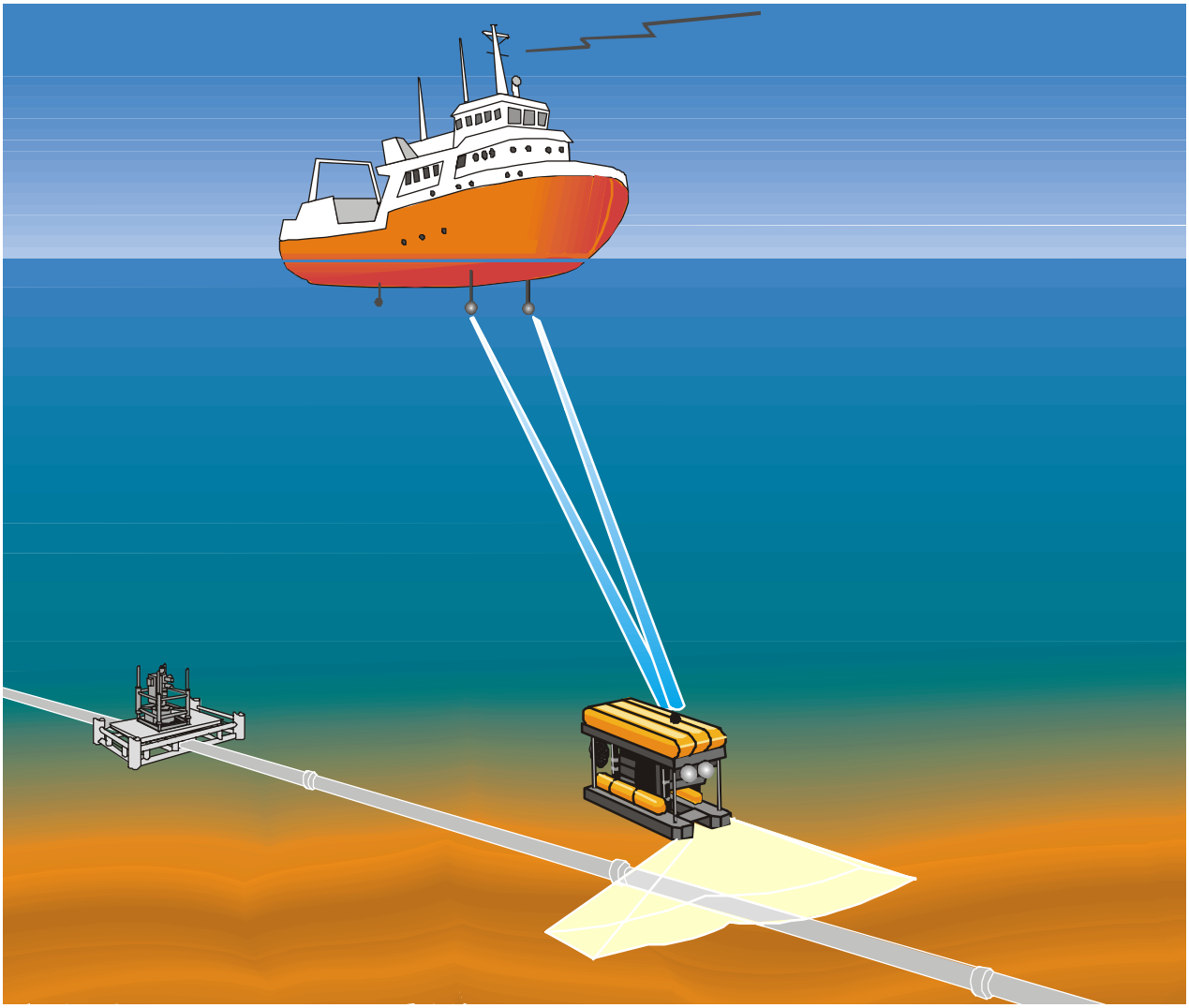
Instruction manual

KONGSBERG

HiPAP

High Precision Acoustic Positioning



HiPAP

High Precision Acoustic Positioning

Instruction manual

857-164055 / AA000

Note

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

Warning

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

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

Copyright

KONGSBERG

Kongsberg Simrad AS, P.O.Box 111, N-3191 Horten, Norway
Telephone: +47 33 03 44 00, Telefax: +47 33 04 76 19
www.kongsberg-simrad.com / E-mail: ui@kongsberg-simrad.com

Sections

This book is the Instruction manual for the Kongsberg Simrad HiPAP system. It describes how to install and to maintain the various units used by the HiPAP system.

The installation and maintenance of the hull units are described in a separate manual.

Additional manuals

Display manual

Separat manual supplied with the display. This is a Kongsberg Simrad document.

Remarks

References

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

- APOS Instruction manual
- HiPAP hull units Instruction manual

The reader

The maintenance information 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 Simrad's maintenance philosophy: The onboard technical personnel shall, with the help of the documentation and the system's built-in test functions, be able to identify malfunctions, locate the fault, and replace major parts, modules and components on the "Line Replaceable Unit" (LRU) level. He/she will however not attempt to repair the LRUs.

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

Note

Distributed copies of this manual will not be updated.

Contents

Document logistics

Rev	Date	Written by	Checked by	Approved by
A	20.06.99	GM	LOS	JEF
B	04.08.99	GM	LOS	JEF
C	12.12.99	GM	LOS	JEF
D	03.01.00	GM	LOS	JEF
E	04.04.00	GM	LOS	JEF
F	07.08.00	GM	LOS	JEF
G	17.01.01	GM	LOS	JEF
H	17.01.02	GM	THG	JEF
I	20.09.02	GM	LOS	JEF
J	10.12.02	GM	LOS	JEF

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

Rev	Comments
A	Original issue.
B	Corrections to figure 50 - Dual HiPAP Master Slave synchronization
C	Added HTC-10 information. Minor corrections in the text.
D	Removed information about the CF 1500 colour displays. Implemented general info about the LCD displays in the text and illustrations.
E	Implemented the APOS LBL Customer Acceptance test, the Single/Dual net and the 1PPS converter (option). Connection for external equipment is changed. Various drawings are updated. Minor corrections in the text. Ref. EM 857-164055E.
F	Implemented the HiPAP 350 system. Removed the RPC board and implemented the RTB as a replacement. Change product name from HiPAP to HiPAP 500 and HiPAP 350. Updated various figures and diagrams. Added section for previous hardware. Minor correction in the text. Ref. EM 857-164055F.
G	Updated the APOS LBL CAT to implement MULBL. Updated the transceiver unit installation procedure and the APC 10 Connector pin allocations description. Updated various figures and diagrams. Removed the Motherboard SE440BX-2 Setup program. Minor correction in the text. New layout. Ref. EM 857-164055G.

H	Supply condition changed. APC 10 updated with new PCBs and connections. Implemented new section - Drawing file. Corrections in the text, figures and spare parts. Updated APC 10 and keyboard wiring diagram. New layout. Ref. EM 857-164055H.
I	Updated Drawing file - APC 10 and keyboard wiring diagram. Implemented Dual system illustration. Updated the CAT procedure. Minor corrections in the text. . Ref. EM 857-164055I.
J	Updated Drawing file - APC 10 desktop mounting and transceiver unit interconnection diagram. Minor corrections in the text. Ref. EM 857-164055J.

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

Kongsberg Simrad AS
Documentation Department
P.O.Box 111
N-3191 Horten
Norway

or e-mail:

simrad.documentation@simrad.com

High voltage safety warning

The voltages used to power this equipment are potentially lethal. Even 110 volts can kill.

Whenever possible, the following precautionary measures should be taken before any work is carried out inside the equipment:

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

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

NEVER WORK ALONE ON HIGH-VOLTAGE EQUIPMENT!

FIRST AID IN THE EVENT OF ELECTRIC SHOCK

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

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

Immediate action

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

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

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

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

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

If his heart is beating but he is not breathing, commence **ARTIFICIAL RESPIRATION**. If the victim's heart is not beating, commence **EXTERNAL CARDIAC MASSAGE (ECM).** Continue to shout for assistance till someone arrives.

EXTERNAL CARDIAC MASSAGE

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

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

ARTIFICIAL RESPIRATION

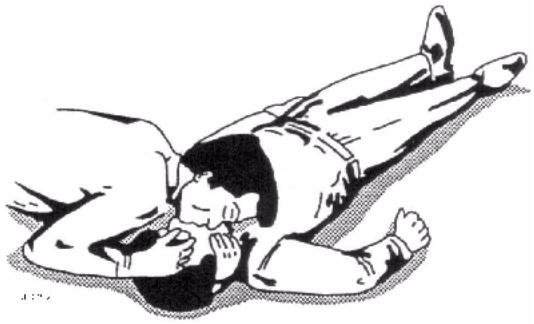
1 Kneel besides the victim's head. Place one hand under his neck and lift, allowing his head to fall back. This will lift his tongue and open the air passage in his throat.

2 Place the palm of the hand on his forehead to maintain the "chin-up" position.

3 Using the index finger and thumb of the same hand, pinch the victim's nostrils closed. Open his mouth.

4 Take a deep breath and cover his mouth with yours. Blow steadily into his lungs to expand his chest. Remove your mouth from his to allow the air to escape from his chest. You should be able to see his chest deflate.

5 Repeat the "inflation-deflation" cycle at a rate of about 12 cycles per minute till the victim begins to breath normally again.



COMBINING EMC AND ARTIFICIAL RESPIRATION

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

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

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

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

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

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

DO YOU KNOW WHAT TO DO?

INTRODUCTION

Manual content

This is the Instruction manual for the Kongsberg Simrad High Precision Acoustic Positioning (HiPAP) system. The manual contains the descriptions and illustrations required to install and maintain the HiPAP units.

→ *The HiPAP hull units are described in a separate manual.*

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.

The manual also defines the equipment responsibility, and provides general information about preservation, packing and storage of the units.

Abbreviations

The following abbreviations have been used in the text of this document:

APC	Acoustic Positioning Computer
BOP	Blow Out Preventer
COS	Common Operator Station
DP	Dynamic Positioning
DGPS	Differential Global Positioning System
GPS	Global Positioning System
HiPAP	High Precision Acoustic Positioning
HPR	Hydroacoustic Position Reference
HTC-10	HiPAP Transceiver Computer
I/O	Input/Output
LBL	Long Base Line
LF	Low Frequency
LRU	Line Replaceable Unit
MF	Medium Frequency
MULBL	Multi-User Long Base Line
PCB	Printed Circuit Board
ROV	Remotely Operated Vehicle
SDP	Simrad Dynamic Positioning

SSBL	Super Short Base Line
SSLBL	Super Short and Long Base Line
USB	Universal Serial Bus

General guidelines

WARNING **Kongsberg Simrad 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 Simrad.**

Training courses are available from Kongsberg Simrad AS.

Installation

The guidelines for installation presented in this manual must be regarded as a base for detailed plans prepared by the installation shipyard. 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 *Detailed mechanical drawings for the installation of the Hull Unit must be provided by the shipyard. All drawings must be approved by the vessel's classification society and/or local maritime authorities before the system is installed.*

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

Maintenance

The technical descriptions included in this manual are intended to 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 hydroacoustic 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 multimeters.

Note

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

Supply conditions

Equipment responsibility

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

Reception, unpacking and storage

A special chapter is provided for this information.

→ *Refer to page 51.*

Installation guidelines

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

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

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

Assistance from Kongsberg Simrad

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

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

Guarantee

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

SYSTEM DESCRIPTION

Introduction

This section presents the standard HiPAP units, and the standard configurations of an operation station.

Systems overview

The following Kongsberg Simrad HiPAP systems are available:

- **HiPAP 500**
  - The HiPAP 500 has a full spherical transducer body including 241 transducer elements. This model has close to full accuracy in the half sphere coverage sector and is the preferred system where the best possible performance is required.
  - The HiPAP 500 transducer has a diameter of 392 mm and will be installed with the 500 mm gate valve.
- **HiPAP 350**
  - The HiPAP 350 has a spherical transducer with a cylindric body including 46 transducer elements. This model has good accuracy in the +/- 60° coverage sector and is suited for operations where the major positioning targets are within this sector.
  - The HiPAP 350 transducer has a diameter of 320 mm and will be installed with the same 350 mm gate valves as the existing HPR systems. It may also be installed with the 500 mm gate valve.

System units

A Kongsberg Simrad HiPAP system consists of the following units:

- Operator station comprising (same for all HiPAP systems):
  - LCD display
  - APC 10 Computer
  - WinKeyboard
- Transceiver unit (specific for each system)
  - HiPAP 500 Transceiver Unit
  - HiPAP 350 Transceiver Unit

- Hull unit
  The HiPAP system is available with two different hull unit types:
  - HiPAP 500
  - HiPAP 350
    * The models have common software and hardware platforms and thereby offer the same kind of additional functionality and options.
- Hoist Control Unit (same unit for all HiPAP systems)
- Remote Control Unit (same unit for all HiPAP systems)

Note *The Display is described in a separate manual.*

Note *The hull units, Hoist Control Unit and Remote Control Unit are described in the HiPAP hull units Instruction manual.*

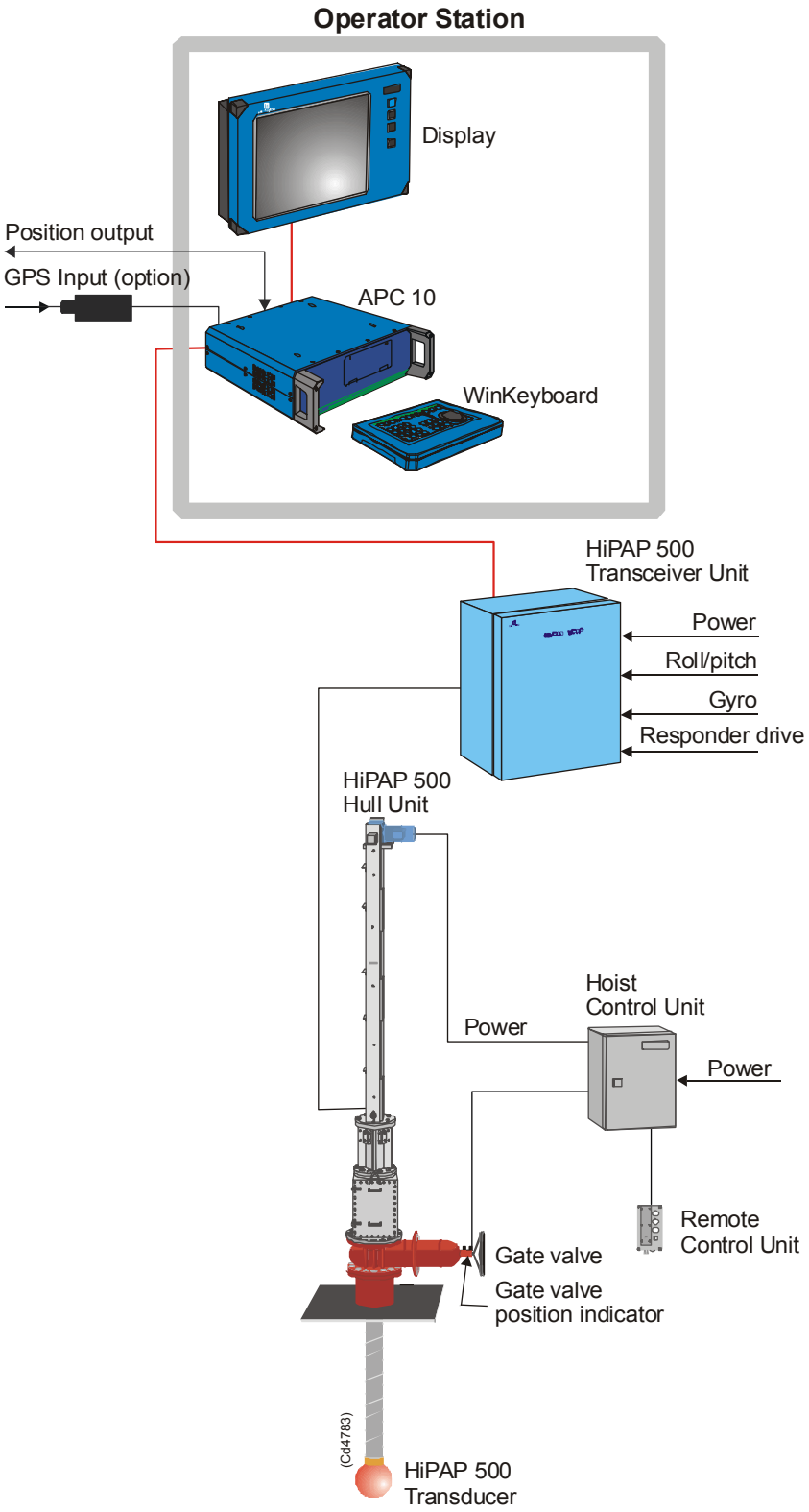


Figure 1 Standard HiPAP 500 system

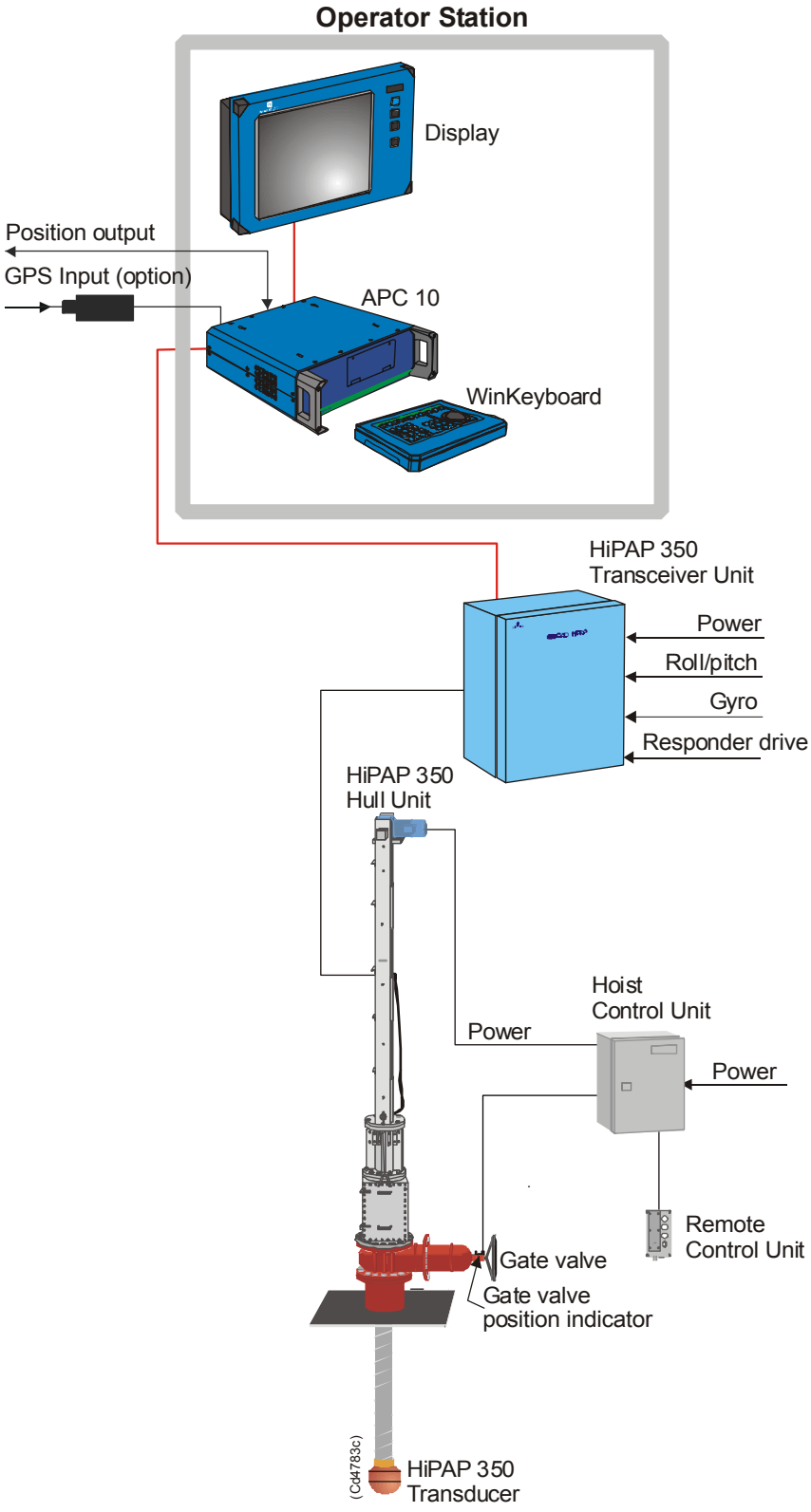


Figure 2 Standard HiPAP 350 system

Operator Station configuration

The HiPAP system may be configured with the Operator Station in two ways:

1 Stand alone
- Stand alone APC 10 computer
- LCD display
- WinKeyboard

2 Integrated in the same operator console as a Dynamic Positioning (DP) system (COS controller is used).

The stand alone configuration can be fitted as one of two standard options:

- **Option 1:** *Contained in a standard 19" rack*
  - The LCD display, the APC 10 computer and the Winkeyboard are fitted into drawers in a standard 19" rack unit. The Transceiver Unit is installed close to the Hull Unit.
- **Option 2:** *Desktop system*
  - The LCD display, the APC 10 computer and the Winkeyboard sit on a desk top or purpose-built shelf. The Transceiver Unit is installed close to the Hull Unit.

HiPAP system principles

General

The HiPAP system provides accurate positions of subsea targets such as:

- Remotely Operated Vchicles (ROVs),
- towed bodies or
- fixed transponders.

HiPAP 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, and it uses the HPR 400 transponders channels.

HiPAP processing - LBL mode

This mode is similar to the HiPAP processing, but the transceiver positions up to 8 LBL transponders for each interrogation. Both ranges and directions to the transponders are measured. The data is sent to the APC 10.

HiPAP processing - telemetry

The unit transmits acoustic telemetry messages, and receives and decodes the acoustic telemetry message from the transponder. The data is sent to the APC 10.

HiPAP processing - MULBL

In this mode the transceiver continuously listen for replies from the transponder. Each replay is detected, and directions and the time difference between replies are sent to the APC 10. The time differences are the delta ranges that is used in the MULBL positioning algorithm.

Dual HiPAP system

HiPAP is designed to operate with one or two sets of transceivers/transducers, both operated from the same operator station(s). The dual system uses both transducers to measure the position of one single target (transponder/responder), by controlling beam forming and directional measurement separately for each system in parallel. This means that both systems will measure and calculate a position for the same reply pulse from the transponder.

→ *Refer to figure on page 142.*

For the dual configuration a synchronisation line between the transceiver are required.

Benefits of a dual system:

- **Accuracy**
  - The improvement factor from 1 to 2 transducers is $\frac{1}{\sqrt{2}}$. This is based on the statistical improvements when using two independent systems. One transducer will give a horizontal bearing accuracy of 0.3°, while two transducers will give 0.2°.
- **Redundancy**
  - The two transducers will normally be installed at different locations onboard. One transducer may then have a better location with respect to noise environments and reflections than the other. The computed position will be a weighted mean of these two measurements, if one of the systems fails to receive a reply, the other system may still receive it and the position will still be computed.
- **Quality**
  - When using two transducers, the system will check and report if the positions from the two systems differ by more than a pre set value. Information about the position quality will also be available based on error ellipses.

APC 10 description

Introduction

The APC 10 unit is constructed of steel and aluminium panels and machined aluminium sections. The same unit is used for all types of installation (desktop or rack), with additional mounting brackets or rails as required.

Figure 3 APC 10 unit - desktop version

External connections

All external connections to the APC 10 unit are made via plugs located on the rear of the unit.

→ *Refer to page 119 for more information.*

Power initialization

The APC 10 unit can be powered from either a 115 Vac or 230 Vac supply.

Caution ***Ensure the switch is set to the power supply available before plugging the mains supply cable into the power outlet.***

The power on/off switch is located behind the hinged cover on the front panel. The switch is of the "push-for-on, push-for-off" type.

WinKeyboard description

Introduction

The WinKeyboard is constructed of aluminium. It consists of a small keyboard and a trackball.

The same unit is used for all types of installations. The background ligth may be adjusted. This is done using the APOS menu.

Figure 4 WinKeyboard

External connections

All external connections to the WinKeyboard are on the 25 pin female D-connector at the rear of the unit.

→ *Refer to APC 10 wiring diagram on page 228.*

GPS receiver signals

Signals from the GPS receiver is normally connected to the APC 10 to give position and time information. This signal is a serial data line, and a separate pulse called 1PPS is a pulse coming every second to synch the clock information.

The 1PPS pulse can have different pulse length and polarity from different suppliers of GPS receivers. To handle this problem a 1PPS converter can be used.

1PPS Converter (option)

General

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

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.

Mounting

The 1PPS converter is mounted on the cable between the GPS receiver and the COM port used on the APC 10.

The box may be mounted wherever suitable. It is attached with a velcroue.

Connections and diagrams

→ *1PPS connections are shown on page 140.*

→ *1PPS converter - block diagram is shown on page 233.*

→ *1PPS converter - assembly drawing is shown on page 234.*

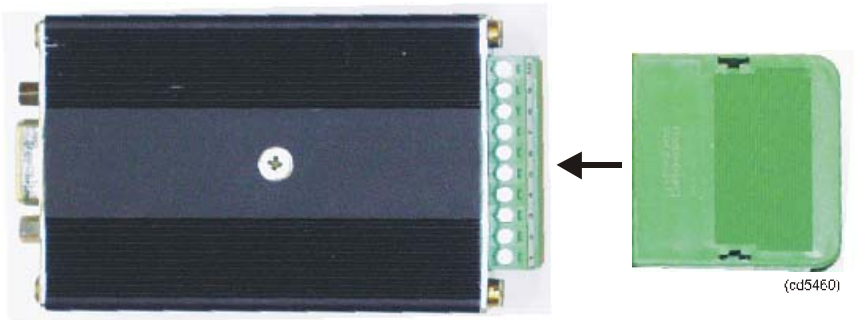


Figure 5 1PPS converter

Transceiver units description

Introduction

A HiPAP transceiver unit is constructed of steel panels, containing a rack holding the system electronics modules. It is designed to be mounted on a suitable bulkhead, and is fitted with vibration/shock dampers to reduce the effects of vibrations.

The design of the HiPAP 500 and HiPAP 350 transceiver units are identical. The figure below illustrates the HiPAP 500 Transceiver Unit.

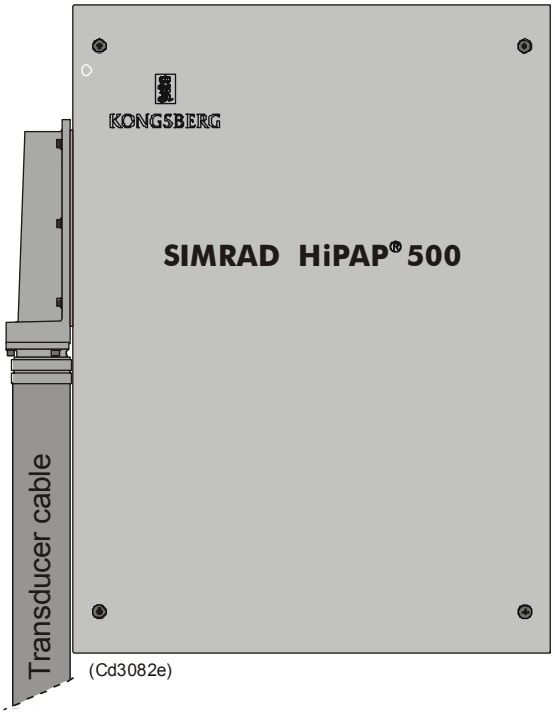


Figure 6 HiPAP 500 Transceiver Unit

External connections

The transducer cable is connected into the transceiver unit via a connector located on the left side of the unit. All other cables to and from the Transceiver Unit enter the unit through the base of the unit.

→ *Refer to figure on page 127.*

Power initialization

The transceiver unit is powered from a 230 Vac supply. A mains supply breaker is located on the front of the main control panel to the right in the rack.

→ *Refer to figure on page 37.*

Transceiver unit principles

Introduction

The transceiver unit is a central part of the HiPAP system. It contains the following:

- Electronic circuitry for the transmission of acoustic pulses.
- Amplifiers and filters for the reception of acoustic signals.
- Interfaces to external sensors, roll, pitch, course and heave.
- Serial line/ethernet link for communication with the Operator Station.

The transceiver unit's main *navigation* function is to interrogate transponders and measure the ranges and directions to them.

It is interfaced to attitude sensors, and controls the triggering of up to 4 responders. The transceiver can operate with one HiPAP transducer. The unit outputs the transponder position to the APC 10.

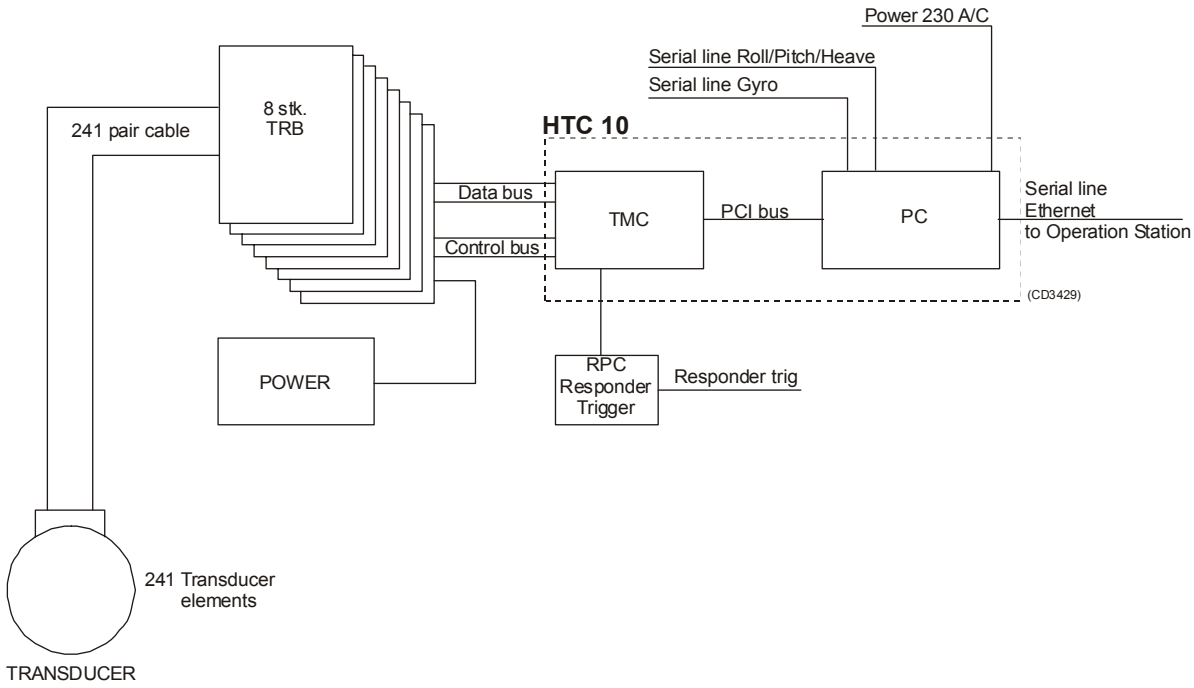


Figure 7 HiPAP 500 transceiver unit - functional block diagram

Transmission

The operator sets up the transmission parameters. This is done using the APOS menu. These parameters are transferred to the transceiver unit via the serial/ethernet line. The transceiver unit generates the appropriate interrogation pulses, amplifies them to the required strength, and sends them via the transducer cable to the transducer. The transducer then transmits the pulses into the water.

The transceiver unit also generates responder trigger pulses which are sent to the responder(s) via an umbilical.

Reception

The transceiver unit receives the analogue signals from the transducer. The signals are demodulated and analogue-to-digital converted, and the digital signals are then converted to position values. These are transferred on the serial/ethernet line to the Operator Station.

Attitude sensors are interfaced to the transceiver unit to enable the vessel's attitude to be taken into account when calculating the position data.

Navigation

The operator will select the active mode of operation. The system will then automatically switch between the selected mode and the other available modes as required.

In the SSBL mode, both the *direction* and the *range* to the transponder are computed.

When a transponder is switched on by the operator, the transceiver will commence interrogation using frequencies corresponding to the applicable transponder channel. This is done using the APOS menu.

Transceiver unit options

→ *A redundant HiPAP system is shown in the APOS Instruction manual.*

In redundant HiPAP systems working with dual ethernet, a serial line RS-422 to dual ethernet converter has to be installed in the HiPAP transceiver unit. This is an option to a standard HiPAP transceiver. This option consists of:

- Serial to Dual Net converter SDN 400
- A dual net termination box

These items are mounted inside the transceiver unit.

→ *The locations are indicated in the figure on page 37.*

→ *The cable connections are shown in the diagram on page 140.*

Serial to Dual Net converter SDN 400

The Serial to Dual Net converter SDN 400 unit is shown in the figure below.

Figure 8 Serial to Dual Net converter SDN 400 unit

Front panel

At normal operation the RUN lamp is light. This is the only function on the front panel in use.

MAINTENANCE

Overview

This section describes the maintenance routines for the standard HiPAP units.

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.

Maintenance philosophy

General

The maintenance philosophy recommended by Kongsberg Simrad AS 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 Simrad AS, 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 a error message appears:

- 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	Monthly	6 Months	Reference
All units - exterior	Clean	-	Check	-
All cable connections	-	-	Check	-
APC 10 filter	-	-	Check/Clean	Page 31
APC 10 motherboard battery	-	-	Check/Clean	Page 76
Transceiver unit filters	-	-	Check/Clean	Page 50
Transceiver unit fans	-	-	Check/Clean	Page 45

Tools

Standard tools

A standard mechanical tool set will be required for:

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

This set should at the minimum contain the following tools:

- Standard screwdrivers in different widths and lengths
- Allen key in metric size
- Phillips screwdrivers in various sizes
- Pozidrive screwdrivers in various sizes
- Flat nosed pliers
- Lap jointed pliers
- Wire cutters
- Wire stripper
- Soldering iron
- Open ended and ring spanners in metric sizes
- Adjustable spanners
- Socket set
- Knife
- 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.
- Grease gun with appropriate nipple connector (if required).
- Grounding bracelet

The following expendables are recommended:

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

Special tools

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

APC 10

Internal layout

The APC 10 contains the following circuit boards and units:

- Serial line adapter board
- Two Ethernet boards
- Video adapter board
- Motherboard
- Hard disk drive
- Processor cooling fan
- Power supply
- CD-read/write
- 3.5” floppy disk drive

The APC 10 is based on a commercially available motherboard, while 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.

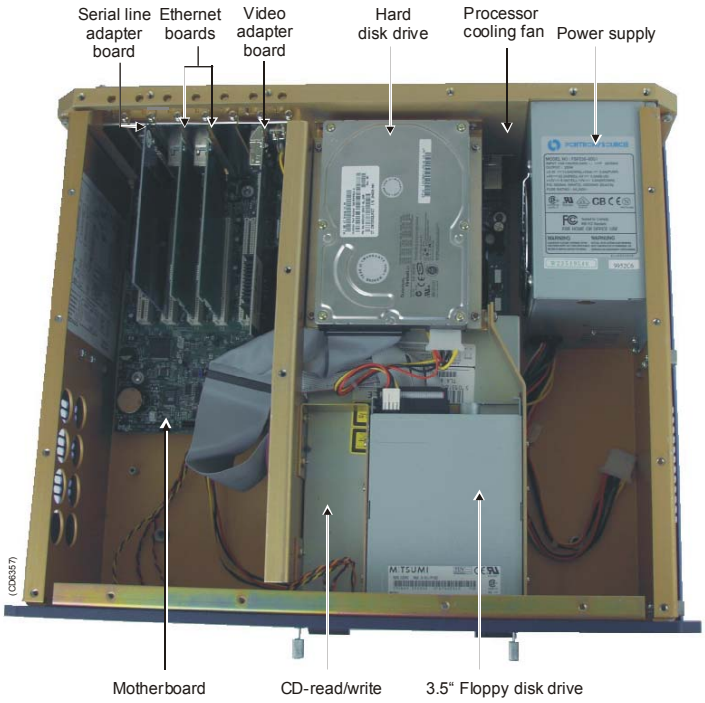


Figure 9 APC 10 - internal layout

Opening the APC 10 unit

To open the APC 10 unit, proceed as follows:

1 Switch of the APC 10 power.

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

3 Switch off power to all other units connected to the APC 10 (that is, display, transceiver, VRU etc).

4 Remove the 14 screws which secure the top cover onto the APC 10 (4 at the front and 4 at the back on the top, and 3 on each side).

5 Lift the top cover clear of the APC 10 chassis.

Closing the APC 10 unit

To close the APC 10 unit, proceed as follows:

1 Ensure all the required units and circuit boards are located correctly, and any securing screws and clips are tight.

2 Ensuring no wires or cables are trapped, carefully replace the cover onto the APC 10.

3 Once all the screw holes are aligned, replace the 14 securing screws.

Note

Do not over-tighten the screws as you may strip the threads off either the screws or the tapped holes in the APC 10 chassis.

4 Remount the APC 10 unit into its rack or desktop as required.

5 Check that the supply voltage change-over switch is set correctly, then plug the mains cable into the connector on the rear of the unit.

6 Apply power to the APC 10 unit and peripherals.

Replacements of APC 10 parts

General

For replacement of the PCBs you must pay special attention to the following:

1 Remove the PCBs cover plate.

- The cover plate has a padding for PCBs protection. This is illustrated in the figure below.
- Extra care must be taken when removing/replacing the padding, to avoid damaging any of the components.

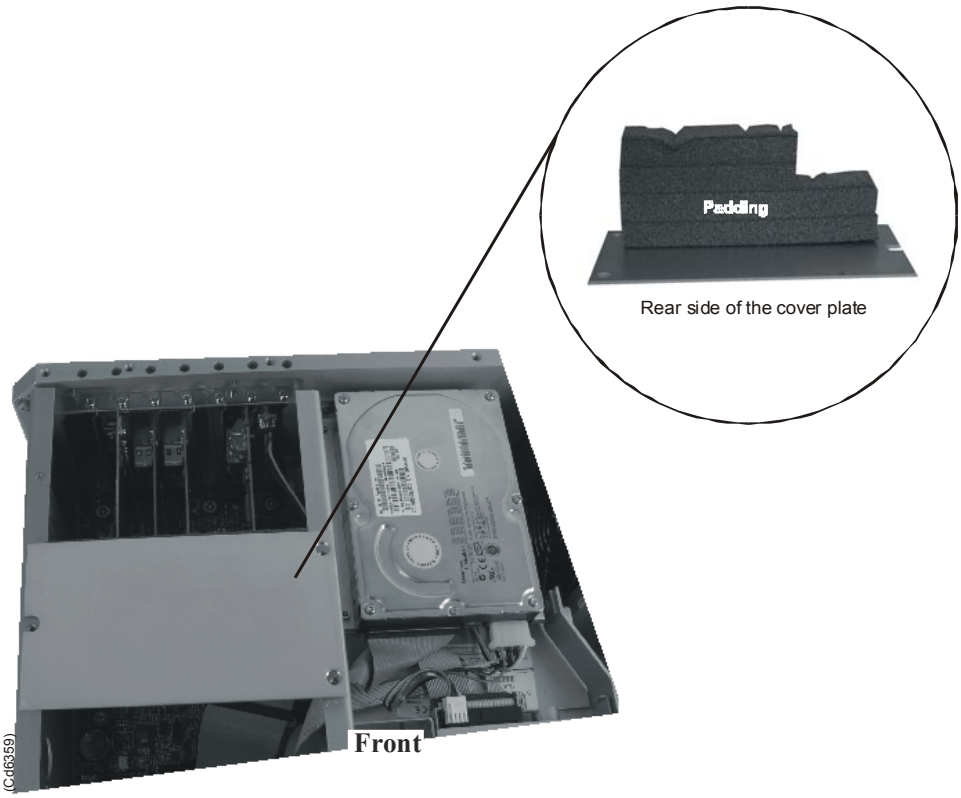


Figure 10 Indicating PCBs cover plate with padding

Replacing the hard disk

To remove the hard disk unit, proceed as follows:

1 Switch of the APC 10 power.

2 Remove the top cover from the APC 10.

3 Use a suitable box spanner and remove the four nuts that secure the hard disk drive onto the disk drive chassis.

4 Lift the hard disk unit off the chassis.

5 Disconnect the two plugs.

The hard disk unit can now be removed from the APC 10.

To replace the unit, follow the above procedure in reverse.

Note

For further details regarding formatting and configuration of the new hard disk, please contact Kongsberg Simrad.

Replacing the floppy disk drive

To remove the floppy disk drive unit, proceed as follows:

1 Switch of the APC 10 power.

2 Remove the top cover from the APC 10.

3 Use a pozidrive screwdriver and remove the six screws that hold the disk drive chassis into the APC 10 unit.

- Four screws are located in the front of the unit behind the drive unit cover plate. Two screws are located in the rear of the unit above the connector panel.

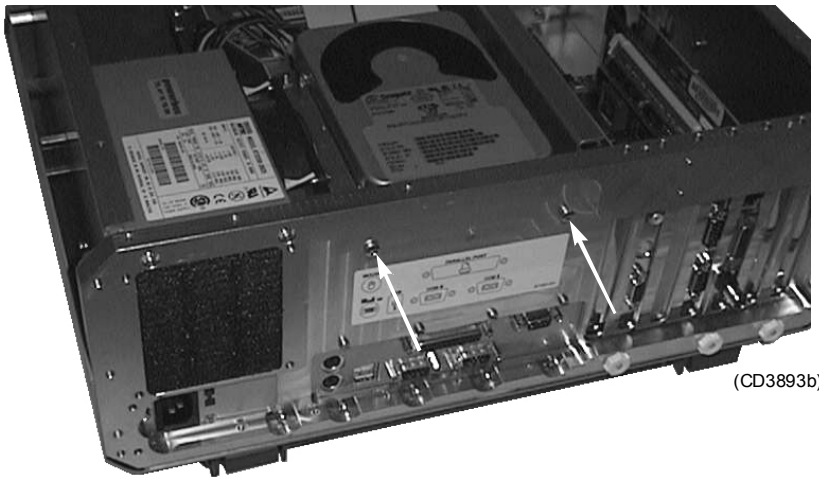


Figure 11 The two screws supporting the rear of the disk drive chassis

4 Carefully lift the disk drive chassis out of the APC 10 unit.

5 Remove the six screws (three on each side) holding the floppy drive into the chassis.

6 Lift the drive unit out of the chassis.

7 Disconnect the two plugs.

The floppy disk drive can now be removed from the APC 10.

To replace the unit, follow the above procedure in reverse.

Replacing the CD-read/write unit

To remove the CD-read/write unit disk drive unit, proceed as follows:

1 Switch of the APC 10 power.

2 Remove the top cover from the APC 10.

3 Use a pozidrive screwdriver and remove the six screws that hold the disk drive chassis into the APC 10 unit.

- Four screws are located in the front of the unit behind the drive unit cover plate. Two screws are located in the rear of the unit above the connector panel.

→ *Refer to figure on page 30.*

4 Carefully lift the disk drive chassis out of the APC 10 unit.

5 Remove the eight screws (four on each side) holding the CD-read/write unit into the chassis.

6 Lift the drive unit out.

7 Disconnect the two plugs.

The CD-read/write unit can now be removed from the APC 10.

To replace the unit, follow the above procedure in reverse.

Replacing the power supply

To remove the power supply unit, proceed as follows:

1 Switch of the APC 10 power.

2 Remove the top cover from the APC 10.

3 Use a flat-blade screwdriver and remove the four cheese-head screws that hold the fan filter retaining plate onto the rear of the APC 10 unit.

4 Remove the filter retaining plate.

5 Use a pozidrive screwdriver and remove the five screws that hold the power supply unit into the APC 10 chassis.

- Four screws are located in the rear of the unit, one is located on the side.

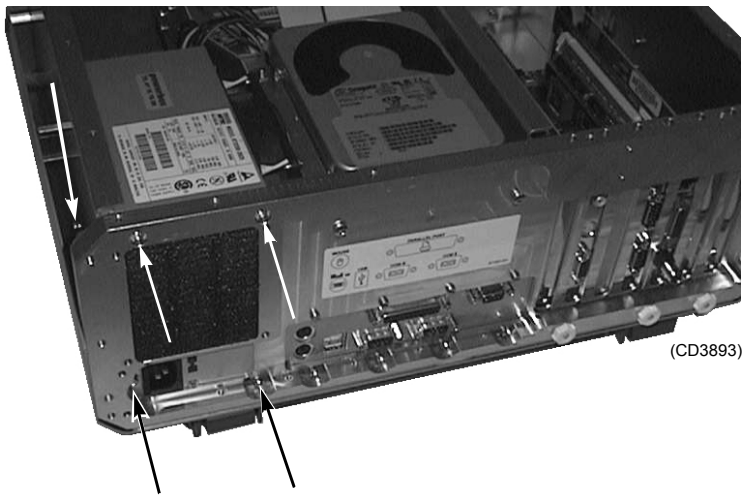


Figure 12 Locations of the five power supply retaining screws

6 Carefully lift the power supply out of the APC 10.

7 Disconnect the plug from the motherboard.

The power supply can now be removed from the APC 10.

To replace the power supply unit, follow the above procedure in reverse.

Dust filter

A filter is fitted at the front of the power supply. When required the filter must be cleaned, to avoid blocking of the air circulation within the unit.

To clean the filters proceed as follows:

1 Remove the filter from the unit.

2 Clean the filter in lukewarm water.

3 Leave it to dry before you reinstall it.

4 When cleaning is no longer sufficient, replace the dust filter. (Filter type SP 120.)

Dust filters types

Note

To ensure correct air flow, it is important to use the correct filter type.

Replacing the circuit boards

General procedure

Caution ***If you are to use a board different from a "standard" board, contact Kongsberg Simrad service personnel for software updates.***

→ *Refer to page 72 for overview of "standard" boards.*

To remove one of the circuit boards, proceed as follows:

1 Switch of the APC 10 power.

2 Remove the top cover from the APC 10.

3 Remove the two screws holding the support block in position.

4 Remove the support block.

5 Insert a small pozidrive screwdriver down through the appropriate hole in the APC 10 rear chassis plate, and remove the screw that secures the faulty circuit board into the chassis.

6 Slacken the three white plastic PCB clamping nuts located on the rear of the APC 10 chassis.

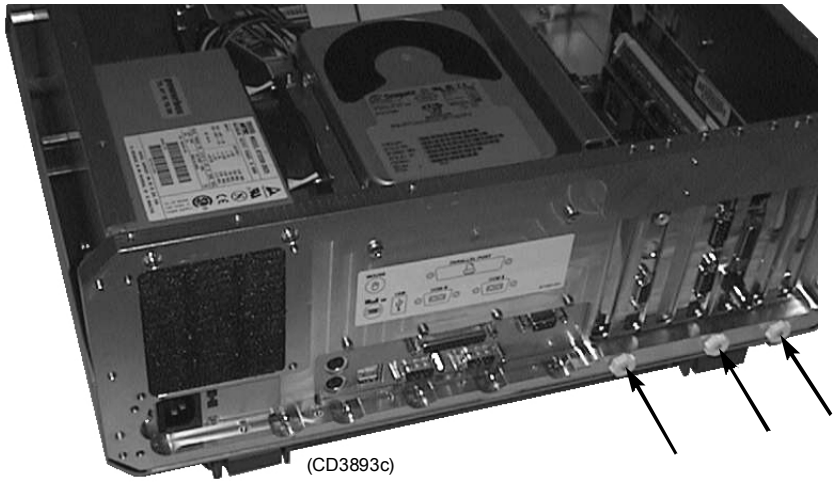


Figure 13 The three PCB clamp nuts

7 Carefully lift the circuit board out of the APC 10.

To replace the board, follow the above procedure in reverse.

WinKeyboard

Internal layout

The Winkeyboard consists of two push-button circuit boards and a trackball mounted together on a front panel. The case is sealed by a base, which is secured into position by 22 screws.

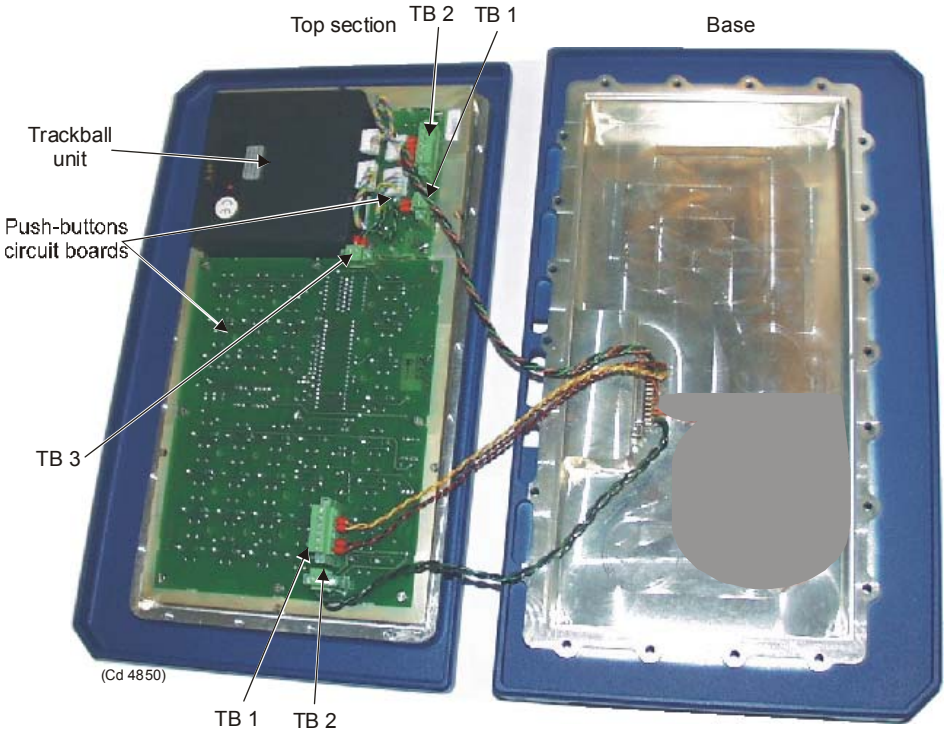


Figure 14 WinKeyboard- internal layout

The WinKeyboard receives power from the APC 10, and power is turned on when the APC 10 is turned on.

→ *For external connections refer to the wiring diagram on page 228.*

As seen in the diagram, a cable with 3 connectors connects the WinKeyboard to the APC 10. These 3 connections are:

- MiniMouse
- COM 1
- Power

Maintenance of the WinKeyboard

Preventive maintenance

The preventive maintenance consists of keeping the keyboard clean.

Note *All other maintenance must be done by either the manufacturers or their representative.*

Note *The Winkeyboard is not water-proof. Use only a damp cloth.*

Use:

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

Wet the cloth, then wring as much of the water out as possible. Ensuring that there is no possibility of water dripping into the unit.

Opening the keyboard

The components within the keyboard can be accessed as follows:

→ *Refer to the figure on page 33.*

1 Switch off the APC 10 power.

2 Disconnect the keyboard.

3 Turn the keyboard over onto a padded surface so the trackball is not damaged.

4 Remove the 22 securing screws.

5 Lift off the base plate.

6 Disconnect all the connectors.

7 Lift the trackball/circuit board unit out of the keyboard case.

Note *The trackball/circuit board unit will usually be replaced as one unit. If so, ignore the remaining procedures and install a new unit by reversing the above procedure.*

Replacing the keyboard components

Replacing the trackball

Replace the trackball as follows:

1 Open the keyboard (see above).

2 Disconnect the two plugs connecting the trackball unit to the small circuit board.

3 Remove the four screws holding the trackball securing ring to the front of the key panel.

4 Remove the trackball unit from the circuit board unit.

- To replace the trackball, follow the above procedure in reverse.

Replacing the large circuit board

Replace the large circuit board as follows:

1 Open the keyboard (see above).

2 Disconnect the three plugs connecting the large circuit board to the small board and the APC 10 connector.

3 Remove the nine screws holding the large circuit board into the key panel.

4 Remove the circuit board from the key panel.

- To replace the large circuit board, follow the above procedure in reverse.

Replacing the small circuit board

Replace the small circuit board as follows:

1 Open the keyboard (see above).

2 Disconnect the four plugs connecting the small circuit board to the trackball and the APC 10 connector.

3 Remove the four screws holding the small circuit board into the key panel.

4 Remove the circuit board from the key panel.

- To replace the small circuit board, follow the above procedure in reverse.

Transceiver units

Overview

Two types of Kongsberg Simrad HiPAP transceiver units are available:

1 HiPAP 500 Transceiver Unit.

2 HiPAP 350 Transceiver Unit.

The to transceiver units are in principle the same. The only difference is:

- The HiPAP 500 Transceiver Unit includes ***eight*** Transmitter/Receiver boards.
- The HiPAP 350 Transceiver Unit includes ***two*** Transmitter/Receiver boards.

→ *The figure on page 37 presents the internal layout of the HiPAP 500 Transceiver Unit.*

HiPAP 500 Transceiver Unit internal layout

The HiPAP 500 Transceiver Unit contains the following circuit boards and units:

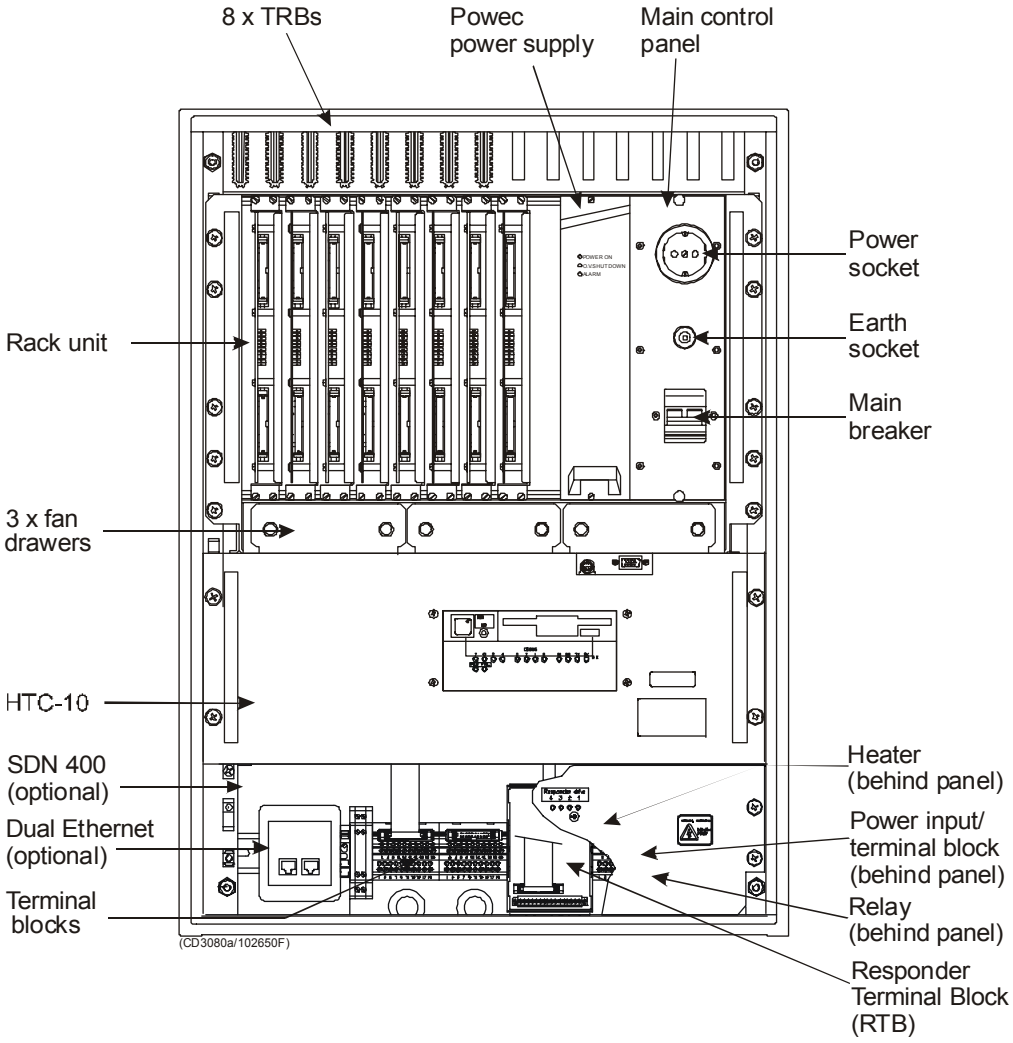


Figure 15 HiPAP 500 Transceiver Unit - internal layout

The boards and units are listed from the left top of the unit.

- **Eight/Transmitter/Receiver boards** (TRBs). The TRBs are located in a standard 19” rack across the upper part of the transceiver unit.
  The TRB boards are double-Europe cards.
- **POWEC power supply unit**. This unit provides the voltages required by the TRBs, and carries a “power on” indicator. This is a plug-in unit.

- **Main control panel**. This is a plug-in unit. The panel holds:
  - A standard 230 Vac power output socket intended for measuring instruments.
  - Main power On/Off breaker.
  - An earth socket to which maintenance personnel must be connected when servicing the unit.
- **Responder Terminal Block** (RTB). The module is located in the bottom of the transceiver unit. This is a "snap-on" unit.
- **Backplanes**. The boards and units are connected into the backplane.
- **Fan rack**, containing three 230 Vac cooling fans.
- **Transceiver Controller** (HTC-10), including:
  - A PC with disk drive.
  - Transceiver Memory Control (TMC) board.
  - The serial lines are connected to a digi board.
  - The PC is loaded with the main operating program for the transceiver unit.
- **A row of terminal blocks**. These are mounted in the lower part of the transceiver unit for connecting in externally supplied signals.
- **Power input/terminal blocks**.
- **Heater and relay**.
  When the main switch is switched off, the heater is switched on. When the mains is switched on again, the heater is automatically switched off. This prevents condensation.

Options

- **Dual Ethernet connectors**.
- **Serial to Dual Net converter SDN 400**.
  If dual Ethernet communication is needed (cable or optical), a Serial to Dual Net converter SDN 400 is mounted at the bottom left side of the transceiver unit.
- **GPS Input signal converter (1PPS converter)**.
  If a GPS is connected to the system, a 1PPS converter is used. The 1PPS converter is a separate box and is connected to the APC 10 with a standard cable.

LEDs indicating operating status

The transceiver unit includes several LEDs that indicates the various status of operation. A LED is active when lit.
The LEDs are as follows:

- **LEDs on the HTC -10 disk drive cover**
  - 0-7 Debug indicators controlled from i960 (For Kongsberg Simrad service personnel only!)
  - D1 Debug indicator controlled from DSP (For Kongsberg Simrad service personnel only!)
  - D2 Debug indicator controlled from DSP (For Kongsberg Simrad service personnel only!)
  - Tx Transmitting
  - Rx Receiving
  - RUN System is running
  - Fail System failure (The TMC II board is not working)
- **LEDs on the lower cover plate**
  - 1-4 Indicating active responder drive(s)

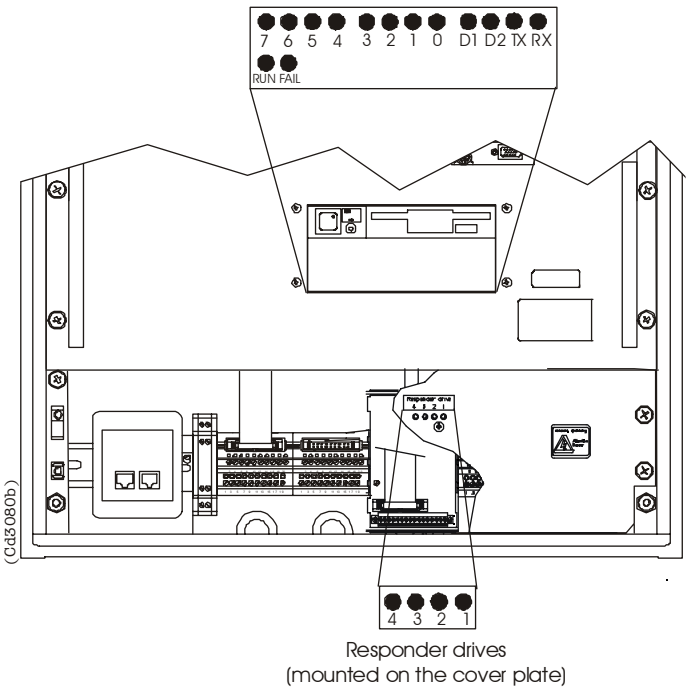


Figure 16 Transceiver unit LEDs

Replacement of transceiver unit parts

Line Replaceable Units (LRUs)

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

- Transmitter/Receiver board (TRB)
- Responder Terminal Block (RTB)
- Main control panel
- POWEC power supply
- Backplane
- Fan unit
- Fuses
- Dust filters

The replacement procedures for each of these parts are described in the following paragraphs.

Before you start removing any board/unit

1. Switch off all power to the HiPAP system, and to other systems connected to the system (for example vertical reference unit etc.).
2. For the other systems, remove the fuses if possible, and label the fuse panels with tags stating that maintenance is being carried out on the system.
3. Open the transceiver unit front door.

Caution ***The maintenance engineer MUST wear a grounding bracelet which is securely connected to the vessel's ground at all times while performing maintenance on the transceiver unit.***

Opening/closing door

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

1. Slacken the four captive screws in the corners of the door.
2. Lift the door off.

To close the door, proceed in reverse order!

Replacement of circuit boards

The circuit boards in the transceiver unit rack are all plug-in modules which are easily replaceable. A small screw-driver will be required to release the screws holding a board into the rack (two screws at the top and two at the bottom). All the boards are replaced using the same procedure.

→ *For circuit board placement refer to figure on page 37.*

Removing a transmitter/receiver board

A circuit board is removed according to the following procedure:

1 Read the section *Before you start removing any board/unit* on page 40.

2 Switch off the transceiver unit using the breaker on the main control panel.

3 Locate the faulty board.

4 Note the locations of, and remove, any connections to the front of the board.

5 Slacken the screws located at the upper and lower edges of the front of the board, and carefully pull the board straight out from the transceiver unit rack.

6 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 transmitter/receiver board

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

When replacing a board into the rack, ensure that the board is correctly located in the rails before any pressure is applied to the board!

If the rear connector pins are damaged, the board will need to be replaced. Proceed as follows:

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

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

Note

The RPC board has only one permanent rail - the lower rail is mounted on the main control panel.

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 When the front of the board is fully home, fasten the securing screws to keep it in position.

- Do not attempt to force the board into the rack by tightening the securing screws. This will damage the board and/or the rack, and result in replacement parts being necessary.

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

5 Close the front of the transceiver unit.

Replacement of units

Removing the responder terminal block (RTB)

The RTB module is located on the support rail at the bottom of the transceiver unit. Remove the module as follows:

1 Read the section *Before you start removing any board/unit* on page 40.

2 Switch off the transceiver unit using the breaker on the main control panel.

3 Disconnect the RTB module.

4 The module is snapped on. To remove it, press it gently upwards, and pull it directly out from the support rail.

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

Replacing the responder terminal block

To replace the RTB module, proceed as follows:

1 Align the RTB module on the support rail.

2 Press the RTB module until it snaps into place.

Removing the main control panel

The main control panel is removed according to the following procedure:

1 Read the section *Before you start removing any board/unit* on page 40.

2 Switch off the transceiver unit using the breaker on the main control panel.

3 Unplug any instruments that are connected into the power socket, and move your ESD bracelet to another connection point.

- Ensure the bracelet is properly earthed before continuing.

4 Slacken the screws located at the upper and lower edges of the front of the main control panel, and carefully pull the unit straight out from the transceiver unit rack.

Replacing the main control panel

In principle, replacing the main control is to perform the steps in paragraph:

→ *Removing the main control panel on page 42 in revers order.*

In principle, replacing the main control is to perform the steps in paragraph in revers order.

- Ensure that the lower edge of the RPC board fits smoothly into the rail on the control panel.

Removing the POWEC power supply

Removal of the POWEC power supply is performed according to the following procedure:

1 Read the section *Before you start removing any board/unit* on page 40.

2 Switch off the transceiver unit using the breaker on the main control panel.

3 Referring to the procedure on page 42, remove the main control panel from the transceiver unit rack.

4 Slacken the screws located at the upper and lower edges of the front of the power supply, and carefully pull it straight out from the transceiver unit rack till it is prevented from coming further by the power cable.

5 Put one hand into the space vacated by the main control panel, and carefully unplug the power cable.

6 Withdraw the power supply from the rack, and place it on a clean, stable work-bench where it cannot come to any harm.

Replacing the POWEC power supply

In principle, replacing the main control is to perform the steps in paragraph *Removing the POWEC power supply* in revers order.

Note

When replacing the power supply into the rack, ensure it is correctly located in the rails before any pressure is applied to it!

The mains power plug must be reconnected before the supply is pushed fully home. Proceed as follows:

1 Locate the supply into the appropriate rails and carefully slide it into the unit.

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

2 When the supply is approximately half way in, reach in to the space vacated by the main control panel and reconnect the mains power plug.

3 Slide the supply fully into the rack.

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

5 When the supply is fully home, fasten the securing screws to keep it in position.

- Do not attempt to force the supply into the rack by tightening the securing screws. This will damage the supply and/or the rack, and result in replacement parts being necessary.

Removing the backplane

The backplane is located behind the circuit board rack, and is accessible only by removing the entire rack from the transceiver unit. All the circuit boards and units in the rack must be removed before the rack can be removed. All connections to the backplane are made using plugs.

To remove the backplane proceed as follows:

1 Read the section *Before you start removing any board/unit* on page 40.

2 Disconnect the cables from the transducer and from the HPC-10.

3 Refer to the procedures in paragraphs:

- Removing transmitter/receiver boards on page 41.
- Removing the main control panel on page 42.
- Removing the POWEC power supply on page 43,

and remove the circuit boards and units from the rack.

4 Support the rack, remove the ten screws that secure the rack into the cabinet, then carefully withdraw the rack from the cabinet till the connectors to the backplane are exposed.

5 Note the locations of the cable connectors connecting the rack to the transceiver unit cabinet, then disconnect all the cables.

6 Place the rack on a clean, stable work-bench. The backplane should now be readily accessible.

7 Note the locations of the cables connected to the backplane, then disconnect all the cables.

8 Slacken and remove the 22 screws securing the backplane into the transceiver unit.

- The backplane should now be loose, and you can remove it carefully from the rack.

If the backplane is going to be out of the transceiver unit for some time, you are recommended to replace the rack into the cabinet and replace the circuit boards into the rack, to protect the boards.

Replacing the backplane

Replacing the backplane is a reversal of the procedure given in paragraph

→ *Removing the backplane on page 44.*

Note

Ensure that parts fit together correctly before securing screws are tightened. Do not attempt to apply force to any of the parts. Do not over tighten the securing screws.

Replacing a fan unit

Three fan drawers are located immediately below the circuit board rack. The fan drawers each hold one fan unit, and are plug-in modules which are easily replaceable.

Note

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

You do not need to switch off power to the transceiver unit while replacing a fan unit. Follow the procedure below:

1 Open the transceiver unit front door.

2 Identify the defective fan unit, slacken the screws securing the fan drawer into the rack, then carefully pull out the fan draw.

3 Locate the new fan drawer into the tracks in the rack, then carefully slide it into the rack.

4 When the contacts at the rear of the drawer begin to mate (the last 5 mm of travel), apply even pressure across the front of the drawer to push it into the rack.

5 Tighten the screws to secure the fan drawer into the rack.

6 Close the transceiver unit front door.

Replacing the HTC-10 LRUs

General

The following parts contained within the HTC-10 computer are defined as Line Replaceable Units (LRUs):

- Power supply
- Hard disk drive
- 3.5” disk drive
- PCBs
  - Digi board
  - TMC II board
  - Display board

Replacement of HTC-10 computer parts are in principle the same as for the APC 10 computer. Only replacement of the PCBs are described here.

→ *Refer to section on page 26.*

Only replacement of the PCBs are described here. The placement of the different LRUs are indicated in the figure below.

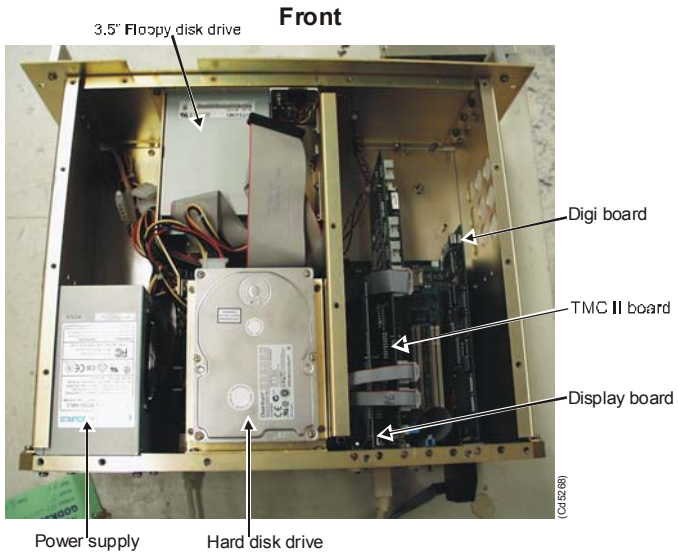


Figure 17 HTC-10 internal layout

PCBs

For replacement of the PCBs you must pay special attention to the following:

1 Remove the PCBs cover plate.

- The cover plate has a padding for PCBs protection. This is illustrated in the figure below.
- Extra care must be taken when removing/replacing the padding, to avoid damaging any of the components.

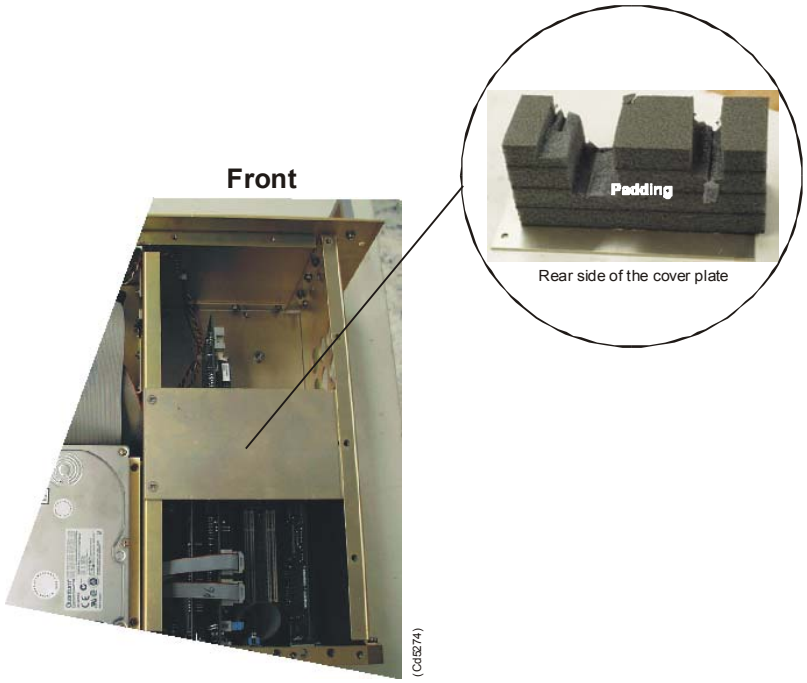


Figure 18 Indication PCBs cover plate with padding

Digi board replacement

Before you plug in the board:

→ *A complete Installation Guide is available on request.*

Before you plug in the Digi board, is important to:

1 Write down the serial number of the board in the space provided.

2 Set all four DIP switches on the ON position (towards the circuit board). You set the switches later without removing the board.

→ *For DIP switch settings, refer to page 101.*

TMC II board replacement

Note *A complete Installation Guide is available on request.*

Standard procedure as for the APC 10.

Display board replacement

Standard procedure as for the APC 10.

Replacing fuses

Fuse locations

A transceiver unit is powered via a main breaker mounted on the front of the main control panel. This breaker is also an automatic fuse. The POWEC power supply holds one fuse.

The fuses are as follows:

POWEC . . . . . 5 mm∅ x 20 mm, 250 V, 3.15 A, slow-blow
The fuse is contained in a holder located on the rear of the unit.

Main breaker . . . . . Trips at 10 A

RPC board . . . . . 4 fuses, 0.1 A, slow-blow (one for each channel, on the +24 V lines)
location, see page 93

Caution ***NEVER attempt to use anything except the correct size and type of fuse in the fuse holder. Irreparable damage may be caused to the transceiver unit if the wrong fuse (or anything else) is used.***

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 breaker.

4 If the suspect fuse is located on the POWEC power supply, refer to paragraph *Removing the POWEC power supply* on page 43 and remove the supply from the transceiver unit.

5 If the fuse is on the RPC board, refer to paragraph *Removing the responder controller on page 42* and remove the RPC board from the transceiver unit.

6 Replace the blown fuse(s) with the correct size and type of fuse.

7 Replace the board/unit into the transceiver unit.

8 If the main breaker has tripped, remake the breaker.

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

9 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 till the fault has been found and corrected.***

10 Close the transceiver unit front door.

Replacing the Serial to Dual Net converter SDN 400 unit

This unit is located behind the row of terminal blocks, and is accessible only by removing the entire terminal block from the Transceiver Unit.

To replace the SDN 400 proceed as follows:

1 Read the section *Before you start removing any board/unit*.

→ *Ref page 40.*

2 Remove the row of terminal blocks.

3 Disconnect the SDN 400 cables.

4 Remove the four screws that secure the rack into the cabinet.

5 To replace the SDN 400, proceed in revers order.

Dust filters

Locations

Dust filters are fitted at the air inlet and air outlet.

When required, these dust filters must be cleaned, to avoid blocking of the air circulation within the unit.

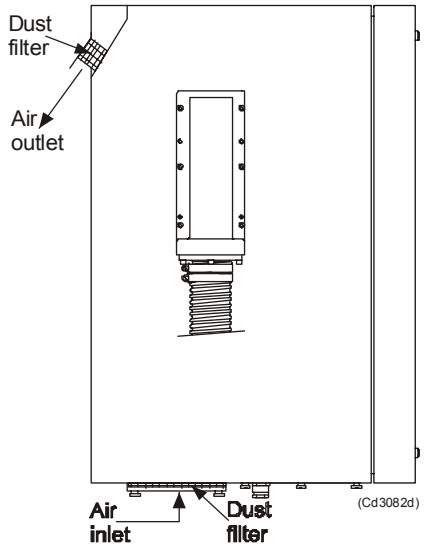


Figure 19 Side view of Transceiver Unit indicating air inlet/outlet and filters

Handling

The filter at the air outlet on the rear side top, you can just press into place or pull out when required. To remove/replace the filter at the bottom air inlet, you must remove the coverplate.

To clean the filters proceed as follows:

1 Remove the filter from the unit.

2 Clean the filter in lukewarm water.

3 Leave it to dry before you reinstall it.

4 When cleaning is no longer sufficient, replace the dust filter.

Types

The filters types are as follows:

- Top filter SP 115
- Bottom filter SP 180

Note

To ensure correct air flow it is important to use the correct filter type.

EQUIPMENT HANDLING

Introduction

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

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

Transportation

General specifications

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

Note

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

Local transportation

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

The carton or case will normally be marked with text or symbols indicating which way up it is to be placed. Follow any instructions given and ensure the case is always placed with its “top” uppermost.

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

Lifting

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

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

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

- The applicable weight certificate for the crane.
- The security of the lifting lugs.

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

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

Initial preservation

Introduction

When a system, a unit or a spare part has been delivered to the customer, it may be subject to long-time storage prior to installation and use. During this storage period, certain specifications must be met.

The equipment must be preserved and stored in such a way that it does not constitute any danger to health, environment or personal injury.

Specific specifications are presented below.

→ *For further information about storage, refer to page 56.*

→ *For further information about re-packing, refer to page 59.*

→ *For further information about temperature protection, refer to page 60.*

Original packing crate

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

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

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

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

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

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

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

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

- Use the original packing material as far as possible.

→ *Refer to the information on page 59.*

Ambient temperature and humidity

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

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

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

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

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

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

Shock and vibration

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

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

ESD precautions

→ *Refer to the information on page 59.*

Batteries

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

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

Inspection and unpacking

Inspection on receipt

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

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

General unpacking procedure

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

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

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

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

- If the carton has been closed using staples, remove the staples from the carton as you open it. This will reduce the possibilities of scratch injury to yourself and damage to the contents.
- If a wooden crate has been closed using screws, always remove them using a screw-driver. Do not attempt to prise the lid off with a crow-bar or similar.
- Once the carton is open, carefully remove all loose packing and insulation material. Check for manuals and other documents that may have been added to the carton during packing, and put these to one side. Check also for special tools, door keys etc.

Electronic and electro-mechanical units

Caution ***Beware of the dangers of Electro-Static Discharge (ESD) both to yourself and to the equipment, when handling electronic units and components. Refer to the precautions starting on page 59.***

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.

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

Inspect the unit for damage before opening the plastic bag.

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.

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

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

Transducers

Transducers may be supplied mounted to a hull unit (if any), or packed separately. Crates are normally identified by the order number and the serial number.

The transducer face must be protected by a rigid, padded cover (e.g. a wooden box lined with foam rubber) all the time it is exposed to the risk of physical damage.

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

Re-packing

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

→ *Refer to the information on page 59.*

Storage

Pre-installation

The equipment should be stored in its original transportation crate until ready for installation. The crate must not be used for any purpose for which it was not intended (eg. work platform etc.).

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

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

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

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

Caution

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

After use

Introduction

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

Cleaning cabinets

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

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

Mechanical units

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

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

Examples:

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

- Ensure that all traces of mud and marine growth are removed. Use a wooden or plastic scraper to remove persistent growth, barnacles etc. On completion, dry the unit thoroughly.

Caution ***Do not use a high pressure hose in the vicinity of cables or transducers. Do not use sharp or metal tools on a transducer face.***

- If the materials or type of unit prevents the use of a high-pressure hose, wipe the unit using a cloth dampened with water containing a little detergent.

  Example:

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

- Do not use excessive amounts of water as some components on the unit may not be water tight. Wipe off the detergent with a damp cloth, then dry the unit thoroughly.
- All surfaces must be inspected for signs of corrosion, eg. flaking/bubbling paint, stains etc. Damaged or suspect areas must be cleaned, prepared and preserved using the correct preservation mediums. The mediums to be used will normally be defined in the unit's maintenance manual.

Cables

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

Internal batteries

If the unit contains batteries, these may discharge slowly during storage. If the unit is to be stored for an extended period, disconnect or remove all internal batteries.

A suitable piece of insulating material can be placed between the battery and the electrical contacts to prevent electrical discharge. The battery can then remain in the unit, reducing the risk of it being misplaced during the storage period.

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

Dehumidifier

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

Coatings

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

Re-packing

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

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

ESD precautions

Electrostatic Discharge (ESD)

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

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

Protection

ESD Protection during transport and storage

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

Unpacking and servicing ESD sensitive equipment

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

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

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

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

Temperature protection

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

These units will be identified as delicate in the system's maintenance manual.

The package must then be clearly marked:

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

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

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

INSTALLATION

Overview

This section describes the installation of the standard HiPAP units.

General installation information

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.*

Note *The Operator station units must be installed as close as possible to each other. The cables between the units must be as short as possible.*

APC 10 installation

Introduction

The APC 10 unit can be mounted either in a standard 19" rack, or on a desk. The type of installation must be stated when ordering the unit so that rails or mounting brackets can be supplied as appropriate.

- APC 10 units supplied for desktop installation must be mounted as "best fit" for the user.
- If the APC 10 unit is to be mounted in a 19" rack, an appropriate rack must be provided by the customer.

Unit location

The APC 10 unit must be installed relatively close to the display and keyboard (the interface cable between the unit and the keyboard is approximately two metres long). The APC 10 unit must be easily accessible during operation of the system.

Logistics

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

Personnel - Minimum 2 trained mechanical/electrical fitters.

Ship location - No special requirements. The watertight integrity of the vessel will not be effected.

Special tools - None.

19" rack installation procedure

The APC 10 and keyboard units are supplied with rail kits to enable the units to be mounted into the rack.

→ *See also drawing on page 226.*

1 Mount the rails and brackets onto the APC 10 unit using the bolts and washers provided.

2 Mount the rails onto the keyboard.

3 Mount the keyboard under the APC 10 unit.

4 Connect the cables.

5 Follow the procedure provided by the rack manufacturer and mount the APC 10 unit and keyboard into the rack.

Desktop installation

The APC 10 cabinet and keyboard 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 the Technical specifications section for the weights of the units, 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.

→ *See also drawing on page 223.*

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 shown in this document for reference only.

WinKeyboard installation

For Winkeyboard installation see section *APC 10 installation*.

→ *See also drawing on page 224.*

Transceiver unit installation

Introduction

The HiPAP transceiver unit (cabinet) is to be mounted to a bulkhead.

Note

The guidelines for installation presented here must be regarded as a base for detailed plans to be prepared by the installation shipyard. 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.

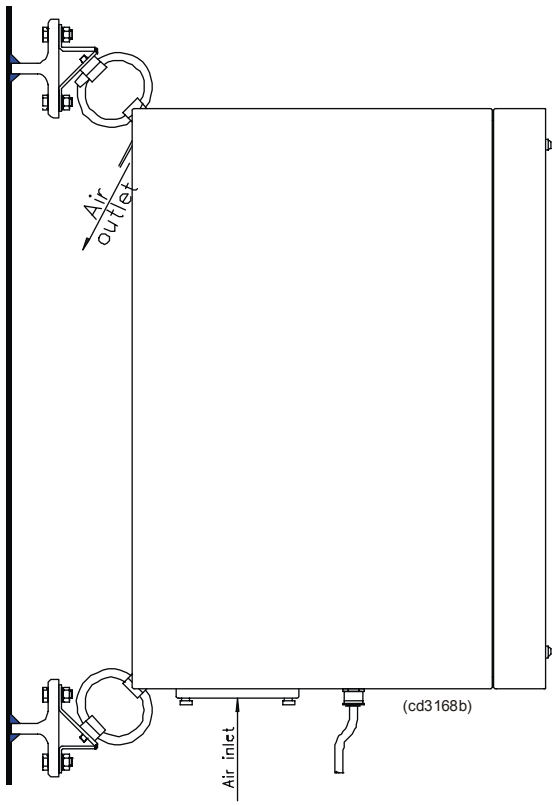


Figure 20 Illustration of cabinet mounting - side view

Note

For ventilation and maintenance purposes, there must be a minimum of 150 mm clear space between the transceiver unit and the next unit or bulkhead horizontally, and a minimum of 200 mm clear space below the unit.

→ *Refer to the figure on page 227 for further details.*

Unit location

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

Note

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

→ *For information about the transducer cables, refer to the HiPAP hull units Instruction manual.*

Logistics

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

Personnel- Minimum 3.

Qualifications - Trained mechanical/electrical fitters.

Ship location - No special requirements. The vessel's watertight integrity will not be effected.

Special tools - None.

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 ensure there will be no "surprises" when you weld the brackets to the bulkhead.

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

1 Select a suitable bulkhead.

→ *Refer to figure on page 227 for distance and access restrictions,*

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 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 a torque of approximately 50 Nm.
- Ensure the correct nuts and washers are used.

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

8 Connect the cables.

→ *Refer to section Cable layout and interconnection on page 104 for the wiring and interconnection diagrams.*

9 Once all the cables have been installed and the installation has been checked, remove all "foreign" matter from the cabinet and shut the door.

Caution ***Do not attempt to run the system before the checks listed in the* Test and Alignment procedure *section have been completed.***

TECHNICAL SPECIFICATION

Overview

This section describes the technical specification of the standard HiPAP 500 and HiPAP 350 units.

APC 10

The APC 10 unit is supplied with several standard cables. These cables limit the maximum distance between the APC 10 and the display unit.

Units dimensions

- Unit for desktop installation:

→ *See also drawing on page 223.*

Height of unit	160 mm
Height including mounting brackets	185 mm
Width	445 mm
Depth of unit	366 mm
Depth including handles	425 mm
Weight	approx. 17 kg

- Unit for rack installation (including rails and side plates):

→ *See also drawing on page 226.*

Height	185 mm
Width	485 mm
Depth	365 mm
Weight	approx. 17 kg

Note

In all cases, allow 100 mm space behind the unit for plug connections and cables.

Power

Voltage	115 / 230 Vac

- Selector-switch beside power connector.
- The power supply must be kept within ±10% of the unit's nominal voltage; 90-132 Vac/180-264 Vac.
- The maximum transient voltage variations on the main switchboard's bus-bars which could occur (except under fault conditions), are not to exceed -15% to +20% of the nominal voltage.

Frequency	50-60 Hz
Maximum current drawn	5 A
Normal current drawn	0.5 A
Nominal	80 W

Environment

Temperature:

Storage	-40 to +70°C
Operating	+10 to +55°C

Humidity:

Storage	95% relative
Operating	85% relative

Note

The unit must be kept in an operational environment with the room temperature and humidity within the specified limits, and in a corrosive, salt and dust-free atmosphere.

Vibration:

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

WinKeyboard

Unit dimensions

→ *See also drawing on page 224.*

Height max.	60 mm
Width	360 mm
Depth	212.5 mm
Weight	3 kg

A cable for connecting the keyboard into the APC 10 unit is provided.

Cable length	2 m

Transceiver unit

Overview

This section includes the transceiver unit technical data. These data are identical for both the HiPAP 500 and the HiPAP 350 transceiver units.

Units dimensions

Width (cabinet)	525 mm
Height	(cabinet) 713 mm/(overall) 919 mm
Depth overall	566 mm
Weight	55 kg

→ *See also drawing on page 227.*

Power

Voltage	230 Vac

- The power supply to a HiPAP transceiver unit must be kept within ± 10% of the unit's nominal voltage; 180-264 Vac.
- The maximum transient voltage variations on the main switchboard's bus-bars which could occur (except under fault conditions), are not to exceed -15% to +20% of the nominal voltage.

Frequency	50 - 60 Hz
Inrush max	500 W
Nominal	250 W

Environment

Temperature:

Storage	-20 to +65° C
Operational	0 to +35° C

Humidity:

Storage	90% relative
Operational	80% relative

Degree of protection	IP 44

The unit must be kept in an operational environment with the room temperature and humidity within the specified limits, and in a dust-free atmosphere.

CIRCUIT BOARDS AND POWER UNITS DESCRIPTION

Overview

This section provides information on the circuit boards and other units used in the Kongsberg Simrad standard HiPAP 500 and HiPAP 350 units. Signal processing with relevant I/O's are explained using block diagrams. Switch settings and links are described where necessary.

Circuit boards and power unit for the APC 10

General

This section provides a short functional description of the circuit boards and power unit contained within the APC 10.

Caution ***The APC 10 may be set up with various configurations of boards and units, depending on the actual delivery. The boards/units may also vary depending on availability. The "standard" boards and units are described here.***

The following circuit boards and units are described:

- Motherboard
- Serial line adapter board
- Ethernet board
- Video adapter board
- Power supply with internal cooling fan

→ *Refer to the figure on page 25.*

Motherboard D185EEA

For complete manual, refer to manufacturer;

fttp://support.intel.com/support/motherboards/desktop/

General

The motherboard is the main computer board in the APC 10 unit. It holds the microprocessor and supporting electronics, and controls all the input/output interfacing for the APC 10.

→ *The motherboard layout is shown in the figure on page 74.*

LEDs

As indicated on the board front panel.

→ *Refer to the figure on page 74.*

Test points

The motherboard D185EEA board holds no test points.

Switches

The motherboard D185EEA board holds no switches.

Links

The configuration jumper on the motherboard has three settings and three modes of operation as described in the table below. For placement of the configuration jumper.

→ *Refer to the figure on page 74.*

Configuration jumper		
Function	**Jumper J7B1**	**Description**
Normal (default)	1-2	BIOS uses current configuration information and passwords for booting.
Configure	2-3	After POST runs, Setup runs automatically. The Maintenance menu is displayed.
Recovery	None	The BIOS attempts to recover the BIOS configuration. A recovery diskette is required.

Table 1 Configuration jumper

Connectors

Front panel I/O connectors

The motherboard connectors and indicators located on the front panel are presented as follows:

→ *The placements of the connectors are illustrated in figure 21.*

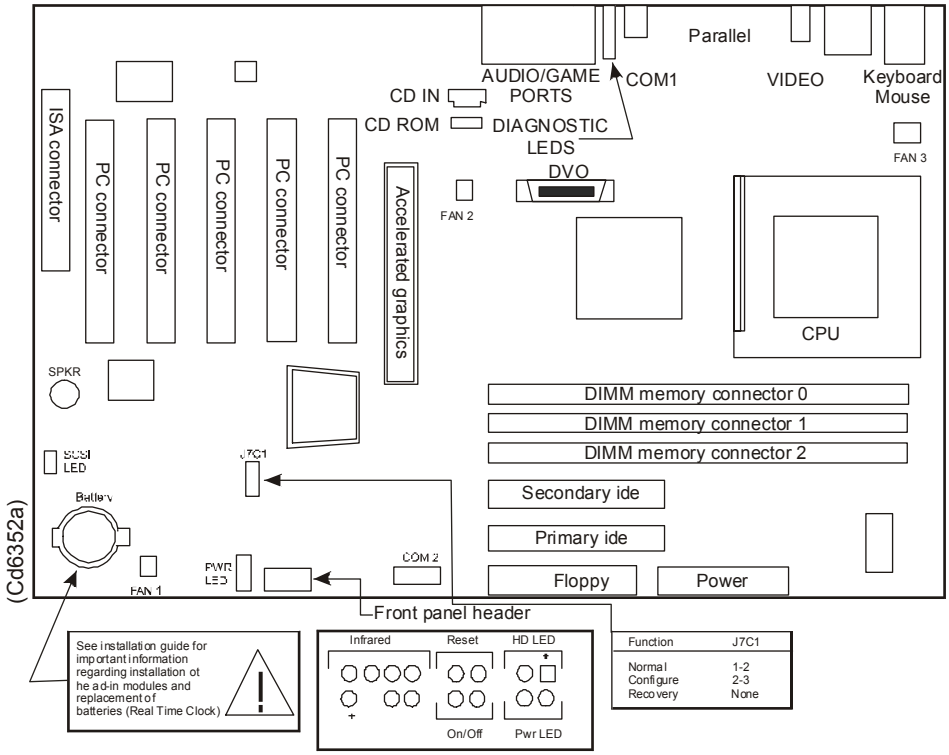


Figure 21 Motherboard with front panel I/O connectors

Rear side I/O connectors

The motherboard connectors on the rear side are presented as follows:

→ *The placements of the connectors are illustrated in figure 22.*

→ *The use of each connector is stated in table 2.*

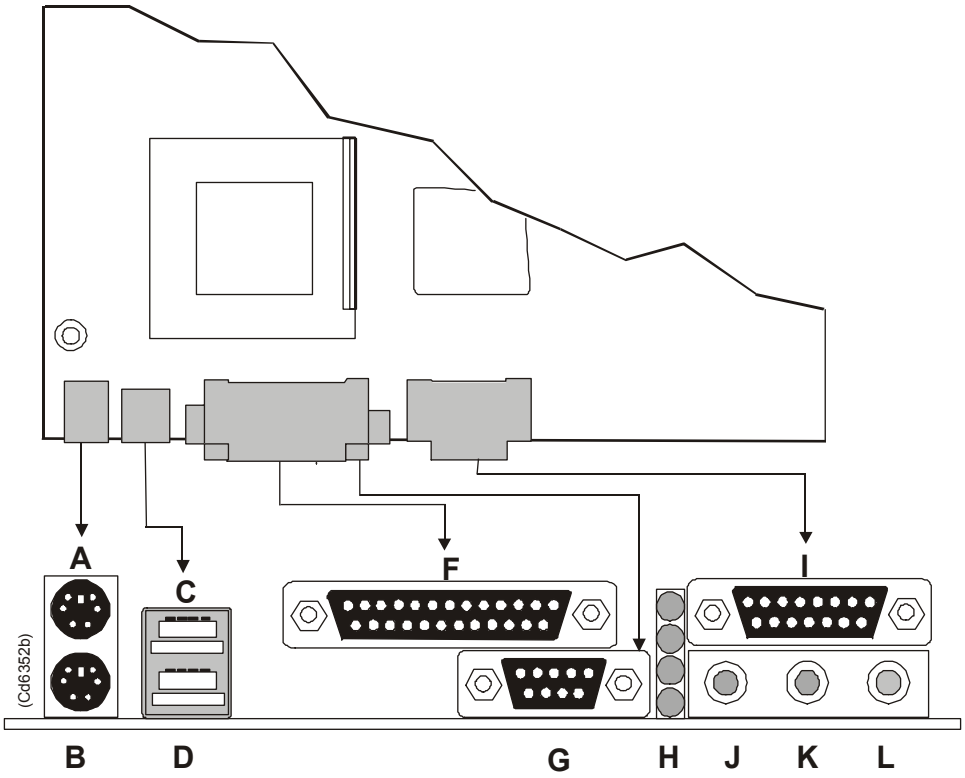


Figure 22 Motherboard rear side I/O connectors

The rear side connectors are as follows:

A PS/2 keyboard or mouse	**H** Diagnostic LEDs
B PS/2 keyboard or mouse	**I** Not used
C LAN connector with LED display (optional)	**J** Audio line out (green)
D USB Port 0	**K** Audio line in (blue)
F Parallel Port	**L** Not used
G Serial port A	

Table 2 Rear side I/O connectors

Battery

General

When your computer is turned off, a lithium battery maintains the current time-of-day clock and the values in CMOS RAM current.

The battery should last about 7 years, but must be replaced when required (for example when the date and time is no longer accurate).

Caution ***Danger of explosion if the battery is replaced incorrectly. Contact your service representative to obtain a qualified replacement.***

Changing the battery

To replace the battery proceed as follows:

1 Switch of the APC 10 power.

2 Turn off all peripheral devices connected to the computer.

3 Remove the APC 10 cover.

4 Locate the battery on the motherboard.

→ *See figure 23.*

5 Use a medium flat-bladed screwdriver, and gently pry the battery free from its socket.
Note the orientation of the + and - on the battery.

6 Install the new battery correctly.

7 Replace the APC 10 cover.

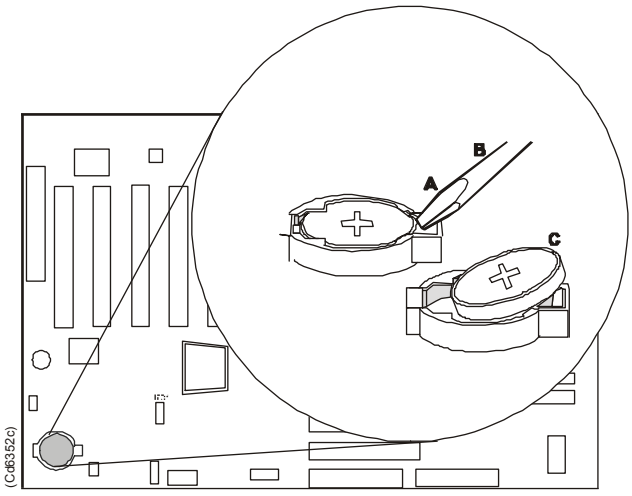


Figure 23 Replacing the battery

Blue Heat/PCI serial adapter

Manufacturer; http://www.connecttech.com

Introduction

The Blue Heat/PCI serial adapter is equipped with two RS-232 and two RS-422.

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

Blue Heat/PCI installation for Windows NT

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

- Install the driver

→ *Refer to the Blue Heat/PCI User Manual*

- Test the board

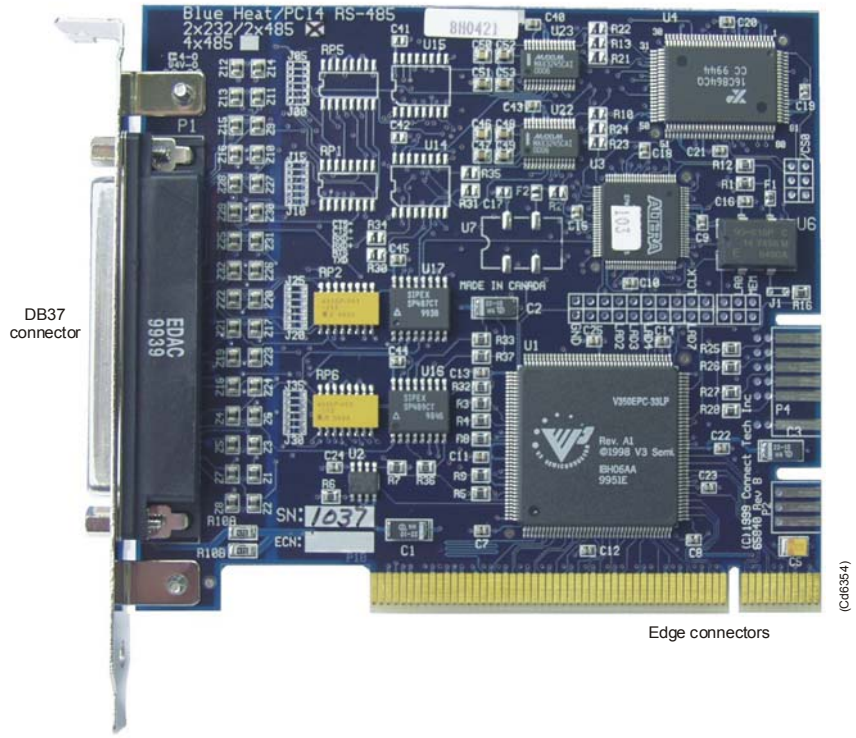


Figure 24 Blue Heat/PCI serial adapter board

Switches

The Blue Heat/PCI board holds no switches.

Links

The Blue Heat/PCI board holds no links.

Connectors

The Blue Heat/PCI board has:

- Two edge connectors to connect it into the motherboard.
- One 37-pin male D connector (DB37) for the serial lines.

→ *Refer to figure on page 77.*

Four cables are connected to the DB37, one for each of the com port connectors. The com port connectors are labelled. This is shown in the figure below.

(Cd6355)

Figure 25 Serial lines cable

COM 2 and COM 3 are RS-232.

COM 4 and COM 5 are RS-232.

Serial lines (Com) RS-232

The two or four serial lines pins are allocated as follows:

1 Carrier detect
2 Receive data
3 Transmit data
4 Data terminal ready
5 Ground
6 Data set ready
7 Ready to send
8 Clear to send
9 Ring indicator

Serial lines (Com) RS-422

The two or four serial lines pins are allocated as follows:

1 Reception data +
2 Transmission data +
3 Transmission data -
4 Reception data -
5 Ground

3Com 3C905C-TX Ethernet board

Introduction

The 3Com 3C905C-TX is a commercially available Ethernet card. A unit fitted with one of these boards will be able to communicate via Ethernet with other similarly equipped units in a system.

Note

For the board to function correctly, the board's Input Address must be set up correctly.

The Ethernet board is a "Repair-by-replacement" item. If the board develops a fault, the entire board must be replaced.

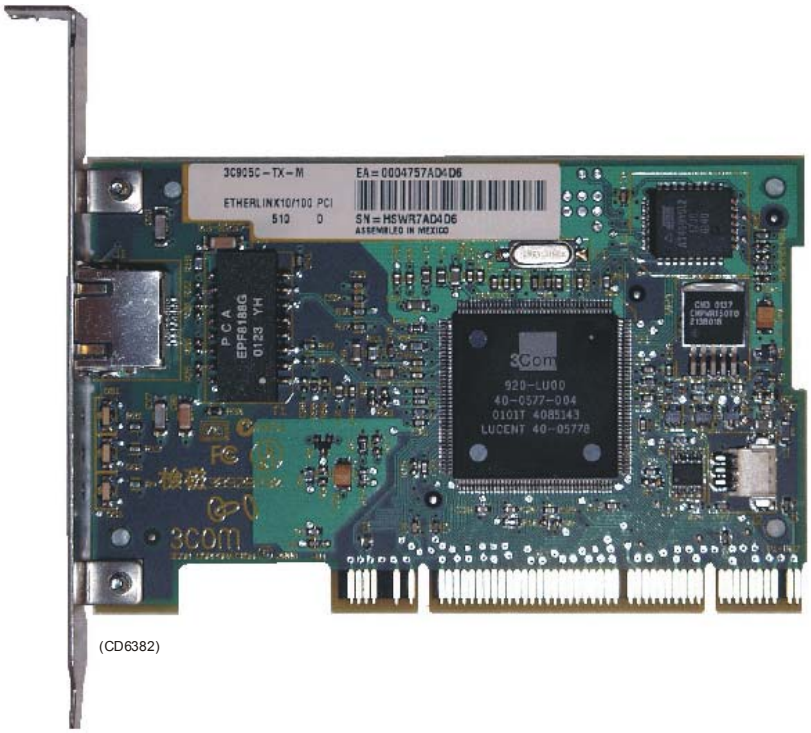


Figure 26 3Com 3C905C-TX board

Switches

The 3Com 3C905C-TX board holds no switches.

Links

The 3Com 3C905C-TX board holds no links.

Connectors

The 3Com 3C905C-TX board has:

- Three edge connectors to connect it into the motherboard.
- One standard RJ45 socket for external ethernet connection.

ATI Xpert 2000 Video adapter board

Introduction

The ATI Xpert 2000 is a commercially available video adapter board.

The video adapter is a “Repair-by-replacement” item. If the board develops a fault, the entire board must be replaced.

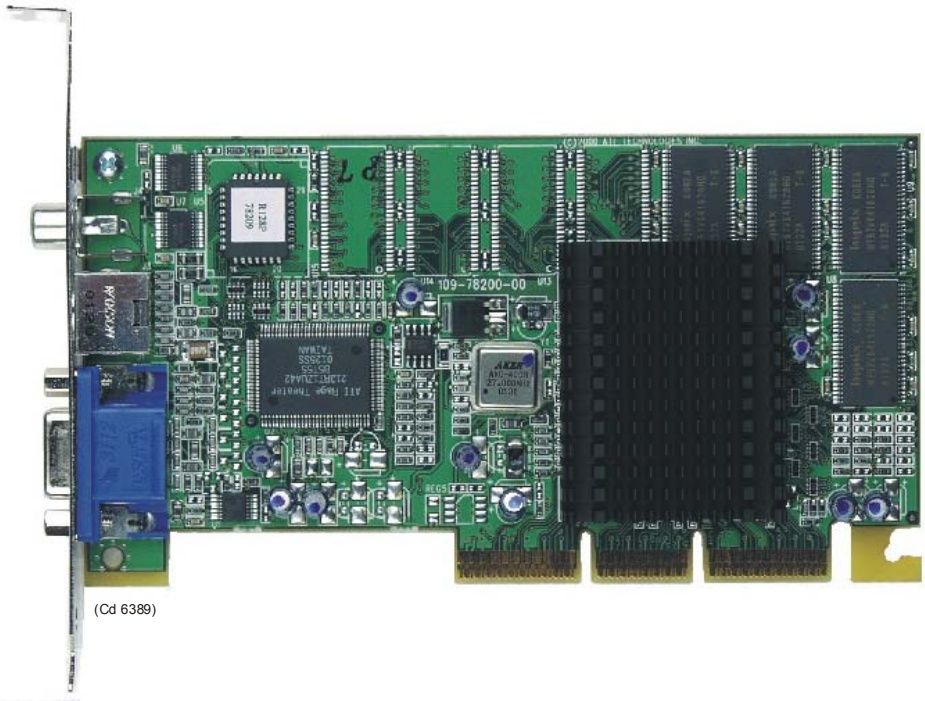


Figure 27 ATI Xpert 2000 video adapter board

Switches

The ATI Xpert 2000 board holds no switches.

Links

The ATI Xpert 2000 board holds no links.

Connectors

The ATI Xpert 2000 board has:

- Three edge connectors to connect it into the motherboard.
- One standard 15 pin D-connector for the monitor.

ATX series power supply

Introduction

The **ATX200-3505-226** AC power supply enables the computer to be powered from a 115/230 Vac mains supply.

The ATX200 is a commercially available power supply, and is purchased complete from an external supplier.

The unit requires a supply of 230 Vac or 115 Vac (change-over is performed by a selector switch on the rear of the unit), and provides a range of outputs to power harddisk, floppy disk, CD-read/write and computer motherboard.

This power supply is a sealed unit. In the event of malfunction, replace the unit.

Technical details

Dimensions (H x W x D)	146 x 120 x 170 mm
Weight	1.32 kg
Connectors:	P1, P2, P3, P4, P5, P6
Power requirements:	90-135 Vac / 180-265 Vac 47 - 63 Hz, 4 A at 115 Vac / 2 A at 230 Vac
Operating temperature	-10°C to +40°C
Storage temperature	-40°C to +70°C
Power outputs	+3.3 V, 0.3 - 14.0 A +5 V, 1.0 - 22.0 A+12 V, 0.05 - 6.0 A-12 V, 0.0 - 0.8 A-5 V, 0.0 - 0.5 A+5 VSB, 0.0 - 10 mA

Connectors

A wire loom holding six connector plugs is attached to the power supply as follows:

- P1 carries the power supplies to the motherboard.
- P2, P3, P4 and P5 carry power supplies to the harddisk and CD-read/write.
- P6 carries power supplies to the 3.5” floppy disk drive.

All the connectors are marked appropriately.

The connector pins in the plugs carry the supplies as follows:

Connector	Pin	Output	Mating connector
P1	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	+3.3 V +3.3 V Common +5 V Common +5 V Common POK +5 VSB +12 V +3.3 V and +3.3 V sense -12 V Common PS ON Common Common Common -5 V +5 V +5 V	Molex 39-28-1203 or equivalent.
P2, P3, P4, P5	1 2 3 4	+12 V Common Common +5 V	Amp 1480426-0 or equivalent.
P6	1 2 3 4	+5 V Common Common +12 V	Amp 171825-4 Vertical MT or equivalent. Amp 171826 -4 Horizontal MT or equivalent

Circuit boards and units for the transceiver units

General

This section gives a functional description of each of the circuit boards and units contained within the transceiver unit.

The following circuit boards and units are described:

- Transmitter/receiver board
- Power supply
- Main control panel
- Responder Terminl Block
- HTC-10 computer
- Transceiver memory control board (within the HTC-10 computer)
- Digi board (within the HTC-10 computer)
- Serial to Dual Net converter SDN 400 (Optional)

→ *Refer to the figure on page 37.*

Transmitter/receiver board (TRB)

General

A TRB holds a total of 32 transmitters and 32 receivers, and each transmitter/receiver pair is connected via a transmit/receive switch to a specific element in the transducer.

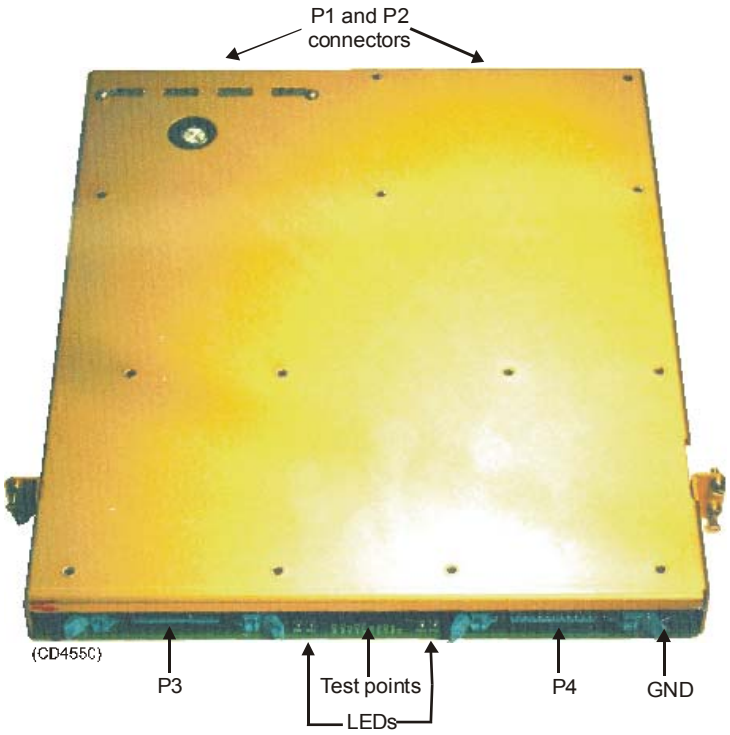


Figure 28 Transceiver/receiver board (TRB)

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

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

Transmission

The TRB contains a control interface that controls the 32 transmitters on the board. The transmitters can be controlled individually to enable beamforming of the transmitted pulse.

Reception

The TRB receives signals from 32 transducer elements. The signals are individually amplified, time-varied-gain regulated, demodulated, and analogue-to-digital converted. The converted signals are then output from the board and sent to the PC for further processing.

Technical details

Dimensions (H x W x D)	233.35 x 220 x 32 mm
Analogue input/output:	32 channels, 60 Ω, + T/R switch
Connectors:	Two 96-pin euro on back edge of board, two 34-pin flat cables on front edge
Frequency range:	Transmitter - 23 to 26.5 kHz Receiver - 25 to 29 kHz.
TVG:	90 dB
Analogue to Digital:	12 bits resolution, I/Q simultaneously converted to 32-bit latched bus
Transmitter:	Max. 20 W per channel. Duty cycle controlled.
Power requirements:	+ 5 Vdc, ± 8 Vdc, + 24 Vdc

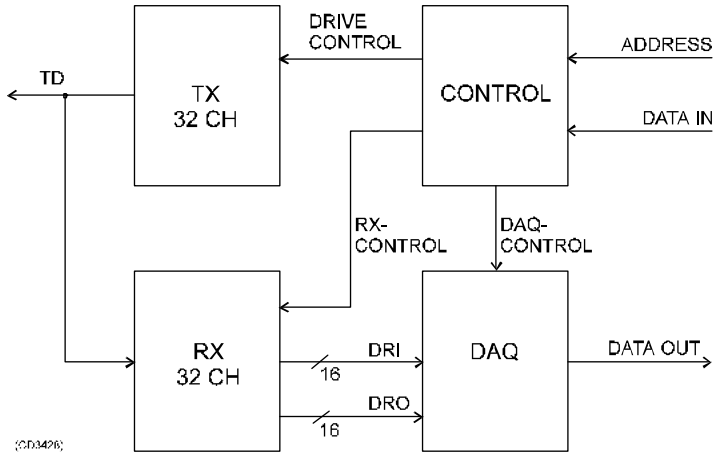


Figure 29 TRB functional block diagram

Test points

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

AVEE analogue voltage	- 5 V
AVCC analogue voltage	+ 5 V
VCC digital voltage	+ 5 V
AVDD analogue voltage	+ 15 V
VCC4 analogue voltage	+ 5 V
HV1 high voltage transmitter	+ 24 V
HV2 high voltage transmitter	+ 24 V
HV3 high voltage transmitter	+ 24 V
HV4 high voltage transmitter	+ 24 V

LEDs

The TRB holds ten red LEDs on its front edge, mounted in a vertical line between the connectors.

→ *See figure on page 85.*

When these LEDs are lit, they indicate the presence of the corresponding voltage levels listed above in paragraph *Test points*.

Switches

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

Links

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

Connectors

The TRB carries four connectors, two located at each end of the board.

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

POWEC power supply

General

The POWEC low-voltage power supply is located in the rack. This supply is a plug-in unit. It is purchased by Kongsberg Simrad.

Technical details

Type	PMP 4.M08 SIC
Dimensions (H x W x D)	262 x 60 x 254 mm
Weight	2.3 kg
Connectors	2 x 48-pin, + mains on rear of board
Power requirements	161 - 276 Vac, 44 - 66 Hz, < 3.2 A at max. load
Power output	+ 5 Vdc, ± 8 Vdc, + 24 Vdc

Test points

The POWEC power supply unit holds no test points intended for use by the maintenance engineer.

Switches

The power supply holds no switches.

Links

The power supply has no links that are adjustable by the maintenance engineer.

LEDs

The power supply unit has three LEDs mounted in a vertical line on its front panel. These are used to indicate as follows:

- LED 1 - Green, indicates power on when lit.
- LED 2 - Red, not used.
- LED 3 - Red, indicates an alarm condition. (If the output goes below 10% of the set value).
  - Does not apply to the 24 Vdc.

Fuse

The POWEC power supply unit contains one fuse. This is located on the rear of the unit, in the mains power connection block. The unit must therefore be removed from the rack if the fuse is to be replaced.

Fuse type:	5 mm Ø x 20 mm, 250 V, 3.15 A, slow-blow

WARNING **Ensure all power to the transceiver unit is switched off before attempting the operation described below.**

Note *The mains power plug must be disconnected before the POWEC unit can be removed from the transceiver unit.*

To achieve this:

1. Remove the service panel from the unit.
2. Withdraw the POWEC unit as far as possible, and then put your hand into the space left by the service panel and disconnect the plug.
   - The mains plug must be reconnected by reversing the procedure when replacing the POWEC unit into the transceiver unit.

Connectors

Two 48-pin connectors and one standard 3-pin mains power input connector are located on the rear of the unit.

Main control panel

General

The main control panel is located to the right side of the 19" rack. The main control panel carries (from the top):

- A standard, earthed, mains power socket
- An earthing bracelet socket
- A double-pole breaker

The panel is a plug-in unit, secured in position by two thumb-screws.

Note

The power socket is only to be used to power measuring instruments.

Technical details

Dimensions (H x W x D)	262 x 82 x 254 mm
Weight	0.9 kg
Power requirements	230 Vac, 50 Hz mains supply
Power output	230 Vac, 50 Hz supply to instruments

Test points

The main control panel has no specific test points for use by the maintenance engineer.

Links

The Main control panel holds no links.

Switches

The main control panel holds one double-pole breaker mounted on its front panel. This breaker is the main power switch for the transceiver unit.

LEDs

The Main control panel holds no LEDs.

Fuse

The double-pole breaker on the front panel serves as an automatic fuse for both power leads into the transceiver unit. The breaker will trip automatically if the current drawn by the transceiver unit exceeds 10 A.

Connectors

The main control panel carries three connectors:

1 The mains power connector is located horizontally on the rear edge. This connects 230 Vac power from the mains input cable into the main control panel while the panel is installed in the transceiver unit.

2 Power is supplied via the main breaker to the transceiver unit's 230 Vac bus.

3 Socket for earthing bracelet.

- The Electro-Static Discharge (ESD) earthing point connector is a standard 4 mm banana socket. An ESD bracelet plugged into this connector **MUST** be used by the maintenance engineer whenever he/she is working on the transceiver unit.

The rear connector is laid out as show below (seen from rear of the main control panel).

The power socket on the front panel is a standard mains supply socket (Norwegian), and is only to be used for powering measuring instruments. The maximum current output is 5 A. Power is available to the mains socket at all times.

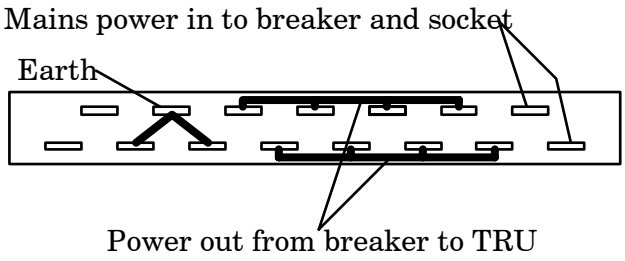


Figure 30 Layout of the rear connector

Responder Terminal Block (RTB)

Purpose

The purpose of the RTB module is to provide responder trigger pulses as ordered by the Operator Station.

Board description

The RTB module is located in the bottom of the transceiver unit. The module holds four identical opto-isolated responder trigger circuits, and communicates with the TMC II board in the HTC-10 via a flat cable.

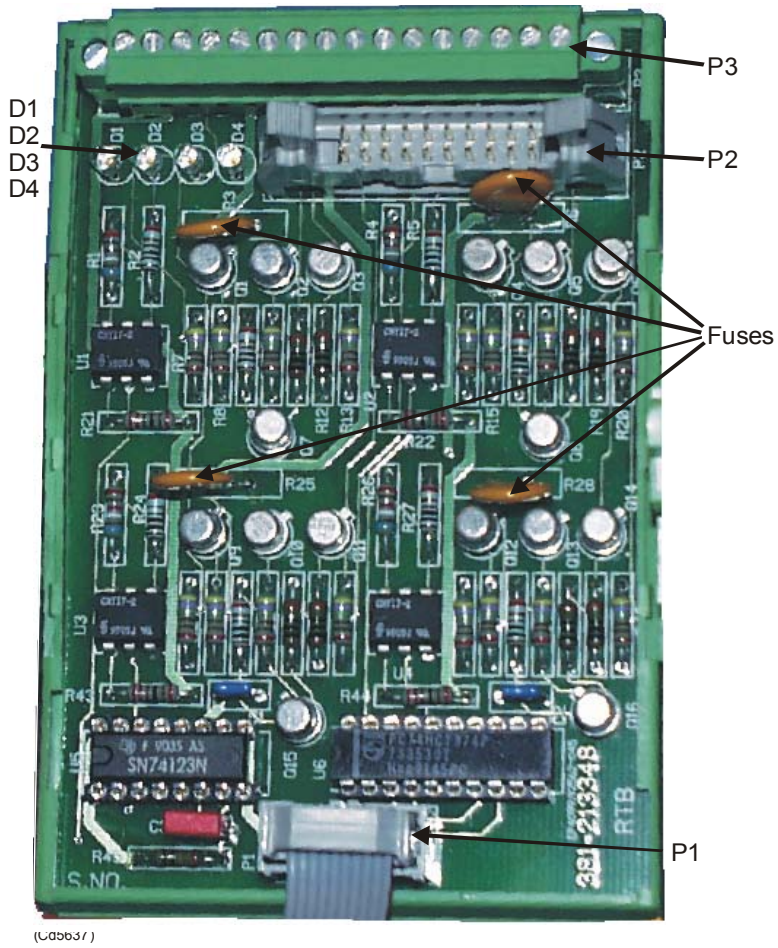


Figure 31 RTB module

Circuit description

The module needs external +5 VDC (P3 15) and GND (P3 16), normally supplied from the transceiver unit backplane.

+24 Vdc is normally supplied from the internal responder power supply. If required, it can be supplied externally.

The select signals (D0 -D3) for the responder to be activated, are latched in U6.

A control WR signal is input to a one shot circuit U5 generating the responder trig pulse of a fixed length (5.5 ms). This pulse is connected to U6 producing the trigger pulse to the selected opto-coupler. The output of the opto-coupler (U1,U3,U4,U2) drives a responder driver circuit.

→ *Refer to the block diagram on page 94.*

Each trigger pulse circuit is protected by a *self repairing fuse* which also secures the supply voltage to the responder.

The trigger pulses are brought out via P3 as follows:

13 - 14 to: Responder 1

10 - 11 to: Responder 2

7 - 8 to: Responder 3

4 - 5 to: Responder 4

Test points

The RPC has no specific test points for use by the maintenance engineer.

LEDs

D1	Lights when Responder 4 is transmitting
D2	Lights when Responder 3 is transmitting
D3	Lights when Responder 2 is transmitting
D4	Lights when Responder 1 is transmitting

Links

The RTB board holds no links.

Switches

The RTB board holds no switches.

Fuses

The unit carries four 1.1 A PTC fuses (self repairing), on the +24 Vdc lines.

→ *Placement of fuses are indicated on the figure on page 94.*

Connections

→ *Placement of P1, P2 and P3 is shown in the figure on page 92.*

- **P1** - connector for the select and control signals coming from the TMC II board in the HTC-10 computer.
- **P2** - socket for connection of the signals for driving LEDs on the cover plate of the module, in parallel with D1, D2, D3 and D4 on the module.

→ *Refer to the figure on page 92.*

- **P3** - terminal block for connection of the driver output signals and power to the responders.

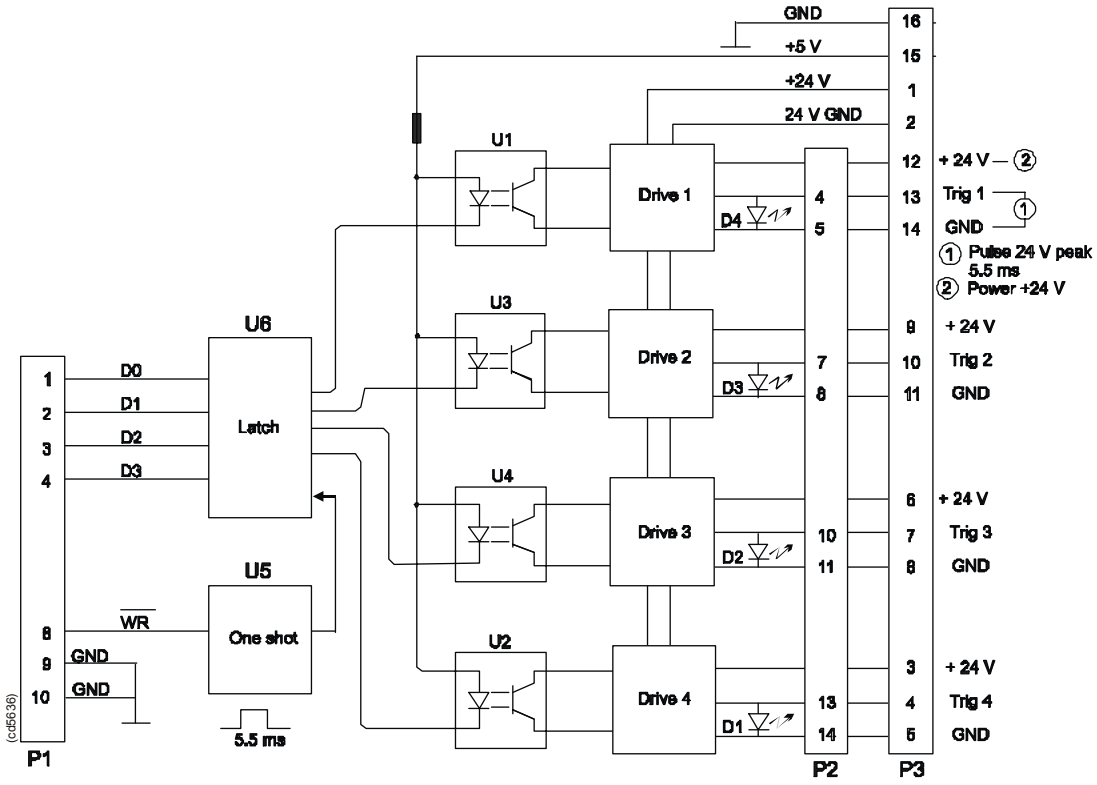


Figure 32 Responder Terminal Block - block diagram

HTC-10 computer

General

A HTC-10 computer is used in the transceiver unit to perform the transmission and reception signal processing calculations.

Technical details

Dimensions:

Height	110 mm
Width	437 mm
Depth	411 mm
Weight	9.1 kg

Power requirements	230 Vac, 50 Hz

Connections

The connections to the HTC-10 computer are as follows:

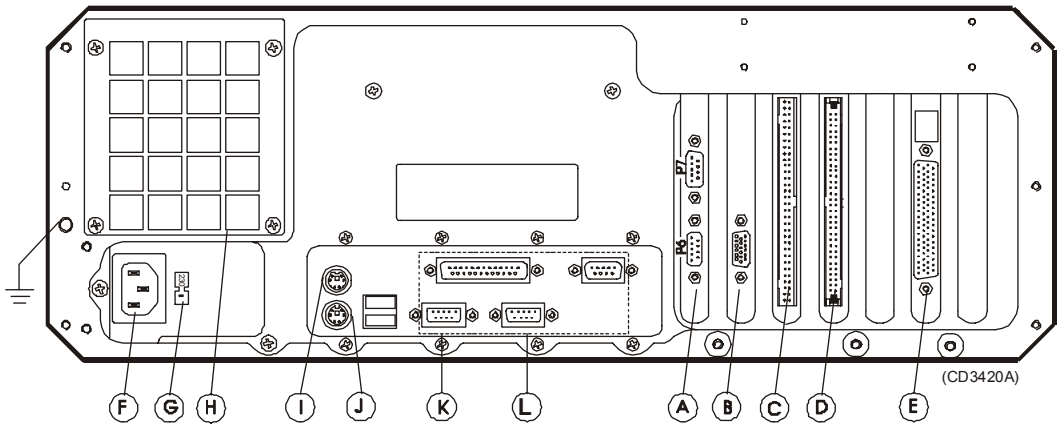


Figure 33 HTC-10 computer - rear-mounted connectors

The features are as follows:

- A
  - **P6** TMC II Sync signals (option)
  - **P7** TMC II Responder control signals
- B VGA video connector
- C TMC II Address control signals
- D TMC II Databus
- E Digi board (serial lines)
- F Socket for ac power cord
- G AC input voltage select switch
- H Power supply fan
- I Keyboard connector
- J Mouse connector
- K Com1
- L Com2

Transceiver memory control (TMC II) board

General description

The main function of this board:

- Controls the transmitters and receivers on the TRB boards.
- Collects all the sample data.
- Transfers the data to the transceiver PC for digital signal processing.

The TMC II board is a PCI plug-in board, containing a digital signal processor (DSP), and a 80960 CPU system with PCI interface.

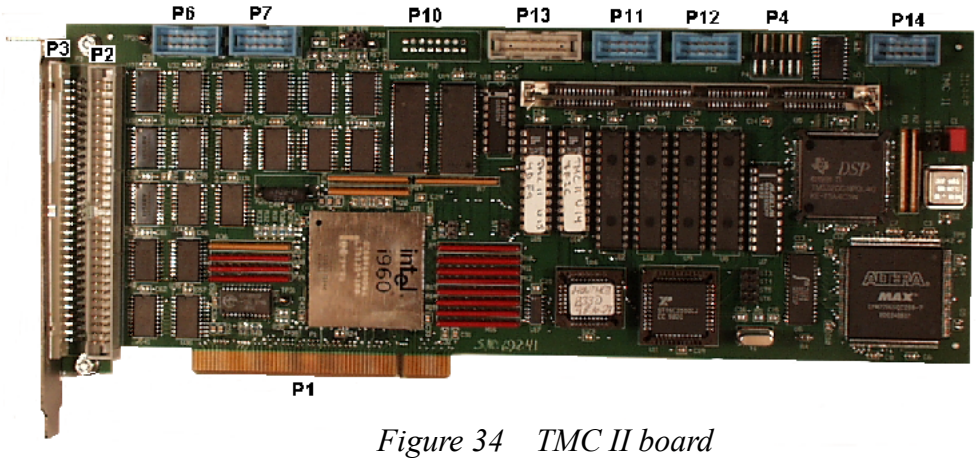


Figure 34 TMC II board

Circuit description

The DSP is loaded with its program from the Transceiver PC (HTC 10), through the PCI Interface connector, the 80960 PCI Interface block,and through buffers to the RAM memory.

The TMC II controls all the transmitters and receivers on the TRBs via a 16-bit address bus and a 32-bit data bus (control TX/RX).

The TMC II receives sample data from the TRBs and stores the data in the FIFO memory.

The Transceiver PC (HTC-10) is supplied with data from the FIFO memory through the 80960 PCI Interface in DMA mode, and processes it as required. The system computer is interrupted by the DSP when real data arrives in the FIFO memory.

The TMC II board is located inside the HTC-10 in a PCI slot.

Technical details

Dimensions (H x W x D)	111 x 20 x 290 mm
Weight	0.3 kg
Power requirements	+ 5 V, + 3.3 V
PCI Interface	PCI PC bus interface
Buffer	Address and Data buffer to isolate the 80960 part and the DSP part of the board
FIFO	Flexible buffer for sample data
DSP	Digital signal processor
RAM	64k x 32-bit program and sample RAM
Frequency generator	Generates all frequencies and sample hold, and control signals needed for the TRB boards
Control TX/RX	Control and Data signals to the receivers and transmitters on the TRB boards

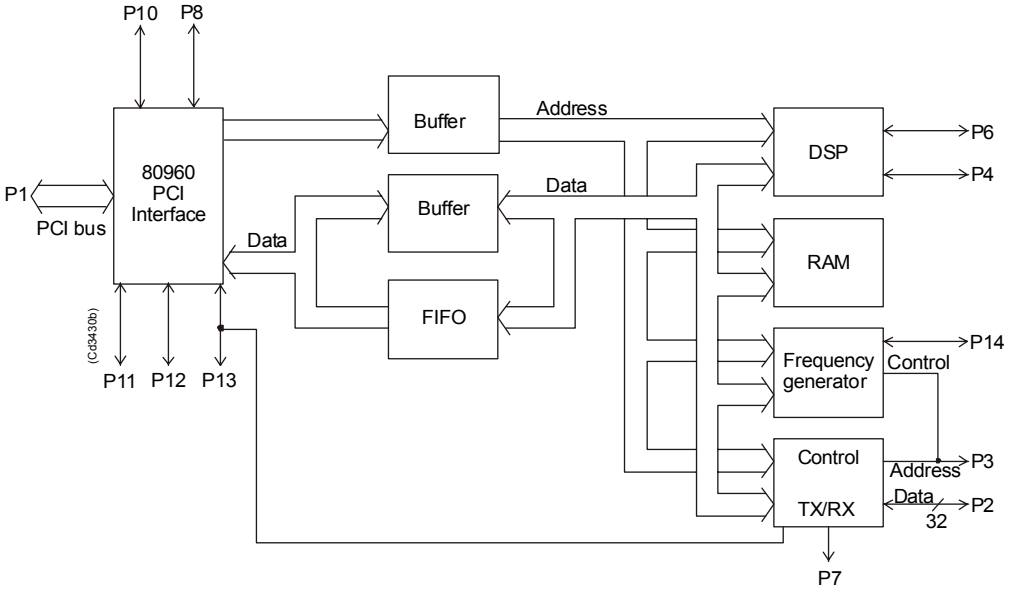


Figure 35 TMC II functional - block diagram

Test points

The following oscilloscope test points are available to assist the maintenance engineer:

- TP1-30 - Not mounted (for internal use only)
- TP31 - S_CLK (PCI clock)
- TP32 - + 5 V
- TP33 - Gnd

Links

The TMC II holds the following links:

- ST1 - Reset (Open)
- ST2 - MCBL/MP (Closed)
- ST3 - RX B Serial line 2 interface 80960 (Open)
- ST4 - /CTSA Serial line 1 interface 80960 (Open)
- ST5 - TX B Serial line 2 interface 80960 (Open)
- ST6 - /RTSA Serial line 1 interface 80960 (Open)
- ST7 - S_IDSEL To 80960 Not used (Open)
- ST8 - /S_REQ 5 To 80960 Not used (Open)
- ST9 - LRST Terminate to GND Not used (Open)
- ST10 - /D/C Terminate to GND Not used (Open)
- SK11 - XFO Not used (Open)

/ indicates active low

Switches

The TMC II holds no switches.

Connectors

The TMC II has the following connectors:

- P1 - PCI PC bus interface
- P2 - 32-bit data bus to TRB boards
- P3 - 16-bit address bus and control signals to TRB boards
- P4 - DSP emulator plug
- P6 - Synch plug
- P7 - Responder control plug
- P10 - 80960 Debug Interface (Not used)
- P11 - Serial line 1 interface 80960
- P12 - Serial line 2 interface 80960
- P13 - LED indicators
- P14 - Frequency generator programming connector

Digi board

General

The Digi board is located inside the HTC-10 in a ISA slot.

The main function of this board is to handle the communication from the HTC-10 computer to the "outside world". The communication is done with RS-422 serial lines. The Digi board is a ISA bus plug-in board.

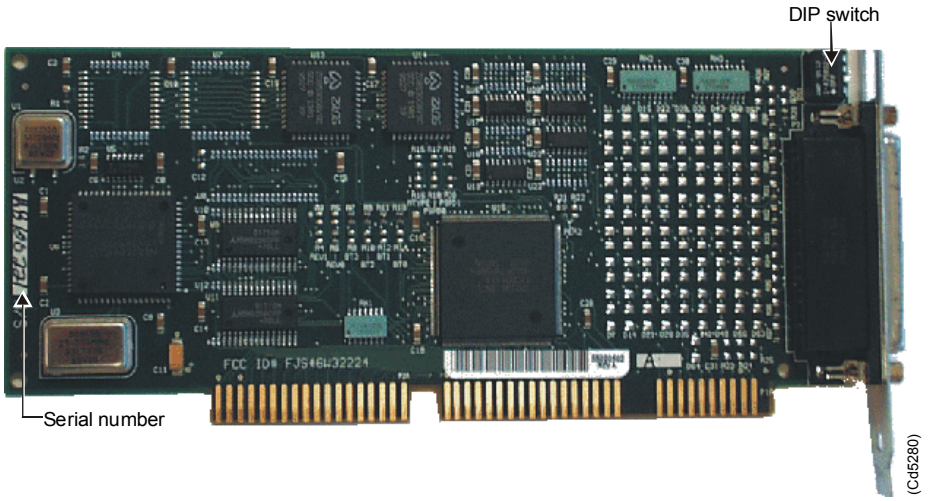


Figure 36 Digi board

A Digi board has 4 COM ports. If your application requires more than 4 COM ports, you have to install one more Digi boards.

Technical details

Dimensions (H x W x D)	90 x 20 x 200 mm
Weight	0.13 kg
Power requirements	+5 Vdc 2.25A
Interface	ISA PC bus interface
CPU	80186 microprocessor
RAM	64k b of dual ported RAM

Test points

The Digi board holds no test points intended for use by the maintenance engineer.

Links

The Digi board has no links that are adjustable by the maintenance engineer.

Switches

The Digi board holds one dip-switch block.

The settings are as follows:
(*ON position* - switch position towards the circuit board)

Settings for COM 3 to COM 6 (220H - 223H)

Switch	Setting
1	**ON**
2	**OFF**
3	**ON**
4	**ON** (This switch must always be in the on position)

Settings for COM 7 to COM 10 (120H - 123H)

Switch	Setting
1	**OFF**
2	**ON**
3	**ON**
4	**ON** (This switch must always be in the on position)

Connectors

The Digi board has the following connectors:

- P1A - ISA PC buss interface
- P2 A - ISA PC buss interface
- P3 - Interface for the RS-422 serial line

SDN 400

General description

This is the Serial to Dual Net converter. The function of this unit is to convert from serial line to dual ethernet interface. This is required to interface the HiPAP transceiver to ethernet.

The unit includes one circuit board. This board is not described here.

Connections

The connections to and from the unit are as follows:

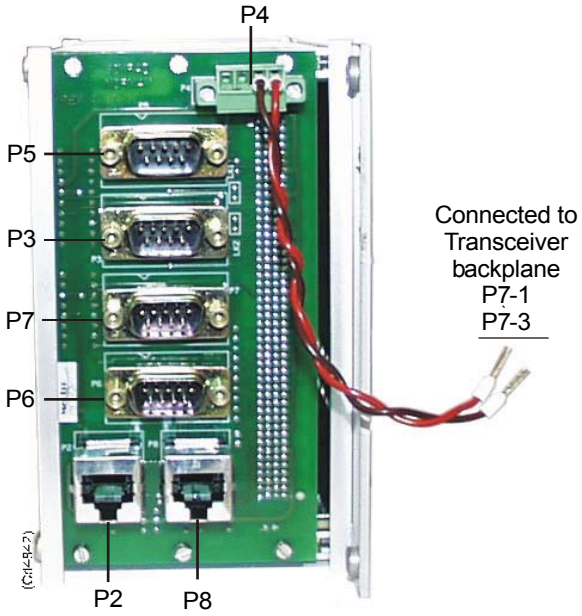


Figure 37 SDN 400 - rear side

- P4 - Power connector
- P5/P3/P7 - Spare
- P6 - Connection to Terminal Block 1 (Signals input/output)
- P2 - Connection from dual ethernet termination box

Connectors

- P8 - Connection from dual ethernet termination box

Maintenance aids

None.

Switch settings

APC 10 computer

There are no switches to be set by the operator at the APC 10 computer.

Display unit

Refer to the separate Display unit manual (delivered with the unit) for information on switch settings.

Transceiver unit

The Responder Controller (RPC) circuit board contained within the transceiver unit holds one switch block. These switches must not be tampered with by unqualified personnel, and are in any case not normally accessible. Only attempt to adjust the settings if they are known to be wrong.

The settings are as follows:

Switch	Setting
1	**ON**
2	**ON**
3	**ON**
All other switches in the block must be set to:	**OFF**

HTC-10, Digi board

The Digi board contained within the transceiver unit's HTC-10 computer holds one switch block.

→ *For switch settings refer to page 101.*

CABLE LAYOUT AND INTERCONNECTIONS

Overview

This section describes the general installation requirements regarding cables, and then describes all the cables used in the HiPAP system. It explains how to perform the interconnections between the various units in the system.

Note — *This section describes only the "cabinet" cables. All cables connected to the hull unit are described in the HiPAP hull units Instruction manual.*

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 Simrad 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.

Cable gland assembly procedure

Purpose

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

Note

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

Even though the cabinets from Kongsberg Simrad may be prepared for specific types, the installation shipyard 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.

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

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

Note

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

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

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

or:

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

Note

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

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

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

Securing and terminating the cables

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

2 Secure the cable within the cabinet using cable clips.

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

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

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

Once all the system cables are connected and checked:

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

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

Multi-diameter modules

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

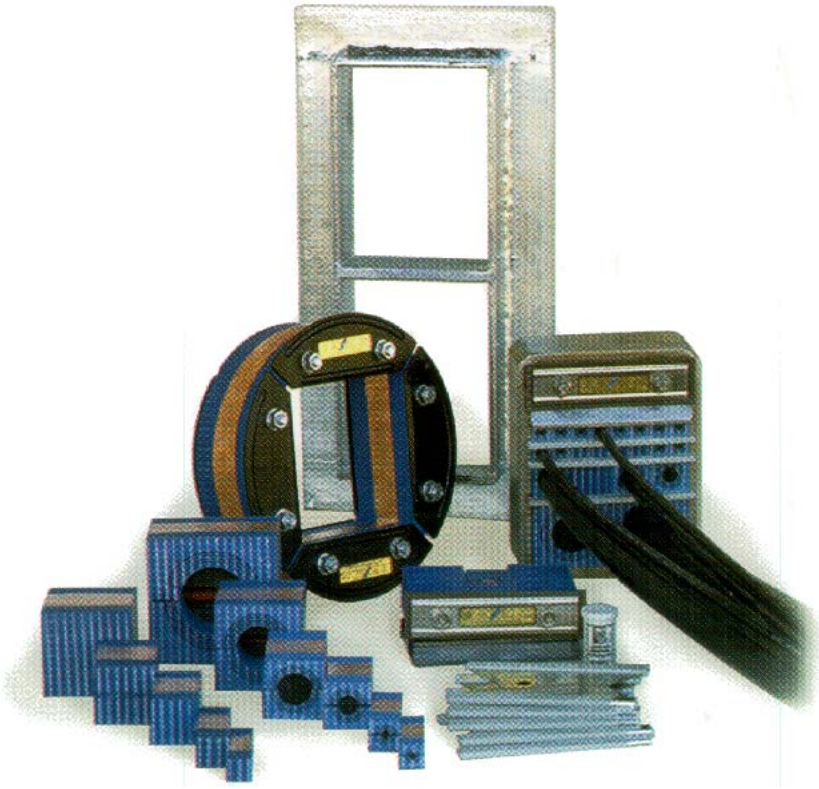


Figure 38 Multi-diameter modules (example)

The illustrations and examples here are from the following manufacturer:

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

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

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

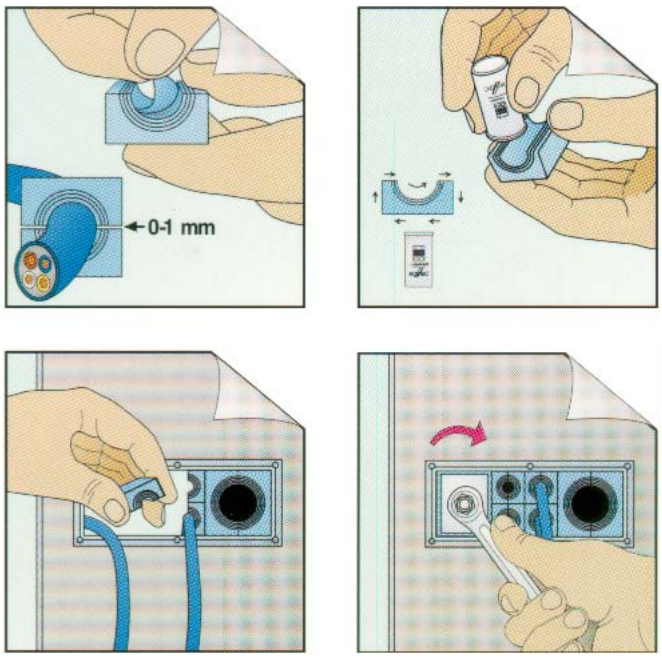


Figure 39 Multi-diameter system - Principal procedure

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

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

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

Standard type

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

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

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

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

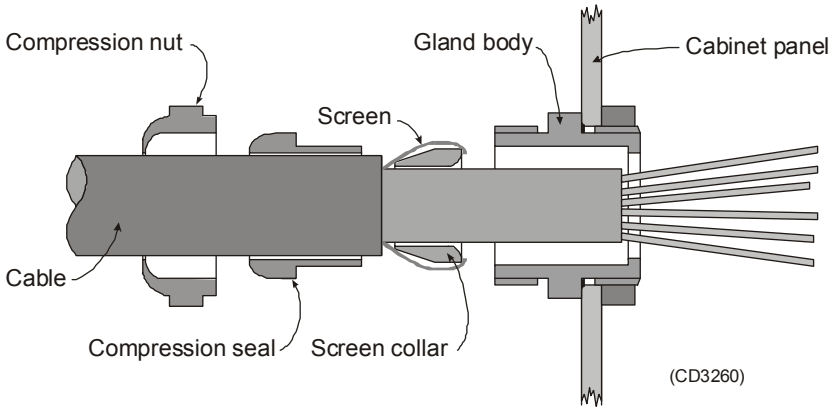


Figure 40 Standard cable gland assembly

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.*

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

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

or:

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

Note

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

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

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

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

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

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

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

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

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

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

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

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

16 Secure the cable within the cabinet using cable clips.

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

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

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

Once all the system cables are connected and checked:

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

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

Additional type 1 (842-093878)

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

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

→ *Refer to figure 41.*

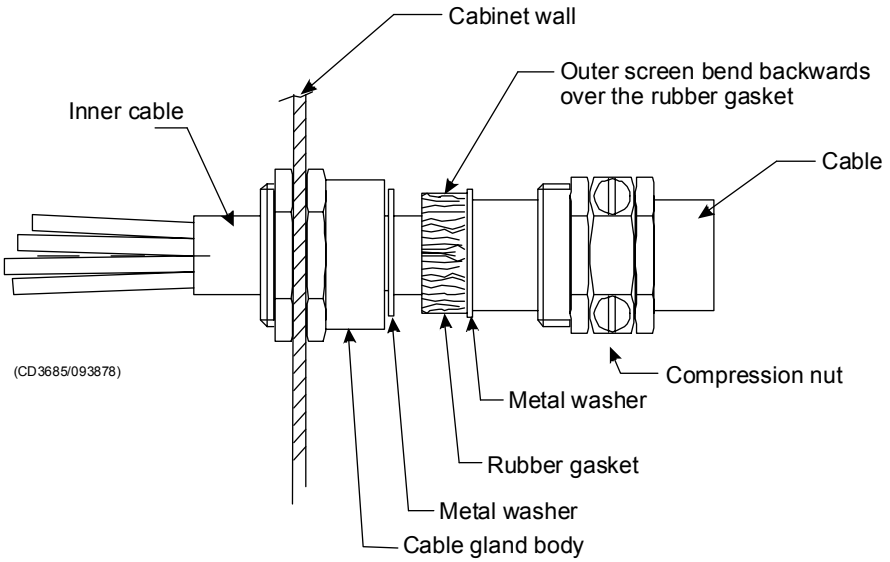


Figure 41 Cable gland, type 1 (842-093878)

3 Bend the screen over the rubber gasket.

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

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

Additional type 2 (541-093642)

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

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

→ *Refer to figure 42.*

3 Bend the screen over the compression cone.

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

5 Close the mounting nut.

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

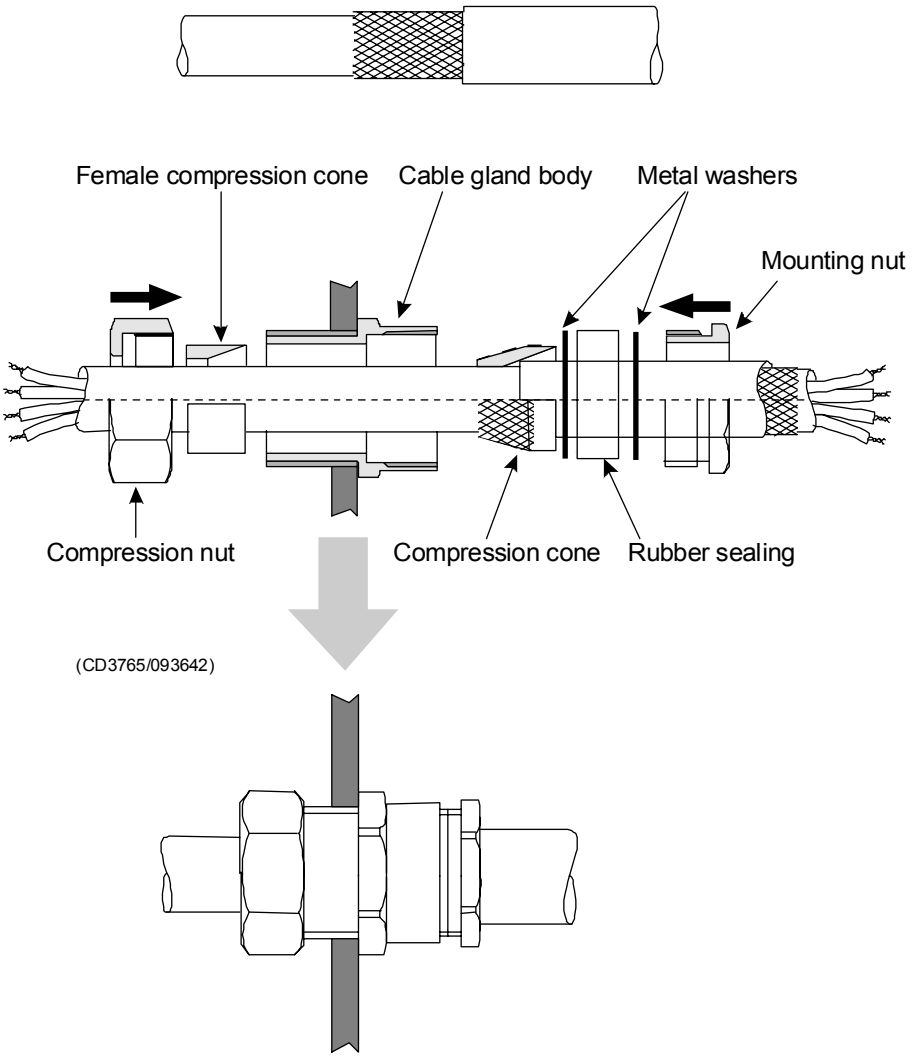


Figure 42 Cable gland, type 2 (541-093642)

Basic cabling requirements

Cable trays

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

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

Radio Frequency interference

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

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

Physical protection

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

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

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

Grounding

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

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

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

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

Cable connections

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

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

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

Cable terminations

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

Cable identification

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

HiPAP cable plan

General

This section describe the cabling required for a standard Kongsberg Simrad HiPAP system installation with the APC 10 computer.

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

Note — *The hull unit cables are described in the HiPAP hull units Instruction manual.*

→ *Refer to page 113 in this section for details of cable laying, requirements for conduits etc.*

→ *Refer to the relevant cable plans and wiring diagrams for details of the terminations and connections.*

All power must be switched off to the system prior to the cable installation.

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

Note — *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.*

APC 10 cables

The figure below illustrates the cabling of the APC 10.

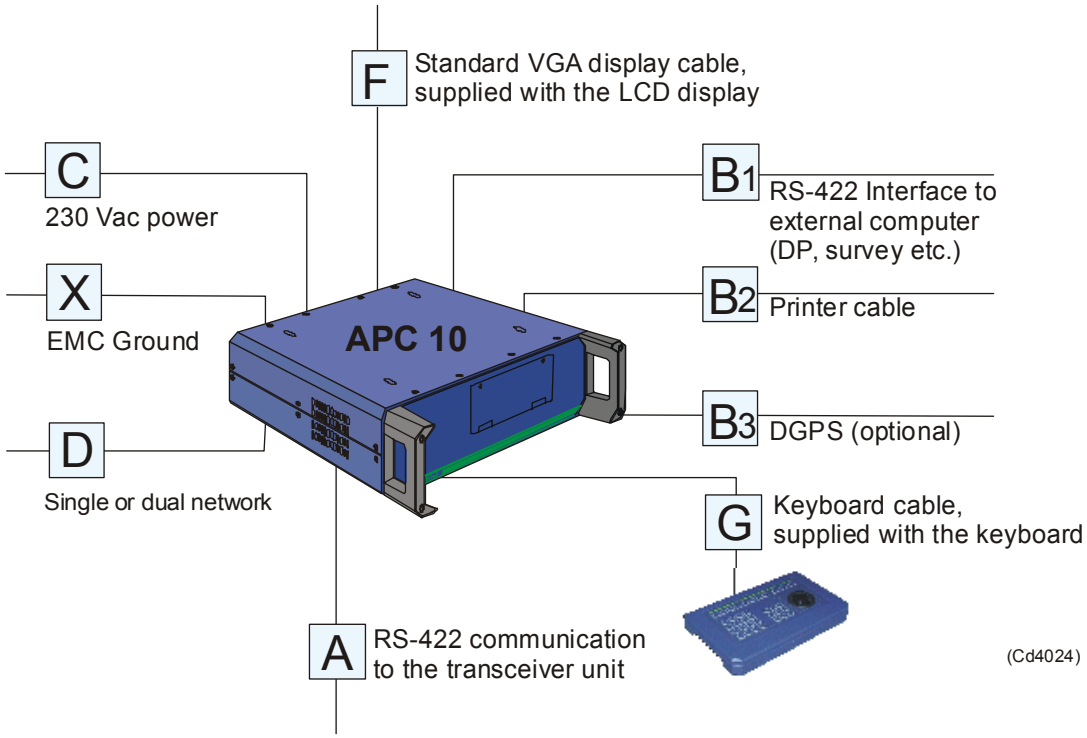


Figure 43 APC 10 cabling

Cable A **RS-422 Serial line cable to the HiPAP transceiver unit**

- Shipyard supply.
- 3 x 2 / 0.5 mm^2, overall braided screen, 60 V.
- RFI screen must be connected to the plug housing.
- Maximum length: 1000 m.

Cable B **RS-422 Serial line cable to external computer or other peripheral devices**

- Shipyard supply.
- 3 x 2 / 0.5 mm^2, overall braided screen, 60 V.
- RFI screen must be connected to the plug housing.
- Maximum length: 1000 m.

Cable C **230 Vac power supply to the APC 10**

- Shipyard supply.
- 3 x 1 / 1.5 mm^2 with ground as separate conductor, 750 V.
- APC 10 end terminated in standard 3-pin AC supply female connector.
- Maximum length: No practical limits.

Cable D **Dual or single network**

→ *Refer to section Single/dual net on page 142.*

Cable F **Standard VGA cable between APC 10 and LCD display**

- Included with the delivery.

Cable G **Signal cable between APC 10 and WinKeyboard**

- Standard 2 m, included with the delivery.

Cable X **Braided grounding cable to connect the cabinet to EMC ground**

- Included with the delivery (Kongsberg Simrad part no.649-096720).
- 2 x 7 mm.
- Maximum length: 1 m.

APC 10 connections

All connections too and from the APC 10 are made on the rear of the unit. The rear panel is made up of three sections of connectors:

- **Mains power input:**
  - Power input
- **Motherboard connectors:**
  - Mouse connector (trackball)
  - Keyboard PS/2 style connector
  - USB connector (not used)
  - 9-pin D-connector, serial port 1 (RS-232) COM 1
  - 25-pin D-connector, parallel port for printer
  - 9-pin D-connector for keyboard lighting and power
- **PCB connectors:**
  - 15-pin D-connector, VGA video connector
  - 37-pin D-connector, COM 2, COM 3, COM 4 and COM 5
  - Ethernet connector

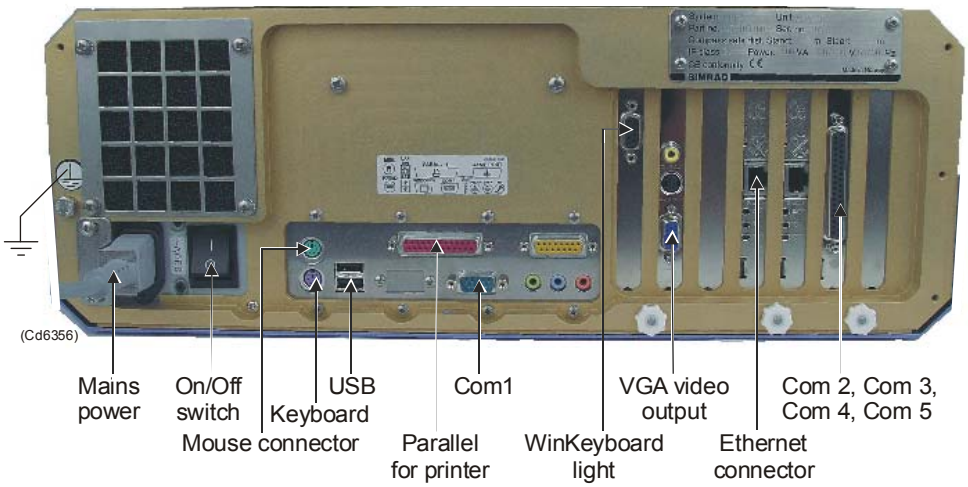


Figure 44 APC 10 rear panel

APC 10 interconnections

Standard cables

The following cables are regarded as “standard”, and are connected into the appropriate sockets on the rear of the APC 10:

C 230 Vac to the APC 10

D 230 Vac to the display

F Special VGA cable

G Keyboard cable

Different connector types are used on the various cables to ensure the correct connections.

Serial line cables

APC 10 computer

Up to four serial lines can be connected to the 37-pin D-connector identified as COM 2, COM 3, COM 4 and COM 5 on the rear of the APC 10.

- The one standard serial line (Serial line 1) on the APC 10 motherboard are always RS-232.
- Serial lines 2, 3, 4 and 5 are normally the four lines on each Serial adapter board mounted within the APC 10, and these can be RS-232 or RS-422.

In principle, a number of serial lines may be used.

Cable A

This serial line is an RS-422 interface. The cable plugs into one of the COM ports on the rear of the APC 10, and to terminal block 1 in the transceiver unit.

Note

RS-422 is the standard. RS-232 can be supplied on special order.

The connections used are recorded in the system software.

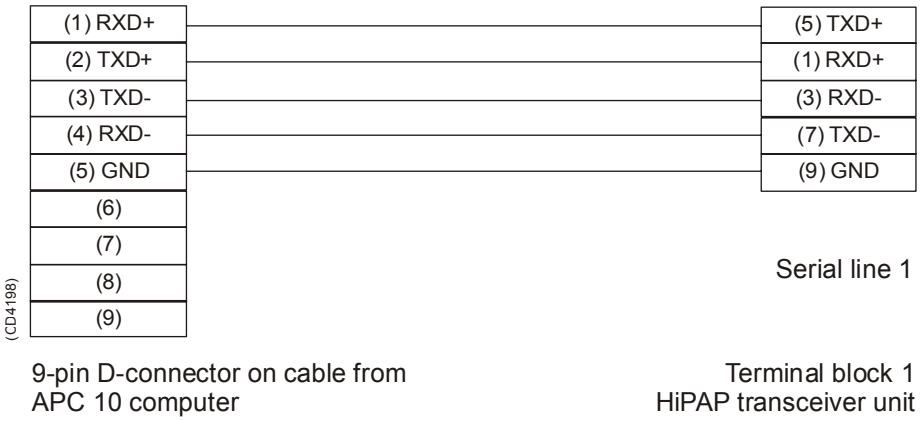


Figure 45 Cable A, RS-422 (standard)

Cable B

This RS-422 serial line cable plugs into one of the COM ports on the rear of the APC 10. The actual connections to the peripheral device will depend on the application.

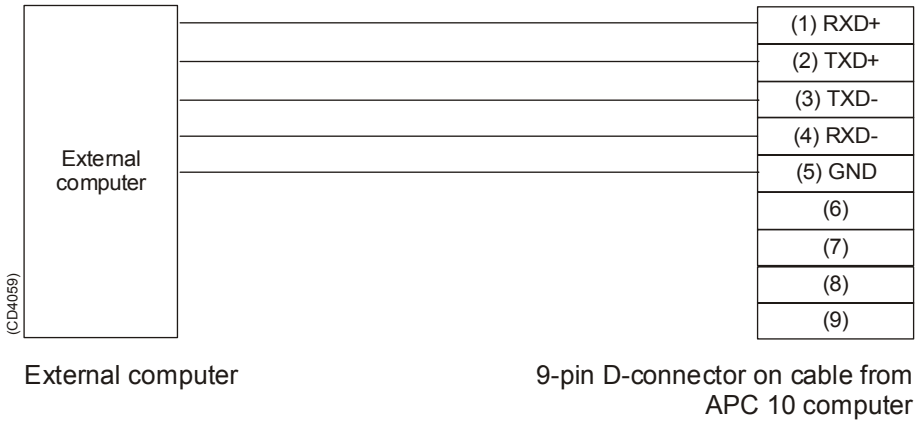


Figure 46 Cable B, External computer RS-422

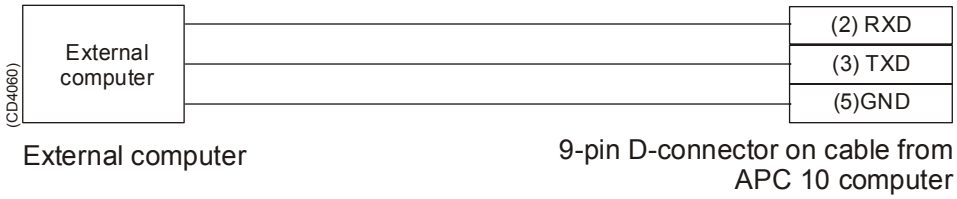


Figure 47 Cable B, External computer RS-232 (option)

APC 10 Connector pin allocations

Serial lines (Com) RS-232

The pins are allocated as follows:

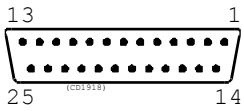
1	Carrier detect
2	Receive data
3	Transmit data
4	Data terminal ready
5	Ground
6	Data set ready
7	Ready to send
8	Clear to send
9	Ring indicator

Serial lines (Com) RS-422

The pins are allocated as follows:

1	Reception data +
2	Transmission data +
3	Transmission data -
4	Reception data -
5	Ground

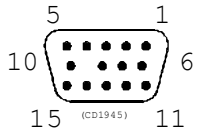
Line printer 1 (LPT1)



The line printer is a 25-pin Delta connector. The pins are allocated as follows:

1	Strobe (active low)
2	Data bit 0
3	Data bit 1
4	Data bit 2
5	Data bit 3
6	Data bit 4
7	Data bit 5
8	Data bit 6
9	Data bit 7
10	Acknowledge (active low)
11	Busy
12	Paper out
13	Select
14	Auto line feed (active low)
15	Error (active low)
16	Initialize printer (active low)
17	Select in (active low)
18 - 25	Ground

VGA to display



The VGA signal uses a standard VGA 15-pin Delta connector. The pins are allocated as follows:

1	Red analogue
2	Green analogue
3	Blue analogue
4	(Not connected)
5	Ground
6/7/8	Ground analogue
9	(Not connected)
10	Ground
11/12	(Not connected)
13	Horizontal synchronization
14	Vertical synchronization
15	(Not connected)

Transceiver unit cabling

General

The transceiver unit has two main connection points:

1 The transducer cable terminates in a plug, which is connected into a socket on the left side (seen from the front) of the transceiver unit.

2 All other cables to and from the transceiver unit enter the unit through cable glands located in the bottom panel, and the cables are then connected into terminal blocks located in the base of the unit.

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.***

Caution ***Ensure that a "service loop" of approximately 15 cm of slack cable is provided inside the cabinet to allow for future maintenance of the unit.***

Transducer cable connection procedure

→ *Refer to the Cable gland section.*

1 Remove the protective cover from the connector on the cable.

2 Align the connector with the socket on the transceiver unit, then carefully press the connector into the socket.

- Ensure the pins are not damaged.

3 Tighten the securing screws to hold the connector firmly into the socket.

Transceiver unit connections

Transducer cable connectors

The HiPAP 500 connector contains a total of sixteen 37-pin “D” connectors.

The HiPAP 350 connector contains a total of three 37-pin “D” connectors.

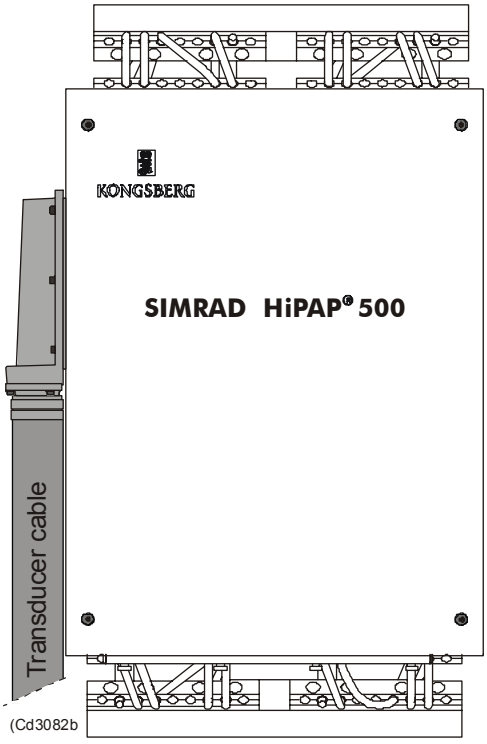


Figure 48 HiPAP 500 Transceiver Unit indicating transducer cable connection

Terminal block connections

The cables pass into the cabinet through cable glands located in the base of the unit. These cable glands ensure that the cabinet prevents stray electro-magnetic fields interfering with the system.

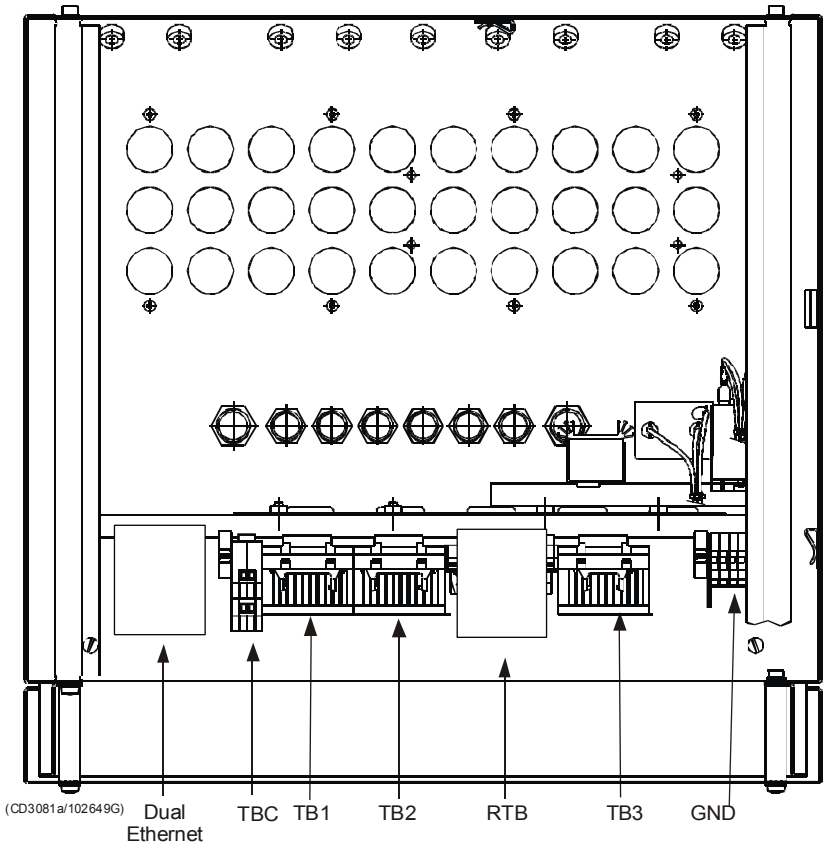


Figure 49 Layout of the terminal blocks within a transceiver unit

Transceiver unit cables

The figure below illustrates the cabling of the transceiver units.

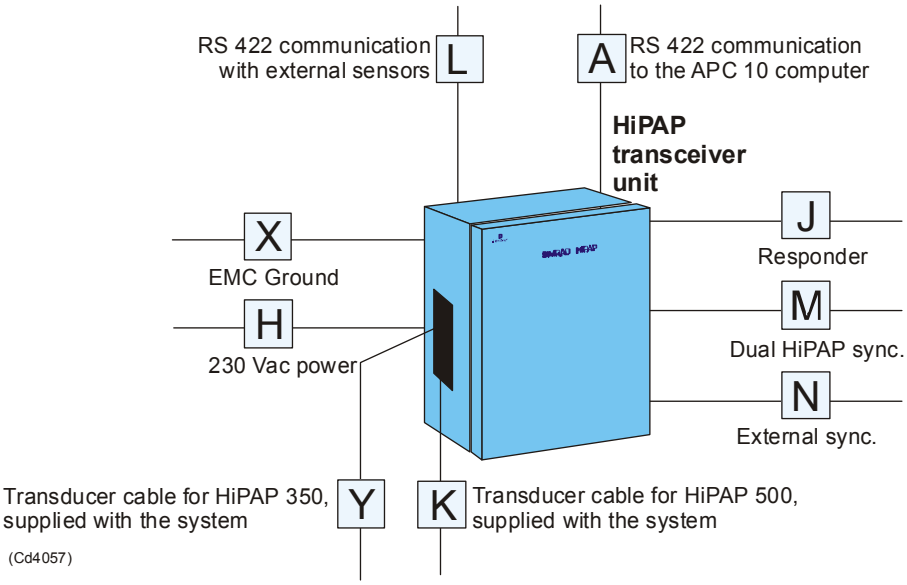


Figure 50 Transceiver units, cables

Cable A **RS-422 Serial line cable to the APC 10**

Cable H **230 Vac power supply to the transceiver**

- Shipyard supply.
- 3 x 1 / 1.5 mm^2 with ground as separate conductor, 750 V.
- Transceiver end terminated in standard 3-pin AC supply female connector.
- Maximum length: No practical limits.

Cable J **Signal cable to responder(s)**

- Shipyard supply.
- Maximum four responders may be connected, each will need a separate “J” cable.
- 3 x 1.5 mm^2, overall braided screen, 60 V.
- Transceiver end terminated in the transceiver’s terminal block, refer to the interconnection drawing.
- Maximum length: 1500 m.

Cable K **(HiPAP 500 system)**
Transducer cable from Transceiver Unit to Transducer

- Kongsberg Simrad supply.
- The transducer cable is screened and consists of 8 flat cables (round w/scr.).
- The hull unit end is attached to the transducer, the free end terminates in a plug for connection to the Transceiver Unit.
- Standard length approximately 5 m (from the top of the transducer shaft).

Note *The transducer cable connections are described in the HiPAP hull units Instruction manual.*

Cable L **RS-422 Serial line cable to external peripheral devices**

- Shipyard supply.
- 3 x 2 / 0.5 mm^2, overall braided screen, 60 V.
- Transceiver end terminated in the transceiver's terminal block, refer to the interconnection drawing.
- Maximum length: 1000 m.

Cable M **RS 422 Master Slave synchronization cable (Sync line for Dual HiPAP)**

- Shipyard supply.
- 3 x 2 / 0.5 mm^2, overall braided screen, 60 V.
- Terminated in a 9 pin Delta connector in both ends.
- Maximum length: 1000 m.

Cable N **External synchronization**

- Shipyard supply.
- 2 x 2 / 0.5 mm^2, overall braided screen, 60 V.
- Maximum length: 20 m.

Cable X **Brained grounding cable**

Cable Y

(HiPAP 350 system)
Transducer cable from Transceiver Unit to Transducer

- Kongsberg Simrad supply.
- The transducer cable is screened and consists of 2 flat cables (round w/scr.).
- The HiPAP 350 transducer cable comprises of two separate cables as follows:
  - **Cable 1:**
    From top of the transducer (bottom of the transducer shaft) to the top of the transducer shaft, into the junction box.
  - **Cable 2:**
    From the junction box to the transceiver unit, via the bracket on the hull unit.

    * Standard length approximately 7.5 m.

Note

The transducer cable connections are described in the HiPAP hull units Instruction manual.

Transceiver unit interconnections

Overview

The transceiver unit normally contains four RS-422 serial lines, available on terminal block 1.

If a system needs more than four serial lines, an additional Digi board can be installed in the Transceiver computer (ATC-10) and connected with an optional cable to terminal block 2. This option can be RS-422 or RS-232 depending on the Digi board installed, and the cable connected to terminal block 2.

The following standard cables are included with the transceiver unit and hull unit:

H 230 Vac to the transceiver unit

K/Y Transducer cables

Cables J

One separate cable is required for each responder to be connected to the system. The HiPAP end connects to terminal block 3 in the transceiver unit.

The +24 Vdc connected to pins (1) and (2) on terminal block 3 is supplied by a dedicated power supply mounted in the Main Control Panel in the transceiver cabinet.

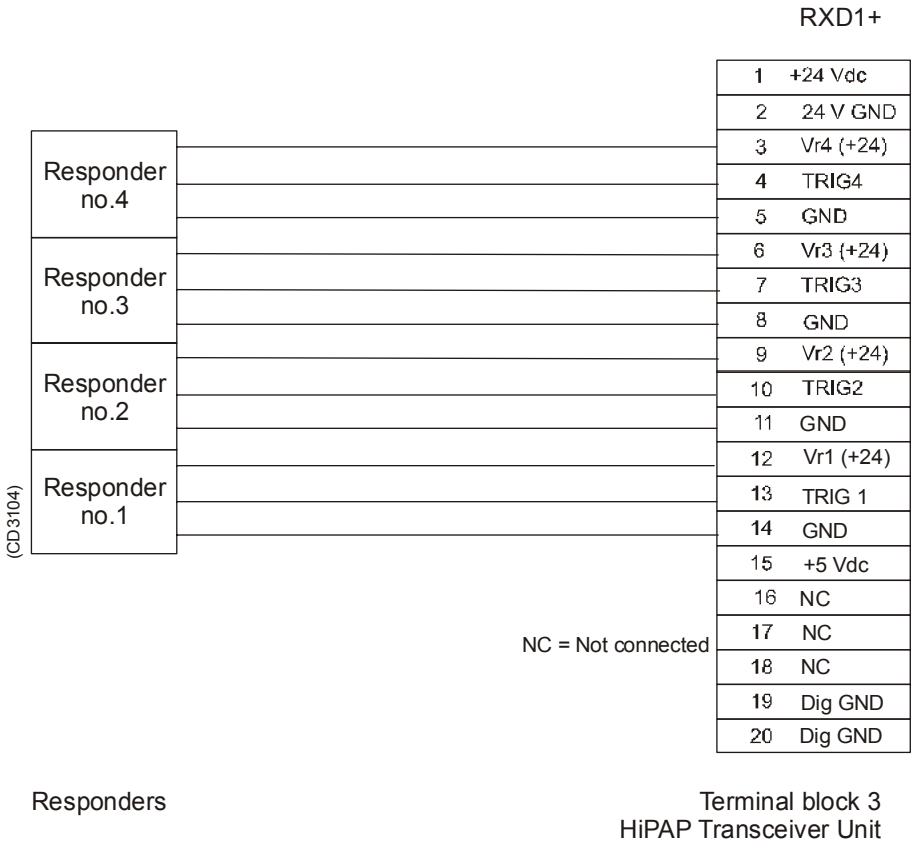


Figure 51 Responder cable

Cable A and L

External sensors such as a Vertical Reference Unit (VRU) or a course gyro may be connected via serial lines to terminal blocks 1 and 2 in the transceiver unit.

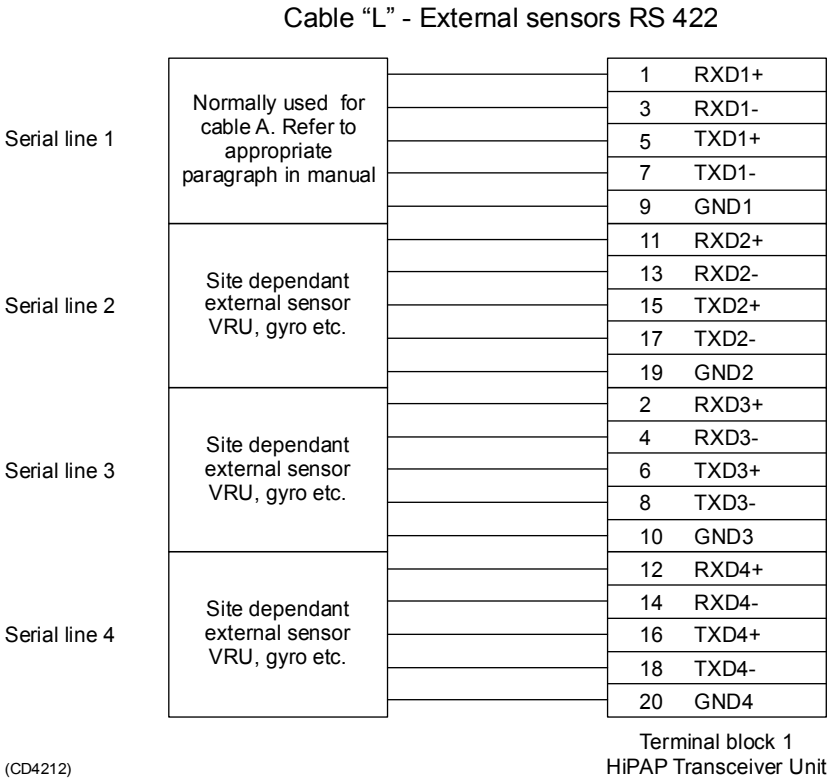


Figure 52 Cable for external sensors

RS-422 serial lines are supplied as standard.

An additional four serial lines can be supplied as an option.

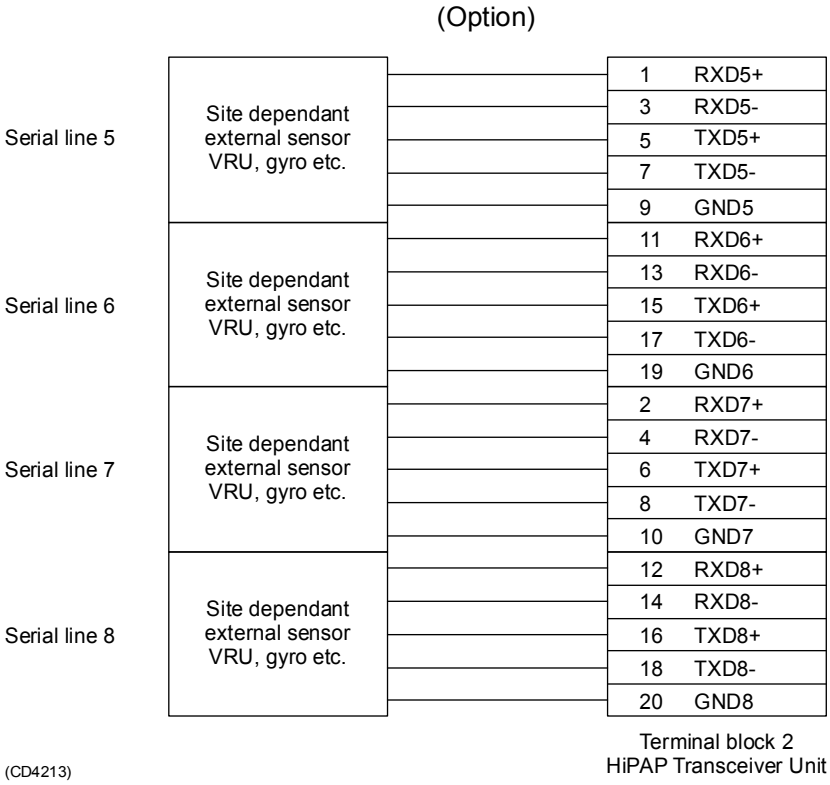


Figure 53 Four serial line - option

RS-232 serial lines can be supplied as an option.

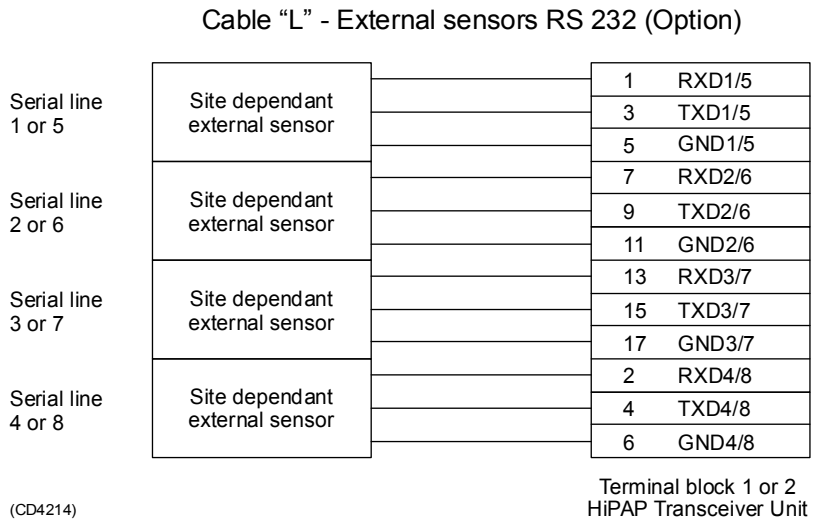


Figure 54 RS-232 serial line - option

Terminal Block Converter

General

An MRU interface to RS-422 Terminal Block Converter (TBC) can also be used.

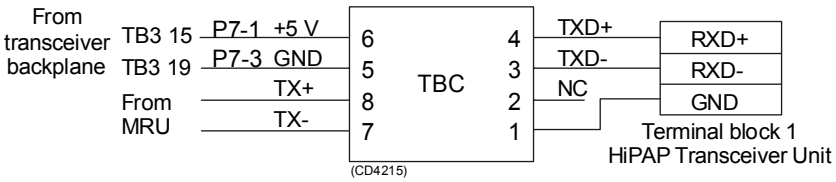
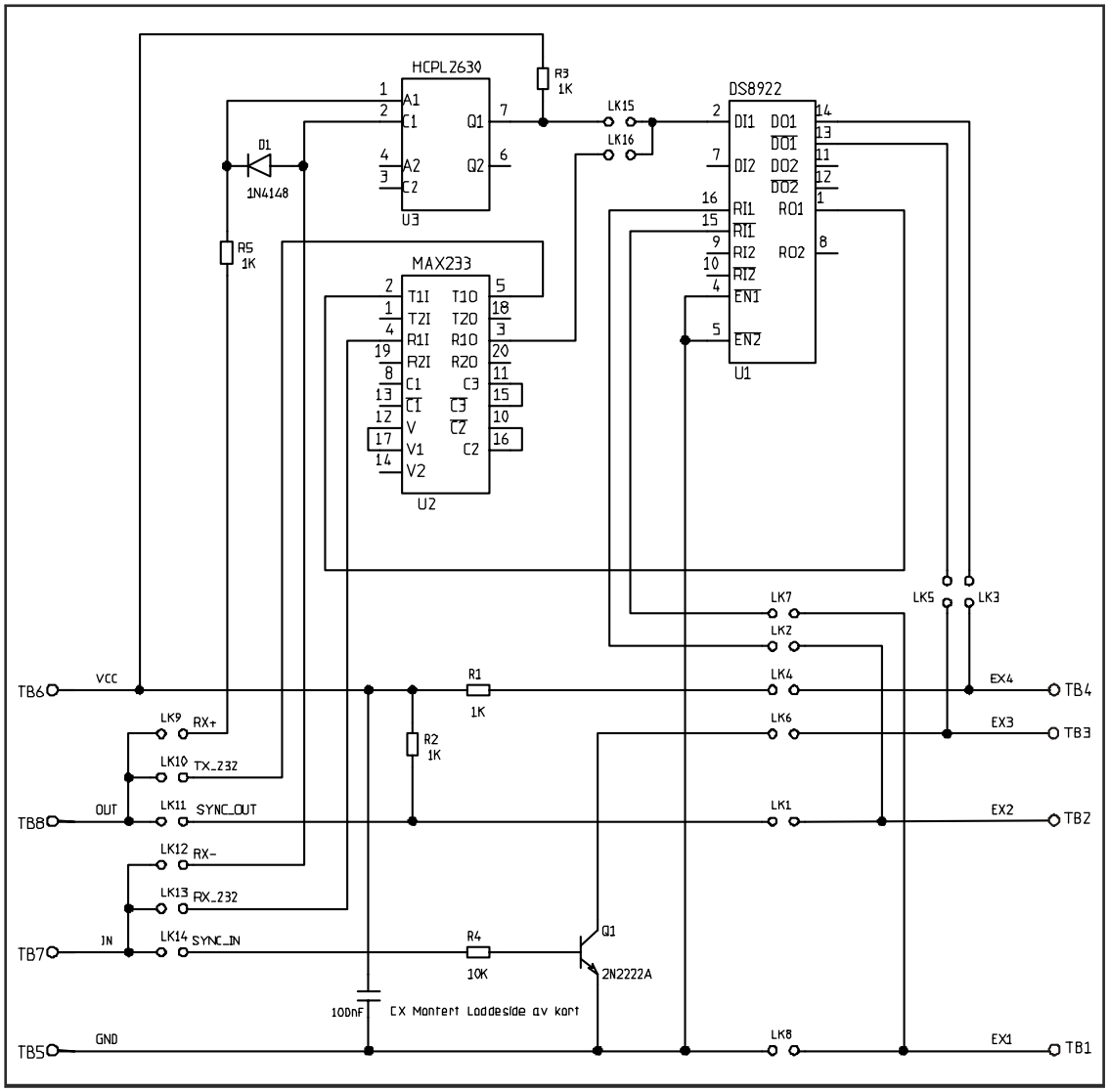


Figure 55 MRU interface RS-232 to RS-422 Terminal Block Converter

The Terminal Block Converter link setting for MRU Interface is as follows:

LK1 = OFF	LK2 = OFF	
LK3 = ON	LK4 = OFF	
LK5 = ON	LK6 = OFF	
LK7 = OFF	LK8 = OFF	
LK9 = ON	LK10= OFF	LK11= OFF
LK12= ON	LK13= OFF	LK14= OFF
LK15= ON	LK16= OFF	

The TBC diagram indicating the links is shown in the figure below.



(Cd4838)

Figure 56 TBC - diagram

Synchronization

Synchronization line for Dual HiPAP, cable M (option)

This cable is required for synchronization of the HiPAP transmitting in a Dual HiPAP system.

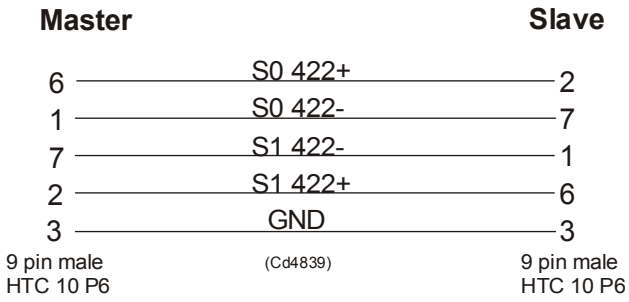


Figure 57 Dual HiPAP Master Slave synchronization

Master P6: TMC II sync signal

Slave P6: TMC II sync signal

External synchronization, cable N

This line is for synchronizing the HiPAP system to external systems.

Standard external synchronization

The Terminal Block Converter (TBC) is used for standard external synchronization. If the TBC installed is already used for MRU interface, an additional TBC have to be installed in the transceiver unit next to the one that is already installed.

The figure below shows the connections from the external synchronization signals to the TBC, and the internal connections in the transceiver from TBC to COM1/2 of the HTC-10, and the power supplied from P9 of the transceiver backplane.

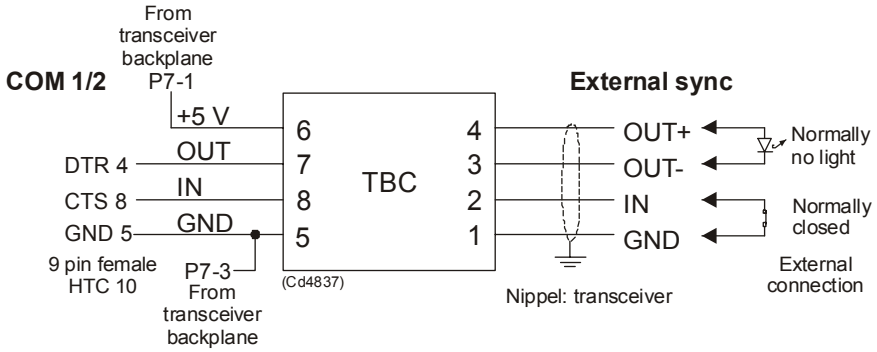


Figure 58 TBC used for external synchronization

→ *The TBC diagram indicating the links, is shown in the figure on page 136.*

The TBC link setting for synchronization input is as follows:

LK1 = ON	LK2 = OFF	
LK3 = OFF	LK4 = ON	
LK5 = OFF	LK6 = ON	
LK7 = OFF	LK8 = ON	
LK9 = OFF	LK10= OFF	LK11= ON
LK12= OFF	LK13= OFF	LK14= ON
LK15= ON	LK16= OFF	

Additional synchronization inputs (Option)

If more synchronization signals are needed, an additional TBC can be mounted in the transceiver unit next to the TBCs' that is already installed.

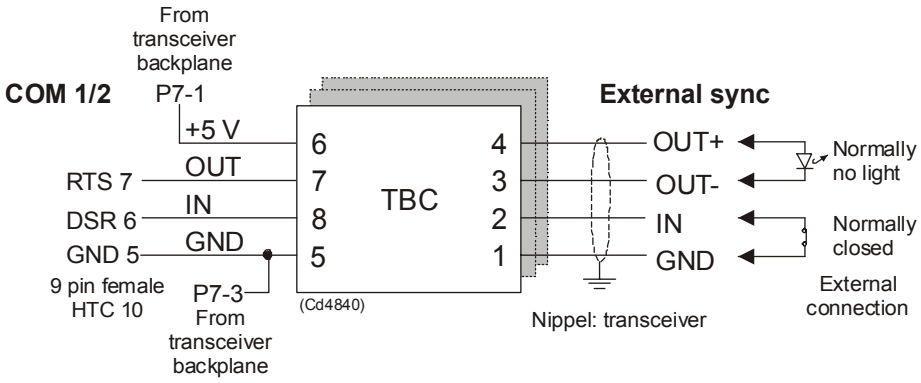


Figure 59 TBC - optional

The link settings are the same as for the standard external synchronization.

Transceiver units connection diagrams

The diagrams are implemented in the Drawing file section.

- **Interconnection diagram**
  (comprises of three illustrations)

→ *Refer to pages 229, 230 and 231.*

- **Dual net connection diagram**

→ *Refer to page 232.*

GPS Input signals connections

General

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 APC 10 internal timing clock to the GPS clock.

This connection is normally done as follows:

RS-232 Data	Pin 2 COM APC 10
1 PPS Pulse*	Pin 8 COM APC 10
Ground ref.	Pin 5 COM APC 10 any COM 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.

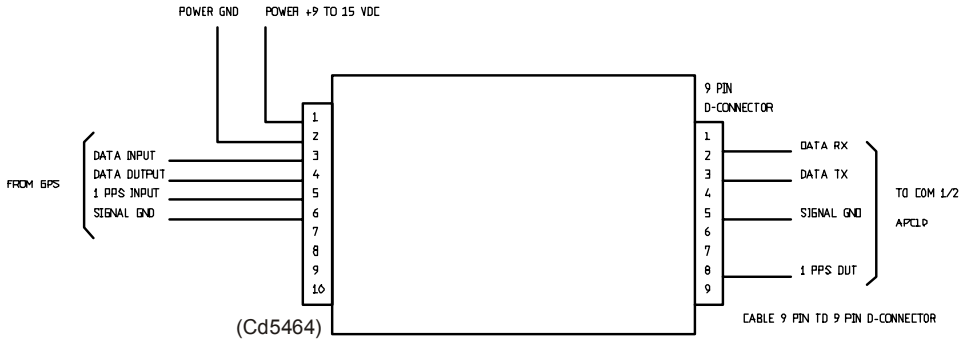


Figure 60 1PPS converter connections

A 9pin D-Connector extension cable is delivered with the converter so it can be mounted where the APC 10 is mounted.

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

If the distance between the GPS receiver and the APC 10 is more than 10 meters, it would be better if the 1PPS converter was mounted close to the GPS receiver.

→ *1PPS converter block diagram is shown on page 233.*

1PPS converter internal

The 1PPS converter contains 2 DIP switch blocks.

→ *Refer to the 1PPS assembly drawing on page 234.*

→ *Function of the switches is indicated in the block diagram on page 233.*

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 to 9 Pin D-SUB Pin 2
(Normally connected)

ST4 = Connect Data TX to 9 Pin D-SUB Pin 3
(Normally connected)

ST7 = Connect 422A+ to 9 Pin D-SUB Pin 9
(Normally open)

ST2 = Connect 422A- to 9 Pin D-SUB Pin 6
(Normally open)

ST6 = Connect 422B- to 9 Pin D-SUB Pin 4
(Normally open)

ST1 = Connect 422B+ to 9 Pin D-SUB Pin 1
(Normally open)

ST8 = Select Length A pulse to RS-422 Converter
(Normally open)

ST9 = Select Length B pulse to RS-422 Converter
(Normally open)

ST5 = Connect 1PPS to 9 Pin D-SUB Pin 8
(Normally connected)

SINGLE/DUAL NET

Overview

This section describes the Net connections. This may be used as a Single or a Dual Net. When used as a Single Net, only *Net A* is used. The Net connections includes the following units:

- APC 10
- HiPAP transceiver unit

The APC 10 connected to a HiPAP transceiver unit on a Dual Ethernet is shown in the figure below.

The Ethernet can be either copper or fibre-optic media.

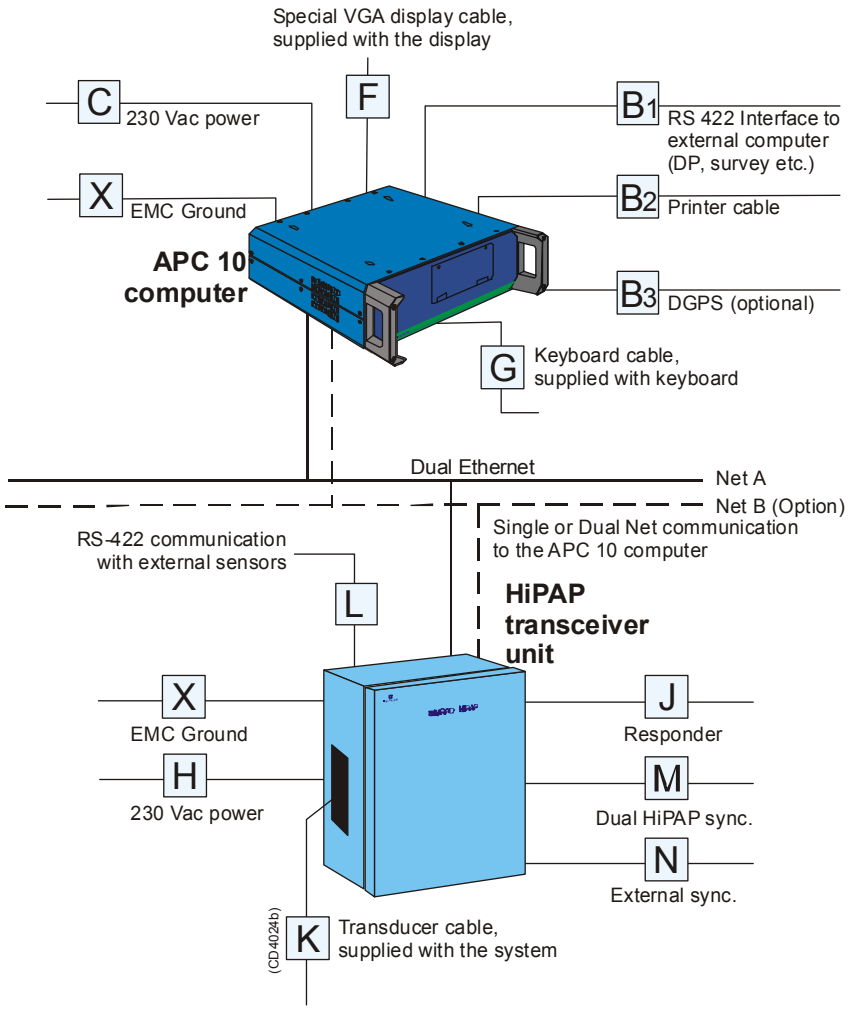


Figure 61 HiPAP Single/Dual Net communication

→ *See also the figure on page 232.*

APC 10

Connections

The APC 10 Net connection is implemented on the APC 10 with the ethernet controller.

If Dual Net is used, two ethernet controller boards are installed in the APC 10. The connector on the Ethernet board is a RJ45 Socket 10baseT.

All the connections too and from the APC 10 are made on the rear of the unit.

→ *Refer to figure on page 119.*

Note

The power supply selector switch must be set to the appropriate mains supply voltage (115 or 230 Vac).

Connector pin allocations

The setup and use of the APC 10 Ethernet lines are controlled via the system software.

Ethernet

The Single/Dual Net is connected to a RJ45 socket 10baseT connector. The pins are allocated as follows:

Pin no.	Description	Colour
1	TX +	White w/Orange
2	TX -	Orange
3	RX +	White w/Green
4		Blue
5		White w/Blue
6	RX -	Green
7		White w/Brown
8		Brown

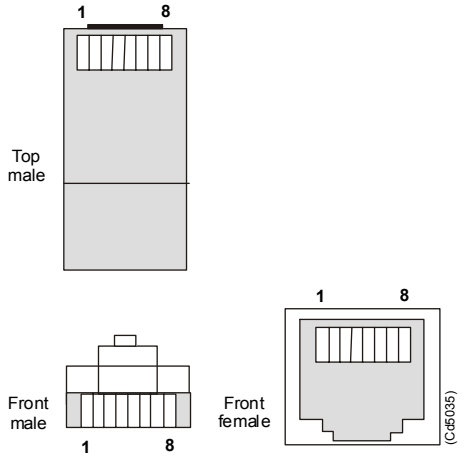


Figure 62 Ethernet RJ45 socket 10baseT

APC 10 Dual Net connection

The APC 10 connections for Dual Net is done via two connectors NET A and NET B.

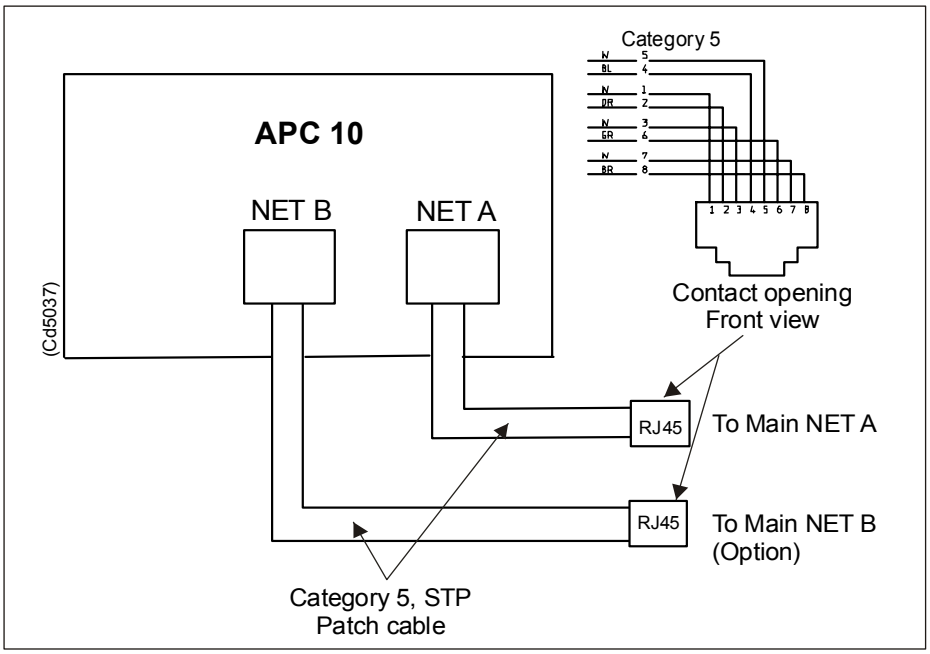


Figure 63 APC 10 Dual Net connection

The RJ45 connector from NET A is connected to the Main Net A.

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

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

If a fibre-optic net is used, a fibre-optic Ethernet converter is to be installed, and the RJ45 connector is then connected to this converter.

When no other units are connected, a Category 5 STP cable can be used directly from APC 10 to the HiPAP/HPR Transceiver unit.

HiPAP transceiver unit Dual Net connection

Dual fibre-optic net

The connections for a dual fibre-optic net to a HiPAP transceiver is illustrated in the figure below.

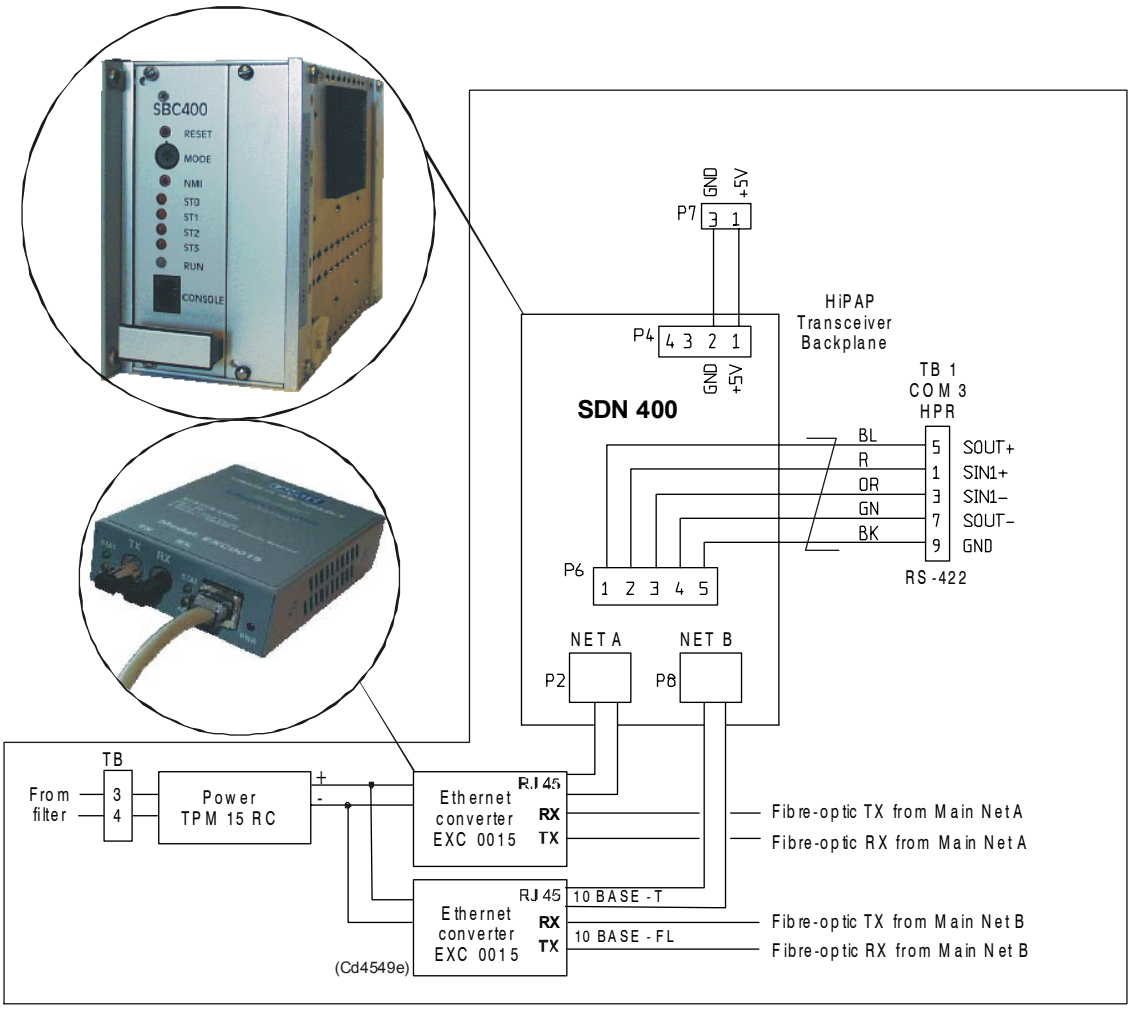


Figure 64 HiPAP transceiver unit, dual fibre-optic net connection

Dual copper net

The connections for a dual copper net to a HiPAP transceiver is indicated on the figure below. The net connections are taken directly from the P2 (NET A) and P8 (NET B).

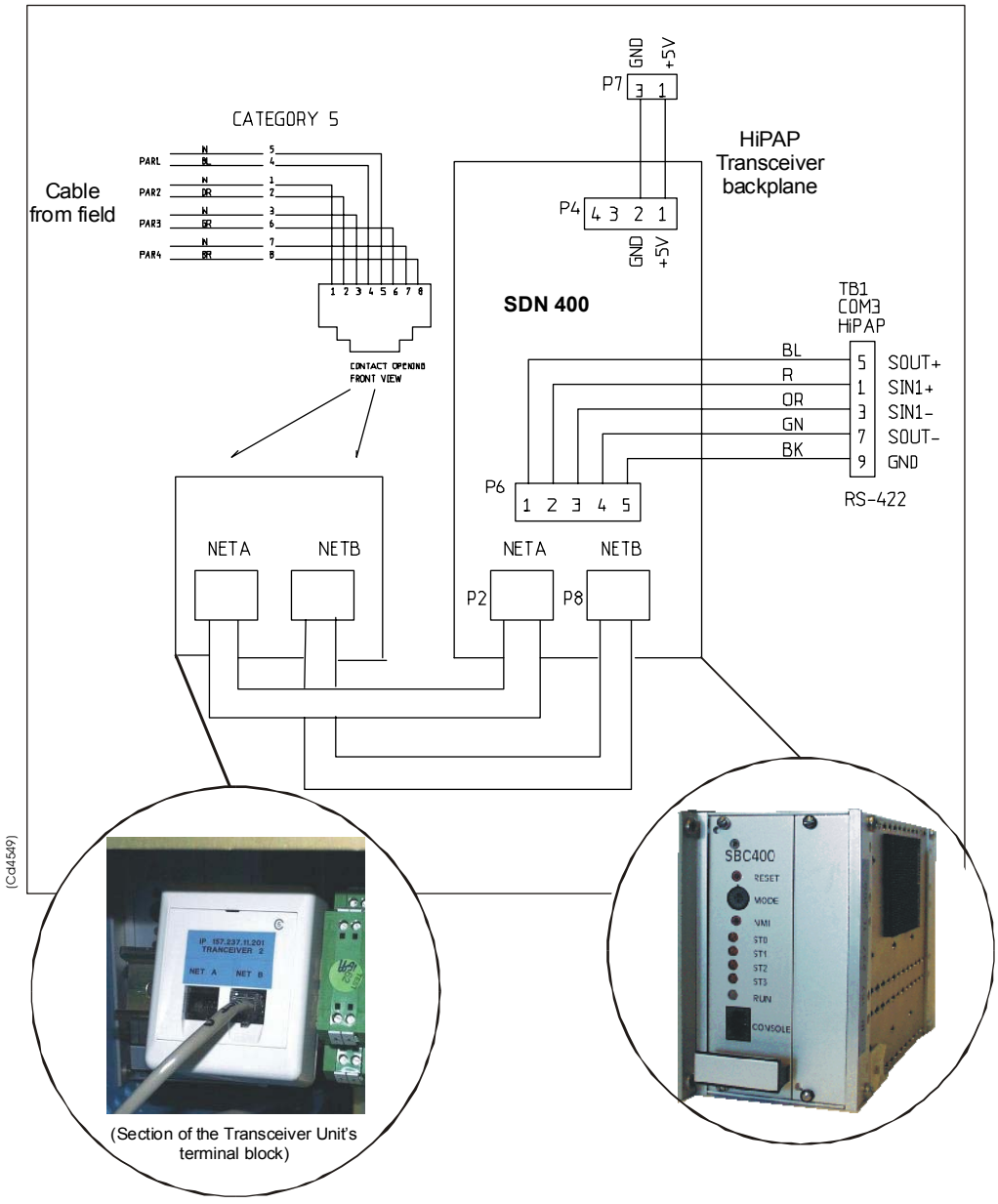


Figure 65 HiPAP transceiver unit, dual copper net connection

Spare parts list

Power TMP 15 RC 290-087699

Ethernet converter EXC 0015 719-087687

INTEGRATED OPERATION WITH SIMRAD'S DYNAMIC POSITIONING (SDP) SYSTEM

Introduction

The operator console integrates a 21" monitor, a system controller and a keyboard. The console is to be mounted on the deck. The following configurations are available for a HiPAP system:

- HiPAP system (APOS software) is implemented in the SDP system controller.
- The HiPAP system controller APC 10, is mounted separately and connected to the console via cable.

Integrated operation with SDP

Note

The implementation of the APOS software in the SDP is an complex operation, and must be performed by Kongsberg Simrad service personnel.

The integrated HiPAP/HPR 400 and SDP operation is available as two different solutions.

HiPAP/HPR 400 and DP - one Operator Station

The operator must select whether the HiPAP/HPR 400 or DP shall be viewed and operated. This is eligible from the menu. When the DP window is active, the HiPAP/HPR 400 can be accessed from the menu selecting the HiPAP/HPR 400 view or accessing a dialogue box for transponder operation. When the HiPAP/HPR 400 window is active, the DP can be accessed from the menu selecting DP view.

HiPAP/HPR 400 and DP - multiple Operator Stations

When several operator stations are available, the operator can view/operate the DP on one/several screen(s) and the HiPAP/HPR 400 on another screen. The operation is the same as for a single operator console.

SPARE PARTS

Introduction

This section lists the parts and modules defined by Kongsberg Simrad as *Line Replaceable Units (LRUs)*. The required mounting components (such as nuts, bolts, washers etc.) are identified on the diagrams, but have not been allocated order numbers as we regard these items as standard commercial parts available from retail outlets around the world.

Codes used

The following codes are used in the parts lists:

Part no. - Kongsberg Simrad's part number.

Item name -The name of the item.

Technical data - Technical specifications and any other relevant information.

List of spare parts for the APC 10 Unit

Part no.	Item name
-	**Technical data**
125-103300	Acoustic Positioning Computer
-	Complete
719-087589	Power supply unit
-	SPI-235 HI
719-087381	Harddisk
-	-
719-087382	Floppy drive
-	Mitsumi 3.5”
719-097881	CD-read/write
-	Plexwriter
719-078424	Ethernet PCB
-	3COM 3C905C-TX-M
719-097270	Serial adapter board
-	Blue Heat/PCI
719-087591	VGA display PCB
-	100-411012-00
329-215303	Keyboard complete
-	-
47734108	Trackball unit
-	Robertson P200, C-CPEC-659-0051
25005323	Large circuit board (for keyboard)
-	Robertson
25005364	Small circuit board (for keyboard)
-	Robertson
311-087501	Beeper unit
-	DSH303LE Ø27
380-215305	Keyboard cable
-	2 m
298-087488	Keyboard panel
-	-

List of spare parts for the transceiver units

Part no.	Item name
-	**Technical data**
125-102650	HiPAP 500 Transceiver Unit complete
-	-
125-214098	HiPAP 350 Transceiver Unit complete
-	-
125-102655	TRU rack
-	-
382-211045	Transmitter/Receiver board
-	-
290-087025	POWEC power supply
-	-
290-089871	Main control panel
-	-
299-214157	Responder Terminal Block (RTB)
-	-
299-049179	Fan unit
-	-
719-087082	HTC-10
-	-
211451	Transceiver Memory Board (TMC II)
-	-
719-087122	Digi board 4 serial lines RS-422
-	-
-	Fuses
-	Local supply recommended
KIT-213098	Fiber converter kit
-	-

HIPAP/HPR 400
TEST AND ALIGNMENT PROCEDURES

Introduction

The procedures are valid for both the High Precision Acoustic Positioning (HiPAP) and the Hydroacustic Position Reference (HPR 400) systems.

Purpose

After the installation has been performed and before the system is brought into operation for the first time, a series of test and alignment procedures must be carried out to confirm a correct installation.

This document contains the instructions and procedures required to ensure the system is installed correctly, is correctly set up and is safe to switch on and use.

Test certificates

Once the testing engineer has performed or witnessed the performance of a test or part of a test, he must sign on the test certificate to certify that the unit or system has passed that particular part of the procedure.

The use of these fields is optional, but we recommend that they are properly filled in for future references.

Note

If the testing engineer is not satisfied with the standard of any part of the installation, he must contact the personnel who performed the installation, to have the work rectified and brought up to the required standards.

Visual inspection

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

The hull unit tests are described in the hull units Installation manual.

Note

These tests must be made before power is applied to the system. None of these tests will require power to be applied.

Test and alignment

WARNING **All required checks must be completed before any power is switched onto the system.**

The following related test procedures must also be performed:

- Hull Unit Test and alignment, document no. 130600/section in the hull units Instruction manual
- The HiPAP/HPR Customer Acceptance Test (CAT), document no. 160901/section in this manual.

Test procedures introduction

In all cases the step-by-step instructions must be followed if the tests are to be trustworthy.

In order to verify that the HiPAP/HPR system works properly, the following tests must be carried out:

- Operator Unit/Station installation
- HiPAP/HPR 400 Transceiver unit
- Roll, pitch and heave sensor
- Heading sensor
- Cabling
- Applying power to the system

Follow the procedures and fill in the tables. Once the system has been tested, sign the signature page (last page).

The test results will be:

OK	when the test is done satisfactory.
FAIL	if the test fails.
NA	if the test is non-applicable.

Operation Unit/Station

Note

This test procedure applies only to those installations where the electronics units have been mounted on a desktop or in a 19" rack. An installation may also be an integrated part in a console - in this case a procedure provided by the console vendor may be used.

General

The installation of the Operator Unit/Station is described in the Instruction manual.

Logistics

Safety - Not applicable.

Personnel - Experienced engineer from the shipyard's quality assurance department. Installation supervisor.

Vessel location - Not applicable.

References - Drawings from the HiPAP Instruction/HPR Installation manual.

Special tools - None.

Procedure

1 Perform a close visual inspection of the installation.

2 Check that the units are installed in the correct locations, and are suitably orientated to enable easy operation.

3 Check that the units are not damaged, and that the paintwork is clean.

4 Check that the Operator Unit/Station is properly secured to the desktop.

5 Check that the display unit is mounted properly as described in the Instruction/Installation manual.

Test certificate

Operator unit/station installation	
Item to be checked	**Checked (sign)**
Visual inspection	
Location and paintwork	
Mounting	
Operator Unit/Station units mounting	
Display unit mounting	
The installation of the desktop assembly has been checked according to the procedures defined in the Instruction/Installation/Installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Installation team supervisor Signature Date	

HiPAP/HPR 400 transceiver unit

General

The transceiver unit must be mounted according to the HiPAP Instruction manual/HPR Installation manual. It is important that environmental requirements are followed. Attention should also be on ease of service.

Logistics

Safety - Not applicable.

Personnel - Experienced engineer from the shipyard's quality assurance department. Installation supervisor.

Vessel location - Not applicable.

References - Standard HiPAP/HPR documentation.

Special tools - None.

Procedure

1 Perform a close visual inspection of the unit's mounting arrangement.

2 Check that the unit is mounted according to Installation manual.

3 Check that the unit is located within the environmental specifications.

Test certificate

HPR 400 Transceiver Unit	
Item to be checked	**Checked (sign)**
Visual inspection	
Mounting	
Environments	
The installation of the transceiver unit has been checked according to the procedures defined in the Installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Installation team supervisor Signature Date	

Roll, pitch and heave sensor

General

The unit shall be installed close to the roll and pitch centre of the vessel, to reduce heave as much as possible. The unit may not have a heave output.

The unit must be calibrated to be inline with the vessels roll and pitch axis before calibrating the integrated navigation system. It is of great importance that the unit's reference in not changed after this. If so, a new calibration of the integrated navigation system may be required.

Logistics

Safety - Not applicable.

Personnel - Experienced engineer from the shipyard's quality assurance department. Installation supervisor.

Vessel location - Not applicable.

References - Manufacturer specifications.

Special tools - None.

Procedure

1 Perform a close visual inspection of the unit's mounting arrangement.

2 Check that the unit is installed according to manufacturer specifications.

3 Check that the unit is installed in the correct location and that the vibration conditions are within the required limits. Check that the unit casing is not damaged.

4 Check that the unit is correctly orientated. It is very important that the unit is mounted with its roll, pitch and axis correctly. Please check with the sensors manual.

5 Check that the unit outputs values that is according to the vessel's trim level.

Test certificate

Roll, pitch and heave sensor	
Item to be checked	**Checked (sign)**
Visual inspection	
Manufacturer specifications	
Location, vibration	
Orientation	
Trim	
The installation of the roll, pitch and heave sensor has been checked according to the procedures defined in the Installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Installation team supervisor Signature Date	

Heading sensor

General

The Heading sensor must be mounted according to manufacturer specifications.

The unit must be calibrated to be inline with the vessels centre line before calibrating the integrated navigation system. It is of great importance that the unit's reference in not changed after this. If so, a new calibration of the integrated navigation system may be required.

Logistics

Safety - Not applicable.

Personnel - Experienced engineer from the shipyard's quality assurance department. Installation supervisor.

Vessel location - Not applicable.

References - Manufacturer specifications.

Special tools - None.

Procedure

1. Perform a close visual inspection of the unit's mounting arrangement.
2. Check that the unit is installed according to manufacturer specifications.
3. Check that the unit is correctly orientated and calibrated to be inline with the vessel's centre line.

Test certificate

Heading sensor	
Item to be checked	**Checked (sign)**
Visual inspection	
Manufacturer specifications	
Orientation and calibration	
The installation of the heading sensor unit has been checked according to the procedures defined in the Installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Installation team supervisor Signature Date	

Cabling

General

This is the test procedures for the system's power and signal interface cables.

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

The installation of the cables is described in the *Cable layout and interconnections* chapter in the HiPAP Instruction manual/HPR Installation manual.

Logistics

Safety - Not applicable.

Personnel - Experienced engineer from the shipyard's quality assurance department. Electrician supervisor.

Vessel location - Not applicable.

References - Drawings from the Installation manual.

Special tools - None.

Procedures

Visual inspection of the cabling

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

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

Cable connections and continuity

After the cable connections have been completed and the visual inspection has been carried out, all the cable cores must be checked for correct connection and continuity.

→ *Refer to the cable plans and interconnection diagrams, and check all inter-connection cables.*

Any locally fitted plugs and connectors should also be checked for shorts or open circuits. Ensure all cable connections have been made according to the cable plan, and that all connections are tight and secure.

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

This check procedure will require pairs of engineers, equipped with the appropriate cable plans and wiring diagrams, two-way communication devices and tool kits. The "tester" will require continuity test equipment, the assistant will require a suitable shorting strap.

Note *The exact resistance values will depend on the type and lengths of the cables, and the units to which the cables are connected. If in doubt, check with the manufacturers.*

Follow the check procedure below for **each cable core**:

1 The test engineers should position themselves one at each end of the cable to be checked.

2 Good communications must be established.

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

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

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

5 The tester then connects his continuity tester to the two terminals in question and checks the continuity.

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

6 The assistant then shorts the two cores together, and the tester repeats the test. The Resistance should be approximately 0Ω.

7 The assistant then removes the shorting strap, and the resistance should go up to approximately ∞ Ω again.

8 The tester then checks each core's resistance to ground, (this should be approximately ∞ Ω depending on the cable and unit(s)), and each core's resistance to all the other cores in the cable, (this should be approximately ∞ Ω).

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

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

Test certificate

Cabling	
Item to be checked	**Checked (sign)**
Visual inspection	
Connections	
Continuity	
The installation of the system cabling has been checked according to the procedures defined in the Installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Electrician supervisor Signature Date	

Applying power to the system

Once all the checks have been completed, power can be applied to the system. Follow the procedure below:

1 Check to ensure that all the test and alignment procedures have been carried out.

2 Check that all power switches to the system, and those on the system units, are set to OFF.

3 Insert the system fuses into the main fuse panel and switch power on to those fuses.

4 Check on the supply terminals in all the various units that the correct supply voltages are being fed to those units.

5 Switch on the units one at a time and ensure each unit operates.

6 Switch on the entire system and perform the Setting To Work procedures as detailed in the contract.

Remarks and signatures

Remarks

Remarks (if any) must be noted here or in a separate report.

Signatures

Checked by:

Place	Date	Signature

Approved by:

Place	Date	Signature

HIPAP/HPR CUSTOMER ACCEPTANCE TEST (CAT)

Introduction

This test procedure explains how to perform the Customer Acceptance Test (CAT) on the High Precision Acoustic Positioning (HiPAP) and the Hydroacustic Position Reference (HPR) systems.

Purpose

The CAT is performed to verify the functions of the HiPAP/HPR system.

After the installation has been performed, and before the system is brought into operation for the first time, a series of test and alignment procedures must be carried out to confirm a correct installation.

The main subjects are:

- Mounting of the system
- Functional test
- Interface test
- Acoustic functional test
- Offshore calibration of system for integrated navigation

Test certificates

Once the test engineer has performed or witnessed the performance of the test or part of a test, he must sign the appropriate field for each check, to certify that the unit or system has passed the particular part of the procedure.

The use of these fields is optional, but we recommend that they are properly filled in for future references.

Note

If the test engineer is not satisfied with the standard of any part of the installation, he must contact the personnel who performed the installation, to have the work rectified and brought to the required standards.

Visual inspections

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

The hull unit tests are described in the hull unit Installation manual.

Note

These tests must be made before power is applied to the system. None of these tests will require power to be applied.

Test and alignments

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

The following related test procedures must also be performed:

- Hull Unit Test and alignment, document no. 130600/section in the hull units Instruction manual.
- HiPAP/HPR 400 Test and alignment, document no. 130315/section in this document.

Test results

Procedures	Checked (sign)
Hull Unit, Test and alignment	
HiPAP/HPR 400, Test and alignment	
Shipyard's quality assurance department Signature Date	
Kongsberg Simrad representative Signature Date	

Test procedures introduction

In all cases the step-by-step instructions must be followed if the tests are to be trustworthy.

In order to verify that the HiPAP/HPR system works properly, the following tests must be carried out:

- Hull unit (Transducer 1)
- Hull unit (Transducer 2)
- Operator unit
- Simulator/training mode
- Transducer 1 using a transponder
- Transducer 2 using a transponder
- Printout on printers
- Calibration for integrated navigation
- Spare parts

Follow the procedures and fill in the tables. Once the system has been tested, sign the signature page (last page).

The test results will be:

OK	when the test is done satisfactory.
FAIL	if the test fails.
NA	if the test is non-applicable.

Hull unit (Transducer 1)

General

This test can be done when the vessel is alongside, and there is sufficient water under the keel to lower the hull unit. Check with the master before the test starts.

Logistics

Safety - Not applicable.

Personnel – The test is performed by a representative for the customer and a representative for Kongsberg Simrad.

Vessel location - Not applicable.

References - Instruction manual for the hull units.

Special tools - None.

Procedure

- Ensure the gate valve is open.
- Make sure that 220V/440V is switched on for the Hoist Control Unit (HCU)/hoist motor.

1 Lower the hull unit approx. 50 cm. Use the control switch (rotary switch, S1) in the HCU. Set the switch in **LOWER** position.

2 To stop the hull unit, set the switch in **STOP** position.

3 Set the switch in **HOIST** position to hoist the hull unit again, to check the down/up function is working.

4 Set the switch in **LOWER** position to lower the hull unit, until it stops at the lower limit switch. Monitor the transducer cable when lowered.

- If there is any chance of the transducer cable might catch onto anything, ***stop*** immediately. Guiderail must then be installed to prevent this.

5 Hoist the hull unit again while still monitoring the transducer cable.

- If there is any chance of the transducer cable might catch onto anything, ***stop*** immediately. Guiderail must then be installed to prevent this.

6 Switch the HCU to **REMOTE** and do the next tests using the Remote Control Unit (RCU).

7 Lower the hull unit while pressing the **LOWER/DOWN** button, until it reaches the lower limit switch.

8 Hoist the hull unit again while pressing **RAISE/UP**.

9 After 10 seconds press **STOP**.

10 Press **RAISE/UP** again to hoist the hull unit until it reaches the upper limit switch.

Test results

Hull unit (Transducer 1)	
Item to be checked	**Checked (sign)**
LOWER/HOIST function-local	
Lower limit switch	
Upper limit switch	
LOWER/DOWN function-remote	
STOP function-remote	
RAISE/UP function-remote	
Installation has been checked according to the procedures defined in the installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Kongsberg Simrad representative Signature Date	

Hull unit (Transducer 2)

General

This test can be done when the vessel is alongside, and there is sufficient water under the keel to lower the hull unit. Check with the master before the test starts.

Logistics

Safety - Not applicable.

Personnel – The test is performed by a representative for the customer and a representative for Kongsberg Simrad.

Vessel location - Not applicable.

References - Instruction manual for the hull units.

Special tools - None.

Procedure

- Ensure the gate valve is open.
- Make sure that 220V/440V is switched on for the Hoist Control Unit (HCU)/hoist motor.

1 Lower the hull unit approx. 50 cm. Use the control switch (rotary switch, S1) in the HCU. Set the switch in **LOWER** position.

2 To stop the hull unit, set the switch in **STOP** position.

3 Set the switch in **HOIST** position to hoist the hull unit again, to check the down/up function is working.

4 Set the switch in **LOWER** position to lower the hull unit, until it stops at the lower limit switch. Monitor the transducer cable when lowered.

- If there is any chance of the transducer cable might catch onto anything, ***stop*** immediately. Guiderail must then be installed to prevent this.

5 Hoist the hull unit again while still monitoring the transducer cable.

- If there is any chance of the transducer cable might catch onto anything, ***stop*** immediately. Guiderail must then be installed to prevent this.

6 Switch the HCU to **REMOTE** and do the next tests using the Remote Control Unit (RCU).

7 Lower the hull unit while pressing the **LOWER/DOWN** button, until it reaches the lower limit switch.

8 Hoist the hull unit again while pressing **RAISE/UP**.

9 After 10 seconds press **STOP**.

10 Press **RAISE/UP** again to hoist the hull unit until it reaches the upper limit switch.

Test results

Hull unit (Transducer 1)	
Item to be checked	**Checked (sign)**
LOWER/HOIST function-local	
Lower limit switch	
Upper limit switch	
LOWER/DOWN function-remote	
STOP function-remote	
RAISE/UP function-remote	
Installation has been checked according to the procedures defined in the installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Kongsberg Simrad representative Signature Date	

Operator unit

General

The following tests are performed in front of the HiPAP/HPR operator unit. In some instances, menu selections have to be made in order to display all information.

Logistics

Safety - Not applicable.

Personnel – The test is performed by a representative for the customer and a representative for Kongsberg Simrad.

Vessel location - Not applicable.

References - Standard HiPAP/HPR documentation.

Special tools - None.

Procedure

1 Check that the transceiver is in Navigation mode. If there are more than one transceiver, check that all are in Navigation mode.

2 Check that gyro input is available. If the system is configured with more than one gyro, check all gyro inputs.

3 Check that VRU input is available. If the system is configured with more than one VRU, check all VRU inputs.

4 Check configuration to external equipment (information sent from/to the HiPAP/HPR from other units, for example DP, navigation system, GPS).

If the system consists of more than one operator unit, do the above check on all dedicated HiPAP/HPR operator units.

Test results

Operator unit	
Item to be checked	**Checked (sign)**
Navigation mode -Transceiver 1 -Transceiver 2	
Gyro data -Gyro 1 -Gyro 2 -Gyro 3	
VRU data -VRU 1 -VRU 2 -VRU 3	
External equipment	
Installation has been checked according to the procedures defined in the installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Kongsberg Simrad representative Signature Date	

Simulator/training mode

General

The HiPAP/HPR can be run in simulator/training mode. All outputs to external equipment will then be activated, and the output signals can then be tested by the external systems.

Note

The telegrams sent from the HiPAP/HPR *contains information that the system is in simulator/training mode, and some systems might not use the* HiPAP/HPR *information for this reason.*

Logistics

Safety - Not applicable.

Personnel – The test is performed by a representative for the customer and a representative for Kongsberg Simrad.

Vessel location - Not applicable.

References - Standard HiPAP/HPR documentation.

Special tools - None.

Procedure

1 Test serial lines to external equipment.

2 Test serial lines from external equipment.

3 Test Ethernet messages.

Test results

Simulator/training mode	
Item to be checked	**Checked (sign)**
Serial lines (output)	
Serial lines (input)	
Ethernet	
Installation has been checked according to the procedures defined in the installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Kongsberg Simrad representative Signature Date	

Transducer 1 using a transponder

General

This test is to be done when the vessel is alongside, and there is sufficient water under the keel to lower the hull unit. Check with the master before the test starts.

This test can also be done at anchorage or at open sea when the vessel has no speed.

- Make sure the gate valve is open.
- Lower the hull unit.
- Prepare a transponder for deployment.
  - The deployment point of the transponder should be close to the hull unit. Take into consideration the installation angle of the transducer, if the transducer is fitted with a tilt adapter.
  - Connect the transponder to a rope long enough to reach 5-10 meters below the keel. Deploy the transponder.

Logistics

Safety - Not applicable.

Personnel - The test is performed by a representative for the customer and a representative for Kongsberg Simrad.

Vessel location - Not applicable.

References - Standard HiPAP/HPR documentation.

Special tools - None.

Procedure

1 Activate the transponder on the HiPAP/HPR operator station, and select Transducer 1.
  - The signal should be received and displayed on the HiPAP/HPR operator station.

Note

When this test is done alongside or in very shallow waters, the signal might be ”jumpy” because of reflections from the seabed and the hull.

Test results

Transducer 1 using a transponder	
Item to be checked	**Checked (sign)**
Transponder on Transducer 1	
Installation has been checked according to the procedures defined in the installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature	Date
Kongsberg Simrad representative Signature	Date

Transducer 2 using a transponder

General

This test is to be done when the vessel is alongside, and there is sufficient water under the keel to lower the hull unit. Check with the master before the test starts.

This test can also be done at anchorage or at open sea when the vessel has no speed.

- Make sure the gate valve is open.
- Lower the hull unit.
- Prepare a transponder for deployment.
  - The deployment point of the transponder should be close to the hull unit. Take into consideration the installation angle of the transducer, if the transducer is fitted with a tilt adapter.
  - Connect the transponder to a rope long enough to reach 5-10 meters below the keel. Deploy the transponder.

Logistics

Safety - Not applicable.

Personnel - The test is performed by a representative for the customer and a representative for Kongsberg Simrad.

Vessel location - Not applicable.

References - Standard HiPAP/HPR documentation.

Special tools - None.

Procedure

1 Activate the transponder on the HiPAP/HPR operator station, and select Transducer 1.
  - The signal should be received and displayed on the HiPAP/HPR operator station.

Note

When this test is done alongside or in very shallow waters, the signal might be ”jumpy” because of reflections from the seabed and the hull.

Test results

Transducer 2 using a transponder	
Item to be checked	**Checked (sign)**
Transponder on Transducer 2	
Installation has been checked according to the procedures defined in the installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Kongsberg Simrad representative Signature Date	

Printout on printers

General

On systems supplied with printers, the printout function is checked. This is done by making a screen dump or a printout of simulated transponder positions.

Logistics

Safety - Not applicable.

Personnel - The test is performed by a representative for the customer and a representative for Kongsberg Simrad.

Vessel location - Not applicable.

References - Standard HiPAP/HPR documentation.

Special tools - None.

Procedure

1 Printout from the HiPAP/HPR system.

Test results

Printout on printers	
Item to be checked	**Checked (sign)**
Printout on printer	
Installation has been checked according to the procedures defined in the installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature	Date
Kongsberg Simrad representative Signature	Date

Calibration for integrated navigation

General

The purpose of the calibration is to define:

- The roll and pitch offsets between the roll and pitch sensor and the HiPAP/HPR roll and pitch axis.
- The orientation offset between the heading reference (SEAPATH- Gyro compass) and the HiPAP/HPR orientation.
- The horizontal and vertical offsets from the HiPAP/HPR transducer and the DGPS antenna to the vessels reference point.

Note *Defining the horizontal and vertical transducer offsets and the calibration of the heading reference is normally not a part of the Kongsberg Simrad responsibility.*

Note *These steps must be repeated for each transducer.*

Logistics

Safety - Not applicable.

Personnel - Surveyor to operate navigation computer and Kongsberg Simrad service engineer.

Vessel location - Along quay side and at sea with water depth from 100 m to 500 m.

References - Standard HiPAP/HPR documentation.

Special tools - DGPS or RTK DGPS and navigation computer able to compute and plot seabed transponder positions in geographical co-ordinates. Vessels DP system.

Procedure

Along quay

Horizontal and vertical offset

The distances from the transducer(s) to the vessel's reference point, must be measured very accurately either from the vessels drawing or real life measurements. This has a direct impact on the final position accuracy. The best way is to use a survey company to measure this by use of theodolite and fixed points. The accuracy of these measurements should be less than 0.05 meters.

The offsets for the surface navigation systems antenna must be determined in the same way.

HiPAP/HPR calibration at sea

When the above subjects are done, the rest of the calibration is done at sea. The following is required:

- A computer that takes the HiPAP/HPR position and integrates this to the surface navigation system.
- The surface navigation must be a good DGPS or better, a cinematic ”on the fly” DGPS. It is important that roll and pitch compensation of the DGPS is properly done in the navigation computer.
- A sound velocity profile must be taken and entered to the system.

Roll and pitch calibration

The first steps at sea are to calibrate the roll and pitch offsets. This is done as follows:

- Water depth approximately 200 m and a fixed transponder at the seabed.
- The pitch correction is found by sailing a line over the transponder and by monitoring the depth. When the correct pitch angle is found the depth is symmetric on both fore and aft of the vessel.
- The pitch correction is entered to the HiPAP/HPR system and the test is repeated in order to verify the correction.
- The same is repeated for the roll correction, but then the vessel needs to stay in one position 1-2 times the water depth with the transponder to port and to starboard of the vessel.

The following note only applies for the HPR system.

Note

If the system has a narrow beam transducer the horizontal distance vessel to transponder should be 1/3 of the water depth and if a medium beam transducer is used it should be 1 times the water depth.

Heading calibration

The heading correction is found by doing a ”4 point box in” with constant heading. Proceed as follows:

- The navigation computer must plot the transponder position in UTM co-ordinates. By using the distance between the centre of the plots the heading correction can be found.
- The correction shall be entered to the HiPAP/HPR system.

- The test shall be repeated to verify the correction. It is of great importance that the survey system uses the same heading sensor as the HIPAP/HPR system.
- Finally the vessel can move to a location on top of the transponder, or to a 50 meters offset, and log/plot the position data with the vessel in 4 - 8 different headings.

The last test will show if there are any offset or roll and pitch errors left in the total system.

Calibration values

Offset	Transducer 1	Transducer 2
X Offset	(m)	(m)
Y Offset	(m)	(m)
Z Offset	(m)	(m)
Orientation (gear/rotation)	(deg.)	(deg.)
X Inclination (roll)	(deg.)	(deg.)
Y Inclination (pitch)	(deg.)	(deg.)

Surface navigation antenna offsets used:

OFFSET	Nav. antenna
X Offset	(m)
Y Offset	(m)
Z Offset	(m)

Test results

Calibration for integrated navigation	
Item to be checked	**Checked (sign)**
Horizontal offsets Td 1	
Inclination offsets Td 1	
Orientation offset Td 1	
Horizontal offsets Td 2	
Inclination offsets Td 2	
Orientation offset Td 2	
Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Kongsberg Simrad representative Signature Date	

Spare parts

General

Supplied spare parts are checked against the contract.

Logistics

Safety - Refer to HiPAP/HPR documentation/handling equipment.

Personnel – The test is performed by a representative for the customer and a representative for Kongsberg Simrad.

Vessel location - Not applicable.

References - Standard HiPAP/HPR documentation.

Special tools - None.

Procedure

Not applicable.

Test results

Spare parts	
Item to be checked	**Checked (sign)**
Supplied spare parts	
Installation has been checked according to the procedures defined in the installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature	Date
Kongsberg Simrad representative Signature	Date

Remarks and signatures

Remarks

Remarks (if any) must be noted here or in a separate report.

Signatures

Checked by:

Place	Date	Signature

Approved by:

Place	Date	Signature

LBL/MULBL POSITIONING CUSTOMER ACCEPTANCE TEST

Introduction

This test procedure explains how to perform the Customer Acceptance Test (CAT) for Long Base Line (LBL) positioning and Multi-User LBL (MULBL) using the APOS OS program.

The test is performed using the High Precision Acoustic Positioning (HiPAP 500/HiPAP 350) or the Hydroacustic Position Reference (HPR 408/418) systems.

Purpose

The Customer Acceptance Test (CAT) is performed to verify the Long Base Line (LBL) or Multi-User LBL (MULBL) function of the system. The test should be done in water depth of more than 100 m.

Note

The Multi-User LBL mode can only be tested if the APOS operator station has the MULBL option installed and the transponders are capable of running the MULBL mode.

- A minimum of 3 transponders has to be deployed before this test (for MULBL 4 transponders minimum). The radius of the array should be adjusted with respect to water depth and transponder type. This is to make sure the system is operating within the defined beams of the transponders/transducers. Use a complete sound velocity profile if possible.
  - For MPT 331 transponders and/or narrow beam transducer, the radius should be approximately 25% or less of the water depth, **depending on the depth**.
  - For MPT 319 or MPT 339 transponders, the radius can be from 25% of the water depth and up to 1 x the water depth, **depending on type of ships transducer**. The radius should not exceed 500 m.
- The vessel has to stay within coverage area of the transponders in the LBL array during this test. Remember the transducer offset when setting up the vessel before the test. It is actually the transducer(s) that needs to be within the array.
- The result depends on:
  - The array geometry
  - Number of transponders in the array
  - Sound velocity data.

Important aspects

Operation area

The area the vessel needs for manoeuvring, defines the operation area. This might also influence on the choice of transponder type, number of transponders and array radius.

Figure 66 Example of operation area

- You must have a good coverage (contact) from the transponders throughout your operation area.
- The vessel heading must be taken into consideration when planning an array.

Ships system/seabed footprint

General

The transducer footprint on the seabed is determined by the system/transducer on board. This figure below shows a narrow/wide beam transducer coverage area. The narrow beam area is indicated by a ”N”, and the wide beam area indicated by ”N”+”W”.

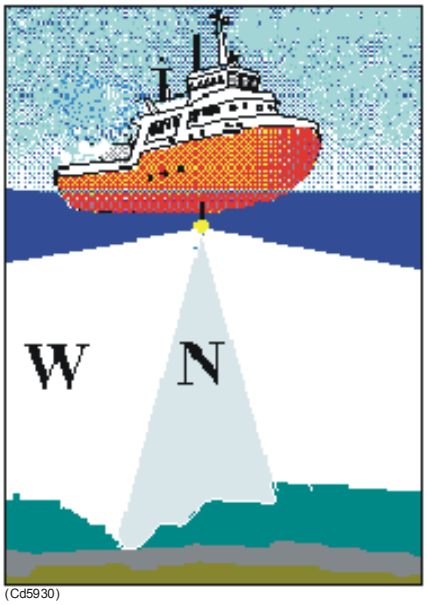


Figure 67 Example of seabed footprints

HPR

HPR 418 systems with narrow/wide transducer (so-called narrow beam transducer) covers ± 22.5° in narrow beam and ± 80° in wide beam. Wide beam is more affected by noise than narrow beam.

HPR 418 systems with medium/wide transducer (so-called standard transducer) covers ± 55° in medium beam and ± 80° in wide beam. Wide beam is more affected by noise than medium beam.

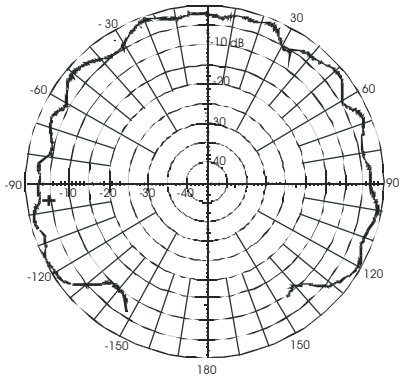
HiPAP

HiPAP 500 systems will cover ± 100° from the vertical. The HiPAP 500 will always make ± 5° narrow beams within the whole coverage area, since this is controlled electronically.

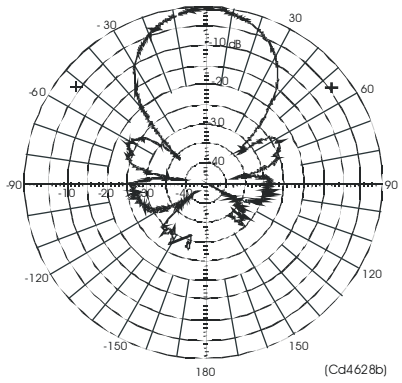
HiPAP 350 systems will cover ± 60° from the vertical. The HiPAP 350 will always make ± 7.5° narrow beams within the whole coverage area, since this is controlled electronically.

Transponder types/surface

The transponder footprint on the surface is dependent on the type of transponder used. There are basically 2 types of LBL transponders.



MPT 339 series
Source level = 195 dB



SPT 331 series
MPT 331/DuB vertical
Source level = 206 dB

Figure 68 Example of transponder beam pattern

MPT 319/MPT 339

The opening angle (cone) of these transponders is ± 90° (hemispherical).

MPT 331/DuB

This transponder type has got dual beams (DuB). One beam pointing upwards during positioning, while there is a horizontal beam during base line measurements.

- The opening angle (cone) for the vertical beam is ± 15°.
- The horizontal cone (doughnut) is ± 15°.

Choosing the transponder type

In general, transponders with narrow beam transducers are more powerful than transponders with wider beam transducers, but the drawback is a reduced footprint on the surface.

Normally the water depth determines the type of transponder to use.

1000 m - MPT 319 transponder is to be used if the ambient noise level on the vessel is low. If the noise level is high, a MPT 339 or MPT 331/DuB might be used.

Note

The MPT 331/DuB might restrict the operation area due to the narrow beam of the transponder.

3000 m - MPT 339/MPT 331/DuB transponders are to be used. For drilling units with azimuth thrusters (high noise level) MPT331DuB is recommended, as these have higher source level (output) than MPT 339.

As you can see from the lobe diagram, the MPT 331/DuB transponder has a very distinct and powerful beam.

Number of transponders

The LBL system works as a range-range system. The transponders on the seabed have known positions when the local calibration is successfully completed.

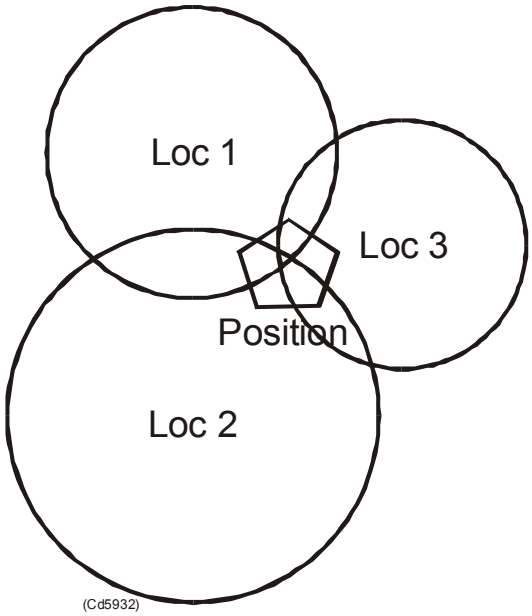


Figure 69 Example of transponder position

When positioning in LBL, the range measured from each transponder is the radius of a sphere. The vessel position is where the spheres from the different locations intersect. In order to establish a position on the surface, a minimum of 3 ranges must be measured.

Using 4 transponders, or preferably 5, gives redundancy in the range measurements.

When using 5 or more transponders, a special software function can be used (auto-exclude), which will process the range measurements and remove incorrect ranges. These ranges can be caused by reflections (not line-of-sight between transponder and vessel) or interference from other transponders (used by other vessels nearby).

Array radius

The size of the array is determined by water depth, the type of transponders and type of vessel transducer/system used.

Deep water

For deep-water operations, the transponder beams determine the radius. This gives a radius equal to about 10° from the centre for the MPT 331/DuB type.

The reason for choosing 10° instead of 15° (which is the opening angle for MPT 331/DuB transponders) is to have some overlap for vessel movements on the surface. Also the transponders might ”lean over” from current or soft seabed depending on the type of installation.

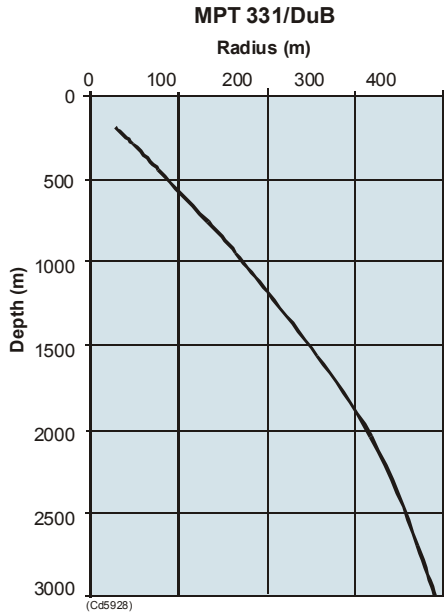


Figure 70 Example of array radius in deep water

The graph shows the water depth/array radius using a 10° array, which is reduced somewhat below 1500-2000 m depth.

The reason for reducing the radius somewhat in greater depths is mainly the seabed topography. The topography of the seabed might be blocking the ”line-of-sight” between the transponders, even if the seabed appears to be ”flat”. This makes baseline measurements difficult, or even impossible.

Shallow water

For shallow water/less noisy environment the MPT 319/MPT 339 (1000 m/3000 m depth rated) transponders can be used. The beam patterns of these transponders are wider, which allows the user to make a wider array. The baselines are much depending on what type of transducer is used on the vessel (refer to the paragraph ”Ships system/seabed footprint”). The system should work inside the narrow/medium beam.

You might encounter other problems having a wide array. The topography of the seabed might be blocking the direct line between the transponders, making baseline measurements difficult, or even impossible.

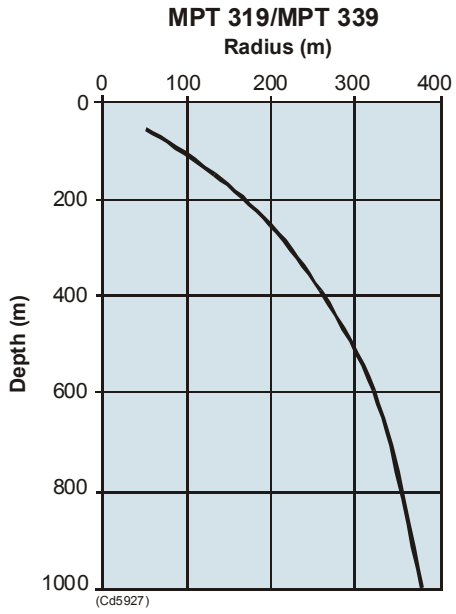


Figure 71 Example of array radius in shallow water

The graph shows the water depth/array radius for MPT 319/339 transponders, starting at 45° and reduced to 20° at 1000 m. This to avoid the long baselines and difficulties during calibration.

Transponder position

Normally the transponders are evenly spaced around the circle (as seen here with 6 transponders). The transponders need ”line-of-sight” between them to do the baseline measurements. Adjust the positions if necessary if structures/templates etc. is already placed on the seabed.

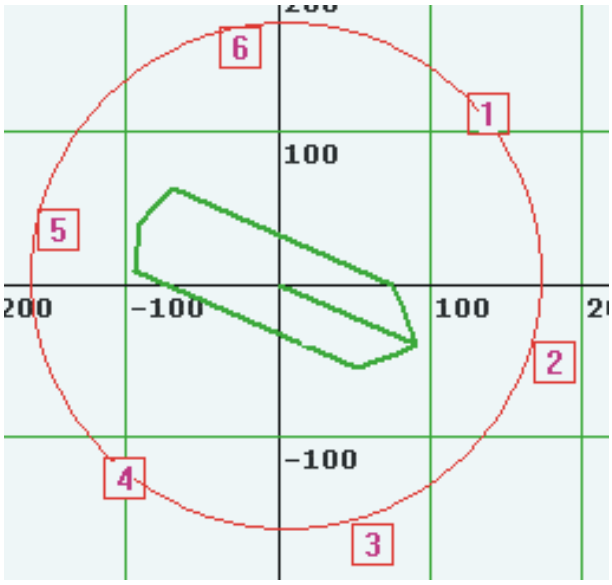


Figure 72 Example of transponder position

Once the calibration is done, objects on the seabed will not cause any problems.

Test certificates

Once the test engineer has performed or witnessed the performance of the test or part of a test, he must sign the appropriate field for each check, to certify that the unit or system has passed the particular part of the procedure.

The use of these fields is optional, but we recommend that they are properly filled in for future references.

Note

If the test engineer is not satisfied with the results, he must contact the personnel who performed the software installation, to have the work rectified and brought to the required standards.

Visual inspections

N/A

Test and alignments

The following related test procedure has to be completed.

- HiPAP/HPR Customer Acceptance Test.
  Refer to the *HiPAP Instruction manual/HPR Installation manual*.

Test procedure introduction

In all cases the step-by-step instructions must be followed if the tests are to be trustworthy.

In order to verify that the LBL function works properly, the following tests must be carried out:

- Baseline measured
- Calibrated transponder positions calculated
- Position the vessel using:
  - Transceiver 1/TD 1
  - Transceiver 1/TD 2
  - Transceiver 2/TD 1
  - Transceiver 2/TD 2

Follow the procedures and fill in the tables. Once the system has been tested, sign the signature page (last page).

The test results will be:

OK	When the test is done satisfactory.
FAIL	If the test fails.
NA	If the test is non-applicable.

In case only Multi-User LBL (MULBL) is to be tested and the array is already calibrated, go directly to paragraph on page 203.

Procedure overview

The following points give an overview of the main steps of the LBL calibration and positioning procedures.

1 Deploy the transponders. Activate the transponders in SSBL mode. Use the SSBL positions as initial positions for the LBL array.

2 De-activate the SSBL transponders and change the mode to LBL calibration.

3 Measure baselines between the transponders (choose 8 times and both ways).

4 Calculate the calibrated positions. Check the results. The max residual should be less than 1-2 meters. If not, exclude the measurement and calculate again.

5 Choose suitable LBL interrogation channel and turn around delay for the transponders. Set all transponders in LBL positioning mode.

6 Start LBL positioning. For HPR 400 systems, make sure the position calculation is based on ranges only. For HiPAP, use both ranges and angles.

7 Start to position the vessel in LBL mode. Observe the vessel position in relation to the array. If connected to a DP system, integrate the LBL position during DP station-keeping.

8 If the vessel is equipped with more than transducer/transceiver, repeat step 7 for all relevant transducers/transceivers.

Test procedures

Hull Unit

1 Ensure the gate valve is open.

2 Make sure that 220V/440V is switched on for the Hoist Control Unit (HCU)/hoist motor.

3 Lower the hull unit until it stops at the lower limit switch.

APOS software

How to start the APOS, is described in the APOS Instruction manual, section Operator manual doc no. 160841.

Refer to the APOS On-line help menu for:

- LBL general information
- LBL position procedure

Transceivers

Select the transceivers to be tested during array calibration.

1	Transceiver to be tested	Selected
	Transceiver: (1, 2, 3 or 4)	

Transponders

* Checked before deployment.

Transponder to be used			
Type	**Serial no**	**Channel**	**Checked***

LBL calibration

General

The calibration is performed using the APOS software.

Procedure

		Checked
1	Add all transponders to be used in the transponder configure dialogue. Remember to set the options correctly!	
2	Set the system default parameters: - Select the transducer to be tested. - Select correct maximum range.	
3	Select graphical view to show **North up**.	
4	If necessary, change the transponders that will result in a channel conflict. - Use the **Switch channel** command.	
5	Select telemetry transducer to be the default.	
6	Use a correct sound velocity profile if possible. If manual values are used, then set **the Sound QA to 5**. - Used sound profile: - Name:	
7	Manual sound velocity: Transducer (Only if a sound velocity profile is not used.)	m/s
8	Manual sound velocity: Mean (Only if a sound velocity profile is not used.)	m/s
9	Manual sound velocity: Transponder (Only if a sound velocity profile is not used.)	m/s
10	Place 3 or more transponders in a circle evenly spaced. Arrange the array to best geometry, based on the transmit and receive angle of the transducer and transponder.	
11	Move the vessel in a position to get the best transponder positions. This is normally with the ship's transducer in the centre of the array.	
12	Activate all transponders in SSBL mode.	
13	Wait for stable transponder position.	
14	Select **LBL Array-LBL calibration**.	
15	If necessary, delete all old position data.	

		Checked
16	Select: - **Initial position** - **Local presentation**	
17	Press **Insert active TPs**.	
18	Press **next** to continue with the change of TP mode.	
19	If necessary change the TP power settings.	
20	Press **Set all in LBL calibrating mode**. The telemetry starts. For each transponder confirm the action to be taken. The mode of all transponders has getting changed from **SSBL to LBL** calibration.	
21	Press **next** to continue with the change measurements.	
22	Set initial offset = 50 m. Select: - All locations - 8 range measurements - measurement one way.	
23	Accept range measurements when there are 4 or more of the 8 requested ranges. The std deviation must be less than 0.5 m. Repeat for all combinations!	
24	Calculate the co-ordinates. The RMS residual should be less than 1 m.	RMS residual:
25	You will get a question on how the error ellipses of the calibrated positions shall be calculated. Select the default alternative by pressing enter.	
26	If necessary then exclude measurements that has a residual more than 1 m and recalculate.	RMS residual:
27	Click the right button in the transponder field and select **Suggest**. Accept the default turnaround delays.	
28	Select a LBL interrogation channel.	LIC channel:
29	Set all in LBL positioning mode. - The telemetry starts. - Confirm the action until all transponders have changed mode from LBL calibration to LBL positioning.	
30	Press **Finish** to go back to the main menu.	

Calibration checked

LBL positioning has been checked according to the procedures defined. Comments concerning inaccuracies and faults have been filed as a separate report.

Shipyard's quality assurance department Signature	Date
Kongsberg Simrad representative Signature	Date

Multi-User LBL (MULBL)

General

This test is only to be carried out if the **Multi-User** LBL function is to be tested. The vessel(s) participating in this test must be within the coverage area (footprint on the surface) of all transponders in the already established LBL array.

The result is greatly dependent on the array geometry, number of transponders in the array and sound velocity data.

Procedure

The LBL array is already calibrated and set up for MULBL operation. All systems/vessels taking part in this test must have a copy of the <name>. HPR file containing transponder and calibration data as well as the sound velocity profile. Pass on the data by floppy disk or by e-mail.

One system/vessel is sending a command to the master transponder to start the MULBL mode:

1 Select:
- LBL array-LBL array data-Position setup.
- Tick ”Multi-user array”.
- Select LIC.
- Select Master transponder.
- Let the APOS determines the turnaround delays.
- Set all transponders in LBL mode.
- Activate the master transponder to start the MULBL mode.

2 Save the set-up by entering ”File-Save as..”. Save both to the harddisk and to a floppy disk (so you can pass on the information to other vessels, if necessary). All systems/vessels start the MULBL mode.

3 Observe the ranges received. All transponders should reply.

4 The RMS residual figure is dependent upon the quality of the calibration.
- The figure is 1 if the measurements are as expected. To obtain this, the sound velocity must be correct (refer to the table below for expected values).
- Integrate the MULBL in the DP (if available). After the MULBL standard deviation has settled on the DP, note the value in the check list.

Expected accuracy (RMS residual)		
Depth	Array radius (331DuBTPs)	RMS residual
500 m	90 m	1.3
1000 m	170 m	1.3
1500 m	240 m	1.3
2000 m	310 m	1.3
2500 m	350 m	1.3
3000 m	380 m	1.3

Test results

Multi-User LBL (MULBL) positioning test using HiPAP/HPR

LBL array data

Array radius: m

Array depth: m

Loc #	Serial no.	Channel	TP type (MPT331/339)	Nav. TX power	TAD	Master
1						
2						
3						
4						
5						
6						

Item to be checked	Result
Pos MULBL array:	
- System_1/Vessel_1 name - RMS residual_1 - DP reference_1 (st.dev)	(m)
- System_2/Vessel_2 name - RMS residual_2 - DP reference_2 (st.dev)	(m)
- System_3/Vessel_3 name - RMS residual_3 - DP reference_3 (st.dev)	(m)
- System_4/Vessel_4 name - RMS residual_4 - DP reference_4 (st.dev)	(m)

MULBL positioning has been checked according to the procedures defined. Comments concerning inaccuracies and faults have been filed as a separate report.

Customer's quality assurance department

Signature Date

Kongsberg Simrad representative

Signature Date

Remarks and signatures

Remarks

Remarks (if any) must be noted here or in a separate report.

Signatures

Checked by:

Place Date Signature

Approved by:

Place Date Signature

PREVIOUS HARDWARE

Overview

This section comprises information about hardware no longer in use in new versions of the HiPAP systems. The information has been provided to aid users of older systems.

- **APC 10**
  - Motherboard SE440BX-2, page 206.
  - DFlex-2 serial adapter, page 212.
- **Transceiver units**
  - Responder Controller (RPC) board, page 219.

Motherboard SE440BX-2

For complete manual, refer to manufacturer;
fttp://download.intel.com/design/motherbd/se2/72163201.pdf

The motherboard is the main computer board in the APC 10 unit. It holds the microprocessor and supporting electronics, and controls all the input/output interfacing for the APC 10.

→ *The motherboard layout is shown in the figure on page 207.*

General

Facilities

LEDs

As indicated on the board front panel.

→ *Refer to the figure on page 207.*

Test points

None.

Links

The configuration jumper on the motherboard has three settings and three modes of operation as described in the table below. For placement of the configuration jumper.

→ *Refer to the figure on page 207.*

Configuration jumper		
Function	**Jumper J8A1**	**Description**
Normal (default)	1-2	BIOS uses current configuration and passwords for booting.
Configure	2-3	After POST runs, Setup runs automatically. The Maintenance menu is displayed. The menu displays options for setting the processor speed and clearing the passwords.
Recovery	None	The BIOS attempts to recover the BIOS configuration. A recovery diskette is required.

Table 3 Configuration jumper

Switches

Advanced Power Management (APM)
. . . . . Suspend/resume switch connected to the front panel sleep connector.

Advanced Configuration and Power Interface (ACPI)
. . . . . Support for a front panel power and sleep mode switch.

I/O Connectors

Front panel I/O connectors

The motherboard connectors and indicators located on the front panel are presented as follows:

→ *The placements of the connectors are illustrated in figure 73.*

→ *The pins layout are described in table 4.*

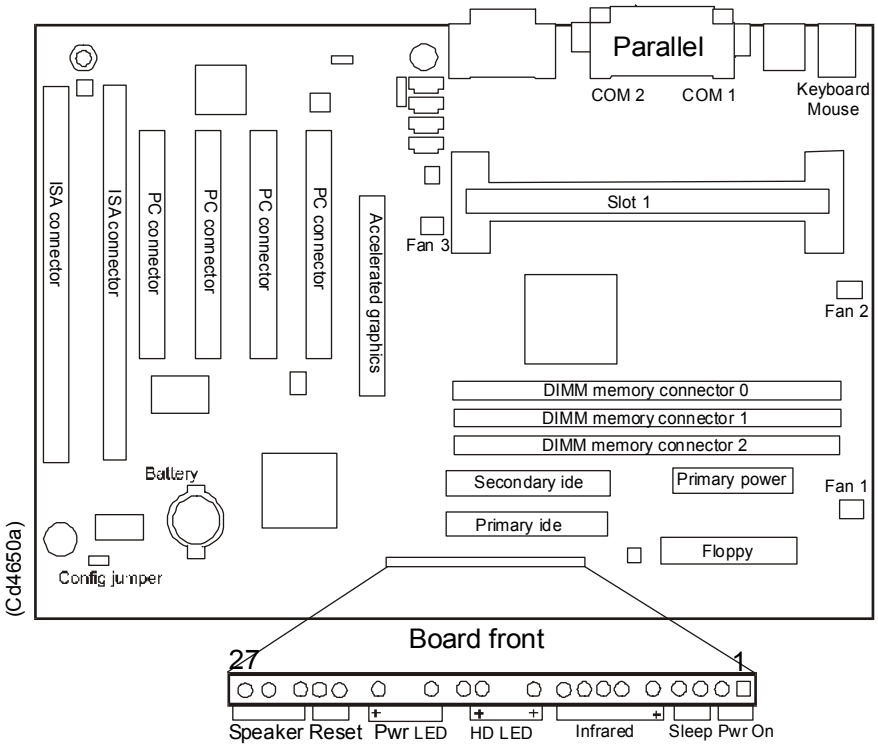


Figure 73 Motherboard with front panel I/O connectors

Front panel I/O connectors					
Connector	**Pin**	**Signal name**	**Connector**	**Pin**	**Signal name**
Speaker	**27**	SPRK		**13**	HD_PWR +5 V (5 V, 15 mA max)
	26	SPRK	None	**12**	Key
	25	Key	Infrared (IfDA) **(Infrared)**	**11**	+5 V
	24	Ground		**10**	IR TX
Reset	**23**	FP_RESET#		**9**	Ground
	22	Ground		**8**	IR RX
None	**21**	Key		**7**	Key
Sleep/ power LED **(Pwr LED)**	**20**	PWR_LED1 (green)		**6**	+5 V
	19	Key	None	**5**	Key
	18	PWR_LED0 (yellow)	Sleep/ Resume (Sleep)	**4**	Ground
None	**21**	Key		**3**	SLEEP_REQ#
None	**17**	Key	Power On (Pwr On)	**2**	Ground
Hard Drive LED (HD LED)	**16**	HD_PWR (5 V, 15 mA max.)		**1**	SW_ON#
	15	HD Active #			
	14	Key			

Table 4 Front panel I/O connectors

Rear side I/O connectors

The motherboard connectors on the rear side are presented as follows:

→ *The placements of the connectors are illustrated in figure 74.*

→ *The use of each connector is stated in table 5.*

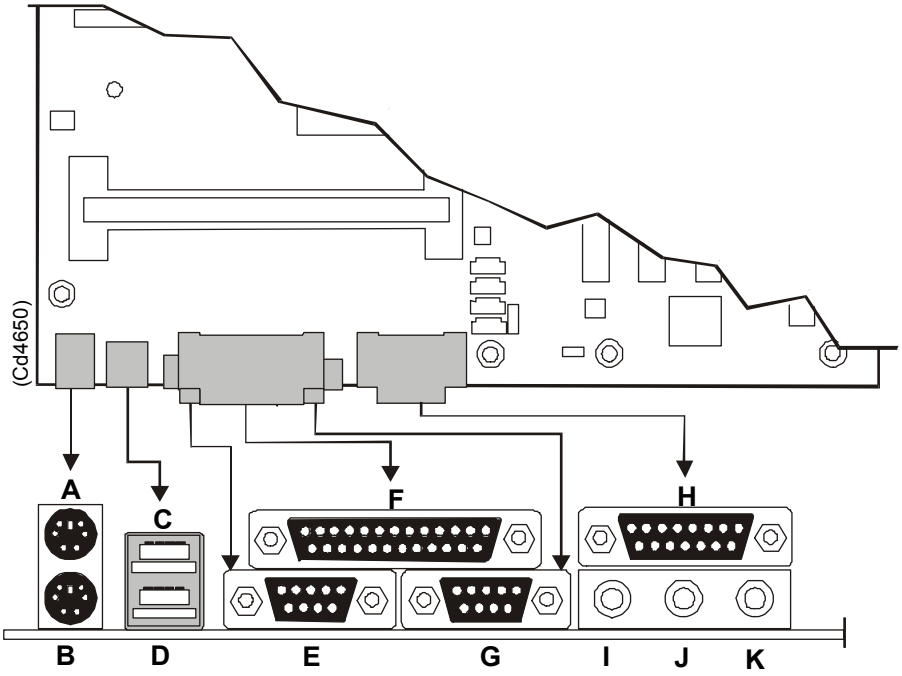


Figure 74 Motherboard rear side I/O connectors

The rear side connectors are as follows:

A PS/2 keyboard or mouse	**G** Serial port B
B PS/2 keyboard or mouse	**H** Not used
C USB Port 1	**I** Not used
D USB Port 0	**J** Not used
E Serial Port A	**K** Not used
F Parallel Port	

Table 5 Rear side I/O connectors

Battery

General

When your computer is turned off, a lithium battery maintains the current time-of-day clock and the values in CMOS RAM current.

The battery should last about 7 years, but must be replaced when required (for example when the date and time is no longer accurate).

Changing the battery

To replace the battery proceed as follows:

1 Turn off all peripheral devices connected to the computer.

2 Remove the computer cover.

3 Locate the battery on the motherboard (see figure 75).

4 Use a medium flat-bladed screwdriver, and gently pry the battery free from its socket.
Note the orientation of the + and - on the battery.

5 Install the new battery correctly.

6 Replace the computer cover.

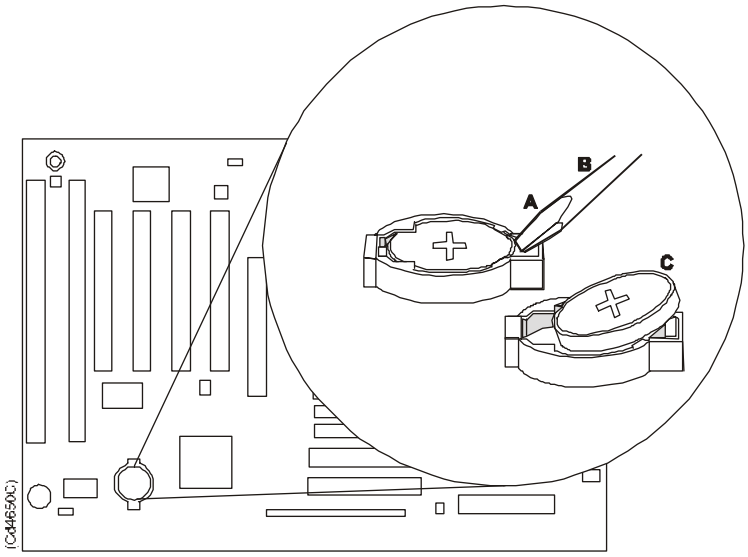


Figure 75 Replacing the battery

How to set the processor speed

Set the processor speed after you have installed or upgraded the processor. The procedure assumes that the motherboard is installed and the configuration jumper block is set to **Normal mode**.

- How to open the computer:

→ *Refer to page 26.*

- Placing the jumpers:

→ *Refer to table on page 206.*

1 Locate the configuration jumpers block.

→ *Refer to figure on page 207.*

2 Place the jumper on pins 2-3.

3 Replace the computer cover.

4 Turn on the computer, and allow it to boot.
- The computer starts the Setup program.

- Setup displays the Maintenance menu.

5 Select **Processor Speed** and press **Enter**.

- The Setup displays a pop-up window with the available processor speeds. confirm clearing the password.

6 Select the required processor speed and press **Enter**.
(For example, select 266 for
a 266 MHz Pentium II Processor).

- The Maintenance menu reappears.

7 Press **F10** to save the current values and exit the Setup.

8 Turn off the computer.

9 Remove the computer cover.

10 Restore to normal operation, by placing the jumpers on pin 1-2.

11 Replace the computer cover.

12 Turn on the computer.

13 Verify the processor speed during POST.

How to clear the passwords

The procedure assumes that the motherboard is installed and the configuration jumper block is set to **Normal mode**.

1 Locate the configuration jumpers block

→ *Refer to figure on page 207.*

2 Place the jumper on pins 2-3.

3 Replace the computer cover.

4 Turn on the computer, and allow it to boot.

- The computer starts the Setup program.

5 Select **Clear Password** and press **Enter**.

- The Setup displays a pop-up window where you must confirm clearing the password.

6 Select **Yes** and press **Enter**.

- The Maintenance menu reappears.

7 Press **F10** to save the current value and exit the Setup.

8 Turn off the computer.

9 Remove the computer cover.

10 Restore to normal operation, by placing the jumpers on pin 1-2.

11 Replace the computer cover.

12 Turn on the computer.

DFlex-2 serial adapter

DFlex manufacturer; http://www.connecttech.com

Introduction

The DFlex-2 serial adapter is a 2-port asynchronous communications adapter board supplied by Connect Tech Inc. of Canada. It uses 16450 or 16550 UARTS, and incorporates electrical interface modules to provide flexible line interfaces. It holds one SIMM module mounted on brackets on the component side of the board.

The SIMM module enables you to select RS-232, RS-422 or 20 mA current loop interface to the board (only one can be selected).

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

In the event of a fault occurring in the board or in the SIMM module, the faulty unit must be replaced.

DFlex Installation for Windows NT

The DFlex board uses a specific driver on Windows NT. This driver makes it possible to use a single interrupt from each board. The following items must be carried out when the board is installed.

- Set board DIP switches and links (see table 6 and 7)
- Reserve interrupt used by board in the BIOS
- Install the driver
- Test the board

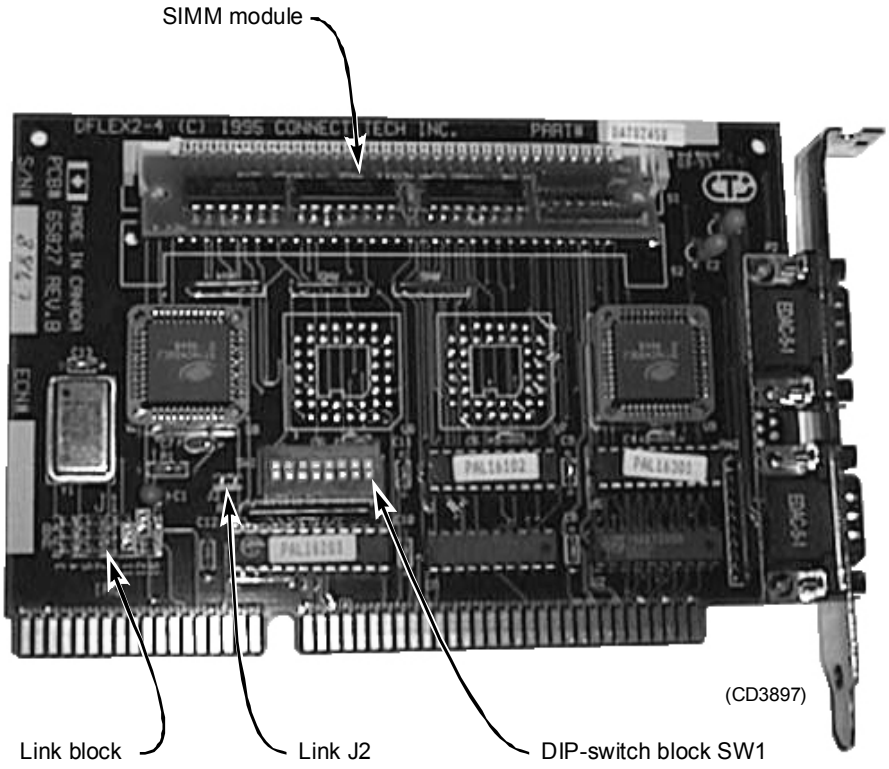


Figure 76 DFlex-2 serial adapter board with its SIMM module

Switch settings

The DFlex-2 board holds one DIP switch block, SW1. This must be set as shown in the tables below to enable the required COM ports. See also the associated link settings.

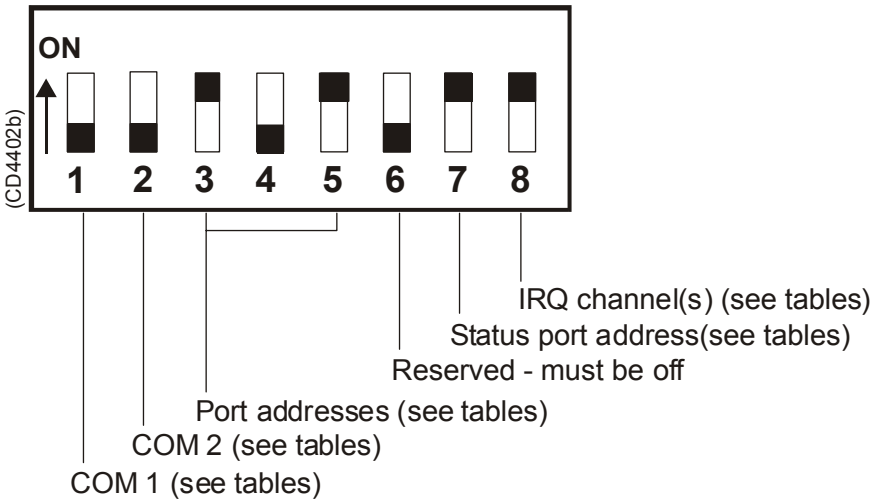


Figure 77 DIP switch settings - block SW1

DFlex-2 DIP switch SW1 as COM3 and COM4 on WinNT		
Switch	Position	Effect
1	Off	COM1 Off
2	Off	COM2 Off
3	On	COM3 address 280h COM4 address 288h
4	Off	
5	On	
6	Off	Reserved, must be Off
7	On	Status port address 2C0h
8	On	Interrupt on A channel

Table 6 DIP switch for standard selection of COM3 and COM4 using WinNT software

DFlex-2 DIP switch SW1 as COM5 and COM6 on WinNT		
Switch	Position	Effect
1	Off	COM1 Off
2	Off	COM2 Off
3	Off	COM5 address 290h COM6 address 298h
4	Off	
5	On	
6	Off	Reserved, must be Off
7	On	Status port address 2D0h
8	On	Interrupt on A channel

Table 7 DIP switch for standard selection of COM5 and COM6 using WinNT software

Switch			**Port Address**		
3	4	5	1	2	Status
On	On	On	200	208	240
On	On	Off	240	248	280
On	Off	On	280	288	2C0
On	Off	Off	2C0	2C8	300
Off	On	On	1B0	1B8	188
Off	On	Off	2B0	2B8	288
Off	Off	On	290	298	2D0
Off	Off	Off	190	198	1D0

Table 8 Address switch combination

Link settings

The DFlex-2 board holds:

→ *Refer to the figure on page 213.*

- One block of eight links.
  - Each link on the block can be open, or set to either position A or position B.
- One individual link (J2).
  - Link J2 must be open.

The figure below shows an example where J1 selected for IRQ 3 and 4 on channel B and A respectively.

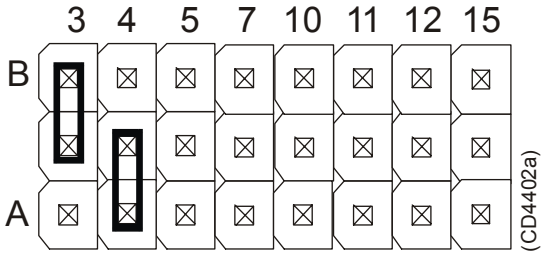


Figure 78 Link block

When the DFlex board is used on Windows NT with a special driver, a single link in position A is used.

The link numbers correspond to IRQ no. Before selecting an IRQ, make sure that this IRQ is NOT used by any other hardware on the computer. Use programs/Administrative tools/Windows NT diagnostics to verify this. When the IRQ no has been selected, restart the computer, enter the BIOS setup and set this IRQ no to Reserved by ISA card.

Typically IRQ 12,11,10 and 5 is free. However, some of these may be in use by one or two network cards. The PS-2 mouse normally uses IRQ 12.

After the board has been installed, (only when it is installed for the first time) run the DFlex installation program:
\WINHPR\DFlex\disk1\SETUP.EXE

1 First install the driver.

2 When the DConf dialogue is displayed, press the Add new board button and set the addresses and IRQ no correct.

3 Press the OK/Exit button.

Connectors

The DFlex-2 card incorporates two edge connectors to connect it into the motherboard, and two 9-pin male D connectors for the serial lines.

→ *Refer to figure on page 213.*

In the figure, the upper D connector is port 1 while the lower connector is port 2.

Serial lines 3 and 4 are normally the two lines on the DFlex board, and can be RS-232, RS-422 or 20 mA current loop depending on the optional SIMM module mounted on the DFlex board.

Serial lines (Com) RS-232

The two or four serial lines are connected to 9-pin Delta connectors. The pins are allocated as follows:

1 Carrier detect
2 Receive data
3 Transmit data
4 Data terminal ready
5 Ground
6 Data set ready
7 Ready to send
8 Clear to send
9 Ring indicator

Serial lines (Com) RS-422

The two or four serial lines are connected to 9-pin Delta connectors. The pins are allocated as follows:

1 Reception data +
2 Transmission data +
3 Transmission data -
4 Reception data -
5 Ground

Serial lines (Com) Current loop

The two or four serial lines are connected to 9-pin Delta connectors. The pins are allocated as follows:

1	Reception data -
2	Transmission data +
3	Transmission source
4	Transmission return
5	Ground
6	Reception return
7	Transmission data -
8	Reception data +
9	Reception source

Responder Controller (RPC) board

Introduction

The location of the responder controller (RPC) is indicated on the figure below.

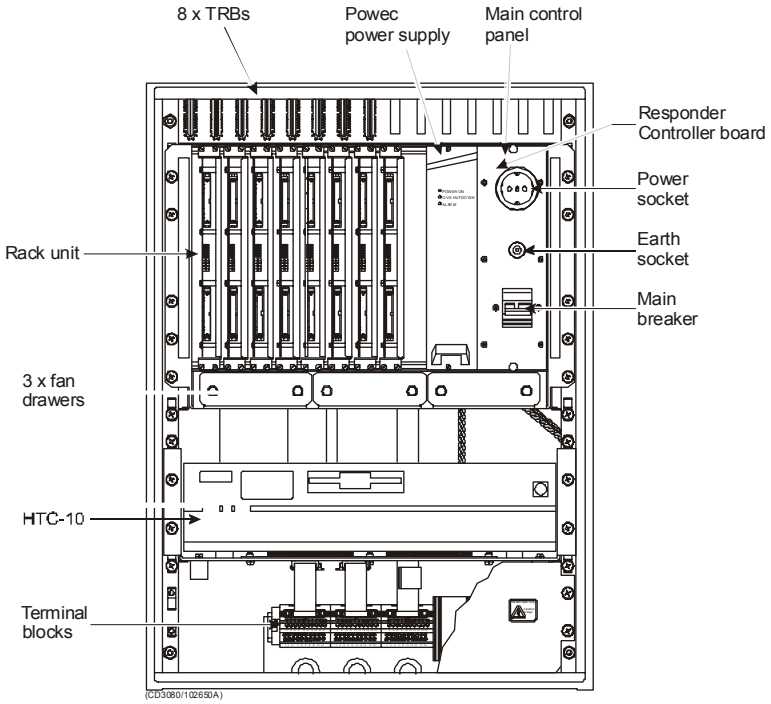


Figure 79 Transceiver unit indicating RPC board

Purpose

The purpose of the responder controller (RPC) board is to provide responder trigger pulses as requested from the Operator Station.

Board description

The RPC board is located behind the main control panel. It is designed to the single Euro-card standard. The board holds four identical opto-isolated responder trigger circuits, and communicates with the TMC board in the PC via a flat cable.

The RPC board's address is set by means of the DIL switch U2.

Switches

Dil switch U2	Address switch block

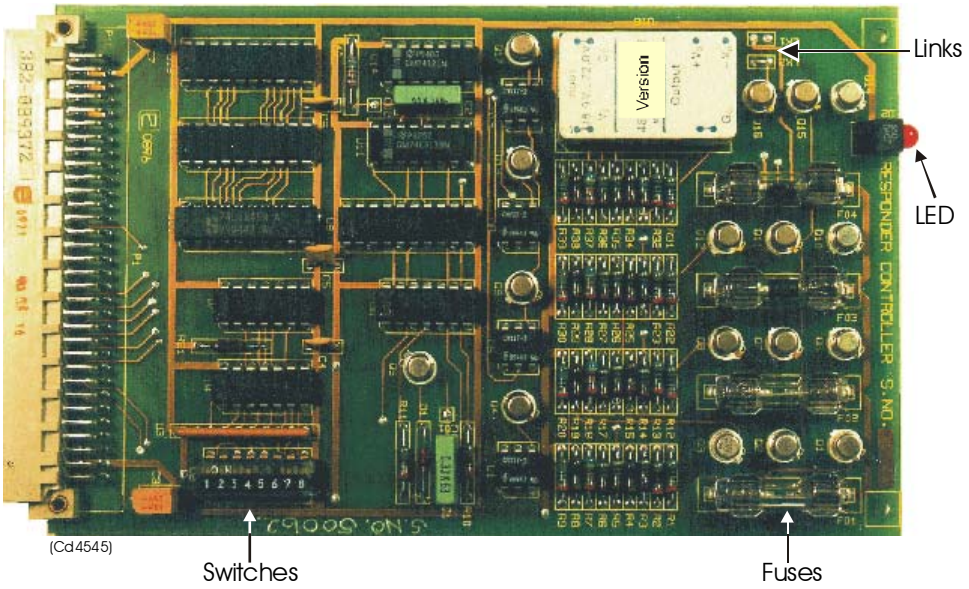


Figure 80 RPC board

Front mounted devices

The RPC board carries four fuses and a diode mounted on its front edge.

Switches 1, 2 and 3 must be set to **ON**, switches 4, 5, 6, 7 and 8 must be set to **OFF**.

Socket-mounted components

The board carries no socket-mounted components.

Connections

The board holds one connector, P1, located on the back edge of the board. This connects the board into the Transceiver Unit backplane.

P1	64-pin, male, right-angled connector

Test points

The RPC has no specific test points for use by the maintenance engineer.

Links

LK1	Connected only when 24 V is supplied and U16 is not mounted
LK2	Always connected

LED

D2	Lights when board is transmitting

Fuses

The board carries four 0.1 A, slow-blow fuses, on the +24 Vdc lines.

DRAWING FILE

Overview

This section contains illustrations referred to in various sections in this manual. The illustrations are based on the original system drawings and wiring diagrams.

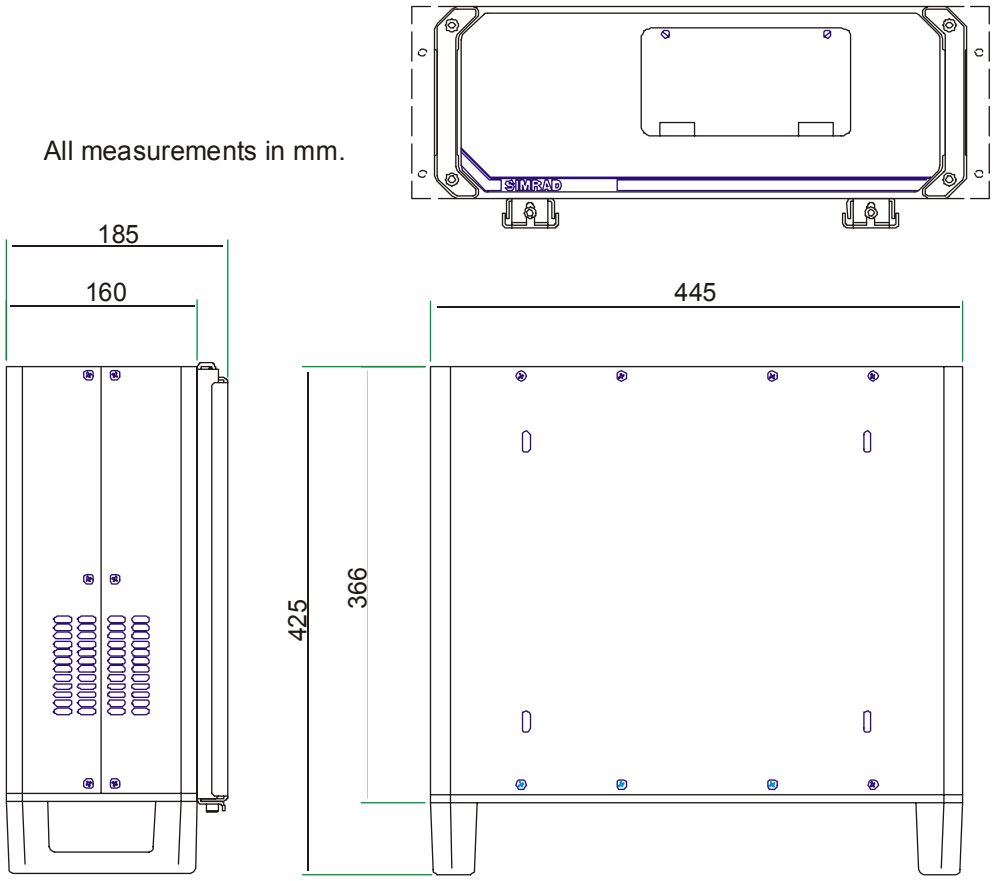
- The illustrations are not in scale.
- The original drawings are available in electronic format (AutoCAD) upon request.

Drawings

The following illustrations are implemented:

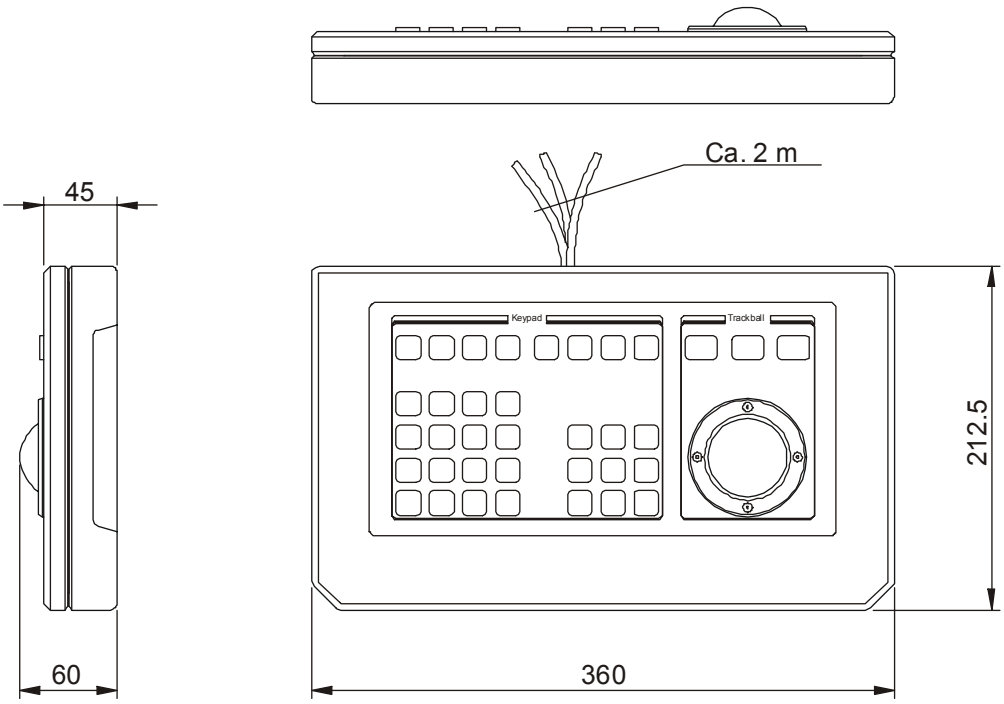
- **Outline dimensions**
  - APC 10, page 223.
  - WinKeyboard, page 224.
  - Transceiver unit, page 227.
- **Installation**
  - APC 10 rack mounting, page 225.
  - APC 10 desktop mounting, page 226.
- **Interconnection and circuit diagrams**
  - APC 10 wiring diagram, page 228.
  - Transceiver unit interconnection diagram (three pages), page 229.
  - Dual net connection diagram, page 232.
  - IPPS Converter - block diagram, page 233.
  - IPPS Converter - assembly drawing, page 234.

All measurements in mm.



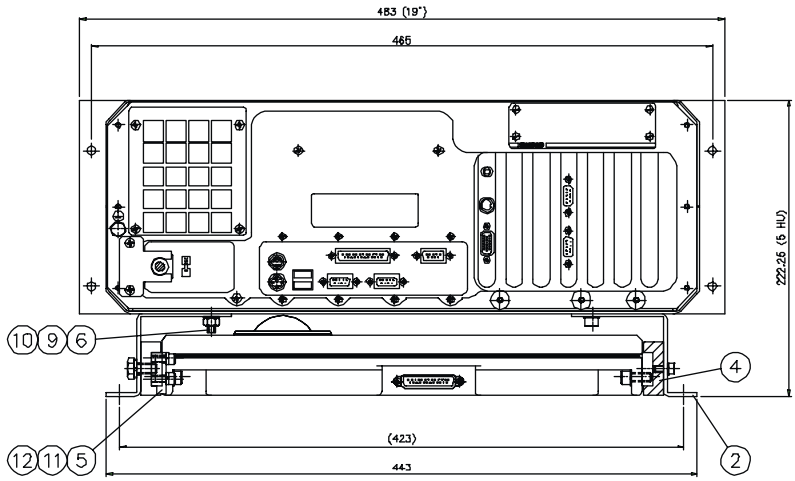
Page 1 of 1 (CD3860B)	APC10 Processor Unit Outline dimensions	**834-210400** Rev.A

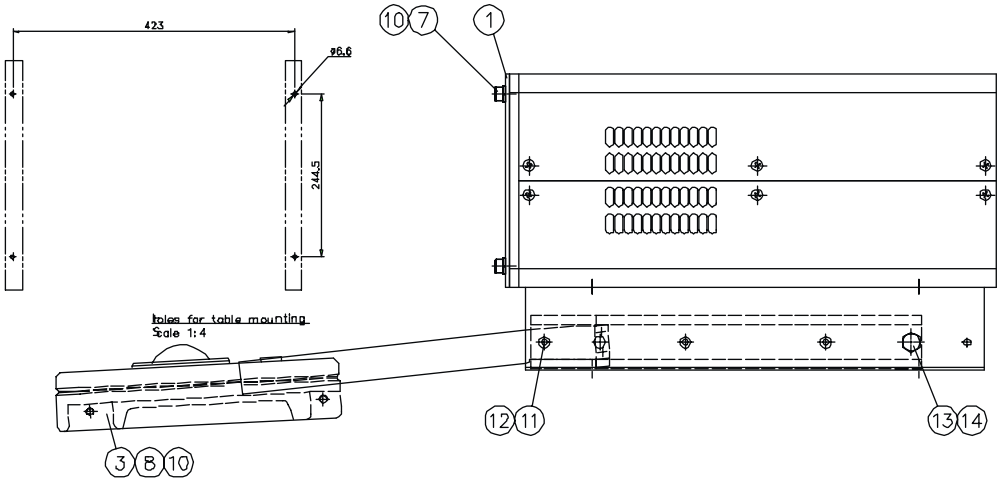
All measurements in mm.



Page 1 of 1 (CD3861a)	WinKeyboard - outline dimensions	**834-210401** Rev.A

All measurements in mm.



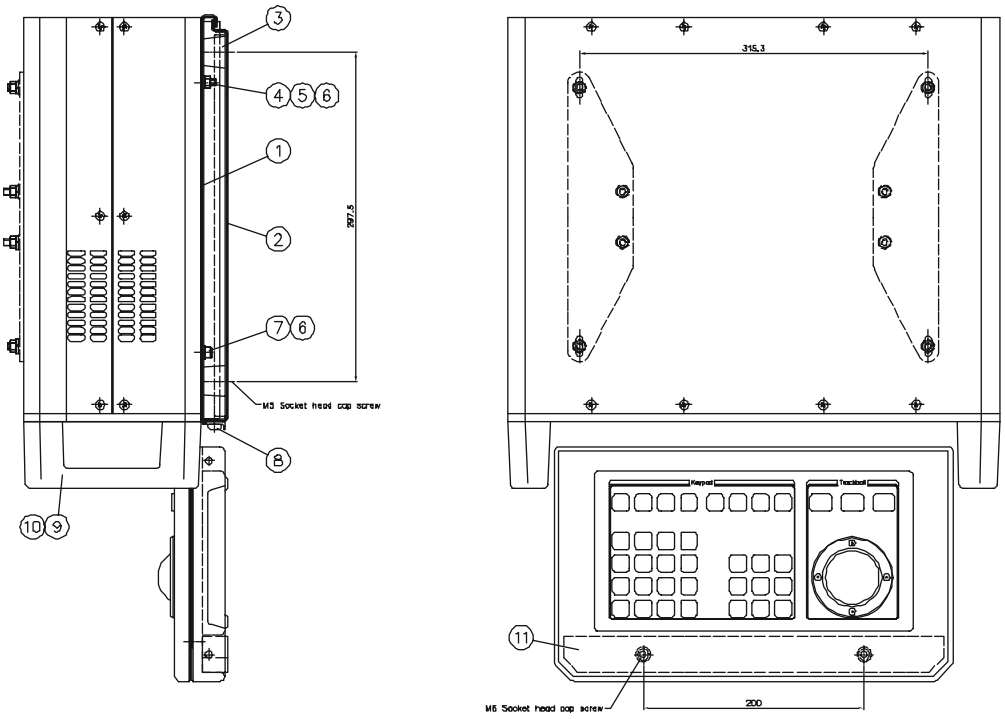


Parts list for rack mounting

1 Mounting brackets for 19" rack - computer
2 Support bracket 19" rack, - APC 10
3 Slide rail WinKeyboard
4 Slide rail WinKeyboard
5 Stop block
6 T-HEAD BOLT, desktop computer
7 M6x10 Soc. h. cap scr. DIN912 A4
8 M6x16 Soc. h. cap scr.DIN912 A4
9 HEX Nuts M6 DIN934 AP
10 Split lockwasher F/M6 DIN127B A4
11 M5x10 Soc. h. cap scr.DIN912 A4
12 Split lockwasher F/M5 DIN127B A4
13 Hex head screw M8x16 DIN933 A4
14 Split lockwasher F/M8 DIN127B A4

Page 1 of 1 (C4781a)	APC 10 - rack mounting	**820-210375** Rev.A

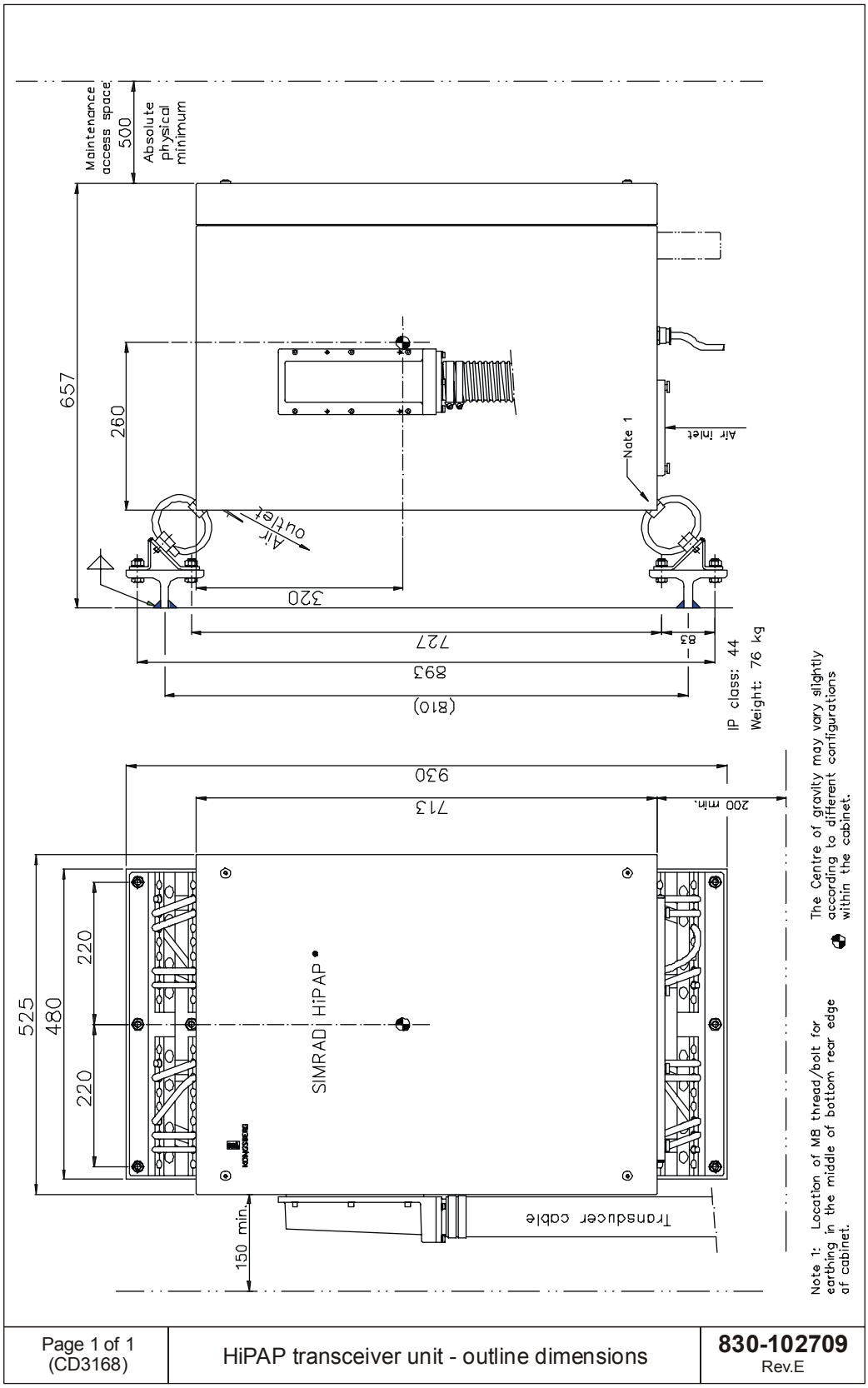
All measurements in mm.



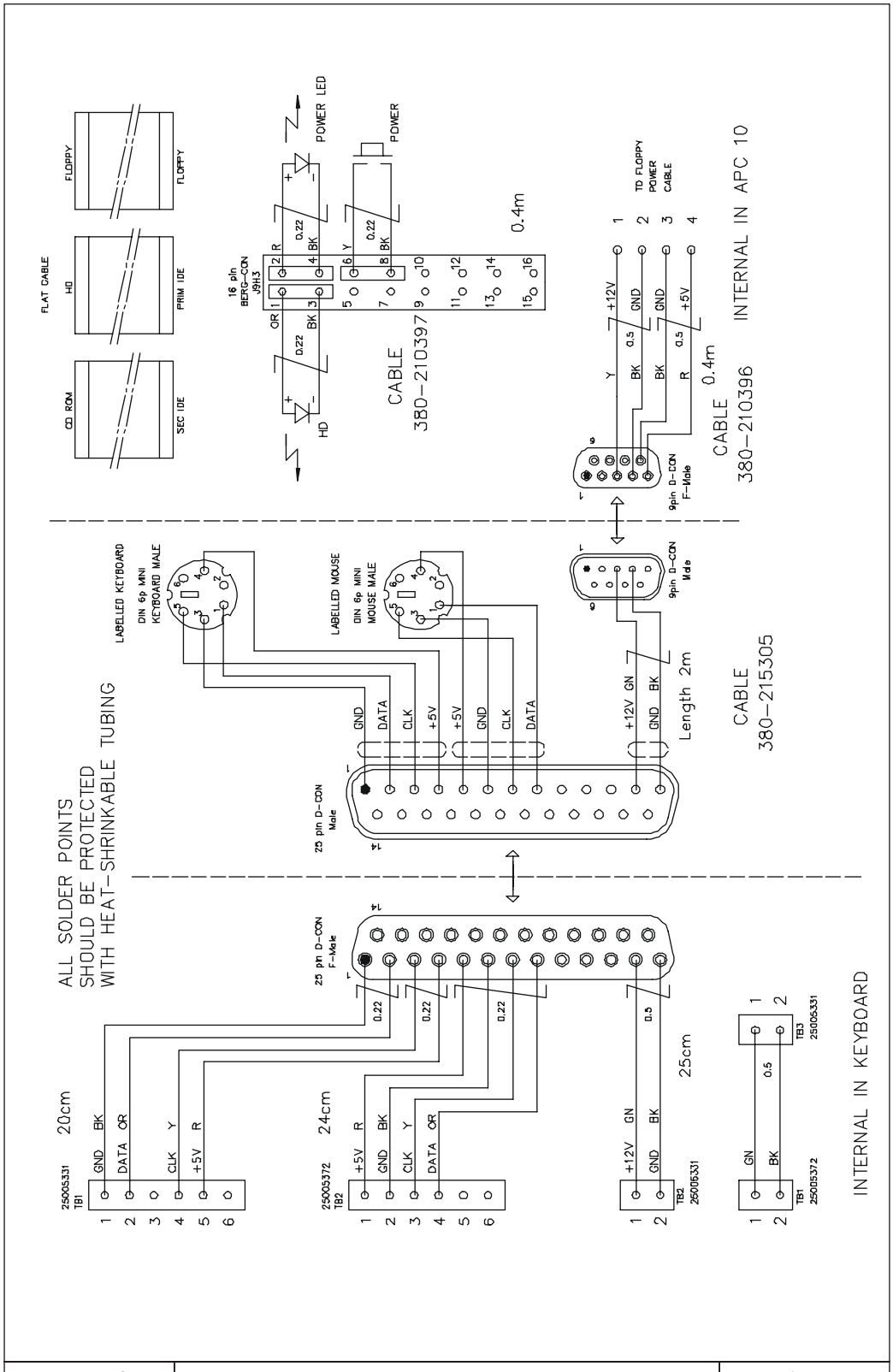
Parts list for desktop mounting

1 Mounting brackets, computer
2 Mounting brackets, display
3 Rubber feet round TF10T-TRP87-black
4 T-head bolt, desktop computer
5 Hex nut M6 DIN934 A4
6 Shake-proof washer, F/M6 DIN6798A A4 serrated
7 M6x10 socket head cap DIN912 A4
8 M6x16 PANH W/ X ~DIN7985 A4
9 M6x60 socket head cap DIN912 A4
10 Handle, desktop computer
11 Mounting block for Winkeyboard

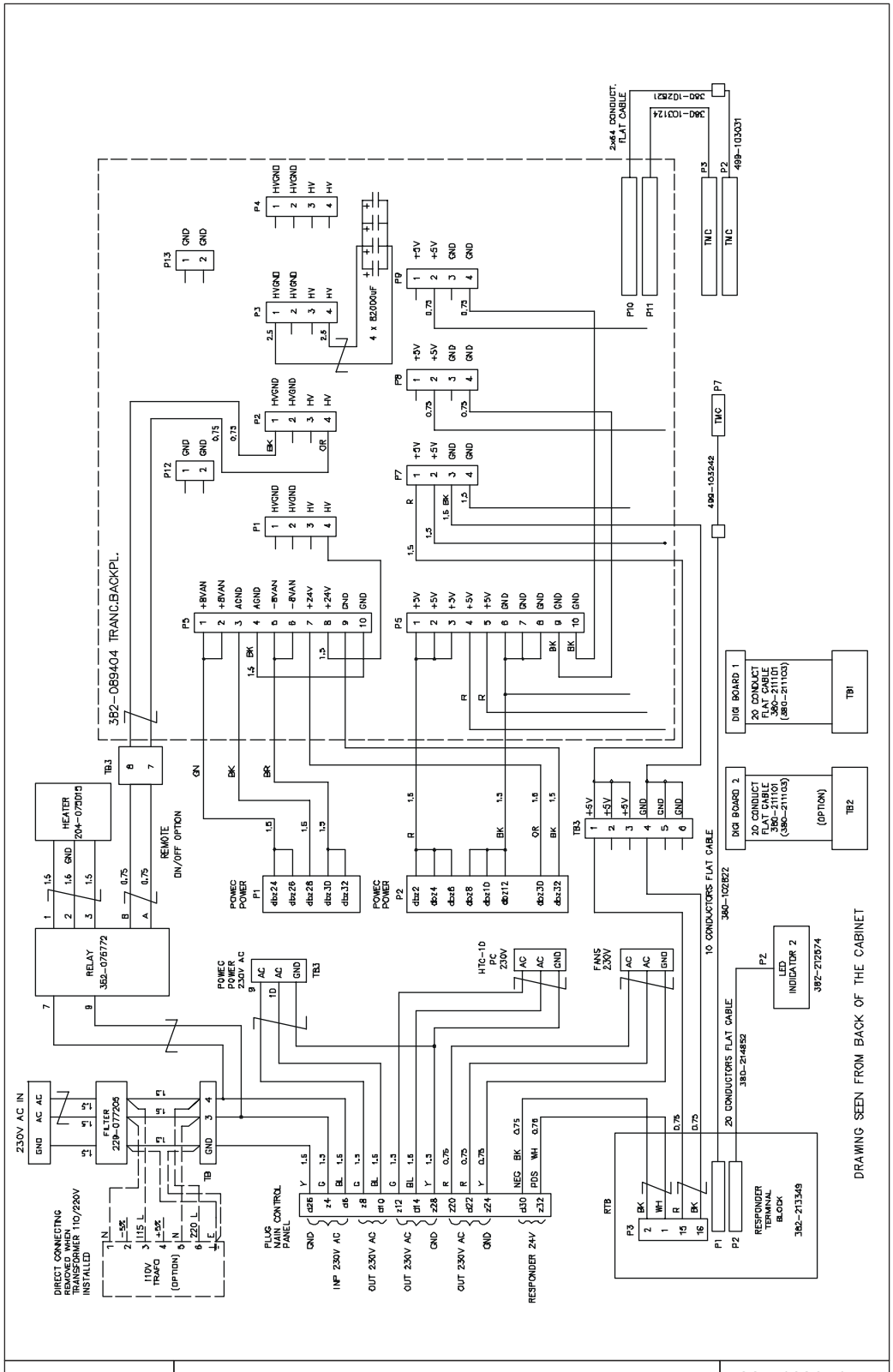
Page 1 of 1 (CD4780a)	APC 10 - desktop mounting	**820-210373** Rev.C



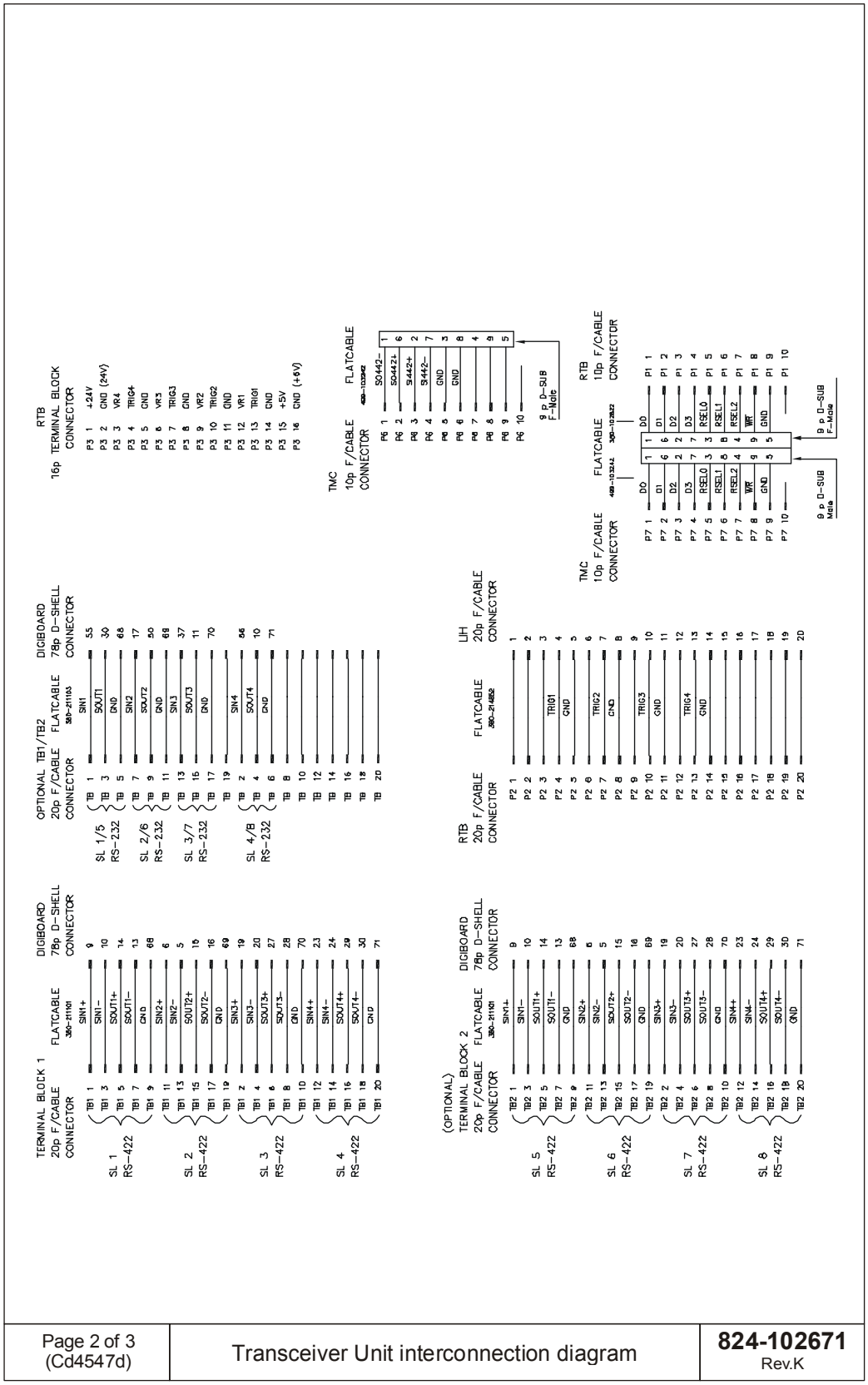
Page 1 of 1 (CD3168)	HiPAP transceiver unit - outline dimensions	**830-102709** Rev.E



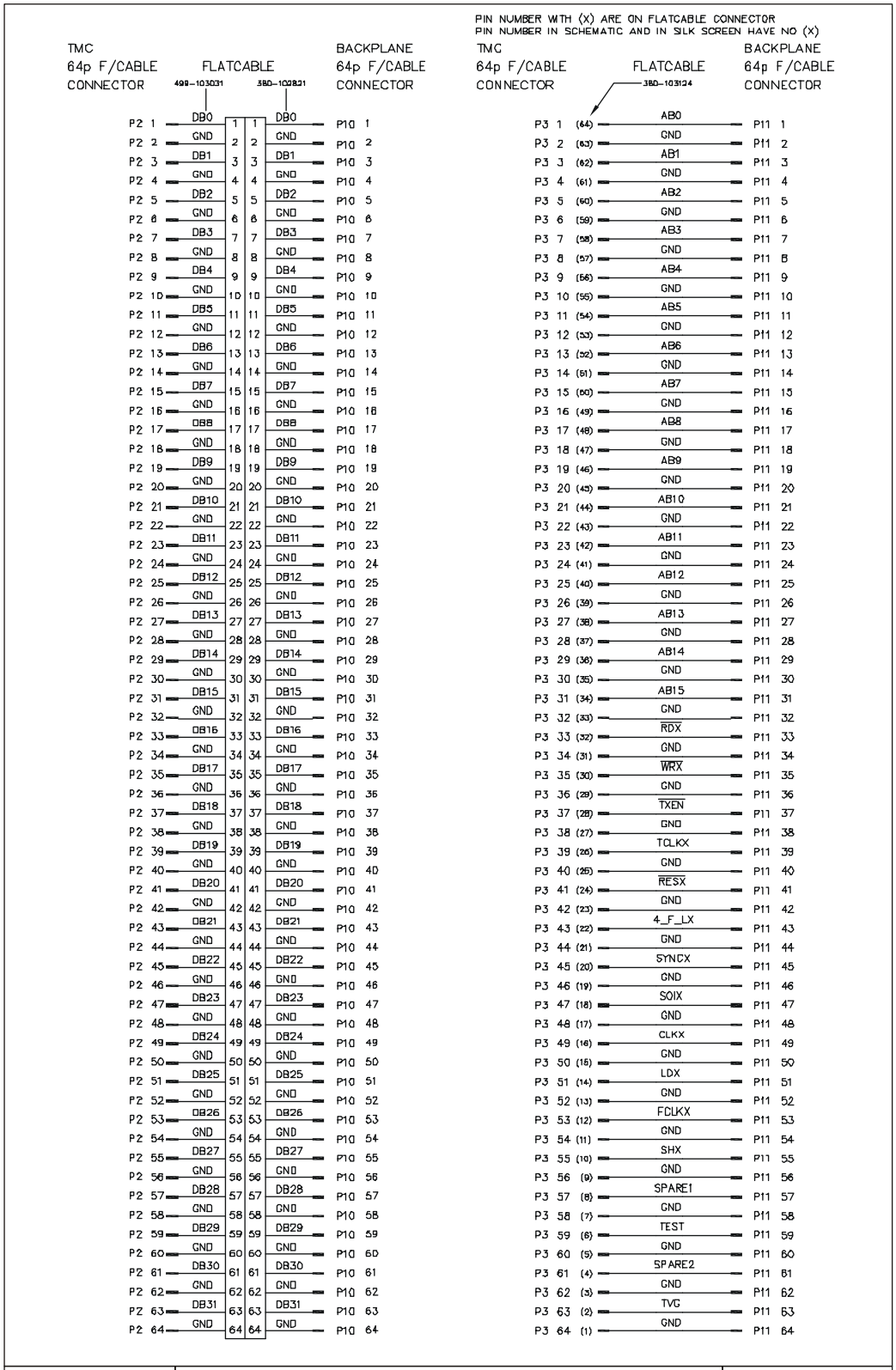
Page 1 of 1 (Cd4788)	APC 10 wiring diagam	**824210399** Rev.D



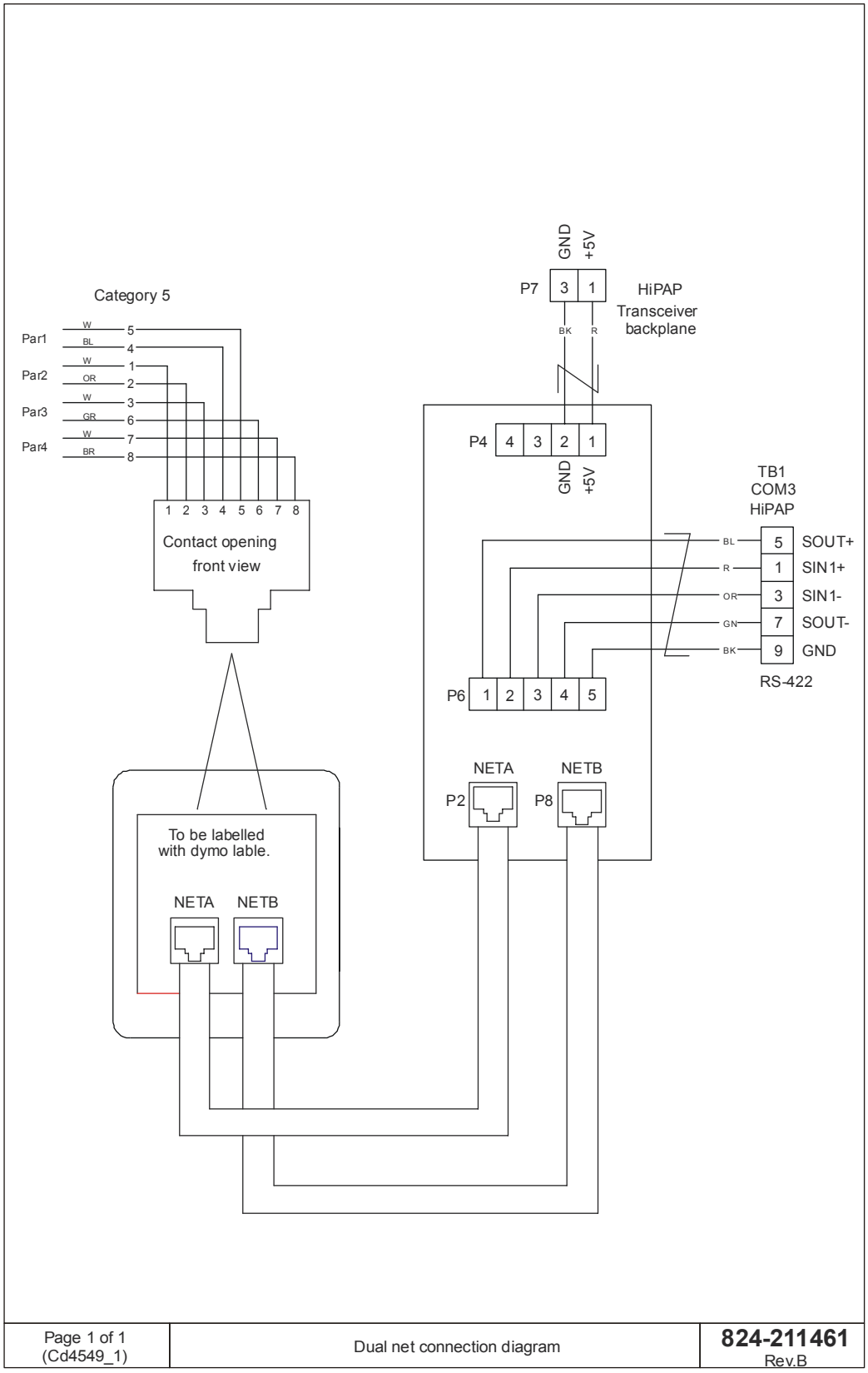
Page 1 of 3 (Cd4547c)	Transceiver Unit interconnection diagram	824-102671 Rev.K



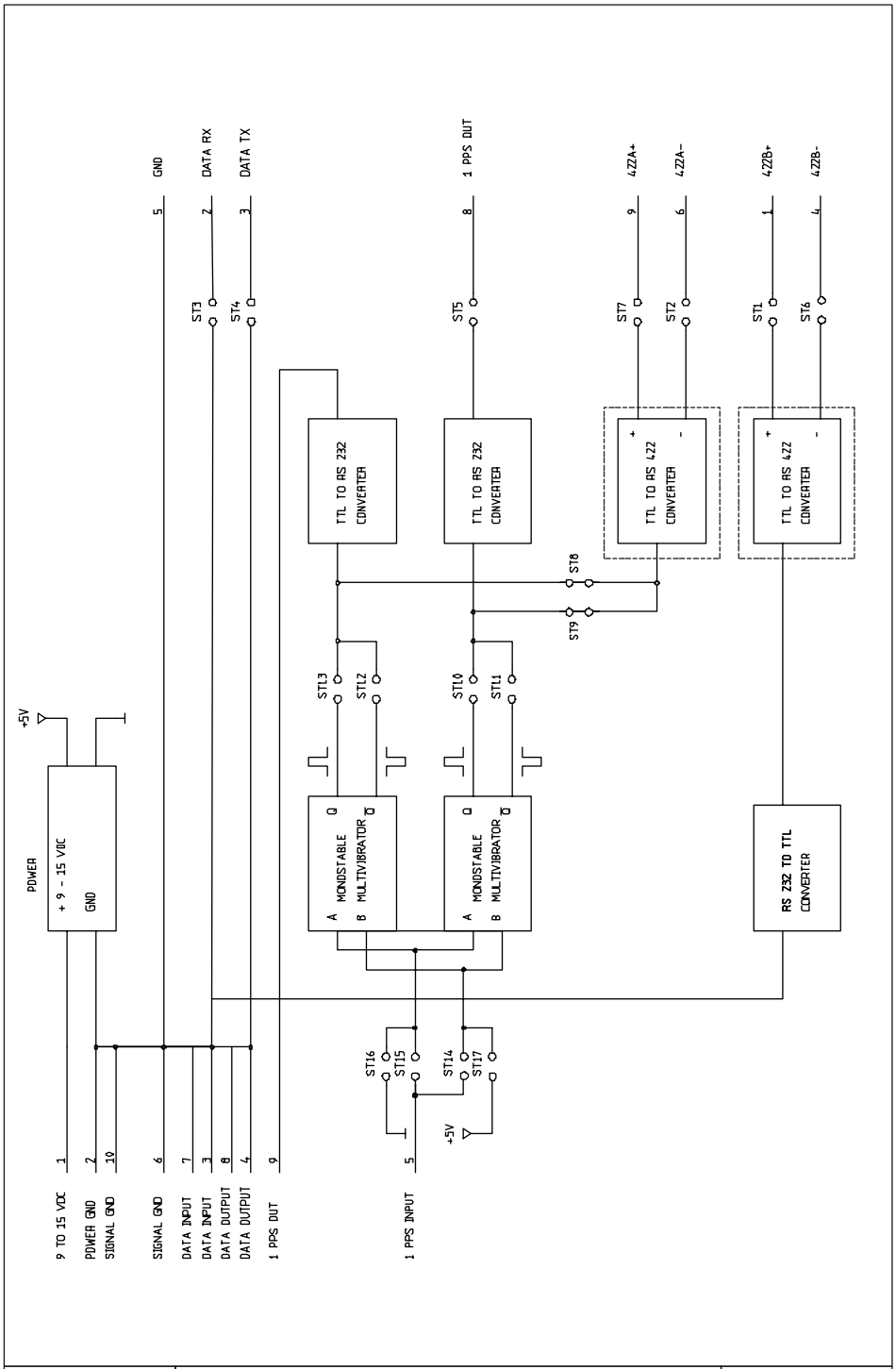
Page 2 of 3 (Cd4547d)	Transceiver Unit interconnection diagram	**824-102671** Rev.K

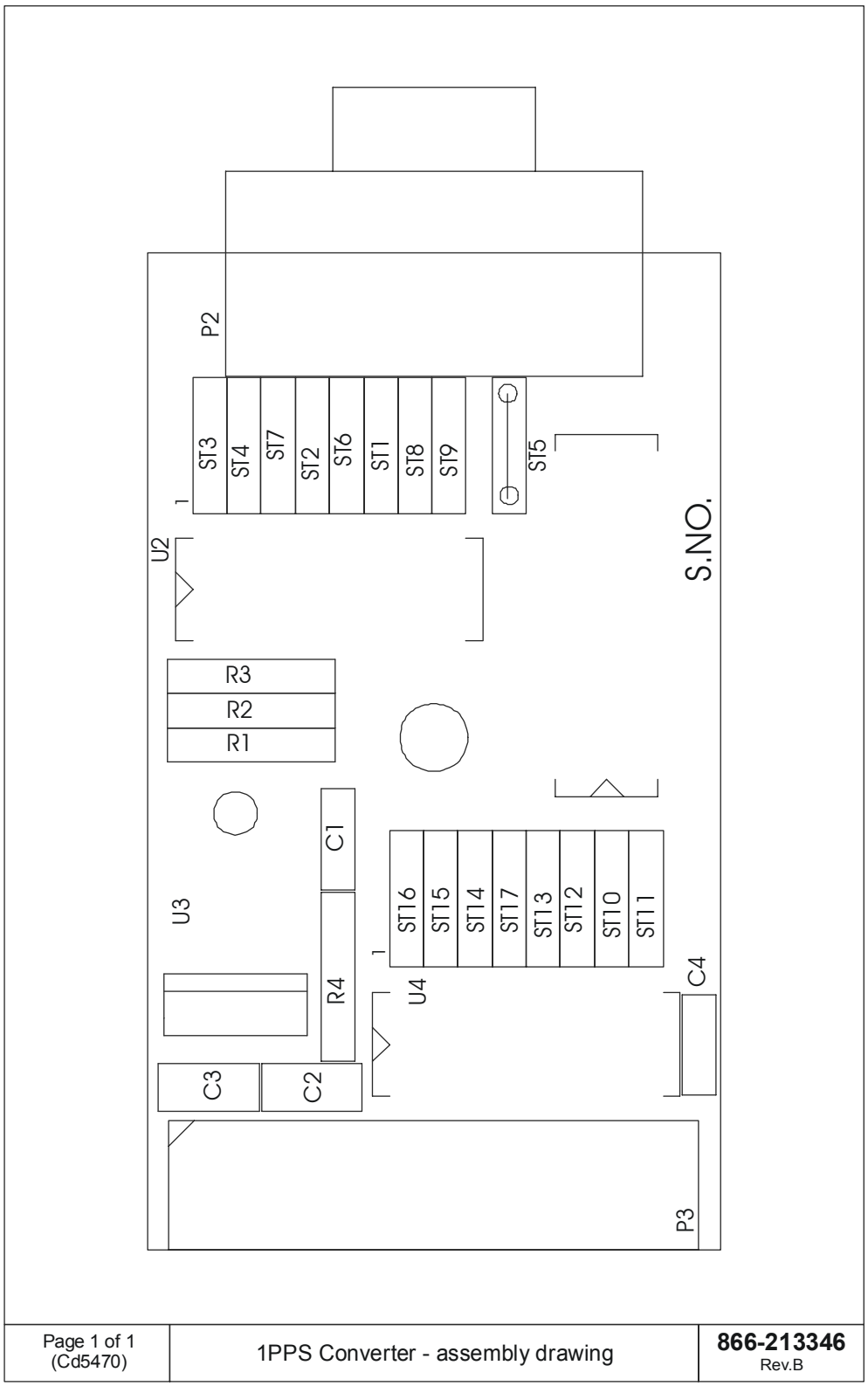


Page 3 of 3 (Cd4547e)	Transceiver Unit interconnection diagram	**824-102671** Rev.K



Page 1 of 1 (Cd4549_1)	Dual net connection diagram	**824-211461** Rev.B


GND
DATA RX
DATA TX
1 PPS OUT
422A+
422A-
422B+
422B-
ST3
ST4
ST5
ST7
ST2
ST1
ST6
TTL TO RS 232 CONVERTER
TTL TO RS 232 CONVERTER
TTL TO RS 422 CONVERTER
TTL TO RS 422 CONVERTER
ST8
ST9
+5V
POWER
+ 9 - 15 VDC
GND
ST13
ST12
ST10
ST11
A MONOSTABLE MULTIVIBRATOR B
A MONOSTABLE MULTIVIBRATOR B
RS 232 TO TTL CONVERTER
ST16
ST15
ST14
ST17
+5V
9 TO 15 VDC
POWER GND
SIGNAL GND
SIGNAL GND
DATA INPUT
DATA INPUT
DATA OUTPUT
DATA OUTPUT
1 PPS OUT
1 PPS INPUT
Page 1 of 1
(CD5465)
IPPS Converter - block diagram
N/A



Filter converter kit: Kit-213098

MAIN INDEX

The next pages presents the main index of this manual.

Numbers

A

B

C

D

E

F

G

H

I

K

L

M

N

O

P

R

S

T

U

V

W

Kongsberg Simrad HiPAP
Instruction manual

Kongsberg Simrad HiPAP
Instruction manual

Kongsberg Simrad HiPAP
Instruction manual

Kongsberg Simrad HiPAP
Instruction manual