



# KODEN

## OPERATION MANUAL

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**GPS Compass**

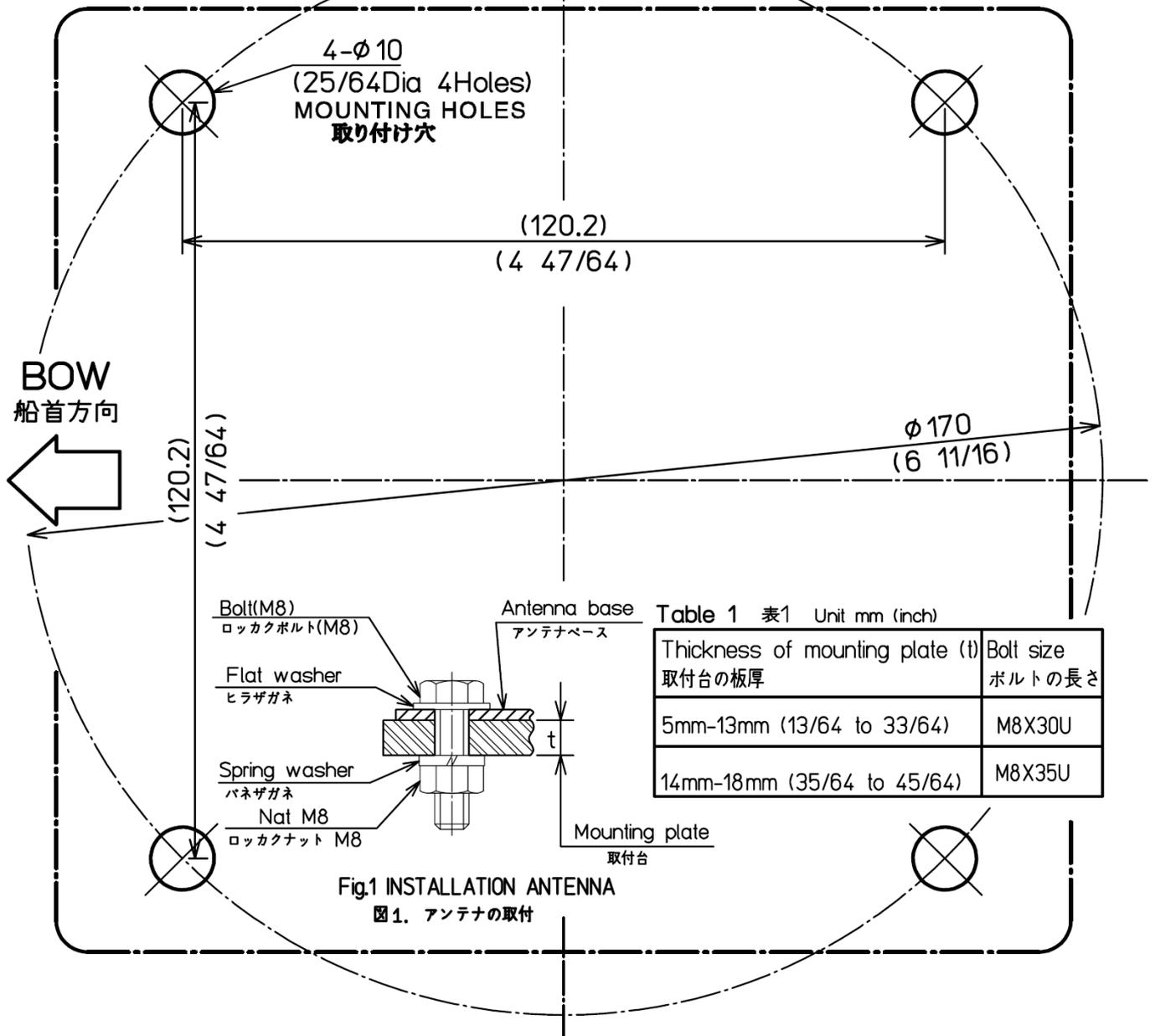
**KGC-1**

This product is specifically designed 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.

# TEMPLATE OF ANTENNA MOUNTING HOLES (FULL SIZE)

アンテナ取付け穴 テンプレート (原寸)

Dimension; mm(inch)



## How to install the GPS compass antenna

1. Make four bolt holes on the mounting plate using the template in this drawing.
2. Place the antenna on the mounting plate and securely fix it with the bolts as shown in Fig.1.
3. We recommend to use the mounting plate with thickness of 5mm to 17mm (13/64 to 45/64).
4. Refer table1 for bolt sizes according to the thickness of mounting plate.

## アンテナ取付要領

1. この図のテンプレートをを用い、取付台に取付ボルト穴を4ヶ所あけてください。
2. アンテナを取付台に乗せ、図1を参考にしっかり取付けてください。
3. 本機を装備する取付台は、5mm-17mmの板材を用いてください。
4. 取付台の板厚に適したボルト長さは、表1を参考にしてください。

AMENDMENT HISTORY  
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5			
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**Amendment policy**

When any change is applied in the document, only the document number of the relevant sheet(s) and cover sheet are modified and the rest of the sheets are not changed. The document number is shown in the footer area, right or left bottom of each sheet..

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## Preface

<b>Handling this book</b>	Keep this operation manual free from lost and damage. When the ownership of this equipment is changed due to resale or delivery, please deliver without fail this operation manual to the new owner.
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## SAFETY PRECAUTIONS

### Symbols used in this manual

The following symbols are used in this manual. You are requested to be fully aware of the meaning of each symbol before carrying out inspection and maintenance of this equipment.

#### Warning mark



Warning

To handle the equipment ignoring this sign may lead to injury to the human body or damage to the equipment.

#### Caution mark



Caution

To handle the equipment ignoring this sign may lead to a malfunction of the equipment.

#### Warning High Voltage mark



To handle the equipment ignoring this sign may lead to electrical shock to the human body.

#### Prohibition mark



This sign indicates that a specified action is prohibited. The prohibited action will be shown in the vicinity of the mark

## OPERATIONAL PRECAUTIONS

 <p><b>Warning</b></p>	<p>This equipment is a navigational aid. For a final determination of navigational command, you should consult regular navigational map chart and other navigational devices in determining own position, depth, information of approaching targets, obstacles, etc, for safer navigation.</p>
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 <p><b>Caution</b></p>	<p>GPS (Global Positioning System) is a world wide positioning system that is composed of 28 satellites, providing seamless positioning service 24 hours a day everywhere on the earth. This system is run by the U.S. Department of Defense. The accuracy of the bearing and speed information it provides may be subject to change without notice according to the US defense policy. Furthermore, a certain number of satellites may be subject to operational interruption for the purpose of adjustment, test, as well as orbital modification.</p>
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## MAINTENACE PRECAUTIONS

 <p><b>Warning</b></p>	<ul style="list-style-type: none"> <li>● <b>Disconnect Main Power</b></li> </ul> <p>It is still possible to receive an electric shock caused by unintentional switching of the unit to on during repair work. To prevent this from happening, be sure to completely disconnect the unit from the ship's main supply before attempting any inspection. Put a safety card on the POWER switch on the unit under repair that reads "Under maintenance" to assist your safety during the maintenance work.</p>
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 <p><b>Caution</b></p>	<ul style="list-style-type: none"> <li>● <b>Dust</b></li> </ul> <p>Dust can accumulate inside after long periods of use. Allergies can result from the inhalation of this dust, therefore during inspection and cleaning it is advisable to use a mask.</p>
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 <p><b>Caution</b></p>	<ul style="list-style-type: none"> <li>● <b>Static Electricity</b></li> </ul> <p>Static sensitive semiconductor devices are used in this unit. Before changing the printed boards be careful not to damage any of these devices due to electrostatic build up from carpet, clothes, seats, etc</p>
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## How to use this manual

### **Scope of this manual**

This manual contains information about installation, operation and maintenance of the KGC-1 GPS Compass unit.

### **Structure of this manual**

This manual is divided into sections according to the contents as described below. This arrangement will help you overview the whole of the contents as well as refer to detailed information for your specific requirement.

#### **Chapter 1: General**

- About GPS Compass
- Equipment overview
- Applicable technical standards
- Equipment configuration
- Software type name

#### **Chapter 2: Equipment Composition**

- Standard equipment list
- Spare Parts list
- Installation Material list
- Available antenna cable types
- Optional items list
- 

#### **Chapter 3: Specifications**

- Functional specification
- Serial data
- Power supply requirements
- Compass safety distance
- Environmental conditions
- External dimensions and weight

#### **Chapter 4: Installation**

- Installation consideration

- Unpacking goods
- Inspection of component unit and accessories
- Siting the units
- Instructions for installation
- Cable layout and connections
- Connecting the units
- Check up after installation

**Chapter 5: Operation**

- Panel layout and operating switches
- Output ports
- Selecting the output data

**Chapter 6 Maintenance and troubleshooting**

- Periodical inspection and cleaning
- Trouble shooting
- 

**Chapter 7: Technical References**

- Details of serial output data
- Data input/output serial line
- Setting the status switch

## Chapter 1 General

	Page No.
<b>1.1</b> About GPS compass .....	<b>1-1</b>
1.1.1 Principle of GPS positioning system.....	1-1
1.1.2 How the GPS Compass works .....	1-1
1.1.3 For proper use of GPS Compass .....	1-1
<b>1.2</b> Equipment overview .....	<b>1-2</b>
<b>1.3</b> Applicable technical standards.....	<b>1-2</b>
<b>1.4</b> Equipment configuration .....	<b>1-2</b>
<b>1.5</b> Software type name .....	<b>1-2</b>

## Chapter 1 General

### 1.1 About GPS compass

#### 1.1.1 Principle of GPS positioning system

GPS (Global Positioning System) is a position measuring system using the artificial satellites, which consists 27 artificial satellites (4 satellites per orbit x 6 orbits plus 3 reserve satellites), orbiting the earth every 11hours 58 minutes along a circular path above the earth. In this system, positioning of a point on the earth is achieved utilizing the triad system that a position on the earth is computed from the distances from 3 satellites. The intersection of 3 imaginary arcs developed from each satellite gives the own position (longitude, altitude and altitude) on the surface.

#### 1.1.2 How the GPS Compass works?

In GPS positioning system, own position is obtained by analyzing the CA code sent from the satellites, to compute the distance from the satellites to the user. In contrast, the GPS Compass utilizes the radio wave itself that carries the positional data.

The GPS Compass uses two GPS antennas for reception. Knowing the time difference of the radio wave arrival at each antenna, positional arrangement with respect to the satellite as well as the angle of the incoming radio wave are computed. From the information sent from the satellite, the satellite position is obtained. As a result, the direction of the two GPS antenna against north can be computed. To obtain a correct ship's heading the GPS Compass unit should sited somewhere on the line that connects across the ship's bow and stern,

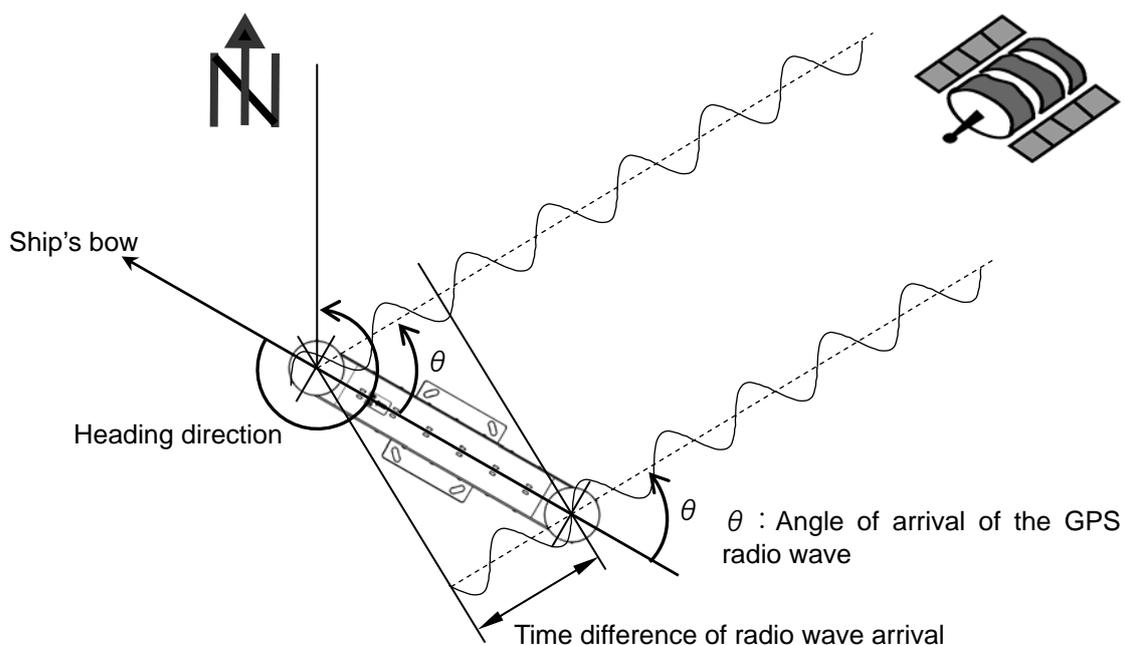


Fig. 1.1 Principle of the measurement by the GPS Compass

### 1.1.3 For proper use of GPS Compass

In the following circumstances the GPS Compass will take time to establish a correct bearing.

- The unit is first operated.
- The unit is left unused for a long period of time. This causes the stored orbital data to become old and not useable.
- The unit is carried to a distant area with power off and turned on again there.
- The satellite positional dispersion is not perfect. This may causes the bearing computation to be not established even though the positioning fix is available.

A GPS receiver is arranged to store the orbital data of the satellites viewable from its site. Due to this arrangement, a fast position fix is possible. When the GPS unit is first turned on, no orbital data has been stored in memory, causing the GPS unit to take about 15 minutes to acquire local orbital data from the satellites. From next operation the orbital data used immediately before the unit is turned off will be stored into memory and used for subsequent position fix. This causes the position fix time to be reduced to one minute or the less.

## 1.2 Equipment overview

From the radio wave broadcast from the GPS satellites, the KGC-1 computes own ship's bearing in high accuracy by measuring the phase difference between two GPS antennas.

Four output ports are available on the KGC-1, two for the compass bearing output, the other two for the GPS position/speed data.

## 1.3 Applicable technical standards

The KGC-1 is fully compliant with the requirements of IEC 60945 3<sup>rd</sup> Edition, general requirements for maritime navigational equipment.

## 1.4 Equipment configuration

The following table lists the name of the unit, type name and the system configuration diagram is shown in Fig. 1.2.

Unit name	Type name
Processing unit	KGC-1
GPS Antenna	GA-11 with 15 m cable

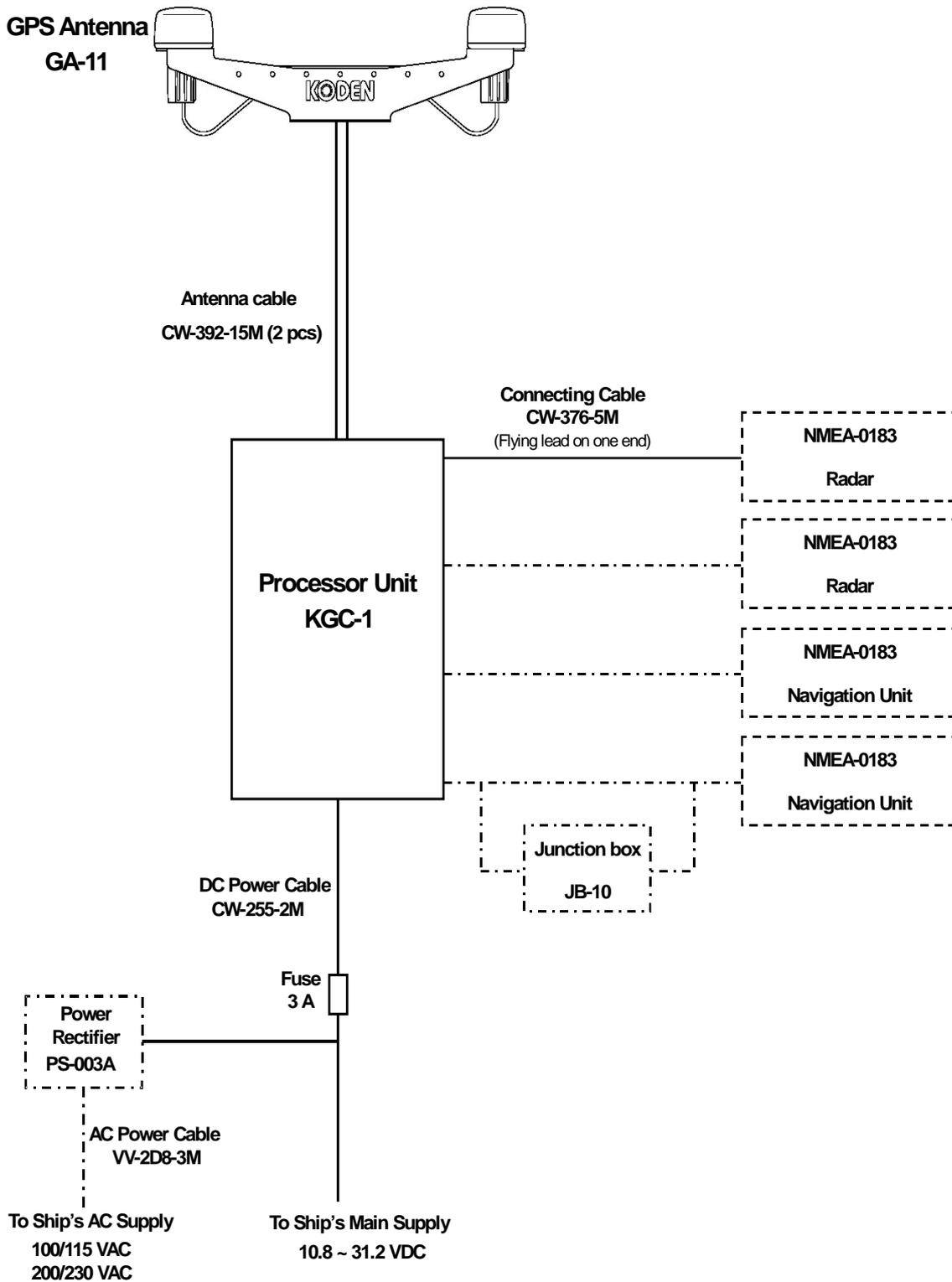
Standard antenna cable length is 15 m. Extra cable lengths of 30 m and 60 m are available on option basis.

## 1.5 Software type name

Two types of software are used in KGC-1 as follows:

<b>Software type name</b>	<b>Application</b>
KM-D92 (Program ROM)	System control
KM-D93 (Program ROM)	System control

**System connecting diagram**



— · — The chained lines are optional cables for connecting extra external units.

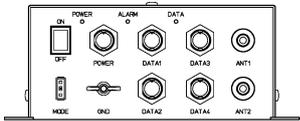
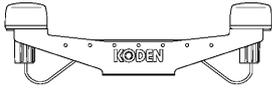
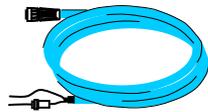
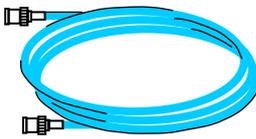
**Fig. 1.2 KGC-1 System connecting diagram**

## Chapter 2 Equipment Composition

	<b>Page No.</b>
2.1 Standard equipment list .....	2-1
2.2 Spare Parts list.....	2-1
2.3 Installation Material list .....	2-1
2.4 Available antenna cable types .....	2-2
2.5 Optional items list.....	2-2

## Chapter 2 Equipment Composition

### 2.1 Standard equipment list

No.	Item name	Type name	Remarks	Weight/Length	Q'ty
1	Processor unit	KGC-1		1.2kg	1
2	GPS antenna	GA-11		1.4kg	1
3	DC Power cable	CW-255-2M		2m	1
4	Antenna cable	CW-392-15M		15m	2
5	Connecting cable	CW-376-5M	6-pin water-proof connector (LTW) one end flying lead other end	5m	1
6	Bird repellent fixture	D73MB23040		0.05kg	2
7	Spare parts	Refer to Spare Parts list			1 set
8	Installation material	Refer to Installation Material list			1 set
9	Operation Manual	English/Japanese			1

### 2.2 Spare Parts list

No.	Item name	Type name	Remarks	Weight/Length	Q'ty
1	Fuse	F-7161-3A /N30C-125V	For Processor unit	6 φ x30mm	1

### 2.3 Installation Material list

No.	Item name	Type name	Remarks	Weight/Length	Q'ty
1	Self-bonding tape	T.5X20MMX10M	For Antenna cable connection	10M	1
2	PVC tape	10M [gray]	For Antenna cable connection	10M	1

## 2.4 Available antenna cable types

No.	Type name	Cable length	Cable type	Mating connector
1	CW-392-15M (Standard)	15m	3D-2V	BNC (both ends)
2	CW-393-30M (Option)	30m	5D-FB	BNC (both ends)
3	CW-394.KIT (Option)	60m	8D-SFA	<ul style="list-style-type: none"> <li>- Type N connector one end / flying lead the other end</li> <li>- N-BNC converter</li> <li>- One complete cable with connectors attached on both ends</li> </ul>

## 2.5 Optional items list

No.	Item name	Type name	Remarks	Weight/Length
1	Connecting cable	CW-373-5M	6P water-proof connector (LTW) both ends	5m
2	Connecting cable	CW-374-5M	6P connector one end / water-proof connector (LTW) the other end	5m
3	Connecting cable	CW-376-5M	Flying lead one end / 6P water-proof connector (LTW) the other end	5m
4	Connecting cable	CW-381-5M	6P water-proof connector (LTW) one end / 36P connector the other end	5m
5	Connector	LTWBD-06BFFA-L180	6P water-proof connector (LTW)	
6	Power rectifier	PS-003A	With 2 pcs. of 5A fuse	28kg
7	AC Power cable	VV-2D8-3M	For AC supply	3m
8	Operation manual	KGC-1.O/M.J	Japanese	
		KGC-1.O/M.E	English	
9	Junction box	JB-10	1input 3outputs X 2circuits	0.4kg

## Chapter 3 Specifications

	Page No.
3.1 Functional specification .....	3-1
3.2 Serial data .....	3-1
3.3 Power supply requirements .....	3-2
3.4 Compass safety distance .....	3-2
3.5 Environmental conditions .....	3-2
3.6 External dimensions and weight.....	3-3
3.6.1 Processor unit KGC-1.....	3-3
3.6.2 GPS Antenna GA-11.....	3-4

## Chapter 3 Specifications

### 3.1 Functional specification

Specification is subject to change without notice.

Type	Processor unit: KGC-1 GPS antenna: GA-11	
Receiving frequency	1575.42MHz ± 1MHz	
Receiving channel	Parallel 9 channel	
Sensitivity	Better than -130dBm	
Setting time	2 minutes (at standard hot-start time)	
Heading accuracy	1° rms	
Heading resolution	0.1°	
Maximum rate of turn	Less than 25°/s	
Maximum follow-up acceleration	Less than 1g	
Maximum roll/pitch angle	Less than 30°	
Base line length	0.5m	
Time to position fix	Cold start Warm start Hot start	50sec (standard) 45sec (standard) 20sec (standard)
Positioning accuracy	Position Velocity	GPS:15m (2drms, SA:OFF, PDOP ≤ 3) 1m/sec (rms, SA:OF, PDOP ≤ 3)
Datum	86 system (WGS-84, Tokyo etc.)	
Output data port	Heading data output: 2 (50ms~1s) Navigational data output: 2 (1s)	
Output data	Format Heading data sentence Navigation data sentence Data level Output current	NMEA 0183 Ver2.0/IEC61162-1 HDT, ROT, GGA, VTG GGA, GLL, HDT, VTG, ZDA, GSA, GSV, PKODA, PKODG1, PKODG7, RMC RS-422 20mA
Mains supply voltage	10.8 ~ 31.2 VDC	
Power consumption	8 W or the less (at 24 VDC)	

### 3.2 Serial data

Output data

Type : NMEA0183 Ver. 2.0/IEC61162-1

Sentence:	HDT	Heading data	Ship's heading (true bearing)
	ROT	Heading data	Rate of Turn
	GGA	Navigation data	GPS position data
	GLL	Navigation data	Ground position (Latitude/Longitude)
	VTG	Navigation data	Ship's bearing and ground speed
	RMC	Navigation data	Minimum sentence for GPS/TRANSIT navigation data
	ZDA	Navigation data	Time and date

GSA	Navigation data	Satellite in use and DOP
GSV	Navigation data	Available satellite
PKODA	Navigation data	Satellite information *KODEN proprietary format
PKODG1	Navigation data	Satellite information *KODEN proprietary format
PKODG7	Navigation data	Satellite information *KODEN proprietary format

### 3.3 Power supply requirements

Input voltage: 10.8 ~ 31.2 VDC

Power consumption: 8 W or the less at 24 VDC

#### AC operation

Power rectifier PS-003A is used.

- Input voltage range: 100/115 VAC or 200/230 VAC
- Input voltage tolerance: +/- 10%
- Input voltage frequency tolerance: 47 ~ 63 Hz

### 3.4 Compass safety distance

Unit name	Type	Standard	Steering
Processor unit	KGC-1	0.4m	0.2m
GPS antenna	GA-11	0.4m	0.2m

### 3.5 Environmental conditions

Major environmental conditions are as follows:

#### (1) Temperature, humidity

Unit name	Operating temperature	Storage temperature	Maximum humidity
Processor unit	-15°C ~ +55°C	-30°C ~ +70°C	93+/-3% @ +40°C
Antenna unit	-25°C ~ +55°C	-0°C ~ +70°C	93+/-3% @ +40°C

#### (2) Vibration

Specified to IEC 60945 3<sup>rd</sup> Edition

#### (3) Waterproof grade

Processor unit:	IPX0 (Not protected)
GPS antenna unit:	IPX6 (Waterproof)

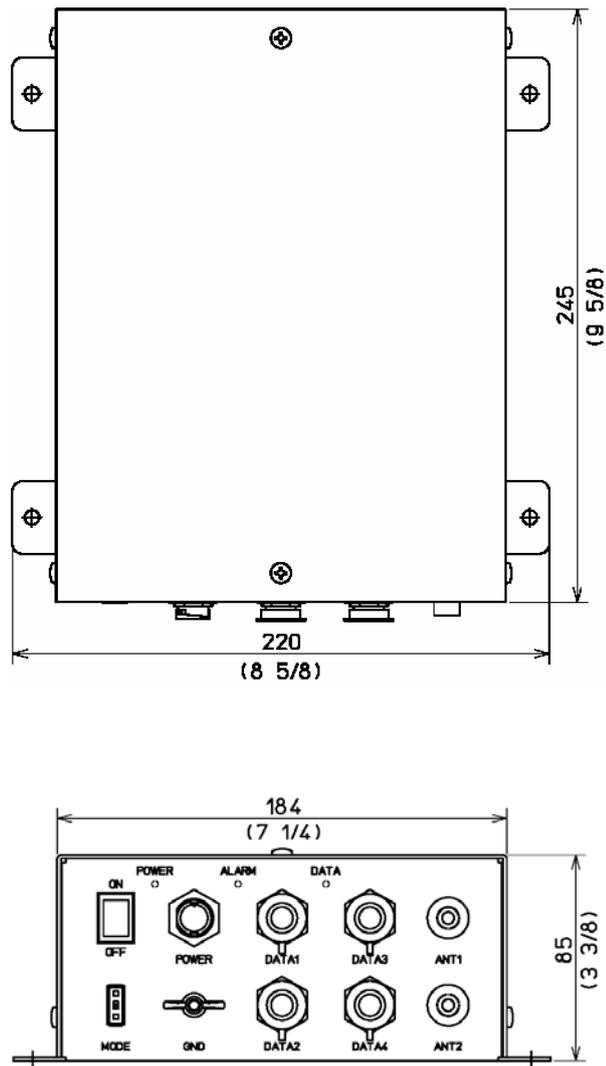
### 3.6 External dimensions and weight

#### 3.6.1 Processor unit KGC-1

External dimensions: 220 (W) x 245 (D) x 85 (H), unit in mm

Weight: 1.2kg

#### [External dimensions]



Unit: mm(inch)

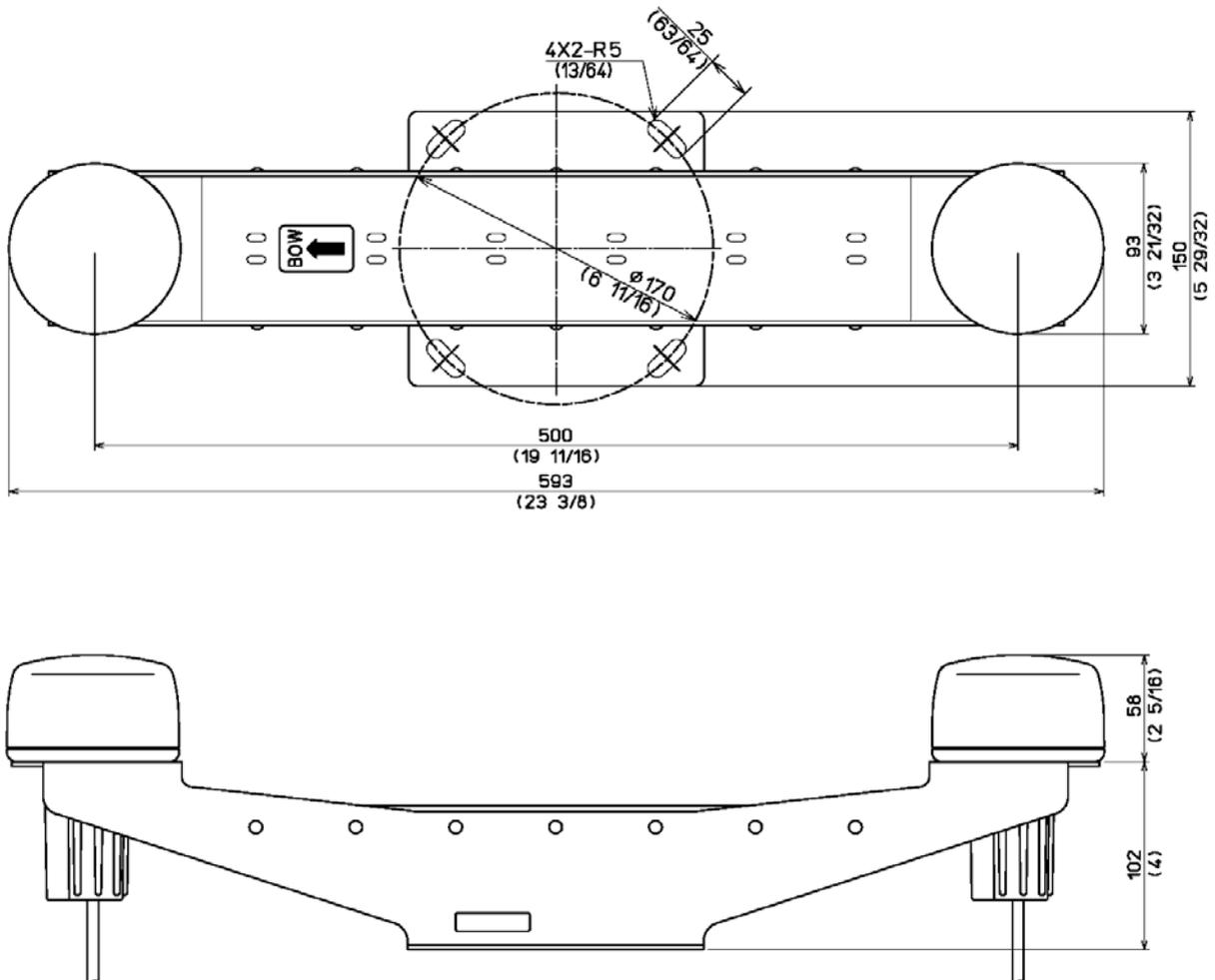
Fig. 3.1 External dimensions of KGC-1

### 3.6.2 GPS Antenna GA-11

External dimensions: 593 (W) x 150 (D) x 160(H), unit in mm

Weight: 1.4kg

#### [External dimensions]



Unit: mm (inch)

Fig. 3.2 External dimensions of GA-11

## Chapter 4 Installation

	Page No.
4.1 Installation consideration .....	4-1
4.2 Unpacking goods.....	4-1
4.3 Inspection of component unit and accessories.....	4-1
4.4 Siting the unit.....	4-1
4.4.1 Ideal site of GPS antenna.....	4-1
4.4.2 Siting the Processor unit.....	4-2
4.5 Instructions for installation .....	4-3
4.5.1 GPS Antenna installation.....	4-3
4.5.1.1 Installing the Bird repellent fixture .....	4-5
4.5.1.2 Heading adjust .....	4-6
4.5.1.3 Waterproofing on the connector jointing section .....	4-6
4.5.1.4 Connecting the 60m antenna cable kit CW-394.KIT to GPS Antenna .....	4-7
4.5.2 Installing the Processor unit.....	4-8
4.6 Cable layout and connections .....	4-8
4.7 Connecting the units.....	4-9
4.7.1 Connectors pinouts of on the Processor unit.....	4-10
4.7.2 Connecting the DC cable CW-255-2M to DC mains supply .....	4-10
4.7.3 Connecting the Data Connecting cable CW-376-5M.....	4-11
4.8 Check up after installation .....	4-11

## Chapter 4 Installation

### 4.1 Installation consideration

Installation of the GPS Compass must be made by qualified personnel, which is essential for good and prolonged operation of the unit. Installation includes the following;

- (1) Unpacking the contents
- (2) Inspecting the component unit, spare parts, accessories.
- (3) Checking the power supply voltage, current capacity
- (4) Deciding on the installation site
- (5) Installing the GPS, Antenna and Processor unit
- (6) Cable layout and connection
- (7) Set up after installation

### 4.2 Unpacking contents

Unpack the contents and check off all items against the "Standard Composition list" in 2.1.

### 4.3 Inspection of component unit and accessories

Check each item for dents or any damage, etc.

### 4.4 Choosing the installation site

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

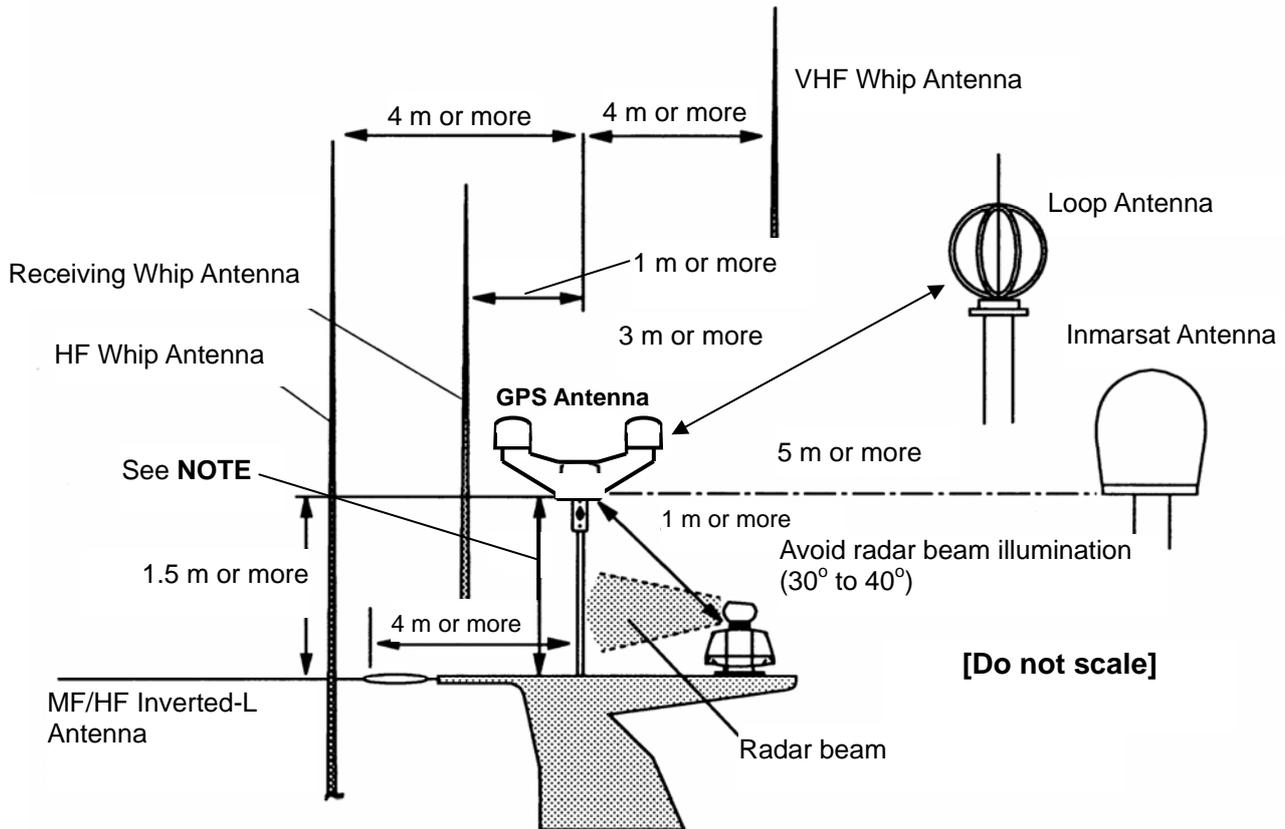
#### 4.4.1 Ideal site of GPS antenna

The GPS antenna GA-11 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: 30° ~ 40°).
- (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 (11) 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.



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

**Fig. 4.1 Recommended GPS Antenna installation**

#### 4.4.2 Siting the Processor unit

- (1) Select a safe location free from dampness, water splash, rain and direct sun light.
- (2) Keep service space, especially for the cable connecting part.
- (3) Keep the unit as far from radio equipment as possible.
- (4) Keep compass safe distance from magnetic compass; standard: 0.4 m, steering: 0.2 m.

## 4.5 Instructions for installation

### 4.5.1 GPS Antenna installation

The GPS Antenna should be installed, as shown in Fig. 4.2, 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. For correct drilling of the fixing holes, use the attached template.

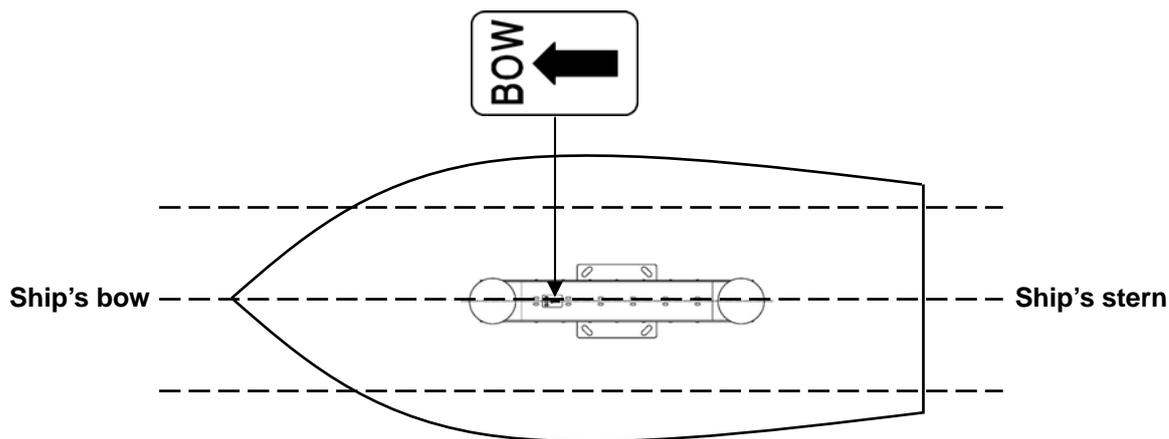


Fig. 4.2 Orientation of the GPS Antenna

#### Installation procedure

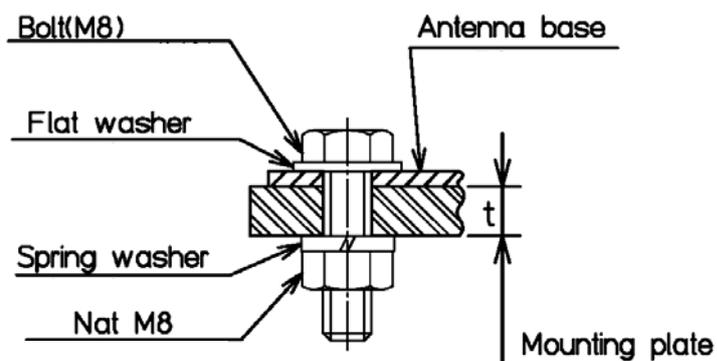
(1) Drill 4 fixing holes on the platform using the template attached.

(2) Connect the coax cable and apply waterproofing. (Refer to 4.5.1.3. for detail)

Secure the waterproofed coax cable to the platform post with a weather-resistant binding tie. Never apply excessive force (pulling, twisting, etc.) to the cable; otherwise the cable may be damaged.

(3) Put the GPS Antenna (GA-11) on the platform and fix, referring to Fig. 4.3.

(Binding ties and fixing bolts are not supplied. Fixing bolts should be locally purchased that best fit the requirements shown in the reference table below.



Suitable bolts for the platform thickness are as follows:

Platform thickness (t)	Bolt length
5mm ~ 12mm	M8×30U
13mm ~ 17mm	M8×35U

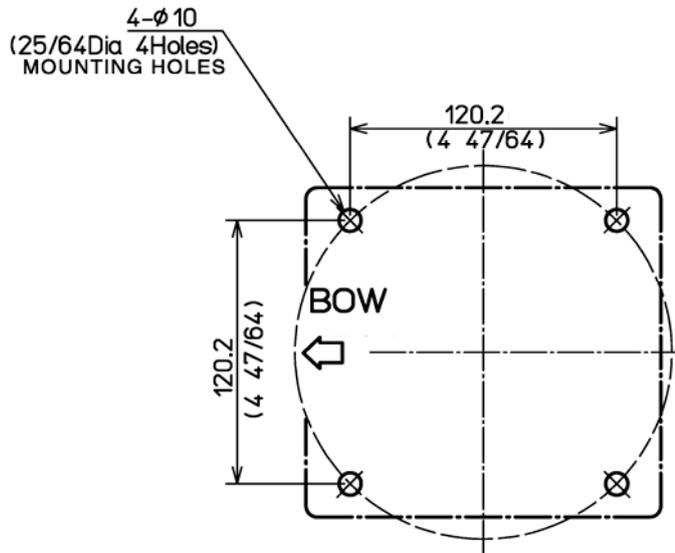
Fig. 4.3 Fixing the GPS Antenna

For efficient maintenance work after the installation, we recommend marking with a permanent marker or felt pen on both ends of the bow side antenna cable. This makes things easier when reconnecting the cable to the bow side antenna.

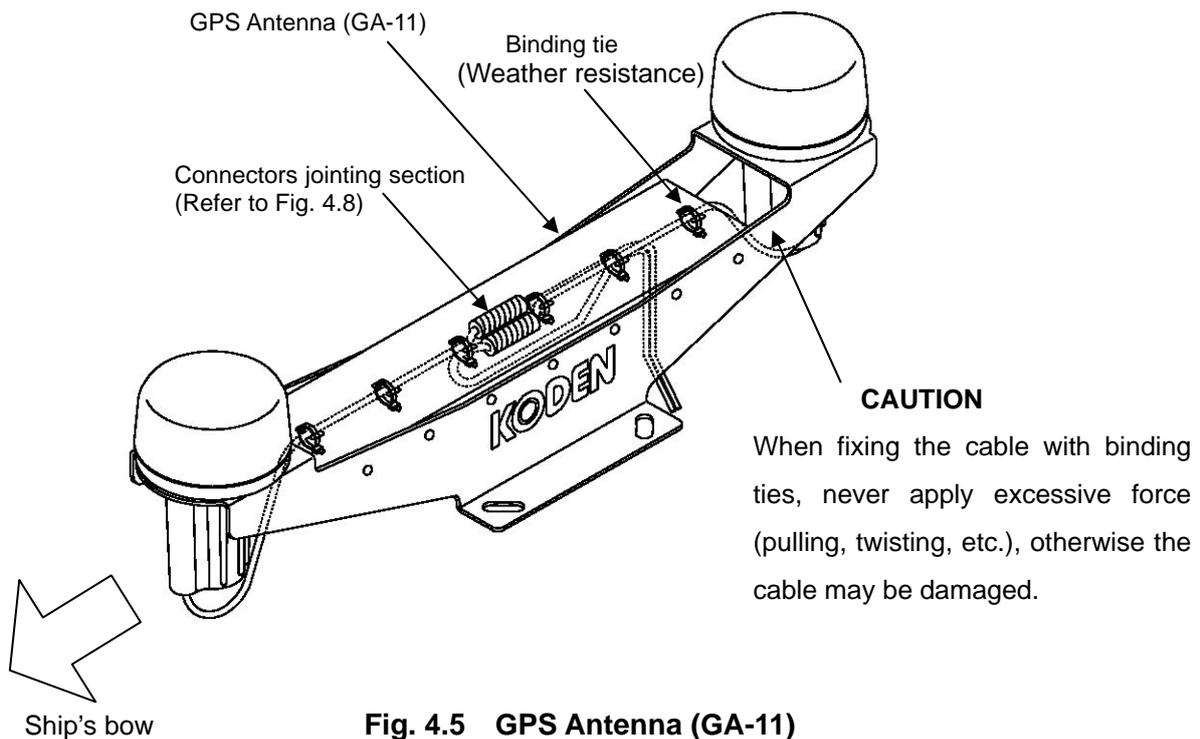
**[Connecting instructions]**

The bow side antenna must be connected to the Processor unit as follows:

- Bow side antenna cable to ANT 1 plug
- Stern side antenna cable to ANT 2 plug



**Fig. 4.4 Antenna mounting holes template**



**Fig. 4.5 GPS Antenna (GA-11)**

#### 4.5.1.1 Installing the Bird repellent fixture

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 repellent fixtures is recommended to alleviate this problem. To fit this device, use the following procedure:

- (1) Secure two bird repellent fixtures (D73MB23040) on the arm of GPS antenna GA-11 as shown.
- (2) Firmly fasten each device using a weather-resistant tie through the GA-11 fixing hole. We recommend that the devices are co-fastened with the waterproofed antenna cable. If these are attached after the antenna cable is fitted, the device may be floated causing loosed fixing.

NOTE: The weather-resistant ties are not supplied as standard.

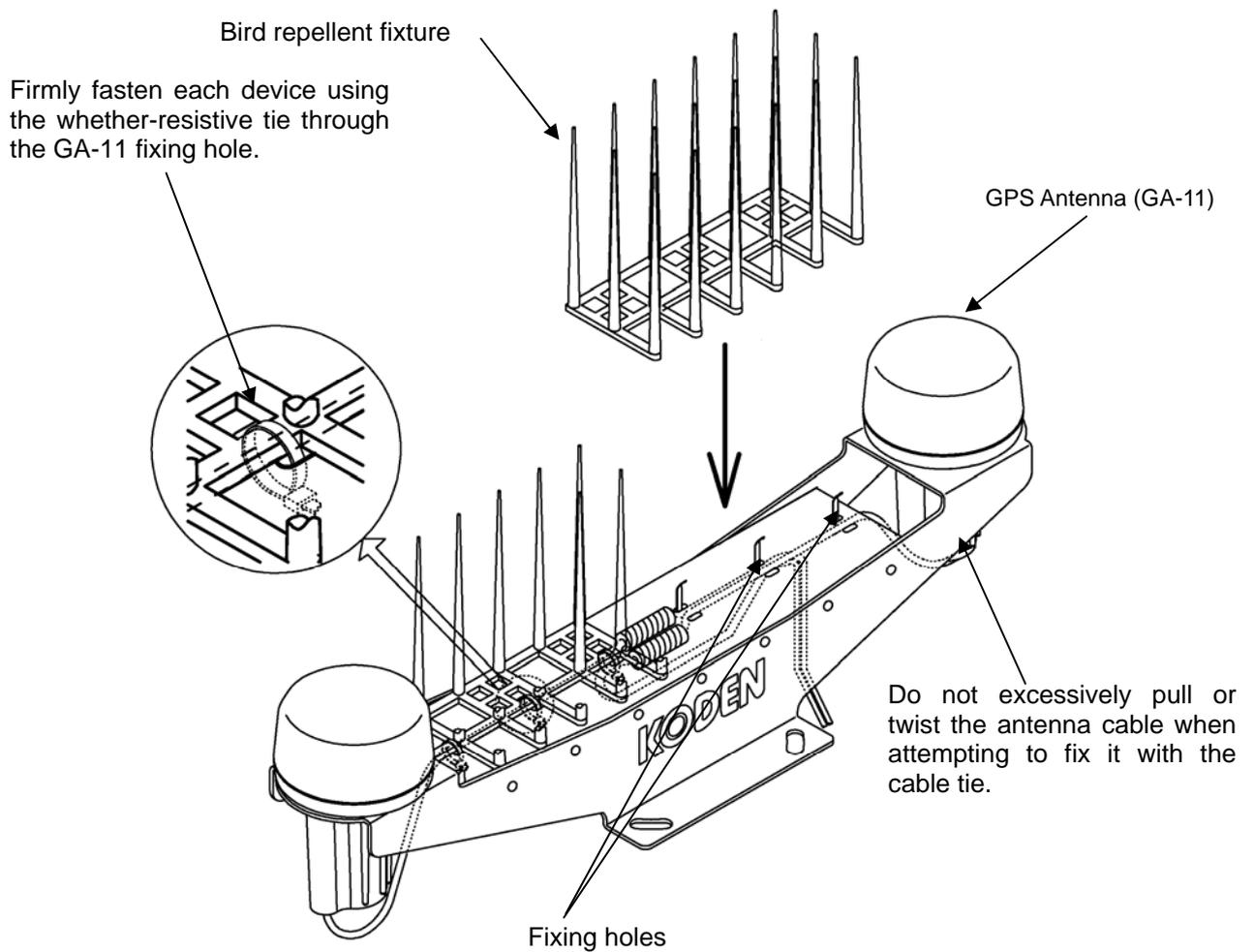
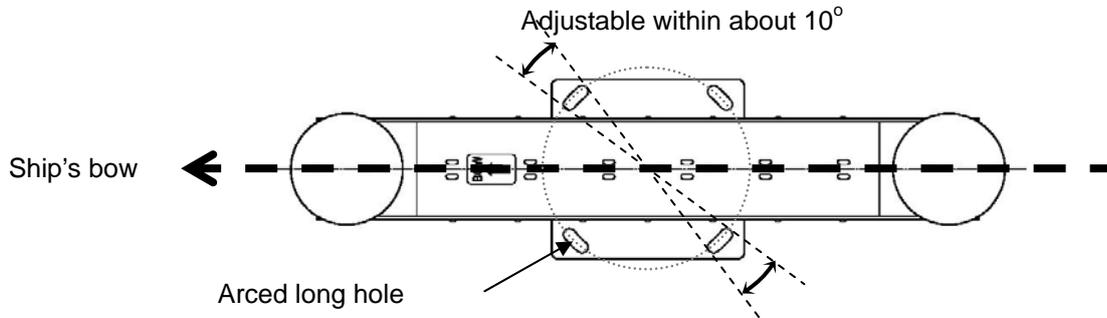


Fig. 4.6 Fitting the Bird repellent fixture for GPS Antenna (GA-11)

### 4.5.1.2 Heading adjust

For post-positional adjustment, the fixing holes on the antenna arm are elongated. If the GPS Antenna direction shifts after fixing, loosen the fixing bolts and gently rotate the entire antenna body to face the correct direction. Refasten the bolts carefully in diagonal order.



**Fig. 4.7 Orienting the GPS Antenna for ship's bow direction**

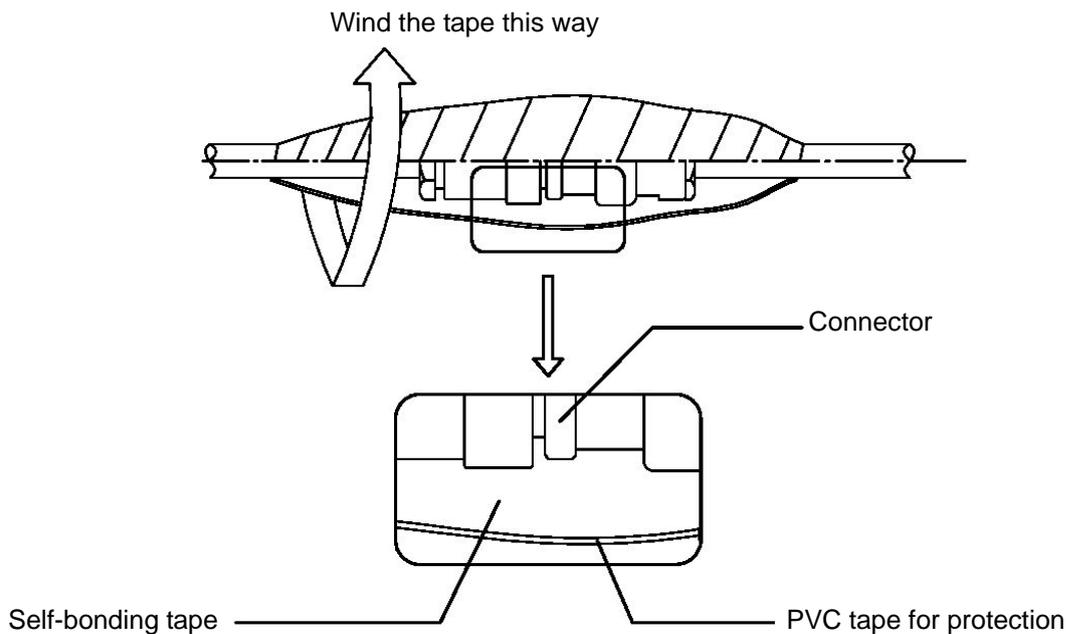
### 4.5.1.3 Waterproofing on the connector jointing section

(1) Wind the self-bonding tape around the joint section.

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.

(2) 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.

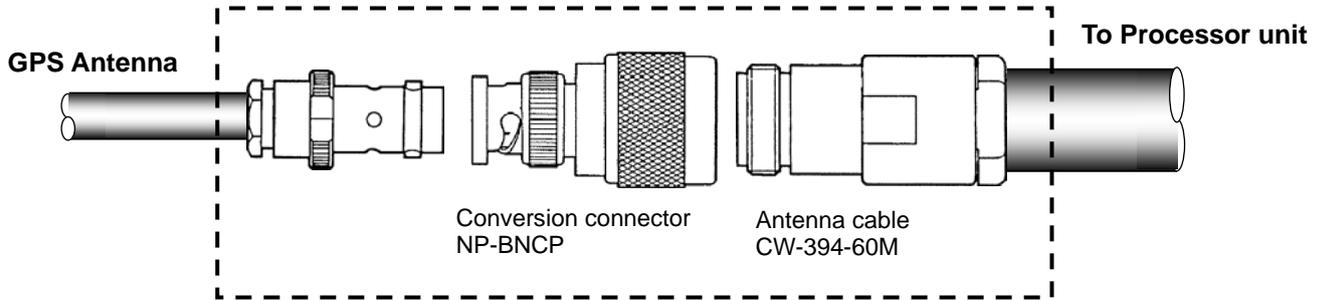


**Fig. 4.8 Processing on the coax cable jointing section**

#### 4.5.1.4 Connecting the 60m antenna cable kit CW-394.KIT to GPS Antenna

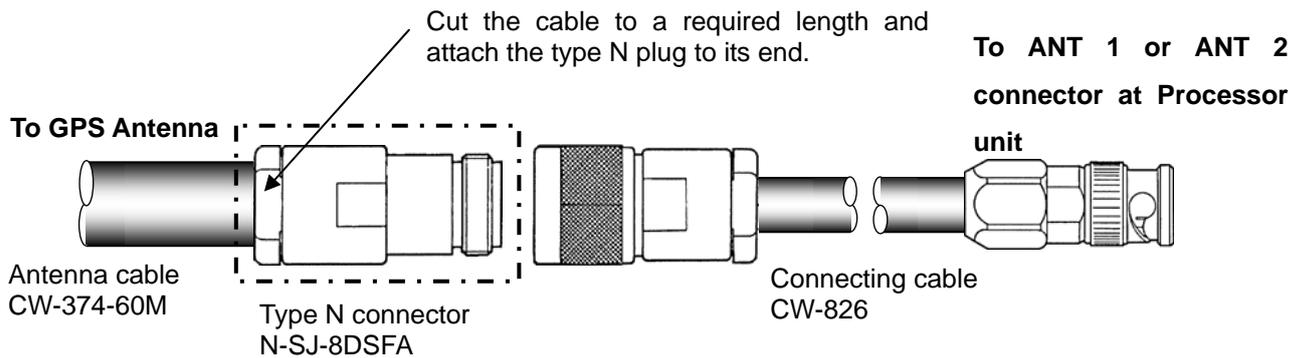
The optional 60 m length cable kit, CW-394.KIT, is composed of the Antenna cable CW-394-60M and the N-to BNC conversion connector. Connect the GPS Antenna and Processor unit via the cable kit as shown in the following figure.

##### (1) Connection at GPS Antenna side



Waterproof the jointing section using self-bonding tape and PVC tape. (Refer to 4.5.1.1 for detail)

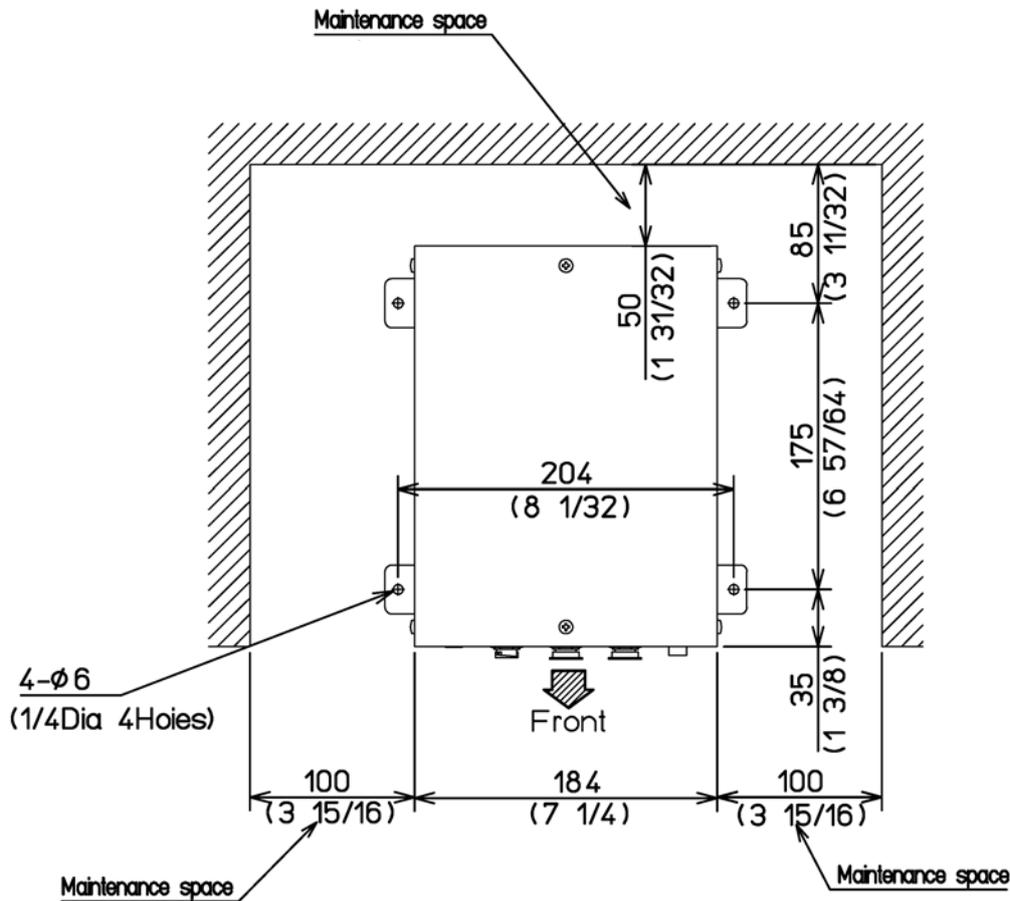
##### (2) Connecting the Processor unit



### 4.5.2 Installing the Processor unit

Place the Processor unit and fix it with 4 pieces of 5 mm screw.

(The 5 mm screws are not supplied with the unit. Please arrange the suitable screws locally)



Unit: mm (inch)

**Fig. 4.9 Service space required for the Processor unit**

### 4.6 Cable layout and connections

- (1) Secure the Antenna cable connection.
- (2) Secure the Jointing cable connections.
- (3) Make sure that the power cable is securely plugged to the Processor unit.
- (4) Connect the ground terminal at the Processor unit to the ship's ground.

### 4.7 Connecting the units

Connect the Antenna cable, power cable and various connecting cables to specified connectors at the Processor unit, according to the diagram shown below. Make sure that the bow side antenna cable is connected to ANT 1 and the stern side antenna cable to ANT 2, respectively.

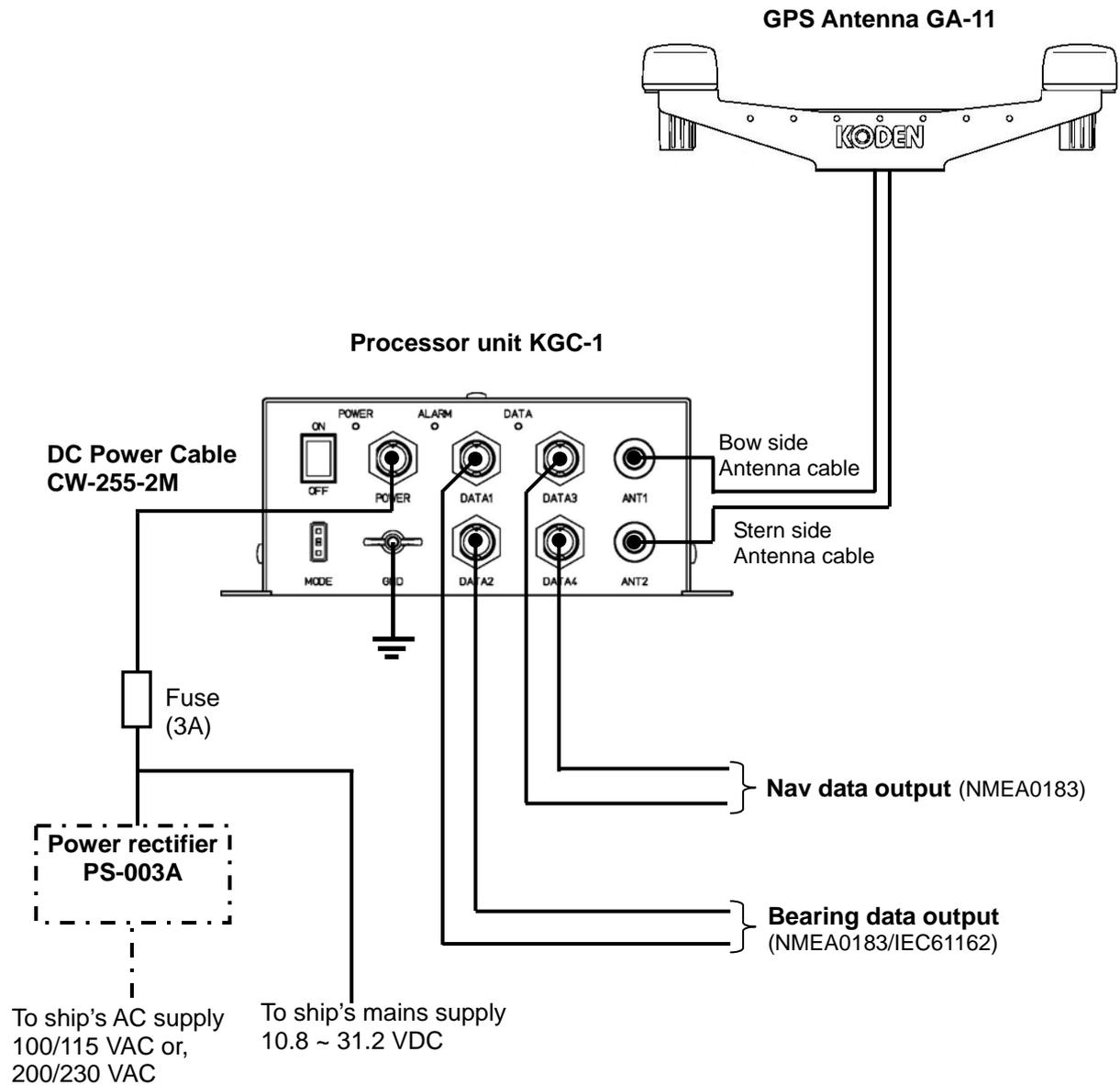
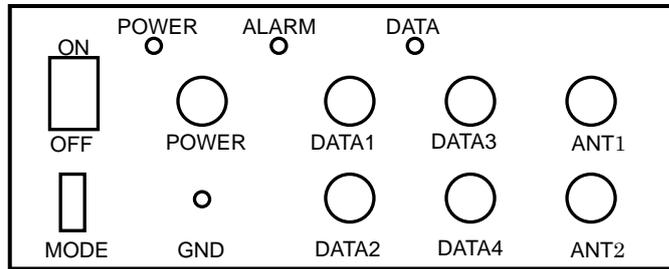


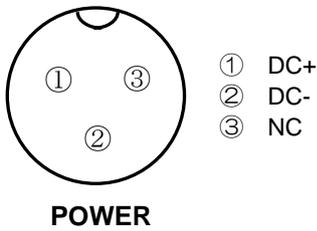
Fig. 4.10 Interconnection diagram of KGC-1

4.7.1 Connectors pinouts of on the Processor unit

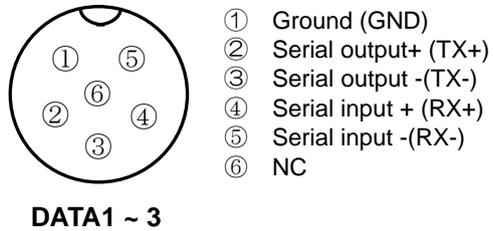


Locations of connectors on the Processor unit

DC 入力 (10.8 ~ 31.2VDC)



NMEA / IEC61162 IN/OUT



NMEA / IEC61162 IN/OUT

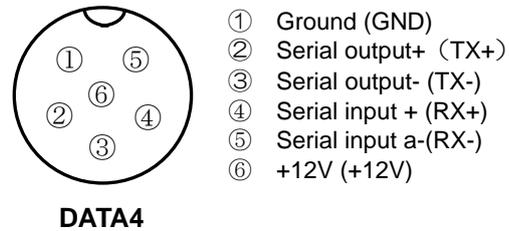


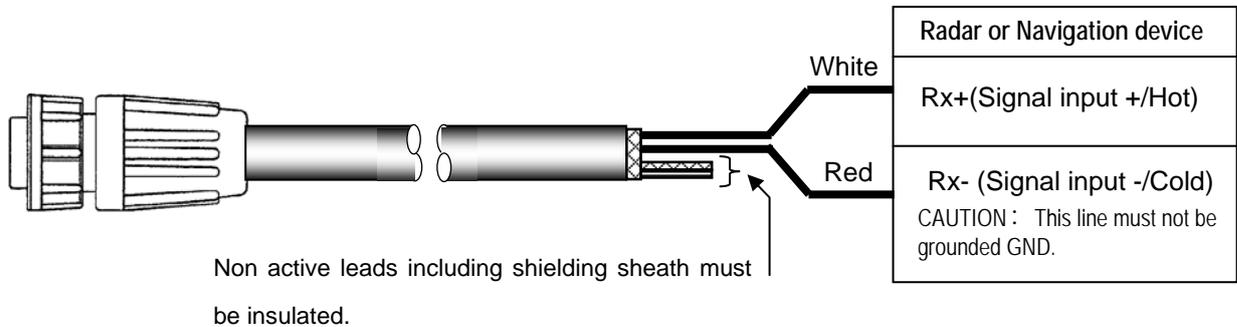
Fig. 4.11 Connector pinouts at the Processor unit

4.7.2 Connecting the DC cable CW-255-2M to DC mains supply



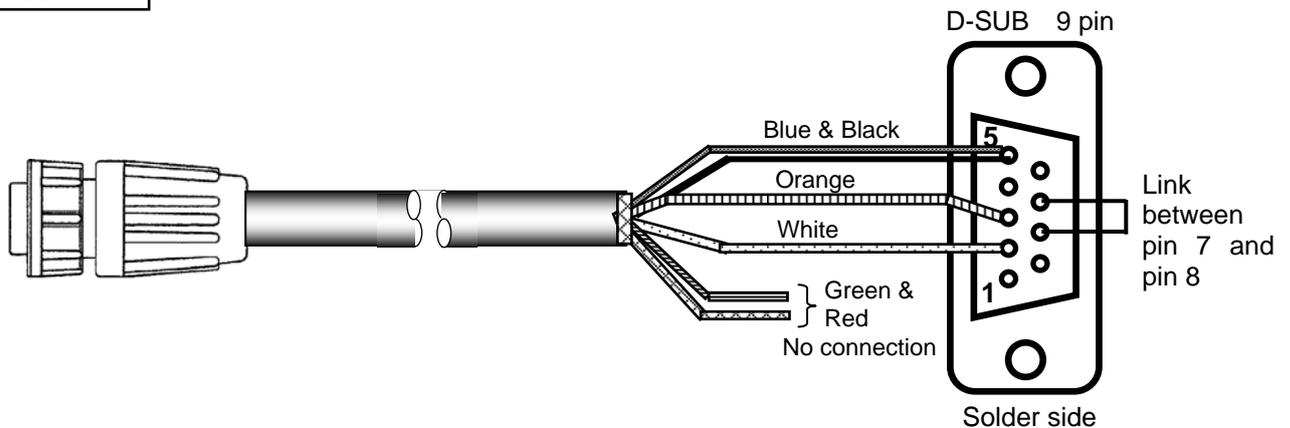
### 4.7.3 Connecting the Data Connecting cable CW-376-5M

The standard cable CW-376-5M has flying leads on one end for various connection needs. Prepare a suited connector for specific device to be connected. The CW-376-5M cable has 6 active leads and shielding braid that sheathes these leads. The white (TX+) and red (TX-) leads are used for signal line. Refer to the following figure for connecting an external device.



\* The cables with connectors are available on optional basis. Select a suitable cable listed in Para. 2.5 "Optional items list" and Fig. 1.2 "KGC-1 System connecting diagram" in Chapter 1.

### Appendix Connecting the Data cable CW-376-5M to PC



\* The D-sub connector is a customer-supplied item.

### 4.8 Check up after installation

Before turning the unit on, check the following points to make sure the equipment functions in normal manner.

- (1) Is the mains supply properly rated for voltage range and current drain?
- (2) Are the Processor unit and the GPS antenna securely connected?
- (3) Is the Processor unit and radar set or navigator unit properly connected?
- (4) Is the cable layout well arranged and properly done?

## Chapter 5 Operation

	Page No
5.1 Panel layout and operating switches .....	5-1
5.1.1 POWER switch .....	5-1
5.1.2 MODE switch .....	5-1
5.1.3 POWER lamp .....	5-1
5.1.4 ALARM lamp .....	5-1
5.1.5 DATA lamp .....	5-1
5.2 Output port .....	5-2
5.3 Selecting the output data .....	5-2

## Chapter 5 Operation

### 5.1 Panel layout and operating switches

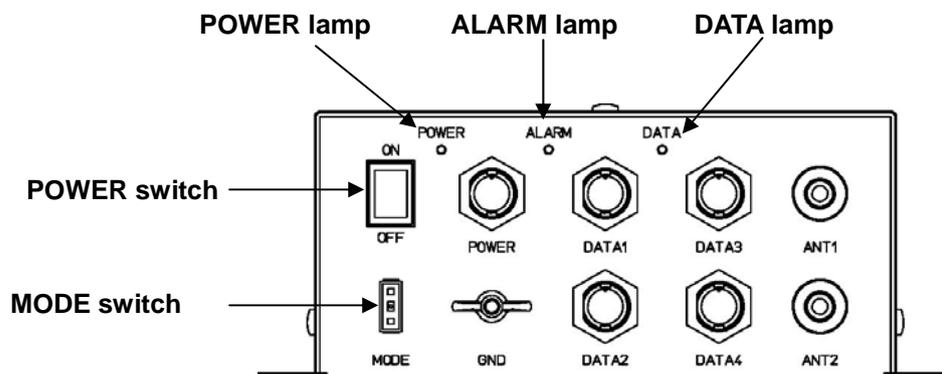


Fig. 5.1 Panel layout on the Processor unit

#### 5.1.1 POWER switch

This switch is used to turn on and off the GPS Compass unit.

#### 5.1.2 MODE switch

This switch is used to change the type of data and its update rate. The relation of the data type and the switch number is shown in Para 5.3.

#### 5.1.3 POWER lamp

The POWER lamp turns on when the POWER switch is pressed to energize the unit. The lamp goes off when the POWER switch is pressed again to turn the unit off..

#### 5.1.4 ALARM lamp

The ALARM lamp blinks when an abnormal condition is detected in the unit as a result of self-diagnosis check-up. The possible fault conditions include; running out of the back-up battery capacity, a shorted antenna cable, etc. According to the nature of a faulty condition, the lamp blinks at a different interval I(The mark and space ratio to be modified) (For detail, please refer to Chapter 6 "Maintenance" and Para 6.2.2 "Trouble shooting.")

#### 5.1.5 DATA lamp

The DATA lamp starts to blink when the unit is set ready to output the navigational data. The lamp lighting becomes stationary when the bearing data is ready to be output.

## 5.2 Output port

The KGC-1 has 4 output ports.

From the DATA1 and DATA2 ports the bearing data output is available at 50 m sec interval

From DATA3 and DATA4 ports the navigation data is output at 1 sec interval.

## 5.3 Selecting the output data

The bearing data or navigational data is selected by means of the MODE switch. Relations of the output data type/interval from each port and the MODE switch position are shown in the following table.

MODE	DATA1, DATA2				DATA3, DATA4	
	Bearing data	Interval	Navigational data	Interval	Navigational data	Interval
0	HDT	50ms	N.A.	-	GGA + GLL + HDT + VTG + ZDA + GSA + GSV + PKODA + PKODG1 + PKODG7	1s
1	HDT	100ms	N.A.	-		
2	HDT + ROT	100ms	N.A.	-		
3	HDT	200ms	N.A.	-		
4	HDT	100ms	GGA+ VTG	1s		
5	HDT	200ms	GGA + VTG	1s		
6	HDT	100ms	GGA + VTG*	1s		
7	HDT	1s	GGA + VTG	1s	GGA + GLL + HDT + VTG + RMC + ZDA + GSA + GSV	1s
8	HDT	50ms	N.A.	-		
9	HDT	100ms	N.A.	-		
10	HDT + ROT	100ms	N.A.	-		
11	HDT	200ms	N.A.	-		
12	HDT	100ms	GGA + VTG	1s		
13	HDT	200ms	GGA + VTG	1s		
14	HDT	100ms	GGA + VTG*	1s		
15	HDT	1s	GGA + VTG	1s		

■ The VTG\* is the sentence specified in IEC 61162-1 format. The VTG without "\*" means the Navigational data is not available in NMEA0183 Ver. 2.0 format.

■ The MODE switch has been set to mode 5 when the unit is shipped from the factory.

■ For the detail of output data sentence, please refer to Chapter 7 "Technical References" Para. 7.1.

## Chapter 6 Maintenance and troubleshooting

	Page No.
6.1 Periodic inspection and cleaning .....	6-1
6.1.1 Monthly check .....	6-1
6.1.2 Maintenance .....	6-1
6.2 Trouble shooting .....	6-1
6.2.1 Information required for service .....	6-1
6.2.2 Trouble shooting .....	6-1
6.2.3 Replacing the memory back-up battery .....	6-4

## Chapter 6 Maintenance and troubleshooting

### 6.1 Periodic inspection and cleaning

#### 6.1.1 Monthly check

Check if there are any loose connections on the Processor unit for GPS Antenna, radar or navigational unit.

#### 6.1.2 Maintenance

If the Processor unit is smeared or stained with dirt, wipe the surface of the unit with a soft dry cloth.



**CAUTION**  
Never use solvent like thinner, alcohol, turpentine, etc.

### 6.2 Trouble shooting

This chapter covers simplified fault locating procedures to assist the ship's crew to locate a faulty module as well as simple fuse replacement.

#### 6.2.1 Information required for service

Please advise the following details:

- (1) Name of vessel, Satcom number if available.
- (2) Equipment type name
- (3) Equipment serial number
- (4) Next port of call, ship's agent name, fax number, email address, etc.
- (5) Faulty conditions (precisely as possible) and the result of on board check

#### 6.2.2 Trouble shooting

The following table provides information about first line check schedules to locate a faulty area and gives remedial measure(s), where applicable.

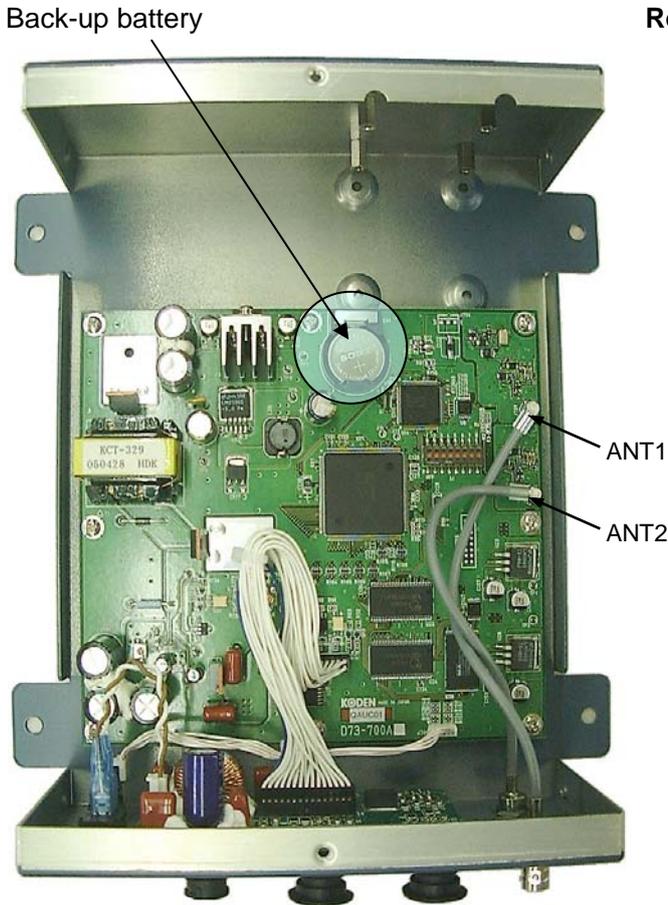
Faults detected	Possible cause of the failure	Remedial action
The POWER lamp does not light and the equipment does not turn on.	<ol style="list-style-type: none"> <li>1. Is the connection between the Processor unit and the power supply cable firmly connected?</li> <li>2. Is the power cable firmly connected to ship's battery?</li> <li>3. Does the power supply voltage lie within the rated range (10.8 – 31.2 VDC)?</li> <li>4. Is the fuse blown?</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the connection between the Processor unit and the power cable. If the cable is damaged, repair the faulty part.</li> <li>2. Reconnect the cable firmly to the battery.</li> <li>3. Use a proper rated main supply.</li> <li>4. Replace the blown fuse with a new one. <b>CAUTION:</b> Make sure to turn off the main supply before attempting to replace the fuse.</li> </ol>

Faults detected	Possible cause of the failure	Remedial action
The POWER lamp lights but the DATA lamp does not light or flash.	1. Is the GPS Antenna connector firmly connected?	1. Make sure that the GPS Antenna and Processor unit are firmly connected. If not, reconnect the cable.
Data lamp is lighted but no bearing data is output to radar or navigation unit.	1. Is the cable connection between the Processor unit output port (DATA1 ~ 4) and radar or navigation unit firm and correct? 2. Is the data reception setting at the radar or navigation unit set to accept the data from the GPS compass?	1. Check the connection and if it is not correct or loose, reconnect the connector. 2. Check the data reception setting at the radar or navigator unit. If the setting is not correct, reset the setting. <b>NOTE:</b> Not often the case however, the data interval setting for the reception and transmission units is set not matched. In such a case, change the bearing data transmission rate by the MODE switch to find a suited data rate. (Refer to Para 5.3 for detail)
DATA lamp keeps flashing and no bearing data is output	*The bearing calculation time may be prolonged in case effective GPS satellites are not properly dispersed.  1. Are the GPS antenna cables firmly connected to the Processor Unit at ANT1 and ANT2? 2. Disconnect the stern side antenna cable at ANT2 with the bow side antenna cable connected to ANT1. Does the DATA lamp flash?  3. Disconnect the bow side antenna cable at ANT1 with the stern side cable connected to ANT2. Does the DATA lamp flash?  4. If the above three items are checked and no faults are located with the DATA lamp still flashing, initialize the unit. (Refer to Para 7.3 for detail)	1. Check the connection.  2. The DATA lamp flashing stops. Change the connection of the bow side antenna to the ANT2 port. If the DATA lamp is still dimmed, the bow side antenna or its cable may be faulty. If the lamp keeps flashing, the ANT1 receiver section (D73-700*) may be faulty. Call for service. 3. The DATA lamp flashing stops. Change the connection of the stern side antenna to the ANT1 port. If the DATA lamp is still dimmed, the bow side antenna or its cable may be faulty. If the lamp keeps flashing, the ANT2 receiver section (D73-700*) may be faulty. Call for service. 4. If the situation does not change even if the unit has been initialized, call for service.

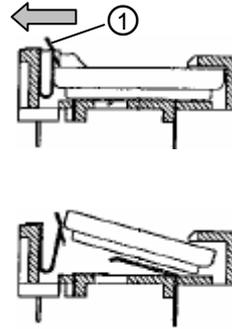
Faults detected	Possible cause of the failure	Remedial action
ALARM is flashing.	The nature of an error is indicated by the frequency of flashing. How often does the lamp flash?	<ol style="list-style-type: none"> <li>1. Once per second: the battery life is nearing the end. Refer to Para. 6.2.3 for the battery replacement procedure.</li> <li>2. Consecutive 8 flashes followed by a 1 sec. pause: the signal line is shorted to ground within the antenna cable. Check the ANT1 or ANT2 cable for short circuits.</li> <li>3. Flashes twice to 7 times with a 1 sec. pause or, 9 long interval flashes with a one second pause: the processing section may be faulty. Record the flashing interval and inform your local KODEN dealer for service.</li> </ol>
Incorrect bearing data is output.	<ol style="list-style-type: none"> <li>1. Are the antenna connections correct as follows? Bow side antenna to ANT1 port and Stern side antenna to ANT2.</li> <li>2. Is the GPS antenna unit properly oriented to the bow?</li> <li>3. Please note faulty bearing data may be output depending on the dispersion of the GPS antenna.</li> </ol>	<ol style="list-style-type: none"> <li>1. If the GPS antenna connections are reversed, i.e. Bow side antenna to ANT2 and Stern side antenna to ANT1, faulty bearing information is output. Correct the antenna connection.</li> <li>2. Check the GPS antenna installation. If the antenna is orientated the wrong way, correct it. (Refer to Para. 4.5 for the detail of installation)</li> <li>3. Turn off the GPS Compass unit and then turn on again to re-calculate the position.</li> </ol>
Positional deviation is found on the electronic chart of the GPS track display unit.	Is the geodetic system of the GPS track display set to WGS-84?	If the GPS Track display system is set to the Tokyo system, change it to WGS-84 or, the GPS compass geodetic system to Tokyo. For setting details, please refer to Para. 7.3 for setting the switch No.5.
Latitude/longitude indication is unstable.	<ol style="list-style-type: none"> <li>1. Are the connections between the GPS antennas (ANT1 and ANT2) and the Processor unit correct and firm?</li> <li>2. Is there any obstacle preventing the GPS unit from receiving the GPS signal?</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the connection and reconnect, if necessary.</li> <li>2. If an obstacle exists viewed from where the GPS antenna is installed, the GPS signal will not be received properly. Remove the obstacle or, if this is not possible, change the antenna position for a better viewing range.</li> </ol>

### 6.2.3 Replacing the memory back-up battery

The memory back-up battery (Back-up battery, hereafter) is installed in the battery cradle EA1, which is mounted on the Main Printed Board (D73-700\*) in the Processor unit. The location of the battery is shown in Fig. 7.1.

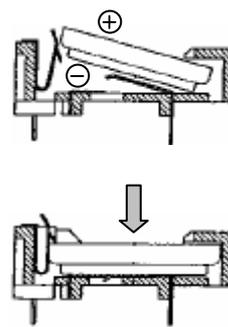


#### Removing the battery



Press the extruded tab ① towards the arrow and the battery will pop out of the holder.

#### Installing the battery



Put the battery body with the positive electrode (⊕) facing up and push it into the holder.

Fig. 7.1 The location of the back-up battery

## Chapter 7 Technical References

	Page No.
7.1 Detail of the serial output data .....	7-1
7.1.1 Start bit configuration of output data .....	7-1
7.1.2 Serial data specification .....	7-1
7.1.3 Detail of output sentences .....	7-1
7.2 Data input/output serial line .....	7-5
7.3 Setting the Status switch .....	7-6

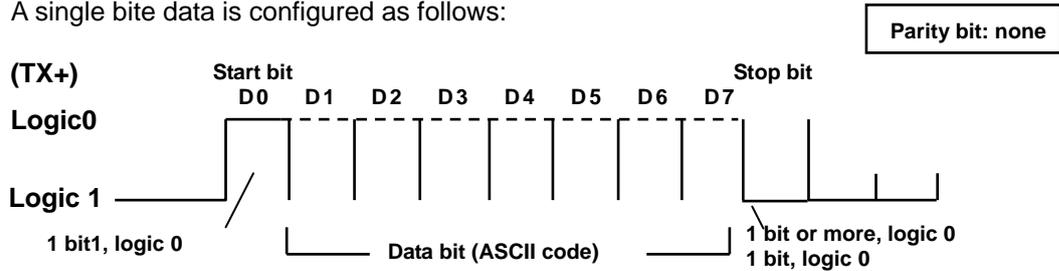
## Chapter 7 Technical References

### 7.1 Detail of the serial output data

Serial data name: NMEA0183 Ver.2.0 or IEC61162-1

#### 7.1.1 Start bit configuration of output data

A single bite data is configured as follows:



#### 7.1.2 Serial data specification

Transmission rate	Output data level	Output current	Output sentences included	Refresh rate
4800 baud	RS-422	20mA max.	Refer to page 5-2	Refer to page 5-2

#### 7.1.3 Detail of output sentences

Sentence name	Data name and contents <b>NOTE:</b> Checksum is a total sum of EX-ORed data that are put between the \$ and asterisk (*) signs.
<b>HDT</b>	<p><b>Ship's heading (True bearing)</b> \$ GPHDT, xxx.x, T *hh &lt;CR&gt;&lt;LF&gt;</p> <p>Diagram labels for HDT: Start of sentence, Talker device code, Sentence name, Ship's Heading, Checksum.</p>
<b>HDM</b>	<p><b>Ship's heading (Magnetic bearing)</b> \$ GPHDM, xxx.x, M *hh &lt;CR&gt;&lt;LF&gt;</p> <p>Diagram labels for HDM: Start of sentence, Talker device, Sentence name, Ship's Heading, Checksum.</p>

<p><b>ROT</b></p>	<p><b>Rate of turn</b>                  \$ GPROT, 0/-xxx.x, a *hh &lt;CR&gt;&lt;LF&gt;</p> <p>Talker device: 0                  (-Neg)/ Angular speed, deg/min: xxx.x                  Status: A: Valid, V: Void                  Checksum: *hh</p>
<p><b>GGA</b></p>	<p><b>GPS position data</b>                  \$ GP GGA, hhmmss, xxxx.xxx, N/S, xxxxx.xxx, E/W, x, xx,                  xxx, 0/-xxxx, M, 0/-xxx, M, xxx, xxx *hh &lt;CR&gt;&lt;LF&gt;</p> <p>Talker device: GP                  Time of measurement (Hour, Min, Sec): hhmmss                  Latitude: N: North latitude, S: South latitude                  Longitude: E: East longitude, W: West longitude                  Number of satellite in use: x                  Status of GPS fix measurement: 0: Fix unable, 1: GPS fix, 2: DGPS fix                  HDOP value: xxx                  Antenna height: 0/-xxxx                  Meter: M                  Goid height: 0/-xxx                  Meter: M                  DGPS reference station ID: xxx                  Checksum: *hh                  -: Negative                  DGPS data correction time elapsed</p>
<p><b>GLL</b></p>	<p><b>Ground position (Latitude/Longitude)</b>                  \$ GP GLL, xxxx.xxx, N/S, xxxxx.xxx, E/W, hhmmss, a *hh &lt;CR&gt;&lt;LF&gt;</p> <p>Talker device: GP                  Latitude: N: North latitude, S: South latitude                  Longitude: E: East longitude, W: West longitude                  Time of measurement (Hour, Min, Sec): hhmmss                  Status: A: Valid, V: Void                  Checksum: *hh                  Fix measurement time elapsed (Hour, Min, Sec)</p>
<p><b>GSA</b></p>	<p><b>Satellite in use and DOP</b>                  \$ GP GSA, M/A, x, xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx, x.x, x.x, x.x *hh &lt;CR&gt;&lt;LF&gt;</p> <p>Talker device: GP                  Mode: M: Manual, A: Auto                  Satellite number in use: x                  GPS DOP: 1: Fix unable, 2: 2 dimensions, 3: 3 dimensions                  PDOP value: x.x                  VDOP value: x.x                  HDOP value: x.x                  Checksum: *hh</p>

<p><b>GSV</b></p>	<p><b>Available satellite</b></p> <p>\$GPGSV, x, x, xx, xx, xx, xx, xx, ..... *hh &lt;CR&gt;&lt;LF&gt;</p> <p>Sentence name</p> <p>Talker device</p> <p>Message number</p> <p>Total message number, 1 ~ 3</p> <p>Available number of satellites</p> <p>2<sup>nd</sup> sv, 3<sup>rd</sup> sv .....</p> <p>S/N (Signal to Noise ratio)</p> <p>Bearing angle</p> <p>Elevation angle</p> <p>Satellite No.</p> <p>Checksum</p> <p>First satellite</p> <p>Start of sentence</p>
<p><b>ZDA</b></p>	<p><b>Time and date</b></p> <p>\$GPZDA, hhmmss, xx, xx, xxxx, *hh &lt;CR&gt;&lt;LF&gt;</p> <p>Sentence name</p> <p>Talker device</p> <p>Time (H,M,S)</p> <p>Day</p> <p>Month</p> <p>Year</p> <p>Checksum</p> <p>This field is not used</p> <p>Start of sentence</p>
<p><b>RMC</b></p>	<p><b>Minimum sentence for GPS/TRANSIT navigation data</b></p> <p>\$GPRMC, hhmmss, x, xxxx.xxx, N/S, xxxxx.xxx, E/W, x.x, xxx.x,</p> <p>ddmmyy, x.x, E/W *hh &lt;CR&gt;&lt;LF&gt;</p> <p>Sentence name</p> <p>Talker device</p> <p>Measurement Time (H,M,S)</p> <p>Latitude</p> <p>Longitude</p> <p>N: North latitude</p> <p>S: South latitude</p> <p>E: East longitude</p> <p>W: West longitude</p> <p>Track bearing (True bearing)</p> <p>Ground speed (KNT)</p> <p>A: Data valid</p> <p>V: Alarm void for Nav receiver</p> <p>Date (D, M, Y)</p> <p>Checksum</p> <p>E: East longitude</p> <p>W: West longitude</p> <p>Magnetic deviation</p> <p>Start of sentence</p>
<p><b>VTG Ver2.0</b></p>	<p><b>Course and ground speed</b></p> <p>\$GPVTG, xxx.x, T, xxx.x, M, xx.x, N, xx.x, K *hh &lt;CR&gt;&lt;LF&gt;</p> <p>Sentence name</p> <p>Talker device</p> <p>Track bearing (True)</p> <p>Track bearing (Magnetic)</p> <p>Ground speed (KNT)</p> <p>Ground speed (Km/H)</p> <p>Checksum</p> <p>Start of sentence</p>

<p><b>VTG</b>  <b>61162-1</b></p>	<p><b>Course and ground speed</b>                  \$GPVTG, xxx.x, T, xxx.x, M, xx.x, N, xx.x, K, a*hh &lt;CR&gt;&lt;LF&gt;</p> <p>                     Sentence name                      Talker device                      Start of sentence                      Track bearing (True)                      Track bearing (Magnetic)                      Ground speed (KNT)                      Ground speed (Km/H)                      Checksum                      Mode                      A: Data valid                      D: Data void                 </p>
<p><b>PKODA</b></p>	<p><b>Satellite information (KODEN proprietary sentence)</b>                  \$PKODA, P/H, xxx.x xx, xx, xx, xx, xx, xx, xx, xxx, M, xxx.x, N, xxx.x, 0/-xx.x, x, x &lt;CR&gt;&lt;LF&gt;</p> <p>                     Start of sentence                      KODEN proprietary sentence                      Company name KOD: KODEN                      KODEN modification code                      P: PDOP                      H: HDOP                      PDOP value                      Satellite No. in use (1 ~ 4 channel)                      S/N ratio of the satellite in use (1 ~ 4 channel)                      Antenna height                      Meter                      Knot                      Ground speed                      True bearing                      X'tal deviation (0: Positive, -: Negative)                      Satellite No.                      Longitude (1/1000 min)                      Latitude (1/1000 min)                 </p>
<p><b>PKODG1</b></p>	<p><b>Satellite information (KODEN proprietary sentence)</b>                  \$PKODG, 1, x, xx, +/-xx, xxx, xx, xx, xx, xx, xx, xx, xx, xx, &lt;CR&gt;&lt;LF&gt;</p> <p>                     Start of sentence                      KODEN proprietary sentence                      Company name KOD: KODEN                      KODEN modification code                      Satellite azimuth angle                      Reception quality                      1: GPS fix available                      0: Fix unable                      Satellite elevation angle                      Satellite No.                      Elevation angle limit                      N/S limit value                      HDOP limit value                      PDOP limit value                      Averaging constant                      Geodetic system                      Day                      Month                      Year                 </p>
<p><b>PKODG7</b></p>	<p><b>DGPS information (KODEN proprietary sentence)</b>                  \$PKODG, 7, x, x, xxx &lt;CR&gt;&lt;LF&gt;</p> <p>                     Start of sentence                      KODEN proprietary sentence                      Company name KOD: KODEN                      KODEN modification code                      DGPS (0: OFF, 1: RTCM ON, 2: SBAS ON)                      DGPS status (1: DGPS ON, 0: DGPS OFF)                      Time out value (010 ~ 180 sec)                 </p>

## 7.2 Data input/output serial line

Port (connector) name: DATA1 ~ DATA4

The connector used: LTWBD-06BFFA-L180

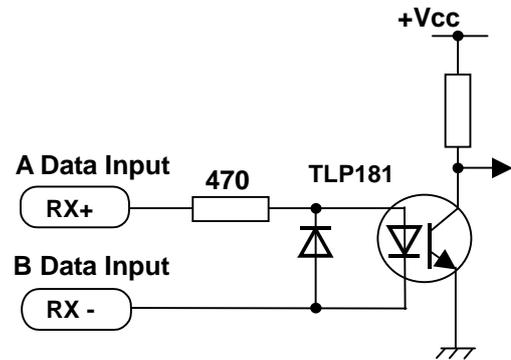
Serial Data input (listener side):

The IEC 61162-1 standard signal can be received.

Input load: 470 ohms

Input device: Photo-coupler

Type TLP181 or TLP115A (Toshiba)



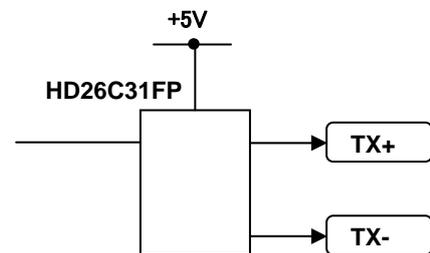
Serial data input circuit

Serial Data output (talker side):

The IEC 61162-1 standard signal can be transmitted.

Output Device: Driver IC

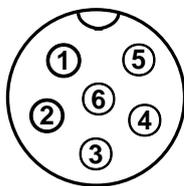
HD26C31FP (Hitachi)



Serial data output circuit

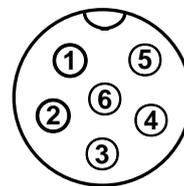
### Connector Pinouts

Data connector (DATA1~3)



- (1) Ground (GND)
- (2) Serial output + (TX+)
- (3) Serial output - (TX-)
- (4) Serial input + (RX+)
- (5) Serial input - (RX-)
- (6) No connection (NC)

Data connector (DATA4)



- (1) Ground (GND)
- (2) Serial output + (TX+)
- (3) Serial output - (TX-)
- (4) Serial input + (RX+)
- (5) Serial input - (RX-)
- (6) +12V

### 7.3 Setting the Status switch

**WARNING**

 Setting of the status is not necessary in normal operation.  
 When a need is arisen, take due care for correct setting.

The following functions can be set on the status switch in the Processor unit.

Switch element No.	Functions	ON	OFF
1	DGPS data selection	WAAS	RTCM SC-104
2	For technical use (Keep OFF)	xResetting prohibited	Keep OFF
3	Bit rate of bearing output	38400 baud	NMEA0183 (4800 baud)
4	Selection of backup period for interruption to calculate bearing	60 sec	0 sec
5	Datum selection	Tokyo	WGS84
6	Limits of elevation angle	5 degree	20 degree
7	Initialization (Cold start)	Initialized	Not initialized
8	For technical use (Keep OFF)	xResetting prohibited	Keep OFF

■ The status switch setting is defaulted to OFF.

CAUTION: When resetting the status switch, be sure to turn off the unit.

CAUTION: The initialization (Cold start) is completed by setting the switch element No.7 to ON and after about 10 seconds, turn the unit off and reset the No.7 to OFF. If the switch element No. 7 is left to ON, the unit will be initialized each time the unit is turned on.

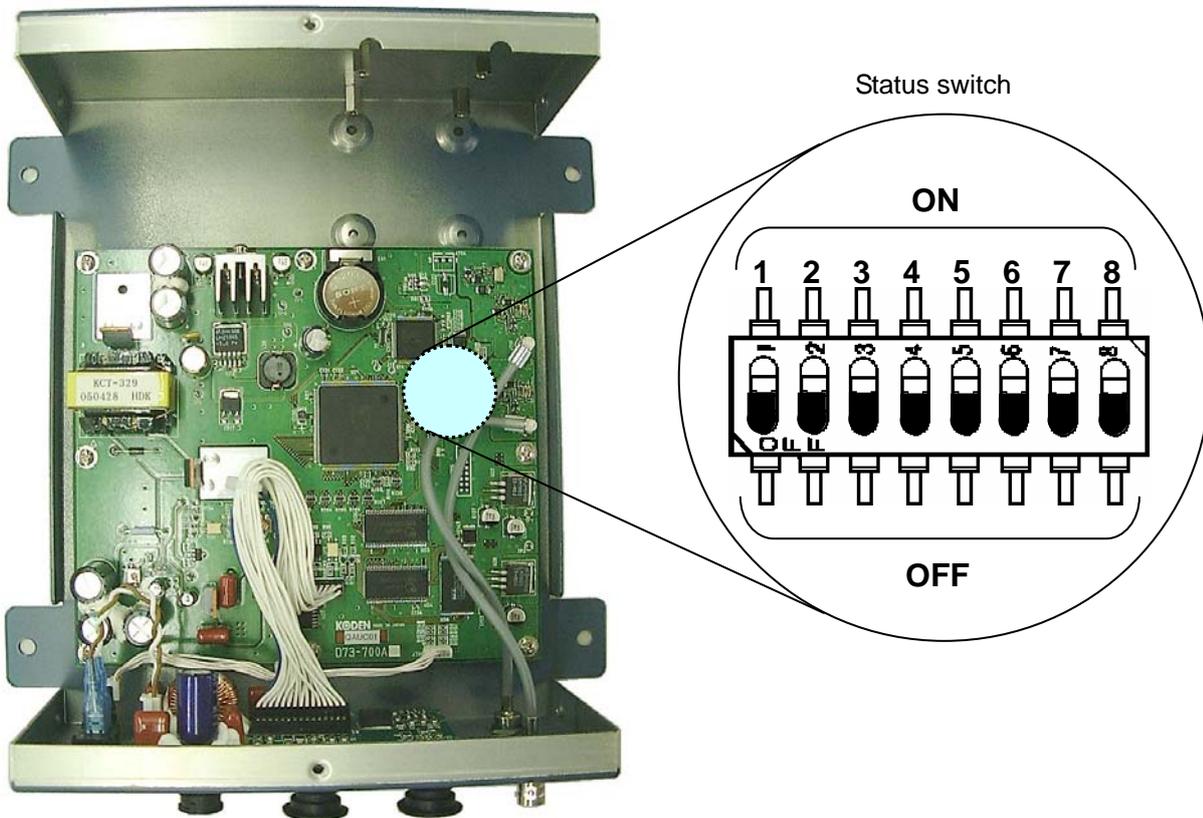


Fig 7.1 The location of the Status switch in KGC-1 Processor unit



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