SYSTEM 4000 GMDSS

SAILOR

HF SSB 250W PEP

Technical Manual

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SAILOR

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1. INTRODUCTION

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GENERAL DESCRIPTION

The equipment is a 250 W MF/HF transceiver for voice, DSC and telex operation designed for maritime applications in voluntary as well as compulsorily fitted vessels. The basic version offers simplex and semi-duplex SSB radiotelephone communication in the maritime mobile frequency bands between 1.6 and 30 MHz. With the built-in DSC/Telex modem and optional single channel or scanning DSC watch receiver the equipment forms an ideal system for MF or MF/HF GMDSS installations.

The equipment consists of a compact transceiver control unit, a fully remote controlled transceiver unit and an automatic antenna tuning unit.

The microprocessor controlled Antenna Unit automatically matches the impedance of antennas between 7 and 18 metres in length and requires no pre-setting at the installation. The typical tuning time is 0.1 to 0.5 s. It is designed for outdoor installation and may be located up to 100 metres from the Transceiver Unit.

The Transceiver Unit contains all receiver and transmitter circuitry. The fully protected solid state 250 W power amplifier, cooled by a temperature controlled fan, matches a 50 ohms antenna system, but is normally used in connection with the Antenna Unit. In the standard version the transmitter covers all marine bands. A version with other PA filters is available which provides continuous coverage of the frequency range 1.6 to 30 MHz. The combined DSC and Telex modem contains two demodulators, one connected to the optional built-in watch receiver for continuous DSC watch, the other connected to the traffic receiver for telex or DSC use. The watch receiver may be either a 2187.5 kHz single channel receiver or a 6 channel scanning receiver dependent on whether the equipment is intended for GMDSS MF or MF/HF installations.

The Control Unit is for operation of radio-telephone as well as DSC functions. Use of the equipment is simple, logic and straight forward.

The most used functions are reached by the simplest key entries. Radio operation is with main emphasis on station/channel operation. DSC operation is based on the use of soft keys. Guiding texts are provided and the large display is able to show the contents of a complete call in one screen. An additional Control Unit may be connected.

GMDSS telex facility is added by connecting a keyboard and a printer to the control unit. Basic telex operation this way is very simple using the keyboard function keys for selecting telex distress frequencies and telex control functions. In addition a PC may be connected to the Transceiver Unit, providing automated telex facilities.

With the AC Power Supply installed in the Transceiver Unit, the equipment may be supplied from 110-120/220-240 V AC main or emergency supplies with automatic switchover to 24 V DC supply in the absence of AC supply voltage. A Battery Charger Extension enables the AC Power Supply to be utilized as a battery charger. It has sufficient capacity to fully charge (80% capacity) a 200 Ah battery in less than 10 hours when the equipment is in the receive condition. Float charging maintains the battery fully charged. The IE characteristic allows batteries of any capacity rating to be charged. For 24 V DC installations where the power supply arrangements are already established, the equipment may be used without the optional AC Power Supply /Battery Charger installed.

The built-in test facilities and easy-to-replace module design of the equipment simplifies the service concept.

TECHNICAL DATA

250 W MF/HF Radiotelephone with Telex, DSC and DSC Watch Receiver for GMDSS MF and MF/HF installations.

GENERAL.
Complies with the relevant IMO performance standards, the ITU Radio Regulations, the relevant ITU-R recommendations and meets the performance specifications of ETSI.
US version in addition complies with FCC Rules.

Frequency Range:
1.6 to 30 MHz.

Frequency Stability:
0.35 ppm.
Ageing: Less than 1 ppm/year.
Warm-up time: Less than one minute.

Pre-set channels:
ITU HF telephony channels (frequency pairs).
ITU HF Telex channels (frequency pairs).

User programmable channels:
100 telephony frequency pairs.
100 DSC frequency pairs.

User programmable stations:
35 stations
with a station name (15 characters),
a station MMSI number,
40 channel numbers,
8 DSC frequency pairs.

User programmable address book:
10 address book calls
with a name (15-characters),
a coast station MMSI number,
a telephone number (16 digits).

Received DSC message storage:
Capacity for 20 distress and 20 other calls. Calls are erased 48 hours after their reception.

Operating Modes:
Simplex and semi-duplex SSB Telephony, AM Telephony , Telex and DSC.

Supply Voltage:
24 V DC
With built-in AC Power Supply (optional): 110-120/220-240 V AC (internal switch), 50/60 Hz.
Automatic change-over to DC in the absence of AC supply.

Supply Voltage Range:
DC: 21.6 V to 31.2 V. Power reduction below 26 V.
AC: +/- 10 %.

Power Consumption:
(approx. at 24 V DC)

RX:	60 W
TX, SSB unmodulat.:	100 W
TX, SSB speech:	200 W
TX, SSB two-tone:	360 W
TX, FEC telex:	360 W
TX, DSC:	530 W

Operating Temperature Range:
-20 deg. C to +55 deg. C.

RECEIVER CHARACTERISTICS.

Frequency Range:
100 kHz to 30 MHz.

Antenna Impedance:
50 Ohm. Automatically matched by the antenna tuning unit.

Input Protection:
30 V RMS (EMF).

IF Selectivity:

SSB Telephony:	350 Hz to 2700 Hz,
AM Telephony:	+/- 3 kHz,
Telex:	+/- 150 Hz.

Sensitivity:
Antenna input for 10 dB SINAD, 50 ohm antenna.

SSB Telephony:	0.6 µV,
AM Telephony:	4 µV,
Telex:	0.25 µV.

Out-of-band Intermodulation:
Two 93 dB µV signals more than 30 kHz off tune produces less output than an equivalent

input signal of 30 dBµV.

In-band Intermodulation:
Less than -40 dB.

Cross modulation:
Unwanted signal of 105 dBµV / 30 % - 400 Hz more than 20 kHz offset from receiver frequency produces cross modulation less than - 30 dB relative to wanted signal of 60 dBµV (SSB).

Blocking:
With a wanted signal of 60 dBµV, an unwanted signal 20 kHz off tune 110 dBµV will affect the output level by less than 3 dB or cause less than 6 dB reduction in SINAD (SSB).

Reciprocal Mixing:
With a wanted signal giving 20 dB SINAD, an unwanted signal 20 kHz off tune and 80 dB above the wanted signal will cause less than 6 dB reduction in SINAD (SSB).

Image rejection:
Greater than 80 dB.

IF Rejection:
Greater than 80 dB.

Spurious Rejection:
Greater than 80 dB.

Internally Generated Spurious Signals:
Less than 5 dB SINAD (SSB).

Spurious Emissions:
Less than 20 pW/50 ohm at antenna connector.

Audio Output Power:
5 W with less than 10 % distortion.

TRANSMITTER CHARACTERISTICS.

Output power:
250 W PEP +/- 1.4 dB into 50 ohm, voice, DSC or ARQ telex,
150 W +/- 1.4 dB into 50 ohm FEC telex,
US version: Max. 150 W PEP below 4 MHz, 200 W above 4 MHz

AC supply or min. 26 V DC.

Single Tone Max. Power:
Rated PEP for a duty cycle less than 55% and modulation rate greater than 3 baud. Reduction to 100 W when continuously keyed during 1 minute. Automatic power recovery after 1 minute.

Power Reduction:
Medium: 60 W
Low: approx. 10 W

Frequency Range:
ITU marine bands / 1605 kHz to 30 MHz.

Intermodulation:
Better than -31 dB/PEP in standard two-tone test.

Hum and Noise:
Less than - 50 dB/PEP.
Spurious Emissions:
Less than -43 dB/PEP, typically better than -60 dB/PEP.
US version: Less than 43 + 10log(mean power in watts) dB.

Suppression of Unwanted Sideband:
Greater than 60 dB PEP (1 kHz, SSB).

DSC-TELEX MODEM CHARACTERISTICS

Protocols:
DSC: ITU-R M.493-8, M.541-7, and M.1082.
Telex: ITU-R M.625-2 (including M.476-4), M.490, M.491-1, and M.492-5.

Modes of Operation:
Continuous DSC reception in combination with DSC or NBDP telex in ARQ, FEC and SELFEC modes.

Ship's Identity:
DSC: 9-digit identity number.
Telex: 5- and/or 9-digit identity numbers.

Interfaces:
Alarm: DSC distress alarm interface.
NMEA: NMEA 0183 interface for GPS equipment.
COM: PC interface for telex control. RS-232, baud rate 9600 bps.

RCI: Remote transceiver control interface for control of frequency, mode and power level. T+Bus protocol, baud rate 2400 bps.
Line, Key: Transceiver AF line input/output and external key interface. -10 to + 10 dBm, 600 ohms.
AUX Alarm 2: Telex and non-distress/urgency DSC alarm output.

DSC WATCH RECEIVER CHARACTERISTICS

Frequency Range:
Single channel: 2187.5 kHz.
Scanning: 100 kHz to 30 MHz.

Antenna Impedance:
50 ohms.

Calling Sensitivity:
Antenna input for symbol error rate below $1x10^{-2}$: 0 dBµV.

Adjacent Channel Selectivity:
With a wanted signal 20 dBµV, an unwanted signal 500 Hz off tune 60 dBµV does not deteriorate the symbol error rate below $1x10^{-2}$

Co-Channel Rejection:
With a wanted signal 20 dBµV, an unwanted signal on the same frequency 14 dBµV does not deteriorate the symbol error rate below $1x10^{-2}$.

RF Intermodulation Response:
With a wanted signal 20 dBµV, two unwanted signals more than 30 kHz off tune 70 dBµV does not deteriorate the symbol error rate below $1x10^{-2}$.

Interference Rejection and Blocking Immunity:
With a wanted signal 20 dBµV, an unwanted signal in the frequency range 100 kHz to 2 GHz except a +/- 3 kHz band around the tuned frequency 90 dBµV does not deteriorate the symbol error rate below $1x10^{-2}$.

Dynamic Range:
With a wanted signal between 80 dBµV and 0 dBµV the symbol error rate is below $1x10^{-2}$.

Conducted Spurious Emissions:
Less than 1 nW measured at the antenna connector.

Input Protection:
30 V RMS (EMF).

BATTERY CHARGER EXTENSION

Charger type:
Automatic, with float charging. IE characteristic.

Nominal battery capacity:
40 - 200 Ah.

Nominal charging time:
Max. 10 hours to 80% capacity (receive condition, 200 Ah battery).
Float charge voltage:
Adjustable 26.8 - 28.8 V to voltage specified by battery manufacturer.

Main charge current:
Min. 20 A (receive condition).

Temperature compensation:
Optional external temperature sensors.
Battery Alarm output:
Make/break relay contacts 0,5 A 32 V.
Alarm in case of
- Battery voltage too low (adjustable 22-24 V).
- Battery voltage too high (adjustable 27-32 V).

AC Mains Alarm output:
Make/break relay contacts 0,5 A 32 V.
Alarm in case of AC supply failure.

ANTENNA UNIT

Frequency Range:
1.6 - 30 MHz.

Antenna Requirements:
7 - 18 m wire and/or whip antenna.
Total electrical antenna length:
Greater than 7 m in the frequency range 2150 kHz to 30 MHz.
Greater than 10 m in the frequency range 1800 kHz to 30 MHz.
Greater than 12 m in the frequency range 1605 kHz to 30 MHz.

Antenna Tuning:
Fully automatic with no pre-setting.

Tuning Speed:
0.1 - 0.5 s.

Power Handling Capability:
250 W PEP.

Output Power to Antenna:
AC supply or min. 26 V DC:
250 W PEP +/- 1.4 dB in 50 ohm.

21.6 V DC supply voltage (requirement):
85 W PEP +/- 1.4 dB in 10 ohm + 250 pF below 4 MHz
150 W PEP +/- 1.4 dB in 50 ohm above 4 MHz.

US version:
Max.150 W PEP below 4 MHz,
200 W PEP above 4 MHz.

DIMENSIONS AND WEIGHTS

Control Unit:
Width: 231 mm with bracket
Height: 120 mm with bracket
Depth: 93 mm with bracket
Weight: 1 kg

Transceiver Unit:
Width: 440 mm
Height: 635 mm
Depth: 160 mm
Weight: 21 kg

Antenna Unit:
Width: 290 mm
Height: 500 mm
Depth: 80 mm

COMPASS SAFE DISTANCE

Compass safe distance in accordance with ISO/R 694 are given below in metres.

Unit	Standard 5.4°/H	Steering 18°/H
Control Unit	0.9	0.6
Transceiver Unit	2.4	1.6
Antenna Unit	1.0	0.6
PS4650	2.2	1.4
PS4651	2.1	1.4
H2099	0.3	0.3
H1252	0.9	0.5
H1640	0.3	0.3

All distances have been rounded up to the nearest 0.1 metres in order to allow for the maximum deviation which might be caused by the most offensive sample of all units manufactured.
Weight: 3.3 kg

2. INSTALLATION

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DESCRIPTION

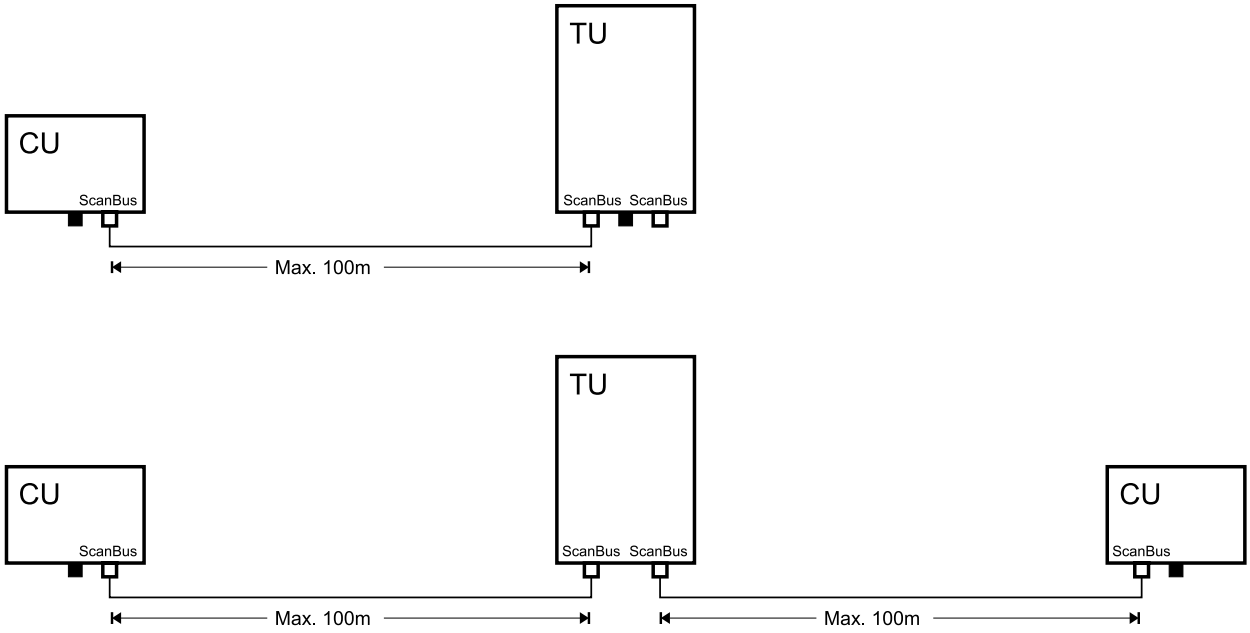
Correct installation of the equipment is important for maximum performance and reliability. Antennas and earth connections must be installed with the greatest care using corrosion resistant materials. Cable routing shall be made so the cables are protected from physical damage. Sharp cable bends especially on coaxial cables must be avoided and a sufficient number of clips or straps should be used to secure the cables.

MOUNTING THE UNITS

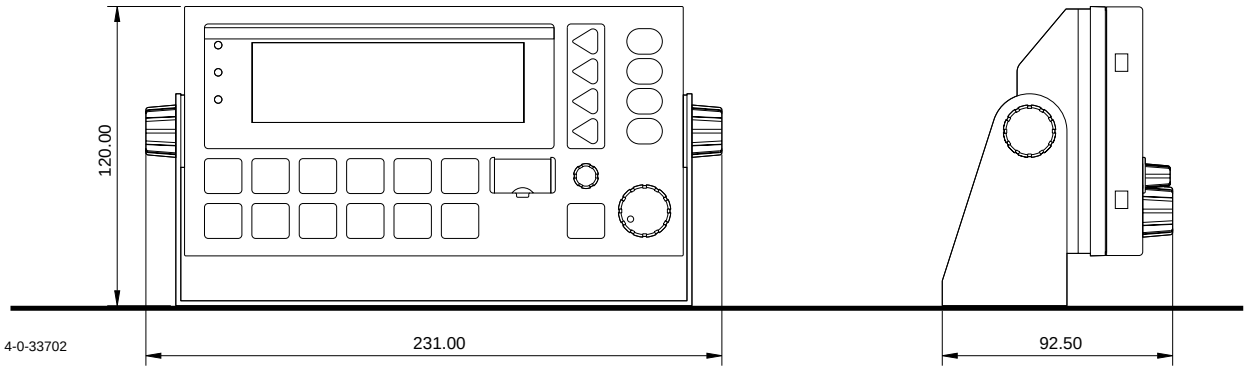
Mounting the Control Unit

One or two Control Units may be connected to the Transceiver Unit using the build-in local area network (ScanBus).
Units on the ScanBus must be chain connected and the maximum length between the most distant units is 250 m. The required type of screened multiwire cable depends on the number of Control Units and the distance between the units.

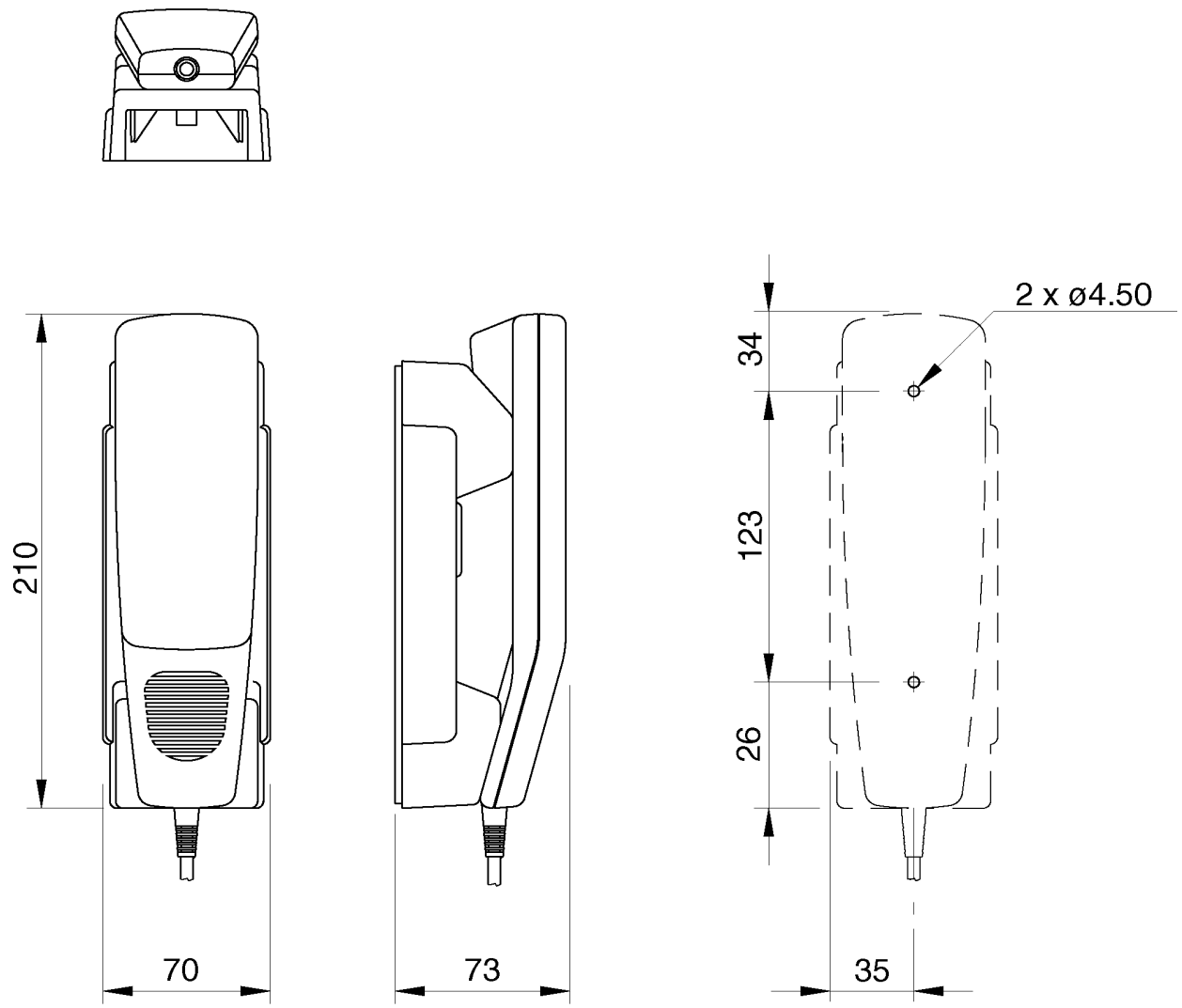
Installation examples
Cable type: 5 x 2 x 0.5 mm^2 screened multiwire
ScanBus termination jumper '■' is removed from the transceiver unit when the unit is not located at the end of the chain.



The Control Unit may be tabletop or bulkhead mounted.



Control Unit Handset



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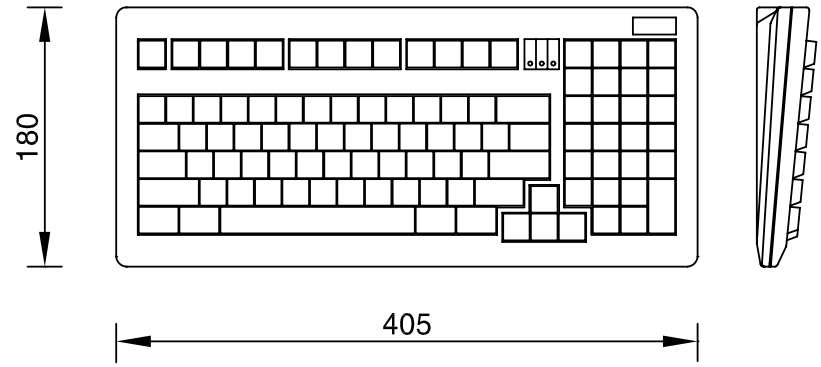
Mounting the Telex keyboard



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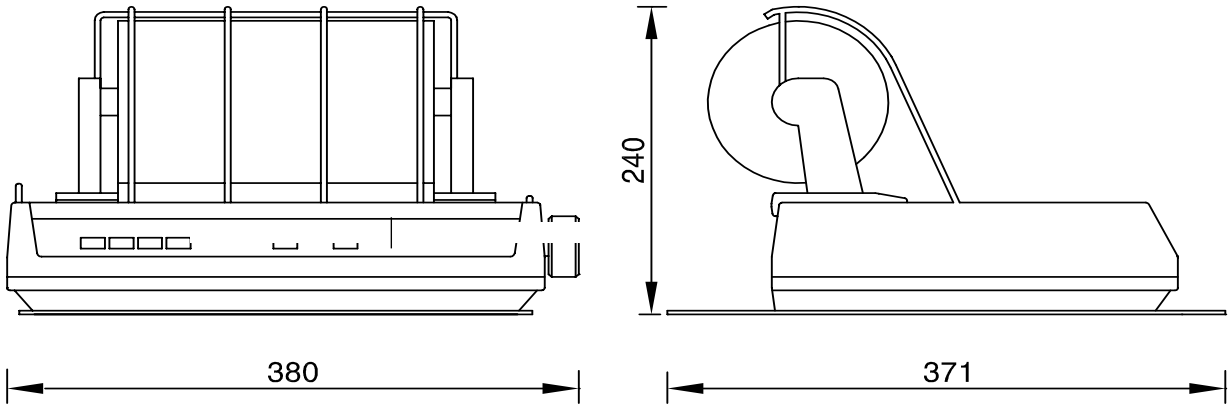
Mounting the Telex printer



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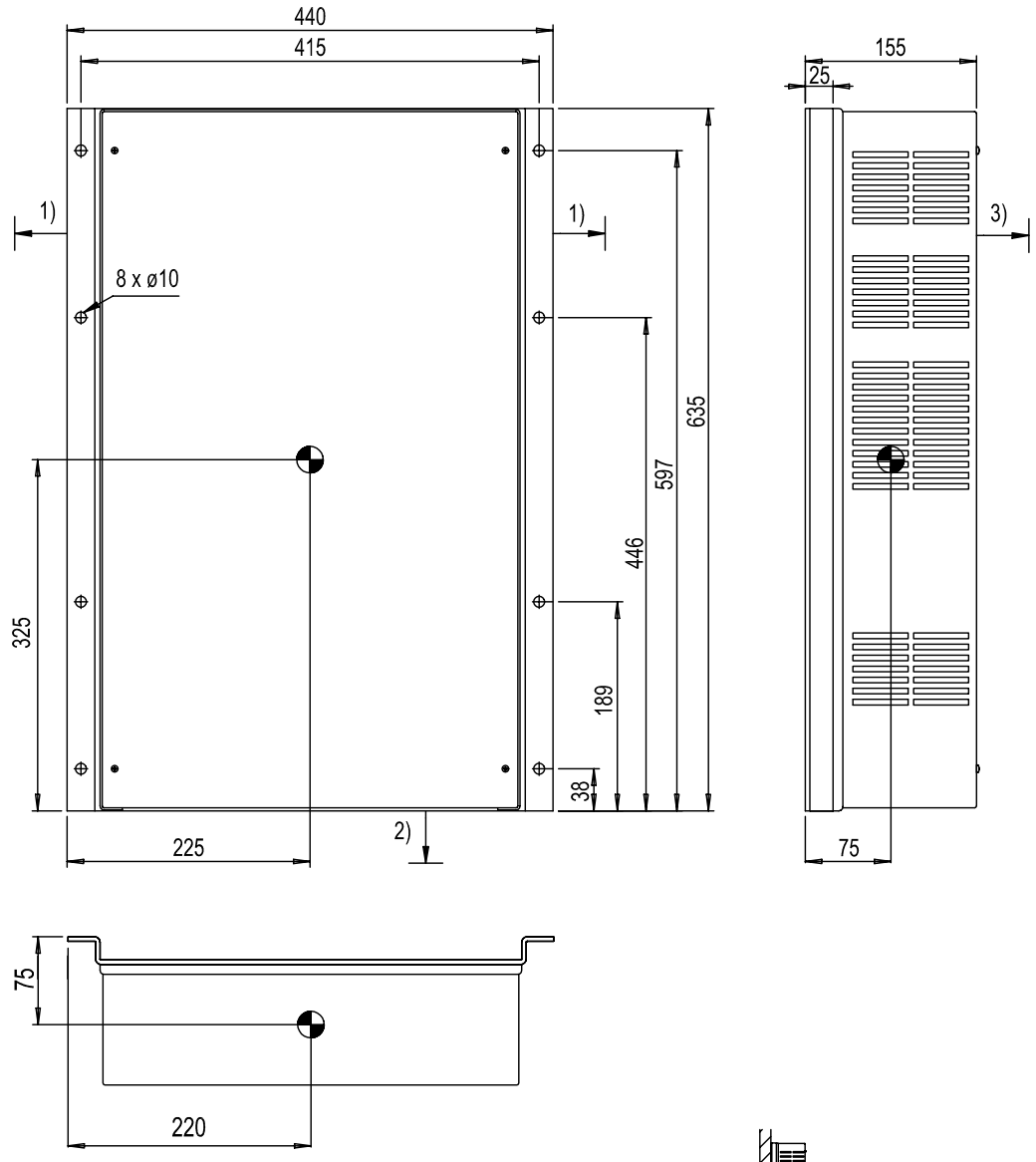
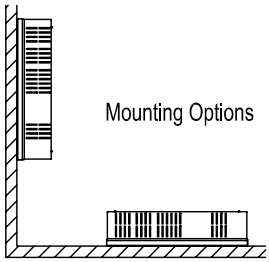
Mounting the Transceiver Unit

The Transceiver Unit should be installed in a dry place and consideration should be given to accessibility for servicing. It is important to provide plenty of airspace on the sides for adequate fan driven air circulation through the unit . Figures - shows the outer dimensions, mounting possibilities and the minimum distance

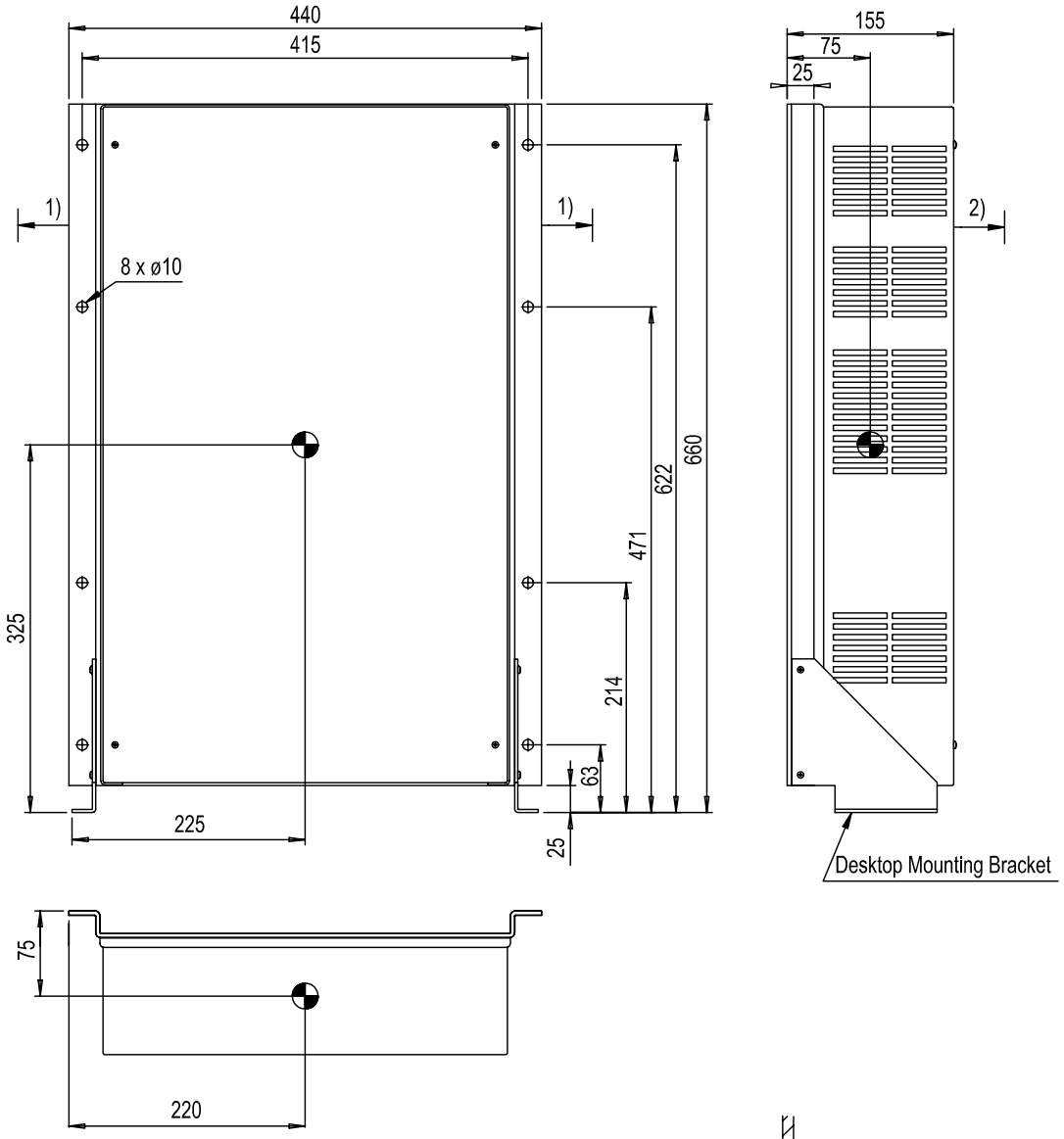
Bulkhead Mounting





1) Space for airflow: min. 200
2) Space for cable and airflow: min. 25
3) Space for service access: min. 1000
Dimensions are in mm
Tolerance: +/- 1 mm
Weight without optional AC power supply: 19.5 Kg
Weight with optional AC power supply: 21 Kg
Centre of gravity
Doc.: 4-0-34091B

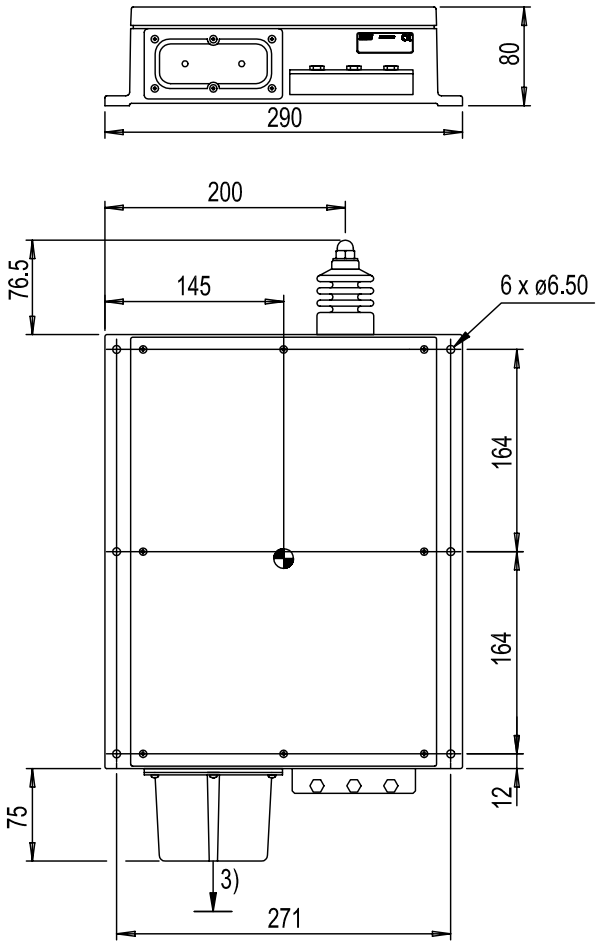
Desktop mounting

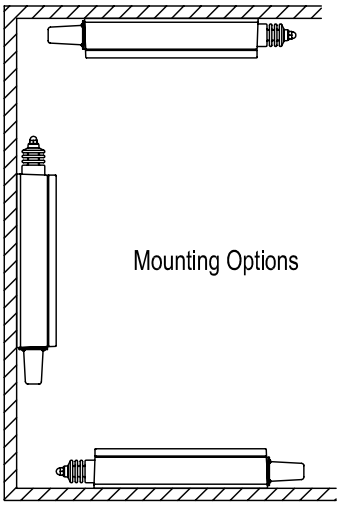


1) Space for airflow: min. 200
2) Space for service access: min. 1000
Dimensions are in mm
Tolerance: +/- 1 mm
Weight without optional AC power supply: 19.5 Kg
Weight with optional AC power supply: 21 Kg
Centre of gravity
Doc.: 4-0-34088B

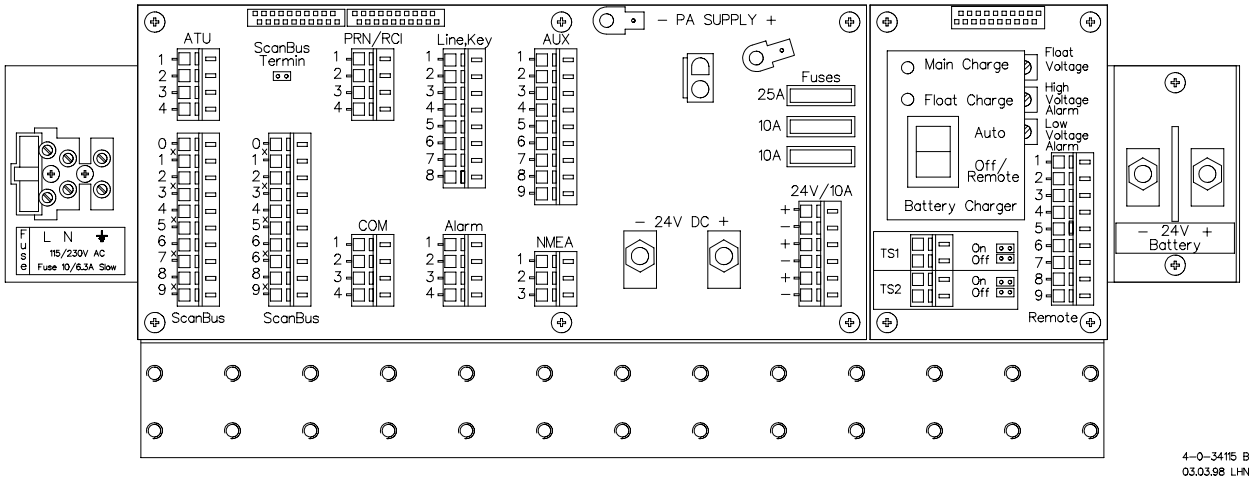
Mounting the Antenna Tuning Unit

The Antenna Tuning Unit may be mounted up to 100 metres from the Transceiver Unit using just one RG-213/U coaxial cable and a 4 x 0.5 mm2 screened multiwire cable for interconnection. The unit should be installed near the antenna feed point.





1) Space to nearest overhang: min. 50
2) Space for service access: min. 500
3) Space for cable and service access: min. 200
Dimensions are in mm
Tolerance: +/- 1 mm
Weight: 3.3 Kg
Doc.: 4-0-34106B



Transceiver Unit Connection Board

Power Supply

DC Supply only

This section applies if the optional built-in AC Power Supply Assembly is not installed.
The supply leads are connected to the 24 V DC supply terminals of the Transceiver Unit located on the Connection Board. Screened power supply cable may be used as required by some administrations. The earth connection of the equipment will not cause the battery to be earthed. Maximum permissible peak voltage between the battery terminals and earth is 100 V. Note that fuses must be provided in the supply leads.The table below shows the necessary cable cross sections and external fuse ratings.

Max. cable length to battery *	Recommended cable Screened multiwire	External fuses
7 m	2 x 10 mm^2	40 A
11 m	2 x 16 mm^2	50 A
17 m	2 x 25 mm^2	63 A

AC / DC SUPPLY

This section applies if the optional built-in AC Power Supply Assembly is installed. Before connecting the AC mains, check that the voltage selector switch on the AC Power supply assembly is set to the correct voltage and that the fuse rating corresponds to the setting used. The voltage selector is located at the AC Power Supply Assembly below the Connection Board. The selected voltage is indicated by an arrow in the outer ring. The equipment is normally dispatched with the selector set to 220 V. To select a different voltage, insert a screwdriver in the slot and turn the switch to the correct setting.

Setting	Voltage range
110	99 - 132 V
220	198 - 264 V

Caution: Incorrect setting of the mains voltage selector may damage the AC Power Supply Assembly

The AC mains fuse holder is an integral part of the AC terminal block which is located to the left of the Connection Board. The fuse is accessed by pulling out the black handle, The correct fuse rating for each voltage setting is as follows.

Setting	Fuse rating
110	10 A Slow
220	6.3 A Slow

Fuses are cartridge type measuring 20 x 5 mm.

The AC supply leads are connected as indicated to the terminal block. Screened power supply cable may be used as required by some administrations. The cable is fastened and the screen connected by the cable clamp on the main chassis below the terminal block.

L	Live
N	Neutral
⏚	Protective earth

Recommende cable type: 3 x 1.5 mm2

The 24 V DC supply leads are connected to the Battery terminals located to the right of the Connection Board. Cable screen is connected to the chassis by means of the cable clamp on the main chassis below the terminals. The earth connection of the equipment will not cause the battery to be earthed. Maximum possible peak voltage betweeen the battery terminals and earth is 100 V. Note that fuses must be provided in the supply leads. A table on the previous page shows the necessary cable cross sections and external fuse ratings.

BATTERY CHARGER

This section applies if the optional Battery Charger Extension CH 2420 is installed.
The Charger Control Board contains a switch for local selection of automatic charging (Auto). In the Off / Remote position the charging function may be controlled remotely. Remote control cable is connected to the terminal strip marked Remote which also contains alarm outputs as indicated in the table below.

Remote
9-way terminal strip.
Battery charger alarm / control interface

Terminal	Designation	Description
1	DC-	Reference, battery -. Galvanically isolated from system ground.
2	VR	Output 26-28 V DC (battery +) when AC and battery voltage are both present. Max. 200 mA,, internally protected. Galvanically isolated from system ground.
3	Auto	Input. Charger off when open,, charger on when connected to VR
4	AC Alarm O	Galvanically isolated AC alarm output. Relay contacts, max. 0.5 A 32 V Alarm condition: AC supply missing (terminals 5 and 6 are closed, terminals 4 and 6 are open in alarm condition)
5	AC Alarm C	
6	AC Alarm	
7	Bat Alarm O	Galvanically isolated battery alarm output. Relay contacts,, max. 0.5 A 32 V Alarm conditions: Battery voltage < 23.4 V or Battery voltage > 27 - 32 V (adjustable) (terminals 8 and 9 are closed, terminals 7 and 9 are open in alarm condition)
8	Bat Alarm C	
9	Bat Alarm	

Note: Automatic charging is normally disabled if the battery voltage is missing.

To enable charger output with missing battery voltage connect a wire between 'Remote' Terminal 2 (VR) and + 24V/10A on the Connection Board.

Where the ambient temperature of the battery is expected to be very variable, the life of the battery may be increased by controlling the charging voltage as a function of the temperature.
Two temperature sensors may be connected to the Charger Control Board for temperature compensation, one for the float charging voltage, the other for the independent High Voltage Alarm Circuit. The temperature sensors should be installed in close proximity to the battery.

TS1
2-way terminal strip
Temperature Sensor input for float charging voltage.

Terminal	Designation	Description
1	TS+	Temperature sensor input for battery temperature compensation. Jumper must be moved to TS1 ON when used.
2	TS-	

TS2
2-way terminal strip
Temperature Sensor input for high voltage alarm.

Terminal	Designation	Description
1	TS+	Temperature sensor input for battery temperature compensation. Jumper must be moved to TS2 ON when used.
2	TS-	

Important: When temperature sensors are not installed, jumpers must be in Off position.

FLOAT CHARGE VOLTAGE AND BATTERY ALARM ADJUSTMENT

Before connecting the battery it is important to adjust the float charge voltage and the battery voltage alarm to the values prescribed by the battery manufacturer.

Before starting the adjustment make the following steps:

1. Be sure the AC Power Supply Assembly is disconnected from the mains.

2. Turn the potentiometers located on the Charger Board marked **'High Voltage Alarm'** and **'Low Voltage Alarm'** clockwise.

3. Connect a voltmeter and a small power supply capable of delivering 1.0A and adjustable up to 33 V DC to the '- 24V Battery +' teminals located to the right of the Charger Board.

4. Connect a ohmmeter between the battery alarm output terminals 8 and 9 of the **'Remote'** terminal strip located on the Charger Board.

Low voltage alarm(LVA)

1. Adjust the small power supply to the desired low voltage alarm level(22.0 - 24.0 VDC).

2. Read on the ohmmeter that the relay contacts are closed.

3. Now carefully turn the potentiometer marked **'Low Voltage Alarm'** anticlockwise until the relay contacts just open.

High voltage alarm(HVA)

1. Adjust the small power supply to the desired high voltage alarm level(27.0 - 32.0 VDC).

2. Read on the ohmmeter that the relay contacts are open.

3. Now carefully turn the potentiometer marked **'High Voltage Alarm'** anticlockwise until the relay contacts just close.

4. Disconnect all instruments.

Float charge voltage

1. Connect a voltmeter to the '- 24V DC +' terminals located on the Connection Board.

2. Set the battery charger switch on the Charger Board in OFF/REMOTE position. A remote switch if any must also be in OFF position.

3. Connect the mains to the AC Power Supply Assembly.

4. Adjust the potentiometer marked **'Float Voltage'** until the charge voltage prescribed by the battery manufacturer is read on the voltmeter(26.8 - 28.8V DC).

5. Disconnect all instruments.

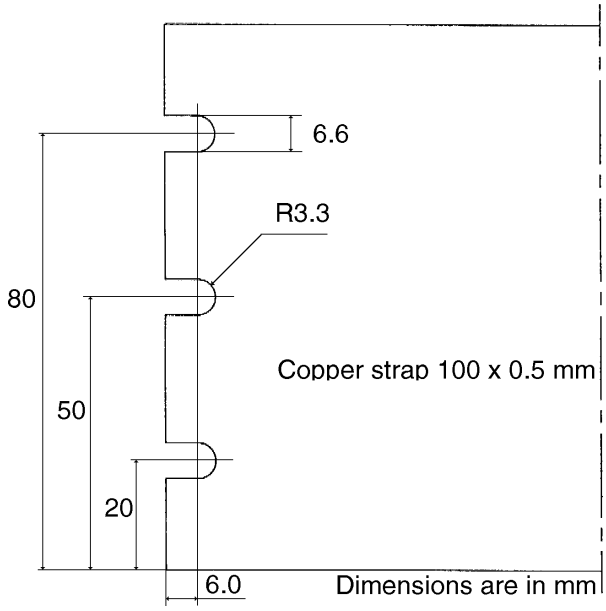
6. Connect the battery to the '- 24V Battery +' terminals.

7. Switch the battery charger to AUTO position.

EARTH CONNECTIONS

Antenna Tuning Unit

As the earth connection of a transmitter is a very important part of the antenna system, it is of the utmost importance to keep in mind that the earth connection of the Antenna Tuning Unit must have the lowest possible RF-impedance. Losses in the earth connection will result in a decrease in radiated power which means that the range of the transmitter will be reduced. In steel ships a 100 x 0.5 mm copper strap as short as possible is connected between the earth terminal at the bottom of the Antenna Tuning Unit and two or three 1/2" or M12 bolts welded to the superstructure. Vessels constructed of non-conducting materials must be equipped with a copper earth plate having a minimum area of 1 square metre mounted below the water line. From a copper earth bolt hard soldered to the earth plate a 100 x 0.5 mm copper strap is run, preferably uninterrupted to the earth terminal at the bottom of the Antenna Tuning Unit.



Should it be necessary to break the copper strap, for example to pass through a deck, two or three 1/2" or M12 bolts should be used for this feed through. On wooden ships having a superstructure of metal, this superstructure should also be effectively connected to the copper strap by using stainless steel bolts and preferably pieces of stainless steel strips between the metal parts. On fibre glass boats, such as yachts and sailing boats, it may be difficult to install a sufficiently good earth. Short copper straps are bolted to conducting parts on the engine, the keel and other conducting objects. Many copper straps can be glued to the inner surface of the hull below the water line to produce a large capacitance to the water. It is important that the total area of copper is large and that the distance between the copper surface and the water is as small as possible. The copper straps are connected directly to the ATU.

Transceiver Unit

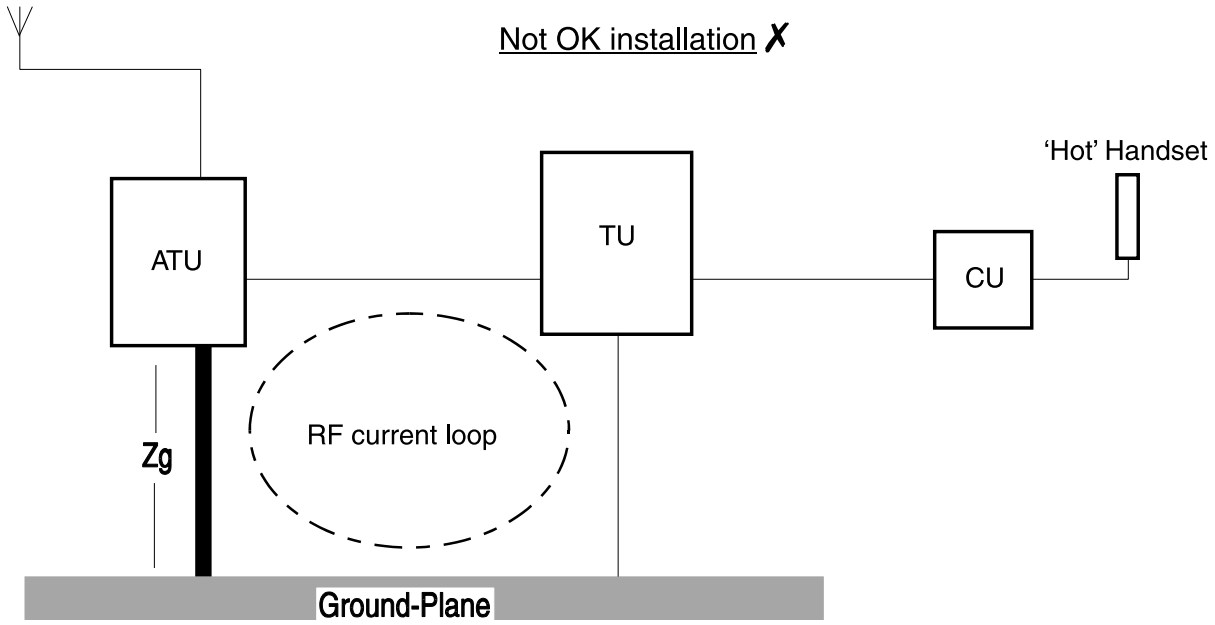
The Transceiver Unit is preferably grounded separately to the ships metal in the shortest possible way. A 10 to 16mm sq. ground wire is connected to the ground terminal (cable clamp) at the bottom of the unit. On vessels with no metallic superstructure the ground connection may be omitted.

GROUNDING CONSIDERATIONS

Proper system grounding is one of the most important installation details.
Two areas of grounding must be considered:

a) The ground connection between the ATU and earth ground plane.
b) The ground connection of the TU and the externally connected equipment.

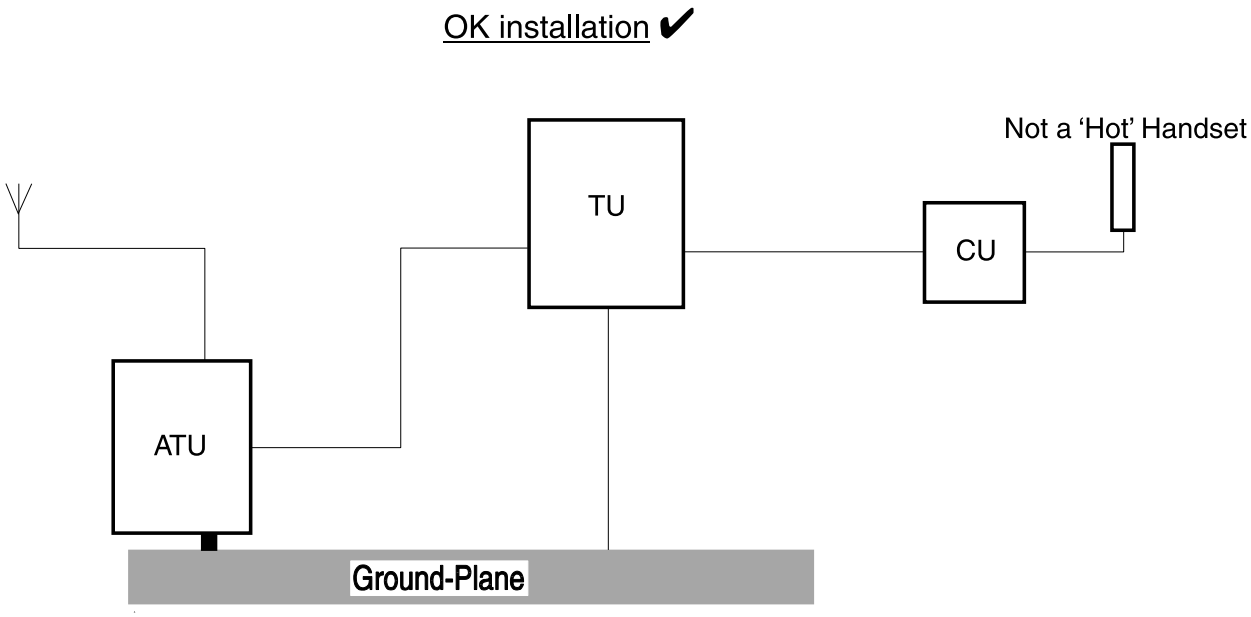
Each area requires separate considerations even though they are interrelated. Ideally the Control Unit, Transceiver Unit, Antenna Tuning Unit and the antenna ground-plane must have the same RF ground potential. Unfortunately this situation is seldom achieved, but interference problems will be reduced along with how close to this “ideal” the grounding of the installation is performed.
On some installations ground loops will cause problems. A ground loop is caused by more than one ground path for a given unit. This will introduce circulating RF currents which may cause malfunction of other equipment onboard the ship as well as a “hot” handset.



Antenna start

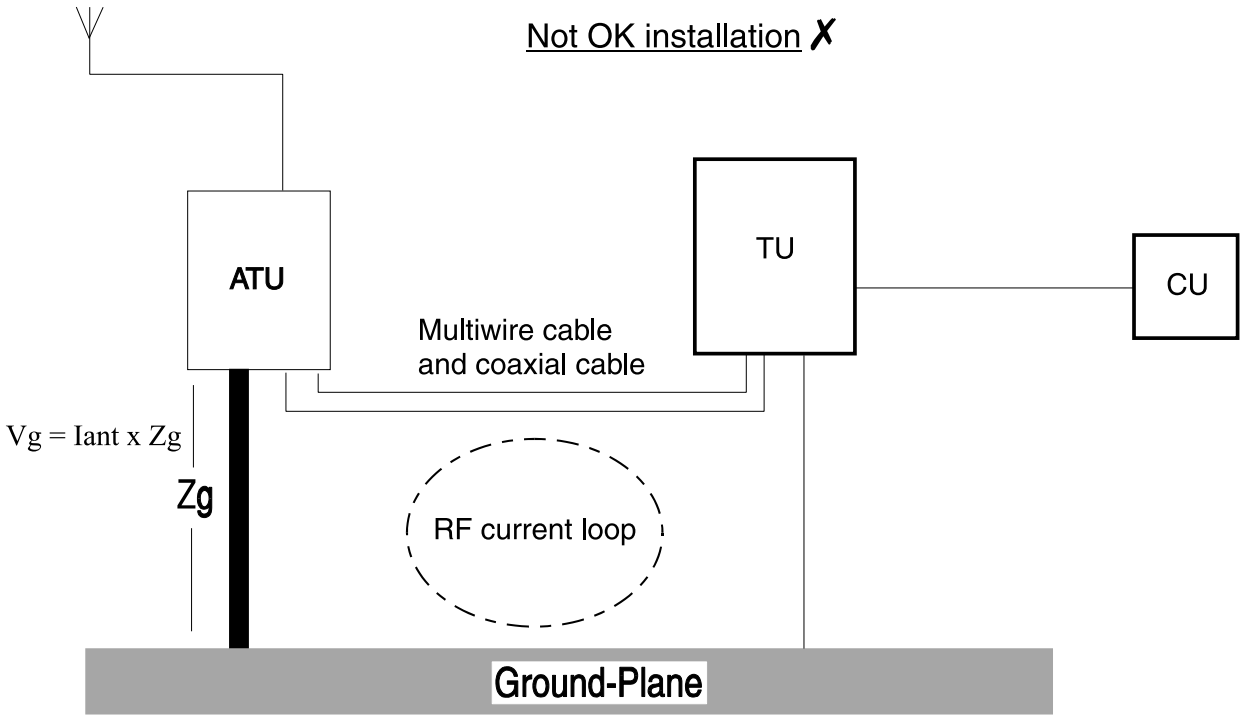
The vertical antenna always start at its electrical ground-plane, whether or not it is physically mounted there. First determine the antenna's electrical ground-plane, which is where the ATU must be mounted. Where possible always take the ATU to the ground, not the ground to the ATU.

In case of a fiberglass boat, the ground-plane may well be at the hull grounding terminal. Then this is where the Antenna Tuning Unit should go and this is where the antenna actually starts.



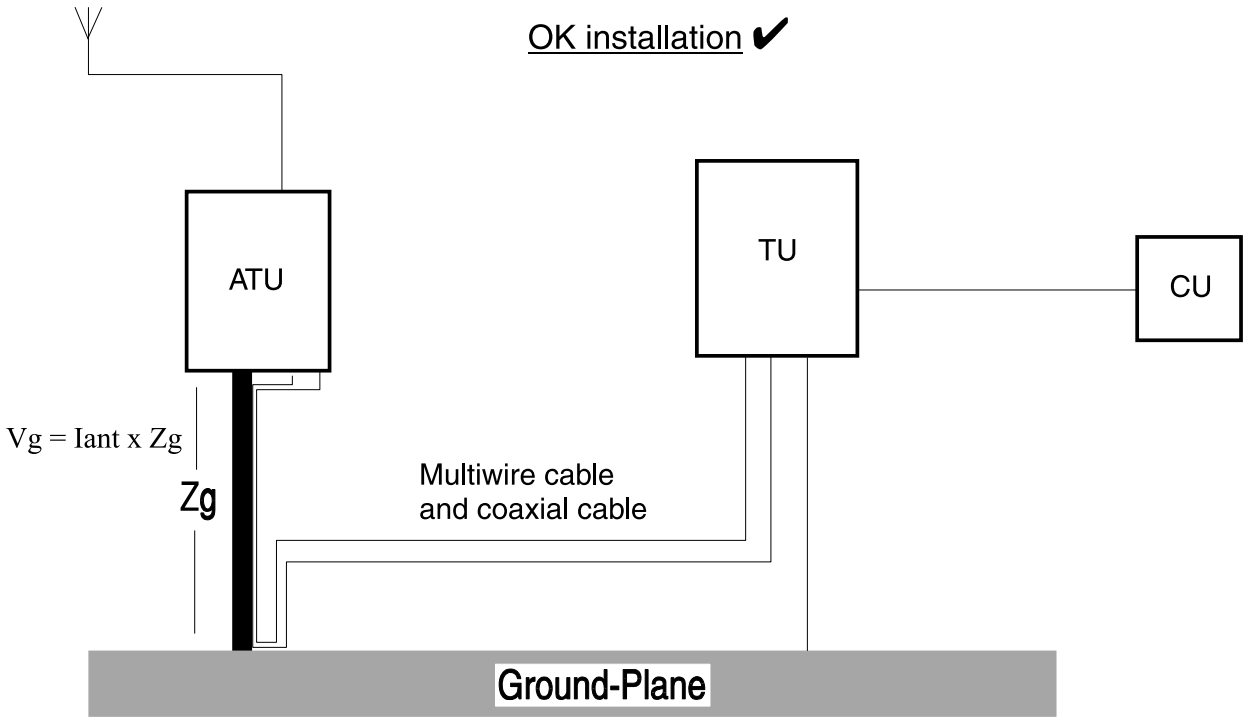
RF ground loop

It is not always possible or practical to mount the ATU using a very short strap to the actual ground-plane. In such a case the coaxial- and multicables may be connected between units with different ground potentials causing RF loop-current to flow.



Minimizing ground loops

By routing the multi and coax cable very closely together with the ATU ground strap (secure good RF coupling between the three) all the way down to the ground-plane, there will be no RF ground loop left to generate the interference.

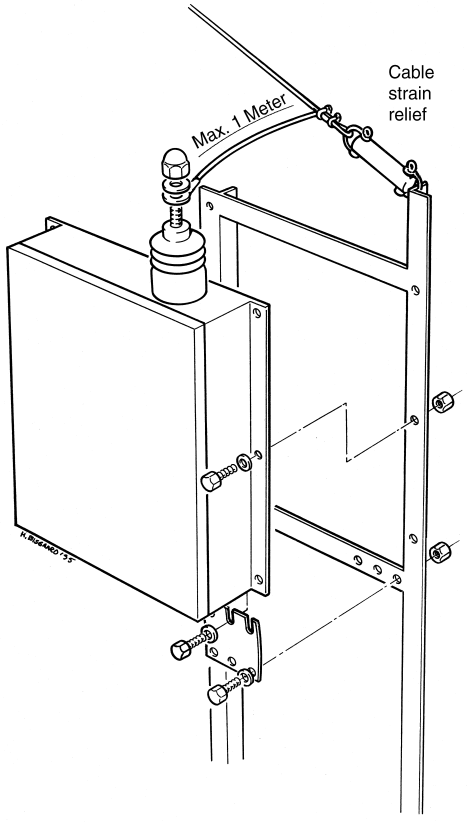


ANTENNAS

Transceiver Antenna

The equipment is used with common transmitting and receiving antenna. The antenna should be erected in the open, away from conducting object such as derricks etc. which may cause reduction of the radiated power. Insulators should be of the best type having low leakage even when wet. Stays, wires, steel masts etc. should be either effectively earthed or insulated. The antenna should also be kept as far away as possible from electrical equipment in order to minimize noise. Electrical installation such as cable braiding (screens) and instruments in the vicinity of the antenna should be earthed effectively, and the instruments in question should be fitted with noise-interference suppression devices, effective in the range 0.1 MHz to 30 MHz to avoid malfunction of these instruments. The Antenna Tuning Unit will tune on any frequency in the range 1.6 to 30 MHz to good whip and/or wire installations of 12 to 18 meters total electrical length. Shorter antennas down to 7 meters can be used restricting the lower frequency to 2150 kHz. Where possible long antennas should be installed to maximize the radiated power in the lower frequency bands. Short antennas of 7 to 8 meters length should therefore only be installed when it is impossible to install a longer and more efficient antenna.

In general a 12 meter antenna installation can be made using an 8 meter whip and 4.5 meter feeder or a 10 meter whip and 2.5 meter feeder. In both cases the whip should be mounted on a pole allowing for the feeder to be erected at an angle of no less than 60 degrees to create a vertical antenna system. Using horizontal feeders or feeders mounted at an angle below 45 degrees usually transform the antenna radiation resistance to a lower value reducing the radiated power. Furthermore, the total antenna system should be kept well away from conductive objects such as the mast. Usually a horizontal distance of more than 4 meters will create good results.
Note: If a whip antenna is used this should have an anti-corona ball as a top termination to prevent crackling noise in the receiver.



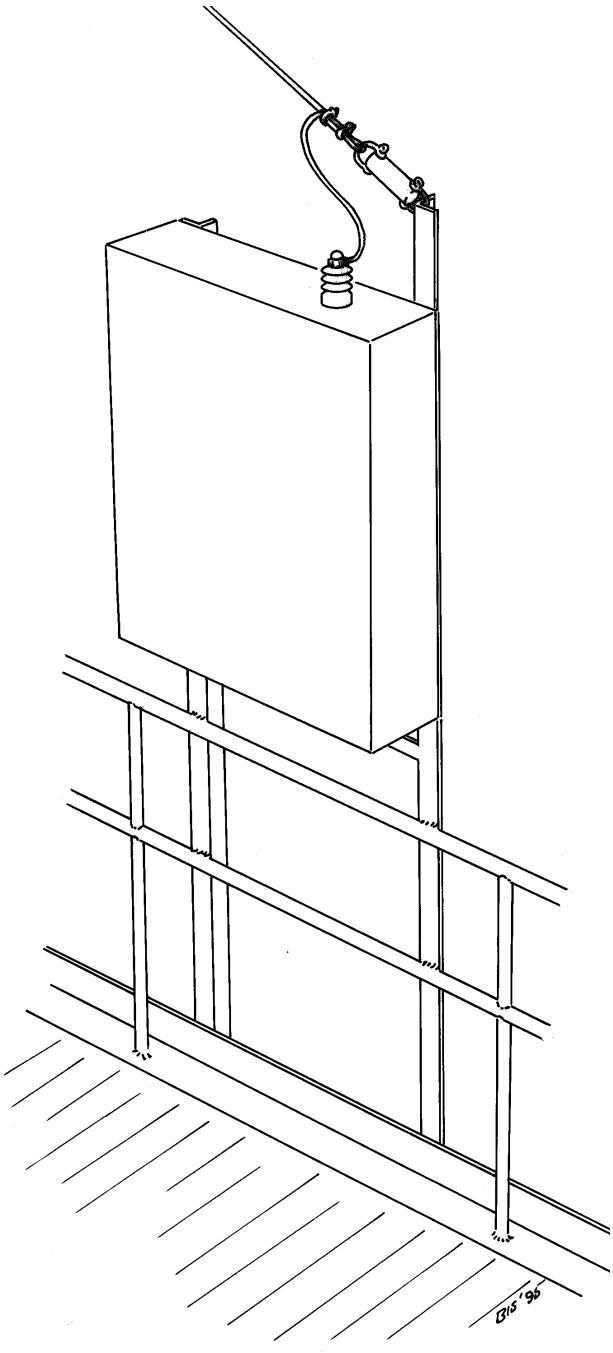
The antenna is terminated at the insulator at the top of the Antenna Tuning Unit. The insulator must be relieved from mechanical stress by using max. 1 metre flexible wire between the insulator and a support. To maximize the radiated power and avoid flash over keep distance to metal parts as long as possible. All wire junctions in the antenna system must be made with cable lugs of correct size according to the wire gauge. This will prevent bad connections due to corrosion. For further corrosion proofing silicone grease may be applied to the cable joints.

DSC receiver antenna

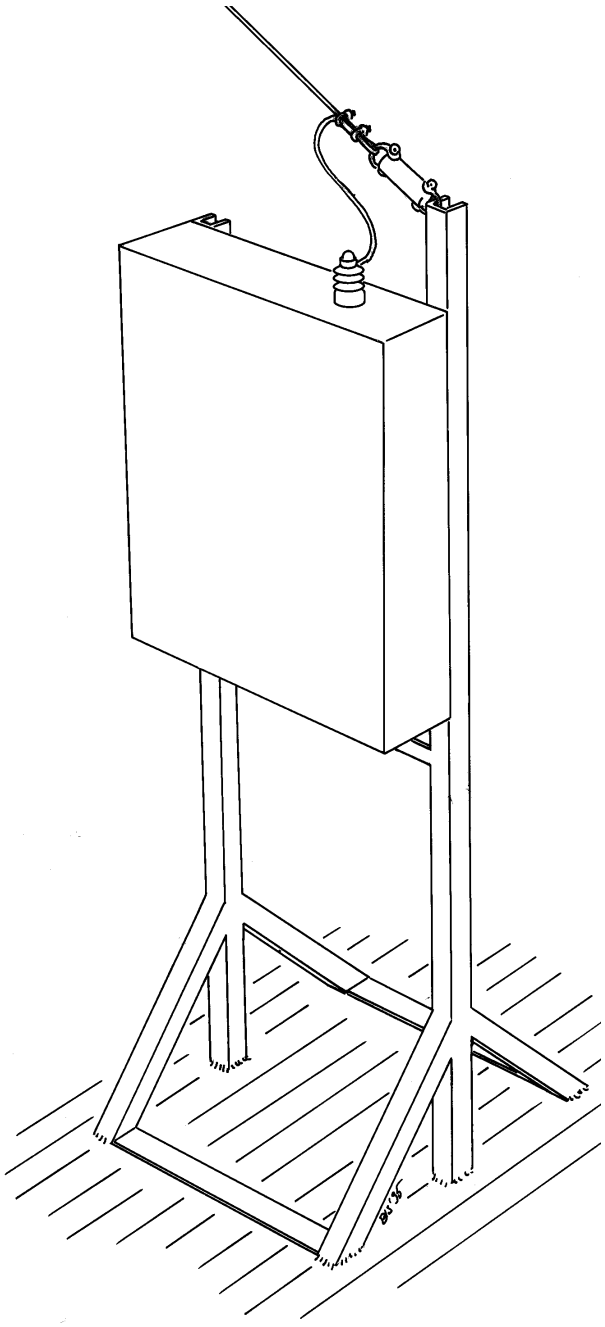
The antenna should be erected well in the clear and kept away as far as possible from electrical equipment in order to minimize noise. The recommanded length is 7-30m. Electrical installation such as cable braiding and instruments in the vicinity of the antenna should be earthed effectively, and the instruments in question should be fitted with noise-interference suppression devices, effective in the range 0.1 to 30 MHz. The antenna feed-in should be coaxial cable, which should be as short as possible, especially in the case of short antennas. If a long cable is used an impedance matching transformer should be inserted in the antenna end of the feeder.

RECOMMENDED ATU INSTALLATION

on a metal-hull vessel. Mount the Antenna Tuning Unit on a custom-built bracket made from iron angle bars (refer to figure on previous page).



Antenna Tuning Unit bracket
welded to the railing



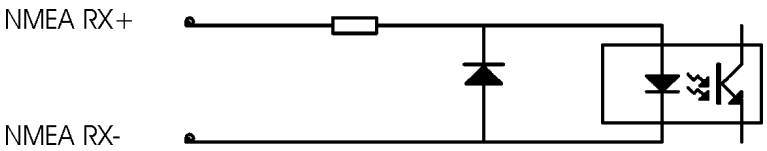
Antenna Tuning Unit bracket
welded to the floor

POSITION AND TIME INFORMATION

Connection of Navigation Equipment

Navigation equipment complying with the NMEA 0183/IEC 1162 standard may be connected for automatic position and time updating. Connection is made to the 'NMEA' terminals of the transceiver unit.

The NMEA receive circuit consists of an optoisolator with a 3.3 kohms series resistor to insure current mode operation and a shunt diode to limit reverse bias as shown below. The circuit is isolated from earth.



The circuit operates with a minimum differential input voltage of 3 volts and takes less than 1 mA from the line at that voltage. The maximum voltage is 15 volts, compatible with RS-232 levels.

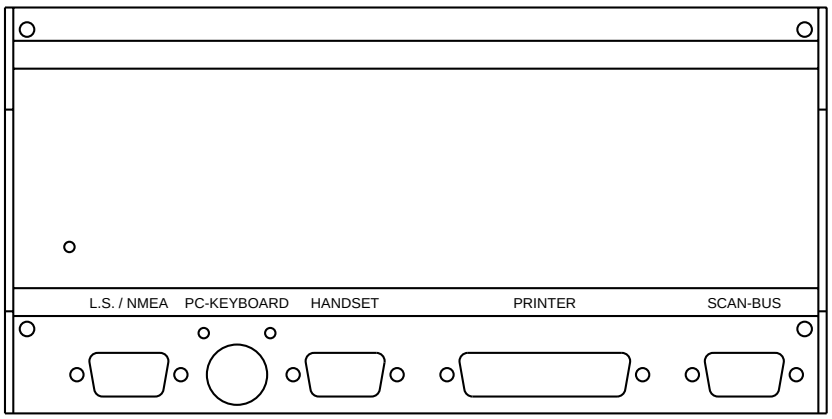
Interconnection between devices may be by means of two-conductor shielded twisted-pair wire. Multiple listeners may be connected to a single talker. The receivers are connected in parallel. The shield should be connected to the navigator chassis and should not be connected at any listener. However the shield should be continuous (unbroken) between all listeners.

Following sentences are recognized by the equipment for extraction of position and associated time information: GGA, GLL, GXP, GDP, GLP, GOP. The optional checksum field is disregarded. GLL sentences with and without time information is recognized, time information is extracted if present.

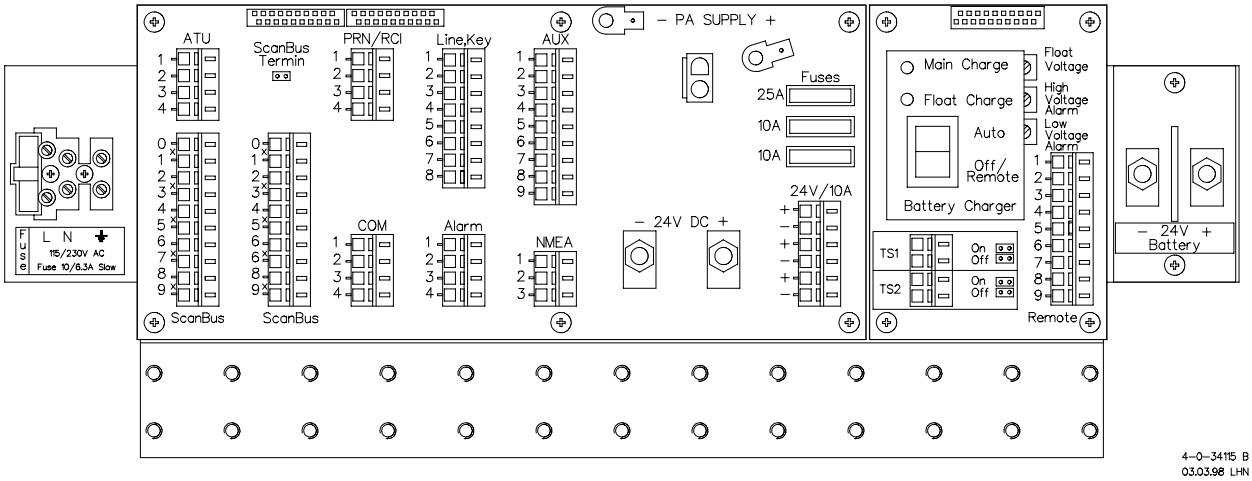
ZDA senteces are recognized by the equipment for extraction of UTC time information for automatic setting of the internal real time clock.

INTERCONNECTION OF UNITS

Control Unit connector panel



Transceiver Unit connector panel



Cable 1: Handset - Control unit
Cable: Supplied with handset

Control unit	Designation	Remarks
'Handset' Dsub 9		
1	TLF	Handset earpiece
2	GND	System ground
3	GND	System ground
4	MIC	Handset microphone
5	PTT	Transmit key
6	HOOK	Low when on hook
7	+5V	5V supply voltage to handset
8	nc	No connection
9	nc	No connection

Cable 2: Control unit - Transceiver unit
Cable: Multicable 5 x 2 x 0.5 mm^2
Twisted pairs: 0 and 1, 2 and 3, 4 and 5, 6 and 7, 8 and 9.
Maximum cable length 100m
Cable-connector: 9 way Dsub male. Part no. 75100064

Transceiv-er unit	Control unit	Designation	Remarks
'ScanBus' TS 10	'ScanBus' Dsub 9		
0	6	GND	System GND
1	1	Supply On	Common 'supply on' signal for all units on the 'ScanBus'. Active when connected to ground.
2	2	Data +	Data communication between units. CAN Net. Baud rate: 76.8 kb/s. Spec.: ISO/DIS 11898
3	3	Data -	
4	4	AF +	TX AF modulation including CW/TLX Tone Key. Vnom = 0.775 Vrms diff.. Vmax= 12V Vpp diff.
5	5	AF -	
6	6	GND	System GND
7	7	+ 24 V	Supply voltage for all units on the 'ScanBus'
8	8	RX AF +	RX AF signal. Vnom = 0.775 Vrms diff.. Vmax= 12V Vpp diff.
9	9	RX AF -	
Shield	Shield	Screen	Screen connected to System GND.

Cable 3: Transceiver unit - Antenna Tuning unit
Cable: Multicable 4 x 0.5 mm^2 screened
Maximum cable length 100 m

Transceiver unit	Antenna Tuning unit	Designation	Remarks
'ATU' TS 4	TS 4		
1	1	+ 24 V	+24V supply voltage to ATU
2	2	TX/RX, PROTEC	TX/RX signalling from TU and protection signalling from ATU
3	3	TU-ATU DATA	Bi-directional serial data communication, 0/24V
4	4	GND	System GND

Cable 4: Transceiver unit - Antenna Tuning unit
Cable: 50 ohm coaxial cable RG213/U part no.: 77.508
Cable-connector: UHF connector PL259. Part no. 75100054

Cable 5: Transceiver unit - DSC RX Antenna
Type: 50 ohm coaxial cable RG213/U part no.: 77.508
Cable-connector: UHF connector PL259. Part no. 75100054

Cable 6: Transceiver unit - AC Mains
3 x 1.5 mm^2 screened. Part no. 701 000 24

Transceiver unit	Designation
'115/230V AC' TS 3	
L	Live
N	Neutral
⏚	Protective earth

Cable 7: Transceiver unit - Battery

Transceiver unit '24V Battery'		
Max. cable length to battery *	Cable type	External fuses
7 m	2 x 10 mm^2	40 A
11 m	2 x 16 mm^2	50 A
17 m	2 x 25 mm^2	63 A

Cable 8: Control unit - External Speaker
Cable: 2 x 0.75 mm^2
Control unit ‘LS/NMEA’ pins 1 and 2. Refer to ‘LS/NMEA’ table.

Cable 9: Control unit - Distress Alarm
Cable: Multicable 4 x 0.5 mm^2 screened

Control unit	Designation	Remarks
'LS/NMEA' Dsub 9		
1	EXT_SP+	External speaker
2	GND	
3	SPARC_BUS+	
4	SPARC_BUS-	
5	NMEA_IN+	
6	NMEA_IN-	
7	NC	No connection
8	+ 8 V	
9	+ 24 V	

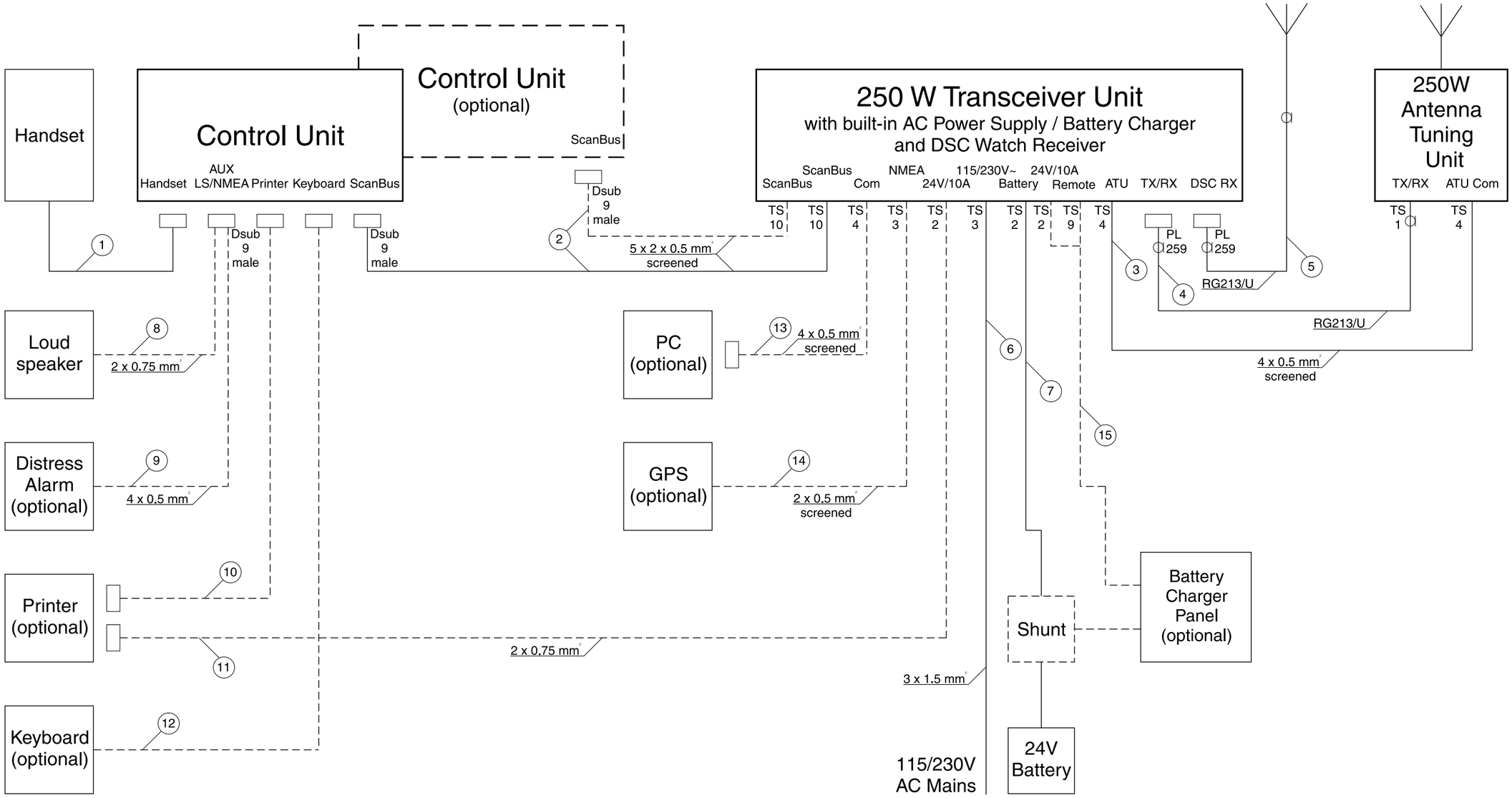
Cable 10: Control unit - Printer
Cable: 2m cable supplied with printer. Part no. 56.013

Control unit	Direction	Designation
'Printer' Dsub 25		
1	Output	LPT_STR
2	Output	LPT_D0
3	Output	LPT_D1
4	Output	LPT_D2
5	Output	LPT_D3
6	Output	LPT_D4
7	Output	LPT_D5
8	Output	LPT_D6
9	Output	LPT_D7
10	Input	LPT_ACK
11	Input	LPT_BUSY
12	Input	PAPER END
13	Input	LPT_SELECT
14	Output	AUTO LINE FEED
15	Input	LPT_ERROR
16	Output	LPT_INIT
17		GND
18		GND
19		GND
20		GND
21		GND
22		GND
23		GND
24		GND
25		GND

Cable 11: Transceiver unit - Printer
Cable: 2 x 0.75 mm^2 screened. Part no. 70100016
2 m cable supplied with printer. Part no. 10650460
Maximum cable length 10 m

Transceiver unit	Designation	Remarks
'24V/10A' TS 2		
1	+	21.6 - 31.2 v output.Max10 A total for all three terminalstrips. Protected by 10 A fuses in both + and -. Galvanically connected to battery.
2	-	Must **not** be connected to GND

INSTALLATION WIRING DIAGRAM



Cable 12: Control unit - PC keyboard
Cable: Supplied with keyboard

Control unit 'Keyboard' Mini DIN(PS2)	Designation	Remarks
1	PC_KEYB_CLK	Keyboard clock
2	GND	System ground
3	PC_KEYB_DATA	Keyboard data
4	nc	No connection
5	+ 5 V	5V supply voltage to keyboard
6	nc	No connection

Cable 13: Transceiver unit - PC
Cable: Multicable 4 x 0.5 mm^2 screened,
Cable-connector: 9 or 25 way D-sub female (PC type dependent)
Serial interface compatible with RS-232 for control of internal telex modem .
Baud rate: 9600 bps

Transceiver unit 'COM' TS 4		PC 9 way COM	PC 25 way COM	Designation	Remarks
1	Out	2	3	PC TX	Galvanically isolated output. Transmit data.
2	In	3	2	PC RX	Galvanically isolated input. Receive data.
3	In	4	20	PC DTR	Galvanically isolated input. Data Terminal Ready*
4		5	7	PC GND	Galvanically isolated ground return.

*) The interface is opto isolated with power delivered from PC DTR, 5-15V, (Non-isolated: Insert jumpers J8, J9 and J13 on PCP Board 717)

Cable 14: Transceiver unit - GPS
Cable: Multicable 2 x 0.5 mm^2 screened. Part no. 70200020

Transceiver unit 'NMEA' TS 3	Designation	Remarks
1	NMEA RX+	Galvanically isolated intput.
2	NMEA RX-	
3	Screen	Not connected.

Cable 15: Transceiver unit - Battery Charger Panel
Cable: Multicable 4 x 0.5 mm^2 screened.

Transceiver unit '24V/10A' TS 2	Designation	Remarks
1	+	21.6 - 31.2 v output.
2	-	Must **not** be connected to GND
'Remote' TS 9	Designation	Remarks
5	AC Alarm C	Galvanically isolated AC alarm output. Relay contacts, max. 0.5 A 32 V Alarm condition: AC supply missing (terminals 5 and 6 are closed, terminals 4 and 6 are open in alarm condition)
6	AC Alarm	

PRN/RCI
4 way terminal strip.
Remote Control Interface for radio control using T+Bus Protocol.
Baud rate: 2400 bps

Transceiver unit 'PRN/RCI' TS 4	Designation	Remarks
1	RXD	Input. Receive Data
2	TXD	Output. Transmit Data
3	DTR	Output. Data Terminal Ready
4	GND	Ground return. Connected to system ground.

Radio control is possible when the transceiver is not engaged by the internal DSC/Telex modem.

LINE, KEY
8 way terminal strip.
AF line input/output and external key interface.

Transceiver unit 'Line, Key' TS 8	Designation	Remarks
1	Line In +	Balanced 600 Ohm 0 dBm AF line input. Galvanically isolated. Accepts -15 dBm to +10 dBm.
2	Line In -	
3	Line Out +	Balanced 600 Ohm 0 dBm AF line ouput Galvanically isolated. Adjustable from -15 dBm to +10 dBm.
4	Line Out -	
5	'Ext Key'	Transmitter key input. Active when connected to GND. Internal pull-up, 12V / 1.8kohm (RS-410N).
6	Line In C	Line input centre tap.
7	Line Out C	Line ouput centre tap.
8	GND	

Line in and Ext. Key are disabled when the transceiver is engaged by the internal DSC/Telex modem.

AUX
9 way terminal strip
Auxiliary inpuy / output

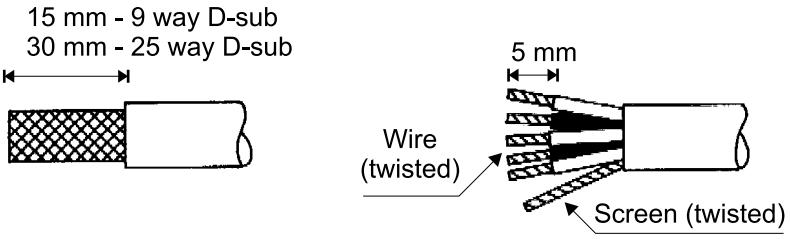
Transceiver unit 'AUX' TS 9	Direction	Designation	Remarks
1	Output	Telex Mode	Connects to GND except when telex mode is selected. Open collector (RS-410N). Max 50 mA, 32 V.
2			Not used.
3		GND	
4	Output	'2182 SEL'	Connects to GND when 2182 kHz is selected. Open collector (RS-410N). Max 50 mA, 32 V.
5	Output	'TX KEYED'	Connects to GND when transmitter is keyed. Delay setting by jumper J3 on DC Power Supply / Interface Board. Open collector (RS-410N). Max 50 mA, 32 V.
6	Output	'Alarm 2' (Telex Alarm)	Connects to GND when alarm is on. Open collector (RS-410N). Max 50 mA, 32 V.
7	Output	+24 V	Max 200 mA. Internally protected.
8	Input	'RX Mute' / 'TX Inhibit'	Function setting by jumper J2 on DC Power Supply / Interface Board. Receiver muted or transmitter inhibeted when connected to GND. Internal pull-up, 12V / 1.8kohm (RS-410N).
9		GND	

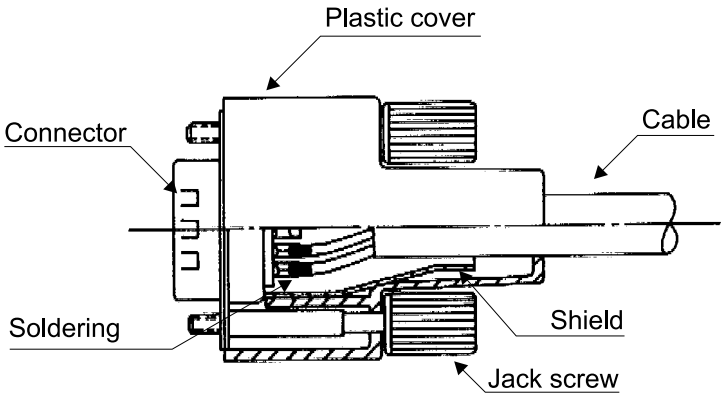
ALARM
Alarm output

Transceiver unit 'Alarm' TS 4	Direction	Designation	Remarks
1			Not used.
2		GND	
3	Output	Alarm 1	Open collector (RS-410N). Max 50 mA, 32 V. Active low
4	Output	+24 V	Max 50 mA. Internally protected.

CONNECTOR MOUNTING INSTRUCTIONS

9 and 25 way D-sub

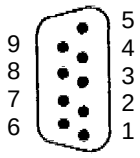


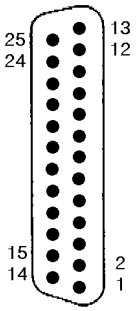


Slide the plastic cover on the cable before the wires are soldered to the pins.

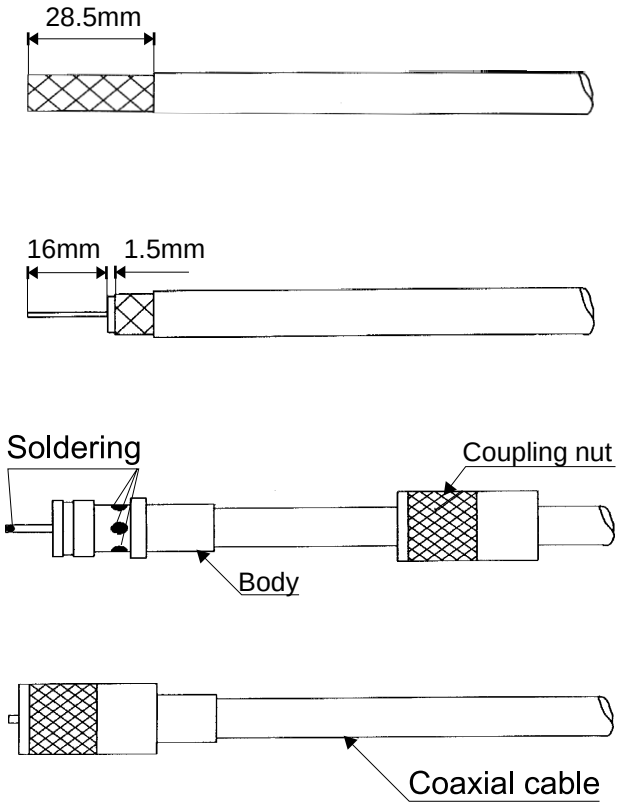
After the pins are soldered; latch the inner and outer shield into the connector and snap in. Finally slide the plastic cover over the shield and fit the two jack screws into the cover.

Contact arrangement
(Viewed from solder side)

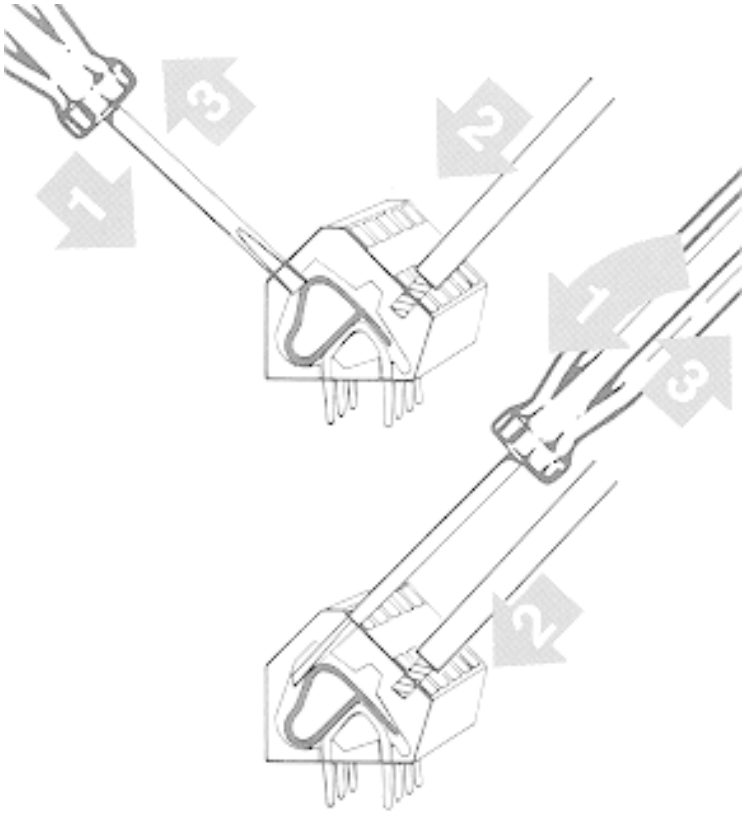




PL 259



Teminal strip



OPTIONS MENU

To open the Options menu, select FUNC and 'OPTIONS' menu item and enter the access code.

Menu	Submenu Level 1	Submenu Level 2	Submenu Level 3	Parameters
Options	Location			Unit priority (SPARC-BUS)
	Telephony	Freq Band	Add	Add new freq band
			Delete	Delete freq band
			View	View freq band
	DSC	MMSI		Change MMSI
		Call Test	Dot	Send Dot pattern
			Mark	Send Mark
			Space	Send Space
	WR 1 Setup	Accept		Watch Receiver 1
		Change		Settings
		View Freq		
	Language			Change language On/Off

Notes:

Location: In installations with two control units, this parameter must be set to **2** or **3** in the control unit with the lowest priority, while it for the one with the highest priority must be **1**. DSC operation is disabled in the control unit with the lowest priority if **3** is selected.

Frequency Bands: Up to 16 frequency bands can be defined. Transmission is inhibited on frequencies outside the defined bands.
Factory pre-programmed:
00: 1.605 - 4.000 MHz
01: 4.000 - 4.438 MHz
02: 6.200 - 6.525 MHz
03: 8.100 - 8.815 MHz
04: 12.230 - 13.200 MHz
05: 16.360 - 17.410 MHz
06: 18.780 - 18.900 MHz
07: 19.680 - 19.800 MHz
08: 22.000 - 22.855 MHz
09: 25.070 - 25.210 MHz
10: 26.100 - 26.175 MHz

DSC MMSI: For programming of DSC self-identification and DSC group-identification see page 2-33.

DSC Call Test: For special purposes only. Disabled in modem.

WR 1 Setup: Change of distress watch frequencies on 6-channel watch receiver.
Factory pre-programmed:
2187.5 kHz
4207.5 kHz
6312.0 kHz
8414.5 kHz
12577.0 kHz
16804.5 kHz

Language: Not used, set to Off.

DSC PROGRAMMING

Programming of DSC self-identification

The Maritime Mobile Service Identity (MMSI) assigned to the station must be stored in the DSC modem before it can be used.

Select FUNC and ‘OPTIONS’ menu item. Enter the access code to open the options menu. Select ‘DSC’, ‘MMSI :’, ‘MMSI :’ and ‘<‘. Key in the MMSI number of the ship. Check the number carefully and select ‘ACCEPT’.

After the MMSI number has been changed it is necessary the restart the system to effect the change: Switch supply off and on.

Check the MMSI number by selecting FUNC, ‘DSC’, ‘MMSI’ and read the number.

Once the MMSI number has been stored in the DSC modem, change of self-identification is not possible (only after a factory resetting).

Programming of DSC group-identification

Two group identities may be assigned to the station. Group call identity numbers always contains a leading zero. The group call identities must be stored in the DSC modem before it is able to respond to group calls.

Select FUNC and ‘OPTIONS’ menu item. Enter the access code to open the options menu. Select ‘DSC’, ‘MMSI :’, ‘GROUP-1’ or ‘GROUP-2’, ‘<‘. Key in the group call identities and select ‘ACCEPT’.

RADIO TELEX
Installation and Initial Set-up

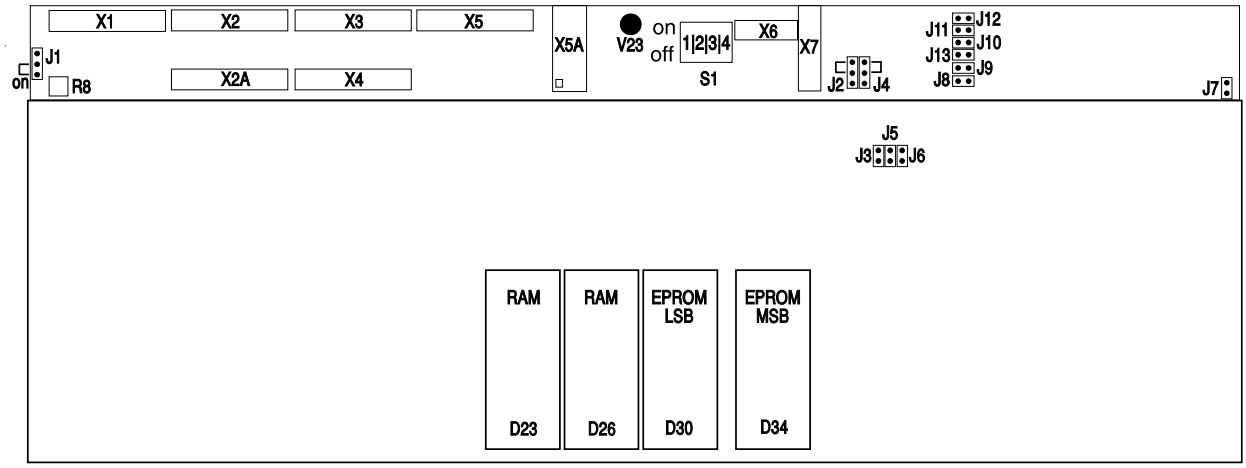
Printer
The terminal uses a parallel interface dot-matrix printer with roll paper stand, please refer to the operation guide delivered with the printer. The printer should be connected to the printer socket at the rear of the control unit by means of the parallel interface cable included with the printer. The printer is equipped with a special firmware which allows the paper to be scrolled up so the current line can be read in printing pauses, and scrolled back down when printing continues. The firmware version can be checked by performing a printer selftest: Disconnect the parallel interface cable. Press the LF button (line-feed) while switching the printer on. When light comes on in the indicator lamps, release the LF button. The printer version is now printed followed by a test print-out. The version must be: F/W 01.01 S38-67-7145.

Keyboard
The keyboard is a PC/AT compatible keyboard. A self-adhesive keyboard template is delivered with the equipment and must be mounted on the keyboard: Remove the protective paper. Carefully place the template around the function keys and indicator lamps so the latter are fully visible.

Modem set-up
Press F10 to turn GNDSS telex on. Modem set-up mode is automatically selected if no call codes are valid or if the abbreviated ID is not valid. To change a valid set-up, a factory re-setting of the modem must be performed. Please note that telex set-up and DSC set-up are independent and following a factory resetting of the modem it will be necessary to program the DSC self-identification and group-identifications.

The 5-digit call code, the MMSI number and the abbreviated ID allocated to the station may then be entered in turn. To leave a setting unchanged just press '¬ Enter'. Otherwise key in a new setting and press '¬ Enter'. The next item is then printed. After the last item follows:
Accept settings (Y/N) ?
Press 'Y' to save the settings or press 'N' to change settings.

PCP BOARD 717 JUMPER AND ADJUSTMENT LOCATIONS



Trimpot R8 — **AF output level**
For adjustment of signal level on Line Out.
Factory setting: 0 dBm.

Jumper J1 — **Input impedance**
When On the input impedance of Rx Line is 600 ohms.
When Off the input impedance is high.
Factory setting: On.

Jumpers J2 and J4 — Not used.

Jumper J3 — **Test mode**
Enables Special Test mode when On.
Factory setting: Off.

Jumper J5, J6 and J7 — Not used. Left open.

Jumpers J8, J9 and J13 — **PC interface (COM)**
When all three jumpers are On the opto-isolation is suspended.
Factory setting: Off.

Jumpers J10, J11 and J12 — Not used.

Red LED V23 — **Program activity**
Normal operation is indicated by regular flashing once every 2 sec.

DIP switch S1 — Normal operation: 3 = on, 1, 2, and 4 = off

Factory resetting — Switch supply off.
Set DIP switch S1-1 on.
Switch supply on for 30 seconds. Red LED V23 is flashing quickly.
Switch supply off.
Se DIP switch S1-1 off.
Switch supply on.
Check that red LED V23 is flashing once every 2 sec

Note: Factory Resetting must be made after exchange of software (EPROMs).

FINAL INSTALLATION CHECK

For operation of the equipment please refer to the Operator's Manual.

Check the hardware configuration of the transceiver by selecting FUNC and the 'USER' and 'CONFIG' menu items, in particular check that the antenna tuning unit is recognized, if installed.

Perform a Self Test of the transceiver by selecting FUNC and the 'TELEPHONY' and 'TEST' menu items. The self test is performed automatically and is used for verification of all functions, except the ones where PA power is applied.

Check the transmitter in all marine bands.
Select a vacant channel press the handset key and whistle into the handset microphone. The Antenna Tuning Unit will tune automatically to the antenna first time the equipment is keyed on a new frequency. During the tune sequence and normal transmission all transmitter circuits are monitored to ensure safe operating conditions. If transmission conditions are bad (bad antenna installation, high temperatures, etc.) the transmitted power will be reduced to a safe limit. If the transmission condition is improved automatic recovery to full power takes place. The reason for the protection can be investigated by selecting the 'FUNC', 'TELEPHONY' and 'PROTECT menu items . The displayed protection code(s) is described in the Service chapter of this manual.

Perform a Self Test of the DSC by selecting FUNC and the 'DSC' and 'TEST' menu items. The self test is performed automatically and is used for verification of all functions.

If a GPS is connected, check the position updating by selecting FUNC and the 'DSC' and 'POSITION' menu items.
Check the time updating by selecting FUNC and the 'DSC' and 'TIME' menu items.

3. TECHNICAL DESCRIPTION

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* In US version ‘Power Amplifier 723’ replaces ‘Power Amplifier 721’.
PA Filters in US version is ‘Continuous Filters 627’.

CONTROL UNIT
Blockdiagram page 3-8, Interconnection diagram page 3-9

The control unit consists of a main module, a display module and a keyboard module.

The main module consists of the digital part, i.e. the microprocessor, program PROM, configuration FLASH PROM, RAM and serial EEPROM, ScanBus data communication driver, SPARC-Bus driver, PC-Keyboard interface and Centronics interface. The main module also consists of an analog part, i.e. the voltage regulators, the analog interface circuits and the analog output drivers (audio and light). The main module contains the encoder and the potentiometer.

The display module contains the graphic display (256x64) dots, and the backlight for the display.

The keyboard module contains the push buttons and the keyboard backlight.

TRANSCEIVER UNIT
Blockdiagram page 3-10 & 11, Interconnection diagram page 3-12 & 13

The Transceiver Unit in its basic version consists of a transceiver control module, a syntesizer including master oscillator, a receiver/exciter module, a power amplifier module, a filter bank module covering either marine frequencies only or the complete range 1,6 to 30 MHz, a power supply/ interface module, and a connection board. The main wiring is by ribbon cables with Micro MaTch connectors on front of the 'plug-in' modules. RF signals are routed in coaxial cables using MCX connectors.
With the optional AC power supply assembly included, the equipment may be supplied from 115/ 230V AC with automatic switch-over to 24 V DC supply in the absence of AC supply voltage. An optional battery charger board enables the AC power supply to be used as a battery charger.
The transceiver unit may include one of three different DSC/telex options, either a DSC/telex modem, a DSC/telex modem in connection with a 2187.5 kHz single channel DSC watch receiver or a a DSC/telex modem and a scanning DSC watch receiver. The scanning receiver consists of two modules, a synthesizer and a receiver signal path.

TU Control Board 910
The digital part includes the micro controller, address decoder, program PROM, configuration PROM, non volatile RAM, real time clock, ScanBus data communication driver, ATU interface, digital TU-bus driver, remote interface and drivers for the analog circuits. The analog part includes voltage regulators, analog interface circuits and analog output drivers. The TU Control Board 910 performs the digital and analog control of the transceiver functions requested by the control unit or the built-in or external modem.

Synthesizer Board 911
The Synthesizer Board 911 includes synthesizers, dividing/multiplication circuits and check detectors. The 1st, 2nd and 3rd local oscillator receive their reference signal from the master oscillator .The 1. local oscillator covers the frequency range from 45 MHz to 75 MHz and generates the injection signal for the 1. mixer on RX/EX signal path. The 2. local oscillator generates by division and multiplication a 44.544 MHz signal for the 2. mixer. The 3. local oscillator generates a 456.5 kHz signal for the modulation/demodulation process.

Master Oscillator 713
The Master Oscillator 713 includes a highly stable Oven Controlled Crystal Oscillator (OCXO). The Master Oscillator 713 generates the accurate 17.8176 MHz reference signal for the synthesizers and sets the 10 Hz frequency stability of the equipment.

RX / EX Signal Path 715
The RX signal path includes protection, antenna attenuator, RF- and IF amplifiers, mixers, filter bank, demodulator, squelch and audio line drivers. The RX signal path performs the handling of the received antenna signal and delivers an AF signal to the control unit via DC Power Supply/Interface Board where the AF-signal is converted from an unbalanced to a balanced signal. The EX signal path includes the AF compressor, modulator, filter bank, mixers and EX amplifier. The EX signal path generates the modulated RF signal for the power amplifier. The RX / EX Signal Path 715 is controlled by the TU Control Board 910 and receives its injection signals from the Synthesizer Board 911.

Power Amplifier 721
The Power Amplifier 721 includes input attenuator, PA drivers, PA-stage, fan circuit, self protection, key circuit and SWR detector. The Power Amplifier 721 receives the modulated RF input signal from the RX/EX Signal Path 715 and delivers the amplified output signal to the low-pass filters, of the Marine Filters or the Continuous Filters. The SWR detector output is a monitor signal for the TU Control Board 910. The fan circuit drives the fan in accordance with the temperature signal monitored on the Power Amplifier 721 and the DC Power Supply/Interface 935.

Marine Filters 726/ Continuous Filters 727
The PA filters includes low-pass filters, relay drivers and a peak detector. The PA Filters removes the unwanted harmonic frequencies from the PA signal received from the Power Amplifier 721. The output of the PA Filters is connected to the input of the ATU via RX/TX Relay on the DC power supply/Interface 935 . The selection of low-pass filter is controlled by the TU Control Board 910. The Peak Detector monitors the output power and the Peak Detector output is used for power level adjustments and for displaying the power level in the control unit.

Marine filters covers the frequency ranges

1.6 - 4.8 MHz

6.2 - 8.95 MHz

12.23 - 17.65 kHz

18.78 - 27.1 kHz

Continuous Filters covers the frequency range 1.6 - 30 MHz

DC Power Supply/Interface 935
The DC switched mode power supply generates all internal the voltages needed in the equipment galvanically isolated from the battery, only the Power amplifier is supplied directly from the battery. The SMPS is switched on from the control unit via the Scanbus SUPPLY ON wire and switched off under software control via the SUPPLY ON/OFF connection from the TU Control Board 910 or the PCP Board 717. A protection circuit switches the SMPS off in the event of an output overload and switches on again when the overload condition has been removed. The DC supply voltage is sensed by a BAT INFO detector circuit and fed to the TU Control Board 910 for automatic RF output power adjustment.
The interface part includes Rx/Tx relay shift, balanced AF line driver for the ScanBus connection to the control unit, and digital interface for auxiliary input/output.

Connection Board 936
The connection board contains the DC supply input terminals and terminal strips for connection of other units. Fuses and diodes for protection against supply voltage reversal and over-voltage are also located on this board.

AC Power Supply Board 958 (optional)
The AC power supply board contains an input filter followed by a rectifier (230V)/voltage doubler (115V) circuit producing an unregulated DC voltage which is converted to 28 V in a full bridge Hy-bridge converter with soft switching and integrated magnetics. The output voltage is adjusted by a regulator circuit optically isolated from the driver circuit. Power for the driver circuit is supplied from a separate winding on the main transformer. A temperature controlled fan contribute to cooling if necessary.
The output is connected to the DC supply input terminals of the Connection Board 936. A 24 V battery connected to the battery terminals will by means of a relay be connected to the output in case of mains failure.
An over-voltage/over-temperature protection circuit disables the SMPS by triggering a failure lock circuit in case of excessive output voltage or temperature. If the failure lock has been triggered it is necessary to disconnect the mains for min. 7 minutes to allow the primary capacitors to discharge before the SMPS can be switched on again.

Charger Control Board 959(optional)
The charger control board enables the AC power supply to be used as a battery charger. With the switch set to position 'Auto' the battery relay in the AC power supply connects the output to the battery terminals, provided a battery is connected and the voltage of the battery exceeds approx. 17 V.
The power supply operates as a constant current/constant voltage charger. The output current capability is min. 24 A. The float voltage is adjustable by means of a potentiometer on the charger control board. Constant current mode is indicated by a yellow 'Main charge' LED while constant voltage is indicated by a green 'Float charge' LED. The board also contains alarm circuits for low and high battery voltage and terminals for AC alarm output. Temperature sensor inputs are provided for compensating the float voltage and the high voltage alarm setting.

PCP Board 717
This board constitutes a combined DSC/Telex modem with two demodulators and one modulator. It contains a 16-bit microprocessor with its peripherals, a real time clock, interface circuits for alarm, handset hook, and key input signals, interface circuits for alarm and key output signals, four asyncronous communication interface adaptors for serial communication with the TU Control Board 910, navigational equipment (NMEA), remote control, and PC. The driver/receivers for PC and NMEA are opto-isolated with driver power delivered from the equipment connected. The modem communicates with the control unit via the ScanBus using a dedicated CAN controller chip. The modulator generates an FSK signal at 1.7 kHz which is routed to the exciter. The input signals for the two demodulators are coming from the dedicated DSC watch receiver and the RX/EX Signal Path respectively.

Single Channel Receiver 914(optional)
The single channel receiver is fixed tuned to the DSC distress frequency 2187.5 kHz. It includes antenna input protection, pre-selection filter, 1. mixer where the input signal is mixed with a 1.7325 MHz signal originating from an oven controlled oscillator, a narrow-band 455 kHz crystal filter, IF amplifier, and 2. mixer. The local oscillator signal for the 2. mixer is generated by a 7.2528 MHz crystal oscillator the output of which is divided by 16 to produce a frequency of 453.3 kHz. The output from the mixer is low-pass filtered and the AF signal centred around 1.7 kHz is finally amplified in AF amplifier.

Synthesizer Board 912(optional)
This Synthesizer Board 912 is similar to the Synthesizer Board 911 but without master oscillator and gets the reference signal from the Synthesizer Board.911 The Synthesizer Board 912 is used together with the optional Receiver Signal Path to constitute a built-in DSC Scanning Receiver.

Receiver Signal Path 915 (optional)
The receiver signal path includes antenna input protection, pre-selection filters, 1. mixer where the input signal is mixed with the 1. local oscillator signal of the synthesizer, a 45 MHz crystal filter, 1. IF amplifier, and 2. mixer. The local oscillator frequency for the 2. mixer is 44.544 MHz corresponding to a 2. IF frequency of 455 kHz. The 2. IF filter is a narrow-band crystal filter. In the 3. mixer the IF signal is mixed with 456.7 kHz producing an AF signal centred around 1.7 kHz.

ANTENNA TUNING UNIT
Blockdiagram page 3-14, Interconnection diagram page 3-15

ATU Board 945
The ATU board comprises tuning network, measuring system and micro-controller circuits. The ATU board matches the impedance of the antenna to 50 ohm in order to gain the best possible SWR. The ATU board communicates tuning process and frequency information with the transceiver unit. The tuning network consists of Capacitor Bank 1, Capacitor Bank 2, and an Inductor Bank. With these it is possible to form either an L-network or a π-network The capacitor banks and inductor bank are built up by binary related capacitors respectively binary related coils. The setting of capacitance and inductance is accomplished by high current, high voltage RF reed relays. A current detector at the antenna output terminal is used for measuring the antenna current for display at the control unit. To prevent overload of the relays, current detectors are incorporated in the Inductor Bank and in Capacitor Bank 2 and information fed back to the transceiver unit to decrease the output power if maximum permissible current is exceeded. To prevent overheating a temperature sensor is incorporated which at excessive temperatures commands the transceiver to reduce the output power.

Dummy Load Board 741
The Dummy Load includes relays and load resistors. When the Dummy Load Board is installed test of the two tone alarm generator is performed by sending RF signals into the dummy load except on the frequency 2182 kHz where only the audio frequencies are tested.

POWER CONTROL AND PROTECTION SYSTEM
Diagram page 3-16

The Transceiver has an automatic power level system, which ensures that optimum power is delivered to the Antenna.
The Tune Sequence, which is automatically initiated when keying the transmitter after a frequency change, makes the Tuning Network of the Antenna Tuning Unit tune to the best obtainable SWR. This is followed by an Automatic Level Control (ALC) adjustment , measuring the output current of the PA Filters (FILPEAK @ 10 Vp at full output), transmitting AM carrier, and setting the overall gain by the ALC voltage (V ALC/MGC). It is now possible to transmit on full output power unless protection is activated or MEDIUM / LOW POWER is selected .
The output power is continuously monitored by the microprocessor, and is automatically adjusted during transmission to provide reliable communication .

Protection Circuits

Power Amplifier Protection
The protection of the Power amplifier consists of SWR protection and thermal protection .
The signals of the reflected power detector and the output voltage detector at the output of the Power amplifier are OR´ed together in a signal PA PEAK , when this signal is exceeding 9V the output power is reduced to a safe level . If the ALC loop is at fault, disconnected or responding too slow and the PA PEAK is exceeding 10V , the 14dB attenuator will be activated , operating as a local and independent PA protection. The attenuator is reset when changing frequency, choosing LOW POWER , TUNING or switching the transmitter OFF.
The thermal protection consist of a temperature sensor on the Power amplifier switching on the 14dB attenuator at 90°C and an average detector on the Control board reducing the output power when the dutycycle of the transmitted signal exceeds 50% for more than 60 seconds .
The power supply voltage is measured in the DC power supply and the information BAT INFO is transferred to the Control board . If the supply voltage is dropping the microprocessor will adjust the output power to keep distortion below the limits .

Antenna Tuning Unit Protection
The ATU is protected by several detectors all monitored by the ATU´s microprocessor, which calculates the SWR, temperature, maximum voltage and current. If these parameters are not below safe operating limits it requests for lower power.

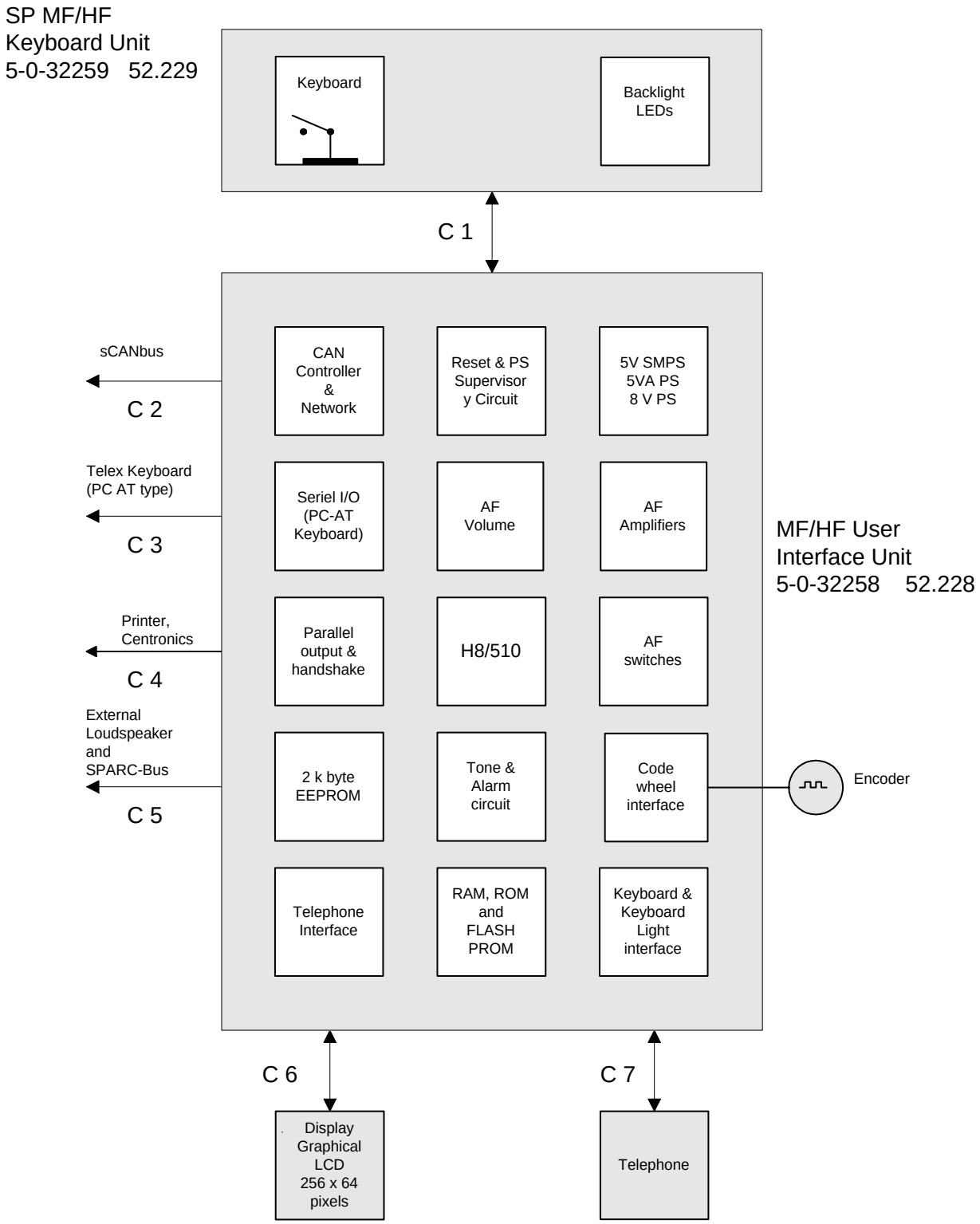
Protection Codes
The current status of the power control and protection may be displayed in the form of Protection Codes by selecting the ‘FUNC’, ‘TELEPHONY’ and ‘PROTECT’ menu items . The Protection Codes are described in the Service chapter of this manual.

It should be noted that protection may be in force even under normal conditions e.g. code nos. **25** , **44** and **48**.

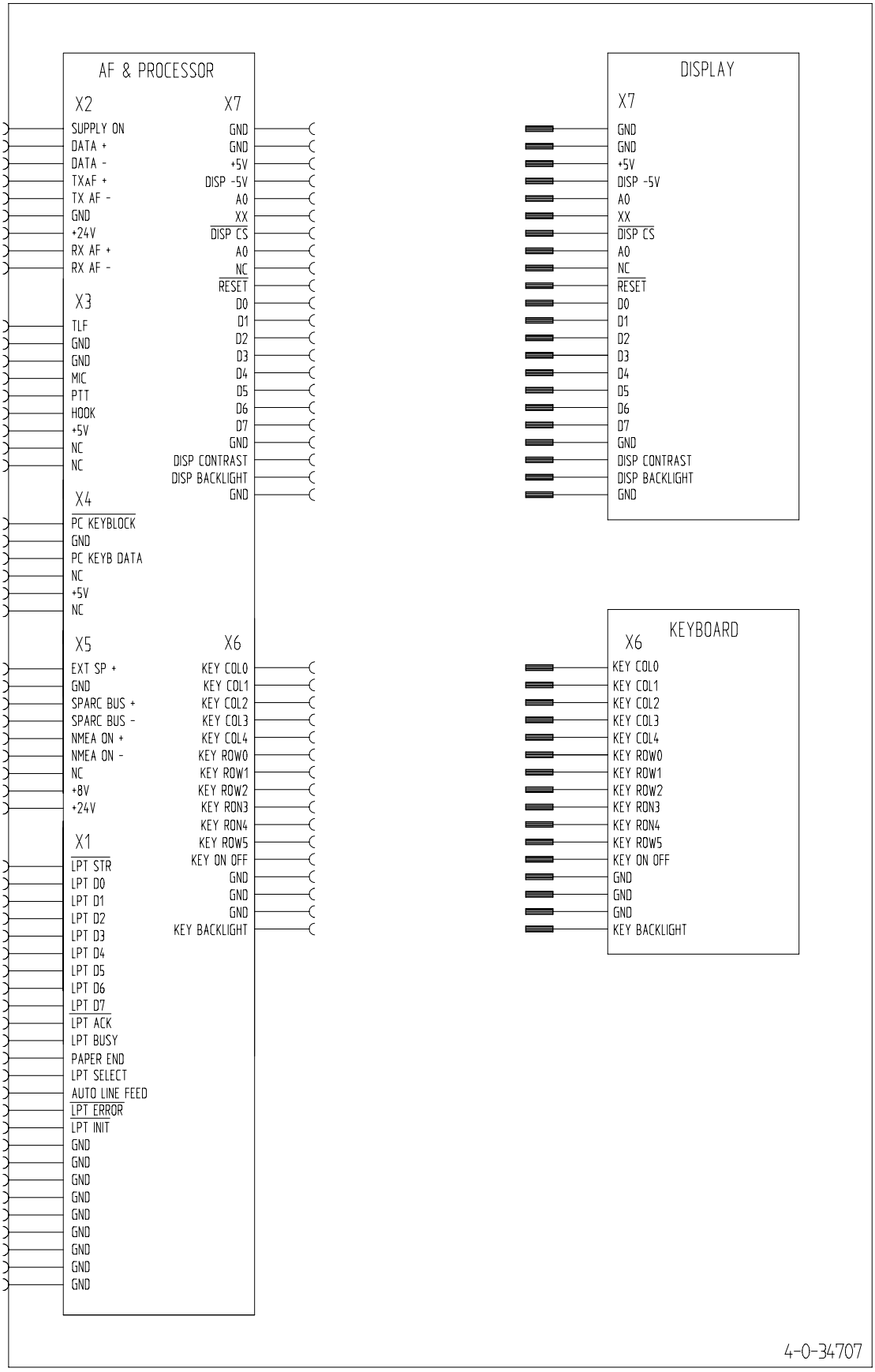
No. 25 requests lower Pout relatively to increasing SWR at the Power amplifier.
@ SWR= 1.1 reduction will only be a few watt’s
@ SWR= 2.0 reduction will be 2-3 dB

No. 44 and 48 requests lower Pout relatively to increasing V or I at ATU.
This is normal when transmitting on lower frequencies and short antennas (L << 1/4wavelength) , and /or parallel capacitance present at the antenna, feeder, insulators etc.

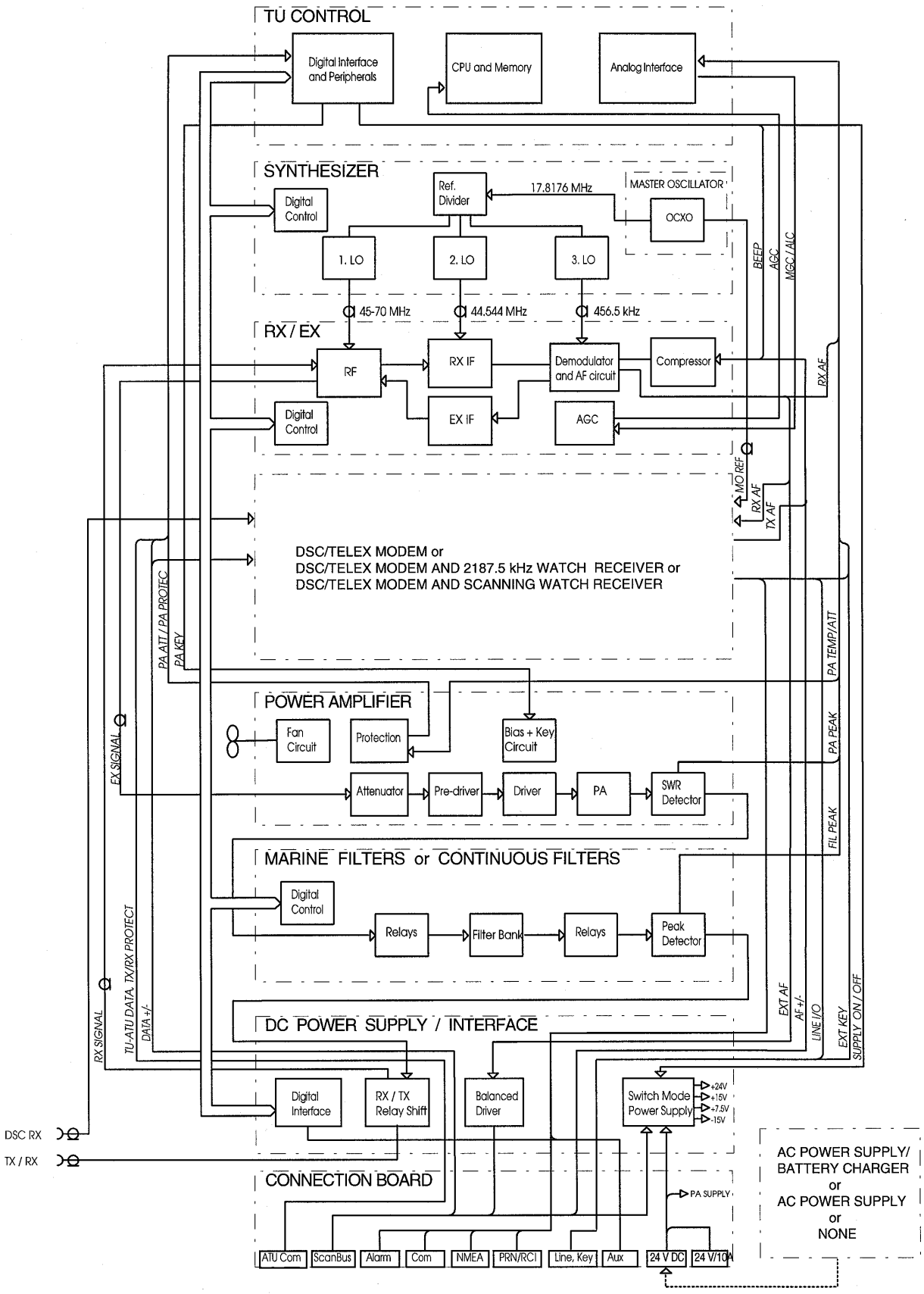
CONTROL UNIT BLOCK DIAGRAM



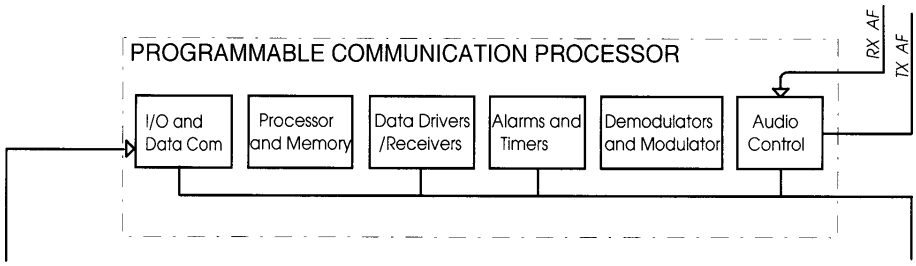
CONTROL UNIT INTERCONNECTION DIAGRAM



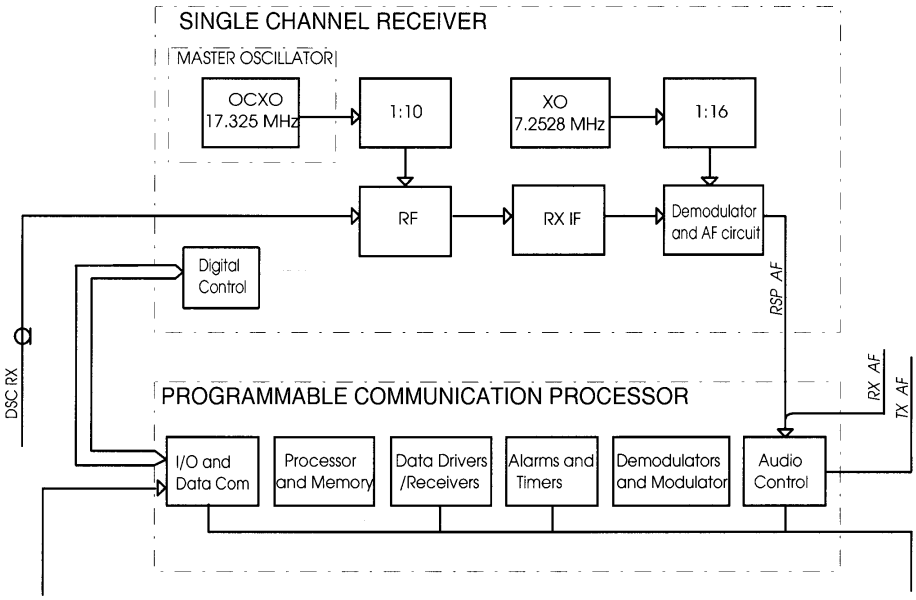
TRANSCEIVER UNIT BLOCK DIAGRAM



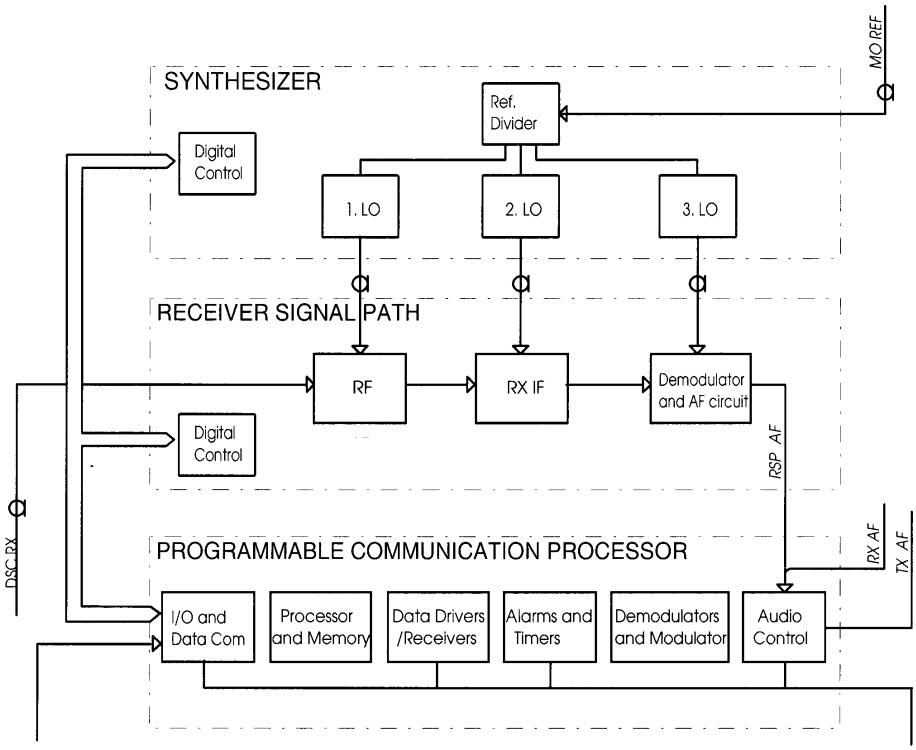
TELEX MODEM - DSC / TELEX MODEM BLOCK DIAGRAM



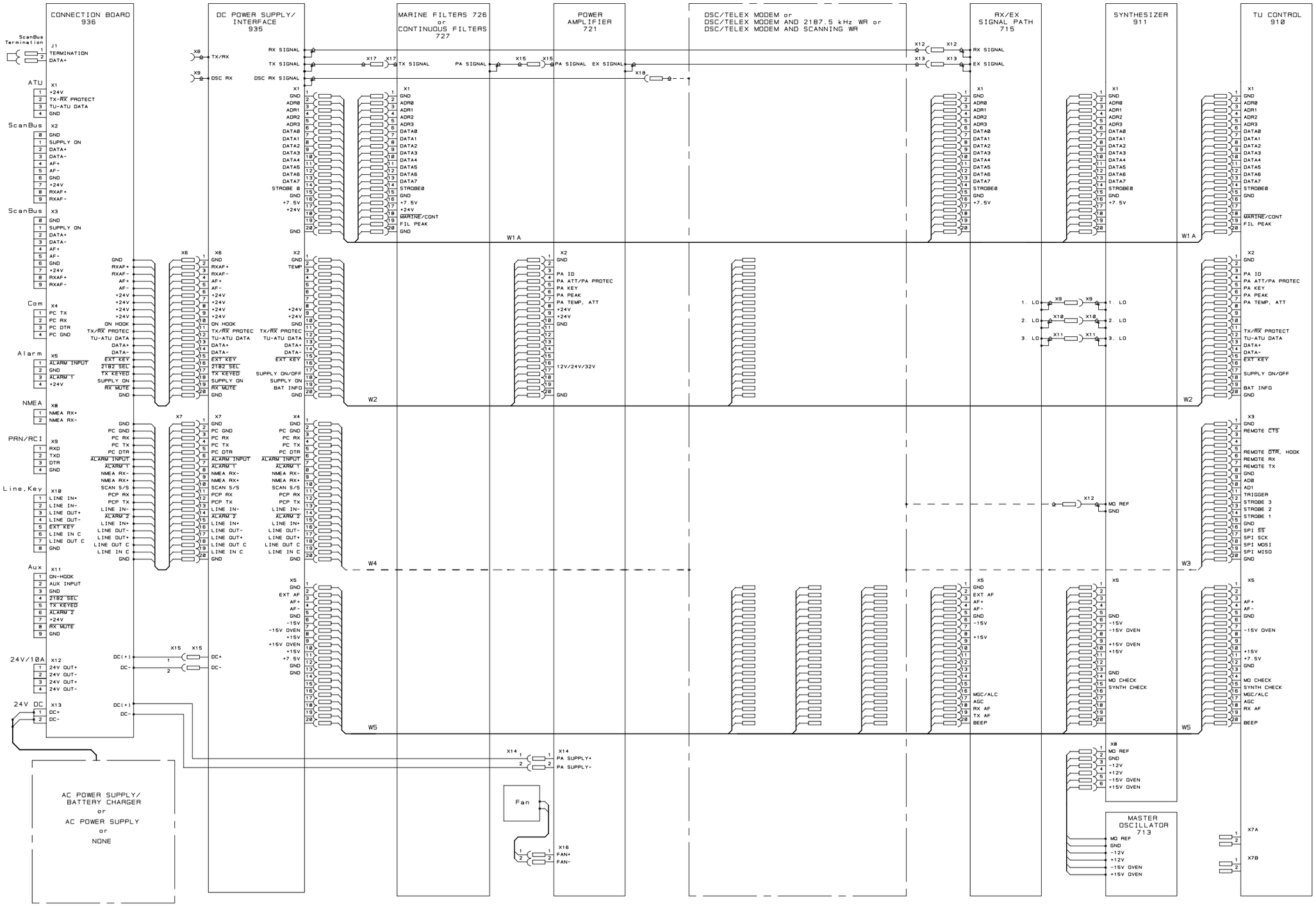
DSC / Telex Modem & 2187.5 kHz Watch Receiver block diagram



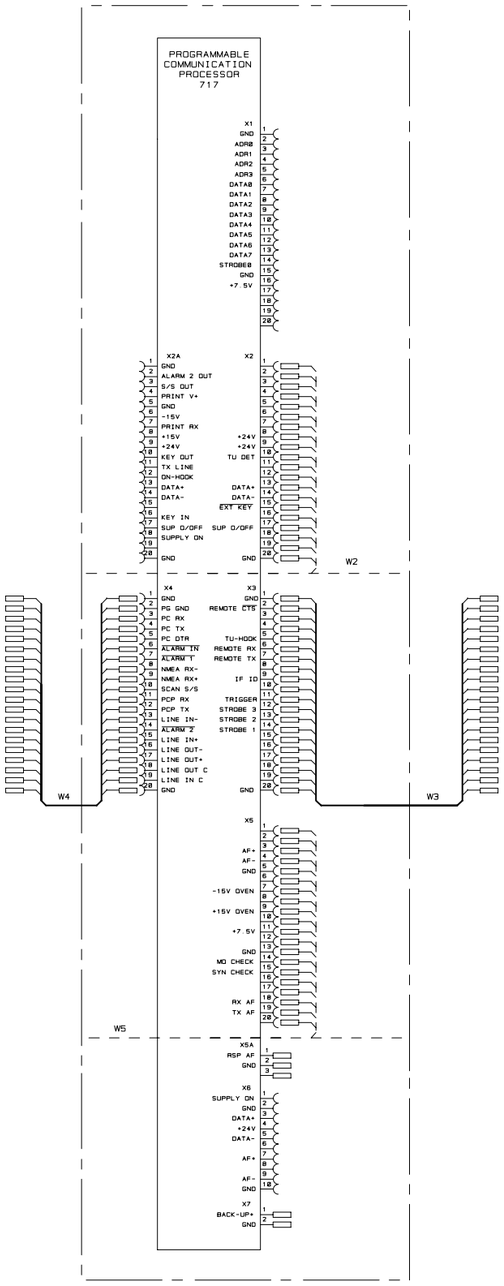
DSC / Telex Modem & Scanning Watch Receiver block diagram



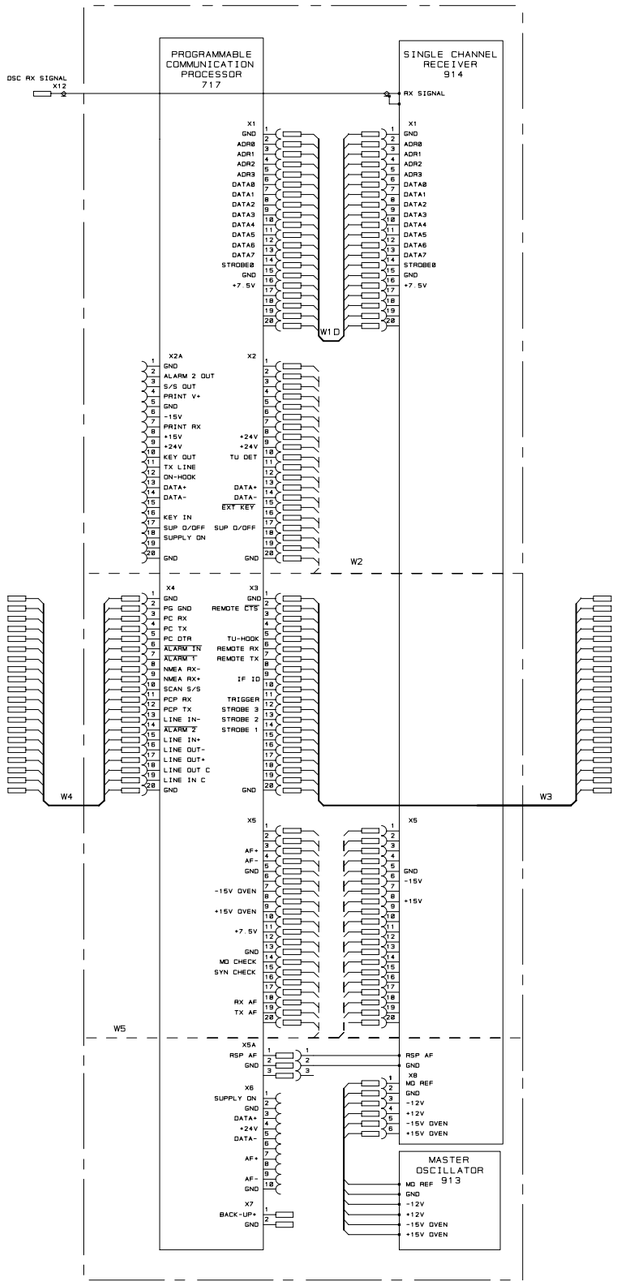
TRANSCEIVER UNIT INTERCONNECTION DIAGRAM



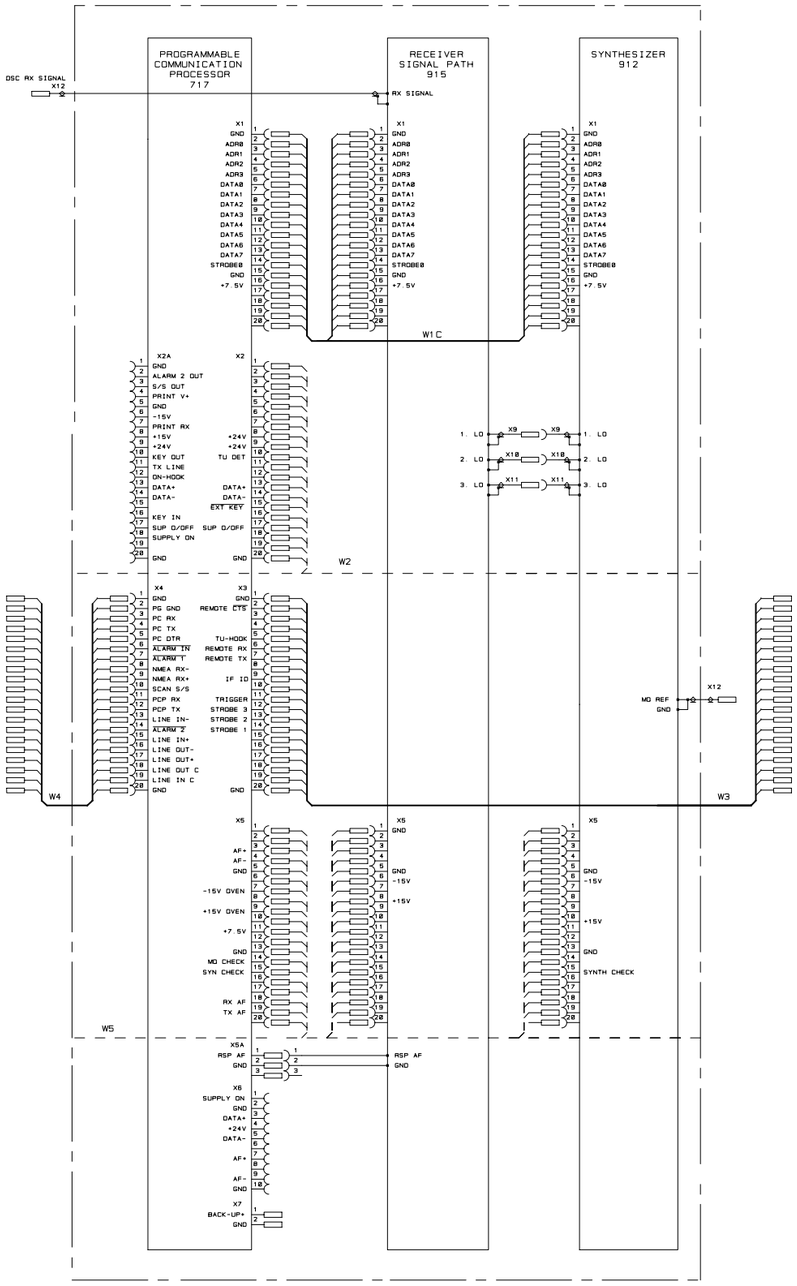
TRANSCEIVER UNIT OPTIONS INTERCONNECTION DIAGRAM



TELEX MODEM - DSC/TELEX MODEM
WIRING DIAGRAM

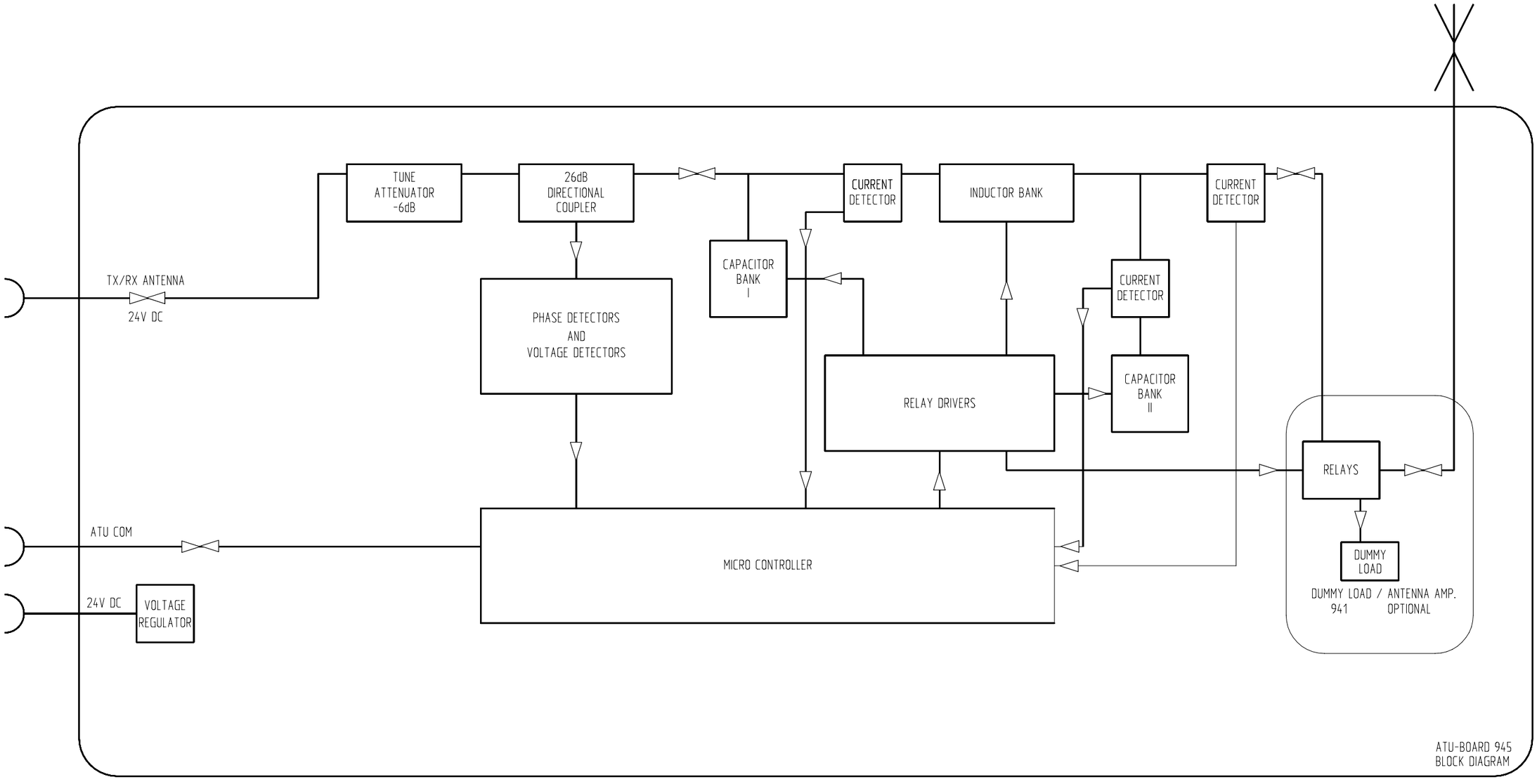


2187.5 kHz DSC WATCH RECEIVER
WIRING DIAGRAM



SCANNING DSC WATCH RECEIVER
WIRING DIAGRAM

ANTENNA TUNING UNIT BLOCK DIAGRAM



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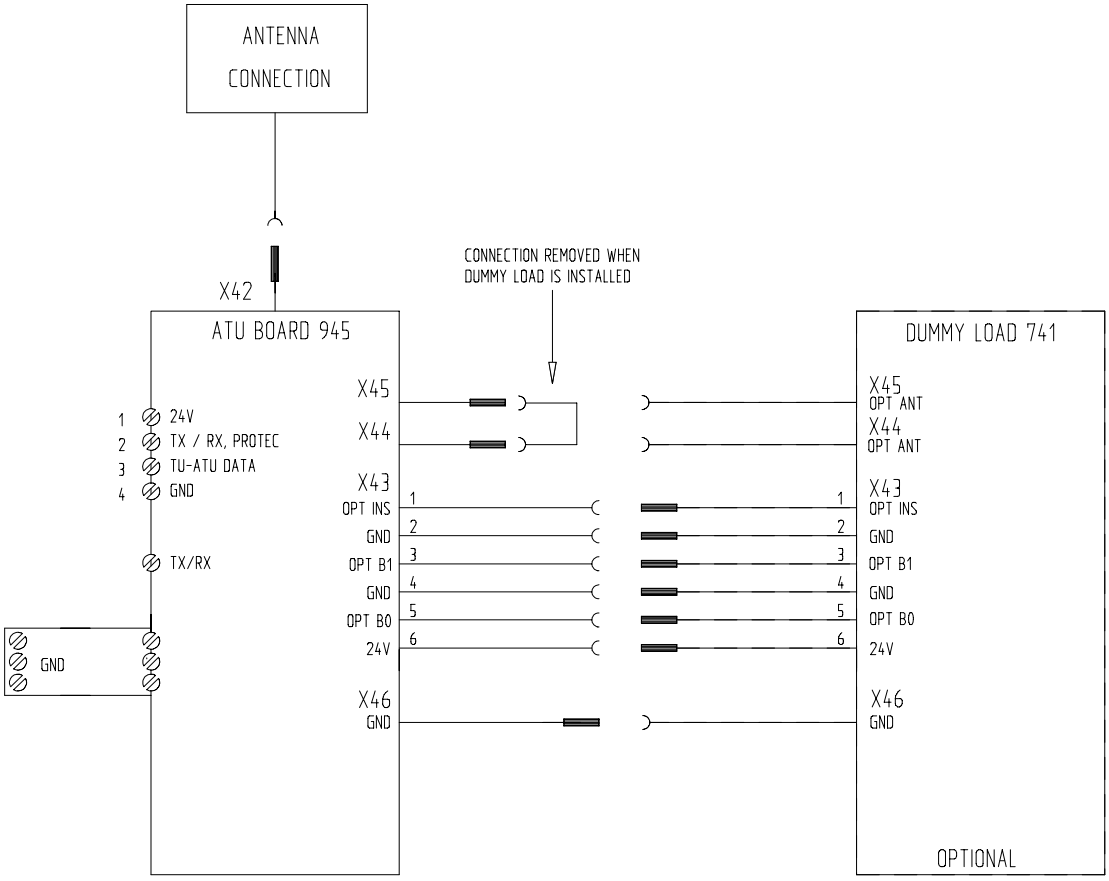
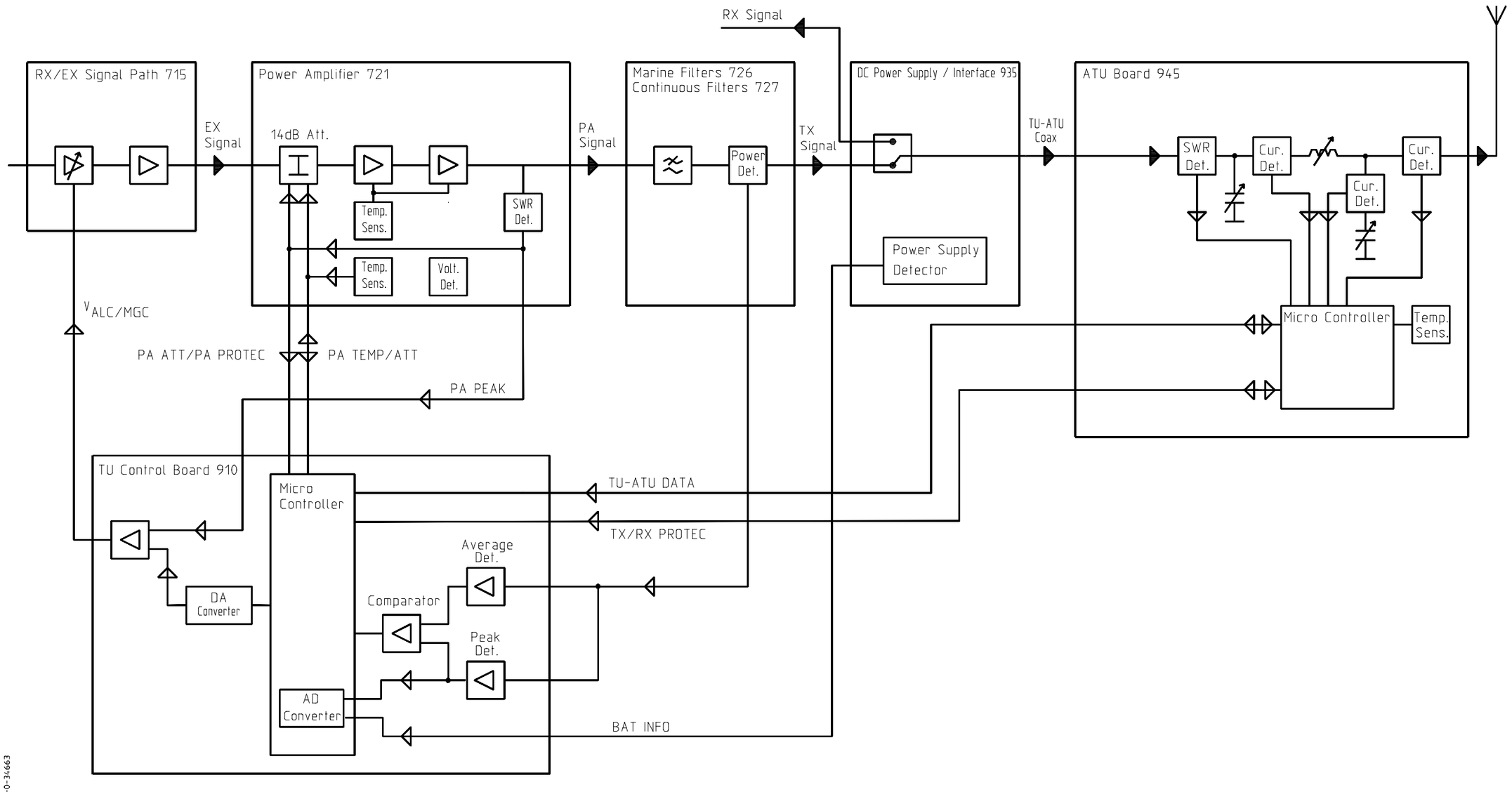
ANTENNA TUNING UNIT INTERCONNECTION DIAGRAM



POWER CONTROL AND PROTECTION SYSTEM



4. SERVICE

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PREVENTIVE MAINTENANCE

Due to the modern design of the transceiver preventive maintenance can be reduced to a minimum provided the equipment is correctly installed. To ensure maximum performance and minimum repair trouble we recommend you to follow the below stated headlines for preventive maintenance.

1. The condition of the battery should be checked at frequent intervals. The battery must always be fully charged and should be topped up frequently with distilled water (liquid should be 5 to 10 mm above the plates).

2. Check the condition of antenna installation, ground connection and cables at regular intervals.

3. Keep antenna feed-through insulators clean and dry.

4. Ensure that no objects are obstructing the free airflow through the cooling channels of the Transceiver Unit and keep the units free of dust accumulation to prevent overheating.

5. For cleaning use a damp cloth. Sticky dirt may be removed using a cloth with a weak soap solution. Wipe off with a clean cloth.

Realignment of Master Oscillator 713

The Master Oscillator frequency should be checked at least once a year. The Master Oscillator determines the exact transmit and receive frequencies of the equipment. All oscillators age very slowly with time, typically with the highest drift rate the first year, approaching zero drift after some years. Adjustment should be performed by a qualified technician with the necessary test equipment at his disposal.

1. Measuring Equipment:

1.1	Frequency Counter:	Frequency range 100 MHz Input impedance = 50 ohm Sensitivity at least 0.2 Vrms Accuracy better than 0.01ppm

2. Preparations:

2.1 Switch on the power at least 30 minutes before adjustment.
2.2 Remove the front cover of the Transceiver Unit.
2.3 Locate and disconnect X10 (green marking) carrying the 2. Local Oscillator signal from the Synthesizer Board 911 to RX/EX Signal Path 715. Connect the frequency counter to the X10 socket on the synthesizer.
2.4 The ambient temperature should be within 10 to 30 deg. Celsius. Do not adjust the Master Oscillator shortly after long keying sequences of the transmitter. Be sure that thermal equilibrium has taken place before adjustment.

3. Realignment of Master Oscillator:
    3.1 Locate the Master Oscillator adjustment hole in the metal shield of Synthesizer Board 911. Use a small screwdriver to gently adjust the frequency.
    3.2 Adjust the frequency as close as possible to 44.544 000 MHz. Adjustment tolerance +/-1Hz.
    3.3 Connect X10 and refit the front cover.

Cleaning the Air Filter

The transceiver uses a fan to cool the circuitry inside the Transceiver Unit. To keep the cooling air clean an Air Filter is placed behind the fan. The Air Filter should be cleaned frequently, especially under dusty working conditions. A dusty Air Filter will block efficient cooling and the transmitter output power is hence reduced to avoid over-heating.
Remove the Front Cover of the Transceiver Unit. Take out the Air Filter located between the fan and the Power Amplifier. Clean the Air Filter, refit it and re-assemble the unit.

TROUBLE SHOOTING

If a malfunction should occur in the transceiver, the following instructions should be followed in order to locate the module which is causing the malfunction:

1. Check the hardware configuration of the transceiver by selecting FUNC and the ‘USER’ and ‘CONFIG’ menu items, in particular check that the antenna tuning unit is recognized, if installed.

2. If the malfunction is related to transmission check the current status of the power and protection monitor. A description of the ’Protection codes’ is included on the following pages.

3. If possible execute the built in selftest. An ’Error code’ for the failing module will be displayed. A description of the ’Error codes’ is included in the Selftest section of this chapter.

4. If an execution of the selftest failed, check that all cables and plugs are correctly connected, and that the supply voltage is correct. At this point the fuses should be checked.

5. The next step is to open the Transceiver Unit and :

    a. Check internal fuses, cables and plugs.

    b. Check that the left LED (Light Emitting Diode) on the SMPS assembly is constantly on; indicating that the Switch Mode Power Supply is on and able to produce +7.5 V DC.

    c. Check that the second left LED on TU Control Board 910 is flashing twice a second, indicating that the microcomputer is operating properly.

    d. Check that the LED on the optional PCP 717S is flashing once every 2 seconds, indicating that the microprocessor is operating properly.

6. If the above steps did not help, please contact your local service agent. A list of service agents is found on the Internet.

POWER PROTECTION

The Power and Protection system is monitoring the transmitter circuits during transmission and will automatcally maximize the radiated power to safe limits. The current status of the Power and Protection monitor is presented in form of protection codes and may be requested at any time by selecting the **'FUNC', 'Telephony'** and then the **'Protection'** menu items.
.
The display will show the Protection Code. More than one Protection Code may be set.Protection is automatically reset when the transmit conditions are normalized.

Protection Code Groups:

No.	Group
00	No protection set
10 - 17	TU power regulation problems. Perform a Self Test.
20 - 23	TU hardware protection.
40 - 51	ATU protection.

Protection Code explanation:
No protection 0

Protection codes10 - 17 in general:
Failure in power regulation loop
Perform an Automatic Self Test.

1**0**	**Tune Power Low**
Measurement:	TU Control Board measures too low power output. Tune power < 30W.
Protection made:	ATU selects feed through setting after „TU Failure" command. Power regulation inhibited
Possible cause:	TU - ATU coaxial cable open. Coaxial cable RX/EX Signal Path 715 - Power Amplifier 721 or Power Amplifier 721 - PA Filters 726 / 727. Coax cables Power Amplifier 721 - PA Filters 726 / 727 - DC Power Supply / Interface 935. Cabling TU Control Board 910 - RX/EX Signal Path 715 or TU Control Board 910 - PA Filters 726 / 727
11	**Tune Power High**
Measurement:	TU Control Board measures too high power output. Tune power > 40W.
Protection made:	ATU selects feed through setting after „TU Failure" command.
Possible cause:	Cabling TU Control Board 910 - RX/EX Signal Path 715 or TU Control Board 910 - PA Filters 726 / 727

12 **ALC Power High**

Measurement: TU Control Board measures too high power output.
ALC power was too high.

Protection made: Exciter level set to ~+12dBm.

Possible cause: Cabling TU Control Board 910 - RX/EX Signal Path 715
or TU Control Board 910 - PA Filters 726 / 727

13 **Supply failure**

Measurement: Supply voltage high.

Protection made: TX key inbitit.

Possible cause: Cabling TU Control Board 910 - DC Power Supply / Interface 935

14 **ALC Power Low**

Measurement: TU Control Board measures too low power output.
ALC power was too low.

Protection made: Exciter level set to ~+12dBm.

Possible cause: Cabling TU Control Board 910 - RX/EX Signal Path 715
or TU Control Board 910 - PA Filters 726 / 727

15 **TU-ATU Failure**

Measurement: TU Control Board measures too high power output.
TX power was too high.

Protection made: Automatic power regulation inhibited.

Possible cause: Cabling TU Control Board 910 - DC Power Supply / Interface 935 - Connection Board 936
or Connection Board 936 - ATU Board 945
Antenna installation or ATU

16 **Med/Low High**

Measurement: TU Control Board measures too high power output.
Medium or Low Power was too high.

Protection made: Power set as Low as possible.

Possible cause: Cabling TU Control Board 910 - Power Amplifier 721
or TU Control Board 910 - PA Filters 726 / 727

17 **Full High**

Measurement: TU Control Board measures too high power output.
Full Power was too high.

Protection made: Automatic power regulation inhibited.

Possible cause: Cabling TU Control Board 910 - 720
or TU Control Board 910 - PA Filters 726 / 727

20 - 23: TU protection by TU hardware

20 **PA Temp**

Measurement: PA temperature too high.
PA/Temp Att = 1 and PA Att/PA Protect = 1.

Protection made: Output power decreased by 14 dB.

Possible cause: Check all Blowers & Blower Filters.

21 **PA SWR high**

Measurement: PA SWR was too high.
Reflected power was detected.
PA Temp Att = 0 and PA Att PA Protect = 1.

Protection made: Output power decreased by 14 dB.

Possible cause: TU - ATU coaxial cable or antenna installation.
Coaxial cable Power Amplifier 721 - PA Filters 726 / 727

Note: It is necessary to select low power or to switch off
the equipment to reset the protection

22 **High Average**

Measurement: Average power reduced to 100W.

Possible cause: CW keyed for more than 1 minute.

23 **PA Hot**

Measurement: PA temperature continuously high.
PA/Temp Att = 1 and PA At/ PA Protect = 1 in more than 5 min.

Protection made: Key inhibit for 5 min.

Possible cause: Fan failure or air filter blocked.

24 **TX Inhibit**

Measurement: External „TX Inhibit“ input is activated.

Action made: TX key inhibit.

25 **PA SWR**

Measurement: PA SWR was high.

Protection made: Output power reduced to safe limits.

Possible cause: High SWR or change in antenna impedance.

40 - 51: ATU protection

40 **Not Tuned**

Measurement: ATU failed tuning the antenna.

Protection made: ATU selects feed through setting.

Possible cause: Antenna installation or ATU

4**1** **No Tune Power**

Measurement: ATU measured no tune power.

Protection made: ATU selects feed through setting.

Possible cause: TU - ATU coaxial cable shorted.
RX/TX relay DC Power Supply / Interface 935 or coax connectors
Coaxial cables PA Filters 726 / 727 - DC Power Supply / Interface 935
ATU

42 **Bad SWR**

Measurement: ATU measured SWR>8 during Tune Procedure.

Protection made: ATU selects feed through setting.

Possible cause: Bad antenna impedance on the selected frequency.
Antenna installation or ATU.

43 **High SWR**

Measurement: ATU measured SWR >3 but <8 during Tune Procedure.

Possible cause: Poor antenna impedance on the selected frequency.

44 **V or I**

Measurement: ATU measured that the maximum voltage or current rating is reached during ALC adjustment.

Possible cause: A short antenna and a low frequency.

45 **Temp**

Measurement: ATU requests for lower power during TX.

Possible cause: Temperature inside ATU cabinet is too high.

46 **Bad SWR TX**

Measurement: ATU measured SWR>8 during transmission.

Protection made: ATU selects feed through setting.

Possible cause: Bad antenna impedance on the selected frequency.
Antenna installation or ATU.

47 **High SWR TX**

Measurement: ATU measured SWR >3 but <8 during transmission.

Possible cause: Poor antenna impedance on the selected frequency.

48 **V or I high TX**

Measurement: ATU measured that the maximum voltage or current rating is reached during transmission.

Possible cause: A short antenna and a low frequency.

50 **V or I high**

Measurement: ATU measured that the maximum voltage or current rating is reached during ALC adjustment and the power had to be reduced more than 6 dB.

Possible cause: A bad antenna and a low frequency.

51 **TU-ATU com bad**

Measurement: TU - ATU communication is not operating.

Protection made: Key inhibit.

Possible cause: TU - ATU multiwire cable problem.

SELF TEST

INTRODUCTION

The 'SELF TEST' BITE (Built-In Test Equipment) of the transceiver is used as a fault diagnosing tool for the service technician. It may also be used by the operator to obtain additional information on a problem when ordering service.
The 'SELF TEST' checks the vital functions of the Transceivers modules by performing and monitoring a sequence of operations. The program controls the analog and digital set ups necessary to perform each test step in the line of tests executed during the 'SELF TEST'. These set ups will result in a digital feed back from the 'Check Detectors' located on most of the modules of the transceiver.

Self test description

Two self tests are included:
1. Telephony selected by the 'FUNC', 'TELEPHONY' and 'TEST' menu items.
2. DSC selected by the 'FUNC', 'DSC' and 'TEST' menu items.

The self test is performed autonatically and is used for verification of all functions, except the ones where PA power is applied. All tests will automatically be performed succesively until the last test has passed or an error condition has occurred. If an error is encountered the self test stops and the display shows 'Error code:' and 4 digits the test no. and the error no. where the failure has occurred.

Explanations to the 'Error codes' are listed on the following pages.

Description of Telephony test steps

'FUNC' - 'TELEPHONY' - 'TEST'

Telephony Test 1
Test 1 is bypassed for the 250W transceiver.

Telephony Test 2
Test 2 tests the AF path on RX/EX Signal Path 715 and DC Power Supply/Interface 935. The test is carried out, by turning off the microprocessor controlled tone generator and turning RXAF on. AF check and RXAF check are both checked for silence.

Error code		Module
0201	AF line, tone shape, volume Cabling: TU Control Board 910 - RX/EX Signal Path 715	RX/EX Signal Path 715
0202	AF output amplifier Cabling: TU Control Board 910 - DC Power Supply/Interface 935	DC Power Supply/Interface 935

Telephony Test 3
Test 3 tests the AF path on RX/EX Signal Path 715 and DC Power Supply/Interface 935. The test is carried out, by turning on the microprocessor controlled tone generator and RXAF on. A 1 kHz tone is generated during this test. AF check and RXAF check are both checked for tone.

Error code	Possible error source	Module
0301	AF line, tone shape, volume, tone generator Cabling: TU Control Board 910 - RX/EX Signal Path 715	RX/EX Signal Path 715
0302	AF output amplifier ScanBus RXAF+, RXAF- shortcircuit Cabling: TU Control Board 910 - DC Power Supply/Interface 935	DC Power Supply/Interface 935

Telephony Test 4
Test 4 tests the volume control on RX/EX Signal Path 715. The test is carried out, by turning on the microprocessor controlled tone generator, and verifying that AF check toggles condition, and keeps it with increasing volume level. Mute is checked in a similar way.

Error code	Possible error source	Module
0401	Volume control Cabling: TU Control Board 910 - RX/EX Signal Path 715	RX/EX Signal Path 715
0402	AF mute Cabling: TU Control Board 910 - RX/EX Signal Path 715	RX/EX Signal Path 715

Telephony Test 7
Test 7 tests Master Oscillator 713/913.
Tests if the MO is oscillating, using MO check.

Error code	Possible error source	Module
0701	Master oscillator Cabling: TU Control Board 910 - Synthesizer Board 911 or Cabling: Synthesizer Board 911 - Master oscillator 713/913	Master oscillator 713/913

Telephony Test 8
Test 8 tests Synthesizer Board 911, all local oscillators.
Tests that the synthesizer is able to lock in midrange .
Band : 45 - 52.5 MHz
1.LO : 50.00000 MHz
3.LO : 456.50 kHz.
The test is OK if SYNCHECK = 1.

Error code	Possible error source	Module
0801	Synthesizer Cabling: TU Control Board 910 - Synthesizer Board 911	Synthesizer Board 911

Telephony Test 9
Test 9 tests Synthesizer Board 911, 1. LO.
Tests if 1. LO is able to get out of lock to check that the microprocessor can control synthesizer.
Band : 45 - 52.5 MHz.
1.LO : 75.00000 MHz
3.LO : 456.50 kHz.
The test is OK if SYNCHECK = 0.

Error code	Possible error source	Module
0901	Synthesizer Cabling: TU Control Board 910 - Synthesizer Board 911	Synthesizer Board 911

Telephony Test 10
Test 10 tests Synthesizer Board 911, 1. LO.
Tests if 1. LO is able to lock in band 0, low border.
Band : 45 - 52.5 MHz
1.LO : 45.00000 MHz
3.LO : 456.50 kHz
The test is OK if SYNCHECK = 1.

Error code	Possible error source	Module
1001	Synthesizer Cabling: TU Control Board 910 - Synthesizer Board 911	Synthesizer Board 911

Telephony Test 11
Test 11 tests Synthesizer Board 911, 1. LO.
Tests if 1. LO is able to lock in band 0, high border.
Band : 45 - 52.5 MHz
1.LO : 52.50000 MHz
3.LO : 456.50 kHz
The test is OK if SYNCHECK = 1.

Error code	Possible error source	Module
1101	Synthesizer Cabling: TU Control Board 910 - Synthesizer Board 911	Synthesizer Board 911

Telephony Test 12
Test 12 tests Synthesizer Board 711, 1. LO.
Tests if 1. LO is able to lock in band 1, low border.
Band : 52.5 - 60 MHz
1.LO : 52.50000 MHz
3.LO : 456.50 kHz
The test is OK if SYNCHECK = 1.

Error code	Possible error source	Module
1201	Synthesizer Cabling: TU Control Board 910 - Synthesizer Board 911	Synthesizer Board 911

Telephony Test 13
Test 13 tests Synthesizer Board 911 1. LO.
Tests if 1. LO is able to lock in band 1, high border.
Band : 52.5 - 60 MHz
1.LO : 60.00000 MHz
3.LO : 456.50 kHz
The test is OK if SYNCHECK = 1.

Error code	Possible error source	Module
1301	Synthesizer Cabling: TU Control Board 910 - Synthesizer Board 911	Synthesizer Board 911

Telephony Test 14
Test 14 tests Synthesizer Board 911, 1. LO.
Tests if 1. LO is able to lock in band 2, low border.
Band : 60 - 67.5 MHz
1.LO : 60.00000 MHz
3.LO : 456.50 kHz
The test is OK if SYNCHECK = 1.

Error code	Possible error source	Module
1401	Synthesizer Cabling: TU Control Board 910 - Synthesizer Board 911	Synthesizer Board 911

Telephony Test 15
Test 15 tests Synthesizer Board 911, 1. LO.
Tests if 1. LO is able to lock in band 2, high border.
Band : 60 - 67.5 MHz
1.LO : 67.50000 MHz
3.LO : 456.50 kHz
The test is OK if SYNCHECK = 1.

Error code	Possible error source	Module
1501	Synthesizer Cabling: TU Control Board 910 - Synthesizer Board 911	Synthesizer Board 911

Telephony Test 16
Test 16 tests Synthesizer Board 911, 1. LO.
Tests if 1. LO is able to lock in band 3, low border.
Band : 67.5 - 75 MHz
1.LO : 67.50000 MHz
3.LO : 456.50 kHz
The test is OK if SYNCHECK = 1.

Error code	Possible error source	Module
1601	Synthesizer Cabling: TU Control Board 910 - Synthesizer Board 911	Synthesizer Board 911

Telephony Test 17
Test 17 tests Synthesizer Board 911, 1. LO.
Tests if 1. LO is able to lock in band 3, high border.
Band : 67.5 - 75 MHz
1.LO : 75.00000 MHz
3.LO : 456.50 kHz
The test is OK if SYNCHECK = 1.

Error code	Possible error source	Module
1701	Synthesizer Cabling: TU Control Board 910 - Synthesizer Board 911	Synthesizer Board 911

Telephony Test 18
Test 18 tests Synthesizer Board 911, 3. LO.
Tests if 3. LO is able to get out of lock to check that the microprocessor can control the synthesizer.
Band : 67.5 - 75 MHz
1.LO : 75.00000 MHz
3.LO : 400.00 kHz
The test is OK if SYNCHECK = 0.

Error code	Possible error source	Module
1801	Synthesizer Cabling: TU Control Board 910 - Synthesizer Board 911	Synthesizer Board 911

Telephony Test 19
Test 19 tests Synthesizer Board 911, 3. LO.
Tests if the synthesizer is able to lock 3. LO, low border.
Band : 67.5 - 75 MHz
1.LO : 70.00000 MHz
3.LO : 452.50 kHz
The test is OK if SYNCHECK = 1.

Error code	Possible error source	Module
1901	Synthesizer Cabling: TU Control Board 910 - Synthesizer Board 911	Synthesizer Board 911

Telophony Test 20
Test 20 tests Synthesizer Board 911, 3. LO.
Tests if the synthesizer is able to lock 3. LO, high border.
Band : 67.5 - 75 MHz
1.LO : 70.00000 MHz
3.LO : 460.50 kHz
The test is OK if SYNCHECK = 1.

Error code	Possible error source	Module
2001	Synthesizer Cabling: TU Control Board 910 - Synthesizer Board 911	Synthesizer Board 911

Telephony Test 21
Test 21 performs receiver test on RX/EX Signal Path 715 in SSB mode and with SSB filter. By choosing the right synthesizer frequency the signal passes the 45 MHz filter and is mixed to a 1 kHz tone in the audio part. This makes the Automatic Gain Control lower the sensitivity and the AF check indicating AF. RX mute is also checked.
Band : 45 - 52.5 MHz
1.LO : 44.99900 MHz
3.LO : 456.00 kHz

Error code	Possible error source	Module
2101	Receiving signal path Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715
2102	AGC Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715
2103	RX mute	RX/EX Signal Path 715

Telephony Test 22

Test 22 performs receiver test on RX/EX Signal Path 715 in AM mode and with AM filter. By choosing the right synthesizer frequency the signal passes the 45 MHz filter and is mixed to generate an unmodulated carrier . This makes the Automatic Gain Control lower the sensitivity and the AF check indicating no AF. Band : 45 - 52.5 MHz
1.LO : 44.99900 MHz
3.LO : 456.00 kHz

Error code	Possible error source	Module
2201	Receiving signal path, AM detector Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715
2202	AGC Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715

Telephony Test 23

Test 23 performs receiver test on RX/EX Signal Path 715 in Telex mode and with Telex filter, if a such is mounted. By choosing the right synthesizer frequency the signal passes the 45 MHz filter and is mixed to a 1 kHz tone in the audio part. This makes the Automatic Gain Control lower the sensitivity and the AF check indicating AF.
Band : 45 - 52.5 MHz
1.LO : 44.99900 MHz
3.LO : 456.00 kHz

Error code	Possible error source	Module
2301	Receiving signal path, option filter Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715
2302	AGC Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715
2399	No optional filter installed	RX/EX Signal Path 715

Telephony Test 24

Test 24 tests squelch on RX/EX Signal Path 715.
By choosing the right synthesizer frequency the signal passes the 45 MHz filter and is mixed to a 500 Hz tone in the audio part. This makes the squelch open. Then a 2 kHz is generated making the squelch close. Squelch hold time is also checked.
Band : 45 - 52.5 MHz
1.LO : 44.99900 MHz
3.LO : 456.00 kHz
3.LO : 457.00 kHz

Error code	Possible error source	Module
2401	Squelch circuit not able to open Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715
2402	Squelch circuit not able to close Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715
2403	Squelch hold time	RX/EX Signal Path 715

Telephony Test 25

Test 25 tests manual Gain Control on RX/EX Signal Path 715. By choosing the right synthesizer frequency the signal passes the 45 MHz filter and is mixed to a 1 kHz tone in the audio part. By controlling the Manual Gain Control to low sensitivity the AF check indicates no AF. High sensitivity shows AF present.
Band : 45 - 52.5 MHz
1.LO : 44.99900 MHz
3.LO : 456.00 kHz

Error code	Possible error source	Module
2501	Not able to lower MGC Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715
2502	Not able to rise MGC Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715

Telephony Test 26
Test 26 tests Automatic Gain Control Hang facility on RX/EX Signal Path 715.
Examine hang function in three steps:
1) Check normally AGC (with 1 kHz tone)
2) Check that AGC hangs (without signal)
3) Check that AGC hang has ended (without signal)
Band : 45 - 52.5 MHz
1.LO : 44.99900 MHz
3.LO : 456.00 kHz
Band : 67.5 - 75 MHz
1.LO : 80.00000 MHz
3.LO : 456.00 kHz

Error code	Possible error source	Module
2601	AGC Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715
2602	AGC hang facility	RX/EX Signal Path 715

Telephony Test 27
Test 27 performs exciter test on RX/EX Signal Path 715 in SSB mode and with SSB filter and no input. The exciter is set up to produce 15 MHz SSB signal. With input grounded; no RF is detected at RF check.
Band : 60 - 67.5 MHz
1.LO : 60.00000 MHz
3.LO : 455.00 kHz

Error code	Possible error source	Module
2701	Exciter signal path Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715

Telephony Test 28
Test 28 performs exciter test on RX/EX Signal Path RX/EX Signal Path RX/EX Signal Path 715 in SSB with SSB filter and tone input. The exciter is set up to produce 15 MHz SSB signal. With tone input; RF is detected at RF check. Shape key is also checked.
Band : 60 - 67.5 MHz
1.LO : 60.00000 MHz
3.LO : 456.00 kHz

Error code	Possible error source	Module
2801	Exciter signal path Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715
2802	Shape key	RX/EX Signal Path 715

Telephony Test 29
Test 29 performs exciter test on RX/EX Signal Path 715 in R3E with SSB filter and tone input. The exciter is set up to produce 15 MHz R3E signal. With tone input; RF is detected at RF check.
Band : 60 - 67.5 MHz
1.LO : 60.00000 MHz
3.LO : 455.00 kHz

Error code	Possible error source	Module
2901	Exciter signal path Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715

Telephony Test 30
Test 30 performs exciter test on RX/EX Signal Path RX/EX Signal Path 715 in AM with SSB filter and no input.
The exciter is set up to produce 15 MHz AM carrier. With input grounded; RF is detected at RF check.
Band : 60 - 67.5 MHz
1.LO : 60.00000 MHz
3.LO : 455.00 kHz

Error code	Possible error source	Module
3001	Exciter signal path Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715

Telephony Test 31
Test 31 performs exciter test on RX/EX Signal Path 715 in CW mode with SSB filter and no input. The exciter is set up to produce 15 MHz carrier. With input grounded; RF is detected at RF check.
Band : 60 - 67.5 MHz
1.LO : 60.00000 MHz
3.LO : 455.00 kHz

Error code	Possible error source	Module
3101	Exciter signal path Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715

Telephony Test 32
Test 32 tests Automatic Level Control on RX/EX Signal Path 715. The exciter is set up to produce 15 MHz CW carrier. With input grounded and low ALC level; no RF is detected at RF check. With high ALC level RF is present.
Band : 60 - 67.5 MHz
1.LO : 60.00000 MHz
3.LO : 455.00 kHz

Error code	Possible error source	Module
3201	Not able to lower ALC Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	RX/EX Signal Path 715
3202	Not able to rise ALC RX/EX Signal Path 715 Cabling: TU Control Board 910 - RX/EX Signal Path 715 or Cabling: Synthesizer Board 911 - RX/EX Signal Path 715	

Telephony Test 33

Test 33 tests Antenna Tuning Unit without power.
The TU checks that an ATU is connected and if so, if it is in manual mode and able to communicate with the TU.
The ATU tests: RAM, Vforward-, Vreflected-, 0 degrees-, 90 degrees-, and temperature-detector.

Error code	Possible error source	Module
3301	ATU in manual mode Cabling DC Power Supply/Interface 935 - TU Control Board 910 or Cabling DC Power Supply/Interface 935 - Connection Board 936 or Cabling Connection Board 936 - ATU Board 945	ATU Board 945
3302	ATU - TU communication failure Cabling DC Power Supply/Interface 935 - TU Control Board 910 or Cabling DC Power Supply/Interface 935 - Connection Board 936 or Cabling Connection Board 936 - ATU Board 945	ATU Board 945 DC Power Supply/Interface 935 TU Control Board 910
3303	ATU ram error	ATU Board 945
3304	Vforward detector	ATU Board 945
3305	Vreflected detector	ATU Board 945
3306	0 deg. detector	ATU Board 945
3307	90 deg. detector	ATU Board 945
3308	Temperature sensor	ATU Board 945

Telephony Test 34

Test 34 tests battery voltage and power amplifier module. Supply voltage is read from module 933/935 and compared with PA module ID. PA ID is performed by a voltage divider and read by the A/D converter.

Error code	Possible error source	Module
3401	Supply voltage too low or voltage measuring circuit Cabling DC Power Supply/Interface 935 - TU Control Board 910	DC Power Supply/Interface 935
3403	Supply voltage too low on 24 V PA module	
3404	Supply voltage too high on 24 V PA module	
3407	Unidentified PA module Cabling TU Control Board 910 - Power Amplifier Board	

DESCRIPTION OF DSC TEST STEPS

‘FUNC’ - ‘DSC’ - ‘TEST’

Single channel DSC watch receiver:

DSC Test 1
Tests Single Channel Receiver Single Channel Receiver 914.
The receiver is muted. The AF Detector at the output checks that no signal is present.
The test is OK if AF CHECK=1

Error code	Possible error source	Module
0101	Single Channel Receiver 914 or cable	Single Channel Receiver 914
0102	RSP AF cable or PCP Board 717	PCP Board 717

DSC Test 2
Tests Single Channel Receiver Single Channel Receiver 914.
A 2187.5 kHz test signal is generated locally and injected at the pre-selector input of the receiver. The signal passes the receiver where it is mixed to a 1.7 kHz tone. The AF Detector at the output checks that signal is present.
The test is OK if AF CHECK=0

Error code	Possible error source	Module
0201	Single Channel Receiver 914 or cable	Single Channel Receiver 914
0202	RSP AF cable or PCP Board 717	PCP Board 717

DSC Test 3
Tests Programmable Communication Processor PCP Board 717.
Checks and re-writes the EEPROM.
The test is OK if the checksum is correct.

Error code	Possible error source	Module
1801	PCP Board 717	PCP Board 717

Scanning DSC watch receiver:

DSC Test 1
Tests if Master Oscillator is oscillating, using MO check.

Error code	Possible error source	Module
0101	Master Oscillator 713/913, Synthesizer Board 912, cable	Master Oscillator 713/913, Synthesizer Board 912

DSC Test 2
Tests Synthesizer Board 912 all local oscillators.
Tests that synthesizer is able to lock in mid-range.
Band: 45 - 52.5 MHz
1. LO: 50.00000 Hz
3. LO: 456.7 kHz
The test is OK if SYNCHECK=1

Error code	Possible error source	Module
0201	Synthesizer Board 912 or cable	Synthesizer Board 912

DSC Test 3
Tests Synthesizer Board 912 1. LO.
Tests if 1. LO is able to get out of lock to check that microprocessor can control synthesizer.
Band: 45 - 52.5 MHz
1. LO: 75.00000 MHz
3. LO: 456.7 kHz
The test is OK if SYNCHECK=0

Error code	Possible error source	Module
0301	Synthesizer Board 912 or cable	Synthesizer Board 912

DSC Test 4
Tests Synthesizer Board 912 1. LO.
Tests if 1. LO is able to lock in band 0 low border.
Band: 45 - 52.5 MHz
1. LO: 45.00000 MHz
3. LO: 456.7 kHz
The test is OK if SYNCHECK=1

Error code	Possible error source	Module
0401	Synthesizer Board 912 or cable	Synthesizer Board 912

DSC Test 5
Tests Synthesizer Board 912 1. LO.
Tests if 1. LO is able to lock in band 0 high border.
Band: 45 - 52.5 MHz
1. LO: 52.50000 MHz
3. LO: 456.7 kHz
The test is OK if SYNCHECK=1

Error code	Possible error source	Module
0501	Synthesizer Board 912 or cable	Synthesizer Board 912

DSC Test 6
Tests Synthesizer Board 912 1. LO.
Tests if 1. LO is able to lock in band 1 low border.
Band: 52.5 - 60 MHz
1. LO: 52.50000 MHz
3. LO: 456.7 kHz
The test is OK if SYNCHECK=1

Error code	Possible error source	Module
0601	Synthesizer Board 912 or cable	Synthesizer Board 912

DSC Test 7
Tests Synthesizer Board 912 1. LO.
Tests if 1. LO is able to lock in band 1 high border.
Band: 52.5 - 60 MHz
1. LO: 60.00000 MHz
3. LO: 456.7 kHz
The test is OK if SYNCHECK=1

Error code	Possible error source	Module
0701	Synthesizer Board 912 or cable	Synthesizer Board 912

DSC Test 8
Tests Synthesizer Board 912 1. LO.
Tests if 1. LO is able to lock in band 2 low border.
Band: 60 - 67.5 MHz
1. LO: 60.00000 MHz
3. LO: 456.7 kHz
The test is OK if SYNCHECK=1

Error code	Possible error source	Module
0801	Synthesizer Board 912 or cable	Synthesizer Board 912

DSC Test 9
Tests Synthesizer Board 912 1. LO.
Tests if 1. LO is able to lock in band 2 high border.
Band: 60 - 67.5 MHz
1. LO: 67.50000 MHz
3. LO: 456.7 kHz
The test is OK if SYNCHECK=1

Error code	Possible error source	Module
0901	Synthesizer Board 912 or cable	Synthesizer Board 912

DSC Test 10
Tests Synthesizer Board 912 1. LO.
Tests if 1. LO is able to lock in band 3 low border.
Band: 67.5 - 75 MHz
1. LO: 67.50000 MHz
3. LO: 456.7 kHz
The test is OK if SYNCHECK=1

Error code	Possible error source	Module
1001	Synthesizer Board 912 or cable	Synthesizer Board 912

DSC Test 11
Tests Synthesizer Board 912 1. LO.
Tests if 1. LO is able to lock in band 3 high border.
Band: 67.5 - 75 MHz
1. LO: 75.00000 MHz
3. LO: 456.7 kHz
The test is OK if SYNCHECK=1

Error code	Possible error source	Module
1101	Synthesizer Board 912 or cable	Synthesizer Board 912

DSC Test 12
Tests Synthesizer Board 912 3. LO.
Tests if 3. LO is able to get out of lock to check that microprocessor can control synthesizer.
Band: 67.5 - 75 MHz
1. LO: 75.00000 MHz
3. LO: 400.00 kHz
The test is OK if SYNCHECK=0

Error code	Possible error source	Module
1201	Synthesizer Board 912 or cable	Synthesizer Board 912

DSC Test 13
Tests Synthesizer Board 912 3. LO.
Tests if 3. LO is able to lock at low border.
Band: 67.5 - 75 MHz
1. LO: 70.0000 MHz
3. LO: 452.57 kHz
The test is OK if SYNCHECK=1

Error code	Possible error source	Module
1301	Synthesizer Board 912 or cable	Synthesizer Board 912

DSC Test 14
Tests Synthesizer Board 912 3. LO.
Tests if 3. LO is able to lock at high border.
Band: 67.5 - 75 MHz
1. LO: 70.0000 MHz
3. LO: 460.50 kHz
The test is OK if SYNCHECK=1

Error code	Possible error source	Module
1401	Synthesizer Board 912 or cable	Synthesizer Board 912

DSC Test 15
Tests Receiver Signal Path 915 I/O register addressing.
Reads the OPTION INST signal.
The test is OK if VERSION-0=1

Error code	Possible error source	Module
1501	Receiver Signal Path 915 jumper or cable	Receiver Signal Path 915

DSC Test 16
Tests Receiver Signal Path 915.
The pre-selector and the synthesizer is set-up so no signal passes the receiver. The AF Detector at
the output checks that no signal is present.
Pre-selector: PRE 0
Band: 67.5 - 75 MHz
1. LO: 75.0000 MHz
3. LO: 456.7 kHz
The test is OK if AF CHECK=1

Error code	Possible error source	Module
1601	Receiver Signal Path 915 or cable	Receiver Signal Path 915
1602	RSP AF cable or PCP Board 717	PCP Board 717

DSC Test 17
Tests Receiver Signal Path 915.
By choosing the right synthesizer frequency the signal passes the 45 MHz filter and is mixed to a
1.7 kHz tone in the audio part of the receiver. The AF Detector at the output checks that signal is present.
Band: 45 - 52.5 MHz
1. LO: 44.99900 MHz
3. LO: 456.7 kHz
The test is OK if AF CHECK=0

Error code	Possible error source	Module
1701	Receiver Signal Path 915 or cable	Receiver Signal Path 915
1702	RSP AF cable or PCP Board 717	PCP Board 717

DSC Test 18
Tests Programmable Communication Processor PCP Board 717.
Checks and re-writes the EEPROM.
The test is OK if the checksum is correct.

Error code	Possible error source	Module
1801	PCP Board 717	PCP Board 717

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