

Technical Handbook

Tron 40S US version **406 MHz EPIRB**



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However, no responsibility is assumed for inaccuracies.



ATTENTION !

This equipment contains CMOS integrated circuits. Observe handling precautions to avoid static discharges which may damage these devices.



CAUTION !

Some RF semiconductor devices used in this equipment may contain Beryllium Oxide. If inhaled, dust from this oxide can be toxic.

No danger will arise from normal handling but no attempt should be made to tamper with these devices. On no account must these transistors be destroyed or discarded with industrial or domestic waste, but should be returned to the manufacturers for subsequent disposal.

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REVISION HISTORY

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Contents

1. TECHNICAL SPECIFICATION	1-1
1.1 GENERAL	1-1
1.2 406 MHZ TRANSMITTER	1-1
1.3 HOMING TRANSMITTER	1-1
1.4 FB4	1-2
2. DESCRIPTION	2-1
2.1 SYSTEM DESCRIPTION	2-1
2.2 SIGNAL DETECTION	2-1
2.3 DISTRESS LOCATION DETERMINATION.....	2-2
2.4 TRON 40S	2-2
3. GENERAL DESCRIPTION	3-1
3.1 ELECTRONIC UNIT WITH ANTENNA.	3-1
3.2 BATTERY UNIT.	3-1
3.3 EQUATOR RING WITH GASKET.	3-1
4. OPERATING INSTRUCTIONS.	4-1
4.1 MANUAL OPERATION	4-1
4.2 AUTOMATIC OPERATION.	4-1
4.3 TESTING TRON 40S.....	4-1
4.4 ERROR MESSAGES	4-2
5. CHANGE OF BATTERY	5-1
6. TECHNICAL DESCRIPTION	6-1
6.1 MAIN BOARD	6-1
6.2 406 MHZ SECTION.	6-1
6.3 121.5 MHZ SECTION.	6-1
6.4 MICROCONTROLLER SECTION	6-1
6.5 POWER SUPPLY SECTION	6-2
6.6 ANTENNA SECTION	6-2
7. AUTOMATIC RELEASE MECHANISM	7-1
7.1 FLOAT FREE BRACKET FB4/FBH4	7-1
7.2 MOUNTING THE FB4/FBH4	7-1
7.3 MOUNTING OF TRON40S IN THE FB4/FBH4	7-1
7.4 REPLACEMENT AND MOUNTING OF THE HYDROSTATIC RELEASE MECHANISM	7-1
8. DRAWINGS	8-1

1. Technical specification

1.1 General

Dimensions:	Height : 38cm Max diameter :18cm
Weight :	app. 2.0 kg
Antenna :	Built in, vertical polarisation, omnidirectional.
Visual indication :	Built in Xenon flash and Test LED.
Operating temperature :	-20°C to +55°C. Class2. -40°C to +55°C. Class1.
Battery:	JOTRON type number X-97780. Lithium, 4 years service life. 4 pcs. SAFT LSH20 Lithium- Thionyl chloride (Li-SOCL2) Connected in series, fuses in each cell.
Operating Life	More than 48 hours at -20°C.
Material housing:	Polycarbonate with 10% glassfibre.

1.2 406 MHz transmitter

Frequency:	406.025 MHz \pm 2ppm
Output power :	5W \pm 2dB
Digital Message	All protocols available.
Modulation :	Phase modulation 1.1 ± 0.1 rad
Data encoding :	Bi Phase L.
Stability :	Short term : $\leq 10^{-9}$ Medium term : $\leq 10^{-9}$ Residual noise : $\leq 3 \times 10^{-9}$
Bitrate :	400 b/s

1.3 Homing transmitter

Frequency :	121.500 MHz \pm 10ppm
Output power:	50mW \pm 3 dB
Modulation:	A9 AM, sweep tone from min 300 Hz to max 1600Hz. Sweep range 700Hz. Sweep rate 2-3 Hz.

1.4 FB4/FBH4

Dimensions: Height : 42cm
 Width : 21cm
 Depth : 20cm (including beacon)

Weight : app. 1.6 kg / app. 2.9kg

Material : LURAN S

Hydrostatick release : Hammar H20

2. Description

2.1 System description

The COSPAS/SARSAT system was introduced in 1982 as a worldwide search and rescue system with the help of satellites covering the earth's surface. Since the introduction of the system more than 3000 people have been rescued by the COSPAS/SARSAT system.

Currently the system consists of 6 different satellites in a polar orbit constellation, these satellites cover the entire earth's surface and receive the emergency signal from the 406 MHz transmitter within the Tron40S, more polar orbit satellites will be available in the future, giving a faster location and rescue time.

In addition there is currently 1 geostationary satellite which is equipped with a 406 MHz transponder, this satellite is not able to locate the Tron40S but will give an early warning to the rescue forces, minimizing the time from an emergency occurs until the rescue forces are at the site.

The COSPAS/SARSAT organization will launch more geostationary satellites that cover the earth's surface (except polar areas) in the near future (1995-2000).

Each emergency beacon in the system is programmed with its own unique code, therefore it is vital that the ships data given to the dealer you obtained your Tron40S from, is correct. It is also important that the beacon is registered in the database for each country. This database is normally located in the same country that the ship is registered.

2.2 Signal detection

When the Tron40S is activated (manually or automatically) it transmits on the frequencies 121.5 MHz and 406.025 MHz. An analog signal is emitted on 121.5 MHz and a digital signal is transmitted on 406.025 MHz.

After the Tron40S is activated, the next passing satellite will detect the transmitted signal and relay it to an antenna at a ground station, called a LUT.

For the 121.5 MHz signal the satellite must be within line of sight of the Tron40S and a ground station. The ground station or LUT has a 2500 km satellite reception radius centered at the LUT. In areas without LUT coverage (mostly southern hemisphere), signals from the 121.5 MHz transmitter will not be detected. However, this is not the case with the 406 MHz transmitter as the satellites have a memory unit which stores the signals for relay to the next available LUT giving it a truly global coverage.

Once the signal is received by the LUT, it is processed for location and sent to a Mission Control Center (MCC). The MCC sorts the alert data according to geographic search and rescue regions and distributes the information to the appropriate Rescue Coordination Center (RCC), or if outside the national search and rescue area, to the appropriate MCC that covers the area that the distress signal was detected. The RCC in turn takes the necessary action to initiate search and rescue activities.

2.3 Distress Location Determination

The location of the distress signal is determined by taking measurements of the Doppler shift in the beacon signal frequency received by the satellite as it approaches and then passes by the Tron40S. The actual frequency is heard at the time of closest approach (TCA). Knowing the position of the satellite and using the received Doppler signal information, it is possible to determine the location of the Tron40S from the satellite at the TCA. At the LUT, actually two positions are calculated. One is the actual position (A) and the other is the mirror image (B) position. A second satellite pass confirms the correct location (A). With the 406 system the real solution can be determined on the first pass with a reliability of nearly 90% and down to an accuracy of less than 5 km (3.1 miles).

2.4 Tron 40S

Tron40S is a float free emergency beacon intended for use with the COSPAS-SARSAT satellite system. Tron40S transmits on the frequencies 406.025 MHz and 121.5 MHz.

Tron 40S can be activated automatically or manually.

For automatic activation, put the beacon in the upright position into the water, and the transmission starts when the sea water completes the circuit between the two external electrodes (sea water contacts).

When the beacon is mounted in the automatic release mechanism, there is a safety switch in the battery compartment that disables the seawater contacts.

If submerged in water the hydrostatic release mechanism will release the beacon at a depth of 2-4 meters. The transmission will start when the circuit between the seawater contacts are closed and the beacon is out of the bracket.

Tron 40S is manually activated with the main switch, and is then independent of seawater contacts.

Tron 40S may easily be released from the mounting bracket manually.

3. General description

Tron 40S may be split into the following main parts:

1. Electronic unit with antenna
2. Battery unit
3. Equator ring with gasket.

3.1 Electronic unit with antenna.

The electronic unit consists of two printed circuit boards which are mounted in the upper housing. One is the main board and the other is the antenna board.

On top of the antenna board the Xenon flash and an indicator LED is placed.

The main switch is also located on the main board.

The housing is made of polycarbonate.

3.2 Battery unit.

The housing is made of polycarbonate. In the lower part of the housing there is one reed relay which is activated by a magnet in the release mechanism. This is the safety switch which prevent the seawater contacts to activate the beacon while placed in the release mechanism. There is a brass weight which gives stability while floating.

The seawater contacts is also mounted in the battery unit, and is connected to the electronic unit via the battery connector.

The batteries is mounted in with a plastic battery holder, and is also moulded with silicon.

3.3 Equator ring with gasket.

The two parts of the housing are held together by the equator ring, and is locked with a U-shaped bolt of stainless steel and a split pin. Between the two halves of the housing there is a gasket made of neoprene.

4. Operating instructions.

4.1 Manual operation

Remove the beacon from the release mechanism.

Break the seal on the main switch and pull the locking pin. Push in the tab on the main switch, and the switch will go to the Emergency (ON) position.

The red indicator lamp and the Xenon flash on top of the beacon will start operating, indicating that the beacon is active.

NOTE!

The beacon performs a complete selftest before any emergency signals are transmitted. The Transmitters will start after approx. 70 seconds.

The transmission can be stopped by turning the switch back to the READY position, and replacing the locking pin. Make sure the battery compartment is dry, to prevent activation of the seawater contacts.

4.2 Automatic operation.

When the beacon is removed from the release mechanism and placed into water it will automatically activate due to the seawater contacts. Transmission will stop when the beacon is lifted out of the water, and if necessary dried off.

When placed in the automatic release mechanism the seawater contacts is disabled. When the mechanism is reaching a depth of 2-4 meters , the beacon will be released and transmission will start automatically.

Note! There is a time delay of approx. 10 seconds of activation/deactivation with the seawater contacts.

4.3 Testing Tron 40S

To perform the selftest the beacon has to be removed from the release mechanism. Turn the switch to the «TEST» position. The red indicator will start flashing for approx. 15 sec. This is to allow the internal OCXO (Oven Controlled Reference Oscillator) to warm up.

Then the output power of both transmitters are checked, the battery voltage and the PLL of the 406 transmitter.

A complete message on the 406 frequency is transmitted, with inverted frame sync.

If all tests are passed there will be one flash in the Xenon bulb, and the red indicator light will turn on and stay on until the switch is released.

A successful test will then consist of a series of rapid flashes in the test indicator , followed by one Xenon flash and continuous light in the test indicator.
Any other behaviour indicates a fault in the beacon.

4.4 Error messages

If the selftest detects a fault in the beacon one or more of the following indications are shown :

1. Flashing LED for 15 sec. followed by one (1) flash , no Xenon flash :
 Low power on 406 MHz transmitter
2. Flashing LED for 15 sec. followed by two (2) flashes, no Xenon flash :
 Low battery voltage.
3. Flashing LED for 15 sec. followed by three (3) flashes , no Xenon flash :
 Low power on 121.5 MHz transmitter
4. Flashing LED for 15 sec. followed by four (4) flash , no Xenon flash :
 PLL on 406 transmitter out of lock.
5. Five (5) flashes , no Xenon flash:
 Beacon not programmed or programming not complete.

5. Change of battery

The lower part of the beacon of the housing is replaced with a new one.

1. Remove split pin and pull the U-shaped bolt from the equator ring.
2. Remove the equator belt by pressing it out from the housing.
3. Separate the two parts of the housing.
4. Unplug the battery connector.
5. Check that the new battery is marked with date of expiration.
6. Place the new gasket on the battery housing.
7. Connect the battery connector.
8. Replace the upper part, taking care that the gasket is correctly fitted and taking note of the orientation marks on the two housings.
9. Replace the equator ring, U-shaped bolt and split pin.
10. Perform a Selftest.

6. Technical description

6.1 Main board

The main board can be divided into the following groups :

1. 406 MHz section
2. 121.5MHz section
3. Microcontroller section
4. Powersupply section
5. Antenna section

6.2 406 MHz section.

The 406 transmitter consists of VCO (Q101), buffer amplifier (Q102) and power amplifier (Q103). The output power is 5W. The supply voltage is regulated and switched in the power supply section.

The output frequency is controlled by a PLL circuit (IC203), prescaler (IC204) and reference oscillator (IC205).

Modulation is applied to the reference signal by pulling the reference signals phase.

6.3 121.5 MHz section.

The 121.5MHz transmitter is Xtal controlled. The output power is approx. 200mW PEP. The output power is controlled by IC301 which senses the current in the output stage. The output signal is fed into the antenna via the matching network consisting of L308 and L307. 406 MHz signal is fed directly to the same antenna via pin diode D809. This diode is reverse biased when transmitting on 121.5MHz., by rectifying and inverting the modulation signal(D306).

6.4 Microcontroller section

This section consists of a microcontroller (IC401), EEPROM (IC402) for storing of programming data, a DIL switch, and an I/R interface for programming.

The DIL switch has the following function :

1. VHF modulation on/off
2. UHF repetition rate normal/fast
3. UHF on/off
4. VHF on/off

6.5 Power supply section

The main switch controls Q503 via reed relays Rel501, Rel502 and Rel503. The seawater circuit (IC503) is supplied from a separate reed in the battery compartment, to prevent it from working when placed in the bracket.

IC502 is the 5V main voltage regulator for the microcontroller. It is also reference voltage for the 406 supply witch/regulator.

The circuit to prevent continuos transmission on 406MHz consist of R512, C503, IC501B and Q504. If the transmission length exceeds a few seconds, Q504 is biased and the fuse F501 will be blown.

6.6 Antenna section

The antenna board is the actual antenna. It behaves as a quarter wave on 406 MHz. It is matched to 121.5 MHz as described in 121.5 MHz section.

The high voltage converter to the Xenon flash is also located on the antenna board. The Xenon bulb and test indicator (LED) is placed at the upper end of the antenna board.

7. Automatic Release Mechanism

7.1 Float Free Bracket FB4/FBH4

When the Tron40S is mounted in the FB4/FBH4 release mechanism, it operates as a float free automatic unit.

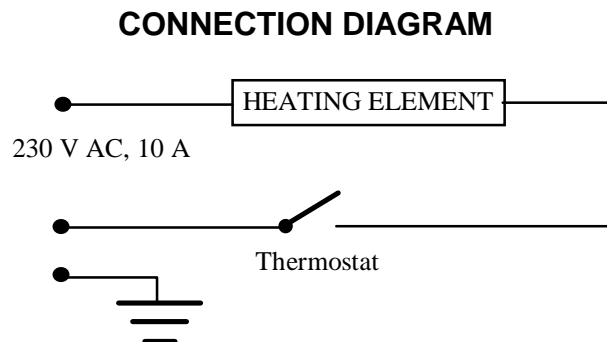
Therefore it is important that the bracket is mounted in a place where there are no obstructions that can endanger the automatic release of the beacon.

The location where the bracket is mounted should be as high as possible on the vessel, protected from environmental conditions such as direct sea spray, chemicals, oil, exhaust and vibrations. The location must also be easily accessible for testing and maintenance.

7.2 Mounting the FB4/FBH4

Bolt the unit to the vessel using the mounting holes.

The **Float Free Bracket FBH4** must be connected to the fixed installation (230V AC, 10A) through the thermostate connection box according to the connection diagram.



7.3 Mounting of Tron40S in the FB4/FBH4

Place the lower part of Tron40S on the grip in the bracket. Then push the beacon into the bracket and fold the clamp over the upper part. Place the retaining rod into the corresponding holes in the clamp and the plastic bolt.

Replace the locking pin.

7.4 Replacement and mounting of the Hydrostatic Release Mechanism

- While holding the Tron 40S in its place, pull out the locking pin on clamp on the top of the bracket.
- Fold the clamp away.
- Lift the Tron 40S out of the bracket.
- Now the H20 unit is accessible. Unscrew the plastic bolt and remove the unit.
- Replace the old unit with a new one. Screw the new plastic bolt on. Make sure the distance piece is in place on the plastic bolt.
- Mount the Tron 40S as described earlier.

8. Drawings

Main Board :

Circuit diagrams: [E-92716-1](#)
[E-92716-2](#)
[E-92716-3](#)
[E-92716-4](#)
[E-92716-5](#)

Component Layout [KP-92716-1](#)
[KP-92716-2](#)

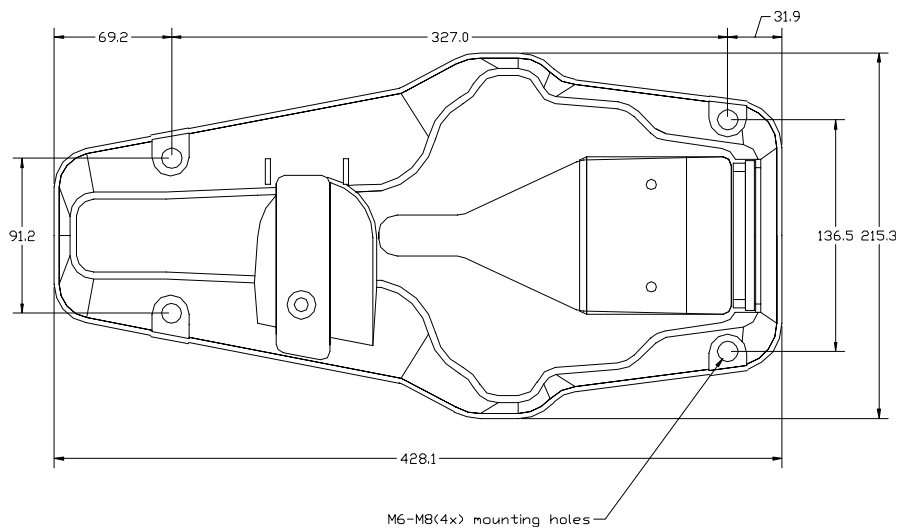
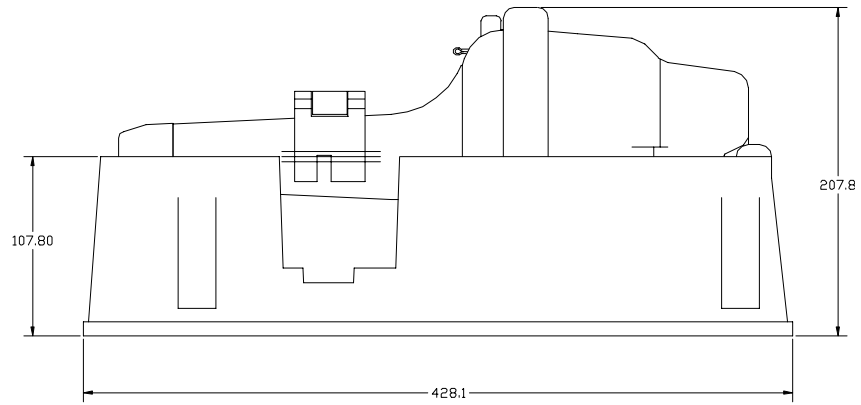
Antenna Board :

Circuit diagrams: [E-92718](#)

Component layout [KP-92718-1](#)
[KP-92718-2](#)

Battery unit: [E-97780](#)

Outline drawing: [Tron40S in FB4](#)



Outline drawings FB4/FBH4

