FURUNO

Installation Manual
MARINE RADAR
Model *FAR-1513/1523/1513-BB/1523-BB/*
FAR-1518/1528/1518-BB/1528-BB

FURUNO ELECTRIC CO., LTD.

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(ETMI) FAR-15x3/15x8/BB

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⚠ SAFETY INSTRUCTIONS

The installer of the equipment must read these safety instructions before attempting to install the equipment.

⚠ DANGER	Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.

⚠ Warning, Caution	🚫 Prohibitive Action	❗ Mandatory Action

⚠ DANGER

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.

⚠ WARNING

Radio Frequency Radiation Hazard

The radar antenna emits electromagnetic radio frequency (RF) energy which can be harmful, particularly to your eyes. Never look directly into the antenna aperture from a close distance while the radar is in operation or expose yourself to the transmitting antenna at a close distance. Distances at which RF radiation level of 100 W/m^2, 50 W/m^2 and 10 W/m^2 are given in the table below.

If the antenna unit is installed at a close distance in front of the wheel house, your administration may require halt of transmission within a certain sector of antenna revolution. See the installation manual for how to manage blind sectors.

Radar model	Transceiver	Magnetron	Antenna	100W/m^2	50W/m^2	10W/m^2
FAR-1513	RTR-086A	MAF1565N	XN12A	N/A		2.1 m
			XN13A	N/A		1.9 m
FAR-1523	RTR-087A	M1458F	XN12A	0.6 m		4.6 m
			XN13A	0.4 m		3.1 m
FAR-1518	RTR-100	MAF1615B	XN12AF	0.3 m	0.7 m	4.1 m
			XN20AF	0.2 m	0.5 m	3.1 m
FAR-1528	RTR-101	MG5436	XN20AF	0.6 m	1.2 m	6.1 m
			XN24AF	0.3 m	0.8 m	4.0 m

⚠ WARNING

ELECTRICAL SHOCK HAZARD	**Do not open the equipment unless totally familiar with electrical circuits and service manual.** Only qualified personnel are allowed to work inside the equipment.
❗	**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.
❗	**Turn off the power at the mains switchboard before beginning the installation.** Fire, electrical shock or serious injury can result if the power is left on or is applied while the equipment is being installed.
❗	**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.
🚫	**Do not install the processor unit, display unit or a control unit in a dusty environment, or a location where the units may get wet from rain or water splash.** Foreign material or water in the units can result in fire, electrical shock, or damage to the equipment.
⏚	**Connect protective earth between the processor unit and the ship's superstructure.** The protective earth (grounding) is required for the AC power supply to prevent electrical shock.

⚠ CAUTION

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

Unit		Standard compass	Steering compass
Antenna Unit for FAR-1513	RSB-0070	1.00 m	0.60 m
	RSB-0073	1.10 m	0.70 m
Antenna Unit for FAR-1523	RSB-0070	1.85 m	1.25 m
	RSB-0073	1.80 m	1.15 m
Antenna Unit for FAR-1518	RSB-120	1.55 m	1.00 m
	RSB-121		
Antenna Unit for FAR-1528	RSB-120	2.05 m	1.30 m
	RSB-121		
Processor Unit (RPU-024)		2.60 m	1.70 m
Control Unit (RCU-028)		0.90 m	0.60 m
Display Unit (MU-150HD)		0.65 m	0.45 m
Display Unit (MU-190)		1.65 m	1.05 m
Trackball Control Unit (RCU-030)		0.50 m	0.30 m

Note: For more information, please refer to IMO SN/Circ.271 "Guidelines for the installation of shipborne radar equipment."

SYSTEM CONFIGURATION

FAR-1513(-BB), FAR-1523(-BB)

ANTENNA UNIT

FAR-1513(-BB)
XN12A-RSB-0070-086A
XN12A-RSB-0073-086A
XN13A-RSB-0070-086A
XN13A-RSB-0073-086A

FAR-1523(-BB)
XN12A-RSB-0070-087A
XN12A-RSB-0073-087A
XN13A-RSB-0070-087A
XN13A-RSB-0073-087A

TRACKBALL CONTROL UNIT RCU-030

CONTROL UNIT RCU-028

12-24 VDC — DISPLAY UNIT*2*4 MU-150HD or MU-152

100-230 VAC 1ø, 50-60 Hz Interswitch

SWITCHING HUB HUB-100

DC Spec.

24 VDC

100/110/115/200/ 220/230 VAC 1ø, 50-60 Hz

Rectifier RU-1746-B-2 RU-3424

PROCESSOR UNIT RPU-024

Gyrocompass *1, AD-10 format

Gyrocompass *1, IEC61162 format

AIS Transponder

EPFS (GPS)

SDME (Speed log)

AMS, IEC61162 format

ECDIS

AMS (Contact)*3

Sub Display 1

Sub Display 2

VDR or Analog RBG Monitor

——— : Standard supply

········· : Optional or local supply

Equipment category

Unit	Category
Antenna	Exposed to the weather
Other units	Protected from the weather

***1:** The gyrocompass must also have an update rate that is adequate for the ship's rate of turn.
The update rate must be better than 40 Hz (HSC) or 20 Hz (conventional vessel).

***2:** This monitor have been approved by the IMO, MU-150HD and MU-152 (planned release: Early 2018) for CAT 3. If a different monitor is to be used on IMO vessels, its effective diameter must meet the applicable Category requirements (CAT 3: Effective diameter 180 mm or higher).
For installation, operation and viewing distance of other monitors, see their respective manuals.
For BB types, a monitor is to be prepared by the user.

***3:** Characteristics of contact output for AMS (Alert Management System):
• (Load current) 250 mA
• (Polarity) Normally Open: 2 ports, Normally Close: 2 ports

***4:** Standard supply with FAR-1513/FAR-1523 only.
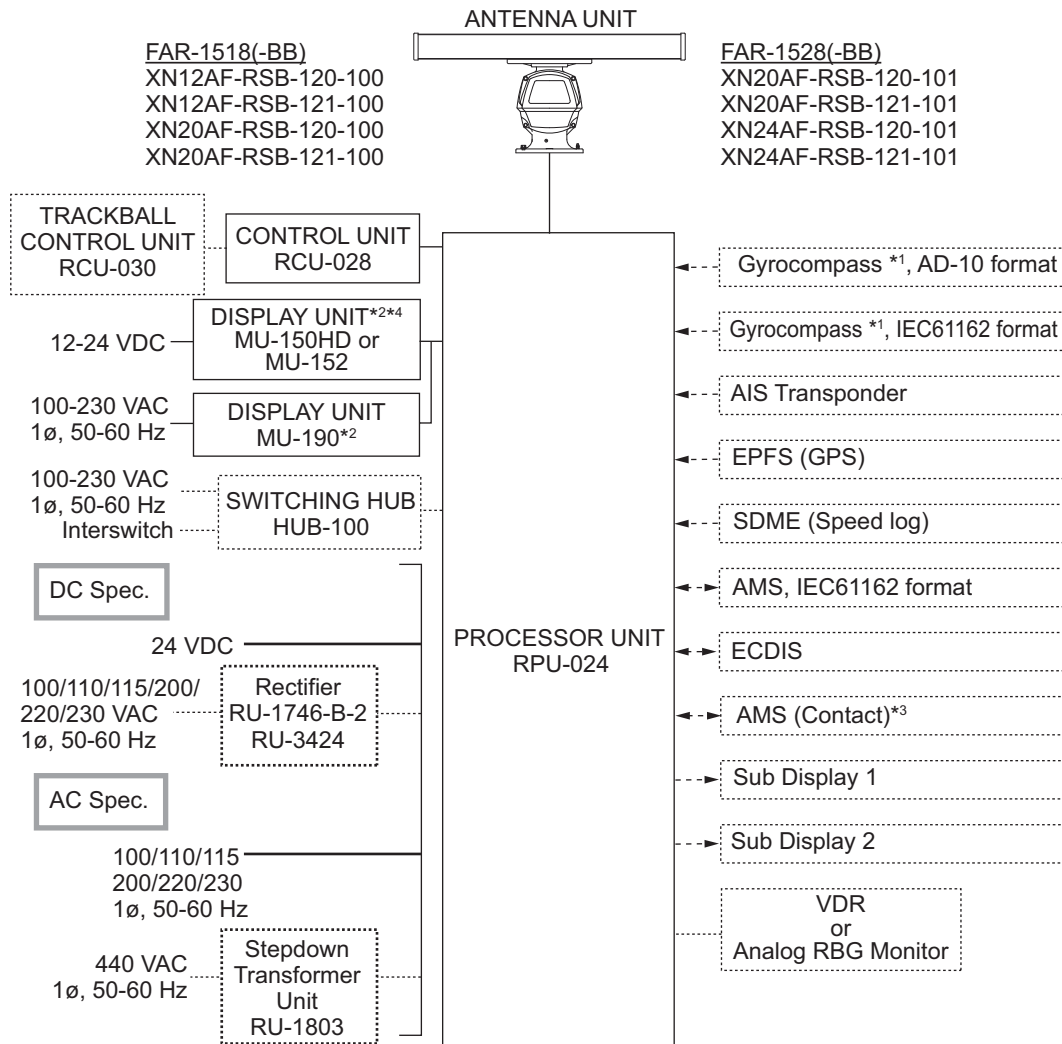
FAR-1518(-BB), FAR-1528(-BB)

> **NOTICE FOR FAR-1518(-BB)/FAR-1528(-BB)**
>
> The radar(s) must be interconnected to the following type approved sensors:
> - Gyrocompass meeting requirements of the IMO resolution A.424(XI).
> - EPFS meeting the requirements of the IMO resolution MSC.112(73).
> - SDME meeting the requirements of the IMO resolution MSC.96(72).
>
> The radar may be interconnected via HUB-100 to other FURUNO processing units having approved LAN ports.
>
> The following sentences cannot be used for installations on SOLAS vessels: BWC, BWR, DBK, GBS, HDG, HDM and TLL.

ANTENNA UNIT

FAR-1518(-BB)
XN12AF-RSB-120-100
XN12AF-RSB-121-100
XN20AF-RSB-120-100
XN20AF-RSB-121-100

FAR-1528(-BB)
XN20AF-RSB-120-101
XN20AF-RSB-121-101
XN24AF-RSB-120-101
XN24AF-RSB-121-101

TRACKBALL CONTROL UNIT RCU-030

CONTROL UNIT RCU-028

12-24 VDC — DISPLAY UNIT*2*4 MU-150HD or MU-152

100-230 VAC 1ø, 50-60 Hz — DISPLAY UNIT MU-190*2

100-230 VAC 1ø, 50-60 Hz Interswitch — SWITCHING HUB HUB-100

DC Spec.

24 VDC

100/110/115/200/ 220/230 VAC 1ø, 50-60 Hz — Rectifier RU-1746-B-2 RU-3424

AC Spec.

100/110/115 200/220/230 1ø, 50-60 Hz

440 VAC 1ø, 50-60 Hz — Stepdown Transformer Unit RU-1803

PROCESSOR UNIT RPU-024

Gyrocompass *1, AD-10 format
Gyrocompass *1, IEC61162 format
AIS Transponder
EPFS (GPS)
SDME (Speed log)
AMS, IEC61162 format
ECDIS
AMS (Contact)*3
Sub Display 1
Sub Display 2
VDR or Analog RBG Monitor

Equipment category

Unit	Category
Antenna	Exposed to the weather
Other units	Protected from the weather

—— : Standard supply
······· : Optional or local supply

*1: The gyrocompass must also have an update rate that is adequate for the ship's rate of turn. The update rate must be better than 40 Hz (HSC) or 20 Hz (conventional vessel).

*2: This monitor have been approved by the IMO, MU-150HD and MU-152 (planned release: Early 2018) for CAT 3, MU-190 for CAT-2. If a different monitor is to be used on IMO vessels, its effective diameter must meet the applicable Category requirements (CAT 3: Effective diameter 180 mm or higher; CAT 2: Effective diameter 250 mm or higher). For installation, operation and viewing distance of other monitors, see their respective manuals. For BB types, a monitor is to be prepared by the user.

*3: Characteristics of contact output for AMS (Alert Management System):
- (Load current) 250 mA
- (Polarity) Normally Open: 2 ports, Normally Close: 2 ports

*4: Standard supply with FAR-1518/FAR-1528 only.

EQUIPMENT LIST

Standard supply

Name	Type	Code No.	Qty	Remarks
Processor Unit	RPU-024	-	1	
Control Unit	RCU-028	-	1	
Display Unit	MU-150HD	-	Select one	
	MU-152	-		
	MU-190	-		
Antenna Unit (FAR-1513, FAR-1513-BB)	XN12A-RSB-0070-086A	-	Select one	24 rpm, 1200 mm
	XN12A-RSB-0073-086A	-		48 rpm, 1200 mm
	XN13A-RSB-0070-086A	-		24 rpm, 1800 mm
	XN13A-RSB-0073-086A	-		48 rpm, 1800 mm
Antenna Unit (FAR-1523, FAR-1523-BB)	XN12A-RSB-0070-087A	-	Select one	24 rpm, 1200 mm
	XN12A-RSB-0073-087A	-		48 rpm, 1200 mm
	XN13A-RSB-0070-087A	-		24 rpm, 1800 mm
	XN13A-RSB-0073-087A	-		48 rpm, 1800 mm
Antenna Unit FAR-1518, FAR-1518-BB)	XN12AF-RSB-120-100	-	Select one	26 rpm, 1200 mm
	XN12AF-RSB-121-100	-		48 rpm, 1200 mm
	XN20AF-RSB-120-100	-		26 rpm, 2000 mm
	XN20AF-RSB-121-100	-		48 rpm, 2000 mm
Antenna Unit (FAR-1528, FAR-1528-BB)	XN20AF-RSB-120-101	-	Select one	26 rpm, 2000 mm
	XN20AF-RSB-121-101	-		48 rpm, 2000 mm
	XN24AF-RSB-120-101	-		26 rpm, 2400 mm
	XN24AF-RSB-121-101	-		48 rpm, 2400 mm
Installation Materials (FAR-1513, FAR-1513-BB)	CP03-36700	000-028-129	Select one	10 m signal cable
	CP03-36710	000-028-130		15 m signal cable
	CP03-36720	000-028-131		20 m signal cable
	CP03-36730	000-028-132		30 m signal cable
Installation Materials (FAR-1523, FAR-1523-BB)	CP03-36800	000-028-133	Select one	10 m signal cable
	CP03-36810	000-028-134		15 m signal cable
	CP03-36820	000-028-135		20 m signal cable
	CP03-36830	000-028-136		30 m signal cable
Installation Materials (FAR-1518, FAR-1518-BB, FAR-1528, FAR-1528-BB)	CP03-36900	000-028-137	Select one	15 m signal cable
	CP03-36910	000-028-138		20 m signal cable
	CP03-36920	000-028-139		30 m signal cable
Installation Materials	CP03-36500	000-027-862	1	For processor unit, includes CP03-36501, DVI-D/D S-LINK (5m)
Installation Materials	CP03-36510	000-028-881	1	For control unit/processor unit, includes CP03-36501, CP03-36601, DVI-D/D S-LINK (5m)
Spare Parts	SP03-18001	001-419-820	1	Fuses (2 pcs.), for DC power processor unit
Spare Parts	SP03-18002	001-419-830	1	Fuses (2 pcs.), for AC power processor unit

Optional supply

Name	Type	Code No.	Remarks
Control Unit	RCU-028	-	
Performance Monitor	PM-32A	001-419-490	Mandatory for IMO radars.
Processor Unit IPX2 Kit	OP03-238	001-419-560	
Stepdown Transformer Unit	RU-1803	-	440 V→100 V
Rectifier	RU-3423	-	For display unit, current capacity max. 7A
	PR-240	-	For display unit, current capacity max. 8A
	RU-1746B-2	-	Current capacity max. 13A
	RU-3424	-	Current capacity max. 20A
	PR-850A	-	100/110/120/220/240 VAC→24 VDC. Current capacity max. 30A
Cable Assy.	RW-4864 1M	001-103-620-10	Radar signal cable, 1 m
	RW-4864 5M	001-103-630-10	Radar signal cable, 5 m
	RW-4864 10M	001-103-640-10	Radar signal cable, 10 m
	RW-4864 15M	001-103-650-10	Radar signal cable, 15 m
Cable Assy.	DVI-D/D S-LINK 10M	001-133-980-10	For Display Unit, DVI cable, 10 m
Switching Hub	HUB-100	-	
Installation Materials	CP03-28900	000-082-658	10 m
Installation Materials	CP03-28910	000-082-659	20 m
Installation Materials	CP03-28920	000-082-660	30 m
Flush Mount Kit	OP26-4	001-080-850	
Hood Assy.	OP26-3	001-080-840	
Bracket Assy.	OP26-2	000-016-268	
LAN Cable	MOD-Z072-020+	001-167-880-10	
	MOD-Z072-050+	001-167-890-10	
	MOD-Z072-100+	001-167-900-10	
Cable Assy.	3COX-2P-6C 5M	001-077-230-10	
	3COX-2P-6C 10M	001-077-220-10	

Local supply

Name	Type	Code No.	Remarks
Display Unit	MU-190	-	For -BB configurations.

1. INSTALLATION

1.1 Before Beginning the Installation...

Please read the instructions below before beginning the installation.

- Do the installation following the instructions contained in this manual.

- Be sure to do the installation setup (tuning, timing, heading alignment, etc.) in chapter 3 after installing the equipment.

- The cable names mentioned throughout this manual are JIS (Japan Industrial Standard) cables. If not available locally, see Appendix 1 for the equivalent cables.

- The control unit cannot be mounted in a console - it is designed to be mounted on a desktop.

- See the table below for retrofit possibility. The existing antenna cable for the FR-8125 or FR-8255 can be used, by attaching a connector (NH and VH). However, replacement of the cable is recommended.

	Retrofit possibility		
	FAR-1513/1523	FAR-1518/1528 (no Performance Monitor)	FAR-1518/1528 (w/Performance Monitor)
FR-8002 series	Yes	No	No
FR-1500 MK3 series	Yes	Yes	No

- The antenna cable for the FAR-1513/FAR-1523 has connectors at both its ends. If the cable is to be passed through a bulkhead, do not remove the connectors (to make it easier to pass the cable through the bulkhead). Make an opening in the bulkhead large enough to pass the cable and the connectors.

- Use only the specified power cable and fuse.

- Connect the DC power specification processor unit to the ship's mains via a breaker.

- Ground the AC power specification processor unit.

- If the processor unit is to be installed near where water or rain splash may occur, install the optional waterproofing kit, which waterproofs the unit to waterproofing standard IPX2. Do not install the unit in an area where water or rain splash exceeds the conditions of IPX2.

- Do not connect the radar to the ship's onboard LAN.

- Connect the drain wires of external equipment to the specified locations in the processor unit to prevent noise.

- Do not disassemble the equipment, to prevent electrical shock.

- Do not apply paint, anti-corrosive sealant or contact spray to exterior surfaces or plastic parts of the equipment. Those items contain organic solvents that can damage coating and plastic parts, especially plastic connectors.

- In case of trouble consult with a FURUNO dealer.

- The "BB" (BlackBox, monitor unit supplied locally) model is not included in section titles or descriptions unless necessary, since the configuration is the same otherwise.
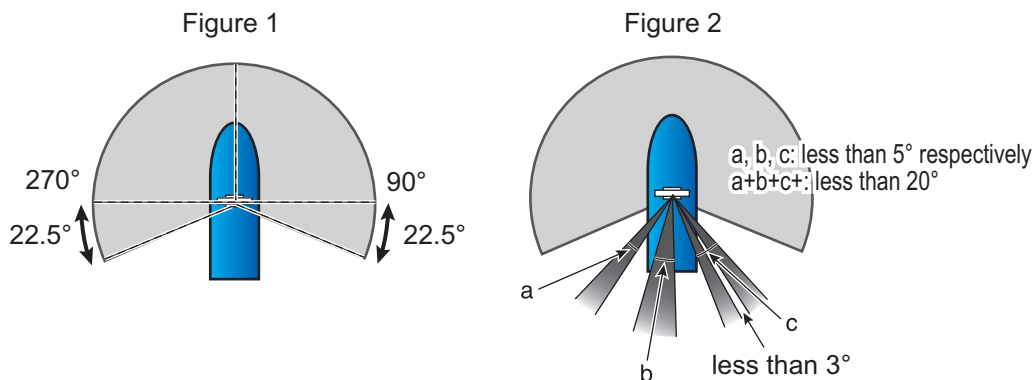
1.2 Antenna Unit Installation Considerations

- The antenna unit is generally installed either on top of the wheelhouse or on the radar mast, on a suitable platform. Locate the antenna unit in an elevated position not interfered by any shipboard structure.

(a) Bridge (b) Common mast (c) Radar mast
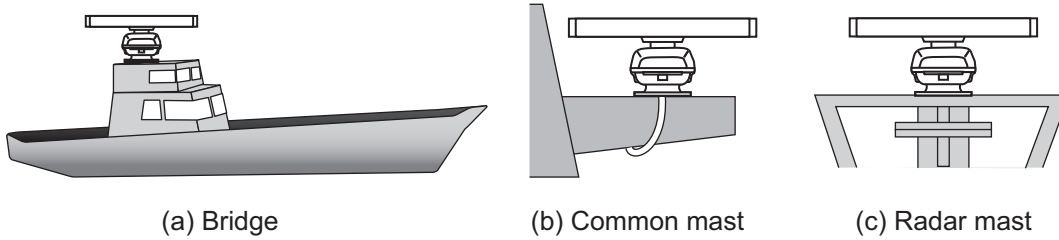
- A line of sight from the antenna unit to the bow of the ship must hit the surface of the sea in not more than 500 m or twice the ship's length, depending whichever value is smaller, for all load and trim conditions.

less than 500 m or twice the ship's length
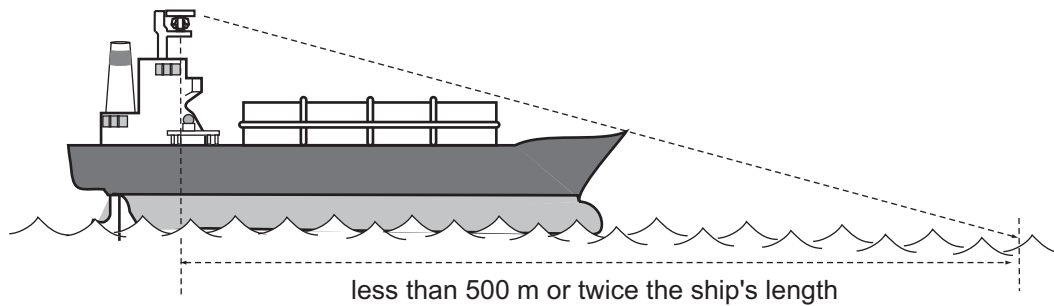
- Install the antenna unit so that any blind sectors caused by objects (mast, etc.) are kept to a minimum. A blind sector must not exist in arc of the horizon from right ahead to 22.5° aft of the beam to either side (see Figure 1 below). Also, individual blind sectors of more than 5° or the total arc of both blind sectors of more than 20°, must not occur in the remaining arc (see Figure 2 below). Note that any two blind sectors separated by 3° or less are regarded as one sector.

Figure 1

Figure 2

270° 90°
22.5° 22.5°

a, b, c: less than 5° respectively
a+b+c: less than 20°

a

c

b less than 3°

- Do not install the antenna where extreme winds may strike the port and starboard sides of the antenna.

- Install the antenna unit away from interfering high-power energy sources and TX radio antennas.

- Keep the following distance and angle between another radar antenna.

More than 20°

More than 1 m
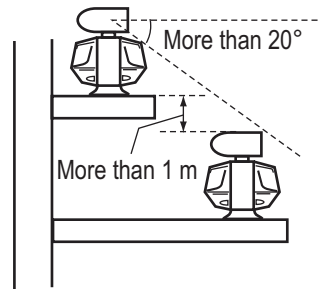
- Keep the lower edge of the antenna unit above the safety rail by at least 500 mm.
- No funnel, mast or derrick shall be within the vertical beamwidth of the antenna unit in the bow direction, especially zero degree ±5°, to prevent blind sectors and false echoes on the radar picture.
- It is rarely possible to place the antenna unit where a completely clear view in all directions is available. Therefore, determine the angular width and relative bearing of any shadow sectors for their influence on the radar at the first opportunity after fitting.
- Locate the antenna of an EPFS clear of the radar antenna to prevent interference to the EPFS. A separation of more than two meters is recommended.
- A magnetic compass will be affected if the antenna unit is placed too close to the compass. Observe the compass safe distances on page ii to prevent interference to a magnetic compass.
- Do not paint the radiator aperture, to ensure proper emission of the radar waves.
- Ground the antenna unit with the supplied ground wire.
- Deposits and fumes from a funnel or other exhaust vent can affect the aerial performance and hot gases may distort the radiator portion. Do not install the antenna unit where the temperature is more than 55°C (131°F).
- Leave sufficient space around the unit for maintenance and servicing. See the antenna unit outline drawing for recommended maintenance space.

Note: For the IMO compliant radar, refer to IMO SN/Circ.271 "Guidelines for the installation of shipborne radar equipment" for further information.

1.3 How to Install the Antenna Unit for FAR-1513, FAR-1523

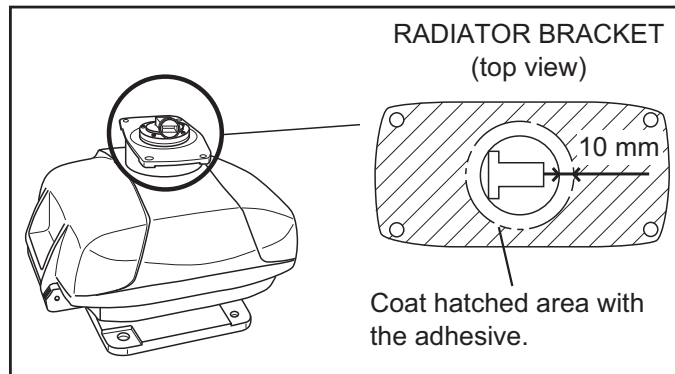### 1.3.1 How to fasten the radiator to the radiator bracket

Make five holes in the platform - four holes to fasten the antenna unit and one hole for the signal cable, referring to the outline drawing at the back of this manual for the dimensions.

See the packing list at the back of this manual for the installation materials.

1. Remove the radiator cap from the radiator bracket.

2. Apply the adhesive to the surface of the antenna radiator and the radiator bracket. See the figure below for the location.

RADIATOR BRACKET
(top view)

10 mm

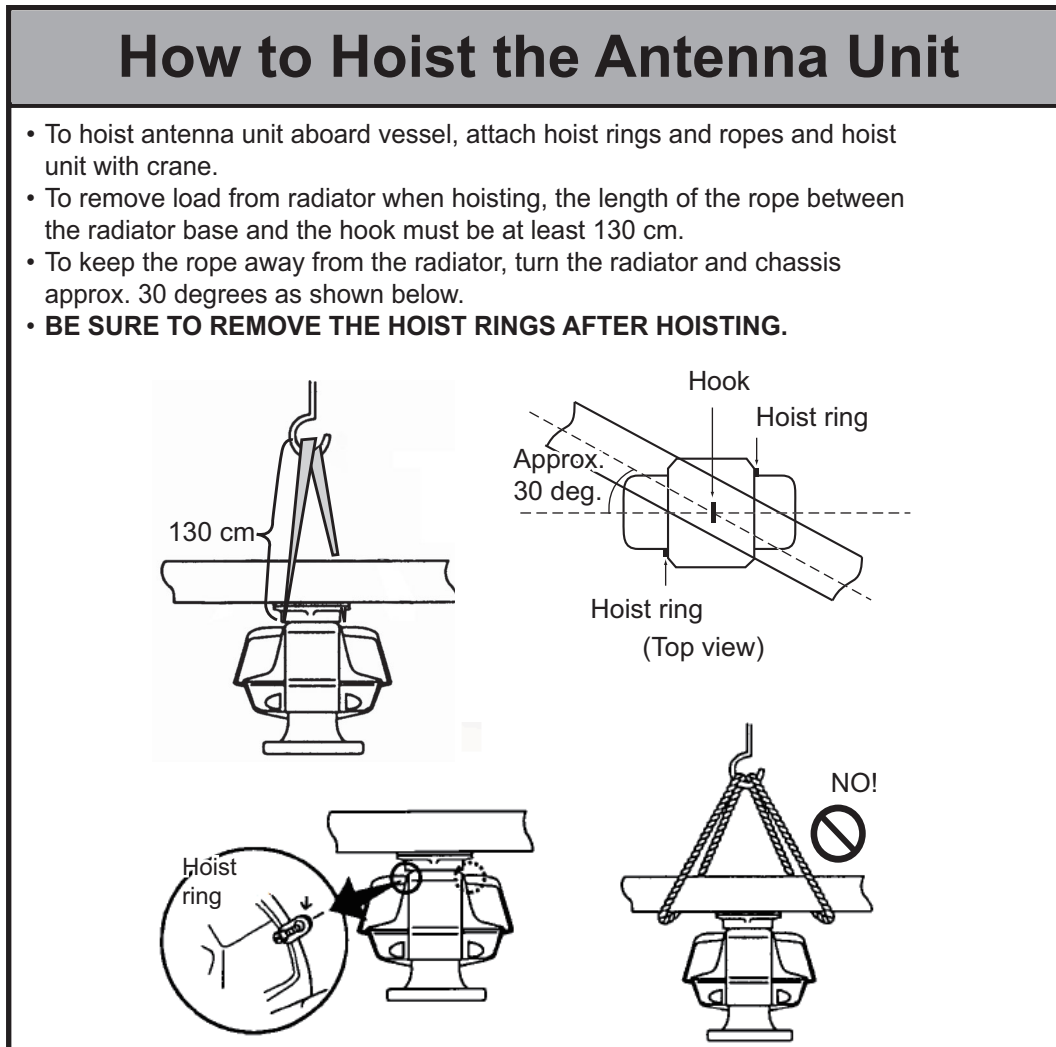Coat hatched area with the adhesive.

3. Apply the adhesive to the threads in the four holes on the antenna radiator.

4. Apply the grease to the O-ring and set the O-ring in its groove on the radiator bracket.

5. Set the antenna radiator on the radiator bracket.

6. Fasten the antenna radiator to the radiator bracket with the hex bolts, flat washers and spring washers. Apply the adhesive to the hex bolts.

Antenna radiator

Apply the adhesive to threaded holes.

O-ring

Radiator bracket

Flat washer

Spring washer

Hex bolt (M8×30)

Apply the adhesive to bolts.
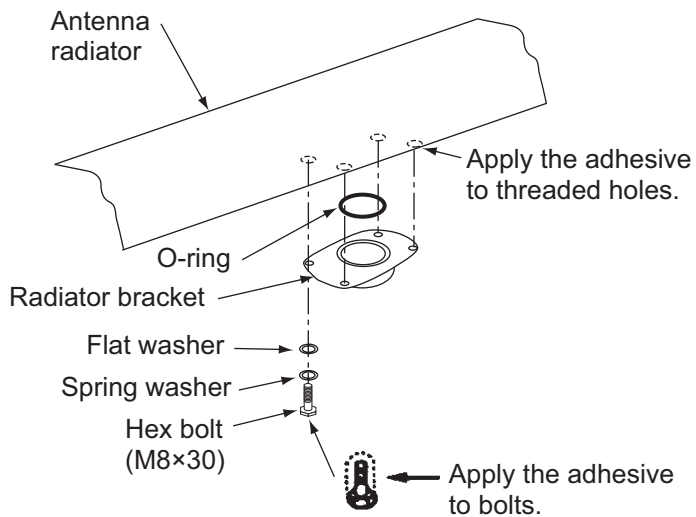
1.3.2   How to mount the antenna unit

The antenna unit may be assembled before hoisting it to the mounting platform. However, do not lift the antenna unit by the radiator. Always lift the unit by its housing. When using a crane or hoist, use the hoist rings which you attach to the antenna housing. See the figure below for hoisting guidelines.
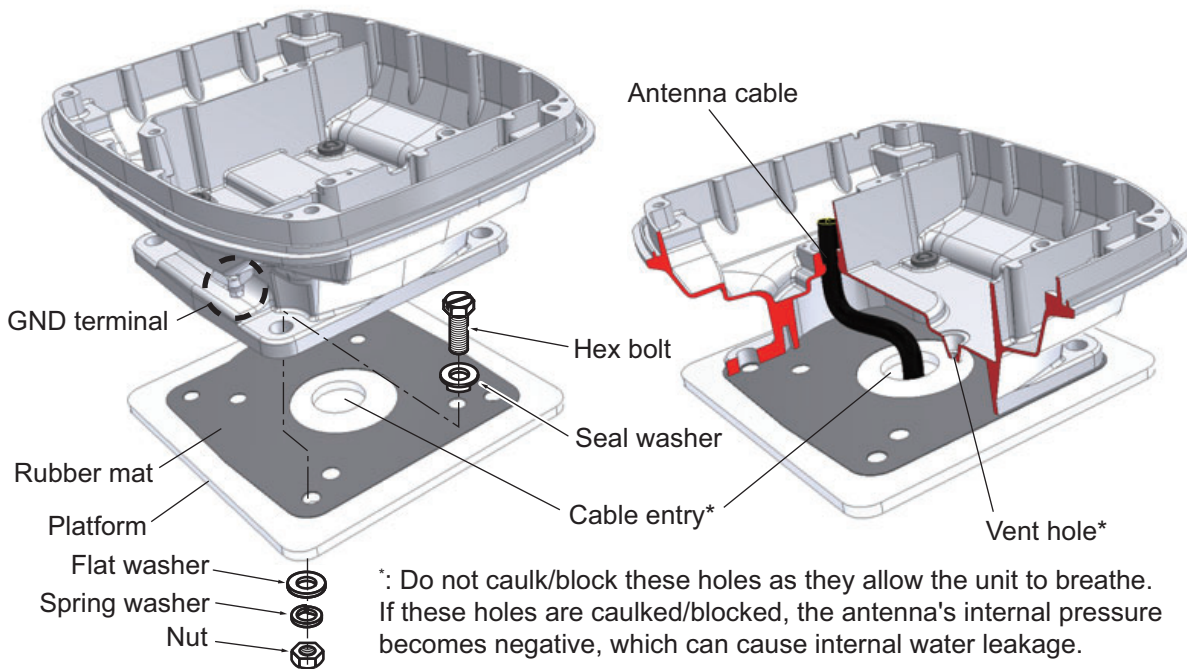

How to Hoist the Antenna Unit

• To hoist antenna unit aboard vessel, attach hoist rings and ropes and hoist unit with crane.
• To remove load from radiator when hoisting, the length of the rope between the radiator base and the hook must be at least 130 cm.
• To keep the rope away from the radiator, turn the radiator and chassis approx. 30 degrees as shown below.
• **BE SURE TO REMOVE THE HOIST RINGS AFTER HOISTING.**

Hook

Hoist ring

Approx. 30 deg.

130 cm

Hoist ring

(Top view)

Hoist ring

NO!

Mounting using the outside holes on the chassis

1. Put the anti-corrosion rubber (supplied) on the mounting location.

2. Referring to paragraph 1.4.2, hoist the antenna unit to the mounting location.

3. Orient the antenna unit so the bow mark on its base is aligned as close as possible with the ship's bow.
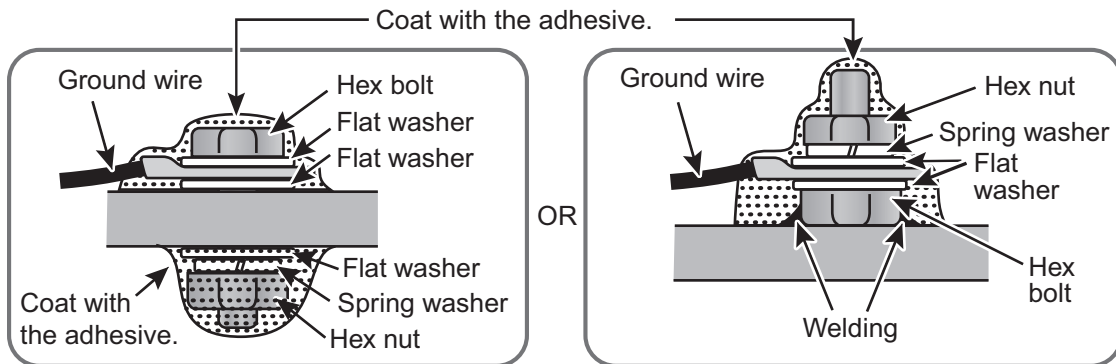
Ground terminal

Corrosion-proof rubber

Bow mark
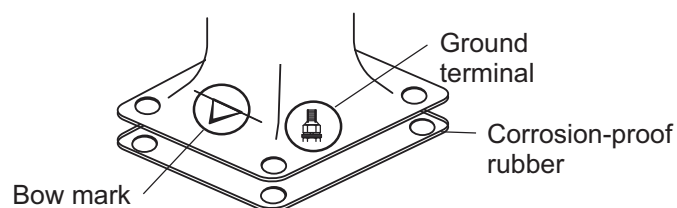
4. Set four hex bolts (M12×60, supplied) and seal washers (supplied) from the top of the antenna housing, as shown below.

Antenna cable

GND terminal

Hex bolt

Seal washer

Cable entry*

Rubber mat

Platform

Vent hole*

Flat washer

Spring washer

Nut

*: Do not caulk/block these holes as they allow the unit to breathe. If these holes are caulked/blocked, the antenna's internal pressure becomes negative, which can cause internal water leakage.

5. Set the flat washers (M12, supplied), spring washers (supplied) and nuts (supplied) to the hex bolts. Tighten by turning the nuts. Do not tighten by turning the hex bolts, to prevent damage to the seal washers.

6. Apply the adhesive to the flat washers, spring washers, nuts and visible parts of bolts.

Bolt

Adhesive

Seal washer

Antenna chassis

Corrosion-proof rubber

Seal washer

Nut

Adhesive
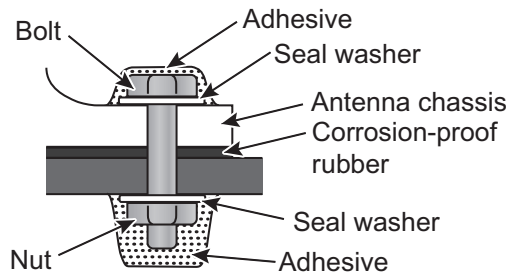
7. Prepare the ground point on the mounting platform. Use an M6×25 bolt, nut and flat washer (supplied). The ground point must be within 340 mm from the ground terminal on the antenna unit.

8. Fasten the ground wire (RW-4747, supplied) between the ground terminal and the ground point.

9. Apply the adhesive to the ground terminal and ground point as shown on the next page.

Coat with the adhesive.

Ground wire — Hex bolt
Flat washer
Flat washer

Coat with the adhesive. — Flat washer
Spring washer
Hex nut

OR

Ground wire — Hex nut
Spring washer
Flat washer

Welding — Hex bolt

Mounting using the inside fixing holes

This method requires removal of the RF unit in the antenna unit to access the inside fixing holes. Use hex bolts, flat washers, spring washers and nuts (local supply) to mount the antenna unit, confirming length of bolts.

1. Unfasten the four antenna bolts on the cover to open the antenna unit.

2. Unfasten the our screws on the RTB cover to remove it.

3. Unplug connector J827 and J834 on the RTB board.

4. Separate the upper chassis from the lower chassis by removing two hex bolts (M8×25).

5. Remove the RF unit by unfastening four hex bolts.

Hex bolt (M10×20)

Hex bolt (M8×25)   Remove from cable clamp.   J827, J834
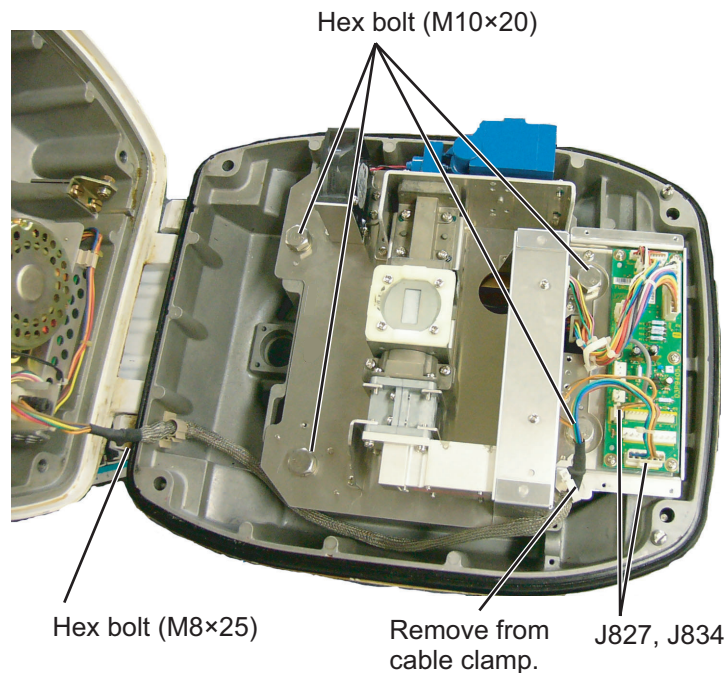
6. Lay the corrosion-proof rubber (supplied) on the mounting platform. Hoist the antenna unit to the mounting location, referring to paragraph 1.4.2.

7. Fasten the lower chassis to the mounting platform with hex head bolts, spring washers, flat washers and nuts (local supply). Coat flat washers, nuts and exposed parts of bolts with the adhesive. Cut a slit in the rubber bushing and insert bolt into the bushing. Do not use seal washers.

8. Reassemble the RF unit, cover and chassis.

9. Set four knob caps (supplied) into the outside fixing holes.

# 1.4 How to Install the Antenna Unit for FAR-1518, FAR-1528

1.4.1 How to fasten the radiator to the radiator bracket

The antenna unit consists of the antenna radiator and the antenna unit chassis, and they are packed separately. Fasten the antenna radiator to the antenna unit chassis as shown below.

1. **For the XN20AF, XN24AF**, Attach two guide pins to the underside of the antenna radiator.

2. Remove the waveguide cap from the radiator bracket. The cap may be discarded.

3. Coat the waveguide flange with the adhesive as shown below.
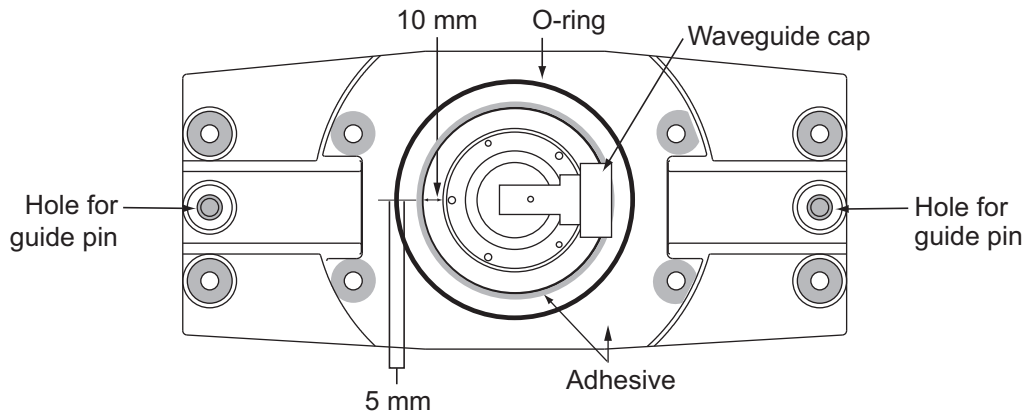
4. Coat the fixing holes for the antenna radiator with the adhesive.

5. Grease the O-ring and set it to the O-ring groove on the radiator flange.

6. Set the antenna radiator to the radiator bracket.

7. Coat the hex bolts with the adhesive and use them to loosely fasten the antenna radiator to the antenna unit chassis.

8. **For the XN20AF, XN24AF**, remove two guide pins (inserted at step 1).

9. Tighten the hex bolts.
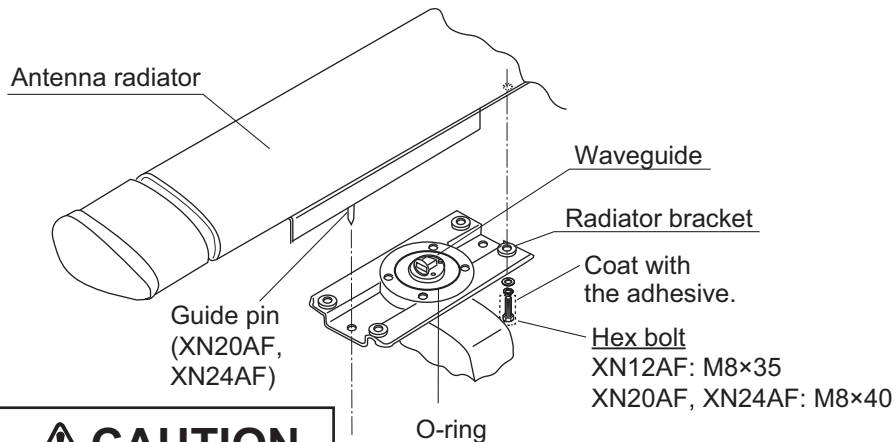
⚠ CAUTION

Be sure to remove the guide pins.
Injury may result if the guide pins loosen and fall.

1.4.2 How to mount the antenna unit

The antenna unit may be assembled before hoisting it to the mounting platform. However, do not lift the antenna unit by the radiator. Always lift the unit by its housing. When using a crane or hoist, use the hoist rings which you attach to the antenna housing. See the hoisting guidelines on page 1-5.

1. Construct a suitable mounting platform referring to the outline drawing at the end of this manual.

2. Drill four mounting holes of 15 mm diameter and one cable entry hole of approx. 50 mm diameter in the mounting platform.

3. Lay the corrosion-proof rubber (supplied) on the mounting platform.

4. Place the antenna unit on the corrosion-proof rubber, and orient the unit so the bow mark on its base faces the ship's bow.
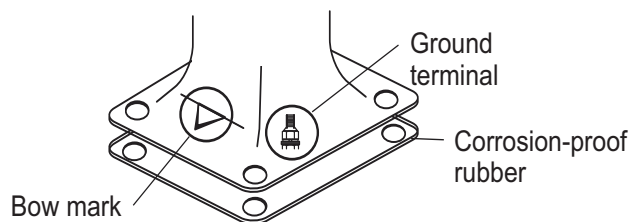

5. Fasten the antenna unit with hex bolts (M12×60), flat washers, spring washers, and seal washers. See the illustration on page 1-6 for details.

6. As shown in the figure below, use hex bolt (M6×25), hex nut (M6), flat washers (M6) and spring washers (M6) to establish the ground system on the mounting platform. The location of the grounding point should be within 340 mm of the ground terminal on the antenna unit, since that is the length of the ground wire. Connect the ground wire (RW-4747, supplied) between the grounding point and the ground terminal on the antenna unit. Coat the entire ground system with the adhesive (supplied).
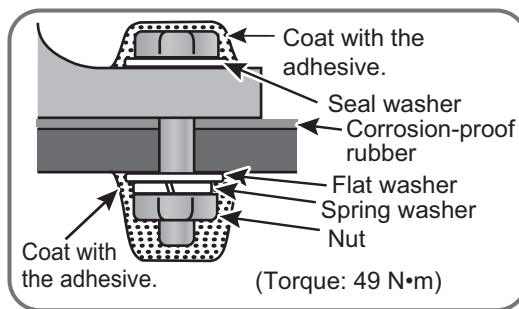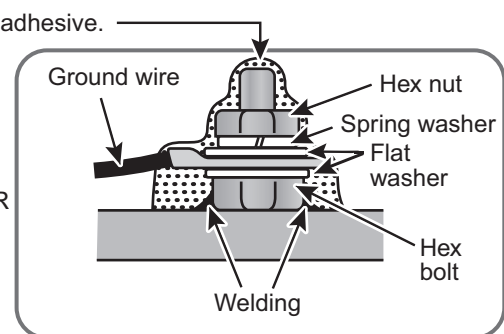

Fixing bolt
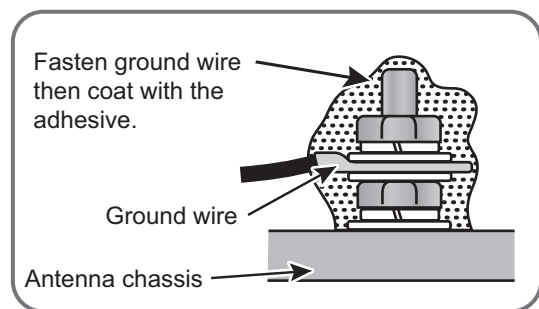
Antenna base
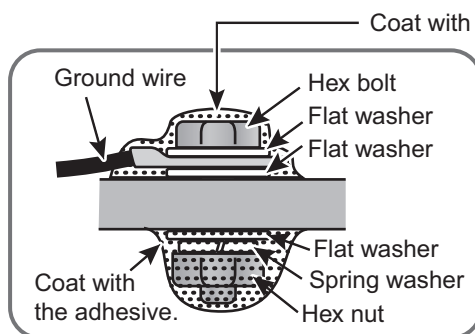
Grounding

7. Detach the hoist rings (if they have not already been detached).

1-9

1.5   Processor Unit

1.5.1   Mounting considerations

The processor unit can be mounted on a desktop or bulkhead. When selecting a mounting location, keep in mind the following points.

- Locate the unit out of direct sunlight and away from heat sources because of heat that can build up inside the cabinet.
- Locate the equipment away from places subject to water splash and rain.
- Select a mounting location considering the length of the cables connected.
- For bulkhead mounting, make sure the mounting location is strong enough to support the weight of the unit under the vibration normally encountered on the vessel. Reinforce the mounting location if necessary.
- Leave sufficient space on the sides and rear of the unit to facilitate maintenance. (See the outline drawing at the back of this manual for recommended maintenance space.)
- A magnetic compass will be affected if placed too close to the processor unit. Observe the compass safe distances shown on page ii to prevent interference to a magnetic compass.

1.5.2   How to mount the processor unit

Desktop installation

Fasten the unit with four bolts (M5, supplied) or self-tapping screws (5×20, local supply).

Note: If the installation must meet the waterproofing standard IPX2, install the processor unit IPX2 kit. See paragraph 2.4.5 for details.

Bulkhead installation

Blind seal

Mark locations for four self-tapping screws if screws will be used. Insert four M5 bolts (or self-tapping screws), leaving approx. 5 mm of the bolts (screws) exposed. Hang the processor unit on the four bolts (screws). Tighten all bolts (screws).

Note: If the installation must meet the waterproofing standard IPX2, set the blind seal supplied with the processor unit installation materials (CP03-36501) to the hole on the unit as shown in the right figure.
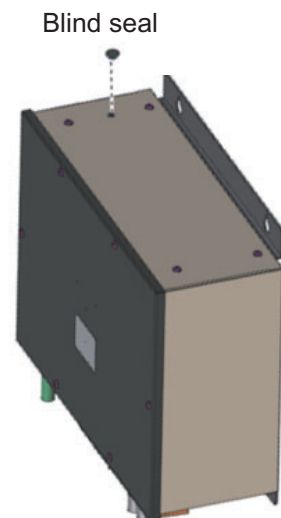
1.6   Display Unit

See the operator's manual for MU-150HD (OMC-44560) and MU-190 (OMC-33670) for the installation procedure. Keep in mind the following points when selecting a location.

- Locate the display unit where no framing is installed immediately forward of the display unit.
- Locate the display unit where it is easy to view the display in all ambient lighting conditions.
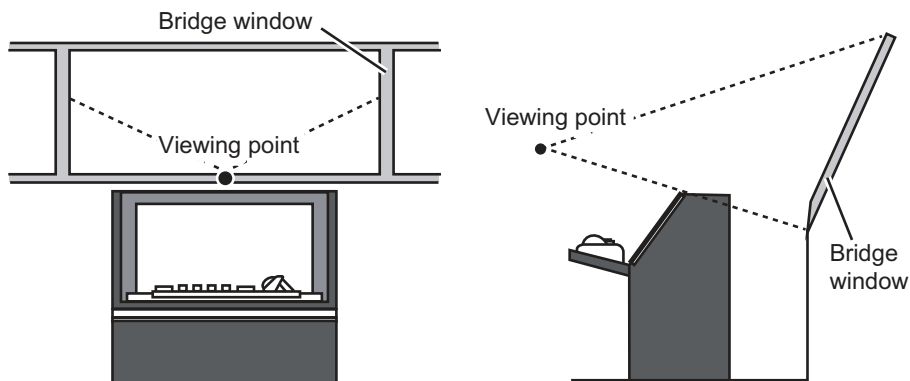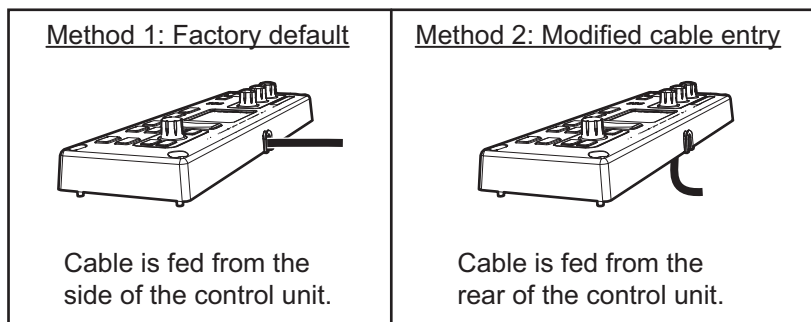
1.7   Control Unit

1.7.1   Mounting considerations

The control unit is designed for desktop/console installations only. Install the control unit at a distance of 5m or less from the processor unit.

Note: The control unit has a cable for connection to the RCU-030. The cable connector is supplied with a plastic cover to prevent water intrusion. If this connector is not used, do not remove the cover. When using this connector, waterproofing the connection with heat-shrink tubing and vinyl tape.
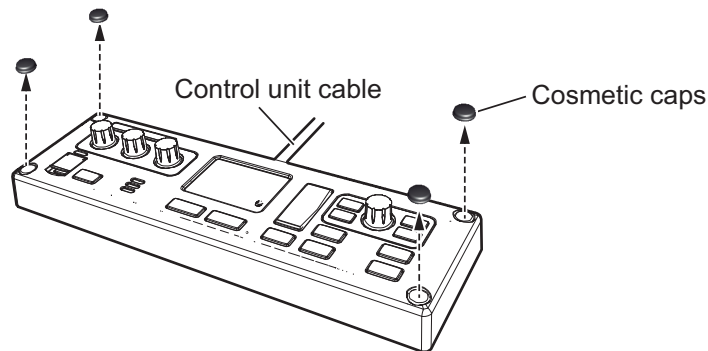
1.7.2   Mounting

There are two methods you can use to mount the control unit.

Method 1: Factory default

1. Referring to the outline drawings at the back of this manual, drill four pilot holes for the self-tapping screws.

2. Remove the four cosmetic caps from the control unit.

3. Secure the control unit to the mounting location with the supplied self-tapping screws ($\phi 4 \times 20$, four pieces).

4. Fit the cosmetics caps (removed at step 2) to the control unit.
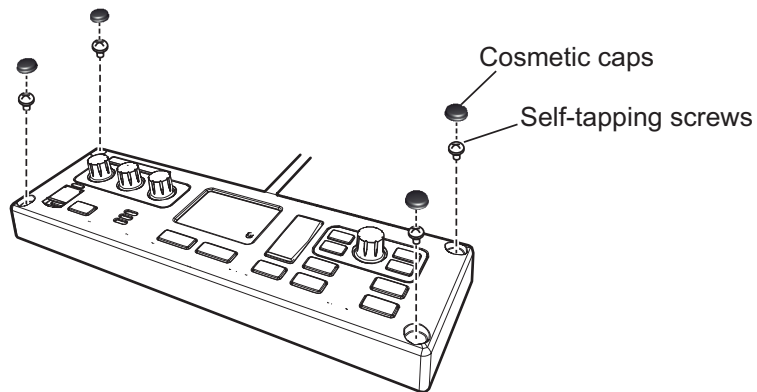

Method 2: Modified cable entry

1. Follow the steps outlined in steps 1 and 2 of "Method 1: Factory default" on page 1-12

2. Unfasten the two screws from the fixing plate at the rear of the control unit.
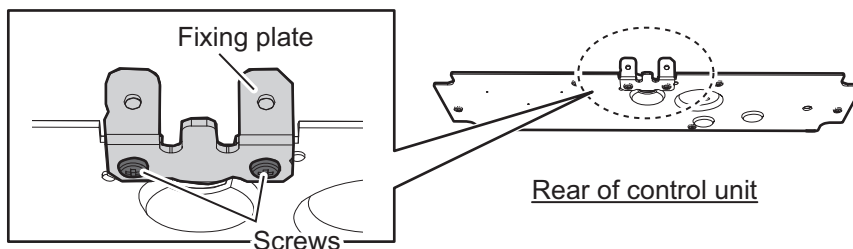

3. Adjust the cable to face the rear of the control unit.

4. Orient the fixing plate as shown in the figure below, then fix the plate in place with the two screws removed at step 2.
Check that the cable is aligned with the fixing plate and facing the rear of the control unit.

Fixing plate
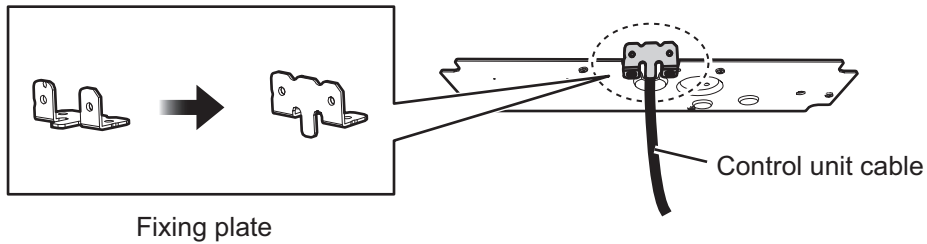
Control unit cable

5. Secure the cable to the fixing plate with a cable tie (local supply).

Cable tie
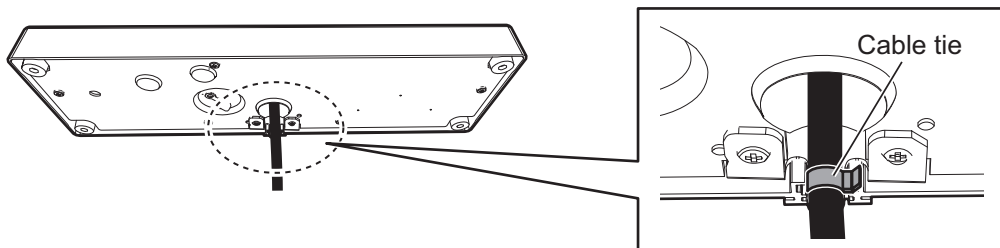
1.8 Trackball Control Unit (option)

How to mount the unit tilted

Use the desk fixing plate to mount the unit tilted on a desktop. Fasten the desk fixing plate to the bottom of the control unit. Fasten the control unit to the desktop with self-tapping screws (local supply).

Desk fixing plate
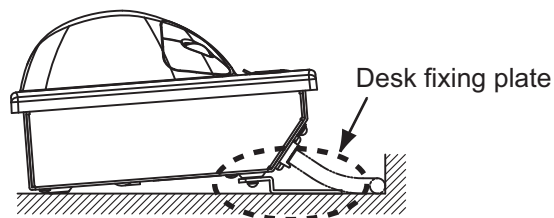
How to mount the unit flush with mounting surface

Drill four mounting holes of 5 mm in diameter in the mounting location, referring to the outline drawing at the back of this manual. Fasten the control unit with four M4 screws (local supply) from the underside of the desk.

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2. WIRING

2.1 Wiring Outline

ANTENNA UNIT

FAR-1513/1523
XN12A
XN13A

ANTENNA UNIT

FAR-1518
XN12AF
XN20AF
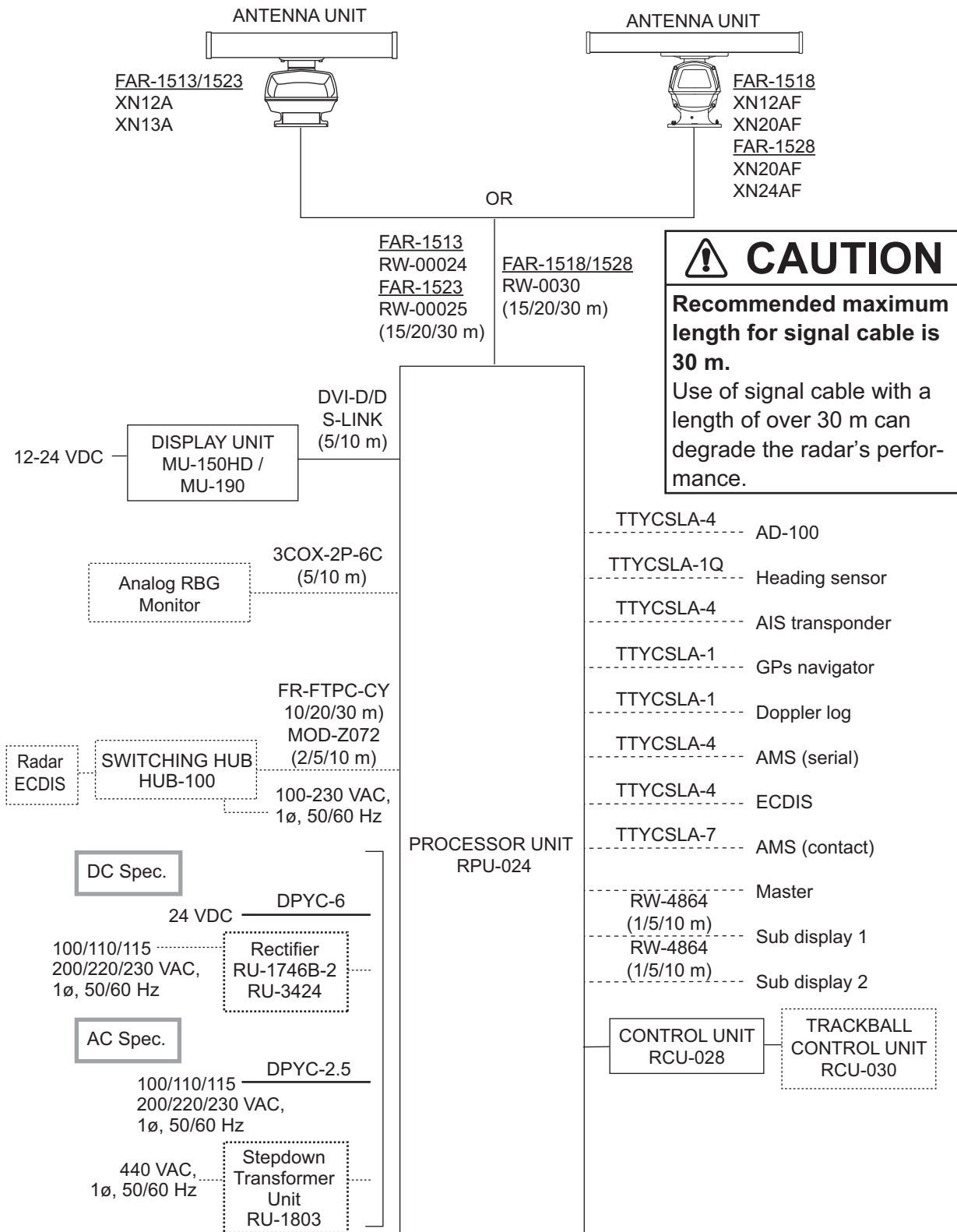FAR-1528
XN20AF
XN24AF

OR

FAR-1513
RW-00024
FAR-1523
RW-00025
(15/20/30 m)

FAR-1518/1528
RW-0030
(15/20/30 m)

⚠ **CAUTION**

Recommended maximum length for signal cable is 30 m.
Use of signal cable with a length of over 30 m can degrade the radar's performance.

DVI-D/D
S-LINK
(5/10 m)

12-24 VDC ─── DISPLAY UNIT
MU-150HD /
MU-190

3COX-2P-6C
(5/10 m)

Analog RBG
Monitor

FR-FTPC-CY
10/20/30 m)
MOD-Z072
(2/5/10 m)

Radar
ECDIS

SWITCHING HUB
HUB-100

100-230 VAC,
1ø, 50/60 Hz

DC Spec.

24 VDC   DPYC-6

100/110/115
200/220/230 VAC,
1ø, 50/60 Hz

Rectifier
RU-1746B-2
RU-3424

AC Spec.

DPYC-2.5
100/110/115
200/220/230 VAC,
1ø, 50/60 Hz

440 VAC,
1ø, 50/60 Hz

Stepdown
Transformer
Unit
RU-1803

PROCESSOR UNIT
RPU-024

TTYCSLA-4 .... AD-100

TTYCSLA-1Q .... Heading sensor

TTYCSLA-4 .... AIS transponder

TTYCSLA-1 .... GPs navigator

TTYCSLA-1 .... Doppler log

TTYCSLA-4 .... AMS (serial)

TTYCSLA-4 .... ECDIS

TTYCSLA-7 .... AMS (contact)

RW-4864 .... Master
(1/5/10 m)
.... Sub display 1
RW-4864
(1/5/10 m)
.... Sub display 2

CONTROL UNIT
RCU-028

TRACKBALL
CONTROL UNIT
RCU-030

## 2.2   How to Connect the Signal Cable for FAR-1513, FAR-1523

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

This signal is ready for connection; no fabrication is required. Connect the cable as shown below.

1.   Open the antenna cover by loosening four bolts, and then fix the stay.
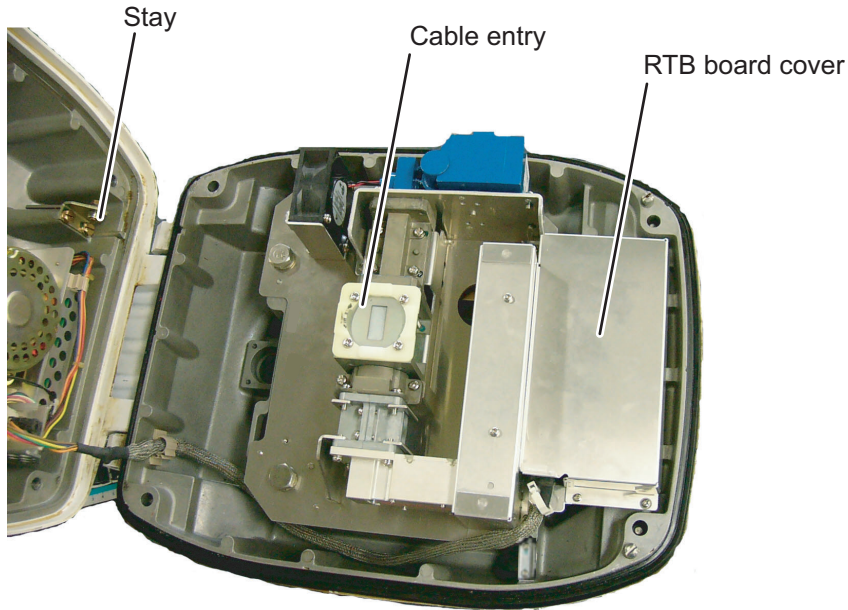
2.   Unfasten the cable gland assembly (gasket, flat washer).

3.   Pass the signal cable with connector through the bottom of the antenna unit chassis. Pass the cable through the gland assembly as shown below.
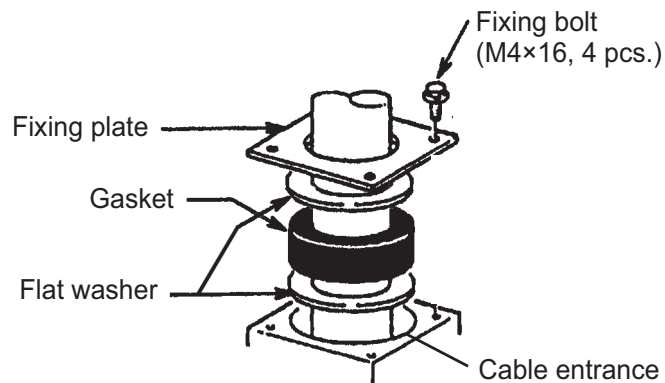

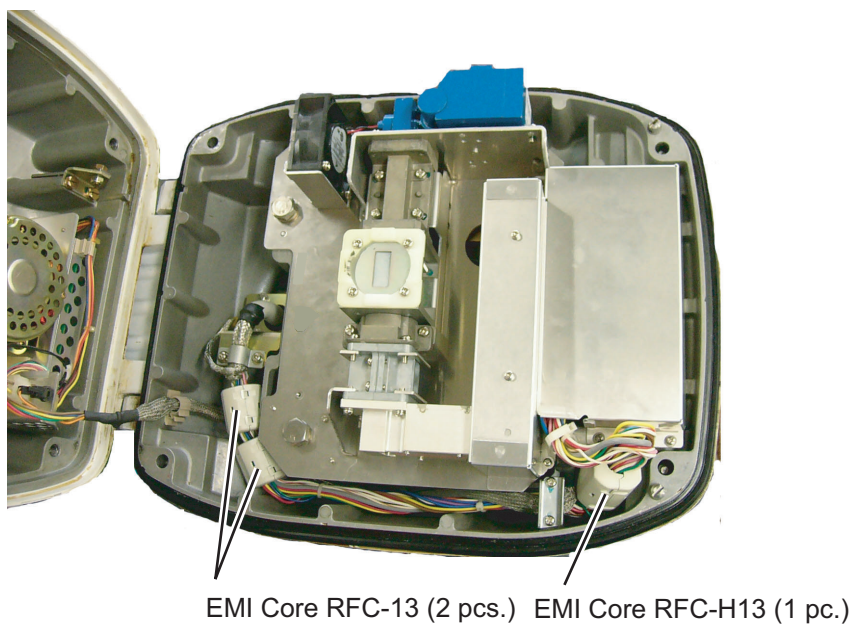4.   Fasten the fixing plate with four bolts.

5. Referring to the figure below, fasten the crimp-on lug on the shield to one of the fixing bolts of the cable gland assembly.

Signal cable

Fasten shield to screw.

Gasket
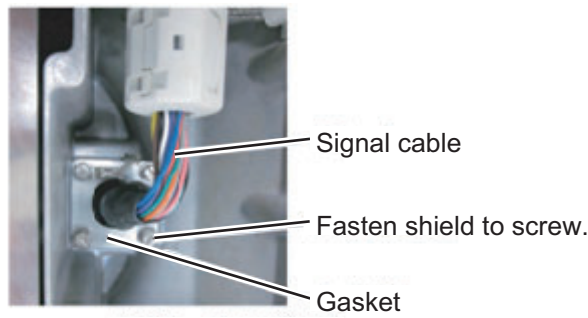
6. Unfasten the four screws fixing the RTB cover. Slide the cover to access the RTB board.

7. Connect the plugs of the signal cable to the RTB board.

RTB board

J820

J823

J824

J821
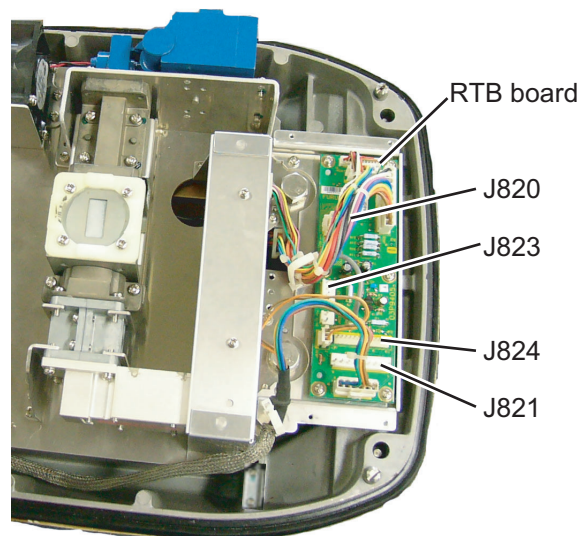
8. Close the RTB board cover.

9. Attach three EMI cores to the signal cable at the locations shown below.

EMI Core RFC-13 (2 pcs.) EMI Core RFC-H13 (1 pc.)
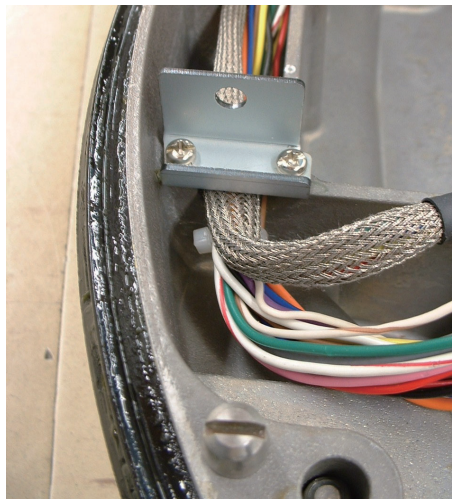
10. Fasten the signal cable with the cable clamp as follows.

a) Dismount the cable clamping plate and remove the clamp and cushion.

Remove cushion.

Remove clamp.
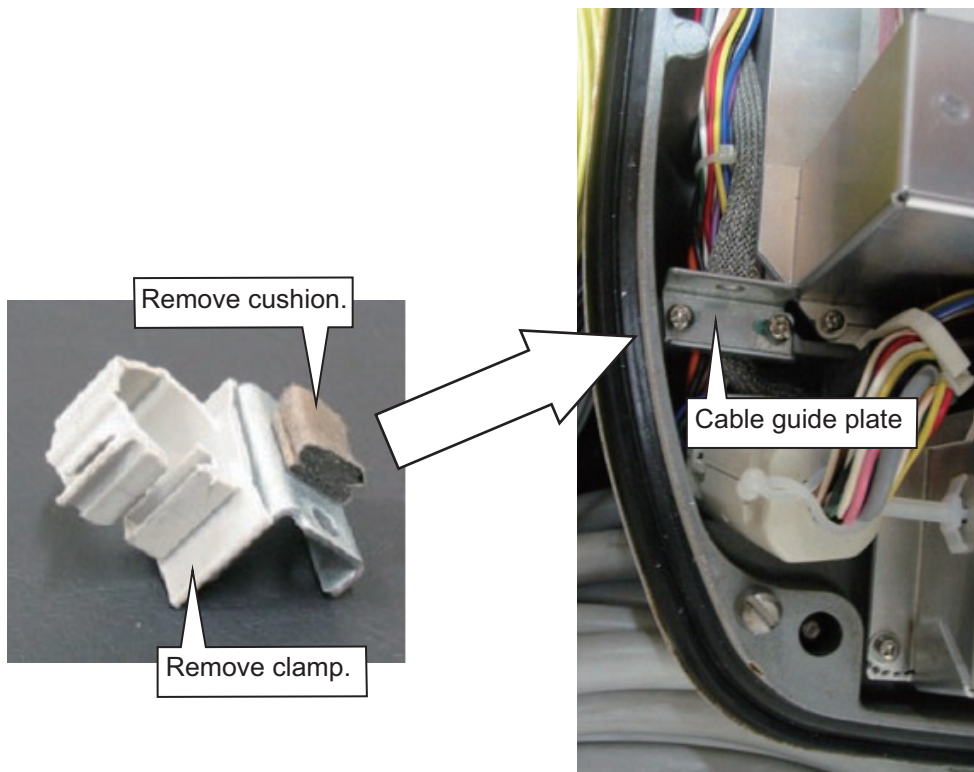
Cable guide plate

b) Pass the signal cable through the cable channel, then refasten the cable guide plate

c) Fasten the signal cable with the cable clamp as shown below.

Cable clamp

RTB board cover

Top view
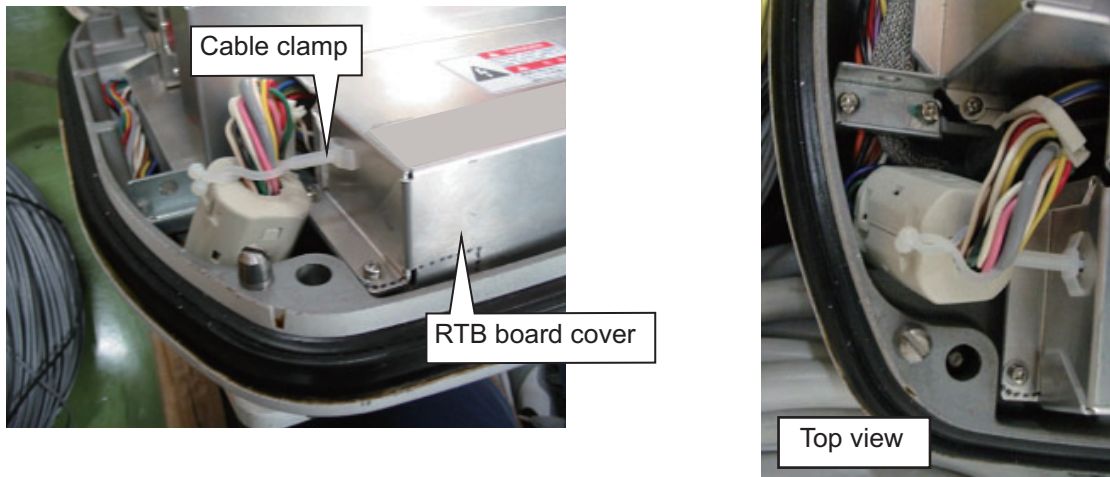
11. Release the stay and close the cover. Loosely fasten the fixing bolts; you will have to make some adjustments inside after completion of wiring.

Note: When closing the cover, set the gaskets to the grooves in the bottom chassis, then tighten the fixing bolts.

Bottom chassis

Groove

Gasket

Fixing bolt
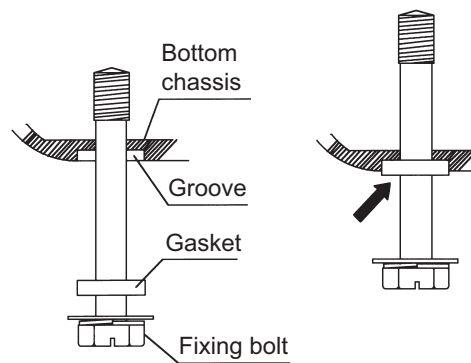
Torque : 9.8 ±0.1 Nm

2.3   How to Connect the Signal Cable for FAR-1518, FAR-1528

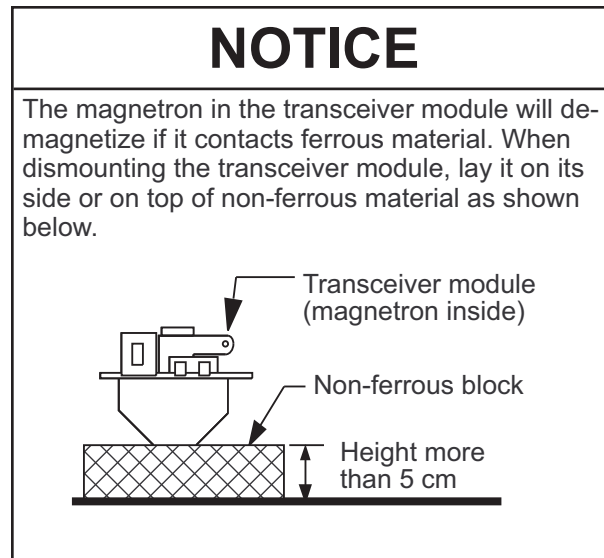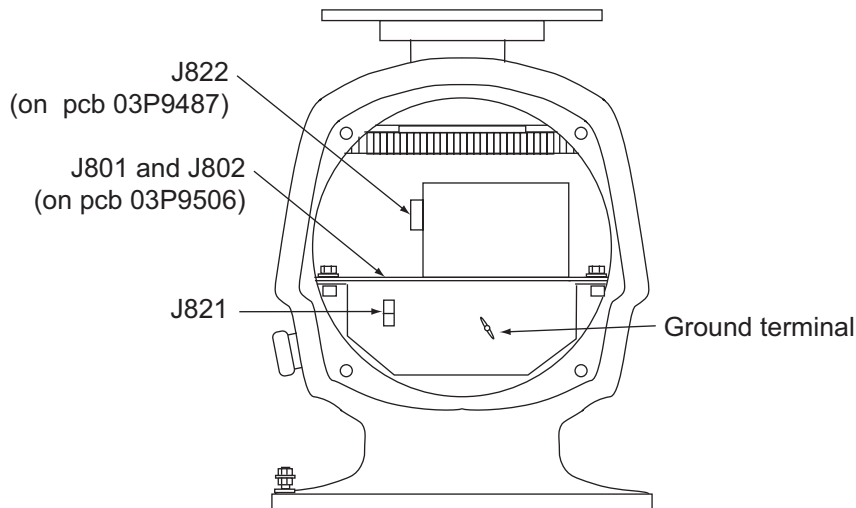In order to minimize the chance of picking up electrical interference, avoid where possible routing the signal cable near other onboard electrical equipment. Also, avoid running the cable in parallel with power cables.

NOTICE

The magnetron in the transceiver module will demagnetize if it contacts ferrous material. When dismounting the transceiver module, lay it on its side or on top of non-ferrous material as shown below.

Transceiver module (magnetron inside)

Non-ferrous block

Height more than 5 cm

1.   Open the antenna cover.

2.   Disconnect the plugs P821, P822, P801 and P802.

J822
(on pcb 03P9487)

J801 and J802
(on pcb 03P9506)

J821

Ground terminal

3.   Unfasten two bolts to dismount the transceiver module. Remove the transceiver module.

4.   Unfasten the four fixing bolts on the cable gland at the base of the antenna unit. Remove clamping ring, rubber gasket and flat washers. Save them for later use.

5.   Pass the signal cable through the cable entry hole in the antenna unit mounting platform. Trim the cable to 500 mm length from the cable gland.

6. Slide flat washers, rubber gasket and clamping ring onto the cable in the order shown below.
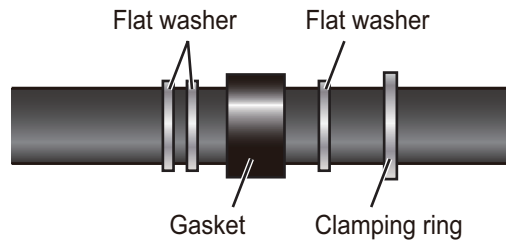
7. Fabricate the signal cable as shown below.

1) Remove the vinyl sheath 500 mm.

2) Trim the armor and vinyl sheath (inner) so their lengths are 10 mm and 20 mm, respectively. Unravel the shield to expose the cable cores.

3) Make the length of the cable cores 430 mm.

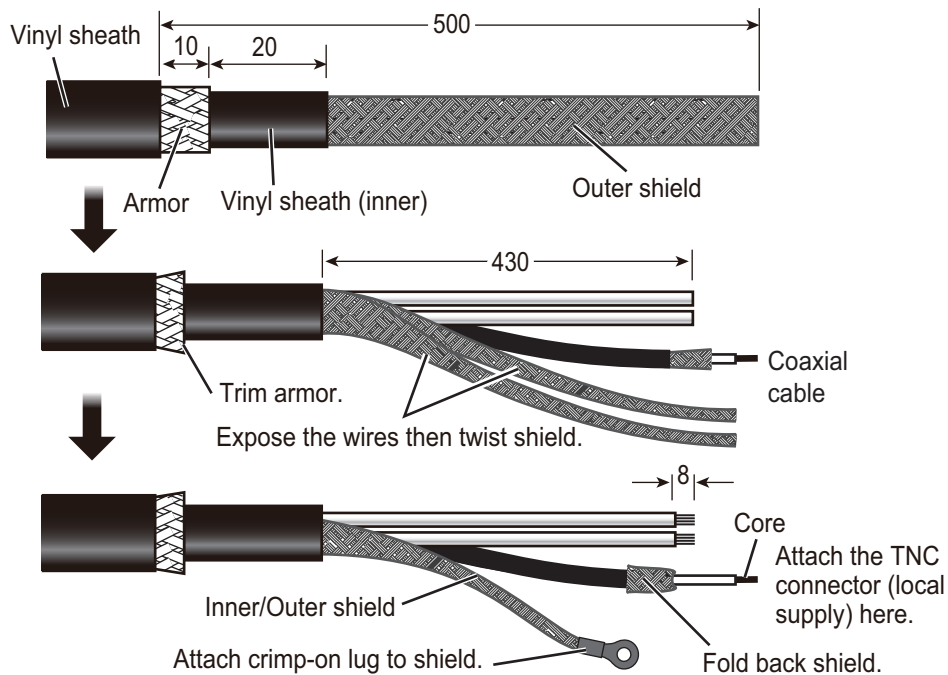4) Make the lengths of the inner and outer shields 510 mm. Twist the inner and outer shields together and attach crimp-on lug FV5.5-4 (yellow, ϕ4).

5) Remove insulation of each core except the coaxial cable approx. 8 mm.

6) Make the length of the core of the coaxial cable approx. 10 mm. Fold back shield onto the coaxial cable.

8. Pass the shield between the clamping ring and the washer as shown below. Fasten the clamping ring with the screws.
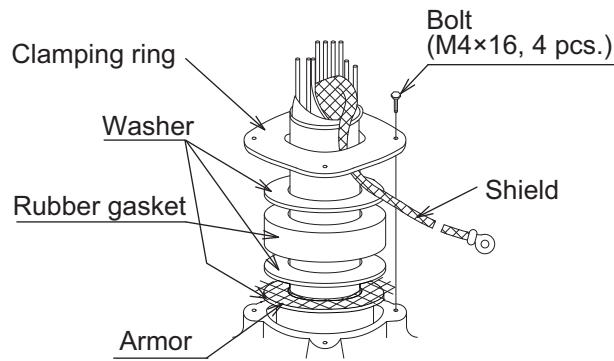
9. Connect the signal cable to TB801, TB802 and TB803 on the RF board (03P9488), referring to the interconnection diagram.

How to connect wires to WAGO connector

Press downward.
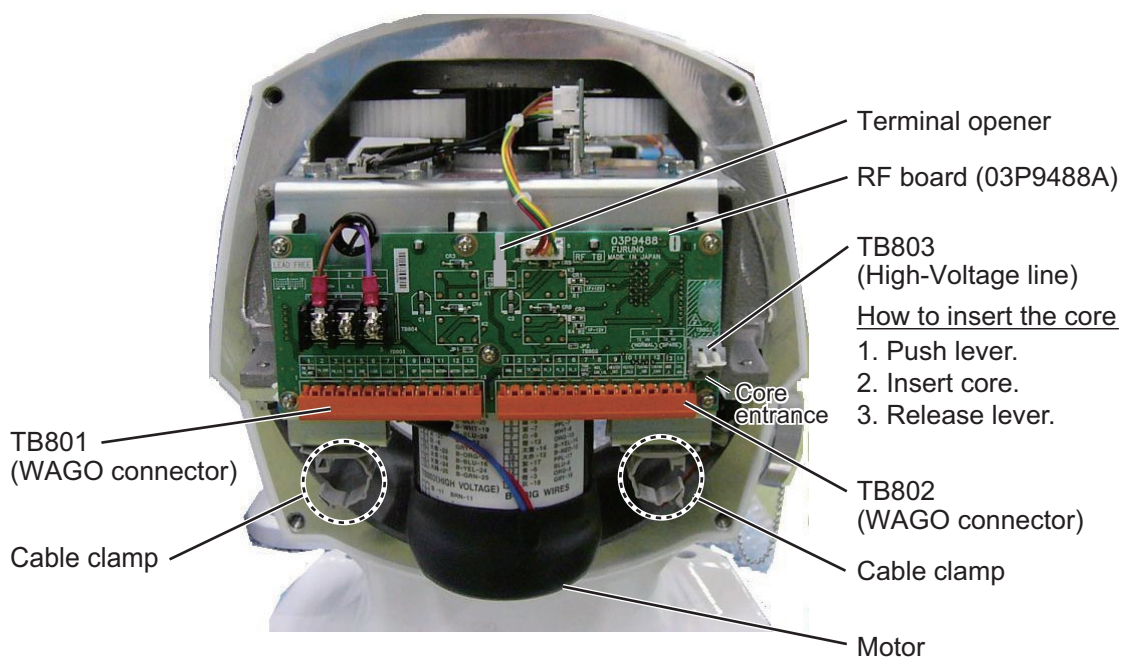
Terminal opener

Wire

Twist

WAGO connector
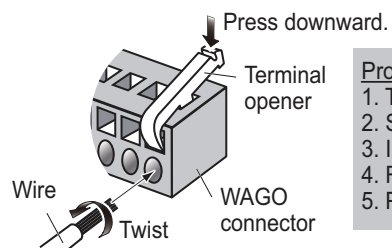
Procedure
1. Twist the core.
2. Set terminal opener and press it downward.
3. Insert the core into hole.
4. Remove the terminal opener.
5. Pull the wire to confirm that it is secure.

2. WIRING

10. Pass the coaxial cable under the transceiver fixing plate (arrow) and the clamp (dashed circle).
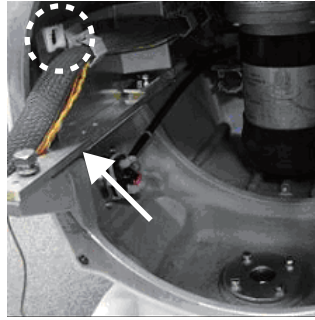
11. Detach the junction box from the transceiver unit.

Junction box

Coaxial cable
entrance

Transceiver unit

Fixing
screw

Core-fixing screw

Shield-fixing clamp
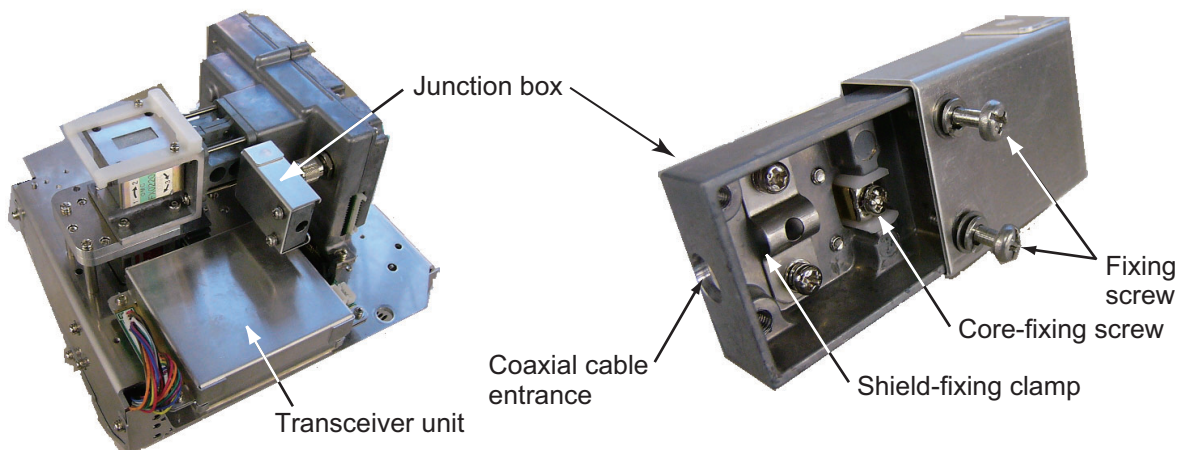
12. Loosen the two screws on the junction box, then slide the cover to open the box. Connect the coaxial cable as shown below.

Position shield beneath clamp.

Fasten core.
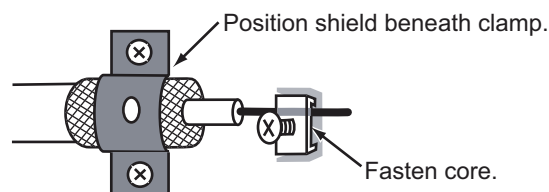
13. Close the junction box and tighten the screws. Reattach the box to the transceiver unit.

14. Reconnect the plugs disconnected at step 2.

15. Set the transceiver module to the antenna unit and push the module in until it stops. Tighten the fixing bolts. **Be sure to push in the transceiver unit until it stops. Failure to do so may cause microwave leakage**.

16. Fasten the shield wire to the wing nut on the transceiver module.

17. Confirm that all screws are tightened and all wiring is properly made. Confirm that the waterproofing gasket, bolts and tapping holes of the antenna unit are coated with silicone grease.

18. Close the antenna unit cover.

2.4 Processor Unit

The illustration below is the AC specification unit. The DC specification unit does not have the fuse.

Power cable
DC power: DPYC-6
AC power: DPYC-2.5

TTYCSLA, antenna, control unit and RW-4864 cables (For clamping positions, see the sticker on the reverse side of the cover.)
* For the antenna cable of the FAR-15x8, remove the spacer to insert the cable.

MAIN SW

FUSE 8A

RGB cable (option) (to external monitor)

Ground terminal
(Use IV-8sq., local supply)

SD card slot

DVI-D cable
(5 m, to Monitor Unit)

USB connector
(No use.)

LAN cable (UTP, CAT5e, local supply)
(to other radar or HUB switch)
(Fasten the cable to the post below the connector with a cable tie.)

2.4.1 How to fabricate the power cable

1. Remove the armor of the cable by the amount shown in the figure below.

2. Remove the insulation of the cores 10 mm.

3. Fix crimp-on lugs (FV5.5-4, yellow, supplied) to the cores. Cover the end of the armor with vinyl tape. Lay the cable in the cable clamp on the cable entry side of the processor unit. Fasten the cable clamp.

4. Fasten the crimp-on lugs to the terminal block inside the unit, referring to the interconnection diagram at the back of this manual.

DC power: DPYC-6
AC power: DPYC-2.5

DC: 60 mm
AC: 50 mm

Armor

10

Taping
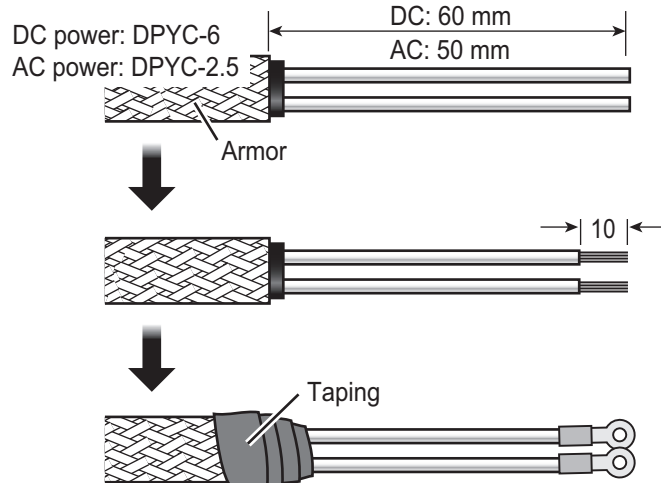
2.4.2 How to fabricate signal cable, cables from external equipment

Signal cable for FAR-1518, FAR-1528

Vinyl sheath

60

300

8

Armor Inner sheath Expose wires then twist shield.

Coaxial cable

Wind the shields onto the armor.

Core

Fold back shield.

Vinyl tape

Set the shields in cable clamp.

Core
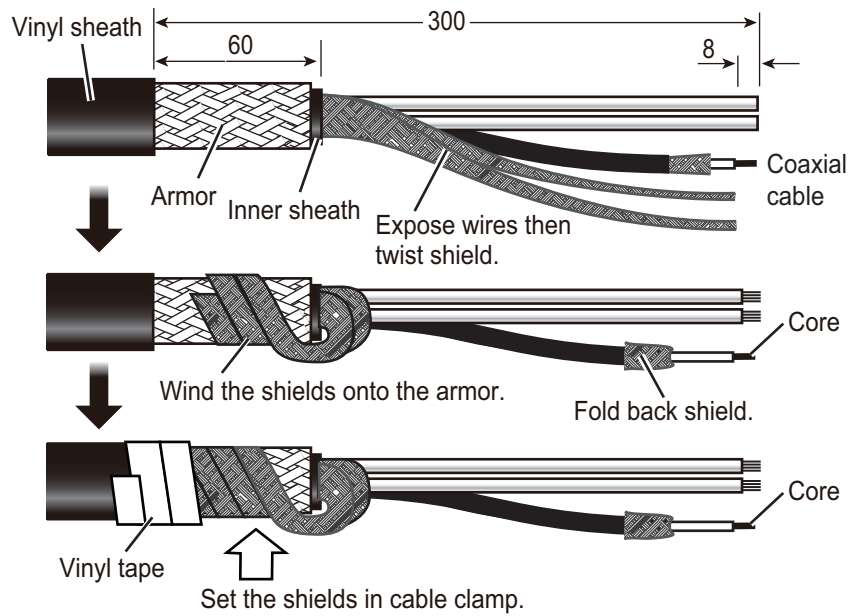
Signal cable for FAR-1513, FAR-1523

This cable is ready for connection; no fabrication is required.

TTYCS, TTYCSLA cables (for external equipment)

For lengths, see the table on the next page

How to fabricate the TTYCS series cable

Armor

L1

L2

Shield

Vinyl tape

Expose cores, then wind
shield around the armor.

6

Secure tape with cable
tie (supplied).

Set this part in cable clamp.
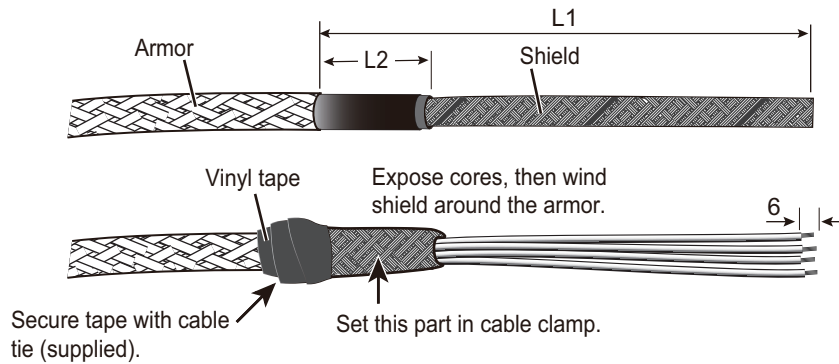
How to fabricate the TTYCSLA series cable

Armor

L1

L2

6

Sheath

Drain wire

5

L3

Vinyl tape

Secure tape with cable
tie (supplied).

Set this part in cable clamp.

Crimp-on lug

Pass the heat-resistant tubing (supplied) onto the
drain wire. Attach a crimp-on lug (preattached to the
processor unit) to the drain wire. Fasten the
crimp-on lug to its original location.

How to connect wires to WAGO connector

Press downward.
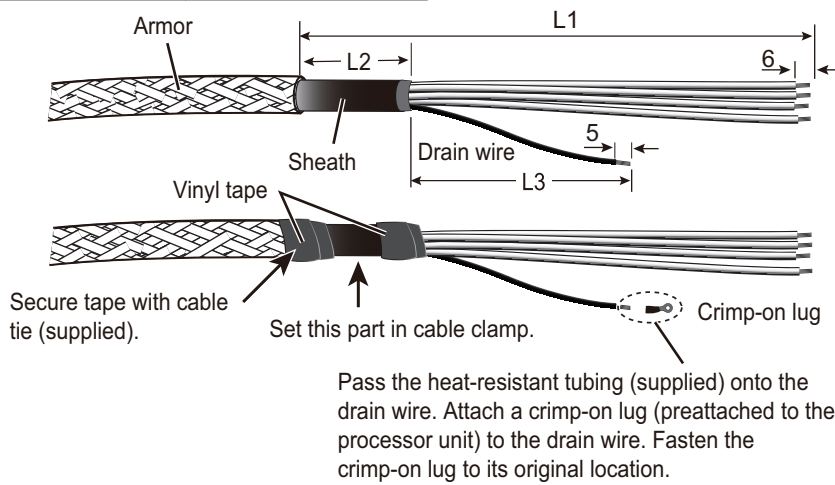
Terminal
opener

WAGO connector
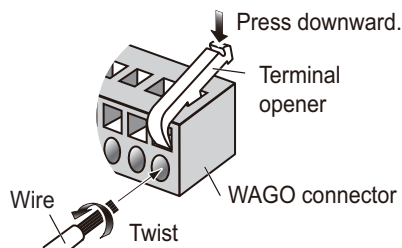
Wire

Twist

<Procedure>
1. Twist the cores.
2. Press the terminal opener downward.
3. Insert the wire into the hole.
4. Remove the terminal opener.
5. Pull the wire to confirm that it is secure.

Connector, cable and lengths (L1, L2 and L3)

Connector No.	Cable type	L1	L2	L3
J613 (Ext. alarm contact signal)	TTYCSLA-7	300	70	150
J614 (HDG)	TTYCSLA-1Q	250	70	150
J615 (AIS)	TTYCSLA-4	200	70	200
J616 (GPS), J617 (LOG)	TTYCSLA-1	200	70	200
J618/J619/J620 (AMS/ECDIS/AD-10)	TTYCSLA-4	200	70	200

LAN cable

If the LAN cable is not fitted with an RJ-45 connector, attach one as shown below. Connect the cable to J202 (on the outside of the processor unit.)

1

Expose inner vinyl sheath.

2

25 mm

Remove the outer sheath by approx 25 mm. Be careful not to damage inner shield and cores.

3

approx. 9 mm

Fold back the shield, wrap it onto the outer sheath and cut it, leaving 9 mm.

4

approx. 9 mm
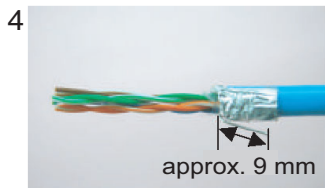
Fold back drain wire and cut it, leaving 9 mm.

5

approx. 11 mm
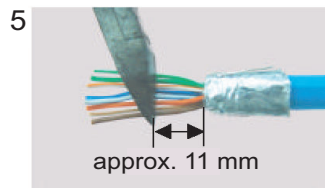
Straighten and flatten the core in order and cut them, leaving 11 mm.
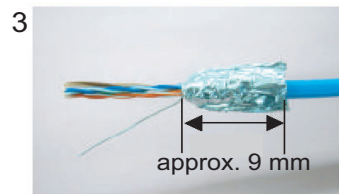
6

Drain wire

Insert the cable into the modular plug so that the folded part of the shield enters into the plug housing. The drain wire should be located on the tab side of the jack.

7

Using special crimping tool MPT5-8AS (PANDUIT CORP.), crimp the modular plug. Finally check the plug visually.
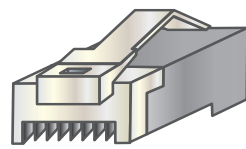
Modular plug

1   8   [Crossover cable]

①WHT/GRN	—	WHT/ORG①
② GRN	✕	ORG ②
③WHT/ORG		WHT/GRN③
④ BLU	—	BLU ④
⑤WHT/BLE		WHT/BLE⑤
⑥ ORG	✕	GRN ⑥
⑦WHT/BRN	—	WHT/BRN⑦
⑧ BRN	—	BRN ⑧

[Straight cable]

①WHT/ORG		WHT/ORG①
② ORG		ORG ②
③WHT/GRN		WHT/GRN③
④ BLU		BLU ④
⑤WHT/BLE		WHT/BLE⑤
⑥ GRN		GRN ⑥
⑦WHT/BRN		WHT/BRN⑦
⑧ BRN		BRN ⑧

2.4.3   Cable for sub display unit (RW-4864)

Two sub display units can be connected to this radar when it functions as the main radar. Use the optional cable RW-4864 to connect the sub display unit to the main radar. Connect the no. 1 sub display unit to J612; the no. 2 sub display unit to J611.

2.4.4   Where to connect cables inside the processor unit

Connect the antenna cable and the cables of external equipment to the FRP_TB board (03P9601) inside the processor unit as shown below.

*1 Attach these crimp-on lugs to drain wire of TTYCLSA cables and fasten drain wires here.

*2 Connect the TX HV line here. For the FAR-1513, FAR-1523, cut the TX-HV lines at the base of the connector and connect them here.

*3 Fasten the bare conductor. Do not use a crimp-on lug to make the connection, to prevent contact resistance from increasing.

Fasten shield with clamp.

Fasten conductor with screw.

2.4.5 How to install the optional processor unit IPX2 kit

The optional processor unit IPX2 kit (OP03-238) has two rainproofing covers that protect the cables and connectors of the processor unit to waterproofing standard IPX2.

Name	Type	Code no.	Qty
Rainproof Cover 2	03-186-1104	100-401-840-10	1
Rainproof Cover	03-186-1105	100-401-850-10	1

Note: The installation also uses the blind seal that is supplied with the processor unit installation materials.

How to attach the Rainproof Cover 2

1. Unfasten the two screws circled in the figure below.
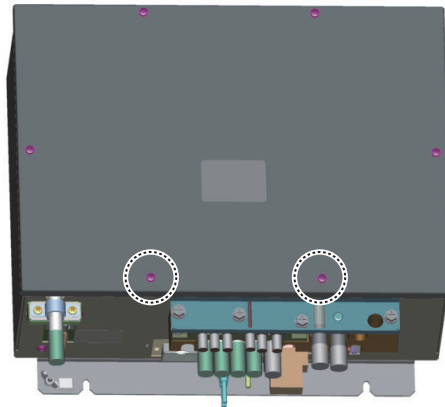
2. Fasten the Rainproof Cover 2 (03-186-1104) with the two screws unfastened at step 1.
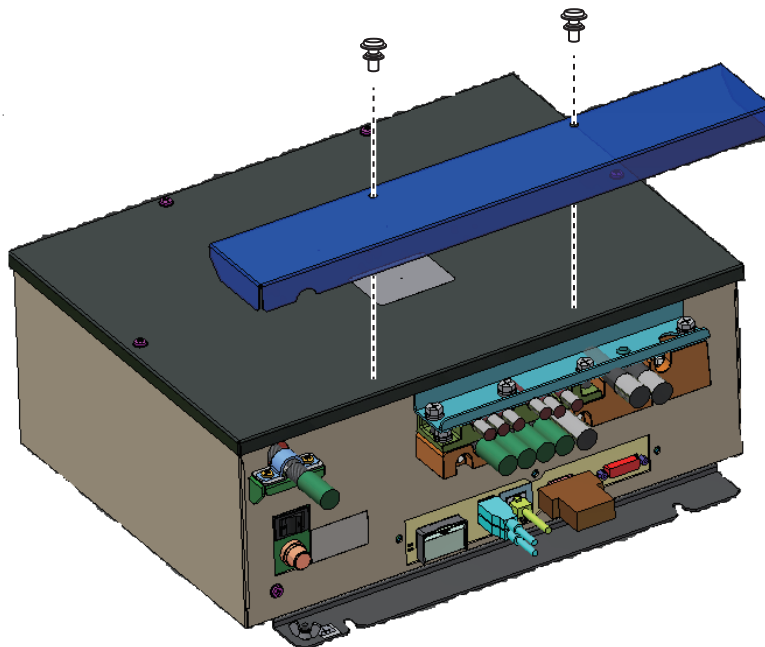
How to attach the Rainproof Cover

1. Unfasten the three screws circled in the figure below.
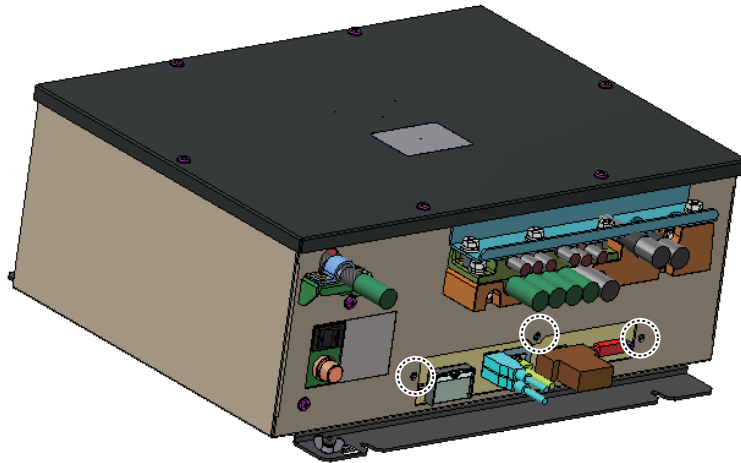
2. Fasten the Rainproof Cover (03-186-1105) with the three screws unfastened at step 1.
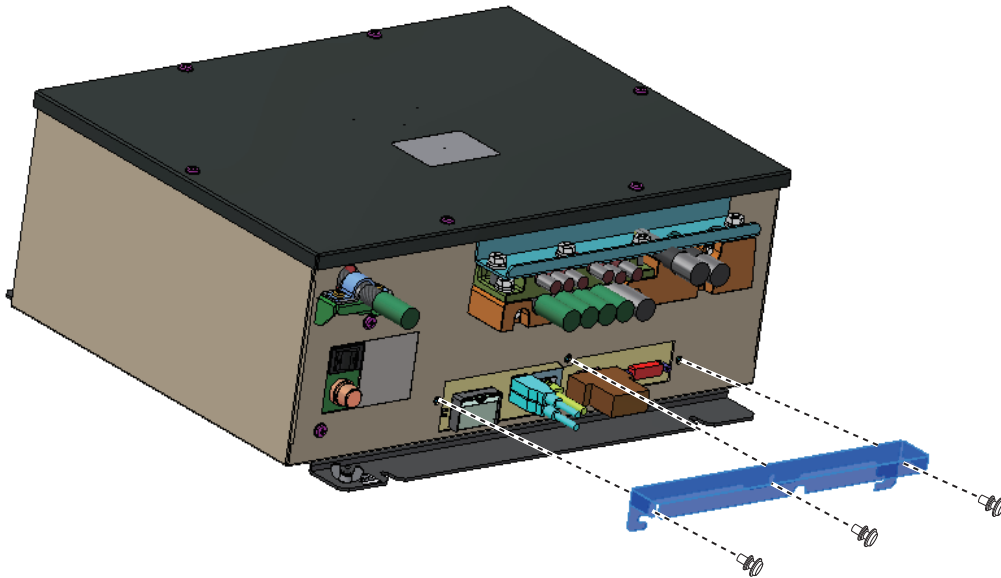
How to attach the blind seal

Attach the blind seal over the hole on the rear side of the unit.

Blind
seal
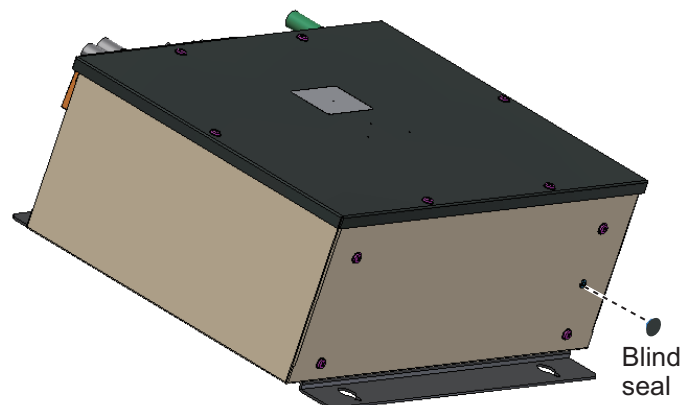
2.5   Trackball Control Unit

Connect the cable from the control unit to the cable on the trackball control unit. Cover the junction with heat shrink tubing, then heat. Cover the heat shrink tubing with vinyl tape.

Connect cables, cover junction with heat shrink tubing, then heat.
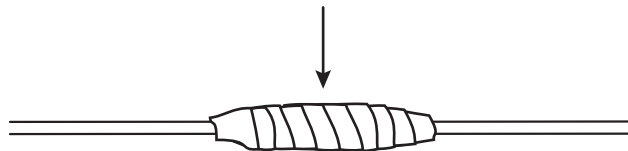
Cover with vinyl tape.

2.6 VDR Connection

The processor unit has an RGB port for connection of a VDR. Use the optional RGB cable (3COX-2P-6C 5m/10m) to connect the VDR.

About the RBG port

- The RGB port and DVI port have their own circuits. This prevents interruption of the radar picture shown on the main monitor connected to the DVI port, if a fault condition occurs at the RGB port.

- The processor unit continuously outputs video signals from its DVI and RGB ports. The operator cannot stop the output.

2.7 Shuttle Ferry Mode

Shuttle ferry mode allows the user to change the screen orientation by 180°. This more requires an external switch (local supply and install) and the following connection must be made to the FRP_TB board (03P9601) in the processor unit.

Connect a short-circuit switch to the 1/3 and 2/4 pins on the J609 connector on the FRP_TB board (XN10P connector required, supplied locally), referring to the figure below.
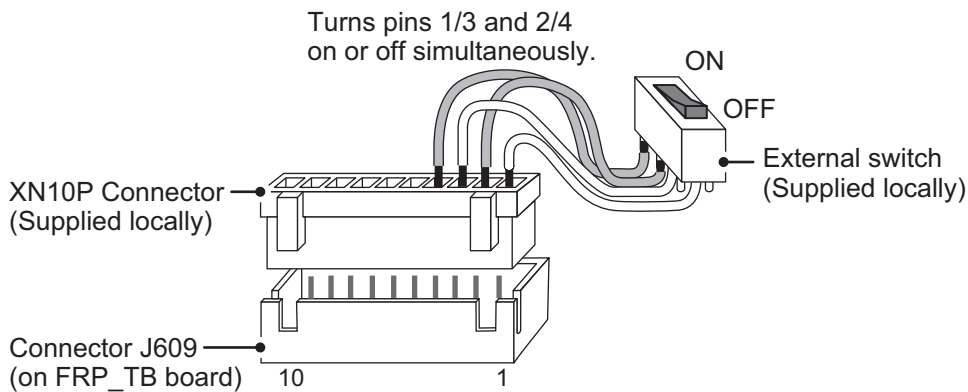
3.   ADJUSTMENTS

Note: After completing the settings and adjustments, copy the setting data to a SD-card (SD card slot is at the back of the processor unit), referring to section 1.51 in the Operator's Manual. This will allow easy restoration of setting data after the SPU Board is replaced, etc.

At the first power up after installation, open the protected menus to adjust the radar. Follow the procedures in this chapter, in the order shown, to complete the adjustment.

Below are the controls on the control unit that are used to make the adjustments.
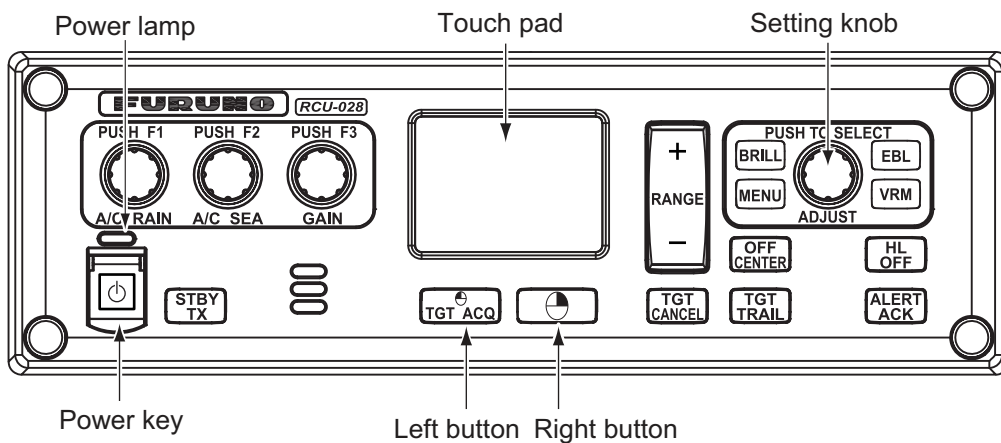
3.1   How to Open the Radar Installation Menu

The [RADAR INSTALLATION] menu has the items for adjustment of the radar. Do the following to access this menu.

1.   Open the cover of the power switch and press the switch to turn on the radar.

2.   Press the **MENU** key five times while pressing the **HL OFF** key to open the [RADAR INSTALLATION] menu.

```
[RADAR INSTALLATION]
                    (1/2)

1    BACK
2    [ECHO ADJUST]
3    [OWN SHIP INFO]
4    [SCANNER]
5    [INSTALLATION]
6    [TT PRESET]
7    [BAUD RATE]
8    [ALERT I/F]
9    [INPUT PORT]




0    [NEXT]
```
Page 1

```
[RADAR INSTALLATION]
                    (2/2)

1    BACK
2    [OTHERS]
```
Page 2
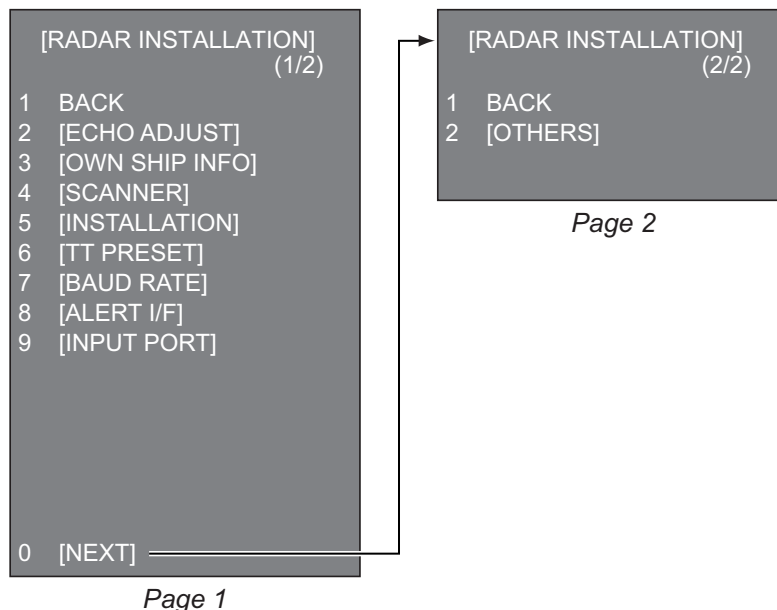
3.2 How to Use the Menu

1. Press the **MENU** key to open the main menu.

```
[MAIN MENU]

1   [ECHO]
2   [MARK]
3   [NAVTOOL]
4   [ALERT]
5   [TT•AIS]
6   [FILES]
7   [INFORMATION BOX]
8   [NAV LINE•WPT]
9   [INITIAL SETTING]
0   [RADAR INSTALLATION]
```
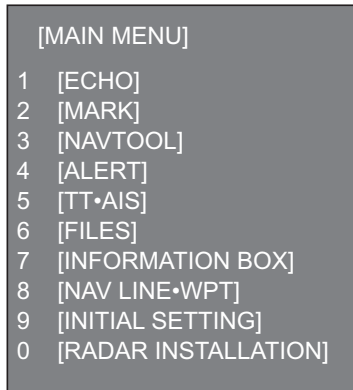
2. Operate the Setting knob to select a menu then push the knob.

3. Operate the Setting knob to select a menu item then push the knob.

4. Operate the Setting knob to select a menu option then push the knob.

5. If the menu option requires entry of numeric data, rotate the setting knob to set then push the knob. The knob can also be long-pushed to set a numeric. Each push increments the numeric by one.

3.3 How to Initialize Tuning

1. Open the main menu.

2. Open the [ECHO] menu.

```
[ECHO]

1   BACK
2   2nd ECHO REJ
    OFF/ON
3   TUNE INITIALIZE
4   PERFORMANCE MON
    OFF/ON
5   PM ARC
    2/3/5/6
6   SART
    OFF/ON
7   ECHO AREA              ← Appears with non-IMO
    CIRCLE/WIDE/             specification.
    ALL/SIMPLE
8   WIPER
    OFF/1/2
9   [ACE]
0   [CUSTOM SELECT]
```
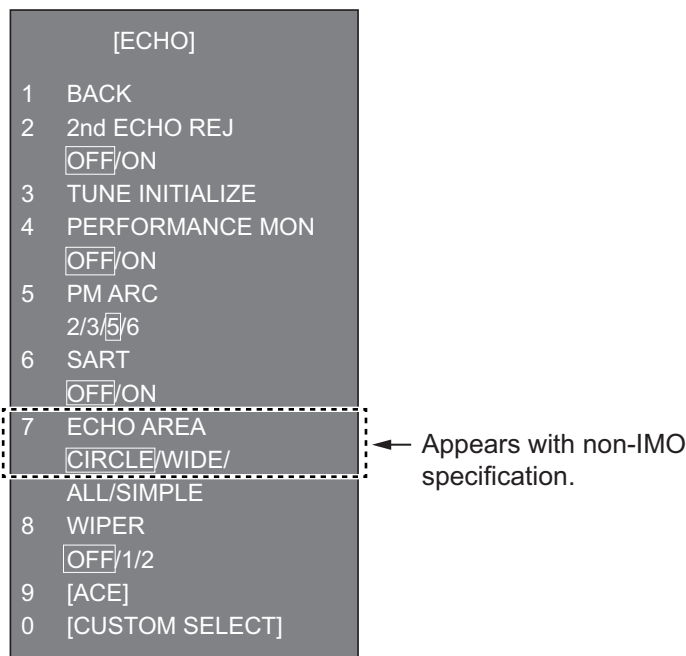
3. Select [TUNE INITIALIZE], then press the Left button.
   The indication "TUNE INITIALIZE" appears on the screen during the initialization.

4. After the tuning is completed, press the Right button twice to close the menu.

3.4 How to Align the 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 this error.
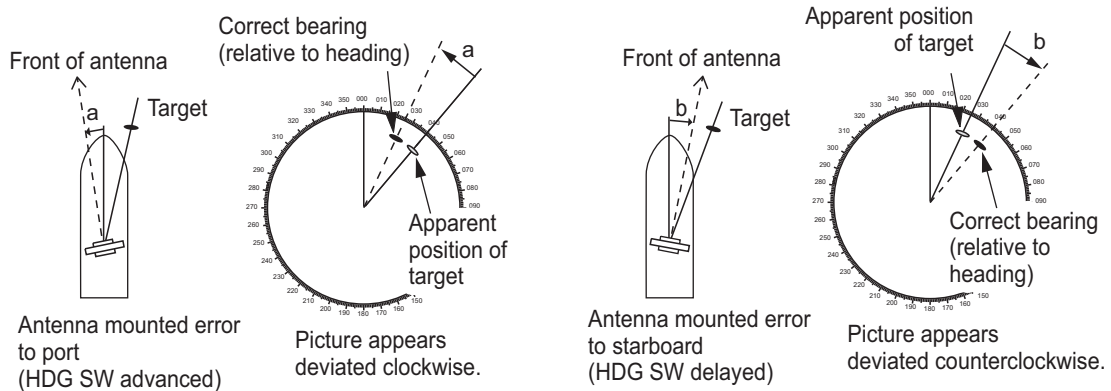
1. Select a stationary target echo at a range between 0.125 and 0.25 NM, preferably near the heading line.

2. Press the **EBL** key to turn on the EBL. Rotate the Setting knob to pass the EBL through the center of the target echo.

3. Read the target bearing.

4. Measure the bearing of the stationary target on the navigation chart and calculate the difference between the actual bearing and apparent bearing on the radar screen.

5. Open the [RADAR INSTALLATION] menu, then open the [ECHO ADJUST] menu.

```
[ECHO ADJUST]

1   BACK
2   VIDEO ADJ
    MAN/AUTO
3   VIDEO ADJ VALUE
     30
4   HD ALIGN
    000.0°
5   TIMING ADJ
    MAN/AUTO
6   TIMING ADJ VALUE
     200
7   MBS LEVEL
      0
```
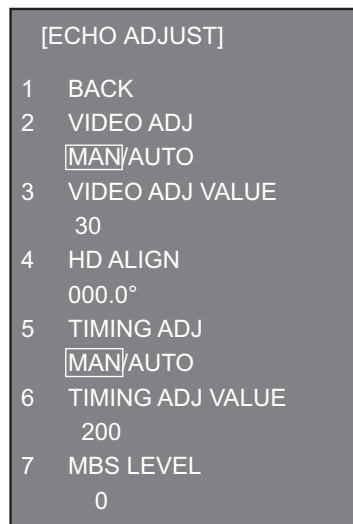
6. Select [HD ALIGN], then enter the bearing difference measured at step 4. The setting range is 0 to 359.9 degrees.

7. Confirm that the target echo is displayed at the correct bearing on the screen.

3.5   How to Adjust Sweep Timing

Sweep timing differs with respect to the length of the signal cable between the antenna unit and the processor unit. Adjust sweep timing at installation to prevent the following symptoms:

* The echo of a "straight" target (for example, pier), on the 0.25 NM range, will appear on the display as being pulled inward or pushed outward. See the figures below.
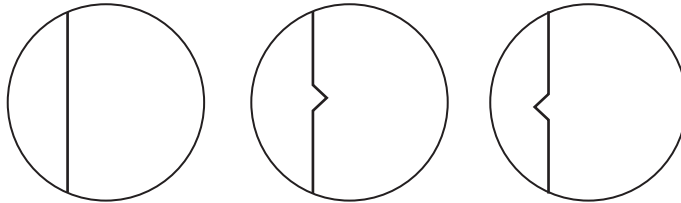
(1) Correct   (2) Target pushed inward   (3) Target pushed outward

* The range of target echoes is incorrect.

1. Set the **GAIN**, **A/C SEA** and **A/C RAIN** controls as shown below.
    GAIN: 80
    A/C SEA: Fully counterclockwise (OFF)
    A/C RAIN: Fully counterclockwise (OFF)

2. Open the [RADAR INSTALLATION] menu, then open the [ECHO ADJUST] menu.

3. Set [TIMING ADJ] to [AUTO] to activate the automatic adjustment, which takes approx. two minutes.

4. After the adjustment is completed, set the radar to the minimum range. Confirm that no echoes are "missing" at the center of the radar screen.
    If echoes are missing, set [TIMING ADJ] to [MAN]. Select [TIMING ADJ VALUE], then use the Setting knob to adjust the timing manually.

3.6   How to Suppress Main Bang

If main bang appears (a red ring at the screen center), suppress it as follows.

1. Transmit the radar on a long range and then wait 10 minutes.

2. Adjust the gain to show a slight amount of noise on the display.

3. Select the 0.125 NM range, then adjust the **A/C SEA** and **A/C RAIN** controls.

4. Go to the [RADAR INSTALLATION] menu, then open the [ECHO ADJUST] menu.

5. Select [MBS LEVEL], then use the Setting knob to enter a value that causes the main bang to faintly disappear. The setting range is 0 to 255.

3.7 RADAR INSTALLATION Menu

This section provides descriptions of the [RADAR INSTALLATION] menu items not previously mentioned.

3.7.1 OWN SHIP INFO menu

Enter the length and width of the ship, and scanner, GPS antenna and conning positions, referring to the description and figure below.

Note: This radar uses the CCRP=CONNING POSITION and ANT=SCANNER POSITION as the reference points for measurements and calculations. The commissioning engineer should understand this point, and enter own ship information accordingly.

```
[OWN SHIP INFO]

1  BACK
2  LENGTH/WIDTH
   LENGTH  0m
   WIDTH   0m
3  SCANNER POSITION
   BOW     0m
   PORT    0m
4  GPS1 ANT POSITION
   BOW     0m
   PORT    0m
5  GPS2 ANT POSITION
   BOW     0m
   PORT    0m
6  CONNING POSITION
   BOW     0m
   PORT    0m
```

Example

L1: Ship length
W1: Ship width
L2: Conning position (from bow)
W2: Conning position (from port)
L3: Scanner position (from bow)
W3: Scanner position (from port)
L4: GPS antenna position (from bow)
W4: GPS antenna position (from port)
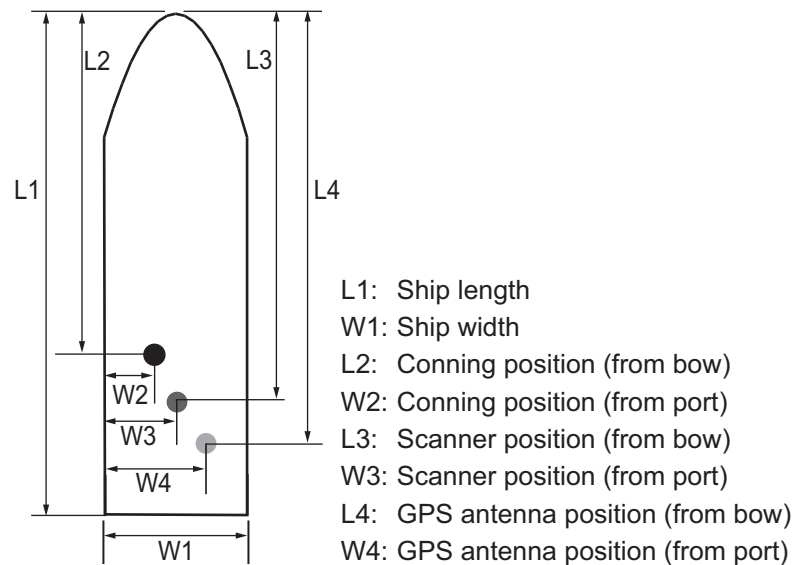
[LENGTH/WIDTH]: Enter the ship's length and width.

[SCANNER POSITION]: Enter the distance from the scanner to both bow and port.

[GPS 1 ANT POSITION]: Enter the distance from the GPS antenna to both bow and port. If a 2nd GPS antenna is installed, enter its position in [GPS 2 ANT POSITION].

[CONNING POSITION]: Enter the distance from the conning position to both bow and port.

3.7.2   INSTALLATION menu

```
[INSTALLATION 1/2]                    [INSTALLATION 2/2]

1   BACK                              1   BACK
2   IP ADDRESS                        2   ON TIME
    172.031.003.017                       000000.0H
3   RANGE UNIT                        3   TX TIME
    NM/km/SM                              000000.0H
4   RADAR NO                          4   PM GAIN ADJ
    1/2/3/4                               MAN/AUTO
5   RADAR POSITION                        255
    FORE/MAIN-TOP/
    MAIN-2ND/MAIN-3RD/
    AFT/PORT/STARBOARD
6   MODEL
    FAR-1513/FAR-1523/
    FAR-1518/FAR-1528
7   TYPE
    IMO/Non-IMO/R



0   NEXT
```

[IP ADDRESS]: Enter IP address. The default address is 172.031.003.017.

[RANGE UNIT]: Select the unit of range measurement, among [NM], [km], or [SM].

[RADAR NO]: Select the radar number - 1, 2, 3, or 4.

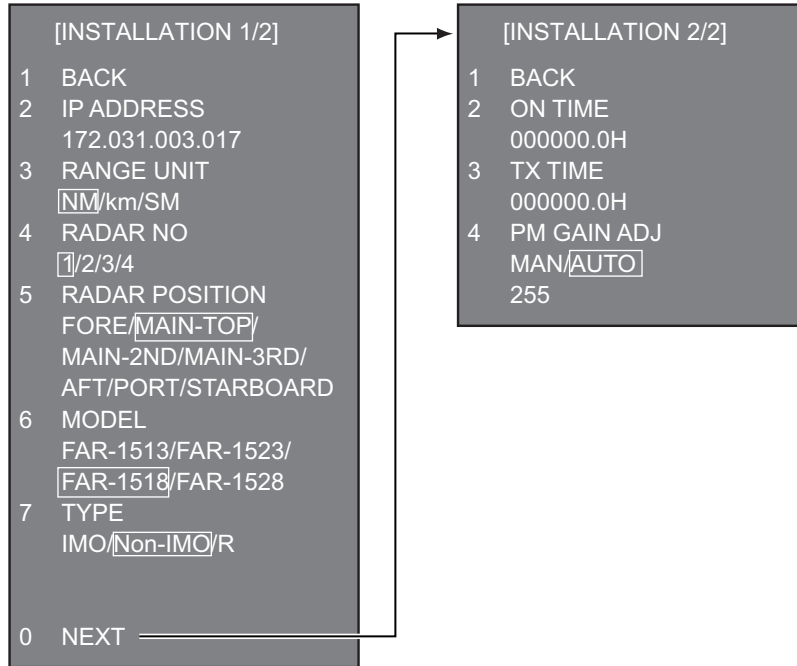**[RADAR POSITION]**: Select the radar position. The choices are [FORE], [MAIN-TOP], [MAIN-2ND], [MAIN-3RD], [AFT], [PORT], and [STARBOARD].

[MODEL]: Select the model name - [FAR-1513], [FAR-1523], [FAR-1518], or [FAR-1528].

[TYPE]: Select the type of radar - [IMO], [Non-IMO] or [R].

[ON TIME], **[TX TIME]**: These items show the number of hours the radar has been turned on and transmitted, respectively. Value can be changed; for example, after replacing the magnetron. [TX TIME] can be reset to 0.

[PM GAIN ADJ]: Adjust the performance monitor gain, automatically or manually, whenever the magnetron is replaced.

To adjust the performance monitor gain, do as follows:

1. Select automatic or manual adjustment. For automatic adjustment, no further operation is required; close the menu at the completion of the adjustment. For manual go to the next step.

2. Set the radar controls as shown below.
    Range: 24 NM
    Pulse Length: Long
    A/C SEA: OFF (turn off manually)
    A/C RAIN: OFF (turn off manually)
    Echo Averaging (EAV): OFF
    Video Contrast: 2-B

3. Adjust the **GAIN** control so that a slight amount of white noise appears on the screen. Arcs for the performance monitor appear on the screen.

4. Select [PM GAIN ADJ]. Operate the Setting knob so that the outer arc faintly appears, then push the Right button to set.

Before setup   After setup

8.1 NM to 10.1 NM

8.1 NM to 10.1 NM

Approx. 12.1 NM (10 dB)
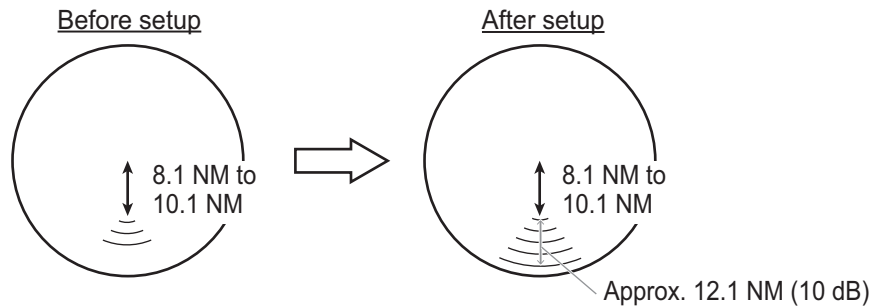
Example: [PM ARC] is set to [5]. (The location of arcs changes with the setting of [PM ARC] in [PERFORMANCE MON] in the [ECHO] menu.)

3.7.3 ECHO ADJUST menu

[VIDEO LEVEL ADJ]: Adjust the video level, automatically or manually. Set the radar as follows:
Interference Rejector (IR): 2
Echo Stretch (ES): OFF
Echo Averaging (EAV): OFF
Gain: 80
Range: 24 NM
Pulse Length: Long
For manual adjustment, select [VIDEO ADJ VALUE]. Rotate the Setting knob so that noise just disappears from the screen. The setting range is 0 to 73.

3.7.4 SCANNER menu


```
[SCANNER]
1   BACK
2   SECTOR BLANK1
    START   000°
    ANGLE   000°
3   SECTOR BLANK2
    START   000°
    ANGLE   000°
5   ANT SW
    OFF/ON/EXT
6   ANT STOPPED
    STBY/TX
7   DEFAULT ANT HEIGHT
    5/7.5/10/15/20/
    25/30/35/40/45/
    more50m
```

Heading

Start bearing

Set angle

Sector blank setting
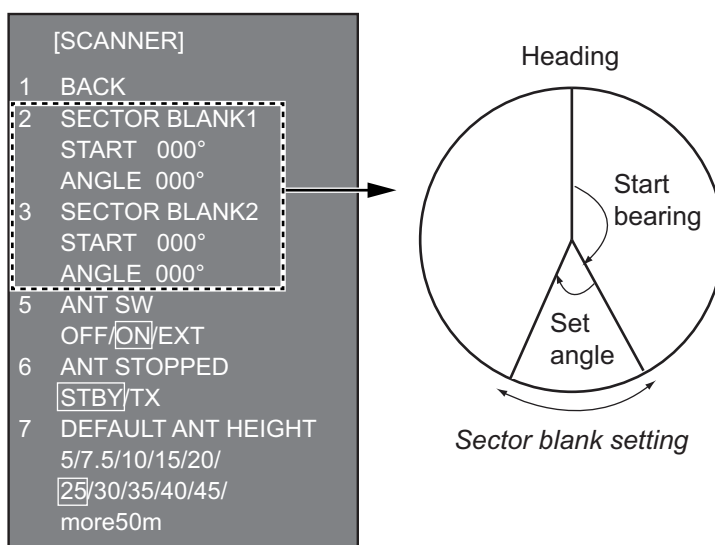
[SECTOR BLANK1], [SECTOR BLANK2]: Set area(s) where to prevent transmission. Heading must be properly aligned (see section 3.4) before setting any blind sector. For example, set the area where an interfering object at the rear of the antenna would produce a dead sector (area where no echoes appear) on the display. To enter

an area, enter start bearing relative to the heading and dead sector angle. To erase the area, enter 0 for both the [START] and [ANGLE] sections. The setting range of [START] is 0° to 359° and [ANGLE] is 0° to 180°.
Note: Turn off a stern blind sector when adjusting the gain of the performance monitor, in order to display the echo from the performance monitor properly.

[ANT STOPPED]: For serviceman.
Note: Select [OFF] at [ANT SW] to prevent antenna rotation. [ANT STOPPED] disables transmission while the antenna is stopped in STBY.

[ANT SW]: Starts or stops antenna rotation.. Select [OFF] to stop antenna rotation. Select [ON] to start antenna rotation.
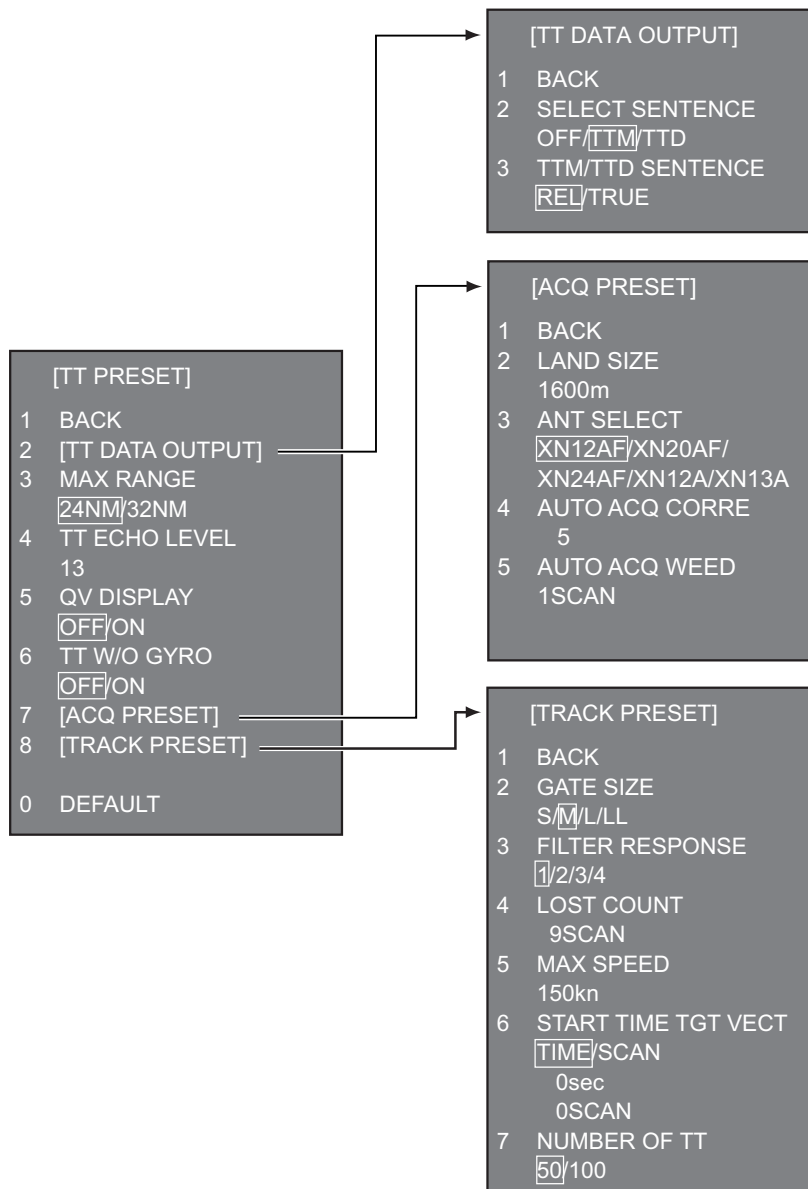
Note: [EXT] is not used.

[DEFAULT ANT HEIGHT]: Select the height (in meters) of the radar antenna above the waterline.

3.7.5   TT PRESET menu

```
                                                        [TT DATA OUTPUT]

                                                        1   BACK
                                                        2   SELECT SENTENCE
                                                            OFF/TTM/TTD
                                                        3   TTM/TTD SENTENCE
                                                            REL/TRUE


                                                        [ACQ PRESET]

                                                        1   BACK
                                                        2   LAND SIZE
                                                            1600m
       [TT PRESET]                                      3   ANT SELECT
                                                            XN12AF/XN20AF/
  1   BACK                                                   XN24AF/XN12A/XN13A
  2   [TT DATA OUTPUT]                                  4   AUTO ACQ CORRE
  3   MAX RANGE                                                5
      24NM/32NM                                         5   AUTO ACQ WEED
  4   TT ECHO LEVEL                                         1SCAN
      13
  5   QV DISPLAY
      OFF/ON
  6   TT W/O GYRO
      OFF/ON                                            [TRACK PRESET]
  7   [ACQ PRESET]
  8   [TRACK PRESET]                                    1   BACK
                                                        2   GATE SIZE
  0   DEFAULT                                               S/M/L/LL
                                                        3   FILTER RESPONSE
                                                            1/2/3/4
                                                        4   LOST COUNT
                                                             9SCAN
                                                        5   MAX SPEED
                                                            150kn
                                                        6   START TIME TGT VECT
                                                            TIME/SCAN
                                                              0sec
                                                              0SCAN
                                                        7   NUMBER OF TT
                                                            50/100
```

[MAX RANGE]: Select the maximum TT (target tracking) range, 24 or 32 NM.

[TT ECHO LEVEL]: Set the detection threshold level for TT echoes.

[QV DISPLAY]: [OFF]: Normal picture, [ON]: Quantized video. The normal picture is in effect whenever the power is turned on regardless of this setting.

[TT W/O GYRO]: Select [ON] to use TT without a gyro.

[DEFAULT]: Restore default settings for this menu.

TT DATA OUTPUT menu

[SELECT SENTENCE]: Select the target data sentence (TTM or TTD) to output. Select [OFF] for no output.

[TTM/TTD REFERENCE]: Select the output format (bearing) for the TTM/TTD sentence.
[REL] (Target bearing from own ship, degree relative, target course, degree relative), or **[TRUE]** (Target bearing, degree true, target course, degree true).

ACQ PRESET menu

[LAND SIZE]: Set the land size in units of 100 m. The setting range is 100 to 3000 m. A target whose length is equal to or greater than the length set here is judged as a land target.

[ANT SELECT]: Select the antenna radiator type of your radar. The size of the echo changes with radiator size. Select the correct radiator type to ensure proper performance.

[AUTO ACQ CORRE]: Set the correlation count for automatic acquisition. The setting range is 3 to 10.

[AUTO ACQ WEED]: Set the cancel count for automatic acquisition. The setting range is 1 to 5.

TRACK PRESET menu

[GATE SIZE]: Select the gate size - [S], [M], [L], or [LL].

[FILTER RESPONSE]: Set the filter response function. The setting range is 1 to 4.
1: Filter response is improved.
4: Filter stability is improved.

[LOST COUNT]: Set the number of scans to allow between the time a target is lost and is declared a lost target. The setting range is 1 to 20.
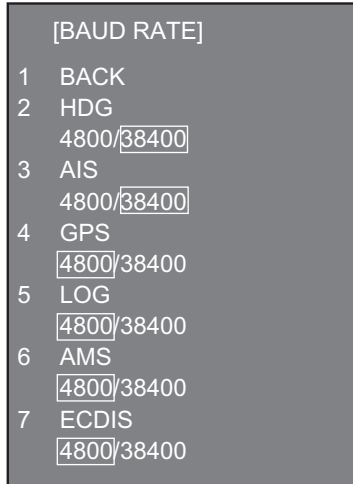
[MAX SPEED]: No use.

[START TIME TGT VECT]: Set the number of seconds or number of scans to wait before showing the vector for a newly acquired target. Select [TIME] or [SCAN] then enter value.

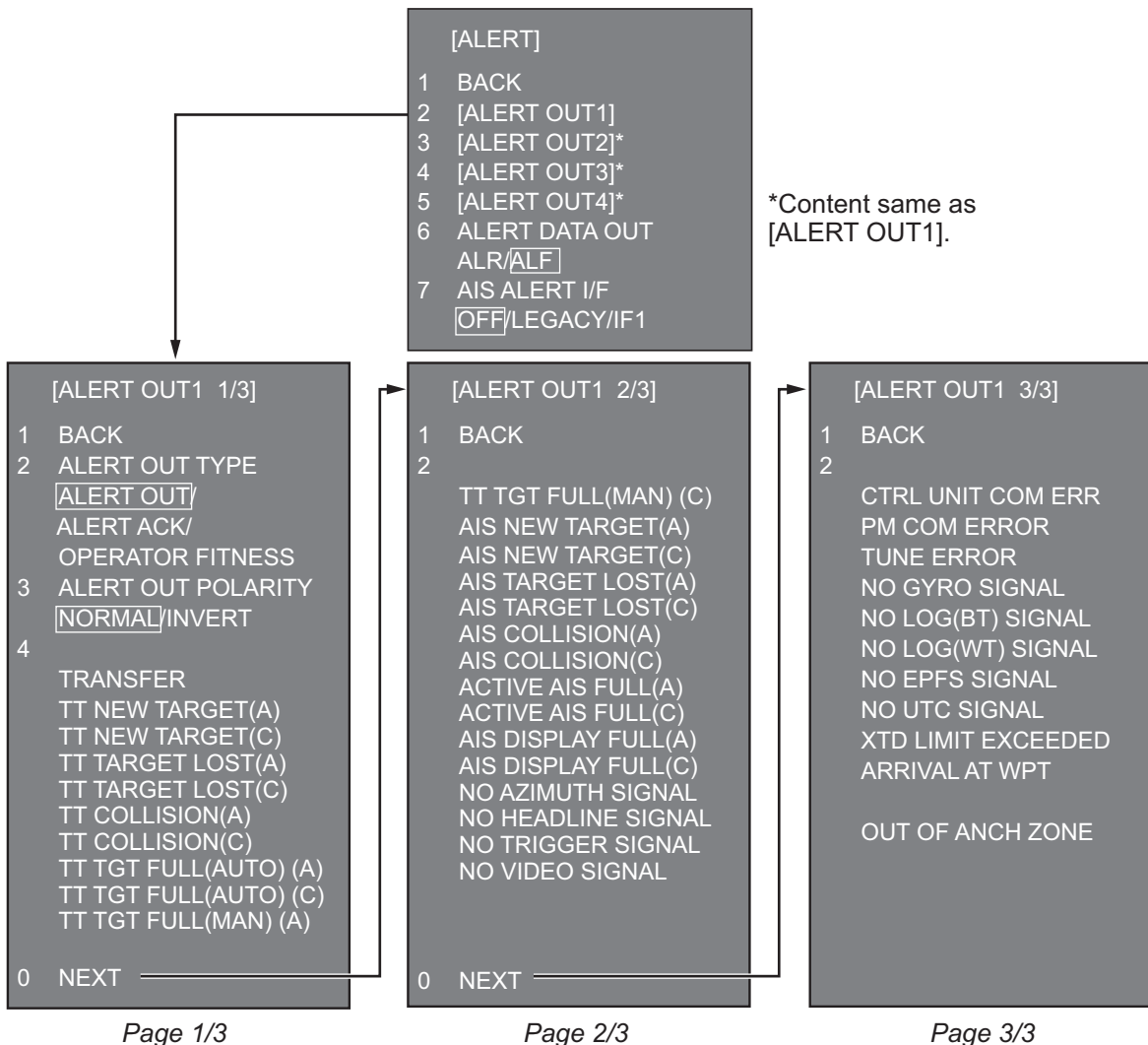**[NUMBER OF TT]**: Select the maximum number of TT to track, 50 or 100.

3.7.6 BAUD RATE menu

Set the baud rate, 4800 or 38400 (bps), for connected equipment - heading sensor, AIS transponder, GPS navigator, Log, AMS, and ECDIS.

```
[BAUD RATE]

1   BACK
2   HDG
    4800/38400
3   AIS
    4800/38400
4   GPS
    4800/38400
5   LOG
    4800/38400
6   AMS
    4800/38400
7   ECDIS
    4800/38400
```

3.7.7 ALERT I/F menu

Four alert contact outputs are available, [ALERT OUT1] - [ALERT OUT4]. Set each alert out referring to the description on the next page.

```
[ALERT]

1   BACK
2   [ALERT OUT1]
3   [ALERT OUT2]*
4   [ALERT OUT3]*
5   [ALERT OUT4]*
6   ALERT DATA OUT
    ALR/ALF
7   AIS ALERT I/F
    OFF/LEGACY/IF1
```

*Content same as [ALERT OUT1].

```
[ALERT OUT1  1/3]

1   BACK
2   ALERT OUT TYPE
    ALERT OUT/
    ALERT ACK/
    OPERATOR FITNESS
3   ALERT OUT POLARITY
    NORMAL/INVERT
4
    TRANSFER
    TT NEW TARGET(A)
    TT NEW TARGET(C)
    TT TARGET LOST(A)
    TT TARGET LOST(C)
    TT COLLISION(A)
    TT COLLISION(C)
    TT TGT FULL(AUTO) (A)
    TT TGT FULL(AUTO) (C)
    TT TGT FULL(MAN) (A)

0   NEXT
```
Page 1/3

```
[ALERT OUT1  2/3]

1   BACK
2
    TT TGT FULL(MAN) (C)
    AIS NEW TARGET(A)
    AIS NEW TARGET(C)
    AIS TARGET LOST(A)
    AIS TARGET LOST(C)
    AIS COLLISION(A)
    AIS COLLISION(C)
    ACTIVE AIS FULL(A)
    ACTIVE AIS FULL(C)
    AIS DISPLAY FULL(A)
    AIS DISPLAY FULL(C)
    NO AZIMUTH SIGNAL
    NO HEADLINE SIGNAL
    NO TRIGGER SIGNAL
    NO VIDEO SIGNAL

0   NEXT
```
Page 2/3

```
[ALERT OUT1  3/3]

1   BACK
2
    CTRL UNIT COM ERR
    PM COM ERROR
    TUNE ERROR
    NO GYRO SIGNAL
    NO LOG(BT) SIGNAL
    NO LOG(WT) SIGNAL
    NO EPFS SIGNAL
    NO UTC SIGNAL
    XTD LIMIT EXCEEDED
    ARRIVAL AT WPT

    OUT OF ANCH ZONE
```
Page 3/3

ALERT menu (main)

[ALERT OUT 1] - **[ALERT OUT 4]**: Select the alert to output for each alert out number. To monitor for unit failure if and when it occurs, set the alert contact outputs referring to the table below.

Unit	Alert
Transceiver unit	• NO AZIMUTH SIGNAL • NO HEADLINE SIGNAL • NO TRIGGER SIGNAL • NO VIDEO SIGNAL
Performance monitor	PM COM ERROR
Control unit	CTRL UNIT COM ERR

To monitor for processor unit failure, connect SYS_FAIL and PWR_FAIL from terminal J613 in the processor unit to the AMS.

[ALERT DATA OUT]: Select the alert output format, [ALR] (Set Alarm State) or [ALF] (Alert Sentence).

[AIS ALERT I/F]: Set the AIS alert interface. [OFF] does not output AIS alert.
[LEGACY]: For connection to FA-100, or connection to FA-150 where the AIS mode is LEGACY.
[IF1]: For connection to FA-150 where the AMS mode is AlertIF1.

ALERT OUT sub menus

[ALERT OUT TYPE]: Select the alert out format, [ALERT OUT], [OPERATOR FIT-NESS] or [ALERT ACK].

[ALERT OUT POLARITY]: Select the alert out polarity, [NORMAL] or [INVERT].

Note: For category A alert, there are two types of output operations, "A" and "C". To inform the AMS of category A alerts via contact signal, connect both "A" and "C" signals.
(A): Alert sound is output when the corresponding item is an unacknowledged alert. Output is stopped when the item is acknowledged.
(C): Alert sound is output when the corresponding item becomes an alert condition. Output is stopped when the alert condition is removed.
The table below shows the operational status of the alert outputs based on the output type.

Output type	Status			
	Normal	A new alert is raised	An existing alert is acknowledged	An existing alert condition becomes non-active
A	Off	On	Off	Off
C	Off	On	On	Off

3.7.8   INPUT PORT menu

```
[INPUT PORT]

1   BACK
2   [GPS]                              [GPS]
3   LOG
    GPS/LOG/ECDIS/HDG/AMS          1   BACK
4   HEADING                         2   GPS1
    GPS/LOG/ECDIS/HDG/AMS              GPS/LOG/ECDIS/HDG/AMS
5   WIND                            3   GPS2
    GPS/LOG/ECDIS/HDG/AMS              GPS/LOG/ECDIS/HDG/AMS
6   CURRENT                         4   PRIORITIZE GLL
    GPS/LOG/ECDIS/HDG/AMS              OFF/ON
7   WATER TEMP
    GPS/LOG/ECDIS/HDG/AMS
8   DEPTH
    GPS/LOG/ECDIS/HDG/AMS
```
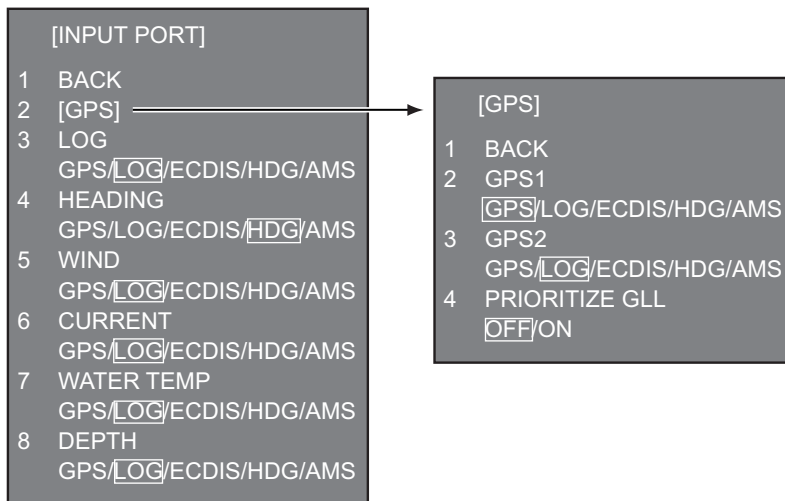
INPUT PORT menu

Select the source for LOG, GPS, HEADING, WIND, CURRENT, WATER TEMP, and DEPTH.

[GPS] (menu): Select the source for GPS navigator GPS1 and GPS2. [PRIORITIZE GLL], when turned on, gives priority to the GLL sentence.
Note: Do not set the same port for GPS1 and GPS2. For example, set GPS1 for the GPS port; GPS2 for any other port (ex. LOG).

[LOG]: Select the source for speed data.

[HEADING]: Select the source for heading data.

[WIND]: Select the source for wind data.

[CURRENT]: Select the source for current (tide) data.

[WATER TEMP]: Select the source for water temperature data.

[DEPTH]: Select the source for depth data.

3.7.9   OTHERS menu

```
[OTHERS]

1    BACK
2    DEMO ECHO
     OFF/EG-3000/TT-TEST/
     PC/EG-4000
3    EAV W/O GYRO
     OFF/ON
4    INS
     OFF/SERIAL/LAN
5    SUB MONITOR
     OFF/ON
6    AIS FUNCTION          ←  Appears with non-IMO
     OFF/ON                   specification.
7    MONITOR TYPE
     1/2/3/4/5/6/7/8/9/10
```
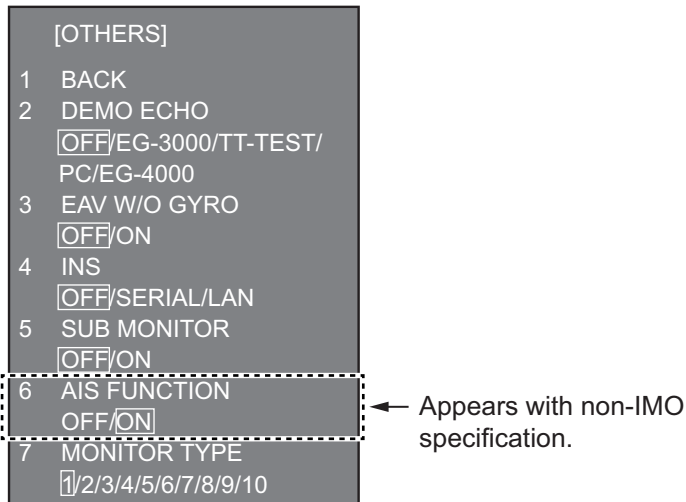
[DEMO ECHO]: Select the source for the demonstration echo, [EG-3000] (Echo Generator EG-3000), [TT-TEST], [EG-4000] (Echo Generator EG-4000) or [PC]. Select [OFF] to disable the demonstration echo feature.

[EAV W/O GYRO]: The each averaging feature can be used without a gyrocompass. Select [ON] to use the feature without a gyrocompass.

[INS]: Select the INS communication method, [SERIAL] or [LAN]. Select [OFF] for no INS connection.

[SUB MONITOR]: No use. Keep in the [OFF] setting.

[AIS FUNCTION]: Enable or disable the AIS function. (Available with non-IMO type only.)

[SUB MONITOR]: No use. Keep in the [OFF] setting.

[MONITOR TYPE]: For future use. Keep default setting ([1]).

3.8 Display Unit Setting

3.8.1 MU-150HD

How to turn the power on/off

The external equipment connected to the DVI port (DVI-D1 or DVI-D2) can power the display unit on/off.

Slide switch

- **ON (upward)**: Allow the digital signal from external equipment to control the on/off of the display unit.

- **OFF (downward)**: Set to this position for analog RGB signal.
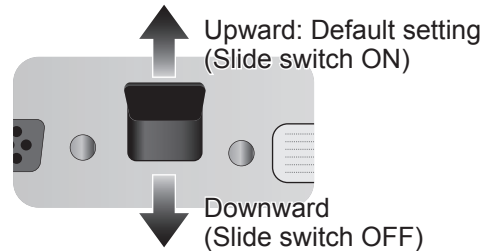
Note: Turn the slide switch OFF to connect equipment to both DVI and RBG ports.

Upward: Default setting
(Slide switch ON)

Downward
(Slide switch OFF)

How to adjust the brilliance from external equipment

You can set the brilliance control on the [SYSTEM] menu. Also, you can check the signal status and the program number on the [SYSTEM] menu.

1. Press the **MENU** key to show the main menu.

2. Press the ▶ key to select [SYSTEM]. The message "Input Signal Searching. Please Wait." appears and then the [SYSTEM] menu is displayed, as shown in the right figure.

RGB DVI1 DVI2 VIDEO1 VIDEO2 VIDEO3 OSD SYSTEM

AUTO DIMMER   OFF   (OFF, 1~5)
EXT BRILL CTRL   OFF   (OFF ／ DVI1 ／ DVI2 ／ USB)
DEFAULT RESET   NO

INFORMATION
RGB   : 1280*1024   Fh : 80kHz   Fv : 75Hz
DVI1   : 640*480   Fh : 31kHz   Fv : 60Hz
DVI2   : NO SIGNAL
VIDEO1   : NTSC
VIDEO2   : PAL
VIDEO3   : NO SIGNAL
PROGRAM NO. : X.XX

Signal status and Program number →
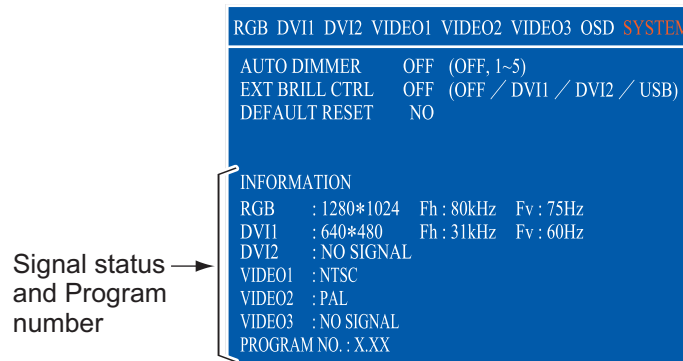
3. Press the ▲ or ▼ key to select [AUTO DIMMER]

4. Press the ◀ or ▶ key to select [OFF].

5. Press the ▲ or ▼ key to select [EXT BRIL CTRL].

6. Press the ◀ or ▶ key to select [DVI1] or [DVI2].

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

How to lock the operation

You can lock the display unit to prevent operation. Any key (except the ⏻ /**BRILL** key) will be inoperative.

1. While you hold the **PIP** key, turn on the display unit. Press and hold the **PIP** key for more than five seconds.
   Note: When the slide switch is "ON", turn on the connected external equipment while pressing the **PIP** key to turn on the display unit.

2. To cancel the lock, turn off the display unit and then turn it on while you hold the **PIP** key.
   Press and hold the **PIP** key more than five seconds.

3.8.2 MU-190

The [INSTALLATION SETTING] menu appears only when the power is turned on for the first time after installation.


```
INSTALLATION SETTING ◁─────────────────────── Menu

EXT BRILL CTRL          RS-485    (OFF/DVI1/DVI2/RS-232C/RS-485/USB)
SERIAL BAUDRATE       4800bps    (4800/9600/19200/38400)
COLOR CALIBRATION        ON      (OFF/ON)                              ◀─── Menu item
KEY LOCK                 ON      (OFF/ON)

SAVE AND EXIT            YES      (NO/YES)
```
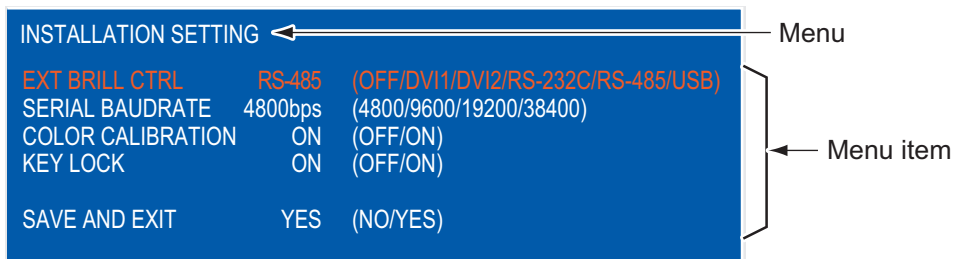
Connected equipment	Connected Unit	EXT BRILL CTRL	SERIAL BAUDRATE	COLOR CALIBRATION	KEY LOCK	DVI PWR SYNC*
FAR-15x3/ 15x8	RPU-024	DVI	-	OFF	ON	ON

* "DVI PWR SYNC" is the slide switch at the bottom rear of the monitor unit. See the "Slide switch" below.

Slide switch

Set the slide switch to "ON" (default setting). This setting automatically powers the monitor unit on or off according to the DVI signal input. The power switch of the monitor unit is inoperative.

Note: The OFF position provides control of the monitor unit power with the power switch of the monitor unit.
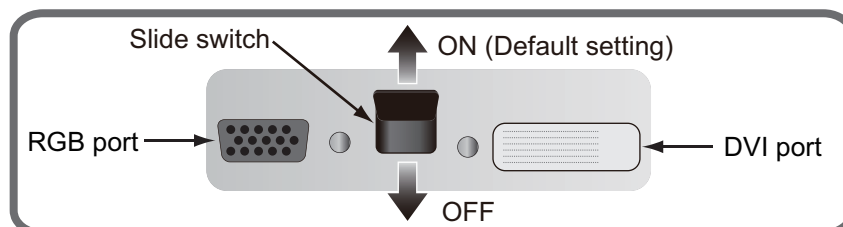
How to open the INSTALLATION SETTING menu

Turn off the monitor unit. While you hold the **DISP** key, press the ⏻/**BRILL** key to turn on the monitor unit. Press and hold the **DISP** key for more than five seconds.

Note: When the "DVI PWR SYNC" slide switch is ON, turn on the connected external equipment while you press the **DISP** key to turn on the monitor unit.

How to adjust the display aspect ratio

1. Press the **MENU** key to show the menu. (The main menu automatically closes in 10 seconds if there is no operation.)

2. Press the ◄ or ► key to select [DVI1] or [DVI2]. The current setting (the cursor) is shown in orange. The menu items available depend on the menu selected. The menu items [DVI1] and [DVI2] have the same options.

Menu →
| RGB | DVI1 | DVI2 | VIDEO | OSD | SYSTEM |

Menu item {
BRIGHTNESS	128	(1~256)
CONTRAST	32	(1~64)
H_POSITION	25	(1~50)
V_POSITION	20	(1~40)
R_LEVEL	128	(1~256)
G_LEVEL	128	(1~256)
B_LEVEL	128	(1~256)
TEMPERATURE	7000K	(5000K~9300K)
B STRETCH	OFF	(OFF, 1~10)
W STRETCH	OFF	(OFF, 1~10)
DISP MODE	FULL	(FULL/NORMAL)
SHARPNESS	1	(1~10)
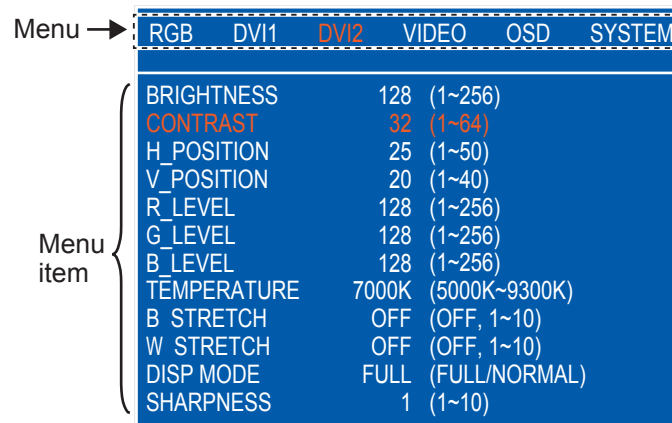
DVI setting menu

3. Press the ▲ or ▼ key to select [DISP MODE].

4. Press the ◄ or ► key to select [NORMAL].

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

4. INPUT/OUTPUT DATA

Notice for FAR-1518(-BB)/FAR-1528(-BB)

These radars must be interconnected to the following type approved sensors:
- **EPFS meeting the requirements of the IMO resolution MSC.112(73).**
- **Gyrocompass meeting the requirements of the IMO resolution A.424(XI).**
- **SDME meeting the requirements of the IMO resolution MSC.96(72).**

4.1 Processor Unit

Input and output data handled at the processor unit are shown in the table below.

Input

Data	Specification	Contents	Remarks
Heading signal	IEC 61162-2*		
Speed signal	IEC 61162-1 Ed.4		
Navaid data	IEC 61162-1 Ed.4	Position, time and date, datum, course, speed, wind, current, depth, temperature, Navtex, etc.	
AIS signal	IEC 61162-2		
Alarm handling signal	Contact closure		Input from alarm system
	IEC 61162-1 Ed.4		Input from alarm system

* Data input cycle must be more than 40 Hz (high speed craft) or 20 Hz (conventional ships).

Output

Data	Specification	Sentence	Remarks
Radar system data	IEC 61162-1 Ed.4	RSD, OSD	
TT data**	IEC 61162-1 Ed.4	TTD, TTM, TLB	
Alarm signal	IEC 61162-1 Ed.4		Four systems, output contents are selected on the [ALERT I/F] menu.
	Contact closure		

** The output sentence can be set on the [TT DATA OUTPUT] menu (see page 3-9).

4.2   IEC 61162 Sentences

Input sentence and sentence priority

Data	Sentence priority
Heading (true)	THS>HDT>HDG*>VHW*
Heading (magnetic)*	HDG>HDM>VHW
Magnetic deviation*	HDG
AIS target message, alert	VDM, VDO, ABK, ALR
Time and date	ZDA
Position	GNS>GGA>RMC>GLL
Datum	DTM
GNSS satellite malfunction detection	GBS
Course over the ground (COG)	VTG>RMC>VBW
Speed over the ground (SOG) (GPS)	VTG>RMC
Speed over the ground (LOG (BT))	VBW
Speed through the water (STW)	VBW>VHW
Alert	ACK, ACN, HBT
Waypoint	RMB>BWR>BWC>WPL
Route data	RTE+WPL
Wind speed and angle (true)	MWV>VWT
Wind speed and angle (relative)	MWV>VWR
Depth	DPT>DBT>DBS>DBK
Water temperature	MTW
Current	CUR, VDR

* No use with IMO-type radar.

Output sentences

Data	Sentence
AIS message, alert	ABM, BBM, ACK, VSD
Alert sentence	ALR, ALC, ALF, ARC, HBT
Operator fitness	EVE
Own ship data	OSD
Radar system data	RSD
Target data	TTM, TLB, TTD
Target L/L position	TLL

APPENDIX 1 JIS CABLE GUIDE

Cables listed in the manual are usually shown as Japanese Industrial Standard (JIS). Use the following guide to locate an equivalent cable locally.

JIS cable names may have up to 6 alphabetical characters, followed by a dash and a numerical value (example: DPYC-2.5).
For core types D and T, the numerical designation indicates the *cross-sectional Area (mm^2)* of the core wire(s) in the cable.
For core types M and TT, the numerical designation indicates the *number of core wires* in the cable.

1. Core Type
D: Double core power line
T: Triple core power line
M: Multi core
TT: Twisted pair communications
  (1Q=quad cable)

2. Insulation Type
P: Ethylene Propylene Rubber

3. Sheath Type
Y: PVC (Vinyl)

DPYCY

TPYCY

4. Armor Type
C: Steel

5. Sheath Type
Y: Anticorrosive vinyl sheath

6. Shielding Type
S: All cores in one sheath
-S: Indivisually sheathed cores
SLA: All cores in one shield, plastic tape w/aluminum tape
-SLA: Individually shielded cores, plastic tape w/aluminum tape
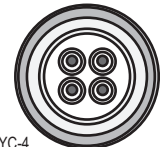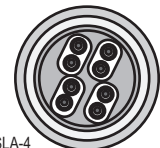
MPYC-4

```
         1 2 3 4 5   6                    1  2  3  4
EX: TTYCYSLA - 4          MPYC - 4
    Designation type  # of twisted pairs    Designation type   # of cores
```

TTYCSLA-4

The following reference table lists gives the measurements of JIS cables commonly used with Furuno products:

Type	Core Area	Core Diameter	Cable Diameter	Type	Core Area	Core Diameter	Cable Diameter
DPYC-1.5	1.5mm^2	1.56mm	11.7mm	TTYCS-1	0.75mm^2	1.11mm	10.1mm
DPYC-2.5	2.5mm^2	2.01mm	12.8mm	TTYCS-1T	0.75mm^2	1.11mm	10.6mm
DPYC-4	4.0mm^2	2.55mm	13.9mm	TTYCS-1Q	0.75mm^2	1.11mm	11.3mm
DPYC-6	6.0mm^2	3.12mm	15.2mm	TTYCS-4	0.75mm^2	1.11mm	16.3mm
DPYC-10	10.0mm^2	4.05mm	17.1mm	TTYCSLA-1	0.75mm^2	1.11mm	9.4mm
DPYCY-1.5	1.5mm^2	1.56mm	13.7mm	TTYCSLA-1T	0.75mm^2	1.11mm	10.1mm
DPYCY-2.5	2.5mm^2	2.01mm	14.8mm	TTYCSLA-1Q	0.75mm^2	1.11mm	10.8mm
DPYCY-4	4.0mm^2	2.55mm	15.9mm	TTYCSLA-4	0.75mm^2	1.11mm	15.7mm
MPYC-2	1.0mm^2	1.29mm	10.0mm	TTYCY-1	0.75mm^2	1.11mm	11.0mm
MPYC-4	1.0mm^2	1.29mm	11.2mm	TTYCY-1T	0.75mm^2	1.11mm	11.7mm
MPYC-7	1.0mm^2	1.29mm	13.2mm	TTYCY-1Q	0.75mm^2	1.11mm	12.6mm
MPYC-12	1.0mm^2	1.29mm	16.8mm	TTYCY-4	0.75mm^2	1.11mm	17.7mm
TPYC-1.5	1.5mm^2	1.56mm	12.5mm	TTYCY-4S	0.75mm^2	1.11mm	21.1mm
TPYC-2.5	2.5mm^2	2.01mm	13.5mm	TTYCY-4SLA	0.75mm^2	1.11mm	19.5mm
TPYC-4	4.0mm^2	2.55mm	14.7mm	TTYCYS-1	0.75mm^2	1.11mm	12.1mm
TPYCY-1.5	1.5mm^2	1.56mm	14.5mm	TTYCYS-4	0.75mm^2	1.11mm	18.5mm
TPYCY-2.5	2.5mm^2	2.01mm	15.5mm	TTYCYSLA-1	0.75mm^2	1.11mm	11.2mm
TPYCY-4	4.0mm^2	2.55mm	16.9mm	TTYCYSLA-4	0.75mm^2	1.11mm	17.9mm

APPENDIX 2 DIGITAL INTERFACE

Digital Interface

Input sentence

ABK, ACK, ACN, ALR, BWC, BWR, CUR, DBK, DBS, DBT, DPT, DTM, GBS, GGA, GLL, GNS, HBT, HDG, HDM, HDT, MTW, MWV, RMB, RMC, RTE, THS, VBW, VDM, VDO, VDR, VHW, VSD, VTG, VWR, VWT, WPL, ZDA

Output sentences

ABM, ACK, ALC, ALF, ALR, ARC, BBM, EVE, HBT, OSD, RSD, TLB, TLL, TTD, TTM, VSD

Data reception

Data is received in serial asynchronous form in accordance with the standard referenced in IEC 61162-2 or IEC 61162-1 Ed.4.

The following parameters are used:
Baud rate: 38,400 bps (HDT, THS, !AIVDM, !AIVDO, !AIABK, $AIALR. The baud rate of all other sentences is 4800 bps
Data bits: 8 (D7=0), Parity: none, Stop bits: 1
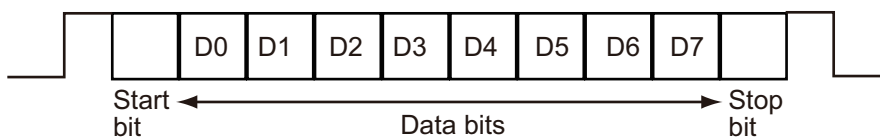
Data Sentences

Input sentences

ABK - UAIS Addressed and binary broadcast acknowledgment

```
$**ABK,xxxxxxxxx,x,x.x,x,x,*hh<CR><LF>
            1     2 3 4 5
```
1. MMSI of the addressed AIS unit (9 digits) (No use)
2. AIS channel of reception (No use)
3. Message ID (6, 8, 12, 14) (No use)
4. Message sequence number (0 - 9) (No use)
5. Type of acknowledgement (See below)
   0 = message (6 or 12) successfully received by the addressed AIS unit
   1 = message (6 or 12) was broadcast, but not ACK by addressed AIS unit
   2 = message could not be broadcast (quantity of encapsulated data exceeds five slots)
   3 = requested broadcast of message (8, 14 or 15) has been successfully completed
   4 = late reception of message (7 or 13) ACK that was addressed to this AIS unit (own ship) and referenced a valid transaction
   5 = message has been read and acknowledged on a display unit.

ACK - Acknowledge alarm

```
$**ACK,xxx,*hh<CR><LF>
        1
```
1. Local alarm number (identifier) (001 - 999)

ACN - Alert command

$**ACN,hhmmss.ss,aaa,x.x,x.x,ca,a*hh<CR><LF>
           1   2 3 4 5 6
1. Time (hh=00 - 23, mm=00 - 59, ss.ss=00.00 - 60.99) (No use)
2. Manufacturer mnemonic code (3 digit alphanumeric code), null
3. Alert identifier (10001 - 10999)
4. Alert instance (null)
5. Alert command (A/Q/O/S)
    A=ACK from ext. equipment,
    Q=Request from ext. equipment
    O=Responsibility transfer
    S=Silence from ext. equipment
6. Sentence status flag (C)
    (C should not be null field. Sentence without C is not a command.)

ALR - Set alarm state

$**ALR,hhmmss.ss,xxx,A,A,c—c,*hh<CR><LF>
            1   2 3 4   5
1. Time of alarm condition change, UTC (No use)
2. Unique alarm number (identifier) at alarm source (001 - 999)
3. Alarm condition (A/V)
    A=threshold exceeded V=not exceeded
4. Alarm acknowledge state (A/V)
    A=acknowledged V=not acknowledged
5. Alarm description text (alphanumeric characters, max. 32)

BWC - Bearing and distance to waypoint - great circle

$ **BWC,hhmmss.ss,llll.ll, a,lllll.ll,a,yyy.y,T, yyy.y,M,yyy.y,N,c--c,A,*hh<CR><LF>
                1   2   3   4 5 6 7   8 9 10 11 12 13
1. UTC of observation (No use)
2. Waypoint latitude (0000.00000 - 9000.00000)
3. N/S (N/S)
4. Waypoint longitude (00000.00000 - 18000.00000)
5. E/W (E/W)
6. Bearing, degrees true (No use)
7. Unit, True (No use)
8. Bearing, degrees (No use)
9. Unit, Magnetic (No use)
10. Distance, nautical miles (No use)
11. Unit, N (No use)
12. Waypoint ID (Max. 15 characters)
13. Mode Indicator (A/D)
    A=Autonomous
    D=Differential
    E=Estimated (dead reckoning) mode
    S=Simulator
    N=Data not valid

APPENDIX 2 DIGITAL INTERFACE

BWR - Bearing and distance to waypoint - rhumb line

$ **BWR,hhmmss.ss,llll.ll,a,lllll.ll,a,yyy.y,T,yyy.y,M,yyy.y,N,c--c,A,*hh<CR><LF>
                    1   2 3   4   5   6   7   8   9   10 11 12 13

1. UTC of observation No use)
2. Waypoint latitude (0000.00000 - 9000.00000)
3. N/S (N/S)
4. Waypoint longitude (00000.00000 - 18000.00000)
5. E/W (E/W)
6. Bearing, degrees true (0.00 - 360.00) (No use)
7. Unit, True (No use)
8. Bearing, degrees magnetic (No use)
9. Unit (No use)
10. Distance, nautical miles (No use)
11. Unit (No use)
12. Waypoint ID (Max. 15 characters)
13. Mode Indicator (A/D)
     A=Autonomous
     D=Differential
     E=Estimated (dead reckoning) mode
     S=Simulator
     N=Data not valid

CUR - Current

$**CUR,A,x,x.x,x.x,x.x,a,x.x,x.x,x.x,a,a,*hh<CR><LF>
         1 2 3   4   5 6 7   8   9 1011

1. Validity of data (A)
    A=valid, V=not valid
2. Data set number (No use)
3. Layer number (1 - 3)
4. Current depth in meters (No use)
5. Current direction in degrees (0.00 - 360.00)
6. Direction reference in use (No use)
7. Current speed in knots (0.00 - 99.94)
8. Reference layer depth in meters (No use)
9. Heading (No use)
10. Heading reference in use (No use)
11. Speed reference (No use)

DBK - Depth below keel

$**DBK,x.x,f,x.x,M,x.x,F<CR><LF>
         1 2 3   4 5   6

1. Water depth (0.00 - 99999.994)
2. f = feet (fixed)
3. Water depth (0.00 - 99999.994)
4. M = Meters (fixed)
5. Water depth (0.00 - 99999.994)
6. F = Fathom (fixed)

DBS - Depth below surface

$**DBS,x.x,f,x.x,M,x.x,F<CR><LF>
         1 2 3   4 5   6

1. Water depth (0.00 - 99999.994)
2. f = feet (fixed)
3. Water depth (0.00 - 99999.994)
4. M = Meters (fixed)
5. Water depth (0.00 - 99999.994)
6. F = Fathom (fixed)

AP-4

DBT - Depth below transducer

$**DBT,xxxx.x,f,xxxx.x,M,xxxx.x,F<CR><LF>
          1 2 3   4 5   6

1. Water depth (0.00 - 99999.994)
2. f = feet (fixed)
3. Water depth (0.00 - 99999.994)
4. M = Meters (fixed)
5. Water depth (0.00 - 99999.994)
6. F = Fathom (fixed)

DPT - Depth

$**DPT,x.x,x.x,x.x,*hh<CR><LF>
       1 2 3

1. Water depth relative to the transducer, meters (0.00-99999.994)
2. Offset from transducer, meters (IMO: -99.994 - 99.994,
   Other than IMO: -99.994 - 99.994, null)
3. Minimum range scale in use (No use)

DTM - Datum reference

$**DTM,ccc,a,x.x,a,x.x,a,x.x,ccc,*hh<CR><LF>
         1 2 3 4 5 6 7 8

1. Local datum (W84/W72/S85/P90)
   W84=WGS84 W72=WGS72 S85=SGS85 P90=PE90
2. Local datum subdivision code (No use)
3. Lat offset, min (No use)
4. N/S (No use)
5. Lon offset, min (No use)
6. E/W (No use)
7. Altitude offset, meters (No use)
8. Reference datum (No use)

GBS - GNSS satellite fault detection

$**GBS, hhmmss.ss, x.x, x.x, x.x, xx, x.x, x.x, x.x,hh*hh<CR><LF>
           1   2   3   4 5 6 7   8 910

1. UTC time of GGA or GNS fix associated with this sentence (No use)
2. Expected error in latitude (0.0 - 999.9)
3. Expected error in longitude (0.0 - 999.9)
4. Expected error in altitude (No use)
5. ID number of most likely failed satellite (No use)
6. Probability of missed detection for most likely failed satellite (No use)
7. Estimate of bias in meters on most likely failed satellite (No use)
8. Standard deviation of bias estimate (No use)
9. GNSS Signal ID (No use)
10. GNSS System ID (No use)

AP-5

GGA - Global positioning system fix data

$**GGA,hhmmss.ss,llll.lll,a,yyyyy.yyy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx,*hh<CR><LF>
            1   2   3   4   5 6 7 8   9 10 11 12 13 14

1. UTC of position (no use)
2. Latitude (0000.00000 - 9000.00000)
3. N/S (N/S)
4. Longitude (0000.00000 - 18000.00000)
5. E/W (E/W)
6. GPS quality indicator (1 - 8)
    0 = fix not available or invalid
    1 = GPS SPS mode
    2 = differential GPS, SPS mode
    3 = GPS PPS mode
    4 = Real Time Kinematic. Satellite system used in RTK mode with fixed integers
    5 = Float RTK. Satellite system used in RTK mode with floating solution
    6 = Estimated (dead reckoning) mode
    7 = Manual input mode
    8 = Simulator mode
7. Number of satellite in use (No use)
8. Horizontal dilution of precision (0.0 - 999.9)
9. Antenna altitude above/below mean sea level (No use)
10. Unit, m (No use)
11. Geoidal separation (No use)
12. Unit, m (No use)
13. Age of differential GPS data (0 - 999, null)
14. Differential reference station ID (No use)

GLL - Geographic position, latitude/longitude

$**GLL,llll.lll,a,yyyyy.yyy,a,hhmmss.ss,A,a,*hh<CR><LF>
         1   2   3   4   5   6 7

1. Latitude (0000.00000 - 9000.00000)
2. N/S (N/S)
3. Longitude (0000.00000 - 18000.00000)
4. E/W (E/W)
5. UTC of position (No use)
6. Status (A)
    A=data valid V=data invalid
7. Mode indicator (A/D/E/M/S)
    A=Autonomous D=Differential E=Estimated M=Manual input S=Simulator N=Data not valid

GNS - GNSS fix data

$**GNS,hhmmss.ss,llll.lll,a,lllll.lll,a,c--c,xx,x.x,x.x,x.x,x.x,x.x,a*hh<CR><LF>
            1   2   3   4   5 6   7 8   9 10 11 12 13

1. UTC of position (No use)
2. Latitude (0000.00000 - 9000.00000)
3. N/S (N/S)
4. Longitude (0000.00000 - 18000.00000)
5. E/W (E/W)
6. Mode indicator (A/D/P/R/F/E/M/S)
    N=No fix A=Autonomous D=Differential P=Precise R=Real Time Kinematic
    F=Float RTK E=Estimated Mode M=Manual Input Mode S=Simulator Mode
7. Total number of satellites in use (No use)
8. HDOP (0.00 - 999.99)
9. Antenna altitude, meters (No use)
10. Geoidal separation, meters (No use)
11. Age of differential data (0 - 999)
12. Differential reference station ID (No use)
13. Navigational status indicator(S/C/U/V, null)
      S=Safe, C=Caution, U=Unsafe, V=Not valid

HBT - Heartbeat supervision sentence

$**HBT,x.x,A,x*hh<CR><LF>
      1 2 3

1. Configured repeat interval (1 - 999, null)
2. Equipment status (No use)
3. Sequential sequence identifier (0 - 9)

HDG - Heading, deviation and variation

$**HDG,x.x,x.x,a,x.x,a*hh<CR><LF>   *No use for
      1 2 3 4 5   Type-IMO

1. Magnetic sensor heading, degrees (0.00 - 360.00)
2. Magnetic deviation, degrees (0.00 - 180.00)
3. E/W
4. Magnetic variation, degrees (0.00 - 180.00)
5. E/W

HDM - Heading, magnetic

$**HDM,x.x,M*hh<CR><LF> *No use for
       1 2   Type-IMO

1. Heading, degrees (0.00 - 360.00)
2. Magnetic (M)

HDT - Heading, true

$**HDT,xxx.x,T*hh<CR><LF>
        1 2

1. Heading, degrees (0.00 - 360.00)
2. True (T)

MTW - Water temperature

$**MTW,x.x,C<CR><LF>
       1 2

1. Water temperature (-9.994 - 99.994)
2. C=degrees C (fixed)

MWV - Wind speed and angle

$**MWV,x.x,a,x.x,a,A*hh<CR><LF>
       1 2 3 4 5

1. Wind angle, degrees (0.00 - 360.00)
2. Reference (R/T)
3. Wind speed (0.00 - 9999.94)
4. Wind speed units (K/M/N/S)
   K=km/h M=m/s N=Knots S=Statute mile
5. Status (A)

AP-7

RMB - Recommended minimum specific navigation information

$**RMB,A,x.x,a,CCCC,CCCC,llll.ll,a,yyyyy.yy,a,x.x,x.x,x.x,A,a*hh <CR><LF>
   1 2 3 4 5 6 7 8 9 10 11 12 1314

1. Data status (A)
  A=Data valid, V=Navigation receiver warning
2. Cross track error (NM) (No use)
3. Direction to steer (L/R) (No use)
4. Origin waypoint ID (No use)
5. Destination waypoint ID (Max. 15 characters)
6. Destination waypoint latitude (0000.00000 - 9000.00000)
7. N/S
8. Destination waypoint longitude (0000.00000 - 18000.00000)
9. E/W
10. Range to destination, nautical miles (No use)
11. Bearing to destination, degrees true (No use)
12. Destination closing velocity, knots (No use)
13. Arrival status (No use)
14. Mode indicator (A/D)
  A=Autonomous mode; D=Differential mode; E=Estimated (dead reckoning) mode;
  M=Manual input mode; S=Simulator mode; N=Data not valid

RMC - Recommended minimum specific GPS/TRANSIT data

$**RMC,hhmmss.ss,A,llll.ll,a,yyyyy.yy,a,x.x,x.x,xxxxxx,x.x,a,a,a*hh<CR><LF>
     1 2 3 4 5 6 7 8 9 10 111213

1. UTC of position fix (No use)
2. Status (A)
  A=data valid, V=navigation receiver warning
3. Latitude (0000.00000 - 9000.00000)
4. N/S (N/S)
5. Longitude (00000.00000 - 18000.00000)
6. E/W (E/W)
7. Speed over ground, knots (0.00 - 9999.94)
8. Course over ground, degrees true (0.00 - 360.0)
9. Date (No use)
10. Magnetic variation, degrees (No use)
11. E/W (No use)
12. Mode indicator (A/D/E/M/S/F/P/R)
  A=Autonomous. Satellite system used in non-differential mode in position fix;
  D=Differential. Satellite system used in differential mode in position fix;
  E=Estimated (dead reckoning) mode;
  F=Float RTK. Satellite system used in real time kinematic mode with floating integers;
  M=Manual input mode;
  N=No fix. Satellite system not used in position fix, or fix not valid;
  P=Precise. Satellite system used in precision mode. Precision mode is defined as: no
    deliberate degradation (such as selective availability) and higher resolution code (P-code) is
    used to compute position fix. P is also used for satellite system used in multi-frequency,
    SBAS or Precise Point Positioning (PPP) mode;
  R=Real time kinematic. Satellite system used in RTK mode with fixed integers;
  S=Simulator mode
13. Navigational status indication (S/C/U/V, null)
  S=Safe, C=Caution, U=Unsafe, V=Not valid

RTE - Routes

$**RTE,x.x,x.x,a,c--c,c--c,...,c--c*hh <CR><LF>
        1   2 3 4   5 ... 6

1. Total number of sentences being transmitted (1 - 500, null)
2. Sentence number (1 - 500, null)
3. Sentence mode (C/W)
    C=Complete route, all waypoints W=Working route, first listed
4. Route identifier (alphabet or null)
5. Waypoint identifier (alphabet or null)
6. Waypoint "n" identifier (alphabet or null)

THS - True heading and status

$**THS,x.x,a*hh<CR><LF>
        1 2

1. Heading, degrees True (0.00 to 360.00)
2. Mode indicator(A/E)
    A=Autonomous; E=Estimated; M=Manual; S=Simulator; V=Data not valid

VBW - Dual ground/water speed

$**VBW,x.x,x.x,a,x.x,x.x,a,x.x,a,x.x,a,*hh<CR><LF>
        1   2 3 4   5 6 7 8 9 10

1. Longitudinal water speed, knots (-9999.994 - 9999.994)
2. Transverse water speed, knots (-9999.994 - 9999.994, null)
3. Status: water speed, A=data valid V=data invalid (A)
4. Longitudinal ground speed, knots (-9999.994 - 9999.994)
5. Transverse ground speed, knots (-9999.994 - 9999.994, null)
6. Status: ground speed, A=data valid V=data invalid (A)
7. Stern transverse water speed, knots (No use)
8. Status: stern water speed, A=data valid V=data invalid (No use)
9. Stern transverse ground speed, knots (No use)
10. Status: stern ground speed, A=data valid V=data invalid (No use)

VDM - UAIS VHF data-link message

!VDM,x,x,x,a,s--s,x,*hh<CR><LF>
       1 2 3 4 5 6

1. Total number of sentences needed to transfer the message (1 - 9)
2. Sentence number (1 - 9)
3. Sequential message identifier (0 - 9, null)
4. AIS channel number (A/B, null)
5. Encapsulated ITU-R M.1371 radio message (1 - 63 bytes)
6. Number of fill-bits (0 - 5)

VDO - UAIS VHFG data-link own vessel report

!VDO,x,x,x,a,s--s,x,*hh<CR><LF>
       1 2 3 4 5 6

1. Total number of sentences needed to transfer the message (1 - 9)
2. Sentence number (1 - 9)
3. Sequential message identifier (0 - 9, null)
4. AIS channel Number (A/B, null)
5. Encapsulated ITU-R M.1371 radio message (1 - 63 bytes)
6. Number of fill-bits (0 - 5)

VDR - Set and drift

$**VDR,x.x,T,x.x,M,x.x,N,*hh <CR><LF>
         1 2 3 4 5 6

1. Direction, degrees (0.00 - 360.00, null)
2. T=True (fixed)
3. Direction, degrees Magnetic (No use)
4. M=Magnetic (No use)
5. Current speed (0 - 99.94)
6. N=Knots (fixed)

VHW - Water speed and headings

$**VHW,x.x,T,x.x,M,x.x,N,x.x,K,*hh <CR><LF>
          1 2 3 4 5 6 7 8

1. Heading, degrees (0.00 - 360.00)
2. T=True (fixed)
3. Heading, degrees (0.00 - 360.00)
4. M=Magnetic (fixed)
5. Speed, knots (0.00 - 999.94)
6. N=Knots (fixed)
7. Speed, knots (0.00 - 999.94)
8. K=km/hr (fixed)

VSD - UAIS Voyage static data

$--VSD,x.x,x.x,x.x,c--c,hhmmss.ss,xx,xx,x.x,x.x*hh<CR><LF>
          1 2   3   4   5   6 7 8   9

1. Type of ship and cargo category (No use)
2. Maximum present static draught (No use)
3. Persons on-board (0 - 8191, null)
4. Destination (No use)
5. Estimated UTC of arrival at destination (No use)
6. Estimated day of arrival at destination (No use)
7. Estimated month of arrival at destination (No use)
8. Navigational status (No use)
9. Regional application flags (No use)

VTG - Course over ground and ground speed

$**VTG,x.x,T,x.x,M,x.x,N,x.x,K,a,*hh <CR><LF>
        1 2 3 4 5 6 7 8 9

1. Course over ground, degrees (0.00 - 360.00)
2. T=True (fixed)
3. Course over ground, degrees (No use)
4. M=Magnetic (No use)
5. Speed over ground, knots (0.00 - 9999.94)
6. N=Knots (fixed)
7. Speed over ground (0.00 - 9999.94)
8. K=km/h (fixed)
9. Mode indicator (A/D/E/M/P/S)
   A=Autonomous mode;
   D=Differential mode;
   E=Estimated (dead reckoning) mode;
   M=Manual input mode;
   P=Precise. Satellite system used in precision mode. Precision mode is defined as: no
     deliberate degradation (such as selective availability) and higher resolution code (P-code)
     is used to compute position fix. P is also used for satellite system used in multi-frequency,
     SBAS or Precise Point Positioning (PPP) mode;
   S=Simulator mode;
   N=Data not valid

VWR - Wind relative bearing and velocity

$**VWR,x.x,a,x.x,N,x.x,M,x.x,K<CR><LF>
            1 2 3 4 5 6 7 8
 1. Measured wind angle relative to the vessel, degrees (0.00 to 180.00)
 2. Left/Right of vessel heading (L/R)
    L=Left semicircle, R=Right semicircle
 3. Velocity, knots (0.00 - 999.94)
 4. N=Knots (fixed)
 5. Velocity (0.00 - 999.94)
 6. M=m/s (fixed)
 7. Velocity, km/h(0.00 - 999.94)
 8. K=km/h (fixed)

VWT - True wind speed and angle

$**VWT,xxx,a,xx.x,N,xx.x,M,xxx.x,K<CR><LF>
             1 2 3 4 5 6   7 8
 1. Measured wind angle relative to the vessel, degrees (0.00 - 180.00)
 2. Left/Right of vessel heading (L/R)
    L=Left semicircle, R=Right semicircle
 3. Calculated wind speed kn (0.00 - 999.94)
 4. N=Knots (fixed)
 5. Wind speed m/s (0.00 - 999.94)
 6. M=m/s (fixed)
 7. Velocity, km/h (0.00 - 999.94)
 8. K=km/h (fixed)

WPL - Waypoint location

$**WPL,llll.ll,a,yyyyy.yy,a,c--c*hh<CR><LF>
            1 2   3   4 5
 1. Waypoint latitude (0000.00000 - 9000.00000)
 2. N/S (N/S)
 3. Waypoint longitude (00000.00000 - 18000.00000)
 4. E/W (E/W)
 5. Waypoint identifier (alphanumeric characters)

ZDA - Time and date

$**ZDA,hhmmss,xx,xx,xxxx,xx,xx<CR><LF>
              1   2 3   4   5 6
 1. UTC (000000.00 - 2400001.00)
 2. Day (01 - 31)
 3. Month (01 -12)
 4. Year (0000-9999)
 5. Local zone, hours (No use)
 6. Loca zone, minutes (No use)

Output sentences

For ACK, see input sentences.

ABM - AIS addressed binary and safety related message

!**ABM,x,x,x,xxxxxxxxx,x,xx,s--s,x,*hh<CR><LF>
      1 2 3   4   5 6 7 8
1. Total number of sentences needed to transfer the message (1 - 9)
2. Sentence number (1 - 9)
3. Sequential message identifier (0 - 3)
4. The MMSI of destination AIS unit for the ITU-R M.1371 message (9 digits / null)
5. AIS channel for broadcast of the radio message (0 - 3 / null)
6. VDL message number (6 / 12 / null), see ITU-R M.1371
7. Encapsulated data (1 - 63 bytes)
8. Number of fill-bits (0 - 5)

ALC - Cyclic alert list

$**ALC,xx,xx,xx,xx, aaa,x.x,x.x,x.x,"""""",*hh<CR><LF>
      1 2 3 4 5 6 7 8 9
1. Total number of sentences this message (01 - 16)
2. Sentence number (01 - 16)
3. Sequential message identifier (00 - 99)
4. Number of alert entries (0 - 3)
5. Manufacturer mnemonic code (FEC, null) —————┐ Alert entry 1
6. Alert identifier (1 - 999 or 10001 - 10999) ————┤ See Note
7. Alert instance (null) ————————————————┤
8. Revision counter (1 - 99) ——————————————┘
9. Additional alert entries (see Note)

Note: Alert entry 0 - n: Each alert entry consists of
- Manufacturer Identifier (see ALF Manufactuer)
- Alert Identifier (see ALF Alert identifier)
- Alert instance (see ALF instance)
- Revision counter (see ALF revision counter)
Each entry identifies a certain alert with a certain state.
It is not allowed that an alert entry is split between two ALC sentences.

ALF - Alert sentence

$**ALF,x,x,x,hhmmss.ss,a,a,a,aaa,x.x,x.x,x.x,x,c--c,*hh<CR><LF>
      1 2 3   4   5 6 7 8 9 10 11 12 13
1. Total number of ALF sentences this message (1, 2)
2. Sentence number (1, 2)
3. Sequential message identifier (0 - 9)
4. Time of last change (000000.00 - 240001.00 / null)
   null when #2 is 2
5. Alert category (A/ B/null)
   A=Alert category A, B=Alert category B, null when #2 is 2
6. Alert priority (A/W/C/null)
  A=Alarm, W=Warning, C=Caution, null when #2 is 2
7. Alert state (A/S/O/U/V/N/null)
   A=Acknowledged
   S=Silence
   O=Active-responsiblity transferred
   U=Rectified-unacknowledged
   V=Not acknowledged
   N=Normal state
   null when #2 is 2
8. Manufacturer mnemonic code (FEC/null)
9. Alert identifier (1 - 999 or 10001 - 10999)
10. Alert instance (null)
11. Revision counter (1 - 99)
12. Escalation counter (0 - 9)
13. Alert text (max. 16 characters)

ALR - Set alarm state

$**ALR,hhmmss.ss,xxx,A,A,c—c,*hh<CR><LF>
            1   2 3 4   5
1. Time of alarm condition change, UTC (000000.00 - 240001.00)
2. Unique alarm number (identifier) at alarm source (001 - 999 / null)
3. Alarm condition (A/V)
   A=threshold exceeded V=not exceeded
4. Alarm acknowledge state (A/V)
   A=acknowledged V=not acknowledged
5. Alarm description text (alphanumeric characters, max. 32)

ARC - Alert command refused

$**ARC,hhmmss.ss,aaa,x.x,x.x,c*hh<CR><LF>
            1   2 3 4 5
1. Release time of the alert command refused (000000.00 - 240001.00, null)
2. Used for proprietary alerts, defined by the manufacturer (FEC)
3. The alert identifier (10001 - 10999)
4. The alert instance (null)
5. Refused alert command (A/O)
   A=acknowledge, O=responsibility transfer

BBM - UAIS broadcast binary message

!**BBM,x,x,x,x,xx,s--s,x,*hh<CR><LF>
      1 2 3 4 5 6 7
1. Total number of sentences needed to transfer the message (1 - 9)
2. Sentence number (1 - 9)
3. Sequential message identifier (0 - 9)
4. AIS channel for broadcast of the radio message (0 - 3/null)
5. VDL message number (8/14/null)
6. Encapsulated data (1 - 63 bytes)
7. Number of fill-bits (0 - 5)

EVE - General event message

$ **EVE,hhmmss.ss,c--c,c--c*hh<CR><LF>
             1   2   3
1. Event time (000000.00 - 240001.00, null)
2. Tag code used for identification of source of event (six alphanumeric characters, two
   English characters, four digits)
3. Event description (OPERATION)

Note: The EVE sentence is output after input has been detected from either the trackball or the keyboard.

HBT - Heartbeat supervision sentence

$**HBT,x.x,A,x*hh<CR><LF>
       1 2 3
1. Configured repeat interval (60.0)
2. Equipment status (A)
   A=Normal
3. Sequential sequence identifier (0 - 9)

AP-13

OSD - Own ship data

$**OSD,x.x,A,x.x,a,x.x,a,x.x,x,x.x,a*hh<CR><LF>
            1 2 3 4 5 6 7   8 9

1. Heading, degrees true (0.0 - 359.9, null)
2. Heading status (A/V)
A=data valid V=data invalid
3. Vessel course, degrees true (0.0 - 359.9)
4. Course reference (B/M/W/R/P, null)
    B=Bottom tracking log
    M=Manually entered
    W=Water referenced
    R=Radar tracking (of fixed target)
    P=Positioning system ground reference
5. Vessel speed (0.0 - 99.9)
6. Speed reference (B/M/W/R/P, null)
7. Vessel set, degrees true, manually entered(0.0 - 359.9, null)
8. Vessel drift (speed), manually entered (0.0 – 19.9, null)
9. Speed units (K/N/S, null)
    K=km/h N=Knots S=Statute mile

RSD - Radar ship data

$**RSD,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,a,aH*hh <CR><LF>
            1   2   3   4   5   6   7   8   9 10 11 12 13

1. Origin 1 range, from own ship (0.000 - 9999, null) (see note 2)
2. Origin 1 bearing, degrees from 0 (0.0 - 359.9) (see note 2)
3. Variable range marker 1(VRM1), range (0.000 – 999.9, null)
4. Bearing line 1(EBL1), degrees from 0 (0.0 - 359.9, null)
5. Origin 2 range (0.000 - 9999, null) (see note 2)
6. Origin 2 bearing (0.0 - 359.9)(see note 2)
7. VRM2,.9 range (0.000 - 999.9, null)
8. EBL2, degrees (0.0 - 359.9, null)
9. Cursor range, from own ship (0.000 - 999.9)
10. Cursor bearing, degrees clockwise from 0 (0.0 - 359.9)
11. Range scale in use (0.0625 - 120)
12. Range units (K/N/S)
    K=km/h N=Knots S=Statute mile
13. Display rotation (C/H/N, null)(see note 1)

NOTES
1 Display rotation:
    C=Course-up, course-over-ground up, degrees true
    H=Head-up, ship's heading(center-line) 0 up
    N=North-up, true north is 0 up
    null=Stern-up
2 Origin 1 and origin 2 are located at the stated range and bearing from own ship and provide for two
    independent sets of variable range markers (VRM) and electronic bearing lines (EBL) originating
    away from own ship position.

TLB - Target label

$**TLB,x.x,c--c,x.x,c--c,…,x.x,c--c*hh<CR><LF>
        1   2   3   3

1. Target number "n" reported by the device (1 - 1023)
2. Label assigned to target "n" (TT=000 - 999, AIS=000000000 - 999999999)
3. Additional label pairs

AP-14

TLL - Target latitude and longitude

$**TLL,xx,llll.ll,a,yyyyy.yy,a,c--c,hhmmss.ss,a,a*hh<CR><LF>
    1 2 3 4 5 6   7 8 9

1. Target number (Fixed at null)
2. Target Latitude (0000.0000 - 9000.0000)
3. Target N/S (N/S)
4. Target Longitude (00000.0000 - 18000.0000)
5. Target E/W (E/W)
6. Target name (Fixed at null)
7. UTC of data (000000.00 - 235959.99)
8. Target status (Fixed at null)
9. Reference target (Fixed at null)

TTD - Tracked target data

!**TTD,hh,hh,x,s--s,x*hh<CR><LF>
    1 2 3 4 5

1. Total hex number of sentences need to transfer the message (1 - FF)
2. Hex sentence number (1 - FF)
3. Sequential message identifier (0 - 9)
4. Encapsulated trancked target data (6 bit binary-converted data)
5. Number of fill bits (0 - 5)

TTM - Tracked target message

$**TTM,xx,x.x,x.x,a,x.x,x.x,a,x.x,x.x,a,c--c,a,a,hhmmss.ss,a*hh<CR><LF>
    1 2 3 4 5 6 7 8 9 10 11 12 13 14   15

1. Target number (00 - 99)
2. Target distance from own ship (0.000 - 99.999)
3. Bearing from own ship,degrees (0.0 - 359.9)
4. True or Relative (T)
5. Target speed (0.00 - 999.99, null)
6. Target course, degrees (0.0 - 359.9, null)
7. True or Relative output (T/R)
8. Distance of closet point of approach (0.00 - 99.99, null)
9. Time to CPA, min., "-" increasing (-99.99 - 99.99, null)
10. Speed/distance units (N)
  N=nm
11. Target name (null)
12. Target status (L/Q/T)
  L=Lost Q=Acquiring T=Tracking
13. Reference target (R/null)
14. UTC of data (null)
15. Type of acquisition (A/M)
  A=Automatic M=Manual

VSD - UAIS Voyage static data

$--VSD,x.x,x.x,x.x,c--c,hhmmss.ss,xx,xx,x.x,x.x*hh<CR><LF>
          1 2   3   4   5   6 7 8   9

1. Type of ship and cargo category (null)
2. Maximum present static draught (0 - 25.5, null)
3. Persons on-board (0 - 8191, null)
4. Destination (Alphanumeric character, null)
5. Estimated UTC of arrival at destination (000000.00 - 246000.00*, null)
6. Estimated day of arrival at destination (00 - 31) (UTC)
7. Estimated month of arrival at destination (00 - 12) (UTC)
8. Navigational status (0 - 15)
   0=Under way using engine
   1=At anchor
   2=Not under command
   3=Restricted maneuverability
   4=Constrained by her draught
   5=Moored
   6=Aground
   7=Engaged in Fishing
   8=Under way sailing
   9=HSC
   10=WIG
   11=Power-driven vessel towing astern
   12=Power-driven vessel pushing ahead or towing alongside
   13=Reserved for future use
   14=AIS-SART (active), MOB-AIS, EPIRB-AIS
   15=Undefined = default (also used by AIS-SART, MOB-AIS and
     EPIRB AIS under test)
9. Regional application flags (null)
* 246000.00 when ETA is not set.

Serial Interface

TD-A

TD-B

COMMON (ISOGND)

RD-A

RD-B

110 ohm*

ADM2587E
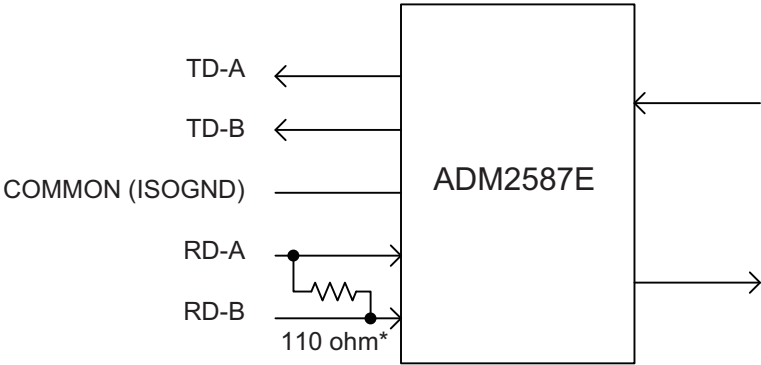
* Set with jumper.
Open/close switchable.

IEC 61162-2 input/output

RD-H

390 ohm   100 ohm

RD-C

PC400

IEC 61162-1 input

SN65HVD30

TD-A

TD-B
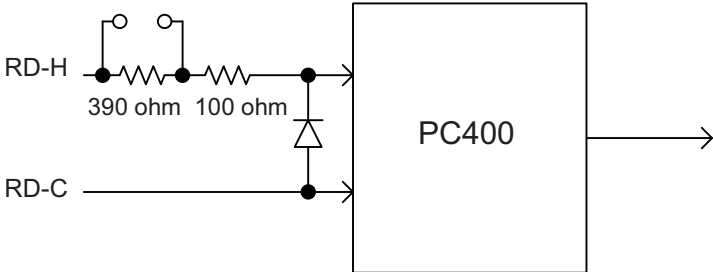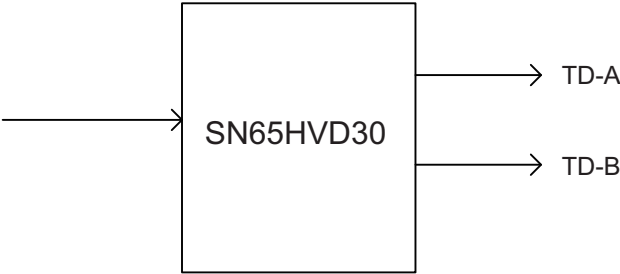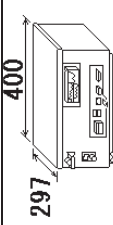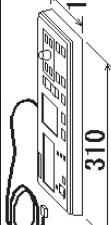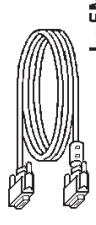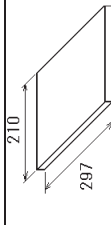
IEC 61162-1 output

PACKING LIST　RC28RP24-*J2*/HK , RC28RP24-*E2*/HK　(DC)

UNIT　ユニット

NAME	OUTLINE	DESCRIPTION/CODE No.	Q'TY
制御部 PROCESSOR UNIT	400 × 297 × 310 / 100	RPU024-*　000-028-065-00 **	1
操作部 CONTROL UNIT		RCU-028*　000-027-860-00 **	1

SPARE PARTS　予備品

NAME	OUTLINE	DESCRIPTION/CODE No.	Q'TY
予備品 SPARE PARTS		SP03-18001　001-419-820-00	1

INSTALLATION MATERIALS　工事材料

NAME	OUTLINE	DESCRIPTION/CODE No.	Q'TY
ケーブル組品 CABLE ASSEMBLY	L=5M	DVI-D/D S-LINK　5M　001-132-960-10	1
工事材料 INSTALLATION MATERIALS		CP03-36501　001-419-860-00	1
工事材料 INSTALLATION MATERIALS		CP03-36601　001-419-600-00	1

DOCUMENT　図書

NAME	OUTLINE	DESCRIPTION/CODE No.	Q'TY
取扱説明書(英) OPERATOR'S MANUAL (EN)	210 × 297	OME-36380-*　000-190-831-1* (*2)	1

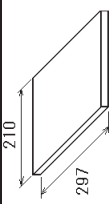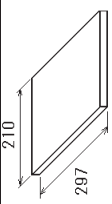| NAME	OUTLINE	DESCRIPTION/CODE No.	Q'TY
取扱説明書(和) OPERATOR'S MANUAL (JP)	210 × 297	OMJ-36420-*　000-192-103-1* (*1)	1
操作要領書(多言語) OPERATOR'S GUIDE (MLG)	210 × 297	MLG-36380-*　000-190-833-1* (*2)	1
操作要領書(和) OPERATOR'S GUIDE (JP)	210 × 297	OSJ-36420-*　000-192-105-1* (*1)	1
装備要領書(英) INSTALLATION MANUAL (EN)	210 × 297	IME-36380-*　000-190-835-1* (*2)	1
装備要領書(和) INSTALLATION MANUAL (JP)	210 × 297	IMJ-36420-*　000-192-104-1* (*1)	1

1.コード番号末尾の[**]は、選択品の代表コードを表します。
CODE NUMBER ENDING WITH "**" INDICATES THE CODE NUMBER OF REPRESENTATIVE MATERIAL.

2.(*1)の書類は、和文仕様専用です。
(*1) MARKED DOCUMENTS ARE FOR JAPANESE SET ONLY.

3.(*2)の書類は、英文仕様専用です。
(*2) MARKED DOCUMENTS ARE FOR ENGLISH SET ONLY.

(略図の寸法は、参考値です。DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

A-1

C3638-Z04-B

PACKING LIST RC28RP24-*J60*/HK , RC28RP24-*E60*/HK , RC28RP24-*E72*/HK (AC)

Table 1

NAME		OUTLINE	DESCRIPTION/CODE No.	Q'TY
ユニット	UNIT			
制御部	PROCESSOR UNIT	400 × 297 × 310	RPU024-* 000-028-065-00 **	1
操作部	CONTROL UNIT	100	RCU-028* 000-027-860-00 **	1
予備品	SPARE PARTS			
予備品	SPARE PARTS		SP03-18002 001-419-830-00	1
工事材料	INSTALLATION MATERIALS			
ケーブル組品	CABLE ASSEMBLY	L=5M	DVI-D/D S-LINK 5M 001-132-960-10	1
工事材料	INSTALLATION MATERIALS		CP03-36501 001-419-860-00	1
工事材料	INSTALLATION MATERIALS		CP03-36601 001-419-600-00	1
図書	DOCUMENT			
取扱説明書 (英)	OPERATOR'S MANUAL (EN)	210 × 297	OME-36380-* 000-190-831-1* (*2)	1

Table 2

NAME	OUTLINE	DESCRIPTION/CODE No.	Q'TY
取扱説明書 (和) OPERATOR'S MANUAL (JP)	210 × 297	OMJ-36420-* 000-192-103-1* (*1)	1
操作要領書 (多言語) OPERATOR'S GUIDE (MLG)	210 × 297	MLG-36380-* 000-190-833-1* (*2)	1
操作要領書 (和) OPERATOR'S GUIDE (JP)	210 × 297	OSJ-36420-* 000-192-105-1* (*1)	1
装備要領書 (英) INSTALLATION MANUAL (EN)	210 × 297	IME-36380-* 000-190-835-1* (*2)	1
装備要領書 (和) INSTALLATION MANUAL (JP)	210 × 297	IMJ-36420-* 000-192-104-1* (*1)	1

1.コード番号末尾の[**]は、選択品の代表コードを表します。
CODE NUMBER ENDING WITH "**" INDICATES THE CODE NUMBER OF REPRESENTATIVE MATERIAL.

2.(*1)の書類は、和文仕様専用です。
(*1) MARKED DOCUMENTS ARE FOR JAPANESE SET ONLY.

3.(*2)の書類は、和文仕様専用です。
(*2) MARKED DOCUMENTS ARE FOR ENGLISH SET ONLY.

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

A-2

C3638-Z05-B

PACKING LIST — 1

RSB-120-*IM0 , RSB-121-*IM0 , RSB-120-*HK , RSB-121-*HK

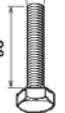| NAME	OUTLINE	DESCRIPTION/CODE No.	Q'TY
ユニット UNIT			
空中線本体部	468	RSB-120-*/121-*	1
SCANNER UNIT		000-027-849-00 **	
予備品 SPARE PARTS			
空中線予備品		SP03-12501	1
SPARE PARTS		008-485-360-00	
工事材料 INSTALLATION MATERIALS			
工事材料		CP03-33402	1
INSTALLATION MATERIALS		001-419-290-00	
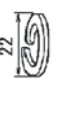
コード番号末尾の[**]は、選択品の代表コードを表します。
CODE NUMBER ENDING WITH "**" INDICATES THE CODE NUMBER OF REPRESENTATIVE MATERIAL.

（略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.）

C3642-Z01-A

PACKING LIST — 2

RSB-0070-085A, RSB-0070-086A, RSB-0070-087A, RSB-0073-085A, RSB-0073-086A, RSB-0073-087A

NAME	OUTLINE	DESCRIPTION/CODE No.	Q'TY
ユニット UNIT			
空中線本体部	438	RSB-0070-08*A/-0073-08*A	1
SCANNER UNIT		001-125-220-00 **	
空中線部工材 ANTENNA UNIT INSTALLATION MATERIALS			
空中線部工材		CP03-33801	1
INSTALLATION MATERIALS		001-141-670-00	

コード番号末尾の[**]は、選択品の代表コードを表します。
CODE NUMBER ENDING WITH "**" INDICATES THE CODE NUMBER OF REPRESENTATIVE MATERIAL.

型式/コード番号が2段の場合、下段より上段に代わる通渡期品であり、どちらかが入っています。 なお、品質は変わりません。
TWO TYPES AND CODES MAY BE LISTED FOR AN ITEM. THE LOWER PRODUCT MAY BE SHIPPED IN PLACE OF THE UPPER PRODUCT. QUALITY IS THE SAME.

（略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.）

C3539-Z04-B

FURUNO

工事材料表 INSTALLATION MATERIALS

| CODE NO. | 001-419-290-00 | 03HQ-X-9401 -1 |
| TYPE | CP03-33402 | 2/2 |

番号 NO.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
11	六角ボルト HEXAGONAL HEAD BOLT		M6X25 SUS304 / CODE NO. 000-162-871-10	1	
12	ケーブル組品 CABLE ASSY.		RW-4747 / CODE NO. 000-566-000-12	1	

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO ELECTRIC CO .,LTD.

C3642-M02-B (2)

FURUNO

工事材料表 INSTALLATION MATERIALS

| CODE NO. | 001-419-290-00 | 03HQ-X-9401 -1 |
| TYPE | CP03-33402 | 1/2 |

番号 NO.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	防蝕ゴム1. CORROSION-PROOF RUBBER		03-001-3001-0 ROHS / CODE NO. 300-130-010-10	1	
2	シールワッシャー SEAL WASHER		03-001-3002-0 ROHS / CODE NO. 300-130-020-10	4	
3	圧着端子 CRIMP-ON LUG		FV5.5-4(LF) YEL / CODE NO. 000-166-744-10	1	
4	六角ナット 1シュ HEXAGONAL NUT		M12 SUS304 / CODE NO. 000-167-491-10	4	
5	ミガキ平座金 FLAT WASHER		M12 SUS304 / CODE NO. 000-167-446-10	4	
6	バネ座金 SPRING WASHER		M12 SUS304 / CODE NO. 000-167-397-10	4	
7	六角ボルト 全ネジ HEXAGON HEAD SCREW		M12X60 SUS304 / CODE NO. 000-162-813-10	4	
8	六角ナット 1シュ HEXAGONAL NUT		M6 SUS304 / CODE NO. 000-158-856-10	1	
9	バネ座金 SPRING WASHER		M6 SUS304 / CODE NO. 000-158-855-10	1	
10	ミガキ平座金 FLAT WASHER		M6 SUS304 / CODE NO. 000-158-854-10	3	

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO ELECTRIC CO .,LTD.

C3642-M02-B (1)

FURUNO

工事材料表
INSTALLATION MATERIALS

			CODE NO.	001-419-600-00			
			TYPE	CP03-36601			
番号 NO.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS			数量 Q'TY	用途／備考 REMARKS
1	+トラスタッピンネジ 1シュ SELF-TAPPING SCREW	φ4 ⊥ 20	4X20 SUS304	CODE NO.	000-158-850-10	4	

03HQ-X-9403 -0   1/1

FURUNO ELECTRIC CO ., LTD.

C3638-M03-A

FURUNO

工事材料表
INSTALLATION MATERIALS

			CODE NO.	001-419-860-00			
			TYPE	CP03-36501			
番号 NO.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS			数量 Q'TY	用途／備考 REMARKS
1	ブラインドシールM2.5 BLIND SEAL N2.5	φ9.5	05-104-6519-0	CODE NO.	100-372-550-10	1	
2	イラックスチューブ A INSULATION TUBE		3.0X0.3 YEL *50CM*	CODE NO.	000-162-841-10	8	
3	+トラスタッピンネジ 1シュ SELF-TAPPING SCREW	φ5 ⊥ 20	5X20 SUS304	CODE NO.	000-162-608-10	4	

03HQ-X-9402 -2   1/1

FURUNO ELECTRIC CO ., LTD.

C3638-M02-C

FURUNO

SPARE PARTS LIST FOR

CODE NO.	001-419-830-00	03HQ-X-9302-1	1/1
TYPE	SP03-18002	BOX NO.	P

SHIP NO.　　USE　　SETS PER VESSEL

ITEM NO.	NAME OF PART	OUTLINE	DWG. NO. OR TYPE NO.	QUANTITY WORKING PER SET	PER VES	SPARE	REMARKS/CODE NO.
1	ヒューズ GLASS TUBE FUSE	30　φ6	FGBO-A 250V 8A PBF	1	1	2	000-155-843-10

MFR'S NAME	FURUNO ELECTRIC CO.,LTD. DIMENSIONS IN DRAWING FOR REFERENCE ONLY.	DWG NO.	C3638-P02-B	1/1

(略図の寸法は、参考値です。)

FURUNO

SPARE PARTS LIST FOR
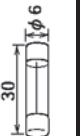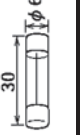
CODE NO.	001-419-820-00	03HQ-X-9301-1	1/1
TYPE	SP03-18001	BOX NO.	P

SHIP NO.　　USE　　SETS PER VESSEL

ITEM NO.	NAME OF PART	OUTLINE	DWG. NO. OR TYPE NO.	QUANTITY WORKING PER SET	PER VES	SPARE	REMARKS/CODE NO.
1	ヒューズ GLASS TUBE FUSE	30　φ6	FGBO-A 125V 15A PBF	1	1	2	000-155-827-10

MFR'S NAME	FURUNO ELECTRIC CO.,LTD. DIMENSIONS IN DRAWING FOR REFERENCE ONLY.	DWG NO.	C3638-P01-B	1/1

(略図の寸法は、参考値です。)

FURUNO ELECTRIC CO., LTD.

FURUNO

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

表2 TABLE 2

種類 TYPE	XN10A	XN12A	XN13A
空中線長（A） ANT.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	25	27

4-M4x16

内側シールド
INNER SHIELD

押え板
CLAMP PLATE

パッキン
PACKING

F.W.
平座金

ケーブル固定詳細
DETAIL OF CABLE FIXING

空中線長（A）　ANTENNA LENGTH

121.5

250
340

アース端子
GND TERMINAL
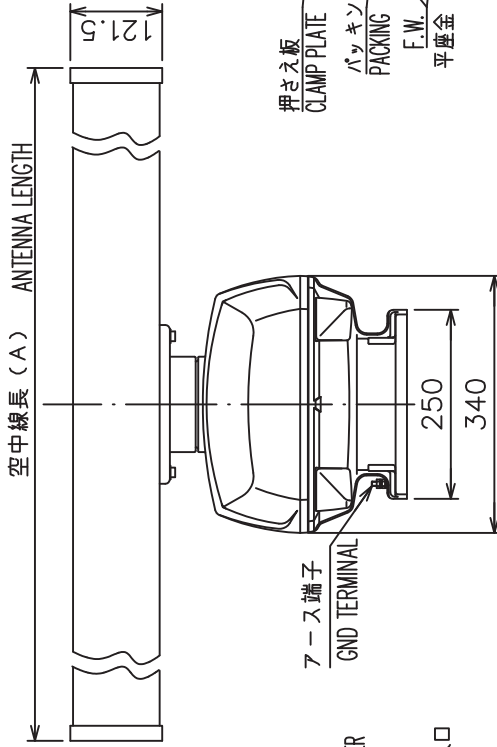
注記　1）　指定なき寸法公差は表1による。
　　　2）　取付にはM12ボルトを使用のこと。
　　　3）　通気孔は塞がないこと。

NOTE　1.　TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
　　　　2.　USE M12 BOLTS FOR FIXING THE UNIT.
　　　　3.　DO NOT COVER THE VENT HOLE.

DRAWN	18/Sep./2015	T.YAMASAKI
CHECKED	18/Sep./2013	H.MAKI
APPROVED	Feb/2015	H.MAKI
SCALE	1/10	MASS 表2参照 SEE TABLE 2
DWG.No.	C3539-G03-D	

OTHERS
MODEL1942M2, MODEL1954C ser.
FR-7062/8062 ser.

REF.No.　03-142-300G-6

TITLE　RSB-0070/0072/0073

名称　空中線部

外寸図

NAME　ANTENNA UNIT

OUTLINE DRAWING

回転中心
CENTER OF ROTATION

通気孔
VENT HOLE

船首方向
BOW

回転安全空間（B）
ANT. CLEARANCE

117 60

438

357

ケーブル導入口
CABLE ENTRY

型式銘板
NAMEPLATE

445

防蝕ゴム
ANTICORROSION RUBBER

Ø25-30 ケーブル導入口
CABLE ENTRY

101
112
138

100°

542

取付台
PLATFORM

アンテナケーブル
ANTENNA CABLE

取付穴（換装用）
4-Ø15
FIXING HOLES
(FOR REMOUNTING)

船首方向
BOW

Ø25-30 ケーブル導入口
CABLE ENTRY

取付寸法
FIXING DIMENSIONS

140±0.5
92
78
150±0.5

250
200±0.5
200±0.5
250

取付穴 4-Ø15
FIXING HOLES

ボルト
M12 BOLT

シールワッシャ
SEAL WASHER

防蝕ゴム
RUBBER SEAT

取付台
PLATFORM

S.W.

ナット
M12 NUT

F.W.

取付部詳細
DETAIL FOR FIXING

FURUNO

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

表2 TABLE 2

アンテナ型式 ANTENNA TYPE	XN12AF (120cm型)
A：空中線長 ANTENNA LENGTH (mm)	1,260±10
B：回転安全空間 ANTENNA CLEARANCE (mm)	1,400

ケーブル導入口 φ25
CABLE ENTRY

φB 回転安全空間
ANTENNA CLEARANCE

型式銘板
NAMEPLATE

取付穴 4-φ15
FIXING HOLES

240±1
300
310

端子台
TERMINAL BOARD

船首方向
BOW

555±10
124
18
#300
468
#300

PMアンテナ
PM ANTENNA

防蝕ゴム
ANTICORROSION RUBBER
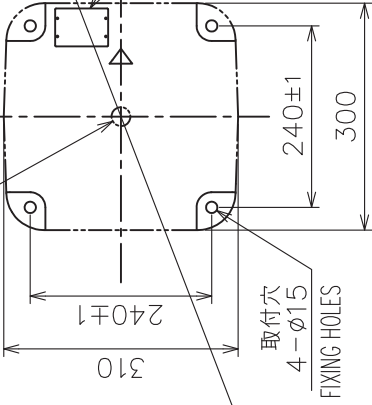
空中線長 A ANTENNA LENGTH
304

アンテナスイッチ
SERVICE SWITCH
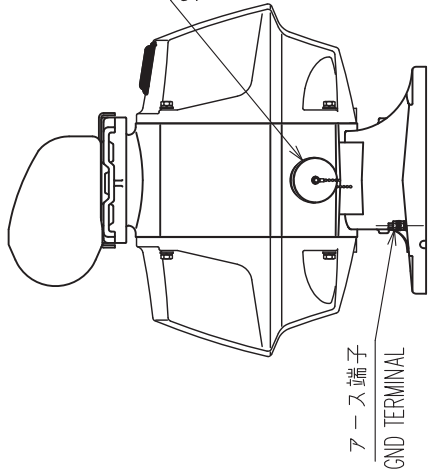
164±5
#150

アース端子
GND TERMINAL

注 記 1) 指定外の寸法公差は表1による。
 2) #印寸法は最小サービス空間寸法とする。
 3) 取付用ネジはM12ボルトを使用のこと。

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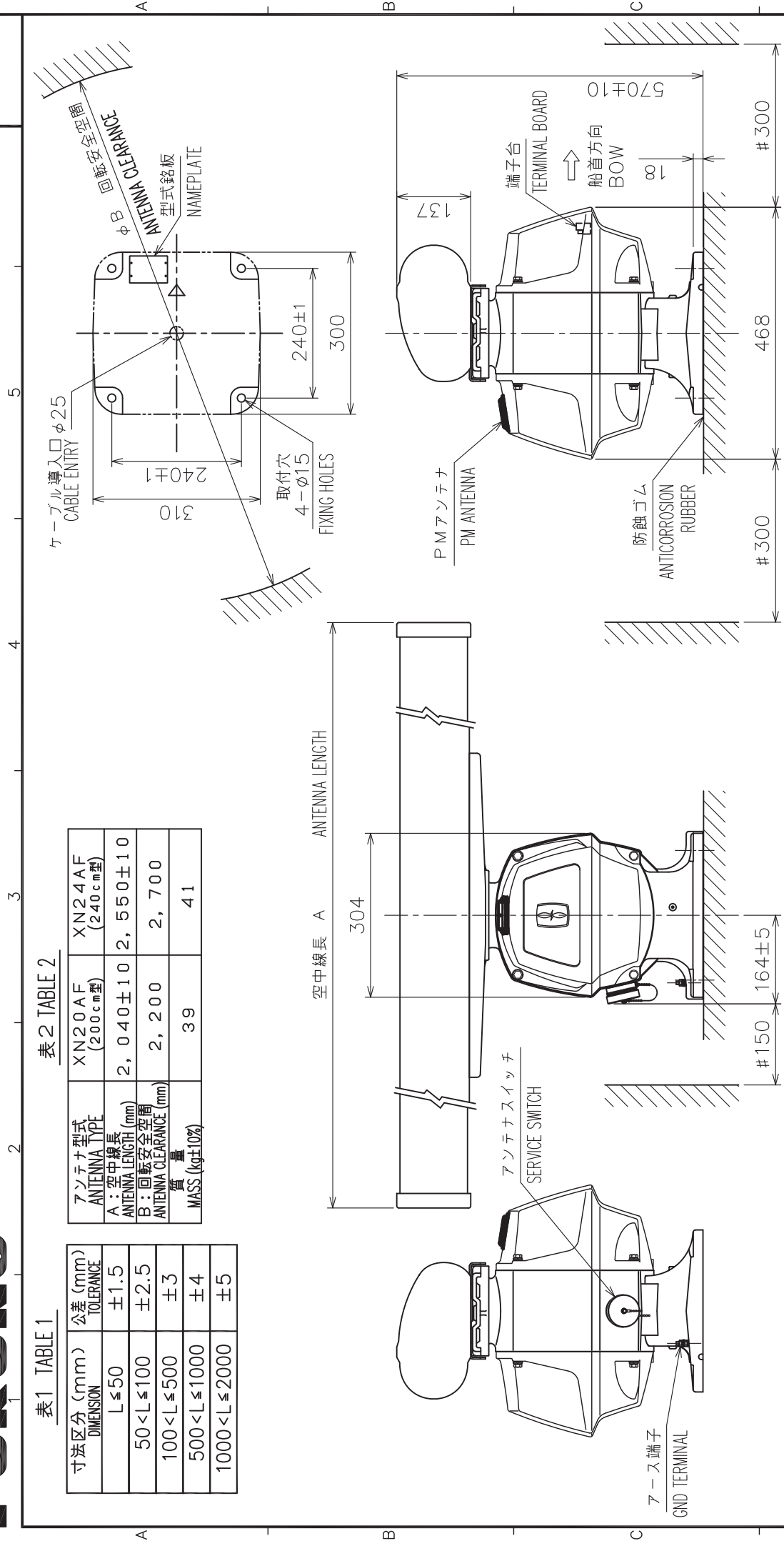 2. #: MINIMUM SERVICE CLEARANCE.
 3. USE M12 BOLTS FOR FIXING THE UNIT.

DRAWN	4/Feb/2015 T.YAMASAKI			TITLE	RSB-120/121 (XN12AF)
CHECKED	4/Feb/2015 H.MAKI			名称	空中線部
APPROVED	5/Feb/2015 H.MAKI	FAR-1518/1528			外寸図
SCALE	1/10	MASS 33	±10% kg	NAME	ANTENNA UNIT
DWG.No.	C3642-G01-A	REF.No.	03-186-300G-0		OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.

FURUNO

型式銘板
NAMEPLATE

回転安全空間
ANTENNA CLEARANCE
φB

ケーブル導入口 φ25
CABLE ENTRY

取付穴 4－φ15
FIXING HOLES

240±1
300
240±1
310

端子台
TERMINAL BOARD

船首方向
BOW

PMアンテナ
PM ANTENNA

防蝕ゴム
ANTICORROSION RUBBER

570±10
137
8
468
#300
#300

空中線長 A
ANTENNA LENGTH

アンテナスイッチ
SERVICE SWITCH

アース端子
GND TERMINAL

304
164±5
#150

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

表2 TABLE 2

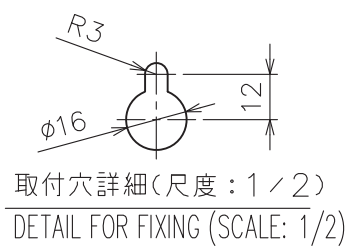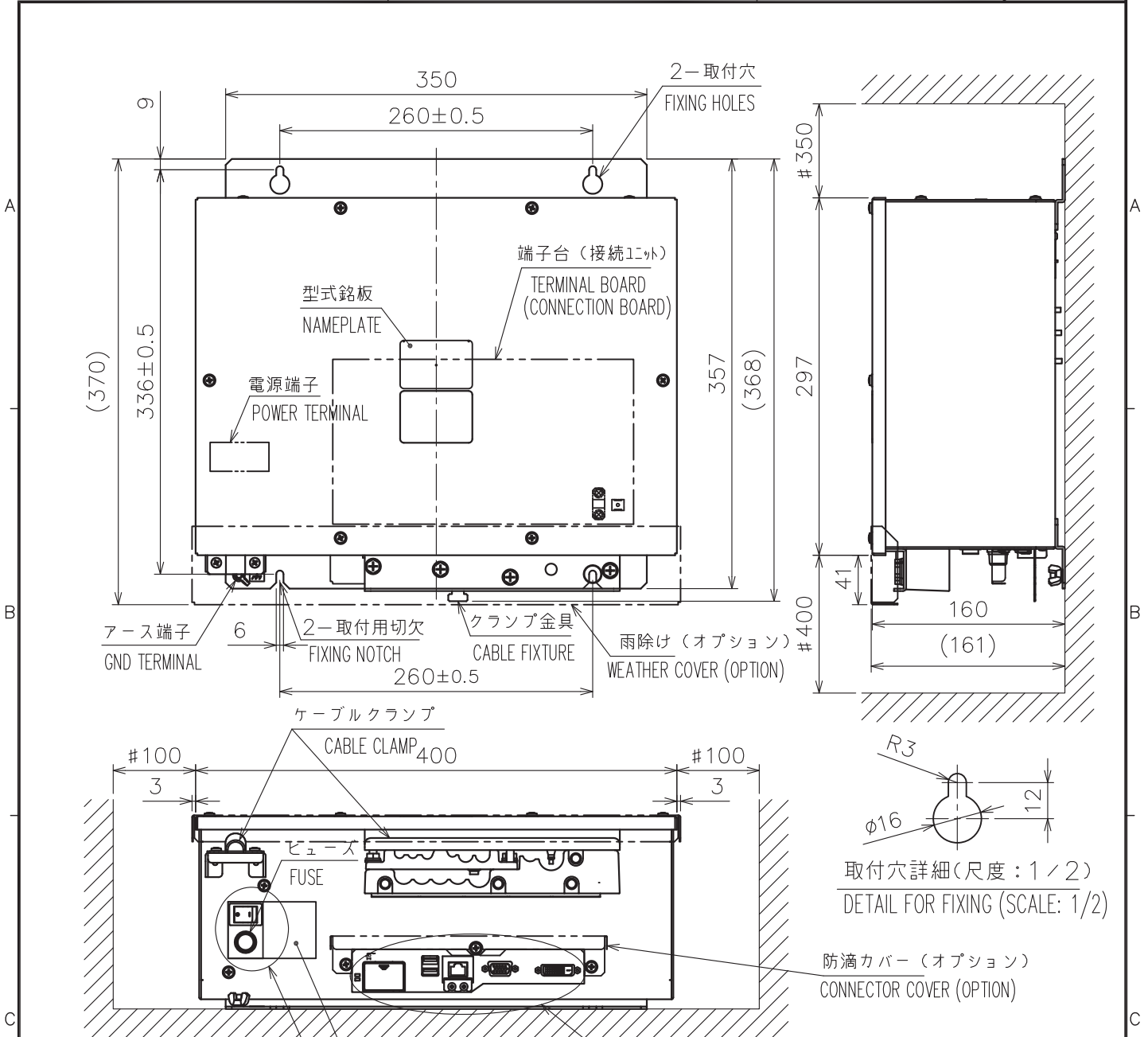| アンテナ型式 ANTENNA TYPE	XN20AF (200cm型)	XN24AF (240cm型)
A：空中線長 (mm) ANTENNA LENGTH (mm)	2,040±10	2,550±10
B：回転安全空間 (mm) ANTENNA CLEARANCE (mm)	2,200	2,700
質量 MASS (kg±10%)	39	41

注記 1) 指定外の寸法公差は表1による。
2) #印寸法は最小サービス空間寸法とする。
3) 取付用ネジはM12ボルトを使用のこと。

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

DRAWN	4/Feb/2015 T.YAMASAKI
CHECKED	4/Feb/2015 H.MAKI
APPROVED	5/Feb/2015 H.MAKI
SCALE 1/10	MASS 表2参照 SEE TABLE 2
DWG.No. C3642-G02-A	

TITLE RSB-120/121 (XN20AF /24AF)
名称 空中線部
外寸図
NAME ANTENNA UNIT
OUTLINE DRAWING

FAR-1518/1528
REF.No. 03-186-301G-0

FURUNO ELECTRIC CO., LTD.

FURUNO

2一取付穴
FIXING HOLES

350
260±0.5

9
#350
357 (368)
297
336±0.5
(370)

型式銘板
NAMEPLATE

端子台（接続ユニット）
TERMINAL BOARD
(CONNECTION BOARD)

電源端子
POWER TERMINAL

アース端子　6　2一取付用切欠
GND TERMINAL　　FIXING NOTCH

クランプ金具
CABLE FIXTURE

雨除け（オプション）
WEATHER COVER (OPTION)

41
#400
160
(161)

260±0.5

ケーブルクランプ
CABLE CLAMP 400

#100　　　　　　　　　　　　　#100
3　　　　　　　　　　　　　　　3

ヒューズ
FUSE

防滴カバー（オプション）
CONNECTOR COVER (OPTION)

R3
φ16
12

取付穴詳細（尺度：1／2）
DETAIL FOR FIXING (SCALE: 1/2)

ヒューズ貼りマーク（ＤＣ）
FUSE LABEL (DC)
&部　ＤＣ仕様
&: FOR DC SPEC

ヒューズ貼りマーク（ＡＣ）
FUSE LABEL (AC)
&部（AC仕様）
&: FOR AC SPEC

信号コネクタ
SIGNAL CONNECTOR

表2　TABLE 2

電源 SOURCE	質量（kg±10%) MASS
DC	6.2
AC	6.8

注　記
１）　指定外の寸法公差は表１による。
２）　＃印寸法は最小サービス空間寸法とする。
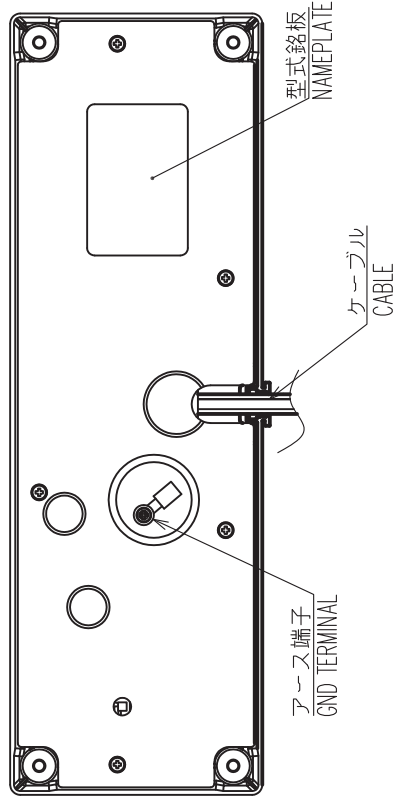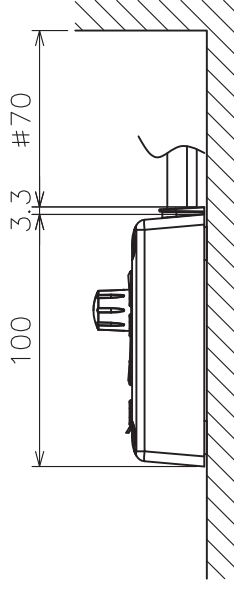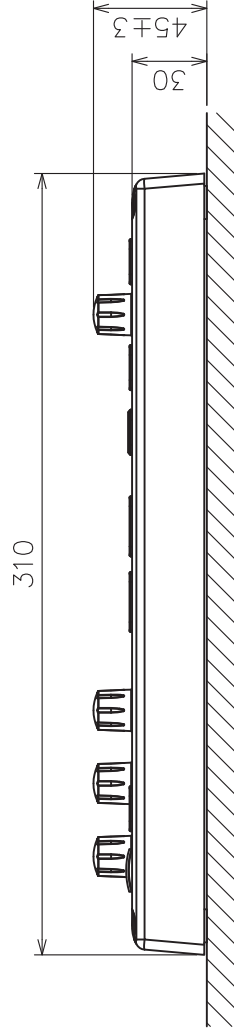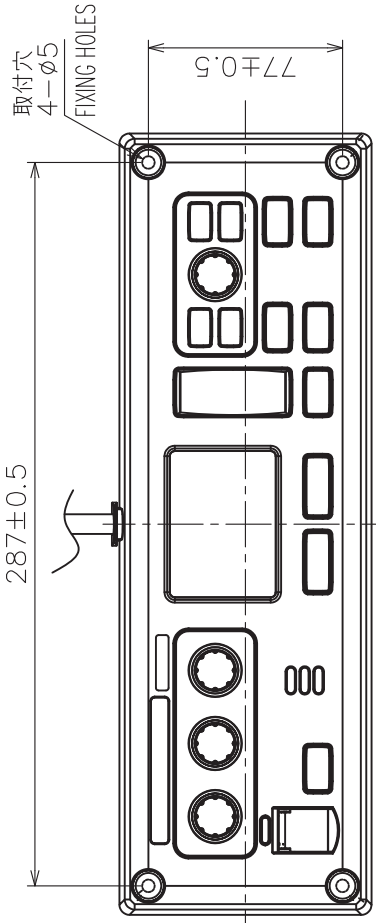３）　取付用ネジはＭ５ボルトまたはトラスタッピンネジ呼径５×２０を使用のこと。

表1　TABLE 1

NOTE
1.　TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2.　#: MIMIMUM SERVICE CLEARANCE.
3.　USE M5 BOLTS OR TAPPING SCREWS φ5x20 FOR FIXING THE UNIT.

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

DRAWN	3/Feb/2015　T.YAMASAKI		TITLE	RPU-024
CHECKED	3/Feb/2015　H.MAKI		名称	制御部
APPROVED	4/Feb/2015 H.MAKI	FAR-1518/1528 FAR-1513/1523		外寸図
SCALE	1/5　MASS 表2参照 SEE TABLE 2		NAME	PROCESSOR UNIT
DWG. No.	C3638-G01- A	REF. No.　03-186-100G- 2		OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.

FURUNO

FURUNO ELECTRIC CO., LTD.

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

#70

3.3

100

45±3

30

取付穴 4-φ5
FIXING HOLES

77±0.5

287±0.5

310

型式銘板
NAMEPLATE

ケーブル
CABLE

アース端子
GND TERMINAL

注記
1） 指定外の寸法公差は表 1 による。
2） #印寸法は最少サービス空間寸法とする。
3） 取付ネジはトラスタッピンネジ呼び径4×20を使用のこと。

NOTE
1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. #: MINIMUM SERVICE CLEARANCE.
3. USE TAPPING SCREWS φ4x20 FOR FIXING THE UNIT.

DRAWN	19/Jun/2015	T.YAMASAKI
CHECKED	19/Jun/2015	H.MAKI
APPROVED	4/Feb/2015	H.MAKI
SCALE	1/3	MASS	1.2	kg
DWG.No.	C3638-G02-B			

TITLE RCU-028
名称 操作部
外寸図
NAME CONTROL UNIT
OUTLINE DRAWING

FAR-158/1528
FAR-1513/1523
±10% 質量はケーブル（5m）を含む。
MASS INCLUDES 5 m CABLE.
REF.No. 03-186-2000G-3

FURUNO

FURUNO ELECTRIC CO., LTD.

水抜き穴
DRAIN

底面図
BOTTOM VIEW

取付穴
2-φ6.5
FIXING HOLES

8

70±0.5

#40

14

130

85±5

100

注 記
1) 指定外の寸法公差は表1による。
2) #印寸法は最小サービス空間寸法とする。
3) 取付ネジはトラスタッピンネジ呼び径5×20を使用のこと。

NOTE
1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. #: MINIMUM SERVICE CLEARANCE.
3. USE TAPPING SCREWS φ5x20 FOR FIXING THE UNIT.

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

TITLE	RCU-030	
名称	トラックボール操作部 (取付金具)	
NAME	TRACKBALL CONTROL UNIT (FIXTURE MOUNT)	
	外寸図 OUTLINE DRAWING	

DRAWN	6/Nov/2013	T.YAMASAKI
CHECKED	6/Nov/2013	H.MAKI
APPROVED	7/Nov/2013	H.MAKI
SCALE	1/2	MASS 0.4 ±10% kg
DWG.No.	C4484-G01-A	

FMD-3100

質量は2mケーブルを含む。
MASS INCLUDES 2m CABLE.

REF.No. 24-016-110G-0

FURUNO

FURUNO ELECTRIC CO., LTD.

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

取付穴寸法 (尺度：1/4)
CUTOUT DIMENSIONS (SCALE: 1/4)

122±1
94±1
R4

水抜き穴
DRAIN

底面図
BOTTOM VIEW

130
47±5
100
#60
13
20 MAX.
60
#60
13
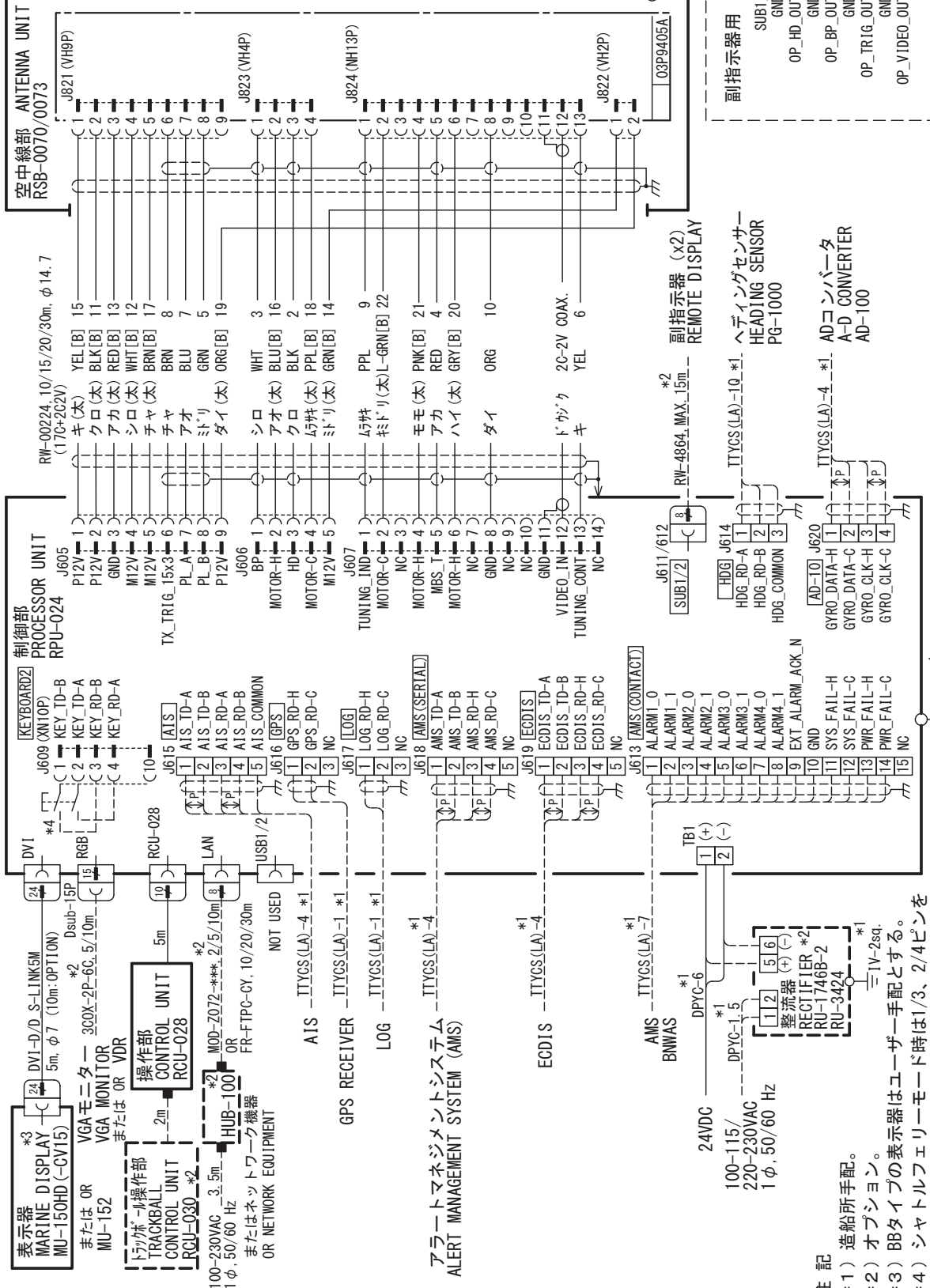
注記
1) 指定外の寸法公差は表1による。
2) #印寸法は最小サービス空間寸法とする。

NOTE
1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. #: MINIMUM SERVICE CLEARANCE.

DRAWN	6/Nov/2013	T.YAMASAKI
CHECKED	6/Nov/2013	H.MAKI
APPROVED	7/Nov/2013	H.MAKI
SCALE	1/2	MASS 0.5 kg
DWG.No.	C4484-G02-A	

TITLE RCU-030
名称 トラックボール操作部 (埋込装備)
外寸図 TRACKBALL CONTROL UNIT (FLUSH MOUNT)
NAME OUTLINE DRAWING

FMD-3100
質量は2mケーブルを含む。
MASS INCLUDES 2m CABLE.
REF.No. 24-016-1206-0

S-1

NOTE
*1: SHIPYARD SUPPLY.
*2: OPTION.
*3: DISPLAY UNIT FOR BB-TYPE SHOULD BE PREPARED BY USER.
*4: SET THE JUMPER TO PIN #1/#3 AND #2/#4 BY EXTERNAL SWITCH (USER SUPPLY)
FOR SHUTTLE FERRY MODE.

注記
*1) 造船所手配。
*2) オプション。
*3) BBタイプの表示器はユーザー手配とする。
*4) シャトルフェリーモード時は1/3、2/4ピンを
外部スイッチ (ユーザー手配) でジャンパーする。

FURUNO ELECTRIC CO., LTD.

INTERCONNECTION DIAGRAM

MARINE RADAR

FAR-1523 (-BB)

船舶用レーダー

相互結線図

TYPE

名称

NAME

DWG. No. C3639-C01- G   REF. No. 03-186-6002-0

DRAWN 29/Aug/2017 T. YAMASAKI
CHECKED 29/Aug/2017 H. MAKI
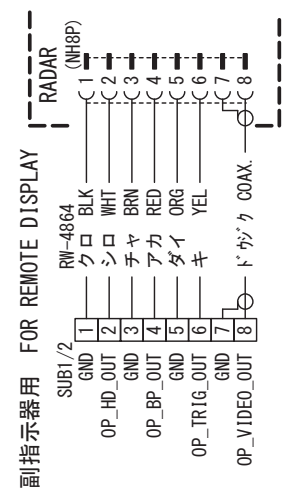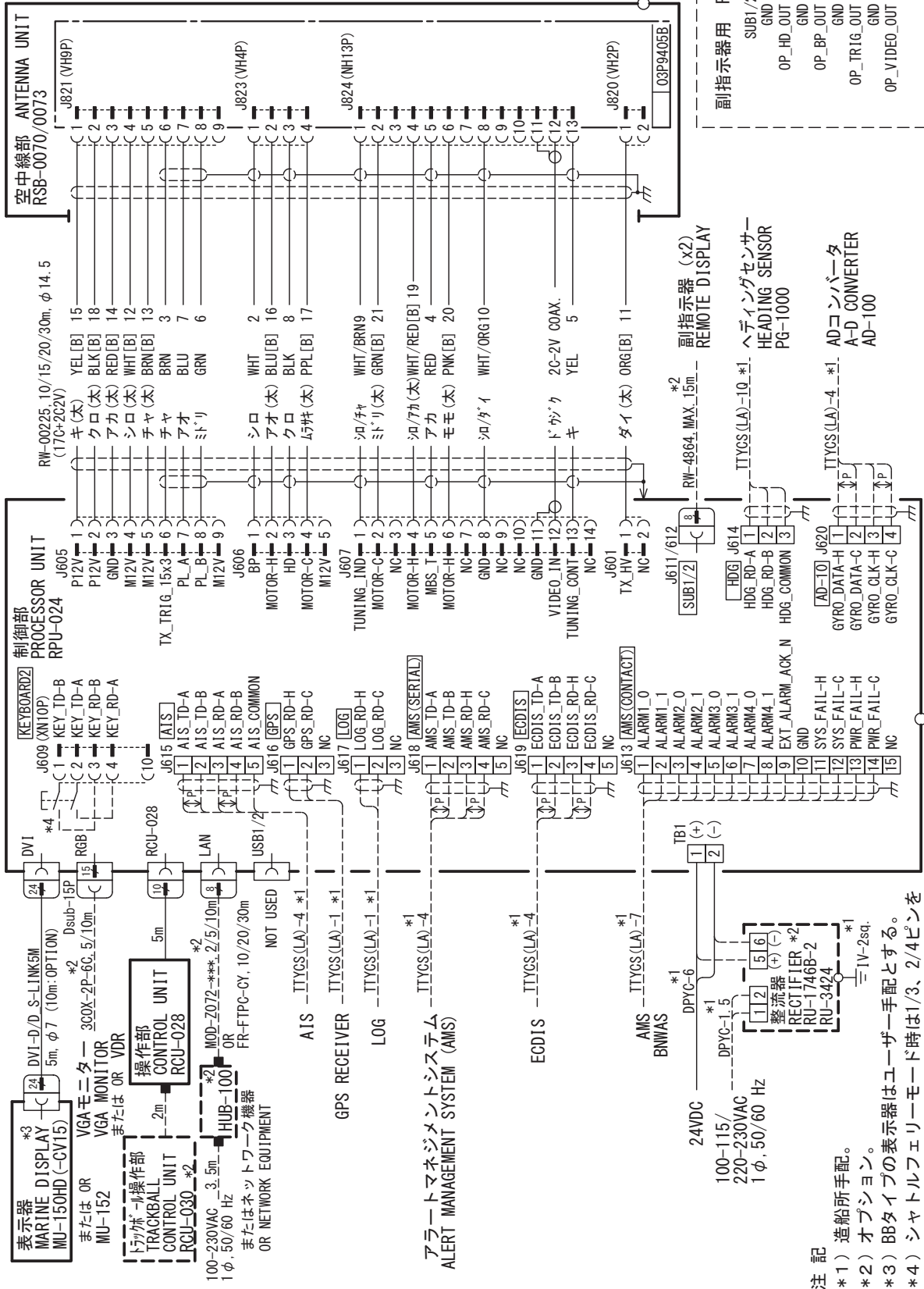APPROVED 31/Aug/2017 H.MAKI
SCALE   MASS   kg

NOTE
*1: SHIPYARD SUPPLY.
*2: OPTION.
*3: DISPLAY UNIT FOR BB-TYPE SHOULD BE PREPARED BY USER.
*4: SET THE JUMPER TO PIN #1/#3 AND #2/#4 BY EXTERNAL SWITCH (USER SUPPLY)
    FOR SHUTTLE FERRY MODE.

注記
*1: 造船所手配。
*2: オプション。
*3: BBタイプの表示器はユーザー手配とする。
*4: シャトルフェリーモード時は1/3、2/4ピンを
    外部スイッチ（ユーザー手配）でジャンパーする。

S-3

FURUNO

空中線部 ANTENNA UNIT RSB-120/121

RSB-120: 26 (24) rpm
RSB-121: 48 (42) rpm
( ): JAPAN ONLY

制御部 PROCESSOR UNIT RPU-024

表示器 MARINE DISPLAY MU-150HD(-CVI5)
または OR MU-152

トラックボール操作部 TRACKBALL CONTROL UNIT RCU-030 *2

操作部 CONTROL UNIT RCU-028

またはネットワーク機器 OR NETWORK EQUIPMENT

副指示器用 FOR REMOTE DISPLAY

RADAR (NH8P)

RW-4864		
クロ BLK		C1
シロ WHT		2
チャ BRN		3
アカ RED		4
ダイ ORG		5
キ YEL		6
		7
ドウジク COAX.		8

SUB1/2
1	GND	
2	OP_HD_OUT	
3	GND	
4	OP_BP_OUT	
5	GND	
6	OP_TRIG_OUT	
7	GND	
8	OP_VIDEO_OUT	

RW-4747

副指示器 REMOTE DISPLAY

ヘディングセンサー HEADING SENSOR PG-1000

ADコンバータ A-D CONVERTER AD-100

アラートマネジメントシステム (AMS) ALERT MANAGEMENT SYSTEM (AMS)

GPS RECEIVER

LOG

AIS

ECDIS

AMS BNWAS

100-115/220-230VAC 1φ, 50/60 Hz
440VAC 1φ, 50/60 Hz
トランス TRANS. *2 RU-1803

注記
*1: 造船所手配。
*2: オプション。
*3: BBタイプの表示器はユーザー手配とする。
*4: シャトルフェリーモード (ユーザー手配) で外部スイッチ
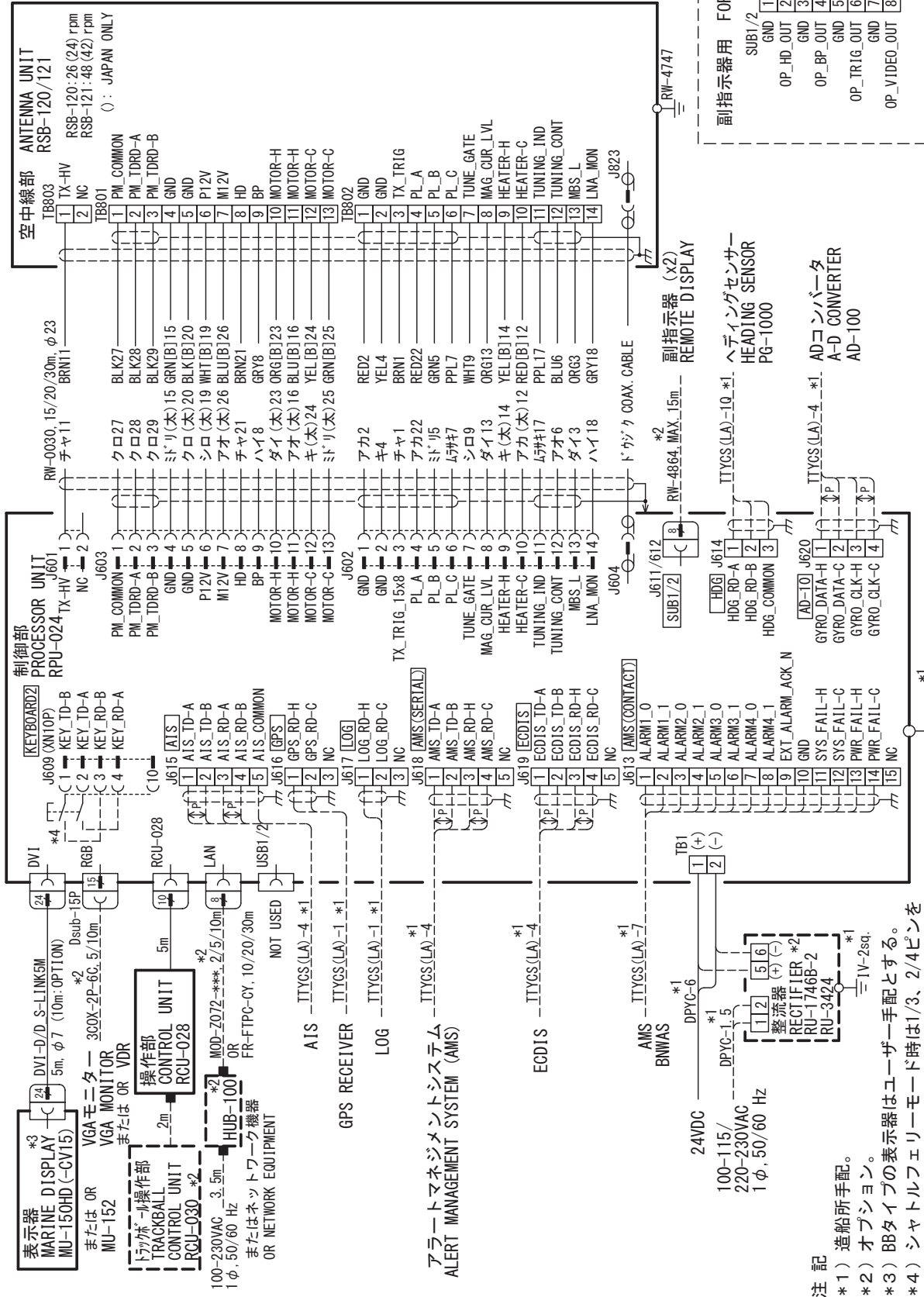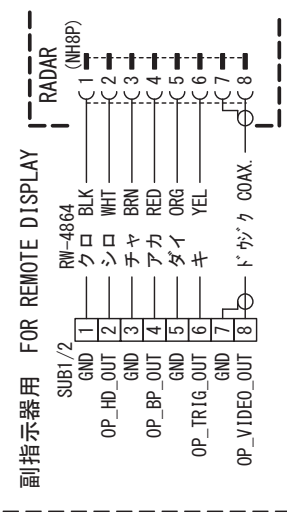
NOTE
*1: SHIPYARD SUPPLY.
*2: OPTION.
*3: DISPLAY UNIT FOR BB-TYPE SHOULD BE PREPARED BY USER.
*4: SET THE JUMPER TO PIN #1/#3 AND #2/#4 BY EXTERNAL SWITCH (USER SUPPLY) FOR SHUTTLE FERRY MODE.

DRAWN 29/Aug/2017 T.YAMASAKI
CHECKED 29/Aug/2017 H.MAKI
APPROVED 31/Aug/2017 H.MAKI
SCALE   MASS   kg
DWG. No. C3642-C01- G   REF. No. 03-186-6004-0

TYPE FAR-1518/1528(-BB)
名称 航海用レーダー (AC仕様)
相互結線図
NAME MARINE RADAR (AC)
INTERCONNECTION DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO ELECTRIC CO., LTD.

TYPE	FAR-1518/1528 (-BB)		
名称	航海用レーダー (DC仕様)		
	相互結線図		
NAME	MARINE RADAR (DC)		
	INTERCONNECTION DIAGRAM		

DRAWN	29/Aug./2017	T.YAMASAKI	
CHECKED	29/Aug./2017	H.MAKI	
APPROVED	31/Aug/2017	H.MAKI	
SCALE		MASS	kg
DWG. No.	C3642-C02- G	REF. No.	03-186-6003-0

NOTE
*1: SHIPYARD SUPPLY.
*2: OPTION.
*3: DISPLAY UNIT FOR BB-TYPE SHOULD BE PREPARED BY USER.
*4: SET THE JUMPER TO PIN #1/#3 AND #2/#4 BY EXTERNAL SWITCH (USER SUPPLY)
    FOR SHUTTLE FERRY MODE.

注記
*1: 造船所手配。
*2: オプション。
*3: BBタイプの表示器はユーザー手配とする。
*4: シャトルフェリーモード (ユーザー手配) 時は1/3、2/4ピンを
    外部スイッチ (ユーザー手配) でジャンパーする。