

**COBHAM**

# SAILOR 6000B MF/HF DSC 150W/150W FCC/250W/500W

Installation manual





**SAILOR 6000B MF/HF DSC  
150W/150W FCC/250W/500W  
Installation manual**

**Document number:** 98-144591-E  
**Release date:** July, 2017

## Disclaimer

Any responsibility or liability for loss or damage in connection with the use of this product and the accompanying documentation is disclaimed by Thrane & Thrane A/S. The information in this manual is provided for information purposes only, is subject to change without notice and may contain errors or inaccuracies. Manuals issued by Thrane & Thrane A/S are periodically revised and updated. Anyone relying on this information should acquire the most current version e.g. from [www.cobham.com/satcom](http://www.cobham.com/satcom), **Cobham SYNC Partner Portal**, or from the distributor. Thrane & Thrane A/S is not responsible for the content or accuracy of any translations or reproductions, in whole or in part, of this manual from any other source. In the event of any discrepancies, the English version shall be the governing text.

Thrane & Thrane A/S is trading as Cobham SATCOM.

## Manufacturer

Thrane & Thrane AS,      Lundtoftegårdsvej 93D, DK-2800 Kgs. Lyngby, Denmark.  
Industrivej 30, DK-9490 Pandrup, Denmark

## Copyright

© 2017 Thrane & Thrane A/S. All rights reserved.

## Trademark Acknowledgements

- SAILOR is a registered trademarks of Thrane & Thrane A/S.
- Other product and company names mentioned in this manual may be trademarks or trade names of their respective owners.

## 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!**

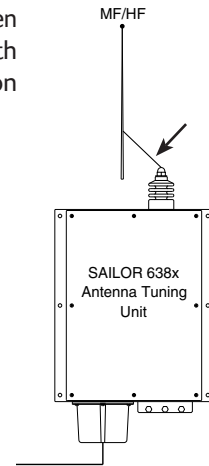
Only skilled service personnel may service and repair the equipment.  
Always carry out work under ESD safe conditions.

## 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                                                                                                                                                                                                                                                                                                                                                                                                         | Release Date  | Initials |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------|
| A    | Original document                                                                                                                                                                                                                                                                                                                                                                                                   | October 2015  | CMA      |
| B    | Installation is changed - page vi<br>Warning is changed - page v<br>Drawing updated - page 2-24.<br>Setup menu updated - page 2-26<br>Cable names are changed (AUX & SYS) - pages 2-18, 2-20, 2-21<br>Accessory list updated - page 5-8                                                                                                                                                                             | November 2015 | CMA      |
| C    | Technical data, - Antenna added - page 1-1<br>Input impedance 20 mA changed to 60 mA - page 1-3<br>Chapter 1.2.4, Input impedance, Sensitivity, Intermodulation, Spurious rejection are removed - page 1-4<br>Chapter 2.4.1 Headline changed from 'Transceiver Antenna' to 'Transmitter Antenna' - page 2-12<br>Chapter 2.4.3 is rewritten - page 2-15<br>RX Antenna & TX Antenna added config. drawing - page 2-18 | February 2016 | CMA      |
| D    | Chapter 4.1 pkt. 6 added - page 4-1<br>Chapter 4.2 Calibrating the master oscillator added - page 4-1                                                                                                                                                                                                                                                                                                               | December 2016 | CMA      |
| E    | Chapter 2.9.2 - 'Mute on TX INHIBIT: ON' added the setup menu - page 2-28<br>Chapter 2.11.14 TX Inhibit added - page 2-35                                                                                                                                                                                                                                                                                           | July 2017     | CMA      |

## Preface

### Radio for occupational use

The SAILOR 6000B MF/HF DSC fulfils the requirements of the SOLAS directive and is intended for use in maritime environment.

SAILOR 6000B MF/HF DSC is designed for occupational use only and must be operated by licensed personnel only. SAILOR 6000B MF/HF DSC is not intended for use in an uncontrolled environment by general public.

## Training information

The SAILOR 6000B 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 6000 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

The SAILOR radio set generates electromagnetic RF (radio frequency) energy when transmitting. To ensure that no personnel will be exposed to excessive amounts of RF-energy and to avoid health hazards from excessive exposure to RF energy, the following safety distances must be followed:

| Antenna | Safety distance                 |
|---------|---------------------------------|
| 150W    | Calculated: 1.71 m or 5.7 feet  |
| 250W    | Calculated: 2.21 m or 7.3 feet  |
| 500W    | Calculated: 3.12 m or 10.3 feet |

Calculations cover a whip antenna with a maximum gain of 3dBi, worst case frequency (30 MHz), full power and 100% duty cycle (transmitter always on) considering the most conservative limits mentioned in:

- FCC OET Bulletin 65 (1997)
- Canada RSS102 (2010)
- Canada Safety Code 6 (2015)

## Installation Example for 150W

1. A whip antenna with a maximum gain of 3 dBi must be mounted at least 12.3 ft. (3.71m) above the highest deck where people may be staying during continuous 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 5.7 feet (1.71 m) plus the 6.6 ft. (2.0 m) height of an adult.
2. On vessels that cannot fulfill requirements in item 1, the antenna must be mounted so that the lowest point of the antenna is at least 5.7 feet (1.71m) vertically above the heads of people on deck and all persons must be outside the 5.7 feet MPE radius during radio transmission.
  - Always mount the antenna at least 5.7 feet from possible human access. Never touch the antenna when transmitting.
  - Never touch the antenna when transmitting.
  - Use only authorized T&T accessories.
  - Only allow trained and certified operators knowing about RF-energy and hazards to operate the radio.
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 an even greater distance. Consult the appropriate standard for exact limits, depending on national specifications.

Failure to observe any of these warnings may cause RF exposure exceeding above mentioned limits or create dangerous conditions..

## Related documents

| Title and description                                                                             | Document number |
|---------------------------------------------------------------------------------------------------|-----------------|
| Installation guide SAILOR 630x MF/HF Control Unit                                                 | 98-132396       |
| Installation guide SAILOR 6000B MF/HF Transceiver Unit & Antenna Tuning Unit<br>150 W/250 W/500 W | 98-144542       |
| User Manual SAILOR 6301 MF/HF Control Unit                                                        | 98-131070       |
| User Manual SAILOR MF/HF System 6000A/6000B MF/HF Radiotelex                                      | 98-151795       |
| Installation and user manual SAILOR 6101 and 6103 Alarm Panel                                     | 98-130981       |
| Emergency call sheet                                                                              | 98-132369       |

# Table of Contents

---

## Chapter 1 General information

|                         |     |
|-------------------------|-----|
| 1.1 Introduction .....  | 1-1 |
| 1.2 Technical data..... | 1-1 |

## Chapter 2 Installation

|                                         |      |
|-----------------------------------------|------|
| 2.1 Description.....                    | 2-1  |
| 2.2 Mounting the units.....             | 2-1  |
| 2.3 Ground connections .....            | 2-9  |
| 2.4 Antennas .....                      | 2-12 |
| 2.5 DC Power cabling .....              | 2-17 |
| 2.6 Interconnection of units .....      | 2-18 |
| 2.7 Position and time information ..... | 2-25 |
| 2.8 Telex operation .....               | 2-26 |
| 2.9 ID Programming.....                 | 2-27 |
| 2.10 Programming Telex ID .....         | 2-29 |
| 2.11 Configuration .....                | 2-31 |
| 2.12 Final installation check .....     | 2-35 |

## Chapter 3 Technical description

|                                                  |     |
|--------------------------------------------------|-----|
| 3.1 Control Unit.....                            | 3-1 |
| 3.2 Transceiver Unit.....                        | 3-1 |
| 3.3 Supply Filter module 57-139985.....          | 3-1 |
| 3.4 Exciter Control module (ECM) 60-139984 ..... | 3-1 |
| 3.5 PA and Filters module 60-122881.....         | 3-2 |
| 3.6 PA and Filters module 60-123937 (FCC) .....  | 3-3 |
| 3.7 SMPS module 60-122882 (150 W/250 W) .....    | 3-3 |
| 3.8 SMPS module 60-126172 (500 W) .....          | 3-3 |
| 3.9 SMPS module 60-126236 (500 W) .....          | 3-4 |
| 3.10 Antenna Tuning Unit .....                   | 3-4 |
| 3.11 Power control and protection system.....    | 3-6 |

**Chapter 4 Service**

|                                                            |     |
|------------------------------------------------------------|-----|
| 4.1 Preventive maintenance .....                           | 4-1 |
| 4.2 Calibrating the master oscillator .....                | 4-2 |
| 4.3 Cleaning the Air filter (500 W Transceiver only) ..... | 4-5 |
| 4.4 System test and verification .....                     | 4-5 |
| 4.5 Software update .....                                  | 4-5 |

**Chapter 5 Spare part exchange**

|                                                            |     |
|------------------------------------------------------------|-----|
| 5.1 Disassembling the Transceiver Unit (150 W/250 W) ..... | 5-1 |
| 5.2 Disassembling the Transceiver Unit (500 W) .....       | 5-2 |
| 5.3 Transceiver Unit module location .....                 | 5-3 |
| 5.4 Module overview .....                                  | 5-5 |
| 5.5 Required service tools .....                           | 5-8 |
| 5.6 Accessory list .....                                   | 5-8 |

|                       |            |
|-----------------------|------------|
| <b>Glossary</b> ..... | Glossary-1 |
|-----------------------|------------|

# 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.

|                                       |                                                                                                                                                                                                  |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Operating modes:</b>               | Simplex and semi-duplex SSB telephony (J3E), DSC (J2B), AM broadcast reception (H3E) and Telex (J2B)                                                                                             |
| <b>Antennas:</b>                      | The Transceiver is designed to operate as a "two antenna simplex/semi-duplex" configuration only, meaning that separate antennas are used for reception (RX) and transmission (TX) respectively. |
| <b>Frequency stability:</b>           | Better than 0.35 ppm<br>Warm-up time. Less than one minute<br>Ageing less than 0.1 ppm/year                                                                                                      |
| <b>Normal operating temperature:</b>  | from 0°C to +40°C                                                                                                                                                                                |
| <b>Extreme operating temperature:</b> | From -15°C to +55°C                                                                                                                                                                              |
| <b>ATU</b>                            | 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<br>5.4°/H | Steering<br>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 carefully 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.  $0.66 \times 175 \text{ W} = 115.5 \text{ W}$  dissipated heat for a 150 W system in SSB speech mode.

For a figure in kilocalories (kcal), multiply dissipation effect by on-time in hours and then by 0.860.

For the 150W system, e.g.  $115.5 \text{ W} \times 2 \text{ h} + 45 \text{ W} \times 22 \text{ h}$  (TX 2 hours + RX 22 hours a day) = 1221 Wh.  $1221 \text{ Wh} \times 0.860 \sim 1050 \text{ kcal}$  a day.

## 1.2.2 Receiver characteristics

|                              |                                                                                          |                                     |
|------------------------------|------------------------------------------------------------------------------------------|-------------------------------------|
| <b>General:</b>              | Complies with ETSI 300373 in the ITU marine bands.                                       |                                     |
| <b>Frequency range:</b>      | 150 KHz to 30 MHz                                                                        |                                     |
| <b>Frequency resolution:</b> | 100 Hz by keyboard entry<br>10 Hz, 100 Hz or 1 KHz search/fine-tune facility is provided |                                     |
| <b>Input impedance:</b>      | Rx : 50 ohm<br><br>12V DC / 60 mA is available for possible use of active antenna.       |                                     |
| <b>Sensitivity:</b>          | Telephony (J3E):                                                                         | below 11 dB $\mu$ V for 20 dB Sinad |
|                              | Broadcast (A3E):                                                                         | below 25 dB $\mu$ V for 20 dB Sinad |
|                              | DSC/Telex (J2B):                                                                         | below 0 dB $\mu$ V                  |

**Intermodulation:**

|                       | Wanted signal | Signal              |
|-----------------------|---------------|---------------------|
| Telephony (J3E)       | 30 dB $\mu$ V |                     |
| Intermodulation level |               | above 80 dB $\mu$ V |
| Telex (J2B)           | 30 dB $\mu$ V |                     |
| Intermodulation level |               | above 90 dB $\mu$ V |
| DSC (J2B)             | 20 dB $\mu$ V |                     |
| Intermodulation level |               | above 80 dB $\mu$ V |

|                            |                                                                                                                                                        |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Spurious rejection:</b> | Above 70 dB                                                                                                                                            |
| <b>Audio output power:</b> | Build-in loudspeaker 6 W typical.<br>Optional loudspeaker output 6 W typical with less than 10 % distortion.<br>Output intended for 8 ohm loudspeaker. |

## 1.2.3 Transmitter characteristics

|                 |                                                                                                                                          |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General:</b> | Complies with ETSI 300373 and FCC in the ITU marine bands.<br>The Transmitter characteristics are with the Antenna Tuning Unit included. |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------|

|                         |                                                                                                              |
|-------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>Frequency range:</b> | 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 |

|                              |                                                                 |
|------------------------------|-----------------------------------------------------------------|
| <b>Frequency resolution:</b> | 100 Hz                                                          |
| <b>Output impedance:</b>     | TX: 50 ohm<br>The Antenna is matched by the Antenna Tuning Unit |
| <b>Power reduction:</b>      | Low power: 20 W PEP                                             |
| <b>Intermodulation:</b>      | below -31 dB/PEP                                                |
| <b>Spurious Emission:</b>    | below -43 dB/PEP<br>below -60 dB/PEP (FCC)                      |
| <b>Hum and noise:</b>        | Less than -40 dB/PEP                                            |

**Output power 150 W SSB:**  $\pm 1.4$  dB into 50 ohm Antenna.

DSC/Telex:  
85 W  $\pm 1.4$  dB

**Output power 250 W SSB:**  $\pm 1.4$  dB into 50 ohm Antenna.

DSC/Telex:  
125 W  $\pm 1.4$  dB

**Output power 500W SSB:** 1.6-4 MHz 400 W PEP  $\pm 0/-1.4$  dB  
4-27 MHz 500 W PEP  $\pm 1.4$  dB into 50 ohm Antenna.

DSC/Telex:  
250 W  $\pm 1.4$  dB

## 1.2.4 DSC Watch keeping receiver characteristics

|                         |                                                                                                                                                                                             |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General:</b>         | Complies with ETSI 300338 and ETSI 301033.                                                                                                                                                  |
| <b>Frequency range:</b> | Default set to D1 - 2187.5 KHz.<br>When scanning is enabled by option code it will default be D6 - 2-4-6-8-12-16 MHz.<br>Can be reduced to minimum 3 frequencies via the Service Interface. |

**Note** | Regarding further receiver characteristics refer to section 1.2.2.

## 1.2.5 Antenna Tuning Unit characteristics

|                                       |                                    |
|---------------------------------------|------------------------------------|
| <b>Frequency range:</b>               | 1.6 MHz - 27.5 MHz                 |
| <b>Antenna requirements:</b>          | 8-18 m wire and/or whip antenna    |
| <b>Antenna tuning:</b>                | Fully automatic with no presetting |
| <b>Tuning speed:</b>                  | 0.1 - 8 sec. (typical)             |
| <b>Power capability</b>               |                                    |
| <b>150 W/250 W:</b>                   | 350 W PEP into 50 ohm antenna      |
| <b>500 W:</b>                         | 600 W PEP into 50 ohm antenna      |
| <b>Extreme operating temperature:</b> | from -25°C to +55°C                |

## 1.2.6 DSC/Telex modem characteristics

|               |                      |                                                     |
|---------------|----------------------|-----------------------------------------------------|
| <b>DSC:</b>   | 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<br>GLL, RMC, ZDA, GGA, GNS |
| <b>TELEX:</b> | 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 (37.5 lbs)

### Equipment category:

|                                                 |           |
|-------------------------------------------------|-----------|
| Control Unit:                                   | Protected |
| Transceiver Unit:                               | Protected |
| Antenna Tuning Unit:<br>(According to IEC60940) | Exposed   |



# Installation

## 2.1 Description

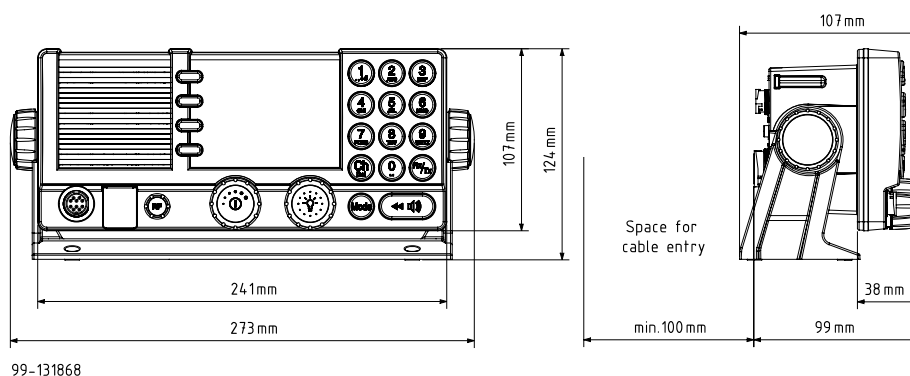
Correct installation of the equipment is important for maximum performance and reliability. Antennas and ground connections must be installed with the greatest care using corrosion resistant materials. Cable routing shall be made so that the cables are protected from physical damage. Sharp cable bends 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

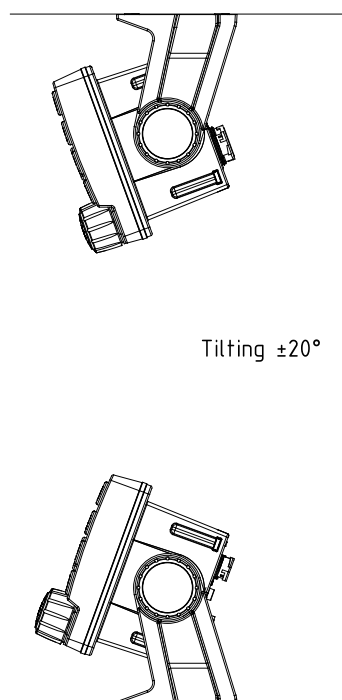
### 2.2.1 Mounting the Control Unit (CU)

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<sup>2</sup> screened. The Control Unit may be tabletop or bulkhead mounted.

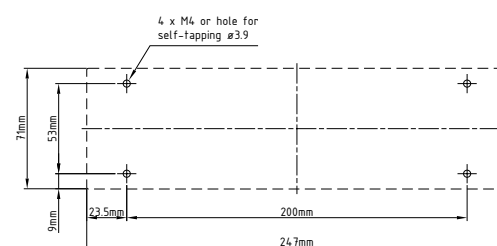
#### Control Units with mounting bracket



#### Mounting option



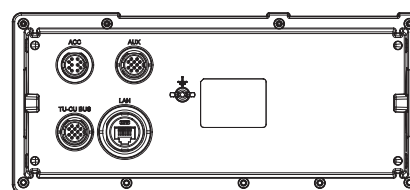
#### Drilling plan for bracket



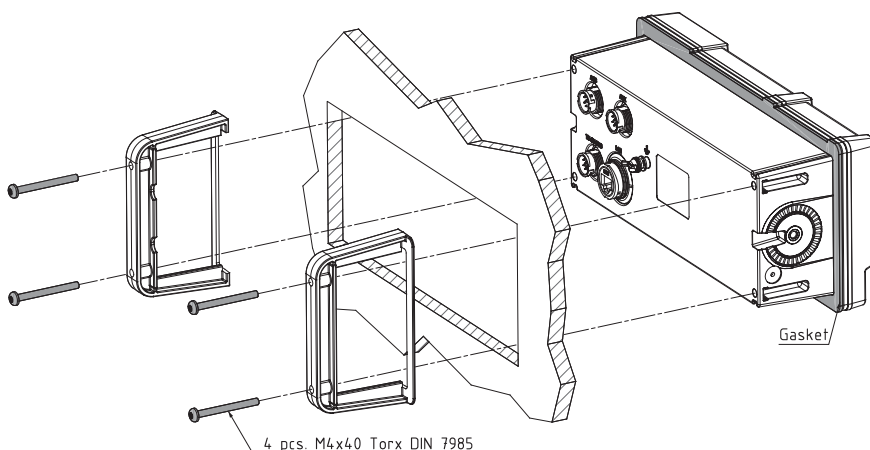
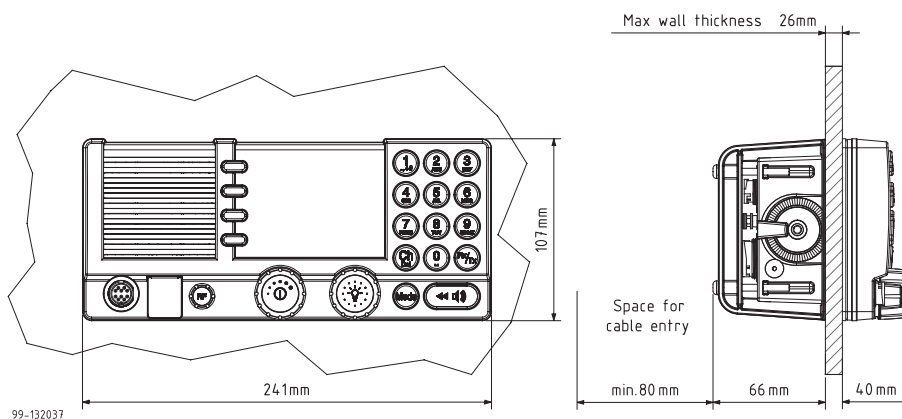
#### Weight:

|                  |         |
|------------------|---------|
| Control Unit     | 0.82 kg |
| Mounting Bracket | 0.20 kg |

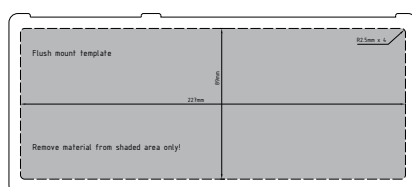
#### Control unit connector panel



## Control Units with flush mounting bracket



### Drilling plan



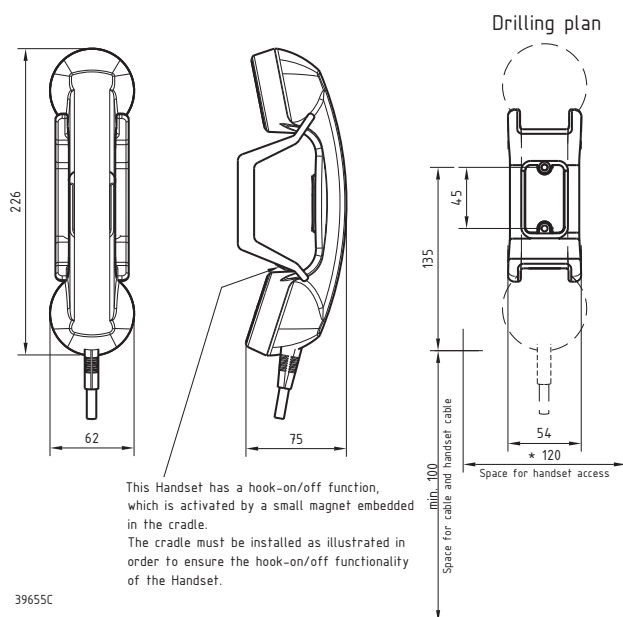
### Weight:

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:

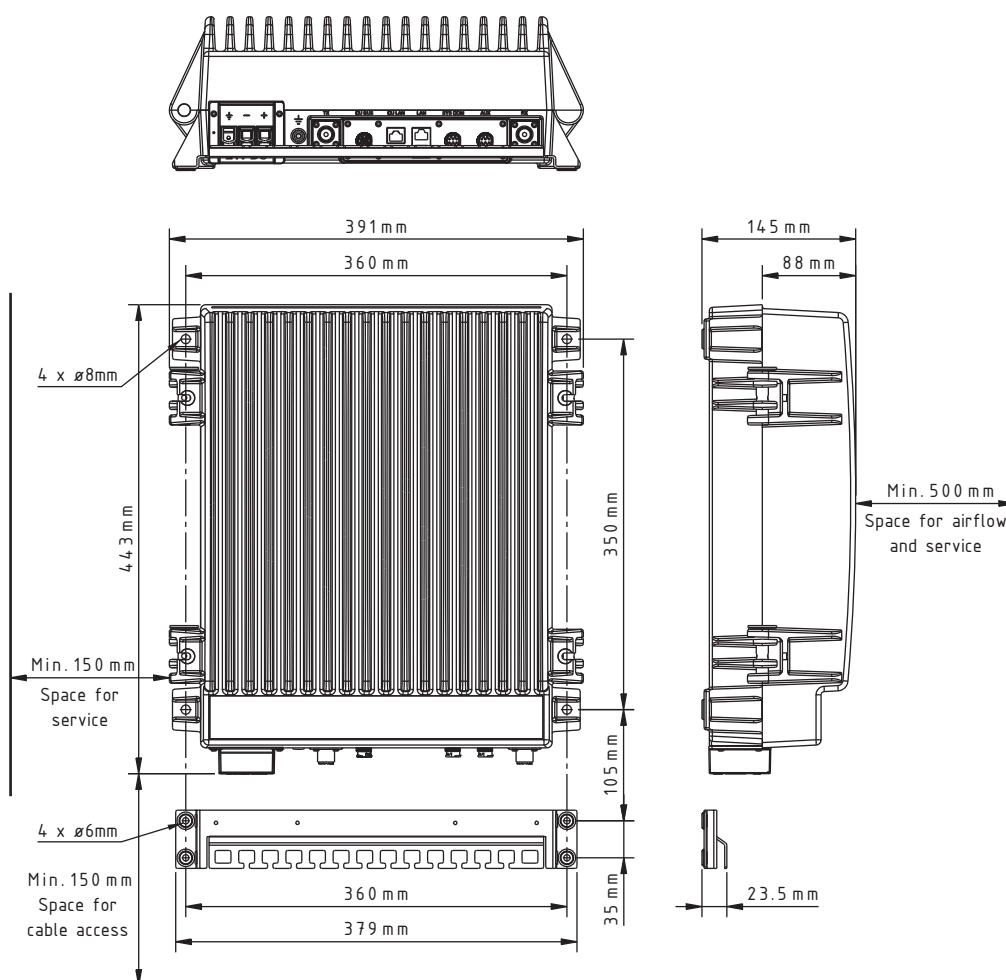
Handset for Control Unit 0.4 kg (0.02 lbs)

Dimensions are in mm

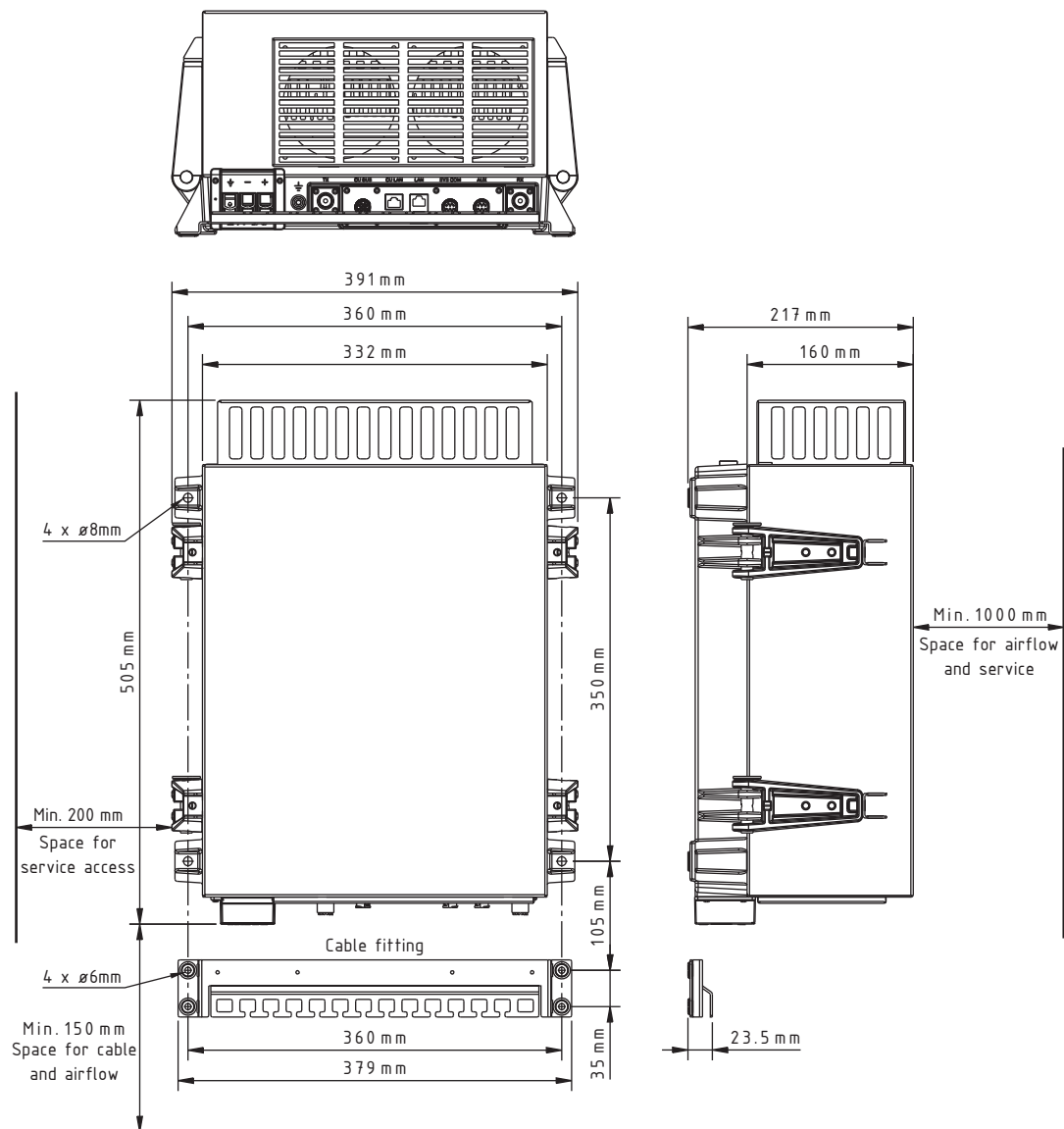
## 2.2.2 Mounting the Transceiver Unit (TU)

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



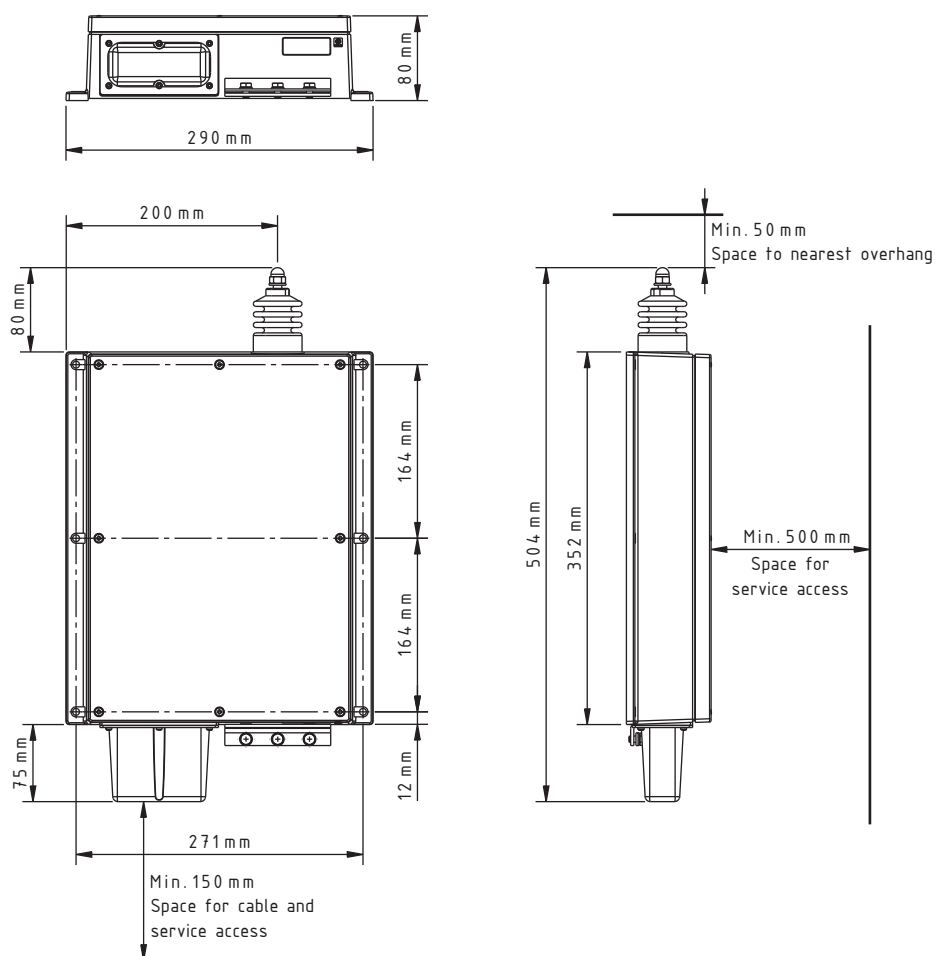
## 2.2.3 Mounting the Antenna Tuning Unit (ATU)

The ATU may be positioned up to 100 metres from the Transceiver Unit using just one RG-213/U or better coaxial cable.

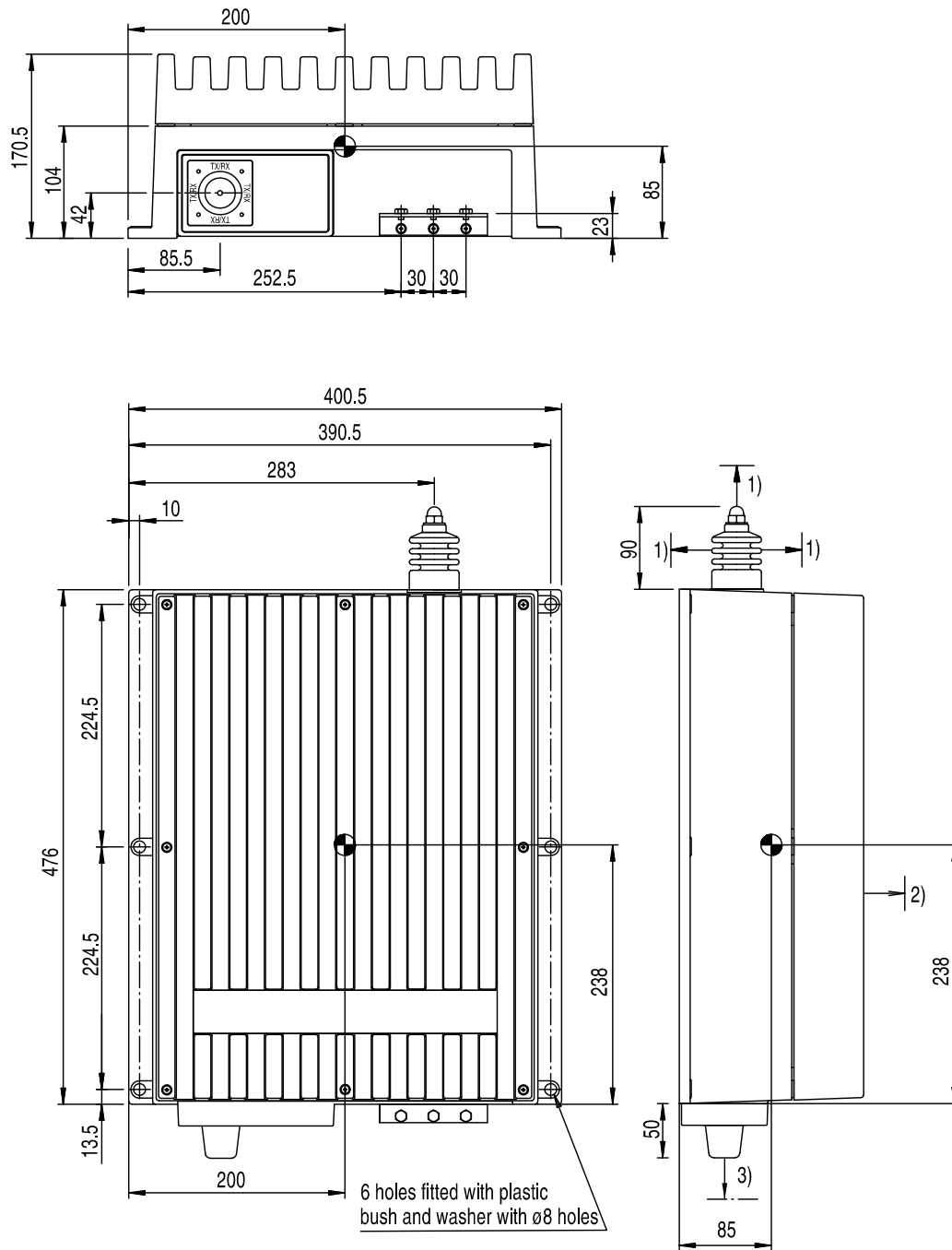
The ATU must be installed outside in a convenient position to have good access for sufficient length of feed wire to meet the antenna connection point. It is recommended that the ATU be installed vertically to allow any moist condensating inside the ATU to drain out through the rubber gasket along the coax cable.

### 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 using the ATU Mounting Kit. The kit is stainless steel which can be bolted or welded to ship's hull to ensure good and solid connection as the radio system primary ground point. The mounting kit will, at the same time ensure straight and flat mounting surface 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 using the ATU Mounting Kit. The kit is made of stainless steel and may be bolted to ship's hull and serve as the ATU grounding point and the radio system's primary ground point.

The ground-plane should preferably be provided by as wide a surface as possible with shortest possible connection to the ATU grounding point.

The ground-plane may be establish in various ways such as e.g. through connecting all accessible metal parts together and connecting to the ATU ground point.

### ATU Mounting Kit

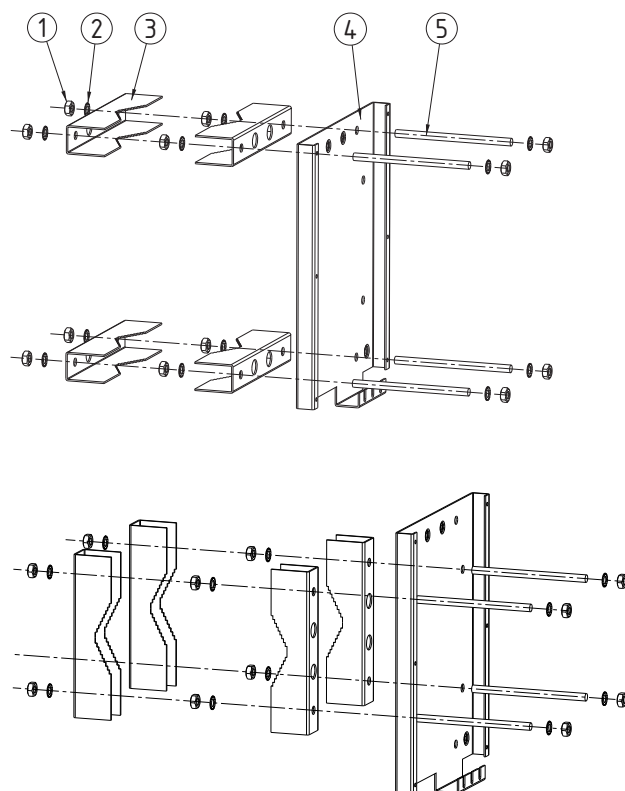
An optional ATU Mounting Kit as shown below is available in two versions:

1. Comprises 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 the mounting plate only ④ - part no. 737588

To get an even mounting surface on an uneven support.

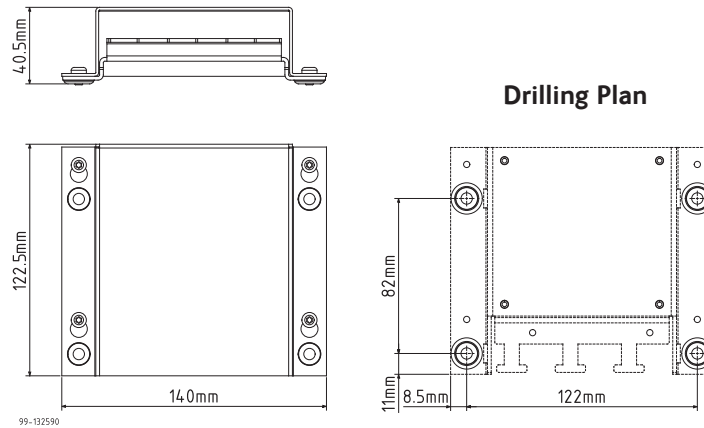


1. Nut M10
2. Toothed lock washer M10
3. Fitting for mast
4. Mountingplate for ATU
5. Treadrod M10

## 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.



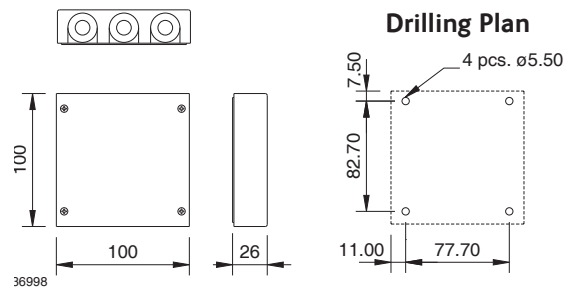
**Weight:**

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

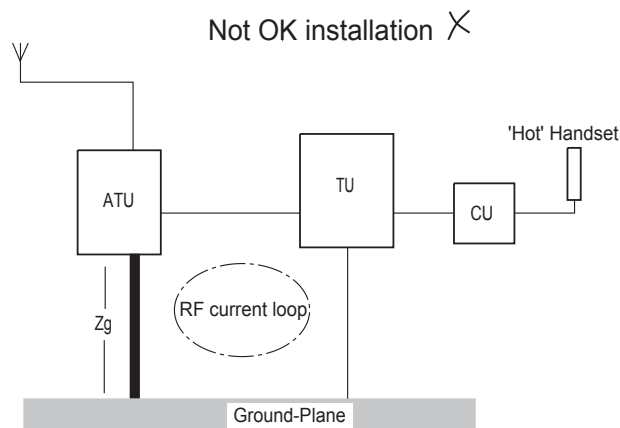
### 2.3.1 Grounding considerations

Proper system grounding is the most important installation detail for obtaining proper RF performance of the MF/HF system.

Two areas of grounding must be considered:

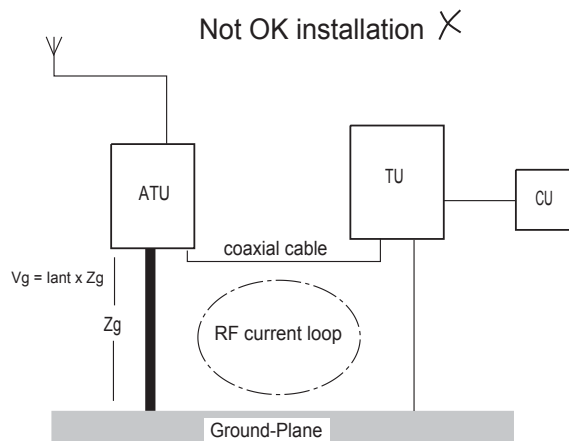
- The grounding connection between the ATU and grounding plane.
- The grounding connection of the TU and the externally connected equipment.

Each area requires separate considerations even though they are interrelated. Ideally the Control Unit, Transceiver Unit, Antenna Tuning Unit and the antenna ground-plane should all have the same RF ground potential. Unfortunately this is seldomly achievable, but interference problems will be reduced proportionately to how close to this "ideal" situation the actual grounding of the installation is achieved. Ground loops may cause problems with heavy interference in an installation. A ground loop is caused by more than one ground path being present 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.



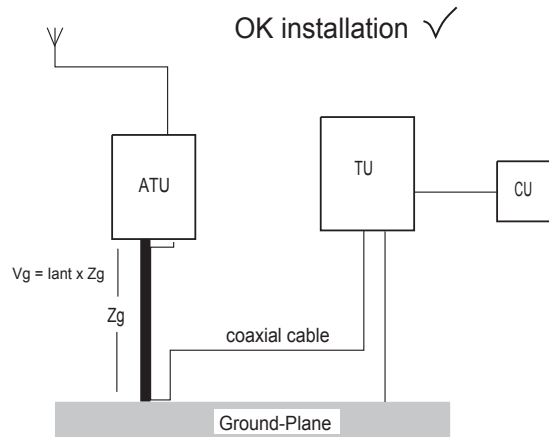
### 2.3.2 RF ground loop

It is not always possible or practical to install the ATU so as to allow for a very short connection to the actual ground-plane. In such a case the coaxial cable connecting the ATU and the TU each with a different ground potential, will cause RF loop currents to flow.



### 2.3.3 Minimizing ground loops

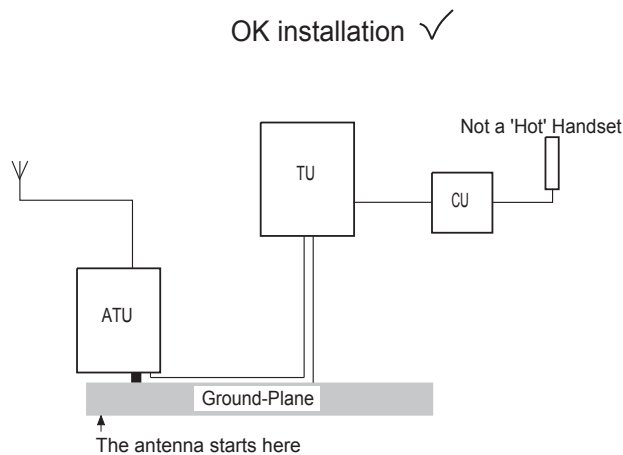
By routing the coax cable very close together with the ATU grounding strap (i.e. secure good RF coupling between the two) all the way down to the ground-plane, there will be no RF ground loop left to generate any interference.



### 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 should preferably be installed. Where possible always take the ATU to the ground, not the ground to the ATU.

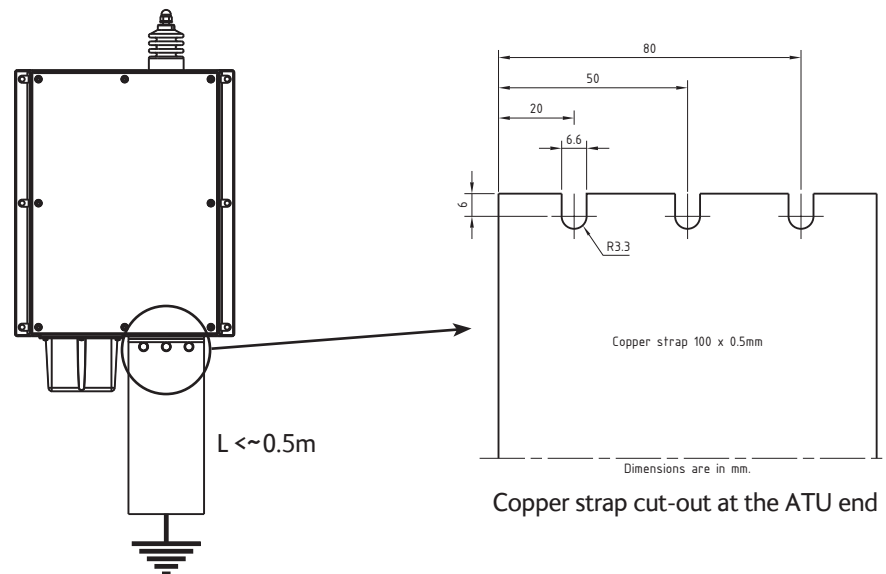
In case of a fibreglass boat, the ground-plane may well be at the hull grounding terminal. Then this will be where the antenna actually "starts" and hence where the ATU preferably should be installed.



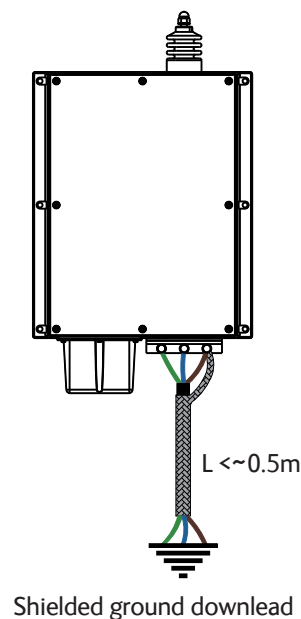
### 2.3.5 Antenna Tuning Unit

It is of the utmost importance that the ATU grounding connection provides the lowest possible RF-impedance. Losses in the ground connection will result in a decrease in radiated power which means that the range of the transmitter will be reduced.

For ATU grounding in steel ships a 100 x 0.5 mm copper strap is connected between the ground terminal at the bottom of the Antenna Tuning Unit and the Antenna Mounting Kit welded to the superstructure or, if not using the ATU Mounting Kit then to two or three ½" or M12 bolts welded to the superstructure. The length of this copper grounding strap should be kept as short as possible within app. 0.5 m in order to ensure that its RF impedance remains within reasonable limits.



In case the described copper strap material should not be readily available, a corresponding length of a 3-conductor cable of minimum 25mm<sup>2</sup> (AWG 3) stranded conductor cross sectional area may be used as illustrated below. This illustration further shows how shielding of the grounding connection to reduce RF radiation from the ground leads may be achieved, if required, by grounding the cable shield at the ATU end only.



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 to the super structure and will provide the best possible none corroding ground connection.

On ships constructed of non-conductive material such as wood or fiberglass other means of establishing a ground plane must be found, such as an external copper ground plate below the water line (e.g. a standard Dynaplate) or utilizing existing internal steel framing or e.g. connecting all accessible metal parts together and use this a ground-plane.

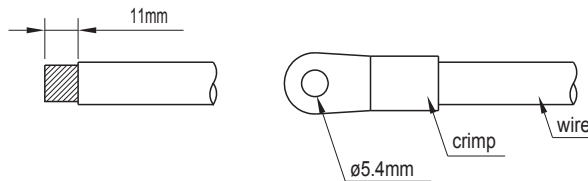
As stated in paragraph 2.3.4 it is important that ground loops be minimized by taking the ATU to the ground rather than taking the ground to the ATU. However, it should not be attempted to install the ATU indoors as this would result in a need to pass the antenna feed wiring through deck and/or bulkhead feedthroughs etc. having severe impact on the RF performance, not to mention the RF fields generated around the feed wiring causing problems in other installations and equipment.

In situations where the grounding connection of the ATU/antenna system cannot be kept within the indicated length limit, finding workable alternative means of grounding through e.g. a longer grounding connection between the ground-plane and the ATU, may require trial and error methods to be applied in order to find a workable solution. It is important here to keep in mind the initial statement of this paragraph saying that the longer the grounding connection, the higher the RF impedance of this and consequently the RF loss, resulting in less power radiated from the antenna.

It should also be noted that, as no two situations are alike, having found a workable solution for one situation this may not necessarily prove workable for another.

### 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 10mm<sup>2</sup> (AWG 7) to 16mm<sup>2</sup> (AWG 5) ground wire is connected to the ground terminal (cable clamp) at the bottom of the unit.



## 2.4 Antennas

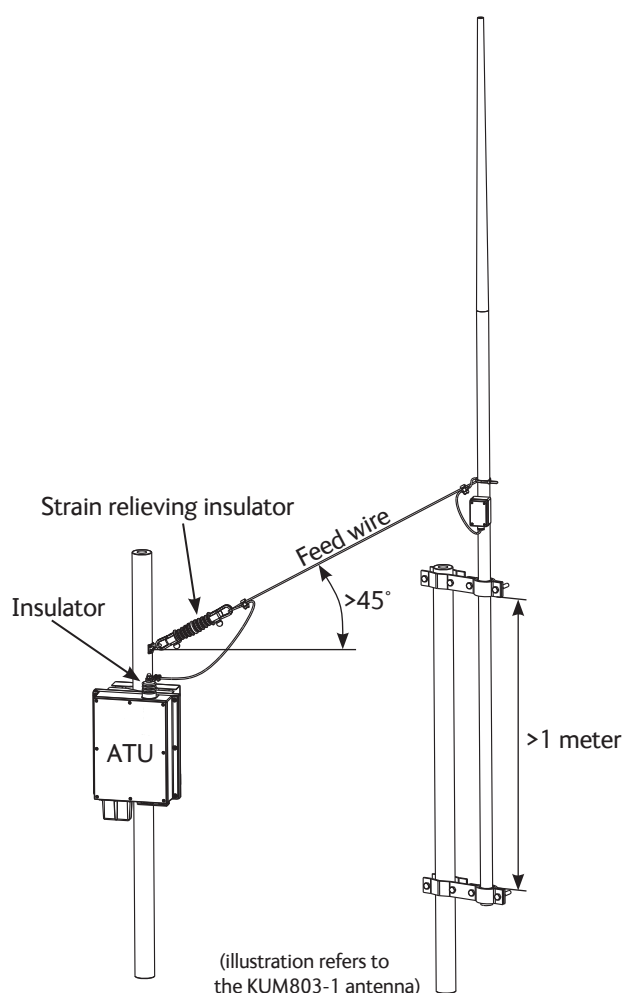
### Important

With the SAILOR 6000B-series MF/HF a two-antenna configuration is introduced which implies that SSB, DSC and Telex reception all take place using a separate RX antenna, as opposed to previous SAILOR MF/HF systems (SAILOR 6000A-, SAILOR 5000-, SAILOR 4000- and SAILOR 2000-series) in which SSB reception takes place using a common TX/RX antenna.

The fact that SSB reception in the SAILOR 6000B-series takes place using a separate RX antenna implies that the same considerations that were given to selecting the proper position of the combined RX/TX antenna in previous systems, must be given to the position of both the RX and TX antenna in a SAILOR 6000B MF/HF system installation.

### 2.4.1 Transmitter Antenna

The transmitter antenna should be erected in the open, away from conducting object such as derricks etc. which may cause reduction of the radiated power. Insulators used should be of the best type having low leakage even when wet. Stays, wires, steel masts etc. should be either effectively grounded or insulated.



The antenna should also be kept as far away as possible from electrical equipment in order to minimize noise. Electrical installations such as cable braiding (screens) and instruments in the vicinity of the antenna should be grounded 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, total electrical length down to 8 m, can be used. Where possible longer antennas should be installed to maximize the radiated power in the lower frequency bands.

In general a recommended 12 m antenna installation can be made up using an 8 m 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 45-60 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. The total antenna system should be kept well away from conductive objects such as the mast, stays, wires etc. a horizontal distance of 6-8 m should be aimed at.

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.

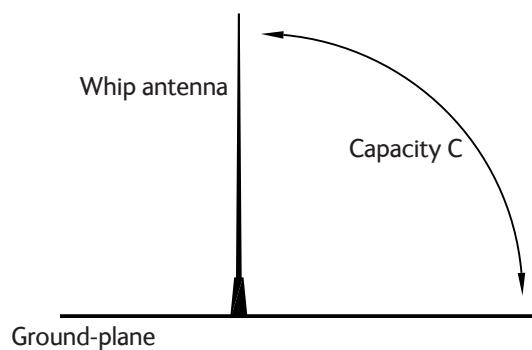
## 2.4.2 Considerations on antenna length requirements

### Antenna impedance

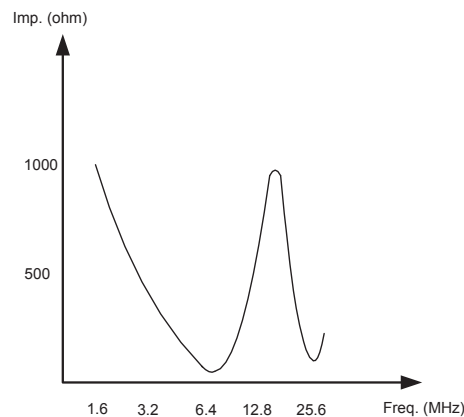
The length of the transmitting antenna used with MF/HF equipment in general and the MF/HF equipment specifically for purpose of this discussion is of utmost importance for the proper performance of the equipment, i.e. the ability to tune properly to the antenna and the effective transmission range. In 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 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 TX antenna is essential in order for this to effectively radiate power into the air. An RF transmitter connected directly to a whip antenna which is in the presence of the ground-plane, looks into an impedance between the whip antenna and the ground-plane which varies considerably with frequency and hence would cause varying load on the transmitter power amplifier.



As an illustration of the typical impedance variation versus frequency of a whip antenna refer to below figure.



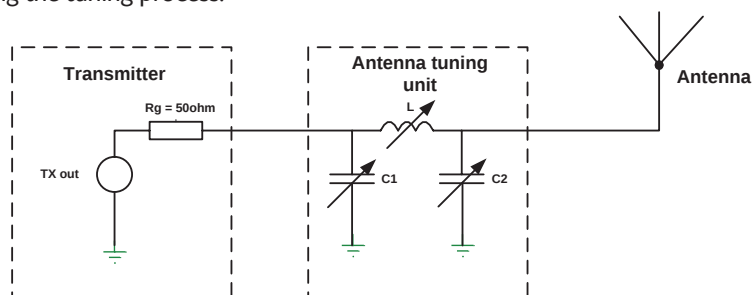
Typical impedance variation versus frequency for an 8m whip antenna with 4 m feed wire

### 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 conditions will not be met. 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 from the transmitter.

The required compensation is achieved through insertion of the correct combination of inductors and capacitors in series with the antenna to form 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 and capacitors are put in-circuit through a number of relays, all controlled by the ATU processor during the tuning process.



Schematic illustration of the insertion of ATU compensation circuitry

## MF/HF ATU

The 6000-series ATUs will easily tune to the varying impedance of an 8 m whip antenna with a properly installed 4 m feed wire, over the operating frequency range 0.15 – 30 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 6-8 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 may suffer compared to longer antenna systems of recommended electrical length 10-18 m.

## Electrical connection of transmitting antennas

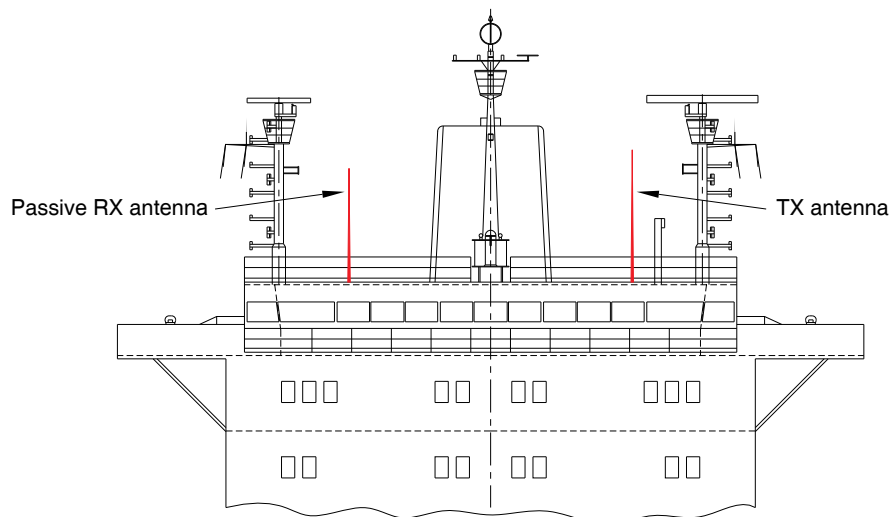
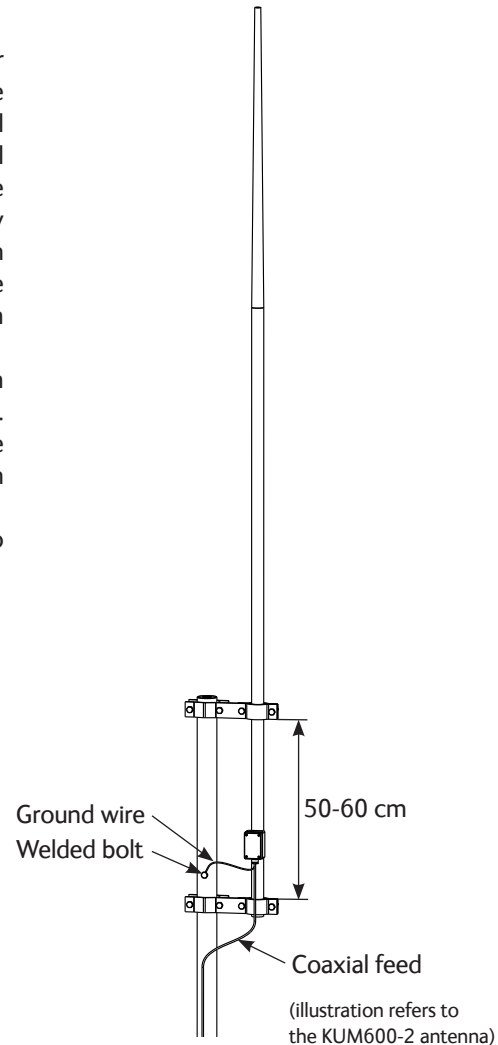
The connection to the transmitting antenna is by a single ended wire - the feed wire - connecting from the ATU insulator (see figure on page 2-12). This feed wire adds to the electrical length of the antenna (when correctly installed), thus in effect increasing the efficiency of the antenna. The longer the feed wire the better the efficiency of the antenna system consisting of transmitting antenna and the feed wire. For direct addition of feed wire length to antenna electrical length, the feed wire should be vertically installed as an extension downwards of the transmitting antenna. In practice, where the ATU is placed between the feed wire 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 with the horizontal plane. Installing the feed wire at lower angles will create capacitance to the ground-plane in turn decreasing the efficiency of the antenna.

### 2.4.3 Receiver antenna

A passive type antenna is recommended as receiver antenna. The antenna should be erected well in the clear and kept away as far as possible from electrical equipment to minimize noise interference. Electrical installations such as cable braiding and instruments in the vicinity of the antenna should be grounded effectively and the instruments in question should be fitted with noise interference suppression devices effective in the frequency range 0.1 to 30 MHz. The antenna feed-in shall be by coaxial cable.

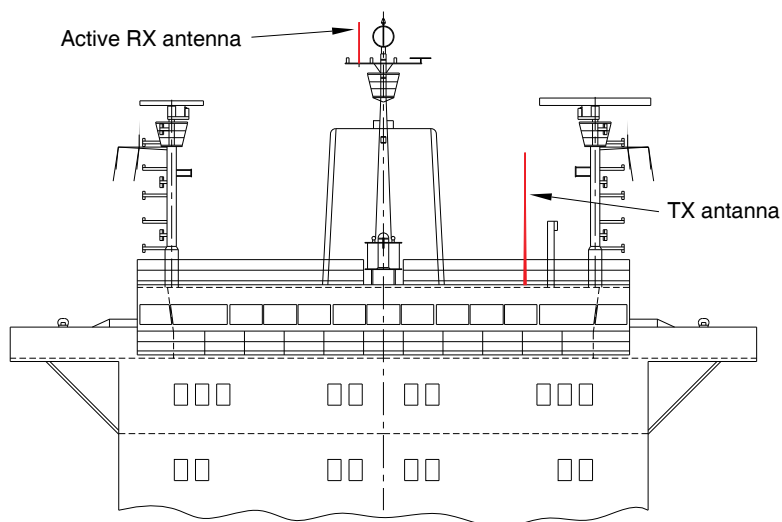
It is recommended to provide the installation with an impedance matching transformer inserted at the antenna. The matching transformer grounding cable should be as short as possible and connected to ground through welded bolt.

Recommended type of antenna is a 6 to 10 meter whip antenna.



Example of possible MF/HF antenna placements with a passive RX antenna.

In case a passive antenna for practical reasons cannot be installed, an active antenna may be used. It is however, important to emphasize that an active antenna may decrease the receiving capabilities through reduction in received signal level and receiver dynamic range. It is of utmost importance for an active receiver antenna to work properly with the MF/HF system that it be installed as high as at all possible with unobstructed horizontal view.



Example of possible MF/HF antenna placements with an active RX antenna.

#### Important

Installation of any type of receiver antenna should be completed by verifying that the receiving capability is adequate in applicable receiving modes (SSB, DSC, Telex).

In order to avoid any unnecessary decrease in receiving capabilities an active antenna used with the SAILOR 6000B MF/HF systems should meet the following main requirements:

#### Electrical requirements

|                      |                                                                                 |
|----------------------|---------------------------------------------------------------------------------|
| Operating frequency: | 0.15 – 30 MHz                                                                   |
| Output impedance:    | 50 $\Omega$                                                                     |
| Noise figure:        | below 12 dB                                                                     |
| Intermodulation:     | Reference signal 30 dB $\mu$ V/m<br>Intermodulation level above 80 dB $\mu$ V/m |

#### Mechanical requirements

Length of the antenna element: 1.0 to 1.5m

Cobham have tested and recommends the AC Antennas KUM121 as a suitable choice.

## 2.5 DC Power cabling

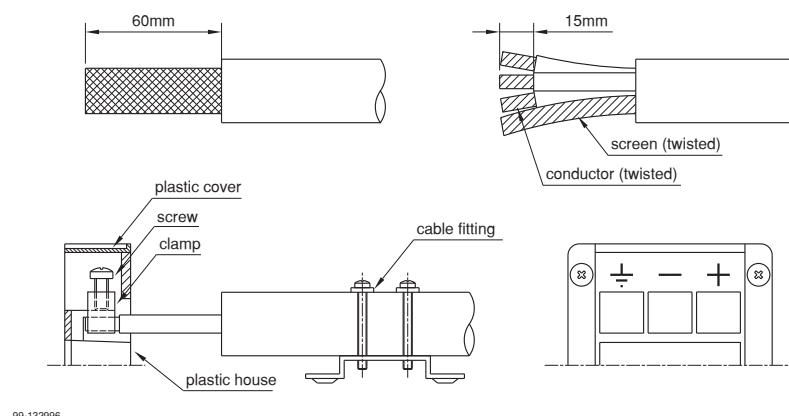
The supply leads are connected to the supply terminal of the Transceiver Unit. The supply terminal is designed for 3 wire shielded power supply cable to meet international installation and EMC requirements. The safety ground wire is connected to the terminal showing ground symbol and shielding connected 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

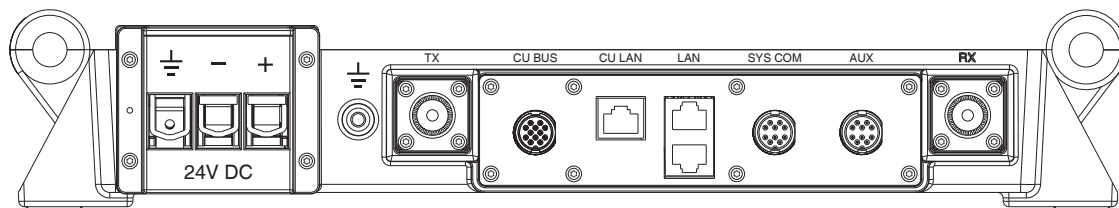
| Max. cable length to battery* | Recommended Cable Sceded multiwire | External fuses |
|-------------------------------|------------------------------------|----------------|
| 5 m                           | 3 x 10 mm <sup>2</sup> (7 AWG)     | 40 A           |
| 8 m                           | 3 x 16 mm <sup>2</sup> (5 AWG)     | 50 A           |
| 12 m                          | 3 x 25 mm <sup>2</sup> (3 AWG)     | 63 A           |

### 500 W

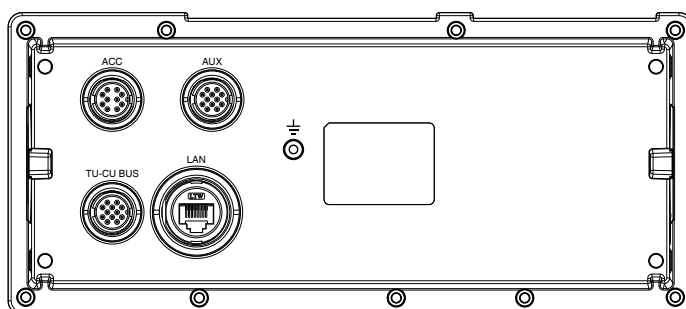
| Max. cable length to battery* | Recommended cable Sceded multiwire | External fuses |
|-------------------------------|------------------------------------|----------------|
| 4 m                           | 3 x 16 mm <sup>2</sup> (5 AWG)     | 100 A          |
| 6 m                           | 3 x 25 mm <sup>2</sup> (3 AWG)     | 100 A          |

## 2.6 Interconnection of units

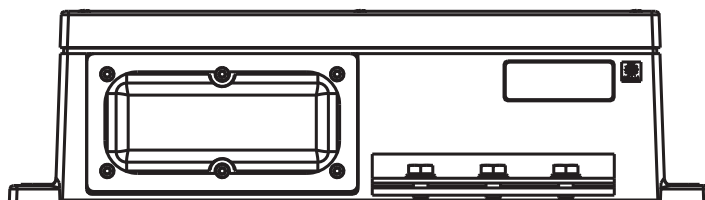
### Transceiver Unit connector panel



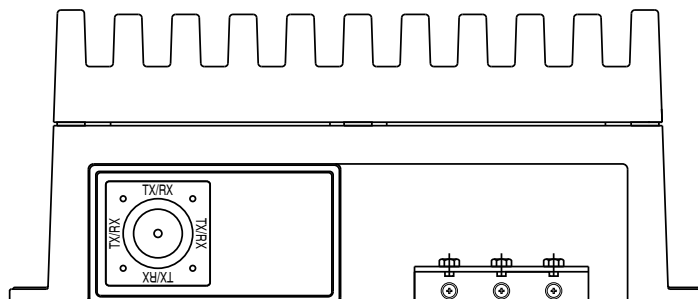
### Control Unit connector panel

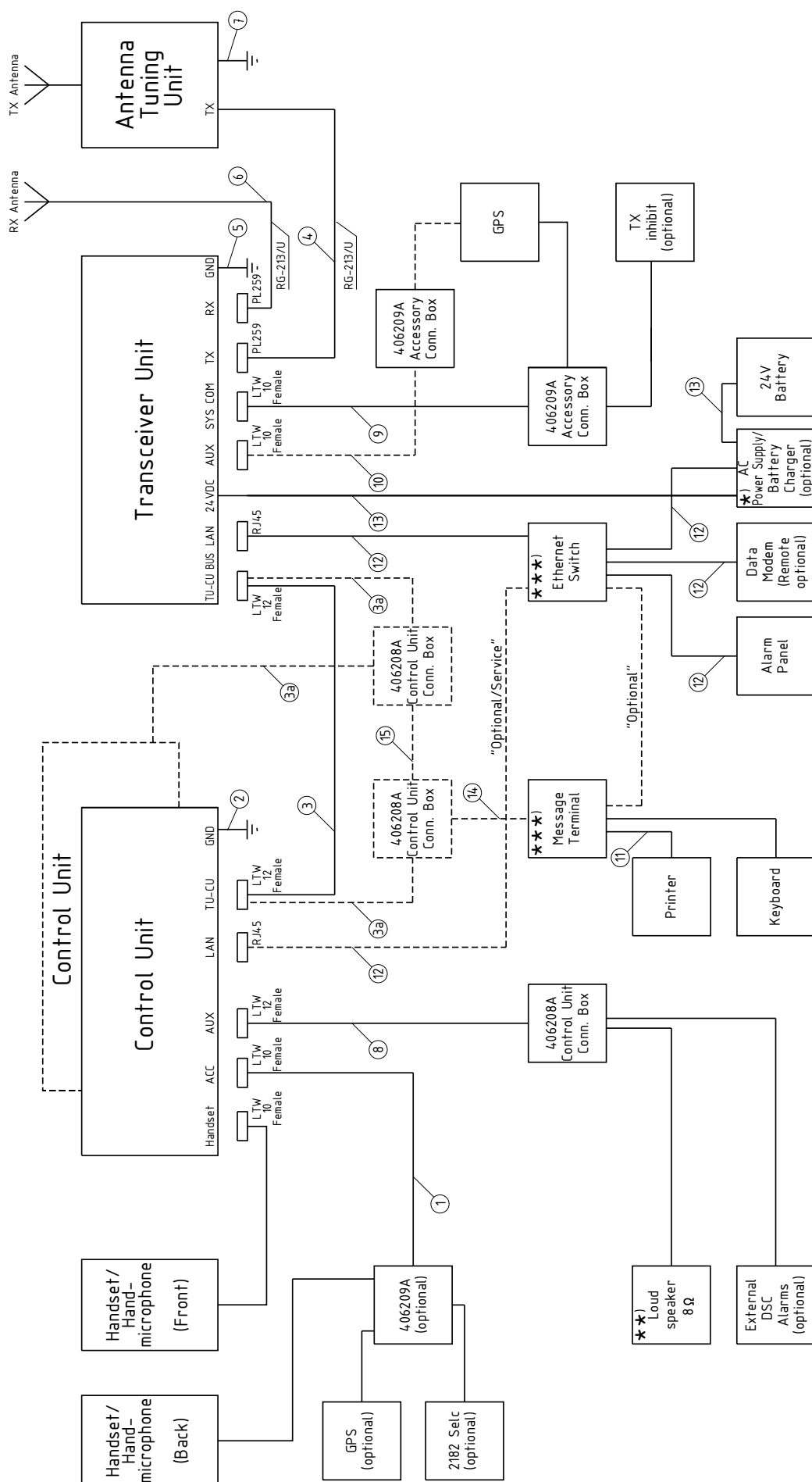


### 150 W/250 W Antenna Tuning Unit connector pane



### 500 W Antenna Tuning Unit connector panel





★) 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 mm<sup>2</sup> instead of 0.5 mm<sup>2</sup>

----- 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'<br>10 way<br>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<sup>2</sup> (AWG 13) - 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                    | Transceiver Unit                |              |             |                                                                          |        |
|---------------------------------|---------------------------------|--------------|-------------|--------------------------------------------------------------------------|--------|
| 'TU-CU<br>BUS'<br>12 way<br>LTW | 'TU-CU<br>BUS'<br>12 way<br>LTW | Twisted 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<br>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<sup>2</sup> (AWG 7)

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 25mm<sup>2</sup> (AWG 3) 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           | Designation        | Cable no. | Remarks                               | Color  |
|------------------------|--------------------|-----------|---------------------------------------|--------|
| 'AUX'<br>12 way<br>LTW |                    |           |                                       |        |
| 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<br>ALARM | 8         | + 5 V Logic Level output, when active | Yellow |
| 6                      | NC                 | 10        | No Connection                         | Grey   |
| 7                      | DISTRESS<br>ALARM  | 10        | + 5 V Logic Level 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 - SYS COM**

Cable: 10 x LTW-UL2464 26AWG

Cable-connector: 10 way (ex. LTW)

6 m cable with connector, available from eShop

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

**Cable 10: 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    | Designation | Remarks                              | Color  |
|---------------------|-------------|--------------------------------------|--------|
| 'AUX'<br>10 way LTW |             |                                      |        |
| 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+        | 1 Hz Puls input for M.O. calibration | Pink   |
| 8                   | PPS-        | 1 Hz Puls input for M.O. calibration | 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**

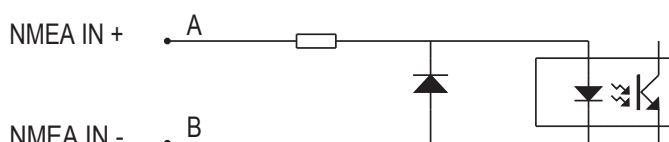
Maximum cable length 100 m  
For extended cable length, use shielded twisted pair cable 6x2x0.5mm<sup>2</sup> (AWG 20) or better  
For connection details refer to wiring table for cable 3.

## 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 or SYSCON 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:

|            |                                          |
|------------|------------------------------------------|
| <b>GLL</b> | (longitude, latitude, utc, status, mode) |
| <b>GGA</b> | (longitude, latitude, utc, quality )     |
| <b>RMC</b> | (longitude, latitude, utc, status, mode) |
| <b>GNS</b> | (longitude, latitude, utc, mode)         |
| <b>ZDA</b> | (utc, day, month, year)                  |

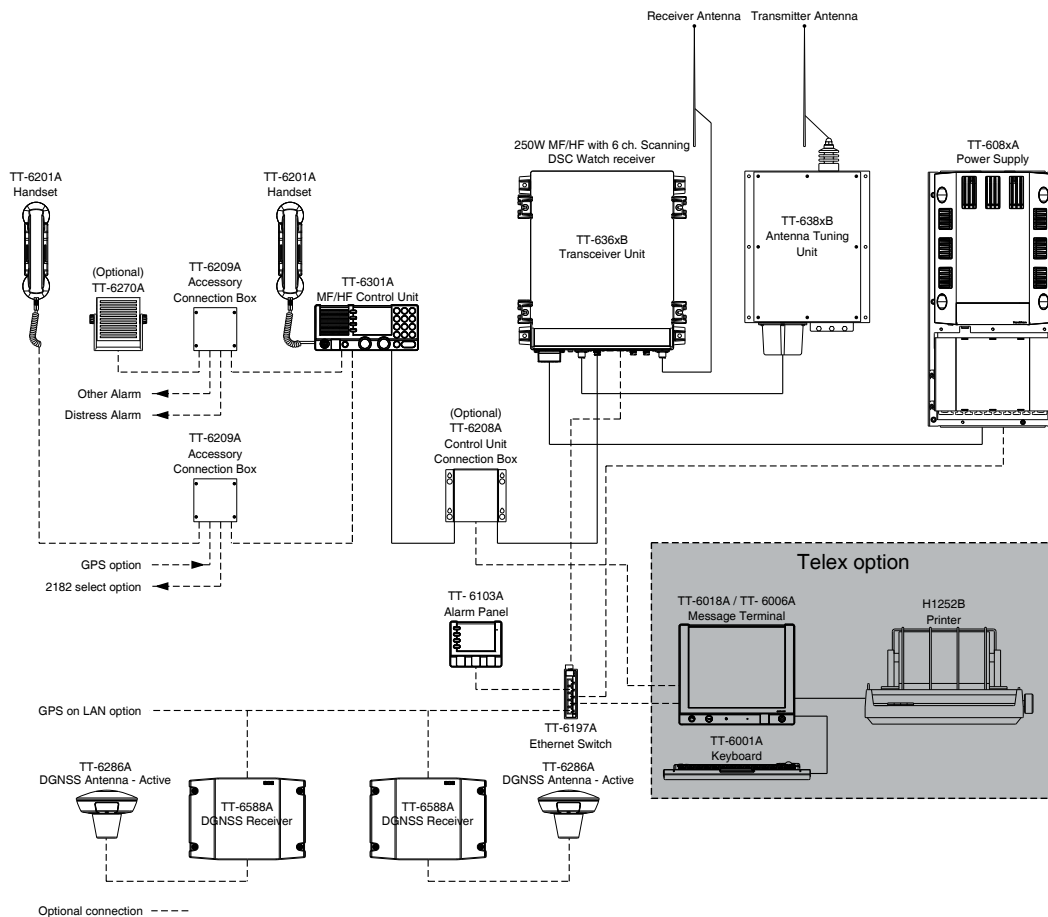
Only the mentioned fields are used - the rest are discarded.

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

## 2.8 Telex operation

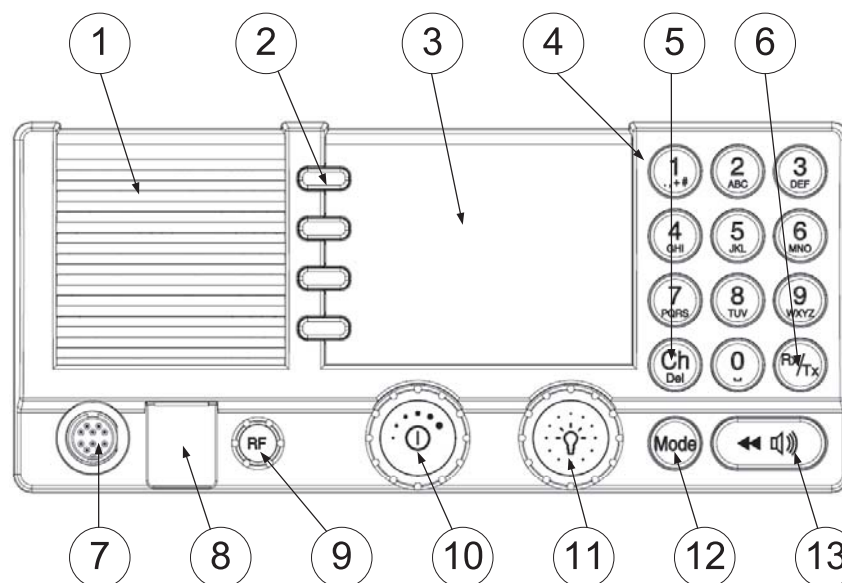
The GMDSS Radiotelex Terminal is designed in accordance with relevant IMO, ITU and ETSI recommendation/specifications and has been approved for shipboard installations to be operating within the Global Maritime Distress and Safety System.

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. Alphanumeric 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 Setup 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 Setup menu.

|               | Setup Menu       |                               |
|---------------|------------------|-------------------------------|
| Soft keys (2) | Radio setup      | Scan Hang Time                |
|               |                  | Scan Resume                   |
|               |                  | Scan Mode                     |
|               |                  | External PTT                  |
|               |                  | <b>Mute on TX INHIBIT: ON</b> |
|               |                  | <b>LSB Mode: OFF</b>          |
|               |                  | <b>ATU: Enabled</b>           |
|               |                  | <b>TX AM 2182: Disabled</b>   |
| 1 x >         | Channel Setup    | Watch Receiver                |
|               |                  | Privat Channels               |
|               |                  | DSC Watch                     |
|               |                  | <b>TX Band</b>                |
| 2 x >         | Power Supply     | Monitor: OFF                  |
| 3 x >         | DSC Setup        | 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 Logs    | Received Distress             |
|               |                  | Transmitted Calls             |
|               |                  | Received Calls                |
| 5 x >         | System Setup     | Printer Configuration         |
|               |                  | System Time & Date            |
|               |                  | Inactivity Timeout            |
|               |                  | Language                      |
|               |                  | Theme                         |
|               |                  | GPS Input                     |
|               |                  | NMEA in                       |
|               |                  | LWE Talkers                   |
|               |                  | LWE Identity                  |
|               |                  | Factory Defaults              |
|               |                  | Password                      |
|               |                  | <b>Reset MMSI no</b>          |
|               |                  | Radio Info                    |
| 6 x >         | Controller Setup | Handset 1 Vol                 |
|               |                  | Handset 2 Vol                 |
|               |                  | Wheel Lock                    |
|               |                  | High Priority                 |
|               |                  | Controller info               |

|       | Setup Menu    |                   |
|-------|---------------|-------------------|
| 7 x > | Diagnostics   | Log               |
|       |               | Self Test         |
|       |               | ATU Status        |
| 8 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 Setup Menu:

| Operation      | Key | Operation | Function          |
|----------------|-----|-----------|-------------------|
| Press          | 2   | 2 x More  |                   |
|                | 2   | Setup     |                   |
|                | 2   | 5 x >     | System Setup      |
| 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 6018/6006 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 6018/6006 Message Terminal when TLX mode is selected.

5 digit TLX call code and answerback is programmed on screen via the SAILOR 6018/6006 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 6000B 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   | Setup     |                        |
|                | 2   | 3 x >     | Controller Setup       |
| 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  $\Omega$  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   | Setup     |                |
|                | 2   | 3 x >     | DSC Setup      |
| 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   | Setup     |                       |
|                | 2   | 5 x >     | System Setup          |
| Scroll down to | 11  | Rotate    | Printer configuration |
| Select         | 11  | Press     |                       |

## 2.11.5 DSC self test

| Menu   | Key | Operation     | Function |
|--------|-----|---------------|----------|
| 3 x >  | 2   | DSC setup     |          |
| 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   | Setup     |                                                |
|                | 2   | 5 x >     | System Setup                                   |
| Scroll down to | 11  | Rotate    | Factory Default                                |
| Press          | 11  | Select    | Continue Factory Reset                         |
| Select         | 2   | Yes / No  | Factory Resetting<br>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 Setup menu:

| Operation               | Key | Operation  | Function             |
|-------------------------|-----|------------|----------------------|
| Press                   | 2   | 2 x More   |                      |
|                         | 2   | Setup      |                      |
|                         | 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](http://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   | Setup     |                  |
|           | 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   | Setup             |                  |
|                    | 2   | 1 x >             | Channel Setup    |
| Scroll down        | 11  | Rotate            | TX-Band          |
| Select             | 11  | Press             |                  |
| Press              | 2   | Add               | New band         |
| Key In Band limits | 4   | 1605,0<br>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   | Setup     |                |
|           | 2   | 1 x >     | Channel Setup  |
| 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.

### 2.11.14 TX Inhibit

TX Inhibit is controlled by the TX\_INHIBIT pin in the SYS CON connector. This feature will inhibit all transmission while activated.

If “Mute on TX INHIBIT” is enabled, (See 2.9.2 Setup menu) received audio will be muted when TX\_INHIBIT is active.

## 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 employed. 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.

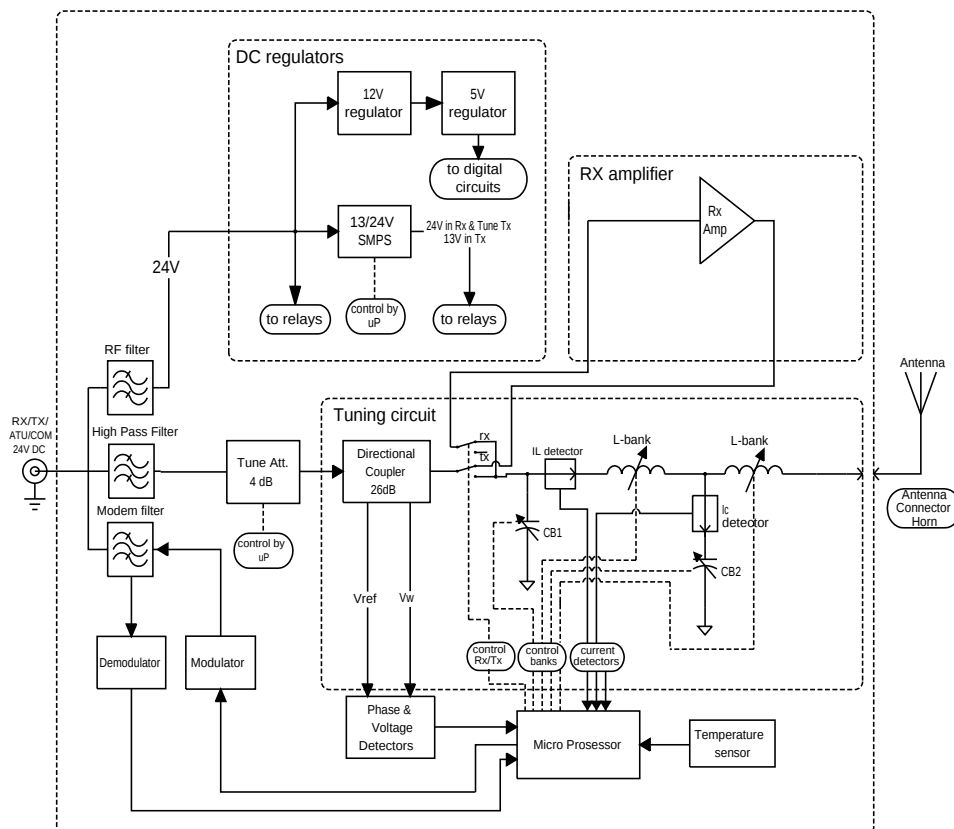
### 3.10 Antenna Tuning Unit

### 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.

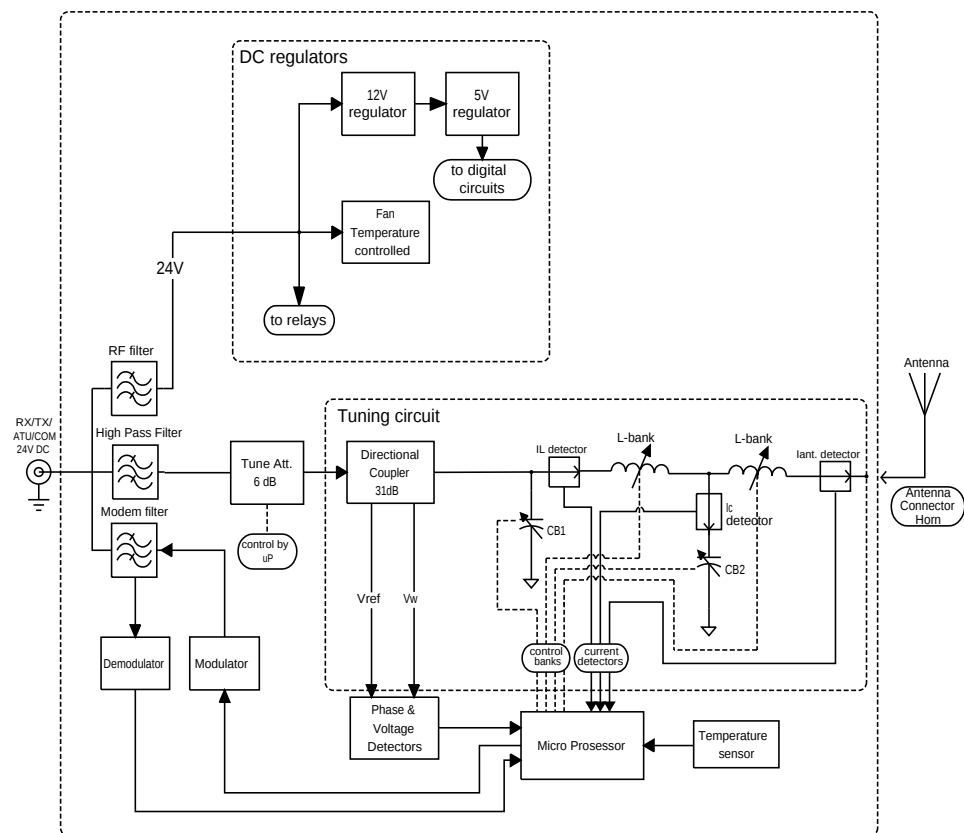
## Block diagram



### 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



### 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

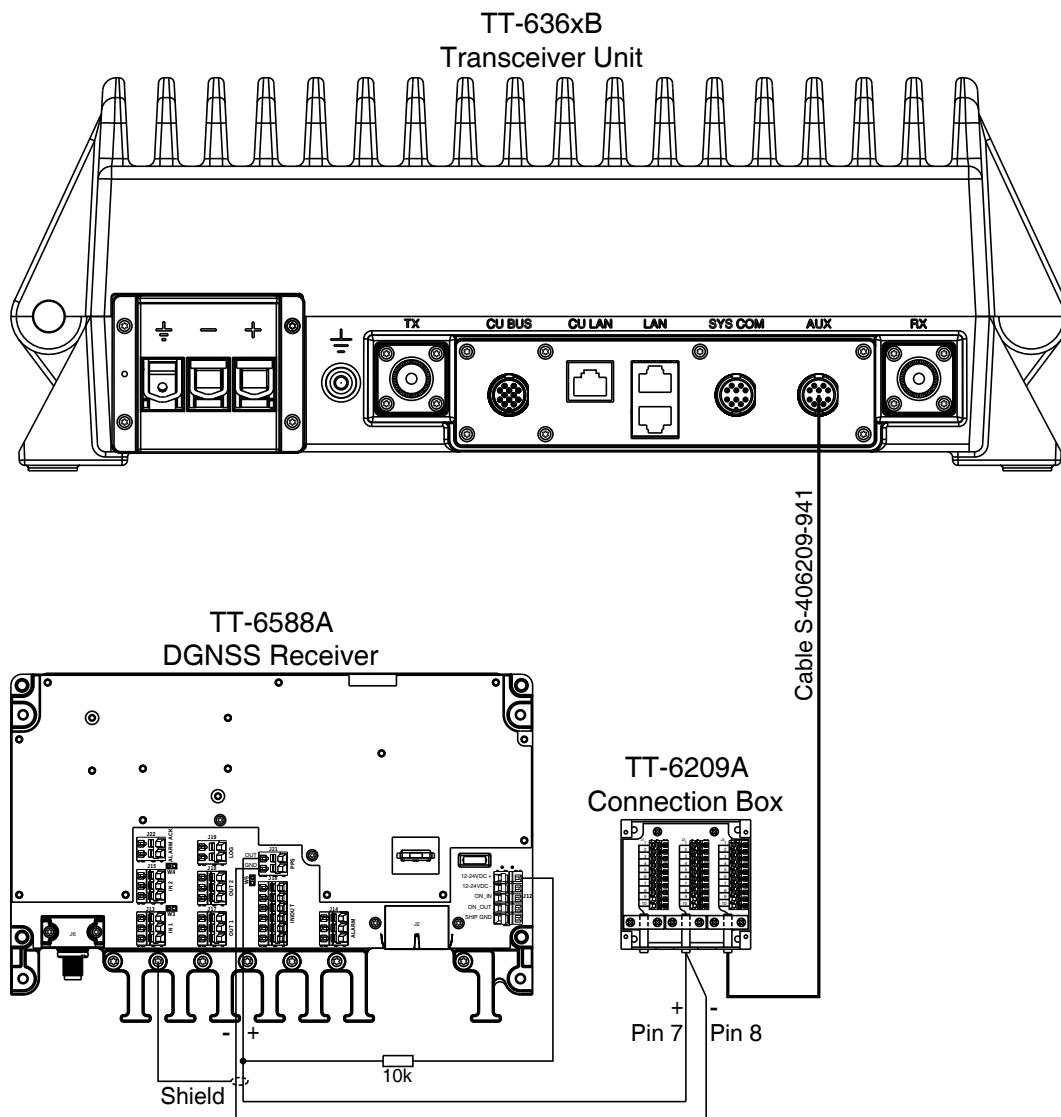
Due to the modern design of the transceiver preventive maintenance can be reduced to a minimum provided the equipment is correctly installed. To ensure maximum performance and minimum repair trouble we recommend following the below stated items for preventive maintenance:

1. The condition of the GMDSS Reserve source battery/batteries 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 fresh 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.
6. Due to aging it is necessary to calibrate the oscillator after each 3 years of operation as described in section 4.2. Calibration shall be performed by a qualified technician with the necessary equipment at disposal.

## 4.2 Calibrating the master oscillator

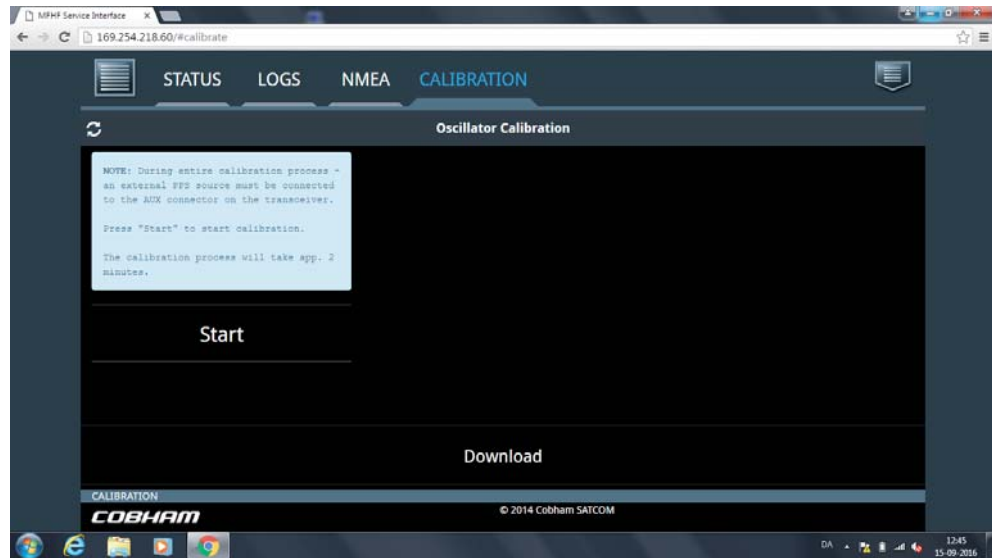
Calibration of the Master Oscillator is achieved by means of a PPS (Pulse Per second) signal generated by e.g. a (D)GNSS position sensor like the TT-6588A (D)GNSS Receiver.

1. The equipment ambient temperature shall be within 20° to 30° Celcius.
2. The TU must be powered up and left idle for 30 minutes prior to calibration.
3. Connect the PPS (Pulse Per second) signal from the (D)GNSS Receiver to the TU AUX-conconnector pins 7 (+) and 8 (-) as indicated in the AUX termination table for Cable 10, page 2-21.  
To access the TU AUX connector use cable p/n S-406209-941. Should the cable need be extended the TT-6209A Connection Box may be used as shown in below drawing.  
If the TT-6288A (D)GNSS receiver is used for sourcing the PPS signal, connect a 10k pull up resistor between the (D)GNSS Receiver positive supply input (+) and J21 Out terminal.



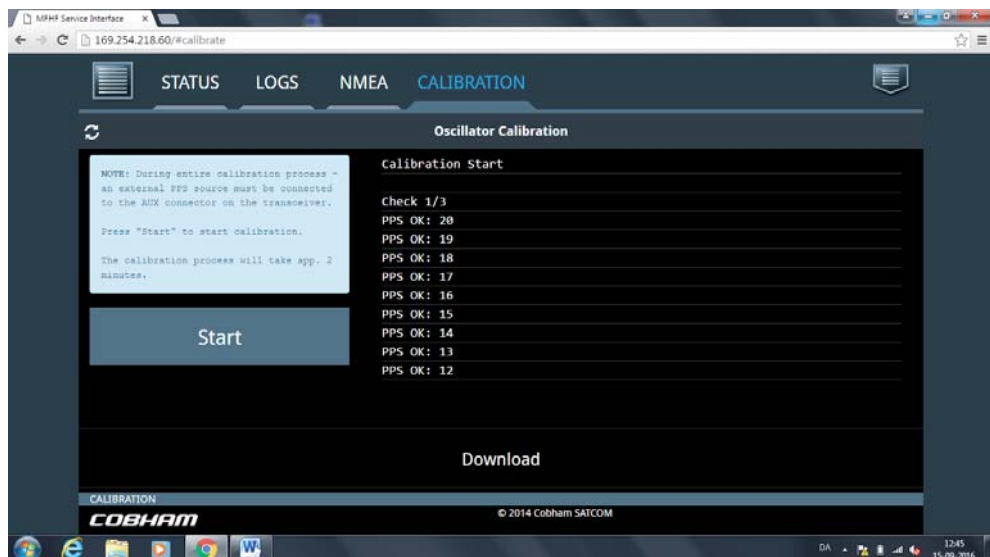
4. Connect service PC to TU using Ethernet connection and Firefox browser to activate the TU WEB Service Interface. Refer to User manual SAILOR 6000B MF/HF Service Interface (Doc. 97-147768 ), available for download at Cobham SYNC.
5. Select Calibration tab and press 'Start' to initiate calibration process.

6.

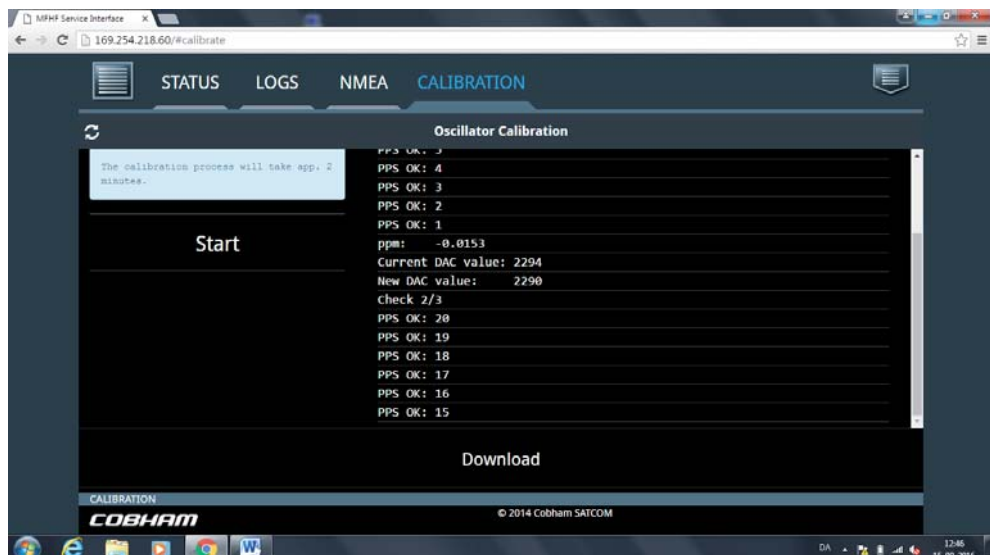


7. The service Interface will perform 3 consecutive calibrations each in 20 steps. The calibration progress will be indicated on the screen.

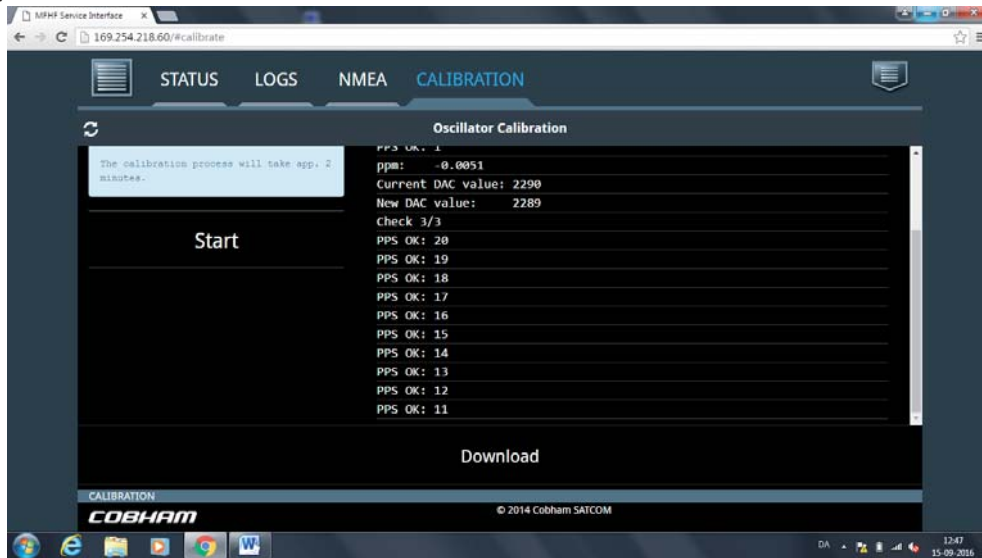
8.



9.

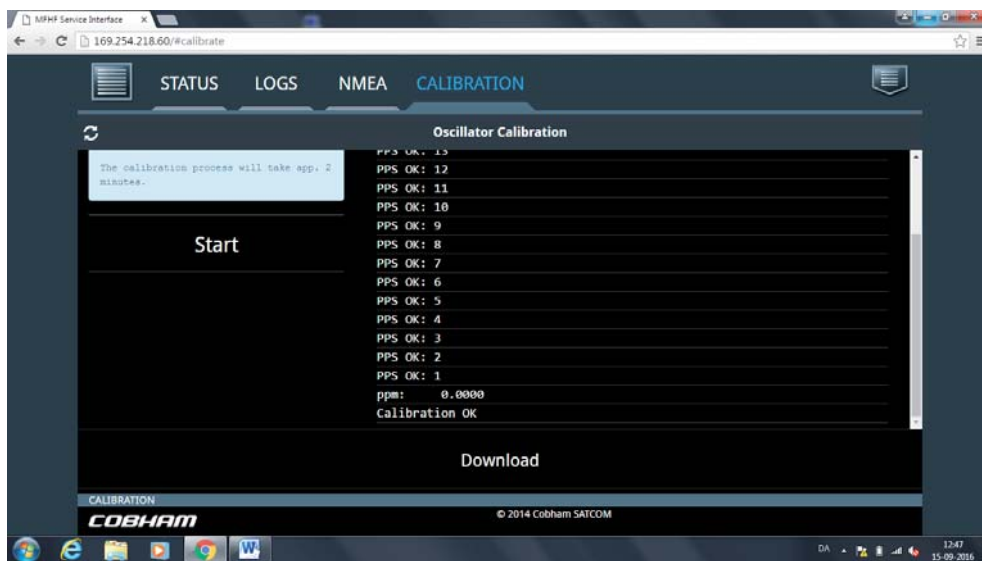


10.



11. The calibration process should result in a final ppm value to lie within  $\pm 0.030$  and the Service Interface indicate "Calibration OK". However, if the final ppm-value lies outside the  $\pm 0.030$  limit the calibration attempt is ignored automatically and the original calibration value restored. The Service Interface will indicate "Calibration failed".

To restore correct frequency accuracy of the transceiver the Exciter Control Module should be replaced.

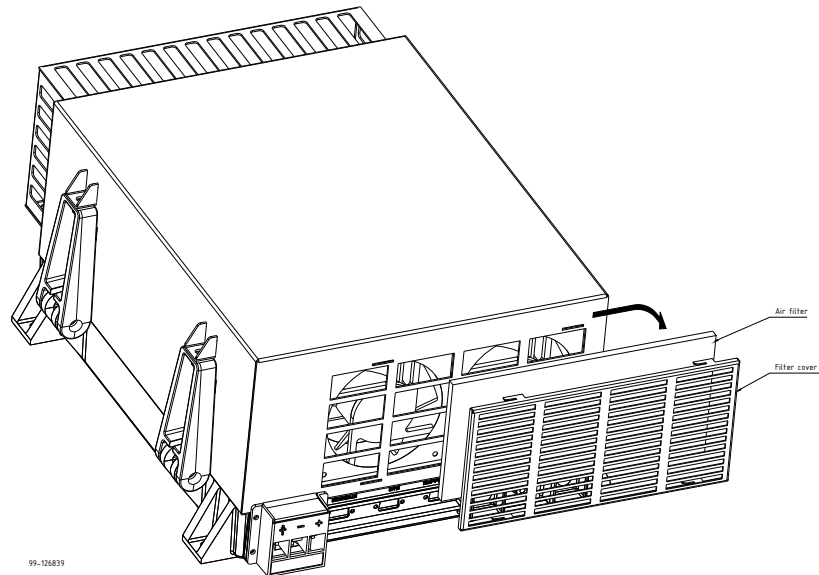


12. Power down the radio system, disconnect the service PC and the AUX interface cable (PPS source connection).

## 4.3 Cleaning the Air filter (500 W Transceiver 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 bottom 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.



## 4.4 System test and verification

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

## 4.5 Software update

For software upload refer to User manual SAILOR 6000B MF/HF Service Interface (Doc. 97-147768 ), available for download at the Cobham SYNC partner portal.

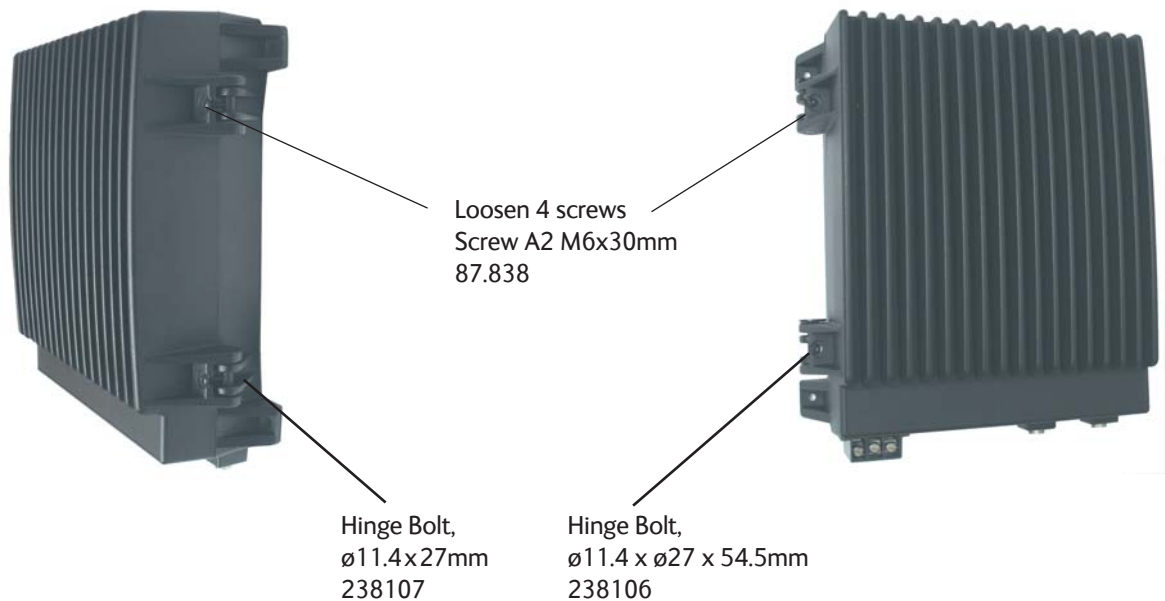
Latest software for CU and TU is available for download also from the Cobham SYNC partner portal.



# Spare part exchange

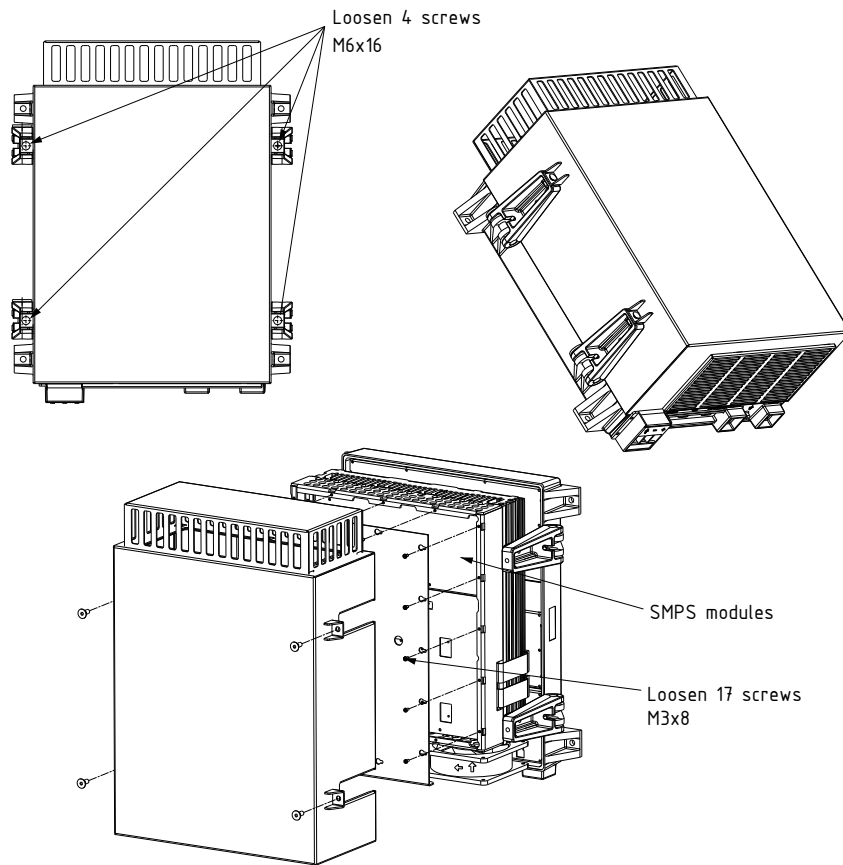
## 5.1 Disassembling the Transceiver Init (150 W/250 W)

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.



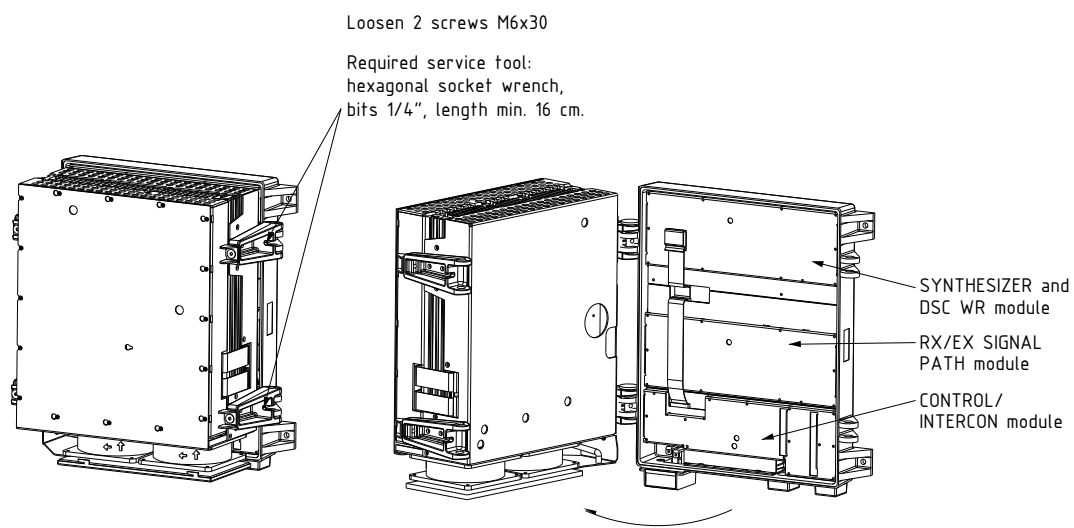
## 5.2 Disassembling the Transceiver Unit (500 W)

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.



99-126728

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

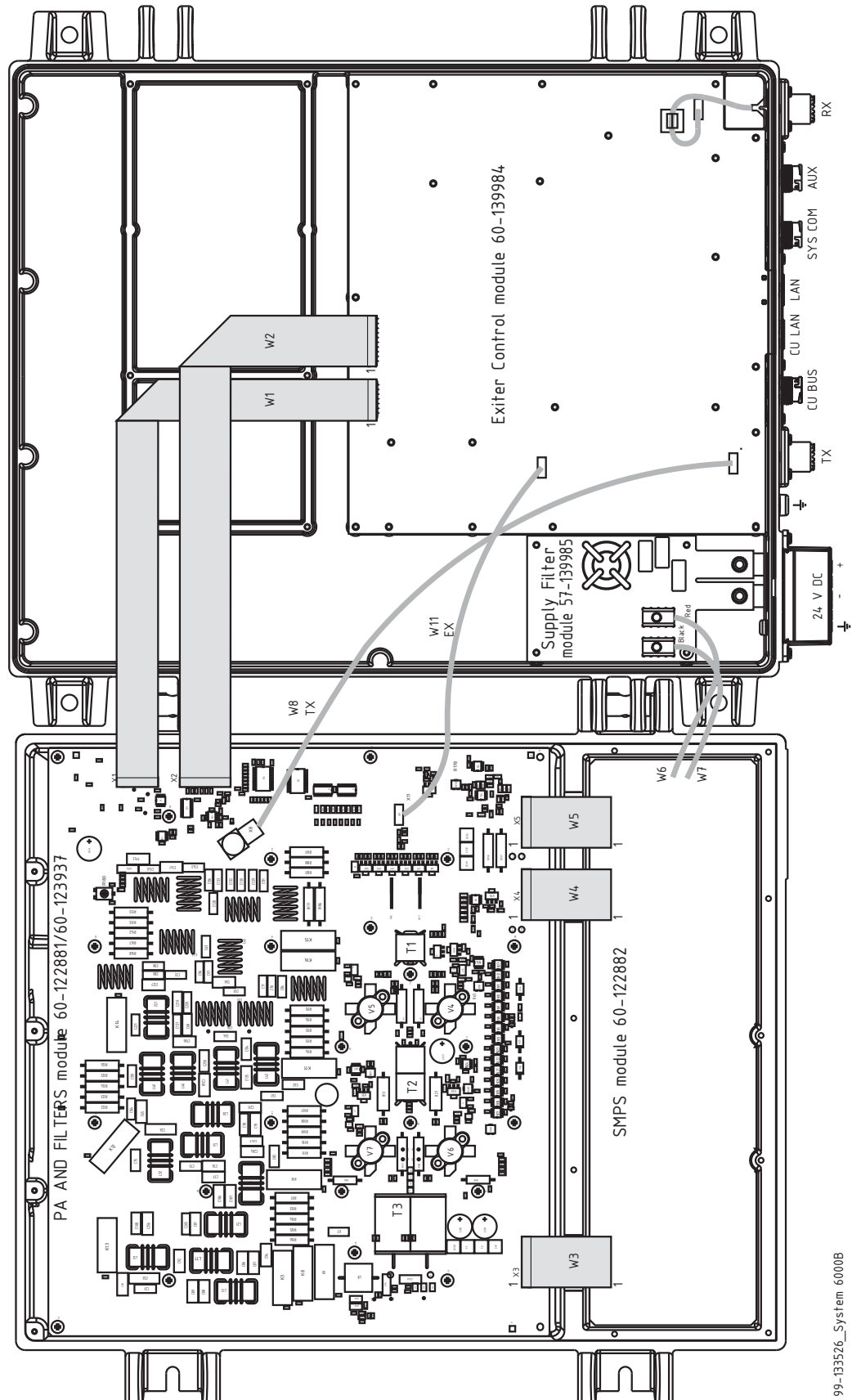


99-126886

## 5.3 Transceiver Unit module location

### 150 W/250 W Transceiver Unit

The following modules are available as service parts.

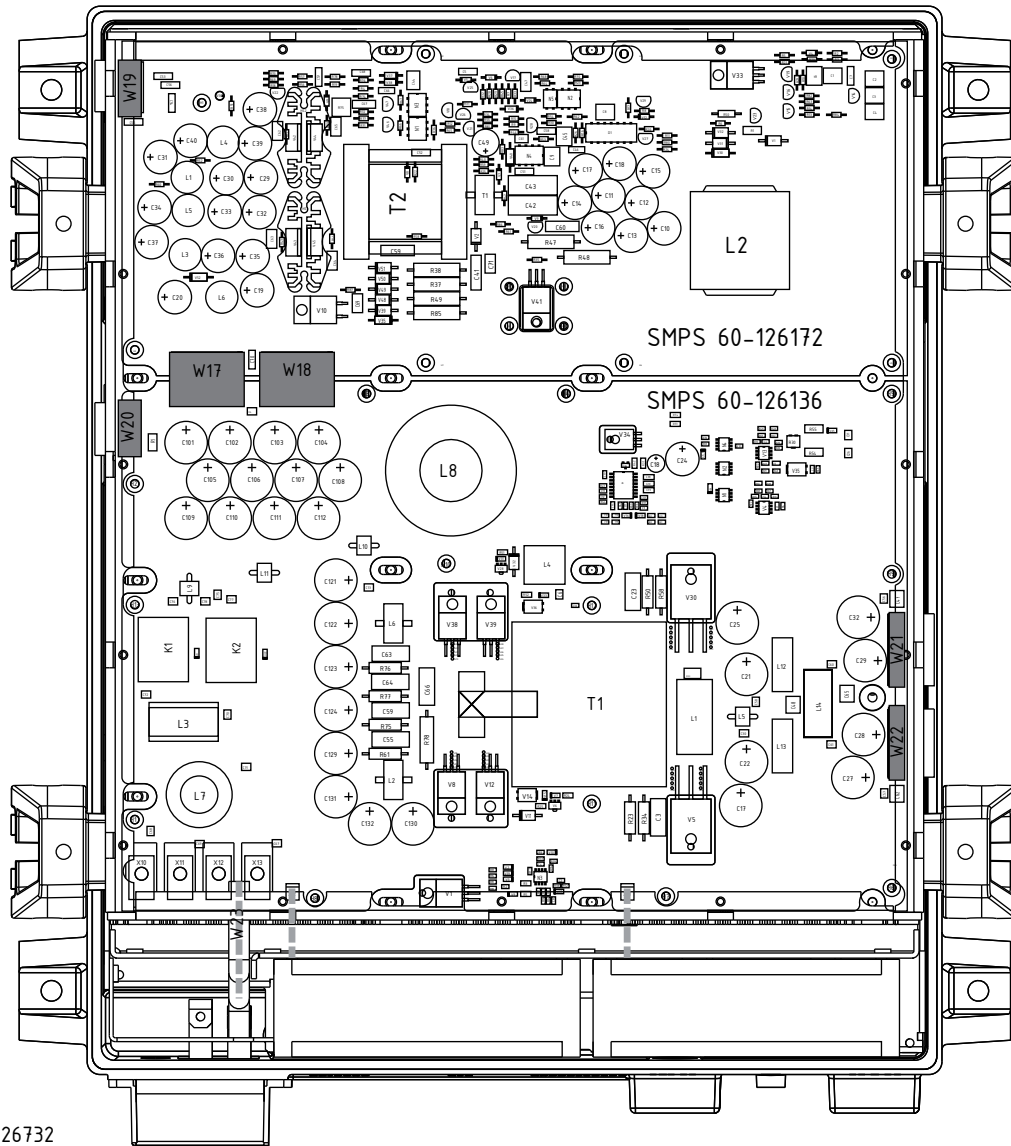


99-133526\_System 6000B

Spare part exchange

## 500 W Transceiver Unit

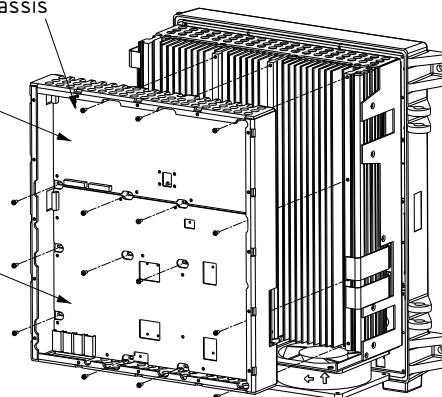
The modules and internal cables illustrated in the following pages are available as spare parts, some as individual parts and others as part of a subassembly or a set. For identification of parts and part numbers refer to the eShop at the Thrane & Thrane Extranet.”



Loosen 15 screws M3x8  
to remove SMPS chassis

Internal SMPS

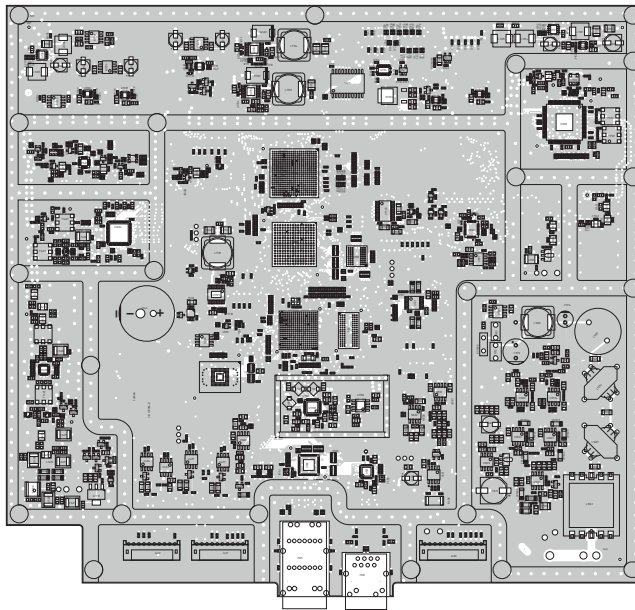
PA SMPS



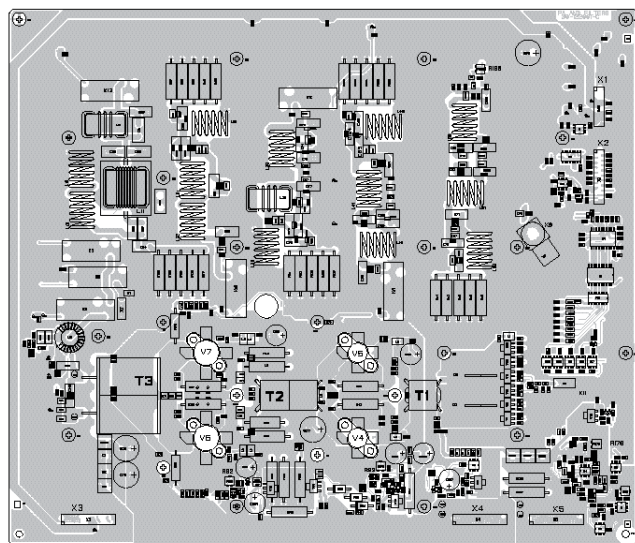
99-126896

## 5.4 Module overview

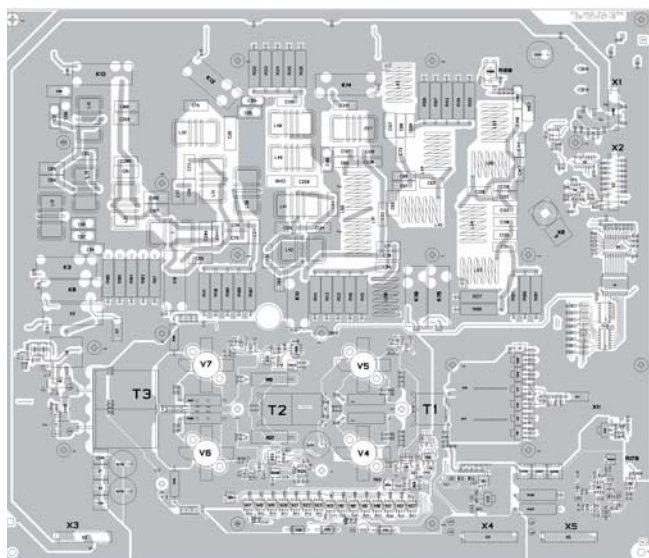
### Exciter Control module 60-139984



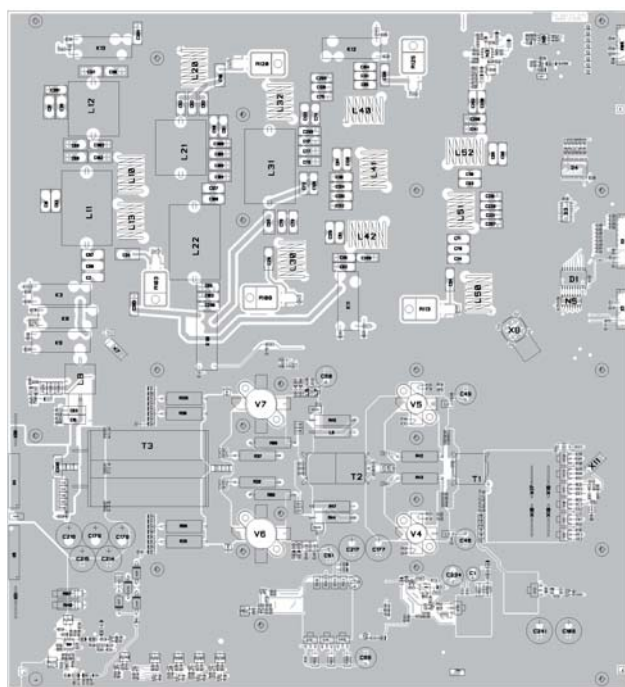
### PA and filters module 60-122881 (150 W/250 W)



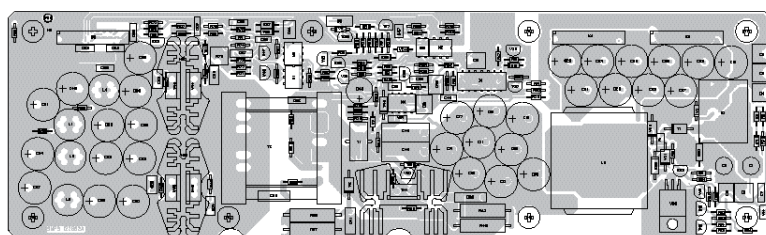
### PA and filters module 60-123937 (FCC)

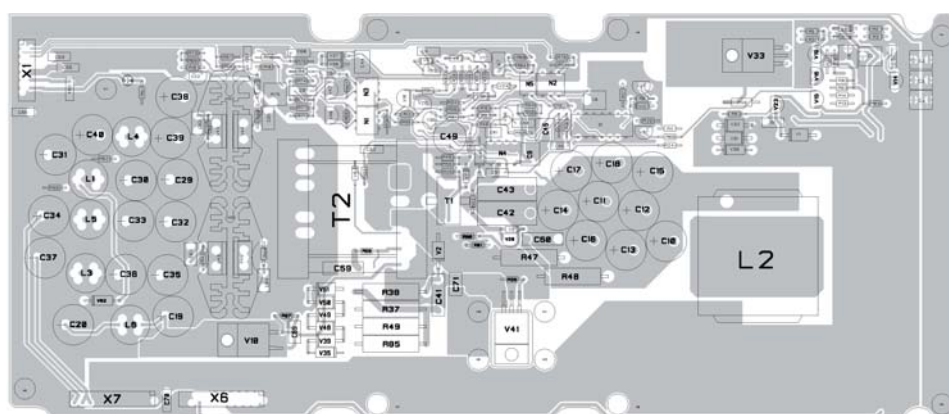
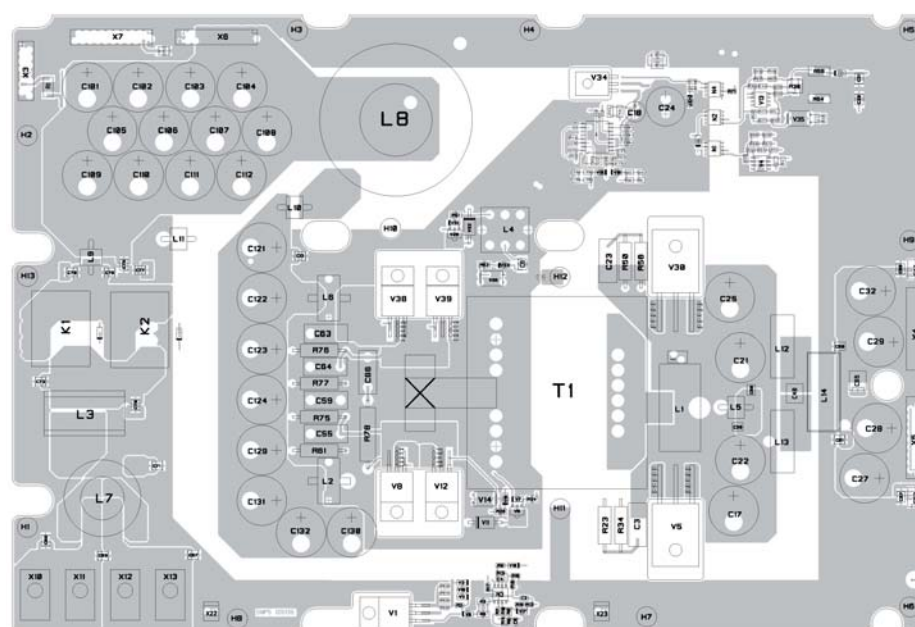


### PA and filters module 60-125886 (500 W)



### 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:  
For shield cover, print and cables:

Slotted screwdriver  
Torx screwdriver T10

### 500 W

For disassembling transceiver unit:  
For transceiver modules and cables:

Hexagonal socket wrench 1/4" length min.16 cm  
Torx screwdriver T10  
Slotted screwdriver  
Spanner for M5 nut

## 5.6 Accessory list

| Item                                                          | Part no.      |
|---------------------------------------------------------------|---------------|
| SAILOR 6301 Control Unit Class A                              | 406301A-00500 |
| 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 6018 Message Terminal                                  | 406018A-00500 |
| SAILOR 6006 Message Terminal                                  | 406006A-00500 |
| SAILOR 6001 Keyboard for Message Terminal                     | 406001A-00500 |
| SAILOR 6103 Multi Alarm Panel                                 | 406103A-00500 |
| SAILOR 6080 Power Supply                                      | 406080A-00500 |
| SAILOR 6081 Power Supply & Charger                            | 406081A-00500 |
| SAILOR 6197 Ethernet Switch                                   | 406197A-00500 |
| SAILOR 6208 Control Unit Connection Box                       | 406208A       |
| SAILOR 6209 Accessory Connection Box                          | 406209A       |
| SAILOR 6270 External 8W Loudspeaker                           | 406270A       |
| SAILOR 6588 DGNSS Receiver                                    | 406588A-00500 |
| SAILOR 6286 DGNSS Antenna - Active                            | 406286A-00500 |
| 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



