IMPORTANT NOTICES

General

• The operator of this equipment must read and follow the descriptions in this manual. Wrong operation or maintenance can cancel the warranty or cause injury.

• Do not copy any part of this manual without written permission from FURUNO.

• If this manual is lost or worn, contact your dealer about replacement.

• The contents of this manual and equipment specifications can change without notice.

• The example screens (or illustrations) shown in this manual can be different from the screens you see on your display. The screens you see depend on your system configuration and equipment settings.

• Save this manual for future reference.

• Any modification of the equipment (including software) by persons not authorized by FURUNO will cancel the warranty.

• All brand and product names are trademarks, registered trademarks or service marks of their respective holders.

How to discard this product

Discard this product according to local regulations for the disposal of industrial waste. For disposal in the USA, see the homepage of the Electronics Industries Alliance (http://www.eiae.org/) for the correct method of disposal.

How to discard a used battery

Some FURUNO products have a battery(ies). To see if your product has a battery, see the chapter on Maintenance. Follow the instructions below if a battery is used. Tape the + and - terminals of battery before disposal to prevent fire, heat generation caused by short circuit.

In the European Union

The crossed-out trash can symbol indicates that all types of batteries must not be discarded in standard trash, or at a trash site. Take the used batteries to a battery collection site according to your national legislation and the Batteries Directive 2006/66/EU.

In the USA

The Mobius loop symbol (three chasing arrows) indicates that Ni-Cd and lead-acid rechargeable batteries must be recycled. Take the used batteries to a battery collection site according to local laws.

In the other countries

There are no international standards for the battery recycle symbol. The number of symbols can increase when the other countries make their own recycling symbols in the future.
## SAFETY INSTRUCTIONS

### Safety Instructions for the Operator

**WARNING**

**ELECTRICAL SHOCK HAZARD**
Do not open the equipment.

Only qualified personnel should work inside the equipment.

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.

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

Distances at which RF radiation levels of 100 and 10 W/m^2 exist are given in the table below.

<table>
<thead>
<tr>
<th>Distance (m)</th>
<th>100 W/m^2</th>
<th>10 W/m^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil</td>
<td>0.7 m</td>
<td></td>
</tr>
</tbody>
</table>

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 LABEL**

A warning label is attached to the equipment. Do not remove the label.

If the label is missing or damaged, contact a FURUNO agent or dealer about replacement.

**WARNING**

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

Name: Warning Label (1)
Type: 86-003-1011-1
Code No.: 100-236-231

---

### Safety Instructions for the Installer

**WARNING**

**ELECTRICAL SHOCK HAZARD**
Do not open the equipment unless totally familiar with electrical circuits and service manual.

Only qualified personnel should work inside the equipment.

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.

Construct a suitable service platform from which to install the antenna unit.

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

Be sure that the power supply is compatible with the voltage rating of the equipment.

Connection of an incorrect power supply can cause fire or damage the equipment.

Use only the specified power cable.

Fire or damage to the equipment can result if a different cable is used.

**CAUTION**

Observe the following compass safe distances to prevent interference to a magnetic compass:

<table>
<thead>
<tr>
<th>Distance (m)</th>
<th>Standard compass</th>
<th>Steering compass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display unit</td>
<td>0.60 m</td>
<td>0.40 m</td>
</tr>
<tr>
<td>Antenna unit</td>
<td>1.25 m</td>
<td>0.85 m</td>
</tr>
</tbody>
</table>

Use the proper fuse.

Use of a wrong fuse can damage the equipment and void the warranty.
COMPLIANCE WITH R&TTE DIRECTIVE 1999/5/EC

This radar complies with the R&TTE Directive 1999/5/EC. In accordance with Article 6-3 of this directive, FURUNO intends to put this radar on the market of the following countries in EU as well other markets.

Austria, Belgium, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Slovenia, Spain, Sweden, The Netherlands, United Kingdom, Iceland, Norway
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<td>1.17 Noise Rejector</td>
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<td>1.19 Echo Stretch</td>
<td>10</td>
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<td>1.20 Guard Alarm</td>
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<td>1.21 Watchman</td>
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<td>INTERCONNECTION DIAGRAM</td>
<td>S-1</td>
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<tr>
<td>Declaration of Conformity</td>
<td></td>
</tr>
</tbody>
</table>
A Word to the Owner of the MODEL 1715

Congratulations on your choice of the FURUNO MODEL 1715 Marine Radar.

For over 60 years FURUNO Electric Company has enjoyed an enviable reputation for innovative and dependable marine electronics equipment. This dedication to excellence is furthered by our extensive global network of agents and dealers.

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

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

Thank you for considering and purchasing FURUNO equipment.

Features

Your radar has a large variety of functions, all contained in a rugged plastic case. All controls respond immediately to the operator's command and each time a key is pressed the corresponding change can be seen on the screen.

The main features of the MODEL 1715 are

- Daylight viewing radar specially designed for small craft and sailing yachts.
- Traditional FURUNO reliability and quality in a compact, light-weight and low-cost radar.
- Compact and light-weight radome antenna with precision 45 cm center-fed radiator.
- High definition 7-inch monochrome LCD display.
- Automatic control of sensitivity (gain), tuning and A/C SEA for simplified operation.
- Targets can be displayed in grey tones on a white background or vice versa, for optimal viewing under any lighting conditions.
- On-screen alphanumeric readout of all operational information.
- User programmable nav data displays.
- [PROG] key acts as a menu shortcut key.
- [TLL] key outputs chosen target’s L/L position to a plotter.
- Standard features include Display Shift, EBL, Echo Stretch, Echo Trail, Guard Alarm, Interference Rejector, VRM, Zoom.
- Guard zone watches for targets entering (or exiting) a guard zone.
SYSTEM CONFIGURATION

- ANTENNA UNIT RSB-0095
- DISPLAY UNIT RDP-142
- RECTIFIER PR-62
- EXTERNAL BUZZER XH3-BZ-L970
- GPS RECEIVER GP-310B/320B
- WIND INDICATOR, SPEED INDICATOR
- NAVIGATOR or ECHO SOUNDER (NMEA 0183)
- SHIP'S MAINS 12-24 VDC
- SHIP'S MAINS 100/110/115/220/230 VAC, 1φ, 50/60 Hz

*: The optional 30 m antenna cable is available for 24 VDC ship's mains only.
# EQUIPMENT LISTS

## Standard supply

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Code No.</th>
<th>Qty</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna Unit</td>
<td>RSB-0095-076</td>
<td>—</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Display Unit</td>
<td>RDP-142</td>
<td>—</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**Installation Materials**

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Qty</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP03-25301</td>
<td>1 set</td>
<td>Antenna unit inst. materials</td>
</tr>
<tr>
<td>CP03-24910</td>
<td>1</td>
<td>Antenna cable (10 m) Type: MJ-A10SPF0003-100 Code No.: 000-129-609</td>
</tr>
<tr>
<td>CP03-24920</td>
<td>1</td>
<td>Antenna cable (15 m) Type: MJ-A10SPF0009-150 Code No.: 000-144-564</td>
</tr>
<tr>
<td>CP03-24930</td>
<td>1</td>
<td>Antenna cable (20 m) Type: MJ-A10SPF0009-200 Code No.: 000-144-565</td>
</tr>
<tr>
<td>CP03-25101</td>
<td>1 set</td>
<td>For display unit</td>
</tr>
</tbody>
</table>

**Spare Parts**

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Qty</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP03-14301</td>
<td>1</td>
<td>Fuse (2 pcs.) Type: FGBO-A 125V 5A, Code No: 000-155-853-10</td>
</tr>
</tbody>
</table>

**Template**

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Qty</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>C32-00302</td>
<td>1</td>
<td>For flush mounting</td>
</tr>
<tr>
<td>C32-00303</td>
<td>1</td>
<td>For bulkhead mounting</td>
</tr>
</tbody>
</table>

## Optional supply

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Code No.</th>
<th>Qty</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable Assy.</td>
<td>XH3-BZ-L970</td>
<td>000-146-422</td>
<td>1</td>
<td>With connector, 0.9 m</td>
</tr>
<tr>
<td>Cable Assy.</td>
<td>MJ-A7SPF0007-050</td>
<td>000-144-418</td>
<td>1</td>
<td>Connector at one end, 5 m, for NMEA</td>
</tr>
<tr>
<td>Cable Assy.</td>
<td>MJ-A15A7F0004-005</td>
<td>000-145-690</td>
<td>1</td>
<td>For NMEA, 0.5 m, With connector at both ends (7P-7P/6P)</td>
</tr>
<tr>
<td>Cable Assy.</td>
<td>MJ-A15A7F0005-020</td>
<td>000-145-691</td>
<td>1</td>
<td>7P-7P, for NMEA, 2 m</td>
</tr>
<tr>
<td>Cable Assy.</td>
<td>MJ-A10SPF0003-300</td>
<td>000-130-034</td>
<td>1</td>
<td>30 m antenna cable, for 24 VDC only</td>
</tr>
<tr>
<td>Radome Mtg. Assy.</td>
<td>OP03-93</td>
<td>008-445-080</td>
<td>1</td>
<td>For mounting antenna on mast</td>
</tr>
<tr>
<td>Rectifier</td>
<td>PR-62</td>
<td>000-013-484</td>
<td>1</td>
<td>For 100 VAC</td>
</tr>
<tr>
<td></td>
<td>PR-62</td>
<td>000-013-485</td>
<td>1</td>
<td>For 110-115 VAC</td>
</tr>
<tr>
<td></td>
<td>PR-62</td>
<td>000-013-486</td>
<td>1</td>
<td>For 220 VAC</td>
</tr>
<tr>
<td></td>
<td>PR-62</td>
<td>000-013-487</td>
<td>1</td>
<td>For 230 VAC</td>
</tr>
<tr>
<td>Antenna Unit</td>
<td>RSB-0095-076</td>
<td>—</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

## Antenna installation materials

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Code No.</th>
<th>Qty</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMI Core</td>
<td>RFC-H13</td>
<td>000-146-570</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Slotted Head Hex Bolt</td>
<td>M10x25 SUS304</td>
<td>000-862-308</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Pan Head Screw B</td>
<td>M4x15 C2700W MBNI2</td>
<td>000-881-448</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>EMI Core Fixing Band</td>
<td>03-160-1026</td>
<td>100-302-450</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

## Display unit installation materials

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Code No.</th>
<th>Qty</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tapping Screw</td>
<td>5x20 SUS304</td>
<td>000-802-081</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Pan Head Screw B</td>
<td>M4x20 SUS304</td>
<td>000-804-742</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Cable Assy. MJ</td>
<td>MJ-A15A3F0019-035-5A</td>
<td>000-147-564</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
1. OPERATION

1.1 Controls

---

**Cursor Pad**
- Chooses menu items; adjusts VRM, EBL and cursor.
- Opens/closes menu; escapes from current operation.
- Sets to TX or ST-BY.
- Chooses display mode.
- Opens dialog box for adjustment of gain, A/C SEA, A/C RAIN.
- Chooses radar range.
- Enables/disables guard alarm.
- Turns EBL on/off.
- Turns VRM on/off.
- Shortcut key
- Outputs chosen target’s L/L position to plotter.

**ESC**
- Turns power on.
- Long press: Turns power off.
- Momentary press: Opens dialog box for adjustment of display contrast, brilliance and mode (TX, ST-BY) selection.

**MENU**
- Opens dialog box for adjustment of gain, A/C SEA, A/C RAIN.

**MODE**
- Chooses display mode.

**GAIN**
- Adjusts VRM, EBL and cursor.

**ALARM**
- Enables/disables guard alarm.

**RANGE**
- Chooses radar range.

**EBL**
- Turns EBL on/off.

**VRM**
- Turns VRM on/off.

**TLL**
- Outputs chosen target’s L/L position to plotter.

**PROG**
- Opens dialog box for adjustment of display contrast, brilliance and mode (TX, ST-BY) selection.

**POWER**
- Turns power on.

---

How to remove the hard cover
Place your thumbs at the center of the cover, and then lift the cover while pressing it with your thumbs.

---

Display unit
1.2 Indications

Indications

About the LCD
The high quality LCD displays better than 99.99% of its picture elements. The remaining elements may drop out or light, however this is not an indication of malfunction; it is a characteristic of the LCD.
1.3 Turning Power On/Off

Press the [POWER/BRILL] key to turn on the power. The unit beeps, the startup screen appears, and then the equipment checks the ROM and RAM for proper operation and displays program number. The ROM and RAM check shows OK or NG (No Good). If NG appears, try to press any key except the [POWER/BRILL] key to continue. If the equipment does not work properly, contact your dealer for advice.

XX.XX = Program version no.

Startup screen

After the completion of the startup test, a timer displays the time remaining for warm up of the magnetron (the device which transmits radar pulses), counting down from 1:00 to 0:00.

To turn off the power, press and hold down the [POWER/BRILL] key (about three seconds) until the screen goes blank.

Provided that the radar was once in use with the transmitter tube (magnetron) still warm, you can turn the radar into TRANSMIT condition without 1-minute of warm-up. If the [POWER/BRILL] key was accidentally turned off and you want to restart the radar promptly, turn on the [POWER/BRILL] key not later than 15 seconds after power-off.

Note 1: In a cold environment the screen appears “foggy” when the power is turned on but is soon restored to normal condition.

1.4 Transmitting, Standby

After the power is turned on and the magnetron has warmed up, “ST-BY” (Stand-by) appears, indicating the radar is ready to transmit radar pulses.

To toggle between transmit and stand-by, do as below. Note that you may also do this with “TX/ST-BY” on the User menu.

1. With the power turned on, press the [POWER/BRILL] key momentarily to show the brilliance/contrast adjustment window.

<table>
<thead>
<tr>
<th>BRILLIANCE/CONTRAST</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX/ST-BY - PRESS [MODE]</td>
</tr>
<tr>
<td>CONT: LOW HIGH</td>
</tr>
<tr>
<td>BRILL: ↓ LOW HIGH ▲</td>
</tr>
</tbody>
</table>

Brilliance/contrast adjustment window

2. Press the [MODE] key to go to stand-by and transmit status alternately.

Note: If you attempt to transmit before “ST-BY” appears, the beeps sound and the radar does not transmit pulses. Wait until “ST-BY” appears.

3. Press the [MENU/ESC] key to close the window.

When radar pulses are transmitted the radar receiver is automatically tuned. Echoes appear in four levels of digitized video according to echo strength.

Note 2: Windows other than menu windows are erased when there is no operation within about 10 seconds.
1.5 Adjusting Display Contrast, Brilliance

1. With the power turned on, press the [POWER/BRILL] key momentarily to show the brilliance/contrast adjustment window.

<table>
<thead>
<tr>
<th>BRILL/CONTRAST</th>
<th>TX/ST-BY - PRESS [MODE]</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>HIGH</td>
</tr>
<tr>
<td>CONT:</td>
<td></td>
</tr>
<tr>
<td>LOW</td>
<td>HIGH</td>
</tr>
<tr>
<td>BRILL:</td>
<td></td>
</tr>
</tbody>
</table>

Brilliance/contrast adjustment window

2. Press ▼ or ► to adjust contrast.
3. Press ▲ or▼ to adjust brilliance.
4. Press the [MENU/ESC] key to escape.

**Note:** The radar starts up with the last-used brilliance level after the startup screen appears. Therefore, adjust the brilliance if it is too low at startup.

1.6 Choosing the Range

The range selected automatically determines the range ring interval, the number of range rings and pulse repetition rate.

Press the [RANGE+] or [RANGE-] key to choose the range. The range and range ring interval appear at the top left corner on the screen.

Location of range and range ring interval indications

1.7 Receiver Sensitivity

The gain control adjusts the sensitivity of the receiver. It works in precisely the same manner as the volume control of a broadcast receiver, amplifying the signals received. The proper setting is such that the background noise is just visible on the screen. If you set up for too little sensitivity, weak echoes may be missed. On the other hand excessive sensitivity yields too much background noise; strong targets may be missed because of the poor contrast between desired echoes and the background noise on the display.

To adjust receiver sensitivity, adjust the gain control so background noise is just visible on the screen.

1. Press the [GAIN] key consecutively until the display shown below appears.

<table>
<thead>
<tr>
<th>GAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTO : MODERATE</td>
</tr>
<tr>
<td>MANU</td>
</tr>
<tr>
<td>[GAIN] : A/C SEA MENU</td>
</tr>
<tr>
<td>[MENU/ESC]: Exit.</td>
</tr>
</tbody>
</table>

Gain adjustment window

2. Press ▲ or▼ to choose AUTO or MANU as appropriate.

**Automatic gain adjustment**

1) Press ► to open the automatic gain options window.

**Automatic gain options**

2) Press ▲ or▼ to choose ROUGH, MODERATE or CALM depending on sea conditions.

3) Press ▼ to close the window.
1. OPERATION

**Manual gain adjustment**

While observing the screen and the gain tuning bar, press ◄ or ► to adjust the gain. The setting range is 0-100.

3. Press the [MENU/ESC] key to finish.

1.8 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 scanner above the water, the further the clutter will extend. When sea clutter masks the picture, suppress it by the A/C SEA control.

**Automatic adjustment by the A/C SEA control**

Sea clutter, as well as rain clutter, can be automatically adjusted with the automatic A/C SEA function.

**Manual adjustment of A/C SEA**

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

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

If the 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.

**Note:** The auto A/C SEA function can erase weak target echoes. Adjust the control carefully watching the display.
Manual A/C SEA adjustment

While observing the screen and the A/C SEA tuning bar, press ◀ or ► to adjust the A/C SEA. The setting range is 0-100.

3. Press the [MENU/ESC] key to finish.

1.9 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 antenna will also pick up rain clutter (rain, snow, or hail) in the same manner as normal targets. The illustration below shows the appearance of rain clutter on the display.

The A/C RAIN control adjusts the receiver sensitivity as the A/C SEA control does but rather in a longer time period. The higher the setting the greater the anti-clutter effect.

Rain clutter at screen center

1. Press the [GAIN] key consecutively until the display shown below appears.

<table>
<thead>
<tr>
<th>A/C RAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>◀ or ►</td>
</tr>
<tr>
<td>[GAIN] : GAIN MENU</td>
</tr>
<tr>
<td>[MENU/ESC]: Exit</td>
</tr>
</tbody>
</table>

A/C RAIN adjustment window

2. While observing the screen and the A/C RAIN tuning bar, press ◀ or ► to adjust the A/C RAIN. The setting range is 0-100.

3. Press the [MENU/ESC] key to finish.

1.10 Measuring the Range

The bearing to a target can be measured by the range rings, by the cursor and by the VRM (Variable Range Marker).

Measuring range by the range rings

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

Measuring range by the cursor

Operate the cursor pad to place the cursor on the inside edge of the target. Read the range to the cursor at the bottom right corner of the display.

Measuring range by the VRM

1. Press the [VRM] key to display the VRM. The message “Place VRM by cursor” appears and “VRM” in the EBL/VRM box is displayed in reverse video. The message is automatically erased after 10 seconds, or you may erase it sooner by pressing any key.

2. Operate the cursor pad to place the VRM on the inside edge of the target.

3. Check the VRM readout at the bottom left corner on the screen to find the range to the target.

To anchor the VRM, press the [VRM] key. (It is automatically anchored if there is no key operation for about 10 seconds.) To erase the VRM, press the [MENU/ESC] key.
1. OPERATION

1.11 Measuring the Bearing

The bearing to a target can be measured with the cursor and the EBL (Electronic Bearing Line).

**Measuring bearing with the cursor**

Operate the cursor pad to place the cursor on the center of the target. Read the bearing to the target at the bottom right corner.

**Measuring bearing with the EBL**

1. Press the [EBL] key to show the EBL. The message “Place EBL by cursor” appears and “EBL” in the EBL/VRM box is displayed in reverse video. The message is automatically erased after 10 seconds, or you may erase it sooner by pressing any key.

2. Operate the cursor pad to bisect the target with the EBL.

3. Check the EBL readout at the bottom left corner on the screen to find the bearing to the target.

   To anchor the EBL, press the [EBL] key. (It is automatically anchored if there is no key operation for about 10 seconds.) To erase the EBL, press the [MENU/ESC] key.

**1.12 Shifting the Display**

Own ship position, or sweep origin, can be displaced manually or automatically to expand the view field without switching to a longer range. The default shift method is manual and the maximum shift is 60% of range.

If shift is activated when nav data is displayed, the nav data is automatically erased.

1. Use the cursor pad to place the cursor where you want to shift own ship position.

2. Press the [MODE] key to show the Display Mode menu.

   ![Display mode menu](image)

   *: If SHIFT (AUTO) is shown, open the System menu and set SHIFT MODE to MANUAL. For further details, see SHIFT MODE on page 17.

3. Press ▲ to choose SHIFT (MANUAL).

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

   ![Select where to shift with the cursor](image)

   ![Shifted display](image)

   *How the manual shift works*

To cancel the shifted display, open the Display Mode menu, set SHIFT to NORMAL and then press the [MENU/ESC] key.
1.13 Zoom

The zoom feature allows you to double the size of a selected area.

If zoom is activated when nav data is displayed, the nav data is automatically erased.

1. Use the cursor pad to place the cursor where you want to zoom.
2. Press the [MODE] key to show the display mode menu.
   
   **DISPLAY MODE**
   
   ▲ SHIFT (MANUAL)*
   • NORMAL
   • ZOOM
   • NAV DISP OFF ON ▼
   [MENU/ESC] : Exit

   * "P" shows current function of PROG key

   **Display mode menu**

3. Press ▼ to choose ZOOM.
4. Press the [MENU/ESC] key to close the menu. The area selected with the cursor appears in the zoom window and "ZOOM" appears at the top left corner.

**Zoom display**

To cancel the zoom display, open the Display Mode menu, choose NORMAL and then press the [MENU/ESC] key. To choose new zoom location, restore to the NORMAL mode and then repeat the zoom procedure.

1.14 User Menu Overview

The User menu, consisting of three pages of menus, contains 10 items which the user may set according to conditions or preference.

1. Press the [MENU/ESC] key to open the User menu.

   **User menu, page 1**

   TX ST-BY ST-BY
   INT REJECTION : LOW
   ECHO STRETCH : LOW
   FTC : OFF
   NOISE REJECTION : LOW
   [MENU/ESC] : Exit

2. Use ▲ or ▼ to scroll the menu to display desired item in reverse video.

   **User menu, page 2**

   WATCHMAN TIME OFF
   HDG LINE OFF
   ECHO TRAIL : OFF
   TRAIL BRILLIANCE : LOW
   SYSTEM MENU...
   [MENU/ESC] : Exit

3. Press ► to show the options window for the item selected. For example, the illustration below shows the interference rejector options window.

   **Interference rejector options**

4. Press ▲ or ▼ to choose option desired.
5. Press ◄ to continue menu operation, or press the [MENU/ESC] key to register your selection and close the User menu.
1. OPERATION

### User menu description

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX/ST-BY</td>
<td>Sets radar in transmit or stand-by status. (Same functions as the [MODE] key.)</td>
</tr>
<tr>
<td>INT REJECTION</td>
<td>Rejects radar interference.</td>
</tr>
<tr>
<td>ECHO STRETCH</td>
<td>Stretches echoes in range direction or range and bearing direction.</td>
</tr>
<tr>
<td>FTC</td>
<td>Suppresses long-range rain clutter.</td>
</tr>
<tr>
<td>NOISE REJECTION</td>
<td>Rejects noise.</td>
</tr>
<tr>
<td>WATCHMAN TIME</td>
<td>Periodically checks for targets in guard zone.</td>
</tr>
<tr>
<td>HDG LINE OFF</td>
<td>Temporarily turns the heading line off.</td>
</tr>
<tr>
<td>ECHO TRAIL</td>
<td>Shows echo movement in afterglow.</td>
</tr>
<tr>
<td>TRAIL BRILLIANCE</td>
<td>Adjusts echo trail brilliance.</td>
</tr>
<tr>
<td>SYSTEM MENU</td>
<td>Opens the system menu. For description see paragraph 1.30.</td>
</tr>
</tbody>
</table>

1.15 Heading Line

The heading line indicates the ship’s heading and it is the solid line which appears at zero degrees on the bearing scale.

To temporarily erase the heading line to look at targets existing dead ahead of own ship, do the following:

1. Press the [MENU/ESC] key to open the User menu.
2. Press ▲ or ▼ to choose HDG LINE OFF from page 2.
3. Press ▶ to turn the heading line off. The line stays off while ▶ is pressed.
4. Press the [MENU/ESC] key to close the menu.

1.16 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. This type of interference can be reduced by activating the interference rejector circuit. “IR” and the rejection level indicator “L,” “M” or “H” appear at the top right corner when the interference rejector circuit is on.

![Appearance of interference](image)

Turn off the interference rejector when no interference exists, to avoid missing small targets.

1. Press the [MENU/ESC] key to open the User menu.
2. Press ▲ or ▼ to choose INT REJECTION from page 1.
3. Press ▶ to open the options window.
4. Press ▲ or ▼ to choose OFF, LOW, MEDIUM or HIGH as appropriate.
5. Press the [MENU/ESC] key to finish.
1.17 Noise Rejector
The noise rejector suppresses white noise, which appears on the screen as many dots scattered randomly over the display.

1. Press the [MENU/ESC] key to open the User menu.
2. Press ▲ or ▼ to choose NOISE REJECTION from page 1.
3. Press ► to open the options window.
4. Press ▲ or ▼ to choose OFF, LOW or HIGH as appropriate.
5. Press the [MENU/ESC] key to close the menu.

1.18 Echo Trail, Trail Brilliance
Echo trails are the afterglow of target echoes that represent their movements relative to own ship. They are useful for monitoring target movement.

Trails are painted for the time period chosen. When the time period has elapsed, trails are erased and restarted whenever the range is changed or zoom or shift is activated.

1. Press the [MENU/ESC] key to open the User menu.
2. Press ▲ or ▼ to choose ECHO TRAIL from page 2.
3. Press ► to open the options window.
4. Press ▲ or ▼ to choose appropriate time, or OFF to cancel echo trails. “CONTIN.” paints trails continuously.
5. Press ◄ to close the options window.
6. Press ▼ to choose TRAIL BRILLIANCE.
7. Press ► to open the options window.
8. Press ▲ or ▼ to choose LOW or HIGH as appropriate.
9. Press the [MENU/ESC] key to close the menu.

“TRAIL” and trail time (no time shown in case of “CONTIN.”) are shown at the upper right-hand corner on the screen.

1.19 Echo Stretch
On long ranges target echoes tend to shrink, making them difficult to see. To enhance target video on long ranges, use the echo stretch feature.

1. Press the [MENU/ESC] key to open the User menu.
2. Press ▲ or ▼ to choose ECHO STRETCH from page 1.
3. Press ► to open the options window.
4. Press ▲ or ▼ to choose OFF, LOW or HIGH as appropriate. LOW stretches echoes in the bearing direction; HIGH stretches echoes in the range and bearing directions. “ES L” or “ES H” appears at the top right-hand corner when echo stretch is turned on.
5. Press the [MENU/ESC] key to close the menu.

How echo stretch works
1.20 Guard Alarm

The guard alarm allows the operator to set the desired range and bearing for a guard zone. When ships, islands, landmasses, etc. violate the guard zone, audio and visual alarms are released to call your attention. The alarms will be released for targets entering or exiting the zone depending on the presence or absence of targets in the zone when the alarm is set.

### NOTICE

- The alarm should not be relied upon as the sole means for detecting possible collision situations.
- A/C SEA, A/C RAIN, FTC and GAIN controls should be properly adjusted to be sure the weak echoes will not be missed by the alarm.

### Setting a guard zone

1. Operate the cursor pad to place the cursor at the top left corner for the zone and then press the [ALARM] key.
2. Operate the cursor pad to place the cursor at the bottom right corner for the zone and then press the [ALARM] key.

- **Guard zone to set**
  - Mentally create the guard zone to set.

- **Place cursor here.**
  - 1) Place cursor at top left corner for zone and press [ALARM].

- **Guard zone completed.**
  - 2) Place cursor at bottom right corner for zone and press [ALARM].

### How to set a guard zone

**How guard zone type is determined**

After the guard zone has been set, the radar checks for targets inside the guard zone, which takes about 8 to 12 seconds. When the check is completed, "G(IN)" or "G(OUT)" replaces G(---) at the top right corner.

- **G(IN):** When no target exists in the zone, "G(IN)" appears. The audio alarm sounds against targets which enter the guard zone.
- **G(OUT):** If there are targets in the guard zone, "G(OUT)" appears. The audio alarm sounds against all targets which exit from the guard zone.

### Inward and outward alarms

(a) Inward target alarm (b) Outward target alarm

**Note:** The guard zone disappears when it is not within the range in use. When this occurs, "UP RNG" replaces G(IN) or G(OUT). Change the range to redisplay the guard zone.

### Silencing the audio alarm

When a target violates the guard zone, the target flashes and the audio alarm sounds. You can silence the audio alarm with the [ALARM] key. The target continues flashing until the reason for the alarm ends or the guard zone is canceled.

### Canceling the guard zone and guard alarm

Press and hold down the [ALARM] key until the guard zone is erased.
1.21 Watchman

How watchman works

Watchman transmits the radar for one minute to check if a target has entered or exited the guard zone from the previous transmission. If no change is found, the radar goes into stand-by for the number of minutes set for the watchman feature. If change is found, the audio alarm sounds, watchman is canceled and the radar transmits. This feature is useful for extending the life of the magnetron.

ST -BY
5,10 or 20 min

Tx
1 min

ST -BY

5,10 or 20 min

Watchman starts

* Beeps emitted just before radar transmits.

How watchman works

Setting watchman stand-by interval

The watchman stand-by interval, that is, the number of minutes the radar is in standby, can be set to 5, 10 or 20 minutes as follows:

1. Set a 360° guard zone referring to paragraph 1.20.
2. Press the [MENU/ESC] key to open the User menu.
3. Press ▲ or ▼ to choose WATCHMAN TIME from page 2.
4. Press ► to open the options window.
5. Press ▲ or ▼ to choose appropriate time out, that is, the amount of time the radar waits in standby, among 5, 10 and 20 minutes.
6. Press the [MENU/ESC] key to close the menu.

Note 1: To turn off the watchman feature, choose OFF at step 5.
Note 2: You cannot put the radar in stand-by when the radar is transmitting for the watchman feature.

1.22 Suppressing Heavy Rain Clutter

In adverse weather, clouds, rain or snow produce spray-like spurious echoes which impair target detection over all ranges. These echoes can be suppressed by turning on the FTC (Fast Time Constant). FTC works by splitting up these unwanted echoes into a speckled pattern, making recognition of solid targets easier.

1. Press the [MENU/ESC] key.
2. Press ▲ or ▼ to choose FTC from page 1.
3. Press ► to open the options window.
4. Press ▲ or ▼ to choose OFF or ON as appropriate.
5. Press the [MENU/ESC] key to close the menu.

“FTC” appears at the top right corner when the FTC is active.

1.23 Panel Backlighting

You may adjust panel backlighting as follows:

1. Press the [MENU/ESC] key to open the User menu.
2. Press ▼ to choose SYSTEM MENU.
3. Press ▲ or ▼ to choose PANEL DIMMER from page 1.
4. Press ► to open the options window.
5. Choose OFF, LOW, MEDIUM or HIGH as appropriate.
6. Press the [MENU/ESC] key twice to close the menu.
1. OPERATION

1.24 Hue
The default hue setting (DAY) displays echoes in tones of gray on a white background, which is most suitable for daytime viewing. For nighttime viewing you may reverse this arrangement.

1. Press the [MENU/ESC] key to open the User menu.
2. Press ▼ to choose SYSTEM MENU.
3. Press ▲ or ▼ to choose HUE from page 1.
4. Press ► to open the options window.
5. Press ▲ or ▼ to choose DAY or NIGHT as appropriate.
6. Press the [MENU/ESC] key twice to close the menu.

1.25 Resetting Distance Run
You may reset distance run to zero as below. You need a navigator or speed log to display distance run.

1. Press the [MENU/ESC] key to open the User menu.
2. Press ▼ to choose SYSTEM MENU.
3. Press ▲ or ▼ to choose “TRIPLOG RESET?” from page 1.
4. Press ► to open the options window.
5. Press ▲ to choose YES to reset distance run to zero.
6. Press the [MENU/ESC] key twice to close the menu.

1.26 PROG Key
The [PROG] key acts as a shortcut key. You may use any User menu item except items on the “SYSTEM MENU.” The default setting is TX/ST-BY.

Using the PROG key
1. Press the [PROG] key. The options window corresponding to the item programmed appears. In the example at the top on this page the echo stretch options window is shown.

2. Press ▲, ▼ or the [PROG] key to choose appropriate option.
3. Press the [MENU/ESC] key to close the options window.

Programming the PROG key
1. Press the [MENU/ESC] key to open the User menu. The “P” mark indicates the current function of the [PROG] key.
2. Press ▲ or ▼ to choose the item you wish to use.
3. Press and hold down the [PROG] key (about three seconds) until you hear a beep and the “P” moves to the item selected.
4. Press the [MENU/ESC] key to close the menu.

1.27 Outputting Target Position to a Plotter
If the radar is interfaced with a plotter, you can output a radar target’s latitude and longitude position to the plotter, and show that position on the plotter’s screen, with the target mark (X). This function requires position and heading data.

1. Use the cursor pad to place the cursor on a target.
2. Press the [TLL] key to output the target’s L/L position. “Output TLL” appears at the bottom of the screen.
1.28 Turning Navigation Data On/Off

Navigation data appears on the bottom half of the screen as in the illustration below. You may turn the navigation data display on or off as shown below.

**Note:** When the nav data is turned on with shift or zoom active, zoom or shift is cancelled.

1. Press the [MODE] key.
2. Press ► to choose ON; ◄ to choose OFF.
3. Press the [MENU/ESC] key to close the menu.

![Sample navigation display](image)

1.29 Setting up Nav Data Displays

The user may arrange the nav data display as desired. You may display between two and four items and choose the item and the order to display them. For how to choose the number of items to display, see "NAV DATA" on page 16.

1. Turn on the nav data referring to paragraph 1.28.
2. Press the [POWER/BRILL] key momentarily followed by the [MODE] key to go into stand-by.
3. Press the [MENU/ESC] key to close the window.
4. Press the cursor pad to display the nav data setup window.
5. Press ▲ or ▼ to choose the data window to process. The dashed rectangle circumscribes current selection.
6. Press ◄ or ► to choose item to display. See the illustration below for the data availability. A description of the nav data displays appears on the next page.

![Nav data display with nav data setup window](image)

**Items displayable in (1) - (3):** depth, position, course, date, time, range and bearing, trip distance, odometer distance, water temperature, heading, time-to-go to destination waypoint, XTE*, speed*, wind speed and direction*, destination waypoint data*, compass*, Time Difference

**Items displayable in (4) - (9):** depth, position, course, range and bearing, trip distance, odometer distance, water temperature, date, time, speed, heading, time-to-go to destination waypoint, XTE*, wind speed and direction, Time Difference

* = Graphic display in standby

Nav data window and item displayable

7. Press the [MENU/ESC] key to close the nav data setup window.
1. OPERATION

**GRAPHIC DISPLAYS**

<table>
<thead>
<tr>
<th>XTE (Cross-Track Error) GRAPHIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital XTE</td>
</tr>
<tr>
<td>Analog XTE (Bar moves right or left according to amount and direction of XTE)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SPEED GRAPHIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed 10.3 m/s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WIND GRAPHIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind direction</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DESTINATION WAYPOINT GRAPHIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing, Course, Destination waypoint direction, XTE scale</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMPASS GRAPHIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing to destination waypoint</td>
</tr>
</tbody>
</table>

**DIGITAL DISPLAYS**

<table>
<thead>
<tr>
<th>DIGITAL DISPLAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth 32.8 ft</td>
</tr>
<tr>
<td>Temperature 69.8°F</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>30° 00.065’N</td>
</tr>
<tr>
<td>130° 00.574’E</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HEADING</th>
</tr>
</thead>
<tbody>
<tr>
<td>318°</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COURSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>123°</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WIND DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>138°</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RANGE &amp; BEARING**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.21 nm 140°</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ODOMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>56 nm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TIME-TO-GO**</th>
</tr>
</thead>
<tbody>
<tr>
<td>00H30M</td>
</tr>
</tbody>
</table>

**NOTE 1:** The graphic data selected on the standby display is shown as digital data on the TX display.

**NOTE 2:** 

- = APP or TRUE depending on menu setting. See WIND SPD/DIR on page 17 for description.
- = Range and bearing to destination waypoint
# = MAG(netic) or TRUE.

Nav data displays
### System Menu

The System menu mainly contains items which once set do not require frequent adjustment. You may display this menu by choosing “SYSTEM MENU” from page 2 of the User menu and then pressing ►.

#### System menu description

**Page 1 of system menu**

**LANGUAGE:** The system language is available in English, several European languages and Japanese. To change the language, choose language desired, and then press the [MENU/ESC] key.

**RANGE UNIT:** Chooses the unit of range measurement among nautical miles, kilometers and statute miles.

**DEPTH UNIT:** Chooses the unit of depth measurement among meters, feet, fathoms, Hiro (Japanese) and Passi/Braza. Requires depth data.

**SPEED UNIT:** Chooses the unit of speed measurement among knot, mile per hour and kilometer per hour. Requires speed data. When changed, AUTO SHIFT SPEED (page 2 of system menu) is set to “15.”

**WIND UNIT:** Chooses the unit of wind measurement among mile per hour, kilometer per hour and meters per second. Requires wind data.

**TEMP UNIT:** Chooses the unit of water temperature measurement from Celsius and Fahrenheit. Requires water temperature data.

**NAV DATA:** Chooses the amount of nav data to display among two, three and four items. Requires appropriate sensors.

**KEY BEEP:** A beep sounds to confirm valid and invalid operation. You can turn this beep on or off.

**RINGS:** Turns the range rings on or off.

**WAYPOINT MARK:** The waypoint mark shows the location of the destination waypoint set on a plotter. You can turn this mark on or off. Requires a plotter.
1. OPERATION

**PANEL DIMMER, HUE, TRIPLOG RESET:** See paragraph 1.23, 1.24, 1.25, respectively.

**EBL REFERENCE:** The EBL readout may be chosen from relative (relative to own ship’s heading) or true (referenced to the North). Heading data required for true bearing.

**Note:** If no bearing data is input, course data from the GPS navigator is used. In this case ship’s speed must be more than two knots.

**BEARING READOUT:** Course indication may be shown in true or magnetic (magnetic compass) degrees. Heading data required for true degrees.

**CURSOR POSITION:**Chooses the information to show for the cursor position: latitude and longitude or range and bearing from own ship. Latitude and longitude position requires a navigator.

**TRIP SOURCE:** Chooses the criteria for calculating distance run: latitude and longitude or speed. Requires navigator or speed log.

**WIND SPD/DIR:** True is the speed and direction (in relation to ship’s bow) of the wind felt or measured when stationary. Apparent 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. Requires wind data.

**SHIFT MODE:** Own ship position, or sweep origin, can be displaced manually or automatically. For automatic displacement, the amount of shift is calculated with ship speed, and the amount is limited to 60% of the range in use. For example, if the “Auto Shift Speed” setting is 15 knots and the ship is running at 10 knots, the amount of shift will be about 40%. The formula for determining shift amount is as below. Requires speed data.

\[
\text{Ship's speed} \times 0.6 = \text{Amount of shift(%)}
\]

**AUTO SHIFT SPEED:** Sets the automatic shift maximum speed. The setting range is 1-99.

**TX SECTOR BLANK:** If the antenna is installed where an object (mast, etc.) will prevent transmission within its breadth, or transmission in area will present a health hazard, you should disable transmission within this area by turning on this feature and setting the area with BLANKING START and BLANKING AREA below.

**BLANKING START:** Sets the starting point (000-359°) of the TX sector blanking area.

**BLANKING AREA:** Sets the angle of the TX sector blanking area (000-135°).

**LOCAL TIME SETUP:** Enter time difference between local time and UTC time to use local time. Press ▲ or ▼ to set value.

**ANTENNA SPEED:** Chooses antenna rotation speed from 24 rpm and AUTO. Use AUTO to automatically change the antenna rotation speed (24 rpm for long pulse, 31 rpm for medium or 41 rpm for short). Choose “24 rpm” to rotate the antenna at 24 rpm regardless of pulse length.

**Page 3 of system menu**

**RANGE:** Chooses the ranges to use.
2. MAINTENANCE, TROUBLESHOOTING

2.1 Maintenance

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

<table>
<thead>
<tr>
<th>Period</th>
<th>Item</th>
<th>Check point</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 6 months</td>
<td>Fixing bolts for antenna unit</td>
<td>Check for corrosion and if tightly fastened.</td>
<td>Replace corroded bolts. Coat new bolts with anticorrosive sealant.</td>
</tr>
<tr>
<td></td>
<td>Antenna unit cleanliness</td>
<td>Check for foreign material on the antenna unit. (Foreign material on the antenna unit can cause a considerable drop in sensitivity.)</td>
<td>Clean the antenna unit with a freshwater-moistened cloth. Alcohol may be used. Do not use commercial cleaners to clean the antenna unit; they can remove paint and markings or deform the equipment.</td>
</tr>
<tr>
<td></td>
<td>Antenna unit cover</td>
<td>Check for cracks. Permanent damage to the unit's circuitry will result if water leaks inside.</td>
<td>If a crack is found, it should be temporarily repaired by using a small amount of sealing compound or adhesive. The unit should then be brought to your dealer for permanent repairs.</td>
</tr>
<tr>
<td></td>
<td>Display unit case, LCD</td>
<td>The display case and LCD will, in time, accumulate a coating of dust, and dust on the LCD 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 commercial cleaners to clean the display unit; they can remove paint and markings or deform the equipment.</td>
</tr>
<tr>
<td>6 months to 1 year</td>
<td>Display unit connectors</td>
<td>Check for tight connection and corrosion.</td>
<td>If corroded, ask your dealer about replacement.</td>
</tr>
</tbody>
</table>
2.2 Replacing the Fuse

The fuse (5 A) in the power cable protects the equipment against reverse polarity of the ship’s mains, overcurrent, and equipment fault. If the fuse blows, find the cause before replacing it.

**CAUTION**

*Use the proper fuse.*

Use of a wrong fuse may cause serious damage to the equipment and void the warranty.

2.3 Troubleshooting

The table below provides simple troubleshooting procedures which the user can follow to restore normal operation. If you cannot restore normal operation contact your dealer for advice.

<table>
<thead>
<tr>
<th>If…</th>
<th>But…</th>
<th>Then…</th>
</tr>
</thead>
<tbody>
<tr>
<td>you pressed the [POWER/BRILL] key to turn on the radar</td>
<td>display contrast is poor</td>
<td>• try adjusting LCD contrast. (See page 4.)</td>
</tr>
<tr>
<td></td>
<td>nothing appears on the display</td>
<td>• battery may have discharged; check battery. • check if fuse has blown.</td>
</tr>
<tr>
<td></td>
<td>the control panel does not light</td>
<td>adjust PANEL DIMMER on page 1 of system menu.</td>
</tr>
<tr>
<td>the radar has warmed up and you pressed the [MODE] key to transmit</td>
<td>the message “NO HEADING PULSE” or “NO BEARING PULSE” appears</td>
<td>check that the antenna cable is firmly connected.</td>
</tr>
<tr>
<td></td>
<td>neither noise or targets appear (characters and markers do)</td>
<td>• try adjusting gain, A/C SEA and A/C RAIN. • check antenna cable for damage.</td>
</tr>
<tr>
<td>a key is pressed</td>
<td>nothing happens</td>
<td>key may be faulty. Contact your dealer.</td>
</tr>
<tr>
<td>the display freezes</td>
<td></td>
<td>press the [POWER/BRILL] key about five seconds to turn off the power and then turn it on again.</td>
</tr>
</tbody>
</table>
2. MAINTENANCE, TROUBLESHOOTING

2.4 Diagnostics

If you feel that your unit is not working properly, conduct the appropriate diagnostic test, display unit or antenna unit, to find the possible cause. If you cannot restore normal operation, contact your dealer for advice.

Display unit

1. Turn on the power while pressing and holding down the [MENU/ESC] key. Continue pressing the [MENU/ESC] key until the Installation menu appears.

   **INSTALLATION MENU**
   
   | SIMULATION * | OFF |
   | TEST ...   |    |
   | LCD PATTERN |    |
   | MEMORY CLEAR|    |
   | NMEA PORT   | IN/OUT |
   | NMEA OUTPUT | OFF   |
   | GPS WAAS    | OFF   |
   | GOTO RADAR SETUP... |

   * The simulation provides internally generated echoes, for use in exhibitions, etc. “SIM” appears at the top left corner when the simulation mode is active.

   **Installation menu**

2. Press ▼ to choose TEST.
3. Press ► to start the test. In a few moments the results will appear.

   **Diagnostic test results**

<table>
<thead>
<tr>
<th>Item</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROM, RAM</td>
<td>OK: Normal</td>
</tr>
<tr>
<td></td>
<td>NG: No Good</td>
</tr>
<tr>
<td>NMEA</td>
<td>Test connector required to test. Normally, “01” is displayed.</td>
</tr>
<tr>
<td>Body</td>
<td>Temperature of display unit</td>
</tr>
<tr>
<td>GPS</td>
<td>Shows program no. of GP-310B or GP-320B (if connected) and GPS status. “OK” shown for normal; no indication if abnormal.</td>
</tr>
</tbody>
</table>

   4. The squares at the right side of the test results display are for checking controls. Press each key and the arrows on the cursor pad one by one. A control’s corresponding on-screen square “lights” in black if the control is working properly.
5. To return to the Installation menu, press the [MENU/ESC] key three times.
6. To restore normal operation, turn off the power and then turn it on again.

Antenna unit

1. Display the installation menu as in step 1 in the display unit diagnostic test.
2. Press ▼ to choose GOTO RADAR SETUP and then press ►. Power is automatically reset.
3. Press the [POWER/BRILL] and [MODE] keys to transmit.

   **RADAR SETUP**
   
   SCANNER TEST ...
   
   [MENU/ESC]: Exit.

   (3/3)

5. Press ▼ to choose SCANNER TEST.
6. Press ► to start the test. In a few moments the results will appear, similar to those shown at the top of the next page.
7. To restore normal operation, turn off the power and then turn it on again.
2. MAINTENANCE, TROUBLESHOOTING

2.1 Antenna Test Results

The antenna unit and heading and bearing signals are checked, and the results shown as OK or NG (No Good). For any NG, contact your dealer for advice. Antenna unit RPM appears below the bearing signal test result.

Note: The result of ANTENNA STATUS is shown as “NG (0)” when the antenna test result screen is initially shown. To confirm the antenna status, press the [MENU/ESC] key and ►.

The “TUNE” bar shows radar receiver tuning status. Total on time and total TX times appear below the TUNE bar. Data sentences currently input to the radar are highlighted in the “INPUT NMEA” window.

2.5 Test Pattern

This feature tests for proper display of tones.

1. Turn on the power while pressing and holding down the [MENU/ESC] key. Continue pressing the [MENU/ESC] key until the Installation menu appears.
2. Press ▼ to choose LCD PATTERN.
3. Press ► to start the test. The entire screen is black.
4. Press the [MENU/ESC] key and the screen turns white.

2.6 Clearing the Memory

You may want to clear the memory to start afresh with default settings. You can do this as follows:

1. Turn on the power while pressing and holding down the [MENU/ESC] key. Continue pressing the [MENU/ESC] key until the Installation menu appears.
2. Press ▼ to choose MEMORY CLEAR.
3. Press ►.
4. Press ▲ to choose YES.
5. To clear the memory turn the power off and on again.

2.7 Replacing the Magnetron

When the magnetron 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. (Type: E3588, Code No: 000-142-270)

2.8 Replacing the Synchro Belt

When the synchro belt has worn out, the sweep is not synchronized with antenna rotation, which results in an abnormal picture. When you suspect that the synchro belt has worn out, contact a FURUNO agent or dealer about replacement. (Type: 40 S2M 266UG, Code No: 000-808-743)
3. INSTALLATION

**NOTICE**

Do not apply paint, anti-corrosive sealant or contact spray to coating or plastic parts of the equipment.

Those items contain organic solvents that can damage coating and plastic parts, especially plastic connectors.

3.1 Antenna Unit Installation

**Mounting considerations**

When choosing a mounting location for the antenna unit, keep in mind the following points:

- Install the antenna unit on the hardtop, radar arch or on a mast on an appropriate platform. (For sailboats, a mounting bracket is optionally available.) It should be placed where there is a good all-round view with, as far as possible, no part of the ship’s superstructure or rigging intercepting the scanning beam. Any obstruction will cause shadow and blind sectors.

- In order to minimize the chance of picking up electrical interference, avoid where possible routing the antenna cable near other electrical equipment onboard. Also, avoid running the cable in parallel with power cables.

- Separate the antenna unit from a magnetic compass by the distances noted below to prevent interference to the magnetic compass:
  - Standard compass: 1.25 m
  - Steering compass: 0.85 m

**Mounting on a platform**

1. Remove mounting hardware at the bottom of the antenna unit; four each of hex bolts (M10X20), spring washers and flat washers. Save mounting hardware to use it to fix the antenna unit to the mounting platform later on.

2. Construct a wood, steel or aluminum platform on which to fix the antenna. (The thickness of the platform depends on the hex bolts to be used to fix the antenna to the platform. See the illustration on the next page for thickness.) Next, position the antenna unit so the cable gland faces toward boat’s stern.

**Note 1:** If corrosive material is used for the platform, take appropriate anticorrosive measures to prevent corrosion.

**Note 2:** When drilling holes in the platform, be sure they are parallel with the fore and aft line.
3. Use the flat washers and spring washers removed earlier and appropriate hex bolts (see the illustration below) to fasten the antenna unit to the platform. **The torque should be between 19.6-24.5 N/m.**

![Antenna Base Assembly Diagram](image)

**Flat washer**
**Spring washer**
**Hex bolt (M10 x 25 or M10 x 20)**

Applying silicone sealant.

*1: Platform thickness
- 5 mm or less: M10 x 20
- 5-10 mm: M10 x 25
- over 10 mm: locally supplied bolts

**How to fasten the antenna base to platform**

4. Unfasten four screws to open the cover. Remove and discard the packing material inside the radome.

![Antenna Unit, Inside View](image)

5. Release the cable of the rotation detector from the cable clamp.

6. Unfasten 11 screws to dismount the shield plate.

![Shield Plate](image)

**Caution**

7. Pass the antenna cable with connector through the gasket and cable clamp, and then tighten the cable gland.

**Note:** Two gaskets are supplied: one gray, one black. Use the proper gasket according to antenna cable used, referring to the illustration below.

**Antenna cable and gasket to use**

![Gaskets](image)

- Use black gasket.
- Use gray gasket.
8. Tighten the cable gland to fix the antenna cable.

9. Referring to the figure below, fasten the shield cable with a screw (M4 x 10) on the chassis to ground the unit.

10. Attach the EMI core to the antenna cable. Set the EMI core fixing band to the EMI core.

11. Connect the 9-pin connector of the antenna cable to J801. See the illustration on the previous page for location.

12. Refasten the shield plate with 10 screws. Be sure not to pinch the cable from the rotation detector with the shield plate.

13. Fasten the EMI core fixing plate with screw (supplied).

14. Temporarily close the cover. You will need to open the cover later to confirm magnetron voltage.

**How to fix the EMI core**

Mounting using the optional mounting bracket

A mounting bracket for fastening the antenna unit to a mast (70-125 mm diameter) on a sailboat is optionally available.

Type OP03-93, Code 008-445-080

**Contents of radome mounting assy.**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Code No.</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolt M4 x 12</td>
<td>000-804-725</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Bolt M8 x 20</td>
<td>000-805-707</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Mounting plate</td>
<td>03-018-9001-0</td>
<td>100-206-740</td>
<td>1</td>
</tr>
<tr>
<td>Support plate (1)</td>
<td>03-018-9005-0</td>
<td>100-206-780</td>
<td>1</td>
</tr>
<tr>
<td>Support plate (2)</td>
<td>03-018-9006-0</td>
<td>100-206-790</td>
<td>1</td>
</tr>
<tr>
<td>Bracket (1)</td>
<td>03-028-9101-0</td>
<td>100-206-810</td>
<td>1</td>
</tr>
<tr>
<td>Bracket (2)</td>
<td>03-028-9102-0</td>
<td>100-206-820</td>
<td>1</td>
</tr>
<tr>
<td>Fixing plate</td>
<td>03-028-9103-0</td>
<td>100-206-830</td>
<td>2</td>
</tr>
</tbody>
</table>

1. Remove mounting hardware at the bottom of the antenna base. You may discard the mounting hardware.
2. Assemble the mounting bracket as below and fasten it to a mast.
3. Fasten the antenna unit to the mounting bracket with hexagon head bolts (M10 x 25).
3. INSTALLATION

(A) Assembling the mounting bracket

(B) Fastening antenna to mounting bracket

How to assemble the optional mounting bracket and mount the antenna

4. Open the cover.
5. Follow steps 5-13 in "Mounting on a platform."

3.2 Display Unit Installation

Mounting considerations

When choosing a mounting location for the display unit, keep in mind the following points:

- Keep the display unit out of direct sunlight.
- The temperature and humidity should be moderate and stable.
- Locate the unit away from exhaust pipes and vents.
- The mounting location should be well ventilated.
- Mount the unit where shock and vibration are minimal.
- Keep the unit away from electromagnetic field-generating equipment such as motors and generators.
- For maintenance and checking purposes, leave sufficient space at the sides and rear of the unit and leave slack in cables.
- Separate the display unit from a magnetic compass unit by the distances noted below to prevent interference to the magnetic compass:
  - Standard compass: 0.60 m
  - Steering compass: 0.40 m
- Be sure the mounting location is strong enough to support the weight of the unit under the continued vibration normally experienced on the boat.

Mounting

The display unit can be mounted on a desktop, overhead or bulkhead, or flush mounted in a console.

Desktop, overhead mounting

1. Fix the hanger to the mounting location with four tapping screws (supplied).
2. Fit the knob bolts to the display unit.
3. Set the display unit to the hanger.
4. Tighten the knob bolts securely.

Flush mounting

Cutout a hole in the mounting area, referring to the template provided. Fasten the display unit with four screws (M4 x 20, supplied).

Bulkhead mounting

Using the template sheet provided, make four holes (Φ4.5) in the mounting location to fix the hanger.
3. INSTALLATION

3.3 Wiring

Connect the antenna cable, the power cable and the ground wire as shown below.

* = Do not confuse the antenna cable with the transducer cable for the Echo Sounder (ex. LS-6100). The transducer cable is black; the antenna cable is white and “RADAR” is written on the cable.

Connecting external equipment

A video sounder, navigator, plotter, wind indicator or GPS receiver GP-310 (320B) can be connected to the display unit. You will need an NMEA cable to make the connection.

To connect two navigators, use the optional cable MJ-A15A7F0004-005. Connect them referring to the interconnection diagram at the back of this manual.

Input sentences

NMEA 0183 Version 1.5/2.0/3.0, 4800 bps

<table>
<thead>
<tr>
<th>Name</th>
<th>Sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship’s Speed</td>
<td>VTG&gt;RMC&gt;RMA&gt;VBW&gt;VHW</td>
</tr>
<tr>
<td>Depth</td>
<td>DPT&gt;DBK&gt;DBS&gt;DBT</td>
</tr>
<tr>
<td>Heading (T)*</td>
<td>HDT&gt;HDG&gt;VHW&gt;HDM</td>
</tr>
<tr>
<td>Heading (M)</td>
<td>HDM&gt;HDG&gt;VHW&gt;HDT</td>
</tr>
<tr>
<td>Course (T)</td>
<td>VTG&gt;RMC&gt;RMA</td>
</tr>
<tr>
<td>Course (M)</td>
<td>VTG&gt;RMC&gt;RMA</td>
</tr>
<tr>
<td>Range/Bearing</td>
<td>RMB&gt;BWR&gt;BWC</td>
</tr>
<tr>
<td>Waypoint</td>
<td>RMB&gt;BWR&gt;BWC</td>
</tr>
<tr>
<td>Own Ship Pos.</td>
<td>GGA&gt;RMC&gt;RMA&gt;GLL</td>
</tr>
<tr>
<td>Time Diff.</td>
<td>RMA&gt;GLC&gt;GTD</td>
</tr>
<tr>
<td>Water Temp.</td>
<td>MTW</td>
</tr>
<tr>
<td>Time, Date</td>
<td>ZDA&gt;RMC</td>
</tr>
<tr>
<td>Wind Data</td>
<td>MWV</td>
</tr>
<tr>
<td>Cross-track Error</td>
<td>RMB&gt;XTE</td>
</tr>
</tbody>
</table>

*Requires magnetic variation (output by navigator).

Output sentence

NMEA 0183 Version 3.0, 4800 bps

<table>
<thead>
<tr>
<th>Name</th>
<th>Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target L/L</td>
<td>TLL</td>
</tr>
</tbody>
</table>
Connecting the external buzzer

The optional external buzzer (type XH3-BZ-L970, code no. 000-146-422) sounds the alarm buzzer in a remote location.

**Note:** This procedure requires making a hole in the display unit, which can affect watertightness. FURUNO cannot guarantee watertight integrity after this modification is made.

1. Detach the rear panel and place it upside down on a workbench.
2. Use a hammer and a Philips head screwdriver to punch out a hole of ø16 at the location shown in the illustration below.

   ![Display unit, rear view](image.png)

   *Make a hole of ø16. Seal hole with sealing compound after connecting cable.*

3. Close the rear panel, making sure the gasket is correctly positioned.
4. Plug in the connector of the external buzzer to J6 on the DU Board.
5. Seal the hole with sealing compound.
6. Fix the buzzer to the location desired with two tapping screws.

### 3.4 Adjustments

After you have installed the radar, do the heading alignment and timing adjustment. If you are connecting external equipment, follow “NMEA port setup, GPS WAAS setup” (for GP-320B) also.

#### Heading alignment

You have mounted the antenna unit facing straight ahead in the direction of the bow. Therefore, a small but conspicuous target dead ahead visually should appear on the heading line (zero degrees).

In practice, you will probably observe some small error on the display because of the difficulty in achieving accurate initial positioning of the antenna unit. The following adjustment will compensate for this error.

1. Turn on the power while pressing and holding down the [MENU/ESC] key. Continue pressing the [MENU/ESC] key until the Installation menu appears.

   ![Installation menu](image.png)

   *Installation menu*

2. Press ▼ to choose GOTO RADAR SETUP.
3. Press ►. Power is then reset.
4. Wait one minute, press the [POWER/BRILL] key followed by the [MODE] key to transmit.
5. Press the [MENU/ESC] key to show the User menu.
3. INSTALLATION

6. Press ► to show the Radar Setup menu.

<table>
<thead>
<tr>
<th>Radar Setup Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HEADING ADJUST</strong> ►</td>
</tr>
<tr>
<td><strong>TIMING ADJUST</strong></td>
</tr>
<tr>
<td>SET ON TIME : 000000h</td>
</tr>
<tr>
<td>SET TX TIME : 000000h</td>
</tr>
</tbody>
</table>

[MENU/ESC]: Exit

Radar setup menu

7. HEADING ADJUST is selected; press ► to show the options window.

<table>
<thead>
<tr>
<th>Radar setup menu (heading adjust)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HEADING ADJUST</strong></td>
</tr>
<tr>
<td><strong>TIMING ADJUST</strong> : YES</td>
</tr>
<tr>
<td>: NO</td>
</tr>
<tr>
<td>SET ON TIME : 000000h</td>
</tr>
<tr>
<td>SET TX TIME : 000000h</td>
</tr>
</tbody>
</table>

[MENU/ESC]: Exit

8. Press ▲ to choose YES, and the display now looks as below.

![Heading adjustment display](image)

9. Visually identify a suitable target (for example, ship or buoy) at a range between 0.125 to 0.25 miles.

10. Point your boat’s bow directly toward the target selected at step 9.

11. Locate the target selected at step 9 on the display and choose a range which places it in the outer half of the picture.

12. Press ◄ or ► to bisect the target with the heading line.


14. Press the [MENU/ESC] key twice to close the menu.

15. Move the boat towards a small buoy and confirm that the buoy shows up dead ahead on the radar when it is visually dead ahead.

**Timing adjustment**

Sweep timing differs with respect to the length of the antenna cable. Adjust sweep timing to prevent pushing or pulling of the target as illustrated below and placement of targets at incorrect ranges.

![Correct, Target pushed inward, Target pushed outward](image)

**Improper and correct sweep timings**

1. Transmit on a range between 0.125 and 0.5 nm and adjust the sensitivity and A/C SEA. (See page 4 and 5 for procedure.)

2. Choose TIMING ADJUST from the Radar Setup menu and press ►.
3. Press ▲ to choose YES, and the display now looks as below.

```
<table>
<thead>
<tr>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWEEP TIMING ADJUSTMENT BY '▲' AND '▼' KEYS.</td>
</tr>
<tr>
<td>THEN PUSH MODE KEY TO SET.</td>
</tr>
</tbody>
</table>
```

Timing adjustment display

4. Find a target which should be “straight” (harbor wall, straight pier) on the radar display.
5. While looking at the target selected at step 4, straighten it by pressing ▲ or ▼.
7. Press the [MENU/ESC] key and then complete the procedure below if you are going to connect external equipment, or shut off the power if no external equipment is connected.

**NMEA port setup, GPS WAAS setup**

The NMEA port can function as an input port or input/output port.

If you are using the GP-320B, turn on the GPS WAAS feature.

1. Show the Installation menu and then press ▼ to choose NMEA PORT.
2. Press ► to display the NMEA port options window.
3. Press ▲ or ▼ to choose IN/OUT or IN/IN as appropriate.

   **IN/OUT**: Input and Output (default setting). For GP-310B or GP-320B, choose this setting.

   **IN/IN**: Input only (Available with connection of multiple navigators.)

4. If you selected IN/OUT at step 3, press ◄, ▼ to choose NMEA OUTPUT, and then press ► to display the NMEA OUTPUT options window.
5. Press ▲ or ▼ to choose OFF or ON. Choose ON to output input data. Choose OFF to not output data or if the GP-310B or GP-320B is connected.
6. Press ◄ to close the window.
7. If the GP-320B is connected, press ▼ to choose GPS WAAS and then complete steps 8-10. Otherwise, go to step 10.
8. Press ► to open the window.
9. Press ▲ to choose message type.

   **Note**: WAAS is currently in the developmental stage. While in the developmental stage choose message type 02. Change to message type 00 when WAAS becomes fully operational.

10. Turn off the power.
3. INSTALLATION

3.5 Magnetron Heater Voltage

Magnetron heater voltage is formed at the MD Board of the antenna unit and is preadjusted at the factory. Therefore, no adjustment is required. However, verify the voltage as below.

**WARNING**

**ELECTRICAL SHOCK HAZARD**

Do not open the equipment.

DO NOT attempt the procedure below unless totally familiar with electrical circuits.

1. Open the antenna cover and open the shield plate.
2. Turn on the power. **DO NOT transmit.**
3. Connect a multimeter, set to 10 VDC range, between #6 (+) and #4 (-) of test point TP804 on the MD Board.

4. Confirm that the multimeter shows 8.0 V ±0.1 V. If it does not, adjust potentiometer VR801 on the MD Board.
5. Turn off the power.
6. Fasten the shield plate.
7. Close the antenna cover.
MENU TREE

TX/ST-BY (TX, ST-BY)
INT REJECTION (OFF, LOW, MEDIUM, HIGH)
ECHO STRETCH (OFF, LOW, HIGH)
FTC (OFF, ON)
NOISE REJECTION (OFF, LOW, HIGH)
WATCHMAN TIME (OFF, 5, 10, 20 min)
HDG LINE OFF (Temporarily turns off heading line.)
ECHO TRAIL (OFF, 30 s, 1, 3, 6 min, CONTIN.)
TRAIL BRILLIANCE (LOW, HIGH)

SYSTEM MENU
LANGUAGE (ENGLISH, JAPANESE, Others)
RANGE UNIT (nm, km, sm)
DEPTH UNIT (m, ft, fa, HR, pb)
SPEED UNIT (kt, km/h, mph)
WIND UNIT (kt, km/h, mph, m/s)
TEMP UNIT (°C, °F)
NAV DATA (OFF, ON)
KEY BEEP (OFF, ON)
RINGS (OFF, ON)
WAYPOINT MARK (OFF, ON)
PANEL DIMMER (OFF, LOW, MEDIUM, HIGH)
HUE (DAY, NIGHT)
TRIPLOG RESET? (NO, YES)
EBL REFERENCE (TRUE, RELATIVE)
BEARING READOUT (TRUE, MAGNETIC)
CURSOR POSITION (LAT/LON, RNG&BGR)
TRIP SOURCE (LAT/LON, SPEED)
WIND SPD/DIR (TRUE, APPARENT)
SHIFT MODE (MANUAL, AUTO)
AUTO SHIFT SPEED (1-99 (kts), 15)
TX SECTOR BLANK (OFF, ON)
BLANKING START (000-359°, 000°)
BLANKING AREA (000-135°, 000°)
LOCAL TIME SETUP (-13:30 - +13:30, 0:00)
ANTENNA SPEED (24rpm, AUTO)
RANGE
nm, sm: 0.125, 0.25, 0.5, 0.75, 1, 1.5, 2, 3, 4, 6, 8, 12, 16, 24
km: 0.25, 0.5, 0.75, 1, 1.5, 2, 3, 4, 6, 8, 12, 16, 24, 36

SIMULATION (OFF, ON, HIGH)
TEST (Tests display unit.)
LCD PATTERN (Displays test pattern.)
MEMORY CLEAR (Restores default menu settings.)
NMEA PORT (IN/OUT, IN/IN)
NMEA OUTPUT (OFF, ON)
GPS WAAS (OFF, WAAS 00-27)
GO TO RADAR SETUP

Choose GO TO RADAR SETUP from the INSTALLATION menu, and then go to page 3 of the USER menu.

RADAR SETUP
HEADING ADJUST (Adjusts heading.)
TIMING ADJUST (Adjusts timing.)
SET ON TIME (Displays total hours radar has been powered.)
SET TX TIME (Displays total hours of transmission.)
SCANNER TEST (Tests antenna unit.)
SPECIFICATIONS OF MARINE RADAR
MODEL 1715

1 GENERAL
1.1 Indication System PPI daylight display, raster scan, 4 tones in monochrome
1.2 Range (shown: nm), Pulselength (PL) & Pulse Repetition Rate (PRR)

<table>
<thead>
<tr>
<th>Range</th>
<th>0.125, 0.25, 0.5, 0.75</th>
<th>1, 1.5, 2</th>
<th>3, 4, 6, 8, 12, 16, 24, 36</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL</td>
<td>0.08 μs (short)</td>
<td>0.3 μs (medium)</td>
<td>0.8 μs (long)</td>
</tr>
<tr>
<td>PRR</td>
<td>3000 Hz nominal</td>
<td>1200 Hz nominal</td>
<td>600 Hz nominal</td>
</tr>
</tbody>
</table>

1.3 Range Resolution 18 m
1.4 Bearing Discrimination 5.2°
1.5 Minimum Range 30 m
1.6 Bearing Accuracy Within 1°
1.7 Range Ring Accuracy 1.0 % of range or 8 m, whichever is the greater

2 ANTENNA UNIT
2.1 Radiator Micro-strip
2.2 Polarization Horizontal
2.3 Antenna Rotation Speed 24/31/41 rpm nominal (auto-select according to range)
2.4 Radiator Length 45 cm
2.5 Horizontal Beamwidth 5.2° typical
2.6 Vertical Beamwidth 25°
2.7 Sidelobe Attenuation Less than -20 dB

3 TRANSCEIVER MODULE
3.1 Frequency 9410 MHz ±30MHz (X-band)
3.2 Modulation P0N
3.3 Peak Output Power 2.2 kW
3.4 Modulator FET Switching Method
3.5 Intermediate Frequency 60 MHz
3.6 Tuning Automatic
3.7 Receiver Front End MIC (Microwave IC)
3.8 Bandwidth 15 MHz (short pulse), 5 MHz (medium/long pulse)
3.9 Duplexer Circulator with diode limiter
3.10 Warm-up Time 1-min. approx.

4 DISPLAY UNIT
4.1 Picture Tube 7” rectangular monochrome LCD
4.2 Display Pixels 240(H) x 320(V) dots, Effective radar display area: 240x240 dots
4.3 Range, Range Interval, Number of Rings

<table>
<thead>
<tr>
<th>Range (nm/km)</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>12</th>
<th>16</th>
<th>24</th>
<th>36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ring Interval</td>
<td>0.0625</td>
<td>0.125</td>
<td>0.125</td>
<td>0.25</td>
<td>0.25</td>
<td>0.5</td>
<td>0.5</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Number of Rings</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Range unit: nm/sm/km selectable, 0.125: nm/sm only, 36: km only
4.4 Markers
Heading Line, Bearing Scale, Range Rings,
Variable Range Marker (VRM), Electronic Bearing Line (EBL),
Cursor, Alarm Zone, Waypoint Mark*

4.5 Alphanumeric Indications
Range, Range Ring Interval, Interference Rejection (IR),
Variable Range Marker (VRM), Electronic Bearing Line (EBL),
Stand-by (ST-BY), Guard Alarm (G (IN), G (OUT), UP RANGE),
Echo Stretch (ES), Range and Bearing to Cursor,
Bearing or L/L Position, Echo Trail (TRAIL), Trail Time,
Watchman (WATCH), Zoomed Display (ZOOM),
Navigation Data*, Heading*  *: External data required

4.6 Input Sentences
IEC 61162, NMEA 0183 (Ver1.5/2.0/3.0) GGA, RMC, RMA, RMB,
GLL, VTG, VBW, VHW, HDT, HDG, HDM, BWR, BWC, GLC, GTD,
DPT, DBK, DBS, DBT, MTW, ZDA, MWV, XTE

4.7 Output Sentences
IEC 61162, NMEA 0183 (Ver3.0)
TLL (by key operation)

5 ENVIRONMENTAL CONDITIONS

5.1 Ambient Temperature
Antenna Unit: -25°C to +55°C, Display Unit: -15°C to +55°C

5.2 Relative Humidity
93% or less at +40°C

5.3 Waterproofing
Antenna Unit: IPX6
Display Unit: IPX5 (IPX0 when an external buzzer installed)

5.4 Bearing Vibration
IEC 60945

6 POWER SUPPLY
12-24 VDC: 3.5-1.6 A

7 COATING COLOR

7.1 Display Unit
N3.0

7.2 Antenna Unit
Cover: N9.5, Bottom: 2.5PB 3.5/10

8 COMPASS SAFE DISTANCE

8.1 Display Unit
Standard: 0.60 m  Steering: 0.40 m

8.2 Antenna Unit
Standard: 1.25 m  Steering: 0.85 m
注記
1) 指定外の寸法公差は表1による。
2) 取付はM10ボルトを使用のこと。
   有効ネジ長さ35～50に応じて、20 (≤35)または25 (50 < ≤50)とする。

注記
1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. USE M10 BOLTS FOR FIXING UNIT.
   SCREW LENGTH SHALL BE ACCORDING TO PLATFORM THICKNESS:
   20 (≤35) OR 25 (35 < ≤50).
Notation:

1. **Recommended Service Clearance.**
2. **Table 1 indicates tolerance of dimensions which is not specified.**
3. **Use tapping screws 5x20 for fixing the unit.**

**(Note:** The text is in Japanese and contains a list of notes.)
寸法区分 (mm) 公差 (mm)

<table>
<thead>
<tr>
<th>DIMENSIONS</th>
<th>TOLERANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>L ≤ 50</td>
<td>± 1.5</td>
</tr>
<tr>
<td>50 &lt; L ≤ 100</td>
<td>± 2.5</td>
</tr>
<tr>
<td>100 &lt; L ≤ 500</td>
<td>± 3</td>
</tr>
</tbody>
</table>

表1 TABLE 1

注記
1) 批注は最小サービス空腹寸法とする。
2) 指定外の寸法公差は表1による。
3) 取付用ネジは、モスネジ M4×20を使用のこと。

NOTE
1. # RECOMMENDED SERVICE CLEARANCE.
2. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
3. USE M4×20 SCREWS FOR FIXING THE UNIT. THICKNESS A: 11±0.14 OR SCREW LENGTH H (A+7.8)±2. DO NOT FASTEN SCREWS INTO UNIT MORE THAN 8 mm (B±8)
寸法区分 (mm) | 公差 (mm) | TOLERANCE
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>L ≤ 50</td>
<td>± 1.5</td>
</tr>
<tr>
<td>50 ≤ L ≤ 100</td>
<td>± 2.5</td>
</tr>
<tr>
<td>100 ≤ L ≤ 500</td>
<td>± 3</td>
</tr>
</tbody>
</table>

表 1 TABLE 1

注 1) ①寸法は最小サービス真空寸法とする。
2) 規定外の寸法は表1による。
3) 取付用ネジは、ビススプリング M4×20 を使用のこと。
   取付ネジAは、ビススプリング M4×20 を使用のこと。
   上記以外の変更は、使用するネジの長さは
   (A + 7.8) ± 2 をとする。ビススプリング B を使用すると
   整体の長さを 8 mm 以上入れないこと。（B = MAX. 8）

NOTE 1. # RECOMMENDED SERVICE CLEARANCE.
2. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS
   WHICH IS NOT SPECIFIED.
3. USE M4×20 SCREWS FOR FIXING THE UNIT,
   THICKNESS A 11×A×14 OR SCREW LENGTH: (A + 7.8) ± 2.
   DO NOT FASTEN SCREWS INTO UNIT MORE THAN 8 mm (B ≤ 8)
Declaration of Conformity

We, FURUNO ELECTRIC CO., LTD.,

(Manufacturer)

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

(Address)

declare under our sole responsibility that the product

Marine radar Type: Model 1715

(Model name, serial number)

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

IEC 60945 Fourth edition: 2002-08
IEC 60936-1 Amendment 1 Annex D: 2002-06
ITU R.R. Appendix S3 Table 2
KSR 142 October 1985, Annex 1

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

For assessment, see:

- Statement of Opinion N° 03214235/AA/01 of 16 January 2004 issued by Telefication, The Netherlands
- Test reports FL1 12-03-025 of 20 May 2003, FL1 12-03-026 of 04 July 2003 and FL1 12-03-030 of 23 June 2003 prepared by Furuno Labotech International Co., Ltd.
- Test report K03-17-169 of 19 November 2003 prepared by Furuno Electric Co., Ltd.

On behalf of Furuno Electric Co., Ltd.

Hiroaki Komatsu
Manager,
International Rules and Regulations

Nishinomiya City, Japan
February 17, 2005

(Place and date of issue)

(name and signature or equivalent marking of authorized person)