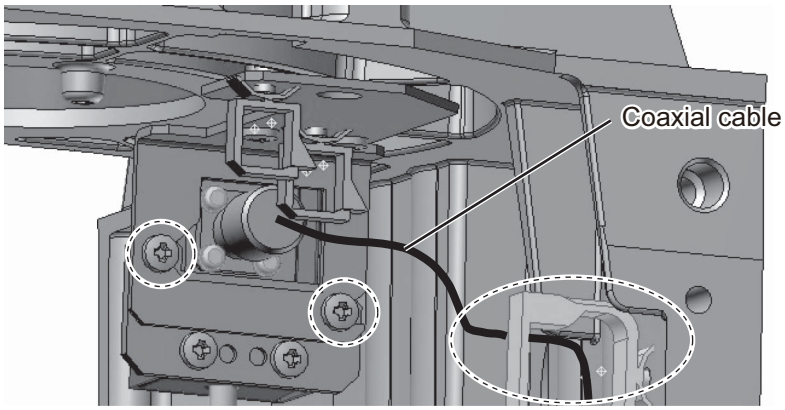
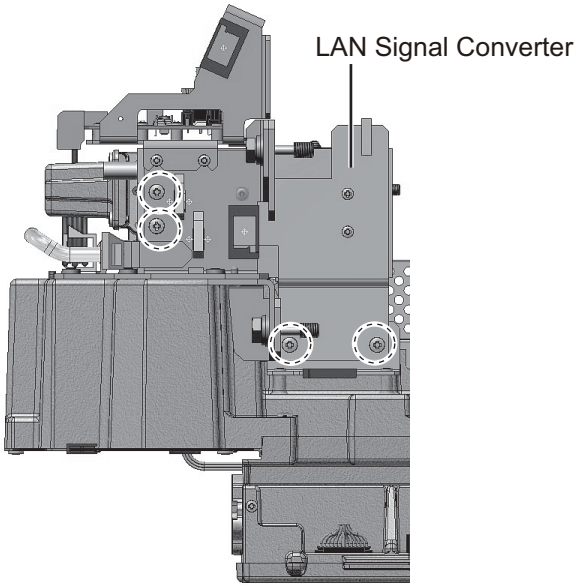
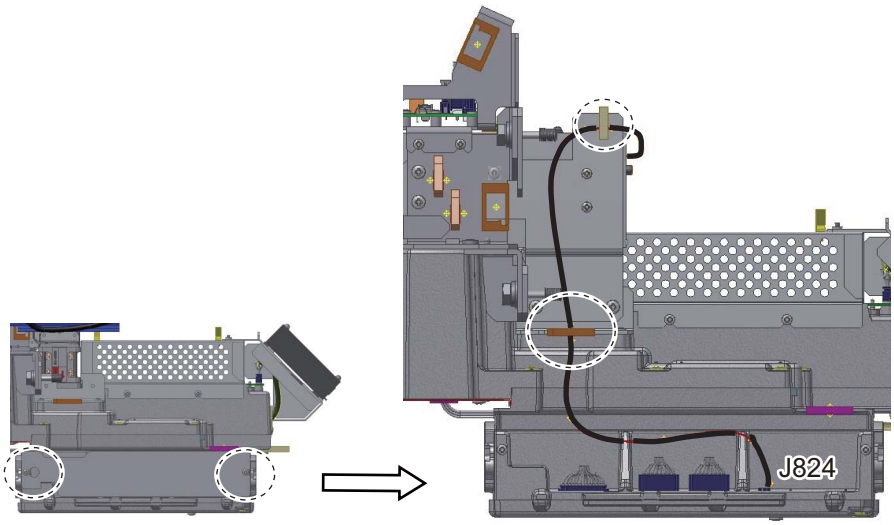
4. Fasten the BNC case to the antenna unit with two screws. Connect the coaxial cable to the BNC case then pass it through the locking wire saddle circled below.



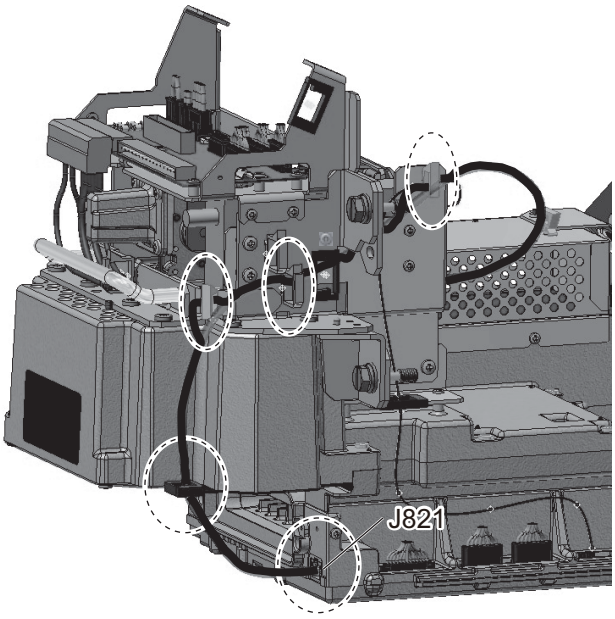
5. Fasten the converter to the transceiver unit with four screws at the locations circled below.



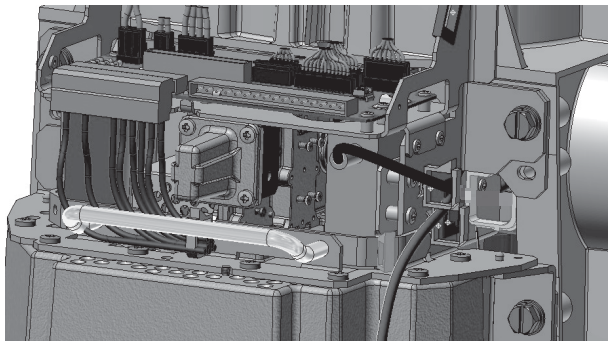
6. Unfasten the two screws from the cover plate that hides the SPU board. Connect the power cable (supplied) to the converter. Pass the cable through the two locking wire saddles circled below then connect the cable to J824 on the SPU board. Close the cover plate.



7. Connect the LAN cable to the LAN port on the converter. Pass the cable through the four locking wire saddles circled below then connect the cable to J821 on the SPU board.



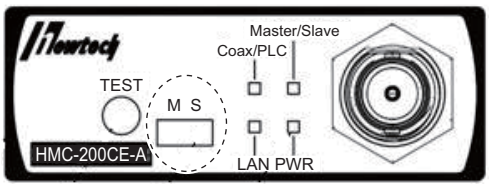
8. Mount the transceiver unit. Connect the coaxial cable from the BNC case to the converter.



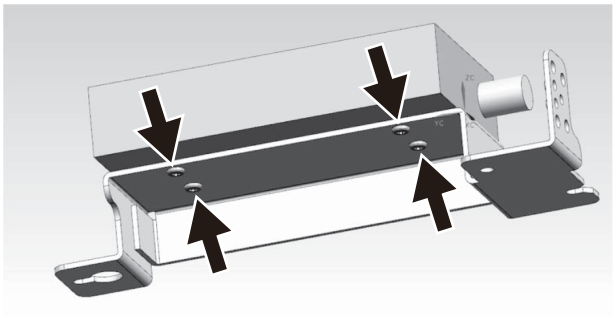
2.7.3 Installation in the power supply unit

Some parts or wiring may have been omitted from the illustrations of the power supply unit for clarity.

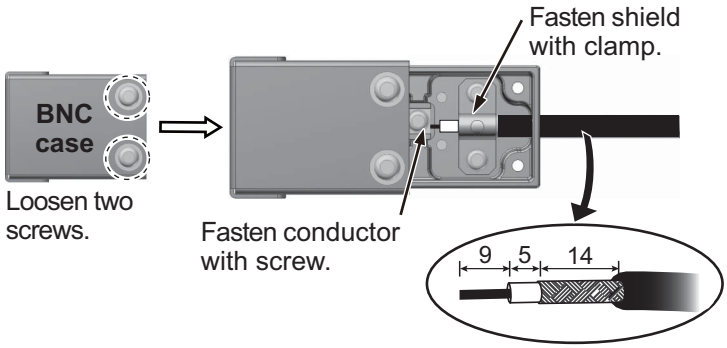
1. Set the M_S switch on the converter to the M (Master) position.



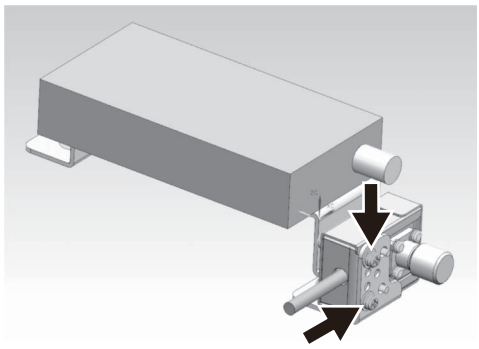
2. Fasten the converter to its mounting bracket with four screws.



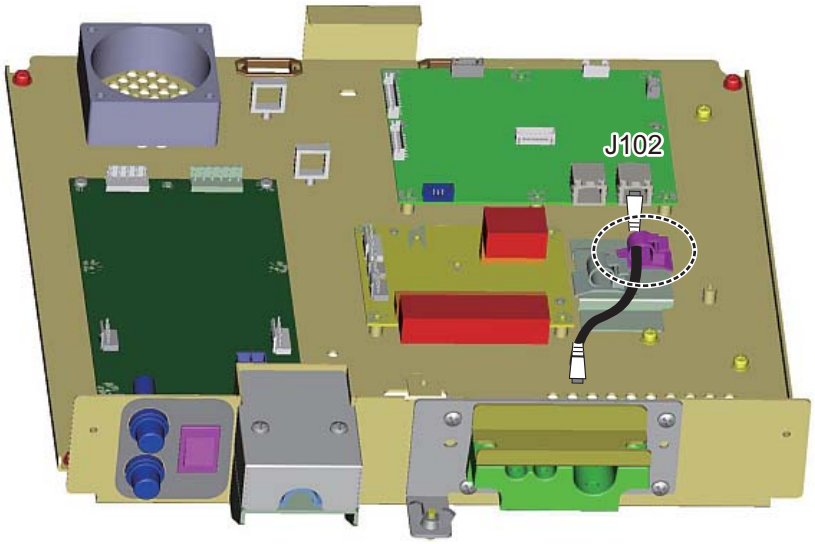
3. Loosen two screws on the BNC case. Attach the coaxial cable from the antenna cable then close the case.



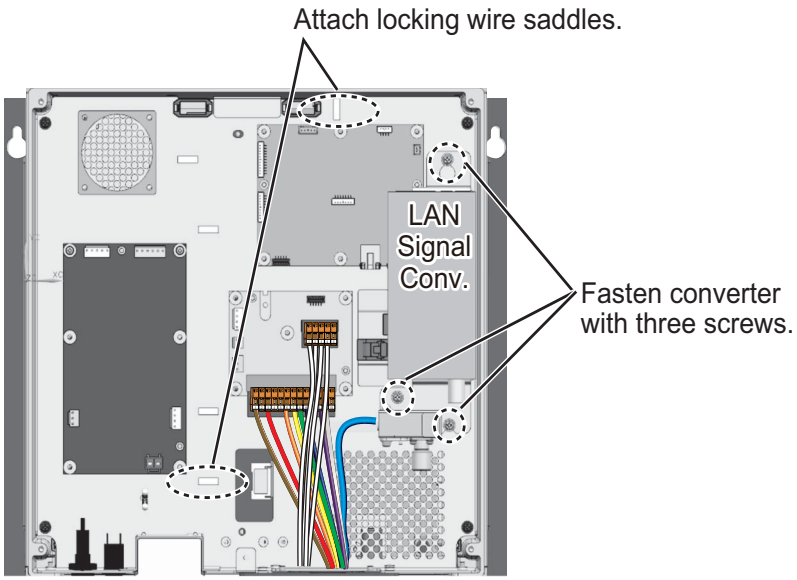
4. Fasten the BNC case to the mounting bracket with two screws.



5. Pass the LAN cable thru the clamp circled below then connect it to J102 on the PSU-CNTL board. (The cable will be connected to the converter after the converter is installed.)

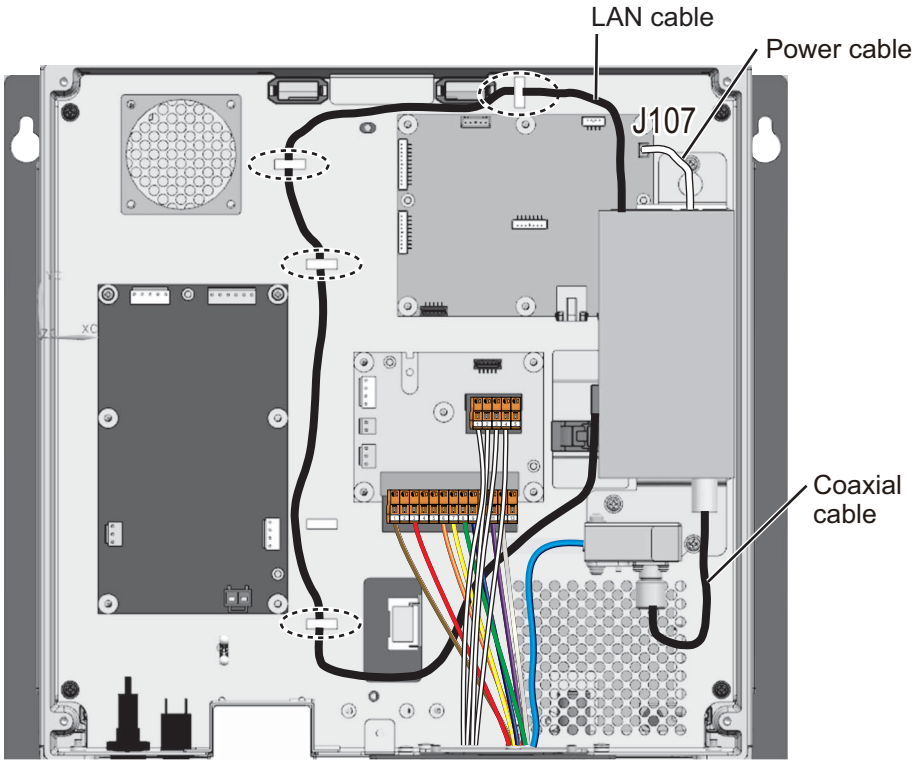


6. Fasten the converter with three screws at the locations shown circled below. Attach the two supplied locking wire saddles to the locations circled below.



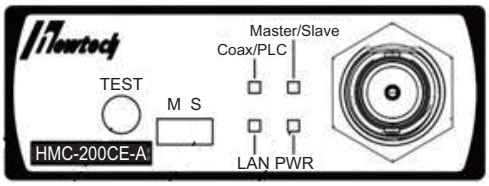
7. Connect the LAN, power and coaxial cables as shown below.

- Pass the LAN cable through the four locking wire saddles circled in the figure on the next page then connect it to the LAN port on the converter.
- Connect the power cable (supplied) between the converter and J107 on the PSU-CNTL Board.
- Connect the coaxial cable between the converter and the BNC case.



2.7.4 How to check the installation

Observe the LEDs on the converter to check for proper operation, troubleshoot.



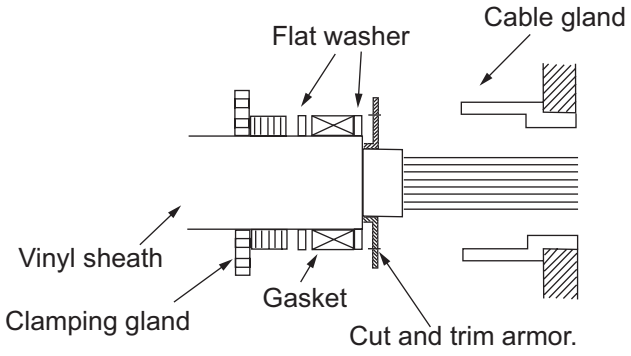
LED	State	Meaning
PWR	OFF	Power OFF
	Lighting green	Power ON
	Flashing orange	Test mode
LAN	OFF	Link down
	Lighting green	100 M link up
	Flashing green	100 M active
	Lighting orange	10 M link up
	Flashing orange	10 M active
Coax/PLC	OFF	Link down
	Lighting green	Link up
Master/Slave	Lighting green	Master mode
	Lighting orange	Slave mode

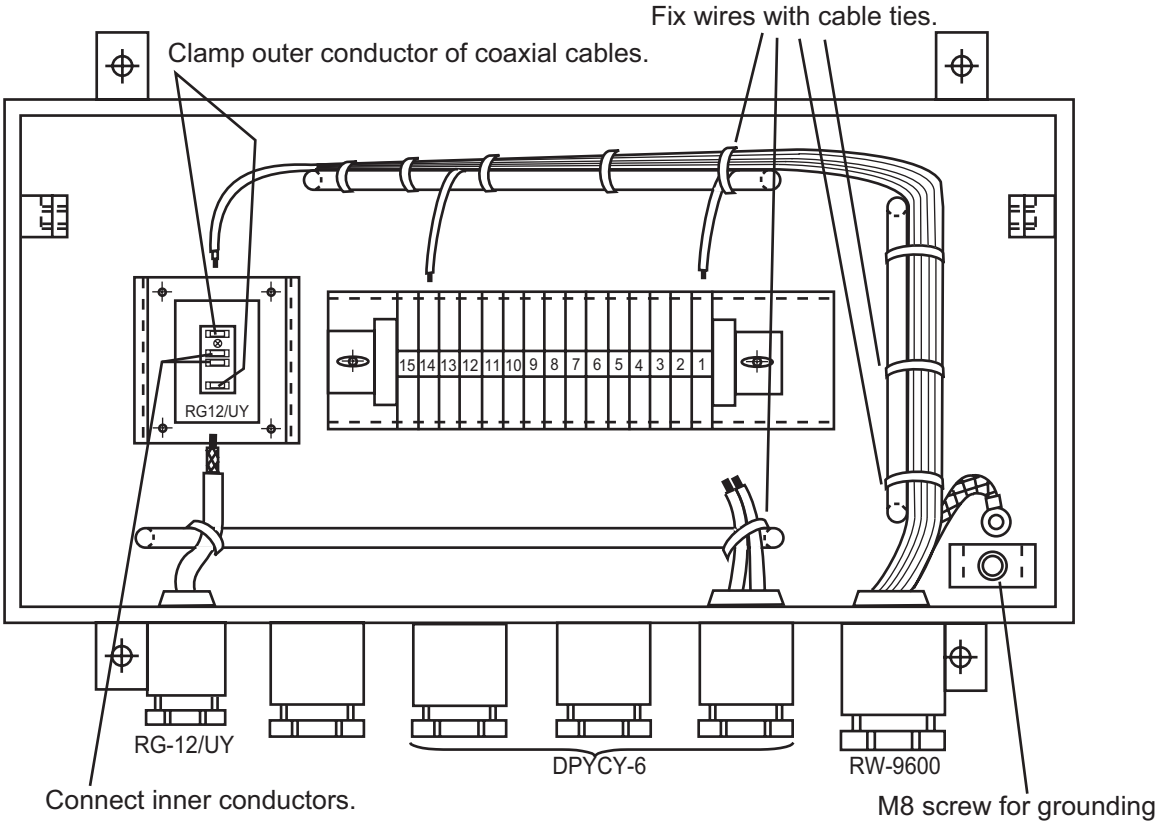
Note: The TEST button is for factory use. Do not operate the button.

2.8 Junction Box (option)

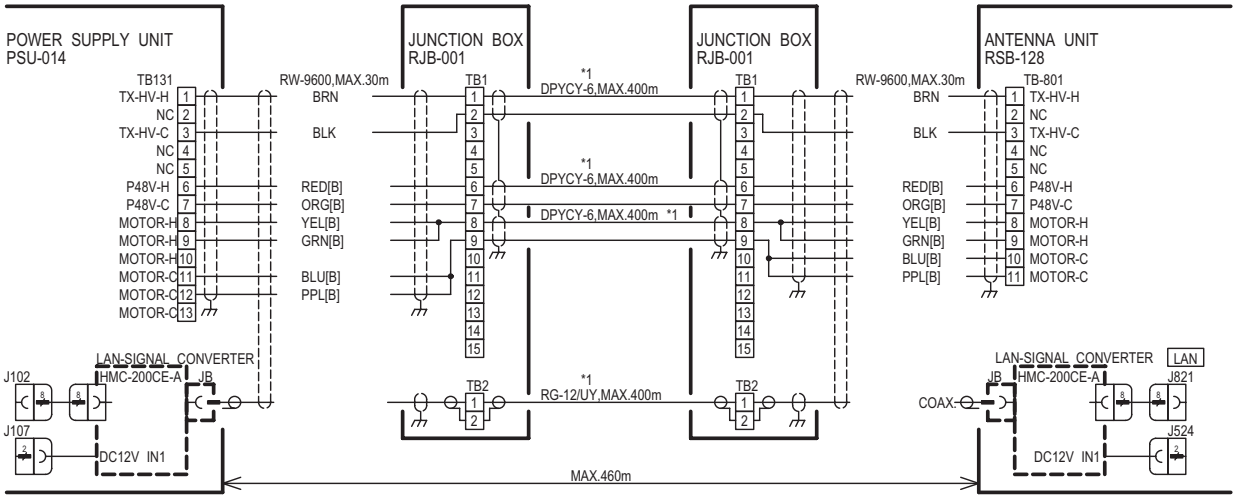
Junction boxes are required when the distance between the antenna unit and power supply unit is greater than 100 meters (max. 460 meters); for example, the antenna unit is installed on the foremast. Use signal cable RW-9600(x2), power cable DPYCY-6(x3), and coaxial cable RG-12/UY(x3).

Pass each cable through its cable gland as shown below.





Connect the RW-9600 cable as shown below. Refer also to the interconnection diagram.



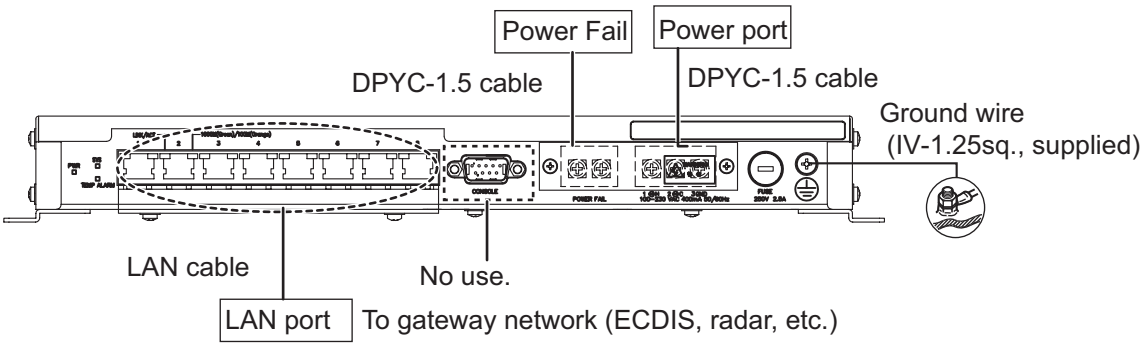
The table below shows the wire colors for the RW-6895 and RW-4873 cables.

Power Supply Unit			Antenna Unit		
TB131	Cable		TB801	Cable	
	RW-9600	RW-6895/ 4873		RW-9600	RW-6895/ 4873
1	Brown	Brown	1	Brown	Brown
3	Black	Black	3	Black	Black
6	Red*	Red*	6	Red*	Red*
7	Orange*	White*	7	Orange*	White*
8	Yellow*	Yellow*	8	Yellow*	Yellow*
9	Green*	Green*	9	Green*	Green*
10	-	-	10	Blue*	Blue*
11	Blue*	Blue*	11	Purple*	Black*
12	Purple*	Black*			

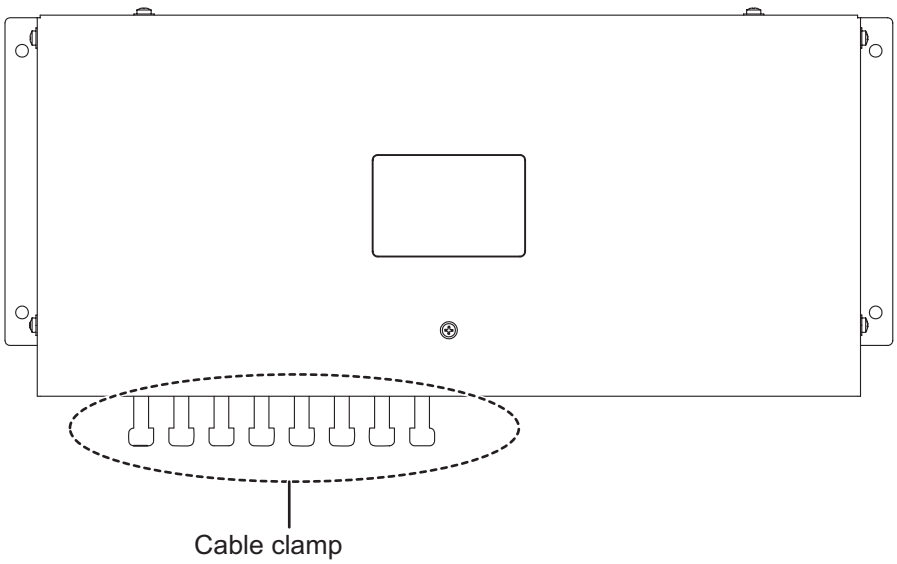
* Thick

2.9 Intelligent HUB (option)

Fix the LAN cables to the cable clamp with the cable ties (supplied).



Attach the LAN cap (supplied) to the unused connector holes to comply with waterproofing standard IPX2.

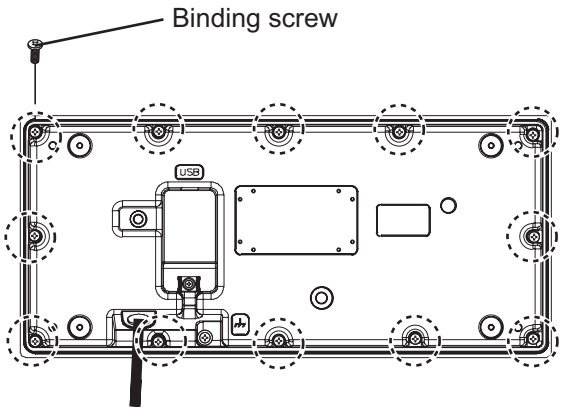


2.10 How to Extend the Control Unit Cable (option)

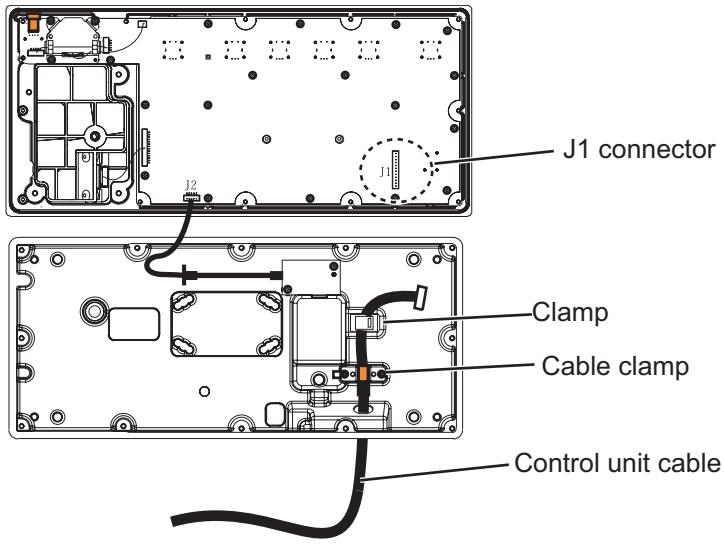
To extend the length of the cable between a control unit and the processor unit, use the optional cable assy 6TPSH-XH12X2-LxxSP1 (for RCU-024) or 6TPSH-XH12X2-LxxSP2 (for RCU-026). You can select the cable length among 10, 20 and 30 m.

2.10.1 Radar control unit (RCU-025)

1. Unfasten 12 binding screws (M3×8) from the bottom of the control unit to remove the cover.
   Note: Remove the cover slowly to prevent damage to the cables connected to the circuit board in the control unit.

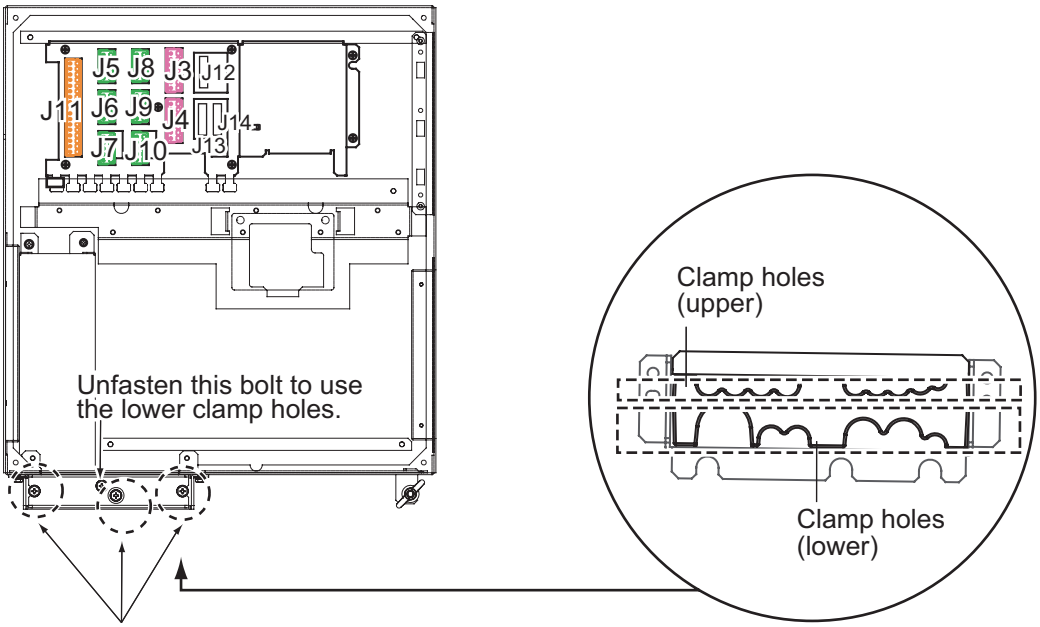


2. Unfasten two pan head screws (M3×12) to remove the clamp and cable clamp from the control unit. Disconnect the control unit cable from the J1 connector.

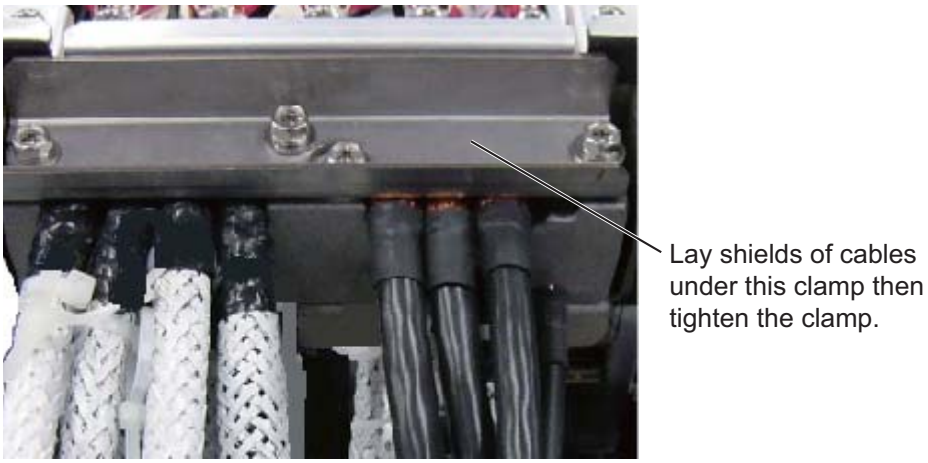


3. Pull out the control unit cable from the cover.
4. Pass the optional cable assy (6TPSH-XH12X2-LxxSP1) through the cable hole on the control unit.
5. Fasten the shield part of the cable assy with the cable clamp (removed at step 2), then connect the connector at the end of the cable assy to the J1 on the circuit board inside the unit.
6. Reattach the control unit cover.
7. Unfasten four screws (M4×8) to remove the processor unit cover.

8. Unfasten the three bolts circled in the figure below to remove the cable clamp (upper).



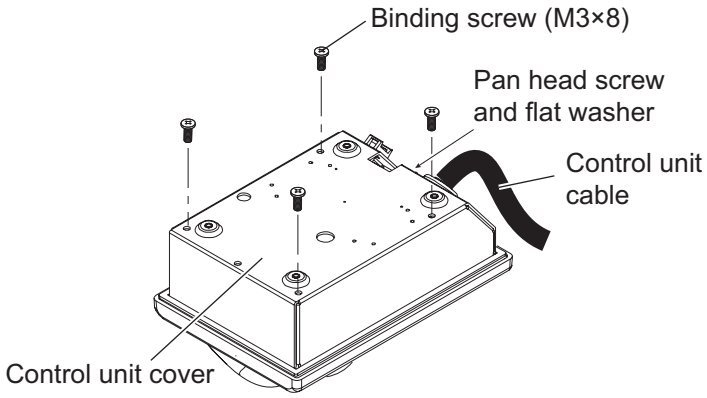
9. Disconnect the control unit cable from the processor unit, then connect the cable assy (6TPSH-XH12X2-LxxSP1).
10. Set the shield part of cables under the cable clamp then tighten the cable clamp.



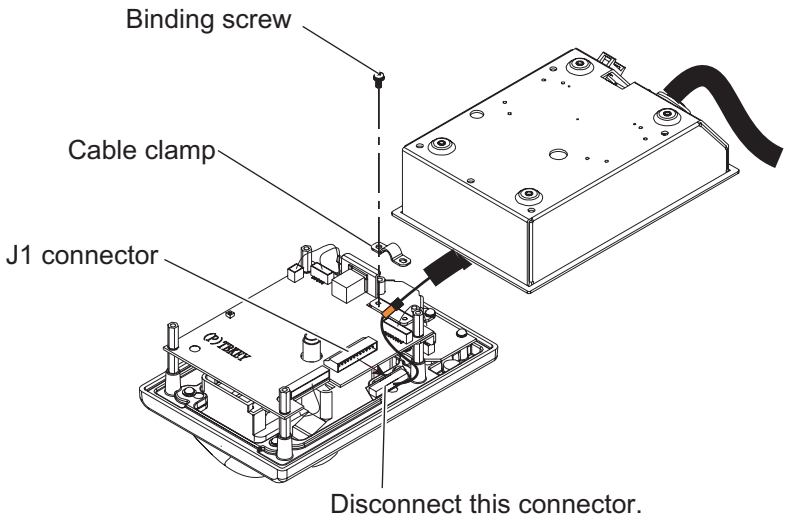
11. Attach the processor unit cover.

2.10.2 Trackball control unit

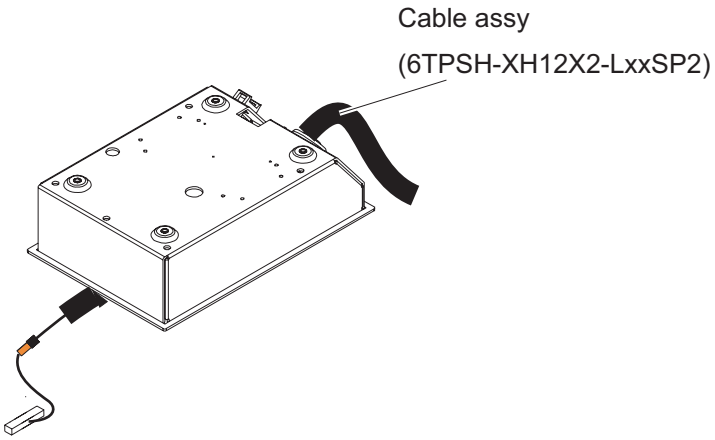
1. Unfasten four binding screws (M3×8) from the bottom of the control unit, and a pan head screw (M3×8) and flat washer from the back of the control unit to remove the cover.
   Note: Remove the cover slowly to prevent damage to the cables connected to the circuit board in the control unit.



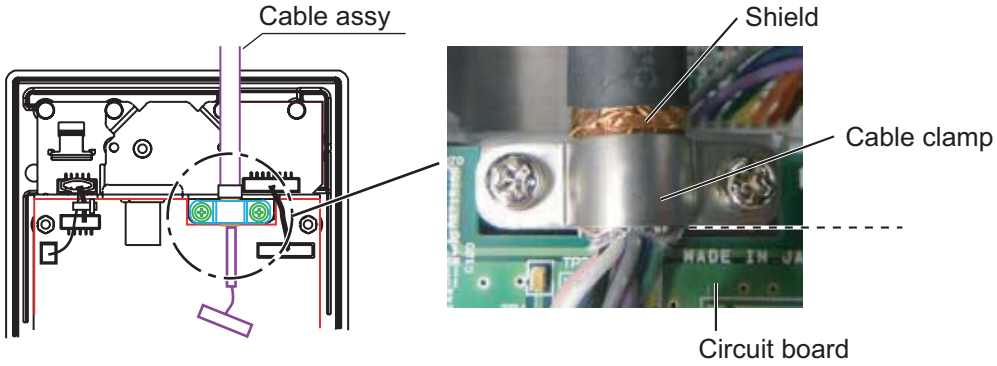
2. Remove the cable clamp from the control unit, then disconnect the control unit cable from the J1 connector.



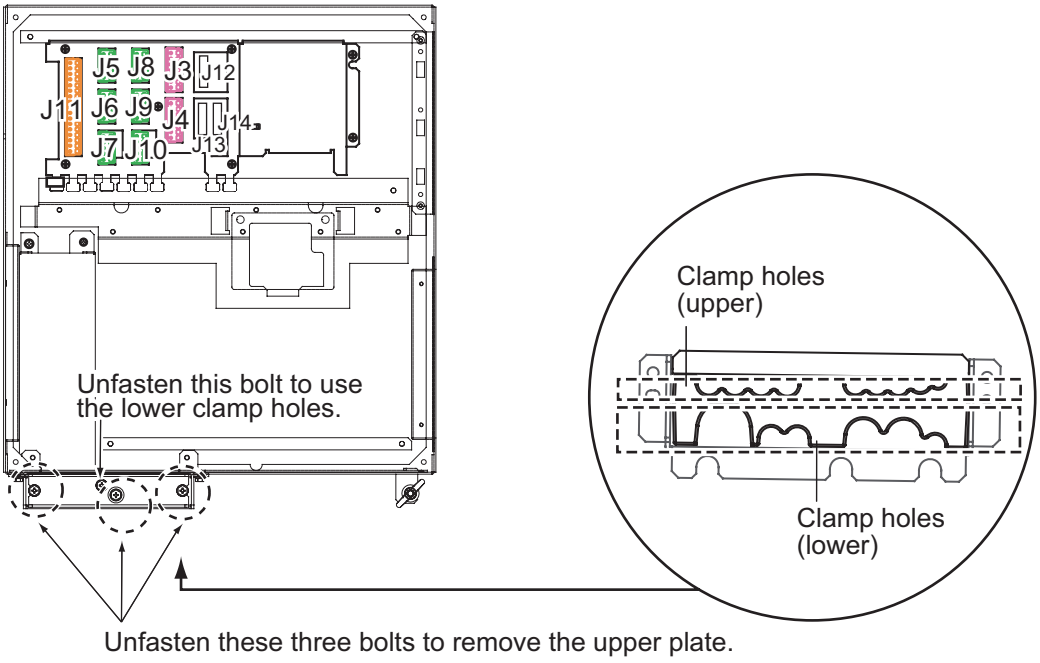
3. Pull out the control unit cable from the cover.
4. Pass the optional cable assy (6TPSH-XH12X2-LxxSP2) through the cable hole on the cover.



5. Fasten the shield of the cable assy with the cable clamp (removed at step 2), then connect the connector at the end of the cable assy to the J1 on the circuit board.
   Note: The shield of the cable must not touch the circuit board.



6. Reattach the control unit cover.
7. Unfasten four screws (M4×8) to remove the processor unit cover.
8. Unfasten the three bolts circled below to remove the cable clamp (upper) as shown below.



9. Disconnect the control unit cable from the processor unit, then connect the cable assy (6TPSH-XH12X2-LxxSP2).

10. Set the shields of cables under the cable clamp then tighten the cable clamp.

11. Remount the processor unit cover.

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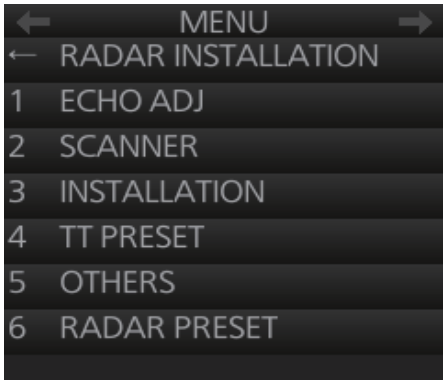
3. SETTINGS AND ADJUSTMENTS

Note: After completing the settings and adjustments, copy the setting data to a USB flash memory, referring to section 23.2 in the Operator's Manual. This will allow easy restoration of setting data after the SPU Board is replaced, etc.

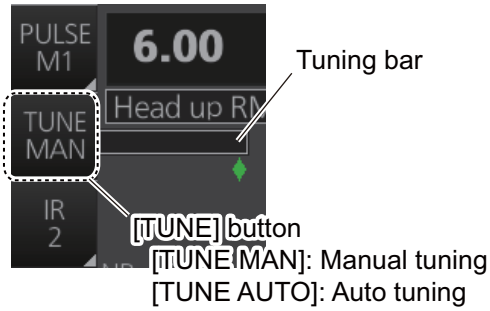
3.1 How to Access the Radar Installation Menu



The [RADAR INSTALLATION] menu has various items for adjustment of the radar. To show this menu, press the **MENU** key five times while pressing and holding the **1 HL OFF** key.

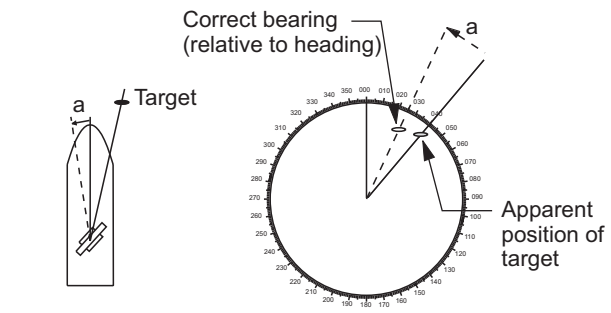
Tuning initialization

Right click the [TUNE] button on the InstantAccess bar then select [Tune Initialize] to start initialization. "TUNE IN" appears during the initialization.

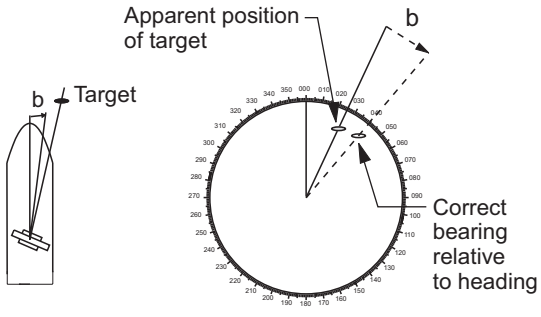


3.2 How to Align the Heading

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



Antenna mounted error to port (HDG SW advanced) Picture appears deviated clockwise.



Antenna mounted error to port (HDG SW delayed) Picture appears deviated counterclockwise.

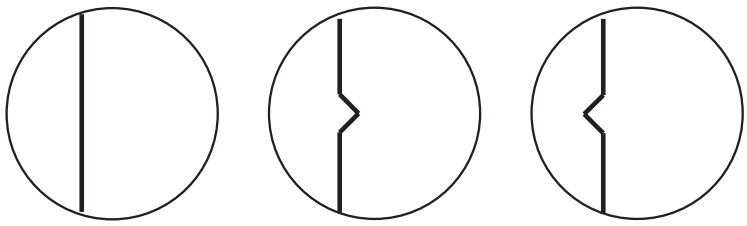
In practice, you will probably observe some small bearing error on the display because of the difficulty in achieving accurate initial positioning of the antenna unit. The following adjustment will compensate for this error.

1. Select a stationary target echo at a range between 0.125 and 0.25 NM, preferably near the heading line.
2. Operate the EBL control to bisect the target echo.
3. Read the target bearing.
4. Measure the bearing of the stationary target on a navigation chart and calculate the difference between the actual bearing and apparent bearing on the radar screen.
5. Show the [RADAR INSTALLATION] menu.
6. Select [1 ECHO ADJ] followed by [2 HD ALIGN].
7. Key in the bearing difference. The setting range is 0° to 359.9°.
8. Confirm that the target echo is displayed at the correct bearing on the screen.

3.3 How to Adjust the Sweep Timing

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

- The echo of a “straight” target (for example, pier), on the 0.25 NM range, appears on the display as being pulled inward or pushed outward. See the figure below.



(1) Correct (2) Target pushed inward (3) Target pushed outward

- The range of target echoes is also be incorrectly shown.

1. Transmit on the 0.25 NM range.
2. Adjust the radar picture controls to display the picture properly.
3. Select a target echo which should be displayed straightly.
4. Show the [RADAR INSTALLATION] menu, then select [1 ECHO ADJ] followed by [3 TIMING ADJ].
5. Set a value which displays the target straightly. The setting range is 0 to 4095.

3.4 How to Suppress Main Bang

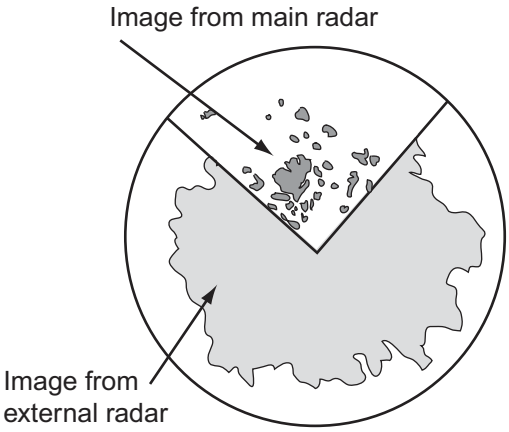
Main bang is the clutter at the center of the screen that you typically see on the radar display, and it may mask close-in targets. If main bang appears at the screen center, suppress it as follows.

1. Transmit the radar on a long range and then wait ten minutes.
2. Adjust the gain to show a slight amount of noise on the display.
3. Select the 0.25 NM range, and turn off the **A/C SEA** control.
4. Show the [RADAR INSTALLATION] menu, then select [1 ECHO ADJ] followed by [4 MBS].
5. Set a value that causes the main bang to just disappear. The setting range is 0 to 255.

3.5 Dual Radar Display

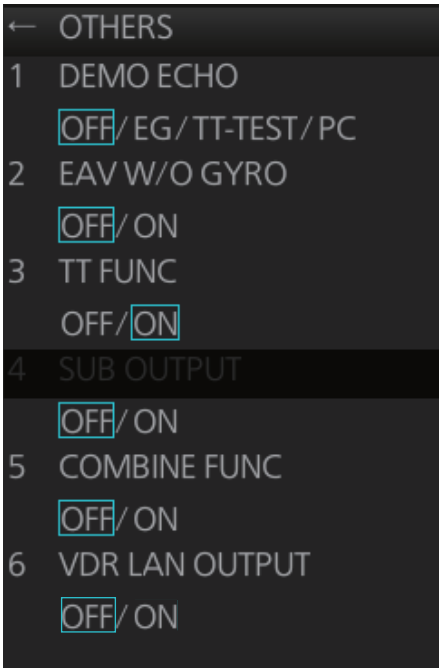
The dual radar display, available with the B-type specification radar, shows radar images from two radar sources on one radar display. Any combination of X- and S-band radars is possible.

Note: The [RADAR INSTALLATION] menu is inoperative (greyed out on the installation menu) when the dual radar display is active.



3.5.1 How to enable, disable the dual radar display

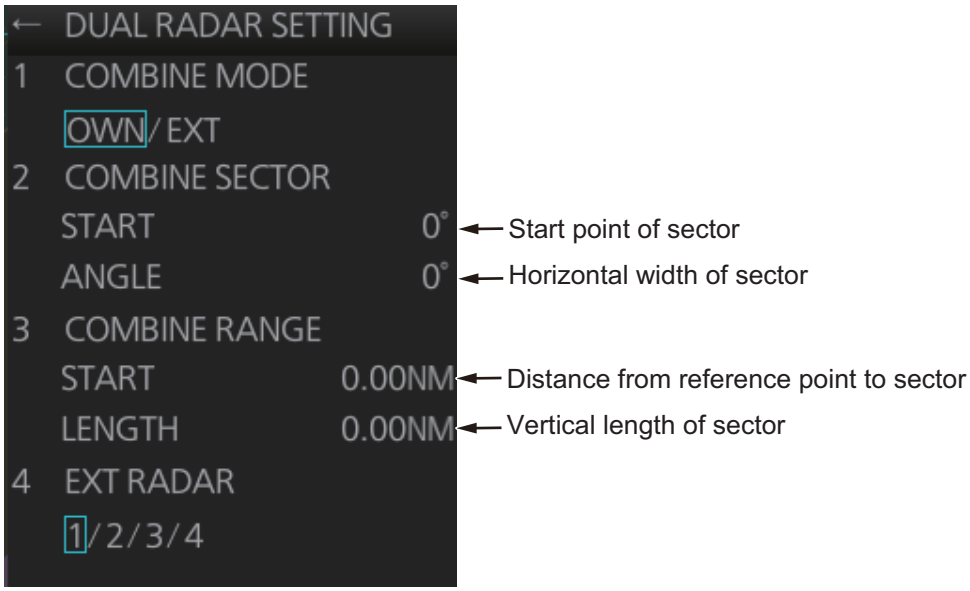
1. Open the [RADAR INSTALLATION] menu, then select [OTHERS] menu.
2. Select [5 COMBINE FUNC].
3. Select [OFF] or [ON] as appropriate.



3.5.2 How to set the width and length for the picture from the external radar

If two FAR-3xx0 series radars are to be used for the dual radar display, set the same display area on each radar to ensure proper performance.

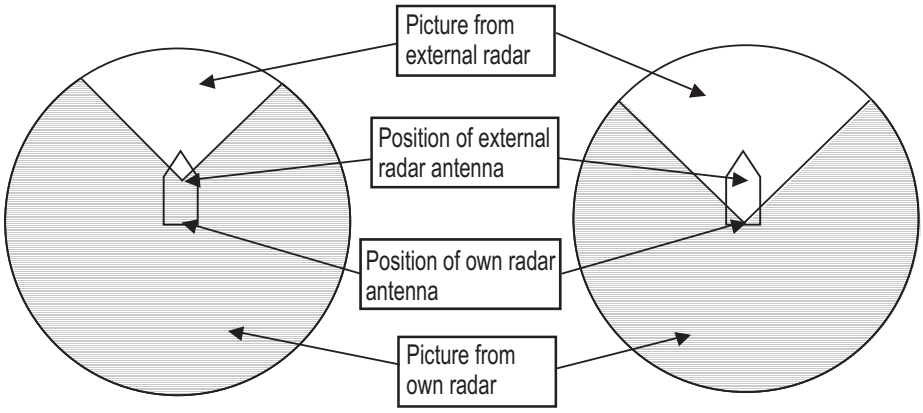
1. Open the [RADAR INSTALLATION] menu, then select [2 SCANNER], [6 DUAL RADAR SETTING] to show the [DUAL RADAR SETTING] menu.



2. Select [1 COMBINE MODE] to select which radar to set as reference point.
3. Select [OWN] or [EXT] as appropriate.
   [OWN]: Set own radar's antenna as the reference point and set display area of own radar. The area outside that set here is where the image from the external radar is displayed.
   [EXT]: Set the external radar's antenna as the reference point and set the display area of the external radar. The area outside that set here is where the image from own radar is displayed.

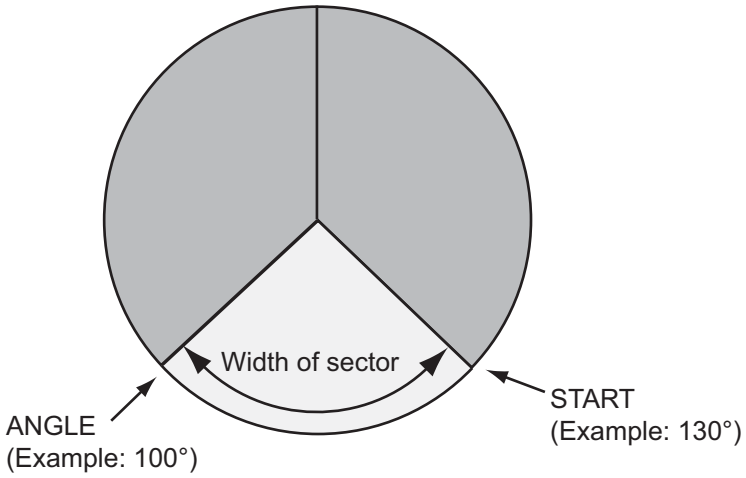
Radar selected for COMBINE MODE: External	
START:	315°
ANGLE:	90°
START:	00.00 nm
LENGTH:	99.99 nm

Radar selected for COMBINE MODE: Own	
START:	45°
ANGLE:	270°
START:	00.00 nm
LENGTH:	99.99 nm



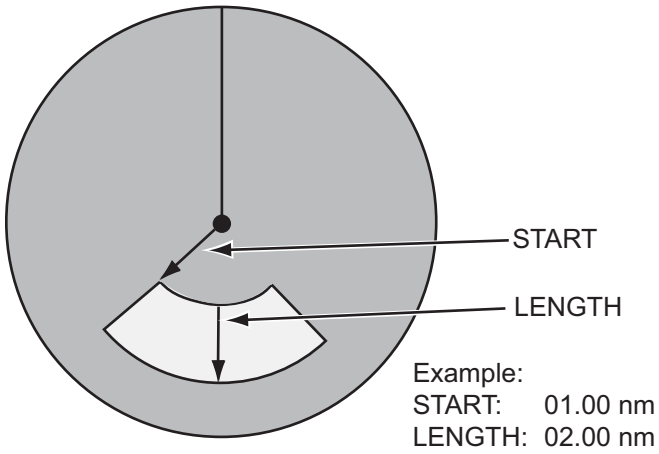
4. Select [2 COMBINE SECTOR] to set the width of the sector.

5. Use the scrollwheel to set [START] and [ANGLE], referring to the example below. Spin the scrollwheel to set and push it to confirm.
   A solid green line marks the dual radar display area.



   - **[START]**: Start point of the sector (in degrees, 000-359).
   - **[ANGLE]**: Horizontal width of the sector (in degrees, 000-359).

6. Select [3 COMBINE RANGE] to set the vertical width of the sector.
7. Use the scrollwheel to set [START] and [LENGTH], referring to the example below. Spin the scrollwheel to set and push it to confirm.



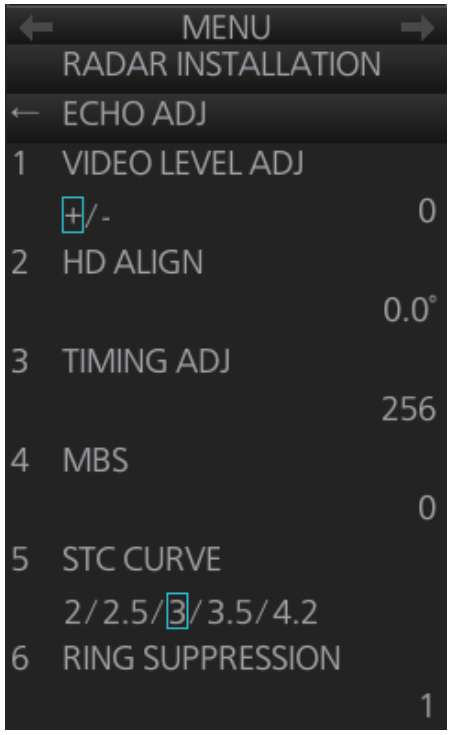
   - **[START]**: Distance from reference point to sector
   - **[LENGTH]**: Vertical length of sector

3.5.3 How to select the external radar (image source) to use

1. From the [RADAR INSTALLATION] menu, select [2 SCANNER], [6 DUAL RADAR SETTING].
2. Select [4 EXT RADAR].
3. Select required radar no. (Only the numbers of radar set on the [RADAR INSTALLATION] menu are vaiid.)
   Note 1: The dual radar will not function if a radar incompatible to the dual radar function is selected.
   Note 2: The dual radar display is designed to be used with two FAR-3xx0 series radars. Other makes or models can be used, however performance may vary.
4. Press the **MENU** key to close the menu.

3.6 Other Settings

ECHO ADJ menu

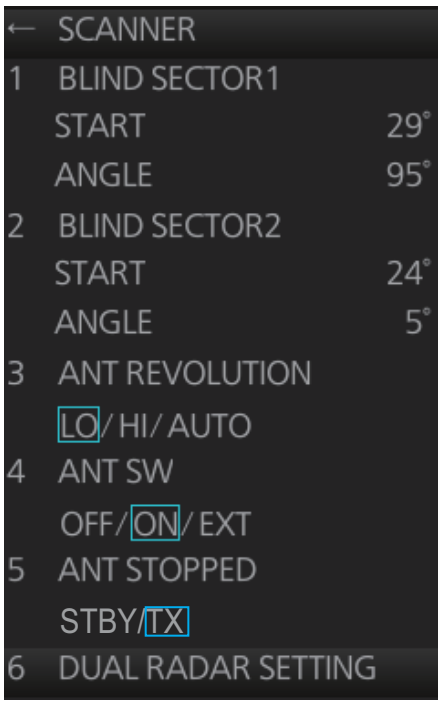


[VIDEO LEVEL ADJ]: Adjust the cable attenuation manually. Set the radar as follows:
Interference Rejector (IR): 2
Echo Stretch (ES): OFF
Echo Averaging (EAV): OFF
Gain: 80
Range: 24 NM
Pulse Length: Long
Select [+] or [-]. Rotate the scrollwheel so that noise just disappears from the screen. The setting range is 0 to 32. After compleiton of the adjustment the radar goes into standby. If the noise does not disappear, switch to [-]([+]) and try again.

[STC CURVE]: Use the default setting. Change the setting according to sea condition. The larger the number the greater the STC effect.

[RING SUPPRESSION]: Remove “ring” noise which appears with the waveguide-type radar. Adjust so the rings disappear at the range of 0.125 nm. The setting range is 0 to 255.

SCANNER menu

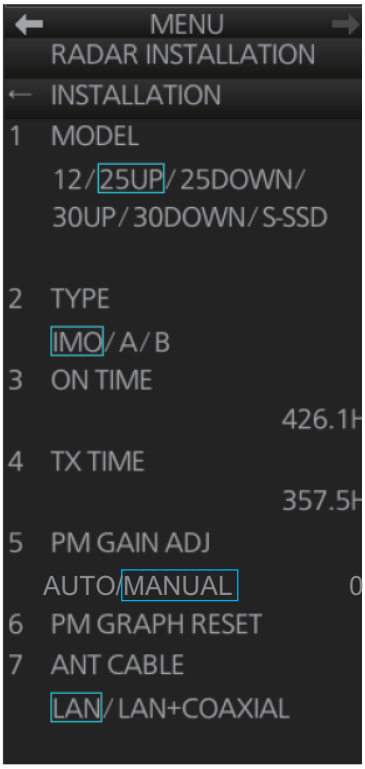


[BLIND SECTOR 1], [BLIND SECTOR 2]: Set area(s) where to prevent transmission. Heading must be properly aligned (see section 3.2) before setting any blind sector. For example, set the area where an interfering object at the rear of the antenna would produce a dead sector (area where no echoes appear) on the display. To enter an area, enter start bearing relative to the heading and dead sector angle. To erase the area, enter 0 for both the [START] and [ANGLE] sections. The setting range of [START] is 0° to 359° and [ANGLE] is 0° to 180°.
Note: Turn off a stern blind sector when adjusting the PM gain, to display the echo from the performance monitor properly.

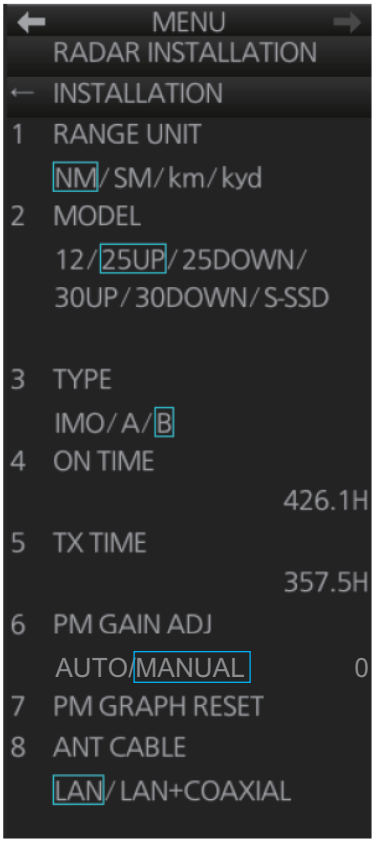
[ANT REVOLUTION]: For HSC only. Select [LO] for 36 rpm, [HI] for 42 rpm. [AUTO] sets the normal rotation speed to 36 rpm and switches the rotation speed to 42 rpm when the short pulse is selected.

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

INSTALLATION menu



IMO- and A-type radars



B-type radar

[RANGE UNIT]: **For the B-type radar**, select the range unit, NM, SM, KM or kyd then push the left button.

[MODEL]: Confirm the model of your radar. If this setting is different from your model, the radar will not function properly. The number before a diagonal (12, 25, 30) is the output power (in kW). [UP], [DOWN] indicates the location of the transceiver unit. [UP] is in the antenna unit, and [DOWN] means separate transceiver unit.
[S-SSD] means S-band solid state device.

[TYPE]: Select the type of radar: [IMO], [A] or [B].
[IMO]: IMO specifications
[A]: Near-IMO specifications
[B]: Non-Japanese fishing vessel specifications

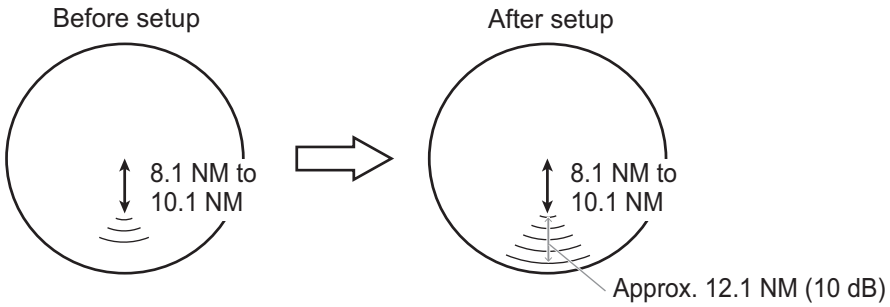
[ON TIME], **[TX TIME]**: These items show the number of hours the radar has been turned on and transmitted, respectively. Value can be changed; for example, after replacing the magnetron. [TX TIME] can be reset to 0.

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

Note: Turn off a stern blind sector before adjusting the PM gain, to display the echo from the performance monitor properly.

To adjust the performance monitor gain, do as follows:

1. Select automatic or manual adjustment. For automatic adjustment, no further operation is required; close the menu at the completion of the adjustment. For manual go to the next step.
2. Set the radar controls as shown below.
   Range: 24 NM
   Pulse Length: Long
   A/C SEA: OFF (turn off manually)
   A/C RAIN: OFF (turn off manually)
   Echo Averaging (EAV): OFF
   Video Contrast: 2-B
3. Adjust the **GAIN** control so that a slight amount of white noise appears on the screen. Arcs for the performance monitor appear on the screen.
4. Select [PM GAIN ADJ] then spin the scrollwheel so that the outer arc faintly appears. The setting range is 0 to 255. Wait at least eight scans then right click to set.

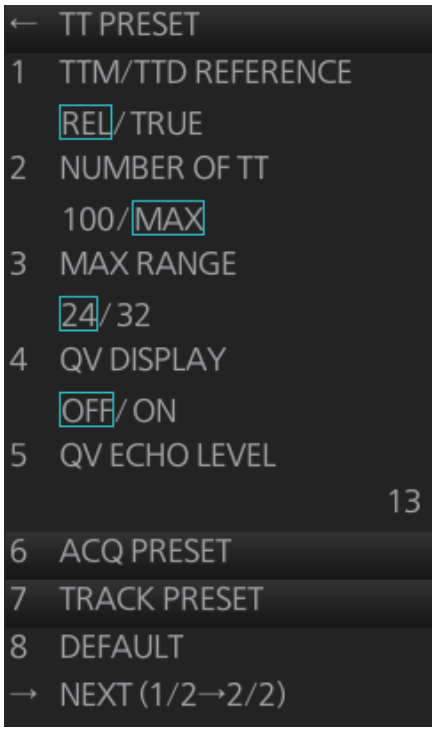


Ex: When [ARC] is set to [5]
(The location of arcs changes with the setting of [ARC] in [PERFORMANCE MON] in the [ECHO] menu.)

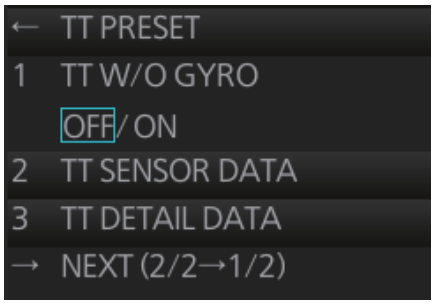
[PM GRAPH RESET]: Select this item to reset all PM graphs, after replacing the magnetron. The message shown below appears. Click the [OK] button to reset the PM graphs.

[ANT CABLE]: Select the method of connection between the radar sensor and the processor unit. [LAN] (LAN cable only) or [LAN+COAXIAL] (LAN and coaxial cables). Select [LAN+COAXIAL] when the optional LAN SIgnal Converter is installed.

TT PRESET menu



Page 1



Page 2

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

[NUMBER OF TT]: Set the number of targets that can be acquired, [100] or [MAX] (200). For FAR-2xx7 radar, select [100].

[MAX RANGE]: Select the maximum target tracking range, 24 or 32 nm.

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

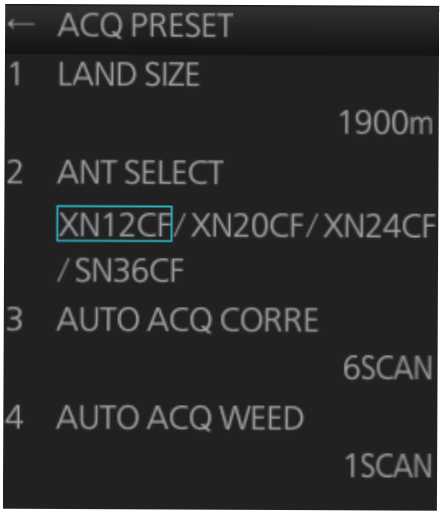
[QV ECHO LEVEL]: Set the detection level of echoes. The setting range is 1 to 31.

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

[TT SENSOR DATA]: Show debug-use TT sensor data.

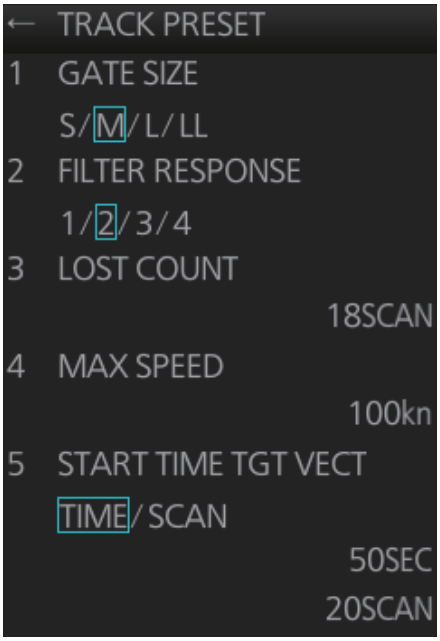
[TT DETAIL DATA]: Display TT detailed data.

[ACQ PRESET]: Show the [ACQ PRESET] menu.



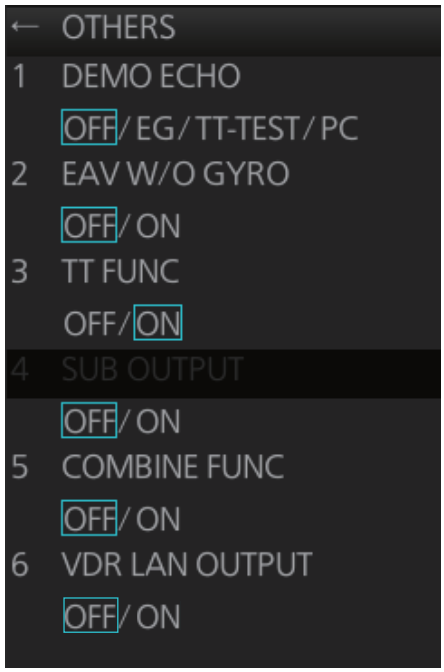
- **[LAND SIZE]**: Set the land size in units of 100 m. The setting range is 100 to 3000 m. A target whose length is equal to or greater than the length set here is judged as a land target.
- **[ANT SELECT]**: Set the antenna radiator type of your radar. The size of the echo changes with radiator size. Select the correct radiator type to ensure proper performance.
- **[AUTO ACQ CORRE]**: Set the correlation count of automatic acquisition. The setting range is 3 to 10.
- **[AUTO ACQ WEED]**: Set the cancel count of automatic acquisition. The setting range is 1 to 5.

[TRACK PRESET]: Show the [TRACK PRESET] menu.



- **[GATE SIZE]**: Set the gate size among [S], [M], [L] or [LL].
- **[FILTER RESPONSE]**: Set the filter response function. The setting range is 1 to 4.
  1: Filter response is improved.
  4: Filter stability is improved.
- **[LOST COUNT]**: Set the number of scans to allow before a target is declared a lost target. The setting range is 1 to 20.
- **[MAX SPEED]**: No use.
- **[START TIME TGT VECT]**: Set the number of seconds or number of scans to wait before showing the vector for a newly acquired target. Select [TIME] or [SCAN] then enter value.

OTHERS menu



[DEMO ECHO]: Select the type of demonstration echo to use. [EG] (Echo Generator), [TT-TEST] or [PC]. Select [OFF] to deactivate the demonstration echo feature.

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

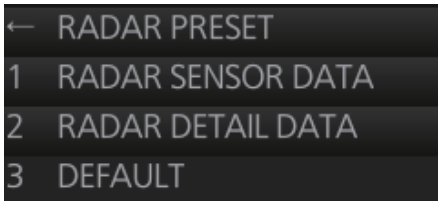
[TT FUNC]: Activate or deactivate the TT function.

[SUB OUTPUT]: No use.

[COMBINE FUNC]: Enables, disables the dual radar display. Select [ON] to enable the dual radar display.

[VDR LAN OUTPUT]: No use.

RADAR PRESET menu



[RADAR SENSOR DATA]: Show debug-use radar data.

[RADAR DETAIL DATA]: No use.

[DEFAULT]: Restore the default settings for the [RADAR INSTALLATION] menu settings.

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4. INPUT/OUTPUT DATA

NOTICE

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

The radar may be interconnected via HUB-3000 to other FURUNO processing units having approved LAN ports.

4.1 Processor Unit

Input and output data are shown in the table below.

Input

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

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

Output

Data	Specification	Contents	Remarks
Radar system data	IEC 61162-1 Ed.4	RSD, OSD	
TT data**	IEC 61162-1 Ed.4	TTD, TTM, TLB	
Alarm signal	IEC 61162-1 Ed.4		4 systems, output contents are selected by menu.
	Contact closure		

**: The output sentence and baud rate can be set at the PC (See the Instruction Manual). The mode can be set at the [TT Preset] menu (See page3-6).

4.2 IEC 61162 Sentences

Input sentence and sentence priority

Data	Sentence priority
Acknowledge alarm	ACK
AIS base station addressed channel management command	ACM
AIS addressed and binary broadcast acknowledgement	ABK
Datum	DTM
Depth	DPT>DBT
Heartbeat supervision report	HBT
Heading (true)	THS>HDT
Position	GNS>GGA>RMC>GLL
Set alarm state	ALR
Set and drift	CUR>VDR
Speed (position)	VTG>RMC
Speed (SOG)	VBW
Speed (STW)	VBW>VHW
Time and date	ZDA
UAIS VHF data-link message	VDM
UAIS VHF data-link own-vessel report	VDO
Water temperature	MTW
Wind speed and angle (relative)	MWV (R)
Wind speed and angle (true)	MWV (T)

Output sentences

Data	Sentence
Cyclic alert list	ALC
Alert sentence	ALF
Alert command refused	ARC
Acknowledge alarm	ACK
Addressed binary and safety related message	ABM
AIS broadcast binary message	BBM
General event message	EVE
Heartbeat supervision report	HBT
Own ship data	OSD
Radar system data	RSD
Set alarm state	ALR
TT target data	TTD, TLB, TTM
Voyage static data	VSD

APPENDIX 1 JIS CABLE GUIDE

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

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

1. Core Type

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

2. Insulation Type

P: Ethylene Propylene Rubber

3. Sheath Type

Y: PVC (Vinyl)

4. Armor Type

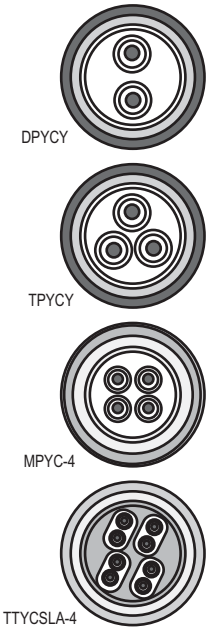
C: Steel

5. Sheath Type

Y: Anticorrosive vinyl sheath

6. Shielding Type

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



EX: TTYCYSLA - 4
(1 2 3 4 5 6)
Designation type ┘ # of twisted pairs ┘

MPYC - 4
(1 2 3 4)
Designation type ┘ # of cores ┘

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

Type	Core Area	Core Diameter	Cable Diameter	Type	Core Area	Core Diameter	Cable Diameter
DPYC-1.5	1.5mm²	1.56mm	11.7mm	TTYCS-1	0.75mm²	1.11mm	10.1mm
DPYC-2.5	2.5mm²	2.01mm	12.8mm	TTYCS-1T	0.75mm²	1.11mm	10.6mm
DPYC-4	4.0mm²	2.55mm	13.9mm	TTYCS-1Q	0.75mm²	1.11mm	11.3mm
DPYC-6	6.0mm²	3.12mm	15.2mm	TTYCS-4	0.75mm²	1.11mm	16.3mm
DPYC-10	10.0mm²	4.05mm	17.1mm	TTYCSLA-1	0.75mm²	1.11mm	9.4mm
DPYCY-1.5	1.5mm²	1.56mm	13.7mm	TTYCSLA-1T	0.75mm²	1.11mm	10.1mm
DPYCY-2.5	2.5mm²	2.01mm	14.8mm	TTYCSLA-1Q	0.75mm²	1.11mm	10.8mm
DPYCY-4	4.0mm²	2.55mm	15.9mm	TTYCSLA-4	0.75mm²	1.11mm	15.7mm
MPYC-2	1.0mm²	1.29mm	10.0mm	TTYCY-1	0.75mm²	1.11mm	11.0mm
MPYC-4	1.0mm²	1.29mm	11.2mm	TTYCY-1T	0.75mm²	1.11mm	11.7mm
MPYC-7	1.0mm²	1.29mm	13.2mm	TTYCY-1Q	0.75mm²	1.11mm	12.6mm
MPYC-12	1.0mm²	1.29mm	16.8mm	TTYCY-4	0.75mm²	1.11mm	17.7mm
TPYC-1.5	1.5mm²	1.56mm	12.5mm	TTYCY-4S	0.75mm²	1.11mm	21.1mm
TPYC-2.5	2.5mm²	2.01mm	13.5mm	TTYCY-4SLA	0.75mm²	1.11mm	19.5mm
TPYC-4	4.0mm²	2.55mm	14.7mm	TTYCYS-1	0.75mm²	1.11mm	12.1mm
TPYCY-1.5	1.5mm²	1.56mm	14.5mm	TTYCYS-4	0.75mm²	1.11mm	18.5mm
TPYCY-2.5	2.5mm²	2.01mm	15.5mm	TTYCYSLA-1	0.75mm²	1.11mm	11.2mm
TPYCY-4	4.0mm²	2.55mm	16.9mm	TTYCYSLA-4	0.75mm²	1.11mm	17.9mm

APPENDIX 2 ROD TERMINALS

MC-3000S, MC-CS Board (24P0114)

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J1	1	24V_VOUT	AI 0.34-6 TQ (blue)	MC1.5-W-Lxxx
	2	24V_GND		
	3	MODBUS-A	AI 0.14-8 GY (gray)	
	4	MODBUS-B		
	5	GND		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J2	1	24V_IN	AI 1.5-6 BK (black)	DPYC-1.5
	2	24V_OUT		
	3	PWR_FAIL-A	AI 0.75-6 GY (Gray)	TTYCS-4 TTYCSLA-4
	4	PWR_FAIL-COM		
	5	PWR_FAIL-B		
	6	NC	-	-

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J4	1	TD1-A	AI 0.75-6 GY (Gray)	TTYCS-4 TTYCSLA-4
	2	TD1-B		
	3	RD1-A		
	4	RD1-B		
	5	ISOGND1		
	6	RD1-H		
	7	RD1-C		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J5	1	TD2-A	AI 0.75-6 GY (gray)	TTYCS-4 TTYCSLA-4
	2	TD2-B		
	3	RD2-A		
	4	RD2-B		
	5	ISOGND2		
	6	RD2-H		
	7	RD2-C		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J6	1	TD3-A	AI 0.75-6 GY (gray)	TTYCS-4 TTYCSLA-4
	2	TD3-B		
	3	RD3-A		
	4	RD3-B		
	5	ISOGND3		
	6	RD3-H		
	7	RD3-C		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J7	1	TD4-A	AI 0.75-6 GY (gray)	TTYCS-4 TTYCSLA-4
	2	TD4-B		
	3	RD4-A		
	4	RD4-B		
	5	ISOGND4		
	6	RD4-H		
	7	RD4-C		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J8	1	TD5-A	AI 0.75-6 GY (gray)	TTYCS-1Q TTYCSLA-1Q
	2	TD5-B		
	3	RD5-H		
	4	RD5-C		
	5	TD6-A		TTYCS-1Q TTYCSLA-1Q
	6	TD6-B		
	7	RD6-H		
	8	RD6-C		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J9	1	TD7-A	AI 0.75-6 GY (gray)	TTYCS-1Q TTYCSLA-1Q
	2	TD7-B		
	3	RD7-H		
	4	RD7-C		
	5	TD8-A		TTYCS-1Q TTYCSLA-1Q
	6	TD8-B		
	7	RD8-H		
	8	RD8-C		

MC-3010A MC-ANALG Board (24P0115)

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J1	1	24V_IN	AI 0.34-6 TQ (blue)	MC1.5-W-Lxxx
	2	24V_GND		
	3	MODBUS-A	AI 0.14-8 GY (gray)	
	4	MODBUS-B		
	5	GND		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J2	1	24V_OUT	AI 0.34-6 TQ (blue)	MC1.5-W-Lxxx
	2	24V_GND		
	3	MODBUS-A	AI 0.14-8 GY (gray)	
	4	MODBUS-B		
	5	GND		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J3*	1	AN1_IN	AI 0.75-6 GY (gray)	TTYCS-1 TTYCSLA-1
	2	AN1_GND		
	3	CURR1_JP1		
	4	CURR1_JP2		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J4*	1	AN2_IN	AI 0.75-6 GY (gray)	TTYCS-1 TTYCSLA-1
	2	AN2_GND		
	3	CURR2_JP1		
	4	CURR2_JP2		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J5*	1	AN3_IN	AI 0.75-6 GY (gray)	TTYCS-1 TTYCSLA-1
	2	AN3_GND		
	3	CURR3_JP1		
	4	CURR3_JP2		

*: For pin #3 and 4, no cable is connected. However the jumper connection is necessary depending on the input specification.

MC-3020D, MC-DIN Board (24P0116)

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J1	1	24V_IN	AI 0.34-6 TQ (blue)	MC1.5-W-Lxxx
	2	24V_GND		
	3	MODBUS-A	AI 0.14-8 GY (gray)	
	4	MODBUS-B		
	5	GND		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J2	1	24V_OUT	AI 0.34-6 TQ (blue)	MC1.5-W-Lxxx
	2	24V_GND		
	3	MODBUS-A	AI 0.14-8 GY (gray)	
	4	MODBUS-B		
	5	GND		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J3*	1	DV12V_OUT1	AI 1-6 RD (red)	MPYC-12
	2	DIGI_IN1		
	3	DIGI_RTN1		
	4	GND		
	5	DC12V_OUT2		
	6	DIGI_IN2		
	7	DIGI_RTN2		
	8	GND		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J4*	1	DV12V_OUT3	AI 1-6 RD (red)	MPYC-12
	2	DIGI_IN3		
	3	DIGI_RTN3		
	4	GND		
	5	DC12V_OUT4		
	6	DIGI_IN4		
	7	DIGI_RTN4		
	8	GND		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J5*	1	DV12V_OUT5	AI 1-6 RD (red)	MPYC-12
	2	DIGI_IN5		
	3	DIGI_RTN5		
	4	GND		
	5	DC12V_OUT6		
	6	DIGI_IN6		
	7	DIGI_RTN6		
	8	GND		

*: Pin #1 and 5: no cable connection. However the jumper connection is necessary between #1 and 2 and #5 and 6 depending on the input specification.

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J6*	1	DV12V_OUT7	AI 1-6 RD (red)	MPYC-12
	2	DIGI_IN7		
	3	DIGI_RTN7		
	4	GND		
	5	DC12V_OUT8		
	6	DIGI_IN8		
	7	DIGI_RTN8		
	8	GND		

*: Pin #1 and 5: no cable connection. However the jumper connection is necessary between #1 and 2 and #5 and 6 depending on the input specification.

MC-3030D, MC-DOUT Board (24P0117)

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J1	1	24V_IN	AI 0.34-6 TQ (blue)	MC1.5-W-Lxxx
	2	24V_GND		
	3	MODBUS-A	AI 0.14-8 GY (gray)	
	4	MODBUS-B		
	5	GND		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J2	1	24V_OUT	AI 0.34-6 TQ (blue)	MC1.5-W-Lxxx
	2	24V_GND		
	3	MODBUS-A	AI 0.14-8 GY (gray)	
	4	MODBUS-B		
	5	GND		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J3	1	A1	AI 1-6 RD (red)	MPYC-12
	2	COM1		
	3	B1		
	4	A2		
	5	COM2		
	6	B2		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J4	1	A3	AI 1-6 RD (red)	MPYC-12
	2	COM3		
	3	B3		
	4	A4		
	5	COM4		
	6	B4		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J5	1	A5	AI 1-6 RD (red)	MPYC-12
	2	COM5		
	3	B5		
	4	A6		
	5	COM6		
	6	B6		

Connector #	Pin #	Signal name	Rod terminal to use	Connected cable
J6	1	A7	AI 1-6 RD (red)	MPYC-12
	2	COM7		
	3	B7		
	4	A8		
	5	COM8		
	6	B8		

APPENDIX 3 DIGITAL INTERFACE

Digital Interface

Input sentence

ABK, ACK, ACM, ACN, ALR, CUR, DBT, DPT, DTM, GGA, GLL, GNS, HBT, HDT, MTW, MWV, RMC, THS, VBW, VDM, VDO, VDR, VHW, VTG, ZDA

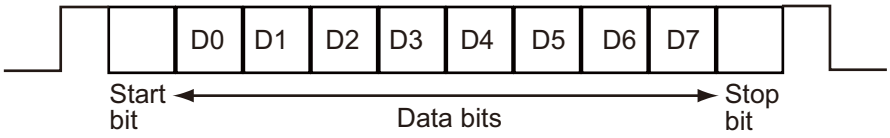
Output sentences

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

Data reception

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

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



Data Sentences

Input sentences

ABK - UAIS Addressed and binary broadcast acknowledgement

$**ABK,xxxxxxxxx,x,x.x,x,x,*hh<CR><LF>
1 2 3 4 5

1. MMSI of the addressed AIS unit (9 digits)
2. AIS channel of reception (No use)
3. Message ID (6, 8, 12, 14)
4. Message sequence number (0 - 9)
5. Type of acknowledgement (See below)
   1 = message was broadcast (6 or 12), 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) (000 - 999)

ACM, ACN - Alert command

$**ACM,hhmmss.ss,aaa,x.x,x.x,ca,a*hh<CR><LF>
$**ACN,hhmmss.ss,aaa,x.x,x.x,ca,a*hh<CR><LF>
1 2 3 4 5 6

1. Time (hh=00 to 23, mm=00 to 59, ss.ss=00.00 to 60.99), null
2. Manufacturer mnemonic code (3 digit alphanumeric code), null
3. Alert identifier (0 to 9999999)
4. Alert instance (1 to 999999), null
5. Alert command (A=ACK from ext. equipment, Q=Request from ext. equipment, O=Responsibility transfer, S=Silence from ext. equipment)
6. Sentence status flag (C should not be null field. Sentence without C is not a command.)

Information about the use of ACN vs ACM

The alert command sentence formatter ACM is defined in IEC 61924-2 Ed. 1. After Ed. 1 was released, the ACM is used by other criteria and the IEC technical corrigendum adopted the sentence formatter ACN to replace the ACM. However, equipment released before the adoption of the ACN may use ACM. This equipment uses both ACN and ACM.

ALR - Set alarm state

$**ALR,Hhmmss.ss,xxx,A,A,c—c,*hh<CR><LF>
1 2 3 4 5

1. Time of alarm condition change, UTC (000000.00 - 235960.99)
2. Unique alarm number (identifier) at alarm source (000 - 999)
3. Alarm condition (A=threshold exceeded, V=not exceeded)
4. Alarm acknowledge state (A=acknowledged, V=not acknowledged)
5. Alarm description text (alphanumeric characters, max. 32)

CUR - Current

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

1. Validity of data (A=valid, V=not valid)
2. Data set number (0 - 9)
3. Layer number (0.0 - 3.0)
4. Current depth in meters (No use)
5. Current direction in degrees (0.00 - 360.00)
6. Direction reference in use (true or relative)
7. Current speed in knots (0.00 - 99.99)
8. Reference layer depth in meters (No use)
9. Heading (0 to 360.00)
10. Heading reference in use (true or magnetic)
11. Speed reference (B=Bottom track W=Water track P=Positioning system)

DBT - Depth below transducer

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

1. Water depth (0.00-99999.99)
2. feet
3. Water depth (0.00-99999.99)
4. Meters
5. Water depth (0.00-99999.99)
6. Fathoms

DPT - Depth

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

1. Water depth relative to the transducer, meters (0.00-99999.99)
2. Offset from transducer, meters (No use)
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=WGS84 W72=WGS72 S85=SGS85, P90=PE90
2. Local datum subdivision code (NULL or one character)
3. Lat offset, min (0 - 59.99999)
4. N/S
5. Lon offset, min (0 - 59.99999)
6. E/W
7. Altitude offset, meters (No use)
8. Reference datum (W84=WGS84 W72=WGS72 S85=SGS85, P90=PE90)

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
4. Longitude (0000.00000 - 18000.00000)
5. E/W
6. GPS quality indicator (1 - 8)
7. Number of satllite in use (No use)
8. Horizontal dilution of precision (0.0 - 999.9)
9. Antenna altitude above/below mean sealevel (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)
14. Differential reference station ID (No use)

GLL - Geographic position, latitude/longitude

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

1. Latitude (0000.00000 - 9000.00000)
2. N/S
3. Longitude (0000.00000 - 18000.00000)
4. E/W
5. UTC of position (No use)
6. Status (A=data valid V=data invalid)
7. Mode indicator (A=Autonomous D=Differential E=Estimated M=Manual input S=Simulator)

GNS - GNSS fix data

$**GNS,hhmmss.ss,llll.lll,a,IIIII.III,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
4. Longitude (0000.00000 - 18000.00000)
5. E/W
6. Mode indicator (P, R, D, F, A, 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 (-999.99 - 9999.99)
10. Geoidal separation (No use)
11. Age of differential data (0 - 99)
12. Differential reference station ID (No use)
13. Naivgational status indicator (S=Safe, C=Caution, U=Unsafe, V=Not valid)