

Installation Manual

Multi-Color LCD RADAR

Model FAR-1416/FAR-1426

(Product Name: Marine Radar)

SAFETY INSTRUCTIONS	i
SYSTEM CONFIGURATION	iii
EQUIPMENT LIST	iv
1. INSTALLATION	1-1
1.1 Antenna Unit	1-1
1.2 Display Unit	1-7
1.3 Control Unit RCU-029	1-9
1.4 Trackball Control Unit (RCU-030)	1-11
1.5 Switching Hub HUB-100 (Optional)	1-14
2. WIRING	2-1
2.1 Wiring Outline	2-1
2.2 How to Connect the Signal Cable	2-2
2.3 Display Unit	2-4
2.4 RGB Monitor	2-8
2.5 Remote Controller RCU-019 (Option)	2-9
3. ADJUSTMENTS	3-1
3.1 [RADAR INSTALLATION] Menu	3-2
3.2 [ECHO ADJUST] Menu	3-2
3.3 RADAR INSTALLATION Menu	3-4
3.4 [SCANNER] Menu	3-5
3.5 [INSTALLATION] Menu	3-5
3.6 [TT PRESET] Menu	3-6
3.7 [ALERT I/F] Menu	3-7
3.8 [PORT SETTING] Menu	3-8
3.9 [OTHERS] Menu	3-9
3.10 [FACTORY] Menu	3-9
3.11 How to Control Charts	3-10
4. INPUT/OUTPUT DATA	4-1
4.1 Input/Output Specification	4-1
4.2 NMEA0183 Sentences	4-2
4.3 CANbus PGN LIST	4-3
APPENDIX 1 JIS CABLE GUIDE	AP-1
APPENDIX 2 DIGITAL INTERFACE	AP-2
PACKING LISTS	A-1
OUTLINE DRAWINGS	D-1
INTERCONNECTION DIAGRAMS	S-1



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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/m² and 10 W/m² 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.

Model	Transceiver	Magnetron	Antenna	100W/m ²	10W/m ²
FAR-1416	RTR-086A	MAF1565N	XN12A	N/A	2.1 m
			XN13A	N/A	1.9 m
FAR-1426	RTR-087A	M1458N	XN12A	0.6 m	4.6 m
			XN13A	0.4 m	3.1 m

WARNING

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 main 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 the proper fuse.

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

Do not install the display unit or the 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.

CAUTION

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

Unit		Standard Compass	Steering Compass
Antenna Unit for FAR-1416	RSB-0070	1.00m	0.60m
	RSB-0073	1.10m	0.70m
Antenna Unit for FAR-1426	RSB-0070	1.85m	1.25m
	RSB-0073	1.80m	1.15m
Display Unit (RDP-155)		1.20m	0.75m
Control Unit (RCU-029)		0.30m	0.30m
Trackball Control Unit (RCU-030)		0.50m	0.30m
Switching Hub (HUB-100)		1.00m	0.60m

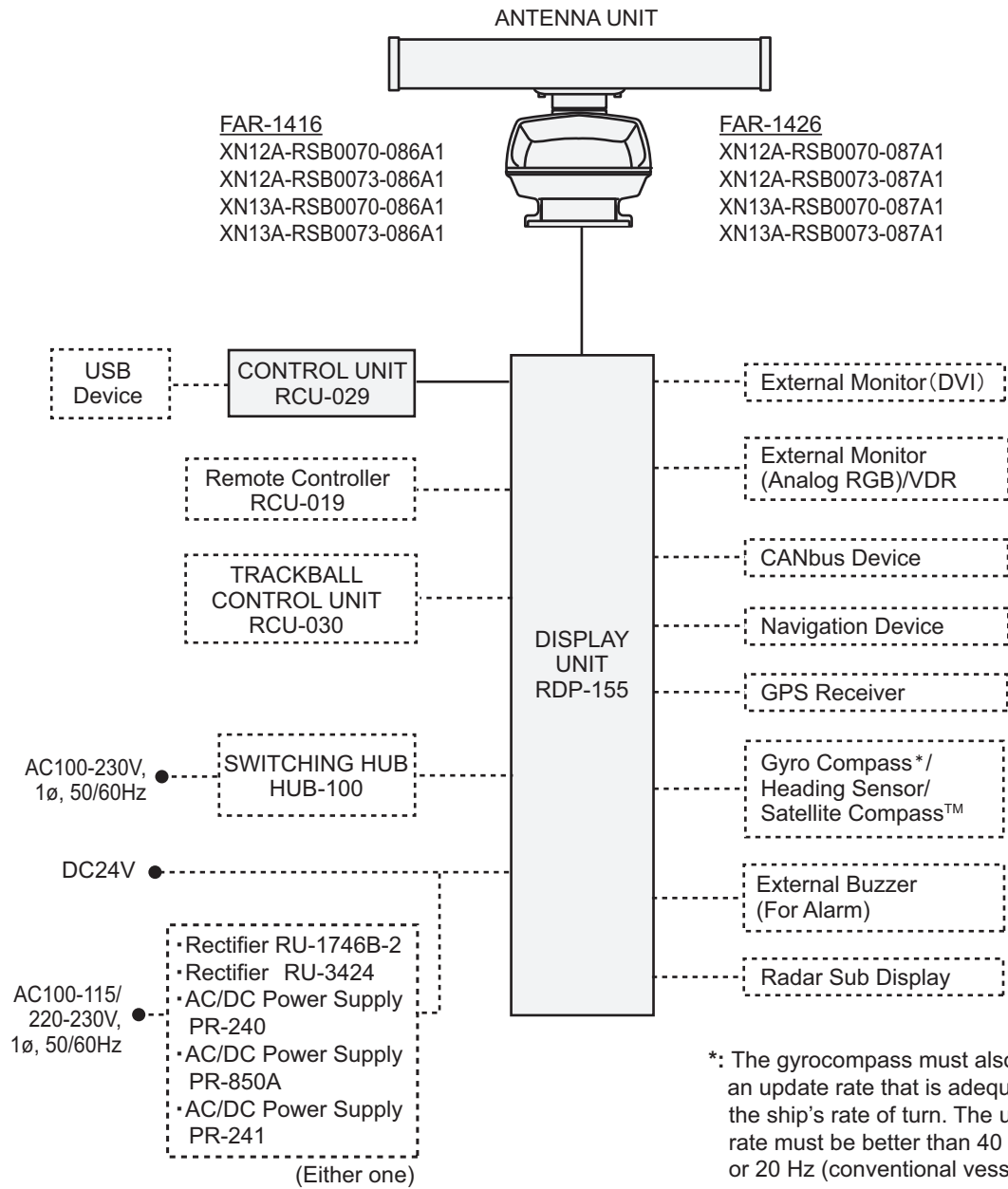
Connect protective earth (grounding) between the display unit and the ship's superstructure.

The protective earth (grounding) is required for the AC power supply to prevent electrical shock.

About the TFT LCD

The TFT LCD is constructed using the latest LCD techniques, and displays 99.99% of its pixels. The remaining 0.01% of the pixels may drop out or blink, however this is not an indication of malfunction.

SYSTEM CONFIGURATION



*: 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).

Equipment category

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

EQUIPMENT LIST

Standard supply

Name	Type	Code No.	Qty	Remarks
Display Unit	RDP-155	-	1	
Control Unit	RCU-029	-	1	
Antenna Unit (FAR-1416)	XN12A-RSB-0070-086A1	000-028-702	Select one	24 rpm, 1200 mm
	XN12A-RSB-0073-086A1	000-028-703		48 rpm, 1200 mm
	XN13A-RSB-0070-086A1	000-028-704		24 rpm, 1800 mm
	XN13A-RSB-0073-086A1	000-028-705		48 rpm, 1800 mm
Antenna Unit (FAR-1426)	XN12A-RSB-0070-087A1	000-028-706	Select one	24 rpm, 1200 mm
	XN12A-RSB-0073-087A1	000-028-707		48 rpm, 1200 mm
	XN13A-RSB-0070-087A1	000-028-708		24 rpm, 1800 mm
	XN13A-RSB-0073-087A1	000-028-709		48 rpm, 1800 mm
Installation Mate- rials	CP03-37201	001-444-460	1	For display unit
	CP03-33200	000-017-258	1	For control unit RCU-029
	CP03-33801	001-141-670	1	
	CP03-22901	008-523-690	1	For attaching the antenna radiator to scanner.
Installation Materials (FAR-1416)	CP03-36700	000-028-129	Select one	10 m signal cable (RW-00224 L10M; 001-421-520-00)
	CP03-36710	000-028-130		15 m signal cable (RW-00224 L15M; 001-421-530-00)
	CP03-36720	000-028-131		20 m signal cable (RW-00224 L20M; 001-421-540-00)
	CP03-36730	000-028-132		30 m signal cable (RW-00224 L30M; 001-421-550-00)
Installation Materials (FAR-1426)	CP03-36800	000-028-133	Select one	10 m signal cable (RW-00225 L10M; 001-423-400-00)
	CP03-36810	000-028-134		15 m signal cable (RW-00225 L15M; 001-423-410-00)
	CP03-36820	000-028-135		20 m signal cable (RW-00225 L20M; 001-423-420-00)
	CP03-36830	000-028-136		30 m signal cable (RW-00225 L30M; 001-423-430-00)
Spare Parts	SP03-18201	001-444-450	1	For display unit: Fuse (FGMB-S 125V 10 A PBF Code: 000-157-470-10, 2 pcs.)
Accessories	FP03-12301	001-258-020	1	LCD cleaning cloth (19-028-3125-6, Code: 100-360-676-10)

Optional supply

Name	Type	Code No.	Remarks
Flush Mount Kit	OP03-240	001-440-050	For display unit
Flush Mount Fixture	OP03-212	001-115-440	For control unit RCU-029
Track Ball Control Unit	RCU-030	000-027-857	
Flush Mount Fixture Assembly	OP24-38	001-263-190	For control unit RCU-030
Remote Controller	RCU-019	000-590-945	
A/D Converter	AD-100-E	000-040-110	
Rectifier	RU-1746B-2	000-030-439	
	RU-3424	000-030-497	
AC/DC Power Supply Unit	PR-240	000-013-632	
	PR-850A	000-025-159	
	PR-241	-	
Ferrite Core	OP86-11	001-594-450	For PR-241
Switching Hub	HUB-100	000-083-353	
Installation Materials	CP03-28920	000-082-660	30 m LAN cable
	CP03-28930	000-084-368	50 m LAN cable
Signal Cable	S03-9-5 (8-8P)	008-206-640	For sub control unit, 5m
	S03-9-10 (8-8P)	008-206-650	For sub control unit, 10m
	S03-9-15 (8-8P)	008-209-160	For sub control unit, 15m
Cable Assy.	DVI-D/D S-LINK 5M	001-132-960-10	For external display unit, DVI cable, 5 m
	DVI-D/D S-LINK 10M	001-133-980-10	For external display unit, DVI cable, 10 m
	3COX-2P-6C 5M	001-077-230-10	For external display unit, RGB cable, 5 m
	3COX-2P-6C 10M	001-077-220-10	For external display unit, RGB cable, 10 m
LAN Cable	MOD-Z072-020+	001-167-880-10	For switching hub
	MOD-Z072-050+	001-167-890-10	
	MOD-Z072-100+	001-167-900-10	
Cable Assy.	M12-05BFFM-010	001-105-780-10	For NMEA2000 device Cable between T connector
	M12-05BFFM-020	001-105-790-10	
	M12-05BFFM-060	001-105-800-10	
	M12-05BM+05BF-010	001-105-750-10	Cable between T connector
	M12-05BM+05BF-020	001-105-760-10	
	M12-05BM+05BF-060	001-105-770-10	
	CB-05BFFM-010	000-167-971-11	
	CB-05BFFM-020	000-167-972-11	
	CB-05BFFM-060	000-167-973-11	
	CB-05PM+05BF-010	000-167-968-11	
	CB-05PM+05BF-020	000-167-969-11	
	CB-05PM+05BF-060	000-167-970-11	

EQUIPMENT LIST

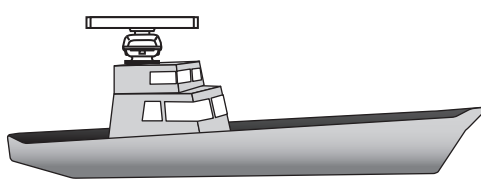
Name	Type	Code No.	Remarks
Connector (NMEA2000)	SS-050505-FMF-T001	000-168-603-10	T connector
	NC-050505-FMF-T001	000-160-507-10	
	LTWMC-05BMMF-SL8001	000-168-605-10	Termination resistor
	LTWMC-05BFFT-SL8001	000-168-604-10	
	LTWMN-05AMMT-SL8001	000-160-508-10	
	LTWMN-05AFFT-SL8001	000-160-509-10	
	FRU-0505-FF-IS	001-077-830-10	
Cable Assy.	MJ-A6SPF0003-020C	000-154-029-10	For NMEA0183 device
	MJ-A6SPF0003-050C	000-154-054-10	
	MJ-A6SPF0003-100C	000-168-924-10	
	MJ-A6SPF0003-150C	000-159-643-10	
	MJ-A7SPF0003-050C	000-159-688-11	For external buzzer

1. INSTALLATION

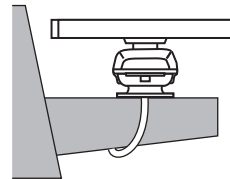
1.1 Antenna Unit

Installation considerations

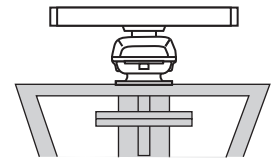
- The antenna unit is generally installed either on top of the wheelhouse, on the radar mast or on a suitable platform. Make sure that they are horizontally level. Locate the antenna unit in an elevated position where not interfered by any shipboard structure.



(a) Bridge

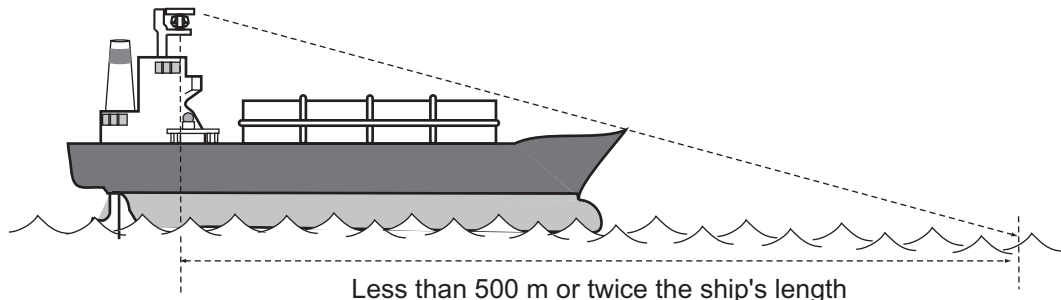


(b) Common mast



(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.



- Install the antenna unit so that any blind sectors caused by objects (mast, etc.) are kept to a minimum. i) 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). ii) An 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
Bow

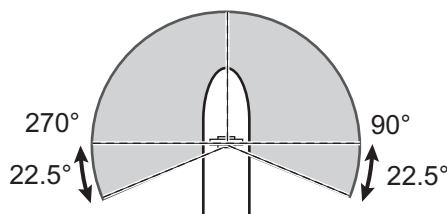
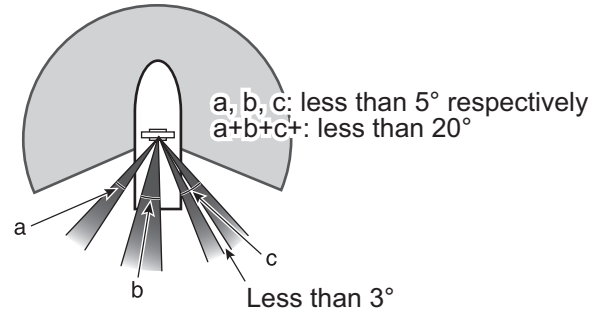


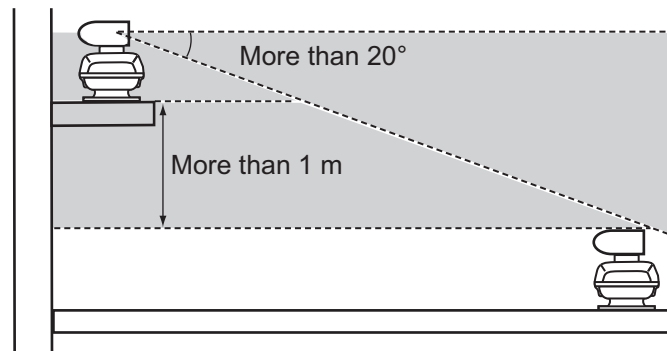
Figure 2
Bow



- 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.

1. INSTALLATION

- Keep the following distance and angle between another radar antenna. Prohibited area is grayed out on below illustration.



- Keep the lower edge of the antenna unit above the safety rail by at least 0.5 meters.
- No funnel, mast or derrick shall be within the vertical beam width of the antenna unit in the bow direction, especially $0 \pm 5^\circ$, 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 installation.
- Locate the antenna of an EPFS device clear of the radar antenna to prevent interference to the EPFS device. 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.
- 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 some part of radiation. 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.
- Do not paint the radiator aperture, to ensure proper emission of the radar waves.

NOTICE

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

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

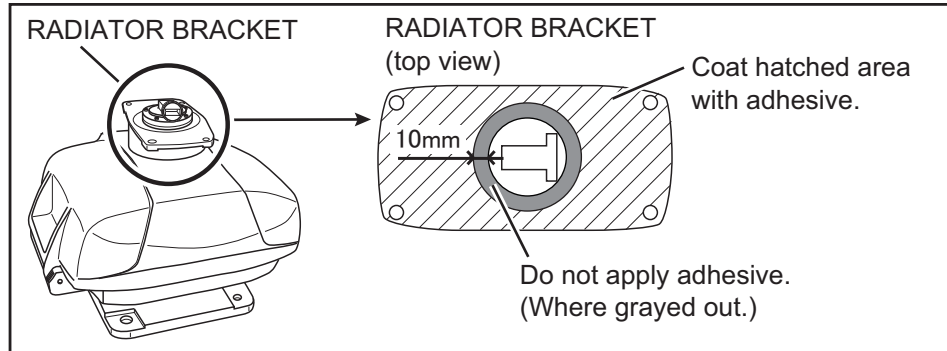
1.1.1 How to fasten the radiator to the radiator bracket

Antenna unit and a scanner are boxed separately. Put the antenna radiator on the scanner unit with the following procedures. Make five holes in the platform - four holes to fasten the scanner unit and one hole for passing through an antenna cable. Regarding the dimensions, refer to the outline drawing at the back of this manual.

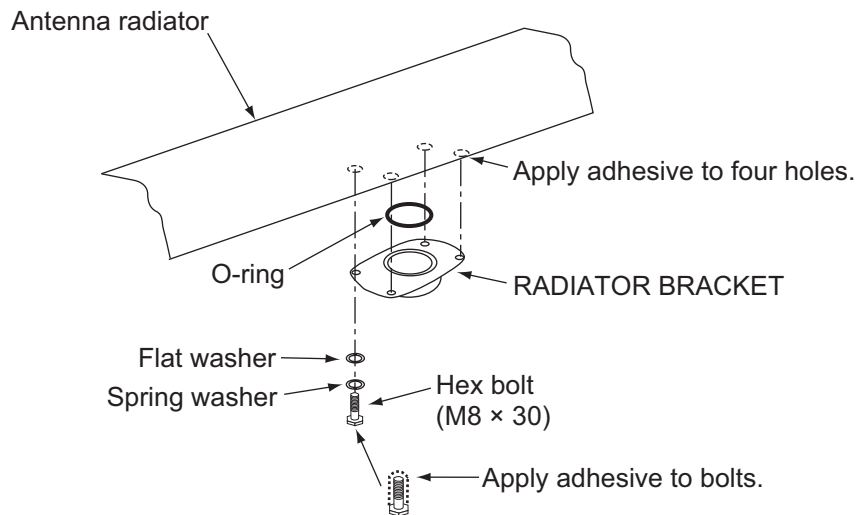
See the packing list at the back of this manual for the installation material (CP03-22901).

Note: Drill a hole with enough size which a connector of the antenna cable can pass through. The cable equipped with this product has connectors at both ends. Do not cut the cable which connects with the scanner unit.

1. Remove a cap from the radiator bracket.
2. Apply adhesive to the surface of the radiator bracket. See the figure below for where to apply the adhesive.



3. Insert the spring washer and flat washer to hex bolt (M8 × 30, installation material) and apply adhesive.
4. Apply the adhesive to four holes on the antenna radiator from its underside.
5. Apply the grease to the O-ring (included in the installation material) to secure the rotation of the antenna radiator. Set the O-ring in the slot of the radiator bracket.
6. Set the antenna radiator on the radiator bracket.
7. Fasten the antenna radiator to the radiator bracket with the hex bolts, flat washers and spring washers. Apply adhesive to the hex bolts.



8. Apply adhesive to the following locations.
 - Four hex bolts (For jointing the antenna radiator and radiator bracket.)
 - Four screw holes (From the underside of antenna radiator for protection.)
 - Edge between antenna radiator and radiator bracket (all the fringes of jointed areas of the antenna radiator and the radiator bracket.)

1. INSTALLATION

1.1.2 How to mount the antenna unit

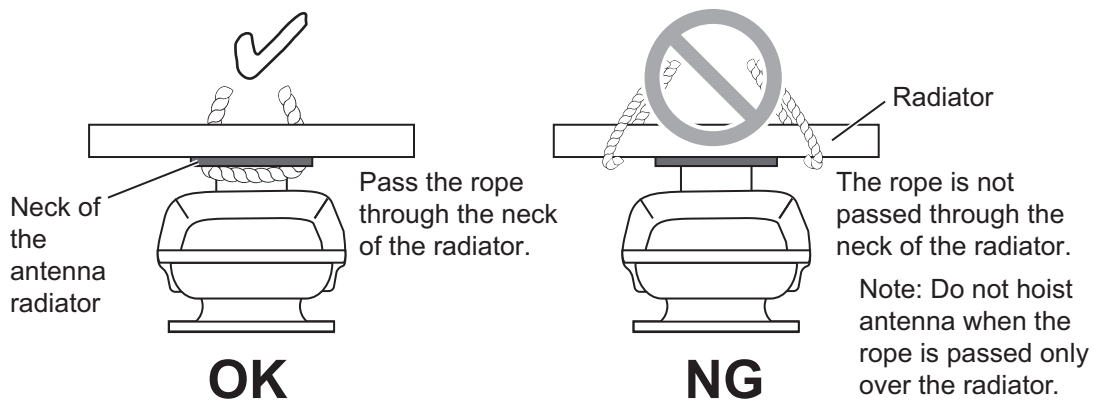
The antenna radiator and scanner unit are to be connected before hoisting to the mounting platform. Mount the antenna unit to the platform with either of the following methods.

- Mounting with using the outside holes (200 × 200 mm) on the chassis
- Mounting with using the fixing holes (140 × 150 mm) inside of the chassis

How to hoist the antenna unit

See the figure below for hoisting guidelines.

- Hoist the assembled antenna unit by passing the rope through the neck of the antenna radiator.

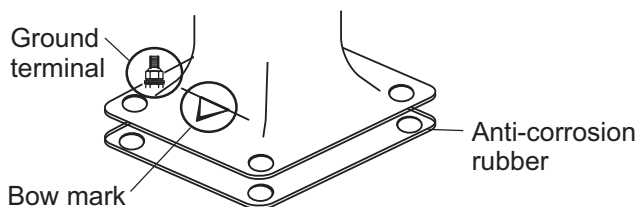


- Slowly hoist the antenna unit. Hoisting swiftly may cause a damage to the antenna radiator or damage the radiator chassis.

Mounting with using the fixing holes outside of the chassis

Regarding the installation material (CP03-33801), refer to the packing list at the end of this manual.

1. Drill the screw holes ($\phi 15$ mm, 4 locations) and a cable entry ($\phi 25$ to 30 mm, 1 location) by referring the outline drawing at the end of this manual.
2. Place the anti-corrosion rubber (supplied) on the mounting location.
Note: Corrosion may occur without this step.
3. Place the antenna unit and adjust the bow mark on its base to be aligned as close as possible with the ship's bow.

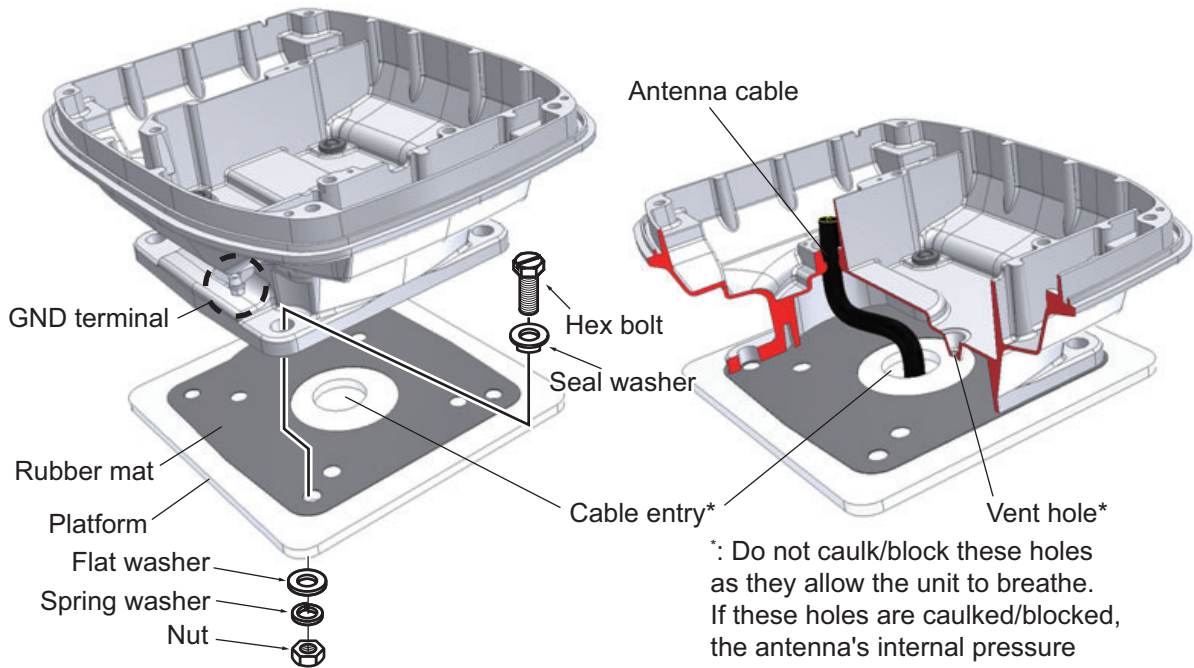


CAUTION

Hoist the antenna unit from the underside of antenna radiator chassis when locating the antenna unit to the mounting platform. Never hoist the antenna radiator.

Rotary unit inside the antenna radiator may be damaged if the radiator was hoisted.

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

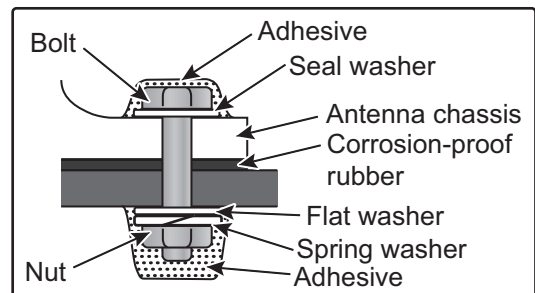


*: Do not caulk/block these holes as they allow the unit to breathe. If these holes are caulked/blocked, the antenna's internal pressure becomes negative, which can cause internal water leakage.

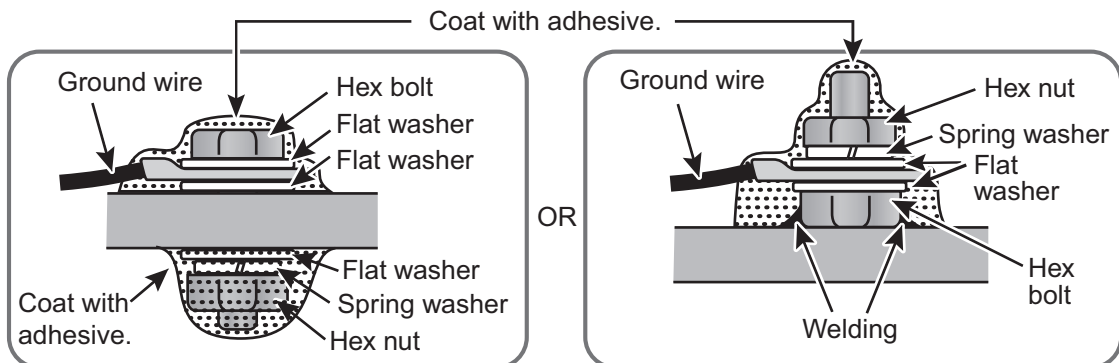
- Set a flat washer (M12, supplied), a spring washer and a nut to each hex bolt. Fasten by turning the nut.

Note: Do not fasten by turning the hex bolts to prevent damage to the seal washers.

- Apply adhesive to the flat washers, spring washers, nuts and visible parts of bolts.
- Prepare the ground point on the mounting platform. Use an M6 × 25 bolt, nut and flat washer. The ground point must be within 340 mm from the ground terminal on the antenna unit.

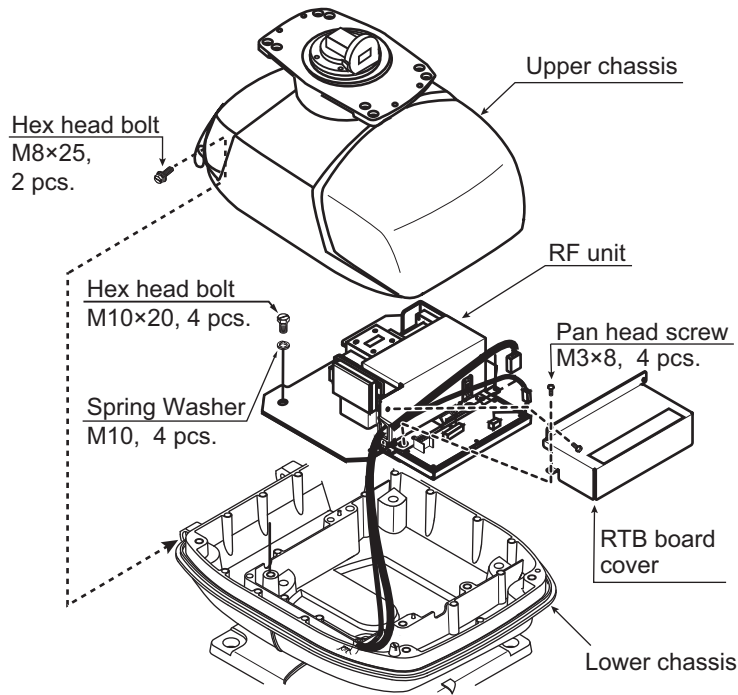


- Fasten the ground wire (RW-4747, supplied) between the ground terminal and the ground point.
- Apply adhesive to the ground terminal and ground point.



Mounting with using the fixing holes inside of the chassis

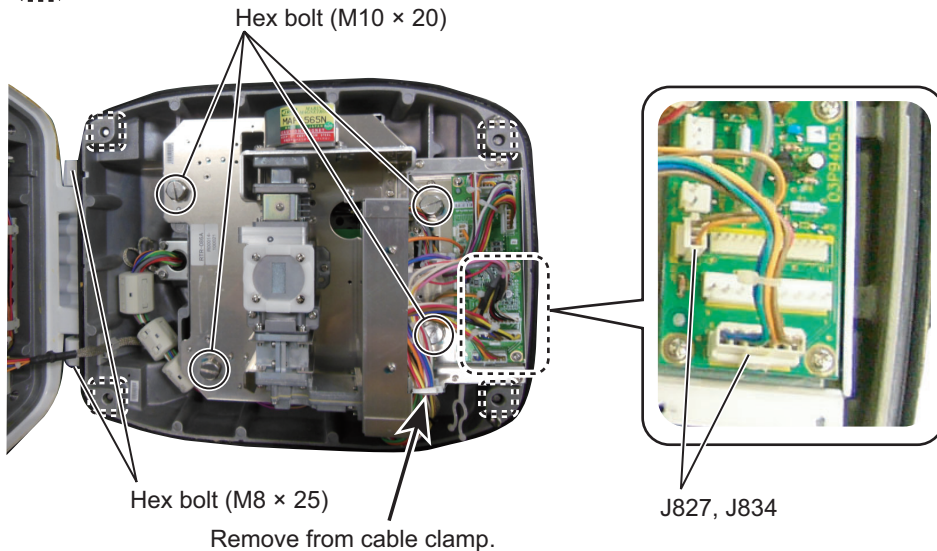
This method requires removal of the RF unit from the antenna unit to access the inside fixing holes. Use four hex head bolts, flat washers, spring washers and nuts (local supply) to install the antenna unit. Check the length of the bolts before you install.



1. Unfasten the four antenna bolts on the cover to open the antenna unit.
2. Disconnect the connectors between the upper chassis and the lower chassis (J827, J834).
3. Remove two hex head bolts (M8 × 25) to separate the upper chassis from the lower chassis.
4. Loosen four pan head screws (M3 × 8) to remove the cover from the RTB board.
5. Remove the connector from the RF unit and remove the cables from cable clamp.
6. Loosen four hex head bolts (M10 × 20) to remove the RF unit.

After removing the RTB cover

: Holes of bolts detached with step 1.



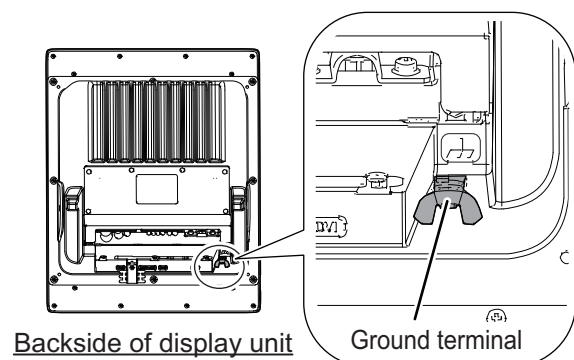
7. Set the corrosion-proof rubber mat (supplied) to the platform.
8. Cut the rubber bushings in the fixing holes and fit four bolts (M12 × 120, local supply) from the inside of the lower chassis. Fasten the lower chassis to the platform with the spring washers, flat washers and nuts (local supply). Apply adhesive to the flat washers, nuts and visible parts of bolts.
9. Fasten the RTB board cover to the RF unit and the RF unit to the lower chassis.
10. Fit four caps (supplied) to the fixing holes of the platform.
11. Prepare the ground point on the platform. Use a bolt (M6 × 25), nut and flat washer (supplied). The ground point must be within 300 mm from the ground terminal on the antenna unit.
12. Run the ground wire (RW-4747, 340 mm, supplied) between the ground terminal and the ground point.
13. Apply adhesive to the ground terminal and ground point. See the illustration on page 1-6 for the instructions.

1.2 Display Unit

The display unit can be desktop mounted or flush mounted. Refer to the packing list at the end of this manual about the installation materials (CP03-37201) used for flush mounting.

Considerations for installation location

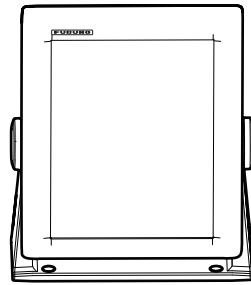
- Select a location where the display unit's weight can be supported. (Refer the outline drawings at the end of this manual for the weight of display unit.)
- Keep the unit away from direct sunlight. The LCD may blackout with long hours of direct sunlight.
- Refer to the outline drawings to allow space for installation and service.
- Set the unit away from the exhaust pipes and vents.
- Install the unit where shock and vibration meet the requirements shown in the equipment specifications. If there is heavy vibration, vertically install the display unit on the hanger.
- Follow the recommended compass safe distance shown on page ii to prevent interference to a magnetic compass.
- Ground the display unit referring to the illustration on the right.



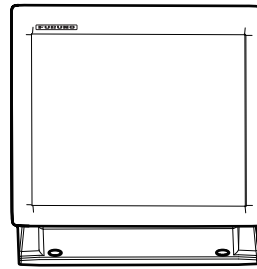
1. INSTALLATION

1.2.1 Desktop Mount

The display unit is boxed with a hard cover and a hanger. Vertical mount and horizontal mount are available.



Vertical Mount



Horizontal Mount

Vertical mount (when shipped)

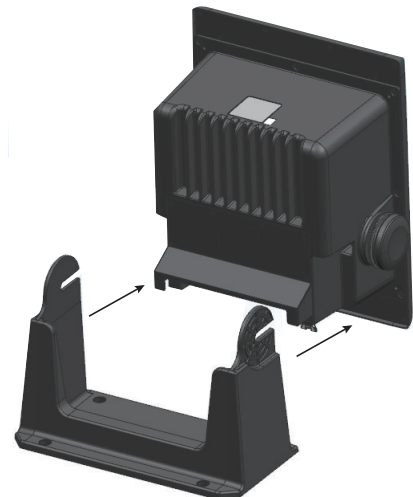
1. Refer to the outline drawing at the end of this manual and drill the four screw holes to attach the hanger.
2. Attach the hanger with four self-tapping screws ($\phi 5 \times 20$, installation material).
3. Detach a hard cover. (Refer to the Operator's Manual section 1.1 about how to detach a hard cover.)
4. Attach the FURUNO logo mark (installation material) to the appropriate position.



Horizontal mount

Use the below procedure to change the vertically mounted display unit to horizontal mount. Disregard step 1 when installing for the first time.

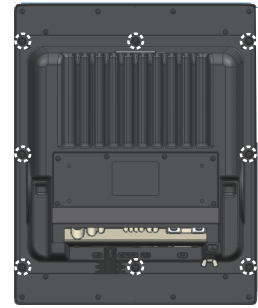
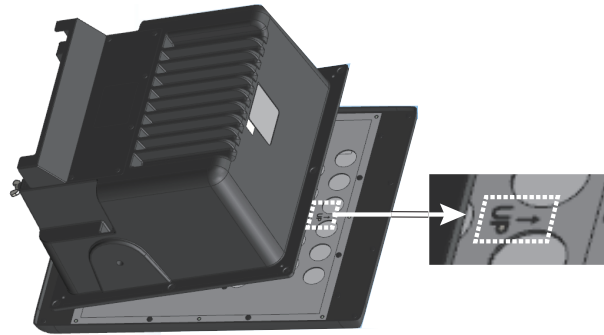
1. Detach a hanger from the display unit.



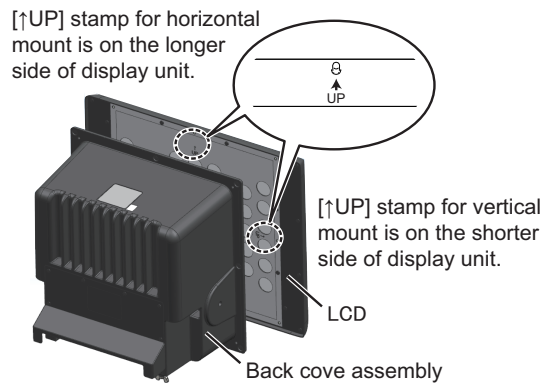
2. Detach the knobs and place the display unit facing downward on the work table.



3. Unfasten the M3 screws marked with dotted circles.
4. Lift the back cover.
Two “↑ UP” stamps will appear at the back of front panel.



5. Set the upside of display unit to the location of horizontal mount stamp.
6. Fasten the M3 screws unfastened at step 3.
7. Attach the hanger with four self-tapping screws ($\phi 5 \times 20$, installation material) to the appropriate position.
8. Attach the hanger and knobs detached at step 1 and 2.
9. Detach a hard cover. (Refer to the Operator's Manual section 1.1 about how to detach a hard cover.)
10. Attach the FURUNO logo seal (installation material) as appropriate.



1.2.2 Flush Mount (Option)

Flush Mount Kit (OP03-240) is required for flush mounting the display unit vertically or horizontally. Refer to the Flush Mounting Instructions (Pub. No. C32-01602) for the details.

1.3 Control Unit RCU-029

The control unit (RCU-029) can be desktop mounted or flush mounted. For the desktop mounting installation material (CP03-33200), refer to the packing list at the end of this manual.

Mounting considerations

- Select a location where the unit can be operated with ease.
- Locate the unit away from heat sources.
- Locate the unit away from areas which may be subject to water splash and rain.
- Referring to the outline diagrams at the back of this manual, leave sufficient space around the equipment to facilitate maintenance.
- Select a location with the consideration for the length of the signal cable.

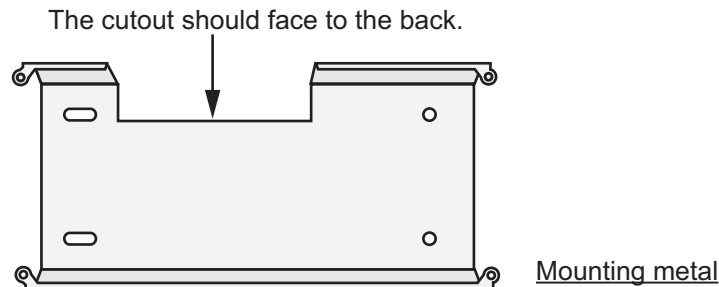
1. INSTALLATION

- A magnetic compass will be affected if the equipment is placed too close to the magnetic compass. Observe the compass safe distances at the front of this manual to prevent interference to a magnetic compass.

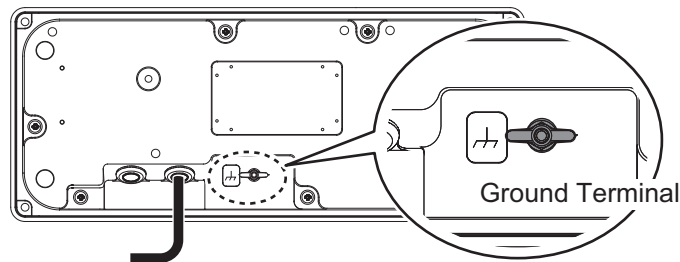
1.3.1 Desktop Mount

The control unit can be installed with desired tilt, by using the mounting metal.

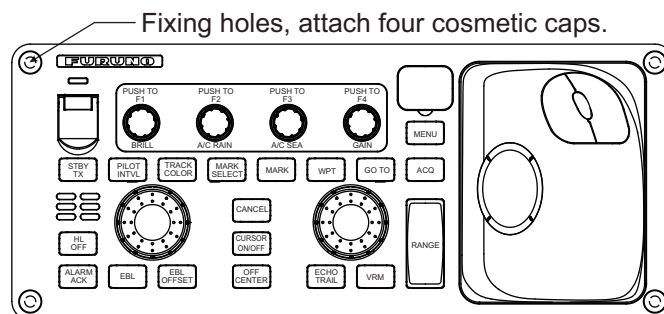
1. Drill four mounting holes referring to the outline drawing at the back of this manual.
2. Fasten the mounting metal with four self-tapping screws ($\phi 5 \times 20$, installation material) to the mounting location. Note that the cutout of the mounting metal should be facing the back of the control unit.



3. Fasten the ground wire (local supply) to the ground terminal at the backside of the control unit before setting the control unit to the cutout.



4. Fit the control unit on the mounting metal and attach the control unit to the cutout using four self-tapping screws ($\phi 5 \times 20$) and wave washers (supplied as installation material).
5. Attach the four cosmetic caps (installation material) to the fixing holes on the control unit.

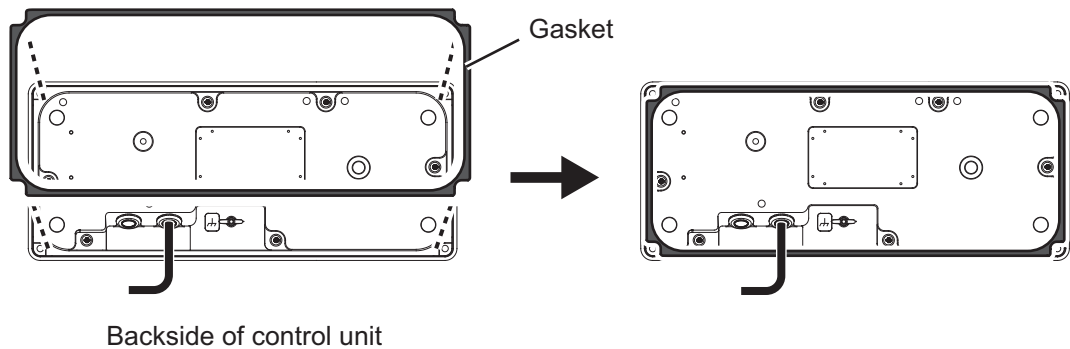


1.3.2 Flush Mount (Option)

The control unit can be flush mounted with the optional flush mount fixture (Type: OP03-212, Code No.: 001-115-440).

Note: Do not flush mount to a curved surface.

1. Make a cutout for mounting the unit and drill the screw holes (four locations) referring to the outline drawing at the back of this manual.
2. Peel the paper from the back of the gasket then attach the gasket to the backside of the control unit.



3. Pass the signal cable through the cutout and then set the control unit to the cutout. Connect the grounding wire (local supply) to the ground terminal at the back of control unit.
4. Insert the control unit into the cutout.
5. Fasten the control unit to the cutout using four self-tapping screws ($\phi 5 \times 20$, installation material).
6. Cover the mounting holes with screw caps (supplied as installation material).

1.4 Trackball Control Unit (RCU-030)

The Trackball Control Unit (RCU-030) can be desktop mounted or flush mounted.

- Desktop mounted with mounting plate (Standard installation)
- Flush mounted inside a console (Optional kit required)

Mounting considerations

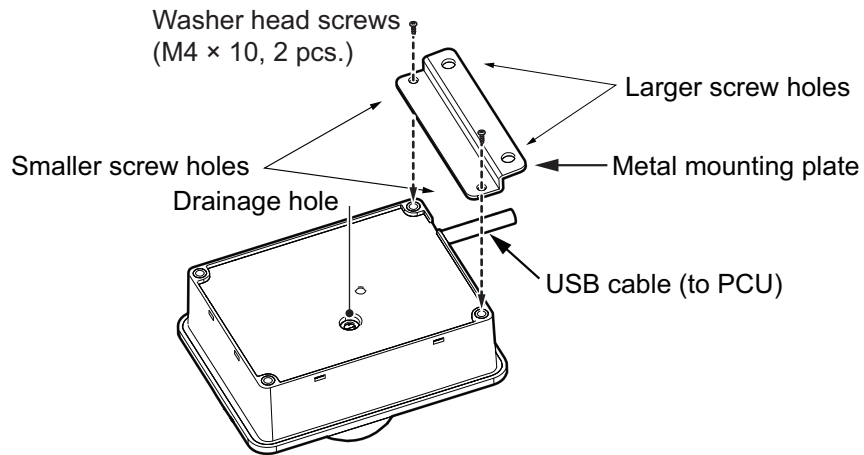
When selecting a mounting location, keep the following points in mind:

- Select a location where the unit can be operated with ease.
- Locate the unit away from heat sources.
- Locate the unit away from areas which may be subject to water splash and rain.
- Referring to the outline diagrams at the back of this manual, leave sufficient space around the equipment to facilitate maintenance.
- Select a location with consideration for the length of the signal cable.
- A magnetic compass will be affected if the equipment is placed too close to the magnetic compass. Observe the compass safe distances at the front of this manual to prevent interference to a magnetic compass.

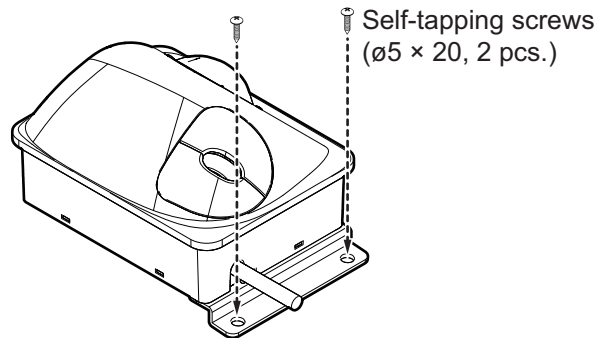
1. INSTALLATION

1.4.1 Desktop Mount (with metal mounting plate)

1. Fix the metal mounting plate (supplied) to the bottom of the unit using two washer head screws (M4×10, supplied), referring to the figure below.



2. Fix the unit to the mounting location using two self-tapping screws ($\phi 5 \times 20$, local supply).



1.4.2 Flush Mounting (Option)

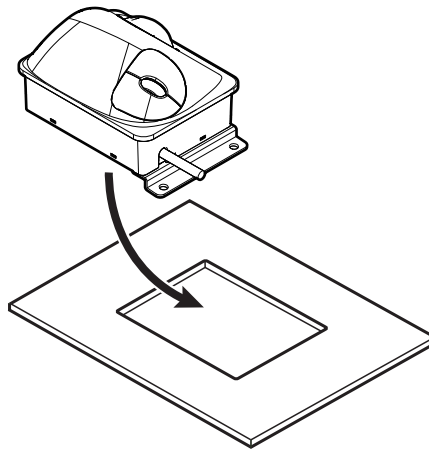
You can use the optional Flush Mount (FM) Fixture Assembly Kit (OP24-38) to flush-mount the unit.

Type: OP24-38, Code No.: 001-263-190

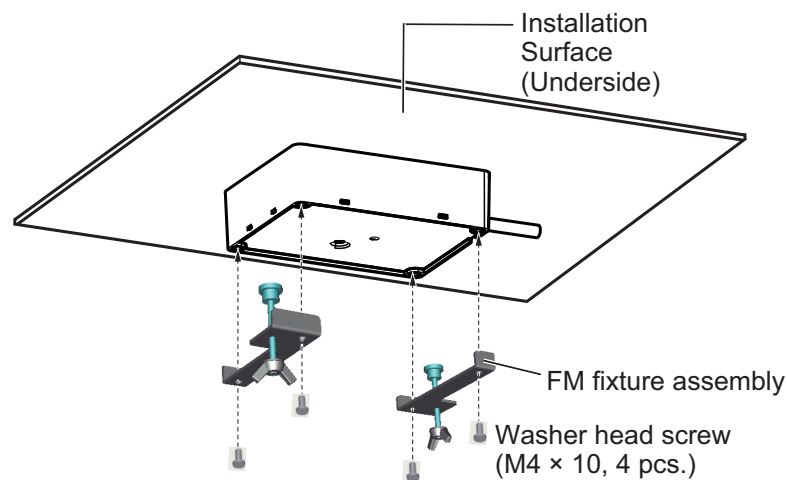
Name	Type	Qty
FM Fixture Assembly	OP24-38-1	2
Washer Head Screw	M4×10	4

Note: The flush mount location must have a thickness of at least 10 mm, with a maximum thickness of 20 mm.

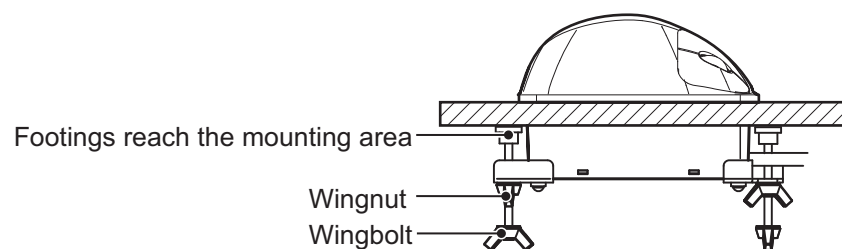
1. Make a cutout on the mounting location referring to the outline drawing at the back of the manual.
2. Pass the USB cable through the hole, then place the unit to the hole.



3. Attach two FM fixture assembly to the unit's under side using four washer head screws (M4 × 10), both included in the kit.



4. Fasten the wingbolts until the footings reach the mounting area.



5. Tighten the wingnuts until the unit is firmly secured.

1.5 Switching Hub HUB-100 (Optional)

Use the optional Switching HUB HUB-100 to connect sensor networks. This network cannot be connected with the LAN network on board. Note that a commercial PC cannot be connected in this network, other than for maintenance. For the mounting procedures, see the operator's manual for HUB-100 (Pub. No. OMC-35191).

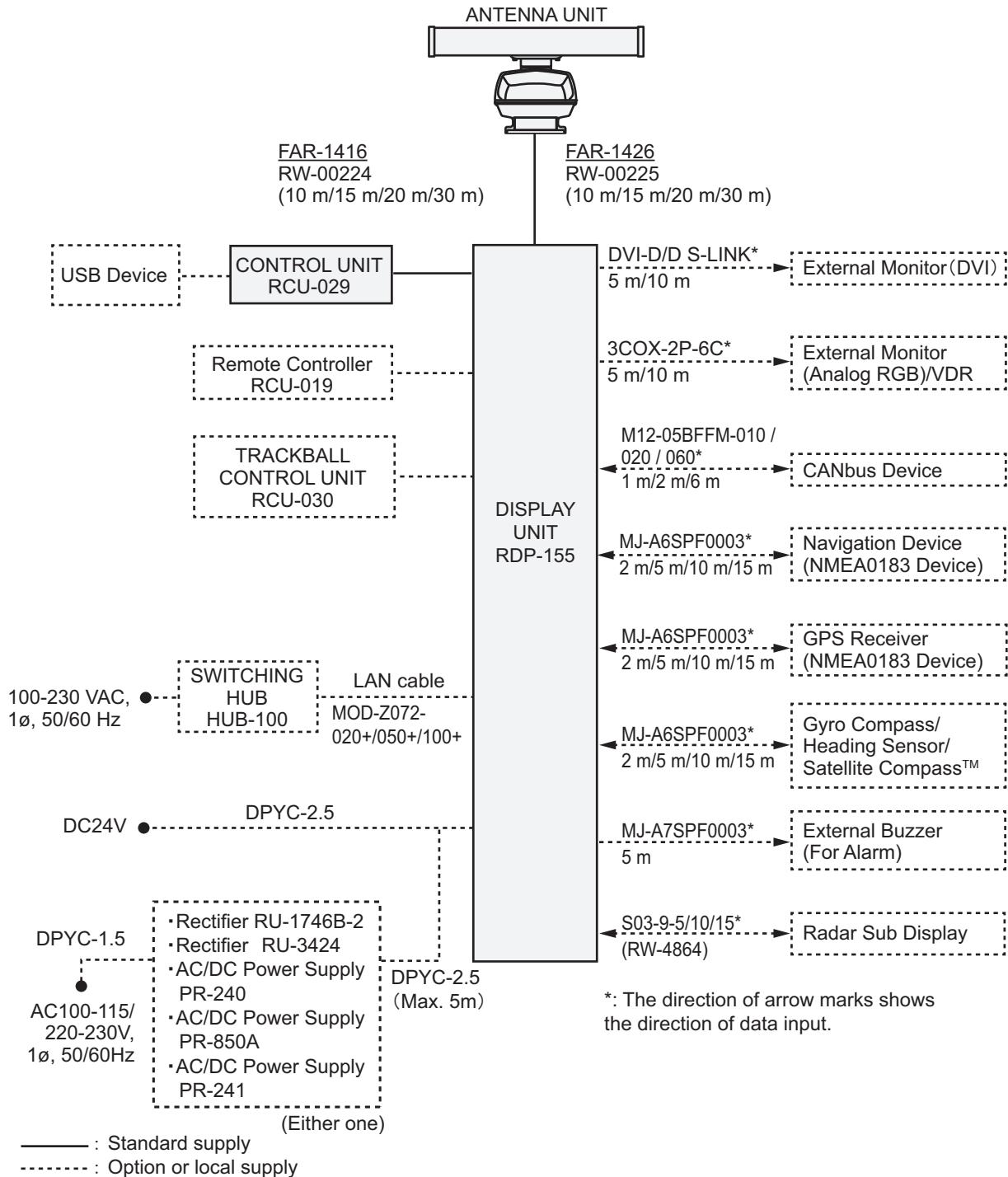
Mounting Considerations

Keep the following points in mind when selection a mounting location:

- Locate the HUB-100 away from heat sources.
- The HUB-100 should be mounted firmly so that rough seas and vibrations do not cause the unit to move in any manner.
- Locate the HUB-100 away from areas which may be subject to splash or rain.
- Referring to the outline diagrams at the back of this manual, leave sufficient space at the rear of the equipment to facilitate maintenance.
- A magnetic compass will be affected if the equipment is placed too close to the magnetic compass. Observe the compass safe distances at the front of this manual to prevent interference to a magnetic compass.
- Vibration at the mounting location should be minimum.

2. WIRING

2.1 Wiring Outline



Contact Output of External Buzzer (For Alarm)

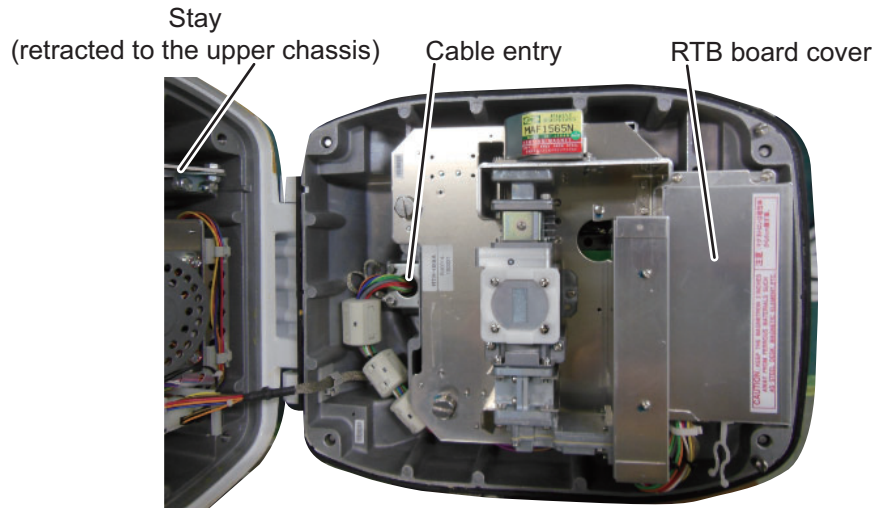
- Load current: 250 mA
- Normal open: 2 ports, Normal close: 1 port

2.2 How to Connect the Signal Cable

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

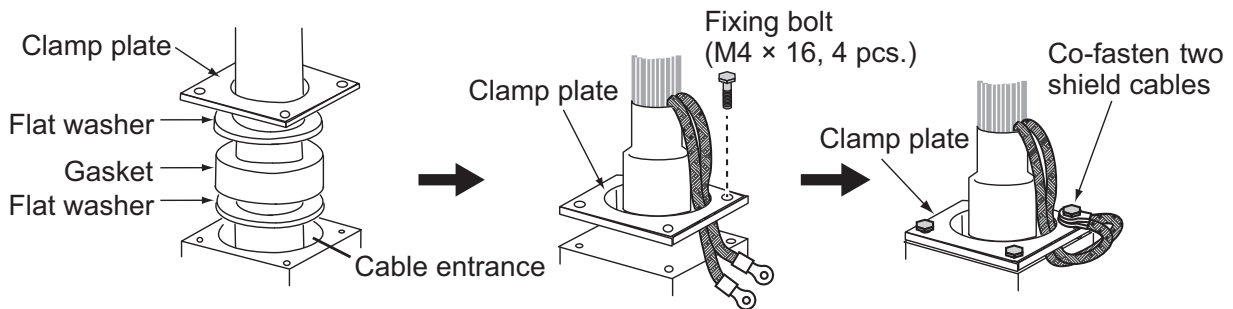
Fabrication is not required for this signal cable. Connect the cable as shown below.

1. Open the antenna cover by loosening four bolts, and then extend the stay.

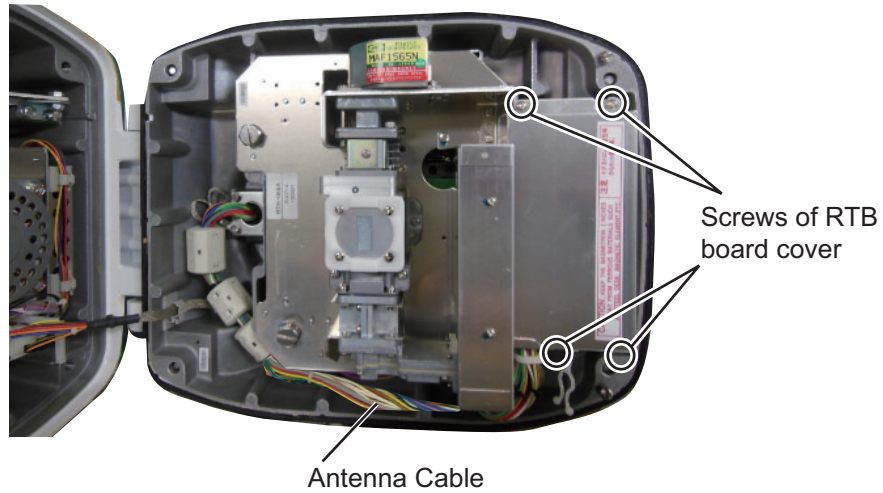


2. Unfasten the cable gland assembly (gasket, flat washer) near the cable entry.
3. Pass the signal cable through the bottom of the antenna unit chassis. Pass the cable through the gland assembly as shown below.

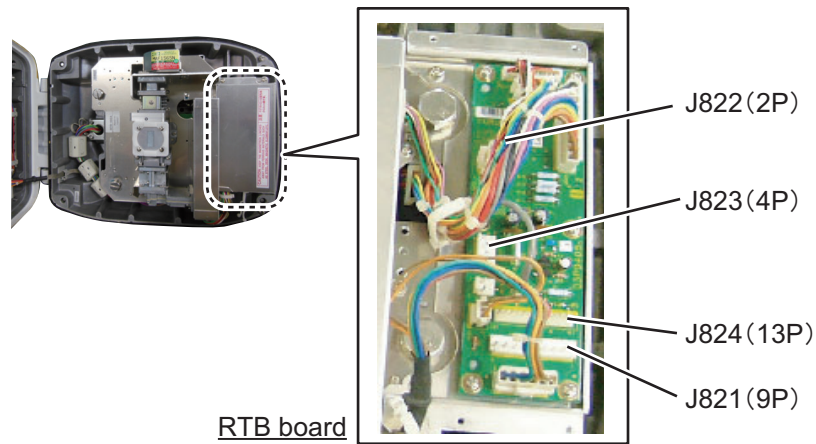
Note: Be careful not to damage the connector attached to the end of cable.
4. Pass the cable through the flat washer, gasket, flat washer and clamp plate.
5. Fasten the clamp plate with four bolts (M4 × 16). Pass the shield cables between the cable gland and clamp plate and fasten the solderless terminals of the two shield cables together with one of those bolts.



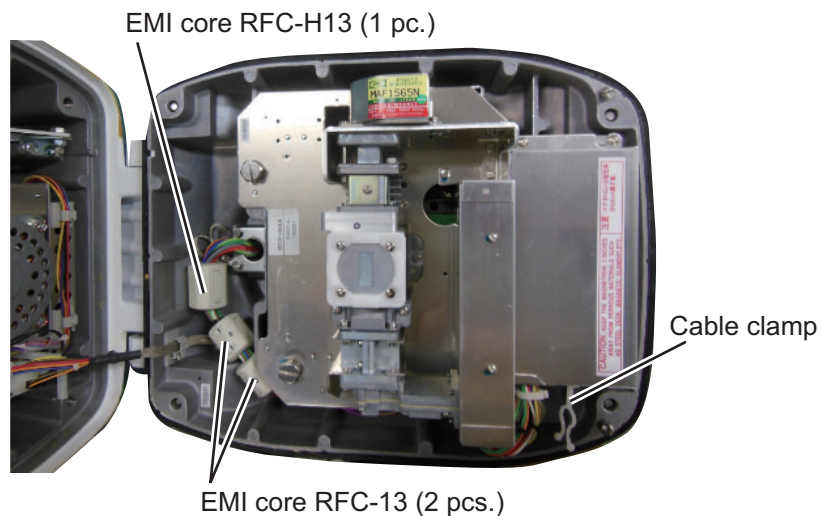
- Pass the antenna cable to RTB board as shown below.



- Unfasten the four screws fixing the RTB cover and detach the RTB board.
- Connect the plugs of the signal cable to the RTB board (03P9405).



- Close the RTB board cover.
- Attach three EMI cores (2 pcs. of RFC-13 and a RFC-H13 are included in installation material CP03-33801) to the signal cable at the locations shown below.

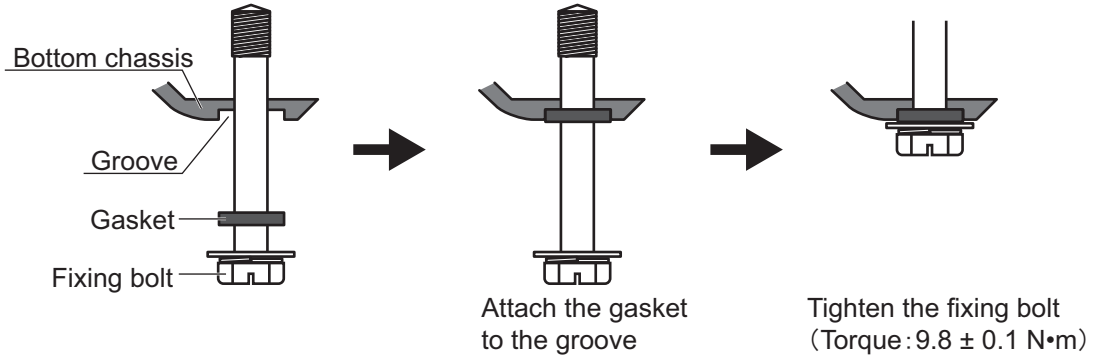


- Pass the antenna cable to cable clamp as shown in above step.

2. WIRING

12. 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.

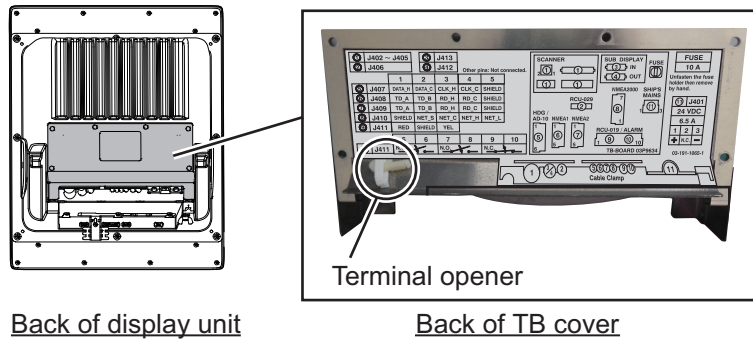


13. Turn on the antenna unit, confirm that the inside of antenna unit does not require adjustment, and fasten the four bolts.

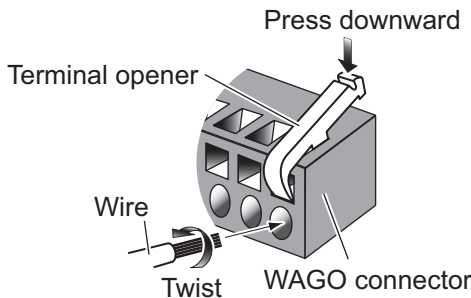
2.3 Display Unit

2.3.1 Cable fabrication

Remove insulation of each cable by 6 mm to connect to WAGO connector. Attach WAGO connector to the display unit. A terminal opener of WAGO connector is attached to the back of Terminal Board (TB) cover.



How to Connect Wires to WAGO Connector

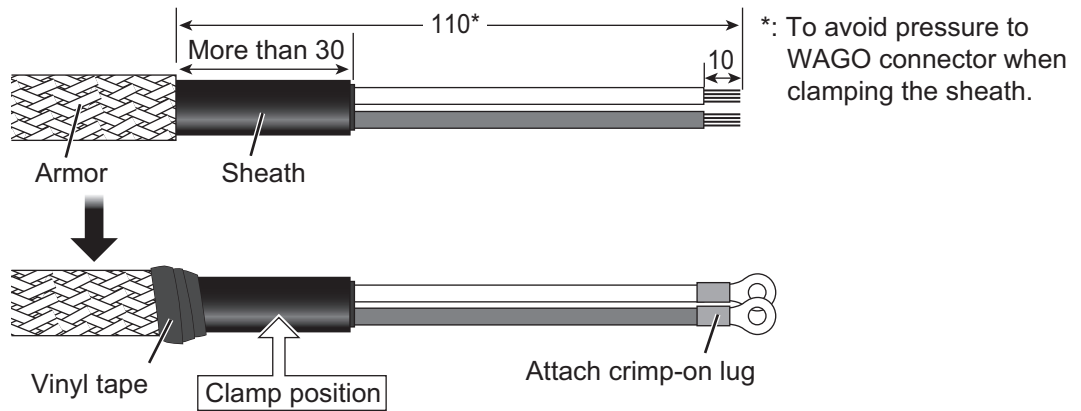


<Procedure>

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

DPYC-2.5 (Power Cable)

Note: Use the specified cable.



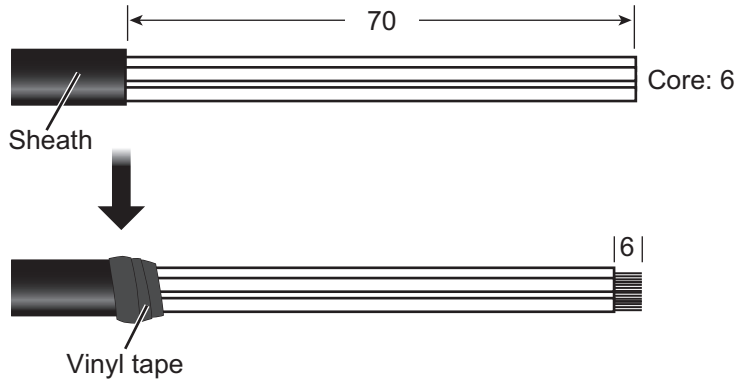
M12-05BFFM (CANbus Device Cable)



MJ-A6SPF0006 (NMEA0183 Device Cable)



MJ-A7SPF0003 (External Buzzer Cable)



Cable for Remote Controller RCU-019

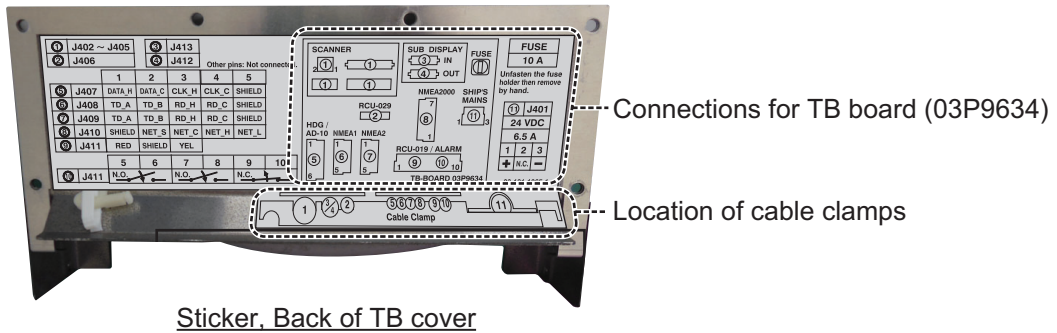
Replace the MJ connector attached to remote controller cable to WAGO connector. Refer to section 2.5 for the details.

2.3.2 Cable Connection

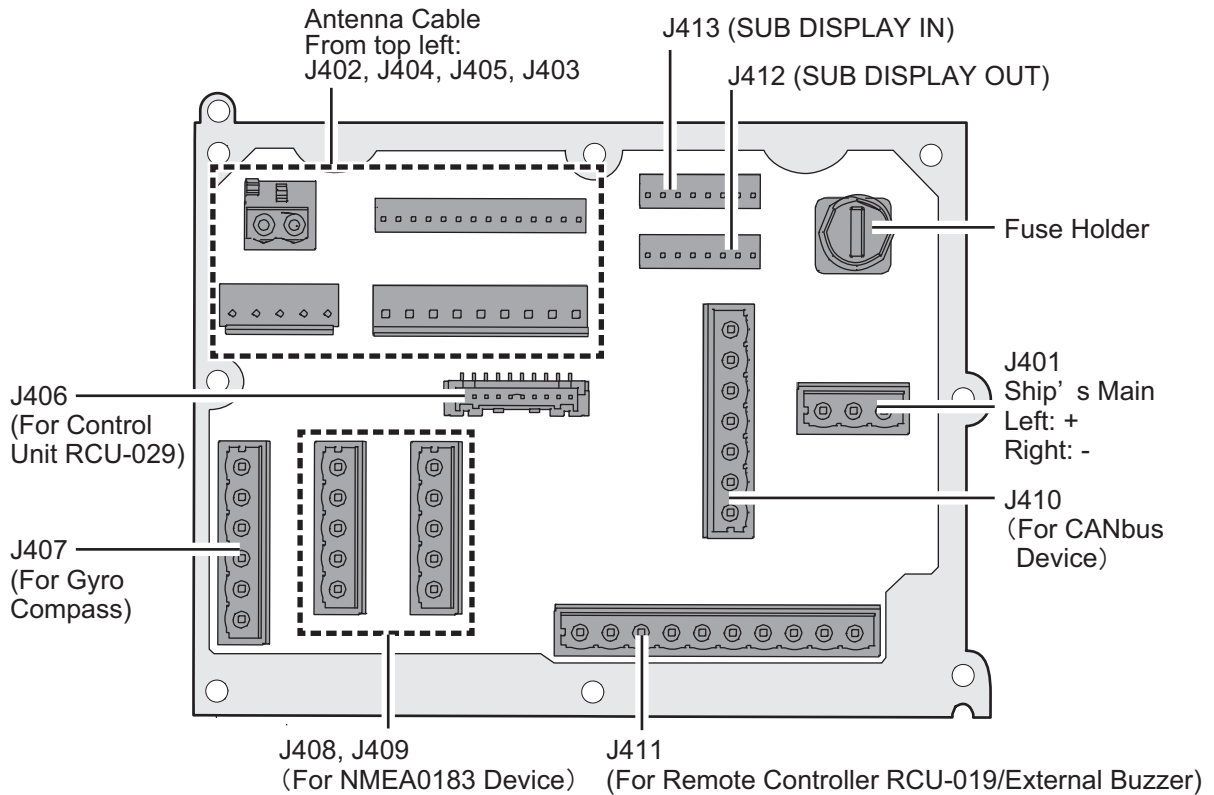
Open the TB cover at the back of display unit to connect the antenna cable, power cable and control unit cable by referring to the illustration of the TB board (03P9634) inside the processor unit. For connecting those cables, detach the WAGO connectors from the TB board and attach cables to the WAGO connectors, then reattach those WAGO connectors to the TB board.

There are four ports (USB port, LAN port, RGB port and DVI port) to connect the LAN devices, network devices, sub-display and external monitors.

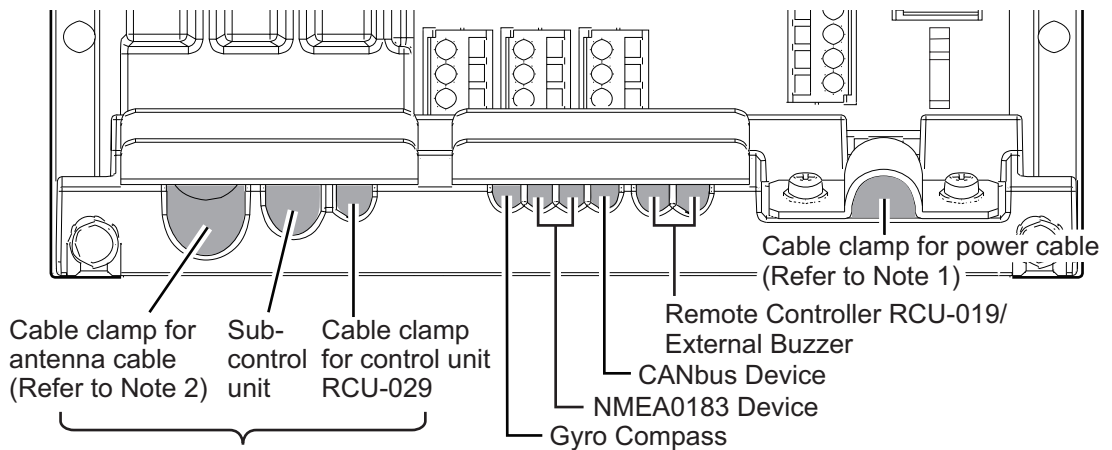
Refer to the sticker attached on the back of TB cover.



Connections inside the Display Unit (03P9634 board)



Cable Clamp Position

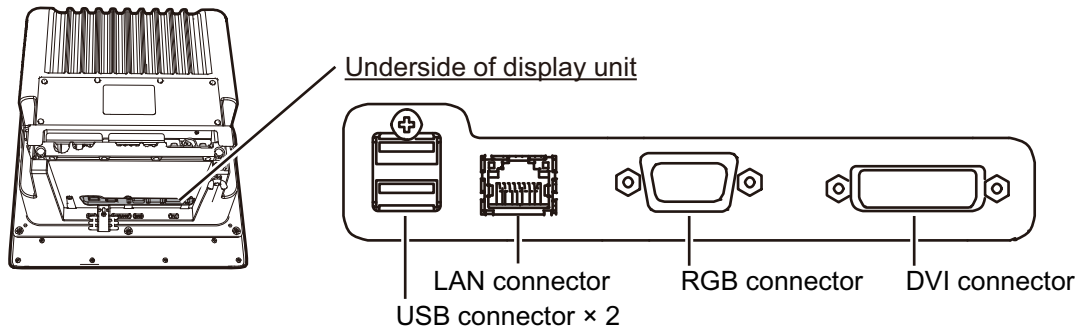


Note: Clamp these cables at shield for grounding.

Note 1: Connect the power cable to a display unit via a circuit breaker.

Note 2: Ground the antenna cable with cable clamp (not with the screws.)

Connection at the Underside of the Display Unit

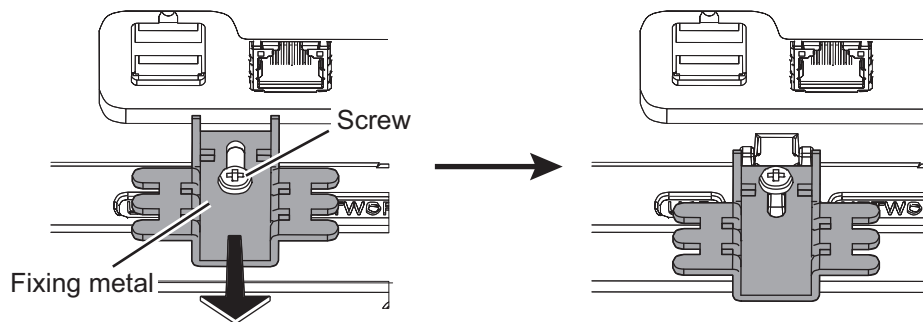
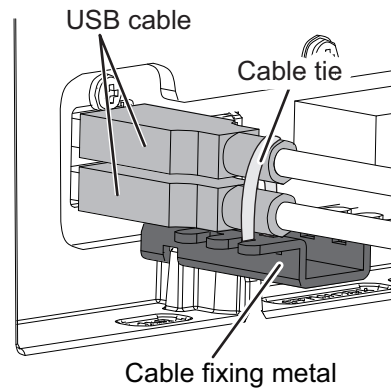


- USB port (2 ports): For trackball control unit RCU-030

Note 1: When connecting one USB cable, use the USB port near the fixing metal and strap the USB connector to the fixing metal with using cable tie AB100-S (included in the installation material CP03-37201).

Note 2: When connecting two USB cables, check that both USB cables do not come off by the clamping tension of cable tie.

Note 3: When it is difficult to clamp the USB cables with cable tie because of the relative positions of a fixing metal and USB connectors, unfasten the screw of fixing metal and pull the fixing metal forth to allow space for clamping.



- LAN port: For HUB-100 connected with network device.
- RGB port: For external RGB monitor
- DVI port: For external DVI monitor

2.4 RGB Monitor

The display unit has a RGB port to connect with a RGB monitor. Use the RGB cable (3COX-2P-6C, 5/10 m, optional supply) to connect the RGB monitor.

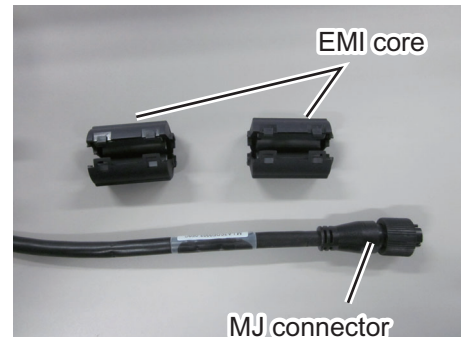
Caution about a RGB/DVI Port

- RGB port and DVI port each have a separate circuit to avoid influence on both ports at the same time.
- The video signal is continuously output from the display unit and is unstoppable.

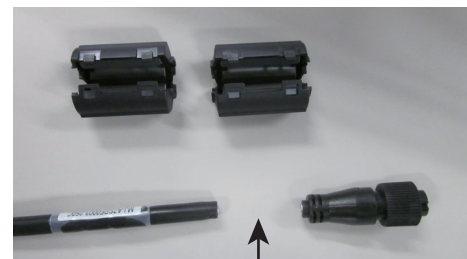
2.5 Remote Controller RCU-019 (Option)

Remote controller RCU-019 has a MJ connector at the end of its cable. To use the remote controller with the display unit, replacement of the MJ connector to a WAGO connector is required.

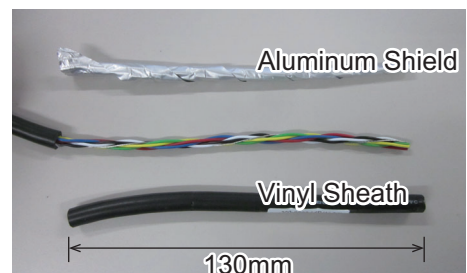
1. Detach the EMI core from the cable.



2. Cut off the MJ connector at the end of cable. The MJ connector can be disposed.



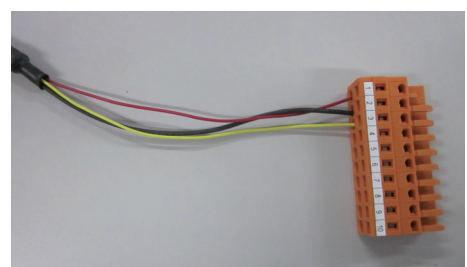
3. Remove the vinyl sheath and aluminum shield for 130 mm from the edge of cable.



4. Cut four cables (white, blue, green and black) to the edge of sheath (130 mm). The other three cables (red, yellow and shield cable) are to be left uncut.

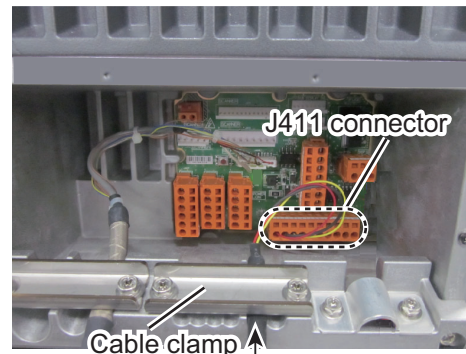


5. Remove the vinyl sheath of red and yellow cables. Cover the shield line with a heat shrinkable tube to 6 mm from the edge of cable.
6. Unfasten the six screws at the back of display unit and take off the TB cover.
7. Detach the WAGO connector from the J411 of board 03P9634 inside the display unit.
8. Connect each fabricated cable to WAGO connector.
Pin No. 1: red, Pin No. 2: black (shield), Pin No. 3: yellow.



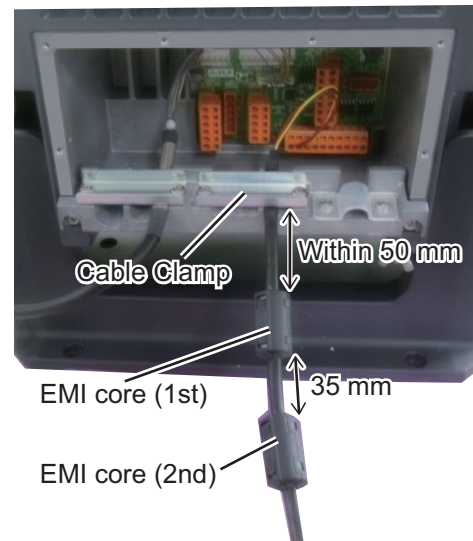
2. WIRING

9. Attach the WAGO connector to J411 from the backside of display unit.



Cable of remote controller RCU-019

10. Attach the two EMI cores which were detached at step 1.
Attach the first EMI core within 50 mm from the cable clamp. Attach the second EMI core within 35 mm of the first EMI core's edge.



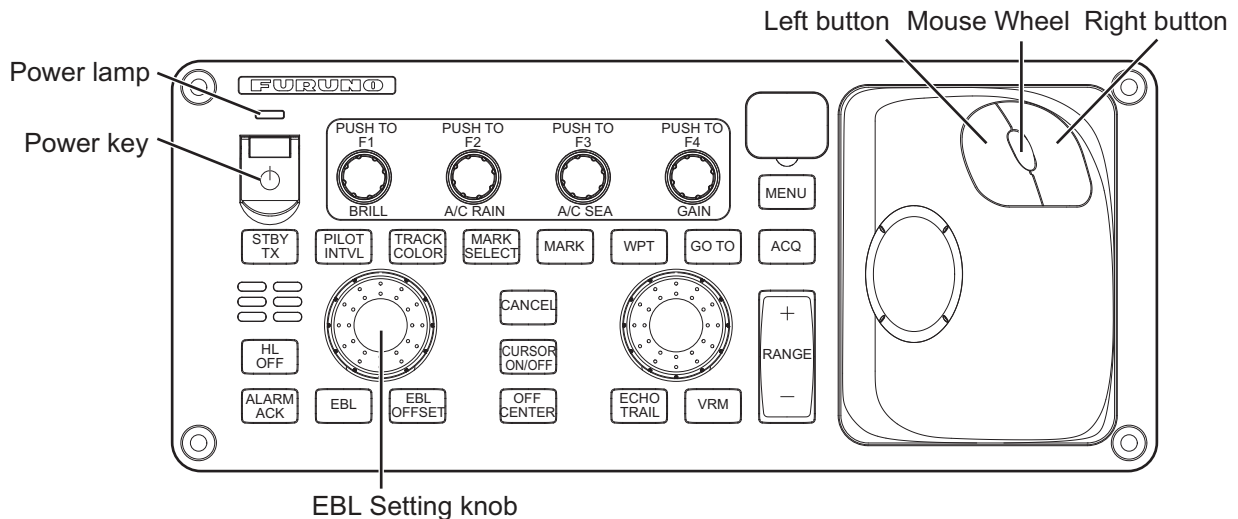
11. Place the TB cover back to the backside of display unit.

3. ADJUSTMENTS

Note: After completing the settings and adjustments, copy the setting data to the internal memory, referring to the Operator's Manual. This will allow easy restoration of setting data after the SPU Board is replaced, etc.

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

Below are the controls on the control unit that are used to make the adjustments.



How to Use the Menu

1. Press the **Power** key to turn on the unit.
2. Press the **MENU** key or **CURSOR ON/OFF** key and click the right button when the cursor is not shown to open the main menu.
 - * The [RADAR INSTALLATION] menu does not appear when the unit is first turned on. It appears on the [MENU] after displaying it by following the procedures on the section 3.1 and is displayed until the unit is turned off.

MENU	
1.	[ECHO]
2.	[ROUTES/WAYPOINTS]
3.	[OTHER SHIP' S INFO.]
4.	[MARK]
5.	[TRACK]
6.	[MEMORY REC./PLAY]
7.	[ALERT SETTINGS]
8.	[CHART]
9.	[CURSOR/OWN SHIP MARK]
10.	[NAV DATA]
11.	[INITIAL SETTING]*

3. Operate the track ball or the mouse wheel to select a menu item then click the left button.
 - Note:** When using the track ball, make the cursor appear with **CURSOR ON/OFF** key.
4. Operate the track ball or the mouse wheel to select a menu option then click the left button. To return to above layer, select [BACK] then click the left button or right button.
5. If the menu option requires entry of numeric data, rotate the mouse wheel to set the value, then click the left button.
6. Close the menu by pressing the **MENU** key once or click the right button few times.

3.1 [RADAR INSTALLATION] Menu

To open the [RADAR INSTALLATION] menu, press the **MENU** key five times while pressing the **HL OFF** key. The [RADAR INSTALLATION] menu contains the items for adjustment of the radar.

[RADAR INSTALLATION]	
1.	BACK
2.	[ECHO ADJUST]
3.	[OWN SHIP INFO]
4.	[SCANNER]
5.	[INSTALLATION]
6.	[TT PRESET]
7.	[ALERT I/F SETTING]
8.	[PORT SETTING]
9.	[OTHERS]
10.	[FACTORY]

3.2 [ECHO ADJUST] Menu

Open the [RADAR INSTALLATION] menu and select [ECHO ADJUST] menu. The radar echo display can be adjusted with this menu.

[ECHO ADJUST]	
1.	BACK
2.	AUTO INITIAL SETTING
3.	VIDEO ADJUST VALUE 0
4.	TIMING ADJUST VALUE 200
5.	HEADING ALIGN 000.0°
6.	MBS TIMING 0

3.2.1 [AUTO INITIAL SETTING] Menu

The [AUTO INITIAL SETTING] automatically performs, tuning, adjustment of sweep timing, video adjustment and MBS timing adjustment.

Note: Before starting the [AUTO INITIAL SETTING] function, [SECTOR BLANK1 (2)] must be deactivated (refer to section 3.4) and long pulse transmission for over 10 minutes is required.

1. Select [AUTO INITIAL SETTING] from [ECHO ADJUST] menu of [RADAR INSTALLATION] menu then click the left button.
2. The indication "AUTO ADJ" appears on the screen during the initialization.
3. After the tuning is completed, press the right button twice to close the menu.

3.2.2 [VIDEO ADJUST VALUE] Menu

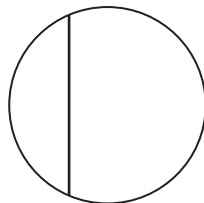
Video level can be manually adjusted.

1. Access to [VIDEO ADJUST VALUE] menu from the [ECHO ADJUST] menu of [RADAR INSTALLATION] menu.
2. Adjust the value to delete the noise from the display. The value can be changed from 0 to 31, default setting is 0.
The larger the setting, the stronger the gain. Select the setting at which white noise disappears. If the number is too high, weak echoes will disappear.
3. Close the menu.

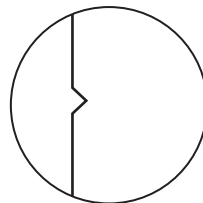
3.2.3 How to Adjust Sweep Timing

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:

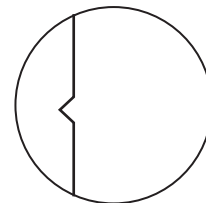
- The range of target echoes is incorrect.
- The echo of a "straight" target (for example, pier), on the 0.25 NM range, will appear on the display as being pulled inward or pushed outward. See the figures below.



(1) Correct



(2) Target pushed inward

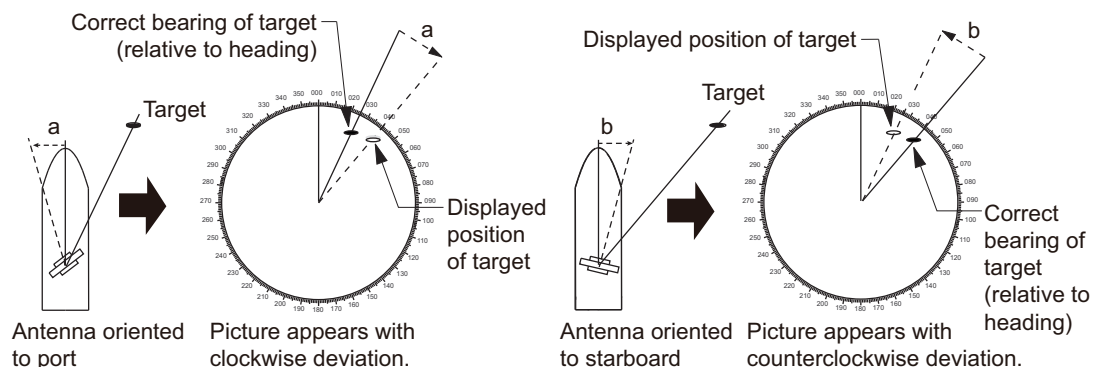


(3) Target pushed outward

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 ADJUST VALUE] to [AUTO] to activate the automatic adjustment, which takes approximately 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, then use the Setting knob to adjust the timing manually. The value can be changed from 0 to 4095, default setting is 200.

3.2.4 How to Align the Heading

A small but conspicuous target dead ahead may appear on the heading line (zero degrees) even if you installed the antenna unit facing straight ahead in the direction of the bow. It is because of the difficulty in achieving accurate initial positioning of the antenna unit in practice. The following adjustment will rectify 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.

3. ADJUSTMENTS

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.
6. Select [HEADING ALIGN], then enter the bearing difference measured at step 4. The setting range is 000.0° to 359.9°.
7. Confirm that the target echo is displayed at the correct bearing on the screen.

3.2.5 How to Suppress Main Bang

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

1. Transmit the radar on a long range and then wait for 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 TIMING], then use the Setting knob to enter a value that causes the main bang to faintly disappear. The setting range is 0 to 255.

3.3 RADAR INSTALLATION Menu

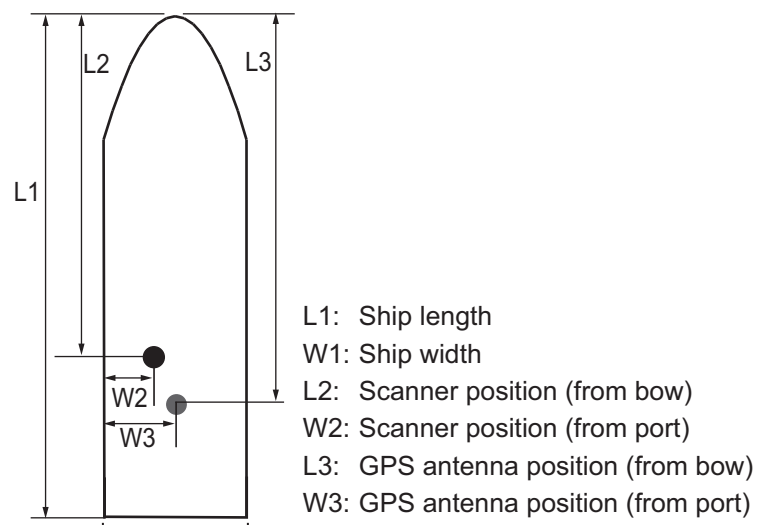
The following sections provides descriptions of the [RADAR INSTALLATION] menu items not previously mentioned.

Enter the length and width of the ship and the 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	0 m
WIDTH	0 m
3. SCANNER POSITION	
BOW	0 m
PORT	0 m
4. GPS ANT POSITION	
BOW	0 m
PORT	0 m

Example



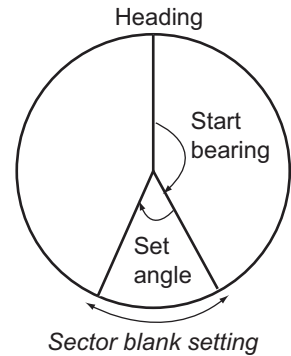
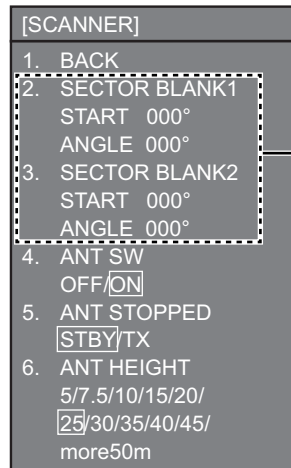
[LENGTH/WIDTH]: Enter the ship's length and width.

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

[GPS POSITION]: Enter the distance from the GPS antenna to bow and port.

3.4 [SCANNER] Menu

[SECTOR BLANK1], [SECTOR BLANK2]: Set area(s) to prevent transmission. Heading must be properly aligned (see section 3.2.4) before setting any blank 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°.



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°.

[ANT SW]: Select [OFF] to prevent antenna rotation while servicing.

[ANT STOPPED]: For service technician. [ANT STOPPED] disables transmission while the antenna is stopped in STBY.

[ANT HEIGHT]: Select the height (in meters) of the radar antenna above the waterline (Initial setting is [25] m). If this is not correctly set, incorrect radar echo may be displayed. If this setting is changed, the setting of the [ANT HEIGHT] menu synchronize to the same value. Refer to the Operator's Manual about the [ANT HEIGHT] menu.

3.5 [INSTALLATION] Menu

[IP ADDRESS (RADAR)]: Enter the IP address of the radar. The default address is 172.031.003.017.

[IP ADDRESS (PLOT)]: Enter the IP address of the plotter. The default address is 000.000.000.000.

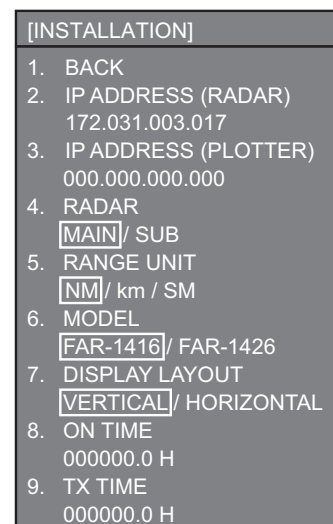
[RADAR]: Choose the radar category - [MAIN] or [SUB].

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

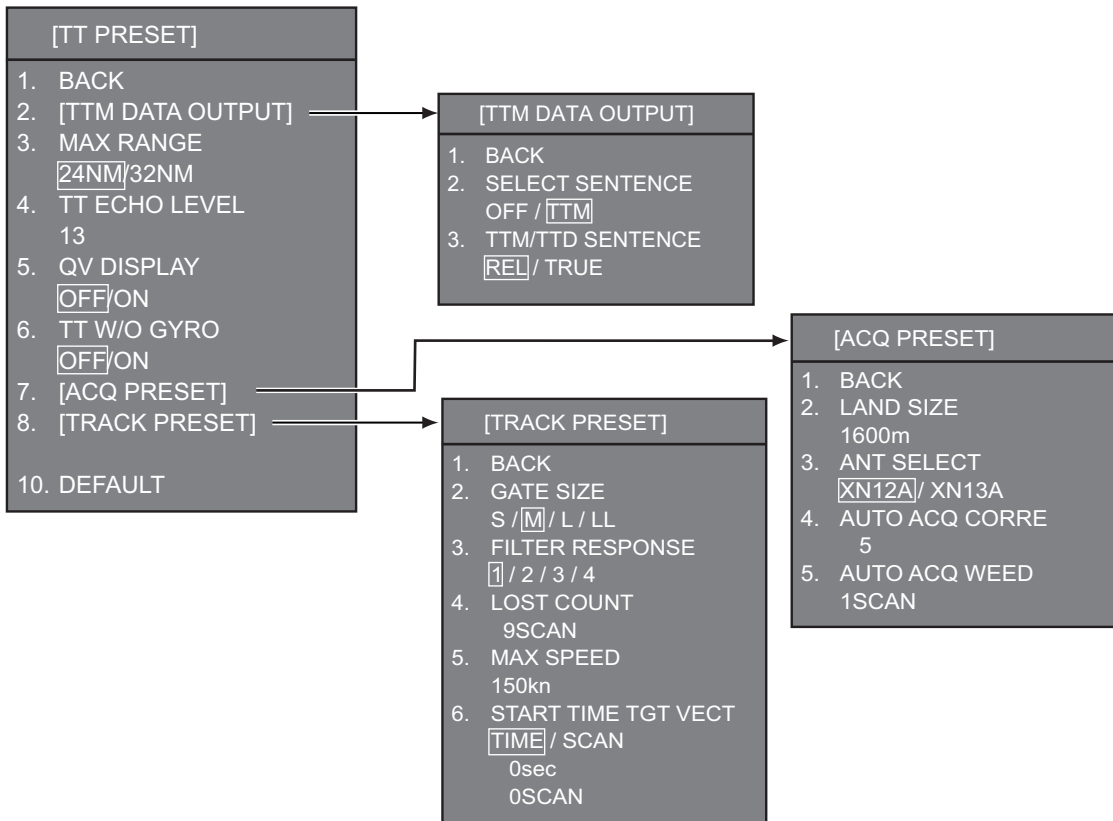
[MODEL]: Select the model name - [FAR-1416] or [FAR-1426].

[DISPLAY LAYOUT]: Select the type of radar display. The choices are [VERTICAL] and [HORIZONTAL].

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



3.6 [TT PRESET] Menu



- [TT DATA OUTPUT] menu

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

[TTM/TTD REFERENCE]: Select the output format (bearing) for the TTM/TTD sentence. [REL] and [TRUE] are the options.

[REL]: Shows the relative bearing and course from own ship to the target. **[TRUE]:** Shows the true bearing and course from own ship to the target.

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

[ACQ PRESET] Menu

[LAND SIZE]: Set the land size in 100 m increments. 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. Default setting is [1600] m.

[ANT SELECT]: Choose the antenna radiator type of your radar (XN-12A or XN-13A). The size of the echo changes with radiator size. Select the correct radiator type to ensure proper performance. Default setting is [XN12A].

[AUTO ACQ CORRE]: Set the correlation count for automatic acquisition. The setting range is [3] to [10]. Default setting is [5].

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

[TRACK PRESET] Menu

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

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

[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 as a lost target. The setting range is [0] to [9999]. Default setting is [9999].

[MAX SPEED]: No use.

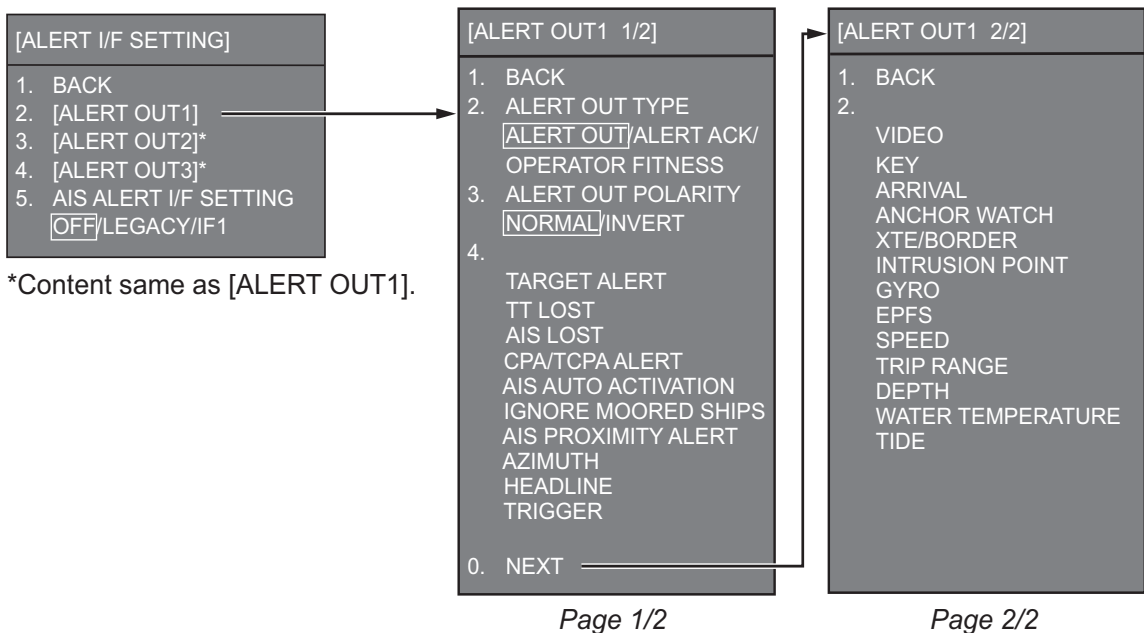
[START TIME TGT VECT]: Set the number of seconds or number of scans to wait before showing the vector for a newly acquired target. Select [TIME] or [SCAN] then enter value.

- [TIME] can be set from [0] to [100] second. Default setting is [0].

- [SCAN] can be set from [0] to [40] scans. Default setting is [0].

3.7 [ALERT I/F] Menu

Three alert contact outputs are available, [ALERT OUT1] - [ALERT OUT3]. Set each alert output referring to the description on the next page.



[ALERT I/F SETTING] Menu (Main)

[ALERT OUT 1] - [ALERT OUT 3]: 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.

3. ADJUSTMENTS

Units	Alert
Transceiver unit	<ul style="list-style-type: none"> • AZIMUTH • HEADLINE • TRIGGER • VIDEO
Control unit	KEY

To monitor for processor unit failure, connect SYS_FAIL and PWR_FAIL from terminal J613 in the processor unit to the external buzzer (for alarm).

[AIS ALERT I/F SETTING]: 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 alert mode is Alert IF1.

[ALERT OUT] Sub Menus

[ALERT OUT TYPE]: Select the alert out format.

[ALERT OUT]: Alerts are output as they occur.

[ALERT ACK]: Alerts are output when acknowledged.

[OPERATOR FITNESS]: Operator fitness signal is output.

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

Note: For category A alert, there are two types of output operations, “A” and “C”. To inform the alert of category A alerts via contact signal, connect both “A” and “C” signals.

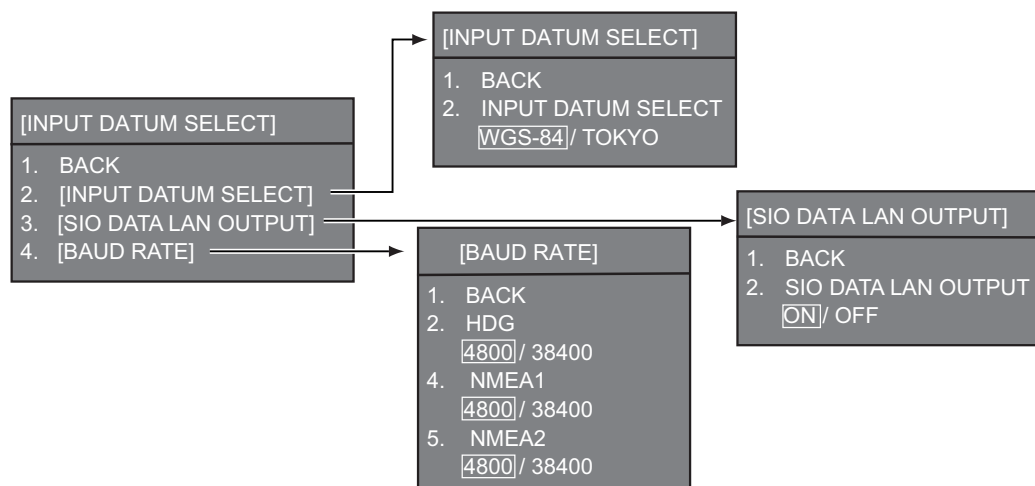
(A): Alert sound is output when the corresponding item is an unacknowledged alert. Output is stopped when the item is acknowledged.

(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

3.8 [PORT SETTING] Menu



[INPUT DATUM SELECT] Menu

Choose the source for GPS datum from [WGS-84] and [TOKYO].

[SIO DATA LAN OUTPUT] Menu

Choose [ON] to output the NAV data (NMEA0183) to LAN. The default is [OFF].

[BAUD RATE] Menu

Choose the baud rate for heading sensor and [NMEA 1], [NMEA 2] equipment.

[HDG]: Choose if the baud rate for heading sensor is [4800] or [38400].

[NMEA 1]: Choose if the baud rate of [NMEA 1] equipment is [4800] or [38400].

[NMEA 2]: Choose if the baud rate of [NMEA 2] equipment is [4800] or [38400].

3.9 [OTHERS] Menu

[DEMO ECHO]: Select the source for the demonstration echo, [OFF], [EG] (Echo Generator), [PC] or [TT-TEST]. Select [OFF] to disable the demonstration echo feature.

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

[UPDATE OS]: Update the plotter OS and application via USB flash memory with this menu. The system reboots after completion. *: USB flash memory is a trade mark of USB Implementers Forum, Inc.

[OTHERS]	
1.	BACK
2.	DEMO ECHO [OFF] / EG / TT-TEST / PC
3.	EAV W/O GYRO [OFF] / ON
4.	UPDATE OS

3.10 [FACTORY] Menu

[LANGUAGE]: Select a language to be displayed from [ENGLISH], [JAPANESE] and [THAI].

Note 1: Language setting does not change after the **[FACTORY DEFAULT]**.

Note 2: [THAI] in the [LANGUAGE] menu is not selectable. [UNLOCK LANGUAGE] is required to activate [THAI] in the selection. (Refer to the [UNLOCK LANGUAGE] on the next page.)

[FACTORY DEFAULT]: Reset the settings to factory default settings.

[FACTORY TEST]: Menu to start the factory test.

[INTERNAL STATE DISPLAY]: Select if data will be stored to internal memory.

[ON TIME RESET]: Menu to reset the [ON TIME] indication (refer to the section 3.5).

[TX TIME RESET]: Menu to reset the [TX TIME] indication (refer to the section 3.5).

[LCD TIME RESET]: Menu to reset the LCD run time.

[FACTORY]	
1.	BACK
2.	LANGUAGE [ENGLISH] / JAPANESE / THAI
3.	FACTORY DEFAULT
4.	FACTORY TEST
5.	INTERNAL STATE DISPLAY [NO] / YES
6.	ON TIME RESET
7.	TX TIME RESET
8.	LCD TIME RESET
9.	UNLOCK LANGUAGE

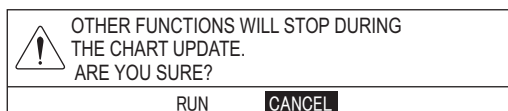
[UNLOCK LANGUAGE]: Menu to unlock [THAI] in the [LANGUAGE] menu by entering the password of six digits. Ask your dealer about the password. The setting range is from [000000] to [FFFFFF] and the default setting is [-----].

3.11 How to Control Charts

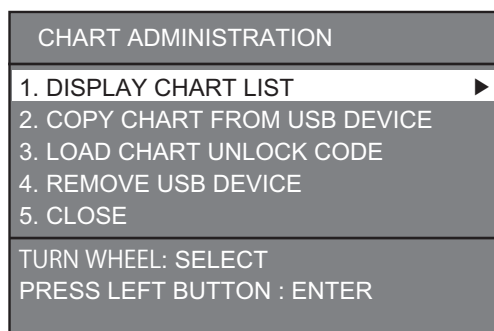
This section shows you how to install or update charts. Before starting an installation or update, prepare a USB flash memory with a minimum capacity of 16GB (hereafter referred to as "USB memory"). If your system already has charts installed, you must first uninstall the charts, then install the new charts and finally, unlock the charts (unlock codes not required for some charts). To obtain new charts, download the required charts from the Mapmedia homepage. When ordering new charts for areas other than the USA, you may need to provide your system ID (see section 3.11.1).

3.11.1 How to uninstall charts

1. Connect the USB flash memory with chart data to the USB drive on the display unit.
2. Press the **MENU** key to open the main menu.
3. Select [11. SYSTEM SETTING].
4. Select [7. MAINTENANCE].
5. Select [3. UPDATE CHART]. The following message appears.



6. Select [RUN]. The message "PROCESSING. PLEASE WAIT." appears, then the [CHART ADMINISTRATION] menu appears.



7. Select [1. DISPLAY CHART LIST]. The chart list appears.
Note: Note down your SYSTEM ID. This may be required when ordering charts.
8. Select the chart you want to uninstall, then press the **CANCEL** key. A confirmation message appears.
9. Select [RUN].
Repeat the steps 8 and 9 as required, to remove unnecessary charts. Chart data files have the following file extensions: ".dbv" for navigational charts, ".dbh" for fishing charts, ".dbh" for contour (bathymetry) charts.
10. Press the **MENU** key to complete the uninstall process.
You can now install you new/updated charts (see paragraph 3.11.2).

3.11.2 How to install charts

Note: Save the chart data to a USB flash memory first. You do not need to create a folder.

1. Connect the USB flash memory with chart data to the USB drive on the display unit.
2. Press the **MENU** key to open the main menu.
3. Select [11. SYSTEM SETTING].
4. Select [7. MAINTENANCE].
5. Select [3. UPDATE CHART]. The following message appears.
6. Select [RUN]. The message "PROCESSING. PLEASE WAIT." appears, then the [CHART ADMINISTRATION] menu appears.
7. Select [2. COPY CHART FROM USB DEVICE] to display the list for data in the USB flash memory. Charts which are not yet installed on this radar are shown with yellow-colored text.
8. Select the chart data to copy.
The text color changes from yellow to white when a chart is selected. Select the chart again to de-select it.
9. Select [SELECT CHART TO COPY]. The confirmation message appears.
10. Select [RUN] to copy the chart data.
The copy process begins. For reference, this process takes approximately 13 minutes for 10GB of data. The system should not be operated during the copying process. A confirmation message appears to inform you when the copying is complete.
11. Click the **left button** to complete the installation.

3.11.3 How to unlock your charts

There are two methods to unlock your charts; automatically, or manually. Both methods are described below.

How to unlock the chart data automatically

Note: Save the unlock code to the USB flash memory first. The file extension is "uc".

1. Connect the USB flash memory with chart data to the USB drive on the display unit.
2. Select [3. LOAD CHART UNLOCK CODE] in the [CHART ADMINISTRATION] menu to display the list for data in the USB flash memory.
3. Select the file for the unlock code. The confirmation message appears.
4. Select [RUN]. The message "UNLOCK CODE VERIFIED." appears.
5. Click the left button.
6. When unlocking the chart data automatically, select [4. REMOVE USB DEVICE]. The message "USB DEVICE CAN BE SAFELY REMOVED." appears. Click the **left button** then remove the USB device.
7. Select [6. CLOSE]. The confirmation message appears.
8. Select [RUN]. The system restarts.

3. ADJUSTMENTS

How to unlock the chart data manually

1. Select [1. DISPLAY CHART LIST] in the [CHART ADMINISTRATION] menu to display the chart list.
2. Select the locked chart data (displayed with yellow letters), then click the **left button** to display the character entry window.
3. Set the unlock code as described below.
Operate the trackball or the mousewheel to select a character, then click the **left button**. Repeat this step to select all other characters. Select [ENTER] then push the knob.
The message "UNLOCK CODE VERIFIED." appears.
4. Push the **ENTER** knob.
5. Select [6. CLOSE]. The confirmation message appears.
6. Select [RUN]. The system restarts.

3.11.4 How to update charts

Note 1: Save the chart data to a USB flash memory first. You do not need to create a folder.

Note 2: Before updating charts, delete the old chart data. If needed, take backups for an unlock code.

1. Connect the USB flash memory with chart data on it to the USB drive on the display unit.
2. Press the **MENU** key to open the main menu.
3. Select [11. SYSTEM SETTING].
4. Select [7. MAINTENANCE].
5. Select [3. UPDATE CHART]. The following message appears.
6. Select [RUN]. The message "PROCESSING. PLEASE WAIT." appears, then the [CHART ADMINISTRATION] menu appears.
7. Select [1. DISPLAY CHART LIST] to display the chart list.
8. Select the chart data to delete then press the **CANCEL** key.
9. Select [RUN]. The message "CHART DELETION COMPLETE" appears.
10. Click the **left button**.
11. Follow steps 7 to 11 in paragraph 3.11.2.
12. Referring to paragraph 3.11.3 unlock the updated charts if required.

4. INPUT/OUTPUT DATA

4.1 Input/Output Specification

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

Port	Signal name	Specification	Input/Output	Remarks
J407	HDG/AD-10	NMEA0183/AD-10 Format	Input	<ul style="list-style-type: none">• Satellite Compass™• Heading Sensor• AD-100
J408	NMEA1	NMEA0183	Input & Output	<ul style="list-style-type: none">• AIS• GPS• Doppler
J409	NMEA2			
J410	NMEA2000	CANbus	Input & Output	NAV equipment
J411	Input for Remote Controller	Analog	Input	RCU-019
	External Buzzer	Open Collector	Output	Alarm System
J412	Radar Sub-Display	HD, BP, Trig. Video	Input	Radar (Main)
J413	Radar Sub-Display		Output	Radar (Sub)
USB1 USB2		USB2.0	Input & Output	<ul style="list-style-type: none">• USB Remote Controller• General USB device
DVI		DVI-D	Output	DVI Monitor
RGB		Analog RGB	Output	Analog RGB Monitor

4.2 NMEA0183 Sentences

Input Sentence and Sentence Priority

Data	Sentence priority
AIS target, Message, Alert	ALR, VDM, VDO
Current	VDR > CUR
Depth	DPT > DBT > DBS > DBK
Heading (true)	THS > HDT > VHW > HDG
Heading (magnetic)	HDG > HDM > VHW
Magnetic deviation	HDG > RMC
Current UTC Time and date	ZDA
Position	GNS > GGA > RMC > GLL
Course over the ground (COG)	VTG > RMC
Speed over the ground (SOG) (GPS)	VTG > RMC
Speed through the water (STW)	VBW > VHW
Waypoint	RMB, WPL > RTE
Wind speed and angle (true)	MWV>VWT
Wind speed and angle (relative)	MWV>VWR
Water temperature	MTW
Target position data	TLL
TT/DR-100 target data	TTM

Output Sentences (Serial)

Data	Sentence	Data	Sentence
Target L/L information	TLL	TT target information	TTM

Output Sentences

Data	Sentence	Data	Sentence
Waypoint	BWC, BWR	Wind speed and angle (true)	MWV, VWT
Depth	DPT, DBT, DBS, DBK	Wind speed and angle (relative)	MWV, VWR
Datum	DTM	Magnetic Deviation	HDG, RMC
Position	GNS, GGA, RMC, GLL	Ship speed and course	VTG, RMC
Heading (true)	THS, HDT, HDG	Speed through water (STW)	VBW
Heading (magnetic)	HDG, HDM	Tidal Current	CUR
Water temperature	MTW	Current UTC Time and date	ZDA

4.3 CANbus PGN LIST

Input PGN

PGN	PGN Contents	Remarks
59392	ISO Acknowledgement	(For Certification Level A/B)
59904	ISO Request	(For Certification Level A/B)
61184	Self Test Group Function	Proprietary PGN
60928	ISO Address Claim	(For Certification Level A/B)
126208	NMEA - Request group function	(For Certification Level A+ α)
	NMEA - Command group function	(For Certification Level A+ α)
	NMEA - Acknowledge group function	(For Certification Level A+ α)
126720	Memory Group Function	Proprietary PGN
	Reset Memory Group Function	Proprietary PGN
126992	System Time	
126996	Product Information	(For Certification Level A/B)
127250	Vessel Heading	
127258	Magnetic Variation	
128259	Speed	
128267	Water Depth	
129025	Position, Rapid Update	
129026	COG & SOG, Rapid Update	
129029	GNSS Position Data	
129033	Local Time Offset	
129291	Set & Drift, Rapid Update	
130306	Wind Data	
130310	Environmental Parameters	
130311	Environmental Parameters	
130316	Temperature, Extended Range	
130577	Direction Data	
130312	Temperature	
130578	Vessel Speed Components	

Output PGN

PGN	PGN Contents	Remarks
59392	ISO Acknowledgement	For Certification Level A/B
59904	ISO Request	For Certification Level A/B
61184	Self Test Group Function	Proprietary PGN
60928	ISO Address Claim	For Certification Level A/B
126208	NMEA - Request group function	For Certification Level A+ α
	NMEA - Acknowledge group function	For Certification Level A+ α
126464	PGN List - Transmit PGN's group function	For Certification Level A+ α
	PGN List - Received PGN's group function	For Certification Level A+ α
126720	Memory Group Function	Proprietary PGN
	Reset Group Function	Proprietary PGN
126993	Heartbeat	
126996	Product Information	For Certification Level A/B
130822	Unit Division Code	Proprietary PGN
130823	Browser Control Status	Proprietary PGN

4. INPUT/OUTPUT DATA

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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 (mm²)* 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)

4. Armor Type

- C: Steel

5. Sheath Type

- Y: Anticorrosive vinyl sheath

6. Shielding Type

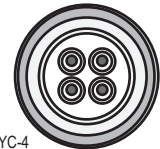
- S: All cores in one sheath
- S: Individually sheathed cores
- SLA: All cores in one shield, plastic tape w/aluminum tape
- SLA: Individually shielded cores, plastic tape w/aluminum tape



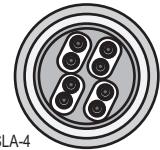
DPYCY



TPYCY



MPYC-4



TTYCSLA-4

EX: ^{1 2 3 4 5 6} TTYC Y S L A - 4
 Designation type # of twisted pairs

EX: ^{1 2 3 4} M P Y C - 4
 Designation type # of cores

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

Type	Core		Cable Diameter	Type	Core		Cable Diameter
	Area	Diameter			Area	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, ALR, CUR, DBK, DBS, DBT, DPT, DTM, GBS, GGA, GLL, GNS, HBT, HDG, HDM, HDT, MTW, MWV, RMB, RMC, THS, TLL, TTM, VBW, VDM, VDR, VHW, VTG, VWR, VWT, ZDA

Output sentences

AAM, APB, BOD, BWC, BWR, DBT, DPT, DTM, GGA, GLL, GNS, GSA, GSV, GTD, HDG, HDT, MSK, MSS, MTW, MWV, RMA, RMB, RMC, RTE, THS, TLL, TTM, VHW, VTG, WPL, XTE, ZDA

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 - AIS Addressed and binary broadcast acknowledgment

\$**ABK,xxxxxxxx,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)

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)

CUR - Water current layer, Mult-layer water current data

```
$**CUR,A,x,x.x,x.x,x.x,a,x,x,x.x,x,a,a,*hh<CR><LF>
      1 2 3 4 5 6 7 8 9 10 11
```

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)

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)

APPENDIX 2 DIGITAL INTERFACE

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 9 10

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)

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

APPENDIX 2 DIGITAL INTERFACE

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)

RMB - Recommended minimum specific navigation information

```
$**RMB,A,x.x,a,CCCC,CCCC,IIII.II,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 13 14
```

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 GNSS data

```
$**RMC,hhmmss.ss,A,IIII.II,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 11 12 13
```

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

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

APPENDIX 2 DIGITAL INTERFACE

TLL - Target latitude and longitude

\$**TLL,xx,IIII.II,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)

TTM - Tracked target message

\$**TTM,05,12.34,23.4,R,45.67,123.4,T,1.23,8.23,N,c--c,T,R,hhmmss.ss,M*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1. Target number (00 to 999)
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
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=nm)
11. Target name (null)
12. Target status (L=Lost Q=Acquiring T=Tracking)
13. Reference target (R, NULL otherwise)
14. UTC of data (null)
15. Type of acquisition (A=Automatic M=Manual)

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)

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)

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)

APPENDIX 2 DIGITAL INTERFACE

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)

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. Local zone, minutes (No use)

Output sentences

Refer to the input sentences for the following ones. DBT, DPT, DTM, GGA, GLL, GNS, HDG, HDT, MTW, MWV, RMB, RMC, THC, TLL, TTM, VHW, VTG

AAM - Waypoint Arrival Alarm

\$GPAAM,A,A,x.x,N,c--c,*hh<CR><LF>
1 2 3 4 5

1. Status (A=Arrival circle entered V=Not arrived)
2. Status (A=Perpendicular passed at waypoint, V=Not arrived)
3. Arrival circle radius, nm (0.000 to 9.999)
4. Units of radius (nautical miles)
5. Waypoint ID

APB - Auto Pilot B sentence

\$--APB,A,A,x.x,a,N,A,A,x.x,a,c--c,x.x,a,x.x,a,A,*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1. Status (A=Data valid V=LORAN-C blink or SNR warning
V=General warning flag for other navigation systems
when a reliable fix is not available)
2. Status (A=OK or no use V=LORAN-C cycle lock warning flag)
3. XTE (cross-track-error) Magnitude (0.000 - 99999.999)
4. Direction to steer, L or R
5. XTE units, N=nautical miles
6. Status (A=arrival circle entered V=arrival circle not passed)
7. Status (A=perpendicular passed at waypoint V=perpendicular not entered)
8. Bearing origin to destination (0.0 - 360.0)
9. M=Magnetic, T=True
10. Destination waypoint ID
11. Bearing, present position to destination
12. M=Magnetic, T=True
13. Heading to steer to destination waypoint
14. M=Magnetic, T=True
15. Mode indicator (A=Autonomous mode D=differential mode S=Simulator mode)

BOD - Bearing Origin to Destination

```
$**BOD,x.x,T,x.x,M,c--c,c--c,*hh<CR><LF>
  1 2 3 4 5 6
```

1. Bearing, degrees (0.00 to 360.0)
2. True
3. Bearing, degrees (0.00 to 360.0)
4. Magnetic
5. Destination waypoint ID (Max. 13 characters)
6. Origin waypoint ID (Max. 13 characters)

BWC - Bearing using Great Circle route

```
$**BWC,hhmmss.ss,IIII.II, a,IIII.II,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

BWR - Bearing and Distance to Waypoint

```
$**BWR,hhmmss.ss,IIII.II,a,IIII.II,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

APPENDIX 2 DIGITAL INTERFACE

GSA - GPS DGPS and active satellites

\$--GSA,a,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,x.x,x.x,x.x,*hh<CR><LF>
1 2 3 4 5 6

1. Mode (M=manual, forced to operate in 2=2D 3=3D mode
A=automatic, allowed to automatically switch 2D/3D)
2. Mode (1=fix not available 2=2D 3=3D)
3. ID number of satellites used in solution (01 to 96, null)
4. PDOP (0.00 to 999.99)
5. HDOP (0.00 to 999.99)
6. VDOP (0.00 to 999.99)

GSV - Detailed Satellite data

\$**GSV,x,x,xx,xx,xx,xxx,xx.....,xx,xx,xxx,xx,*hh<CR><LF>
1 2 3 4 5 6 7 8 9

1. Total number of messages (1 to 9)
2. Message number (1 to 9)
3. Total number of satellites in view (01 to 99)
4. Satellite ID number (01 to 96)
5. Elevation, degrees (00 to 90)
6. Azimuth, degrees true (000 to 359)
7. SNR(C/No) (00 to 99(dB-Hz), null when not tracking)
8. Second and third SVs
9. Fourth SV

GTD - Geographic Location in Time Differences

\$**GTD,x.x,x.x,x.x,x.x,x.x,*hh<CR><LF>
1 2 3 4 5

1. TD1, microseconds (0.0 to 99999.9)
2. TD2, microseconds (0.0 to 99999.9)
3. TD3, microseconds (0.0 to 99999.9)
4. TD4, microseconds (0.0 to 99999.9)
5. TD5, microseconds (0.0 to 99999.9)

MSK - MSK receiver interface

\$**MSK,x.x,a,x.x,a,x.x,x,a*hh<CR><LF>
1 2 3 4 5 6 7

1. Beacon frequency (283.5 - 325.0 kHz)
2. Auto/manual frequency, A/M
3. Beacon bit rate (25, 50, 100, 200), bit/s
4. Auto/manual bit rate A/M
5. Interval for sending \$--MSS (status) in seconds
6. Channel number
7. Sentence status Flag

MSS - Beacon Receiver Status

\$CRMSS,32.1,43.2,312.5,100,1*hh<CR><LF>
1 2 3 4 5

1. Signal strength (0.0 to 999.9)
2. Signal-to-noise ratio (SN), db (0.0 to 999.9)
3. Beacon frequency, kHz (283.5 to 325.0)
4. Beacon bit rate, bits/s 25, 50, 100, 200)
5. Channel number (0 to 9, equal to "1" or null for single channel receivers)

MTW - Mean Temperature of Water

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

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

RMA - Recommended Minimum specific LORAN-C data

```
$GPRMA,A,III.II,a,yyyy.yy,a,x.x,x.x,x.x,x.x,x.x,a,*hh <CR><LF>
  1 2 3 4 5 6 7 8 9 10 1112
```

1. Status: A=Data valid, V=Blink, cycle or SNR warning
2. Latitude, degrees (0.0000 to 9000.0000)
3. N/S
4. Longitude, degrees (0.0000 to 18000.0000)
5. E/W
6. Time difference A, microseconds (0.0 to 99999.9)
7. Time difference B, microseconds (0.0 to 99999.9)
8. Speed over ground, knots (0.0 to 9999.9)
9. Course over ground, degrees true (0.0 to 359.9)
10. Magnetic variation, degrees (0.0 to 180)
11. E/W
12. Mode indicator (A= Autonomous D= Differential mode E=Estimated (dead reckoning mode) M=Manual input mode S= Simulator N=Data 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)

WPL - Waypoint Location information

```
**WPL,III.II,a,yyyy.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)

XTE - measured cross track error

```
**XTE,A,A,x.x,a,N,a,*hh<CR><LF>
  1 2 3 4 5 6
```

1. Status: A=data valid V=LORAN C blink or SNR warning
2. Status: V=LORAN C blink or SNR warning
3. Magnitude of cross-track error (0.0000 - 9.9999)
4. Direction to steer, L/R
5. Units, nautical miles (fixed)
6. Mode indicator (A=Autonomous mode D=Differential mode S=Simulator mode)

ZDA - Date and Time

```
**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. Local zone, minutes (No use)

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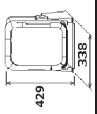



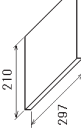
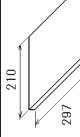
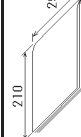
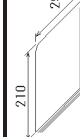
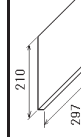
PACKING LIST

RDP-155

03HT-X-9851 -2

1/1

A-1

NAME	OUTLINE	DESCRIPTION/CODE No.	QTY
ユニット			
指示部 DISPLAY UNIT		RDP155-* 000-030-103-00 **	1
予備品			
予備品 SPARE PARTS		SPO3-18201 001-444-450-00	1
付属品			
付属品 ACCESSORIES		FPO3-12301 001-258-020-00	1
工事材料			
工事材料 INSTALLATION MATERIALS		CP03-37201 001-444-460-00	1
図書			
技術証必要領 APPLICATION GUIDE		J32-00501-* 000-179-373-1*	1
取扱説明書 OPERATOR'S MANUAL		OM*-36500-* 000-191-861-1* **	1
操作要領書 OPERATOR'S GUIDE		OS*-36500-* 000-191-863-1* **	1
操作要領書(タイ) OPERATOR'S GUIDE (THAI)		NTH-36500-* 000-191-869-1* **	1 (*1)
装備要領書 INSTALLATION MANUAL		IM*-36500-* 000-191-865-1* **	1

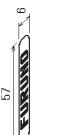
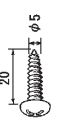
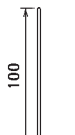
1. ユニット番号末尾の「*」は、選用品の代表コードを表します。
1. CODE NUMBER ENDING WITH "*" INDICATES THE CODE NUMBER OF REPRESENTATIVE MATERIAL.
2. 「*1」の書類は、英文仕様専用です。
2. 「*1」 MARKED DOCUMENTS ARE FOR ENGLISH SET ONLY.

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

C3650-Z01-C

FURUNO

A-2

CODE NO.	001-444-460-00	03HT-X-9401-0			
TYPE	CP03-37201	1/1			
工事材料表					
INSTALLATION MATERIALS					
番号 NO.	名称 NAME	略図 OUTLINE	型名/規格 DESCRIPTIONS	数量 QTY	用途/備考 REMARKS
1	FURUNOマキ H4 FURUNO MARK H4		19-028-2002-0 100-339-640-10	1	
2	+selfタッピングネジ 1/2 SELF-TAPPING SCREW		5X20 S05304 000-162-608-10	4	
3	ワイヤバンド TIEING WIRE BAND		AB100-S 000-191-622-10	3	

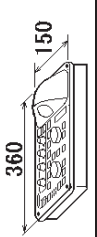


(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO ELECTRIC CO., LTD.

C3650-M02-A

PACKING LIST
RCU-029-*, RCU-029-J-MSA

03HT-X-9852 -1 1/1
A-3

NAME	OUTLINE	DESCRIPTION/CODE No.	Q'TY
ユニット 操作部 CONTROL UNIT		RCU-029-*	1
工事材料 INSTALLATION MATERIALS			
KB取付金具 KB FIXTURE ASSEMBLY		CP03-33202	1
工事材料 INSTALLATION MATERIALS		CP03-33201	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.

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

C3650-Z02-B

A-4

FURUNO

CODE NO.	001-115-510-00	03HE-X-9407-0			
TYPE	CP03-33202				
RCU-021, FSV-8501					
工事材料表 INSTALLATION MATERIALS					
番号 NO.	名称 NAME	略図 OUTLINE	型名/規格 DESCRIPTIONS	数量 Q'TY	用途/備考 REMARKS
1	KB取付金具 KB FIXTURE		03-177-2201-0	1	
			CODE NO. 100-353-860-10		

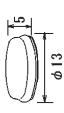

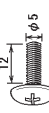

型式/コード番号が2段の場合、下段より上段に代わる適量部品であり、どちらかが入っています。なお、品質は変わりません。
TWO TYPES AND CODES MAY BE LISTED FOR AN ITEM. THE LOWER PRODUCT MAY BE SHIPPED IN PLACE OF THE UPPER PRODUCT.
QUALITY IS THE SAME.
(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO ELECTRIC CO., LTD.

C3584-M07-A

FURUNO

CODE NO.	001-104-970-00	03HE-X-9401-3
TYPE	CP03-33201	1/1

工事材料表		RCU-021		INSTALLATION MATERIALS	
番号 NO.	名称 NAME	略図 OUTLINE	型名/規格 DESCRIPTIONS	数量 QTY	用途/備考 REMARKS
1	帽子 CAP		03-177-2204-0 CODE NO. 100-355-880-10	4	
2	タップインドネジ TAPPING SCREW		5X20 SUS304 CODE NO. 000-177-997-10	4	
3	インドネジ BINDING HEAD SCREW		HEX12 SUS304 CODE NO. 000-177-999-10	4	
4	波座金 WAVE WASHER		HW-5 SUS CODE NO. 000-167-383-10	4	

型式/コード番号が2段の場合、下段より上段に代わる通線部品であり、どちらが入っています。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.)

FURUNO ELECTRIC CO., LTD.

C3584-M01-D

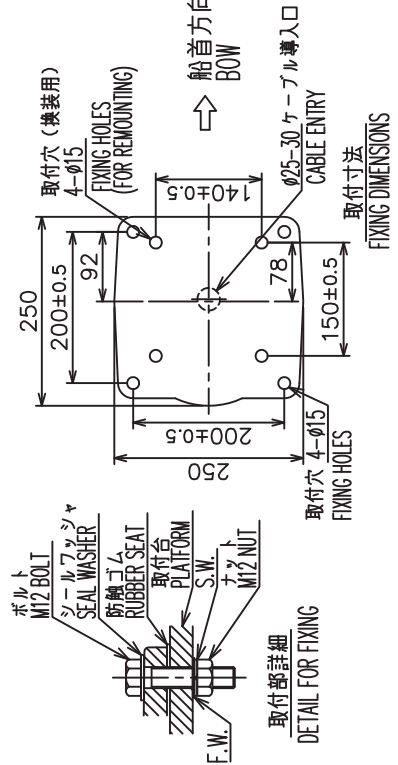
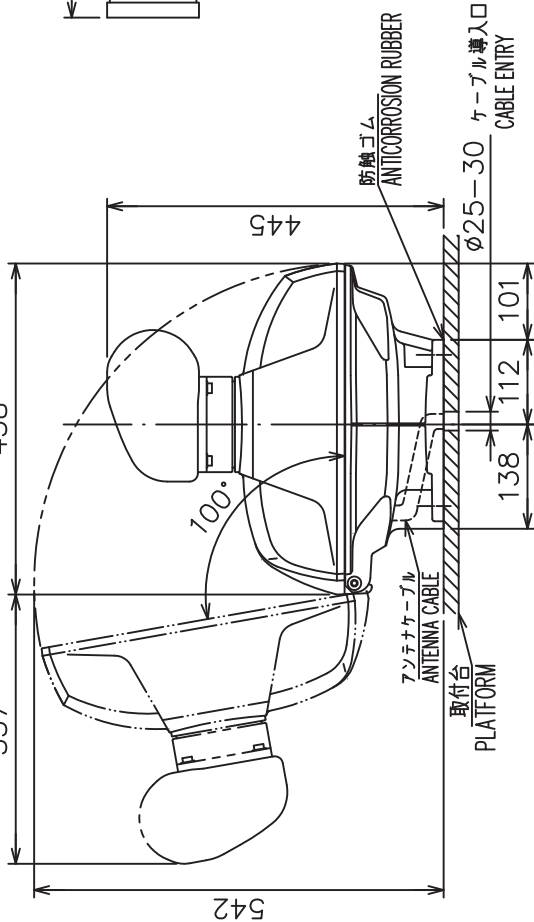
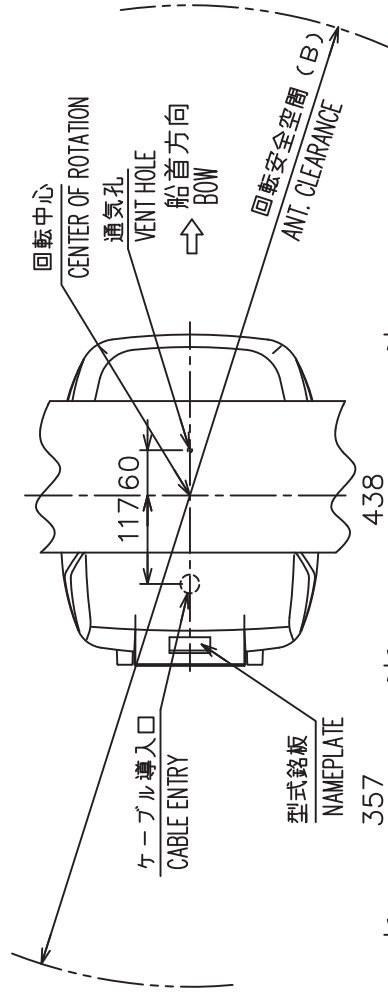
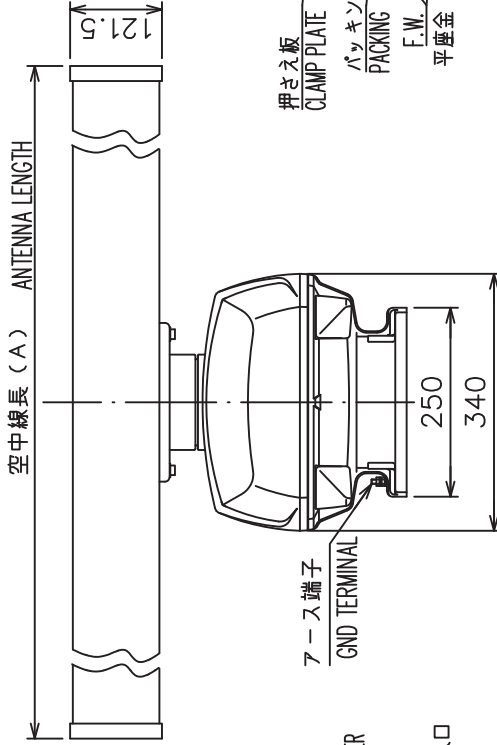


表 2 TABLE 2

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

表 1 TABLE 1

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



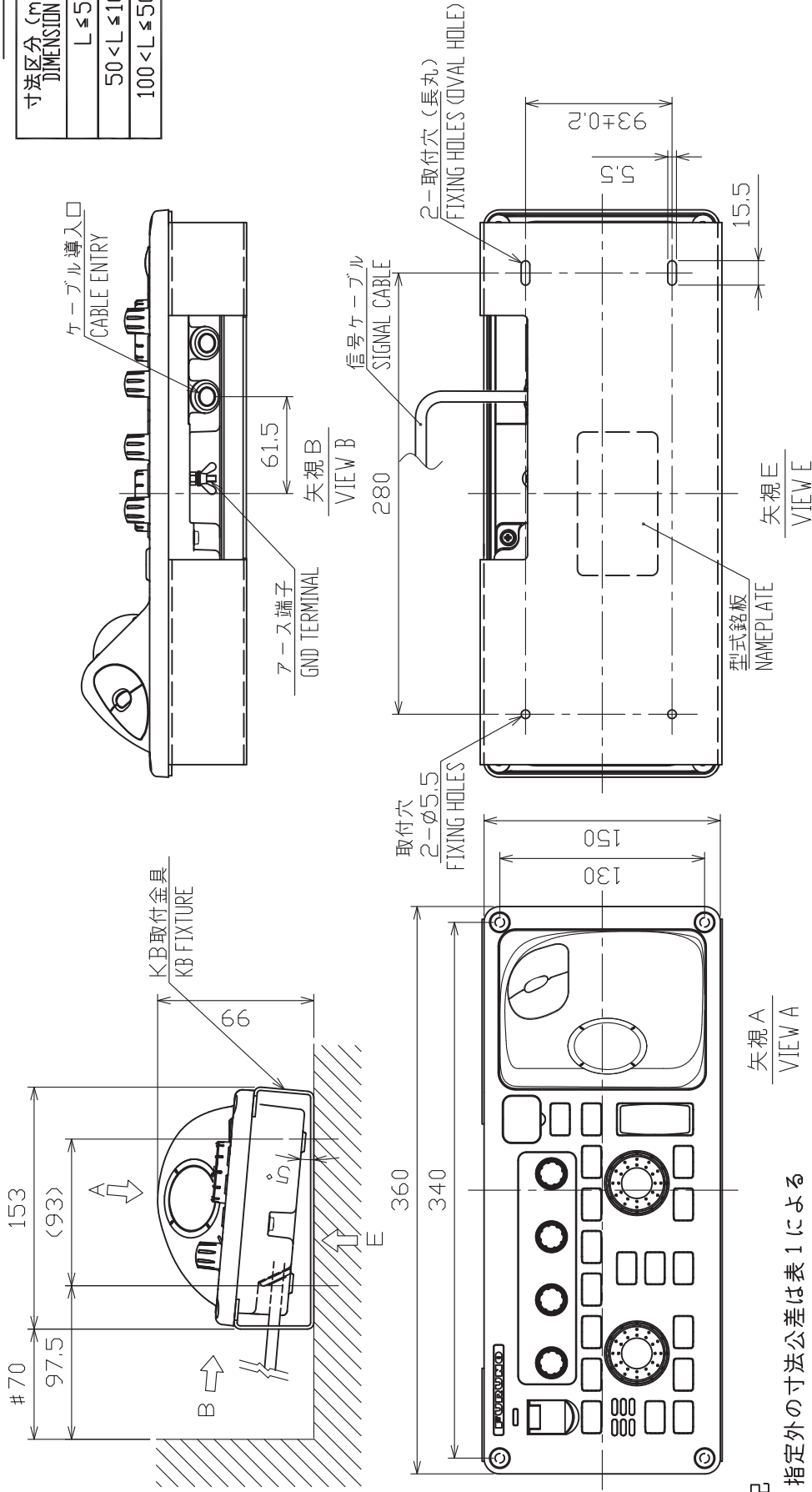
- 注記 1) 指定なき寸法公差は表 1 による。
 2) 取付には M12 ボルトを使用のこと。
 3) 通気孔は塞がないこと。

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 I. YAMASAKI	TITLE RSB-0070/0072/0073
CHECKED 18/Sep/2015 H. MAKI	名称 空中線部
APPROVED 18/Sep/2015 H. MAKI	外寸図
SCALE 1/10 MASS 表参照 SEE TABLE 2	NAME ANTENNA UNIT
DWG.No. C3539-G03-D	REF.No. 03-142-300C-6
	OUTLINE DRAWING

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



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) KB取付金具への取付にはM5×12+バインドコネジを使用のこと
- 4) 取付用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 M5x12 BINDING SCREWS TO MOUNT THE KB FIXTURE.
4. USE TAPPING SCREWS φ5x20 FOR FIXING THE UNIT.

DRAWN	CHECKED	APPROVED	SCALE	DATE	REF. No.	TITLE
17/May/2016 I.YAMASAKI	17/May/2016 H.MAKI	18/May/2016 H.MAKI	1/4	17/May/2016	03-191-151G-0	RCU-029
						名称
						操作部 (卓上装備)
						外形図
						NAME
						CONTROL UNIT (TABLETOP MOUNT)
						OUTLINE DRAWING

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

4-取付穴
PILOT HOLES

340±0.5

346±1

136±1

130±0.5

R27

取付穴寸法
CUTOUT DIMENSIONS

信号ケーブル
SIGNAL CABLE

アース端子
GND TERMINAL

型式銘板
NAMEPLATE

55

33

#100

15 MAX.

取付穴
4-φ6
FIXING HOLES

360

340±0.5

130±0.5

150

ケーブル導入口
CABLE ENTRY

61.5

8

88

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) 取付用ネジはトラスタックピンネジ呼び径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.

DRAWN	17/May/2016	I.YAMASAKI	TITLE	RCU-029
CHECKED	17/May/2016	H.MAKI	名称	操作部 (埋込装備)
APPROVED	18/May/2016	H.MAKI	外寸図	
SCALE	1/4	WSS 2.5 kg	WWE	CONTROL UNIT (FLUSH MOUNT)
IMG/No.	C3650-G05-A	REF.No.	03-191-150G-0	OUTLINE DRAWING

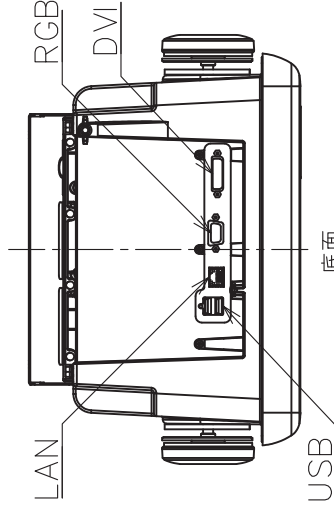
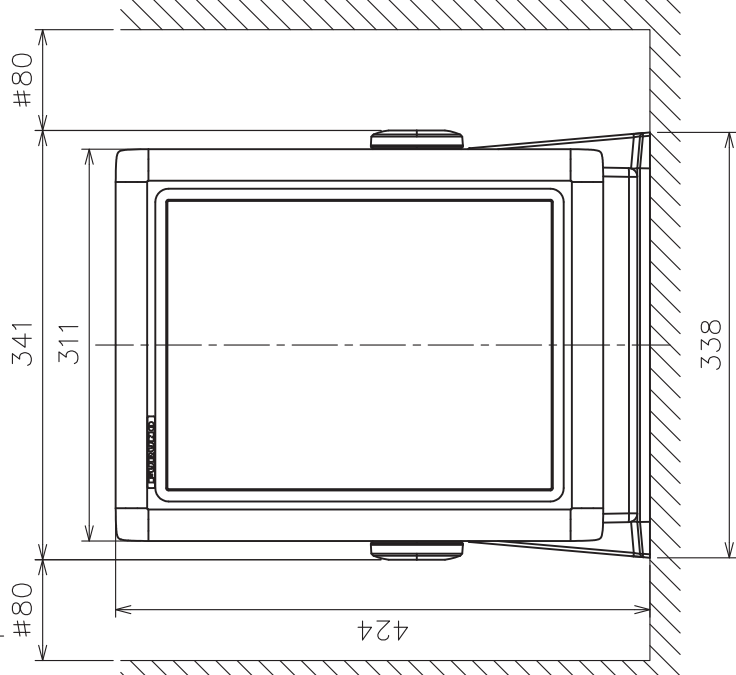
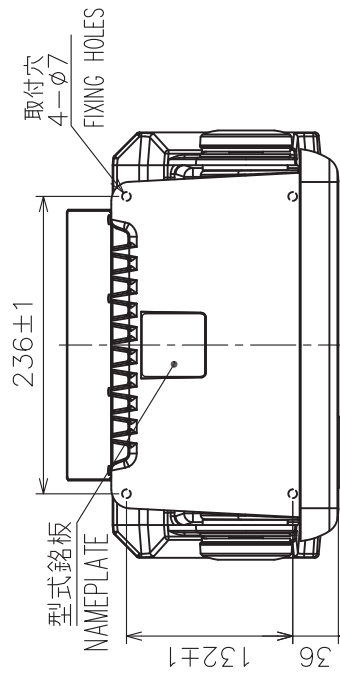
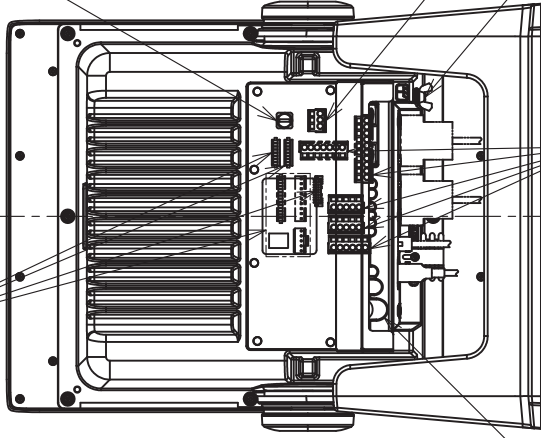


表1 TABLE 1

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

信号コネクタ
SIGNAL CONNECTOR

ヒューズ
FUSE



電源端子
POWER TERMINAL

アース端子
GND TERMINAL

信号コネクタ
SIGNAL CONNECTOR

ケーブル導入口
CABLE ENTRY

DRAWN	16/Feb/2016	T.YAMASAKI	TITLE	RDP-155
CHECKED	16/Feb/2016	H.MAKI	名称	指示部 (縦型、卓上装備)
APPROVED	22/Feb/2016	H.MAKI	外寸図	
SCALE	1/6	100% MASS 8.5 kg	NAME	DISPLAY UNIT (PORTRAIT, TABLETOP MOUNT)
DWG.No.	C3650-601-A	REF.No.	03-191-100G-2	OUTLINE DRAWING

- 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+トラス呼び径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.

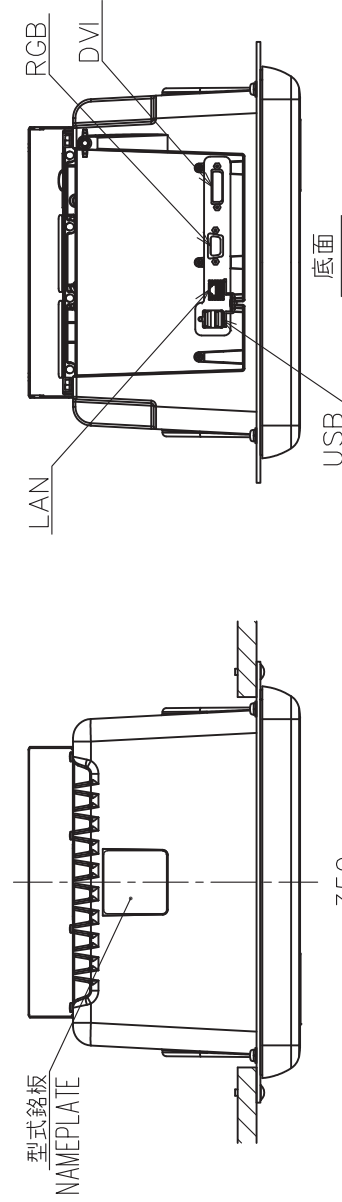
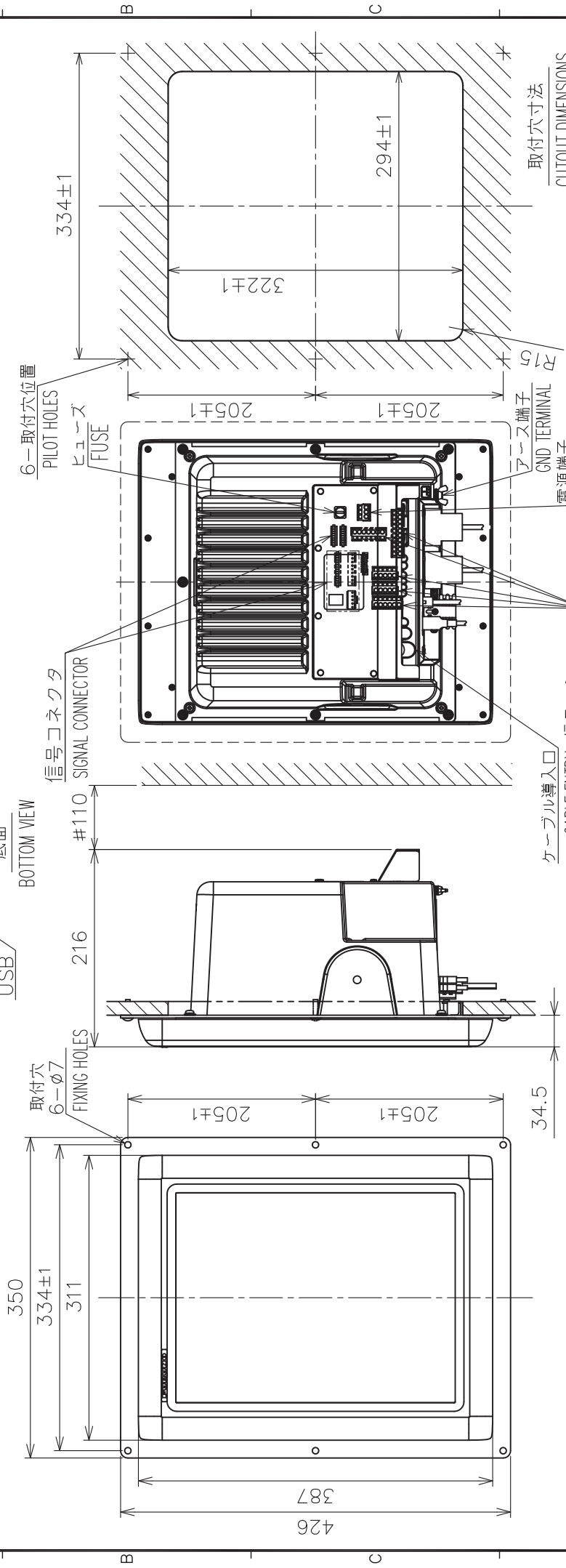


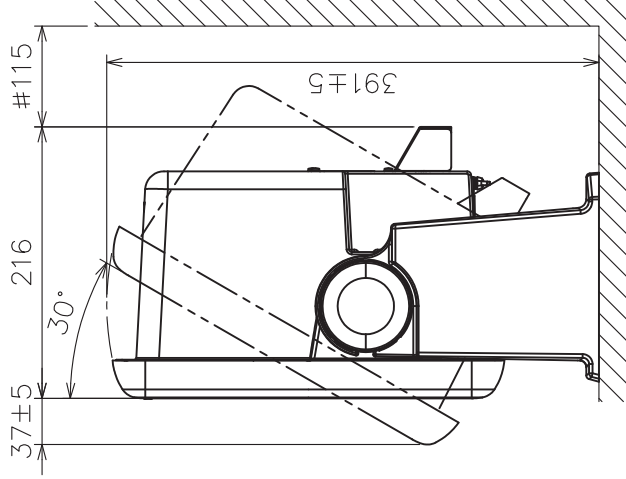
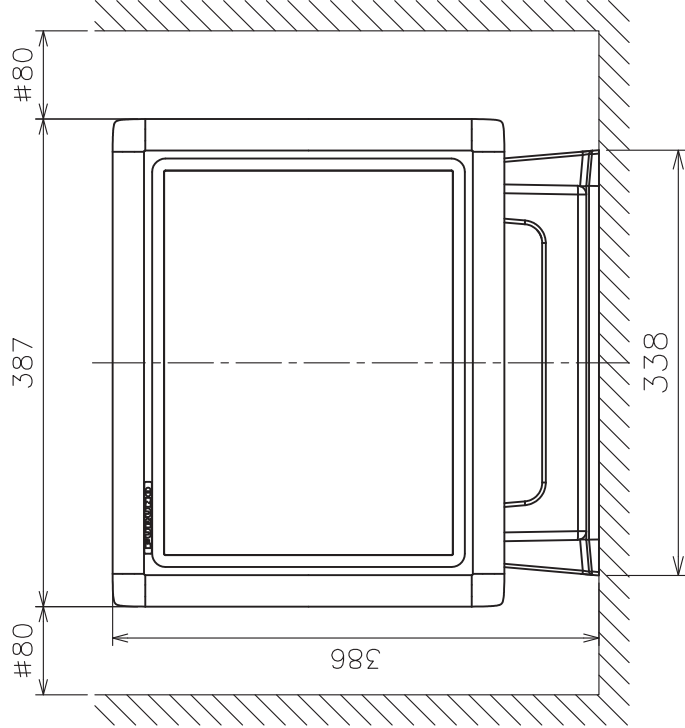
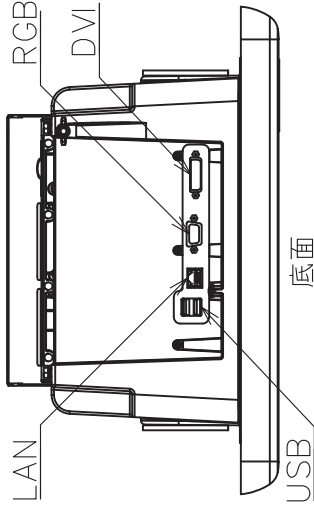
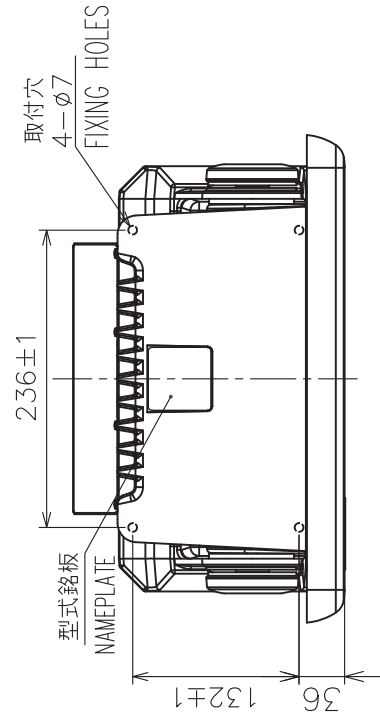
表1 TABLE 1

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



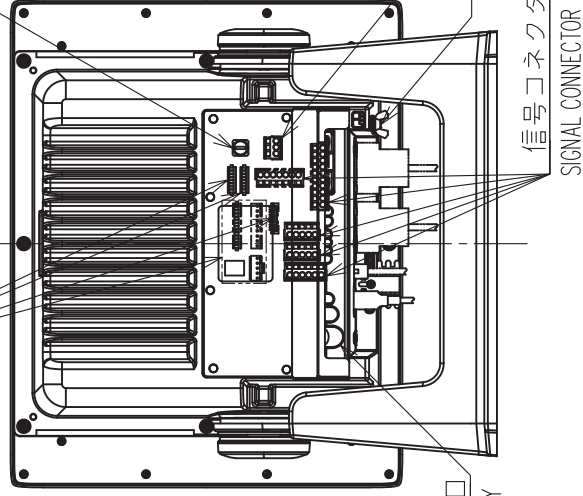
- 注記 1) 指定外の寸法公差は表1による。
 2) #印寸法は最小サービス空間寸法とする。
 3) 取付用ネジは+トラス呼び径5×20を使用のこと。
- NOTE 1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
 2. #: MINIMUM SERVICE CLEARANCE.
 3. USE TAPPING SCREWS Ø5x20 FOR FIXING THE UNIT.

DRAWN	16/Feb/2016	T.YAMASAKI	TITLE	RDP-155
CHECKED	16/Feb/2016	H.MAKI	名称	指示部 (縦型、埋込装備)
APPROVED	22/Feb/2016	H.MAKI	外寸図	外寸図
SCALE	1/6	MASS 8.1 kg	NAME	DISPLAY UNIT (PORTRAIT, FLUSH MOUNT)
DWG.No.	C3650-603-A	REF.No.	03-191-1206-0	OUTLINE DRAWING



信号コネクタ
SIGNAL CONNECTOR

ヒューズ
FUSE



ケーブル導入口
CABLE ENTRY

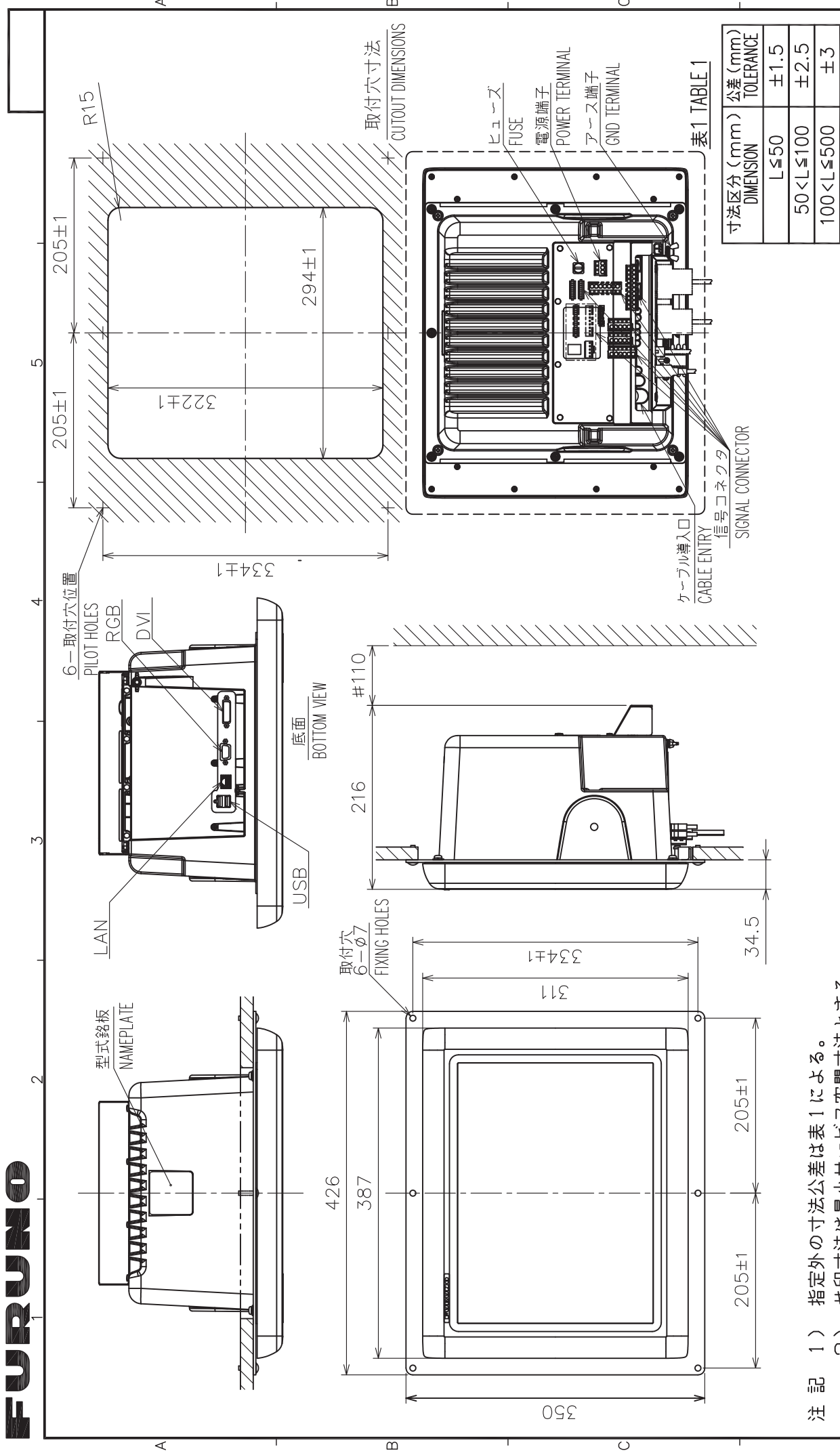
表1 TABLE 1

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

- 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+トラス呼び径5×2.0を使用のこと。

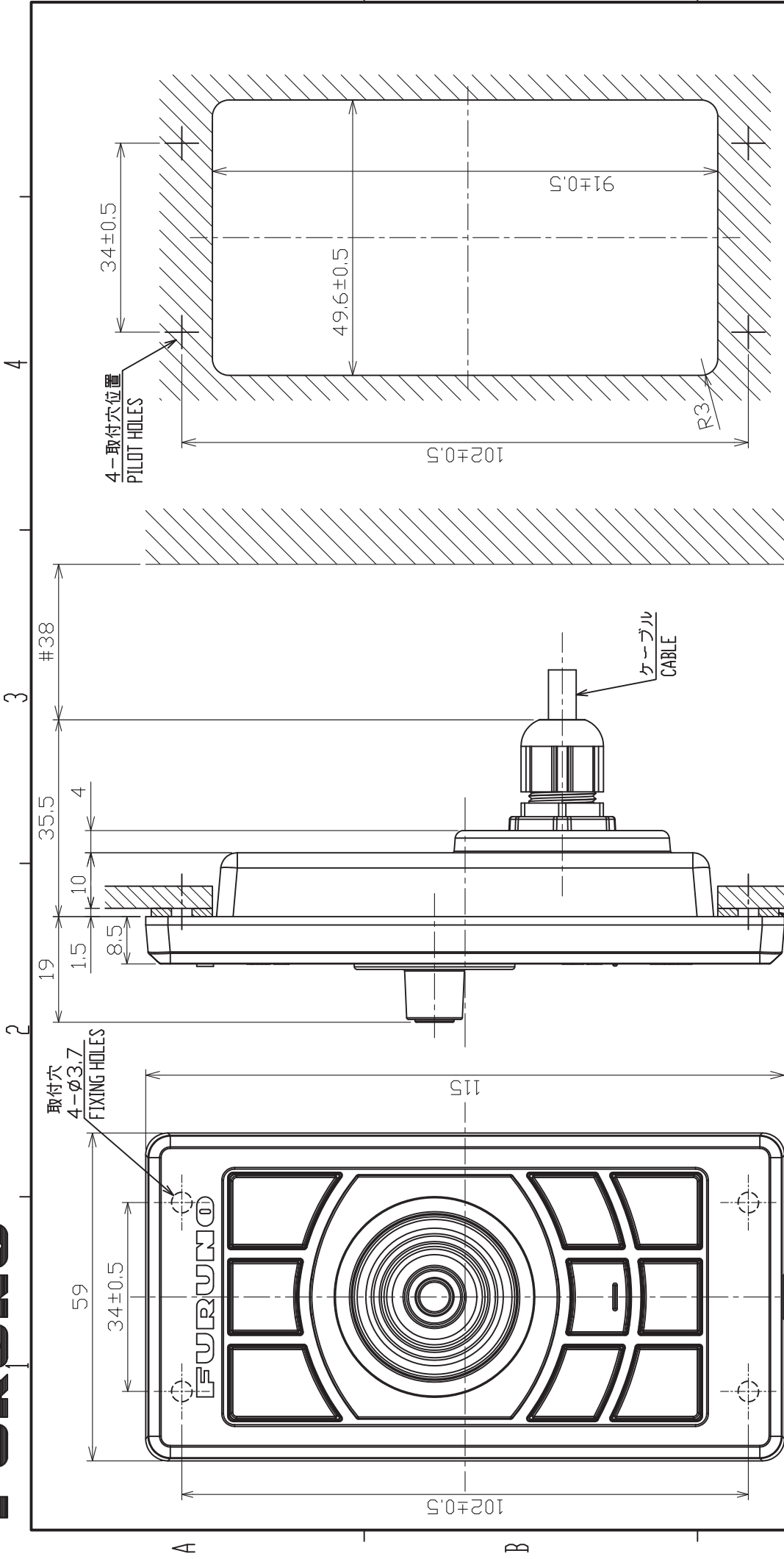
- NOTE 1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
 2. #: MINIMUM SERVICE CLEARANCE.
 3. USE TAPPING SCREWS Ø5x2.0 FOR FIXING THE UNIT.

DRAWN	16/Feb/2016	T.YAMASAKI	TITLE	RDP-155
CHECKED	16/Feb/2016	H.IMAKI	名称	指示部 (横型、卓上装備)
APPROVED	22/Feb/2016	H.IMAKI	外寸図	
SCALE	1/6	MASS 8.5 kg	NAME	DISPLAY UNIT (LANDSCAPE, TABLETOP MOUNT)
DWG.No.	C3650-602-A	REF.No.	03-191-110G-2	OUTLINE DRAWING



DRAWN	16/Feb/2016	T.YAMASAKI	TITLE	RDP-155
CHECKED	16/Feb/2016	H.MAKI	名称	指示部 (横型、埋込装備)
APPROVED	22/Feb/2016	H.MAKI	外寸図	
SCALE	1/6	8.1	NAME	DISPLAY UNIT (LANDSCAPE, FLUSH MOUNT)
DWG.No.	C3650-604-A	REF.No.	03-191-130G-0	OUTLINE DRAWING

- 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+トラスチック呼び径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 $\phi 5 \times 20$ FOR FIXING THE UNIT.



注記

- 指定なき寸法公差は表1による。
- 印寸法は最小サービス空間寸法とする。
- 取付にはタッピングネジ呼び径 3×12 を使用のこと。

NOTE

- TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
- # MINIMUM SERVICE CLEARANCE.
- USE TAPPING SCREWS $\phi 3 \times 12$ FOR FIXING THE UNIT.

表 1 TABLE 1

寸法区分(mm)	公差(mm)
DIMENSION	TOLERANCE
$0 < L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3

DRAWN	19/Nov/2015	I.YAMASAKI	TITLE	MCU-003
CHECKED	19/Nov/2015	H.MAKI	名称	リモコン (埋込装置)
APPROVED	19/Nov/2015	H.MAKI	外寸図	
SCALE	1/1	質量は1.8mケーブルを含む。 MASS INCLUDES CABLE (1.8m).	NAME	REMOTE CONTROL UNIT (FLUSH MOUNT)
DWG.No.	C4491-G03-A	REF.No.	FRC-001-002	OUTLINE DRAWING

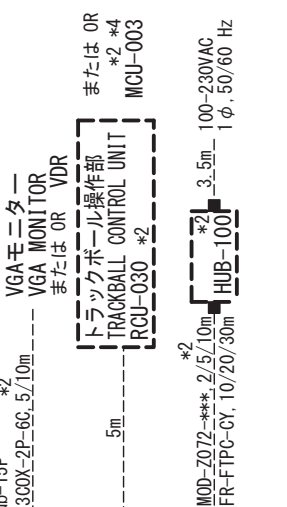
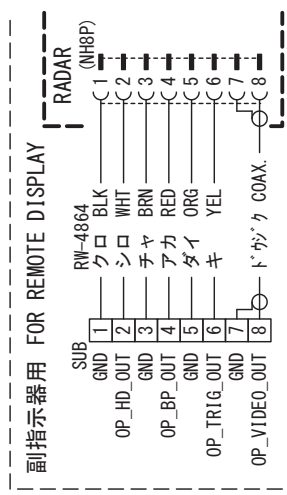
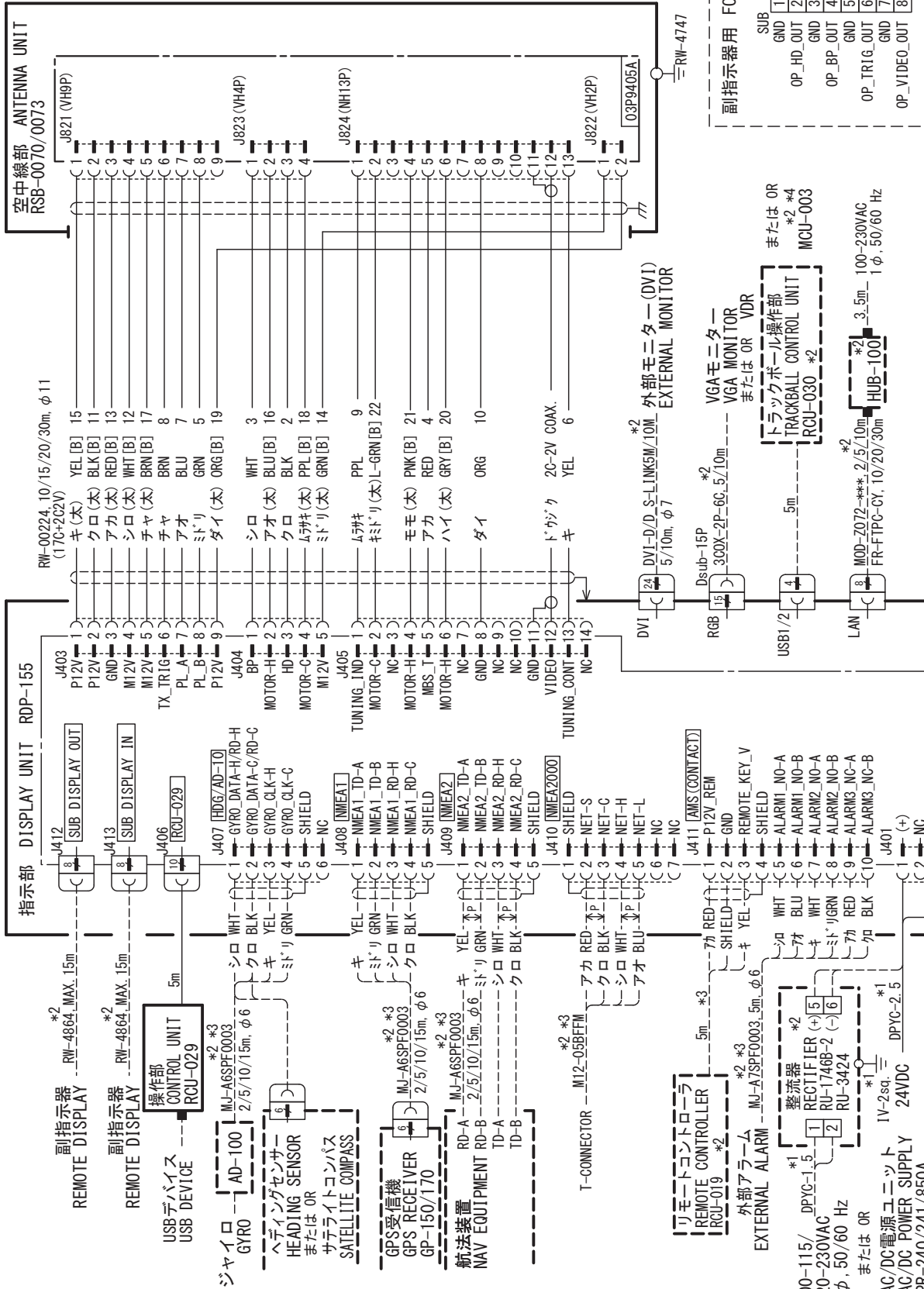
4

3

2

1

RSB-0070 : 24rpm
RSB-0073 : 48rpm



TYPE	FAR-1416
名称	船舶用レーダー
相互結線図	
NAME	MARINE RADAR
INTERCONNECTION DIAGRAM	

DRAWN	2/Mar/2021	I. YAMASAKI	
CHECKED	2/Mar/2021	H. MAKI	
APPROVED	3/Mar/2021	H. MAKI	
SCALE	MASS	kg	
DWG. No.	C3650-C01-D	REF. No.	03-191-6001-0

注記

- *1) 造船所手配。
- *2) オプション。
- *3) 端末加工が必要。
- *4) 日本国内のみ。

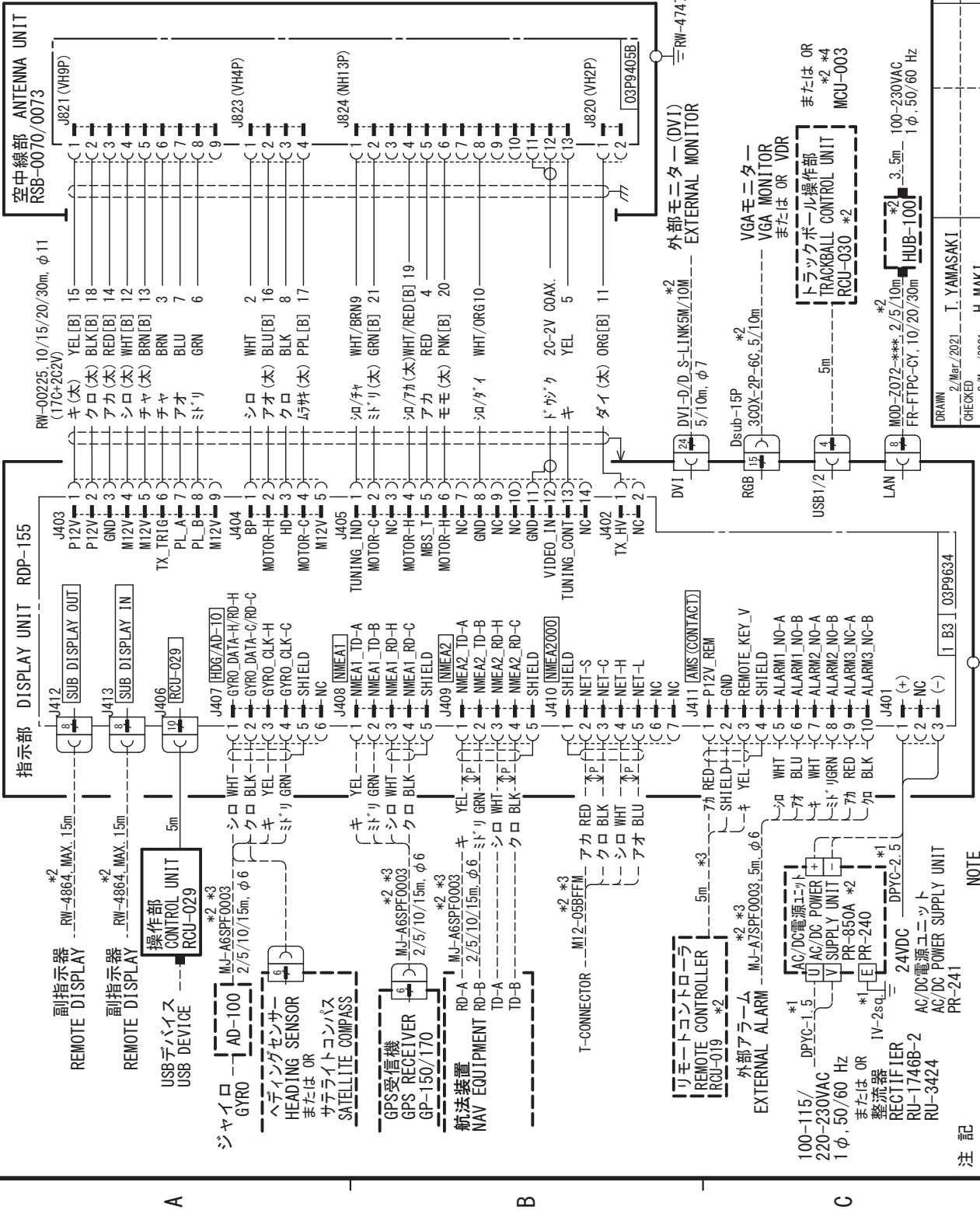
4

3

2

1

RSB-0070: 24rpm
RSB-0073: 48rpm



DRAWN	2/Mar/2021	T. YAMASAKI
CHECKED	2/Mar/2021	H. MAKI
APPROVED	3/Mar/2021	H. MAKI
SCALE	1/MASS	kg
DWG. No.	C3651-001-D	REF. No.
TYPE	FAR-1426	名称
	船舶用レーダー	
	相互接続図	
	MARINE RADAR	
	INTERCONNECTION DIAGRAM	

注記
 *1) 造船所手配。
 *2) オプション。
 *3) 端末加工が必要。
 *4) 日本国内のみ。