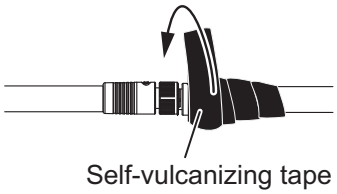
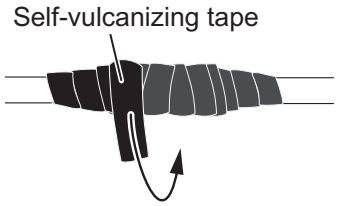
3. Wrap the junction of the connectors with self-vulcanizing tape and vinyl tape (locally supply) for waterproofing as follows:

1) Wrap the junction of the connectors with one layer of self-vulcanizing tape.

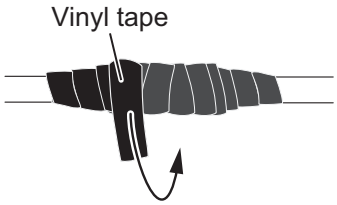


2) Change wrap direction and wrap one layer of the self-vulcanizing tape again.

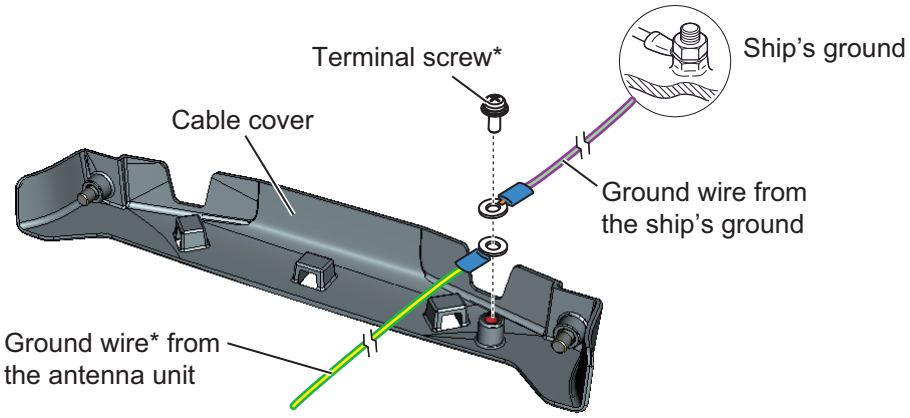


3) Wrap one layer of the vinyl tape over the self-vulcanizing tape.

4) Change wrap direction and wrap one layer of the vinyl tape again.

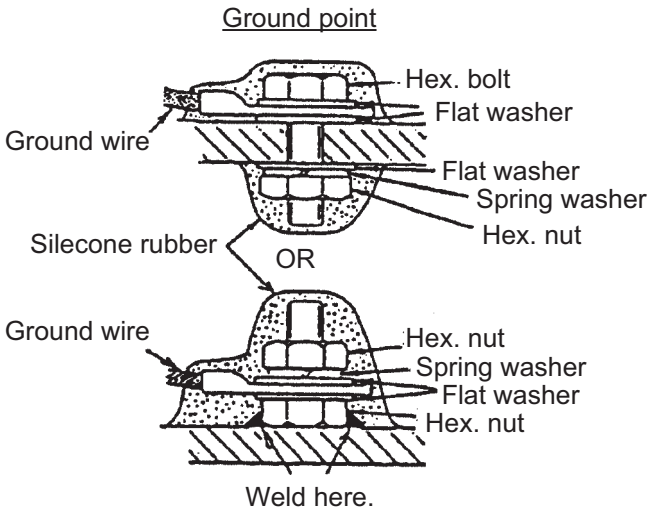


4. As shown in the figure below, attach a ground wire (IV-2sq, local supply) between the ship's ground and the screw on the cable cover of the antenna unit.

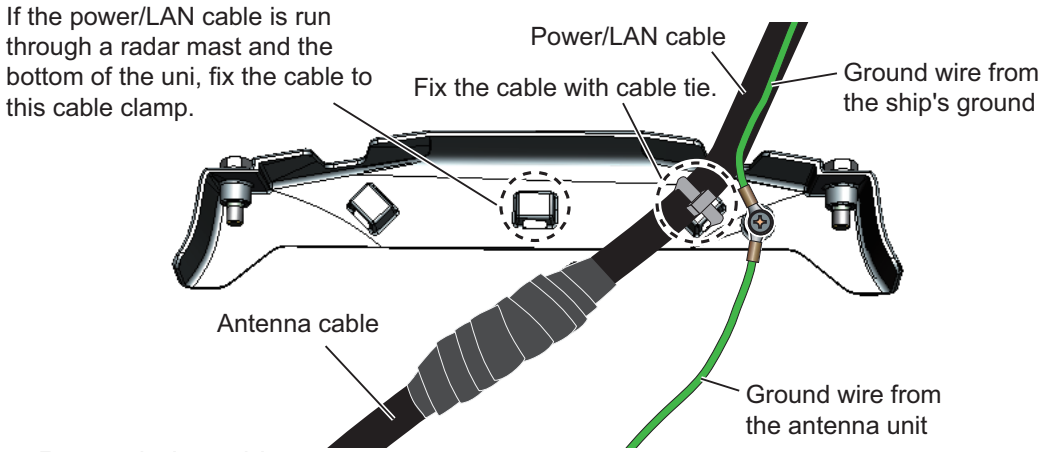


*: Pre-attached to the cable cover.

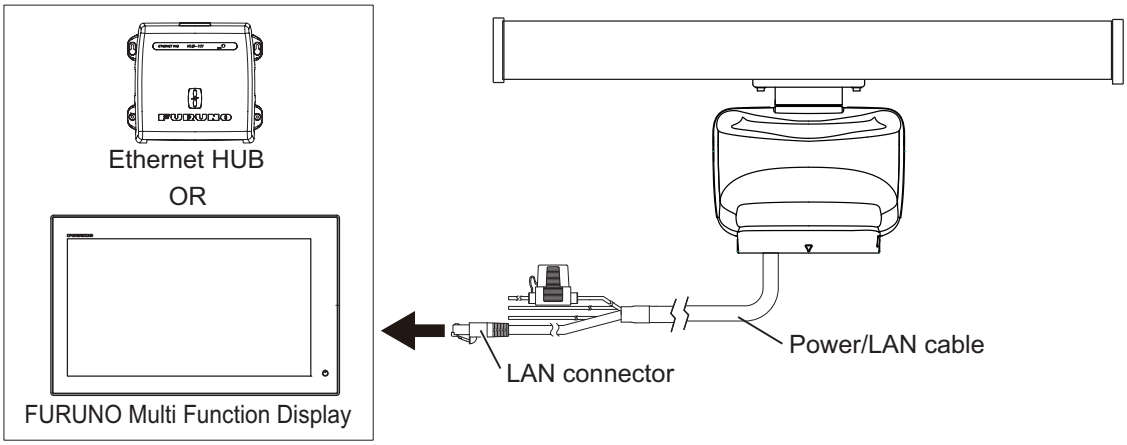
5. Apply the silicone rubber about ground point of the ship's ground.



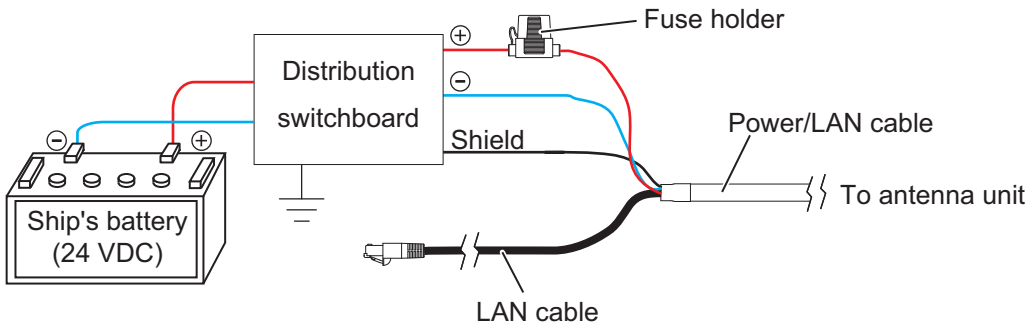
6. Fix the power/LAN cable to the cable cover with the cable ties (locally supply) as shown in the figure below.



7. Reattach the cable cover.
8. Connect the LAN connector of the power/LAN cable to a LAN port on the FURUNO Multi Function Display or Ethernet HUB.
   Note: Do not connect the LAN connector to on-board LAN.



9. Connect the power wires to the ship's battery (24 VDC).
   - Red wire: Connect to the positive terminal. The red wire has the fuse holder.
   - Blue wire: Connect to the negative terminal.
   - Black wire: The black wire is a shielding wire for grounding.



Note 1: The antenna unit has no power switch. Connect the antenna unit to a distribution switchboard with a switch for power control.

Note 2: If the voltage of the ship's battery is 12 VDC, prepare a DC-to-DC converter whose output current is 10 A or more.

Note 3: The antenna unit cannot accept the input voltage more than 24 VDC.

2. INITIAL SETUP

⚠ WARNING

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.

Distances at which RF radiation levels of 100, 50 and 10 W/m^2 exist are given in the table below.

Radiator	100 W/m^2	50 W/m^2	10 W/m^2
XN10A	0.1m	0.5m	3m
XN12A	N/A	0.4m	2.2m
XN13A	N/A	0.2m	1.9m

⚠ WARNING

Before turning on the radar, be sure no one is near the antenna.

Prevent the potential risk of being struck by the rotating antenna, which can result in serious injury or death.

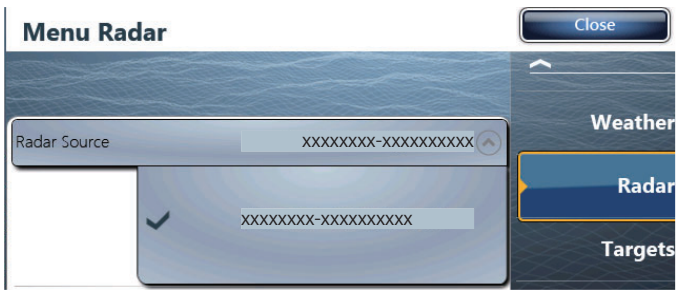
The DRS6A X-Class is compatible with the FURUNO Multi Function Display shown below. The combination with other models may not operate properly.

- NavNet TZtouch: TZT9, TZT14, TZTBB
- NavNet TZtouch2: TZTL12F, TZTL15F

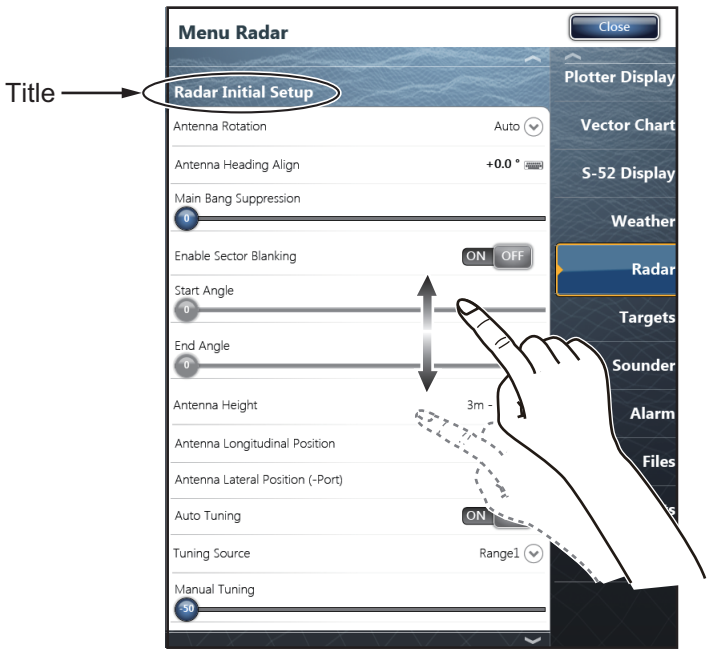
Turn on the antenna unit and FURUNO Multi Function Display, and do the initial setup for the antenna unit on the FURUNO Multi Function Display.

2.1 Initial Setup for TZT9/TZT14/TZTBB

1. Press the **Home** key (or tap the **Home** icon).
2. Select [Menu] on the menu icon bar to open the main menu.
3. Select [Radar].
4. Select [Radar Source] on the [Menu Radar] sub menus, then select the radar type connected.
   Note: If the antenna unit is connected but does not appear in the [Radar Source] list, close the list and open it again. The name of the antenna unit should appear with a check mark, as in the example below.

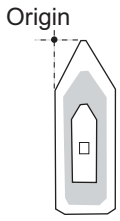


5. Drag the [Menu Radar] sub menus to find the menu item [Radar Initial Setup].



6. Set the items referring to the table shown below

Menu Radar (Radar Initial Setup)

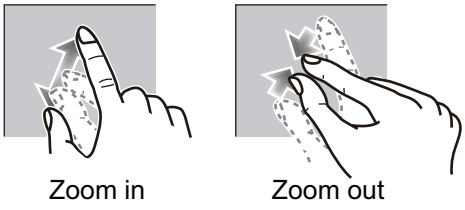
Menu item	Description
[Antenna Rotation]	Select the speed of antenna rotation.
[Antenna Heading Align]	See the topic of "How to align the antenna heading" on page 15.
[Main Bang Suppression]	If main bang appears at the screen center, slide the circle icon so that the main bang disappears, while watching the radar echo at the left-hand side of the display.
[Antenna Height]	Select the height of the antenna above the waterline.
[Antenna Longitudinal Position] [Antenna Lateral Position (-Port)]	Enter the antenna positioning bow-stern (Longitudinal) and port-starboard (lateral) position from the origin. 
Others	See Operator' Manual for TZT9/14/BB.

How to align the antenna heading

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 bearing error on the display because of the difficulty in achieving accurate initial positioning of the antenna unit. The following adjustment will compensate for the error.

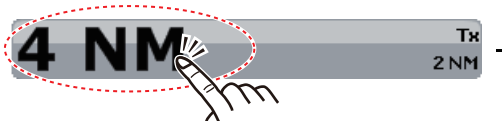
1. Select a range between 0.125 and 0.25 NM and set the mode to “head up“. You can select a range by a pinch action. The range and range ring interval appear at the bottom left of the screen.



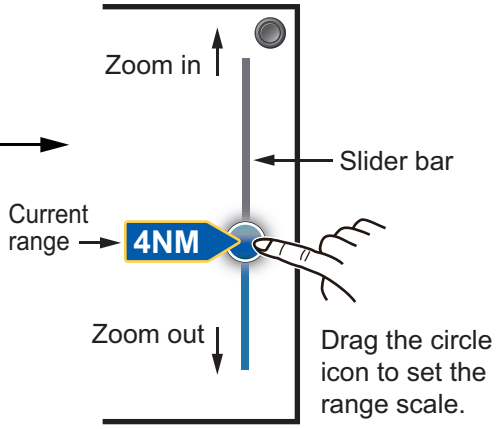
Pinch action

Range indications

For TZTBB, you can also control the range in the operation as follows. Tap the radar scale box at the bottom left-hand corner of the screen to display the slider bar. Drag the circle icon to set the range scale.



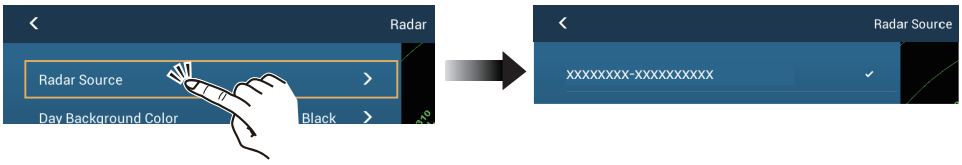
Tap the area circled in the dashed line to display the slider bar.
Note: You can switch between transmit and stand-by by tapping the right side of the radar scale box.



2. Turn the vessel’s bow toward a target.
3. Press the **Home** key (or tap the **Home** icon), then select [Menu] icon, [Radar], and [Antenna Heading Align] in that order to show the numeric software keyboard.
4. Key in the offset value so that the target is at the very top of the screen (setting range: +/- 0° to 180°, +: clockwise direction, -: counterclockwise direction), then tap [Save].
5. Confirm that the target echo is displayed at correct bearing on the screen.

2.2 Initial Setup for TZTL12F/TZTL15F

1. Tap the [Home] icon to show the home screen and display mode settings.
2. Tap [Radar] from the [Settings] menu.
3. Tap [Radar Source], then select the appropriate antenna unit.
   Note: If the antenna unit is connected but does not appear in the [Radar Source] list, close the list and open it again. The name of the antenna unit should appear with a check mark, as in the example below.



4. Drag the [Radar] menu display the menu item [Radar Initial Setup], then tap [Radar Initial Setup].
5. Referring to the tables below, set up the radar.

[Radar] menu - [Radar Initial Setup]

Menu item	Description
[Antenna Rotation]	Select the speed of antenna rotation.
[Antenna Heading Align]	See "How to align the antenna heading" on page 17.
[Main Bang Suppression]	If main bang appears at the screen center, slide the circle icon so that the main bang disappears, while watching the radar echo at the left-hand side of the display.
[Enable Sector Blanking]	Up to two sectors may be selected for blanking (no transmission). Select [ON] to enable this feature. Set the start and end angles (0° to 359°).
[Enable Sector 2 Blanking]	

[Radar] menu - [Antenna Position]

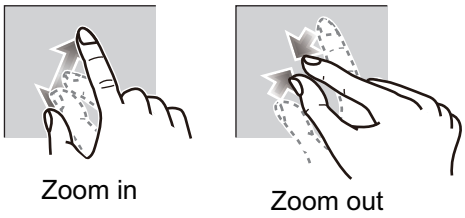
Menu item	Description
[Longitudinal (from bow)]	Referring to the figure on the right, enter the radar antenna positioning bow-stern (Longitudinal) and port-starboard (Lateral) position from the origin. 
[Lateral (-Port)]	
[Antenna Height]	Select the height of the antenna above the waterline.
[Auto Tuning]	Enable/disable auto tuning for the connected radar.
[Tuning Source]	Select the range to tune.
[Manual Tuning]	Manually tune the radar. Not available when [Auto Tuning] is enabled.
[Radar Monitoring]	Display various information regarding the connected radar.
[Radar Optimization]	Automatically adjust magnetron output and tuning for the connected radar. Do not change these settings.
[ARPA Advanced Settings]	Do not change these settings.
[Set Hardware To Factory Default]	Resets the radar selected at [Radar Source] to factory default.
[Reset Default Settings]	Resets [Radar] menu settings to default.

How to align the antenna heading

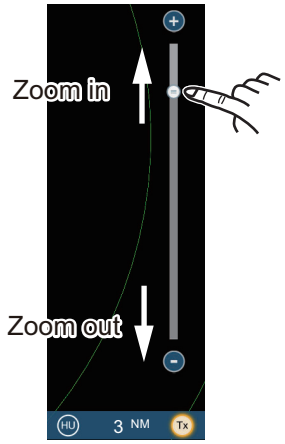
You have mounted the antenna unit facing straight ahead in the direction of the bow. Therefore, a small but conspicuous target dead ahead visually should appear on the heading line (zero degrees).

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

1. Set your radar with 0.125 and 0.25 NM range and the head up mode.
   The range scale can be selected two ways, as shown below. The slider bar can be shown or hidden with [Show Scale Slider] in the [Settings] - [Radar] menu.



Method 1: Pinch screen



Method 2: Drag slider
(or tap bar or +, - icons)

2. Turn the vessel's bow toward a target.
3. Tap the [Home] icon to show the home screen and display mode settings.
4. Tap [Radar] to show the [Radar] menu.
5. Drag the [Radar] menu to show the [RADAR INITIAL SETUP] menu.
6. Tap [Antenna Heading Align].
7. Key in the offset value so that the target is displayed at the very top of the screen (setting range: +179.9° to -180°, +: clockwise direction, -: counterclockwise direction), then tap the ✓ icon.
8. Confirm that the target echo is displayed at correct bearing on the screen.

3. MAINTENANCE, TROUBLE SHOOTING

Periodic checks and maintenance are important for proper operation of any electronic system. This chapter contains maintenance and troubleshooting instructions to be followed to obtain optimum performance and the longest possible life of the equipment. Before attempting any maintenance or troubleshooting procedure please review the safety information below and at the front of this manual. If you cannot restore normal operation after following the troubleshooting procedures, do not attempt to check inside any unit; there are no user serviceable parts inside. Contact your dealer to check the equipment.

⚠ WARNING

Do not open the equipment.

Hazardous voltage which can cause electrical shock exists inside the equipment. Only qualified personnel should work inside the equipment.

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

Prevent the potential risk of being struck by the rotating antenna.

A transmitting radar antenna emits electromagnetic waves, which can be harmful, particularly the eyes.

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.

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 Maintenance

Regular maintenance is important for good performance. Check the points mentioned below every 3 to 6 months to keep the antenna unit in good working order.

Check point	Action	Remedy, remarks
Cable	Check that all cables are firmly connected and are not damaged.	• Connect a cable if it has loosened. • Replace damaged cables.
Exposed bolts and nuts	Check that bolts and nuts are corroded and are securely fastened.	• Replace corroded bolts. • Tighten loosened bolts. • Coat new bolts with marine sealant.
Radiator	Dust, dirt and salt deposits on the radiator cause signal attenuation, resulting in loss of sensitivity.	• Wipe radiator with a freshwater-moistened cloth. • The radiator is made of fiberglass reinforced plastic. Therefore, do not used gasoline, benzene and the like to clean the radiator. • If the radiator is iced, use a wooden or plastic headed hammer to remove the ice. DO NOT use a steel hammer.
Ground connection	Check for tight connection and rust.	• Fasten if loosened. • Remove rust if present.

3.2 Troubleshooting

The table below provides simple troubleshooting procedures to restore normal operation. If you cannot restore normal operation, contact your dealer for advice.

Problem	Remedy
The multi function display cannot control the radar.	• Check that all cables are tightly fastened. • Check if the radar source setting is correct. • Check if the fuse of the power/LAN cable has blown. • Check that the power supply is compatible with the voltage rating of the antenna unit (24 VDC).
Marks and characters appear, but echoes do not appear.	• Check that the antenna cable is tightly fastened. • Check the cables for damage.
Picture is not updated or the picture freezes.	• Check that all cables are tightly fastened. • Check the cables for damage. • If the picture has frozen, reboot the multi function display.
You tuned the receiver or increase the gain, but radar echoes are too week.	• The life span of the magnetron is over. Contact your dealer to check the magnetron.
You changed the range, but the radar picture does not change.	• Try to change the range again. • Reboot the multi function display.
Poor discrimination in range.	• Adjust the sea control.
Range rings are not displayed.	• Check if the range rings is turned on in the menu.
You set the radar in the transmit state. The "TX screen" appears momentarily, but the radar soon goes into stand-by.	• The overload protection has activated. To restore normal operation, turn off all equipment in the network. Wait a few seconds then turn on all the equipment.

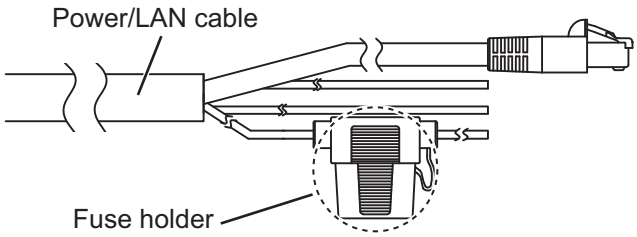
3.3 Replacement of Fuse

The 5 A fuse (Type: FRU-2P5S-FU-5A-B, Code No.: 000-168-869-10) in the fuse holder on the power/LAN cable protects the antenna unit from overcurrent and equipment fault. If you cannot turn on the power, check the fuse to see if it has blown. If the fuse has blown, find the reason before you replace the fuse. If the fuse blows again after the replacement, contact your dealer for advice.

⚠ WARNING

Use the proper fuse.

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



How to replace the fuse
Open the fuse holder cover and replace the fuse. Then close the cover.

3.4 Life of Parts

Magnetron

When a magnetron reaches the end of its life, targets do not appear on the display. If long-range performance appears to have declined, contact your dealer about replacement of the magnetron.

Name	Type	Code No.	Approx. Life
Magnetron	MAF1422B	000-158-788-12	5,000 hours

Antenna Motor

When an antenna motor reaches the end of its life, the antenna's rotation may stop or abnormal noise sounds from the antenna unit. If such symptom occurs, contact your dealer about replacement of the antenna motor.

Name	Type	Code No.	Approx. Life
Antenna Motor	DJ8G-23B48H	TBD	10,000 hours

SPECIFICATIONS OF RADAR SENSOR
DRS6A X-Class

1 ANTENNA UNIT

1.1	Antenna type	Slotted waveguide array
1.2	Antenna length	3.4 ft (XN10A), 4 ft (XN12A), 6 ft (XN13A)
1.3	Horizontal beam width	2.3° (XN10A), 1.9° (XN12A), 1.4° (XN13A)
1.4	Vertical beam width	22°
1.5	Gain	27.5 dBi (XN10A), 28.5 dBi (XN12A), 30 dBi (XN13A)
1.6	Sidelobe attenuation	
	XN10A	-20 dB (within ±20°), -28 dB (±20° or more)
	XN12A	-24 dB (within ±20°), -30 dB (±20° or more)
	XN13A	-28 dB (within ±10°), -35 dB (±10° or more)
1.7	Rotation	24/36/48 rpm range coupled or 24 rpm fixed

2 RADAR FUNCTION

2.1	Tx frequency	9410 ±30 MHz
2.2	Output power	6 kW nominal
2.3	Duplexer	Ferrite circulator with diode limiter
2.4	Intermediate frequency	60 MHz
2.5	Range, Pulse length and Pulse Repetition Rate (PRR)	

Range (NM)	Pulse length (μs)	PRR (Hz. approx.)
0.0625 to 0.75	0.08	3000
1 to 1.5	0.15	3000
2	0.3	1500
3 to 4	0.5	1000
6 to 8	0.8	600
12 to 120	1.2	600

2.6	Maximum range	120 NM
2.7	Minimum range	25 m
2.8	Range resolution	20 m
2.9	Range accuracy	1% of range in use or minimum VRM, whichever is the greater
2.10	Bearing resolution	2.3° (XN10A), 1.9° (XN12A), 1.4° (XN13A)
2.11	Bearing accuracy	±1°
2.12	Warm-up time	90 s approx.
2.13	Target tracking (TT)	Auto or manual acquisition: 30 targets in 16 NM
		Past position: 5/10 pts on all activated targets
		Vector time: Off, 1 to 60 min.

3 INTERFACE

LAN: 1 port, Ethernet, 100Base-TX

4 POWER SUPPLY

24 VDC: 3.7 A

5 ENVIRONMENTAL CONDITIONS

5.1	Ambient temperature	-25°C to +55°C (storage: -30°C to +70°C)
5.2	Relative humidity	95% or less at +40°C
5.3	Degree of protection	IP56
5.4	Vibration	IEC 60945 Ed.4

6 UNIT COLOR

N9.5

FURUNO

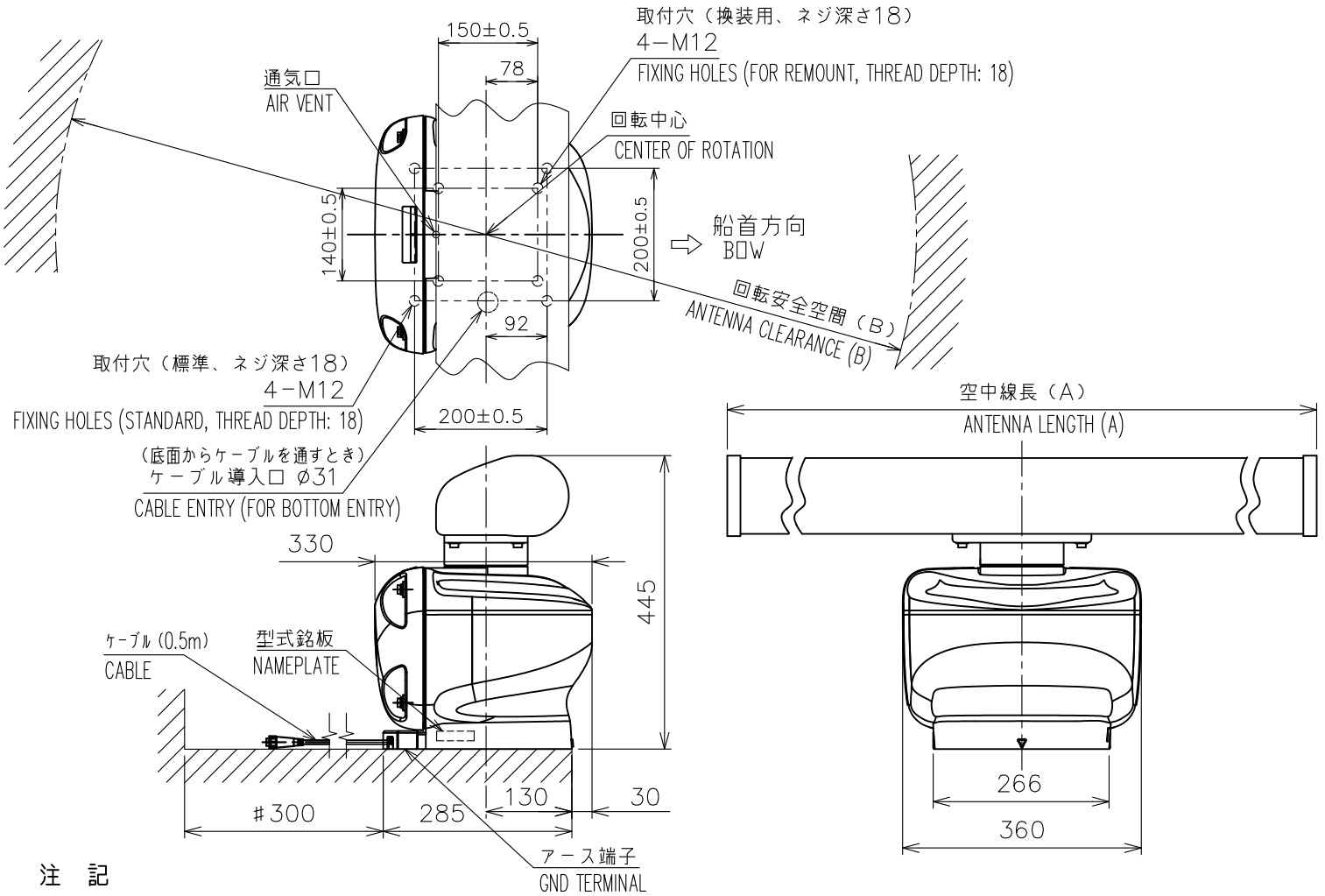


表２ TABLE 2

輻射器 RADIATOR	XN10A	XN12A	XN13A
空中線長（A） ANTENNA LENGTH (mm)	1036±10	1255±10	1795±10
回転安全空間（B） ANT. CLEARANCE (mm)	1200	1400	1940
質量（kg±10%） MASS	22	23	25

表１ TABLE 1

寸法区分（mm） DIMENSION	公差（mm） TOLERANCE
L≦50	±1.5
50<L≦100	±2.5
100<L≦500	±3
500<L≦1000	±4
1000<L≦2000	±5

注　記

１）指定なき寸法公差は表１による。

２）＃印寸法は最小サービス空間寸法とする。

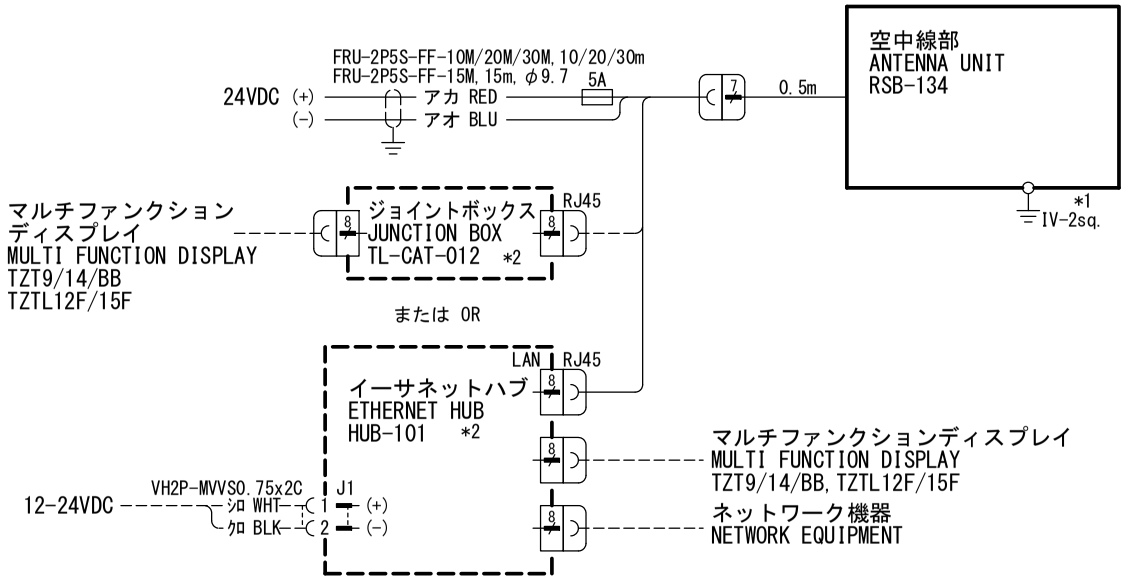
３）取付はＭ１２ボルトを使用のこと。

NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPWCIFIED.
2. #: MINIMUM SERVICE CLEARANCE.
3. USE M12 BOLTS FOR FIXING THE UNIT.

DRAWN 25/Jun/2015 T.YAMASAKI		TITLE	RSB-134
CHECKED 25/Jun/2015 H.MAKI		名称	空中線部
APPROVED 30/Jun/2015 H.MAKI	DRS6A X-CLASS		外寸図
SCALE 1/10 MASS 表2参照 SEE TABLE 2		NAME	ANTENNA UNIT
DWG.No. C3646-G01- A	REF.No. 03-189-3006-1		OUTLINE DRAWING

FURUNO



注記
＊１）造船所手配。
＊２）オプション。

NOTE
*1: SHIPYARD SUPPLY.
*2: OPTION.

DRAWN 25/Jun/2015 T. YAMASAKI			TITLE DRS6A X-CLASS
CHECKED 25/Jun/2015 H. MAKI			名 称 レーダーセンサー
APPROVED 30/Jun/2015 H.MAKI			相互結線図
SCALE	MASS kg		NAME RADAR SENSOR
DWG. No. C3646-C01- A	REF. No.		INTERCONNECTION DIAGRAM

FURUNO ELECTRIC CO., LTD.

S-1

(Elemental Chlorine Free)

The paper used in this manual
is elemental chlorine free.

FURUNO ELECTRIC CO., LTD.

9-52 Ashihara-cho,
Nishinomiya, 662-8580, JAPAN

・FURUNO Authorized Distributor/Dealer

 Printed in Japan

A : 0000
Z2 : JUL. 22, 2015

Pub. No. IME-36460-Z2

(REFU) DRS6A_X-CLASS

0 0 0 1 9 1 0 8 5 1 0