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KODEN

OPERATION MANUAL

GPS Compass

KGC-222

This product is specifically desingned to be installed on boats and other means of maritime transport. If your country forms part to the EU, please contact your dealer for advice before attempting to install elsewhere.

KODEN

Declaration of Conformity

This declaration is issued according to the Directive 2014/53/EU of the European Parliament and of the Council on the harmonization of the laws of the Member States relating to making available on the market of radio equipment.

We, Koden Electronics Co., Ltd.

5278 Uenohara

Uenohara-Shi,

Yamanashi-Ken

409-0112, Japan

declare as manufacturer under our sole responsibility that the Marine GPS compass (Transmitting Heading Device)

GPS compass KGC-222

intended for use as a Marine Transmitting Heading Device for use aboard non-SOLAS vessels to which this declaration relates conforms to the following standard(s)

- · IEC 60945 Ed.4.0 2002 EMC related items
- · EN 60950-1 :2006 + A2: 2013 Safety related items
- · EN 303 413 V1.1.1: 2017-06

Type names: KGC-222
Consisting of: Display Unit: KGC-222.MU
                    Antenna Unit: GA-12

For assessment, see
- EU-type examination (Module B) certificate no: T818206E-01-TEC issued by CTC advanced (0682), Germany

Software: KM-F27*
Frequency: 1575.42MHz ± 1MHz

EU representative: Koden Elektronik GmbH
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Signature........*Jun Harayama*............

Jun Harayama
Manager / Quality Assurance Department

Dated ....09 November 2017........

CE

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1	0093122202-01	2013/12/11	Configuration of Equipment, Chapter 3
2	0093122202-02	2014/03/04	Introduction, Chapter 3
3	0093122202-03	2014/06/05	Chapter 1
4	0093122202-04	2014/09/04	For Your Safe Opration, Chapter 1, Chapter 2, Chapter 3, Chapter 4, Chapter 5
5	0093122202-05	2014/11/19	Chapter 1
6	0093122202-06	2016/12/20	Configuration of Equipment, Chapter 3
7	0093122202-07	2017/11/13	Declaration
8			
9			
10			

Document No. Revised Version Norm

When part of the document needs to be revised, the document has advanced revision number. The document No. is indicated at the lower right side on the cover and at the left or right side of the footer region of each page.

Important Notice

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- The specification of the products and the contents in this manual are subject to change without notice.

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For Your Safe Operation

Pictograms used in this Operation Manual

The following pictograms are used in this manual. The meaning of each symbols shall be well understood and the maintenance and inspection shall be carried out.

Symbol	Meaning
⚠ **Warning**	**Mark for warning** This mark denotes that there is a risk of death or serious injury when dealt with incorrectly.
⚡	**Mark for danger of high voltage** This mark denotes that there is a risk of death or serious injury due to electric shock when dealt with incorrectly.
⚠ **Caution**	**Mark for caution** This mark denotes that there is a risk of slight injury or damages of devices when dealt with incorrectly.
🚫	**Mark for prohibition** This mark denotes prohibition of specified conducts. Description of the prohibition is displayed near the mark.

Precautions on equipment

⚡	**Be careful of high voltage inside** High voltage, which may risk you life, is used. This high voltage may remain in the circuit even after the power is switched off. To prevent contact with the high voltage circuits accidentally, a protective cover or the label with this mark is provided on the high voltage circuit. When the inside is to be checked, ensure to switch off the power and to discharge the residual voltage for safety. An engineer authorized by Koden shall carry out the inspection and maintenance works.
⚠ **Warning**	**Power off in the boat** An accidental power-on during works may result in worker's electrification. To prevent such accident in advance, ensure that power in the boat and on the equipment are switched off. Furthermore, it is safer to hang a caution tag saying "Under work" near the power switch of equipment.
⚠ **Warning**	**Be careful of dust** Inhaled dust may cause respiratory affection. At the time of cleaning the inside of equipment, be careful not to inhale dust. Wearing a safety mask is recommended.
⚠ **Caution**	**Caution on location of installment** The equipment shall not be installed at locations which are excessively damp and suffers from water drops. Otherwise, dew condensation may occur inside the display screen, and corrosion may occur inside the unit box.

⚠ Caution	**Measures against static electricity** Static electricity may be generated from the carpet on the floor in the cabin or clothes made of synthetic fiber, and it may destroy the electronic components on circuit boards. The circuit boards shall be handled with appropriate measures against static electricity.

Precautions on handling

⚠ Warning	No disassembly or modification of this equipment is allowed. It may lead to failure, firing, smoking or electric shock. In case of failure, please contact Koden's dealers or Koden.
⚠ Warning	In case of smoking or firing, switch off the power in the boat and of this equipment. It may lead to firing, electric shock or damages.
⚡	**Be careful of residual high voltage** High voltage may remain in capacitors for several minutes after switching off the power. Before inspection of the inside, please wait at least 5 minutes after switching off or discharge the residual electricity in an appropriate manner. Then, start the work.
⚠ Caution	The information displayed on this equipment is not intended to use for your navigation. For your navigation, be sure to see the specified materials.

Contents

Introduction

KGC-222 is a GPS compass.

Through the use of GPS satellites, it outputs the heading of vessel with a high degree of accuracy by calibrating the phase difference of two GPS antennas.

The main features of this unit are as follows:

- KGC-222 consists of two main components, Display and Antenna.
  Display unit has processor, receiver and LCD display built-in.

- KGC-222 has internal electronic compass as backup sensor.
  This enables the backup sensor to output heading even if the GPS signals are interrupted in such case as the vessel passing under a bridge.

- KGC-222 can also output pitch / roll and heaving data.
  When KGC-222 is used with an echo sounder with heaving compensation function, you can obtain stable sea bottom without effect from heaves and waves.

- It has 3 heading data output ports. Up to 5 ports will be available with connecting an optional junction box.
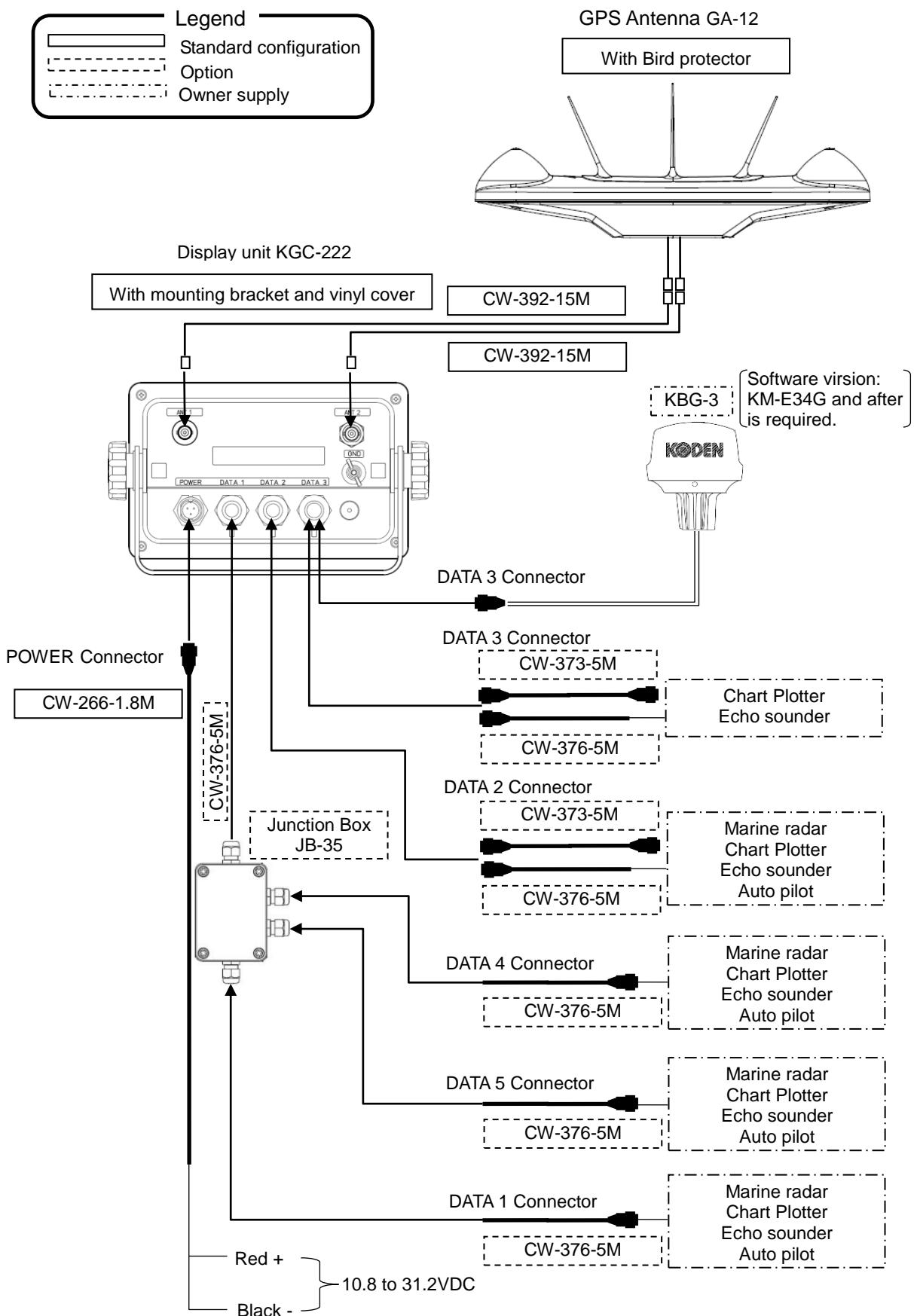
System Configuration

Connection diagram

Legend
- Standard configuration
- Option
- Owner supply

GPS antenna   GA-12

With Bird protector

Display unit KGC-222

With mounting bracket and vinyl cover | CW-392-15M

CW-392-15M

ANT 1   ANT 2

GND

POWER   DATA 1   DATA 2   DATA 3

KBG-3 | Software virsion: KM-E34G and after is required.

KODEN

POWER Connector

DATA 3 Connector

CW-266-1.8M

DATA 3 Connector

CW-373-5M

Chart Plotter
Echo sounder

CW-376-5M

DATA 2 Connector

CW-373-5M

Marine radar
Chart Plotter
Echo sounder
Auto pilot

CW-376-5M

DATA 1 Connector

CW-373-5M

Marine radar
Chart Plotter
Echo sounder
Auto pilot

CW-376-5M

Red +
Black -
10.8 to 31.2VDC

System Configuration (with Junction box)

Connection diagram

Legend
Standard configuration
Option
Owner supply

GPS Antenna GA-12

With Bird protector

Display unit KGC-222

With mounting bracket and vinyl cover

CW-392-15M

CW-392-15M

KBG-3 | Software virsion: KM-E34G and after is required.

KODEN

ANT 1   ANT 2   GND

POWER   DATA 1   DATA 2   DATA 3

DATA 3 Connector

DATA 3 Connector

POWER Connector

CW-266-1.8M

CW-376-5M

CW-373-5M

Chart Plotter
Echo sounder

CW-376-5M

DATA 2 Connector

Junction Box
JB-35

CW-373-5M

Marine radar
Chart Plotter
Echo sounder
Auto pilot

CW-376-5M

DATA 4 Connector

Marine radar
Chart Plotter
Echo sounder
Auto pilot

CW-376-5M

DATA 5 Connector

Marine radar
Chart Plotter
Echo sounder
Auto pilot

CW-376-5M

DATA 1 Connector

Marine radar
Chart Plotter
Echo sounder
Auto pilot

CW-376-5M

Red +

10.8 to 31.2VDC

Black -

Configuration of Equipment

Standard Equipment Configuration List

No.	Name of item	Type	Remark	Weight/ Length	Qty
1	Display unit	KGC-222.MU	With mounting bracket and vinyl cover	0.87 kg	1
2	DC power cable	CW-266-1.8M	With a 3-pin connector and one end plain	1.8m	1
3	GPS antenna	GA-12	With bird protector		1
4	Antenna cable	CW-392-15M	3D-2V With BNC connectors on the both sides	15m	2
5	Installation material	TPT5 X 20U T.5X20MMX10M 10M [gray] B8X25U	Truss tapping screw (2) Self-bonding tape (1) PVC tape (1) Hexagon bolt for antenna installation (4)		1 set
6	Operation Manual	KGC-222.OM.E	English		1
7	Cautionary Note	KGC-222.RM.E	English		1
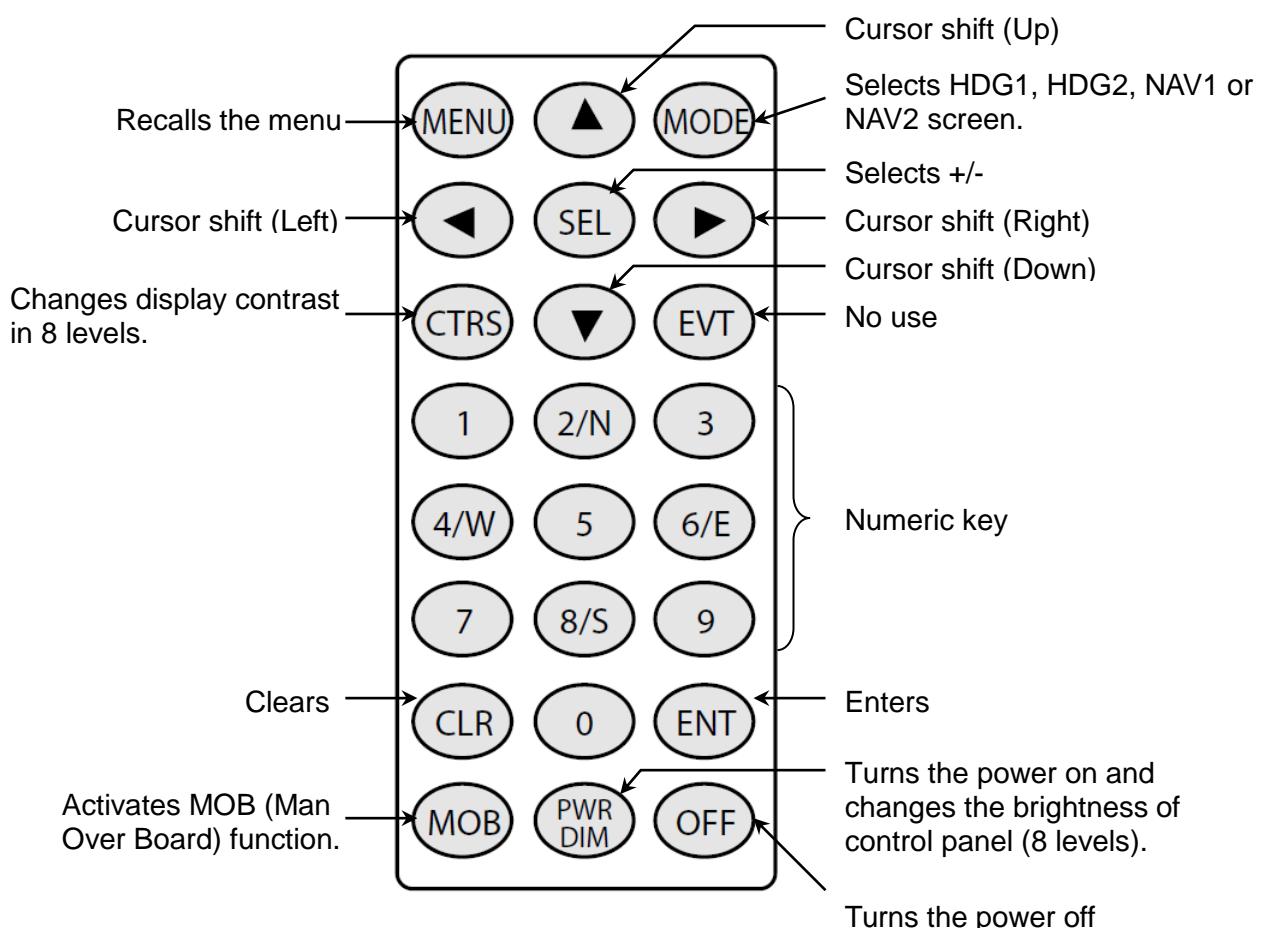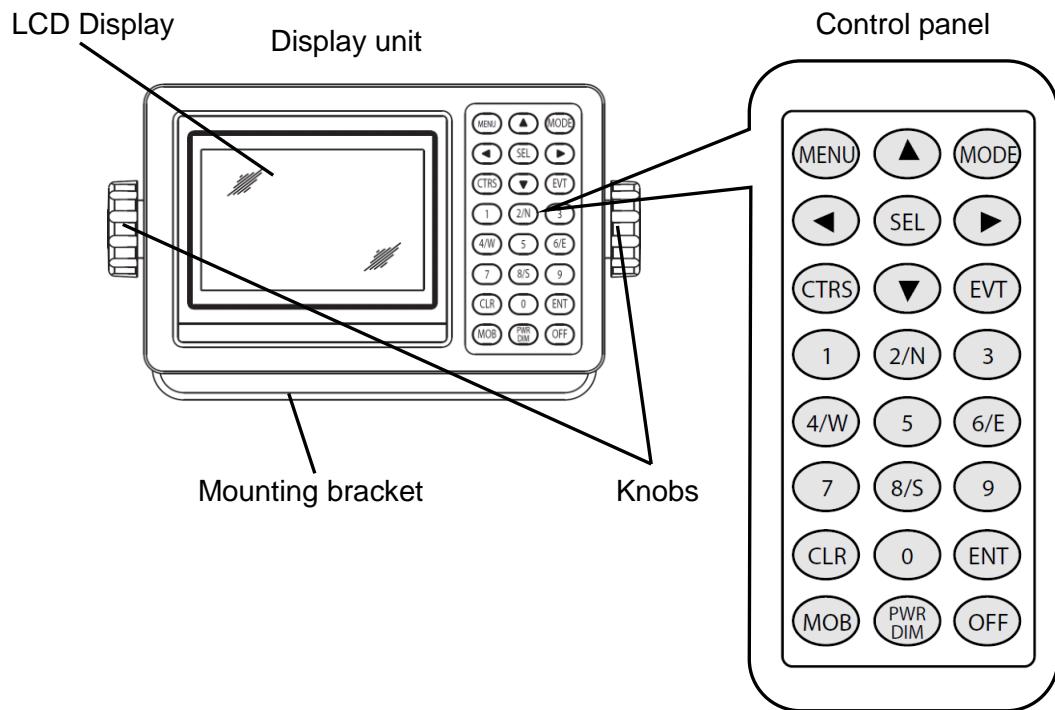
Option List

No.	Name of Item	Specification	Remark	Weight/ Length
1	Connecting cable	CW-373-5M	6P water resistant connectors at both ends	5m
2		CW-376-5M	With 6P water resistant connector and one end plain	5m
3	Junction box	JB-35	1 input, 3 outputs with CW-376-5M	
4	Power rectifier	PS-010	With 5A fuses 2pcs	3.5kg
5	AC power cable	VV-2D8-3M	Without connectors on the both sides (cable for PS-010)	3m
6	Flush mount kit	FMK-1	Flush mount frame with bolts, washers and screws	
7	Antenna cable extension kit	CW-393-30M	5D-FB cable with BNC connectors at both ends (2cables/1 unit)	30m
8		CW-394-60M KIT	8D-SFA cable with N connector and other end plain, N connector, and CW-826-0.5M (2sets/1 unit)	60m
9	Connector	BD-06BFFA-LL6001	6P water resistant connector	
10	Mount base	D86MB21110	For Antenna (GA-12)	1
11	Attachment	D86MB21120	Conversion metal attachment (Switching the mounting holes of GA11 to GA12)	1

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Chapter 1   Basic Operation

1.1 The name and function of each part

LCD Display

Display unit

Control panel

Mounting bracket

Knobs

Recalls the menu — MENU

Cursor shift (Up)

Selects HDG1, HDG2, NAV1 or NAV2 screen.

Cursor shift (Left) — ◄

SEL

Selects +/-

Cursor shift (Right)

Cursor shift (Down)

Changes display contrast in 8 levels. — CTRS

EVT

No use

Numeric key

Clears — CLR

0

Enters

Activates MOB (Man Over Board) function. — MOB

PWR DIM

OFF

Turns the power on and changes the brightness of control panel (8 levels).

Turns the power off

1.2   The name and function of each part

Power ON (When the power is switched on for the first time after installation)

1. Press (PWR DIM) to power on.
   When the power is on, the below screens are displayed in order.

Initial display	Select language	Initial screen
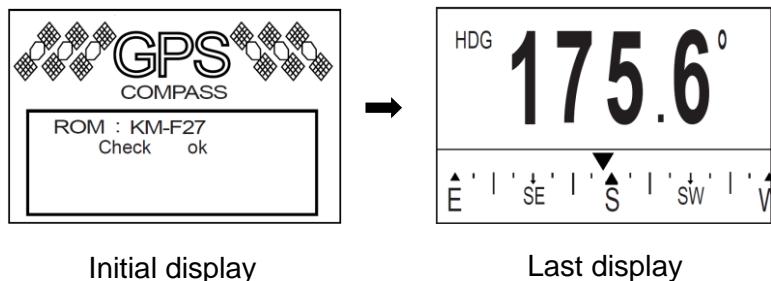
Initially, select the language with (▼) / (▲) key and press (ENT) in the LANGUAGE menu.

After that, press (MODE) key to display the initial screen.

Power ON (Ordinary)

1. Press (PWR DIM) to power on.

   When the power is on, the below screens are displayed in order.

Initial display	Last display

Power OFF

1. Keep pressing (OFF) for 3 seconds for power off.

1.3   Adjusting display/keyboards brightness and contrast

Adjusting display/keyboards brightness

The brightness of display/keyboards can be adjusted.

1. Press (PWR DIM) to change the display/keyboards brightness in 8 levels.
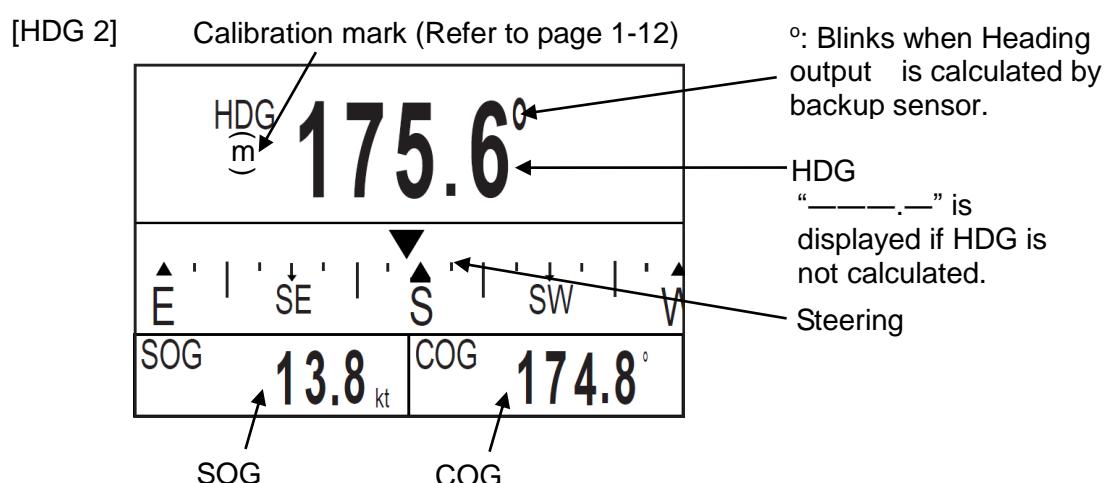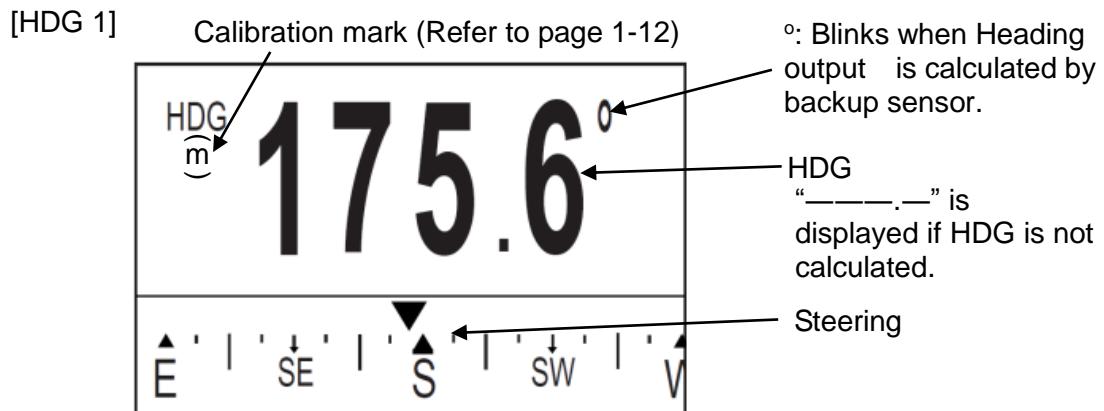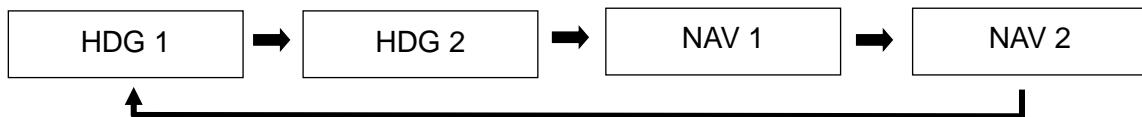
Adjusting LCD contrast
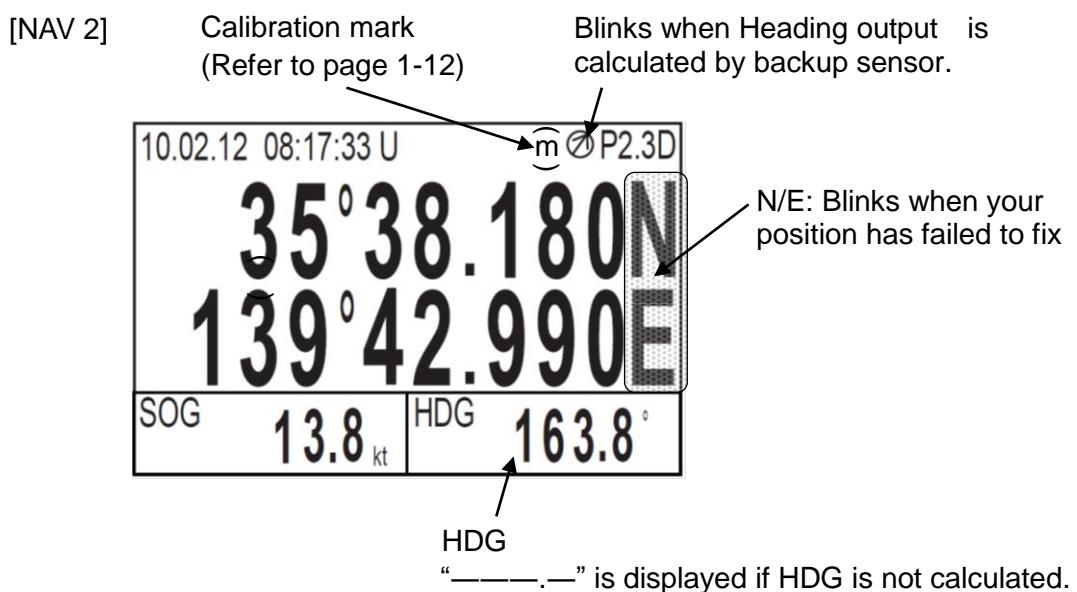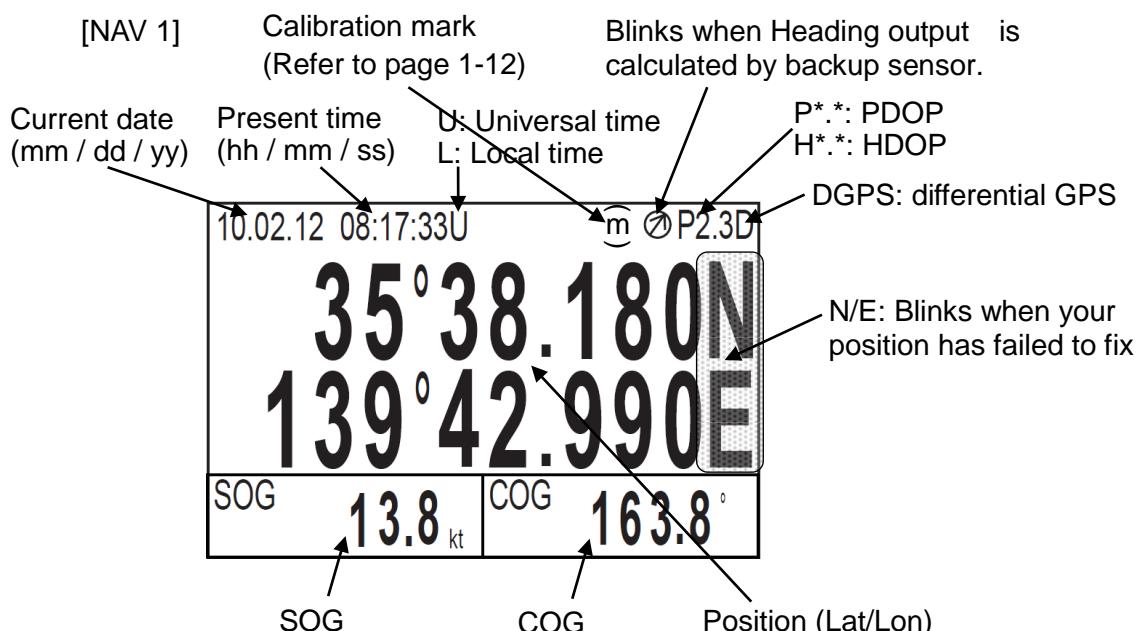
The contrast of the LCD can be adjusted.

1. Press (CTRS) to change the LCD contrast in 8 levels.

1.4   Selecting the screen

There are four screen modes. Press (MODE) key to switch the screen sequentially.

[HDG 1]   Calibration mark (Refer to page 1-12)

º: Blinks when Heading output   is calculated by backup sensor.

HDG
"———.—" is displayed if HDG is not calculated.

Steering

[HDG 2]   Calibration mark (Refer to page 1-12)

º: Blinks when Heading output   is calculated by backup sensor.

HDG
"———.—" is displayed if HDG is not calculated.

Steering

SOG   COG

[NAV 1]

Calibration mark
(Refer to page 1-12)

Blinks when Heading output   is
calculated by backup sensor.

Current date
(mm / dd / yy)

Present time
(hh / mm / ss)

U: Universal time
L: Local time

P*.*: PDOP
H*.*: HDOP

DGPS: differential GPS

10.02.12 08:17:33U m ⊘P2.3D

35°38.180 N
139°42.990 E

N/E: Blinks when your
position has failed to fix

SOG 13.8 kt   COG 163.8 °

SOG   COG   Position (Lat/Lon)

[NAV 2]

Calibration mark
(Refer to page 1-12)

Blinks when Heading output   is
calculated by backup sensor.

10.02.12 08:17:33 U m ⊘P2.3D

35°38.180 N
139°42.990 E

N/E: Blinks when your
position has failed to fix

SOG 13.8 kt   HDG 163.8 °

HDG
"———.—" is displayed if HDG is not calculated.

1.5 Using MOB (Man Over Board) key
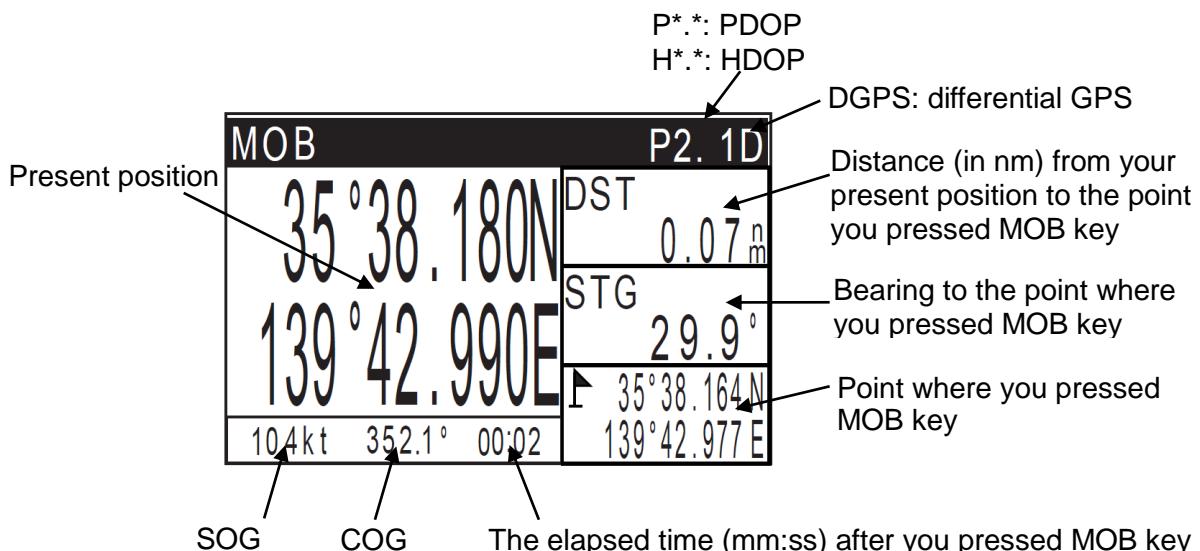
MOB function is provided for an emergency situation (if a person falls into the water) to make it easier to return to MOB point.

Press (MOB) key, and your position is stored immediately and MOB screen appears.

You can see the distance and bearing from your present position to the point you pressed MOB key.

⚠ Caution: MOB key does not function when positioning is invalid

P*.*: PDOP
H*.*: HDOP

DGPS: differential GPS

Present position

Distance (in nm) from your present position to the point you pressed MOB key

Bearing to the point where you pressed MOB key

Point where you pressed MOB key

SOG   COG   The elapsed time (mm:ss) after you pressed MOB key
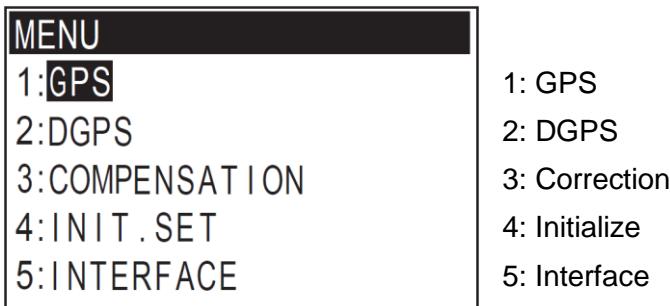
1.6   How to operate the Menu

Menu is used to set up and change items in display mode. Menu operation is provided in following manner.

Menu Operation

1. Press (MENU) to be displayed the menu.
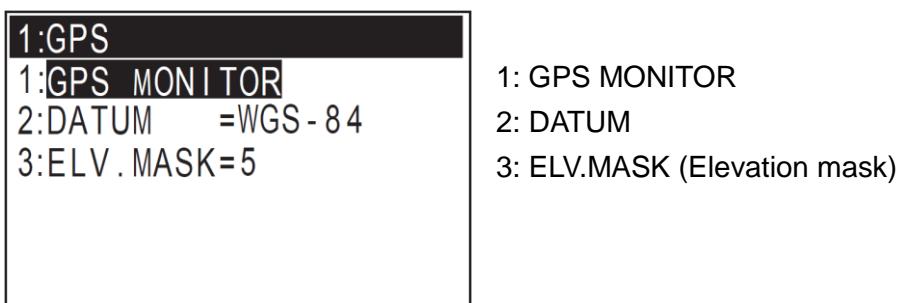
> KGC-222 has five sub menus.

MENU
1:GPS
2:DGPS
3:COMPENSATION
4:INIT.SET
5:INTERFACE

1: GPS

2: DGPS

3: Correction

4: Initialize

5: Interface

2. Press (▼) / (▲) key to move cursor and press (ENT) key to select a page, or press a numeric key directry.

Menu 1: GPS

Press (▼) / (▲) key to move cursor and press (ENT) key to select a page, or press a numeric key directry.

1:GPS
1:GPS MONITOR
2:DATUM   =WGS-84
3:ELV.MASK=5

1: GPS MONITOR

2: DATUM

3: ELV.MASK (Elevation mask)
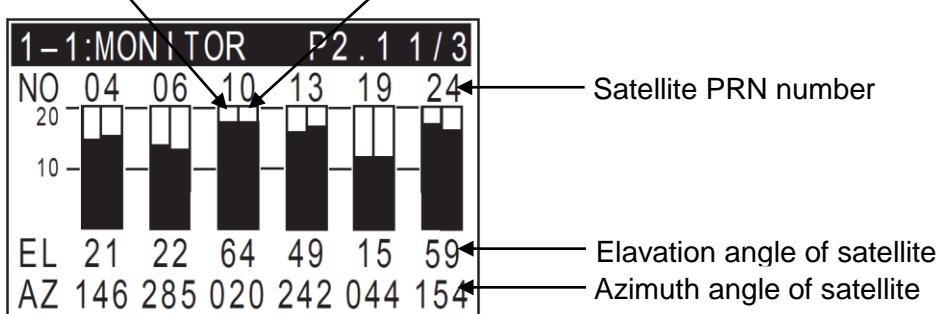
1. Monitoring GPS satellite signal reception
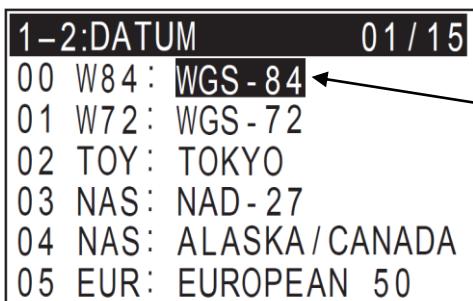
> Elevation angle of satellite, Azimuth angle of satellite and Satellite signal S/N can be monitored.

Satellite signal S/N of ANT2   Satellite signal S/N of ANT1

1–1:MONITOR   P2.1 1/3
NO 04 06 10 13 19 24 — Satellite PRN number

EL 21 22 64 49 15 59 — Elavation angle of satellite
AZ 146 285 020 242 044 154 — Azimuth angle of satellite

2. Selecting a geodetic datum (Initial setup: WGS-84)
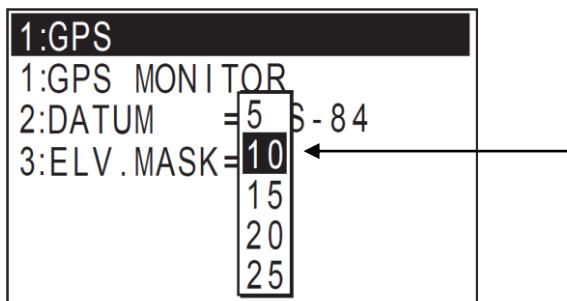
    Geodetic datum of present position (Lat/Lon) can be seleted.

```
1-2:DATUM          01/15
00 W84: WGS-84
01 W72: WGS-72
02 TOY: TOKYO
03 NAS: NAD-27
04 NAS: ALASKA/CANADA
05 EUR: EUROPEAN 50
```

Press ▼ / ▲ to move cursor onto the desired geodetic datum.

Press ENT .

3. Masking satellite elevation angle (Initial setup: 5degrees)

    Positioning accuracy can be improved by masking the elevation angle.

```
1:GPS
1:GPS MONITOR
2:DATUM   =5  S-84
3:ELV.MASK=10
          15
          20
          25
```
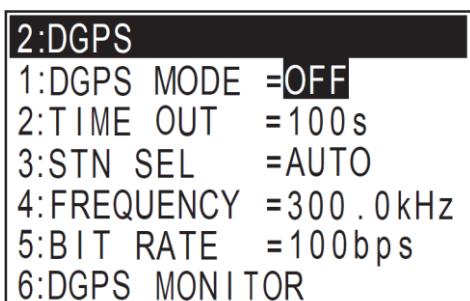
Press ▼ / ▲ to move cursor onto elevation angle masking.

Press ENT .

Menu 2: DGPS
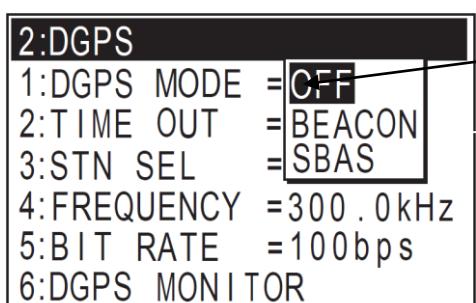
Select a Differrential GPS type.

Press ▼ / ▲ key to move cursor and press ENT key to select a page, or press a numeric key directry.

```
2:DGPS
1:DGPS MODE =OFF
2:TIME OUT  =100s
3:STN SEL   =AUTO
4:FREQUENCY =300.0kHz
5:BIT RATE  =100bps
6:DGPS MONITOR
```

1: DGPS MODE
2: TIME OUT
3: STN SEL (Station select)
4: FREQUENCY
5: BIT RATE
6: DGPS MONITOR

1. DGPS type (Initial setup: OFF)

```
2:DGPS
1:DGPS MODE =OFF
2:TIME OUT  =BEACON
3:STN SEL   =SBAS
4:FREQUENCY =300.0kHz
5:BIT RATE  =100bps
6:DGPS MONITOR
```
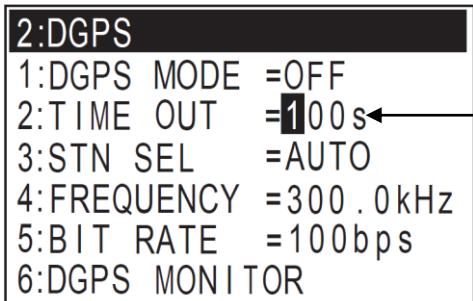
Press ▼ / ▲ to move cursor onto OFF, BEACON or SBAS.

Press ENT .

OFF: Canceled DGPS positioning

BEACON: DGPS MODE by MF beacon
         (Effective only when connected KBG-3)

SBAS: Satellite information
         (MSAS, WAAS, EGNOS)

2. Setting a DGPS timeout (Initial setup: 100 sec)

    If the correction data from beacon receiver is interrupted or has errors, NAVIGATOR holds the last differential correction for the duration of timeout. You can set TIMEOUT to 010 to 180 seconds. However, the position accuracy is reduced as TIMEOUT lengthens.

```
2:DGPS
1:DGPS MODE =OFF
2:TIME OUT  =100s
3:STN SEL   =AUTO
4:FREQUENCY =300.0kHz
5:BIT RATE  =100bps
6:DGPS MONITOR
```
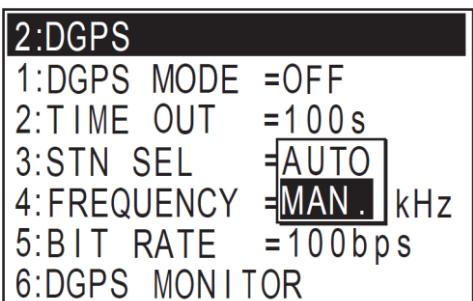
Enter a timeout (010 to 180 seconds) using numeric keys.

Press (ENT) .
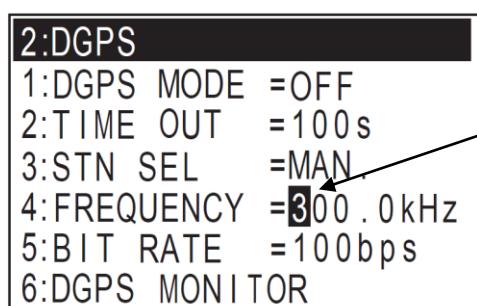
3. Selecting a beacon station (Initial setup: MANUAL)

    A beacon station can be selected in both the manual or auto mode. In auto mode, an optimal reference station is selected automatically. (Effective only when connected to KBG-3)

```
2:DGPS
1:DGPS MODE =OFF
2:TIME OUT  =100s
3:STN SEL   =AUTO
4:FREQUENCY =MAN. kHz
5:BIT RATE  =100bps
6:DGPS MONITOR
```

4. Setting receiving frequency of beacon station

    When MAN. is selected in STN SEL nemu, a frequency of a beacon station must be entered. (Effective only when connected to KBG-3)

```
2:DGPS
1:DGPS MODE =OFF
2:TIME OUT  =100s
3:STN SEL   =MAN.
4:FREQUENCY =300.0kHz
5:BIT RATE  =100bps
6:DGPS MONITOR
```
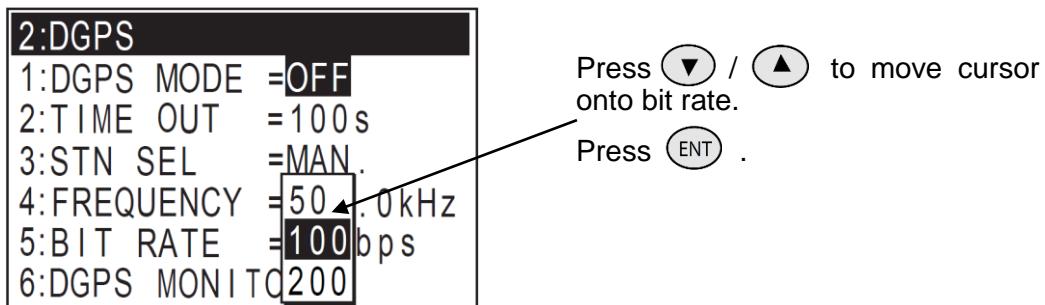
Enter receiving frequency (283.5 to 325.0 kHz) of beacon station using numeric keys.

Press (ENT) .
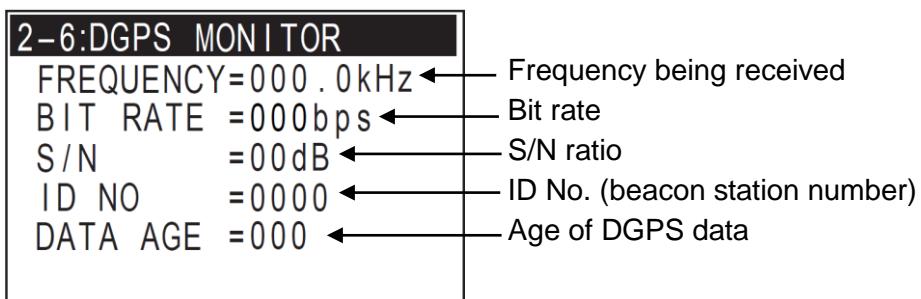
5. Setting bit rate of beacon station

When MAN mode is selected in STN SEL, bit rate of the beacon station must be entered. (Effective only when connected to KBG-3)

```
2:DGPS
1:DGPS MODE =OFF
2:TIME OUT  =100s
3:STN SEL   =MAN.
4:FREQUENCY =50 .0kHz
5:BIT RATE  =100 bps
6:DGPS MONITO200
```

Press ▼ / ▲ to move cursor onto bit rate.

Press (ENT) .
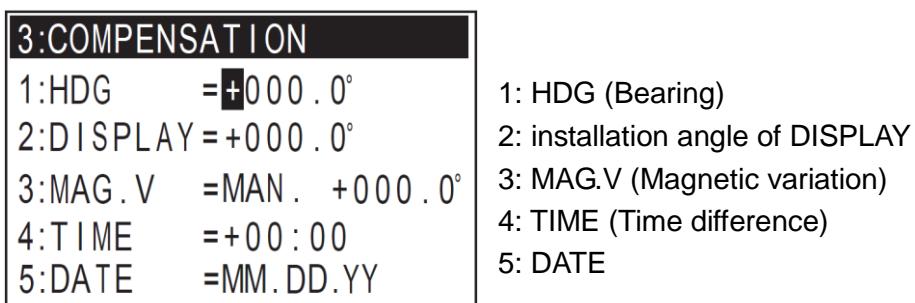
6. DGPS monitor

DGPS monitor provides information on the DGPS beacon receiver interface and receiving status. (Frequency being received, bit rate, S/N ratio, ID No. and age of DGPS data)

```
2-6:DGPS MONITOR
 FREQUENCY=000.0kHz  ← Frequency being received
 BIT RATE =000bps    ← Bit rate
 S/N      =00dB      ← S/N ratio
 ID NO    =0000      ← ID No. (beacon station number)
 DATA AGE =000       ← Age of DGPS data
```

Menu 3: Compensation
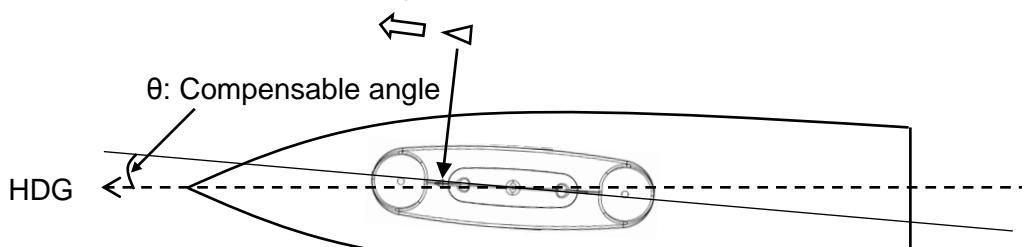
The below items can be compensated.

Press ▼ / ▲ key to move cursor and press (ENT) key to select a page, or press a numeric key directry.

```
3:COMPENSATION
1:HDG     =+000.0°       1: HDG (Bearing)
2:DISPLAY =+000.0°       2: installation angle of DISPLAY
3:MAG.V   =MAN. +000.0°  3: MAG.V (Magnetic variation)
4:TIME    =+00:00        4: TIME (Time difference)
5:DATE    =MM.DD.YY      5: DATE
```

1. HDG (Initial setup: +000.0°)

The GPS antenna should be installed on the keel line with the BOW mark oriented to the ship's bow. If not, it should be compensated.

θ: Compensable angle

HDG

When it is installed with 5° clockwise, enter a compensation value [-005.0°] using numeric keys.
When it is installed with 5° counterclockwise, enter a compensation value [+005.0°] using numeric keys.

```
3:COMPENSATION
1:HDG     =-005.0°
2:DISPLAY=+000.0°
3:MAG.V   =MAN.  +000.0°
4:TIME    =+00:00
5:DATE    =MM.DD.YY
```
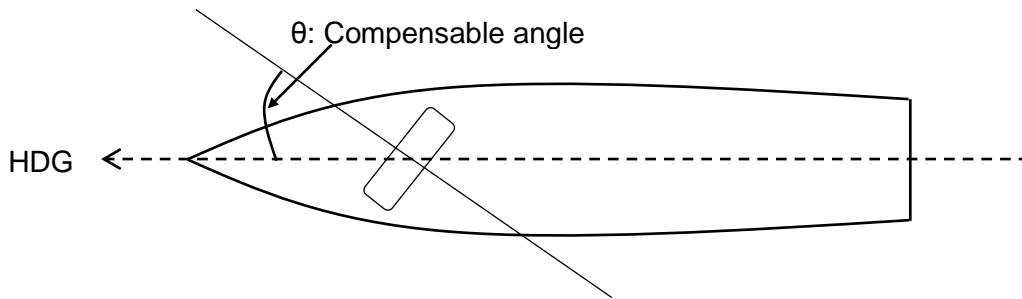
Press (SEL) to move cursor onto [+] or [-]. Enter a compensation value using numeric keys.

Press (ENT) .

To release HDG compensation, press (CLR) to move cursor onto [+] or [-].

2. Setting angle of Display unit (Initial setup: +000.0°)

When Pitch/Roll and Heaving data used with other equipment, it may be necessary to enter compensated value of displays installation. However, when the install position of the display unit is fit to the Heading line, it is not necessary to compensate.

θ: Compensable angle

HDG

When it is installed with 45° clockwise, enter a compensation value [+045.0°] using numeric keys.

```
3:COMPENSATION
1:HDG     =+000.0°
2:DISPLAY=+045.0°
3:MAG.V   =MAN.  +000.0°
4:TIME    =+00:00
5:DATE    =MM.DD.YY
```

Press (SEL) to move cursor onto [+] or [-]. Enter a compensation value using numeric keys.
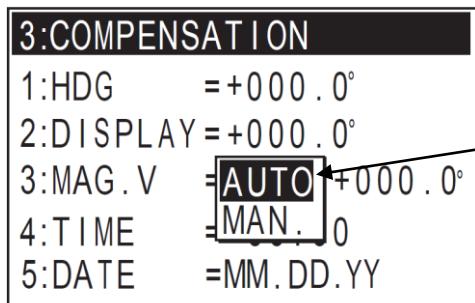
Press (ENT) .

To cancel DISPLAY compensation, press (CLR) to move cursor onto [+] or [-].

When Pitch/Roll and Heaving data are not used with other equipment, it is not necessary to compensate.

3. Magnetic variation (Initial setup: MANUAL +000.0°)

When MAG. V is set to AUTO, the magnetic heading which is compensated by the magnetic deviation at the current Latitude/ Longitute will be displayed.

```
3:COMPENSATION
1:HDG      =+000.0°
2:DISPLAY =+000.0°
3:MAG.V   =AUTO +000.0°
              MAN. 0
4:TIME
5:DATE     =MM.DD.YY
```
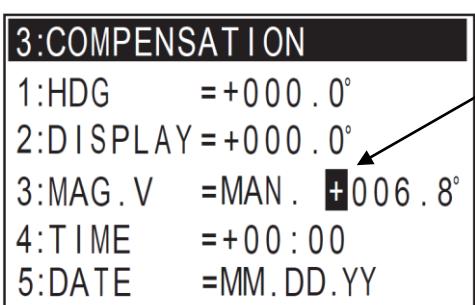
Press ▼ / ▲ to move cursor onto AUTO or MANUAL.

Press ENT.

(Manual compensation)

In case of [MAN. +000.0°], a true heading will be displayed.

In case of except [MAN. +000.0°], a magnetic heading which is compensated by the setting value will be displayed.

```
3:COMPENSATION
1:HDG      =+000.0°
2:DISPLAY =+000.0°
3:MAG.V   =MAN. +006.8°
4:TIME     =+00:00
5:DATE     =MM.DD.YY
```

Press SEL to move cursor onto [+] or [-]. Enter a deviation value using numeric keys.
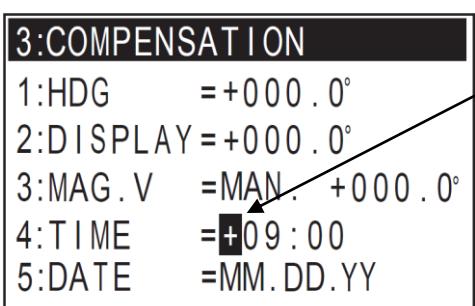
Press ENT.

To cancel MAG.V compensation, press CLR to move cursor onto [+] or [-].

4. Time (Initial setup: +00:00)

A local time can be displayed by entering a time difference from the Greenwich standard time (GMT).

Enter the time difference using numeric keys.

```
3:COMPENSATION
1:HDG      =+000.0°
2:DISPLAY =+000.0°
3:MAG.V   =MAN. +000.0°
4:TIME     =+09:00
5:DATE     =MM.DD.YY
```
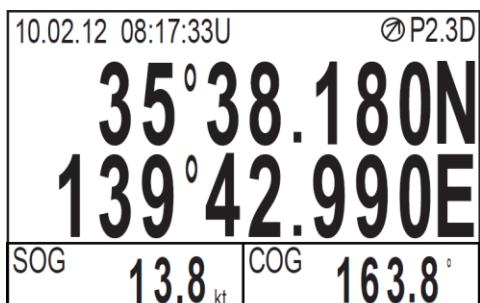
Press SEL to move cursor onto [+] or [-]. Enter a time difference using numeric keys.
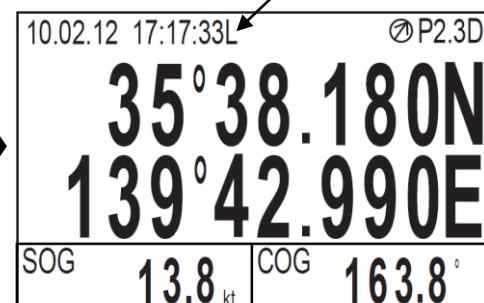
Press ENT.

To cancel TIME compensation, press CLR to move cursor onto [+] or [-].

NAV 1 Display: Before entering the time difference
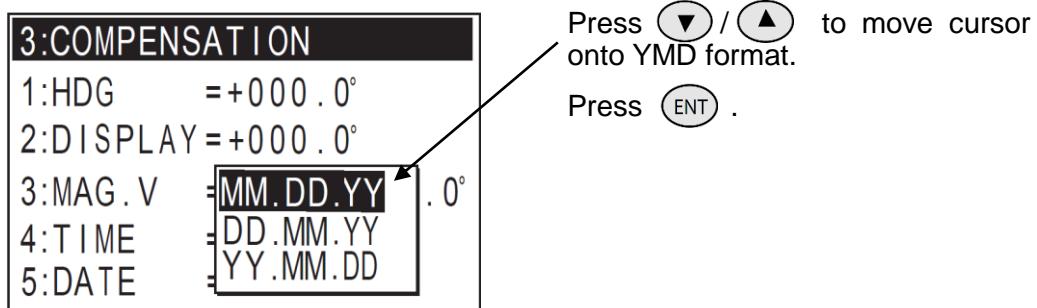
After entering the time difference

Display "L": Local time

```
10.02.12 08:17:33U       P2.3D
35°38.180N
139°42.990E
SOG  13.8 kt   COG  163.8°
```

```
10.02.12 17:17:33L       P2.3D
35°38.180N
139°42.990E
SOG  13.8 kt   COG  163.8°
```
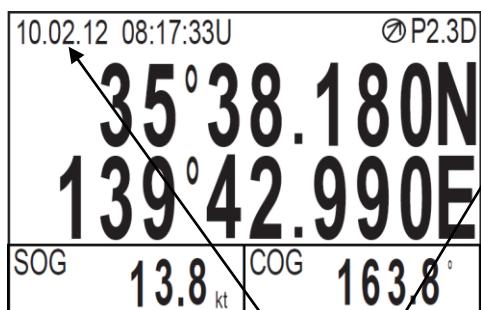
5.   Date (Initial setup: MM.DD.YY)
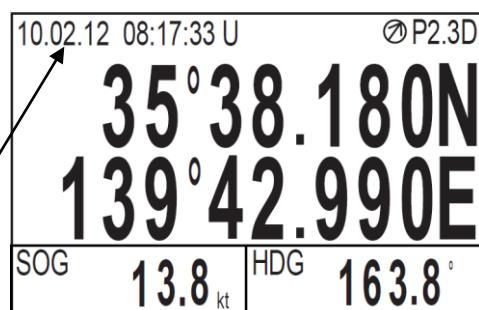
YMD (Year-Month-Day) format displayed on the NAV1 and NAV2 screen can be changed.

Press ▼ / ▲ to move cursor onto YMD format.

Press ENT .

NAV 1   NAV 2

MM.DD.YY

Menu 4: Initial setting

Initial settings setup

Press ▼ / ▲ key to move cursor and press (ENT) key to select a page, or press a numeric key directly.

```
4:INIT.SET
1:BACKUP    =000
2:AVE.(HDG)=3
3:AVE.(POS)=1
4:UNIT      =kt
5:L/L UNIT =.001
6:ACCEL (g)=2
```

1: BACKUP
2: AVE. (Heading Average)
3: AVE. (Position Average)
4: UNIT (Range)
5: Lat/Lon UNIT
6: ACCEL

1. BACKUP time (Initial setup: 000 sec)

   If heading becomes temporarily unavailable due to signal blocking or other reason, HDG can be provided by the internal auxiliary backup sensor. The backup duration time can be set from 1sec to 600 sec ("000" means no backup.)
   Please set the BACKUP time just before starting of the following calibration.
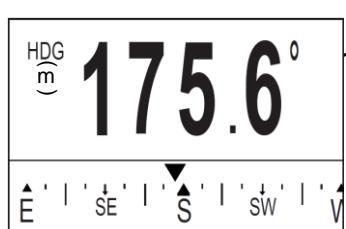
```
4:INIT.SET
1:BACKUP    =030  ◄─────
2:AVE.(HDG)=3
3:AVE.(POS)=1
4:UNIT      =kt
5:L/L UNIT =.001
6:ACCEL (g)=2
```

Enter a backup time (0 to 600 seconds) using numeric keys.
Press (ENT).
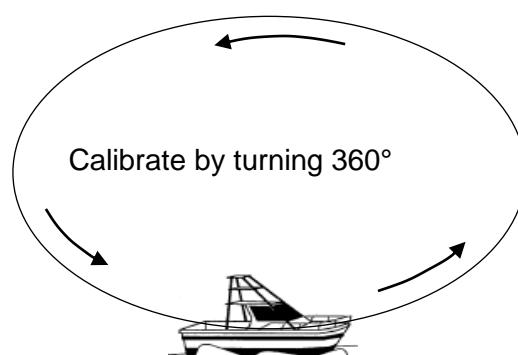
⚠ **Caution: Heading accuracy is reduced during the backup.**
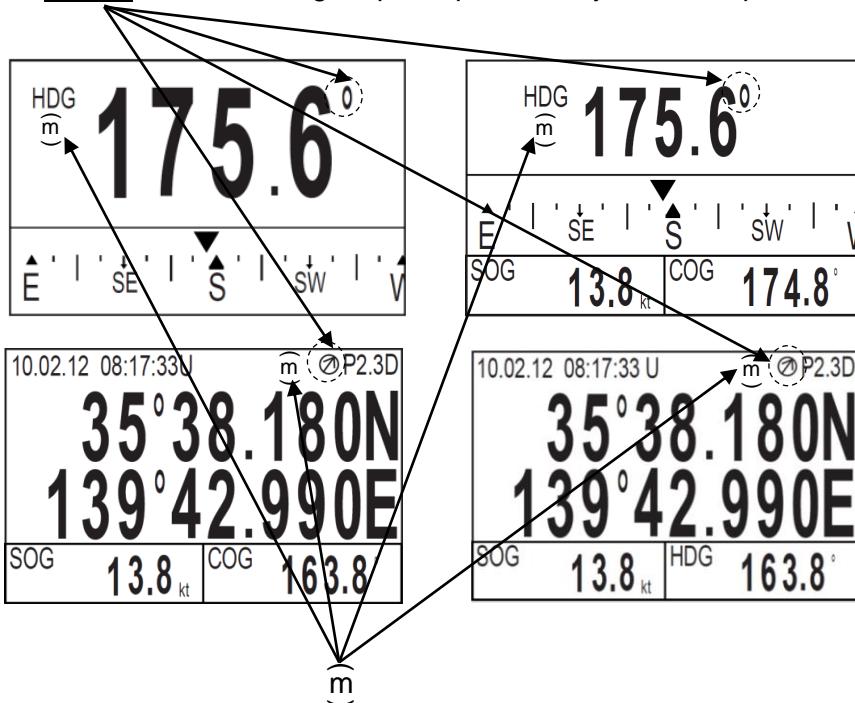
If you choose to use the internal backup sensor and set the backup duration other than 000sec, internal sensor calibration must be completed by turning the vessel 360° at less than 5 knots. The calibration must be completed within 10 minutes. Therefore set the BACKUP time just before starting of the calibration. If the calibration is not completed within 10minutes, set the BACKUP time to "000" once and turn power off and on. After that, set the BACKUP time again and carry out the calibration. When the calibration is completed, the calibration mark turns off from blinking. (For calibration information refer to page 1-14)

"°" is lit when HDG is available from GPS.

HDG
m
175.6°

E | SE | S | SW | V

Calibrate by turning 360°

Blinks when Heading output is provided by the backup sensor.

[Calibration mark]: This is displayed during backup ON.
Blinking: Calibration is not completed.
Off: Calibration is completed.
Lit: Heading output is provided by the backup sensor.

⚠ **Caution: When calibration is not finished, a calibration mark is blinking and Heading output is not provided by the backup sensor built in.**

⚠ **Caution: Disconnect either one of the antenna cables from the display unit to verify the backup function. When the calibration is completed without fail, the calibration mark will turn ON and HDG is provided by the backup sensor. At this time, HDG may shift a little due to a change of current within the unit, but there is no problem for verification of the backup function.**
After verification, reconnect the antenna cable with the display unit.

⚠ **Caution: Heading accuracy is reduced during the backup, especially in rough sea conditions.**
During and after calibration, do not tilt or rotate the display as it will cause the unit to provide incorrect HDG data during the backup.
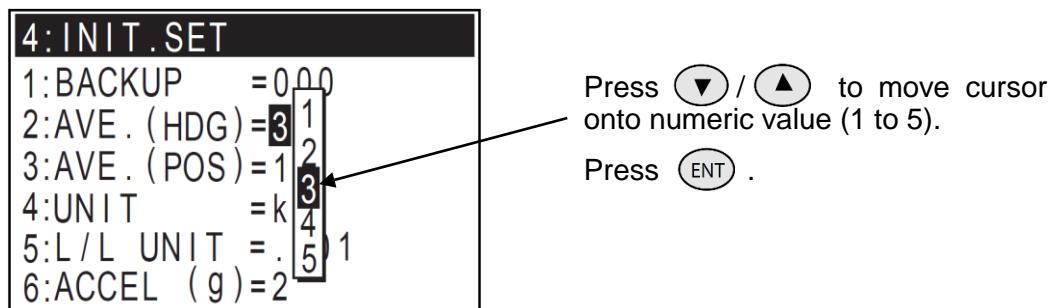
⚠ **Caution: After calibration, if the BACKUP time is set to 000, the calibration data will become invalid. Therefore please calibrate once again.**

2. Setting average constants of HDG (Initial setup: 3)

This setting is used to the avaraging of the Heading to stabilize the HDG.
The maximum averaging rate is "5" and the minimum averaging rate is "1". When a higher value is selected, heading data is averaged more often and more stable, but the avaraged HDG will be far from the actual Heading. When a lower value is selected, heading data is averaged less, but HDG will not be far from the actual Heading and react quickly.
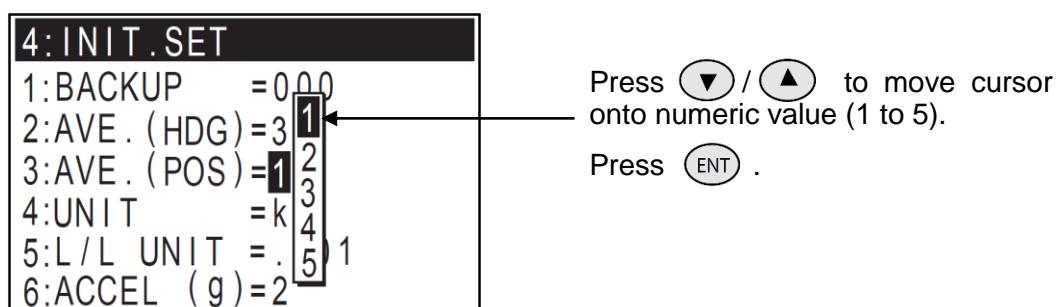
```
4:INIT.SET
1:BACKUP    =000
2:AVE.(HDG)=3 1
              2
3:AVE.(POS)=1 3
4:UNIT     =k 4
5:L/L UNIT =. 5 1
6:ACCEL (g)=2
```

Press ▼ / ▲ to move cursor onto numeric value (1 to 5).

Press ENT .

3. Setting average constants of GPS position (Lat/Lon) (Initial setup: 1)
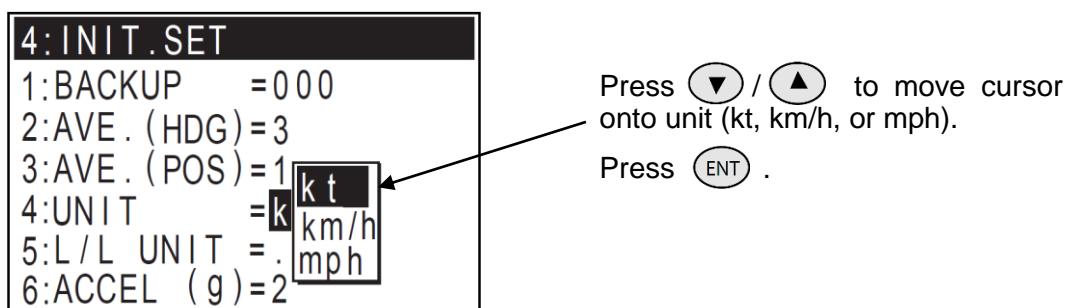
Use the averaging function to compare GPS sensor signals several times and get their average. This setting is used to the avaraging of the positioning to stabilize the position. The maximum averaging rate is "5" and the minimum averaging rate is "1". When a higher value is selected, position data is averaged more often and more stable, but the avaraged position will be far from the actua position. When a lower value is selected, a position data is averaged less but a position data will not be far from the actual position and react quickly.

```
4:INIT.SET
1:BACKUP    =000
2:AVE.(HDG)=3 1
3:AVE.(POS)=1 2
              3
4:UNIT     =k 4
5:L/L UNIT =. 5 1
6:ACCEL (g)=2
```

Press ▼ / ▲ to move cursor onto numeric value (1 to 5).

Press ENT .
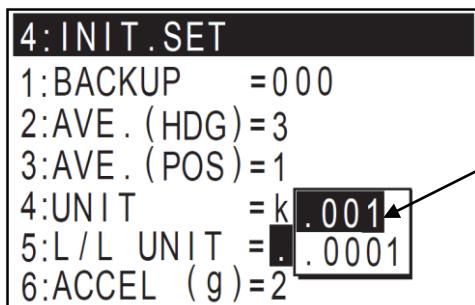
4. UNIT of range (Initial setup: nm)

The measuring unit of distance (to WPT or final destination) and speed on MOB screen. (kt, km/h, mph) can be changed

```
4:INIT.SET
1:BACKUP    =000
2:AVE.(HDG)=3
3:AVE.(POS)=1
              kt
4:UNIT     =k km/h
5:L/L UNIT =. mph
6:ACCEL (g)=2
```

Press ▼ / ▲ to move cursor onto unit (kt, km/h, or mph).

Press ENT .

5. Lat/Lon UNIT (Initial setup: 0.001)
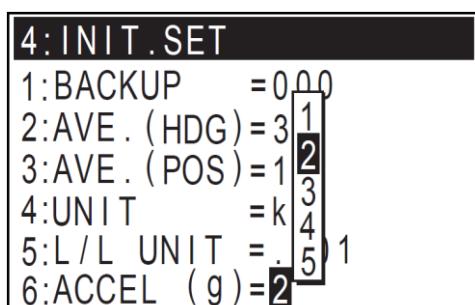
   The following operations enable to display the latitude and longitude of present position up to 0.0001 minute. If you select .0001', the latitude and longitude data of GGA/RMC sentence will also be output in 0.0001'.

```
4:INIT.SET
1:BACKUP    =000
2:AVE.(HDG)=3
3:AVE.(POS)=1
4:UNIT      =k .001
5:L/L UNIT =. .0001
6:ACCEL (g)=2
```

Press ▼ / ▲ to move cursor onto unit (.001 or .0001).

Press ENT .

6. Following acceleration (Initial setup: 2)

   This setting is used to the following performance of the antenna swinging to avoid losing HDG. The maximum acceleration rate is [5] and minimum acceleration rate is [1]. When a higher value is selected, the following performance of the antenna swinging is more often and more hard to lose the heading, but the HDG will be unstable. Normally, it should be set to [2] to stabilize the HDG. In the heavy sea, it should be set to [3] to avoid losing the HDG.

```
4:INIT.SET
1:BACKUP    =000
2:AVE.(HDG)=3  1
3:AVE.(POS)=1  2
4:UNIT      =k 3
5:L/L UNIT =. 4 1
6:ACCEL (g)=2  5
```
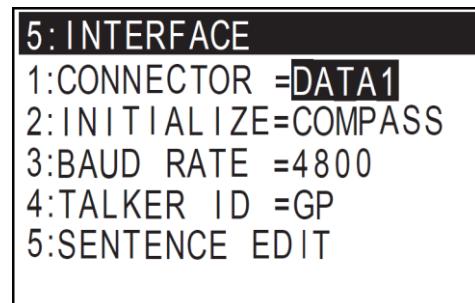
Press ▼ / ▲ to move cursor onto value (1 to 5).

Press ENT .

Menu 5: Interface

The following menu is used to setup output for optimal connection with external equipment.
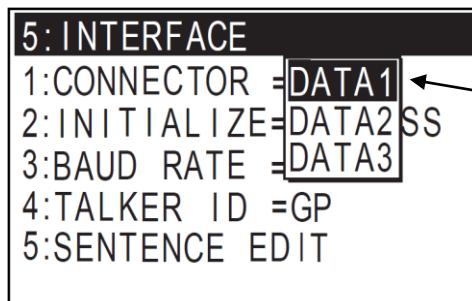
Press ▼ / ▲ key to move cursor and press ENT key to select a page, or press a numeric key directry.

```
5:INTERFACE
1:CONNECTOR =DATA1
2:INITIALIZE=COMPASS
3:BAUD RATE =4800
4:TALKER ID =GP
5:SENTENCE EDIT
```
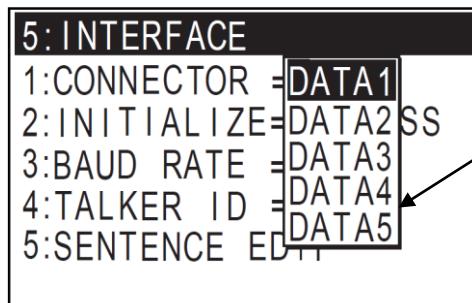
1: CONNECTOR

2: INITIALIZE

3: BAUD RATE

4: TALKER ID

5: SENTENCE EDIT

1. CONNECTOR (Initial setup: DATA 1)

   Select the DATA connecter to set up. (DATA1, DATA2 or DATA3)

   ```
   5:INTERFACE
   1:CONNECTOR =DATA1
   2:INITIALIZE=DATA2 SS
   3:BAUD RATE =DATA3
   4:TALKER ID =GP
   5:SENTENCE EDIT
   ```

   Press (▼)/(▲) to move cursor onto DATA1, DATA2 or DATA3.

   Press (ENT) .

   ```
   5:INTERFACE
   1:CONNECTOR =DATA1
   2:INITIALIZE=DATA2 SS
   3:BAUD RATE =DATA3
   4:TALKER ID =DATA4
   5:SENTENCE ED DATA5
   ```

   DATA4 and DATA5 are added to the list when Junction box JB-35 is connected.

   Refer to page 3-12

2. INITIALIZE
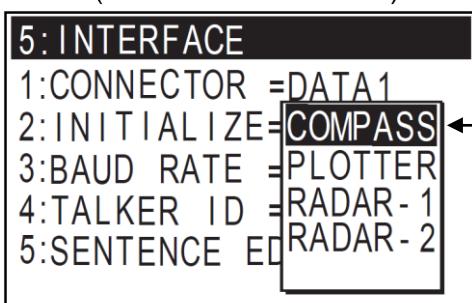
   One touch optimal output sentence setup based on equipment connected.
   COMPASS: Should be selected when connected to marine radar and requires high rate HDG.
   PLOTTER: Should be selected when connecting to plotter and no need for a high speed HDG.
   RADAR-1: Should be selected when connecting to KODEN's marine radar (MDC-2200/-2500/-2900series).
   RADAR-2: Should be selected when connecting to KODEN's marine radar (MDC-900/-2000series).
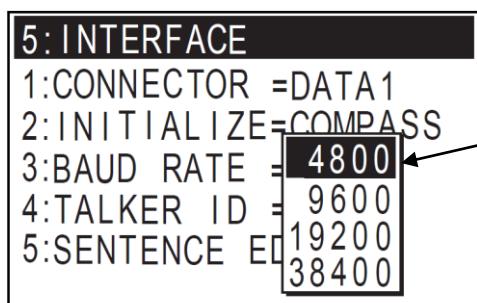
   ```
   5:INTERFACE
   1:CONNECTOR =DATA1
   2:INITIALIZE=COMPASS
   3:BAUD RATE =PLOTTER
   4:TALKER ID =RADAR-1
   5:SENTENCE ED RADAR-2
   ```

   Press (▼)/(▲) to move cursor onto compass, plotter, RADAR-1 or RADAR-2.

   Press (ENT) .

3. BAUD RATE (Initial setup: 4800)
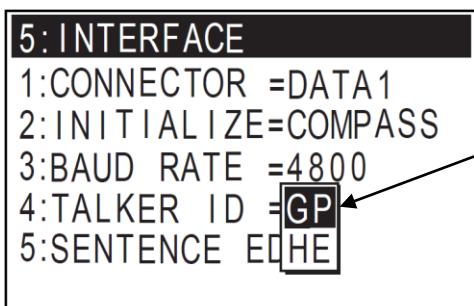
   Select the baud rate output (4800/9600/19200/38400) for proper connection with external equipment.

   ```
   5:INTERFACE
   1:CONNECTOR =DATA1
   2:INITIALIZE=COMPASS
   3:BAUD RATE = 4800
   4:TALKER ID = 9600
   5:SENTENCE ED 19200
                 38400
   ```

   Press (▼)/(▲) to move cursor onto baud rate (4800 to 38400).

   Press (ENT) .

4. TALKER ID (Initial setup: GP)
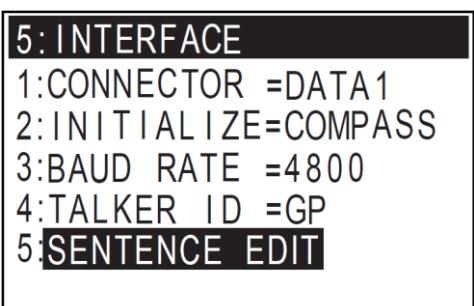
   Select the TALKER ID (GP/HE) to fit a connected equipment.

```
5:INTERFACE
1:CONNECTOR =DATA1
2:INITIALIZE=COMPASS
3:BAUD RATE =4800
4:TALKER ID =GP
5:SENTENCE ED HE
```

Press ▼/▲ to move cursor onto talker ID (GP or HE).

Press ENT .
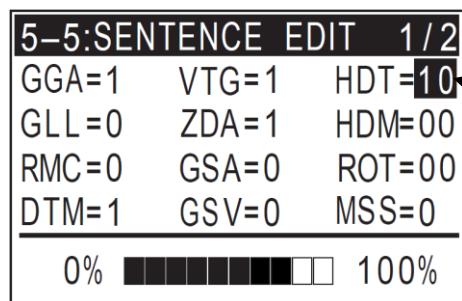
5. SENTENCE EDIT

   Output sentences of the data port selected by [1: CONNECTOR] can be edited.

```
5:INTERFACE
1:CONNECTOR =DATA1
2:INITIALIZE=COMPASS
3:BAUD RATE =4800
4:TALKER ID =GP
5:SENTENCE EDIT
```
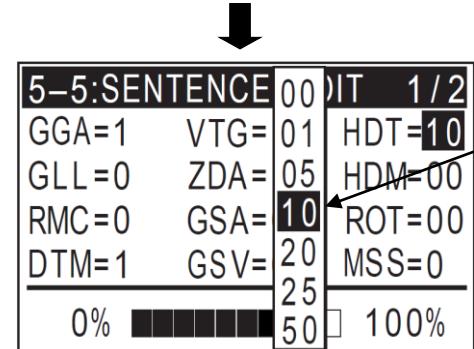
Press ENT to move SENTENCE EDIT 1/2 or 2/2.

SENTENCE EDIT 1/2

```
5-5:SENTENCE EDIT  1/2
GGA=1   VTG=1   HDT=10
GLL=0   ZDA=1   HDM=00
RMC=0   GSA=0   ROT=00
DTM=1   GSV=0   MSS=0
 0% ■■■■■■■□□ 100%
```

Press ▼ / ▲ / ► / ◄ to move cursor onto sentence.

Press ENT .

```
5-5:SENTENCE 00 DIT  1/2
GGA=1   VTG= 01 HDT=10
GLL=0   ZDA= 05 HDM=00
RMC=0   GSA= 10 ROT=00
DTM=1   GSV= 20 MSS=0
                 25
 0% ■■■■■■■ 50 □ 100%
```

Press ▼/▲ to move cursor onto output interval.

Press ENT .

Output interval in one second is in ( ).
00: No output
01:   1Hz (1s)   05:   5Hz (200ms)
10: 10Hz (100ms)   20: 20Hz (50ms)
25: 25Hz (40ms)   50: 50Hz (20ms)

*In case of VTG, it can be selected as [0], [1] and [2].
0: No output
1: NMEA 0183 Ver.2.0, 1Hz (1s)
2: IEC 61162-1, 1Hz (1s)

SENTENCE EDIT 2/2

```
5-6:SENTENCE EDIT  2/2
PKODA  =0      PKODQ=0
PKODG,1 =0        ATT=00
PKODG,7 =0        HVE=00
PKODG,21=00
0%  ■■■■■■■□□ 100%
```

Press ▼ / ▲ / ▶ / ◀ to move cursor onto sentence.

Press ENT .

```
5-6:SENTENCE EDIT  2/2
PKODA  =0      PKODQ=0
PKODG,1 =1        ATT=00
PKODG,7 =0        HVE=00
PKODG,21=00
0%  ■■■■■■■□□ 100%
```

Press ▼ / ▲ to move cursor onto output interval.

Press ENT .

0: No output
1: 1sec

Explanation of sentence (Refer to "Chapter 4 Detail of the serial output data")
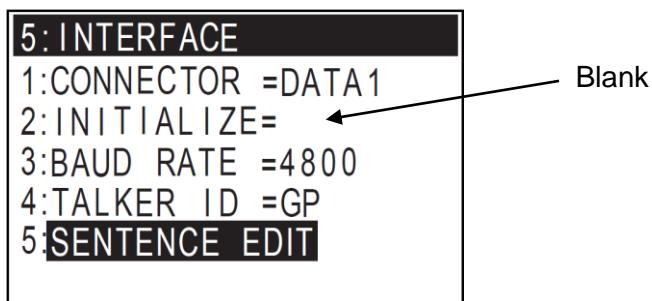
Heading data sentence

ATT: Pitch / Roll
HDM: Heading magnetic
HDT: Heading true
HVE: Heaving
ROT: Rate of turn
PKODG,21: Pitch / Roll, Heaving

Navigation data sentence

DTM: Datum reference
GGA: Global Positioning System Fix Data (time, lat/lon, S/N, SV, DOP)
GLL: Geographic Position - Latitude/Longitude/Time
GSA: GPS DOP and Active Satellites
GSV: GPS Satellites in View
MSS: MSK receiver signal status (S/N, frequency, data rate)
RMC: Recommended Minimum Specific GPS/TRANSIT Data (UTC time, lat/lon, ground
          speed, true bearing, magnetic deviation, date)
VTG: Course Over Ground (true and magnetic bearing) and Ground Speed
ZDA: Time & Date (hour, minute, second, day, month, year, time difference) by UTC
PKODA: Satellite Information (satellite information, signal to noise ratio)
PKODG,1: Satellite Information (satellite information, elevation angle, azimuth, command)
PKODG,7: DGPS Information (mode, status, time out)
PKODQ: Weather information

The status of the [2: INITIALIZE] will be blank after initialize.

```
5:INTERFACE
1:CONNECTOR =DATA1
2:INITIALIZE=                    ← Blank
3:BAUD RATE =4800
4:TALKER ID =GP
5:SENTENCE EDIT
```

When Heaving data is compensated and connected to KODEN's echo sounder, the connecting cable should be connected to the DATA1 / DATA2 port. Set up as follows.
• BAUD RATE: 38400
• SENTENCE EDIT: ATT = 20 or more (20/25/50)
                 HVE = 20 or more (20/25/50)

Chapter 2   Maintenance and Inspection

Inspection

The daily maintenance and inspection extends the life of equipment. To always keep the equipment in the best condition, implement periodically the inspection shown in the table below.

Item	Content of Inspection
Connector at the rear of Display unit	Check the looseness.
Wiring of cables	Check the wiring of cables connecting the equipment and the damage of cable.
Grounding of display unit	Scrape the rust off the ground terminal and make its contact well.

Cleaning

Display unit

Contamination on the screen may cause faint images. For cleaning the screen, wipe the screen with soft and clean cloth dipped with diluted neutral detergent. Pay full attention as the screen is easily getting scratched. No thinner shall be used.

> ⚠ **Caution:** **Do not use a solvent such as paint thinner, acetone, alcohol, and benzene, etc.**
> **Strong rubbing may cause bruising and scratching.**

For cleaning the housing, do not use a solvent such as thinner or alcohol. Painting on the surface and characters at the operating portion may melt. After wiping with soft and clean cloth dipped with diluted neutral detergent, wipe away with dry soft and clean cloth.
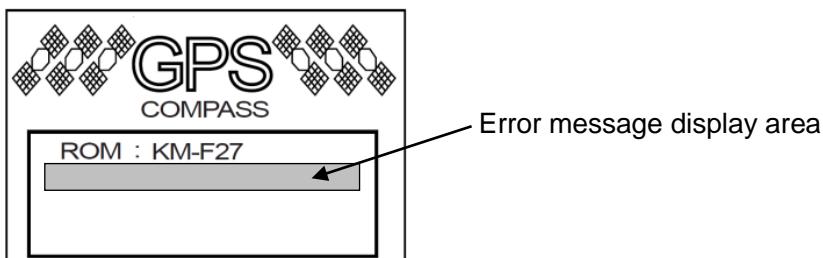
If you suspect a trouble

Symptom	Possible cause of trouble	Measure
Even with power on, nothing is displayed.	• Power connector may be loose. • The power supply voltage is out of specification (10.8 to 31.2 VDC). • Poor connection between power cable and battery. • Defect of LCD display block.	• Connect the connector securely. • Use a proper power as per specification. • Check the connection between power cable and battery. • Consult a repair shop or sales agent.
Heading bearing is not displayed. (---.-° is displayed)	• Antenna Connection on the back of display may be loose. • Antenna View may be blocked by obstacles.	• Connect the connector securely. • Change the installation position of the Antenna.

Heading bearing is displayed, but heading output is not available.	• DATA connector of Display unit may be loose. • The baud rate output for external equipment is wrong. • Heading data output may be turned off in settings.	• Tighten the connector surely. • Change the baud rate output (4800 or 38400) for proper connection with external equipment.(Refer to MENU 5:Interface, 3:BAUD RATE) • Check Sentence output.
Incorrect heading bearing data is displayed / output.	• Cables on the back of the display may be swapped between ANT1 and ANT2 • Forward orientation of the antenna may not be correct.	• Connect the bow side antenna cable to ANT 1 of Display unit, and connect the stern side antenna cable to ANT 2 of Display unit. • The direction of GPS antenna should be installed in conformity to the ship's bow. Compensate of HDG. (Refer to MENU 3: Compensation, 1:HDG)
The heaving data is not compensated. The rolling/pitching data is abnormal.	• Compensated value of Display unit installation is wrong.	• Input the Compensation angle value of Display unit installation correctly. (Refer to MENU 3: Compensation, 2:DISPLAY)

Error Message

The error messages are as follows.

Error message display area

Error message	Possible cause	Measure
Power Down ****	▴ Instantaneous interruption of the power source is occurred. • Power supply voltage is below normal.	• Check the connection betweeen power cable and battery. • Set the power supply voltage to more than 10.8V.
Vin High ****	• Power supply voltage is too high.	• Set the power supply voltage below 31.2V.
Over Load ****	• Electrical power of internal equipment is over load. (For effect of external equipment) • Electrical power of internal equipment is over load. (Display unit may be broken.)	• Check the external equipment. • Consult a repair shop or sales agent.

RTC Error ****	• Back up of Time Clock failure.	• Consult a repair shop or sales agent.
ANT Error ****	• Short-circuits of the antenna cable.	• Consult a repair shop or sales agent.
RAM1 Error ****	• Backup DATA failure.	• Press (CLR) to initialize. • If the situation does not change even if the unit has been initialized, consult a repair shop or sales agent.
FPGA Error **** LSI Error **** CPU1 Error **** ROM2 Error **** CPU2 Error ****	• Internal circuits or parts failure.	• Consult a repair shop or sales agent.
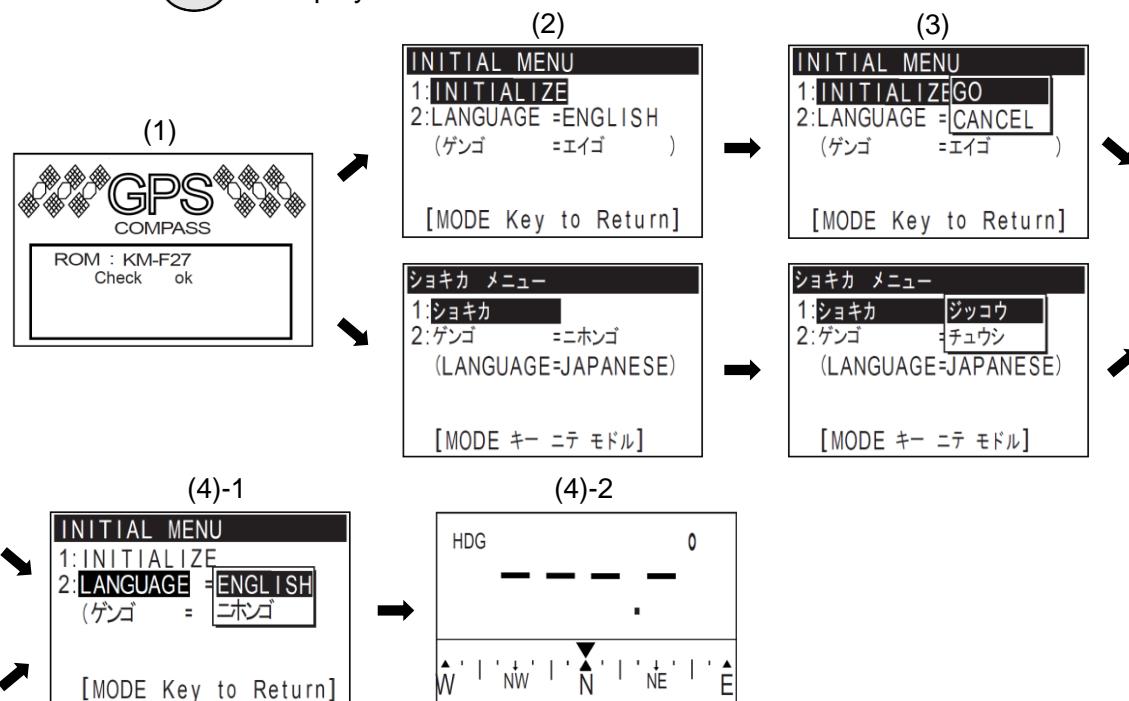
2.1   Initialize

Initialization of KGC-222 is performed.

When some malfunction of Display unit is found, followng initialization procedure may be required. It returns all the settings in the menu to the factory settings. Before initializing please note all system parameters and reset them after initialize.

Initialization

(1) Press (PWR DIM) to power on.

(2) Press (MENU) → (5) → (6/E) → (ENT) to move to INITIAL MENU during displaying self check.

(3) [ショキカ メニュー] or [INITIAL MENU] will appear at the top of the display.

Press (ENT) → (▲) → (ENT) to initialize.

(4) Press (▼) / (▲) to select the language to be used, and press (ENT) .

Press (MODE) to display the HDG1 screen.

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Chapter 3 Installation

3.1 Items of Caution on Installation

In order to obtain the maximum performance of the GPS compass, this compass should be installed by a qualified technician. Installation procedures include the following:

(1) Unpacking the components

(2) Inspection of configuration unit, spare parts, accessories and installation materials

(3) Checking of supply voltage and current capacity

(4) Selection of installation location

(5) Installation of Display unit and Antenna

(6) Attachment of accessories

(7) Planing and implementation of cable layout and connection

(8) Coordinataion after installation

Unpacking the components

Unpack components and check that all of the items correspond with the contents discription of the packing list. When a discrepancy or damage has been found, contact the dealer you purchased this product.

Appearance varification of each unit and accessories

Inspect the appearance of each components and accessories and check that no dents or damage exist.

If any dents or damages exist and they are believed to be caused by accident during transportation, contact the transportation and insurance company and consult our sales company or our dealer nearest to you.

Selection of location for installation

In order to obtain the maximum performance of the unit, it is necessary to install following below recommendations.

1. Display unit of KGC-222

(1) Install the display in the bridge where it will be easy to see and read.

(2) Choose the best location from humidity, spray, rain and direct sunlight.

(3) Keep safety distance from magnetic objects such as magnetic compasses.

(4) Keep sufficient maintenance space around the equipment, pay attention to the back of the display where cables are connected.

(5) Keep the equipment as far away from wireless transmitter/receivers as possible.
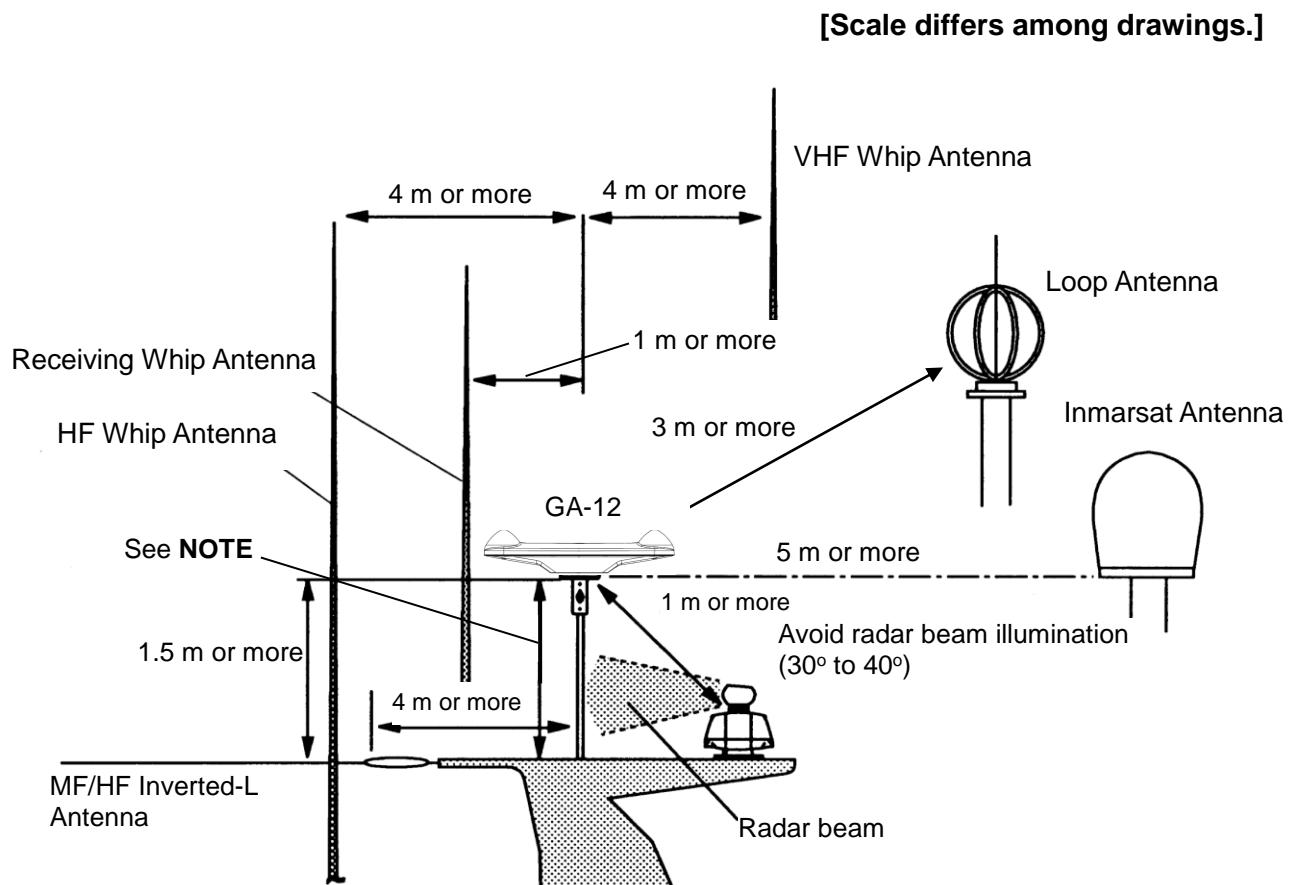
2. GPS antenna: GA-12

To operate the equipment in good order, the following points should be observed for installation of GPS antenna.

The GPS antenna GA-12 must be installed where good radio wave reception is achieved. No obstacles should be located above the antenna otherwise the radio wave reception may be interrupted. This causes the available GPS service hours to be reduced and degrades the positioning accuracy.

(1)   Select a site away from metallic objects, where possible.

(2)   Locate the GPS antenna at least 4 m away from radio antennas such as, Inverted-L antennas for MF/HF transmission, Whip Antennas for VHF or UHF.

(3)   Locate the GPS antenna at least 1.5 m above any Inverted-L antenna for MF/HF transmission.

(4)   Locate the GPS antenna at least 1 m from receiving antennas.

(5)   Locate the GPS antenna away from radar beams (Vertical beam width: 30º to 40º).

(6)   Locate the GPS antenna at least 1 m away from radar antennas.

(7)   Locate the GPS antenna at least 5 m away from Inmarsat radomes.

(8)   Locate the GPS antenna at least 3 m away from DF loop antennas.

(9)   Locate the GPS antenna at least 2 m away from the ship's engine.

(10) Locate the GPS antenna at least 0.5 m away from metallic objects.

Should any of the requirements mentioned in item (1) to item (10) not be met, try to fulfill the requirements of item (10) and install the GPS Antenna as far as possible from the antennas described in item (1) to item (9). Put the GPS Antenna as trial on a promising site to make sure that the unit operates as specified before fixing the GPS Antenna position and then fix the antenna firmly. The GPS Antenna installed in an improper site may result in poor bearing accuracy and positioning error that may lead to potential hazards.

[Scale differs among drawings.]

NOTE: Keep away from metallic objects at least 0.5 m.

Laying and Connection of Cable

(1) Keep the antenna cable and power cable as far away from the cables of other electronic equipment as possible.

(2) The cabinet of Display unit shall be securely grounded to the hull, using the ground terminal on the rear panel.

(3) If you connect the power cable directly to the battery, the interference from other electronic equipment is expected to be less. (See Fig. 3.1.)
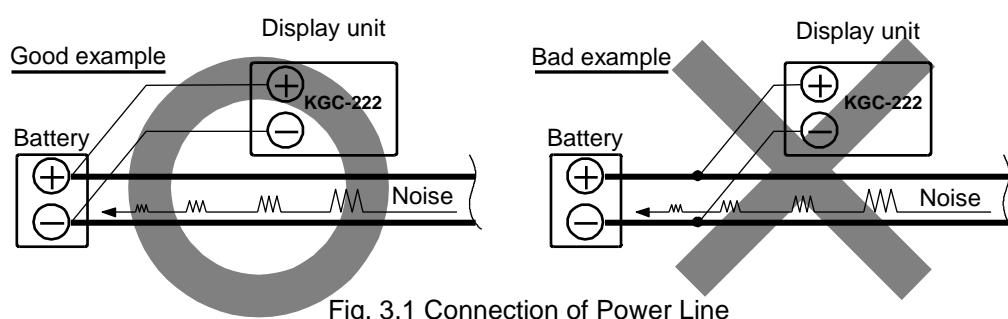
Fig. 3.1 Connection of Power Line

Confirmation after Installation

Be sure to confirm the following points before starting up this equipment. The confirmation is mandatory to operate the equipment normally.
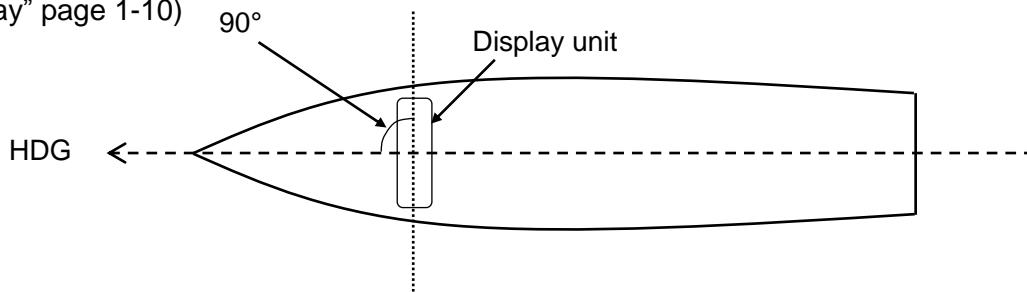
(1) Is the power voltage in the boat within the appropriate voltage range? Is the current capacity enough?
(Voltage Range: 10.8 to 31.2 VDC when measured at the power connector input.)

(2) Is the electric current capacity sufficient? (Power consumption: 9 W)

(3) Is the wiring correct? Is the wiring shorted?

3.2   Installation of Display unit

Display unit can be installed either on pedestal or flush-mounted.
The following points shall be taken into consideration:
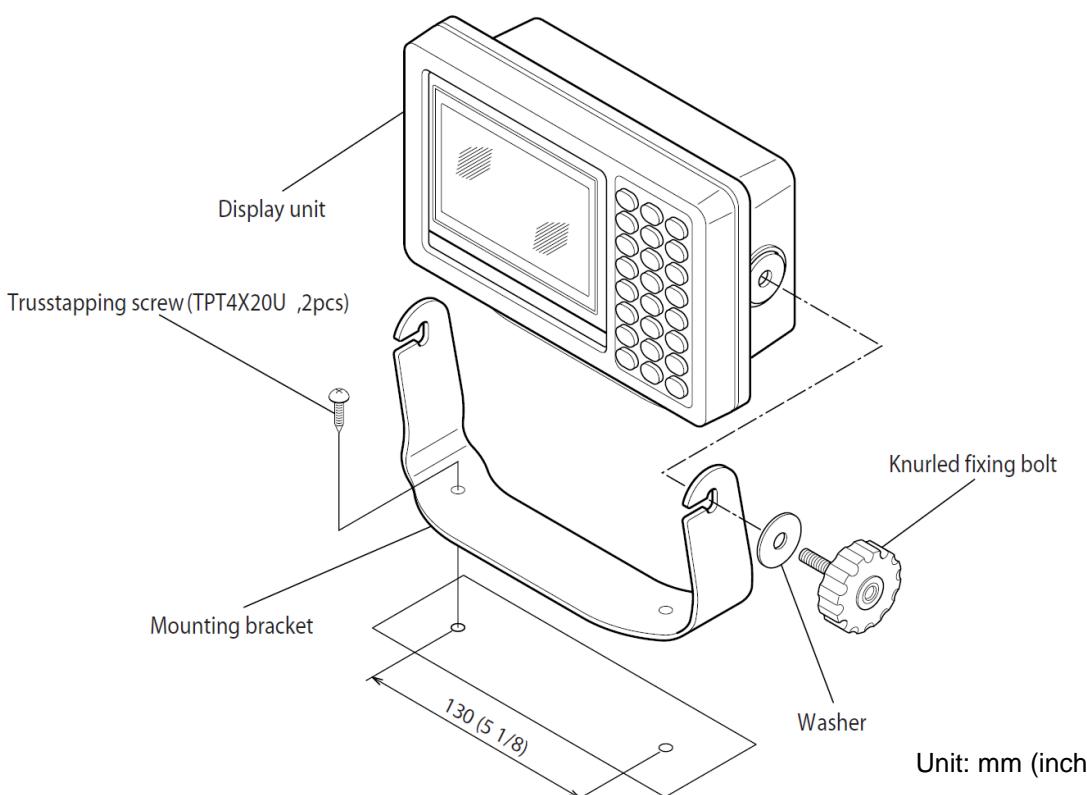
(1)   The KGC-222 has a magnetic backup sensor built in and needs to be installed as far away from other magnetic equipment or ferrous objects as possible, such as compass and others. Strong magnetic field may cause interference during backup function of the display.

(2)   When Pitch/Roll and Heaving data is used with other equipment such as echo sounder, the display needs to be installed in head up orientation, if display is installed at an angle with the bow line then it needs to be compensated in the menu. (Refer to "Setting angle of Display" page 1-10)
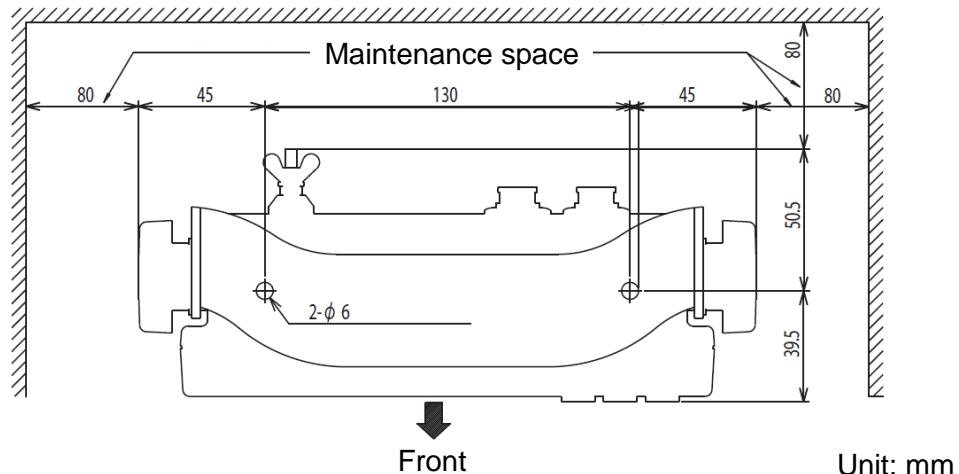
Install the Display unit as follows.

Table mounting

(1)   Remove two knob bolts fixing the display unit to the bracket.

(2)   Remove the display unit from the bracket and place it on the stable flat place.

(3)   Place the bracket on the position where the display unit will be installed and fix the bracket with two (2) attached truss tapping screws.

(4)   Place the display unit on the installation bracket and fix the display unit with two knob bolts removed in step 1.

Unit: mm (inch)
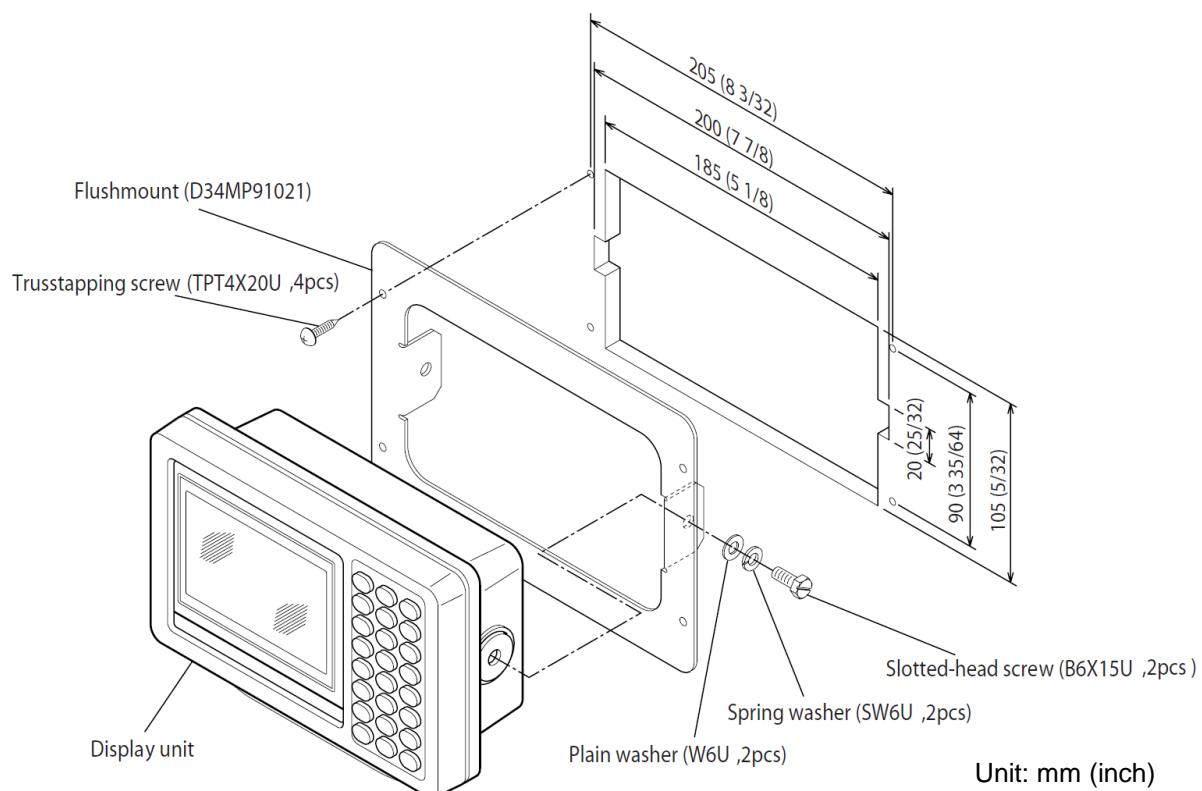
⚠ **Caution: In the case of mounting the display unit on the table, some maintenance space is required for cabling, connector access, fuse replacement, fastening of bolts, etc. as shown in the following illustration.**

Front   Unit: mm
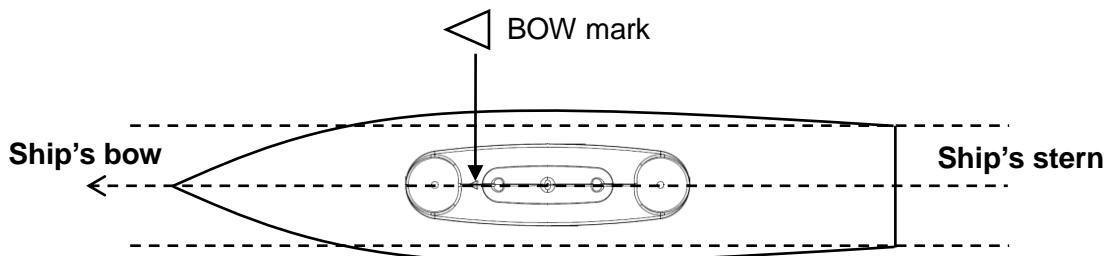
Flush mounting

(1) Make a square hole at the location to be installed.

(2) Loosen two (2) fixing knobs that fasten the Display unit onto the mounting bracket. The bracket and knob bolts are no longer used.

(3) Install the Display unit on the Flush mount kit and fix it with two (2) slotted-head screws.

(4) Connect the connectors for power, DATA, and antenna to the Display unit respectively.

(5) Install the Display unit in the installing location (square hole) and fix it with four 4mm tapping screws. (Prepare 4mm screws suitable for thickness of installing location.)

Unit: mm (inch)

3.3   Installation of GPS antenna GA-12
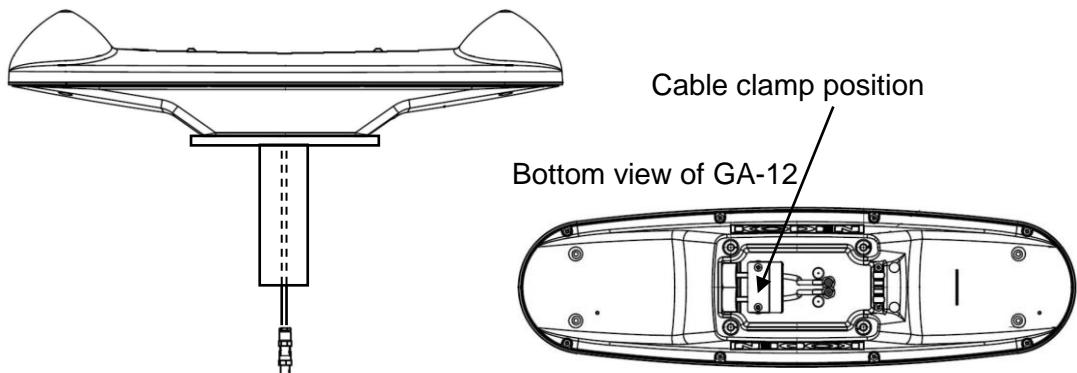
The GPS antenna GA-12 should be installed, as illustrated below, on the keel line with the BOW mark oriented to the ship's bow. If this is not possible due to the ship's superstructure, the antenna may be moved in parallel to the keel line. However, the antenna should be, where possible, installed on the midship, to minimize bearing deviation between the ship's bearing and course.

Antenna cable layout method
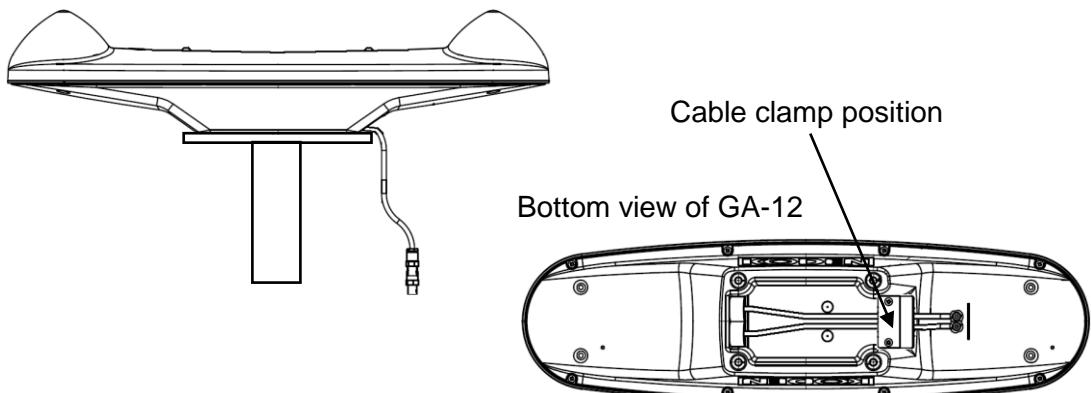
Two ways to run antenna cable from the antenna.

(1)   Antenna cable inserted into the bracked and ran inside the mast pipe.
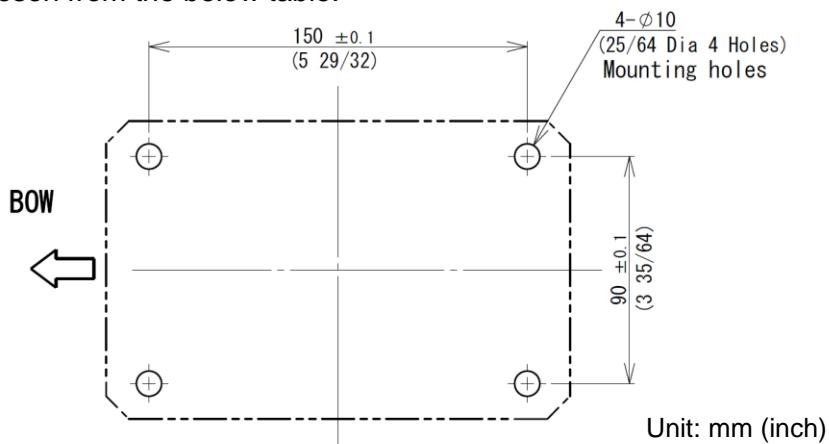
(2)   Antenna cable is dropped off from the side of the antennal and ran outside of the mast pipe.
      In this case it is necessary to change the setting position of the cable clamp.
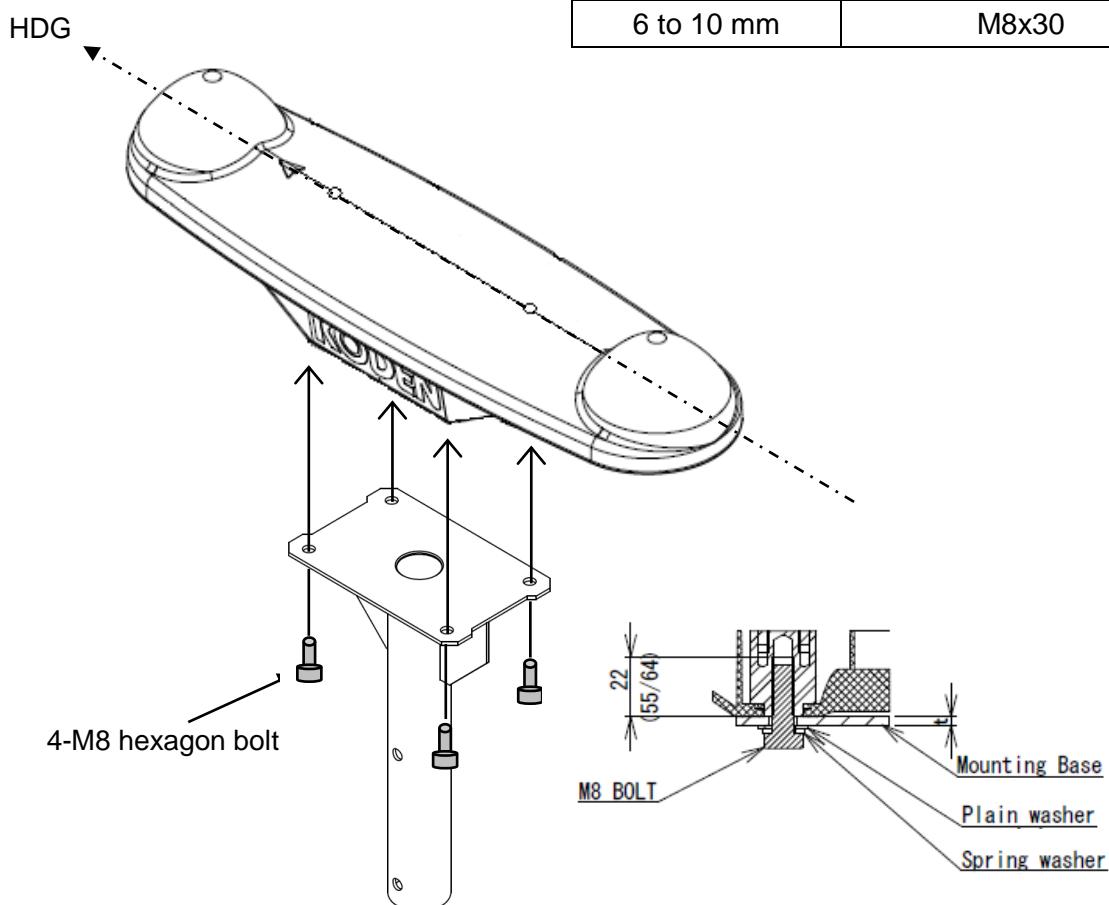
Installation of GPS antenna

To attach the GPS antenna, four (4) M8 bolts are used. Referring to the illustration below, make four (4) holes on the cradle, fix the bracket. When the thickness of the bracket is 4 to 5mm, supplied bolts may be used (M8 x 25). When the bracket is more than 6 mm thick, the bolts should be choosen from the below table.

Unit: mm (inch)

Drawing of work for mounting holes
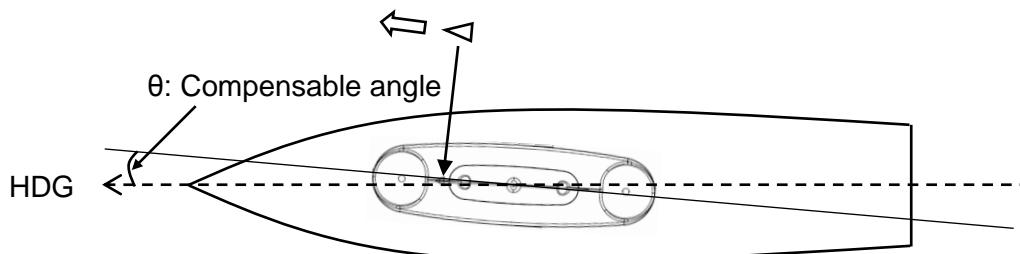
Platform thickness	Bolt for fixing the antenna
4 to 5 mm	M8x25
6 to 10 mm	M8x30

4-M8 hexagon bolt

Unit: mm (inch)

Angle compensation of Antenna
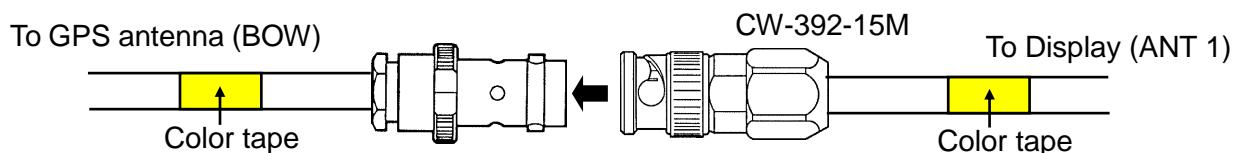
The GPS antenna should be installed on the keel line with the BOW mark oriented to the ship's bow. If not, HDG should be compensated. (Refer to "HDG Compensation" page 1-9)
When it is installed with θ° clockwise off, enter a compensation value [-θ] in the "MENU 3, COMPENSATION". When it is installed with θ° counterclockwise off, enter a compensation value [+θ] in the menu.

θ: Compensable angle

HDG
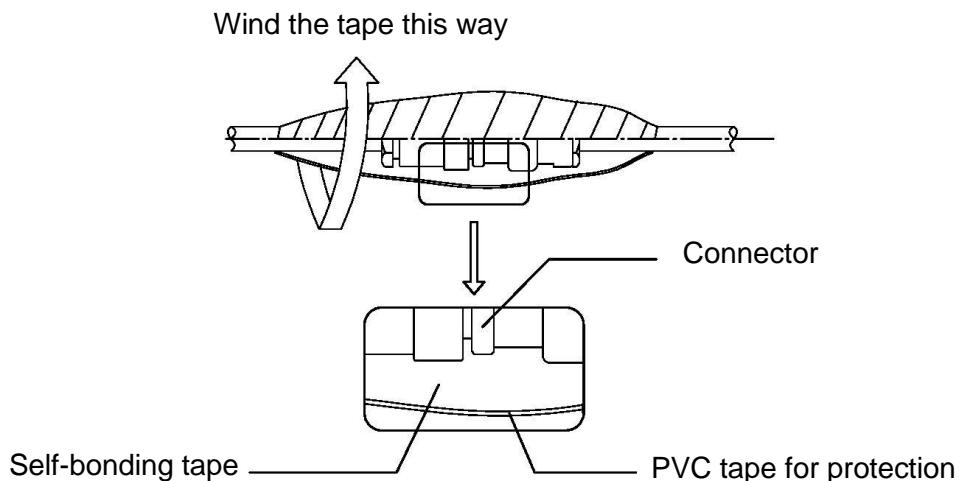
Connecting and waterproofing the connector

Make sure the BOW antenna cable is connected to ANT 1 of the display unit.
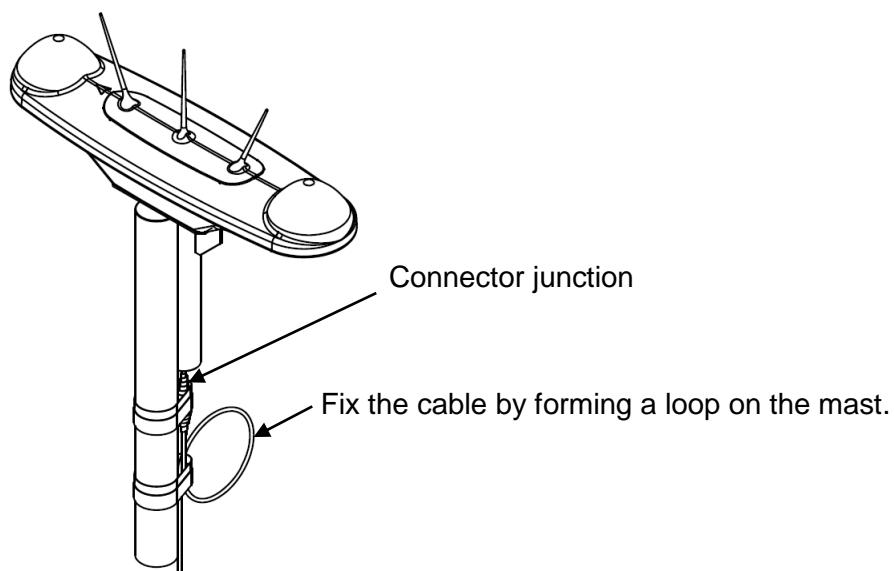
(1)   Pay attention to the BOW antenna cable marked with tape.

To GPS antenna (BOW)   CW-392-15M   To Display (ANT 1)

Color tape   Color tape

(2)   Wind the self-bonding tape around the joint section after connecting.
      Pull the end of the tape and stretch it to twice its length. Wrap it around joint section a total of 3 layers. When completed, apply gentle pressure over the surface with fingers to expedite the fusion.

(3)   Use PVC tape for extra protection.
      PVC tape should not be strained. Wrap it around joint section a total of 3 layers. When finished, press the surface evenly without strain for complete adhesion of the tape.

Wind the tape this way

Connector

Self-bonding tape   PVC tape for protection
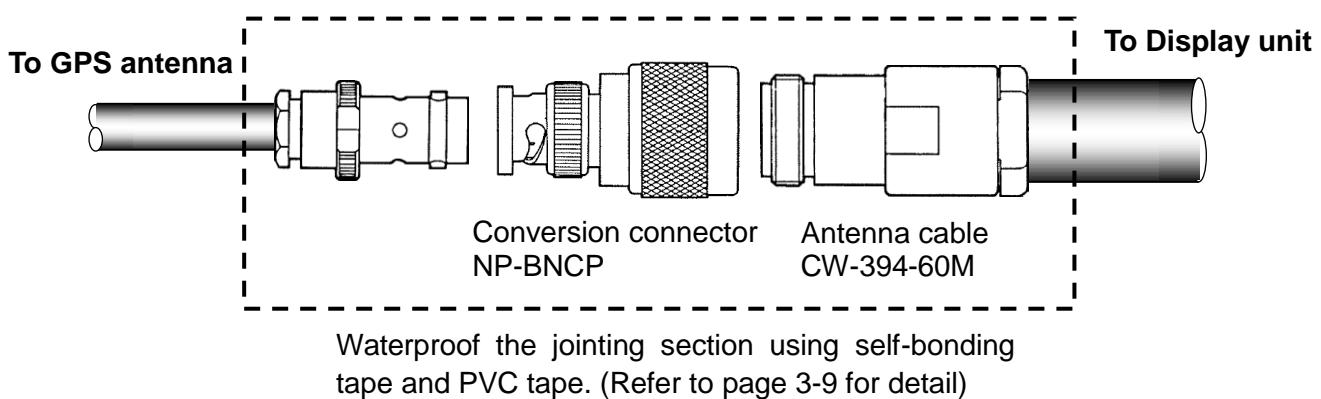
To prevent the tension hanging over the connector junction, the cable shall be fixed as described in the illustration below.

Connector junction

Fix the cable by forming a loop on the mast.
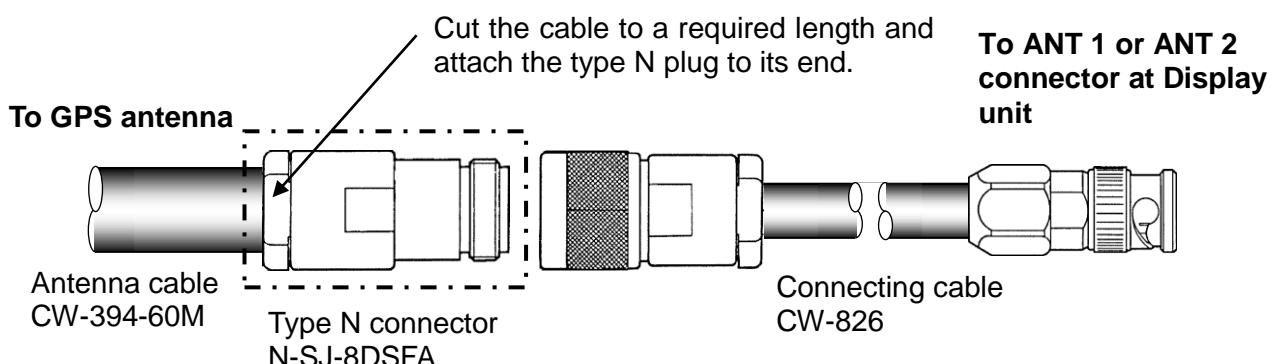
Connecting the 60m antenna cable kit CW-394.KIT to GPS antenna

The optional 60 m length cable kit, CW-394.KIT, is composed of the Antenna cable CW-394-60M and the N-to BNC conversion connector. Connect the GPS antenna and Display unit via the cable kit as shown in the following figure.

(1) Connection at GPS Antenna side

To GPS antenna

To Display unit

Conversion connector   Antenna cable
NP-BNCP   CW-394-60M

Waterproof the jointing section using self-bonding tape and PVC tape. (Refer to page 3-9 for detail)
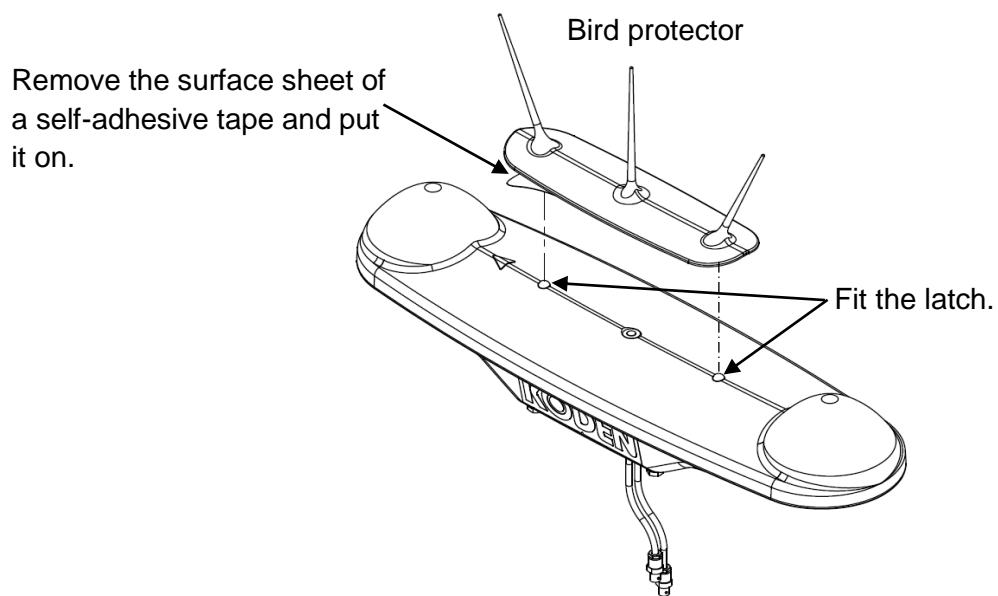
(2) Connecting the Display unit

Cut the cable to a required length and attach the type N plug to its end.

To ANT 1 or ANT 2 connector at Display unit

To GPS antenna

Antenna cable
CW-394-60M

Type N connector
N-SJ-8DSFA

Connecting cable
CW-826

Installing the bird protector to Antenna unit

Sea birds such as seagulls may be the cause of poor reception of the GPS signal when perched on top of the GPS antenna unit. The use of bird protector is recommended to avoid this problem. To fit this device, use the following procedure:

Bird protector

Remove the surface sheet of a self-adhesive tape and put it on.

Fit the latch.

KODEN
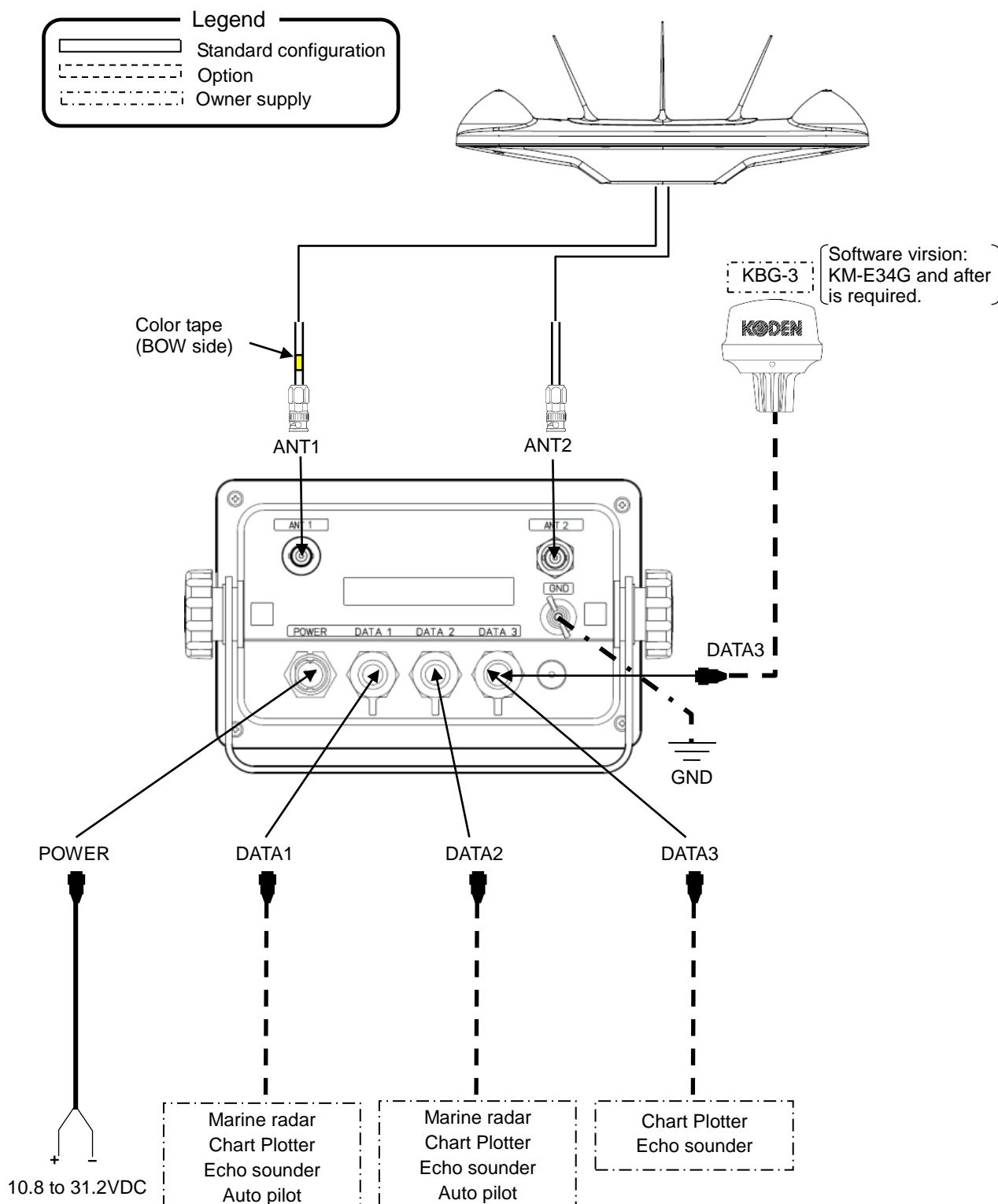
⚠ **Caution: Put it on the surface without any gaps.**

3.4   Wiring
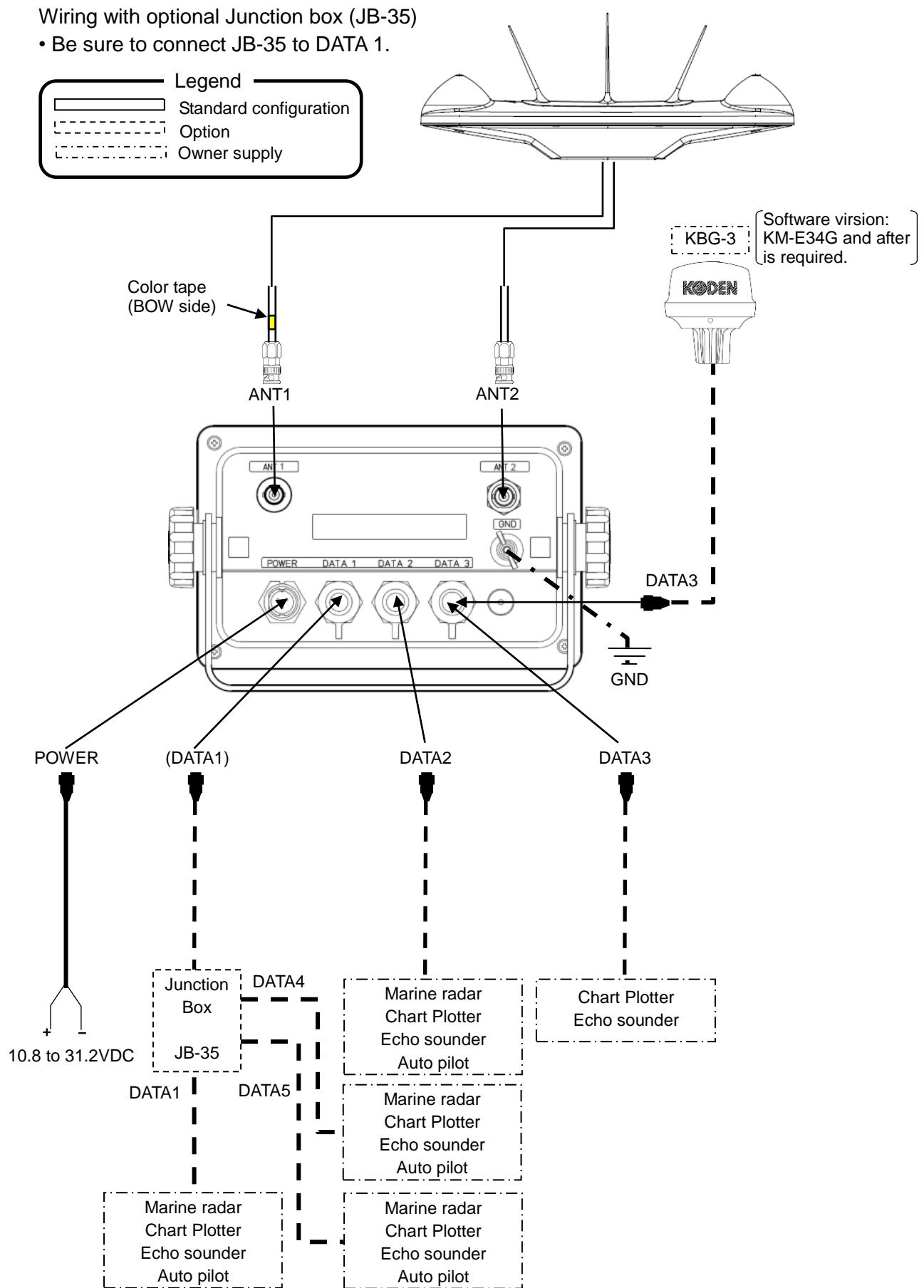
Connect the power cable and cables from the antenna to the connectors on the Display unit. Connect the cables from the external equipments to the DATA connectors on the Display unit.

• DATA 3 is for navigational data. Be sure to connect the Plotter or the KBG-3 to DATA 3.

Wiring with optional Junction box (JB-35)
• Be sure to connect JB-35 to DATA 1.
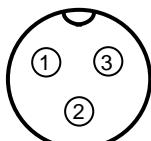
Legend
Standard configuration
Option
Owner supply

Software virsion:
KM-E34G and after
is required.

KBG-3

KODEN

Color tape
(BOW side)

ANT1   ANT2

ANT 1   ANT 2

GND

POWER   DATA 1   DATA 2   DATA 3

DATA3

GND

POWER   (DATA1)   DATA2   DATA3

10.8 to 31.2VDC

Junction
Box

JB-35

DATA4

DATA1   DATA5

Marine radar
Chart Plotter
Echo sounder
Auto pilot

Chart Plotter
Echo sounder

Marine radar
Chart Plotter
Echo sounder
Auto pilot

Marine radar
Chart Plotter
Echo sounder
Auto pilot

Marine radar
Chart Plotter
Echo sounder
Auto pilot

Pin Assignment of Rear Connector

The pin assignment is viewed from the rear of the Display unit.
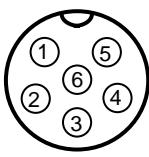
Power Input

① POWER+
② F.GND
③ POWER-

POWER

DATA IN/OUT

① GND
② TX+
③ TX-
④ RX+
⑤ RX-
⑥ +12V (Maximum 300 mA)

⚠ Caution: The maximum current capacity
is 300 mA in total, then it should not
exceed.
Take care that the grand total of each
connector does not exceed 300 mA.

DATA1/2/3

Connector acceptable: BD-06BFFA-LL6001

⚠ Caution: KGC-222 Compass has 12V power on PIN 6 of each DATA connector.
Please pay attention not to accidentally connect 12V to other equipment
NMEA input. Equipment damage may occur.

For reference:

Wire color of CW-376-5M

① Blue+Shield
② White
③ Red
④ Orange
⑤ Black
⑥ Green
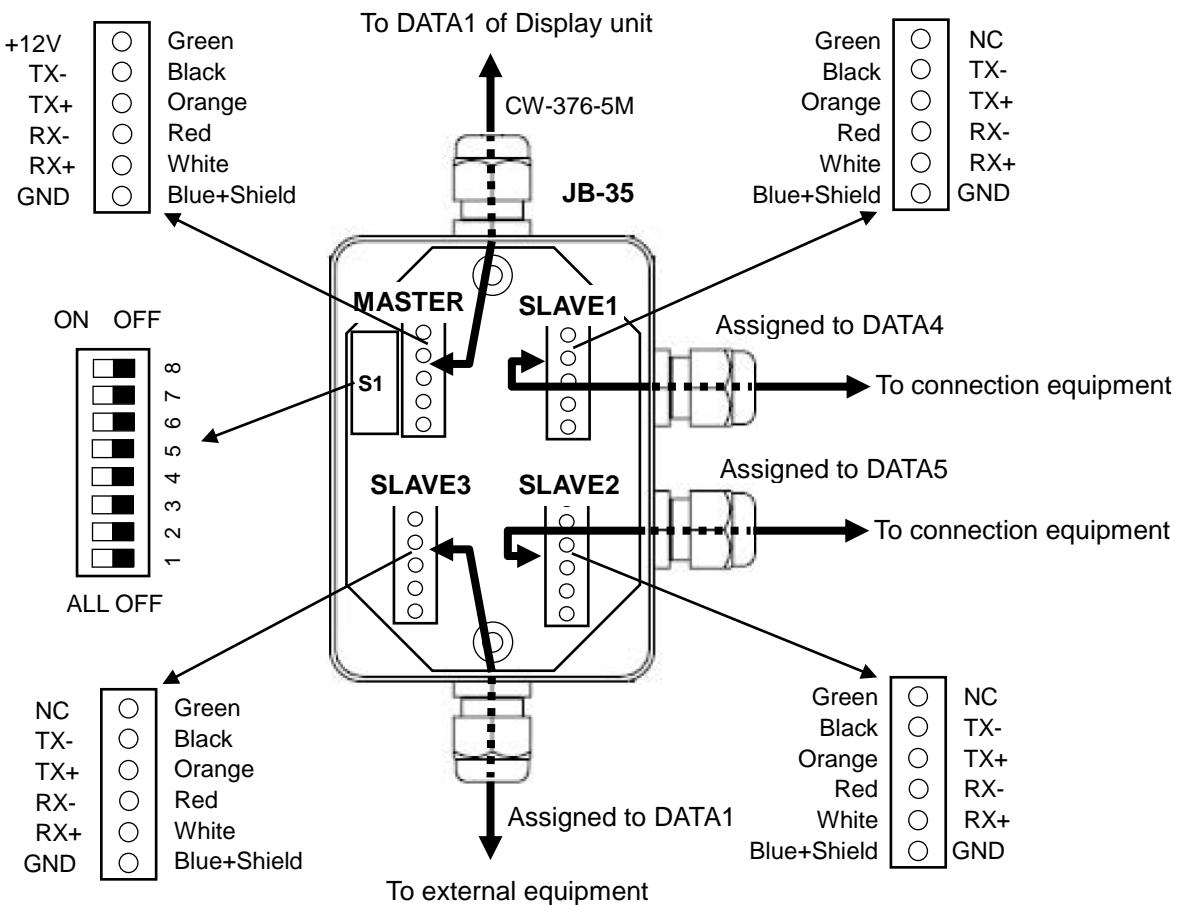
Connection with Junction box (JB-35)

To extend the ports, connect the junction box (JB-35) to the data connectors as shown in the figure below.

Set the DIP switch (S1) as shown in the figure below.

Wire the cables with the CW-376-5M (option) as shown in the following color chart.

+12V	○	Green			
TX-	○	Black			
TX+	○	Orange			
RX-	○	Red			
RX+	○	White			
GND	○	Blue+Shield			

To DATA1 of Display unit

CW-376-5M

JB-35

Green	○	NC
Black	○	TX-
Orange	○	TX+
Red	○	RX-
White	○	RX+
Blue+Shield	○	GND

ON   OFF

ALL OFF

S1

MASTER   SLAVE1

Assigned to DATA4

To connection equipment

SLAVE3   SLAVE2

Assigned to DATA5

To connection equipment

NC	○	Green
TX-	○	Black
TX+	○	Orange
RX-	○	Red
RX+	○	White
GND	○	Blue+Shield

Assigned to DATA1

To external equipment

Green	○	NC
Black	○	TX-
Orange	○	TX+
Red	○	RX-
White	○	RX+
Blue+Shield	○	GND

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Chapter 4   Detail of the serial output data
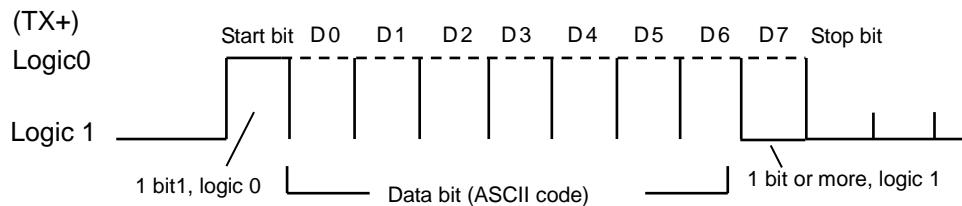
4.1   Output data format

Serial data name: NMEA0183 Ver.2.0

4.2   Details of the output data format

Data per one byte
  is as follows:

Parity bit: none
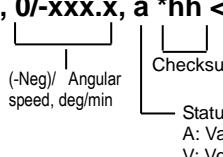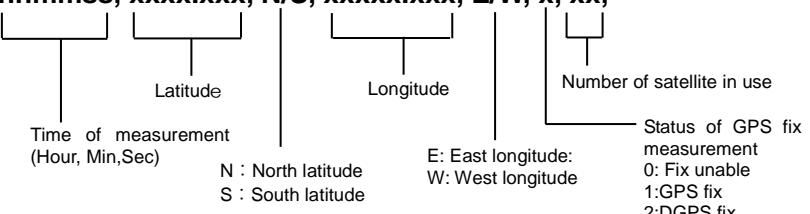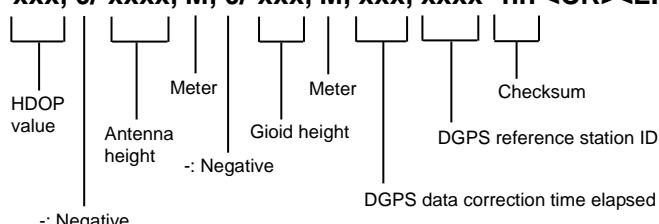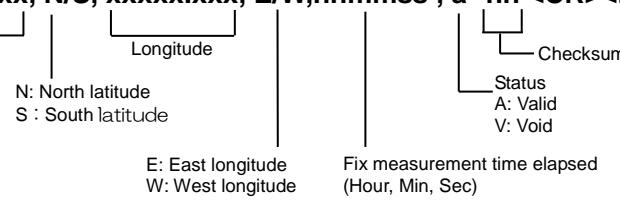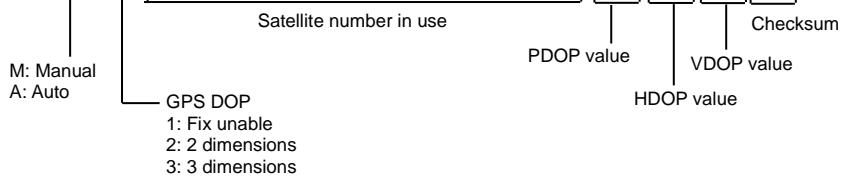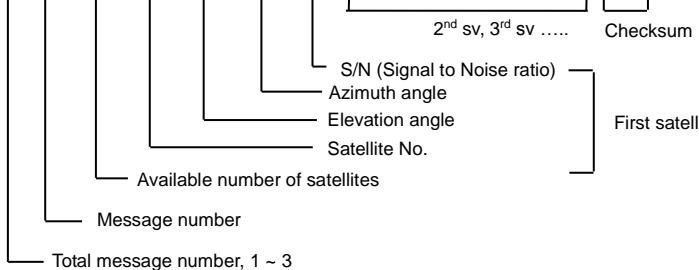
4.3   Output data specification
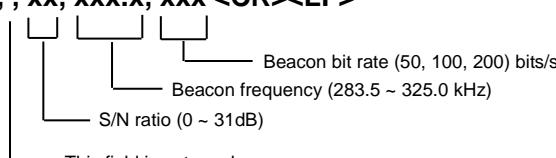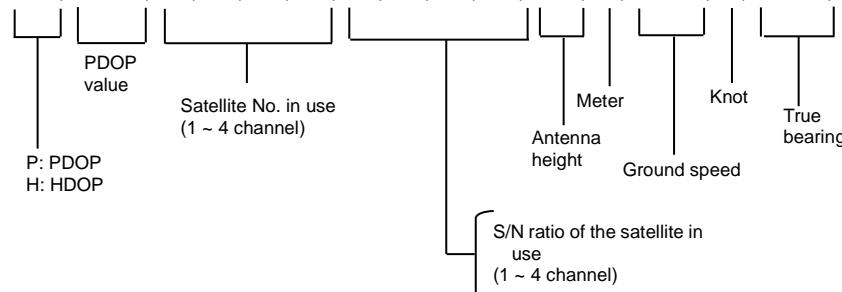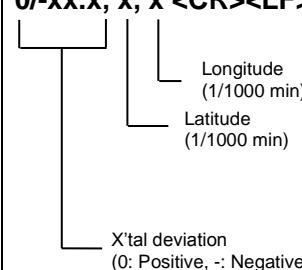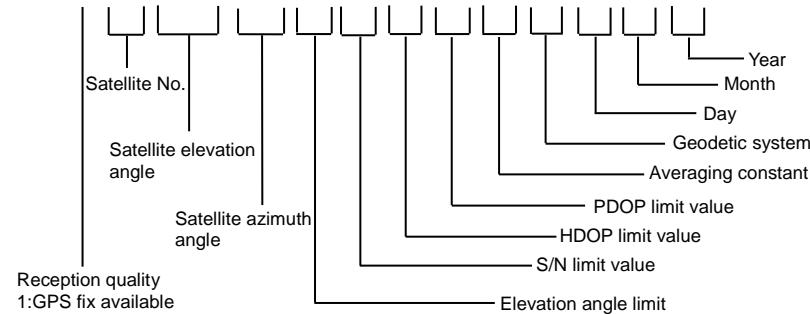
Baud rate	Output level	Output current	Sentence	Output interval
4800/38400 bps	RS-422	20mA max.	Refer to page 1-18	Refer to page 1-17

4.4   Details of output sentences

Sentence name	Data name and contents **NOTE:** *Checksum is a total sum of EX-ORed data that are put between the $ and asterisk (*) signs.*
HDT	Ship's heading (True bearing) **$ GPHDT, xxx.x, T *hh <CR><LF>**
HDM	Ship's heading (Magnetic bearing) **$ GPHDM, xxx.x, M *hh <CR><LF>**

ROT	Rate of turn
	$ GPROT, 0/-xxx.x, a *hh <CR><LF>
	(-Neg)/ Angular speed, deg/min — Checksum — Status A: Valid V: Void

GGA	GPS position data
	$ GP GGA, hhmmss, xxxx.xxx, N/S, xxxxx.xxx, E/W, x, xx,
	Time of measurement (Hour, Min,Sec) — Latitude — N : North latitude S : South latitude — Longitude — E: East longitude: W: West longitude — Number of satellite in use — Status of GPS fix measurement 0: Fix unable 1:GPS fix 2:DGPS fix
	xxx, 0/-xxxx, M, 0/-xxx, M, xxx, xxxx *hh <CR><LF>
	HDOP value — -: Negative — Antenna height — -: Negative — Meter — Gioid height — Meter — DGPS data correction time elapsed — DGPS reference station ID — Checksum

GLL	Ground position (Latitude/Longitude)
	$ GP GLL, xxxx.xxx, N/S, xxxxx.xxx, E/W,hhmmss , a *hh <CR><LF>
	Latitude — N: North latitude S : South latitude — Longitude — E: East longitude W: West longitude — Fix measurement time elapsed (Hour, Min, Sec) — Status A: Valid V: Void — Checksum

GSA	Satellite in use and DOP
	$ GP GSA, M/A, x, xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx, x.x, x.x, x.x *hh <CR><LF>
	M: Manual A: Auto — GPS DOP 1: Fix unable 2: 2 dimensions 3: 3 dimensions — Satellite number in use — PDOP value — HDOP value — VDOP value — Checksum

GSV	Available satellite
	$GPGSV , x , x , xx , xx , xx , xx , xx ,·················· *hh <CR><LF>
	Total message number, 1 ~ 3 — Message number — Available number of satellites — Satellite No. — Elevation angle — Azimuth angle — S/N (Signal to Noise ratio) — First satellite — 2nd sv, 3rd sv ..... — Checksum

ZDA	Time and date **$ GPZDA , hhmmss , xx , xx , xxxx, , *hh <CR><LF>** Time (H,M,S) Day Month Year Checksum This field is not used
RMC	Minimum sentence for GPS/TRANSIT navigation data **$ GPRMC , hhmmss , x , xxxx.xxx, N/S, xxxxx.xxx, E/W, x.x , xxx.x ,** Meassurement Time (H,M,S) Latitude A: Data valid V: Alarm vaid for Nav receiver N: North latitude S: South latitude Longitude E: East latitude W: West latitude Track bearing (True bearing) Ground speed (KNT) **ddmmyy , x.x ,E/W *hh <CR><LF>** Date (D, M, Y) Magnetic deviation E: East longitude W: West longitude Checksum
VTG Ver2.0	Course and ground speed **$GPVTG, xxx.x, T, xxx.x, M , xx.x, N, xx.x, K *hh <CR><LF>** **>** Track bearing (True) Track bearing (Magnetic) Ground speed (KNT) Ground speed (Km/H) Checksum
VTG 61162-1	Course and ground speed **$GPVTG, xxx.x, T, xxx.x, M , xx.x, N, xx.x, K, a *hh <CR><LF>** Track bearing (True) Track bearing (Magnetic) Ground speed (KNT) Ground speed (Km/H) Checksum Mode A: Data valid (Autonomous mode) D: Data valid (Differential mode) N: Data invalid

DTM	Datum reference
	$GPDTM, ccc, , x.x, a, x.x, a, , W84 *hh <CR><LF>
	
	Checksum
	Reference datum WGS84
	Lon offset, min, E/W
	Lat offset, min, N/S
	Local datum
	    W84: WGS84
	    W72: WGS72
	    999: user
	    IHO datum code

MSS	MSK receiver signal status **$ GPMSS, , xx, xxx.x, xxx <CR><LF>** Beacon bit rate (50, 100, 200) bits/s Beacon frequency (283.5 ~ 325.0 kHz) S/N ratio (0 ~ 31dB) This field is not used
PKODA	Satellite information (KODEN proprietary sentence) **$ PKODA, P/H, xxx.x, xx, xx, xx, xx, xx, xx, xx, xx, xxx, M, xxx.x, N, xxx.x,** PDOP value Satellite No. in use (1 ~ 4 channel) Meter Knot True bearing Antenna height Ground speed P: PDOP H: HDOP S/N ratio of the satellite in use (1 ~ 4 channel) **0/-xx.x, x, x <CR><LF>** Longitude (1/1000 min) Latitude (1/1000 min) X'tal deviation (0: Positive, -: Negative)
PKODG,1	Satellite information (KODEN proprietary sentence) **$ PKODG, 1, x, xx, +/-xx, xxx, xx, xx, xx, xx, xx, xx, xx, xx, xx, <CR><LF>** Satellite No. Satellite elevation angle Satellite azimuth angle Year Month Day Geodetic system Averaging constant PDOP limit value HDOP limit value S/N limit value Elevation angle limit Reception quality 1: GPS fix available 0: Fix unable
PKODG,7	DGPS information (KODEN proprietary sentence) **$ PKODG, 7, x, x, xxx <CR><LF>** Time out value (010 ~ 180 sec) DGPS status (1: DGPS ON, 0: DGPS OFF) DGPS (0: OFF, 1: RTCM ON, 2: SBAS ON)
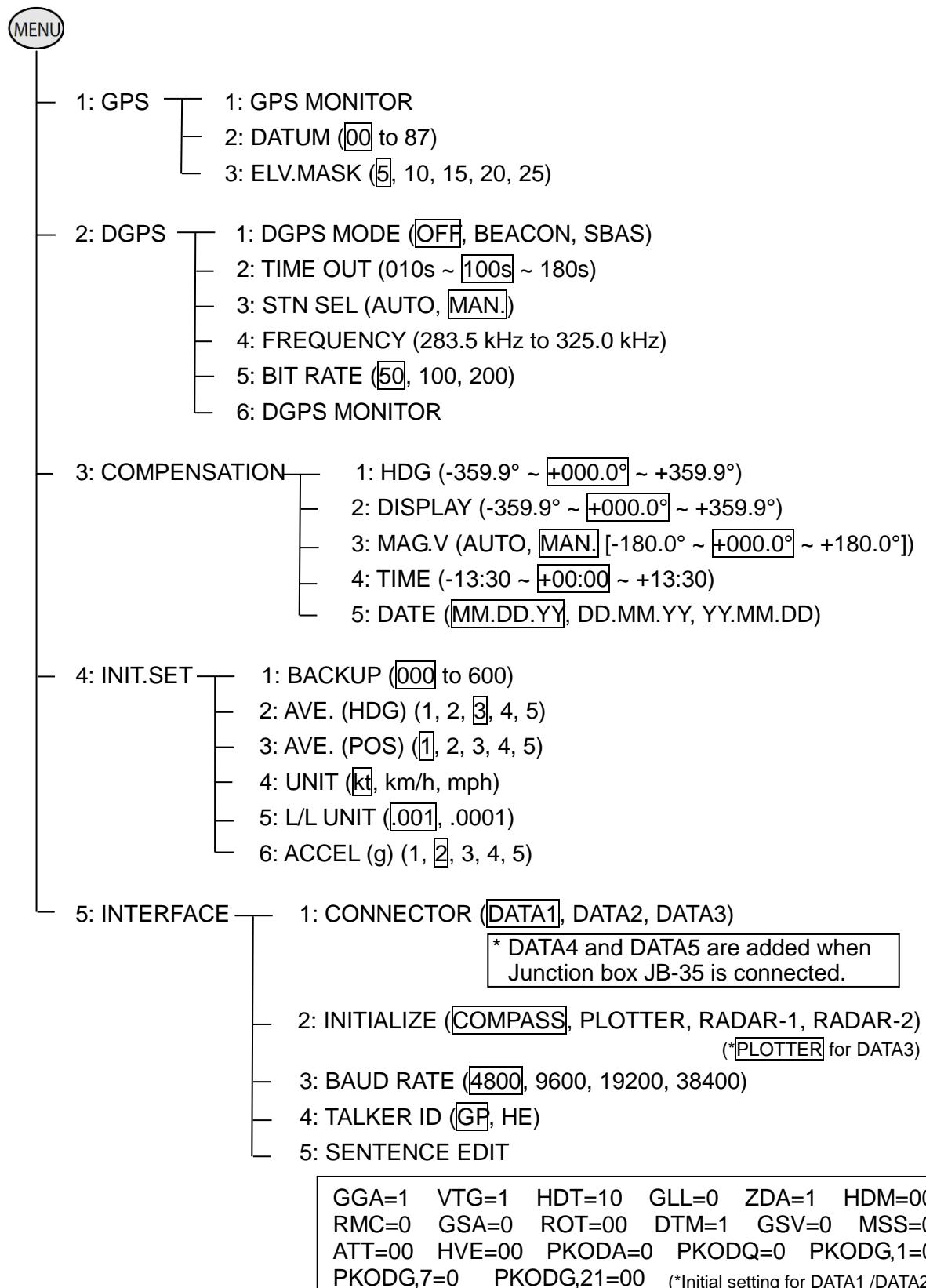
PKODG,21	Ship's heading, Pitch/Roll and Heaving information (KODEN proprietary sentence) **$PKODG, 21 ,xxx.x, +/-xx.x, +/-xx.x, +/-xx.xxx, a *hh <CR><LF>** Checksum Status A: Valid V: Void Heaving data Rolling data Pitching data Ship's Heading
PKODQ	Type 16 weather information (KODEN proprietary sentence) **$ PKODQ, xxxx, x……x, xxx, xxm, xxxxhPa, Wavexxm <CR><LF>** Observation time Wind direction Atmospheric pressure (hPa) Wave height (m) Observation point Wind speed *Only be used in japan with message type 16 provided from a Japanese beacon station.
ATT	Ship's heading, Pitch and Roll information (FURUNO proprietary sentence) **$ PFEC,GPatt, xxx.x, +/-00.0, +/-00.0 *hh <CR><LF>** Checksum Rolling data Pitching data Ship's Heading
HVE	Heaving information (FURUNO proprietary sentence) **$ PFEC,GPhve, +/-00.011, A *hh <CR><LF>** Checksum Status A: Valid V: Void Heaving data

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Chapter 5   Attached table

5.1   Menu Configuration

The factory set value is shown by the surrounding boxes.

(MENU)

- 1: GPS — 1: GPS MONITOR
  - 2: DATUM (00 to 87)
  - 3: ELV.MASK (5, 10, 15, 20, 25)

- 2: DGPS — 1: DGPS MODE (OFF, BEACON, SBAS)
  - 2: TIME OUT (010s ~ 100s ~ 180s)
  - 3: STN SEL (AUTO, MAN.)
  - 4: FREQUENCY (283.5 kHz to 325.0 kHz)
  - 5: BIT RATE (50, 100, 200)
  - 6: DGPS MONITOR

- 3: COMPENSATION — 1: HDG (-359.9° ~ +000.0° ~ +359.9°)
  - 2: DISPLAY (-359.9° ~ +000.0° ~ +359.9°)
  - 3: MAG.V (AUTO, MAN. [-180.0° ~ +000.0° ~ +180.0°])
  - 4: TIME (-13:30 ~ +00:00 ~ +13:30)
  - 5: DATE (MM.DD.YY, DD.MM.YY, YY.MM.DD)

- 4: INIT.SET — 1: BACKUP (000 to 600)
  - 2: AVE. (HDG) (1, 2, 3, 4, 5)
  - 3: AVE. (POS) (1, 2, 3, 4, 5)
  - 4: UNIT (kt, km/h, mph)
  - 5: L/L UNIT (.001, .0001)
  - 6: ACCEL (g) (1, 2, 3, 4, 5)

- 5: INTERFACE — 1: CONNECTOR (DATA1, DATA2, DATA3)

  > * DATA4 and DATA5 are added when Junction box JB-35 is connected.

  - 2: INITIALIZE (COMPASS, PLOTTER, RADAR-1, RADAR-2)
    (*PLOTTER for DATA3)
  - 3: BAUD RATE (4800, 9600, 19200, 38400)
  - 4: TALKER ID (GP, HE)
  - 5: SENTENCE EDIT

  > GGA=1   VTG=1   HDT=10   GLL=0   ZDA=1   HDM=00
  > RMC=0   GSA=0   ROT=00   DTM=1   GSV=0   MSS=0
  > ATT=00   HVE=00   PKODA=0   PKODQ=0   PKODG,1=0
  > PKODG,7=0   PKODG,21=00   (*Initial setting for DATA1 /DATA2)

5.2 Specifications

Model	Display unit : KGC-222.MU GPSantenna : GA-12
Receiving frequency	1575.42MHz±1MHz
Receiving channel	Parallel 16 channel
Sensitivity	Better than -130 dBm
Setting time	2 minutes (at standard hot-start time)
Heading accuracy	1° rms
Heading resolution	0.1°
Maximum rate of turn	45°/s
Maximum follow-up acceleration	1g
Maximum role / pitch angle	30°
Base line length	0.5m
Time to position fix Cold start Warm start Hot start	 50 sec (standard) 45 sec (standard) 20 sec (standard)
Positioning accuracy Position Velocity	 GPS: 10m (2 drms, SA:OFF, PDOP: 3 or less) DGPS: 3m (2 drms, SA:OFF, PDOP: 3 or less) 1 m / sec (rms, SA:OFF, PDOP: 3 or less)
Datum	88 (WGS-84, Tokyo etc.)
Output data port	3 (standard), 5 (with connecting an optional junction box)
Output data Format Heading data sentence Navigation data sentence Data level Output current Output interval	 NMEA 0183 Ver2.0 ATT, HDM, HDT, HVE, ROT, PKODG,21 DTM, GGA, GLL, GSA, GSV, MSS, RMC, VTG, ZDA, PKODA, PKODG,1, PKODG,7, PKODQ RS-422 20mA 20ms, 40ms, 50ms, 100ms, 200ms, 1s
Power supply	10.8 to 31.2VDC
Power Consumption	9W or less (at 24 VDC)
Operating temperature	-15°C to +55°C
Water protection Display unit GPS antenna	 IPX4 IPX6
Store temperature	-30°C to +70°C
Upper limit of humidity	93% +/- 3% @ +40°C

5.3   Local geodetic system list

No.	IHO* code	Name	No.	IHO code	Name
00	W84	WGS-84	27	AIN	BAHRAIN
01	W72	WGS-72	28	ANO	COCOS
02	TOY	TOKYO	29	ARF	ARC 50
03	NAS	NAD-27	30	ARS	ARC 60
04	NAS	ALASKA/CANADA	31	ASC	ASCENSION
05	EUR	EUROPEAN 50	32	ATF	IWO JIMA
06	AUG	AUSTRALIAN 84	33	TRN	TERN
07	SOA	SOUTH ASIA	34	SHB	ST.HELENA
08	SAN	SOUTH AMERICA	35	ASQ	MARCUS
09	QUO	GREENLAND	36	IBE	EFATE
10	NAR	NAD-83	37	BER	BERMUDA 57
11	HJO	ICELAND 55	38	BOO	COLOMBIA
12	IRL	IRELAND 65	39	CAI	ARGENTIN
13	GEO	NEW ZEALAND	40	CAO	PHOENIX
14	EUS	EUROPEAN 79	41	CAC	FLORIDA
15	MOD	ROME 40	42	CGE	TUNISIA
16	CAP	SOUTH AFRICA	43	CHI	CHATHAM
17	NAH	SAUDI ARABIA	44	CHU	PARAGUAY
18	IND	INDIAN/NEPAL	45	COA	BRAZIL
19	LUZ	PHILIPPINES	46	GIZ	NEW GEORGIA
20	OGB	ENGLAND	47	EAS	EASTER
21	OHA	HAWAII	48	GAA	MALDIVE
22	BAT	DJAKARTA	49	GUA	GUAM 63
23	KEA	MALAYSIA	50	DOB	GUADALCANAL
24	TOY	JAPAN	51	HKD	HONG KONG 63
25	ADI	ETHIOPIA	52	IST	DIEGO GARCIA
26	AFG	SOMALIA	53	JOH	JHONSTON
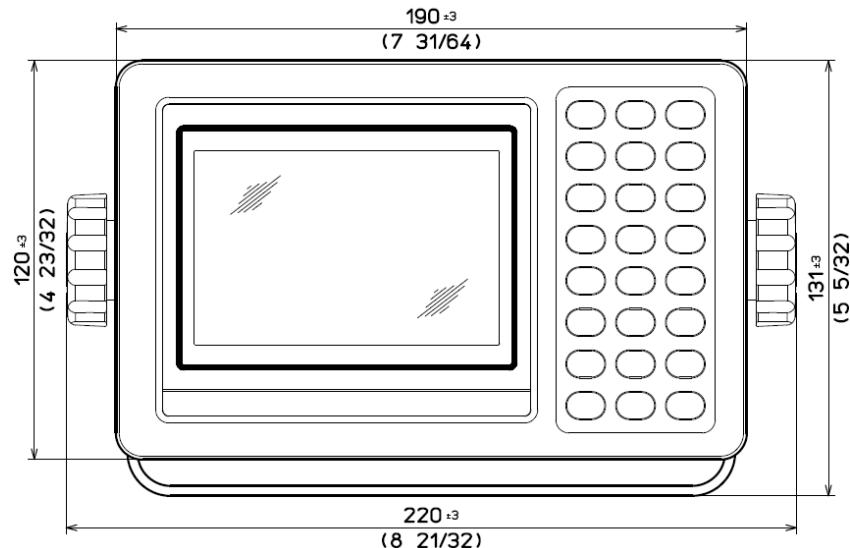
*IHO : nternational Hydrographic Organization

No.	IHO code	Name	No.	IHO code	Name
54	KAN	SRI LANKA	81	MVS	FIJI
55	KEG	KERGUELEN	82	ENW	MARSHALL
56	LCF	CAYMAN BRAC	83	ZAN	SURINAME
57	LIB	LIBERIA 64	84	999	FINLAND
58	MIK	MAHE 71	85	999	SWEDEN
59	SGM	SALVAGE	86	HTN	HU-TZU-SHAN
60	MAS	ERITREA	87	PUK	RUSSIA
61	MER	MOROCCO			
62	MID	MIDWAY 61			
63	MIN	NIGERIA			
64	NAP	TRINIDAD			
65	FLO	CORVO/FLORES			
66	OEG	EGYPT			
67	FAH	OMAN			
68	PLN	CANARY			
69	PIT	PITCAIRN			
70	HIT	SOUTH CHILE			
71	PUR	PUERTO RICO			
72	QAT	QATAR			
73	REU	MASCARENE			
74	SAE	SANTO			
75	SAO	SANTA MARIA			
76	SAP	EAST FALKLAND			
77	POS	PORTO SANTO			
78	GRA	FAIAL			
79	TIL	EAST MALAYSIA			
80	TDC	TRISTAN			
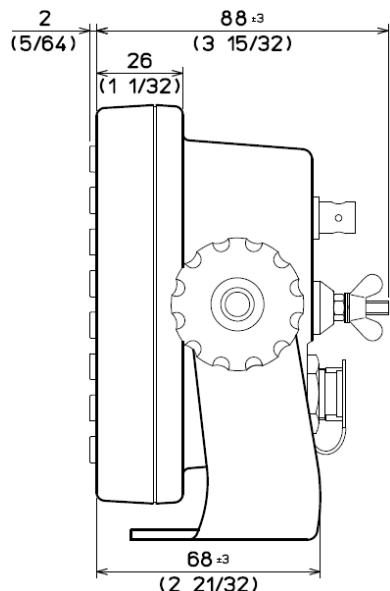
5.4   External view and dimensions

Display unit: KGC-222.MU

Front view

190 ±3
(7 31/64)

120 ±3
(4 23/32)

131 ±3
(5 5/32)

220 ±3
(8 21/32)

Side view

2
(5/64)

88 ±3
(3 15/32)

26
(1 1/32)

68 ±3
(2 21/32)
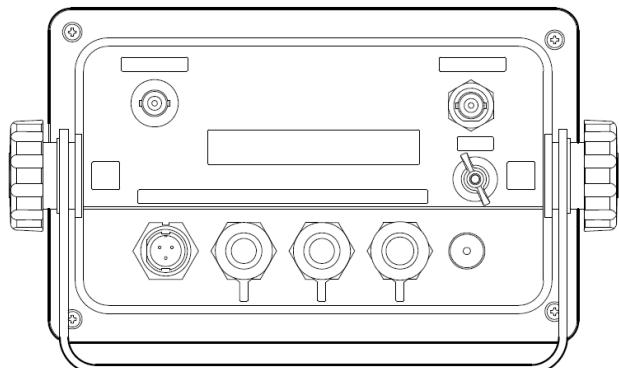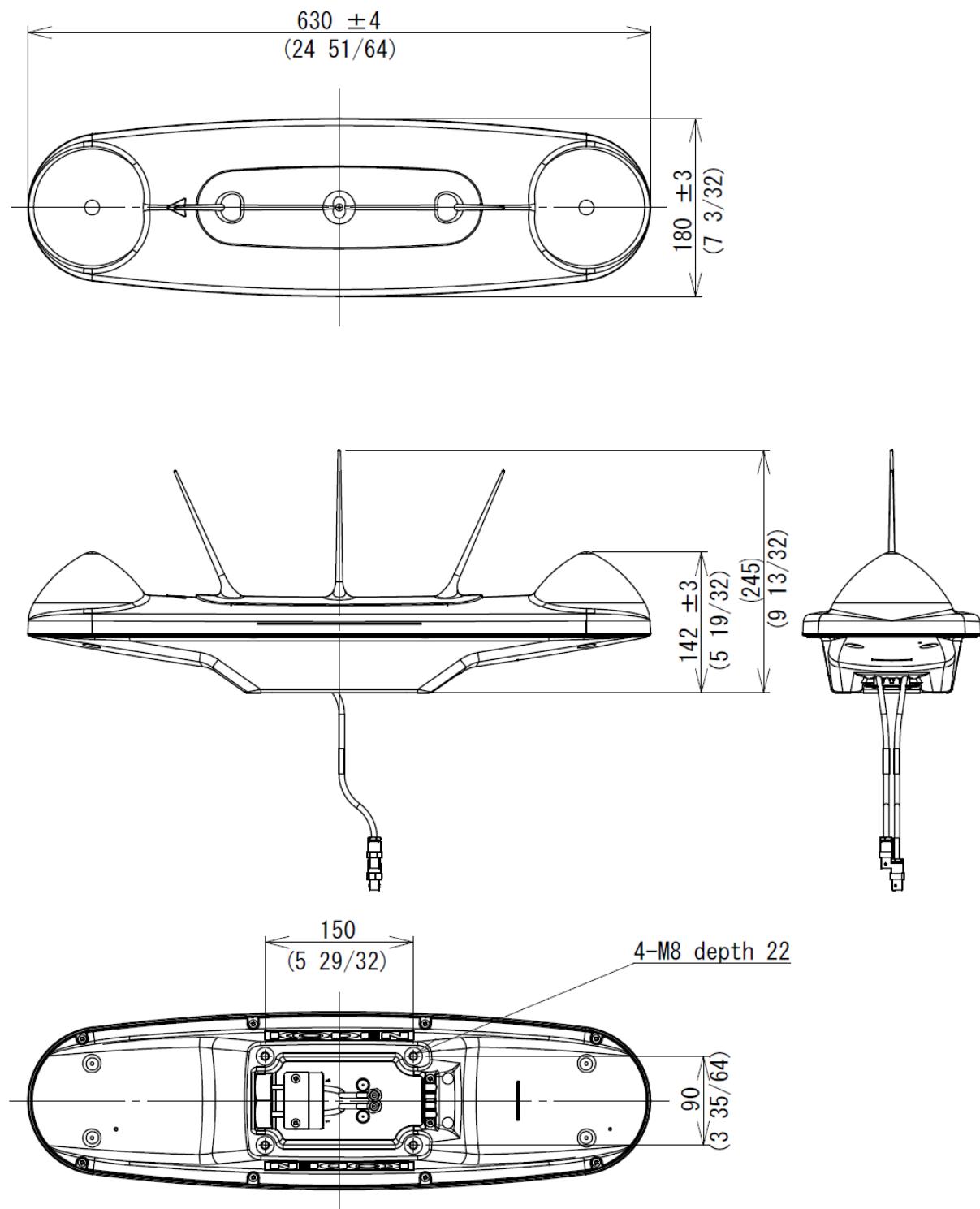
Rear view

Weight: 0.89kg (With mounting bracket)

Unit: mm (inch)

GPS antenna: GA-12

630 ±4
(24 51/64)

180 ±3
(7 3/32)

142 ±3
(5 19/32)

(245)
(9 13/32)

150
(5 29/32)

4-M8 depth 22

90
(3 35/64)

Weight: 2.2kg (With antenna cables)

Unit: mm (inch)

Chapter 6 INDEX

KODEN

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