FURUNO

OPERATOR'S MANUAL

取扱説明書

SATELLITE COMPASS™

サテライトコンパス™

Model **SCX-21**

NMEA 0183 Specification
NMEA 0183 仕様

FURUNO ELECTRIC CO., LTD.

www.furuno.com

ECF
(Elemental Chlorine Free)

The paper used in this manual
is elemental chlorine free.

・ 機器の修理・使用方法等に関するお問い合わせは、お買い上げの販売店・代理店、最寄りの
当社支店・営業所あてへお願いします。

FURUNO ELECTRIC CO., LTD.
古野電気株式会社

・FURUNO Authorized Distributor/Dealer お問い合わせは

A : DEC. 2019
A1 : FEB. 3, 2020

Printed in Japan

Pub. No. OMC-72870-A1

(ETMI) SCX-21

00019529410

IMPORTANT NOTICES

General

- This manual has been authored with simplified grammar, to meet the needs of international users.
- The operator of this equipment must read and follow the instructions in this manual. Wrong operation or maintenance can void the warranty or cause injury.
- Do not copy any part of this manual without written permission from FURUNO.
- If this manual is lost or worn, contact your dealer about replacement.
- The contents of this manual and the equipment specifications can change without notice.
- The example screens (or illustrations) shown in this manual can be different from the screens you see on your display. The screens you see depend on your system configuration and equipment settings.
- Save this manual for future reference.
- Any modification of the equipment (including software) by persons not authorized by FURUNO will cancel the warranty.
- The following concern acts as our importer in Europe, as defined in DECISION No 768/2008/EC.
  - Name: FURUNO EUROPE B.V.
  - Address: Ridderhaven 19B, 2984 BT Ridderkerk, The Netherlands
- All brand, product names, trademarks, registered trademarks, and service marks belong to their respective holders.

How to discard this product

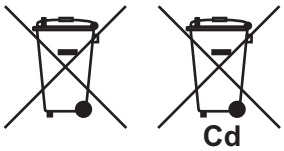
Discard this product according to local regulations for the disposal of industrial waste. For disposal in the USA, see the homepage of the Electronics Industries Alliance (http://www.eiae.org/) for the correct method of disposal.

How to discard a used battery

Some FURUNO products have a battery(ies). To see if your product has a battery, see the chapter on Maintenance. If a battery is used, tape the + and - terminals of the battery before disposal to prevent fire, heat generation caused by short circuit.

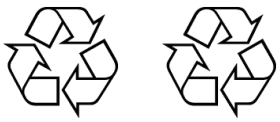
In the European Union

The crossed-out trash can symbol indicates that all types of batteries must not be discarded in standard trash, or at a trash site. Take the used batteries to a battery collection site according to your national legislation and the Batteries Directive 2006/66/EU.



In the USA

The Mobius loop symbol (three chasing arrows) indicates that Ni-Cd and lead-acid rechargeable batteries must be recycled.
Take the used batteries to a battery collection site according to local laws.



In the other countries

There are no international standards for the battery recycle symbol. The number of symbols can increase when the other countries make their own recycle symbols in the future.

SAFETY INSTRUCTIONS

The operator and installer must read the applicable safety instructions before attempting to operate or install the equipment. Failure to comply with these safety instructions may cause injury, loss of life or damage to 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

Safety instructions for the installer

WARNING

Turn off the power at the mains 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.

ELECTRICAL SHOCK HAZARD
Do not open the equipment unless totally familiar with electrical circuits and service manual.

Only qualified personnel should work inside the equipment.

Use the specified power cable.

Fire can result if an incorrect cable is used.

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can occur.

CAUTION

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

	Standard compass	Steering compass
Satellite Compass SCX-21	0.30 m	0.30 m

Safety instructions for the operator

⚠ WARNING

ELECTRICAL SHOCK HAZARD
Do not open the equipment unless totally familiar with electrical circuits and service manual.

Only qualified personnel should work inside the equipment.

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can occur.

Turn off the power immediately if water leaks into the equipment or smoke or fire is coming from the equipment.

Failure to turn off the equipment can cause fire or electrical shock.
Contact a FURUNO agent for service.

Use the correct fuse.

A wrong fuse can cause fire or serious damage to the equipment.

CAUTION

No single navigation aid (including this unit) should ever be relied upon as the exclusive means for navigating your vessel.

The navigator is responsible for checking all aids available to confirm his position. Electronic aids are intended to assist, not replace, the navigator.

TABLE OF CONTENTS

Note: This manual contains both English and Japanese instructions. The Packing Lists, Outline Drawings, and Interconnection Diagram are located at the back of this manual.

FOREWORD

A Word to the Owner of the SCX-21

FURUNO Electric Company thanks you for purchasing the FURUNO SCX-21 Satellite Compass™. We are confident you will discover why the FURUNO name has become synonymous with quality and reliability.

Since 1948, FURUNO Electric Company has enjoyed an enviable reputation for quality and reliability throughout the world. This dedication to excellence is furthered by our extensive global network of agents and dealers.

Your equipment is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless properly operated and maintained. Please carefully read and follow the operation and maintenance procedures in this manual.

We would appreciate feedback from you, the end-user, about whether we are achieving our goal.

Thank you for considering and purchasing FURUNO equipment.

Features

The SCX-21 is a new Satellite Compass™ designed with FURUNO advanced GPS kinematic technology. This compass has a wide range of applications for both land and sea vessels.

The main features are:

- Heading accuracy of 0.5° RMS (1.0° when stationary).
- Perfect for use as a heading sensor for RADAR/TT, Echo trails, AIS, Autopilot and Scanning SONARs.
- Outputs accurate heading, position, time, speed and course.
- Pitch and roll output in digital format for ship's motion correction.
- Attitude settling time of 60 seconds.
- Outputs data in NMEA 0183 format
- Aesthetically pleasing antenna fits nicely on recreational boats.
- Can use the GP-39 as a dedicated display unit.

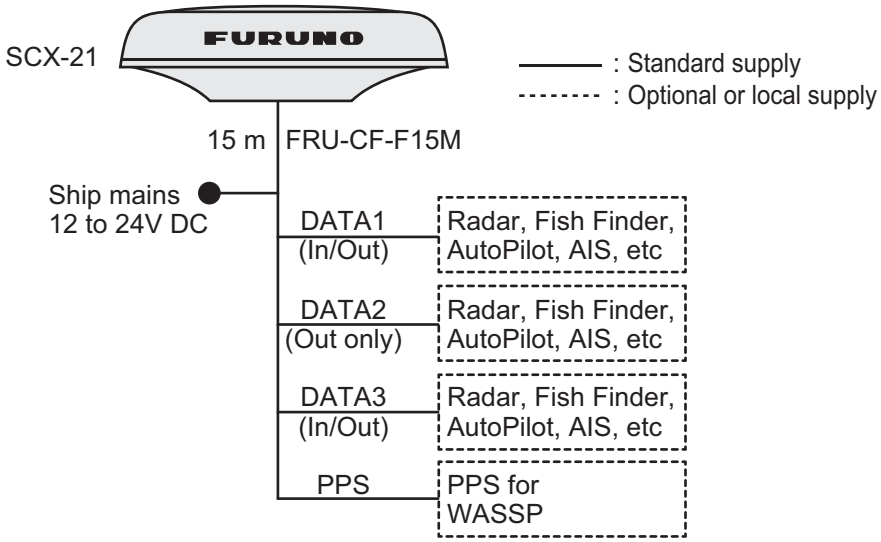
Program numbers

Unit & PC Board	PCB/Application	Program No.*
Antenna Unit	STARTER	2051599 01.xx
	BOOTER	2051600 01.xx
	APL	2051601 01.xx
	GNSS (1 to 4)	48505230 xx

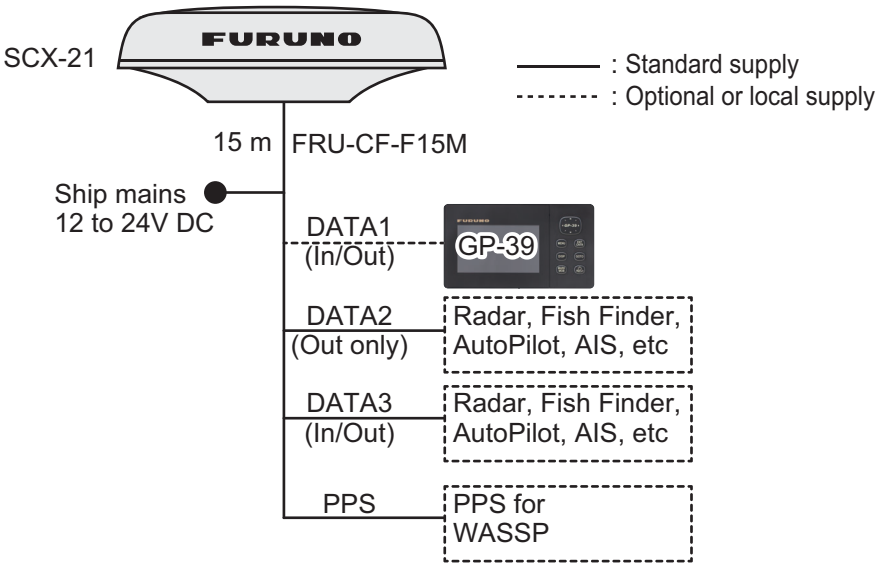
*: "xx" denotes version number.

SYSTEM CONFIGURATION

Basic configuration for sensor only



Basic configuration with display unit (GP-39)



EQUIPMENT LIST

Standard supply

Name	Type	Code No.	Qty.	Remarks
Antenna Unit	SCX-21	-	1	For NMEA 0183
Spare Parts	SP20-01901	001-556-110	1	Fuse, 2 pcs.
Installation Materials	CP20-04630	000-036-771	1 (Select one)	For pole mount kit of antenna unit with cable FRU-CF-F15M (15 m).
	CP20-04640	000-036-772		For pole mount kit (w/Mast Mounting Kit CP20-04605*) of antenna unit. Includes cable FRU-CF-F15M (15 m). *: Includes Fixing Support Fixture, Pipe and Hose Clamp (ϕ25 to 35 mm), and 32A to 40A (ϕ35 to 50 mm) diameter mast installations.

Optional supply

Name	Type	Code No.	Remarks
Cable Assembly	FRU-CF-F15M	001-555-560	
	FRU-CF-F30M	001-555-570	
Right Angle Mounting Base	NO.13-QA330	001-111-910-10	
Pole Mount Kit*	CP20-04603	001-556-200	
Mast Mounting Kit*	CP20-04605	001-556-240	Requires CP20-04603.
Hose Clamp (Large)	OP20-52	001-556-260	For 32A to 40A (ϕ35 to 50 mm) diameter mast installations.
Bird-Repellent Fixture	OP20-54	001-556-280	2 pcs.
Snow Cover Kit	OP20-53	001-556-320	

*: Select the appropriate kit depending on the installation location and configuration.

1. INSTALLATION

NOTICE

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

You can install the antenna unit as follows. See the outline drawings at the back of this manual.

- Platform mount, fixed from bottom (section 1.2)
- Pole mount (section 1.3)
- Antenna Base mount (section 1.4, option)

Use the NMEA 0183 antenna cable (FRU-CF-F15/30M) for installation.

1.1 Installation Considerations

1.1.1 General considerations

- Keep the length of the antenna cable in mind when selecting a mounting location.
- Make sure the mounting location is strong enough to support the weight of the unit. See the outline drawings at the back of the manual.
- Leave enough space around the unit for service and maintenance. See the outline drawings at the back of this manual for minimum service clearance.
- The sensor should be separated more than three meters from Inmarsat F/FB antennas. Select a location outside this transmission area.
- Do not bundle the antenna cable with radio equipment cables. When these noise reductions are insufficient, adjust the squelch on the radio equipment.
- Select a location with no obstructions to the radio waves.
- Select a location with no local vibration or impact (including vibrations generated by an engine or the mounting mast for this equipment) for the GPS sensor in the antenna unit.
- Observe the compass safe distances (see page iii) to prevent interference to a magnetic compass.

How to select the installation site

The installation site must satisfy the conditions described in the antenna installation procedure at the back of this manual (Dwg. No. C7286-Y01-*).

1.2 Platform Mount

The antenna unit is mounted on a level platform, with the fixing screws inserted from the underside of the unit.

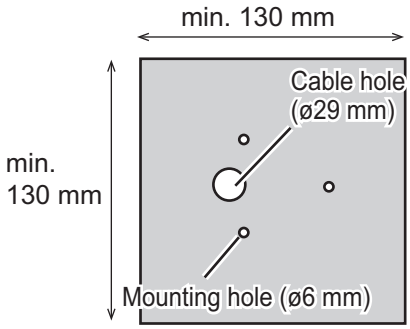
1.2.1 Required tools

The following tools should be prepared in advance for this installation.

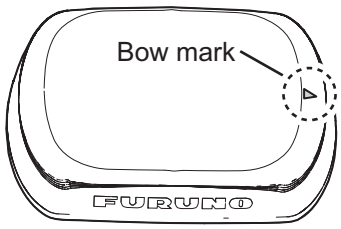
Name	Remarks
Electrical Drill	For making the mounting holes
Drill Bit	ϕ6
Hole Saw	For making the cable hole ϕ29 mm.
File	For smoothing the cut edge of the cable hole
Phillips-head Screwdriver	#2

1.2.2 How to mount the Antenna Unit

1. Construct a suitable mounting platform, minimum size 130 mm × 130 mm.
   Note: The mounting platform must be flat, level and firmly secured.
2. Referring to the outline drawing at the back of this manual, drill three mounting holes (ϕ6 mm) and a cable hole for passing the supplied antenna in the mounting platform. The diameter of a cable hole is ϕ29±2 mm for SCX-21.

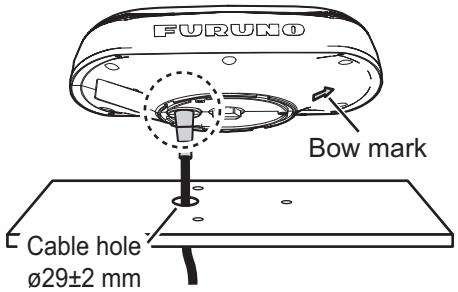


   Note: Place the antenna unit on the platform, then orient the unit so the bow mark on its base is facing the ship's bow.

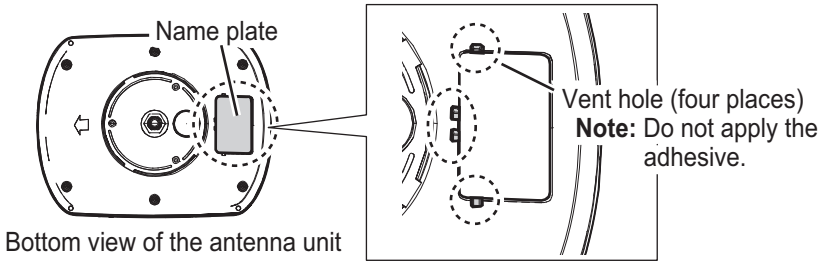


3. Pass the antenna cable through the hole made at step 2 so the connector of the antenna cable exits on the upper side of the mounting platform.

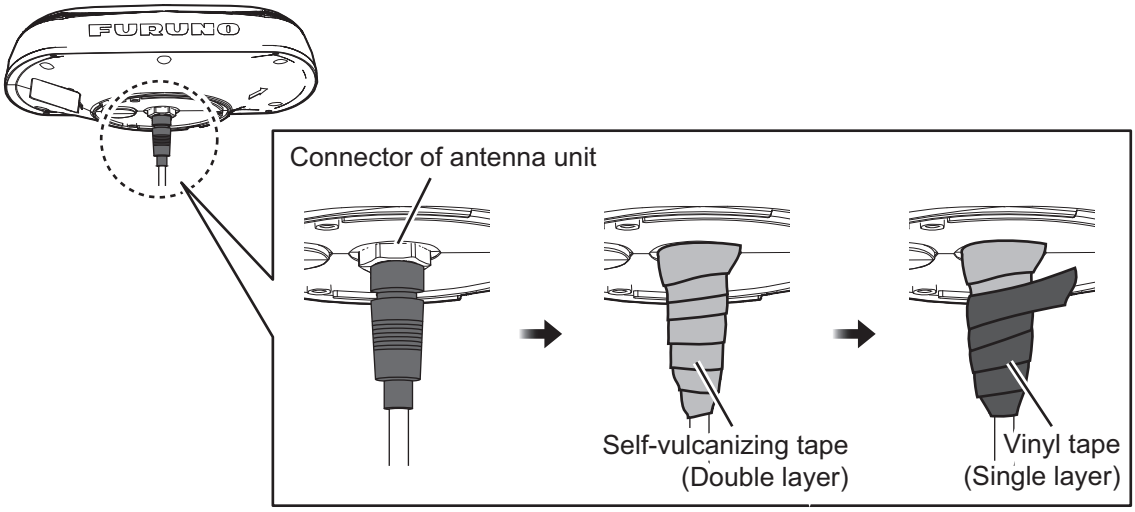
4. Connect the antenna cable to the antenna unit connector.



Note: DO NOT apply the supplied adhesive to the four vent holes near the name plate.

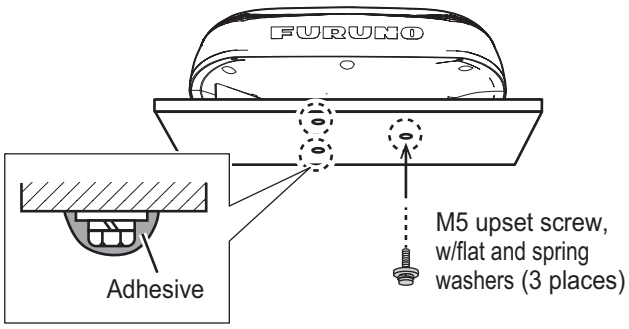


5. Wrap self-vulcanizing tape **twice** at the junction between connectors of the antenna unit and the antenna cable. Then wrap vinyl tape **once** over the self-vulcanizing tape for waterproofing.
Note: Wrap the tapes so as to cover both connectors of the antenna unit and the antenna cable.



6. Adjust the direction of the antenna unit so the bow mark on its base is facing the ship's bow.
Note: When the antenna unit is placed on the platform, make sure that the platform is not inclined.

7. Fasten the antenna unit to the mounting location with the three sets of supplied upset screws (M5×20, flat and spring washers attached) from the bottom through the mounting holes at step 2. After fastening the screws, coat the screw heads with the supplied adhesive.

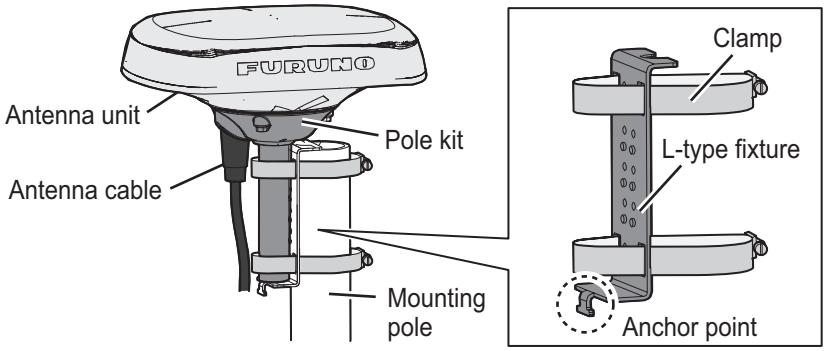


Thickness (mounting plate)	Length of M5 screw
2 to 10 mm	20 mm (supplied)
Otherwise	thickness + 8 to 16 mm (local supply)

Note: Screw length is dependent on the thickness of the mounting platform.

1.3 Pole Mount

Combine the antenna unit with the pole kit with the pole kit fixture then attach the antenna unit assembly to the mounting pole.

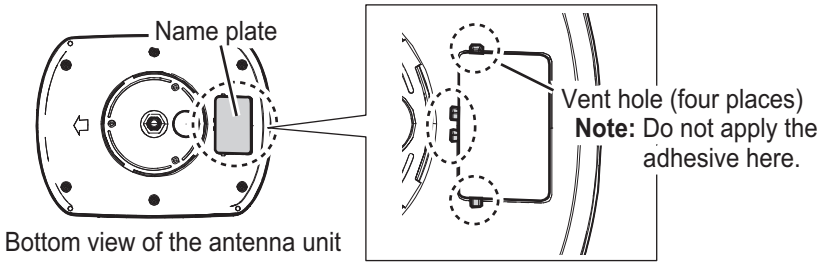


1.3.1 Installation notices

- The diameter of the mounting pole must be 25 to 50 mm.
- Use the **supplied** pole kit and the **supplied** pole kit fixture for the pole mount installation so that the bow mark of the antenna unit faces to the bow.
- Select the correct clamp size of the pole kit fixture considering the diameter of the mounting pole.

Name	Mast diameter	Remarks
Hose Clamp	For 20A to 25A (ϕ25 to 35 mm)	Standard supply with CP20-04603
	For 32A to 40A (ϕ35 to 50 mm)	Optional supply (OP20-52).

- DO NOT apply the supplied adhesive to the four vent holes near the name plate.



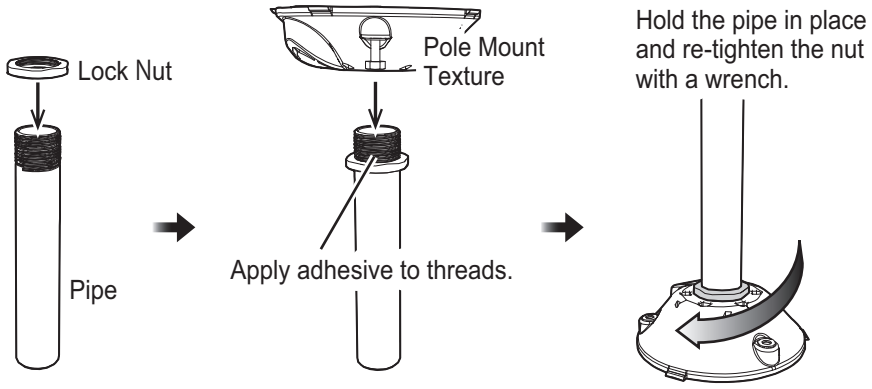
1.3.2 Required tools

The following tools should be prepared in advance for this installation.

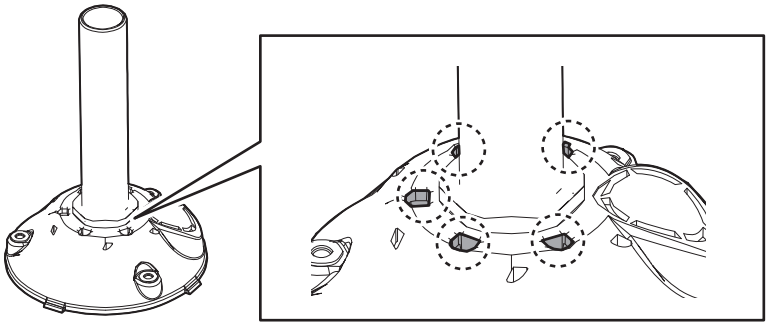
Name	Remarks
Phillips-head Screwdriver	#2
Slotted Head Screwdriver	For clamp bolts.
Wrench	For fixing lock nut.
Cable tie	Two pieces (at least), for fixing the antenna cable.
Nipper	For removing the cable entrance cover.
Self-vulcanizing tape	For waterproofing the connector.
Vinyl tape	For waterproofing the connector.

1.3.3 How to assemble the pole kit

1. Thread the supplied lock nut onto the supplied pipe then tighten to the end of thread as shown in the figure below.
2. Apply the adhesive around the threads of the pipe then attach the pole mount texture to the pipe.
3. Turn the assembly upside down, hold the pipe steady and tighten the nut again with a wrench. The torque must be 15 N•m.

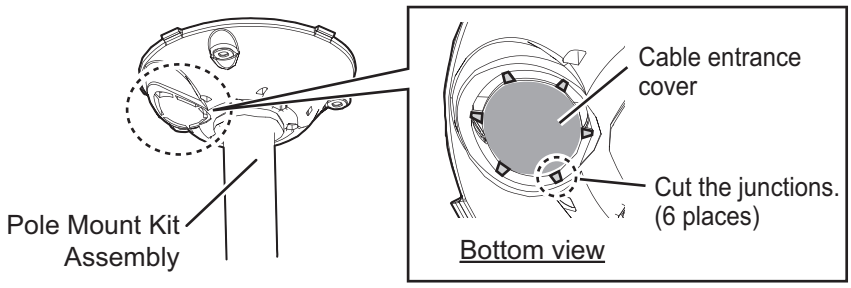


4. Wipe off the excess adhesive.
   Note: Do not cover the five drain holes (shown in the figure below) with the adhesive.

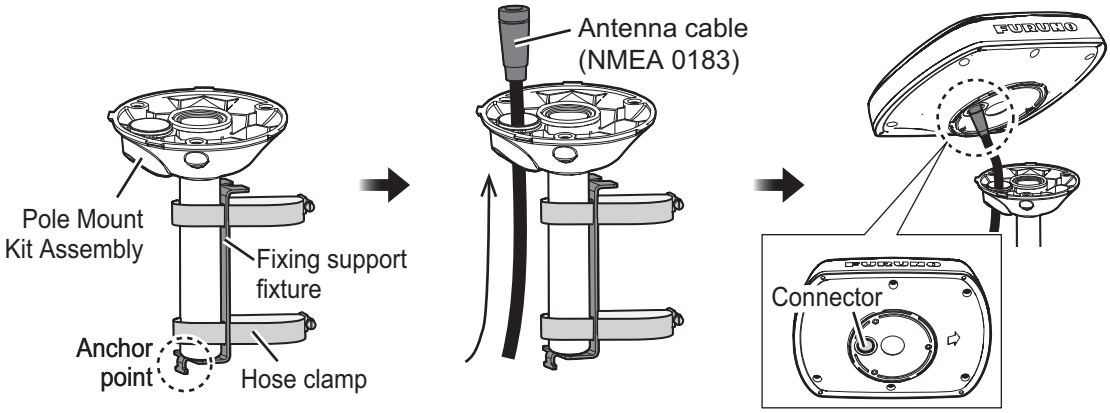


1.3.4 How to mount the Antenna Unit

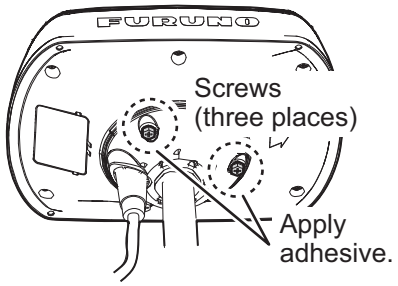
1. Remove the cable entrance cover on the pole mount kit assembly with a nipper to pass through the antenna cable for NMEA 0183 on the antenna base.



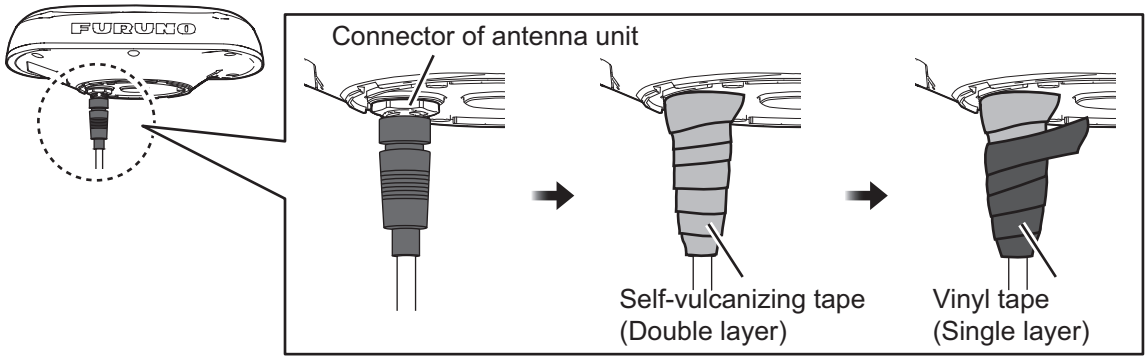
2. Set the hose clamps on the pole mount kit assembly and pass the antenna cable for NMEA 0183 from the underside through the cable entrance of the pole mount kit assembly. Then connect the antenna cable for NMEA 0183 to the connector of the antenna unit.
   Note: Make sure the anchor point of the fixing support fixture faces downward.



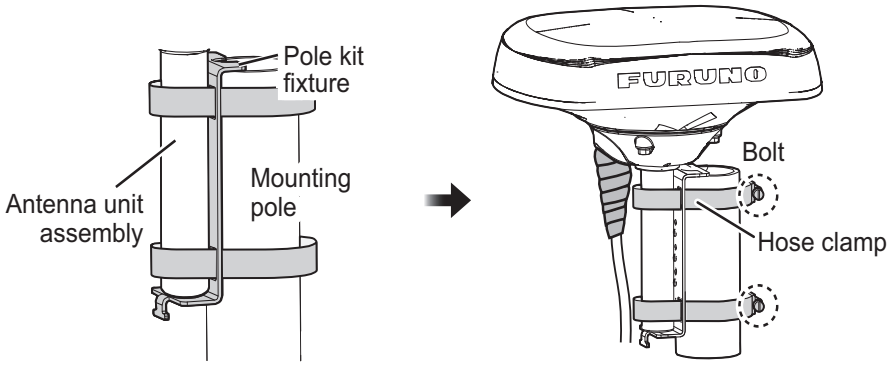
3. Set the antenna unit to the pole mount kit assembly and secure the antenna unit with the three supplied M5 screws from the underside. After fixing screws, coat the screw heads with the supplied adhesive.



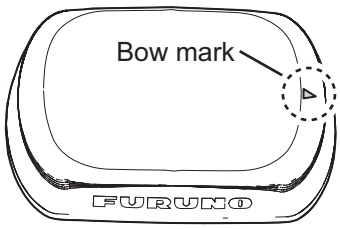
4. Wrap self-vulcanizing tape **twice** at the junction between connectors of the antenna unit and the antenna cable. Then wrap vinyl tape **once** over the self-vulcanizing tape for waterproofing.
   Note: Wrap the tapes so as to cover both connectors of the antenna unit and the antenna cable.



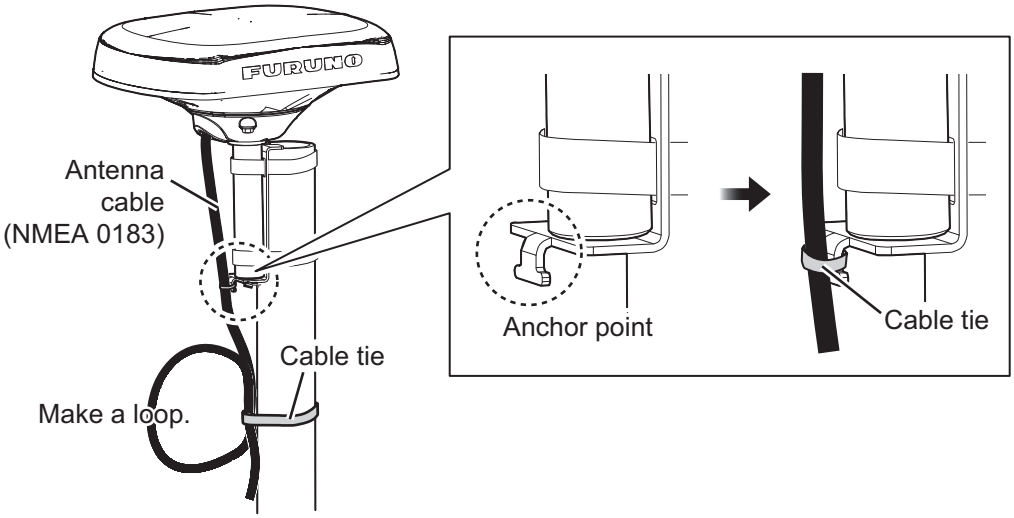
5. Set the antenna unit assembly to the mounting pole so that the pole kit fixture is located at the top of the mounting pole and easily adjust the position of the antenna later in this procedure, as shown in the figure shown below. Then fasten the hose clamps loosely.



6. Adjust the direction of the antenna unit so the bow mark is facing the ship's bow.



7. Fasten the hose clamps to fix the antenna unit.
8. Secure the antenna cable for NMEA 0183 at the anchor point of the fixing support fixture with the supplied cable tie. Make a loop in the antenna cable, then fix the looped section to the pole as shown in the figure below.



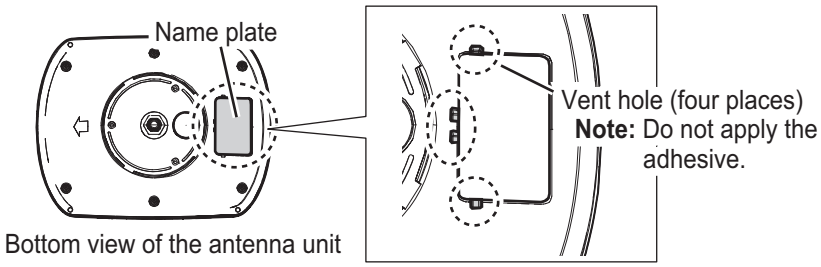
1.4 Antenna Mounting Base (option)

The antenna unit can be mounted on the following locations, using the optional antenna base.

- Inclined surface (adjustable up to 35°)
- Narrow, flat surface

1.4.1 Installation notices

- Do not install the unit on an uneven surface.
- DO NOT apply the adhesive to the four vent holes near the name plate.



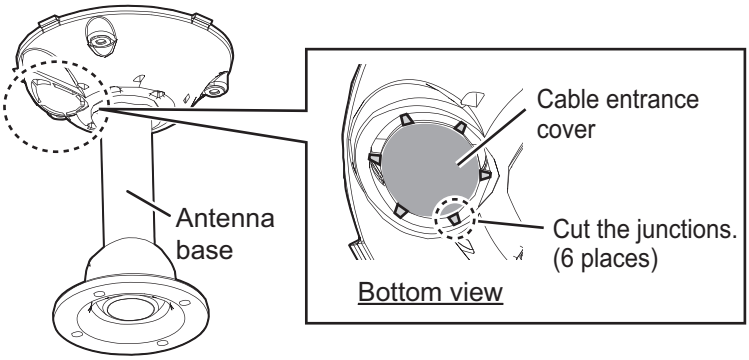
1.4.2 Required tools

The following tools should be prepared in advance for this installation.

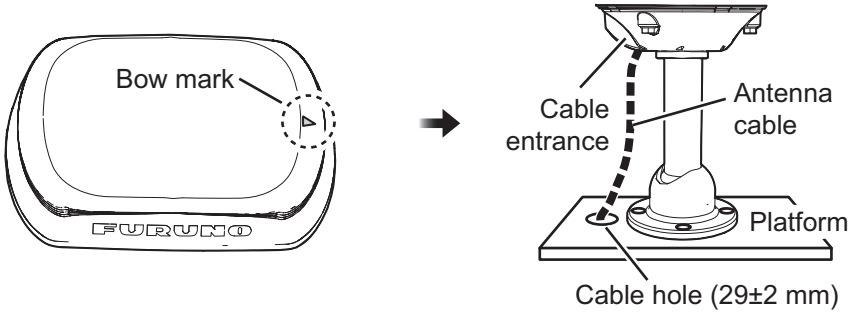
Name	Remarks
Electrical Drill	For making the mounting holes
Drill Bit	ϕ4.2 to 5
Hole Saw	For making the cable hole (ϕ25 mm)
File	For smoothing the cut edge of the cable hole
Phillips-head Screwdriver	#2
Nipper	For removing the cable entrance cover

1.4.3 How to mount the Antenna Unit

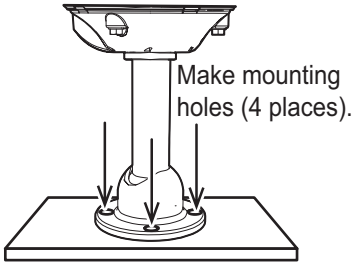
1. Remove the cable entrance cover on the antenna base with a nipper to pass through the antenna cable for NMEA 0183 on the antenna base.



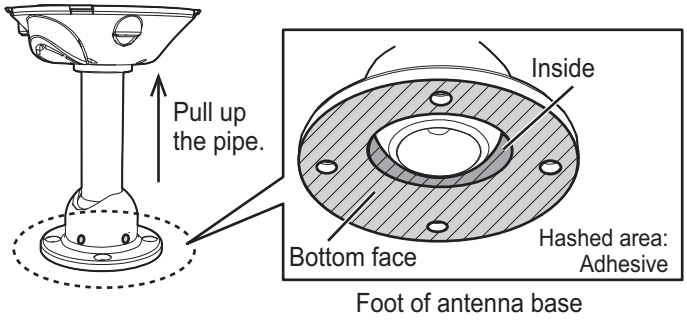
2. Attach the pole mount kit to the antenna base referring to section 1.3.3.
   Note: The pipe included in the pole mount kit is not used.
3. Set the antenna base to the mounting location considering the tilt direction of the antenna base. If the antenna cable needs to be pulled out from a hole on the platform, make an antenna cable hole (more than ϕ29 mm) on the mounting platform considering the location of the cable entrance of the antenna base.
   Note: The possible tilt direction of the antenna base depends on the setting position of the antenna base.



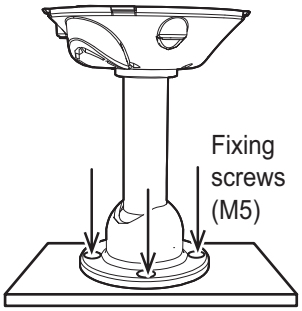
4. Make four mounting holes (ϕ4.2 to 5 mm) on the mounting platform.



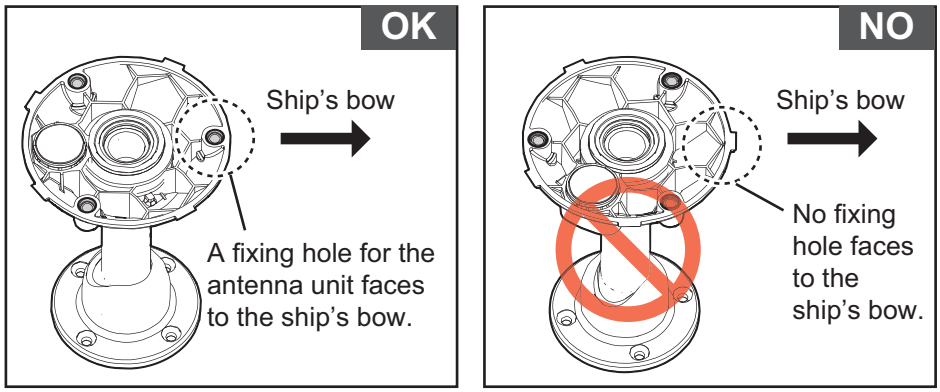
5. <u>If a hole (not for the cable hole) is located just below the antenna base,</u> pull the pipe slightly upwards then apply the supplied marine sealant to the inside and bottom face the antenna base footing.



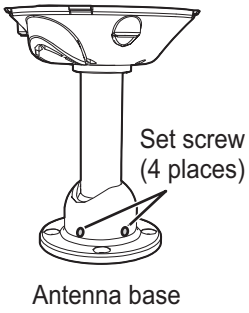
6. Fit the antenna base to the platform so that the mounting holes are aligned with each other, then fasten the four supplied M5 screws tightly to secure the antenna base.



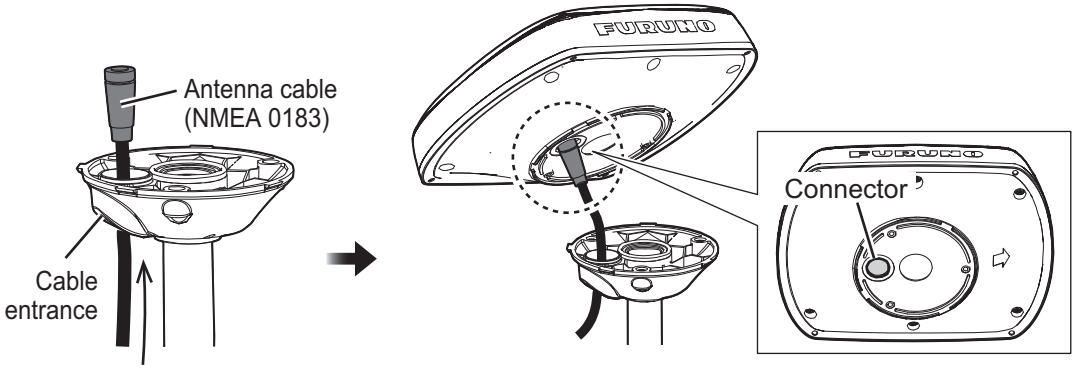
7. Loosen the four set screws on the antenna base with the supplied hex wrench and adjust the direction of the pipe while keeping in mind the fixing hole is pointed towards the ship's bow as illustrated below.



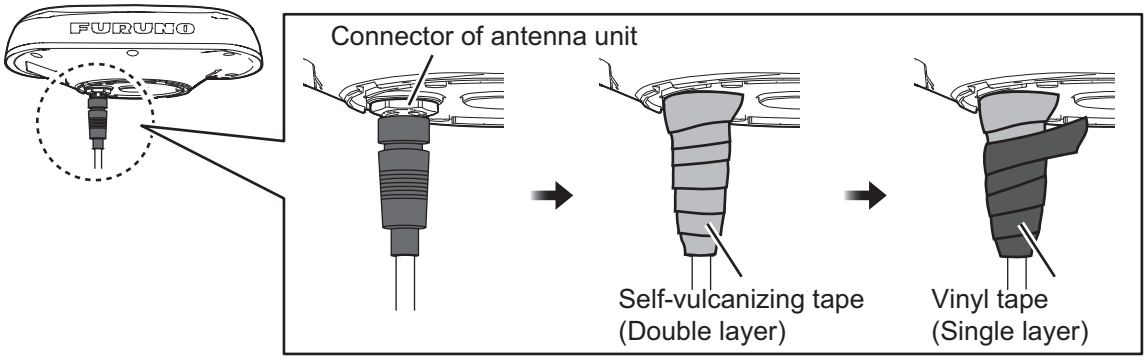
8. Remove the hex socket head bolt one by one and fasten the supplied screws with adhesive loosely. After loosely fastening four screws, fasten them tightly then wipe off the excess adhesive.
Note: The adhesive takes approximately 30 minutes to adhere.



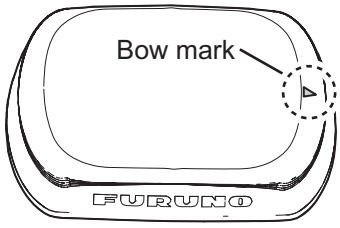
9. Pass NMEA 0183 cable through the cable entrance of the antenna base then connect the NMEA 0183 antenna cable to the bottom of the antenna unit.



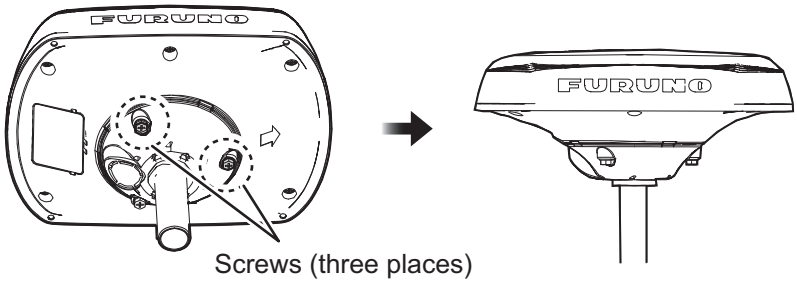
10. Wrap self-vulcanizing tape **twice** at the junction between connectors of the antenna unit and the antenna cable. Then wrap vinyl tape **once** over the self-vulcanizing tape for waterproofing.
Note: Wrap the tapes so as to cover both connectors of the antenna unit and the antenna cable.



11. Set the antenna unit to the antenna base, then adjust the direction of the antenna unit so the bow mark on its base is facing the ship's bow.



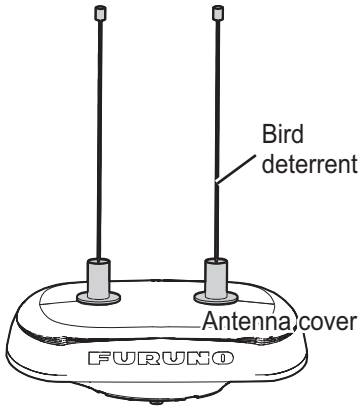
12. Secure the antenna unit with the supplied three M5 screws from the underside.



1.5 Bird Deterrents (Option)

The optional bird deterrents (OP20-54) can help keep birds from resting on your antenna.

Remove the double-sided tape from two bird deterrents, then attach to the antenna cover. Coat around the contact area of both bird deterrents with the supplied adhesive.



1.6 Snow Cover Kit (Option)

The optional Snow Cover Kit (Type: OP20-53; Code: 001-556-320) is available to reduce snow build-up on your antenna.

To install this kit, see the instructions (C72-01901) supplied with the kit.

1.7 Wiring

Connect the antenna cable to each navigational equipment using data ports.

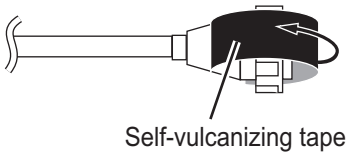
Note: When using the GP-39 as a dedicated display unit, connect the DATA1 cable to the GP-39 port1 connector.

1.7.1 How to secure and protect cable connectors

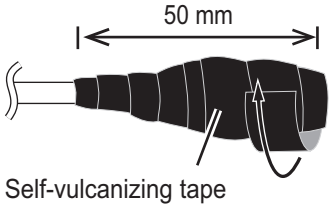
Where the connectors are subject to rain or water splash, the connectors should be wrapped with vinyl tape to prevent corrosion and avoid short-circuits. This also includes any unused connectors.

Securing and protecting unused cable connectors

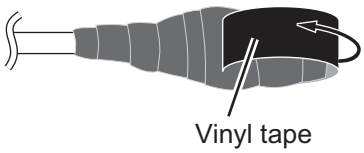
1) Cover the loose end of the cable connector with self-vulcanizing tape.



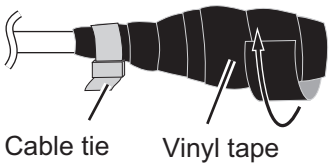
2) Wrap the connector with a layer of vulcanizing tape, covering approx. 50 mm of the connected cable. Confirm that the connector is covered.



3) Wrap vinyl tape over the self-vulcanizing tape.

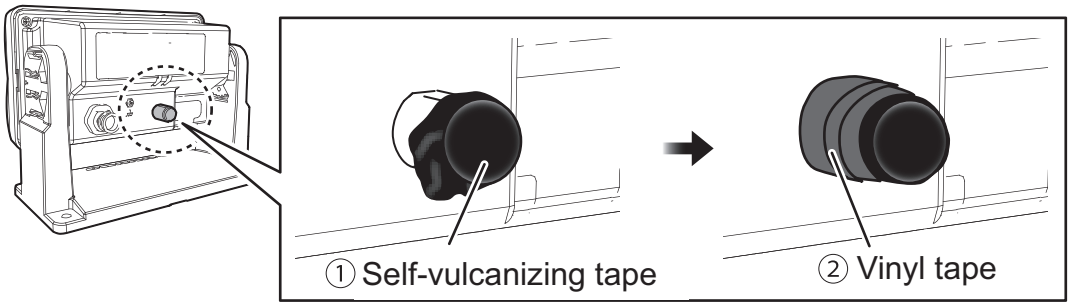


4) Wrap the connector with a layer of vinyl tape. Bind the tape end with a cable tie to prevent the tape from unraveling.



1.7.2 How to protect unused connector of display unit

The unused connector of GP-39 should be wrapped with self-vulcanizing tape and vinyl tape (local supply) to prevent corrosion and avoid short-circuits.



1. Cover the cable entry for unused connector of GP-39 with self-vulcanizing tape.
2. Wrap the side of the connector with vinyl tape to prevent the self-vulcanizing tape from peeling off.

2. OPERATIONAL OVERVIEW

2.1 How to Turn the Power On/Off

Your SCX-21 has no power switch. To turn the SCX-21 on or off, use the ship's mains.

2.2 How to Access the SCX-21 Settings

You can view and change the settings for your SCX-21 using one of two methods:

1) From the dedicated display (GP-39 using SCX-21 operation mode).
   This manual uses the GP-39 for all operations and display examples are taken from the GP-39. For detailed instruction on how to use the GP-39, see the operator's manual included with the GP-39.

   Also, the applicable program version of GP-39 for SCX-21 connection is shown below;

   - CPU Main: 2051584-03.01 (or later)
   - CPU Boot: 2051583-03.01 (or later)

2) From the PC Setting Tool software.
   For operation from the PC Setting Tool, see the manual included with the software.

2.2.1 GP-39 Controls

No.	Key name	Description
1	CursorPad	• Moves the cursor • Selects (highlights) items in the menu.
2	MENU key	• Opens the menu. For plotter and highway displays, press twice. For all other displays, press once. • Shows the zoom window (plotter and highways displays only).
3	DISP key	Changes the display mode.
4	MARK/MOB key	• **Long press**: Inscribe a MOB mark. • **Short press**: Registers own ship position as waypoint.

No.	Key name	Description
5	ENT/CNTR key	• **Long press**: Returns own ship position to center (plotter display only). • **Short press**: Confirms menu selection.
6	GOTO key	Set the cursor location on the screen as a destination.
7	PWR/BRILL key	• **Long press**: Turns power off. • **Short press**: Turns power on, shows Brill window.

2.2.2 How to operate the menu

To operate the menu, do the following:

1. Press the **MENU** key to show the main menu. From [Plotter] or [Highway] display modes, press the **MENU** key twice.
2. Press ▼ or ▲ on the CursorPad to select the desired menu item, then press the **ENTER** key.
3. Press ▼ or ▲ on the CursorPad to select the desired sub-menu item, then press the **ENTER** key.
4. Press ▼ or ▲ on the CursorPad to select the desired setting, then press the **ENTER** key.
5. Press the **DISP** key to close the menu or press the **MENU** key to go back one layer in the menu.

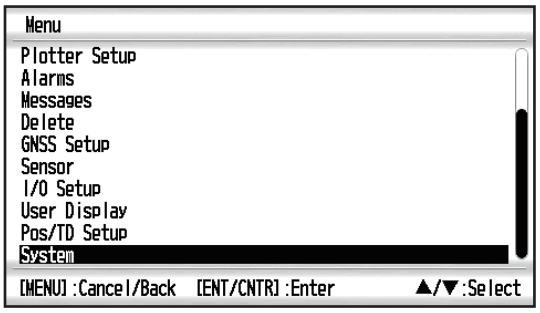
For the sake of brevity, procedures in this manual use the following terminology:

Terminology	Meaning
Open the menu.	Do step 1 of the above procedure.
Select “xxx”.	Press ▼ or ▲ on the CursorPad to select xxx, the press the **ENTER** key.
Close the menu.	Do step 5 of the above procedure.

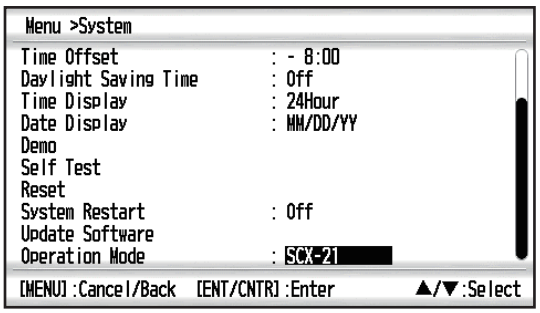
2.2.3 How to change the GP-39 operation mode

1. Open the menu.
2. Select [System] to show the [System] menu.
3. Select [Operation Mode] to show the setting options.
4. Select the required operation mode.
   To use the GP-39 as a dedicated display for the SCX-21, select [SCX-21].
   To use the GP-39 normally (with no access to the SCX-21 settings), select [GP-39].
5. Close the menu.

Main menu



System menu



Note 1: Settings are not shared between operation modes.

Note 2: Some default settings are different, depending on the operation mode. For details, see the menu tree at the back of this manual. This manual uses the default settings for SCX-21 operation mode.

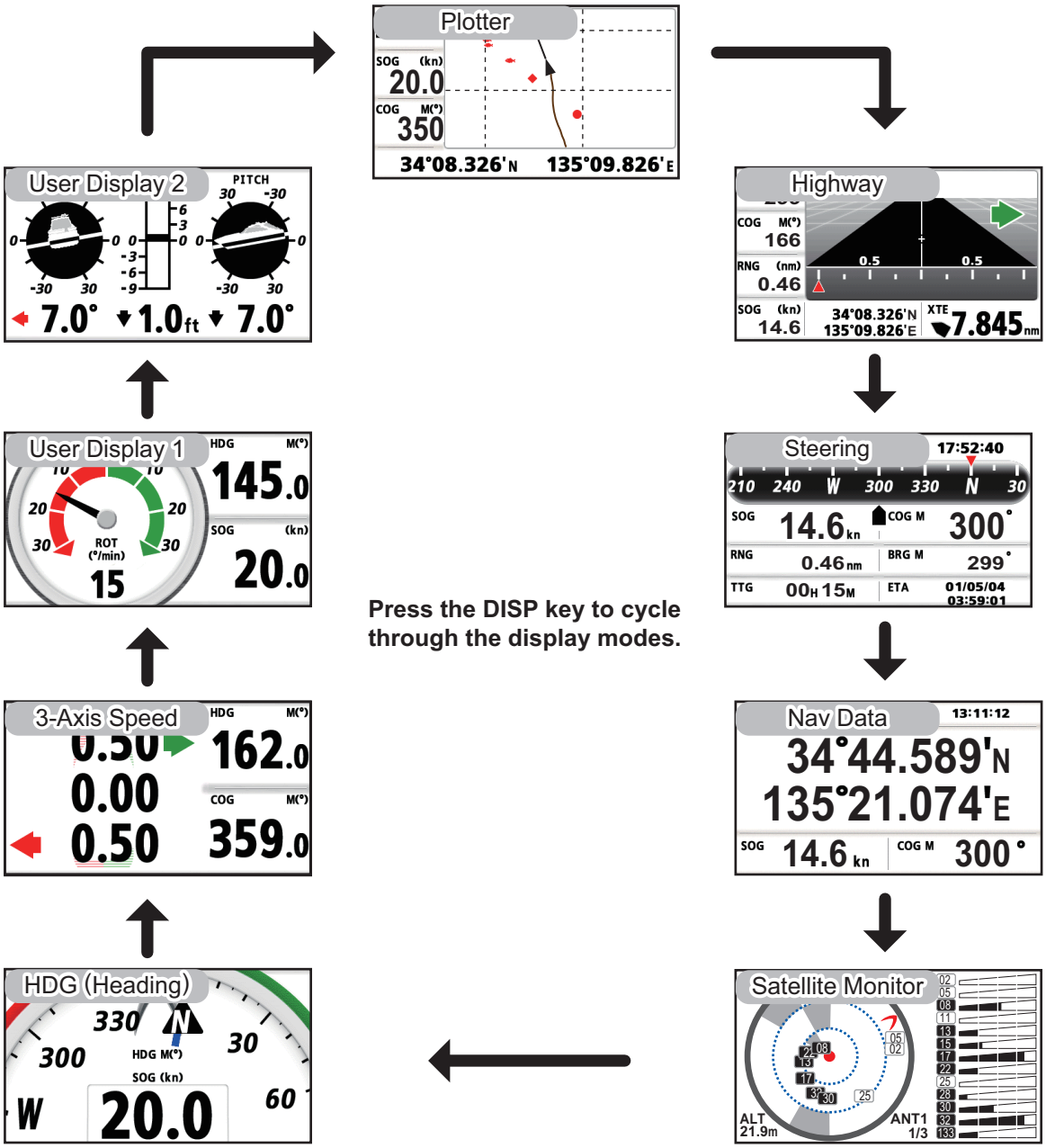
If you selected SCX-21 as the operation mode, you can now use your GP-39 as a dedicated display unit for the SCX-21. You also have access to all GP-39 functions.

2.3 Display Modes

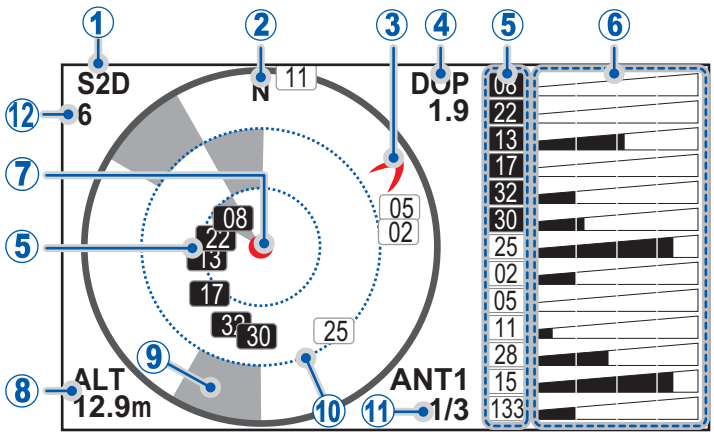
As a dedicated display for the SCX-21, the GP-39 has the following additions to its current display modes and User Displays.

- HDG (Heading) display mode (see section 2.3.2).
- 3-axis speed display mode (see section 2.3.3).
- ROT (Rate Of Turn) User Display (see section 2.3.4).
  Appears as [User Display 1] under default settings.
- Attitude (roll and pitch) User Display (see section 2.3.5).
  Appears as [User Display 2] under default settings.

Note: For detailed information regarding the existing display modes, see the GP-39 operator's manual.



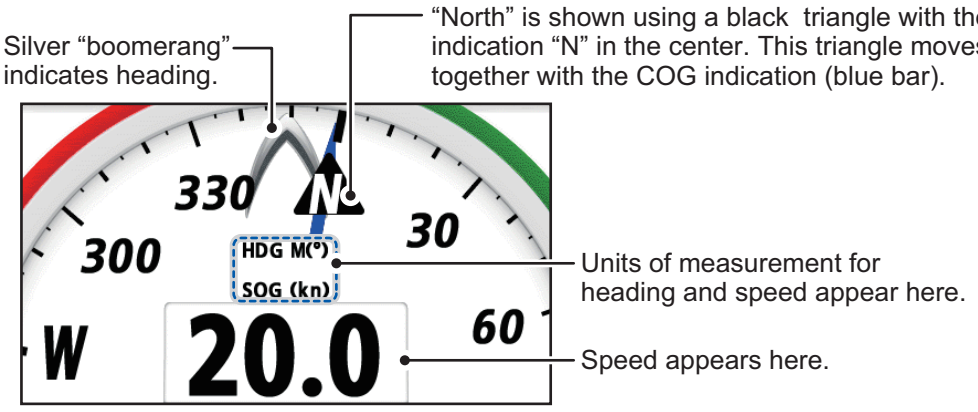
2.3.1 [Satellite monitor] display mode



The satellite monitor display mode shows the following information:

No.	Name/description
1	**Positioning mode** - indicated as [2D], [S2D], [3D] or [S3D]. If positioning is interrupted or the signal is stopped, this indication changes to show "---" (hyphens). The prefix "S" appears when SBAS is used to assist positioning.
2	**North mark** - indicates magnetic north as "N". The indication appears at the outer edge of the elevation rings.
3	**Heading mark** - shows your current heading. The mark appears as a red “boomerang” shape at the outer edge of the elevation rings.
4	**DOP (Dilution Of Position)** - indicates the reliability of the positioning fix. A lower value indicates high reliability.
5	**Satellite number and signal strength** - shows the number of each satellite currently in view, indicated as a small box with the satellite number in the center. The satellites are color coded as follows: • **White:** satellite is not used for any calculations. • **Gray:** satellite is used for calculating positioning only. • **Black:** satellite is used for calculating positioning and heading.
6	**SNR (Signal to Noise Ratio)** - shows the overall reliability of the satellite signal. Signal to noise ratio, or the overall reliability of the signal, is indicated in black. A longer bar indicates a more reliable signal.
7	**Own ship position** - indicated as a red circle at the center of the satellite details.
8	**ALT (Altitude)** - shows your altitude. When the positioning mode is S2D or 2D, the value indicated is the antenna height. When the positioning mode is S3D or 3D, the value indicated is calculated from sea level.
9	**Blocked areas** - indicated as gray -colored “sectors” in each elevation range. Indicates areas which have been detected to be blocked. Satellites which appear within a blocked area may not be reliable.
10	**Elevation rings** - indicates elevation in relation to your ship. The outermost ring (thick, gray line) indicates 0°. The outermost of the two inner rings (blue, dashed lines) indicates 30° and the innermost ring indicates 60°.
11	**ANTx (Antenna number)** - shows the antenna whose details are currently displayed as "ANT1", "ANT2", "ANT3" or "ANT4". The number of the details page currently displayed (indicated "1/2", "2/3" or "3/3") appears below the antenna number. **Note:** ANT4 (antenna number 4) cannot detect GLONASS satellites.
12	**Bearing status** - The number of common satellites are shown (1 to 32). “0” and “DR” means under dead-reckoning. “-” means the signal is not received.

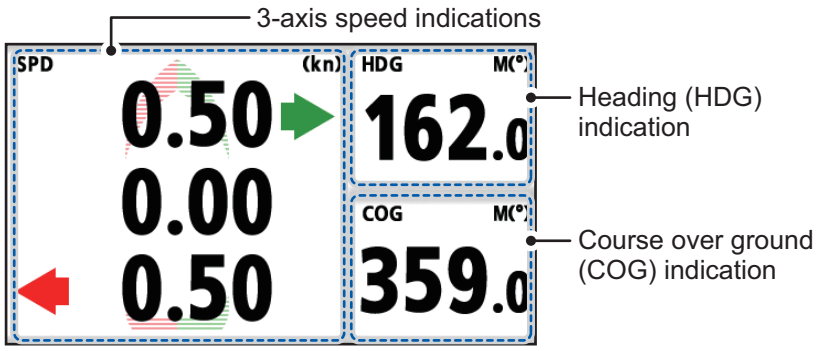
2.3.2 [Heading] display mode



The heading display mode shows the following information:

- **HDG (heading)** - shown as a silver “boomerang” indicating your current heading with the reference method used (selected in [COG/BRG ref.] from the [Plotter Setup] menu).
- **COG (course over ground)** - shows your course. The indication for North also appears as a triangle, with the top of the triangle pointing to the north.
- **SOG (speed over ground)** - your vessel speed is indicated at the bottom-center of the display.

2.3.3 [3-Axis Speed] display mode

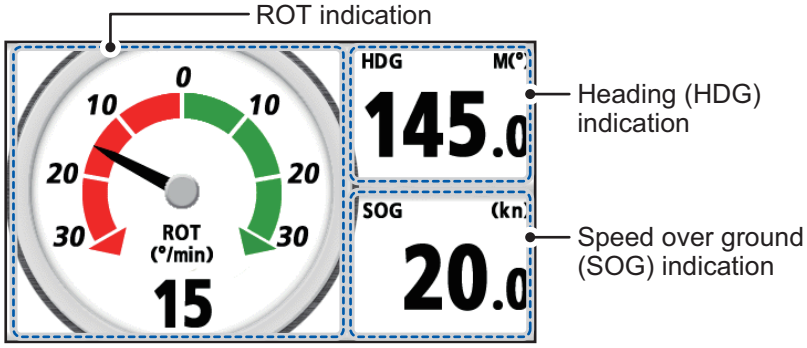


The 3-Axis Speed display mode shows the following information:

- **SPD (speed)** - shows the speeds for fore (uppermost) and aft (lowermost), and appears along with the direction in which the fore/aft of your vessel is moving. The center value shows the forward/reverse speed of your vessel. Forward speed is indicated with an arrow pointing upwards, reverse speed with an arrow pointing downwards. For the fore/aft speeds, the direction is indicated with a green arrow for starboard, red arrow for port movement. The speed measurement unit (selected in [Units] from the
[System] menu) appears at the top-left of the display section.
- **HDG (heading)** - shows your current heading and the reference method used (selected in [COG/BRG ref.] from the [Plotter Setup] menu).
- **COG (course over ground)** - shows your current course and the reference method used (selected in [COG/BRG ref.] from the [Plotter Setup] menu).

2.3.4 [ROT] user display

Note: This user display is set by default as User Display 1. To change these contents, see section 2.3.6.

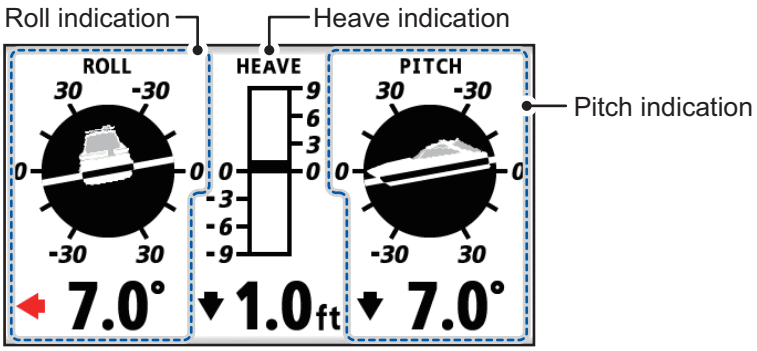


The ROT user display shows the following information:

- **ROT (rate of turn)** - indicated with a black needle with the background dial representing either port (red) or starboard (green) direction for the turn.
- **HDG (heading)** - shows your current heading and the reference method used (selected in [COG/BRG ref.] from the [Plotter Setup] menu).
- **SOG (speed over ground)** - shows your current speed and the measurement unit (selected in [Units] from the [System] menu).

2.3.5 [Attitude] user display

Note: This user display is set by default as User Display 2. To change these contents, see section 2.3.6.



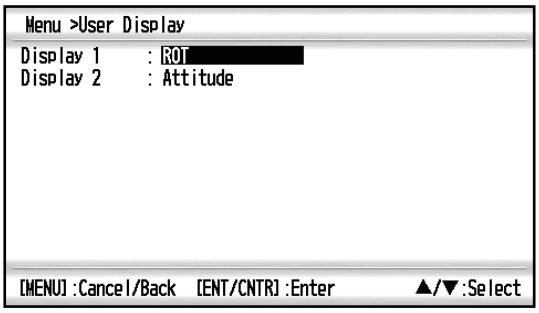
The attitude user display shows the following information:

- **ROLL** - your vessel's attitude in the port-starboard direction and the amount of roll, in degrees.
- **PITCH** - your vessel's attitude in the fore-aft direction and the amount of pitch, in degrees.
- **HEAVE** - your vessel's motion in the upwards/downwards direction, with the amount of heave. Heave amount is shown with the measurement unit selected in [Units] from the [System] menu.

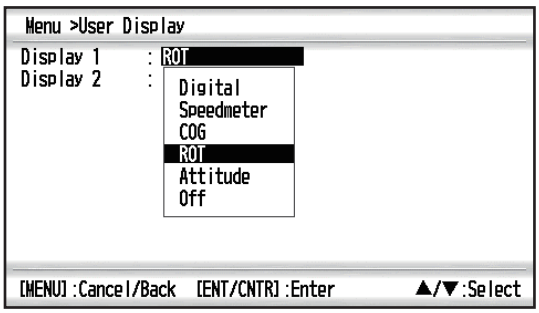
2.3.6 How to setup the user displays

When used as a dedicated display for the SCX-21, your GP-39 has two customizable displays. To change the contents of these displays, do the following:

1. Open the menu.
2. Select [User Display] to show the [User Display] menu.



3. Select [Display 1] or [Display 2] as required to show the available display options.



4. Select the desired display option.
5. Close the menu.

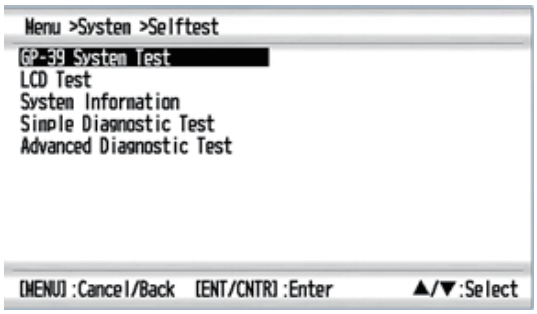
2.4 How to View System Information and Conduct Diagnostic Tests

When connected with the GP-39 as a dedicated display, the SCX-21 can display its system data and conduct a test to see if the SCX-21 is functioning correctly.

2.4.1 Viewing system information

The system information screen shows program numbers, operating times and the SCX-21's serial number. To access the system information, do the following:

1. Open the menu.
2. Select [System] → [Selftest] to show the [Selftest] menu.



3. Select [System Information]. The following information appears.

Displayed item	Meaning/description
[Main PCB]	SCX-21's main PCB program version.
[Starter Ver.]	Starter application program version.
[Booter1(2) Ver.]	Booter applications 1 & 2 program versions.
[App. Ver.]	Main application program version.
[Powered Time]	Time since the SCX-21 was last turned on.
[Overall Powered Time]	Total time the SCX-21 has been powered since installation.
[GP-39 SW Ver.]	GP-39's software program version.
[GP-39 Overall Powered Time]	Total time the GP-39 has been powered since installation.
[Serial No.]	SCX-21's serial number.
[GNSS1(2/3/4)]	Program number for each of SCX-21's GNSS modules.

2.4.2 Conducting a simple diagnostic test

1. Open the menu.
2. Select [System] → [Selftest] to show the [Selftest] menu.
3. Select [Simple Diagnostic Test]. Test results appear as follows (“NG” means “No Good”). The following items are tested in this diagnostic:

Item	Description
[ROM]	ROM status (OK/NG (No Good))
[RAM]	RAM status (OK/NG) (No Good)
[Rate Gyro]	Gyro meter status (Good/Bad)
[Acceleromtr]	Accelerometer status (Good/Bad)
[Magnetic]	Magnetometer status (Good/Bad)
[Press./Temp.]	Status for atmospheric pressure/air temperature sensor (Good/Bad).
[Installation]	Detects the numbers of antenna vibrations (0 to 99).
Port1/2/3 IO	Exception for diagnostic test
GNSS1/2/3/4	Status for GNSS modules 1, 2, 3 and 4 (Good/Bad).
ANT1/2/3/4	Status for antennas 1, 2, 3 and 4 (OK/NG (No Good)).

2.4.3 Conducting an advanced diagnostic test

1. Open the menu.
2. Select [System] → [Selftest] to show the [Selftest] menu.
3. Select [Advanced Diagnostic Test]. Test results appear as either "OK" or "NG" (No good). The following items are tested in this diagnostic:

Item	Description
[ROM]	ROM status
[RAM]	RAM status
[Rate Gyro]	Gyrocompass status
[Acceleromtr]	Accelerometer status
Port1/2/3 IO	For factory setting.
GNSS1/2/3/4 RAM	RAM status for GNSS modules 1, 2, 3 and 4.
GNSS1/2/3/4 ROM	ROM status for GNSS modules 1, 2, 3 and 4.

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3. INITIAL SETTINGS

When the unit is powered for the first time, it is in a “cold start” state, meaning there is no satellite data (almanac data) stored. In this state, the unit searches for, and stores, satellites to find its heading. This process takes approximately 60 seconds.

If the heading is not found within 30 minutes, the antenna installation location may not be suitable. A lack of visible satellites (less than five) can also prevent the unit from finding a heading. Resolve the problem, then re-check the tracking status.

If the installed heading error is found to be 5° or higher, physically turn the antenna while monitoring the heading indication to reduce the error as much as possible. Errors less than 5° can be adjusted in software.

Once a heading is found, check the following items and set or adjust them as required.

- Vessel dimensions and antenna location. See section 3.1.
- Satellite settings (SBAS, elevation mask, smoothing, etc). See section 3.2.
- Offset for heading, roll, pitch, heave, etc. See section 3.3.
- I/O menu settings as appropriate. See section 3.4.

Initial settings can be done with one of the following methods:

- From a dedicated GP-39
  This method is covered within this manual.
- Connect a PC and setup the SCX-21 using the SC setting tool
  You can download the SC setting tool from the quick response code to the right. For how to use the SC setting tool, see the operator's manual of the SC setting tool (OME-72851).

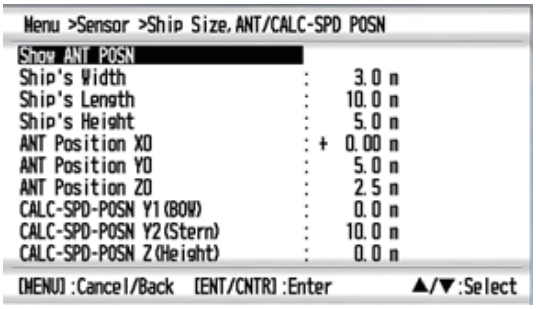
Note: This manual covers only SCX-21-specific menus and settings. Detailed settings and procedures for the GP-39 are covered in the GP-39 operator’s manual.

3.1 How to Set the Ship Dimensions

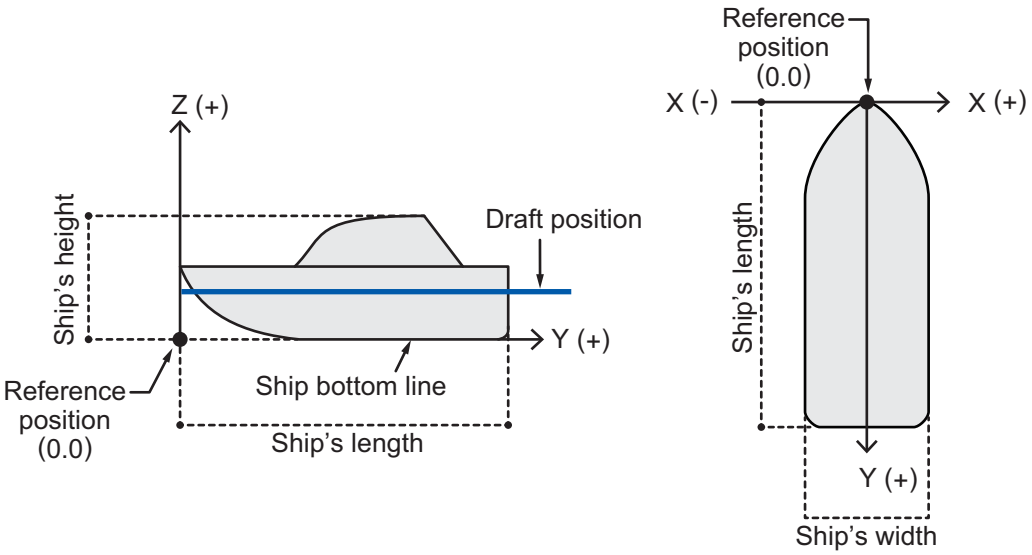
Some features, such as 3-axis speed, require ship dimensions and reference points in order to calculate and display a correct value.

You can set your vessel’s dimension with the following procedure.

1. Open the menu.
2. Select [Sensor], then [Ship Size,ANT/CALC-SPD POSN].
3. Select [Ship's Width], then enter the width of your vessel. This is the distance at the widest point of the vessel, from starboard edge to port edge.
4. Select [Ship's Length], then enter the length of your vessel. This is distance at the longest point of the vessel, from bow to stern.



5. Select [Ship's Height], then enter the height of your vessel. This is the distance at the highest point of the vessel, from keel to mast-top.
6. Referring to the following table, set the remainder of the menu items accordingly. Enter the appropriate value according to the ship's size, **to improve the accuracy of the 3-axis speed**. The reference position for installation location and calculating position of the 3-axis speed is shown in the following figure.



Note: Antenna location and speed calculation values require ship dimensions. If ship dimensions are not yet set, restart this procedure.

[ANT Position X0]	Set the port-starboard (Lateral) location of the SCX-21. Enter negative value for port-side, positive value for starboard-side. The center of the vessel is "0" (Setting range: -327.64 to +327.64 m).
[ANT Position Y0]	Set the bow-stern (Longitudinal) location of the SCX-21. Set the distance from the bow to the stern with the bow as 0 m (Setting range: 0.0 to 999.9 m).
[ANT Position Z0]	Set height of the SCX-21, from the bottom of the ship (Setting range: 0.0 to 199.9 m).

[CALC-SPD-POSN Y1 (BOW)]**	Set the bow-stern location for calculating the 3-axis speed. Ship's speed can be measured at two locations in addition to the antenna position. Enter the backward distance from the reference position (Fwd Center of the bow) to the position where you want to measure the ship's speed. Normally, enter the bow position (Y1) and stern position (Y2). **Note:** In the default setting, Y1 and Y2 are entered as follows: • Y1: 0 m (bow position) • Y2: 10 m (10 m backward from bow position)
[CALC-SPD-POSN Y2 (Stern)]**	
[CALC-SPD-POSN Z (Height)]**	Set the height for calculating the 3-axis speed. Enter the distance from the bottom of the ship to the position where you want to measure the ship's speed. For example, enter the draft value when you want to measure the speed at draft position.

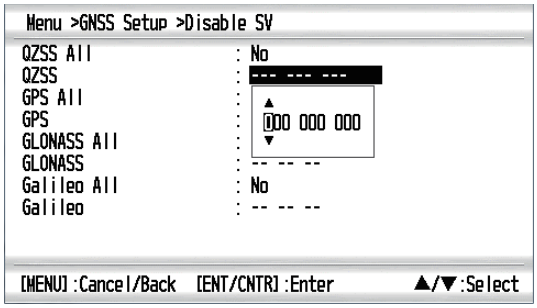
7. To apply the settings, press the **ENT** key.
   To discard the changes and start again, press the **MENU** key.
8. Close the menu.

3.2 Satellite Settings

3.2.1 How to ignore satellites

The SCX-21 has an almanac of satellite numbers which is used to filter and ignore disabled or inoperative satellites. You can manually set a satellite to ignore with the following procedure.

1. Open the menu.
2. Select [GNSS Setup], then select [Disable SV] to show the [Disable SV] menu.



3. Referring to the table below, select and set the satellite(s) to ignore. Up to three individually specified satellites can be ignored for each satellite group.

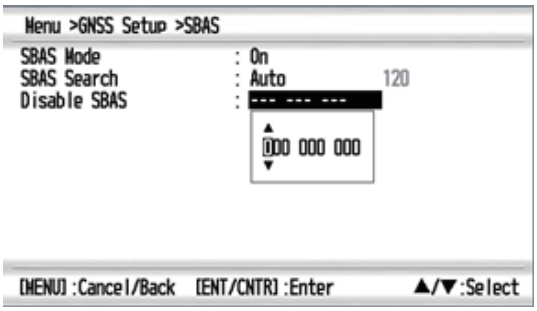
Menu item	Description
[QZSS All]	Select [Yes] to ignore all QZSS satellites, or select [No] to ignore only the specified satellites, set at [QZSS].
[QZSS]	Set the satellite number for each satellite you want to ignore.
[GPS All]	Select [Yes] to ignore all GPS satellites, or select [No] to ignore only the specified satellites, set at [GPS].
[GPS]	Set the satellite number for each satellite you want to ignore.
[GLONASS All]	Select [Yes] to ignore all GLONASS satellites, or select [No] to ignore only the specified satellites, set at [GLONASS].
[GLONASS]	Set the satellite number for each satellite you want to ignore.
[Galileo All]	Select [Yes] to ignore all Galileo satellites, or select [No] to ignore only the specified satellites, set at [Galileo].
[Galileo]	Set the satellite number for each satellite you want to ignore.

4. Close the menu.

3.2.2 How to setup SBAS

SBAS (Satellite Based Augmentation Systems) are available to assist with position fixing. These systems correct measurement errors and improve the overall reliability of your GNSS position fix. You can enable, disable and setup how you want to use SBAS with the following procedure.

1. Open the menu.
2. Select [GNSS Setup], then select [SBAS] to show the [SBAS] menu.



3. Referring to the table below, setup the SBAS as required.

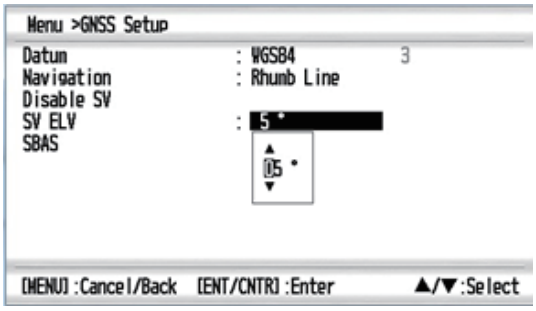
Menu item	Description
[SBAS Mode]	Select [On] to enable SBAS or select [Off] to disable the feature.
[SBAS Search]	Select the appropriate option. • Auto: automatically search for and use SBAS. • Manual: manually enter the SBAS you want to use.
[Disable SBAS]	Set the number for each SBAS you want to ignore.

Note: You cannot manually select an SBAS which is set to ignore at [Disable SBAS]. Further, you cannot ignore an SBAS which is already manually selected at [SBAS Search].

3.2.3 How to set an elevation mask

Satellites with a low elevation may be unreliable due to atmospheric conditions or signal multipath. For this reason, you may want to apply an elevation mask, which excludes satellites below the specified elevation. You can set an elevation mask with the following procedure.

1. Open the menu.
2. Select [GNSS Setup] to show the [GNSS Setup] menu.

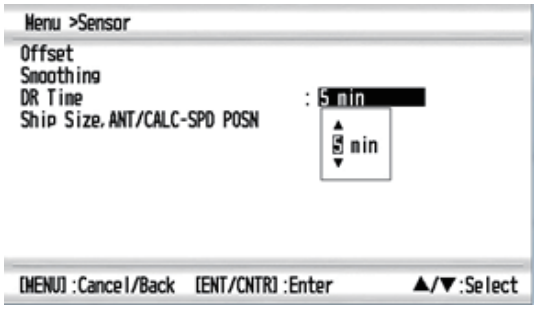


3. Select [SV ELV].
4. Set the elevation at which you want the mask to stop. Satellites below this elevation will be ignored.
5. Close the menu.

3.2.4 How to set a time limit for dead reckoning

When the SCX-21 cannot receive the signal from a satellite, the SCX-21 continues to output heading data as “dead reckoning” for the time set here. If the signal from the satellite cannot be retrieved within the time set here, the SCX-21 stops outputting the heading data. You can set a time limit for the use of dead reckoning with the following procedure.

1. Open the menu.
2. Select [Sensor]. The [Sensor] menu appears.



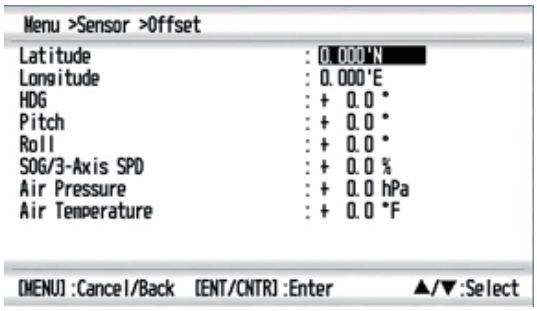
3. Select [DR Time], then select the desired time limit.
4. Close the menu.

3.3 How to Apply Offsets

The SCX-21 outputs various data, such as roll and pitch, which may require minor adjustment based on installation location and other factors. You can offset the sensor data with the following procedure.

Note: Offsets selected in the following procedure are applied only to the SCX-21; to offset data for other sensors on your vessel, access the respective sensor.

1. Open the menu.
2. Select [Sensor], then select [Offset] to show the [Offset] menu.



3. Referring to the following table, apply any necessary offsets.

Menu item	Description
[Latitude], [Longitude]	Offset the position of your own vessel. Only change this setting if you are absolutely sure of the offset value required. Typically, this adjustment should be done by a qualified technician.
[HDG]	Offset the heading value. Set a negative value to offset in the port direction, set a positive value to offset in the starboard direction. For example, if the on-screen heading shows 10° to port, and the actual heading is 0°, set the offset as [+10°].

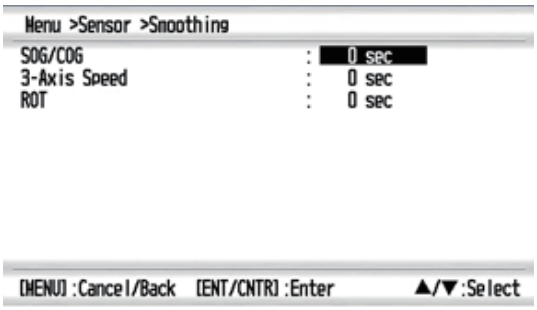
Menu item	Description
[Pitch]	Offset the pitch value. Set a negative value to lower the bow, set a positive value to raise the bow. For example, if the on-screen pitch shows +10°, and the vessel is in fact moored and in calm waters, set the offset as [-10°].
[Roll]	Offset the roll value. Set a negative value to offset in the port direction, set a positive value to offset in the starboard direction. For example, if the on-screen roll shows +0°, and the vessel is in fact listing to port at 10°, set the offset as [+10°].
[SOG/3-Axis SPD]	Offset the speed value. Set a negative value (%) to reduce the displayed speed, set a positive value (%) to increase the displayed speed.
[Air Pressure]	Offset the atmospheric air pressure value. Set a negative value to reduce the displayed pressure, set a positive value to increase the displayed pressure.
[Air Temperature]	Offset the atmospheric air temperature value. Set a negative value to reduce the displayed temperature, set a positive value to increase the displayed temperature.

4. Close the menu.

3.3.1 Data Smoothing (Damping)

Data output from the SCX-21 and input to the GP-39 can be smoothed (damped). Smoothing places a small delay on the output of data from the SCX-21, which reduces variations caused by unfavorable receiving conditions, or other factors.

1. Open the menu.
2. Select [Sensor], then select [Smoothing] to show the [Smoothing] menu.



3. Select the item whose data you want smooth, then select the smoothing time.
4. Close the menu.

To disable smoothing for any of the menu items, repeat the above procedure, then set the smoothing value to [0] (zero).

3.4 How to Setup Data Output

The SCX-21 can output NMEA 0183 sentences to other equipment on the same NMEA 0183 connection. Output can be setup for up to three channels (data ports) depending on your ship's equipment configuration.

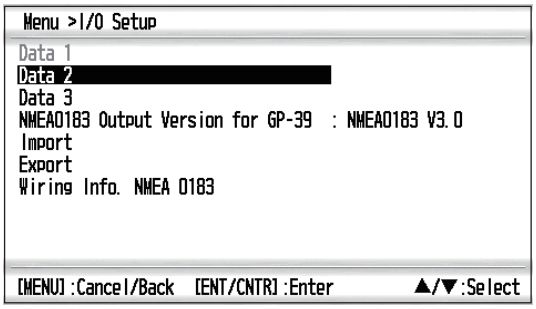
When a GP-39 is used as a dedicated display unit, the Data 1 port is not available for output. However, in this case, both Data 2 and Data 3 ports are available for data output.

When the SCX-21 is connected directly to the NMEA 0183, all three data ports can output.

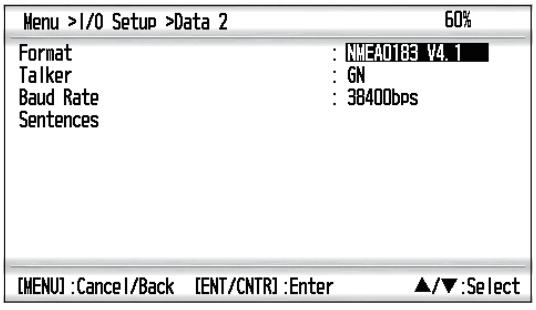
3.4.1 Setting up a data port for output

All three data ports can be setup for output with the following procedure.

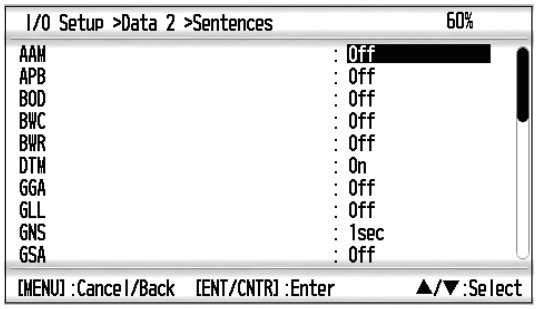
1. Open the menu.
2. Select [I/O Setup] to show the [I/O Setup] menu.



3. Select the data port you want to setup.
   Note: Data 1 is not available for output when a GP-39 is connected as a dedicated display unit.



4. Select [Format], to show the NMEA 0183 versions available for output.
5. Select the NMEA 0183 version used within your ship's network.
   For configurations using a NMEA data converter to output NMEA 0183 data to a NMEA 2000 device or network, select [IEC61162-1 Ed.5].
6. Select [Talker], then select the talker to use.
7. Select [Baud Rate], then select the same baud rate as used by your NMEA 0183 network.
8. Select [Sentences] to show the sentence setup menu. This menu allows you to select which sentences you want the SCX-21 to output and the cycle at which to send each sentence.
   Note: Output cycle is dependent on the sentence and available options differ.



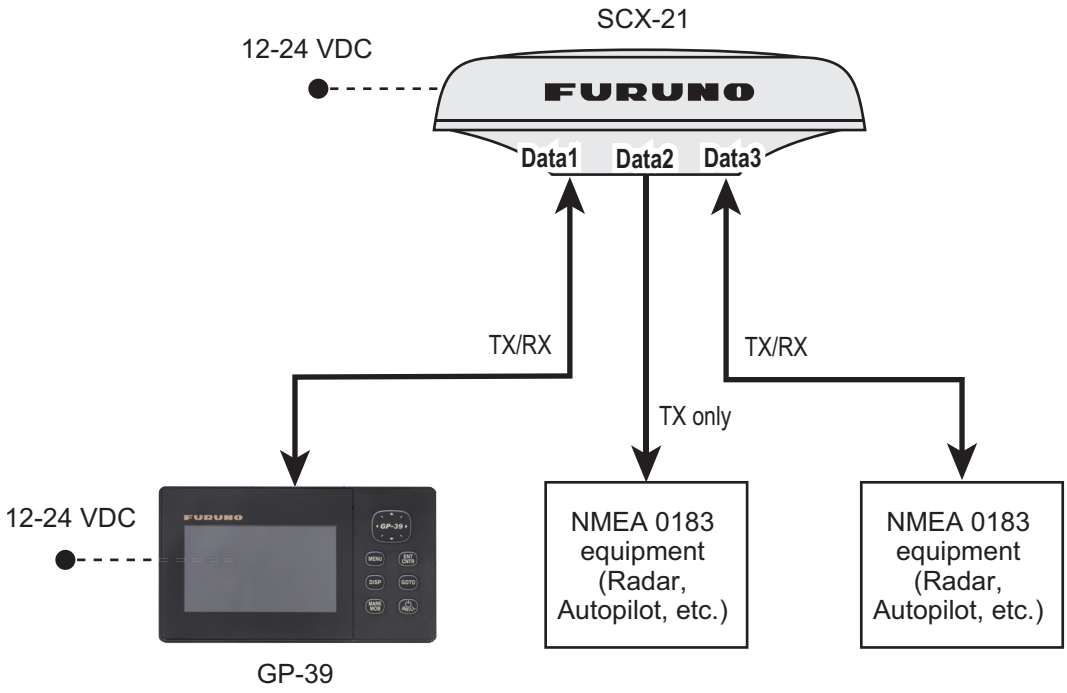
9. Select the sentence you want to setup.
10. To prevent the output of a selected sentence, select [Off]. In all other cases, select the appropriate output cycle for the sentence.
11. Repeat steps 9 and 10 as required to setup other sentences (noting output percentage utilized at the top of screen).
12. Close the menu.

3.4.2 How to setup the SCX-21 as a data relay

The GP-39 has only one SIO port, allowing only a single connection to an NMEA 0183 network. The SCX-21 can act as a “data relay”, allowing multiple data connections to the GP-39.

The following figure shows a connection example. For further details regarding the relay feature, consult your local FURUNO dealer.

Note: The SCX-21 and GP-39 require different power supplies. You cannot turn SCX-21 on/off from power button on GP-39.



Connect the external equipment to the appropriate data port (Data 1 to Data 3) on the SCX-21. Each port role is shown below;

Data 1 port: Connect the GP-39. **Receive/Send** relayed data between GP-39 and the external equipment via SCX-21.

Data 2 port: **Send** relayed data from GP-39 to the external equipment via SCX-21.

Data 3 port: **Receive/Send** relayed data between GP-39 and the external equipment via SCX-21.

Setup on the external equipment

Select the output data sentences you want to send to the GP-39. See the appropriate equipment's operator's manual for how to set up sentence output.

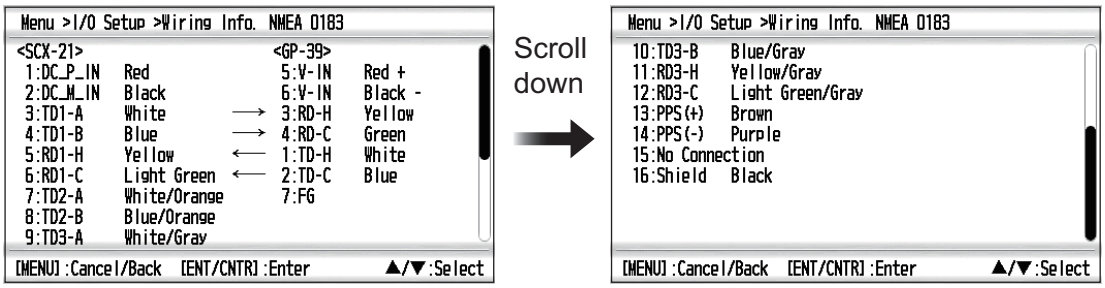
Setup on GP-39s

Set up sentence output referring to subsection 3.4.1.

Set the sentence formats which is output to an external equipment via SCX-21 from GP-39 at [NMEA0183 Output Version for GP-39] menu on [I/O Setup] menu.

3.5 Wiring Information between SCX-21 and GP-39

To show the wiring information between SCX-21 and GP-39, select [Wiring Info. NMEA 0183] menu on [I/O Setup] menu.



4. MAINTENANCE

4.1 Preventative Maintenance

The following preventative maintenance and checks are important for good performance.

Item to check	Points to check	Remedy
Connectors	Check that the connectors are firmly connected.	Reconnect loosened cables.
Cable run (cabling)	Visually check the cables for wear and tear or damage.	Consult your dealer for cable replacement.
Cover	Cleanliness of the cover	Dust can be removed with a soft cloth. Do not use chemical-based cleaners or solvents as they can remove paint/markings and cause the cover to deform.

4.2 Fuse Replacement

The SCX-21 has a fuse, located on the power cable, to protect the equipment from overcurrent, reverse polarity and equipment fault. If power cannot be turned on, check if the fuse has blown. If the fuse has blown, determine and rectify the cause before replacing the fuse.

Type	Code
FRU-60V-FU-2A	000-195-429-10

4.3 Troubleshooting

This section covers possible problems which may arise while using the SCX-21 and how to address each problem.

Problem	Possible cause	Remedy
Data is not received from the SCX-21.	Cable is disconnected, damaged, or faulty.	Check the SCX-21 cable connectors are firmly connected. Check that the cable is not damaged or severed. Also confirm that the power source of SCX-21 is powered and functioning normally. Contact your local dealer for service as required.
	Incorrect settings at the SCX-21.	Check the SCX-21 output settings are correct and the following settings for output sentences matches the display unit's specifications. • Format • Talker • Baud rate
	Incorrect settings at the display.	Refer to the display unit's manual and adjust the settings as required.

Problem	Possible cause	Remedy
Data (heading, etc.) shown on the screen is not correct.	Offsets not applied at installation, or not applied correctly.	• Check that the antenna location is proper. • Check the incorrect item against other equipment by sight. Adjust the offsets as required.
GLONASS satellites do not appear on the satellite monitor.	ANT4 is selected.	Antenna number 4 cannot detect GLONASS satellites. Select a different antenna.
Diagnostic test is not completed, or results seem incorrect.	The diagnostic test is started before the SCX-21 has completed startup and obtained a position fix.	Wait until data output from the SCX-21 is stable, then retry the diagnostic test.

4.4 GP-39 Related Errors and Remedies

This section covers errors which may occur when the SCX-21 is connected with the GP-39 as a dedicated display. For GP-39 specific errors and remedies, see the GP-39 operator's manual.

Error text	Meaning, possible cause(s), remedies
HDG ERROR!	**Meaning:** Heading data has not been received from the SCX-21 for more than 5 seconds.
	Possible cause: Power is not supplied to the SCX-21. **Remedy:** Check that power is supplied to the SCX-21. If the problem persists, contact your local dealer.
	Possible cause: The SCX-21 is currently in diagnostic test mode, or a factory reset is in process. **Remedy:** Wait until the test or reset is complete.
COMMUNICATION TIMEOUT!	**Meaning:** Communications between the SCX-21 and GP-39 is not possible or has been interrupted.
	Possible cause: Bad/loose connection. **Remedy:** Check the connections between the units and re-fasten any loose connections. If the problem persists, contact your local dealer.
	Possible cause: SCX-21 is not powered. **Remedy:** Check that power is supplied to the SCX-21. If the problem persists, contact your local dealer.
	Possible cause: Damaged cables. **Remedy:** Check connecting cables for damage, replace as required. If the problem persists, contact your local dealer.
Antenna1 Error	**Meaning:** The indicated antenna has malfunctioned or is damaged. **Remedy:** Contact your local dealer for service.
Antenna2 Error	
Antenna3 Error	
Antenna4 Error	
GPS NO FIX!	**Meaning:** SCX-21 is unable to obtain a positioning fix for more than 80 seconds. **Possible cause:** Too many obstructions. **Remedy:** Check the area around the SCX-21 for obstructions. Move the unit if necessary.
	Possible cause: Insufficient satellites available from the selected group. **Remedy:** Check the settings at [GNSS Setup] → [Disable SV] and adjust as necessary.

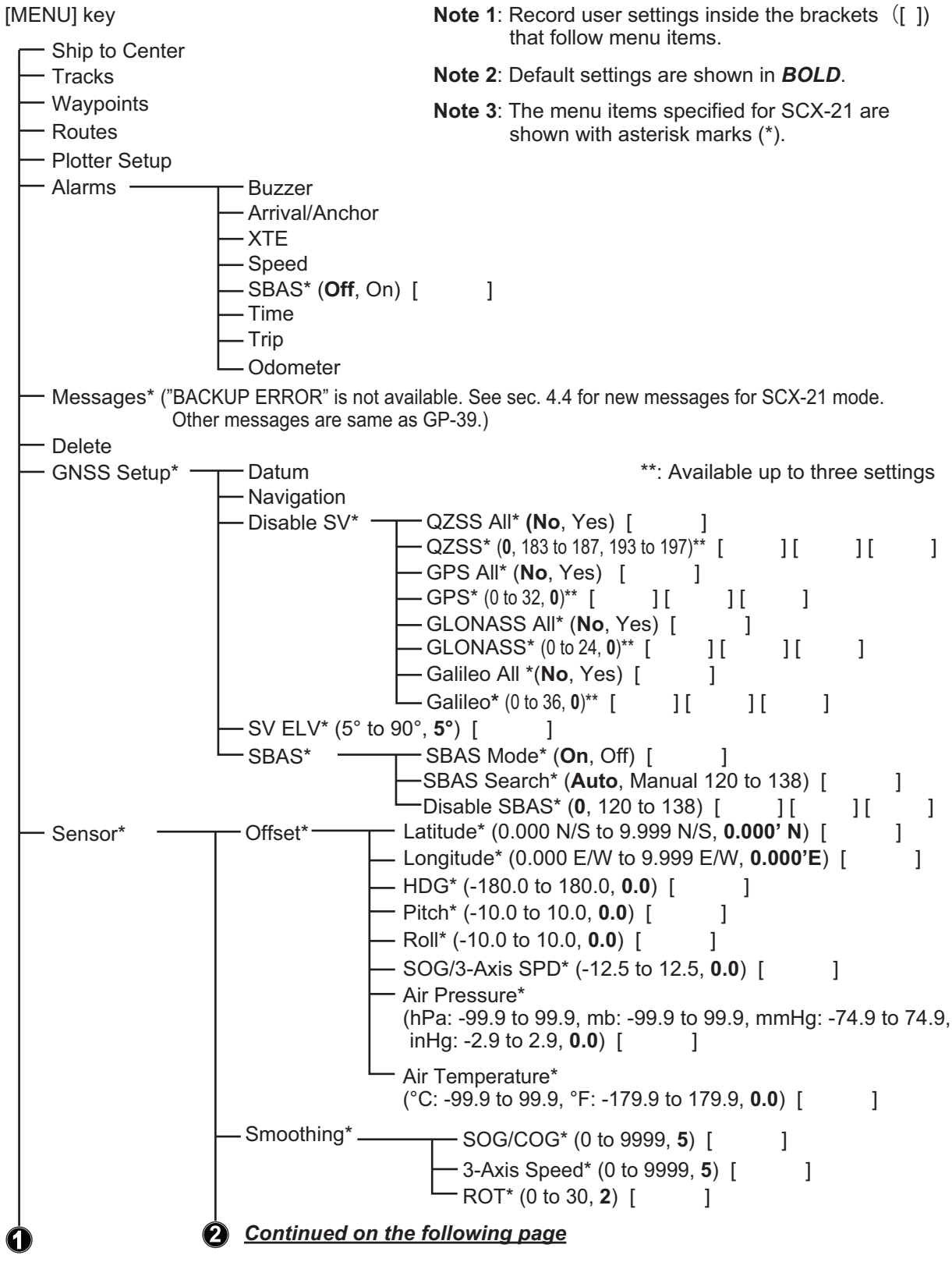
APPENDIX 1 MENU TREE

The following menu trees are shown the menu tree of GP-39 which connected to SCX-21. Basically, the menu items are common to GP-39 when it is not connected to SCX-21. Unique menu settings when connected to the SCX21 are shown with "*" (Asterisk) mark. Otherwise, see the menu tree in the Operator's manual for GP-39 for details.

Note 1: Record user settings inside the brackets （[ ]) that follow menu items.

Note 2: Default settings are shown in ***BOLD***.

Note 3: The menu items specified for SCX-21 are shown with asterisk marks (*).



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- DR Time* (1 to 5, **5**) [ ]
- Ship Size, ANT/CALCSPD POSN*
  - Show ANT POSN* (Displays antenna position.)
  - Ship's Width* (1.0 to 999.9, **3.0**) [ ]
  - Ship's Length* (1.0 to 999.9, **10.0**) [ ]
  - Ship's Height* (1.0 to 199.9, **5.0**) [ ]
  - ANT Position X0* (-327.64 to +327.64, **0.00**) [ ]
  - ANT Position Y0* (0.0 to 999.9, **5.0**) [ ]
  - ANT Position Z0* (0.0 to 199.9, **2.5**) [ ]
  - CALC-SPD-POSN Y1 (BOW)* (0.0 to 999.9, **0.0**) [ ]
  - CALC-SPD-POSN Y2 (Stern)* (0.0 to 999.9, **10.0**) [ ]
  - CALC-SPD-POSN Z (Height)* (0.0 to 199.9, **0.0**) [ ]

- I/O Setup*
  - DATA 1* (fixed and displayed in grey when GP-39 is connected)
    - • Format* (NMEA0183 V3.0) • Talker* (GN) • Baud Rate* (38400)
    - • Sentences*: AAM (Off), APB (Off), BOD (Off), BWC (Off), BWR (Off), DTM (Off), GGA (Off), GLL (Off), GNS (1sec), GSA (Off), GSV (Off), HDG (Off), HDT (Off), HRM (Off), POS (Off), RMB (Off), RMC (1sec), ROT (200msec), THS (200msec), VBW (1sec), VTG (1sec), XDR (1sec), XTE (Off), ZDA (1sec), GPatt (200msec), GPhve (200msec), GPimu (Off), GPmsv (On)

    Note) The default settings of SCX-21 are shown below (when GP-39 is NOT connected).
    - • Format* (**NMEA0183 V4.1**) • Talker* (**GN**) • Baud Rate* (**38400**)
    - • Sentences*: AAM (**Off**), APB (**Off**), BOD (**Off**), BWC (**Off**), BWR (**Off**), DTM (**On**), GGA (**Off**), GLL (**Off**), GNS (**1sec**), GSA (**Off**), GSV (**1sec**), HDG (**Off**), HDT (**100msec**), HRM (**Off**), POS (**Off**), RMB (**Off**), RMC (**Off**), ROT (**200msec**), THS (**100msec**), VBW (**1sec**), VTG (**1sec**), XDR (**Off**), XTE (**Off**), ZDA (**1sec**), GPatt (**100msec**), GPhve (**100msec**), GPimu (**Off**), GPmsv (**Off**)

  - DATA 2*
    - Format* (NMEA0183 V1.5, NMEA0183 V2.0, NMEA0183 V3.0, **NMEA0183 V4.1**, IEC61162-1 Ed.5) [ ]
    - Talker* (GP, GL, GA, **GN**, HE, HN, HC) [ ]
    - Baud Rate* (4800, **38400**) [ ]
    - Sentences*;
      - AAM (**Off**, 1sec) [ ]
      - APB (**Off**, 1sec) [ ]
      - BOD (**Off**, 1sec) [ ]
      - BWC (**Off**, 1sec) [ ]
      - BWR (**Off**, 1sec) [ ]
      - DTM (Off, **On**) [ ]
      - GGA (**Off**, 100msec, 200msec, 1sec, 2sec) [ ]
      - GLL (**Off**, 100msec, 200msec, 1sec, 2sec) [ ]
      - GNS (Off, 100msec, 200msec, **1sec**, 2sec) [ ]
      - GSA (**Off**, 1sec, 2sec) [ ]
      - GSV (Off, **1sec**, 2sec) [ ]
      - HDG (**Off**, 20msec, 25msec, 100msec, 200msec, 1sec, 2sec) [ ]
      - HDT (Off, 20msec, **25msec**, 100msec, 200msec, 1sec, 2sec) [ ]
      - HRM (**Off**, 20msec, 25msec, 100msec, 200msec) [ ]
      - POS (**Off**, 3sec, 30sec) [ ]
      - RMB (**Off**, 1sec) [ ]
      - RMC (**Off**, 100msec, 200msec, 1sec, 2sec) [ ]
      - ROT (**Off**, 20msec, 25msec, 100msec, 200msec, 1sec, 2sec) [ ]
      - THS (**Off**, 20msec, 25msec, 100msec, 200msec, 1sec, 2sec) [ ]
      - VBW (**Off**, 1sec, 2sec) [ ]
      - VTG (Off, **1sec**, 2sec) [ ]
      - XDR (**Off**, 1sec, 2sec) [ ]
      - XTE (**Off**, 1sec) [ ]
      - ZDA (Off, **1sec**, 2sec) [ ]
      - GPatt (**Off**, 20msec, 25msec, 100msec, 200msec, 1sec, 2sec) [ ]
      - GPhve (**Off**, 20msec, 25msec, 100msec, 200msec, 1sec, 2sec) [ ]
      - GPimu (**Off**, 25msec, 100msec, 200msec, 1sec, 2sec) [ ]
      - GPmsv (**Off**, On) [ ]

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- DATA 3*
  - Format* (NMEA0183 V1.5, NMEA0183 V2.0, NMEA0183 V3.0, **NMEA0183 V4.1**, IEC61162-1 Ed.5) [ ]
  - Talker* (GP, GL, GA, **GN**, HE, HN, HC) [ ]
  - Baud Rate* (**4800**, 38400) [ ]
  - Sentences***;**
    - AAM (**Off**, 1sec) [ ]
    - APB (**Off**, 1sec) [ ]
    - BOD (**Off**, 1sec) [ ]
    - BWC (**Off**, 1sec) [ ]
    - BWR (**Off**, 1sec) [ ]
    - DTM (Off, **On**) [ ]
    - GGA (**Off**, 100msec, 200msec, 1sec, 2sec) [ ]
    - GLL (**Off**, 100msec, 200msec, 1sec, 2sec) [ ]
    - GNS (Off, 100msec, 200msec, **1sec**, 2sec) [ ]
    - GSA (**Off**, 1sec, 2sec) [ ]
    - GSV (**Off**, 1sec, 2sec) [ ]
    - HDG (**Off**, 20msec, 25msec, 100msec, 200msec, 1sec, 2sec) [ ]
    - HDT (Off, 20msec, 25msec, 100msec, **200msec**, 1sec, 2sec) [ ]
    - HRM (**Off**, 20msec, 25msec, 100msec, 200msec) [ ]
    - POS (**Off**, 3sec, 30sec) [ ]
    - RMB (**Off**, 1sec) [ ]
    - RMC (**Off**, 100msec, 200msec, 1sec, 2sec) [ ]
    - ROT (**Off**, 20msec, 25msec, 100msec, 200msec, 1sec, 2sec) [ ]
    - THS (**Off**, 20msec, 25msec, 100msec, 200msec, 1sec, 2sec) [ ]
    - VBW (**Off**, 1sec, 2sec) [ ]
    - VTG (Off, **1sec**, 2sec) [ ]
    - XDR (**Off**, 1sec, 2sec) [ ]
    - XTE (**Off**, 1sec) [ ]
    - ZDA (Off, **1sec**, 2sec) [ ]
    - GPatt (**Off**, 20msec, 25msec, 100msec, 200msec, 1sec, 2sec) [ ]
    - GPhve (**Off**, 20msec, 25msec, 100msec, 200msec, 1sec, 2sec) [ ]
    - GPimu (**Off**, 25msec, 100msec, 200msec, 1sec, 2sec) [ ]
    - GPmsv (**Off**, On) [ ]
- NMEA0183 Output Version for GP-39*
  - (NMEA0183 V1.5, NMEA0183 V2.0, **NMEA0183 V3.0**) [ ]
- Import*
  - Load WPT/RTE <- USB*
  - Load WPT/RTE <- GP-32*
- Export*
  - Save WPT/RTE -> USB*
- Wiring Info. NMEA 0183*

- User Display
  - Display 1
    - Digital (ODO, Trip, Time, Date, POSN, Volts, SOG, COG, RNG, BRG, XTE, TTG, ETA, WPT, ROT*, Heave*, Roll*, Pitch*, HDG*, 3-Axis Speed*, Air Pressure*, Air Temperature*, **None***) [ ]
    - Speedmeter
    - COG
    - **ROT*** (**0-30**, 0-60, 0-90) [ ]
    - Attitude*
    - Off
  - Display 2
    - Digital (ODO, Trip, Time, Date, POSN, Volts, SOG, COG, RNG, BRG, XTE, TTG, ETA, WPT, ROT*, Heave*, Roll*, Pitch*, HDG*, 3-Axis Speed*, Air Pressure*, Air Temperature*, **None***) [ ]
    - Speedmeter
    - COG
    - ROT* (**0-30**, 0-60, 0-90) [ ]
    - **Attitude***
    - Off

❺

Continued on the following page

❺ ***Continued from the previous page***

- Pos/TD Setup
- System
  - Key Beep
  - Language
  - Units
    - Distance & Speed* (**nm-kn**, km-km/h, sm-mph) [ ]
    - 3-Axis Speed* (**kn**, km/h, mph, m/s) [ ]
    - Height* (**m,** ft) [ ]
    - Air Temperature* (**°C,** °F) [ ]
    - Air Pressure* (**hPa**, mb, mmHg, inHg) [ ]
  - Time Offset
  - Daylight Saving Time
  - Time Display
  - Date Display
  - Demo
  - Self Test
    - GP-39 System Test*
    - LCD Test
    - System Information*
      (Displays system information of GP-39 and SCX-21.)
    - Simple Diagnostic Test*
      (Executes the simple diagnostic test and displays the result.)
    - Advanced Diagnostic Test*
      (Executes the advanced diagnostic test and displays the result.)
  - Reset
    - Trip
    - Menu Settings* (**Off**, On) [ ]
    - Factory Reset* (**Off**, On) [ ]
  - System Restart* (**Off**, On) [ ]
  - Update Software*
    - Update SCX-21 Software*
  - Operation Mode* (**GP-39**, SCX-21) [ ]

Installation (Displayed at startup of GP-39)

- Language
- Units
  - Distance & Speed* (**nm-kn**, km-km/h, sm-mph) [ ]
  - 3-Axis Speed* (**kn**, km/h, mph, m/s) [ ]
  - Height* (**m,** ft) [ ]
  - Air Temperature* (**°C,** °F) [ ]
  - Air Pressure* (**hPa**, mb, mmHg, inHg) [ ]
- Time Offset
- Demo
- Operation Mode* (**GP-39**, SCX-21) [ ]

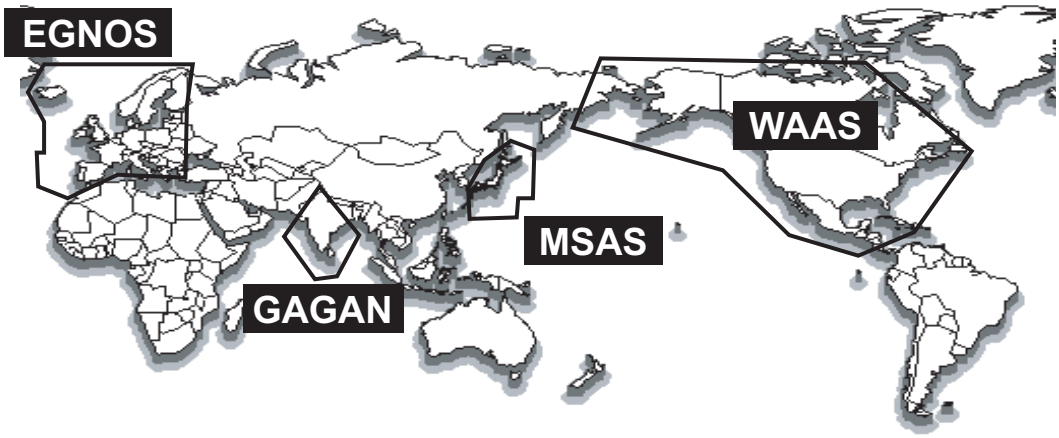
APPENDIX 2 GEODETIC CHART CODES

001: WGS84
002: WGS72
003: TOKYO : Mean Value (Japan, Korea & Okinawa)
004: NORTH AMERICAN 1927 : Mean Value (CONUS)
005: EUROPEAN 1950 : Mean Value
006: AUSTRALIAN GEODETIC 1984 : Australia & Tasmania
007: ADINDAN : Mean Value (Ethiopia & Sudan)
008: ADINDAN : Ethiopia
009: ADINDAN : Mali
010: ADINDAN : Senegal
011: ADINDAN : Sudan
012: AFG : Somalia
013: AIN EL ABD 1970 : Bahrain Is.
014: ANNA 1 ASTRO 1965 : Cocos Is.
015: ARC 1950 : Mean Value
016: ARC 1950 : Botswana
017: ARC 1950 : Lesotho
018: ARC 1950 : Malawi
019: ARC 1950 : Swaziland
020: ARC 1950 : Zaire
021: ARC 1950 : Zambia
022: ARC 1950 : Zimbabwe
023: ARC 1960 : Mean Value (Kenya & Tanzania)
024: ARC 1960 : Kenya
025: ARC 1960 : Tanzania
026: ASCENSION IS. 1958 : Ascension Is.
027: ASTRO BEACON "E" : Iwo Jima Is.
028: ASTRO B4 SOR. ATOLL : Tern Is.
029: ASTRO POS 71/4 : St. Helena Is.
030: ASTRONOMIC STATION 1952 : Marcus Is.
031: AUSTRALIAN GEODETIC 1966 : Australia & Tasmania
032: BELLEVUE (IGN) : Efate & Erromango Is.
033: BERMUDA 1957 : Bermuda Is.
034: BOGOTA OBSERVATORY : Columbia
035: CAMPO INCHAUSPE : Argentina
036: CANTON IS. 1966 : Phoenix Is.
037: CAPE : South Africa
038: CAPE CANAVERAL : Mean Value (Florida & Bahama Is.)
039: CARTHAGE : Tunisia
040: CHATHAM 1971 : Chatham Is. (New Zealand)
041: CHUA ASTRO : Paraguay
042: CORREGO ALEGRE : Brazil
043: DJAKARTA (BATAVIA) : Sumatra Is. (Indonesia)
044: DOS 1968 : Gizo Is. (New Georgia Is.)
045: EASTER IS. 1967 : Easter Is.
046: EUROPEAN 1950 (Cont'd) : Western Europe
047: EUROPEAN 1950 (Cont'd) : Cyprus
048: EUROPEAN 1950 (Cont'd) : Egypt
049: EUROPEAN 1950 (Cont'd) : England, Scotland, Channel & Shetland Is.
050: EUROPEAN 1950 (Cont'd) : England, Ireland, Scotland & Shetland Is.
051: EUROPEAN 1950 (Cont'd) : Greece
052 EUROPEAN 1950 (Cont'd) : Iran
053: EUROPEAN 1950 (Cont'd) : Italy, Sardinia
054: EUROPEAN 1950 (Cont'd) : Italy, Sicily
055: EUROPEAN 1950 (Cont'd) : Norway & Finland
056: EUROPEAN 1950 (Cont'd) : Portugal & Spain
057: EUROPEAN 1979 : Mean Value
058: GANDAJIKA BASE : Republic of Maldives
059: GEODETIC DATUM 1949 : New Zealand
060: GUAM 1963 : Guam Is.
061: GUX 1 ASTRO : Guadalcanal Is.
062: HJORSEY 1955 : Iceland
063: HONG KONG 1963 : Hong Kong
064: INDIAN : Thailand & Vietnam
065: INDIAN : Bangladesh, India & Nepal
066: IRELAND 1965 : Ireland
067: ISTS 073 ASTRO 1969 : Diego Garcia
068: JOHNSTON IS. 1961 : Johnston Is.
069: KANDAWALA : Sri Lanka
070: KERGUELEN IS. : Kerguelen Is.
071: KERTAU 1948 : West Malaysia & Singapore
072: LA REUNION : Mascarene Is.
073: L. C. 5 ASTRO : Cayman Brac Is.
074: LIBERIA 1964 : Liberia
075: LUZON : Philippines (excl. Mindanao Is.)
076: LUZON : Mindanao Is.
077: MAHE 1971 : Mahe Is.
078: MARCO ASTRO : Salvage Islands
079: MASSAWA : Eritrea (Ethiopia)
080: MERCHICH : Morocco
081: MIDWAY ASTRO 1961 : Midway Is.
082: MINNA : Nigeria
083: NAHRWAN : Masirah Is. (Oman)
084: NAHRWAN : United Arab Emirates
085: NAHRWAN : Saudi Arabia
086: NAMIBIA : Namibia
087: MAPARIMA, BWI : Trinidad & Tobago
088: NORTH AMERICAN 1927 : Western United States
089: NORTH AMERICAN 1927 : Eastern United States
090: NORTH AMERICAN 1927 : Alaska
091: NORTH AMERICAN 1927 : Bahamas (excl. San Salvador Is.)
092: NORTH AMERICAN 1927 : Bahamas, San Salvador Is.
093: NORTH AMERICAN 1927 (Cont'd): Canada (incl. Newfoundland Is.)
094: NORTH AMERICAN 1927 (Cont'd): Alberta & British Columbia
095: NORTH AMERICAN 1927 (Cont'd): East Canada
096: NORTH AMERICAN 1927 (Cont'd): Manitoba & Ontario
097: NORTH AMERICAN 1927 (Cont'd): Northwest Territories & Saskatchewan
098: NORTH AMERICAN 1927 (Cont'd): Yukon
099: NORTH AMERICAN 1927 (Cont'd): Canal Zone
100: NORTH AMERICAN 1927 (Cont'd): Caribbean
101: NORTH AMERICAN 1927 (Cont'd): Central America
102: NORTH AMERICAN 1927 (Cont'd): Cuba
103: NORTH AMERICAN 1927 (Cont'd): Greenland
104: NORTH AMERICAN 1927 (Cont'd): Mexico
105: NORTH AMERICAN 1983 : Alaska
106: NORTH AMERICAN 1983 : Canada
107: NORTH AMERICAN 1983 : CONUS
108: NORTH AMERICAN 1983 : Mexico, Central America
109: OBSERVATORIO 1966 : Corvo & Flores Is. (Azores)
110: OLD EGYPTIAN 1930 : Egypt
111: OLD HAWAIIAN : Mean Value
112: OLD HAWAIIAN : Hawaii
113: OLD HAWAIIAN : Kauai
114: OLD HAWAIIAN : Maui
115: OLD HAWAIIAN : Oahu
116: OMAN : Oman
117: ORDNANCE SURVEY OF GREAT BRITAIN 1936: Mean Value
118: ORDNANCE SURVEY OF GREAT BRITAIN 1936: England
119: ORDNANCE SURVEY OF GREAT BRITAIN 1936: England, Isle of Man & Wales
120: ORDNANCE SURVEY OF GREAT BRITAIN 1936: Scotland & Shetland Is.
121: ORDNANCE SURVEY OF GREAT BRITAIN 1936 : Wales
122: PICO DE LAS NIVIES : Canary Is.
123: PITCAIRN ASTRO 1967 : Pitcairn Is.
124: PROVISIONAL SOUTH CHILEAN 1963: South Chile (near 53°S)
125: PROVISIONAL SOUTH AMERICAN 1956: Mean Value
126: PROVISIONAL SOUTH AMERICAN 1956: Bolivia
127: PROVISIONAL SOUTH AMERICAN 1956: Chile-Northern Chile (near 19°S)
128: PROVISIONAL SOUTH AMERICAN 1956: Chile-Southern Chile (near 43°S)
129: PROVISIONAL SOUTH AMERICAN 1956: Columbia
130: PROVISIONAL SOUTH AMERICAN 1956: Ecuador
131: PROVISIONAL SOUTH AMERICAN 1956: Guyana
132: PROVISIONAL SOUTH AMERICAN 1956: Peru
133: PROVISIONAL SOUTH AMERICAN 1956: Venezuela
134: PUERTO RICO : Puerto Rico & Virgin Is.
135: QATAR NATIONAL : Qatar
136: QORNOQ : South Greenland
137: ROME 1940 : Sardinia Is.
138: SANTA BRAZ : Sao Miguel, Santa Maria Is. (Azores)
139: SANTO (DOS) : Espirito Santo Is.
140: SAPPER HILL 1943 : East Falkland Is.
141: SOUTH AMERICAN 1969 : Mean Value
142: SOUTH AMERICAN 1969 : Argentina
143: SOUTH AMERICAN 1969 : Bolivia
144: SOUTH AMERICAN 1969 : Brazil
145: SOUTH AMERICAN 1969 : Chile
146: SOUTH AMERICAN 1969 : Columbia
147: SOUTH AMERICAN 1969 : Ecuador
148: SOUTH AMERICAN 1969 : Guyana
149: SOUTH AMERICAN 1969 : Paraguay
150: SOUTH AMERICAN 1969 : Peru
151: SOUTH AMERICAN 1969 : Trinidad & Tobago
152: SOUTH AMERICAN 1969 : Venezuela
153: SOUTH ASIA : Singapore
154: SOUTHEAST BASE : Porto Santo & Madeira Is.
155: SOUTHWEST BASE : Faial, Graciosa, Pico, Sao Jorge & Terceria Is.
156: TIMBALAI 1948 : Brunei & East Malaysia (Sarawak & Sabah)
157: TOKYO : Japan
158: TOKYO : Korea
159: TOKYO : Okinawa
160: TRISTAN ASTRO 1968 : Tristan da Cunha
161: VITI LEVU 1916 : Viti Levu Is. (Fiji Is.)
162: WAKE-ENIWETOK 1960 : Marshall Is.
163: ZANDERIJ : Surinam
164: BUKIT RIMPAH : Bangka & Belitung Is. (Indonesia)
165: CAMP AREA ASTRO : Camp Mcmurdo Area, Antarctica
166: G. SEGARA : Kalimantan Is. (Indonesia)
167: HERAT NORTH : Afghanistan
168: HU-TZU-SHAN : Taiwan
169: TANANARIVE OBSERVATORY 1925 : Madagascar
170: YACARE : Uruguay
171: RT-90 : Sweden
172: CK42 (PULKOVO 1942) : Russia
173: FINNISH KKJ : Finland
174: PZ90 : Russia
175: CK95 : Russia

APPENDIX 3 WHAT IS SBAS?

A satellite-based augmentation system, or SBAS (Satellite Based Augmentation System), is an augmentation system that uses additional messages from satellite broadcasts to support regional and wide area augmentation. SBAS provides GPS signal corrections to SBAS users, for even better position accuracy, through the GPS error corrections that are widely broadcasted from the geostationary satellite.

SBAS is used in America, Europe, Japan and India. These four systems; WAAS, EGNOS, MSAS and GAGAN, have interoperability. The illustration below shows the coverage area for each provider. This manual uses "SBAS" for these four providers generically.



Provider	Satellite type	Longitude	Satellite No.
WAAS (Wide Area Augmentation System, America)	Intelsat Galaxy XV	133°W	135
	TeleSat Anik F1R	107.3°W	138
	Inmarsat-4-F3	98°W	133
EGNOS (Euro Geostationary Navigation Overlay Service, Europe)	Inmarsat-3-F2/AOR-E	15.5°W	120
	Artemis	21.5°E	124
	Inmarsat-4-F2	25°E	126
	SES-5	5°E	136
MSAS (Multi-Functional Satellite Augmentation System, Japan)	MTSAT-1R	140°E	129
	MTSAT-2	145°E	137
GAGAN (GPS And GEO Augmented Navigation, India)	GSAT-8	55°E	127
	GSAT-10	83°E	128

SPECIFICATIONS OF SATELLITE COMPASS
SCX-21

1 GENERAL

1.1	Receiving frequency	1575.42 MHz (GPS/Galileo/QZSS/SBAS), 1602.5625 MHz (GLONASS)
1.2	Tracking code	C/A code (GPS/QZSS/SBAS), E1B (Galileo), L1OF (GLONASS)
1.3	Attitude resolution	Heading/ Roll/ Pitch 1.0° rms (static), 0.5° rms (dynamic)
1.4	Tracking bearing	45°/s
1.5	Heave accuracy	5 cm (1σ)
1.6	Attitude setting time	60 s approx.
1.7	Positional accuracy (dependent on ionospheric activity and multipath)	
	GPS	5 m approx. (2drms, HDOP<4)
	MSAS	4 m approx. (2drms, HDOP<4)
	WAAS	3 m approx. (2drms, HDOP<4)
1.8	Position fixing time	50 s approx.
1.9	Update interval	Attitude: 50 Hz max, Position: 10 Hz max.
1.10	Ship's speed accuracy	
	SOG	0.02 kn rms (tracking satellites 5 or more) 0.2 kn rms (tracking satellites 3 or 4)
	VBW (speed on ground)	0.02 kn rms (tracking satellites 5 or more, at antenna position) 0.08 kn rms (tracking satellites 5 or more, at another position) 2.0% of ship's speed or 0.2 kn whichever is the greater (tracking satellites 3 or 4)
1.11	Atmosphere sensor	
	Pressure	850 to 1100 hPa (temperature range: 0°C to +50°C), accuracy: ±1.0 hPa (offset adjustment)
	Temperature	-20°C to +55°C (relative wind: 4 kn or more), accuracy: ±2.0°C (offset adjustment)
1.12	Timing (1PPS) accuracy	50 μs

2 INTERFACE

2.1	Number of ports	NMEA0183: Tx 3 channel, Rx 2 channel PPS: 1 channel, RS-485, rising edge detecting
2.2	Data sentences	
	Input	AAM*, APB*, BOD*, BWC*, BWR*, RMB*, TLL*, XTE*
	Output	AAM*, APB*, BOD*, BWC*, BWR*, DTM, GGA, GLL, GNS, GSA, GSV, HDG, HDT, HRM, POS, RMB*, RMC, ROT, THS, TLL*, VBW, VTG, XDR, XTE*, ZDA
2.3	Output P sentences	
	PFEC	GPatt, GPhve, GPimu, pidat, SDmrk*, GPmsv, hdcom

*: GP-39 required

3 POWER SUPPLY

12-24 VDC (10.8-31.2V): 0.2-0.1 A

4 ENVIRONMENTAL CONDITIONS

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

5 UNIT COLOR

N9.5

重要なお知らせ

- マニュアル記載内容の一部または全部の転載、複写は著作権者である当社の許諾が必要です。無断転載することを固くお断りします。
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- お買い上げの機器を廃棄するときは、産業廃棄物として地方自治体の条例または規則に従って処理してください。詳しくは、各地方自治体に問い合わせてください。
- マニュアルに記載されている社名、製品名は、一般に各開発メーカーの登録商標または商標です

⚠ 安全にお使いいただくために

必ずお守りください

お使いになる人や他の人への危害、財産への損害を未然に防止するため、以下のことを必ずお守りください。表示内容を無視して誤った使い方をしたときに生じる危害や、損害の程度を本書では次の表示で区分し、説明していますので十分に気をつけてください。

⚠ 危険	この表示は「取扱いを誤った場合、死亡または重傷を負う危険が切迫して生じることが想定される」内容です。
⚠ 警告	この表示は「取扱いを誤った場合、死亡または重傷を負う可能性が想定される」内容です。
⚠ 注意	この表示は「取扱いを誤った場合、中程度または軽傷の傷害、あるいは財産への損害を負う可能性が想定される」内容です。

⚠「注意喚起」の内容　　「禁止」の内容　　「強制」の内容

装備上の安全事項

⚠ 警告

機器を装備する前には必ず配電盤の電源を切ること。

電源を入れたまま工事を行うと、感電や火災の事故が起こる恐れがあります。

当社または当社の指定する代理店の技術者以外はカバーを外さないこと。

誤って触れると、感電の原因になります。

電源ケーブルは必ず指定のもの（工事材料として支給しているもの）を使用すること。

指定外のものを使用すると、火災の原因になる恐れがあります。

分解・改造は絶対にしないこと。

火災、感電、ケガの原因になります。

⚠ 注意

次のコンパス安全距離を確保すること。

	標準コンパス	操舵コンパス
SCX-21（サテライトコンパス）	0.30m	0.30m

アース（接地）は確実に取り付けてください。

接地が悪いと感電の恐れや他の機器から干渉を受ける恐れがあります。

取扱い上の安全事項

⚠ 警告

当社または当社の指定する代理店の技術者以外はカバーを外さないこと。

誤って触れると、感電の原因になります。

分解・改造は絶対にしないこと。

火災、感電、ケガの原因になります。

発煙・発火のときは、配電盤の電源スイッチを切ること。

そのまま使用すると火災の恐れがあります。必ずお買い上げ店へ連絡してください。

ヒューズは規定のものを使用すること。

規定外のものを使った場合、重大な故障を引き起こす恐れがあります。

⚠ 注 意

電源を入れた状態で、信号ケーブルコネクタの抜き差しを行わないでください。

本機が故障する恐れがあります。

本機は航海に役立つ各種の情報を提供します。しかし、どのような場合でも単一の航法に頼るのは問題です。他の航海機器も併用し、人間によるワッチも怠らないようにしてください。

本機に表示される情報は、直接航海の用に供するためのものではありません。詳細な情報および最新の情報については、海図を参照してください。

目　次

はじめに

このたびは、当社製品をお買い求めいただき、誠にありがとうございます。当社は1948 年の創業以来、数々の舶用電子機器を製造販売しており、性能、品質、信頼性については全世界のユーザーの方々から高い評価を受けています。本機は、厳しい品質管理のもとで設計・製造されていますので、性能・耐久性ともに安心してご使用いただけます。この取扱説明書をよくお読みいただき、本来の性能を十分発揮させていただきますようお願い申し上げます。

特徴

本機は、当社独自のコア技術による動揺に強い安定性を備え、豊富な情報出力が可能な小型サテライトコンパス TM です。陸上、海上の両方に対して幅広い用途で使用することができます。

主な特徴は、次のとおりです。

- ヘディング精度：0.5°（静止時は 1.0°）
- レーダーの TT、エコートレイル、AIS、オートパイロット、スキャニングソナーの方位センサーとして最適
- 位置情報の精度が向上
- 船の動きを補正するデジタル形式のピッチ、ロールの出力が可能。
- ヒーブ出力が可能なことより、動揺補正も実現。
- 姿勢角静定まで 60 秒
- NMEA 0183 対応機器
- プレジャー機器にも適した魅力的な外観をもつ筐体

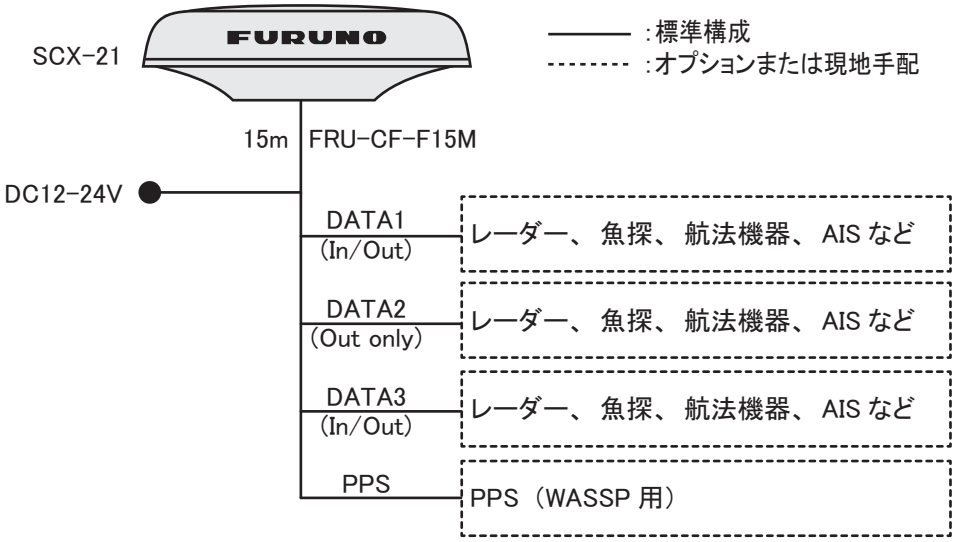
プログラム番号

ユニット	名称	プログラム番号
空中線部	STARTER	2051599 01.xx
	BOOTER	2051600 01.xx
	APL	2051601 01.xx
	GNSS (1 to 4)	48505230 xx

xx：軽微な変更の進度

システム構成

センサーとして使用する場合



構成表

標準構成

名称	型式	コード番号	数量	備考
サテライトコンパス	SCX-21	-	1	NMEA 0183 用
予備品	SP20-01901	001-556-110	1	ヒューズ、2 個
工材	CP20-04630	000-036-771	1（選択）	ポールマウントキット用、ケーブル FRU-CF-F15M（15m）含む
	CP20-04640	000-036-772		ポールマウントキット用（マスト取付金具 CP20-04605* 付)、マスト適合径 ϕ25 ～ 35mm、、ケーブル FRU-CF-F15M（15m）含む *: 取付補助金具、パイプ、ホースクランプ ϕ25 ～ 35mm、含む

オプション構成

名称	型式	コード番号	数量
ケーブル組品	FRU-CF-F15M	001-555-560	
	FRU-CF-F30M	001-555-570	
直型アンテナベース	NO.13-QA330	001-111-910-10	
ポールマウントキット *	CP20-04603	001-556-200	
マスト取付金具 *	CP20-04605	001-556-240	ポールマウントキット（CP20-04603）用
ホースクランプ（大)	OP20-52	001-556-260	マスト適合径 ϕ35 ～ 50mm 用
鳥除け	OP20-54	001-556-280	2 本
積雪カバーキット	OP20-53	001-556-320	

*：装備場所やシステム構成に応じた適切なキットを選択して下さい。

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1章　取付け

ご注意

塗料、防錆剤、接点復活剤などは有機溶剤を含んでいるので、機器の塗装部分や樹脂部品には使用しないでください。

機器の塗装部分や樹脂部品を劣化させることがあります。特に、樹脂のコネクタに使用すると破損する恐れがありますので絶対に使用しないでください。

本機は次のような装備方法で取り付けることができます。詳細は巻末の外寸図を参照してください。

- 平面装備（底面からの固定）→1.2 節
- ポールマウント →1.3 節
- アンテナベース装備 →1.4 節、オプション

空中線ケーブルは NMEA 0183 用のケーブル（FRU-CF-F15/30M）を使用します。

1.1　装備上の注意

取付け場所の選定には、以下の点に注意してください。

- 空中線ケーブル長を考慮して、装備位置を選定してください。
- 本機の重量に耐えうる強度のある取付位置を選定してください（巻末の外寸図参照）。
- 保守点検のため、空中線部の周囲には十分なサービス空間を設けること。サービス空間寸法については、巻末の外寸図を参照してください。
- インマルサット F/FB の送信アンテナからは、少なくとも 3m 離して、送信ビーム内に入る場所には設置しないでください。
- 本機の空中線ケーブルと無線機のケーブルをまとめて配線しないようにしてください。このようにケーブル装備しても、ノイズ低減が不十分な場合は、無線機でスケルチを調整してください。
- 周囲に大きな電波の遮蔽物がある場所には、設置しないでください。
- 空中線内部には GPS センサーを内蔵しているため、局所的な振動や衝撃（船のエンジンによる共振や、マストによる共振など）を受けにくい場所に取り付けてください。
- コンパス安全距離を確保して、磁気コンパスに誤差が発生しないようにしてください。

空中線部の設置場所

空中線部を設置する際には、巻末の装備要領図面（Dwg. No. C7286-Y01-*）を参照してて、適切な場所を決定してください。

1.2 平面装備

空中線部単体を平面に取り付けることが出来ます。このとき、取付位置の下側からネジで固定します。

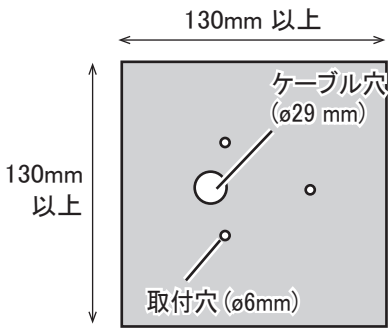
1.2.1 必要な工具

本機を取り付ける前に、次の工具を事前に準備する必要があります。

名称	備考
電動ドリル	取付穴用
ドリルビット	ϕ6
穴のこぎり	ケーブル穴用 (ϕ25mm)
やすり	ケーブル穴の切り口の処理用
プラスドライバ	#2

1.2.2 取付け

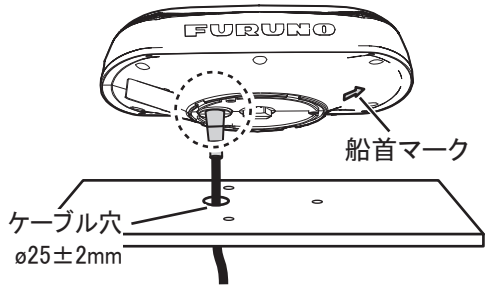
1. 現地で取付台（130mm×130mm 以上）を用意します。
   錆びが発生する取付台の場合は、防錆剤を塗布してください。
   注）取付け面は平らで、がたつきがない場所を選択してください。
2. 取付穴 3ヵ所と、空中線ケーブル用のケーブル穴（ϕ29±2mm）を 1 カ所あけます（巻末の外寸図参照）。



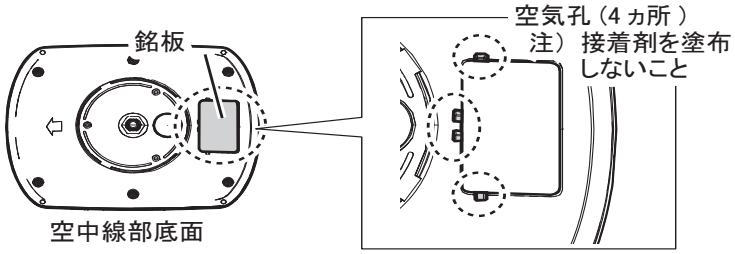
注）空中線部の船首マークが船首方向を向くように、取付台に載せます。

3. 手順 2 のケーブル穴に空中線ケーブルのコネクタ部が上になるように取付台の下から通します。

4. 空中線ケーブルのコネクタと空中線部を接続します。

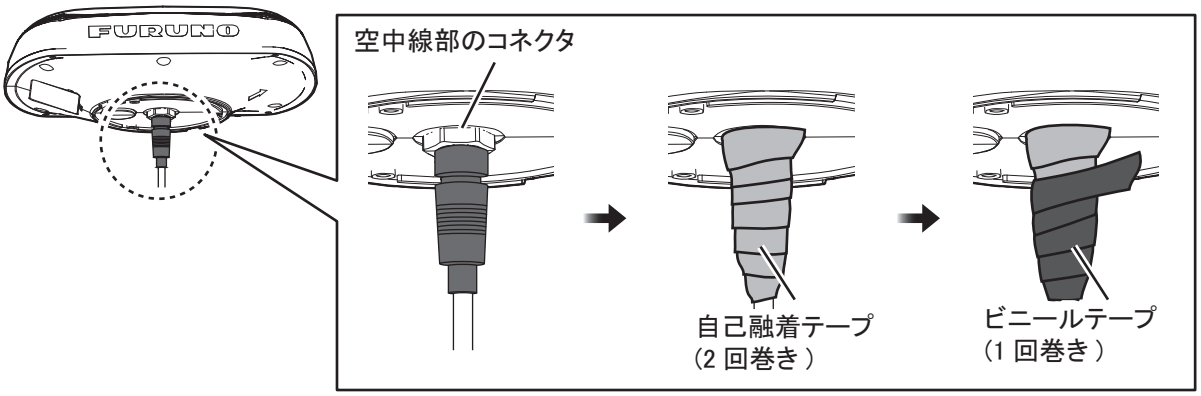


注）空中線部底面の銘板近くにある空気孔（4ヵ所）には接着剤を塗布しないでください。



5. コネクタ接続部に自己融着テープを 2 回巻き、その上からビニールテープを 1 回巻きます。

注）このとき、空中線部とケーブルのコネクタ両方にテープがかかるように巻いてください。

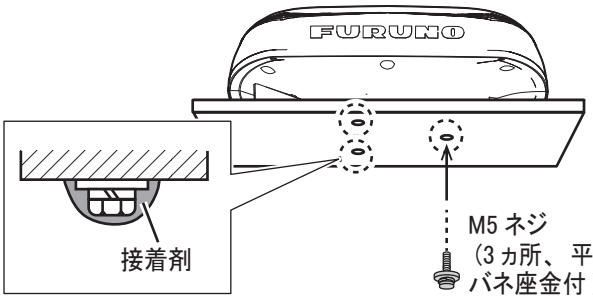


6. 空中線部の船首マークが船首方向に向くように調整します。

注）取付台に設置した空中線部が傾いていないことを確認してください。

7. 空中線部の底面から 4 本のネジ（M5×20、平座金、バネ座金付）で手順 2 の取付穴から空中線部を取付位置に固定します。ネジで固定後、ネジの頭に工材の接着剤を塗布します。

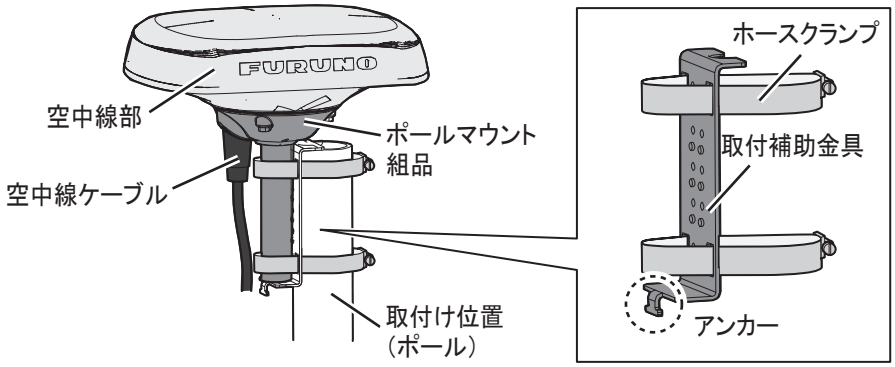
注）ネジの長さは取付け位置の板厚によって異なります。



板厚（取付け位置）	M5 ネジの長さ
2 ～ 10mm	20mm（工材）
10mm 以上	板厚 + 8 ～ 16mm（現地手配）

1.3 ポールマウント装備

あらかじめポールマウントキットと空中線部を組み立ててから、取付け位置に固定します。



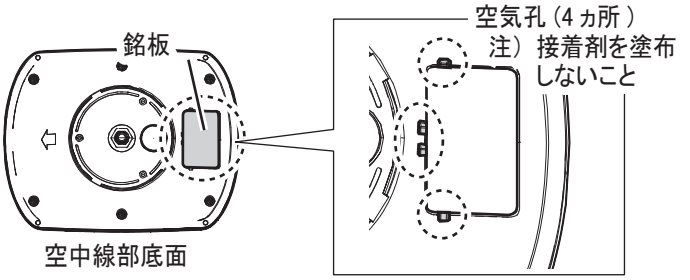
装備イメージ図

1.3.1 装備上の注意

- 取付け位置のポールの直径は 25 ～ 50mm 以内の必要があります。
- ポールマウントキットを取り付けた空中線部は船首マークが船首方向を向くように取り付けます。
- ホースクランプは取付け位置のポールの直径に応じて、正しいサイズのものを使用してください。

名称	適用マスト径	備考
ホース クランプ	20A ～ 25A (ϕ25 ～ 35mm)	工材 CP20-04603 で標準支給
	32A ～ 40A (ϕ35 ～ 50mm)	オプション OP20-52 で支給

- 空中線部底面の銘板近くにある空気孔（4ヵ所）には接着剤を塗布しないでください。



空中線部底面

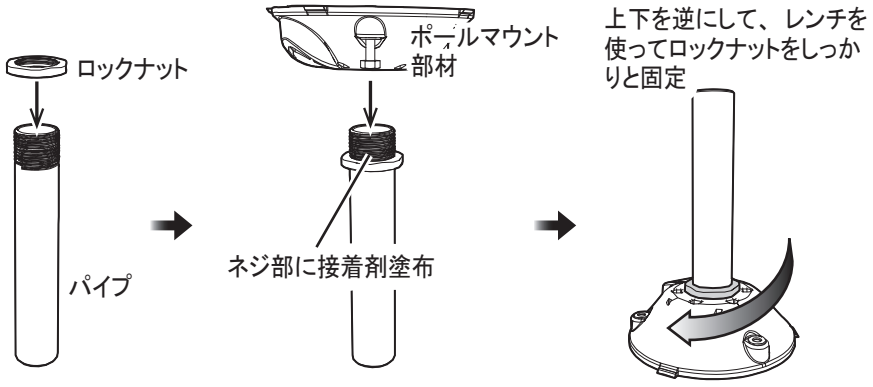
1.3.2 必要な工具

本機を取り付ける前に、次の工具を事前に準備する必要があります。

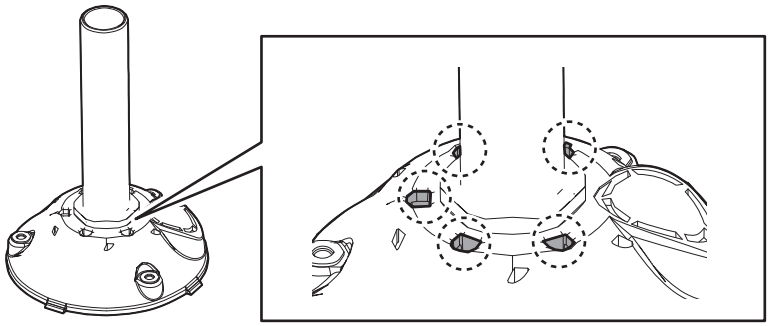
名称	備考
プラスドライバ	#2
マイナスドライバ	ホースクランプ取付用
レンチ	• ロックナット締付用（対辺 32mm） • ポールマウント部材固定用（対辺 8mm）
束線バンド	2 本 (最低)、空中線ケーブルのポール固定用
ニッパー	空中線部ケーブル導入口カバー用
自己融着テープ	コネクタ結合部の防水用
ビニールテープ	コネクタ結合部の防水用

1.3.3 ポールマウントキットの組立て

1. ロックナット（工材）をパイプ（工材）のネジ部の一番下まで取り付けます。
2. パイプのネジ部に接着剤を塗布し、ポールマウント部材を取り付けます。
3. 取り付けた組品を上下逆にして、レンチ（現地手配）を使ってロックナットをしっかりと固定します（締付トルク：15N•m）。

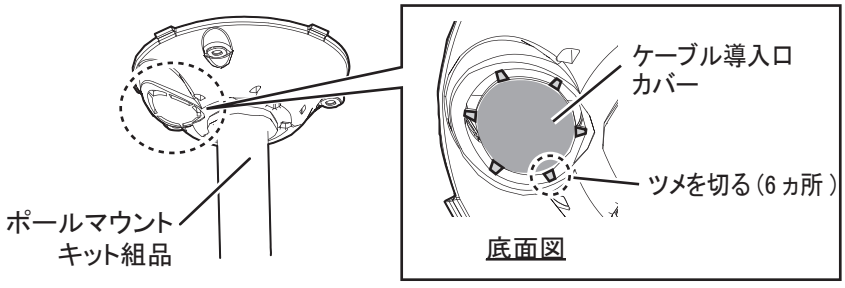


4. 余分な接着剤を拭き取ります。
   注）このとき、下図 5 か所の水抜き穴を塞がないように注意してください。

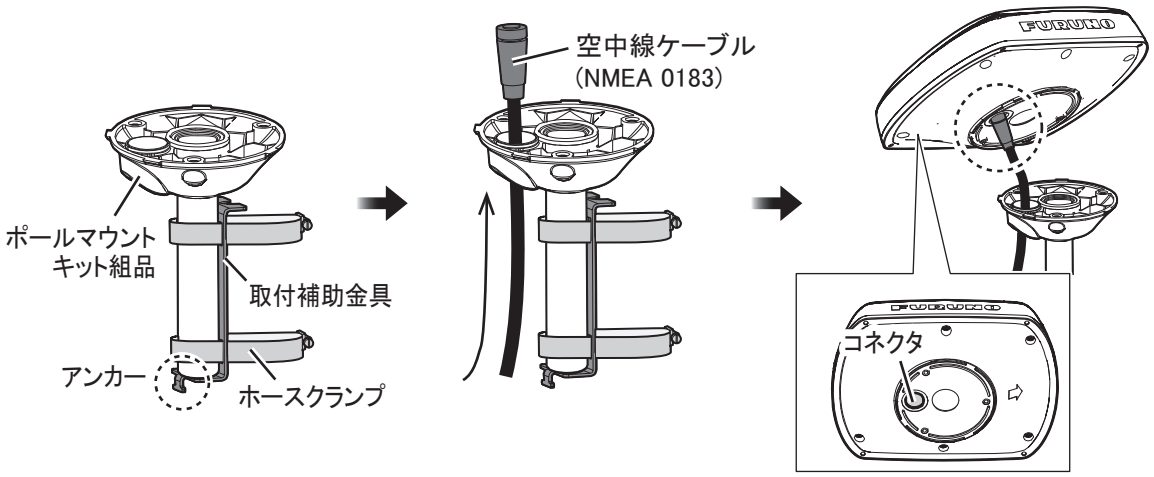


1.3.4 取付け

1. ニッパー（現地手配）を使ってポールマウントキット組品のケーブル導入口カバーを取り外します。

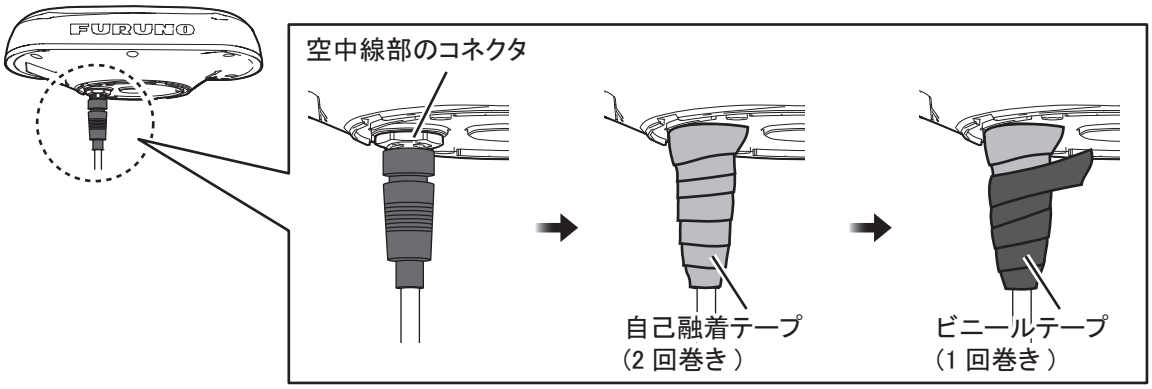


2. ポールマウントキット組品にホースクランプを通し、組品の下から空中線ケーブルを通し、空中線ケーブルのコネクタと空中線部を接続します。
   注）アンカーが**下向き**になるように取付補助金具を配置します。

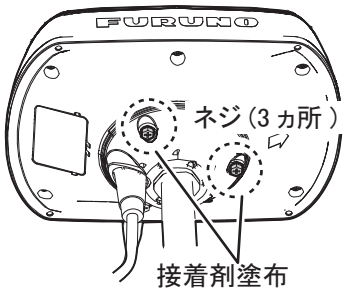


3. コネクタ接続部に自己融着テープを 2 回巻き、その上からビニールテープを 1 回巻きます。

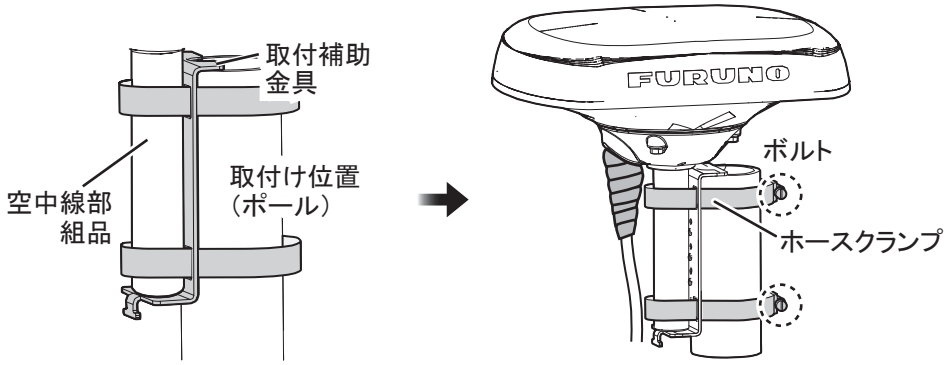
   注）このとき、空中線部とケーブルのコネクタ両方にテープがかかるように巻いてください。



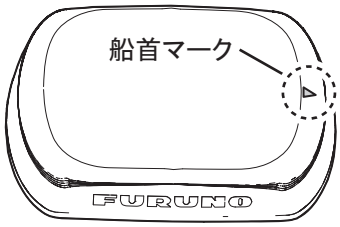
4. 空中線部の底面から空中線部をポールマウントキット組品に取付け、3 本のネジ（M5、工材）で固定します。取付け後、ネジの頭に接着剤（工材）を塗布します。



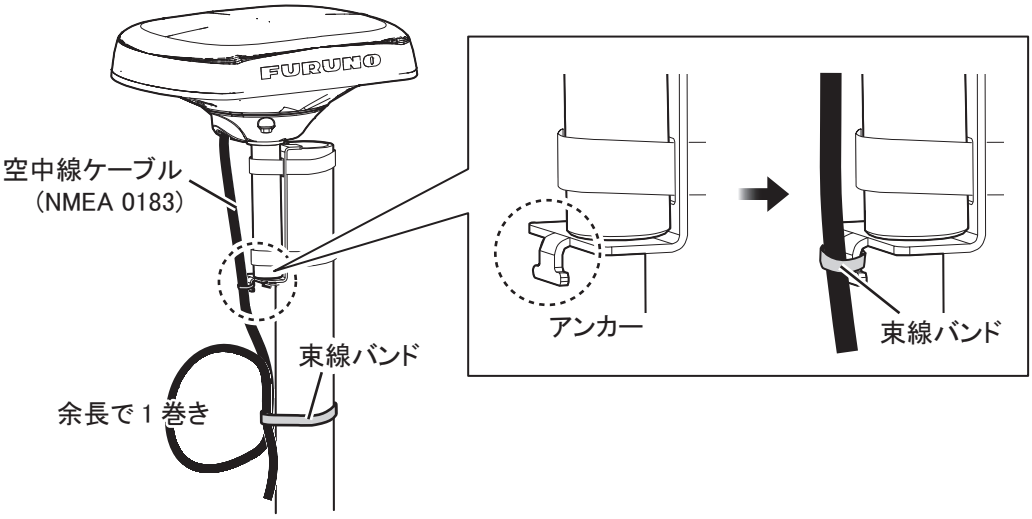
5. 空中線部組品にある取付補助金具が、取付位置のポールの上部に来るように配置します。その後、ホースクランプのボルトを緩く締めます。



6. 空中線部の船首マークが船首方向を向くように配置を調整します。



7. ホースクランプの 2 本のボルトをしっかりと締め、空中線部組品を固定します。
8. 空中線ケーブルを取付け補助金具のアンカーで束線バンド（工材）を使って固定します。空中線ケーブルの余長を 1 巻きし、束線バンド（現地手配）を使って取付位置のポールに固定します。



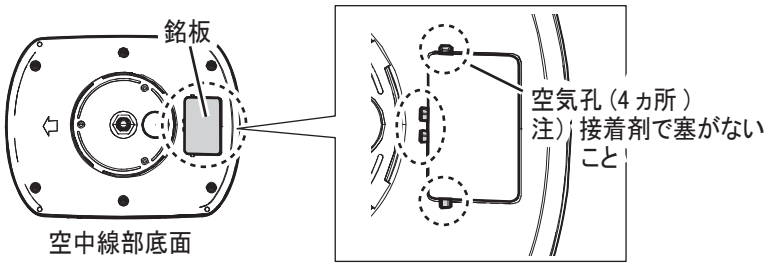
1.4 アンテナベース装備 (オプション)

オプションの直型アンテナベース（NO.13-QA330）を使うことで、次のような場所への装備が可能です。

- 斜面（傾き 35° まで）
- 装備面が狭い場所

1.4.1 装備上の注意

- がたつきのある面には装備しないでください。
- 空中線部底面の銘板近くにある空気孔（4ヵ所）には接着剤を塗布しないでください。



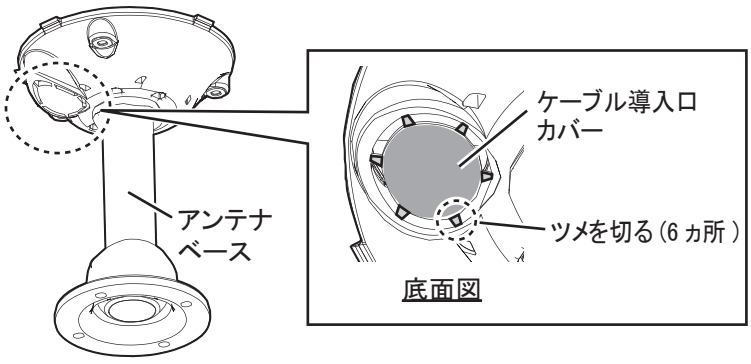
1.4.2 必要な工具

本機を取り付ける前に、次の工具を事前に準備する必要があります。

名称	備考
電動ドリル	取付穴用
ドリルビット	ϕ4.2 ～ 5
穴のこぎり	ケーブル穴用 (ϕ25mm)
やすり	ケーブル穴の切り口の処理用
プラスドライバ	#2
ニッパー	空中線部ケーブル導入口カバー用

1.4.3 取付け

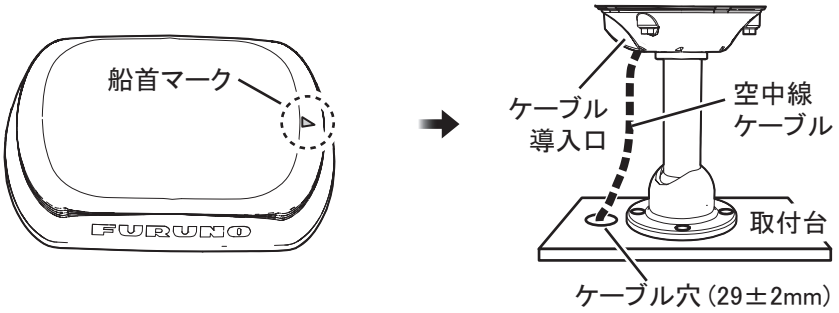
1. ニッパー（現地手配）を使ってポールマウントキット組品のケーブル導入口カバーを取り外します。



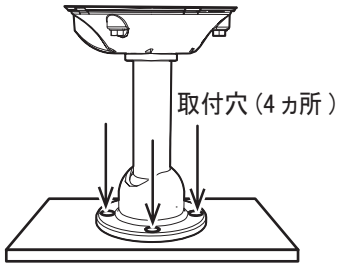
2. 1.3.3 節を参考にして、アンテナベースにポールマウントキットを組み立てます。
   注）ポールマウントキットに含まれるパイプは使用しません。
3. 空中線部の船首マークが船首方向を向くように直型アンテナベースを取付台に配置します。斜面に取り付ける場合は、傾ける方向に注意して配置しま

す。取付台に穴をあけて空中線ケーブルを配線する必要がある場合は、ケーブル穴（ϕ29mm 以上）をあけます。

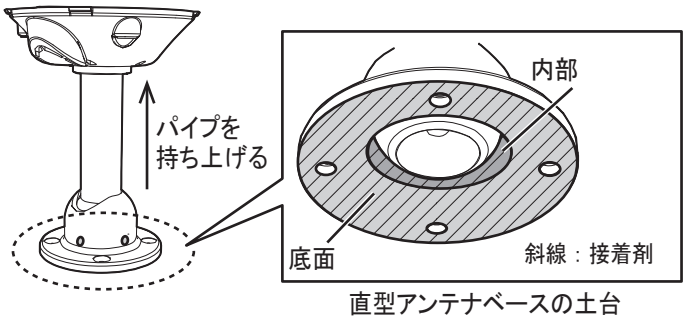
注）アンテナベースは配置した向きによって傾けることができる方向が決まります。



4. 取付台に直型アンテナベースを固定する 4 つの取付穴（ϕ4.2 ～ 5mm）をあけます。

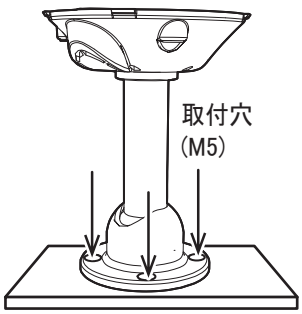


5. 直型アンテナベースの直下が空洞である場合（ケーブル穴ではなく）は、パイプを上方向に引っ張ります。その後、直型アンテナベースの底面とその内側（下図の斜線部）に接着剤を塗布します。

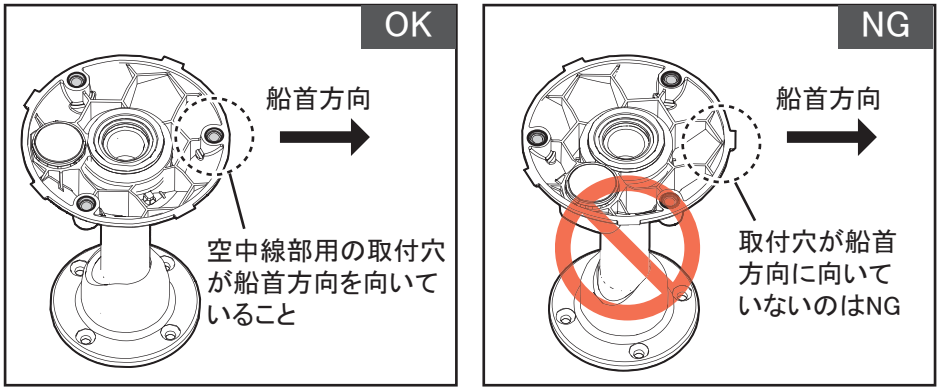


直型アンテナベースの土台

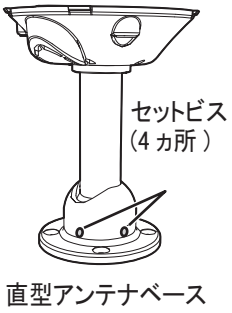
6. 取付台にあけた取付穴と直型アンテナベースのネジ穴が一致するように配置し、4 本のネジ（M5、工材）を使ってしっかりと締めつけます。



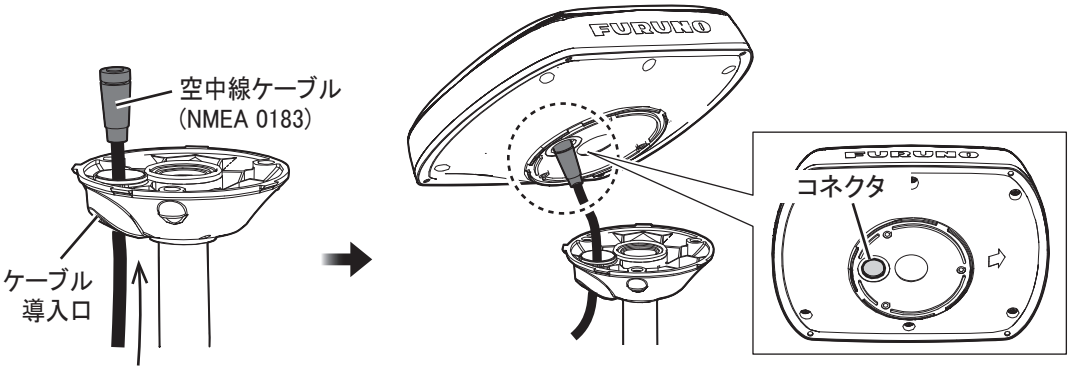
7. 直型アンテナベースの下部にある 4 か所のセットビスを六角レンチ（工材）で緩め、船首方向を考慮し、直型アンテナベースの向きを調整します。



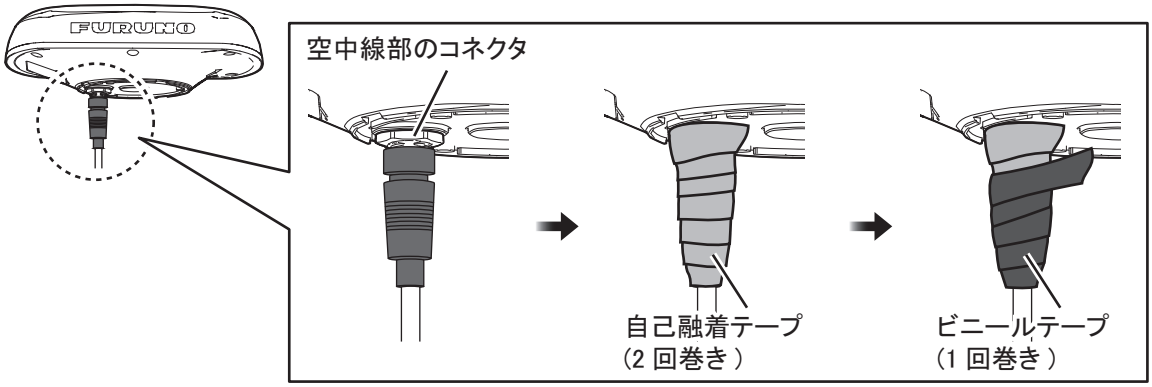
8. 直型アンテナベースで緩めたセットビスを 1 つずつ外して、工材のセットビス（接着剤塗布済み）と交換して取り付けます。締め付け後、余分な接着剤はしっかりと拭き取ります。
   注）接着剤が固まるには、およそ 30 分かかります。



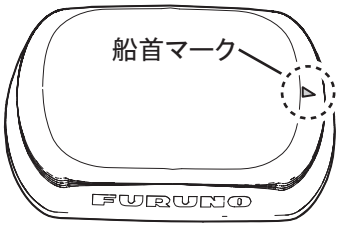
9. 空中線ケーブルのコネクタと空中線部を接続します。



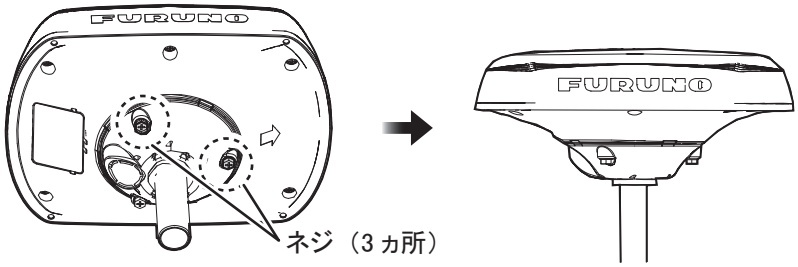
10. コネクタ接続部に自己融着テープを 2 回巻き、その上からビニールテープを 1 回巻きます。
    注）このとき、空中線部とケーブルのコネクタ両方にテープがかかるように巻いてください。



11. 船首マークが船首方向を向くように空中線部の向きを調整します。



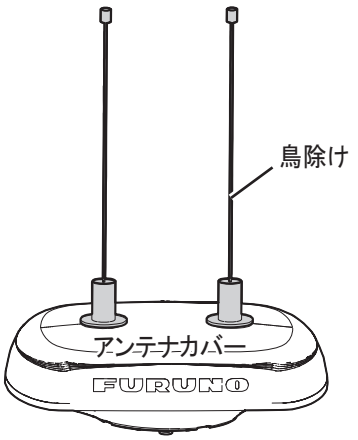
12. 空中線部の底面からネジ 3 本（工材、M5）を使って、空中線部を固定します。



1.5 鳥除け (オプション)

オプションの鳥除け（OP20-54）を空中線部の上部に取り付けることで、鳥が空中線部に止まることを軽減することができます。

2 本の鳥除けにある両面テープを外して、空中線部上部に取り付けます。取付後、空中線部との接触面を覆うように接着剤を塗布します。



1.6 積雪カバー (オプション)

オプションの積雪カバーキット（OP20-53）を使用することで、空中線部での積雪を軽減することができます。

取付け方については、キットに同梱されている要領書 (C72-01901) を参照してください。

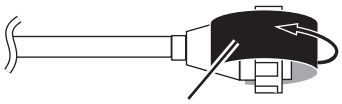
1.7 結線

空中線部からのケーブルを必要な航海機器に接続します。

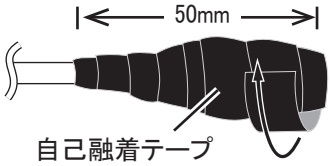
ケーブルコネクタの防水処理

使用しないケーブルコネクタは、下記の防水処理を行う必要があります。

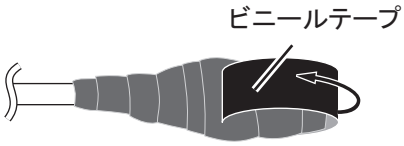
1) ケーブルのコネクタ先端を自己融着テープで覆います。



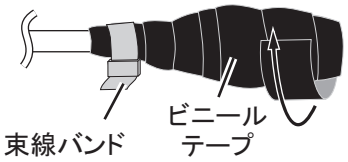
2) 巻く方向を変えて、自己融着テープを約 50mm 巻きつけます。このとき、ケーブルのコネクタ先端が隠れるように巻きます。



3) 自己融着テープの上から、コネクタ先端にビニールテープを巻きます。



4) 自己融着テープを覆うように、ビニールテープを巻きつけます。テープの終端はほどけないように束線バンドで固定します。



2 章　装備後の設定

本機は、電源投入のたびにコールドスタートし、約 60 秒で方位計算が終了します。30 分経過しても船首方位が計算されない場合は、空中線部の取付位置が適当でない可能性があります。本機と衛星の間の通信を遮断するような障害物がないことを確認してください。造船所内または岸壁で確認するときは、周囲に影になるような障害物や建造物がないか確認してください。

方位誤差が 5° 以上あるときは、船首方位を確認しながら空中線部の向きを合わせます。

本機は、PC を接続し SC 設定ツールから設定を行います。SC 設定ツールの操作や設定項目については、当社支店・営業所・代理店にお問い合わせ下さい。

このページは空白です。

3 章　保守

3.1　保守点検

機器の性能を十分に発揮させるには、定期的な点検が必要です。定期的に次の項目を点検してください。

項目	チェックポイント	対処
コネクタ	コネクタすべてが確実に締まっているか確認する。	ケーブルのコネクタを確実に接続する。
ケーブル配線	ケーブルに傷などがないか確認する。	ケーブル交換が必要な場合は、お買い上げ先、または当社支店・営業所に問い合わせる。
ユニット カバー	カバーの清掃	ほこりや汚れは、柔らかい乾いた布でふき取る。泥や塩などがこびり付いている場合は、濡れた布でゆっくりとふきます。 清掃にシンナーやアセトン、アルコール、ベンジンなどのプラスチック溶剤は使用しないでください。 表面の塗装や表示部の文字などが溶ける場合があります。

3.2　ヒューズの交換

過電流から本機を保護するために、ヒューズが付いています（電源ケーブル）。電源が入らないときは、まずヒューズを調べてみてください。ヒューズが原因の場合は、規定のヒューズと交換してください。ヒューズを交換しても再び切れるときは、お買い上げの販売店・代理店、最寄りの当社支店・営業所あてへお問い合わせください。

型式	コード番号
FRU-60V-FU-2A	000-195-429-10

3.3 トラブルシューティング

「故障かな」と思ったら、まず次の点検を行ってください。修理は資格をもったサービスマンに依頼してください。また、サービスマンを呼ぶときには、点検した事柄を詳しく報告していただくと、サービスが迅速になります。

項目	考えられる要因	対処
データが出力されない	ケーブルの接続不良 / 損傷 / 欠陥	ケーブルコネクタがしっかりと接続されていることを確認する。またケーブルに損傷がないか確認する。本機に電力が正しく供給されていることを確認する。必要に応じて、お買い上げ先、または当社支店・営業所に問い合わせる。
	本機メニュー設定の不備	本機の出力設定が正しいか確認する。下記の設定について、接続機器の要求と一致していることを確認する。 • フォーマット • トーカー • ボーレート
	表示部の設定不備	接続機器側の説明書を参照して、メニュー設定を確認する。
データが正しく出力されない	装備後の設定でオフセットが正しく設定されていない / 適用されていない	• 装備場所が適切か確認する • 接続されている他の機器での設定値を確認する。必要に応じて、オフセットを再調整する。
GLONASS 衛星が衛星モニターで表示されない	ANT4 が選択されている	アンテナ番号 4 は GLONASS 衛星を検知できないため、異なる衛星番号を選択して確認する。
自己診断テストが終了しない / 正しい結果を表示しない	本機が起動し、位置情報を取得する前に、自己診断テストが始まった	本機からのデータ出力が安定するまで待ってから、自己診断テストを再度実施する。

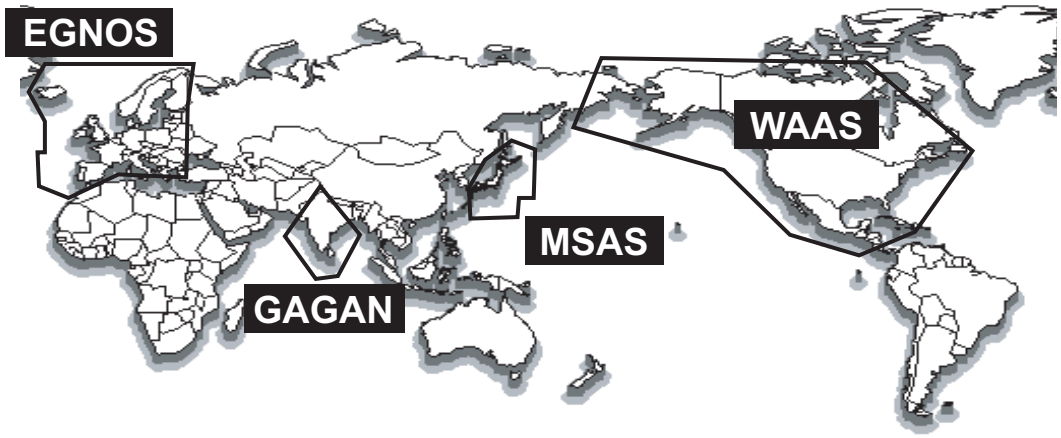
追補 1 測地系リスト

001: WGS84
002: WGS72
003: TOKYO : Mean Value (Japan, Korea & Okinawa)
004: NORTH AMERICAN 1927 : Mean Value (CONUS)
005: EUROPEAN 1950 : Mean Value
006: AUSTRALIAN GEODETIC 1984 : Australia & Tasmania
007: ADINDAN : Mean Value (Ethiopia & Sudan)
008: ADINDAN : Ethiopia
009: ADINDAN : Mali
010: ADINDAN : Senegal
011: ADINDAN : Sudan
012: AFG : Somalia
013: AIN EL ABD 1970 : Bahrain Is.
014: ANNA 1 ASTRO 1965 : Cocos Is.
015: ARC 1950 : Mean Value
016: ARC 1950 : Botswana
017: ARC 1950 : Lesotho
018: ARC 1950 : Malawi
019: ARC 1950 : Swaziland
020: ARC 1950 : Zaire
021: ARC 1950 : Zambia
022: ARC 1950 : Zimbabwe
023: ARC 1960 : Mean Value (Kenya & Tanzania)
024: ARC 1960 : Kenya
025: ARC 1960 : Tanzania
026: ASCENSION IS. 1958 : Ascension Is.
027: ASTRO BEACON “E” : Iwo Jima Is.
028: ASTRO B4 SOR. ATOLL : Tern Is.
029: ASTRO POS 71/4 : St. Helena Is.
030: ASTRONOMIC STATION 1952 : Marcus Is.
031: AUSTRALIAN GEODETIC 1966 : Australia & Tasmania
032: BELLEVUE (IGN) : Efate & Erromango Is.
033: BERMUDA 1957 : Bermuda Is.
034: BOGOTA OBSERVATORY : Columbia
035: CAMPO INCHAUSPE : Argentina
036: CANTON IS. 1966 : Phoenix Is.
037: CAPE : South Africa
038: CAPE CANAVERAL : Mean Value (Florida & Bahama Is.)
039: CARTHAGE : Tunisia
040: CHATHAM 1971 : Chatham Is. (New Zealand)
041: CHUA ASTRO : Paraguay
042: CORREGO ALEGRE : Brazil
043: DJAKARTA (BATAVIA) : Sumatra Is. (Indonesia)
044: DOS 1968 : Gizo Is. (New Georgia Is.)
045: EASTER IS. 1967 : Easter Is.
046: EUROPEAN 1950 (Cont’d) : Western Europe
047: EUROPEAN 1950 (Cont’d) : Cyprus
048: EUROPEAN 1950 (Cont’d) : Egypt
049: EUROPEAN 1950 (Cont’d) : England, Scotland, Channel & Shetland Is.
050: EUROPEAN 1950 (Cont’d) : England, Ireland, Scotland & Shetland Is.
051: EUROPEAN 1950 (Cont’d) : Greece
052 EUROPEAN 1950 (Cont’d) : Iran
053: EUROPEAN 1950 (Cont’d) : Italy, Sardinia
054: EUROPEAN 1950 (Cont’d) : Italy, Sicily
055: EUROPEAN 1950 (Cont’d) : Norway & Finland
056: EUROPEAN 1950 (Cont’d) : Portugal & Spain
057: EUROPEAN 1979 : Mean Value
058: GANDAJIKA BASE : Republic of Maldives
059: GEODETIC DATUM 1949 : New Zealand
060: GUAM 1963 : Guam Is.
061: GUX 1 ASTRO : Guadalcanal Is.
062: HJORSEY 1955 : Iceland
063: HONG KONG 1963 : Hong Kong
064: INDIAN : Thailand & Vietnam
065: INDIAN : Bangladesh, India & Nepal
066: IRELAND 1965 : Ireland
067: ISTS 073 ASTRO 1969 : Diego Garcia
068: JOHNSTON IS. 1961 : Johnston Is.
069: KANDAWALA : Sri Lanka
070: KERGUELEN IS. : Kerguelen Is.
071: KERTAU 1948 : West Malaysia & Singapore
072: LA REUNION : Mascarene Is.
073: L. C. 5 ASTRO : Cayman Brac Is.
074: LIBERIA 1964 : Liberia
075: LUZON : Philippines (excl. Mindanao Is.)
076: LUZON : Mindanao Is.
077: MAHE 1971 : Mahe Is.
078: MARCO ASTRO : Salvage Islands
079: MASSAWA : Eritrea (Ethiopia)
080: MERCHICH : Morocco
081: MIDWAY ASTRO 1961 : Midway Is.
082: MINNA : Nigeria
083: NAHRWAN : Masirah Is. (Oman)
084: NAHRWAN : United Arab Emirates
085: NAHRWAN : Saudi Arabia
086: NAMIBIA : Namibia
087: MAPARIMA, BWI : Trinidad & Tobago
088: NORTH AMERICAN 1927 : Western United States
089: NORTH AMERICAN 1927 : Eastern United States
090: NORTH AMERICAN 1927 : Alaska
091: NORTH AMERICAN 1927 : Bahamas (excl. San Salvador Is.)
092: NORTH AMERICAN 1927 : Bahamas, San Salvador Is.
093: NORTH AMERICAN 1927 (Cont’d): Canada (ind. Newfoundland Is.)
094: NORTH AMERICAN 1927 (Cont’d): Alberta & British Columbia
095: NORTH AMERICAN 1927 (Cont’d): East Canada
096: NORTH AMERICAN 1927 (Cont’d): Manitoba & Ontario
097: NORTH AMERICAN 1927 (Cont’d): Northwest Territories & Saskatchewan
098: NORTH AMERICAN 1927 (Cont’d): Yukon
099: NORTH AMERICAN 1927 (Cont’d): Canal Zone
100: NORTH AMERICAN 1927 (Cont’d): Caribbean
101: NORTH AMERICAN 1927 (Cont’d): Central America
102: NORTH AMERICAN 1927 (Cont’d): Cuba
103: NORTH AMERICAN 1927 (Cont’d): Greenland
104: NORTH AMERICAN 1927 (Cont’d): Mexico
105: NORTH AMERICAN 1983 : Alaska
106: NORTH AMERICAN 1983 : Canada
107: NORTH AMERICAN 1983 : CONUS
108: NORTH AMERICAN 1983 : Mexico, Central America
109: OBSERVATORIO 1966 : Corvo & Flores Is. (Azores)
110: OLD EGYPTIAN 1930 : Egypt
111: OLD HAWAIIAN : Mean Value
112: OLD HAWAIIAN : Hawaii
113: OLD HAWAIIAN : Kauai
114: OLD HAWAIIAN : Maui
115: OLD HAWAIIAN : Oahu
116: OMAN : Oman
117: ORDNANCE SURVEY OF GREAT BRITAIN 1936: Mean Value
118: ORDNANCE SURVEY OF GREAT BRITAIN 1936: England
119: ORDNANCE SURVEY OF GREAT BRITAIN 1936: England, Isle of Man & Wales
120: ORDNANCE SURVEY OF GREAT BRITAIN 1936: Scotland & Shetland Is.
121: ORDNANCE SURVEY OF GREAT BRITAIN 1936 : Wales
122: PICO DE LAS NIVIES : Canary Is.
123: PITCAIRN ASTRO 1967 : Pitcairn Is.
124: PROVISIONAL SOUTH CHILEAN 1963: South Chile (near 53°S)
125: PROVISIONAL SOUTH AMERICAN 1956: Mean Value
126: PROVISIONAL SOUTH AMERICAN 1956: Bolivia
127: PROVISIONAL SOUTH AMERICAN 1956: Chile-Northern Chile (near 19°S)
128: PROVISIONAL SOUTH AMERICAN 1956: Chile-Southern Chile (near 43°S)
129: PROVISIONAL SOUTH AMERICAN 1956: Columbia
130: PROVISIONAL SOUTH AMERICAN 1956: Ecuador
131: PROVISIONAL SOUTH AMERICAN 1956: Guyana
132: PROVISIONAL SOUTH AMERICAN 1956: Peru
133: PROVISIONAL SOUTH AMERICAN 1956: Venezuela
134: PUERTO RICO : Puerto Rico & Virgin Is.
135: QATAR NATIONAL : Qatar
136: QORNOQ : South Greenland
137: ROME 1940 : Sardinia Is.
138: SANTA BRAZ : Sao Miguel, Santa Maria Is. (Azores)
139: SANTO (DOS) : Espirito Santo Is.
140: SAPPER HILL 1943 : East Falkland Is.
141: SOUTH AMERICAN 1969 : Mean Value
142: SOUTH AMERICAN 1969 : Argentina
143: SOUTH AMERICAN 1969 : Bolivia
144: SOUTH AMERICAN 1969 : Brazil
145: SOUTH AMERICAN 1969 : Chile
146: SOUTH AMERICAN 1969 : Columbia
147: SOUTH AMERICAN 1969 : Ecuador
148: SOUTH AMERICAN 1969 : Guyana
149: SOUTH AMERICAN 1969 : Paraguay
150: SOUTH AMERICAN 1969 : Peru
151: SOUTH AMERICAN 1969 : Trinidad & Tobago
152: SOUTH AMERICAN 1969 : Venezuela
153: SOUTH ASIA : Singapore
154: SOUTHEAST BASE : Porto Santo & Madeira Is.
155: SOUTHWEST BASE : Faial, Graciosa, Pico, Sao Jorge & Terceria Is.
156: TIMBALAI 1948 : Brunei & East Malaysia (Sarawak & Sabah)
157: TOKYO : Japan
158: TOKYO : Korea
159: TOKYO : Okinawa
160: TRISTAN ASTRO 1968 : Tristan da Cunha
161: VITI LEVU 1916 : Viti Levu Is. (Fiji Is.)
162: WAKE-ENIWETOK 1960 : Marshall Is.
163: ZANDERIJ : Surinam
164: BUKIT RIMPAH : Bangka & Belitung Is. (Indonesia)
165: CAMP AREA ASTRO : Camp Mcmurdo Area, Antarctica
166: G. SEGARA : Kalimantan Is. (Indonesia)
167: HERAT NORTH : Afghanistan
168: HU-TZU-SHAN : Taiwan
169: TANANARIVE OBSERVATORY 1925 : Madagascar
170: YACARE : Uruguay
171: RT-90 : Sweden
172: CK42 (PULKOVO 1942) : Russia
173: FINNISH KKJ : Finland
174: PZ90 : Russia
175: CK95 : Russia

追補 2 SBAS のサービス範囲

静止衛星を使用した GPS の広域補強システムを総称して SBAS（Satellite Based Augmentation System）といいます。静止衛星から広範囲に GPS の誤差補正情報などが放送されるため、GPS 測位に比べ高精度に測位できます。

米国、欧州、日本、インドでは、広域補強システムを運用しており、相互に共通運用性があります。各プロバイダ（WAAS、EGNOS、MSAS、GAGAN）のサービス範囲については、下図を参照してください。本書では、WAAS、EGNOS、MSAS、GAGAN を含めて、「SBAS」と記載しています。



SBAS の衛星配置

プロバイダ	運用国	衛星の種類	経度	衛星番号
WAAS	米国	Intelsat Galaxy XV	133°W	135
		TeleSat Anik F1R	107.3°W	138
		Inmarsat-4-F3	98°W	133
EGNOS	欧州	Inmarsat-3-F2/AOR-E	15.5°W	120
		Artemis	21.5°E	124
		Inmarsat-4-F2	25°E	126
		SES-5	5°E	136
MSAS	日本	MTSAT-1R	140°E	129
		MTSAT-2	145°E	137
GAGAN	インド	GSAT-8	55°E	127
		GSAT-10	83°E	128

2014/3/6 現在

サテライトコンパス　SCX-21　仕　様

１．総合

(1)	受信周波数	1575.42 MHz（GPS/Galileo/QZSS/SBAS)、1602.5625 MHz（GLONASS）
(2)	受信コード	C/A コード（GPS/QZSS/SBAS）、E1B(Galileo)、L1OF（GLONASS）
(3)	姿勢角精度	ヘディング/ロール/ピッチ
		1.0° rms（静止時）、0.5° rms（動揺時）
(4)	追従角速度	45° /s
(5)	ヒーブ精度	5 cm（1σ）
(6)	姿勢角静定時間	約 60 秒
(7)	測位精度（電離層、マルチパスの状態により変化）	
	GPS	約 5 m（2drms、HDOP<4）
	MSAS	約 4 m（2drms、HDOP<4）
	WAAS	約 3 m（2drms、HDOP<4）
(8)	初期捕捉時間	約 50 秒
(9)	更新周期	姿勢角：最大 50 Hz、位置：最大 10 Hz
(10)	船速精度	
	SOG	0.02 kn（衛星 5 個以上）
		0.2 kn（衛星 3～4 個）
	VBW（対地船速）	0.02 kn（衛星 5 個以上、空中線位置）
		0.08 kn（衛星 5 個以上、空中線位置以外）
		船速の 2.0%または 0.02 kn のいずれか大きい方（衛星 3～4 個）
(11)	環境センサー	
	気圧	測定範囲：850～1100 hPa（周囲温度 0～+50℃）
		精度：±1.0 hPa（オフセット調整後）
	気温	測定範囲：-20℃～+55℃（相対風速 4kn 以上）
		精度：±2.0℃（オフセット調整後）
(12)	タイミング（1PPS）精度	50 μs

２．インターフェイス

(1)	ポート数	NMEA0183：送信 3 チャンネル、受信 2 チャンネル
		PPS：1 チャンネル、RS-485、立ち上がりエッジ同期
(2)	データセンテンス	
	出力	DTM, GGA, GLL, GNS, GSA, GSV, HDG, HDT, HRM, POS, RMC, ROT,
		THS, VBW, VTG, XDR, ZDA
(3)	出力 P センテンス	
	PFEC	GPatt, GPhve, GPimu, pidat, GPmsv, hdcom

３．電源

DC12-24 V（10.8-31.2V）：0.2-0.1 A

４．環境条件

(1)	使用温度範囲	-25℃～+55℃（保存温度：-30℃～+70℃）
(2)	相対湿度	95%以下（＋40℃）
(3)	保護等級	IP56
(4)	振動	IEC60945 Ed.4

５．ユニットカラー

N9.5

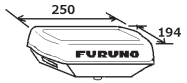
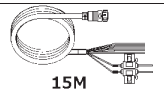
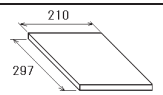
J7287S01G
200130

PACKING LIST

20BK-X-9852 -1 1/1

SCX-21-*

A-1

NAME	OUTLINE	DESCRIPTION/CODE No.	Q'TY
ユニット UNIT			
ｻﾃﾗｲﾄｺﾝﾊﾟｽ SATELLITE COMPASS		SCX-21 000-036-767-00	1
予備品 SPARE PARTS			
予備品 SPARE PARTS		SP20-01901 001-556-110-00	1
工事材料 INSTALLATION MATERIALS			
ｹｰﾌﾞﾙ(組品) CABLE ASSEMBLY		FRU-CF-F15M 001-555-560-00	1
工事材料 INSTALLATION MATERIALS		CP20-04601 001-556-150-00	1
ﾎﾟｰﾙﾏｳﾝﾄｷｯﾄ POLE MOUNT KIT		CP20-04603 001-556-200-00	1
ﾏｽﾄ取付金具 MAST MOUNTING KIT		CP20-04605 001-556-240-00	1 (*1)
図書 DOCUMENT			
取扱説明書(和/英) OPERATOR'S MANUAL (JP/EN)		OMC-72870-* 000-195-294-1*	1

(*1)の工事材料はP-M仕様のみ必要
(*1) IS ONLY REQUIRED FOR P-M SPECIFICATION.

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

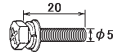
A-2

FURUNO

CODE NO.	001-556-150-00	20BK-X-9401 -0
TYPE	CP20-04601	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 Q'TY	用途／備考 REMARKS
1	+ｱﾌﾟｾｯﾄUIｾﾑｽB UP SET UI SCREW		M5X20 SUS304 CODE NO. 000-160-442-10	3	

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

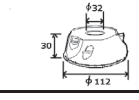
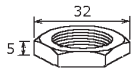
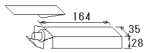
FURUNO ELECTRIC CO . , LTD.

FURUNO

CODE NO.	001-556-200-00	20BK-X-9403 -0
TYPE	CP20-04603	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 Q'TY	用途／備考 REMARKS
1	ﾎﾟｰﾙﾏｳﾝﾄ POLE MOUNT ASSEMBLY		CP20-04604 CODE NO. 001-556-210-00	1	
2	ﾛｯｸﾅｯﾄ LOCK NUT		20-040-1118-0 CODE NO. 100-429-750-10	1	
3	接着剤袋詰 ADHESIVE		TB5211 50G CODE NO. 001-477-870-00	1	

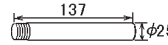
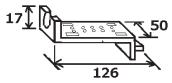
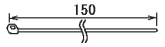
(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO

CODE NO.	001-556-240-00	20BK-X-9404 -0
TYPE	CP20-04605	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 Q'TY	用途／備考 REMARKS
1	ﾊﾟｲﾌﾟ PIPE		20-007-3011-4 CODE NO. 100-183-264-10	1	
2	取付補助金具 FIXING SUPPORT FIXTURE		20-040-1117-2 CODE NO. 100-429-742-10	1	
3	ｺﾝﾍﾞｯｸｽ CABLE TIE		CV-150B CODE NO. 000-167-183-10	1	
4	ﾎｰｽｸﾗﾝﾌﾟ(ABA) HOSE CLAMP		SUS316 12MM 38-50 CODE NO. 000-196-736-10	2	

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

FURUNO

CODE NO.	001-556-110-00	20BK-X-9301-0 1/1
TYPE	SP20-01901	BOX NO. P

SHIP NO.	SPARE PARTS LIST FOR	U S E	SETS PER VESSEL

ITEM NO.	NAME OF PART	OUTLINE	DWG. NO. OR TYPE NO.	QUANTITY WORKING PER SET	QUANTITY WORKING PER VES	QUANTITY SPARE	REMARKS/CODE NO.
1	ﾋｭｰｽﾞ FUSE		FRU-60V-FU-2A	0	0	2	000-195-429-10

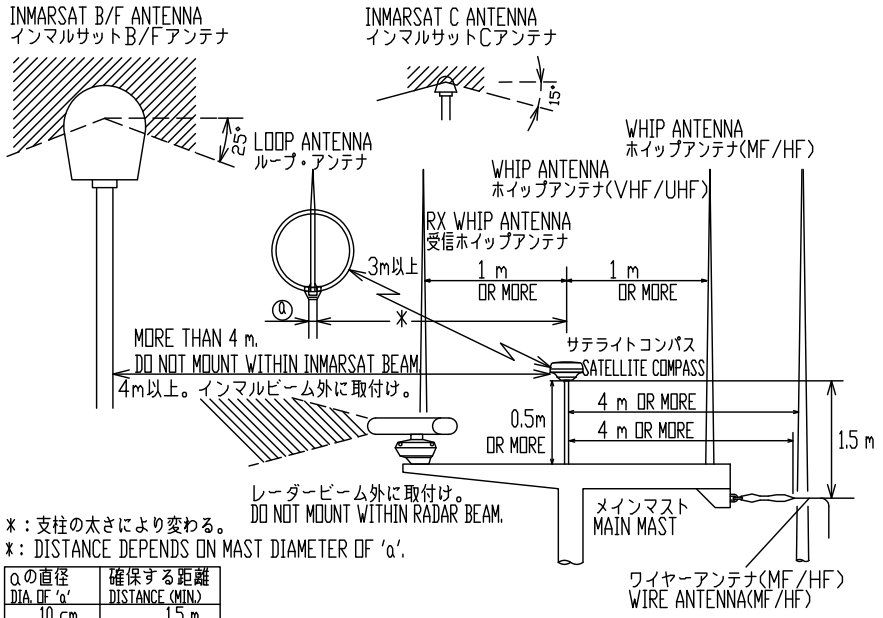
MFR'S NAME	FURUNO ELECTRIC CO.,LTD.	DWG NO.	C7287-P01-A	1/1

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

FURUNO

取付位置
MOUNTING LOCATION

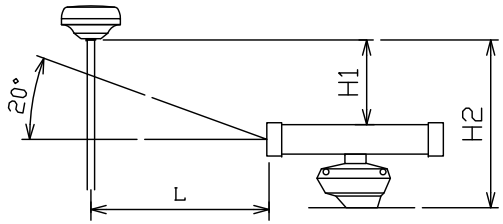
他の機器のアンテナから下の図の距離以上離す。
THIS FIGURE SHOWS THE SEPARATION DISTANCES FROM OTHER ANTENNAS TO AVOID MUTUAL INTERFERENCE.



*：支柱の太さにより変わる。
*: DISTANCE DEPENDS ON MAST DIAMETER OF 'a'.

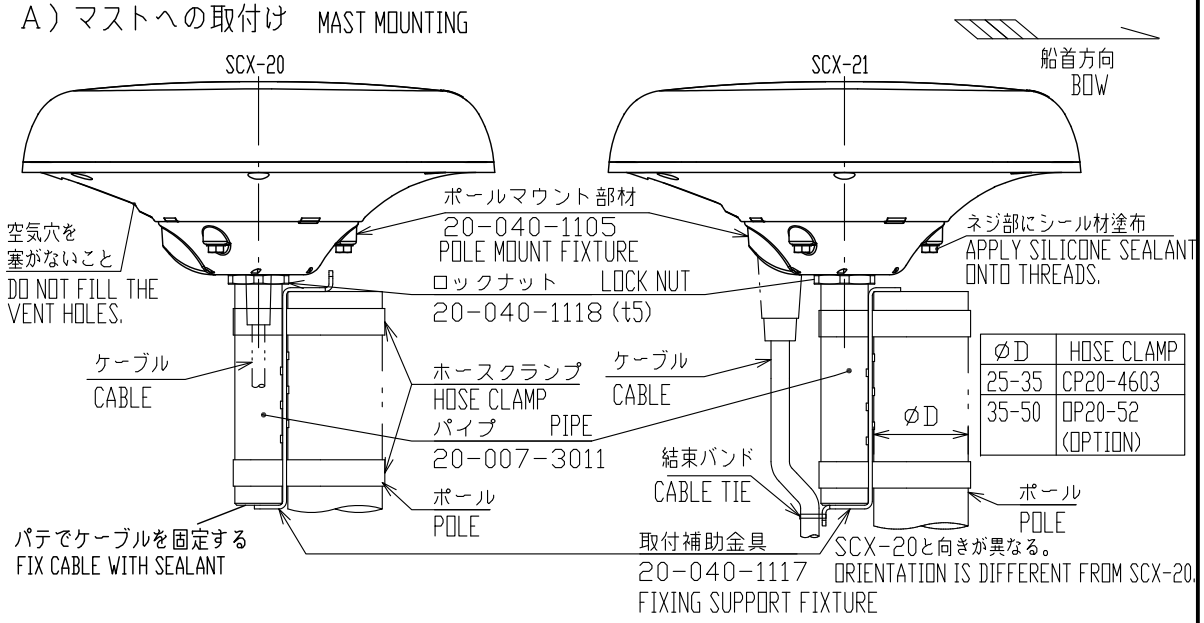
aの直径 DIA. OF 'a'	確保する距離 DISTANCE (MIN.)
10 cm	1.5 m
30 cm	3 m

B）レーダー空中線部との位置関係
RADAR ANTENNA LOCATION



H2が1m以上で、Lが3m以上の時、レーダーからの仰角は20度以上。
Lが3m未満のときは、H1は0.8m以上とること。
IF H2 IS AT LEAST 1 m AND L IS MORE THAN 3 m, THE ELEVATION ANGLE FROM THE RADAR SHOULD BE MORE THAN 20°. IF L IS LESS THAN 3 m, H1 SHOULD BE MORE THAN 0.8 m.

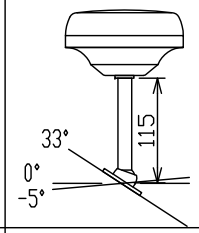
A）マストへの取付け　MAST MOUNTING



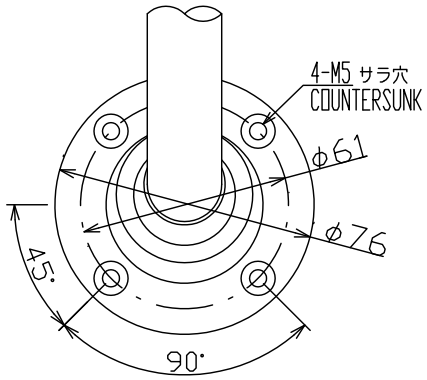
ØD	HOSE CLAMP
25-35	CP20-4603
35-50	CP20-52 (OPTION)

C）取付ける場所が傾斜しているとき
ANTENNA BASE MOUNTING ON INCLINATION SURFACE

オプションのアンテナベースを使う。
USE OPTIONAL ANTENNA BASE.

傾斜 INCLINATION	-5° - 33°
装備方法 MOUNTING METHOD	
名称 NAME	直型アンテナベース RIGHT ANGLE ANTENNA BASE
型式 TYPE	No.13-QA330
コード番号 CODE No.	000-803-239

アンテナベース基部
MOUNTING DIMENSIONS OF ANTENNA BASE.



DRAWN	27/Sep/2019 T.YAMASAKI		TITLE SCX-20/21
CHECKED	27/Sep/2019 H.MAKI		名称 サテライトコンパス
APPROVED	27/Sep/2019 H.MAKI		装備要領図
SCALE	MASS		NAME SATELLITE COMPASS
DWG. No.	C7286-Y01- A	REF. No.	INSTALLATION PROCEDURE

FURUNO ELECTRIC CO., LTD.

FURUNO

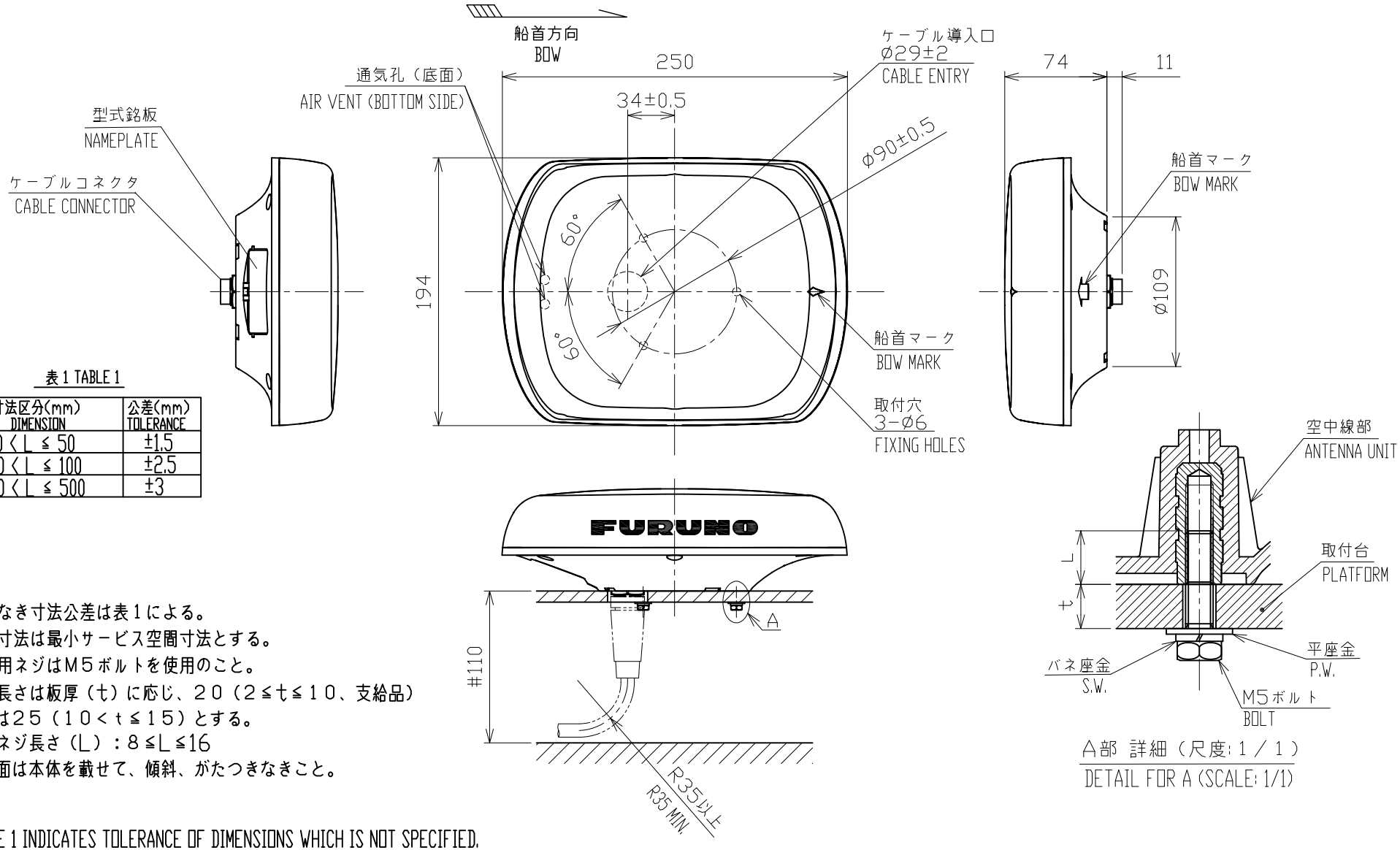


表1 TABLE 1

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

A部 詳細（尺度：1／1）
DETAIL FOR A (SCALE: 1/1)

注記

1）指定なき寸法公差は表1による。
2）#印寸法は最小サービス空間寸法とする。
3）取付用ネジはM5ボルトを使用のこと。
　ネジ長さは板厚（t）に応じ、20（2≦t≦10、支給品）
　または25（10＜t≦15）とする。
　有効ネジ長さ（L）：8≦L≦16
4）取付面は本体を載せて、傾斜、がたつきなきこと。

NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. #: MINIMUM SERVICE CLEARNCE
3. USE M5 BOLTS FOR FIXING THE UNIT.
   SCREW LENGTH SHOULD BE 20 (2≦t≦10) OR 25 (10<t≦15). t: THICKNESS OF PLATFORM.
   EFFECTIVE THREAD LENGTH (L): 8≦L≦16.
4. MOUNTING AREA MUST BE LEVEL AND STABLE.

DRAWN 18/Jul/2019 A. MURAO			TITLE SCX-21
CHECKED 18/Jul/2019 T.YAMASAKI			名称 サテライトコンパス
APPROVED 31/Jul/2019 H.MAKI			外寸図
SCALE 1/4	MASS 1.0 ±10% kg	質量はケーブル／ボルト／座金を含まず。 MASS DOES NOT INCLUDE CABLE/BOLTS/WASHERS.	NAME SATELLITE COMPASS
DWG.No. C7287-G01- B		REF.No. 20-040-101G- 1	OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.

FURUNO

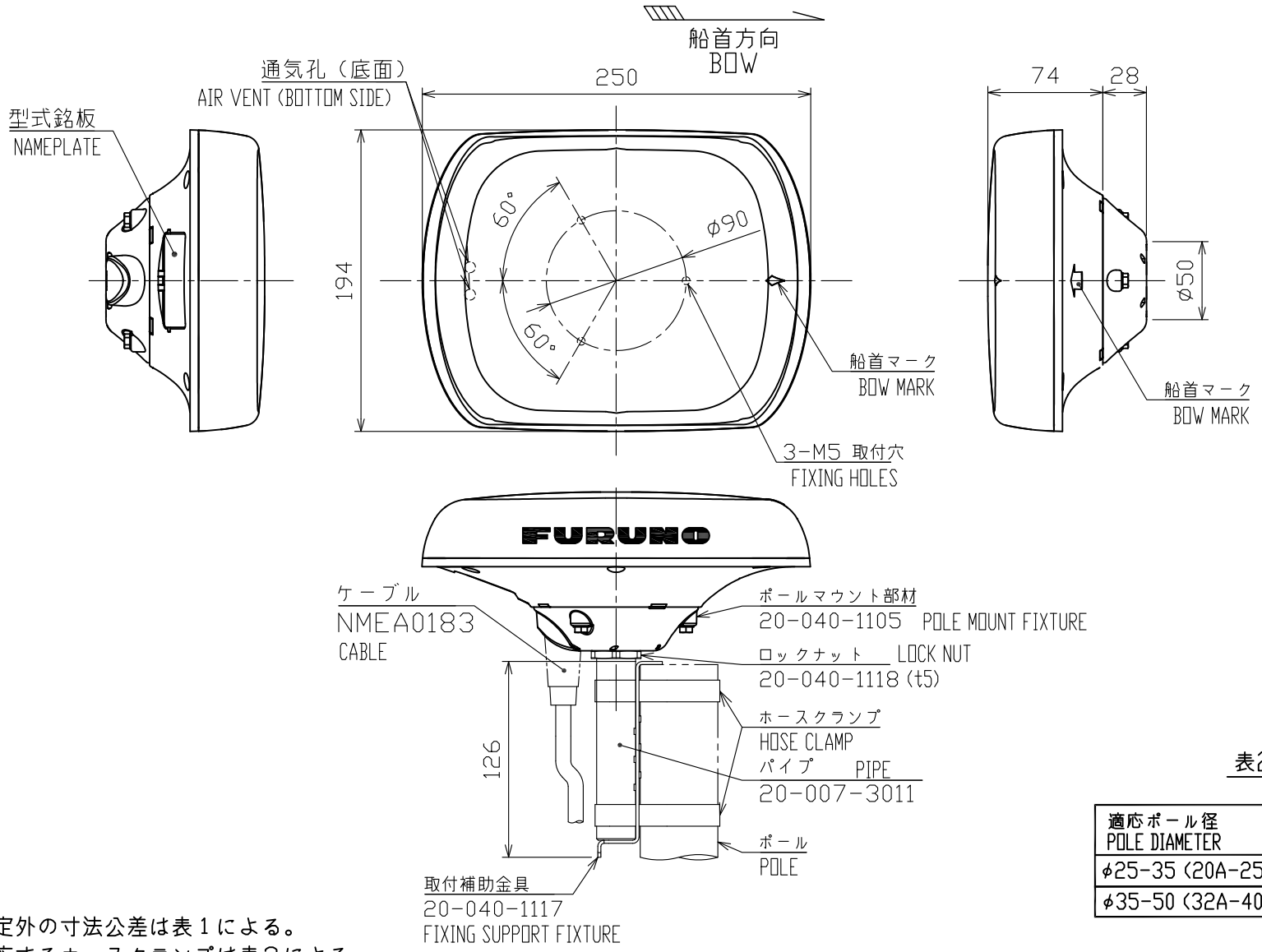


表1 TABLE 1

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

表2 TABLE 2

適応ポール径 POLE DIAMETER	型式 MODEL
φ25-35 (20A-25A)	CP20-4603（標準） STANDARD
φ35-50 (32A-40A)	OP20-52（オプション）OPTION

注 記

1）指定外の寸法公差は表1による。

2）適応するホースクランプは表2による。

NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. TABLE 2 INDICATES HOSE CLAMP SIZE.

DRAWN 21/Sep/2019 T. YAMASAKI		TITLE	SCX-21
CHECKED 21/Sep/2019 H. MAKI		名称	サテライトコンパス（ポールマウント）
APPROVED 24/Sep/2019 H.MAKI			外寸図
SCALE 1/4 MASS 1.2 ±10% kg	質量はケーブル・工材を含まず。 MASS DOES NOT INCLUDE CABLE/INST. MATERIAL.	NAME	SATELLITE COMPASS (POLE MOUNT)
DWG.No. C7287-G02- C	REF.No. 20-040-103G- 2		OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.

FURUNO

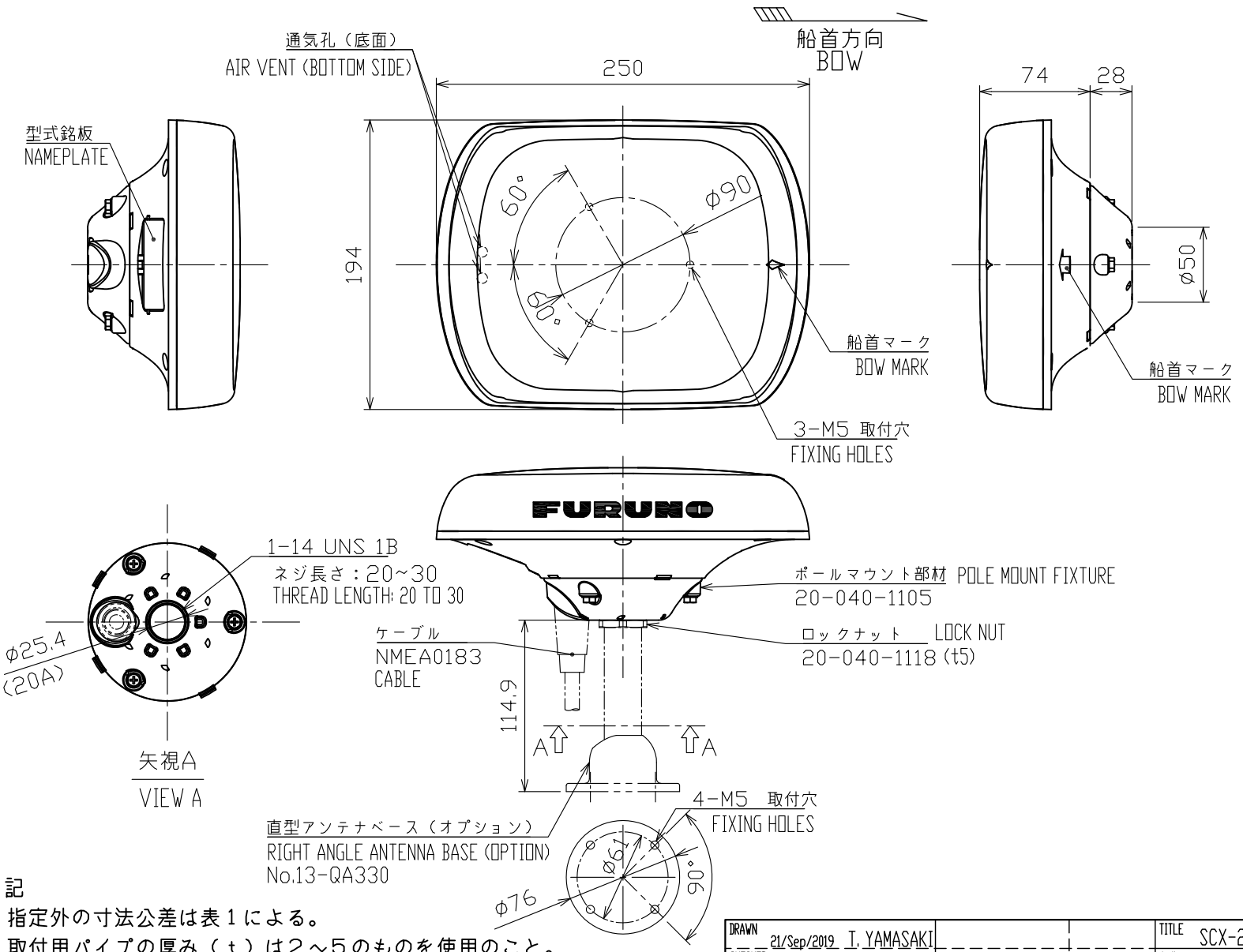


表1 TABLE 1

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

注　記

1）指定外の寸法公差は表1による。

2）取付用パイプの厚み（t）は2～5のものを使用のこと。

NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. THICKNESS OF FIXING PIPE (t): 2 TO 5 mm.

DRAWN 21/Sep/2019 T. YAMASAKI		TITLE	SCX-21
CHECKED 21/Sep/2019 H. MAKI		名称	サテライトコンパス（直型アンテナベース）
APPROVED 24/Sep/2019 H.MAKI			外寸図
SCALE 1/4	MASS 1.2 ±10% kg 質量はケーブル・工材を含まず。 MASS DOES NOT INCLUDE CABLE/INST. MATERIAL.	NAME	SATELLITE COMPASS (RIGHT ANGLE ANTENNA BASE)
DWG.No. C7287-G03- A	REF.No. 20-040-106G- 0		OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.

FURUNO

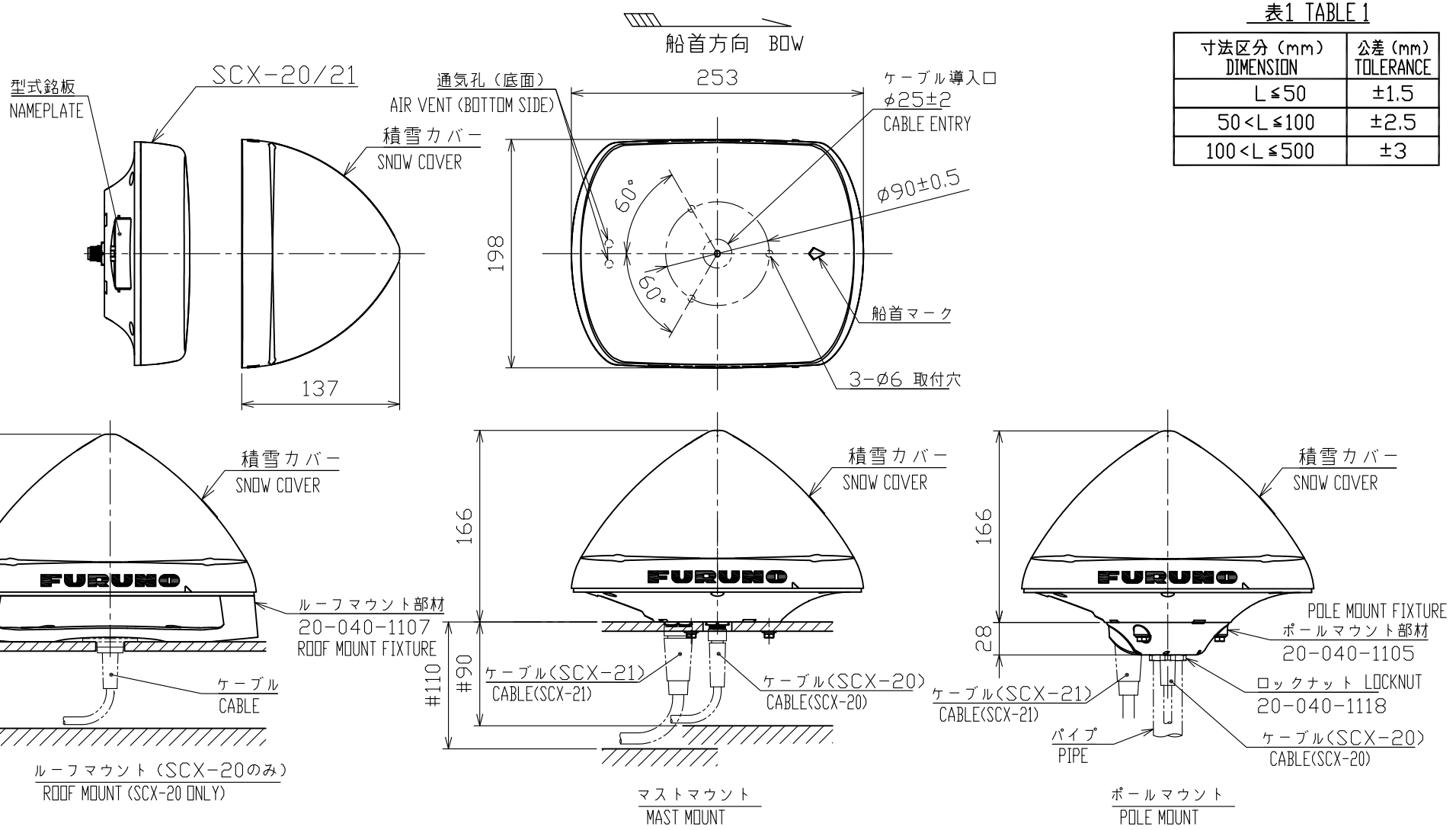


表1 TABLE 1

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

注　記

1）指定外の寸法公差は表1による。

2）＃印寸法は最小サービス空間寸法とする。

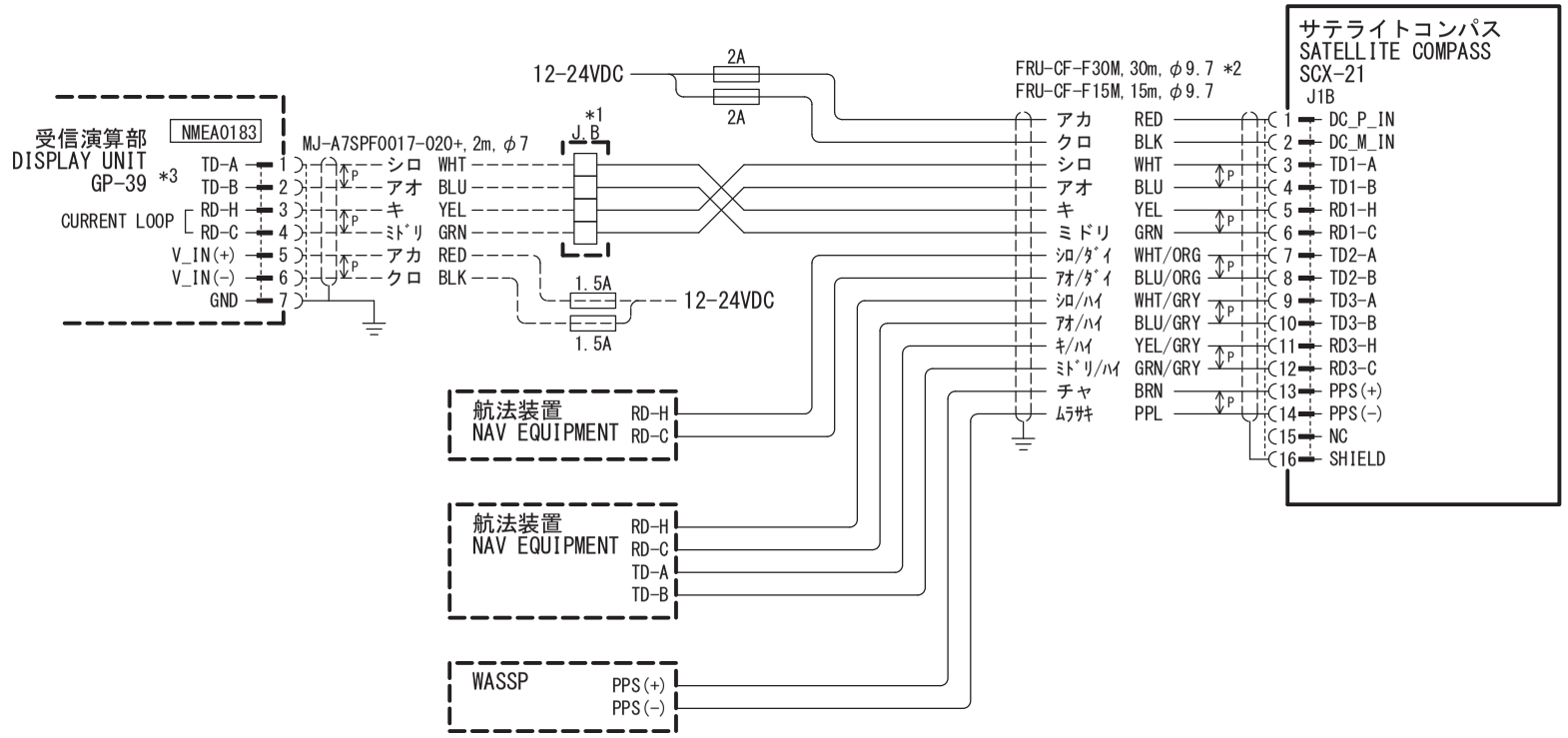
NOTE

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

DRAWN 26/Nov/2019 T.YAMASAKI		TITLE SCX-20/21
CHECKED 26/Nov/2019 H.MAKI		名称 積雪カバー
APPROVED 27/Nov/2019 H.MAKI		装備要領
SCALE 1/5 MASS		NAME SNOW COVER
DWG No. C7286-Y02- A	REF. No. 20-040-110G-1	INSTALLATION INSTRUCTION

FURUNO ELECTRIC CO., LTD.

FURUNO



注記
＊１）造船所手配。
＊２）オプション。
＊３）海外のみ。

NOTE
*1: SHIPYARD SUPPLY.
*2: OPTION.
*3: N/A IN JAPAN.

DRAWN 10/Dec/2019 T. YAMASAKI			TITLE SCX-21
CHECKED 10/Dec/2019 H. MAKI			名 称 サテライトコンパス
APPROVED 12/Dec/2019 H.MAKI			相互結線図
SCALE / MASS kg			NAME SATELLITE COMPASS
DWG. No. C7287-C01- B	REF. No. 20-040-5002-0		INTERCONNECTION DIAGRAM

FURUNO ELECTRIC CO., LTD.