COBHAM

SAILOR 6300B MF/HF DSC 150W/150W FCC/250W/500W

Installation manual

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150W/150W FCC/250W/500W
Installation manual

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Safety summary

The following general safety precautions must be observed during all phases of operation, service and repair of this equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture and intended use of the equipment. Thrane & Thrane assumes no liability for the customer's failure to comply with these requirements.

GROUND THE EQUIPMENT

To minimise shock hazard, the equipment chassis and cabinet must be connected to an electrical ground and the cable instructions must be followed.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the equipment in the presence of flammable gases or fumes.
Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove equipment covers. Component replacement and internal adjustment must be made by qualified maintenance personnel. Do not service the unit with the power cable connected. Always disconnect and discharge circuits before touching them.

Service

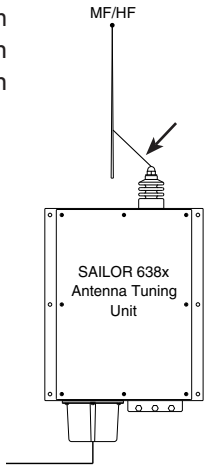
General service must be done by skilled service personnel.

Caution! Only skilled service personnel may service and repair the equipment.
Always carry out work under ESD safe conditions.

RF exposure hazards and instructions

Your Thrane & Thrane radio generates electromagnetic RF (radio frequency) energy when transmitting. To ensure that you and those around you are not exposed to excessive amounts of energy and thus to avoid health hazards from excessive exposure to RF energy, all persons must obey the following:

Caution! Never touch the horn of the Antenna Tuning Unit or feeder wire when the MF/HF radio is transmitting. High voltage which can cause death or serious injury is present at the locations shown in the illustration below.



Warranty limitation

The radio is not a user maintainable unit, and under no circumstances should the unit be opened except by authorized personnel. Unauthorized opening of the unit will invalidate the warranty.

Record of revisions

Rev.	Description	Relase Date	Initials
A	Original document	October 2015	CMA

Preface

Radio for occupational use

The SAILOR 6300B MF/HF DSC fulfils the requirements of the SOLAS directive and is intended for use in maritime environment.
SAILOR 6300B MF/HF DSC is designed for occupational use only and must be operated by licensed personnel only.
SAILOR 6300B MF/HF DSC is not intended for use in an uncontrolled environment by general public.

Training information (for FCC approved equipment)

The SAILOR 6300B MF/HF DSC is designed for occupational use only and is also classified as such. It must be operated by licensed personnel only. It must only be used in the course of employment by individuals aware of both the hazards as well as the way to minimize those hazards.

The radio is thus NOT intended for use in an uncontrolled environment by general public. The SAILOR 6300 MF/HF DSC has been tested and complies with the FCC RF exposure limits for Occupational Use Only. The radio also complies with the following guidelines and standards regarding RF energy and electromagnetic energy levels including the recommended levels for human exposure:

- FCC OET Bulletin 65 Supplement C, evaluating compliance with FCC guidelines for human exposure to radio frequency electromagnetic fields.
- American National Standards Institute (C95.1) IEEE standard for safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 kHz to 300 GHz
- American National Standards Institute (C95.3) IEEE recommended practice for the measurement of potentially hazardous electromagnetic fields - RF and microwaves.

Below the RF exposure hazards and instructions in safe operation of the radio within the FCC RF exposure limits established for it are described.

Warning

Your Thrane & Thrane radio set generates electromagnetic RF (radio frequency) energy when it is transmitting. To ensure that you and those around you are not exposed to excessive amounts of that energy (beyond FCC allowable limits for occupational use) and thus to avoid health hazards from excessive exposure to RF energy, FCC OET bulletin 65 establishes an Maximum Permissible Exposure (MPE) radius of 6 ft. (1.8 m) for the maximum power of your radio (150 W selected) with a whip antenna having a maximum gain of 3.0 dBi.
The safety distance from the antenna is stated to:

Antenna	Safety distance
150W	6 ft. which are equal to 184 cm > 156 cm
250W	7 ft. which are equal to 215 cm > 201 cm
500W	10 ft. which are equal to 307 cm > 285 cm

Installation

1. A whip antenna with a maximum gain of 3 dBi must be mounted at least 12.6 ft. (3.9m) above the highest deck where people may be staying during radio transmissions. The distance is to be measured vertically from the lowest point of the antenna. This provides the minimum separation distance which is in compliance with RF exposure requirements and is based on the MPE radius of 6 ft. (1.8m) plus the 6.6 ft. (2.0 m) height of an adult.

2. On vessels that cannot fulfil requirements in item 1, the antenna must be mounted so that its lowest point is at least 6 ft. (1.8m) vertically above the heads of people on deck and all persons must be outside the 6 ft. (1.8 m) MPE radius during radio transmission.
   - Always mount the antenna at least 6 ft (1.8 m) from possible human access.
   - Never touch the antenna when transmitting
   - Use only authorized T&T accessories.

3. If the antenna has to be placed in public areas or near people with no awareness of the radio transmission, the antenna must be placed at a distance not less than 12 ft. (3.6 m) from possible human access.

Failure to observe any of these warnings may cause you or other people to exceed FCC RF exposure limits or create other dangerous conditions.

Related documents

Title and description	Document number
Installation guide SAILOR 630x MF/HF Control Unit	98-132396
Installation guide SAILOR 6300B MF/HF Transceiver Unit & Antenna Tuning Unit 150 W/250 W/500 W	98-144542
User Manual SAILOR 6301 MF/HF Control Unit	98-131070
User Manual SAILOR 6300 MF/HF Radiotelex	98-132519
Installation and user manual SAILOR 6101 and 6103 Alarm Panel	98-130981
Emergency call sheet	98-132369

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General information

1.1 Introduction

The 150 W/250 W/500 W MF/HF transceiver with integrated DSC and telex (NBDP) is designed for maritime applications in voluntary as well as compulsorily fitted vessels. It offers simplex and semi-duplex SSB radiotelephone communication in the maritime mobile frequency bands between 1.6 and 30 MHz. The basic version of the transceiver includes voice, DSC and a dedicated 2187.5 KHz DSC watch receiver, forming an ideal system for MF 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 Tuning Unit automatically matches the impedance of antennas between 8 and 18 metres in length and requires no presetting at the installation. 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 circuits. The fully protected solid state 150 W/ 250 W /500 W power amplifier matches a 50 ohm antenna system, but is normally used in connection with the Antenna Tuning Unit. The DSC/Telex modem contains two demodulators, one connected to the built-in watch receiver for continuous watch on the DSC distress frequencies, the other connected to the communication receiver which may be used to keep simultaneous watch on other DSC frequencies or telex communication.
The transceiver can be upgraded to scan 6 DSC channels, and Telex operation to comply with MF/HF requirements in sea area A4. Codes are purchased as accessories for the system.
The Control Unit is for operation of radiotelephony as well as DSC and configuration. Use of the equipment is simple, logic and straight forward. 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.
For telex operation the Message Terminal must be connected to the system via the CAN bus.
The equipment is designed for operation from a 24 V DC supply, like e.g. a battery. With the optional AC Power Supply unit installed the equipment may be supplied from 115/230 V AC main or emergency supplies with automatic switch-over to 24 V DC supply in the absence of AC supply voltage. Also optionally, a battery charger for AC is available in the product line.
The built-in test facilities and easy-to-replace module design of the equipment simplifies the service concept.

1.2 Technical data

1.2.1 General

Complies with the relevant IMO performance standards for MF, MF/HF, MSI, and NBDP GMDSS equipment, the ITU Radio Regulations, the ITU-R recommendations and the relevant performance specifications of ETSI, IEC and FCC, in the ITU marine bands.

Operating modes:	Simplex and semi-duplex SSB telephony (J3E), DSC (J2B), AM broadcast reception (H3E) and Telex (J2B)
Frequency stability:	Better than 0.35 ppm Warm-up time. Less than one minute Ageing less than 0.1 ppm/year
Normal operating temperature:	from 0˚C to +40˚C
Extreme operating temperature: **ATU**	From -15˚C to +55˚C From -25˚C to +55˚C
User-programmable channels:	199 frequency pairs with mode (1-199)

User-programmable stations: 40 stations with name, MMSI and station channel

Supply voltage: Nominal 24V DC (-10 +30% — 21.6 - 31.2 V DC)
With optional external AC power supply:
115/230V AC 50/60 Hz. Automatic change-over to DC in the absence of AC supply

Power consumption:

Rx Mode: Approximately 45W	150 W	250 W	500 W
Tx, SSB speech	175 W	300 W	600 W
Tx, SSB two-tone	300 W	550 W	1100 W
Tx, DSC/TELEX	310 W	600 W	1000 W

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	1.2	0.5
Transceiver Unit	0.85	0.25
Antenna Tuning Unit	0.6	0.3
Handset	0.3	0.2
Cradle	1.1	0.7
Loudspeaker	2.2	1.6

IP ratings (estimated):

System	Transceiver Unit	Antenna Tuner Unit *	Control Unit
150 W	IP43	IP56	IP54
250 W	IP43	IP56	IP54
500 W	IP20	IP56	IP54

* Antenna cable must be careflly installed to obtain this IP rating

Dissipated heat: The dissipated heat in standby RX mode is typically 45 W depending on attached ancillary equipment.
In transmit mode, use the consumption figures for the appropriate mode, multiplied by 0.66.
E.g. 0.66 x 175 W = 115.5 W dissipated heat for a 150 W system in SSB speech mode.

For a figure in kilocalories (kcal), multiply dissipation effect by on-time in hous and then by 0.860.
For the 150W system, e.g. 115.5 W x 2 h + 45 W x 22 h (TX 2 hours + RX 22 hours a day) = 1221 Wh. 1221 Wh x 0.860 ˜ 1050 kcal a day.

1.2.2 Receiver characteristics

General: Complies with ETSI 300373 in the ITU marine bands.

Frequency range: 150 KHz to 30 MHz

Frequency resolution: 100 Hz by keyboard entry
10 Hz, 100 Hz or 1 KHz search/fine-tune facility is provided

Input impedance: Rx : 50 ohm

12V DC / 20 mA is available for possible use of active antenna.

Sensitivity:

Telephony (J3E):	below 11 dBµV for 20 dB Sinad
Broadcast (A3E):	below 25 dBµV for 20 dB Sinad
DSC/Telex (J2B):	below 0 dBµV

Intermodulation:

	Wanted signal	Signal
Telephony (J3E)	30 dBµV	
Intermodulation level		above 80 dBµV
Telex (J2B)	30 dBµV	
Intermodulation level		above 90 dBµV
DSC (J2B)	20 dBµV	
Intermodulation level		above 80 dBµV

Spurious rejection: Signal: above 70 dB

Audio output power: Build-in loudspeaker 6 W typical.
Optional loudspeaker output 6 W typical with less than 10 % distortion.
Output intended for 8 ohm loudspeaker.

1.2.3 Transmitter characteristics

General: Complies with ETSI 300373 and FCC in the ITU marine bands.
The Transmitter characteristics are with the Antenna Tuning Unit included.

Frequency range: All frequencies in the range 1605 KHz to 30 MHz however by factory default arranged in the ITU marine bands.

Factory pre-programmed:

Band	Frequency
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	2.230 - 13.200 MHz
05	6.360 - 17.410 MHz
06	8.780 - 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

Frequency resolution: 100 Hz

Output impedance: TX: 50 ohm
The Antenna is matched by the Antenna Tuning Unit

Power reduction: Low power: 20 W PEP

Intermodulation: below -31 dB/PEP

Spurious Emission: below -43 dB/PEP
below -60 dB/PEP (FCC)

Hum and noise: Less than - 40 dB/PEP

Output power 150 W SSB: ± 1.4 dB into 50 ohm Antenna.

DSC/Telex:
85 W ± 1.4 dB

Output power 250 W SSB: ± 1.4 dB into 50 ohm Antenna.

DSC/Telex:
125 W ± 1.4 dB

Output power 500W SSB: 1.6-4 MHz 400 W PEP +0/-1.4 dB
4-27 MHz 500 W PEP ±1.4 dB into 50 ohm Antenna.

DSC/Telex:
250 W ± 1.4 dB

1.2.4 DSC Watch keeping receiver characteristics

General: Complies with ETSI 300338 and ETSI 301033..

Frequency range: Default set to D1 - 2187.5 KHz.
When scanning is enabled by option code it will default be D6 - 2-4-6-8-12-16 MHz.
Can be reduced to minimum 3 frequencies via the Service Interface.

Input impedance: DSC/Telex: 50 ohm
12V DC / 60 mA is available for use of active antenna.

Sensitivity: DSC (J2B): below 0 dBµV

Intermodulation: DSC (J2B): Wanted Signal: 20 dBµV
Intermod. level: above 70 dBµV

Spurious rejection: above 70 dB

1.2.5 Antenna Tuning Unit characteristics

Frequency range: 1.6 MHz - 27.5 MHz

Antenna requirements: 8-18 m wire and/or whip antenna

Antenna tuning: Fully automatic with no presetting

Tuning speed: 0.1 - 8 sec. (typical)

Power capability
150 W/250 W: 350 W PEP into 50 ohm antenna
500 W: 600 W PEP into 50 ohm antenna

Extreme operating temperature: from -25˚C to +55˚C

1.2.6 DSC/Telex modem characteristics

DSC:	DSC Equipment class:	Class A
	Protocols:	ITU-R M. 493-13
	Ship's identity:	9-digit identity number
	NMEA interface:	According to IEC 61162-1 GLL, RMC, ZDA, GGA, GNS
TELEX:	Protocols:	ARQ, FEC and Selective FEC
	Ship's identity:	5- and/or 9-digit identity number

1.2.7 Dimensions and weight

Control Unit
6301/02/03:
Width: 241 mm (9.5")
Height: 107 mm (4.2")
Depth: 99 mm (3.9")
Weight: 0.82 kg (1.8 lbs)

Transceiver Unit 150 W/250 W
6365/66/68:
Width: 390 mm (15.3")
Height: 445 mm (17.5")
Depth: 127 mm (5")
Weight: 19 kg (41.9 lbs)

Transceiver Unit 500 W
6369:
Width: 392 mm (15.4")
Height: 507 mm (20")
Depth: 217 mm (8.5")
Weight: 28 kg (61.7 lbs)

Antenna Tuning Unit 150 W/250 W
6384:
Width: 290 mm (11.4")
Height: 500 mm (19.7")
Depth: 80 mm (3.1")
Weight: 3.3 kg (7.3 lbs)

Antenna Tuning Unit 500 W
6383:
Width: 401 mm (15.8")
Height: 617 mm (24.3")
Depth: 356 mm (14")
Weight: 17 kg (7.3 lbs)

Equipment category:	Control Unit:	Protected
	Transceiver Unit:	Protected
	Antenna Tuning Unit:	Exposed
	(According to IEC60940)	

Installation

2.1 Description

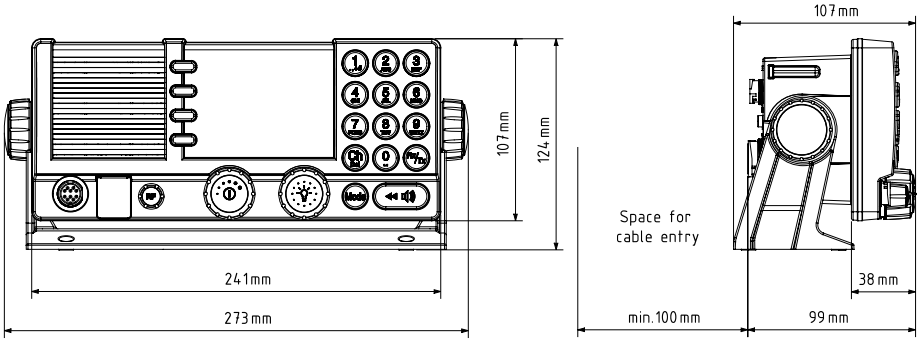
Correct installation of the equipment is important for maximum performance and reliability. Antennas and earth connections must be installed with the greatest care using corrosion resistant materials. Cable routing shall be made so that the cables are protected from physical damage. Sharp cable bends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

2.2 Mounting the units

2.2.1 Mounting the Control Unit (CU)

One Control Unit can be connected to the Transceiver Unit using the cable supplied (CU-TU Bus). The CU may be mounted up to 100 m from the Transceiver Unit using just a multicable 5 x 2 x 0.5 mm^2 screened. The Control Unit may be tabletop or bulkhead mounted.

Control Units with mounting bracket



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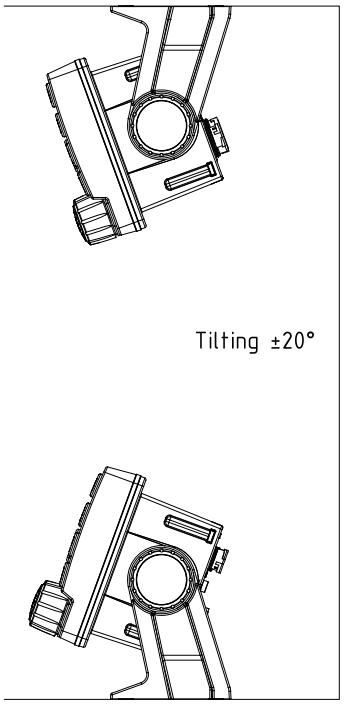
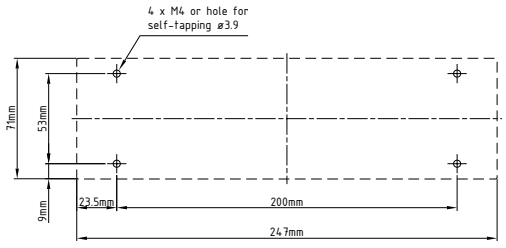
Mounting option



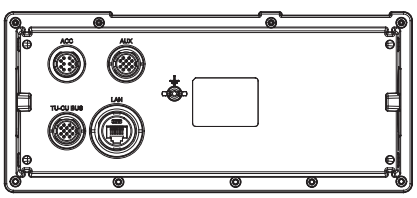
Drilling plan for bracket



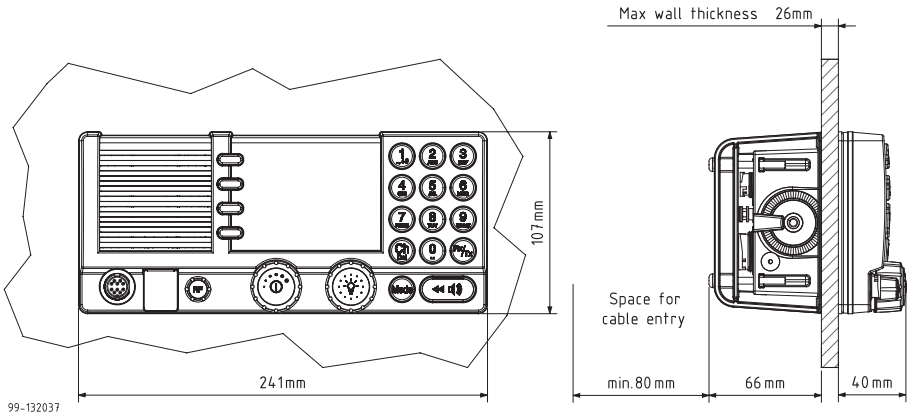
Weight:

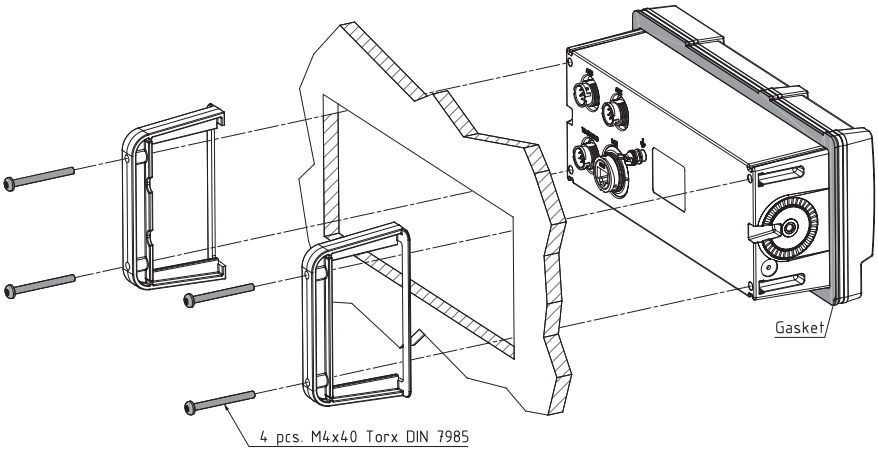
Control Unit	0.82 kg
Mounting Bracket	0.20 kg

Control unit connector panel

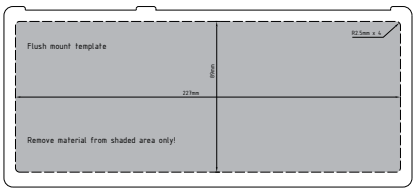


Control Units with flush mounting bracket





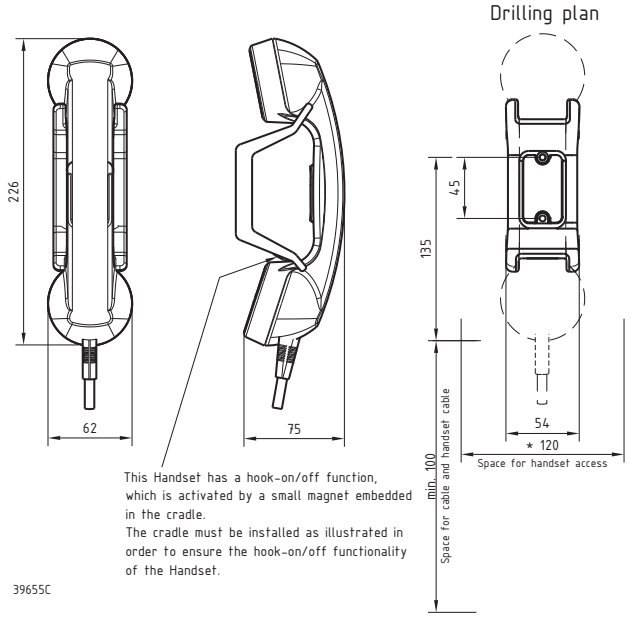
Drilling plan



Weight:
Flush mount bracket 0.04 kg

WARNING:
Only use screws supplied with mounting kit for attaching flush mounting bracket to Control Unit.

Handset for Control Unit



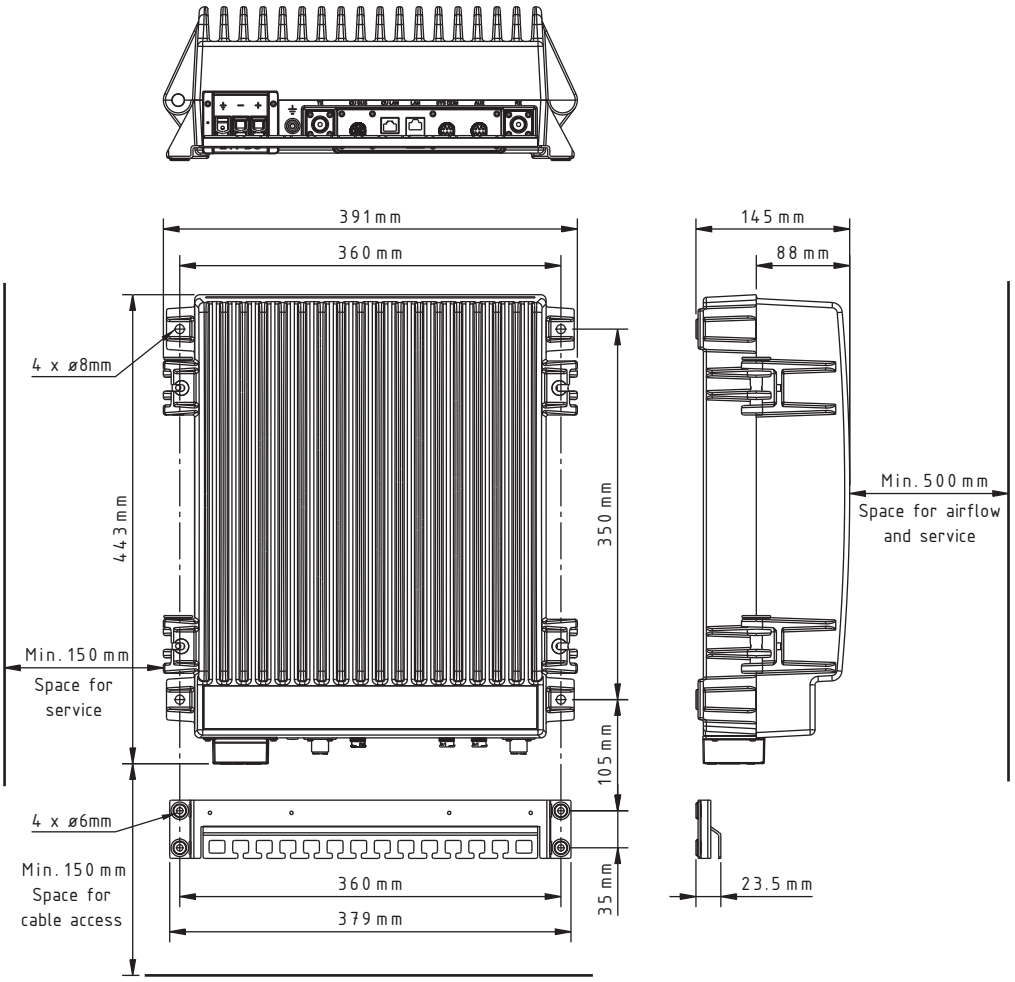
Weight:
Handset for Control Unit 0.4 kg (0.02 lbs)

Dimensions are in mm

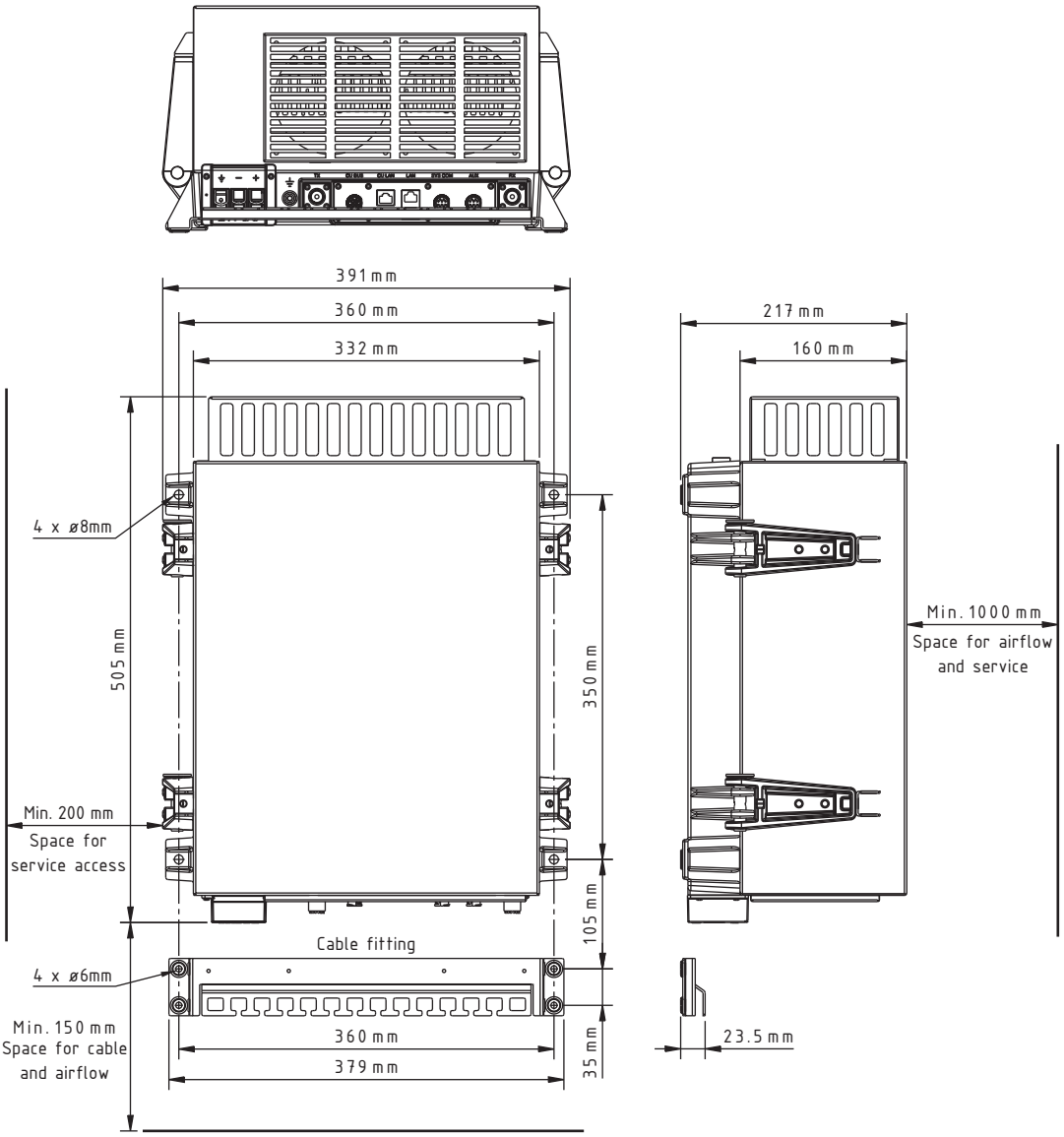
2.2.2 Mounting the Transceiver Unit (TU)

The Transceiver Unit should be installed in a dry place and consideration should be given to accessibility for servicing. It is important to provide sufficient airspace below, above and in front of the unit for adequate air circulation through the cooling fins. The drawing below shows the outer dimensions, mounting possibilities and the minimum distance to other objects, as well as a drilling plan.

Transceiver Unit 150 W/250 W



Transceiver Unit 500 W

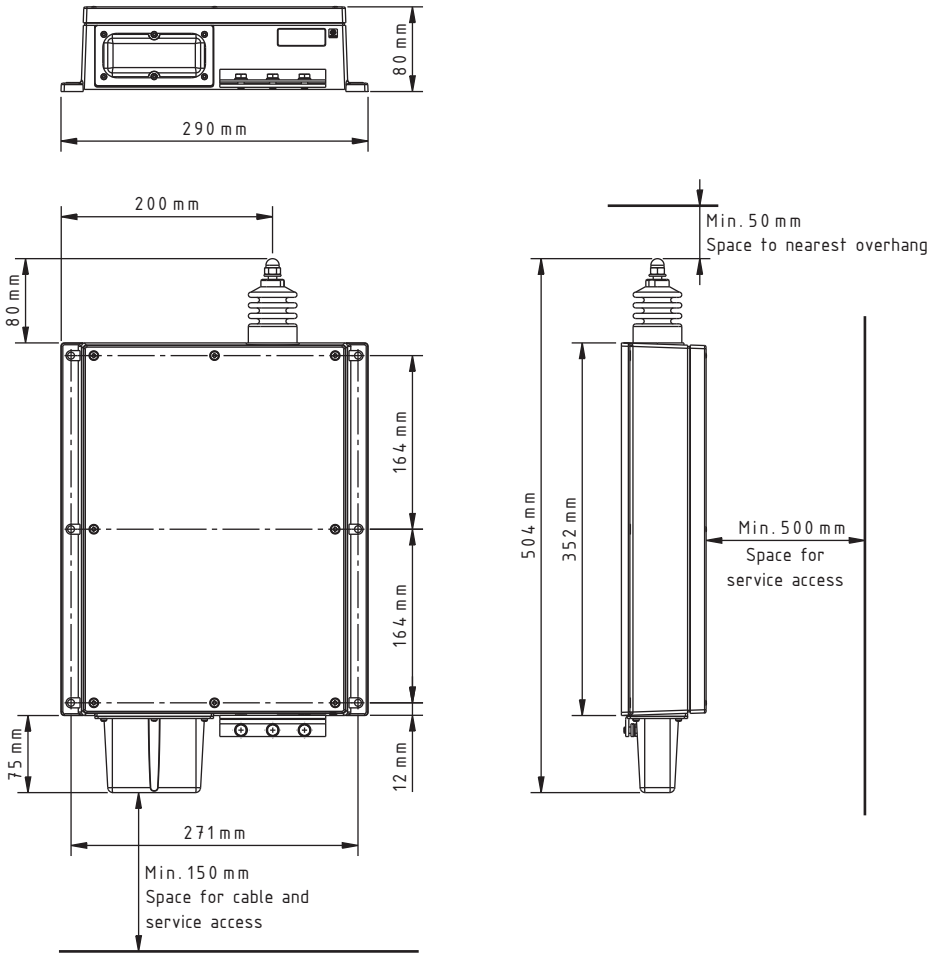


2.2.3 Mounting the Antenna Tuning Unit (ATU)

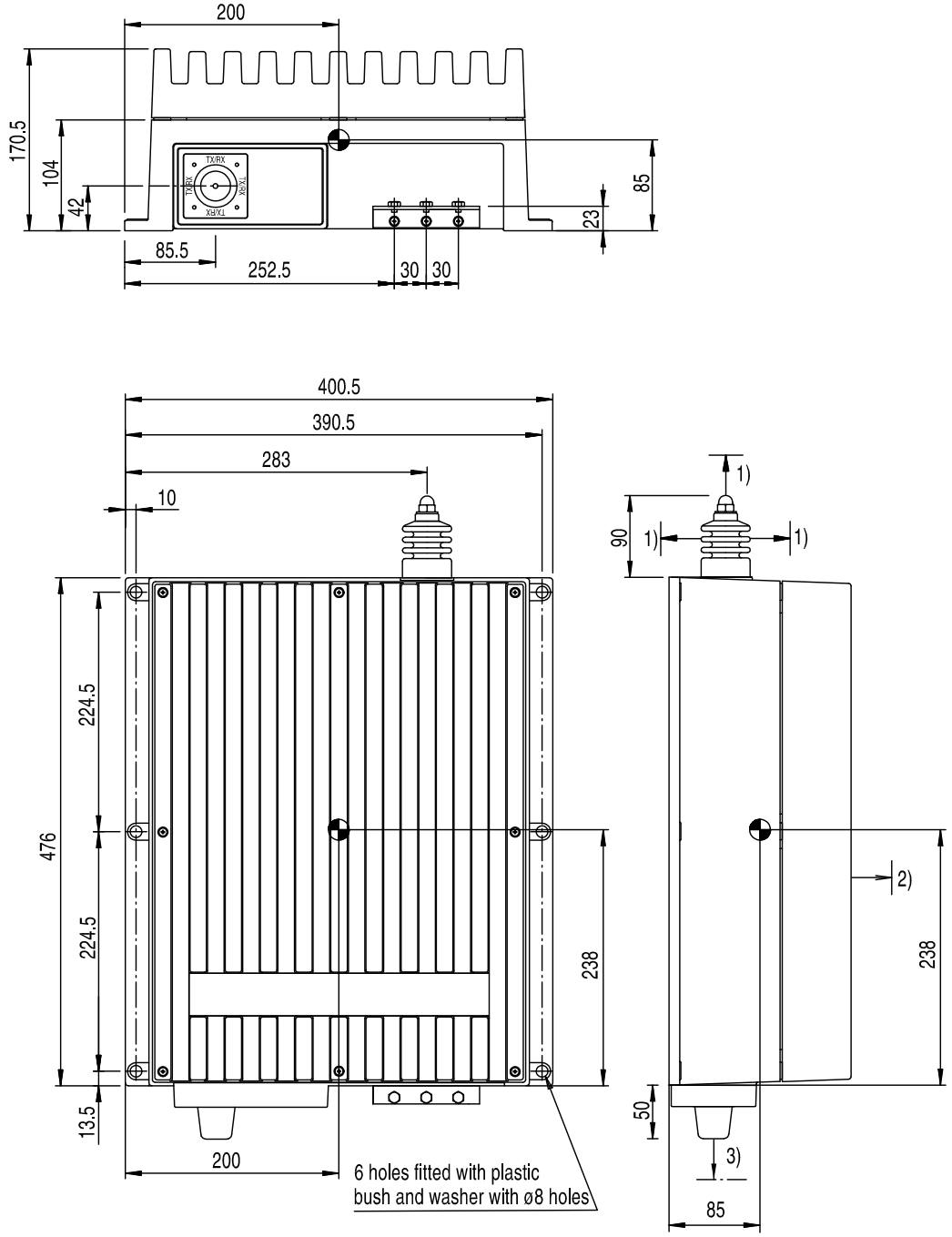
The ATU may be mounted up to 100 metres from the Transceiver Unit using just one RG-213/U or better coaxial cable.
The ATU must be installed outside in a convenient position to have good access for sufficient length of feeder wire to meet the antenna connection point.

Antenna Tuning Unit 150 W/250 W

It is recommended to use the mounting bracket shown in section 2.2.4



Antenna Tuning Unit 500 W



1) Distance to metal constructions: min. 150
2) Space for service access: min. 500
3) Space for cable and service access: min. 200
Dimensions are in mm
Tolerance: +/- 1 mm
Mounting hole: ø8
Weight: 17 Kg

2.2.4 Recommended ATU installation

On a metal-hull vessel

Install the ATU on an ATU Mounting Kit. The kit is stainless steel which can be bolted or welded to ship's hull to ensure good and solid connection in the radio system primary ground point.
The mounting kit will at the same time ensure straight and flat mounting for the ATU cabinet and provide good airflow around the ATU for better heat dissipation.

On a wooden or fibreglass hull vessel

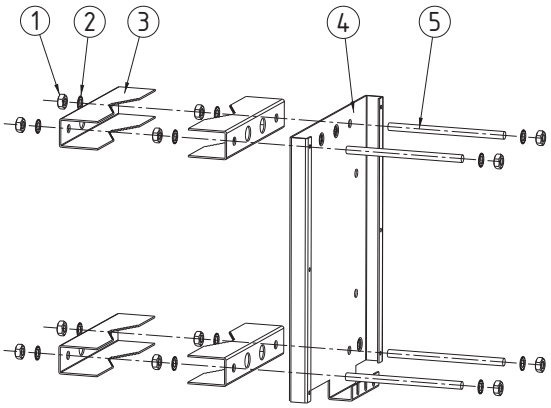
Install the ATU on an ATU Mounting Kit. The kit is stainless steel which can be bolted to ship's hull and then provide a ground plane connection to ensure good and solid connection in the radio system primary ground point.
The ground plane should normally be provided in as wide surface as possible with shortest possible connection to ships earth connection to the water surface.
Alternatively and in case of long ground connections the grounding should be arranged in a solid and shielded cable connection where sufficient cable square material to provide the connection and the shielding connected to ATU Mounting Kit and left open at earth connection side.

ATU Mounting Kit

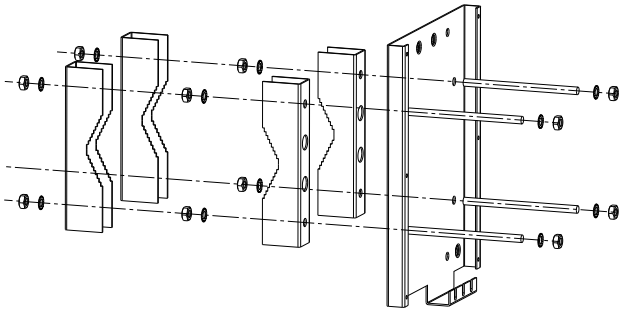
An optional ATU Mounting Kit as shown below is available in two versions:

1. Comprises of mounting plate and fittings for mast - part no. 737589
   For mounting the ATU directly on a mast, where the Mounting Plate and fittings for mast can form a sufficient earth connection on a steel mast welded to the superstructure.

2. Comprises of the mounting plate only - part no. 737588
   To get an even mounting surface on an uneven support.

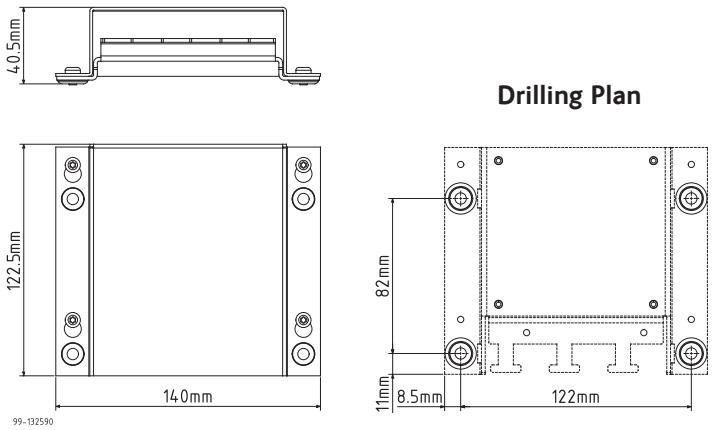


1. Nut M10
2. Tooth lock washer M10
3. Fitting for mast
4. Mounting plate for ATU
5. Treadrod M10



2.2.5 SAILOR 6208 Control Unit Connection Box

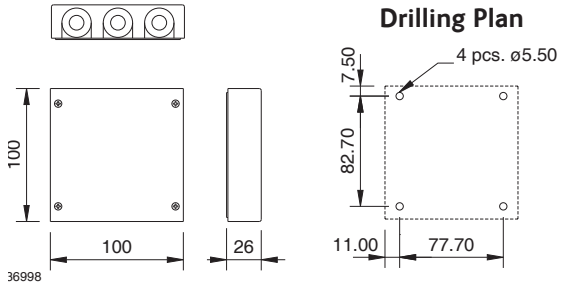
The SAILOR 6208 is used to convert the small cable dimension from preconfigured cable plug to spring loaded terminals with strain relief for connection to larger cable dimensions.
The box is used to connect the Transceiver Unit to Control Units and Message Terminal respectively.
The box is fitted with optional 120 ohm CAN-BUS termination.



Weight:
SAILOR 6208 0.5 kg.

2.2.6 SAILOR 6209 Accessory Connection Box

The SAILOR 6209 is used to convert the small cable dimension from LTW plug to screw terminals with strain relief for connection larger cable dimensions.
The box is used to connect the Transceiver Unit and /or the Control Unit to peripheral equipment e.g. GPS, external loudspeaker etc.



Weight:
SAILOR 6209 0.4 kg.

Dimensions are in mm

The SAILOR 6208 and the SAILOR 6209 may be ordered as accessory. Please find accessory list on the last page of this manual.

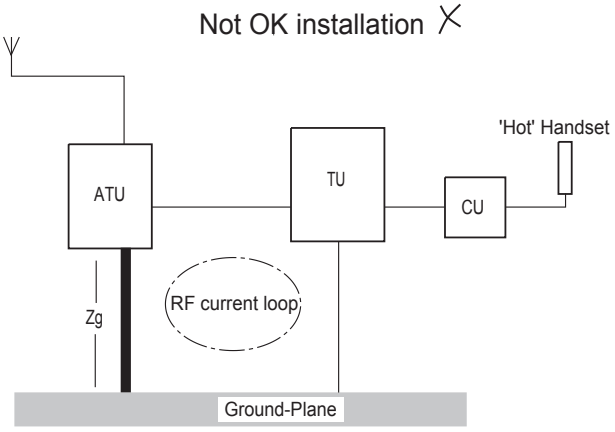
2.3 Ground connections

2.3.1 Grounding considerations

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

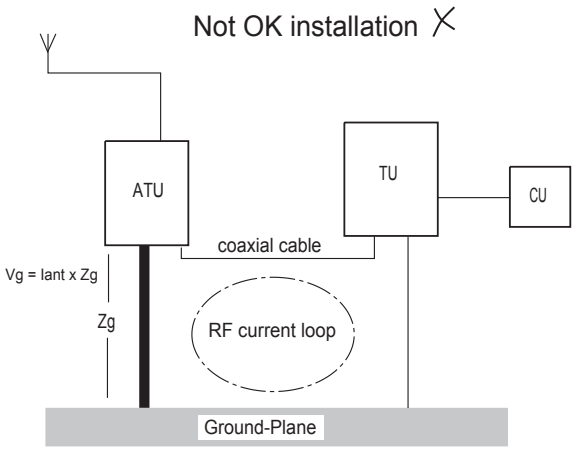
a) The ground connection between the ATU and earth plane.
b) The ground connection of the TU and the externally connected equipment.

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 seldomly 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.



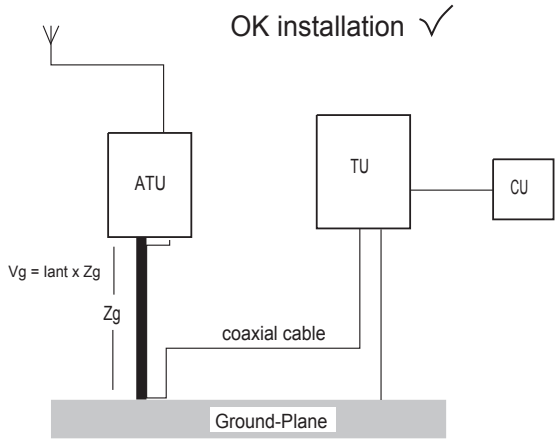
2.3.2 RF ground loop

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 coaxialcable may be connected between units with different ground potentials causing RF loop-current to flow.



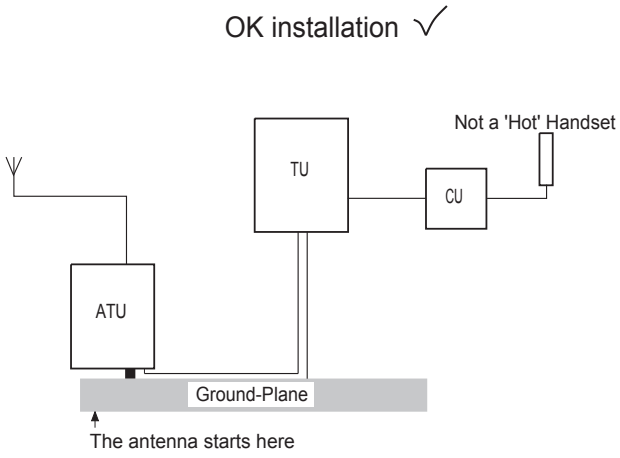
2.3.3 Minimizing ground loops

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



2.3.4 Antenna start

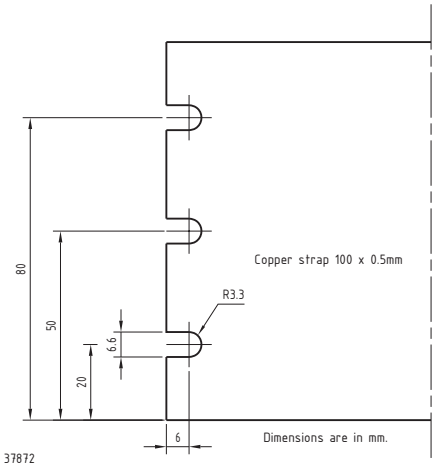
The vertical antenna always starts at its electrical ground-plane, whether or not it is physically mounted there. First determine the antenna's electrical ground-plane, which is where the ATU must be mounted. Where possible always take the ATU to the ground, not the ground to the ATU.
In case of a fibreglass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



2.3.5 Antenna Tuning Unit

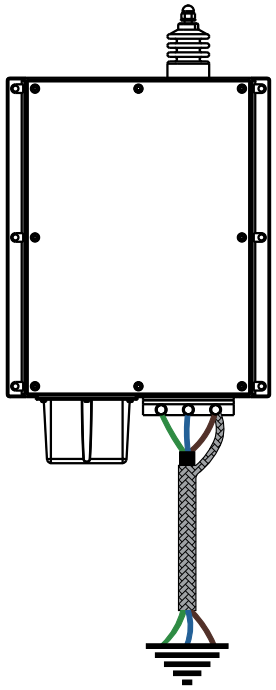
As the earth connection of a transmitter is a very important part of the antenna system, it is of the utmost importance to keep in mind that the earth connection of the Antenna Tuning Unit must have the lowest possible RF-impedance. Losses in the earth connection will result in a decrease in radiated 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.
It is recommended to install the ATU by means of the ATU mounting bracket shown in section 2.2.4 as this stainless steel bracket can be welded into the super structure and will provide the best possible none corroding connection.

Copper strap cut-out at the ATU end



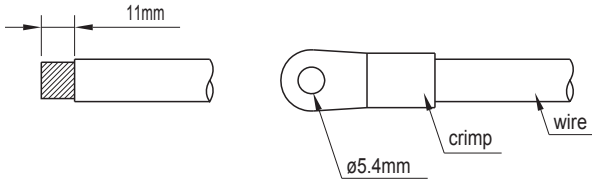
Vessels constructed of non-conducting materials must be equipped with a copper earth plate having a minimum area of 1 square metre mounted below the water line. From a copper earth bolt hard soldered to the earth plate a 100 x 0.5 mm copper strap is run, preferably uninterrupted to the earth terminal 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.
On ships where the environmental conditions require shielded grounding downlead in order to avoid radiation from same downlead, it is recommended to use a shielded cable with a non-stranded wire having adequate wire dimension to secure the proper grounding. Cable shielding should be connected the earth terminal at the bottom of the Antenna Tuning Unit and left open at the earth connection side.

Shielded ground downlead



2.3.6 Transceiver Unit and Control Unit

The Transceiver Unit is preferably grounded separately to the ships metal in the shortest possible way. A 10mm² (AWG 7) to 16mm² (AWG 5) ground wire is connected to the ground terminal (cable clamp) at the bottom of the unit.

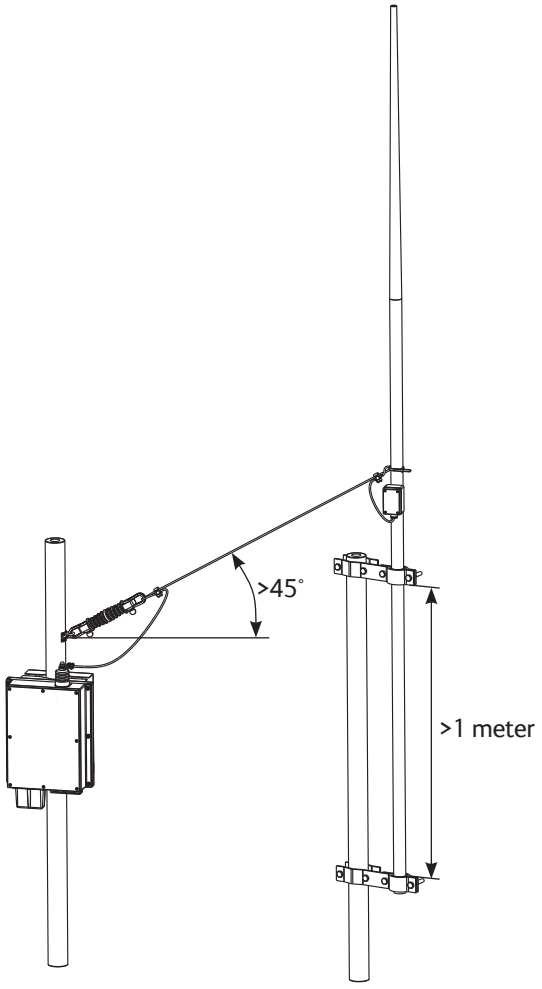


2.4 Antennas

2.4.1 Transceiver Antenna

The equipment is used with separate transmitting and receiving antennas. The antennas 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 27 MHz to good whip and/or wire installations of 12 to 18 m total electrical length.
Shorter antennas, electrical length down to 8 m can be used. Where possible long antennas should be installed to maximize the radiated power in the lower frequency bands.

In general a 12 m antenna installation can be made using an 8 metres whip and 4.5 m feeder or a 10 m whip and 2.5 m 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 metres will create good results.



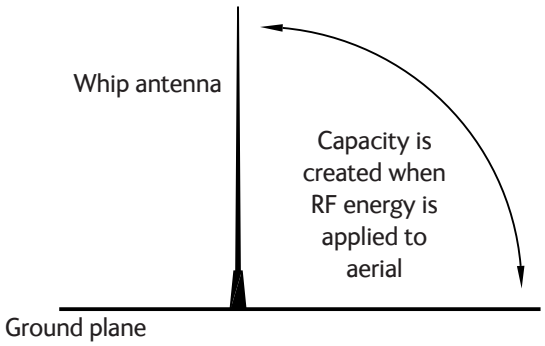
The antenna is terminated at the insulator at the top of the Antenna Tuning Unit. The insulator must be relieved from mechanical stress by using max. 1 meter flexible wire between the insulator and a support. To maximize the radiated power and avoid flash over keep distance to metal parts as long as 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 grease may be applied to the cable joints.

2.4.2 Considerations on antenna length requirements

Antenna impedance

The length of the transmitting antenna used with MF/HF equipment in general and the MF/HF equipment specifically for purpose of this discussion is of utmost importance for the proper performance of the equipment, i.e. the ability to tune properly to the antenna and the effective transmission range. In terms of transmission range, more important than increasing the transmitter RF output power from say 150 W to 250 W is in fact the use of an adequate length antenna.
Comparatively, any practical length whip antenna remains by far too short for the wavelength for which it is used, especially at the lower frequencies. For the frequency range 1.6 – 30 MHz defining the commercial MF/HF marine band, the wavelength spans the range 190 – 10 m approximately.

A proper ground plane for the transmitting antenna is essential in order for this to effectively radiate power into the air. When applying RF energy to the whip antenna, the presence of the ground plane creates capacitance between the whip antenna and the ground plane. This capacitance will vary with frequency, hence, the impedance of the whip antenna as seen from the transmitter will vary with the frequency range over which the transmitter is operated.



As an illustration of the impedance variation with frequency of a transmitting antenna refer to below table listing the impedance as measured on a 6, 7 and 8 m whip antenna respectively with a 2 m feed line.

Frequency (MHz)	Transmitting Antenna 6 m	Transmitting Antenna 7 m	Transmitting Antenna 8 m
1.6	3-j1.310	3-j1.200	4-j1.060
2.0	4-j1.025	4-j970	5-j800
3.0	7-j970	8-j550	9-j470
4.0	9-j410	10-j325	11-j250
5.0	17-j260	18-j200	20-j145
6.0	20-j150	25-j95	28-j38
7.0	35-j65	40-j10	55+j55
8.0	40+j30	50+j90	60+j155
10.0	100+j190	130+j270	200+j400
12.0	600+j450	650+j450	1000+j300
16.0	1000+j200	900-j500	500-j500
18.0	700-j500	400-j500	250-j450
22.0	200-j400	90-j280	70-j80
25.0	90-j195	75-j10	240-j200
30.0	200+j150	500+j0	400-j300

In the figures for the impedance in this table the imaginary part (jxxx) describes the value of capacitance part.

Function of the Antenna Tuning Unit (ATU)

The MF/HF transmitter power amplifier (PA) provides a fixed output impedance of 50 ohms over its operating frequency range to which the load (the antenna) should be matched (i.e. load should preferably be 50 ohms also) in order for the transmitter to deliver its full power output to the load. However, with the varying impedance of an antenna, as described above such a condition may only be met at one or - at best - a few specific frequencies. On the remaining frequencies within the transmission band the varying mismatch between the transmitter fixed output impedance and the different impedance of the antenna at any given frequency will result in reduced RF power delivered to the antenna – in worst case hardly any power at all - if the antenna was connected directly to the transmitter.

To overcome the frequency dependant mismatch between the transmitter output impedance and the antenna (load) impedance, the ATU is put into the antenna circuit to provide variable compensation counteracting the varying impedance of the antenna, the end result of which is the "transformation" of this into a "fixed" app. 50ohms load, as "seen" by the transmitter.

The compensation is achieved mainly through the introduction of an induction in series with the antenna circuit, the value of which will create a resonance circuit at the given frequency. Hence, depending on the impedance of the antenna (i.e. the transmission frequency) a suitable combination of inductors from a bank of inductors in the ATU, are selected through of a number of relays, the activation of which is controlled by the ATU processor during the tuning process.

MF/HF ATU

For the impedance of e.g. an 8 metres transmitting antenna of 5-j800 ohms at 2 MHz, as stated by the manufacturer, the ATU will easily tune to the impedance of this antenna system - in fact, the array of coils in the ATU tuning circuitry allows tuning all the way down to the impedance of 4-j1060 ohms of this antenna system at 1.6 MHz. A slightly shorter antenna system might be used at the possible sacrifice of the ability to tune at the extreme low end of the frequency band below 2 MHz.

However the impedance of the antenna system is, influenced by any nearby metallic objects such as the vessel's superstructure and/or nearby metal poles/masts or stays/wires. Consequently, in order not to alter the impedance of the antenna system which may eventually cause difficulties for the ATU to match the resulting impedance, the transmitting antenna should be kept at a distance of no less than 4 m from any such objects. Similarly goes for the feed wire connecting the ATU to the antenna which should be kept at a minimum of 1 m from metallic objects.

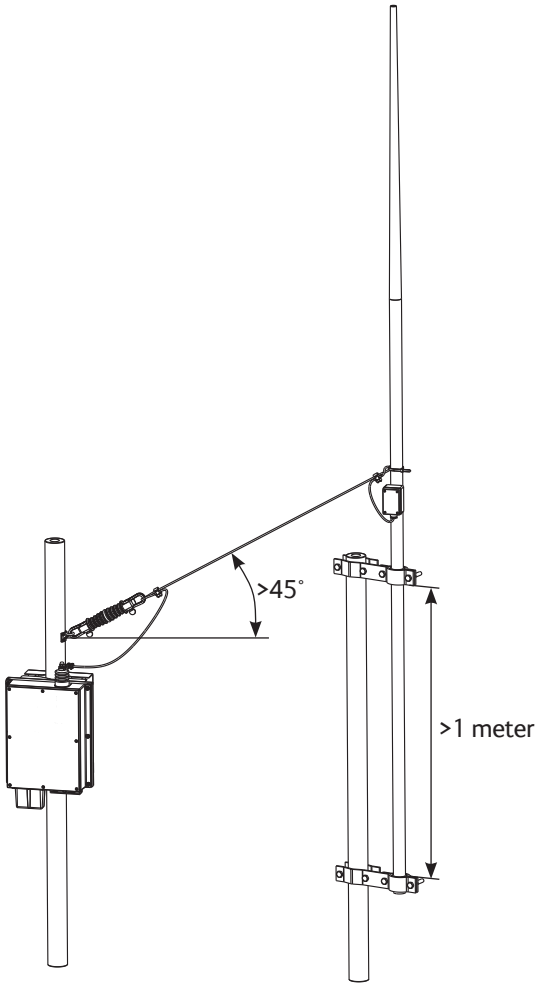
It should be noted that even though the ATU will tune to the mentioned antenna system length, the effective radiated power (i.e. the efficiency of the antenna) in the low frequency end will suffer compared to longer antenna systems of recommended electrical length 10-18 m.

Antenna system installation in practice

As noted on the impedance figures in above table, the measurements were made with the antenna raised on a 2 m steel pipe over a flat steel roof (ground plane) and a 2 m feed line. This implies that the measured impedance is in fact that of the actual antenna (electrical) length plus additional 2 m. The electrical length of the 8 m bracket mount (side fed) Comrod transmitter antenna is 6.8 m resulting in a total electrical length of the antenna system of 8.8 m.

Electrical specifications transmitting antennas

The connection to the transmitting antenna is by a single ended wire - the feed line - connecting from the ATU top connector. This feed line adds to the electrical length of the antenna (when correctly installed), thus in effect increasing the efficiency of the antenna. The longer the feed line the better the efficiency of the antenna system consisting of transmitting antenna and the feed line.
For direct addition of feed line length to antenna electrical length the feed line should be vertically installed as an extension downwards of the transmitting antenna. In practice, where the ATU must be placed between the feed line and the ground plane (steel deck), the direct vertical installation of the feed wire may be difficult in terms of total height. This may partly be accounted for by allowing the feed wire installed at an angle of at least 45 degrees towards the horizontal plane. Installing the feed wire at lower angles will create capacitance to the ground plane decreasing the efficiency of the antenna.



2.4.3 Receiver antenna

The receiver antenna may be an active or a passive type.
The antenna should be erected well in the clear and kept away as far as possible from electrical equipment in order to minimize noise. 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.
In case of a passive antenna the feed-in should be as short as possible, especially in the case of short antennas. The recommended antenna length is 7-30 meters. If a long coax cable is necessary an impedance matching transformer should be inserted at the antenna or an active antenna should be used. DC supply voltage for an active antenna is available at the RX antenna connector after switching is on in service interface. The supply voltage is +12 V (60 mA). The RX port is short circuit protected.
The receiver antenna should be mounted as far from the transmitter antenna as possible - recommended minimum 6 metres.

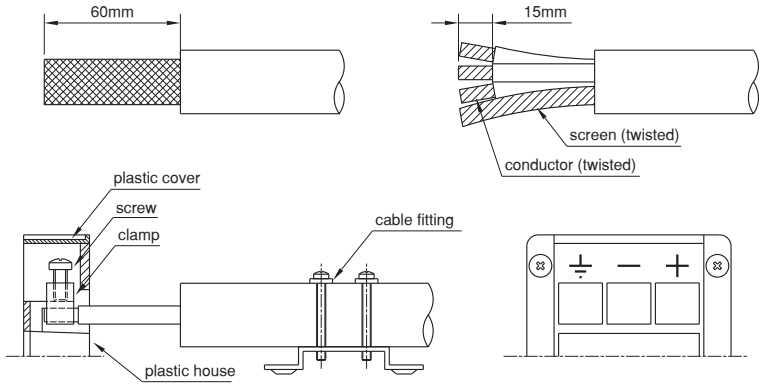
Note | For active RX antennas, it is recommended to choose a physical length ≥1 meter.

2.5 DC Power cabling

The supply leads are connected to the supply terminal of the Transceiver Unit. The supply terminal is designed for 3 wire shielded power supply cable to meet international installation and EMC requirements. The safety ground wire is connected to the terminal showing ground symbol and shielding connected to the cable fitting shown in page 2-3 must be well grounded to ships hull.
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 | Fusing must be provided in the supply leads for cable protection.

Cable lengths stated in tables are the total cable length from battery terminals via charger, shunt box, DC distribution to TU DC-terminals.
Table below shows the necessary cable cross sections and external fuse ratings.



150 W/250 W

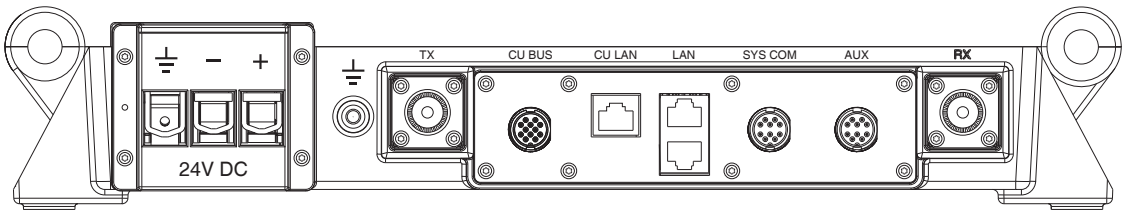
Max. cable length to battery*	Recommended Cable Sceened multiwire	External fuses
5 m	3 x 10 mm² (7 AWG)	40 A
8 m	3 x 16 mm² (5 AWG)	50 A
12 m	3 x 25 mm² (3 AWG)	63 A

500 W

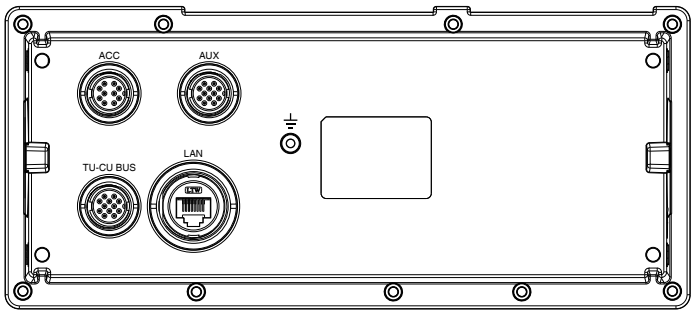
Max. cable length to battery*	Recommended cable Sceened multiwire	External fuses
4 m	3 x 16 mm² (5 AWG)	100 A
6 m	3 x 25 mm² (3 AWG)	100 A

2.6 Interconnection of units

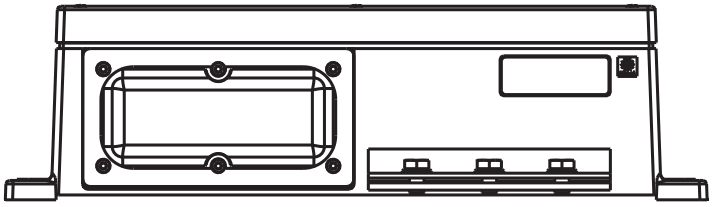
Transceiver Unit connector panel



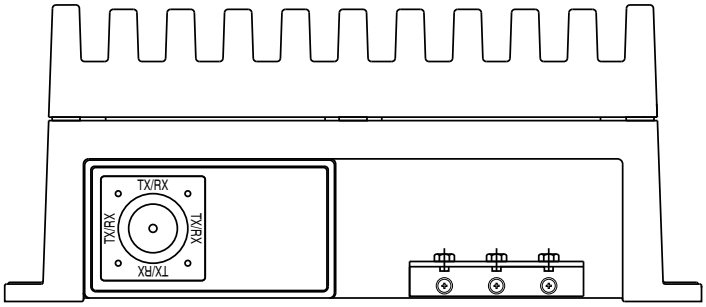
Control Unit connector panel

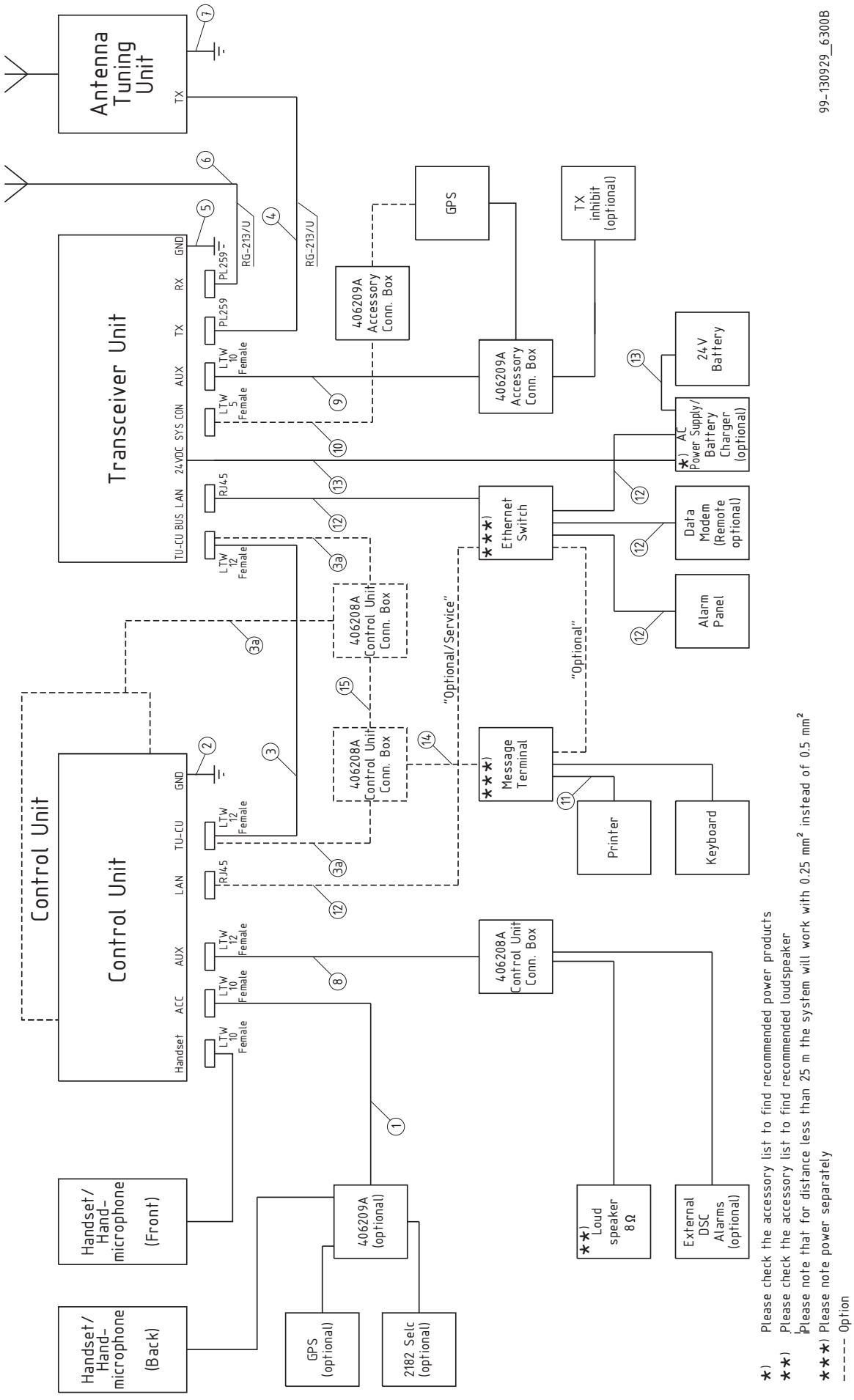


150 W/250 W Antenna Tuning Unit connector pane



500 W Antenna Tuning Unit connector panel




Antenna Tuning Unit
TX
Transceiver Unit
TU-CU BUS LAN 24VDC SYS CON AUX TX RX GND
RJ45
LTW 12 Female
LTW 5 Female
LTW 10 Female
PL259
RG-213/U
406209A Accessory Conn. Box
GPS
TX inhibit (optional)
24V Battery
*) AC Power Supply/ Battery Charger (optional)
***) Ethernet Switch
Data Modem (Remote optional)
Alarm Panel
406208A Control Unit Conn. Box
"Optional/Service"
"Optional"
***) Message Terminal
Printer
Keyboard
Control Unit
Control Unit
Handset ACC AUX LAN TU-CU GND
LTW 10 Female
LTW 12 Female
RJ45
406209A (optional)
Handset/ Hand-microphone (Front)
Handset/ Hand-microphone (Back)
GPS (optional)
2182 Selc (optional)
**) Loud speaker 8Ω
External DSC Alarms (optional)
*) Please check the accessory list to find recommended power products
**) Please check the accessory list to find recommended loudspeaker
Please note that for distance less than 25 m the system will work with 0.25 mm² instead of 0.5 mm²
***) Please note power separately
----- Option
99-130929_6300B

Cable 1: Control Unit - ACC

Cable: 10 x LTW-UL2464 26AWG
Cable-connector: 10 way (ex. LTW)
5 m cable with connector supplied

Control Unit 'ACC' 10 way LTW	Designation	Remarks	Color
1	NMEA+	NMEA position input	Brown
2	NMEA-	NMEA position input	Blue
3	2182 Select	OC output. Low when 2182 kHz is selected	White
4	NC	No Connection	Green
5	MIC	Handset microphone	Yellow
6	EAR	Handset earpiece	Grey
7	HOOK PTT	Hook and PTT	Pink
8	+12 V DC	12 V supply to handset	Red
9	GND	System ground	Black
10	GND	System ground	Orange

Cable 2: Control Unit - Ground

Recommended wire dimension: min. 2.5 mm^2
Maximum length 0.2 m

Cable 3: Control Unit - Transceiver Unit

Cable: 12 x LTW-UL2464 20AWG
Cable-connector: 12 way (ex. LTW)
6 m cable with connectors supplied with equipment

Control Unit 'TU-CU BUS' 12 way LTW	Transceiver Unit 'TU-CU BUS' 12 way LTW	Tvisted pair	Designation	Remarks	Color
1	1	a	SHIELD	Screen connected to system ground	Brown
2	2	b	GND	System ground	Blue
3	3	b	+24 V	Supply voltage for the Control Unit	White
4	4	c	CAN Vcc	CAN supply (15 V DC)	Green
5	5	d	CAN H	CAN data H	Yellow
6	6	d	CAN L	CAN data L	Grey
7	7	c	CAN GND	CAN ground	Pink
8	8	a	SUPPLY_ON	Supply on signal to the Transceiver Unit Active when connected to GND	Red
9	9	e	AUDIO IN+	Balanced Audio IN	Black
10	10	e	AUDIO IN-		Orange
11	11	f	AUDIO OUT+	Balanced Audio OUT	Violet
12	12	f	AUDIO OUT-		Cyan

Cable 3a: 2nd Control Unit - Transceiver Unit

If a 2nd control unit is installed, this can be done by splitting and extending the CAN bus, using e.g. the 406208A control unit box.
Note that the CAN bus must be terminated with 120 Ohm in each end of the bus (not in the middle!). The transceiver unit is terminated per default. Move Jumper W402 placed just inside the transceiver unit, if termination is not needed in the place the transceiver is installed. In this case, termination must added at both control units.

Cable 4: Transceiver Unit - TX Antenna

Cable: 50 ohm coaxial cable RG213/U (or better)
Maximum cable length 100 m
Cable-connector: UHF connector PL259, Crimp type connector should be used.

Cable 5: Transceiver Unit - Ground

Recommended wire dimension: min. 10 mm^2
Maximum length 0.2 m

Cable 6: Transceiver Unit - RX Antenna

Type: 50 ohm coaxial cable RG213/U (or better)
Maximum cable length 100 m
Cable-connector: UHF connector PL259, Crimp type connector should be used.

Cable 7: Antenna Tuning Unit - Ground

Copper strap 100 x 0.5 mm or 3 x 6 mm shielded cable with wires and shielding connected to ATU GND and shielding left open at the other end.
Refer to section 'Ground Connections'

Cable 8: Control Unit – AUX

Cable: 12 x LTW-UL2464 20AWG
Cable-connector: 12 way (ex. LTW)
6 m cable with connector, available from eShop

Control Unit 'AUX' 12 way LTW	Designation	Cable no.	Remarks	Color
1	NC	10	No Connection	Brown
2	NC	11	No Connection	Blue
3	NC	11	No Connection	White
4	NC	9	No Connection	Green
5	OTHER DSC ALARM	8	+ 5 V output, when active	Yellow
6	NC	10	No Connection	Grey
7	DISTRESS ALARM	10	+ 5 V output, when active	Pink
8	GND	9	System ground	Red
9	SPEAKER OUT	8	External speaker (max. 6W in 8 ohm)	Black
10	NC	10	No Connection	Orange
11	NC	11	No Connection	Violet
12	NC	12	No Connection	Cyan

Cable 9: Transceiver Unit - AUX

Cable: 10 x LTW-UL2464 26AWG
Cable-connector: 10 way (ex. LTW)
6 m cable with connector, available from eShop

Transceiver Unit 'AUX' 10 way LTW	Designation	Remarks	Color
1	NMEA_IN+	NMEA position input	Brown
2	NMEA_IN-	NMEA position input	Blue
3	GND	System ground	White
4	LINE_OUT	Single ended 600 ohms AF output Nominal 0 dBm in 600 ohm Refers to system ground (GND)	Green
5	LINE_IN	Single ended 600 ohms AF input Nominal level 0 dBm Refers to system ground (GND)	Yellow
6	TX_INHIBIT	Transmitter inhibit/RX mute input Pulled up to +15 V Active when connected to GND	Grey
7	TX_KEYED	Low when TX keyed OC output, max. 50 mA, 12 V	Pink
8	12V_OUT	+12 V output Max. 50 mA	Red
9	EXT KEY	Transmitter key input. Pulled up to +15 V Active when connected to GND	Black
10	GND	System ground	Orange

Cable 10: Transceiver Unit - SYS CON

Cable: 10 x LTW-UL2464 26AWG
Cable-connector: 10 way (ex. LTW)
6 m cable with connector, available from eShop

Transceiver Unit 'SYS CON' 10 way LTW	Designation	Remarks	Color
1	NMEA_IN+	NMEA input	Brown
2	NMEA_IN-	NMEA input	Blue
3	NMEA_OUT+	NMEA out	White
4	NMEA_OUT-	NMEA out	Green
5	Test_TX	Reserved for factory test	Yellow
6	Test_RX	Reserved for factory test	Grey
7	PPS+	Future use (1 Hz Puls input)	Pink
8	PPS-	Future use (1 Hz Puls input)	Red
9	AC_ALR	Supply Alarm input, active low	Black
10	GND	GND	Orange

Cable 11: Message Terminal

Cable: Shielded high quality USB-cable
Maximum cable length 1 m

Cable 12: Ethernet

Cable: STP/FTP CAT-5E or better
Maximum cable length 100 m

Cable 13: Transceiver Unit – 24 V Battery

For power cable information see section 2.6 DC Power Cabling

Cable 14: Message terminal

Cable: 5 x LTW-UL2464 24AWG
5 m cable supplied with Telex option kit

Message terminal	Designation	Remarks	Color	SAILOR 6208 Control Unit Connecton Box
'NMEA' 5 way LTW				Pin number
1	System GND	GND		1
2	CAN S	CAN Vcc	Red	4
3	CAN C	CAN GND	Black	7
4	CAN H	CAN H	White	5
5	CAN L	CAN L	Blue	6

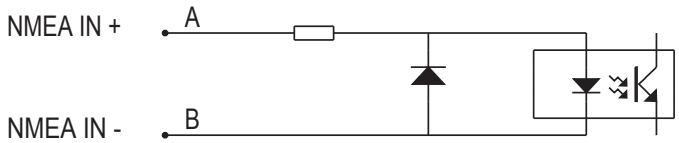
Cable 15: Control Unit - Transceiver Unit

Maximum cable length 100 m
For extended cable length, use shielded twisted pair cable 6x2x0.5mm^2 or better
For connection details refer to wiring table for cable 3.

2.7 Position and time information

2.7.1 Connection of Navigation Equipment

Navigation equipment complying with the NMEA 0183/IEC 61162-1 standard may be connected for automatic position and time updating. Connection is made to the NMEA+/NMEA- connections in the Control Unit ACC connector or the NMEA+/NMEA- connections in the Transceiver Unit AUX connector. The NMEA receive circuit consists of an optoisolator with a 470 ohms series resistor to insure current mode operation and a shunt diode to limit reverse bias as shown below. The circuit is isolated from ground.



The circuit operates with a minimum differential input voltage of 2 volts and draws less than 2 mA from the line at that voltage. The maximum voltage is 15 volts.

Interconnection between devices may be by means of two-conductor shielded twisted-pair cable. 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.

Supported sentences:

GLL	(longitude, lattitude, utc, status, mode)
GGA	(longitide, lattitude, utc, quality)
RMC	(longitude, lattitude, utc, status, mode)
GNS	(longitude, lattitude, utc, mode)
ZDA	(utc, day, month, year)

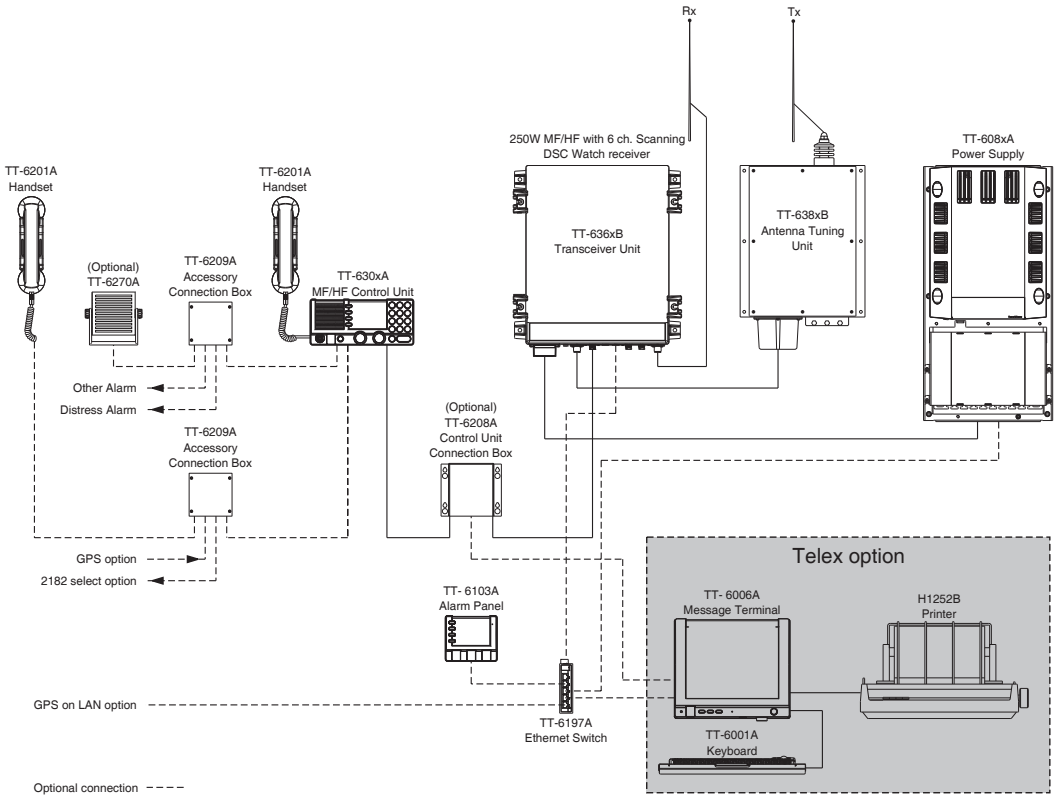
Only the mentioned fields are used - the rest are discarded.

NMEA data on the LAN-connection is also accepted. This data should comply with IEC 61162-450.

2.8 Telex operation

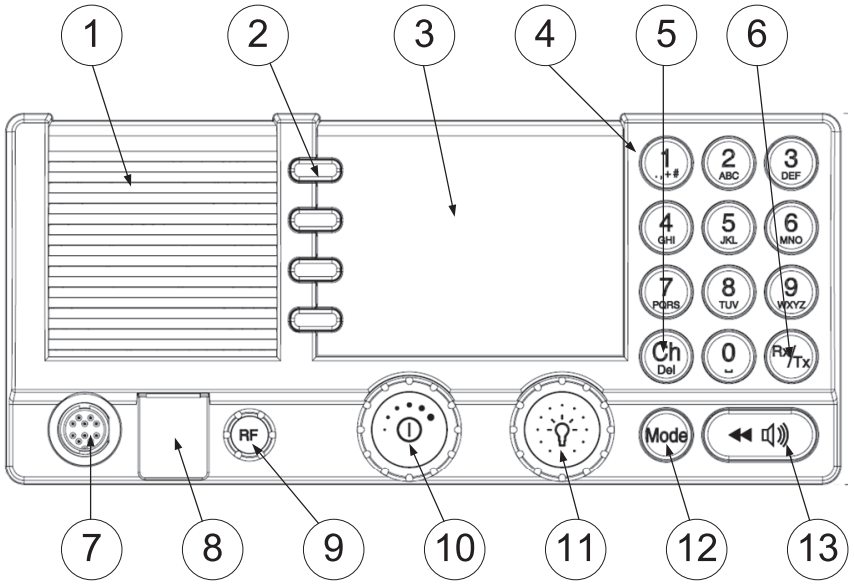
The GMDSS Radiotelex Terminal is designed in accordance with relevant IMO, ITU and ETSI recommendation/specifications and has been approved for shipboard installations to be operating within the Global Maritime Distress and Safety System.

It supports world-wide ship-to-ship, shore-to-ship and ship-to-shore communication by utilizing the radiotelex protocols described in ITU-R M.625. In case of two-way communication an ARQ (Automatic Repetition reQuest) algorithm is used, and when broadcasting FEC (Forward Error Correction) is used.



2.9 ID programming

2.9.1 Front Panel



1. Loudspeaker.
2. Four soft keys with function title in the display.
3. Large TFT color display.
4. Alphanumerical keys to enter Rx or Tx frequency or text strings.
5. CH button for channel selection.
6. Rx/Tx Key to enter Tx or RX frequency.
7. Connector for handset or handmicrophone.
8. Distress button for sending a Distress alert.
9. RF gain control (IF).
10. Volume knob with key-press function for power on/off.
11. Selector and dim knob with key-press function for radio operation and setup.
12. Mode key to select the work mode: SSB, AM Broadcast, DSC, Telex.
13. Replay button to play back up to 240 s voice messages.

2.9.2 Set-up Menu

Menu items shown in bold is only available in the menu structure when it is extended by access password >1-2-3-4-5< in the System Set-up menu.

	Set-up Menu	
Soft keys (2)	Radio set-up	Scan Hang Time
		Scan Resume
		Scan Mode
		External PTT
		LSB Mode: OFF
		ATU: Enabled
		TX AM 2182: Disabled
1 x >	Channel Set-up	Watch Receiver
		Privat Channels
		DSC Watch
		TX Band
2 x >	Power Supply	Monitor: OFF
3 x >	DSC Set-up	Position & MMSI
		DSC Groups
		Auto- Ack Test
		Auto-Ack Polling
		Auto-Ack Position
		Auto-Ack Individual
		Non-Distr. Inactivity
		Distress Inactivity
		Comm. Inactivity
		Non-Distr. Alarms
		Self-Term. Distr. Alarms
		Medical Transport
		Neutral Crafts
		Print DSC
		DSC self-test
4 x >	DSC Call Log	Received Distress
		Transmitted Calls
		Received Calls
5 x >	System Set-up	Printer Configuration
		System Time & Date
		Inactivity Timeout
		Language
		Theme
		GPS Input
		Diagnostics
		Factory Defaults
		Password
		Reset MMSI no
		Radio Info
6 x >	Controller Set-up	Handset 1 Vol
		Handset 2 Vol
		Wheel Lock
		High Priority
		Controller Set-up
7 x >	System Config	6 Ch WR: Disabled
		Telex: Disabled

2.9.3 Change / reset MMSI

MMSI no is requested at 'first time power up' and directly programmed via the numeric keyboard (4)
If a MMSI reset or change of registration is needed it is accessed via the Set-up Menu:

Operation	Key	Operation	Function
Press	2	2 x More	
	2	Set-up	
	2	5 x >	System Set-up
Scroll down to	11	Rotate	Password
Select (press)	11		
Key in	4	1-2-3-4-5	
Scroll down to	11		Reset MMSI Number
Select (press)	11	Yes	
Key in MMSI	4	9 digits	123456789

2.10 Programming Telex ID

Programming Telex ID is done via the in SAILOR 6006 Message Terminal.
Requires that the Telex option has been enabled in the radio (see 'Option Code Activation') and TLX mode selected on the Control Unit (12).
The MMSI (9 digits) is automatically transferred from radio to SAILOR 6006 Message Terminal when TLX mode is selected.
5 digit TLX call code and answerback is programmed on screen via the SAILOR 6006 Message terminal.

Operation	Key	Action
Press	Settings	
	Identification	
Key in Pswd	1-2-3-4	
Key in	5 digit call code	(1-2-3-4-5)
Press	Answer back	
Key in*	Answer back	max 20 characters
Press	OK	

If a 5 digit TLX call code has not been issued or otherwise is not available, insert 5 x 2 (22222) to indicate invalid call code.
*

Step	Action	Step	Action
1	Figure shift (FS)	6	Space
2	Carriage return (CR)	7	Abbreviated ID
3	Line feed (LF)	8	Space
4	5 or 9 digit call ID	9	X
5	letter shift (LS)	10	Letter shifts to obtain 20 characters

Figure Shift (FS), Letter Shift (LS), Carriage Return (CR) and Line Feed (LF) are normally not required inserted in the answerback.

2.11 Configuration

The GMDSS approved radio is by default configured to meet the legislative requirements and restrictions. Optional functionality may be configured and will normally require national exemptions to be utilized. Configuration and test facilities, which are considered 'user facilities and basic settings', are available via the menu structure.
Further configuration possibilities are available behind the access password >1-2-3-4-5< indicating that any changes in this area will affect the system operation and therefore should be done with caution.
Other configurations considered installation features are accessed via the Service Interface.
Please refer to the '97-147768 – User manual SAILOR 6300B MF/HF Service Interface', available for download at Cobham extranet.

2.11.1 CU configuration

Priority setting is via the menu and Main CU is High Priority = ON and Slave CU is High Priority = OFF.

Operation	Key	Operation	Function
Press	2	2 x More	
	2	Set-up	
	2	3 x >	Controller Set-up
Scroll down to	11	Rotate	High Priority
Select	11	Press	
Select	11	Rotate	High Priority = ON/OFF
Press	2	Exit	To store

2.11.2 ATU configuration

ATU is default enabled.
ATU enable/disable is configured via the Service Interface.
Only disable ATU when testing on 50 Ω load or using a dedicated antenna matched for a certain frequency.

2.11.3 DSC printing ON/OFF

Operation	Key	Operation	Function
Press	2	2 x More	
	2	Set-up	
	2	3 x >	DSC Set-up
Scroll down to	11	Rotate	Print DSC: OFF
Select	11	Press	
Select	11	Select	ON/OFF

LAN connected printer can now be selected to print DSC messages from the log. A SAILOR 6004 Control Panel with printer is also accepted. Please check '2.12.4 DSC Printer Configuration' for setup.

2.11.4 DSC Printer configuration

Operation	Key	Operation	Function
Press	2	2 x More	
	2	Set-up	
	2	5 x >	System Set-up
Scroll down to	11	Rotate	Printer configuration
Select	11	Press	

2.11.5 DSC self test

Menu	Key	Operation	Function
3 x >	2	DSC set-up	
Scroll	11	DSC Self Test	
Press	11	Select	RUN
Press	11	To Activate	

System start TX test With DSC call on 2187.5 kHz to own WR.

2.11.6 Factory default/reset

Factory default is a 'User defined' reset of settings and address books etc.

Operation	Key	Operation	Function
Press	2	2 x More	
	2	Set-up	
	2	5 x >	System Set-up
Scroll down to	11	Rotate	Factory Default
Press	11	Select	Continue Factory Reset
Select	2	Yes / No	Factory Resetting Please wait up to 30 sec.

System reboot and Control Unit connecting to radio.

2.11.7 Factory reset via service tool

Factory reset will bring all ID and configuration settings in the radio system back to factory level as a new system and is performed via the Service Interface or in the protected menu on the Control Unit. Options already enabled in the system will remain activated. Resetting of options require separate operation via the Service Interface.

2.11.8 LSB mode configuration

LSB (Lower Side Band) mode is configured via the Service Interface or in the protected menu.
GMDSS radios require SSB operation in USB (Upper Side Band) mode and may only have LSB mode enabled on a special exemption depending on national requirements where the ship is registered.
Radios installed and operated as 'non-GMDSS radios' can have LSB enabled.

2.11.9 Option code activation

6-channel Watch Receiver and Telex functions are optional features and are thus disabled in the radio as supplied from factory.
Both functions are enabled by inserting a unique 10 digit option code for each via the System Configuration in the Set-up menu:

Operation	Key	Operation	Function
Press	2	2 x More	
	2	Set-up	
	2	6 x >	System configuration
Select	11	6 CH WR	Option Code
Key in DSC6 option code	2	xxxxxxxxxx	Enabled
Scroll down to	11	TLX mode	Option Code
Key in TLX option code	4	xxxxxxxxxx	Enabled

The 10 digit option codes for 500 W systems are foc and supplied with equipment (not programmed).
The 10 digit option codes for 150 W/250 W systems may be ordered with the system or any time later.
DSC6 option code part number: 406300-006
TLX option code part number: 406300-001
DSC6 and TLX option codes are unique to each radio and generated on basis of the TU serial number and locked to this.
Option codes already generated either through purchase or as factory supplied for the 500 W systems may be looked up in the 'Configuration Key Search' at www.cobham.com/satcom.
Options already enabled in a system will remain activated even after 'Factory default' and 'Factory Reset' operation. To disable these optional functions requires reset of the respective option code using the Service Interface.

2.11.10 Power Supply monitoring

Note | This item requires a SAILOR 6081A located on same LAN network segment as the TU.

Power Supply monitoring is by default set 'OFF' from factory.
When the Power Supply monitoring is set 'ON' the TU 'Supply Alarm' connector becomes active and ready for interconnection to the Power Supply/Charger in order to monitor 'AC Alarm' and 'Battery High/Low Voltage Alarm' states.
The Power Supply monitoring function meets the GMDSS requirements for AC fail and Battery voltage alarms with acoustic and visual indication on the Control Unit.

Operation	Key	Operation	Function
Press	2	2 x More	
	2	Set-up	
	2	2 x >	Power Supply
Select	11	Press	Monitor
Scroll	11	Select	Enabled/Disabled
Select	11	Press	Enabled
Press	2	OK	Enabled
Press	2	Exit	

Detailed Power Supply and Charger configuration is available in the in the SAILOR 6081 Power Supply Unit and Charger Installation & User Manual.

2.11.11 TX band configuration

Operation	Key	Operation	Function
Press	2	2 x More	
	2	Set-up	
	2	1 x >	Channel Set-up
Scroll down	11	Rotate	TX-Band
Select	11	Press	
Press	2	Add	New band
Key In Band limits	4	1605,0 26175,0	The freqs wanted
Press	2	Save	Free run TX

2.11.12 Watch Receiver settings

Operation	Key	Operation	Function
Press	2	2 x More	
	2	Set-up	
	2	1 x >	Channel Set-up
Select	11	Press	Watch Receiver

This menu will show watch receiver frequencies.

2.11.13 Special configuration

Ship counter part configuration and special facilities are configured via the Service Interface. Please refer to 2.11 for details

2.12 Final installation check

Refer to 'User Manual' – chapter Service & Preventive Maintenance.

Technical description

3.1 Control Unit

The Control Unit consists of a main module 60-127962 and two sub modules: HMI module 60-127963 and the Intercon module 60-127964.
The main module consists of the digital part, i.e. the microprocessor, program FLASH, SDRAM, TU-CU Bus communication driver and Ethernet 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 supports a build-in speaker and the connectivity of an external 8 ohm speaker. The module also controls the the graphical TFT color display (240x320 dots).
The HMI module contains a small keyboard interface and encoders for volume and rotary knob.
The Intercon module contains the connectors for external interfaces.

3.2 Transceiver Unit

The Transceiver Unit consists of four modules. Two modules located in the base part of the unit: a Supply Filter module, an Exciter Control module, and two modules are located in the door part of the unit: a power amplifier module including filter bank and a switched mode power supply. The main wiring is by ribbon cables with Micro Match connectors. RF signals are routed in coaxial cables.

3.3 Supply Filter module 57-139985

To reduce electromagnetic interference even when transmitting at high power, a supply filter PCB consisting of a common mode choke and high voltage decoupling capacitors is integrated in the transceiver unit.
There are no serviceable parts on this PCB.

3.4 Exciter Control module (ECM) 60-139984

The ECM board is the main board of the system 6000B MF/HF. This board consists of the following main items:

- Local power supplies generating supplies to the integrated circuitry present on the ECM board.
- RF input with Surge Arrester (90VDC +/-20% and in accordance with ITU-T Rec. K.12 and DIN 57845/VDE0845) .
- Anti-aliasing and power line noise filter with pass band of 150kHz to 30MHz.
- Variable Gain Amplifier and input overload protection.
- 16 bit Analog to Digital Converter sampled at 98.304MHz generated by 0.3ppm local oscillator on 17.8176MHz
- FPGA doing direct sampling, multiple receiver chains, filtering, SWR protection and direct up-conversion transmitter chain.
- Flash ADC used as input to protection circuitry yielding response time in microseconds towards bad SWR.
- Dual TX DAC modulating directly on the transmitter frequency.
- Broad band high linearity amplifier outputting RF signal at approximately +9 dBm.
- DSP for signal processing, modulation schemes, power loop, modem and ATU control.
- FSK modem for communication with the antenna tuning unit.
- ARM processor with DDR3 RAM and eMMC Flash for LAN connectivity, control and boot of other peripherals. Furthermore, NMEA, real time clock and CAN.

LEDs on the ECM boards can be used to verify the following items:

LED	Normal state	Status
FPGA A	Off	Transmit protection detected in current PTT session (reset when PTT is released and pressed again)
FPGA D	Off	Reset from CPU has not been detected after FPGA boot.
FPGA B	Blink	Reserved
FPGA C	Blink	Reduced DAC clock ~2.93Hz – not necessarily in phase with FPGA LED
FPGA OWRFLW	Off	ADC Overflow
FPGA ALIVE	Blink	Alive led – Shall blink at ~2.93Hz
LED C	-	On when transmitting – on while tuning – off in RX
LED B	Off	Lit if SWR protection is engaged
LED A	-	On when transmitting – off during tune – off in RX (TX monitor)
CPU HB	Blink	Kernel heartbeat
ARM CPU ALIVE	Blink	MFHF Application heartbeat
CPU Act	Blink	Off when CPU is idle
eMMC Act	-	Blinks when accessing flash file system
STATUS	Blink	DSP is running
ALIVE	Off	

3.5 PA and Filters module 60-122881

The PA and Filters module includes PA drivers, PA-stage, protection circuits, bias circuits, key circuit and five low-pass filters with relays and relay drivers. The PA and Filters receive the modulated RF input signal from the RX/EX Signal Path and delivers the amplified and filtered output signal to the TX/RX connector via a receive/transmit relay on the Control/Intercon module.
The low-pass filters remove the unwanted harmonic frequencies from the PA signal. The Filpeak and PAprotec outputs are monitoring signals for the Control/Intercon module. The driver and final power amplifier stages are galvanically isolated on input and output as they are supplied directly from the 24 V DC input. The selection of low-pass filter is controlled by the Control/Intercon module.

The PA filters cover the frequency ranges:

1.6	3.1 MHz
3.1	5.0 MHz
5.0	9.0 MHz
9.0	17.0 MHz
17.0	29.7 MHz

3.6 PA and Filters module 60-123937 (FCC)

The PA and Filters module includes PA drivers, PA-stage, protection circuits, bias circuits, key circuit and five low-pass filters with relays and relay drivers. The PA and Filters receive the modulated RF input signal from the RX/EX Signal Path and delivers the amplified and filtered output signal to the TX/RX connector via a receive/transmit relay on the Control/Intercon module.
The low-pass filters remove the unwanted harmonic frequencies from the PA signal. The Filpeak and PAprotec outputs are monitoring signals for the Control/Intercon module. The driver and final power amplifier stages are galvanically isolated on input and output as they are supplied directly from the 24 V DC input. The selection of low-pass filter is controlled by the Control/Intercon module.

The PA filters cover the frequency ranges:

1.6	2.3 MHz
2.3	3.05 MHz
3.05	4.5 MHz
4.5	8.8 MHz
8.8	16.81 MHz
16.81	19.0 MHz
19.0	30.0 MHz

3.7 SMPS module 60-122882 (150 W/250 W)

The Switched Mode Power Supply supplies the low power circuits of the equipment with the various stabilized voltages required, and provides galvanic isolation from the supply source. The equipment is supplied from a 21.6 – 31.2 V DC power source. The module also carries the input filter and PA supply output which is not galvanically isolated.
The power supply converts the incoming voltage to 7.5 V, +15 V, -15, and 25 V. The SMPS is switched on from the Control Unit via the TU-CU Bus SUPPLY ON wire and switched off under software control via the SUPPLY ON/OFF connection from the Control/Intercon module. The DC supply voltage is sensed by a BAT INFO detector circuit and fed to the Control/Intercon module for automatic RF output power adjustment.

3.8 SMPS module 60-126172 (500 W)

The Switched Mode Power Supply supplies the low power circuits of the equipment with the various stabilized voltages required, and provides galvanic isolation from the supply source. The equipment is supplied from a 21.6 – 31.2 V DC power source. The module also carries a protection circuit for over/under voltage, wrong polarity and error detection. This circuit operates a relay on SMPS module 60-126136.
The power supply converts the incoming voltage to 7.5 V, +15 V, -15, 25 and 30 V. 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 Control/Intercon module. The DC supply voltage is sensed by a BAT INFO detector circuit and fed to the Control/Intercon module for automatic RF output power adjustment.

3.9 SMPS module 60-126136 (500 W)

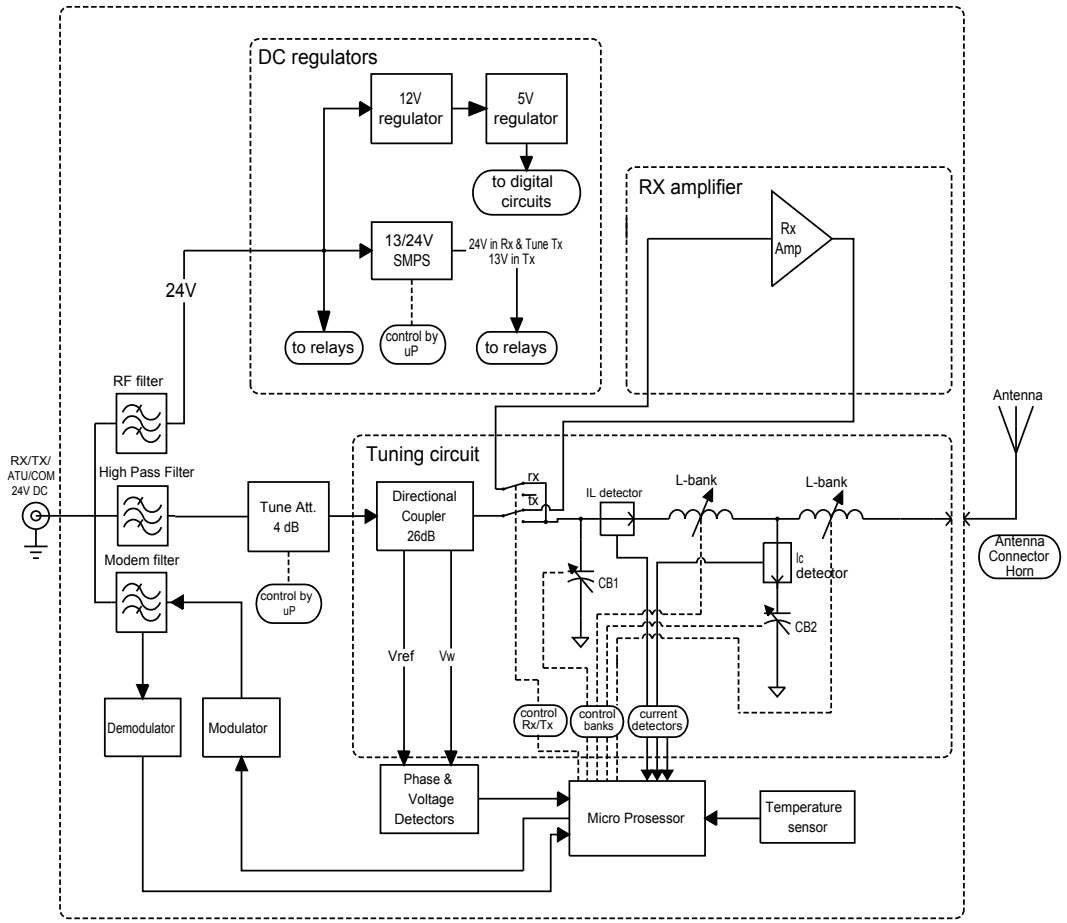
This switched mode power supply contains a common input filter for 60-126136 and 60-126172 and supplies the PA. The input and output are galvanically isolated, and the output is floating with regards to ground.
The supply for the PA is 45 V, and is switched on with the HT On connection. A reduced voltage for the PA is available in Telex-mode.
A fan blower control circuit is also employded. As the PA and / or the SMPS heats up, the fans will be activated. Should the temperature reach unsafe levels, the power for the PA will be switched off.

3.10 Antenna Tuning Unit

3.10.1 ATU module 60-122883 (150 W/250 W)

The ATU module comprises of a tuning network, measuring system and micro-controller circuits. The ATU module matches the impedance of the antenna to 50 ohm in order to gain the best possible SWR towards the TU. The TU communicates tuning process and frequency information with the ATU. The tuning network consists of capacitor bank 1, capacitor bank 2, and an inductor bank. With these banks it is possible to form either an L-network or a pi-network. The capacitor banks and inductor bank are built up by binary related capacitors and coils. The setting of capacitance and inductance is accomplished by relays. 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.
In receive mode an RX-Amplifier included in the Antenna Tuning Unit is utilized, to improve the sensitivity of the system by providing 50 ohm impedance. This is only used when connected to a 6000A MF/HF System.

Block diagram



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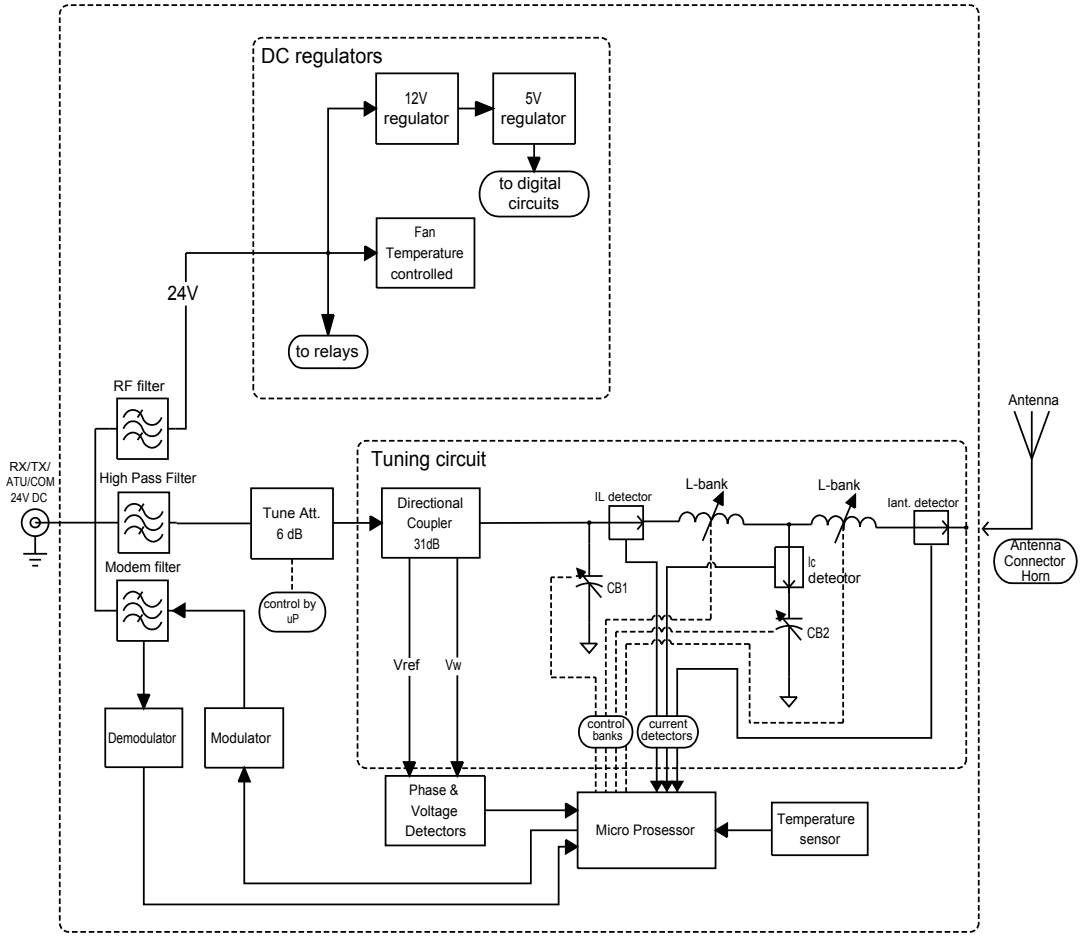
3.10.2 ATU module 60-131020 (500W)

The ATU module comprises of a tuning network, measuring system and micro-controller circuits. The ATU module matches the impedance of the antenna to 50 ohm in order to gain the best possible SWR towards the TU. The TU communicates tuning process and frequency information with the ATU. The tuning network consists of capacitor bank 1, capacitor bank 2, and an inductor bank. With these banks it is possible to form either an L-network or a pi-network. The capacitor banks and inductor bank are built up by binary related capacitors and coils. The setting of capacitance and inductance is accomplished by relays. 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.

Block diagram



99-126349

3.11 Power control and protection system

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 according to the available power supply voltage, 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. It is now possible to transmit at full output power unless protection is activated or LOW POWER is selected. The output power is continuously monitored by the TU, and is automatically adjusted during transmission to provide reliable communication.

3.11.1 Power Amplifier Protection

The protection of the power amplifier consists of V+I protection, SWR protection, and thermal protection. When the output signal of the voltage detector at the output of the power amplifier exceeds 10 V the output power is reduced to a safe level. The thermal protection consist of a temperature sensor on the power amplifier. The available power supply voltage is measured in the DC power supply and the information is transferred to the ECM module. If the supply voltage drops the microprocessor will adjust the output power to keep distortion below the limits.

3.11.2 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.

Service

4.1 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 following the below stated items for preventive maintenance:

1. The condition of the battery should be checked at frequent intervals.

2. Check the condition of antenna installation, ground connection and cables at regular intervals. Salt deposits on insulators must be removed with water to avoid flash-over when transmitting.

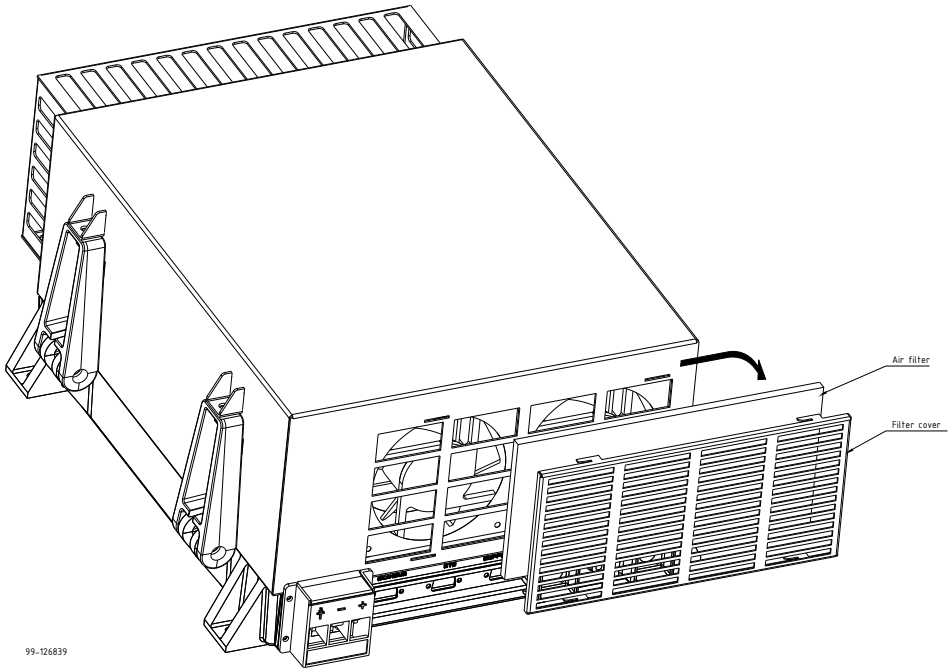
3. Keep antenna feed-through insulators clean.

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.

4.2 Cleaning the Air filter (500 W Transciver only)

The transceiver unit uses 2 fans to cool all circuitry inside the unit. To keep the cooling air clean an air filter is placed in front of each fan. These air filters should be cleaned frequently, especially under dusty working conditions. A clogged air filter will block efficient cooling and the transmitter output power will be reduced to avoid over-heating.
Remove the air filter cover from the buttom of the transceiver unit by gently pushing towards right and pulling it out from the cabinet. Take out the air filters from the cover. Clean the air filters refit and re-assemble the unit.



4.3 System test and verification

Ref to 'User Manual' – chapter 'Service & Preventive Maintenance'

4.4 Software update

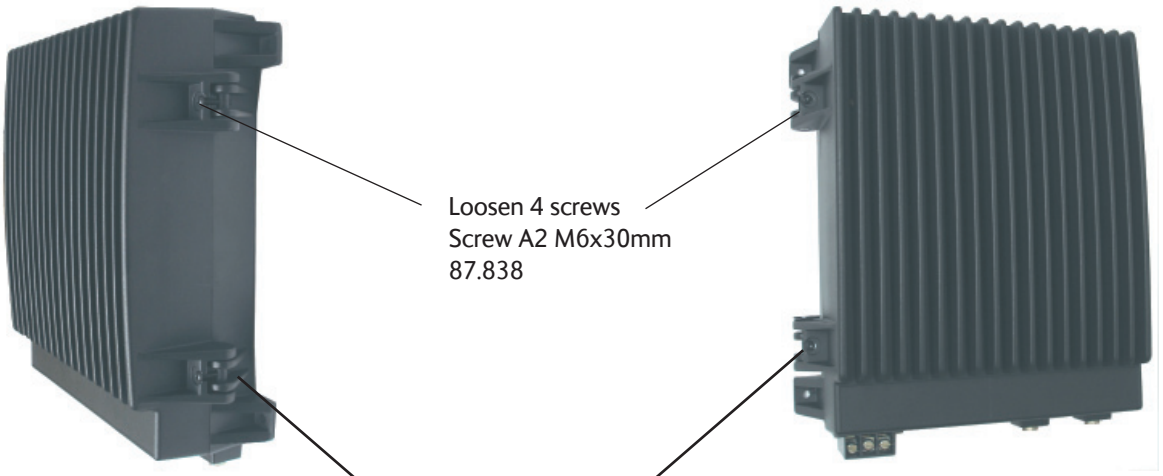
For Software upload please refer to '97-147768 – User manual SAILOR 6300B MF/HF Service Interface', available for download at Cobham extranet.

Latest SW for CU and TU is available for download at www.cobham/satcom.

Spare part exchange

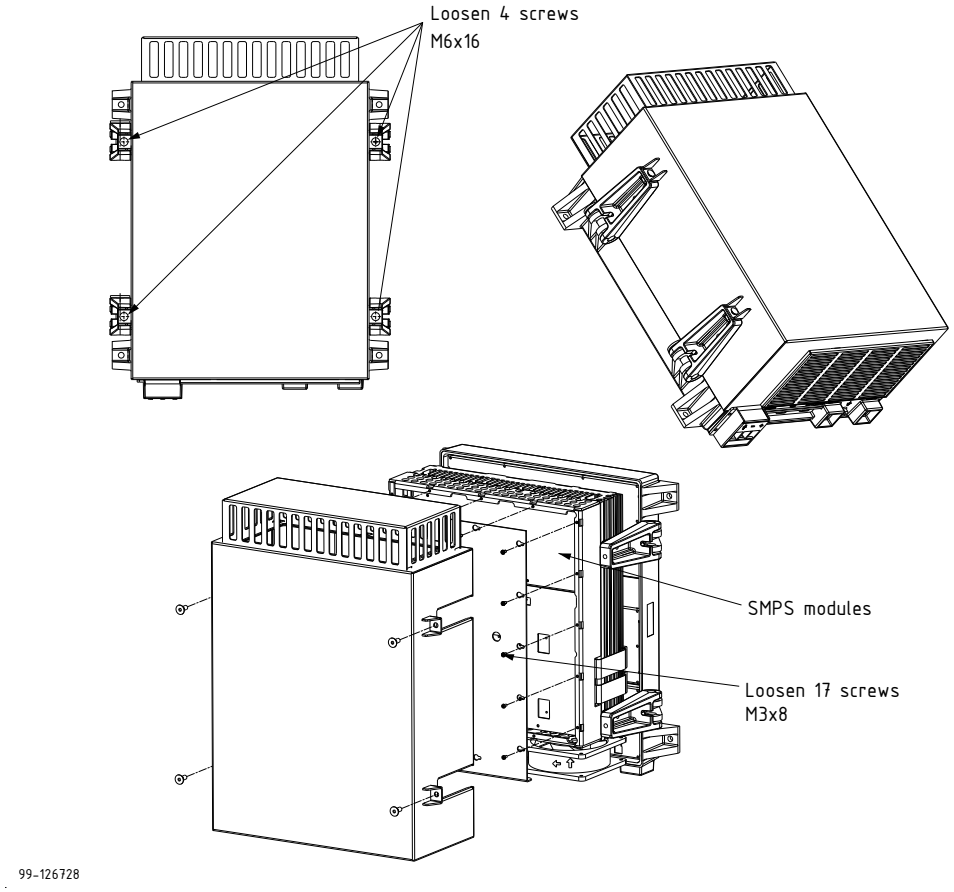
5.1 Disassembling the Transeciver Init (150 W/250 W)

To open the transceiver unit loosen the 4 screws (2 on each side) on the side of the cabinet.
Move the screws to the side to unlock the TU. Now open the TU by pulling the front door towards you.

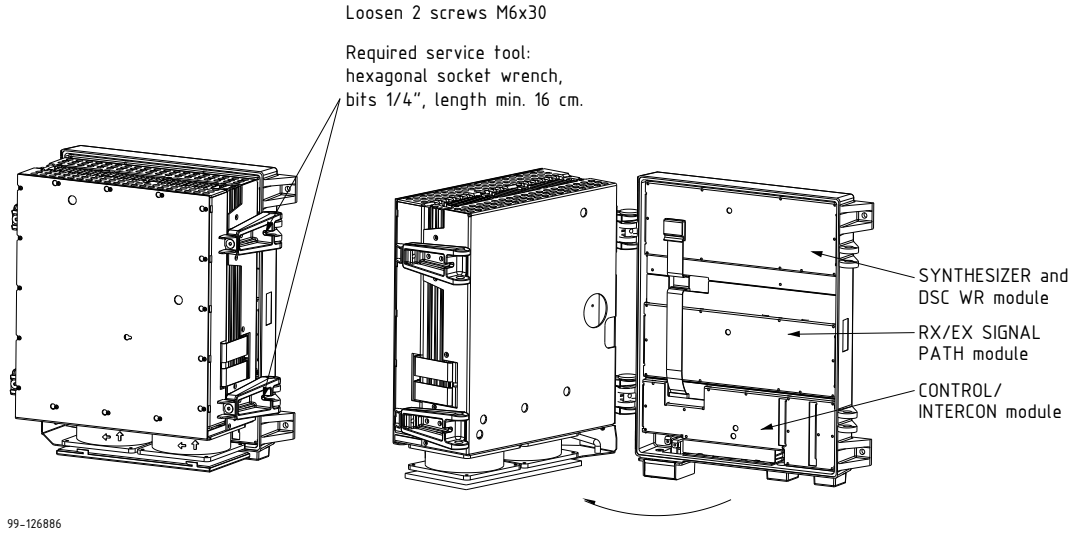


5.2 Disassembling the Transceiver Unit (500 W)

To remove the transceiver cover loosen the 4 screws (2 on each side) on the side of the cabinet and pull the cover from the transceiver.



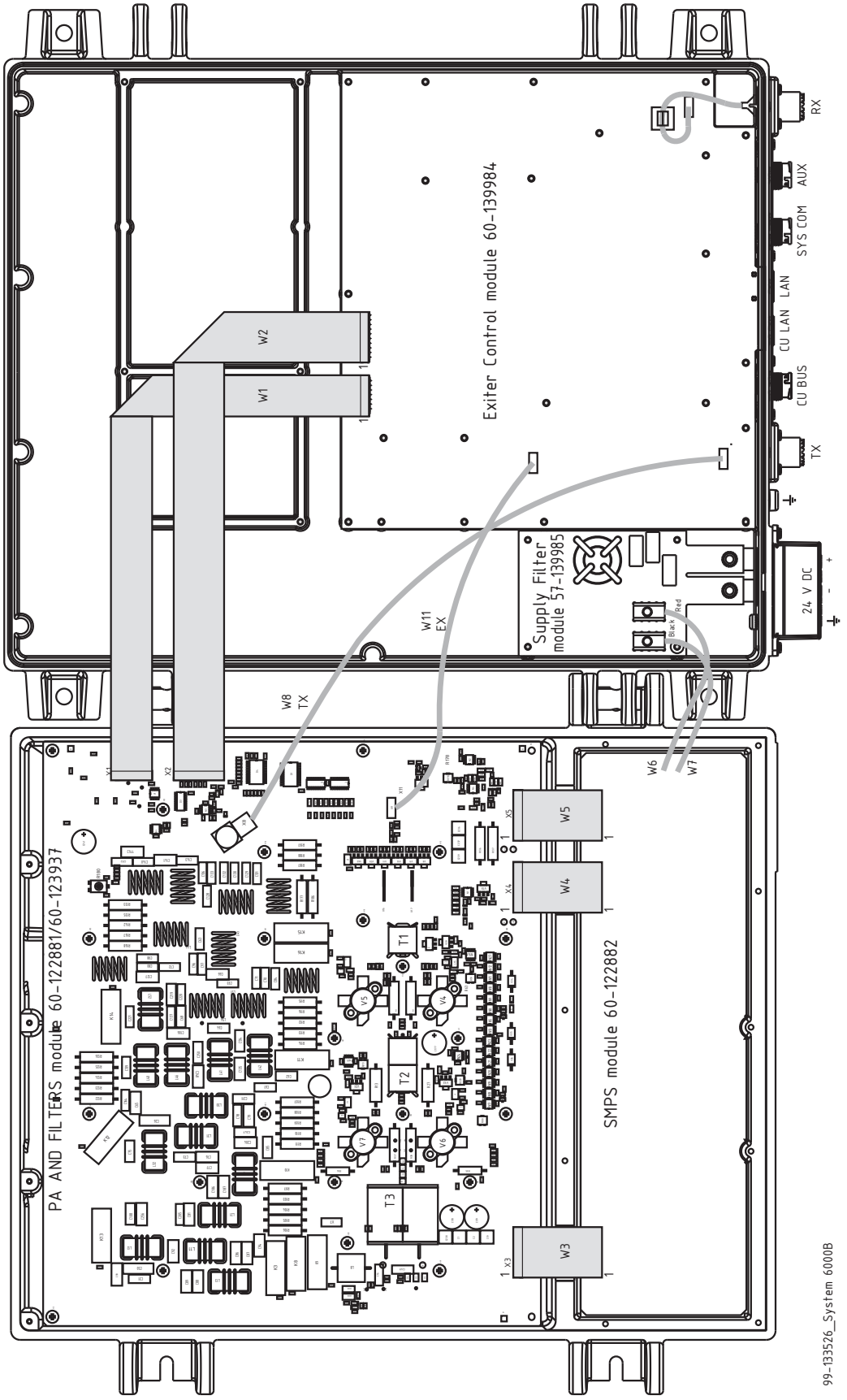
To open the transceiver loosen the 2 screews on the right hand side of the cabinet.



5.3 Transceiver Unit module location

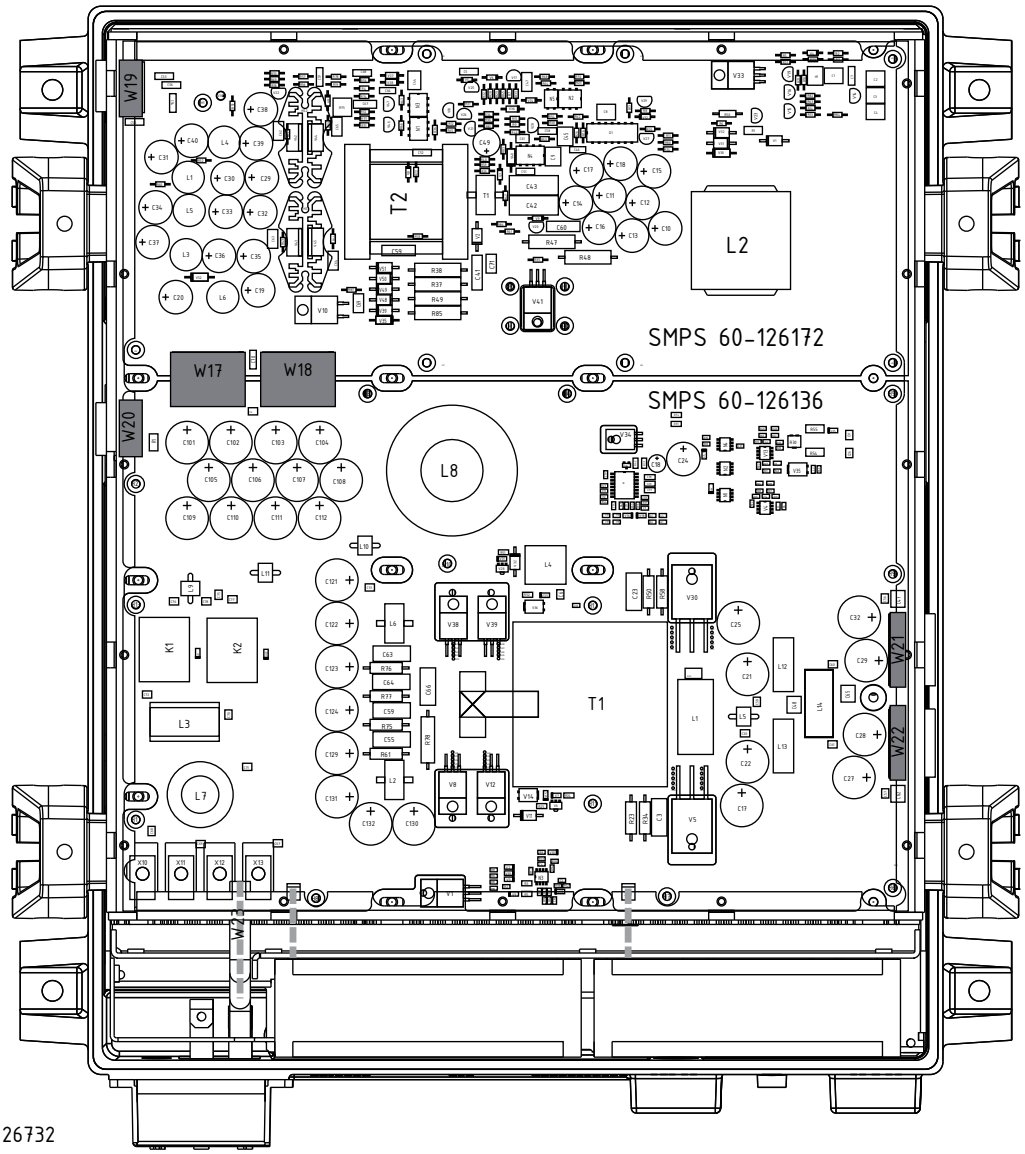
150 W/250 W Transceiver Unit

The following modules are available as service parts.

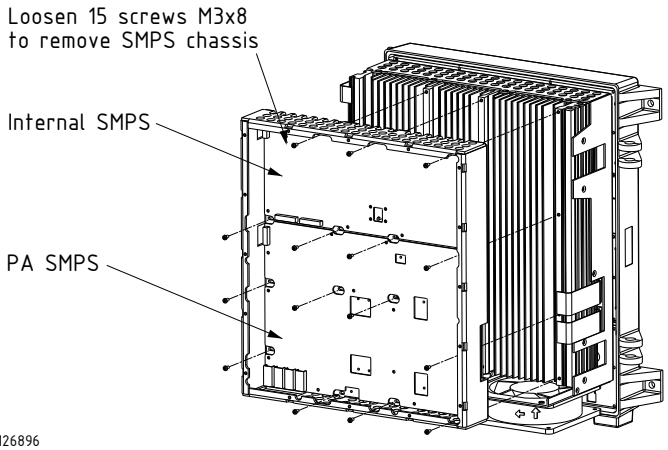


500 W Transciver Unit

The modules and internal cables illustrated in the following pages are available as spare parts, some as individual parts and others as part of a subassembly or a set. For identification of parts and part numbers refer to the eShop at the Thrane & Thrane Extranet."



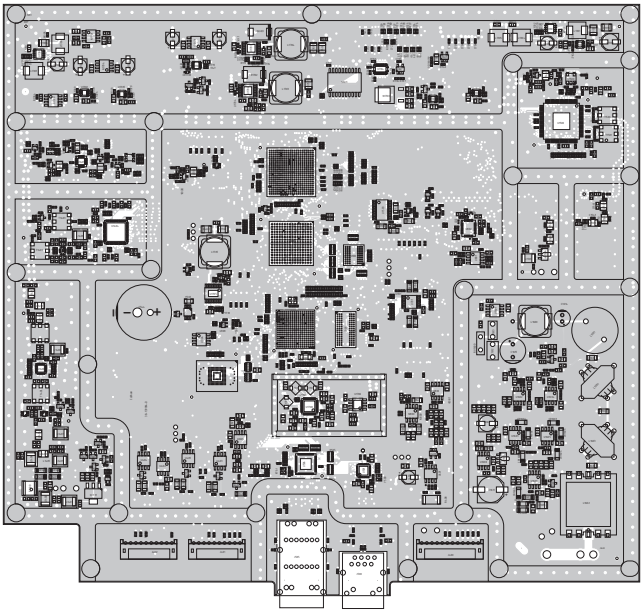
99-126732



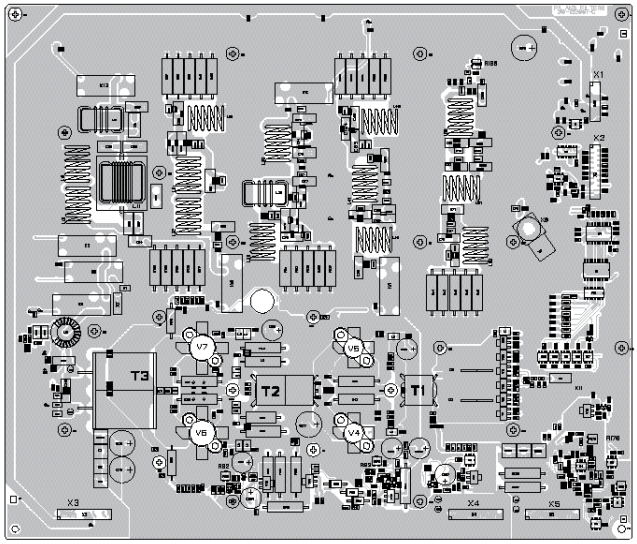
99-126896

5.4 Module overview

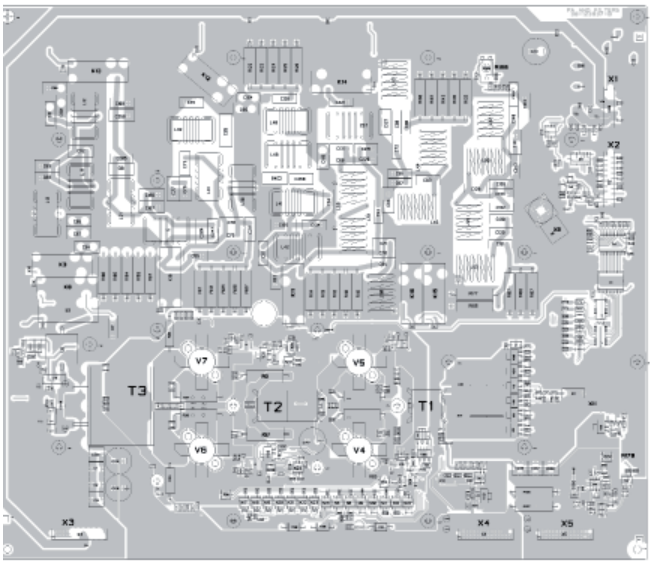
Exciter Control module 60-139984



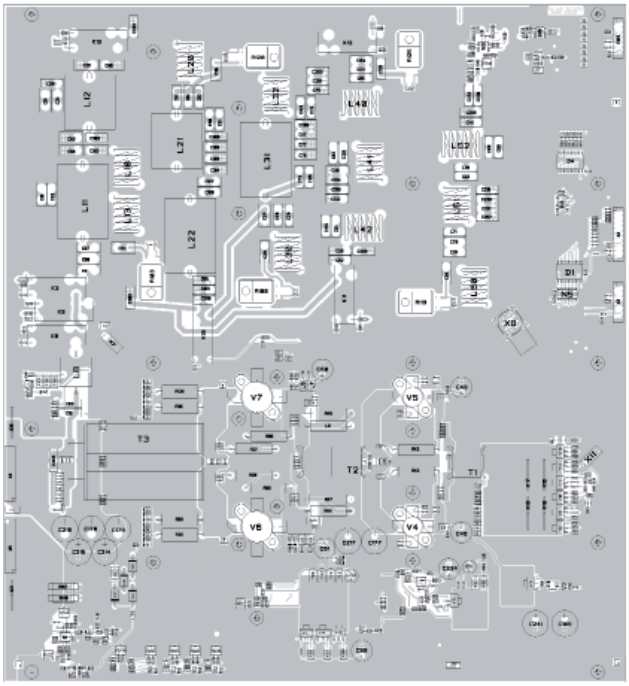
PA and filters module 60-122881 (150 W/250 W)



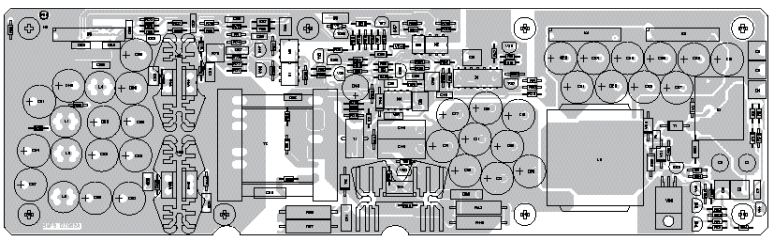
PA and filters module 60-123937 (FCC)



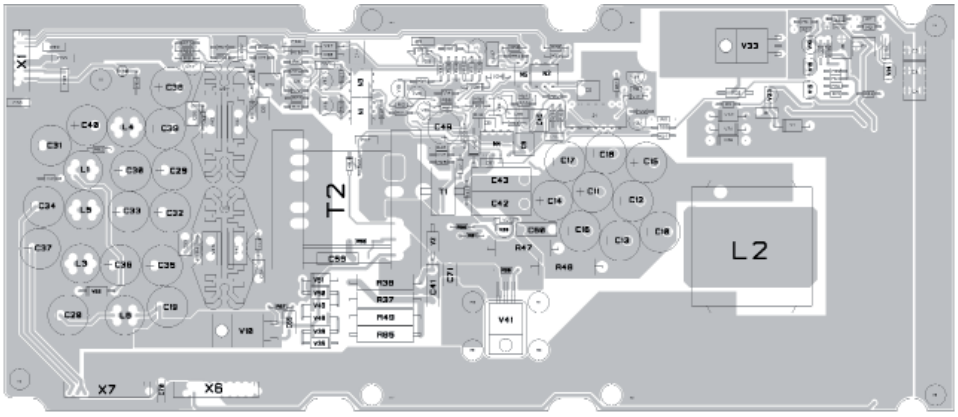
PA and filters module 60-125886 (500 W)



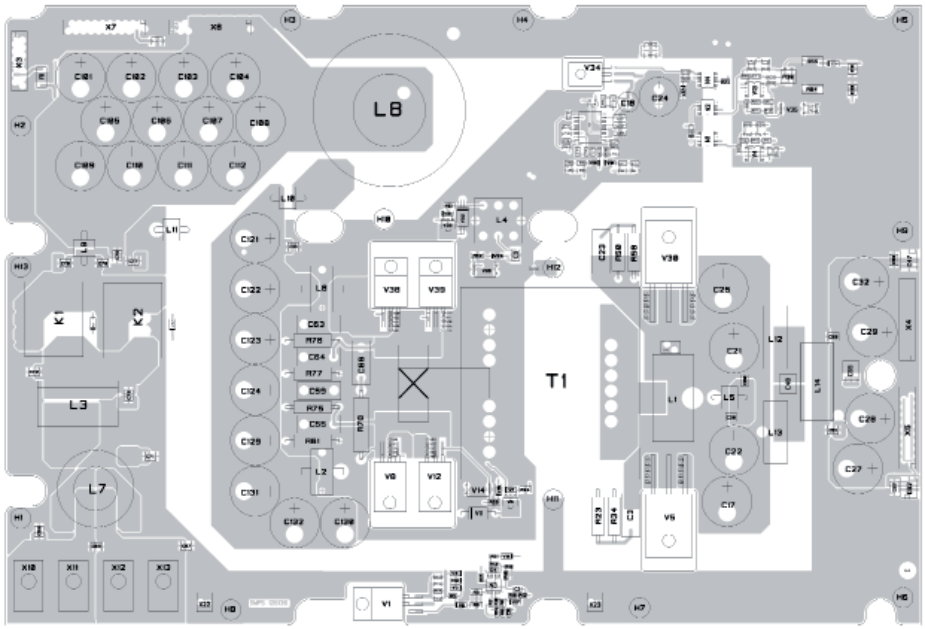
SMPS module 60-122882 (150 W/250 W)



SMPS module 60-126172 (500 W)



SMPS module 60-126136 (500 W)



5.5 Required service tools

150 W/250 W

For disassembling transceiver unit:	Slotted screwdriver
For shield cover, print and cables:	Torx screwdriver T10

500 W

For disassembling transceiver unit:	Hexagonal socket wrench 1/4" lenght min.16 cm
For transceiver modules and cables:	Torx screwdriver T10
	Slottet screwdriver
	Spanner for M5 nut

5.6 Accessory list

Item	Part no.
SAILOR 6301 Control Unit Class A	406301A
SAILOR 6365B 150 W MF/HF Transceiver Unit DSC Class A	406365B
SAILOR 6366B 150 W MF/HF Transceiver Unit DSC Class A FCC	406366B
SAILOR 6368B 250 W MF/HF Transceiver Unit DSC Class A	406368B
SAILOR 6369B 500 W MF/HF Transceiver Unit DSC Class A	406369B
SAILOR 6381 150 W/250 W Antenna Tuning Unit DSC Class A	406381A
SAILOR 6383 500 W Antenna Tuning Unit DSC Class A	406383A
SAILOR 6384B 500 W Antenna Tuning Unit DSC Class A	406384B
SAILOR 6006 Massage Terminal	406006A
SAILOR 6001 Keyboard for Message Terminal	406001A
SAILOR 6103 Multi Alarm Panel	406103A
SAILOR 6080 Power Supply	406080A
SAILOR 6081 Power Supply & Charger	406081A
SAILOR 6197 Ethernet Switch	406197A
SAILOR 6208 Control Unit Connection Box	406208A
SAILOR 6209 Accessory Connection Box	406209A
SAILOR 6270 External 8W Loudspeaker	406270A
Optional installation kit (3 x SAILOR 6080 + 1 x SAILOR 6081)	406081-004
ATU Mounting Kit	
Mounting plate and fittings for mast	737589
Mounting plate	737588
Gasket kit for Antenna Tuning Unit	737822

A

AGC	Automatic Gain Control
ALC	Automatic Level Control
AM	Amplitude Modulation
ATU	Antenna Tuning Unit

C

CU	Control Unit

D

DSC	Digital Selective Call

F

FEC	Forward Error Correction

H

HF	High Frequency 3-30 MHz

J

J2B	DSC/Telex (modulation)
J3E	SSB Telephony (modulation)

L

LSB	Lower Side Band

M

MF	Medium Frequency 300-3000 KHz
MMSI	Maritime Mobile Service Identity
MSI	Maritime Safety Information

N

NBDP	Narrow Band Direct Printing (Radio Telex)
NMEA	National Marine Electronics Association

P

PA	Power Amplifier
PTT	Push To Talk

R

RX	Receive(r)

S

Sitor	SImplex Teletype Over Radio (Radio Telex)
SMPS	Switch Mode Power Supply
SSB	Single Side Band (either lower or upper)

T

TU	Transmitter Unit
TX	Transmit

U

USB	Upper Side Band