

# SC50 Separate Type Operator's Manual

## Safety Instructions for the Operator

**WARNING**

**ELECTRICAL SHOCK HAZARD**  
Do not open the equipment.

Only qualified personnel should work inside the equipment.

**Do not disassemble or modify the equipment.**

Fire, electrical shock or serious injury can result.

**Immediately turn off the power at the switchboard if the equipment is emitting smoke or fire.**

Continued use can cause fatal damage to the equipment. Contact a FURUNO agent for service.

**Do not place liquid-filled containers on the top of the processor unit.**

Fire or electrical shock may result if the liquid enters the equipment.

**Use the proper fuse.**

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

**CAUTION**

**No one navigation device should ever be solely relied upon for the navigation of a vessel.**

Always confirm position against all available aids to navigation (incl. nautical charts), for safety of vessel and crew.

## Safety Instructions for the Installer

**WARNING**

**Turn off the power at the switchboard before beginning the installation.**

Fire or electrical shock can result if the power is left on.

**Do not install the equipment where it may get wet from rain or water splash.**

Water in the equipment can cause fire, electrical shock or damage to the equipment.

### NOTICE

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

	Standard Compass	Steering Compass
Display unit SC-502	0.4 m	0.3 m
Processor unit SC-501	0.9 m	0.6 m
Antenna unit XXXXX?????	X.X m	X.X m

**WARNING LABEL**  
A warning label is attached to the processor unit. Do not remove the label. If the label is missing or damaged, contact a FURUNO agent or dealer about replacement.

**WARNING**

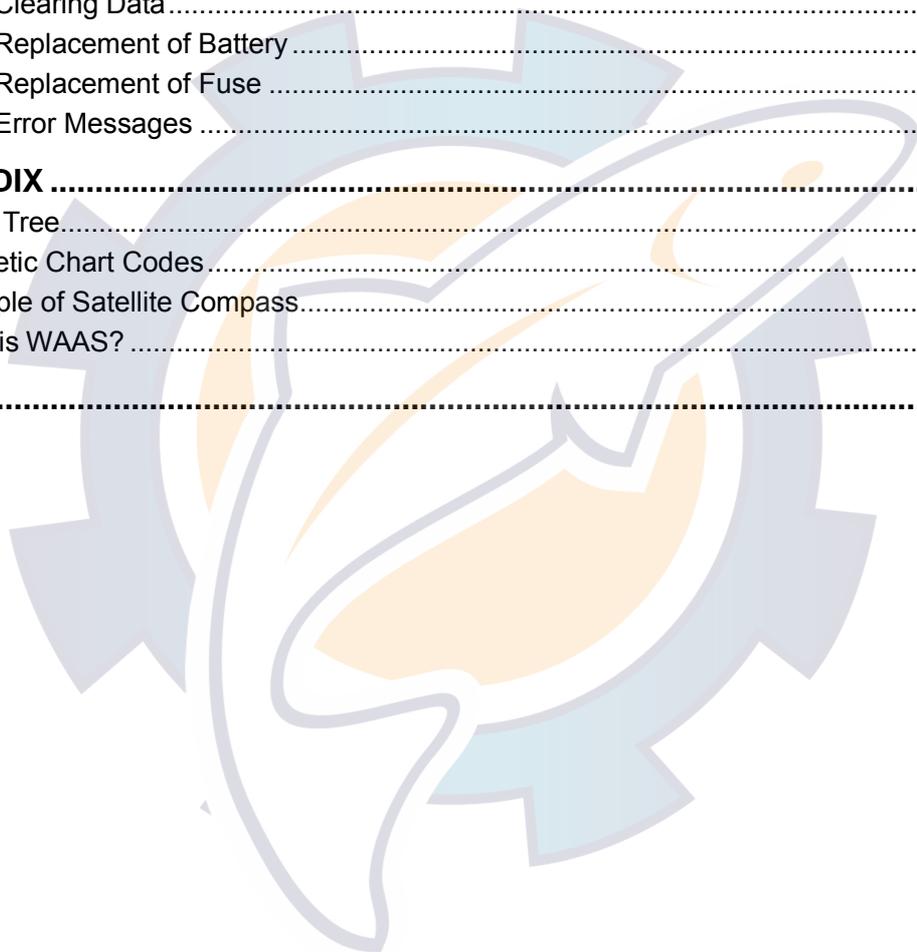
To avoid electrical shock, do not remove cover. No user-serviceable parts inside.

**WARNING LABEL**  
Name: Warning Label (1)  
Type: 86-003-1011-1  
Code No.: 100-236-231

# TABLE OF CONTENTS

<b>FOREWORD .....</b>	<b>iv</b>
<b>SYSTEM CONFIGURATION .....</b>	<b>v</b>
<b>EQUIPMENT LIST .....</b>	<b>vi</b>
<b>1 INSTALLATION .....</b>	<b>1-1</b>
1.1 Installing the Antenna Unit.....	1-1
1.1.1 Mounting considerations for single antenna.....	1-1
1.1.2 Mounting considerations for three antennas.....	1-4
1.1.3 Summary of installation conditions.....	1-6
1.1.4 Mounting the antenna unit.....	1-10
1.2 Installing the Processor Unit.....	1-11
1.2.1 Mounting considerations.....	1-11
1.2.2 Bulkhead mount.....	1-11
1.2.3 Deck mount.....	1-12
1.2.4 Mounting on the underside of a desk.....	1-13
1.3 Installing the Display Unit.....	1-14
1.3.1 Mounting considerations.....	1-14
1.3.2 Desktop, overhead mounting.....	1-14
1.3.3 Flush mount.....	1-15
1.4 Wiring.....	1-16
1.5 Initial Settings.....	1-19
1.5.1 Confirming satellite status.....	1-19
1.5.2 Choosing processor unit mounting method.....	1-20
1.6 Connection of External Equipment.....	1-21
1.6.1 General wiring.....	1-21
1.6.2 Fabrication of cables.....	1-22
<b>2 OPERATION.....</b>	<b>2-1</b>
2.1 Controls.....	2-1
2.2 Turning the Power On/Off.....	2-2
2.3 Panel Illumination, Display Contrast.....	2-2
2.4 Choosing a Display.....	2-3
2.4.1 Description of displays.....	2-3
2.5 Alarm Setup.....	2-6
2.6 Confirming Satellite Status.....	2-7
2.7 GPS Setup.....	2-8
2.7.1 Displaying the GPS setup menu.....	2-8
2.7.2 GPS SETUP menu description.....	2-8
2.8 Output Data.....	2-9
2.8.1 Heading.....	2-9
2.8.2 Log pulse.....	2-13
2.9 System Setup.....	2-14
2.9.1 Geodetic data.....	2-14
2.9.2 Units of measurement.....	2-15
2.9.3 Using local time.....	2-15
2.9.4 Time format.....	2-15

2.9.5	Demonstration mode .....	2-16
2.10	WAAS/DGPS Setup.....	2-17
2.11	OTHERS Menu.....	2-20
2.12	TRIP Menu.....	2-21
2.13	Resetting Distance Run.....	2-22
2.14	Choosing External Heading Source for Backup.....	2-22
<b>3</b>	<b>MAINTENANCE, TROUBLESHOOTING.....</b>	<b>3-1</b>
3.1	Preventive Maintenance .....	3-1
3.2	Troubleshooting .....	3-2
3.3	Diagnostics .....	3-3
3.4	Program Number .....	3-7
3.5	Clearing Data.....	3-7
3.6	Replacement of Battery .....	3-8
3.7	Replacement of Fuse .....	3-9
3.8	Error Messages .....	3-9
<b>APPENDIX</b>	<b>.....</b>	<b>1</b>
	Menu Tree.....	1
	Geodetic Chart Codes.....	2
	Principle of Satellite Compass.....	3
	What is WAAS? .....	4
<b>INDEX</b>	<b>.....</b>	<b>3-1</b>



# FOREWORD

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## A Word to the Owner of the SC-50S

FURUNO Electric Company thanks you for purchasing the FURUNO SC-50S THD Satellite Compass. (Hereafter, for sake of brevity, we refer to the SC-50S as Satellite Compass.) We are confident you will discover why the FURUNO name has become synonymous with quality and reliability.

For over 50 years 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 satellite compass is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless properly installed and maintained. Please carefully read and follow the operation, installation and maintenance procedures set forth in this manual.

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

Thank you for considering and purchasing FURUNO.

## Features

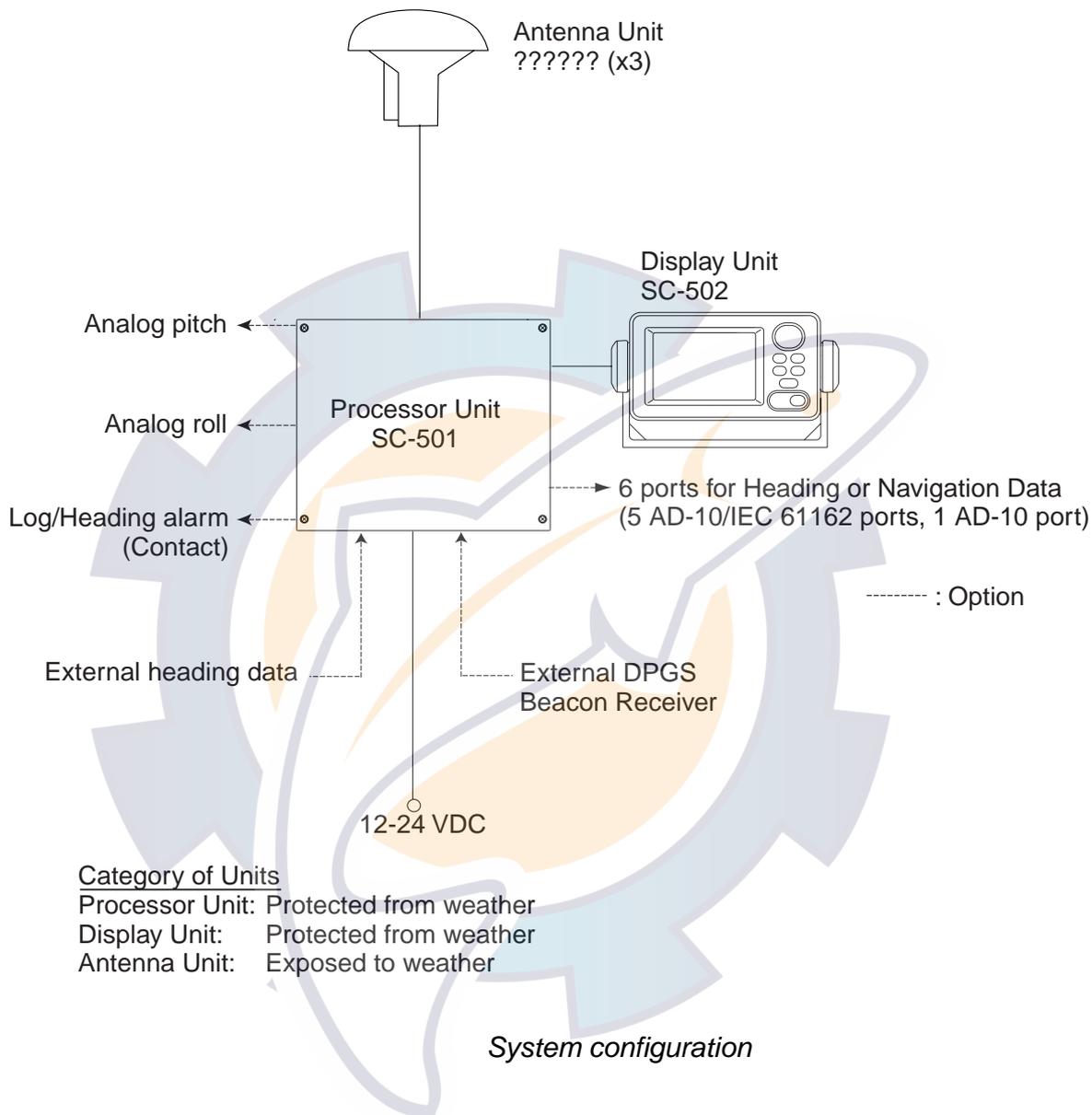
The SC-50S is a new satellite compass designed with FURUNO's advanced GPS kinematic technology. This compass finds a wide range of applications for any type of ships and mobile units at sea or on land.

The main features are

- Perfect for use as heading sensor for Radar/ARPA, AIS, ECDIS, scanning sonar
- There are no mechanical parts such as gimbals or rotating motor, thus the compass is free from routine maintenance
- The performance is not affected by geomagnetism thus it is suitable for use on any vessel
- No need for speed correction like a gyrocompass
- Short settling time - three minutes
- Meets the following requirements: IMO MSC. 116(73), ISO/FDIS 22090-3, IMO A. 694(17), IEC 60945 (2002-08), IEC 61162 (2000).

# SYSTEM CONFIGURATION

The SC-50S consists of three antennas, a display unit and a processor unit.



# EQUIPMENT LIST

## Standard supply

Name	Type	Code No.	Qty	Remarks
GPS Antenna	?????	—	1	Set of three
Display Unit	SC-502	—	1	
Processor Unit	SC-501	—	1	
Installation Materials	CP20-02230*	004-378-110	1	TPPX cable
	CP20-02260*	004-379-660		TNC cable
	CP20-02600	000-041-905	1	For processor unit: CP20-02601*, MJ-A7SPF0006-100
	CP20-02203*	004-380-660	1	For display unit: Tapping screw (5X20 4 pcs.)
Spare Parts	SP20-01101*	004-379-720	1	For processor unit

## Optional supply

Name	Type	Code No.	Qty	Remarks
Antenna Cable Set	CP20-01700	004-372-110	1	30 m
	CP20-01710	004-372-120		50 m
Cable Assy.	TPPX6-3D2V-15M	000-143-559	1	Antenna cable
Flush Mount F	OP20-29*	000-041-405	1	For display unit
Flush Mount S	OP20-17*	000-040-720	1	For display unit
Bird-repellant Fixture	OP20-37??????	004-380-840	1	Set of three??????????

\* See packing list at back of manual.

# 1 INSTALLATION

## 1.1 Mounting the Antenna Unit

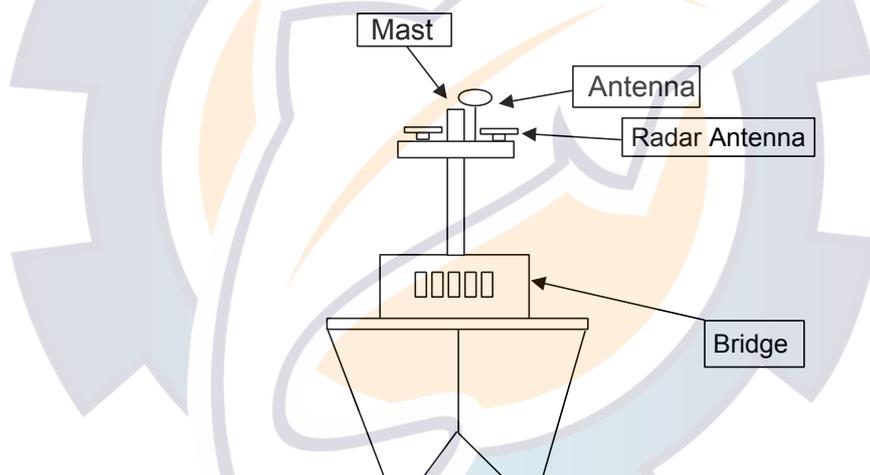
### 1.1.1 Mounting considerations for single antenna

#### General

- Keep the length of the antenna cable in mind when selecting a mounting location. Do not shorten the antenna cable.
- The location should not be where movement is different from ship's movement.

#### Installing the antenna above superstructures

The antenna must be mounted above all other structures on the vessel to obtain an unobstructed view of the satellites, regardless of vessel heading. Failure to do so will cause shadows and multipath reflection problems.



*Example of antenna installed above all superstructures*

#### Installing the antenna below superstructures

If it is not possible to mount the antenna above all superstructures on the vessel, as shown in the illustration above, shading and multipath problems may occur on at least one heading, and possibly more. To possibly avoid those problems, observe the guidelines in this section.

### NOTICE

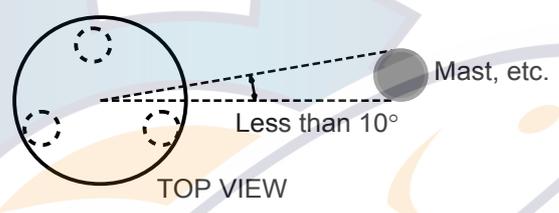
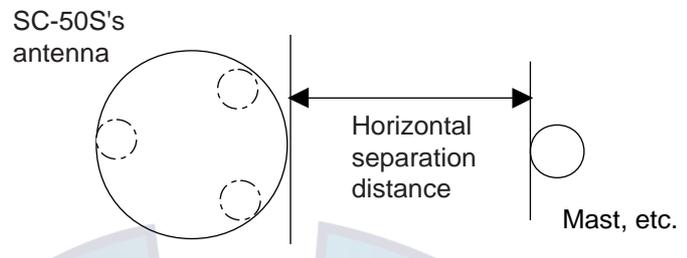
**If the antenna is installed below any superstructure, the installation must be done over a two-day period, following the procedure in the service manual.**

At least 12 hours are required to capture tracking data to measure multipath indexes and locate areas of shading.

**Antenna placement and shipboard equipment and structures**

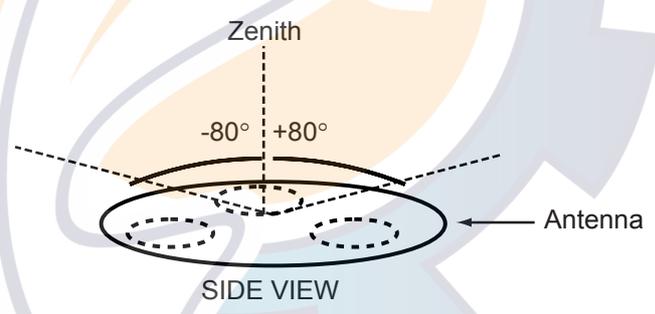
- The horizontal separation between the antenna and masts must be as follows:

Mast diameter	Separation distance (minimum)
10 cm	1.5 m
30 cm	3 m



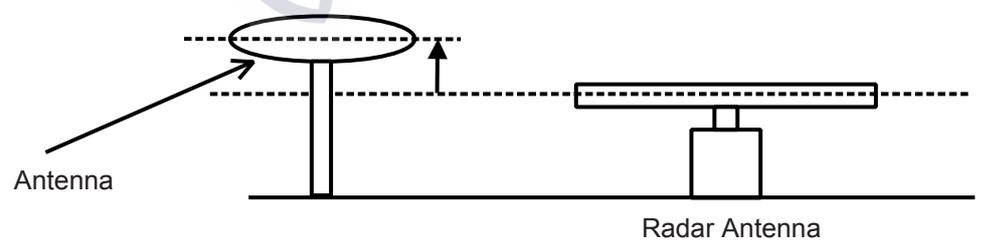
*Horizontal separation between antenna and masts*

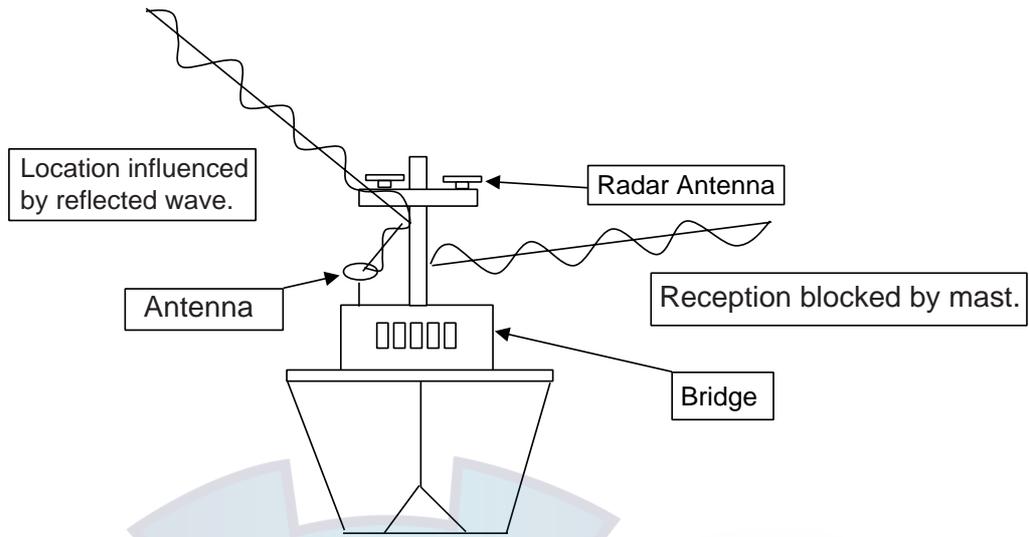
- The field of view above the antenna should be as shown below,  $\pm 80^\circ$  against zenith. To avoid reflections from masts and the like, locate the antenna well away from the shadows of the radar mast, etc.



*Antenna and field of view*

- Locate the antenna unit above the radar antenna, out of the radar beam.



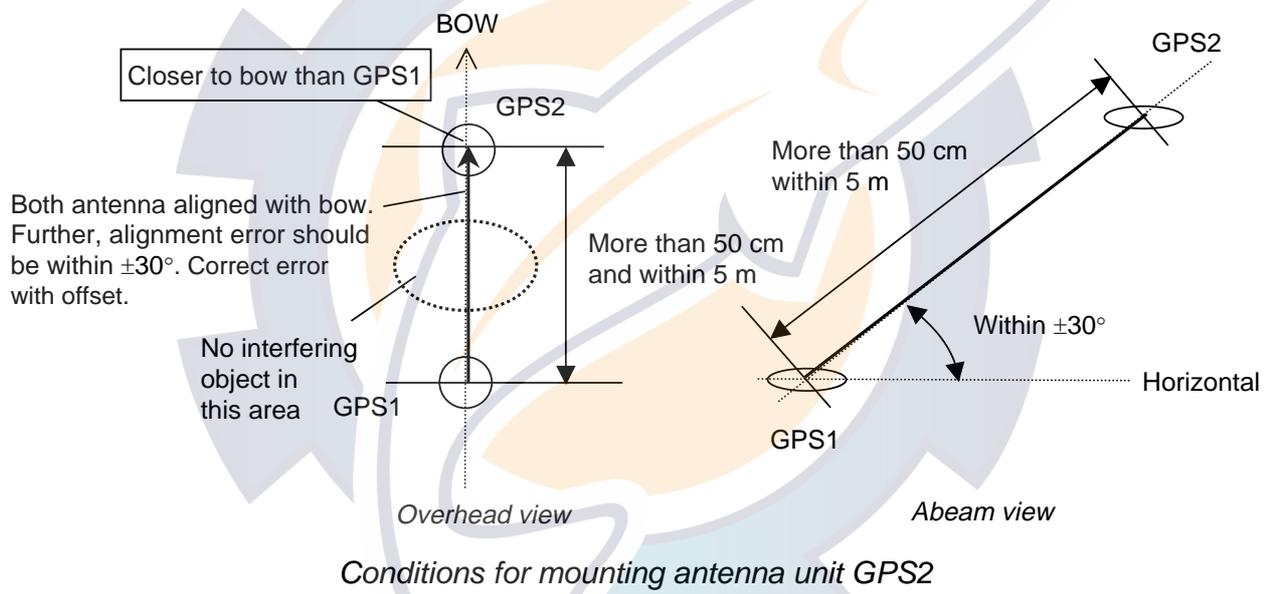


*Example of antenna installed below superstructures*



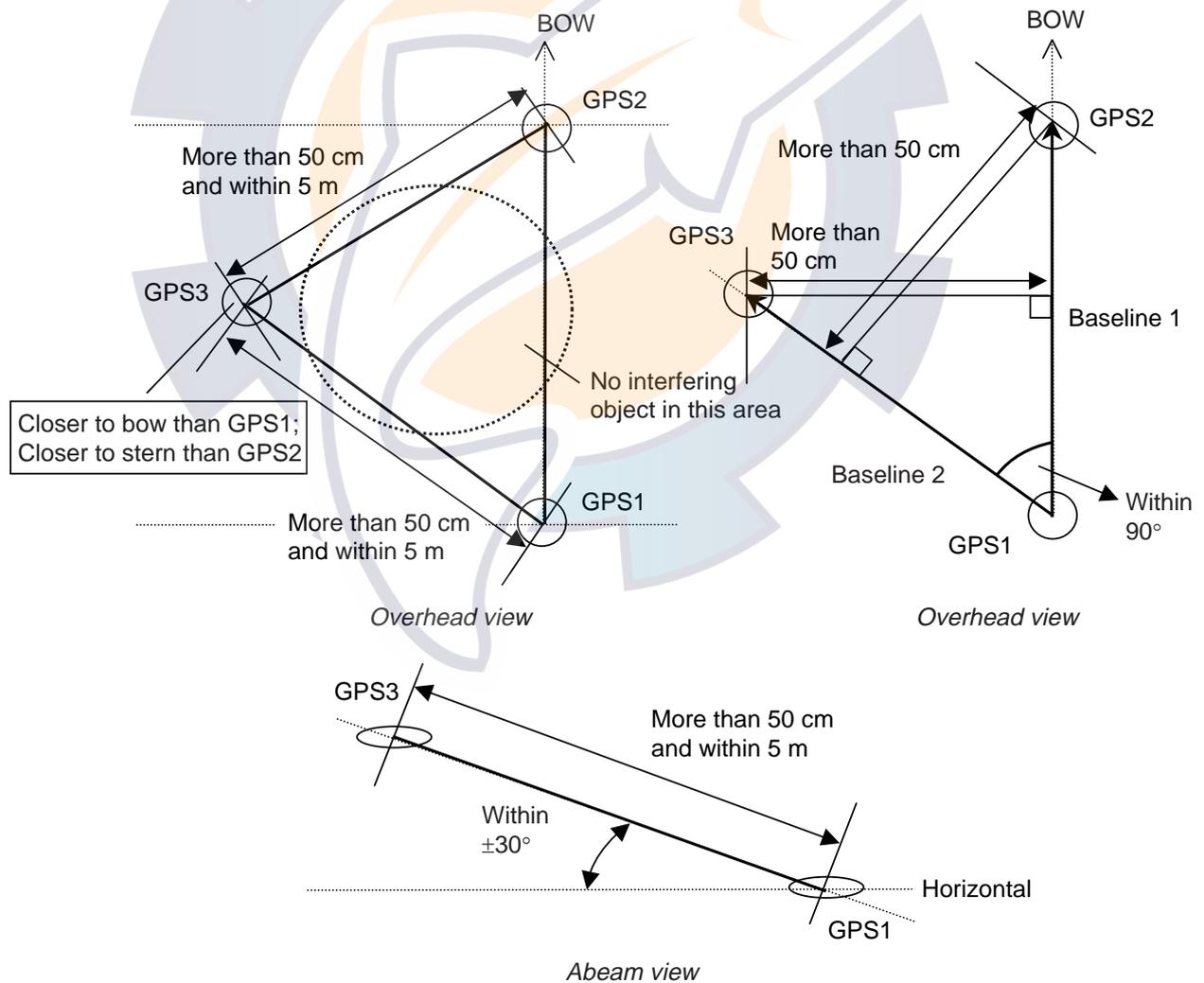
### 1.1.2 Mounting considerations for three antennas

- 1) Install antenna unit GPS1 where it meets the requirements for single antenna.
- 2) Install antenna unit GPS2 where it meets the following conditions:
  - The mounting location shall meet the requirements for single antenna.
  - GPS2 shall be closer to the bow than GPS1.
  - The distance between GPS1 and GPS2 shall be more than 50 cm and within the 5 m.
  - The distance between GPS1 and GPS2 shall not change by more than 1 cm.
  - There shall be no interfering objects between GPS1 and GPS2.
  - If the GPS1 and GPS2 cannot be installed perpendicular to one another, the angle between the two shall be  $\pm 30^\circ$ . The amount of offset in the bow direction shall be manually input into the equipment as heading offset.
  - The angle between GPS1 and GPS2 shall not exceed  $\pm 30^\circ$ .



3) Install GPS3 where the following conditions are satisfied:

- Install GPS3 where it meets the requirements for single antenna.
- GPS3 shall be closer to the bow that GPS2 but not closer to the bow than GPS1.
- The distance between GPS1 and GPS3 shall be more than 50 cm and within the 5 m.
- The distance between GPS2 and GPS3 shall be more than 50 cm and within the 5 m.
- The distance between all three antennas shall not change by more than 1 cm.
- The vertical length between baseline 1 (from GPS1 to GPS2) and baseline 2 (from GPS1 to GPS3) shall be more than 50 cm.
- The vertical length between baseline 2 (from GPS1 to GPS3) and baseline 1 (from GPS1 to GPS2) shall be more than 50 cm.
- The angle formed by GPS1, GPS2 and GPS3 shall be no more than 90°
- The angle from the GPS1 to GPS3 shall not be more than  $\pm 30^\circ$ .



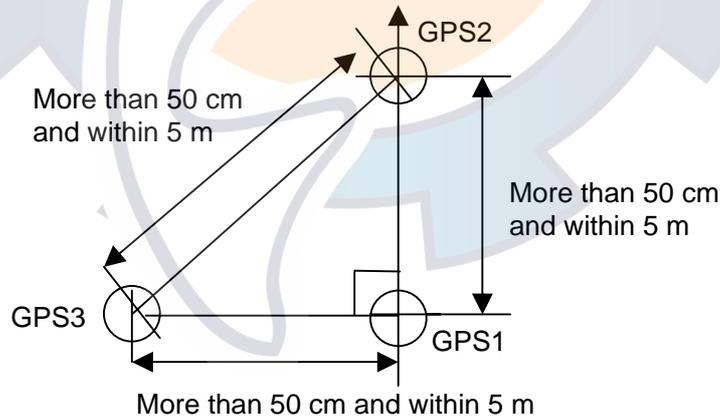
Conditions for mounting antenna unit GPS3

### 1.1.3 Summary of mounting conditions

- 1) All three antennas meet the requirements for single antenna. See “Conditions for mounting single antenna” on page 1-1.
- 2) Antenna unit GPS1 should be the antenna closest to the stern.
- 3) Antenna unit GPS2 should be the antenna closest to the bow.
- 4) The distance between each antenna should be more than 50 cm and less than 5 m.
- 5) The distance between antennas should not change by more than 1 cm.
- 6) No interfering object should be within the triangle formed by the three antennas.
- 7) If the direction from GPS1 to GPS2 is seen as a horizontal plane, then they are aligned with the bow. If not, they should be located within  $\pm 30^\circ$  from the bow. The amount of offset in the bow direction should be entered in the equipment as heading offset.
- 8) The vertical length between baseline 1 (from GPS1 to GPS2) and baseline 2 (from GPS1 to GPS3) shall be more than 50 cm.
- 9) The vertical length between baseline 2 (from GPS1 to GPS3) and baseline 1 (from GPS1 to GPS2) shall be more than 50 cm.
- 10) The angle which is formed by GPS1-GPS2-GPS3 should be within  $90^\circ$ .
- 11) The angle between two antennas should not exceed  $30^\circ$ .

#### Basic antenna arrangement

- Viewing from overhead, the basic arrangement should look as below.
- When viewed from abeam, the plane formed by the three antennas is parallel with ship.



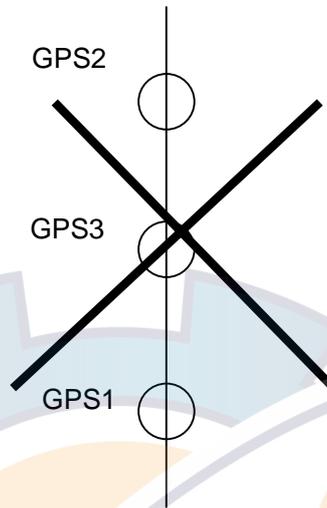
Top view

Basic antenna arrangement (view from overhead)

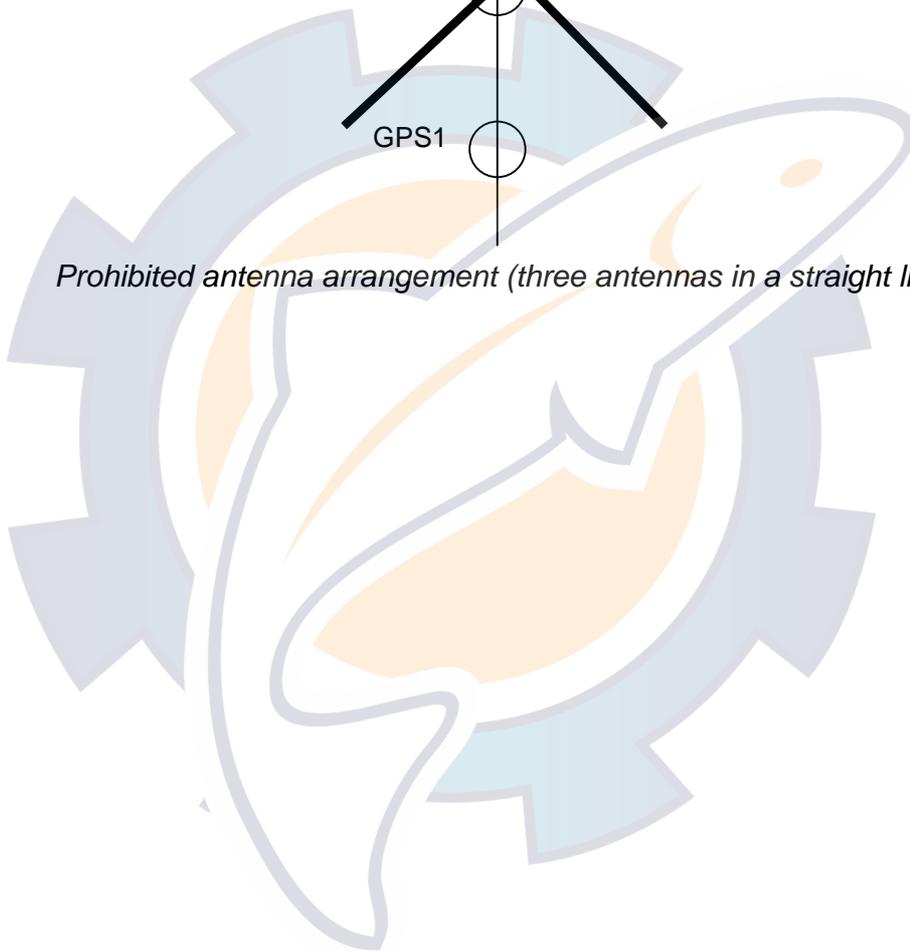
**Prohibited antenna arrangement**

Looking from overhead, the three antennas are arranged in a straight line. This arrangement is prohibited.

*Overhead view*

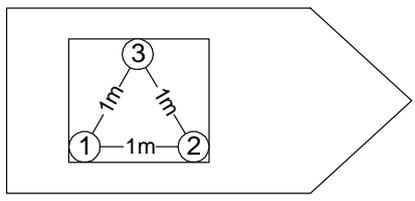


*Prohibited antenna arrangement (three antennas in a straight line)*

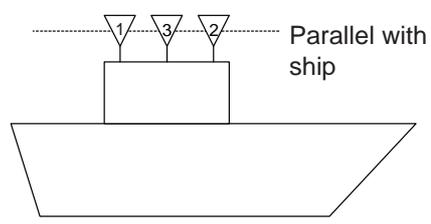


**Examples of proper and improper antenna arrangements**

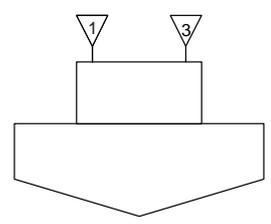
**Ideal arrangement**



(View from top of ship)

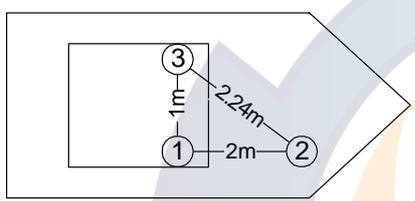


(View from side of ship)

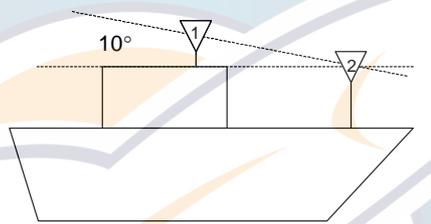


(View from bow of ship)

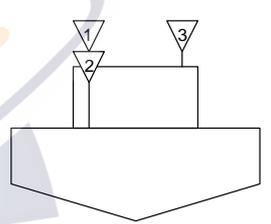
**Suitable arrangement**



(View from top of ship)

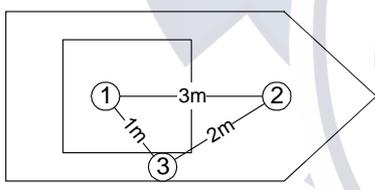


(View from side of ship)

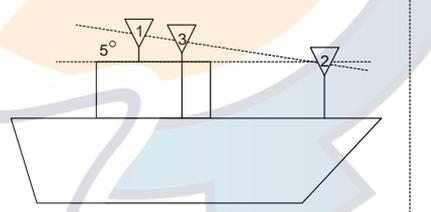


(View from bow of ship)

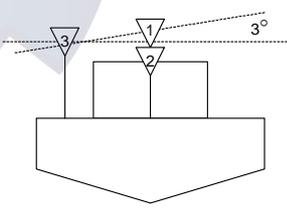
**Suitable arrangement**



(View from top of ship)

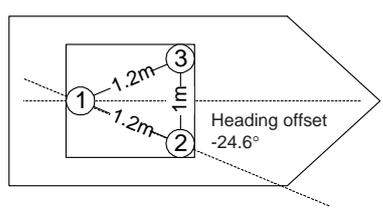


(View from side of ship)

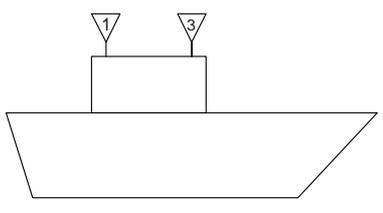


(View from bow of ship)

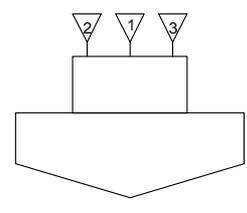
**Improper arrangement**



(View from top of ship)



(View from side of ship)

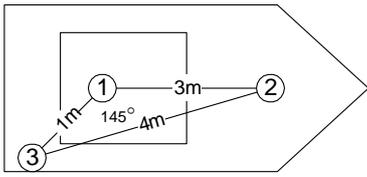


(View from bow of ship)

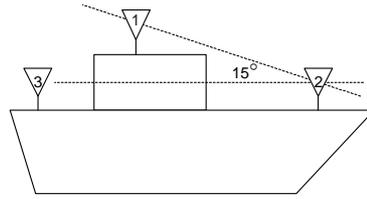
\* Enter accurate heading offset. Otherwise heading will be in error.

Manual input of heading offset is required.

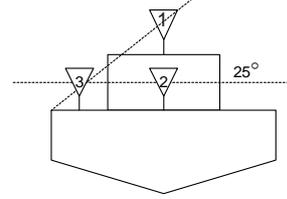
Improper arrangement



(View from top of ship)



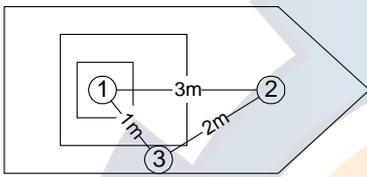
(View from side of ship)



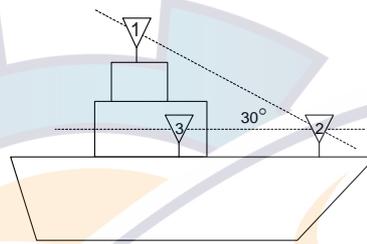
(View from bow of ship)

GPS1 is not the antenna closest to stern

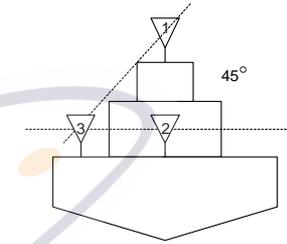
Improper arrangement



(View from top of ship)



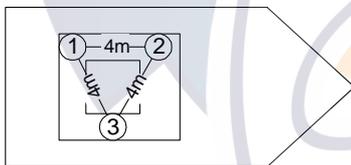
(View from side of ship)



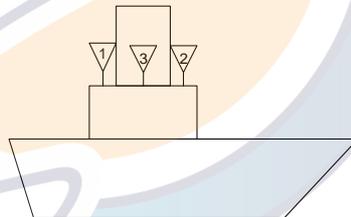
(View from bow of ship)

Roll and pitch angles too large

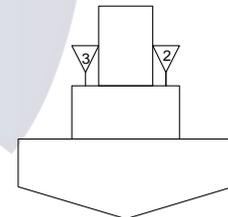
Improper arrangements



(View from top of ship)

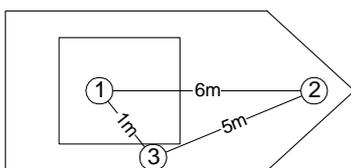


(View from side of ship)

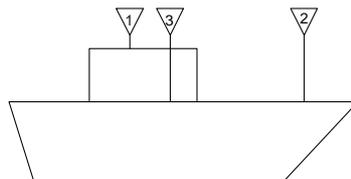


(View from bow of ship)

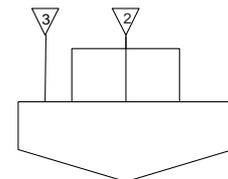
Interfering object within triangle formed by three antennas



(View from top of ship)



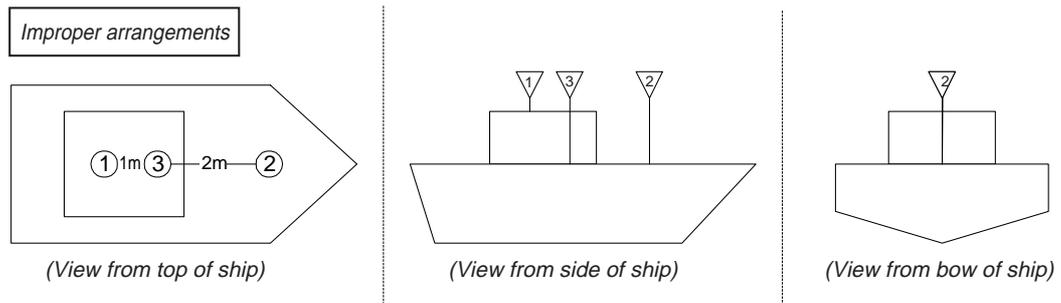
(View from side of ship)



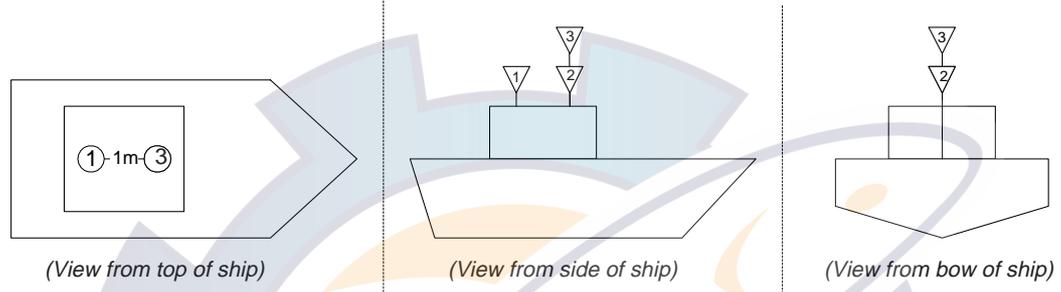
(View from bow of ship)

Distance between antennas is more than 5 m

1. INSTALLATION

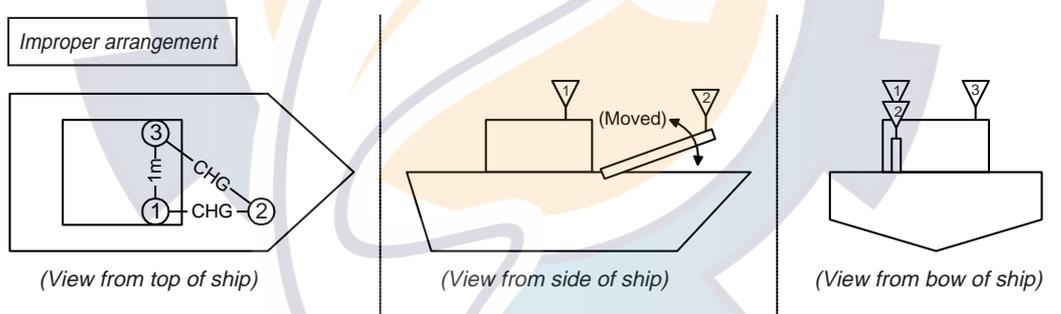


**Three antennas in straight line**



**Two antennas perpendicular to one another**

\* Two antennas may be not be perpendicular to one another because of vibration problems.



**Distance between antennas changed**

*Mast bending, etc., causes the distance between antennas to change by more than 1 cm.*

**1.1.4 Mounting the antenna unit**

The antenna unit may be installed three ways: screwed into a pipe (local supply), fixed to a post with the optional mast mounting kit or screwed into an optional mounting base. For fixing by post, it is recommended to use stays to secure the post or pipe to prevent damage to the GPS receiver by vibration. For mounting details, see the antenna outline drawing at the back of this manual.

## 1.2 Mounting the Processor Unit

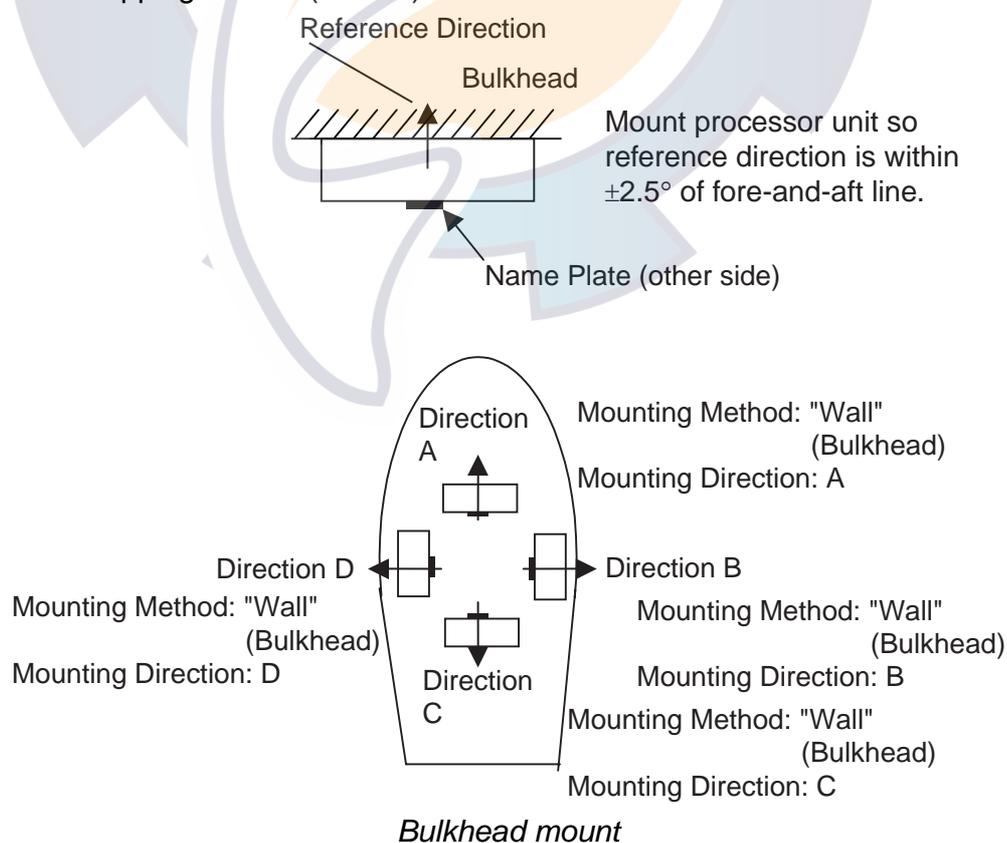
### 1.2.1 Mounting considerations

The processor unit should be mounted aligned with the ship's fore-and-aft line. It can be mounted on the deck, bulkhead, or on the underside of a desk. When choosing a mounting location keep the following points in mind.

- Choose a mounting location which allows you to easily view the power lamp on the top of the unit and which is within  $\pm 2.5^\circ$  of the ship's fore-and-aft line.
- Choose a location where vibration and shock are minimal.
- Install the unit well away from locations subject to rain and water splash.
- Locate the unit away from air conditioner vents.
- Keep the unit out of direct sunlight because of heat that can build up inside its cabinet.
- Choose a well-ventilated location.
- Leave sufficient space around the unit to permit access for maintenance. See the outline drawing for recommended maintenance space.

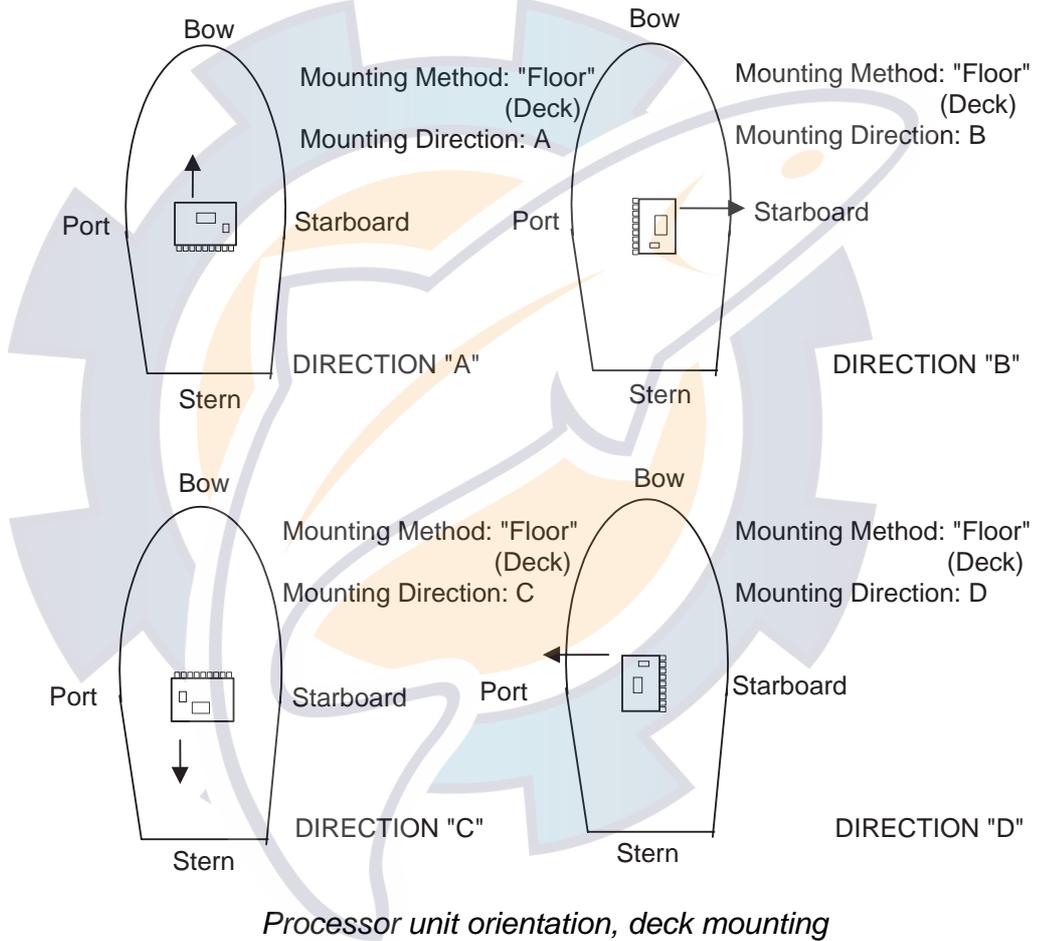
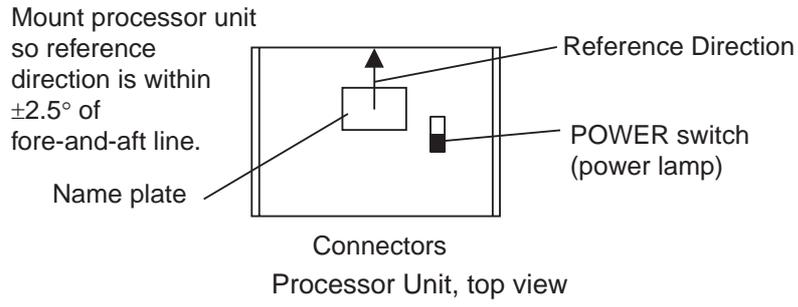
### 1.2.2 Bulkhead mount

The processor unit is shipped from the factory ready for bulkhead mounting. Orient the processor unit as shown below and fix it to the mounting location with four tapping screws (M5x20). You will set the orientation later on the menu.



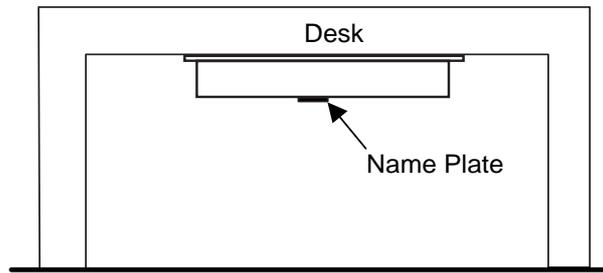
### 1.2.3 Deck mount

Orient the processor unit as shown below and fix it to the mounting location with four tapping screws (M5x20). You will set the orientation later on the menu.

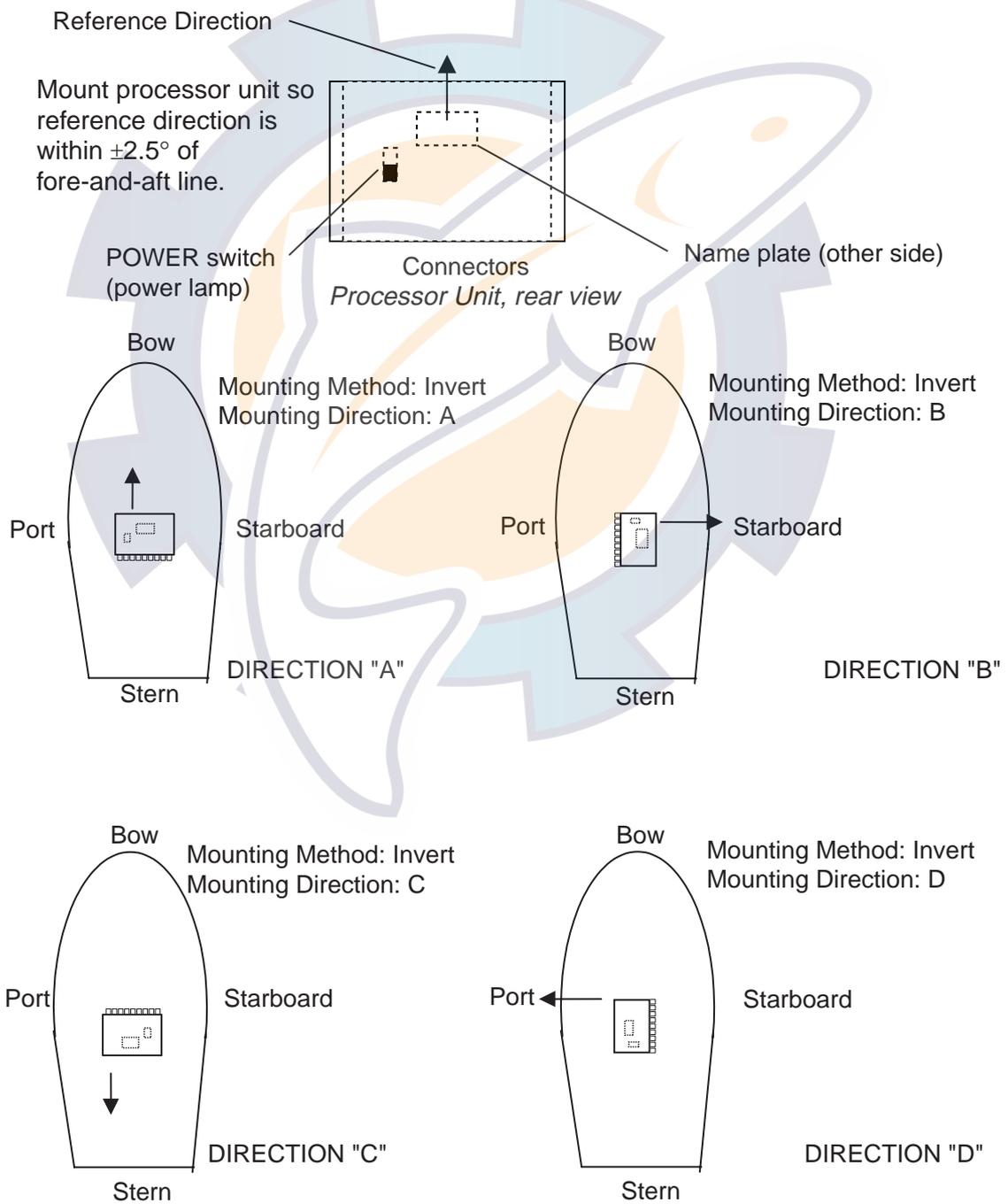


### 1.2.4 Mounting on the underside of a desk

The processor unit may be mounted on the underside of a desk as shown in the figure below. **Do not install it on the overhead.**



*Installation of processor unit on the underside of a desk*



*Mounting on underside of desk*

## 1.3 Mounting the Display Unit

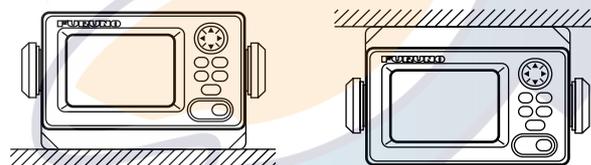
### 1.3.1 Mounting considerations

Consider the following points when choosing a mounting location.

- Choose a location where vibration and shock are minimal.
- Install the unit well away from locations subject to rain and water splash.
- Locate the unit away from air conditioner vents.
- Keep the unit out of direct sunlight because of heat that can build up inside its cabinet.
- Choose a well-ventilated location.
- Leave sufficient space around the unit to permit access for maintenance. See the outline drawing for recommended maintenance space.
- Choose a location where it can be easily operated.

### 1.3.2 Desktop, overhead mounting

1. Fasten the hanger to the mounting location with four tapping screws (supplied). See the outline drawing for mounting dimensions.
2. Screw the knobs into the display unit.
3. Set display unit to the hanger and tighten the knobs.
4. Run the ground wire between the ground terminal on the display unit and the ship's superstructure.



Desktop

Overhead

*Desktop and overhead mounting*

### 1.3.3 Flush mount

Two types of flush mounts are available. See the outline drawing at the back of the manual for details.

#### **Flush mount “F”**

*Flush mount “F” kit Type: OP20-29, Code No: 000-041-405)*

Name	Type	Code No.	Qty
Cosmetic Panel	20-016-1051	100-251-370	1
Tapping Screw	5X20	000-802-840	4
Hex Bolt	M6X12	000-862-127	2
Spring Washer	M6	000-864-260	2

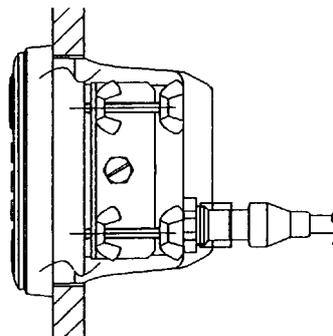
1. Make a cutout in the mounting location. The dimensions are 183(W) x 92(H) mm.
2. Fasten the cosmetic panel to the display unit with hex bolts and spring washers.
3. Fasten the display unit to the mounting location with tapping screws.

#### **Flush mount “S”**

*Flush mount “S” kit Type: OP20-17, Code No.: 000-040-720)*

Name	Type	Code No.	Qty
Flush Mount Fixture	20-007-2401	100-183-190	2
Wing Bolt	M4X30	000-804-799	4
Wing Nut	M4	000-863-306	4
Hex Bolt	M6X12	000-862-127	2
Spring Washer	M6	000-864-260	2

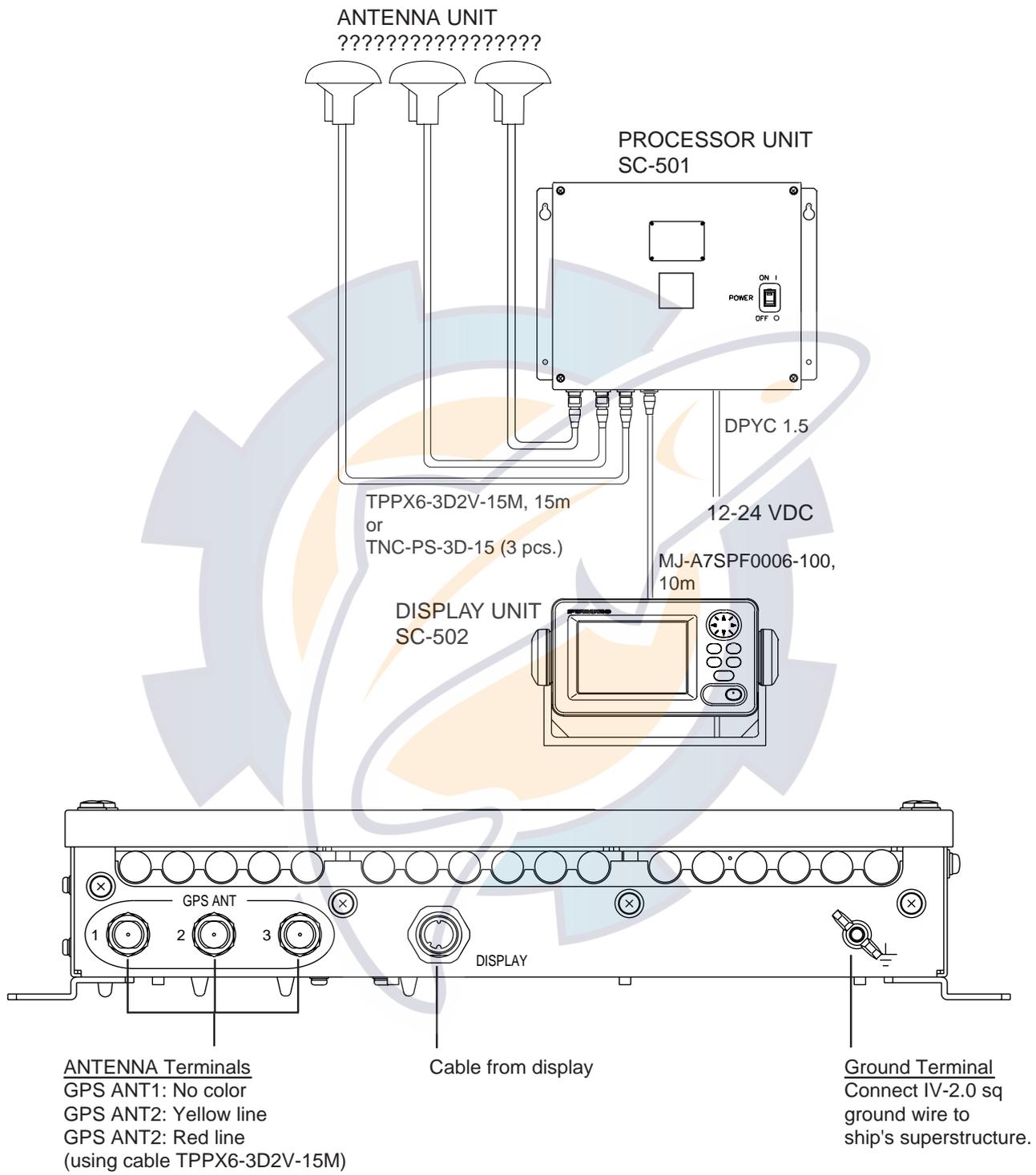
1. Make a cutout in the mounting location. The dimensions are 167(W) x 92(H) mm.
2. Place the display unit in the cutout.
3. Fix the display unit to the two flush mount fixtures with hex bolts and spring washers.
4. Screw the butterfly nut on the butterfly bolt.
5. Fix the display unit with the butterfly bolt and then tighten the butterfly nut.



*Flush mount “S”*

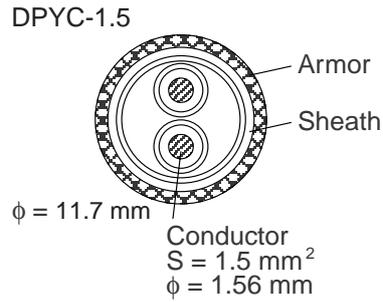
# 1.4 Wiring

This section covers general wiring. For further details see the interconnection diagram at the back of this manual.



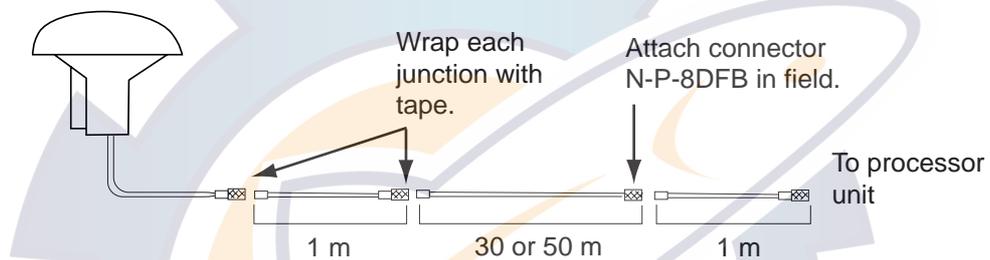
Wiring

**Note 1:** Use cable type DPYC-1.5 (or equivalent) for the power cable.



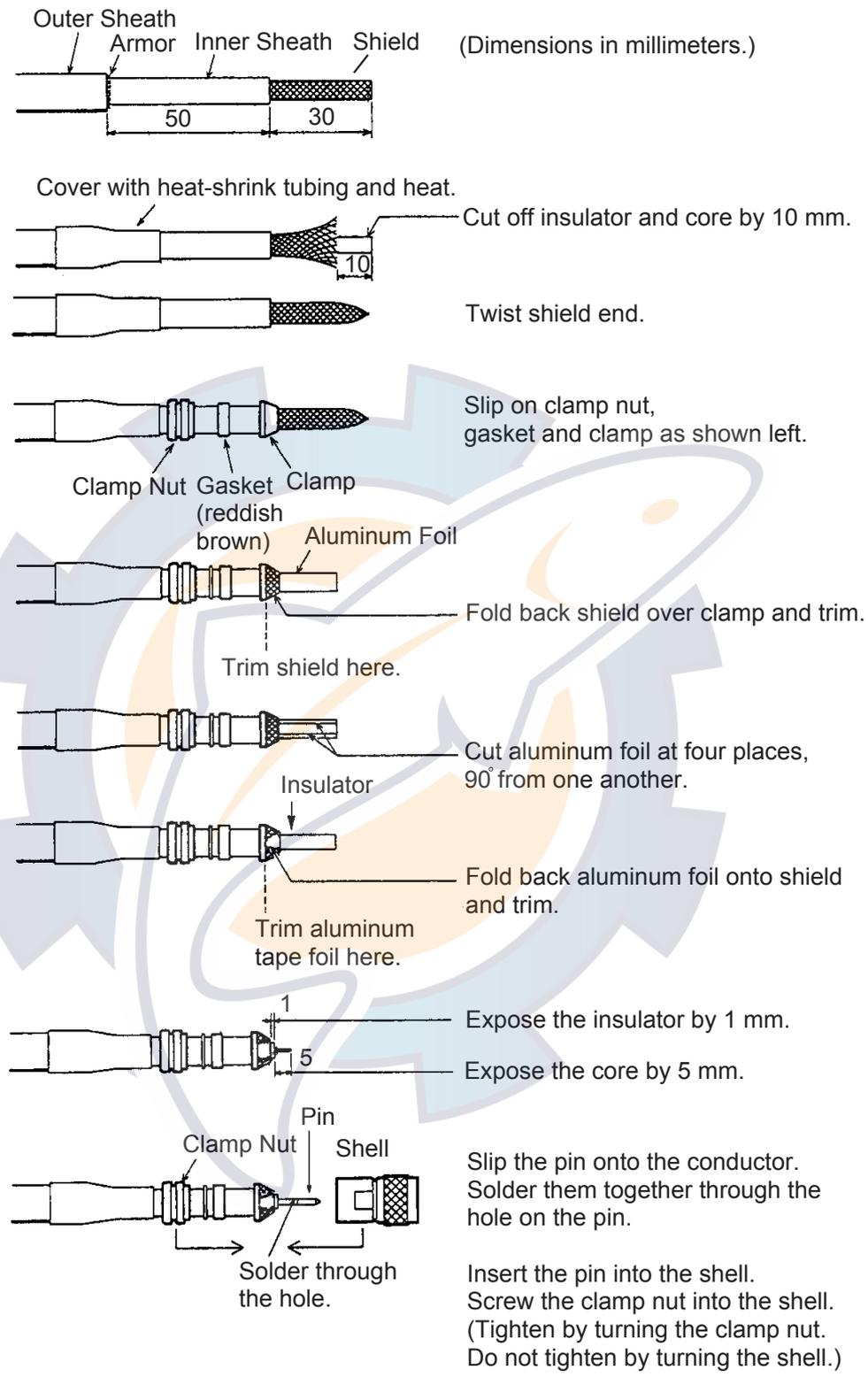
*Sectional view of coaxial cable DPYC-1.5*

**Note 2:** The optional antenna cable set (CP20-01700 or CP20-01710) allows you to extend antenna cable length to 30 m (50 m). See next page for how to attach the connector.



*How to install the optional antenna cable set*

**How to attach connector N-P-8DFB**



*How to attach connector N-P-8DFB*

## 1.5 Initial Settings

Follow the procedures in this section to enter initial settings.

<b>NOTICE</b>	
Improper menu settings may stop output of data and display the message "RATE ERROR." Be sure to enter correct data.	

### 1.5.1 Confirming satellite status

Press the **SAT STATUS** key.

Satellites used for measurement

Satellites being tracked

SAT TRACKING STATUS			
TIMER	5'52"		OK
	NO.	GOOD	STATUS
GPS1	8	8	D3D
GPS2	7	7	D3D
GPS3	8	8	D3D

"OK" displayed when the "GOOD" column shows that the number of satellites acquired is five or more.

"3D" shown when no beacon receiver is used. "W3D" shown when receiving WAAS.

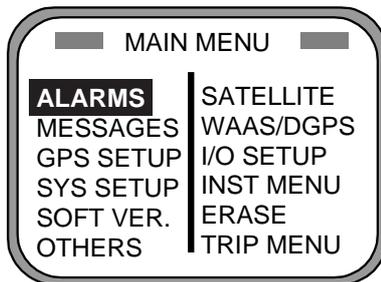
#### *Satellite tracking status display*

When the system is turned on for the first time it is in the "cold-start" state, which means there is no satellite data (almanac data) stored. In this condition it takes about 12 minutes to find heading. When heading is found the display shows "OK." The timer at the top left corner of the screen shows time since power on. If OK is not displayed within 30 minutes after turning on the power, the antenna mounting location may not be suitable. Suspect that the number of satellites in view is less than five due to signal blockage. (For the open-type antenna, loosen the nut at the center of the antenna unit to adjust antenna orientation.) Resolve the problem and then recheck tracking status.

If the heading error is between 5° and 10°, adjust orientation of the antenna unit, while watching the heading indication on the display.

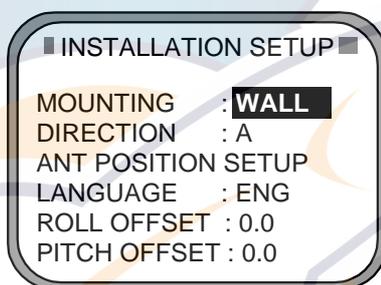
### 1.5.2 Choosing processor unit mounting method and direction and measuring distances between antennas

1. Turn on the processor unit and then press the **MENU** key to show the menu.



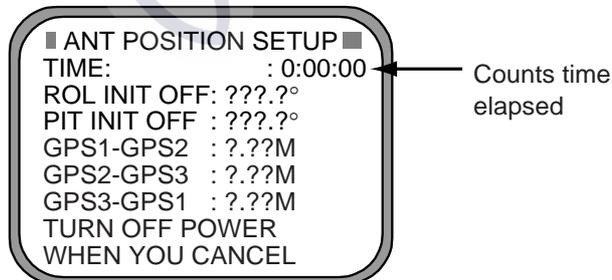
*Main menu*

2. Use the **Omnipad** (⊙) to choose “INST MENU” and then press the **ENT** key.



*Installation setup menu*

3. “MOUNTING” is selected; press the **ENT** key.
4. Use the **Omnipad** to choose the mounting method: “FLOOR”, “WALL” or “INVERT” as appropriate.
5. Press the **ENT** key.
6. “DIRECTION” is selected; press the **ENT** key.
7. Use the **Omnipad** to choose mounting direction (“A”, “B”, “C” or “D”) as appropriate. Refer to paragraph 1.2.
8. Press the **ENT** key.
9. ANT POSITION SETUP is selected; press the **ENT** key.
10. You are asked if it is OK to setup the antenna; press ◀ to choose YES and then press the **ENT** key to show the ANT POSTION SETUP display.



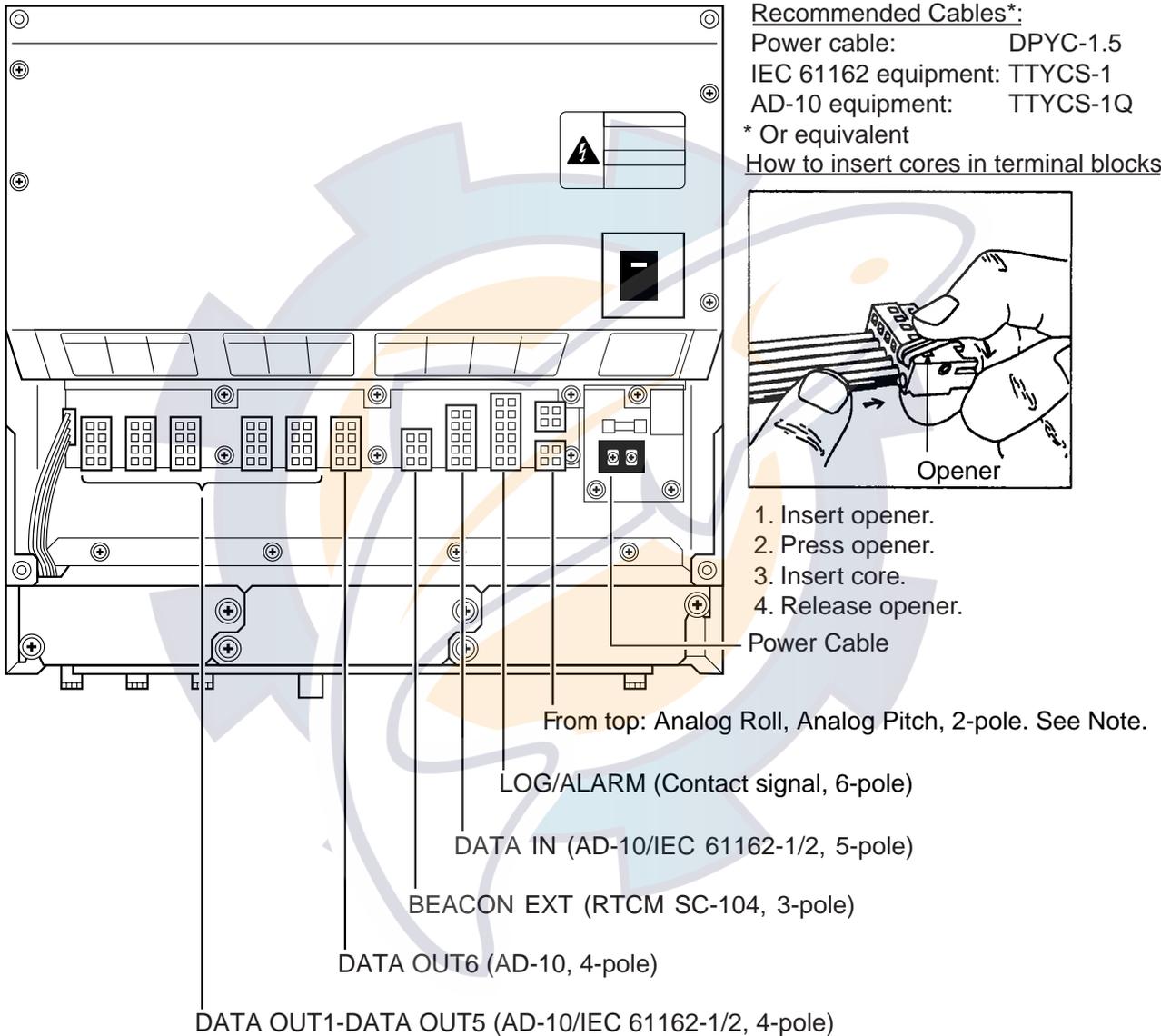
*Antenna position setup display*

It takes approx. 40 minutes to measure the distances between antennas. If the measurement is completed satisfactorily, the message “SETUP COMPLETED. TURN OFF POWER.” appears. If the measurement failed, the message “ANT POS OR LENGTH IS NOT PROPER.” appears. In this case, adjust antenna positions referring to the mounting guidelines.

## 1.6 Connection of External Equipment

### 1.6.1 General wiring

All external equipment are terminated on the MAIN Board inside the processor unit. Turn off the power and unfasten four screws to remove the cover. Connect wiring from external equipment referring to the interconnection diagram. Use the terminal opener supplied to open terminal blocks, referring to the instructions below.



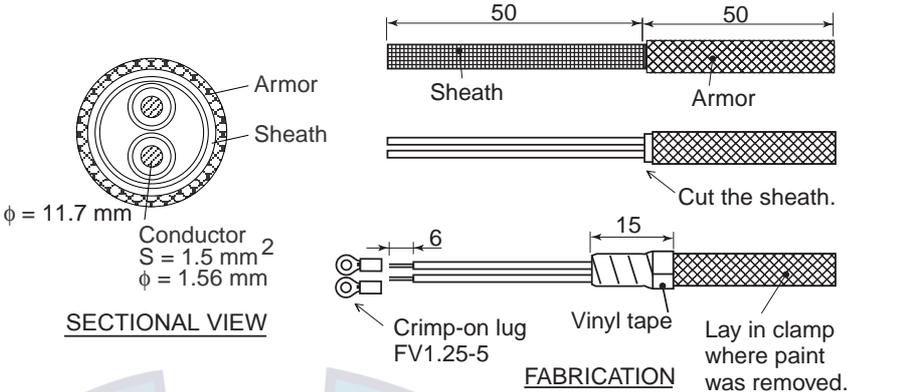
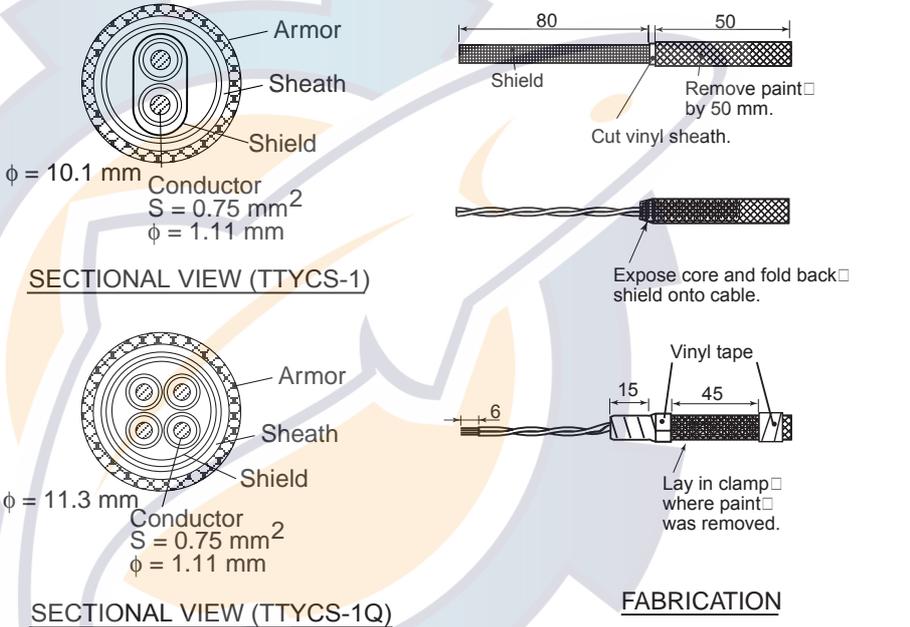
*Processor unit, cover opened*

**Note:** Roll, pitch analog out voltage [V] = 0.0785 x θ (deg.) + 3.5 (θ = roll, pitch angle)

Output example

Roll or pitch angle	Analog out voltage
0 [deg]	3.5 [V]
5 [deg]	3.8925 [V]
10 [deg]	4.285 [V]
20 [deg]	5.07 [V]

1.6.2 Fabrication of cables

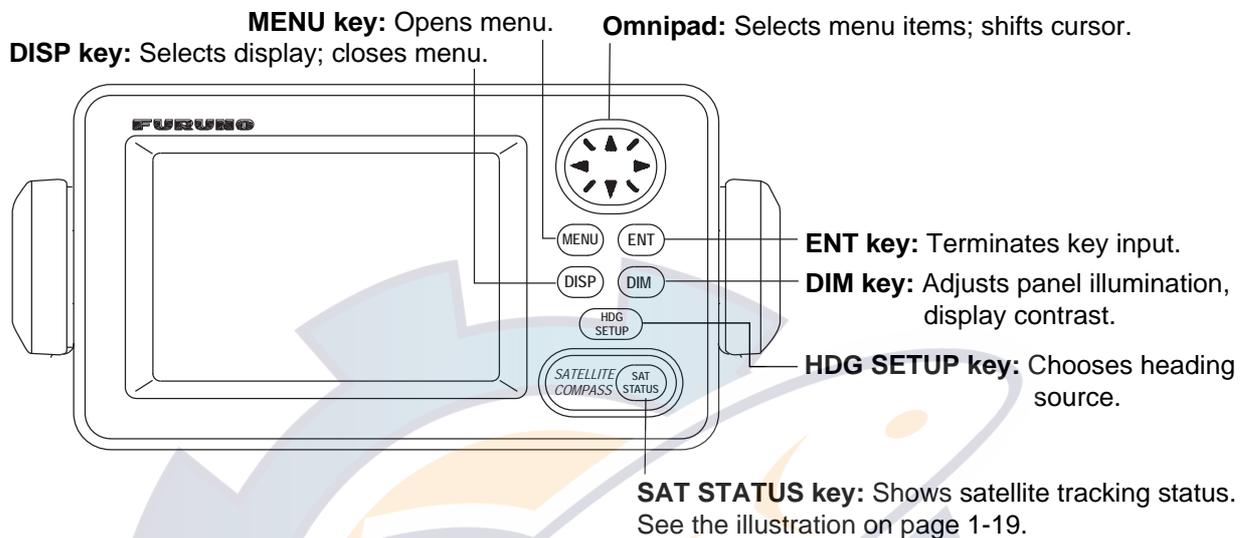
Cable	Sectional view, fabrication
<p>Power cable DPCY-1.5 (or equivalent)</p>	 <p>SECTIONAL VIEW</p> <p>FABRICATION</p>
<p>Cable for IEC 61162 format equipment (JIS cable TTYCS-1 or equivalent)</p> <p>Cable for AD-10 format equipment (JIS cable TTYCS-1Q or equivalent)</p>	 <p>SECTIONAL VIEW (TTYCS-1)</p> <p>SECTIONAL VIEW (TTYCS-1Q)</p> <p>FABRICATION</p>

**Note 1:** Attach labels (supplied) to cables to differentiate between them.

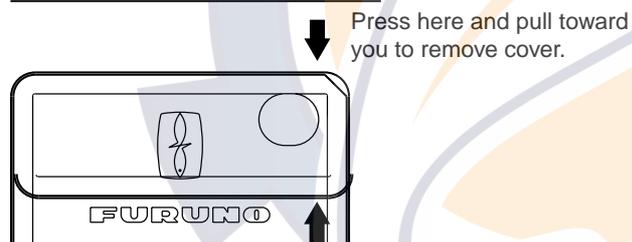
**Note 2:** A plastic sheet is placed across the cable glands of the processor unit to keep out foreign material. Cut out holes in the plastic where cables are to be lead in.

# 2 OPERATION

## 2.1 Controls



### HOW TO REMOVE THE COVER



Display unit

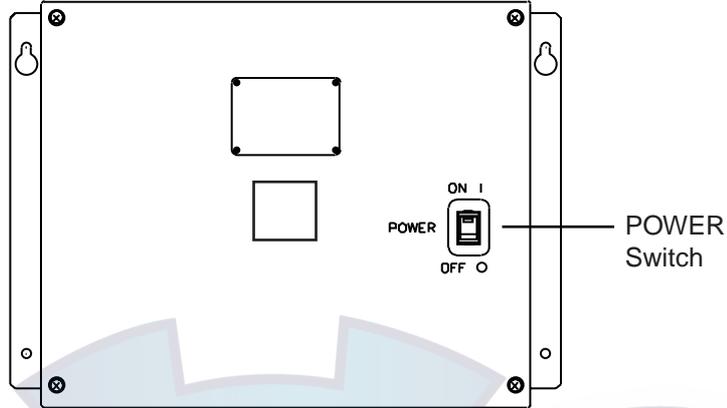
### NOTICE

Reduced accuracy may occur in case of unfavorable satellite constellation, worsened HDOP, etc.

Always confirm position against other navigation devices to verify reliability.

## 2.2 Turning the Power On/Off

Use the power switch on the processor unit to turn the power to the display unit on and off.



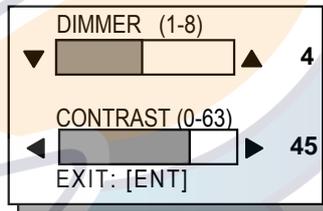
*Processor unit*

A beep sounds and the display starts up with the last-used display.

**Note:** If backup heading data is used the heading indication flashes until faithful heading data becomes available.

## 2.3 Panel Illumination, Display Contrast

1. Press the **DIM** key.



*Dialog box for adjustment of panel illumination, display contrast*

2. Press ▲ or ▼ to adjust panel illumination (dimmer).
3. Press ◀ or ▶ to adjust display contrast.
4. Press the **ENT** key.

## 2.4 Choosing a Display

Use the **DISP** key to show a display desired.

### 2.4.1 Description of displays

#### Heading display

The heading display shows heading, course, speed, date, time and position-fixing status. The heading status mark changes in the sequence shown below. The “final calculations” mark disappears after heading becomes reliable, which is approximately 90 seconds after that mark appears.

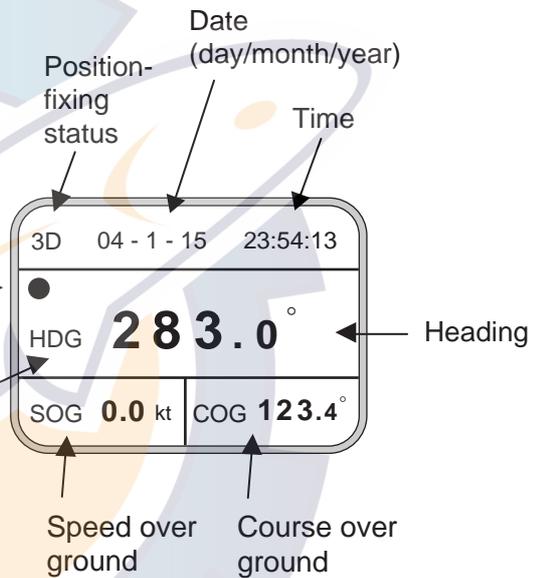
*Position-fixing status indications*

2D	2D GPS position fix
3D	3D GPS position fix
D2D	2D DGPS position fix
D3D	3D DGPS position fix
SIM	Simulation mode
W2D	WAAS 2D position fix
W3D	WAAS 3D position fix

Heading Calculation Status

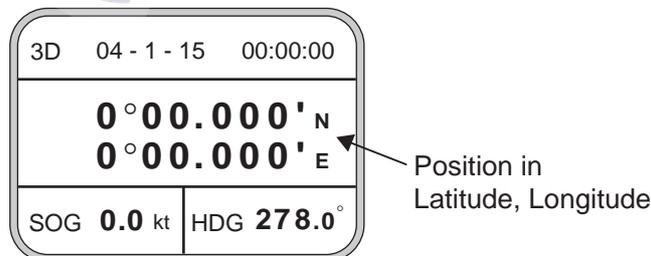
- = Acquiring satellite
- = Calculating heading
- ⊙ = Final calculations

When the data of external sensor is input, EXT (in reverse video) replaces HDG on the Heading, Nav data, Steering and Compass displays.



#### Nav data display

The nav data display shows position in latitude and longitude, speed, heading, date, time and position-fixing status.



*Nav data display*

### Steering display

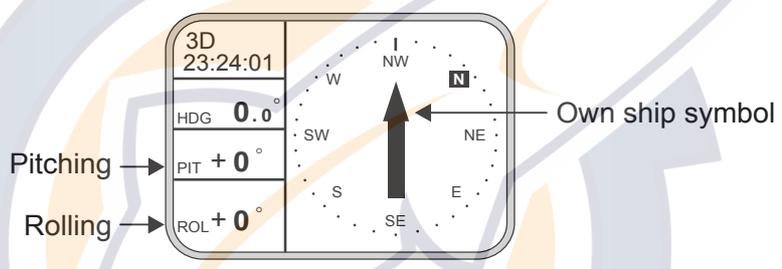
The steering display shows heading in digital and analog form. SOG and COG are also indicated. Note that COG accuracy is low when the own ship speed is low. The faster the speed, the more accurate the COG.



*Steering display*

### Compass display

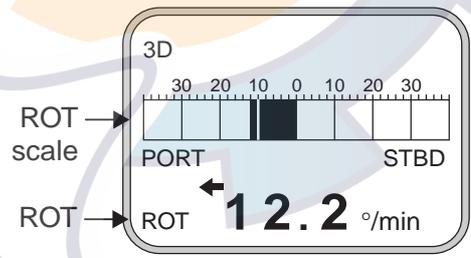
The compass display shows heading by compass direction. Pitch and roll are also indicated. The compass rose rotates with heading.



*Compass display*

### ROT (Rate-of-Turn) display

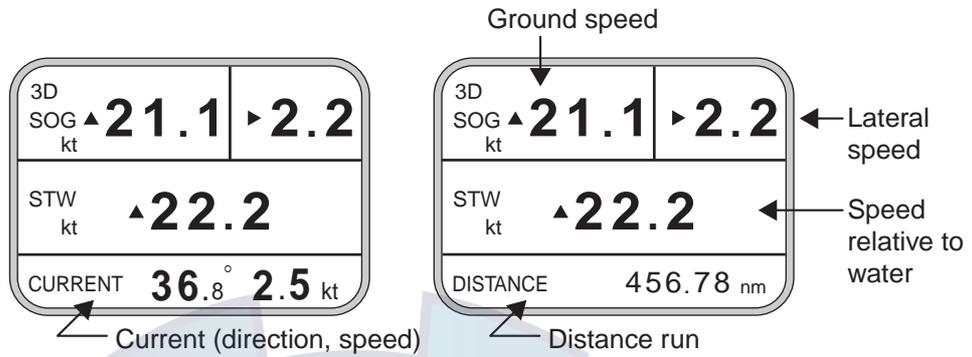
The ROT display provides digital and analog indications of rate of turn.



*ROT display*

**Speed display**

Depending on the setting of DISTANCE DISP on the TRIP menu, the Set and Drift display or the Distance Run display is shown. The current indication requires a Doppler Speed Log.



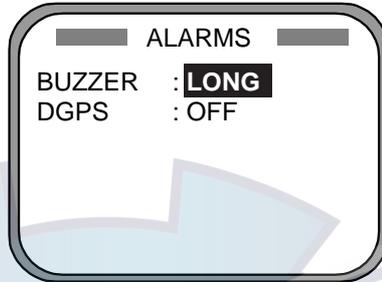
*Speed display*



## 2.5 Alarm Setup

The SC-50S can alert you with audible and visual alarms when GPS signal, DPGS signal and WAAS signal are lost. To set the DGPS alarm, do the following:

1. Press the **MENU** key to show the menu.
2. Choose ALARMS and then press the **ENT** key.



*Alarm menu*

3. BUZZER is selected; press the **ENT** key.



*Buzzer options*

4. Use ▲ or ▼ to choose buzzer type desired and then press the **ENT** key.

SHORT: Two short beeps  
LONG: Three long beeps  
CONSTANT: Continuous beep

5. Press the **ENT** key.
6. DPGS is selected; press the **ENT** key.



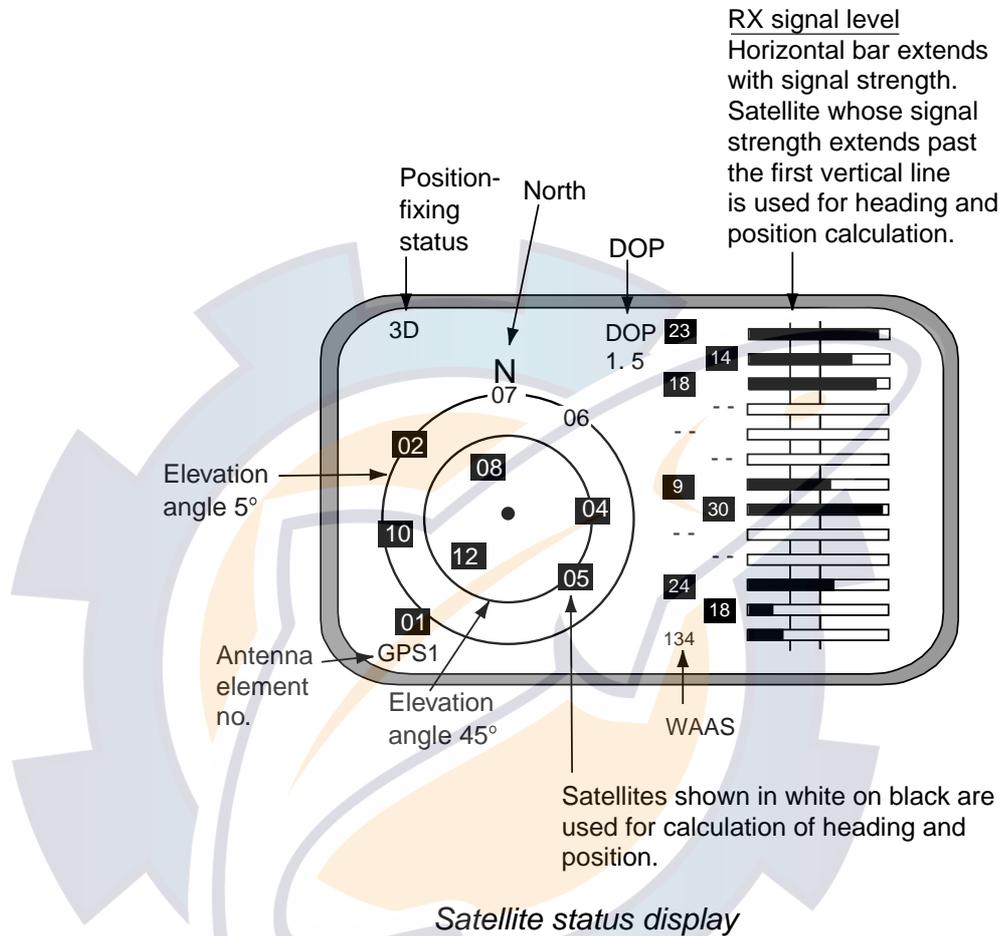
*DGPS alarm options*

7. Use ▲ or ▼ to choose OFF or ON as appropriate.
8. Press the **ENT** key.
9. Press the **DISP** key to close the menu.

## 2.6 Confirming Satellite Status

You can check the receiving condition of each antenna unit as follows:

1. Press the **MENU** key to open the menu.
2. Choose **SATELLITE** and then press the **ENT** key.



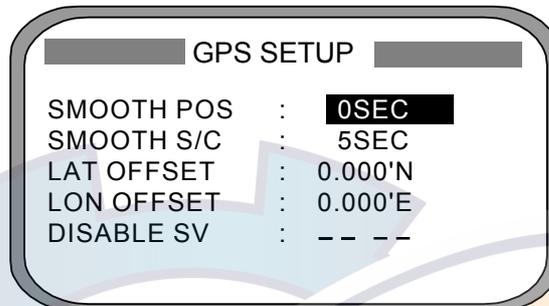
3. Use ◀ or ▶ to choose antenna element for which to confirm receiving status.
4. Press the **DISP** key to close the menu.

## 2.7 GPS Setup

The GPS SETUP menu smoothes position and course, averages speed, applies position offset, and deactivates unhealthy satellites.

### 2.7.1 Displaying the GPS setup menu

1. Press the **MENU** key to open the menu.
2. Choose GPS SETUP and then press the **ENT** key.



*GPS SETUP menu*

### 2.7.2 GPS SETUP menu description

#### **SMOOTH POS (Smoothing position)**

When the DOP (Dilution of Precision, the index for position-fixing accuracy) or receiving condition is unfavorable, the GPS fix may change randomly, even if the vessel is at anchor. This change can be smoothed by averaging a number of GPS fixes. The setting range is from 0 (no smoothing) to 999 seconds. The higher the setting the more smoothing. However, too high a setting slows updating of position.

#### **SMOOTH S/C (Smoothing speed/course)**

Ship's speed and course are directly measured by receiving GPS satellite signals, independent of positions. The data varies with receiving conditions and other factors. You can reduce this random variation by increasing the smoothing. The higher the setting the more that speed and course are smoothed. If the setting is too high, however, the follow-up to actual values gets slower. The setting range is from 0 (no smoothing) to 999 seconds.

#### **LAT/LON OFFSET (L/L position offset)**

If GPS fixes are erroneous while at anchor, enter a position offset to compensate for position error. Consult a nautical chart to determine latitude and longitude differences between the chart and GPS display. Enter that value as the offset.

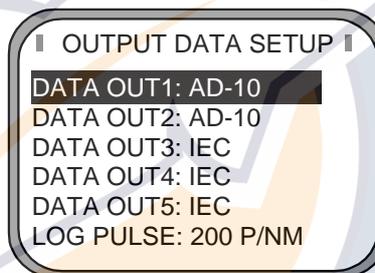
**DISABLE SV (Disable satellite)**

Every GPS satellite is broadcasting abnormal satellite number(s) in its Almanac, which contains general orbital data about all GPS satellites. Using this information, the GPS receiver automatically eliminates any malfunctioning satellite from the GPS satellite schedule. However, the Almanac sometimes may not contain this information. If you hear of an inoperative satellite you can disable it manually. Enter satellite number in two digits and then press the **ENT** key. To restore a satellite, enter "00".

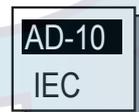
**2.8 Output Data****2.8.1 Heading**

Heading data is output from the DATA OUT port on the processor unit, in IEC 61162-1/2 format.

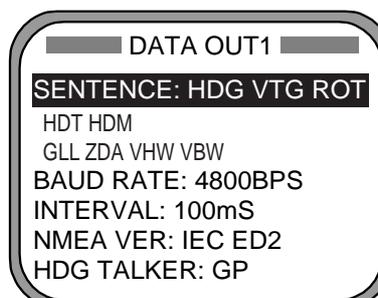
1. Press the **MENU** key to open the menu.
2. Choose I/O SETUP and then press the **ENT** key.

*OUTPUT DATA SETUP menu*

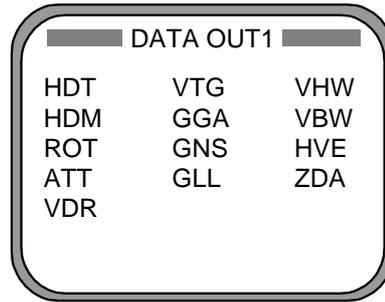
3. Choose DATA OUT1 and then press the **ENT** key.

*Data out options*

4. Use the **Omnipad** to choose AD-10 or IEC as appropriate and then press the **ENT** key. If you choose AD-10, no further operation is required; go to step 18 to finish. For IEC go to the next step.

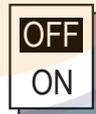
*DATA OUT1 menu*

- Choose SENTENCE and then press the **ENT** key.

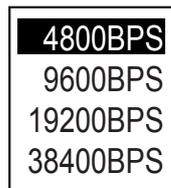


*DATA OUT1 menu, sentences*

- Use the **Omnipad** to choose a sentence and then press the **ENT** key.
  - HDT: True heading (required for radar, AIS, ECDIS, etc.)
  - HDM: Magnetic heading (HDM is obtained in this equipment by adding the magnetic variation to HDT.)
  - ROT: Rate-of-turn data
  - ATT: True heading, pitching, rolling (FURUNO's proprietary sentence)
  - VDR: Set and drift
  - VTG: Course over ground and ground speed
  - GGA: Global positioning system (GPS) fix data
  - GNS: GNSS fix data
  - GLL: Geographic position, latitude/longitude
  - VHW: Water speed and heading
  - VBW: Dual ground/water speed
  - HVE: GPS antenna up-down motion amplitude (FURUNO proprietary sentence)
  - ZDA: Time and date

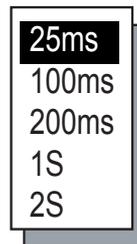


- Use the **Omnipad** to choose OFF or ON as appropriate and then press the **ENT** key. Sentences selected for output are marked with an asterisk.
- Repeat steps 6 and 7 for other items. All sentences cannot be selected. The message "SENTENCE OVERLOAD" appears when too many sentences have been selected. Change settings as appropriate. For further information see page 2-12.
- Press the **MENU** key to return to the DATA OUT1 menu.
- Choose BAUD RATE and then press the **ENT** key.



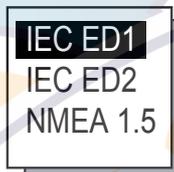
*Baud rate options*

11. Use the **Omnipad** to choose the baud rate of the equipment connected and then press the **ENT** key.
12. INTERVAL is selected; press the **ENT** key.



*Tx interval options*

13. Use the **Omnipad** to choose appropriate output interval and then press the **ENT** key.
14. Choose IEC VERSION and then press the **ENT** key.



*IEC, NMEA version options*

15. Choose appropriate IEC (or NMEA) edition and then press the **ENT** key.
16. Choose HDG TALKER and then press the **ENT** key.



*Heading talker options*

17. Choose appropriate heading talker and then press the **ENT** key.

GP: GPS navigator talker

HE: North-seeking gyrocompass talker

HN: Non-north seeking gyrocompass talker

HC: Magnetic compass talker

18. Press the **DISP** key to close the menu, or press the **MENU** key to return to the I/O SETUP menu to setup another output port.

**Output sentence limitation**

The number of sentences which can be output depends on baud rate and output interval settings. The maximum number of characters per each data sentences are shown in the table below and the total number of characters must satisfy the formula shown below. The number of characters which can be output “N” is calculated by the following formula

$$N \leq 0.083 \times T \times B$$

T: Interval (s)

B: Baud rate

*Sentence and maximum number of characters*

Sentence	HDT	HDM	ROT	ATT	HVE	VTG*	GGA*	GNS*	GLL*	ZDA*	VHW*	VBW*	VDR*
No. of Characters	19	19	21	34	23	46	66	62	47	36	44	45	35

\*: Output is 1 s if interval set is shorter than 1 s.

For example, the baud rate is 4800 bps, interval is 100 ms (= 0.1 s). Therefore, the number of characters is  $N < 0.083 \times 0.1(s) \times 4800(bps) = 39.4$ .

Then, the number of characters which can be output is 39. For sentences (sentences not having an asterisk in the table) where the output interval is variable the number of characters is as shown in the table, however sentences where the output interval is not smaller than 1 s (asterisk-marked sentences in table) the number of characters which can be output is “number of characters in table” x “setting interval.”

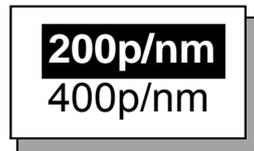
For the above settings the following applies:

- If both HDT and HDM are selected the total number of characters is  $19+19 = 38$ . Since the count is less than 39 both can be selected.
- If both HDT and VTG are selected the total number of characters is  $19+46 \times 0.1 = 23.6$ . Since the count is less than 39 both can be selected.
- If HDT, HDM and VTG are selected the total number of characters is  $19+19+46 \times 0.1 = 42.6$ . In this case, the message “SENTENCE OVERLOAD” appears.

## 2.8.2 Log pulse

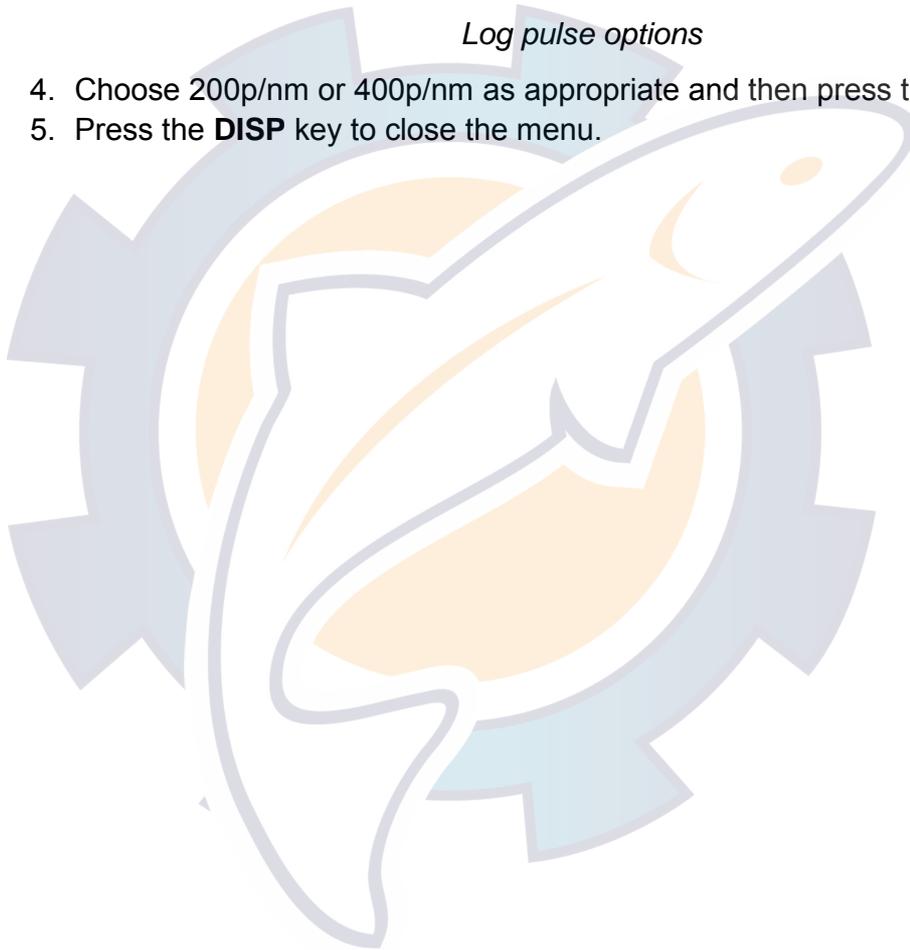
This equipment provides SOG (speed over ground) in high accuracy. It converts an SOG value to a pulse signal and outputs at the rate of 200 or 400 pulses/nm.

1. Press the **MENU** key.
2. Choose I/O SETUP and then press the **ENT** key.
3. Choose LOG PULSE and then press the **ENT** key.



*Log pulse options*

4. Choose 200p/nm or 400p/nm as appropriate and then press the **ENT** key.
5. Press the **DISP** key to close the menu.

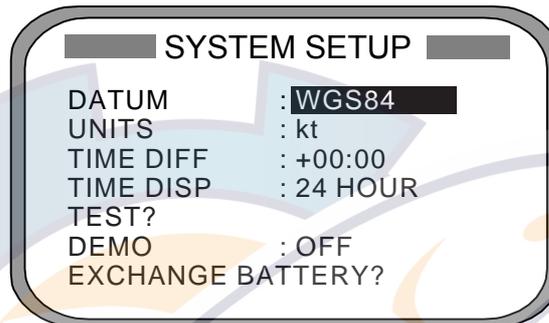


## 2.9 System Setup

### 2.9.1 Geodetic data

Your unit is preprogrammed to recognize most of the major chart systems of the world. Although the WGS-84 system (default setting) is the GPS standard, other categories of charts in other datum still exist. Match the GPS datum with the chart system you use.

1. Press the **MENU** key to open the menu.
2. Choose SYS SETUP and then press the **ENT** key.



*SYSTEM SETUP menu*

3. Confirm that the cursor is selecting DATUM and then press the **ENT** key.
4. Choose WGS84 (GPS standard), WGS72 or OTHER according to the nautical chart you use and then press the **ENT** key.
5. If you chose WGS72 or WGS84, press the **DISP** key to finish. For OTHER, go to step 6.
6. Press the **ENT** key.
7. Use the **Omnipad** to enter chart number, referring to the geodetic chart list on page A-2. Choose location with ◀ or ▶; change value with ▲ or ▼.
8. Press the **ENT** key.
9. Press the **DISP** key to close the menu.

### 2.9.2 Units of measurement

Distance/speed can be displayed in nautical miles/knots, kilometers/kilometers per hour, or miles/miles per hour.

1. Press the **MENU** key to open the menu.
2. Choose SYS SETUP and then press the **ENT** key.
3. Choose UNITS.
4. Press the **ENT** key.
5. Choose unit of measurement combination desired; kt, km/h, mi/h.
6. Press the **ENT** key.
7. Press the **DISP** key to close the menu.

### 2.9.3 Using local time

GPS uses UTC time. If you would rather use local time, enter the time difference (range: -13:30 to +13:30) between local time and UTC.

1. Press the **MENU** key to open the menu.
2. Choose SYS SETUP and then press the **ENT** key.
3. Choose TIME DIFF and then press the **ENT** key.
4. Press **▲** or **▼** to display + or – as appropriate.
5. Enter time difference with the **Omnipad**. Choose digit with **◀** or **▶**; change value with **▲** or **▼**.
6. Press the **ENT** key.
7. Press the **DISP** key to close the menu.

### 2.9.4 Time format

Time can be displayed in 12 hour or 24 hour format.

1. Press the **MENU** key to open the menu.
2. Choose SYS SETUP and then press the **ENT** key.
3. Choose TIME DISP and then press the **ENT** key.
4. Choose 12HOUR or 24HOUR as appropriate and then press the **ENT** key.
5. Press the **DISP** key to close the menu.

### 2.9.5 Demonstration mode

The demonstration mode provides simulated operation of the equipment.

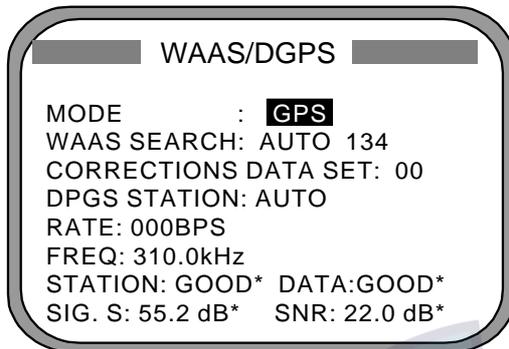
1. Press the **MENU** key to open the menu.
2. Choose SYS SETUP and then press the **ENT** key.
3. Choose DEMO and then press the **ENT** key.
4. Choose ON or OFF as appropriate and then press the **ENT** key.
5. Press the **DISP** key to close the menu.

The indication SIM appears at the top of the screen when the demonstration mode is active. When the demonstration mode is first made active, SIMULATION MODE appears when the power is turned on and it is erased when any key is pressed.



## 2.10 WAAS/DGPS Setup

1. Press the **MENU** key to open the menu.
2. Choose WAAS/DGPS and then press the **ENT** key.



**STATION:** Shows GOOD or NG.

**DATA:** Shows GOOD or NG.

**SIG. S:** Signal Strength. A figure between 0 and 99 is shown. The higher the figure the stronger the beacon signal.

**SNR:** Signal to Noise Ratio. A figure between 1 and 22 is shown. When your boat is in the service area of a beacon station, SNR should be 21 or 22. If the figure is below 21 the position will be inaccurate. If this happens, check for radar interference, poor ground and generator noise on own ship.

*WAAS/DGPS menu*

3. MODE is selected; press the **ENT** key.



*Position fix mode options*

4. Choose appropriate mode referring to the description below and then press the **ENT** key.

GPS: Position fix by GPS

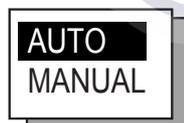
WAAS: Position fix by WAAS

DPGS: Position fix by DGPS (external beacon receiver required)

AUTO: Position fix in order of DGPS, WAAS and GPS

5. For WAAS or AUTO do as below. For DGPS go to step 6; for GPS go to step 8.

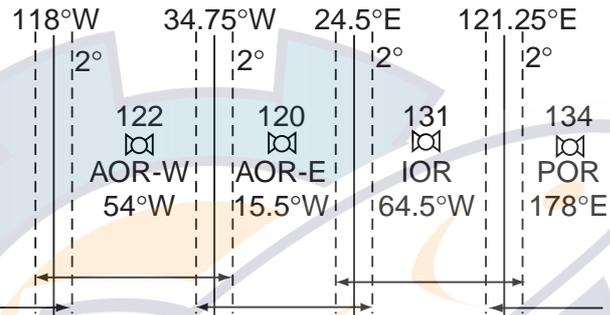
- 1) WAAS SEARCH is selected; press the **ENT** key.



*WAAS SEARCH options*

- 2) Use the **Omnipad** to choose WAAS satellite search method, AUTO or MANUAL as appropriate. For MANUAL, press the **ENT** key, enter appropriate WAAS satellite referring to the illustration below and then press the **ENT** key.

Provider	GEO Satellite	Longitude
WAAS	POR (134)	178°E
	AOR-W (122)	54°W
EGNOS	AOR-E (120)	15.5°W
	IOR (131)	64.5°E

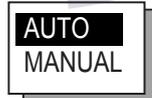


*One-degree threshold*

Longitude Range	Satellite
120.25°E to 117°W	134
119°W to 33.75°W	122
35.75°W to 25.5°E	120
23.5°E to 122.25°E	131

*GEO satellite and coverage area*

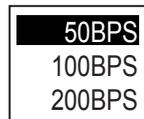
- 3) CORRECTIONS DATA SET is selected; press the **ENT** key. CORRECTIONS DATA SET determines how to use the WAAS signal. Use the default setting "00". Do step 6 and 7 for DGPS.
6. Choose DPGS STATION and press the **ENT** key.



*AUTO/MANUAL options*

7. Choose MANUAL or AUTO as appropriate and press the **ENT** key. For AUTO got to step 8. For MANUAL do the following:

- 1) RATE is selected; press the **ENT** key.



*Baud rate options*

- 2) Choose appropriate baud rate and press the **ENT** key.

- 3) **FREQ** is selected; press the **ENT** key.
  - 4) The cursor is selecting the hundredths digit so press ▲ or ▼ to display appropriate digit. Press ► to shift the cursor to the tenths place.
  - 5) Set other digits appropriately.
8. Press the **DISP** key to close the menu.



## 2.11 OTHERS Menu

The OTHERS menu contains the following items:

**HOLD HDG DATA:** Choose whether to display last-used heading data at power on or not. Because this data is not reliable, the heading indication flashes to alert you.

**HDG RESTORATION:** Choose how to restore GPS signal, automatically or manually, after it is lost. For manual restoration, a key must be pressed to restart heading output. This is done for safety purposes; for example, when an autopilot is used.

**HDG BACKUP:** Choose how long to display backup data when the GPS signal is lost. (This data is also output to external equipment.)

1. Press the **MENU** key to display the main menu.
2. Choose OTHERS and then press the **ENT** key.



*Others menu*

3. HOLD HDG DATA is selected; press the **ENT** key.



4. Choose ON or OFF as appropriate.
5. Press the **ENT** key.
6. HDG RESTORATION is selected; press the **ENT** key.



*HDG RESTORATION options*

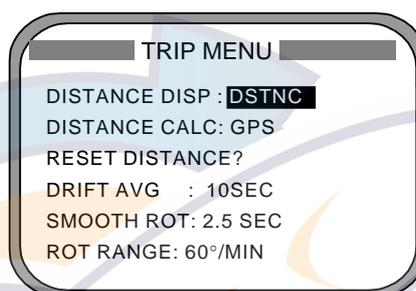
7. Use the **Omnipad** to choose MAN or AUTO as appropriate and then press the **ENT** key.
8. HDG BACKUP is selected; press the **ENT** key.
9. Choose 1, 2, 3, 4 or 5 minutes as appropriate.
10. Press the **ENT** key followed by the **DISP** key to close the menu.

## 2.12 TRIP Menu

The TRIP menu functions to

- Choose the indication to show on the SOG/STW display
- Choose source of distance run
- Reset distance run to zero
- Smooth the tide drift indication
- Enter smoothing for rate of turn and display range scale

1. Press the **MENU** key to display the main menu.
2. Choose TRIP MENU and then press the **ENT** key.



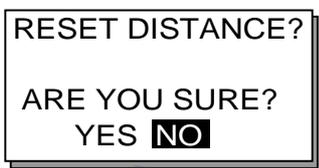
*TRIP menu*

3. Choose DISTANCE DISP and then press the **ENT** key.
4. Choose what to display on the Speed display; distance run (DSTNC) or tide direction and speed (DRIFT). Press the **ENT** key.
5. Choose DISTANCE CALC and then press the **ENT** key.
6. Choose the source for distance run; GPS, VLW (distance traveled through water) or VBW (Dual ground/water speed). (VLW requires DS-80 type Doppler speed log and VBW requires Current indicator or Doppler speed log.) Press the **ENT** key.
7. Choose DRIFT AVG. and then press the **ENT** key.
8. If tide current and speed data is unstable, enter a smoothing figure to stabilize the data. The higher the figure the more smoothed the data. A setting between 0 (no smoothing) and 9999 (seconds) is available.
9. Choose SMOOTH ROT and then press the **ENT** key.
10. Use the **Omnipad** to enter rate of turn smoothing rate. Choose location with ◀ or ▶; change value with ▲ or ▼. The setting range is 0.1 to 30.0 (seconds).
11. Press the **ENT** key.
12. Choose ROT RANGE and then press the **ENT** key.
13. Choose the range of the ROT graph from among 30, 60 and 90 (degree/min.) and then press the **ENT** key.
14. Press the **DISP** key to close the menu.

## 2.13 Resetting Distance Run

The distance run may be reset to zero as below when the source of distance run is GPS or VBW.

1. Press the **MENU** key to display the main menu.
2. Choose TRIP MENU and then press the **ENT** key.
3. Choose RESET DISTANCE and then press the **ENT** key.

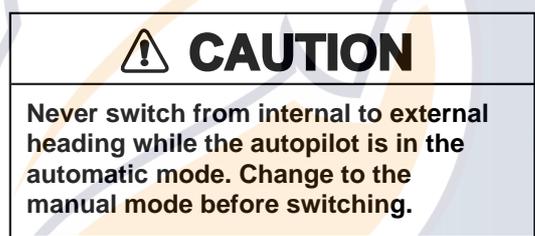


*RESET DISTANCE prompt*

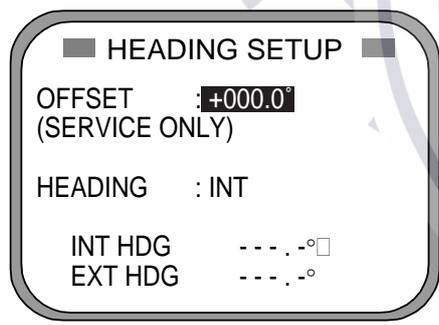
4. Choose YES and then press the **ENT** key.
5. Press the **DISP** key to close the menu.

## 2.14 Choosing External Heading Source for Backup

Choose the source of heading data as below.



2. Press the **HDG SETUP** key.



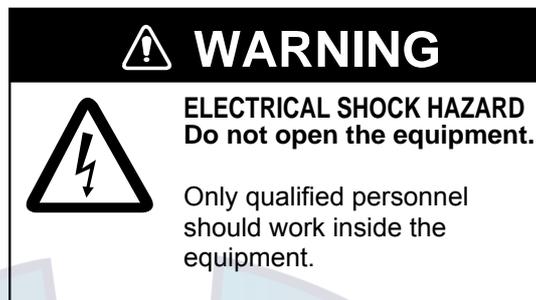
- OFFSET : Heading offset. See service manual for instructions. "SERVICE ONLY" means heading offset shown for display only.
- HEADING : Select heading source. Choose INT for normal use. If a gyrocompass is connected for primary means, leaving this equipment as backup, choose EXT.
- INT HDG : Bow heading. Includes offset.
- EXT HDG : Heading fed from external equipment.

*Heading setup menu*

3. "HEADING" is selected; press the **ENT** key.
4. Choose INT or EXT as appropriate. Normally choose INT. If own GPS sensor is not working and a heading sensor such as a gyrocompass is available, choose EXT.
5. Press the **ENT** key.
6. Press the **DISP** key to close the menu.

## 3 MAINTENANCE, TROUBLESHOOTING

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### 3.1 Preventive Maintenance

Regular maintenance is important for good performance. A maintenance program should be established and should include the following points.

- Check connectors and ground terminal on the processor unit and display unit for tightness.
- Check ground terminal for rust. Clean or replace as necessary.
- Check for water leakage in the antenna cable. Replace the cable if there are signs of water leakage.
- Remove dust and dirt from the display unit and processor unit with a dry, soft cloth. For the LCD, wipe it carefully to prevent scratching, using tissue paper and an LCD cleaner. To remove stubborn dirt, use an LCD cleaner, wiping slowly with tissue paper so as to dissolve the dirt. Change paper frequently so the dirt will not scratch the LCD. Do not use chemical cleaners for cleaning - they can remove paint and markings.

### 3.2 Troubleshooting

This section provides basic troubleshooting procedures which the user may follow to restore normal operation.

Troubleshooting

Symptom	Cause	Remedy
Cannot turn on the power.	Power cable on the processor unit	Firmly connect the power cable
	Power supply failure	Check the power supply.
	Blown fuse	Have a qualified technician check the fuse.
Heading indication changes randomly when ship is at anchor or does not change when ship moves.	Sensor trouble	Run the diagnostic test2 to determine cause.
Heading output from SC-50S does not appear on external equipment.	Connection between SC-50S and external equipment has loosened.	Firmly fasten the connector.
	Sensor trouble	Run the diagnostic test1 to determine the cause.

If large heading error occurs or heading indication is frequently interrupted, contact your dealer for advice.

## 3.3 Diagnostics

### Diagnostic test1

The diagnostic test1 checks the equipment for proper operation.

**Note:** Heading is not output during the diagnostic test, and this is communicated with an appropriate message. After completing the diagnostic test, turn the power off and on to update heading data.

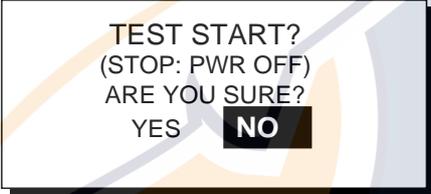
1. Press the **MENU** key to open the menu.
2. Choose SYS SETUP and then press the **ENT** key.
3. Choose TEST? and then press the **ENT** key.



A screenshot of a menu with three options: TEST1, TEST2, and TEST3. The option TEST1 is highlighted with a black background and white text.

*Test menu options*

4. Confirm that TEST1 is selected and then press the **ENT** key.



A screenshot of a prompt screen with the text: TEST START? (STOP: PWR OFF) ARE YOU SURE? YES NO. The option NO is highlighted with a black background and white text.

*Test start prompt*

5. Press **◀** to choose YES and then press the **ENT** key. The test proceeds in the sequence shown on the next page.

**Note:** The output port test (see next page) is intended for the service technician, using a special test connector. If TEST1 is conducted without the test connector, disconnect the DATA IN connector from the processor unit.

**ROM, RAM, KEY TEST**

OK shown for normal;  
 NG (No Good) shown for error

GPS receiver  
 Processor unit  
 Display unit

	ROM	RAM	<b>PUSH KEY</b>
GPS1	OK	OK	
GPS2	OK	OK	
GPS3	OK	OK	
CAL	OK	OK	OK
DISP	OK	OK	
CNT= (STOP: PWR OFF)			

**KEY TEST**  
 Press each key one by one. Pressed key's name appears here if key is functioning properly.

Number of times test executed

After 3 sec.

**OUTPUT TEST (for serviceman)**

	AD-10	IEC
OUT1	--	--
OUT2	--	--
OUT3	--	--
OUT4	--	--
OUT5	--	--
OUT6	--	--

To stop the test turn off the power.

After 5 sec.

(For serviceman)

B-EXT	--
DISP	OK

All LCD segments go on 2 sec.,  
 All LCD segments go off 3 sec.

**DISPLAY TEST**

<LCD CHECK>	
ALL ON 2 SEC.	
ALL OFF 3 SEC.	

**PROGRAM NUMBER DISPLAY**

SOFTWARE VERSION	
DISPLAY	205-1342-***
PROCESS	205-1341-***
GPS1	4850263***
GPS2	4850263***
GPS3	4850263***
CNT= (STOP: PWR OFF)	

\*\* Program Version No.

ROM, RAM, KEY check appears after 3 sec.

*Diagnostic test sequence*

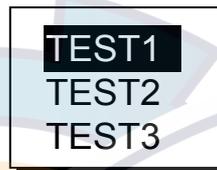
6. Turn off the processor unit to quit the diagnostic test1.

**Diagnostic test2**

If the heading indication changes randomly when ship is at anchor or does not change when the ship moves, run the test2 following the procedure below, with the ship at anchor and satellite signal received.

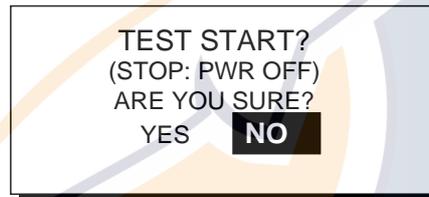
**Note:** Heading is not output during the diagnostic test, and this is communicated with an appropriate message. After completing the diagnostic test, turn the power off and on to update heading data.

1. Press the **MENU** key to open the menu.
2. Choose SYS SETUP and then press the **ENT** key.
3. Choose TEST? and then press the **ENT** key.



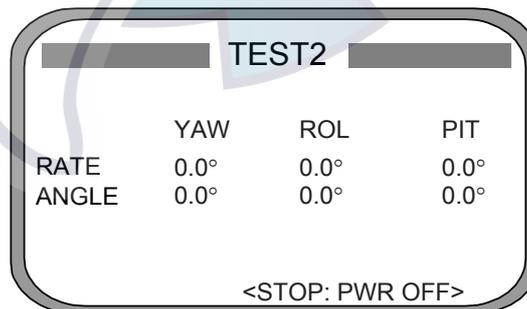
*Test menu options*

4. Choose TEST2 and then press the **ENT** key.



*Test start prompt*

5. Press **◀** to choose YES and then press the **ENT** key.
6. Press the **ENT** key twice. Rate and angle values are 0.0°. If the values increase or decrease markedly (with ship at anchor), suspect rate sensor trouble. Contact your dealer to request service.



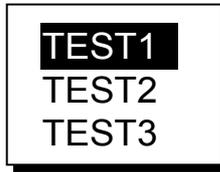
*TEST2 display*

7. Turn off the processor unit to quit the diagnostic test2.

### Diagnostic test3

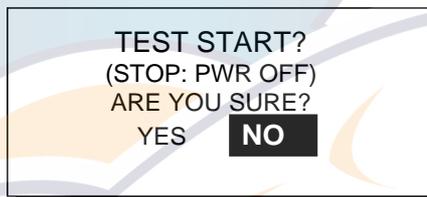
This test checks the buzzer signal/contact for proper operation.

1. Press the **MENU** key to open the menu.
2. Choose SYS SETUP and then press the **ENT** key.
3. Choose TEST? and then press the **ENT** key.



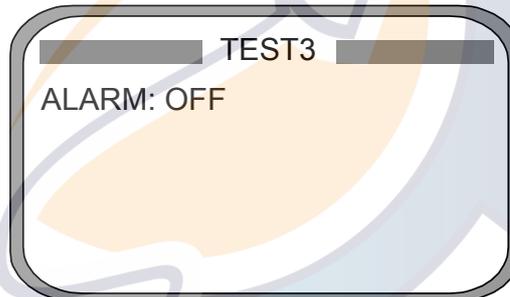
*Test menu options*

4. Choose TEST3 and then press the **ENT** key.



*Test start prompt*

6. Press **◀** to choose YES and then press the **ENT** key.



*TEST3 menu*

7. Press the **ENT** key.



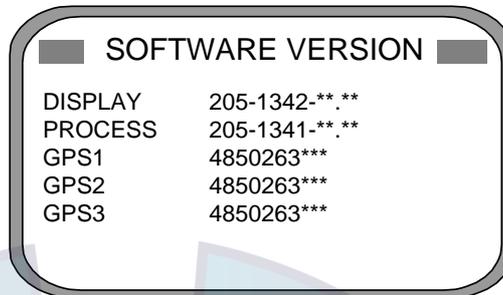
*ALARM options*

8. Choose OFF or ON as appropriate and then press the **ENT** key.  
OFF: Buzzer sound goes off, alarm contact signal is closed.  
ON: The buzzer sounds and the alarm contact is open.
9. To quit the test, turn off the processor unit.

### 3.4 Program Number

You may display the program number as follows:

1. Press the **MENU** key to open the menu.
2. Choose SOFT VER. and then press the **ENT** key.



\*\* = Program version no.

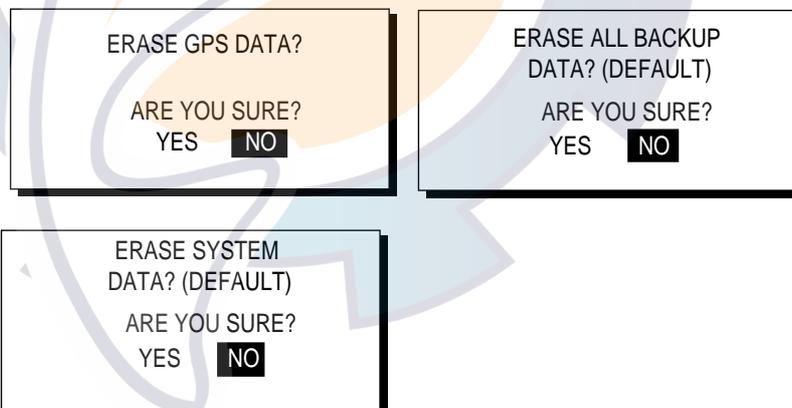
*Program number display*

3. Press the **DISP** key to close the program version no. display.

### 3.5 Clearing Data

You may clear GPS data and system data all at once or individually as follows:

1. Press the **MENU** key to open the menu.
2. Choose ERASE and then press the **ENT** key.



*Prompts for erasure of data*

3. Choose GPS DATA?, SYSTEM DATA? or ALL BACKUP DATA? (clears GPS and SYSTEM data) as appropriate. One of the following displays appears depending on your selection.
4. Press **◀** to choose YES and then press the **ENT** key to erase. After data is erased the message "Completed erasing. Turn off the unit." is displayed.
 

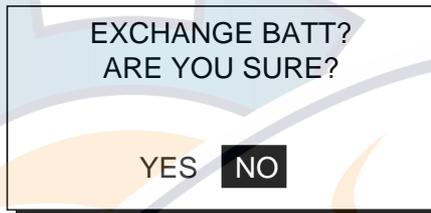
**Note:** MOUNTING, DIRECTION and LANGUAGE in the INST menu, HDG RESTORATION and HDG BACKUP in the OTHERS menu and OFFSET in the HEADING SETUP menu are not cleared.
5. Turn off and on the power.

### 3.6 Replacement of Battery

The processor unit has a battery which stores data when the power is turned off. When the battery voltage is low, the message “BATTERY!” appears on the display. Have a qualified technician replace the battery, following the procedure below. The life of the battery is 3-5 years.

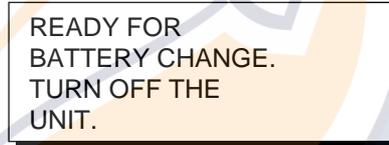
Battery Location	Type	Code No.
Processor Unit	CR2450-F2ST2L	000-144-941

1. Press the **MENU** key to open the menu.
2. Choose SYS SETUP and then press the **ENT** key.
3. Choose “EXCHANGE BATTERY?” and then press the **ENT** key.



*Prompt for exchanging battery*

4. Press **◀** to choose YES and then press the **ENT** key. The following message appears.



*Prompt for turning off the power*

5. At this time the contents of the RAM are temporarily moved to the flash memory. Turn off the power.
6. Have a qualified technician replace the battery.

**Note:** If the equipped will not be used for a long period of time, save data by following the above procedure. This will prevent loss of data even if the battery dies.

### 3.7 Replacement of Fuse

The 3 A fuse on the POWER Board inside the processor unit protects the equipment from overcurrent and reverse polarity of the power supply. If the power cannot be turned on, have a qualified technician check the fuse.

 **WARNING**

**Use the proper fuse.**

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

### 3.8 Error Messages

The alarm sounds for equipment error and is accompanied by a flashing exclamation mark (⚠). Press any key to silence the alarm. The exclamation mark remains on the screen until the cause for error is eliminated. Find the cause for the alarm(s) as follows:

1. Press the **MENU** key to open the menu.
2. Choose MESSAGES and then press the **ENT** key.



*Message display*

3. Press the **DISP** key to close the menu.

*Error messages*

Error Message	Meaning	Remedy
ABORTING!	GPS heading error continues for one minute. For example, satellite cannot be acquired because of unfavorable environment.	Check for obstruction.
ABORTING CALC!	GPS signal lost for one minute.	Press any key to try to restore normal operation.
BACKUP ERROR!(DISP)	Corrupted backup data found in display unit at power on.	Default settings are automatically restored.
BACKUP ERROR!(PRCSSR)	Corrupted backup data found at processor unit at power on.	Default settings are automatically restored.

*(Continued on next page)*

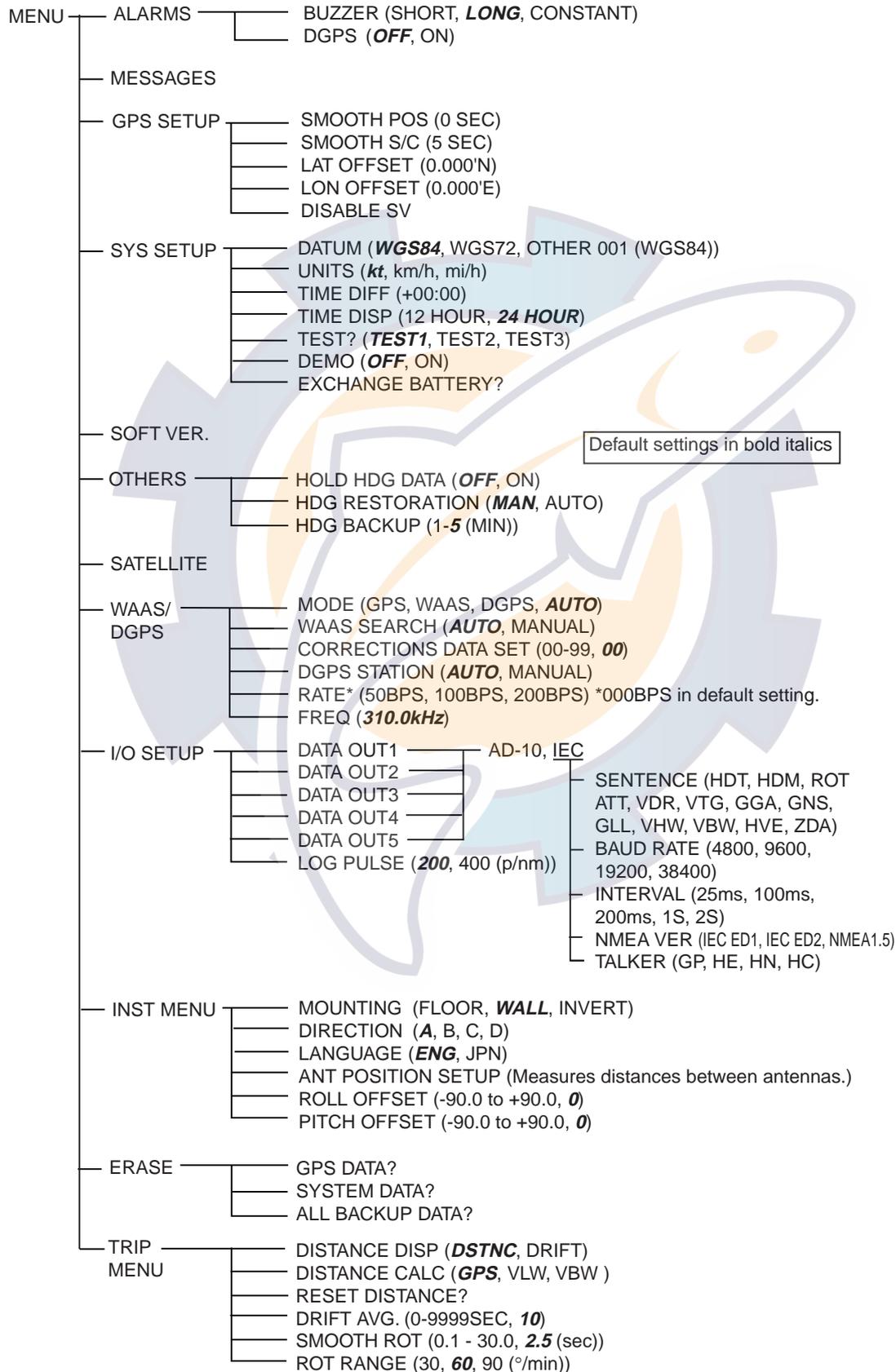
*Error messages (con't from previous page)*

<b>Error Message</b>	<b>Meaning</b>	<b>Remedy</b>
BATTERY ALM!	Voltage of battery in processor unit is low.	Have battery replaced at earliest convenience.
DATA ERR!	GPS data (from the GPS receiver in the processor unit) is lost for one minute. Heading output is stopped and the heading indication shows " - - -".	Check GPS receiver.
DGPS ERROR!	DGPS data (from external DGPS receiver) is lost for one minute.	Ship may not be within DPGS service area.
GPS DATA ERROR!	GPS data (from internal GPS receiver) is lost for one minute. Heading output is stopped and the heading indication shows " - - -".	Conduct diagnostic test1 and check if NG appears for results for GPS receivers GPS1, GPS2 and GPS3.
GPS NO FIX!	No GPS data.	Check antenna cable.
HDG ERROR!	Heading error	Request service.
NO HEADING OUTPUT!	GPS heading error continues for five* minutes. In this case the heading indication shows " - - -" and heading output is stopped. * = default setting. May be changed by "backup" setting.	Press any key to try to restore normal operation.
RAM ERROR!	RAM problem	Request service.
RATE ERROR(YAW)!	Data output stopped.	Request service.
RATE ERROR(ROLL)!	Data output stopped.	Request service.
RATE ERROR(PITCH)!	Data output stopped.	Request service.
COMMUNICATION ERR!	Communication between display unit and processor has been interrupted.	Request service.
WAAS ERROR	WAAS data lost for one minute.	Request service.
ROM ERROR!	ROM problem	Request service.

\*: Alarm port goes open when message appears.

# APPENDIX

## Menu Tree



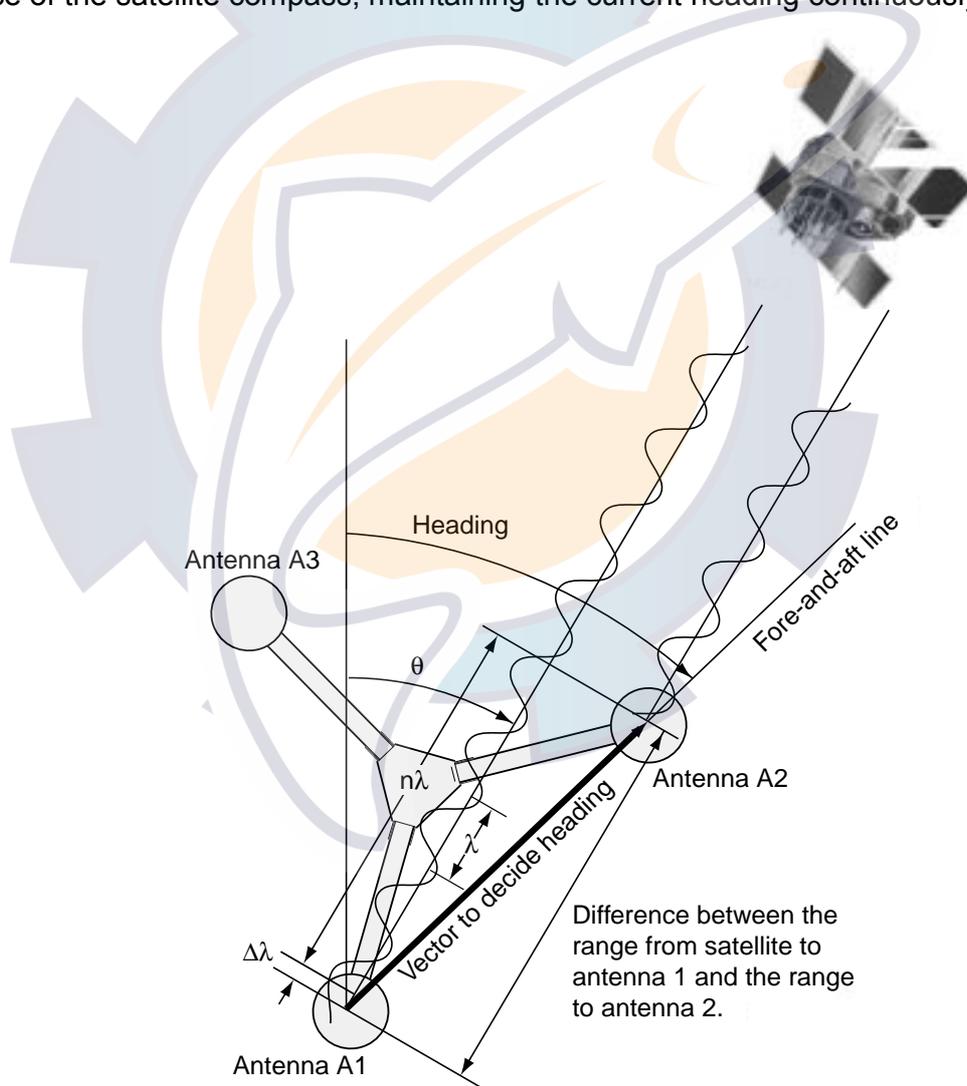
# Geodetic Chart Codes

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

## Principle of Satellite Compass

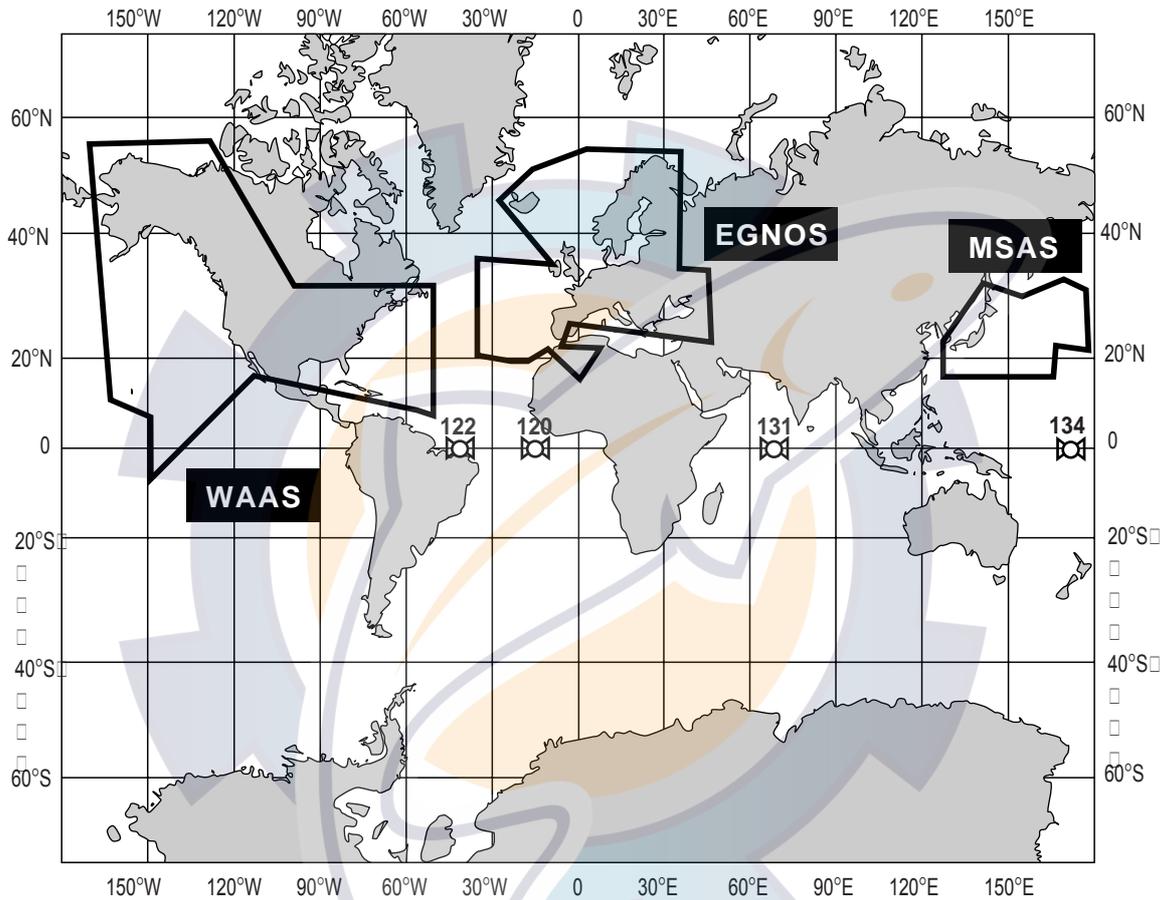
Own ship's heading can be determined by decoding the data in the carrier frequency in addition to ordinary GPS parameters. In principle, a pair of two antennas A1(ref) and A2(fore), each connected with an associated GPS engine and processor, are installed along the ship's fore-and-aft line. GPS systems at A1 and A2 calculate the range and azimuth to the satellite. Difference in range between A1 and A2 is  $\Delta\lambda + n\lambda$  where  $\lambda$  is 19 cm. "n" is automatically found during the initialization stage by receiving three satellites. A fraction of a carrier wavelength,  $\Delta\lambda$ , is processed by FURUNO's advanced kinematic technology in geographical survey, thus determining a vector (range and orientation) A1 to A2.

In reality, a third antenna is used to reduce the influence of pitch, roll and yaw, and five satellites are processed to process 3D data. If the GPS signal is blocked by a tall building or the vessel is under a bridge, the 3-axis solid-state angular rate gyros in the processor unit take place of the satellite compass, maintaining the current heading continuously.



## What is WAAS?

WAAS, available in North America, is a provider in the worldwide SBAS (Satellite Based Augmentation System) navigation system. SBAS provides GPS signal corrections to SBAS users, for even better position accuracy, typically better than three meters. Two more SBAS providers are also currently under development, MSAS (Multi-Functional Satellite Augmentation System) for Japan and EGNOS (Euro Geostationary Navigation Overlay Service) for Europe. All providers will be compatible with one another, thus providing “seamless” position fixes to SBAS users.



Satellite, Region	Position
120, AOR-E	15.5°W
122, AOR-W	54°W
131, IOR	64.5°E
134, POR	178°E

At the time of this software release, only WAAS is operational. During the developmental period in other areas, which may last for several years, there is no guarantee of the accuracy, integrity, continuity, or availability of the SBAS signal. FURUNO will accept no responsibility for the use of the signal for other than the above stated purpose. It is the user’s responsibility to exercise common prudence and navigational judgment while using the SBAS signal.

**Note:** This manual uses “WAAS” when referring to any SBAS provider.

# INDEX

<b>A</b>		<b>M</b>	
Alarms menu .....	2-6	Maintenance	
<b>B</b>		battery replacement .....	3-8
Battery replacement .....	3-8	cleaning .....	3-1
<b>C</b>		fuse replacement .....	3-9
Compass display .....	2-4	Menu tree .....	2
Control description .....	2-1	<b>N</b>	
<b>D</b>		Nav data display .....	2-3
Data clearing .....	3-7	<b>O</b>	
Demonstration mode .....	2-16	OTHERS menu .....	2-20
Diagnostics		Output data setup menu .....	2-9
test 1 .....	3-3	<b>P</b>	
test 2 .....	3-5	Position offset .....	2-8
test 3 .....	3-6	Power on/off .....	2-2
DIM key .....	2-2	Program version no. ....	3-7
DISP key .....	2-3	<b>R</b>	
Distance run display .....	2-4	Rate-of-turn display .....	2-4
Distance run resetting .....	2-22	ROT range, smoothing .....	2-21
<b>E</b>		<b>S</b>	
Error messages .....	3-9	SAT STATUS key .....	2-1
<b>F</b>		Satellite status display .....	2-7
Fuse replacement .....	3-9	Satellites	
<b>G</b>		disabling .....	2-9
Geodetic data .....	2-14	status display .....	2-7
GPS setup menu .....	2-8	Smoothing .....	2-8
<b>H</b>		Speed display .....	2-5
Heading		Steering display .....	2-4
backup .....	2-20	System configuration .....	v
external source for backup .....	2-22	System setup menu .....	2-14
output .....	2-9	<b>T</b>	
restoration .....	2-20	Time format .....	2-15
Heading display .....	2-3	TRIP menu .....	2-21
<b>L</b>		Troubleshooting .....	3-2
Local time .....	2-15	<b>U</b>	
Log pulse .....	2-13	Units of measurement .....	2-15
		<b>W</b>	
		WAAS/DGPS menu .....	2-17