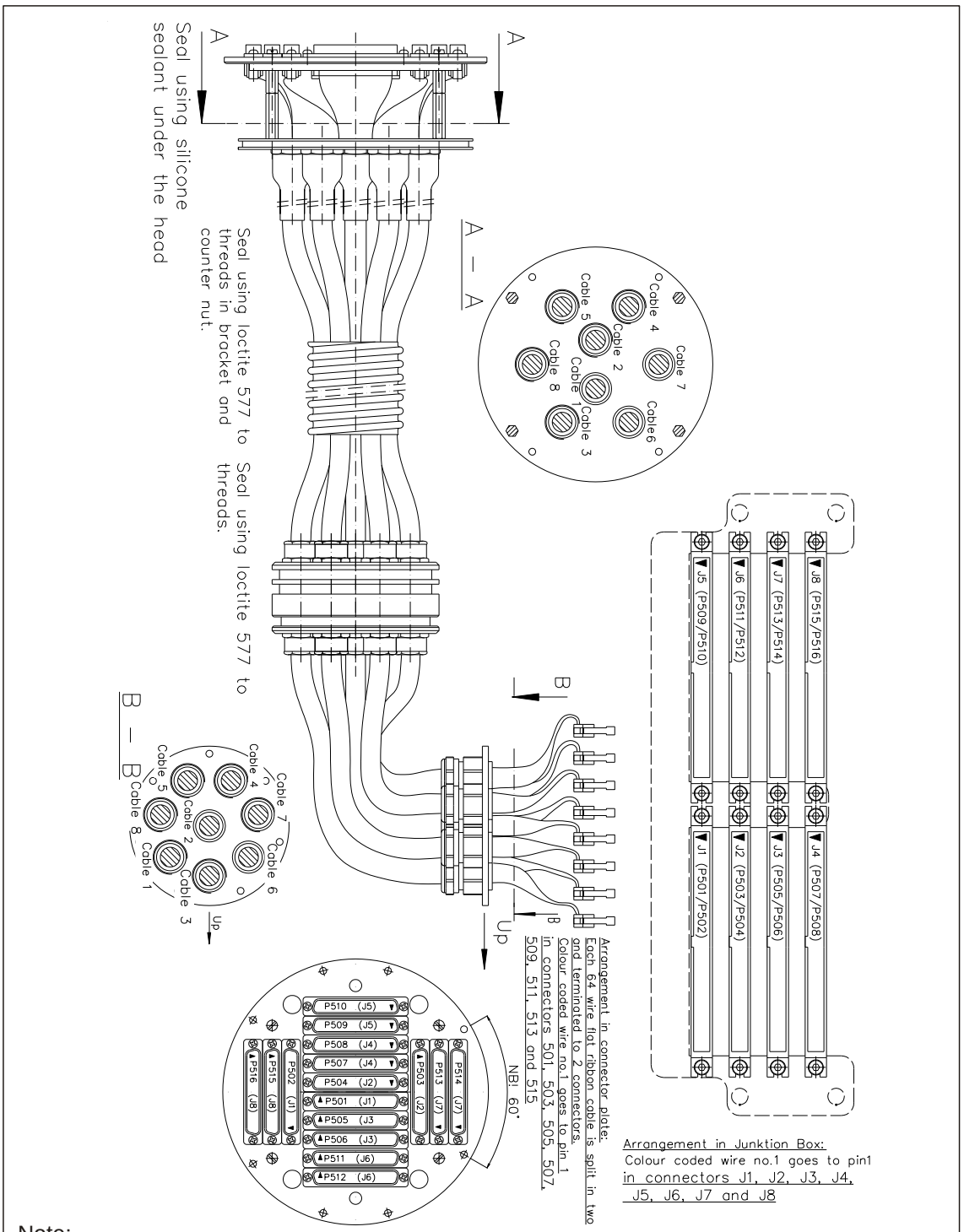
306580 Rev.C

Transducer hull unit cable, for all HiPAP® systems, page 1



Note:
The drawing is not in scale.

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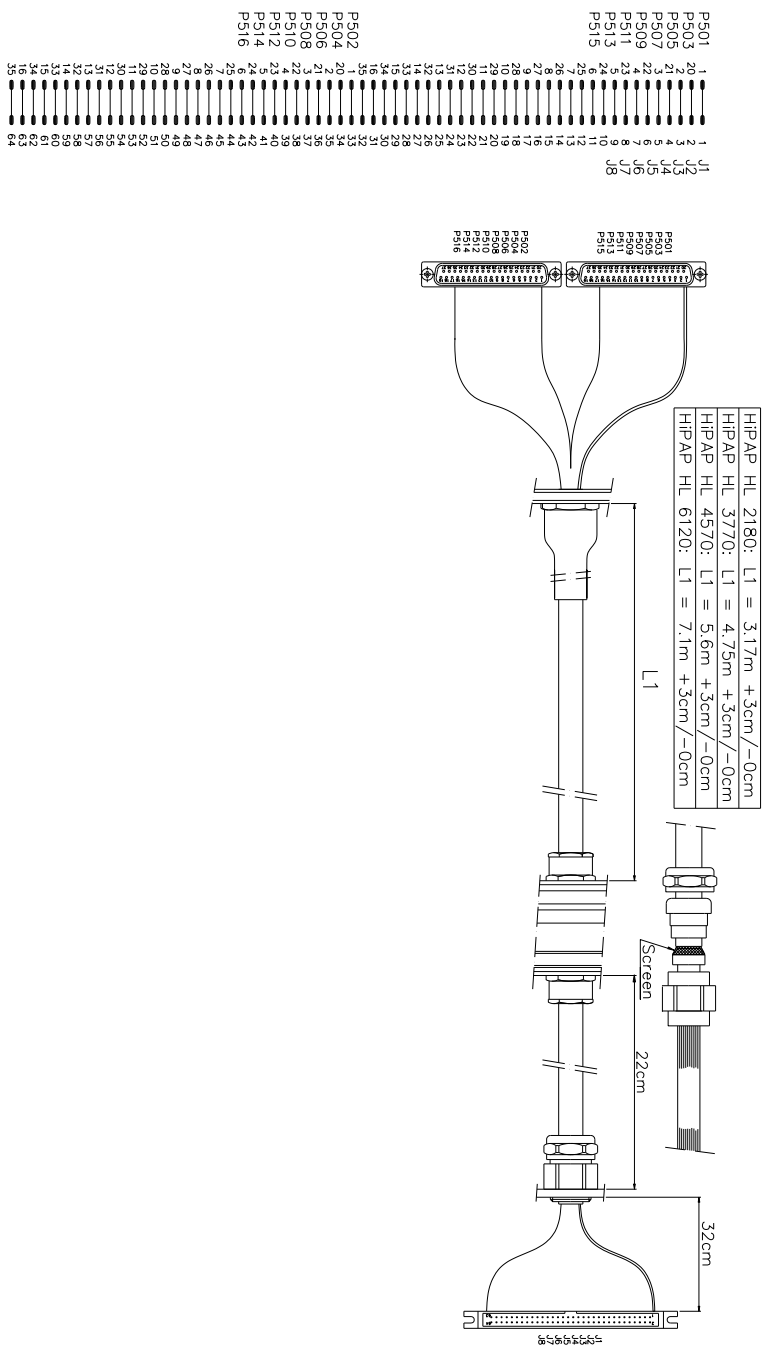
305992 Rev.B

Transducer hull unit cable, for all HiPAP® systems, page 2



Note:
The drawing is not in scale.

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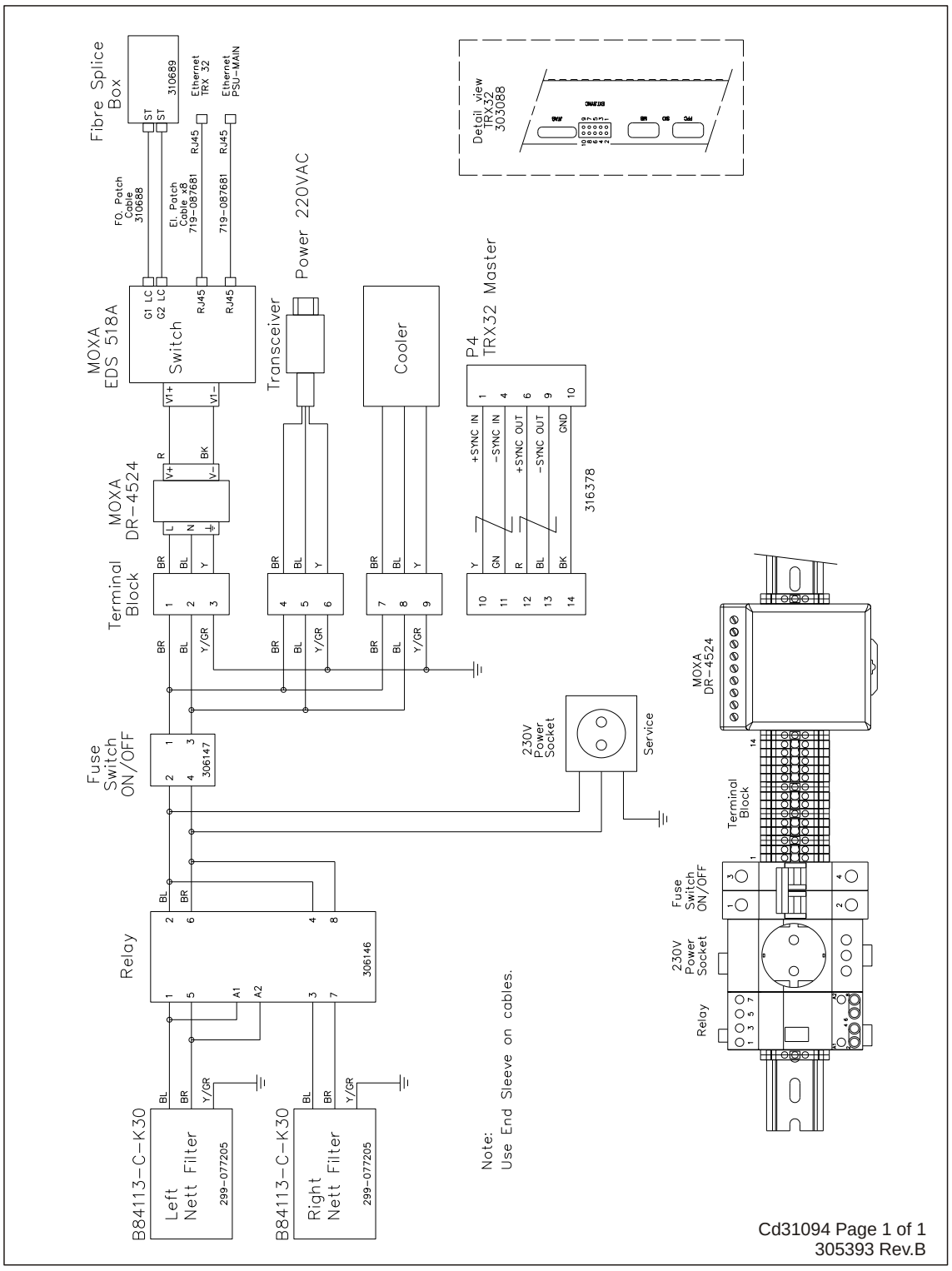
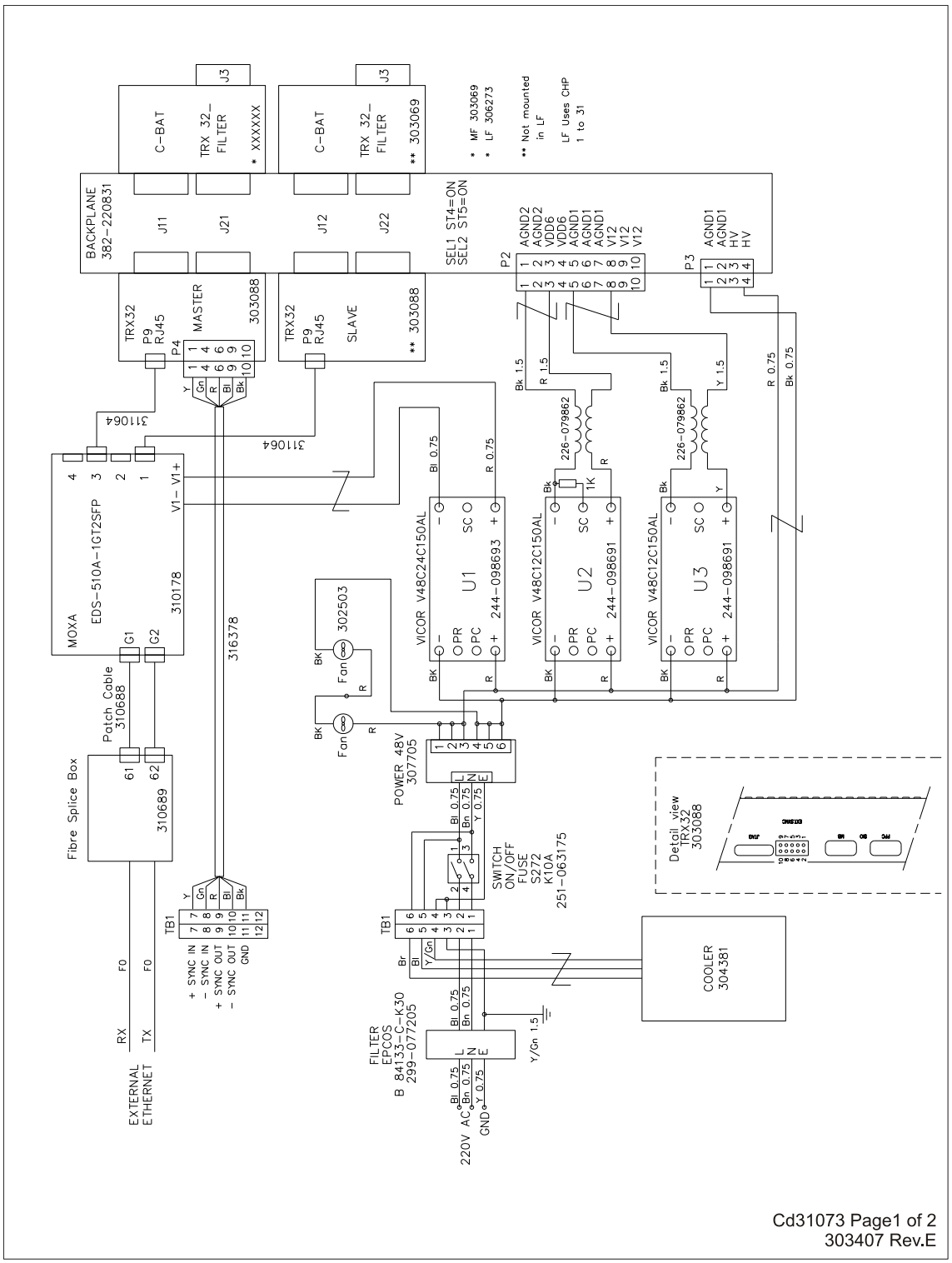
305992 Rev.C

Transceiver unit Model x81 - wiring diagram



Transceiver unit Model x21 - wiring diagram, page 1



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303407 Rev.E

Transceiver unit Model x21 - wiring diagram, page 2

J3 MASTER

Pin	Row A	Row B	Row C
1	CHP(1)	N.C.	CHN(1)
2	CHP(2)	N.C.	CHN(2)
3	CHP(3)	N.C.	CHN(3)
4	CHP(4)	N.C.	CHN(4)
5	CHP(5)	N.C.	CHN(5)
6	CHP(6)	N.C.	CHN(6)
7	CHP(7)	N.C.	CHN(7)
8	CHP(8)	N.C.	CHN(8)
9	CHP(9)	N.C.	CHN(9)
10	CHP(10)	N.C.	CHN(10)
11	CHP(11)	N.C.	CHN(11)
12	CHP(12)	N.C.	CHN(12)
13	CHP(13)	N.C.	CHN(13)
14	CHP(14)	N.C.	CHN(14)
15	CHP(15)	N.C.	CHN(15)
16	CHP(16)	N.C.	CHN(16)
17	CHP(17)	N.C.	CHN(17)
18	CHP(18)	N.C.	CHN(18)
19	CHP(19)	N.C.	CHN(19)
20	CHP(20)	N.C.	CHN(20)
21	CHP(21)	N.C.	CHN(21)
22	CHP(22)	N.C.	CHN(22)
23	CHP(23)	N.C.	CHN(23)
24	CHP(24)	N.C.	CHN(24)
25	CHP(25)	N.C.	CHN(25)
26	CHP(26)	N.C.	CHN(26)
27	CHP(27)	N.C.	CHN(27)
28	CHP(28)	N.C.	CHN(28)
29	CHP(29)	N.C.	CHN(29)
30	CHP(30)	N.C.	CHN(30)
31	CHP(31)	N.C.	CHN(31)
32	CHP(32)	N.C.	CHN(32)

J3 SLAVE

Pin	Row A	Row B	Row C
1	CHP(33)	N.C.	CHN(33)
2	CHP(34)	N.C.	CHN(34)
3	CHP(35)	N.C.	CHN(35)
4	CHP(36)	N.C.	CHN(36)
5	CHP(37)	N.C.	CHN(37)
6	CHP(38)	N.C.	CHN(38)
7	CHP(39)	N.C.	CHN(39)
8	CHP(40)	N.C.	CHN(40)
9	CHP(41)	N.C.	CHN(41)
10	CHP(42)	N.C.	CHN(42)
11	CHP(43)	N.C.	CHN(43)
12	CHP(44)	N.C.	CHN(44)
13	CHP(45)	N.C.	CHN(45)
14	CHP(46)	N.C.	CHN(46)
15		N.C.	
16		N.C.	
17		N.C.	
18		N.C.	
19		N.C.	
20		N.C.	
21		N.C.	
22		N.C.	
23		N.C.	
24		N.C.	
25		N.C.	
26		N.C.	
27		N.C.	
28		N.C.	
29		N.C.	
30		N.C.	
31		N.C.	
32		N.C.	

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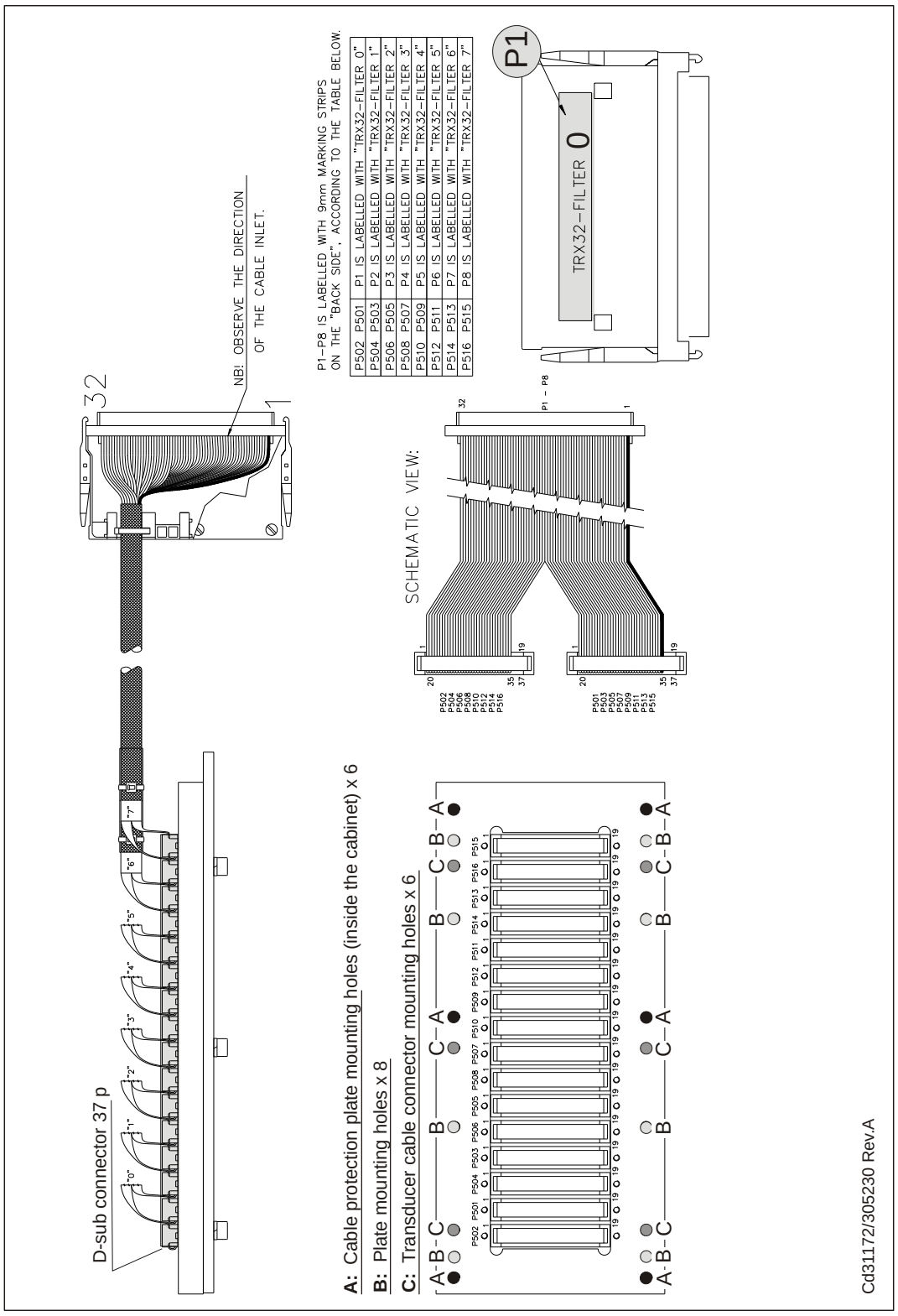
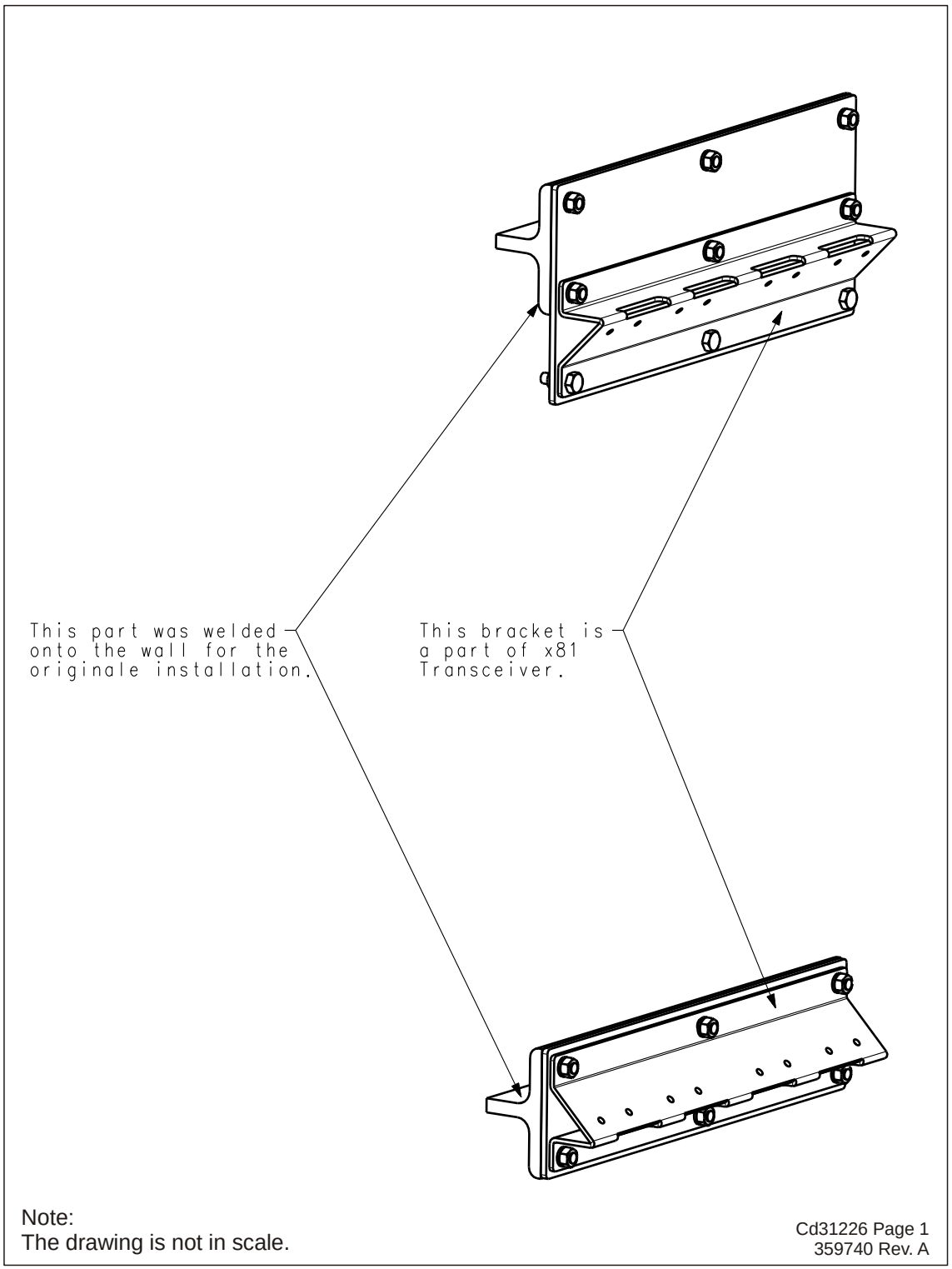
Cable conversion kit for Transceiver unit Model x81 - drawing



Adapter Kit for Transceiver x81 Unit



Note:
The drawing is not in scale.

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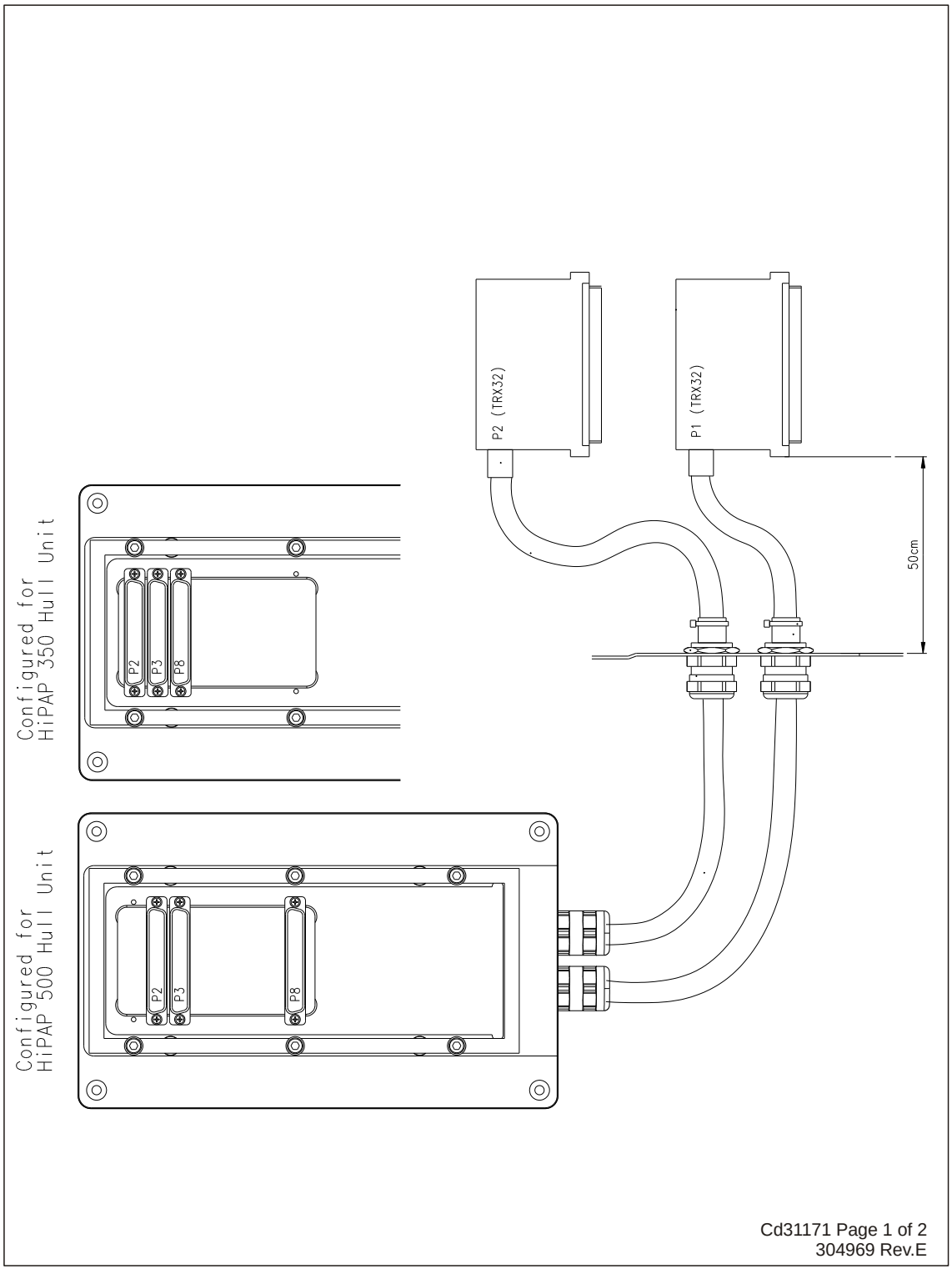
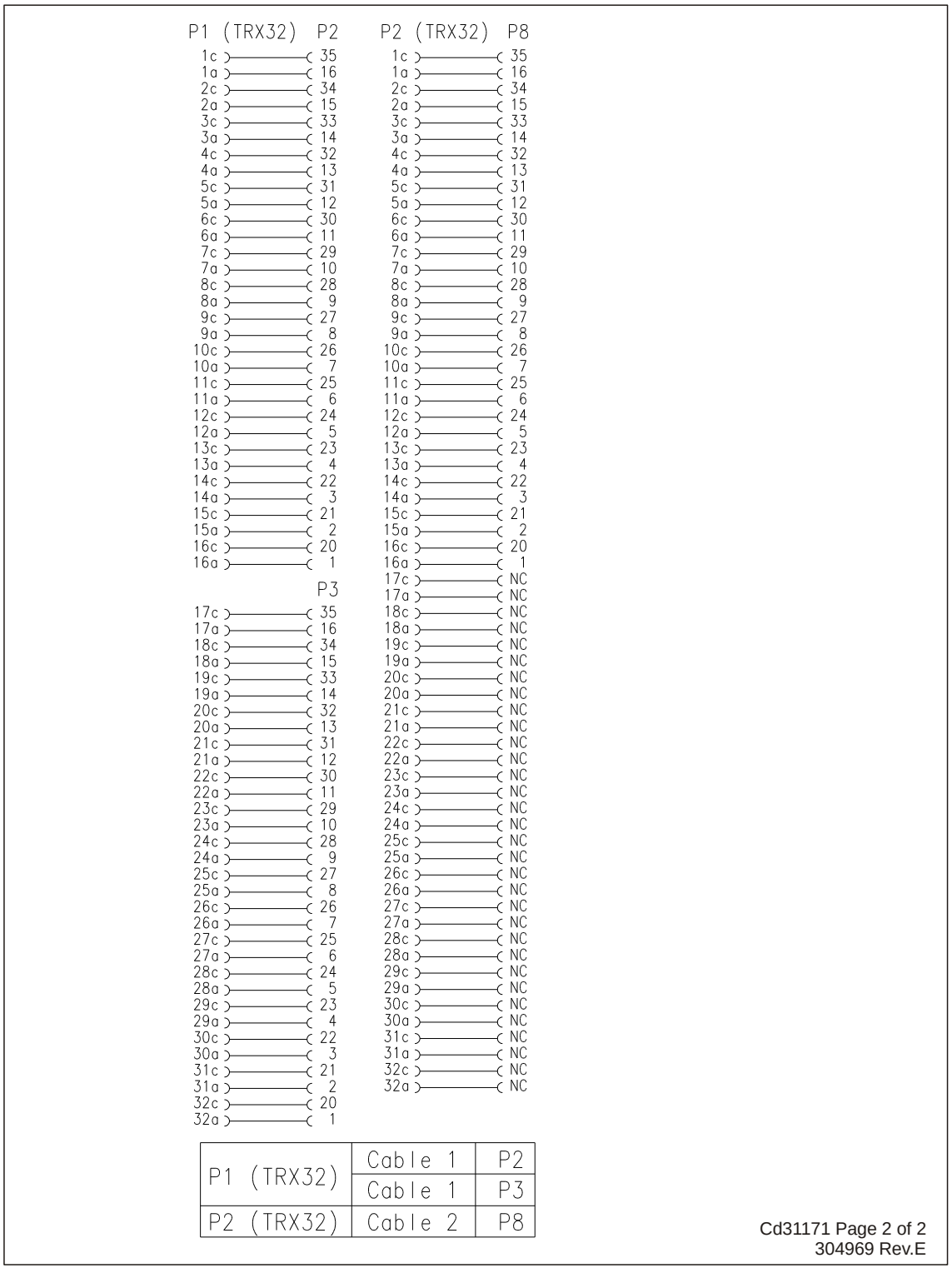
Junction box conversion kit for Transceiver unit Model x21 – drawing, page 1



Junction box conversion kit for Transceiver unit Model x21 – drawing, page 2



P1 (TRX32)	Cable 1	P2
	Cable 1	P3
P2 (TRX32)	Cable 2	P8

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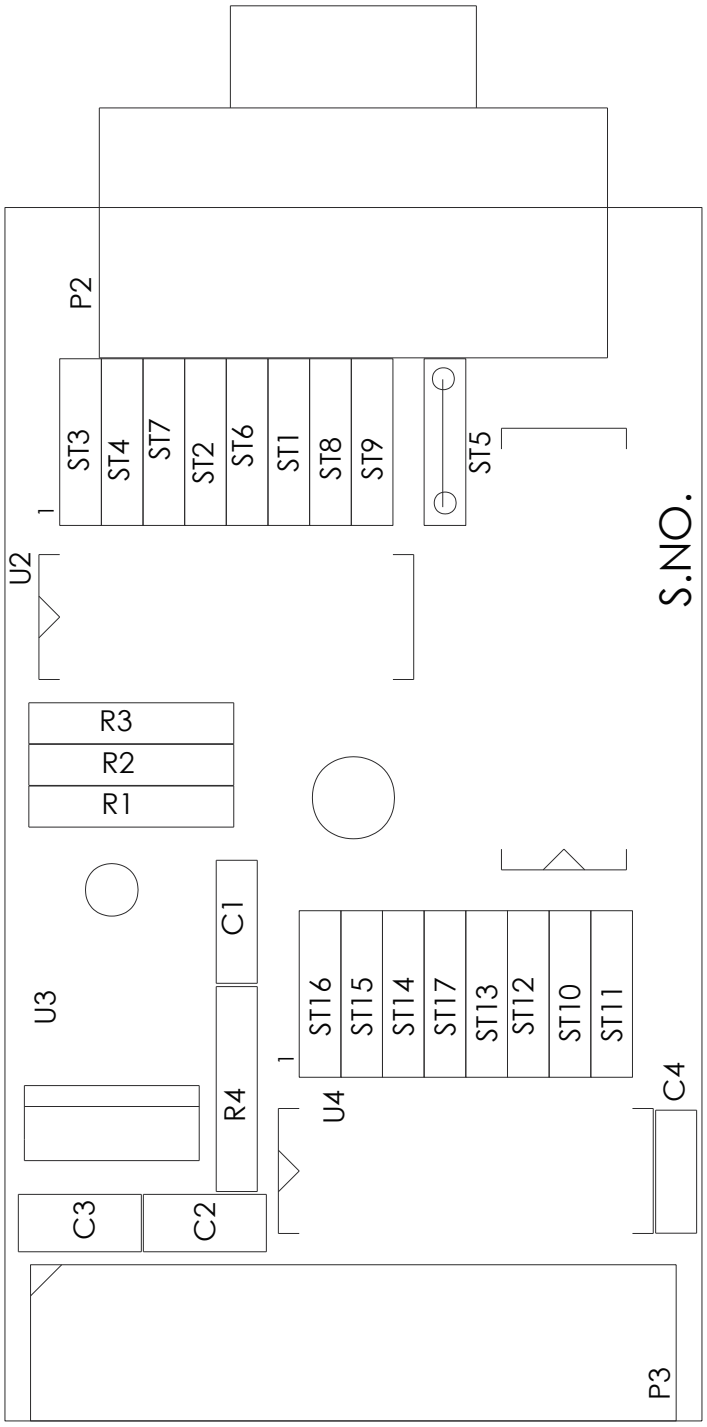
1PPS converter – component layout drawing



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

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17 CABLE PLAN AND INTERCONNECTIONS

Separate document; ***Cable plan and interconnections***
doc. No 325840.

18 INDEX

The next pages present the index of this manual.

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