SI-TEX

MDS 1

Radome 0.9 Feet

MDS 8

Radome 1.5 Feet

MDS 9

Radome 1.8 Feet

MDS 10

Open 4 or 5 Feet

User Manual

code: (D 050608e)

Safety Precaution

HIGH VOLTAGE WARNING

Dangerously high voltages are present within the RADAR scanner unit. There are no internal connections or adjustments necessary for installation. Only a qualified radar service technician should remove the cover. Technicians must exercise extreme care when working inside the unit. Always remove power before removing the cover. Some capacitors may take several minutes to discharge, even after switching off the radar. Before touching the magnetron or any high voltage components, ground them with a clip lead.

MICROWAVE RADIATION HAZARD

The microwave energy radiated by a radar antenna is harmful to humans, especially to one's eyes. Never look directly into an open waveguide or into the path of radiation from an enclosed antenna. Radar and other radio frequency radiation can upset cardiac pacemakers. If someone with a cardiac pacemaker suspects abnormal operation, immediately turn off the equipment and move the person away from the antenna. Turn off the radar whenever it is necessary to work on the antenna unit or on other equipment in the beam of the radar.

MAGNETRON PREHEATING

When starting your RADAR for the first time or when restarting it after a two month or longer non-operating period, preheat the magnetron at least 30 minutes in standby mode.

Please read through this manual before the first operation. If you have any questions, please contact the Company's customer service or your local dealer.

Contents

About this User Manual

INTRODUCTION

Your RADAR consists of two main components, the RADAR scanner unit and a ColorMax Series display unit. The display unit is a user-supplied plotter capable of running the radar operating application. The RADAR scanner unit includes the radar antenna, transmitter, receiver and necessary electronics to deliver radar information to the user's plotter. The mounting hardware kit, interconnection cable and a Radar junction box are included in the Radar scanner box.

Any menu operation and functions activation in this User Manual is related to the following chart plotter models (see the following table). Whenever it is necessary, a note has been inserted for those models with operational differences.

CHART PLOTTER NAME	SOFTWARE	SN	Radar Serial Port	Available from Sw
EXPLORER II Plus	S5egSWctc	All	2 or 3	11.00
EXPLORER II Plus	S3egSWctcj	All	2 or 3	11.00
EXPLORER II Plus	XSegSWctcj	After February 2005	2 or 3	11.00
COLOR MAX WIDE E	S4egSW7wc	All	2 or 3	11.00
COLOR MAX WIDE I	S4igSW7wc	All	2	11.00
COLOR MAX WIDE E	S3egSW7wc	All	2 or 3	11.00
COLOR MAX WIDE I	S3igSW7wc	All	2	11.00
COLOR MAX SEALINK E	S4egSW8wc	All	2 or 3	11.00
COLOR MAX SEALINK I	S4igSW8wc	All	2	11.00
COLOR MAX 11	XSegSW11c	After February 2005	2 or 3	11.00
COLOR MAX 11	S3egSW11c	All	2 or 3	11.00
COLOR MAX PRO	S4egSW11c	All	2 or 3	11.00
TRAWL PLOT 12	S5egSW12c	All	2 or 3	11.00
TRAWL PLOT 12*	XSegSW12c	After February 2005	2 or 3	11.00
COLOR MAX 15	S5egSW15c	All	2 or 3	11.00
COLOR MAX 15	S3egSW15c	All	2 or 3	11.00

NOTE *The serial Port 3 is usually used for the Smart GPS.*

NOTE* *To connect the TRAWL PLOT below s/n 4129999 (before February 2005) please contact your local dealer (to make the hardware change necessary).*

The Radar full functionality, as described in this User Manual, is obtained only when the scanner is included in an integrated system including chart plotter, gyrocompass and GPS antenna.
Please read carefully this User Manual to learn the operating features for your Radar. Please refer to your chart plotter User Manual for all other operating instructions.

CONVENTIONS USED

Throughout this User Manual, the labelled keys are shown in capital letters enclosed in square brackets, for example [ENTER]; the software keys are shown in small capital letters enclosed in square brackets, for example [EDIT].
Menu operations are in bold characters listed by keys sequence with the menu names enclosed between inverted commas, for example **[MENU] + "ALARMS" + [ENTER]** means: press the [MENU] key, using the cursor key select the Alarms menu and then press [ENTER].

HOW THIS USER MANUAL IS ORGANIZED

- **CHAPTER 1: Radar Installation**
  Installation of the Radar and set up of the hardware configuration.
- **CHAPTER 2: Functions**
  How to connect the chart plotter and the Radar; and how to operate them.
- **CHAPTER 3: Radar Pages**
  Description of the available Radar pages, full and split pages.
- **CHAPTER 4: Technical Specifications**
  Technical specification and dimensions of the Radar.
- **CHAPTER 5: Troubleshooting**
- **CHAPTER 6: Frequently Asked Questions**
- **APPENDIX A: What is Radar?**
- **APPENDIX B: Installation**

The Analytical Index is at the end of this User Manual.

IF YOU NEED ASSISTANCE

If your chart plotter does not operate properly, please refer to the chart plotter User Manual.

EQUIPMENT SUPPLIED

- Scanner Unit, Radar scanner with cable
- Fasteners, stainless steel:
  - 4 Bolts, hex metric M8 x 25U (approx. 3/8 dia. x 1 in. long)
  - 4 Flat washer
  - 4 Lock washer
- 1 Radar Junction Box
- 1 Template, for locating mounting holes
- 1 Switch, Rocker type, DPST
- 2 Fuses, 5A (spare)

Optional Equipment

- Magnetic Heading Sensor
- Extended length cables, 15 or 20 meters

1. Radar Installation

This chapters illustrates the instructions on electrical connections of the Radar and the necessary software settings to operate it.

WARNING

In order for the Radar to communicate with the Chart Plotter, the software configuration explained in the Par. 1.7 is mandatory.

1.1 INSTALLATION CONSIDERATIONS

Prior to the actual installation of the RADAR scanner unit, several factors must be considered to ensure maximum performance. The scanner must be located so that passengers and crew are not exposed to the direct Radar beam. The scanner unit should be mounted on the centerline of your vessel in a location that has an unobstructed view forward and the rest of the area around the scanner is as unobstructed as possible. A location as high as practical to improve maximum range is preferable, keeping in mind that minimum range objects may be overlooked if mounted too high. Place the units in before large structures and exhaust stacks. Large structure or stacks cause blind spots. Contamination from engine exhaust on the scanner housing reduces radar performance.
Antennas for GPS, radio communication or other equipment should not be in the radar beam. Use non-metallic extension poles to move the active area of antennas above the radar beam.
In selecting a location, consider the suitability of the mounting surface. It must be flat and approximately levelled with the vessel's water line. The surface must support the weight of the scanner and have access to the under side for installation of the four mounting bolts.

NOTE *The recommended mounting surface thickness is 3/8 to 1/2 in. (9 mm to 13 mm). If the mounting surface is thin, a doubler should be added. If it is thicker, longer bolts must be purchased. The scanner will be damaged if bolts penetrate more than 9/16 in. (15 mm).*

Also, consider the cable route from the scanner to the operator's location. Avoid routing the interconnecting cable through areas of possible damage from moving objects, machinery, and exposure to chemicals or high temperature.

1.2 PREPARE THE RADAR FOR INSTALLATION

Unpack your new RADAR and check that the contents correspond to the packing list. Do not remove the cover from the unit. There are no connections or adjustments inside the unit that are needed for installation or operation. The cable must remain attached. For ease of handling, coil the cable and place it on top of the scanner. Then secure it with tape. Invert the scanner and make sure the four mounting holes are clear to accept bolts.
Working at higher elevations may become necessary while installing the scanner unit. Observe safety measures and take sufficient precaution to avoid personal injury or damage to the equipment.

1.3 INSTALLATION PROCEDURE

- Prepare the mounting surface by making sure it is clean and flat.

NOTE *It is a better to check the accuracy of the template by measuring the actual dimension between the hole locations. The reproduction process and moisture absorption can affect accuracy.*

- Use the template provided to mark the location of four mounting holes. Align the template squarely with the centerline of the vessel and with the arrow pointing forward.
- Drill four 3/8 in. (10 mm) diameter holes through the mounting surface.
- Check that each bolt (with lock washer and flat washer) protrude through the mounting surface at least 5/16 in. (8 mm) but less than 9/16 in. (15 mm). The scanner will be damaged if bolts protrude more than 9/16 in. (15 mm).
- Apply sealant around each mounting hole.
- Place the Radar scanner unit on the mounting surface. Orient the scanner with the index mark on the housing facing forward (cable gland facing aft).
- Install and tighten four M8 x 25U (M8 x 1 in.) mounting bolts.
- Uncoil the scanner cable.
- Secure the cable near the scanner to support the weight of the cable and prevent strain on the watertight cable seal. If the cable is to pass through tubing or a bulkhead, protect the unfinished end. Do not use the unfinished wires or fabric braid to pull the cable. Attach a fish cord only to the cable jacket.
- Route the cable to the operator's location, securing it at appropriate points along the way. Make a drip loop and apply sealant at the entry point of an exterior bulkhead.

1.4 ELECTRICAL AND DATA CONNECTIONS

The cable from RADAR scanner unit provides all power, data and control connections necessary for operation. The large black and white leads are for power connections and connect directly to a 12 to 24 VDC power buss; the five small leads, in the fabric braid, connect to the Radar Junction Box; and the two remaining small leads connect to the On/Off control switch. The On/Off control switch does not switch the main power leads to the scanner unit, but it does provide a signal that controls DC power inside the scanner unit.

1.5 CONNECTION PROCEDURE

NOTE *In the following procedures, small wires must be stripped and tinned, and then connected to the proper connections in the Radar Junction Box, and to pins on the On/Off control switch. If you are uncertain of your skill in completing these tasks, it is strongly advised to obtain the services of a qualified technician. It is essential to the operation and reliability of your RADAR that these procedures are accomplished properly.*

- Arrange the free end of the scanner cable so that the unfinished leads will reach their intended points for connections. The two large wires must reach a power panel; the five leads in the braided fabric jacket must reach the Radar Junction Box and the two remaining leads must

reach the desired location for the On/Off control switch. If the leads must go in different directions, first route the five leads in the fabric braid to the Junction Box. Then extend the shorter leads using the same size or larger size wire.

1.6 RADAR JUNCTION BOX CONNECTIONS

Referring to the diagram below, connect the color coded wires from the Radar cable to the designated place on Terminal strip A in Radar Junction Box as follows.

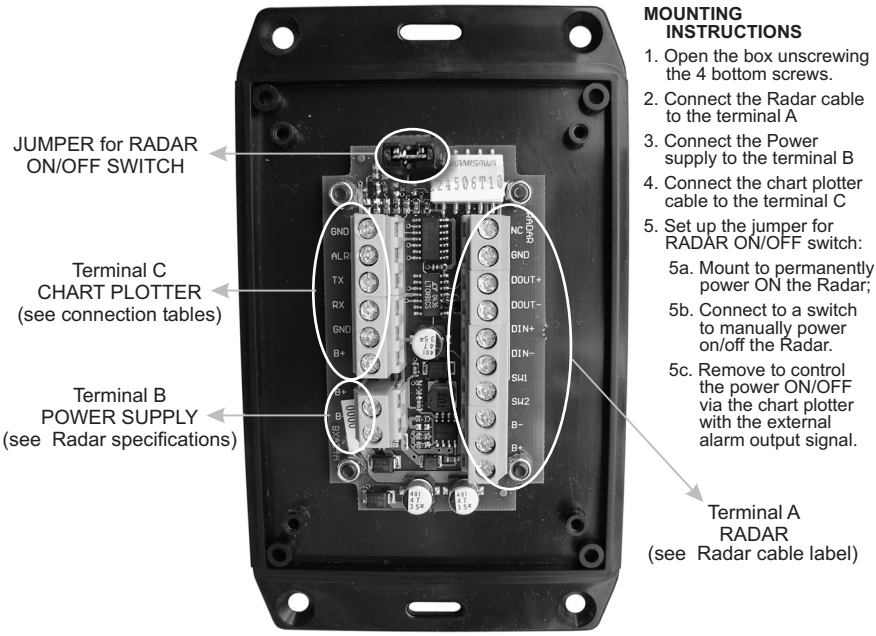
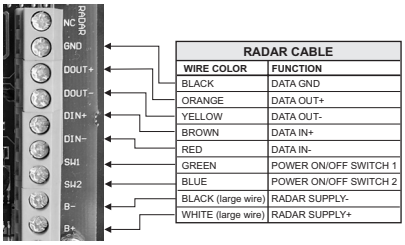


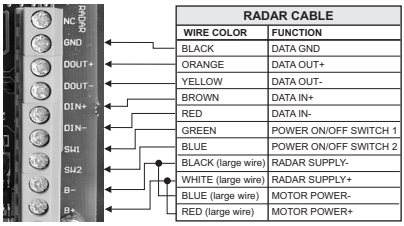
Fig. 1.6 - Junction Box

Terminal Strip A



RADAR CABLE	
WIRE COLOR	**FUNCTION**
BLACK	DATA GND
ORANGE	DATA OUT+
YELLOW	DATA OUT-
BROWN	DATA IN+
RED	DATA IN-
GREEN	POWER ON/OFF SWITCH 1
BLUE	POWER ON/OFF SWITCH 2
BLACK (large wire)	RADAR SUPPLY-
WHITE (large wire)	RADAR SUPPLY+

Fig. 1.6a - Terminal Strip A Connection for MDS 1/MDS 8/MDS 9



RADAR CABLE	
WIRE COLOR	**FUNCTION**
BLACK	DATA GND
ORANGE	DATA OUT+
YELLOW	DATA OUT-
BROWN	DATA IN+
RED	DATA IN-
GREEN	POWER ON/OFF SWITCH 1
BLUE	POWER ON/OFF SWITCH 2
BLACK (large wire)	RADAR SUPPLY-
WHITE (large wire)	RADAR SUPPLY+
BLUE (large wire)	MOTOR POWER-
RED (large wire)	MOTOR POWER+

Fig. 1.6a1 - Terminal Strip A Connection for MDS 10

Terminal Strip B IS TO BE CONNECTED TO POWER SUPPLY (12 TO 24 VDC NOMINAL)
Do not omit the in-line fuse unless a dedicated and fused terminal is available. If so, install a 5 Amp fuse. If you are installing a MDS 10 open scanner Radar, it is important to also connect the Red (+) to positive power terminal, and Blue (-) to negative power terminal, as this provides power to scanner motor.
This terminal leads the power to the Scanner unit and to the chat plotter (*).

NOTE*(*)Only if the chart plotter power wires are connected to Terminal strip C, on B+ and GND terminals.*

12-24V POWER SUPPLY	
WIRE COLOR	**FUNCTION**
RED	POWER SUPPLY+
BLACK	POWER SUPPLY-

Fig. 1.6b - Terminal Strip B

WARNING

Please make sure that the connected power supply is able to supply the current at the voltage required by the Radar to operate.

Terminal Strip C
See connection tables to determine proper way to connect the chart plotter to Radar Junction Box.

POWER & I/O CABLE CONNECTION TO PORT 2		
PIN	**WIRE COLOR**	**FUNCTION**
1	BLACK	GND/COMMON
2	RED	POWER INPUT+ (10-35 Vdc)
3	WHITE	INPUT 1+
4	GREEN	INPUT 1-
5	GRAY	OUTPUT 2+
6	YELLOW	OUTPUT 1+
7	BROWN	INPUT 2+
8	BLUE	OUTPUT EXTERNAL ALARM+

Connect to control the Radar ON/OFF via the chart plotter. Make sure that:
1) This signal is not used for any other operation (external alarm)
2) The jumper is removed on the junction box

Connect to power the chartplotter via the junction box

Fig. 1.6c - Connection to Port 2

QUICK DISCONNECT BRACKET CABLE	
WIRE COLOR	**FUNCTION**
BLACK	GND
BROWN	INPUT 2+
GRAY	OUTPUT 2+

Fig. 1.6c1 - Connection to Port 2 for Quick Disconnect Bracket Cable

1.6.1 Jumper To Control Radar On/Off Operation

1.6.1.1 Radar Powered On all the time

Leave jumper located at top of Radar Junction Box mounted. This will keep powered On at all times.

1.6.1.2 Radar Powered On/Off Controlled by an External Switch

The two remaining small leads, the Green wire and the Blue wire, connect to the On/Off control switch. The On/Off control switch does not switch the main power leads to the scanner unit, but it does provide a signal that controls DC power inside the scanner unit.

1.6.1.3 Radar Power On/Off Controlled by the Chart Plotter Software

Not Available For COLOR MAX WIDE I/E & COLOR MAX SEALINK I/E

Remove jumper. Connect the EXTERNAL ALARM signal of the chart plotter to TERMINAL Strip C, Terminal ALR (see connection tables).
Setting up the chart plotter I/O in the following mode:

➤ **[MENU] + [MENU] + "ADVANCED" + [ENTER] + "Input/Output" + [ENTER] + "RADAR" + [ENTER] + "EXT. ALARM" + [ENTER]**

Power the Radar On/Off directly from:

➤ **[MENU] + "POWER" + [ENTER] + "ON"/"OFF" + [ENTER]**

1.6.2 Alternative Power Connection

You can feed the Power supply to the Radar directly.

1.6.2.1 Power Connections

- Route the large black and white wires directly to the power panel. No switch is required.
- Connect the large black wire to the battery negative (—) terminal of the power panel.
- Connect the large white wire (with the in-line fuse) to the battery positive (+) terminal of the power panel (12 to 24 VDC nominal). Do not omit the in-line fuse unless a dedicated and fused terminal is available. If so, install a 5 Amp fuse. If you are installing a MDS 10 open scanner Radar, it is important to also connect the Red (+) to positive power terminal, and Blue (-) to negative power terminal, as this provides power to scanner motor.

This completes the installation of your Radar scanner unit.
Please proceed with setting up the data ports in your chart plotter, following the instructions below.

1.7 SOFTWARE CONFIGURATION

First you have to install the Radar. Refer to the following paragraphs to configure the chart plotter to operate with the Radar.

1.7.1 I/O Setup

Setting up the chart plotter I/O depends upon which port is used to connect the Radar. If you use the connecting cable supplied with the Radar, the Port2 is the default setting. In this case follow the procedure:

➤ **[MENU] + [MENU] + "ADVANCED" + [ENTER] + "Input/Output" + [ENTER] + "Port 2 Input" + [ENTER] + "RADAR" + [ENTER]**

1.7.2 Warming Up

It has to be noted that at start-up the Radar needs a variable time from 90 to 120 seconds to heat up the magnetron (microwave emitting tube). During this time it is not possible to turn on the transmission.
Radar pages are visible but with a small overlapping message window showing the time remaining to Warm Up completion:

"Radar Warming Up! xx seconds remaining!"

At completion of the Warm Up sequence the following message will be displayed:

"Radar Warming Up! Warm Up Completed!"

This window shall remain open for 2 seconds, then it will close automatically.
At this point the Radar is ready for operation. Transmission is turned Off and "STAND BY" message is displayed at the center of the Radar page.

1.7.3 Transmission On

Turn On the transmission pressing:

➤ **[ENTER]**

NOTE *or following the procedure:*

➤ **[MENU] + "TRANSMISSION" + [ENTER] + "ON" + [ENTER]**

or using soft keys:

➤ **any soft key + [Tx]**

The Radar image is displayed on the screen.

1.7.4 Radar calibration

At first installation it is necessary to properly calibrate the Radar:

➤ **[MENU] + "TUNING" + [ENTER]**

The Radar calibration includes:

- Heading Line
- Antenna Parking Position (**ONLY FOR MDS 9/MDS 10)**
- Sector Transmission Off (**ONLY FOR MDS 9/MDS 10)**
- Transmission Trigger Delay

1.7.4.1 Heading Line

This function is used if the Radar Antenna was not installed pointing directly parallel with the centerline of the vessel. Adjusting the heading line ensures that targets are shown relative to your ship's bow.

- select Head Up mode

➤ **[MENU] + "ORIENTATION" + [ENTER] + "HEAD UP" + [ENTER]**

- Press **[CLEAR]** until the Radar page is shown.
- Select a target about 1- 2NM and adjust the vessels speed to accurately head to the target (preferably on a flat calm day).
- If the target is not shown directly ahead on the Radar full page display, adjust heading the line to correct the target heading:

➤ **[MENU] + "TUNING" + [ENTER] + "HEADING LINE" + [ENTER] + Apply the Heading Correction + [ENTER]**

- The screen updates as the heading line is adjusted. Repeat the steps until the target is shown correctly.

1.7.4.2 Antenna Parking Position

AVAILABLE ONLY FOR MDS 9/MDS 10

When the Radar is turned Off, the antenna comes to a stop. If you want to have the antenna to stop in a specific position, the Antenna Parking Position function can be used to choose the desired antenna position. This function only controls the antenna position at which the power to the motor is cut off. The distance

through which it comes to a stop from this point depends on temperature and wind conditions. The setting of antenna does not affect the operation of the Radar at all. To set the antenna position follow this procedure:

➤ **[MENU] + "TUNING" + [ENTER] + "ANTENNA PARKING POSITION" + [ENTER]**

Use the cursor keys to adjust the position (between 0 and 90).
The displayed number represents the change from the default setting. The final setting that parks the antenna straight ahead will likely be a few degrees left or right from the default setting.

1.7.4.3 Sector Transmission Off

Available Only For MDS 9/MDS 10

This is used to block transmission and target reflection in some special application for fixed installation like sea watching. Within this sector, targets can not be detected.
Selecting the Sector Transmission Off from the menu:

➤ **[MENU] + "TUNING" + [ENTER] + "SELECT TRANSMISSION OFF" + [ENTER]**

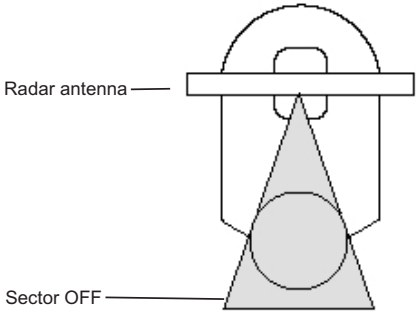


Fig. 1.7.4.3 - Sector Off

1.7.4.4 Transmission Trigger Delay

Tuning the Transmission Trigger Delay (TTD) allows making accurate distance measurement. In practice, you need to align the start of the sweep with the leading edge of the transmission pulse.
IMPORTANT: The unit comes with a default Tuning value already setup by the factory but to obtain maximum precision you should finely adjust this value. Use the following procedure.

- Enter the Transmission Trigger Delay page.

➤ **[MENU] + "TUNING" + [ENTER] + "TRANSMISSION TRIGGER DELAY" + [ENTER]**

Since the STC is automatically turned off when entering this page, the screen appear completely covered with clutter, this is a mandatory condition to allow properly setting the TTD. The screen should appear as follows:

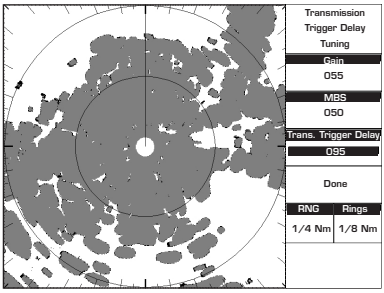


Fig. 1.7.4.4 - Transmission Trigger Delay tuning (I)

- Set MBS to 0. The white spot in the Radar origin will disappear.

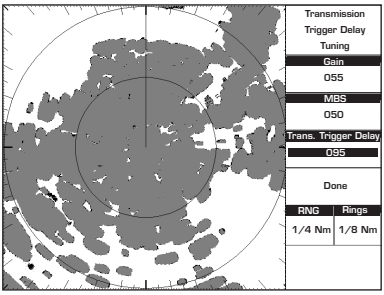


Fig. 1.7.4.4a- Transmission Trigger Delay tuning (II)

- Slowly decrease the GAIN value until the clutter clears out and you can clearly distinguish a round spot in the Radar origin:

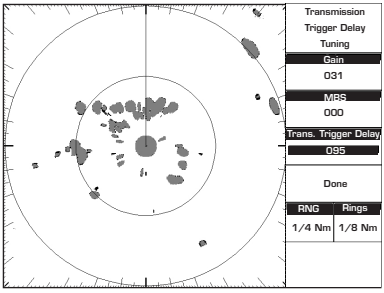


Fig. 1.7.4.4b - Transmission Trigger Delay tuning (III)

- If the Transmission Trigger Delay is properly tuned the spot in the Radar origin should appear as in the picture above. In any case to be sure your TTD is properly tuned try to decrease the Transmission Trigger Delay until a hole start forming in the center of the round spot:

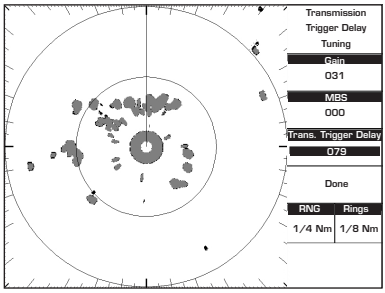


Fig. 1.7.4.4c - Transmission Trigger Delay tuning (IV)

- Now increase the TTD until the hole closes (not more than just the value to make it close). The increase rate should be very slow: just increase by a single step at the time and wait until you see the effect on the screen. When the hole in the center of the spot closes you have reached the optimal TTD setting.

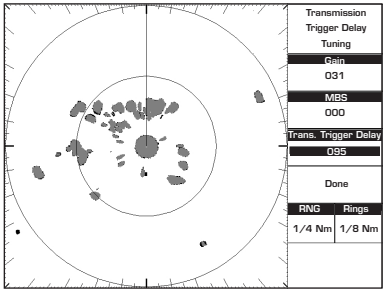


Fig. 1.7.4.4d - Transmission Trigger Delay tuning (V)

- The spot in the Radar origin is the transmission pulse itself. Targets within such range are not detectable because their echoes are completely overwritten by the Radar still transmitting. Such spot is called Main Bang. To remove it from the screen it is necessary to properly set the MBS (Main Bang Suppression) control. To do this, increase slowly the MBS. The spot is progressively deleted from the inside toward the outside

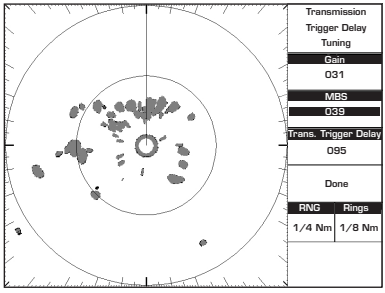


Fig. 1.7.4.4e - Transmission Trigger Delay tuning (VI)

- Continue increasing the MBS until the spot completely disappear:

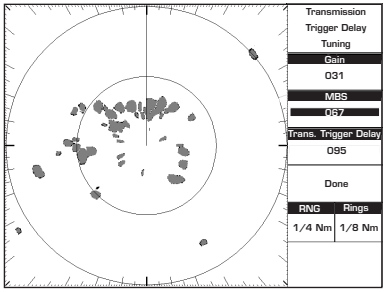


Fig. 1.7.4.4f - Transmission Trigger Delay tuning (VII)

- Select DONE to exit the TTD tuning menu saving your settings.
- The main Radar page is displayed. Please note that since initially Gain was decreased, now it's necessary to increase it back in order to achieve maximum sensitivity:

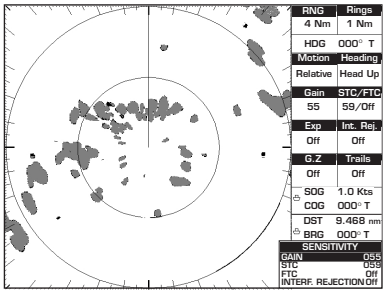


Fig. 1.7.4.4g - Transmission Trigger Delay tuning (VIII)

Once the calibration has been performed, the calibration data is retained. However if a Clear RAM operation is performed it may be necessary to repeat the calibration.

1.7.4.5 Automatic and Manual Tune

Not Necessary At First Installation

The Tune control is used to tune the receiver in the Radar antenna for maximum target returns on the display. The Radar comes from the factory already tuned so this operation is not necessary at first installation. In general Radar Tuning may be necessary if any component of the Radar is replaced for maintenance.

The Radar receiver can be tuned in Automatic or Manual mode. In Automatic Tune mode, the Radar tunes itself automatically on all range scales. **It is recommended to execute the Tune function in Automatic mode.** This generally ensures that the Radar receiver is always tuned to receive the maximum signal. If you choose the Manual Tune, you will need to adjust it again after 10 minutes, after you have turned on the Radar, since the required setting will change after the magnetron has warmed.

NOTE *The Manual Tune function should be made only by professional operators.*

Manual Tune

To execute manual tuning follow the procedure:

➤ **[MENU] + "TUNING" + [ENTER] + "MANUAL TUNE" + [ENTER]**

- The following Warning message is displayed:

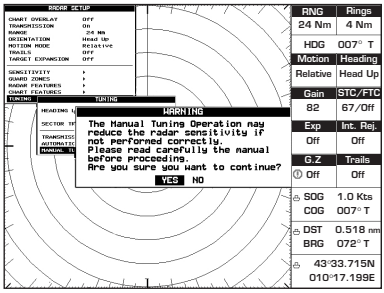


Fig. 1.7.4.5 - Manual Tune Warning message

- Press **[ENTER]** to proceed, the Manual Tuning page is displayed:

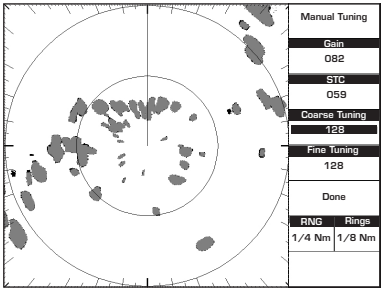


Fig. 1.7.4.5a - Manual Tune page

- Try increasing or decreasing the Course Tuning very slowly and in small steps from its middle value (128) until you obtain the maximum echo returns. If no land or ship targets are available, you may tune for maximum STC.

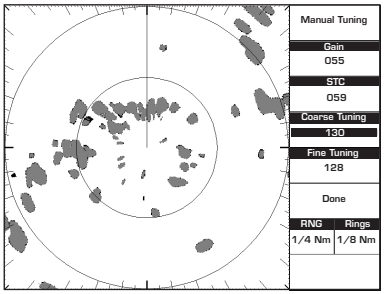


Fig. 1.7.4.5b - Manual Tuning procedure (I)

- Once the Course Tuning has been set, repeat the same procedure with the Fine Tuning:

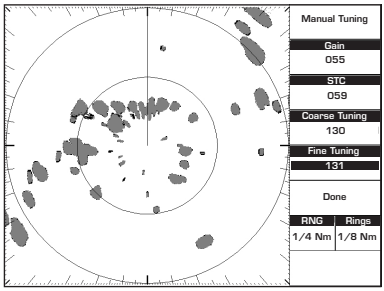


Fig. 1.7.4.5c - Manual Tuning procedure (II)

- Select DONE to exit the Manual Tuning page saving your settings.

Automatic Tune

To execute automatic tuning follow the procedure:

➤ **[MENU] + "TUNING" + [ENTER] + "AUTOMATIC TUNE" + [ENTER]**

- The following Warning message is displayed to alert the user that the Auto Tuning procedure may require up to 10 minutes. Please note that during Auto Tuning all the Radar functionalities are disabled.

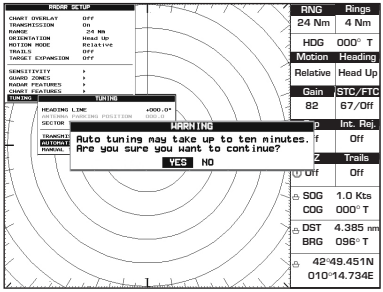


Fig. 1.7.4.5d - Automatic Tune Warning message

- Press **[ENTER]** to proceed, the Automatic Tuning starts and the following Window is displayed on the screen:

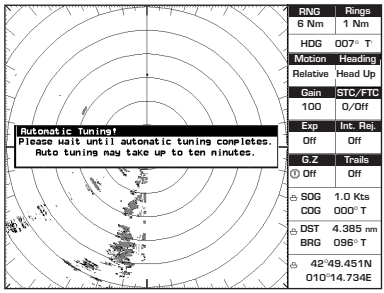


Fig. 1.7.4.5e - Automatic Tune page

- When the Auto Tuning completes the Warning Message is hidden and all Radar functionalities return to be available.

1.7.4.6 Save Tuning to User C-CARD

This is useful to avoid the user having to retune up Radar after a Clear RAM operation or a software update. The following data will be saved:

- Heading Line angle
- Antenna Parking Position
- Sector Transmission Off Start Angle
- Sector Transmission Off End Angle
- Transmission Trigger Delay
- Course Tune
- Fine Tune

Insert the User C-CARD into the slot, then follow the procedure:

➤ **[MENU] + "TUNING" + [ENTER] + "SAVE TUNING TO USER C-CARD" + [ENTER]**

The file name is given automatically as TUNING1.

1.7.4.7 Load Tuning from User C-CARD

Loads the complete settings from the User C-CARD and changes the active menu settings.

Insert the User C-CARD into the slot, then follow the procedure:

➤ **[MENU] + "TUNING" + [ENTER] + "LOAD TUNING FROM USER C-CARD" + [ENTER]**

2. Functions

2.1 BASIC

2.1.1 Cross Cursor

When on the Full Radar page or when the focus is on the Radar window, moving the Cursor Keys will show the cursor on the screen. It is automatically hidden when the Cursor is not used for more than 5 seconds. It can temporarily be hidden to check for small targets under it by pressing **[CLEAR]**.
When the Cursor Keys are moved a popup window will show the position of the Cursor, the Distance and Bearing from the cursor to the vessels position.
It is context-sensitive. The following table reports the list of objects and the labels that appear under the cursor:

- Center of Radar CTR
- EBL/VRM E/V
- Parallel Cursor ///
- Guard Zone GZ
- Ship Heading Marker HM

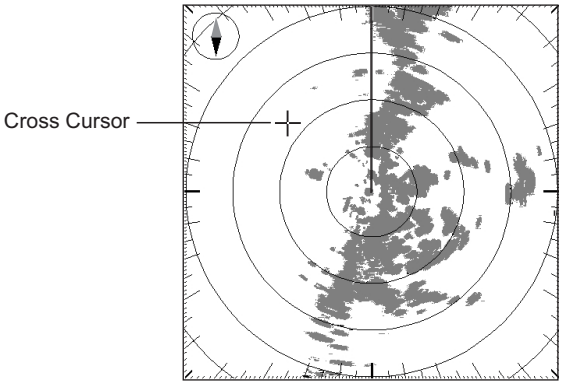


Fig. 2.1.1 - The Cross Cursor in the default Radar picture

2.1.2 Chart Overlay

Available Only in the Radar Full page

Chart Overlay function merges Radar and chart data into a single picture by drawing Radar targets over the cartography. When in Chart Overlay mode, the chart inherits the Radar page setting, e.g. Orientation, True Motion mode (for more information refer to Chapter 6, 6.16).
To enable (On) or disable (Off) the Chart Overlay follow this procedure:

➤ **[MENU] + "CHART OVERLAY" + [ENTER]**

NOTE *Requires a heading and a position sensor connected to the chart plotter through an NMEA 0183 interface. The heading sensor can be either a gyrocompass or a fluxgate compass. The gyrocompass provides the best performance in all conditions.*

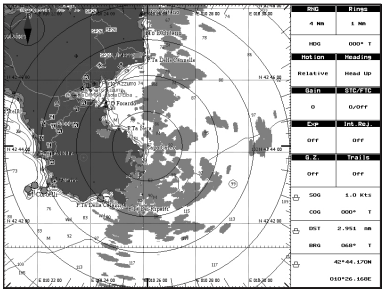


Fig. 2.1.2 - Chart Overlay

2.1.3 Range

Selects the Radar range among 1/8, 1/4, 1/2, 3/4, 1, 1 + 1/2, 2, 3, 4, 6, 8, 12, 16, 24, 36 and 48 Nm (the maximum range depends on the antenna used).
To select the Radar Range value follow this procedure:

➤ **[MENU] + "RANGE" + [ENTER]**

NOTE *Changing scale takes about 5 seconds.*

Also it is possible to select the Range in Radar page using **[ZOOM IN]/[ZOOM OUT]**.

2.1.4 Orientation

The Radar orientation option allows to choose the display mode, Head Up (HU), North Up (NU) or Track Up (TU), that refers to the top of the screen as it relates to the direction of the boat.
The Radar direction modes are described in the following table:

Head Up	:	The Radar picture is displayed with the vessel's current heading upwards. As the heading changes the picture will rotate. It doesn't require heading information. It is the default value.
North Up	:	The Radar picture is stabilized and displayed with north upwards. As heading changes, the ship's Heading Marker moves. Requires a heading sensor connected to the chart plotter.
Track Up	:	The Radar picture is stabilized and displayed with the currently selected Course Leg upwards. As heading changes, the ship's heading marker moves. If you select a new course leg, the picture rotates to display the new course leg upwards. Requires a heading sensor connected to the chart plotter.

NOTE *Head Up cannot be selected in True Motion mode.*

To change the orientation mode follow this procedure:

➤ **[MENU] + "ORIENTATION" + [ENTER]**

2.1.5 Motion Mode

Allows choosing between two different presentation of targets and ship position over the Radar screen Relative Motion (RM) and True Motion (TM). See the following table:

True	:	In True Motion, fixed Radar targets maintain a constant position on the screen, while your own ship moves across the Radar image at the appropriate speed and heading. A map-like image is thus displayed, with all moving vessels traveling in true perspective to each other and to fixed landmasses. As your ship's position approaches the edge of the screen, the Radar center offset is automatically reset to reveal the area ahead of your ship.
Relative	:	In Relative Motion your own ship's position remains fixed on the Radar screen and all Radar targets move relative to your own ship. It is the default for the Radar display.

NOTE *True Motion is only available in North Up and Track Up modes (not in Head Up mode). Also True Motion requires a heading sensor and GPS position information.*

To change the Motion mode follow this procedure:

➤ **[MENU] + "MOTION MODE" + [ENTER]**

2.1.6 Echo Trails Settings

Echo Trails causes the persistence of the Radar targets on the screen for the time specified. Selecting an appropriate trail plotting time help determining the speed and course of a target vessel and help prevent collision with it. Selects Radar Trails among Continuous, 15 seconds, 30 seconds, 1 Minute, 3 Minutes, 6 Minutes (or disables - Off). To choose the Echo Trails follow this procedure:

➤ **[MENU] + "ECHO TRAILS" + [ENTER]**

2.1.7 Target Expansion

Target Expansion is used to enlarge the target size without changing the range. This function is useful to see and detect very small targets in open seas. To enable (On) or disable (Off) the Target Expansion follow this procedure:

➤ **[MENU] + "TARGET EXPANSION" + [ENTER]**

2.2 SENSITIVITY

To select the Sensitivity menu follow this procedure:

➤ **[MENU] + "SENSITIVITY" + [ENTER]**

NOTE *The Sensitivity menu can be also opened by pressing:*
➤ **[ENTER]**
directly from the Radar page when the Cross Cursor is not placed over any features.

2.2.1 Interference Rejection

Reduces the interference caused by Radar signals from other Radar units. It is possible to turn Interference Rejection to Off, Level 1 (weak), Level 2 (middle), Level 3 (strong). The higher you set the Interference Rejection value the less interference you will receive.
To select the Interference Rejection value follow this procedure:

➤ **[MENU] + "SENSITIVITY" + [ENTER] + "INTERF REJECTION" + [ENTER]**

2.2.2 Gain Adjustment

Controls the Radar Gain. To see more details on the screen, increase the receiver sensitivity by selecting a higher gain percentage. If there is too much detail or if the screen is cluttered, lowering the sensitivity may increase the clarity of the display.
To select the Gain value follow this procedure:

➤ **[MENU] + "SENSITIVITY" + [ENTER] + "GAIN" + [ENTER]**

NOTE *The Gain can be also controlled by pressing:*
➤ **[GAIN]**
directly from the Radar page, after pressing any soft keys.

2.2.3 STC (Sensitivity Time Constant) Adjustment

Reduces the effects of the sea clutter that can adversely affect displayed targets.
To select the STC value follow this procedure:

➤ **[MENU] + "SENSITIVITY" + [ENTER] + "STC" + [ENTER]**

NOTE *The STC can be also controlled by pressing:*
➤ **[STC]**
directly from the Radar page, after pressing any soft keys.

NOTE *At low scales (as 1/4 of mile) some attempts are necessary to adjust STC value.*

2.2.4 FTC (Fast Time Constant) Adjustment

Reduces the effects of rain, snow, fog and cloud that can adversely affect displayed targets.
To select the FTC value follow this procedure:

➤ **[MENU] + "SENSITIVITY" + [ENTER] + "FTC" + [ENTER]**

NOTE *The FTC can be also controlled by pressing:*
➤ **[FTC]**
directly from the Radar page, after pressing any soft keys.

NOTE *At low scales (as 1/4 of mile) some attempts are necessary to adjust FTC value.*

2.2.5 MBS (Main Bang Suppression) Adjustment

AVAILABLE ONLY FOR MDS 9/MDS 10

The MBS adjustment is fundamental for getting clear near center spot image. In general, you must adjust MBS and STC and Gain to obtain desired Radar image.
To select the MBS value follow this procedure:

➤ **[MENU] + "SENSITIVITY" + [ENTER] + "MBS" + [ENTER]**

2.3 RADAR FEATURES

2.3.1 Cursor Window

The content of the Cursor Window depends on cursor location.
It shows detailed information on the cursor Lat/Lon, the cursor bearing and range, the center of the screen, EBL/VRM, Guard Zone, Heading Marker and Parallel Cursor. It is hidden when the cursor is hidden.
To turn On or Off the Cursor Window follow this procedure:

➤ **[MENU] + "RADAR FEATURES" + [ENTER] + "CURSOR WINDOW" + [ENTER]**

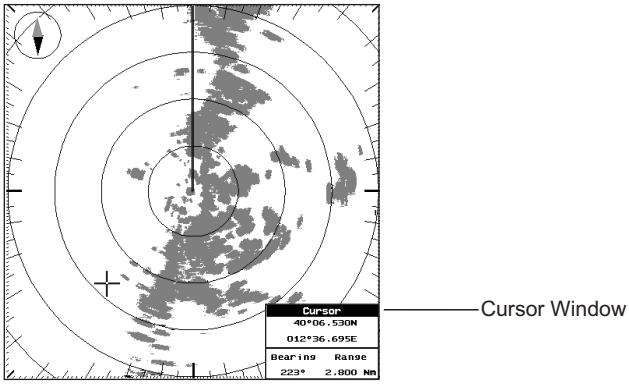


Fig. 2.3.1- The Cursor Window

2.3.2 Heading Marker

The Heading Marker (HM) is the line from the own vessel's position to the edge of the picture at the vessel's current heading with respect to the North indicated by the compass.

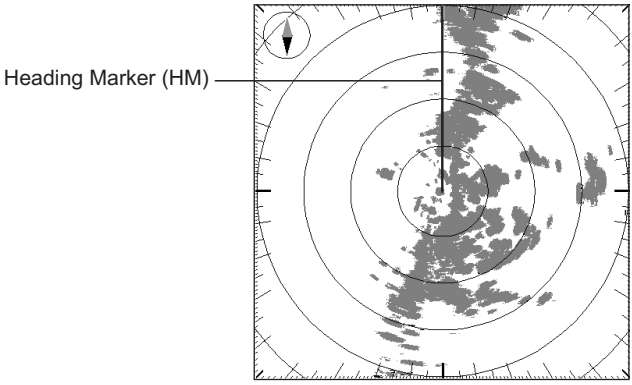


Fig. 2.3.2- The Heading Marker

The Heading Marker is updated each time the Radar image is updated. It can temporarily be hidden to check for small targets under it by positioning the Cross Cursor over it and pressing **[CLEAR]**.
To turn On or Off the display of the Heading Marker follow this procedure:

➤ **[MENU] + "RADAR FEATURES" + [ENTER] + "HEADING MARKER" + [ENTER]**

2.3.3 Degree Scale

The Degree Scale is the graduated scale located on the most external visible range ring edge of the Radar page, with major ticks at 0, 10, 20, …, 350 degrees and minor ticks at 5, 15, 25, …, 355 degrees.

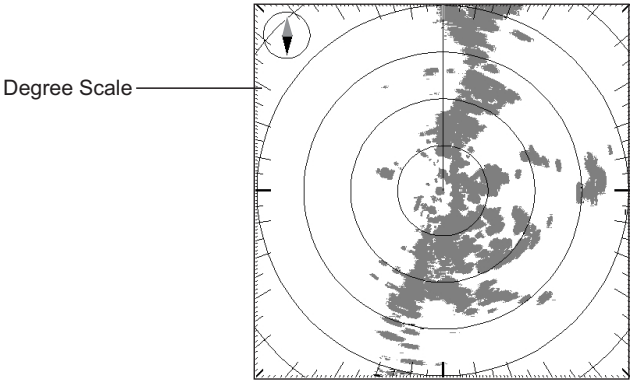


Fig. 2.3.3- The Degree Scale

To hide (Off) or unhide (On) the display of the Degree Scale follow this procedure:

➤ **[MENU] + "RADAR FEATURES" + [ENTER] + "DEGREE SCALE" + [ENTER]**

2.3.4 Range Rings

The Range Rings are concentric rings centered on the ship position, equally spaced.

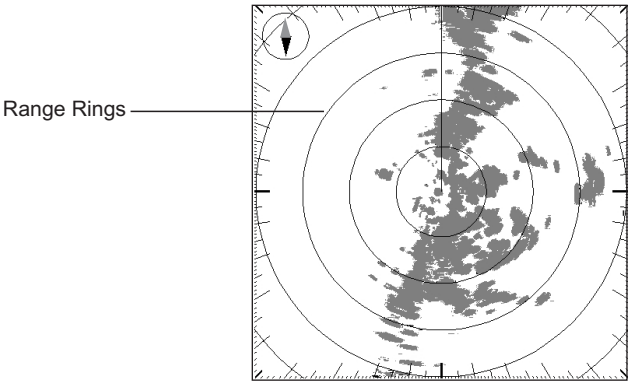


Fig. 2.3.4- The Range Rings

They are used to give an immediate idea of the range of targets from the ship. Their number and spacing are adjusted automatically accordingly with the Range Scale. The indication of the Range Rings interval is indicated in the Status Bar (see Par. 3.2.1).
To turn On or Off the display of the Range Rings follow the procedure:

➤ **[MENU] + "RADAR FEATURES" + [ENTER] + "RANGE RINGS" + [ENTER]**

2.3.5 Compass Rose

The Compass Rose is an icon used to identify four main directions: North, South, East and West. It is North oriented.

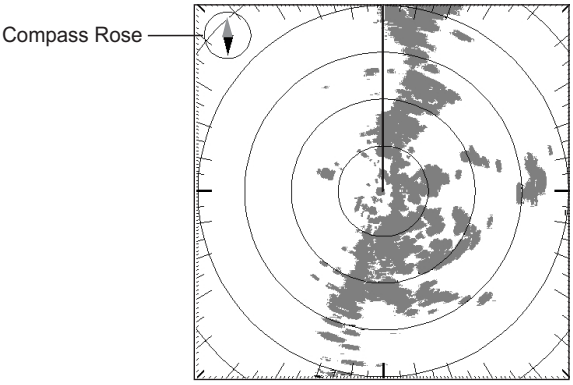


Fig. 2.3.5- The Compass Rose in the default Radar picture

NOTE *Requires a heading and position sensor connected to the chart plotter*

To hide (Off) or unhide (On) the display of the Compass Rose follow the procedure:

➤ **[MENU] + "RADAR FEATURES" + [ENTER] + "COMPASS ROSE" + [ENTER]**

2.3.6 EBL & VRM

Electronic Bearing Lines (EBL) and Variable Range Marker (VRM) are used to measure the range (distance) and the bearing between two points. A standard

VRM is displayed by default as a circle with its center located on your vessel's position, and EBL is displayed as a line from the vessel's position to the edge of the Radar picture display.

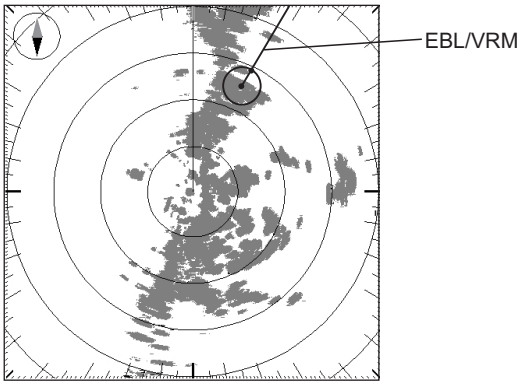


Fig. 2.3.6 - EBL & VRM display

2.3.6.1 Handling of EBL/VRM

Positioning the Cross Cursor on the EBL/VRM activates a pop up message "E/V" underneath the cursor. It is possible to allow to Move, Hook and Hide it.

- **[Move]:** Allows moving EBL/VRM from the own ship's position to any location of the Radar page. Pressing **[Confirm]** once more confirms the new position; pressing **[Cancel]** resets the original position.
- **[Hook]:** hooks the EBL/VRM cross point allowing changing bearing and range using the Cursor Keys. Pressing **[Confirm]** once more confirms the new range and bearing, pressing **[Cancel]** resets the original range and bearing values.
- **[Off]:** disables the EBL/VRM.

Up to 2 EBL/VRM's may be placed on the Radar screen at the same time. To turn EBL/VRM On or Off or to select 1 EBL/VRM, 2 EBL/VRM or both (1+2) EBL/VRM, follow this procedure:

➤ **[MENU] + "RADAR FEATURES" + [ENTER] + "EBL/VRM" + [ENTER]**

2.3.7 Parallel Cursor

A set of parallel lines with first line passing through the ship's position and next lines being placed equally spaced and extending from the ship's position towards one direction.

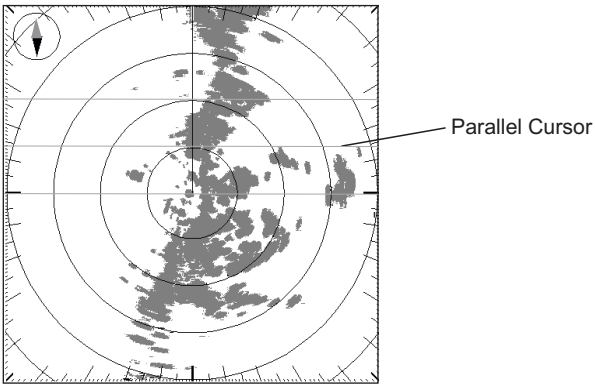


Fig. 2.3.7 - Parallel Cursor display

The user can change the angle of the lines and the range between lines. It is used to measure the bearing of other boats, navigate at a fixed distance from the coast, measure the distance between two points.
The display of the Parallel Cursor can be turned On or Off following this procedure:

➤ **[MENU] + "RADAR FEATURES" + [ENTER] + "PARALLEL CURSOR" + [ENTER]**

2.3.8 Center Offset

Allows to move the Radar center in any location of the screen.

2.3.8.1 Handling of Center Offset

If the Radar is in Relative Motion mode, positioning the Cross Cursor on the center of the Radar image, allows editing the Center Offset ("CTR" message is shown under the cursor position).
The soft keys are automatically displayed:

- **[Move]:** hooks the Radar image center allowing the user, using the Cursor Keys, to move it at any location on the Radar screen. At this point pressing **[ENTER]** confirms the new position of the center, pressing **[CLEAR]** resets the position of the Radar image at 0,0.
- **[Offset]:** opens an edit window where it is possible to edit the X Offset and Y Offset position in pixel at which the center of the screen is positioned.
- **[Ctr Scrn]:** resets screen offset position to 0,0.

NOTE *In True Motion mode the user cannot change the screen center position.*

To set the Center Offset follow this procedure:

➤ **[MENU] + "RADAR FEATURES" + [ENTER] + "CENTER OFFSET" + [ENTER]**

2.3.9 Status Bar

Available only in the Radar Split pages

Allows to display the Status Bar on the screen. Note that in Radar Split pages the Status Bar is displayed always in compact mode to allow for more space for the graphical data.
To enable (On) or disable (Off) the Status Bar displaying follow the procedure:

➤ **[MENU] + "RADAR FEATURES" + [ENTER] + "STATUS BAR" + [ENTER]**

2.4 CHART FEATURES

2.4.1 Chart Overlay Mode

Available only in the Radar Full page.

Selects which cartographic objects are to be displayed when Chart Overlay function is active in Radar Full page.
The following chart presets are available:

- **Full**: Full cartographic representation.
- **Medium**: includes "Low" settings plus Ports & Services and Auto Chart Boundaries.
- **Low**: includes also area fills, important city names, Nav-Aids & Lights and Underwater Object icons.
- **Minimum**: only the coast lines and elevation objects, no area fill.
- **As Cartography**: inherits settings from the current cartography setting.
- **Custom**: Custom chart representation.

To select the desired Chart Overlay Mode follow this procedure:

➤ **[MENU] + "CHART FEATURES" + [ENTER] + "CHART OVERLAY MODE" + [ENTER]**

2.4.2 Chart Synchronization

Available Only in the Radar Chart Split page

When Chart Synchronization is enabled, the chart display is synchronized to the Radar display. This function is enabled when Home mode is active (e.g. by pressing **[CLEAR]** from the chart screen). An alert window showing the message "Radar - Chart Synchronization mode On" is displayed.
To enable (On) or disable (Off) the Chart Synchronization follow this procedure:

➤ **[MENU] + "CHART FEATURES" + [ENTER] + "CHART SYNCHRONIZATION" + [ENTER]**

2.4.3 Cursor Echo

Available Only in the Radar Chart Split page

This function allows to correlate targets on the Radar display with objects in the chart.
Moving the Radar cursor on Radar display will cause moving another cursor over the chart. The cursor over the chart shall be positioned over the same Lat/Lon of the cursor over the Radar.
When the Cursor Echo function is enabled, the Radar cursor in the chart display is always shown even if the cursor in the Radar display is hidden.

To enable (On) or disable (Off) the Cursor Echo follow this procedure:

➤ **[MENU] + "CHART FEATURES" + [ENTER] + "CURSOR ECHO" + [ENTER]**
CHART FEATURES" + [ENTER] + "CART. OBJECTS DISPLAY" + [ENTER]

2.5 GUARD ZONES

Your Radar allows a function to help you avoid a collision. It is possible to set an alarm to trigger when a target is within a specified zone, the Guard Zone.
It is allowed to display up to 2 Guard Zones, Sector or Circular.

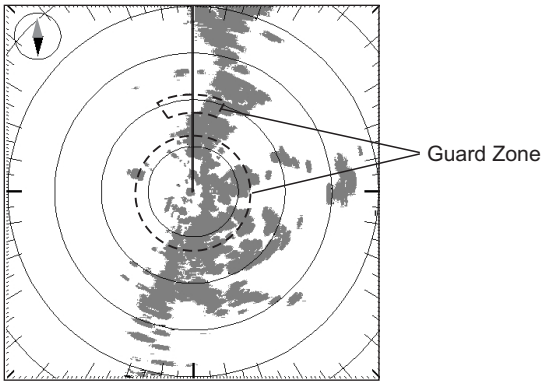


Fig. 2.5 - Guard Zone display

When a Guard Zone is active, the Guard Alarm sounds when a target enters its area.

NOTE *A Guard Zone only operates when the whole zone is displayed on the screen. In addition, a Guard Zone is inactive for 10 seconds after it is placed or re-sized, to avoid inappropriate alarms during positioning.*

2.5.1 Handling of Guard Zone

Positioning the Cross Cursor over a Guard Zone, causes the message "GZ" to be displayed under the cursor. It is possible to handle the Guard Zone.

- **[HOOK]:** allows changing Guard Zone range by moving up/down Cursor Keys. Pressing **[CONFIRM]** to confirm, **[CANCEL]** otherwise.
- **[TYPE]:** allows changing Guard Zone type: press **[SECTOR]** to select the Sector Guard Zone, press **[CIRCULAR]** to select the Circular Guard Zone.
- **[OFF]:** disables the Guard Zone.

2.5.2 Guard Zone Sensitivity

It defines a limit (selectable from 0 to 100) under which echoes activate an alarm condition, when detected inside a Guard Zone.
Guard Zone Sensitivity default is 50.
The value 100 is the most sensitive (the system is always on, every detected echo cause an alarm condition) and the value 000 is the least sensitive (same as switching the alarm off).

To turn the alarm On or Off follow this procedure:

➤ **[MENU] + "GUARD ZONES" + [ENTER] + "GUARD ZONE" + [ENTER]**

3. Radar Pages

This section will assist you to select the preferred Radar page.

NOTE *The Radar display page is available only if the Radar is connected and powered On, and the Radar is in Transmit mode (see Chapter 1).*

3.1 PAGES SELECTION

The Page Selection menu allows you to change the Radar page displayed. To access this menu:

- **[MENU] + [MENU] + "PAGE" + [ENTER] + "RADAR" + [ENTER] + select the desired page + [ENTER]**

COLOR MAX 11/COLOR MAX PRO/COLOR MAX 15:

- **[DATA] + "RADAR" + [ENTER] + select the desired page + [ENTER]**

TRAWL PLOT 12:

- **[PAGE] + "RADAR" + [ENTER] + select the desired page + [ENTER]**

The menu now shows five selections related to the Radar: Radar Full page (**"RADAR"**), Radar Split Chart page (**"RADAR/CHART"**), Radar Split Fish Finder page (**"RADAR/FF"**), Radar Split Highway page (**"RADAR/NAV DATA"**), Radar Combo Page (**"RADAR/FF/CHART/NAV DATA"**). Move the cursor to select the desired item and then press **[ENTER]**.

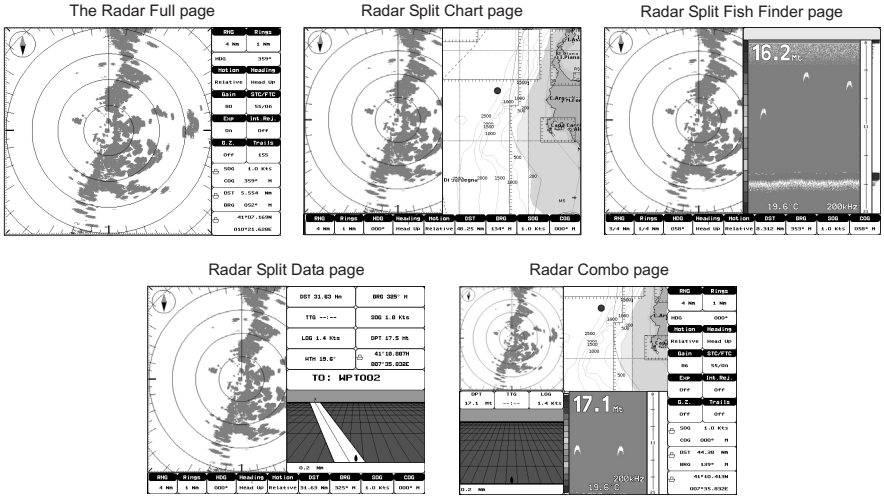


Fig. 3.1 - Available Radar pages

3.1.1 Selection by Soft Key

The default soft keys configuration can be customized. When the Radar is connected, any soft key can be assigned any of the Radar pages.
From the Chart page, pressing and holding down any of the four soft key shows a pop-up window on the top of the soft key pressed that contains all possible data pages assignable to the soft key pressed. Move the Cursor key up/down to place

the selector on the desired item; move the Cursor key to the right or press **[ENTER]** to set the selected item; move the Cursor key to the left or press **[CLEAR]** to close the pop-up window.
In the picture below, the four soft keys are customized to select four among the five available Radar pages:

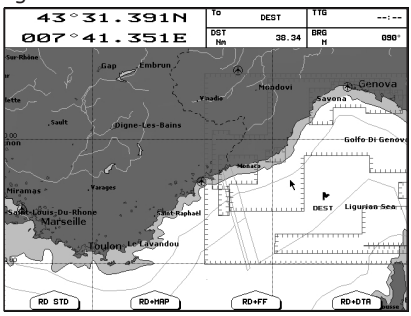


Fig. 3.1.1 - Radar page selection by Soft Key

Press **[RD STD]** to show the Full page, **[RD+MAP]** to show the Radar Split Chart page, **[RD+FF]** to show the Radar Split Fish Finder page, **[RD+DTA]** to show the Radar Split Data page and **[COMBO 4]** to show the Radar/Chart/Fish Finder/ Highway page.

3.2 STATUS BAR

You may choose to select the data displayed in the boxes in the system set up.

1. RNG (Radar Range) and Range rings interval
2. Current Heading
3. Motion Mode and Heading Mode indication
4. Gain and STC/FTC indication
5. Expansion and Interference Rejection
6. Guard Zone alarms and Trails
7. Ship Speed Over Ground and Course Over Ground
8. Ship Distance and Bearing from destination
9. Ship Lat/Lon
10. Cursor Window

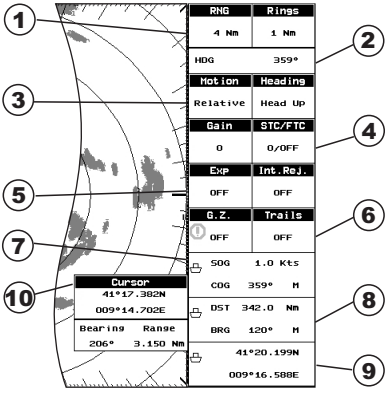


Fig.3.2 - The Default Status Bar

Note that in Radar Split pages the Status Bar displayed always in compact mode to allow more space for the graphical data (see Par. 2.3.9):

1. RANGE and Range rings interval
2. Guard Zone alarms
3. Current Heading
4. Heading Mode indication
5. Motion Mode indication
6. Distance to Destination
7. Bearing to Destination
8. Ship Speed Over Ground
9. Course Over Ground

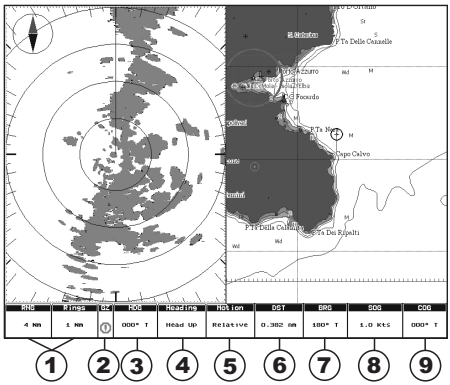


Fig.3.2a - The "compact" Status Bar

3.3 MENU HANDLING ON FULL PAGES

When in Radar Full page pressing **[MENU]** once opens the Radar Setup menu. Pressing **[MENU]** twice opens the Main menu.

3.4 SELECTION OF THE "ACTIVE" VIEW IN SPLIT/ COMBO PAGES

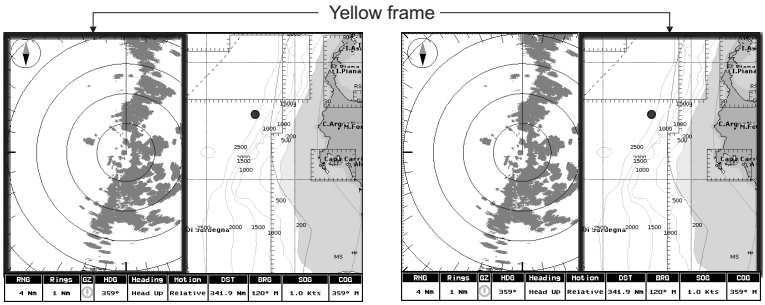


Fig. 3.4- Selection of active View

When in Split/Combo pages, the active view is highlighted by a focus (Yellow frame). The keyboard commands are related to that focused view. To move the focus press **[MENU]** twice.

4. Technical Specifications

This chapter provides specifications of the several types of Radar.

4.1 MDS 1

Antenna unit

Power supply		: 10.8 to 31.2 VDC
Power consumption		: 30W or less
Preheat times		: 90 sec
Aerial		: Radome 0.9 Feet
Peak power output		: 2kW
Transmitting frequency		: 9445+/-30MHz
Beam width (degree)	Horizontal	: 7°
	Vertical	: 25°
Side Lobes Within +/-10°		: <=-20dB
Rotation		: 30rpm
Pulse Length (μsec)/PRF (Hz)	S	: 0.1/2200
	M, M1	: 0.3/1100
	L, M2	: 0.8/550
IF center frequency		: 60MHz (Linear amplifier)
IF bandwidth	S	: 6MHz
	M, M1	: 6MHz
	L, M2	: 3MHz
Noise figure		: 10dB nominal
Operating Temperature		: -25°C ~ +55° C
Operation in wind (relative)		: 100 knots
Water Resistance		: IPX6 (IEC60529)
Preheat times output (by 5 sec step)		: 85 sec to 5 sec

Dimensions and Mounting

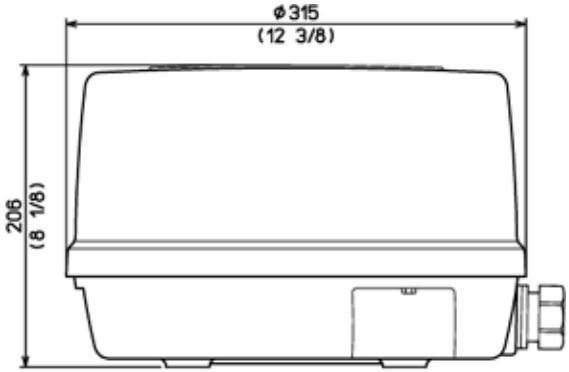
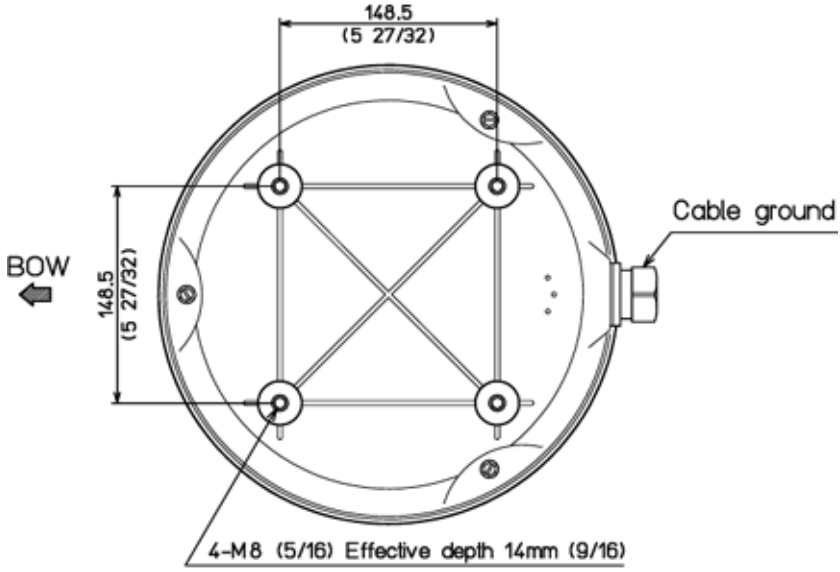


Fig. 4.1 - Radar MDS 1 (I)



Weight: 4.5 kg (10 lb) without cable
Weight: 5.5 kg (12.5 lb) 10m cable included

Fig. 4.1a - Radar MDS 1 (II)

4.2 MDS 8

Antenna unit

Power supply		: 10.8 to 41.6 VDC
Power consumption		: 30W or less
Preheat times		: 90 sec
Aerial		: Radome 1.5 Feet
Peak power output		: 2kW
Transmitting frequency		: 9445+/-30MHz
Beam width (degree)	Horizontal	: 4.7°
	Vertical	: 25°
Side Lobes Within +/-10°		: <=-20dB
Rotation		: 30rpm
Pulse Length (μsec)/PRF (Hz)	S	: 0.1/2200
	M, M1	: 0.3/1100
	L, M2	: 0.8/550
IF center frequency		: 60MHz (Linear amplifier)
IF bandwidth	S	: 6MHz
	M, M1	: 6MHz
	L, M2	: 3MHz
Noise figure		: 10dB nominal
Operating Temperature		: -25°C ~ +55°C
Operation in wind (relative)		: 100 knots
Water Resistance		: IPX6 (IEC60529)
Preheat times output (by 5 sec step)		: 85 sec to 5 sec

Dimensions and Mounting

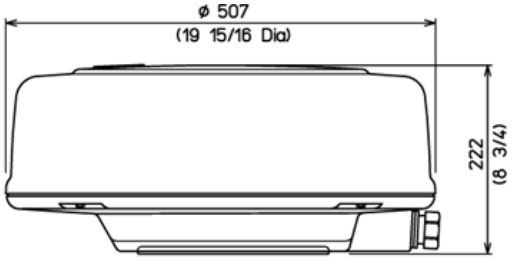
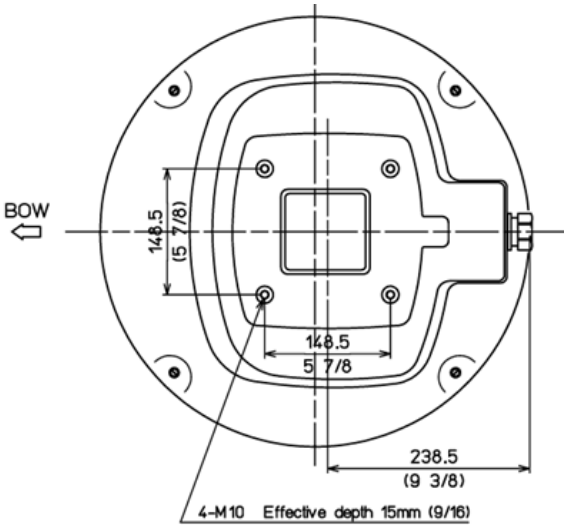


Fig. 4.2 - Radar MDS 8 (I)



Weight: 8.1 kg (18.0 lb) 10m cable included
Weight: 6.8 kg (15.0 lb) without cable

Fig. 4.2a - Radar MDS 8 (II)

4.3 MDS 9

Antenna unit

Power supply		: 10.8 to 41.6 VDC
Power consumption		: 45W or less
Preheat times		: 120 sec
Aerial		: Radome 1.8 Feet
Peak power output		: 4kW
Trasmitting frequency		: 9410+/-30MHz
Beam width (degree)	Horizontal	: 4.0°
	Vertical	: 25°
Side Lobes Within +/-10°		: <=-20dB
Rotation		: 24rpm
Pulse Length (μsec)/PRF (Hz)	S	: 0.1/2000
	M, M1	: 0.25/2000

	L, M2	: 0.5/1000
	L, L1	: 1.0/500
IF center frequency		: 60MHz (Linear amplifier)
IF bandwidth	S	: 6MHz
	M, M1	: 6MHz
	L, M2	: 3MHz
	L, L1	: 3MHz
Noise figure		: 6.0dB or less
Operating Temperature		: -25°C ~ +55°C
Operation in wind (relative)		: 100 knots
Water Resistance		: IPX6 (IEC60529)
Preheat times output (by 5 sec step)		: 115 sec to 5 sec

Dimensions and Mounting

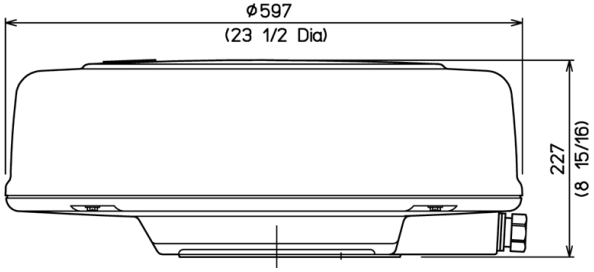
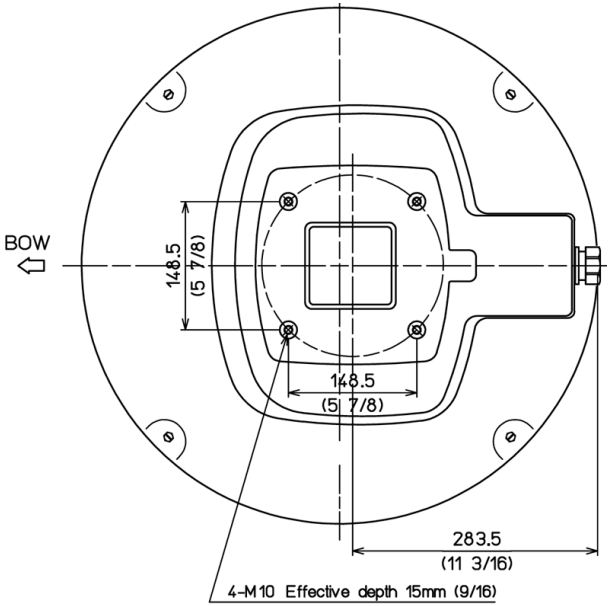


Fig. 4.3 - Radar MDS 9 (I)



Weight: 9.7 kg (21.5lb) 10m cable included
Weight: 8.4 kg (19.0lb) without cable

Fig. 4.3a - Radar MDS 9 (II)

4.4 MDS 10

Antenna unit

Power supply		: 10.8 to 41.6 VDC
Power consumption		: 80W or less
Preheat times		: 120 sec
Aerial		: Open 4 or 5 Feet
Peak power output		: 4kW
Trasmitting frequency		: 9410+/-30MHz
Beam width (degree)	Horizontal	: 2.4° or 1.7°
	Vertical	: 25°
Side Lobes	Within +/-10°	: <=-23dB
	Outside +/-10°	: <=-32dB
Rotation		: 24rpm
Pulse Length (μsec)/PRF (Hz)	S	: 0.06/4000
	M, M1	: 0.15/2000
	L, M2	: 0.4/1000
	L, L1	: 1.0/500
IF center frequency		: 60MHz (Linear amplifier)
IF bandwidth	S	: 20MHz
	M, M1	: 20MHz
	L, M2	: 5MHz
	L, L1	: 5MHz
Noise figure		: 5.0dB or less
Operating Temperature		: -25°C ~ +55°C
Operation in wind (relative)		: 70 knots
Water Resistance		: IPX6 (IEC60529)
Preheat times output (by 5 sec step)		: 115 sec to 5 sec

Dimensions and Mounting

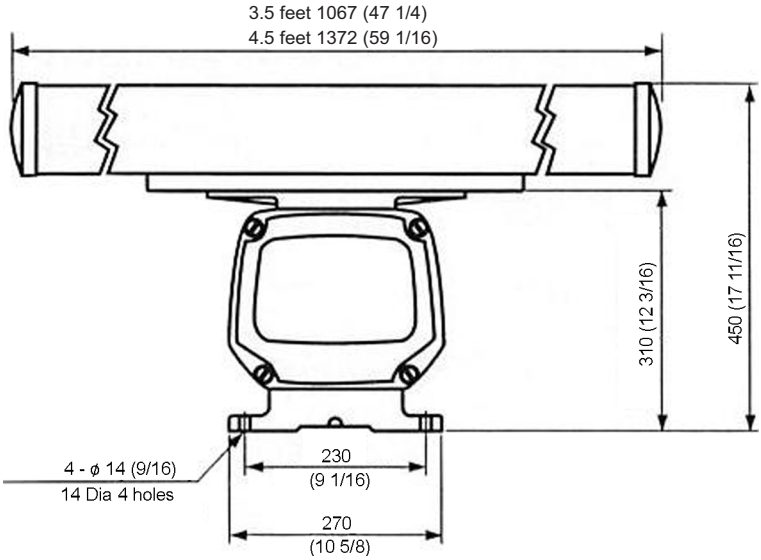
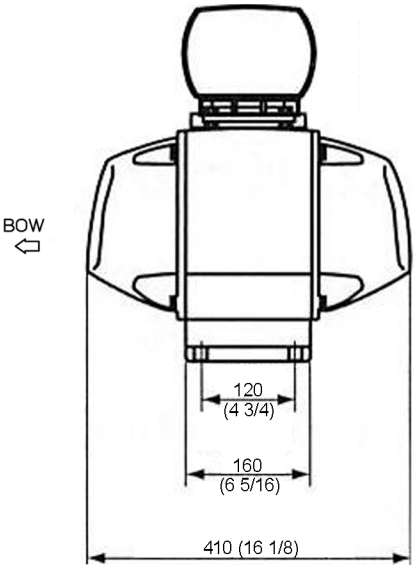


Fig. 4.4 - Radar SWR 10 (I)



Weight: 21.2 Kg (47lb) 4 feet
Weight: 21.9 Kg (49lb) 5 feet

Fig. 4.4a - Radar MDS 10 (II)

5. Troubleshooting

5.1 The Radar page is not available

This means you didn't configure the I/O setup to connect to the Radar. Enter the I/O Setup menu (see procedure at Par. 1.7.1) and select the Radar on the serial port to which the Radar is connected.

5.2 The message "Please Turn On Radar" is displayed on the Radar window

This means that even if the I/O Setup has been configured for Radar, no Radar is being detected. This may depend on several factors:

- Verify that the correct serial port is set in the I/O Setup menu, eventually try setting the Radar on another serial port.
- Check that the Radar is connected to the chart plotter, to the same serial port as set in the I/O Setup menu, in case try connecting it to another serial port.
- Verify that all the connections in the Junction Box are done properly.
- Verify using a Voltage Meter that the Radar power supply level at the Junction Box is at least 12V. The Radar is able to operate with 10V but some volts may be dropped due to the cable length.

If everything above is correct, try shorting the green and the blue wires in cable coming from the Radar. If the Radar still doesn't work you need to call for assistance.

5.3 The Radar preheating countdown timer is displayed but when the preheating terminates it restarts over and over again

The power supply level is too low. This may be caused by battery low, cable too long, cable section to narrow.

5.4 Too much clutter near the Radar screen center

This is a typical phenomenon with Radar. Echoes from nearby vessel may hit other objects like other vessels or other objects randomly and reflections can be received by Radar antenna due to very short distance between the objects. This is normal condition in a port where nearby targets (such as sailboat masts) may cause multiple reflections. In this case, increase the STC and decreasing the GAIN.

5.5 During navigation in open sea the center of the screen is covered by a large spot

It means that most probably the Transmission Trigger Delay and/or the Main Bang Suppression need to be correctly tuned (refer to Par. 1.7.4.4).

5.6 After turning transmission On, the Radar page remains completely black

The Gain setting could be too low or STC setting too high. The Radar is probably not properly tuned. Execute the Automatic Tuning procedure to restore optimal performance (refer to Par. 1.7.4.5).

5.7 The Radar sensitivity appears to be low

Radar sensitivity depends on several factors. To increase sensitivity act as follows:

- Execute the Automatic Tuning procedure to ensure that the Radar is perfectly tuned.
- Increase the GAIN.
- Reduce the STC, since the STC has the effect to reduce the echo intensity of nearby targets.
- Turn Off the FTC, since it has the effect to reduce the echoes intensity of big targets.

5.8 Radar targets are delayed with respect to the antenna rotation

The Radar image on the GPS is updated every 2.5 seconds as information is acquired from the antenna. This could cause a mis-match between the actual target position and the targets shown on the screen.

5.9 Radar target appear to be pulsing

This is a rather common problem for any Radar. For long distance targets, when the Radar pulse hits a target, the reflection strength which depends on the hit angle. Perpendicular hits give the strongest echo. Hard objects give stronger echo and soft objects give weaker echo.
To eliminate the pulsing effect of Radar targets the Echo Trails function may be used (see Par. 2.1.6).

5.10 Stationary target appear to be oscillating around their actual position

Radar targets may appear to be oscillating around their actual position due to the movement of your vessel. In fact even a minimum oscillation of the position where the Radar is located may cause an apparent movement of the targets detected.
For short distance targets, surface waves lower the detectivity. The STC should be adjusted to properly to maximize the detectivity.

6. Frequently Asked Questions

6.1 What should I do at first Radar installation?

At first installation its necessary to:
1) properly set up the Radar calibration
2) set up the I/O to detect the Radar

6.2 How can I turn Radar power On/Off

Radar power On/Off can be either directly controlled from the chart plotter (NOT AVAILABLE FOR **COLOR MAX WIDE I/E & COLOR MAX SEALINK I/E**) or by an external switch depending on how you have set up your chart plotter.
In case the power is managed by the chart plotter you can turn power On by pressing **[MENU]** when in the Radar Page. Otherwise you have to turn power On by acting on the external switch.

NOTE *For a pratical matter we suggest to use Radar Powered On/Off controlled by an external switch, because at a glance we can check the Radar status without having to switch to the Radar page.*

6.3 How should I setup the chart plotter to control the Radar power On/Off?

Please refer to Chapter 1 for wiring schematic.

6.4 How can I turn Radar Transmission On/Off?

Press **[ENTER]** in the Radar page or enter the Radar Main Menu and set Transmission On from the related menu choice. Transmission can be set in Stand-by only from the Radar menu.

6.5 What is the preheating?

Each time you power On the Radar you must allow 90 to 120 seconds (depending on the Radar model) to warm up the Radar. Operating the Radar before this time could cause damage to it. For this reason the chart plotter doesn't allow operating the Radar until the preheating is complete.

6.6 Some time the preheating takes less than 90 seconds, is this normal?

Yes it is. It means that the Radar was already powered on at the time you turned On the chart plotter so the preheating started before.

6.7 What is the Radar calibration?

Radar calibration is a set of options that allows to properly set the Radar to work on your boat. You can set up the Heading correction, to compensate of orientation errors due to the installation, the Radar trigger delay to properly adjust the Radar beam as to correctly measure ranges, and finally the sensitivity of the Radar to maximize the Radar sensitivity.

6.8 When and how should I adjust the Radar heading?

At first installation you should correct the Radar heading as to ensure that it is perfectly aligned with your bow.

6.9 When and how should I adjust the Radar Trigger delay?

At first installation. It is required to ensure the Radar is capable to perfectly measure ranges and avoid distortions. Please follow the procedure described at Par. 1.7.4.4.

6.10 When should I do the Radar tuning?

Radar tuning is generally not necessary since it is already tuned at the factory. However in the long run or in case some components are replaced it could be necessary to perform tuning to achieve the maximum sensitivity.

6.11 Should I use the Manual or Auto Tuning?

We strongly suggest to use the Auto Tuning that generally is capable to give optimal results.

6.12 How should I do the Manual Tuning?

Follow procedure at Par. 1.7.4.5.

6.13 What is the STC, and how should I operate it?

STC is the Sensitivity Time Constant. It is used to reduce the sensitivity and thus the clutter in the range closer to the Radar. Operate the STC as to reduce the echoes coming from the closer ranges to an acceptable level.

6.14 What is the FTC and how should I operate it?

FTC is the Fast Time Constant. It is used to reduce the echoes coming from large objects that can hide other small objects. It is also called the rain control since it is capable to reduce the effects of the rain on the display.

6.15 What is the MBS?

The MBS is the Main Bang Suppression. It is used to suppress the stronger echoes caused by Radar transmission in the receiver. It is like the STC but its operates in a shorter range.

6.16 I can't turn Chart Overlay On, why?

To turn Chart Overlay On you must have both a GPS and a heading sensor connected to the chart plotter. If the chart plotter doesn't detect such devices it will automatically disable the Chart Overlay option.

6.17 I can't set the North Up or Course Up navigation mode, why?

To turn On the North Up or Course Up navigation modes you must have both a GPS and a heading sensor connected to the chart plotter. If the chart plotter doesn't detect such devices it will automatically disable such option.

6.18 I can't set up the True Motion mode, why?

To turn On the True Motion mode you must have both a GPS and a heading sensor connected to the chart plotter. If the chart plotter doesn't detect such devices it will automatically disable such option.

6.19 Why do I need a Heading Sensor and a GPS to use all Radar functionalities?

Because the Radar need to know the current position of the boat and its current heading.

6.20 What are the functions that require a GPS or a Heading Sensor?

Function	Heading	GPS FIX
North Up Radar orientation	Y	N
Track Up Radar orientation	Y	N
True Motion mode	Y	Y
Chart Overlay	Y	Y
Radar/Chart Synchronization	Y	Y
Cursor Echo	Y	Y
Head Up Mode	N	N
Relative Motion mode	N	N

6.21 Is it better a gyrocompass or a flux gate compass?

The gyrocompass it is a better choice because it is faster but it is much more expensive. The flux gate compass is slower but it is much cheaper. Using a flux-gate you have to expect to see delays in the rotation of the chart when in Chart Overlay mode.

6.22 How can I be advised of potential dangers for the navigation?

Using the Guard Zone alarms.

6.23 What are Guard Zones?

Guard Zones are zones defined by the user that causes an audible and visual alarm to be triggered when a target exceeding a certain density enters into it. The density of the target that may trigger the alarm is regulated by mean of the Guard Zone sensitivity. There are of two types of Guard Zones: Circular or Sectorial. They are fixed with respect to the ship position and heading but their range and orientation (only for sector type) are user defined.

6.24 How should I set the Guard Zone sensitivity?

Guard Zone sensitivity must be regulated accordingly to the current Gain of the Radar. The higher the sensitivity the smaller the target that may trigger the alarm. In general if you regulated your Radar to obtain a clean picture you can set the Guard Zone sensitivity very high to detect even the smaller targets. In case the Radar picture has clutter present due to the higher gain set, you'll have to reduce the Guard Zone sensitivity to avoid triggering false alarms. In general a way to set the maximum sensitivity for a Guard Zone is to start increasing the sensitivity until an alarm is triggered and then reduce the sensitivity until the alarm stops.

A. What is Radar?

A.1 GENERAL

The word "radar" is an acronym for "RAdio Detecting And Ranging." In very simple terms, this is how it works. A radio transmitter sends a quick microwave pulse, and then a receiver listens for that signal's echo when it is bounced back from something in its path. The returning signal is processed by a computer to determine its relative distance, position and bearing. This information is graphically displayed on a screen for you to see. Other boats or ships, navigational markers, landmasses and such are referred to as targets.

By knowing how long it takes for a signal to return, the distance to a target can be determined. As the Radar antenna scans through a 360-degree rotation, it can show where the target is relative to your position. By repeated scans, you can see which direction another vessel is moving.

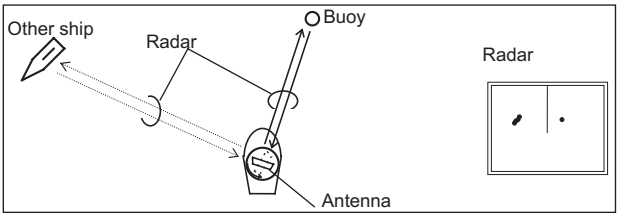


Fig. A.1 - Radar

A.1.1 Antenna

How Radar will perform is largely determined by its antenna or scanner. Increasing the size of the antenna improves long-range performance and target discrimination, or the ability to distinguish two separate targets at a distance. The critical factors are the antenna's beam width and side lobe level. Typically, a Radar antenna will radiate a tightly focused beam from the front of the array. The longer the antenna array is, the narrower the beam width will be.

Additionally, it will also emit smaller amounts of energy to each side. The lower the side lobe level, the less the effect of a false echo.

A.1.2 Side Lobe

The beam in which the strongest radio signal is radiated from the antenna is called the "main lobe". Those beams that are radiated in other directions are referred to as the "side lobes". The side lobe level refers to the difference in level (signal strength) between the largest side lobe and the main lobe.

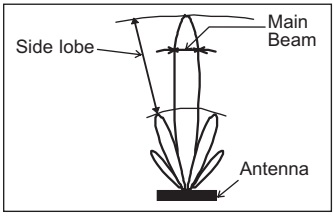


Fig. A.1.2 - Antenna Pattern

A.2 CHARACTERISTICS OF RADAR WAVE

Radio waves travel out from the antenna while bending slightly along the earth's surface. The amount they bend depends on atmospheric conditions. The sight distance of a Radar generally is about 6% longer than the optical sight distance and is calculated using this equation:

$$\text{Radar sight distance (NM)} = 2.22\,(\sqrt{\text{antenna height}}\ \text{(m)} + \sqrt{\text{target height}}\ \text{(m)})$$

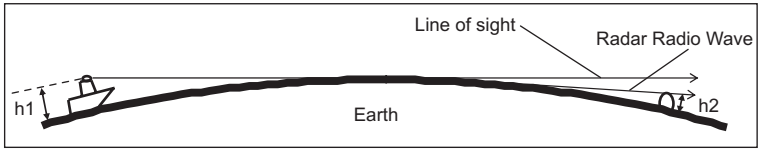


Fig. A.2 - Radar wave

A.2.1 Targets difficult to display on screen

The intensity of the reflected radio signal from a target depends on the distance, height, and size of the target, as well as its material and shape, along with the Radar's transmitter power output and antenna size. Targets made of fibreglass, wood, or other low-reflectance materials or those that have a small incident angle are difficult to display on a screen. Sandy beaches, and sandy or muddy shallows can be difficult to catch. Because there's not much to reflect a signal back to you, a coastline can actually be closer to your boat than it appears on the screen.

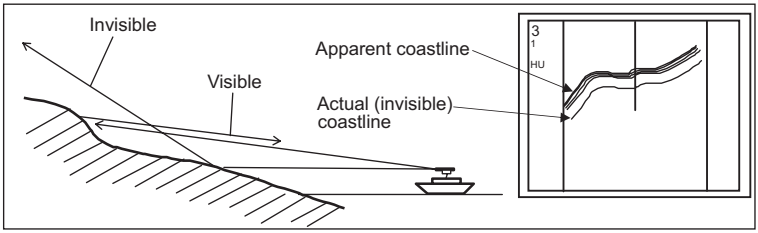


Fig. A.2.1 - Targets difficult to display on screen

A.2.2 Shadow zones of Radar

Radar waves propagate in a straight line. A high outcropping of land or a large ship will create a shadow zone behind it and prevent you from seeing targets on the other side. More importantly, if a mast or some part of the boat's superstructure is in the path of the antenna's sweep, this will also create a shadow zone. No targets will be recognized behind it and it could create a dangerous situation.

A.2.3 False echoes

Sometimes Radar will display targets on screen that do not exist in the real world. You should be aware of howand why this happens.

A.2.3.1 Ghost echoes

Sometimes one large object very near your boat will appear as two different targets on screen. One is the actual Radar echo. The other is a ghost echo generated by a re-reflection of the original signal. It comes back to your own boat, bounces back to the target, and then is picked up by the antenna on the second bounce. The actual echo appears at the correct distance and bearing on the screen. The ghost echo appears somewhere behind your boat. This type of false echo is also generated by re-reflection of waves from bridges, break walls or building along shore.

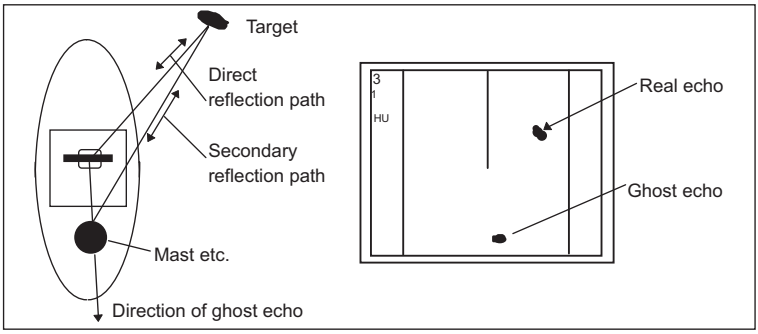


Fig. A.2.3.1 - Ghost Echoes

A.2.3.2 Multiple echoes

If there is a large vertical reflecting surface near your boat, as in the case when you pass alongside a large ship, Radar signals are repeatedly bounced back and forth between your boat and the other object. Two to four images appear on the screen at equal intervals in the same bearing. This is called a multiple echo. The image appearing closest to you is the real echo. Multiple echoes will disappear as you move away from the reflecting object or its bearing changes.

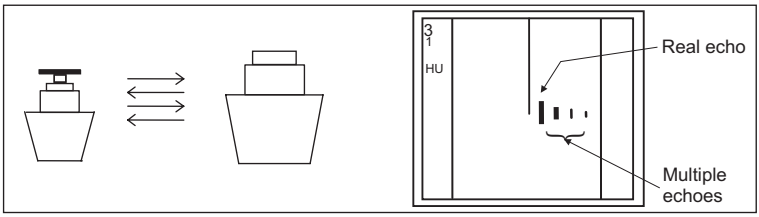


Fig. A.2.3.2 - Multiple Echoes

A.2.3.3 False echoes caused by side lobe

An antenna's side lobe emissions are low power, and will not register distant targets. However, if there is a strong reflecting target near your boat, it sometimes may appear as a circular-arc false echo on the screen.

WARNING

When near large targets or land, your boat's mast may sometimes appear as circular-arc shaped false echo.

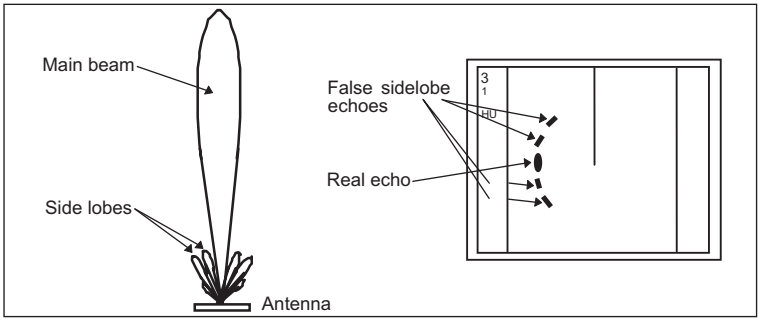


Fig. A.2.3.3 - False Echoes caused by side lobe

A.2.3.4 Distant False echoes caused by duct phenomenon

The duct phenomenon sometimes occurs when meteorological conditions create a temperature inversion between layers of air. When this happens, Radar waves propagate erratically and can reach a location considerably farther away from your boat than the Radar's maximum distance range. What appears on screen is a false echo that looks to be nearer than the actual target. Since the true echo from the distant target is outside the measurement capabilities of the Radar, its apparent distance will change when you change ranges, and you can conclude that it's a false echo.

A.2.3.5 Radar interference

If another boat's Radar is operating on the same frequency as yours, it can create interference on your display. The interference usually appears as spiral or radial patterns. This Radar has an interference rejection control to eliminate interference. Turn it on to reduce or eliminate the interference.

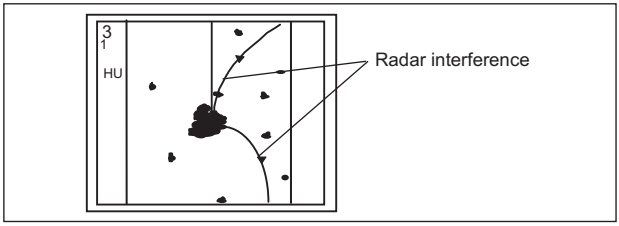


Fig. A.2.3.5 - Radar interference

B. Installation

B.1 MORE INSTALLATION CONSIDERATIONS

B.1.1 Shifting from keel line

By shifting the scanner position from the keel line to the starboard side of the boat, it is possible to move shadow zones to the port side. This makes it possible to keep a clear view to the bow. The distance to be shifted can calculated using the following equation:

Ls = 0.4R+D/2 [m] (when R<15m)
Ls = 0.025R+D/2 [m] (when R>=15m)

where Ls = distance to be shifted from keel line
D = diameter of obstacle on keel line
R = distance from scanner to obstacle

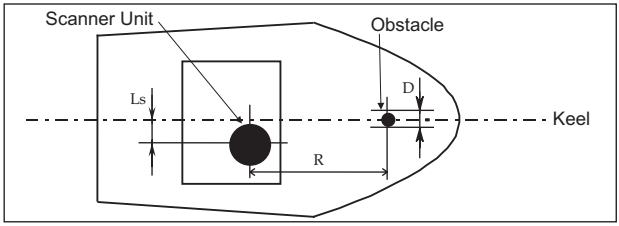


Fig. B.1.1 - Shifting from keel line

B.1.2 Obtaining sufficient dip angle

Raise the scanner position so that there is a sufficient dip angle available between the line of sight from the scanner to the obstacle and the horizontal line. By raising the dip angle above 5°, it is possible to prevent mid- and long-distance shadow zones. The Radar cannot detect objects below the line of sight.

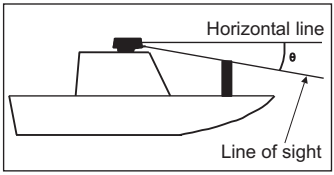


Fig. B.1.2 - Obtaining sufficient dip angle

B.2 INSTALLING SCANNER UNIT

Use a mounting base such as the ones shown in Fig. B.1.1, or you can install the scanner directly to a roof or other flat surface. Be certain you keep the water drain tube clear. It's located at the bottom of the scanner unit.

NOTE *If the mounting bracket or surface has a curvature of more than 2mm, use spacers with the mounting bolts to prevent stress on the scanner housing.*

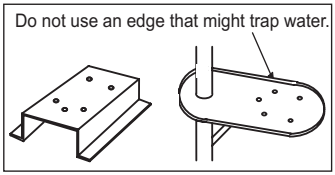


Fig. B.2 - Installing scanner unit

Analytical Index

CERTIFICATE OF LIMITED WARRANTY

Providing you present a valid proof of purchase, SI-TEX warrants all parts of each new product against defect in material and workmanship under normal use and will repair or exchange any parts proven to be defective at no charge for a period of two years for parts and one year for labor from the date of purchase, except as provided below under Limited Warranty Exceptions.
Defects will be corrected during normal working hours by an authorized SI-TEX dealer, service center, or at the SI-TEX office in St. Petersburg, Florida. There will be no charge for labor for a period of one year from the date of purchase, except as provided below under Limited Warranty Exceptions.
This Warranty and Proof of Purchase must be made available to the authorized SI-TEX service location or dealer at the time of service.

LIMITED WARRANTY EXCEPTIONS

SI-TEX will not be responsible for equipment which has been subjected to water or lightning damage, accident, abuse, or misuse, nor any equipment on which the serial number label has been removed, altered or mutilated. SI-TEX assumes no responsibility for damage incurred during installation.
This Limited Warranty is effective only with respect to the original purchaser. Any cost associated with transducer replacement, other than the cost of the transducer itself, is specifically excluded from this Limited Warranty. Travel cost incurred will not be accepted for SI-TEX products. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION OF THE FACE HEREOF.

SPECIFIC EXCLUSIONS

Charges for overtime, stand-by, holiday, and per diem are specifically excluded from the Limited Warranty. Chart paper, stylus, stylus belt, lamps, and fuses are consumable items and are not covered by this Limited Warranty. Installation workmanship or materials, except as provided directly by SI-TEX, are not covered by this Limited Warranty. SI-TEX equipment or parts thereof which have been repaired or altered except by an authorized SI-TEX dealer or service center are not warranted in any respect.
Transducer, software update, battery, microphone, magnetron, and microwave components and water damage on water resistant VHF radio are items excluded from the two-year warranty and are covered by warranty for a period of one year for both parts and labor. SI-TEX will not, at any time, assume any costs or labor charges for checkout or external line fuse replacement or problems not found to be at fault in equipment itself.

THERE ARE NO WARRANTIES OR GUARANTEES EXPRESSED OR IMPLIED WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY. SI-TEX HAS NO OTHER LIABILITY TO PURCHASE FOR DIRECT OR CONSEQUENTIAL DAMAGE OR ANY THEORY INCLUDING ABSOLUTE LIABILITY, TORT, OR CONTRACT. THIS LIMITED WARRANTY CANNOT BE ALTERED OR MODIFIED IN ANY WAY AND SHALL BE INTERPRETED IN ACCORDANCE WITH THE LAWS OF THE STATE OF FLORIDA. THIS WARRANTY IS LIMITED TO THE CONTINENTAL U.S.A., ALASKA, HAWAII, AND CANADA.

HOW TO OBTAIN SERVICE UNDER THIS WARRANTY

To provide better flexibility, SI-TEX gives you the option of obtaining service under this warranty by either:

a) Contacting an authorized SI-TEX service station (The closest service station may be found by contacting your dealer of purchase.) OR
b) Shipping your equipment prepaid via UPS or truck with insurance prepaid to SI-TEX at the address provided below. SI-TEX will, whenever possible, make all repairs covered by Limited Warranty within two weeks of receiving the equipment in Florida and return same to you, freight prepaid.
c) You must present a copy of your Purchase Sales Slip at the time you request warranty service.

Shipping/Mailing Address:

SI-TEX
Koden America, Inc.
11001 Roosevelt Blvd., Suite 800
St. Petersburg, FL 33716
727-576-5734

SI-TEX offers a complete line of quality marine electronics including echo sounders, electronic charting systems, radars, autopilots, GPS/WAAS/Loran receivers, SSB receivers, VHF radios, and integrated systems.

For more information, contact your SI-TEX dealer or the main office, located in St. Petersburg, Florida.