

# 2. WIRING

---

## 2.1 Overview

### Cabling considerations

To lessen the chance of picking up electrical interference, avoid where possible routing the antenna cable (power and LAN) near other onboard electrical equipment (radars, TX radio antennas, etc.). Also avoid running the cable in parallel with power cables. When crossing with other cable, the angle must be 90° to minimize the magnetic field coupling.

The antenna cable between the antenna and processor units is available in lengths of 15 m, 30 m, 40 m, and 50 m. Whatever length is used, it must be unbroken; namely, no splicing allowed. Use the antenna cable as short as possible to minimize attenuation of the signal.

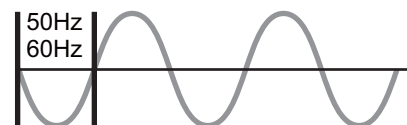
The radar must be connected to an emergency power source, as required by SOLAS II-1.

### About network construction

- Use the optional Switching Hub HUB-100 to connect the sensor networks. For the gateway networks, use the optional Intelligent Hub HUB-3000.
- Do not connect the ship's LAN network to the optional HUBs. Also, commercial PCs cannot be connected to the gateway network, other than for maintenance.
- To connect the FEA-2xx7, FMD-32xx, FAR-2xx7, FCR-2xx9 via LAN network, use the INS network.

### About wiring

- Use the optional USB cable (type: OP24-32) to connect to the USB port on the control unit.
- The length of the USB cable must be within 5 m to prevent equipment trouble.
- The length of LAN cables must be within 50 m.
- Use the Cat5e or Cat6 LAN cable for the network if available locally.
- If LAN cables are not available locally, use the optional LAN cables (FR-FTPC-CY for sensor network, DTI-C5E350 VCV for gateway network).
- If extension or division of the DVI or RGB cables is necessary, use the dividers shown below.
  - DVI cable divider: DVI-12A (maker: IMAGENICS)
  - RGB divider: CIF-12H, DD-106 or WBD-14F (maker: IMAGENICS)
- Make sure that the ground wires are connected between the ground terminals on each equipment and the ship's earth.
- If a UPS (user supply) is connected to this equipment, be sure that the grounding lamp does not light.
- The output from the UPS must be a sine wave, as in the right figure.



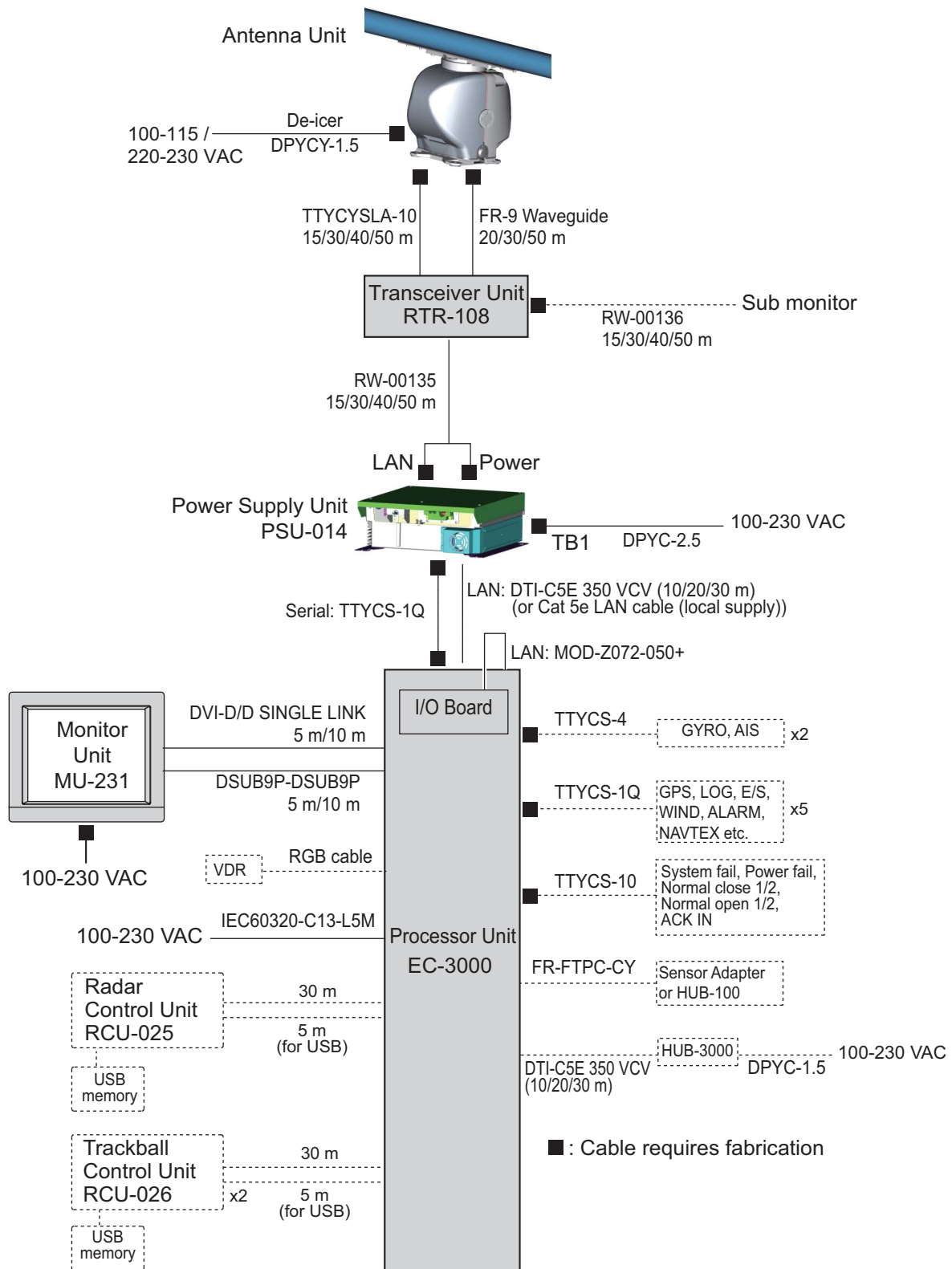
## 2. WIRING

### **FAR-3320W, FAR-3320W-BB wiring**

The maximum length of cabling is 130 m.

Cabling between the transceiver unit and the antenna unit: 80 m

Waveguide: 50 m

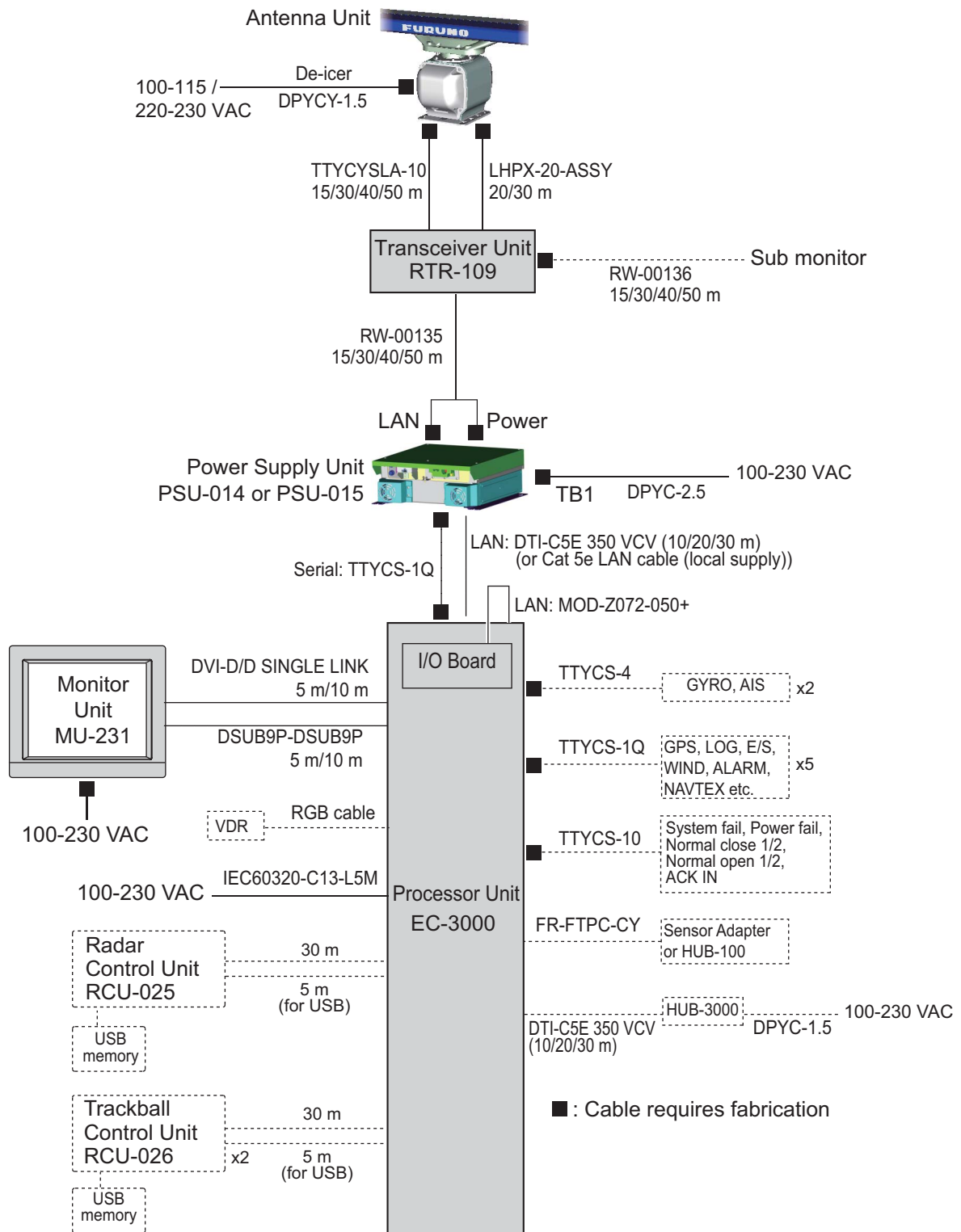


**FAR-3330SW, FAR-3230SW-BB wiring**

The maximum length of cabling is 110 m.

Cabling between the transceiver unit and the antenna unit: 80 m

Microwave coaxial cable: 30 m



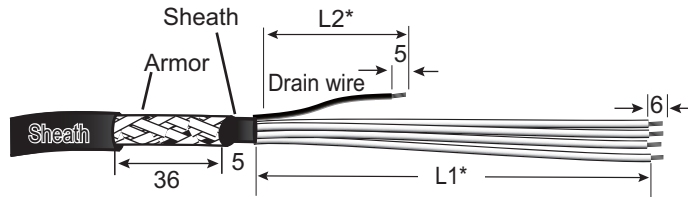
## 2.2 Antenna Unit

### 2.2.1 How to fabricate the cables

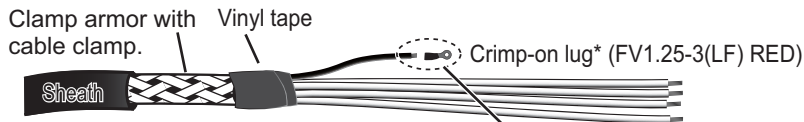
#### **FAR-3320W, FAR-3330SW**

Three cables are connected to the antenna unit: the serial cable from the transceiver unit, waveguide (FAR-3220W) or microwave coaxial cable (FAR-3330SW), and power cable for the de-icer (option).

#### **Serial cable (TTYCYSLA-10)**



\* L1: X-band, 450, S-band, 350 L2: X-band, 450, S-band, 200

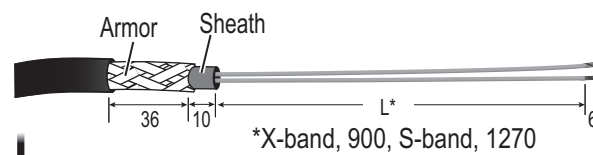


Pass the heat shrink tubing (local supply) onto the drain wire. Attach crimp-on lug to the wire.

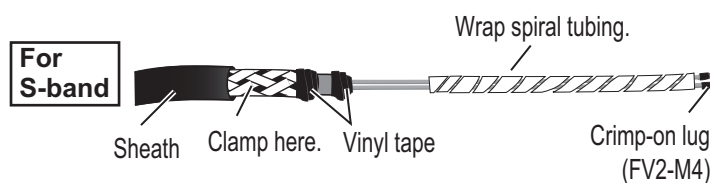
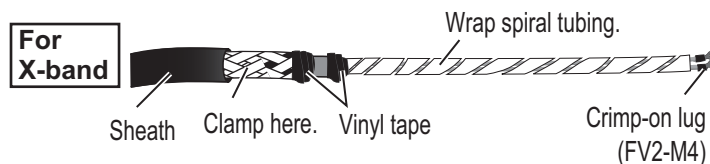
\* Preattached to the X-band antenna. See figure on page 2-7 for location.)

#### **Power cable (DPYCY-1.5) for de-icer**

- ? Before beginning any work on the antenna unit, turn off the breaker for the de-icer at the mains switchboard. (Turning of the display unit has not effect.)
- ? The neck of the antenna unit becomes VERY HOT when the de-icer is working. (The de-icer turns on when ambient temperature goes down to 5°C and heats to 55°C.)



\*X-band, 900, S-band, 1270



**Flexible waveguide for FAR-3220W**

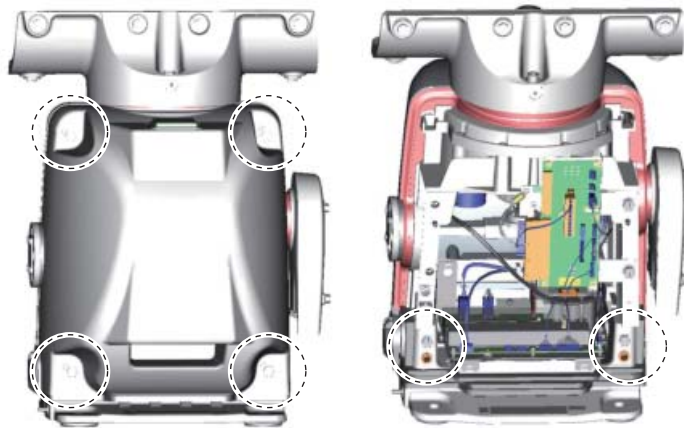
The connector at the antenna side is preattached to the flexible waveguide. The bending radius shown below must be observed to prevent damage to the waveguide.  
E-bend: 200 mm, H-bend: 400 mm

**Microwave coaxial cable for FAR-3330SW**

See the FURUNO Installation Handbook (publication no. TIE-00160) for how to treat this cable.

**2.2.2 How to connect the serial cable, power cable for de-icer****FAR-3320W**

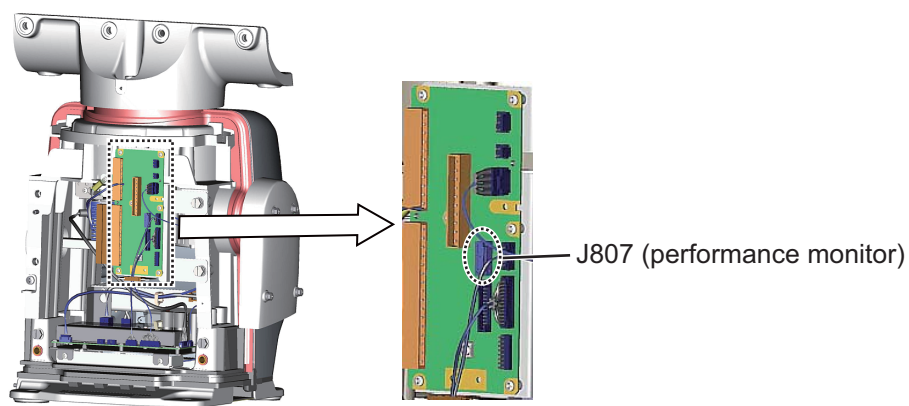
1. Unfasten four bolts from the rear cover to remove the rear cover. If the de-icer is to be installed, remove two bolts inside the antenna to remove the front cover. See Note 2 below.



**Note 1:** The cable for the performance monitor is connected between the rear cover and the RF-TB Board in the antenna unit. Open the cover slowly to prevent damage to the cable and connector.

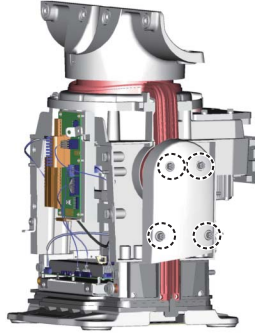
**Note 2:** If the de-icer is to be installed, spread open the right and left heater elements on the cover, then remove the cover, being careful not to hit the elements on the radiator or chassis.

2. Detach the performance monitor connector (J807) from the RF-TB board.

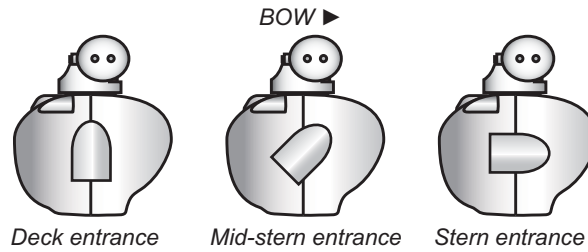


## 2. WIRING

3. Unfasten four screws to open the cable entrance cover.



**Note:** The orientation of the cable entrance assy. can be changed, in one of the three positions shown below. The default entrance is “deck”. **No other orientation is allowed, to maintain watertight integrity.** To change the entrance, unfasten the four screws circled in the figure below, then orient the cable entrance assy. in the required direction. Refasten the screws.

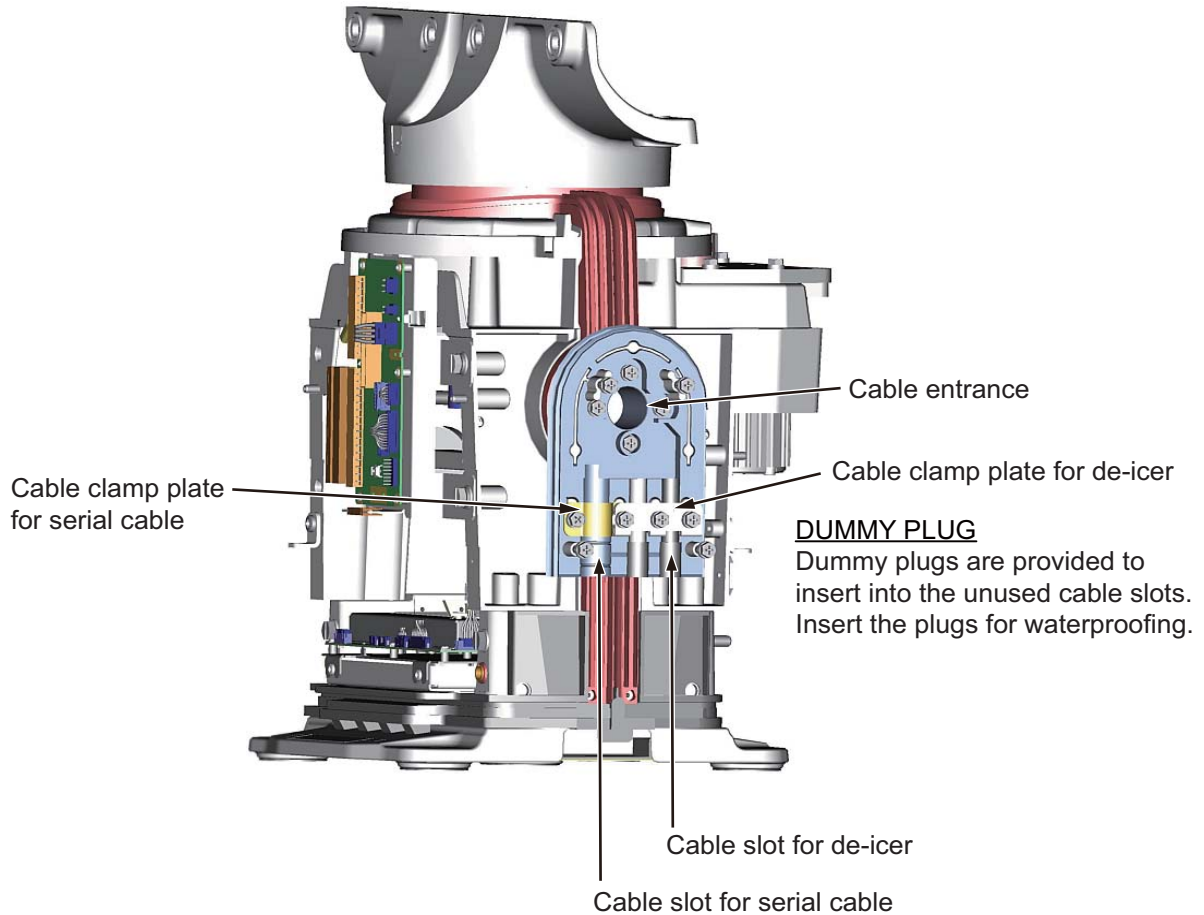


TO CHANGE THE ORIENTATION:

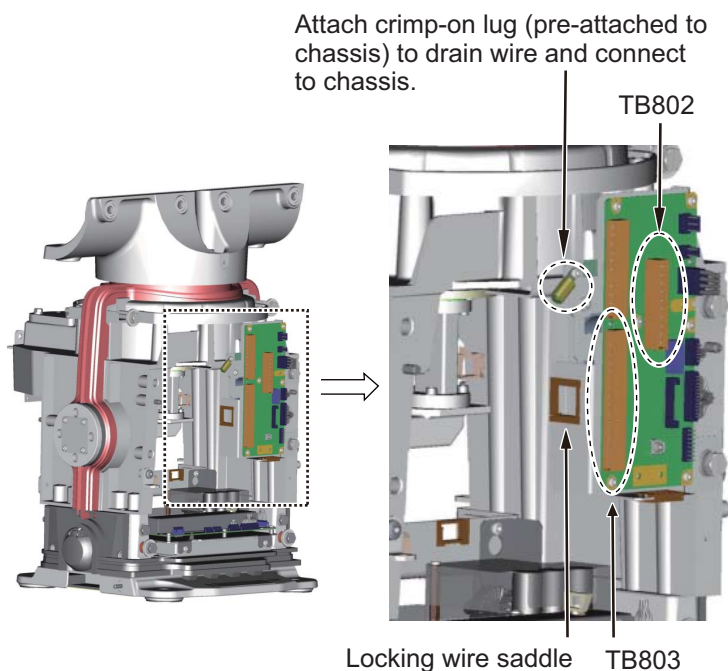
Unfasten these screws to change the orientation of the cable entrance assy.



4. Unfasten the four screws fixing the cable clamp plates (2 pcs.).



5. Pass the serial cable (TTYCYSLA-10) through the cable entrance and the locking wire saddle circled below. Attach appropriate WAGO connectors (TB802, 8 pin; TB803, 16 pin, 10 pins used) to the serial cable and attach the connectors to the RF-TB board. Attach the crimp-on lug (preattached to chassis) shown below to the drain wire and connect the wire to the chassis.



**How to connect wires to WAGO connector**

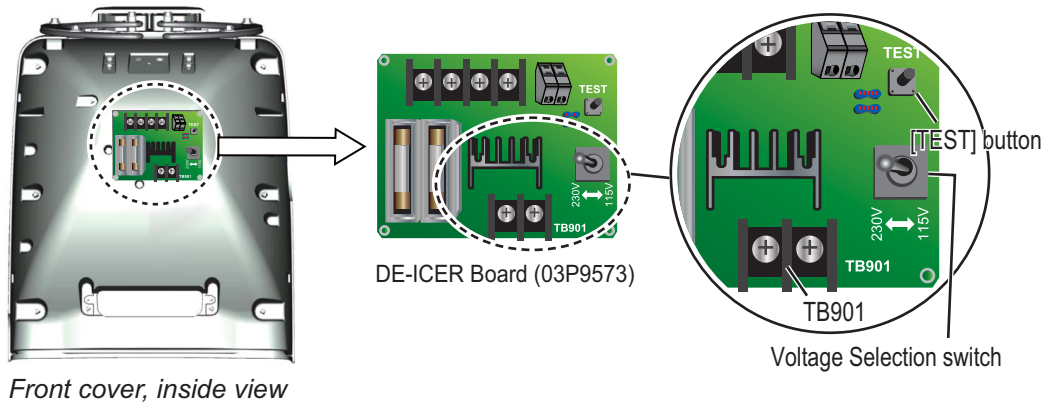
Press downward.  
Terminal opener  
Wire  
Twist  
WAGO connector

<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.

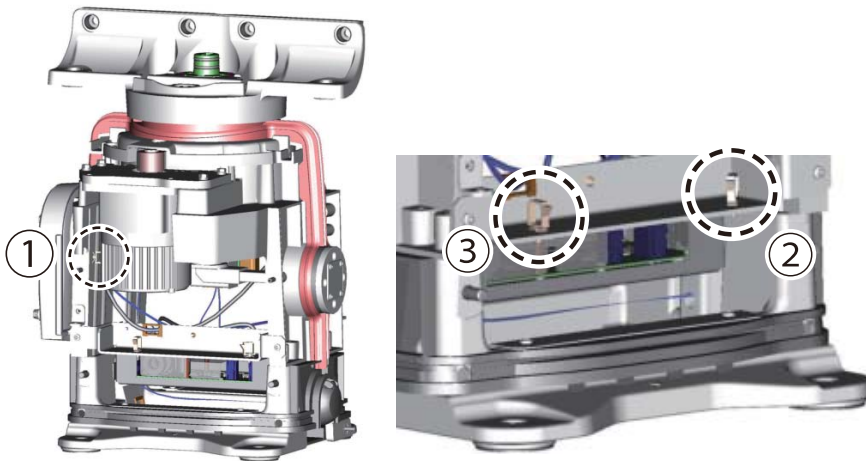
**Note:** A terminal opener is provided on the RF-TB Board.

## 2. WIRING

6. **DE-ICER INSTALLATION.** See also “X-band De-icer Kit Installation Instructions”, issued separately, for the de-icer not fitted at the factory. If the de-icer is not provided, go to step 7.



- 1) Set a locking wire saddle (supplied at locations (2) and (3) shown below). Pass the power cable through the locking wire saddles (1) through (3) and pull it to the front side.

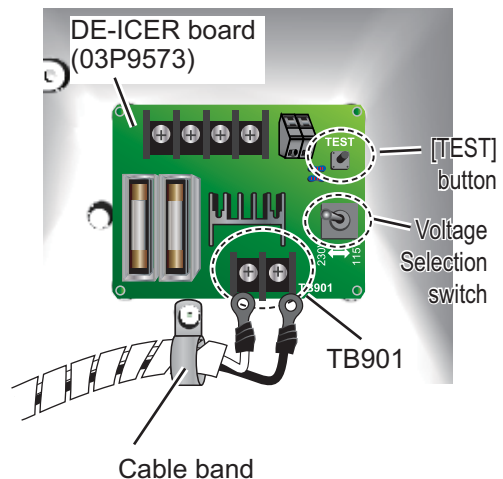


- 2) Unfasten the cable band\*. Pass the power cable for the de-icer through the band then fasten the band. Connect the cable to TB901 on the DE-ICER board (03P9573), using the crimp-on lugs supplied.

\* For the DE-ICER installation kit, unfasten the cable band on the cover supplied. (The original cover can be discarded.).

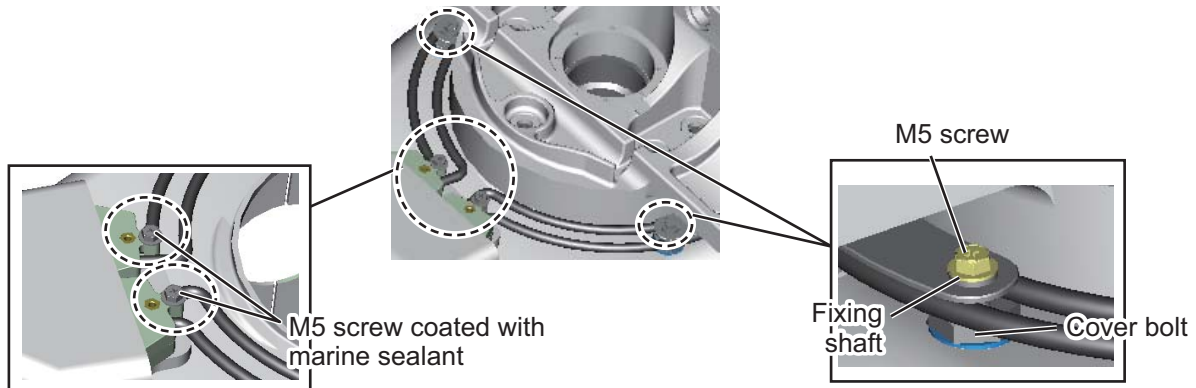
- 3) Set the voltage setting switch according to the power source for the de-icer; 115 V or 230 V. The default setting is 230 V.

- 4) Apply power to the de-icer then press the [TEST] button on the DE-ICER board approx. ten seconds. Check that the heater gets hot.

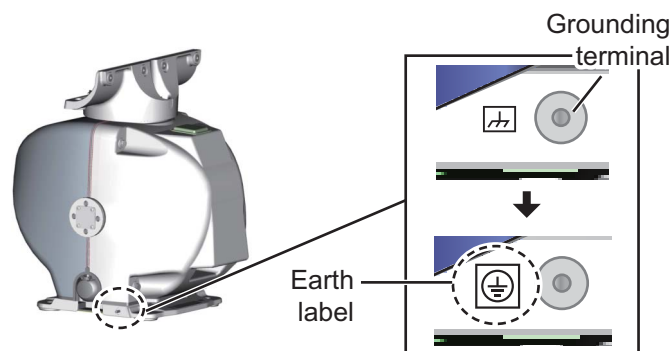




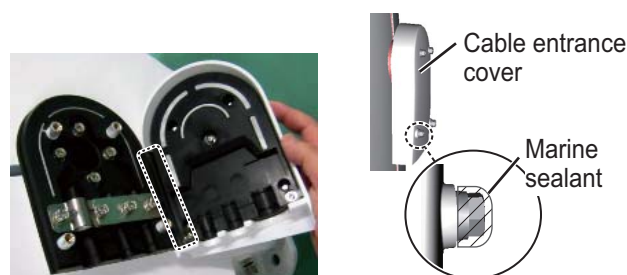
- 5) Set the front cover supplied with the kit. Take care not to hit the heater elements on the chassis or radiator.
- 6) Coat two M5 screws (supplied) with marine sealant then use them to fasten the base of the heater. Take care not to hit the heater elements on the chassis or radiator. Fasten the installation materials shown below to each of the cover bolts.



- 7) Attach the supplied earth label over the earth label currently attached near the grounding terminal.



7. Position the cables so their armors lie beneath their respective cable clamp plates in the cable entrance. Fasten the plates.
8. Close the cable entrance cover as shown in the figure below.



① Coat this part of gasket with marine sealant.

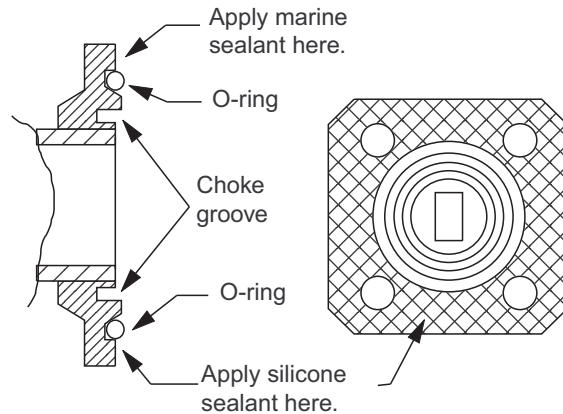
② Close cover then coat screw heads with marine sealant.

9. Connect the performance monitor connector (J807) to the RF-TB Board.
10. **Check that the gasket on the front and rear covers is seated properly**, then close the covers. Be careful not to hit the heater elements on the chassis or radiator. The torque for the fixing bolts is 10.0 N•m.

## 2. WIRING

11. Connect the waveguide to the antenna with either an E-bend or H-bend waveguide. See FURUNO Technical Information TIE00160 for further information.

1) Grease the O-ring and set it in its groove on the antenna unit.



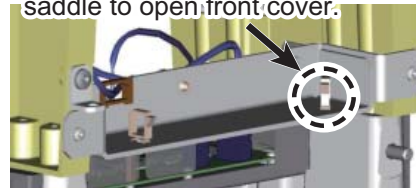
Evenly coat the waveguide flange with marine sealant. Apply sealant sparingly; it leaks out slightly when the fixing bolts are tightened. Be sure no sealant contacts the choke groove and waveguide.

2) Wipe the surface of the waveguide flange with a clean, dry cloth to remove any foreign material.

3) Evenly coat the waveguide flange with marine sealant.

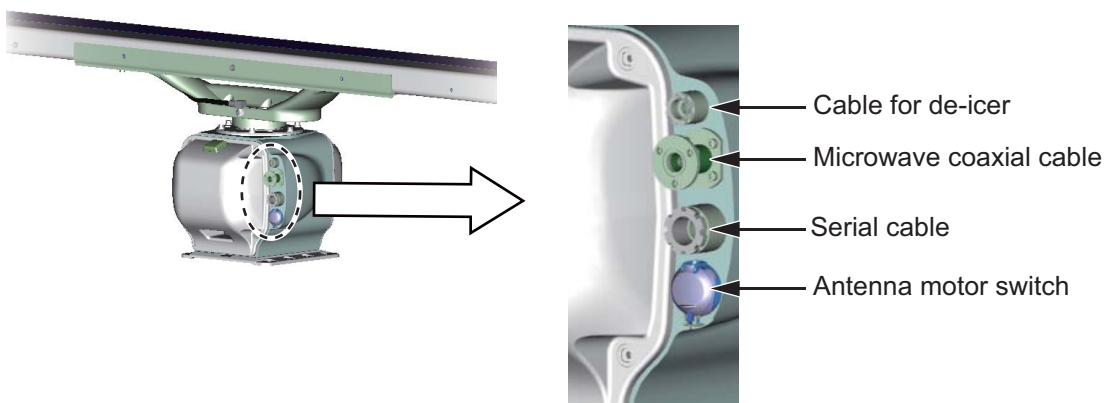
**Note:** If it is necessary to open the front cover after installing the de-icer kit, remove the power cable from the locking wire saddle shown in the right figure then detach the cover slowly to prevent damage to the heater element.

Remove cable from locking wire saddle to open front cover.



### **FAR-3300SW**

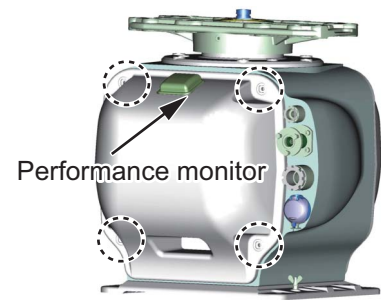
Connect the cables as follows:



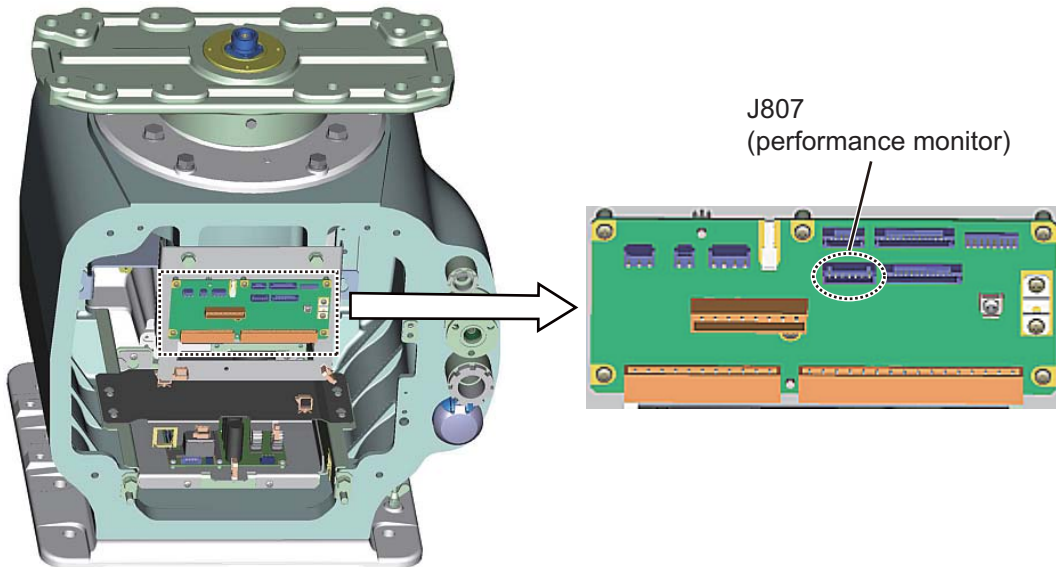
- Unfasten four bolts to detach the stern cover.
 

**Note 1:** The connector for the performance monitor is connected between the stern cover and the RF-TB Board. Detach the stern cover slowly to prevent damage to the connector.

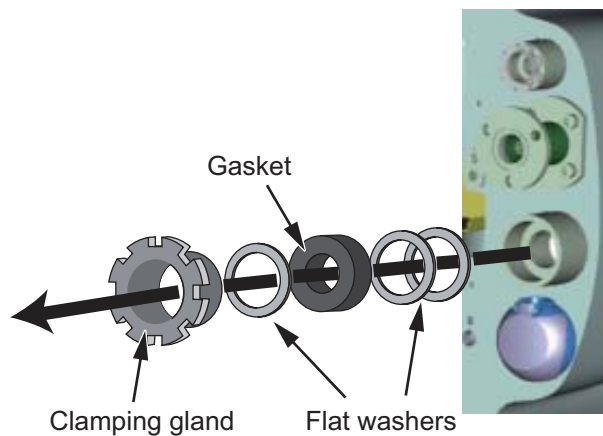
**Note 2:** If the de-icer is to be installed, remove the bow cover also. Spread open the right and left heater elements on the cover, then remove the cover, being careful not to hit the elements on the radiator or chassis.



- Disconnect the performance monitor connector (J807) from the RF-TB board



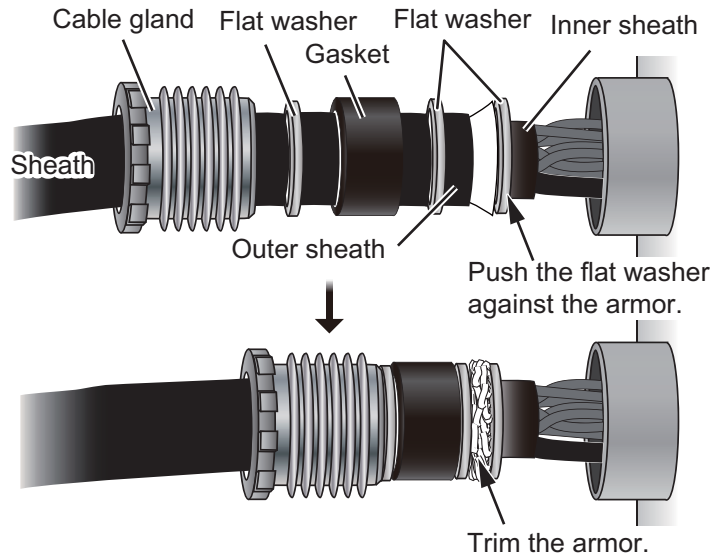
- Unfasten the clamping gland for the serial cable and remove the gasket and flat washers.



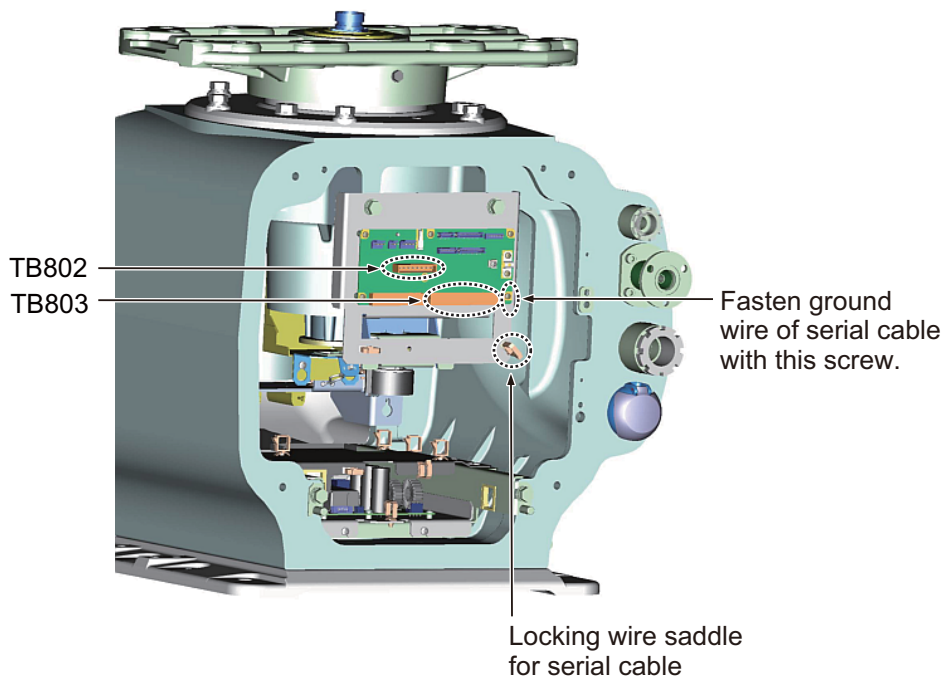
- Slide the clamping gland, flat washer, gasket and flat washers in that order onto the serial cable. Push the flat washer against the armor. Trim the armor so that it

## 2. WIRING

does not extend past the flat washers, then pass the antenna cable through the cable entrance.

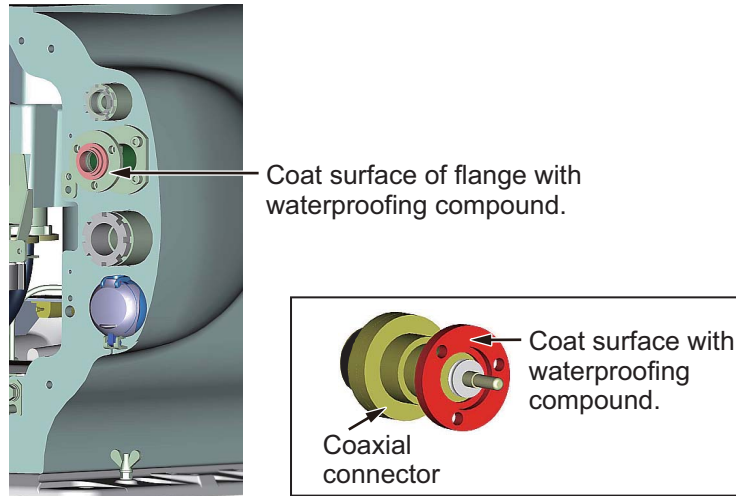


5. Pass the serial cable through the locking wire saddle circled below. Attach the cable to appropriate WAGO connectors, referring to the interconnection diagram, then connect them to the RF-TB Board.
  - **TB802 (motor):** 8 pin
  - **TB803 (signal):** 16 pin
  - **Ground wire:** Attach crimp-on lug (FV1.25-3(LF) RED) to wire. Fasten the crimp-on lug to the chassis with the screw shown below.

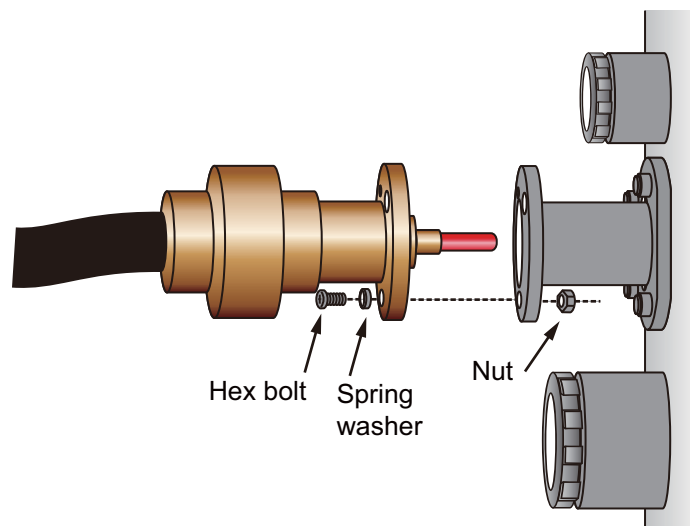


6. Apply sealant 1211 (supplied as installation material) to the threads of the clamping gland, and then fasten it tightly with the hook spanner wrench.  
**Note:** Use the wrench of the correct size. If you do not have the hook spanner wrench, contact your dealer.

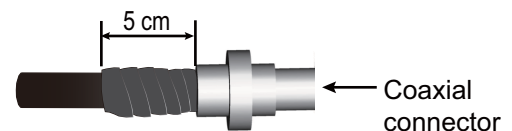
7. Coat the O-ring in the gland for the microwave coaxial cable with silicon grease. Using the supplied waterproofing compound, coat the mating surface between the coaxial connector of the cable and the waveguide flange on the antenna unit. Do not coat the O-ring with the waterproofing compound.



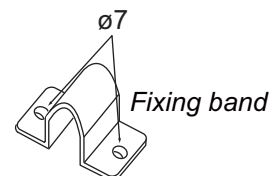
8. Fasten the coaxial connector to the waveguide flange with three sets of M6×20 hex bolts, M6 spring washers and M6 nuts.



9. Tape the cable with two or more turns of self-bonding tape then wrap with PVC tape.

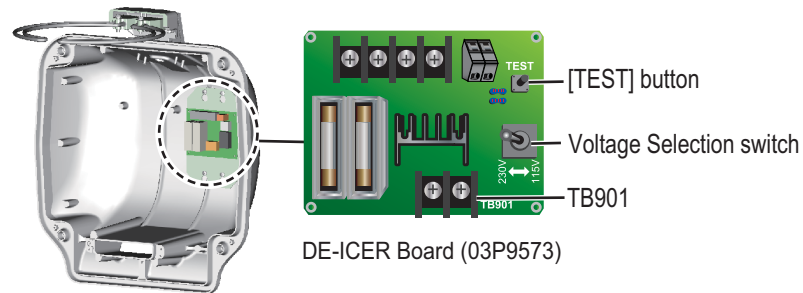


10. Secure the cable with fixing bands (supplied) or the optional clamping metal (Type: 03-011-3228, Code no.: 100-049-620) to the mast and to the wheel-house structure. For the optional through-deck cable gland, see the outline drawing at the back of this manual.

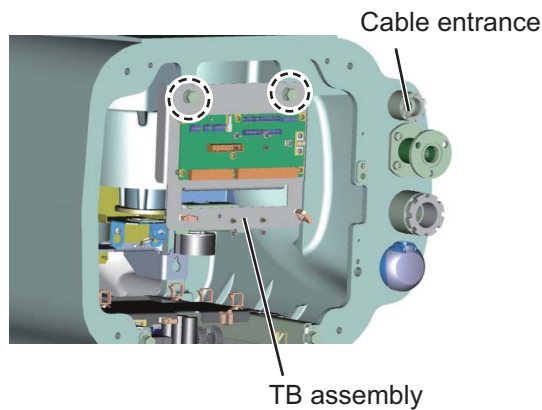


## 2. WIRING

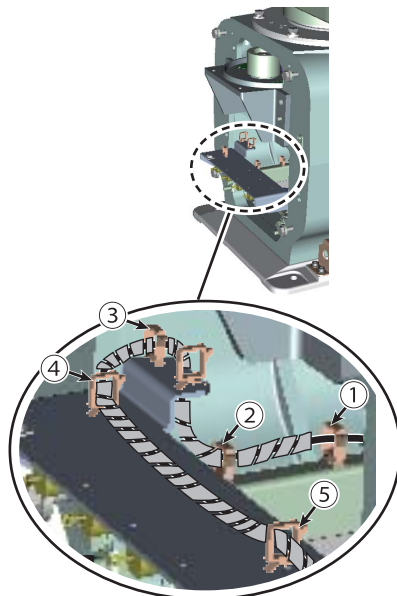
11. **DE-ICER INSTALLATION.** Follow all steps if the de-icer is not already installed. (See also “X-band De-icer Kit Installation Instructions”, issued separately.) If the de-icer is already installed, do only steps 1) through 7). If the de-icer is not provided, go to step 12.



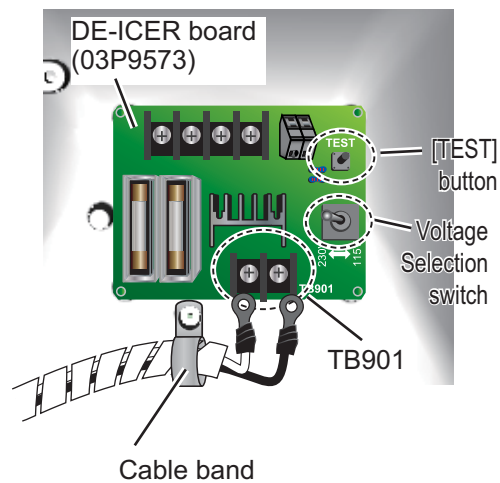
- 1) Unfasten the clamping gland for the de-icer’s power cable, then remove the gasket, flat washers and cover.
- 2) Slide the clamping gland, flat washer, gasket and flat washers in that order onto the cable as shown in step 4 on page 2-11.
- 3) Unfasten two bolts to remove the RF-TB assembly, then pass the power cable for the de-icer through the cable entrance.



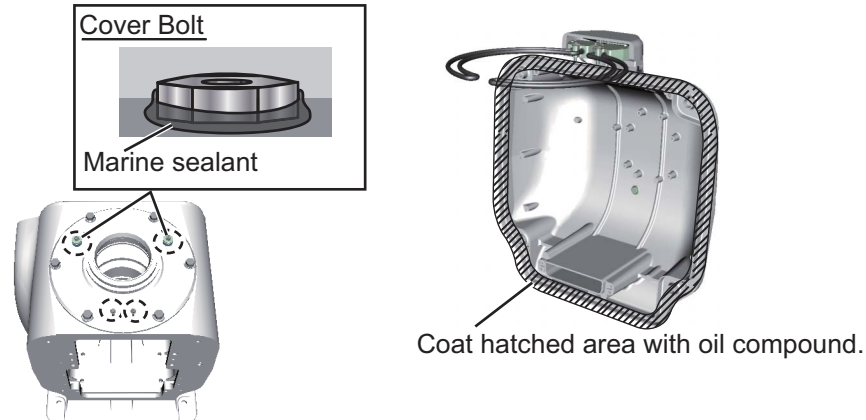
- 4) Set the supplied locking wire saddle at location (5) in the figure below. Pass the cable through locking wire saddles (1) to (5).



- 5) Unfasten the cable band. Pass the power cable through the band then fasten the band. Connect the cable to TB901 on the DE-ICER board (03P9573), using the crimp-on lugs supplied.



- 6) Set the Voltage Selection switch according to the power source for the de-icer; 115 V or 230 V. The default setting is 230 V.
- 7) Turn on the power to the de-icer. Press the [TEST] button on the DE-ICER board about ten seconds to check if the heater gets hot.
- 8) Remove seals and hex bolts from four locations. Insert the two cover bolts. Coat the cover bolts with marine sealant. Coat the rubber gasket of the cover with the supplied oil compound. Be sure the compound contacts no other areas.

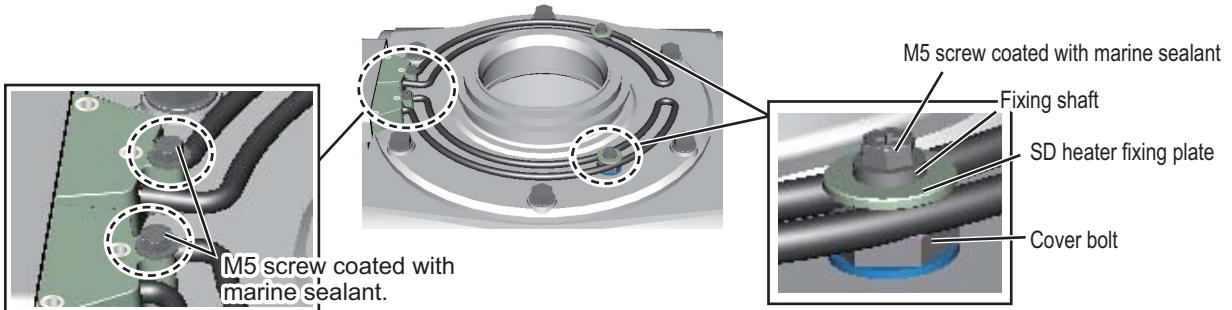


- 9) Set the bow cover supplied with kit. (You can discard the original bow cover.) Also, fasten the cable entrance for the DE-ICER. Take care not to hit the heater elements on the chassis or radiator.
- 10) Fasten the bow cover, fasten the RF-TB assembly, and close the rear cover. (You can discard the original bow cover.) Also, fasten the cable entrance for the DE-ICER. Take care not to hit the heater elements on the chassis or radiator.

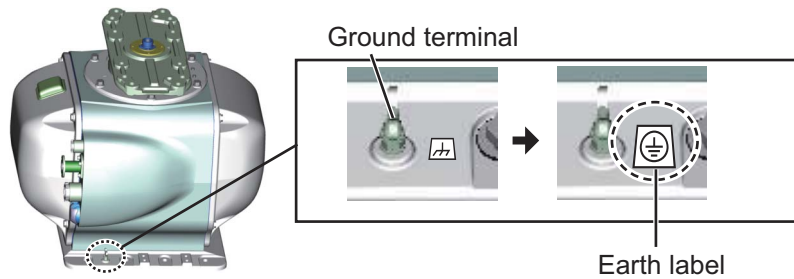
## 2. WIRING

11) Fasten the two heater elements to the chassis as follows:

- ? Fasten the base of the heater with two M5 screws (supplied) coated with marine sealant.
- ? Fasten the installation materials shown in the right figure below to each of the cover bolts.



12) Attach the supplied earth label over the earth label currently attached near the ground terminal.



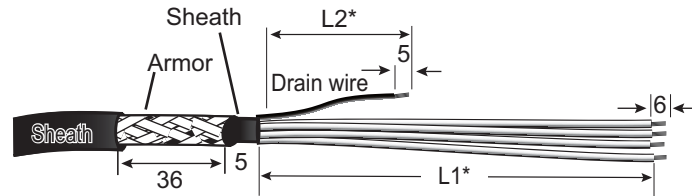
12. Reconnect the performance monitor connector (J807) then close the stern cover. The torque for the fixing bolts is 21 N•m.



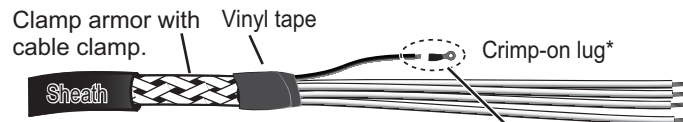
## 2.3 Transceiver Unit

### 2.3.1 Fabrication of cables

#### Serial cable (TTYCYSLA-10)



\* L1: X-band, 250, S-band, 480 L2: X-band, 100, S-band, 320



Pass the heat shrinkable tube (local supply) onto the drain wire, then attach the crimp-on lug to the wire.

\* X-band: FV1.25-3(LF) RED  
S-band: FV1.25-4(LF) RED

**How to connect wires to WAGO connector**

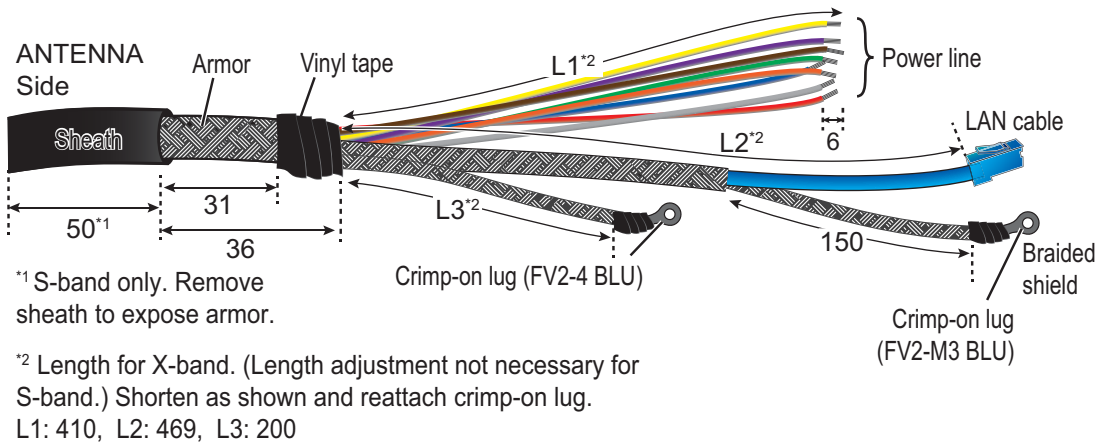
The diagram shows a **Wire** being inserted into a **WAGO connector** using a **Terminal opener**. The wire is first **Twist**ed. An arrow indicates to **Press downward** on the terminal opener.

**<Procedure>**

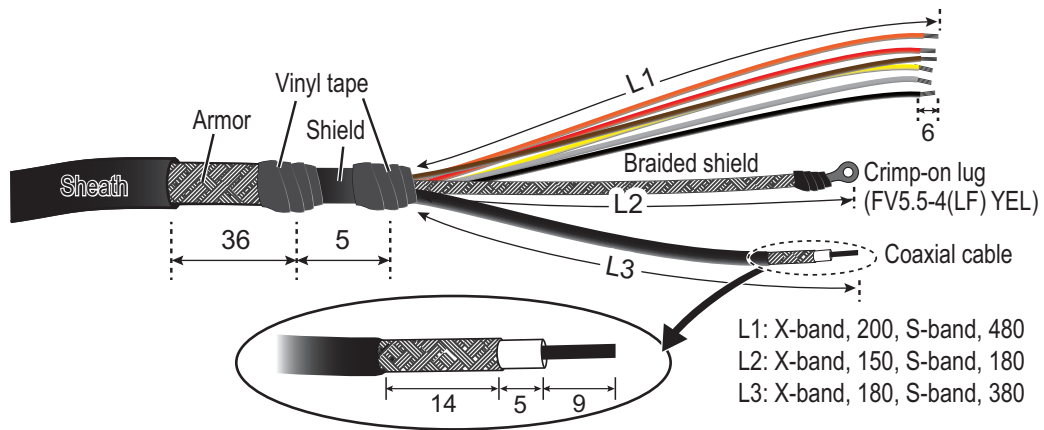
1. Twist the cores.
2. Press the terminal opener downward.
3. Insert the wire to hole.
4. Remove the terminal opener.
5. Pull the wire to confirm that it is secure.

**Antenna cable (RW-00135)**

Fabricate the LAN cable as shown below. See "How to fabricate the LAN cable" on page 2-27 for how to attach the LAN cable connector.



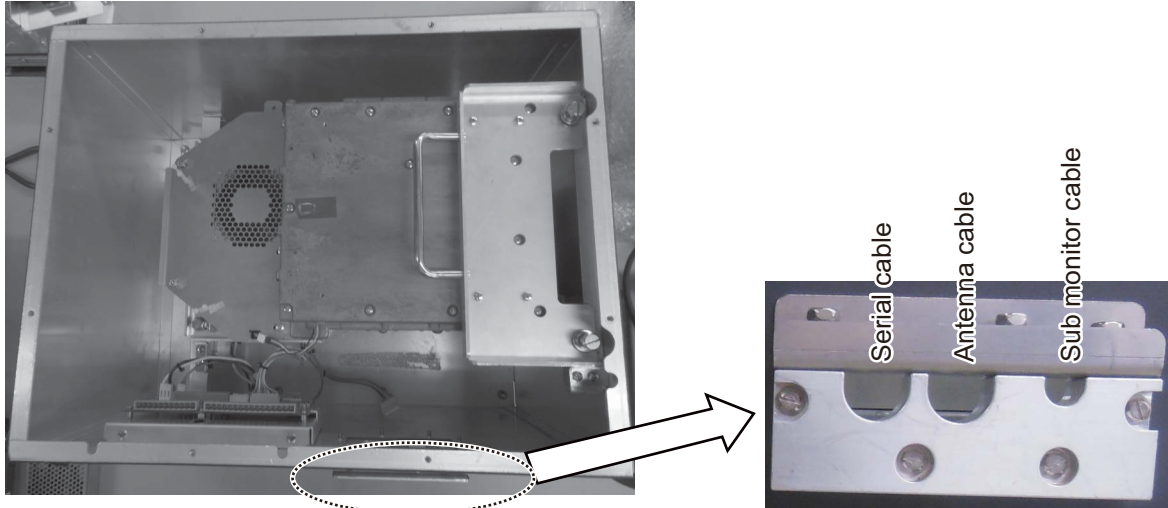
**Sub monitor cable (RW-00136)**



### 2.3.2 Transceiver unit for FAR-3320W

#### Antenna cable, serial cable, sub monitor cable

1. Remove the cover of the unit.
2. Unfasten the bolts from the cable clamp. Lay the cables in respective cable slots so their armors rest in the slots.



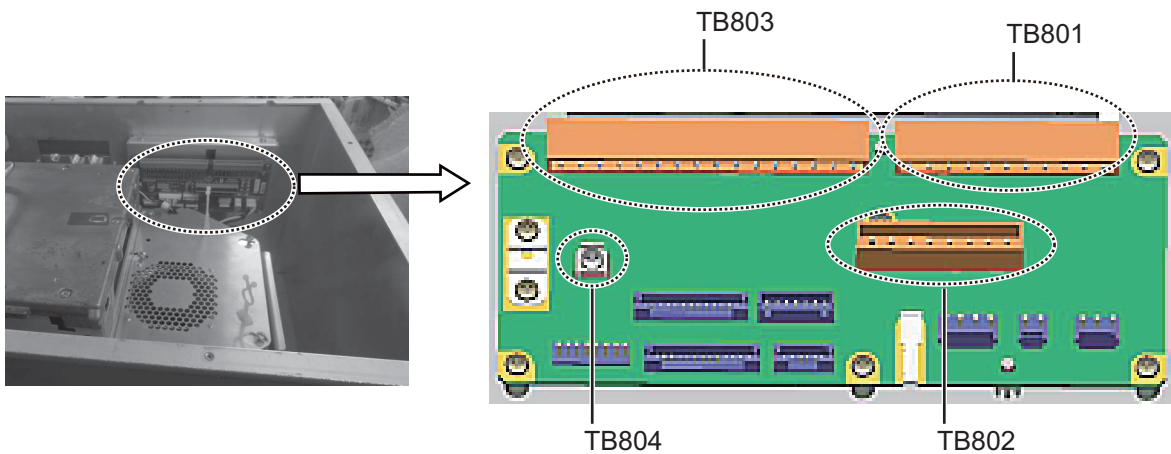
3. Connect the power line of the antenna cable, serial cable and sub monitor cable on the RF-TB board. See the figure on the next page for pin arrangement, etc.

? Antenna cable (power): TB801

? Serial cable: TB802, TB803

? Sub monitor cable (serial): TB803

? Sub monitor cable (coaxial): TB804



2. WIRING

**POWER:** TB801 on RF-TB Board (03P9570)

Pin	1	2	3	4	5	6	7	8	9	10	11
Color	BRN	/	RED	/	/	ORG	YEL	GRN	BLU	PPL	WHT

How to connect wires to WAGO connector

Press downward.

Terminal opener

Wire

Twist

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.

**SIGNAL:** TB803 on RF-TB board

Pin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Color	/	/	/	/	/	/	/	/	/	/	/	BRN	RED	ORG	YEL	WHT	BLK

**COAXIAL CABLE:** TB804 on RF-TB board

How to fasten the coaxial cable

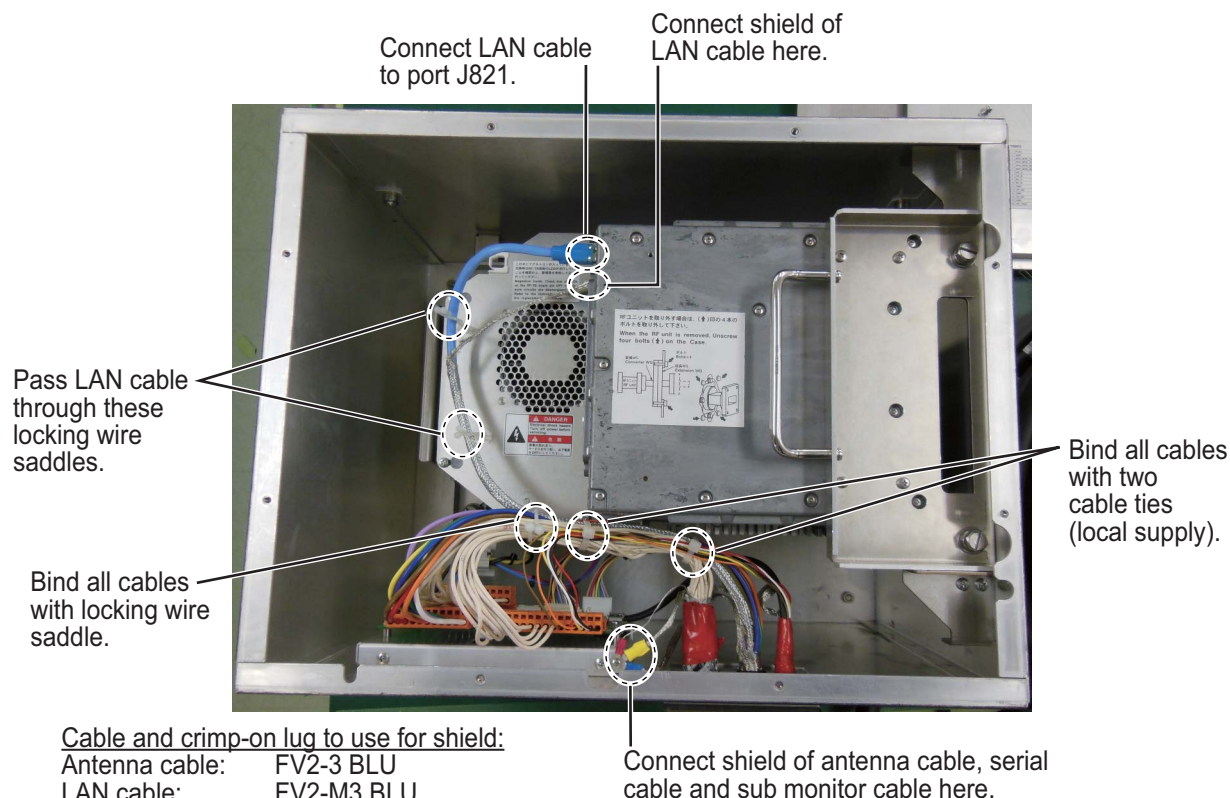
Fasten shield with clamp.

Fasten conductor with screw.

**NOTICE**

Do not use crimp-on lug, to prevent contact resistance from increasing.

- Pass the LAN cable through two locking wire saddles and connect it to port J821. Attach a crimp-on lug to the shield of each cable, referring to the figure below for the type of crimp-on lug to use. Connect shields to the locations shown below. Bind all cables with the locking wire saddle and two cable ties (local supply).



- Check that armor of cables are lying in their respective cable slots then fasten the cable clamp.

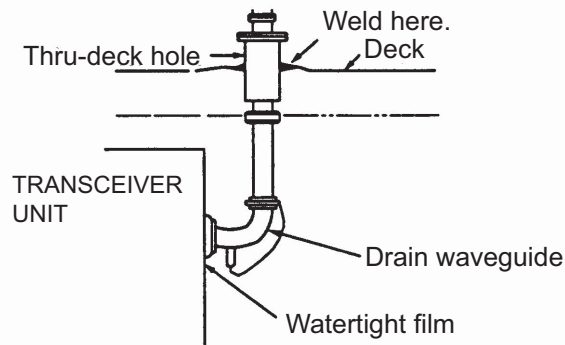
### **Flexible waveguide (FR-9)**

The RF interconnection between the antenna unit and the transceiver can be made with a flexible waveguide (FR-9). If the rectangular waveguide is used, observe the following installation guidelines.

- ? Correctly installed waveguide runs ensure the most efficient transmission of electrical energy at high frequencies. Electrical losses, however, occur in the waveguide runs. To minimize them the following factors are of great importance: minimum length, airtightness and electrical continuity.
- ? Another consideration required is that of frequency disturbance. The transmitting valve, a magnetron, is the primary oscillator in the radar. This is different from the oscillation system at lower frequencies in which conventional radio valves are used. In the latter case, the primary oscillator is always protected from the effects of load impedance by a buffer stage so that frequency and waveform are left unobstructed. With a waveguide and magnetron, however, mismatch of impedance causes "frequency pulling." For this reason, the number of possible mismatches in a waveguide run, i.e., joins and bends, must be kept minimum.
- ? Each pair of flanges should be coupled with one O-ring, four bolts and spring washers and the choke flange must be in the upper position. The bolts and O-ring must be greased before insertion to facilitate removal if required at a later date.

## 2. WIRING

- ? The transceiver unit output flange is a plain type and the antenna unit output flange is a choke type, and it is important to maintain this relationship throughout the waveguide run.

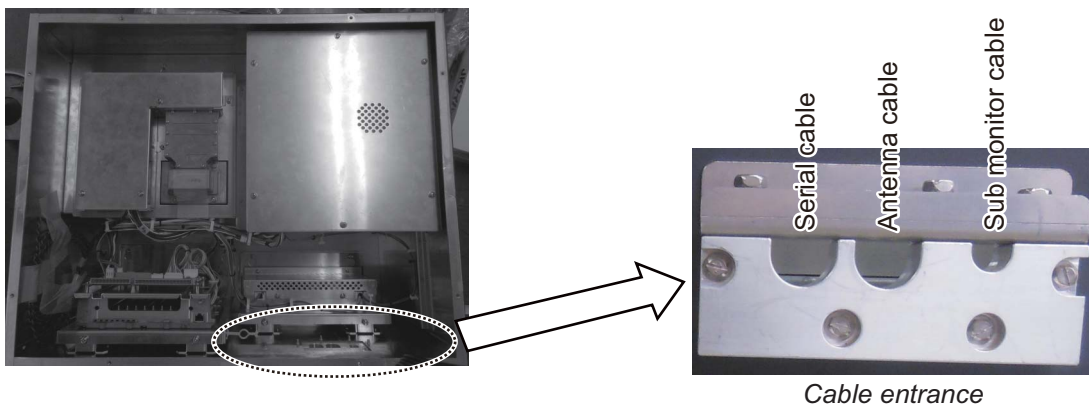


- ? After installation of the waveguide is completed, the coupling portions must be sealed by using the adhesive supplied.
- ? In a very short time the surface of the waveguide becomes green with verdigris. Therefore, paint both the surface of the waveguide and flanges to avoid corrosion and water penetration. Paint must not be allowed to reach the inner surface of the waveguide or the mating surface of any flange.

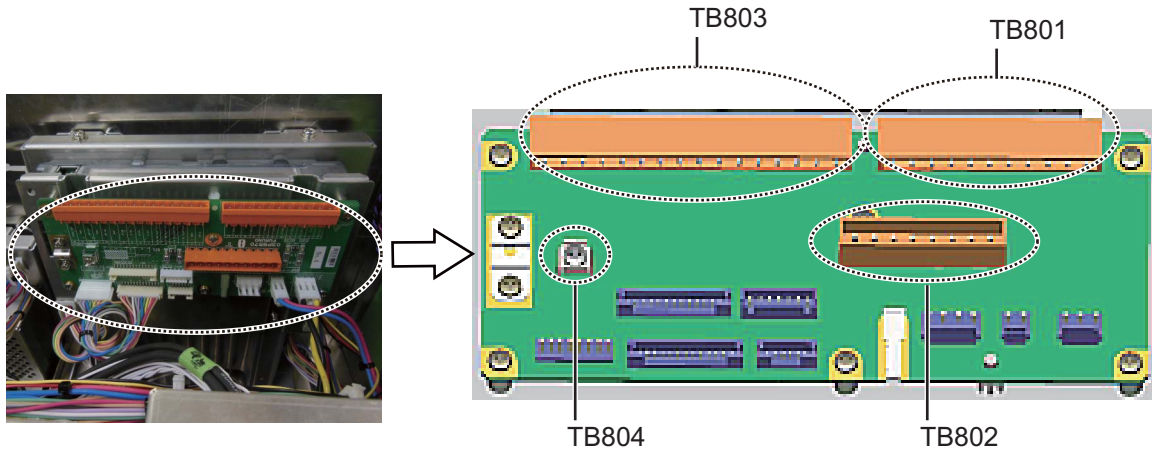
### 2.3.3 Transceiver unit for FAR-3330SW

#### Antenna cable, serial cable, sub monitor

1. Remove the cover of the unit.
2. Unfasten the bolts from the cable clamp. Lay the cables in their cable slots so their armors rest in the slots.



3. Connect the power line of the antenna cable, serial cable and sub monitor to the RF-TB Board as shown in the figure below and on the next page.
  - ? Antenna cable (power): TB801
  - ? Serial cable: TB802, TB803
  - ? Sub monitor cable (power): TB803
  - ? Sub monitor cable (coaxial): TB804



**POWER:** TB801 on RF-TB Board (03P9570)

Pin	1	2	3	4	5	6	7	8	9	10	11
Color	BRN	/	RED	/	/	ORG	YEL	GRN	BLU	PPL	WHT

How to connect wires to WAGO connector

Press downward.

Terminal opener

WAGO connector

Wire

Twist

<Procedure>

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

**SIGNAL:** TB803 on RF-TB board

Pin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Color	/	/	/	/	/	/	/	/	/	/	BRN	RED	ORG	YEL	WHT	BLK

**COAXIAL CABLE:** TB804 on RF-TB board

How to fasten the coaxial cable

Fasten shield with clamp.

Fasten shield with clamp.

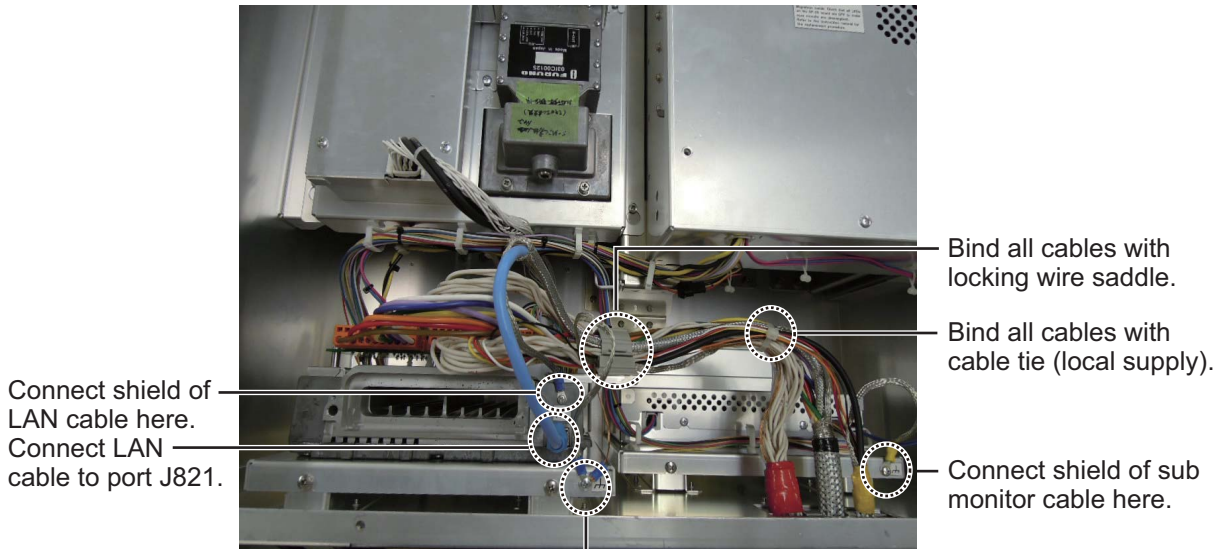
Fasten conductor with screw.

**NOTICE**

Do not use crimp-on lug, to prevent contact resistance from increasing.

## 2. WIRING

- Connect the LAN cable to J821. Attach a crimp-on lug to the shield of each cable, referring to the figure below for the type of crimp-on lug to use. Connect the shields to the locations shown below. Bind all cables with a cable tie (local supply).



Cable and crimp-on lug to use for shield:

Antenna cable: FV2-4 BLU  
 LAN cable: FV2-M3 BLU  
 Serial cable: FV1.25-4(LF) RED  
 Sub monitor cable: FV5.5-4(LF) YEL

- Check that armor of cables are lying in their respective cable slots then fasten the cable clamp.

### **Microwave coaxial plug**

Attach the microwave coaxial plug to the coaxial cable. See the applicable FURUNO technical information for the procedure. Attach the coaxial cable assy. to the transceiver unit as follows:

- Unfasten four bolts (M6×10) to remove the dust cover from the output WG adapter.
- Fasten eight bolts (removed at step 1) to attach the flange to the transceiver unit.
- Attach the coaxial cable to the converter of the flange.

