JLR-8600
NWZ-1650

GPS NAVIGATOR

INSTRUCTION
MANUAL

Foreword

Thank you for purchasing the JRC GPS Navigator JLR-8600.
This equipment is a high-performance navigation equipment consisting of a GPS sensor and navigator, can retrieve the position data using the GPS sensor to display various navigation information on the display.

- Thoroughly read this instruction manual before operating the equipment.

- Keep this manual nearby the equipment to allow ready access to it if necessary. It may provide valuable information on how to deal with a given situation that may arise during the operation.

Symbols

Several symbols are used in this manual to ensure safety and proper operation of the equipment and to avoid possible human injury or property damage. These symbols and their meanings are shown below. Please read and understand these symbols before proceeding to read this manual.

⚠	**WARNING**	Instructions shown with this symbol represent what can cause death or serious injury if not observed.
⚠	**CAUTION**	Instructions shown with this symbol represent what may cause injury or property damage if not observed.

Examples of the Symbols

The symbols shown in the $\triangle$ mark represent those that require attention (including potential dangers and warnings).
A depiction of the type of caution is shown inside the symbol (the left symbol indicates a general caution).

The symbols shown in the $\oslash$ mark represent actions which are prohibited. A depiction of the type of prohibited action is shown inside the symbol (the left symbol indicates that disassembly is prohibited).

The ● symbol indicates required actions.   A depiction of the type of required action is shown inside the symbol (the left symbol indicates that the power plug must be disconnected from the outlet).

⚠ WARNING

Do not disassemble or modify the equipment.   Doing so may result in fire, electric shock, or equipment failure.

Do not allow the display to become wet.   Doing so may result in fire, electric shock, or equipment failure.

Operate the equipment only at the indicated voltage.   Failure to do so may result in fire, electric shock, or equipment failure.

Install this unit at least 1 m away from any magnetic compasses.   Installation near a magnetic compass may result in interference with the magnetic compass, and may result in an accident.

Do not perform internal inspections or modifications of the equipment.   Inspection or modification by unauthorized personnel may result in fire, electric shock, or equipment failure.   Please consult with JRC or an affiliate to perform internal inspections or repair.

When disposing of the used lithium battery, place insulating tape over the battery terminals, or otherwise insulate the battery.   Failure to do so may result in heating, explosion, or fire due to a shorted battery.

⚠ CAUTION

This equipment is not designed to automatically make judgments on the position data. The navigation information including the position data needs to be judged by the user himself.

Do not use the equipment in the environment other than those provided in the specification.   Doing so may result in equipment failure, malfunction, or injury.

Do not install the display unit in the location where it may come in contact with water, oil, or chemicals.   Doing so may result in equipment failure, malfunction, or injury.

Do not install the equipment in the place subject to vibration or shock.
Doing so may result in the equipment falling or collapsing, resulting in equipment failure or injury.

Do not place any item on the top of the equipment.
Doing so may result in equipment failure, malfunction, or injury.

Please consult with JRC or an affiliate to perform installation.   Installation by unauthorized personnel may result in malfunction.

Use only the specified battery.   Failure to do so may result in battery leakage or rupture, resulting in fire, injury, or equipment failure.

Do not use benzine, alcohol or thinner when caring this equipment.
Doing so may result in removing the paint or changing of properties.
Wipe off the grime lightly with a dry soft cloth.

Use the indicated screws when installing the display unit to a stable wooden surface.   Failure to do so may result in the display unit falling over, causing injury or property damage.

Use only the specified fuse.
Failure to do so may result in fire or equipment failure.

Use only the specified battery.
Failure to do so may result in equipment failure or malfunction.

⚠ CAUTION

🚫 When connecting the cable attached to the equipment, do not bend it acutely, twist it, or impart excessive force. Doing so sometimes causes cracks or damage to the coating, resulting in fire or electrocution.

🚫 Do not install the sensor where there is excessive vibration.
Vibration may cause sensor failure.

🚫 Do not paint the sensor.
Doing so may result in reception problems.

🚫 Do not install the sensor where temperature exceeds 55 degrees Celsius and there is covered with exhaust gas from funnel. Doing so may result in flood and cause sensor failure.

❗ The junction box rubber gaskets (25 f Gland side) fit ϕ 10mm – 20mm cables.

❗ Install the sensor where there are no obstacles, in order to ensure that GPS signals can be directly received from satellites without interference or reflection of signals from surrounding objects.
Whenever possible, select a place with the following characteristics.

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1. **An open space, which allows uniform reception of satellite signals.**
2. **Far away from any high power transmission antennas.**
3. **Outside radar beams.**
4. **Away from the INMARSAT antenna by at least 5 meters and outside the INMARSAT beam.**
5. **Away from the antenna of a VHF transmitter and a direction finder by at least 3 meters.**
6. **Away from a Magnetic Compass by at least 1 meter.**
7. **3 meters or more away from amateur radio antennas.**

If it is difficult to find an ideal site, select a place temporarily and install the equipment. Conduct a test to make sure that the proper performance can be obtained and then fix the equipment in position. If it is installed at an improper place, reception accuracy may be impaired.

❗ If occurs bad positioning of such as satellite can not be received, please execute the master reset of sensor.

❗ There are cases when time lags in the gps navigator and gps compass.
This is not a malfunction due to the delay in the internal processing.

❗ There are cases when time lags in the main display unit and sub display unit.
This is not a malfunction due to the delay in the internal processing.

Appearance of the Equipment

●**NWZ-1650 Display Unit**

●**NDC-4100 Processor Unit**

●**JLR-4350 GPS Sensor Unit**

Terminology

Term	Meaning (Descriptions)
2D (2 dimension)	Positioning with antenna elevation height in addition to satellite data.
3D (3 dimension)	The three dimensional position fix, 4 or more satellites required.
Active route	Route that is currently used by a ship
Anchor alert	This alert monitors that the own ship is the preset distance or more away from the waypoint.
Arrival alert	This alert informs that the own ship has traveled the preset distance, approaching the waypoint.
Beacon information	Beacon data which is broadcast by message type 16.
BeiDou	BeiDou is a satellite positioning system that is managed by China.
Boundary alert	This alert informs that the own ship has got into the preset route.
CCRP	Abbreviation of Consistent Common Reference Point. Reference position of the own ship.
CDI	Abbreviation of Course Deviation Indicator. This indicator shows information on the deviation from the scheduled route and on the direction into which the ship should be steered.
Checksum	An error detection method to check that the data has been correctly transmitted.
COG	Course Over Ground.
Course	Direction in which the ship is traveling, which is the bearing mainly displayed by the GPS.
CURRENT	Sea and ocean currents, expressed in speed and direction.
Data route	Ship route data that is stored in the memory of the equipment
Default gateway	Equipment connected externally from a constructed network.
DGPS	Abbreviation of Differential Global Positioning System. GPS satellite error data sent from a reference station whose position is accurately known is received via beacon from a beacon station, improving positioning accuracy.
DISP-DPU	The main circuitry of display unit.
FRAM	Nonvolatile memory using a ferroelectric substance.
Geodetic	Conditions for expressing position via latitude and longitude.
GPS Satellite (GPS)	Abbreviation of Global Positioning System. Refers to satellites launched for navigational support of military vessels managed by the United States Department of Defense.
GLONASS	GLONASS is a satellite positioning system that is managed by Russia.
HDOP	Abbreviation of Horizontal Dilution of Precision. Indicates accuracy of positioning. The smaller the number, the higher the accuracy. If GPS satellites are unevenly distributed, this number will grow. If GPS satellites are evenly distributed, this number will be smaller.
IEC	IEC is the abbreviation of International Electrotechnical Commission. It is an international standard governing electrical and electronic technologies.
IPXX	IPXX is Degrees of protection provided by enclosures (IP Code)

	1st numeral: Against ingress of solid foreign objects (0 – 6) 2nd numeral: Against ingress of water with harmful effects (0 - 8). (IPX4: splash-proof, IPX6: waterproof)
IP address	ID number assigned to equipment on a constructed network.
LAN	Abbreviation of Local Area Network. A network is constructed for transmitting and receiving data.
LCD Unit (LCD)	Liquid Crystal Display Unit.
Log Pulse	Contact output signal, output in 1 pulse per nm. Expressed in units of "p/nm". mi/h Unit of ship speed.
Loran time difference display	Method for expressing the present position with loran system time difference. (The method is for operators who have a background in loran navigation.)
MAC address	ID number assigned to LAN IC
Multi GNSS	Positioning using multiple satellite systems at the same time.
Master reset	This function changes the settings of the display unit and GPS sensor back to the factory settings. The function clears all the data.
Multipath Wave	Waves received from multiple directions due to reflection or refraction of an initial wave by obstacles.
Mutual monitoring mode	When two navigators are installed, they monitor their position fixing status each other by using this function.
NMEA0183 (NMEA)	Abbreviation of National Marine Electrical Association 0183. International standard for naval equipment transmission established by the National Marine Electrical Association.
QZSS	QZSS is a Quasi-zenith satellite system that is managed by Japan and complements GPS.
Positioning	Use of GPS or DGPS receiving functions to determine the current position of a ship.
RAIM Accuracy Standard (RAIM)	Abbreviation of Receiver Autonomous Integrity Monitoring. This system automatically detects failed satellites and deselects their positioning data from calculations. Including data from failed satellites will result in a decrease in positioning accuracy; the RAIM accuracy standard indicates the accuracy degradation base for removal of failed satellites from positioning calculations.
Ranging	Positioning with the use of SBAS satellite in addition to GPS satellite.
Reception Level	GPS signal reception level.
Route plan	Plan registered with multiple waypoints in the navigation order
RS-232C	Serial data transmission standard. It is unbalanced, and hence can only be used for short distance transmission.
RS-422	Balanced serial transmission standard.
SBAS	Abbreviation of Satellite Based Augmentation System. It is a blanket term for wide scale GPS support systems using fixed position satellites which send GPS error correction data over a wide range.
SBAS Search	SBAS reception mode (manual / automatic).

Shared route	Function that uses the same route as other functions such as ECDIS do. The route can be updated automatically by sharing the active route.
Smoothing	Function for averaging over a specified number of seconds.
SOG	Speed Over Ground, This is the ship's relative speed to the ground.
SPEED	The speed mainly measured by the GPS.
STW	Speed Through Water.
Subnet mask	Value for identifying the network address
Symbol information	Information of symbols displayed on the plotting screen. The information includes symbol positions, comments, etc.
TD	Abbreviation of Time Difference. Time difference from the master-station signal of the loran system to the slave-station signal.
Message Type 0	SBAS satellite test broadcasting.
UTC	Abbreviation of Coordinated Universal Time.
XTD alert	This alert informs that the own ship has got out of the scheduled route by the preset distance or more.

x

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Chapter 1 Equipment Overview

1.1　Functions

This equipment (JLR-8600) is a GPS navigator with a JLR-4350GPS sensor that is connected to the NWZ-1650 display unit and the NDC-4100 processing unit.

JLR-4350, which is a multi-GNSS receiver that is capable of receiving data from GPS as well as GLONASS or BeiDou, operates around-the-clock to measure positions with high accuracy anywhere in the world and in all weather conditions by using the GPS satellite and the GLONASS satellite, or the BeiDou satellite, and produces highly reliable positioning results. In addition, the GPS navigator can increase the accuracy of position fixing by receiving correction data from the DGPS beacon station and SBAS satellites.

1.2　Features

- Registration of up to 100 routes and 10000 waypoints

- Many output ports installed with the built-in buffer unit

- Enables sharing of a route with ECDIS by the mounted LAN

- High visibility 6.5-inchi large colour LCD

- Provided with many graphic display modes

- Mutual acknowledgment through a contact or ALR

- Improved operability by touch panel and abundant menus

- High reliability by the multi-GNSS receivers (GPS/GLONASS/BeiDou/QZSS/SBAS)

- Built-in RAIM function

1.3　Configuration

1.3.1　Standard Configuration

JLR-8600

No	Name	Model	Q'ty	Note
1	GPS Sensor Unit	JLR-4350	1	
1-1	Screw Adapter	MTV302007A	1	
1-2	Mounting Band	MPBP02520	1	Include 2 bands
1-3	Instruction manual	7ZPNA4695	1	English
1-4	Cable guard rubber	MPPK31462	1	
2	Processor Unit	NDC-4100	1	
2-1	Fuse	MF51NR 250V 5 MF51NR 250V 2	1	MF51NR 250V 5　:4 Fuses MF51NR 250V 2　:1 Fuses
3	Display Unit	NWZ-1650	1	
3-1	Model Identification Plate	MPNN50903	1	
3-2	Clamp Filter	5MBIR00009	1	
3-3	Flush mount kit	MPBX50891	1	
4	Display cable	CFQ-7540	1	LAN 15m for DISPLAY
5	Instruction manual	7ZPNA4699	1	7ZPNA4698(Japanese)/7ZPNA4699(English)

NWZ-1650

No	Name	Model	Q'ty	Note
1	Display Unit	NWZ-1650	1	Refer to JLR-8600(3〜3-3)
2	Instruction manual	7ZPNA4699	1	7ZPNA4698(Japanese)/7ZPNA4699(English)

1.3.2 Option

No	Name	Model	Q'ty	Note
1	AC/DC Power supply unit	NBG-320	1	100/220VAC,24VDC Input 12VDC Output
2	AC/DC Power supply unit	NBD-577C	1	100/220VAC,24VDC Input 24VDC Output
3	AC/DC Power supply unit	NBD-904	1	100/220VAC,24VDC Input 24VDC Output
4	Data Power Cable	CFQ-7539	1	For Remote Display/ 8 cores 15m
5	Data power Cable	CFQ-7539-5	1	For Remote Display/ 8 cores 5m
6	Printer	DPU-414	1	
7	Printer	NKG-104	1	
8	Printer Cable	7ZCNA4109	1	Single end D-Sub/ 3m For DPU-414
9	Printer Cable	7ZCNA4112	1	Single end D-Sub9/ 10m For DPU-414
10	Printer Paper	6ZCAF00252A	1	For DPU-414
11	Printer Paper	7ZPJD0384	1	For NKG-104
12	Extension Cable	CFQ-9002	1	Dual end 6 cores connecter 15m/ For Sensor
13	Extension Cable	CFQ-9000	1	Single end 6 cores 5m
14	Junction Box	NQE-7700A	1	6 terminals
15	Pole Mounting Kit	MPBP30608	1	For NQE-7700A
16	Coaxial Cable Kit	NQD-4414	1	Outdoor NQD-4410, Indoor NQD-4411
17	Select Switch	NCZ-777	1	Manual
18	Select Switch	NCZ-1537B	1	Automatic
19	Junction Box	CQD-10	1	16 terminals
20	Screw Adapter	MTV302007A	1	For Sensor
21	Mounting Band	MPBP02520	1	For Sensor
22	Output Buffer	NQA-4351	1	
23	Select Switch	NCZ-1663	1	For NQA-4351
24	External Dimmer unit	NCM-227	1	
25	Printer	RP-D10	1	Network printer
26	Power supply	NBG-980		Power supply unit for Network printer
27	Base kits	MPBX50347	1	with Tapping screws

1.4   Construction

NWZ-1650   Display Unit
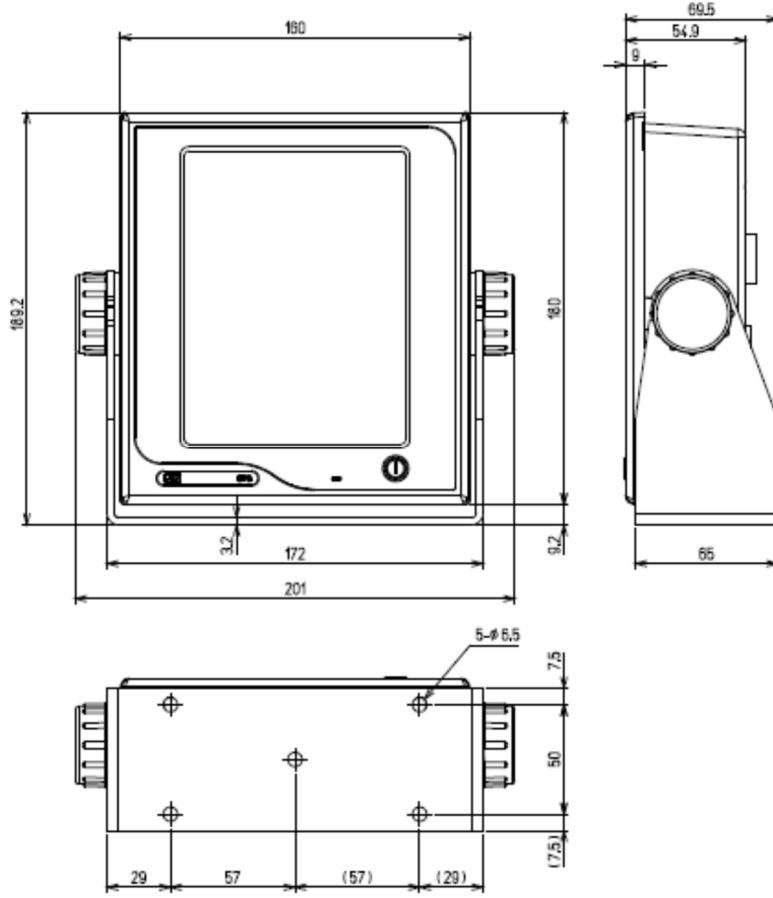
Unit: mm
Mass: Approximately 2kg
Color: Munsell N2.5
IP Grade: IP56

NDC-4100   Processor Unit
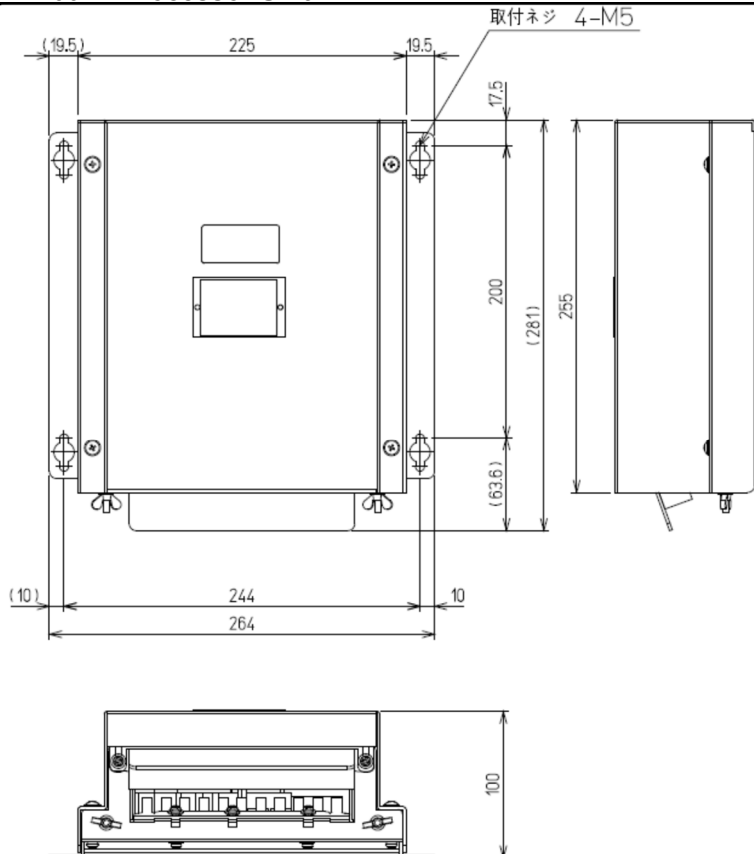
Unit: mm
Mass: Approximately 2.2kg
Color: Munsell N2.5
IP Grade: IP22

1-4

ø 134

ø 19

ø 6

129

1 INCH 14UNS-2B
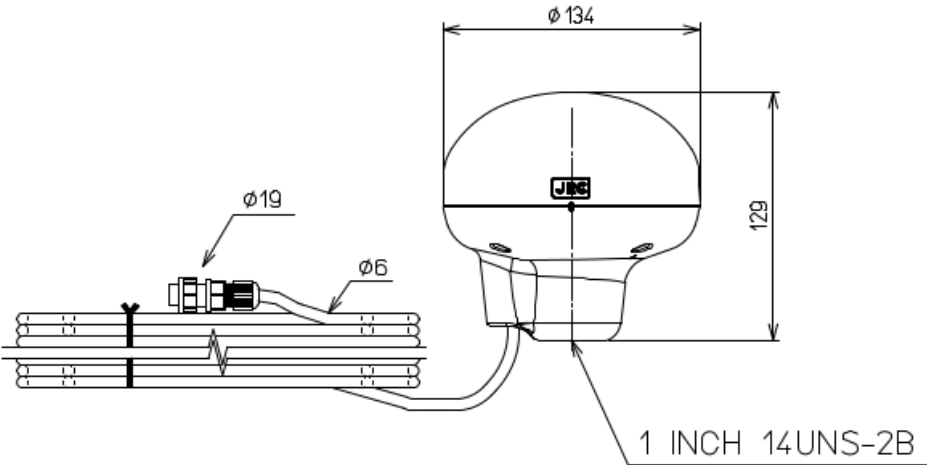
Unit: mm
Mass: Approximately 1.5kg (include 15m cable)
Color: Munsell N9
IP Grade: IP56 (IEC60945)

NBD-904   Power Supply
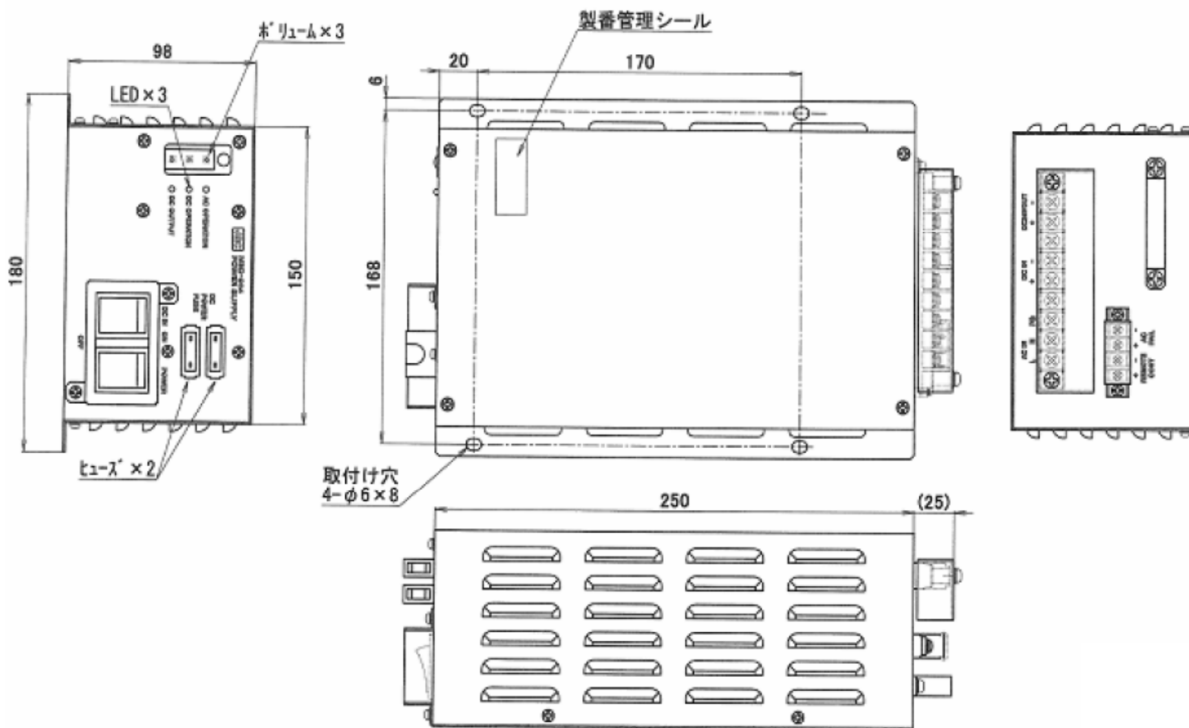
Unit： mm
Mass ：Approximately 2.6 kg

NBD-577C Power Supply
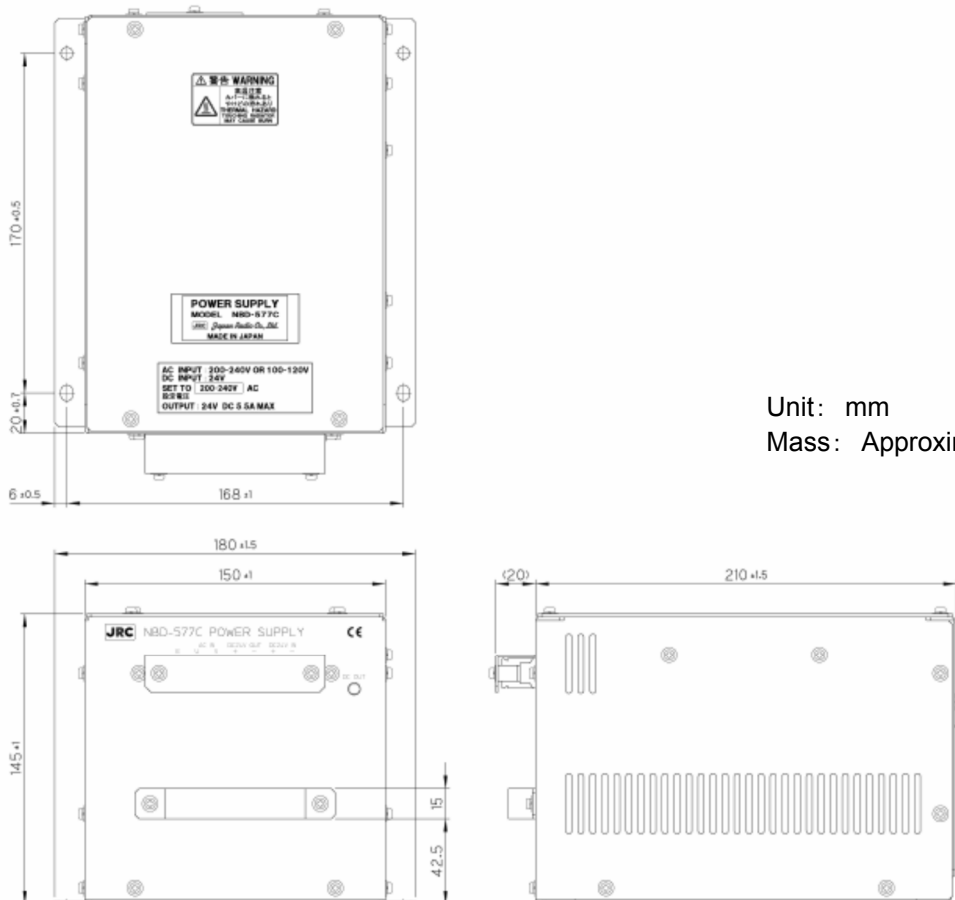
Unit： mm
Mass： Approximately 5.4 kg

NBG-320　Power Supply
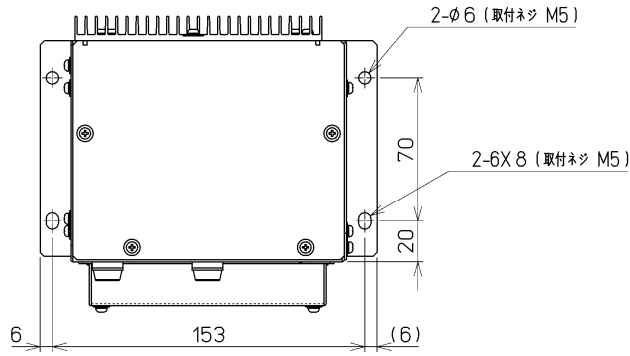
Unit： mm
Mass： Approximately 3.5 kg

NQE-7700A　Junction Box

GPS cable
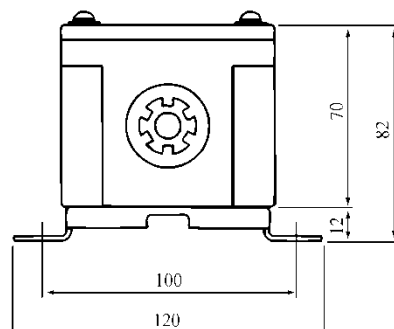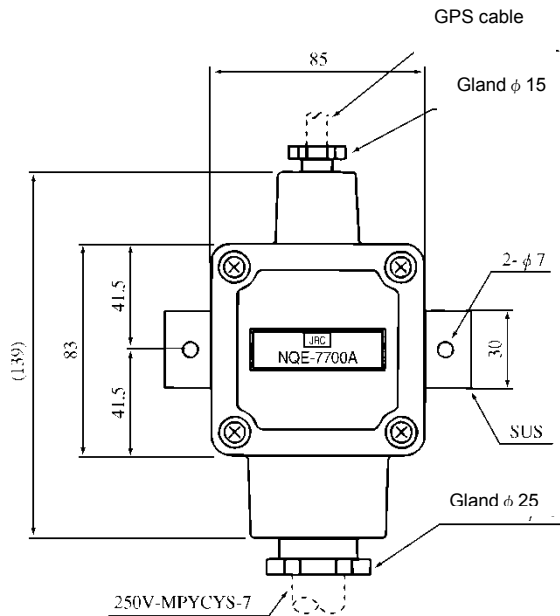
Unit： mm
Mass： Approximately 0.6 kg

NQD-4414　Coaxial Cable Kit (NQD-4410)

2-φ10　Screw M8

JUNCTION BOX
MODEL　NQD-4410
JRC Japan Radio Co.,Ltd.
MADE IN JAPAN

117

58.5

136

150

170

110

137

140.5

86

Unit： mm
Mass： Approximately 1.5 kg

NQD-4414　Coaxial Cable Kit (NQD-4411)

4-φ　(Screw M3)

(10)

JUNCTION BOX
MODEL　NQD-4411
JRC Japan Radio Co.,Ltd.
MADE IN JAPAN

158

154

134

10

120

20　　80　　(20)

35

Unit： mm
Mass： Approximately 0.7 kg
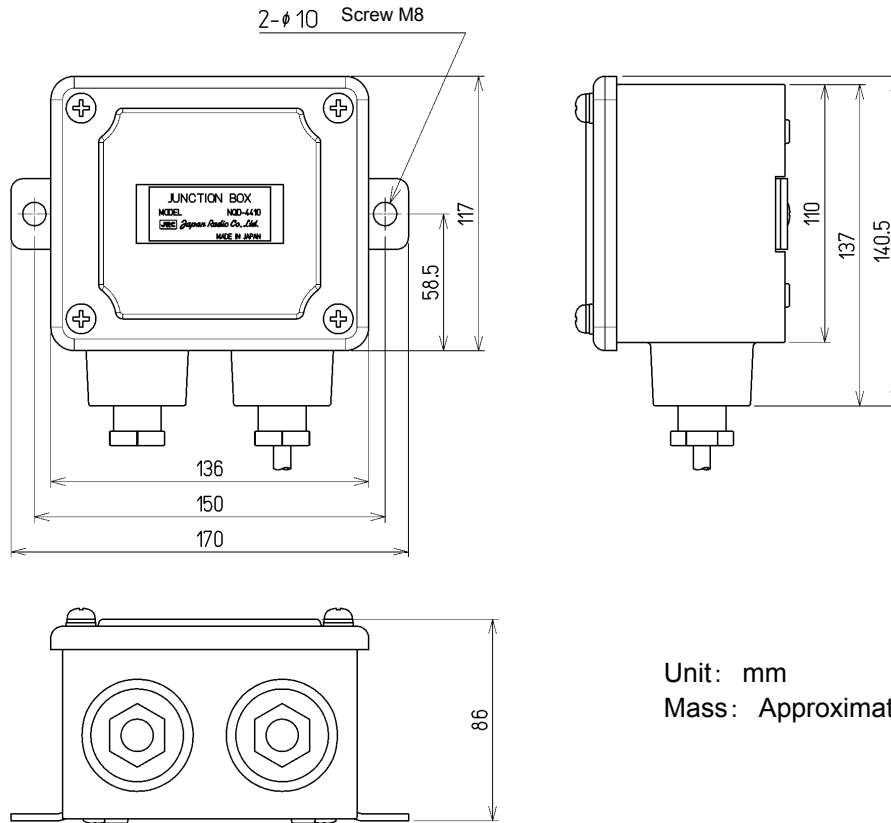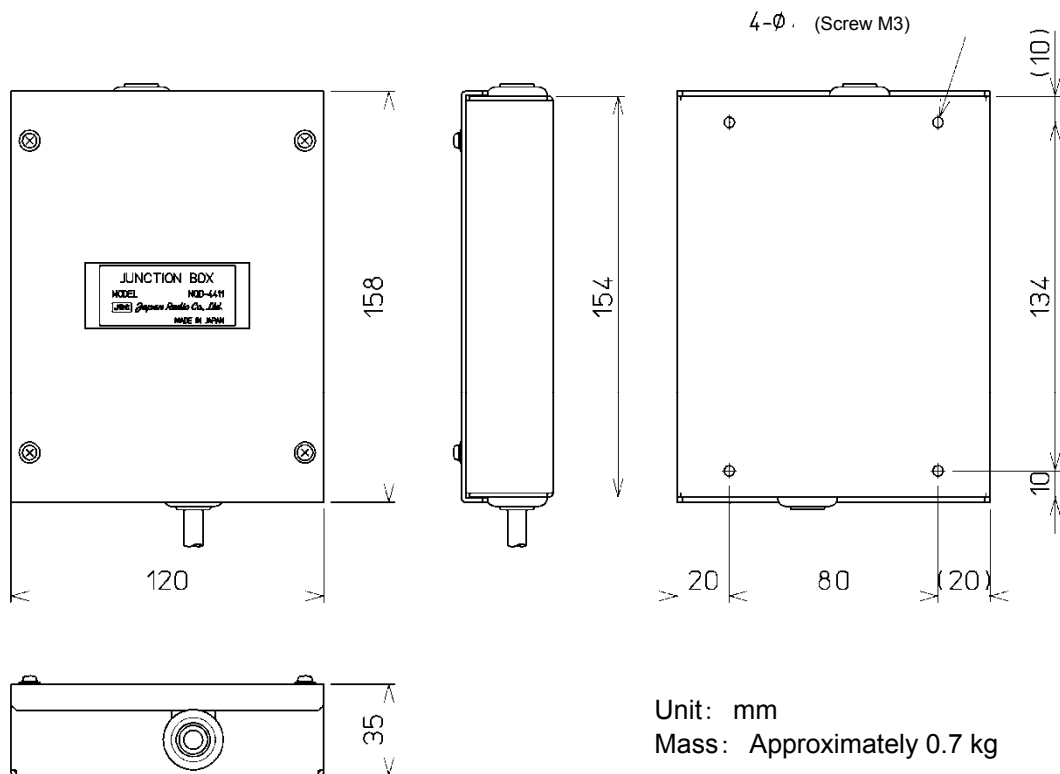
NQA-4351A   Output Buffer

DC Input
(IEC61162-1 or NMEA)

Data Output
(IEC61162-1 or NMEA)
Select signal

15   76   15

45

取付穴(2-φ7)
(取付ねじ M6)

(8)

TB1   TB2

銘板

174   190

TB3   TB4

53

(8)

106
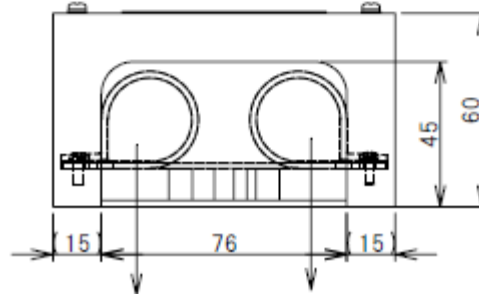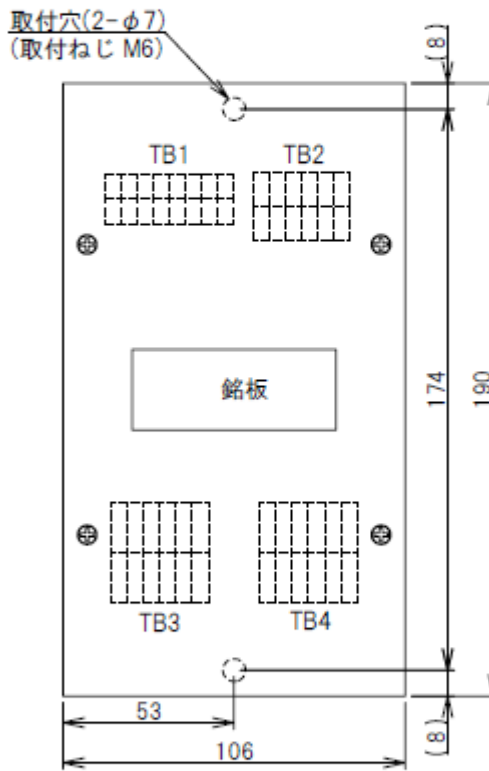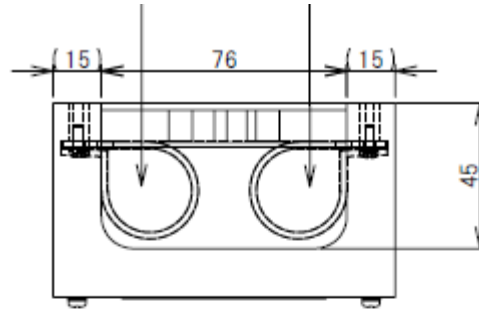
JUMPER SETTING for DC Input	
DC Input	JUMPER Terminal
DC 12V	TB1-IN 1 2 JUMPER ON 9-16V JUMPER Cable 0.25~2.5mm^3
DC 24V	TB1-IN 1 2 JUMPER ON 9-16V Not connect

60

45

15   76   15

Data Output
(IEC61162-1 or NMEA)

Data Output
(IEC61162-1 or NMEA)

Unit： mm
Mass： 0.8 kg

NCZ-777　Select Switch

4-φ7.5（取付ネジ M6）

(9)

JRC NCZ-777 SELECT SWITCH

(20)

70

92

70

110

20

10

130

(10)

9

150

66

86
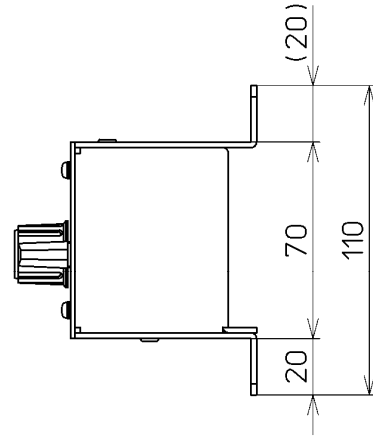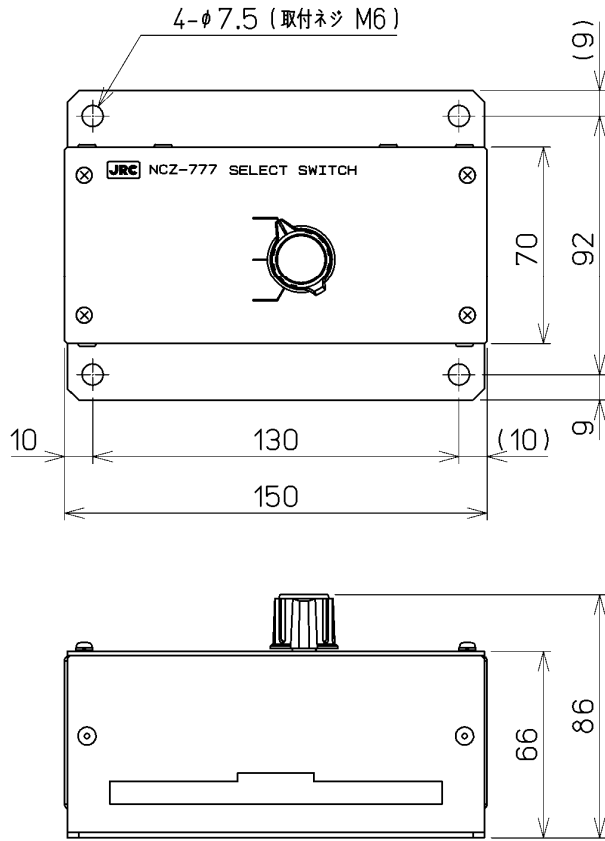
Unit： mm
Mass： Approximately 0.5 kg

NCZ-777　Select Switch (Flush Mounting)

4-φ7.5（取付ネジ M6）

(7)

JRC NCZ-777 SELECT SWITCH

(20)

136

150

70

110

20

34

102

(34)

7

170

66.5

86.5
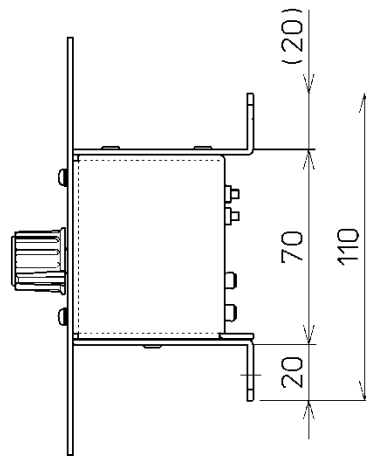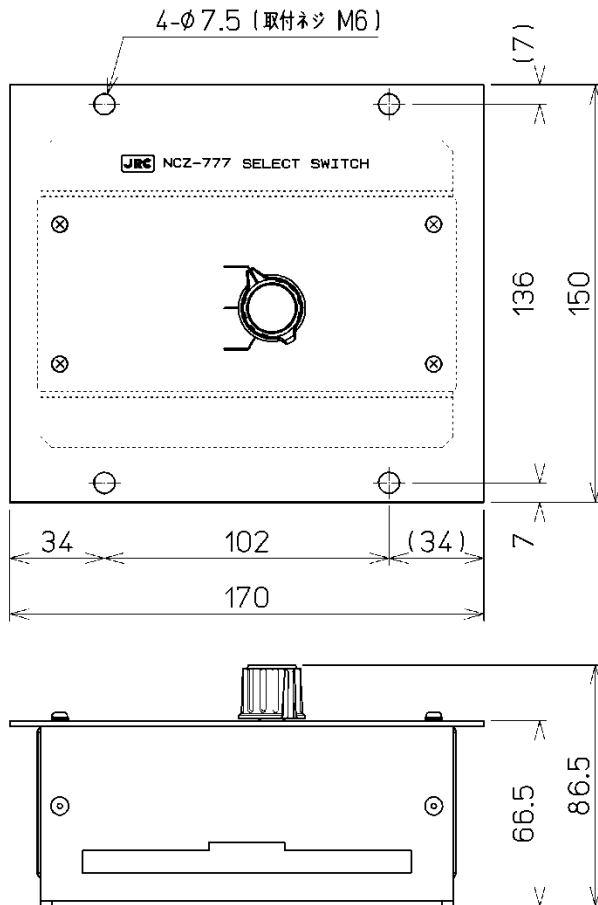
Unit： mm
Mass： Approximately 0.7 kg

NCZ-1663　Select Switch

取付穴(4-φ7.5)
(取付ねじ M6)

銘板

NCZ-1663 SELECT SWITCH

(CH3) (CH2) (CH1)

配線穴

Unit：　mm
Mass：　0.2 kg

NCZ-1663　Select Switch (Flush Mounting)

パネルカット図
4-φ7.5またはM6

取付穴(4-φ7.5)

NCZ-1663 SELECT SWITCH

(CH3) (CH2) (CH1)
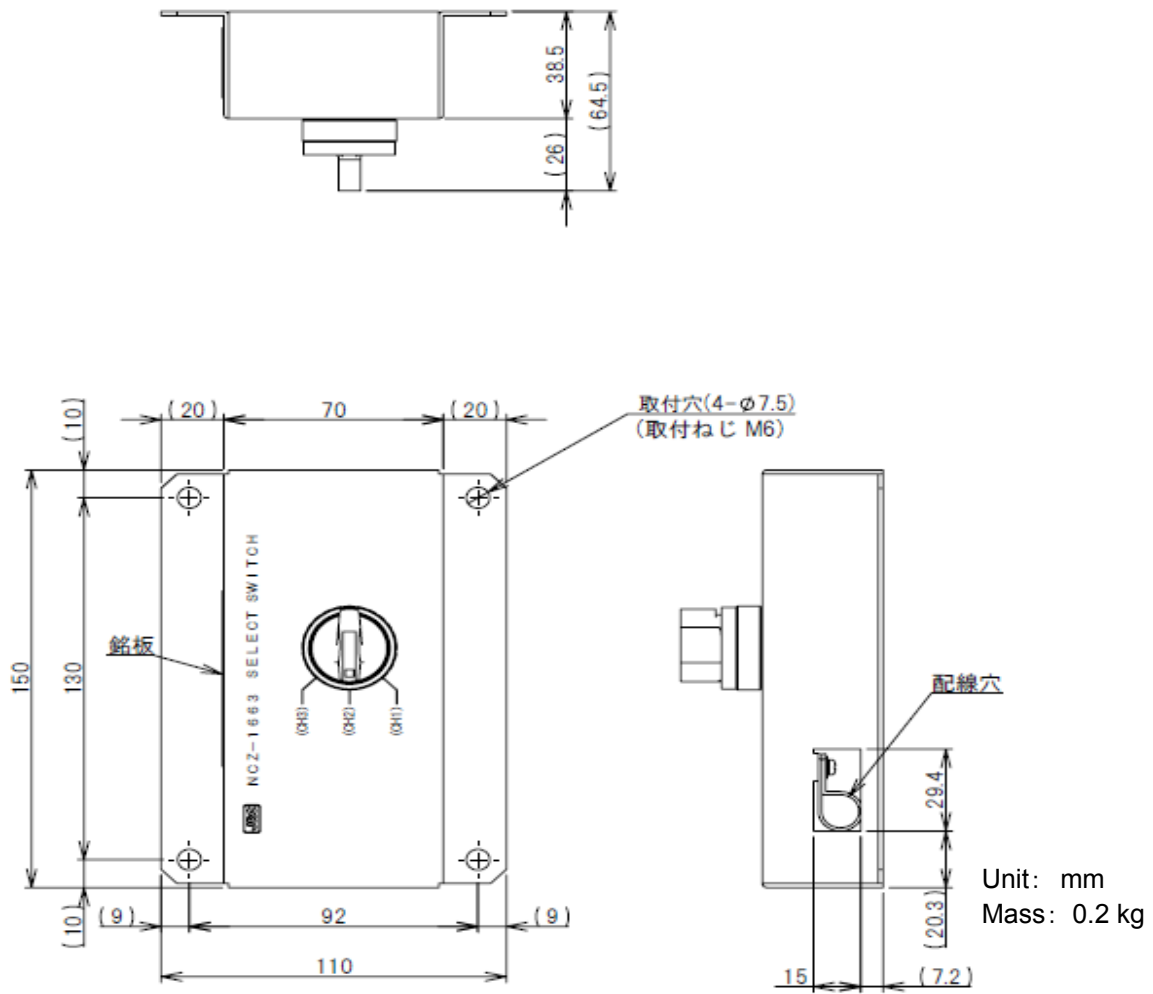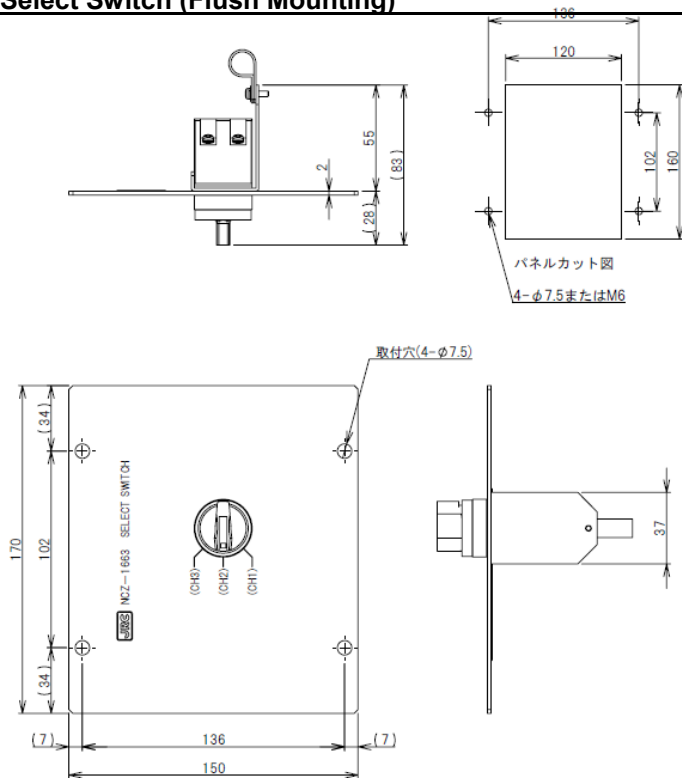
NCZ-1537A/B   Select Switch (Flush Mounting)

取付穴(4-φ7.5)
（取付ねじ M6）

JRC NCZ-1537B SELECT SWITCH

DIM   AUTO
       GPS1
       GPS2

(7)
136
150
(7)
(34) 102 (34)
170

銘板
(25)
100
(25)
2
20.5   64.5

配線用穴

(10) 150 (10)

4-M6

角穴

110
136

102
160

パネルカット図

Unit： mm
Mass： 0.55 kg

1-12
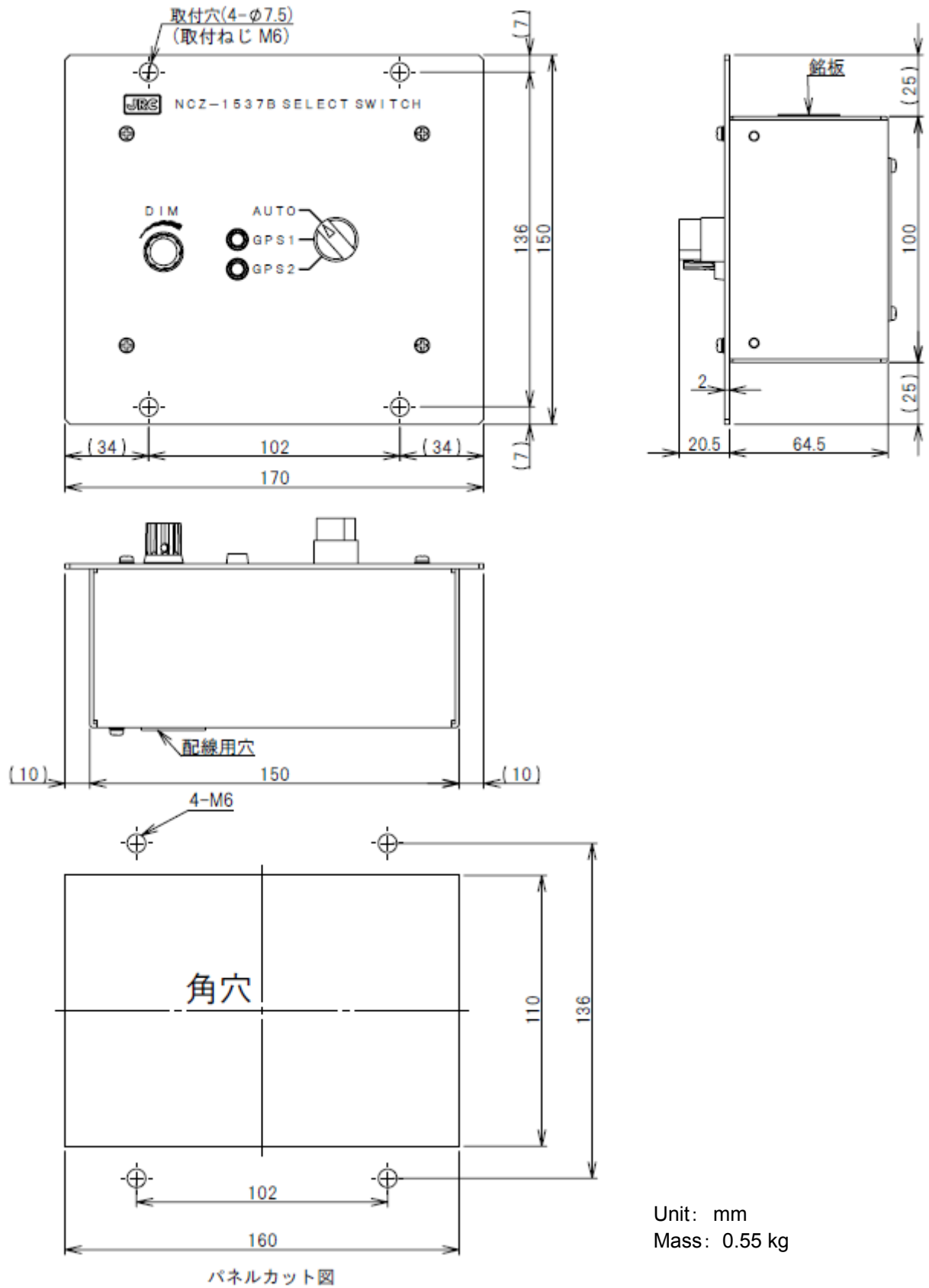
CQD-10　Junction Box
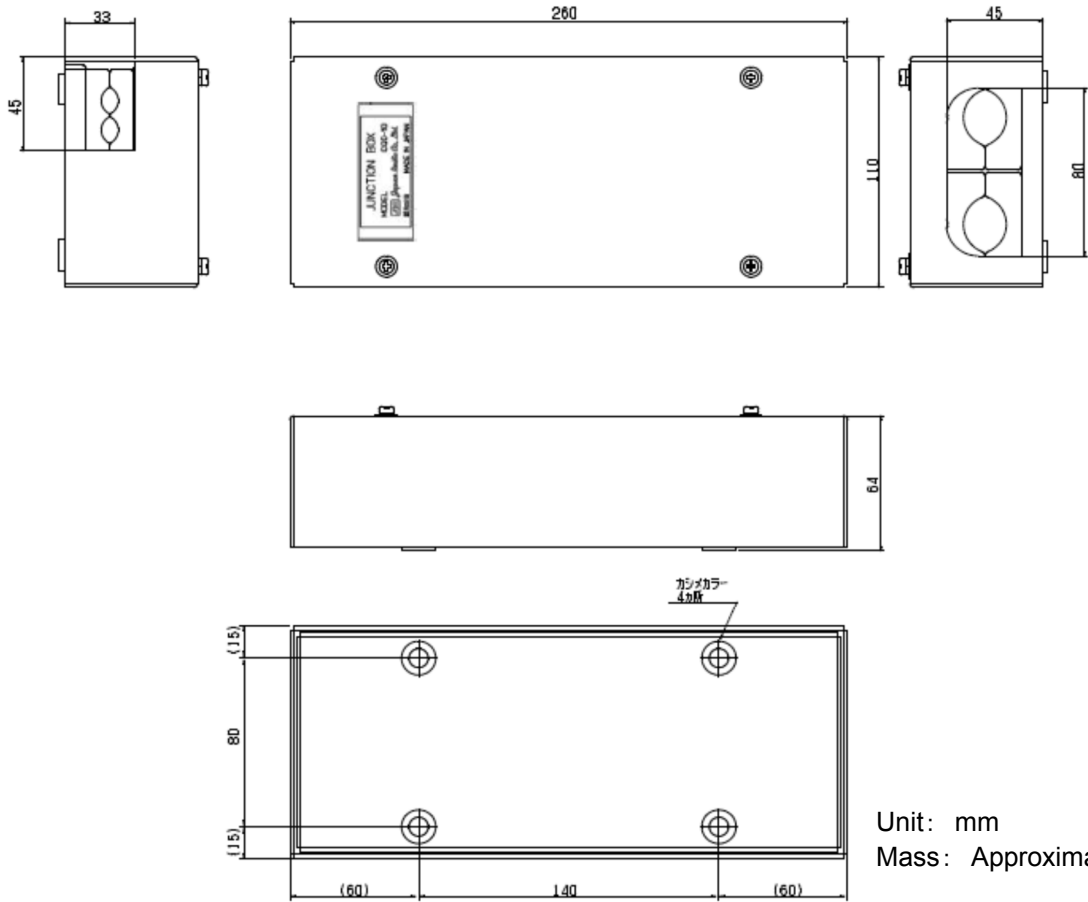
Unit： mm
Mass： Approximately 1.1 kg

NKG-104　Printer
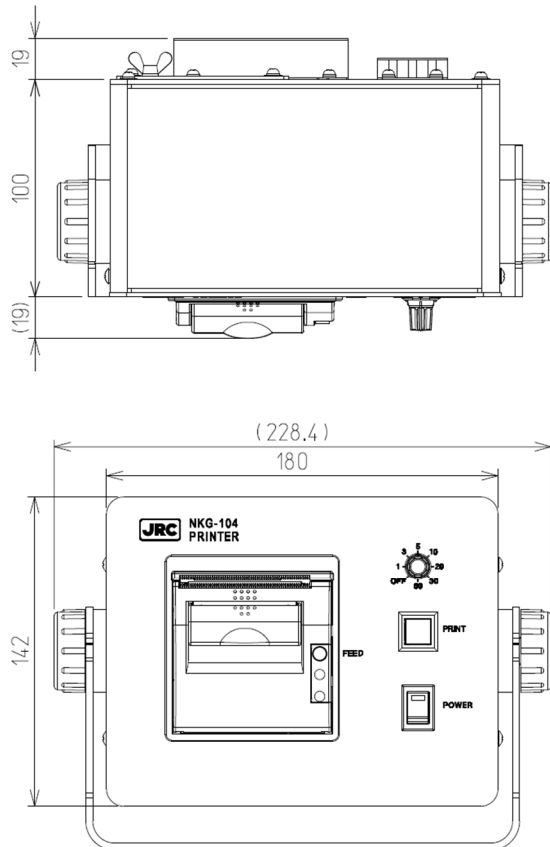
Unit： mm
Mass： Approximately 2.1 kg

1.5   System Diagram

JLR-4350
GPS Sensor

NQE-7700A Junction Box

250V-MPYCYS-7

NWZ-1650
Display Unit

LAN
CFQ-7540

Sensor

Display Unit

NDC-4100
Processor Unit

LAN

Ethernet × 2

ECDIS
Remote Maintenance
MFD

RS-422

250V-TTYCS-1
IN × 2 OUT × 5

External equipment

Contact

250V-TTYCS-1
IN × 1 OUT × 4

Alarm System

RS-422
(Internal Buffer)

250V-TTYCS-1
OUT × 8

Radar
ECDIS/Plotter
Tide Current Calculator
Printer NKG-104

RS-232C

7CNA4109 or
7ZCNA4112

DPU-414
Printer

7ZCJD0257B

Power Supply

0.6/1kV-DPYC-1.5

DC12V

DC24V

NBD-904
PowerSupply

NBD-577C
PowerSupply

NBG-320
PowerSupply

DC24V

DC12/24V

AC110/22012/24V

Chapter 2 Name and Function of Each Unit

2.1 NWZ-1650 DISPLAY UNIT

Status area
Displays the status of the equipment or system with the icon.

DISPLAY
Displays the information of own ship and equipment setting screen.
Operated by the touch panel.

Power supply key

Buzzer
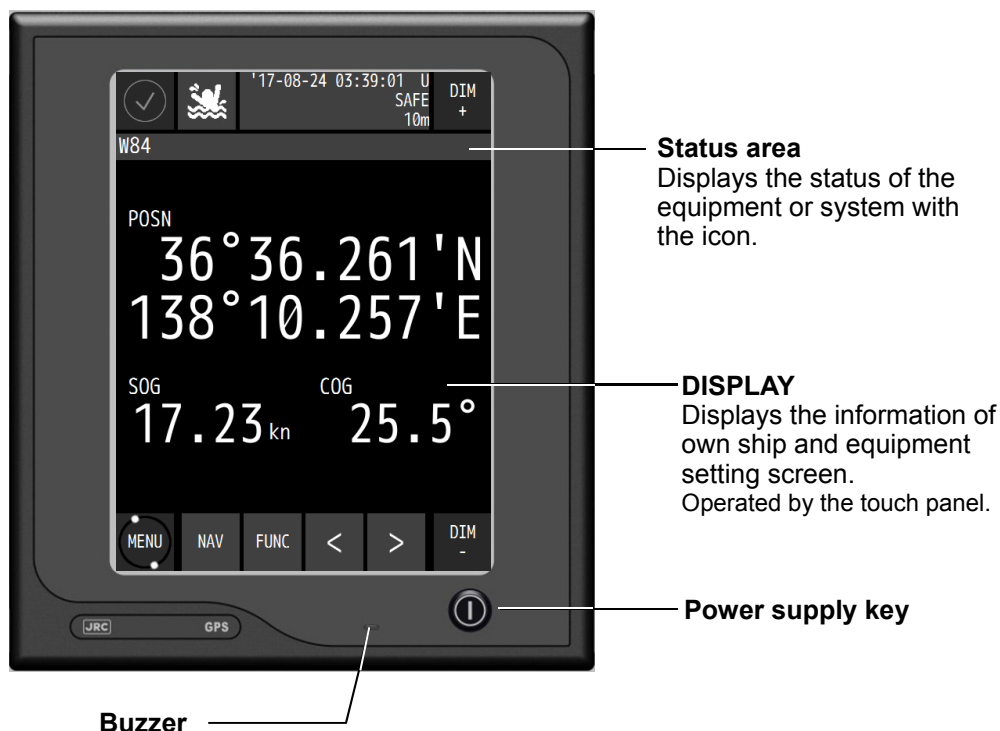
Touch panel

Key	Name	Function
	Alert	Displays the icon when an alert is issued. The icon changes according to the alert state.
	MOB	Displays a plotting screen and stores the Man OverBoard position.
DIM +	DIM UP	Increases the brightness.
DIM -	DIM DOWN	Reduces the brightness.
MENU	Menu	Displays a menu. Displays a freeze indicator.
NAV	Screen	Switches a main screen. Select from a main screen list.
FUNC	Function	Displays the operation menu on the main screen.
<	Screen switch	Switches to a sub screen.
>	Screen switch	Switches to a sub screen.

How to read the information on the display

Geodetic positioning system

Date and time display (note1
- U: UTC
- L: Local

In the 12-hour display, AM/PM is displayed.

Status
See the status list for the contents of the status.

```
'17-08-24 03:39:01  U          DIM
                        SAFE    +
                        10m
W84

POSN
36°36.261'N
138°10.257'E

SOG              COG
17.23 kn         25.5°

MENU   NAV   FUNC   <   >   DIM
                                -
```

RAIM
Displays the currently set accuracy level.
- RAIM operating: 10m, 30m, 50m,100m
- RAIM OFF : OFF

No faulty satellite: SAFE
RAIM disabled: CAUTION
Faulty satellite: UNSAFE

note1
Although the displayed time may be out of sync with other display devices, it is because the data output timing is different and it is not a malfunction.

Status list

1	2	3	4	5	6	7	8	9	10	11	12	13
M1	W	⊘	WPT AUTO	🖥1	✗	MOB	S	GPS	HDOP	AUTO No.1	GPS GLO QZSS	GNSS 3DFix

No	Icon	Description
1	M1 / R1	Display unit number M: Main display unit R: Remote display unit
2	W	Received beacon information. Displayed when beacon information is received.
3	⊘	Magnetic correction Displayed when magnetic correction is set.
4	WPT AUTO / WPT MAN	Waypoint update state Displays the waypoint update mode during route execution. AUTO: Automatic MAN: Manual
5	🖥1 / 🖥S	Route sharing Displayed when an Active route is shared. 1: Share 1, 2: Share 2, 3: Share 3, 4: Share 4, 5: Share 5
6	✗	Installation mode Displayed in the installation setting mode.
7	MOB	MOB Displays when MOB is active.

No	Icon	Description
8	S	Demo mode Displayed in demo mode.
9	GPS	DGPS switched. Indicates that the mode has just changed from GPS to DGPS. This icon is cleared automatically five minutes after the switch.
10	HDOP	HDOP alert Displayed when the value exceeded the setting value.
11	AUTO No.1 / MAN No.1	Sensor number using display AUTO: A sensor is selected automatically. MAN: A sensor is selected manually.
12	GPS GLO QZSS / GPS BDS QZSS	Positioning system Indicates the currently set positioning system. The positioning system that is set but cannot be used is displayed in yellow. GPS: GPS GLO: GLONASS QZSS: QZSS BDS: BeiDou
13	GNSS 3DFix / NoFix	Position fixing status GNSS: GNSS position fixing GPS: GPS position fixing DGPS: Beacon DGPS position fixing SBAS: SBAS position fixing 2D: 2 dimensional position fixing 3D: 3 dimensional position fixing No Fix: Non position fixing

2.2   JLR-4350 GPS Sensor

Radome

6 pins Connector
Approx. φ19mm

Base

Data Cable 15m
Approx. φ6mm

Mounting Screw
1 inch 14 UNS-2B

2.3   NDC-4100 Processor

Mounting Screw hole

Cover

Cable Inlet

Earth terminal
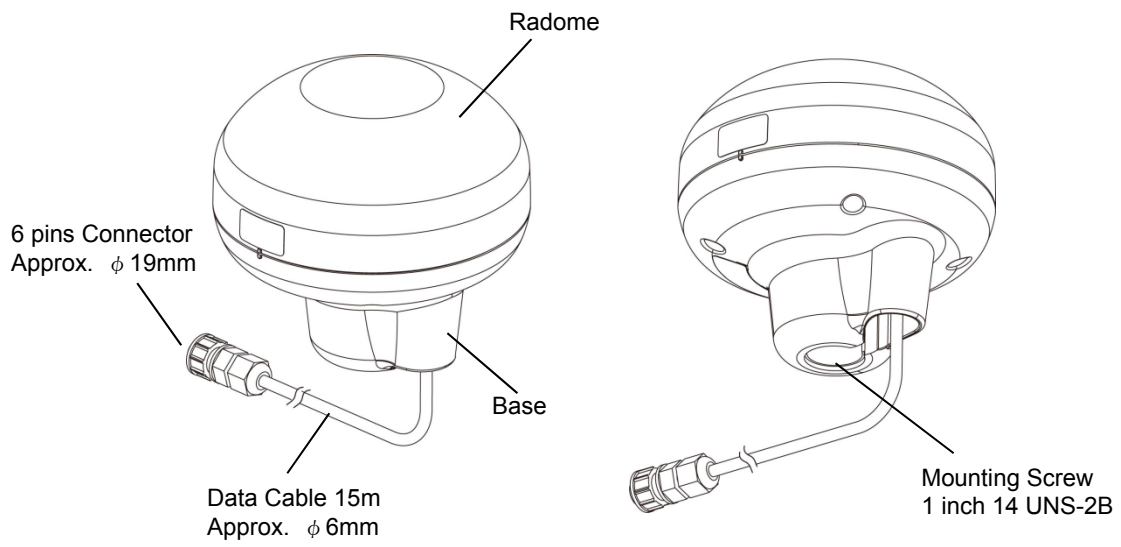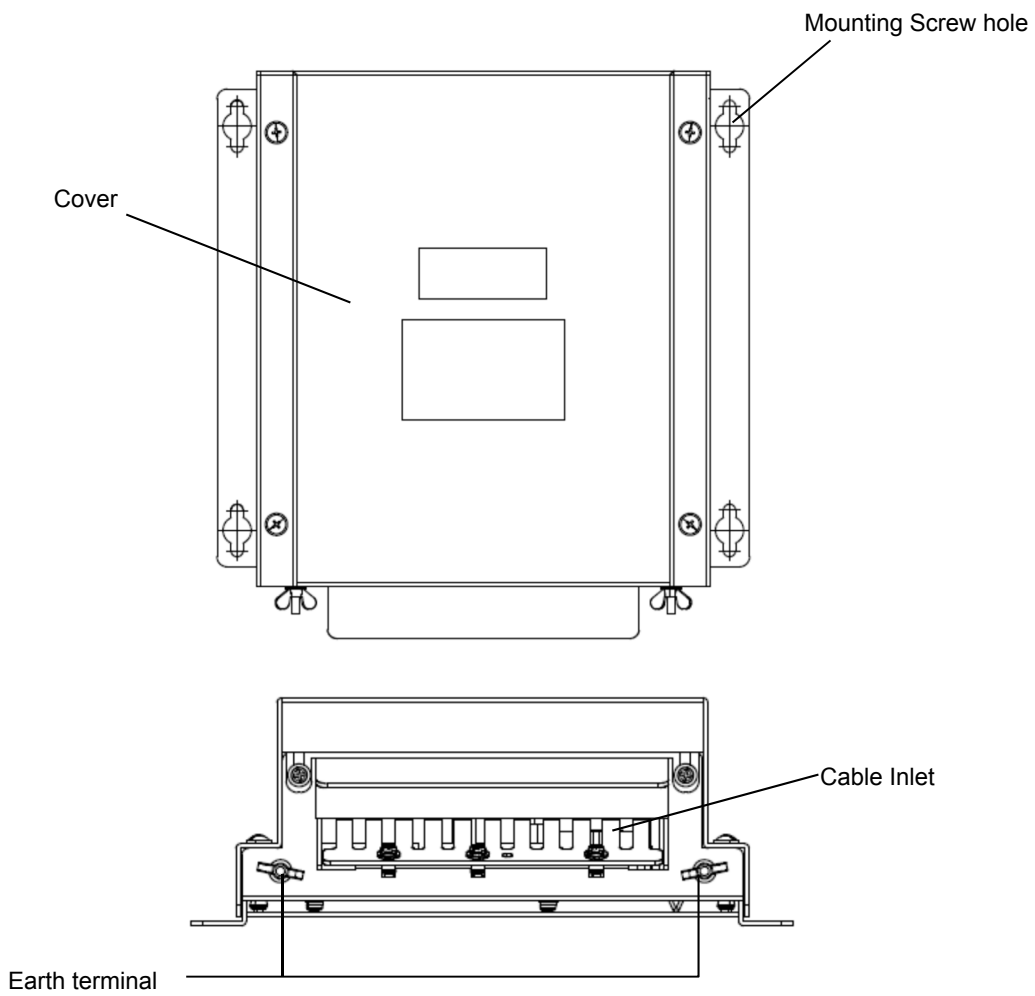
Chapter 3 Display Screens

3.1 Display Screens

3.1.1 Switching display

When the screen key [NAV] is tapped, a display screen list is displayed. Select a screen to be displayed from the list. The screen name is displayed on the screen key.

On the navigation information screen, the analogue screen, and the navigation support screen, a sub screen can be displayed by using [<] or [>].

Display screen list
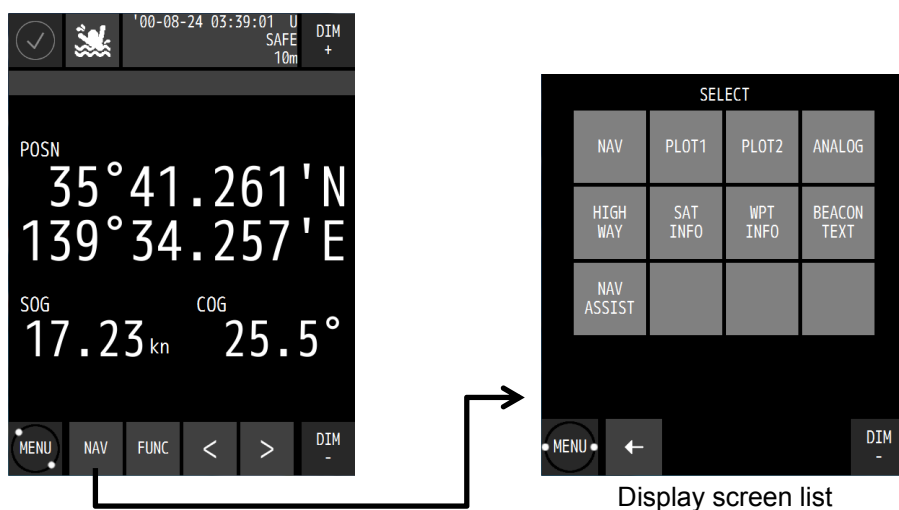
3.1.2 Navigation information screen

The navigation information screen displays the position, speed, and course of own ship. When a waypoint is available, the waypoint number and estimated time of arrival are also displayed.

A sub screen can be displayed by using [<] or [>]. The sub screen varies depending on the presence or absence of the waypoint.

Own ship's position
(latitude and longitude)
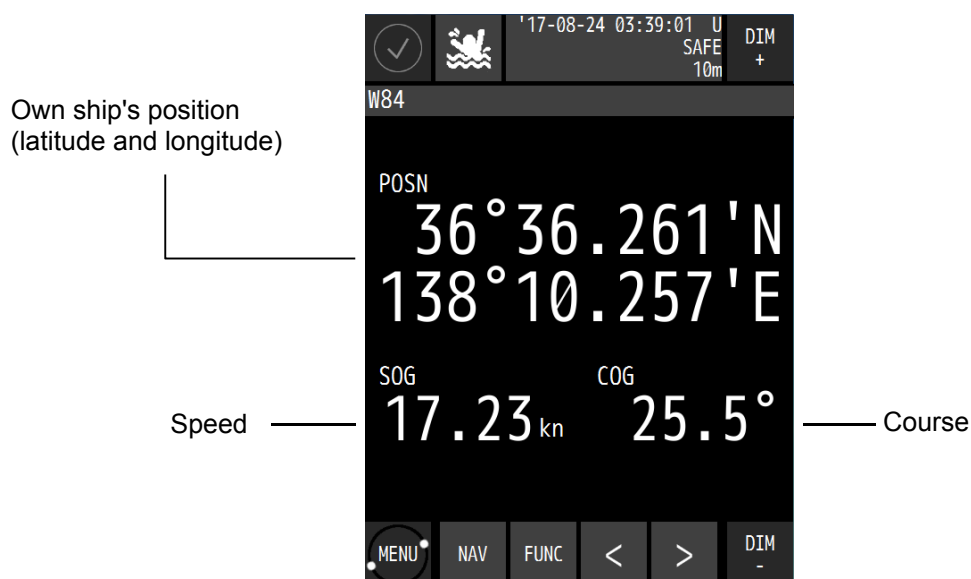
Speed

Course

Sub screen
a) If there are no waypoints

Sub Screen 1 (4 digit position screen)

Own ship's position
(latitude and longitude)
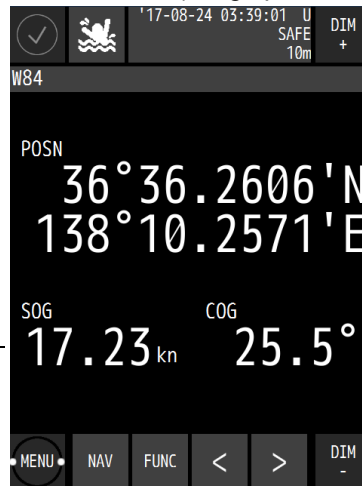
Speed

Course

Sub Screen 2 (SOG and COG screen)

Own ship's position
(latitude and longitude)
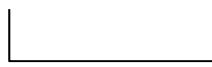
Speed

Course
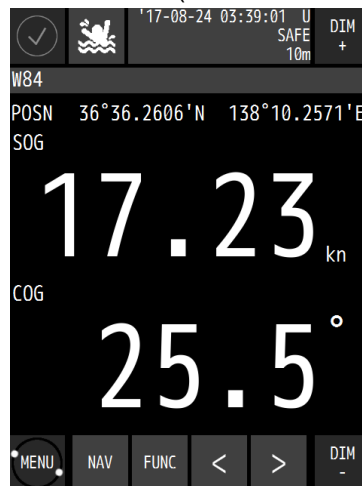
b) If there are waypoints

Sub Screen 1 (4 digit position screen)

Number of the waypoint for which the ship is heading

Route number

Own ship's position (latitude and longitude)

Speed

Course

Distance from the own ship's position to the waypoint

Bearing from the own ship's position to the waypoint

Estimated arrival time at the waypoint

Estimated arrival time at the final waypoint

APR 25, '18 09:58:42 U
100m
W84
WPT AUTO
AUTO No.2 GPS GPS 3DFix
WPT 00019   ROUTE 008
POSN
35°00.1157'N
137°00.2680'E
SOG 10.6 kn   COG 73.2°
DTG 9.4 NM   BRG 62.0°
ETA APR 25, '18 10:53 (U)
FINAL ETA APR 25, '18 21:29 (U)
MENU NAV FUNC < > DIM

Sub Screen 2 (Detail screen)

Number of the waypoint for which the ship is heading

Own ship's position (latitude and longitude)

Speed

Course

Distance from the own ship's position to the waypoint

Bearing from the present position to the waypoint

Speed of the destination component (See Memo.)

Speed of the COG component (See Memo.)

Deviation from the route and the steering direction
L: Steered to the left
R: Steered to the right

Average bearing (See Memo.)

Estimated arrival time at the waypoint

APR 25, '18 09:59:20 U
100m
W84
WPT AUTO
AUTO No.2 GPS GPS 3DFix
WPT 00019
POSN 35°00.1473'N 137°00.3816'E
SOG 8.5 kn   COG 69.5°
DTG 9.3 NM   BRG 61.9°
VTD 8.4 kn   VEAR 8.4 kn
XTD 0.02L NM   CMG 71.7°
ETA APR 25, '18 11:05 (U)
MENU NAV FUNC < > DIM

Sub Screen 3 (SOG and COG screen)

Number of the waypoint for which the ship is heading

Own ship's position (latitude and longitude)

Speed

Course

Estimated arrival time at the waypoint

APR 25, '18 09:59:47 U
100m
W84
WPT AUTO
AUTO No.2 GPS GPS 3DFix
WPT 00019
POSN 35°00.1692'N 137°00.4543'E
SOG
8.2 kn
COG
69.2°
ETA APR 25, '18 11:07 (U)
MENU NAV FUNC < > DIM

VTD (Speed of the destination component)
VTD (An acronym of "Velocity Toward Destination)
This in an index that shows how fast the boat is approaching toward the destination in the unit of knot when it is navigation at a given bearing angle and speed.

VEAR(Speed of the COG component)
VEAR(An acronym of "Velocity Along Route")
This in an index that shows how fast the vessel is approaching along the planned route in the unit of knot when it is navigating at a given course and speed.

CMG(Average bearing)
CMG(An acronym of "Course Made Good")
The bearing angle to the current position when viewed from the starting point.

$$VTD = V \cos a°$$
$$VEAR = V \cos b°$$
$$CMG = c°$$
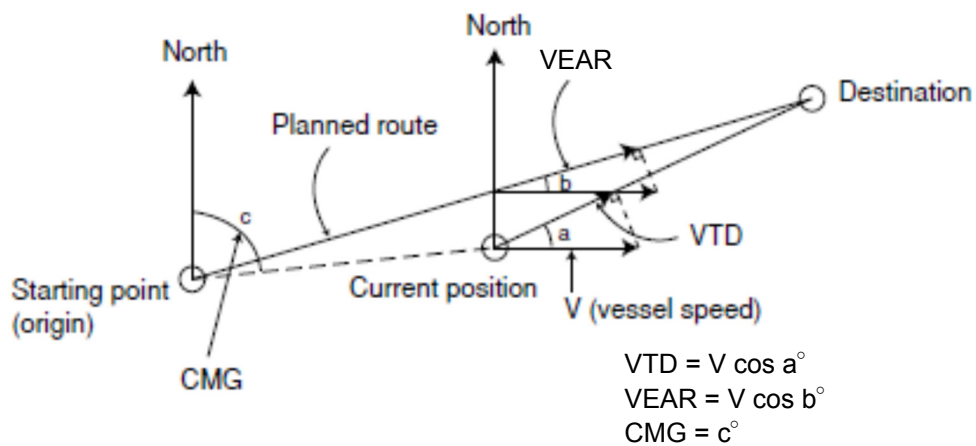
Plotting screen 1 displays the course, speed, bearing, and distance at the bottom of the screen.

The screen can be enhanced and reduced by using [ZOOM IN] and [ZOOM OUT].

Event symbol

Date and Time
Own ship's position
(latitude and longitude)

Northerly directions

APR 25,'18 10:47:03 U
35°04.0799'N -------
137°09.1271'E 100m

DIM +

W84

WPT AUTO

AUTO No.2 GPS GPS 3DFix

N UP

Waypoint symbol

Width of the starboard-side route

Route

Own ship symbol

Arrival circle

Mark symbol

Width of the port-side route

0.40NM

Scale bar

Speed

SOG 9.1kn

COG 77.4°

Course

DTG 1.1NM

BRG 66.5°

Distance from the own ship's position to the waypoint

MENU PLOT1 FUNC ZOOM IN ZOOM OUT DIM -

Bearing from the own ship's position to the waypoint

3.1.4 Plotting screen 2

Plotting screen 2 displays a plotting screen in full screen mode.
The display contents and the operation are the same as for the plotting screen 1.

'17-08-24 03:39:01 U
36°36.2606'N SAFE
138°10.2571'E 10m

DIM +

W84

Northerly directions

N UP

Own ship symbol

MENU PLOT2 FUNC ZOOM IN ZOOM OUT DIM -
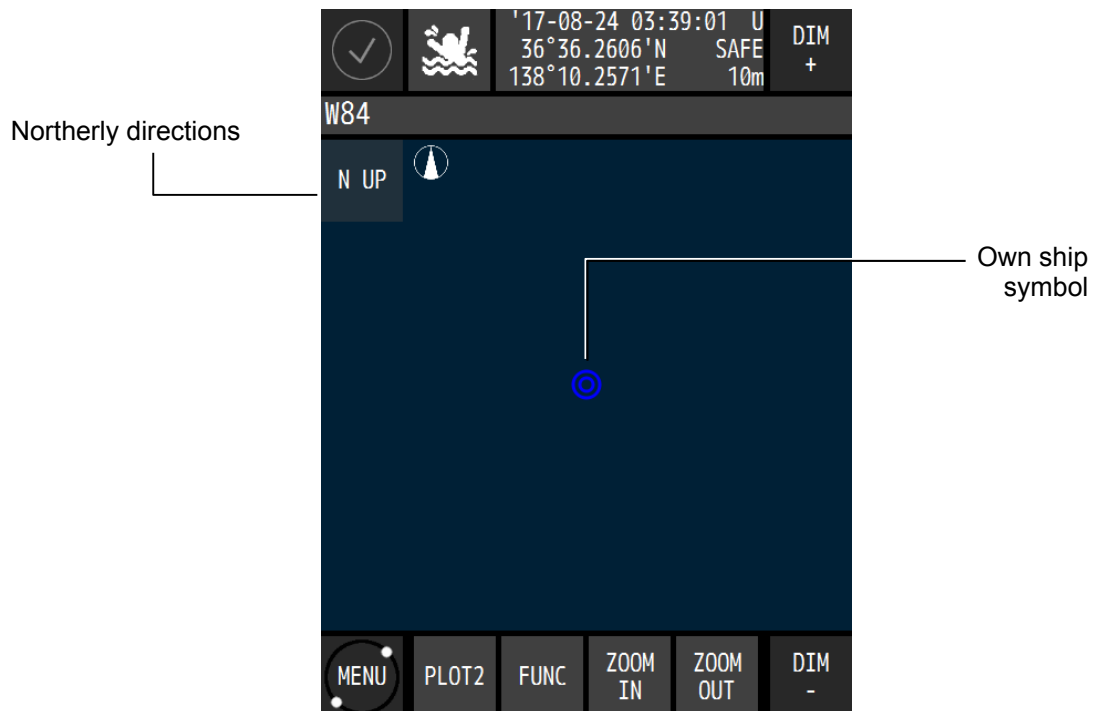
3.1.5   Analogue screen

The analogue screen displays the course, waypoint bearing, and CDI in graphic format. During route execution, the screen displays the off-course and distance to the waypoint.

The ship speed meter can be displayed by using [<] or [>].

Main screen

Course indicator bar

Course

Deviation from the route

Distance from the
own ship's position
to the waypoint

▼Bearing from the
own ship's position
to the waypoint

Route deviation indicator bar

Center of the route

Sub screen (Speed)
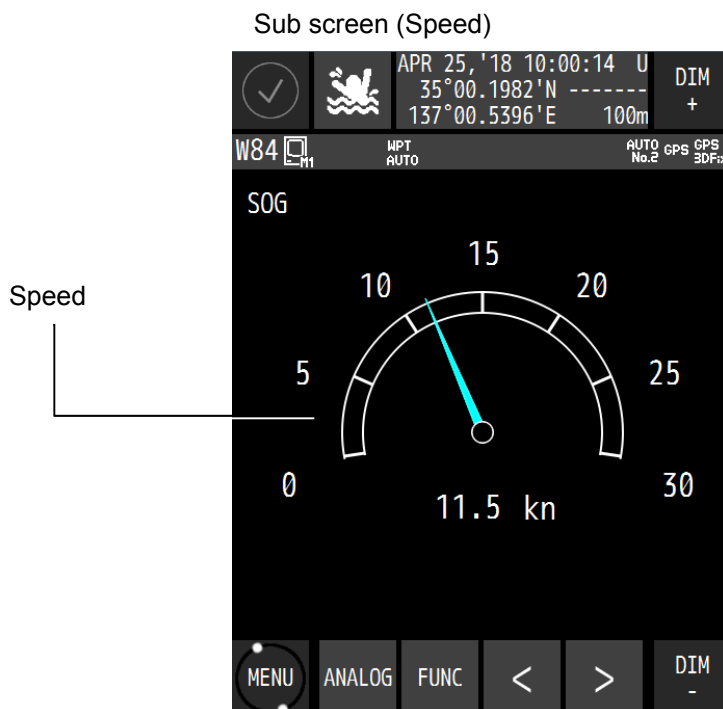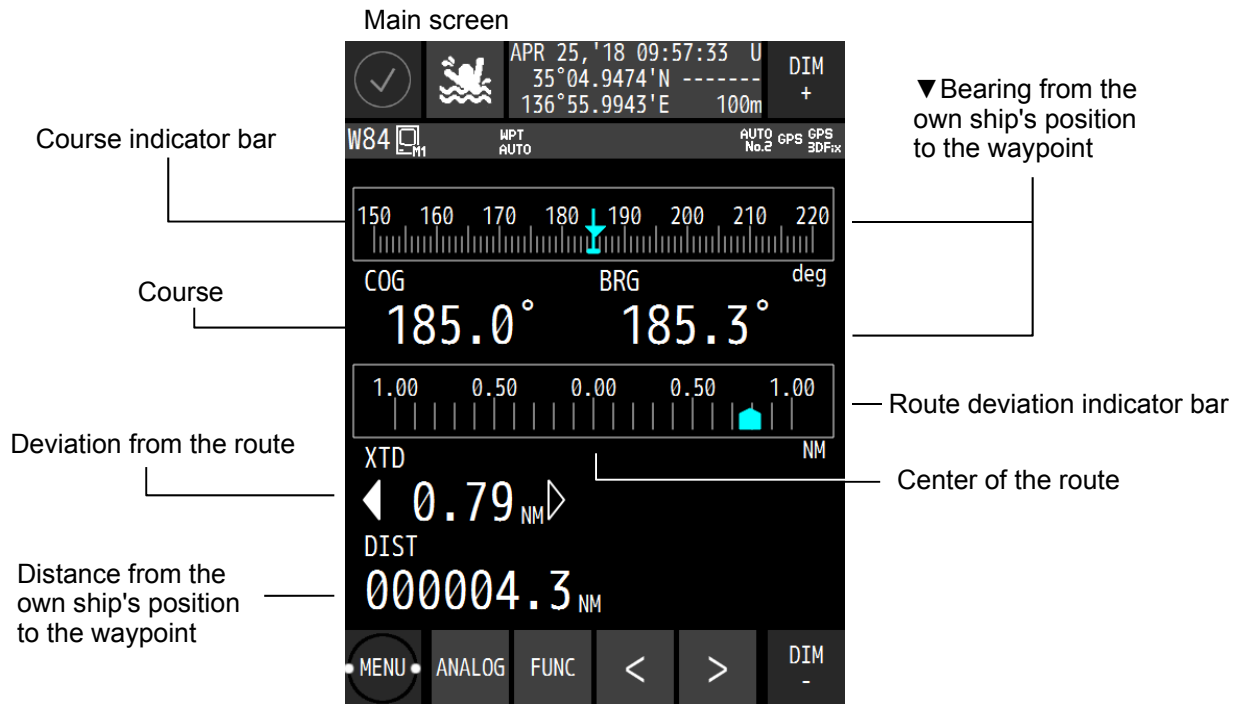
Speed

3.1.6   Highway screen

The highway screen displays the CDI, course, speed, bearing, and distance.

The screen can be enhanced or reduced by using [ZOOM IN] and [ZOOM OUT] respectively.

Deviation from the route and the steering direction

Next waypoint

Route

Speed   Own ship

Distance from the own ship's position to the waypoint

Waypoint direction

Waypoint

LEG

Scale bar

Course

Bearing from the own ship's position to the waypoint

NOV 25,'18 13:29:39 U
35°09.9305'N   SAFE
136°53.2540'E   100m
W84   WPT AUTO   AUTO No.2 GPS GPS 3DFix
XTD ◁ 0.20NM ▷
4.00NM
SOG 10.0kn   COG 180.0°
DTG 10.6NM   BRG 174.0°
MENU   HIGH WAY   FUNC   ZOOM IN   ZOOM OUT   DIM -

3.1.7   Satellite information screen

The satellite information screen displays the GNSS satellite and the beacon reception state.
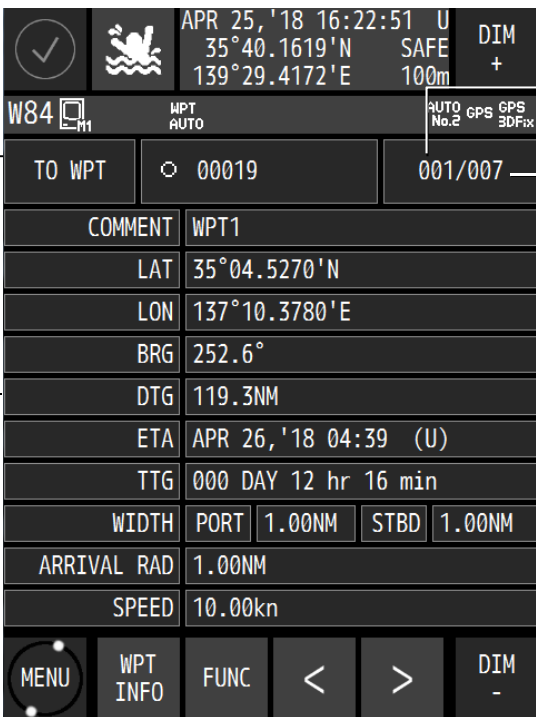
The GNSS system can be switched by using [<] or [>].

GNSS satellite number
Unframed: Search
□   : Completion of demodulation
■   : Use of position fixing

GNSS satellite location and the receiving status
Unframed: Search
○: Completion of demodulation
●: Use of position fixing

Beacon frequency

Beacon SNR
Beacon error rate

GNSS HDOP

Antenna height

'17-08-24 03:39:01 U
36°36.2606'N   SAFE
138°10.2571'E   10m
W84
GPS
BEACON   319.0kHz
31dB   200bps 30
WER   0.0%
HDOP   1.0
ANTENNA   +21m   0 30 40 50 60
MENU   SAT INFO   FUNC   DIM -

GNSS signal intensity bar 45 to 55 under normal conditions

Beacon signal intensity
Beacon bit rate

3.1.8   Waypoint information screen

The waypoint information screen displays waypoint information on the route.

The information can be switched to the next waypoint information by using [<] or [>].
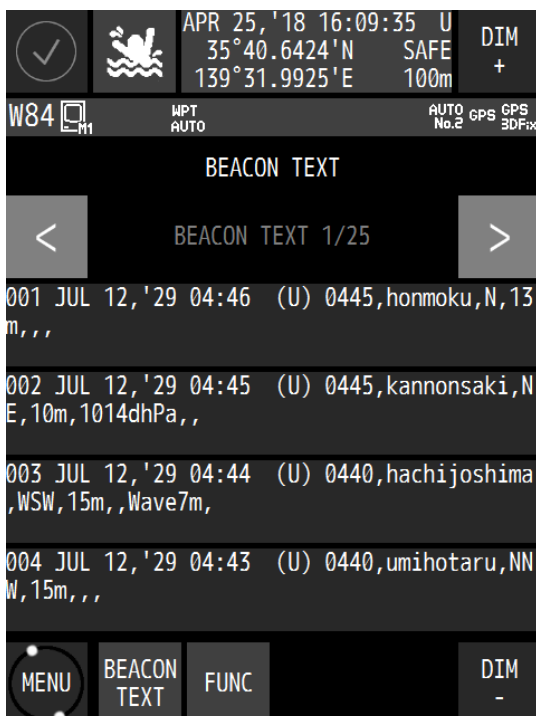
Waypoint number

n-th waypoint

Total number of waypoints

Comment on the waypoint

Waypoint position

Distance from the own ship's position to the displayed waypoint

Bearing from the own ship's position to the displayed waypoint

Expected arrival time at the displayed waypoint

Time required for reaching the displayed waypoint

Arrival-circle radius

Planned ship speed

Width of the port and starboard-side route

| APR 25,'18 16:22:51 U |
| 35°40.1619'N SAFE |
| 139°29.4172'E 100m |
| DIM + |

W84

WPT AUTO

AUTO No.2 GPS GPS 3DFix

TO WPT	○ 00019	001/007
COMMENT	WPT1	
LAT	35°04.5270'N	
LON	137°10.3780'E	
BRG	252.6°	
DTG	119.3NM	
ETA	APR 26,'18 04:39 (U)	
TTG	000 DAY 12 hr 16 min	
WIDTH	PORT 1.00NM	STBD 1.00NM
ARRIVAL RAD	1.00NM	
SPEED	10.00kn	

MENU WPT INFO FUNC < > DIM -

3.1.9   Beacon text screen

The beacon text screen displays the beacon text information (Type 16) that is received by the beacon receiver.

| APR 25,'18 16:09:35 U |
| 35°40.6424'N SAFE |
| 139°31.9925'E 100m |
| DIM + |

W84

WPT AUTO

AUTO No.2 GPS GPS 3DFix

BEACON TEXT

< BEACON TEXT 1/25 >

Beacon information

001 JUL 12,'29 04:46 (U) 0445,honmoku,N,13 m,,,

002 JUL 12,'29 04:45 (U) 0445,kannonsaki,N E,10m,1014dhPa,,

003 JUL 12,'29 04:44 (U) 0440,hachijoshima ,WSW,15m,,Wave7m,

004 JUL 12,'29 04:43 (U) 0440,umihotaru,NN W,15m,,,

MENU BEACON TEXT FUNC DIM -
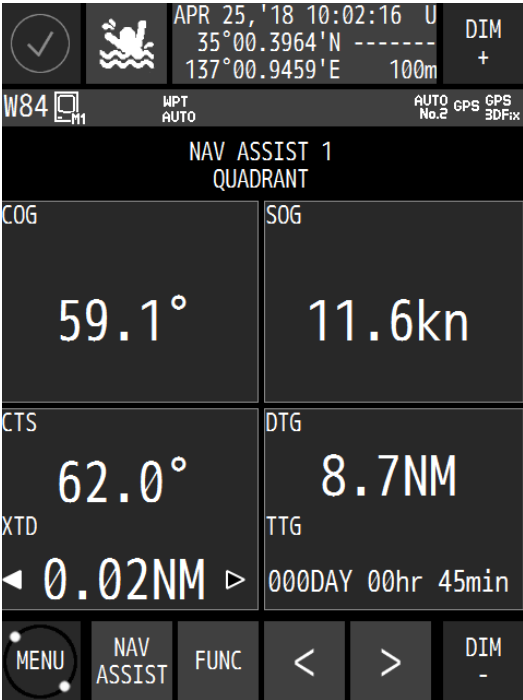
3.1.10　Navigation aid screen

The navigation aid screen calculates and displays navigation information including a 4-split screen, navigation measurement, trip distance, external equipment information, and distance between two points.

The screen can be switched by using [<] or [>] .

Navigation assistance screen 1

Course	APR 25,'18 10:02:16 U 35°00.3964'N ------ 137°00.9459'E 100m DIM + W84 WPT AUTO AUTO No.2 GPS GPS 3DFix NAV ASSIST 1 QUADRANT COG **59.1°**

Course ——— COG **59.1°**　　　SOG **11.6kn** ——— Speed

CTS ——— CTS **62.0°**　　　DTG **8.7NM** ——— Distance from the own ship's position to the waypoint

Deviation from the route ——— XTD ◄ **0.02NM** ►　　　TTG 000DAY 00hr 45min ——— Time required for reaching the waypoint

MENU | NAV ASSIST | FUNC | < | > | DIM -

Navigation assistance screen 2 (measurement for navigation)

NOV 25,'18 14:08:19 U
35°46.3608'N SAFE
139°37.6598'E 100m
DIM +
W84 AUTO No.2 GPS GPS 3DFix

RUNNING:
　Measurement in progress
END:
　Measurement complete

NAV ASSIST 2
NAV CALC

CALC STATE	RUNNING
LAT	35°46.3608'N
LON	139°37.6598'E
SOG	11.5kn
COG	359.0°
START	NOV 25,'18 12:49:10 (U)
END	--- --,'-- --:-- (U)
TIME	0000 DAY 01 hr 19 min
TRIP DIST	14.7NM
TOTAL DIST	3031.2NM

Own ship position ——— LAT / LON

Speed ——— SOG

measurement start time ——— START

Total time ——— TIME

Trip ——— TRIP DIST

Course ——— COG

measurement end time ——— END

Total distance ——— TOTAL DIST

MENU | NAV ASSIST | FUNC | < | > | DIM -

Navigation assistance screen 3 (measurement for navigation)

RUNNING: Measurement in progress
END: Measurement complete

measurement start time

measurement end time — measurement end time

Total time — trip

Average speed

RUNNING: Measurement in progress
END: Measurement complete

measurement start time

measurement end time

Total time

Average speed — trip

```
        NOV 25,'18 15:42:46 U
        35°47.3083'N      SAFE   DIM
        139°37.5223'E     100m    +

W84                        AUTO GPS GPS
                           No.2     3DFix
               NAV ASSIST 3
                 TRIP CALC
TRIP1 CALC STATE  END
        START  NOV 25,'18 12:48:52  (U)
          END  NOV 25,'18 13:28:12  (U)
         TIME  0000 DAY 00 hr 39 min
      AVG SPD  12.4kn      TRIP  8.1NM
TRIP2 CALC STATE  RUNNING
        START  NOV 25,'18 12:48:56  (U)
          END  --- --,'-- --:--  (U)
         TIME  0000 DAY 02 hr 53 min
      AVG SPD  10.5kn      TRIP  30.4NM

 MENU   NAV   FUNC   <     >    DIM
       ASSIST                    -
```

Navigation assistance screen 4 (External equipment screen)

Forward/backward speed through water
▲:Forward
▼:Backward

Baw speed through water
◀ Leftward
▶ Rightward

Stern speed through water
◀ Leftward
▶ Rightward

Water depth

Water temperature

Current direction, speed and depth.
Layer A
Layer B
Layer C
Layer D
Layer E

```
        APR 25,'18 10:09:04 U
        35°01.0043'N  -------  DIM
        137°02.1858'E     100m    +
W84        WPT             AUTO GPS GPS
           AUTO            No.2     3DFix
               NAV ASSIST 4
                 EXT EQUIP
                        ◁ 1.2kn    ▶
 STW   ▲ 9.9kn
       ▼                ◁ 1.1kn    ▶
DPTH  253.0m        TEMP  +15.0°C
                CURRENT
        DIR          SPD       DEPTH
   A  125.7°        3.3kn       51.0m
   B  132.2°        2.8kn      102.0m
   C  128.4°        2.6kn      155.0m
   D  130.7°        2.3kn      178.0m
   E  131.2°        2.1kn      200.0m

 MENU   NAV   FUNC   <     >    DIM
       ASSIST                    -
```

Navigation assistance screen 5 (Calculation of a distance/bearing between two points)

Starting point
(Latitude and longitude)

Terminal point
(Latitude and longitude)

Distance calculation method
GC: Great circle sailing
RL: Rhumb line sailing

Distance

Bearing

```
        NOV 25,'18 13:38:45 U
        35°42.7031'N      SAFE   DIM
        139°35.1115'E     100m    +
W84                        AUTO GPS GPS
                           No.2     3DFix
               NAV ASSIST 5
                 DIST CALC
             STARTING POINT
          LAT  35°42.5563'N
          LON  139°34.9947'E
             TERMINAL POINT
          LAT  35°36.5422'N
          LON  138°08.1036'E
         SAIL  RL

         DIST  71.17NM
          BRG  265.1°

 MENU   NAV   FUNC   <     >    DIM
       ASSIST                    -
```

Chapter 4 Operation

4.1　　　Menu List

4.1.1　　　Main Menu

MENU	Sub Menu	Sub Menu	Sub Menu	Range	Reference
DISPLAY	THEME			DAY/DUSK/NIGHT	
	BEEP			OFF / ON	
	DAY SCREEN			OFF / ON	
	NAV			OFF / ON	
	PLOT			OFF / ON	
	ANALOG			OFF / ON	
	HIGHWAY			OFF / ON	
	SAT INFO			OFF / ON	
	WPT INFO			OFF / ON	
	BEACON TEXT			OFF / ON	
	NAV ASSIST			OFF / ON	
VOYAGE	WPT	WPT LIST			
	ROUTE	ROUTE LIST			
	RUN				
	EVENTMARK	EVENTMARK LIST			
	WPT COPY				
	ROUTE COPY				
	WPT DELETE				
	ROUTE DELETE				
	EVENT DELETE				
	SHARED	ROUTE SEND			
		ROUTE RECEIVE	SOURCE IP		
	DEFAULT SETTINGS	WIDTH PORT(NM)		0.00~9.99	
		WIDTH STBD(NM)		0.00~9.99	
		ARRIVAL RADIUS(NM)		0.00~9.99	
		SPEED(kn)		00.00~99.99	
		SAIL		GC/RL	
		SOG SMOOTHING(s)		0~99	
ALERT	SYSTEM	SET		OFF / ON	
		SOUND		OFF / ON	
	ARRIVAL/ ANCHOR	SET		OFF / ARRIVAL / ANCHOR	
		SOUND		OFF / ON	
	XTD/ BOUNDARY	SET		OFF / XTD / BOUNDARY	
		SOUND		OFF / ON	
	HDOP	SET			
		SOUND		OFF / ON	
	SPD	SET			
		SOUND		OFF / ON	
	TRIP	SET			
		SOUND		OFF / ON	
	EARLY COURSE CHANGE	SET			
		SOUND		OFF / ON	
	END OF TRACK	SET			
		SOUND		OFF / ON	
	ARRIVED AT WOL	SET		OFF / ON	
		SOUND		OFF / ON	

MENU	Sub Menu	Sub Menu	Sub Menu	Range	Reference
ALERT	ACTUAL COURSE CHANGE	SET		OFF / ON	
		SOUND		OFF / ON	
	TEMP	SET			
		SOUND		OFF / ON	
	DPTH	SET			
		SOUND		OFF / ON	
	DGPS	SET		OFF GPS→DGPS DGPS→GPS GPS⇔DGPS	
		SOUND		OFF / ON	
	BUFFER	SET		OFF / ON	
		SOUND		OFF / ON	
	POWER	SET		OFF / ON	
		SOUND		OFF / ON	
GNSS SETTING	SENSOR1	GNSS	GPS MODE	GPS	
		FIX MODE		2D / 3D / AUTO	
		ELV MASK		5~89 deg	
		HDOP		4/10/20	
		SMOOTH	POSN SMOOTHING(s)	0~99	
			SPEED SMOOTHING(s)	0~99	
			COURSE SMOOTHING(s)	0~99	
		RAIM	RAIM ACCURACY LEVEL(m)	OFF/10/30/50/100	
		DATUM			
		INIT	QUADRANT		
			LAT		
			LON		
			ANT HEIGHT(m)		
			YEAR		
			MONTH		
			DAY		
			HOUR(hr)		
			MINUTE(min)		
		DGPS		OFF / AUTO BEACON / SBAS	
		BEACON	AUTO		
			MANUAL	FREQUENCY/ BITRATE	
			SEMI AUTO		
			MONITOR		
		SBAS	SAT SEARCH	AUTO / MANUAL (SBAS SETTING)	
			TYPE0	OFF / ON	
			RANGING	OFF / ON	
		STN LIST			

MENU	Sub Menu	Sub Menu	Sub Menu	Range	Reference
GNSS SETTING	SENSOR2	GNSS	GPS MODE	GPS	
		FIX MODE		2D / 3D / AUTO	
		ELV MASK		5~89 deg	
		HDOP		4/10/20	
		SMOOTH	POSN SMOOTHING(s)	0~99	
			SPEED SMOOTHING(s)	0~99	
			COURSE SMOOTHING(s)	0~99	
		RAIM	RAIM ACCURACY LEVEL(m)	OFF/10/30/50/100	
		DATUM			
		INIT	QUADRANT		
			LAT		
			LON		
			ANT HEIGHT(m)		
			YEAR		
			MONTH		
			DAY		
			HOUR(hr)		
			MINUTE(min)		
		DGPS		OFF / AUTO BEACON / SBAS	
		BEACON	AUTO		
			MANUAL	FREQUENCY/ BITRATE	
			SEMI AUTO		
			MONITOR		
		SBAS	SAT SEARCH	AUTO / MANUAL (SBAS SETTING)	
			TYPE0	OFF / ON	
			RANGING	OFF / ON	
		STN LIST			
SYSTEM	DATE / TIME	TIME DIFF		+00:00~+13:30	
		DATE DISP		'YY-MM-DD DD MMM,'YY MMM DD,'YY	
		TIME DISP(hr)		12hr / 24hr	
	UNIT	DIST / SPEED		NM,kn km,km/h mi,mi/h	
		HIGHT / DPTH		m / ft / fm	
		TEMP		℃ / F	
	MAG CORR				
	LORAN			OFF / LORAN A,C	
	SENSOR SELECT			AUTO/ SENSOR1,2	
LANGUAGE				JAPANESE/ ENGLISH	
VERSION	DISPLAY				
	PROCESSOR				
	SENSOR1				
	SENSOR2				
ALERT LIST	ALERT HISTORY				
	ACTIVE ALERT				
	LAN1				
	LAN2				

MENU	Sub Menu	Sub Menu	Sub Menu	Sub Menu	Range	Reference
EQUIP	TYPE	TYPE1 / 2 DISPLAY	DISPLAY TYPE		MAIN REMOTE(LAN) REMOTE (SERIAL)	
			SFI		GP0000	
		TYPE2/2 PROCESSOR	DEVICE No.		No1.~No3.	
			SFI		GP0000	
			SENSOR1		OFF GPS COMPASS OTHER EQUIP	
			SENSOR2		OFF GPS COMPASS OTHER EQUIP	
	DATA I/O	IN/OUT1				
		IN/OUT2				
		IN/OUT3				
		OUT4				
		OUT5				
		OUT6				
		LAN	LAN1	DATA OUT		
				RMS SEND		
				PRINTER		
			LAN2	DATA OUT		
				RMS SEND		
				PRINTER		
			COMMON	ACTIVE ROUTE		
				DATA ROUTE		
				MUTUAL		
		CONTACT1	CONTACT OUT			
		CONTACT2	CONTACT OUT			
		CONTACT3	CONTACT OUT			
		CONTACT4	CONTACT OUT			
		BUFFER	FORMAT			
			BITRATE(bps)			
			VERSION			
			TALKER			
		SENSOR	SENSOR1 PORT2(bps)		4800 / 9600 19200 / 38400	
			SENSOR2 PORT2(bps)		4800 / 9600 19200 / 38400	
		RS-232C	FORMAT			
			BITRATE(bps)			
			VERSION			
			TALKER			
	SWITCH	CONTROLL METHOD			OFF MFD FIX/NOFIX FIX/NOFIX + DOP	
		SWITCH SELECTION			PROCESSOR No1. PROCESSOR No2.	

MENU	Sub Menu	Sub Menu	Sub Menu	Sub Menu	Range	Reference
EQUIP	DIMMER	SETTINGS	DIMMER GROUP		1~10	
			DISPLAY		OFF/ON	
			NCM-227		OFF/ON	
			DDC		OFF/ON	
			GPS		OFF/ON	
			GP DDC		OFF/ON	
		DIMMER CAL			MIN/MAX	
	IP	DISPLAY	IP ADDRESS			
			MAC ADDRESS			
			SUBNET MASK			
			DEFAULT GATEWAY			
		PROCESSOR LAN 0	IP ADDRESS			
			MAC ADDRESS			
			SUBNET MASK			
			DEFAULT GATEWAY			
		PROCESSOR LAN 1	IP ADDRESS			
			MAC ADDRESS			
			SUBNET MASK			
			DEFAULT GATEWAY			
		PROCESSOR LAN 2	IP ADDRESS			
			MAC ADDRESS			
			SUBNET MASK			
			DEFAULT GATEWAY			
	CCRP	BEAM (m)				
		LENGTH(m)				
		CCRP(m)				
		SENSOR1 (m)				
		SENSOR2 (m)				
	CTS	CLASS				
		TRACKING GAIN				
		TRACKING HIGH				
		TORACING MIDDLE				
		TRACKING LOW				
		TRACKING MULTIPLE				
		TRACKING COUNT A				
		TRACKING D GAIN				
	LOW SPEED COG	OUTPUT			OFF/ON	

MENU	Sub Menu	Sub Menu	Sub Menu	Sub Menu	Range	Reference
EQUIP	MAINTENANCE	DIAGNOSIS	DISPLAY			
			PROCESSOR			
			SENSOR1			
			SENSOR2			
		MONITOR	DATA IN1			
			DATA IN2			
			DATA IN3			
			RS-232C			
			SWITCH			
			LAN1			
			LAN2			
			SENSOR1			
			SENSOR2			
		OPERATING TIME	OPERATING TIME(hr)			
			LCD TIME(hr)			
	RESET					
	DEMO	DEMO TYPE				
		START/ STOP				
		YEAR				
		MONTH				
		DAY				
		HOUR(hr)				
		MINUTE(min)				
		SECOND(s)				
		QUADRANT				
		LAT				
		LON				
		SPEED(kn)				
		COURSE(°)				
		RADIUS(NM)				
		ROUTE				
	ALL SETTING VALUE	BACKUP INFO				
		IMPORT/ EXPORT	MPORT/ EXPORT		PROCESSOR → DISPLAY DISPLAY → PROCESSOR	
			PROCESS		BACKUP/ OVERWRITE	

4.1.2　　　Function menu

DISPLAY	FUNC	
COMMON	PRINT	Outputs data to a printer.
	GOTO	Sets a waypoint.
	EVENT	Registers the own ship's position in the event mark list.
	DIMMER DEFAULT	Resets the dimmer setting to the default value.
PLOT1/PLOT2	MARK	Displays a mark at the cursor position.
	CURSOR MODE	Displays a cursor.
	HOME	Moves own ship to the centre of the screen.
	PLOT	Sets display/non-display on the plotting screen.
	BACK GROUND COLOUR	Changes the background colour of the plotting screen.
ANALOG	SPEED METER	Sets the maximum value of the ship speed meter.
HIGHWAY	BACK GROUND COLOUR	Changes the background colour of the HIGHWAY screen.
SAT INFO	NEAREST STN	Displays the nearest beacon station. JLR-8600 does not support this function.
BEACON TEXT	BEACON DELETE	Deletes the received data. JLR-8600 does not support this function.
	BUZZER	Sets whether to sound a buzzer when TYPE16 is received.
NAV ASSIST	CALC START	Starts distance calculation.
	TRIP RESET	Stops trip distance calculation.
	TOTAL TRIP RESET	Resets the total trip distance.
	TRIP 1 CAL START/END	Starts/Stops distance calculation of TRIP1.
	TRIP 2 CAL START/END	Starts/Stops distance calculation of TRIP2.
	TRIP 1 RESET	Resets distance calculation of TRIP1.
	TRIP 2 RESET	Resets distance calculation of TRIP2.
	CURRENT SETTING	Sets the layer of the current to be displayed.
	CALC SETTING	Sets the position of two points between which the distance is to be calculated.

4.2　Basic Operation

4.2.1　Turning on the power of the unit

When the power of the equipment is turned on by pressing the Power key, the startup screen appears.
When installation is completed, self-diagnosis starts and the setting value confirmation screen is changed to the normal screen.

Startup screen　　　　　Self diagnosis　　　　　Setting value confirmation

---
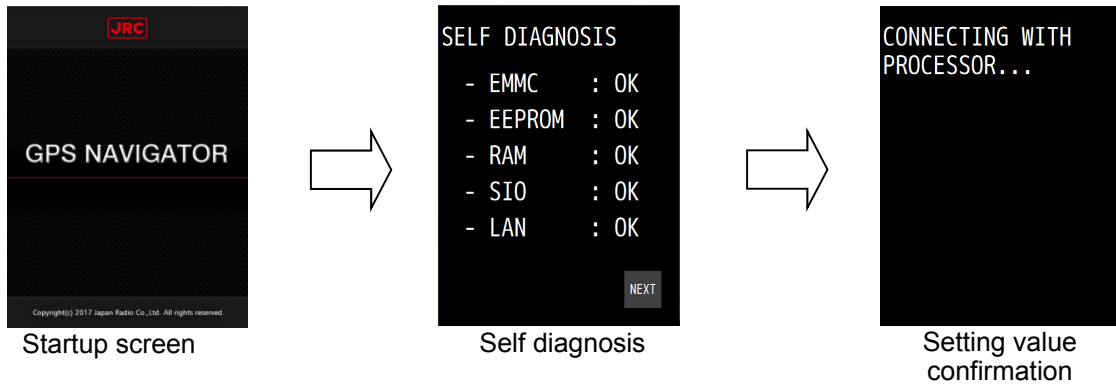
Attention

If the power for the equipment is not turned on, check the main power supply of the power board, power cable connection to the processor, or cable connection to the display unit.
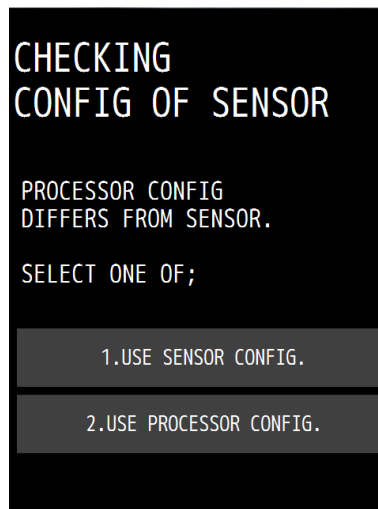

4.2.2　Startup

1)　Normal startup

If all the self-diagnosis results are 'OK' and all the settings of the processor and sensor settings match, the screen is switched to the normal screen automatically.
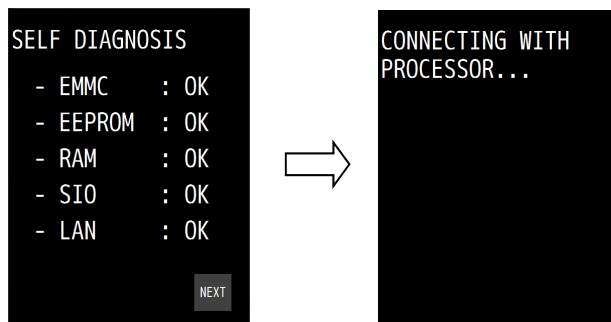
2) Error startup 1

The message that is shown below may be displayed in the receiver diagnosis.
This message is displayed when the setting values do not match between the processor and the receiver due to the equipment replacement or other reason.

```
CHECKING
CONFIG OF SENSOR


PROCESSOR CONFIG
DIFFERS FROM SENSOR.

SELECT ONE OF;


        1.USE SENSOR CONFIG.

        2.USE PROCESSOR CONFIG.
```

In this case, select one of the following items.

[USE SENSOR CONFIG.]:   The setting value of the processor is rewritten so as to match the setting value of the <u>receiver</u>.
[USE PROCESSOR CONFIG.]: The setting value of the receiver is rewritten so as to match the setting value of the <u>processor</u>.

3) Error startup 2

If any one of the diagnosis results is 'NG', the result will be displayed continuously.
The screen is not switched to the normal screen unless "SKIP" is tapped.

Attention
When there is any error (NG), contact Nippon Signal or your distributor.

4.2.3   Turning off the power of the unit

When the Power key is pressed, the following message is displayed. When "YES" is selected, the power is turned off.

```
POWER OFF
ARE YOU SURE
```

Memo
• Even if the message is displayed, the power of the display is turned off forcibly if the Power key is held down for about 8 seconds. In this case, the power of the display is turned off, but the processor operates continuously. • When the display unit is energised even if the power is Off, the LED of the Power key is lit.

4.2.4　　Adjusting the backlight

The brightness can be adjusted to 17 levels/OFF by using the DIM key.
Even if the brightness is set to OFF, the DIM key alone remains lit.

To reset the brightness to the default value, tap `DIMMER DEFAULT` from `FUNC` .

1. Whenever "DIM+" at the top right corner of the screen is pressed, the screen brightness increases.
2. Whenever "DIM-" at the bottom of the screen is pressed, the screen brightness decreases and finally is set to OFF.

4.2.5　　Menu operation

When the MENU key is pressed, a menu is displayed.
When the MAIN key is pressed while a menu is displayed, the screen returns to the normal screen.
For the details of the menu, refer to "4.1 Menu List".

4.2.6   Alert and acknowledgment (ACK)

1.   Notifying the occurrence of an alert
When an alert occurs, an alert icon is displayed at the top left corner of the screen and the occurrence of an alert is notified by a buzzer sound. The alert target value is displayed with blinking.

Icon list

Icon	Priority	Status
	Alarm	Active-Unacknowledged
		Active-Silenced
		Active-Acknowledged
		Rectified- Unacknowledged
	Warning	Active-Unacknowledged
		Active-Silenced
		Active-Acknowledged
		Rectified- Unacknowledged
	Caution	Active

When any icon is tapped, an alert display bar is displayed at the centre of the screen.

2.   Alert acknowledgment (ACK)
1) Tap the alert detail bar at the centre of the screen.
2) The alert icon changes to the acknowledged state and the buzzer sound stops. When a NOFIX alert occurs, the alert target value that is displayed is lit in yellow.

> **Memo**
>
> - When multiple alerts occur simultaneously, the alert with the highest priority is displayed first and all the alerts must be acknowledged.
>
> - Even if the alert is rectified before being acknowledged, the "Unacknowledged" state icon is displayed. All the alerts that have occurred must be acknowledged.

Screen transition at the occurrence of an alert
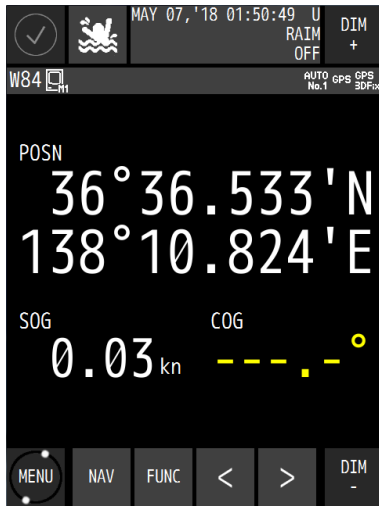
1. Operating normally

Alert occurred →

An alert occurrence icon is displayed.

2. Alert occurred (Non ACK)

Tap the alert occurrence icon.

3. Alert is occurring
The alert contents are displayed.

Acknowledge by tapping the alert contents.

103 01:51:36 WARNING
GPS1 no fix

The icon indicating an acknowledged state is displayed.

4. Alert occurred (acknowledged)

103 01:51:36 WARNING ACK
GPS1 no fix

Tap the icon indicating an acknowledged state.

5. The alert contents are cleared.

Rectified. →
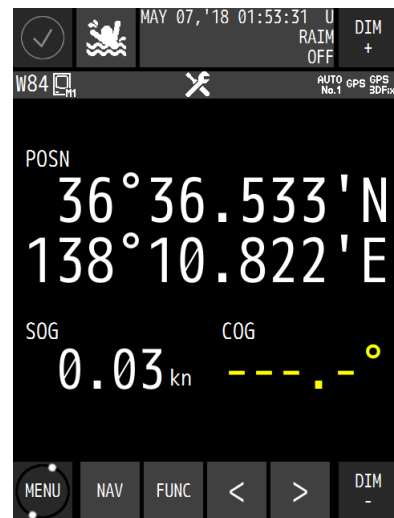
6. Rectified

4.2.7 Screen operation

See below for the screen operation.

Menu level

Page

Setting item

Setting value

+/- setting value switching

MENU>VOYAGE>WPT

ENTRY WPT 1/2
WPT No.00002

Page feed (< >)
Move to the next page

WPT No.

00002

COMMENT

Blue underline
Indicates that numeric key input is enabled.

POSN

0°00.0000'N 0°00.0000'E

Return to the main screen

MAIN

DIM -

Returns to the previous screen by discarding the editing on this screen.

Maintains the screen by discarding the editing on this screen.

Returns to the full screen by confirming the editing on this screen.

Returns to the top menu by discarding the editing on this screen.

4.2.8 Inputting numeric values

Numeric value input by numeric keys is allowed for the setting values with blue underline.
Tap the blue underline of the numeric item to be input.

Enter a numeric value and confirm with [✓].

MENU>VOYAGE>WPT

ENTRY WPT 1/2
WPT No.00002

WPT No.

00002

CO

POSN

0°00.0000'N 0°00.0000'E

MAIN   DIM -

INPUT

00006

1	2	3
4	5	6
7	8	9
	0	⌫

Deletes 1 character.

MAIN   DIM -

Confirm
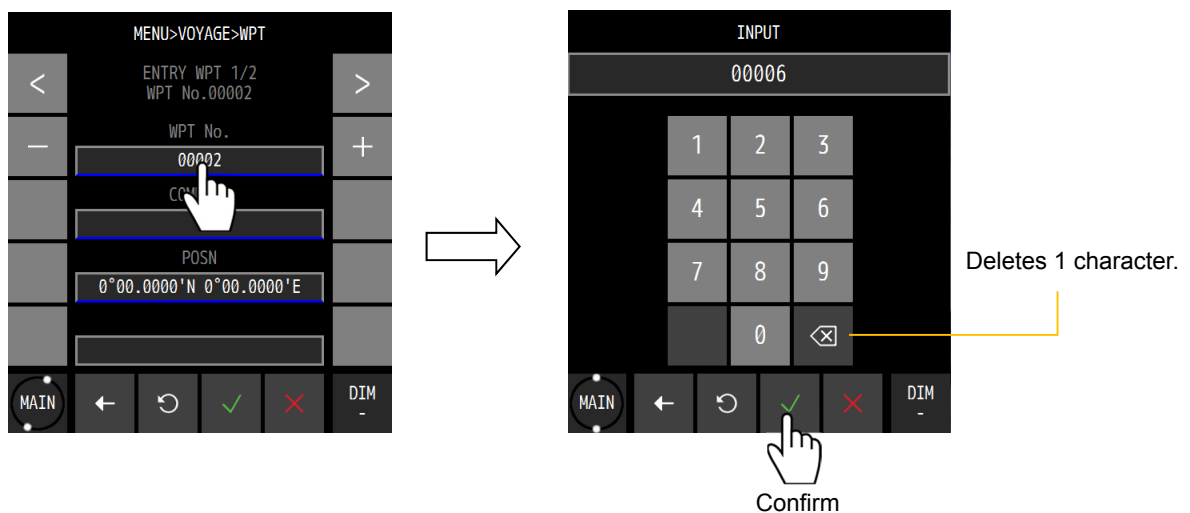
4.2.9   Inputting comments

Input of characters by using numeric keys is allowed for the setting items with blue underline.
Tap the blue underline of the setting item to be input.
Change the input mode by tapping ABC (characters), #&$ (symbols), or 123 (numeric values).
Display the character or numeric value that is assigned to the key by tapping it.
When entering the same character or symbol consecutively, take a small interval between them.

Enter a character and confirm it with [✓].
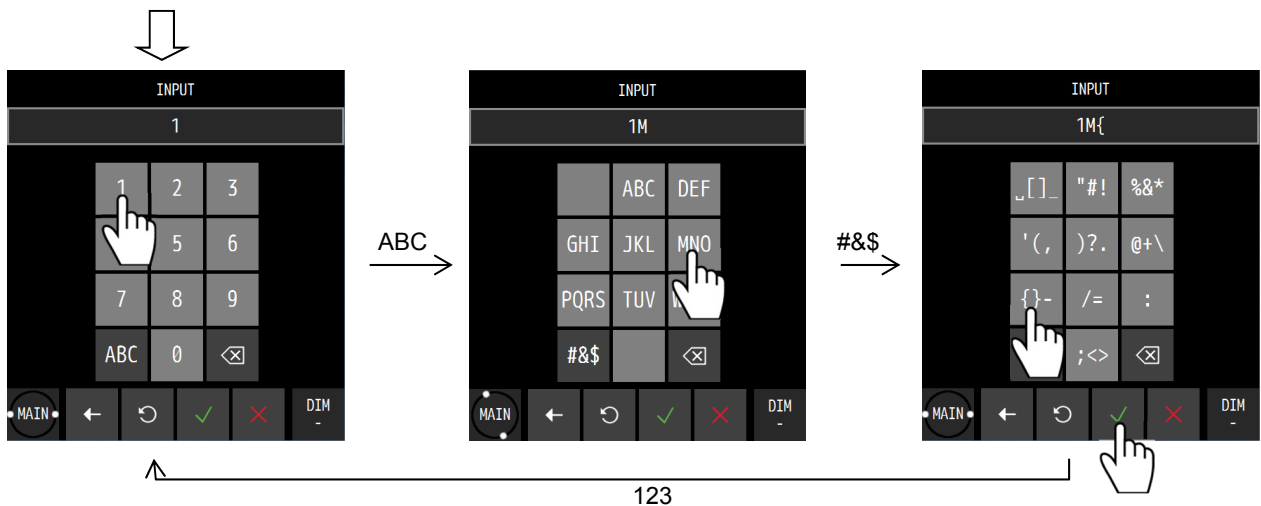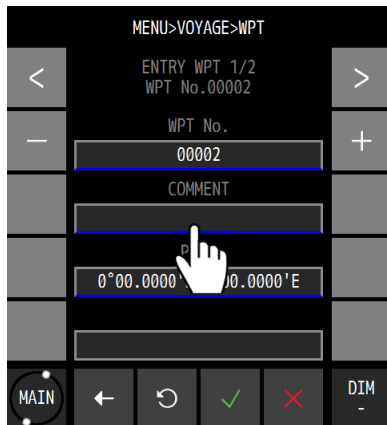
4.2.10 List operation

This section shows the list operation method.
The same operation method is applied for a waypoint list, a route list, and an event mark list.

Menu level

Page

Page feed (< >)
Move to the next page.

MENU>VOYAGE>WPT

WPT LIST 1/2500
TOTAL 1/10000

No. of waypoints registered/total
number of waypoints that can be
registered

HOME

00002 ◯ 36°36.2606'N 138°10.2571'E
NAGANO

List content display area

00003

00004

MAIN   ←   NUMBER   PREV   NEXT   DIM
            JUMP   SPACE SPACE   -

The number input screen is
displayed and control jumps
to the input number.

Jumps to the
previous free
number

Jumps to the next
free number

When the list is empty, the following message is displayed.

LIST IS EMPTY

OK
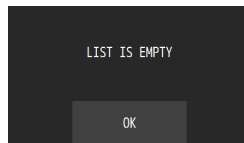
4.2.11 Entering a password in CODE INPUT

Some setting items are protected by a password to prevent them being changed easily.
If the power is turned off or no operation is performed for five minutes after a password is set, the
password is reset.
To set a password, enter a password again in CODE INPUT.

Procedure

1. MENU → CODE INPUT

2. Enter a password and confirm it with ✓ .

MENU

DISPLAY VOYAGE ALERT GNSS SETTING

SYSTEM LANGUAGE VERSION ALERT LIST

CODE INPUT

MAIN   ←   DIM -

INPUT

****

Entered password
Indicated by ****.

1 2 3
4 5 6
7 8 9
0 ⌫

MAIN ← ↺ ✓ ✕ DIM -

4-15
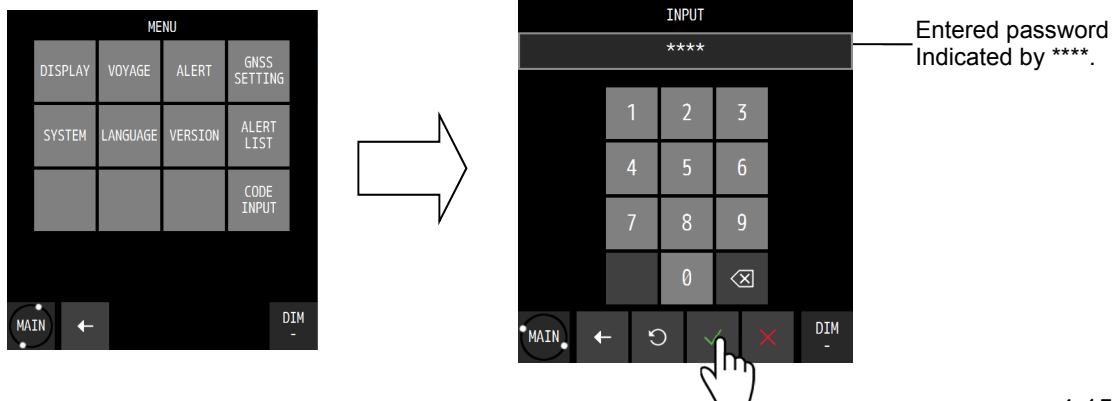
4.3 Setting Display

Set a screen.
Set a THEME, a beep tone, and background colour.

```
MENU>DISPLAY

<        DISPLAY 1/3        >

           THEME
—          DAY              +

           BEEP
—          OFF              +

         DAY SCREEN
—          OFF              +



MAIN   ←   ↺   ✓   ✗      DIM
                             -
```
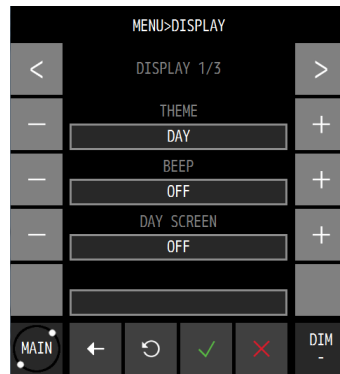
4.3.1 Setting a theme

Screen brightness can be adjusted according to the time zone for using this equipment.

Procedure

1. MENU → DISPLAY → THEME

THEME	Description
DAY	Specify this when using the equipment during daytime.
DUSK	Specify this when using the equipment at dusk.
NIGHT	Specify this when using the equipment at night.

4.3.2 Setting a beep tone

Set a beep tone ON/OFF when the screen is tapped.

Procedure

1. MENU → DISPLAY → BEEP

BEEP	Description
ON	Sets the beep tone to ON.
OFF	Sets the beep tone to OFF.

4.3.3 Setting reverse video display

Set the background colour to white/black.

Procedure

1. MENU → DISPLAY → DAY SCREEN

DAY SCREEN	Description
ON	Sets the background colour to white.
OFF	Sets the background colour to black.

4.3.4   Selecting a display screen

A screen to be displayed can be selected.
It is not possible to set all the screens to non-display.

Procedure

1. MENU → DISPLAY → Select a display.

DISPLAY	Description
NAV	
PLOT1	ON: Set to Display.
PLOT2	OFF: Set to Non-display.
ANALOG	
HIGH WAY	
SAT INFO	
WPT INFO	
BEACON TEXT	
NAV ASSIST	

4.4 Registering Waypoints

- To execute a route, a waypoint must be registered in a waypoint list.
- This equipment allows registration of 10000 waypoints.
- A waypoint list is divided into three areas and it is managed by numbers from 1 to 11024.
  1 to 10000: Waypoints that are registered in this equipment are registered.
  10001 to 10512: Waypoints of the shared active routes that are sent from ECDIS are registered.
  10513 to 11024: Waypoints that were used by a temporary route are registered.
- While waypoints from number 1 to number 10512 are saved and are not cleared even if the power is turned off, waypoints from number 10513 to number 11024 are cleared if the power is turned off.
- Waypoints can be set up to North latitude/South Latitude 89 degrees.

4.4.1 Displaying a waypoint list

Registered waypoints (waypoint numbers from 1 to 10000) can be displayed.
Waypoint number 00001 is registered as "HOME PORT".
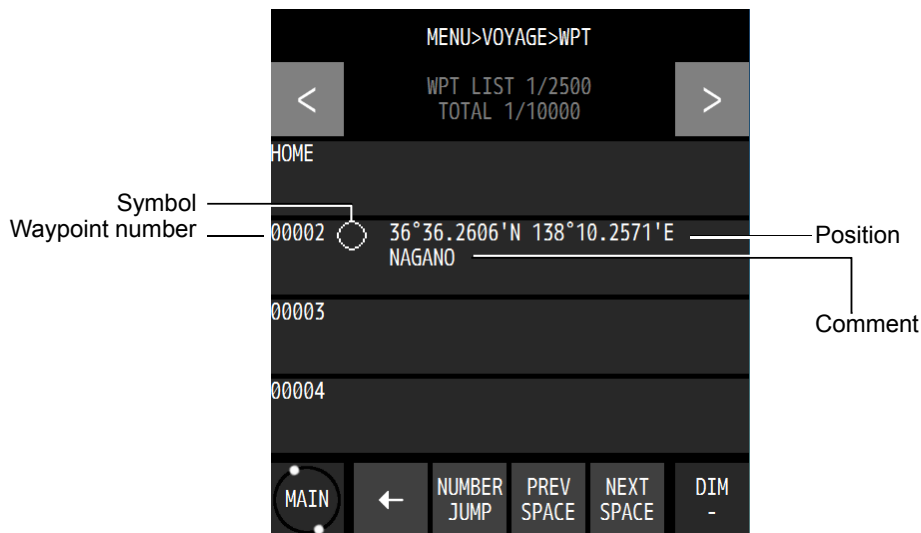
Procedure

1. MENU → VOYAGE → WPT → A waypoint list is displayed.

┌─ **Memo** ───┐
│   │
│   • The position that is registered in HOME in a waypoint list can be set easily as a waypoint by the GOTO function.
│   It is useful to register a point that is set as a waypoint frequently (such as home port).
│
│   The GOTO function can be set from FUNC on each screen.
│   │
└───┘

4.4.2 Registering waypoints

The following five positions can be registered in a waypoint list.
(1) Own ship's position
(2) Any latitude and longitude
(3) Cursor position
(4) Position measured by the bearing and distance from any position
(5) Position that is registered in an event/mark list
Up to 10000 points can be registered.

Procedure

1. [MENU] → [VOYAGE] → [WPT] → A waypoint list is displayed.

2. Tap the number you want to register.
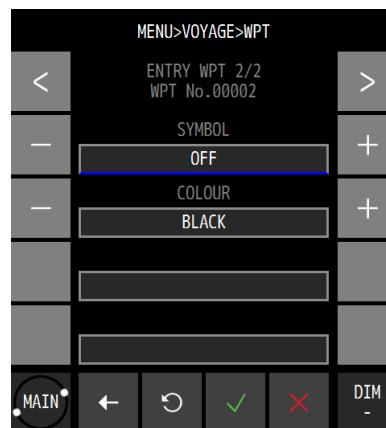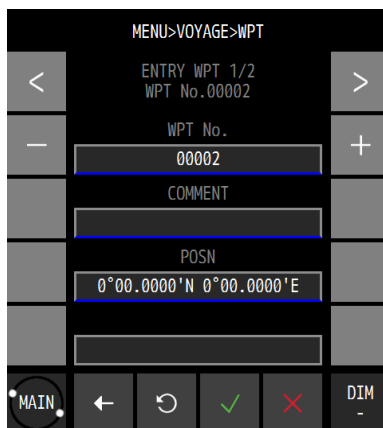
Item	Description
WPT No.	Enter a waypoint number.
COMMENT	Enter a comment.
POSN	Enter a waypoint position.
SYMBOL	Select a symbol.
COLOUR	Select a symbol colour.

3. Tap "POSN".
4. A registration method selection screen is displayed.
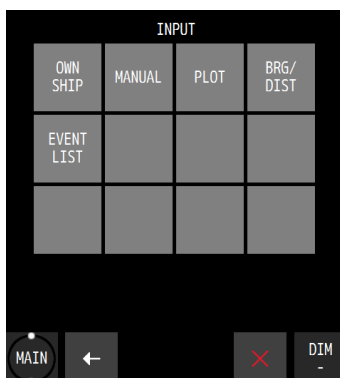
The registration method submenu is outlined below.
(1) OWN SHIP: Register an own ship's position.
(2) MANUAL: Register any latitude and longitude.
(3) PLOT: Register a cursor position from the plotting screen.
(4) BEG/DIST: Register based on the bearing/distance from any position.
(5) EVENT LIST: Register from an event mark list.

(1) When selecting OWN SHIP

    a) Tap [OWN SHIP].

    b) Set a comment, a symbol, and a colour, and tap [✓].

(2) When selecting MANUAL

    a) Tap [MANUAL].
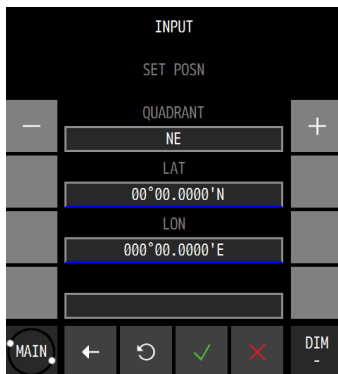
Item	Description	
QUADRANT	Select North latitude/South latitude/East latitude/West latitude of the latitude/longitude.	
	NE	North latitude/East latitude
	NW	North latitude/West latitude
	SE	South latitude/East latitude
	SW	South latitude/West latitude
LAT	Enter a latitude.	
LON	Enter a longitude.	

    b) Set a comment, a symbol, and a colour, and tap [✓].

(3) Selecting PLOT

    a) Tap [PLOT].

    b) A plotting screen is displayed.
    c) Move the cursor to the position you want to register by using the Up/Down/Left/Right arrows.
    d) Tap "SET".
    e) The cursor position is registered.

Cursor position
Bearing/distance from own ship to the cursor position
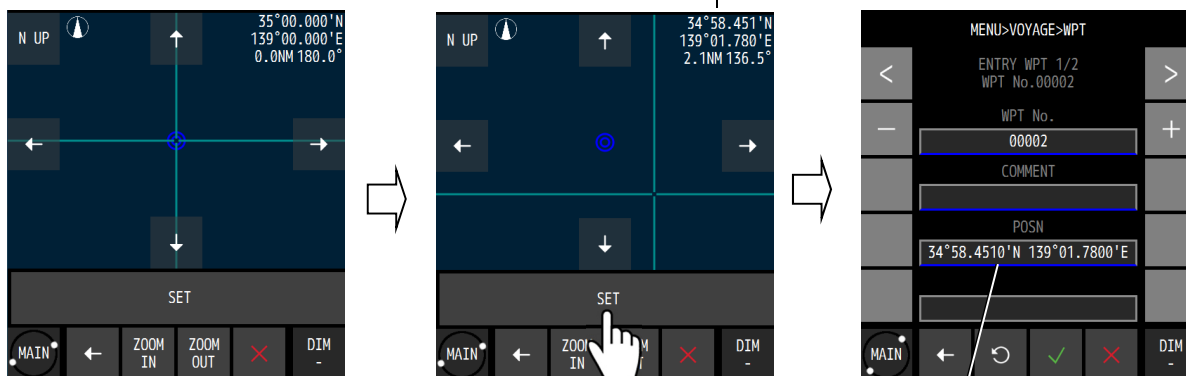
Registered waypoint

    f) Set a comment, a symbol, and a colour and tap [✓].

(4) Selecting BRG/DIST

    a) Tap [BRG/ DIST].

    b) When a waypoint position screen is displayed, tap WPT POSN.

Enter a starting position, a bearing, and a distance.
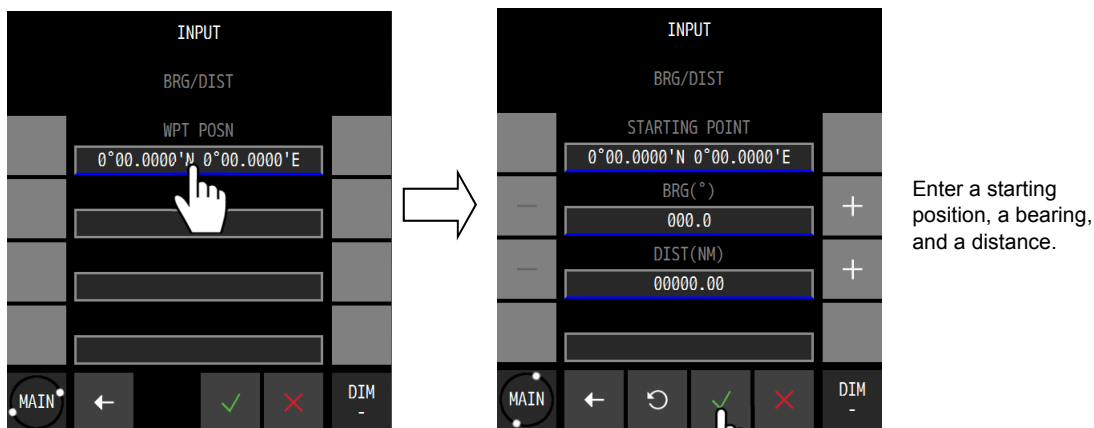
    c) Set a starting position, a bearing, and a distance.

The submenu for setting a starting position is outlined below.
(1)   OWN SHIP: Set an own ship's position.
(2)   MANUAL: Set any latitude and longitude.
(3)   PLOT: Set a cursor position from the plotting screen.
(4)   WP LIST: Select from a waypoint list.
(5)   EVENT LIST: Select from an event mark list.
(6)   PRE WPT: Set the previous waypoint as the starting position.

Item	Description
STARTING POINT	Enter a starting point.
BRG	Enter a bearing.
DIST	Enter a distance.

    d) Confirm the setting by tapping [✓].

    e) Set a comment, a symbol, and a colour and tap [✓].

(5) Selecting EVENT LIST

    a) Tap [EVENT LIST].

    b) An event mark list is displayed.
    c) Select a number of the event mark you want to register.

When you want to register number 001, tap 001.
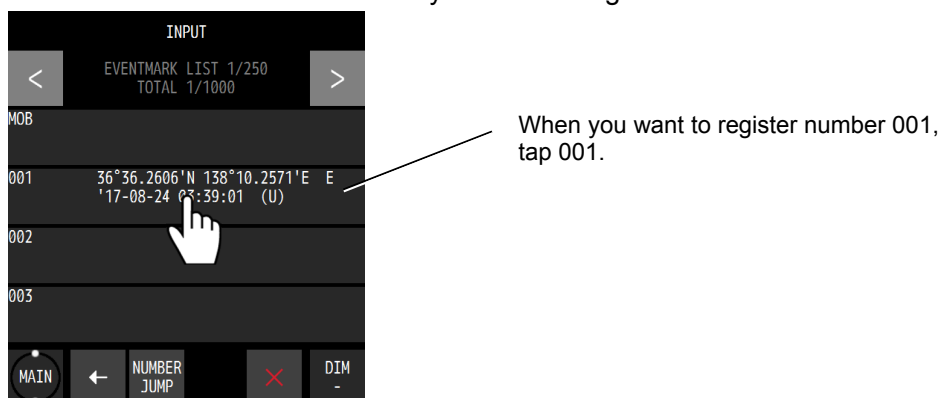
    d) Set a comment, a symbol, and a colour and tap [✓].

4.4.3　Editing waypoints

- Registered waypoint information (symbol shape, comment, and waypoint position) can be edited.
- The waypoint on the route that is currently being executed cannot be edited.

Procedure

1. [MENU] → [VOYAGE] → [WPT] → A waypoint list is displayed.

2. Tap the number you want to edit.
3. Tap the item you want to edit and edit the item.

4. After editing, tap [✓].

To edit a position, refer to "4.4.2 Registering waypoints".
A symbol, a colour, and a comment can be edited from the plotting screen. For the editing method, refer to "4.9.10 Displaying symbol information".

4.4.4　Copying waypoints

- Waypoint information can be copied on to another waypoint number. Information on an event and a mark can be copied on to a waypoint list. Number 1 in a waypoint list is handled as HOME.
- Waypoints that are saved under numbers from 10001 to 10512 and are used by the shared active route that is sent from ECDIS are automatically overwritten when next route is sent. Waypoints to be kept must be copied under numbers between 1 and 10000.
- Waypoints of a temporary route that are saved under numbers from 10513 to 11024 are cleared when another temporary route is created or the power is turned off. Waypoints to be kept must be copied under numbers between 1 and 10000.
- When no free area is available, waypoints can be overwritten. However, waypoints cannot be overwritten to those that are used by the route.

Procedure

1. [MENU] → [VOYAGE] → [WPT COPY]

2. Enter a starting point and an ending point of the copy source.
   When only one point is to be copied, enter the same number for a starting point and an ending point.

3. Tap a copy destination. The copy destination submenu is outlined below.
   (1)　Any input: Enter an input number.
   (2)　Waypoint list: Specify from a waypoint list.

(1)　Any input
　　　Enter a starting point of the copy destination.

(2)　Waypoint list
　　　When a waypoint list is displayed, tap a number of the copy destination.

4. Confirm the operation by tapping ✓ .

> **Memo**
>
> - When selecting copy sources with consecutive numbers, numbers that cross over a boundary such as 10000 or 10512 cannot be selected.
>
>   Example) Numbers from 9999 to 10001 or numbers from 10511 to 10513 cannot be selected.

4.4.5　Deleting waypoints

- Waypoints registered from numbers 1 to 10000 can be deleted.
- Waypoints on the route that is currently executed cannot be deleted.
- If a waypoint is on the route that is not being executed is deleted, the waypoint is deleted from the route also.

Procedure

1. [MENU] → [VOYAGE] → [WPT DELETE]

2. Tap a deletion source. A deletion source submenu is outlined below.
    (1)　Any input: Enter a waypoint number to be deleted.
    (2)　Waypoint list: Specify from a waypoint list.
    (3)　ALL: All the waypoints are deleted.

(1)　Any input
    Enter a starting point and an ending point of the number of the waypoint to be deleted.
    When deleting one point only, enter the same number for a starting point and an ending point.

(2)　Waypoint list
    When a waypoint list is displayed, select a starting point and an editing point of the waypoints to be deleted.
    When deleting one point only, enter the same number for a starting point and an ending point.

(3)　All
    All the waypoints are deleted.

3. The range to be deleted and the number of waypoints to be deleted are displayed.

4. Confirm the selection by tapping ✓ .

Waypoints can be deleted from a plotting screen. For the editing method, refer to "4.9.10 Displaying symbol information".

4.5   Route Plan

- A route can be created by using registered waypoints.
- Up to 100 routes can be created in this equipment and up to 512 waypoints can be specified per route. Waypoint information can be set for each LEG such as a route width, an arrival radius, and GC/RL.
  For the waypoint information that can be set, refer to "4.5.1 Displaying a route list".
- A created route can be shared with external equipment such as ECDIS.
- A created route is registered in a route list.
- A route list is divided into three areas and is managed by numbers from 1 to 102.
  Numbers from 1 to 100:   The route that was created in this equipment is registered.
  Number 101:   The shared active route that is sent from ECDIS is registered.
  Number 102:   A temporary route is registered.
- Since routes from numbers 1 to 101 are saved, they are not cleared even if the power is turned off. However, route number 102 is cleared if the power is turned off since it is not saved.

4.5.1   Displaying a route list

Routes that were created can be displayed in a route list. Information on each LEG of the route and waypoint information of each LEG can be displayed.
The required time cannot be calculated for the route that contains the LEG without planned ship speed.
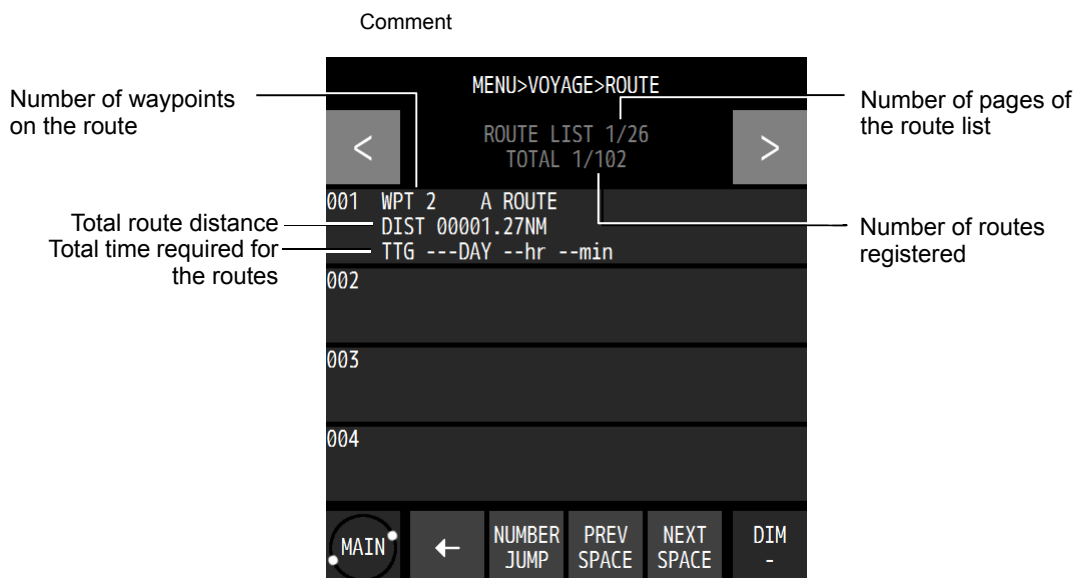
Procedure

1. [MENU] → [VOYAGE] → [ROUTE] → A route list is displayed.

When a registered route is tapped, the LEG information can be displayed.

- To create a route, determine a route number and sequentially select the waypoints, which are turn points.
- The same waypoint cannot be selected continuously.
- Up to 100 routes can be created.
- Up to 512 waypoints can be set per route.
- Either a TCS route or a normal route can be selected.

Procedure

1. [MENU] → [VOYAGE] → [ROUTE] → A route list is displayed.

2. Tap a number to be registered.

3. Tap [HEADER].
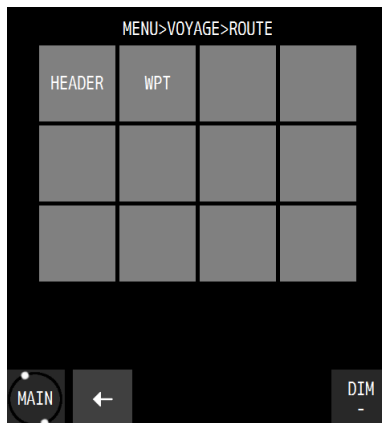
Item	Description	
ROUTE	ARRIVAL CIRCLE	Creates a normal route.
	WHEEL-OVER LINE(WOL)	Creates a TCS route.
COMMENT	Enter a comment.	

4. Tap [WPT].

When a waypoint input screen is displayed, tap 001.

Route number currently being created

Number of the displayed waypoint
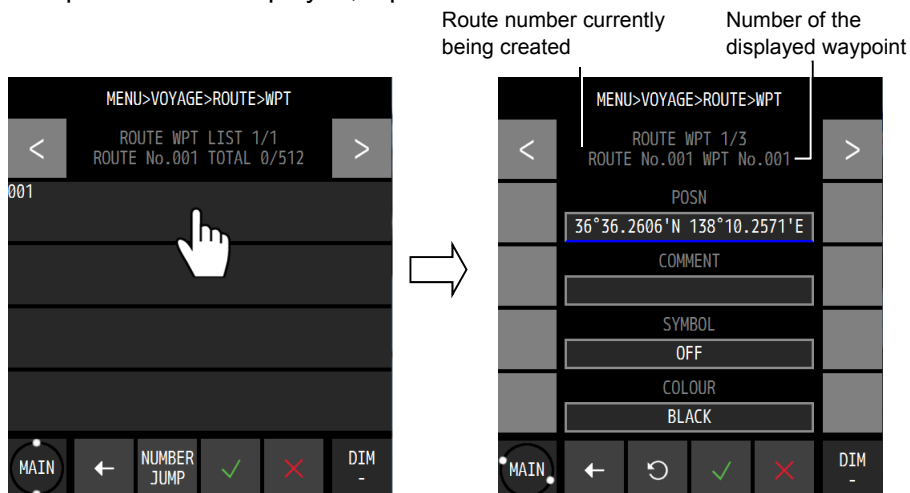
Item	Description
POSN	When "POSN" is tapped, a waypoint list is displayed. Select a waypoint position from the waypoint list.
COMMENT	A comment cannot be set for a waypoint. It can be edited from the waypoint list.
SYMBOL	A waypoint symbol cannot be set. It can be edited from the waypoint list.
COLOUR	A colour of a waypoint cannot be set. It can be edited from the waypoint list.
ARRIVAL RADIUS	Set an arrival radius.
WIDTH PORT	Set a port route width.
WIDTH STBD	Set a starboard route width.
SPEED	Set a planned ship speed.
SAIL	Route distance calculation method for LEG GC: Calculated by the great circle sailing. RL: Calculated by the Meridional part sailing (Rhumb Line).
STATE	Set whether to use the waypoint. USE: Use the waypoint. SKIP: Although the waypoint is kept on the route, it is skipped. DELETE: The waypoint is deleted from the route. It is kept in the waypoint list. Waypoints of the route that is currently being executed cannot be deleted.
ROT	This item can be set for a TCS route only. Set a Rate Of Turn.
TURN RADIUS	This item can be set for a TCS route only. Set a turn radius.
TIME ZONE	This item can be set for a TCS route only. Set a time zone.

5. Set each item and tap ✓.

First waypoint is set. To set two or more waypoints, repeat from Step 4.
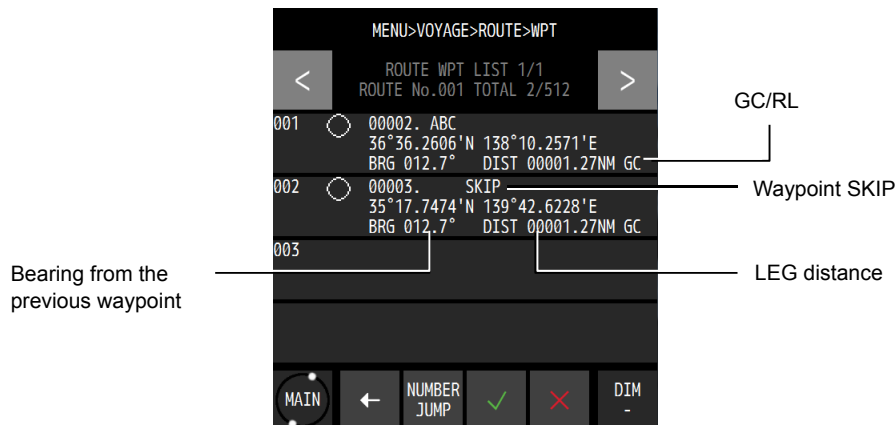
6. Set a waypoint and tap ✓.

4.5.3   Editing routes

Waypoint addition, change, and deletion are allowed for routes.

Procedure

1. [MENU] → [VOYAGE] → [ROUTE] → A route list is displayed.

2. Tap a route you want to edit.

3. Tap [WPT]

4. Tap a waypoint you want to edit.

Tap a route you want to edit

Tap a waypoint you want to edit

Route list

Display of waypoints on the route
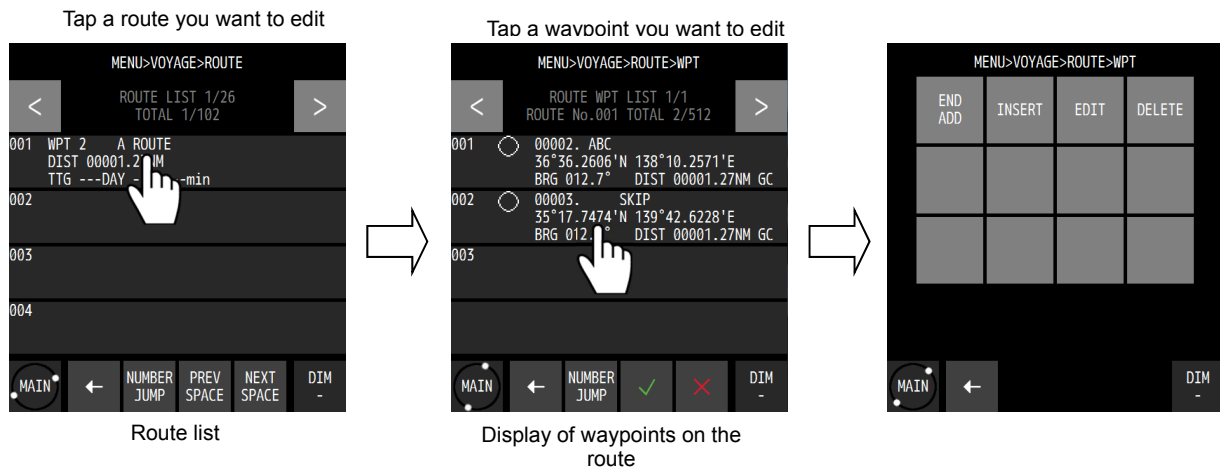
Item	Description
END ADD	Adds the final waypoint.
INSERT	Adds a waypoint before the waypoint that is tapped.
EDIT	Edits the waypoint that was tapped.
DELETE	Deletes the waypoint that was tapped from the route.

5. Set a waypoint and tap [✓].

Headers can also be edited in the same way.

4.5.4   Copying routes

The route that was created can be copied on to a different route number.
The waypoint that is used by the shared active route and is sent from ECDIS and is saved in number 101 is overwritten automatically when the next route is sent. Routes that are to be saved must be copied on to numbers between 1 and 100.
The waypoint of a temporary route that is saved under number 102 is cleared when another temporary route is created or the power is turned off. To save the route, the route must be copied on to a number between 1 and 100.
Routes of consecutive numbers can be copied in bulk.
When no free area is available, a route can be overwritten. However, the route that is being executed cannot be overwritten.
Select a copy source and specify a copy destination number.
When a temporary route or a shared route is to be copied, the waypoints must also be copied.

Procedure

1. MENU → VOYAGE → ROUTE COPY
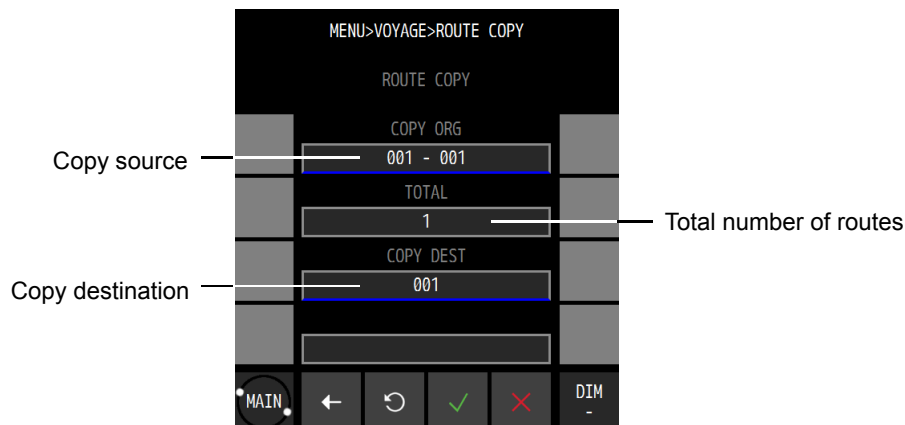
2. Tap "COPY ORG" and enter a number of a starting point and an ending point of the copy source.
    The input method is outlined below.
    (1)   MANUAL: Enter an ending point and a starting point.
    (2)   ROUTE LIST: Select from the route list.
    When copying one point only, enter the same number for a starting point and an ending point.

(1)   MANUAL input

a) Tap MANUAL .

Item	Description
FROM	Set a starting number.
TO	Set an ending number.

(2)   Selecting from a ROUTE LIST

a) Tap ROUTE LIST .

b) Tap a starting point and an ending point on the route list.

c) Confirm the setting by tapping ✓ .

3. Tap "COPY DEST" and enter a starting point of the copy destination.
   The input method is outlined below.
   (1) MANUAL: Enter an ending point.
   (2) ROUTE LIST: Select from the route list.

(1) MANUAL input

a) Tap MANUAL .

Item	Description
INSART	Set a copy destination number.

b) Confirm the setting by tapping ✓ .

(2) Select from a ROUTE LIST

a) Tap ROUTE LIST .

b) Tap a copy destination on the route list.

c) Confirm the setting by tapping ✓ .

4. Execute by tapping ✓ .

4.5.5   Deleting routes

- Registered routes from numbers 1 to 100 can be deleted.
- The waypoints of the route to be deleted can be deleted concurrently.
- When deleting waypoints also, the waypoints that are used by another route cannot be deleted.
- An Active route cannot be deleted.

Procedure

1. MENU → VOYAGE → ROUTE DELETE

Numbers to be deleted ——

Total numbers selected

Deletion method ——

4-29
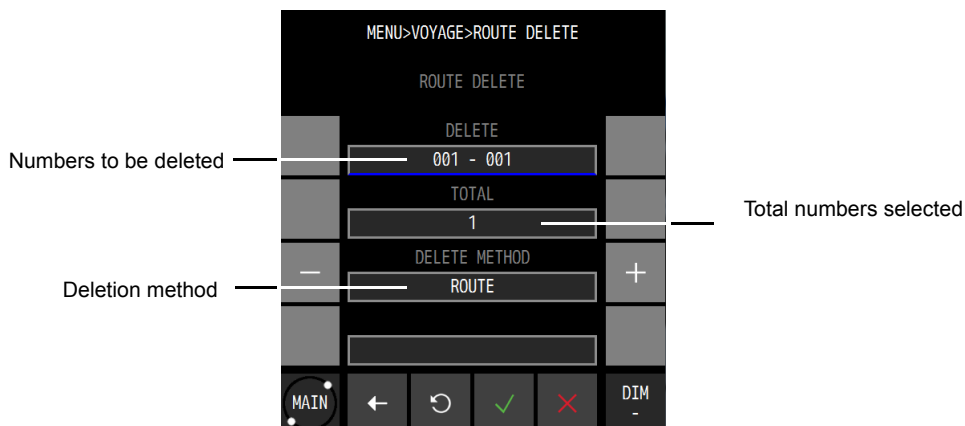
2. Tap "DELETE" and enter a number of a starting point and an ending point of the deletion source.
The input method is outlined below.
(1)   MANUAL: Enter an ending point and a starting point.
(2)   ROUTE LIST: Select from the route list.
(3)   ALL: All the routes are deleted.
When copying one point only, enter the same number for a starting point and an ending point.

(1) MANUAL input

    a) Tap MANUAL .

Item	Description
FROM	Set a starting number.
TO	Set an ending number.

(2) Selecting from a ROUTE LIST

    a) Tap ROUTE LIST .

    b) Tap a starting point and an ending point on the route list.

    c) Confirm the selection by tapping ✓ .

(3) Selecting ALL

    a) Tap ALL .

      All the routes are selected.

3. Tap "DELETE METHOD" and select a deletion method.

DELETE METHOD	Description
ROUTE	Only the selected route is deleted. The waypoint is not deleted.
ROUTE+WPT	The selected route and the waypoint on the route are deleted.

4. Tap ✓ and execute the deletion.

4.5.6   Sharing a route with another piece of equipment

The route that was created by this equipment can be sent to EDCIS or a radar and also the route that was created by ECDIS can be shared by receiving it (Data route sharing).
To use the route sharing function, equipment (ECDIS or radar) corresponding to the sharing must be connected to LAN.

Procedure

1. [MENU] → [VOYAGE] → [SHARED]
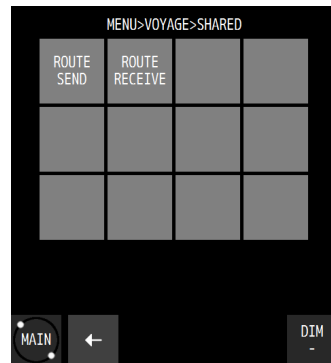
Item	Descriptions
ROUTE SEND	Sends a route.
ROUTE RECEIVE	Sets route reception.

(1) Sending a route

a) Tap [ROUTE SEND].

b) Set each item.

Item	Description	
CONNECT	Select multicast, unicast, or broadcast.	
IP	Set a destination ID when selecting unicast.	
PORT	Set a destination port when selecting unicast.	
OUTPUT	Set a LAN port for output.	
FORMAT	NMEA VER1.5	Sends under the RTE/WPL sentence of NMEA Ver 1.5.
	NMEA VER2.1	Sends under the RTE/WPL sentence of NMEA Ver 2.1.
	NMEA VER2.3	Sends under the RTE/WPL sentence of NMEA Ver 2.3
	NMEA VER4.0	Sends under the RTE/WPL sentence of NMEA Ver 4.0.
	IEC	Sends under the RTE/WPL sentence of IEC.
	JRC	Sends the route in the JRC format.
	SHARE ROUTE	Use ROUTE to set the route to be sent.
DATA	Select the data to be sent.	
	ALL WPT	Sends all the waypoints.
	ALL WPT+ROUTE	Sends all the waypoints and routes.
	SELECT WPT+ROUTE	Sends the selected route and the waypoint.
	ALL ROUTE	Sends all the routes.
	SELECT ROUTE	Sends the selected route.
ROUTE	This item can be set when SHARE ROUTE is selected. Select a route to be sent.	
TOTAL	This item can be set when SHARE ROUTE is selected. Displays the number of selected routes.	

A ROUTE can be selected manually or from a route list.

    c) When [START] is tapped, the route is sent.

(2) Receiving a route

    a) Tap [ROUTE RECEIVE].

Item	Description
SOURCE IP	Set a sending source IP.

    b) Tap [START] to set the sending source.

4.5.7 Setting route initial values

Set an initial value of each parameter of the route.
The values are applied to the route that was created by GOTO.

Procedure

1. [MENU] → [VOYAGE] → [DEFAULT SETTINGS]
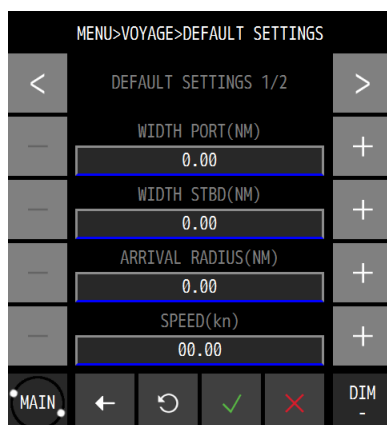
2. Set each item.

Item	Description
WIDTH PORT	Set a port route width.
WIDTH STBD	Set a starboard route width.
ARRIVAL RADIUS	Set an arrival radius.
SPEED	Set a planned ship speed.
SAIL	Route distance calculation method for LEG GC: Calculated by the great circle sailing. RL: Calculated by the Meridional part sailing (Rhumb Line).
SOG SMOOTHING	Set a SOG smoothing constant. Smoothing is applied to the ship speed for calculating the estimated time of arrival and the estimated time required. Smoothing can be applied up to 99 seconds. When the estimated time of arrival fluctuates significantly, increase the smoothing value.

3. Confirm the setting by tapping [✓].

4.6　Executing a Route

- A registered route or a temporary route can be executed.
- The following route selection methods are available.
  - (1) Select a route from a route list.
  - (2) Select a waypoint by using the GOTO key.
  - (3) Select a route by using the GOTO key.
  - (4) Select a temporary route by using the GOTO key.
- A route cannot be executed at the position exceeding North latitude/South latitude 89 degrees.
- For the route width, arrival radius, planned ship speed of the temporary route that was created by GOTO, the initial values of the route are used. For the setting of route initial values, refer to "4.5.7 Setting route initial values".
- The waypoint is updated when the ship arrives at the arrival circle.

4.6.1　Executing a route by selecting from a route list

A route can be executed by selecting from a route list.

Procedure

1.　MENU → VOYAGE → RUN

```
MENU>VOYAGE>RUN
          RUN
        RUNNING
         ROUTE
          001
      LEG CHANGE
  −      AUTO        +
       DIRECTION
  −      ORDER        
      NAVIGATION
  −       END        +
 MAIN  ←  ↺  ✓  ✕  DIM
                    -
```

2. Set each item.

Item	Description
ROUTE	Displays the route number to be executed.
LEG CHANGR	Select a waypoint update method.
	AUTO: When the ship arrives at the arrival circle (normal route) or WOL (TSC route), the waypoint is updated automatically. **WPT AUTO** is displayed. "WPT CHANGE" is displayed for 5 seconds.
	MANUAL: When the ship arrives at the arrival circle (normal route) or WOL (TSC route), the effect is notified to the user. The waypoint is to be updated manually. **WPT MAN** is displayed. "PLEASE PUSH "OK" AND CHANGE A ROUTE is displayed. Tap "OK". The waypoint is updated.
DIRECTION	Set an order of the waypoints to be executed. ORDER: Executes the route in the order of waypoints. REVERSE: Executes the route starting from the last waypoint.
NAVIGATION	Executes the route. START: Executes the route. END: Ends the route.

3. Select "START" in "NAVIGATION".

4. Execute the route by tapping [✓] .

4.6.2　Selecting a waypoint/route by using the GOTO key

When a waypoint or a route is selected by using GOTO that is assigned to "FUNC" of each screen, the route is executed towards the waypoint.
When a waypoint on the route that is being executed is selected by using the GOTO key, the route restarts from the waypoint.
The route that was created by GOTO is registered under route number 102 as a temporary route.

Procedure

1. Each screen → [FUNC] → [GOTO]

```
                    NAV>FUNC
        ┌──────┬──────┬──────┬──────┐
        │ WPT  │ROUTE │CURSOR│ WPT  │
        │ No.  │ No.  │ POSN │ LIST │
        ├──────┼──────┼──────┼──────┤
        │ROUTE │ROUTE │      │      │
        │ LIST │ END  │      │      │
        ├──────┼──────┼──────┼──────┤
        │      │      │      │      │
        │      │      │      │      │
        └──────┴──────┴──────┴──────┘

     ●MENU●    ←                 DIM
                                  -
```
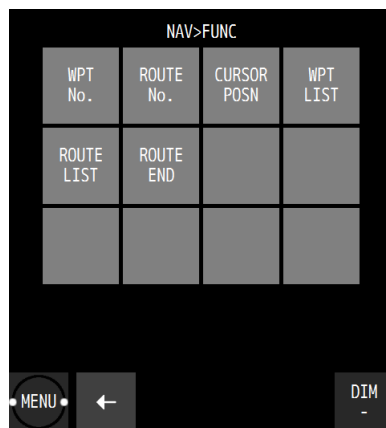
The GOTO submenu is outlined below.
(1)　HOME: Sets HOME in the waypoint list as the waypoint.
(2)　WPT No.: Enter a waypoint number.
(3)　ROUTE No.: Enter a route number.
(4)　EVENT No.: Enter an event number.
(5)　CURSOR POSN: The cursor position is specified as the waypoint (a temporary route can be created by setting up to 512 waypoints).
(6)　WPT LIST: Select from a waypoint list.
(7)　ROUTE LIST: Select from a route list.
(8)　EVENT LIST: Select from an event list.
(9)　ROUTE END: The route can be ended during the execution of the route.

(1)　Entering "HOME"

　　a) Tap [HOME] .

(2)　Entering a waypoint number

　　a) Tap [WPT No.] and enter a waypoint number.

　　b) Execute by tapping [✓] .

(3) Entering a route number

a) Tap [ROUTE No.] and enter a waypoint number.

b) Execute by tapping [✓].

(4) Entering an event number

a) Tap [EVENT No.] and enter an event number.

b) Execute by tapping [✓].

(5) Specifying the cursor position as the waypoint

a) When [CURSOR POSN] is tapped, a plotting screen is displayed.
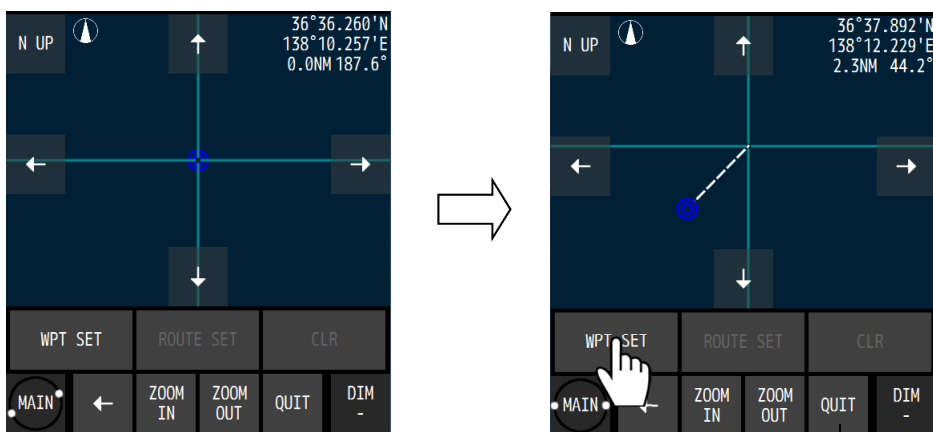
b) Move the cursor to the waypoint and tap "WPT SET".

Cancels GOTO processing

To create a route, repeat the operation b).
To delete a waypoint, tap "CLR".

c) Tap "ROUTE SET".

d) The following popup window is displayed.

REGISTER THE ROUTE INTO ROUTE LIST.
ARE YOU SURE?

YES   NO
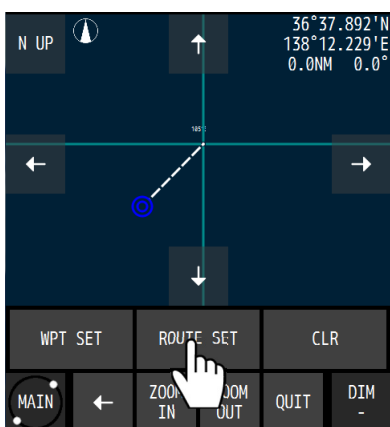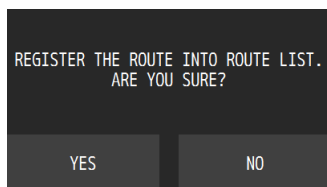
Item	Description
YES	Registers the route in the route list.
	When a route list is displayed, set a route number.
NO	Stores the route as a temporary route.
	A temporary route is cleared when the power is turned off.

(6) Selecting a waypoint from a waypoint list

a) When [WPT LIST] is tapped, a waypoint list is displayed.

b) Tap the number to be set as for the waypoint.

(7) Selecting from a route list

a) When [ROUTE LIST] is tapped, a waypoint list is displayed.

b) Tap the route number to be executed.

c) Select a waypoint update method and an execution sequence.

Item	Description
LEG CHANGE	Select a waypoint update method.
	AUTO: When the ship arrives at the arrival circle (normal route) or WOL (TSC route), the waypoint is updated automatically. **WPT AUTO** is displayed. "WPT CHANGE" is displayed for 5 seconds.
	MANUAL: When the ship arrives at the arrival circle (normal route) or WOL (TSC route), the effect is notified to the user. The waypoint is to be updated manually. **WPT MAN** is displayed. "PLEASE PUSH "OK" AND CHANGE A ROUTE" is displayed. Tap "OK". The waypoint is updated.
DIRECTION	Set a direction of the waypoints to be executed.
	ORDER: Executes the route in the order of waypoints.
	REVERSE: Executes the route starting from the last waypoint.

d) Select "START" in "NAVIGATION".

(8) Selecting from an event list

a) Tap [EVENT LIST] to display an event list.

b) Tap the number to be set as the waypoint.

(9) Ending the route that is currently being executed

a) Tap ROUTE END .

b) The following popup window is displayed.

```
┌─────────────────────────────────┐
│   ROUTE IN USE IS CANCELED      │
│        ARE YOU SURE             │
│                                 │
│      YES          NO            │
└─────────────────────────────────┘
```
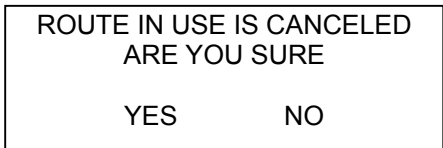
c) Tapping YES will end the route.

4.6.3   Ending a route

End a route.

Procedure

1. MENU → VOYAGE → RUN

3. Select "END" in "NAVIGATION".

4. Execute by tapping ✓ .

Ending by using GOTO

1. FUNC → GOTO

2. Tap ROUTE END .

3. The following popup window is displayed.

```
┌─────────────────────────────────┐
│   ROUTE IN USE IS CANCELED      │
│        ARE YOU SURE             │
│                                 │
│      YES          NO            │
└─────────────────────────────────┘
```
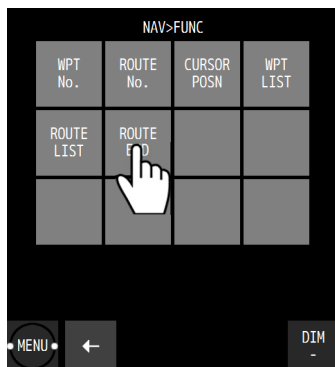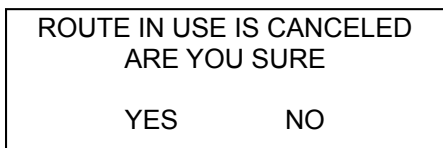
4. Tapping YES will end the route.

4.7 Event/Mark

- Events, marks, MOB, and lines are registered in an event mark list.

4.7.1 Displaying an event/mark list

- All the registered events and marks can be displayed in a list.
- MOB is registered under event number 000.
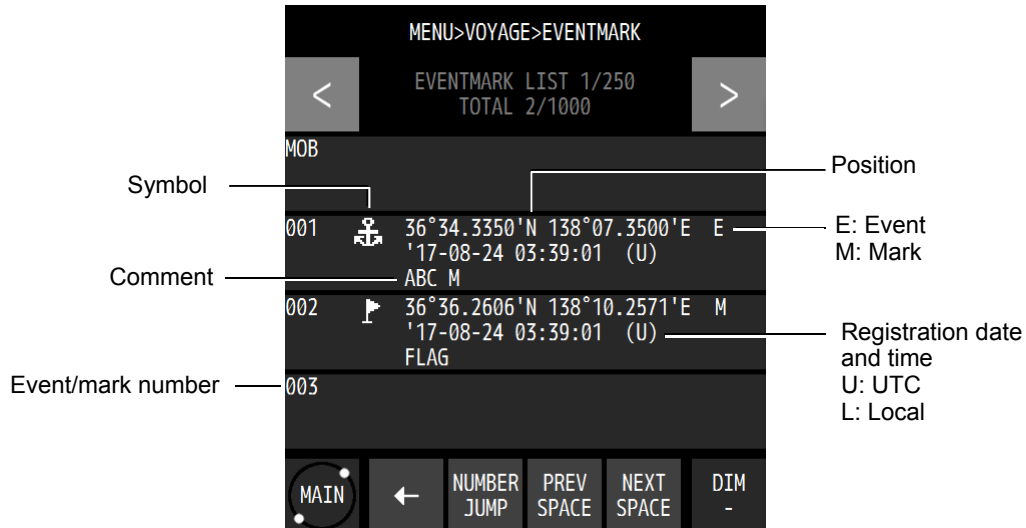
Procedure

1. MENU → VOYAGE → EVENT MARK

4.7.2 Registering events

Register an own ship's position as an event.

Procedure

1. FUNC → EVENT

Registering from a screen

1. Tap the position display section at the top of the screen.
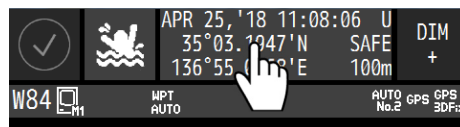
4.7.3   Registering marks

Register a cursor position as a mark.

Procedure

1. Display the PLOT1 or PLOT2 screen.
2. Display a cursor and move the cursor to the position to be marked.

3. FUNC → MARK

4.7.4 Editing events/marks

Symbols, colours, and comments of events/marks can be edited.

Procedure

1. [MENU] → [VOYAGE] → [EVENT MARK]

2. Tap an event or a mark to be edited.
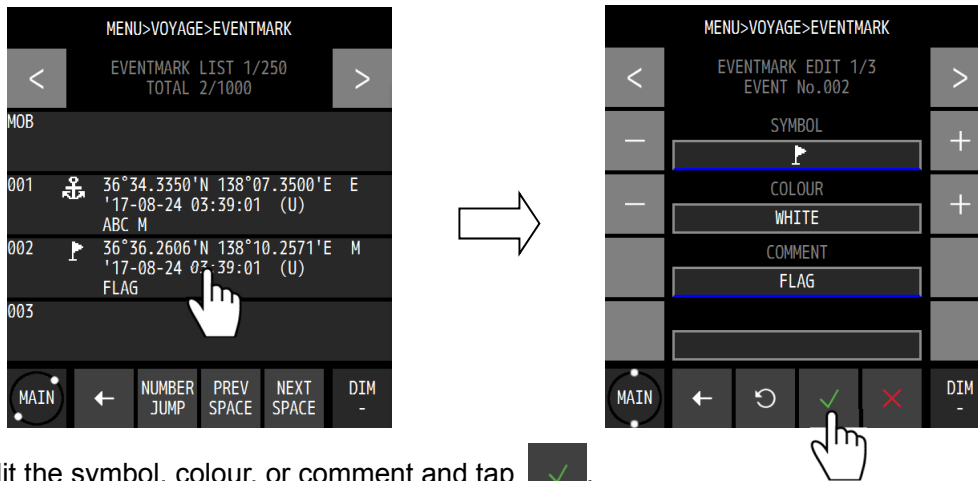
3. Edit the symbol, colour, or comment and tap [✓].

4.7.5 Deleting events/marks

Events/marks can be deleted.

Procedure

1. [MENU] → [VOYAGE] → [EVENT DELETE]

The event/mark deletion submenu is outlined below.
(1) EVENT MARK LIST: Select a deletion range from the event mark list.
(2) ALL EVENT: Deletes all the events.
(3) ALL MARK: Deletes all the marks.
(4) ALL EVENT MARK: Deletes all the events/marks.

(1) EVENT MARK LIST

a) When [EVENT MARK LIST] is tapped, an event mark list is displayed.

b) Tap a starting point and an ending point of the event marks to be deleted.
When deleting only one point, specify the same number for a starting point and an ending point.

c) Confirm by using [✓].

(2) ALL EVENT

a) Tap ALL EVENT .

(3) ALL MARK

a) Tap ALL MARK .

(4) ALL EVENT MARK

a) Tap ALL EVENT MARK .

2. When a deletion confirmation popup window is displayed, tap "YES".

4.8 Plotting Screen

4.8.1 Operating the cursor

Procedure

1. Display the PLOT1 or PLOT2 screen.

2. [FUNC] → [CURSOR MODE]

3. Move the cursor by using the Up/Down/Left/Right arrow keys.

Cursor position
Bearing/distance from own
ship to the cursor position
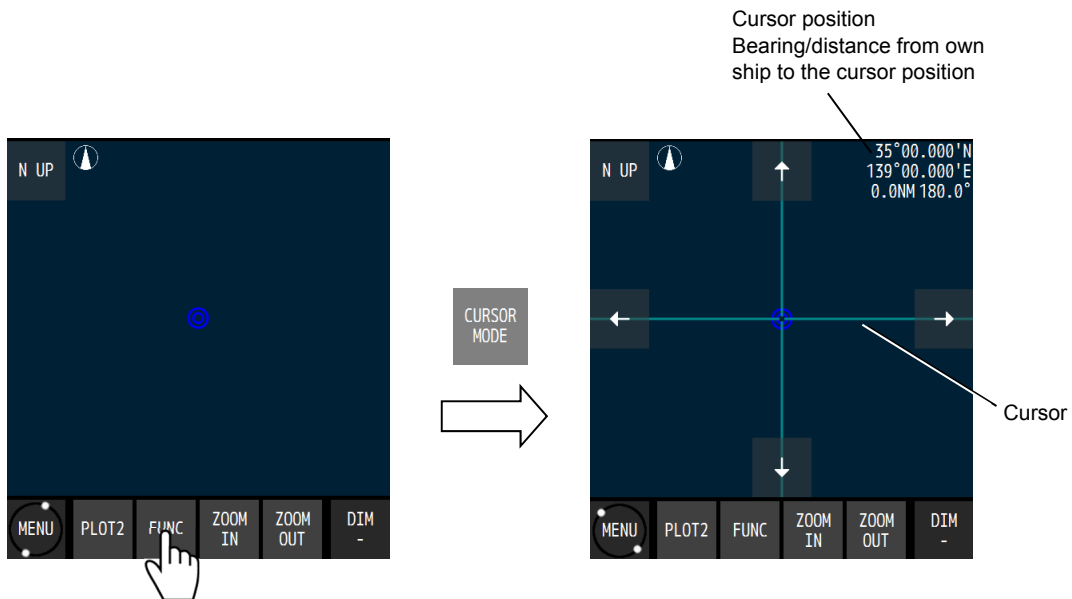
Cursor

4.8.2 Changing the cursor size

A cursor size can be selected from LARGE/MIDDLE/SMALL.

Procedure
1. Display the PLOT1 or PLOT2 screen.

2. [FUNC] → [PLOT] → [CURSOR]

3. Select a size and confirm it with [✓].

4.8.3 Moving a screen

The mouse can be used to move the tapped position to the centre of the screen.
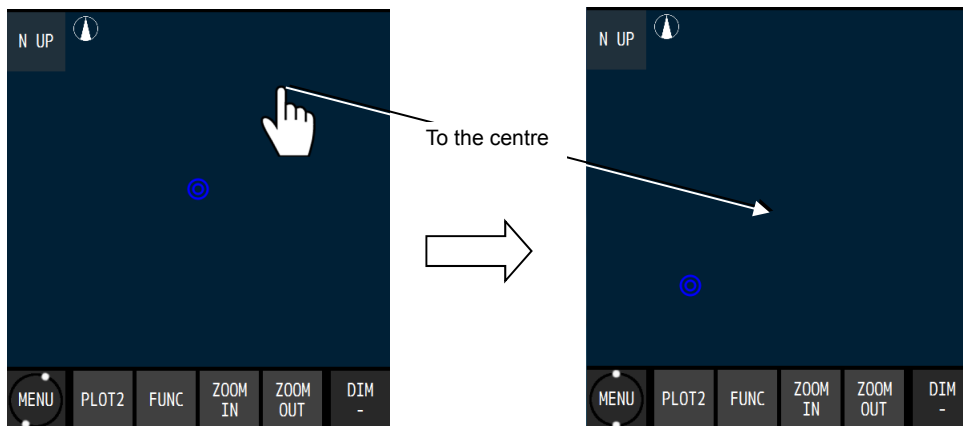
To the centre

4.8.4 Moving own ship to the centre of the screen

When own ship is within the screen range, the own ship's position can be moved to the centre of the screen by tapping it.
When own ship is moved to the position outside of the screen range, disabling its display, tap "HOME" at the bottom left corner of the screen.
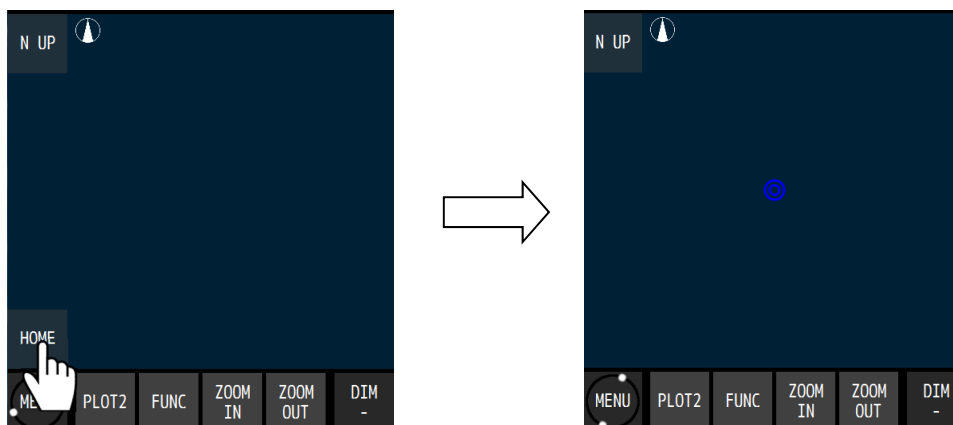
Memo

- When own ship is moved to the end of the screen, own ship is returned to the centre of the screen automatically.

- Own ship can also be moved to the centre of the screen by selecting "FUNC" → "HOME".

4.8.5   Screen Zoom In/Out

The plotting screen horizontal width is set in the following scale.
0.2, 0.5, 1.0, 2.0, 5.0, 10.0, 20.0, 50.0, 100.0, 200.0, and 300.0 [NM]

ZOOM IN ——————————   ———— ZOOM OUT
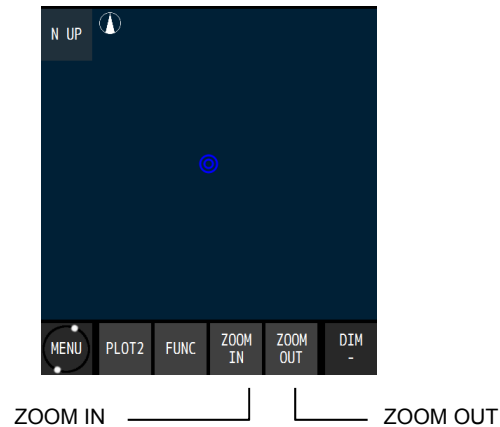
4.8.6   Changing North Up/Course Up

The screen mode can be changed to North Up, Course Up, or Relative North Up.
North Up: Own ship moves on the screen with North Up.
Course Up: The course of own ship is constantly set to the up position on the screen and the surrounding image moves.
Relative North Up: The top of the screen faces North and own ship's position is fixed and the surrounding image moves.
Whenever screen mode switching is tapped, the screen mode changes.

Switch
screen mode
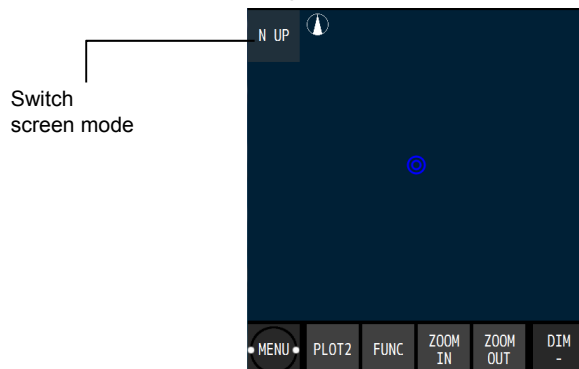
4.8.7　　Displaying tracks

Tracks can be displayed.
A track storage interval can be set by time or distance.

Procedure

1. Display the PLOT1 or PLOT2 screen.

2. FUNC → PLOT → TRACK

```
                PLOT>FUNC

                  TRACK

                TRACK LINE
   —       [         .         ]       +

                TRACK PERIOD
   —       [        OFF        ]       +


           [                   ]

           [                   ]
  MENU    ←    ↺    ✓    QUIT   DIM
                                  -
```

Item	Description	
TRACK LINE	Select a track drawing line.	
	• • •	A track is drawn with dots.
	———	A track is drawn with a line.
	- - - - - - ·	A track is drawn with a dotted line.
TRACK PERIOD	Set a track storage interval.	
	TIME	Up to 60 minutes can be set in second units by MIN/SEC.
	DIST	Up to 99.99NM can be set in 0.01NM units.
	OFF	Not stored

3. Set a storage interval and confirm with ✓ .

Deleting a track

1. Display the PLOT1 or PLOT2 screen.

2. FUNC → PLOT → TRACK DELETE

When the following popup window is displayed, select "YES".

```
          TRACK IS DELETED
          ARE YOU SURE?


          YES          NO
```
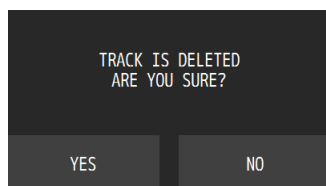
When "YES" is selected, the entire track is deleted. Partial deletion is not allowed.

When a radius is specified, a circle is displayed positioning own ship at the centre. The range that can be set is from 0.1NM to 9.9NM.
By setting a time, a vector line up to the position where the ship reaches within the set time can be displayed. The time can be set within the range from 0.1 to 9.9 minutes.

Own ship vector
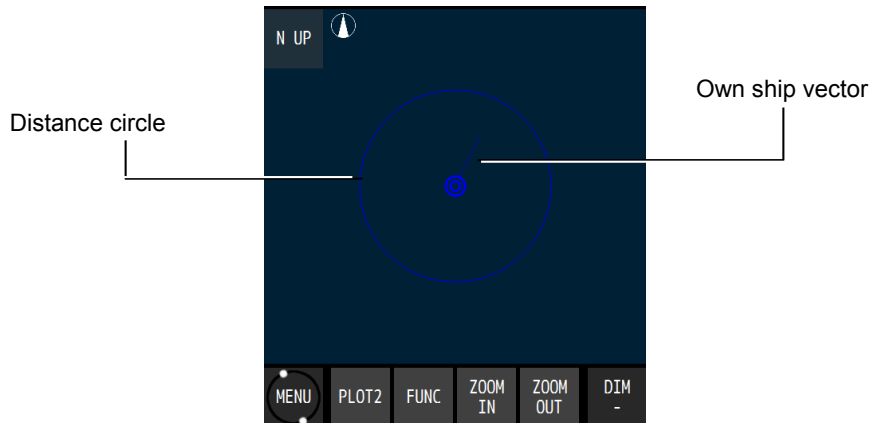
Distance circle

Procedure

1. Display the PLOT1 or PLOT2 screen.

2. FUNC → PLOT → OWN SHIP
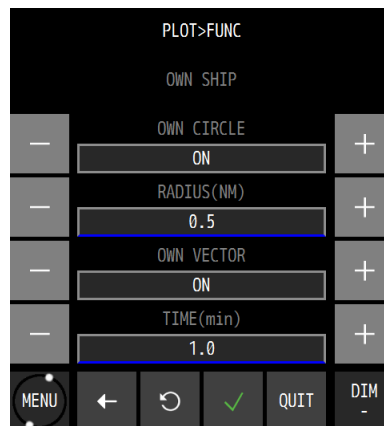
Item	Description
OWN CIRCLE	Set a distance circle from own ship.
RADIUS(NM)	Displayed when OWN CIRCLE is set to ON. Input a radius of the distance circle.
OWN VECTOR	Set an own ship's vector.
TIME(min)	Displayed when OWN VECTOR is set to ON. Displays the vector line up to the position that is reached within the time that is set.

3. Set a radius and a time and confirm the setting with ✓ .

4.8.9　Setting symbols to display/non-display

- Symbols that are displayed on a plotting screen can be set to non-display individually.
- Set the symbols that are not to be displayed to "OFF".
- Set the symbols that are to be displayed to "ON".
- The following symbols can be set to display/non-display.
  Waypoint, waypoint number, mark, event, event/mark number, track, arrival circle, route width, scale bar, symbol information, cursor position information, grid line, grid latitude, and grid longitude

Procedure

1. Display the PLOT1 or PLOT2 screen.

2. FUNC → PLOT → VISIBLE

3. Set the items to be displayed to "ON".

4. Confirm the setting with ✓ .

4.8.10　Displaying symbol information

When the cursor is moved to a waypoint, an event, or mark symbol, the contents of each symbol are displayed.

Procedure

1. Display the PLOT1 or PLOT2 screen.

2. FUNC → CURSOR MODE → A cursor is displayed...

3. Move the cursor to symbol whose information is to be displayed.
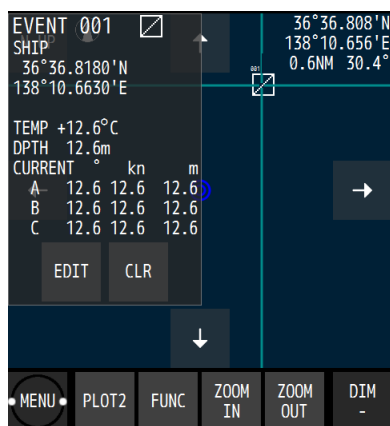
When a water temperature, a depth, and a current are received from external equipment, the water temperature, depth, and current at the storing of EVENT can be displayed. However, the external equipment must be connected.

To clear symbol information, move the cursor from the symbol.
To edit the information, tap "EDIT" and to clear the information, tap "CLR".

4.8.11　Changing a background colour

A background colour of a plotting screen can be changed.
The colors that can be set are DARK BLUE and WHITE.

Procedure

1. Display the PLOT1 or PLOT2 screen.

2. FUNC → PLOT → BACK GROUND COLOUR

3. Select a background colour.

4. Confirm the selection with ✓ .
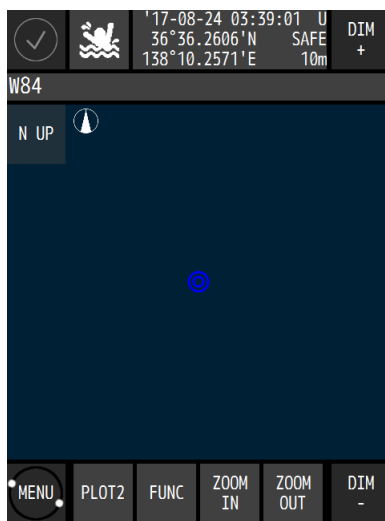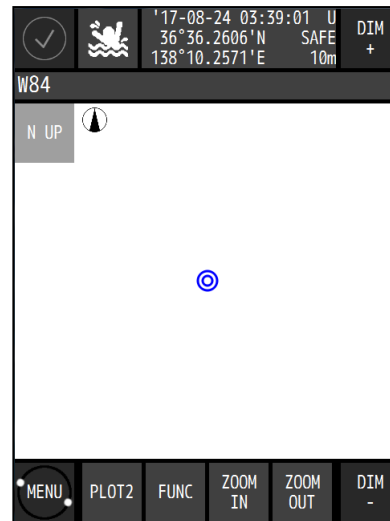
DARK BLUE   WHITE

4.9   Setting MOB

- MOB (Man-overboard) stores the position when a person or a material item fell overboard, by executing the MOB function. This function enables the ship to return to the position quickly.
- The MOB function is available on all the screens.

- When MOB is executed, a plotting screen is displayed automatically, the MOB mark is displayed, indicating the bearing and distance from the current position to the man-overboard position.

Procedure

1. Tap [icon].

Countdown for 5 seconds starts at the bottom right corner of the screen.   When [icon] is tapped again within 5 seconds, the MOB function is cancelled.

Executing MOB

After 5 seconds

Countdown

Bearing and distance up to the man-overboard position

Man-overboard position
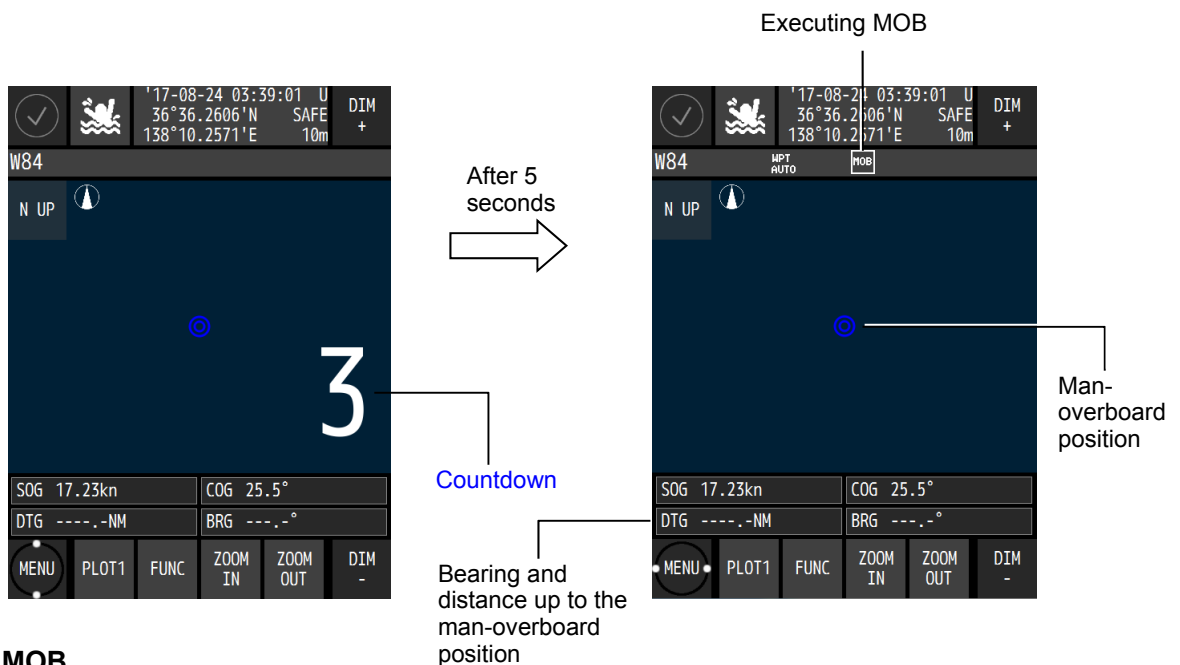
Ending MOB

1. Tap [icon] again.

2. When the following popup window is displayed, select "YES".

> EXIT FROM MOB.
> ARE YOU SURE?
>
> YES   NO
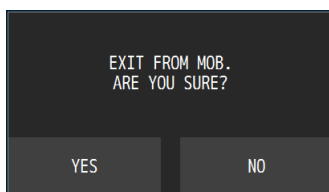
4.10 Setting Alerts

Fifteen types of alerts can be set. ON/OFF setting and buzzer ON/OFF can be set individually.
The alerts that can be set are outlined below.

(1) SYSTEM: The alert is issued at the occurrence of non-position fixing.
(2) ARRIVAL/ANCHOR: The alert is issued when the ship arrives at or crosses the track of the arrival circle radius.
Arrival and cross-track cannot be set concurrently.
(3) XTD/BOUNDARY: The alert is issued when the ship crosses from or approached the route width.
Cross-track and approach cannot be set concurrently.
(4) HDOP: The alert is issued when the HDOP value exceeds the setting value.
(5) SPEED: When the speed reaches within the setting range, the alert is issued.
(6) TRIP: The alert is issued when the trip exceeds the setting value.
(7) EARLY COURSE CHANGE:
The alert is issued when the time for reaching the wheel over point becomes below the setting value.
(8) END OF TRACK: The alert is issued when the time for reaching the final waypoint is below the setting value.
(9) ARRIVED AT WOL: The alert is issued when the ship reaches the wheel over point.
(10) ACTUAL COURSE CHANGE:
The alert is issued 30 seconds before the ship reaches the wheel over point.
(11) TEMP: The alert is issued when the water temperature comes within the setting range.
(12) DEPTH: The alert is issued when the water depth comes within the setting range.
(13) DGPS: The alert is issued when position fixing is changed from GPS to DGPS or from DGPS or GPS.
(14) BUFFER: The alert is issued at the occurrence of a built-in buffer unit error.
(15)POWER: The alert is issued at the occurrence of an external power supply error.
External equipment is required for water temperature and water depth alerts.

4.10.1 Setting alert/buzzer sounds

To set an alert, a password is necessary. For the input method, refer to "4.2.11 Entering a password with CODE INPUT".

Procedure
1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
   Password: 1650

2. [MENU] → [ALERT] → An alert list is displayed.
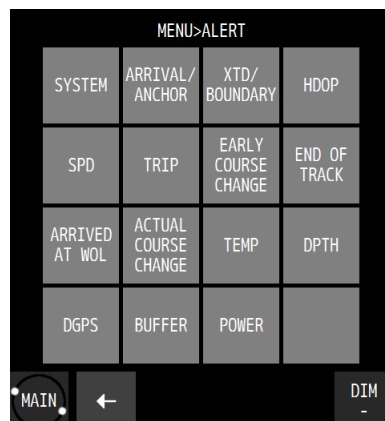
(1) Setting the SYSTEM alert

a) Tap SYSTEM .

MENU>ALERT>SYSTEM

SYSTEM

SET
OFF

SOUND
OFF

MAIN ← ✕ DIM -
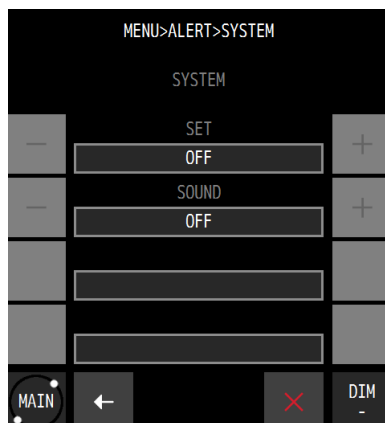
Item	Description
SET	Sets alert notification to ON/OFF. ON: Notifies the occurrence of an alert. OFF: Sets alert to OFF.
SOUND	Sets the buzzer sound upon the issuance of an alert to ON/OFF. ON: When an alert is issued, the alert is notified with a buzzer sound. OFF: Even if an alert is issued, a buzzer sound is not emitted.

(2) Setting ARRIVAL/ANCHOR alerts

The alert is issued when the ship arrives at or crossed the arrival circle radius that was set in the route. If the arrival circle radius is not set in the route, the alert is issued when the ship reaches the arrival circle radius that is set as the route initial value.
Arrival and cross-track cannot be set concurrently.

a) Tap ARRIVAL/ANCHOR .

Item	Description
SET	Sets alert notification to ON/OFF. ARRIVAL: Notifies the waypoint arrival alert. ANCHOR: Notifies the waypoint cross-track alert. OFF: Sets the alert to OFF.
SOUND	Sets the buzzer sound upon the issuance of an alert to ON/OFF. ON: When an alert is issued, the alert is notified with a buzzer sound. OFF: Even if an alert is issued, a buzzer sound is not emitted.

(3) Setting XTD/BOUNDARY alerts

The alert is issued when the ship cross-tracks from or approaches the route width that was set in the route. When the route width is not set in the route, an alert is issued when the ship cross-tracks from or enters in the route width that is set as the initial value in the route.
Cross-track and approach cannot be set concurrently.

a) Tap XTD/BOUNDARY .

Item	Description
SET	Sets alert notification to ON/OFF. XTD: Notifies a cross-track distance alert. BOUNDARY: Notifies a route approach alert. OFF: Sets the alert to OFF.
SOUND	Sets the buzzer sound upon the issuance of an alert to ON/OFF. ON: When an alert is issued, the alert is notified with a buzzer sound. OFF: Even if an alert is issued, a buzzer sound is not emitted.

(4) Setting the HDOP alert

a) Tap HDOP .

Item	Description
SET	Sets alert notification to ON/OFF. THRESHOLD: The alert is issued when HDOP exceeded the threshold value. OFF: Sets the alert to OFF.
THRESHOLD	Sets a HDOP threshold value. This item is not displayed when SET is OFF.
SOUND	Sets the buzzer sound upon the issuance of an alert to ON/OFF. ON: When an alert is issued, the alert is notified with a buzzer sound. OFF: Even if an alert is issued, a buzzer sound is not emitted.

(5) Setting the SPEED alert

a) Tap SPD .

Item	Description
SET	Sets alert notification to ON/OFF. OVER: The alert is issued when the ship speed exceeds the set speed. UNDER: The alert is issued when the ship speed is below the set speed. IN RANGE: The alert is issued when the ship speed is within the set speed range. OUT RANGE: The alert is issued when the ship speed is outside of the set ship speed range. OFF: Sets the alert to OFF.
THRESHOLD THRESHOLD(OVER) THRESHOLD(UNDER)	Set a ship speed threshold value when selecting "OVER"/"UNDER" in "SET". Set an upper limit and a lower limit of the ship speed range when selecting "IN RANGE"/"OUT RANGE" in "SET".
SOUND	Sets the buzzer sound upon the issuance of an alert to ON/OFF. ON: When an alert is issued, the alert is notified with a buzzer sound. OFF: Even if an alert is issued, a buzzer sound is not emitted.

(6) Setting the TRIP alert

a) Tap TRIP .

Item	Description
SET	Sets alert notification to ON/OFF. THRESHOLD: The alert is issued when the trip exceeds the set trip. OFF: Sets the alert to OFF.
THRESHOLD	Set a threshold value of the trip. This item is not displayed when SET is OFF.
SOUND	Sets the buzzer sound upon the issuance of an alert to ON/OFF. ON: When an alert is issued, the alert is notified with a buzzer sound. OFF: Even if an alert is issued, a buzzer sound is not emitted.

(7) Setting the EARLY COURSE CHANGE alert

a) Tap `EARLY COURSE CHANGE`.

Item	Description
SET	Sets alert notification to ON/OFF. THRESHOLD: The alert is issued when the time to reach the Wheel Over Point is less than the threshold value. OFF: Sets the alert to OFF.
THRESHOLD	Set a threshold value of EARLY COURSE CHANGE. A value from 3 minutes to 6 minutes can be set. This item is not displayed when SET is OFF.
SOUND	Sets the buzzer sound upon the issuance of an alert to ON/OFF. ON: When an alert is issued, the alert is notified with a buzzer sound. OFF: Even if an alert is issued, a buzzer sound is not emitted.

(8) Setting the END OF TRACK alert

a) Tap `END OF TRACK`.

Item	Description
SET	Sets alert notification to ON/OFF. THRESHOLD: The alert is issued when the time to reach the final waypoint is less than the threshold value. OFF: Sets the alert to OFF.
THRESHOLD	Set a threshold value of END OF TRACK. A value from 3 minutes to 6 minutes can be set. This item is not displayed when SET is OFF.
SOUND	Sets the buzzer sound upon the issuance of an alert to ON/OFF. ON: When an alert is issued, the alert is notified with a buzzer sound. OFF: Even if an alert is issued, a buzzer sound is not emitted.

(9) Setting the ARRIVED AT WOL alert

a) Tap `ARRIVED AT WOL`.

Item	Description
SET	Sets alert notification to ON/OFF. ON: Notifies the alert. OFF: Sets the alert to OFF.
SOUND	Sets the buzzer sound upon the issuance of an alert to ON/OFF. ON: When an alert is issued, the alert is notified with a buzzer sound. OFF: Even if an alert is issued, a buzzer sound is not emitted.

(10) Setting the ACTUAL COURSE CHANGE alert

a) Tap `ACTUAL COURSE CHANGE`.

Item	Description
SET	Sets alert notification to ON/OFF. ON: Notifies the alert. OFF: Sets the alert to OFF.
SOUND	Sets the buzzer sound upon the issuance of an alert to ON/OFF. ON: When an alert is issued, the alert is notified with a buzzer sound. OFF: Even if an alert is issued, a buzzer sound is not emitted.

(11) Setting the water temperature alert

a) Tap TEMP .

Item	Description
SET	Sets alert notification to ON/OFF. OVER: The alert is issued when the water temperature exceeds the set temperature. UNDER: The alert is issued when the water temperature is below the set temperature. IN RANGE: The alert is issued when the water temperature is within the set temperature range. OUT RANGE: The alert is issued when the water temperature is outside of the set water temperature range. OFF: Sets the alert to OFF.
THRESHOLD THRESHOLD(OVER) THRESHOLD(UNDER)	Set a water temperature threshold value when selecting "OVER"/UNDER" in "SET". Set an upper limit and a lower limit of the water temperature range when selecting "IN RANGE"/"OUT RANGE" in "SET".
SOUND	Sets the buzzer sound upon the issuance of an alert to ON/OFF. ON: When an alert is issued, the alert is notified with a buzzer sound. OFF: Even if an alert is issued, a buzzer sound is not emitted.

The water temperature alert requires external equipment.

(12) Setting the water depth alert

a) Tap DPTH .

Item	Description
SET	Sets alert notification to ON/OFF. OVER: The alert is issued when the water depth exceeds the set depth. UNDER: The alert is issued when the water depth is below the set depth. IN RANGE: The alert is issued when the water depth is within the set water depth range. OUT RANGE: The alert is issued when the water depth is outside of the set water depth range. OFF: Sets the alert to OFF.
THRESHOLD THRESHOLD(OVER) THRESHOLD(UNDER)	Set a water depth threshold value when selecting "OVER"/"UNDER" in "SET". Set an upper limit and a lower limit of the water depth range when selecting "IN RANGE"/"OUT RANGE" in "SET".
SOUND	Sets the buzzer sound upon the issuance of an alert to ON/OFF. ON: When an alert is issued, the alert is notified with a buzzer sound. OFF: Even if an alert is issued, a buzzer sound is not emitted.

The water depth alert requires external equipment.

(13) Setting the DGPS alert

a) Tap [DGPS] .

Item	Description
SET	Sets alert notification to ON/OFF. GPS→DGPS: The alert is issued when the positioning system is changed from GPS to DGPS. DGPS→GPS: The alert is issued when the positioning system is changed from DGPS to GPS. GPS⇔DGPS: The alert is issued when the positioning system is changed from GPS to DGPS or DGPS to GPS. OFF: Sets the alert to OFF.
SOUND	Sets the buzzer sound upon the issuance of an alert to ON/OFF. ON: When an alert is issued, the alert is notified with a buzzer sound. OFF: Even if an alert is issued, a buzzer sound is not emitted.

The DGPS alert is not notified to external equipment.

(14) Setting the BUFFER alert

a) Tap [BUFFER] .

Item	Description
SET	Sets alert notification to ON/OFF. ON: Notifies the alert. OFF: Sets the alert to OFF.
SOUND	Sets the buzzer sound upon the issuance of an alert to ON/OFF. ON: When an alert is issued, the alert is notified with a buzzer sound. OFF: Even if an alert is issued, a buzzer sound is not emitted.

(15) Setting the POWER alert

a) Tap [POWER] .

Item	Description
SET	Sets alert notification to ON/OFF. ON: Notifies the alert. OFF: Sets the alert to OFF.
SOUND	Sets the buzzer sound upon the issuance of an alert to ON/OFF. ON: When an alert is issued, the alert is notified with a buzzer sound. OFF: Even if an alert is issued, a buzzer sound is not emitted.

3. Confirm the settings with [✓] .

4.11 Alert List

The alerts that have occurred so far and the alert that is occurring, and the alerts that occurred in LAN can be displayed.

4.11.1 Displaying alert history

The alerts that have occurred so far can be displayed.
Up to 100 alerts can be displayed. If the number of alerts exceeds 100, the existing alerts are overwritten from the oldest one.

Procedure

1. [MENU] → [ALERT LIST] → [ALERT HISTORY]
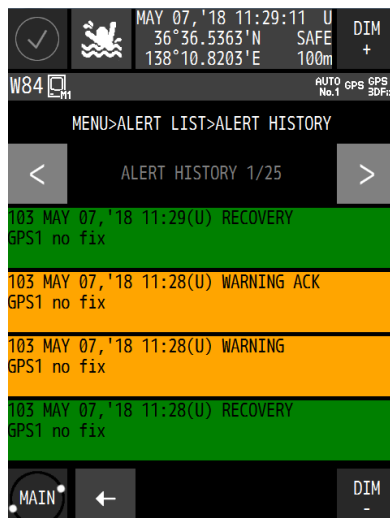
Rad : Alarm
Orange : Warning
Yellow : Caution
Green : Recovery

4.11.2 Displaying the alert that is occurring

The alert that is occurring can be displayed.
After the alert is resolved, the alert is deleted from the alert list.

Procedure

1. [MENU] → [ALERT LIST] → [ACTIVE ALERT]
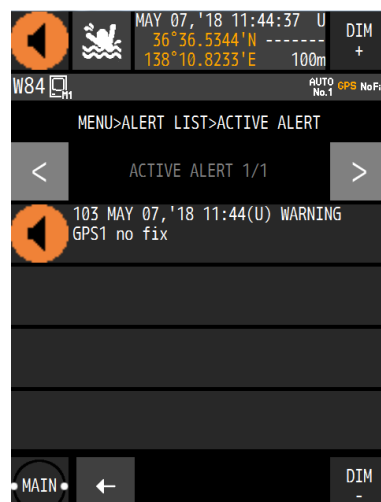
4.11.3   Displaying the alerts that occurred in LAN

The number of errors that occurred in LAN1/LAN2 is displayed.
The error court is cleared when the power is turned off.

Procedure

1. [MENU] → [ALERT LIST]

(1) Displaying the error count of LAN1

   a) Tap [LAN1].

(2) Displays the error count of LAN2

   a) Tap [LAN2].

```
                  MAY 08,'18 02:28:12  U    DIM
   (✓)     🏊      36°36.5347'N      SAFE    +
                  138°10.8235'E      100m
  W84 🖵              AUTO  GPS  GPS
      M1              No.1      3DFix
              MENU>ALERT LIST>LAN1
   <          ERROR COUNT 4/16          >
                      NAVD
    - DATAGRAM HEADER    :      0
    - TAG FORMAT         :      0
    - TAG CHECKSUM       :      1
    - TAG SYNTAX         :      0
    - TAG FRAMING        :      0
    - NMEA CHECKSUM      :      2
    - NMEA SYNTAX        :      0
    - NMEA LENGTH        :      0
    - NMEA CRP           :      0

   MAIN    ←            ALL    ×    DIM
                        CLR           -
```
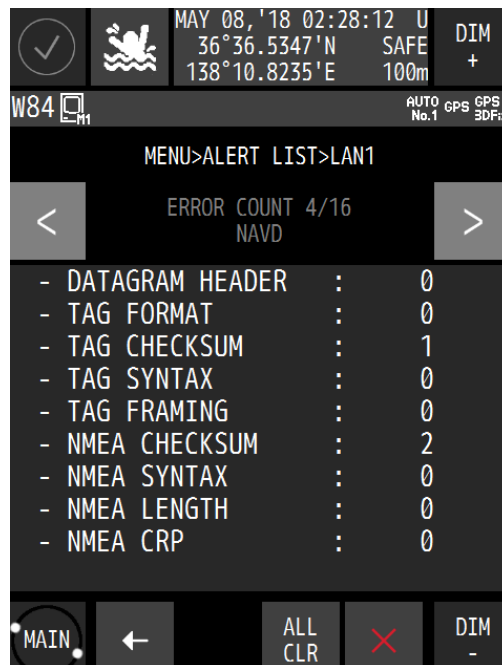
Clearing an alert

1. Enter a password by referencing "4.2.11 Entering a password in CODE INPUT".
    Password: 1650

2. [MENU] → [ALERT LIST] → [LAN1] → [ALL CLR]

To clear the LAN2 alert list, select [LAN2].

4.12 Initial Settings of GNSS/Beacon/SBAS

Set the GNSS sensor.
JLR-4350 supports multi-GNSS.
The available GNSS system combinations are as follows.
(1) GPS mode
    a) GPS
(2) Multi-GNSS mode
    a) GPS+QZSS
    b) GPS+GLONASS
    c) GPS+QZSS
    d) GPS+QZSS+GLONASS
    e) GPS+QZSS+BeiDou
Even in multi-GNSS mode also, GLONASS and BeiDou cannot be used concurrently.
DGLONASS and DBeiDou are not supported. When using DGPS by SBAS/beacon, use it in GPS mode.
In multi-GNSS mode also, position fixing is performed without using the systems that cannot be received by the satellites.

Memo	
GPS:	Global Positioning System. Positioning system that is operated by the U.S.A.
QZSS:	Quasi-Zenith Satellite System (Michibiki). Positioning system that is operated by Japan.
GLONASS:	Global Navigation Satellite System. Positioning system that is operated by Russia.
DeiDou:	Positioning system that is operated by China.

In JLR-4350, only QZSS No.1 can be used. Correction data cannot be received from QZSS.

4.12.1 Setting a positioning system

Select a GNSS system to be used.

In the processor with two sensors installed, the sensors must be set individually.
In this example, sensor 1 is connected. The same procedure is applied for setting sensor 2.

Procedure
1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
   Password: 1650

2. [MENU] → [GNSS SETTING] → [SENSOR1] → [GNSS]

GPS MODE	Description
GPS	Operates in GPS mode. Only GPS is used. To perform DGPS by SBAS/beacon, set "GPS".
GPS+QZSS	Operates in multi-GNSS mode. GPS and QZSS are used concurrently.
GPS+GLONASS	Operates in multi-GNSS mode. GPS and GLONASS are used concurrently.
GPS+BDS	Operates in multi-GNSS mode. GPS and BeiDou are used concurrently.
GPS+QZSS+GLONASS	Operates in multi-GNSS mode. GPS, QZSS, and GLONASS are used concurrently.
GPS+QZSS+BDS	Operates in multi-GNSS mode. GPS, QZSS, and BeiDou are used concurrently.

```
┌─────────┐
│  Memo   │
└─────────┘─────────────────────────────────────────────────────────
When a positioning system is changed, non-positioning is set temporarily.
Although the condition is rectified immediately, note that the information to the external equipment
that is connected is also set to non-positioning.
```

4.12.2　Setting a position fixing mode

A position fixing mode can be selected from Automatic, 3-dimensional position fixing, and 2-dimensional position fixing.

For a processor with two sensors connected, the sensors must be set individually.
In this example, sensor 1 is connected. The same procedure is applied for setting sensor 2 also.

Procedure
1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
   Password: 1650

2. [MENU] → [GNSS SETTING] → [SENSOR1] → [FIX MODE]

FIX MODE	Description
AUTO	Switches to the optimum position fixing mode automatically from the 3-dimensional position fixing or 2-dimensional position fixing mode.
2D	Positions in 2-dimensional position fixing mode.
3D	Positions in 3-dimensional position fixing mode.

4.12.3　Setting an elevation mask

Set an elevation mask.
When an elevation mask is set, the satellites of the elevations lower than the set value are not used for position fixing.

For a processor with two sensors connected, the sensors must be set individually.
In this example, sensor 1 is connected. The same procedure is applied for setting sensor 2 also.

Procedure
1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
   Password: 1650

2. [MENU] → [GNSS SETTING] → [SENSOR1] → [ELV MASK]

ELV MASK	Description
SAT ELV MASK	Set an elevation mask. Set an elevation within the range from 5 to 89 degrees.

4.12.4　Setting HDOP

Set a HDOP limit of the sensor. When HDOP exceeded the set value, the system is set to a non-position fixing mode.

For a processor with two sensors connected, the sensors must be set individually.
In this example, sensor 1 is connected. The same procedure is applied for setting sensor 2 also.

Procedure
1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
   Password: 1650

2. [MENU] → [GNSS SETTING] → [SENSOR1] → [HDOP]

HDOP	Description
HDOP	Set the threshold value of HDOP. Select 4, 10, or 20.

4.12.5　Setting position, speed, and course smoothing

Smoothing can be applied to the position that is fixed, speed, and course for the smooth changes. If the smoothing value is increased, processing becomes smoother, however, the trackability deteriorates. If the smoothing value is reduced, changes increase, however, the trackability improves. Set the optimum value according to the purpose.
JLR-4350 supports individual smoothing of position, speed, and course.

For a processor with two sensors connected, the sensors must be set individually.
In this example, sensor 1 is connected. The same procedure is applied for setting sensor 2 also.

Procedure
1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
   Password: 1650

2. [MENU] → [GNSS SETTING] → [SENSOR1] → [SMOOTH]

SMOOTH	Description
POSN SMOOTHING	Applies smoothing to position changes. A value between 0 second and 99 seconds can be set.
SPEED SMOOTHING	Applies smoothing to speed changes. A value between 0 second and 99 seconds can be set.
COURSE SMOOTHING	Applies smoothing to course changes. A value between 0 second and 99 seconds can be set.

Memo

When the smoothing value is increased, the trackability of quick turning and sudden speed change deteriorates.
Normally, the setting of 10 seconds or less is recommended. The default value is 10 seconds.
When setting a higher value, adequate caution is necessary.

4.12.6　Setting RAIM

RAIM (Receiver Autonomous Integrity Monitoring) checks the accuracy of GPS with the accuracy level and displays the status.
When the reliability of the error that was obtained is 95% or higher, the state is displayed as "SAFE" or "UNSAFE". When the reliability is 95% or lower, "CAUTION" is displayed.
　　SAFE: The position error is within the set accuracy level.
　　CAUTION: Cannot calculate with the set accuracy level.
　　UNSAFE: The position error exceeded the set accuracy level.
An accuracy level of RAIM can be set.
An accuracy level can be selected from OFF, 10m, 30m, 50m, and 100m.
To perform GPS independent position fixing, set 30m or more. If GPS independent position fixing is performed by setting 10m, the reliability 95% is not satisfied and this may result in "CAUTION".
When OFF is set, "RAIM OFF" is displayed on the screen, and the RAIM function stops. Therefore, when RAIM is OFF, the system cannot perform calculation as to whether the reliability is within the accuracy level.

For a processor with two sensors connected, the sensors must be set individually.
In this example, sensor 1 is connected. The same procedure is applied for setting sensor 2 also.

Procedure

1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
    Password: 1650

2. MENU → GNSS SETTING → SENSOR1 → RAIM

RAIM	Description
RAIM ACCURACY LEVEL	Set an accuracy level of RAIM. Select from OFF, 100m, 50m, 30m, and 10m.

> **Memo**
>
> RAIM
> RAIM is the abbreviation of Receiver Autonomous Integrity Monitoring and checks, in the receiver, if the position accuracy that was fixed by GNSS is within the necessary accuracy.

4.12.7　Setting a geodetic system

A geodetic system of the position that was fixed can be set.
For the geodetic systems that can be set, refer to "Appendix 1 Geodetic System".

For a processor with two sensors connected, the sensors must be set individually.
In this example, sensor 1 connected. The same procedure is applied for setting sensor 2 also.

Procedure

1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
    Password: 1650

2. MENU → GNSS SETTING → SENSOR1 → DATUM

DATUM	Description
DATUM	Set a geodetic system. For the geodetic systems that can be set, refer to "Appendix 1 Geodetic System".

4.12.8   Initialising sensors

Initialise sensors.
Set a general position and current date and time (UTC) of the sensor.

For a processor with two sensors connected, the sensors must be set individually.
In this example, sensor 1 is connected. The same procedure is applied for setting sensor 2 also.

Procedure

1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
    Password: 1650

2. [MENU] → [GNSS SETTING] → [SENSOR1] → [INIT]

INIT	Description
QUADRANT	Select North latitude/South latitude/East latitude/West latitude of the sensor position.
LAT	Enter a general position (latitude) of the sensor.
LON	Enter a general position (longitude) of the sensor.
ANT HEIGHT	Enter a general position (height) of the sensor. For 2-dimensional position fixing, this height is used.
YEAR	Enter the current year (UTC).
MONTH	Enter the current month (UTC).
DAY	Enter the current day (UTC).
HOUR	Enter the current hour (UTC).
MINUTE	Enter the current minute (UTC).

4.12.9   Setting a DGPS correction mode

A DGPS correction mode can be selected.
To perform DGPS correction, set the positioning system to "GPS".
In multi-GNSS mode, DGPS positioning cannot be performed.
If a correction mode is set in multi-GNSS mode, the positioning system is automatically set to "GPS".
JLR-4350 does not support DGLONASS and DBeiDou. Correction data of QZSS cannot be received.

For a processor with two sensors connected, the sensors must be set individually.
In this example, sensor 1 is connected. The same procedure is applied for setting sensor 2 also.

Procedure
1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
    Password: 1650

2. [MENU] → [GNSS SETTING] → [SENSOR1] → [DGPS]

DGPS	Description
AUTO	Selects beacon or SBAS automatically. When both a beacon and SBAS can be received, priority is given to a beacon. When neither a beacon nor SBAS can be received, GPS positioning is performed.
BEACON	Performs DGPS by using a beacon. When a beacon cannot be received, GPS positioning is performed.
SBAS	Performs DGPS by SBAS. When SBAS cannot be received, GPS positioning is performed.
OFF	DGPS positioning is not performed.

Memo

・When a correction mode is set in multi-GNSS mode, the positioning system is automatically switched to "GPS". In this case, the system is set to non-positioning temporarily.
・When setting SBAS, it takes time to SBAS positioning because it searches SABS satellites.

4.12.10 Setting a beacon

Set DGPS by using a beacon.

For a processor with two sensors connected, the sensors must be set individually.
In this example, sensor 1 is connected. The same procedure is applied for setting sensor 2 also.

Procedure
1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
   Password: 1650

2. MENU → GNSS SETTING → SENSOR1 → BEACON

3. Set a beacon station selection method.
The selection method is outlined below.
(1) AUTO: Selects an optimum beacon station from the GPS position.
(2) MANUAL: Set a frequency and a baud rate of the beacon station manually.
(3) SEMI AUTO: Automatically selects an optimum beacon station from up to three stations that
             are selected from the adjacent stations at random. JLR-8600 does not support
             this function.
(4) MONITOR: JLR-8600 does not support this function.

(1) AUTO

   a) Tap AUTO .

(2) MANUAL

   a) Tap MANUAL .

MANUAL	Description
FREQUENCY	Set a frequency.
BITRATE	Set a bit rate.

   b) Tap ✓ to confirm the setting.

4.12.11   Setting SBAS

Set DGPS by SBAS.

For a processor with two sensors connected, the sensors must be set individually.
In this example, sensor 1 is connected. The same procedure is applied for setting sensor 2 also.

Procedure
1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
    Password: 1650

2. MENU → GNSS SETTING → SENSOR1 → SBAS

SBAS	Description
SAT SEARCH	AUTO: Selects an optimum SBAS satellite. MANUAL: Set a SBAS satellite number.
SBAS	When SAT SEARCH is set to MANUAL, set a SBAS satellite number.
TYPE 0	Set the use of TYPE 0 data (test data) to ON/OFF. Normally, set to "OFF".
RANGING	Set whether the SBAS satellite is used for positioning in the same way as the GPS satellite. Since JLR-4350 is not equipped with the ranging function, set to "OFF".

4.12.12   Displaying a beacon station list

JLR-8600 does not support this function.

Display a list of all the beacon stations.
Up to 1024 stations can be displayed.

For a processor with two sensors connected, the sensors must be set individually.
In this example, sensor 1 is connected. The same procedure is applied for setting sensor 2 also.

4.13   Configuring a System

4.13.1   Setting time difference/date display

A time difference between UTC and the local time can be set.
In the case of a Japan time, enter +-9:00 since the time difference is +9 hours.
When a time difference is set, the local time ("L") is displayed.
A date/time display format can be selected.

Procedure
1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
   Password: 1650

2. MENU → SYSTEM → DATE/TIME

Item	Description
TIME DIFF	Set a time difference.
DATE DISP	Select a date display format from the following: 'YY-MM-DD / DD MMM, 'YY / MMM DD, 'YY.
TIME DISP	24hr: Displays a time from 00:00 to 23:59. 12hr: Displays a time from AM/PM 00:00 to 11:59.

3. Confirm the setting with ✓ .

4.13.2   Setting units

Set units of ship speed, distance, height, depth, and temperature.

Procedure
1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
   Password: 1650

2. MENU → SYSTEM → UNIT

Item	Description
DIST/SPEED	Select a unit of a distance and a ship speed from NM,kn / km,km/h / mi,mi/h.
HIGHT/DPTH	Select a unit of a height and a depth from m / ft / fm.
SETTING METHOD	Case where fm is selected MANUAL: A converted value between fm and m can be set. DEFAULT: A converted value between fm and m is 1.8288m.
CONVERTED VALUE	Set a converted value between fm and m.
TEMP	Select a water temperature from Celsius/Fahrenheit.

3. Confirm the selecting with ✓ .

4.13.3　Setting magnetic correction

Magnetic correction can be applied to the route that was obtained from GPS.

Procedure
1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
   Password: 1650

2. [MENU] → [SYSTEM] → [MAG CORR]

MAG CORR	Description
AUTO	Performs correction automatically by calculating the correction value from the GPS position.
MANUAL	Performs correction with the correction value that was input. EAST/WEST: Select East longitude or West longitude. CORRECTION VALUE: Enter a correction value.
OFF	Does not perform correction.

3. Confirm the setting with [✓].

4.13.4　Setting LORAN A/C

A position can be displayed or set with a time difference.
When LORAN A/C is set, all the position information is displayed in time difference.

Procedure
1. Enter a password by referencing "4.2.11 Entering a password in CODE INPUT".
   Password: 1650

2. [MENU] → [SYSTEM] → [LORAN]

LORAN	Description
LORAN A	[<] [>] : Moves to the LORAN A setting screen.
LORAN C	[<] [>] : Moves to the LORAN C setting screen.
OFF	Displays in the latitude/longitude.

3. Enter each setting value.

4. Tap [✓] to confirm the setting.

> **Memo**
> - LORAN A stations that can be set
>   1S1,1S2,1S3,1S4,1S6,1L0,1L1,1L4,1L5,2S0,2S1,2S2,2S3,2S4,2S5,2S6,2S7,2H4,2H5, 2H6
> - LORAN C chains that can be set
>   4990, 5930, 5970, 5980, 5990, 6730, 6731, 6780, 7001, 7030, 7170, 7270, 7430, 7499, 7930, 7950, 7960, 7970, 7980, 7990, 8000, 8290, 8390, 8830, 8930, 8970, 8990, 9007, 9610, 9930, 9940, 9960, 9970, 9980, 9990

4.13.5   Selecting a sensor

Specify which sensor will be displayed when two sensors are connected to one processor.

Procedure
1. Enter a password by referencing "4.2.11 Entering a password in CODE INPUT".
    Password: 1650

2. [MENU] → [SYSTEM] → Select a sensor.

Item	Description
AUTO	Preferentially displays the sensor of sensor port 1.
SENSOR1	Displays the sensor connected to sensor port 1.
SENSOR2	Displays the sensor connected to sensor port 2.

4.14   Printing

When a network printer or serial printer (DPU-414/NKG-104) is connected, data is transmitted to the printer.

Procedure

1. [FUNC] → [PRINT]

Whenever [PRINT] is tapped, printing data is transmitted.

> **Memo**
>
> To perform printing, a port must be set in the installation.
> To perform interval printing, a port must be set in the installation.

4.15   Setting a Language

Select a display language.
Japanese and English can be selected as the language.

Procedure
1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
   Password: 1650

2. [MENU] → [LANGUAGE]

4.16   Verifying Versions

Display version information of each unit.

Procedure
1. Enter a password by referencing "4.2.11. Entering a password with CODE INPUT".
   Password: 1650

2. [MENU] → [VERSION]

3. Change the unit by using [<] [>].

4.17 Displaying a total trip distance

A total trip distance can be displayed on navigation aid screen 2.
A trip distance can be calculated on the total trip distance display screen.
Total trip distance calculation continues even if the trip distance measurement is interrupted.

4.17.1 Starting/stopping measurement of a trip distance

Procedure

1. Display navigation aid information screen 2 by selecting [NAV ASSIST] and tapping [>] several times.

2. [FUNC] → [CALC START]

Trip distance calculation starts.

Tap the following to interrupt the calculation.

3. [FUNC] → [CALC END]

Trip distance calculation is interrupted.

By tapping [CALC START] again, trip distance calculation can be restarted.

4.17.2 Resetting a trip distance

A trip distance can be reset even during the calculation of a total trip distance.
Even if a trip distance is reset, the total trip distance is not reset.

Procedure

1. Display navigation aid information screen 2 by selecting [NAV ASSIST] and tapping [>] several times.

2. [FUNC] → [TRIP RESET]

The trip distance is reset.

4.17.3 Resetting a total trip distance

A total trip distance can be reset.
Once a total trip distance is reset, it is reset to zero. The trip distance is also reset to zero.

Procedure

1. Display navigation aid information screen 2 by selecting [NAV ASSIST] and tapping [>] several times.

2. [FUNC] → [TOTAL TRIP RESET]

The total trip distance is reset.

4.18 Measuring a trip distance

A trip distance can be measured on navigation aid screen 3.
Two trip distances can be measured simultaneously in this equipment.

4.18.1 Starting/stopping measurement

Procedure

1. Display navigation aid information 3 screen by selecting [NAV ASSIST] and tapping [>] several times.

2. [FUNC] → [TRIP1 CALC START]

Measurement of trip distance 1 starts.

To start measurement of trip distance 2, tap [TRIP2 CALC START].

To stop measurement, do the following.

3. Display navigation aid information 3 screen by selecting [NAV ASSIST] and tapping [>] several times.

4. [FUNC] → [TRIP1 CALC END]

Measurement of trip distance 1 stops.

To stop measurement of trip distance 2, tap [TRIP2 CALC END].

4.18.2 Resetting a trip distance

A trip distance can be reset.
Once a trip distance is reset, it is set to zero.

Procedure

1. Display navigation aid information screen 3 by selecting [NAV ASSIST] and tapping [>] several times.

2. [FUNC] → [TRIP1 RESET]

Trip distance 1 is reset.

To reset trip distance 2, tap [TRIP2 RESET].

4.19   Displaying external equipment information

Information on the ship speed through water, water temperature, water depth, and tidal stream can be displayed by entering it on the external equipment.
It is possible to make the setting of each layer of the tidal stream to be displayed. Up to five layers can be displayed.

Procedure

1. Display navigation aid information screen 4 by selecting [NAV ASSIST] and tapping [>] several times.

2. [FUNC] → [CURRENT SETTING]

3. By using [<] or [>], select a layer (layer A to layer E) to be set.

Item	Description
SELECT	SELECT: Set a Layer Number. ALL: Displays the data having the highest Layer Number.
LAYER	Specify a Layer Number to be displayed.
DATA SETTING METHOD	SELECT: Set a data set number. ALL: Displays data of all the data set numbers.
DATA	Specify a data set number to be displayed.

Recommended setting

Item	LAYER A	LAYER B	LAYER C	LAYER D	LAYER E
SELECT	SELECT	SELECT	SELECT	SELECT	SELECT
LAYER	1	2	3	4	5
DATA SETTING METHOD	ALL	ALL	ALL	ALL	ALL
DATA	—	—	—	—	—

4.20   Measuring a distance and an azimuth between two points

A distance and an azimuth between any two points can be measured.

Procedure

1. Display navigation aid information screen 5 by selecting [NAV ASSIST] and tapping [>] several times.

2. [FUNC] → [CALC SETTING]

3. Enter a start position.

4. Enter an end position.

5. Select a calculation method.

6. Tap [✓].

Chapter 5 Maintenance and Inspection

Proper maintenance may greatly affect the lifespan of the equipment.   In order to maintain the equipment in peak state, perform the following regularly.

⚠ WARNING

🚫 Do not perform internal inspections or modifications of the equipment. Inspection or modification by unauthorized personnel may result in fire, electric shock, or equipment failure.   Please consult with JRC or an affiliate to perform internal inspections or repair.

⚠ CAUTION

🚫 Do not use benzine, alcohol or thinner when caring this equipment. Doing so may result in removing the paint or changing of properties. Wipe off the grime lightly with a dry soft cloth.

❗ Use only the specified fuse.
Failure to do so may result in fire or equipment failure.

❗ Use only the specified batteries.
Failure to do so may result in equipment failure or malfunction.

5.1   General Maintenance and Inspection

・Operate the equipment under standard power voltage levels (DC 10.8 - 31.2 V).

・The following shows general maintenance and inspection methods using standard tools.

No.	Item	Maintenance and Inspection
1	Cleaning	Clean the panel screen, knobs, and switches with a soft cloth. There are no gears in the unit, so oil lubrication is unnecessary.
2	Parts Securing	Check for loose screws, nuts, and connectors, and connect securely any that have loosened.

Perform inspection of the displayed items when the equipment is functioning normally.   Compare operating results to the normal operation values in order to det

5.2   Alerts

Refer to "4.12 Alert Lists" and check if any alert is given or not. If it is, check the details referring to the list shown below.

Main GPS Sensor

Alert Number	Alert text	Causes	Category	Priority
103	GPS1 no fix	No Fix	B	W
106	GPS2 no fix	No Fix	B	W
109	GPS3 no fix	No Fix	B	W
002	GPSn HDOP over	HDOP value has been exceeded setting level	B	C
003	GPSn no heading	No Heading	B	W
020	GPSn Ant open	GPS Antenna Open	B	W
021	GPSn Ant short	GPS Antenna Short	B	W
022	GPSn ROM error	GPS core ROM Error	B	W
023	GPSn RAM error	GPS core RAM Error	B	W
024	GPSn RTC error	GPS core RTC Error	B	W
025	Cntln ROM error	ROM Error (Controller of Sensor)	B	W
026	Cntln RAM error	RAM Error (Controller of Sensor)	B	W
027	Cntln FPGA error	FPGA Error (Controller of Sensor)	B	W
028	Cntln BACK error	Data Backup Error (Controller of Sensor)	B	W
029	GPSn ID error	Sensor Product information Error	B	C
030	GPSn core1 err	GPS core 1 Error	B	W
031	GPSn core2 err	GPS core 2 Error	B	W
032	GPSn core3 err	GPS core 3 Error	B	W
033	GPSn x gyro err	X axis Gyroscope Error	B	W
034	GPSn y gyro err	Y axis Gyroscope Error	B	W
035	GPSn z gyro err	Y axis Gyroscope Error	B	W
036	GPSn g sen err	Tilt meter Error	B	W
037	GPSn temp err	Temperature Sensor Error	B	W
038	GPSn inner err	Sensor inside Error	B	W
039	GPSn core1no prg	GPS core 1 program Error	B	W
040	GPSn core2no prg	GPS core 2 program Error	B	W
041	GPSn core3no prg	GPS core 3 program Error	B	W
042	GPSn Vibration	Excessive Vibration	B	W
043	GPSn ctrl no prg	Controller program Error	B	W

Sub GPS Sensor

Alert Number	Alert text	Causes	Category	Priority
113	GPS4 no fix	No Fix	B	W
116	GPS5 no fix	No Fix	B	W
119	GPS6 no fix	No Fix	B	W
012	GPSm HDOP over	HDOP value has been exceeded setting level	B	C
013	GPSm no heading	No Heading	B	W
060	GPSm Ant open	GPS Antenna Open	B	W
061	GPSm Ant short	GPS Antenna Short	B	W
062	GPSm ROM error	GPS core ROM Error	B	W
063	GPSm RAM error	GPS core RAM Error	B	W
064	GPSm RTC error	GPS core RTC Error	B	W
065	Cntlm ROM error	ROM Error (Controller of Sensor)	B	W
066	Cntlm RAM error	RAM Error (Controller of Sensor)	B	W
067	Cntlm FPGA error	FPGA Error (Controller of Sensor)	B	W
068	Cntlm BACK error	Data Backup Error (Controller of Sensor)	B	W
069	GPSm ID error	Sensor Product information Error	B	C
070	GPSm core1 err	GPS core 1 Error	B	W
071	GPSm core2 err	GPS core 2 Error	B	W
072	GPSm core3 err	GPS core 3 Error	B	W
073	GPSm x gyro err	X axis Gyroscope Error	B	W
074	GPSm y gyro err	Y axis Gyroscope Error	B	W
075	GPSm z gyro err	Y axis Gyroscope Error	B	W
076	GPSm g sen err	Tilt meter Error	B	W
077	GPSm temp err	Temperature Sensor Error	B	W
078	GPSm inner err	Sensor inside Error	B	W
079	GPSm core1no prg	GPS core 1 program Error	B	W
080	GPSm core2no prg	GPS core 2 program Error	B	W
081	GPSm core3no prg	GPS core 3 program Error	B	W
082	GPSm Vibration	Excessive Vibration	B	W
083	GPSm ctrl no prg	Controller program Error	B	W
103	GPS1 no fix	No Fix	B	W
106	GPS2 no fix	No Fix	B	W
109	GPS3 no fix	No Fix	B	W
113	GPS4 no fix	No Fix	B	W
116	GPS5 no fix	No Fix	B	W
119	GPS6 no fix	No Fix	B	W

Display Unit

Alert Number	Alert text	Causes	Category	Priority
150	DISP eMMC err	eMMC Deletion, Write Error	B	W
151	DISP E2PROM err	EEPROM Deletion, Write Error	B	W
152	DISP RAM err	RAM Read, Write Error	B	W
153	DISP SIO err	Serial Port Error	B	W
154	DISP LAN err	LAN Port Error	B	W

Processing Unit

Alert Number	Alert text	Causes	Category	Priority
200	Flash rom1 error	FLASH ROM Deletion, Write Error	B	W
201	Flash rom2 error	FLASH ROM2 Deletion, Write Error	B	W
202	Flash rom3 error	FLASH ROM3 Deletion, Write Error	B	W
203	RAM error	RAM Read, Write Error	B	W
204	SIO1 error	Serial Port 1 Error	B	W
205	SIO2 error	Serial Port 2 Error	B	W
206	SIO3 error	Serial Port 3 Error	B	W
207	SIO4 error	Serial Port 4 Error	B	W
208	SIO5 error	Serial Port 5 Error	B	W
209	SIO6 error	Serial Port 6 Error	B	W
210	SIO7 error	Serial Port 7 Error	B	W
211	SIO8 error	Serial Port 8 Error	B	W
212	SIO9 error	Serial Port 9 Error	B	W
213	SIO10 error	Serial Port 10 Error	B	W
214	SIO11 error	Serial Port 11 Error	B	W
215	SIO12 error	Serial Port 12 Error	B	W
216	SIO13 error	Serial Port 13 Error	B	W
217	LAN disp error	Display LAN port Error	B	W
218	LAN1 error	LAN 1 Error	B	W
219	LAN2 error	LAN 2 Error	B	W
220	BUFF error	Inside Buffer Error	B	W
221	main power fail	Main Power Unit Fail	B	W
230	GPSn no rx	Periodic input not possible from Main GPS Sensor	B	W
231	GPSn no res	Answer back not possible from Main GPS Sensor	B	W
232	GPSn data short	Main GPS data is invalid	B	W
233	GPSn no through	Sensor through data input not possible from Main GPS	B	W
240	GPSm no rx	Periodic input not possible from Sub GPS Sensor	B	W
241	GPSm no res	Answer back not possible from Sub GPS Sensor	B	W
242	GPSm data short	Sub GPS data is invalid	B	W
243	GPSm no through	Sensor through data input not possible from Sub GPS	B	W
250	Disp no rx	Input Data from Display not possible	B	W
251	Disp no res	Answer back from Display not possible	B	W
260	No mutal data	Unable to obtain mutual data	B	W
261	CCRP error	CCRP disagreement with other equipment	B	W
270	SIO1 HBT error	HBT can not receive for Serial Port 1	B	W
271	SIO2 HBT error	HBT can not receive for Serial Port 2	B	W
272	SIO3 HBT error	HBT can not receive for Serial Port 3	B	W
276	SIO7 HBT error	HBT can not receive for Serial Port 7	B	W
280	Temp alert	Temperature alert is occurred	B	W
281	Depth alert	Depth alert is occurred	B	A
282	Dist alert	Trip alert is occurred	B	W
283	SOG alert	Speed alert is occurred	B	W
284	Wind alert	Wind alert is occurred	B	W
300	Arrival wpt	Arrival at Waypoint	B	W
301	Anchor out	Anchor alert is occurred	B	A
302	Boundary	Boundary alert is occurred	B	W
303	Xtd	XTD alert is occurred	A	A
304	Early Crs change	Early cource change	A	W/A
305	End of track	End of track	B	W
306	Arrived at wol	Arrived at WOL	B	W
307	Actual Crs chg	Actual cource change	A	W/A

5.3 Troubleshooting

⚠ WARNING

🚫 Never carry out internal inspection or repair of the equipment. Inspection or repair performed by anyone other than the specialized maintenance engineers may result in fire, electric shock, or failure. For inspection or repair, please contact us or your distributor.

For your reference, the guideline for detecting faulty sections is provided below.

Fault symptom	Possible cause/cause of failure	Action to be taken
The power is not supplied even if the power switch of the display unit is pressed.	The power is not supplied from the on-board power panel.	Check if the breaker and the power board are wired correctly.
	The power is not supplied from the power supply unit, which is the option.	Check if the power supply unit is wired correctly.
	The display is faulty.	Contact us or your distributor.
	The fuse of the processor is blown out.	After checking if the wiring is correct and replace the fuse.
	The main switch of the processor is set to OFF.	After checking if the wiring is correct, set the switch to ON.
	The LAN port for display connection on the processor is incorrect.	Connect to the correct LAN port.
LCD does not display a screen.	The display unit is faulty.	Contact us or your distributor.
	Power is not supplied to the display unit.	Check the cable connection.
The brightness is not changed.	The display unit is faulty.	Contact us or your distributor.
No buzzer sound is emitted.	The buzzer is faulty.	Contact us or your distributor.
	The buzzer is set to OFF.	Refer to 4.10.1 for the setting.
No key-tone is emitted.	The buzzer is faulty.	Contact us or your distributor.
	The key-tone is set to OFF.	Refer to 4.3.2 for the setting.
Symbols on the plot screen are not displayed.	The display of the symbols on the plot screen is set to OFF.	Refer to 4.8.9 for the setting.

Fault symptom	Possible cause/cause of failure	Action to be taken
Does not perform position fixing	The sensor is faulty.	Contact us or your distributor.
	The sensor is hidden behind the obstacle.	Move the sensor to the location free from obstacles.
	Noise is entered.	Move the sensor from the noise generating source.
	Power is not supplied to the sensor.	Check the cable connection. Check the output power from the processor.
Data is not received from the sensor to the processor.	The sensor cable is disconnected.	Check the cable connection.
	The connection terminal on the processor is incorrect.	Check the cable connection.
	Power is not supplied to the sensor.	Check the output power from the processor.
Data is not displayed.	The display is faulty.	Contact us or your distributor.
	The display cable is disconnected.	Check the cable connection.
Output to the external equipment does not function.	The setting of the output port is incorrect.	Check the port setting.
	The connection terminal on the processor is incorrect.	Check the cable connection.
	The processor is faulty.	Contact us or your distributor.
Reception from the external equipment does not function.	The setting of the input port is incorrect.	Check the port setting.
	The connection terminal on the processor is incorrect.	Check the cable connection.
	The processor is faulty.	Contact us or your distributor.
The built-in switch does not function.	The switch is faulty.	Contact us or your distributor.
	The setting of the switch port is incorrect.	Check the port setting.
	The connection terminal on the processor is incorrect.	Check the cable connection.
Output from the built-in buffer does not function.	The buffer is faulty.	Contact us or your distributor.
	The setting of the buffer port is incorrect.	Check the port setting.
	The connection terminal on the processor is incorrect.	Check the cable connection.
	The dip-switch setting is incorrect.	Check the dip-switch setting.
The route cannot be shared. The printer does not function.	The port setting is incorrect.	Check the port setting.
	The connection terminal on the processor is incorrect.	Check the cable connection.
	The processor is faulty.	Contact us or your distributor.
The printer does not function.	The setting of the printer is incorrect.	Check the printer setting.
	The connection terminal on the processor is incorrect.	Check the cable connection.
	The processor is faulty.	Contact us or your distributor.

5.4 Replacement Parts

5.4.1 Repair units

The following table shows the repair unit replacement units.

No.	Name	Model	Remarks
1	Receiver processing unit	CMJ-610	GPS sensor
2	Antenna radome replacement kit	MPTG32528	JLR-4350
3	Processing unit	CMJ-611	Processor
4	Terminal block	CMH-2500	NDC-4100
5	LCD panel kit	＊＊＊＊	Display unit
6	Control board	CMJ-612	NWZ-1650
7	Fuse	＊＊＊＊	Processor NDC-4100

To replace the sensor repair unit, also replace the radome and packing with the antenna radome replacement kit.

5.4.2 Regular replacement parts

No.	Name	Model	Replacement time	Remarks
1	LCD unit	＊＊＊＊	40,000 hours	About 5 years in continuous use as the guideline

Chapter 6 After-Sales Service

6.1 Warranty

- Specific periods may vary based on our warranty policies, but the standard warranty period is **one year** from the date of purchase.

6.2 Repair parts stocking Period

- We keep functional repair parts for this equipment (parts necessary for the functioning of this equipment) in stock for 10 years from the discontinuation of production.

6.3 When Requesting Service

When you think the equipment is not operating properly, please read "5.3 Troubleshooting" carefully, and inspect the equipment again. If the problem persists, stop using the equipment, and consult your dealer, or a JRC branch or affiliate.

- **Repairs during the warranty period**
  Should a malfunction or failure occur when the equipment is operated according to the descriptions and instructions contained herein, it is repaired free of charge during the warranty period by JRC or another location specified by your dealer. However, any repair for failures resulting from misuse, negligence, or natural disasters, fire, or other Acts of God is charged.

- **Repairs after the warranty period**
  Repairs to restore the proper equipment operation can be made at a specified rate with the user's consent. In this case, the equipment can either be sent to JRC or an affiliate, or on-ship repairs can be performed at a location specified by JRC or a sales affiliate. Repairs which cannot be performed on-board the ship needs to be performed in a repair plant.

- **Information that needs to be provided when requesting service**
  • Name, model, production date, and serial number
  • Detailed description of the malfunction (alert number, etc.)
  • Name, address, and telephone number of your company or organization

6.4 Recommended Checks Inspection

Equipment performance is subject to degradation due to age and change of component conditions over time. In addition to your own routine check, additional inspection and maintenance is recommended. Please consult with your dealer or one of our local offices. Note that this inspection and maintenance is not free of charge.

If you have any other questions about after-sales service, please direct your inquiries to your dealer or nearest local office.

A list of branches is provided at the end of the "Contact List".

Chapter 7 Disposal

⚠ WARNING

When disposing of the used lithium battery, place insulating tape over the battery terminals, or otherwise insulate the battery. Failure to do so may result in heating, explosion, or fire due to a shorted battery.

7.1   Disposal of Equipment

- Observe all rules and regulations of the local authorities when disposing of this equipment.

7.2   Disposal of Used Batteries

This equipment contains a lithium battery.

- When disposing of the used lithium battery, place insulating tape over the battery terminals, or otherwise insulate the battery.   Dispose of the battery properly as directed by the local authorities.   Consult your dealer, our sales office, or the local authorities for further details on disposal methods.

Chapter 8 Specification

8.1   NWZ-1650   DISPLAY UNIT

8.1.1   Basic

- Display Unit   6.5 inch Color LCD 640×480 dots
- Touch Screen   Available
- Brightness   1,000cd/m^2 (800cd/m2 with Touch screen)
- Viewing Angle   80 degree at all angle
- Backlight   LCD and Key lighting
- Dimmer Levels   17 steps/OFF
- Data Input/Output   LAN × 1
                          IEC61162-1 input × 1
- Power Supply Voltage   DC12/24V（+30%,-10%）
- Power Consumption   less than 10W
- Dimension   160(W)×180(H)×50.5(D)mm (Not include Base)
- Mass   Approximately 2.0kg
- Software version   R56.00
- Viewing Distance   1m

8.1.2   Environment

- Operating Temperature   -15℃～+55℃
- Storage Temperature   -25℃～+70℃
- Vibration   IEC60945 Ed.4 conformant
- EMC   IEC60945 Ed.4 conformant
- Waterproofing   IP56
                          Permanent installation in an exposed section requires a waterproof cover.

8.2   JLR-4350 GPS Sensor

8.2.1   Basic

- GNSS   GPS/GLONASS/BeiDou
                               Can not receive GLONASS and BeiDou at the same time.
- Maximum Number of
     Tracked Satellites   22 satellites
- Accuracy   GPS：5m 2DRMS (HDOP≦4   SA off)
                          Beacon DGPS：4m 2DRMS
                          SBAS：4m 2DRMS
- SBAS   WAAS、MSAS、EGNOS
- QZSS   QZSS(L1-C/A) No.1 Satellite only
- Geodetic datum   Selection among 49 geodetic datum (Default：WGS-84)
- Power Supply Voltage   DC12/24V (+30%,-10%)
- Power Consumption   less than 1.0W
- Dimensions   134(Φ)mm×129(H)mm
- Mass   Approximately 1.5kg
- Software version   R41.0

8.2.2　　　　Environment

- ・　Operating Temperature　-25℃～+55℃
- ・Storage Temperature　　　-40℃～+70℃
- ・Vibration　　　　　　　　IEC60945 ed.4 conformant
- ・EMC　　　　　　　　　　IEC60945 ed.4 conformant
- ・Waterproofing　　　　　　IP56

8.3　　　NDC-4100 Processor Unit

8.3.1　　　　Basic

- ・Memories　　　　　　　Waypoints 10000points maximum
  Event/Mark 1000points maximum (include MOB)
  Track 2000points maximum
  Route 100routes maximum
- ・Route plan　　　　　　512 waypoints per one route
- ・Magnetic Variation　　Automatic or manual
- ・Navigation Calculation　Grate circle or Rhumb line selectable
- ・Alert　　　　　　　　　Arrival, Anchor, Boundary, XTD, No position fix, Speed, Trip, HDOP
  Temperature[*], Depth[*]
- ・Plot Function Scale　　0.2,0.5,1,2,5,10,20,50,100,200,300NM
  　　　　　　Interval　　1～60min (1 sec) or 0.01～99.99NM (0.01NM) selectable
- ・Data Input/Output　　　IEC61162-1 Output ×5, Input ×2
  IEC61162-2 Output ×1, Input ×1
  Buffer Unit: IEC61162-1 Output ×8
  LAN×2
- ・Dry Contact　　　　　　Output ×4, Input ×1
- ・Remote maintenance　　Available
- ・Unit　　　　　　　　　Distance, Speed：NM,kn or km,km/h or mi,mi/h
  Height, Depth：m or ft or fm
  Temperature：℃ or ℉
- ・Loran C/A　　　　　　Latitude and Longitude can be converted into the Loran time difference
- ・Language　　　　　　Japanese or English
- ・8ch Buffer　　　　　　Built-in
- ・2ch Select Switch　　　Built-in
- ・Power Supply Voltage　DC12/24V（+30%,-10%）
- ・Power Consumption　　15W 以下
  JLR-8600：less than 25W
- ・Dimensions　　　　　264(W)mm×100(H)mm×281(D)mm
- ・Mass　　　　　　　　Approximately 2.2kg
- ・Software version　　　R60.0

＊：External sensor must be connected

8.3.2　　　　Environment

- ・Operating Temperature　-15℃～+55℃
- ・Storage Temperature　　-25℃～+70℃
- ・Vibration　　　　　　　IEC60945 ed.4 conformant
- ・EMC　　　　　　　　　IEC60945 ed.4 conformant
- ・Waterproofing　　　　　IP22

8.3.3 Interface

1) Serial Transmission

Channel	Signal	Input / Output	Format
Data IN/OUT 1	RS-422	Input	IEC61162-2/NMEA
		Output	IEC61162-2/NMEA/JRC/SWITCH/SC-104
Data IN/OUT 2	RS-422	Input	IEC61162-1/NMEA
		Output	IEC61162-1/NMEA/JRC/SWITCH/SC-104
Data IN/OUT 3	RS-422	Input	IEC61162-1/NMEA
		Output	IEC61162-1/NMEA/JRC/SWITCH/SC-104
DATA OUT 4	RS-422	Output	IEC61162-1/NMEA/JRC/SWITCH/SC-104
DATA OUT 5	RS-422	Output	IEC61162-1/NMEA/JRC/SWITCH/SC-104
DATA OUT 6	RS-422	Output	IEC61162-1/NMEA/JRC/SWITCH/SC-104
Buffer Unit	RS-422	Output	IEC61162-1/NMEA
DATA IN/OUT 7	RS-232C	Input	IEC61162-1/NMEA
		Output	IEC61162-1/NMEA/Printer data for DPU-414

1-1) NMEA
- Specification　　　　　NMEA0183
- Version　　　　　　　Ver1.5,2.1,2.3,4.0
- Bit Rate　　　　　　　4800,9600,19200,38400bps
- Data Bit　　　　　　　8bit
- Parity　　　　　　　　None
- Start Bit　　　　　　　1bit
- Stop Bit　　　　　　　1bit
- Output Sentence　　　GGA,RMC,GLL,VTG,GSA,GSV,DTM,GBS,GRS,GST,ZDA,GNS,
  ALR,APB,BOD,BWC,BWR,RMB,XTE,ZTG,AAM,RTE,WPL,ACK
  HDT[*],THS[*],DBT[*],DPT[*],MTW[*],CUR[*],VBW[*],VHW[*]
- Output Interval　　　　1s,2s,3s,4s,5s,6s,7s,8s,9s,OFF
- Input Sentence　　　　HDT,THS,DBT,DPT,MTW,CUR,VBW,VHW,ACK,WPL,RTE,ALR
  　　　　　　　　　　　　　　　　　　　*External sensor must be connected

Note) Some combinations of output sentence, bit rates, and output intervals may not be possible.

1-2) IEC
- Specification　　　　　IEC61162-1 Ed.5

1-3)JRC
- Specification　　　: JRC
- Bit Rate　　　　　: 1200bps
- Data Bit　　　　　: 8bit
- Parity　　　　　　: None
- Start Bit　　　　　: 1bit
- Stop Bit　　　　　: 2bit

2) Dry Contact

Channel	Input / Output	None
Contact 1,2,3,4	Output	Alert, 200p/NM, 400p/NM, ACK
Contact 5	Input	ACK

3)LAN
- Specification　　　　　: IEC61162-450/JRC
- Bit Rate　　　　　　　: 10/100Mbps
- Shared route　　　　　: JRC Format
- Data output　　　　　: NMEA,IEC

Appendix

Appendix 1 List of Geodetic System

Display	Setting		Geodetic System
W84	WGS-84	0	WGS-84
W72	WGS-72	1	WGS-72
TOY	JAPAN	2	Tokyo Datum
NAS	NAD27 USA	3	North American 1927 (USA)
NAS	NAD27 CAN	4	North American 1927 (Canada, Alaska)
EUR	EUROPE 50	5	Europe 1950 (Europe)
AUA	AUSTRA 66	6	Australian geodetic 1966 (Australia)
OGB	OSGB-36	7	Ordnance Survey of Great Britain (England)
008	NAD-83	8	NAD-83
ADI	ADI	11	Adindan (Ethiopia, Sudan)
ARF	ARF	12	ARC 1950 (Botswana)
AUG	AUG	13	Australian Geodetic 1984 (Australia)
BER	BER	14	Bermuda 1957 (Bermuda islands)
BOO	BOO	15	Bogota Observatory (Columbia)
CAI	CAI	16	Compo Inchauspe (Argentine)
CHI	CHI	17	Chatham 1971 (Chatham Islands)
CHU	CHU	18	Chua Astro (Paraguay)
COA	COA	19	Corrego Alegre (Brazil)
BAT	BAT	20	Djakarta (Vatavia) (Sumatra)
EUR	EUR	21	European 1979 (Europe)
GEO	GEO	22	Geodetic Datum 1949 (New Zealand)
GUA	GUA	23	Guam 1963 (Guam)
024	024	24	Hayford 1910 (Finland)
HJO	HJO	25	Hjorsey 1955 (Iceland)
IND	IND	26	Indian (India, Nepal)
IRL	IRL	27	Ireland 1965 (Ireland)
KEA	KEA	28	Kertau 1948 (West Malaysia, Singapore)
LCF	LCF	29	L.C.5 Astro (Cayman Brac island)
LIB	LIB	30	Liberia 1964 (Liberia)
LUZ	LUZ	31	Luzon (Philippines)
MER	MER	32	Merchich (Morocco)
MIN	MIN	33	Minna (Cameroon)
NAH	NAH	34	Nahrwan (Oman)
NAP	NAP	35	Naparima, BWI (Trinidad and Tobago)
OEG	OEG	36	Old Egyptian (Egypt)
OHA	OHA	37	Old Hawaiian (Hawaiian Islands)
PLN	PLN	38	Pico de las Nieves (Canary Islands)
PRP	PRP	39	Provisional south American 1956 (South America)
HIT	HIT	40	Provisional south Chilean 1963 (South Chile)
PUR	PUR	41	Puerto Rico (Puerto Rico, Virgin Islands)
QUO	QUO	42	Qornoq (South Greenland)
043	043	43	RT90 (Sweden)
SAO	SAO	44	Santa Braz (San Miguel, Santa Maria islands)
SAN	SAN	45	South American 1969 (South America)
046	046	46	Southwest Base (Faial, Gracinao, Pico, San Jorge, Terceira islands)
TIL	TIL	47	Timbalai 1948 (Brunei, Malaysia)
048	048	48	PZ-90.02
SPK	SPK	49	SK-42 (Pulkovo 42)

Appendix 2 List of standard terms, units and abbreviations

Term	Abbreviation
Acknowledge	ACK
Acquire, Acquisition	ACQ
Acquisition Zone	AZ
Adjust, Adjustment	ADJ
Aft	AFT
Alarm	ALARM
Altitude	ALT
Amplitude Modulation	AM
Anchor Watch	ANCH
Antenna	ANT
Anti Clutter Rain	RAIN
Anti Clutter Sea	SEA
April	APR
Audible	AUD
August	AUG
Automatic	AUTO
Automatic Frequency Control	AFC
Automatic Gain Control	AGC
Automatic Identification System	AIS
Automatic Identification System – Search and Rescue Transmitter	AIS-SART
Automatic Radar Plotting Aid	ARPA
Autopilot	AP
Auxiliary System/Function	AUX
Available	AVAIL
Azimuth Indicator	AZI
Background	BKGND
Bearing	BRG
Bearing Waypoint To Waypoint	BWW
Bow Crossing Range	BCR
Bow Crossing Time	BCT
Brilliance	BRILL
Built in Test Equipment	BITE

Term	Abbreviation
Calibrate	CAL
Cancel	CNCL
Carried (for example, carried EBL origin)	C
Central Processing Unit	CPU
Centre	CENT
Change	CHG
Circularly Polarised	CP
Clear	CLR
Closest Point of Approach	CPA
Compact Disk Read Only Memory	CDROM
Consistent Common Reference Point	CCRP
Consistent Common Reference System	CCRS
Contrast	CONT
Coordinated Universal Time	UTC
Correction	CORR
Course	CRS
Course Over the Ground	COG
Course Through the Water	CTW
Course To Steer	CTS
Course Up	C UP [a]
Cross Track Distance	XTD
Cursor	CURS
Dangerous Goods	DG
Date	DATE
Day	DAY
Dead Reckoning, Dead Reckoned Position	DR
December	DEC
Decrease	DECR
Delay	DELAY
Delete	DEL
Departure	DEP
Depth	DPTH

Term	Abbreviation	Term	Abbreviation
Destination	DEST	Fix	FIX
Deviation	DEV	Forward	FWD
Differential GLONASS	DGLONASS [a]	Frequency	FREQ
Differential GNSS	DGNSS [a]	Frequency Modulation	FM
Differential GPS	DGPS [a]	Full	FULL
Digital Selective Calling	DSC	Gain	GAIN
Display	DISP	Geographics	GEOG
Distance	DIST	Geometric Dilution Of Precision	GDOP
Distance Root Mean Square	DRMS [a]	Global Maritime Distress and Safety System	GMDSS
Distance To Go	DTG	Global Navigation Satellite System	GNSS
Drift	DRIFT	Global Orbiting Navigation Satellite System	GLONASS
Dropped (for example, dropped EBL origin)	D	Global Positioning System	GPS
East	E	Great Circle	GC
Echo Reference	REF	Grid	GRID
Electronic Bearing Line	EBL	Ground	GND
Electronic Chart Display and Information System	ECDIS	Grounding Avoidance System	GAS
Electronic Chart System	ECS	Group Repetition Interval	GRI
Electronic Navigational Chart	ENC	Guard Zone	GZ
Electronic Position Fixing System	EPFS	Gyro	GYRO
Electronic Range and Bearing Line	ERBL	Harmful Substances (applies to AIS)	HS
Emergency Position Indicating Radio Beacon	EPIRB	Head Up	H UP [a]
Emergency Position Indicating Radio Beacon – AIS	EPIRB-AIS	Heading	HDG
		Heading Control System	HCS
Enhance	ENH	Heading Line	HL
Enter	ENT	High Frequency	HF
Equipment	EQUIP	High Speed Craft	HSC
Error	ERR	Horizontal Dilution Of Precision	HDOP
Estimated Position	EP	Identification	ID
Estimated Time of Arrival	ETA	In	IN
Estimated Time of Departure	ETD	Increase	INCR
		Indication	IND
European Geo-Stationary Navigational Overlay System	EGNOS	Information	INFO
		Infrared	INF RED
Event	EVENT	Initialisation	INIT
Exclusion Zone	EZ	Input	INP
External	EXT	Input/Output	I/O
F-Band (applies to radar)	F-Band	Integrated Navigation System	INS
February	FEB	Integrated Radio Communication System	IRCS
Foreword	FWD		
Fishing Vessel	FISH	Interference Rejection	IR

Term	Abbreviation	Term	Abbreviation
Interswitch	*ISW*	Not Less Than	NLT
Interval	*INT*	Not More Than	NMT
January	*JAN*	Not Under Command	NUC
July	*JUL*	*November*	*NOV*
June	*JUN*	*October*	*OCT*
Label	LBL	*Off*	*OFF*
Latitude	*LAT*	*Officer On Watch*	*OOW*
Latitude/Longitude	L/L	*Offset*	*OFFSET*
Leeway	LWY	*On*	*ON*
Limit	*LIM*	*Out/Output*	*OUT*
Line Of Position	*LOP*	*Own Ship*	*OS*
Log	*LOG*	*Panel Illumination*	*PANEL*
Long Pulse	*LP*	*Parallel Index Line*	*PI*
Long Range	*LR*	Past Positions	PAST POSN
Longitude	*LON*	*Passenger Vessel*	*PASSV*
Loran	*LORAN*	*Performance Monitor*	*MON*
Lost Target	*LOST TGT*	*Permanent*	*PERM*
Low Frequency	*LF*	*Person Overboard*	*POB*
Magnetic	*MAG*	*Personal Identification Number*	*PIN*
Man Overboard	MOB	*Pilot Vessel*	*PILOT*
Manoeuvre	*MVR*	*Port/Portside*	*PORT*
Manual	*MAN*	*Position*	*POSN*
Map(s)	*MAP*	*Positional Dilution Of Precision*	*PDOP*
March	*MAR*	*Power*	*PWR*
Maritime Mobile Services Identity number	*MMSI*	*Predicted*	*PRED*
Maritime Pollutant (applies to AIS)	*MP*	*Predicted Area of Danger*	*PAD*
Maritime Safety Information	*MSI*	*Predicted Point of Collision*	*PPC*
Marker	*MKR*	*Pulse Length*	*PL*
Master	*MSTR*	*Pulse Modulation*	*PM*
Maximum	*MAX*	*Pulse Repetition Frequency*	*PRF*
May	*MAY*	*Pulse Repetition Rate*	*PRR*
Medium Frequency	*MF*	*Pulses Per Revolution*	*PPR*
Medium Pulse	*MP*	*Racon*	*RACON*
Menu	*MENU*	*Radar*	*RADAR*
Minimum	*MIN*	Radar Plotting	RP
Missing	*MISSING*	Radar Transponder	TPR
Mute	*MUTE*	*Radius*	*RAD*
Navigation	*NAV*	*Rain*	*RAIN*
Night	*NT*	*Range*	*RNG*
Normal	*NORM*	*Range Rings*	*RR*
North	*N*	*Raster Chart Display System*	*RCDS*
North Up	*N UP* [a]		

Term	Abbreviation	Term	Abbreviation
Raster Navigational Chart	RNC	Synchronised/ Synchronous	SYNC
Rate Of Turn	ROT	System Electronic Navigational Chart	SENC
Real-time Kinematic	RTK		
Receive	RX [a]	Target	TGT
Receiver	RCDR	Target Tracking	TT
Receiver Autonomous Integrity Monitoring	RAIM	Test	TEST
		Time	TIME
Reference	REF	Time Difference	TD
Relative	REL [b]	Time Dilution Of Precision	TDOP
Relative Motion	RM	Time Of Arrival	TOA
Revolutions per Minute	RPM	Time Of Departure	TOD
Rhumb Line	RL	Time to CPA	TCPA
Roll On/Roll Off Vessel	RoRo	Time To Go	TTG
Root Mean Square	RMS	Time to Wheel Over Line	TWOL
Route	ROUTE	Track	TRK
Safety Contour	SF CNT	Track Control System	TCS
Sailing Vessel	SAIL	Tracking	TRKG
Satellite	SAT	Trail(s)	TRAIL
S-Band	S-BAND	Transmit and Receive	TXRX [a]
Scan to Scan	SC/SC	Transceiver	TCVR
Search And Rescue	SAR	Transferred Line Of Position	TPL
Search And Rescue Transponder	SART		
		Transmit	TX
Search And Rescue Vessel	SARV	Transmitter	TMTR
		Transmitting Heading Device	THD
Select	SEL		
September	SEP	Trial	TRIAL [c]
Sequence	SEQ	Trigger Pulse	TRIG
Set (i.e., set and drift, or setting a value)	SET	True	T
		True Motion	TM
Ship's Time	TIME	Tune	TUNE
Short Pulse	SP	Ultrahigh Frequency	UHF
Signal to Noise Ratio	SNR	Uninterruptible Power Supply	UPS
Simulation	SIM [c]		
Slave	SLAVE	Universal Time, Coordinated	UTC
South	S		
Speed	SPD	Universal Transverse Mercator	UTM
Speed and Distance Measuring Equipment	SDME		
		Unstabilised	UNSTAB
Speed Over the Ground	SOG	Variable Range Marker	VRM
Speed Through the Water	STW	Variation	VAR
Stabilized	STAB	Vector	VECT
Standby	STBY	Very High Frequency	VHF
Starboard/Starboard Side	STBD	Very Low Frequency	VLF
Station	STN	Vessel Aground	GRND
Symbol(s)	SYM	Vessel at Anchor	ANCH

Term	Abbreviation		Term	Abbreviation
Vessel Constrained by Draught	*VCD*		Visual Display Unit	VDU
Vessel Engaged in Diving Operations	*DIVE*		*Voyage*	*VOY*
Vessel Engaged in Dredging or Underwater Operations	*DRG*		*Voyage Data Recorder*	*VDR*
			Warning	*WARNING*
Vessel Engaged in Towing Operations	*TOW*		*Water*	*WAT*
			Waypoint	*WPT*
Vessel Not Under Command	*NUC*		Waypoint Closure Velocity	WCV
Vessel Restricted in Manoeuvrability	*RIM*		*West*	*W*
			Wheel Over Line	*WOL*
Vessel Traffic Service	*VTS*		Wheel Over Point	WOP
Vessel Underway Using Engine	*UWE*		*Wheel Over Time*	*WOT*
			World Geodetic System	*WGS*
Video	*VID*		*X-Band*	*X-BAND*

Appendix 3 List of Symbols

Symbol name	Symbol graphic
Own ship - simplified symbol	Double circle ◎
Velocity vector	Short-dashed line ◉ ▬ ▬ ▬
Past track	Small filled circle ••••••••••••• ◎
Waypoint	Circle ○
Route	Long-dashed line ○▬ ▬ ▬ ▬ ▬ ▬ ○
Event	Square with diagonal line ◪
User cursor	Cross line ✚

Appendix 4 List of Default Setting Values

MENU	Sub Menu	Sub Menu	Sub Menu	Default
DISPLAY	THEME			DAY
	BEEP			ON
	DAY SCREEN			OFF
	NAV			ON
	PLOT			ON
	ANALOG			ON
	HIGHWAY			ON
	SAT INFO			ON
	WPT INFO			ON
	BEACON TEXT			ON
	NAV ASSIST			ON
VOYAGE	WPT	WPT LIST		-
	ROUTE	ROUTE LIST		-
	RUN			-
	EVENTMARK	EVENTMARK LIST		-
	WPT COPY			-
	ROUTE COPY			-
	WPT DELETE			-
	ROUTE DELETE			-
	EVENT DELETE			-
	SHARED	ROUTE SEND	CONNECT	UNICAST
			IP	000.000.000.000
			PORT	0
			OUTPUT	LAN1
			FORMAT	NMEA VER 1.5
			DATA	ALL WPT
		ROUTE RECEIVE	SOURCE IP	000.000.000.000
	DEFAULT SETTINGS	WIDTH PORT(NM)		1.00
		WIDTH STBD(NM)		1.00
		ARRIVAL RADIUS(NM)		1.00
		SPEED(kn)		10.00
		SAIL		RL
		SOG SMOOTHING(s)		0
ALERT	SYSTEM	SET		ON
		SOUND		ON
	ARRIVAL/ ANCHOR	SET		ARRIVAL
		SOUND		ON
	XTD/ BOUNDARY	SET		XTD
		SOUND		ON
	HDOP	SET		THRESHOLD 4
		SOUND		OFF
	SPD	SET		OFF
		SOUND		ON
	TRIP	SET		OFF
		SOUND		ON
	EARLY COURSE CHANGE	SET		OFF
		SOUND		ON
	END OF TRACK	SET		OFF
		SOUND		ON
	ARRIVED AT WOL	SET		OFF
		SOUND		ON
	ACTUAL COURSE CHANGE	SET		OFF
		SOUND		ON

MENU	Sub Menu	Sub Menu	Sub Menu	Range
ALERT	TEMP	SET		OFF
		SOUND		ON
	DPTH	SET		OFF
		SOUND		ON
	DGPS	SET		OFF
		SOUND		OFF
	BUFFER	SET		OFF
		SOUND		ON
	POWER	SET		ON
		SOUND		ON
GNSS SETTING	SENSOR1	GNSS	GPS MODE	GPS
		FIX MODE		AUTO
		ELV MASK		5
		HDOP		10
		SMOOTH	POSN SMOOTHING(s)	10
			SPEED SMOOTHING(s)	10
			COURSE SMOOTHING(s)	10
		RAIM	RAIM ACCURACY LEVEL(m)	100
		DATUM		WGS-84
		INIT	QUADRANT	-
			LAT	-
			LON	-
			ANT HEIGHT(m)	-
			YEAR	-
			MONTH	-
			DAY	-
			HOUR(hr)	-
			MINUTE(min)	-
		DGPS		AUTO
		BEACON	AUTO	-
			MANUAL	283.5kHz/25bps
			SEMI AUTO	-
			MONITOR	-
		SBAS	SAT SEARCH	AUTO
			TYPE0	OFF
			RANGING	OFF
		STN LIST		-
GNSS SETTING	SENSOR2	Same as SENSOR1		
SYSTEM	DATE / TIME	TIME DIFF		+00:00
		DATE DISP		MMM DD,'YY
		TIME DISP(hr)		24hr
	UNIT	DIST / SPEED		NM,kn
		HIGHT / DPTH		m
		TEMP		℃
	MAG CORR			OFF
	LORAN			OFF
	SENSOR SELECT			AUTO
LANGUAGE				ENGLISH
VERSION	DISPLAY			-
	PROCESSOR			-
	SENSOR1			-
	SENSOR2			-
ALERT LIST	ALERT HISTORY			-
	ACTIVE ALERT			-
	LAN1			-
	LAN2			-

MENU	Sub Menu	Sub Menu	Sub Menu	Sub Menu	Range
EQUIP	TYPE	TYPE1 / 2 DISPLAY	DISPLAY TYPE		MAIN
			SFI		GP0000
		TYPE2/2 PROCESSOR	DEVICE No.		No1
			SFI		GP0001
			SENSOR1		GPS
			SENSOR2		OFF
	DATA I/O	IN/OUT1	FORMAT		NMEA
			BITRATE		4800
			VERSION		2.3
			TALKER		GNSS
			SENTENCE		GGA,RMC,VTG,DTM,ZDA,APB,RMB
		IN/OUT2	FORMAT		SC-104
			BITRATE		4800
			VERSION		2.5
			TALKER		GNSS
		IN/OUT3	Same as IN/OUT1		
		OUT4	Same as IN/OUT1		
		OUT5	Same as IN/OUT1		
		OUT6	Same as IN/OUT1		
		LAN	LAN1	DATA OUT	MULTICAST 239.192.000.004 60004 NMEA/2.3/GNSS GGA,RMC,VTG,DTM,ZDA,APB,RMB
				RMS SEND	ON MULTICAST 239.192.000.005 60005
				PRINTER	UNUSED OFF 000.000.000.000 9100
			LAN2	DATA OUT	Same as LAN1
				RMS SEND	Same as LAN1
				PRINTER	Same as LAN1
			COMMON	ACTIVE ROUTE	OFF MULTICAST 239.000.096.001 6203
				DATA ROUTE	Same as ACTIVE ROUTE
				MUTUAL	OFF MULTICAST 239.000.000.001 5101
		CONTACT1	CONTACT OUT		SYSTEM
		CONTACT2	CONTACT OUT		XTD
		CONTACT3	CONTACT OUT		ACK
		CONTACT4	CONTACT OUT		ARV
		BUFFER	FORMAT		NMEA
			BITRATE(bps)		4800
			VERSION		2.3
			TALKER		GNSS
			SENTENCE		GGA,RMC,VTG,DTM,ZDA,APB,RMB

MENU	Sub Menu	Sub Menu	Sub Menu	Sub Menu	Range
EQUIP	DATA I/O	SENSOR	SENSOR1 PORT2(bps)		4800
			SENSOR2 PORT2(bps)		4800
		RS-232C	FORMAT		NMEA
			BITRATE(bps)		4800
			VERSION		2.3
			TALKER		GNSS
			SENTENCE		GGA,RMC,VTG,DTM,ZDA,APB,RMB
	SWITCH	CONTROLL METHOD			MFD
		SWITCH SELECTION			PROCESSOR No1.
	DIMMER	SETTINGS	DIMMER GROUP		1
			DISPLAY		OFF
			NCM-227		OFF
			DDC		OFF
			GPS		OFF
			GP DDC		OFF
		DIMMER CAL			-
	IP	DISPLAY	IP ADDRESS		172.018.001.169
			MAC ADDRESS		-
			SUBNET MASK		255.255.000.000
			DEFAULT GATEWAY		000.000.000.000
		PROCESSOR LAN 0	IP ADDRESS		172.018.001.163
			MAC ADDRESS		-
			SUBNET MASK		255.255.000.000
			DEFAULT GATEWAY		172.016.060.001
		PROCESSOR LAN 1	IP ADDRESS		172.016.060.163
			MAC ADDRESS		-
			SUBNET MASK		255.255.000.000
			DEFAULT GATEWAY		172.016.060.001
		PROCESSOR LAN 2	IP ADDRESS		172.017.060.163
			MAC ADDRESS		-
			SUBNET MASK		255.255.000.000
			DEFAULT GATEWAY		172.016.060.001
	CCRP	BEAM (m)			1.0
		LENGTH(m)			1.0
		CCRP(m)			0.0/0.0/0.0
		SENSOR1 (m)			0.0/0.0/0.0
		SENSOR2 (m)			0.0/0.0/0.0

MENU	Sub Menu	Sub Menu	Sub Menu	Sub Menu	Range
EQUIP	CTS	CLASS			TANKER
		TRACKING GAIN			LOW
		TRACKING HIGH			2880
		TORACING MIDDLE			960
		TRACKING LOW			270
		TRACKING MULTIPLE			1.0
		TRACKING COUNT A			6
		TRACKING D GAIN			0.0
	LOW SPEED COG	OUTPUT			OFF
	MAINTENANCE	DIAGNOSIS	DISPLAY		-
			PROCESSOR		-
			SENSOR1		-
			SENSOR2		-
		MONITOR	DATA IN1		-
			DATA IN2		-
			DATA IN3		-
			RS-232C		-
			SWITCH		-
			LAN1		-
			LAN2		-
			SENSOR1		-
			SENSOR2		-
		OPERATING TIME	OPERATING TIME(hr)		-
			LCD TIME(hr)		-
	RESET				-
	DEMO	DEMO TYPE			STATIC
		START/ STOP			-
		YEAR			-
		MONTH			-
		DAY			-
		HOUR(hr)			-
		MINUTE(min)			-
		SECOND(s)			-
		QUADRANT			-
		LAT			-
		LON			-
		SPEED(kn)			-
		COURSE(°)			-
		RADIUS(NM)			-
		ROUTE			-
	ALL SETTING VALUE	BACKUP INFO			-
		IMPORT/ EXPORT	MPORT/ EXPORT		PROCESSOR → DISPLAY
			PROCESS		BACKUP

Appendix 5　　　　Data Format

Output Sentence

・GGA – Global positioning system (GPS) fix data

$--GGA, hhmmss.ss, llll.ll, a, yyyyy.yy, a, x, xx, x.x, x.x, M, x.x, M, x.x, xxxx*hh<CR><LF>
　　　　　　　1　　　　　　　2　　　　　　3 4 5　　6　 7　 8　 9　10 11　 12

- 1：UTC of position
- 2：Latitude N/S
- 3：Longitude E/W
- 4：GPS quality indicator (see Note 1)
- 5：Number of satellites in use, 00-12, maybe different from the number in view
- 6：Horizontal dilution of precision
- 7：Antenna altitude above/below mean sea level (geoid)
- 8：Units of antenna altitude, m
- 9：Geoidal separation (see Note 3)
- 10：Units of geoidal separation,m
- 11：Age of differential GPS data (see Note 2)
- 12：Differential reference station ID, 0000-1023

NOTE 1 All GPS quality indicators in headings 1 through 8 are considered "valid". The heading "0" is the only "invalid" indicator. The GPS quality indicator field should not be a null field.
0 = fix not available or invalid
1 = GPS SPS mode
2 = differential GPS, SPS mode
8 = Simulator mode

NOTE 2 Time in seconds since last SC104 type 1 or 9 update, null field when DGPS is not used.

NOTE 3 Geoidal separation: the difference between the WGS-84 earth ellipsoid surface and mean sea level (geoid) surface, " – " = mean sea level surface below the WGS-84 ellipsoid surface.

・RMC – Recommended minimum specific GNSS data

$--RMC, hhmmss.ss, A, llll.ll,a, yyyyy.yy, a, x.x, x.x, xxxxxx, x.x,a, a, a*hh<CR><LF>
　　　　　　　1　　　 2　3　4　　5　　 6　7　 8　　9　　　10 11 12 13

- 1：UTC of position fix
- 2：Status (see Note 3) A = data valid V = navigation receiver warning
- 3：Latitude, N/S
- 4：Latitude, N/S
- 5：Longitude, E/W
- 6：Longitude, E/W
- 7：Speed over ground, knots
- 8：Course over ground, degrees true
- 9：Date: dd/mm/yy
- 10：Magnetic variation,degrees, E/W (see Note 1)
- 11：Magnetic variation,degrees, E/W (see Note 1)
- 12：Mode indicator(see Notes 2 and 3)
- 13：Navigational status (see Note 4)

NOTE 1 E = Easterly variation subtracts from True course
W = Westerly variation adds to True course

NOTE 2 Positioning system Mode Indicator:
A = Autonomous. Satellite system used in non-differential mode in position fix;
D = Differential. Satellite system used in differential mode in position fix;
P = Precise. Satellite system used in precision mode. Precision mode is defined as: no deliberate degradation (such as selective availability) and higher resolution code (P-code) is used to compute position fix. P is also

used for satellite system used in multi-frequency, SBAS or Precise Point Positioning (PPP) mode;
S = Simulator mode.

NOTE 3 The positioning system mode indicator field supplements the positioning system status field, the status field should be set to V = Invalid for all values of indicator mode except for A= Autonomous and D = Differential. The positioning system mode indicator and status fields should not be null fields.

NOTE 4 The navigational status indicator is according to IEC 61108 requirements on 'Navigational (or Failure) warnings and status indications'. This field should not be a NULL field and the character should take one of the following values:
S = Safe when the estimated positioning accuracy (95 % confidence) is within the selected accuracy
level corresponding to the actual navigation mode, and/or integrity is available and within the
requirements for the actual navigation mode, and/or a new valid position has been calculated
within 1 s for a conventional craft and 0,5 s for a high speed craft.
C = Caution when integrity is not available.
U = Unsafe when the estimated positioning accuracy (95 % confidence) is less than the selected
accuracy level corresponding to the actual navigation mode, and/or integrity is available but
exceeds the requirements for the actual navigation mode, and/or a new valid position has not
been calculated within 1 s for a conventional craft and 0,5 s for a high speed craft.
V = Navigational status not valid, equipment is not providing navigational status indication.

・GLL – Geographic position – Latitude/longitude

$--GLL, llll.ll, a, yyyyy.yy, a, hhmmss.ss, A, a *hh<CR><LF>
         1   2   3   4   5   6 7

1 : Latitude, N/S
2 : Latitude, N/S
3 : Longitude, E/W
4 : Longitude, E/W
5 : UTC of position
6 : Status (see Note 2) A=data valid V=data invalid
7 : Mode indicator (see Notes 1 and 2)

NOTE 1 Positioning system mode indicator:
D = Differential
S = Simulator
N = Data not valid

NOTE 2 The mode indicator field supplements the status field (field 6). The status field should be set to V = invalid for all values of operating mode except for A = Autonomous and D = Differential. The positioning system mode indicator and status fields should not be null fields.

・VTG – Course over ground and ground speed

$--VTG, x.x, T, x.x, M, x.x, N, x.x, K,a*hh<CR><LF>
         1 2 3 4 5 6 7 89

1 : Course over ground, degrees true
2 : Course over ground, degrees true
3 : Course over ground, degrees magnetic
4 : Course over ground, degrees magnetic
5 : Speed over ground, knots (see Note 1)
6 : Speed over ground, knots (see Note 1)
7 : Speed over ground, km/h (see Note 1)
8 : Speed over ground, km/h (see Note 1)
9 : Mode indicator (see Note 2)

NOTE 1 The speed over the ground should always be non-negative.

NOTE 2 The mode indicator provides status information about the operation of the source device (such as positioning systems, velocity sensors, etc.) generating the sentence, and the validity of data being provided. The possible indications are as follows:
A = Autonomous mode;
D = Differential mode;
P = Precise. Satellite system used in precision mode. Precision mode is defined as: no deliberate degradation (such as selective availability) and higher resolution code (P-code) is used to compute position fix. P is also used for

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satellite system used in multi-frequency, SBAS or Precise Point Positioning (PPP) mode;
S = Simulator mode;
N = Data not valid.
The mode indicator field should not be a null field.

・GSA – GNSS DOP and active satellites

$--GSA, a, x, xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,x.x,x.x,x.x,h*hh<CR><LF>
　　　　 1 2　　　　　　　　 3　　　　　　　 4　 5　 6　 7

　 1 : Mode: M = manual, forced to operate in 2D or 3D mode
　　　　　　 A = automatic, allowed to automatically switch 2D/3D
　 2 : Mode: 1 = fix not available, 2 = 2D, 3 = 3D
　 3 : ID numbers (see Note 1) of satellites used in solution
　 4 : PDOP
　 5 : HDOP
　 6 : VDOP
　 7 : GNSS System ID (see Note 2)

NOTE 1 Satellite ID numbers. To avoid possible confusion caused by repetition of satellite ID numbers when using
multiple satellite systems, the following convention has been adopted.
a) GPS satellites are identified by their PRN numbers, which range from 1 to 32.
b) The numbers 33 to 64 are reserved for WAAS satellites. The WAAS system PRN numbers are 120 to 138.
The offset from WAAS SV ID to WAAS PRN number is 87. A WAAS PRN number of 120 minus 87 yields
the SV ID of 33. The addition of 87 to the SV ID yields the WAAS PRN number.
c) The numbers 65 to 96 are reserved for GLONASS satellites. GLONASS satellites are identified by 64+
satellite slot numbers. The slot numbers are 1 through 24 for the full GLONASS constellation of 24
satellites, thus giving a range of 65 through 88. The numbers 89 through 96 are available if slot numbers
above 24 are allocated to on-orbit spares.

NOTE 2 GNSS System ID identifies the GNSS System ID according to the Table below.

・GSV – GNSS satellites in view

$--GSV, x, x, xx, xx, xx, xxx, xx.............., xx, xx, xxx, xx, h*hh<CR><LF>
　　　　　 1 2 3　 4　 5　 6　 7　 8　　　　　　 9　　 10

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

NOTE 1 Satellite information may require the transmission of multiple sentences all containing identical field
formats when sending a complete message. The first field specifies the total number of sentences, minimum value 1.
The second field identifies the order of this sentence (sentence number), minimum value 1. For efficiency it is
recommended that null fields be used in the additional sentences when the data is unchanged from the first
sentence.

NOTE 2 A variable number of "Satellite ID-Elevation-Azimuth-SNR" sets are allowed up to a maximum of four sets
per sentence. Null fields are required for unused sets when less than four sets are transmitted.

NOTE 3 Satellite ID numbers. To avoid possible confusion caused by repetition of satellite ID numbers when using
multiple satellite systems, the following convention has been adopted:
a) GPS satellites are identified by their PRN numbers, which range from 1 to 32.
b) The numbers 33 to 64 are reserved for WAAS satellites. The WAAS system PRN numbers are 120 to 138.
The offset from WAAS SV ID to WAAS PRN number is 87. A WAAS PRN number of 120 minus 87 yields
the SV ID of 33. The addition of 87 to the SV ID yields the WAAS PRN number.
c) The numbers 65 to 96 are reserved for GLONASS satellites. GLONASS satellites are identified by
64+satellite slot number. The slot numbers are 1 through 24 for the full GLONASS constellation of 24 satellites, this gives a range
of 65 through 88. The numbers 89 through 96 are available if slot numbers

above 24 are allocated to on-orbit spares.

NOTE 4 Signal ID see Table below.

・**DTM – Datum reference**

$--DTM,ccc,a,x.x,a,x.x,a, x.x,ccc*hh<CR><LF>
       1 2 3 4 5 6 7 8

1 : L o cal datum(see Note 1)
   WGS84 = W84 / WGS72 = W72 / SGS85 = S85 / PE90 = P90
   User defined = 999 / IHO datum code (see Note 4)
2 : Local datum subdivision code (see Note 2)
3 : Lat offset, min, N/S (see Note 3)
4 : Lat offset, min, N/S (see Note 3)
5 : Lon offset, min, E/W (see Note 3)
6 : Lon offset, min, E/W (see Note 3)
7 : Altitude offset, m (see Note 3)
8 : Reference datum (WGS84 = W84 / WGS72 = W72 / SGS85 = S85 / PE90 = P90)

NOTE 1 Three character alpha code for local datum. If not one of the listed earth-centred datums, or 999 for user defined datums, use IHO datum code from International Hydrographic Organisation Publication S-60, Appendices B and C. Null field if unknown. This field should be set to 999 when manual offsets are entered and in use by the position fixing device.

NOTE 2 One character subdivision datum code when available or user defined reference character for user defined datums, null field otherwise. Subdivision character from IHO Publication S-60, Appendices B and C.

NOTE 3 Latitude and longitude offsets are positive numbers, the altitude offset may be negative. Offsets change with position: position in the local datum is offset from the position in the reference datum in the directions indicated:
$$P_{local\ datum} = P_{ref\ datum} + offset$$
When field 1 contains a value of 999, these fields may not be null, and should contain the manually entered or user defined offsets.

NOTE 4 Users should be aware that chart transformations based on IHO S60 parameters may result in significant positional errors when applied to chart data.

・**GBS – GNSS satellite fault detection**

$--GBS, hhmmss.ss, x.x, x.x, x.x, xx, x.x, x.x, x.x, h, h *hh <CR><LF>
        1   2   3   4   5 6   7   8 9 10

1 : UTC time of the GGA or GNS fix associated with this sentence
2 : Expected error in latitude (see Note 1)
3 : Expected error in longitude (see Note 1)
4 : Expected error in altitude (see Note 1)
5 : ID number (see Note 2) of most likely failed satellite
6 : Probability of missed detection for most likely failed satellite
7 : Estimate of bias on most likely failed satellite(in metres)
8 : Standard deviation of bias estimate
9 : GNSS System ID (see Note 3)
10 : GNSS Signal ID (see Note 4)

NOTE 1 Expected error in metres due to bias, with noise = 0.

NOTE 2 Satellite ID numbers. To avoid possible confusion caused by repetition of satellite ID numbers when using multiple satellite systems, the following convention has been adopted (these legacy systems remain in effect for new systems see NOTE 3):
a) GPS satellites are identified by their PRN numbers, which range from 1 to 32.
b) The numbers 33-64 are reserved for WAAS satellites. The WAAS system PRN numbers are 120-138.
The offset from WAAS SV ID to WAAS PRN number is 87. A WAAS PRN number of 120 minus 87
yields the SV ID of 33. The addition of 87 to the SV ID yields the WAAS PRN number.
c) The numbers 65-96 are reserved for GLONASS satellites. GLONASS satellites are identified by 64+
satellite slot number. The slot numbers are 1 through 24 for the full GLONASS constellation of 24
satellites; this gives a range of 65 through 88. The numbers 89 through 96 are available if slot numbers
above 24 are allocated to on-orbit spares.

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NOTE 3 System ID identifies the GNSS System ID according to the Table below. Note that legacy numbering system as above should remain in effect.

NOTE 4 GNSS Signal ID identifies the GNSS Signal ID according to the Table below.

・GRS – GNSS range residuals

$--GRS, hhmmss.ss,x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,h,h *hh<CR><LF>
          1   2   3   4 5

1 : UTC time of the GGA or GNS fix associated with this sentence
2 : Mode: 0 = residuals were used to calculate the position given in the matching GGA or GNS sentence
        1 = residuals were re-computed after the GGA or GNS position was computed
3 : Range residuals for satellites used in the navigation solution (see Notes 1 and 2)
    Order should match order of satellite ID (see Note 3) numbers in GSA.
    When GRS is used, GSA and GSV are generally required. Null for unused fields
4 : GNSS System ID (see Note 3)
5 : Signal ID (see Note 4)

NOTE 1 If the range residual exceeds ±99,9 m, then the decimal part is dropped, resulting in an integer (–103,7 becomes –103). The maximum value for this field is ±999.

NOTE 2 The sense or sign of the range residual is determined by the order of parameters used in the calculation. The expected order is as follows: range residual = calculated range - measured range.

NOTE 3 When multiple GRS sentences are being sent then their order of transmission should match the order of corresponding GSA sentences. Listeners should keep track of pairs of GSA and GRS sentences and discard data if pairs are incomplete.

NOTE 4 Signal ID identifies the actual ranging signal according to the Table below.

NOTE 5 System ID, see Table below.

・GST – GNSS pseudorange noise statistics

$--GST, hhmmss.ss, x.x, x.x, x.x, x.x, x.x, x.x, x.x*hh<CR><LF>
          1   2   3   4   5   6   7   8

1 : UTC time of the GGA or GNS fix associated with this sentence
2 : RMS value of the standard deviation of the range inputs to the
    navigation process. Range inputs include pseudoranges and DGPS corrections
3 : Standard deviation of semi-major axis of error ellipse (m)
4 : Standard deviation of semi-minor axis of error ellipse (m)
5 : Orientation of semi-major axis of error ellipse (degrees from true north)
6 : Standard deviation of latitude error (m)
7 : Standard deviation of longitude error (m)
8 : Standard deviation of altitude error (m)

・ZDA – Time and date

$--ZDA, hhmmss.ss, xx, xx, xxxx, xx, xx*hh<CR><LF>
          1   2 3   4   5 6

1 : UTC
2 : Day, 01 to 31 (UTC)
3 : Month, 01 to 12 (UTC)
4 : Year (UTC)
5 : Local zone hours(see Note), 00 h to ±13 h
6 : Local zone minutes (see Note), 00 to +59

NOTE Local time zone is the magnitude of hours plus the magnitude of minutes added, with the sign of local zone

hours, to local time to obtain UTC. Local zone is generally negative for East longitudes with local exceptions near the international date line.
Example: At Chatham Is. (New Zealand) at 1230 (noon) local time on June 10, 1995:
$GPZDA,234500,09,06,1995,-12,45*6C<CR><LF>
In the Cook Islands at 1500 local time on June 10, 1995:
$GPZDA,013000,11,06,1995,10,30*4A<CR><LF>

・GNS – GNSS fix data

$-- GNS, hhmmss.ss, llll.ll, a, yyyyy.yy, a, c--c,xx,x.x,x.x,x.x,x.x,x.x,a *hh<CR><LF>
　　　　　　1　　　　　2　3　　4　　　5　6　　7　8　9　10 11 12 13

  1 : UTC of position

  2 : Latitude, N/S

  3 : Latitude, N/S

  4 : Longitude, E/W

  5 : Longitude, E/W

  6 : Mode indicator (see Note 1)

  7 : Total number of satellites in use, 00-99

  8 : HDOP (see Note 3)

  9 : Antenna altitude, m, re: mean-sea-level (geoid)

10 : Geoidal separation, m (see Note 4)

11 : Age of differential data (see Note 2)

12 : Differential reference station ID (see Note 2)

13 : Navigational status indicator (see Note 5)

NOTE 1 Mode indicator. A variable length valid character field type with the first three characters currently defined. The first character indicates the use of GPS satellites, the second character indicates the use of GLONASS satellites and the third indicate the use of Galileo satellites. If another satellite system is added to the standard, the mode indicator will be extended to four characters, new satellite systems should always be added on the right, so the order of characters in the mode indicator is: GPS, GLONASS, Galileo, other satellite systems in the future. The characters should take one of the following values:
A = Autonomous. Satellite system used in non-differential mode in position fix
D = Differential. Satellite system used in differential mode in position fix
N = No fix. Satellite system not used in position fix, or fix not valid
P = Precise. Satellite system used in precision mode. Precision mode is defined as: no deliberate degradation (such as selective availability) and higher resolution code (P-code) is used to compute position fix. P is also used for satellite system used in multi-frequency, SBAS or Precise Point Positioning (PPP) mode
S = Simulator mode
The mode indicator should not be a null field.

NOTE 2 Age of differential data and Differential Reference Station ID:
a) When the talker is GN and more than one of the satellite systems are used in differential mode, then the "Age of differential data" and "Differential reference station ID" fields should be null. In this case, the "Age of differential data" and "Differential reference station ID" fields should be provided in following GNS sentences with talker IDs of GP, GL, etc. These following GNS messages should have the latitude, N/S, longitude, E/W, altitude, geoidal separation, mode, and HDOP fields null. This indicates to the listener that the field is supporting a previous $GNGNS sentence with the same time tag. The "Number of satellites" field may be used in these following sentences to denote the number of satellites used from that satellite system.
Example: A combined GPS/GLONASS receiver using only GPS differential corrections has the following GNS sentence sent.
$GNGNS,122310.2,3722.425671,N,12258.856215,W ,DA,14,0.9,1005.543,6.5,5.2,23*59<CR><LF>
Example: A combined GPS/GLONASS receiver using both GPS differential corrections and GLONASS differential corrections may have the following three GNS sentences sent in a group.
$GNGNS,122310.2,3722.425671,N,12258.856215,W ,DD,14,0.9,1005.543,6.5,,*74<CR><LF>
$GPGNS,122310.2, , , , , ,7, , , ,5.2,23*4D<CR><LF>
$GLGNS,122310.2, , , , , ,7, , , ,3.0,23*55<CR><LF>
The Differential Reference station ID may be the same or different for the different satellite systems.
b) Age of Differential Data
For GPS Differential Data:
This value is the average age of the most recent differential corrections in use. When only RTCM SC104 Type 1 corrections are used, the age is that of the most recent Type 1 correction. When RTCM SC104 Type 9 corrections are used solely, or in combination with Type 1 corrections, the age is the average of the most recent corrections for the satellites used. Null field when Differential GPS is not used.
NOTE 3 HDOP calculated using all the satellites (GPS, GLONASS, Galileo and any future satellites) used in computing the solution reported in each GNS sentence.

NOTE 4 Geoidal Separation: the difference between the earth ellipsoid surface and mean-sea-level (geoid) surface defined by the reference datum used in the position solution, "-" = mean-sea-level surface below ellipsoid. The reference datum may be specified in the DTM sentence.

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NOTE 5 The navigational status indicator is according to IEC 61108 requirements on 'Navigational (or Failure) warnings and status indications'. This field should not be a NULL field and the character should take one of the following values:
S = Safe when the estimated positioning accuracy (95 % confidence) is within the selected accuracy
level corresponding to the actual navigation mode, and integrity is available and within the
requirements for the actual navigation mode, and a new valid position has been calculated
within 1 s for a conventional craft and 0,5 s for a high speed craft
C = Caution when integrity is not available
U = Unsafe when the estimated positioning accuracy (95 % confidence) is less than the selected
accuracy level corresponding to the actual navigation mode, and/or integrity is available but
exceeds the requirements for the actual navigation mode, and/or a new valid position has not
been calculated within 1 s for a conventional craft and 0,5 s for a high speed craft
V = Navigational status not valid, equipment is not providing navigational status indication.

・MSS – MSK receiver signal status

$--MSS,x.x,x.x,x.x,x.x,x*hh<CR><LF>
       1 2 3   4 5

1 : Signal strength (SS), dB/1 mV/m
2 : Signal-to-noise ratio (SNR), dB
3 : Beacon frequency, 283,5 kHz to 325,0 kHz
4 : Beacon bit rate (25, 50, 100, 200) bits/s
5 : Channel number (see Note)

NOTE Set equal to "1" or null for single channel receivers.

・ALR – Set alarm state

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

1 : Time of alarm condition change, UTC
2 : Unique alarm number (identifier) at alarm source
3 : Alarm condition (A = threshold exceeded, V = not exceeded)
4 : Alarm's acknowledge state, A = acknowledged / V = unacknowledged
5 : Alarm's description text

・APB – Heading/track controller (autopilot) sentence B

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

1 : Status: A = Data valid V = LORAN-C blink or SNR warning (see Note 2)
       V = general warning flag for other navigation systems when a reliable fix is not available
2 : Status: A = OK or not used V = LORAN-C cycle lock warning flag (see Note 2)
3 : Magnitude of XTE (cross-track-error)
4 : Direction to steer, L/R
5 : XTE units, nautical miles
6 : Status: A = arrival circle entered V = arrival circle not passed
7 : Status: A = perpendicular passed at waypoint
       V = perpendicular not entered
8 : Bearing origin to destination, M/T
9 : Bearing origin to destination, M/T
10 : Destination waypoint ID
11 : Bearing, present position to destination, magnetic or true
12 : Bearing, present position to destination, magnetic or true
13 : Heading to steer to destination waypoint, magnetic or true
14 : Heading to steer to destination waypoint, magnetic or true

15 : Mode indicator (see Notes 1 and 2)

NOTE 1 Positioning system mode indicator:
A = Autonomous mode;
D = Differential mode;
S = Simulator mode;
N = Data not valid.

NOTE 2 The positioning system mode indicator field supplements the positioning system status fields (fields
1 and 2), the status fields should be set to V = invalid for all values of mode indicator except for A = Autonomous
and D = Differential. The positioning system mode indicator should not be null fields.

・BOD – Bearing origin to destination

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

 1 : Bearing, degrees true
 2 : Bearing, degrees true
 3 : Bearing, degrees magnetic
 4 : Bearing, degrees magnetic
 5 : Destination waypoint ID
 6 : Origin waypoint ID

・BWC – Bearing and distance to waypoint – Great circle

$--BWC, hhmmss.ss, llll.ll, a, yyyyy.yy, a, x.x, T, x.x, M, x.x, N, c--c, a*hh<CR><LF>
           1   2   3   4   5 6 7 8 9 10 11 12 13

 1 : UTC of observation
 2 : Waypoint latitude, N/S
 3 : Waypoint latitude, N/S
 4 : Waypoint longitude, E/W
 5 : Waypoint longitude, E/W
 6 : Bearing, degrees true
 7 : Bearing, degrees true
 8 : Bearing, degrees magnetic
 9 : Bearing, degrees magnetic
10 : Distance, nautical miles
11 : Distance, nautical miles
12 : Waypoint ID
13 : Mode indicator (see Note)

NOTE Positioning system mode indicator:
A = Autonomous mode;
D = Differential mode;
S = Simulator mode;
N = Data not valid.
The mode indicator field should not be a null field.

・BWR – Bearing and distance to waypoint – Rhumb line

$--BWR, hhmmss.ss, llll.ll, a, yyyyy.yy, a, x.x, T, x.x, M, x.x, N, c--c, a*hh<CR><LF>
           1   2   3   4   5 6 7 8 9 10 11 12 13

 1 : UTC of observation
 2 : Waypoint latitude, N/S
 3 : Waypoint latitude, N/S
 4 : Waypoint longitude, E/W
 5 : Waypoint longitude, E/W

6：Bearing, degrees true

7：Bearing, degrees true

8：Bearing, degrees magnetic

9：Bearing, degrees magnetic

10：Distance, nautical miles

11：Distance, nautical miles

12：Waypoint ID

13：Mode indicator (see Note)

NOTE Positioning system mode indicator:
A = Autonomous mode;
D = Differential mode;
S = Simulator mode;
N = Data not valid.
The mode indicator field should not be a null field.

・**RMB – Recommended minimum navigation information**

$--RMB, A, x.x, a, c--c, c--c, llll.ll, a, yyyyy.yy,a,x.x, x.x, x.x, A, a *hh<CR><LF>
           1 2 3 4   5   6   7   8   9 10 11 12 13 14

1：Status (see Note 4): A = data valid
                          V = navigation receiver warning

2：Cross track error (see Note 2), nautical miles

3：Direction to steer L/R

4：Origin waypoint ID

5：Destination waypoint ID

6：Destination waypoint latitude, N/S

7：Destination waypoint latitude, N/S

8：Destination waypoint longitude, E/W

9：Destination waypoint longitude, E/W

10：Range to destination, nautical miles (see Note 1)

11：Bearing to destination, degreestrue

12：Destination closing velocity, knots

13：Arrival status
      A = arrival circle, entered or
      perpendicular passed
      V = not entered or passed

14：Mode indicator (see Notes 3 and 4)

NOTE 1 If range to destination exceeds 999,9 nautical miles, display 999,9.

NOTE 2 If cross track error exceeds 9,99 nautical miles, display 9,99.

NOTE 3 Positioning system mode indicator:
A = Autonomous mode;
D = Differential mode;
S = Simulator mode;
N = Data not valid.

NOTE 4 The positioning system mode indicator field supplements the status field (field No. 1) which should be set
to V = invalid for all values of Mode indicator except for A = Autonomous and D = Differential. The positioning system
mode indicator and status fields should not be null fields.

・**XTE – Cross-track error, measured**

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

1：Status (see Note 2) A = data valid, V = LORAN – C blink or SNR warning
                        V = general warning flag for other navigation systems
                        when a reliable fix is not available

2：Status: A = data valid V = Loran-C cycle lock warning flag

3 : Magnitude of cross-track error
4 : Direction to steer, L/R
5 : Units, nautical miles
6 : Mode indicator (see Notes 1 and 2)

NOTE 1 Positioning system mode indicator:

A = Autonomous mode;
D = Differential mode;
S = Simulator mode;
N = Data not valid.

NOTE 2 The positioning system mode indicator field supplements the positioning system status fields (fields 1 and 2); the status fields should be set to V = invalid for all values of indicator mode except for A = Autonomous and D = Differential. The positioning system mode indicator and status fields should not be null fields.

· ZTG – UTC and time to destination waypoint

$--ZTG, hhmmss.ss, hhmmss.ss, c--c*hh<CR><LF>
　　　　　　　　　1　　　　　　2　　　　3

1 : UTC of observation
2 : Time-to-go, hh = 00 to 99
3 : Destination waypoint ID

· AAM – Waypoint arrival alarm

$--AAM, A, A,x.x, N, c--c*hh<CR><LF>

1 : Status: A = arrival circle entered; V = not entered
2 : Status: A = perpendicular passed at waypoint; V = not passed
3 : Arrival circle radius
4 : Units of radius, nautical miles
5 : Waypoint ID

· RTE – Routes

$--RTE, x.x, x.x, a, c--c, c--c,...... c--c*hh<CR><LF>
　　　　　1　2　3　4　　5 6　　7 8

1 : Total number of sentences being transmitted (see Note 2)
2 : Sentence number (see Note 2)
3 : Message mode: c = complete route, all waypoints
　　　w = working route, first listed waypoint is "FROM",
　　　second is "TO" and remaining are rest of route
4 : Route identifier
5 : Waypoint identifier
6 : Additional waypoint identifiers (see Note 1)
7 : Additional waypoint identifiers (see Note 1)
8 : Waypoint "n" identifier (see Note 1)

NOTE 1 A variable number of waypoint identifiers, up to "n", may be included within the limits of allowed sentence length. As there is no specified number of waypoints, null fields are not required for waypoint identifier fields.

NOTE 2 A single route may require the transmission of multiple sentences, all containing identical field formats when sending a complex message. The first field specifies the number of sentences, minimum value = 1. The second field identifies the order of this sentence (sentence number), minimum value = 1. For efficiency, it is permitted that null fields be used in the additional sentences when the data is unchanged from the first sentence. (Note that this practice can lead to the incorrect assembly of sentences if there is a high risk of loss of sentence.)

・WPL – Waypoint location

$--WPL, llll.ll, a, yyyyy.yy, a, c--c*hh<CR><LF>
          1   2   3   4   5

 1 : Waypoint latitude, N/S
 2 : Waypoint latitude, N/S
 3 : Waypoint longitude, E/W
 4 : Waypoint longitude, E/W
 5 : Waypoint identifier

・ACK – Acknowledge alarm

$--ACK,xxx*hh<CR><LF>
          1

 1 : Unique alarm number (identifier) at alarm source

・HDT – Heading true

$--HDT, x.x, T*hh<CR><LF>
          1   2

 1 : Heading, degrees true
 2 : Heading, degrees true

・THS – True heading and status

$--THS,x.x,a*hh<CR><LF>
          1   2
 1 : Heading, degrees true
 2 : Mode indicator (see Note)

NOTE Mode indicator. This field should not be null.
A = Autonomous
S = Simulator mode
V = Data not valid (including standby)

・DBT – Depth below transducer

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

 1 : Water depth, feet
 2 : Water depth, feet
 3 : Water depth, m
 4 : Water depth, m
 5 : Water depth, fathoms
 6 : Water depth, fathoms

・DPT – Depth

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

1 : Water depth relative to the transducer, in metres
2 : Offset from transducer, in metres (see Notes 1 and 2)
3 : Maximum range scale in use

NOTE 1 "positive" = distance from transducer to water line; "-" = distance from transducer to keel.

NOTE 2 For IEC applications, the offset should always be applied so as to provide depth relative to the keel.

・MTW – Water temperature

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

1 : Temperature, degrees C
2 : Temperature, degrees C

・CUR – Water current layer – Multi-layer water current data

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

1 : Validity of the data, A = Valid, V = not valid
2 : Data set number, 0 to 9 (see Note 1)
3 : Layer number (see Note 2)
4 : Current depth in metres
5 : Current direction in degrees
6 : Direction reference in use, True/Relative T/R
7 : Current speed in knots
8 : Reference layer depth in metres (see Note 3)
9 : Heading
10 : Heading reference in use, True/Magnetic T/M
11 : Speed reference (see Note 4)
        B: Bottom track
        W: Water track
        P: Positioning system

NOTE 1 The data set number is used to identify multiple sets of current data produced in one measurement instance. Each measurement instance may result in more than one sentence containing current data measurements at different layers, all with the same data set number. This is used to avoid the data measured in another instance to be accepted as one set of data.

NOTE 2 The layer number identifies which layer the current data measurements were made from. The number of layers that can be measured varies by device. The typical number is between 3 and 32, though many more are possible.

NOTE 3 The current of each layer is measured according to this reference layer, when the speed reference field is set to "water track", or the depth is too deep for bottom track.

NOTE 4 "Speed reference" identifies the method of ship speed used for measuring the current speed.

・**VBW – Dual ground/water speed**

$--VBW, x.x, x.x, A, x.x, x.x, A, x.x, A, x.x, A*hh<CR><LF>
              1 2 3 4   5 6 7 8 9 10

  1 : Longitudinal water speed (see Note 1), knots
  2 : Transverse water speed (see Note 1), knots
  3 : Status (see Note 2): water speed, A = data valid, V = data invalid
  4 : Longitudinal ground speed (see Note 1), knots
  5 : Transverse ground speed (see Note 1), knots
  6 : Status (see Note 2), ground speed, A = data valid, V = data invalid
  7 : Stern transverse water speed (see Note 1), knots
  8 : Status (see Note 2): stern water speed, A = data valid, V = data invalid
  9 : Stern transverse ground speed (see Note 1), knots
10 : Status (see Note 2): stern ground speed, A = data valid, V = data invalid

NOTE 1 Transverse speed: "-" = port,
      Longitudinal speed: "-" = astern.

NOTE 2 The status field should not be a null field.

・**VHW – Water speed and heading**

$--VHW, x.x, T, x.x, M, x.x, N, x.x, K*hh<CR><LF>
            1 2 3 4 5 6 7 8

  1 : Heading, degrees true
  2 : Heading, degrees true
  3 : Heading, degrees magnetic
  4 : Heading, degrees magnetic
  5 : Speed, knots
  6 : Speed, knots
  7 : Speed, km/h
  8 : Speed, km/h

Input Sentence

・HDT – Heading true

$--HDT, x.x, T*hh<CR><LF>
   1 2

 1 : Heading, degrees true
 2 : Heading, degrees true

・THS – True heading and status

$--THS,x.x,a*hh<CR><LF>
    1 2
 1 : Heading, degrees true
 2 : Mode indicator (see Note)

NOTE Mode indicator. This field should not be null.
A = Autonomous
S = Simulator mode
V = Data not valid (including standby)

・DBT – Depth below transducer

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

 1 : Water depth, feet
 2 : Water depth, feet
 3 : Water depth, m
 4 : Water depth, m
 5 : Water depth, fathoms
 6 : Water depth, fathoms

・DPT – Depth

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

 1 : Water depth relative to the transducer, in metres
 2 : Offset from transducer, in metres (see Notes 1 and 2)
 3 : Maximum range scale in use

NOTE 1 "positive" = distance from transducer to water line; "-" = distance from transducer to keel.

NOTE 2 For IEC applications, the offset should always be applied so as to provide depth relative to the keel.

・MTW – Water temperature

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

 1 : Temperature, degrees C
 2 : Temperature, degrees C

・**CUR – Water current layer – Multi-layer water current data**

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

 1 : Validity of the data, A = Valid, V = not valid
 2 : Data set number, 0 to 9 (see Note 1)
 3 : Layer number (see Note 2)
 4 : Current depth in metres
 5 : Current direction in degrees
 6 : Direction reference in use, True/Relative T/R
 7 : Current speed in knots
 8 : Reference layer depth in metres (see Note 3)
 9 : Heading
10 : Heading reference in use, True/Magnetic T/M
11 : Speed reference (see Note 4)
       B: Bottom track
       W: Water track
       P: Positioning system

NOTE 1 The data set number is used to identify multiple sets of current data produced in one measurement instance. Each measurement instance may result in more than one sentence containing current data measurements at different layers, all with the same data set number. This is used to avoid the data measured in another instance to be accepted as one set of data.

NOTE 2 The layer number identifies which layer the current data measurements were made from. The number of layers that can be measured varies by device. The typical number is between 3 and 32, though many more are possible.

NOTE 3 The current of each layer is measured according to this reference layer, when the speed reference field is set to "water track", or the depth is too deep for bottom track.

NOTE 4 "Speed reference" identifies the method of ship speed used for measuring the current speed.

・**VBW – Dual ground/water speed**

$--VBW, x.x, x.x, A, x.x, x.x, A, x.x, A, x.x, A*hh<CR><LF>
        1 2 3 4   5 6 7 8 9 10

 1 : Longitudinal water speed (see Note 1), knots
 2 : Transverse water speed (see Note 1), knots
 3 : Status (see Note 2): water speed, A = data valid, V = data invalid
 4 : Longitudinal ground speed (see Note 1), knots
 5 : Transverse ground speed (see Note 1), knots
 6 : Status (see Note 2), ground speed, A = data valid, V = data invalid
 7 : Stern transverse water speed (see Note 1), knots
 8 : Status (see Note 2): stern water speed, A = data valid, V = data invalid
 9 : Stern transverse ground speed (see Note 1), knots
10 : Status (see Note 2): stern ground speed, A = data valid, V = data invalid

NOTE 1 Transverse speed: "-" = port,
     Longitudinal speed: "-" = astern.

NOTE 2 The status field should not be a null field.

・**VHW – Water speed and heading**

```
$--VHW, x.x, T, x.x, M, x.x, N, x.x, K*hh<CR><LF>
          1  2    3    4    5    6    7    8
```

1 : Heading, degrees true
2 : Heading, degrees true
3 : Heading, degrees magnetic
4 : Heading, degrees magnetic
5 : Speed, knots
6 : Speed, knots
7 : Speed, km/h
8 : Speed, km/h

・**RTE – Routes**

```
$--RTE, x.x, x.x, a, c--c, c--c,...... c--c*hh<CR><LF>
          1    2   3   4    5 6    7  8
```

1 : Total number of sentences being transmitted (see Note 2)
2 : Sentence number (see Note 2)
3 : Message mode: c = complete route, all waypoints
       w = working route, first listed waypoint is "FROM",
       second is "TO" and remaining are rest of route
4 : Route identifier
5 : Waypoint identifier
6 : Additional waypoint identifiers (see Note 1)
7 : Additional waypoint identifiers (see Note 1)
8 : Waypoint "n" identifier (see Note 1)

NOTE 1 A variable number of waypoint identifiers, up to "n", may be included within the limits of allowed sentence length. As there is no specified number of waypoints, null fields are not required for waypoint identifier fields.

NOTE 2 A single route may require the transmission of multiple sentences, all containing identical field formats when sending a complex message. The first field specifies the number of sentences, minimum value = 1. The second field identifies the order of this sentence (sentence number), minimum value = 1. For efficiency, it is permitted that null fields be used in the additional sentences when the data is unchanged from the first sentence. (Note that this practice can lead to the incorrect assembly of sentences if there is a high risk of loss of sentence.)

・**WPL – Waypoint location**

```
$--WPL, llll.ll, a, yyyyy.yy, a, c--c*hh<CR><LF>
          1     2     3      4    5
```

1 : Waypoint latitude, N/S
2 : Waypoint latitude, N/S
3 : Waypoint longitude, E/W
4 : Waypoint longitude, E/W
5 : Waypoint identifier

・**ACK – Acknowledge alarm**

```
$--ACK,xxx*hh<CR><LF>
         1
```

1 : Unique alarm number (identifier) at alarm source

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・ALR – Set alarm state

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

 1：Time of alarm condition change, UTC
 2：Unique alarm number (identifier) at alarm source
 3：Alarm condition (A = threshold exceeded, V = not exceeded)
 4：Alarm's acknowledge state, A = acknowledged / V = unacknowledged
 5：Alarm's description text

Appendix 6 Compass Safe Distance

No	Name	Model	Compass Safe Distance [m]	
			Standard	Steering
1	AC Power Supply	NBG-320	0.3	0.2
2	AC Power Supply	NBD-577C	0.9	0.6
3	Dimmer	NCM-227	0.1	0.1
4	Printer	NKG-104	0.8	0.5
5	Select Switch	NCZ-777	0.2	0.1
6	Select Switch	NCZ-1663	0.1	0.1
7	Select Switch	NCZ-1537B	0.2	0.1
8	Junction Box	NQE-7700A	0.2	0.1
9	Output Buffer	NQA-4251A	0.1	0.1
10	Output Buffer	NQA-4351	0.1	0.1
11	Junction Box (note 1)	NQD-4410	0.2	0.1
12	Junction Box (note 1)	NQD-4411	0.2	0.1
13	Junction Box	CQD-10	0.3	0.2

note 1) Coaxial Cable Kit NQD-4414: cosisting of NQD-4410 and NQD-4411