TT-3020C/TT-3022D

Maritime/Fisheries Capsat Transceiver

for the
Inmarsat-C Network

Technical Reference Manual

Version A

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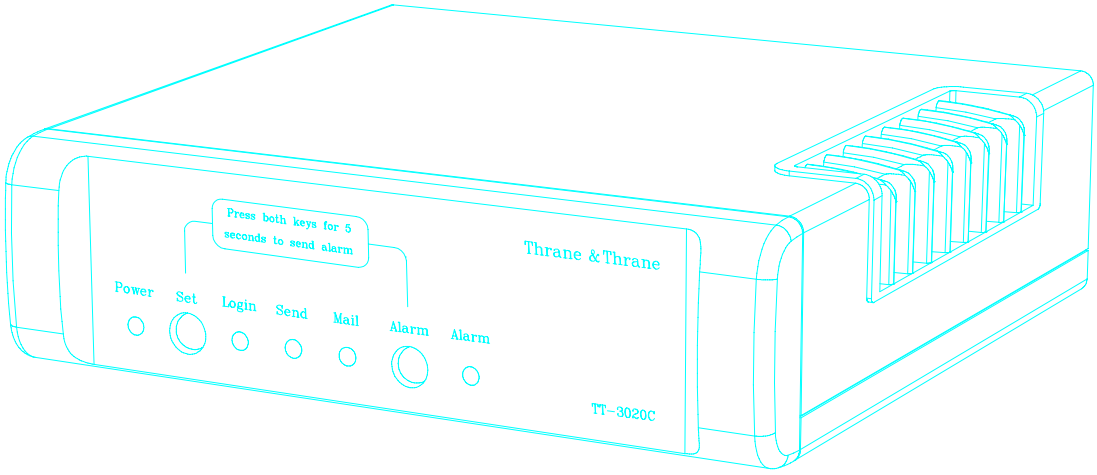
Table of Contents

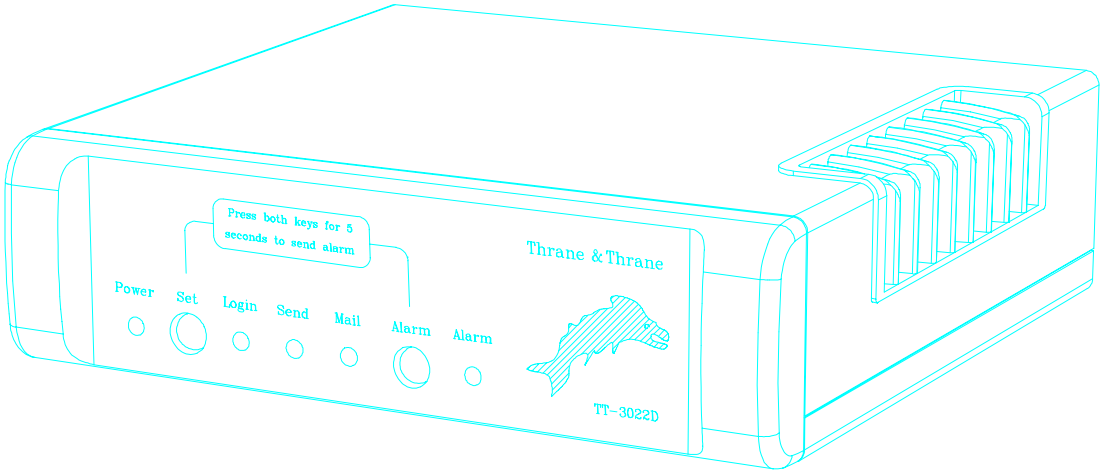
1. Introduction

This manual explains some of the details of a model TT-3020C Maritime/TT-3022D Fisheries Capsat Transceiver and provides instructions for using non-standard equipment together with the Transceiver. Instructions about servicing and testing the Transceiver is also provided in this manual.

The only difference between the TT-3020C Maritime Capsat Transceiver and the TT-3022D Fisheries Capsat Transceiver is the Transceiver software and the layout of the frontpanel.

For instructions about installing, configuring and testing a TT-3000 Integrated Capsat System please refer to the TT-3020C or TT-3022D Capsat Transceiver Installation Manual.




Press both keys for 5 seconds to send alarm
Power
Set
Login
Send
Mail
Alarm
Alarm
Thrane & Thrane
TT-3022D

2. Maritime facilities

2.1 Scanning and Login

Scanning and login must be manually started by the user.

The Bulletin Board Error Rate is an indication of the satellite link quality. If the BBER exceeds 80% of the last hundred received bulletin board packets an alarm will be indicated on the message terminal and on the TT-3042C Alarm/Distress Box. This advises the operator to initiate a manual scan of NCS Common Channels.

2.2 Distress

The Maritime Transceiver can send a distress to an LES by pressing the TT-3020C/TT-3022D **Set** and **Alarm** frontpanel buttons or by pressing the Alarm button on the TT-3042C Alarm/Distress Box. The Transceiver will now send an unspecified distress.

2.3 Link Test

A manual distress alert test is possible.

The Maritime/Fisheries Transceiver will ask the user during a Link Test (Performance Verification Test) to manually send a **test** distress alert.

If the request is ignored the Transceiver will automatically send the Distress Test after 2 minutes.

2.4 Message transmission

The Maritime/Fisheries Transceiver will allow you to send your text messages with distress priority in case of an emergency. Such messages will be routed to a default destination that is pre-programmed in the LES. This destination is normally the Search And Rescue (SAR) authority in the country where the LES is located.

2.5 EGC message reception

In the TT-3020C the EGC System and SafetyNet calls can not be turned off.

In the TT-3022D the EGC System and SafetyNet calls can be turned off.

3. System Generation

3.1 Alteration of the System Parameters

Alteration of the TT-3020C/TT-3022D Capsat Transceiver parameters may be accomplished by means of:

- ✧ TT-3606A Message Terminal.
- ✧ IBM compatible PC running DOS version 2.00 or later, with a communication software or the Message Terminal emulating software TT-10202 ver 3.00 or later.
- ✧ Computerised equipment.
- ✧ Handheld terminals, etc.

Please follow the below listed guide lines to set up the connected equipment in a direct terminal emulating manner.

In terminal emulation mode a ':' prompt appears. Commands are entered after the prompt. The commands are executed by pressing the <CR> key.

3.1.1 TT-3606A Message Terminal

Enter the terminal emulation mode by selecting:

OPTIONS - CONFIGURATION - TERMINAL

3.1.2 IBM Compatible PC

Enter the terminal emulation mode in the TT-10202 A/B software by selecting:

OPTIONS - CONFIGURATION - TERMINAL

3.1.3 Computerised equipment/handheld terminals

Your computer/terminal should display the ASCII characters as they appear being send from the TT-3020C/TT-3022D Capsat Transceiver.

No alphabet or protocol conversion should take place.

3.2 Entering your mobile number

For ease of operation and general information when you operate your Capsat system, you should consider to enter the mobile number.

Just type in the Inmarsat-C 9 digit number that you have received from your PTT authorities.

The Mobile Number in the Transceiver is entered using the 'set - u' command:

```
:set -u ?<CR>
Mobile Number    :492380049
Enter new number >
```

An Inmarsat-C mobile number is always in the range:

400000000 to 499999999

If you type a number outside this range the Transceiver will ignore it.

You should not attempt to use your equipment before you have received a mobile number.

The Transceiver only uses the mobile number when sending Message Position Reports (see the *Message Handling Software Operators Guide*), to indicate which Transceiver originated the position message.

3.3 Initialise System Parameters

This option will set most parameters in the non-volatile Flash-memory to their default values.

It should only be used in case the contents of the non-volatile memory has been destroyed, or a new Transceiver is to be used for the very first time.

The System Parameters is initialised using the 'set -b' command:

```
:set - b<CR>
```

After issuing this command the following menu appears with a number of initialisation options.

```
Init system parameters menu
  0 Quit
  1 All
  2 Basic system parameters
  3 EGC Network ID's
  4 Data Network ID's
  5 LES Network Table
  6 Link Test Results
Enter number >
```

If the equipment has never been used before you should select option 1: All parameters. If you have used the equipment previously with Data Reporting or EGC FleetNet you should select option 2: Basic system parameters, to avoid erasing the information these services uses. You will receive a warning reminder on the screen when select an option that erases these data.

A Yes/No prompt now appears. Hit the 'Y' key to start the process, or 'N' to abort.

Never leave the init system parameters menu by turning off the Transceiver or pressing the ESC key. Choose the (0) Quit command for leaving the menu, otherwise all your new settings will be lost.

4. Optional GPS

4.1 Introduction to the GPS System

The Global Positioning System (GPS) is based on 21 satellites (plus 3 spares) orbiting at an altitude of 10,900 nautical miles (20,183 km) with an orbital period of 12 hours, which will ensure that at least four satellites will be visible from any point on earth.

Each satellite transmits a unique C/A code on the same frequency. The C/A code (Course/Acquisition) is a sequence of 1023 pseudo-random binary numbers.

Every satellite starts its transmission of the C/A code at the exactly same time (the timing is accomplished by the satellites atomic clock). The GPS receiver knows the C/A code for each satellite and by comparing the received signal with the C/A code of the satellite it is currently tracking it can determine the time delay between the two.

If we assume the GPS receiver has an accurate clock (atomic) it can synchronise its C/A code for the satellite it is tracking to start at the same time as the satellite starts the C/A code transmission. The time delay between the two codes will then equal the time it takes the electromagnetic wave to travel from the satellite to the GPS receiver, multiplying this with the speed of light will give us the distance to the satellite. This measurement is called *satellite ranging.*

The GPS receiver also needs to know the position of the satellite it is tracking. The GPS receiver has an "almanac" where all the satellites orbital parameters are stored. The "almanac" is frequently transmitted by all satellites so the GPS receiver has access to the newest. In addition to this each satellite will transmit minor corrections to its orbital parameters, the Ephemeris parameters.

The GPS receiver can establish its position by making a satellite ranging measurement to three different satellites. The GPS receiver does not as we assumed have an atomic clock

as reference, and therefore it will need a satellite ranging measurement to a fourth satellite in order to synchronise its internal clock with the atomic clocks on the satellites.

To summarise the GPS receiver must make satellite ranging measurements to four different satellites before it can determine its position and the time. This navigation solution is called a 3-D solution.

Time and position can also be determined by the GPS module with only three different satellites using the last computed altitude. This navigation solution is called a 2-D solution.

The accuracy of the C/A code, can be degraded through an operational mode called "Selective Availability" or "S/A". The Selective Availability is implemented to deny non-military GPS users high position accuracy. In principle the Selective Availability introduces errors into the satellite ranging measurement by manipulating the satellites clock.

The Standard Position Service (SPS) uses the C/A code with Selective Availability. SPS is planned to provide the capability to obtain horizontal position accuracy within 100 meters (95 percent probability) and vertical position accuracy within 156 meters (95 percent probability).

4.2 The GPS Module

The Capsat Transceiver uses a GARMIN GPS 20 module as an option.

The GARMIN GPS 20 module is a single-board, parallel Global Positioning System (GPS) receiver suitable for integration. GPS 20 track up to eight satellites at a time. The GPS Module uses spread-spectrum receiver technology for reception of L1 GPS, 1575.42-MHz Standard Positioning Service (SPS) signals. The GARMIN GPS module design utilises the latest surface mount technology as well as high level circuit integration to achieve superior performance while minimising space and power requirements.

Rapid Time-To-First-Fix (TTFF) is achieved utilising efficient search algorithms that make use of all tracked satellites. A typical TTFF is 15 seconds with a current almanac and ephemeris data loaded from on-board battery backup memory. The GPS module provides position within 100 m. Typical acquisition time for GARMIN GPS 20 with initial position, time and almanac known and ephemeris data unknown is 2 minutes from cold, 7 minutes with almanac known but

position and time unknown and 15 minutes if no data known. The GPS module board automatically update satellite orbital data as it operates. The GPS Module can maintain this performance in applications where the board temperature is between -30 to +85 degrees Celsius.

If the GPS module is not operated for a period of more than six month or if initial data is significantly inaccurate ease of acquisition can be achieved upon power-up by providing the receiver its Position, Velocity and Time data from a completely powered down state.

The GPS module works in automatic mode in which the module determines the desired mode (2-D or 3-D navigation solution) based on satellite availability and geometry considerations. However, because the GPS 20 module track eight satellites the 2-D mode condition will be minimal.

4.2.1 Feature list

Full navigation accuracy provided by Standard Positioning Service (SPS)

High performance receiver tracks up to 8 satellites while providing fast first fix and low power consumption.

On-board clock and memory are sustained by a memory backup battery

User initialisation is not required

4.3 Satellite Navigation

The GPS Module provides four (3D) and three (2D) satellite navigation solutions. The Default Primary Navigation solution is 3D, Four Satellite Vehicle (4SV) Navigation. Three Satellite Navigation is considered a secondary navigation solution, which requires a known altitude.

Automatic Three Satellite Navigation utilising the last known altitude is implemented from a Four Satellite Navigation state when only three satellites are unobscured.

Either method will provide you with a position. However. the 4SV-(3D) solution will be the most accurate of all the solutions when satellites with good geometry are available.

In general, accurate three-dimensional (3D) position determinations are based on the measurement of the transit time of RF signals from four satellites. Three of the four satellites provide the horizontal X and Y co-ordinates. However, with errors of different atmospheric delays and imperfections in clocks standards, the horizontal position can be located in two places along the Z-axis which is perpendicular to the horizontal plane. The fourth satellite essentially removes the error on the Z-axis; thus an accurate altitude is given.

The GPS Module automatically proceeds from an acquisition state, or 3SV navigation state, to a 4SV navigation state when four or more satellite measurements are considered reliable. At various points in time, satellites may become obscured. The GPS Module minimises the effects of obscuration by tracking remaining in view in order to maintain Four Satellite Navigation as much as possible.

4.4 Almanac

The Almanac used by the GPS Module is a set of Keplerian orbital parameters which approximate the entire orbits of the GPS satellites. This information is used by the GPS Module to determine where to best search for the satellites signals. Once a satellite is being tracked by the GPS Module, the Ephemeris parameters, which are more accurate but only span a four-hour portion of the orbit, are used to continue tracking the satellite or reacquire a satellite where it's signal is best. Note that the almanac parameters for all GPS satellites are broadcast by each GPS satellite, but each GPS satellite broadcasts ephemeris only for itself.

The almanac parameters are uploaded to the GPS satellites once per week. The almanac parameters are also continually broadcast from the GPS satellites so that GPS User sets, such as the GPS Module, have access to the most current almanac. Although updated weekly, the almanac parameters are still acceptable for use for longer periods of time, up to several months, except for the rare cases in which satellites have been repositioned or new satellites have been launched. Even in these circumstances, the almanac data for the unaltered satellites is still acceptable for use.

When the GPS Module is tracking any GPS satellite, it is constantly reading the almanac parameters for all GPS satellites, comparing them against the almanac parameters currently being used and updating them when they change.

The accuracy of these sets of almanac data will degrade with time, and eventually cause longer acquisition times if the set remains without power for a period of several months.

As mentioned above, please note that the GPS Module updates the almanac data for all satellites if it is tracking at least one satellite.

4.4.1 Error Outputs

The GPS Module provides error information in two forms with the position: expected errors and Figure of Merit.

```
Test Summary: OK      09 visible satellites   SW Version 2.00
  Navigation Mode: 1    FOM:  1    UTC:   1
  Accept Altitude: 0    Hold: 0    VPerr: 3 m
  PDOP:            02   HDOP: 01   HPerr: 4 m
  Elevation mask:  00              HVerr: 0 cm/s

Satellite Tracking Status
  Satellites:   20* 24* 25* 29* 15*
  Signal Level: 47  44  53  38  46
  Elevation:    06  13  20  78  06
  Azimuth:      360 317 041 147 152

V. Speed :     25 ft/m  Altitude:    405 ft
Position : 55 44 39 N 012 28 64 E at 10:03:48 UTC
Course   : 000 deg/true north
Speed    : 000 knots : 0001 kmph : 0000 mph
```

Figure 1: The Transceivers GPS status screen

An expected error value output by the GPS Module is based on the estimation error used to update the associated quantity being estimated by the GPS Module navigational computations. There are 2 expected error quantities displayed by the Capsat Transceiver's *ru -g* command.:

Horizontal position

Vertical position

Each expected error value is the standard deviation of the associated estimation error. It is not an expected value as defined by probability theory, e.g. an average value of error.

Estimation errors are derived from errors in satellite range measurements used in the calculations to update the navigation solution. Thus, estimation errors depend primarily on the number of satellite range measurements processed each second. This means that the error in the solution is reduced as more range measurements are processed and used to update the navigation solution.

Note that these error values reflect estimation errors which are in turn used to update the navigation solution. Therefore, they are not to be viewed as computations of actual error, but as indications of how well the navigation solution has converged. In Acquisition Mode, expected error outputs initially reflect default error estimates assumed by the GPS Module. The error outputs increase in value during Acquisition until maximum values are reached, since no measurements are being input into the navigation filter.

The Figure of Merit is simply a quantization of the position error. It is set to the maximum value during Acquisition.

Figure of merit:	Estimated position error
1:	< 26m
2:	26-50m
3:	51-75m
4:	76-100m
5:	101-200m
6:	201-500m
7:	501-1000m
8:	1001-5000m
9:	> 5000m

5. Transceiver Software Details

5.1 EGC Message header format

When an EGC messages is received by the Transceiver it puts a text header in front of the received message.

The header format is:

"<CR><LF>LES <number> - MSG <number> - <text> <text> Call to Area: <text> - <text> <CR><LF><CR><LF>"

An example is:

LES 102 - MSG 1078 - MetWarn/Fore Safety Call to Area: 1 - NoPos

BT CSAT 46464 HYDRNW G 22-APR-1996 17:24:12 263051

zczc
navarea one 188
satnav gps prn 18 unusable from 210215z apr 96 until further
notice.

The header can be interpreted as (see the following page)

Example	Name	Description	Values
LES 102	EGC originator ID	LES ID	Other LES ID's
MSG 578	Sequence Number	NCS identification number	Up to 5 digits
MetWarn/Fore	Service Name	EGC service. This is the IMO name of the message service type.	See below
Urgent	Priority	There are four possible.	Normal Safety Urgent Distress
Area: 1	EGC Addressing	This is mostly an area number but there are other possibilities	See below
PosOK	Status	The status of the position information in the Transceiver (from a navigator device or the internal GPS).	NoPos PosOK

Table 1 Interpretation of the header in a EGC message

The different service types have different addressing in the message. There are the following possibilities (see next page):

Service Number	Service name	EGC Addressing	Meaning
00	General	"ALL"	All Transceivers should receive this
11	Inmarsat	"ALL"	All Transceivers should receive this
23	System	"ID"	Individually addressed
33	ENID	"ID"	Individually addressed
02	Group	Number	EGC Network ID: ENID
31	MetWarn/Fore	Number	Navigational Area: NavArea (1-16)
13	CoastalWarn	Number Letter	Navtex NavArea SubArea Service
14	Distress	Number Letter Number Letter Number	Circular Area Description: Latitude N/S Longitude E/W Radius (in nautical miles)
24	Met/NavWarn	Number Letter Number Letter Number	Circular Area Description: Latitude N/S Longitude E/W Radius (in nautical miles)
04	NavWarn	Number+Number Letter Number+Number Letter	Rectangular Area Description: Latitude+Extent N/S Longitude+Extent E/W
34	SAR	Number+Number Letter Number+Number Letter	Rectangular Area Description: Latitude+Extent N/S Longitude+Extent E/W
44	SAR	Number Letter Number Letter Number	Circular Area Description: Latitude N/S Longitude E/W Radius (in nautical miles)
72	Chart	Number	EGC Network ID: ENID
73	Chart	"All"	Addressing is not used
	New	"All"	Unknown type

Table 2 Addressing in an EGC-message

5.2 Baudot Characters

The following table lists the Baudot (telex) alphabet characters that you can use when sending to a telex network destination.

The table also lists the perforation pattern that corresponds to each letter on a paper tape.

No.	Letters	Figures	Hex	5	4	3		2	1
1	A	-	03				○	●	●
2	B	?	19	●	●		○		●
3	C	:	0E		●	●	○	●	
4	D	✠	09		●		○		●
5	E	3	01				○		●
6	F	% Å	0D		●	●	○		●
7	G	@ Æ	1A	●	●		○	●	
8	H	# Ø	14	●		●	○		
9	I	8	06			●	○	●	
10	J	🔔	0B		●		○	●	●
11	K	(	0F		●	●	○	●	●
12	L	)	12	●			○	●	
13	M	.	1C	●	●	●	○		
14	N	,	0C		●	●	○		
15	O	9	18	●	●		○		
16	P	0	16	●		●	○	●	
17	Q	1	17	●		●	○	●	●
18	R	4	0A		●		○	●	
19	S	'	05			●	○		●
20	T	5	10	●			○		
21	U	7	07			●	○	●	●
22	V	=	1E	●	●	●	○	●	
23	W	2	13	●			○	●	●
24	X	/	1D	●	●	●	○		●
25	Y	6	15	●		●	○		●
26	Z	+	11	●			○		●
27	<		08		●		○		
28	≡		02				○	●	
29	A...		1F	●	●	●	○	●	●
30	1...		1B	●	●		○	●	●
31	Space		04			●	○		
32	Unperf		00				○		

Table 3 The Baudot (telex) alphabet characters.

5.3 Use of the Transceiver built-in speaker

The following table lists the way the software uses the built-in speaker in the Capsat Transceiver

Transceiver function	**Mobile Type (version)**	**Information Type Description**	**Beep**
EGC reception	All (Maritime)	Distress/Urgent When receiving an Urgent or distress priority message or a Distress Alert type message	4 fast
Printing	Landmobile and Maritime	When printer error occurs	2 normal
Printing	All	To local Printer (all versions) When the message contains a Bell character	1 normal
Sending Messages	All	Starting new TX Beep once if not in silent mode to indicate start of TX	1 normal
Distress Alert	All	Starting Indicate that a distress has been started	1 normal
Distress Alert	All	Receiving After acknowledgement if not in silent mode	1 normal
GPS	All	Position Fix When getting a position fix after power ON	2 fast

Table 4 Use of the Built-in speaker

6. Front Panel

The Front Panel of the Transceiver is shown in Figure 2. The function of the five indicators and the two buttons are as follows.

The **Power indicator** will always be on when there is DC-power on the Transceiver.

The **Set button** is used to set the serial port to the default values. If this button is pressed at power-on the serial port is set to 4800 baud, 8 databits, no parity, 1 stopbit. If the button is pressed when the Transceiver has been turned-on nothing will happen. The button has to be pressed at power-on if the function are to take effect.

The **Login indicator** will be on when the Transceiver is logged into an earth station. If the Transceiver is in sync. but hasn't been logged into an earth station the indicator will flash. If the Transceiver is unable to get sync. the indicator will be off.

The **Send indicator** will be flashing when the Transceiver goes into the Transmit protocol. When the Transceiver is transmitting the indicator will be on. When the transmission is completed the indicator will flash until an acknowledgement is received from the LES.

The **Mail indicator** will flash if the Transceiver is about to receive a Non-EGC message. When the message has been received the indicator will be on. The indicator will be on until the message has been read. If the Capsat program is used the message will be read immediately. Because of this the user will se the Mail indicator flash when a message is about to be received and then turn off when the message has been received.

The **Alarm button** is used together with the Set button to send a distress alert. Press the Set button and the Alarm button simultaneously for at least 5 seconds until the Alarm LED starts flashing.

The **Alarm indicator** will normally be off. When a distress alert has been sent the Alarm LED will flash until an acknowledgement has been received from the LES. Then the indicator will be on.

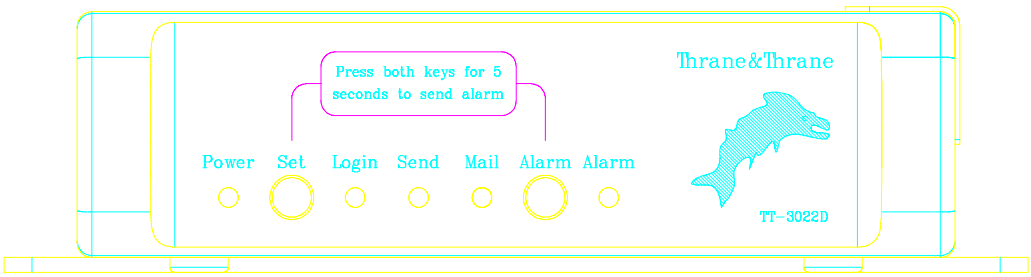


Figure 2 Front panel of the TT-3022D Capsat Transceiver.

7. Interfaces

The Transceiver interfaces are all located on the rear panel of the Capsat Transceiver. A drawing of the rear panel of the Transceiver is shown in Figure 3.

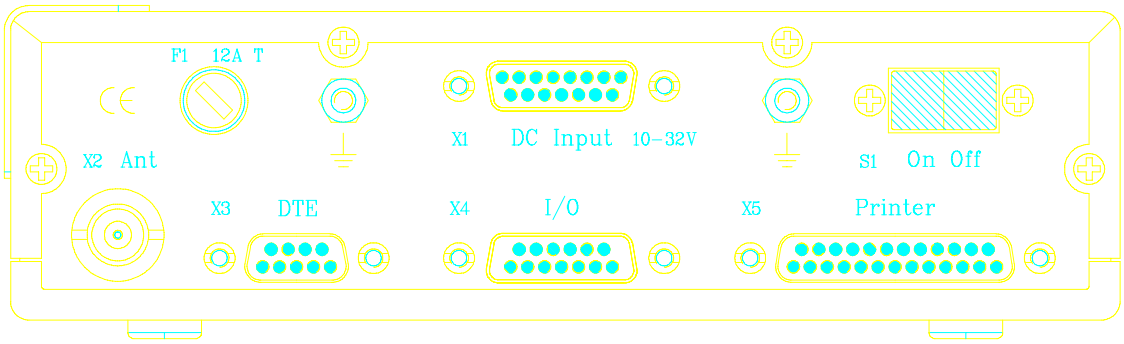


Figure 3 Rear panel of the TT-3020C/TT-3022D Capsat Transceiver.

7.1 DC input (X1)

The power connector (X1) is a standard DB-15 male. The pin assignments on the power connector is shown in Table 5 below. The DC Cable TT37-107054 comes with the Transceiver.

X1 Pins	Name	Signal Description	DC Cable 37-107050B
1,2,9,10	SUP+	10-32 Vdc (Battery Positive input)	Red 2.5mm^2

3		NC	
4,5,12, 13	SUP-	DC RN (Battery Negative input)	Black 2.5mm^2
6	ON/OFF	Remote ON/OFF	White 0.25mm^2
7,8	SGND	Chassis (Secondary GND)	Yellow/green 0.5mm^2
11		NC	
14,15	9V out	Floating +9V out max 400mA on pin 14 & 15 referred to Chassis (SGND). Note: Max. load (400 mA) is a combi-nation of this output and X4 pin 5.	Red wire with Red connector. Secondary GND Yellow/green wire with Transparent connector
Ground	GND		Ground shield

Table 5 Pin assignment on power connector (X1)

Pin 6 is used as an power switch for the TT-3020C/TT-3022D Capsat Transceiver. When this pin is left floating the Transceiver is turned off, but if pin 6 is shorted to the negative terminal of the battery or DC-supply the Transceiver will be switched on. This makes it possible for other equipment for remote power control of the TT-3020C/TT-3022D.

The remote power control can be controlled by an external relay or solid state switch.

The battery input is floating, i.e. there is no galvanic connection from any of the battery poles to the cabinet frame.

7.1.1 On/Off features

The TT-3020C/TT-3022D Transceiver/GPS is powered from a DC source (10-32V). The system is switched ON by the S1 ON/OFF switch placed on the back panel of the Transceiver, or the remote on/off wire in the DC input cable. An internal Timer can be used to put the transceiver into sleep mode for power consumption. The Timer, which is powered from a lithium battery, will then turn the transceiver back on again after a programmable time. The priority of these functions are defined in the table.

Master on/off switch S1	Remote on/off by the input DC cable (pin 6 white)	TT-3020C/TT-3022D Timer	Transceiver on/off
0	x	x	off
1	0	0	off
1	x	1	on
1	1	x	on

Table 6: TT-3020C/TT-3022D Capsat Transceiver ON/OFF overview . ‘’1’’ - feature active ‘’0’’ - feature disable ‘’x’’ - don’t care.

7.2 Antenna connector (X2)

The antenna connector (X2) is a standard TNC-connector.

X2 is used for both TX and RX.

The antenna-cable is also used to supply the Antenna with DC-power. When the Transceiver is transmitting there will be +28 V DC on the antenna connector. When the transceiver is receiving there will be either +9 V DC or +14 V DC on the antenna connector. +9 V DC should

be used if a TT-3005B antenna is used with the transceiver. If any other Antenna Type is used +14 V DC should be used.

The TT-3005B will not be damaged if it is supplied with +14 V DC. It will be operational, but the power consumption will be higher than necessary.

If a different antenna type is used and is supplied with +9 V DC it will not be operational. The antenna will however not be damaged by this.

The Transceiver will have a default antenna supply voltage of +14 V DC. With this supply voltage all antennas will be operational with the Transceiver.

The supply voltage to the antenna can be changed to +9V DC by the command:

```
set -z antvolt=low
```

The supply voltage to the antenna can be changed back to +14V DC by the command:

```
set -z antvolt=high
```

7.3 DTE interface (X3)

The TT-3020C/TT-3022D Capsat Transceiver communicates with a controller device via the standard EIA/TIA-232E ports on a female 9 pole Sub-D connector (X3).

The TT-3020C/TT-3022D accepts the baudrates and settings shown in the table below.

Baud rates	**Protocol settings**	**Handshake**
110 Baud	7/8 databits	Hardware
150 Baud	No/Even/Odd parity	Using DTR and CTS
300 Baud	1/2 stopbits	
600 Baud		Software
1200 Baud		XON and XOFF
2400 Baud		
4800 Baud		
9600 Baud		
19200 Baud		
38400 Baud		

Table 7 Baudrates and settings accepted by TT-3020C/TT-3022D

The serial port communication parameters are factory programmed to:

4800 Baud, 8 databits, no parity, 1 stopbit

The parameters of the serial port can be changed with the command:

```
set -c <baudrate, parity, databits, stopbits, 1 or 0>
```

where the last number should be 1 if software handshake will be used and 0 if software handshake will not be used.

As an example if you want 9600 baud, no parity, 8 databits, 1 stopbit and no software handshake you must type:

```
set -c 9600, N, 8, 1, 0
```

Default values can be retained by typing:

```
set -c 4800, N, 8, 1, 0
```

The TT-3020C/TT-3022D uses the following signals (marked with a ✓ in the *Used* column):

Name	Signal description	9-Pin	Used	Levels	Direction
DCD	Data Carrier Detect	1		EIA/TIA-232-E	□→
RxD	Received Data	2	✓	EIA/TIA-232-E	□→
TxD	Transmitted Data	3	✓	EIA/TIA-232-E	□←
DTR	Data Terminal Ready	4	✓	EIA/TIA-232-E	□←
GND	Ground	5	✓		
DSR	Data Set Ready	6	✓	EIA/TIA-232-E	□←
RTS	Request To Send	7		EIA/TIA-232-E	□←
CTS	Clear To Send	8	✓	EIA/TIA-232-E	□→
RI	Ring Indicator	9	✓	EIA/TIA-232-E	□→

Table 8 Pin assignment on the DTE interface. The □→ symbol means that the signal is generated by the Transceiver.

For full operating specifications for the serial interface, you are kindly requested to refer to the CCITT Rec. V24and the EIA/TIA-232-E specifications.

7.4 I/O interface (X4)

The I/O connector (X3) on the back panel of the TT-3020C/TT-3022D Transceiver can be used for

- ArcNet 2.5Mbit communication
  when connecting to the TT-3606C Message Terminal or other ArcNet devices

- The International NMEA 0183 version 2.1 communication standard input and output when connecting to a commercial available navigator device or using the built-in GPS in navigation mode.

- Four parallel In/Out RS-410 pins and two RS-410 input pins
  To TT-3042C Remote Alarm/Distress Box or SCADA I/O applications

The general purpose I/O allows connection of both general purpose I/O, ArcNet and NMEA devices.

Signal	X4 pin	Specification general purpose I/O
I/O0 (io)	1	Digital open collector output with pull-up/input with pull-up (RS-410N).
I/O1 (io)	2	Digital open collector output with pull-up/input with pull-up (RS-410N).
I/O2 (io)	3	Digital open collector output with pull-up/input with pull-up (RS-410N).
I/O3 (io)	4	Digital open collector output with pull-up/input with pull-up (RS-410N).
9Vdc *(o)*	5	DC +9V, ±10%. Max. 400mA. Floating Supply voltage for external devices. Note: Max. load (400 mA) is a combination of this output and X1 pin 14, 15.
Ground	6,9	Ground reference.
ArcNet A/B *(io)*	7/8	ArcNet signal wires A/B (ATA/ANSI 878.1; ARCNET/TB).
NMEA Out A/B	10/11	NMEA 0183 output signal wires A/B (NMEA 0183 version 2.1).
NMEA In A/B	12/13	NMEA 0183 input signal wires A/B (NMEA 0183 version 2.1).
I4 *(i)*	14	Digital input with pull-up (RS-410N).
I5 *(i)*	15	Digital input with pull-up (RS-410N).

Table 9 Pin assignment on I/O interface

The I/O connector, a standard DB-15 female connector, is located on the rear panel of the transceiver and is marked X4.

7.4.1 ArcNet

When the TT-3020C/TT-3022D Capsat Transceiver is connected with other devices using the ArcNet it is very important that the ArcNet is terminated correctly.

Coax-cables or Twisted-pairs cables can be used to make connections to other devices. The impedance of the cable should be 93 Ohms.

If the TT-3020C/TT-3022D is placed at the end of the ArcNet, as shown in figure 4, a 91 Ohms (or 100 Ohms) resistor should be connected between pin 7 and 8 of X4 in order to terminate the ArcNet.

If the TT-3020C/TT-3022D isn't placed at the end of the ArcNet as illustrated in figure 5 no resistor is placed between pin 7 and 8 of X4.

In general both ends of the ArcNet should be terminated in 91 Ohms (or 100 Ohms).

All cabling outside the coax-lines (or twisted pairs lines) should be made as short a possible.

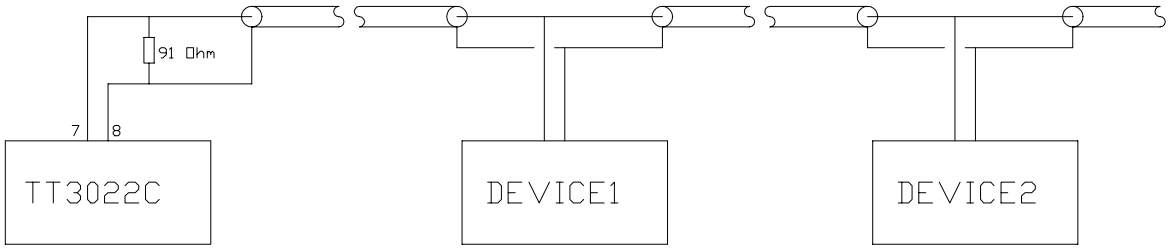


Figure 4. A 91 Ohms resistor should be connected between pin 7 and pin 8 if the TT-3020C/TT-3022D is placed at the end of the ArcNet.

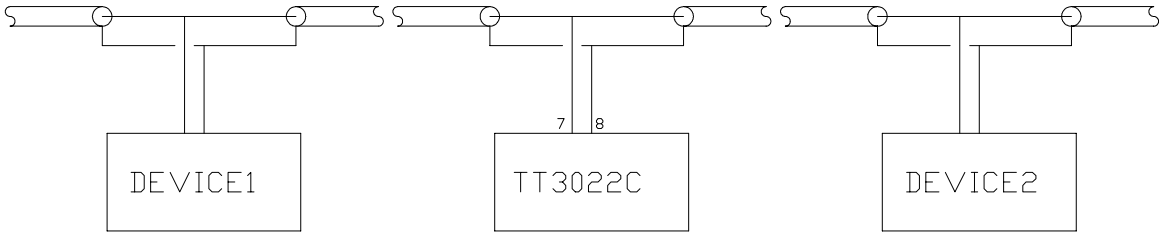


Figure 5. No resistor is placed between pin 7 and 8 if the TT-3020C/TT-3022D is not at the end of the ArcNet.

7.5 Printer interface (X5)

The printer port connector, X5, is located on the rear panel.

This parallel interface conforms to the standard Centronics interface used e.g. on IBM compatible PC's.

Pin	Name	Signal Description
1	STRB	Strobe
2	DAT0	Data Bit 0
3	DAT1	Data Bit 1
4	DAT2	Data Bit 2
5	DAT3	Data Bit 3
6	DAT4	Data Bit 4
7	DAT5	Data Bit 5
8	DAT6	Data Bit 6
9	DAT7	Data Bit 7
10	ACKN	Acknowledge
11	BUSY	Printer Busy
12	PE	Paper End (out of paper)
13	SEL	Printer Selected
14	ALFD	Auto Line Feed
15	ERR	Printer Error
16	INIT	Initialize Printer
17	SLCT	Select Printer
18	GND	Ground
19	GND	Ground
20	GND	Ground
21	GND	Ground
22	GND	Ground
23	GND	Ground
24	GND	Ground
25	GND	Ground

Table 10 Pin assignment on printer interface

8. Capsat Transceiver Service

8.1 Service

The TT-3020C/TT-3022D Maritime/Fisheries Capsat Transceiver consists of the TT37-106110 Main Board, the TT37-106138 Power Supply and the optional GPS Module. The 3 modules are described below.

8.1.1 Main Board

The Main Board is found in the bottom of theTT-3020C/TT-3022D.

Figure 6 shows a drawing of the Main Board.

There are 6 LED's on the board which are not visible from the front panel. They are intended for service use. The function of the LED's are:

DS1 1.LO lock. This LED indicates that the Phase Locked Loop controlling 1.LO is
in lock. This LED should always light.
DS2 TX ON. This LED lights when the transceiver is transmitting.
DS3 Packet data. This LED toggles every time a packet has been received. When the
receiver is in sync. this LED should be toggling.
DS4 RX signal OK. This LED lights when the RX signal strength and the RX signal
to noise ratio is sufficient for reception. If this LED does not light the receiver
can't be expected to go into sync.
DS11 Future use
DS12 Future use

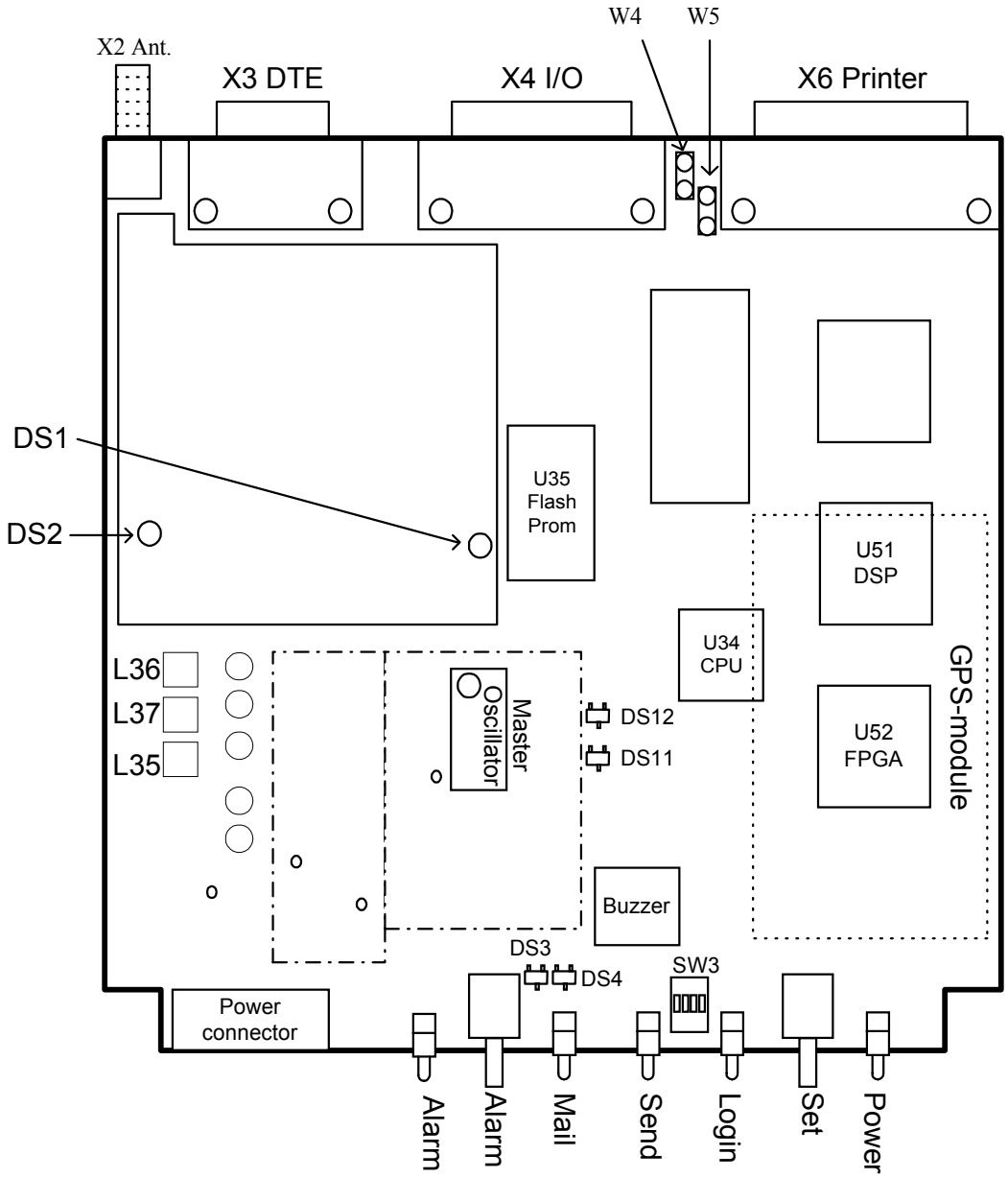


Figure 6: TT-3020C/TT-3022D C-Transceiver Main Board, TT 37-106110

There are two jumpers on the board. The function of these are:

W3 +9V out on connector X4, ArcNet I/O pin 7
W4 GND on connector X4, ArcNet I/O pin 8

Factory default is that neither W3 nor W4 is set.

8.1.2 Power supply

The switch mode power supply is found at the upperside of the TT-3020C/TT-3022D. Figure 7 shows a drawing of the Power supply.

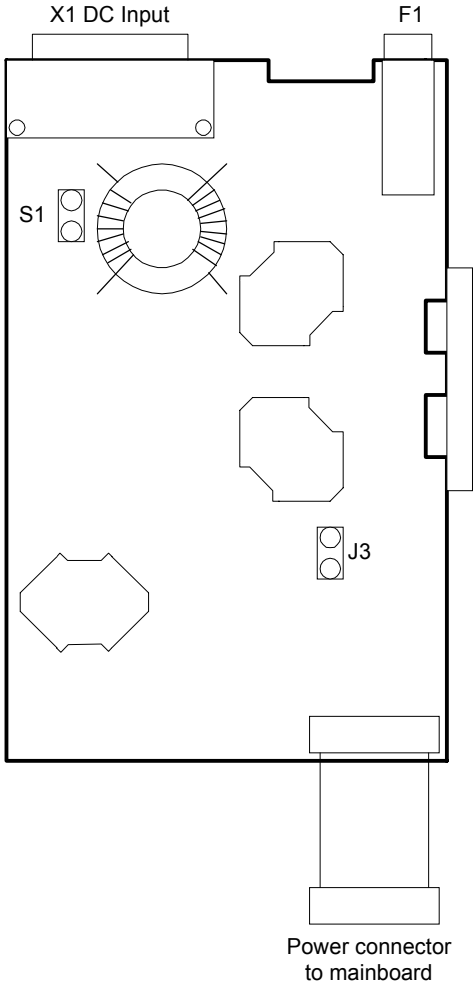


Figure 7. SMPS Board, TT37-106138

The jumper J3 is used to adjust the maximum antenna-current. When J3 is set, the maximum short-circuit antenna-current is raised with 200 mA.

The jumper J3 is used for factory adjustment. It is strongly recommended not to change the setting of J3. If the setting of J3 is changed it might cause a malfunctioning Transceiver.

8.1.3 Optional GPS Module

The optional GPS module is (if used) located in the bottom of the TT-3020C/TT-3022D. It is fastened to the TT37-106110 C-Transceiver Main Board with four stays. This is indicated in Figure 6 with dashed lines. The GPS-module is located on the opposite side of the Main Board than the one shown in Figure 6

The built-in GPS module will always be self-tested at power-on. In case you suspect a malfunction in the module you should check the GPS status screen by selecting:

```
OPTIONS - GPS STATUS
```

Look at the first line at *Test Summary* and see the status information readout. Normally you should see *OK*, but in case of error you will see an error code.

The error code is a 16 bit error word and is described in the following section.

In case you want to test the module manually you can also start the test from the Terminal mode. Type:

```
OPTIONS - CONFIGURATION - TERMINAL MODE
```

Then hit the ENTER key and see the colon prompt appear. Now type the command:

```
ru -t<ENTER>
```

And hit the ESC key to get back to the main menu. After max. 60 seconds the test results are available in the GPS Status window.

8.1.3.1 Test Summary Word

If the built-in self-test fails, a 4 digit number will appear in the first line of the GPS status together with the word *ERROR*. This indicates the cause of the error as a hexadecimal number. The number is composed of error bits in different locations as described below.

Bit 0 is the least significant bit (displayed as 0001H) and bit 12 is the most significant used bit (displayed as 1000H).

Bit Number	Name	Description
Bit 0	System Health	Logic 1 indicates the GPS Module has some kind of receiver failure
Bit 8	ROM Failure	Logic 1 indicates a fault has been detected in the ROM
Bit 9	Oscillator Failure	Logic 1 indicates a fault has been detected in the oscillator.
Bit 10	Stored data Failure	Logic 1 indicates that the stored data was lost.
Bit 11	Board configuration Failure	Logic 1 indicates that the board configuration was lost.
Bit 12	Real time clock Failure	Logic 1 indicates that a failure has been detected in the RTC.
Bit 15	Fix type	Logic 1 indicates that the GPS module currently has no valid position fix.
Other bits		Spare

Table 11: Description of the GPS Modules Test Summary word.

8.2 Fault diagnostics

If the TT-3020C/TT-3022D Capsat Transceiver for some reason doesn't work properly and a hardware fault is suspected it can be useful to try to locate the fault.

At power-on the CPU performs a selftest. This selftest can be followed by watching the indicators on the Front Panel. The selftest takes about 7 seconds. During this period the indicators will flash. When the selftest is completed only the Power indicator should light.

If any other indicators lights after the selftest it is likely that there is a fault on the Main Board.

If no indicators lights before, during and after the selftests it is likely that there is a fault on the Power Supply Board. Before proceeding you should make sure that the Transceiver is connected to a 10 - 32 V DC power source. Verify that the On/off switch on the rear panel has been turned on and that the remote on/off pin (pin 6) of X1 has been connected to Battery negative (pin 4, 5, 12, 13).

With a simple check it is possible to check that the power supply is working.

Remove the bottom plate of the Transceiver. Refer to section 10 for information on how to do this. *This operation must only be performed by T&T approved personnel.*

With the bottom plate removed you will have access to the Main Board shown in Figure 6. Examine the board and locate L35, L36 and L37 in the lower left quarter of the board. L35, L36 and L37 are shown on the drawing in Figure 6.

With a voltmeter you should now measure the voltage between chassis and L36. The measurement can be made from chassis to either side of L36. This voltage should be about 9.5 V DC.

Now measure the voltage between chassis and L35. The measurement can be made from chassis to either side of L35. This voltage should be about 5.0 V DC.

Next measure the voltage between chassis and L37. The measurement can be made from chassis to either side of L37. This voltage should be about 5.0 V DC.

Finally disconnect the antenna cable from the Antenna connector (X2). With the voltmeter measure the DC-voltage from chassis to the inner-connector of X2. This voltage should be about +14 V. (It is possible to change the antenna voltage to +9V with a software command. If this facility has been used the voltage should only be +9 V. Please refer to section 7.2 for information about how to change the antenna voltage).

If any of these voltages are not present it is likely that the Power supply board is malfunctioning. The Power supply board must be replaced and/or send to repair.

If all of the mentioned voltages are present the fault is likely to be located on the Main Board.

8.3 Replacements

Information about how to replace the Main Board, the Power Supply board and the GPS-module is given in section 8.3.1, 8.3.2 and 8.3.3.

For information about how to disassemble the transceiver please refer to section 10.

8.3.1 How to replace the Main Board

The identity of the TT-3020C/TT-3022D Capsat Transceiver is contained in a Flash-prom. This Flash-prom can't be removed from the board.

If it is required to replace the TT37-106110 Main Board and the Transceiver has to remain the same logical mobile unit in the Inmarsat-C System the whole Transceiver has to be returned to Thrane & Thrane.

If it is not required for the Transceiver to remain the same logical unit the board is simply replaced by a new board.

Please refer to section 10 for information on how to disassemble the TT-3020C/TT-3022D Capsat Transceiver.

WARNING
Do not attempt to tune the TT-3020C/TT-3022D Master oscillator. This operation must only be performed by T&T approved service personnel.
(The location of the Master oscillator is indicated on Figure 6)

8.3.2 How to replace the Power Supply board

This board can be changed with no further action.

8.3.3 How to install/replace the optional GPS Module

The optional-GPS module is electrically connected to the Transceiver via a small ribbon cable and a 14 cm long RF cable.

If you need to change the GPS module or install one for the first time, you must disassemble the Transceiver and take out the TT37-106110 Main Board.

The GPS-module is fastened to the C-transceiver with 4 stays, 4 screws and 4 nuts. To install a GPS-module please follow the following procedure (refer to Figure 8):

1) Fasten the 4 stays to the TT37-106110 Main Board using the 4 screws.

2) Place the Garmin GPS-module on the stays.

3) Put the cable binder around the RF cable. Place the cable binder on the stay to the right of the ribbon cable as shown in Figure 8.

3) Fasten the GPS-module and cable binder to the stays using the 4 nuts.

4) Connect the Ribbon cable and the RF cable.

The Transceiver is now assembled again.

At power-on the Transceiver will automatically detect the presence of a GPS module. No further actions are required to tell the Transceiver that a GPS module has been installed.

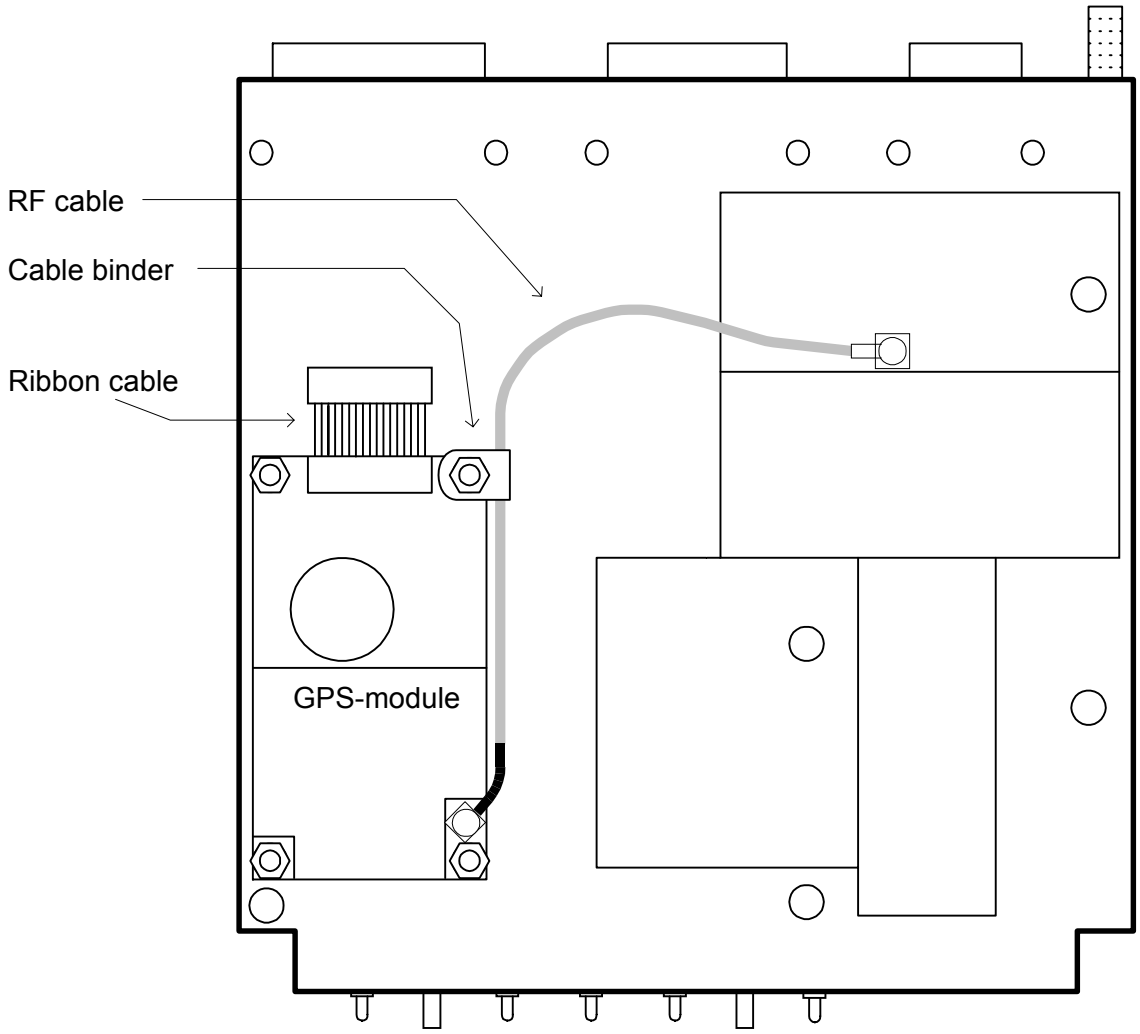


Figure 8 Installation/Replacement of a Garmin GPS-module

8.4 The TT-3020C/TT-3022D status screen information

The TT-3020C/TT-3022D Capsat Transceiver offers you the possibility to inspect the status of the hardware and the software of the Transceiver.

This is done by means of the **Status Screen**. An example of a Status Screen is shown below.

```
HARDWARE:    System Clock 1995-05-30  13:02
LO Vtune/Level    OSC offset/Acc    RX/TX/AGC     B/S
3358mV              -473Hz              65mA        1
3040mV              -421Hz              0mA         4
                                        810


SOFTWARE:    Version 3.00, 95-09-07,   Service 95-05-30 by kbr
Synchronization    : yes                   Serial no       : 890254
Logged in          : no                    Mobile no       : 92380021
TDM type           : LES                   Preferred ocean :  None
TDM channel number : 11790
Current channel    : NCS
Current protocol   : Free
TDM origin         : 131
TDM frame number   : 4810
BB error rate      :   0 of 100
```

If your Transceiver is in terminal mode you can use the TT-3020C/TT-3022D command *st -w* to display the status screen. If you use a Thrane & Thrane Message Handling Software you can display the same information by selecting the menu:

```
OPTIONS - TRANSCEIVER STATUS
```

We will refer to the information in the status screen in the following description.

8.4.1 Hardware information

The HARDWARE part has a headline and four columns: The local oscillator, the frequency tracking, the antenna part and Viterbi decoder part.

The headline gives you the readout from the built-in clock circuit. This has a resolution of one minute.

The rows in each column are now described:

8.4.1.1 LO Vtune/Level

This row gives information about the status of the local oscillator.

LO Vtune indicates what the tuning voltage to the Local Oscillator is at the moment.

When the Transceiver is receiving this voltage will typically be in the area 3000 - 4500 mV. When the Transceiver is transmitting the voltage will typically be in the area 5500 - 7200 mV. The voltage must never be below 1500 mV or above 7750 mV.

LO Level shows the voltage level of the detector circuit. This voltage indicates the level of the Local Oscillator signal.

This voltage will typically be in the range 2800 - 4200 mV.

8.4.1.2 OSC offset/Acc.

This row gives information about the frequency inaccuracy of the Transceiver relative to the LES due to short term environmental, and long term crystal ageing frequency variation.

The OSC offset value indicates the momentary frequency inaccuracy and the OSC Acc. value indicates an accumulated frequency inaccuracy.

The software will compensate the receive- and the transmit-frequencies for these inaccuracies.

8.4.1.3 RX/TX/AGC

This row gives you information about the antenna current and the present AGC (Automatic Gain Control) setting.

The receiving current (RX) is the current that the transceiver will measure on the antenna connector, in the idle receive state.

The value depends on the type of antenna used. For a TT-3005B antenna it will typically be 65 mA. A typically value for other types of Antenna Units is 100 mA.

If the antenna is disconnected the current will be 0 mA.

The transmit power consumption (TX) is the value that was measured at the last transmission on the antenna connector.

This value will typically be around 2400 - 3000mA. If you have not used the TT-3020C/TT-3022D for transmissions yet, the value will be 0mA.

The Automatic Gain Control level (AGC) indicates the state of an attenuator in the receiver. This attenuator is used to perform the automatic gain control. When the received signal is strong the attenuation will be high and when the received signal is very weak there will be no attenuation.

A very low AGC value corresponds to a low attenuation and thus a weak signal and/or a very long cable between the Transceiver and the antenna. A high AGC value corresponds to a high attenuation and thus a strong signal and/or a short cable.

With a good signal the AGC value will typically be about 800. With no antenna connected the AGC value will be about 0.

8.4.1.4 B/S

B

The bulletin board check (B) is done by the main processor on the basis of the received data for each 8.64 seconds of data. This 8.64 seconds of data is called a frame. The frame will contain packets, and the first and most important is the bulletin board packet, which contains a frame number and the identification and possible services of the emitting station and this particular channel.
The bulletin board check will normally read 1, which signifies a valid bulletin board, but when tuning or transmitting it may read 0.

The readout is valid for the last-received data, so in case the transceiver looses signal for a longer period, the data shown here will be from the last received frame.

S

The Signal Strength (S) can vary from 0 to 5 where 5 is the best signal. You should have a reading above 2 to ensure a proper communications link.
The signal strength is measured directly on the received signal (after demodulating), where the renormalization count (R) is calculated after the decoding, so (R) has a 8.64 seconds delay in respect to (S).

The value is measured as an average over 512 demodulated bits.

The resulting number is on a scale from 0 to 5 that has the following correspondence with the signal-to-noise ratio:

Signal strength	0	1	2	3	4	5
SNR in dBHz	<29	29-31	31-33	33-35	35-37	>37

The Signal Strength (S) will always be correct even when the Transceiver looses the synchronisation.

8.4.2 Software information

The SOFTWARE part has a headline and two columns: The currently available information about the satellite link, and the long term information with an overview of user commands waiting to be executed.

The headline gives you the version number of the TT-3020C/TT-3022D software, and the corresponding release date, and the date and time of last service together with the initials of the service engineer.

The rows in each column are now described:

8.4.2.1 Synchronisation

This corresponds to the status of the front panel LED "login". The readout will be "Yes" if the transceiver can receive and decode the satellite signal properly.

8.4.2.2 Logged in

This corresponds to the status of the front panel LED "login". The readout will be "Yes" if the user has issued a login command and received a login acknowledgement from the Network Co-ordinating Station (NCS) in the current ocean region. The readout will be "No" the first time the equipment is turned on, and if the user issues a logout command and receives a logout acknowledgement from the NCS in the current ocean region.

8.4.2.3 TDM type

This tells you if the transceiver is currently tuned to an NCS or an LES channel, or in rare cases a stand-alone station. The possible readouts are: NCS, LES, Joint NCS or Standby NCS,

8.4.2.4 TDM channel number

This is a number from 8000 to 14000, that corresponds to an Inmarsat-C system receive or transmit frequency.

8.4.2.5 Current channel

This information tells what type of channel the transceiver is using. If receiving the channel can be an NCS, LES, and if transmitting it can be "Message" or "Signalling". When changing channel the readout will be "Retuning".

The possible readouts are: NCS, LES, Signalling, Message or Retuning.

8.4.2.6 Current protocol

This will tell you what protocol the transceiver is engaged in.

The possible readouts are:

Free
Pending
Sending Distress
Sending Distress Test
Login
Logout
Changing NCS
Scanning
Link Test
Transmission
Receiving message
Confirmation request
Message delivery
Position report
Data report
Link Test request

The "Pending" status will appear if the Land Earth Station has postponed a transmission or a link test. In this case the LES will automatically inform the transceiver when to try the protocol again.

8.4.2.7 TDM origin

This number is received in the frame-data from the current station. It will correspond to a station found either in the LES or the NCS table.

8.4.2.8 TDM frame number

This is the number of the current received data-frame. The numbers start from 0 at midnight and ends a 9999 just before midnight, which gives a new frame every 8.64 seconds. In case the readout shows "-" the transceiver did not receives a valid bulletin board (see column six in the hardware part).

8.4.2.9 BB error rate

The transceiver keeps a statistics of the bulletin boards last 100 frames. This gives an idea of the signal quality in the last 15 minutes. When transmitting, the transceiver will not increase the error rate. This figure is transmitted to the LES as part of a link test.

8.4.2.10 Serial number

The serial number is mostly hardware identification but also a logical identification of a transceiver, as a specific serial number must follow a specific mobile number.

8.4.2.11 Mobile number

This number is the call code of the unit. It is not used by the equipment to perform it duties, but is merely shown to help you remembering it.

8.4.2.12 Preferred ocean

This information will be used for the next login command you perform.

8.4.2.13 Activities in queue

This information will only be present if you have specified several commands in a row. Transmit commands has the lowest priority of all.

8.4.3 Printing the information

Using the message terminal window program, this information can readily be printed out. Just select the following menus:

```
OPTIONS - TRANSCEIVER STATUS - PRINT
```

Using the TT-3020C/TT-3022D interface this operation can be accomplished by giving the command:

```
st -w p
```

where the letter 'p' means "print".

8.4.4 Storing the information in a file for transmission

In some cases it may be useful to store the status information in a file (on disk) for later use or even transmission via the Inmarsat-C system.

Using the message terminal window program, this information can easily be stored. Just select the following menus:

```
OPTIONS - TRANSCEIVER STATUS - SAVE
```

You can now view the file, load it into the editor and add your own comments, and perhaps transmit the file later.

9. Handling of communication-error situations

9.1 No synchronisation

If you turn on your TT-3020C/TT-3022D Capsat Transceiver and the LOGIN Indicator does not start to either flash or to light steady after 5 minutes, you should check the following:

Do you have an antenna connected?

Is the antenna cable properly fitted?

Look at the status screen. Check the RX reading indicating the antenna current. This current should be above 20 mA. If not the Antenna is not proberly connected.

Check the reading of the status screen's AGC level with the antenna connected and without the antenna connected.

with antenna:	AGC level approx. 800
without antenna:	AGC level approx. 0

Check the reading of the NCS origin ID. Does this match your ocean region?

1-44	Atlantic West
101-144	Atlantic East
201-244	Pacific
301-344	Indian

Has the antenna direct line-of-sight to the selected satellite?

Atlantic West	54°W
Atlantic East	15.5°W
Pacific	178°E
Indian	64.5°E

9.2 Protocol errors

Whenever a link error occurs you will see either

Message from Transceiver:

or

Message from Land Station:

appear before the reason of the error.

Only in case of non-delivery you will still find message codes like:

Land Station gives error code: PRF

where PRF would stand for "Protocol Failure".

These codes cannot completely be eliminated as they can vary from station to station. In case you want a full explanation you should contact the Station Operator.

The current list of Inmarsat-C telex service three-letter errors codes is:

ABS	Absent subscriber.
ACB	Access barred
ADR	Addressee refuses
ATD	Attempting to deliver the message
BK	Message Aborted
BMC	No end of message or end of transmission received
BUS	Busy
CCD	Call cut or disconnected
CIE	The LES ran out of processing/communications capacity to process your message
CNS	Call not started
DER	Out of order
DTE	Remote DTE clearing
EOS	Element of service not subscribed (X.400)
FAU	Faulty
FMT	Format error
FSA	Fast select acceptance not subscribed
IAB	Invalid answerback
IAM	Was unable to process the address information in the following message
IDS	Invalid data from ship
IDT	Input data time-out
IFR	Invalid facility request
IMS	Message size is invalid, 7932 characters max.
INC	Inconsistent request (X.400)
IND	Incompatible destination
INF	Call the network information service

INH	Was unable to establish the type of message from the following header:
INV	Invalid call
ISR	Invalid ship request
ITD	Awaiting delivery
LDE	Maximum message length exceeded
LEF	Local equipment failure
LPE	Local procedure error
MBB	Message broken by higher priority
MCC	Message channel congestion
MCF	Message channel failure
MKO	Message killed by operator
MSO	Machine switched off
NA	Access barred
NAL	No address line was present
NC	Network congestion
NCH	Subscribers number has been changed
NDA	There was no delivery attempt
NFA	No final answerback
NIA	No initial answerback
NOB	Not obtainable
NOC	No connection
NP	No party (Not obtainable)
NRC	Reverse charging acceptance not subscribed
NTC	Network congestion
OAB	Operator aborted
OCC	Occupied
OOO	Out of order
PRC	Premature clearing
PRF	Protocol failure
RCA	Reverse charging acceptance not subscribed
RDI	Redirected call
REF	There was a failure in the remote equipment
RIS	Recipient improperly specified (X.400)
RLE	Ressource limit exceeded
RPE	Remote procedure error
RPO	RPOA (Recognized Private Operating Agency) out of order
RSB	Retransmission still being attempted
SCC	Call completed successfully
SHE	Mobile unit hardware error
SNF	The satellite network has failed
SPE	Mobile unit protocol error
SUC	Test results being delivered
TBY	Trunks busy
TGR	TDM group reset
TIM	Timeout
TMD	Maximum number of addresses exceeded
UNK	Unknown status
WFA	Wrong final answerback
WIA	Wrong initial answerback

9.2.1 List of Link Error Messages

A complete list of error messages is found in this section for your reference.

9.2.1.1 LES messages in case of a pending or rejected call

811 "Message from Land Station: Call rejected: "
814 "Message from Land Station: Call pending: "

followed by:

"Land Station message store full."
"Requested destination not served."
"Satellite circuit not available."
"Terrestrial circuit not available."
"Requested type of transmission not provided."
"Transmission request in queue."
"You are not allowed to use the system."
"Your Transceiver is not logged in."
"Your Transceiver is not commissioned."
"Will call you up later."
"Illegal request."
"Land Station out of service."

9.2.1.2 LES messages in case of an aborted call

813 "Message from Land Station: Call aborted: "

followed by:

"Did not receive your message."
"Transceiver did not follow call procedure."
"Fatal Land Station error."
"Call cleared by Land Station operator."
"Call cleared by Transceiver."
"Land Station did not follow call procedure."
"Land Station has detected Transceiver error."
"Transceiver did not receive message from Land Station."
"Land Station does not support this message type."
"Invalid address."
"Your destination is not commissioned."
"Your destination is not logged in."
"Your destination is not allowed to use the system."

9.2.1.3 Transceiver Messages

"Message from Transceiver:"

followed by:

"Land Station out of service."
The TDM information indicates by a flag in the bulletin board that the particular LES is out of service.

"Satellite link occupied."
The Transceiver has tried to find a free signalling channel slot for 5 times without success, or the TDM bulletin board indicated "congestion".

"No Store and Forward service available."
The TDM information indicates by a flag in the signalling channel descriptor that there are no signalling channels for general use.

"No Distress service available."
The TDM information indicates by a flag in the signalling channel descriptor that there are no signalling channels for distress use and general use.

"No Closed User Group service available."
The TDM information indicates by a flag in the signalling channel descriptor that there are no signalling channels for the closed user group service available.

"No usable signalling channels available at present."
The TDM information indicates by a flag in the signalling channel descriptor that there are no slotted Aloha signalling channels available.

"Your reception is OK,
but erroneous information is transmitted from Land Station."
The TDM bulletin board information indicates 0 or more than 40 signalling channels available.

"Your reception is OK,
but vital information is not transmitted by Land Station."
Either the signalling channel descriptor or the transmission burst was not received two times during reserved access transmission, or the signalling channel descriptor was not received 25 times in unreserved access.

"Your reception is OK,
but your transmission is not received by Land Station."
The Transceiver tried to send the burst 9 times without success.

"Land Station did not respond to transmission request"
The Transceiver did not receive an assignment to send a message.

"Land Station did receive request, but did not respond to it."
The Transceiver timed-out waiting for a response packet from the LES.

"Transmission aborted by operator."
The user or the Transceiver aborted the operation.

"The Land Station does not exist in this Ocean Region."
The coast station selected for transmission was not found in the LES table.

"Cannot acquire synchronisation at the satellite channel."
Either the transceivers synthesisers did not lock after 10 seconds, or the synchronisation was not found, or the tracking was not successful.

"Did not receive any message from Land Station."
The Transceiver tried 4 times to request message packets from the LES.

"Land Station did not finish message."
The Transceiver tried 4 times to end a message reception with the LES.

"Reception aborted by operator."
The user or the Transceiver aborted message reception.

"Transmission hardware error."
Error detected in transmit queue hardware.

"Frequency cannot be tracked."
The Transceiver could not get the frequency difference within 150 Hz of the TDM carrier.

"Land Station did not follow call procedure."
The LES did not reserve a signalling channel slot for the Transceiver as expected.

"Inmarsat-C System is now in Restoration mode."
The system cannot be used for login, logout and link tests as the NCS is out of operation at the moment.

"Land Station does not support Land Mobile Alerts"
The TDM channel information indicated that the LES did not support the alert service.

"No response from Land Station."
The Transceiver sent a login request 4 times without a response.

"Illegal service specified."
The store-and-forward service type was not specified for the transmission.

"Expected Land Station was not found"
The Transceiver has checked the LES ID in your DNID table against the origin ID in the LES TDM and found that they were different. Either your Transceiver tuned to the wrong channel, or the LES TDM channel has been configured incorrectly.

9.3 Login impossible

If your Transceiver cannot login you should first of all contact your LES Operator to verify that the Transceiver is in fact present in the Inmarsat-C System database.

If you have just sent the commissioning forms to your PTT authorities, your Transceiver may not yet be registered with Inmarsat.

In any circumstance you should not use the equipment if you do not know the mobile number of your Capsat System.

9.4 Tuning fails

If your Transceiver looses synchronisation while in a protocol (e.g. message transmission), this may have been caused by incorrect channel information.

If this happens the Transceiver will automatically check if the LES Network Table version number stored in memory is different from the version that the Inmarsat-C system currently uses.

If this is the case, the Transceiver will automatically start a login, to get a new LES Network Table.

You should then attempt to send your message again.

If the tuning still fails you should printout and inspect the hardware status screen. Please refer to section 8.4 on page 39.

If you only have a problem with one specific LES, you should take note of the Signal Strength value in the Status Screen, when the Transceiver is tuned to the particular channel.

For further information please contact your dealer.

10. How to disassemble the Transceiver

If you have to disassemble the TT-3020C/TT-3022D Capsat Transceiver it is important, that you follow the procedure described in this section. Otherwise you will find it very difficult and you risk to permanently damage the Transceiver.

WARNING
Do not try to disassemble the TT-3020C/TT-3022D Capsat Transceiver yourself. This operation must only be performed by T&T approved service personnel.

The procedure used to disassemble the TT-3020C/TT-3022D Capsat Transceiver depends on whether you want to remove the Main Board or the Power Supply Board.

A. Removing the Main Board.

To remove the Main Board you must follow the procedure (please refer to the drawing on Figure 9):

1) Remove the Bottomcover (H3). To do this you must loosen 6 screws. The Main Board will now be visible.

2) Remove the Shield cover from the Main Board (please refer to Figure 10). The Shield cover has been soldered to the Shield Frame. You must unsolder the Shield cover in order to remove it.

3) The next step is to remove the Heatsink Block (H5). The Heatsink Block is secured by 2 screws through the Main Board. One of these screws were located under the Shield cover. These 2 screws are loosened and the Heatsink are removed. The screws used to fasten the Main Board is shown in Figure 10

4) Remove the Support Angle (H4). To do this you must loosen 6 stays.

5) It is now possible to remove the Main Board (TT37-106110). This is done by loosening the remaining 3 screws. Gently take the board out of the Frame (H1). Disconnect the power connector.

B. Removing the Power Supply Board.

If you are interested in removing the Power Supply Board you must first remove the Main Board using the procedure described above. Then you must continue with the step below.

6) Remove the Frontcover (H6). The Frontcover is fastened with 2 snaps. Gently push these snaps toward the middle of the Front using a screwdriver. When you do this the Frontcover can be taken off. If you are not very gentle in this process the snaps may break off and you will have to order a new Frontcover.

7) Remove the Topcover (H2). In order to do this you must loosen 9 screws.

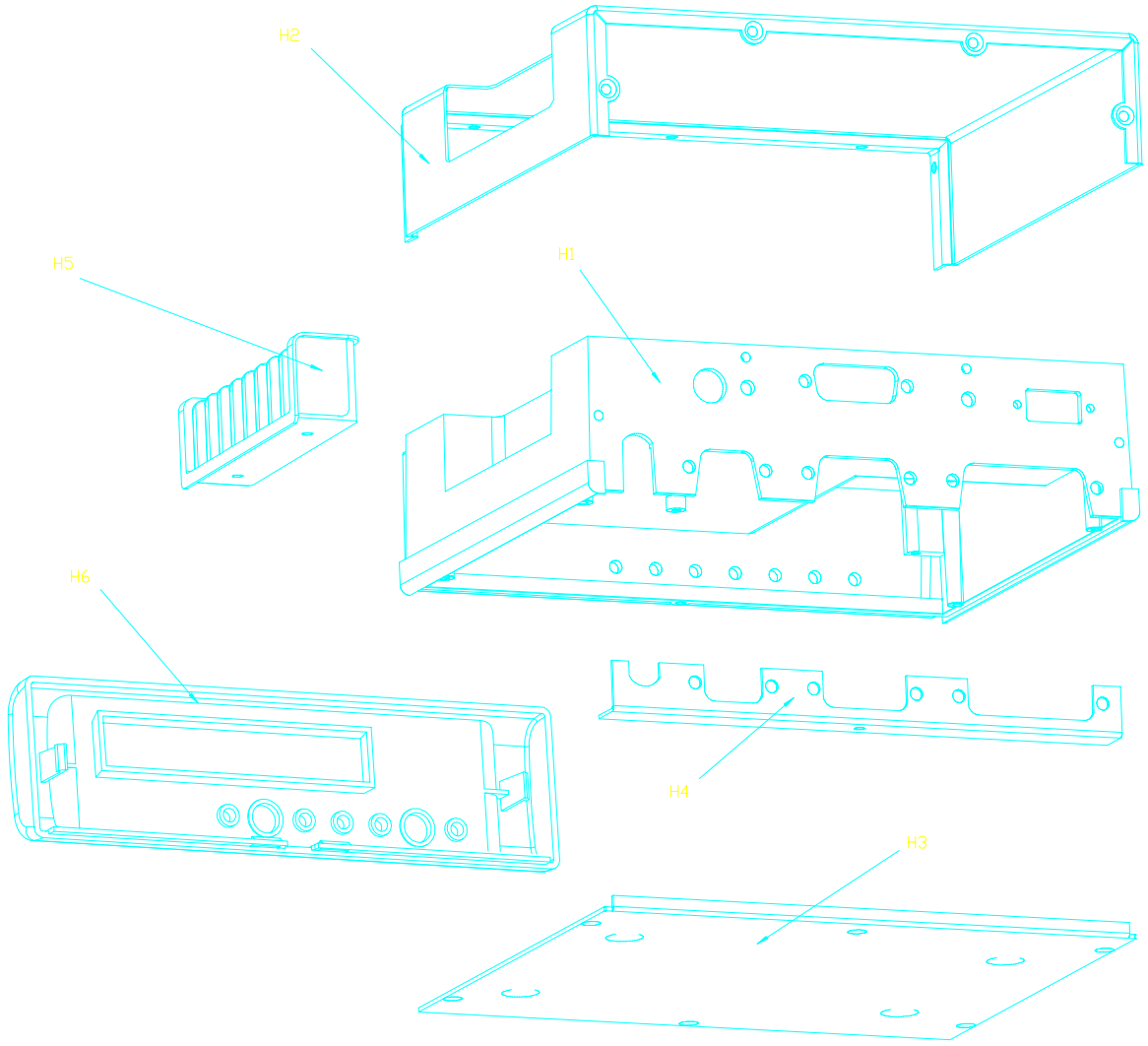


Figure 9 Mechanical parts of the TT-3020C/TT-3022D Capsat Transceiver.

8) The Power Supply now becomes visible. The Power Supply is removed from the Frame (H1). To do this you must first loosen 2 stays and 7 screws. Gently take the board out of the Frame (H1).

You have now completely disassembled the TT-3020C/TT-3022D Capsat Transceiver. To Assemble the Transceiver reverse the process. In this case however you must fasten the 6 stays to the Main Board *before* you mount any screws on the board.

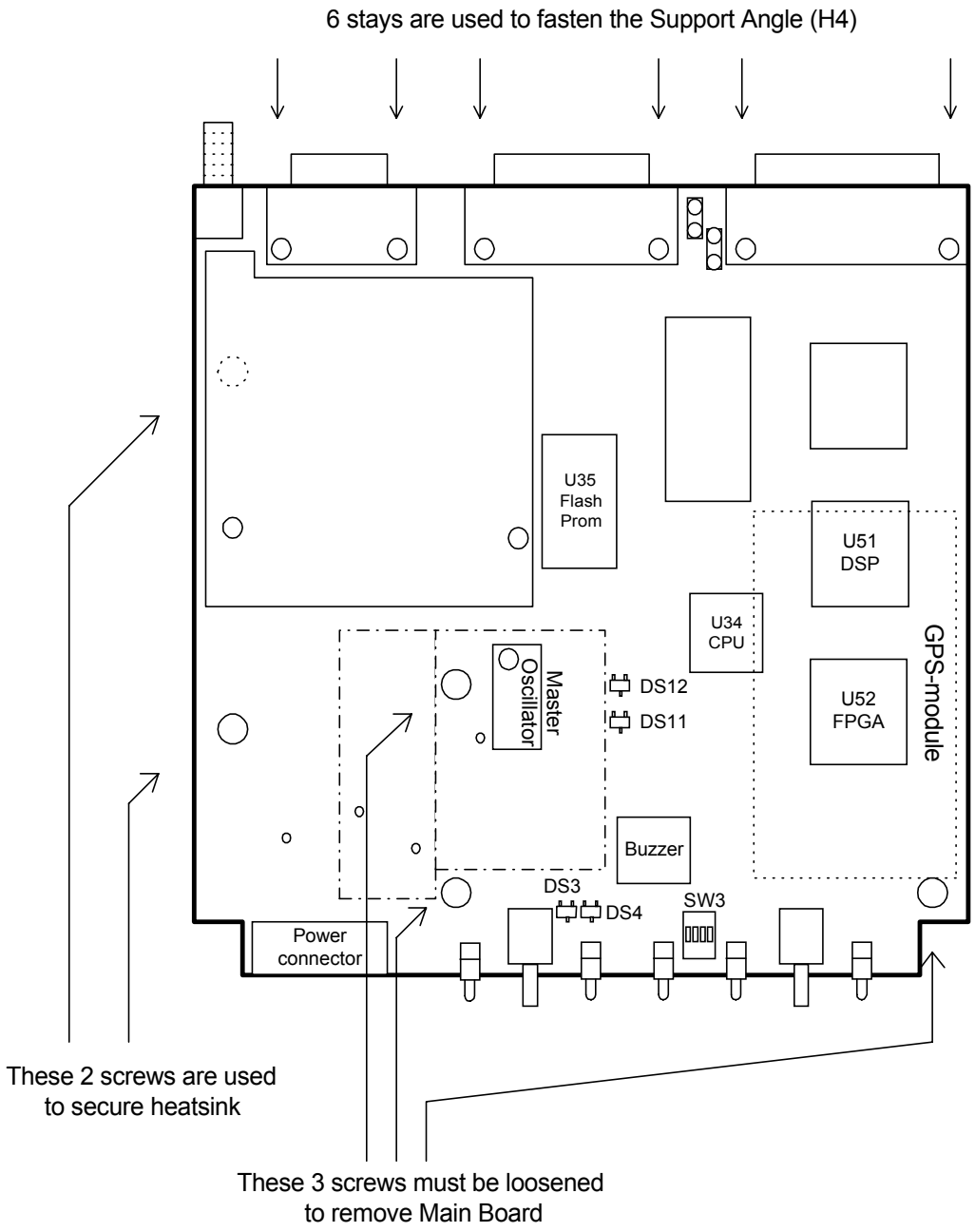


Figure 10 The Main Board are fastened with 5 screws and 6 stays.

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