

FURUNO

OPERATOR'S MANUAL

RADAR PLOTTER SOUNDER

MODEL FRS-1000A/FRS-1000B/FRS-1000C



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SAFETY INSTRUCTIONS



WARNING

Radio Frequency Radiation Hazard

The radar antenna emits electromagnetic radio frequency (RF) energy which can be harmful, particularly to your eyes. Never look directly into the antenna aperture from a close distance while the radar is in operation or expose yourself to the transmitting antenna at a close distance.

Distances at which RF radiation levels of 100 and 10 W/m² exist are given in the table below.

Note: If the antenna unit is installed at a close distance in front of the wheel house, your administration may require halt of transmission within a certain sector of antenna revolution. This is possible—Ask your FURUNO representative or dealer to provide this feature.

Model	Distance to 100 W/m ² point	Distance to 10 W/m ² point
FRS-1000A	Nil	1.3 m
FRS-1000B	Worst case 0.2 m	Worst case 3.0 m
FRS-1000C	Nil	2.5 m



WARNING



ELECTRICAL SHOCK HAZARD
Do not open the equipment.

Only qualified personnel should work inside the equipment.



Turn off the radar power switch before servicing the antenna unit. Post a warning sign near the switch indicating it should not be turned on while the antenna unit is being serviced.

Prevent the potential risk of being struck by the rotating antenna and exposure to RF radiation hazard.



Wear a safety belt and hard hat when working on the antenna unit.

Serious injury or death can result if someone falls from the radar antenna mast.

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Turn off the power immediately if water leaks into the equipment or the equipment is emitting smoke or fire.

Continued use of the equipment can cause fire or electrical shock.

WARNING

Do not place liquid-filled containers on the top of the equipment.

Fire or electrical shock can result if a liquid spills into the equipment.

Do not operate the equipment with wet hands.

Electrical shock can result.

Keep heater away from equipment.

Heat can alter equipment shape and melt the power cord, which can cause fire or electrical shock.

TFT LCD

The TFT LCD panel is constructed using the latest LCD techniques, and displays more than 99.99% of its pixels. The remaining 0.01% of its pixels may drop out or blink, however this is not an indication of malfunction.

CAUTION

Do not use the equipment for other than its intended purpose.

Use of the equipment as a stepping stool, for example, can result in personal injury or equipment damage.

No one navigation device should ever be solely relied upon for the navigation of a vessel.

Always confirm position against all available aids to navigation, for safety of vessel and crew.

A warning label is attached to the display unit, processor unit and the scanner unit (FRS-1000B and FRS-1000C). Do not remove the labels. If the label is peeling off or is illegible, contact a FURUNO agent or dealer.

WARNING

To avoid electrical shock, do not remove cover. No user-serviceable parts inside.

Name: Warning Label (1)

Type: 86-003-1011-0

Code No.: 100-236-230

PROCESSOR UNIT

WARNING

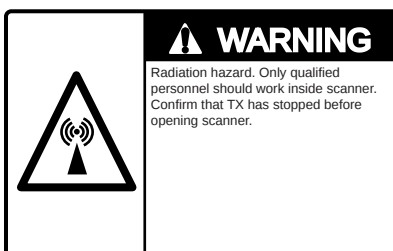
To avoid electrical shock, do not remove cover. No user-serviceable parts inside.

Name: Warning Label (2)

Type: 86-003-1011-0

Code No.: 100-236-230

DISPLAY UNIT



SCANNER UNIT
(FRS-1000B
FRS-1000C)

Name: RF Hazard Label

Type: 03-142-3201-0

Code No.: 100-266-890

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FOREWORD

A Word to FRS-1000 Owners

Congratulations on your choice of the FURUNO FRS-1000 Radar Plotter Sounder. We are confident you will see why the FURUNO name has become synonymous with quality and reliability.

For nearly 50 years FURUNO Electric Company has enjoyed an enviable reputation for innovative and dependable marine electronics equipment. This dedication to excellence is furthered by our extensive global network of agents and dealers.

Your FRS-1000 is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless installed, operated and maintained properly. Please carefully read and follow the recommended procedures for operation and maintenance.

We would appreciate hearing from you, the end-user, about whether we are achieving our purposes.

Thank you for considering and purchasing FURUNO equipment.

Features

The FRS-1000 is a fully integrated radar, GPS plotter and video sounder consisting of a display unit, a radar antenna, a GPS antenna, a processor unit, and a transducer. The FRS-1000 comes in three types: FRS-1000A, FRS-1000B or FRS-1000C depending on the type of radar antenna unit.

Pictures are displayed on a bright 10.4-inch TFT (Thin Film Transistor) LCD. The radar displays radar targets in monochrome or three colors. The plotter section employs a high sensitivity GPS receiver which tracks up to eight satellites simultaneously. The sounder section uses a dual-frequency transducer which displays underwater conditions in 16 (or 8) colors.

General features

- Fully integrated radar, GPS plotter and color video sounder.
- Bright 10.4-inch TFT LCD.
- Connection of two sub-display displays to control main display unit from remote location.
- Remote controller for armchair operation.

Radar

- Radar and plotter combination display.
- Head-up, Course-up, North-up, Relative Motion presentation modes.
- Echo trail feature trails movement of other vessels.
- Optional Auto Plotter ARP-10 automatically plots movements of other vessels.
- Guard alarm watches for vessels entering or exiting an area.

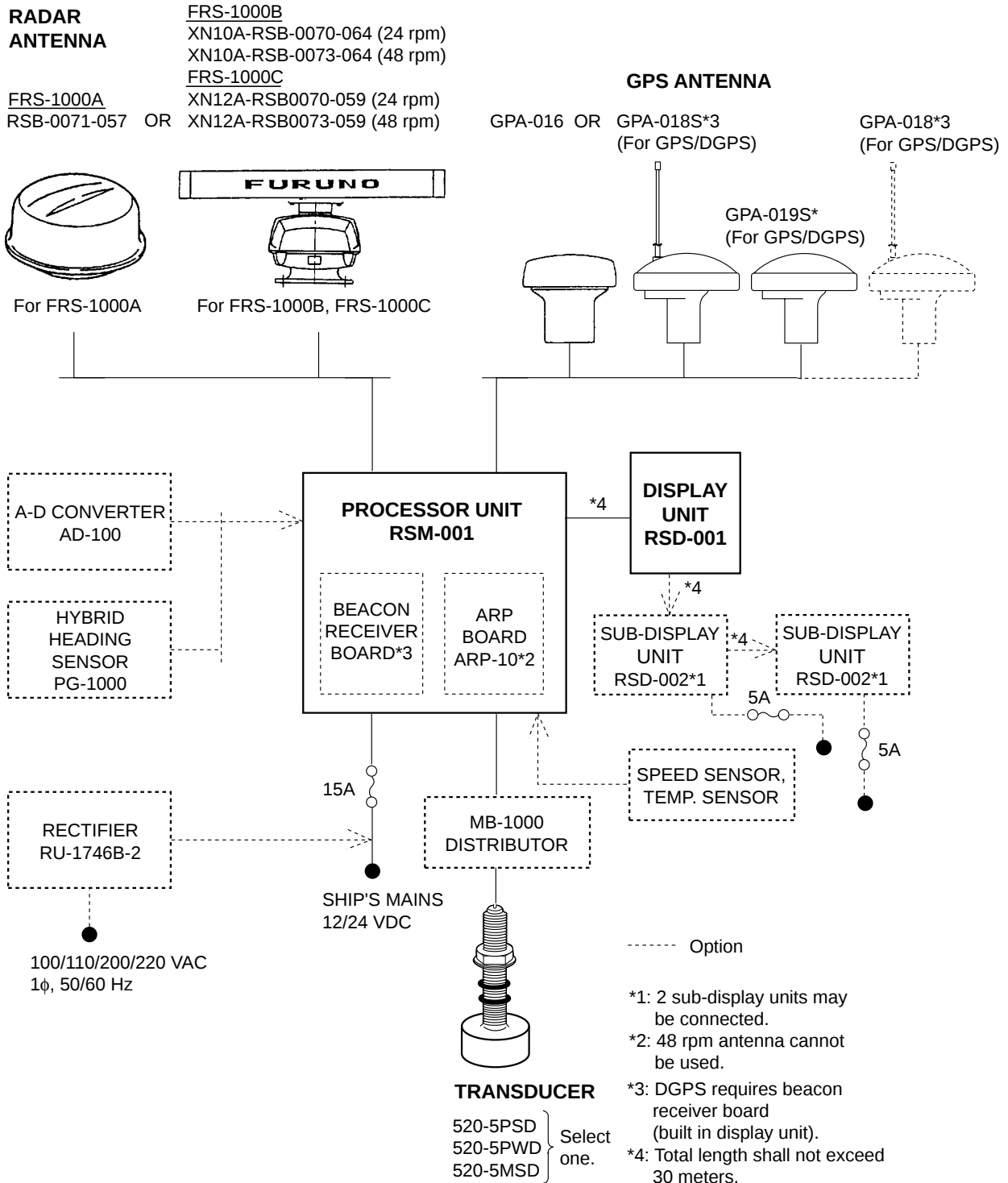
Plotter

- High capacity memory stores 3,800 points of track, 3,800 marks, 198 waypoints, 20 routes.
- Position display available in latitude and longitude or Loran C TDs.
- Uses FURUNO standard chart cards, FURUNO mini chart cards and NAVIONICS chart cards.
- Beacon receiver board (option) provides DGPS function (gives position accuracy within about five meters).

Sounder

- Dual- or single-frequency operation.
- Echoes displayed in 16 (or 8) colors.
- Sounding range 5 to 500 m.
- Automatic hands-off operation.
- Water temperature sensor (option) provides water temperature data.

SYSTEM CONFIGURATION



OPERATIONAL OVERVIEW

The FRS-1000 incorporates virtually all the marine electronics you will need to navigate and fish: a radar, a GPS plotter and a color video sounder. To get you acquainted with the many functions of the FRS-1000, this chapter covers basic operations such as turning on the power, adjusting display brilliance and menu operation.

1.1 Control Description

Display unit

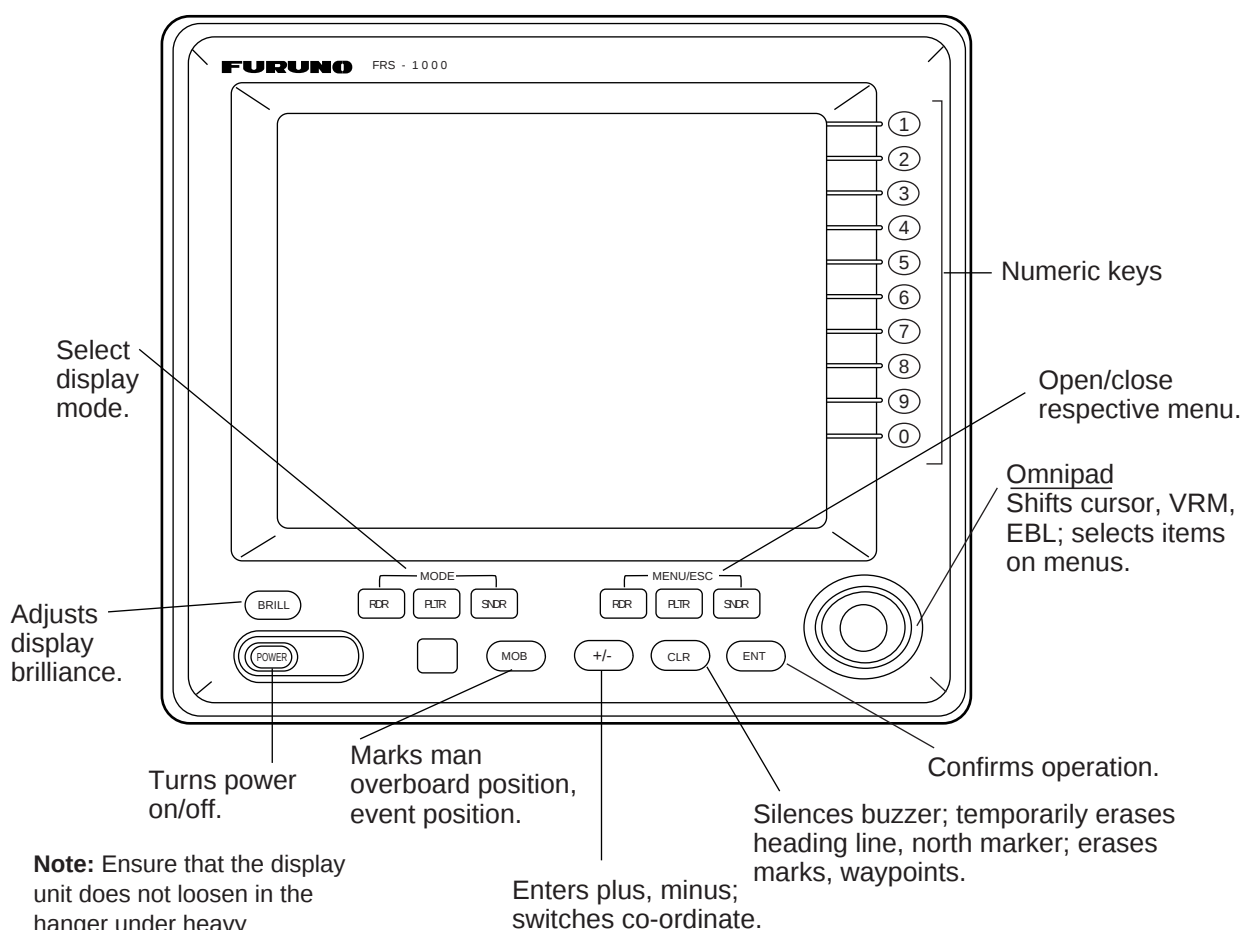


Figure 1-1 Display unit

Remote controller

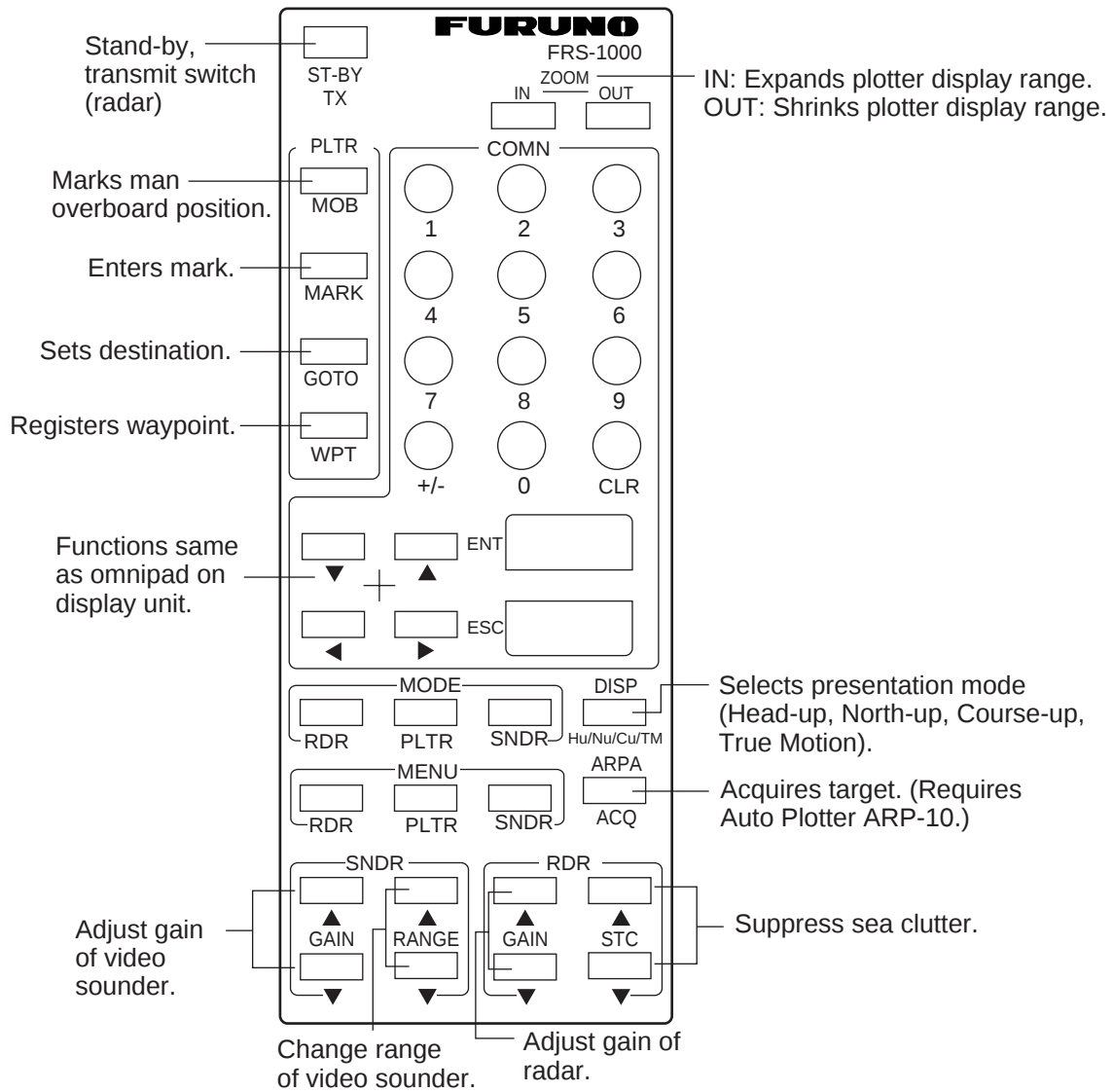


Figure 1-2 Remote controller

1.2 Inserting Chart Cards

Appropriate chart card should be inserted before turning on the power to display the chart automatically. (If it is inserted after turning on the power, change the chart scale to display it.) The slot for inserting chart cards is in the processor unit. The FRS-1000 accepts three types of chart cards: FURUNO conventional cards, NAVIONICS cards and the new mini cards.

 CAUTION
• The Processor Unit is not waterproof. Be sure to close the slot cover. • Turn off power before removing mini chart card. Removing the card with the power turned on may damage the card.

1. Open the slot cover on the processor unit.

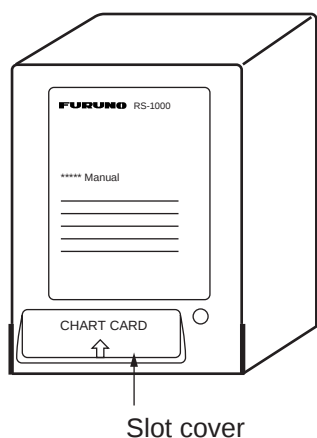
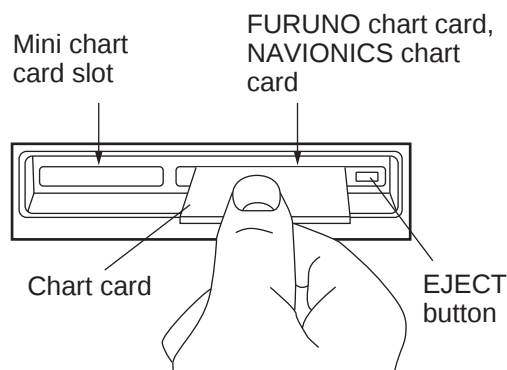


Figure 1-3 Processor unit

2. Insert the chart card label side up into the appropriate slot.



Note: Right-hand slot also holds memory cards.

Figure 1-4 Chart slots

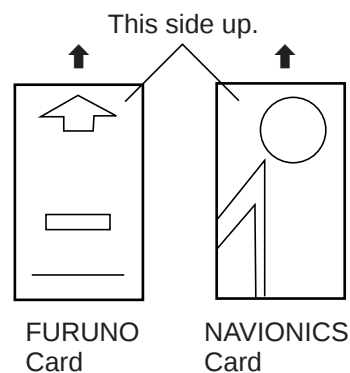


Figure 1-5 How to insert FURUNO or NAVIONICS chart card

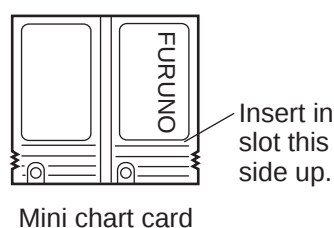


Figure 1-6 How to insert mini chart card

3. Close the slot cover.

Removing cards

1. Open the slot cover.
2. For the conventional chart card, press EJECT button to eject card. For the mini chart card, simply pull out the card.
3. Close the slot cover.

1.3 Turning the Power On/Off

1. Press the POWER switch to turn the system on. (Push it in until it stops and then release.) The hourglass  appears for about 20 seconds and then the system proceeds as shown below. For the plotter display the chart is automatically loaded and displayed provided a chart card is inserted before turning on the power. The hourglass appears at the screen center while the chart is being loaded.

When a sub-display unit is installed, turn on the main display unit first and then turn on the sub-display unit.

2. To turn off the power press the POWER switch again.

Note 1: If the "DEMO" icon appears and you do not require the demonstration mode, turn on the power while pressing and holding down the [ENT] key. For further details on the demonstration mode, see Paragraph 1.7.

Note 2: The sub-display unit shows the same picture as the main display whenever its power is reset.

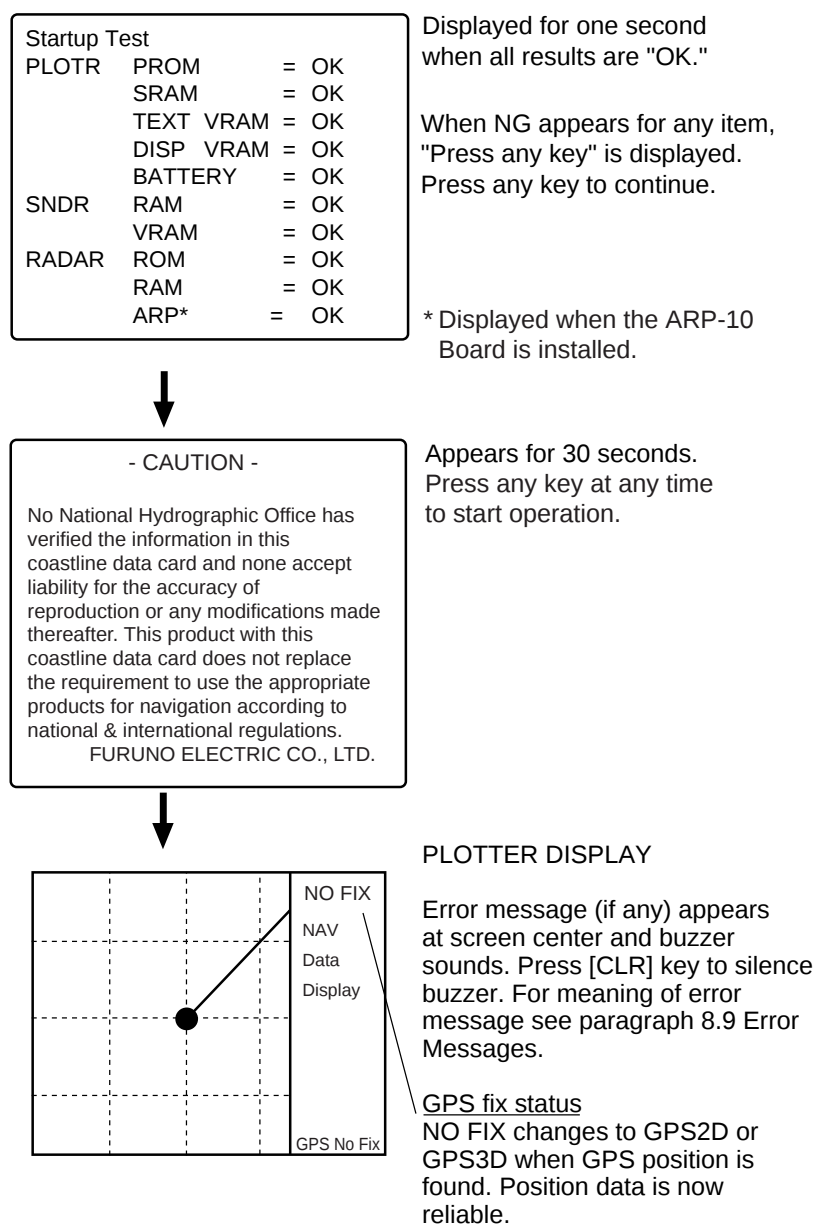


Figure 1-7 Start-up sequence

1.4 Adjusting Display Screen Brilliance

1. Press the [BRILL] key. The following display appears.

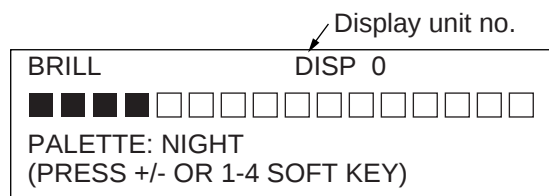


Figure 1-8 Brilliance adjustment screen

2. Press the [BRILL] key again within 10 seconds to select desired brilliance level (16 levels are available). If the [BRILL] key is not pressed again after 10 seconds the brilliance adjustment display disappears.

Note: Either MAIN DISP, SUB DISP 1 or SUB DISP 2 appears, whichever is being operated. This message also appears on other displays, however only the brilliance for the display operated is changed.

1.5 Selecting Operating Mode

The FRS-1000 has four operating modes: radar, plotter, sounder, and combination mode. The combination mode lets you show any two or all three of radar, plotter and sounder. Note that the display must show at least one of the modes; you cannot turn off all modes.

To select a display use the MODE keys, RDR, PLTR and SNDR. Each pressing of a MODE key turns on/off the corresponding display.

When the sounder display is selected its picture appears at the right 1/5 of the screen. To display it over the left 4/5 of the screen, display it together with the plotter screen or radar screen and then turn off the plotter or radar screen.

See the next several pages for examples.

Radar display

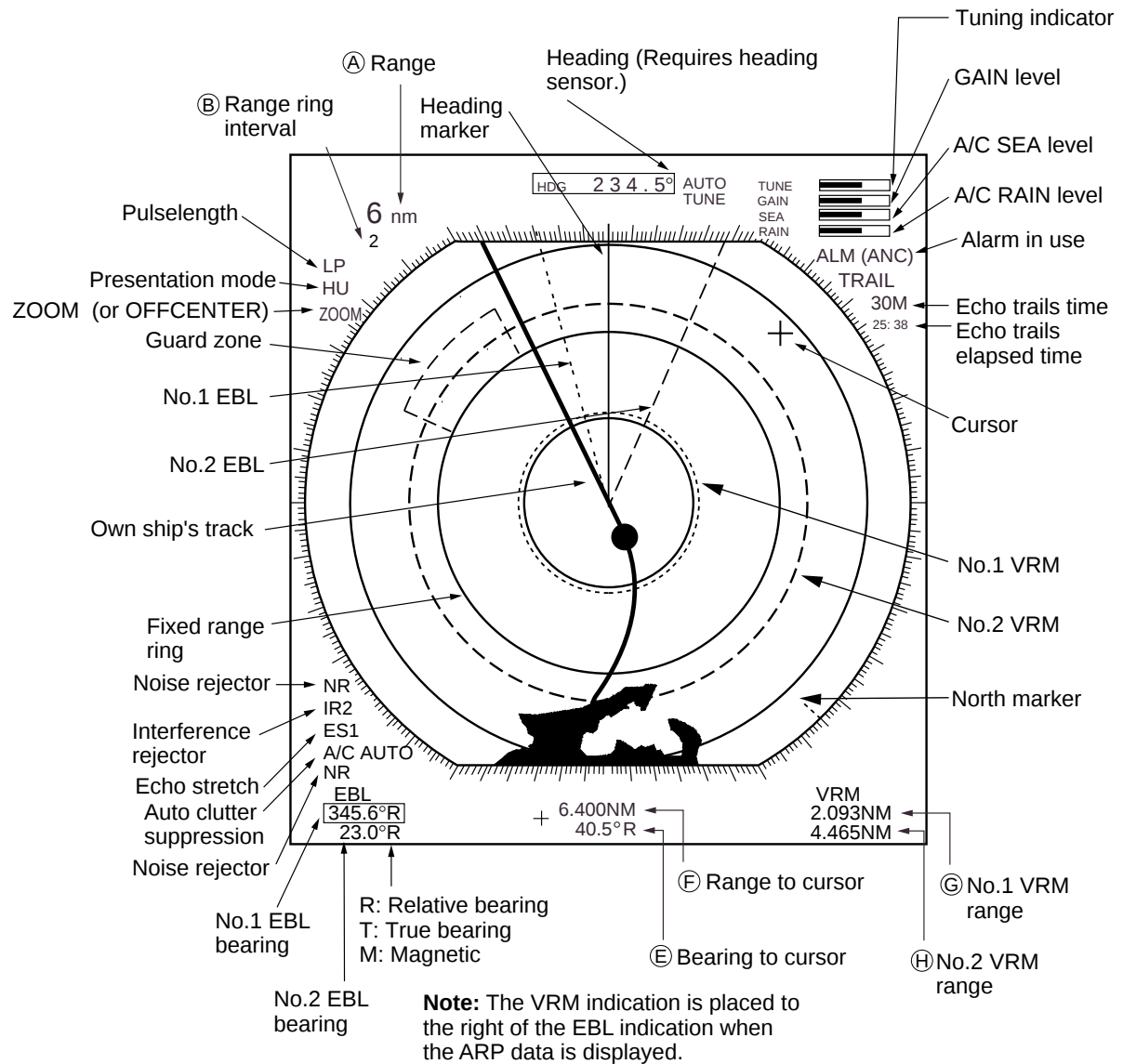


Figure 1-9 Radar display

Plotter display

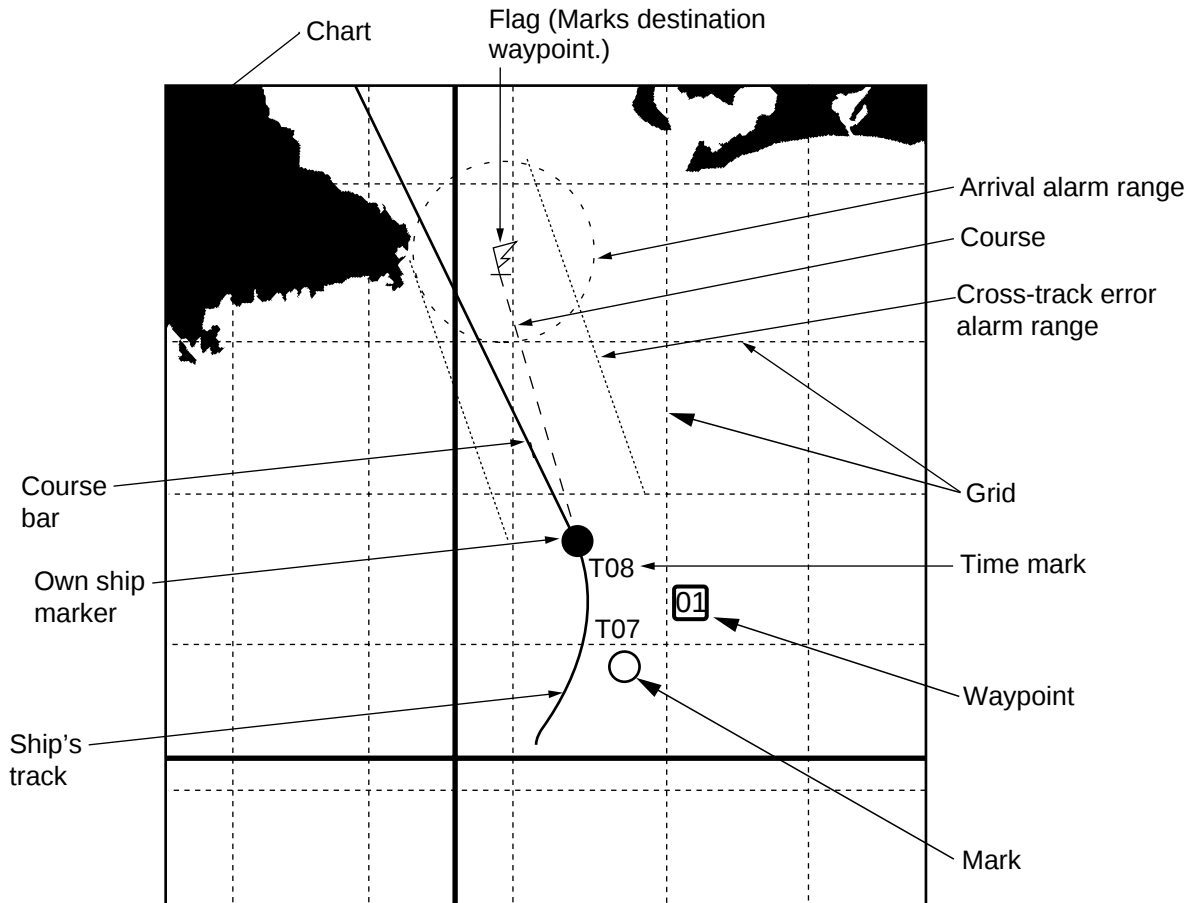


Figure 1-10 Plotter display

Radar/plotter display

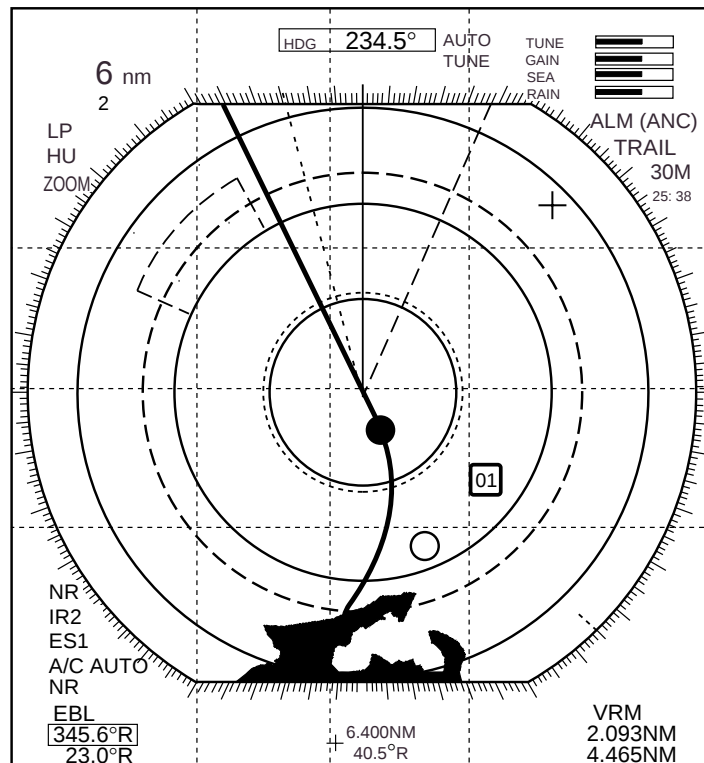


Figure 1-11 Radar/plotter combination display

Sounder display

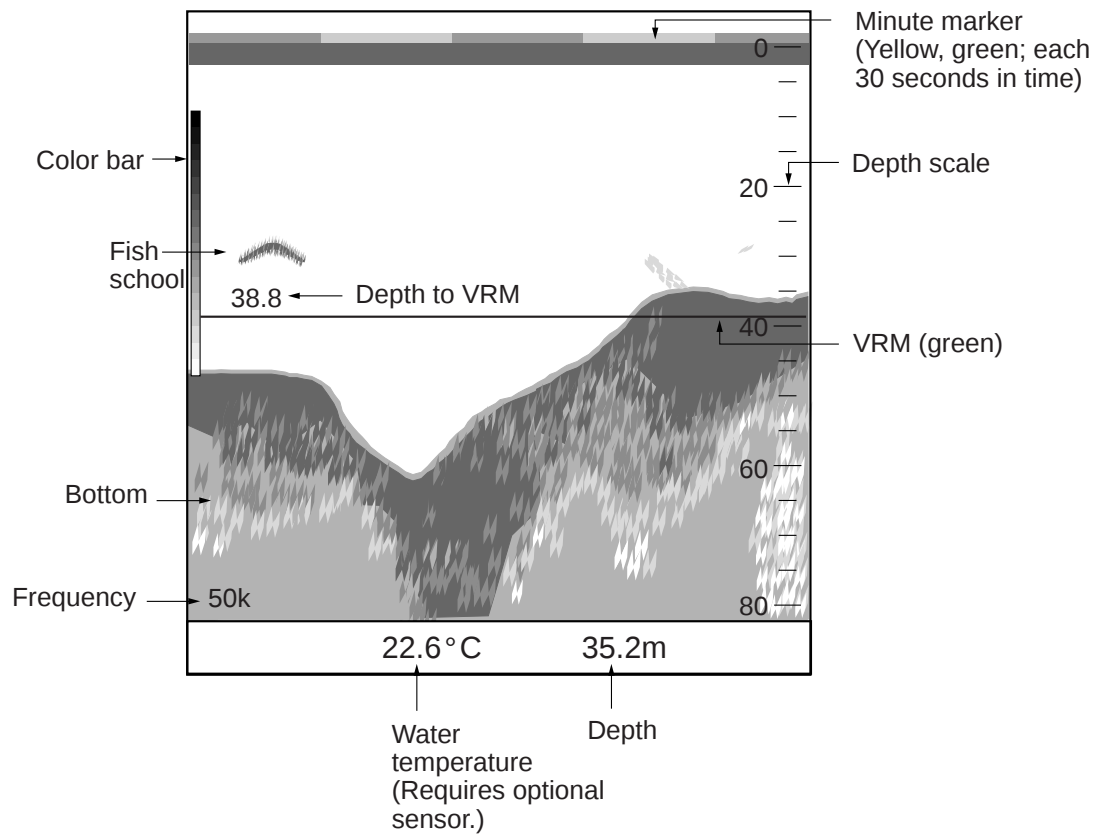


Figure 1-12 Sounder display

Nav data display

Normally the right 1/5 of the screen shows navigation data. Two types of navigation displays are available: NAV DATA 1 (comprehensive data display, default display) and NAV DATA 2 (basic data, large characters). You can select which to display on Page 6 of the Plotter System Setting menu.

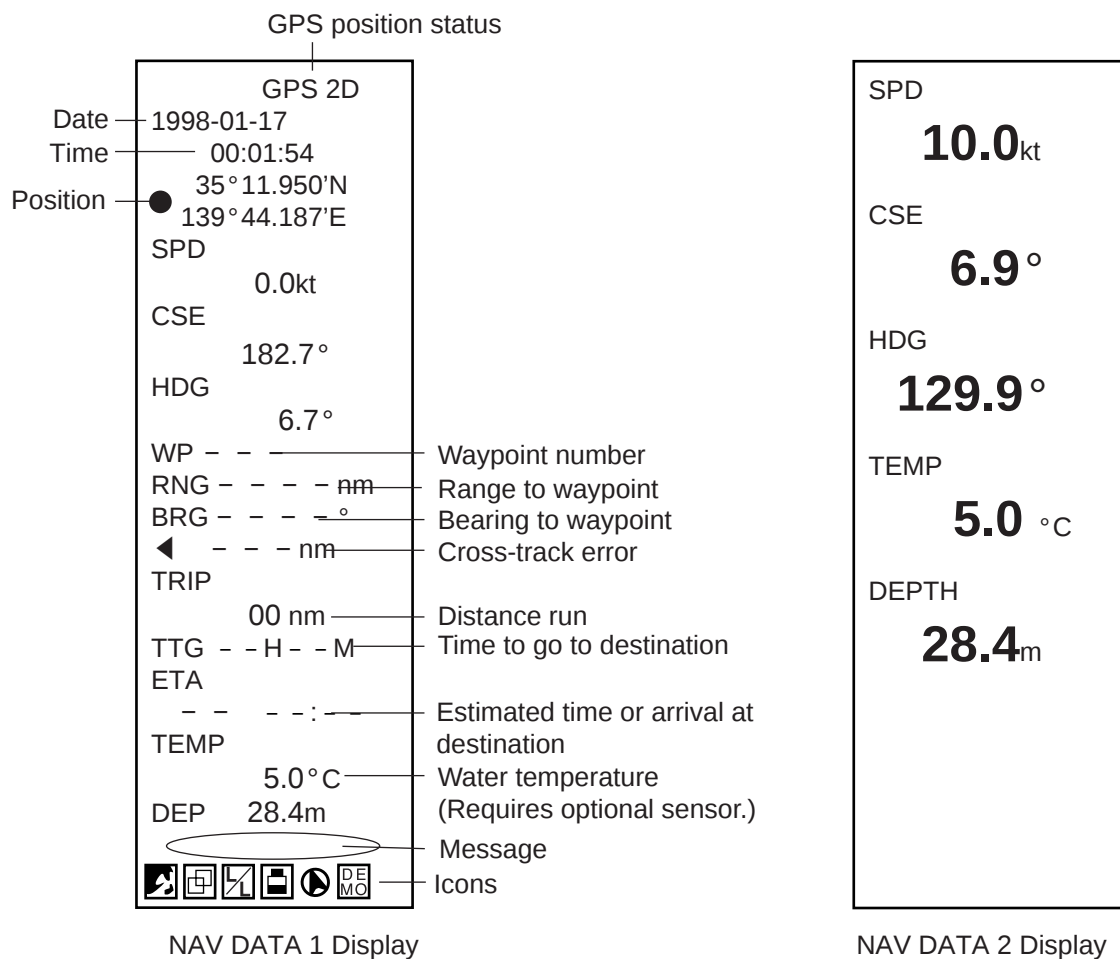


Figure 1-13 Nav data displays

1.6 Menu Operation

Most operations are carried out through the menu system. The radar, plotter and sounder each have their own menus, and you may access the menu system from the display unit or remote controller, with the MENU keys.

1. To open a menu, press appropriate MENU/ESC key among [RDR MENU/ESC], [PLTR MENU/ESC], [SNDR MENU/ESC]. When this is done the appropriate "function display" replaces the nav data display. For example, press the [RDR MENU/ESC] key to display the radar function display.

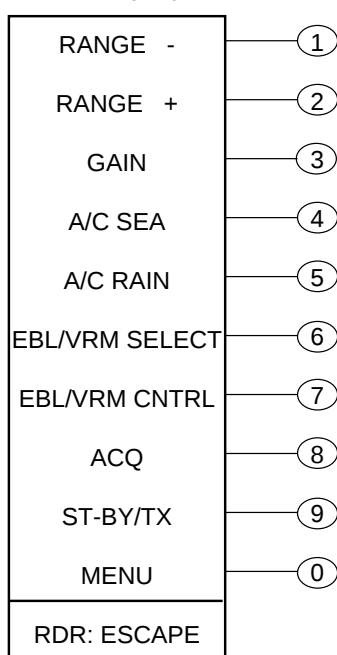


Figure 1-14 Radar function display

Note: When you operate one of the top three keys, the message MAIN DISP, SUB DISP 1 or SUB DISP 2 appears, whichever display is being operated. This message also appears on other displays

2. To open the RADAR menu, press the [0] key.

RADAR MENU	
1.CONTROLS	
2.SETTINGS	
3.INSTALLATION	
4.FACTORY SETTING	
5.ARP SETTING*	
6.ARP ACQ/CANCEL*	
9.ALARM SETTING	
0.UNIT SETTING	
↓↑: SELECT ENT : ENTER RDR : ESCAPE	

* Requires ARP-10 Board.

Figure 1-15 Radar menu

3. Select a menu by pressing appropriate numeric key or operating the omnipad and pressing the [ENT] key. For example, press the [1] key to select CONTROLS.

CONTROLS	
PAGE	1 2
RING	OFF 1 2 3 4
COLOR	1 2 3 4 5
EBL OFFSET	OFF ON
SHIFT/ZOOM	SHIFT OFF ZOOM
DISP MODE	HU CU NU TM
ECHO STRETCH	OFF ES 1 ES 2
INT. REJECT	OFF ON
LEVEL	1 2 3
↓↑←→: SEL/ENTER RDR : ESCAPE	

Figure 1-16 Radar Controls menu, page 1

- To switch between pages on multi-page menus, operate the omnipad to select appropriate page number from the PAGE field. The figure below shows page 2 of the CONTROLS menu.

CONTROLS			
PAGE	1	2	
A/C AUTO	OFF	ON	
WATCHMAN	OFF	ON	
INTERVAL	5	10	20 min
RADAR LOCK	OFF	ON	
RADAR PICT.	ROUND	WIDE	
↓↑←→: SEL/ENTER RDR: ESCAPE			

Figure 1-17 Radar Controls menu, page 2

- Press the top or bottom of the omnipad to select item.
- Press the right or left side of omnipad to select option.
- Press the appropriate menu key to register selection and close menu.

1.7 Color Palette

The color palette feature provides optimal plotter, radar and sounder color combinations for daytime, nighttime and dusk, as well as custom colors which the user may choose.

- Press the [BRILL] key to display the BRILL window.
- Press the [+/-] key or the soft keys 1-4 to select desired color setting among DAY, NIGHT, DUSK or CUSTOM. Your selection appears to the right of PALETTE.

BRILL		Display unit no.	
DISP 0			
■ ■ ■ ■	□ □ □ □ □ □ □ □ □ □		
PALETTE: NIGHT (PRESS +/- OR 1-4 SOFT KEY)			

Figure 1-18 Brilliance adjustment screen

Color combinations by the BRILL key

		DAY	NIGHT	DUSK	USER
R A D A R	Characters	WHT	WHT	WHT	Respective menu settings
	Range Rings	WHT	GRN	GRN	
	EBL/VRM	WHT	RED	RED	
	Cursor	WHT	RED	RED	
	Heading Line	WHT	WHT	WHT	
	North Marker	WHT	WHT	WHT	
	Guard Alarm	WHT	RED	RED	
P L O T T E R	Land Brilliance	BRT	DIM	BRT*	
	Land Color	BLU	LBLU	LBLU	
	Place Name	WHT	WHT	WHT	
	Grid	WHT	WHT	WHT	
	Course Bar	YEL	GRN	PPL	
	Background	BLK	BLK	BLK	
S N D E R	Background	WHT	BLU	BLU	

*: DIM in radar/plotter combination display

Note: The DAY mode sometimes may not display the range rings and north marker in white. If this occurs, reselect the DAY mode.

1.8 Sub-Display Units

The sub-display units provide fully independent operation from remote locations, and two may be connected.

Note: Other displays cannot be operated when the menu is opened. Normal operation is restored once the menu operation is terminated.

1.9 Demonstration Display

The demonstration display provides simulated operation of the plotter and sounder. All plotter and sounder controls are fully operational to help you become acquainted with the many features of the FRS-1000.

1. Turn on the power while pressing and holding down the [ENT] key. Release the [POWER] key. Hold down the [ENT] key until the following display appears.

DEMO SETTING	
BASE POSITION	000.0°N 000.0°W
SPEED	00.0 kt
← → : CURSOR ↓ : COLUMN ENT: ENTER +/- : N/S, E/W	

Figure 1-18 Demo Setting display

2. Switch latitude co-ordinate (North, South) with the [+/-] key if necessary, and then enter current latitude. The default latitude is North.
4. Switch longitude co-ordinate (East, West) with the [+/-] key if necessary, and then enter current longitude. The default longitude is West.
5. Press the bottom of the omnipad to select the SPEED field.
6. Key in speed to use for the demonstration.
7. Press the [ENT] key.

The Startup Test results are displayed. “DEMO” appears at the lower right-hand corner, and the “ship” starts tracking a figure eight pattern.

To return to normal operation, turn on the power while pressing and holding down the [ENT] key. Note that you may also return to normal operation by clearing the memory.

This chapter shows you how to operate the radar and interpret the radar display.

2.1 Transmitting

1. After confirming that ST-BY is displayed, press the [RDR MENU/ESC] key. The radar functions display replaces the nav data display. (If the radar display appears when the unit is turned on, the count-down timer is displayed, and it counts down three minutes of warm-up time. During this period the magnetron, that is, the transmitter tube, is warmed for transmission. When the timer has reached 0:00, the indication ST-BY appears, indicating that the radar is now ready to transmit pulses.)

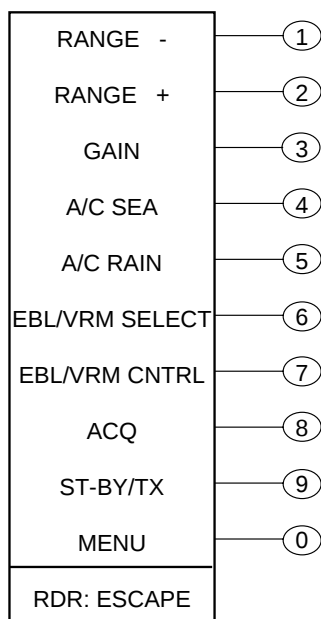


Figure 2-1 Radar functions display

2. Press the [9] key (ST-BY/TX) to transmit. The radar display appears.
3. When the radar picture is not required, but you want to keep it in a state of readiness, press the [9] key again to go into the stand-by mode. ST-BY appears on the display.
4. Press the [RDR MENU/ESC] key to close the radar menu.

2.2 Adjusting the Gain

The gain circuit adjusts the gain (sensitivity) of the radar receiver. It works in precisely the same manner as the volume control of a broadcast receiver, amplifying the signals received.

The proper setting is such that the background noise is just visible on the screen. If you set up for too little gain, weak echoes may be missed. On the other hand excessive gain yields too much background noise; strong targets may be missed because of the poor contrast between desired echoes and the background noise on the display.

To adjust receiver gain, transmit on long range, and then do the following:

1. Press the [RDR MENU/ESC] key.
2. Press the [3] key (GAIN).
3. Operate the left side of the omnipad to lower the gain; right to raise it.
4. Press the [RDR MENU/ESC] key to finish.

2.3 Selecting the Range Scale

The range selected automatically determines the range ring interval, the number of range rings, pulselength and pulse repetition rate, for optimal detection capability in short to long ranges.

The range, range ring interval and pulselength appear at the top left-hand corner of the display.

1. Press the [RDR MENU/ESC] key.
2. Press the [2] key (raises range) or [1] key (lowers range).
3. Press the [RDR MENU/ESC] key to finish.

2.4 Reducing Sea Clutter

Echoes from waves can be troublesome, covering the central part of the display with random signals known as “sea clutter”. The higher the waves, and the higher the antenna above the water, the further the clutter will extend. Sea clutter appears on the display as many small echoes which might affect radar performance. (See the left-hand figure in Figure 2-2.) When sea clutter masks the picture, adjust the A/C SEA circuit to reduce the clutter.

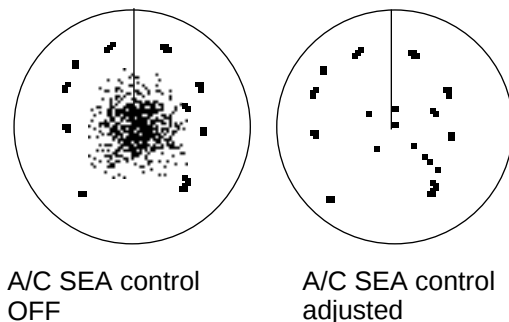


Figure 2-2 Effect of A/C SEA

How the A/C SEA circuit works

The A/C SEA circuit reduces the amplification of echoes at short ranges (where clutter is the greatest) and progressively increases amplification as the range increases, so amplification will be normal at those ranges where there is no sea clutter.

Adjusting A/C SEA

The proper setting of the A/C SEA should be such that the clutter is broken up into small dots, and small targets become distinguishable.

If the control is set too low, targets will be hidden in the clutter, while if it is set too high, both sea clutter and targets will disappear from the display. In most cases adjust the control until clutter has disappeared to leeward, but a little is still visible windward.

1. Press the [RDR MENU/ESC] key.
2. Press the [4] key (A/C SEA).

3. Operate the left or right side of the omnipad to adjust the A/C SEA. The current level is shown on the A/C SEA level bar at the top right-hand corner of the screen.
4. Press the [RDR MENU/ESC] key to finish.

Tip for adjusting A/C SEA

A common mistake is to over-adjust the circuit so all the clutter is removed. As an example set up for maximum A/C SEA. You will see how the center of the display becomes dark. This dark zone can be dangerous (targets may be missed), especially if the gain is not properly adjusted. Always leave a little clutter visible on the display to be sure weak echoes will not be suppressed. If there is no clutter visible on the display, turn off the circuit.

Automatic clutter rejection

The A/C AUTO feature automatically suppresses sea and rain clutters. You can activate or deactivate it as follows:

1. Press the [RDR MENU/ESC] key.
2. Press [0], [1], and select PAGE 2.
3. Select A/C AUTO to ON or OFF as appropriate.
4. Press the [RDR MENU/ESC] key to finish.

2.5 Cursor Data, Own Ship Data

You may display cursor data and own ship data by turning the cursor on and off respectively with the [+/-] key as below. For further details see Figures 3-4 and 3-5 on page 3-2.

Cursor ON: Cursor position, range and bearing from own ship to cursor

Cursor OFF: Own ship position, speed and course

2.6 Reducing Precipitation Clutter

The vertical beamwidth of the antenna is designed to see surface targets even when the ship is rolling. However, by this design the unit will also detect rain clutter (rain, snow, hail, etc.) in the same manner as normal targets. Figure 2-3 shows the appearance of rain clutter on the display.

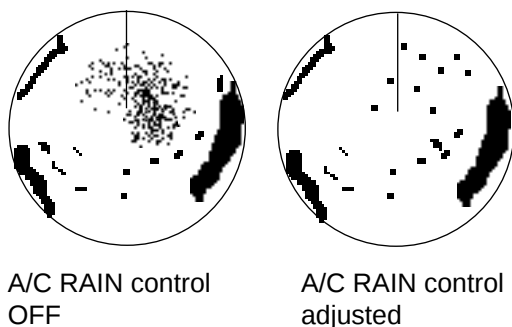


Figure 2-3 How the A/C RAIN circuit works

Adjusting A/C RAIN

When rain clutter masks echoes, adjust the A/C RAIN circuit. This circuit splits up these unwanted echoes into a speckled pattern, making recognition of solid targets easier.

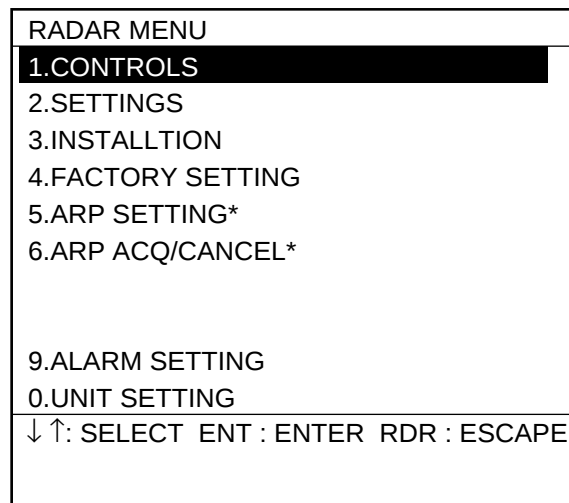
1. Press the [RDR MENU/ESC] key.
2. Press the [5] key (A/C RAIN).
3. Operate the omnipad to adjust the A/C RAIN affect. The current level is shown on the A/C RAIN level bar at the top right-hand corner of the display.
4. Press the [RDR MENU/ESC] key to finish.

Note: In addition to reducing clutter, the A/C RAIN circuit can be used in fine weather to clarify the picture when navigating in confined waters. However, with the circuit activated the receiver is less sensitive. Therefore, turn off the circuit when its function is not required.

2.7 Presentation Mode

This radar provides four presentation modes: head-up, course-up, north-up and true motion.

1. Press the [RDR MENU/ESC] key.
2. Press the [0] key to display the RADAR menu.



* Requires ARP-10 Board.

Figure 2-4 Radar menu

3. Press the [1] key to display the CONTROLS menu, and select PAGE 1.

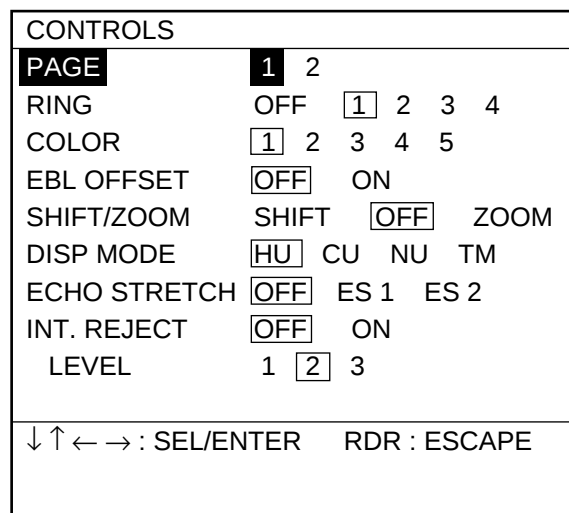


Figure 2-5 Radar controls menu, page 1

4. Select HU, CU, NU or TM from the DISP MODE field.
5. Press the [RDR MENU/ESC] key to finish.

The display mode in use appears at the top left-hand corner on the screen, using the indication HU, CU, NU or TM. If there is no heading sensor connected, the display mode is always HU. CU, NU and TM modes require a compass signal. The TM mode additionally requires a speed signal.

Presentation mode description

Head-up (HU)

A display without azimuth stabilization in which the line connecting the center with the top of the display indicates own ship's heading. The target pips are painted at their measured distances and in their directions relative to own ship's heading.

A short line on the bearing scale is the north marker indicating compass north. A failure of the heading sensor input will cause the north marker to disappear and the HDG readout to show xxx.x°.

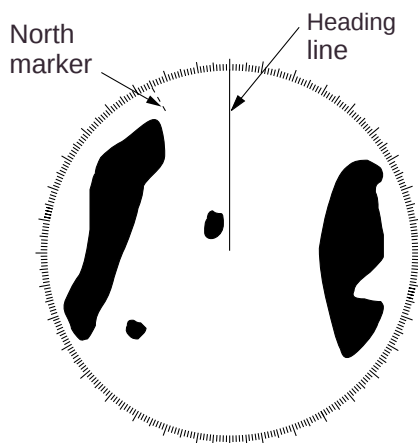


Figure 2-6 Head-up presentation mode

Course-up (CU)

An azimuth stabilized display in which a line connecting the center with the top of the display indicates own ship's intended course (namely, own ship's previous heading just before this mode has been selected).

Target pips are painted at their measured distances and in their directions relative to the intended course which is maintained at the 0-degree position while the heading line moves in accordance with ship's yawing and

course changes. This mode is useful to avoid smearing of picture during course change. After a course change, press the [CLR] key to reset the picture orientation if you wish to continue using the course-up mode.

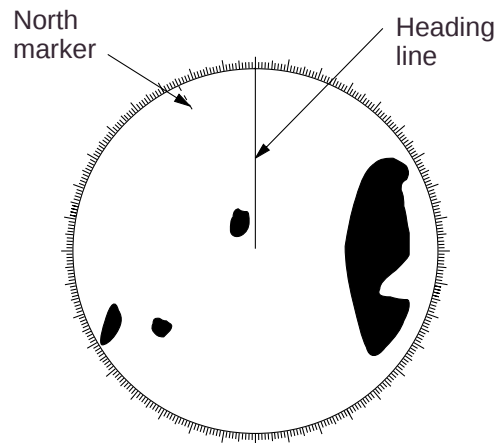


Figure 2-7 Course-up presentation mode

North-up (NU)

In the north-up mode, target pips are painted at their measured distances and in their true (compass) directions from own ship, north being maintained UP of the screen. The heading line changes its direction according to the ship's heading.

If the heading sensor fails, the presentation mode changes to head-up and the north maker disappears. Also, the HDG readout shows xxx.x.

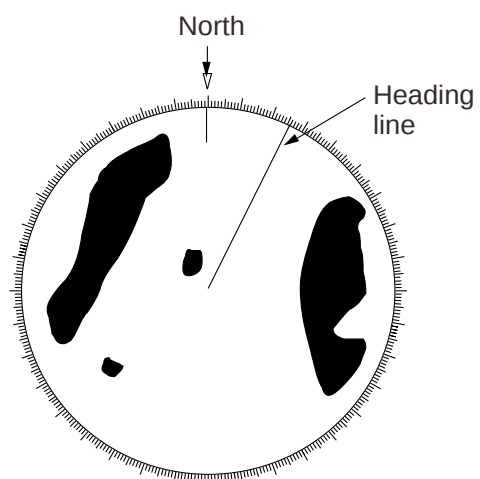


Figure 2-8 North-up presentation mode

True motion (TM)

Own ship and other moving objects move in accordance with their true courses and speeds. All fixed targets, such as land-masses, appear as stationary echoes.

When own ship reaches a point corresponding to 75% of the radius of the display, the own ship is automatically reset to a point of 75% radius opposite to the extension of the heading line passing through the display center. Resetting can be made at any moment before the ship reaches the limit by pressing the [CLR] key. Automatic resetting is preceded by a beep sound. If the heading sensor fails, the presentation mode is changed to the head-up mode and the north marker disappears. The HDG readout at the top of the screen shows xxx.x°.

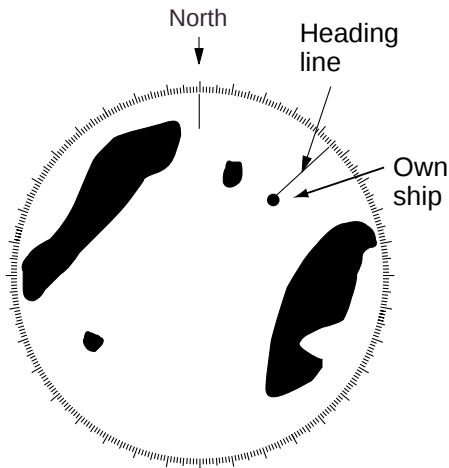


Figure 2-9 True motion presentation mode

Loss of Compass Signal

When the compass signal is lost, the presentation mode automatically becomes head-up and the compass readout at the screen top shows xxx.x°. Once the compass signal is restored the presentation mode in use when the compass signal was lost is restored.

2.8 Measuring the Range

You can measure the range to a target three ways: by the range rings, by the cursor, and by the VRM (Variable Range Marker).

Measuring range by range rings

Count the number of rings between the center of the display and the target. Check the range ring interval and judge the distance of the echo from the inner edge of the nearest ring.

To turn the rings on/off, do the following:

1. Press the [RDR MENU/ESC] key.
2. Press [0], [1] and select PAGE 1.
3. Select a brilliance level (1, 2, 3, 4) from the RING field. ("OFF" turns off the rings.)
4. Press the [RDR MENU/ESC] key to finish.

Measuring range by cursor

Operate the omnipad to place the cursor in intersection on the inside edge of the target echo. The range to the target, as well as the bearing, appears to the right of "+" at the bottom of the display.

Measuring range by VRM

1. Press the [RDR MENU/ESC] key.
2. Press the [6] key (EBL/VRM SELECT) to select the No. 1 VRM (dotted ring) or No. 2 VRM (dashed ring).
3. Press the [7] key (EBL/VRM CNTRL). The selected VRM and its indication (at the bottom right-hand corner) is circumscribed. (You may erase a VRM and its indication by selecting it at step 2 and pressing and holding down the [7] key until the VRM and indication are erased.)

Note: Do the following step within five seconds of step 3. Otherwise, the VRM will become stationary.

4. Operate the omnipad to place the VRM on the inside edge of a target echo. Read the VRM indication to find range.
5. To erase a VRM, press the [7] key about three seconds.
6. Press the [RDR MENU/ESC] key to finish.

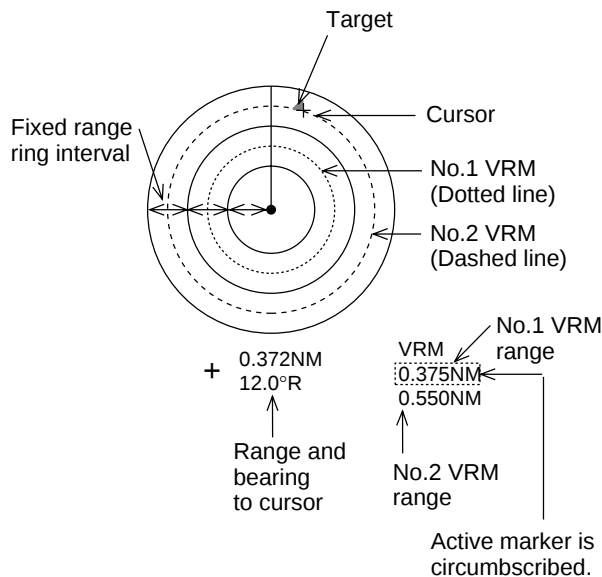


Figure 2-10 How to measure range

2.9 Measuring the Bearing

There are two ways to measure the bearing to a target: by the cursor, and by the EBL (Electronic Bearing Line).

Measuring bearing by cursor

Operate the omnipad to bisect the target with the cursor intersection. The bearing to the target appears at the bottom to the right of "+" at the bottom of the display.

Measuring bearing by EBL

1. Press the [RDR MENU/ESC] key.
2. Press the [6] key (EBL/VRM SELECT) to select the No.1 EBL (dotted line) or No. 2 EBL (dashed line).

3. Press the [7] key (EBL/VRM CNTRL). The selected EBL appears and its indication (at the bottom left-hand corner) is circumscribed. (You may erase an EBL and its indication by selecting it at step 2 and pressing and holding down the [7] key until the EBL and indication are erased.)

Note: Do the following step within five seconds of step 3. Otherwise, the EBL will become stationary.

4. Operate the omnipad to bisect the target echo with the EBL. Read the EBL indication to find bearing.

Note: The bearing readout for the EBL can be displayed in relative, true (true bearing requires heading sensor input), or magnetic bearing. For North-up and Course-up display modes the bearing reference is always true.

5. To erase a EBL, press the [7] key about three seconds.
6. Press the [RDR MENU/ESC] key.

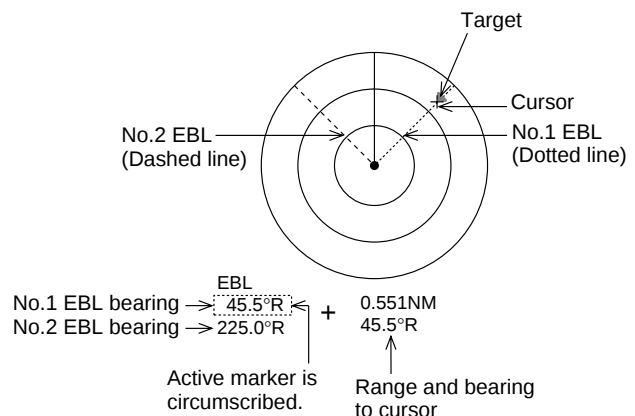


Figure 2-11 How to measure bearing with the EBL

Tips for measuring bearing

- Bearing measurements of smaller targets are more accurate; the center of larger target pips is not as easily identified.
- Bearings of stationary or slower moving targets are more accurate than bearings of faster moving targets.
- To minimize bearing errors keep echoes in the outer half of the picture by changing the range scale; angular difference becomes difficult to resolve as a target approaches the center of the display.

2.10 Predicting Collision Course with the Offset EBL

The procedure below checks if the target echo shown in Figure 2-12 is on a collision course.

1. Press the [RDR MENU/ESC] key followed by the [0] key.
2. Press the [1] key to select the CONTROLS menu, and then select PAGE 1.
3. Select ON from the EBL OFFSET field.
4. Operate the omnipad to place the cursor on the target of interest and press the [ENT] key.
5. Press the [RDR MENU/ESC] key.
6. After waiting for a few minutes (at least 3 minutes), press the [RDR MENU/ESC] key again.
7. Press the [6] key to select the No.1 EBL.
8. Press the [7] key.
9. Operate the omnipad so the EBL bisects the target at the new position (A'). The EBL readout shows the target ship's course, which may be true, relative or magnetic depending on menu setting. If the target tracks along the EBL towards the center of the display (your ship's position), the target may be on a collision course.
10. Press the [RDR MENU/ESC] key to finish.
11. To cancel the offset EBL, select OFF from the EBL OFFSET field in the Radar Functions menu.

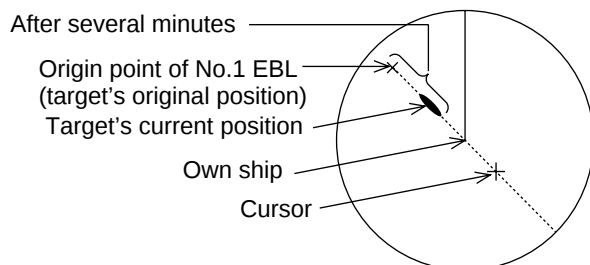


Figure 2-12 Predicting collision course with the offset EBL

2.11 Measuring Range & Bearing Between Two Targets

The procedure which follows shows how to measure the range and bearing between target "A" and target "B" in Figure 2-13.

1. Press the [RDR MENU/ESC] key.
2. Press the [0] key to display the RADAR menu.
3. Press the [1] key to display the CONTROLS menu, and then select PAGE 1.
4. Select ON from the EBL OFFSET field.
5. Operate the omnipad to place the cursor on the target "A" and press the [ENT] key.
6. Press the [RDR MENU/ESC] key.
7. Press the [RDR MENU/ESC] key again.
8. Press the [7] key.
9. Operate the omnipad so the EBL bisects the target "B". Bearing is shown relative to own ship with suffix "R" or as a true bearing with suffix "T" or as a magnetic bearing with suffix "M".
10. Display the No.1 VRM.
11. Operate the omnipad to place the No.1 VRM on the inner edge of the target "B".
12. Press the [RDR MENU/ESC] key to finish.

To cancel the offset EBL, select OFF from the EBL OFFSET field in the Radar Functions menu.

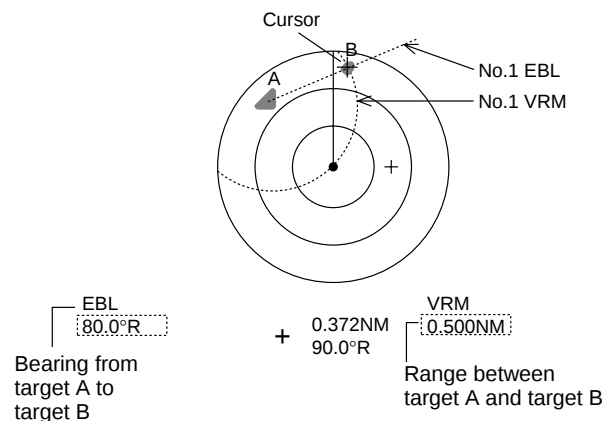


Figure 2-13 How to measure the range and bearing between two targets

2.12 Echo Trails

Echo trails are simulated afterglow of target echoes that represent their movements relative to own ship in a single tone or gradual shading depending on menu setting. This function is useful for alerting you to possible collision situations.

Trail time

1. Press the [RDR MENU/ESC] key.
2. Press [0], [2] to display the SETTINGS menu, and then select PAGE 1.
3. Select INTERVAL.

SETTINGS			
PAGE	1	2	
ECHO TRAIL	☐ OFF	☐ ON	
INTERVAL	15 sec	30 sec	☐ 1 min
	3 min	6min	15min
	30 min	CONT	
TRAIL TONE	☐ SINGLE	☐ MULTI	
TRAIL COLOR	☐ YEL	☐ GRN	
ECHO COLOR	YEL	☐ WHITE	COLOR
PULSELENGTH	SHORT	☐ LONG	
NOISE REJECT	☐ OFF	☐ ON	
↓↑←→ : SEL/ENTER ENT : ENTER			
RDR : ESCAPE			

Figure 2-14 Radar Settings menu, page 1

4. Press the omnipad to select desired trail time; 15 sec, 30 sec, 1 min, 3 min, 6 min, 15 min, 30 min, CONT (continuous).
5. Press the [RDR MENU/ESC] key.

Starting echo trail

1. Press the [RDR MENU/ESC] key.
2. Press [0], [2], and select PAGE 1.
3. Select ON from the ECHO TRAIL field.
4. Press the [RDR MENU/ESC] key.

TRAIL, the echo trail time selected and elapsed time appear at the top right-hand corner of the display. Then, afterglow starts extending from all targets. Trails are restarted when range or mode is changed or zoom or shift is turned on.

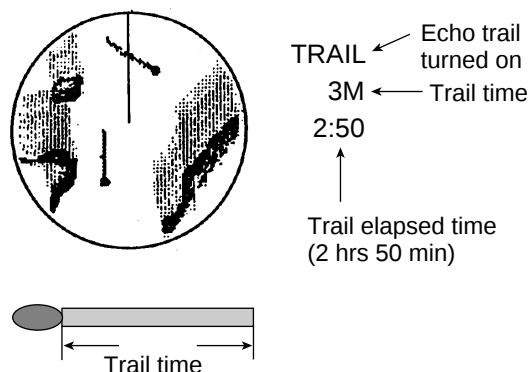


Figure 2-15 How the echo trail feature works

5. To turn off echo trail, select OFF at step 3 in this procedure.

Continuous trail

The maximum continuous trail time is 99 minutes and 59 seconds. When the elapsed time clock counts up to that time the elapsed time display is reset to zero and trail begins again.

Trail gradation

Trails can be shown in single or multiple gradations. Multiple paints trails getting thinner with time just like the afterglow on an analog PPI radar.



Figure 2-16 Single and multiple trail gradations

1. Press the [RDR MENU/ESC] key.
2. Press [0], [2], and select PAGE 1.
3. Select TRAIL TONE.
4. Select SINGLE or MULTI.
5. Press the [RDR MENU/ESC] key.

Trail color

Trail color can be selected for yellow or green as follows:

1. Press the [RDR MENU/ESC] key.
2. Press [0], [2], and select PAGE 1.
3. Select TRAIL COLOR.

4. Select YEL or GRN.
5. Press the [RDR MENU/ESC] key.

2.13 Guard Alarm

The guard alarm allows the operator to set the desired range and bearing for a guard zone. When ships, islands, landmasses, etc. violate the guard zone an audible alarm sounds and the offending target blinks to call the operator's attention.



CAUTION

- The alarm should not be relied upon as the sole means for detecting possible collision situations.
- A/C SEA, A/C RAIN and GAIN controls should be properly adjusted to be sure the alarm system does not overlook target echoes.

Selection of guard zone type, activating the guard zone

The guard alarm can be set to sound when a target enters or exits the guard zone. You can select which type of guard alarm you want through the menu.

Inward alarm

The alarm sounds on targets entering the guard zone. "G (IN)" appears at the top right-hand corner when the Inward alarm is selected.

Outward alarm

The alarm sounds on targets exiting the guard zone. "G (OUT)" appears at the top right-hand corner when the Outward alarm is selected.

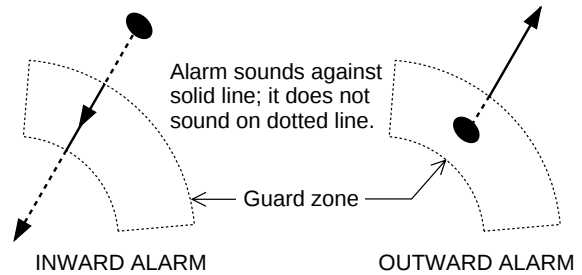


Figure 2-17 How the Inward and Outward alarms work

Setting a guard alarm zone

Transmit and do the following;

1. Press the [RDR MENU/ESC] key.
2. Press [0], [9] to display the ALARM SETTING menu.
3. Select PAGE 4.

ALARM SETTING					
PAGE	1	2	3	4	5*
ALM SENSE LVL	LOW		MID		HIGH
GUARD ZONE	OUT		IN		
GUARD ALARM	ON		OFF		
↓ ↑ ← → : SELECT ENT : ENTER RDR : ESCAPE					

* Requires ARP-10 Board.

Figure 2-18 Alarm Setting menu, page 4

4. Select OUT or IN from the GUARD ZONE field.
5. Select ON from the GUARD ALARM field. the following message appears.

Set Guard Zone area by cursor
RADAR MENU KEY: ESCAPE

6. Referring to Figure 2-19 on the next page, operate the omnipad to set the cursor on point A or B. Press the [ENT] key. "*G (IN)" or "*G (OUT)", with asterisk blinking, appears at the top right-hand corner of the display. The asterisk indicates the guard zone is partially set.

7. Operate the omnipad to set the cursor on point C or D.
8. Press the [ENT] key. The asterisk disappears. "ACK/ON" appears at the "1" position on the radar functions display.
9. Press the [RDR MENU/ESC] key.

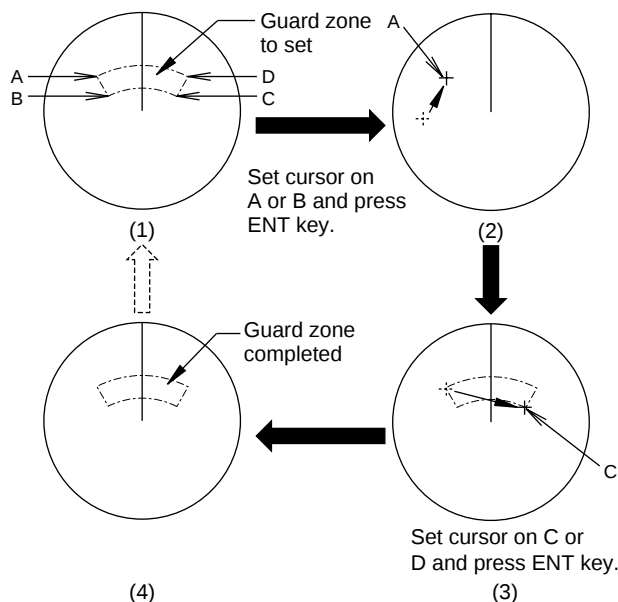


Figure 2-19 How to set the guard zone

When the radar range is less than one half of the guard zone range, the guard zone disappears and "G (IN)" or "G (OUT)" appears in inverse video. If this happens, raise range to re-display the guard zone.

Note 1: To temporarily deactivate the alarm, press the [1] key on the radar functions display. Press the key again to reactivate.

Note 2: To change the guard zone, repeat above procedure.

Note 3: To use last-used guard alarm at next power-on, transmit, press [RDR MENU/ESC], [0], [9], select GUARD ALARM and press the [1] key on the radar functions display to reactivate the alarm.

Silencing the audible alarm

Any radar targets violating the guard zone will trigger the audible alarm and display GUARD ALARM (IN) or GUARD ALARM (OUT). When this occurs, press the [CLR] key once to silence the alarm and again to erase the alarm message.

Setting guard alarm sensitivity

You may select which echo strength triggers the guard alarm as follows:

1. Press the [RDR MENU/ESC] key.
2. Press [0], [9], and select PAGE 4.
3. Select ALM SENSE LEVEL.
4. Select which echo strength triggers the guard alarm; LOW, echo strength 3 or higher; MID, echo strength 4 or higher, HIGH, echo strength 5 or higher.
5. Press the [RDR MENU/ESC] key.

Cancelling the guard zone and alarm

Select Off in step 4 in the procedure for setting the guard alarm.

2.14 Reducing Radar Interference

Radar interference may occur when near another shipborne radar is operating in the same frequency band as your radar. Its on-screen appearance is many bright dots either scattered at random or in the form of dotted lines extending from the center to the edge of the display. Figure 2-20 illustrates interference in the form of curved spokes. Interference effects are distinguishable from normal echoes because they do not appear in the same place on successive rotations of the scanner.

Be sure to turn off the interference rejection circuit when no interference exists – weak targets may be missed.

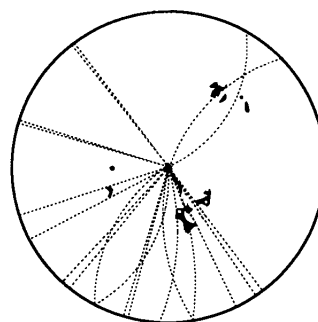


Figure 2-20 Radar interference

1. Press the [RDR MENU/ESC] key.
2. Press [0], [1], and select PAGE 1.
3. Select OFF or ON from the INT. REJECT field.
4. Select level of interference rejection desired from the LEVEL field. 3 is the strongest rejection level.
5. Press the [RDR MENU/ESC] key.

2.15 Shifting the Picture

Your vessel's position can be shifted up to 75% (in the TM mode 75% in the stern direction) of the range in use to view the situation around your vessel without changing the range or size of targets. Note that this feature is inoperative when the zoom function is on.

1. Press the [RDR MENU/ESC] key.
2. Press [0], [1], and select PAGE 1.
3. Select SHIFT from the SHIFT/ZOOM field.
4. You are asked to set cursor where you want own ship position to be shifted. Operate the omnipad to set cursor where desired and press the [ENT] key.
5. Press the [RDR MENU/ESC] key. OFFCENTER appears at the top right corner of the display when the picture is shifted.

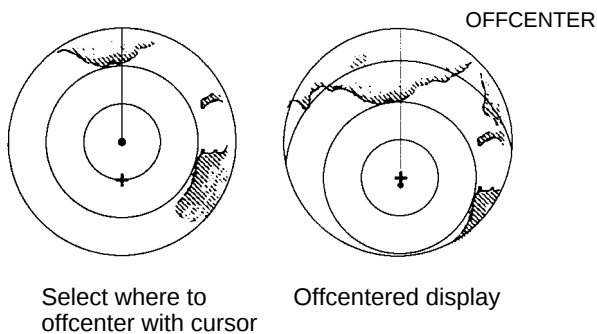


Figure 2-21 Shifting the picture

Cancelling shifted picture

Select Off at step 3 in the above procedure.

2.16 Zoom

The zoom feature allows you to double the size of the area between your vessel and any location within the current range to take a closer look at an area of interest. Note that zoom is inoperative when the display is shifted or the presentation mode is TM.

1. Press the [RDR MENU/ESC] key.
2. Press [0], [1], and select PAGE 1.
3. Select ZOOM from the SHIFT/ZOOM field.
4. You are asked to set cursor where you want to zoom. Operate the omnipad to set cursor where desired and press the [ENT] key.
5. Press the [RDR MENU/ESC] key. ZOOM appears and flashes at the top right corner of the display when the zoom feature is turned on.

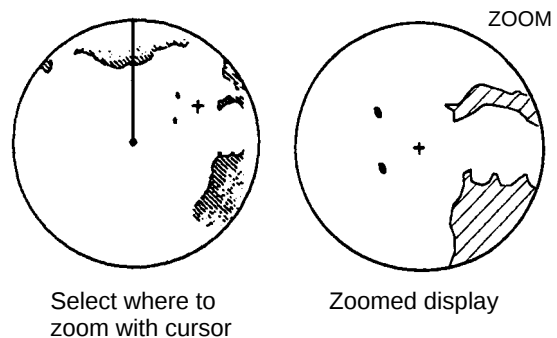


Figure 2-22 Zoom feature

Cancelling zoomed picture

Select Off at step 3 in the previous procedure. Note that zoom is cancelled whenever the range or presentation mode is changed.

2.17 Erasing the Heading Line, North Marker

The heading line or north marker (available with heading sensor connection) may occasionally mask a target. To view the target, you can temporarily erase the heading line and north marker by pressing and holding down the [CLR] key. Release the key to re-display them.

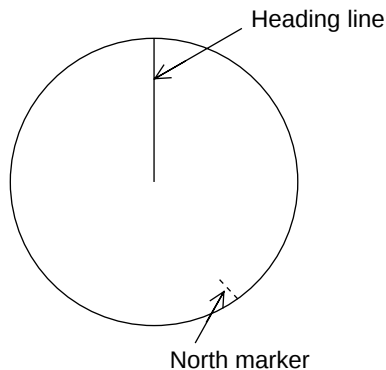


Figure 2-23 Heading line, north marker

2.18 Magnifying Long Range Echoes (echo stretch)

Normally, the reflected echoes from long range targets appear on the display as weaker and smaller blips even though they are compensated by the radar's internal circuitry. The echo stretch function magnifies these small blips in all ranges. Two types of echo stretch are available: ES 1 which stretches echoes in bearing direction and ES 2 which stretches them in both range and bearing directions.

This function magnifies not only targets but also sea clutter and radar interference. For this reason be sure sea clutter and radar interference are properly suppressed before activating the echo stretch.

1. Press the [RDR MENU/ESC] key.
2. Press [0], [1], and select PAGE 1.
3. Select ECHO STRETCH.
4. Select ES 1 or ES 2.

Note: ES 2 is not available on the ranges between 0.125 and 1.0 or the 1.5 mile range.

5. Press the [RDR MENU/ESC] key to finish.

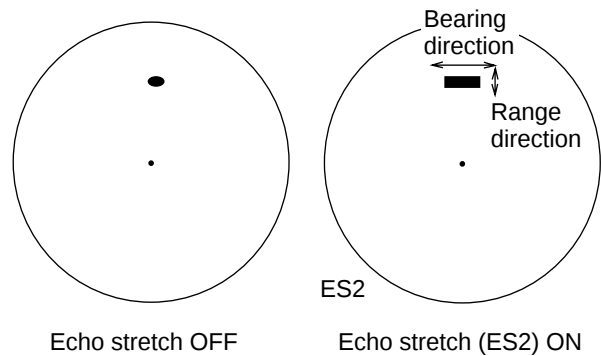


Figure 2-24 Echo stretch

2.19 Watchman

The watchman function periodically transmits the radar for one minute to check for targets in a guard zone. If it finds change in the zone from the previous transmission the audible alarm sounds and the radar transmits continuously. This feature is useful when you do not need the radar's function continuously but want to be alerted to radar targets in a specific area.

How watchman works

When the time selected for the watchman rest period has elapsed, the radar automatically transmits for one minute to check the condition inside the guard zone. If there is no change, the radar goes into stand-by ("WATCHMAN" appears during stand-by.) If there is change, the radar sounds the audible alarm, cancels the watchman function and transmits continuously.

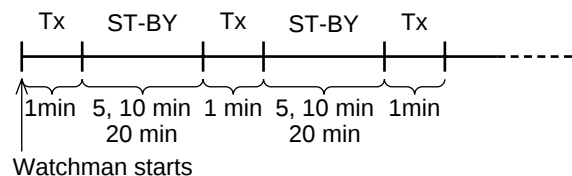


Figure 2-25 How watchman works

Turning on watchman

1. Create a guard zone (usually 360 degrees) with the guard alarm function.
2. Press the [RDR MENU/ESC] key.
3. Press [0], [1].
4. Select PAGE 2.
5. Select ON from the WATCHMAN field.
6. Select INTERVAL.
7. Select watchman rest period; 5 min, 10 min or 20 min. "WATCHMAN" appears at the top of the screen, the radar transmits for one minute to check for targets inside the guard zone, and then the radar goes into stand-by.
8. Press the [RDR MENU/ESC] key.

Note: Watchman can be used without a guard zone, in which case the alarm sounds when the radar starts transmitting.

Cancelling watchman

Select Off in step 5 in the above procedure.

2.20 Pulselength

Pulselength can be selected on the 1.5 nm and 3 nm ranges as follows:

1. Press the [RDR MENU/ESC] key.
2. Press [0], [2], and select PAGE 1.
3. Select PULSELENGTH.
4. Select SHORT or LONG.
5. Press the [RDR MENU/ESC] key.

2.21 Reducing Noise Interference

White noise can be rejected as follows:

1. Press the [RDR MENU/ESC] key.
2. Press [0], [2], and select PAGE 1.
3. Select NOISE REJECT.
4. Select ON. NR appears at the lower left corner.
5. Press the [RDR MENU/ESC] key.

2.22 Radar Echo Color

You may display radar echoes in yellow or white or in colors of red (strongest), yellow (medium) and green (weakest) according to strength.

1. Press the [RDR MENU/ESC] key.
2. Press [0], [2], and select PAGE 1.
3. Select ECHO COLOR.
4. Select YEL, WHITE or COLOR.
5. Press the [RDR MENU/ESC] key.

Note : To view the radar echoes in green or multi-color in the radar/plotter combination mode, the plotter background color should be black (keying sequence: [PLTR MENU/ESC], [0], [1], Select PAGE 1, set BACKGROUND to BLK). Radar echoes may not be displayed in intended color(s) unless the plotter background color is black.

2.23 Enabling/Disabling Control by Sub-Display Unit

Two sub-displays may be connected to the FRS-1000 to control the main radar from remote locations. To prevent (or enable) control of the main radar from a sub-display unit do the following:

1. Press the [RDR MENU/ESC] key.
2. Press [0], [1].
3. Select PAGE 2.
4. Select RADAR LOCK.
5. Select OFF or ON as appropriate.
6. Press the [RDR MENU/ESC] key.

2.24 Selecting Item Colors

1. Press the [RDR MENU/ESC] key.
2. Press [0], [1], and select PAGE 1.
3. Select COLOR.
4. Select 1, 2, 3, 4 or 5 referring to the table below.

Item	1	2	3	4	5
Characters	GRN	WHT	YEL	RED	WHT
Range Rings	BLU	RED	WHT	GRN	GRN
EBL/VRM	RED	GRN	PPL	YEL	RED
Cursor	RED	GRN	PPL	YEL	RED
Heading Line	GRN	YEL	LBLU	GRN	WHT
North Marker	GRN	YEL	LBLU	GRN	WHT
Guard Zone	WHT	GRN	PPL	YEL	RED

5. Press the [RDR MENU/ESC] key.

2.25 Marker, Character Brilliance

1. Press the [RDR MENU/ESC] key.
2. Press [0], [2].
3. Select PAGE 2.
4. Select MARK BRILL, CHARACT. BRILL, or HEADING MARK.
5. Select desired brilliance level; 4 provides the highest brilliance.
6. Press the [RDR MENU/ESC] key.

2.26 EBL Bearing Reference

EBL bearing may be displayed relative to own ship (relative) or with reference to north (True) as follows:

1. Press the [RDR MENU/ESC] key.
2. Press [0], [2].
3. Select PAGE 2.
4. Select EBL REFERENCE.
5. Select REL or TRUE.
6. Press the [RDR MENU/ESC] key.

2.27 Automatic/Manual Tuning

The receiver can be tuned automatically or manually, and the default method is automatic.

Automatic tuning

1. Press the [RDR MENU/ESC] key.
2. Press [0], [2].
3. Select PAGE 2.
4. Select TUNE.
5. Select AUTO or MANUAL.
6. Press the [RDR MENU/ESC] key.

Manual tuning

1. Select manual tuning by following above procedure.
2. While pressing and holding down the [CLR] key, operate the omnipad to display the longest tuning indicator.

2.28 Displaying Dead Sector

When the antenna is installed at a close distance in front of the wheelhouse, the radar should be set to transmit no echoes within that area, to prevent microwave radiation hazard. The area is usually set at installation and may be shown on the display. For further details contact your dealer.

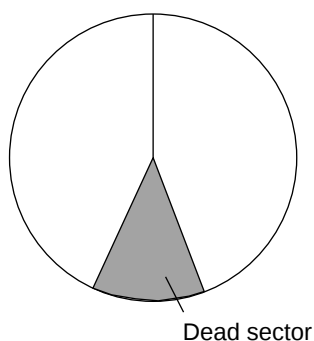


Figure 2-26 Dead sector

1. Press the [RDR MENU/ESC/ESC] key.
2. Press [0], [2].
3. Select PAGE 2.
4. Set DEAD SECTOR to ON.
5. Enter starting and ending points of the dead sector.
6. Press the [RDR MENU/ESC] key.

2.29 Radar Picture Format

The radar picture format is available in two types: Round and Wide. The Wide setting provides a larger viewing area compared to Round.

1. Press the [RDR MENU/ESC] key.
2. Press [0], [1], and select PAGE 2.
3. Select ROUND or WIDE from the RADAR PICT. field.
4. Press the [RDR MENU/ESC] key.

2.30 Units of Measurement

You may select the unit of measurement for range, depth and water temperature as follows:

1. Press the [RDR MENU/ESC] key.
2. Press [0], [0].

UNIT SETTING					
DISTANCE	nm	km	sm		
DEPTH	m	ft	Fa	Hiro*	PB
TEMP	°C	°F			
↓↑ : SEL/ENTER RDR : ESCAPE					

* Hiro (Hiro, Japanese) equals 1.8 meter.

Figure 2-27 Unit Setting menu

3. Select unit of measurement for distance, depth and temperature as required.
4. Press the [RDR MENU/ESC] key.

2.31 False Echoes

Occasionally false echoes appear on the screen at positions where there is no target. In some cases the effects can be reduced or eliminated. The operator should familiarize himself or herself with the appearance and effects of these false echoes, so as not to confuse them with echoes from legitimate contacts.

Indirect echoes

Indirect echoes may be returned from either a passing ship or returned from a reflecting surface on your own ship, for example, a stack. In both cases, the echo will return from a legitimate contact to the antenna by the same indirect path. The echo will appear on the same bearing of the reflected surface, but at the same range as the direct echo. Figure 2-28 illustrates the effect of an indirect echo. Indirect echoes may be recognized as follows:

- they usually occur in a shadow sector
- they appear on the bearing of the obstruction but at the range of the legitimate contact
- when plotted, their movements are usually abnormal, and
- their shapes may indicate they are not direct echoes.

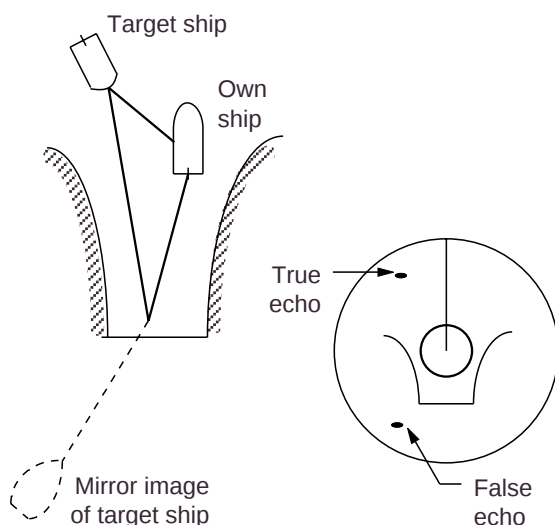


Figure 2-28 Indirect echoes

Multiple echoes

Multiple echoes occur when a short range, strong echo is received from a ship, bridge, or breakwater. A second, a third or more echoes may be observed on the display at double, triple or other multiples of the actual range of the target as shown in Figure 2-29. Multiple reflection echoes can be reduced and often removed by decreasing the sensitivity or properly adjusting the A/C SEA.

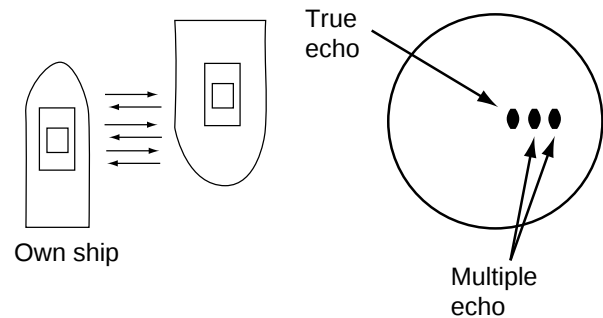


Figure 2-29 Multiple echoes

Side-lobe echoes

Every time the antenna rotates, some radiation escapes on each side of the beam. This radiation is called "side-lobes." If a target exists where it can be detected by the side-lobes as well as the main-lobe, the side-lobe echoes may be represented on both sides of the true echo at the same range, as shown in Figure 2-30. Side-lobes show usually only at short ranges and from strong targets. They can be reduced through careful reduction of the sensitivity or proper adjustment of the A/C SEA.

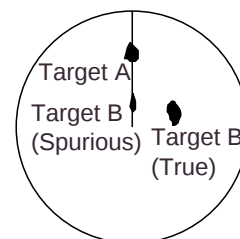


Figure 2-30 Side-lobe echoes

Dead sectors

Funnels, stacks, masts, or derricks in the path of antenna may reduce the intensity of the radar beam. If the angle subtended at the antenna is more than a few degrees a dead sector may be produced. Within the dead sector small targets at close range may not be detected while larger targets at much greater ranges may be detected. See Figure 2-31.

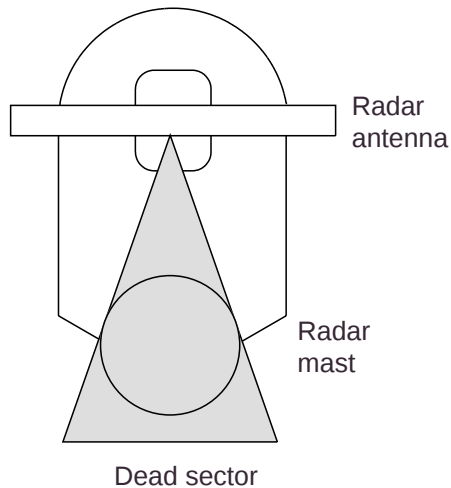


Figure 2-31 Dead sector

2.32 SART (Search and Rescue Transponder)

A Search and Rescue Transponder (SART) may be triggered by any X-Band (3 cm) radar within a range of approximately 8 nm. Each radar pulse received causes it to transmit a response which is swept repetitively across the complete radar frequency band. When interrogated, it first sweeps rapidly ($0.4 \mu\text{s}$) through the band before beginning a relatively slow sweep ($7.5 \mu\text{s}$) through the band back to the starting frequency. This process is repeated for a total of twelve complete cycles. At some point in each sweep, the SART frequency will match that of the interrogating radar and be within the pass band of the radar receiver. If the SART is within range, the frequency match during each of the 12 slow sweeps will produce a response on the radar display, thus a line of 12 dots equally spaced by about 0.64 nautical miles will be shown.

When the range to the SART is reduced to about 1 nm, the radar display may show also the 12 responses generated during the fast sweeps. These additional dot responses, which also are equally spaced by 0.64 nm, will be interspersed with the original line of 12 dots. They will appear slightly weaker and smaller than the original dots.

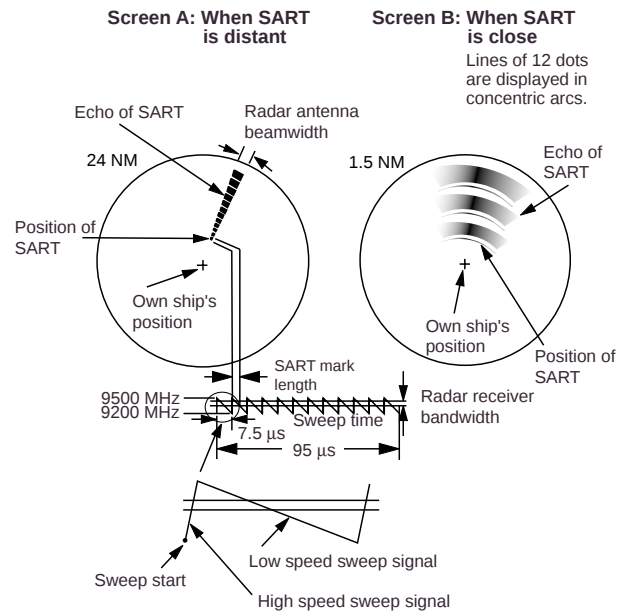


Figure 2-32 Appearance of SART signal on the radar display

Showing SART marks on the radar display

To show the SART marks only on the radar display, detune the radar receiver by manually turning the receiver out of best tuning condition. This erases or weakens all normal radar echoes, but the SART marks are not erased because the SART response signal scans over all frequencies in the 9 GHz band. When the radar approaches the SART in operation, the SART marks will enlarge to large arcs, blurring a large part of the screen. Reduce the sensitivity and adjust the A/C SEA of the radar.

Summary to detect SART response

1. Use range scale of 6 or 12 nm as the spacing between the SART responses is about 0.6 nm (1125 m) to distinguish the SART.
2. Turn off the automatic clutter suppression.
3. Turn off the interference rejector.

General remarks on receiving SART

SART range errors

When responses from only the 12 low frequency sweeps are visible (when the SART is at a range greater than about 1 nm), the position at which the first dot is displayed may be as much as 0.64 nm beyond the true position of the SART. When the range closes so that the fast sweep responses are seen also, the first of these will be no more than 150 meters beyond the true position.

Radar bandwidth

This is normally matched to the radar pulselength and is usually switched with the range scale and the associated pulselength. Narrow bandwidths of 3-5 MHz are used with long pulses on long range and wide bandwidths of 10-25 MHz with short pulses on short ranges.

Any radar bandwidth of less than 5 MHz will attenuate the SART signal slightly, so it is preferable to use a medium bandwidth to ensure optimum detection of the SART.

Radar side lobes

As the SART is approached, side lobes from the radar scanner may show the SART responses as a series of arcs or concentric rings. These can be removed by the use of the A/C SEA although it may be operationally useful to observe the side lobes as they may be easier to detect in clutter conditions and also they will confirm that the SART is near to the ship.

Gain

For maximum range SART detection the normal gain setting for long range detection should be used, that is, with background noise speckle visible.

A/C SEA control

For optimum range SART detection, this control should be set to the minimum. Care should be exercised as wanted target in sea clutter may be obscured. Note also that in clutter conditions the first few dots of the SART response may not be detectable, irrespective of the setting of the anti-clutter sea control. In this case, the position of the SART may be estimated by measuring 9.5 nautical miles from the furthest dot back towards own ship.

Some sets have automatic/manual anti-clutter sea control facilities in which case the operator should switch to manual.

A/C RAIN control

This should be used normally (to break up areas of rain) when trying to detect a SART response which, being a series of dots, is not affected by the action of the anti-clutter rain circuitry. Note that Racon responses, which are often in the form of a long flash, will be affected by the use of this control.

Some sets have automatic/manual anti-clutter rain control facilities in which case the operator should switch to manual.

Note: This SART information is excerpted from IMO SN/Circ 197 Operation of Marine Radar for SART Detection.

2.33 Racon (Radar Beacon)

A racon is a radar transponder which emits a characteristic signal when triggered by a ship's radar (usually only the 3 centimeter band). The signal may be emitted on the same frequency as that of the triggering radar, in which case it is superimposed on the ship's radar display automatically.

The racon signal appears on the PPI as a radial line originating at a point just beyond the position of the radar beacon or as a Morse code signal (figure below) displayed radially from just beyond the beacon.

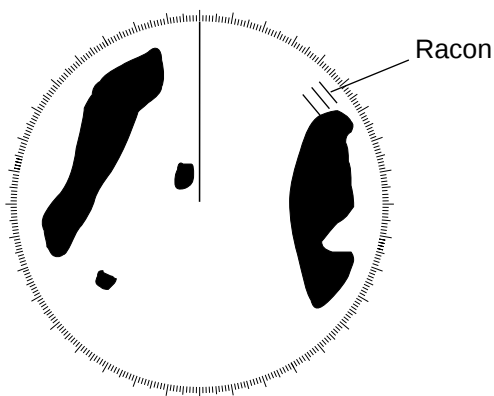


Figure 2-33 Appearance of Racon signal on the radar display

This chapter covers operation of the plotter section. Instruction begins with basic plotter operation and proceeds to advanced functions such as route planning.

3.1 Changing Display Range

Shrink or expand the display range as follows to easily view the display.

1. Press the [PLTR MENU/ESC] key. The plotter functions display replaces the nav data display.

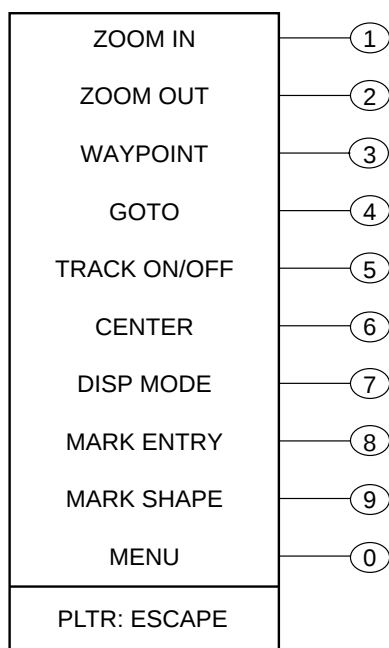


Figure 3-1 Plotter functions display

2. Press the [1] key to expand the display range; the [2] key to shrink it. Selected horizontal range (or scale) appears at the screen center.
3. Press the [PLTR MENU/ESC] key to finish.

Note: When the display is expanded or shrunk beyond the range of the coastline data card in use the message NO CHART appears. Note also that it may take several seconds to refresh the screen after the display range is changed.

3.2 Presentation Mode

Three presentations are provided for the plotter display: north-up (relative or true motion), heading-up and course-up.

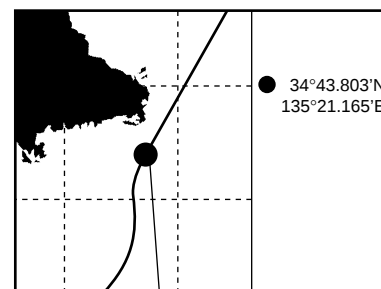
North-up, True motion

North (zero degrees) is at the top of the display and own ship is at the center of the screen. This mode is useful for long-range navigation.

Own ship marker moves on the screen with ship's actual movement, and is shown as a filled circle. Land is stationary.

North-up, Relative motion

Own ship marker is fixed at the screen center and is shown as a filled circle. Land is shown as moving.



Own ship position

Figure 3-2 North-up display

Head-up

The heading line is at zero degrees. Own ship marker is a filled triangle. Note that the cursor does not appear when head-up is selected on the radar/plotter combination display.

Course-up

Destination is at the top of the screen when destination is set. The north marker (⬆) appears at the bottom right side of the screen and points to North. Own ship marker is a filled triangle.

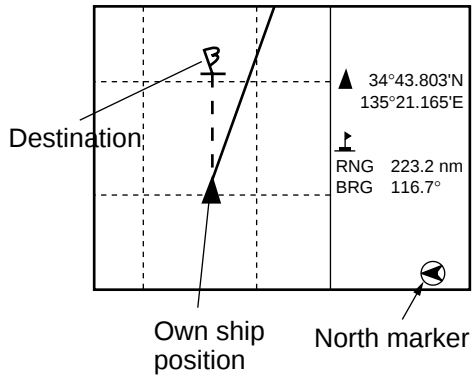


Figure 3-3 Course-up display

To select presentation mode:

1. Press the [PLTR MENU/ESC] key.
2. Press the [7] key to select mode desired. The presentation mode and the presentation mode icon at the bottom right corner of the screen change in the sequence of HU, CU, NU and TM.
3. Press the [PLTR MENU/ESC] key.

3.3 Shifting the Cursor, Finding Cursor Position

The cursor can be shifted as follows when the mode is north-up, TM.

1. Press the [+/-] key to turn on the cursor.
2. Operate the omnipad to shift the cursor.

The display shifts in the direction the omnipad is operated. When the cursor is at an edge of the screen, it will be shifted in the opposite direction.

Cursor position data

Cursor position in latitude and longitude is displayed on the nav data display.

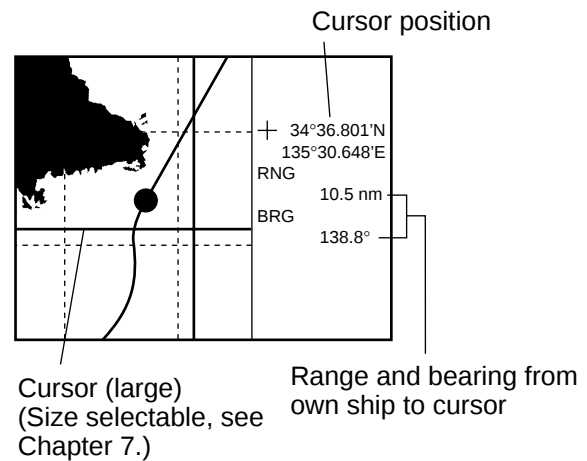


Figure 3-4 Location of cursor position display

When the cursor is turned off, ship's navigation data is displayed instead of cursor position.

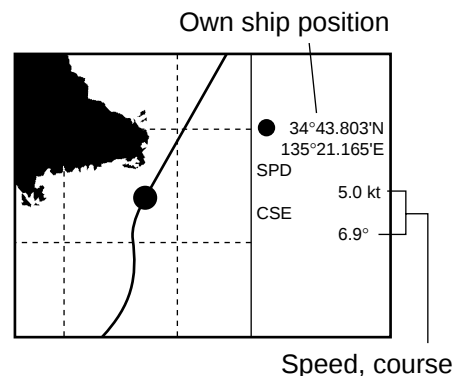


Figure 3-5 Ship's navigation data

3.4 Selecting Screen Center by Cursor

The screen center can be changed as follows when in the north-up, TM mode.

1. Press the [+/-] key to turn on the cursor.
2. Use the omnipad to place the cursor at the location desired for screen center.
3. Press the [PLTR MENU/ESC] key.
4. Press the [6] key (CENTER).
5. Press the [PLTR MENU/ESC] key.

3.5 Shifting the Display

The cursor can be shifted when the mode is north-up, TM.

1. Press the [+/-] key to turn off the cursor.
2. Operate the omnipad. The display shifts in the direction the omnipad is operated.

3.6 Centering Position

Own ship's position can be centered when in the north-up, TM mode:

1. Press the [+/-] key to turn off the cursor.
2. Press the [PLTR MENU/ESC] key.
3. Press the [6] key (CENTER).
4. Press the [PLTR MENU/ESC] key.

Note that when own ship nears and edge of the screen it is automatically returned to the display center.

3.7 Stopping, Resuming Plotting of Track

When your boat is at anchor or returning to port you probably won't need to record its track. You can stop recording the track, to conserve the track memory, as follows:

1. Press the [PLTR MENU/ESC] key.
2. Press the [5] key (Track On/Off). The message "Track Plot Off" appears, own ship mark becomes a hollow circle (hollow triangle in case of head-up and course-up modes), and "H" appears at the lower right-corner of the display.

3. Press the [PLTR MENU/ESC] key.

To resume plotting of the track, repeat the above procedure. Then, the message "Track Plot On" appears, own ship mark becomes a solid circle (triangle), and "H" disappears.

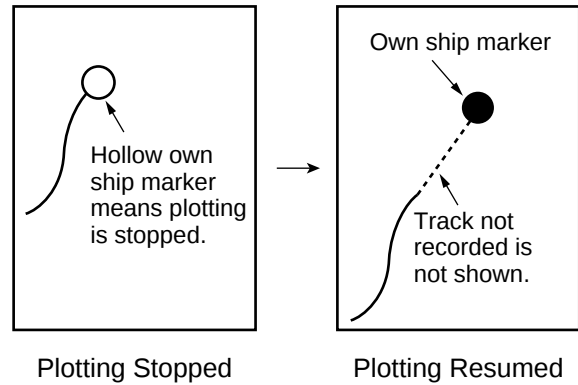


Figure 3-6 Own ship mark appearance when plotting is stopped/resumed

3.8 Selecting Track Color

Track can be displayed in red, yellow, green, light-blue, purple, blue or white. It can be useful to change track color on a regular basis to discriminate between previous day's track, etc.

1. Press the [PLTR MENU/ESC] key.
2. Press the [0] key.

PLOTTER MENU	
1. DISPLAY SETTING	
2. TRACK SETTING	
3. ERASE TRACK/MARK	
4. ROUTE/ROUTE LIST	
5. MEMORY CARD	
6. DIAGNOSTIC	
7. SYSTEM SETTING	
8. CHART OFFSET	
9. ALARM SETTING	
0. UNIT SETTING	
↓ ↑ : SELECT ENT : ENTER PLTR : ESCAPE	

Figure 3-7 Plotter menu

3. Press the [2] key to display the TRACK SETTING menu.

TRACK SETTING			
PLOT INTERVL	AUTO	TIME	DIST.
		00m10s	
		00.10nm	
TRACK COLOR	☐ 1	☐ 2	☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
↓↑←→ : SELECT ENT : ENTER PLTR : ESCAPE			

1 - RED, 2 - YELLOW, 3 - GREEN, 4 - LIGHT-BLUE,
5 - PURPLE, 6 - BLUE, 7 - WHITE

Figure 3-8 TRACK Setting menu

4. Select TRACK COLOR.
5. Select color desired with the omnipad.
6. Press the [PLTR MENU/ESC] key to close the menu. The track color is changed the moment the [PLTR MENU/ESC] key is pressed.

3.9 Erasing Track

Track may be erased collectively or within a specific area. If you require track data save it to a memory card before erasing it; track cannot be restored once it is erased. (See Chapter 5 for how to save track.)

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [3] to display the ERASE TRACK/MARK menu.

ERASE TRACK/MARK			
ERASE	TRACK	MARK	TRACK+MARK
RANGE	AREA	☐ OFF	☐ ALL
TRACK USED 200/2800 pt MARK USED 300/3800 pt			
↓↑←→ : SEL/ENTER PLTR : ESCAPE			

Figure 3-9 Erase Track/Mark menu

3. Select TRACK from the ERASE field.
4. Select erasure method (AREA or ALL) from the RANGE field.
5. If you selected ALL in step 4, press the [ENT] key and go to step 10. (To cancel erasure, press any key.)
6. For AREA erasure, designate the starting point of the erasure range with the cursor.

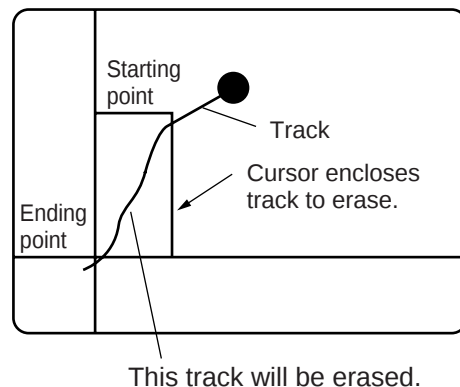


Figure 3-10 Selecting area where to erase track

7. Press the [ENT] key.
8. Designate the ending point of the erasure range with the cursor.
9. Press the [ENT] key.
10. Press the [PLTR MENU/ESC] key.

3.10 Selecting Track Plotting Interval

In drawing the track, first the ship's position (fed from the GPS receiver) is stored in the FRS-1000's memory at an interval of time or distance. The default setting is 10 minutes, and track is stored for 7.7 hours at this setting. The advantage of plotting track by distance is that it is only plotted when the ship is moving, thus no track is saved to the memory when the your boat is dead in water.

A shorter interval provides better reconstruction of the track, but the storage time of the track is reduced. When the track memory becomes full, the oldest track is erased to make room for the latest.

To select track plotting interval do the following:

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [2] to display the TRACK SETTING menu.
3. Select PLOT INTERVL.
4. Select AUTO, TIME or DIST. (AUTO records track according to REC RESOLUTION setting. For further details, see Paragraph 7.9 Recording Resolution.)
5. For TIME or DIST, key in interval desired with the numeric keys.
6. Press the [ENT] key.
7. Press the [PLTR MENU/ESC] key to close the menu.

3.11 Chart Cards

The chart cards contain nautical charts. When you insert a suitable chart card in the drive and your boat is near land, a chart appears with the land portion arranged according to the "land settings" in page 1 of the Plotter Display Setting menu.

When a wrong card is inserted or a wrong chart scale is selected, the land will be hollow. Insert the proper card and select a suitable chart scale. Chart icons appear to help you select suitable chart scale, and they and their meanings appear in Figure 3-11.



Chart properly displayed.

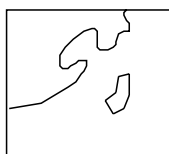


Chart overenlarged.

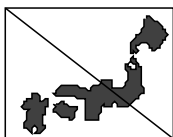


Chart overenlarged or wrong chart.

Figure 3-11 Chart icons

Indices and chart enlargement

When the chart is expanded you will see several frames on the display. These frames are called indices and they show you what parts of the chart can be enlarged in the current picture range. The areas circumscribed with smaller frames can be enlarged, but the area enclosed by the largest frame cannot.

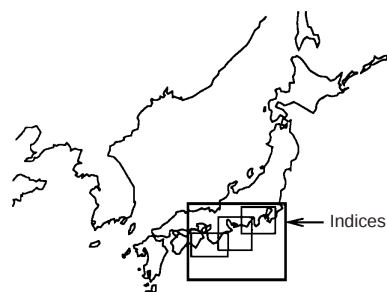


Figure 3-12 Sample chart (Japan and South Korea) showing indices

Remarks on chart display

A chart will not be displayed in the following conditions:

- When the chart scale is too large or too small.
- When scrolling the chart outside the indices.

When this happens, the message NO CHART appears for a couple of seconds. The appropriate chart icon also appears.

FURUNO chart symbols

The table below shows FURUNO charts symbols and their meanings.

Table 3-1 FURUNO chart symbols

Symbol	Description	Symbol	Description
	Summit		Position of Sounding
	Wreck		Obstruction
	Lighthouse		Fishing Reef
	Lighted		Platform
	Buoy		Anchorage
	Radio		

Lighthouse and buoy data display on NAVIONICS charts

You can find data of lighthouses and buoys by placing the cursor on them. Lighthouse and buoy data are displayed as shown in Figure 3-13.

1. Insert a NAVIONICS chart card in the card slot. Buoys and lighthouses are shown on the chart as in the figure below.

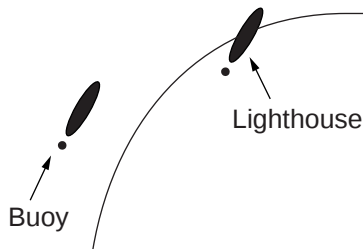


Figure 3-13 Appearance of lighthouse and buoys on NAVIONICS charts

2. Place the cursor on a buoy or lighthouse mark to display data about that mark.

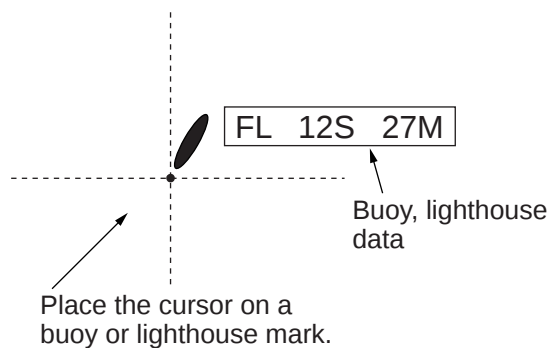


Figure 3-14 Lighthouse, buoy data

How to interpret lighthouse, buoy data

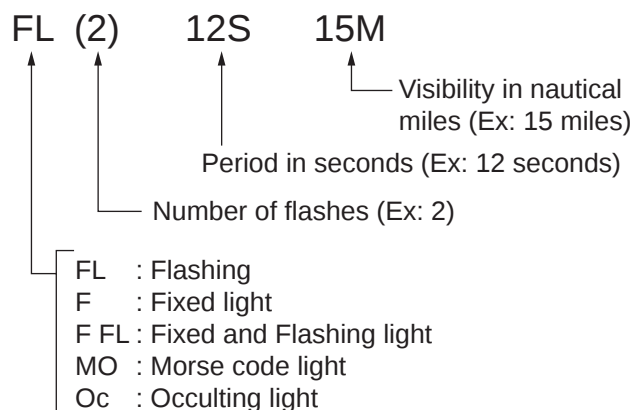


Figure 3-15 Interpreting lighthouse, buoy data

3.12 Entering, Erasing Marks

You can inscribe marks on the plotter display to denote important locations; for example, buoy, fishing point, wreck, etc. Further, marks can be connected with lines to depict an area such as a hot fishing spot.

The display can show 3,800 marks. When the mark memory is full the oldest mark is deleted to make room for the latest.

Entering a mark at ship's position

1. Press the [+/-] key to turn off the cursor.
2. Press the [PLTR MENU/ESC] key.
3. Press the [8] (MARK ENTRY) key. The mark currently selected on the Track/Mark Setting menu appears at own ship's position.
4. Press the [PLTR MENU/ESC] key.

Entering a mark at cursor intersection

1. Press the [+/-] key to turn on the cursor.
2. Operate the omnipad to place the cursor where you want to inscribe a mark.
3. Press the [PLTR MENU/ESC] key.
4. Press the [8] key.
5. Press the [PLTR MENU/ESC] key.

Erasing individual marks

1. Press the [+/-] key to turn on the cursor.
2. Operate the omnipad to place the cursor on the mark you want to erase.
3. Press the [CLR] key.

Erasing all marks, marks within a specific area

You may erase all unnecessary marks or those within a specific area.

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [3] to display the ERASE TRACK/MARK menu.

3. Select MARK from the ERASE field.
4. Select erasure method from the RANGE field; AREA or ALL.
5. If you selected ALL in step 4, press the [ENT] key and then go to step 10. For erasure by AREA go to step 6.
6. Designate the starting point of the erasure range with the cursor.
7. Press the [ENT] key.
8. Designate the ending point of the erasure range with the cursor.
9. Press the [ENT] key.
10. Press the [PLTR MENU/ESC] key.

3.13 Changing Mark Attributes

Marks are available in seven shapes. You may select mark shape as follows:

1. Press the [PLTR MENU/ESC] key.
2. Press the [9] key (MARK SHAPE).

MARK SHAPE/COLOR							
MARK SHAPE	○	□	◇	×	⬆	⬇	●
LINE TYPE	■	—	---	----			
MARK COLOR	1	2	3	4	5	6	7
EVENT MARK	△	▽	◎	☆			
↓↑ : SELECT ENT : ENTER PLTR : ESCAPE							

Figure 3-16 Mark/Shape Color menu

3. Select MARK SHAPE.
4. Select shape desired.
5. Press the [PLTR MENU/ESC] key twice to close the menu.

Connecting marks with lines

Marks can be connected with lines. This is useful for denoting an important area such as a good fishing spot. To connect marks do the following:

1. Press the [PLTR MENU/ESC] key.
2. Press the [9] key.
3. Select LINE TYPE.
4. Select any line type except single "dot."
5. Press the [PLTR MENU/ESC] key twice to close the menu.

To again enter individual marks, select "dot" in step 4 in the above procedure.

Changing mark size

You may change the size of all marks to large or small as follows:

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [1] to show the DISPLAY SETTING menu, and display PAGE 1.

DISPLAY SETTING												
PAGE	1 2											
LAND BRILL	BRIGHT DIM											
LAND COLOR	1	2	3	4	5	6	7	OFF				
PLACE NAME	1	2	3	4	5	6	7	OFF				
GRID COLOR	1	2	3	4	5	6	7	OFF				
COURSE BAR	1	2	3	4	5	6	7	OFF				
BACKGROUND	1	2	3	4	5	6	7	BLK				
MOB	ON OFF											
WPT MARK SIZE	LARGE SMALL											
MARK SIZE	LARGE SMALL											
↓↑←→ : SEL/ENTER PLTR : ESCAPE												

Figure 3-17 Display Setting menu, page 1

3. Select MARK SIZE.
4. Select LARGE or SMALL.
5. Press the [PLTR MENU/ESC] key. The size of all marks change according to the mark size selected.

Changing mark color

Marks can be displayed in red, yellow, green, light-blue, purple, blue or white.

1. Press the [PLTR MENU/ESC] key.
2. Press the [9] key.
3. Select MARK COLOR.
4. Select color desired.
5. Press the [PLTR MENU/ESC] key twice to close the menu.

3.14 Entering Event Marks

The event mark denotes a point of interest at own ship's position. 99 event marks may be entered, beginning with event mark 01. When the event mark memory is full the oldest event mark is deleted to make room for the latest.

To enter an event mark press the [MOB] key. The currently selected event mark is inscribed at own ship's position and that position is shown.

SAVED EVENT POSITION.
34°43. 803N
135°23. 271E

3.15 Changing Event Mark Shape

Four types of event marks are available and you may select one as follows:

1. Press the [PLTR MENU/ESC] key.
2. Press the [9] key (MARK SHAPE).
3. Select EVENT MARK.
4. Select shape desired.
5. Press the [PLTR MENU/ESC] key.

3.16 Entering the MOB Mark

The MOB mark functions to mark man overboard position. When it is selected as destination, the range and bearing to the MOB position are continuously updated on the display, to help you navigate to the MOB position.

Enabling entry of the MOB mark

The [MOB] key inscribes either an event mark (default setting) or the MOB mark when pressed. To inscribe a MOB mark do the following:

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [1], and then select PAGE 1.
3. Select ON from the MOB field.
4. Press the [PLTR MENU/ESC] key to close the menu.

Note: MOB data remains on the screen even if the MOB mark is erased. To erase MOB data select Off at step 3 of the above procedure.

Entering the MOB mark

Press the [MOB] key for at least five seconds. MOB position is marked with an "M" and the following display appears:

Set MOB as destination?
Are you sure to navigate to the MOB?
ENT: YES ANY KEY: NO

2. Press the [ENT] key to set MOB position as destination, or any key to escape.

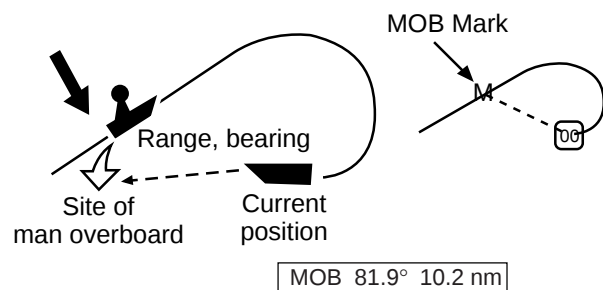


Figure 3-18 MOB concept,
MOB data display

3.17 Entering, Erasing Waypoints

In navigation terminology, a waypoint is a particular location on a voyage whether it be a starting, intermediate or destination point. A waypoint is the simplest piece of information the FRS-1000 requires to get you to a destination, in the shortest distance possible.

This unit has 198 waypoints into which you can enter position information. There are four methods by which you can enter a waypoint: by own ship's position, through the waypoint list (manual input of latitude and longitude), by event position or MOB position, and by the cursor.

Entering waypoint at own ship's position

1. Press the [PLTR MENU/ESC] key.
2. Press the [3] key (WAYPOINT).

WAYPOINT	
CURSOR	001
L/L POSITION	001
OS POSITION	001
WPT LIST	001
↓↑ : SELECT ENT : ENTER PLTR : ESCAPE	
← → : SELECT WAYPOINT NUMBER	

Figure 3-19 Waypoint menu

3. Select OS POSITION. The number shown to the right of OS POSITION is the youngest empty waypoint. If you want to register the waypoint under that number go to step 5.
4. Select waypoint number by pressing the right or left side of the omnipad.
5. Press the [ENT] key. (If you selected a waypoint number which already exists, is currently set as destination or is part of a route you are asked if it is all right to write over the waypoint. In this case you may overwrite the waypoint by pressing the [ENT] key, or press any key to escape.)

The screen for entering waypoint comment appears. You may enter a comment of up to 15 characters in length.

X	XXXX	XXXXX	XXXXX	XXXXX	XXXXX
XXXXX	XXXXX	XXX()	XXXXX	XXX*	
ABCDE	FGHIJ	KLMNO	PQRST	UVWXY	
Z,-!?	/&=#	12345	67890		
abcde	fghij	klmno	pqrst	uvwxy	
z	XXXXX	XXXXX		end	

Figure 3-20 Screen for selecting characters for comment

6. Select character with the omnipad and press the [ENT] key. Repeat to complete comment. Select "end" and press the [ENT] key. (If you do not require a comment, simply select "end" and press the [ENT] key.)
7. Press the [PLTR MENU/ESC] key twice to finish.

Entering waypoints by the cursor

1. Press the [PLTR MENU/ESC] key.
2. Press the [3] key.
3. Select CURSOR. The number shown to the right of CURSOR is the youngest empty waypoint. If you want to register the waypoint under that number go to step 5.
4. Select waypoint number by pressing the right or left side of the omnipad.
5. Press the [ENT] key. (If you selected a waypoint number which already exists, is currently set as destination or is part of a route you are asked if it is all right to write over the waypoint. In this case you may overwrite the waypoint by pressing the [ENT] key, or press any key to escape.)
6. Place the cursor on the location for the waypoint.
7. Press the [ENT] key.
8. Enter comment as in "Entering waypoints at own ship's position."
9. Press the [PLTR MENU/ESC] key.

Entering waypoints by latitude and longitude

1. Press the [PLTR MENU/ESC] key.
2. Press the [3] key.
3. Select WPT LIST.
4. Press the [ENT] key.

WAYPOINT LIST			
001	°	'N	° 'E ON
002	°	'N	° 'E ON
003	°	'N	° 'E ON
004	°	'N	° 'E ON
005	°	'N	° 'E ON
006	°	'N	° 'E ON
007	°	'N	° 'E ON
008	°	'N	° 'E ON
009	°	'N	° 'E ON
010	°	'N	° 'E ON
↓↑ : SELECT ENT : ENTER PLTR : ESCAPE			
←→ : CURSOR +/- : N/S, E/W			

Figure 3-21 Waypoint list

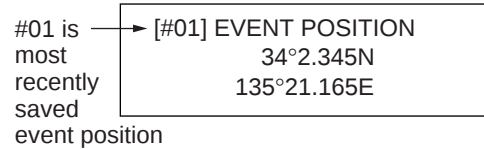
5. Select vacant waypoint number with the omnipad. To scroll the list, use the omnipad.
6. Enter latitude and longitude. (To switch latitude or longitude polarity, use the [+/-] key, before entering latitude or longitude data.)
7. If you do not want show the waypoint press the [+/-] key to change ON to OFF.
8. To enter a comment, place the cursor in the comments column. Select character with the omnipad and press the [ENT] key. Repeat to complete comment. Select "end" and press the [ENT] key to finish.
9. Press the [PLTR MENU/ESC] key to close the menu.

Entering waypoints by event position, MOB position

1. Press the [PLTR MENU/ESC] key.
2. Press the [3] key.
3. Select L/L POSITION. The number shown to the right of L/L Position is the youngest empty waypoint. If you want to register

the waypoint under that number go to step 5.

4. Select waypoint number by pressing the right or left side of the omnipad.
5. Press the [ENT] key. The following display appears.



6. Operate the omnipad to select position to register as waypoint.
7. Press the [ENT] key.
8. Enter comments: select character with cursor and press the [ENT] key. Repeat to complete comment. Select "end" to finish and press the [ENT] key.
9. Press the [PLTR MENU/ESC] key.

Erasing waypoints

Erasing waypoints by the cursor

1. Press the [+/-] to turn on the cursor.
2. Place the cursor on the waypoint which you want to erase.
3. Press the [CLR] key.

Erasing waypoints by the waypoint list

1. Press the [MENU] key.
2. Press the [3] key.
3. Select WPT LIST.
4. Press the [ENT] key.
5. Use the omnipad to select waypoint to erase.
6. Press the [CLR] key. (If you selected a waypoint which is selected as destination, or is part of a route you are asked if it is all right to erase the waypoint. Press the [CLR] key to erase, or any key to escape.)
7. Press the [ENT] key.
8. Press the [PLTR MENU/ESC] key to close the menu.

3.18 Changing Waypoint Position

You may change the latitude and longitude position, as well as comments you have entered, through the waypoint list.

1. Press the [PLTR MENU/ESC] key.
2. Press the [3] key to select WAYPOINT.
3. Select WPT LIST.
4. Press the [ENT] key.
5. Select waypoint which you want to change.
6. Change data as necessary.
7. Press the [ENT] key to register data. (You are asked whether it is all right to edit the waypoint. Press the [ENT] key to register, or any key to escape.)
8. Press the [ENT] key again.
9. Press the [PLTR MENU/ESC] key to close the menu.

3.19 Entering, Erasing Routes

Often a trip from one place to another involves several course changes, requiring a series of route points (waypoints) which you navigate to, one after another. The sequence of waypoints leading to the ultimate destination is called a route. The FRS-1000 can automatically advance to the next waypoint on a route, so you do not have to change the destination waypoint repeatedly.

You can store up to 20 routes. A route may consist of 30 points.

A route is constructed using waypoints, therefore enter waypoints beforehand.

Entering routes

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [4] to display the ROUTE/ROUTE LIST.

ROUTE/ROUTE LIST			
NO.	WPT	TOTAL DIST.	TTG (H : M)
1	0	0.00 nm	0 : 00
2	0	0.00 nm	0 : 00
3	0	0.00 nm	0 : 00
4	0	0.00 nm	0 : 00
5	0	0.00 nm	0 : 00
6	0	0.00 nm	0 : 00
7	0	0.00 nm	0 : 00
8	0	0.00 nm	0 : 00
9	0	0.00 nm	0 : 00
↓↑ : SELECT ENT: ENTER PLTR : ESCAPE			

Figure 3-22 Route/Route List

3. Select route number.
4. Press the [ENT] key.

ROUTE/ROUTE LIST				ROUTE: 01	
WPT	LAT.	LONG.	LEG	TIME	
01	__°__'N	__°__'E	__ nm	__ :	
02	__°__'N	__°__'E	__ nm	__ :	
03	__°__'N	__°__'E	__ nm	__ :	
04	__°__'N	__°__'E	__ nm	__ :	
05	__°__'N	__°__'E	__ nm	__ :	
06	__°__'N	__°__'E	__ nm	__ :	
07	__°__'N	__°__'E	__ nm	__ :	
08	__°__'N	__°__'E	__ nm	__ :	
09	__°__'N	__°__'E	__ nm	__ :	
↓↑ : SELECT PLTR : ESCAPE					
+/- : ADD/SKIP					

Figure 3-23 Route input screen, page 1

5. Key in waypoint number in three digits. (If you enter a waypoint which has not been registered an error message appears.)
6. Press the [ENT] key. The position registered under the waypoint number entered appears.
7. Repeat steps 5 and 6 to complete the route.
8. Scroll the screen upward or downward to show waypoints 28-30.

ROUTE/ROUTE LIST				ROUTE: 01	
WPT	LAT.	LONG.	LEG	TIME	
28	° 'N	° 'E		nm	:
29	° 'N	° 'E		nm	:
30	° 'N	° 'E		nm	:
SPEED FOR ETA 10.0 KT					
↓↑ : SELECT PLTR : ESCAPE +/- : ADD/SKIP					

Figure 3-24 Route input screen, page 4

9. Select SPEED FOR ETA.
10. Key in ship's speed.
11. Press the [ENT] key.
12. Press the [PLTR MENU/ESC] key.

Erasing a route

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [4].
3. Select route number.
4. Press the [CLR] key.
5. Press the [ENT] key to erase the route, or any key to escape.
6. Press the [PLTR MENU/ESC] key.

3.20 Editing Routes

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [4].
3. Select route number.
4. Press the [ENT] key.
5. Select waypoint to edit.
6. Key in new waypoint number in three digits.
7. Press the [ENT] key. Press the [ENT] key again.
8. Press the [PLTR MENU/ESC] key to close the menu.

3.21 Setting, Canceling Destination

The FRS-1000 offers four methods by which you can set destination: by waypoint, by cursor position, by L/L position (event position/ MOB position), and route.

Setting destination by waypoint

1. Press the [PLTR MENU/ESC] key.
2. Press the [4] key (GOTO).

GOTO	
CURSOR	
L/L POSITION	
WAYPOINT	_____
ROUTE	_____ (FORWARD)
CANCEL	
↓↑ : SELECT ENT : ENTER PLTR : ESCAPE +/- : FORWARD/REVERSE	

Figure 3-25 Setting destination by waypoint

3. Select WAYPOINT.
4. Key in waypoint number in three digits with the numeric keys.
5. Press the [ENT] key.
6. Press the [PLTR MENU/ESC] key.

A dashed line (color depends on background color) runs between destination selected and own ship's position (marked as 00). Range and bearing from own ship to the destination appear on the screen.

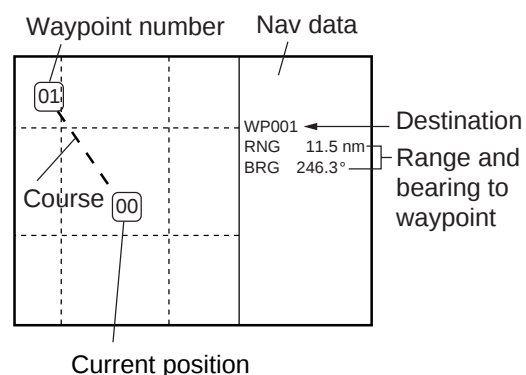


Figure 3-26 Appearance of display when destination is selected by waypoint

Setting destination by cursor

Single destination

1. Press the [PLTR MENU/ESC] key.
2. Press the [4] key.
3. Select CURSOR.
4. Press the [ENT] key.
5. Set cursor on location to set as destination.
6. Press the [ENT] key.
7. Press the [PLTR MENU/ESC] key.

Own ship's position is marked as "00." A dashed line (color depends on background color) connects own ship with destination and intermediate waypoints (marked with a flag). Range and bearing from own ship to the destination appear on the screen.

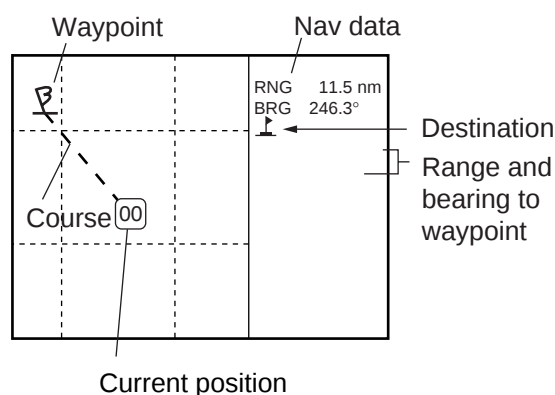


Figure 3-27 Destination selected by cursor

Multiple destinations

1. Press the [PLTR MENU/ESC] key.
2. Press the [4] key.
3. Select CURSOR.
4. Press the [ENT] key.
5. Set cursor on location.
6. Press the [+/-] key. A black square appears at the cursor position.
7. Repeat steps 5 and 6 to enter other destinations.
8. Press the [ENT] key. The route number entry screen appears.

Enter route number
Route No. 01
ENT: Entry

Figure 3-28 Route number entry screen

9. Key in new route number or retain the one shown.
10. Press the [ENT] key. (If you enter a route number which is already registered you are asked if it is OK to write over the route. Press the [ENT] key to write over the number, or press any key to escape.)
11. Press the [PLTR MENU/ESC] key.

Own ship's position is marked as "00." A dashed line (color depends on background color) connects own ship with destination and intermediate waypoints (marked with a flag). Range and bearing from own ship to the destination appear on the screen.

Setting destination by event position, MOB position

1. Press the [PLTR MENU/ESC] key.
2. Press the [4] key.
3. Select L/L POSITION.
4. Press the [ENT] key.

#01 is most recently saved event position	[#01] EVENT POSITION 34°2.345N 135°21.165E
---	--

Figure 3-29 Screen for selection of event position, MOB position

5. Press right or left side of omnipad to select event position.
6. Press the [ENT] key.

Own ship's position is marked as "00." A dashed line (color depends on background color) connects own ship with destination (marked with a flag). Range and bearing from own ship to the destination appear on the screen.

7. Press the [PLTR MENU/ESC] key.

Setting a route as destination

1. Press the [PLTR MENU/ESC] key.
2. Press the [4] key.
3. Select ROUTE.
4. Key in route number in two digits.
5. Use the [+/-] key to select direction in which to traverse the route points; Forward or Reverse.
6. Press the [ENT] key. Own ship's position is marked as "00." Dashed lines (color changes with background color) run between route waypoints. Range and bearing from own ship to the next destination waypoint appear on the screen.
7. Press the [PLTR MENU/ESC] key.

Cancelling destination

1. Press the [PLTR MENU/ESC] key.
2. Press the [4] key.
3. Select CANCEL.
4. Press the [ENT] key.
5. Press the [PLTR MENU/ESC] key.

3.22 Erasing Flag Marks

Flag marks show destination waypoints. When you no longer require a flag mark you can erase it as follows:

1. Place the cursor on the flag mark to erase.
2. Press the [CLR] key. (If the waypoint is part of a route or is currently set as destination, you are asked if it is OK to erase the waypoint.)
3. Press the [ENT] key.

3.23 Skipping Route Waypoints

There are times when you won't need to follow all waypoints in a route. In Figure 3-30, for example, the ship has skipped waypoint 04.

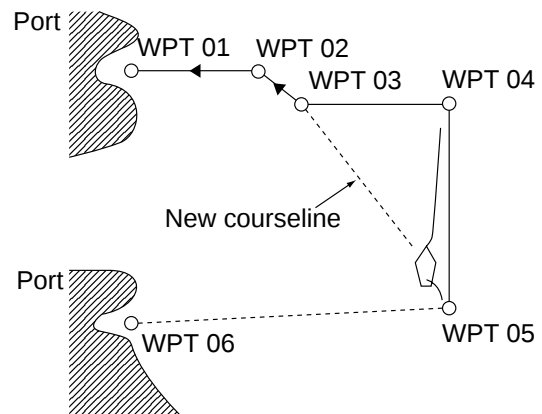


Figure 3-30 How a waypoint is skipped

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [4].
3. Select route number.
4. Press the [ENT] key.
5. Select waypoint to skip.
6. Press the [+/-] key. A minus sign appears to the left of the waypoint skipped.

"—" (minus) sign indicates waypoint is skipped.

ROUTE/ROUTE LIST					ROUTE: 01
WPT	LAT.	LONG.	LEG	TIME	
01	001 33° 11.234'N	132° 21.000'E	0.00 nm	0 : 00	
04	004 32° 21.279'N	135° 26.231'E	___ nm	__ : __	
05	005 30° 27.231'N	128° 27.293'E	25.00 nm	30 : 19	
06	006 27° 21.292'N	130° 21.272'E	42.05 nm	50 : 02	
07	___ ° ___ 'N	___ ° ___ 'E	___ nm	__ : __	
08	___ ° ___ 'N	___ ° ___ 'E	___ nm	__ : __	
09	___ ° ___ 'N	___ ° ___ 'E	___ nm	__ : __	
↓ ↑ : SELECT PLTR : ESCAPE					
+/- : ADD/SKIP					

Figure 3-31 Route/Route List display

7. Press the [ENT] key.
8. Press the [PLTR MENU/ESC] key.

To restore a waypoint, select it at step 5 in the above procedure and press the [+/-] key to change the minus sign to a plus sign.

3.24 Alarms

The plotter section has six conditions which can trigger audible and visual alarms: Arrival alarm, Anchor watch alarm, XTE (Cross track error) alarm, Border alarm, Speed alarm, and Temperature (water) alarm.

When an alarm setting is violated, the audible alarm sounds and the alarm icon () appears along with the indication SPEED ALARM, XTE ALARM, BORDER ALARM, ARRIVAL, ANCHOR ALARM, SPEED ALARM or TEMP ALARM. You may silence the alarm with the [CLR] key. The indication remains on the screen until the cause of the alarm is corrected.

Arrival/Anchor watch alarm

The **Arrival alarm** informs you that your boat is approaching a destination waypoint. The area that defines an arrival zone is that of a circle which you approach from the outside of the circle. The alarm will be released if your boat enters the circle. The **Anchor watch alarm** sounds to warn you that your boat is moving when it should be at rest.

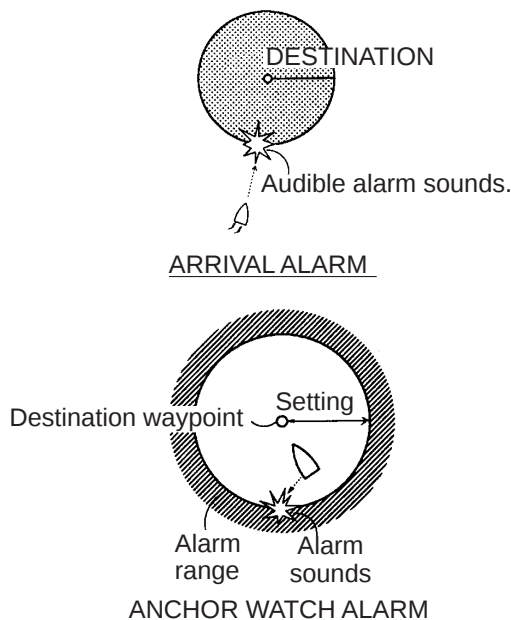


Figure 3-32 How the arrival and anchor watch alarms work

The arrival and anchor watch alarms cannot be activated together. You may activate one as follows:

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [9], and select PAGE 1.

ALARM SETTING				
PAGE	1	2	3	4 5*
ARRIVAL/ANCHOR	ANCHOR	OFF	ARRIVL	
RANGE		00.500 nm		
XTE/BORDER	XTE	OFF	BORDER	
RANGE		00.250 nm		
TEMPERATURE	WITHIN	OFF	OVER	
LOWEST		11.0 °C		
HIGHEST		15.0 °C		
↓↑←→ : SELECT ENT : ENTER				
PLTR : ESCAPE				

* Requires ARP-10 Board.

Figure 3-33 Alarm Setting menu, page 1

3. Select ANCHOR or ARRIVL from the ARRIVAL/ANCHOR field.
4. Select RANGE.
5. Key in the alarm range desired. The available range is 00.001 to 99.999 miles (statute miles) or 00.001-53.995 kilometers.
6. Press the [ENT] key.
7. Press the [PLTR MENU/ESC] key. A dashed circle marks the alarm range.

When the alarm setting is violated the audible alarm sounds and the message ARRIVAL ALARM (or ANCHOR WATCH ALARM) appears. (The nav data display shows ANCHOR or ARRIVAL at this time.) Press the [CLR] key once to silence the audible alarm and again to erase the alarm message.

To cancel the alarm, select OFF at step 3 in the above procedure.

XTE (Cross Track Error) alarm, Border alarm

The **XTE alarm** warns you when your boat is off its intended course. The **Border alarm** defines an area, consisting of two waypoints, which you do not want to cross.

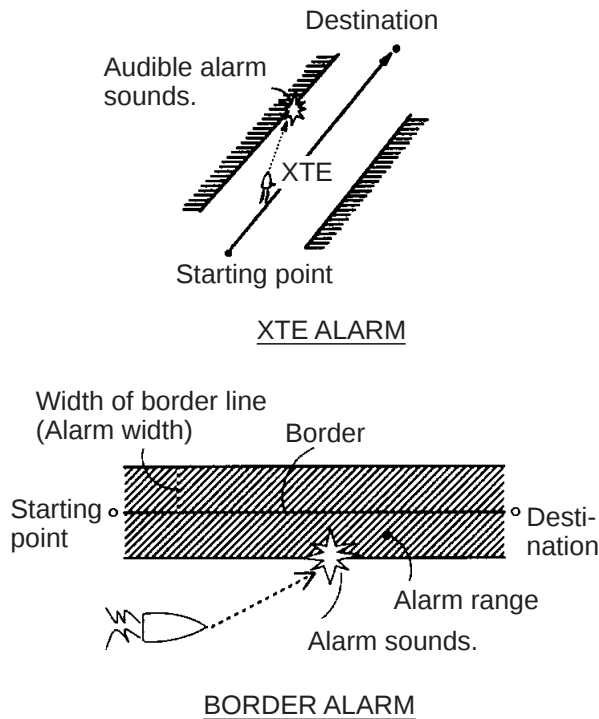


Figure 3-34 How the XTE and border alarms work

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [9], and select PAGE 1.
3. Select XTE or BORDER from the XTE/BORDER field.
4. Select RANGE.
5. Key in the alarm range desired. The available range is 00.001 to 99.999 miles (statute miles) or 00.001-53.595 kilometers.
6. Press the [ENT] key.
7. Press the [PLTR MENU/ESC] key.

When the alarm setting is violated the audible alarm sounds and the message XTE ALARM (or BORDER ALARM) appears at the screen center. (The nav data display shows XTE or BORDER at this time.) Press the [CLR] key once to silence the audible alarm and again to erase the alarm message.

Water temperature alarm

The water temperature alarm sounds when the water temperature is within (or over) the temperature range set.

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [9], and select PAGE 1.
3. Select WITHIN or OVER from the TEMPERATURE field.
4. Enter low temperature in the LOWEST field.
5. Press the [ENT] key.
6. Enter high temperature in the HIGHEST field.
7. Press the [ENT] key.
8. Press the [PLTR MENU/ESC] key.

Speed alarm

The speed alarm sounds when ship's speed is within (or over) the alarm range set.

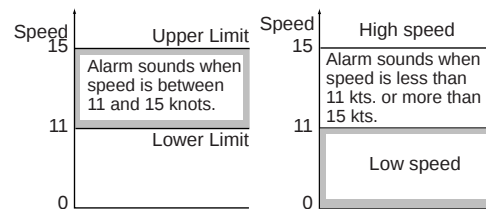


Figure 3-35 How the speed alarm works

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [9], and select PAGE 2.

ALARM SETTING					
PAGE	1	2	3	4	5*
SPEED	WITHIN		OFF		OVER
SLOWEST		11.0 kt			
HIGHEST		15.0 kt			
↓ ↑ ← → : SELECT ENT : ENTER					
PLTR : ESCAPE					

* Requires ARP-10 Board.

Figure 3-36 Alarm Setting menu, page 2

3. Select WITHIN or OVER from the SPEED field.
4. Enter low speed in the SLOWEST field.
5. Press the [ENT] key.
6. Enter high speed in the HIGHEST field.
7. Press the [ENT] key.
8. Press the [PLTR MENU/ESC] key.

3.25 Offsetting Chart Position, Bearing Position, L/L Position

In some instances position may be off by a few minutes. For example, the position of the ship is shown to be at sea while it is in fact moored at a pier. You can compensate for this error by offsetting chart position, bearing position or GPS position.

Offsetting chart position (FURUNO charts only)

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [8] to display the CHART OFFSET menu.

CHART OFFSET	
CORRECTION	NO ← • → YES (00.000N 00.000E)
DATUMS :	
ORIENTATN	000.00°
↓ ↑ ← → : SELECT ENT : ENTER PLTR : ESCAPE	

Figure 3-37 Chart Offset menu

3. Select YES from the CORRECTION field.
4. Set cursor on correct own ship position.
5. Press the [ENT] key. The chart offset icon () appears at lower left corner of the display.

6. Press the [PLTR MENU/ESC] key.

To remove the offset select "ΣÆ" at step 3 in the above procedure.

Offsetting bearing (rotating the chart)

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [8].
3. Select ORIENTATN.
4. Key in number of degrees to rotate the chart.
5. Press the [ENT] key.
6. Press the [PLTR MENU/ESC] key.

To remove the correction, enter all zeroes at step 4 of the above procedure.

Offsetting L/L position

You may wish to offset the L/L position fed from the internal GPS navigator to refine position accuracy. First, moor boat at a pier and plot position shown by FRS-1000 on a nautical chart. Then, enter offset as follows:

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [7].
3. Select PAGE 4.

SYSTEM SETTINGS	
PAGE	1 2 3 4 5 6
POSITION OFFSET	00.000N 00.000W
BACK TO DEFAULTS	☐ NO ☐ ALL
	PLOTTER RADAR GPS RCVR SOUNDER
↓ ↑ ← → : SELECT ENT : ENTER +/- : E, W PLTR : ESCAPE	

Figure 3-38 System Settings menu, page 4

4. Consulting a nautical chart, enter latitude in the POSITION OFFSET field.

5. Press the [ENT] key.
6. Enter longitude.
7. Press the [ENT] key.
8. Press the [PLTR MENU/ESC] key.

The position offset icon (L/L) appears at the bottom right corner of display. To remove the offset enter all zeroes at step 4 and 6 in the above procedure.

3.26 Plotter Display Attributes

Plotter markers can be turned on or off and, in some cases, the size and color may be changed.

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [1].
3. Select PAGE 1 or PAGE 2 as appropriate.

DISPLAY SETTING									
PAGE	1	2							
LAND BRILL	BRIGHT		DIM						
LAND COLOR	1	2	3	4	5	6	7	OFF	
PLACE NAME	1	2	3	4	5	6	7	OFF	
GRID COLOR	1	2	3	4	5	6	7	OFF	
COURSE BAR	1	2	3	4	5	6	7	OFF	
BACKGROUND	1	2	3	4	5	6	7	BLK	
MOB	ON		OFF						
WPT MARK SIZE	LARGE		SMALL						
MARK SIZE	LARGE		SMALL						
↓↑←→: SEL/ENTER PLTR: ESCAPE									

Figure 3-39 Display Setting menu, page 1

4. Select item and option.
5. Press the [ENT] key.
6. Press the [PLTR MENU/ESC] key.

DISPLAY SETTING menu page 1 description

PAGE: Selects page number.

LAND BRILL: Selects land brilliance to bright or dim.

LAND COLOR: Selects land color among red, yellow, green, light blue, purple, blue or white.

PLACE NAME: Turns geographic name display on/off and selects its color.

GRID: Turns grid on/off and selects its color.

COURSE BAR: Turns course bar on/off and selects its color.

BACKGROUND: Sets background color of plotter display.

MOB DISP: Enable/disables entry of MOB mark.

WPT MARK SIZE: Selects waypoint mark size to large or small.

Large Small
 ×

MARK SIZE: Selects mark size to large or small.

Large Small
 Mark  
 Flag Mark  

Note: Colors and brilliance settings selected on page 1 of the DISPLAY SETTING menu are only effective when "CUSTOM" palette is selected ([BRILL] key + [+/-] key).

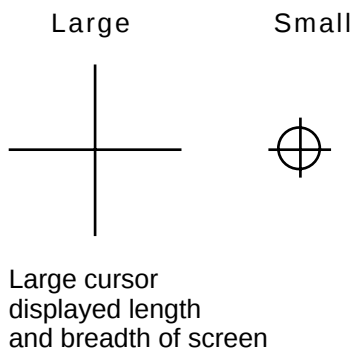
DISPLAY SETTING menu page 2 description

DISPLAY SETTING									
PAGE	1	2							
CURSOR SIZE	LARGE	SMALL							
CONTOUR LINE	OFF	ON							
DEPTH INFO	1	2	3	4	5	6	7	OFF	
BUOYS	OFF	ON							
CHART LICENSE	OFF	ON							
↓↑←→ : SEL/ENTER PLTR : ESCAPE									

Figure 3-40 Display Setting menu, page 2

PAGE: Selects page number.

CURSOR SIZE: Selects cursor size to large or small.



CONTOUR LINE: Turns depth contour on/off.

DEPTH INFO: Turns the depth contour data on/off.

BUOYS: Turns buoy marker on/off.

CHART LICENSE: Turns chart license indication on/off on charts which can display chart license number.

This chapter shows you how to operate the sounder section. A unique feature of the FRS-1000 is its automatic sounder operation. Simply set up for automatic operation and the FRS-1000 automatically selects optimum gain, range and clutter reduction level.

4.1 Selecting a Sounder Display

Four sounder displays are available: Normal, Bottom Marker, Marker Zoom, and Bottom-lock.

1. Press the [SNDR MENU/ESC] key.

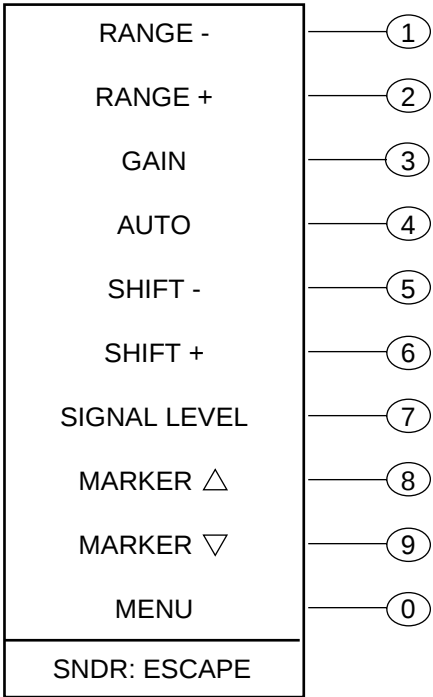


Figure 4-1 Sounder functions display

2. Press [0] to display the SOUNDER menu.

SOUNDER MENU	
1. CONTROLS	
2. SETTINGS	
9. ALARM SETTING	
0. UNIT SETTING	
↓↑: SELECT ENT: ENTER SNDR: ESCAPE	

Figure 4-2 Sounder menu

3. Press the [1] key to display the CONTROLS menu, and select PAGE 1.

CONTROLS	
PAGE	1 2
FREQUENCY	50 200 50/200kHz
DISPLAY MODE	NORMAL BTM ZOOM
	MKR ZOOM BOTTOM LOCK
CLUTTER	4 (0 ~ 9)
NOISE LM	
200kHz	OFF
50kHz	OFF
PICT. ADVANCE	1/1
TX POWER	2
↓↑←→: SEL/ENTER SNDR: ESCAPE	

Figure 4-3 Sounder Controls menu, page 1

4. Select FREQUENCY.
5. Select 50 kHz, 200 kHz or 50/200 kHz.
6. Select DISPLAY MODE.
7. Select display mode desired among NORMAL, BTM ZOOM, MKR ZOOM and BOTTOM LOCK. If you selected 50/200 kHz in step 5, only the Normal display is available.
8. Press the [SNDR MENU/ESC] key to close the menu.

Normal display, 50 kHz

The sounder uses ultrasonic pulses to detect bottom conditions. The lower the frequency of the pulse, the wider the detection area. Therefore, the 50 kHz frequency is useful for general detection and judging bottom condition.

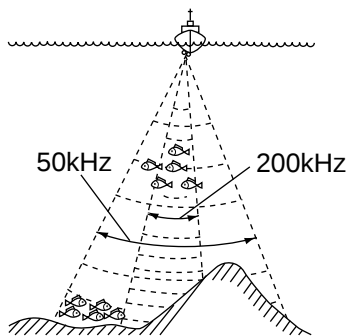


Figure 4-4 Comparison of detection ranges of 50 kHz and 200 kHz transducers

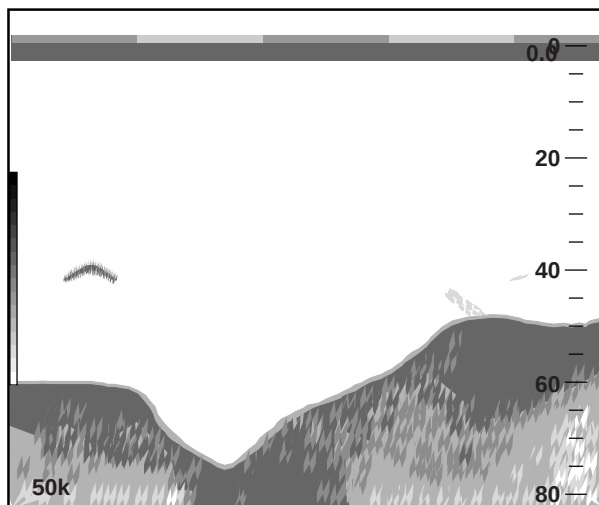


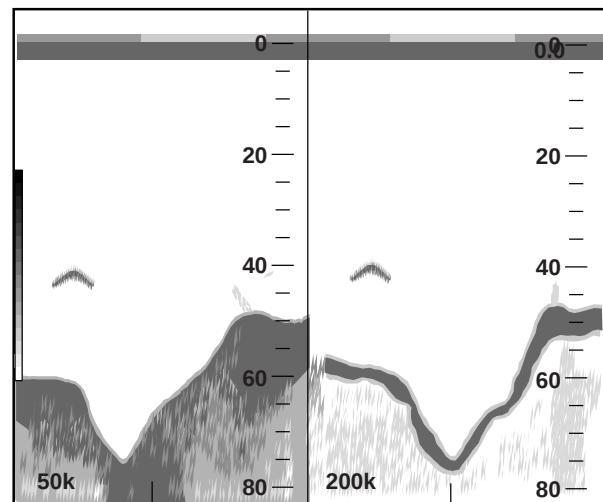
Figure 4-5 Typical 50 kHz normal display

Normal display, 200 kHz

The higher the frequency of the ultrasonic pulse the better the resolution. Therefore, the 200 kHz frequency is ideal for detailed observation of fish schools.

50/200 kHz display

The 50 kHz picture appears on the left; the 200 kHz picture on the right. This display is useful for comparing the same picture with two different transmitting frequencies.



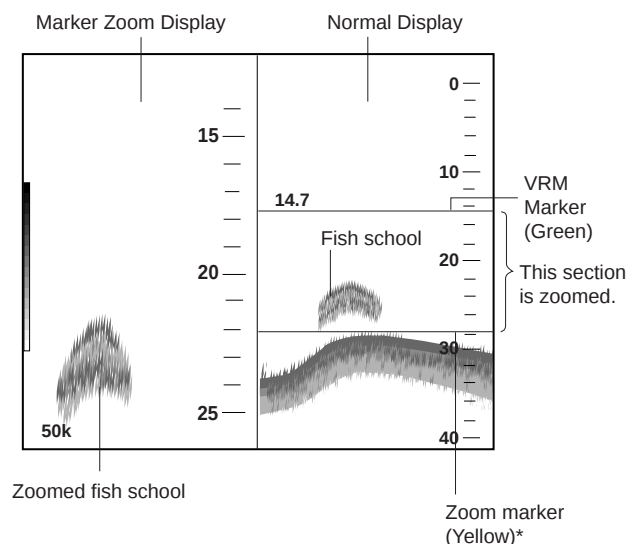
50 kHz picture

200 kHz picture

Figure 4-6 Dual-frequency display

Marker zoom display

This mode expands selected area of the normal picture to full vertical size of the screen on the left-half window. You may specify the portion to expand by operating the VRM (Variable Range Marker), which you can shift with the omnipad. The area between the VRM and zoom range marker is expanded. The length of the segment is equal to one division of the depth scale.



*: May look white depending on background color.

Figure 4-7 Marker zoom display

Bottom zoom display

This mode expands bottom and bottom fish echoes two to five times to vertical size of the screen, and is useful for determining bottom hardness. A bottom displayed with a short echo tail usually means it is a soft, sandy bottom. A long echo tail means a hard bottom.

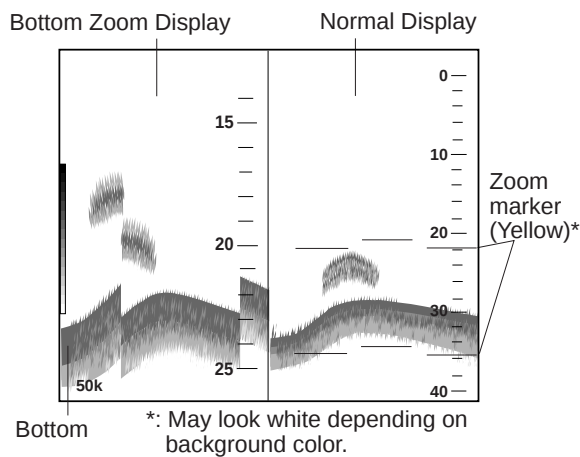


Figure 4-8 Bottom zoom display plus normal display

Bottom-lock display

The bottom-lock display provides a compressed normal picture on the right half of the screen and a 5 or 10 meter (10 or 20 feet) wide layer in contact with the bottom is expanded onto the left half of the screen. This mode is useful for bottom discrimination.

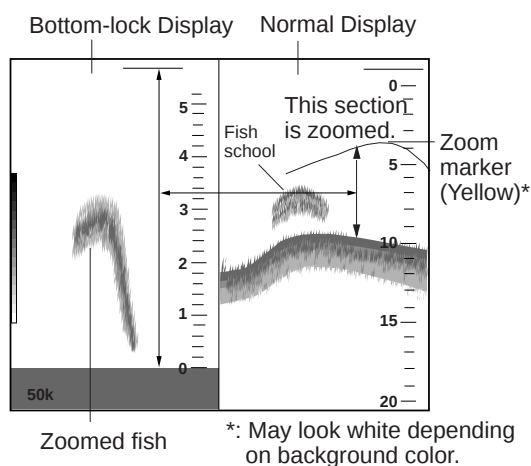


Figure 4-9 Bottom-lock display plus normal display

Note: The zoom marker is not displayed in the default setting. It may be turned on in page 2 of the Sounder Settings menu. More on this later.

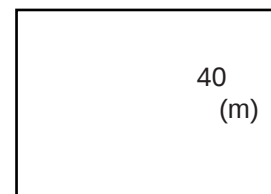
4.2 Manual Sounder Operation

The basic range and range shifting functions used together give you the means to select the depth you can see on the screen. The basic range can be thought of as providing a “window” into the water column and range shifting as moving the “window” to the desired depth.

Basic range selection

The basic range may be selected from the eight ranges shown in the table below.

1. Press the [SNDR MENU/ESC] key.
2. Press [1] (RANGE-) to raise the range; [2] (RANGE+) to lower it. The range selected appears at the bottom right corner of the screen for about 10 seconds.



Shifting the display range

The basic range may be shifted up or down as desired.

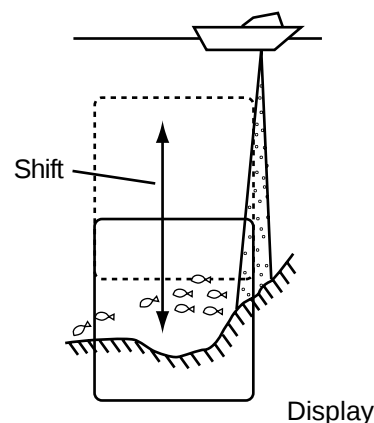
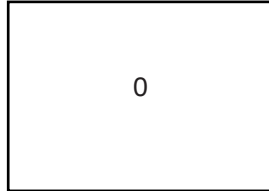


Figure 4-10 Range and display shift concept

To shift the display;

1. Press the [SNDR MENU/ESC] key.
2. Press [5] (SHIFT-) to raise the shift range; [6] (SHIFT+) to lower it. The amount of shift selected appears on the screen for about 10 seconds.

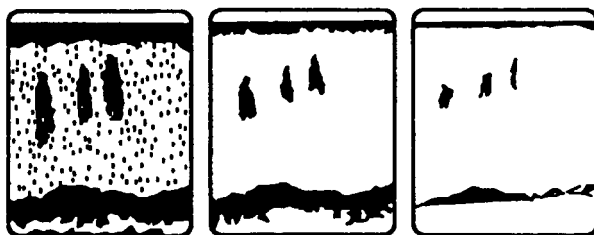


Note 1: The Range and Shift functions are inoperative in automatic operation. See 4.3 Automatic Operation for details.

Note 2: The maximum shift range is 8000 feet (2400 m). However, actual range will depend on underwater conditions. In the worst case, for example, when the ultrasonic pulse is blocked, echoes will not appear.

Adjusting the gain

The gain circuit adjusts the sensitivity of the receiver. Adjust it so that a slight amount of noise remains on the screen. Generally, use a higher gain setting for greater depths and a lower setting for shallower waters.



Gain too high Gain proper Gain too low

Figure 4-11 Examples of proper and improper gain

1. Press the [SNDR MENU/ESC] key.
2. Press [3] (GAIN).

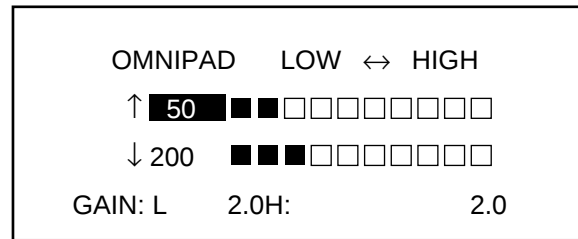


Figure 4-12 Gain setting display

3. Use the omnipad to adjust the gain.
4. Press the [SNDR MENU/ESC] key to close the menu.

Note that the gain cannot be adjusted in automatic operation.

4.3 Automatic Sounder Operation

Automatic operation is useful when you are preoccupied with other tasks and do not have time to adjust the display.

How automatic sounder operation works

The automatic function automatically selects the proper gain, range scale and clutter rejection level according to depth. It works as follows:

- The range changes automatically to locate the bottom on the lower half of the screen. It jumps to one step shallower range when bottom echoes reach a halfway point of the full scale from top and to one step deeper range when they come to the lower edge of the scale.
- The gain is automatically adjusted to display the bottom echo in reddish-brown (default color arrangement).
- Clutter level (on the Sounder Functions menu), which suppresses low level noise, is automatically adjusted.

Note that shift, range, gain and clutter cannot be adjusted in the auto mode.

How to enable automatic operation

1. Press the [SNDR MENU/ESC] key.
2. Press the [4] key. Each time the key is pressed the indication at the bottom of the nav data display shows OFF, AUTO FISHING or AUTO CRUISING. Select an automatic mode appropriate to your objective.
3. Press the [SNDR MENU/ESC] key.

4.4 Erasing Weak Echoes

Dirty water or reflections from plankton may be painted on the display in green or light-blue. These weak echoes may be erased as follows:

1. Press the [SNDR MENU/ESC] key.
2. Press the [7] key (SIGNAL LEVEL) to erase echo(es) desired. Each time the key is pressed a number from 0-4 appears at the bottom of the display. This number corresponds to a color to erase as follows:

- 0: Weak echo colors (8 or 16 color display)
- 1: Dark blue (8 or 16 color display)
- 2: Bright blue (8 or 16 color display)
- 3: Dark light-blue (16 color display only)
- 4: Bright light-blue (16 color display only)

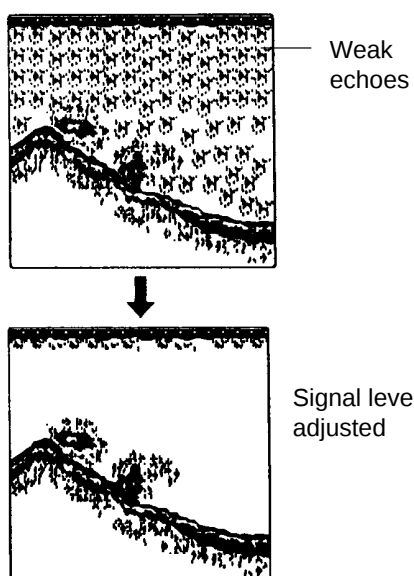


Figure 4-13 How signal level works

3. Press the [SNDR MENU/ESC] key.

4.5 Suppressing Low Level Noise

Light-blue dots may appear over most of screen. This is mainly due to dirty water or noise. This noise can be suppressed by adjusting Clutter on the Sounder Functions menu.

When the automatic mode is on, the clutter reduction circuit is automatically adjusted. To suppress low level noise in manual sounder operation do the following:

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [1] to display the CONTROLS menu and select PAGE 1.

CONTROLS			
PAGE	1	2	
FREQUENCY	50	200	50/200kHz
DISPLAY MODE	NORMAL		BTM ZOOM
		MKR ZOOM	BOTTOM LOCK
CLUTTER	4 (0 ~ 9)		
NOISE LM			
	200kHz	OFF	
	50kHz	OFF	
PICT. ADVANCE	1/1		
TX POWER	2		
↓ ↑ ← → : SEL/ENTER SNDR : ESCAPE			

Figure 4-14
Sounder Controls menu, page 1

3. Select clutter rejection level (0-9) desired. The higher the number the higher the degree of suppression. Note that weak echoes may not be displayed when the clutter circuit is on.
4. Press the [SNDR MENU/ESC] key.

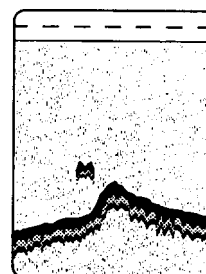


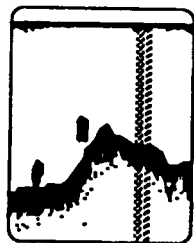
Figure 4-15 Clutter appearance

4.6 Suppressing Interference

Interference from other acoustic equipment operating nearby or other electronic equipment on your boat may show itself on the display as shown in Figure 4-16.

To suppress interference, do the following:

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [1] to display the CONTROLS menu, and select PAGE 1.
3. Select 50 kHz or 200 kHz from the NOISE LM field.
4. Use the omnipad to select degree of suppression; OFF, NL1, NL2 or NL3. The higher the number the greater the degree of suppression.
5. Press the [SNDR MENU/ESC] key.



Interference from other sounder



Electrical interference

Figure 4-16 Forms of interference

Turn the noise limiter circuit off when no interference exists, otherwise weak echoes may be missed.

4.7 Selecting Picture Advance Speed

The picture advance speed determines how quickly the vertical scan lines run across the screen. When selecting a picture advance speed, keep in mind that a fast advance speed will expand the size of the fish school horizontally on the screen and a slow advance speed will contract it.

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [1] to display the CONTROLS menu, and select PAGE 1.
3. Select PICT. ADVANCE.

4. Select picture advance speed with the omnipad. The fractions in the menu denote number of scan lines produced per transmission. For example, 1/4 means one scan line is produced every 4 transmissions. "STOP" freezes the display and it is convenient for observing an echo.

5. Press the [SNDR MENU/ESC] key.

4.8 Alarms

Fish alarm

The fish alarm sounds when a fish echo of a preset strength is within the preset alarm range.

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [9].
3. Select PAGE 3.

ALARM SETTING					
PAGE	1	2	3	4	5*
BOTTOM	OFF	ON			
RANGE	001 ~ 002 (m)				
FISH	OFF	ON			
ECHO LEVEL	2				
RANGE	003 ~ 004 (m)				

↓ ↑ ← → : SELECT ENT : ENTER
SNDR : ESCAPE

* Requires ARP-10 Board.

Figure 4-17 Alarm Setting menu, page 3

4. Select ON from the FISH field.
5. Key in the ECHO LEVEL field the strength of the echo which will trigger the buzzer when a fish echo is within the alarm range. 1, Echoes of medium blue strength and higher; 2, Echoes of yellow strength and higher, 3, Echoes of red strength and higher.
6. Key in alarm range.
7. Press the [ENT] key.
8. Press the [SNDR MENU/ESC] key.

When a fish echo is within the alarm range the buzzer sounds and the message FISH ALARM appears. (FISH appears at the bottom of the NAV DATA display.) Press the [CLR] key once to silence the buzzer and again to erase the alarm message.

Bottom alarm

The bottom alarm sounds when the bottom is within the alarm range set. To activate the bottom alarm the depth must be displayed.

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [9].
3. Select PAGE 3.
4. Select ON from the BOTTOM field.
5. Key in alarm range.
6. Press the [ENT] key.
7. Press the [SNDR MENU/ESC] key.

To disable the bottom alarm, select OFF at step 4 in the above procedure.

When the bottom echo is within the alarm range the buzzer sounds and the message BOTTOM ALARM appears, (BOTTOM appears on the NAV DATA display.) Press the [CLR] key once to silence the alarm and again to erase the alarm message.

4.9 Measuring Depth

The VRM (Variable Range Marker) functions to measure the depth to fish schools, etc.

1. Press the [SNDR MENU/ESC] key.
2. Press [8] (MARKER▲) to raise the VRM; [9] (MARKER▼) to lower it.
3. Read the VRM range just above the VRM.

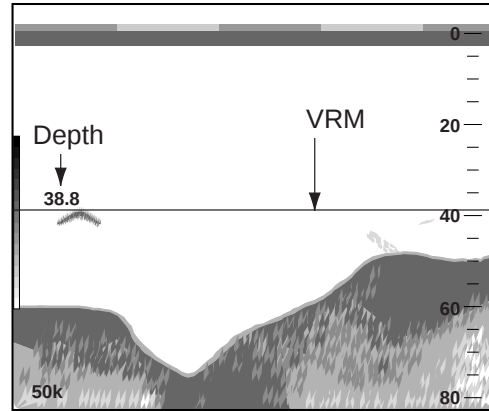


Figure 4-18 How to measure depth with the VRM

4. Press the [SNDR MENU/ESC] key to close the menu.

4.10 Offsetting Depth Indication

You may apply an offset to the depth indication as follows to correct it.

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [2].
3. Select PAGE 2.
4. Enter offset at the DRAFT field. Use the [+/-] key to enter plus, minus, respectively.
5. Press the [ENT] key.
6. Press the [SNDR MENU/ESC] key.

4.11 Water Temperature Graph

A line graph type water temperature graph is available. (Requires water temperature data.) You may display the graph as follows:

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [1].
3. Select PAGE 2.
4. Select ON or OFF from the TEMP. GRAPH field as appropriate.
5. Press the [ENT] key.
6. Press the [SNDR MENU/ESC] key.

4.12 Selecting Unit of Measurement for Depth, Water Temperature

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [0].
3. Select in the DEPTH field the unit of depth measurement desired.
4. Select in the TEMP. field the unit of water temperature desired.
5. Press the [ENT] key.
6. Press the [SNDR MENU/ESC] key.

4.13 Selecting Background and Echo Colors

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [1].
3. Select PAGE 2.
4. Select HUE.
5. Key in hue arrangement number referring to the table in the next column.

Table 4-1 Hue setting and color arrangement

Hue No.	Echo Color	Background Color
1	16 color	Blue
2	8 color	White
3	16 color	Light-blue
4	8 color	Black
5	16 color	Black
6	Monochrome yellow, eight intensities	
7	16 color	Dark blue
8	8 color	Dark blue
9	16 color	Dark blue

6. Press the [ENT] key.
7. Press the [SNDR MENU/ESC] key.

4.14 Changing Output Power

You may select transmitter output power. In shallow waters, select a lower power to avoid unwanted surface noise.

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [1], and select PAGE 1.
3. Select TX POWER.
4. Use the omnipad to select output desired. "2" provides maximum output power.
5. Press the [SNDR MENU/ESC] key.

4.15 TVG Level

TVG (Time Varied Gain) compensates for propagation attenuation of the ultrasonic waves. It does this by equalizing echo presentation so that fish schools of the same size appear in the same density in both shallow and deep waters. In addition, it reduces surface noise. Note that if the TVG level is set too high short range echoes may not be displayed.

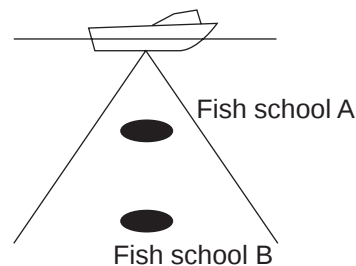


Figure 4-19 TVG concept

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [2], and select PAGE 1.
3. Select TVG.
4. Key in TVG level for both 50 kHz and 200 kHz.
5. Press the [SNDR MENU/ESC] to close the menu.

4.16 Echo Level Offset

The echo level offset feature functions to compensate for too weak or too strong echo level. If the on-screen echo level appears to be too weak or too strong and the level cannot be adjusted satisfactorily with the gain control, do the following to adjust echo level:

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [2], and select PAGE 1.
3. Select ECHO LEVEL OFFSET.
4. Key in echo level offset for both 50 kHz and 200 kHz. The setting range is -20 to +20.
5. Press the [SNDR MENU/ESC] to close the menu.

4.17 Zoom Marker

The zoom marker appears in the normal, bottom marker and bottom zoom displays and marks the area which is expanded in the bottom marker and bottom zoom pictures. You can turn on/off the marker as desired. The default setting is off.

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [2].
3. Select PAGE 2.
4. Select ON or OFF from the MARKER ZOOM field as appropriate.
5. Press the [SNDR MENU/ESC] to close the menu.

4.18 Expansion Width for the Bottom-Lock Display

The expansion width for the bottom-lock display can be selected to 5 or 10 meter.

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [2], and select PAGE 2.

3. Select 5 or 10 (m) from the BTM LOCK RANGE field.
4. Press the [SNDR MENU/ESC] to close the menu.

4.19 Expansion Range for Bottom Zoom and Marker Zoom

The range scale for the bottom zoom and marker zoom pictures can be selected to X2, X3, X4 or X5. X2, for example, expands echoes to double size relative to those on the normal picture.

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [2].
3. Select PAGE 2.
4. Select X2, X3, X4, or X5 from the ZOOM RANGE field.
5. Press the [SNDR MENU/ESC] to close the menu.

4.20 Bottom Echo Level

If the depth indication is unstable in automatic operation or the bottom echo cannot be displayed in reddish-brown by adjusting the gain control in manual operation, you may adjust the bottom echo level detection circuit, for both 50 kHz and 200 kHz, to stabilize the indication. Note that if the level is set too low weak echoes may be missed and if set too high the depth indication will not be displayed.

1. Press the [SNDR MENU/ESC] key.
2. Press [0], [2], and select PAGE 1.
3. Select ECHO LEVEL.
4. Key in suitable bottom echo level. The setting range is 000 to 999. The default settings for both 50 kHz and 200 kHz is 080.
5. Press the [SNDR MENU/ESC] to close the menu.

4.21 Interpreting the Display

Zero line

The zero line (sometimes referred to as the transmission line) represents the transducer's position, and moves off the screen when a deep phased range is used.

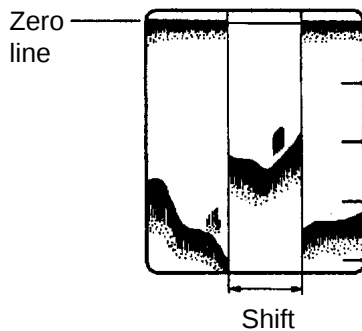


Figure 4-20 Zero line

Fish school echoes

Fish school echoes will generally be plotted between the zero line and the bottom. Usually the fish school/fish echo is weaker than the bottom echo because its reflection property is much smaller compared to the bottom. The size of the fish school can be ascertained from the density of the display.

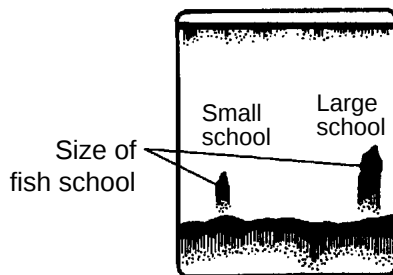


Figure 4-21 Fish school echoes

Bottom echo

Echoes from the bottom are normally the strongest and are displayed in reddish-brown color but the color and width will vary with bottom composition, water depth, frequency, sensitivity, etc.

In a comparatively shallow depth, a high gain setting will cause a second or sometimes a third echo to be displayed at the same interval between them below the first echo trace. This is because the echo travels between the bottom and the surface twice or more in shallow depths.

The color of the bottom echo can be used to help determine the density of the bottom materials (soft or hard). The harder the bottom, the wider the trace. If the gain is set to show only a single bottom echo on mud, a rocky bottom will show a second or third bottom return. The range should be chosen so the first and second bottom echoes are displayed when bottom hardness is being determined.

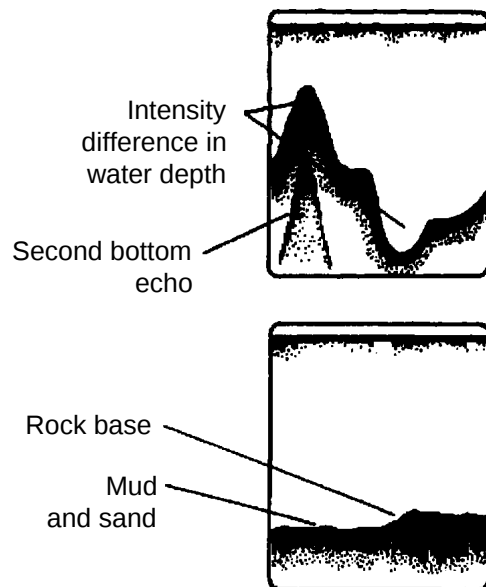


Figure 4-22 Bottom echoes

Surface noise/Aeration

When the waters are rough or the boat passes over a wake, surface noise may appear near the zero line. As surface turbulence is acoustically equivalent to running into a brick wall, the bottom echo will be displayed intermittently. Similar noise sometimes appears when a water temperature difference (thermocline) exists. Different species of fish tend to prefer different temperature zones, so the thermocline may be useful to help identify target fish. 200 kHz tends to show shallow thermoclines better than 50 kHz.

In rough waters the display is occasionally interrupted due to below-the-ship air bubbles obstructing the sound path. This also occurs when the boat makes a quick turn or reverses movement. Lowering the picture advance speed may reduce the interruption. However, reconsideration of the transducer installation may be necessary if the interruption occurs frequently.

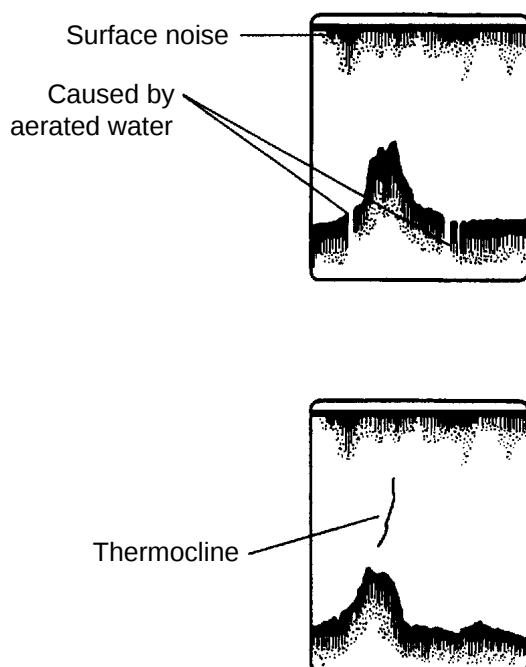


Figure 4-23 Surface noise/aeration

RECORDING, REPLAYING DATA

This chapter shows you how to record and playback plotter data, that is, track, marks, lines, waypoints, routes and plotter menu settings.

5.1 Formatting Memory Cards

Before you can use a memory card with the FRS-1000 the card must be formatted. This prepares the card for use with the system.

1. Open the slot cover on the processor unit.
2. Insert new memory card in the right-hand slot, label side up, connector forward. Close the slot cover.
3. Press the [PLTR MENU/ESC] key.
4. Press [0], [5] to display the MEMORY CARD menu.

MEMORY CARD	
1. SAVE	
2. REPLAY	
3. ERASE	
4. FORMAT	
5. UPLOAD SETTING	
6. DOWNLOAD SETTING	
↓↑ : SELECT ENT : ENTER PLTR : ESCAPE	

Figure 5-1 Memory Card menu

5. Press the [4] key to select FORMAT.
6. Press the [ENT] key.
7. Press the [PLTR MENU/ESC] key when formatting is completed.

 CAUTION
The Processor Unit is not waterproof; keep the slot cover closed always.

5.2 Saving Data

The FRS-1000 cannot save data endlessly. For example, when the track or mark memory becomes full the oldest track or marks are erased to make room for the latest. For this reason, you should save important data to a memory card. Note that charts cannot be saved.

Note: If no memory card is inserted or a chart card is inserted, the message “No or improper card inserted. Insert correct card and press ENT key.” appears.

1. Open the slot cover on the processor unit and insert a formatted memory card in the right-hand side card slot. Close the slot cover.
2. Press the [PLTR MENU/ESC] key.
3. Press [0], [5], [1] to display the Save menu.

SAVE		
TRACK	YES	NO
MARK/LINE	YES	NO
WPT/ROUTE	YES	NO
MENU SETTINGS	YES	NO
↓↑←→ : SELECT ENT : ENTER PLTR : ESCAPE		

Figure 5-2 Save menu

4. Choose YES from appropriate field(s) to select data to record.
5. Press the [ENT] key. The screen for entering file name appears.

SAVE
NEW FILE
012
01-JAN-1998 10:17 231
↓↑←→ : SELECT ENT : ENTER PLTR : ESCAPE

Figure 5-3 File list

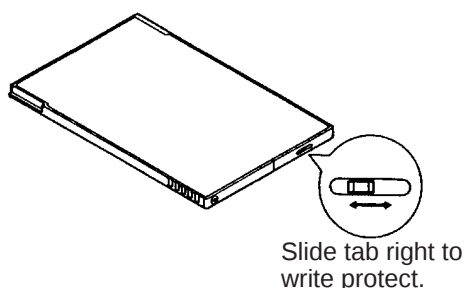
- Press the [ENT] key, and the following display appears.

X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	(	X	X	X	X	X	*
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
P	Q	R	S	T	U	V	W	X	Y	Z	!	?	/	&=#
1	2	3	4	5	6	7	8	9	0	a	b	c	d	e
f	g	h	i	j	k	l	m	n	o	p	q	r	s	t
u	v	w	x	y	z	X	X	X	X	X	X	X	X	X
end														

Figure 5-4 Characters available for file name

- Enter file name: Select character and press the [ENT] key. Repeat to complete file name.
- Select “end” and press the [ENT] key.
- Press the [PLTR MENU/ESC] key.
- Press the eject button to eject the memory card. Close the slot cover.

Note: The memory card contains a switch which can prevent writing of information to the card. This prevents accidental erasure of important data. To write protect a memory card, set the switch at the base of the card rightward.



5.3 Replaying Data

Data on a memory card can be replayed on the display screen. This is useful for analyzing past track, restoring menu settings and displaying user-constructed charts. Note that data cannot be replayed when a destination is set.

Note: An on-screen waypoint having the same number as a waypoint in a file will be erased when the file is replayed.

- Open the slot cover on the processor unit and insert a formatted memory card in the right-hand side card slot. Close the slot cover.
- Press the [PLTR MENU/ESC] key.
- Press [0], [5], [2] to display the REPLAY menu.

REPLAY		
TRACK	YES	NO
MARK/LINE	YES	NO
WPT/ROUTE	YES	NO
MENU SETTINGS	YES	NO
↓↑←→ : SELECT ENT : ENTER PLTR : ESCAPE		

Figure 5-5 Replay menu

- Choose YES from appropriate field(s) to select data to playback.
- Press the [ENT] key. A list of files stored on the card appears.

REPLAY			
012			
	01-JAN-1998	10:17	231
SEATTLE			
	10-APR-1998	12:03	211
↓↑ : SELECT ENT : ENTER PLTR : ESCAPE			

Figure 5-6 File list

6. Select file to play back.
7. Press the [ENT] key.
8. Press the [PLTR MENU/ESC] key.
9. Open the slot cover and press the eject button to eject the memory card. Close the slot cover.

5.4 Deleting Files

You may delete unnecessary data from memory cards as follows:

1. Open the slot cover on the processor unit and insert a formatted memory card in the right-hand side card slot. Close the slot cover.
2. Press the [PLTR MENU/ESC] key.
3. Press [0], [5], [3] to display the ERASE menu.

ERASE		
TRACK	YES	NO
MARK/LINE	YES	NO
WPT/ROUTE	YES	NO
MENU SETTINGS	YES	NO
↓↑←→ : SELECT ENT : ENTER PLTR : ESCAPE		

Figure 5-7 Erase menu

4. Choose YES from appropriate field(s) to select data to erase.
5. Press the [ENT] key. File list appears.

ERASE			
012			
	01-JAN-1998	10:17	231
SEATTLE			
	10-APR-1998	12:03	211
↓↑ : SELECT ENT : ENTER PLTR : ESCAPE			

Figure 5-8 File list

6. Select file to erase.
7. Press the [ENT] key.
8. Press the [PLTR MENU/ESC] when the erasing is finished.
9. Open the slot cover and press the eject button to eject the memory card. Close the slot cover.

AUTO PLOTTER ARP-10 (OPTION)

6.1 Usage Precautions



WARNING

No one navigational aid should be relied upon for the safety of vessel and crew. The navigator has the responsibility to check all aids available to confirm position. Electronic aids are not a substitute for basic navigational principles and common sense.

- This Auto Plotter automatically tracks an automatically or manually acquired radar target and calculates its course and speed, indicating them by a vector. Since the data generated by the Auto Plotter are based on what radar targets are selected, the radar must always be optimally tuned for use with the Auto Plotter, to ensure required targets will not be lost or unwanted targets such as sea returns and noise will not be acquired and tracked.
- A target does not always mean a land-mass, reef, ships or other surface vessels but can imply returns from sea surface and clutter. As the level of clutter changes with environment, the operator should properly adjust the A/C SEA, A/C RAIN and GAIN controls to be sure target echoes are not eliminated from the radar screen.



CAUTION

The plotting accuracy and response of this Auto Plotter meets IMO standards. Tracking accuracy is affected by the following:

- Tracking accuracy is affected by course change. One to two minutes is required to restore vectors to full accuracy after an abrupt course change. (The actual amount depends on gyrocompass specifications.)
- The amount of tracking delay is inversely proportional to the relative speed of the target. Delay is on the order of 15—30 seconds for high relative speed; 30—60 seconds for low relative speed.

Display accuracy is affected by the following:

- Echo intensity
- Radar transmission pulsewidth
- Radar bearing error
- Gyrocompass error
- Course change (own ship or target)

6.2 Introduction

The FRS-1000 can accommodate the optional ARP circuit board ARP-10 in its processor unit. The ARP-10 automatically or manually acquires and tracks 10 targets, providing range, course, speed and bearing data of tracked targets. Once a target is acquired automatically or manually it is automatically tracked within 0.1 to 16 nm, whether inside or outside the acquisition area. When a target is deemed to be on collision course an audible alarm sounds.

The ARP-10 requires heading signal input. A target echo of 800 meters or more in length is judged to be landmass and is not tracked.

6.3 Activating the ARP-10

1. Confirm that gain, A/C and A/C RAIN are properly adjusted.
2. Press the [RDR MENU/ESC] key.
3. Press [0], [6] to display the ARP DATA DISPLAY menu.

ARP DATA DISPLAY	
ARP DISPLAY	NO YES
DATA DISPLAY	NO YES
SELECT/CANCEL	SELECT ← • → CANCEL
↓↑←→ : SELECT ENT : ENTER RDR : ESCAPE	

Figure 6-1 ARP Data Display menu

4. Select ARP DISPLAY.
5. Select YES.
6. Press the [RDR MENU/ESC] key.

To deactivate the ARP-10, select NO at step 5 in the above procedure.

6.4 Acquiring and Tracking Targets

Manual acquisition

10 targets within the range of 0.2 to 16 nm can be manually acquired and automatically tracked. When automatic acquisition is turned on only five targets can be manually acquired.

1. Place the cursor on the target to acquire.
2. Press the [RDR MENU/ESC] key.
3. Press the [8] key.
4. Press the [RDR MENU/ESC] key.

The plot symbol changes its shape according to the status as below. A vector appears in about 20 antenna scans after acquisition indicating the target's motion trend. If the target is consistently detected for three minutes, the plot symbol changes to a solid mark. If acquisition fails, the target symbol blinks and disappears shortly. When all 10 targets have been acquired the buzzer sounds once and the message TARGET OVER appears. To acquire another target, terminate tracking of an unnecessary target.

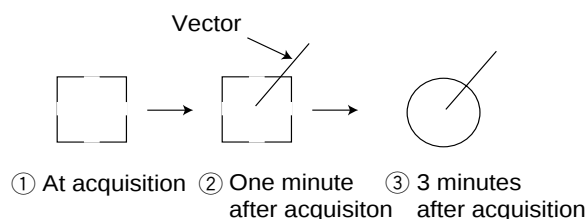


Figure 6-2 Plot symbols

Automatic acquisition

The ARP-10 automatically acquires up to five targets which come into the acquisition area. However, if more than five targets have been acquired manually, only the remaining number from ten may be acquired automatically. For example, if seven targets have been acquired manually, only three targets may be automatically acquired.

1. Press the [RDR MENU/ESC] key.
2. Press [0], [5].

ARP SETTINGS			
ALL CANCEL	NO	YES	
HISTORY	☐ OFF	15sec	30sec
		1min	2min
		3min	
		6min	
VECT. LENGTH	30sec	☐ 1min	3min
	6min	15min	30min
VECTOR REF	☐ REL	TRUE	
AUTO ACQ	☐ OFF	ON	
↓↑←→ : SEL/ENTER RDR: ESCAPE			

Figure 6-3 ARP Setting menu

3. Select AUTO ACQ.
4. Select ON.
5. Press the [RDR MENU/ESC] key. An acquisition area of 2.0 to 2.5 miles in range and $\pm 45^\circ$ from the heading line appears.



Figure 6-4 Acquisition area

When the automatic acquisition capacity is reached the buzzer sounds once and the messages AUTO TARGET FULL appears.

6.5 Terminating Tracking of Targets

When 10 targets have been acquired, no more acquisition occurs unless targets are lost. Should this happen, cancel tracking of individual targets or all targets by the procedure described below.

Terminating tracking of selected targets

1. Press the [RDR MENU/ESC] key.
2. Press [0], [6].
3. Select CANCEL from the SELECT/CANCEL field.
4. Place the cursor on the target to terminate tracking.

5. Press the [ENT] key.
6. Press the [RDR MENU/ESC] key.

Terminating tracking of all targets

1. Press the [RDR MENU/ESC] key.
2. Press [0], [5].
3. Select YES from the ALL CANCEL field.
4. Press the [RDR MENU/ESC] key.

6.6 Displaying Target Data

The ARP-10 calculates motion trends (range, bearing, course, speed, CPA and TCPA) of all targets under tracking, and displays data of selected target at the bottom right corner of the screen.

Note: At a speed under 5 kt the target data is displayed with a delay due to filtration processing.

1. Press the [RDR MENU/ESC/ESC] key.
2. Press [0], [6].
3. Set DATA DISPLAY to YES.
4. Press the [RDR MENU/ESC] key.

		Vector mode
REL VECTOR	6MIN	Vector time
BRG	119.7°T	
RNG	2.4NM	
CSE	268.3°T	
SPD	0.7KT	
CPA	2.76NM	Closest Point of Approach
TCPA	00 : 05	Time to CPA

Figure 6-5 Target data

To select a target to display its data;

1. Press the [RDR MENU/ESC] key
2. Press [0], [6].
3. Set SELECT/CANCEL to SELECT.
4. Place the cursor on the target symbol.
5. Press the [ENT] key.

6. Press the [RDR MENU/ESC] key. (A beep sounds and the symbol of the target selected grows double in size. Data for the target appears at the lower right-hand side of the screen.)
7. Press the [RDR MENU/ESC] key.

6.7 Vectors

True or relative vector

Target vectors display speed and course of tracked targets, and are displayed in relative or true mode. Own ship does not have a vector in relative mode.

Vector time

Vector time can be set to 30 seconds, 1, 3, 6, 15 or 30 minutes and the selected vector time is indicated on the screen.

The vector tip shows an estimated position of the target after the selected vector time elapses. It can be valuable to extend the vector length to evaluate the risk of collision with any target.

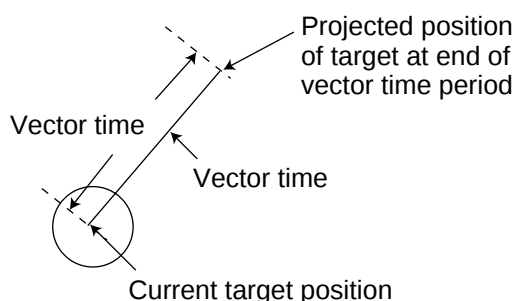


Figure 6-6 Vector description

1. Press the [RDR MENU/ESC] key.
2. Press [0], [5].
3. Select vector length among 30 sec, 1 min, 3 min, 6 min, 15 min and 30 min from the VECT. LENGTH field.
4. Select TRUE or RELATIVE from the VECTOR REF field.
5. Press the [RDR MENU/ESC] key.

6.8 Past Position Display

The ARP-10 displays equally time-spaced dots (maximum 10 dots) marking the past positions of any targets being tracked.

If a target changes its speed, the spacing will be uneven. If it changes the course, its plotted course will not be a straight line in TM mode.

To turn the past position display on/off:

1. Press the [RDR MENU/ESC] key.
2. Press [0], [5].
3. Select plotting interval among 15 sec, 30 sec, 1 min, 2 min, 3 min, and 6 min from the HISTORY field. (OFF turns off the past position display.)
4. Press the [RDR MENU/ESC] key.

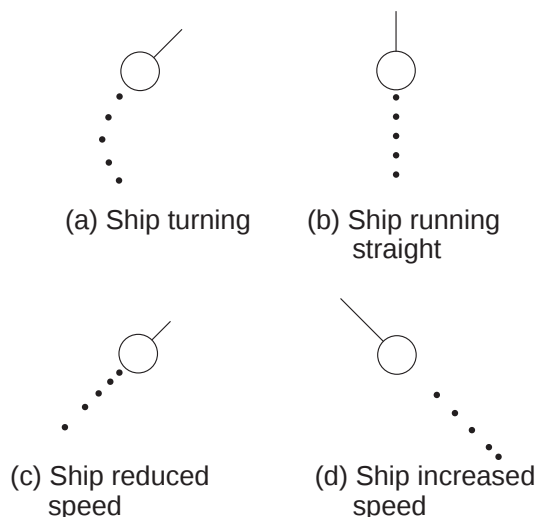


Figure 6-7 Past position display examples

6.9 CPA/TCPA Alarm

Visual and audible alarms are generated when the predicted CPA and TCPA of any target become less than their preset limits. Press the [CLR] key to acknowledge and silence the CPA/TCPA audible alarm.

The ARP-10 continuously monitors the predicted range at the Closest Point of Approach (CPA) and predicted time to CPA (TCPA) of each tracked target to own ship.

When the predicted CPA of any target becomes smaller than a preset CPA alarm range and its predicted TCPA less than a preset TCPA alarm limit, the ARP-10 releases an audible alarm. In addition, the target plot symbol changes to a triangle and flashes together with its vector and the message CPA ALARM appears.

Provided that this feature is used correctly, it will help prevent the risk of collision by alerting you to threatening targets. It is important that gain, A/C SEA, A/C RAIN and other radar controls are properly adjusted and the ARP-10 is set up so that it can track targets effectively.

CPA/TCPA alarm ranges must be set up properly taking into consideration the size, tonnage, speed, turning performance and other characteristics of own ship.

 **CAUTION**

The CPA/TCPA alarm should never be relied upon as a sole means for detecting the risk of collision. The navigator is not relieved of the responsibility to keep visual lookout for avoiding collisions, whether or not the radar or other plotting aid is in use.

Follow the steps shown below to set the CPA/TCPA alarm ranges:

1. Press [RDR MENU/ESC].
2. Press [0], [9].
3. Select PAGE 5.

ALARM SETTING				
PAGE	1	2	3	4 5
CAP SET	OFF	0.5	1	2
	3	4	5	6nm
TCPA SET	30sec	1min	2min	
	3min	4min	5min	
	6min	12min		
↓↑←→ : SELECT ENT : ENTER				
RDR : ESCAPE				

4. Select a CPA limit desired among 0.5 nm, 1 nm, 2 nm, 3 nm, 4 nm, 5 nm and 6 nm.
5. Select a TCPA limit among 30 sec, 1 min, 2 min, 3 min, 4 min, 4 min, 6 min, and 12 min.
6. Press the [RDR MENU/ESC] key to close the menu.

Silencing CPA/TCPA audible alarm, erasing visual alarm

Press the [CLR] key once to silence the audible alarm and again to erase the visual alarm.

6.10 Lost Target Alarm

When the system detects a lost target, the target symbol becomes a flashing diamond (◈) and tracking is discontinued one minute later. The normal plotting symbol is restored to the target when the target is manually acquired.

Figure 6-8 Alarm Setting menu, page 5

PLOTTER SECTION FEATURES

7.1 GPS Smoothing

GPS position smoothing

When the DOP or receiving condition is unfavorable, the GPS fix may change greatly, even if the vessel is dead in water. This change can be reduced by smoothing the raw GPS fixes. Note however that too high a setting slows response time to change in latitude and longitude. This phenomenon is especially noticeable at high ship's speeds. "00" is the normal setting; increase the setting if the GPS fix changes greatly. The higher the setting the more smoothed the raw data.

GPS speed smoothing

During position fixing, ship's velocity (speed and course) is directly measured by receiving GPS satellite signals. The raw velocity data may change randomly depending on receiving conditions and other factors. You can reduce this random variation by increasing the smoothing. Like with latitude and longitude smoothing, the higher the speed smoothing setting the more smoothed the raw data. If the setting is too high, however, the response to speed changes slows. For no smoothing, enter "00". "05" is suitable for most conditions.

Setting GPS smoothing

The default GPS smoothing settings are suitable for most all conditions. If change of the default settings is necessary, do the following:

1. Press [PLTR MENU/ESC], [0], [7].
2. Select PAGE 3.

SYSTEM SETTING						
PAGE	1	2	3	4	5	6
TIME DIFFERENCE	-13:30					
DISABLE SATELLITE	_____	_____	_____	_____	_____	_____
GPS SMOOTHING						
POSN :	00					
SPD :	05					
DATUMS	WGS84 TOKYO					
	OTHERS (001)					
↓ ↑ ← → : SELECT ENT : ENTER						
+/- : E, W PLTR : ESCAPE						

Figure 7-1 Plotter System Setting menu, page 3

3. Select POSN from the GPS SMOOTHING field.
4. Enter position smoothing time in two digits.
5. Select SPD and enter speed smoothing time in two digits.
6. Press the [ENT] key to register your selection followed by the [PLTR MENU/ESC] key to finish.

7.2 Geodetic Datum

A nautical chart is usually made by either trigonometrical survey or astronomical survey and according to the geodetic chart standards of the country it is used in. For example, the USA uses the system called Clarke; India, Everest, and Japan, Bessel. Accordingly when you are getting position fixes by GPS in the USA, the system should be Clarke so you don't get a position fix which shows you're somewhere offshore when you're actually moored to a dock.

While the use of one category of chart systems is fine if you don't do transoceanic voyages, ocean-going vessels may require all categories to get reliable position information. To solve this inconvenience, a standard chart system was adopted by GPS: the WGS-84.

Selecting chart system

Although the WGS-84 system is now widely used the other categories of charts still exist. Thus it is necessary to apply a correction value to the WGS-84 to match it to local geodetic systems.

The FRS-1000 can perform this calculation automatically if you tell it what type of chart you're using. Select the chart system used, not the area where your boat is sailing.

1. Press [PLTR MENU/ESC], [0], [7].
2. Select PAGE 3.

SYSTEM SETTING					
PAGE	1	2	3	4	5 6
TIME DIFFERENCE	-13:30				
DISABLE SATELLITE	_____	_____	_____		
	_____	_____	_____		
	_____	_____	_____		
GPS SMOOTHING					
POSN :	00				
SPD :	05				
DATUMS	WGS84		TOKYO		
	OTHERS (001)				
↓↑←→ : SELECT ENT : ENTER					
+/- : E, W PLTR : ESCAPE					

Figure 7-2 Plotter System Setting menu, page 3

3. Select the DATUMS field.
4. WGS-84 and Tokyo charts can be selected directly. For other charts, select OTHERS and key in three digit chart code referring to the Geodetic Chart List in the Appendix.
5. Press the [ENT] key to register your selection followed by the [PLTR MENU/ESC] key to finish.

7.3 Displaying Position in Loran LOPs

You can display own ship's position and cursor position in Loran C LOPs, as well as latitude and longitude. This function does not require connection of a Loran C receiver; Loran chain information is stored in the unit.

1. Press [PLTR MENU/ESC], [0], [7].
2. Select PAGE 2.

SYSTEM SETTING	
PAGE	1 2 3 4 5 6
POSITION DISPLAY L/L LC	
CHAIN	9970: 11-30
LOP 1	+000.0 μs
LOP 2	+000.0 μs
↓↑←→ : SELECT ENT : ENTER	
+/- : E, W PLTR : ESCAPE	

Figure 7-3 Plotter System Setting menu, page 2

3. Select LC from the POSITION DISPLAY field.
4. In the CHAIN field, key in the Loran C Chain and slave which you will use. Refer to the Loran C list in the Appendix.
5. If necessary, key in position offset in the LOP 1 and LOP 2 fields.
6. Press the [ENT] key.
7. Press the [PLTR MENU/ESC] key.

7.4 Bearing Display Reference

A navigation device outputs both true and magnetic bearings. A magnetic bearing is true bearing plus (or minus) earth's magnetic deviation. Thus the equation for finding magnetic bearing is;

true bearing – x (magnetic variation) = magnetic bearing

You can display your ship's course and bearing to waypoint in true or magnetic bearing.

Displaying true bearing

1. Press [PLTR MENU/ESC], [0], [7], and select PAGE 1.

SYSTEM SETTING					
PAGE	1	2	3	4	5 6
SCALE/RANGE	SCALE	RANGE			
REC RESOLUTION	2				
NAVAID	OWN GPS	EXT. GPS			
	LC	DE	All		
SMOOTHING	00				
SPEED AVERAGING	00 M				
BEARING REF	TRUE	MAG			
MAG VARIATION	AUTO	MANUAL			
VARIATION	00 °E				
↓ ↑ ← → : SELECT ENT : ENTER					
+/- : E, W PLTR : ESCAPE					

Figure 7-4 Plotter System Setting menu, page 1

2. Select BEARING REF.
3. Select MAG or TRUE as appropriate.
4. Press the [ENT] key. The bearing display shows "M" when you are using magnetic bearing.
5. Press the [PLTR MENU/ESC] key.

7.5 Magnetic Variation

The magnetic variations for all areas of the earth are preprogrammed into this unit. The preprogrammed variation is accurate for most instances, however you may wish to manually enter a variation to further refine accuracy.

1. Press [PLTR MENU/ESC], [0], [7], and select PAGE 1.
2. Select MAG VARIATION.
3. Select AUTO or MANUAL as appropriate.
4. If you selected MANUAL at step 3, enter magnetic variation referring to a nautical chart. Enter magnetic variation value and plus for East or minus for West. If the magnetic variation is plus 6 E, for example, press [0], [6] and [+].
5. Press the [PLTR MENU/ESC] key.

7.6 Reading Number of Track, Marks Used

1. Press [PLTR MENU/ESC], [0], [3].

ERASE TRACK/MARK			
ERASE	TRACK	MARK	TRACK+MARK
RANGE	AREA	OFF	ALL
TRACK USED		200/2800 pt	
MARK USED		300/3800 pt	
↓ ↑ ← → : SEL/ENTER PLTR : ESCAPE			

Figure 7-5 Erase Track/Mark screen

The display shows number of track and mark points used. In the example above, 200 out of 3800 points of track and 300 marks of 3800 marks have been used.

2. Press the [PLTR MENU/ESC] key to close the menu.

7.7 Smoothing, Speed Averaging

The track shown on the display may show irregular track plotting (solid line) even though the ship is running straight. This is due to navaid signal variation. To smooth this track, the "Weight Factor" given to new position data compared to previous fixes should be changed.

For instance, number 03 provides a weighting factor of 13/16 for new data and 3/16 for previous data. The higher the smoothing number, the slower the position updating becomes.

Calculations such as ETA and TTG are based on an average ship's speed over a given period. If the period is too long and ship's speed is changed suddenly, calculation error will result. If ETA and TTG show error change the speed averaging setting to compensate for the error.

1. Press [PLTR MENU/ESC], [0], [7], and select PAGE 1.
2. Enter smoothing rate in the SMOOTHING field.
3. Enter speed averaging figure in the SPD AVERAGING field.
4. Press the [PLTR MENU/ESC] key.

7.8 Selecting Navaid

Navigation data can be fed from the internal GPS receiver or external navigator. The default navaid setting is the internal GPS receiver.

To select an external navaid;

1. Press [PLTR MENU/ESC], [0], [7], and select PAGE 1.
2. Select navaid to use from the NAVAID field.
3. Press the [PLTR MENU/ESC] key.

7.9 Recording Resolution

When the plotting interval is automatic you may set the number of dots to record. The equation for determining the number of dots to record is 5×2^k (k is setting value). For example, if the recording resolution is set for "2", the number of dots to record per plotting interval would be 20; $5 \times 2^2 = 20$ (dots).

1. Press [PLTR MENU/ESC], [0], [7], and select PAGE 1.
2. Enter recording resolution in the REC RESOLUTION field, referring to the above formula.
3. Press the [PLTR MENU/ESC] key.

7.10 Using Local Time

The GPS uses UTC time. If you would rather use local time enter the difference in hours between local time and UTC. Use the [+/-] key to enter minus or plus time.

1. Press [PLTR MENU/ESC], [0], [7].
2. Select PAGE 3.

SYSTEM SETTING						
PAGE	1	2	3	4	5	6
TIME DIFFERENCE	-13:30					
DISABLE SATELLITE	_____		_____		_____	
	_____		_____		_____	
GPS SMOOTHING						
POSN :	00					
SPD :	05					
DATUMS	WGS84		TOKYO			
	OTHERS (001)					
↓ ↑ ← → : SELECT ENT : ENTER						
+/- : E, W			PLTR : ESCAPE			

Figure 7-6 Plotter System Settings menu, page 3

3. Enter time difference between local time and UTC time(-13:30~+13:00).
4. Press the [PLTR MENU/ESC] key.

7.11 Uploading, Downloading Data from/to a PC

Uploading data from a PC

Data can be uploaded from a PC.

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [5], and [5] to display the UPLOAD SETTING menu.

UPLOAD SETTING	
BAUD RATE	19200bps
DATA	WPT WPT/ROUTE
UPLOAD	STOP START

↓↑←→ : SELECT ENT : ENTER
PLTR : ESCAPE

Figure 7-7 Upload Setting menu

3. Select the BAUD RATE field and set baud rate with the omnipad.
4. Select data to upload from the DATA field; waypoints, or waypoints and routes.
5. Select START from the UPLOAD field. You are informed that all data will be erased.
6. Press the [ENT] key to start, or any key to escape. The screen shows what data is being uploaded (selected at step 4).
7. Save data at the computer.
8. Press the [PLTR MENU/ESC] key. The screen informs whether the uploading was successful or not.
9. Press any key.
10. Press the [PLTR MENU/ESC] key.

To cancel uploading while it is in process do the following:

1. Press any key. Are you asked if it is OK to stop uploading.
2. Press the [ENT] key to stop uploading, or any key to escape. The display shows results of uploading.
3. Press any key.
4. To continue uploading change Stop to Start.
5. Press the [ENT] key.

Downloading data to a PC

Data can be downloaded to a PC.

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [5], [6] to display the DOWNLOAD SETTING menu.

DOWNLOAD SETTING	
BAUD RATE	19200bps
DATA	WPT/ROUTE
DOWNLOAD	STOP START

↓↑←→ : SELECT ENT : ENTER
PLTR : ESCAPE

Figure 7-8 Download Setting menu

3. Select the BAUD RATE field and set baud rate with the omnipad.
4. Select START from the DOWNLOAD field. You are asked if you are ready to download.
5. Save data at the computer.
6. Press the [ENT] key. The screen shows what data is being downloaded.
7. When the data has been downloaded, press the [PLTR MENU/ESC] key to finish.

7.12 DGPS Setup

The processor unit can accommodate an DGPS beacon receiver (option) which further refines position accuracy. Set up the receiver as follows:

1. Press [PLTR MENU/ESC], [0], [7].
2. Select PAGE 5.

SYSTEM SETTING						
PAGE	1	2	3	4	5	6
DGPS	OFF		ON			
BAUD RATES	4800		9600			
REF. STATION	AUTO		MANUAL			
FREQ.	283.5kHz					
BAUD RATE	25	50	100			
	150	200				
↓ ↑ ← → : SELECT ENT : ENTER +/- : E, W PLTR : ESCAPE						

Circumscribed items shown when Manual is selected from Ref. Station field.

Figure 7-9 Plotter System Settings menu, page 5

3. Select ON from the DGPS field.
4. Set the baud rate of the DGPS beacon receiver from the BAUD RATES field.
5. From the REF. STATION field, select how you want to choose reference station; AUTO or MANUAL. For AUTO, go to step 7.
6. If you selected MANUAL at step 5, enter frequency and baud rate of reference station (standard baud rate is 4800 bps) you will use.
7. Press the [PLTR MENU/ESC] key to finish.

7.13 Outputting Position Data

You may output position data to an autopilot navaid, or remote display as follows:

1. Press [PLTR MENU/ESC], [0], [7].
2. Select PAGE 2.

SYSTEM SETTING						
PAGE	1	2	3	4	5	6
OUTPUT FORMAT	NMEA183V1.5		V2.0			
	NMEA180					
EXT. DEVICE	AUTOPILOT		NAVAID			
	REMOTE					
POSITION DISPLAY	L/L		L/C			
↓ ↑ ← → : SELECT ENT : ENTER +/- : E, W PLTR : ESCAPE						

Figure 7-10 Plotter System Settings menu, page 2

3. Select output format of the external equipment from the OUTPUT FORMAT field. (If you are unsure of actual format version, try several and select the one which correctly outputs data.)
4. Select type of external device from the EXT. DEVICE field.
5. Press the [PLTR MENU/ESC] key to finish.

7.14 Selecting Nav Data

The FRS-1000 offers two nav data displays: a comprehensive data display and one with fewer data but in large characters.

1. Press [PLTR MENU/ESC], [0], [7].
2. Select PAGE 6.

SYSTEM SETTING						
PAGE	1	2	3	4	5	6
NAV DISPLAY	NAV1		NAV2			
RESET TRIP	NO		YES			
↓ ↑ ← → : SELECT ENT : ENTER +/- : E, W PLTR : ESCAPE						

Figure 7-11 Plotter System Setting menu, page 6

3. Select NAV1 (comprehensive display) or NAV2 (basic data, large characters) from the NAV field.
4. Press the [PLTR MENU/ESC] key to finish.

7.15 Resetting Trip Distance

1. Press [PLTR MENU/ESC], [0], [7].
2. Select PAGE 6.
3. Select YES from the RESET TRIP field.
4. Press the [PLTR MENU/ESC] key to finish.

7.16 Deselecting Unhealthy Satellites

Each time the FRS-1000 is switched on the GPS receiver receives the Almanac from GPS satellites. The Almanac contains position information on all GPS satellites, including those which are malfunctioning. Using the Almanac, the GPS receiver automatically eliminates any malfunctioning satellite from the GPS satellite schedule. However, the Almanac sometimes may not contain information about malfunctioning satellites. If you hear about a malfunctioning satellite you may deselect it manually as follows:

1. Press [PLTR MENU/ESC], [0], [7].
2. Select PAGE 3.

SYSTEM SETTING						
PAGE	1	2	3	4	5	6
TIME DIFFERENCE	-13:30					
DISABLE SATELLITE	_____		_____		_____	
	_____		_____		_____	
	_____		_____		_____	
GPS SMOOTHING						
POSN :	00					
SPD :	05					
DATUMS	WGS84		TOKYO			
	OTHERS (001)					
↓ ↑ ← → : SELECT ENT : ENTER +/- : E, W PLTR : ESCAPE						

Figure 7-12 Plotter System Setting menu, page 3

3. Select vacant location on the DISABLE SATELLITE field and press the [1] or [2] key to display satellite number.
4. Press the [PLTR MENU/ESC] key to finish.

MAINTENANCE & TROUBLESHOOTING

Regular maintenance is important for continued performance. Following the recommended maintenance procedures will keep your equipment in good condition for years to come.

**WARNING**



ELECTRICAL SHOCK HAZARD
Do not open the equipment.

Only qualified personnel should work inside the equipment.



Turn off the equipment before performing any maintenance on the radar antenna unit.

Serious injury can result if someone is struck by the rotating antenna.

8.1 Preventive Maintenance

Table 8-1 Preventive maintenance

Item	Check Point	Remedy, Caution
General		
Display screen	Dust and foreign material on the display unit and display screen.	Dust on the display dims the picture. Dust may be removed with a soft cloth. If necessary anti-static cleaner may be used. Never use chemical solvents to clean the display; they can remove paint and markings.
Ground terminal	Check for tight connection and corrosion.	Clean or replace as necessary.
Display unit connectors	Check for tight connection.	Tighten loosened connectors.

(Continued on next page)

Table 8-1 Preventive maintenance (con't)

Item	Check Point	Remedy, Caution
Radar		
Antenna unit fixing bolts and nuts	Check that all fixing bolts and nuts are firmly tightened and are free of corrosion.	Tighten loosened bolts and nuts. Replace heavily corroded parts. Coat newly replaced parts with silicone sealant.
Antenna radiator (radome)	Check for dirt and cracks on radiator (radome) surface. Thick dirt should be wiped off with soft cloth dampened with fresh water. If a crack is found, apply a slight amount of sealing compound or adhesive as a temporary remedy, then call for repair.	Do not use plastic solvent (acetone) for cleaning. If you need to remove ice from antenna unit, use a wooden hammer or plastic head hammer. Crack on the unit may cause water ingress, causing serious damage to internal circuits.
GPS Plotter		
Antenna	Check for loosened and corroded bolts.	Tighten loosened bolts. Replace heavily corroded bolts.
Antenna cable	• Check connection point for watertightness. • Check connector for tightness and corrosion. • Check cable for damage.	Replace damaged parts.
Sounder		
Transducer	Check for marine life on transducer face each time the boat is docked.	Carefully remove any marine life with a piece of wood or sandpaper.

8.2 Replacement of Fuse

A 15A fuse in the power cable protects the equipment from overcurrent, overvoltage and equipment fault. If the fuse blows, find the cause before replacing it. If the fuse blows after replacement, call for service.

 CAUTION
Use the proper fuse. Use of a wrong fuse can cause fire or equipment damage.

8.3 Replacement of Magnetron

The life of the magnetron is as shown in the table below. When the life of the magnetron is reached, output power is greatly reduced and distant radar targets are difficult to see. When the radar is exhibiting the above-mentioned symptoms contact a FURUNO dealer for replacement of the magnetron.

Table 8-2 Magnetron life

Model	Magnetron	Code No.	Life*
FRS-1000A	E3571	000-137-529	About 3000 hrs.
	MG5248	000-116-121	
	MAF1421B	—	
FRS-1000B	E3571	000-137-529	
FRS-1000C	E3560	000-139-050	
	MG5389	000-135-146	

* Including stand-by hours.

8.4 Replacement of Batteries

The battery icon (🔋) appears on the display when the voltage of the memory card battery or the battery on a circuit board in the processor unit is low. The life of the memory card battery is about three years. For replacement of the battery on the circuit board, see your dealer.

Table 8-3 Battery ordering information

Battery Location	Battery Type	Code No.
Memory Card	CR2025	000-141-093
Circuit Board 02P6223 in Processor Unit	BR-2/3AE2P	000-123-713

 CAUTION
Use only the recommended battery type. Use of other types may result in explosion.

Replacement of battery in memory card

- Slide the stopper on the memory card leftward.
- Pull out the battery case and remove the battery.

Note: Replace the battery within 10 minutes to prevent loss of data.

- Insert new battery to case plus (+) side up.
- Insert battery case to memory card.

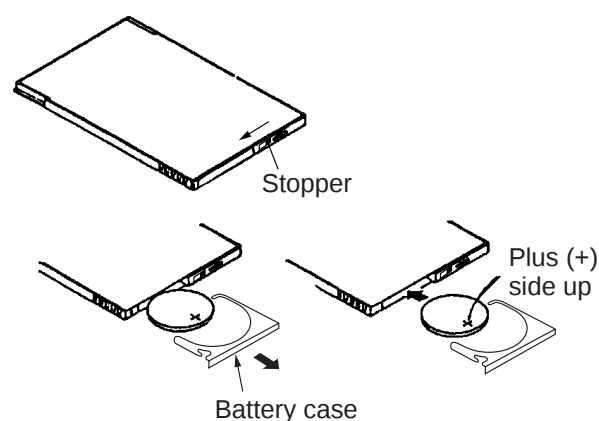


Figure 8-1 Replacement of memory card battery

8.5 Troubleshooting Table

The troubleshooting table below provides simple troubleshooting procedures which the user may follow to restore normal operation. If you cannot restore normal operation, contact a FURUNO agent or dealer.

Table 8-4 Troubleshooting table

If...	But...	Then...
General		
you cannot turn on the power		check for blown fuse.
		check that the power connector is firmly tightened.
		check for corrosion on power cable connector.
		check for damaged power cable.
		check ship's mains for proper voltage.
power is on but nothing appears		press the [BRILL] key to raise display brilliance.
there is no response when a key is pressed		turn on the power again.
If a key is pressed but nothing happens		key may be faulty. Request service.
Radar		
If the power is on	characters are distorted	request service.
the radar has warmed up and you tried to transmit	the antenna does not rotate	the problem may be in antenna unit. Request service.
	characters and indications are abnormal	have a qualified technician check the set.
you have adjusted the gain with A/C RAIN and A/C SEA off	neither noise nor targets appear (indications and markers do)	check signal cable for damage.
	neither indications nor markers appear (noise and targets do)	check the signal cable for damage.
	the sweep (radial line sweeping around the display) is not synchronized with antenna rotation	the problem may be in the antenna unit. Request service.
	there is no change in sensitivity	request service.

(Continued on next page)

Table 8-4 Troubleshooting table (con't)

If...	Then...
Sounder	
no picture but marks and characters appear	check if picture advance speed is set to "0."
	check for loosened transducer connector.
picture appears but no zero line	range is shifted; set shifting to zero to correct.
picture sensitivity is too low	check gain setting, if using manual operation.
	marine life or air bubbles may be clinging to transducer face.
	water may be dirty.
	bottom may be too soft to return a suitable echo.
depth is not displayed	adjust gain to display bottom echo in reddish brown.
	correctly display bottom echo on the display.
noise or interference obstructs the display	check to be sure transducer cable is not near ship's engine.
	check ground.
	other video sounders may be operating nearby and on same frequency.
water temperature graph appears but no or wrong readout	check for loosened sensor cable.
GPS Plotter	
position is not fixed within 10 minutes	check for loosened antenna connector.
	check for frequency deviation of GPS receiver.
	check that three satellites are being received; three filled squares should appear at the top right-hand corner on the display.
position is wrong	check that the correct geodetic chart system is selected.
	enter chart offset value.
track is not plotted	plotting is stopped. "H" appears on the display in this case.
bearing is wrong	check that correct magnetic compensation is entered.
Loran LOPs do not appear	check that proper Loran chain codes are entered.
Loran LOPs are wrong	enter correction value.
ship's speed display is not zero after ship is stopped	try to decrease ship speed smoothing setting.

8.6 Diagnosis

The self tests check the equipment for proper operation. Whenever you feel the equipment is not operating normally, run appropriate self test to identify the problem. If you cannot restore normal operation, do not attempt to check inside the unit. There are no user-serviceable parts inside.

Memory, I/O test

This test is available for checking the memory and I/O circuits of each of the radar & ARP, plotter and sounder sections.

Radar & ARP section

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [6] (DIAGNOSTIC).

DIAGNOSTIC
1. GPS MONITOR DISPLAY
2. RADAR & ARP
3. SOUNDER
4. PLOTTER
5. KEYBOARD
6. DISPLAY TEST
7. PROGRAM VER. NO.
8. FACTORY CHECK
↓↑ : SELECT ENT : ENTER PLTR : ESCAPE

Figure 8-2 Diagnostic menu

3. Press the [2] key.

RADAR & ARP
1. MEMORY, I/O PORT
↓↑ : SELECT ENT : ENTER PLTR : ESCAPE

Figure 8-3 Radar & ARP menu

4. Press the [1] key to start the test.

RADAR MEMORY, I/O TEST	
PROM	= OK
SRAM	= OK
ARP	= OK
→ Appears when fitted with ARP-10 Board.	
Press any key to return to Diagnostic Menu.	

Figure 8-4 Radar memory, I/O test result

The test results appears: OK for normal operation; NG (No Good) for error. If NG appears, contact a FURUNO agent for advice.

5. Press the [PLTR MENU/ESC] key twice to quit the self test.

Plotter section

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [6], [4], [1] to start the test.

PLOTTER MEMORY, I/O TEST	
PROM	= OK
SRAM	= OK
TEXT VRAM	= OK
DISP VRAM	= OK
BATTERY	= OK
SIO	= OK
GPS	= OK
DGPS	= OK
Press any key to return to Diagnostic Menu.	

Figure 8-5 Plotter test results

The test results appears: OK for normal operation; NG (No Good) for error. If NG appears, contact a FURUNO agent for advice.

Note: Requires test connector, otherwise NG appears.

- 3. Press the [PLTR MENU/ESC] key twice to quit the self test.

Sounder section

- 1. Press the [PLTR MENU/ESC] key.
- 2. Press [0], [6], [3], [1] to start the test.

SOUNDER MEMORY, I/O TEST		
RAM	=	OK
VRAM	=	OK
Press any key to return to Diagnostic Menu.		

Figure 8-6 Sounder section test results

- 3. Press the [PLTR MENU/ESC] key twice to quit the self test.

Color test

This test displays a test pattern to check for proper display of colors in the plotter and sounder displays.

Plotter section

- 1. Press the [PLTR MENU/ESC] key.
- 2. Press [0], [6], [4], [2] to start the test.

PLOTTER TEST PATTERN							
B K G D	R E D	Y E L L O W	G R E E N	L I G H T B L U E	P U R P L E	B L U E	W H I T E
Press any key to return to Diagnostic menu.							

Figure 8-7 Plotter section color test

- 3. Press the [PLTR MENU/ESC] key twice to quit the self test.

Sounder section

- 1. Press the [PLTR MENU/ESC] key.
- 2. Press [0], [6], [3], [2].

SOUNDER TEST PATTERN							
B K G D	R E D	Y E L L O W	G R E E N	L I G H T B L U E	P U R P L E	B L U E	W H I T E
Press any key to return to Diagnostic menu.							

Figure 8-8 Sounder section color test

- 3. Press the [PLTR MENU/ESC] key twice to quit the self test.

Keyboard test

This checks keys and controls of the display unit and the remote controller.

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [6], [5] to display the keyboard test screen.

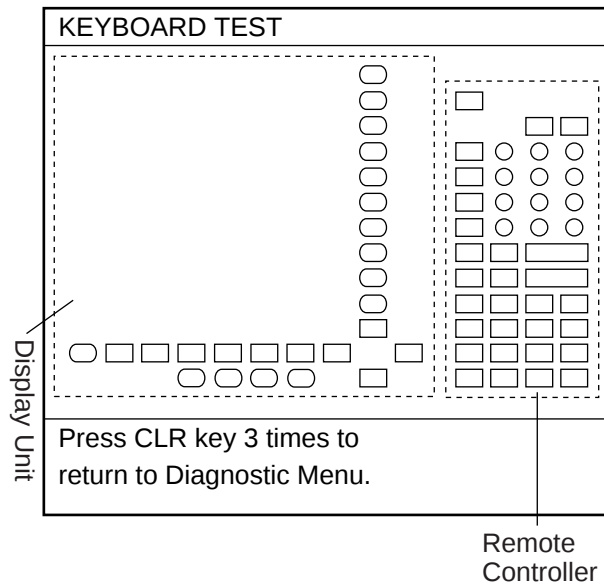


Figure 8-9 Keyboard, remote controller test

3. Press any key except the [POWER] switch. The pressed key's corresponding location on the screen lights if the key is operating normally.
4. Press the [CLR] key three times to quit the self test.
5. Press the [PLTR MENU/ESC] key to escape.

Display test

This test checks the display section. Remove the chart card before starting this test.

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [6], [6] to show the display test.
3. Press the [ENT] key. Press the key again to switch the display. Each press changes the display as below.

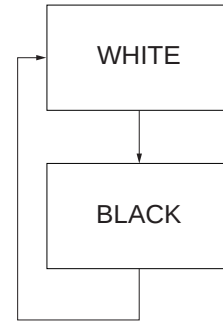


Figure 8-10 Display test

4. Press the [PLTR MENU/ESC] key twice to quit the display test.

8.7 Satellite Monitor Display

The satellite monitor display shows information about GPS satellites. You can display it as follows:

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [6], [1] to display the Satellite Monitor Display.

SATELLITE MONITOR							
POSITNG MODE GPS 3D ALT. 123 M							
DOP 1.2							
DGPS DATA : -- BEACON STATN --							
SV CONDITION							
NO.	ELV	AZM	SNR	NO.	ELV	AZM	SNR
23	77	278	40	01	21	303	30
12	16	042	70	17	18	220	50
29	30	100	40	26	27	095	35
27	50	050	60	05	52	142	60
SS: 60*				SN: 21**			
Press any key to return to MENU.							

* SS = Signal Strength. A figure between 1 and 84 is displayed. The higher the value the stronger the signal.

** SN = Signal to Noise Ratio. A figure between 1 and 22 is displayed. When the value becomes less than 20, error is included in the correction data. When the ship is in the service area of a beacon station, this value should be 21 or 22. If not, the problem may lie with grounding, radar interference or generator on board own boat.

Figure 8-11 Satellite monitor display

3. Press the [PLTR MENU/ESC] key twice to quit the satellite monitor display.

8.8 Confirming Program Version No.

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [6], [7] to show the PROGRAM VERSION NO. display.

GPS section program no.
Plotter program no.

PROGRAM VER. NO.		
→ PLOTTER	No.	02522760**
→ GPS	No.	48501030**
→ DGPS	No.	08501781**
	No.	08501791**
→ RADAR	No.	02522810**
→ ARP	No.	18590271**
→ SOUNDER	No.	02522820**

Press any key to return to Diagnostic Menu.

Sounder program no. **: Version No.
ARP program no.
Radar program no.
DGPS program no.
(Requires DGPS Beacon Receiver Board.)

Figure 8-12 Program version no. display

8.9 Clearing Memories

The FRS-1000 has four memories, plotter, sounder, GPS, radar, and they can be cleared collectively or individually to start afresh. To clear memories do the following:

1. Press the [PLTR MENU/ESC] key.
2. Press [0], [7], and select PAGE 4.

SYSTEM SETTING						
PAGE		1	2	3	4	5 6
POSITION OFFSET 00.000N						
00.000W						
BACK TO DEFAULTS	NO	ALL				
		PLOTTER		RADAR		
		GPS RCVR		SOUNDER		
↓ ↑ ← → : SELECT ENT : ENTER						
+/- : E, W PLTR : ESCAPE						

Figure 8-13 Plotter System Setting, page 4

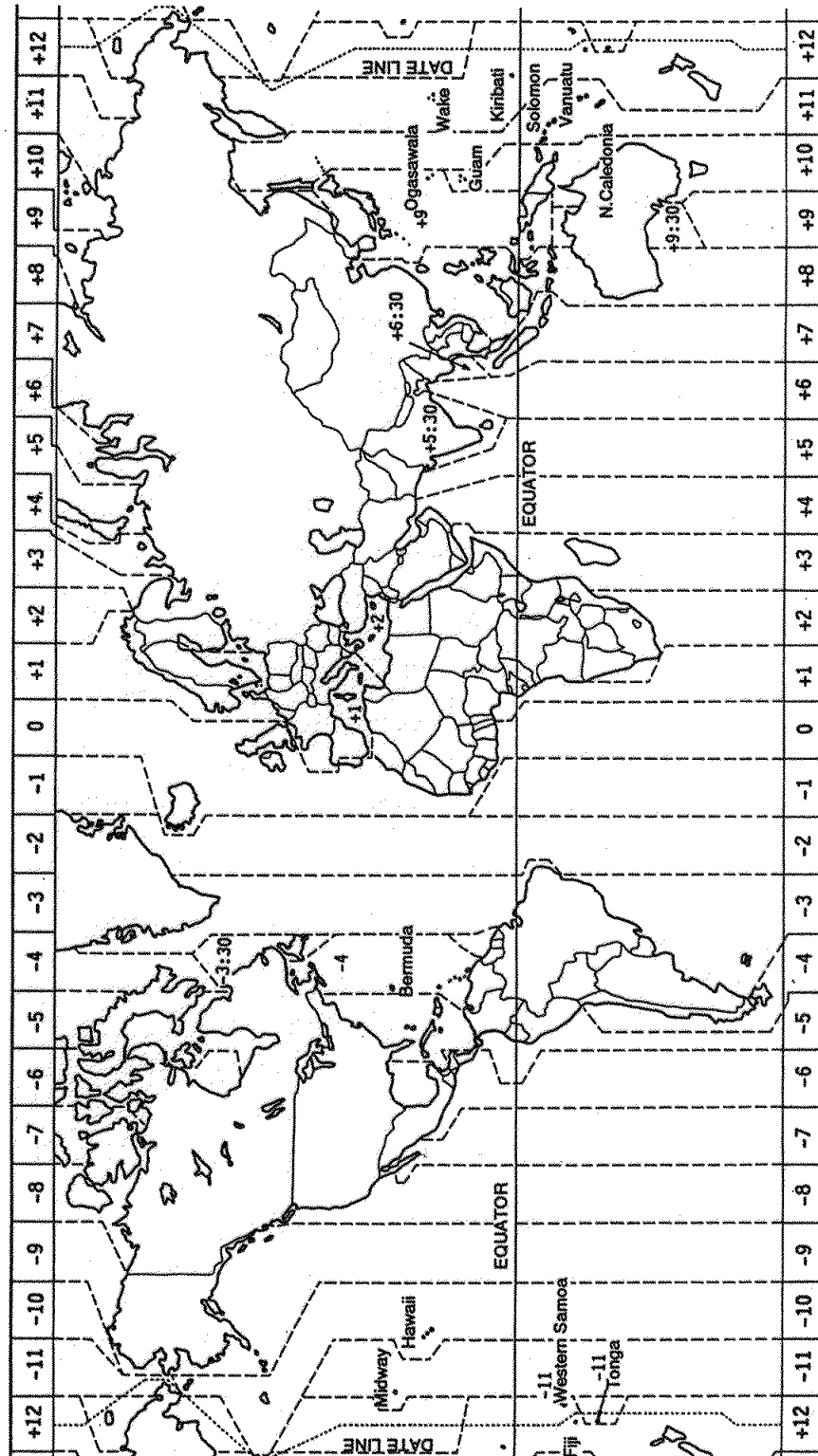
3. From the BACK TO DEFAULTS field, use the omnipad to select the memory to clear.
4. Press the [ENT] key. You are asked if you are sure to clear memory selected at step 3.
5. Press the [ENT] key. To cancel, press any key.
6. Turn the power off and on again.

8.10 Error Messages

Below is a list of error messages and their meanings.

Table 8-4 Error messages

Error Message	Meaning
Alarms	
No Fix - Acquiring	GPS receiver is acquiring data from satellites in view.
No Fix - Rcptn blkcd by objt	An object (mast, etc.) between the GPS receiver and satellite is blocking reception.
No Fix - No GPS sat in sight	No satellites within view of the GPS receiver.
No Fix - Receiving almanac	GPS receiver is receiving the almanac to find position.
No Fix - Cold start	Appears when the power is turned on for the first time or the memory is cleared.
DGPS ERR	DGPS data error or DGPS reference station error.
Backup Memory Error	Voltage of battery on circuit board 02P6223 is low.



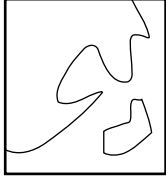
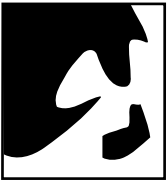
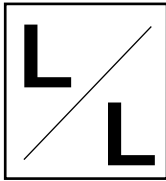
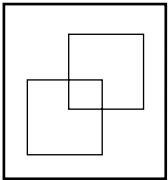
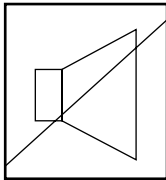
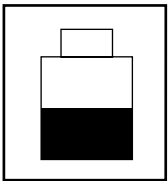
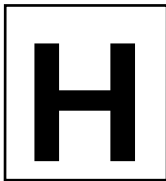
Geodetic Chart List

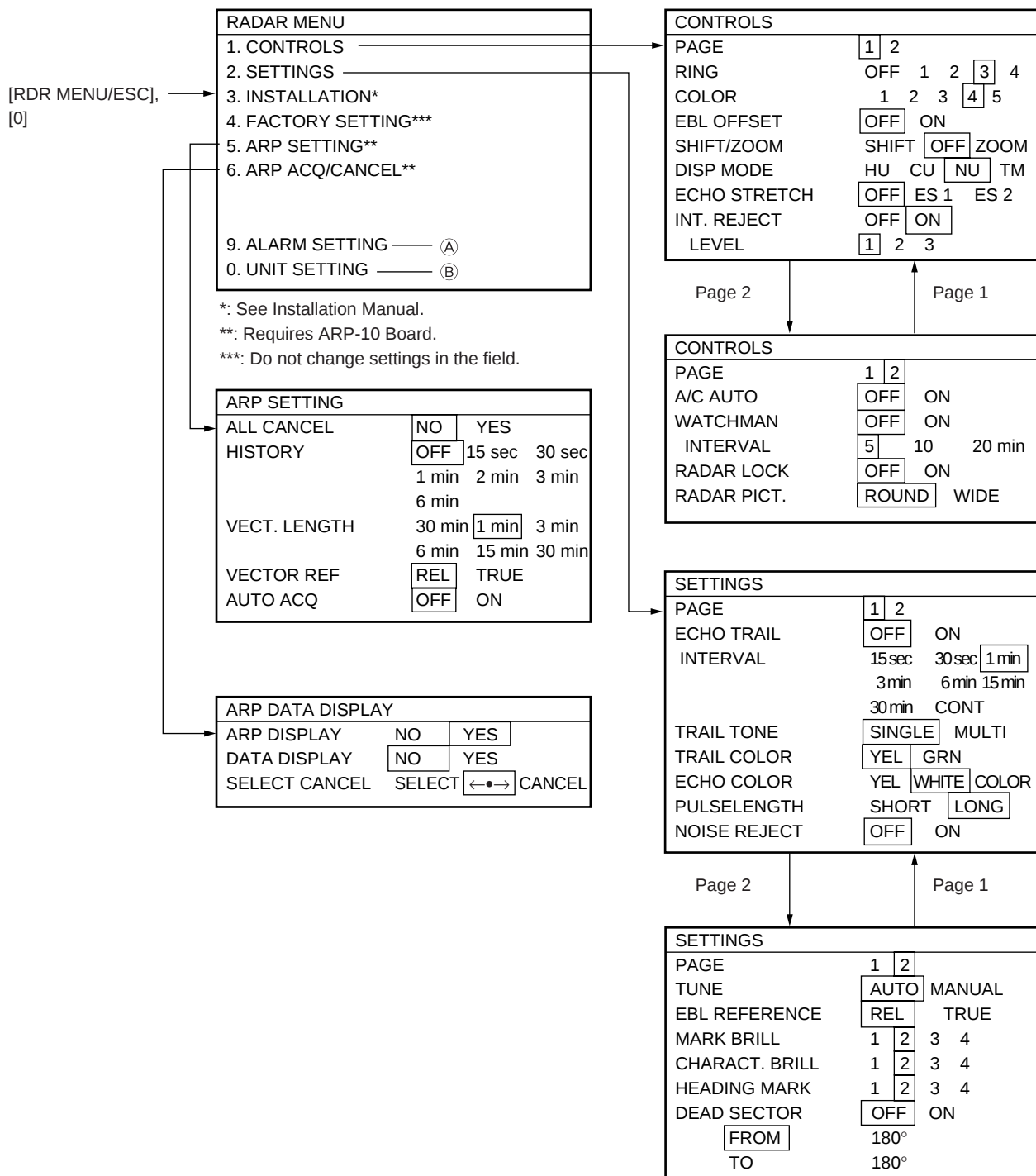
001:	WGS84		096:		: Manitoba & Ontario
002:	WGS72		097:		: Northwest Territories & Saskatchewan
003:	TOKYO	: Mean Value (Japan, Korea & Okinawa)	098:		: Yukon
004:	NORTH AMERICAN 1927	: Mean Value (CONUS)	099:		: Canal Zone
005:	EUROPEAN 1950	: Mean Value	100:		: Caribbean
006:	AUSTRALIAN GEODETIC 1984	: Australia & Tasmania	101:		: Central America
007:	ADINDAN	: Mean Value (Ethiopia & Sudan)	102:		: Cuba
008:		: Ethiopia	103:		: Greenland
009:		: Mali	104:		: Mexico
010:		: Senegal	105:	NORTH AMERICAN 1983	: Alaska
011:		: Sudan	106:		: Canada
012:	AFG	: Somalia	107:		: CONUS
013:	AIN EL ABD 1970	: Bahrain Is.	108:		: Mexico, Central America
014:	ANNA 1 ASTRO 1965	: Cocos Is.	109:	OBSERVATORIO 1966	: Corvo & Flores Islands (Azores)
015:	ARC 1950	: Mean Value	110:	OLD EGYPTIAN 1930	: Egypt
016:		: Botswana	111:	OLD HAWAIIAN	: Mean Value
017:		: Lesotho	112:		: Hawaii
018:		: Malawi	113:		: Kauai
019:		: Swaziland	114:		: Maui
020:		: Zaire	115:		: Oahu
021:		: Zambia	116:	OMAN	: Oman
022:		: Zimbabwe	117:	ORDNANCE SURVEY OF GREAT BRITAIN 1936: Mean Value	
023:	ARC 1960	: Mean Value (Kenya & Tanzania)	118:		: England
024:		: Kenya	119:		: England, Isle of Man & Wales
025:		: Tanzania	120:		: Scotland, & Shetland Islands
026:	ASCENSION IS. 1958	: Ascension Is.	121:		: Wales
027:	ASTRO BEACON "E"	: Iwo Jima Is.	122:	PICO DE LAS NIVIES	: Canary Islands
028:	ASTRO B4 SOR. ATOLL	: Tern Is.	123:	PITCAIRN ASTRO 1967	: Pitcairn Is.
029:	ASTRO POS 71/4	: St. Helena Is.	124:	PROVISIONS SOUTH CHILEAN 1963: South Chile (near 53° S)	
030:	ASTRONOMIC STATION 1952	: Marcus Is.	125:	PROVISIONAL SOUTH AMERICAN 1956: Mean Value	
031:	AUSTRALIAN GEODETIC 1966	: Australia & Tasmania	126:		: Bolivia
032:	BELLEVUE (IGN)	: Efate & Erromango Islands	127:		: Chile-Northern Chile (near 19° S)
033:	BERMUDA 1957	: Bermuda Islands	128:		: Chile-Southern Chile (near 43° S)
034:	BOGOTA OBSERVATORY	: Columbia	129:		: Columbia
035:	GAUPO INCHAUSPE	: Argentina	130:		: Ecuador
036:	CANTON IS. 1966	: Phoenix Islands	131:		: Guyana
037:	CAPE	: South Africa	132:		: Peru
038:	CAPE CANAVERAL	: Mean Value (Florida & Bahama Islands)	133:		: Venezuela
039:	CARTHAGE	: Tunisia	134:	PUERTO RICO	: Puerto Rico & Virgin Islands
040:	CHATHAM 1971	: Chatham Is. (New Zealand)	135:	QATAR NATIONAL	: Qatar
041:	CHUA ASTRO	: Paraguay	136:	QORNOQ	: South Greenland
042:	CORREGO ALEGRE	: Brazil	137:	ROME 1940	: Sardinia Islands
043:	DJAKARTA (BATAVIA)	: Sumatra Is. (Indonesia)	138:	SANTA BRAZ	: Sao Mague, Santa Maria Islands (Azores)
044:	DOS 1968	: Gizo Is. (New Georgia Is.)	139:	SANTO (DOS)	: Espirito Santo Is.
045:	EASTER IS. 1967	: Easter Is.	140:	SAPPER HILL 1943	: East Falkland Is.
046:	EUROPEAN 1950 (Cont'd)	: Western Europe	141:	SOUTH AMERICAN 1969	: Mean Value
047:		: Cyprus	142:		: Argentina
048:		: Egypt	143:		: Bolivia
049:		: England, Scotland, Channel & Shetland Islands	144:		: Brazil
050:		: England, Ireland, Scotland, & Shetland Islands	145:		: Chile
051:		: Greece	146:		: Columbia
052:		: Iran	147:		: Ecuador
053:		: Italy, Sardinia	148:		: Guyana
054:		: Italy, Sicily	149:		: Paraguay
055:		: Norway & Finland	150:		: Peru
056:		: Portugal & Spain	151:		: Trinidad & Tobago
057:	EUROPEAN 1979	: Mean Value	152:		: Venezuela
058:	GANDAJIKA BASE	: Republic of Maldives	153:	SOUTH ASIA	: Singapore
059:	GEODETIC DATUM 1949	: New Zealand	154:	SOUTHEAST BASE	: Porto Santo & Madeira Islands
060:	GUAM 1963	: Guam Is.	155:	SOUTHWEST BASE	: Faial, Graciosa, Pico, Sao Jorge, & Terceira Is.
061:	GUX 1 ASTRO	: Guadalcanal Is.	156:	TIMBALAI 1948	: Brunei & East Malaysia (Sarawak & Sadah)
062:	HJORSEY 1955	: Iceland	157:	TOKYO	: Japan
063:	HONG KONG 1363	: Hong Kong	158:		: Korea
064:	INDIAN	: Thailand & Vietnam	159:		: Okinawa
065:		: Bangladesh, India & Nepal	160:	TRISTAN ASTRO 1968	: Tristan da Cunha
066:	IRELAND 1965	: Ireland	161:	VITI LEVU 1916	: Viti Levu Is. (Fiji Islands)
067:	ISTS 073 ASTRO 1969	: Diego Garcia	162:	WAKE-ENIWETOK 1960	: Marshall Islands
068:	JOHNSTON IS. 1961	: Johnston Is.	163:	ZANDERIJ	: Surinam
069:	KANDAWALA	: Sri Lanka	164:	BUKIT RIMPAH	: Bangka & Belitung Islands (Indonesia)
070:	KERGUELEN IS.	: Kerguelen Is.	165:	CAMP AREA ASTRO	: Camp Mcmurdo Area, Antarctica
071:	KERTAU 1948	: West Malaysia & Singapore	166:	G. SEGARA	: Kalimantan Is. (Indonesia)
072:	LA REUNION	: Mascarene Is.	167:	HERAT NORTH	: Afghanistan
073:	L. C. 5 ASTRO	: Cayman Brac Is.	168:	HU-TZU-SHAN	: Taiwan
074:	LIBERIA 1964	: Liberia	169:	TANANARIVE OBSERVATORY 1925:	Madagascar
075:	LUZON	: Philippines (excl. Mindanao Is.)	170:	YACARE	: Uruguay
076:		: Mindanao Is.	171:	RT-90	: Sweden
077:	MAHE 1971	: Mahe Is.			
078:	MARCO ASTRO	: Salvage Islands			
079:	MASSAWA	: Eritrea (Ethiopia)			
080:	MERCHICH	: Morocco			
081:	MIDWAY ASTRO 1961	: Midway Is.			
082:	MINNA	: Nigeria			
083:	NAHRWAN	: Masirah Is. (Oman)			
084:		: United Arab Emirates			
085:		: Saudi Arabia			
086:	NAMIBIA	: Namibia			
087:	MAPARIMA, BWI	: Trinidad & Tobago			
088:	NORTH AMERICAN 1927	: Western United States			
089:		: Eastern United States			
090:		: Alaska			
091:		: Bahamas (excl. San Salvador Is.)			
092:		: Bahamas, San Salvador Is.			
093:		: Canada (incl. Newfoundland Is.)			
094:		: Alberta & British Columbia			
095:		: East Canada			

Loran C Chains

Chain	GRI	S1	S2	S3	S4	S5
Central Pacific	4990	11	29	–	–	–
Canadian East Coast	5930	11	25	38	–	–
Commando Lion (Korea)	5970	11	31	42	–	–
Canadian West Coast	5990	11	27	41	–	–
South Saudi Arabia	7170	11	26	39	52	–
Labrador Sea	7930	11	26	–	–	–
Eastern Russia	7950	11	30	46	61	–
Gulf of Alaska	7960	11	26	44	–	–
Norwegian Sea	7970	11	26	46	60	–
Southeast USA	7980	11	23	43	59	–
Mediterranean Sea	7990	11	29	47	–	–
Western Russia	8000	10	25	50	65	–
North Central USA	8290	11	27	42	–	–
North Saudi Arabia	8990	11	25	40	56	69
Great Lakes	8970	11	28	44	59	–
South Central USA	9610	11	25	40	52	65
West Coast USA	9940	11	27	40	–	–
Northeast USA	9960	11	25	39	54	–
Northwest Pacific (old)	9970	11	30	55	81	–
Icelandic	9980	11	30	–	–	–
North Pacific	9990	11	29	43	–	–
Suez	4991	10	24			
England, France	8940	12	30			
Northwest Pacific	8930	11	30	50	70	
Newfoundland East Coast	7270	11	25			
Lessay	6731	10	39			
BØ	7001	11	27			
Sylt	7499	11	26			
Ejde	9007	10	23	38		
Saudia Arabia North	8830	11	25	39	56	
Saudia Arabia South	7030	11	25	37	55	

Icon Chart

 • Incorrect card inserted. • No chart card. • Display range too small. (P 3-1)	 • Display range too large. • Chart data not reliable. (P 3-5)
 • Full chart reliability. (P 3-5)	 • Offset applied to position. (P 3-17)
 • Offset applied to chart position. (P 3-17)	 • Alarm setting violated. • Remove reason for violation to erase icon. (P 3-15, 4-6)
 • Battery (internal) voltage low. Replace battery. (P 8-3)	 • Track recording/plotting stopped. (P 3-4)



Plotter Menu

[PLTR MENU/ESC],
[0]

PLOTTER MENU	
1. DISPLAY SETTING	_____
2. TRACK SETTING	_____
3. ERASE TRACK/MARK	_____
4. ROUTE/ROUTE LIST	_____
5. MEMORY CARD	_____
6. DIAGNOSTIC	①
7. SYSTEM SETTING	②
8. CHART OFFSET	③
9. ALARM SETTING	Ⓐ
0. UNIT SETTING	Ⓑ

DISPLAY SETTING	
PAGE	1 2
LAND BRILL	BRIGHT DIM
LAND COLOR	1 2 3 4 5 6 7 OFF
PLACE NAME	1 2 3 4 5 6 7 OFF
GRID COLOR	1 2 3 4 5 6 7 OFF
COURSE BAR	1 2 3 4 5 6 7 OFF
BACKGROUND	1 2 3 4 5 6 7 BLK
MOB	ON OFF
WPT MARK SIZE	LARGE SMALL
MARK SIZE	LARGE SMALL

Page 2

Page 1

MEMORY CARD	
1. SAVE	_____
2. REPLAY	_____
3. ERASE	_____
4. FORMAT	_____
5. UPLOAD SETTING	_____
6. DOWNLOAD SETTING	_____

DISPLAY SETTING	
PAGE	1 2
CURSOR SIZE	LARGE SMALL
CONTOUR LINE	OFF ON
DEPTH INFO	1 2 3 4 5 6 7 OFF
BUOYS	OFF ON
CHART LICENSE	OFF ON

SAVE		
TRACK	YES	NO
MARK/LINE	YES	NO
WPT/ROUTE	YES	NO
MENU SETTINGS	YES	NO

TRACK SETTING	
PLOT INTERVL	AUTO TIME DIST.
	00m10s
	00.10nm
TRACK COLOR	1 2 3 4 5 6 7

REPLAY		
TRACK	YES	NO
MARK/LINE	YES	NO
WPT/ROUTE	YES	NO
MENU SETTINGS	YES	NO

ERASE TRACK/MARK			
ERASE	TRACK	MARK	TRACK + MARK
RANGE	AREA	OFF	ALL

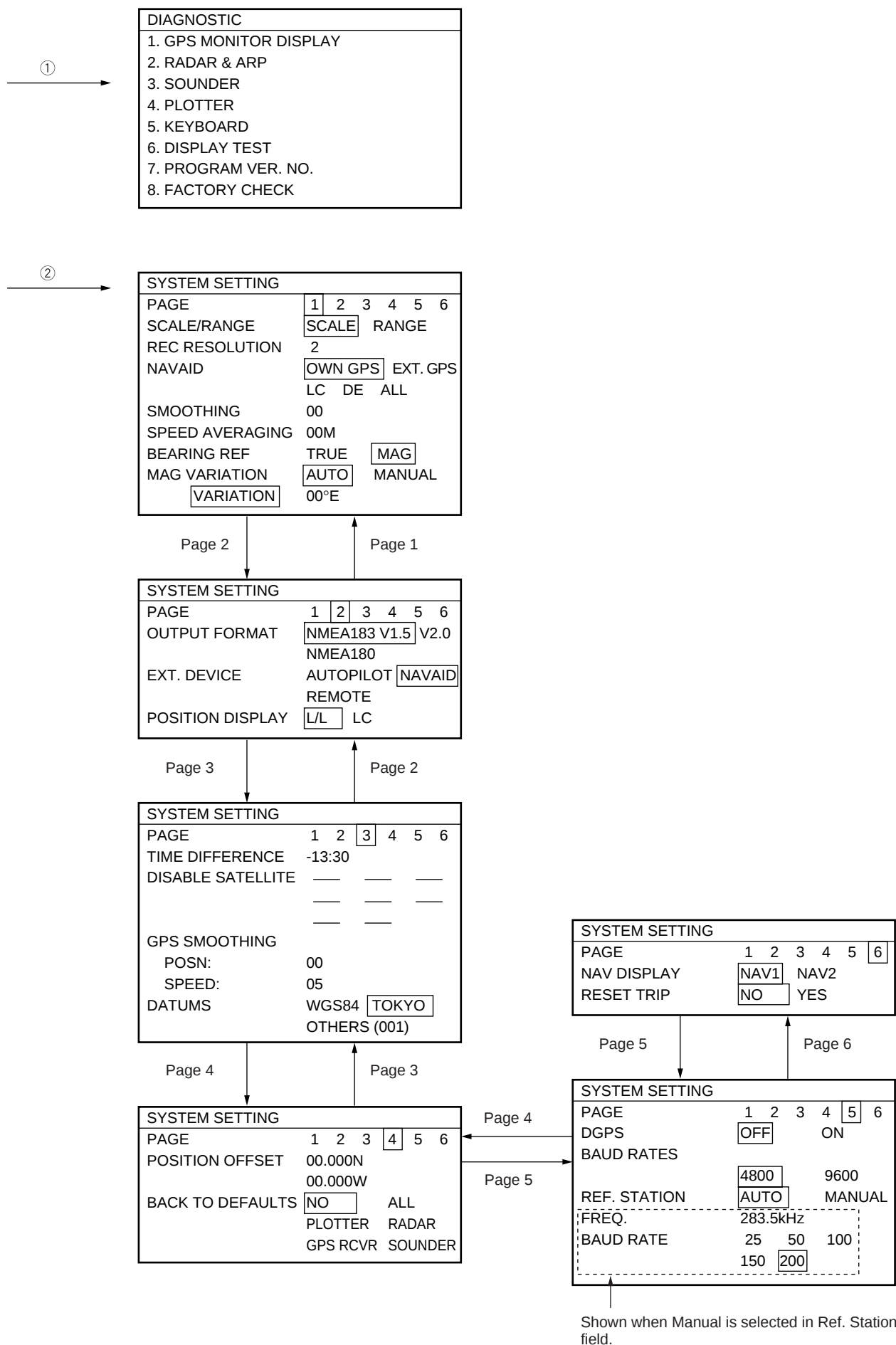
ERASE		
TRACK	YES	NO
MARK/LINE	YES	NO
WPT/ROUTE	YES	NO
MENU SETTINGS	YES	NO

ROUTE/ROUTE LIST			
NO.	WPT	TOTAL DIST.	TTG (H: M)
1	0	0.00 nm	0:00
2	0	0.00 nm	0:00
3	0	0.00 nm	0:00
4	0	0.00 nm	0:00
5	0	0.00 nm	0:00
6	0	0.00 nm	0:00
7	0	0.00 nm	0:00
8	0	0.00 nm	0:00
9	0	0.00 nm	0:00

UPLOAD SETTING		
BAUD RATE	19200bps	
DATA	WPT	WPT/ROUTE
UPLOAD	STOP	START

DOWNLOAD SETTING		
BAUD RATE	19200bps	
DATA	WPT/ROUTE	
UPLOAD	STOP	START

Plotter Menu (con't)



Plotter Menu (con't)

③ →

CHART OFFSET	
CORRECTION	NO ☐ ☒ YES (00.000N 00.000E)
DATUMS:	
ORIENTATN	000.0

[PLTR MENU/ESC], →
[3]

WAYPOINT	
CURSOR	001
L/L POSITION	001
OS POSITION	001
WPT LIST	

[PLTR MENU/ESC], →
[4]

DESTINATION	
CURSOR	
L/L POSITION	
WAYPOINT	
ROUTE	(FORWARD)
CANCEL	

[PLTR MENU/ESC], →
[9]

MARK SHAPE/COLOR	
MARK SHAPE	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
LINE TYPE	☐ ☐ ☐ ☐ ☐ ☐ ☐
MARK COLOR	1 2 3 4 5 6 7
EVENT MARK	☐ ☐ ☐ ☐

Sounder Menu

[SND R MENU/ESC],
[0]

SOUNDER MENU	
1.CONTROLS	
2. SETTINGS	
9. ALARM SETTTING	Ⓐ
0. UNIT SETTING	Ⓑ

SETTINGS	
PAGE	1 2
TVG	
200kHz	[3]
50kHz	[3]
ECHO LEVEL OFFSET	
200kHz	[+00]
50kHz	[+00]
ECHO LEVEL	
200kHz	080
50kHz	080

Page 2

Page 1

SETTINGS	
PAGE	1 2
DRAFT	+0.0 (m)
MARKER ZOOM	OFF ON
ZOOM RANGE	X2 X3 X4 X5
BTM LOCK RANGE	5 10 (m)

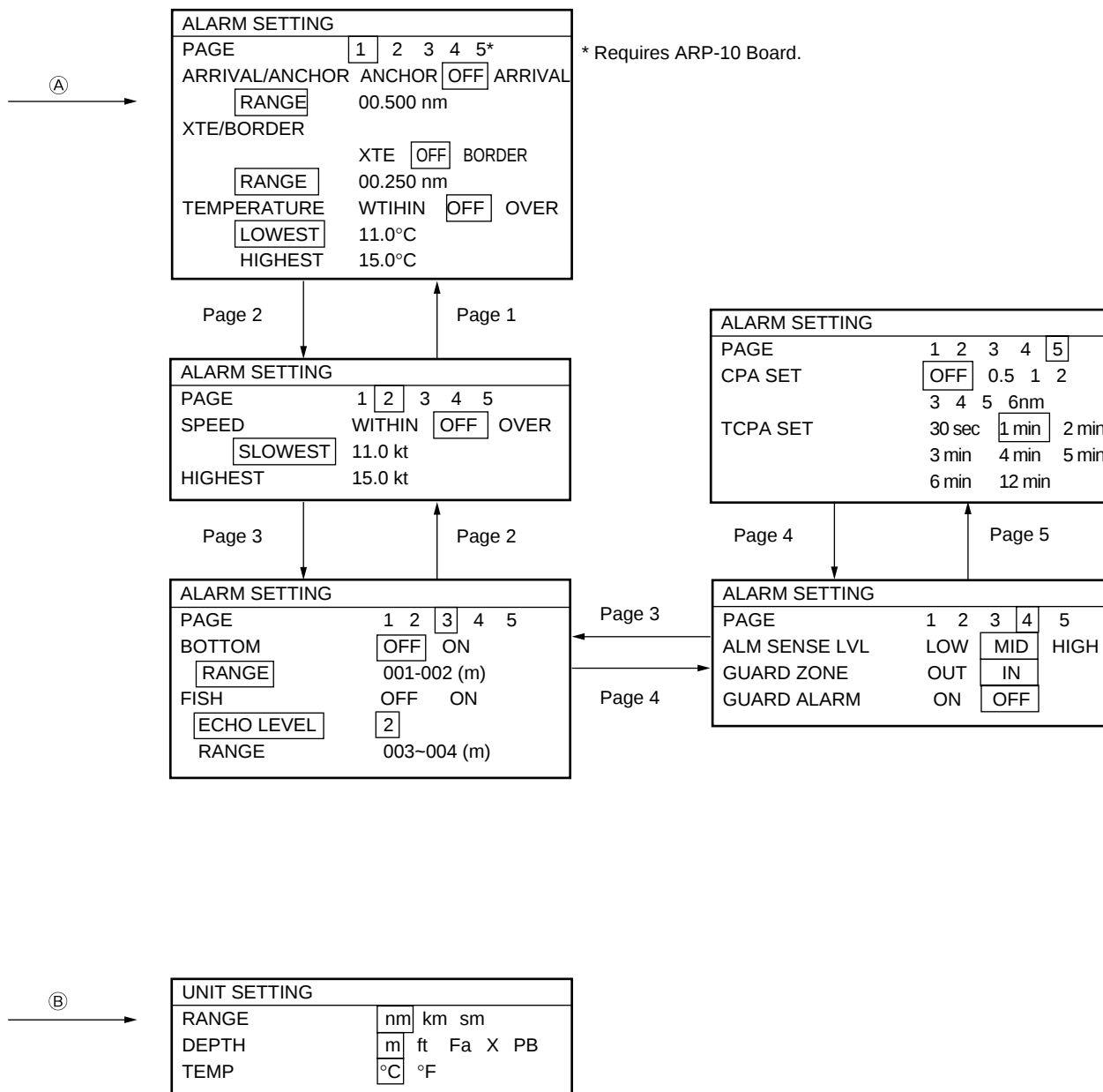
SYSTEM SETTING	
PAGE	1 2
FREQUENCY	50 200 50/200 kHz
DISPLAY MODE	NORMAL BTM ZOOM
	MKR ZOOM BOTTOM LOCK
CLUTTER	4 (0~9)
NOISE LM	
200kHz	NL1
50kHz	NL1
PICT. ADVANCE	1/1
TX POWER	2

Page 2

Page 1

FUNCTIONS	
PAGE	1 2
TEMP. SENSOR	EXT OWN
	(+00.0°C)
SPEED SENSOR	NAV OWN
	(+00%)
TEMP GRAPH	OFF ON
HUE	1(1~9)

Common Menu



SPECIFICATIONS OF RADAR/PLOTTER/SOUNDER FRS-1000 A/B/C

1. RADAR ANTENNA (RADOME TYPE) FOR FRS-1000A

(1) Radiator	Printed array
(2) Polarization	Horizontal
(3) Horizontal Beamwidth	4°
(4) Vertical Beamwidth	20°
(5) Sidelobe Attenuation	Within $\pm 20^\circ$ of main-lobe: less than -18 dB Outside $\pm 20^\circ$ of main-lobe: less than -23 dB
(6) Antenna Rotation Speed	24 rpm nominal
(7) Frequency	9410 $\pm$ 30 MHz (X band)
(8) Peak Output Power	4 kW nominal

2. RADAR ANTENNA (OPEN TYPE) FOR FRS-1000B

(1) Radiator	Slotted waveguide array
(2) Polarization	Horizontal
(3) Radiator Length	100 cm (XN10A)
(4) Horizontal Beamwidth	2.4°
(5) Vertical Beamwidth	27°
(6) Sidelobe Attenuation	Within $\pm 20^\circ$ of main-lobe: less than -24 dB Outside $\pm 20^\circ$ of main-lobe: less than -30 dB
(7) Antenna Rotation Speed	24 rpm or 48 rpm nominal
(8) Frequency	9410 $\pm$ 30 MHz (X band)
(9) Peak Output Power	4 kW nominal

3. RADAR ANTENNA (OPEN TYPE) FOR FRS-1000C

(1) Radiator	Slotted waveguide array
(2) Polarization	Horizontal
(3) Radiator Length	120 cm (XN12)
(4) Horizontal Beamwidth	1.9°
(5) Vertical Beamwidth	22°
(6) Sidelobe Attenuation	Within $\pm 20^\circ$ of main-lobe: less than -24 dB Outside $\pm 20^\circ$ of main-lobe: less than -30 dB
(7) Antenna Rotation Speed	24 rpm or 48 rpm nominal
(8) Frequency	9410 $\pm$ 30 MHz (X band)
(9) Peak Output Power	6 kW nominal

4. RADAR DISPLAY UNIT

(1) Range, Pulselength (PL) & Pulse Repetition Rate (PRR)

		Range (nautical miles)																	
PL	PRR	0.125	0.25	0.5	0.75	1.0	1.5	2	3	4	6	8	12	16	24	36	48	64	
SP	2100 Hz	0.08 μs																	
MP	1200 Hz						0.3 μs												
LP	600 Hz								0.8 μs										

*Maximum range; FRS-1000A: 36 nm, FRS-1000B: 48 nm, FRS-1000C: 64 nm

- (2) Range Resolution 20 m (1.5 NM range)
- (3) Bearing Discrimination FRS-1000A: 4°, FRS-1000B: 2.4°, FRS-1000C: 1.9° (1.5 NM range)
- (2) Minimum Range 25 m (0.25 NM range)
- (3) Bearing Accuracy Within 1°
- (4) Range Ring Accuracy 0.9 % of range or 8 m, whichever is the greater

(5) Range, Range Interval, Number of Rings

Range (NM)	0.125	0.25	0.5	0.75	1	1.5	2	3	4	6	8	12	16	24	36	48	64
Ring Interval (NM)	0.0625	0.125	0.125	0.25	0.25	0.5	0.5	1	1	2	2	3	4	6	12	12	16
Number of Rings	2	2	4	3	4	3	4	3	4	3	4	4	4	4	3	4	4

- (6) Markers Heading Line, Bearing Scale, Range Rings,
Variable Range Marker (VRM1, VRM2),
Electronic Bearing Line (EBL1, EBL2),
Tuning Bar, Cursor, Parallel Cursor,
Alarm Zone, Waypoint Mark (navigation input required),
North Mark (heading sensor input required)
- (7) Alphanumeric Indications Range, Range Ring Interval, Pulselength(SP, MP, LP),
Display Mode (HU,CU,NU,TM), Interference Rejection(IR1,IR2,IR3),
Variable Range Marker (VRM1, VRM2),
Electronic Bearing Line (EBL1, EBL2),
Automatic A/C SEA (A/C AUTO), Stand-by (ST-BY),
Radar Alarm (G(IN), G(OUT), G(ACKN)),
Echo Stretch (ES1, ES2), Cursor Range, Bearing or L/L Position,
Echo Tailing (TRAIL), Trailing Time, Trailing Elapsed Time,
Navigation Data(navigation input required),
Heading (HDC, heading sensor input required)

5. AUTO PLOTTER BLOCK (OPTION)

- (1) Functions • Calculation/indication of own ship speed relative to a fixed target
- Manual target acquisition, automatic tracking
- Target information:

- Distance and bearing from own ship to target
- Moving direction and speed
- History presentation
- (2) Acquisition and Tracking Manual acquisition by trackball and cursor
 - Maximum number of targets: 10
 - Acquisition range: 0.2 to 16 nm
 - Tracking range: 0.1 to 16 nm
- (3) Vector
 - Vector length: 30 sec; 1,2,3,6,12,15 min
 - Mode: true velocity or relative velocity
- (4) History
 - plotting interval: 30 sec; 1,2,3,5 min
 - Number of plotting points: 5,10,20 per target, selected through menu
- (5) Alarms
 - Visual and audible alarm against target violating CPA/TCPA limits
 - Visual and audible alarm against guard-zone limits (5 targets max.)
 - Visual alarm against lost target, target full and system failure

6. PLOTTER MODULE

- (1) Colors 7 colors: red, yellow, green, blue, light-blue, purple, white
- (2) Display pixels 512 x 480 and 128 x 480 separated
- (3) Projection Mercator
- (4) Useable Area 85° latitude or below
- (5) Electronic Chart FURUNO chart card or ERC card available
- (6) Effective Projection Area 0.094 nm to 4,094 nm (at equatorial area)
- (7) Memory Capacity track: 2800 points, waypoint: 200 points
- (8) Mark Colors 8 colors
- (9) Marks 8 characters
- (10) Waypoint Mark 4 characters
- (11) Route Capacity 20 routes
- (12) Alarms
 - Arrival and Anchor watch, Cross track error and border alarms,
 - Ship's speed in and out alarms
- (13) Plotting Function Own ship's position, MOB, Waypoint, Route plotting
- (14) Color Setting Color selectable; coastline, track line and marks.

7. SOUNDER

- (1) Transmit Frequency 50/200 kHz
- (2) Transmission 600 W
- (3) Display range 5/10/20/40/80/150/300/500/800/1200 m, shift; 0-1200 m
- (4) Extension Mode Marker zoom, Bottom zoom, Bottom Lock,
- (5) Auto Mode Cruising/Fishing selected
- (6) Picture advance 7 steps

- (7) Alarms Fish school alarm, Bottom alarm
- (8) Ship's Speed Accuracy 0.34 knot (range: 0 to 50 knot)
- (9) Water Temperature Accuracy 0.14 °C (range: -5 °C to +35 °C)

8. GPS RECEIVER

- (1) Receiving Channels 8 channels parallel, 8 satellite tracking
- (2) Rx Frequency 1575.42 MHz
- (3) Rx Code C/A code
- (4) Position Fixing System All in view, 8-state Kalman filter
- (5) Position Accuracy 50 m approx., 95% of the time,
horizontal dilution of position (HDOP)≤4
Note: All GPS receiver are subject to degradation of position and velocity accuracy under the U.S. Department of Defense.
Position may be degraded.
DGPS: 5 m approx., 95% of the time
- (6) Tracking Velocity 900 kts
- (7) Position-fixing Time Warm start: 20 seconds, Cold start: 2 minutes
- (8) Position Update Interval 1 second
- (9) DGPS data receiving RTCM SC-104 Ver 2.1 formatted

9. DISPLAY SECTION

- (1) Picture Tube 10.4" multi-color LCD
- (2) Display pixels 640×480 dots
- (3) Horizontal Frequency 31.5 kHz
- (4) Vertical Frequency 60 Hz

10. DATA INPUT / OUTPUT

- (1) Input data IEC61162-1 adopted
 - Own Ship's Position RMC>RMA>GLL>GGA
 - Ship's Speed, Course RMC>RMA>VTG
 - Waypoint BWR
 - Time Lag for Loran RMA
 - Bottom Depth DPT>DBT>DBS
 - Water temperature MTW
 - Clock ZDA
 - Heading HDG/HDM/HDT(NMEA0183) or AD-100 format
- (2) Output data IEC61162-1 adopted
 - GPAAM, GPAPA, GPVTG, GPXTE, GPAPB, GPBOD, GPRMC, GPBWR, GPGLL, GPRMC, GPZDA, GPMTW, GPDBT, GPDPT, GPRMB, GPWPL, GPGGA

11. POWER SUPPLY

(1) Display Unit/ Processor Unit

12-24 VDC: 8.1-3.9 A

(2) Slave Display Unit

12-24 VDC: 1.1-0.6 A

(3) Rectifier (option)

RU-1746B for Display and Processor Unit,

PR-62 for Slave Display Unit

Input: 100-115/200-220 VAC

Output: 12/24 VDC

12. ENVIRONMENTAL CONDITIONS

(1) Ambient temperature

Display Unit: -15 °C to +55 °C

Radar Antenna: -25 °C to +70 °C

GPS Antenna: -30 °C to +70 °C

DGPS Antenna: -40 °C to +70 °C

Display Unit -15 °C to +55 °C

Remote Controller 0 °C to +40 °C

Transducer -15 °C to +55 °C

(2) Relative Humidity

Processor Unit and Display Unit: 95% at +40 °C

Radar and GPS/DGPS Antenna Unit: 100% at +40 °C

Remote Controller: 95% at +40 °C

(3) Water Proofing

Processor Unit: IPX2

Radar and GPS/DGPS Antenna Unit: IPX6

Display Unit: IPX5

Remote Controller: IPX3 (vinyl case required)

(4) Category of Equipment Units

Display Unit, Remote Controller: To be installed in a protected area

Slave Display Unit: To be installed in a protected area

Radar and GPS/DGPS Antenna Unit: To be installed in an exposed area

Temperature, Speed Sensor To be installed in an exposed area

13. COATING COLOR

(1) Processor Unit and Display Unit:

Chassis: 2.5GY5/1.5

Panel: N3.0 Newton No.5

(2) Radar and GPS/DGPS Antenna Unit:

N9.5

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(Model name, serial number)

is in conformity with the essential requirements as described in the Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment (R&TTE Directive) and satisfies all the technical regulations applicable to the product within this Directive

**EN 60945: 1997-01 (IEC 945 Third edition: 1996-11)
KSR 142, Annex 1**

(title and/or number and date of issue of the standard(s) or other normative document(s))

For assessment, see

- Statement of Opinion N° 00214115/AA/00 of 7 December 2000 issued by KTL Certification, The Netherlands
- Test report KTL 98387237 of 18 January 1999 and KTL 98387238 of 18 January 1999

On behalf of Furuno Electric Co., Ltd.

Hiroaki Komatsu
Manager,
International Rules and Regulations

Nishinomiya City, Japan
December 28, 2000

(Place and date of issue)

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(Serial No. 3381-0001)**

(Model name, serial number)

is in conformity with the essential requirements as described in the Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment (R&TTE Directive) and satisfies all the technical regulations applicable to the product within this Directive

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KSR 142, Annex 1**

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For assessment, see

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- Test report KTL 98387237 of 18 January 1999 and KTL 98387238 of 18 January 1999

On behalf of Furuno Electric Co., Ltd.

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declare under our sole responsibility that the product

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(Serial No. 3381-0001)**

(Model name, serial number)

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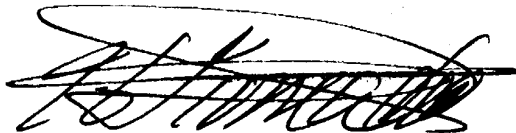
**EN 60945: 1997-01 (IEC 945 Third edition: 1996-11)
KSR 142, Annex 1**

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For assessment, see

- Statement of Opinion N° 00214118/AA/00 of 8 December 2000 issued by KTL Certification, The Netherlands
- Test report KTL 98387237 of 18 January 1999 and KTL 98387238 of 18 January 1999

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