















































3. Select "6. Int Reject."
4. Select level desired by operating the omnipad.
5. Press the [ACQ/ENTER] key.
6. Press the [MENU] key to close the menu.

IR1, IR2 or IR3 appears at the bottom right corner on the display when the interference rejection circuit is turned on.

### 3.6 Selecting Pulsewidth


Pulsewidth is the time in microseconds necessary to transmit a single radar pulse. The longer the pulsewidth the greater the direction range capability, however range accuracy and range resolution are reduced.

Pulsewidth can be selected to short or long on the 1.5 and 3 nautical mile ranges.

1. Press the [MENU] key.
2. Select "OTHER MENU" and press the [ACQ/ENTER] key.
3. Select "7. Pulselength."
4. Select Short or Long by pressing the omnipad.
5. Press the [ACQ/ENTER] key to select.
6. Press the [MENU] key to close the menu.

### 3.7 Guard Alarm

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

	CAUTION
<p>The guard alarm is a useful anti-collision aid, but does not relieve the operator of the responsibility to also keep a visual lookout for possible collision situations. The alarm should never be used as the sole means for detecting possible collision situations.</p>	

### Selection of guard zone type

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

#### In alarm

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

#### Out alarm

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

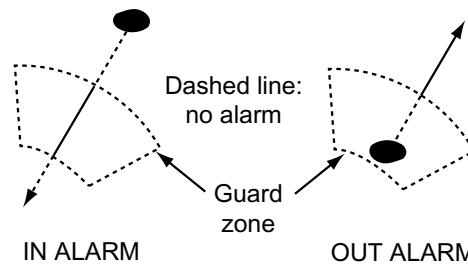


Figure 3-7 In and Out alarms

### Selecting guard zone type

1. Press the [MENU] key, select "OTHERS MENU," and then press the [ACQ/ENTER] key.
2. Select "17. Guard Mode" and "In" (alarm on target entering zone) or "Out" (alarm on target exiting zone) by operating the omnipad.
3. Press the [ACQ/ENTER] key.
4. Press the [MENU] key to close the menu.

### Setting a guard zone

1. Mentally create the guard zone you want to set. Figure 3-8 shows an example.
2. Operate the omnipad to set the cursor on point A (or B). Press the [GUARD] key. "\*G (IN)" or "\*G (OUT)," with asterisk blinking, appears at the top right-hand corner of the display. See Figure 3-8 (2). (The asterisk indicates the guard zone is partially set.)

- Operate the omnipad to set the cursor on point C (or D). See Figure 3-8 (3).
- Press the [GUARD] key. The asterisk disappears. See Figure 3-8 (4).

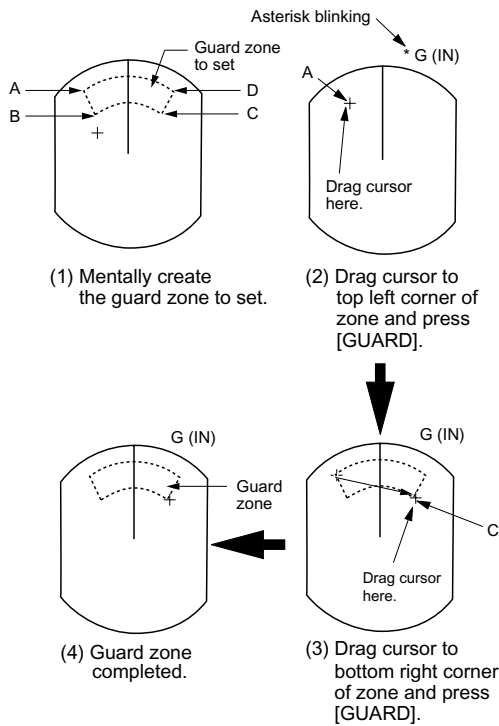


Figure 3-8 How to set the guard zone

### Silencing the audible alarm

Any radar targets violating the guard zone will trigger the audible alarm. You can silence the audible alarm by pressing the [GUARD] key. When this is done, "G(ACKN)" replaces "G(IN)." This means the alarm is acknowledged. Press the key again to reactivate the alarm. You may select minimum echo strength which triggers the guard alarm. This can be done at "20, Alm Sence Lv" on the "OTHER MENU."

### Cancelling the guard zone and guard alarm

Press and hold down the [GUARD] key until the guard zone disappears.

### Notes on the guard alarm

- The alarm is a useful anti-collision aid, but does not relieve the operator of the responsibility to also keep a visual lookout for possible collision situations.
- When the radar range is less than one half of the guard zone range, the guard zone disappears and "G (IN)" or "G (OUT)" appears in inverse video. If this happens, raise range to re-display the guard zone.
- A target echo does not always mean a landmass, reef, ships or surface objects but can imply returns from sea surface or precipitation. As the level of these returns varies with environment, the operator should properly adjust the A/C SEA, A/C RAIN and GAIN to be sure the alarm system does not overlook target echoes.

### 3.8 Watchman

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

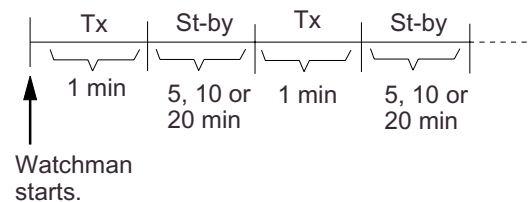


Figure 3-9 How watchman works

### How watchman works

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

## Turning on watchman

1. Create a guard zone (usually 360 degrees) with the guard alarm function.
2. Press the [MENU] key.
3. Select "OTHERS MENU."
4. Press the [ACQ/ENTER] key.
5. Select "15. Watchman."
6. Operate the omnipad to select watchman rest period; 5 minutes, 10 minutes or 20 minutes.
7. Press the [ACQ/ENTER] key.
8. Press the [MENU] key to close the menu.

"WATCHMAN" appears at the top of the screen, the radar transmits for one minute to check for targets inside the guard zone, and then the CRT shuts off and the radar goes into stand-by.

## Cancelling watchman

Go into the "OTHERS" menu, and set "15. Watchman" for OFF.

**Note 1:** Watchman can be used without a guard zone.

**Note 2:** The alarm sounds just before the radar starts or stops transmitting.

## 3.9 Displaying Navigation Data

Navigation data can be displayed at the screen bottom if this radar receives navigation input in IEC 61 162 format. Navigation data includes

- Position in latitude and longitude or Loran-C time differences
- Range, bearing and time-to-go to both waypoint selected on the navigator and the cursor
- Speed.

(If the navigation input includes destination data, the waypoint marker , shown by a dashed ring with a line extending from it to the screen center appears. This marker can be turned on/off the "OTHER MENU")

## To turn navigation data on or off;

1. Press the [MENU] key.
2. Select "DISP DATA."
3. Press the [ACQ/ENTER] key.
4. Press the [ACQ/ENTER] key to select the navigation display.
5. Press the [MENU] key to close the menu.

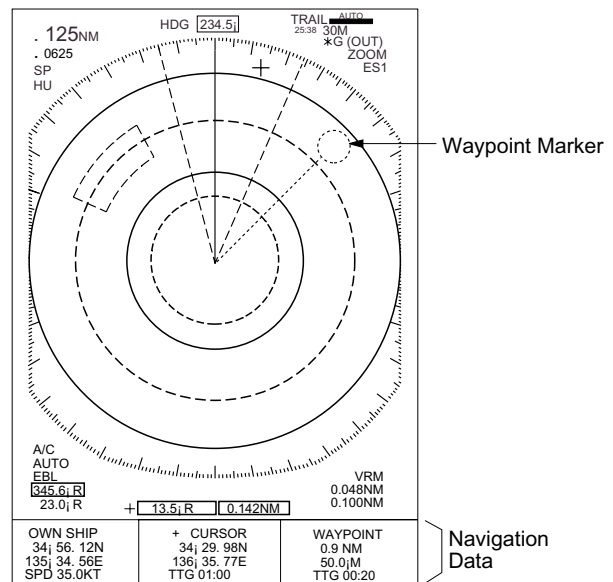


Figure 3-10 Typical navigation data display

### 3.10 OTHER MENU Description

The table below summarizes the OTHER menu.

*Table 3-2 OTHER MENU Description*

Item	Description
1. Panel Dimmer	Selects level of panel backlight.
2. Mark Brill	Selects brilliance of VRM, EBL, cursor, guard zone and WP marker.
3. HD Mark	Selects brilliance of heading marker.
4. Characters*	Selects brilliance of characters.
5. Trail Tone	Selects brilliance of echo trails.
6. Int Reject	Selects level of interference rejection.
7. Pulselength	Selects pulselength for 1.5 and 3 mile ranges.
8. Noise Reject	Selects "On" to reject noise.
9. Trail Time	Selects the echo trail time.
10. Tune	<p>Selects automatic or manual tuning. To tune manually;</p> <ol style="list-style-type: none"> <li>1. Select "Manu" by the omni-pad.</li> <li>2. Press the [ENTER] key to enable manual tuning.</li> <li>3. While pressing and holding down the [GAIN] control, operate the omni-pad to obtain best tuning condition, observing the tuning indicator bar (1.0~11.9V).</li> <li>4. Press the [ENTER] key.</li> </ol> <p>"MANUAL" appears at the top right-hand corner when manual tuning is in effect.</p>
11. Disp Data	<p>Select the down source to display. Selects data to display; Nav, ARP, or All (both Nav and ARP).</p>
12. WPT Mark	Selects "On" to display the waypoint marker.
13. EBL Ref	Selects EBL reference for relative or true.
14. VRM Unit	Selects distance unit of VRM and cursor for nm, km or sm.
15. Watchman	Turns watchman on (set rest period) or off.
16. STBY Disp	Select the display to use at stand-by; display "STBY" or navigation data, or go into the economy mode.
17. Guard Mode	Select condition which triggers guard alarm; targets entering guard zone (In), target exiting guard zone (out).
18. Own Position	Select position display format; L/L on Loarn TD.
19. Cursor Posi	Display the cursor data in range/bearing or lat/long.
20. Alm Sense LV	Select minimum echo strength which triggers guard alarm.
21. Dead Sector	Select "On" to display the dead sector.
22. Range	Select ranges to use.
23. Self Test	Test keys, ROM and RAM; checks antenna rotation speed, and displays program no.
24. Installation Setup	Displays to the installation setup menu.

**\*Note:** Level 1 and 2 are same brilliance while the menu is displayed. The brilliance changes after the menu is erased.

### 3.11 Function Controls

The function controls (F1 and F2) work like the auto-dialing feature of a telephone, automatically executing the function assigned to them. The function can be turned off by pressing appropriate function control again.

#### Default settings

F1: Shift (brief press) or Zoom (long press)

F2: Ring brilliance

#### How to register menu items

1. Press the [MENU] key.
2. Press [A/C SEA] (F1) or [A/C RAIN] (F2) to open the function menu.



Figure 3-11 Function menu

3. Select function desired.
4. Press the [ACQ/ENTER] key.
5. Press the [MENU] key to close the menu.

### 3.12 Suppressing Noise

Electrical noise can be suppressed by turning on “8. NOISE REJ” on the OTHERS menu.

### 3.13 Adjusting Brilliance of Markers

“2. Mark Brill” on the OTHER menu adjusts the brilliance of markers other than the heading marker.

### 3.14 Outputting Target Position

Radar target position data can be output to a navaid in IEC 61162 format. Select the radar target with the cursor, and then press and hold down the [TLL] key to output the data. This function requires position data and heading signal.

### 3.15 Dead Sector

When the scanner is installed at a close distance in front of the wheelhouse the radar should be set not to transmit within that area, to prevent microwave hazard. Ask your FURUNO representative or dealer to provide this feature.

# 4. FALSE ECHOES

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

## 4.1 Multiple Echoes

Multiple echoes occur when a short range, strong echo is received from a ship, bridge, or breakwater. A second, a third or more echoes may be observed on the display at double, triple or other multiples of the actual range of the target as shown in Figure 4-1. Multiple reflection echoes can be reduced and often removed by decreasing the sensitivity or properly adjusting the A/C SEA.

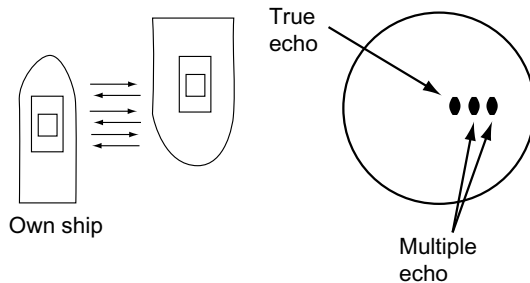


Figure 4-1 Multiple echoes

## 4.2 Side-lobe Echoes

Every time the scanner rotates, some radiation escapes on each side of the beam—called “side-lobes.” If a target exists where it can be detected by the side-lobes as well as the main-lobe, the side-lobe echoes may be represented on both sides of the true echo at the same range, as shown in Figure 4-2. Side-lobes show usually only at short ranges and from strong targets. They can be reduced through careful reduction of the sensitivity or proper adjustment of the A/C SEA.

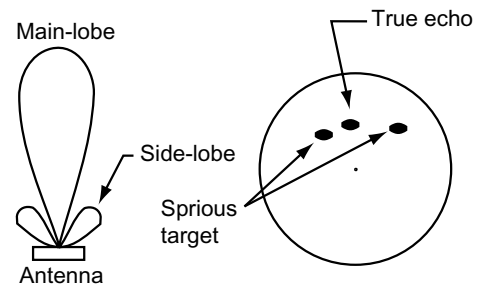


Figure 4-2 Side-lobe echoes

### 4.3 Indirect Echoes

Indirect echoes may be returned from either a passing ship or returned from a reflecting surface on your own ship, for example, a stack. In both cases, the echo will return from a legitimate contact to the scanner by the same indirect path. The echo will appear on the same bearing of the reflected surface, but at the same range as the direct echo. Figure 4-3 illustrates the effect of an indirect echo. Indirect echoes may be recognized as follows:

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

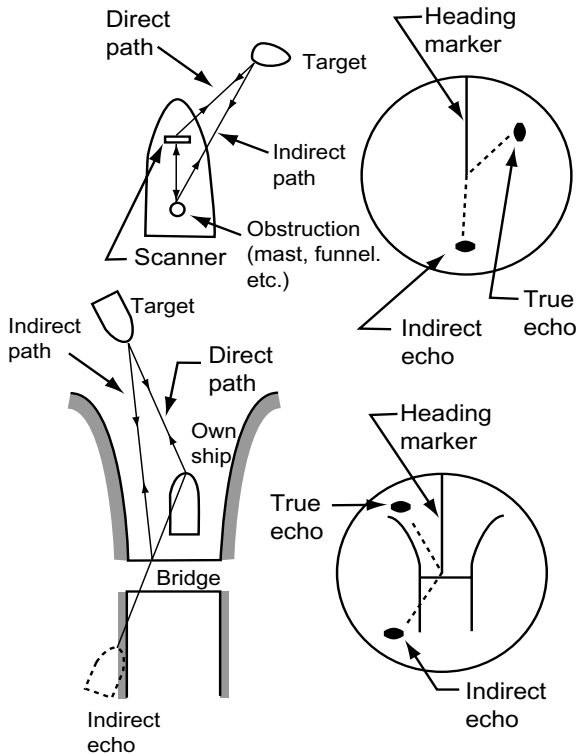


Figure 4-3 Indirect echoes

### 4.4 Blind and Shadow Sectors

Funnels, stacks, masts, or derricks in the path of antenna may reduce the intensity of the radar beam. If the angle subtended at the antenna is more than a few degrees a blind sector may be produced. Within the blind sector small targets at close range may not be detected while larger targets at much greater ranges may be detected. See Figure 4-4.

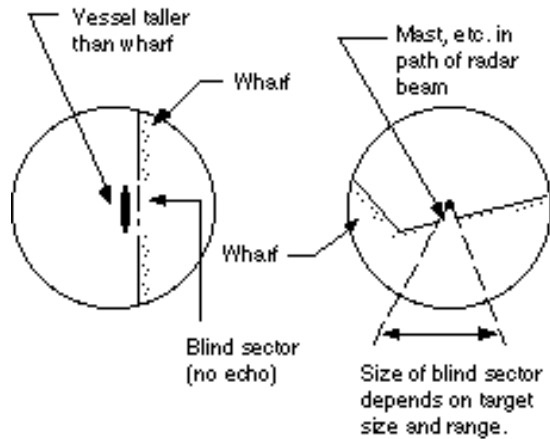


Figure 4-4 Blind and shadow sectors

## 4.5 SART (Search and Rescue Transponder)

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

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

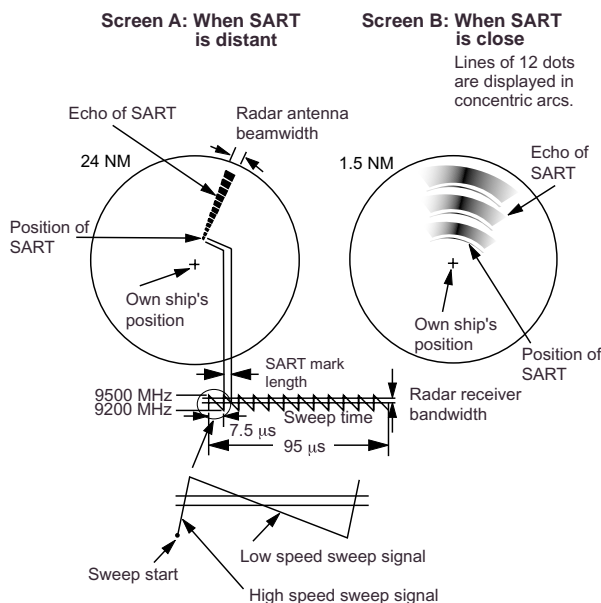


Figure 4-5 SART display

## Showing SART marks on the radar display

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

## Summary to detect SART response

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

## General remarks on receiving SART

### Radar range scale

When looking for a SART it is preferable to use either the 6 or 12 nautical mile range scale. This is because the total displayed length of the SART response of 12 (or 24) dots may extend approximately 9.5 nautical miles beyond the position of the SART and it is necessary to see a number of response dots to distinguish the SART from other responses.

### 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.

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# 5. MAINTENANCE & TROUBLESHOOTING

This chapter tells you how to keep your radar in good working order. Before reviewing this chapter please read the safety information which follows.

## DANGER

**Turn off the power before performing any maintenance or troubleshooting procedure.**

Hazardous voltages can shock, burn or cause death. Only qualified personnel totally familiar with electrical circuits should work inside the units.

---

**RF RADIATION HAZARD**

The radar scanner emits high frequency radio radiation which can be harmful, particularly to your eyes.

Never look directly into the scanner from a distance of less than two feet when the radar is in operation as you could injure the cornea of your eyes. Always make sure the radar is set to stand-by or is turned off before starting work on the scanner unit.

## 5.1 Preventive Maintenance

Regular maintenance is important for good performance. Always keep the equipment as free as possible from dirt, dust, and water splashes. Make sure all screws securing the components are properly tightened.

A maintenance program should be established and should at least include the items listed in Table 5-1.

## 5.2 Replacing the Fuse

The fuse in the power cable protects the equipment against reverse polarity of ship's mains, overcurrent, and equipment fault. If the fuse blows, find the cause before replacing it. Never use an incorrect fuse - serious damage to the equipment may result and void the warranty.

12V: 10A fuse  
24/32V: 5A fuse

## CAUTION

**Use the proper fuse.**

Use of a wrong fuse can result in equipment damage.

*Table 5-1 Recommended maintenance program*

Period	Item	Check point	Remarks
3 to 6 months	Exposed nuts and bolts on scanner unit	Check for corroded or loosened nuts and bolts. If necessary, clean and repaint them thickly. Replace them if heavily corroded.	Sealing compound may be used instead of paint. Apply a small amount of grease between nuts and bolts for easy removal in future.
	Scanner radiator	Check for dirt and cracks on radiator surface. Thick dirt should be wiped off with soft cloth dampened with fresh water. If a crack is found, apply a slight amount of sealing compound or adhesive as a temporary remedy, then call for repair.	Do not use plastic solvent (acetone) for cleaning. If you need to remove ice from scanner unit, use a wooden hammer or plastic head hammer. Crack on the unit may cause water ingress, causing serious damages to internal circuits.
6 months to 1 year	Display unit connectors	Check for tight connection and corrosion.	If corroded, contact your dealer for replacement.

## 5.3 Troubleshooting

Table 5-2 contains simple troubleshooting procedures which you can follow to try to restore normal operation. If you cannot restore normal operation, do not attempt to check inside any unit of the radar system. Any repair work is best left to a qualified technician.

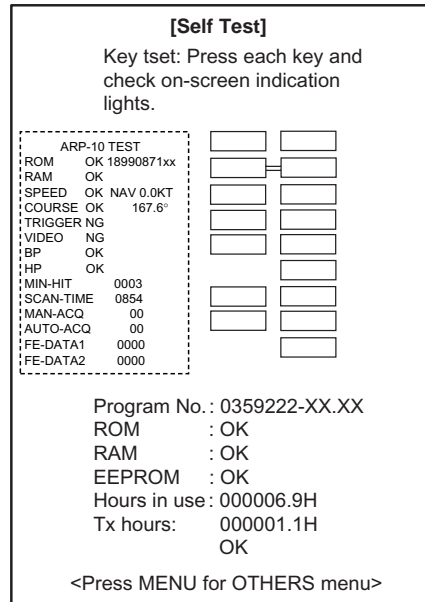
*Table 5-2 Troubleshooting table*

<b>If...</b>	<b>But...</b>	<b>Then...</b>
you pressed the [POWER] key to turn on the radar	the control panel does not light	<ul style="list-style-type: none"> <li>• try adjusting the control panel back-lighting on the OTHERS menu.</li> <li>• battery may have discharged.</li> <li>• check fuse in power cable.</li> </ul>
	nothing appears on the display or display contrast is poor	<ul style="list-style-type: none"> <li>• try adjusting the brilliance.</li> </ul>
	characters are distorted	<ul style="list-style-type: none"> <li>• request service.</li> </ul>
the radar has warmed up and you pressed the [STBY TX] key to transmit	the scanner does not rotate	<ul style="list-style-type: none"> <li>• the problem may be in scanner unit. Request service.</li> </ul>
	characters and indications are abnormal	<ul style="list-style-type: none"> <li>• have a qualified technician check the set.</li> </ul>
you have adjusted the gain with A/C RAIN and A/C SEA off	neither noise nor targets appear (indications and markers do)	<ul style="list-style-type: none"> <li>• check signal cable for damage.</li> </ul>
	neither indications nor markers appear (noise and targets do)	<ul style="list-style-type: none"> <li>• check signal cable for damage.</li> </ul>
	the sweep (radial line sweeping around the display) is not synchronized with scanner rotation	<ul style="list-style-type: none"> <li>• the problem may be in the scanner unit. Request service.</li> </ul>
	there is no change in sensitivity	<ul style="list-style-type: none"> <li>• request service.</li> </ul>
a key is pressed	nothing happens	<ul style="list-style-type: none"> <li>• key may be faulty. Request service.</li> </ul>

## 5.4 Self Test

The self test facility checks the keyboard, ROM and RAM for proper operation.

1. Press the [MENU] key.
2. Select "OTHER MENU".
3. Select "23. Self Test" and press the [ACQ/ ENTER] key. The following display appears.



XX: Program Version No.

Figure 5-1 Self test screen

4. The ROM and RAM are automatically checked. If NG (No Good) appears to the right of ROM or RAM indication, contact your dealer for advice. ARP-10 TEST results appear only when optional ARP-10 board is mounted.
5. To check the keyboard. Press any key except the omnipad, ACQ.and power keys. Its corresponding location on the display lights in black if the key is operating properly.

6. Press the [ACQ] key to check the display circuit. The following pattern should appear.

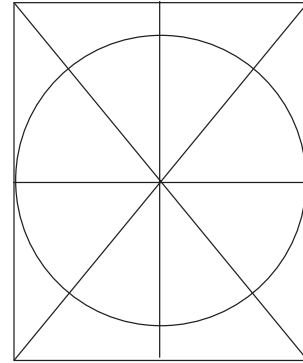


Figure 5-2 Test pattern

7. Press the [MENU] key to show the brilliance adjustment menu.
8. To escape from the selftest, press the [MENU] key.

## 5.5 Life Expectancy of Magnetron

The following table shows the life expectancy of the magnetrons.

Table 5-3 Life expectancy of magnetrons

Model	Type	Code no.	Life expectancy
1932 M2	E3571	000-146-867	2,000-3,000 hours (Including stand-by)
	MG4004	000-158-895	
	MAF1421B	000-158-786 -10	
1942 M2	MAF1422B	000-146-871	
		000-158-788 -10	
	MG4006	000-150-838	

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## 6. OPERATION OF ARP-10 (OPTION)

### **WARNING**

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

This auto plotter automatically tracks an automatically or manually acquired radar target and calculates its course and speed, indicating them by a vector. Since the data generated by the auto plotter are based on what radar targets are selected, the radar must always be optimally tuned for use with the auto plotter, to ensure required targets will not be lost or unwanted targets such as sea returns and noise will not be acquired and tracked.

A target does not always mean a land-mass, reef, ships or other surface vessels but can imply returns from sea surface and clutter. As the level of clutter changes with environment, the operator should properly adjust the A/C SEA, A/C RAIN and GAIN controls to be sure target echoes are not eliminated from the radar screen.

### **CAUTION**

**The plotting accuracy and response of this auto plotter meets IMO standards. Tracking accuracy is affected by the following:**

Tracking accuracy is affected by course change. One to two minutes is required to restore vectors to full accuracy after an abrupt course change. (The actual amount depends on gyrocompass specifications.)

The amount of tracking delay is inversely proportional to the relative speed of the target. Delay is on the order of 15–30 seconds for high relative speed; 30–60 seconds for low relative speed.

**Display accuracy is affected by the following:**

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

This ARPA board is not available with 42 rpm radar.

### **NOTICE**

Heading data required for plotting function.

## 6.1 General

The Auto Plotter ARP-10 is an optional circuit board which is accommodated in the display unit of this radar (24 rpm only) radars. It requires heading data to function.

The Auto Plotter permits manual or automatic acquisition and automatic tracking of up to 10 radar targets. An internal microprocessor calculates target data such as speed and course and displays the results in alphanumeric data and by vector. To ensure the reliability of the displayed target data, the radar must be properly adjusted for minimum sea returns and noise.

### Principal specifications

#### Acquisition and tracking

Acquisition of up to 10 targets between 0.2 and 16 nm.

Automatic tracking of up to 10 acquired targets between 0.1 and 16 nm.

#### Vectors

Vector length: 30 s, 1, 3, 6, 15, 30 min.

Orientation: True velocity or relative velocity

Past positions: 5 past positions at intervals of 15, 30 s, 1, 2, 3, 6 min.

Alarm: Visual and audible alarms against targets violating CPA/TCPA limits, Visual alarm against lost targets

Target discrimination: A target measuring about 800 m or more in the radial or circumferential direction is regarded as a landmass and not acquired or tracked. Echoes smaller than about 800 m are regarded as true targets.

#### Keys used for auto plotter

The ARP-10 uses the following touchpad keys. Given below is a brief description of these keys.

**MENU:** opens/closes the main menu.

#### SELECT/CANCEL:

A long press terminates plotting of the target selected with the cursor, and a brief press displays the data of the target selected with the cursor.

**ACQ/ENTER:** Acquires the target selected with the cursor.

## 6.2 ARP-10 MENU Operation

The ARP-10 MENU contains the following items.

**Display:** Turns on/off the plot symbols, past positions and target data.

**All Cancel:** Cancels the tracking of all targets.

**Vector Ref:** Selects relative or true vectors. To select your choice, open the ARP-10 menu. Select "3 Vector Ref" to Relative or True, and then, press the [ACQ/ENTER] key

**Vector Length:** Selects vector time.

**History:** Selects past position plot interval.

**CPA Set:** Selects CPA alarm limit. When a target is predicted to come within this limit, an audible alarm sounds and at the same time the corresponding target symbol changes to a blinking triangle.

**Note:** If the preset CPA limit is set at OFF, a target which is on collision course will not produce an alarm.

**TCPA Set:** Selects TCPA alarm limit.

**Auto ACQ:** Turns on/off Auto Acquisition Area.

#### Activating the auto plotter

To activate the Auto Plotter, follow the steps shown below.

1. Adjust the GAIN, A/C SEA and A/C RAIN controls for proper radar picture.
2. Press the [MENU] key to open the main menu.

3. Select "ARP-10 MENU."
4. Press the [ACQ/ENTER] key to display the ARP menu.

[ ARP MENU ]		
Select item by omnipad and press ENTER key.		
1. Display	Off	<b>On</b>
2. All Cancel		
3. Vector Ref	Rel	<b>True</b>
4. Vector Length		30S 1M
	3M 6M 15M	<b>30M</b>
5. History	<b>Off</b>	15S 30S 1M
	2M 3M 6M	
6. CPA Set	<b>Off</b>	0.5 1nm 2nm
	3nm 5 nm 6nm	
7. TCPA Set	<b>30S</b>	1M 2M 3M
	4M 5M 6M 12M	
8. Auto ACQ	<b>Off</b>	On

Figure 6-1 ARP Menu

5. Select the menu item "1. Display."
6. Select "On."
7. Press the [ACQ/ENTER] key.
8. Press the [MENU] key to close the menu.

### Deactivating the auto plotter

To deactivate the Auto Plotter;

1. Open the "ARP-10 MENU."
2. Select the "1. Display."
5. Select "Off."
6. Press the [ACQ/ENTER] key.
7. Press the [MENU] key to close the menu.

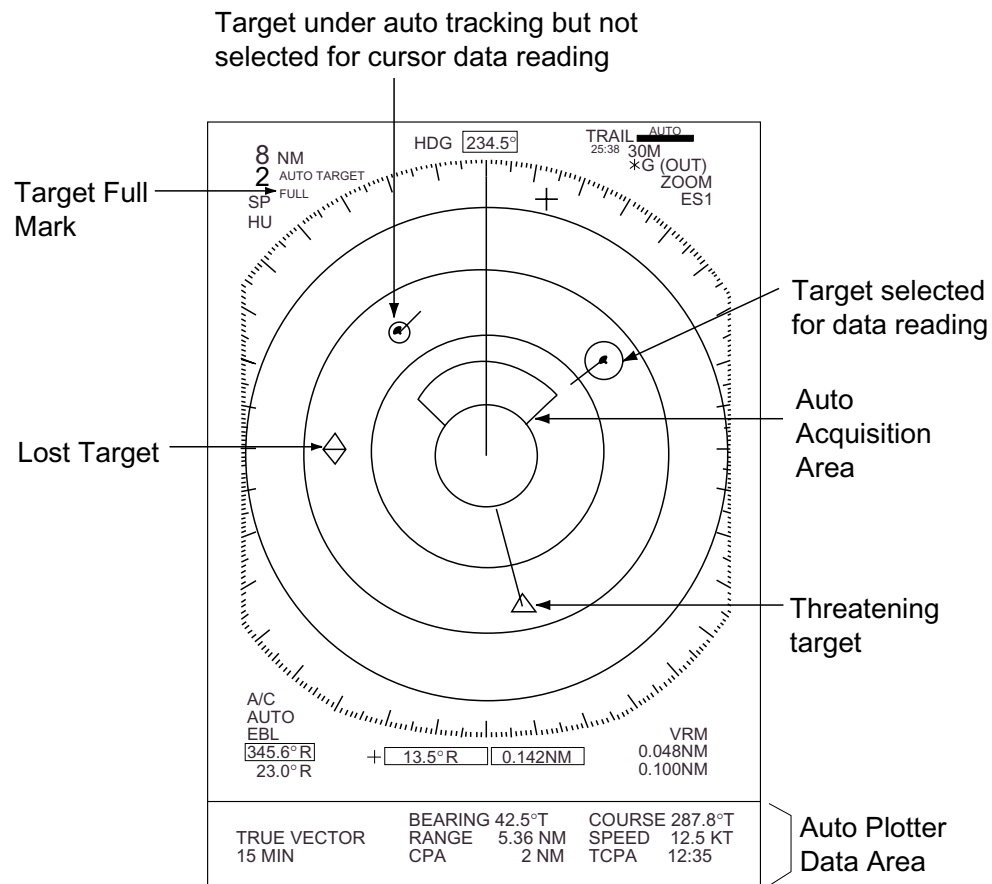


Figure 6-2 ARPA display

## 6.3 Acquiring Targets

### Manual acquisition

Follow the steps below to manually acquire a target. Up to 10 targets can be manually acquired.

1. Place the cursor (+) on a target of interest by operating the omnipad.
2. Press the [ACQ/ENTER] key.

The plot symbol changes its shape according to the status as below. A vector appears in about one minute after acquisition indicating the target's motion trend. If the target is consistently detected for three minutes, the plot symbol changes to a solid mark. If acquisition fails, the target symbol blinks and disappears shortly thereafter.

 **SQUARE (dotted)**

Immediately after acquisition - Plot symbol shown in broken lines.

 **SQUARE (dotted with a vector)**

One minute after acquisition - Vector still unreliable.

 **CIRCLE (Solid with a vector)**

3 minutes after acquisition - Plot symbol changes to a solid circle indicating the stable tracking condition.

 **LARGE CIRCLE**

The plot symbol of a target under tracking becomes twice as large as the normal symbol when the target is selected for data reading.

**Note 1:** The target to be acquired should be within 0.2 to 16 nm from own ship and not obscured by sea or rain clutter for successful acquisition.

**Note 2:** When you want to acquire 11th target, cancel tracking of the one of less important targets.

**Note 3:** When the auto acquisition mode (Auto ACQ) is on, up to five targets can be acquired. For details, see next section titled Automatic Acquisition.

### **CAUTION**

When a tracked target nears another tracked target, the targets may be "swapped." When two targets come close to each other, one of the two can become a "lost target." Should this happen, reacquisition of the "lost target" is required after the two targets have separated.

### Automatic acquisition

The Auto Plotter ARP-10 can acquire up to five targets automatically by setting the Auto Acquisition area predefined in the system. If Auto ACQ is selected after more than five targets have been manually acquired, only the remaining capacity of targets can be automatically acquired. (For example; when seven targets are acquired manually, and then the Auto ACQ is switched on only three targets can be acquired automatically) When five targets have been automatically acquired, "AUTO TARGET FULL" message appears at top left corner on the display.

### Setting auto acquisition area

Auto acquisition area is predefined between 2.0 and 2.5 nm in range and 45° on either side of the heading marker in bearing. If a target come into this area, it is acquired automatically.

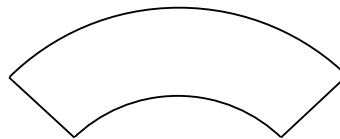


Figure 6-3 Auto acquisition area

Follow the steps shown below to activate the auto acquisition area.

1. Open the "ARP-10 MENU."
2. Select "8. Auto ACQ."
3. Select "On."
4. Press the [ACQ/ENTER] key.
5. Press the [MENU] key to close the menu.

## Terminating Tracking of Targets

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

### Individual targets

Place the cursor (+) on a target which you do not want to be tracked any longer by operating the omnipad and press and hold down the [SELECT/CANCEL] key.

### All targets

All targets can be canceled from "ARP-10 MENU" at a time.

1. Open the "ARP-10 MENU."
2. Select "2. All Cancel."
3. Press the [ACQ/ENTER] key.

## 6.4 Displaying Target Data

The Auto Plotter calculates motion trends (range, bearing, course, speed, CP A and TCPA) of all targets under tracking at the ARP Data area.

To turn ARP data on;

1. Press the [MENU] key.
2. Select "DISP DATA."
3. Press the [ACQ/ENTER] key to select the message for "ARP" or "NAV" or "ARP."

4. Press the [ACQ/ENTER] key.
5. Press the [MENU] key to close the menu.

### CAUTION

At the speed under 5 kts the target data is displayed with a delay because of filtration.

Place the cursor on a wanted target and press the [SELECT/CANCEL] key. Data on the selected target is displayed at the bottom of the screen. The symbol of the selected target gets twice as large as the normal circle. The data includes the following:

**RNG/BRG (Range/Bearing):** Range and bearing from own ship to the last-plotted or selected target position with suffix "T" (True) or "M" (Magnetic). For true bearings suffix "T" is used in case of gyrocompass input and suffix "M" is used in case of magnetic compass input.

**COURSE/SPEED (Course/Speed):** Course and speed are displayed for the last-plotted or selected target with suffix "T" (True) or "M" (Magnetic). For true bearings suffix "T" is used in case of gyrocompass input and suffix "M" is used in case of magnetic compass input.

**CPA (Closest Point of Approach):** is the closest range a target will approach to own ship. Do not mix it with the operator preset CPA alarm limit.

**TCPA:** The time to CP A measured with present speeds of own ship and the targets. Both CPA and TCPA are automatically calculated. When a target ship has passed clear of own ship, the CP A is displayed and the TCPA appears as "\*\*\*.\*". TCPA is counted up to 99.9 min. and beyond this it is indicated as TCPA>99.9 min.

## 6.5 Mode and Length of Vectors

### True or relative vector (vector mode)

Target vectors are displayed relative to own ships reading (Relative) or with reference to North (True). Own ship does not have a vector in relative mode.

### Vector length

From the ARP-10 MENU, Vector Length can be set to 30 seconds, 1, 3, 6, 15 or 30 minutes and the selected vector time is indicated on the screen.

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

## 6.6 Past Position Display

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

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

To turn past position display on or off do the following:

1. Open the ARP-10 menu.
2. Select History.
3. Select plot interval among 15, 30 seconds, 1, 2, 3 or 6 minutes. Select OFF to erase the past position display.
4. Press the [ACQ/ENTER] key.
5. Press the [MENU] key.

## 6.7 Operational Warnings

There are two main situations which cause the ARP-10 to trigger visual and audible alarms:

CPA/TCPA alarm

Lost target alarm

### CPA/TCPA alarm

#### **CAUTION**

The CPA/TCPA alarm feature should never be relied upon as a sole means for detecting the risk of collision.

The navigator is not relieved of the responsibility to keep visual lookout for avoiding collisions, whether or not the radar or other plotting aid is in use.

Visual and audible alarm are generated when the predicted CPA and TCPA of any target become less than their preset limits. The audible alarm continues for 10 seconds.

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

When the predicted CPA of any target becomes smaller than a preset CPA alarm range and its predicted TCPA less than a preset TCPA alarm limit, the ARP-10 releases an audible alarm. In addition, the target plot symbol changes to a triangle and flashes together with its vector. The flashing of the triangle plot symbol and vector remain on the screen until the dangerous situation is no longer present or you intentionally terminate tracking of the target by using the [SELECT/CANCEL] key.

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

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

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

1. Open the "ARP-10 MENU."
2. On the "CPA Set" line, select a CPA limit desired. (Off, 0.5, 1, 2, 3, 5, 6 nm)
3. Press the [ACQ/ENTER] key.
4. On the "TCPA Set" line, select a TCPA limit desired. (30s, 1, 2, 3, 4, 5, 6, 12M)
5. Press the [ACQ/ENTER] key.
6. Press the [MENU] key to close the menu.

### **Lost target alarm**

When the system detects a loss of a tracked target, the target symbol becomes a flashing diamond.

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## SPECIFICATIONS OF MARINE RADAR MODEL 1932/1942 MARK-2

### 1. GENERAL

- (1) Indication System                      PPI Daylight display, raster scan, 8 tones in monochrome
- (2) Range, Pulselength (PL) & Pulse Repetition Rate (PRR)

		Range (nautical miles)																		
PL	PRR	0.125	0.25	0.5	0.75	1	1.5	2	3	4	6	8	12	16	24	36	48	64		
SP	2100 Hz	0.08 $\mu$ s																		
MP	1200 Hz					0.3 $\mu$ s														
LP	600 Hz*								0.8 $\mu$ s											

\*550 Hz on 48 nm range or more

Maximum Range;                              MODEL 1932 M2: 48 nm, MODEL 1942 M2: 64 nm

- (3) Range Resolution                        20 m
- (4) Bearing Discrimination                1.9°
- (5) Minimum Range                         25 m (0.25 NM range)
- (6) Bearing Accuracy                        Within 1°
- (7) Bearing Resolution                      4°
- (8) Range Ring Accuracy                  0.9 % of range or 8 m, whichever is the greater

### 2. SCANNER UNIT

- (1) Radiator                                    Slotted waveguide array
- (2) Polarization                                Horizontal
- (3) Antenna Rotation Speed                24 rpm or 48 rpm nominal
- (4) Radiator Length                         M1932M2: 100 cm (XN10A), M1942M2: 120 cm (XN12A)
- (5) Horizontal Beamwidth                 M1932M2: 2.4°, M1942M2: 1.9°
- (6) Vertical Beamwidth                      M1932M2: 27°, M1942M2: 22°
- (7) Sidelobe Attenuation                  Within  $\pm 20^\circ$  of main-lobe: less than -24 dB  
Outside  $\pm 20^\circ$  of main-lobe: less than -30 dB

### 3. TRANSCIVER MODULE

- (1) Frequency                                 9410 MHz  $\pm 30$  MHz (X band)
- (2) Modulation                                 P0N
- (3) Peak Output Power                     M1932M2: 4 kW nominal, M1942M2: 6 kW nominal
- (4) Modulator                                 FET Switching Method
- (5) Intermediate Frequency                60 MHz
- (6) Tuning                                        Automatic or manual
- (7) Receiver Front End                      MIC (Microwave IC)

- (8) Bandwidth Tx pulselength 0.08  $\mu$ s and 0.3  $\mu$ s: 25 MHz  
Tx pulselength 0.8  $\mu$ s: 3 MHz
- (9) Duplexer Circulator with diode limiter

#### 4. DISPLAY UNIT

- (1) Indication System PPI Daylight display, raster scan, 8 tones in monochrome
- (2) Picture Tube 10 inch rectangular monochrome CRT  
effective display area more than 150 mm

- (3) Range, Range Interval, Number of Rings

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

Maximum Range; MODEL 1932 M2: 48 nm, MODEL 1942 M2: 64 nm

- (4) Markers Heading Line, Bearing Scale, Range Rings,  
Variable Range Marker (VRM1, VRM2),  
Electronic Bearing Line (EBL1, EBL2),  
Tuning Bar, Cursor, Parallel Cursor,  
Alarm Zone, Waypoint Mark (navigation input required),  
North Mark (heading sensor input required)
- (5) Alphanumeric Indications Range, Range Ring Interval, Pulselength (SP, MP, LP),  
Display Mode (HU,CU,NU,TM),  
Interference Rejection (IR1,IR2,IR3),  
VRM (1, 2), EBL (1, 2), Automatic A/C SEA (A/C AUTO),  
Stand-by (ST-BY), Radar Alarm (G(IN), G(OUT), G(ACKN)),  
Echo Stretch (ES1, ES2), Cursor Range, Bearing or L/L Position,  
Echo Tailing (TRAIL), Trailing Time, Trailing Elapsed Time,  
Navigation Data (navigation input required),  
Heading (HDC, heading sensor input required)
- (6) Input Data NMEA0183 (Ver.1.5/2.0), current loop
- Own ship's position: GGA>RMC>RMA>GLL (accept GLL in NMEA Version 1.5 only)
- Speed: RMC>RMA>VTG>VHW
- Heading (True): HDT>HDG<sup>\*1</sup>>HDM<sup>\*1</sup>>VHW>VHW<sup>\*1</sup>
- Heading (Magnetic): HDM>HDG<sup>\*1</sup>>HDT<sup>\*1</sup>>VHW>VHW<sup>\*1</sup>
- Course (True): RMC>RMA>VTG
- Course (Magnetic): VTG>RMC>RMA
- Waypoint (Range, Bearing): RMB>BWC>BWR
- Loran time difference: RMA>GLC>GTD
- Water depth: DPT>DBT>DBK>DBS

Water temperature: MTW>MDA  
Time: ZDA  
Cross track error: RMB>XTE>APB

\*1: calculate by magnetic drift.

- (7) Output Data NMEA0183 (Version1.5/2.0), RS-422  
TLL (target data) and RSD

## 5. ENVIRONMENTAL CONDITION

- (1) Ambient Temperature Scanner Unit: -25°C to +70°C  
Display Unit: -15°C to +55°C  
(2) Relative Humidity 95 % or less at +40°C  
(3) Waterproofing Scanner Unit: IPX6  
Display Unit: IPX4

## 6. POWER SUPPLY & POWER CONSUMPTION

- (1) Power Supply 12-32 VDC (10.8 to 41.6 VDC)  
(2) Voltage and Current 24rpm: 12 VDC/7.8A, 24VDC/3.9A, 32VDC/2.9A (100 kt)  
48rpm: 12 VDC/8.8A, 24VDC/4.4A, 32VDC/3.3A (70 kt)  
(3) Power Consumption 24rpm: 70 W to 90 W (100 kt)  
48rpm: 85 W to 105 W (70 kt)

## 7. DIMENSIONS AND MASS

See the Outline Drawings

## 8. COATING COLOR

- (1) Display Unit Panel: N3.0  
Chassis: 2.5GY5/1.5  
(2) Scanner Unit N9.5

## 9. COMPASS SAFE DISTANCE

- (1) M1932M2  
Display Unit Standard: 1.1 m Steering: 0.8 m  
Scanner Unit Standard: 1.0 m Steering: 0.8 m  
(2) M1942M2  
Display Unit Standard: 0.75 m Steering: 0.6 m  
Scanner Unit Standard: 1.1 m Steering: 0.8 m

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(Address)

declare under our sole responsibility that the product

Marine radar – Type: Model 1932 MARK-2

(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 60936-1 Amendment-1 Annex D: 2002-06

EN 60945: 1997-01 (IEC 60945 Third edition: 1996-11)

ITU Radio Regulations Appendix S3, Table 2

ITU-R Recommendations M.1177-3, SM.1539, SM.1541 and SM.329-9

KSR 142, Annex 1: 1985-10

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

For assessment, see

- Statement of Opinion N° 00214120/AA/01 of 18 April 2005 issued by Telefication bv, The Netherlands
- Test reports KTL 98323220 of 8 October 1998 and KTL 98323222 of 1 October 1998 issued by KTL Certification, The Netherlands
- Test reports K03-17-173, K03-17-174 and K03-17-175 of 5 January 2004 prepared by Furuno Electric Co., Ltd.

On behalf of Furuno Electric Co., Ltd.

Hiroaki Komatsu  
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- Test report KTL 98323221 of 1 October 1998 issued by KTL Certification, The Netherlands
- Test reports K03-17-176 and K03-17-177 of 5 January 2004 prepared by Furuno Electric Co., Ltd.

On behalf of Furuno Electric Co., Ltd.

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