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 W/m² 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, it may be necessary to prevent transmission in that area to protect passengers and crew from microwave radiation. This can be done with Sector Blank in the System menu.

<table>
<thead>
<tr>
<th>Model</th>
<th>Antenna</th>
<th>Distance to 100 W/m² point</th>
<th>Distance to 10 W/m² point</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR-8062</td>
<td>XN-12A</td>
<td>Nil</td>
<td>1.20 m</td>
</tr>
<tr>
<td></td>
<td>XN-13A</td>
<td>Nil</td>
<td>1.10 m</td>
</tr>
<tr>
<td>FR-8122</td>
<td>XN-12A</td>
<td>Nil</td>
<td>1.90 m</td>
</tr>
<tr>
<td></td>
<td>XN-13A</td>
<td>Nil</td>
<td>1.40 m</td>
</tr>
<tr>
<td>FR-8252</td>
<td>XN-12A</td>
<td>0.40 m</td>
<td>4.60 m</td>
</tr>
<tr>
<td></td>
<td>XN-13A</td>
<td>0.40 m</td>
<td>3.10 m</td>
</tr>
</tbody>
</table>
## 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

**Use the proper fuse.**

Fuse rating is shown on the equipment. Use of a wrong fuse can result in damage to the equipment.

**Keep heater away from equipment.**

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

**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.
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.

• The ARP automatically tracks automatically or manually acquired radar targets and calculates their courses and speeds, indicating them by vectors. 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 ARP 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 ARP 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.

The data generated by ARP and AIS are intended for reference purposes only.

Check all available navigation aids to determine target movement.
SAFETY INSTRUCTIONS

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

**WARNING LABELS**
Warning labels are attached to the equipment. Do not remove any label. If a label is missing or damaged, contact a FURUNO agent or dealer about replacement.

**DISPLAY UNIT**
Name: Warning Label 1  
Type: 86-003-1011-1  
Code No.: 100-236-231

**ANTENNA UNIT**
Name: Warning Sticker  
Type: 03-142-3201-0  
Code No.: 100-266-890

**TFT LCD**
The high quality TFT (Thin Film Transistor) LCD displays 99.999% of its picture elements. The remaining 0.001% may drop out or light, however this is an inherent property of the LCD; it is not a sign of malfunction.
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A Word to the Owner of the FR-8xx2 Marine Radar

FURUNO Electric Company thanks you for purchasing the FR-8xx2 series Color LCD Marine Radar. We are confident you will discover why the FURUNO name has become synonymous with quality and reliability.

For over 50 years FURUNO Electric Company has enjoyed an enviable reputation for quality and reliability throughout the world. This dedication to excellence is furthered by our extensive global network of agents and dealers.

Your equipment is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless properly installed and maintained. Please carefully read and follow the operation and maintenance procedures set forth in this manual.

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

Thank you for considering and purchasing FURUNO.

Features

The FR-8xx2 series display radar targets on a bright 12.1” color LCD. Operation is simplified with the combination of discrete keys and trackball.

The main features are

- The FR-8xx2 series consists of the following models:

<table>
<thead>
<tr>
<th>Model</th>
<th>Output</th>
<th>Range</th>
<th>Radar Antenna, Radiator Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR-8252</td>
<td>25 kW</td>
<td>96 nm</td>
<td>XN-12A (4ft) or XN-13A (6 ft)</td>
</tr>
<tr>
<td>FR-8122</td>
<td>12 kW</td>
<td>72 nm</td>
<td>XN-12A (4ft) or XN-13A (6 ft)</td>
</tr>
<tr>
<td>FR-8062</td>
<td>6 kW</td>
<td>72 nm</td>
<td>XN-12A (4ft) or XN-13A (6 ft)</td>
</tr>
</tbody>
</table>

- Bright 12.1” LCD visible even under direct sunlight
- User-friendly operation with combination of discrete keys and trackball
- Antenna speed may be automatically selected according to range (48 rpm motor only)
- Built in Auto Plotter (ARP-11) optionally available
- AIS data shown with connection of FURUNO AIS Transponder FA-150
- User programmable function keys
- One touch setup of major controls with custom setup feature
- Echoes in yellow or green, or colors of red, yellow or green in order of descending strength
FOREWORD

Notice

• This manual is intended for use by native speakers of English.
• No part of this manual may be copied or reproduced without written permission.
• If this manual is lost or worn, contact your dealer about replacement.
• The contents of this manual and equipment specifications are subject to change without notice.
• The example screens (or illustrations) shown in this manual may not match the screens you see on your display. The screen you see depends on your system configuration and equipment settings.
• FURUNO will assume no responsibility for the damage caused by improper use or modification of the equipment by an unauthorized dealer or a third party.
• Store this manual in a convenient place for future reference.
SYSTEM CONFIGURATION

FR-8252

ANTENNA UNIT
RSB-0073-087-XN12A/XN13A

POWER SUPPLY UNIT
PSU-008

DISPLAY UNIT
RDP-150

Gyrophase

Remote
Controller
RCU-019

Auto Plotter
ARP-11
(built in display unit)

Category of units
Antenna unit: Exposed to weather
All other units: Protected from weather

Optional equipment
**FR-8122, FR-8062**

**Antenna Unit**
- RSB-0070-085-XN12A: FR-8062
- RSB-0073-085-XN12A/XN13A: FR-8062
- RSB-0073-086-XN12A/XN13A: FR-8122

**Display Unit**
- RDP-150

**Rectifier**
- RU-3423
- 100/110/115/220/230 VAC, 1φ
- 12-24 VDC

**Remote Display**

**Commercial Monitor** (SVGA or better)

**Gyro Converter**
- AD-100

**Heading Sensor**
- PG-1000

**NMEA Device**

**External Buzzer**
- OP03-136

**Remote Controller**
- RCU-019

**Auto Plotter**
- ARP-11 (built in display unit)

**Gyrocompass**

**Category of units**
- Antenna unit: Exposed to weather
- All other units: Protected from weather

*: Optional equipment
1. OPERATIONAL OVERVIEW

1.1 Controls

1.1.1 Display unit

This radar is operated with the controls of the display unit (and the remote controller), which includes 18 keys that are labeled with their functions, three knob controls and a trackball. When you correctly execute an operation, the unit generates a beep. Invalid operation causes the unit to emit several beeps.

<table>
<thead>
<tr>
<th>No.</th>
<th>Control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BRILL</td>
<td>Momentary press: Turns power on; adjusts brilliance. Long press: Turns power off. Note: Hereafter this control is referred to as “POWER/BRILL”.</td>
</tr>
<tr>
<td>2</td>
<td>STBY/TX</td>
<td>Transmits radar pulses and places radar in stand-by alternately.</td>
</tr>
<tr>
<td>3</td>
<td>MODE</td>
<td>Chooses presentation mode.</td>
</tr>
<tr>
<td>4</td>
<td>CUSTOM</td>
<td>Presets radar controls for one-touch set up of radar.</td>
</tr>
<tr>
<td>5</td>
<td>RANGE</td>
<td>Chooses radar range.</td>
</tr>
<tr>
<td>6</td>
<td>ZOOM</td>
<td>Zooms chosen location (or target).</td>
</tr>
<tr>
<td>7</td>
<td>TARGET ALARM</td>
<td>Sets target alarm, which watches for targets entering (or exiting) an alarm zone.</td>
</tr>
<tr>
<td>8</td>
<td>EBL</td>
<td>Measures bearing to a target.</td>
</tr>
<tr>
<td>9</td>
<td>MENU</td>
<td>Opens/closes menu.</td>
</tr>
<tr>
<td>10</td>
<td>ENTER</td>
<td>Saves chosen menu option; acquires ARP target; chooses ARP or AIS target to display its data.</td>
</tr>
<tr>
<td>11</td>
<td>GAIN</td>
<td>Adjusts the sensitivity of the radar receiver.</td>
</tr>
<tr>
<td>12</td>
<td>A/C SEA</td>
<td>Suppresses sea clutter.</td>
</tr>
<tr>
<td>13</td>
<td>A/C RAIN</td>
<td>Suppresses rain clutter.</td>
</tr>
<tr>
<td>14, 15</td>
<td>F1, F2</td>
<td>Function keys providing instant call up of desired function.</td>
</tr>
<tr>
<td>16</td>
<td>OFF CENTER</td>
<td>Shifts display.</td>
</tr>
<tr>
<td>17</td>
<td>TRAILS</td>
<td>Plots radar echo movement.</td>
</tr>
<tr>
<td>18</td>
<td>VMR</td>
<td>Measures range to a target.</td>
</tr>
<tr>
<td>19</td>
<td>TLL</td>
<td>Outputs latitude and longitude position of a target to a navigation plotter or inscribes mark at cursor location, or both the above.</td>
</tr>
<tr>
<td>20</td>
<td>CANCEL/HL OFF</td>
<td>Temporarily erases heading line; cancels last entry in menu operation; cancels tracking of ARP target; removes data of selected ARP or AIS target from data box; goes back one layer in multilayer menu.</td>
</tr>
<tr>
<td>21</td>
<td>Trackball</td>
<td>Chooses menu items and options; shifts cursor.</td>
</tr>
</tbody>
</table>
1. OPERATIONAL OVERVIEW

1.1.2 Remote controller

The optional remote controller provides armchair control over transmit, standby, range and display offcentering (30% in stern direction).

![Remote controller diagram]

- Offcenters display.
- Toggles STBY/TX.
- Chooses range.

*Remote controller*
1.2 Turning the Radar On/Off, Transmitting

Press the **POWER/BRILL** key at the top of the control panel to turn the radar on, and the lamp to its left lights. To turn the radar off, press and hold down the key until the screen turns black.

At power-up, the start-up screen appears, showing the model name, program number and the results of the ROM and RAM check, OK or NG (No Good). If an NG appears, try pressing any key other than the power key to proceed. If normal operation is not possible, contact your dealer for advice.

![Start-up screen](image)

After the tests are completed, the bearing scale and a digital timer appear. The digital timer counts down the time remaining to warm up the magnetron, which transmits the radar pulses. This warm-up takes 180 sec. (FR-8252) or 90 sec. (FR-8062, FR-8122).

After the timer has counted down to 0:00, the STBY screen appears, the appearance of which you may choose according to your needs. (For further details, see paragraph 1.4.1.2.) The radar is now ready to transmit radar pulses. Press the **STBY/TX** key to transmit radar pulses.

The **STBY/TX** key toggles between stand-by and transmit status. The antenna rotates in transmit condition and is stopped in standby. Because the magnetron ages with use it is highly recommended to set the radar in standby when it will not be required for an extended period of time, to extend the life of the magnetron.

**Quick start**

Provided that the radar was once in use with the transmitter tube (magnetron) still warm, you can get the radar into TRANSMIT condition without the warm-up. If the **POWER/BRILL** key was turned off by mistake or the like and you wish to restart the radar promptly, turn on the **POWER/BRILL** key not later than 10 seconds after power-off. **This feature is not available with the FR-8252.**
1. OPERATIONAL OVERVIEW

1.3 Display Indications

**Display Indications**

The screen configuration, chosen during the installation, is available in three types, “Sea”, “River” and “IEC”, and the default configuration is “Sea”. The majority of the descriptions in this manual use the “Sea” configuration. The major difference between the Sea, River and IEC configurations is the effective display area - it is elliptical on the Sea and River types and circular on the IEC type.
1. OPERATIONAL OVERVIEW

1.4 Adjusting Display Brilliance, Panel Dimmer

The display brilliance and panel dimmer may be adjusted as follows:

1. Press the POWER/BRILL key momentarily to show the Brill/Panel dialog box.

<table>
<thead>
<tr>
<th>Brill/Panel dialog box</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brill (1 - 15) 15</td>
</tr>
<tr>
<td>Panel (1 - 15) 15</td>
</tr>
<tr>
<td>[ENTER]: Select</td>
</tr>
<tr>
<td>[CANCEL/HL OFF]: Close</td>
</tr>
</tbody>
</table>

2. Press the ENTER key to choose Brill or Panel, whichever you wish to adjust.
3. Roll the trackball rightward or leftward to adjust. (For brilliance, you may also use the POWER/BRILL key.)
4. Press the CANCEL/HL OFF key to close the window.

1.5 Menu Overview

Less-often used functions are controlled through the menu, which consists of 15 menus and 5 sub menus. Below is the basic procedure for menu operation.

1. Press the MENU key to display the menu.

<table>
<thead>
<tr>
<th>Menu Items and current settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brill/Color</td>
</tr>
<tr>
<td>Display</td>
</tr>
<tr>
<td>Echo</td>
</tr>
<tr>
<td>Target Trails</td>
</tr>
<tr>
<td>Mark</td>
</tr>
<tr>
<td>Custom 1</td>
</tr>
<tr>
<td>Custom 2</td>
</tr>
<tr>
<td>Custom 3</td>
</tr>
<tr>
<td>Tuning</td>
</tr>
<tr>
<td>GPS Buoy</td>
</tr>
<tr>
<td>Target</td>
</tr>
<tr>
<td>ARP*1</td>
</tr>
<tr>
<td>AIS*2</td>
</tr>
<tr>
<td>GPS*3</td>
</tr>
<tr>
<td>System</td>
</tr>
</tbody>
</table>

2. Roll the trackball to choose a menu or sub menu. As you roll the trackball, the yellow (highlight) cursor in the Menu column indicates the menu currently selected and the menu items change according to the menu selected.

---

*1 Displayed if equipped with ARP Board.
*2 Displayed if radar is interfaced with AIS transponder.
*3 Displayed if radar is interfaced with GPS receiver.
*4 Title bar is currently controllable column is blue; selected cursor is yellow. Title bar of inactive column is gray.
Menu description

Brill/Color: Choose colors; adjust range ring brilliance.
Display: Control display functions.
Echo: Adjust radar echo.
Target Trails: Process target trails.
Mark: Process markers such as VRM and EBL.
Custom 1-Custom 3: One-touch set up for given navigation situation.
Tuning: Adjust radar tuning.
GPS Buoy: Set up GPS buoy display.
Target: Set up ARP and AIS targets.
ARP: Set up ARP display.
AIS: Set up AIS display.
GPS: Set up FURUNO GPS receiver interfaced with this radar.
System:
Initial: Initial settings.
Factory: System diagnostic and LCD test.
Installation: Items for installation. Not accessible by user.
Sector Blank 1, Sector Blank 2: Set up for preventing transmission in a certain area.

3. Press the ENTER key to switch control to the menu items column. At this time the cursor in the menu column turns gray and the cursor in the menu items column is yellow, indicating that control is now with the menu items column.

To switch control between the menu column and menu items column, use the CANCEL/HL OFF key. The color of the title bar of the active column is blue and the color of the title bar of the inactive column is gray.

4. Roll the trackball to choose the menu item desired and press the ENTER key. A window with options for the corresponding menu item appears. For example, the window below shows the options for Color in the Target Trails menu.

5. Roll the trackball upward or downward to choose appropriate option.

6. Press the ENTER key to save your selection. To close the window without saving, press the CANCEL/HL OFF key (instead of the ENTER key).

7. Press the MENU key to close the menu.

The menus on the IEC-type radar close automatically when there is no menu operation for 10 seconds, as per IEC regulations. The following menus and screens however are exempt from this rule: Alarm message, GPS self test, Satellite monitor, Diagnostic, LCD pattern, tuning initial adjust and auto installation setup.

Menus do not close automatically in the “River” or “Sea” configuration.
1.6 Tuning

The radar receiver can be tuned automatically or manually, and the default tuning method is automatic. If you require manual tuning, do the following:

1. Use the **RANGE** key to choose the 48-mile range.
2. Press the **MENU** key to display the main menu.
3. Use the trackball to choose Tuning and press the **ENTER** key.

4. Use the trackball to choose Tuning Mode and press the **ENTER** key.

5. Choose Manual and press the **ENTER** key.

6. Choose Manual Tuning and push the **ENTER** key. The window shown below appears.

7. Roll the trackball upward or downward to adjust the tuning, watching the tuning bar at the top right corner. The best tuning point is where the tuning bar swings maximum. The vertical bar on the tuning bar shows tuning control position; not the tuning condition.

8. Push the **ENTER** key.

9. Press the **MENU** key to close the menu.
1.7 Presentation Modes

This radar has the following presentation modes:

**Relative Motion (RM)**

- **Head-up**: Unstabilized display. Heading is at the top of the screen.
- **Course-up**: Compass-stabilized relative to ship’s orientation. The bearing scale rotates to place ship’s heading (course set) at the screen top at the moment the course-up mode is selected.
- **North-up**: Compass-stabilized with reference to north. Bearing scale is fixed.

**True Motion (TM)**

- **North-up**: Ground or sea stabilized with compass and speed inputs. Own ship moves on the display. Landmasses and sea are fixed.

1.7.1 Choosing presentation mode

Press the **MODE** key consecutively to choose presentation mode desired. The presentation mode in use appears at the top left corner on the screen.

*Note* All modes except head-up require a heading signal, in AD-10 format or NMEA format. If the heading signal is lost, the mode is changed to head-up and the north marker disappears. Further, the heading readout shows XXX.X and the message “GYRO” (AD-10 format data) or “NMEA-HEAD” (NMEA format data) appears in the alarm message display. Restore gyro input and confirm bearing.

1.7.2 Description of presentation modes

**Head-up mode**

The head-up mode is a display in which the line connecting own ship and 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. Echoes (other than landmass) may be unstable if ship’s yawing and turning are severe.

A short line on the bearing scale is the north marker, indicating heading sensor north.
Course-up mode

The course-up mode is 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. The heading line moves in accordance with ship's yawing and course change. This mode is useful to avoid smearing of picture during course change.

North-up mode

The north-up mode paints target pips at their measured distances and in their true (heading sensor) directions from own ship, north bearing maintained at the top of the screen. The heading line changes its direction according to the ship's heading.

True motion mode

Own ship and other moving objects move in accordance with their true courses and speed. In ground stabilized TM, all fixed targets, such as landmasses, appear as stationary echoes.

When own ship reaches a point corresponding to 75% of the radius of the display, own ship position is automatically reset to a point of 75% radius opposite to the extension of the heading line passing through the display center. You may also reset the own ship symbol manually by pressing the OFF CENTER key. The method of resetting is the same as mentioned above.
1. OPERATIONAL OVERVIEW

**Automatic resetting of own ship marker in true motion mode**

- (a) True motion is selected
- (b) Own ship has reached a point 75% of display radius
- (c) Own ship is automatically reset to 75% of radius

### 1.8 Choosing a Range Scale

The selected range scale, range ring interval and pulse length are shown at the upper left corner on the screen. When a target of interest comes closer, reduce the range scale so that it appears in 50-90% of the display radius.

Use the **RANGE** key to choose range desired. Hit the "+" part of the key to raise the range; the "-" part to lower the range.
1.9 Choosing a Pulse Length

The pulse length in use appears at the top left position on the screen. Appropriate pulse lengths are preset to individual range scales and custom setups. If you are not satisfied with the pulse length setting on the 1.5 nm or 3 nm range, you may change it as below. Use a longer pulse when your objective is long range detection, a shorter pulse when resolution is important.

1. Press the **MENU** key to open the menu.
2. Use the trackball to choose the Echo menu and press the **ENTER** key.

<table>
<thead>
<tr>
<th>Menu</th>
<th>Echo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brill/Color</td>
<td>Auto Gain</td>
</tr>
<tr>
<td>Display</td>
<td>Auto Sea</td>
</tr>
<tr>
<td>Echo</td>
<td>Auto Rain</td>
</tr>
<tr>
<td>Target Trails</td>
<td>Pulse Length</td>
</tr>
<tr>
<td>Mark</td>
<td>Echo Stretch</td>
</tr>
<tr>
<td>Custom 1</td>
<td>Echo Average</td>
</tr>
<tr>
<td>Custom 2</td>
<td>Noise Rejector</td>
</tr>
<tr>
<td>Custom 3</td>
<td>Interference Rejector</td>
</tr>
<tr>
<td>Tuning</td>
<td>Auto Anti Clutter</td>
</tr>
<tr>
<td>GPS Buoy</td>
<td>Display-Dynamic</td>
</tr>
<tr>
<td>Target</td>
<td>Display-Curve</td>
</tr>
<tr>
<td>ARP</td>
<td>Antenna Speed</td>
</tr>
<tr>
<td>AIS</td>
<td>2nd Echo Rejector</td>
</tr>
</tbody>
</table>

3. Use the trackball to choose Pulse Length and press the **ENTER** key.

4. Choose Short or Long as appropriate and press the **ENTER** key.
5. Press the **MENU** key to close the menu.
1.10 Adjusting the Gain (sensitivity)

The gain functions to adjust the receiver sensitivity for the best reception of signals of widely varying amplitudes.

1.10.1 Choosing gain adjustment method

Gain may be adjusted automatically or manually. Push the GAIN control to choose automatic or manual adjustment alternately. The adjustment method currently chosen is show at the top right corner of the screen. In the example below the gain adjustment method is “AUTO”.

![Gain adjustment method indicator]

1.10.2 Setting automatic gain level

1. Press the MENU key to open the menu.
2. Choose the Echo menu and press the ENTER key.
3. Choose Auto Gain and press the ENTER key.
4. Choose the option which best matches current sea condition and press the ENTER key.
5. Press the MENU key to close the menu. Gain is automatically adjusted according to the level selected.

1.10.3 Manual gain adjustment

Adjust the gain such that noise faintly appears over the entire screen. If the gain is too low weak echoes will not be displayed and if the gain is too high, weak echoes will be hidden in background noise.

1. Push the GAIN control to show “GAIN MAN” as the gain adjustment method.
2. Rotate the GAIN control to adjust the gain. Adjust the control so background noise is just visible on the screen.
1.11 Suppressing Sea Clutter

Echoes from waves cover 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. When sea clutter masks the picture, use the A/C SEA control to suppress the clutter, either manually or automatically.

1.11.1 Choosing sea clutter adjustment method

Push the A/C SEA control to choose automatic or manual adjustment alternately. The adjustment method currently chosen is shown at the top right corner of the screen. In the example below the sea clutter adjustment method is “AUTO”.

A/C SEA indicator

1.11.2 Setting automatic sea clutter suppression level

1. Press the MENU key to open the menu.
2. Choose the Echo menu and press the ENTER key.
3. Choose Auto Sea and press the ENTER key.

Rough
Moderate
Calm

4. Choose the option which best matches current sea condition and press the ENTER key.
5. Press the MENU key to close the menu. Sea clutter is automatically adjusted according to the level selected.
1. OPERATIONAL OVERVIEW

1.11.3 Manual sea clutter adjustment

1. Push the A/C SEA control to show “SEA MAN” as the A/C SEA adjustment method.
2. Rotate the A/C SEA control to suppress sea clutter.

The proper setting of the A/C SEA control is such that the clutter is broken up into small dots, and small targets become distinguishable. If the setting is set too low, targets will be hidden in the clutter, while if the setting is 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.

1.12 Suppressing Rain 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, or hail) in the same manner as normal targets.

The A/C RAIN control adjusts the receiver sensitivity as the A/C SEA control does but rather in a longer time period (longer range). The higher the setting the greater the anti-clutter effect. When echoes from precipitation mask solid targets, adjust the control to split up these unwanted echoes into a speckled pattern, making recognition of solid targets easier.

1.12.1 Choosing rain clutter adjustment method

Rain clutter may be adjusted automatically or manually. Push the A/C RAIN control to choose automatic or manual adjustment alternately. The adjustment method currently chosen is show at the top right corner of the screen. In the example below the rain clutter adjustment method is “AUTO.”
1.12.2 Setting automatic rain clutter suppression level

1. Press the **MENU** key to open the menu.
2. Choose the Echo menu and press the **ENTER** key.
3. Choose Auto Rain and press the **ENTER** key.
4. Choose the option which best matches current sea condition and press the **ENTER** key.
5. Press the **MENU** key to close the menu. Rain clutter is automatically adjusted according to the level selected.

1.12.3 Manual rain clutter adjustment

1. Push the **A/C RAIN** control to show “RAIN MAN” as the A/C RAIN adjustment method.
2. Rotate the **A/C RAIN** control to suppress the rain clutter.

Appearance of rain clutter

1.13 Automatic Suppression of Sea and Rain Clutters

If neither sea clutter or rain clutter are sufficiently suppressed in spite of adjustment of respective controls, turn on the automatic anti clutter feature to suppress them. **A/C AUTO** appears at the top left corner when this feature is turned on.

1. Press the **MENU** key to open the menu.
2. Choose the Echo menu and press the **ENTER** key.
3. Choose Auto Anti Clutter and press the **ENTER** key.
4. Choose Off or On as appropriate and press the **ENTER** key.
5. Press the **MENU** key to close the menu.
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1.14 Cursor

The cursor functions to find the range and bearing (default function) to a target or the latitude and longitude position of a target. Roll the trackball to position the cursor and read the cursor data at the screen bottom.

Cursor data

Cursor data can be shown as latitude and longitude or range and bearing from own ship to the cursor. Position and heading bearing signal are required.

1. Press the MENU key to open the menu.
2. Choose the Mark menu and press the ENTER key.
3. Choose Cursor Position and press the ENTER key. (Note that cursor latitude and longitude position cannot be displayed when nav data is displayed.)
4. Choose Brg/Rng or Lat/Long as appropriate and press the ENTER key.
5. Press the MENU key to close the menu.

Cursor data

Cursor data (latitude and longitude or range and bearing)
1.15 **Interference Rejector**

Mutual radar interference may occur in the vicinity of another shipborne radar operating in the same frequency band (9 GHz). It is seen on the screen as a number of bright spikes either in irregular patterns or in the form of usually curved spoke-like dotted lines extending from the center to the edge of the picture. Activating the interference rejector circuit can reduce this type of interference.

1. Press the **MENU** key to open the menu.
2. Choose the Echo menu and press the **ENTER** key.
3. Choose Interference Rejector and press the **ENTER** key.
4. Choose Off, Low, Med or High as appropriate and press the **ENTER** key. High provides the highest degree of interference rejection.
5. Press the **MENU** key to close the menu.

Be sure to turn off the interference rejector when no interference exists, so as not to miss small targets.
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1.16 Measuring the Range to a Target

The range to a target may be measured three ways: with the fixed range rings, with the cursor (if set to measure range and bearing), and with the VRM.

Use the fixed range rings to obtain a rough estimate of the range to a target. They are the concentric solid circles about own ship, or the sweep origin. The number of rings is automatically determined by the selected range scale and their interval is displayed at the upper-left position of the screen. 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.

1.16.1 Adjusting range ring brilliance

1. Press the **MENU** key to open the menu.
2. Choose the Brill/Color menu and press the **ENTER** key.

```
<table>
<thead>
<tr>
<th>Menu</th>
<th>Brill/Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brill/Color</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>Range Rings Brill:High</td>
</tr>
<tr>
<td>Echo</td>
<td>Echo Color:Yellow</td>
</tr>
<tr>
<td>Target Trails</td>
<td>Display Color:Night</td>
</tr>
<tr>
<td>Mark</td>
<td>Background Color:Black/Green</td>
</tr>
<tr>
<td>Custom 1</td>
<td>[ENTER]: Enter [CANCEL/HL OFF]: Back</td>
</tr>
<tr>
<td>Custom 2</td>
<td>[MENU]: Exit</td>
</tr>
<tr>
<td>Custom 3</td>
<td></td>
</tr>
<tr>
<td>Tuning</td>
<td></td>
</tr>
<tr>
<td>GPS Buoy</td>
<td></td>
</tr>
<tr>
<td>Target</td>
<td></td>
</tr>
<tr>
<td>ARP</td>
<td></td>
</tr>
<tr>
<td>AIS</td>
<td></td>
</tr>
<tr>
<td>GPS</td>
<td></td>
</tr>
<tr>
<td>➤System</td>
<td></td>
</tr>
</tbody>
</table>
```

3. Choose Range Rings Brill and press the **ENTER** key.

```
Off
Low
Med
High
```

4. Choose appropriate brilliance and press the **ENTER** key.
5. Press the **MENU** key to close the menu.
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1.16.2 Measuring range by the variable range marker (VRM)

There are two VRMs, No. 1 and No. 2, which appear as dashed rings so that you can discriminate them from the fixed range rings. The two VRMs can be distinguished from each other by different lengths of dashes.

1. Press the **VRM** key to display either of the VRMs. Successively pressing the **VRM** key toggles the active VRM between No. 1 and No. 2. The currently active marker is enclosed with >.....< in the VRM indication box.

2. Operate the Trackball to align the variable range marker with the inner edge of the target of interest and read its distance at the lower-right corner of the screen. Each VRM remains at the same geographical distance when you operate the **RANGE** key. This means that the apparent radius of the VRM ring changes in proportion to the selected range scale.

3. You may “anchor” the VRM by choosing it and pressing the **ENTER** key.

4. To erase a VRM, make it active and press the **CANCEL/HL OFF** key.

![Measuring range and bearing between two targets with the EBL](image_url)
1. OPERATIONAL OVERVIEW

1.16.3 Choosing VRM unit

The unit of measurement used by the VRM can be selected to nautical miles, kilometers, statute miles or kiloyard. Note that the cursor range unit is also changed when the VRM unit is changed.

1. Press the **MENU** key to open the menu.
2. Choose the Mark menu and press the **ENTER** key.
3. Choose VRM Unit and press the **ENTER** key.
4. Choose desired unit and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

1.17 Measuring the Bearing to a Target

Use the Electronic Bearing Lines (EBLs) to take bearings of targets. There are two EBLs, No. 1 and No. 2. Each EBL is a straight dashed line extending out from the own ship position up to the circumference of the radar picture. The fine dashed line is the No. 1 EBL and the coarse dashed one is the No. 2 EBL.

1.17.1 Measuring the bearing with an EBL

1. Press the **EBL** key to display either of the EBLs. Successively pressing the **EBL** key toggles the active EBL between No. 1 and No. 2. The currently active marker is enclosed with >.....< in the EBL indication box.
2. Operate the Trackball to bisect the target of interest with the EBL and read its bearing at the lower-left corner of the screen.
3. You may “anchor” an EBL by choosing it and pressing the **ENTER** key.
4. To erase an EBL, make it active and press the **CANCEL/HL OFF** key.

*How to measure the bearing to a target with the EBL*
1.17.2 EBL reference

The EBL readout is affixed by "R" (relative) if it is relative to own ship's heading, "T" (true) if it is referenced to the north. You may choose relative or true in the head-up modes; in all other modes it is always TRUE. True bearing requires a heading sensor.

1. Press the **MENU** key to open the menu.
2. Choose the Mark menu and press the **ENTER** key.
3. Choose EBL Reference and press the **ENTER** key.

4. Choose Relative or True as appropriate and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

1.18 Measuring the Range and Bearing Between Two Targets

You may shift the origin of the EBL to measure the range and bearing between two targets.

1. Press the **EBL** key to choose the bearing indication of No. 1 EBL or No. 2 EBL (whichever you want to use). (The currently active marker is enclosed with >.....<).
2. Place the cursor on target A.
3. Press the **OFFCENTER** key to shift the EBL origin to the location chosen at step 2. Use the trackball to bisect target B with the EBL.
4. Use the **VRM** key to display the VRM having the same number as the EBL activated at step 1.
5. Roll the trackball to set the VRM on the inner edge of target B.
6. Read the bearing and range indications at the bottom of the screen.

To return the origin of an EBL to the screen center, choose appropriate EBL with the **EBL** key, press the **OFFCENTER** key followed by the **ENTER** key. Pressing the **OFFCENTER** key alone places the EBL origin at the screen center and cursor location alternately.
1.19 Target Alarm

The target alarm serves to alert the navigator to targets (ships, landmasses, etc.) entering a set area, with audio and visual alarms.

The alarm may be set to sound against targets entering or exiting the zone. See paragraph 1.19.3.

1.19.1 Setting a target alarm

The procedure which follows shows you how to set a target alarm, using the illustration below as an example.

1. Press the TARGET ALARM key to activate ALARM 1 or ALARM 2 as appropriate.
2. Use the trackball to drag the cursor to the location “A” and press the ENTER key.
3. Drag the cursor to the location “B” and press the ENTER key.

How to set a target alarm zone

- If you wish to create a target alarm zone having a 360-degree coverage around own ship, set point “B” in almost the same direction as point “A.”
- When the target alarm zone is not within the range in use, the indication OUTRNG replaces ALARM1(or 2) IN(or OUT) in the alarm status area. In this case choose a range which will display the target alarm zone.

1.19.2 Silencing the audio alarm

A target in the target alarm zone produces both visual (flashing) and audio (beep) alarms. To silence the audio alarm, press any key. This will deactivate the audio alarm but will not stop the flashing of the offending target.

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.

Note

- If you wish to create a target alarm zone having a 360-degree coverage around own ship, set point “B” in almost the same direction as point “A.”
- When the target alarm zone is not within the range in use, the indication OUTRNG replaces ALARM1(or 2) IN(or OUT) in the alarm status area. In this case choose a range which will display the target alarm zone.
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1.19.3 Choosing alarm type

As noted earlier the target alarm may be set sound against targets entering or exiting the alarm. Choose desired type as below.

In and Out alarms

1. Press the **MENU** key to shown the menu.
2. Choose the Mark menu and press the **ENTER** key.
3. Choose Target Alarm 1 Mode or Target Alarm 2 Mode as appropriate and press the **ENTER** key.

4. Choose "In" to get the alarm on targets entering a target alarm zone or "Out" to alert you to targets exiting a target alarm zone.
5. Press the **ENTER** key followed by the **MENU** key.

1.19.4 Temporarily deactivating a target alarm

You may temporarily deactivate a target alarm when its use is not immediately required. The alarm zone remains on the screen, however any targets entering (or exiting) it will not trigger the audio and visual alarms.

1. Press the **TARGET ALARM** key to choose the ALARM1 or ALARM2 indication at the bottom right corner on the screen. The selected indication is circumscribed with a rectangle.
2. Press the **CANCEL/HL OFF** key. The alarm indication now shows ALARM1(or 2)_ACK.

To reactivate a temporarily deactivated target alarm, press the **ENTER** key with the alarm zone displayed on the screen. The alarm indication then changes to ALARM1(or 2)_IN(or OUT).

1.19.5 Deactivating a target alarm

1. Press the **TARGET ALARM** key to choose ALARM1 or ALARM2 indication at the bottom right corner on the screen. The selected indication is circumscribed with a rectangle.
2. Press the **CANCEL/HL OFF** key.
3. Press the **TARGET ALARM** key again, and a dashed rectangle circumscribes the alarm indication which now reads ALARM1(or 2)_ACK.
4. Press the **CANCEL/HL OFF** key again. The target alarm zone and the alarm indication are erased from the screen.
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1.19.6 Choosing target strength which triggers target alarm

You may choose the target strength level which triggers the alarm as follows:

1. Press the MENU key to open the menu.
2. Choose the Initial sub menu from the System menu and the press the ENTER key.
3. Choose Alarm Level and press the ENTER key.
4. Choose the echo strength level which you want to trigger the target alarm.
5. Press the ENTER key.
6. Press the MENU key to close the menu.

1.20 Off Centering the Display

Own ship position, or sweep origin, can be displaced to expand the view field without switching to a larger range scale.

The display may be off centered manually, or automatically according to ship's speed. Press the OFF CENTER key successively to choose desired off centering method or turn off centering, in the sequence of manual, automatic, off. OFF CENTER(M) or OFFCENTER(A) appears at the top left corner on the display when off centering is enabled. Note that off center is not available on the 96 nm range scale.

1.20.1 Automatic off center

The amount of automatic shift is calculated according to ship's speed, and the amount is limited to 75% of the range in use. The formula for calculating automatic shift is shown below.

\[
\text{Amount of shift(\%)} = \frac{\text{Ship's speed}}{\text{Shift speed setting}} \times 0.75
\]

For example, if you set the shift speed setting for 15 knots and the ship is running at 10 knots the amount of shift will be 50% of the effective display area.

Choosing speed to use

1. Press the MENU key to open the menu.
2. Choose the Initial sub menu from the System menu and the press the ENTER key.
3. Choose Shift Speed and press the ENTER key.
4. Choose the speed to use and press the ENTER key.
5. Press the MENU key to close the menu.
Activating automatic off center
Press the OFF CENTER key to display OFF CENTER (A) at the top of the screen. Own ship position is placed at stern position. To cancel automatic shift press the key again.

1.20.2 Manual off center
The own ship position may be shifted to the cursor position on any mode, within 75% of the effective display area.
1. Place the cursor where you want locate to locate sweep origin.
2. Press the OFF CENTER key to show OFF CENTER (M) at the top of the screen.
3. To cancel shift, press the OFF CENTER key again.

1.21 Zoom
The zoom function enlarges an area of interest as large as twice the normal viewing size, in the zoom window. You choose the target of interest to zoom with the zoom cursor and that target is zoomed in the zoom window.

Three types of zoom are available: Relative, True and Target.
Relative: The zoom cursor moves relative to own ship.
True: The zoom cursor is fixed at set geographical position.
Target: The zoom cursor is fixed to the zoomed AIS or ARP target.

1.21.1 How to zoom
1. Press the ZOOM key to turn on the zoom feature.
   ZOOM appears at the top right hand corner of the screen and the zoom window and zoom cursor in the effective display area. The zoom cursor is a dashed line square in case of true or relative zoom mode or a solid line square in case of target zoom mode. The location of the zoom window depends on the location of the zoom cursor. If the zoom cursor is on the left-half of the screen, the zoom window is located at the right side of the screen and vice versa.
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2. Do one of the following depending on the zoom mode in use.

**Relative or true zoom mode**

1. Use the trackball to place the cursor where you want to zoom and press the **ENTER** key. The zoom cursor is shown with solid lines and is fixed at the location chosen. Each press of the **ZOOM** key enables or disables the zoom cursor. The zoom cursor is shown with dashed lines when it is active and solid lines when it is inactive.

2. To quit zoom, press the **ZOOM** key to show the zoom cursor with dashed lines and press the **CANCEL/HL OFF** key.

**Target zoom mode**

The zoom cursor is interlinked with zoomed ARP or AIS target. The zoomed ARP or AIS target corresponds to the data last-displayed in the data box at the bottom of the display. To quit target zoom, press the **ZOOM** key again.

*Note: If neither ARP nor AIS target exists, the message NO TARGET appears. Press any key to erase the message.*

### 1.21.2 Zoom mode

You may choose the zoom mode from among Relative, True or Target.

1. Press the **MENU** key to open the menu.
2. Choose the Display menu and press the **ENTER** key.
3. Choose Zoom Mode and press the **ENTER** key.

```
Relative
True
Target
```

4. Choose the appropriate option and press the **ENTER** key.
5. Press the **MENU** key to close the menu.
1.22 Echo Stretch

The echo stretch feature enlarges targets in the range and bearing directions to make them easier to see, and is available on any range. There are three levels of echo stretch as shown in the table below.

*Echo stretch settings*

<table>
<thead>
<tr>
<th>ES Setting</th>
<th>Range</th>
<th>Bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stretched to two dots</td>
<td>An echo is stretched to three dots if its size is less than three dots. If its size is larger than three dots it is not stretched.</td>
</tr>
<tr>
<td>2</td>
<td>Stretched to three dots</td>
<td>An echo is stretched to four dots if its size is less than four dots. If its size is larger than four dots it is not stretched.</td>
</tr>
<tr>
<td>3</td>
<td>Stretched to three dots</td>
<td>An echo is stretched to five dots if its size is less than five dots. If its size is larger than five dots it is not stretched.</td>
</tr>
</tbody>
</table>

*Note* The echo stretch magnifies not only small target pips but also returns (clutter) from sea surface, rain and radar interference. For this reason, make sure those types of interference have been sufficiently suppressed before activating the echo stretch.

1. Press the **MENU** key to open the menu.
2. Choose the Echo menu and press the **ENTER** key.
3. Choose Echo Stretch and press the **ENTER** key.
4. Choose the appropriate echo stretch option and press the **ENTER** key.
5. Press the **MENU** key to close the menu.
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1.23Echo Averaging

To distinguish real target echoes from sea clutter, echoes are averaged over successive picture frames. If an echo is solid and stable, it is presented in its normal intensity. Sea clutter is averaged over successive scans resulting in reduced brilliance, making it easier to discriminate real targets from sea clutter.

```
• Do not use the echo average function under heavy pitching and rolling; loss of target detection can result.
• This feature requires a heading signal. When the signal becomes lost, echo average is automatically disabled.
```

To properly use the echo average function, it is recommended to first suppress sea clutter with the A/C SEA control. Then, do as follows:

1. Press the MENU key to open the menu.
2. Choose the Echo menu and press the ENTER key.
3. Choose Echo Average and press the ENTER key.

```
Off
1
2
3
```

4. Choose the appropriate echo averaging option and press the ENTER key.
   - **Off**: Disable echo average.
   - **1**: Distinguish targets from sea clutter and suppress brilliance of unstable echoes.
   - **2**: Effective against sea clutter which cannot be reduced with setting 1.
   - **3**: Stably display distant, unstable targets.
5. Press the MENU key to close the menu. The chosen echo average (EAV1, EAV2 or EAV3) appears at the top left corner of the display.
1.24 Target Trails

The trails of the radar targets may be displayed in the form of synthetic afterglow. Target trails are chosen either relative or true. True motion trails require a heading bearing signal and position data.

1.24.1 Starting, stopping trails

1. Press the TRAILS key to start trails and choose trail time. The chosen time, along with trail mode, is shown at the bottom left corner as shown in the figure below. Trail time is available among 15 s, 30 s, 1 min., 3 min., 6 min., 15 min., and 30 min., and CONTINUOUS. (If 12 H or 24 is selected for Length on the Target Trails menu, one of those times plus CONTINUOUS are the choices.)

![Trail indications]

Trail Mode (T, True, R, Relative) → TRAILS (T) → Trail Time → 15S

2. To change trail time, press the TRAILS key to choose desired trail time. The longer the trail time, the longer the trail itself. The trial time selectable with the TRAILS key changes according to trail length setting on the menu. For further details, see paragraph 1.24.10.

Note

• To erase trails, press and hold down the TRAILS key until a beep sounds. Alternatively, execute All Cancel on the Trails menu.

• To disable trails, press and hold down the TRAILS key several times until the trail indications and trails are erased from the display.
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1.24.2 Trail mode

You may display echo trails in true or relative motion. Relative trails show relative movements between targets and own ship. True motion trails present true target movements in accordance with their over-the-ground speeds and course, and require a gyrocompass signal and own ship speed input.

(a) True target trails
(No smearing of stationary targets)

(b) Relative target trails
(Targets moving relative to own ship)

To choose trail mode, do the following:

1. Press the MENU key to open the menu.
2. Choose the Target Trails menu and press the ENTER key.
3. Choose Mode and press the ENTER key.
4. Choose the appropriate mode and press the ENTER key.
5. Press the MENU key to close the menu.
1.24.3 Trail gradation

Trails may be shown in single or multiple gradation. Multiple gradation provides gradual shading over time. This feature is available when Length on the Target Trails menu is set to Normal.

1. Press the MENU key to open the menu.
2. Choose the Target Trails menu and press the ENTER key.
3. Choose Trail Gradation and press the ENTER key.

![Single and Multi options]

4. Choose Single or Multi and press the ENTER key.

![Single and Multiple shading options]

5. Press the MENU key to close the menu.

1.24.4 Trail color

You may choose the color in which to paint trails. This feature is available when Length on the Target Trails menu is set to Normal.

1. Press the MENU key to open the menu.
2. Choose the Target Trails menu and press the ENTER key.
3. Choose Color and press the ENTER key.

![Color options]

4. Choose the appropriate color and press the ENTER key.
5. Press the MENU key to close the menu.

1.24.5 Trail level

You may choose which target strength for which to generate trails.

1. Press the MENU key to open the menu.
2. Choose the Target Trails menu and press the ENTER key.
3. Choose Level and press the ENTER key.

![Level options]

4. Choose 1, 2 or 3 as appropriate and press the ENTER key.

   1: Trails generated for all targets (including weak ones), 2: Normal usage, 3: Trails generated for strong targets only

5. Press the MENU key to close the menu.
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1.24.6 Trail copy

The trail copy feature, which is turned on in the default setting, lets you continue tracing target trails when switching to a range twice as large or up to half the current range. (If the newly selected range is out of those limits, trails are cleared from the screen and then restarted.) When trail copy is turned off, trails are erased and restarted whenever the range is changed.

How trail copy works

1. Press the **MENU** key to open the menu.
2. Choose the Target Trails menu and press the **ENTER** key.
3. Choose Copy and press the **ENTER** key.
4. Choose Off or On as appropriate and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

1.24.7 Narrow trails

Target trails may be painted in thinner trails if desired. This can be useful when there are a lot of targets on the screen.

1. Press the **MENU** key to open the menu.
2. Choose the Target Trails menu and press the **ENTER** key.
3. Choose Narrow and press the **ENTER** key.
4. Choose Off or On as appropriate and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

1.24.8 Own ship trail

You may show own ship's trail as follows:

1. Press the **MENU** key to open the menu.
2. Choose Own Ship and press the **ENTER** key.
3. Choose Off or On as appropriate and press the **ENTER** key.
4. Press the **MENU** key to close the menu.
1.24.9 Restarting trails

When the range is changed while the trail feature is active, trails within the former range scale may stopped and restarted. The relationship between trail restart and trail copy is shown in the table below.

<table>
<thead>
<tr>
<th>Restart feature</th>
<th>Trail copy feature</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>On or Off</td>
<td>Range switched to adjacent range scale</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All trails are erased when range is changed. Trails are not restarted.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Return to previous range scale</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Previous trails are displayed and are continued.</td>
</tr>
<tr>
<td>On</td>
<td>On</td>
<td>Range switched to adjacent range scale</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Previous trails remain on the display and are continued.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Return to previous range scale</td>
</tr>
<tr>
<td></td>
<td>Off</td>
<td>Range switched to adjacent range scale</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trails are restarted.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Return to previous range scale</td>
</tr>
</tbody>
</table>

1. Press the **MENU** key to open the menu.
2. Choose Restart and press the **ENTER** key.
3. Choose Off or On as appropriate and press the **ENTER** key.
4. Press the **MENU** key to close the menu.

1.24.10 Trail length

Several preset trail lengths (times) are programmed for the **TRAILS** key for your convenience.

Standard trail times: 15 s, 30 s, 1 min, 3 min, 6 min, 15 min, 30 min, continuous 12H and 24 times: Long trail settings, continuous

If you prefer a different time you may set it as below.

1. Press the **MENU** key to open the menu.
2. Choose Target Trails and press the **ENTER** key.
3. Choose Length and press the **ENTER** key.

**Normal**

12H

24H

4. Choose Normal, 12H or 24H as appropriate and press the **ENTER** key.

**Normal**: Use times programmed for the **TRAILS** key.

**12H**: Continuous trail from 30 minutes to 12 hours, in increments of 30 minutes.

**24H**: Continuous trail from one hour to 24 hours, in increments of one hour.

For Normal, go to step 7. For 12H or 24H, go to the next step.
5. Choose Time and press the **ENTER** key.

6. Roll the trackball upward or downward as appropriate to set time and press the **ENTER** key.

7. Press the **MENU** key to close the menu.

### 1.25 Parallel Index Lines

Parallel index lines are useful for keeping a constant distance between own ship and a coastline or a partner ship when navigating. You may control the orientation and line interval.

![Parallel index lines](Parallel_index_lines.png)

#### 1.25.1 Turning parallel index lines on or off

1. Press the **MENU** key to show the menu.
2. Choose Mark and press the **ENTER** key.
3. Choose Parallel Line and press the **ENTER** key.

   ![Parallel index lines](Off_2_3_6.png)

4. Choose the number of parallel index lines to show (2, 3 or 6) or choose Off to turn off the lines. (The actual number of lines visible may be less depending on line interval.)
5. Press the **ENTER** key.
6. Press the **MENU** key to close the menu.

#### 1.25.2 Adjusting parallel index line orientation and interval

1. Press the **EBL** key to activate the No. 2 EBL.
2. Roll the trackball to adjust the orientation of the lines.
3. Press the **VRM** key to activate the No. 2 VRM.
4. Roll the trackball to adjust the interval between lines.
1.25.3 Parallel index lines mode

You may choose the index line orientation against the No. 2 EBL (dashed line) for parallel or vertical as follows:

1. Press the MENU key to open the menu.
2. Choose Mark and press the ENTER key.
3. Choose Parallel Line Mode and press the ENTER key.
4. Choose Parallel or Vertical as appropriate and press the ENTER key.

1.26 Outputting Target Position, Inscribing Origin Mark

The TLL key functions to both output cursor position to external equipment such as a navigation plotter (where it is marked on its screen) and inscribe an asterisk (*) at cursor position on the radar. Twenty marks may be inscribed on the screen. When you enter a 21st mark, the eldest mark is erased to make room for the latest. To erase a mark, place the cursor on it and press the CANCEL/HL OFF key.

1.26.1 TLL key mode

The TLL key can be preset to output target position, inscribe the origin mark or do both.

1. Press the MENU key to open the menu.
2. Choose Mark and press the ENTER key.
3. Choose TLL Key Mode and press the ENTER key.

4. Choose TLL Output, Origin Mark or Both as appropriate and press the ENTER key.
   - **TLL Output**: Cursor Lat/Lon output to plotter (heading signal and position data required)
   - **Origin Mark**: Origin mark is inscribed at cursor position.
   - **Both**: Origin mark is entered and that position is output to a navigator.
5. Press the MENU key to close the menu.
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1.26.2 Origin mark mode

You may choose how the origin mark moves on the screen from either True or Relative.

1. Press the **MENU** key to open the menu.
2. Choose Mark and press the **ENTER** key.
3. Choose Origin Mark Mode and press the **ENTER** key.

4. Choose Relative or True as appropriate and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

The asterisk mark is dashed in relative motion; solid in true motion.

1.27 Temporarily Hiding the Heading Line

The heading line indicates the ship's heading in all presentation modes. The heading line is a line from the own ship position to the outer edge of the radar display area and appears at zero degrees on the bearing scale in head-up mode; it changes the orientation depending on the ship orientation in north-up and true motion modes and when course is changed in the course-up mode.

To temporarily hide the heading line (and any other marker present) to look at targets existing dead ahead of own ship, press and hold down the **CANCEL/HL OFF** key. To re-display the heading line, release the key.

1.28 Custom Setup

1.28.1 About custom setup

Every time your navigating environment or task changes, you must adjust the radar, which can be a nuisance in a busy situation. Instead of changing radar settings case by case, it is possible to assign the **CUSTOM** key to provide optimum settings for often encountered situations.

The radar's internal computer offers three default custom setups (see the table below). However, you may customize these settings to meet your navigation needs, on the Custom 1, Custom 2 and Custom 3 menus.

To enable a custom setup, press the **CUSTOM** key. Each press of the key enables Custom1, Custom2 or Custom3 cyclically. (Custom setup numbers which are turned off will be skipped.) The chosen custom setup name is shown at the top left corner. To escape from custom setup, operate any control.
## 1.28.2 Description of custom setup items

*Description of custom setup items*

<table>
<thead>
<tr>
<th>Menu item</th>
<th>Available settings</th>
<th>See para., page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custom 1, 2 or 3</td>
<td>Turn respective custom program on/off.</td>
<td></td>
</tr>
<tr>
<td>Copy</td>
<td>Copy settings from the Echo menu.</td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Choose name of custom setup among harbor, long, sea, rain, buoy, and bird.</td>
<td></td>
</tr>
<tr>
<td>Gain</td>
<td><strong>Rough, Moderate, Calm:</strong> Automatic gain adjustment according to sea state.</td>
<td>1.10, 1-12</td>
</tr>
<tr>
<td></td>
<td><strong>Manual:</strong> Manual adjustment</td>
<td></td>
</tr>
<tr>
<td>Sea</td>
<td><strong>Rough, Moderate, Calm:</strong> Automatic sea clutter adjustment according to sea state.</td>
<td>1.11, 1-13</td>
</tr>
<tr>
<td></td>
<td><strong>Manual:</strong> Manual adjustment</td>
<td></td>
</tr>
<tr>
<td>Rain</td>
<td><strong>Rough, Moderate, Calm:</strong> Automatic rain clutter adjustment according to sea state.</td>
<td>1.12, 1-14</td>
</tr>
<tr>
<td></td>
<td><strong>Manual:</strong> Manual adjustment</td>
<td></td>
</tr>
<tr>
<td>Pulse length</td>
<td>Short or Long, selectable on 1.5 and 3 nm ranges.</td>
<td>1.9, 1-11</td>
</tr>
<tr>
<td>Echo stretch</td>
<td>Off, 1, 2, 3</td>
<td>1.22, 1-27</td>
</tr>
<tr>
<td>Echo average</td>
<td>Off, 1, 2, 3</td>
<td>1.23, 1-28</td>
</tr>
<tr>
<td>Noise rejector</td>
<td>Off, Low, Med, High</td>
<td>1.30, 1-40</td>
</tr>
<tr>
<td>Interference rejector</td>
<td>Off, Low, Med, High</td>
<td>1.15, 1-17</td>
</tr>
<tr>
<td>Auto anti-clutter</td>
<td>Off, On</td>
<td>1.13, 1-15</td>
</tr>
<tr>
<td>Display-dynamic</td>
<td><strong>Narrow:</strong> See small targets located on near ranges</td>
<td>1.35, 1-45</td>
</tr>
<tr>
<td></td>
<td><strong>Normal:</strong> Normal use</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Wide:</strong> Suppress unwanted reflections</td>
<td></td>
</tr>
<tr>
<td>Display-curve</td>
<td>1: Suppress unwanted reflections</td>
<td>1.36, 1-45</td>
</tr>
<tr>
<td></td>
<td>2: Normal use</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3: See small targets located on near ranges</td>
<td></td>
</tr>
<tr>
<td>Antenna speed</td>
<td>24 rpm, 36 rpm, 48 rpm, Auto/Range</td>
<td>1.37, 1-46</td>
</tr>
</tbody>
</table>
1. OPERATIONAL OVERVIEW

1.28.3 Setting custom setups

1. Press the **MENU** key to show the menu.
2. Choose Custom 1, Custom 2 or Custom 3 as appropriate and press the **ENTER** key.

3. Choose Name and press the **ENTER** key to display the options shown right.
4. Choose the name which best matches your desired objective and press the **ENTER** key.
5. Set other menu items as appropriate.

   **Note:** For easy set up, you can copy the settings of the Echo menu (to Custom 1, Custom 2, Custom 3). Choose Copy and press the **ENTER** key. The message “Complete” appears upon completion of copying.

6. Press the **MENU** key to close the menu.

### Sample custom setups

<table>
<thead>
<tr>
<th>Menu item</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Harbor</td>
</tr>
<tr>
<td>Gain</td>
<td>Moderate</td>
</tr>
<tr>
<td>Sea</td>
<td>Calm</td>
</tr>
<tr>
<td>Rain</td>
<td>Calm</td>
</tr>
<tr>
<td>Pulse length</td>
<td>Short</td>
</tr>
<tr>
<td>Echo stretch</td>
<td>Off</td>
</tr>
<tr>
<td>Echo average</td>
<td>Off</td>
</tr>
<tr>
<td>Noise rejector</td>
<td>Off</td>
</tr>
<tr>
<td>Int. rejector</td>
<td>High</td>
</tr>
<tr>
<td>Auto anti-clutter</td>
<td>Off</td>
</tr>
<tr>
<td>Display-dynamic</td>
<td>Narrow</td>
</tr>
<tr>
<td>Display-curve</td>
<td>2</td>
</tr>
<tr>
<td>Antenna speed</td>
<td>48 rpm</td>
</tr>
</tbody>
</table>
1.29 Programming Function Keys (F1 and F2 keys)

Many functions are provided in the menu. To avoid opening the menus to set up the radar for a particular situation, you may program a function key, F1 and F2, to provide one-touch access to a desired function.

**Function key operation**

To activate a function, simply press the appropriate function key, F1 or F2. Push the same function key again to display appropriate option and press the ENTER key.

The default programs are F1, Echo Average, F2, Auto Anti Clutter.

**Changing function key program**

To change function key program, do the following:

1. Press the MENU key to show the menu.
2. Choose Display and press the ENTER key.
3. Choose Function 1 Setup or Function 2 Setup as appropriate and press the ENTER key.
4. Choose desired function from the list and press the ENTER key. Below are the functions available.

<table>
<thead>
<tr>
<th>Range Rings Brill</th>
<th>Antenna Speed</th>
<th>GPS Buoy-Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Echo Color</td>
<td>2nd Echo Rejector</td>
<td>GPS Buoy-Symbol Color</td>
</tr>
<tr>
<td>Display Color</td>
<td>Trails-Gradation</td>
<td>GPS Buoy-History Dots</td>
</tr>
<tr>
<td>Background Color</td>
<td>Trails-Color</td>
<td>Vector Time</td>
</tr>
<tr>
<td>Echo Area</td>
<td>Trails-Mode</td>
<td>Vector Reference</td>
</tr>
<tr>
<td>Watchman Time</td>
<td>Trails-Level</td>
<td>History Dots</td>
</tr>
<tr>
<td>Data Box</td>
<td>Trails-Length</td>
<td>History Intervals</td>
</tr>
<tr>
<td>Zoom Mode</td>
<td>Trails-Copy</td>
<td>CPA</td>
</tr>
<tr>
<td>STBY Mode Display</td>
<td>Trails-Restart</td>
<td>TCPA</td>
</tr>
<tr>
<td>Auto Gain</td>
<td>Trails-Narrow</td>
<td>Proximity Alarm</td>
</tr>
<tr>
<td>Auto Sea</td>
<td>Trails-Own Ship</td>
<td>ARP-Display</td>
</tr>
<tr>
<td>Auto Rain</td>
<td>Waypoint Mark Display</td>
<td>ARP-Symbol Color</td>
</tr>
<tr>
<td>Tuning Mode</td>
<td>Origin Mark Mode</td>
<td>ARP-Auto Acquire</td>
</tr>
<tr>
<td>Pulse Length</td>
<td>TLL Key Mode</td>
<td>AIS-Display</td>
</tr>
<tr>
<td>Echo Stretch</td>
<td>Parallel Line</td>
<td>AIS-Symbol Color</td>
</tr>
<tr>
<td>Echo Average</td>
<td>Parallel Line Mode</td>
<td>AIS-Sort By</td>
</tr>
<tr>
<td>Noise Rejector</td>
<td>EBL Reference</td>
<td>GPS-Mode</td>
</tr>
<tr>
<td>Interference Rejector</td>
<td>VRM Unit</td>
<td>GPS-Datum</td>
</tr>
<tr>
<td>Auto Anti Clutter</td>
<td>Cursor Position</td>
<td>GPS-WAAS</td>
</tr>
<tr>
<td>Display-Dynamic</td>
<td>Target Alarm 1 Mode</td>
<td></td>
</tr>
<tr>
<td>Display-Curve</td>
<td>Target Alarm 2 Mode</td>
<td></td>
</tr>
</tbody>
</table>

**Function list**

5. Press the MENU key to close the menu.
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1.30 Noise Rejector

White noise may show itself on the screen as random "speckles" spread over the entire display. You can suppress this noise as follows:

1. Press the **MENU** key to show the menu.
2. Choose Echo and press the **ENTER** key.
3. Choose Noise Rejector and press the **ENTER** key.

   - Off
   - Low
   - Med
   - High

4. Choose Off, Low, Med or High as appropriate and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

1.31 Suppressing Second-trace Echoes

In certain situations, echoes from very distance targets may appear as false echoes (second-trace echoes) on the screen. This occurs when the return echo is received one transmission cycle later, or after a next radar pulse has been transmitted.

![Diagram of how second-trace echoes are produced]

*How 2nd trace echoes are produced*

1. Press the **MENU** key to show the menu.
2. Choose Echo and press the **ENTER** key.
3. Choose 2nd Echo Rejector and press the **ENTER** key.
4. Choose On or Off as appropriate and press the **ENTER** key.
5. Press the **MENU** key to close the menu.
1.32 **Watchman**

The Watchman feature transmits for one minute at the elapse of the chosen time interval to help you keep regular watch of the radar picture for safety or other purposes.

How watchman works

In standby condition, the timer below the WATCH label at the upper right corner of the screen counts down the time remaining until transmission. When the preset time interval has elapsed, the audio alarm sounds, the timer disappears and the radar transmits for one minute. After one minute, the watch alarm timer begins the countdown sequence again.

If you press the **STBY/TX** key before the preset time interval has elapsed, the radar goes into standby.

Do the following to activate Watchman:

1. Press the **MENU** key to show the menu.
2. Choose **Display** and press the **ENTER** key.
3. Choose Watchman and press the **ENTER** key.
4. Choose Off or appropriate time (5, 10 or 20 min) and press the **ENTER** key.
5. Press the **MENU** key to close the menu.
1.33 Color Schemes

1.33.1 Preset color schemes

Preset color schemes are provided for optimum viewing in daytime, nighttime and twilight. Below are the default color settings for each preset color scheme.

Display item, color scheme and color

<table>
<thead>
<tr>
<th>Display item</th>
<th>Day</th>
<th>Night</th>
<th>Twilight</th>
<th>User</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text</td>
<td>Black</td>
<td>Red</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Range rings</td>
<td>Green</td>
<td>Red</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Echo</td>
<td>Yellow</td>
<td>Green</td>
<td>Green</td>
<td>Yellow</td>
</tr>
<tr>
<td>Background</td>
<td>White</td>
<td>Black</td>
<td>Blue</td>
<td>Black</td>
</tr>
</tbody>
</table>

1. Press the MENU key to show the menu.
2. Choose Brill/Color and press the ENTER key.
3. Choose Display Color and press the ENTER key.
4. Choose a color scheme and press the ENTER key.
5. Press the MENU key to close the menu.

1.33.2 User color scheme

The user color scheme lets you choose desired echo color and background color. The display color must be set for “User” (see paragraph 1.33.1) to use user chosen echo and background colors.

1. Press the MENU key to show the menu.
2. Choose Brill/Color and press the ENTER key.
3. Choose Echo Color and press the ENTER key.
4. Choose appropriate option and press the ENTER key. “Multi” displays echoes in colors of red, yellow and green according to echo strength, and it is not available in the IEC mode.
5. Choose Background Color and press the ENTER key.
6. Choose background color desired and press the ENTER key.
7. Press the MENU key to close the menu.
1.34 Navigation Data

1.34.1 Navigation data during standby

Navigation data is shown in standby when STBY Mode Display in the Initial Menu is set to “Nav”. Appropriate sensors required to display data.
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**Depth and water temperature graphs**

These graphs display the latest 30 minutes of respective data. The horizontal axis scale is fixed and data is plotted at intervals of 10 seconds. The vertical axis scale is adjusted automatically for every 30 minutes of data. The unit of measurement may be chosen on the Initial sub menu in the System menu.

**Wind graph**

Wind direction reference may be chosen (on the Initial sub menu) from True or Apparent. **Apparent wind** is the direction (in relation to ship’s bow) and speed of the wind as it appears to those on board, relative to the speed and direction of the boat; combination of the true wind and the wind caused by the boat's movement. **True wind** is the speed and direction (in relation to ship’s bow) of the wind felt or measured when stationary.

### 1.34.2 Navigation data at the bottom of the screen

Navigation data may be displayed at the bottom of the screen.

<table>
<thead>
<tr>
<th>OWN SHIP</th>
<th>CURSOR</th>
<th>WAY POINT</th>
<th>TEMP</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAT: 34°56.123 N LON: 135°34.567 E</td>
<td>LAT: 34°56.123 N LON: 135°34.567 E</td>
<td>POINT: 202.2° TTG: 00:20</td>
<td>12.3°C</td>
<td>56.7 m</td>
</tr>
<tr>
<td>SPEED 12.3 kt</td>
<td></td>
<td>TTG: 01:00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Own ship position and speed
Cursor latitude position
Cursor longitude position
Time to go to cursor position

Water temperature, Depth

**Navigation data**

To show navigation data at the bottom of the screen, do the following:

1. Press the **MENU** key to open the menu.
2. Choose the Display menu and press the **ENTER** key.
3. Choose Data Box and press the **ENTER** key.

<table>
<thead>
<tr>
<th>Off</th>
<th>Nav</th>
<th>Target</th>
<th>All</th>
</tr>
</thead>
</table>

4. Choose appropriate option and press the **ENTER** key.
   - **Off**: Turn data display off.
   - **Nav**: Navigation data
   - **Target**: ARP and AIS target data
   - **All**: Navigation data plus ARP and AIS target data

5. Press the **MENU** key to close the menu.
1.35 Dynamic Range

You may change the dynamic range to cope with sea conditions or get a better view at a certain target.

1. Press the **MENU** key to open the menu.
2. Choose the Echo menu and press the **ENTER** key.
3. Choose Display-Dynamic and press the **ENTER** key.

   - **Narrow**
   - **Normal**
   - **Wide**

4. Choose Narrow, Normal or Wide as appropriate and press the **ENTER** key.
   - **Narrow**: See small targets located on near ranges.
   - **Normal**: Normal use
   - **Wide**: Suppress unwanted reflections

5. Press the **MENU** key to close the menu.

1.36 Characteristics Curve

The characteristics curve of this radar may be changed to cope with sea conditions or get a better view at a certain target.

1. Press the **MENU** key to open the menu.
2. Choose the Echo menu and press the **ENTER** key.
3. Choose Display-Curve and press the **ENTER** key.

   - **1**
   - **2**
   - **3**

4. Choose 1 or 2(Exponential) or 3(Logarithm) as appropriate and press the **ENTER** key.
   - **1**: Suppress unwanted reflections
   - **2**: Normal use
   - **3**: See small targets on near ranges.

5. Press the **MENU** key to close the menu.
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1.37 Antenna Speed

The antenna speed may be changed to meet operating requirements. Choose a high speed when cruising at high speed to ensure timely update of radar targets. Note that the speed cannot be changed on the 24 rpm motor; it is fixed at 24 rpm.

1. Press the **MENU** key to open the menu.
2. Choose the Echo menu and press the **ENTER** key.
3. Choose Antenna Speed and press the **ENTER** key.
4. Choose appropriate antenna speed. Auto/Range automatically changes antenna speed according to range.
5. Press the **ENTER** key.
6. Press the **MENU** key to close the menu.

1.38 Waypoint Marker

The waypoint marker shows the location of the destination waypoint set on a navigation plotter. You can turn this mark on or off as follows:

1. Press the **MENU** key to open the menu.
2. Choose Mark and press the **ENTER** key.
3. Choose Waypoint Mark Display and press the **ENTER** key.
4. Choose On or Off as appropriate and press the **ENTER** key.
5. Press the **MENU** key to close the menu.
1.39 Alarm Message Display

When trouble occurs the radar generates audio and visual (alarm message display) alarms to alert you. The alarm message display shows all alarms currently violated. You may show this display as follows:

1. Press the **MENU** key to open the menu.
2. Choose the Display menu and press the **ENTER** key.
3. Choose Alarm Message and press the **ENTER** key.

<table>
<thead>
<tr>
<th>Alarm Message</th>
<th><img src="image" alt="Alarm message display" /></th>
</tr>
</thead>
</table>

**Alarm message display**

To close the alarm message display, press any key.

**List of alarm messages**

![List of alarm messages](image)

<table>
<thead>
<tr>
<th>Alarm category</th>
<th>Alarm name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal missing</td>
<td></td>
</tr>
<tr>
<td>BEARING</td>
<td>Bearing signal lost</td>
</tr>
<tr>
<td>GYRO</td>
<td>AD-10 format gyro signal lost</td>
</tr>
<tr>
<td>HEADING</td>
<td>Heading signal lost</td>
</tr>
<tr>
<td>NMEA-HEAD</td>
<td>NMEA format heading signal lost</td>
</tr>
<tr>
<td>POSITION</td>
<td>NMEA format position data lost</td>
</tr>
<tr>
<td>TRIGGER</td>
<td>Trigger signal lost</td>
</tr>
<tr>
<td>VIDEO</td>
<td>Video signal lost</td>
</tr>
<tr>
<td>Target alarm</td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>An echo has entered a target alarm zone.</td>
</tr>
<tr>
<td>OUT</td>
<td>An echo has exited a target alarm zone.</td>
</tr>
<tr>
<td>ARP alarm</td>
<td></td>
</tr>
<tr>
<td>COLLISION</td>
<td>CPA and TCPA of an ARP target is less than CPA and TCPA alarm settings.</td>
</tr>
<tr>
<td>LOST</td>
<td>Acquired ARP target becomes lost.</td>
</tr>
<tr>
<td>PROXIMITY</td>
<td>The range to an ARP target is less than the user-set proximity alarm range.</td>
</tr>
</tbody>
</table>
### List of alarm messages

<table>
<thead>
<tr>
<th>Alarm category</th>
<th>Alarm name</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIS alarm</td>
<td></td>
</tr>
<tr>
<td>COLLISION</td>
<td>CPA and TCPA of an AIS target is less than CPA and TCPA alarm settings.</td>
</tr>
<tr>
<td>PROXIMITY</td>
<td>The range to an AIS target is less than the user-set proximity alarm range.</td>
</tr>
<tr>
<td>AIS system</td>
<td></td>
</tr>
<tr>
<td>ANT</td>
<td>Antenna VSWR trouble</td>
</tr>
<tr>
<td>CH1</td>
<td>TDM2 RX1 board trouble</td>
</tr>
<tr>
<td>CH2</td>
<td>TDM2 RX2 board trouble</td>
</tr>
<tr>
<td>CH70</td>
<td>X channel 70 trouble</td>
</tr>
<tr>
<td>COG</td>
<td>Course data lost</td>
</tr>
<tr>
<td>FAIL</td>
<td>System failure</td>
</tr>
<tr>
<td>EPFS</td>
<td>Navigator (GPS, etc.) trouble</td>
</tr>
<tr>
<td>HDG</td>
<td>Heading data lost</td>
</tr>
<tr>
<td>L/L</td>
<td>Position data lost</td>
</tr>
<tr>
<td>MKD</td>
<td>Minimum input device lost</td>
</tr>
<tr>
<td>ROT</td>
<td>Rate of turn data lost</td>
</tr>
<tr>
<td>SOG</td>
<td>Speed data lost</td>
</tr>
<tr>
<td>TX</td>
<td>TX stopped or TX error</td>
</tr>
</tbody>
</table>
1.40  **Echo Area**

The effective display area can be either ellipse or square shaped.

Area in which echoes are displayed

1. Press the **MENU** key to open the menu.
2. Choose the Display menu and press the **ENTER** key.
3. Choose Echo Area and press the **ENTER** key.

<table>
<thead>
<tr>
<th>Ellipse</th>
<th>Square</th>
</tr>
</thead>
</table>

4. Choose appropriate configuration and press the **ENTER** key.
5. Press the **MENU** key to close the menu.
1. OPERATIONAL OVERVIEW

1.41 Customizing (Initial Menu)

The Initial sub menu in the System menu contains items which allow you to customize your radar to meet your operational needs.

1.41.1 Opening the Initial menu

1. Press the MENU key to open the menu.
2. Roll the trackball to choose System followed by Initial and press the ENTER key.

```
[ENTER]: Enter  [CANCEL/HL OFF]: Back  
[MENU]: Exit
```

1.41.2 Description of Initial sub menu

**Key Beep:** A beep sounds when a key are pressed. You may turn this beep on or off.

**Range Unit:** Range may be shown in nm, km or sm.

**Alarm Level:** The target alarm may be set to sound against weak, medium or strong echoes.

**Antenna Rotation:** “Rotate,” the default setting, stops transmission when the antenna is not rotating. “Stop” transmits radar pulses without rotating the antenna.

**Shift Speed:** Set the ship’s speed to use calculate amount of display shift. The setting range is 1-99 (kts).

**STBY Mode Display:** Set the function of the radar in standby.

- **Normal:** Display “STBY” at the screen center.
- **Nav:** Display navigation data.
- **Economy:** Extinguish the backlight of the LCD. The radar must be switched from TX to ST-BY to activate this mode.

**Bearing Source:** Choose the type of bearing sensor connected to the radar; True (gyrocompass, satellite compass) or Magnetic (magnetic compass).
**Range Preset:** You may choose the radar ranges you wish to use. Choose a range and press the **ENTER** key to turn that range on or off alternately. At least two ranges must be turned on. The maximum range available depends on radar model. Note that 0.125 is not available in kilometers.

<table>
<thead>
<tr>
<th>nautical miles</th>
<th>kilometers</th>
<th>statute miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.125 On</td>
<td>0.125 On</td>
<td>0.125 On</td>
</tr>
<tr>
<td>0.25 On</td>
<td>0.25 On</td>
<td>0.25 On</td>
</tr>
<tr>
<td>0.5 On</td>
<td>0.5 On</td>
<td>0.5 On</td>
</tr>
<tr>
<td>0.75 On</td>
<td>0.75 On</td>
<td>0.75 On</td>
</tr>
<tr>
<td>1 Off</td>
<td>1 Off</td>
<td>1 Off</td>
</tr>
<tr>
<td>1.5 On</td>
<td>1.5 On</td>
<td>1.5 On</td>
</tr>
<tr>
<td>2 Off</td>
<td>2 Off</td>
<td>2 Off</td>
</tr>
<tr>
<td>3 On</td>
<td>3 On</td>
<td>3 On</td>
</tr>
<tr>
<td>4 Off</td>
<td>4 Off</td>
<td>4 Off</td>
</tr>
<tr>
<td>6 On</td>
<td>6 On</td>
<td>6 On</td>
</tr>
<tr>
<td>8 Off</td>
<td>8 Off</td>
<td>8 Off</td>
</tr>
<tr>
<td>12 On</td>
<td>12 On</td>
<td>12 On</td>
</tr>
<tr>
<td>16 Off</td>
<td>16 Off</td>
<td>16 Off</td>
</tr>
<tr>
<td>24 On</td>
<td>24 On</td>
<td>24 On</td>
</tr>
<tr>
<td>36 Off</td>
<td>36 Off</td>
<td>36 Off</td>
</tr>
<tr>
<td>48 On</td>
<td>48 On</td>
<td>48 On</td>
</tr>
<tr>
<td>64 Off</td>
<td>64 Off</td>
<td>64 Off</td>
</tr>
<tr>
<td>72 On</td>
<td>72 On</td>
<td>72 On</td>
</tr>
<tr>
<td>96* On</td>
<td>96* On</td>
<td>96* On</td>
</tr>
<tr>
<td>Exit? Yes</td>
<td>Exit? Yes</td>
<td>Exit? Yes</td>
</tr>
</tbody>
</table>

* FR-8252 only

**Ship Speed Unit:** The ship’s speed unit may be selected to knots (kts), kilometers/hour (km/h) or miles per hour (mph).

**Depth Unit:** The depth unit is available in meters (m), feet (ft), fathoms (fa), passi/braza (p/b) or Hiro (hr).

**Temperature Unit:** Temperature may be displayed in °C (Celsius) or °F (Fahrenheit).

**Wind Direction:** Wind direction may be shown as True or Apparent. For further details, see paragraph 1.34.1.

**Wind Speed Unit:** Wind speed may be shown in knots (kts), kilometers per hour (km/h), miles per hour (mph) or meters/second (m/s).

**Port 1:** Set the baud rate of the equipment connected to Port1. “Auto” provides automatic detection of baud rate, for external equipment’s whose baud rate is 4800 or 38400 (bps).

**Port 2:** Same function as Port1 but for Port2.

**Through Output:** Data input to port 1 may be output from port 2. Choose “On” to use this feature.
1. OPERATIONAL OVERVIEW

1.42 Sector Blank

It may be necessary to prevent transmission in a certain area to protect passengers and crew from microwave radiation. For example, if the antenna unit is installed at a close distance in front of the wheel house you would want to prevent transmission in that area. Two sectors can be set.

1. Press the MENU key to open the menu.
2. Choose Sector Blank 1 or Sector Blank 2 from the System menu and press the ENTER key.

3. Choose Sector Status and press the ENTER key.

   ![Sector Status Menu](image)

   - Off
   - On

4. Choose On and press the ENTER key.
5. Choose Sector Start and press the ENTER key.

   ![Sector Start Menu](image)

   - $0^\circ$
   - $(0^\circ - 359^\circ)$

6. Roll the trackball upward or downward to set the starting point of the sector and press the ENTER key.
7. Choose Sector Area and press the ENTER key.

   ![Sector Area Menu](image)

   - $0^\circ$
   - $(0^\circ - 180^\circ)$
8. Roll the trackball upward or downward to set the width of the sector and press the **ENTER** key.

**Note:** The combined width of sector 1 and sector 2 may not exceed 270 degrees.

9. Press the **MENU** key to close the menu.

As shown in the illustration below, dashed lines mark the starting and ending points of the sector and two dashed arcs run the width of the sector.

*Appearance of sector blank*
1. OPERATIONAL OVERVIEW

1.43 GPS Buoy

With connection of a GPS radio buoy locator, GPS buoy position can be monitored on the radar screen. One application of a GPS buoy is to tether it to a fishing net to monitor net position on the radar screen. Up to five buoys may be shown.

1.43.1 Displaying GPS buoys

1. Press the MENU key to show the menu.
2. Choose GPS Buoy and press the ENTER key.

<table>
<thead>
<tr>
<th>Menu</th>
<th>GPS Buoy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brill/Color</td>
<td>Display: Off</td>
</tr>
<tr>
<td>Display</td>
<td>Symbol Color: Green</td>
</tr>
<tr>
<td>Echo</td>
<td>History Dots: Off</td>
</tr>
<tr>
<td>Target Trails</td>
<td>All Cancel</td>
</tr>
<tr>
<td>Mark</td>
<td></td>
</tr>
<tr>
<td>Custom 1</td>
<td></td>
</tr>
<tr>
<td>Custom 2</td>
<td></td>
</tr>
<tr>
<td>Custom 3</td>
<td></td>
</tr>
<tr>
<td>Tuning</td>
<td></td>
</tr>
<tr>
<td>GPS Buoy</td>
<td></td>
</tr>
<tr>
<td>Target</td>
<td></td>
</tr>
<tr>
<td>ARP</td>
<td></td>
</tr>
<tr>
<td>AIS</td>
<td></td>
</tr>
<tr>
<td>GPS</td>
<td></td>
</tr>
<tr>
<td>System</td>
<td></td>
</tr>
</tbody>
</table>

[ENTER]: Enter [CANCEL/HL OFF]: Back [MENU]: Exit

GPS buoy menu

3. Choose Display and press the ENTER key.
4. Choose Off or On as appropriate and press the ENTER key.
5. Press the MENU key to close the menu.
1.43.2 Choosing symbol color

1. Press the **MENU** key to open the menu.
2. Choose GPS Buoy and press the **ENTER** key.
3. Choose Symbol Color and press the **ENTER** key.

```
Green
Red
Blue
White
Black
```

4. Choose appropriate color and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

1.43.3 History display

This radar can display time-spaced dots (maximum 20 dots) marking the past positions of any GPS buoy being tracked. You can choose the number of dots to display as follows:

1. Press the **MENU** key to open the menu.
2. Choose Target and press the **ENTER** key.
3. Choose History Dots and press the **ENTER** key.

```
Off
5
10
20
```

4. Choose number of history dots to display (5, 10 or 20), or choose Off to turn off the history display.
5. Press the **ENTER** key.
6. Press the **MENU** key to close the menu.
1. OPERATIONAL OVERVIEW

1.43.4 Erasing GPS buoy symbols

When the screen becomes cluttered with GPS buoy symbols and their tracks you can erase them individually or collectively as shown below. The symbols will be erased, however GPS buoys will again be displayed whenever they are received by the GPS radio buoy locator.

**Erasing individual GPS buoy symbols**

Place the cursor on the GPS buoy symbol you wish to erase and press the HL OFF/CANCEL key. Two beeps sounds and the symbol is erased.

**Erasing all GPS buoys symbols**

1. Press the MENU key to open the menu.
2. Choose GPS Buoy and press the ENTER key.
3. Choose All Cancel and press the ENTER key.
4. You are asked if you are sure to erase all buoy symbols. Choose Yes and press the ENTER key. A beep sounds while the GPS buoys symbols are being erased.

   Are you sure?
   Yes
   No

5. Press the MENU key to close the menu.
2. RADAR OBSERVATION

2.1 General

2.1.1 Minimum and maximum ranges

Minimum range

The minimum range is defined by the shortest distance at which, using a scale of 1.5 or 0.75 nm, a target having an echoing area of 10 m$^2$ is still shown separate from the point representing the antenna position.

It is mainly dependent on the pulse length, antenna height, and signal processing such as main bang suppression and digital quantization. It is a good practice to use a shorter range scale as far as it gives favorable definition or clarity of picture. This series of radars satisfy the requirement of IEC 62252 5.14.1 (Class A).

Maximum range

The maximum detecting range of the radar, $R_{\text{max}}$, varies considerably depending on several factors such as the height of the antenna above the waterline, the height of the target above the sea, the size, shape and material of the target, and the atmospheric conditions.

Under normal atmospheric conditions, the maximum range is equal to the radar horizon or a little shorter. The radar horizon is longer than the optical one by about 6% because of the diffraction property of the radar signal. The $R_{\text{max}}$ is given in the following equation.

$$R_{\text{max}} = 2.2 \times (\sqrt{h_1} + \sqrt{h_2})$$

where $R_{\text{max}}$: radar horizon (nautical miles)

$h_1$: antenna height (m)

$h_2$: target height (m)

For example, if the height of the antenna above the waterline is 9 meters and the height of the target is 16 meters, the maximum radar range is;

$$R_{\text{max}} = 2.2 \times (\sqrt{9} + \sqrt{16}) = 2.2 \times (3 + 4) = 15.4 \text{ nm}$$

It should be noted that the detection range is reduced by precipitation (which absorbs the radar signal).
2.2 Radar resolution

There are two important factors in radar resolution (discrimination): bearing resolution and range resolution.

**Bearing resolution**

Bearing resolution is the ability of the radar to display as separate pips the echoes received from two targets which are at the same range and close together. It is proportional to the antenna length and reciprocally proportional to the wavelength. The length of the antenna radiator should be chosen for a bearing resolution better than 4.5 degrees (IEC 62252 Class A). This condition is normally satisfied with a radiator of 1.2 m (4 ft) or longer in the X-band.

**Range resolution**

Range resolution is the ability to display as separate pips the echoes received from two targets which are on the same bearing and close to each other. This is determined by pulse length only.

Test targets for determining the range and bearing resolution are radar reflectors having an echoing area of 10 m².

2.3 Bearing accuracy

One of the most important features of the radar is how accurately the bearing of a target can be measured. The accuracy of bearing measurement basically depends on the narrowness of the radar beam. However, the bearing is usually taken relative to the ship’s heading, and thus, proper adjustment of the heading line at installation is an important factor in ensuring bearing accuracy. To minimize error when measuring the bearing of a target, put the target echo at the extreme position on the screen by selecting a suitable range.

2.4 Range measurement

Measurement of the range to a target is also a very important function of the radar. Generally, there are two means of measuring range: the fixed range rings and the variable range marker (VRM). The fixed range rings appear on the screen with a predetermined interval and provide a rough estimate of the range to a target. The variable range marker's diameter is increased or decreased so that the marker touches the inner edge of the target, allowing the operator to obtain more accurate range measurements.
2.2 False Echoes

Occasionally echo signals appear on the screen at positions where there is no target or disappear even if there are targets. They are, however, recognized if you understand the reason why they are displayed. Typical false echoes are shown below.

2.2.1 Multiple echoes

Multiple echoes occur when a transmitted pulse returns from a solid object like a large 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 below. Multiple reflection echoes can be reduced and often removed by decreasing the gain (sensitivity) or properly adjusting the A/C SEA control.

2.2.2 Sidelobe echoes

Every time the radar pulse is transmitted, some radiation escapes on each side of the beam, called "sidelobes." If a target exists where it can be detected by the sidelobes as well as the main lobe, the side echoes may be represented on both sides of the true echo at the same range. Side lobes show usually only on short ranges and from strong targets. They can be reduced through careful reduction of the gain or proper adjustment of the A/C SEA control.
2.2.3 Virtual image

A relatively large target close to your ship may be represented at two positions on the screen. One of them is the true echo directly reflected by the target and the other is a false echo which is caused by the mirror effect of a large object on or close to your ship as shown in the figure below. If your ship comes close to a large metal bridge, for example, such a false echo may temporarily be seen on the screen.

![Virtual image diagram]

2.2.4 Shadow sector

Funnels, stacks, masts, or derricks in the path of the antenna block the radar beam. If the angle subtended at the antenna is more than a few degrees, a non-detecting sector may be produced. Within this sector targets cannot be detected.

![Shadow sector diagram]
2.3 SART (Search and Rescue Transponder)

2.3.1 SART description

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 µs) through the band before beginning a relatively slow sweep (7.5 µs) 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 radar 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 nautical miles, will be interspersed with the original line of 12 dots. They will appear slightly weaker and smaller than the original dots.

![Appearance of SART echo](attachment:image.png)
2.3.2 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 pulse length and is usually switched with the range scale and the associated pulse length. Narrow bandwidths of 3-5 MHz are used with long pulses on long range scales and wide bandwidths of 10-25 MHz with short pulses on short ranges.

A 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 antenna may show the SART responses as a series of arcs or concentric rings. These can be removed by the use of the anti-clutter sea control 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 own ship.

Note: SART information excerpted from IMO SN/Circ 197 OPERATION OF MARINE RADAR FOR SART DETECTION.

2.4 RACON

A RACON is a radar beacon which emits radar receivable signals in the radar frequency spectrum (X- or S-band). There are several signal formats; in general, the RACON signal appears on the radar screen as a rectangular echo originating at a point just beyond the position of the radar beacon. It has a Morse coded pattern. Note that the position on the radar display is not accurate.
3. ARP OPERATION

The Automatic Radar Plotter ARP-11 (option) manually or automatically acquires and tracks ten targets. Once a target is acquired automatically or manually it is automatically tracked within 0.1 to 16 nm.

3.1 Usage Precautions

CAUTION

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 landmass, 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)
3. ARP OPERATION

3.2 Controls for Use with ARP

**ENTER:** Acquire cursor-selected target; displays data for tracked target (in the data box at the bottom of the screen).

**CANCEL/HL OFF:** Remove data of cursor-selected tracked target from the data box; stops tracking cursor-selected target (when its data is not displayed in the data box).

**MENU:** Access the Target and ARP menus for ARP operations.

**Trackball:** Choose target to acquire, cancel tracking or show target data.

3.3 ARP Display On/Off

You may turn off the ARP display as shown below.

1. Press the **MENU** key to display the main menu.
2. Use the trackball to choose ARP and press the **ENTER** key.

```
Menu
Brill/Color Display Echo Target Trails Mark Custom 1 Custom 2 Custom 3 Tuning GPS Buoy Target ARP AIS GPS ▶ System

ARP
Display : Off
Symbol Color : Green
Auto Acquire : Off
All Cancel

ARP menu
```

3. Use the trackball to choose Display and press the **ENTER** key.

4. Choose Off or On as appropriate and press the **ENTER** key.

5. Press the **MENU** key to close the menu.
3.4 Acquiring and Tracking Targets

Ten targets may be acquired and tracked manually and automatically. When you attempt to acquire an 11th target, the message "ARP FULL - ALREADY TRACKING 10 TARGETS!" appears for five seconds. To acquire another target, terminate tracking of an unnecessary target, as shown in the paragraph 3.5.

3.4.1 Manual acquisition

When the automatic acquisition (AUTO ACQ. AREA) is set to on, up to five targets may be acquired manually. If you attempt to acquire a sixth target, the alert message appears.

1. Place the cursor on the target to acquire.
2. Press the ENTER key twice.

The plot symbol changes over time as below. A vector appears about one minute after acquisition, indicating the target's motion trend. The target number is the youngest empty number.

\[\text{At acquisition} \quad - \quad 1\text{ min. after acquisition} \quad - \quad 3\text{ min. after acquisition}\]

\[\text{ARP target mark}\]

3.4.2 Automatic acquisition

The ARP can acquire up to ten targets automatically by setting an automatic acquisition area. When automatic acquisition is selected after acquiring targets manually, only the remaining capacity for targets may be automatically acquired. For example, if seven targets have been manually acquired, three targets may be automatically acquired.

The automatic acquisition area is 2.0 to 2.5 miles in range and ±45° on either side of the heading line in bearing. Targets being tracked in automatic acquisition are continuously tracked when switching to manual acquisition.

\[\text{Automatic acquisition area}\]

1. Press the MENU key to show the main menu.
2. Choose ARP and press the ENTER key.
3. Choose Auto Acquire and press the ENTER key.
4. Choose On to enable automatic acquisition.
5. Press the **ENTER** key.
6. Press the **MENU** key to close the menu.

### 3.5 Terminating Tracking of ARP Targets

When ten targets have been acquired, no more acquisition occurs unless targets are cancelled. If you need to acquire additional targets, you must first cancel one or more individual targets, or all targets, using one of the procedures below.

#### 3.5.1 Terminating tracking of selected targets

1. Place the cursor on the target to terminate tracking.
2. Press the **CANCEL/HL OFF** key to terminate tracking and erase the ARP symbol. A few beeps sound and the symbol is erased from the display.

#### 3.5.2 Terminating tracking of all targets

1. Press the **MENU** key to open the menu.
2. Choose ARP and press the **ENTER** key.
3. Choose All Cancel and press the **ENTER** key. The prompt shown below appears.

```
Are you sure?
Yes
No
```

4. Choose Yes and press the **ENTER** key to terminate tracking on all ARP targets.
5. Press the **MENU** key to close the menu.
### 3.6 Vector Attributes

**What is a vector?**

A vector is a line extending from a tracked target which shows estimated speed and course of the target. The vector tip shows an estimated position of the target after the selected vector time elapses. It can be useful to extend the vector length (time) in order to evaluate the risk of collision with any target.

![Vector](image)

**Vector time, vector reference**

Vector time can be set to 30 seconds, 1, 3, 6, 15 or 30 minutes. You may reference the vectors to North (True, requires heading and speed data) or ship's heading (relative) as desired.

1. Press the **MENU** key to open the menu.
2. Choose Target and press the **ENTER** key.
3. Choose Vector Time and press the **ENTER** key.
4. Choose desired vector time and press the **ENTER** key.
5. Choose Vector Reference and press the **ENTER** key.
6. Choose Relative or True as appropriate and press the **ENTER** key.

- **Relative**: Other ships move relative to own ship. This mode is useful as an anti-collision aid. If a vessel is on a collision course with own ship its vector will be pointing toward own ship position.
- **True**: Own ship and other ships move at true motions and speeds. This mode is useful for discriminating between moving and stationary targets. Press the **MENU** key to close the menu.

**Note**

The functions of the Target menu are commonly shared by ARP and AIS.
3.7 History Display (target past position)

This radar can display time-spaced dots (maximum ten dots) marking the past positions of any ARP or AIS target being tracked. You can evaluate a target's actions by the spacing between dots. Below are examples of dot spacing and target movement.

(a) Ship turning  (b) Ship running straight  (c) Ship reduced speed  (d) Ship increased speed

Target movement and history display

You may choose the number of history dots to display and the time interval to display them.

1. Press the MENU key to open the menu.
2. Choose Target and press the ENTER key.
3. Choose History Dots and press the ENTER key.

   Off
   5
   10

4. Choose number of history dots to display (5 or 10) or choose Off to turn off the history display.
5. Press the ENTER key.
6. Choose History Intervals and press the ENTER key.

   15sec
   30sec
   1min
   2min
   3min
   6min
   12min

7. Choose appropriate time interval and press the ENTER key.
8. Press the MENU key to close the menu.
3.8 ARP Target Data

You can show target data (range, bearing, course, speed, CPA and TCPA) for two tracked ARP targets, in the data box at the bottom of the screen. To display ARP target data, the ARP display must be activated and the menu item Data Box in the Display menu must be set for Target or All.

1. Place the cursor on the ARP target for which you want to know its data.
2. Press the **ENTER** key to show the target’s data.

The target is enlarged and its target number is prefixed with (A) or (B) to show which data box its data appears in. The box is automatically chosen on a first-in, last-out basis. For example, if both data box A and data box B are currently showing data and target A was selected before target B, the data in data box A will be erased and replaced with the data of the newly selected target.

To remove a target’s data from a data box, place the cursor on its target symbol and press the **CANCEL/HL OFF** key.
3.9 CPA/TCPA Alarm

When the predicted CPA of any ARP target or AIS target becomes smaller than the preset CPA alarm range and its predicted TCPA less than the preset TCPA alarm limit, the audio alarm sounds and the target plot symbol of the offending target changes to a triangle and flashes together with its vector. You may silence the audio alarm with the CANCEL/HL OFF key. The flashing of the triangle plot stops when the vessel’s CPA and TCPA are out of the CPA and TCPA alarm setting. The ARP continuously monitors the predicted range at the Closest Point of Approach (CPA) and predicted time to CPA (TCPA) of each track to own ship.

This feature helps alert you to targets which may be on a collision course with own ship. However, it is important that GAIN, A/C SEA, A/C RAIN and other radar controls are properly adjusted and the ARP is set up so that it can track targets effectively.

![CAUTION]

The CPA/TCPA alarm should never be relied upon as the 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.

1. Press the MENU key to open the menu.
2. Choose Target and press the ENTER key.
3. Choose CPA and press the ENTER key.
   - Off
   - 0.5nm
   - 1nm
   - 2nm
   - 3nm
   - 5nm
   - 6nm
4. Choose appropriate CPA distance and press the ENTER key.
5. Choose TCPA and press the ENTER key.
   - 30sec
   - 1min
   - 2min
   - 3min
   - 4min
   - 5min
   - 6min
   - 12min
6. Choose appropriate TCPA and press the ENTER key.
7. Press the MENU key to close the menu.
3.10 Proximity Alarm

The proximity alerts you by audio and visual alarms when an ARP target (or AIS target) is within the range you specify.

1. Press the MENU key to open the menu.
2. Choose Target and press the ENTER key.
3. Choose Proximity Alarm and press the ENTER key.

<table>
<thead>
<tr>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
</tr>
<tr>
<td>0.5nm</td>
</tr>
<tr>
<td>1nm</td>
</tr>
<tr>
<td>2nm</td>
</tr>
<tr>
<td>3nm</td>
</tr>
<tr>
<td>5nm</td>
</tr>
<tr>
<td>6nm</td>
</tr>
<tr>
<td>12nm</td>
</tr>
<tr>
<td>24nm</td>
</tr>
</tbody>
</table>

4. Choose appropriate range and press the ENTER key.
5. Press the MENU key to close the menu.

When an ARP target comes within the range set here its symbol becomes a flashing triangle and the audio alarm sounds. Press the CANCEL/HL OFF key to silence the audio alarm. The flashing continues until the target is no longer within the range set, the alarm range is changed to exclude the offending target or the proximity alarm is disabled.

3.11 Lost Target

When the system detects a lost target, the audio alarm sounds, the target symbol becomes a flashing diamond and tracking is discontinued after one minute.

![Lost target mark]

Canceling a lost target

Place the cursor on the target and press the CANCEL/HL OFF key. The audio alarm sounds and the target symbol (and its data if displayed) is erased.
3. ARP OPERATION

3.12 Symbol Color

You may choose the ARP/AIS symbol color from among Green, Red, Blue, White or Black.

1. Press the **MENU** key to open the menu.
2. Choose ARP and press the **ENTER** key.
3. Choose Symbol Color and press the **ENTER** key.

4. Choose appropriate color and press the **ENTER** key.
5. Press the **MENU** key to close the menu.
4. **AIS OPERATION**

Connected to the FURUNO AIS Transponder FA-150, the FR-8xx2 series can show the name, position and other nav data of the nearest 100 AIS transponder-equipped ships. (For connection of other makes of AIS transponders, AIS Interface IF-1500AIS (option) is required.)

This radar accepts position data fixed by WGS-84 geodetic datum. Set the datum to WGS-84 on the GPS navigator connected to this radar. If this radar is interfaced with the FURUNO GPS Navigator GP-320B, see paragraph 5.2 for the procedure. Additionally, confirm that Mode on the GPS menu is set to GPS or WAAS, referring to page 5-1. The AIS function is inoperative if the mode is DGPS.

4.1 **Controls for Use with AIS**

**ENTER:** Press, after choosing target with the trackball, to display data for selected active AIS target (in the data box at the bottom of the screen).

**CANCEL/HL OFF:** Remove data of cursor-selected AIS target from the data box.

**MENU:** Access the Target and AIS menus for AIS operations.

**Trackball:** Choose active target to display its data.

4.2 **Turning the AIS Display On or Off**

You may turn the AIS display on or off. The system continues processing AIS targets regardless of whether the AIS display is on or off, provided the AIS transponder is turned on.

1. Press the **MENU** key to display the main menu.
2. Choose AIS and press the **ENTER** key.

   3. Choose Display and press the **ENTER** key.
   4. Choose Off (all AIS symbols are erased) or On (all AIS-received targets are displayed) as appropriate and press the **ENTER** key.
   5. Press the **MENU** key to close the menu.
4.3 **AIS Symbols**

When the AIS is turned on, AIS targets are marked with appropriate AIS symbol as below.

- Sleeping target
- Activated target
- Dangerous target
- Lost target
- Target selected for data display

AIS symbols

*Note*  
*AIS symbols are momentarily erased after the screen is redrawn when the heading is changed while using the head-up mode.*

4.4 **Activating, Sleeping Targets**

When you convert a sleeping target to an activated target, that target's course and speed are shown with a vector. You can easily judge target movement by monitoring the vector.

- SOG (Speed Over Ground) and Course over Ground (COG) vector
- ROT (Rate of Turn)
- Heading line
- (If there is no heading data, the line points in direction of COG.)

Appearance of an activated target

**To activate a target:** Place the cursor on the target and press the **ENTER** key.

**To sleep a target:** Place the cursor on the target and press the **CANCEL HL/OFF** key.
4.5 Displaying AIS Target Data

The data box at the bottom of the screen can show the data (MMSI No., ship name, bearing, course, range, CPA and TCPA) for up to two AIS targets. (Set Data Box in the Display menu to Target or All to show AIS target data.)

To show AIS target data, place the cursor on the activated target that you want to know its data and press the ENTER key.

AIS data

The AIS target chosen is marked with MMSI no. and the alphabet A or B, which corresponds to the data box in which the target’s data appears. The box is automatically chosen on a first-in, last-out basis. For example, if both data box A and data box B are currently showing data and target A was selected before target B, the data in data box A will be erased and replaced with the data of the newly selected AIS target.

To remove a target’s data from a data box, place the cursor on its target symbol and press the CANCEL/HL OFF key.
4. AIS OPERATION

4.6 Display Range

You may set the AIS target display range as below to view only those AIS targets within the range you specify. The setting range is 0.1-72 miles (96 miles for FR-8252) but actual range depends on the AIS Transponder. If the target sorting method is selected to “Range,” the target data within the range set here is transmitted to this radar.

1. Press the MENU key to open the menu.
2. Choose AIS and press the ENTER key.
3. Choose Range and press the ENTER key.
4. Use the trackball to set the display range and press the ENTER key.
5. Press the MENU key to close the menu.

4.7 Sorting Targets

You may sort the data of AIS targets received from the AIS transponder by range from own ship, by sector, by CPA or TCPA.

1. Press the MENU key to open the menu.
2. Choose AIS and press the ENTER key.
3. Choose Sort By and press the ENTER key.
4. Use the trackball to choose desired sorting method and press the ENTER key.
   - Range: Sort targets within the display range set (see paragraph 4.6), from nearest to furthest.
   - Sector: Sort targets within the display sector set (see paragraph 4.8) and within 24 nm, from nearest to furthest.
   - CPA: Sort by CPA, from closest to furthest.
   - TCPA: Sort by TCPA, from earliest time to latest time.
5. Press the MENU key to close the menu.
4.8 Displaying Targets Within a Specific Sector

You may choose to display AIS targets only within a specific sector. If the target sorting method is selected to "Range," the target data within the sector set here is transmitted to this radar.

1. Press the **MENU** key to open the menu.
2. Choose AIS and press the **ENTER** key.
3. Choose Sector Start and press the **ENTER** key.

   ![340° (0°-359°)]

4. Use the trackball to set the start point for the sector and press the **ENTER** key.
5. Choose Sector End and press the **ENTER** key.

   ![20° (0°-359°)]

6. Use the trackball to set the end point for the sector and press the **ENTER** key.
7. Press the **MENU** key to close the menu.

4.9 Number of Targets to Display

You may choose the number of AIS targets to display, from 10-100. This feature is useful when the screen becomes cluttered with AIS targets. Targets are selected and displayed according to sort method. (See paragraph 4.7.)

1. Press the **MENU** key to open the menu.
2. Choose AIS and press the **ENTER** key.
3. Choose Number of Targets and press the **ENTER** key.

   ![30 (0-100)]

4. Use the trackball to choose the number of targets to display and press the **ENTER** key.
Press the **MENU** key to close the menu.
4.10 Vector Attributes

**What is a vector?**

A vector is a line extending from a tracked target which shows estimated course of the AIS target. The vector tip shows an estimated position of the target after the selected vector time elapses. It can be useful to extend the vector length (time) in order to evaluate the risk of collision with any target. (See the illustration on page 4-2 for the appearance of a vector.)

**Vector time, vector reference**

Vector time can be set to 30 seconds, 1, 3, 6, 15 or 30 minutes. Vectors may be displayed in True or Relative motion.

1. Press the **MENU** key to open the menu.
2. Choose **Target** and press the **ENTER** key.

3. Choose Vector Time and press the **ENTER** key.
4. Choose desired vector time and press the **ENTER** key.
5. Choose Vector Reference and press the **ENTER** key.
6. Choose Relative or True as appropriate and press the **ENTER** key.
   - **Relative:** Other ships move relative to own ship. This mode is useful as an anti-collision aid. If a vessel is on a collision course with own ship its vector will be pointing toward own ship position.
   - **True:** Own ship and other ships move at true motions and speeds. This mode is useful for discriminating between moving and stationary targets. Press the **MENU** key to close the menu.
7. Press the **MENU** key to close the menu.
4.11 History Display (target past position)

This radar can display time-spaced dots (maximum ten dots) marking the past positions of any AIS target being tracked. You can evaluate a target's actions by the spacing between dots. Below are examples of dot spacing and target movement.

(a) Ship turning  
(b) Ship running straight  
(c) Ship reduced speed  
(d) Ship increased speed

Target movement and history display

You may choose the number of history dots to display and the time interval to display them.

1. Press the MENU key to open the menu.
2. Choose Target and press the ENTER key.
3. Choose History Dots and press the ENTER key.

4. Choose number of history dots to display (5 or 10) or choose Off to turn off the history display.
5. Press the ENTER key.
6. Choose History Intervals and press the ENTER key.

7. Choose appropriate time interval and press the ENTER key.
8. Press the MENU key to close the menu.
4.12 CPA/TCPA Alarm

When the predicted CPA of any AIS target or ARP target becomes smaller than the preset CPA alarm range and its predicted TCPA less than the preset TCPA alarm limit, an audio alarm sounds and the symbol of the offending AIS target changes to the dangerous target symbol.

Dangerous target symbol

You may silence the audio alarm with the CANCEL/HL OFF key. The flashing of the symbol stops when the target's CPA and TCPA become greater than the CPA and TCPA alarm setting. Predicted range at the Closest Point of Approach (CPA) and predicted time to CPA (TCPA) of each AIS target are monitored.

This feature helps alert you to targets which may be on a collision course with own ship.

1. Press the MENU key to open the menu.
2. Choose Target and press the ENTER key.
3. Choose CPA and press the ENTER key.
4. Choose appropriate CPA distance and press the ENTER key.
5. Choose TCPA and press the ENTER key.
6. Choose appropriate TCPA and press the ENTER key.
7. Press the MENU key to close the menu.
4.13 Proximity Alarm

The proximity alerts you by audio and visual alarms when an AIS target (or ARP target) is within
the range you specify.

1. Press the **MENU** key to open the menu.
2. Choose Target and press the **ENTER** key.
3. Choose Proximity Alarm and press the **ENTER** key.

<table>
<thead>
<tr>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
</tr>
<tr>
<td>0.5nm</td>
</tr>
<tr>
<td>1nm</td>
</tr>
<tr>
<td>2nm</td>
</tr>
<tr>
<td>3nm</td>
</tr>
<tr>
<td>5nm</td>
</tr>
<tr>
<td>6nm</td>
</tr>
<tr>
<td>12nm</td>
</tr>
<tr>
<td>24nm</td>
</tr>
</tbody>
</table>

4. Choose appropriate range and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

When an AIS target comes within the range set here its symbol flashes and the audio alarm
sounds. Press the **CANCEL/HL OFF** key to silence the audio alarm. The flashing continues
until the target is no longer within the range set, the alarm range is changed to exclude the
offending target or the proximity alarm is disabled.

4.14 Lost Target

When AIS data is not received from a target at prescribed intervals (3-5* report intervals), the audio
alarm sounds and the target symbol (flashing) appears as below.

\[Lost target symbol\]

* The interval at which AIS data is sent depends on speed of AIS transponder equipped vessel,
  and it is shown in the table below. For further details, consult the operator's manual for the AIS
  transponder.

<table>
<thead>
<tr>
<th>Ship speed</th>
<th>Reporting interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-14 kts</td>
<td>Every 10 seconds</td>
</tr>
<tr>
<td>23 kts or higher</td>
<td>Every two seconds</td>
</tr>
</tbody>
</table>
4. AIS OPERATION

4.15 Symbol Color

You may choose the ARP/AIS symbol color from among Green, Red, Blue, White or Black.

1. Press the **MENU** key to open the menu.
2. Choose ARP and press the **ENTER** key.
3. Choose Symbol Color and press the **ENTER** key.

```
Green
Red
Blue
White
Black
```

4. Choose appropriate color and press the **ENTER** key.
5. Press the **MENU** key to close the menu.
5. GPS OPERATION

If you are using the FURUNO GPS Navigator GP-320B, you may set it up from this radar.

5.1 Navigator Type

1. Press the **MENU** key to show the menu.
2. Choose GPS and press the **ENTER** key.

   \[
   \begin{array}{|c|}
   \hline
   \text{Menu} \\
   \hline
   \text{Brill/Color} & \text{Display} \\
   \hline
   \text{Echo} & \text{Target Trails} \\
   \hline
   \text{Mark} & \text{Custom 1} \\
   \hline
   \text{Custom 2} & \text{Custom 3} \\
   \hline
   \text{Tuning} & \text{GPS Buoy} \\
   \hline
   \text{Target} & \text{ARP} \\
   \hline
   \text{AIS} & \text{GPS} \\
   \hline
   \text{System} & \text{GPS} \\
   \hline
   \end{array}
   \]

3. Choose Type and press the **ENTER** key.

   \[
   \begin{array}{|c|}
   \hline
   \text{Type} & \text{WAAS} \\
   \hline
   \text{Datum} & \text{WGS-84} \\
   \hline
   \text{Datum Number} & 001 \\
   \hline
   \text{WAAS} & \text{Auto} \\
   \hline
   \text{WAAS Number} & 120 \\
   \hline
   \text{GPS Self Test} & \\
   \hline
   \text{Satellite Monitor} & \\
   \hline
   \text{Type 16 Message} & \\
   \hline
   \text{Forward Offset} & 0 \\
   \hline
   \text{Right Offset} & 0 \\
   \hline
   \text{Cold Start} & \\
   \hline
   \end{array}
   \]

4. Choose type of navigator connected to this radar and press the **ENTER** key. Note that GPS or WAAS should be selected if this radar is interfaced with an AIS Transponder. The AIS Transponder will be inoperative if DPGS is selected.

   - **GPS**: GPS Navigator GP-320B connected
   - **WAAS**: GPS Navigator GP-320B connected
   - **DPGS**: DPGS Beacon Receiver GR-80 connected.

5. Press the **MENU** key to close the menu.
5. GPS OPERATION

5.2 Datum

Choose the datum type which matches the paper nautical charts you are using. Choose WGS-84 if the radar is connected to an AIS Transponder.

1. Press the **MENU** key to show the menu.
2. Choose GPS and press the **ENTER** key.
3. Choose Datum and press the **ENTER** key.

![Datum Options]

4. Choose appropriate datum type and press the **ENTER** key. For Other, do steps 5 and 6. For other choices, go to step 7.
5. Choose Datum Number and press the **ENTER** key.

![Datum Number Options]

6. Use the trackball to choose datum number and press the **ENTER** key. (The setting range is 001-192 and 201-254.)
7. Press the **MENU** key to close the menu.

5.3 WAAS Setup

Geostationary satellites, the type used with WAAS, provide more accurate position data when compared to GPS or DGPS. These satellites may be tracked automatically or manually. Auto tracking automatically searches for the best geostationary satellite based on your current position.

1. Press the **MENU** key to show the menu.
2. Choose GPS and press the **ENTER** key.
3. Choose WAAS and press the **ENTER** key.

![WAAS Options]

4. Choose Auto or Manual as appropriate and press the **ENTER** key. For Manual, do steps 5 and 6. For Auto, go to step 7.
5. Choose WAAS Number and press the **ENTER** key.

![WAAS Number Options]

6. Use the trackball to choose appropriate WAAS satellite number and press the **ENTER** key.
7. Press the **MENU** key to close the menu.
5.4 Satellite Monitor

The Satellite Monitor provides comprehensive information about GPS and WAAS satellites. For more detailed information, see your GPS navigator’s owner’s manual.

1. Press the MENU key to show the menu.
2. Choose GPS and press the ENTER key.
3. Choose Satellite Monitor and press the ENTER key.

To close only the satellite monitor display, press the ENTER key.
5. GPS OPERATION

5.5 Displaying Type 16 Message

The type 16 message, available with connection of a DGPS beacon receiver (FURUNO FR-80, etc.) and within range of a DGPS beacon reference station, provides weather information (time, wind direction and speed, atmospheric pressure and wave height). It is transmitted every minutes by the Japan Maritime Safety Agency, and two reports are provided for each observation point.

1. Press the **MENU** key to show the menu.
2. Choose GPS and press the **ENTER** key.
3. Choose Type 16 Message and press the **ENTER** key. (If no messages are present you cannot choose this menu item.)

4. To close only the message board, press the **ENTER** key.

<table>
<thead>
<tr>
<th>Name of DGPS reference station</th>
<th>Time</th>
<th>Wind direction and speed (16 compass pts.)</th>
<th>Atmospheric pressure (0-9999 hPa)</th>
<th>Wave height (0-99 m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murotasaki</td>
<td>13:25</td>
<td>ENE</td>
<td>1015hPa</td>
<td>10m</td>
</tr>
<tr>
<td></td>
<td>13:55</td>
<td>NE</td>
<td>1016hPa</td>
<td>13m</td>
</tr>
<tr>
<td>Kobe</td>
<td>13:50</td>
<td>N</td>
<td>1017hPa</td>
<td>9m</td>
</tr>
<tr>
<td></td>
<td>13:55</td>
<td>NW</td>
<td>1017hPa</td>
<td>10m</td>
</tr>
<tr>
<td>Osakako</td>
<td>13:45</td>
<td>NW</td>
<td>1015hPa</td>
<td>11m</td>
</tr>
<tr>
<td></td>
<td>13:15</td>
<td>N</td>
<td>1017hPa</td>
<td>10m</td>
</tr>
<tr>
<td>Oseki</td>
<td>13:35</td>
<td>SSW</td>
<td>1013hPa</td>
<td>8m</td>
</tr>
<tr>
<td></td>
<td>13:05</td>
<td>S</td>
<td>1015hPa</td>
<td>9m</td>
</tr>
<tr>
<td>Tomgashima</td>
<td>13:30</td>
<td>NW</td>
<td>1015hPa</td>
<td>5m</td>
</tr>
<tr>
<td></td>
<td>13:00</td>
<td>W</td>
<td>1016hPa</td>
<td>10m</td>
</tr>
<tr>
<td>Shinomisaki</td>
<td>13:30</td>
<td>NW</td>
<td>1015hPa</td>
<td>5m</td>
</tr>
<tr>
<td></td>
<td>13:00</td>
<td>W</td>
<td>1016hPa</td>
<td>10m</td>
</tr>
</tbody>
</table>

**Type 16 message**

Weather messages from as many as six DGPS reference stations are shown and the latest is at the top. The oldest message is erased when a new message arrives.
5.6 GPS Sensor Installation Position Offset

The installation position of the GPS sensor antenna and the radar antenna must be the same in order to get accurate position information on the radar. If they are different, measure the distance between the GPS sensor antenna and the radar antenna, in the bow/stern and/or port/starboard direction, and enter those distances in the menu as follows:

1. Press the **MENU** key to show the menu.
2. Choose GPS and press the **ENTER** key.
3. Choose Forward Offset (bow or stern offset) or Right Offset (port or starboard offset), the direction of the offset, and press the **ENTER** key.

4. Measure the distance from the GPS sensor position to the radar antenna and use the trackball to set value. Enter a “+” value for bow direction or port direction offset; a “-” value for stern direction or starboard direction offset.

5. Press the **ENTER** key
6. Press the **MENU** key to close the menu.
5. GPS OPERATION

5.7 Cold Start

Cold start, which clears the Almanac from the GPS receiver, may be necessary in the following conditions:

- If the GPS receiver has been powered off for a long period of time.
- The vessel has moved far away from the previous fixing position (e.g., more than 500 km).
- Other reason that prevents the receiver from finding its position within five minutes after power on.

To perform cold start, do the following:

1. Press the **MENU** key to show the menu.
2. Choose GPS and press the **ENTER** key.
3. Choose Cold Start and press the **ENTER** key.
4. Choose Yes and press the **ENTER** key. (To stop cold start, press **CANCEL/HL OFF** key instead of the **ENTER** key.
5. Press the **MENU** key to close the menu.
This chapter provides the necessary procedures for maintenance and troubleshooting. Follow the recommend procedures to keep your radar in good working order.

**WARNING**

Do not open the equipment.

Hazardous voltage which can cause electrical shock exists inside 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.
6.1 Preventive Maintenance

Regular maintenance is important for optimum performance. A maintenance program should be established and should at least include the items shown in the table below.

<table>
<thead>
<tr>
<th>Interval</th>
<th>Item</th>
<th>Check point</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>When necessary</td>
<td>LCD</td>
<td>The LCD will, in time, accumulate a coating of dust which tends to dim the picture.</td>
<td>Wipe the LCD carefully to prevent scratching, using tissue paper and an LCD cleaner. To remove dirt or salt deposits, use an LCD cleaner, wiping slowly with tissue paper so as to dissolve the dirt or salt. Change paper frequently so the salt or dirt will not scratch the LCD. Do not use solvents such as thinner, acetone or benzene for cleaning. They may remove paint and markings.</td>
</tr>
<tr>
<td>3 to 6 months</td>
<td>Ground terminal on display unit</td>
<td>Check for tight connection and rust.</td>
<td>Tighten or replace as necessary.</td>
</tr>
<tr>
<td></td>
<td>Display unit connectors</td>
<td>Check for tight connection.</td>
<td>Tighten if loosened.</td>
</tr>
<tr>
<td></td>
<td>Exposed nuts and bolts on antenna unit</td>
<td>Check for corroded or loosened bolts.</td>
<td>Clean and repaint as necessary. Sealing compound may be used in place of paint.</td>
</tr>
<tr>
<td></td>
<td>Antenna radiator</td>
<td>Check for dirt and cracks on radiator surface.</td>
<td>Clean radiator surface with freshwater-moistened cloth. Do not use plastic solvents for cleaning.</td>
</tr>
</tbody>
</table>
6.2 Fuse Replacement

A fuse is in the fuse holder on the power cable and inside the power supply unit, and they protect the equipment from reverse polarity of the ship's mains and equipment fault. If a fuse blows, find out the cause before replacing it. Use the correct fuse. Using the wrong fuse will damage the equipment and void the warranty.

**WARNING**

Use the proper fuse.

Use of a wrong fuse can result in damage to the equipment or cause fire.

<table>
<thead>
<tr>
<th>Unit and fuses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit</strong></td>
</tr>
<tr>
<td>Display unit (fitted on power cable)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Power supply unit (for FR-8252)</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

6.3 Magnetron Life

When the magnetron (generates microwaves) has expired, distant targets cannot be seen on the display. When you feel that long range performance has decreased, contact a FURUNO agent or dealer about replacement of the magnetron.

<table>
<thead>
<tr>
<th>Model and magnetron</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
</tr>
<tr>
<td>FR-8062</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>FR-8122</td>
</tr>
<tr>
<td>FR-8252</td>
</tr>
</tbody>
</table>

6.4 LCD Backlight Life

The life of the LCD backlight, which provides illumination for the LCD, is approximately 4,300 hours. The display brilliance cannot be raised when the backlight has worn out. Have a qualified technician replace the backlight when brilliance cannot be raised.

<table>
<thead>
<tr>
<th>Part and fuses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part</strong></td>
</tr>
<tr>
<td>Lamp holder complete set</td>
</tr>
</tbody>
</table>
6.5 Trackball Maintenance

If the cursor skips or moves abnormally, you may need to clean the Trackball.

1. Turn the retainer ring counterclockwise 45° to unlock it.
2. Remove the retainer ring and ball.
3. Clean the ball with a soft lint-free cloth, and blow carefully into the ball-cage to dislodge dust and lint.
4. Look for a build-up of dirt on the metal rollers. If dirty, clean the rollers with a cotton swab moistened lightly with isopropyl-rubbing alcohol.
5. Make sure that fluff from the swab is not left on the rollers.
6. Replace the ball and retainer ring. Be sure the retainer ring is not inserted reversely.

---

Display unit

Trackball maintenance parts are available as below.

<table>
<thead>
<tr>
<th>Part</th>
<th>Type No.</th>
<th>Code No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retainer ring and ball</td>
<td>MU3721</td>
<td>000-144-645</td>
</tr>
</tbody>
</table>
6.6 Simple Troubleshooting

This section provides simple troubleshooting procedures which the user can follow to restore normal operation. If you cannot restore normal operation do not attempt to check inside the unit. Any trouble should be referred to a qualified technician.

**Simple troubleshooting**

<table>
<thead>
<tr>
<th>If...</th>
<th>But...</th>
<th>Then...</th>
</tr>
</thead>
<tbody>
<tr>
<td>you cannot turn on the power</td>
<td>• check for blown fuse.</td>
<td>• check that the power connector is firmly fastened.</td>
</tr>
<tr>
<td></td>
<td>• check that the power connector is firmly fastened.</td>
<td>• check for corrosion on the power cable connector.</td>
</tr>
<tr>
<td></td>
<td>• check for damaged power cable.</td>
<td>• check battery for proper voltage output (10.8-31.2 V).</td>
</tr>
<tr>
<td>there is no response when a key is pressed</td>
<td>turn off and on the power. If there still is no response the key may be faulty. Contact your dealer for advice.</td>
<td></td>
</tr>
<tr>
<td>if the power is on and you operated the STBY/TX key to transmit</td>
<td>nothing appears on the display</td>
<td>check that the antenna cable is firmly fastened.</td>
</tr>
<tr>
<td>marks and legends appears</td>
<td>no echo appears</td>
<td>check that the antenna cable is firmly fastened.</td>
</tr>
<tr>
<td>tuning is properly adjusted</td>
<td>sensitivity is poor</td>
<td>the magnetron may need to be replaced. Contact your dealer.</td>
</tr>
<tr>
<td>the range is changed but radar picture does not change</td>
<td>• try to hit the RANGE key again.</td>
<td>• turn the display unit off and on.</td>
</tr>
<tr>
<td>Poor discrimination in range</td>
<td>Try to adjust A/C SEA control.</td>
<td></td>
</tr>
<tr>
<td>the true motion presentation is not working properly</td>
<td>• reselect the true motion mode.</td>
<td>• check if heading and speed are input.</td>
</tr>
<tr>
<td>the range rings are not displayed</td>
<td>check that the setting of Range Rings Brill in the Brill/Color sub menu is set to other than Off.</td>
<td></td>
</tr>
</tbody>
</table>
### 6.7 Advanced-level Troubleshooting

This paragraph describes how to cure hardware and software troubles which should be carried out by qualified service personnel.

*Note*  
*This radar equipment contains complex modules in which fault diagnosis and repair down to component level are not practical by users.*

#### Advanced-level troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Probable cause or check points</th>
<th>Remedy</th>
</tr>
</thead>
</table>
| Power cannot be turned on | 1) Blown fuse.  
2) Mains voltage/polarity  
3) Power supply board | 1) Replace blown fuse.  
2) Correct wiring and input voltage.  
3) Replace power supply board. |
| Brilliance adjusted but no picture | 1) SPU Board | 1) Replace SPU board. |
| Antenna not rotating | 1) Antenna drive mechanism | 1) Replace antenna drive mechanism. |
| Data and marks not displayed in Transmit status | 1) SPU board | 1) Replace SPU board. |
| Adjust GAIN with A/C SEA set at minimum. Marks and indications appear but no noise or echo | 1) Signal cable between antenna and display unit  
2) IF amplifier  
3) Video amplifier board | 1) Check continuity and isolation of coaxial cable.  
2) Replace IF amplifier.  
3) Check coax line for secure connection. If connection is good, replace SPU board. |
| Marks, indications and noise appear but no echo (Transmission leak representing own ship position is absent) | 1) Magnetron  
2) Modulator board  
3) SPU board | 1) Check magnetron current.  
2) Replace modulator board.  
3) Replace SPU board. |
| Picture not updated or picture freeze-up | 1) Bearing signal generator  
2) SPU board  
3) Video freeze-up | 1) Check that signal cables are fastened securely.  
2) Replace SPU board.  
3) Turn the radar off and on. |
| Radar is properly tuned but sensitivity is poor | 1) 2nd trace echo rejector is ON.  
2) Dirt on radiator face  
3) Deteriorated magnetron  
4) Detuned MIC | 1) Turn off the 2nd-trace echo rejector, from the Echo menu.  
2) Clean radiator.  
3) With the radar transmitting on 48 nm range, check magnetron current. If current is below normal, magnetron may be defective. Replace the magnetron.  
4) Check MIC detecting current. If it is below normal value, MIC may have become detuned. MIC must be tuned. |
| Range changed but radar picture does not change | 1) Defective range key  
2) SPU board  
3) Video freeze-up | 1) Try to operate the RANGE key. If unsuccessful, replacement of the keypad may be necessary.  
2) Replace SPU board.  
3) Turn radar off and on. |
### Advanced-level troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Probable cause or check points</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interference rejector is not working</td>
<td>1) SPU Board</td>
<td>1) Replace SPU Board.</td>
</tr>
<tr>
<td>(interference rejection level not displayed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Echo stretch is not working (Neither ES1, ES2 or ES3 is displayed)</td>
<td>1) SPU Board</td>
<td>1) Replace SPU Board.</td>
</tr>
<tr>
<td>Range rings are not displayed</td>
<td>1) Adjust their brilliance on the Brill/Color menu. 2) SPU Board</td>
<td>1) Replace associated circuit board if unsuc- cessful. 2) Replace SPU Board.</td>
</tr>
<tr>
<td>Poor discrimination in range</td>
<td>Sea clutter control not functioning properly</td>
<td>Try to adjust A/C SEA control.</td>
</tr>
<tr>
<td>True motion presentation not working properly</td>
<td>1) Poor contact of MODE key. 2) TM display accurate</td>
<td>1) Try to press the key a little harder. 2) Make sure that position and heading inputs are accurate.</td>
</tr>
<tr>
<td>Target not tracked correctly</td>
<td>Poor definition of targets in sea clutter</td>
<td>Adjust A/C SEA and A/C RAIN controls.</td>
</tr>
</tbody>
</table>
6. MAINTENANCE & TROUBLESHOOTING

6.8 Diagnostic Test

The diagnostic test checks the system for proper operation. It is primarily intended for use by service technicians, however the user may execute it to provide the service technician with information.

1. Press the MENU key to open the menu.
2. Use the trackball to choose Factory from the System menu and press the ENTER key.

3. Use the trackball to choose Test and press the ENTER key.
6. MAINTENANCE & TROUBLESHOOTING

Diagnostics screen

- At the top of the screen the results of the ROM, RAM and data ports NMEA1, NMEA2 and RS232C are displayed as OK or NG (No Good). For any NG contact your dealer for advice. (Ports NMEA1, NMEA2 and RS-232C require a special test connector in order to test them. "- -" is shown when no test connector is connected.) PROGRAM NUMBER and FFPGA VERSION show respective program number and program version number (XXXX).
- Heading and bearing signals are checked for proper input and the result displayed as OK or NG. Tune and indicator voltages, antenna rotation speed, antenna motor voltage, echo level and trigger frequency are measured and shown. TOTAL ON TIME and TOTAL TX TIME show the total number of hours the radar has been powered and transmitted, respectively.
- The INPUT NMEA window shows all the NMEA sentences being input to this radar. Sentences are updated every second.
6. MAINTENANCE & TROUBLESHOOTING

• If the optional ARP board is installed, its program number and test results (OK or NG) are shown below the INPUT NMEA window. “--” shown with no ARP board. The radar must be transmitting in order to test ARP function.
• The lamp to the left of the POWER/BRILL key and the panel backlight flash if the panel backlight is working properly.

4. At the right side of the display there are squares, circles and ovals, and they are for checking the controls of the display unit and remote controller.

Key check: Press each key one by one. The key’s on-screen location fills in green if the key is functioning normally and returns to background color when the key is released. The F1 key tests the buzzer. Press it again to silence the buzzer.
Control check: The three digits below the on-screen location for the GAIN, A/C SEA and A/C RAIN controls show control position, and the range of indication is 0-255.
Trackball check: The three digits below the trackball’s on-screen location show the trackball’s X-Y position, and the range of indication is -127 to +127.

5. Press the MENU key three times on the display unit or remote controller to escape from the test.

6.9 LCD Test
The LCD pattern test checks the LCD for proper display of colors.

1. Press the MENU key to open the menu.
2. Use the trackball to choose Factory from the System menu and press the ENTER key.
3. Use the trackball to choose LCD Pattern and press the ENTER key. The screen is initially all red. Hit the MENU key to change the color of the display, in the following sequence.

   ![LCD test screens]

4. Press the MENU key several times to close the menu.
• You may cancel the test at anytime by pressing the CANCEL/HL OFF key.
• You may adjust screen brilliance during the test with the brilliance control.

6.10 GPS Test
The FURUNO GPS receiver interfaced with this radar can be checked for proper operation as follows:

1. Press the MENU key to open the menu.
2. Use the trackball to choose GPS and press the ENTER key.
3. Use the trackball to choose GPS Self Test and press the ENTER key. The program no. and results of the test are shown, as OK or NG (No Good). For NG, check the GPS receiver.
4. Press the MENU key to close the menu.

   | GPS Self Test |
   | Program No.  | 48502380XX |
   | Result       | OK         |
XX = Program version no.
## APPENDIX

### MENU key

<table>
<thead>
<tr>
<th>Brill/Color</th>
<th>Range Ring Brill (Off, Low, <strong>Med</strong>, High)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Echo Color (Yellow, Green, Multi)</td>
</tr>
<tr>
<td></td>
<td>Display Color (Day, <strong>Night</strong>, Twilight, User)</td>
</tr>
<tr>
<td></td>
<td>Background Color (Black/Green, Black/Red, Blue/White, DK Blue/White, White/Green)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Display</th>
<th>Alarm Message</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Echo Area (Ellipse, Square)</td>
</tr>
<tr>
<td></td>
<td>Watchman (Off, 5min, 10min, 20min)</td>
</tr>
<tr>
<td></td>
<td>Data Box (Off, Nav, Target, All)</td>
</tr>
<tr>
<td></td>
<td>Zoom Mode (Relative, True, Target)</td>
</tr>
<tr>
<td></td>
<td>Function 1 Setup (See the list below; default setting is &quot;Echo Average&quot;)</td>
</tr>
<tr>
<td></td>
<td>Function 2 Setup (Same choices as above; default setting is &quot;Auto Anti Clutter&quot;)</td>
</tr>
</tbody>
</table>

| Echo | Auto Gain (Rough, **Moderate**, Calm) |
|      | Auto Sea (Rough, **Moderate**, Calm) |
|      | Auto Rain (Rough, **Moderate**, Calm) |
|      | Pulse Length (Short, **Long**) |
|      | Echo Stretch (Off, 1, 2, 3) |
|      | Echo Average (Off, 1, 2, 3) |
|      | Noise Rej ector (Off, Low, Med, High) |
|      | Interference Rej ector (Off, Low, **Med**, High) |
|      | Auto Anti Clutter (Off, On) |
|      | Display-Dynamic (Narrow, **Normal**, Wide) |
|      | Display-Curve (1, 2, 3) |
|      | Antenna Speed (24rpm, 36rpm, 48rpm, Auto/Range) |
|      | 2nd Echo Rej ector (Off, On) |

| Target | Gradation (Single, **Multi**) |
|        | Color (Green, Red, **Blue**, White, Black) |
|        | Mode (Relative, **True**) |
|        | Level (1, 2, 3) |
|        | Length (**Normal**, 12H, 24H) |
|        | Time (12h, 00h:30m - **12h:00m**; 24H, 01h00m - 24h:00m) |
|        | Copy (Off, On) |
|        | Restart (Off, On) |
|        | Narrow (Off, On) |
|        | Own Ship (Off, On) |
|        | All Cancel |

(Continued on next page)

### Choices for Function 1 Setup, Function 2 Setup

<table>
<thead>
<tr>
<th>Range Rings Brill</th>
<th>Echo Stretch</th>
<th>Trails-Copy</th>
<th>GPS Buoy-Display</th>
<th>AIS-Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Echo Color</td>
<td>Echo Average</td>
<td>Trails-Restart</td>
<td>GPS Buoy-Symbol Color</td>
<td>AIS-Symbol Color</td>
</tr>
<tr>
<td>Display Color</td>
<td>Noise Rej ector</td>
<td>Trails-Narrow</td>
<td>GPS Buoy-History Dots</td>
<td>AIS-Sort By</td>
</tr>
<tr>
<td>Background Color</td>
<td>Interference Rej ector</td>
<td>Trails-Own Ship</td>
<td>Vector Time</td>
<td>GPS-Mode</td>
</tr>
<tr>
<td>Echo Area</td>
<td>Auto Anti Clutter</td>
<td>Waypoint Mark Display</td>
<td>Vector Reference</td>
<td>GPS-Datum</td>
</tr>
<tr>
<td>Watchman Time</td>
<td>Display-Dynamic</td>
<td>Origin Mark Mode</td>
<td>History Dots</td>
<td>GPS-WAAS</td>
</tr>
<tr>
<td>Data Box</td>
<td>Display-Curve</td>
<td>TLL Key Mode</td>
<td>CPA</td>
<td></td>
</tr>
<tr>
<td>Zoom Mode</td>
<td>Antenna Speed</td>
<td>Parallel Line</td>
<td>TCPA</td>
<td></td>
</tr>
<tr>
<td>STBY Mode Display</td>
<td>2nd Echo Rej ector</td>
<td>Parallel Line Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auto Gain</td>
<td>Trails-Gradation</td>
<td>EBL Reference</td>
<td>Proximity Alarm</td>
<td></td>
</tr>
<tr>
<td>Auto Sea</td>
<td>Trails-Color</td>
<td>VRM Unit</td>
<td>ARP-Display</td>
<td></td>
</tr>
<tr>
<td>Auto Rain</td>
<td>Trails-Mode</td>
<td>Cursor Position</td>
<td>ARP-Symbol Color</td>
<td></td>
</tr>
<tr>
<td>Tuning Mode</td>
<td>Trails-Level</td>
<td>Target Alarm 1 Mode</td>
<td>ARP-Auto Acquire</td>
<td></td>
</tr>
<tr>
<td>Pulse Length</td>
<td>Trails-Length</td>
<td>Target Alarm 2 Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mark</td>
<td>Waypoint Mark Display (Off, On)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Origin Mark Mode (Relative, True)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TLL Key Mode (TLL Output, Origin Mark, Both)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parallel Line (Off, 2, 3, 6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parallel Line Mode (Parallel, Vertical)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EBL Reference (Relative, True)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>VRM Unit (nm, km, sm, kyd)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cursor Position (Rng/Brg, Lat/Lon)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Target Alarm1 Mode (In, Out)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Target Alarm2 Mode (In, Out)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Custom 1</th>
<th>Custom 1 (Off, On)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copy</td>
<td></td>
</tr>
<tr>
<td>Name (Harbor, Long, Sea, Rain, Buoy, Bird)</td>
<td></td>
</tr>
<tr>
<td>Gain (Manual, Rough, Moderate, Calm)</td>
<td></td>
</tr>
<tr>
<td>Sea (Manual, Rough, Moderate, Calm)</td>
<td></td>
</tr>
<tr>
<td>Rain (Manual, Rough, Moderate, Calm)</td>
<td></td>
</tr>
<tr>
<td>Pulse Length (Short, Long)</td>
<td></td>
</tr>
<tr>
<td>Echo Stretch (Off, 1, 2, 3)</td>
<td></td>
</tr>
<tr>
<td>Echo Average (Off, 1, 2, 3)</td>
<td></td>
</tr>
<tr>
<td>Noise Rejector (Off, Low, Med, High)</td>
<td></td>
</tr>
<tr>
<td>Interference Rejector (Off, Low, Med, High)</td>
<td></td>
</tr>
<tr>
<td>Auto Anti Clutter (Off, On)</td>
<td></td>
</tr>
<tr>
<td>Display-Dynamic (Narrow, Normal, Wide)</td>
<td></td>
</tr>
<tr>
<td>Display-Curve (1, 2, 3)</td>
<td></td>
</tr>
<tr>
<td>Antenna Speed (24rpm, 36rpm, 48rpm, Auto/Range)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Custom 2</th>
<th>Custom 2 (Off, On)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copy</td>
<td></td>
</tr>
<tr>
<td>Name (Harbor, Long, Sea, Rain, Buoy, Bird)</td>
<td></td>
</tr>
<tr>
<td>Gain (Manual, Rough, Moderate, Calm)</td>
<td></td>
</tr>
<tr>
<td>Sea (Manual, Rough, Moderate, Calm)</td>
<td></td>
</tr>
<tr>
<td>Rain (Manual, Rough, Moderate, Calm)</td>
<td></td>
</tr>
<tr>
<td>Pulse Length (Short, Long)</td>
<td></td>
</tr>
<tr>
<td>Echo Stretch (Off, 1, 2, 3)</td>
<td></td>
</tr>
<tr>
<td>Echo Average (Off, 1, 2, 3)</td>
<td></td>
</tr>
<tr>
<td>Noise Rejector (Off, Low, Med, High)</td>
<td></td>
</tr>
<tr>
<td>Interference Rejector (Off, Low, Med, High)</td>
<td></td>
</tr>
<tr>
<td>Auto Anti Clutter (Off, On)</td>
<td></td>
</tr>
<tr>
<td>Display-Dynamic (Narrow, Normal, Wide)</td>
<td></td>
</tr>
<tr>
<td>Display-Curve (1, 2, 3)</td>
<td></td>
</tr>
<tr>
<td>Antenna Speed (24rpm, 36rpm, 48rpm, Auto/Range)</td>
<td></td>
</tr>
</tbody>
</table>
Tuning Mode (Auto, Manual)
Manual Tuning (0-4095, 2048)

GPS Buoy
Display (Off, On)
Symbol Color (Green, Red, Blue, White, Black)
History Dots (Off, 5, 10, 20 (min))
All Cancel

Target
Vector Time (30sec, 1min, 3min, 6min, 15min, 30min)
Vector Reference (Relative, True)
History Dots (Off, 5, 10)
History Intervals (15sec, 30sec, 1min, 2min, 3min, 6min, 12min)
CPA (Off, 0.5nm, 1nm, 2nm, 3nm, 5nm, 6nm)
TCPA (30sec, 1min, 2min, 3min, 4min, 5min, 6min, 12min)
Proximity Alarm (Off, 0.5nm, 1nm, 2nm, 3nm, 5nm, 6nm, 12nm, 24nm)

ARP*1
Display (Off, On)
Symbol Color (Green, Red, Blue, White, Black)
Auto Acquire (Off, On)
All Cancel
*1 Requires ARP board (built in)

AIS*2
Display (Off, On)
Symbol Color (Green, Red, Blue, White, Black)
Range (0.1-96(nm), 24.0)
Sector Start (0-359(deg), 340)
Sector End (0-359(deg), 020)
Sort By (Range, Sector, CPA, TCPA)
Number of Targets (10-100, 30)
*2 Requires AIS transponder

(Continued on next page)
(Continued from previous page)

**GPS**

- Mode (GPS, **WAAS**, DGPS)
- Datum (**WGS-84**, Tokyo, Other)
- Datum Number (001-254, **001**)
- WAAS (**Auto**, Manual)
- WAAS Number (120-150, **120**)
- GPS Self Test
- Satellite Monitor
- Type 16 Message
- Forward Offset (-999 - +999(m), 0)
- Right Offset (-999 - +999(m), 0)
- Cold Start

**System**

- Initial
  - Key Beep (Off, **On**)
  - Range Unit (nm, km, sm)
  - Alarm Level (Low, Med, High)
  - Antenna Rotation (**Rotate**, Stop)
  - Shift Speed (1-99(kt), **15**)
  - STBY Mode Display (**Normal**, Nav, Economy)
  - Bearing Source (Magnetic, True)
  - Range Preset (**0.125**, **0.25**, **0.5**, **0.75**, 1, 1.5, 2, 3, 4, 6, 8, 12, 16, 24, 36, 48, 64, 72, 96**²**(nm))
  - Ship Speed Unit (kt, km/h, mph)
  - Depth Unit (m, ft, fa, pb, HR)
  - Temperature Unit (°C, °F)
  - Wind Direction (**Apparent**, True)
  - Wind Speed Unit (kt, km/h, mph, m/s)
  - Port1 (**Auto**, 4800bps, 38400bps)
  - Port2 (**Auto**, 4800bps, 38400bps)
  - Through Output (**Off**, On)

**Factory**

- Test
- LCD Pattern

**Installation** (For use by the installer. Not accessible by user.)

- Sector
  - Sector Status (**Off**, On)
  - Sector Start (0-359(deg), 0)
  - Sector Area (0-180(deg), 0)
  - Blank 1
  - Blank 2

*1 Requires GPS receiver.
*2 FR-8252 only
1. GENERAL
1.1 Range, Pulse length & Pulse repetition rate (PRR)

<table>
<thead>
<tr>
<th>Range (nm)</th>
<th>Pulse length (µs)</th>
<th>PRR (Hz approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.125 to 1.5</td>
<td>0.08</td>
<td>2100</td>
</tr>
<tr>
<td>1.5 to 3</td>
<td>0.3</td>
<td>1200</td>
</tr>
<tr>
<td>3 to 96</td>
<td>0.8</td>
<td>600</td>
</tr>
</tbody>
</table>

1.2 Maximum Range 96 nm (FR-8252), 72 nm (FR-8122 and FR-8062)
1.3 Range Resolution 20 m
1.4 Bearing Resolution 1.9° (4 ft), 1.2° (6 ft)
1.5 Minimum Range 20 m
1.6 Bearing Accuracy ±1.0°
1.7 Range, Range Ring Accuracy 1.0% of range or 8 m, whichever is the greater

2. ANTENNA UNIT
2.1 XN-12A (4 ft)
2.1.1 Radiator Slotted array
2.1.2 Polarization Horizontal
2.1.3 Antenna Rotation 24 rpm, 36 rpm, 48 rpm, range dependent rpm. (24 rpm motor fixed at 24 rpm.)
2.1.4 Radiator Length 120 cm (4 ft)
2.1.5 Horizontal Beamwidth 1.9°
2.1.6 Vertical Beamwidth 22°
2.1.7 Sidelobe Attenuation -24 dB or less (within ±10° of main-lobe)
-30 dB or less (±10° of main-lobe or more)

2.2 XN-13A (6 ft)
2.2.1 Radiator Slotted array
2.2.2 Polarization Horizontal
2.2.3 Antenna Rotation 24 rpm*, 36 rpm, 48 rpm, range dependent rpm. (24 rpm motor fixed at 24 rpm.) * Not available with antenna XN-13A.
2.2.4 Radiator Length 180 cm (6 ft)
2.2.5 Horizontal Beamwidth 1.35°
2.2.6 Vertical Beamwidth 22°
2.2.7 Sidelobe Attenuation -28 dB or less (within ±10° of main-lobe)
-35 dB or less (±10° of main-lobe or more)
3. RF TRANSCEIVER

3.1 Frequency and Modulation 9410 MHz ±30MHz (X band), P0N


3.3 Intermediate Frequency 60 MHz

3.4 Tuning Automatic or manual

3.5 Noise figure 5 dB (typical)

4. DISPLAY UNIT

4.1 Display 12.1-inch rectangular TFT color LCD, 600 x 800 dots, Effective radar display 300 dots

4.2 Range, Range Ring Interval, Number of Rings

<table>
<thead>
<tr>
<th>Range</th>
<th>0.125</th>
<th>0.25</th>
<th>0.5</th>
<th>0.75</th>
<th>1</th>
<th>1.5</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ring Interval</td>
<td>0.025</td>
<td>0.05</td>
<td>0.1</td>
<td>0.25</td>
<td>0.25</td>
<td>0.5</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>No. of rings</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

Max. range: FR-8252: 96 nm, FR-8062, FR-8122, 72 nm

4.3 Markers Heading Line, Bearing Scale, Range Rings, Variable Range Marker (VRM), Electronic Bearing Line (EBL), Target Alarm Zone, Waypoint Mark (navigation input required), Zoom Window

4.4 Alphanumeric Indications Range, Range Ring Interval, Interference Rejection (IR), Variable Range Marker (VRM), Electronic Bearing Line (EBL), Stand-by (ST-BY), Echo Averaging (EAV), TX Pulse width, Guard Alarm (G(IN), G(OUT)), Echo Stretch (ES), Range and Bearing to Cursor or Cursor Position, Echo Trail Reference, Echo Trail Time, Nav Data (Position, Speed, Course, etc.), ARP/AIS Target Data

5. POWER SUPPLY

5.1 Rated Voltage/Current FR-8062 - 12-24 VDC: 3.2 A (24 V, no wind)
FR-8122 - 12-24 VDC: 3.8 A (24 V, no wind)
FR-8252 - 12-24 VDC: 5.0 A (24 V, no wind)

5.2 Rectifier (option) 100-115/220-230 VAC, 1 phase, 50/60 Hz

6. ENVIRONMENTAL CONDITIONS

6.1 Ambient Temperature Antenna Unit: -25°C to +55°C
Display Unit: -15°C to +55°C
Remote Controller: +5°C to +45°C
Power Supply Unit for Antenna Unit: -15°C to +55°C

6.2 Relative Humidity 93% or less at +40°C
6.3 Waterproofing

Antenna Unit: IPX2
Display Unit: IPX2 for front panel, IPX22 for rear panel
Remote Controller: IPX4
Power Supply Unit for Antenna Unit: IPX0

6.4 Vibration IEC 60945-4th

- 2Hz to 5 Hz and up to 13.2 Hz with a deviation of ±1 mm ±10% (7 m/s² maximum acceleration at 13.2 Hz);
- above 13.2 Hz and up to 100 Hz with a constant maximum acceleration of 7 m/s².

7. COATING COLOR

7.1 Display Unit N3.0
7.2 Antenna Unit N9.5
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Declaration of Conformity

We, FURUNO ELECTRIC CO., LTD.,

9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan

declare under our sole responsibility that the product

Marine radar Type FR-8XX2 series (FR-8062, FR-8122 and FR-8252)

are 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

IEC 60945 Fourth edition: 2002-08 – Clauses 9.2, 9.3, 10.3, 10.4, 10.5 and 10.8
ITU Radio Regulations (R.R.) Appendix S3, table 2
ITU-R M.1177-3, SM.1539, SM.1541 and SM.329-9

For assessment, see
• Statement of Opinion N°: 06214004/AA/00 of 19 January 2006 issued by Telefication BV, The Netherlands
• Test reports of unwanted emissions measurements K03-17-176, K03-17-177, K03-17-191, K03-17-193 and K03-17-194 of 5 January 2004 prepared by Furuno Electric Co., Ltd., Japan

On behalf of Furuno Electric Co., Ltd.

Nishinomiya City, Japan
January 23, 2006

Hiroaki Komatsu
Manager,
International Rules and Regulations