CMZ 900B/900S
Gyrocompass
User's Manual

IM 80B10M-16E

IM 80B10M-16E
1st Edition

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CONTENTS

Foreword

Thank you for purchasing the Yokogawa Denshikiki Co.,Ltd. CMZ900 Gyrocompass.

This manual describes the functions, operating procedures, and the handling precautions of the CMZ900 Gyrocompass. To ensure correct use, please read this manual thoroughly before beginning operation.

About this manual

- This manual should be read by the end user.
- Read this manual thoroughly and have a clear understanding of the product before operation.
- After you have finished reading this User's Manual, be sure to keep it at your side.
- This manual explains the functions of the product. Yokogawa Denshikiki Co.,Ltd. does not guarantee that the product will suit a particular purpose of the user.
- Copying or reproducing all or any part of the contents of this manual without the permission of Yokogawa Denshikiki Co.,Ltd. is strictly prohibited.
- The contents of this manual are subject to change without prior notice.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest Yokogawa Denshikiki Co.,Ltd. dealer.

Trademarks

- All the brands or names of Yokogawa Denshikiki Co.,Ltd.'s products used in this manual are either trademarks or registered trademarks of Yokogawa Denshikiki Co.,Ltd..
- For purposes of this manual, the TM and ® symbols do not accompany their respective trademark names or registered trademark names.
- Company and product names that appear in this manual are trademarks or registered trademarks of their respective holders.

Safety precautions

Notes about environmental condition for using

To use the CMZ900 Gyrocompass, keep the environment that satisfies "Specification" and "Equipment condition" of this product.

See chapter 6 about specification of this products. And see section 7.3 about precautions during installation. The details of precautions during installation is described in approval drawing.

Notes about installation

- To install this products , follow the "Notes for installation" of approval drawing.
- If reinstallation will be needed , contact your nearest service agent of Yokogawa Denshikiki Co., Ltd..

Notes about preparation before using

Read this manual thoroughly and have a clear understanding of the product before operation.

Notes about using other than usage

This products are designed for gyrocompass for vessel. Do not use for other purpose.

Notes about maintenance and inspection

- Regular inspection is recommended to keep this system good condition.
- Do not detach the unit cover without the instruction of service engineer.
- Contact your nearest service agent when the inspection which is not permitted in this manual is needed.

Notes about abnormal circumstances

- When abnormal allophone or abnormal smell is generated from this product, turn off the power supply. After then deal with referring to this manual chapter 5. If it is impossible to deal, contact your nearest service agent of Yokogawa Denshikiki Co., Ltd..
- Do not keep using the system , if dealing methods are unknown when the system is under abnormal condition.
- Contact your nearest service or sales agent to repair the system.
- When there is some instruction about the method of trouble shooting from service department of Yokogawa Denshikiki Co., Ltd. , obey the instructions and work.

Notes about disposal of the products

When this product is scrapped , follow the regulations specified by each country.

Notes about disposal of the used supporting liquid

- To dispose of used supporting liquid , please request processing to permitted industrial waste disposal trader.
- Or contact your nearest service agent of Yokogawa Denshikiki Co., Ltd..

Precautions related to the protection, safety, and alteration of the product

- The following safety symbols are used on the product and in this manual.

"Handle with care." To avoid injury and damage to the instrument, the operator must refer to the explanation in the manual.

Protective ground terminal

AC

"High temperature." To avoid injury caused by hot surface, do not touch locations where this symbol appears.

- For the protection and safe use of the product and the system controlled by it, be sure to follow the instructions and precautions on safety that are stated in this manual whenever you handle the product. Take special note that if you handle the product in a manner that violate these instructions, the protection functionality of the product may be damaged or impaired. In such cases, Yokogawa Denshikiki Co., Ltd. does not guarantee the quality, performance, function, and safety of the product.
- When installing protection and/or safety circuits such as lightning protection devices and equipment for the product and control system or designing or installing separate protection and/or safety circuits for fool-proof design and fail-safe design of the processes and lines that use the product and the control system, the user should implement these using additional devices and equipment.
- If you are replacing parts or consumable items of the product, make sure to use parts specified by Yokogawa Denshikiki Co., Ltd..
- Do not modify this product without instruction from service engineer of Yokogawa Denshikiki Co., Ltd. .

Exemption from responsibility

- Yokogawa Denshikiki Co., Ltd. makes no warranties regarding the product except those stated in the WARRANTY that is provided separately.
- Yokogawa Denshikiki Co., Ltd. assumes no liability to any party for any loss or damage, direct or indirect, caused by the user or any unpredictable defect of the product.

How to use this manual

The following markings are used in this manual.

Improper handling or use can lead to injury to the user or damage to the instrument. This symbol appears on the instrument to indicate that the user must refer to the user's manual for special instructions. The same symbol appears in the corresponding place in the user's manual to identify those instructions. In the manual, the symbol is used in conjunction with the word "WARNING" or "CAUTION."

WARNING

Calls attention to actions or conditions that could cause serious or fatal injury to the user, and precautions that can be taken to prevent such occurrences.

CAUTION

Calls attentions to actions or conditions that could cause light injury to the user or damage to the instrument or user's data, and precautions that can be taken to prevent such occurrences.

NOTE

Calls attention to information that is important for proper operation of the instrument.

Important cautions

WARNING

Risk of Electric Shock

Turn off the power before carrying out any wiring.

CAUTION

Do not perform an insulation resistance test using a megohmmeter except on the ship's power terminals. Performing such a test may cause a failure in the gyro system.

Precautions in handling the gyrosphere

- Hold the gyrosphere firmly with both hands so as not to subject it to any shock.
- Do not drop the gyrosphere. Dropping the gyrosphere may result in damage to the internal mechanism or lead to personal injury.
- Do not disassemble the gyrosphere.

Precautions in handling the container

- Hold the container firmly with both hands.
- Do not drop it. Dropping the gyrosphere may result in damage to the internal mechanism or lead to personal injury.

Polishing of the slip ring is prohibited

- Carry out cleaning by wiping dirt off the slip ring with ethyl alcohol or ligroin.

Handling precautions

Startup of gyrocompass

(1) Startup the gyrocompass at least 5 hours before the ship's departure.

(2) After startup, do not touch the internal unit of the Master compass. Otherwise the equipment may be damaged or an error generated.

Handling in cold districts

Since the Master compass container containing the gyrocompass is filled with liquid, if a gyrocompass is to be stopped in a cold district where the ambient temperature is -3°C or less it should therefore be handled as shown below.

(1) In the case where it is stopped for a period of a few days or less:

Wrap the Master compass in a blanket or the like to provide heat insulation.

(2) In the case of a prolonged stopping period (a week or more):

Drain the liquid completely.

External heading out put

External heading can use with the Master compass's signal driver circuits.

Turn on the main power of the Master compass (MKM026) in case of using external heading.

NOTE

The external heading sensor is optional unit. If the external heading sensor is not installed or connected to gyrocompass, external heading signal can not be used.

Heading changeover

Normally the heading signal is switched from other gyrocompass or external heading signal with operating key on the C.operation unit. In the following condition, it is not possible to switch.

- **Master compass is standing by to start.**
- **The other sensor which is scheduled to switch is abnormal.**
- **Exchanging the signal is prohibited.**

CAUTION

Please execute the switch of heading signal between gyrocompass and external sensor in the safety area.

NOTE

When external heading signal is used at other systems of RADAR , ECDIS or etc , the signal format should be fit for other system.

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1. Overview

The CMZ900 Gyrocompass fully conforms to the technical requirements of the IMO resolution A.424 (XI), gyrocompass performance standards, as well as to JIS F9602, Class A standards. The anti-vibration structure has been strengthened and improvement of the follow-up performance has been achieved, leading to increased rigidity of the gyrocompass in all types of ships, from small to large.

1.1 Features of CMZ900

- **High north-seeking accuracy**

  High north-seeking accuracy is achieved because of the following configuration: The gyrosphere, the heart of the gyrocompass, is supported in a container filled with liquid, which prevents disturbance from affecting the center pin. In addition, two gyro-rotors rotate at a high speed and work with each other to cancel out errors due to the rolling, pitching and yawing of a ship.

- **Excellent vibration resistance and shock resistance**

  The gyrocompass is designed to disperse forces due to vibration and shock by the inclusion of liquid in the container to support the gyrosphere. In addition, the container is protected from vibration and shock with a diaphragm-shaped rubber vibration-isolator and bellows damper. The diaphragm-shaped rubber vibration-isolator has universal joints as a countermeasure against the affect of attitude change due to rolling, pitching and yawing. This configuration produces excellent resistance against vibration and shock.

- **Improvement of follow-up performance**

  A follow-up speed of 30 °/s has been realized by reducing the size and weight of the container. This has made smooth follow-up without delay possible in response to sudden turning as is characteristic with small ships.

- **Digitalization of Master compass heading**

  The display of the Master compass heading has been changed to digital. This increases the ease of reading a heading.

- **Digitalization of Repeater compass signal**

  Electromagnetic wave noise is suppressed to a minimum by expressing the Repeater compass signal in a digital form and having the driving circuit for the compass motor on the Repeater compass side.

- **Automatic speed-error correcting function**

  Speed-error is corrected automatically by entering the ship's speed signal and latitude signal respectively from the log and GPS or the like. The amount of latitude change in the case where there is no latitude signal input is estimated from a calculation of the ship's speed and heading. In a basic system, this function is implemented in the remote unit.

- **Functions for various displays and settings**

  Various types of gyrocompass information can be displayed and set on the Master compass operation unit and remote unit.

- **Preparation of outputs corresponding to every requirement**

  In addition to the digital heading signal output for the Repeater compass, the stepper heading signal output, digital signal output (IEC61162-1/-2), analog heading, quadrant, and angular turning velocity signal output are equipped as standard.

- **Onboard battery drive**

  Compass running by the onboard battery is available as standard.

- **Built-in startup timer**

  The restart time of the timer can be set from 1 to 99 hours.

- **Heading output using external azimuth sensor signal**

  Using the heading signal from the external heading sensor (GPS compass, magnet compass, etc.) signals can be output to external connecting device such as Repeater compasses or a radar.

1.2 Gyrocompass System

The CMZ900 Gyrocompass determine the ship's heading using gyro sphere which is included in Master compass.

The heading signal is displayed on operation unit, and is output to Repeater compass or external units.

If any system failure will be occurred, the buzzer will sounds and the FAIL LED will blink.

The gyrocompass system is composed of the following units;

- **Master compass**

  The Master compass is detect ship's heading and calculate rate of turn.

  These signals are output to any units. The M.operation unit is included in this Master compass.

- **Repeater compass / Steering repeater compass**

  The Repeater compass is receive serial heading signal from Master compass, and indicates ship's heading.

- **Control box**

  The Control box is connected to Master compass and other external device. This unit drives each heading signals. This unit is used with S-Type.

- **Operation unit**

  The operation unit is used to control gyrocompass. There are two kinds of operation units. One is C.operation unit and the other is M. Operation Unit. C.Operation unit is standard device in Type-S and optional device in Type-B.

See chapter 2. for detail of system construction.

1.3 Device Composition Type

CMZ900 has 3 type systems. Each systems has different composition and specification. The system composition is described in chapter 2.

- **CMZ900B**

  B-Type is composed of Master compass, Repeater compass and Steering repeater compass. This type is used with a medium ship by a small ship.

  The automatic speed error correction is achieved using C.operation unit (option) and Junction unit (option). The backup of power supply is achieved using AC adapter (option).

- **CMZ900S**

  S-Type is composed of Master compass, Control box, Repeater compass and Steering repeater compass. This type is used with a large ship by a medium ship. This type equips Control box normally and can execute the functions which are optional functions for CMZ900B. This type has many signal distribution drivers for external units.

- **CMZ900D (Not explain in this manual)**

  D-Type is composed of two Master compasses, Control box, dual AC adapter, Repeater compasses, Steering repeater compass. This type is used with a large ship by a medium ship. This system always observes errors by using the heading signal comparison data. If some error occurs on the system, it is possible to exchange heading signal from the one hand to the other hand by operating the C.operation unit (software) or selector switch (hardware).

  This changeover function improves the reliability of the system.

1.4 Connection with External Devices

CMZ900 Gyrocompass has speed error correction using ship's speed and position signal from external devices. The heading signal or external input signal is output to external devices such as Autopilot, Radar, Course Recorder and more.

1.4.1 Input Signal

The following signals can be input from external devices to gyrocompass.

Input signal	External devices	Signal format
Ship's speed signal	E.M.Log, Doppler Log, GPS, etc	IEC61162-1 Serial , Pulse
Latitude signal	GPS etc.	IEC61162-1 Serial
Heading / Rate of turn signal	Magnet compass , GPS etc.	IEC61162-1 Serial

The setting of serial signal format is possible according to the generation command.

See chapter 6 for specification of signal input.

See chapter 4 to set signal format using generation command.

1.4.2 Output Signal

The following signals can be output to external devices from gyrocompass.

Output signal	External devices	Signal format
Repeater compass heading signal	Repeater compass	IEC61162-1 Serial
Stepper heading signal	Radar etc.	3Bit gray code
Serial heading / Rate of turn signal	Autopilot, Digital repeater compass etc.	IEC61162-1 Serial
Analog heading / Rate of turn signal	Course recorder, ROT Indicator etc.	Analog (0 to 5V)

The setting of serial signal format is possible according to the generation command.

See chapter 6 for specification of signal input.

See chapter 4 to set signal format using generation command.

1.5 Outline of Operation

This section describes the operation of gyrocompass.

1.5.1 Startup and Stoppage

The gyrocompass starts when the main power supply is turned on.

The Master compass starts North-seeking. The Repeater compasses receive heading signal and start display.

The gyrocompass settles within 5 hours, and displays true heading.

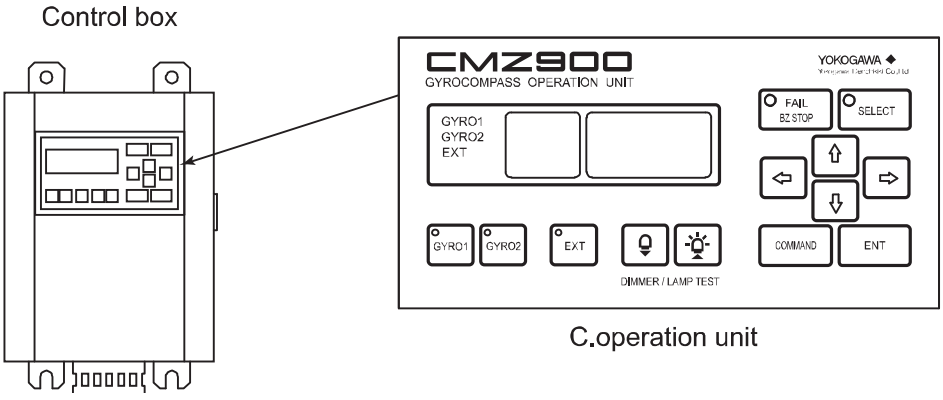
The gyrocompass stops when the main power supply is turned off.

The detail of startup is described in section 3.1.

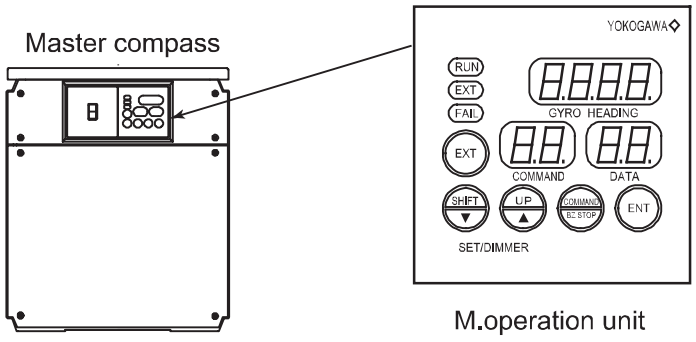
1.5.2 Operation Unit

The gyrocompass is operated with the operation unit. Operation unit displays heading and the information. And it is used for setting the gyrocompass. There are two kinds of operation units. One is C.operation Unit and the other is M.operation unit. C.operation unit is standard device in Type-S/D and optional device in Type-B.

See section 3.2 for details of function and operation of operation unit.



C.operation unit



M.operation unit

1.5.3 Normal Display

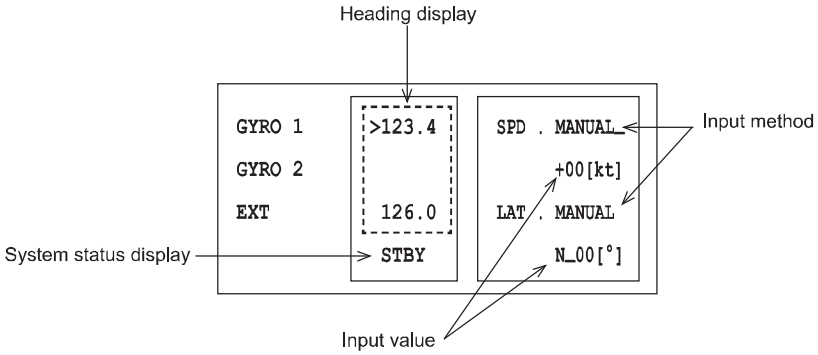
The gyrocompass become to “Normal Mode” through the “Standby status” at startup.

The operation unit displays the heading and status like at the standby.

See section 3.3 for details of displays in “Normal Mode”.

● Normal display on C.operation unit

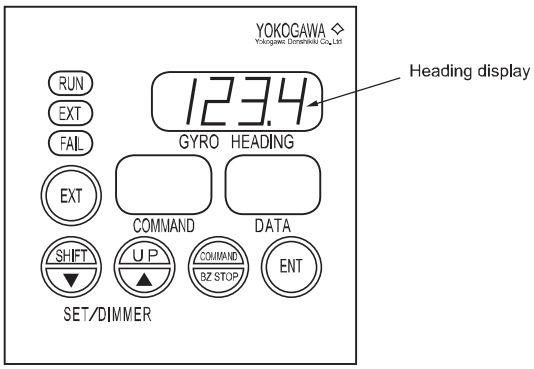
The heading and system status are displayed on screen.



● Normal display on M.operation unit

The heading is displayed on the heading display.

(The displayed heading is not corrected speed error. So the displayed heading on M.operation unit might be different from the heading on C.operation unit or Repeater compass while the ship is navigating.)



1.5.4 Output Heading Selection

If CMZ900 is connected to external heading device, it is possible to select gyro heading or external heading.

To select the heading, push the heading selection key.

1.5.5 Command Function

The command for the setting is prepared in CMZ900.

Call-up code for various data display/setting in the CMZ900 Gyrocompass are assigned to the predetermined numbers (command code). Calling the command code, it is possible to achieve various function.

Move to command mode from normal mode to use command function.

See section 3.4 for detail of command function.

● List of Command Function

Classification	Command code	Operation unit C	Operation unit M	Function item	Execution during standby	Page
Display Function		○	○	Compass heading display	○	3-11
		○	–	True heading and system status display		
	10	○	–	True heading and value of speed error correction display	○	4-2
	11	○	–	Heading deviation display	○	4-3
	12	○	–	Turn rate display	○	4-4
	13	○	○	Gyro sphere running time display	○	4-5
		○	–	Total running time and the time after startup display		
	14	○	–	Dimmer rank display	○	4-6
	15	○	○	Gyro-sphere phase current display	○	4-7
	16	○	○	Backup battery voltage display	○	4-8
	17	○	○	Deviation voltage display	○	4-9
	19	○	○	Software version number display	○	4-10
Setting Function	20	○	–	External heading input selection	○	4-14
	21	○	○	Speed setting for speed error correction	○	4-15
	22	○	○	Latitude setting for speed error correction	○	4-16
	23	○	○	Automatic alignment of Master compass	×	4-17
	24	○	○	Manual alignment of Master compass	×	4-19
	25	○	○	Setting the Master compass follow-up gain	○	4-21
	26	○	○	Displaying/resetting cause of Master compass alarm	○	4-22
	27	○	–	Displaying/resetting cause of C.operation unit alarm	○	4-23
	28	○	–	Deviation alarm setting	○	4-24
	29	○	○	Startup timer setting	○	4-25

Clas-sifi-cation	Command code	Operation unit		Function item	Execu-tion during standby	Page
		C	M			
Maintenance Function	30	○	○	Permission for maintenance function	○	4-33
	31	○	○	Outputting simulated DAC signals	×	4-34
	32	○	○	Manual drive of Master compass	○	4-36
	33	○	○	Manual drive of Repeater compass	○	4-37
	34	○	○	Resetting gyrosphere running time	○	4-38
	35	○	○	Resetting log	○	4-39
	36	○	○	Initialization of backup memory	○	4-40
	37	○	○	Correcting Master compass installation error	○	4-41
	39	○	○	Log display	○	4-43
Generation Function	40	○	○	Permission for generation function	○	4-53
	41	○	○	Setting the follow-up speed for stepper signal	○	4-54
	42	○	–	Setting communication protocol of output port	○	4-55
	43	○	–	Setting format of output port	○	4-56
	45	○	–	Setting format of input port	○	4-62
	49	○	–	Miscellaneous functions	○	4-66

○ : Means that execution is permitted
× : Means that execution is not permitted
– : Means that the function is not Implemented.

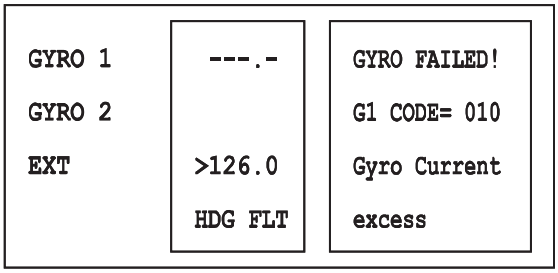
1.6 Outline of Alarm

If abnormal condition occurs on gyrocompass, an alarm is generated.

1.6.1 The Display when Alarm is Generated

When an alarm is generated, the buzzer sounds and the alarm lamp blinks.

The error code and the cause of the alarm are displayed on the screen of C.operation unit.



The error message disappears by pushing the command key.

1.6.2 Buzzer Stop

Pressing the buzzer-stop key stops the buzzer.

1.6.3 Confirmation of Alarm Causes

The alarm lamp goes out if the alarm is reset, but continues to light up if the alarm continues.

The check procedure when the alarm is generated is described to Chapter 5.

1.7 Maintenance and Inspection

Implement the following procedures of the daily inspection and regular inspection to maintain the gyrocompass in a state of normal working order:

1.7.1 Daily Inspection

Inspection Item		Inspection Contents and Procedure	Recommended Inspection Interval
1	Gyrosphere drive current	Check that the current is within the range 0.15 A to 0.35 A by executing the command code “15”. (See section 4.1.6)	Once/day (at an arrival)
2	Repeater compass alignment	Check that the heading of each Repeater compass agrees with that of the Master compass.	Once/departure
3	Ship’s speed value latitude	Check that there are no errors in ship’s speed and latitude by executing the command codes “21” and “22”. (See section 4.2.2 and 4.2.3)	Once/day
4	Azimuth error	Check that there is no azimuth error using astronomical or physical target observation.	Once/day

NOTE

Check the readings of the Repeater compass card when the ship’s speed is set to “0.” If a speed-error correction is performed, the Master compass card reading will not agree with the Repeater compass card reading.

1.7.2 Regular Maintenance

Perform the following maintenance once a year.

NOTE

Order to the Service Department of Yokogawa Denshikiki Co., Ltd. for regular inspection.

Inspection Item		Procedure
1	Gyrosphere	Cleaning of lower electrode . Cleaning of band electrode.
2	Container	Cleaning of inside surface ,center pin (Exercise care when handling.) , lower electrode ,band electrode, follow-up electrode.
3	Supporting Liquid	Replace

(Note) For disassembling and assembling procedures, see Section 7.2.

1.8 Definition of Terms

This section describes the definition of terms used in this manual.

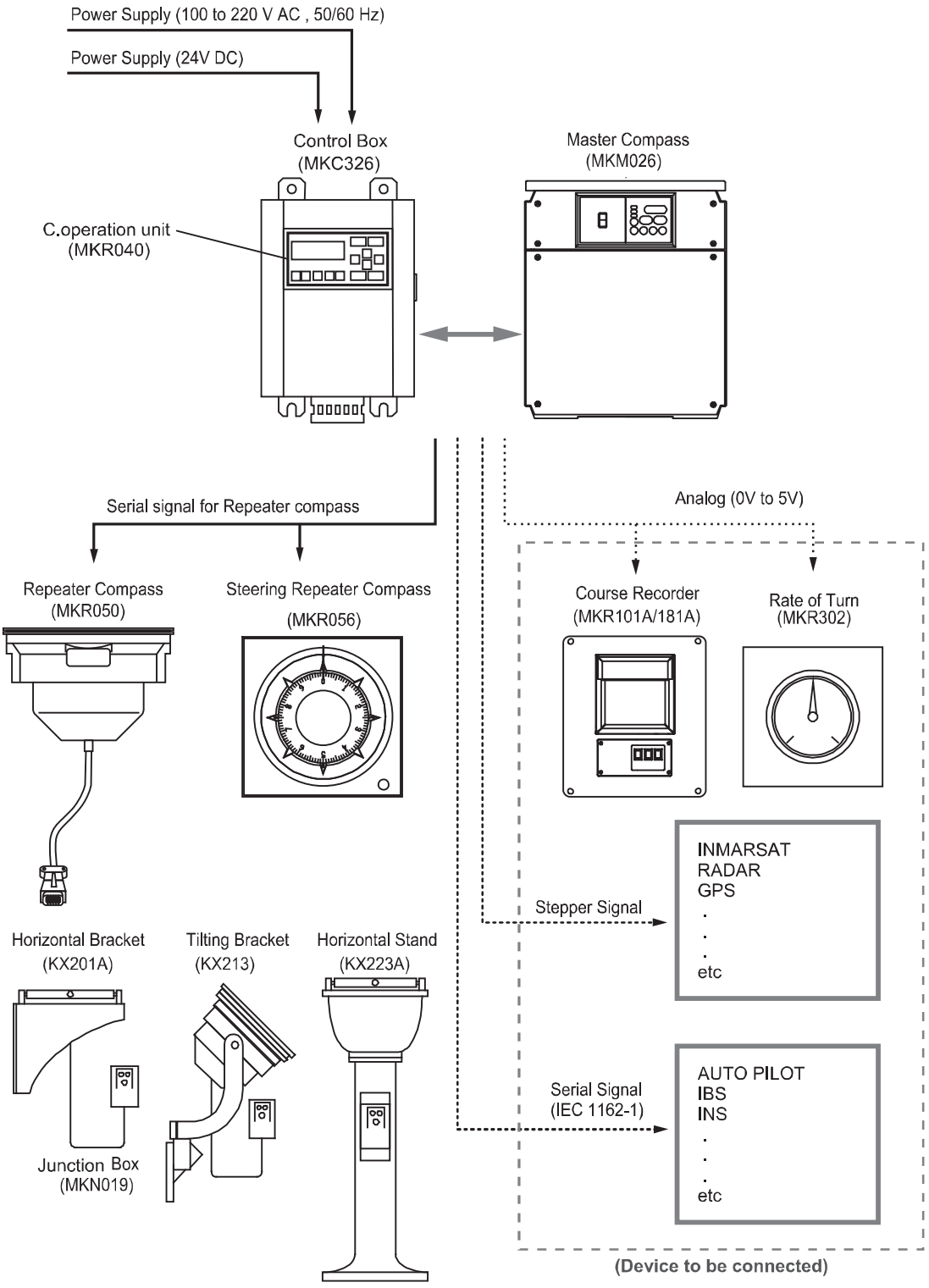
Compass heading	The heading detected by the Master compass
True heading	The heading obtained by subtracting the value of the speed error correction from the compass heading
Value of speed-error correction	The error calculated from the ship's heading, speed and latitude
Output heading	A heading output to external connected device (such as Repeater compasses). Either the gyro heading or external sensor heading should be selected.
Gyro heading	True heading
External sensor heading	A heading to be input from external heading sensors (such as magnet compass/GPS compass and the like)

2. Hardware

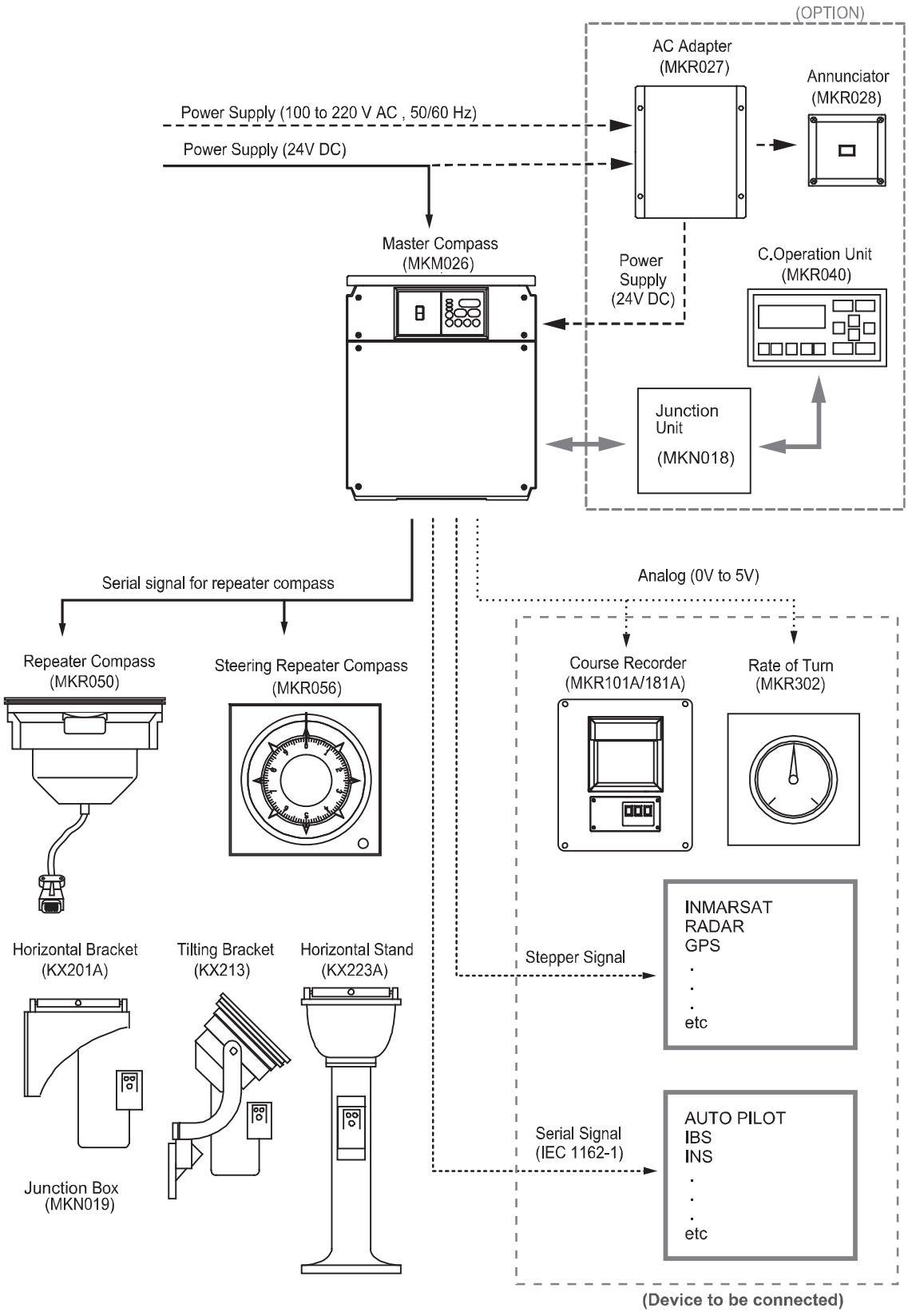
2.1 Component Models

CMZ900B/900S are composed following units. The units are selected for the usage.

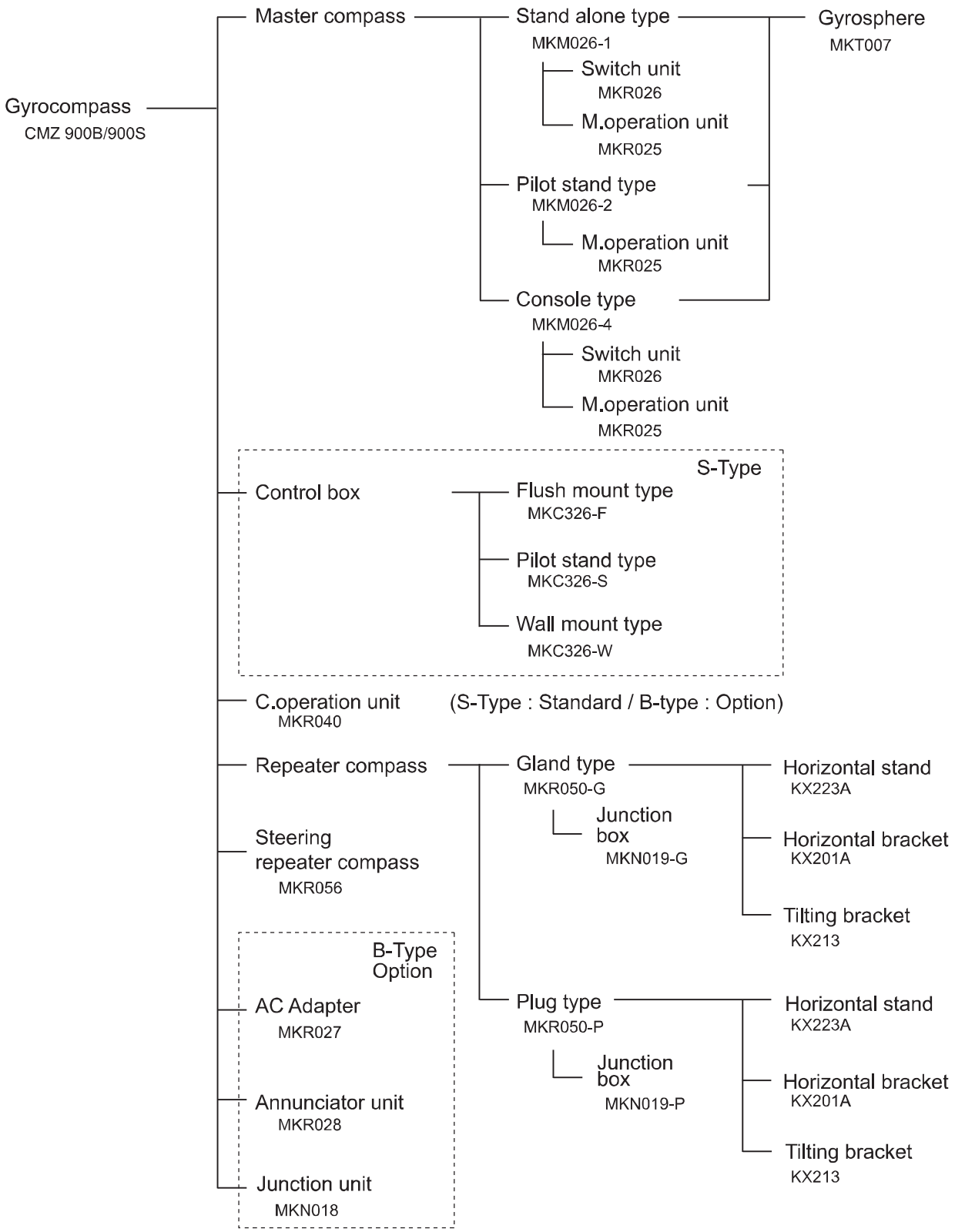
- **CMZ900S system configuration**



CMZ900B system configuration



Component models



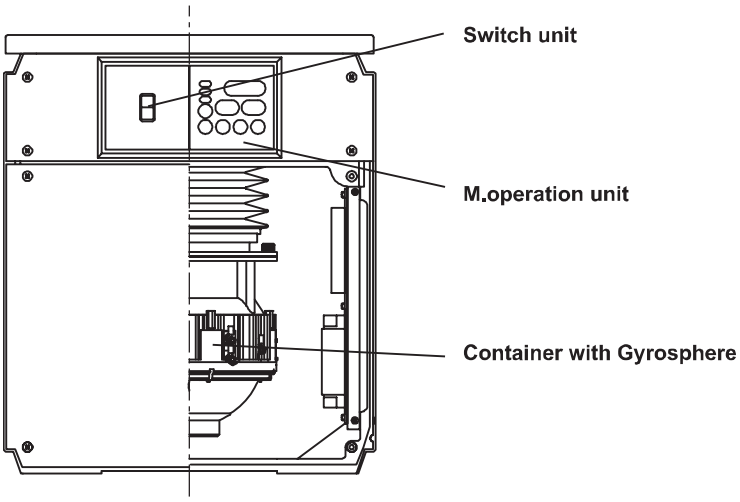
2.2 Component Names and Functions

2.2.1 Master Compass [MKM026]

Master compass detects ship's heading.

- **Master compass stand alone type**

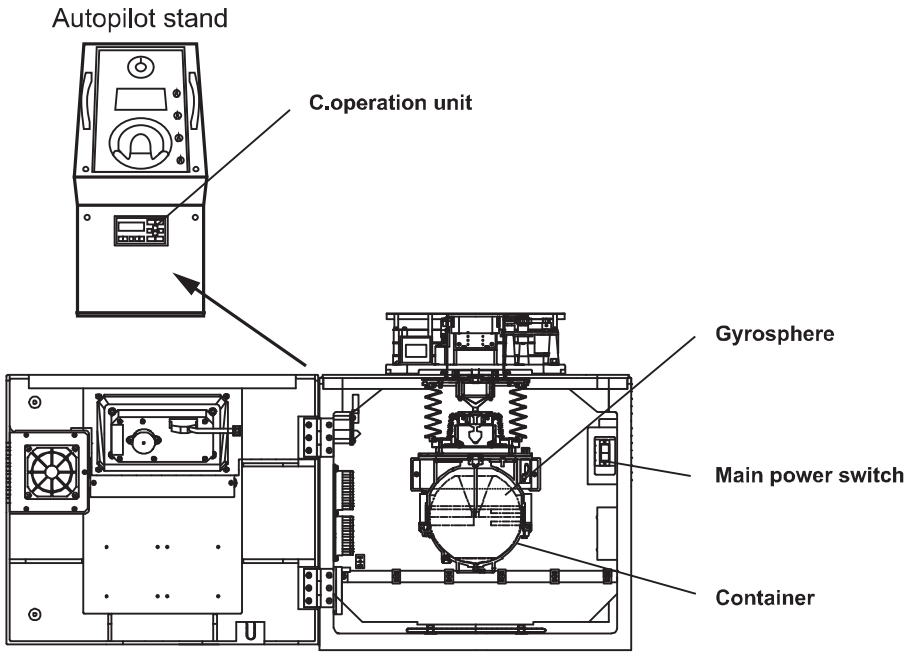
This Master compass is stand alone type which includes components to exclusive case.



See section 3.2.2 for name of each part of M.operation unit and its functions.

- **Pilot stand type**

This type includes gyrocompass units into stand.



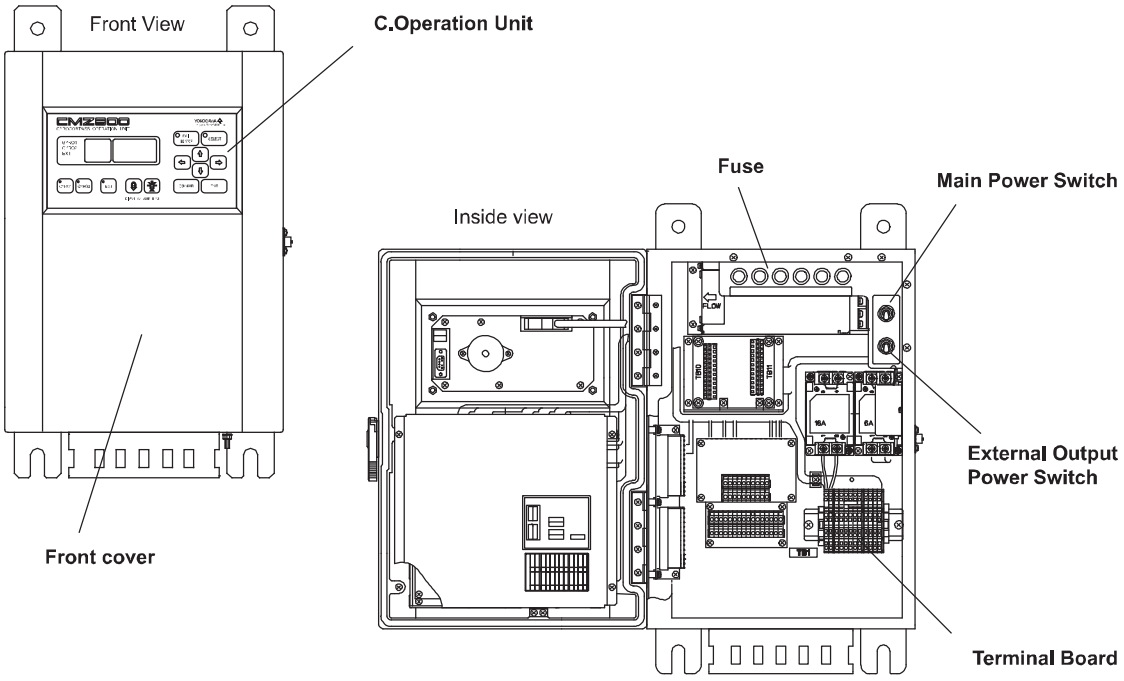
See section 3.2.1 for name of each part of C.operation unit and its functions.

- **Console type**

This type is used to be included into ship's bridge console. This type Master compass has plate and rails for drawing it out.

2.2.2 Control Box [MKC326] (S-Type)

The Control box distributes heading signals and power to other units and receives signals from other units. The Control box equips C.operation unit on the front cover and equips power switches and terminals into the box.

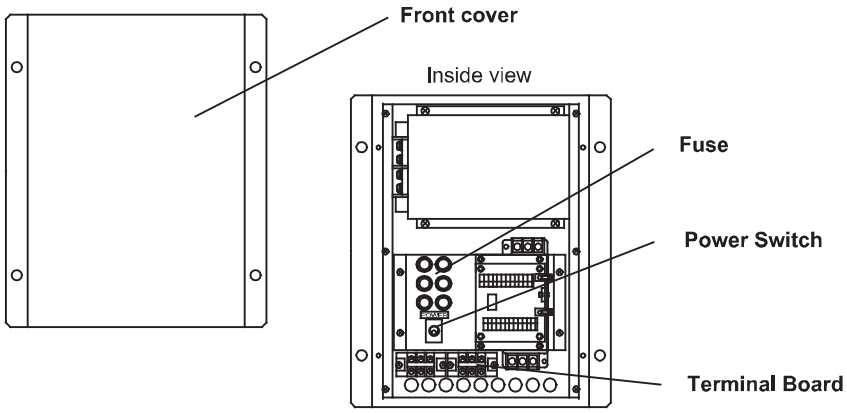


The Control box has three kinds of structures which are wall mount type, flush mount type and built-in Pilot stand type.

See section 3.2.1 for name of each part of C.operation unit and its functions.

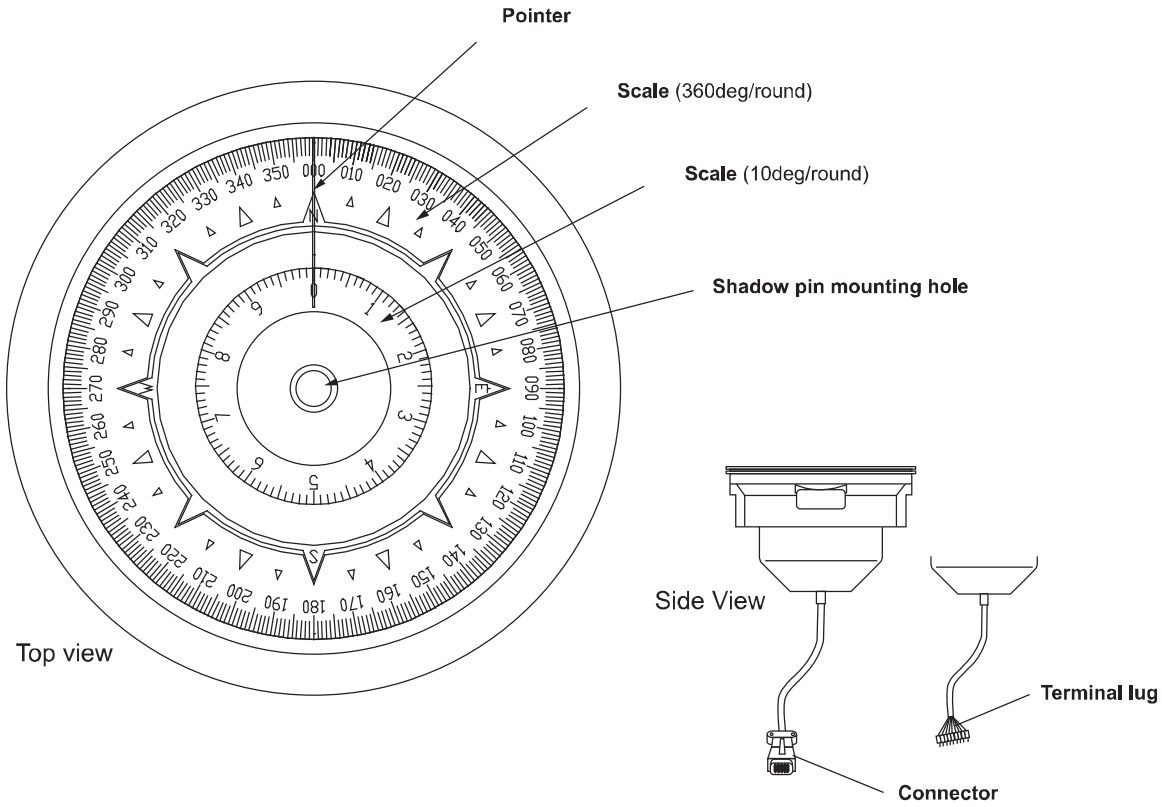
2.2.3 AC Adapter [MKR027] (B-Type Option)

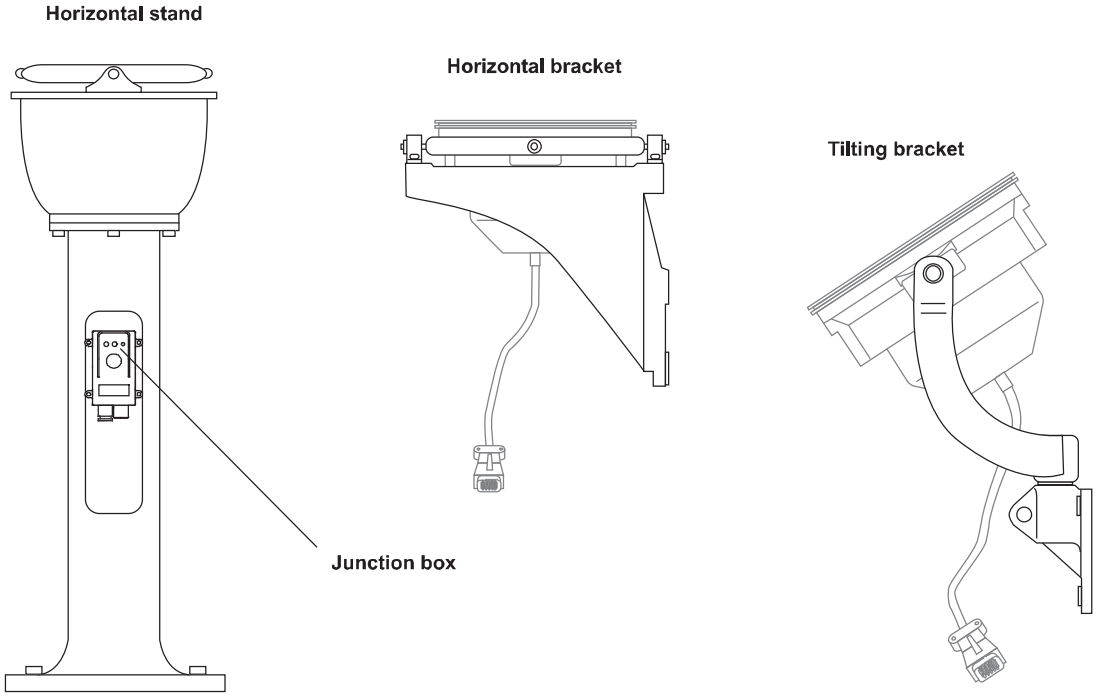
This unit supplies DC power to Master compass.



2.2.4 Repeater Compass [MKR050]

The Repeater compass receives a heading signal from the Master compass, indicates the true heading.



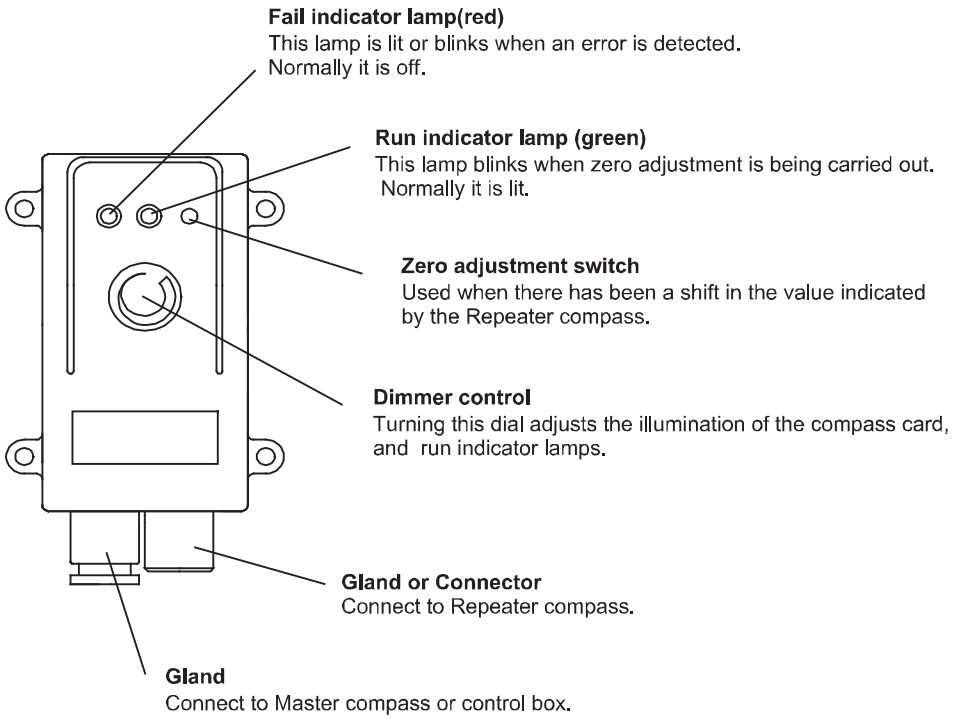


NOTE

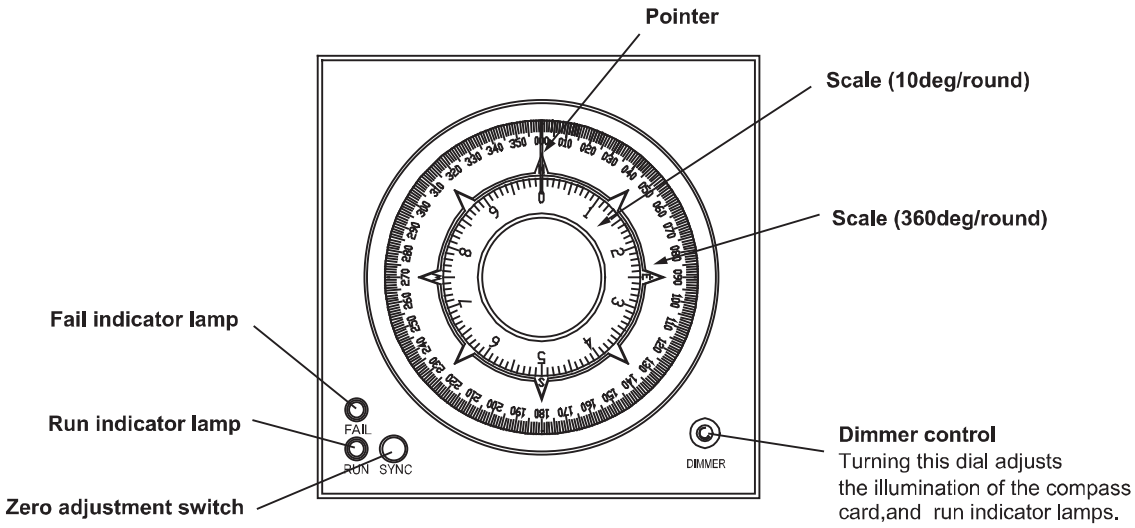
If the heading of Repeater compass has errors, check and adjust it referring to chapter 5.

2.2.5 Junction Box [MKN019]

This unit receives heading signal and power from Master compass and drives Repeater compass. It is used to adjust dimmer.

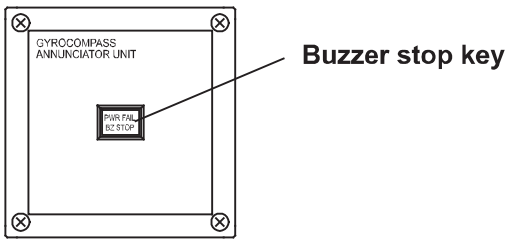


2.2.6 Steering Repeater Compass [MKR056]



2.2.7 Annunciator [MKR028] (B-Type Option)

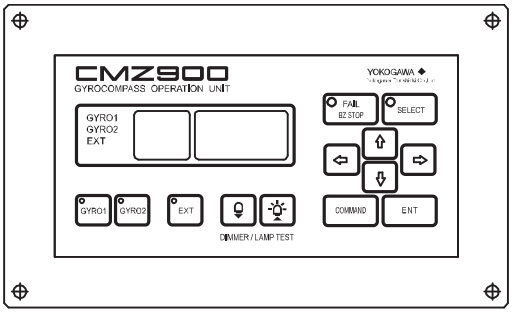
This unit informs an AC power error of AC adapter with the buzzer and blinking LED.



2.2.8 C.operation Unit [MKR040] (B-Type Option)

C.operatioun unit is used to control and operate gyrocompass.

This unit is equipped normally for CMZ900S and equipped optionally for CMZ900B.



See section 3.2.1 for name of each part of C.operation unit and its functions.

3. Operation

This chapter describes the operation of the CMZ900 Gyrocompass system.

3.1 Startup and Stoppage

NOTE

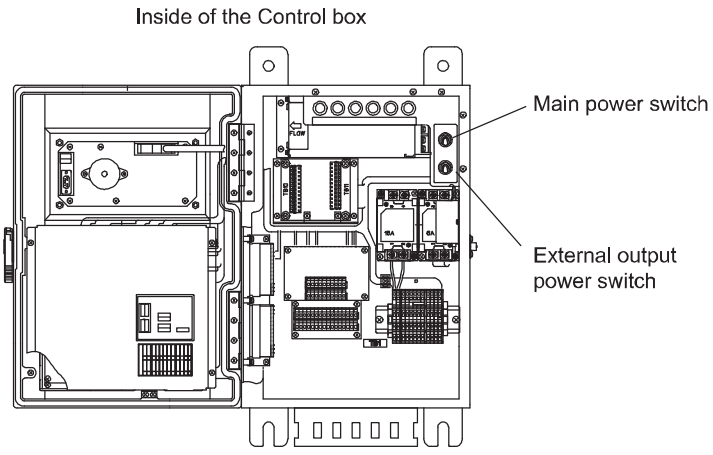
Startup the gyrocompass at least 5 hours before the ship's departure.

3.1.1 The Procedure of Startup and Stoppage

Confirm the presence of power supply for the system at startup.

- **The operation on the Control box and Autopilot stand.**

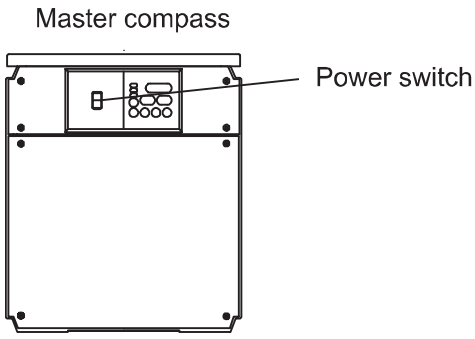
The gyrocompass is started up and stopped by operating the main power switch in the Control box or Autopilot stand. The power switch is placed at right hand in the Control box or Autopilot stand. For startup, locate the toggle switch to ON side. For stoppage, locate the toggle switch to OFF side.



- **The operation on the Master compass**

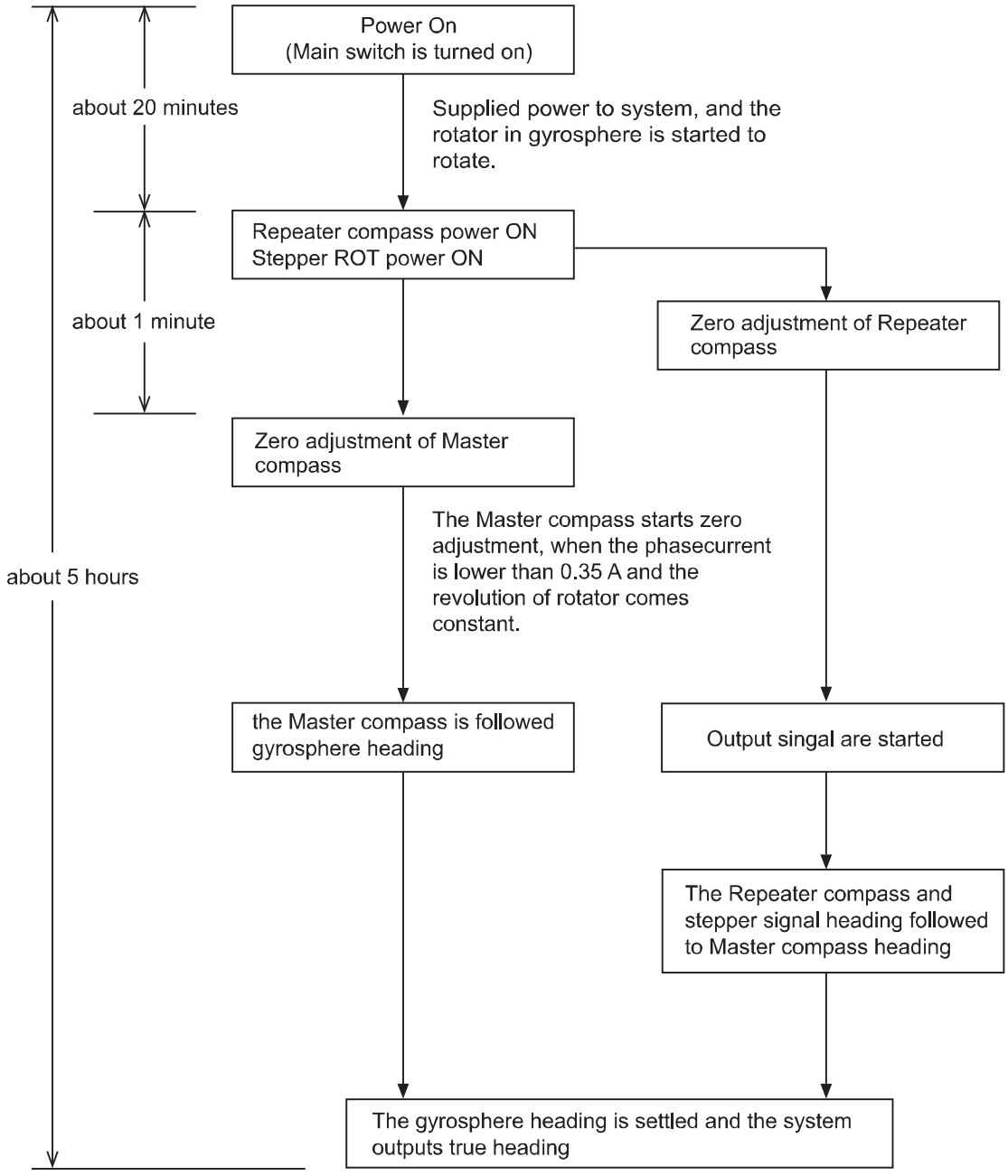
The power switch is included in the front panel of Master compass.

For startup, press the switch to ON side. For stoppage, press the switch to OFF side.



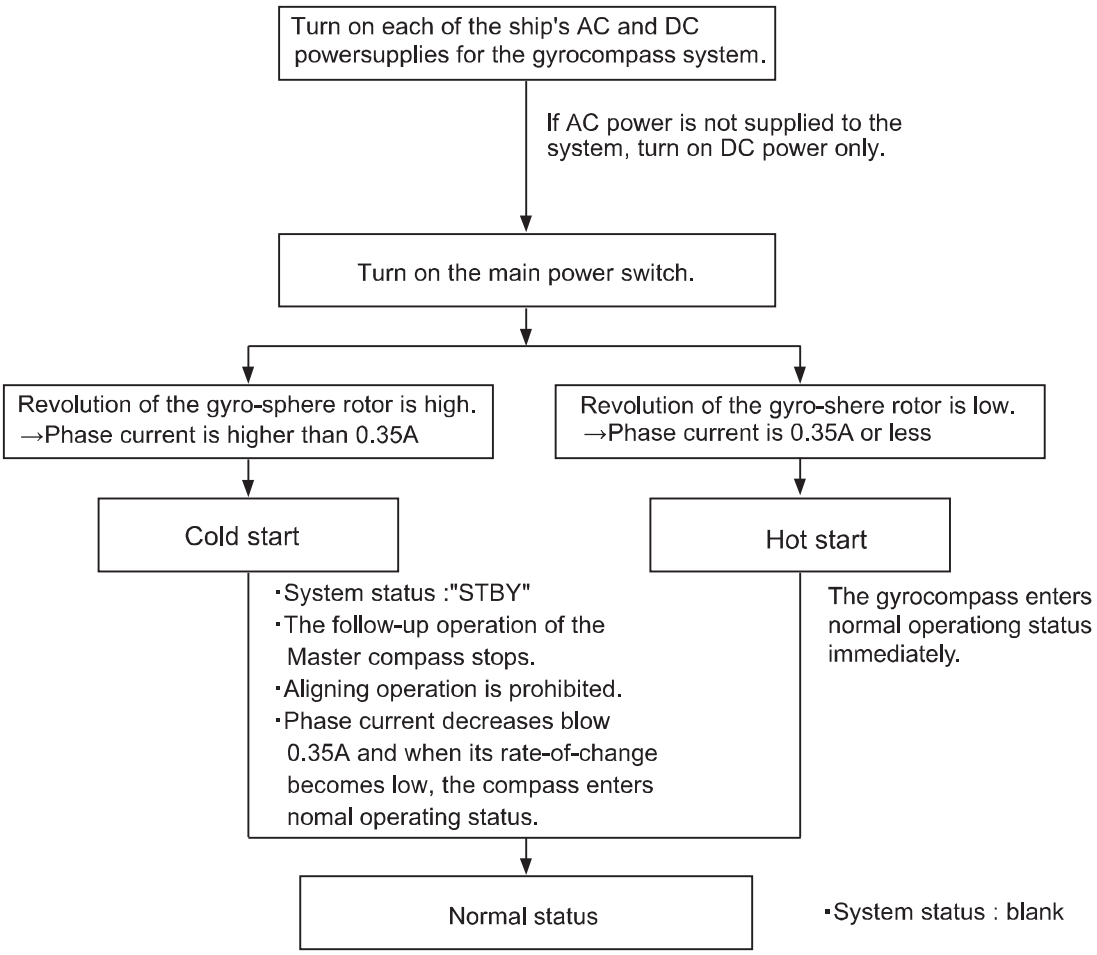
3.1.2 Startup Sequence

The following processes are passed until gyro sphere is stabilized and true heading is output.



3.1.3 Hot Start and Cold Start

● Flow diagram



Start up the gyrocompass at least 5 hours before performing normal operation.

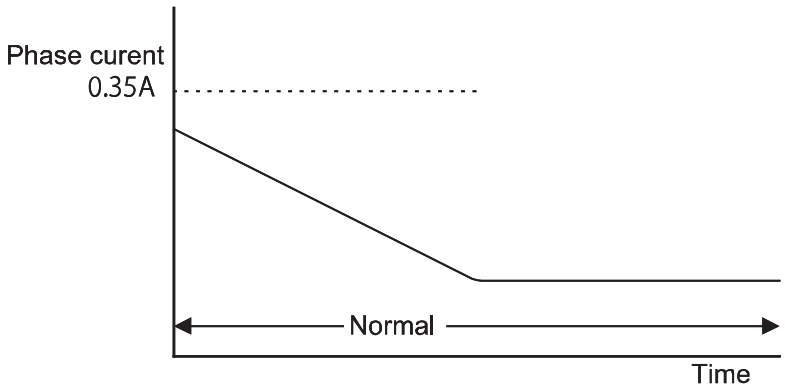
After the power switch is turned on, the gyrocompass system is started up at either hot start or cold start depending on the condition of the gyro-sphere.

If the gyro rotor is rotating at a high enough speed to detect the heading, hot start begins, however, if it is rotating at a speed that is too low to detect the heading, cold start begins.

The rotating status of the gyro rotor is determined by monitoring the phase current.

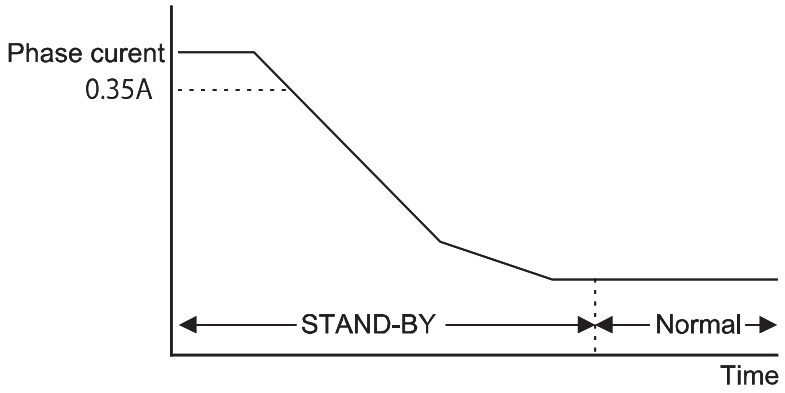
Hot start

Hot start begins if the value of the phase current immediately after turning on the power is 0.35 A or less and follow-up of Master compass, signal input/output, and indicator lamps are normal.



Cold start

Cold start begins if the value of the phase current immediately after turning on the power is higher than 0.35 A. The stand-by state continues until the phase current drops and the rate of change in the phase current drops below a specified level. Normal operation will start when these requirements are met. During stand-by, functions of Master compass automatic aligning and manual aligning cannot be carried out. After about 2 hours, the heading becomes to practical and gyrocompass is ready for operation.



3.2 Operation Unit

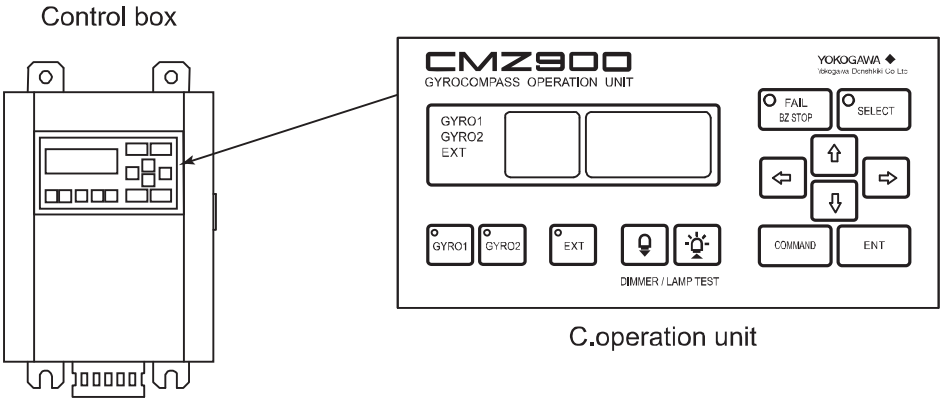
The gyrocompass is operated with the operation unit. Operation unit displays heading and the information. And it is used for setting the gyrocompass. There are two kinds of operation units. One is C.operation Unit and the other is M.operation unit.

NOTE

C.operation unit is standard device in Type-S/D and optional device in Type-B. If C.operation unit is not equipped , M.operation unit is used for operating the gyrocompass.

● C.operation unit

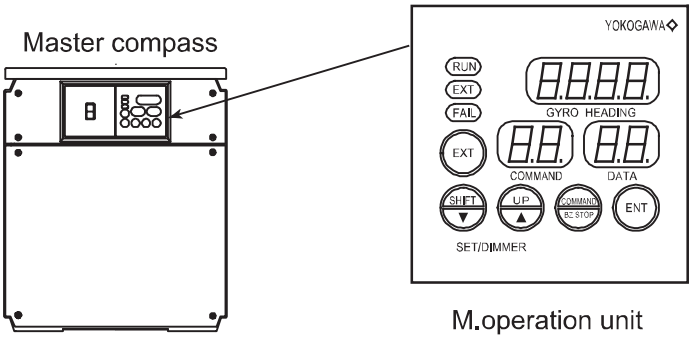
The C.operation unit is equipped on the front door of Control box or Autopilot stand. The operation unit is used for operating the master compass and setting the communication port to connect with the external devices. It is possible to shift operation right to M.operation unit.



C.operation unit

● M.operation unit

The M.operation unit is equipped on the front panel of Master compass. (Stand alone type / Console type) The M.operation unit is used for operating the Master compass which is connected with. Some commands can not be operated with M.operation unit. (Refer to section 3.2.4)

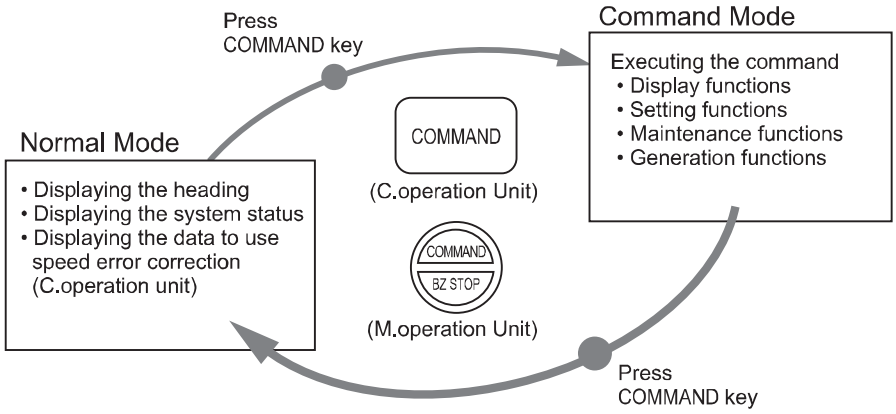


M.operation unit

The operation mode of operation unit

The operation units have two mode. The one mode is used for displaying the azimuth data and system status. This mode is named “Normal mode”.

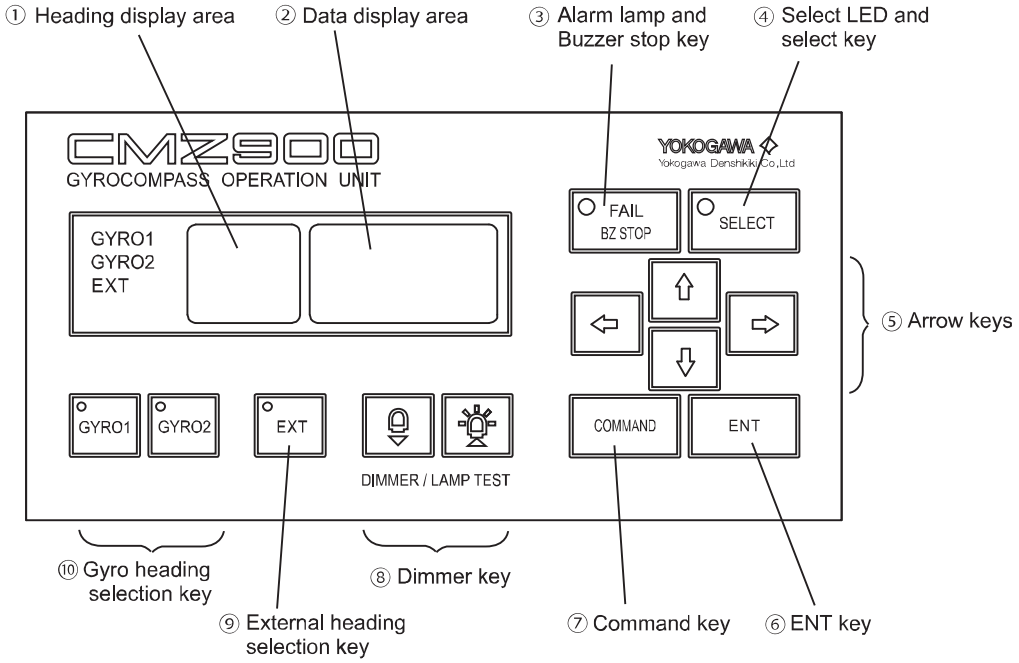
The other mode is used for displaying the detail information and setting the system. This mode is named “Command mode”.



3.2.1 The Name of Each Part of C.operation Unit and Its Functions

This section describes the name of each part of C.operation unit and its functions.

● The name of each part



● The function of each part

① **Heading display**

Displays a compass heading and system status.

② **Data display**

Indicates displays corresponding to menus and each command code.

③ **Alarm lamp and buzzer stop key**

Displays alarm statuses for the gyrocompass system.

If pressed when an alarm is generated, the alarm buzzer is stopped.

④ **Select LED and Select key**

Displays and selects the operating initiative (C.operation unit or M.operation unit). keep the key pressed for at least two seconds.

When LED is lit, this unit can be operated.

When LED goes off, M.operation unit can be operated.

⑤ **Arrow key**

Carry out selection of commands and data and switching of displays.

⑥ **ENT key**

Enters and sets commands and data.

⑦ **COMMAND key**

If pressed when in normal mode, the display switches from the data display to the MAIN MENU.

If pressed when the display is in access mode, the display returns to normal mode.

⑧ **Dimmer key**

Adjusts brightness of the displays of this unit.

In addition, if this key is pressed in combination with the ENT key, contrast of the LCD can be adjusted.

If both keys are simultaneously pressed, a lamp test is performed.

⑨ **External heading selection key**

Changes the output heading to that of the external heading (bow heading input from external heading sensor). Keep the key pressed for at least two seconds.

⑩ **Gyro heading selection key**

If GYRO1 key is pressed, the output heading is changed to the gyro heading (true heading of the Master compass). GYRO2 key is not used. Keep the key pressed for at least two seconds.

If key ④, ⑨ or ⑩ is to be operated, keep the key pressed for at least two seconds.

NOTE

The back-light of GYRO 2 gyro heading selection key is not lit on this system.

NOTE

The back-light of external heading selection key is not lit on system that the external-input is not available.

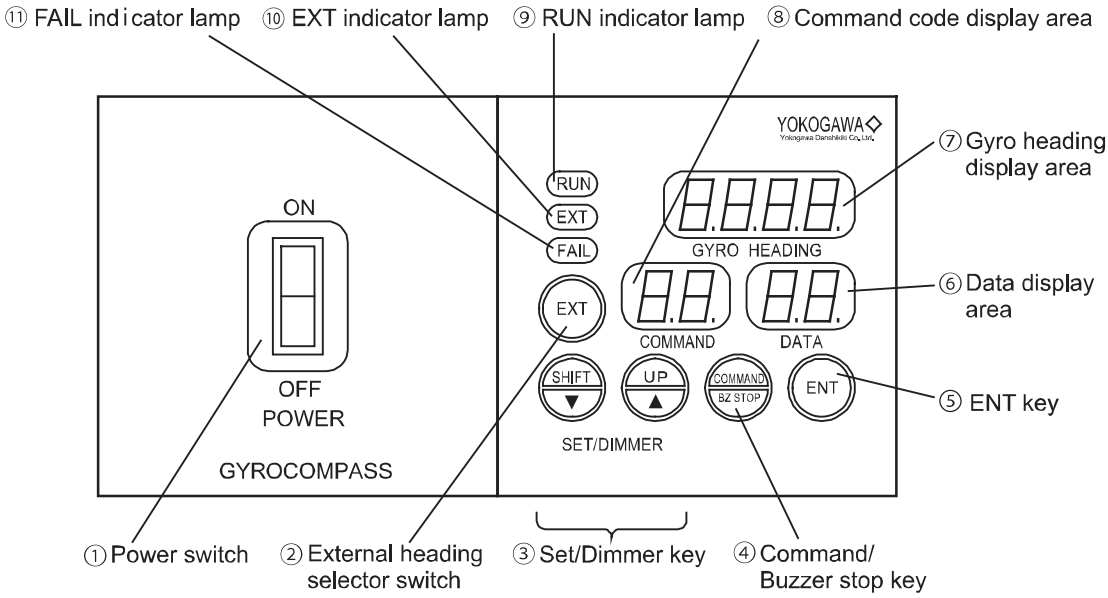
3.2.2 The Name of Each Part of M.operation unit and Its Functions

This section describes the name of each part of M.operation unit and its functions.

NOTE

If the C.operation unit is equipped and it has operation rights ,the M.operation unit can not be operated. To operate the M.operation unit, press the selection key on the C.operation unit and turn off the selection LED.

● The name of each part



● The function of each part

① Power switch

Turns on/off the power to the gyro system.

② External heading selector switch

If the switch is kept pressed for 2 seconds or more when in normal mode, the output heading (gyro heading/external heading) is selected.

When the C.operation unit is used, this switch isn't used.

③ Set/dimmer key

In normal mode these are dimmer keys that adjust the level of brightness of all displays on the M.operation unit. The displays can be darkened by pressing the ▼ key and brightened by pressing the ▲ key. Brightness can be adjusted in 32 steps.

If two keys are simultaneously pressed, a lamp test is performed.

If the key is pressed in command selection mode or command execution mode, data is input. Pressing the SHIFT key changes the input digit (blinks) while pressing the UP key changes the numeric value in the input digit.

④ **Command/buzzer stop key**

If this key is pressed in normal mode, the mode changes to the command selection mode, and if pressed in command selection mode or command execution mode, the mode returns to normal.

If pressed when an alarm is generated, the alarm buzzer and blinking of the FAIL indicator lamp stops.

⑤ **ENT key**

Enters an input value in command selection mode or command execution mode. To carry out operations with this key switch, keep it pressed for 2 seconds.

⑥ **Data display area**

Displays/sets data when a command is executed.

⑦ **Gyro heading display area**

Displays a compass heading.

⑧ **Command code display area**

Displays a command code.

⑨ **RUN indicator lamp**

Lights up when the power switch is turned “on.”

⑩ **EXT indicator lamp**

Goes out when the currently selected output heading is the gyro heading and lights up when the output heading is the external sensor heading.

⑪ **FAIL indicator lamp**

Blinks when an alarm is generated.

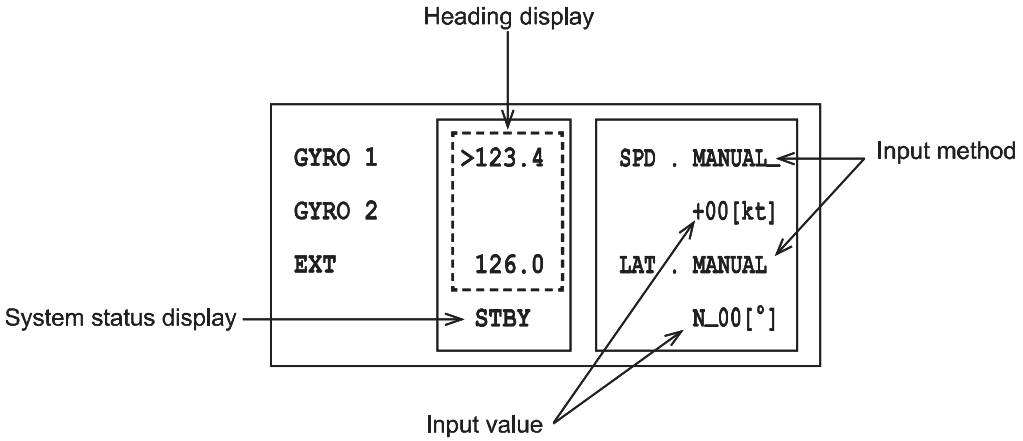
If the “BZ STOP” key is pressed, it lights up during an alarm and goes out when the alarm is restored to normal.

3.3 Display of Normal state

Displays of the operation unit at startup (normal state) will be described below.

■ Displays of the C.operation unit at normal state

The heading display indicates true headings of each heading sensor and system status, and the data display indicates input method and input value of ship's speed and ship's position (the figure on the right is an example of this display).



● Heading display

The true heading of the Master compass is displayed in the first line (GYRO 1) and the true heading of external heading sensor is displayed in the third line (EXT) of the heading display.

The display is blank for heading values not connected to this C.operation unit.

The true heading whose heading value is ineffective is displayed with "- - - . - ". (i.e. signal input error.)

For the heading sensor that is selected, ">" is displayed immediately before the true heading.

To switch to another heading sensor, press the external heading selector key or the gyro heading selector key (cannot be selected to an unconnected compass).

● System status display

The gyro system status is displayed in the bottom line of the heading display. The system status at normal running is not shown and the display is blank.

System Status

STBY	Displayed when the Master compass is in stand-by status.
HDG FLT	Displayed when there is a failure with the heading sensor that is selected.
PWR FLT	Displayed when there is a failure of the AC power supply to the system equipped with the DC backup system. **This indication is held even if an AC power supply recovers. Indication disappears when a COMMAND key is pushed.**
C/O PRF	Displayed when the changeover operation is not permitted.
MUTE	Displayed when the mute function of alarm sound is enable.

Input method

There are displayed the method of input for speed and latitude.

MANUAL	The value is set manually.
AUTO	The value is input from external sensor.

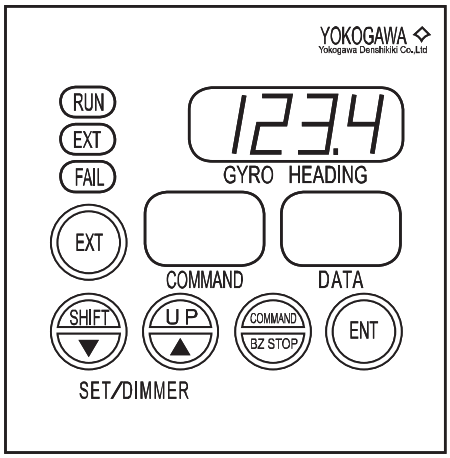
Input value

The values to correct the speed error is displayed.

Displays of the M.operation unit at normal mode

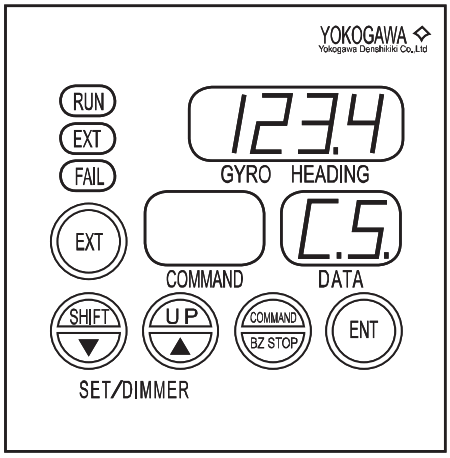
Heading display

The gyro heading display shows a compass heading, indications in the command and data displays disappear.



System status display

During standby the gyro heading dispaly indicates the compass heading when the power was last turned off , and the data display indicates “C.S.” .



3.4 Command Mode

This section describes the functions which are achieved in command mode and the procedures to execute.

3.4.1 The Classification of Command Functions

The command functions are classified into following four types.

- **The displaying function**

  The displaying function is used for displaying various information.

- **The setting function**

  The setting function is used for setting and adjusting to using the gyrocompass properly.

- **The maintenance function**

  The maintenance function is used for maintaining and operation verification when the system is rigged or regular inspection. This function is not used for normally. The system will request to input password when this function is used.

- **The generation function**

  The generation function is used for setting to connect external units.

  This function is not used for normally. The system will request to input password when this function is used.

See chapter 4 for the operation procedure of each functions.

Column:
Each functions are assigned individual command code. The command function is a generic name of the function that can be achieved by operating these command codes.

3.4.2 Command Code List

This section shows the list of command codes assigned for each function.
Some functions can not be operated when gyrocompass is standing by.
See chapter 4 for the operation procedure of each functions.

NOTE

Some commands can not be operated with M.operation unit.
Refer to the following table for the executable commands on the M.operation unit.

● Command code list

Clas-sifi-cation	Command code	Operation unit		Function item	Execu-tion during standby	Page
		C	M			
Display Function		○	○	Compass heading display	○	3-11
		○	–	True heading and system status display		
	10	○	–	True heading and value of speed error correction display	○	4-2
	11	○	–	Heading deviation display	○	4-3
	12	○	–	Turn rate display	○	4-4
	13	○	○	Gyro sphere running time display	○	4-5
		○	–	Total running time and the time after startup display		
	14	○	–	Dimmer rank display	○	4-6
	15	○	○	Gyro-sphere phase current display	○	4-7
	16	○	○	Backup battery voltage display	○	4-8
	17	○	○	Deviation voltage display	○	4-9
	19	○	○	Software version number display	○	4-10
Setting Function	20	○	–	External heading input selection	○	4-14
	21	○	○	Speed setting for speed error correction	○	4-15
	22	○	○	Latitude setting for speed error correction	○	4-16
	23	○	○	Automatic alignment of Master compass	×	4-17
	24	○	○	Manual alignment of Master compass	×	4-19
	25	○	○	Setting the Master compass follow-up gain	○	4-21
	26	○	○	Displaying/resetting cause of Master compass alarm	○	4-22
	27	○	–	Displaying/resetting cause of C.operation unit alarm	○	4-23
	28	○	–	Deviation alarm setting	○	4-24
	29	○	○	Startup timer setting	○	4-25

Clas-sifi-cation	Command code	Operation unit		Function item	Execu-tion during standby	Page
		C	M			
Maintenance Function	30	○	○	Permission for maintenance function	○	4-33
	31	○	○	Outputting simulated DAC signals	×	4-34
	32	○	○	Manual drive of Master compass	○	4-36
	33	○	○	Manual drive of Repeater compass	○	4-37
	34	○	○	Resetting gyrosphere running time	○	4-38
	35	○	○	Resetting log	○	4-39
	36	○	○	Initialization of backup memory	○	4-40
	37	○	○	Correcting Master compass installation error	○	4-41
	39	○	○	Log display	○	4-43
Generation Function	40	○	○	Permission for generation function	○	4-53
	41	○	○	Setting the follow-up speed for stepper signal	○	4-54
	42	○	–	Setting communication protocol of output port	○	4-55
	43	○	–	Setting format of output port	○	4-56
	45	○	–	Setting format of input port	○	4-62
	49	○	–	Miscellaneous functions	○	4-66

○ : Means that execution is permitted
× : Means that execution is not permitted
– : Means that the function is not Implemented.

3.4.3 Operation in the Command Mode

To execute the commands shift to “Command Mode”. This section describes about “Command Mode”.

■ Operation on C.operation unit

Press the command key to shift the “Command Mode”. After then an menu appears on the data display area. The commands are executed by selecting the menu item.

Press the command key to return to the Normal Mode from the Command Mode.

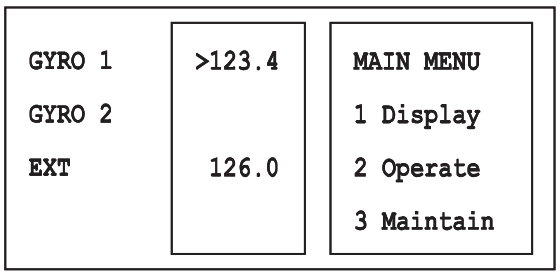
● Accessing Menus

(1) Rough classification menu

If the command key is pressed when in normal mode, the MAIN MENU appears in the data display (the figure on the right).

The item that is selected blinks. (The blinking part is called the cursor.)

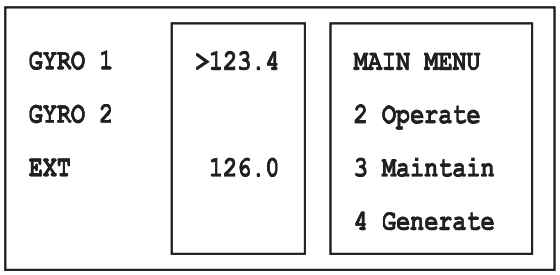
Select an item by moving the position of the cursor with the up and down arrow keys.



If the down arrow key is pressed when the cursor resides in the bottom line, the displayed menu shows the next page.

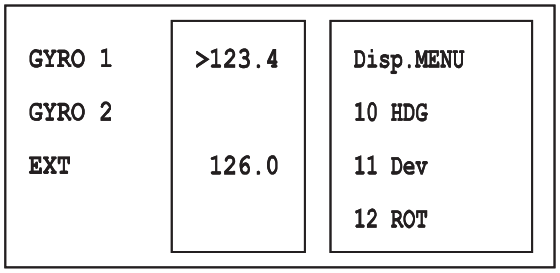
If the up arrow key is pressed when the cursor resides in the top line, the displayed menu shows the preceding page.

To return to normal mode from the display thus accessed, press the COMMAND key.

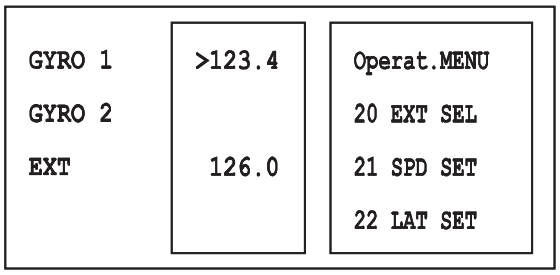


(2) Medium classification menu

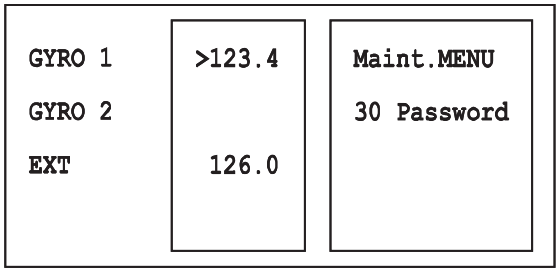
Select “1 Display” from the MAIN MENU and press the ENT key. The MAIN MENU switches to the Disp.MENU (as shown in the figure on the right).



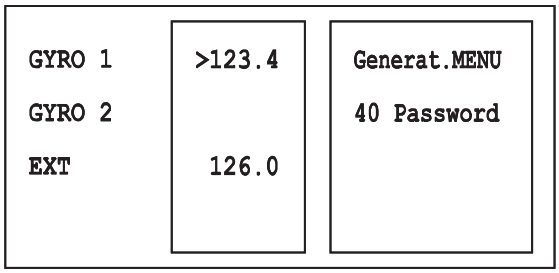
Select “2 Operate” from the MAIN MENU and press the ENT key. The MAIN MENU switches to the Operat.MENU (as shown in the figure on the right).



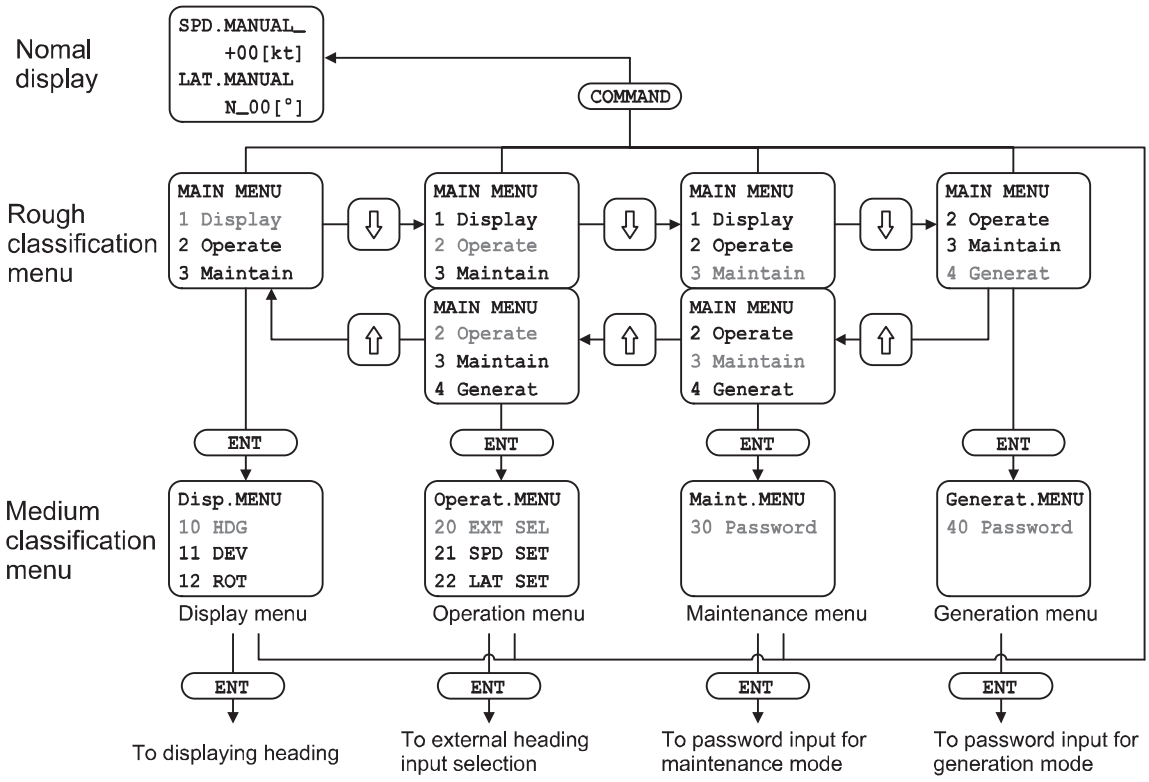
Select “3 Maintain” from the MAIN MENU and press the ENT key. The MAIN MENU switches to the Maint.MENU (as shown in the figure on the right).



Select “4 Generate” from the MAIN MENU and press the ENT key. The MAIN MENU switches to the Generat.MENU (as shown in the figure on the right).



Flow of accessing menus



Operation on M.operation unit

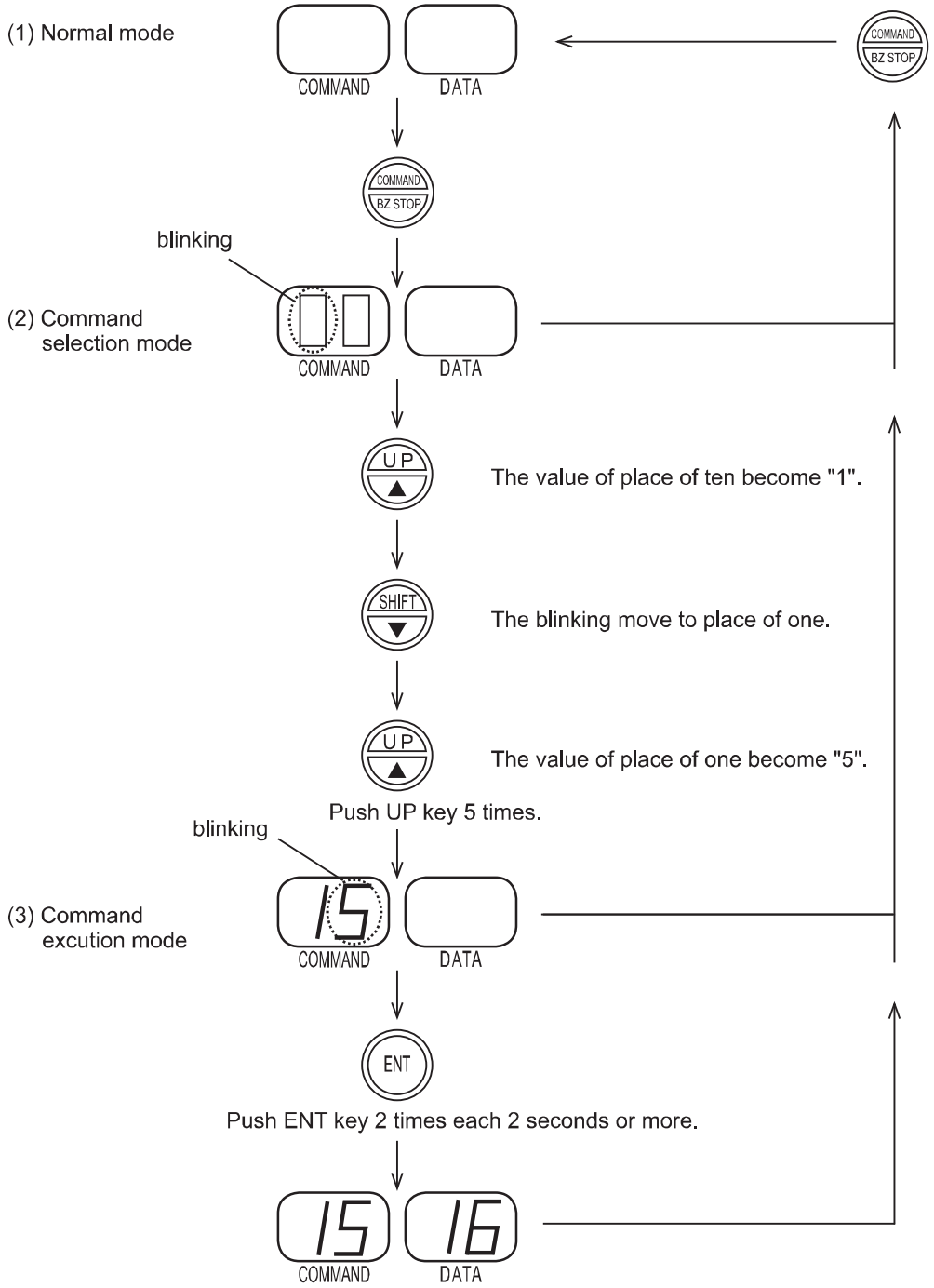
This paragraph describes the operation procedures on the M.operation unit.

Press the command key to shift the “Command Mode”.

Press the command key to return to the Normal Mode from the Command Mode.

Operation flow

Press the command key to shift the “Command Mode”. After then the code number “00” appears and blinks on the command code display area. Input the command code for executing the command. Press the ENT key 2 times each 2 seconds or more for command decision. (If command code number is less than 20, press ENT key 1 time.)



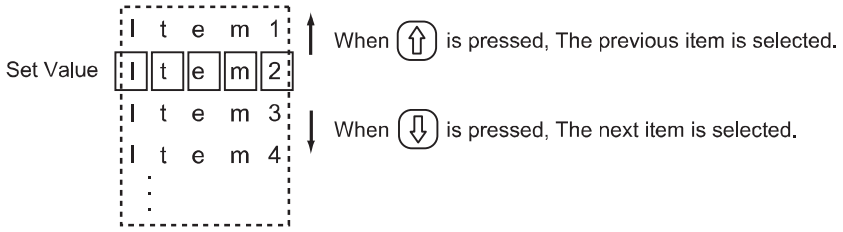
3.4.4 The Procedure for Changing the Value

This section describes the procedure for changing the set value.

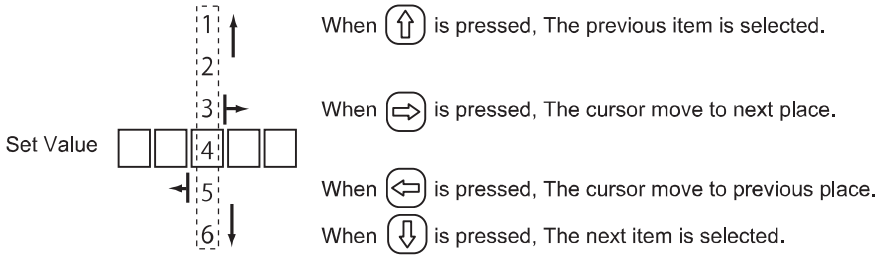
The procedure on C.operation unit

The set value is changed using arrow keys on the C.operation unit. The set value is fixed by pressing ENT key.

The item selection operation



The setting value input operation

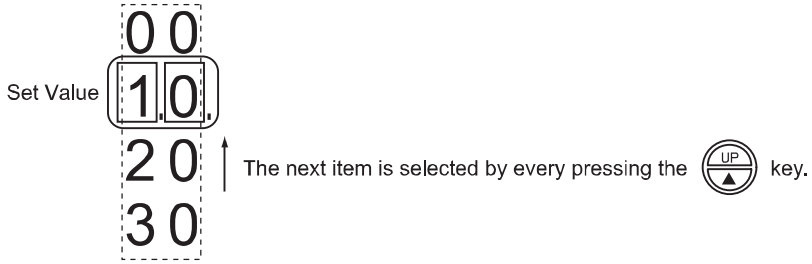


It is same procedure to input alphabet.

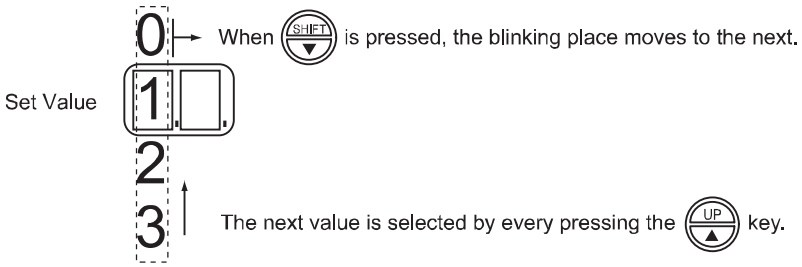
The procedure on M.operation unit

The set value is changed using SHIFT and UP keys on the M.operation unit. The set value is fixed by pressing ENT key.

The item selection operation



The setting value input operation



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4. Operation for the Command Functions

This chapter describes the operation , the adjusting and the setting methods of gyrocompass which are executed by using the command functions.

Refer to the chapter 3 for the procedure of executing the command function. And execute these operation with enough understanding.

4.1 Display Functions

This section describes how to display various information.

The following 9 items can be displayed.

Command Code	Operation Unit		Function Item	Execution during Standby	Page
	C	M			
	○	○	Compass heading display	○	3-10
	○	–	True heading and system status display		
10	○	–	True heading and value of speed error correction display	○	4-2
11	○	–	Heading deviation display	○	4-3
12	○	–	Turn rate display	○	4-4
13	○	○	Gyro sphere running time display	○	4-5
	○	–	Total running time and the time after startup display		
14	○	–	Dimmer rank display	○	4-6
15	○	○	Gyro-sphere phase current display	○	4-7
16	○	○	Backup battery voltage display	○	4-8
17	○	○	Deviation voltage display	○	4-9
19	○	○	Software version number display	○	4-10

Each functions are executed by operating of the C.operation unit or the M.operation unit.

See the section 3.2 for the operation unit.

See the section 3.4 for the command function.

See the section 3.5 for the command mode and the value input method.

4.1.1 Displaying Heading

COMMAND CODE :10

This function displays the true heading , the compass heading, and the value of speed error correction .

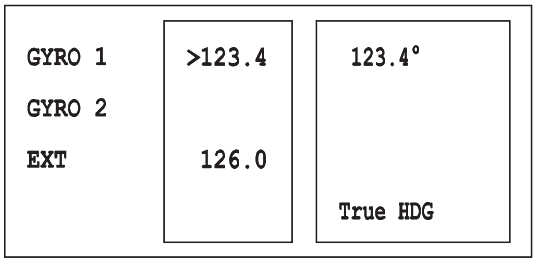
■ Operation with The C.operation Unit

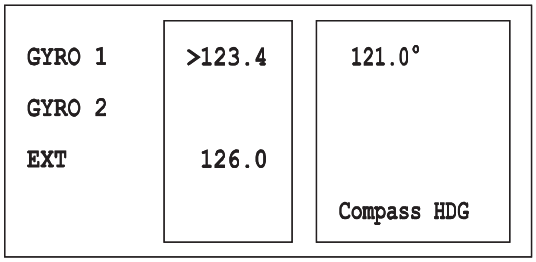
Selecting “10 HDG” from the Disp. MENU and pressing the ENT key switches to the display showing the heading.

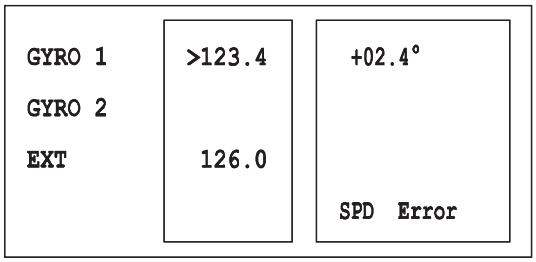
Pressing the right and left arrow keys switches the display between true heading, compass heading and the value of speed error correction.

The upper, middle and lower figure on the right is an example of displaying the true heading (True HDG), compass heading (Compass HDG) and the value of speed error correction (SPD Error).

If the command key is pressed, the screen returns to normal mode.





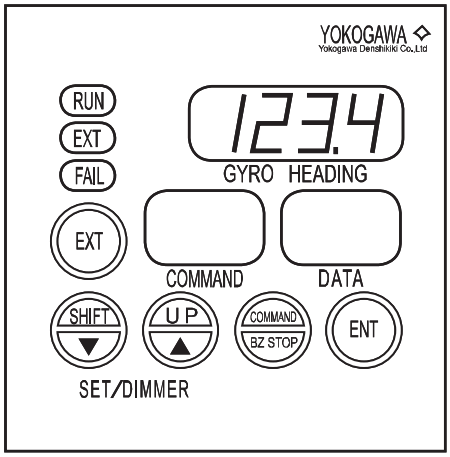


■ Operation with The M.operation unit

NOTE

It is not possible to execute this function with the M.operation unit.

The M.operation unit displays a compass heading at normal mode.



4.1.2 Displaying Heading Deviation

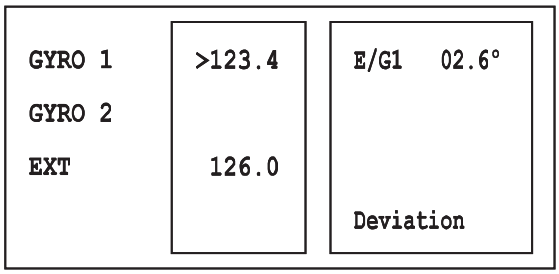
COMMAND CODE : 11

This function displays the heading deviation between gyrocompass heading and external heading. The unit of display is degree(s).

■ Operation with The C.operation Unit

Selecting “11 Dev” from the Disp.MENU and pressing the ENT key switches to the display showing the heading deviation.

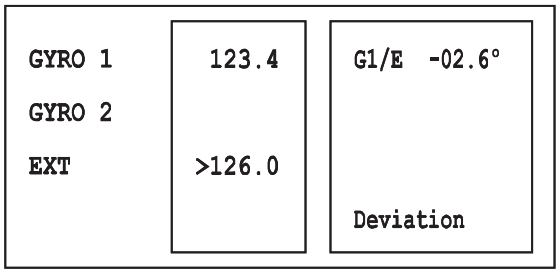
Deviation values of each heading sensor based on the heading currently being output are displayed.



The upper figure on the right shows an example of displaying the heading deviation of the external heading sensor based on the gyro heading.

(Heading deviation) =

(External heading) - (Gyro heading)



The lower figure on the right shows an example of displaying the heading deviation of the gyro-heading sensor based on the external heading.

(Heading deviation) =

(Gyro heading) - (External heading)

If the command key is pressed, the screen returns to normal mode.

NOTE

If an external heading is not input to the gyrocompass , the deviation is not displayed.

■ Operation with the M.operation unit

NOTE

It is not possible to execute this function with the M.operation unit.

4.1.3 Displaying Rate of Turn

COMMAND CODE : 12

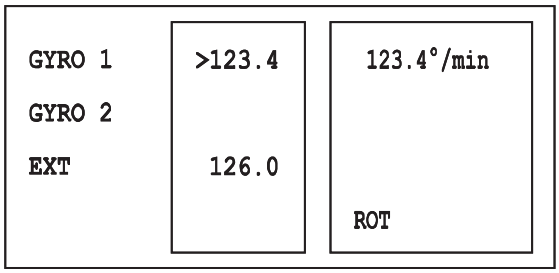
This function displays the Rate of Turn. There are two kinds of units of display. One is “degree(s)/second”, the other hand is “degree(s)/minute”.

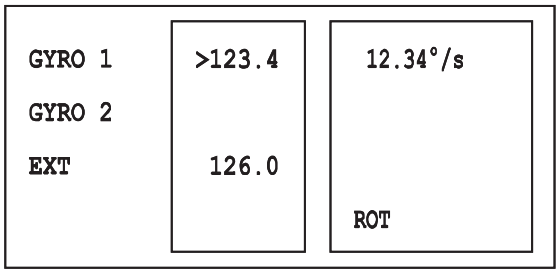
■ Operation with the C.Operation unit

Selecting “12 ROT” from the Disp. MENU and pressing the ENT key switches to the display showing the rate of turn.

If the right and left arrow keys are pressed, the display for rate of turn units can be changed from degrees/minute to degrees/second.

The upper figure on the right shows an example of displaying a rate of turn in degrees/minute and the lower figure on the right, an example of displaying a rate of turn in degrees/second.





■ Operation with the M.operation unit

NOTE

It is not possible to execute this function with the M.operation unit.

4.1.4 Displaying Running Time

COMMAND CODE : 13

This function displays the total running time of Master compass, the running time of gyrosphere and the running time after startup.

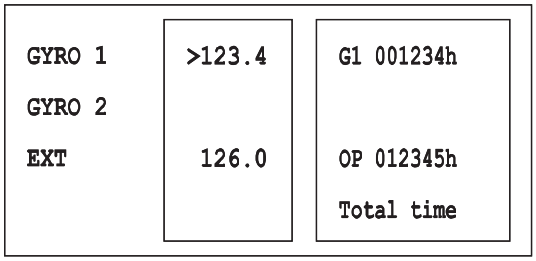
Operation with the C.operation unit

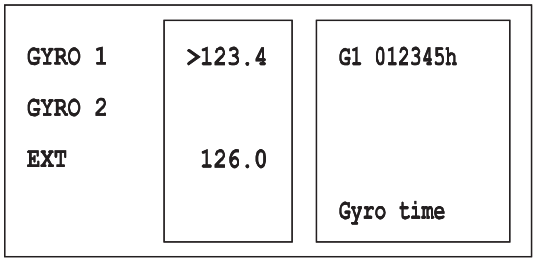
Selecting “13 Run Time” from the Disp.MENU and pressing the ENT key switches to the display showing the running time.

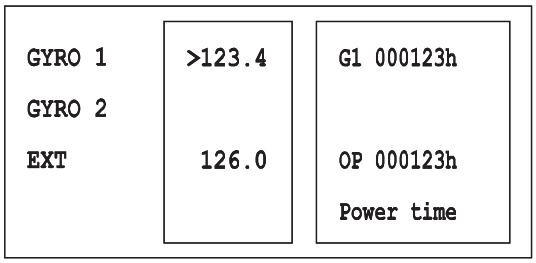
The first line (G1) indicates the Master compass running time and the third line (OP) the C.operation unit running time.

If the right and left arrow keys are pressed, the display can be switched between the total running time, gyrosphere running time, and time after startup.

The upper, middle and lower figures on the right show examples of displaying total running time (Total time), gyrosphere running time (Gyro time) and the time after startup (Power time) respectively.







Operation with the M.operation unit

NOTE

The M.operation unit displays the gyrosphere-running-time only .

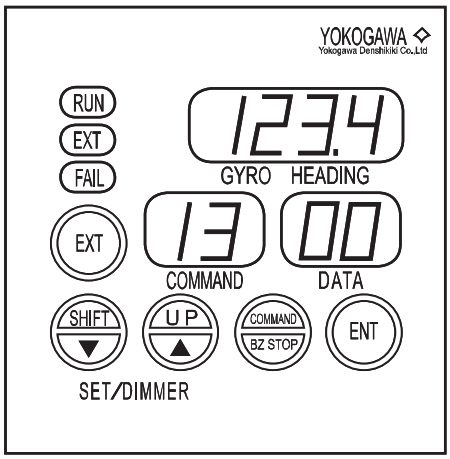
Running hours of the current gyrosphere is displayed (from 000000 to 999999 hours).

If the command code “13” is executed, the upper two digits of the six digits of the gyrosphere running time are displayed in the data display.

If the SHIFT key is pressed, the middle two digits of the six digits are displayed, and if the SHIFT key is pressed once more the lower two digits of the six digits with a decimal point after the least significant digit are displayed.

If for example, the running time of the gyrosphere is 1952 hours, the digits “00” → “19” → “52.” will be displayed.

If the COMMAND key is pressed, the mode returns to normal.



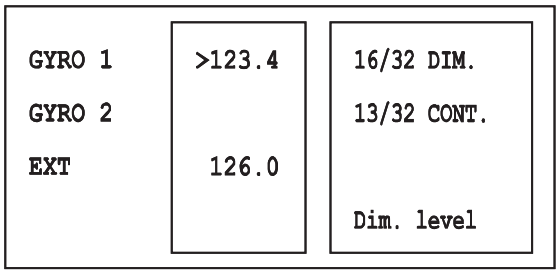
4.1.5 Dimmer and Contrast Rank Display and Adjust

COMMAND CODE : 14

This function displays dimmer rank and contrast rank on the C.operation unit.

■ Operation with the C.operation unit

Selecting “14 Dim.level” from the Disp.MENU and pressing the ENT key switches to the display showing the dimmer rank (as shown in the figure on the right).



● adjusting the value

The dimmer rank is adjusted by operating the DIMMER key.

The contrast rank is adjusted by operating the DIMMER key while pressing the ENT key.

To increase the brightness and contrast, press  key.

To decrease the brightness and contrast, press  key.

■ Operation with the M.operation unit

NOTE

M.operation unit does not display the dimmer rank.

● adjusting the value

The dimmer rank is adjusted by operating the SET/DIMMER key. To increase the brightness, press ▲ key. To decrease the brightness , press ▼ key.

4.1.6 Displaying Gyrosphere Phase Current

COMMAND CODE : 15

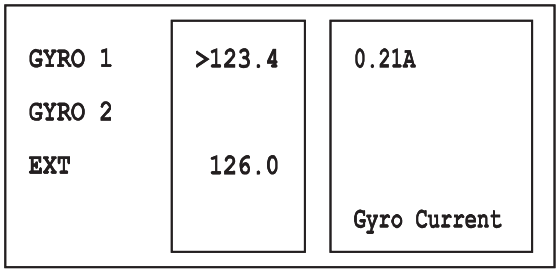
This function displays the gyro sphere's phase current (gyro sphere's driving current). This value is useful for estimating the gyro sphere's state.

The normal value is in the range from 0.15 A to 0.35 A.

■ Operation with the C.operation unit

Selecting "15 G.Current" from the Disp.MENU and pressing the ENT key switches to the display showing the gyro-sphere phase current (as shown in the figure on the right).

The normal value is in the range from 0.15 A to 0.35 A.



■ Operation with the M.operation unit

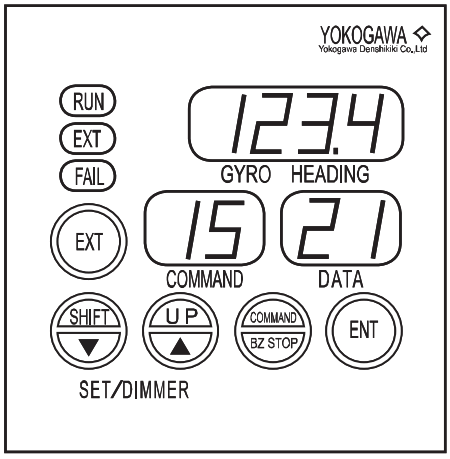
The gyrosphere phase current (current for driving the gyrosphere) is displayed (0.00 to 0.99 A).

Normal value : from 0.15 A to 0.35 A.

If the command code "15" is executed, two decimal places of the gyrosphere phase current are displayed in the data display.

The figure to the right shows an example of 0.21A of the gyrosphere phase current.

If the COMMAND key is pressed, the mode returns to normal.



4.1.7 Displaying Backup Battery Voltage

COMMAND CODE : 16

This function displays battery voltage of being used for backup memory.

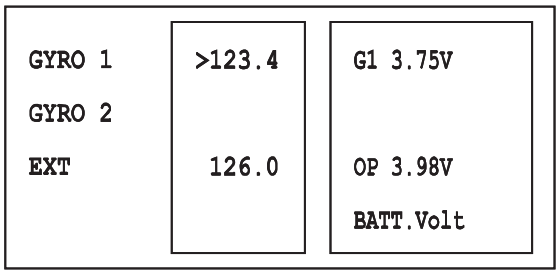
If this command is executed with the C.operation unit, the unit displays battery voltage of the C.operation unit and the Master compass.

If this command is executed with the M.operation unit, the unit displays battery voltage of the Master compass.

The normal value is in the range from 2.5 V to 4.0 V.

Operation with the C.operation unit

Selecting “16 BT.Volt” from the Disp.MENU and pressing the ENT key switches to the display showing the backup battery voltage (as shown in the figure on the right).



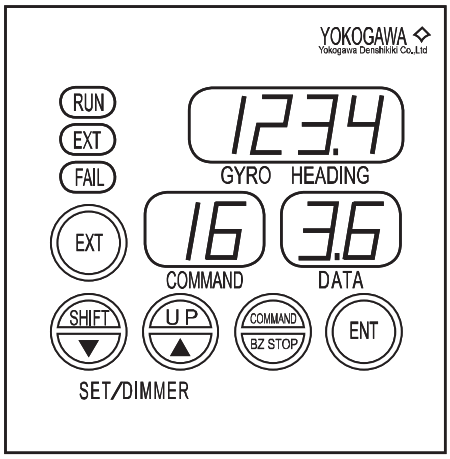
Operation with the M.operation unit

The voltage of the battery for backup memory is displayed (from 0.0 to 9.9 V).

If the command code “16” is executed, the backup battery voltage is displayed in the data display.

The figure to the right shows an example of 3.6 V for the voltage of the backup battery.

If the COMMAND key is pressed, the mode returns to normal.



4.1.8 Displaying Deviation Voltage

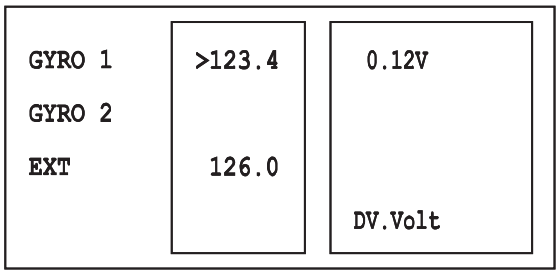
COMMAND CODE : 17

This function displays deviation voltage of used Master compass.

The normal value is in the range from -0.4 V to 0.4 V.

■ Operation with the C.operation unit

Selecting “17 DV.Volt” from the Disp.MENU and pressing the ENT key switches to the display showing the deviation voltage (as shown in the figure on the right).



■ Operation with the M.operation unit

NOTE

It is not possible to execute this function with the M.operation unit.

4.1.9 Displaying Software Version Number

COMMAND CODE : 19

This function displays software version number.

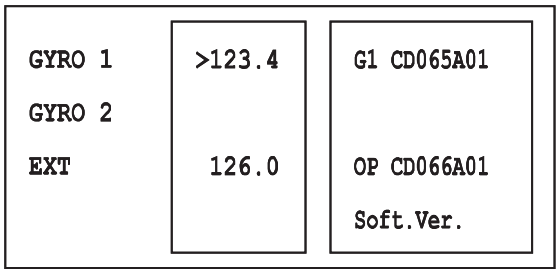
If this command is executed with the C.operation unit, the unit displays the version of the C.operation unit and the Master compass.

If this command is executed with the M.operation unit, the unit displays version of the Master compass.

Operation with the C.operation unit

Selecting “19 ROM ID” from the Disp.MENU and pressing the ENT key switches to the display showing the software version number (as shown in the figure on the right).

If the command key is pressed, the screen returns to normal mode.



Operation with the M.operation unit

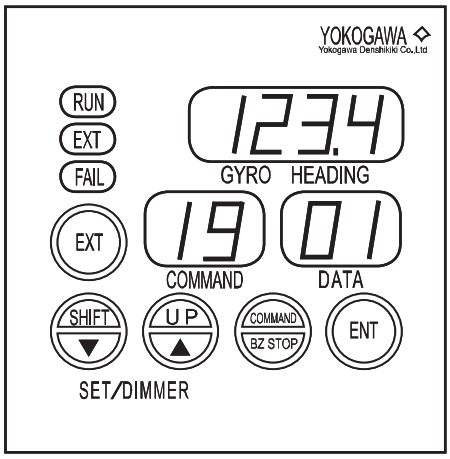
The software version number of master compass is shown by major version (alphabet) and minor version (numerical value).

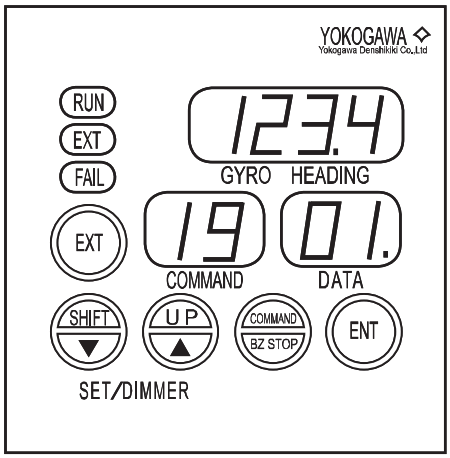
The major version is shown by numerical value at M.operation unit. The version "A" is shown as '01'. The minor version is shown by numerical value of two digits.

When command 19 is executed, the major version is displayed. The minor version is displayed by pressing shift key. The decimal point is displayed in displaying the minor version.

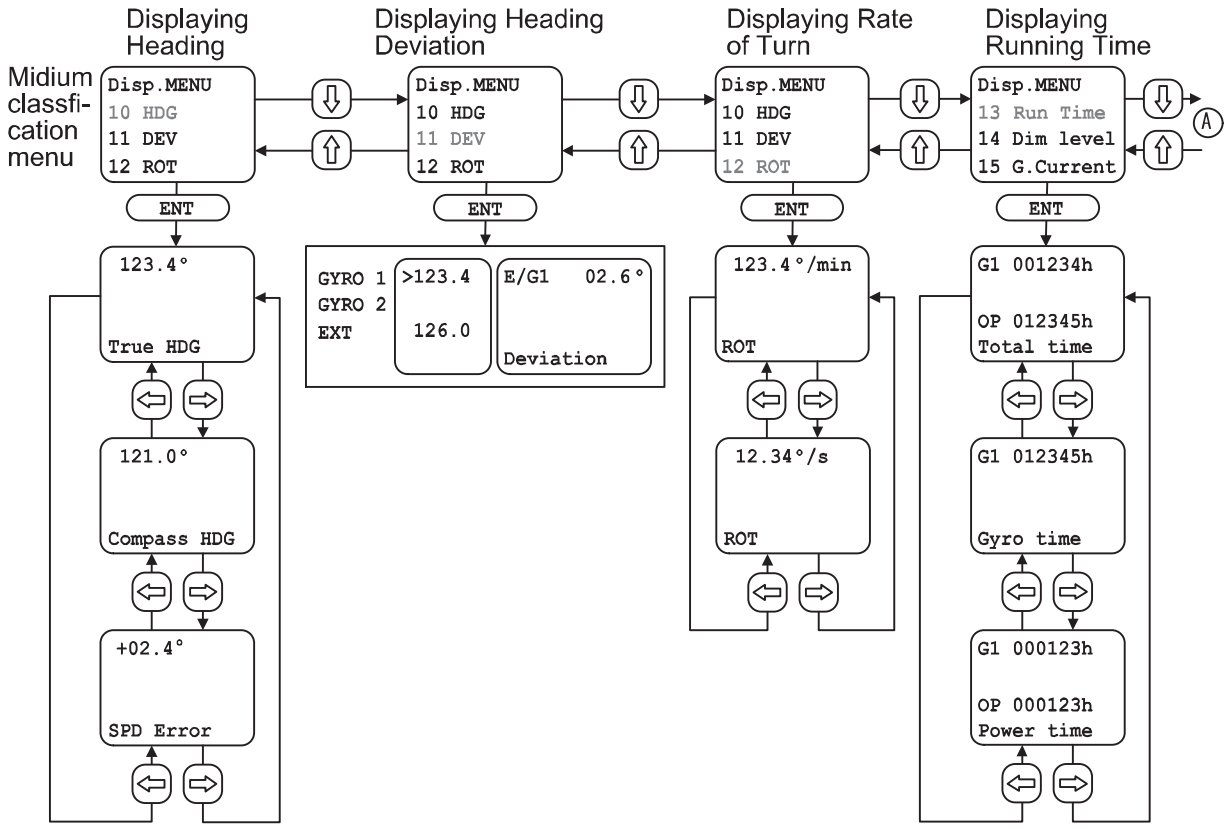
The display is switched by pressing the shift key.

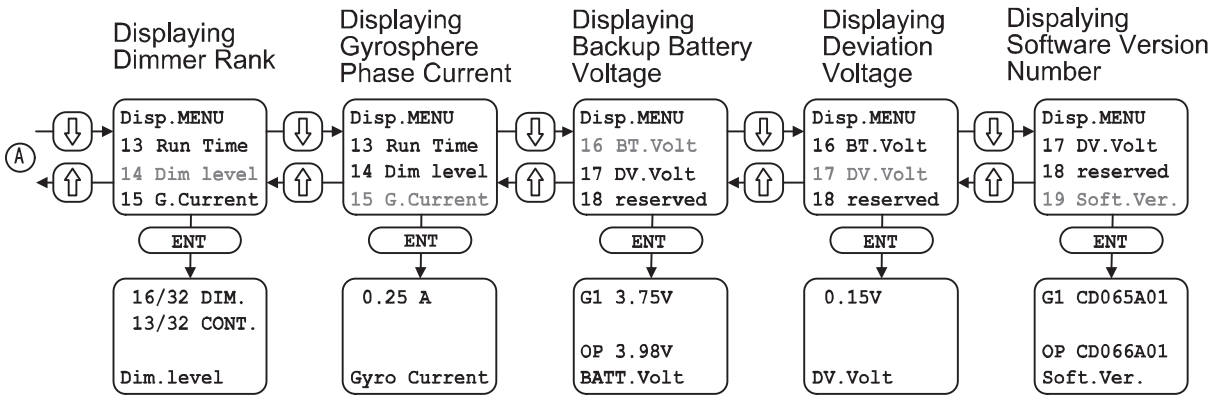
The figure on the right shows an example of displaying software version number “A01”.





The operation flow diagram of the display function (C.operation unit)



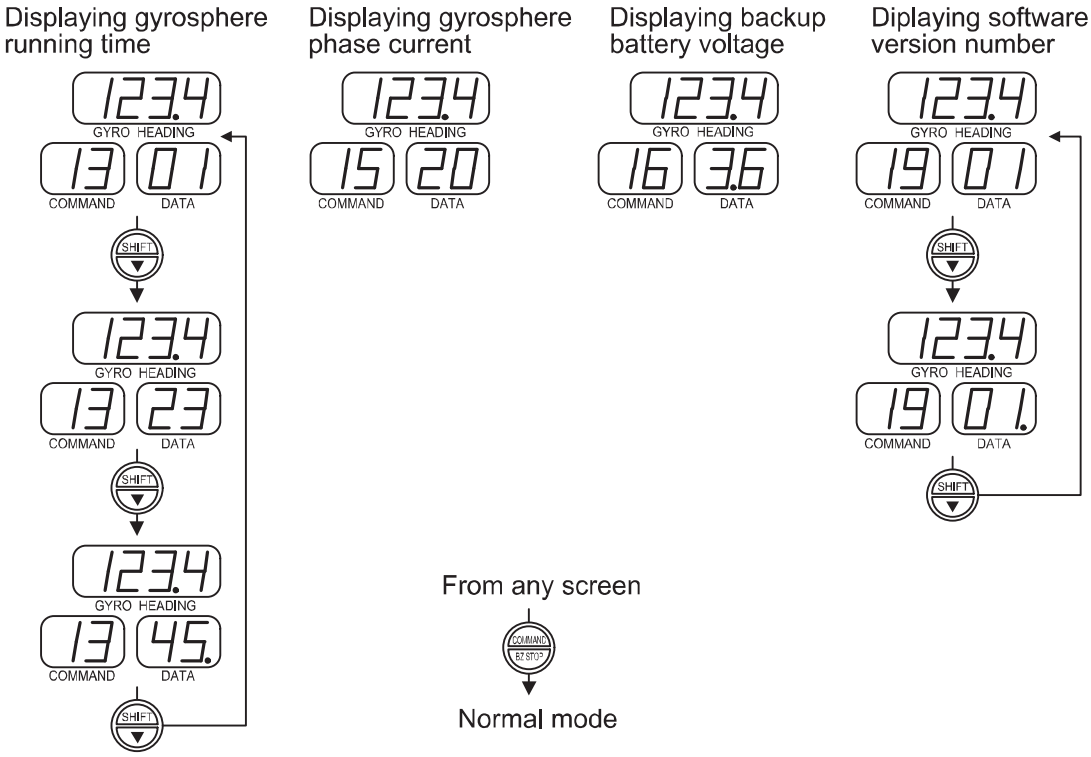


From any screen

COMMAND

Normal mode

The operation flow diagram of the display function (M.operation unit)



4.2 Setting Functions

The setting function is used for setting and adjusting to using the gyrocompass properly.

The maintenance functions include the following:

Command Code	Operation Unit		Function Item	Execution during Standby	Page
	C	M			
20	○	–	External heading input selection	○	4-14
21	○	○	Speed setting for speed error correction	○	4-15
22	○	○	Latitude setting for speed error correction	○	4-16
23	○	○	Automatic alignment of Master compass	×	4-17
24	○	○	Manual alignment of Master compass	×	4-19
25	○	○	Setting the Master compass follow-up gain	○	4-21
26	○	○	Displaying/resetting cause of Master compass alarm	○	4-22
27	○	–	Displaying/resetting cause of C.operation unit alarm	○	4-23
28	○	–	Deviation alarm setting	○	4-24
29	○	○	Startup timer setting	○	4-25

Each functions are executed by operation of the C.operation unit or the M.operation unit.

See the section 3.2 for the operation unit

See the section 3.4 for the command function.

See the section 3.5 for the comand mode and the value input method.

4.2.1 External Heading Input Selection

COMMAND CODE : 20

C.operation unit has 3 input ports for the serial signal and all port can be connected the heading sensors. This COMMAND executes the status display of each port and the selection of external heading sensor that display as EXT.

The example of connected external heading sensor and the selecting procedure are as follows.

☐ The example of connected external heading sensor

Port 1 : Magnetic compass (TMC unit)

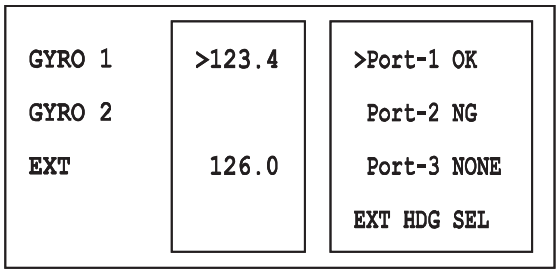
Port 2 : Transmitting heading device

Port 3 : disconnected

■ Operation with the C.operation unit

Selecting “20 EXT SEL” from the Operat. MENU and pressing the ENT key switches to the display showing the external heading input selection.

External heading input information for external heading input ports 1 to 3 is displayed (as shown in the figure on the right).



External heading input information

NONE	Without external heading input setting
OK	With external heading input setting; External heading input information is being normally input.
NG	With external heading input setting; External heading input information failure is being generated.

For the port used as the external heading, “>” is displayed immediately before “Port-.”

In order to change input ports, move the “>” to the targeted port by pressing the up or down arrow key and press the ENT key. The display blinks, signaling the need to validate the change.

If the ENT key is pressed again, blinking stops and the input port is changed. However, the port cannot be changed without setting the external heading input.

■ Operation with the M.operation unit

NOTE

It is not possible to execute this function with the M.operation unit.

4.2.2 Speed Setting for Speed Error Correction

COMMAND CODE : 21

This is a function to setting the ship's speed for correcting speed-error.

Determine the true heading by calculation the value for speed-error-correction from the values of speed and latitude.

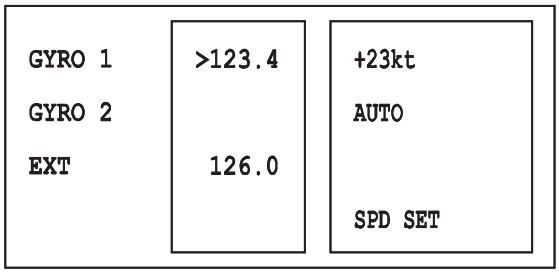
True heading (deg) = (compass heading) – (Value of speed-error-correction)

$$\text{Value of speed-error-correction (deg)} = \frac{\text{Ship's speed [kt]}}{5\pi} \times \frac{\cos(\text{Compass heading})}{\cos(\text{Latitude})}$$

Operation with the C.operation unit

Selecting "21 SPD SET" from the Operat.MENU and pressing the ENT key switches to the display showing speed-error correction speed input.

The figure on the right shows an example of displaying ship's speed of 23 knots (kt) with automatic input.



To select automatic or manual input, press the ENT key. Both AUTO and MANUAL blink. Then, with the up or down key select either AUTO or MANUAL and press the ENT key.

If AUTO is selected, the automatic ship's speed input becomes valid.

If MANUAL is selected, the tens digit of the ship's speed blinks, allowing for a value between 00 to 99 kt to be entered for the ship's speed by manual.

Press the right or left arrow key to change the place of input and press the up or down arrow key to change the numeric value.

After entering ship's speed press the ENT key. The input value blinks, signaling the need to validate the change. If the ENT key is pressed again, blinking stops and the input value is changed.

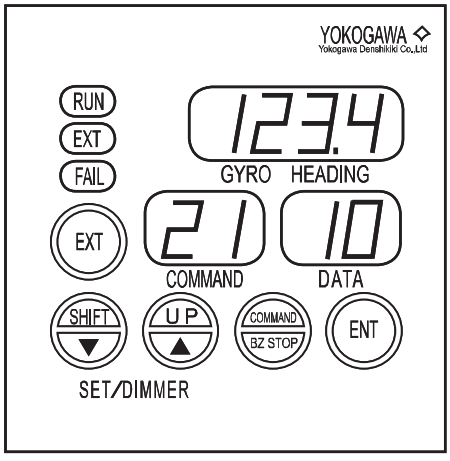
Operation with the M.operation unit

If the command code "21" is executed, the current speed is displayed in the data display and its tens digit (digit to be entered) blinks.

Press the shift key to change the digit and then change the numeric value of the digit by pressing the UP key to enter a new speed (from 00 to 99 kt). The figure to the right shows an example of entering the speed 10 kt.

After entering the speed, the entered value blinks if the ENT key is kept pressed for 2 seconds to enable the operator to confirm the value. If the ENT key is pressed for another 2 seconds, the entered value is displayed continuously and is set as the final value.

If the COMMAND key is pressed, the mode returns to normal.



4.2.3 Latitude Setting for Speed Error Correction

COMMAND CODE : 22

This is a function to setting the ship's latitude for correcting speed-error.

Determine the true heading by calculation the value for speed-error-correction from the values of speed and latitude.

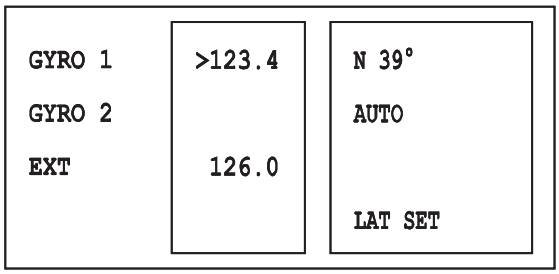
True heading (deg) = (compass heading) – (Value of speed-error-correction)

$$\text{Value of speed-error-correction (deg)} = \frac{\text{Ship's speed [kt]}}{5\pi} \times \frac{\cos(\text{Compass heading})}{\cos(\text{Latitude})}$$

Operation with the C.operation unit

Selecting "22 LAT SET" from the Operat.MENU and pressing the ENT key switches to the display showing the speed-error correcting latitude input.

The figure on the right shows an example of displaying the latitude of 39 °N.



To select automatic or manual input, press the ENT key. Both AUTO and MANUAL blink. Then, with the up or down key select either AUTO or MANUAL and press the ENT key.

If AUTO is selected, the automatic latitude input becomes valid.

If MANUAL is selected, the character N or S blinks allowing for a value between 00 to 70 degrees N or S to be entered for the ship's latitude by manual.

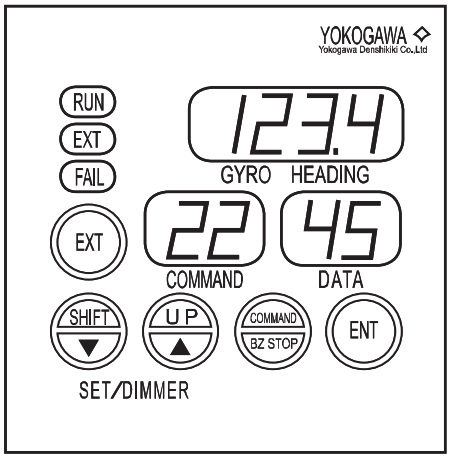
Press the right or left arrow key to change the place of input and press the up or down arrow key to change the numeric value.

After entering the latitude press the ENT key. The input value blinks, signaling the need to validate the change. If the ENT key is pressed again, blinking stops and the input value is changed.

Operation with the M.operation unit

If the command code "22" is executed, the current latitude is displayed in the data display and its tens digit (digit to be entered) blinks. If the latitude displayed is south, a decimal point is displayed after the least significant digit. For example, with a latitude of 16° S, "16." is displayed.

To change the digit, press the SHIFT key and then change the numeric value of the digit by pressing the UP key to enter a latitude (from 00 N or S to 70 N or S). The figure to the right shows an example of entering 45° N.



After a value for the latitude has been entered, the entered value blinks if the ENT key is kept pressed for 2 seconds to enable the operator to confirm the value. If the ENT key is pressed for another 2 seconds, the entered value is displayed continuously and is set as the final value.

If the COMMAND key is pressed, the mode returns to normal.

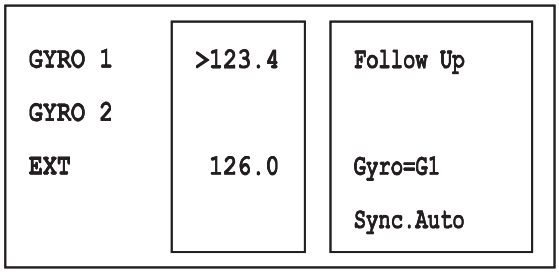
4.2.4 Automatic Alignment of Master Compass

COMMAND CODE : 23

This is a function to align the azimuth of the container and the compass heading by detecting the zero point of the gyrocompass system again.

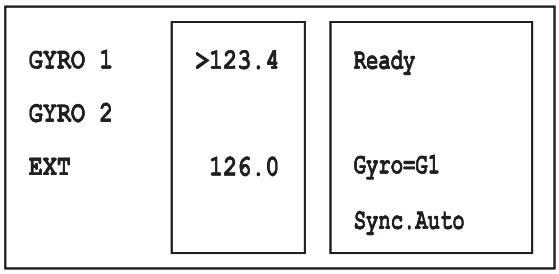
Operation with the C.operation unit

Selecting “23 Sync.Auto” from the Operat. MENU and pressing the ENT key switches the display showing automatic Master compass alignment (as shown in the figure on the right).

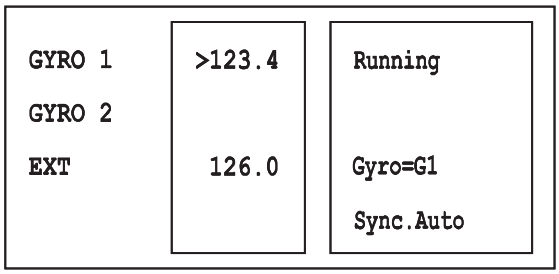


“Follow Up” is displayed, signifying that the Master compass is following up the gyrosphere.

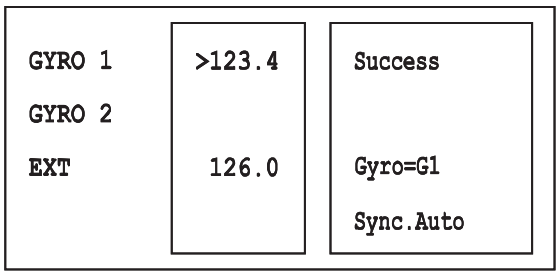
If the ENT key is pressed when in this state, the “Ready” display appears showing standby for automatic alignment.



If the ENT key is again pressed, the “Running” display appears showing that automatic alignment is being carried out. (The Master compass starts automatic alignment.)



If automatic alignment finishes normally, the “Success” display appears. However if it finishes due to a failure, the “Error” display appears. If a failure occurs, execute Master compass alignment manually.



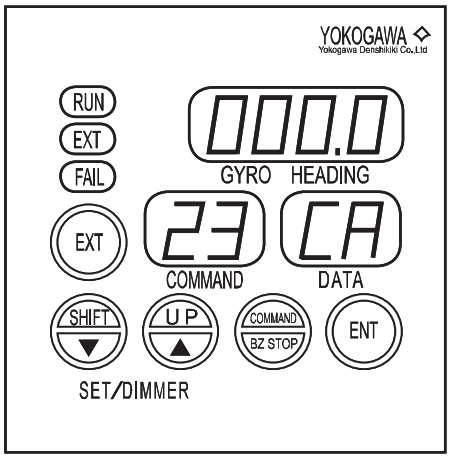
Operation with the M.operation unit

If the command code “23” is executed, alignment starts and the container rotates to detect the zero point: “CA” blinks in the data display and the alignment can be suspended by pressing the COMMAND key.

If the alignment is completed normally, “CA” is still displayed but stops blinking and the gyro heading display indicates “000.0” (see the figure to the right).

If the alignment is not successful (zero point cannot be detected), an alarm is generated and the “CA” continues to blink. If this occurs, carry out manual alignment.

If the COMMAND key is pressed, the mode returns to normal.



4.2.5 Manual Alignment of Master Compass

COMMAND CODE : 24

If automatic Master compass alignment cannot be executed, it is necessary to adjust the compass heading to the container heading. There are relative value alignment and absolute value alignment as the adjustment method.

CAUTION

Please make zero degree the speed error correction value by setting ship's speed 0 kt by using code "21" when you execute this adjustment.

- **Relative value alignment**

The error of the observation bearing that was measured by the gyrocompass is entered as the input value. (Input range : - 180 ° to + 180°)

Input value = (true reading through astronomical observation) - (compass reading)

Easterly : "-", Westerly : "+"

For example, if compass reading is "050.0" and the true reading through astronomical observation is "020.0", the input value is "- 30".

This method may be effective in case of sailing because the standard of absolute heading can be not obtained.

- **Absolute value alignment**

By inputting present absolute heading the compass heading is adjusted to the value.

Input value = (true heading)

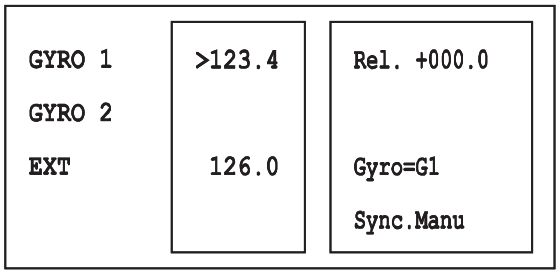
This method may be effective in the dock, because the standard of absolute heading can be obtained.

Operation with the C.operation unit

Selecting "24 Sync.Manu" from the Operat.MENU and pressing the ENT key, switches to the display showing the manual Master compass alignment (as shown in the figure on the right).

If the ENT key is pressed, "Rel." blinks allowing for a heading (absolute value: ±180.0 degrees; relative value: 000.0 to 359.9 degrees) to be entered.

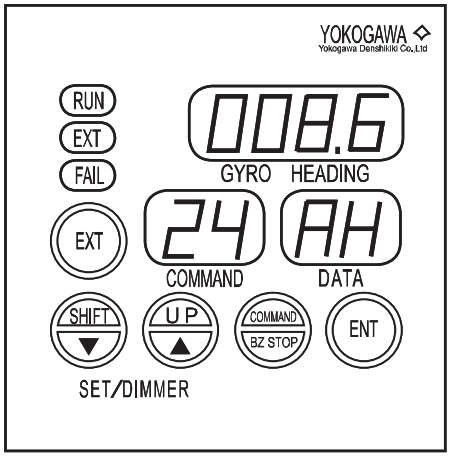
Press the right or left arrow key to change the place of input and press the up or down arrow key to select the absolute value of alignment (Abs.) or relative value of alignment (Rel.) and to change the numeric value.



After entering the heading press the ENT key.
The input value blinks, signaling the need to validate the change. If the ENT key is pressed again, blinking stops and the input value is changed.

Operation with the M.operation unit

If the command code “24” is executed, the data display indicates “AE,” the gyro heading display indicates “000.0” and the mode changes to relative value alignment setting mode.



If the EXT key is kept pressed for 2 seconds, the data display indicates “AH” and the gyro heading display indicates the current compass heading and the mode changes to the absolute value alignment setting mode. (Switch between the setting modes with the EXT key.)

The hundreds digit (digit to be entered) of the display in the gyro heading display blinks.

To change the digit, press the SHIFT key and then change the numeric value of the digit by pressing the UP key (relative value: - 180.0 to 180.0 degrees; absolute value: 000.0 to 359.9 degrees).

If a negative value is to be entered, set the digit to be entered to the most significant digit (hundreds digit) and press the UP key several times until the data display indicates “AE.” display.

After entering a heading, the entered value blinks if the ENT key is kept pressed for 2 seconds to enable the operator to confirm the value. If the ENT key is pressed for another 2 seconds, the entered value is displayed continuously and is set as the final value.

If the COMMAND key is pressed, the mode returns to normal.

4.2.6 Setting the Master Compass Follow-up Gain

COMMAND CODE : 25

Adjust the Master compass follow-up gain when there is a deadband in the follow-up actions and thus follow-up is not smooth or when hunting occurs because the gain is too high.

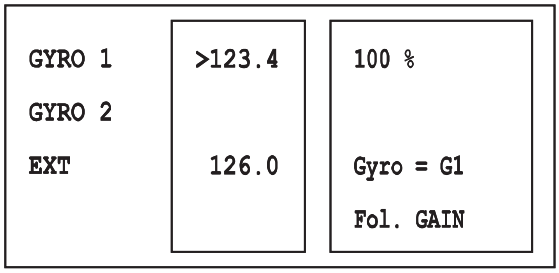
Operation with the C.operation unit

Selecting “25 Fol. GAIN” from the Maint. MENU and pressing the ENT key switches to the display showing the current setting of follow-up gain.

Press the ENT key again, then the follow-up gain blinks.

Pressing the upper arrow key increases the gain by 5 % (max. 200 %).

Pressing the lower arrow key decreases the gain by 5 % (min. 10 %).



After entering the gain value, press the ENT key. All the digits blink for confirmation.

Press the ENT key again. The follow-up gain finally changes to the value you set.

Operation with the M.operation unit

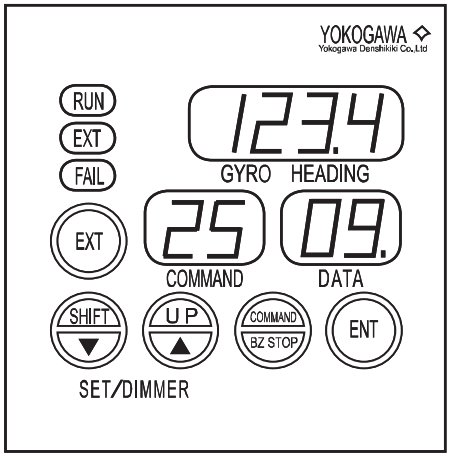
If the command code “25” is executed, the data display indicates the current gain (two digits of hundreds and tens) and the digit of hundreds (digit to be entered) blinks.

Change the digit to be entered by pressing the SHIFT key and then change the numeric value of the digit to be entered by pressing the UP key to enter a gain value (01 to 20).

The figure on the right shows an example of entering a gain of 95 %. (Standard: 100 %)

After entering a gain, the entered value blinks if the ENT key is kept pressed for 2 seconds to enable the operator to confirm the value. If the ENT key is pressed for another 2 seconds, the entered value is displayed continuously and is set as the final value.

If the COMMAND key is pressed, the mode returns to normal.



4.2.7 Displaying/Resetting Cause of Master Compass Alarm

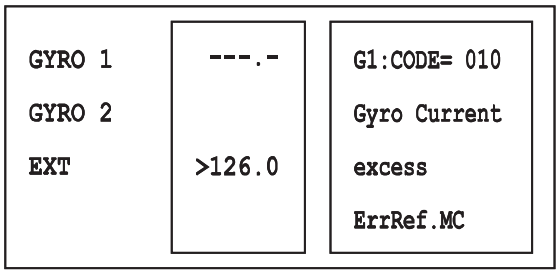
COMMAND CODE : 26

When an alarm is generated, carry out the following procedure to check the error contents.

Operation with the C.operation unit

Selecting “26 ErrRef.MC” from the Operat. MENU and pressing the ENT key switches to the display showing the cause of the Master compass alarm.

The figure on the right shows an example of a display when a gyrosphere failure is generated in the Master compass.



If there is an alarm occurring, the corresponding error code is displayed on the first line and the error contents on the second and third lines.

If the first line of the display blinks, it means that the cause of the alarm has not yet been recovered; if it is not blinking the cause has already been recovered.

If there are two or more causes of an alarm, the other causes of the alarm are displayed by pressing the right or left arrow key.

When the cause of an alarm has already been recovered, pressing the ENT key cancels the display.

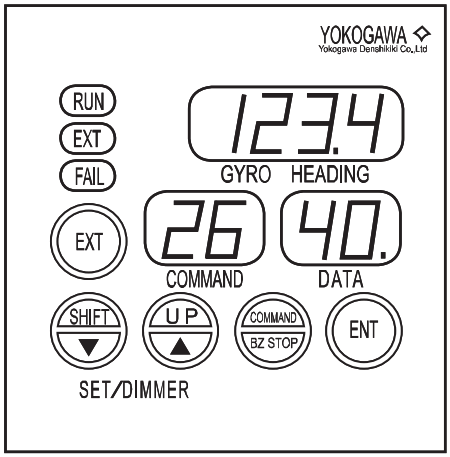
Operation with the M.operation unit

If the command code “26” is executed, an error code is displayed in the data display for the cause of alarm generated and detected in the Master compass.

A decimal point is displayed after the least significant digit of the error code. The figure to the right shows an example in which the backup battery voltage failure is being generated.

An error code without a decimal point means that the error that caused the alarm has already been rectified, and if the ENT key is kept pressed for 2 seconds it will be reset and the error message will disappear.

If there was no reason for the generation of the alarm, then “--” is displayed.



In addition, if there is more than one cause for the generation of the alarm, the error code with the smallest code number is displayed first and the following codes can be displayed by pressing the UP key. For example, pressing the UP key may switch the displayed error codes between “40” → “50” → “60” .

If the COMMAND key is pressed, the mode returns to normal.

4.2.8 Displaying/Resetting Cause of C.operation Unit Alarm

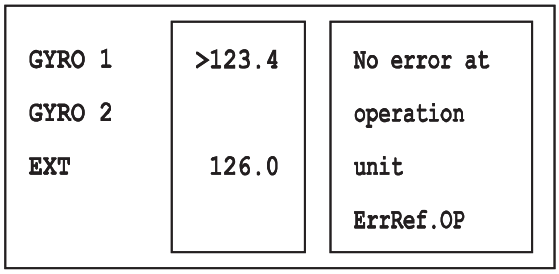
COMMAND CODE : 27

When an alarm is generated, carry out the following procedure to check the error contents:

Operation with the C.operation unit

Selecting "27 ErrRef.OP" from the Operat.MENU and pressing the ENT key switches to the display showing the cause of C.operation unit alarm.

The figure on the right shows an example of a display when no alarm cause in C.operation unit is shown.



If there is an alarm occurring, the corresponding error code is displayed on the first line and the error contents on the second and third lines.

If the first line of the display blinks, it means that the cause of the alarm has not yet been recovered; if it is not blinking the cause has already been recovered.

If there are two or more causes of an alarm, the other causes of the alarm are displayed by pressing the right or left arrow key.

When the cause of an alarm has already been recovered, pressing the ENT key cancels the display.

See section 5.3.4 for the procedure to check the error contents.

Operation with the M.operation unit

NOTE

It is not possible to execute this function with the M.operation unit.

4.2.9 Deviation Alarm Setting

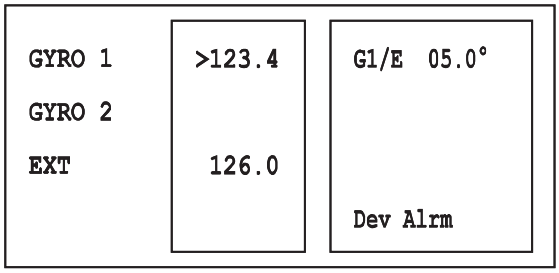
COMMAND CODE : 28

This is the function to set a limit value of the deviation alarm that is generated by difference between the current heading and the external heading.

Operation with the C.operation unit

Selecting "28 Dev Alrm." from the Operat.MENU and pressing the ENT key switches to the display showing the deviation alarm setting.

The figure on the right shows an example of the deviation limit value to generate a deviation alarm (difference of Master compass heading from external input heading) being at 10.0 degrees.



If the ENT key is pressed, the tens place of the deviation alarm limit value blinks to allow the value to be entered.

Press the right or left arrow key to change the place of input and press the up or down arrow key to change the numeric value.

After entering the limit value press the ENT key. Then the input value blinks, signaling the need to validate the change. If the ENT key is pressed again, blinking stops and the input value is changed.

In addition, if the limit value is set to "00.0," a deviation alarm is not generated.

Operation with the M.operation unit

NOTE

It is not possible to execute this function with the M.operation unit.

4.2.10 Startup Timer Setting

COMMAND CODE : 29

This function restarts the gyro system automatically after a preset time.

CAUTION

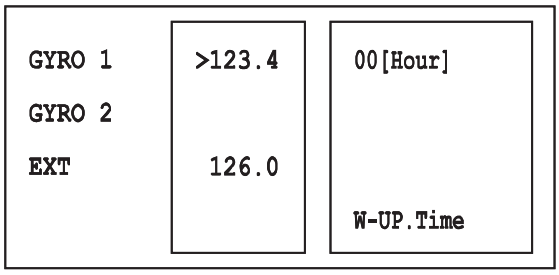
Don't cut off DC power supply for gyro system during timer mode.

If the startup time is set to "00", the system goes into "timer mode" for one minute and the power supply to the gyrosphere is stopped.

In addition, the system is normally started up at the heading that was selected when the power switch was turned off, however, the output heading if the system is started up using the timer function, becomes the gyro heading.

Operation with the C.operation unit

Selecting "29 W-UP.Time" from the Operat. MENU and pressing the ENT key switches to the display showing the startup timer setting (as shown in the figure on the right).

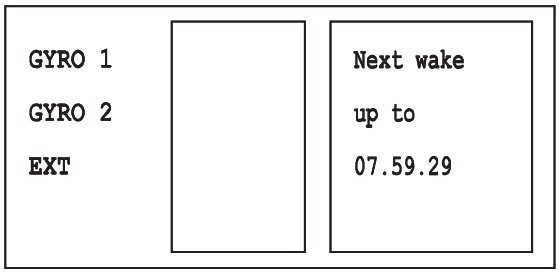


If the ENT key is pressed, the tens place of the startup time blinks to allow a startup time between 00 to 99 hours to be entered.

Press the right or left arrow key to change the place of input and press the up or down arrow key to change the numeric values.

After entering the time press the ENT key. The input value blinks, signaling the need to validate the input.

If the ENT key is again pressed, the system goes into timer mode and the power supply to the gyrosphere is stopped.



In timer mode the time until restart is displayed (as shown in the figure on the right).

If the ENT key is pressed when in timer mode, the timer is reset and the system can be immediately started.

In addition, the system is normally started up at the heading that was selected when the power switch was turned off, however, the output heading if the system is started up using the timer function, becomes the gyro heading.

Operation with the M.operation unit

If the command code “29” is executed, the data display indicates “00” and its tens digit (digit to be entered) blinks.

To change the digit, press the SHIFT key and then change the numeric value of the digit by pressing the UP key to enter the startup time (00 to 99 hours).

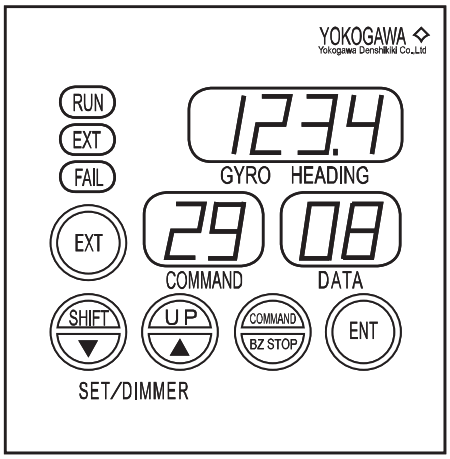
The figure on the right shows an example of setting the time of the startup timer to 8 hours.

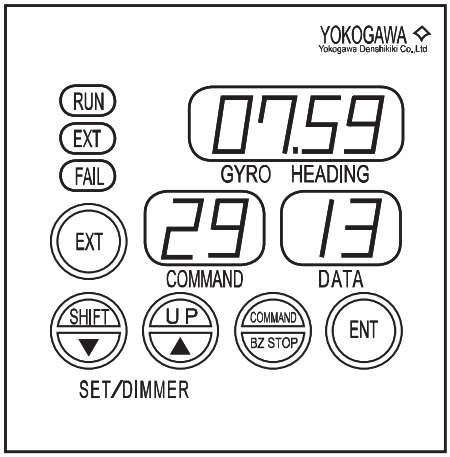
After setting the time, the value blinks if the ENT key is kept pressed for 2 seconds to enable the operator to confirm the value. If the ENT key is pressed for another 2 seconds, the entered value is displayed continuously and is set as the final value and the mode changes to timer startup mode.

If the COMMAND key is pressed before moving to timer startup mode, the mode returns to normal.

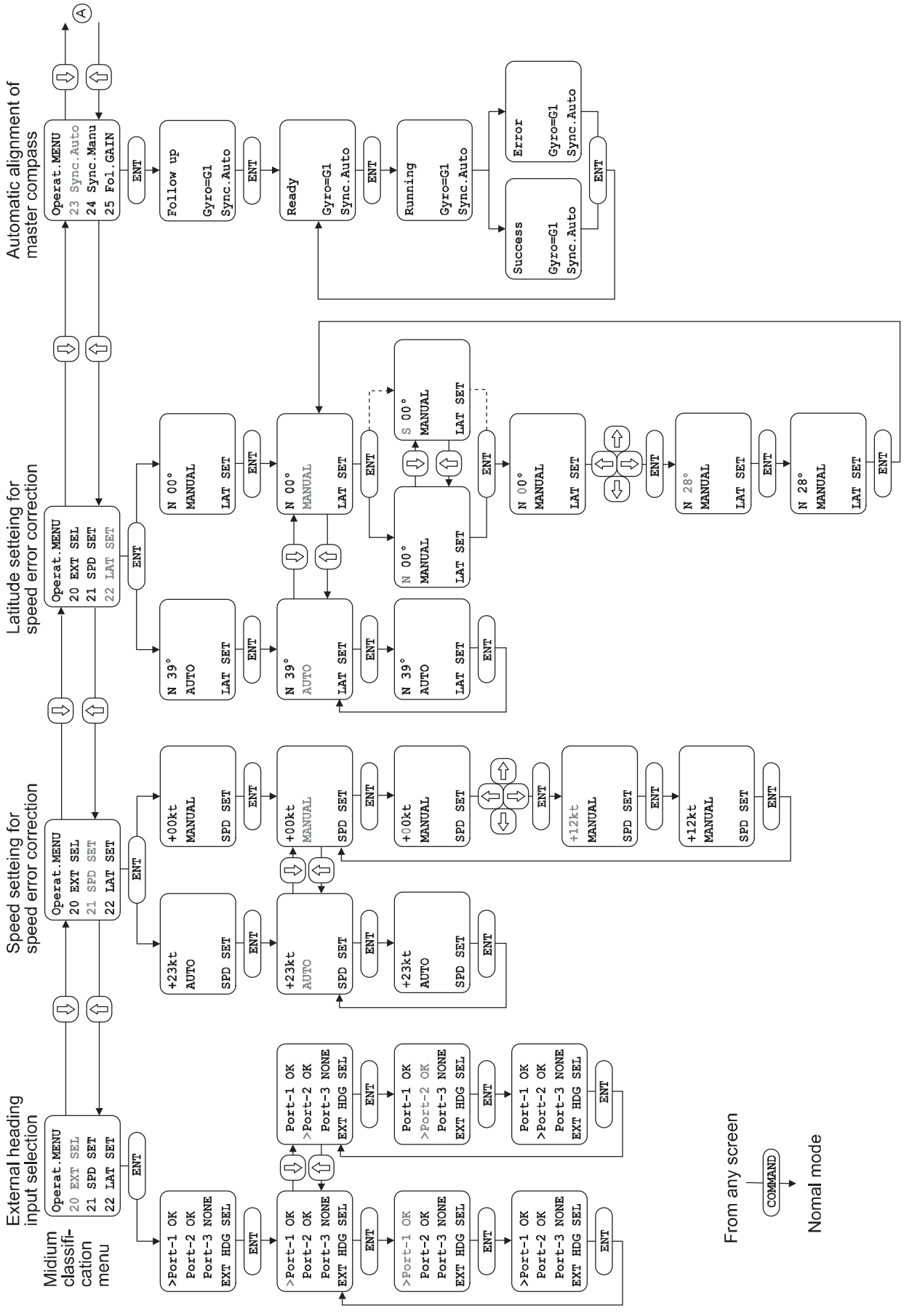
If the mode enters timer startup mode, the time remaining before restart is displayed in both the gyro heading display and data display. The figure on the right shows an example of displaying the time before restart as 7 hours 59 minutes and 13 seconds.

If the ENT key is kept pressed for 2 seconds when in timer startup mode, the timer is turned off and the system can be started up immediately.

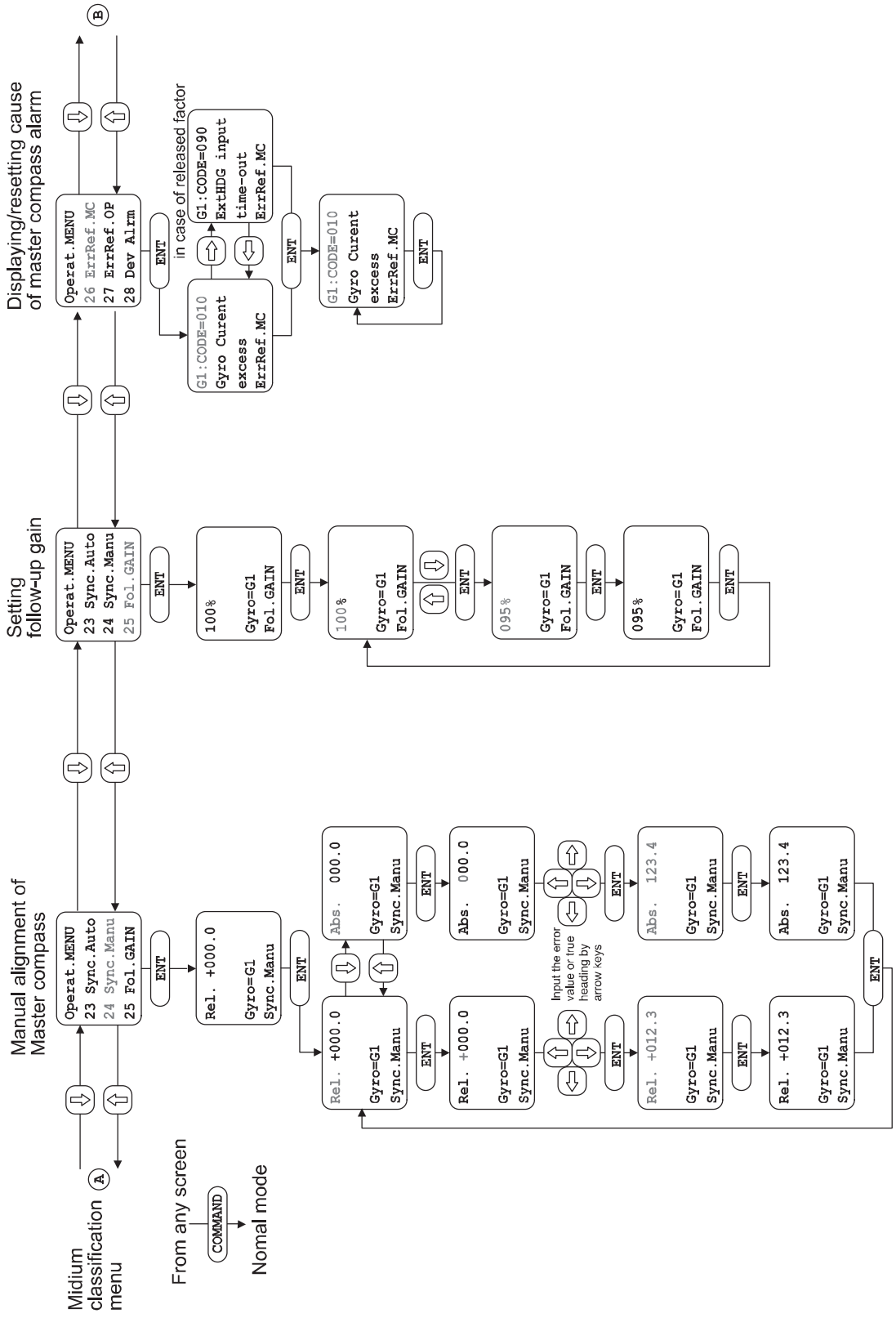




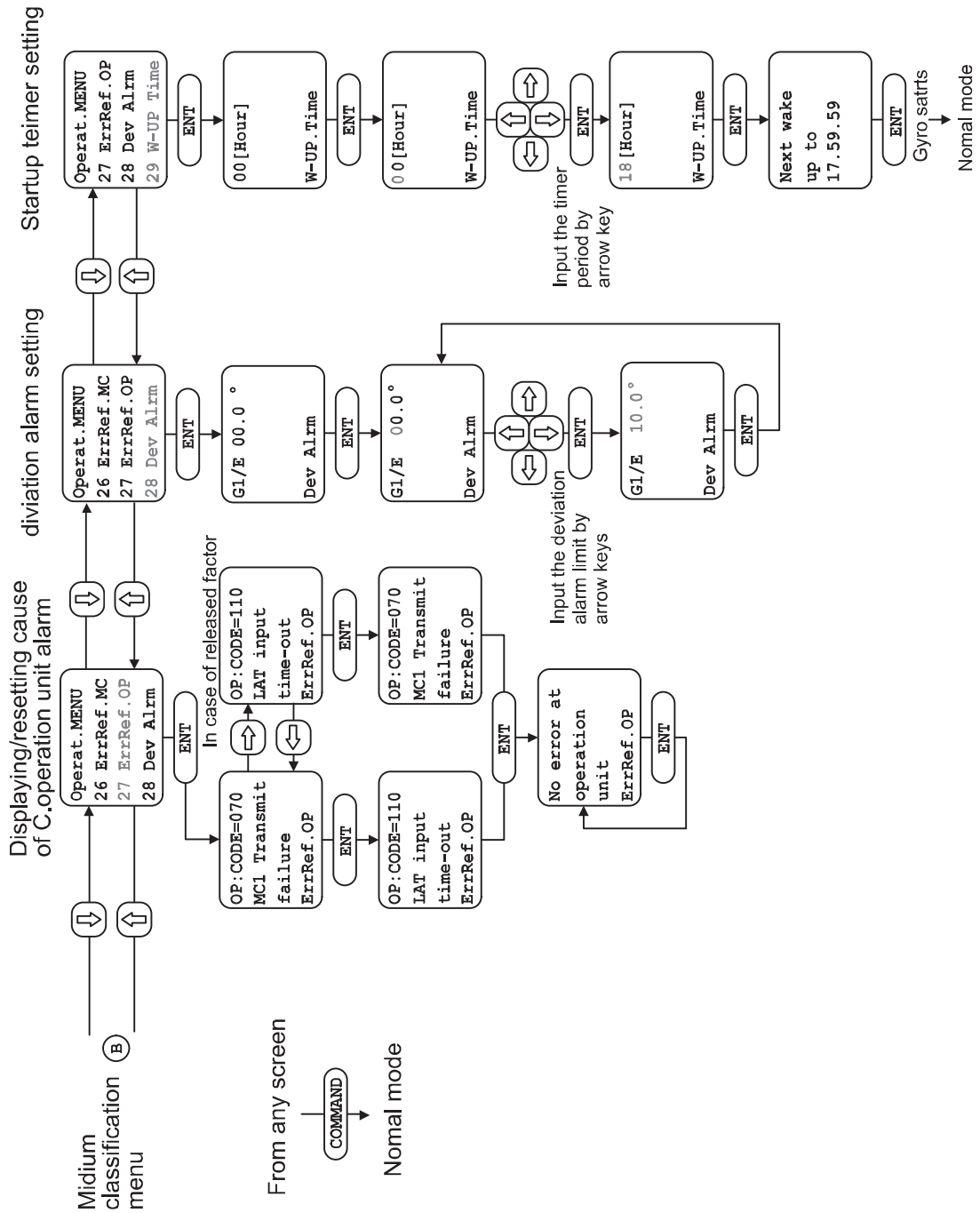
● The operation flow diagram of the setting function (C.operation unit) ···1/3



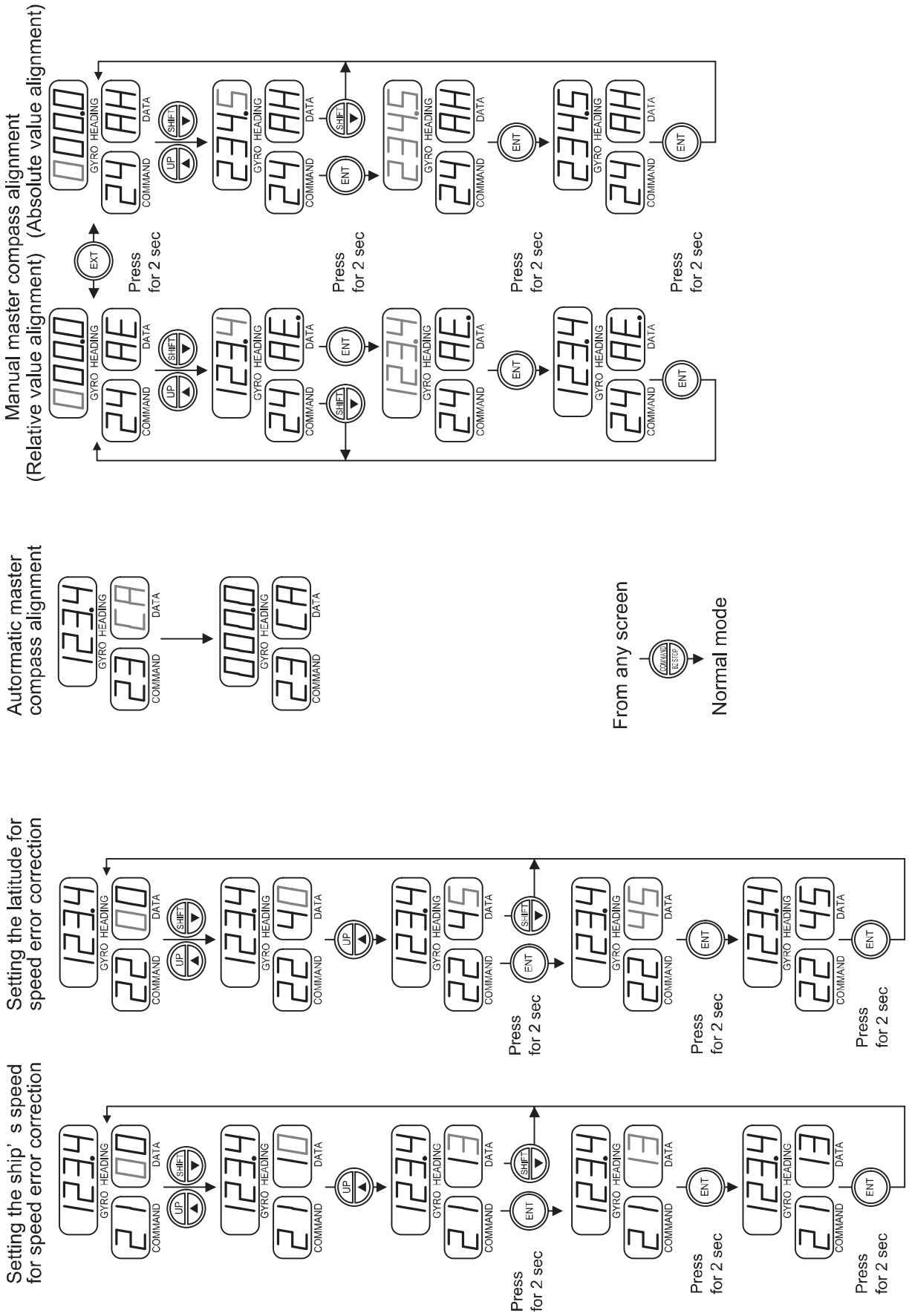
● The operation flow diagram of the setting function (C.operation unit) ···2/3



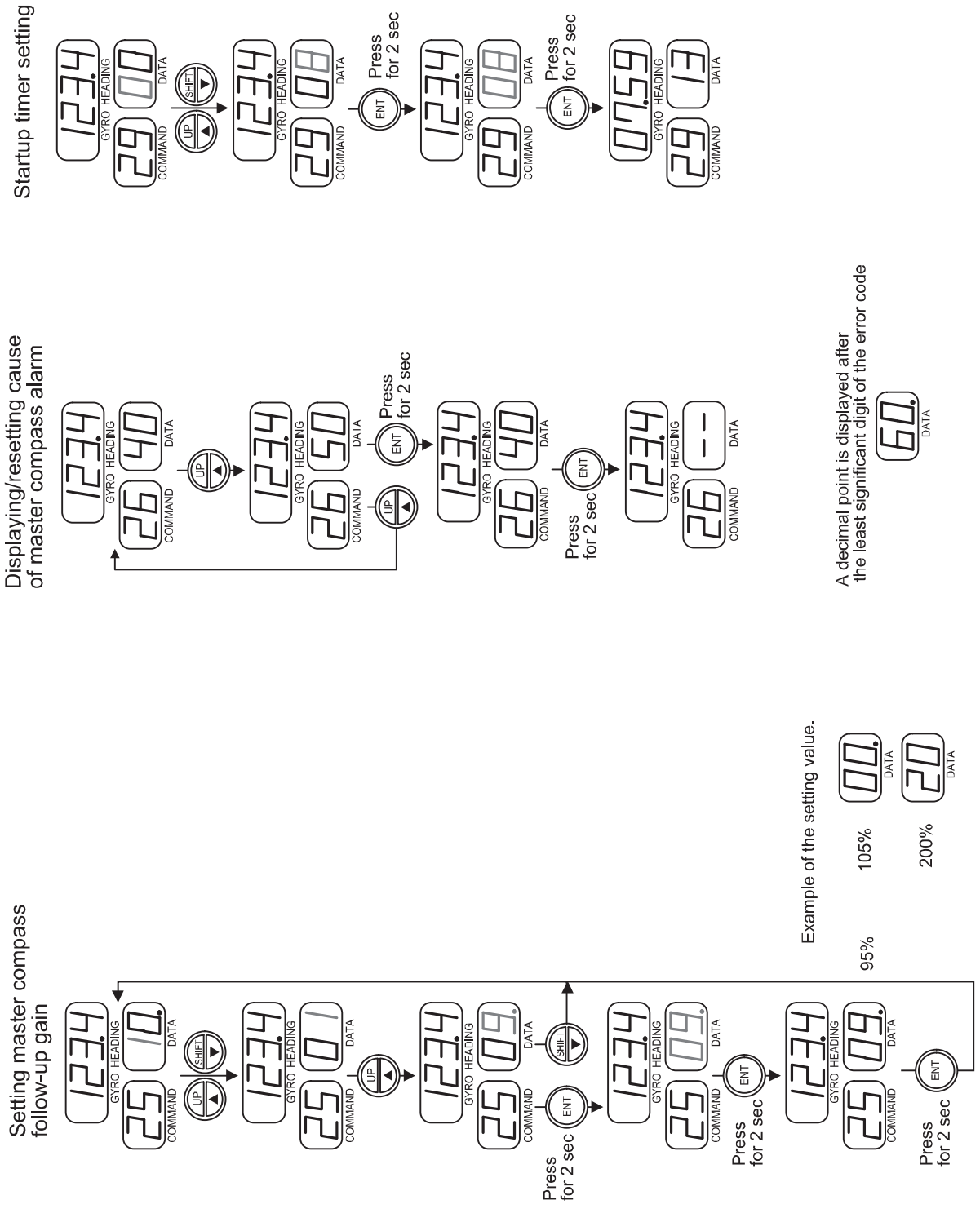
● The operation flow diagram of the setting function (C.operation unit) ···3/3



The operation flow diagram of the setting function (M.operation unit) ···1/2



● The operation flow diagram of the setting function (M.operation unit) ···2/2



4.3 Maintenance Functions

This section describes the functions used for maintenance. Do not use these functions in normal state. When command codes of 30's in the command functions are to be used, enable the maintenance functions as shown in section 4.3.1

CAUTION

Only technicians of the Service department of Yokogawa Denshikiki Co.,Ltd. are authorized to implement the operations and other work described in this chapter. However, if for some reason the service department of Yokogawa Denshikiki Co., Ltd. permits you to perform these operations, be sure to follow the instructions described in this section.

The maintenance functions include the following:

Command Code	Operation Unit		Function Item	Execution during Standby	Page
	C	M			
30	○	○	Permission for maintenance function	○	4-33
31	○	○	Outputting simulated DAC signals	×	4-34
32	○	○	Manual drive of Master compass	○	4-36
33	○	○	Manual drive of Repeater compass	○	4-37
34	○	○	Resetting gyrosphere running time	○	4-38
35	○	○	Resetting log	○	4-39
36	○	○	Initialization of backup memory	○	4-40
37	○	○	Correcting Master compass installation error	○	4-41
39	○	○	Log display	○	4-43

Each functions are executed by operation of the C.operation unit or the M.operation unit.

See the section 3.2 for the operation unit.

See the section 3.4 for the command function.

See the section 3.5 for the command mode and the value input method.

4.3.1 Permission for Maintenance Function

COMMAND CODE : 30

The maintain function is protected by password to reject mis-operation.

The command code “30” is the function to check password.

NOTE

Ask your nearest service agent of Yokogawa Denshikiki Co., Ltd. to implement the operation above.

■ Operation with the C.operation unit

Selecting “30 Password” from the Maint. MENU and pressing the ENT key switches to the display for entering a password (as shown in the upper figure on the right).

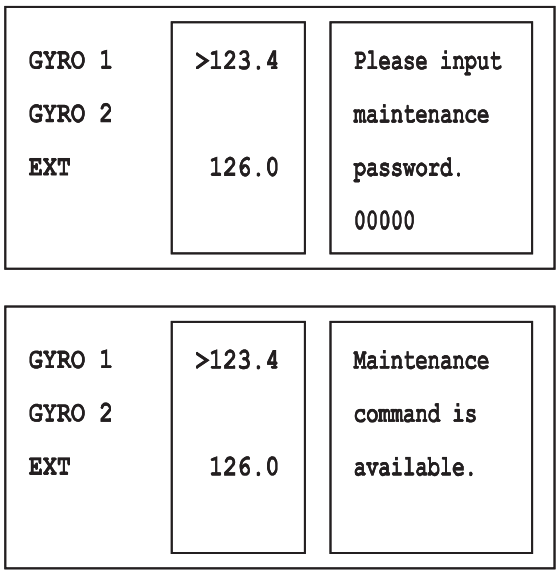
Press the ENT key again. The ones digit of “00000” blinks, prompting you to enter a password.

Press the right and left arrow keys to change the blinking digit, and press the upper and lower arrow keys to change the numeric value.

After entering the correct password “XXXXX”, press the ENT key. All the digits blink for confirmation.

Press the ENT key again. If the password is correctly entered, the maintenance functions are enabled (as shown in the lower figure on the right).

When a wrong password is entered, the ones digit of “00000” blinks again, prompting you to reenter a password.



The maintenance functions are disabled by default whenever the power is turned on.

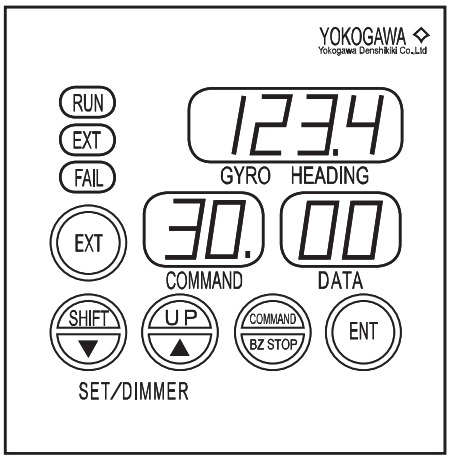
■ Operation with the M.operation unit

If the command code “30” is executed “00” is displayed in the data display and the tens digit (digit to be entered) of “00” is blinking.

Change the displayed code to “XX” by using the up key to change the blinking numeric value and the SHIFT key to change the blinking digit.

After entering the code, the entered value blinks if the ENT key is kept pressed for 2 seconds to enable the operator to confirm the value. If the ENT key is pressed for another 2 seconds, the entered value is displayed continuously and the maintenance functions are enabled (in which the decimal point is displayed after the least significant digit of the command display).

If the COMMAND key is pressed, the mode returns to normal.



The figure on the right shows an example of displaying the state in which the maintenance functions are enabled.

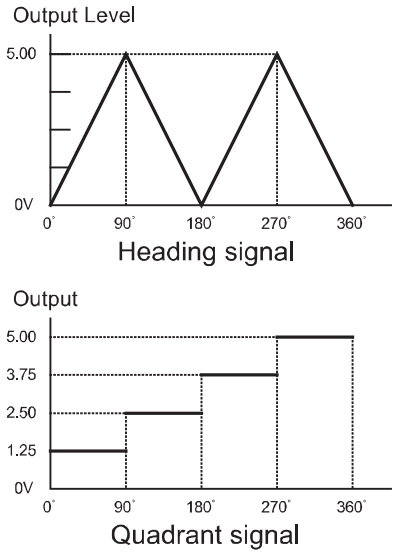
4.3.2 Outputting Simulated DAC Signals

COMMAND CODE : 31

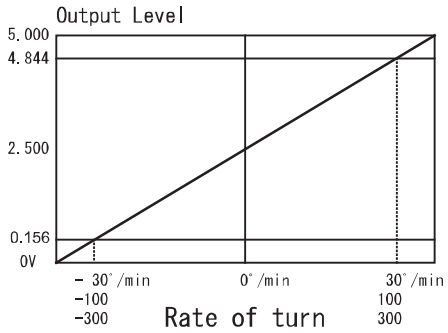
A simulated output of any of the following signals can be selected using this function : analog heading signal, analog quadrant signal, or analog rate-of-turn signal.

The following graphs show the output span for each analog output.

☐ Heading (HDG) and quadrant (QUAD)

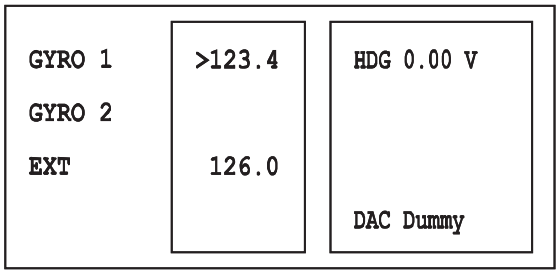


☐ Rates of turn (ROT1, ROT2, and ROT3)



Operation with the C.operation unit

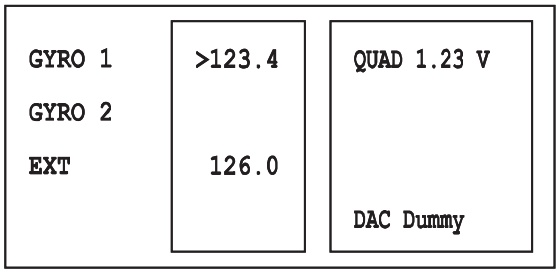
Selecting “31 DAC Dummy” from the Maint. MENU and pressing the ENT key switches to the display showing the simulated DAC signal setting (as shown in the upper figure on the right).



Press the ENT key again. The HDG blinks and an analog signal can be selected.

Press the upper and lower arrow keys to select a channel from HDG (heading), QUAD (quadrant), ROT1 (rate of turn), ROT2, and ROT3, then the ENT key. The channel stops blinking and the ones digit of the output voltage level blinks.

Press the right and left arrow keys to change the blinking digit, and press the upper and lower arrow keys to change the numeric value.



After entering the voltage level, press the ENT key. All the digits blink for confirmation.

Press the ENT key again. The voltage level stops blinking and finally changes to the value you set.

The lower figure on the right shows an example of setting the simulated output of 1.23 V for the quadrant signal of the Master compass.

Operation with the M.operation unit

If the command code “31” is executed, channel number “1” blinks in the data display, and the analog output signal level of each channel is set to the most recent level (initial value of the simulated output).

If the UP key is pressed, the blinking display of channel number (1 to 5 channels) changes.

If a channel number is selected and the SHIFT key is pressed, the current output level of that channel is displayed in the data display and its tens digit (digit to be entered) blinks.

Change the digit to be entered by pressing the SHIFT key and then change the numeric value of the digit to be entered by pressing the UP key to enter a simulated output level (0.0 to 5.0 V).

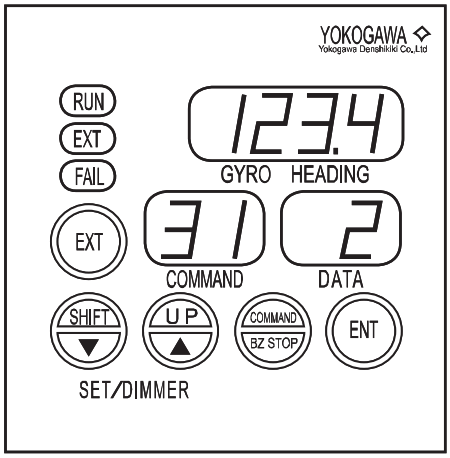
After entering the simulated output level, the channel number and entered value alternately blink to enable the operator to confirm the value if the ENT key is kept pressed for 2 seconds. If the ENT key is pressed for another 2 seconds;

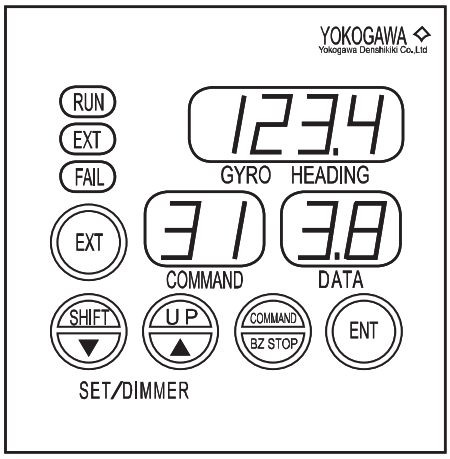
(1) the entered value is displayed continuously, (2) the output level finally changes to the level you set, and (3) the channel number is again displayed in the data display (blinking).

The figure on the right shows an example of setting the simulated output of 3.8 V for channel 2.

If the COMMAND key is pressed, the mode returns to normal.

Until the COMMAND key is pressed, the simulated output remains in the set level.





Channel No.	Output signal
1	Analog heading
2	Analog quadrant
3	Analog rate of turn : port 1
4	Analog rate of turn : port 2
5	Analog rate of turn : port 3

4.3.3 Manual Drive of Master Dompass

COMMAND CODE : 32

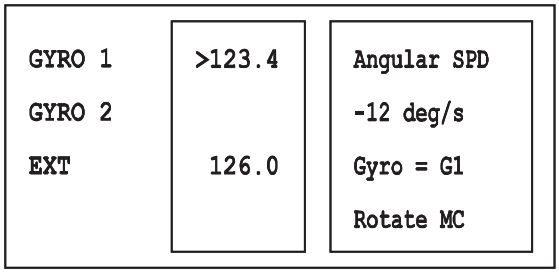
This function turns the Master compass at a specified speed to check the follow-up system of Master compass.

During execution of this command, the container is released from the follow-up of the gyrosphere and can be rotated at a specified turning speed. In this condition, the Repeater compass remains stopped.

■ Operation with the C.operation unit

Selecting "32 Rotate MC" from the Maint. MENU and pressing the ENT key switches to the display showing the angular speed setting of "00" degree/sec.

Press the ENT key again, then the "00" blinks. Press the upper and lower arrow keys to change the angular speed as follows:



Pressing the upper arrow key repeatedly:

Accelerates the speed clockwise: 00 → 01 → 02 → 03 → 04 → 05 → 06 → 12 → 18 → 24 → 30

Decelerates the speed counterclockwise: -30 → -24 → -18 → -12 → -06 → -05 → -04 → -03 → -02 → -01 → 00

Pressing the lower arrow key repeatedly:

Accelerates the speed counterclockwise: 00 → - 01 → - 02 → -03 → -04 → -05 → -06 → -12 → -18 → -24 → -30

Decelerates the speed clockwise: 30 → 24 → 18 → 12 → 06 → 05 → 04 → 03 → 02 → 01 → 00

The figure on the right shows an example of displaying the angular speed of -12 degrees/sec.

■ Operation with the M.operation unit

If the command code "32" is executed, the gyro heading display remains the present heading value, and the data display indicates the turning speed (00 deg/s).

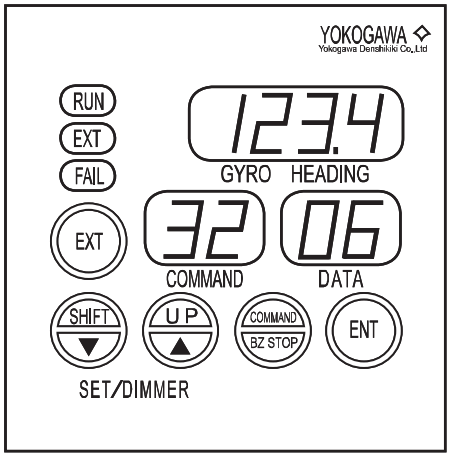
If the ▼ key is pressed, the Master compass turns clockwise (CW) and if the ▲ key is pressed, it turns counterclockwise (CCW).

The figure on the right shows an example of displaying the turning speed of 06 deg/s.

By pressing ▼ key or either ▲ key repeatedly, turning speed accelerates.

By pressing the key for the opposite direction, the turning of Master compass decelerates, stops and then accelerates in the opposite direction.

If the COMMAND key is pressed, the mode returns to normal.



The following is an example of the sequence of the data display when the ▼ key or ▲ key is pressed repeatedly.

Pressing the same key : 00 → 01 → 02 → 03 → 04 → 05 → 06 → 12 → 18 → 24 → 30

Pressing the opposite key: 30 → 24 → 18 → 12 → 06 → 05 → 04 → 03 → 02 → 01 → 00

4.3.4 Manual Drive of Repeater Compass

COMMAND CODE : 33

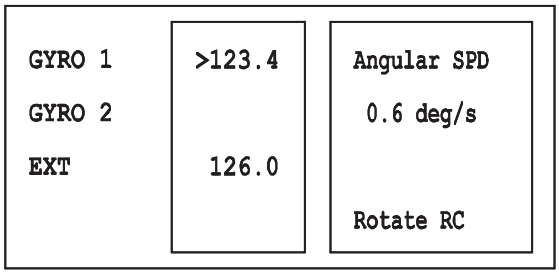
This function turns the Repeater compass at a specified speed to check the follow-up system of Repeater compass.

During execution of this command, the Repeater compass is released from the follow-up of the Master compass and can be rotated at a specified turning speed.

Operation with the C.operation unit

Selecting "33 Rotate RC" from the Maint. MENU and pressing the ENT key switches to the display showing the angular speed setting of "0.0" degree/sec.

Press the ENT key again, then the "0.0" blinks. Press the upper and lower arrow keys to change the angular speed as follows:



Pressing the upper arrow key repeatedly:

Accelerates the speed clockwise: 0.0 → 0.1 → 0.2 → 0.3 → 0.4 → 0.5 → 0.6 → 1.2 → 1.8 → 2.4 → 3.0

Decelerates the speed counterclockwise: -3.0 → -2.4 → -1.8 → -1.2 → -0.6 → -0.5 → -0.4 → -0.3 → -0.2 → -0.1 → 0.0

Pressing the lower arrow key repeatedly:

Accelerates the speed counterclockwise: 0.0 → - 0.1 → - 0.2 → -0.3 → -0.4 → -0.5 → -0.6 → -1.2 →- 1.8 → -2.4 → -3.0

Decelerates the speed clockwise: 3.0 → 2.4 → 1.8 → 1.2 → 0.6 →0.5 → 0.4 → 0.3 → 0.2 → 0.1 → 0.0

The figure on the right shows an example of displaying the angular speed of 0.6 degrees/sec.

Operation with the M.operation unit

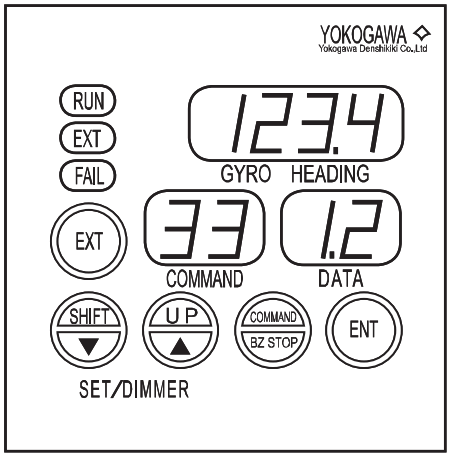
If the command code "33" is executed, the gyro heading display continues to indicate the compass heading and the data display indicates the turning speed (0.0 deg/s).

If the ▼ key is pressed, the repeater-compass turns clockwise (CW), and if the ▲ key is pressed, it turns counterclockwise (CCW).

The figure on the right shows an example of displaying the turning speed of 1.2 deg/s.

By pressing ▼ key or either ▲ key repeatedly, turning speed accelerates.

By pressing the key for the opposite direction, the turning of Repeater compass decelerates, stops and then accelerates in the opposite direction.



If the COMMAND key is pressed, the mode returns to normal.

The following is an example of the sequence of the data display when the ▼ key or ▲ key is pressed repeatedly.

Pressing the same key : 0.0 → 0.1 → 0.2 → 0.3 → 0.4 → 0.5 → 0.6 → 1.2 → 1.8 → 2.4 → 3.0

Pressing the opposite key: 3.0 → 2.4 → 1.8 → 1.2 → 0.6 → 0.5 → 0.4 → 0.3 → 0.2 → 0.1 → 0.0

4.3.5 Resetting Gyrosphere Running Time

COMMAND CODE : 34

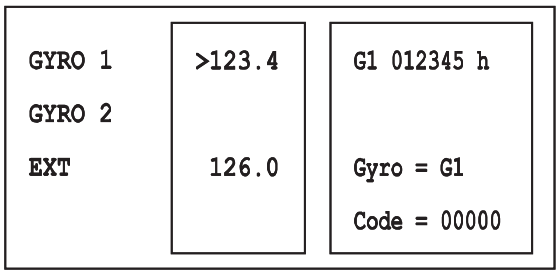
Use this function to reset the running time (hours) of the gyrosphere to zero when replacing the gyrosphere. This operation is required to grasp the accurate running time of the gyrosphere for adequate maintenance scheduling.

NOTE

Ask your nearest service agent of Yokogawa Denshikiki Co., Ltd. to implement the operation above.

Operation with the C.operation unit

Selecting “34 Reset RT” from the Maint.MENU and pressing the ENT key switches to the display for entering a password.



Press the ENT key again. The ones digit of “00000” blinks, prompting you to enter a password.

Press the right and left arrow keys to change the blinking digit, and press the upper and lower arrow keys to change the numeric value.

After entering the correct password “XXXXX”, press the ENT key. All the digits blink for confirmation.

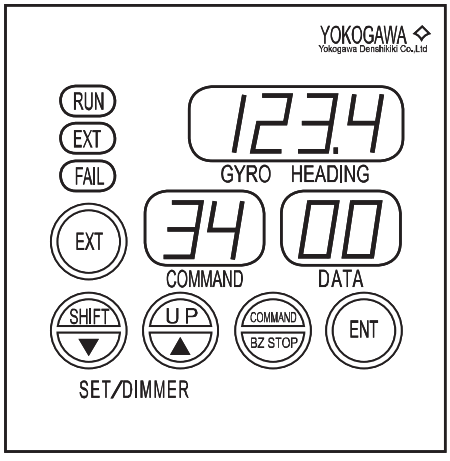
Press the ENT key again. If the password is correctly entered, the running time is reset to zero.

When a wrong password is entered, the ones digit of “00000” blinks again, prompting you to reenter a password.

Operation with the M.operation unit

If the command code “34” is executed, “00” is displayed in the data display and the tens digit (digit to be entered) blinks.

Change the displayed code to “XX” by using the up key to change the blinking numeric value and the SHIFT key to change the blinking digit. See the figure on the right for an example.



After entering the code, the entered value blinks if the ENT key is kept pressed for 2 seconds to enable the operator to confirm the value. If the ENT key is pressed for another 2 seconds, the entered value is displayed continuously and the gyrosphere runtime is reset to zero.

If the COMMAND key is pressed, the mode returns to normal.

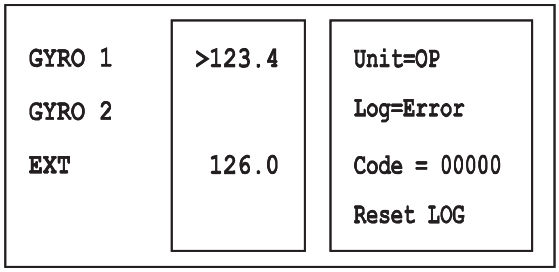
4.3.6 Resetting Log

COMMAND CODE : 35

This function clears the error history and the command operation history.

Operation with the C.operation unit

Selecting “35 Reset. LOG” from the Maint. MENU and pressing the ENT key switches to the log display.



Press the ENT key again. The OP blinks and a target unit can be selected.

Press the upper and lower arrow keys to select the unit from OP (C operation unit) and G1 (Master compass), then the ENT key.

The Err blinks and the log type can be selected.

Press the upper and lower arrow keys to select the log type from Err (Error log) or Com (Command log), and press the ENT key.

The ones digit of “00000” blinks, prompting you to enter a password.

Press the right and left arrow keys to change the blinking digit, and press the upper and lower arrow keys to change the numeric value.

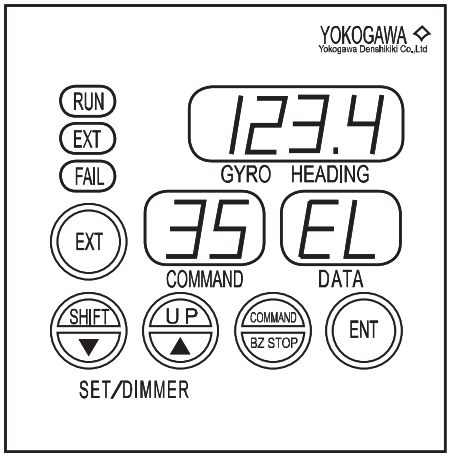
After entering the correct password “XXXXX”, press the ENT key. All the digits blink for confirmation.

Press the ENT key again. If the password is correctly entered, the log is reset.

When a wrong password is entered, the ones digit of “00000” blinks again, prompting you to reenter a password.

Operation with the M.operation unit

If the command code “35” is executed, the data display indicates [EL] and press the shift key to select the log type from EL (Error Log) or CL (Command Log).



Press the ENT key for 2 seconds.

“00” is displayed in the data display and the tens digit (digit to be entered) blinks.

Change the displayed code to “XX” by using the up key to change the blinking numeric value and the SHIFT key to change the blinking digit. if the ENT key is kept pressed for 2 seconds to enable the operator to confirm the value. If the ENT key is pressed for another 2 seconds, the entered value is displayed continuously and the selected log is reset .

If the COMMAND key is pressed, the mode returns to normal.

4.3.7 Initializing Backup Memory

COMMAND CODE : 36

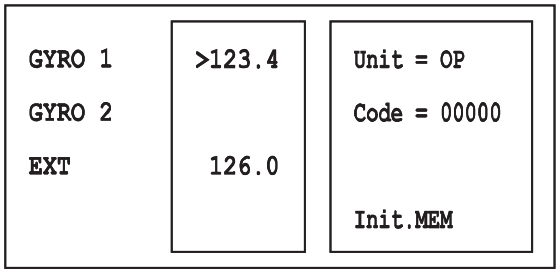
Use this function to reset all the function settings.

CAUTION

DO NOT carry out the following operation unless instructed by an authorized service technician of Yokogawa Denshikiki Co., Ltd.

Operation with the C.operation unit

Selecting “36 Init. MEM” from the Maint.MENU and pressing the ENT key switches to the display for entering a password.



Press the ENT key again. The OP blinks and a target unit can be selected.

Press the upper and lower arrow keys to select the unit from OP (C operation unit) and G1 (Master compass), then the ENT key. The unit stops blinking and the ones digit of “00000” blinks.

Press the right and left arrow keys to change the blinking digit, and press the upper and lower arrow keys to change the numeric value.

After entering the correct password “XXXXX”, press the ENT key. All the digits blink for confirmation.

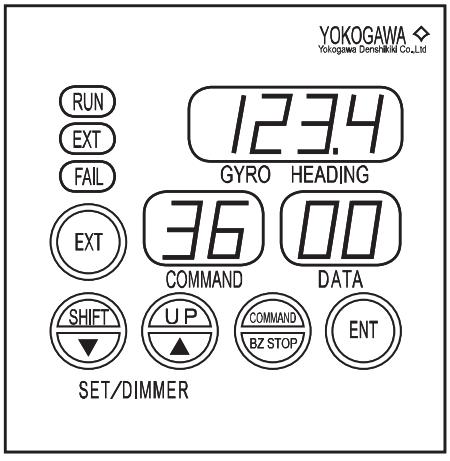
Press the ENT key again. If the password is correctly entered, the backup memory is initialized when the power is turned on next time.

When a wrong password is entered, the ones digit of “00000” blinks again, prompting you to reenter a password.

Operation with the M.operation unit

If the command code “36” is executed, “00” is displayed in the data display and the tens digit (digit to be entered) blinks.

Change the displayed code to “XX” by using the up key to change the blinking numeric value and the SHIFT key to change the blinking digit. See the figure on the right for an example.



After entering the code, the entered value blinks if the ENT key is kept pressed for 2 seconds to enable the operator to confirm the value. If the ENT key is pressed for another 2 seconds, the entered value is displayed continuously but the backup memory has not yet been initialized. The backup memory is initialized when the power is turned on next time.

If the COMMAND key is pressed, the mode returns to normal.

4.3.8 Correction of the Master Compass Installation Error

COMMAND CODE : 37

This section describes the procedure for correcting the error caused when the gyrocompass is not installed in such a way that the lubber line of the Master compass is precisely aligned parallel with the ship's fore-and-aft line.

① Relative value correction

The procedure uses the compass heading error as the amount of correction.

Example:

0.56 (Amount of error correction) =

42.56 (true heading through astronomical observation) – 42.00 (compass heading)

CAUTION

The setting of installation-error by the relative value should be executed, after the last setting value is returned to zero to prevent the setting mistake.

NOTE

The amount of correction for Master compass installation error is determined from the difference between the compass heading detected by a reading when the Master compass is settled and an accurate turn heading obtained through astronomical observation.

Perform these measurements when there is no change in the heading, such as when the ship is docked.

② Absolute value correction

If the absolute true heading can be obtained, such as when the ship is docked, set it as the compass heading.

Example:

(Input value) = (absolute true heading when the ship is docked)

NOTE

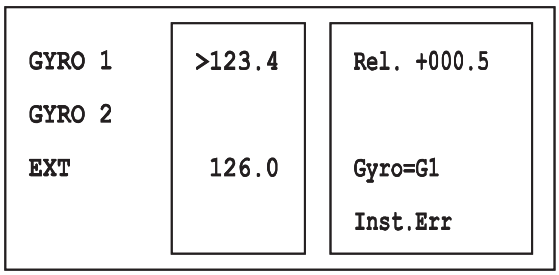
Whenever performing error correction, be sure to record the amount of correction in the maintenance record book.

Operation with the C.operation unit

Selecting “37 Inst. Err” from the Maint. MENU and pressing the ENT key switches to the display showing the current correction setting.

There are two correction procedures: relative value correction and absolute value correction. The figure on the right shows the current setting of 0.5°.

In the example of display above, press the ENT key, then Rel. (relative value correction) blinks.



Press the right and left arrow keys to change the blinking digit: correction procedure → sign (for absolute correction only) → the hundreds digit → the tens digit → the ones digit → the first decimal place

Press the upper and lower arrow keys to select the correction procedure from Rel. (relative) and Abs. (absolute), or to change the numeric value.

After entering the amount of correction, press the ENT key. All the digits blink for confirmation.

Press the ENT key again. The blinking stops and the correction method and the amount is finally set.

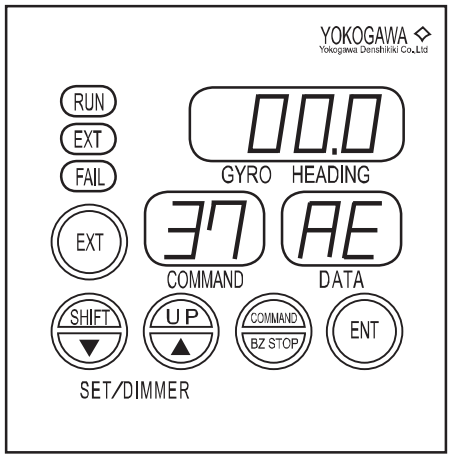
The value for difference correction is limited to ±10 degrees, even if a value that exceeds this is entered. Adjust the lubber line of the Master compass so that the difference between it and the true heading is within ±10 degrees, before.

Operation with the M.operation unit

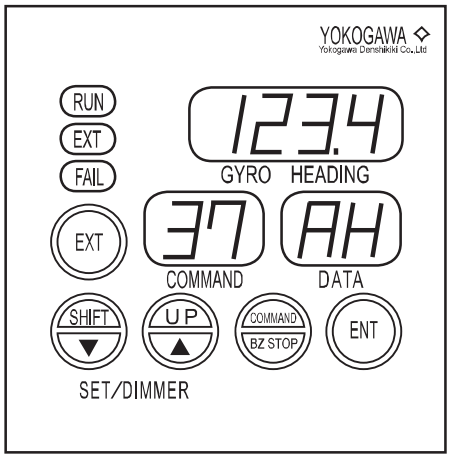
If error compensation is to be carried out using key operation, execute the command code “37.”

There are two compensation procedures; relative value compensation and absolute value compensation. Pressing the EXT key for 2 seconds switches between these two procedures.

① Example of display for relative value compensation



② Example of display for absolute value compensation



① Relative vlaue correction (AE)

The error of the observation bearing that was measured by the gyrocompass is entered as the compensation value.

The gyro heading display indicates the current value of compensation and its tens digit (digit to be entered) blinks.

Change the digit to be entered by pressing the SHIFT key and then change the numeric value of the digit to be entered by pressing the UP key to enter the value of error compensation (- 10.0 to 10.0 degrees)

To enter a negative value, set the digit to be entered to the most significant digit (tens digit) and press the UP key several times.

After entering the value of compensation, the entered value blinks if the ENT key is kept pressed for 2 seconds to enable the operator to confirm the value. If the ENT key is pressed for another 2 seconds, the entered value is displayed continuously and is set as the final value.

If the COMMAND key is pressed, the mode returns to normal.

② Absolute value correction (AH)

If absolute ship's heading is obtained by the quay-bearing etc. its heading value is input as compass heading.

On the ② display, the gyro heading display indicates "container heading + installation error compensating value" and the hundreds digit (digit to be entered) blinks.

Change the digit to be entered by pressing the SHIFT key and then change the numeric value of the digit to be entered by pressing the UP key to enter the compass heading (000.0 to 359.9 degrees).

After entering a heading, the entered value blinks if the ENT key is kept pressed for 2 seconds to enable the operator to confirm the value. If the ENT key is pressed for another 2 seconds, the entered value is displayed continuously and is set as the final value.

If installation error exceeds more than ± 10 degrees, the value for error compensation is limited to ± 10 degrees. Therefore, adjust the base line of Master compass and execute this compensation after the deviation between base line of Master compass and the ship's fore-and-aft line is less than ± 10 degrees.

If the COMMAND key is pressed, the mode returns to normal.

4.3.9 Displaying Log

COMMAND CODE : 39

Up to a 100 data entries can be recorded and displayed in the log.

There are two types of the log: error log and command log If the number of the log data exceeds 100 data the oldest log data is erased.

■ Operation with the C.operation unit

Selecting “39 Err. LOG” from the Maint.MENU and pressing the ENT key switches to the log display.

Press the ENT key again. The OP blinks and a target unit can be selected.

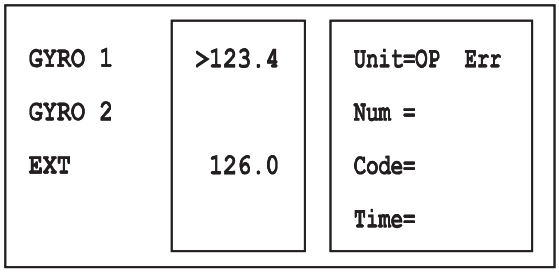
Press the upper and lower arrow keys to select the unit from OP (C operation unit) and G1 (Master compass), then the ENT key.

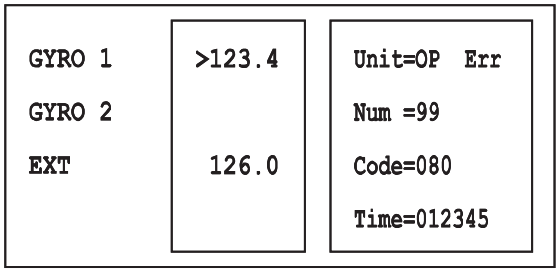
The Err blinks and the log type can be selected.

Press the upper and lower arrow keys to select the log type from Err (Error log) or Com (Command log), then press enter key.

The latest error log of the selected unit is displayed.

The second line indicates the error number (00 to 99), the third line the error code, and the fourth line the time of occurrence.





If the error number is 1 or more, or more than one error has occurred, pressing the lower arrow key displays the immediately preceding log, and pressing the upper arrow key displays the immediately following log. A larger error number corresponds to a later error.

■ Operation with the M.operation unit

If the command code “39” is executed, the data display indicates [EL] and press the shift key to select the log type from EL (Error Log) or CL (Command Log).

Press the ENT key for 2 seconds, then the data display indicates the log number of the most recent log data (0 to 99). (① That is the 31st log number is shown.)

Press the SHIFT key to switch between the log data display items.

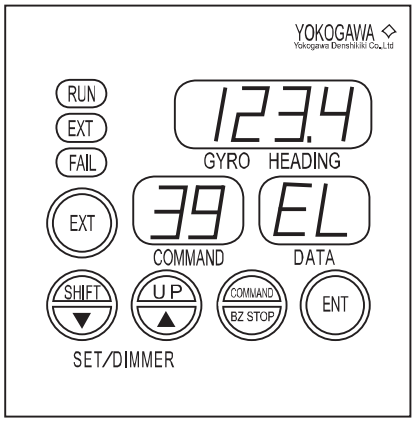
Log number → Log code → (Lower 2 digits of Log code :at CL) →Upper 2 digits of the generated time →intermediate 2 digits of the generated time → Lower 2 digits of the generated time

If gyrosphere runtime is reset at replacing of gyrosphere, the error that generated later is recorded by using the new runtime.

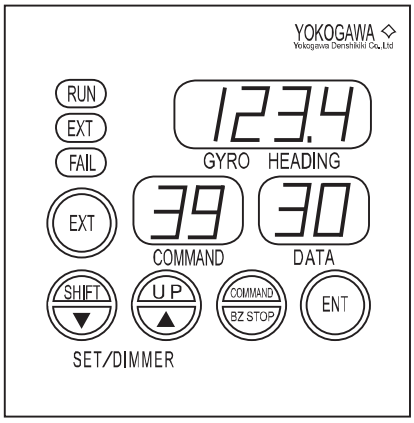
If the UP key is pressed, the previous data item is displayed.

If the COMMAND key is pressed, the mode returns to normal.

① Example of displaying "EL"



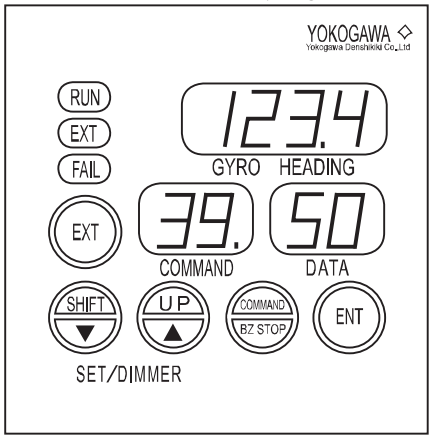
② Example of displaying log number



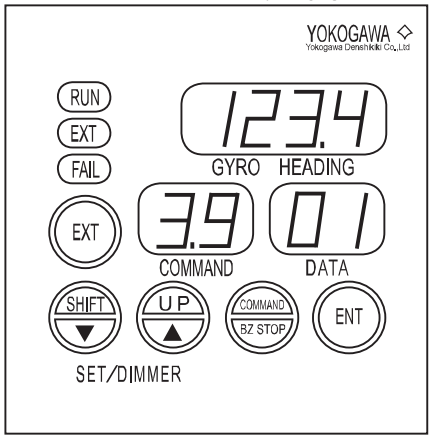
The display items can be identified by the decimal point displayed in the command display and data display.

Decimal point		Display item
Command display	Data display	
00	00	Log number
00.	00	Upper 2 digits of log code
00.	00.	Lower 2 digits of log code (at CL)
0.0	00	Upper 2 digits of generated time
0.0	00.	Intermediate 2 digits of generated time
0.0	0.0.	Lower 2 digits of generated time

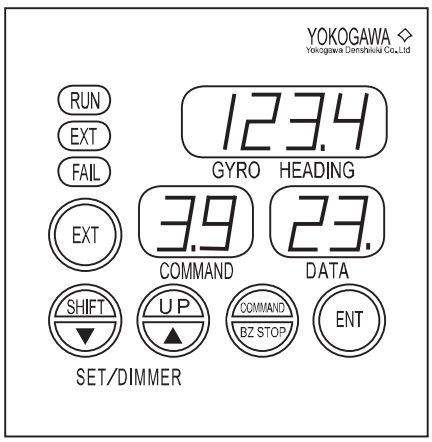
③ Example of displaying an error code



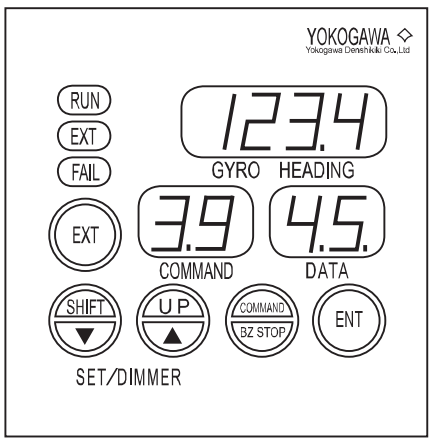
④ Example of displaying generated time 1



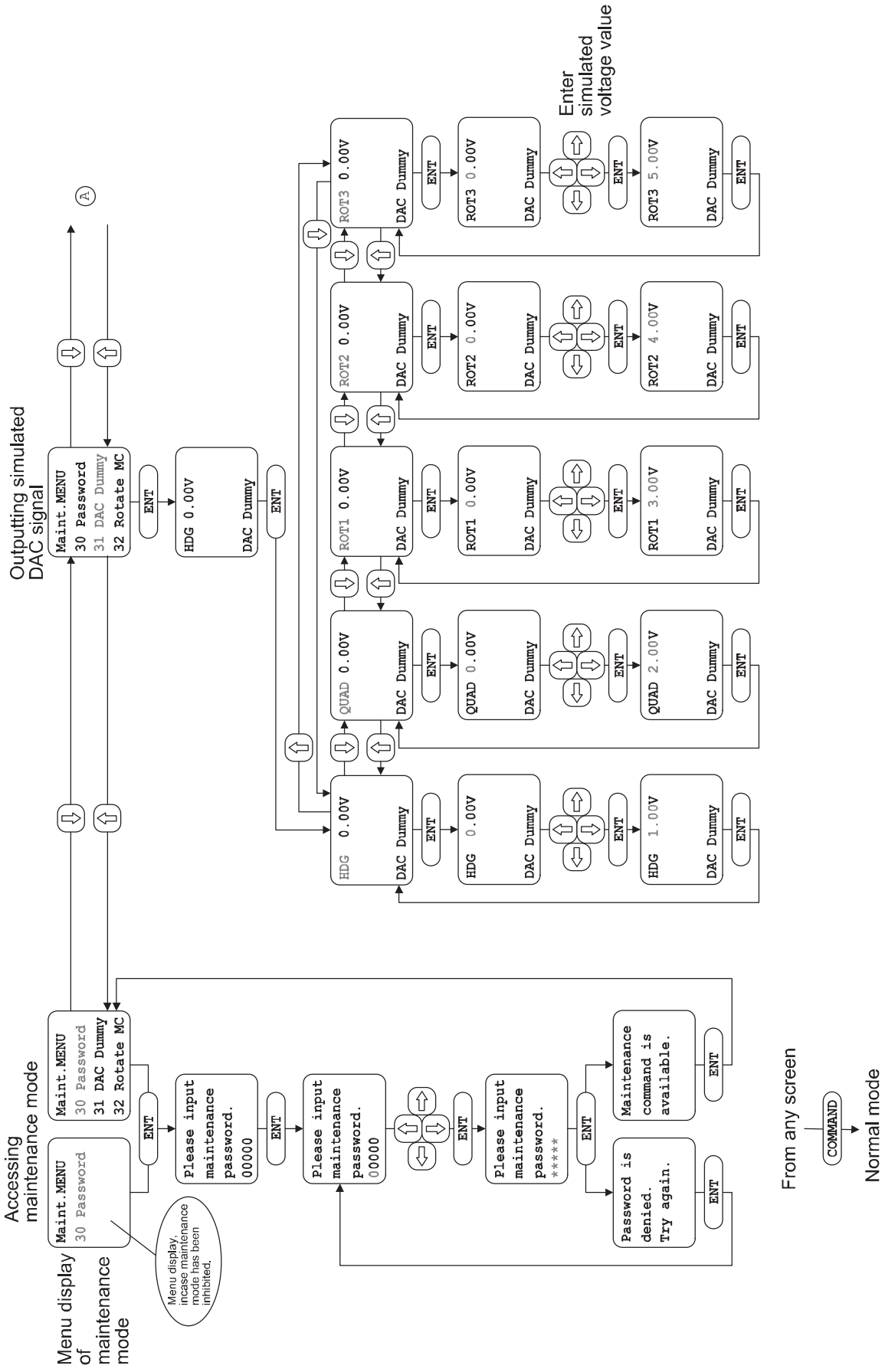
⑤ Example of displaying generated time 2



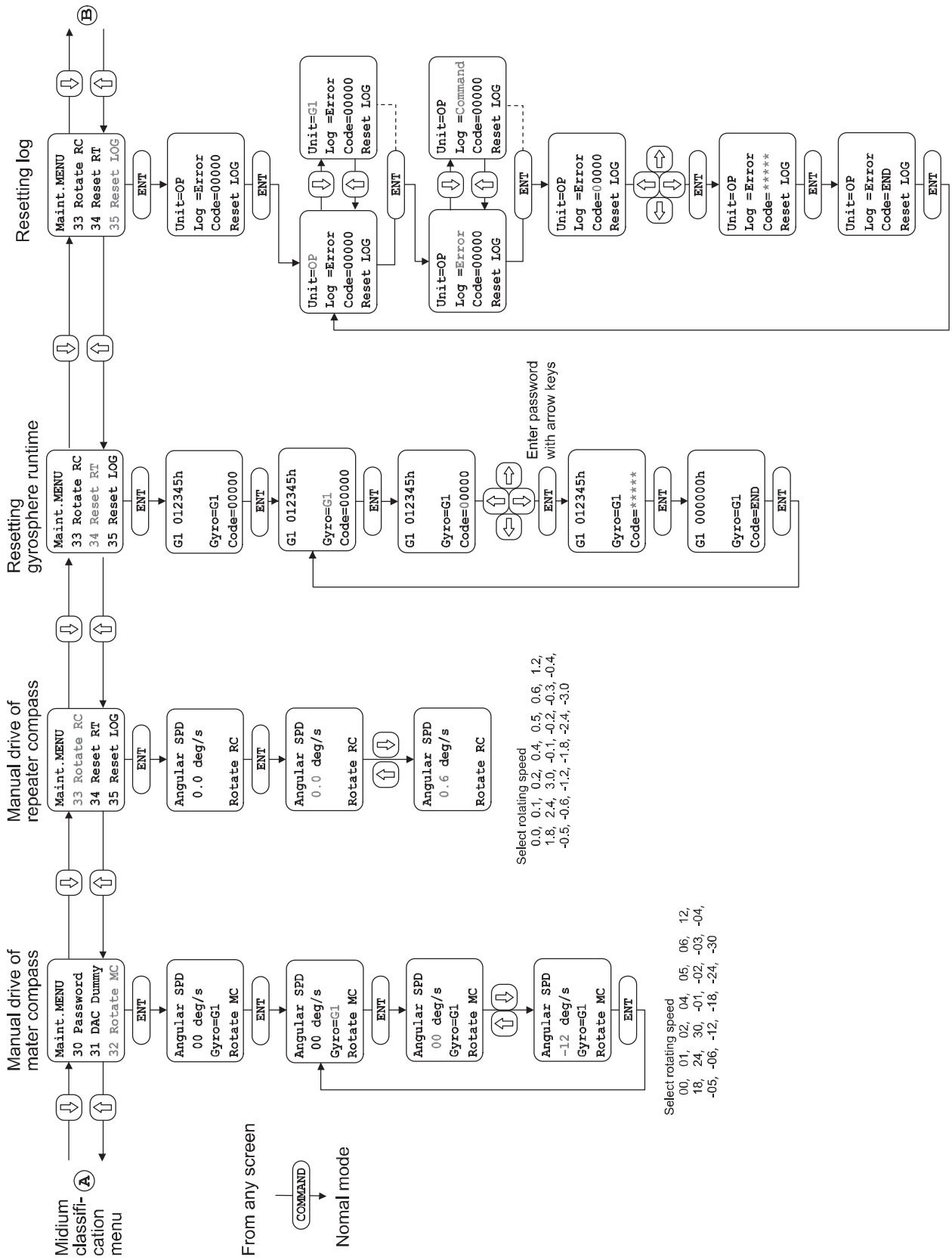
⑥ Example of displaying generated time 3



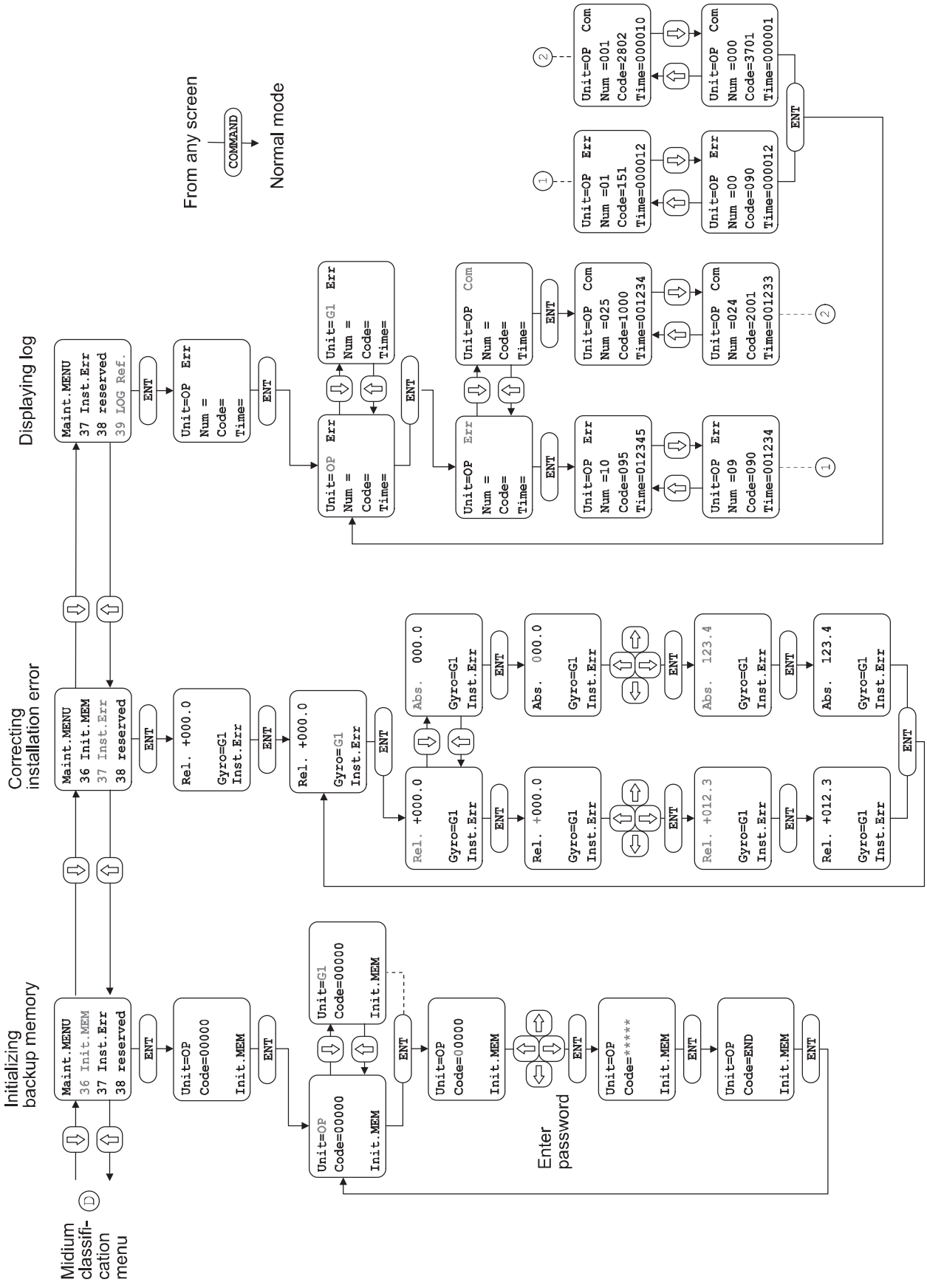
The operation flow diagram of the maintenance function (C.operation unit) ···1/3



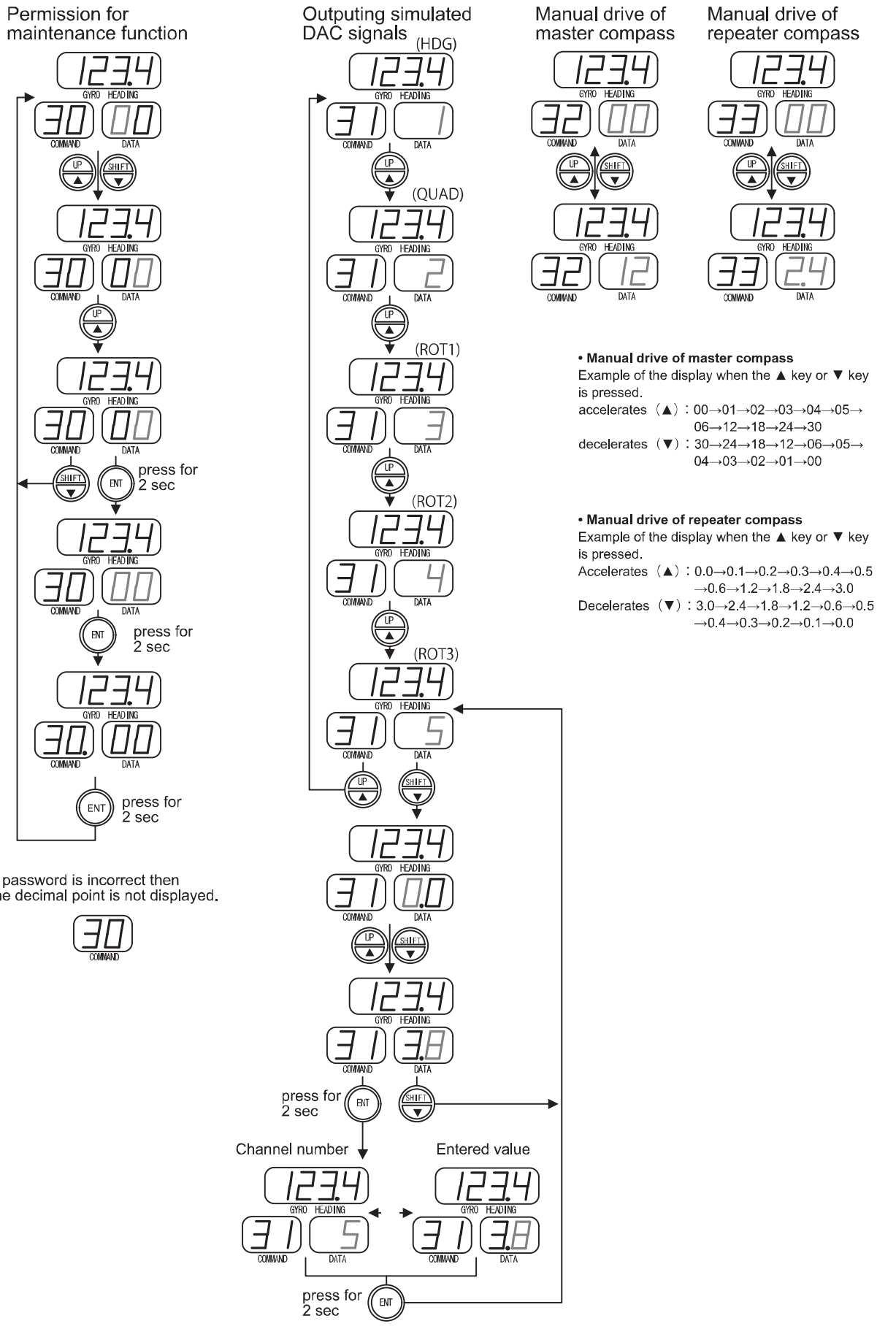
● The operation flow diagram of the maintenance function (C.operation unit) ···2/3



● The operation flow diagram of the maintenance function (C.operation unit) ···3/3



● The operation flow diagram of the maintenance function (M.operation unit) ···1/4



• Manual drive of master compass

Example of the display when the ▲ key or ▼ key is pressed.

accelerates（▲）: 00→01→02→03→04→05→06→12→18→24→30

decelerates（▼）: 30→24→18→12→06→05→04→03→02→01→00

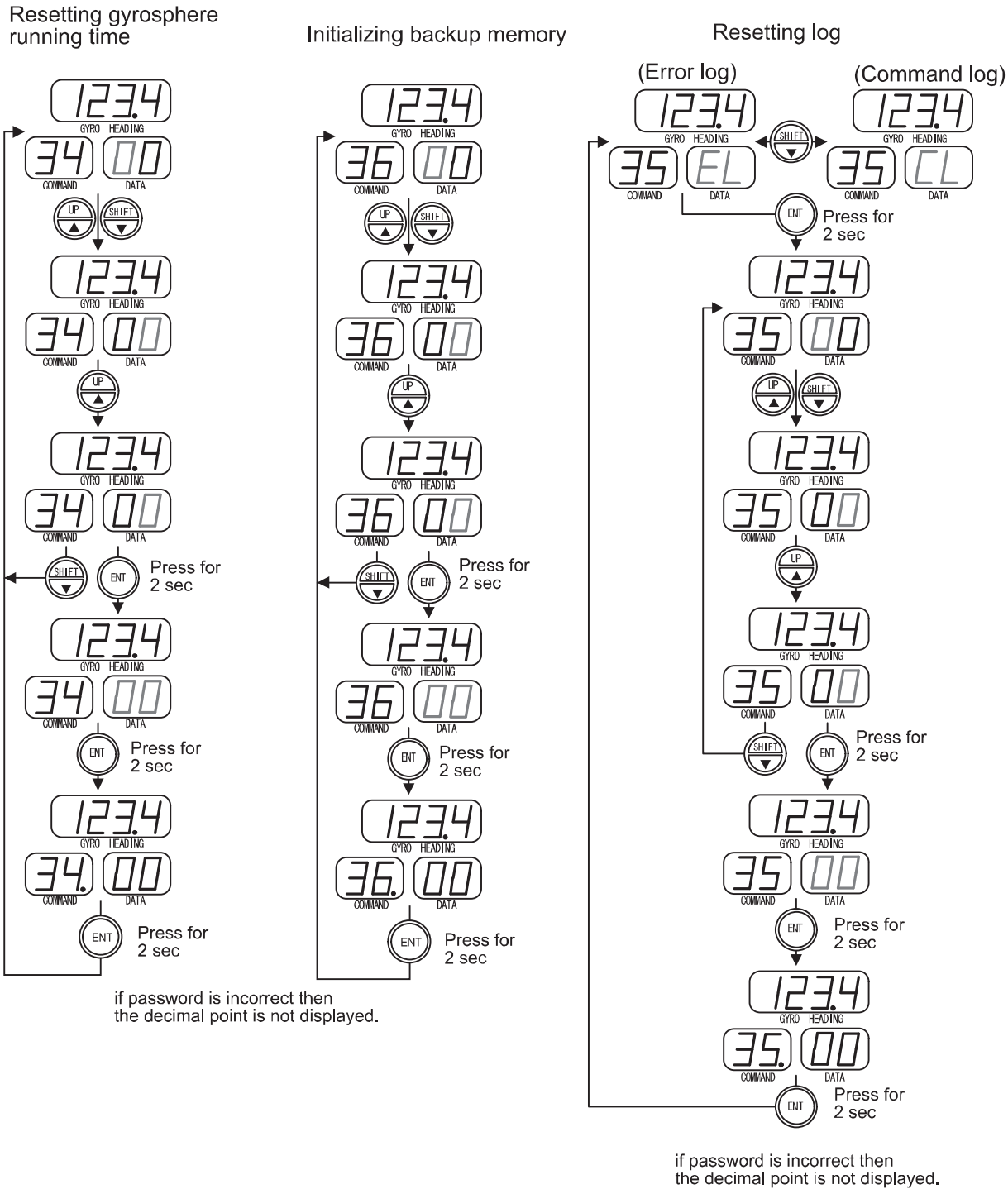
• Manual drive of repeater compass

Example of the display when the ▲ key or ▼ key is pressed.

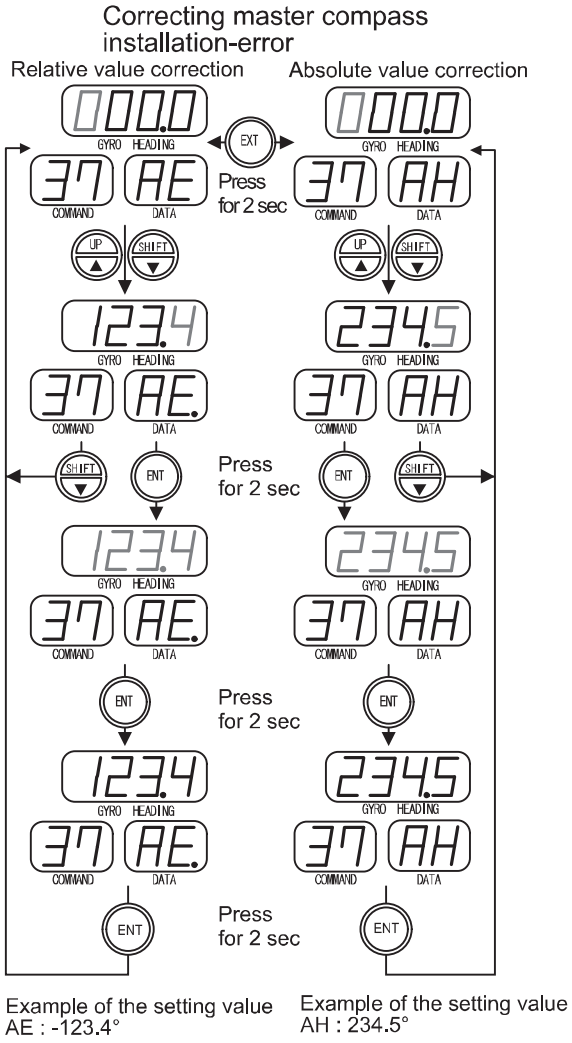
Accelerates（▲）: 0.0→0.1→0.2→0.3→0.4→0.5→0.6→1.2→1.8→2.4→3.0

Decelerates（▼）: 3.0→2.4→1.8→1.2→0.6→0.5→0.4→0.3→0.2→0.1→0.0

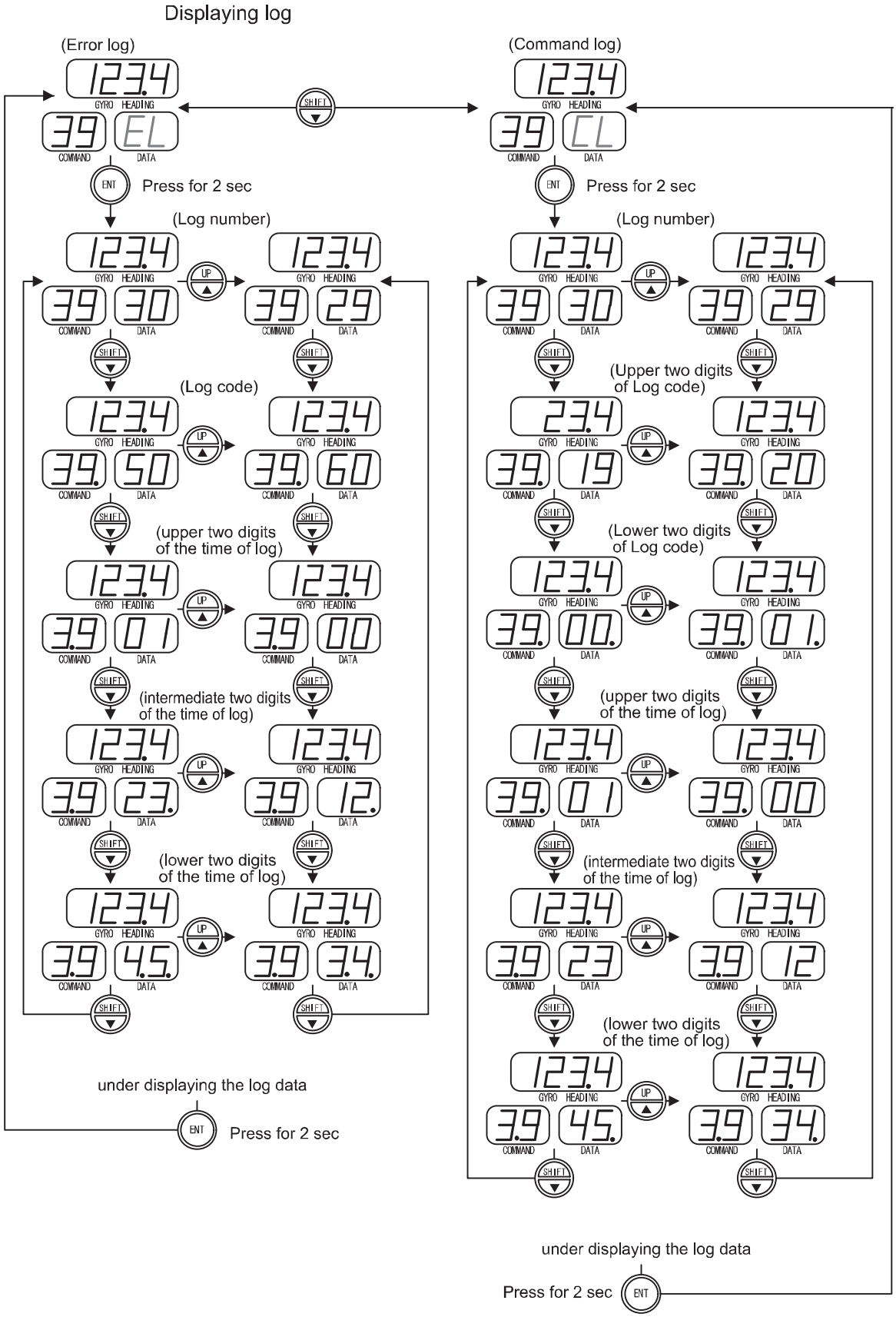
● The operation flow diagram of the maintenance function (M.operation unit) ···2/4



● The operation flow diagram of the maintenance function (M.operation unit) ···3/4



The operation flow diagram of the maintenance function (M.operation unit) ···4/4



4.4 Generation Function

This section describes the functions that facilitate communication with input / output devices connected to the CMZ900. The generation functions are divided into two groups : command functions with codes of 40's and settings with the dip switches. When command codes of 40's in the command functions are to be used, enable the generation functions as shown in section 4.4.1.

CAUTION

Only technicians of the Service department of Yokogawa Denshikiki Co.,Ltd. are authorized to implement the operations and other work described in this chapter. However, if for some reason the service department of Yokogawa Denshikiki Co., Ltd. permits you to perform these operations, be sure to follow the instructions described in this section.

The generation functions include the following:

Command code	Operation unit		Function item	Execution during Standby	Page
	C	M			
40	○	○	Permission for generation function	○	4-54
41	○	○	Setting the follow-up speed for stepper signal	○	4-55
42	○	–	Setting communication protocol of output port	○	4-56
43	○	–	Setting format of output port	○	4-57
45	○	–	Setting format of input port	○	4-61
49	○	○	Miscellaneous functions	○	4-66

Each functions are executed by operation of the C.operation unit or the M.operation unit.

See the section 3.2 for the operation unit.

See the section 3.4 for the command function.

See the section 3.5 for the command mode and the value input method.

See the section 7.3 for the settings with the dip switches.

4.4.1 Permission for Generation Function

COMMAND CODE : 40

The generation function is protected by password to reject mis-operation.

The command code “40” is the function to check password.

NOTE

Ask your nearest service agent of Yokogawa Denshikiki Co., Ltd. to implement the operation above.

Operation with the C.operation unit

Selecting “40 Password” from the Generat. MENU and pressing the ENT key switches to the display for entering a password (as shown in the upper figure on the right).

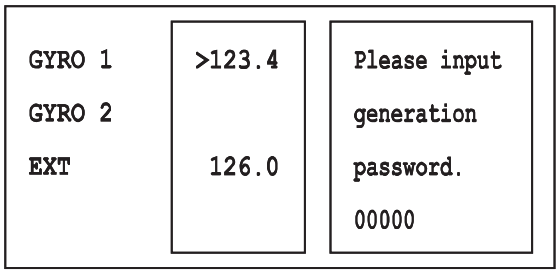
Press the ENT key again. The ones digit of “00000” blinks, prompting you to enter a password.

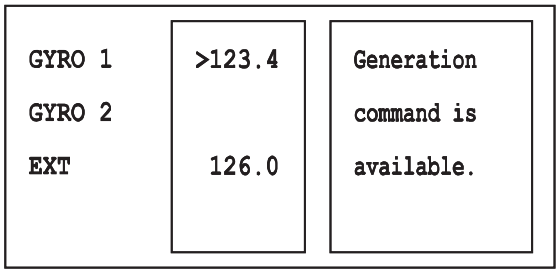
Press the right and left arrow keys to change the blinking digit, and press the upper and lower arrow keys to change the numeric value.

After entering the correct password “XXXXX”, press the ENT key. All the digits blink for confirmation.

Press the ENT key again. If the password is correctly entered, the generation functions are enabled (as shown in the lower figure on the right).

When a wrong password is entered, the ones digit of “00000” blinks again, prompting you to reenter a password.





The generation functions are disabled by default whenever the power is turned on,

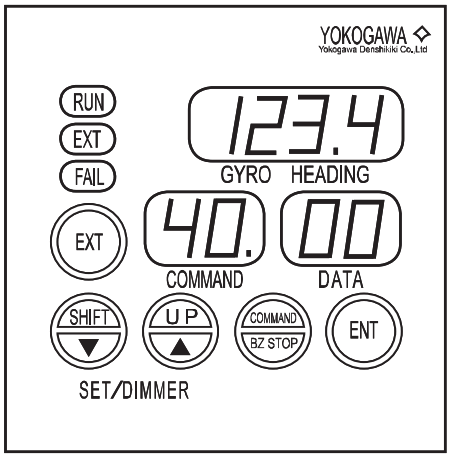
Operation with the M.operation unit

Executing the command code “40” displays “00” in the data display, in which the tens digit (digit to be entered) is blinking.

Press the SHIFT key to change the blinking digit, and then change the displayed code to “XX” using the UP key.

After entering the code, the entered value blinks if the ENT key is kept pressed for 2 seconds to enable the operator to confirm the value. If the ENT key is pressed for another 2 seconds, the entered value is displayed continuously and the generation functions are enabled (in which the decimal point is displayed after the least significant digit of the command display).

If the COMMAND key is pressed, the mode returns to normal.



The figure on the right shows an example of displaying the state in which the generation functions are enabled.

When it turns on the power supply again the generation function is refused. And also, it is refused even in the case that the codes of “ XX ” the exception was input.

4.4.2 Setting the Follow-up Parameter for Stepper Signal

COMMAND CODE : 41

This function sets the limit values of angular speed and angular acceleration speed of stepper-signal.

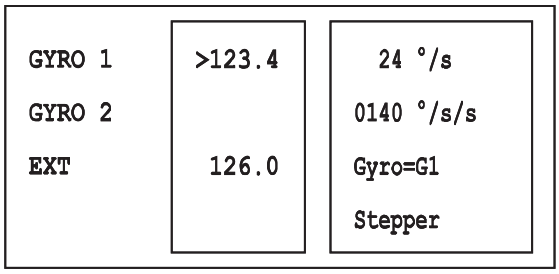
Initial Value

Follow-up Speed Angular Limit: 24 deg/s

Follow-up Acceleration Angular Limit: 140 deg/s^2

Operation with the C.operation unit

Selecting “41 Stepper” from the Generat. MENU and pressing the ENT key switches to the display showing the current settings for the maximum follow-up angular speed on line 1, and the maximum follow-up angular acceleration on line 2.



The figure on the right shows the standard settings.

Press the ENT key again. The tens digit of the angular speed blinks.

Press the right and left arrow keys to change the blinking digit and press the upper and lower arrow keys to change the numeric value.

After entering the angular speed (00 to 99), press the ENT key. All the digits blink for confirmation.

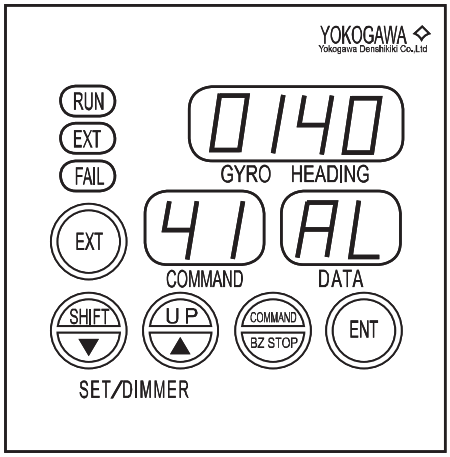
Press the ENT key again. The angular speed stops blinking and the thousands digit of the angular acceleration blinks.

Enter the angular acceleration (0000 to 9999) in the same way and press the ENT key. All the digits blink for confirmation.

Press the ENT key once more. The angular acceleration stops blinking and the settings finally change to the values you set.

Operation with the M.operation unit

The command code “41” is executed, the data display indicates “SL”, the gyro heading display indicates the maximum follow-up speed. If SHIFT key is pressed the display contents changes to the maximum follow-up acceleration and the data display indicates “AL”, the gyro heading display indicates the maximum follow-up acceleration.



“SL” : Setting of follow-up Speed Limit

“AL” : Setting of follow-up Acceleration Limit

The figure on the right shows an example of displaying the maximum follow-up acceleration of 140 deg/s^2.

If the EXT key is kept pressed for 2 seconds, the left digit of the data display blinks.

To change the digit, press the SHIFT key and then change the numeric value of the digit by pressing the UP key

After entering the setting value, the entered value blinks if the ENT key is kept pressed for 2 seconds to enable the operator to confirm the value. If the ENT key is pressed for another 2 seconds, the entered value is displayed continuously and is set as the final value.

If the COMMAND key is pressed, the mode returns to normal.

4.4.3 Setting Communication Protocol of Output Port

COMMAND CODE : 42

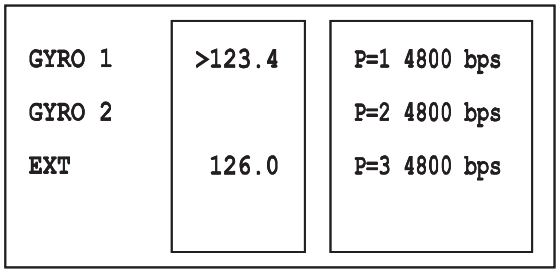
This function sets the protocol of the serial output ports which output the signal to external unit.

The gyrocompass system has four serial output ports, and a different communication protocol can be set for each.

The gyrocompass system has three serial output ports, (or four serial ports, if the C.operation unit is used) and a different communication protocol can be set for each.

■ Operation with the C.operation unit

Selecting “42 Out Port” from the Generat. MENU and pressing the ENT key switches to the display for selecting a port number (as shown in the figure on the right).



Press the ENT key again. The port number “1” blinks.

Press the upper and lower arrow keys to change the port number (1 to 4).

After selecting the port, press the ENT key. The port number stops blinking and the baud rate blinks.

Press the upper and lower arrow keys to change the baud rate (4800 bps or 38400 bps).

After selecting the baud rate, press the ENT key.

The port number blinks for confirmation.

Press the ENT key once more. The port number stops blinking and the communication protocol settings finally change to the values you set.

NOTE

The baud rate of port 1 is fixed to 4800 bps.

■ Operation with the M.operation unit

NOTE

It is not possible to execute this function with the M.operation unit.

The protocol setting is set by dip-switches in Master compass.

see section 6.3 for dip-switches definition.

4.4.4 Setting Format of Output Port

COMMAND CODE : 43

This function sets the communication format of the serial output signal.

The gyrocompass has three serial output ports. Three records can be set to each port. And different format can be set to each port for gyro heading and external heading.

The format is set for gyro heading selected

Port 1	Gyro heading (GYRO)	Record 1
		Record 2
		Record 3
	External azimuth (EXT)	Record 1
		Record 2
		Record 3

There are two types of format setting: ready-made formats and new formats.

- **Ready-made formats:**

The gyrocompass has several ready-made format.

One of the ready-made format (see following table) can be set to each record.

With the ready-made formats, one of the following formats can be set for each record.

Data	Ready-made Format
Heading (HDG)	$**HDT, $**HDG, $**HDM, $**THS
Rate of turn (ROT)	$**ROT
Heading / Rate of turn (HDG / ROT)	$**HRC, $HEHRC, $HCHRC,$PYDKH

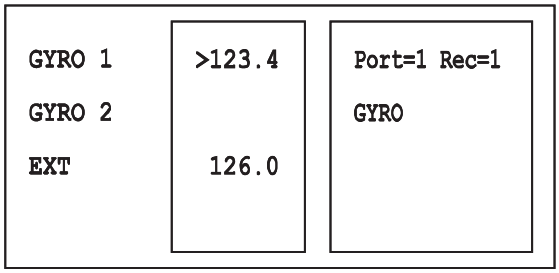
See appendix-5 about outline of ready-made format.

- **New formats:**

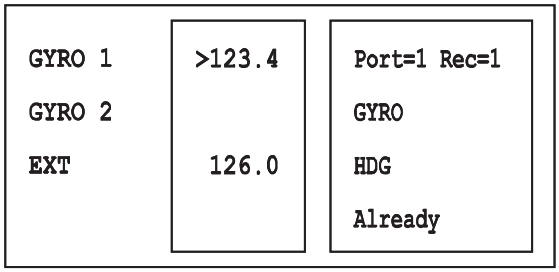
If ready-made format can not be used for connecting with external unit , it is possible to generate new format.

Operation with the C.operation unit

Selecting “43 Out Form” from the Generat. MENU and pressing the ENT key switches to the display for setting the communication formats for serial output ports (as shown in the upper figure on the right).



Selecting the output port, record number, and types



Press the ENT key, then the port “1” blinks.

Press the upper and lower arrow keys to select the port number (1 to 4), and press the ENT key. The port number stops blinking and the record “1” blinks.

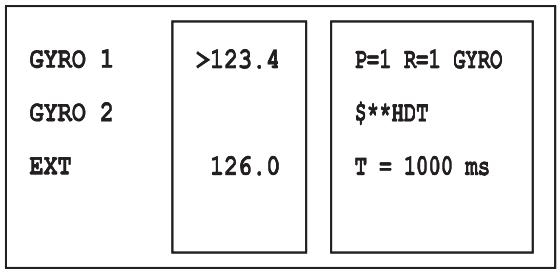
Press the upper and lower arrow keys to select the record number (1 to 3), and press the ENT key. The record number stops blinking and the output heading “GYRO” blinks.

Press the upper and lower arrow keys to select the output heading (GYRO or EXT), and press the ENT key. The output heading stops blinking and the data type “HDG” blinks.

Press the upper and lower arrow keys to select the data type (HDG, ROT, HDG/ROT, or NONE), and press the ENT key. When NONE is selected here, no data is output for the selected port, record number, or output heading. When other type is selected, then Already/New blinks on line 4.

Press the upper and lower arrow keys to select the type of format, and press the ENT key. When Already is selected here, then go to “Selecting a ready-made format” When New is selected, then go to “Creating a new format”.

Selecting a ready-made format



The display shows the current settings (as shown in the figure on the right) and the current ready-made format blinks.

Press the upper and lower arrow keys to select a format. The selectable ready-made formats depend on the data type. See the table on page 6-33.

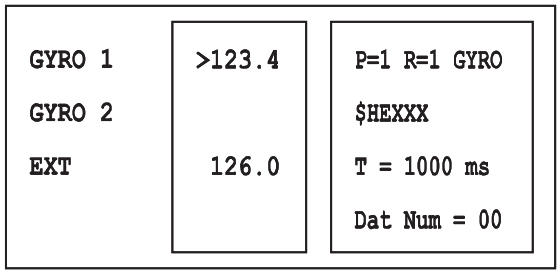
After selecting a ready-made format, press the ENT key. The format stops blinking and the current communication period blinks.

Press the upper and lower arrow keys to select the communication period (20ms (*1) / 200ms / 500ms / 1000ms). *1: Only at 38400bps

After entering the communication period, press the ENT key. The output port, record number, and output format finally change to the selected settings.

Creating a new format

The display shows the current settings (as shown in the figure on the right) and the second leftmost character of the header blinks.



Press the right and left arrow keys to change the blinking character (except for $), and press the upper and lower arrow keys to change the letter (A to Z, cyclic).

After entering the header, press the ENT key. and communication period blinks.

Press the upper and lower arrow keys to select the communication period (20ms (*1) / 200ms / 500ms / 1000ms). *1: Only at 38400bps

After entering the communication period, press the ENT key. and the tens digit of the number of data items (Dat Num) blinks.

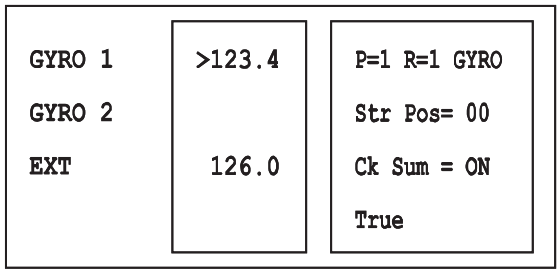
Press the right and left arrow keys to change the blinking digit, and press the upper and lower arrow keys to change the numeric value.

After entering the number of data items, press the ENT key.

The display shows the current settings for the selected data type.

· Example of creating an HDG format

The figure on the right shows an example of selecting HDG for the data type.



The tens digit of the starting position (Str Pos) blinks. Press the right and left arrow keys to change the blinking digit, and press the upper and lower arrow keys to change the numeric value.

After entering the starting position, press the ENT key. All the digits blink for confirmation.

Press the ENT key again. The starting position stops blinking and the designation for use of the check sum (Ck Sum) blinks. Press the upper and lower arrow keys to select on/off.

After selecting the check sum, press the ENT key. The check sum stops blinking and the True/Magnetic blinks.

Press the upper and lower arrow keys to select True, Magnetic, or None, and press the ENT key. The new format (heading) for the selected output port, record number, and output heading is finally confirmed.

· Example of creation an ROT format

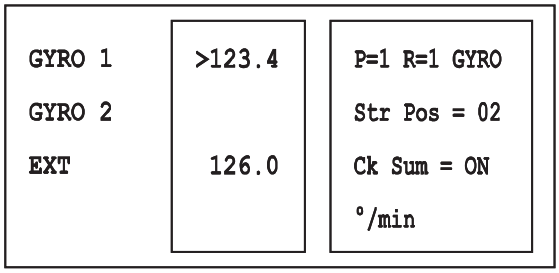
The upper figure on the right shows an example of selecting ROT for the data type.

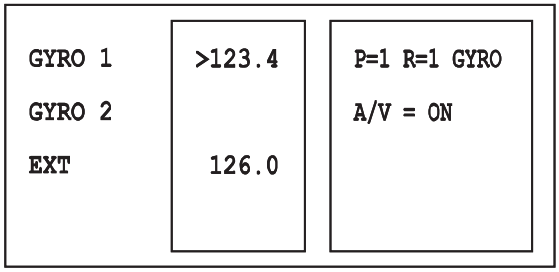
The tens digit of the starting position (Str Pos) blinks. Press the right and left arrow keys to change the blinking digit, and press the upper and lower arrow keys to change the numeric value.

After entering the starting position, press the ENT key. All the digits blink for confirmation.

Press the ENT key again. The starting position stops blinking and the designation for use of the check sum blinks. Press the upper and lower arrow keys to select on/off.

After selecting the check sum, press the ENT key. The check sum stops blinking and the unit blinks.





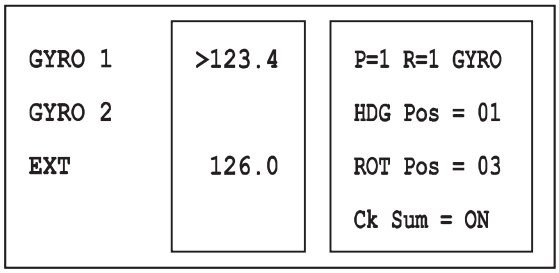
Press the upper and lower arrow keys to select a unit (degrees/min or degrees/sec), and press the ENT key. The designation for use of the A/V status blinks as shown in the lower figure on the right.

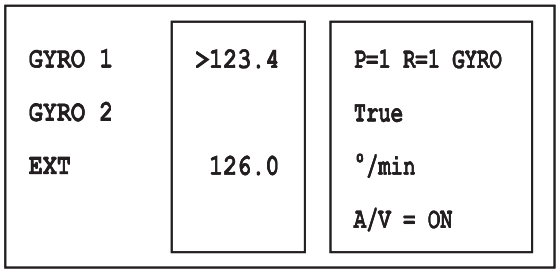
Press the upper and lower arrow keys to select on/off, and press the ENT key. The new format (rate of turn) for the selected output port, record number, and output heading is finally confirmed.

· Example of creation a HDG/ROT format

The upper figure on the right is an example of selecting HDG/ROT for the data type. The display shows the current settings of starting positions of the heading (HDG Pos) and the rate of turn (ROT Pos), and the designation for use of the check sum. Set all the items as in the case of the HDG and ROT.

After selecting the check sum, the display changes as shown in the lower figure on the right. Set all the items likewise. When all of the settings are completed, the new format (heading/rate of turn) for the selected output port, record number, and output heading is finally confirmed.





■ Operation with the M.operation unit

NOTE

It is not possible to execute this function with the M.operation unit.

4.4.5 Setting Format of Input Port

COMMAND CODE : 45

This function sets the communication format of the input signals which are position, speed and heading/ROT sent from external unit.

Heading and ROT input:

The heading and ROT signal formats can be set to three ports. The ROT signal can not set to different port from the heading signal.

Position input:

The position signal format can be set to one port.

Speed input:

The speed signal format can be set to one port. The speed signal can be selected from the serial signal or pulse signal.

There are two types of serial signal format settings: ready-made formats (see the table below) and new formats (according to the basic format below).

- **Ready-made format:**

The gyrocompass has several ready-made format.

One of the ready-made format (see following table) can be set to each record.

Data	Ready-made Format
Ship's speed (SPD)	VMVSD, VBW, VHW, VTG
Latitude (POS)	GGA, GLL
Heading (HDG)	HDT, HDG, HDM, HRC, THS
Rate of turn (ROT)	ROT, HRC

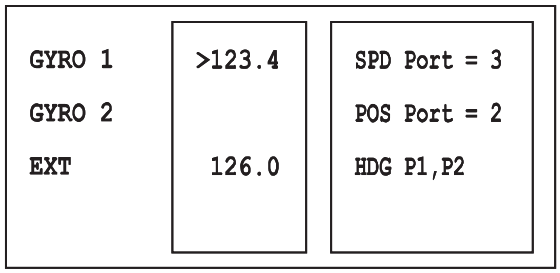
See appendix-5 about outline of ready-made format.

- **New formats:**

If ready-made format can not be used for connecting with external unit, it is possible to generate new format.

Operation with the C.operation unit

Selecting “45 In Form” from the Generat. MENU and pressing the ENT key switches to the display showing the current settings for the communication formats for serial output ports. The figure on the right is an example of setting the ship’s speed to port 3, the ship’s position (latitude) to port 2, and the heading to ports 1 and 2.



Press the ENT key, then the ship’s speed input port (SPD) blinks.

Press the upper and lower arrow keys to select the port (1 to 3, P, or “-”). Select P for the ship’s speed pulse input and “-” if there is no input for the ship’s speed. After selecting the port, press the ENT key. The ship’s speed input port stops blinking and the ship’s position input port (POS) blinks.

Press the upper and lower arrow keys to select the port (1 to 3, or “-”). Choose “-” if there is no input for the ship’s position. After selecting the port, press the ENT key. The ship’s position input port stops blinking and SPD blinks.

Press the upper and lower arrow keys to change the blinking item and select the data type (SPD, POS, or HDG).

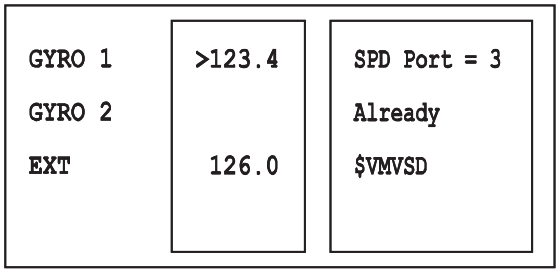
When selecting SPD (for the input ports 1 to 3 only) and pressing the ENT key, then go to "① Creating a ship’s speed format”.

When selecting POS (for the input ports 1 to 3 only) and pressing the ENT key, then go to "② Creating a ship’s position format”.

When selecting HDG and pressing the ENT key, then go to "③ Setting serial input ports for heading”.

① Creating a ship’s speed format

The figure on the right shows an example of selecting SPD for the data type.



Already/New blinks. Press the upper and lower arrow keys to select the type of format, and press the ENT key.

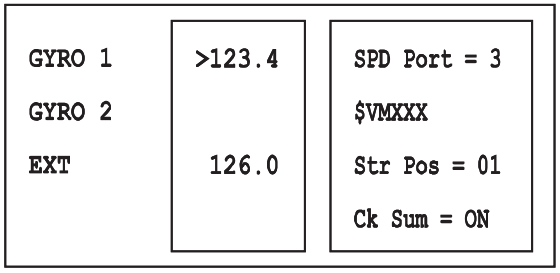
When Already is selected here, the current ready-made format blinks on line 3. Press the upper and lower arrow keys to select a ready-made format and press the ENT key. The selected format is finally confirmed.

When New is selected, the display changes as shown in the lower figure on the right.

The second leftmost character of the header blinks. Press the right and left arrow keys to change the blinking character (except for $), and press the upper and lower arrow keys to change the letter (A to Z, cyclic).

After entering the header, press the ENT key. All the characters blink for confirmation.

Press the ENT key again. The header stops blinking and the tens digit of the starting position (Str Pos) blinks. Press the right and left arrow keys to change the blinking digit, and press the upper and lower arrow keys to change the numeric value.

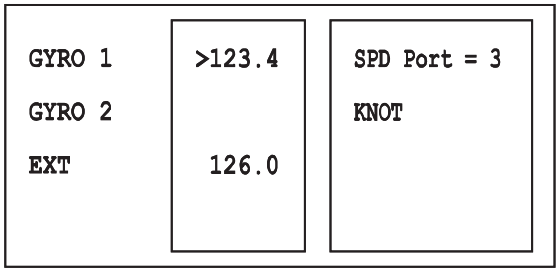


After entering the starting position, press the ENT key. All the digits blink for confirmation.

Press the ENT key again. The starting position stops blinking and the designation for use of the check sum (Ck Sum) blinks. Press the upper and lower arrow keys to select on/off.

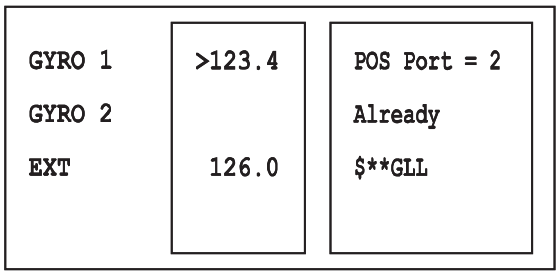
After selecting the check sum, press the ENT key. The display changes as shown in the upper figure on the right. and the unit blinks.

Press the upper and lower arrow keys to select a unit (KNOT or Km/h), and press the ENT key. The new format of ship's speed is finally confirmed.



② Creating a ship's position format

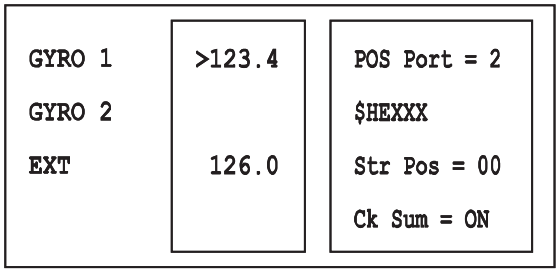
The figure on the right shows an example of selecting POS for the data type.



Already/New blinks. Press the upper and lower arrow keys to select the type of format, and press the ENT key.

When Already is selected here, the current ready-made format blinks on line 3. Press the upper and lower arrow keys to select a ready-made format and press the ENT key. The selected format is finally confirmed.

When New is selected, the display changes as shown in the upper figure on the right.



The second leftmost character of the header blinks. Press the right and left arrow keys to change the blinking character (except for $), and press the upper and lower arrow keys to change the letter (A to Z, cyclic).

After entering the header, press the ENT key. All the characters blink for confirmation.

Press the ENT key again. The header stops blinking and the tens digit of the starting position (Str Pos) blinks. Press the right and left arrow keys to change the blinking digit, and press the upper and lower arrow keys to change the numeric value.

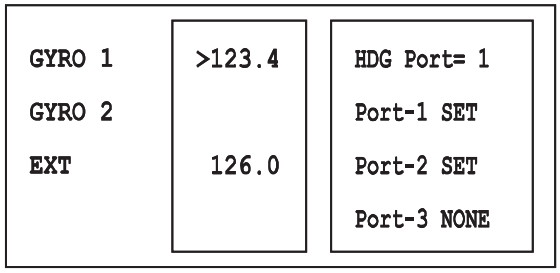
After entering the starting position, press the ENT key. All the digits blink for confirmation.

Press the ENT key again. The starting position stops blinking and the designation for use of the check sum (Ck Sum) blinks. Press the upper and lower arrow keys to select on/off.

After selecting the check sum, Press the ENT key . The new format of ship's position is finally confirmed.

③ Setting serial input ports for heading

The upper figure on the right shows an example of selecting HDG for the data type.



The display shows whether the heading is input to the serial ports 1 to 3. Either SET (yes) or NONE (no) is displayed.

The heading input status for port 1 blinks. Press the upper and lower arrow keys to select SET or NONE.

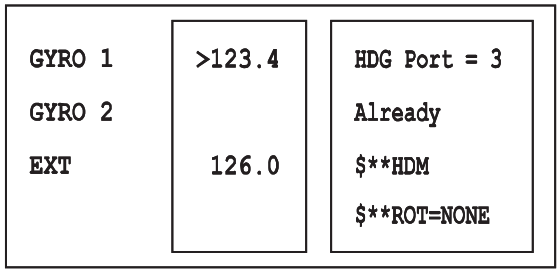
After selecting the heading input status for port 1, press the ENT key. The setting is finally confirmed. Set the heading input status for ports 2 and 3 likewise.

When all the ports are set for the heading input status, the display shows “Port = 1” and the number blinks.

Press the upper and lower arrow keys to select an input port (1 to 3) and press the ENT key. The display changes as shown in the middle figure on the right.

Already/New blinks. Press the upper and lower arrow keys to select the type of format, and press the ENT key.

When Already is selected here, the current ready-made format blinks on line 3. Press the upper and lower arrow keys to select a ready-made format and press the ENT key. The ROT input status blinks on line 4, Press the upper and lower arrow keys to select SET or NONE.



After selecting the ROT input status ,press the ENT key.

The selected format is finally confirmed.

When New is selected, the display changes as shown in the lower figure on the right.

The second leftmost character of the header blinks. Press the right and left arrow keys to change the blinking character (except for $), and press the upper and lower arrow keys to change the letter (A to Z, cyclic).

After entering the header, press the ENT key. All the characters blink for confirmation.

Press the ENT key again. The header stops blinking and the tens digit of the starting position (Str Pos) blinks. Press the right and left arrow keys to change the blinking digit, and press the upper and lower arrow keys to change the numeric value.

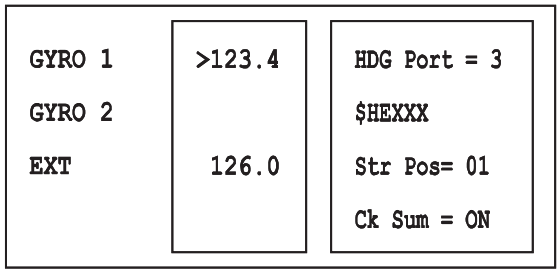
After entering the starting position, press the ENT key. All the digits blink for confirmation.

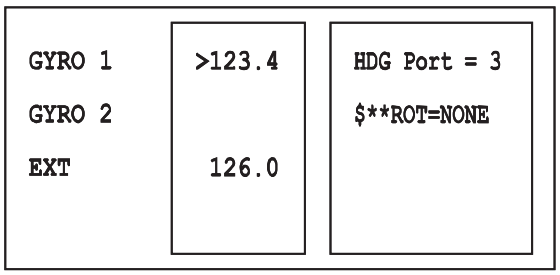
Press the ENT key again. The starting position stops blinking and the designation for use of the check sum (Ck Sum) blinks. Press the upper and lower arrow keys to select on/off.

After selecting the check sum, press the ENT key. The display changes as shown in the lower figure on the right.

The ROT input status blinkes on line 2. Press the upper and lower arrow keys to select SET ro NONE.

After selecting the ROT input status ,press the ENT key. The selected format is finally confirmed.





Operation with the M.operation unit

NOTE

It is not possible to execute this function with the M.operation unit.

4.4.6 Miscellaneous Function

COMMAND CODE : 49

This function executes the ON/OFF setting of following functions.

- **Mute function**

  If this function is set to ON, the buzzer is made to mute while any alarm are generated. This function is used when the gyrocompass is connected to the center alarm unit.

- **Bow Swap Function**

  If this function is set to ON, the heading signals are reversed by 180 degrees while being input the inverse contact signal.

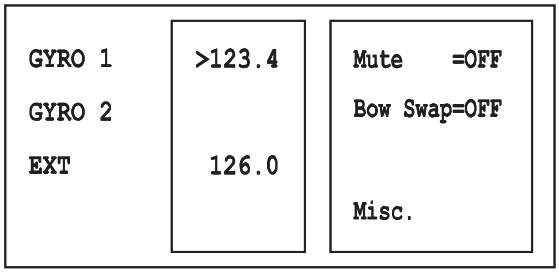
Operation with the C.operation unit

Selecting "49 Misc" from the Generat.MENU and press the ENT key switches to the display for Miscellaneous function.

Press ENT key again .

The MUTE blinks. press the upper and lower arrow keys to select the MUTE function (MUTE) or the Bow swap Function (Bow swap).

After selecting a function, press the ENT key.



The current settings of the selection blinks. press the upper and lower arrow keys to select ON/OFF.

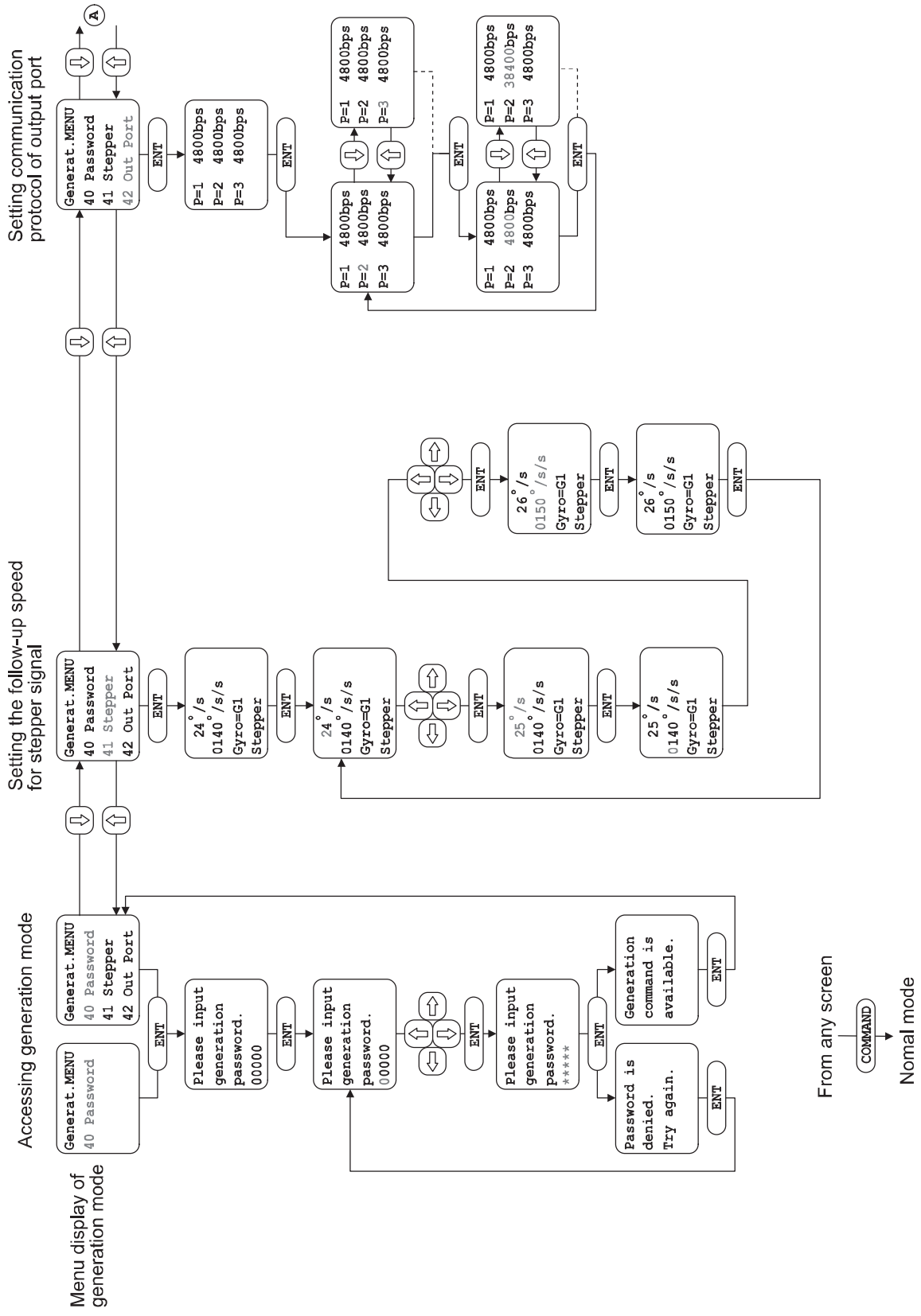
If the COMMAND key is pressed, the mode returns to normal.

Operation with the M.operation unit

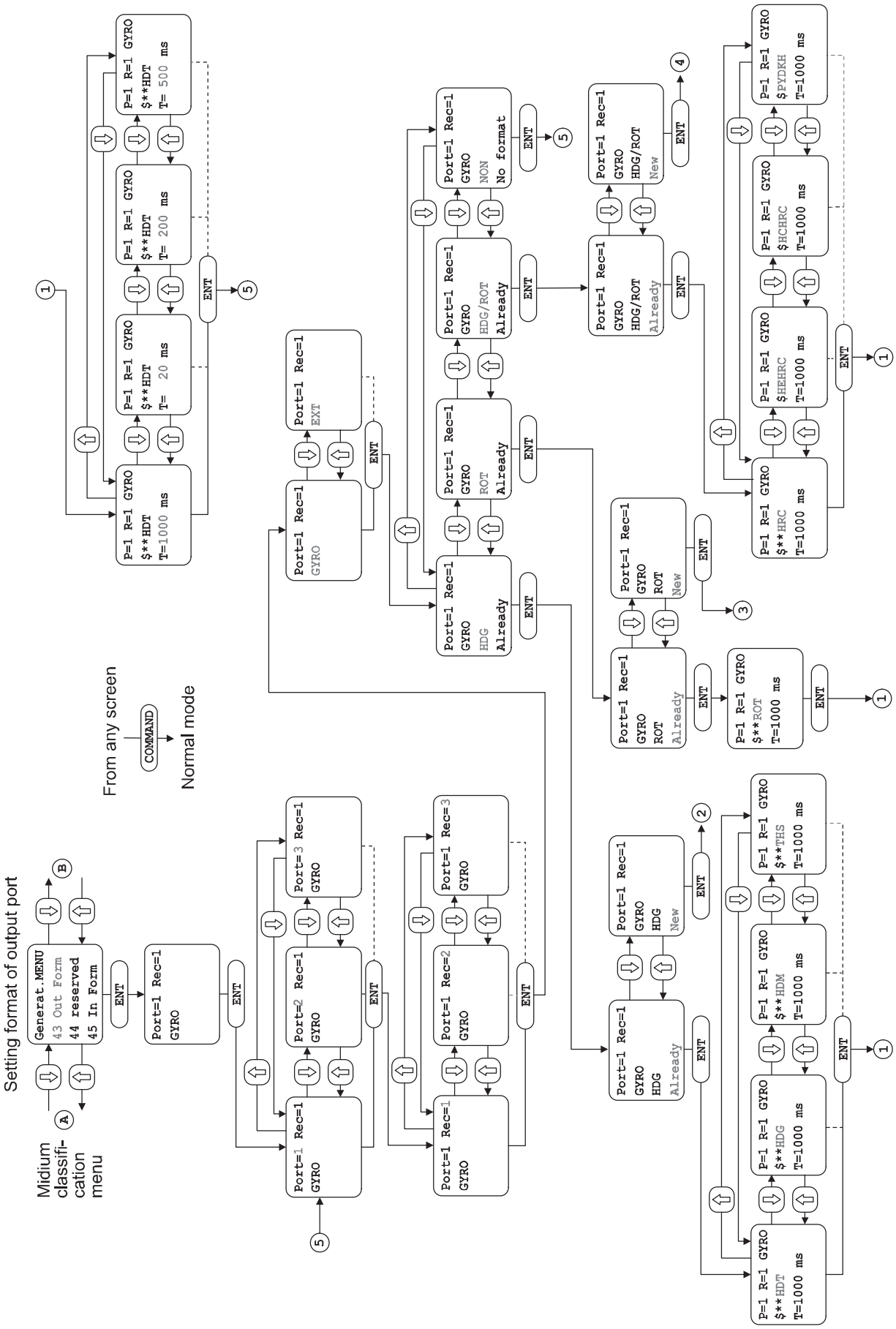
NOTE

It is not possible to execute this function with the M.operation unit.

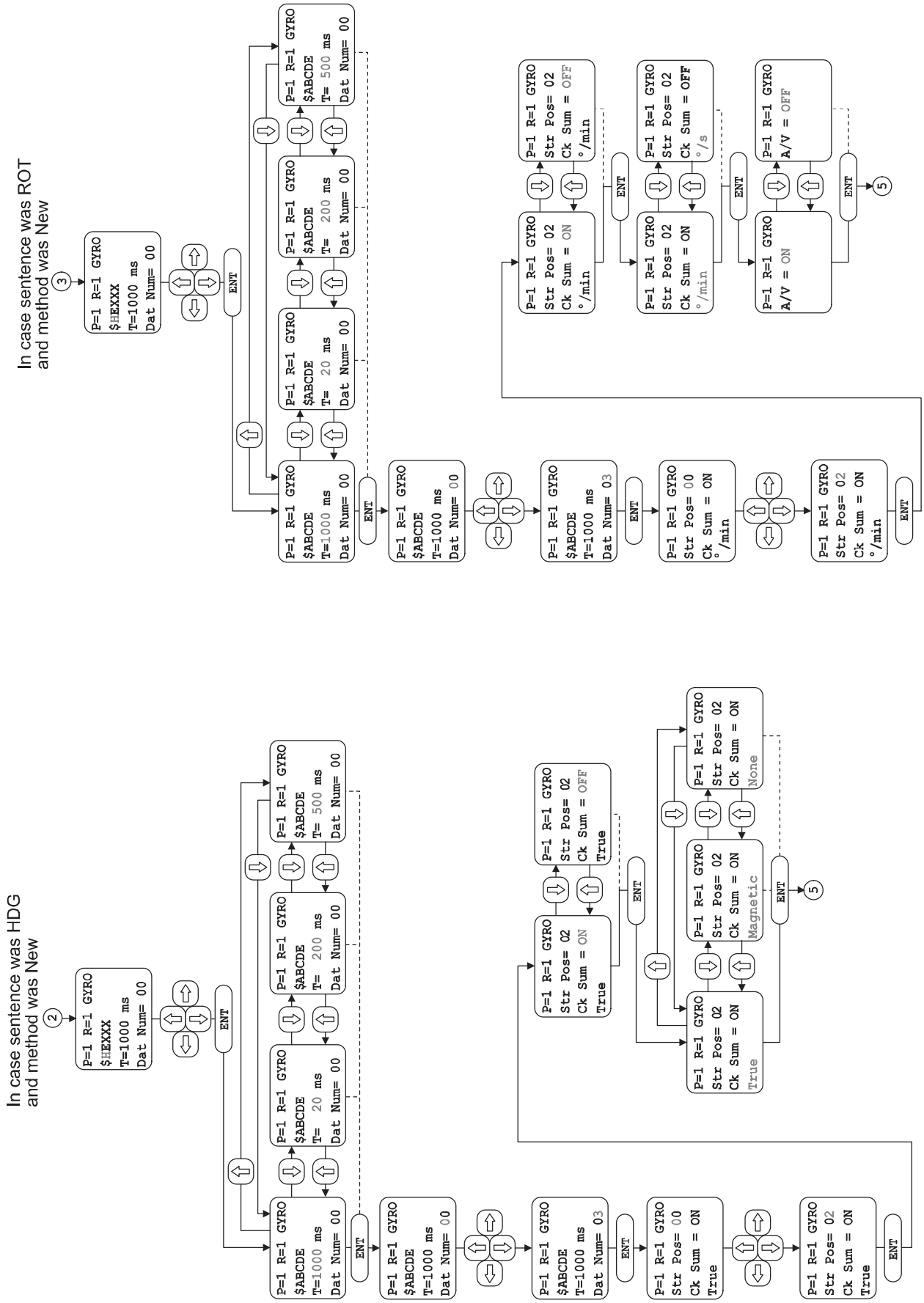
● The operation flow diagram of the generation function (C.operation unit) ···1/7



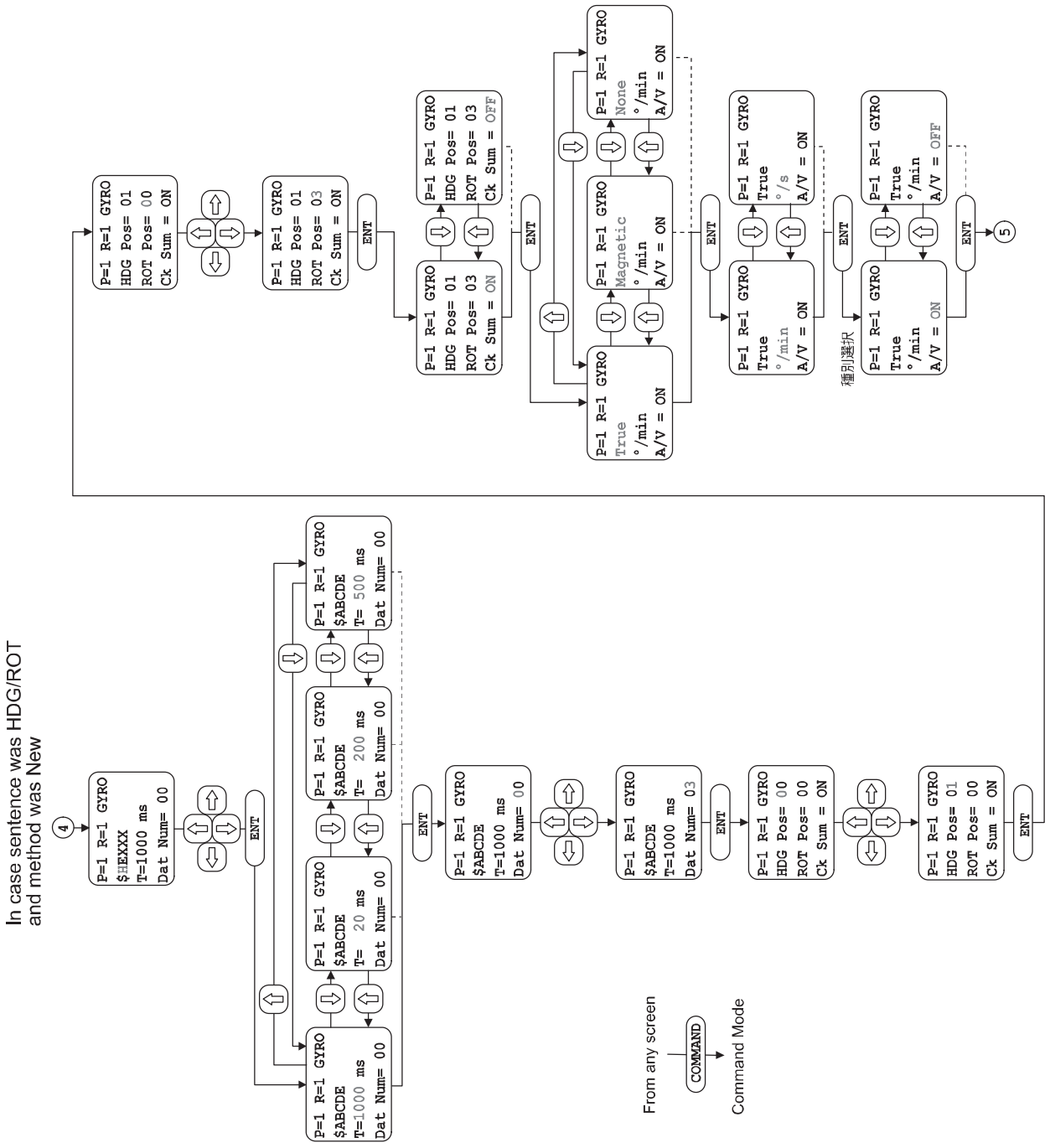
The operation flow diagram of the generation function (C.operation unit) ···2/7



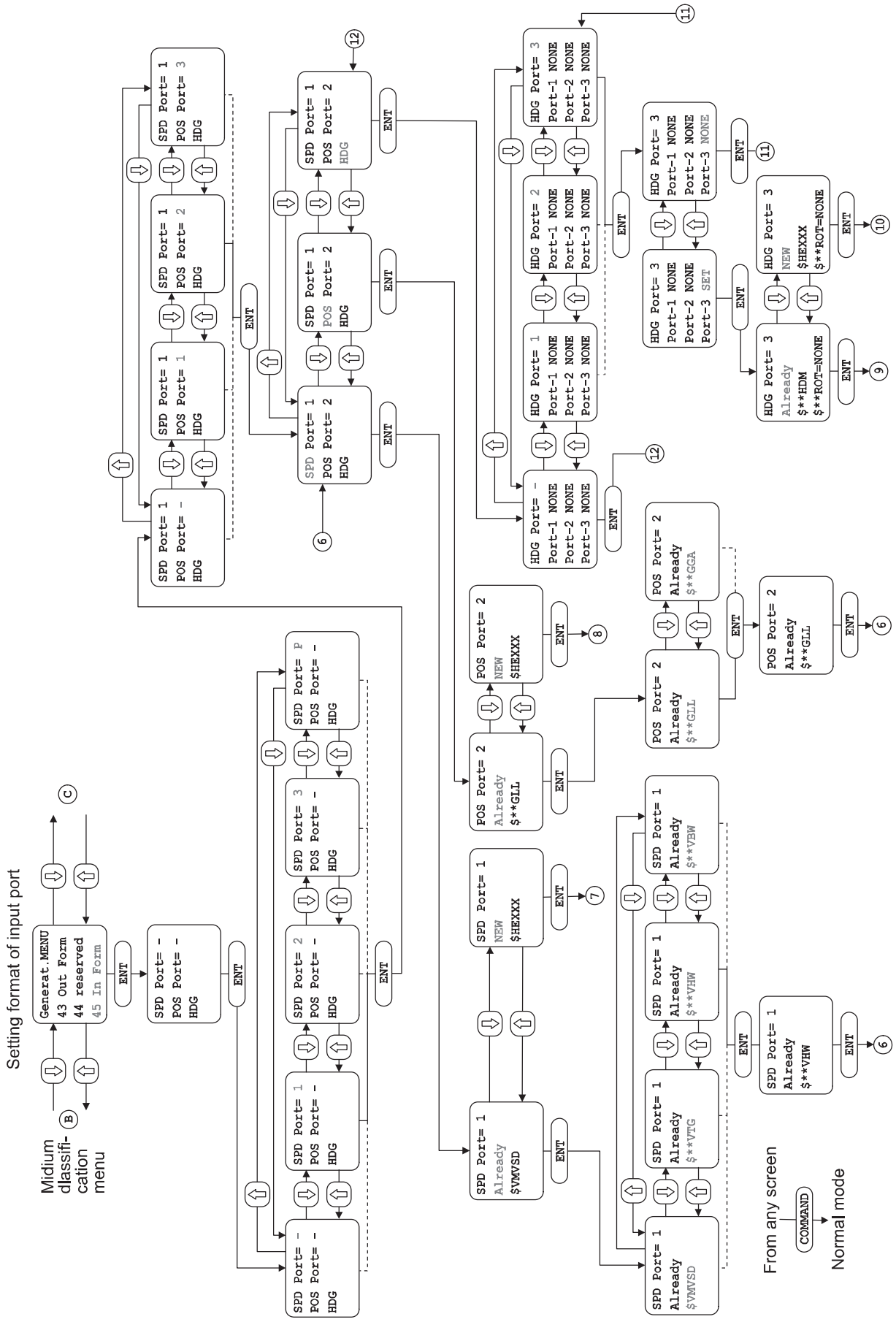
● The operation flow diagram of the generation function (C.operation unit) ···3/7



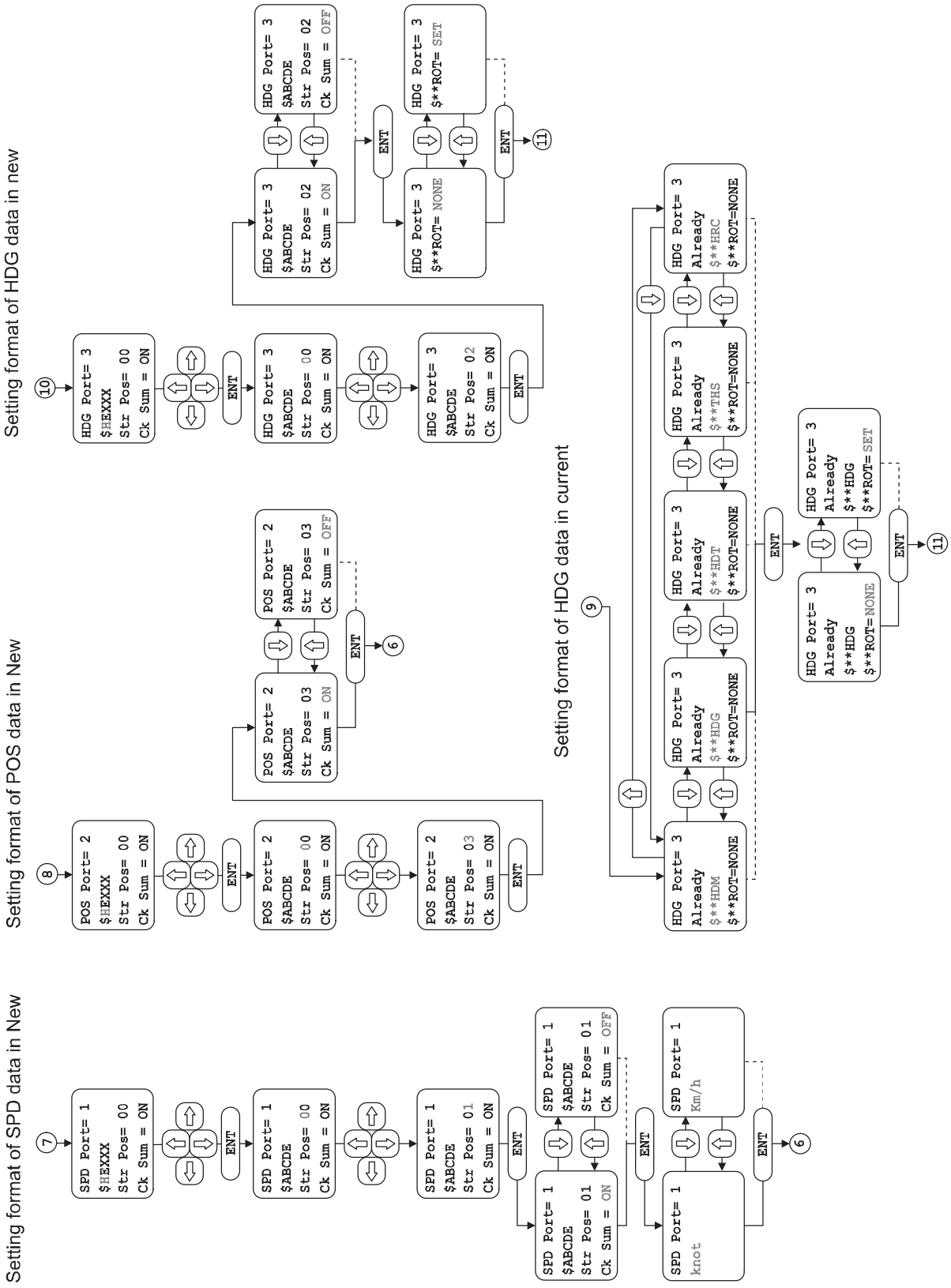
● The operation flow diagram of the generation function (C.operation unit) ···4/7



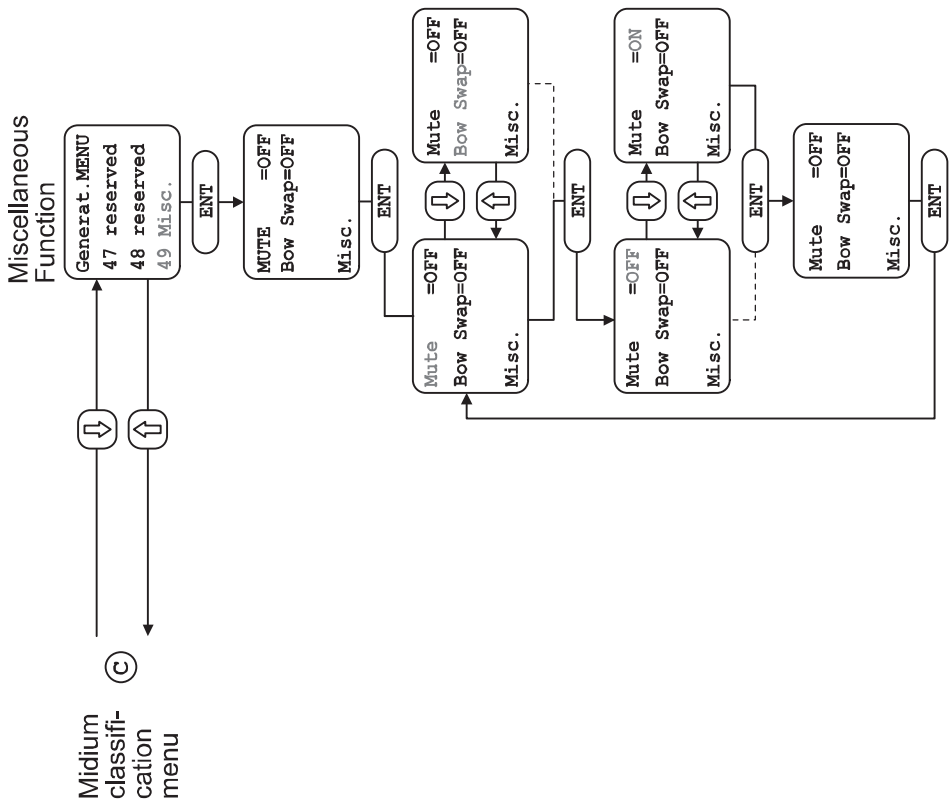
The operation flow diagram of the generation function (C.operation unit) ···5/7



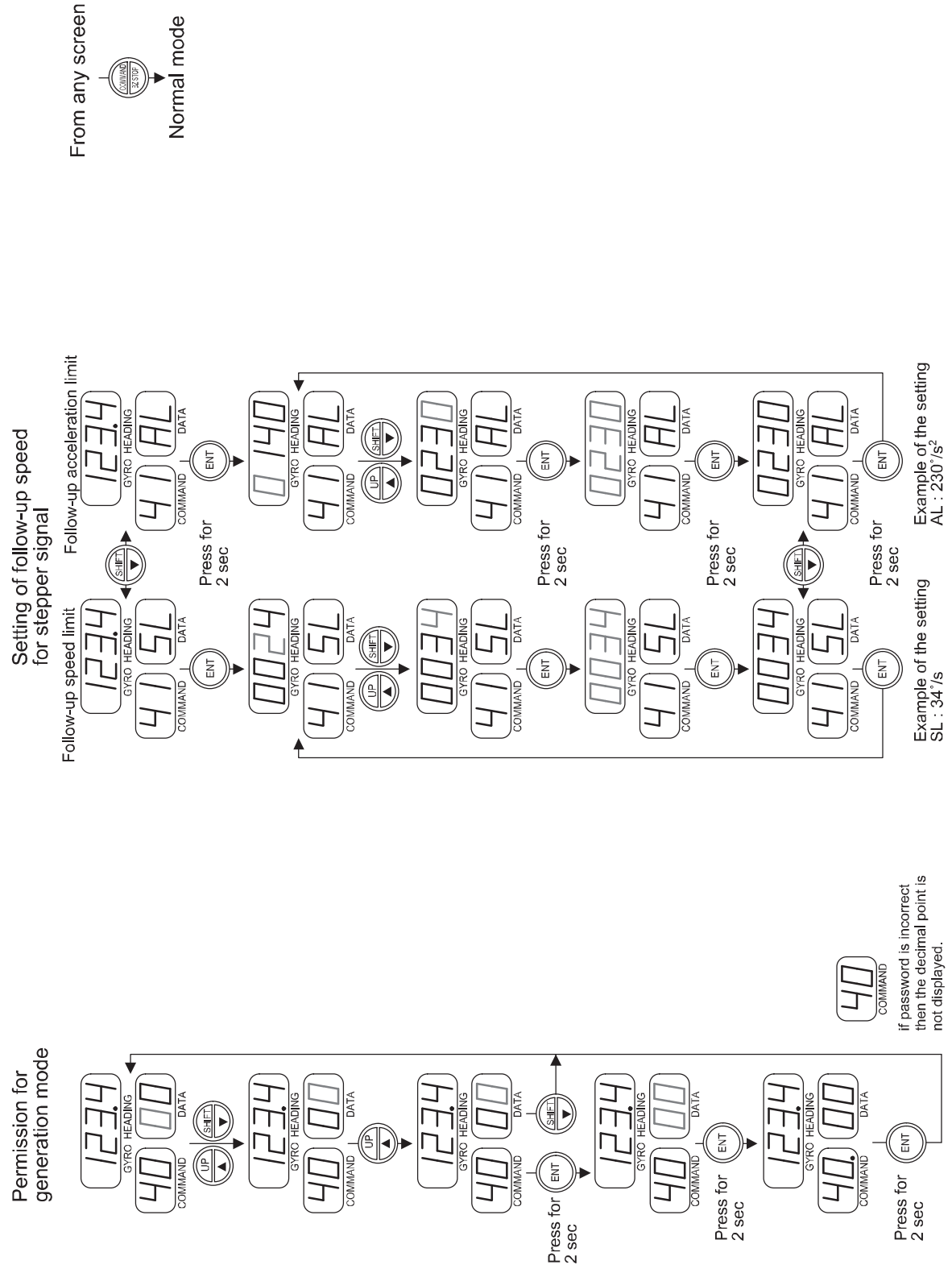
The operation flow diagram of the generation function (C.operation unit) ···6/7



● The operation flow diagram of the generation function (C.operation unit) ···7/7



The operation flow diagram of the generation function (M.operation unit)



5. Troubleshooting

5.1 Advice for Specific Situations

(1) If it is suspected that there is an error in a heading shown by a Repeater compass or an Autopilot:

① Check the settings for the ship's speed and latitude for correcting speed-error using command codes 21 and 22. If they are not correct, correct the values.

(See 4.2.2 and 4.2.3 of this manual.)

② Set the ship's speed to zero and check that indications on the Master compass and Repeater compass are the same. If they are not, align the indications of the Repeater compass and Master compass.

(See 5.3.2 of this manual.)

③ Check the accuracy of Master compass heading with using astronomilcal or physical target observation. If the heading is not accurate, operate the automatic or manual alignment command.

(See 4.2.4 and 4.2.5 of this manual.)

(2) If an abnormal sounds can be heard from the Master compass:

① Continue to operate the gyro system if there are no errors in indications of the Master and Repeater compasses.

② When there are errors in indications of the Master and Repeater compasses, use the external azimuth selector switch to set the operation of the system so that the azimuth sensor is selected to "external azimuth."

(See 5.4 of this manual.)

*: In either case, replace the gyrosphere as soon as possible.

(3) If you desire to know the gyrosphere running time:

This can be displayed using the command code 13. However, a correct value cannot be obtained unless the running time was reset when the gyrosphere was replaced.

(See 4.1.4 of this manual.)

(4) If you desire to know the phase current of the gyrosphere:

This can be displayed using the command code 15.

(See 4.1.6 of this manual.)

(5) If you desire to implement automatic re-startup using the timer:

The timer can be set using the command code 29.

(See 4.2.6 of this manual.)

(6) There is a possibility that abnormality has occurred on the selected device.

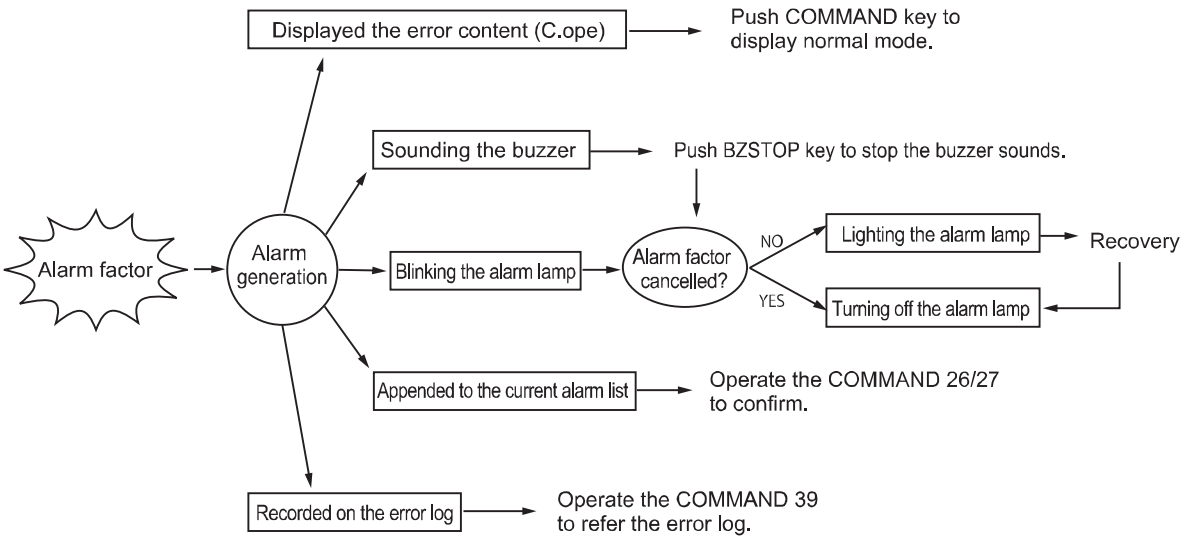
(See 5.4.1 of this manual.)

5.2 Alarm

The gyrocompass system generates an alarm in the following situations.

- **The units break down.**
- **A communication error is generated.**
- **etc**

This section describes that confirm method and action method of the error content.



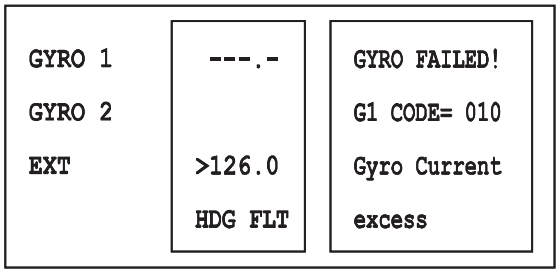
5.2.1 The Display when Alarm has been Generated

The gyrocompass system generates an alarm when an error has been generated.

The buzzer sounds and the alarm lamp blinks at that time.

C.operation unit displays cause of alarm at the general display area.

The right figure shows an example that “GYRO SPHERE FAILURE” is generated.



The buzzer is stopped by pushing the BZ STOP key. If cause of alarm still remains when BZ STOP key pushed, the alarm lamp is kept turning on.

If cause of alarm is already cleared when BZ STOP key pushed, the alarm lamp turns off.

If two or more alarms cause, push the right or left arrow key to display other error factors.

Push the COMMAND key, to display “NORMAL MODE”.

The detail of error code is described in section 5.2.4.

5.2.2 Confirmation of Error Factor

Operate the command 26 or 27 to confirm the error factors.

The error code is displayed by operating above command. If the cause of alarm is already cancelled, it is possible to delete from error list.

The operation of command 26 is described in section 4.2.6.

The operation of command 27 is described in section 4.2.7.

The contents of error , presumption causes and action method are described in section 5.2.4.

5.2.3 Cancellation of Alarm

The buzzer is stopped by pushing the BZ STOP key. If cause of alarm still remains when BZ STOP key pushed, the alarm lamp is kept turning on.

If cause of alarm is already cleared when BZ STOP key pushed, the alarm lamp turns off. The alarm lamp keeps light on until cause of alarm will be cancelled.

To cancel the alarm, refer to the section 5.2.4. The causes of alarm are classified as follows.

- **Cancelled by system restoration**

  When the alarm is generated by temporarily stopping the signal which communicates external device, the alarm will be cancelled by restoration of signal communication.

- **Cancelled by checking the power supply, connected device**

  When the alarm is generated by down of the power supply or abnormality of connected device, the alarm will be cancelled by turning on power supply or restarting the connected device.

- **Cancelled by manual operation or changing the setting**

  There are some cases that to cancel the cause of alarm by manual operation or changing the setting. ex) ERROR CODE : 080 , 151

- **Cancelled by exchanging to spare parts**

  If a fuse is cut, the alarm will be cancelled by exchanging to spare fuse.

- **The service call is necessary**

  When a serious breakdown occurs, the service call is necessary for repair.

  Ask your nearest service agent of Yokogawa Denshikiki Co., Ltd. to repair or maintain.

5.2.4 Presumption Causes and Countermeasures

If an alarm is generated , confirm the error code and countermeasure with referring the below table.

The operation of command function is described in chapter 4.

If it is not possible to countermeasure by using following method, ask your nearest service agent of Yokogawa Denshikiki Co., Ltd.

● ERROR CODE LIST

The number described in [ ] is an error code for the M.operation unit.

Error code	Error Contents	Presumption Cause	Countermeasure
10's : Gyroshere failure			
010 [10]	Gyrosphere failure Phase current of 350 mA or more continued for 20 min. or more. (40 min. for startup)	The phase current become large by abnormality of gyro sphere.	The gyro sphere replacement is necessary. (*1) **[Correspondence method under navigation]** • If the Autopilot is used in auto navigation mode, switch to the hand navigation mode according to the situation. (*2) • If the external heading device is connected, switch to the external device. (*2)
20's : Inverter failure			
020 [20]	Inverter failure Phase current of 75 mA or less continued for 3 seconds. (no inverter output voltage)	• Power unit (inverter section) failure • Wiring failure	• Check the connectors of container assy. (*1) • Check the cable connections of M. MAIN BD ASSY, M.PWM INV BD ASSY, M.PS BD ASSY and TRANS ASSY of Master compass. **[Correspondence method under navigation]** • If the Autopilot is used in auto navigation mode, switch to the hand navigation mode according to the situation. (*2) • If the external heading device is connected, switch to the external device. (*2)
021 [21]	Inverter failure Phase current of 75 mA or less continued for 3 seconds. (with inverter output voltage)	• No phase current flow due to gyrosphere failure. • Wiring failure	
30's : Memory Failure		(The memory test is executed at start up)	
030 [30]	Memory failure ROM check sum failure is generated.	Memory element failure	Replace the main-assembly unit. (*1)
031 [31]	Memory failure RAM read/write failure is generated.	Memory element failure	

*1: Ask your nearest service agent of Yokogawa Denshikiki Co., Ltd. to repair or maintain. Only technicians of the Service department of Yokogawa Denshikiki Co., Ltd. are authorized to maintain. However, if for some reason the service department of Yokogawa Denshikiki Co., Ltd. permits you to perform maintenance or exchanging the parts , obey instructions and execute it.
*2: Take enough care to navigation in consideration of the characteristic of the external heading device.
*3: Repair the system as soon as possible.
*4: It is limited that this alarm is generated , when the external signal is input to Master compass.

Error code	Error Contents	Presumption Cause	Countermeasure
40's : Backup battery voltage failure			
040 [40]	Backup battery voltage failure. Voltage of memory back-up battery falls to 2.5 V or less.	Memory backup battery dissipation	Replace the main-assembly unit. (*1) **[Correspondence method under navigation]** If the power supply is supplied continuously, all set values are kept. However if the power supply is stopped, various settings are initialized. (*3)
50's : Follow-up failure			
050 [50]	Follow-up failure Deviation of 0.5° or more is generated for 12 seconds or more.	• The follow-up gain is set with large value. • Follow-up mechanism failure • Motor drive circuit failure • Wiring failure	• Execute command 23 or 24 to restart following-up. • Decrease the follow-up gain using command 25. • Replace the main-assembly unit. • Replace the follow up mechanism. • Replace the container. (*1) • Check wiring and connections.
60's : Operation panel switch failure			
060 [60]	Switch failure ON continuously for 60 seconds or more	Switch failure of the operation unit.	• Replace the operation unit. (*1) **[Correspondence method under navigation]** There is no effect for heading detect, displaying and signal output, but there is a possibility that various operations cannot be done.
70's : Communication failure between C.operation unit and Master compass			
070 [70]	Communication failure	• Breakdown of C.operation unit • Breakdown of PWB of Master compass broke • The defectiveness of wiring between the C.operation unit and the Master compass.	• Check the cable connections of each units. • Exchange the PWBs or cable assy in Master compass. (M.TERMINAL BD ASSY, M.MAIN BD ASSY, C.MAIN BD ASSY, C. TERMINAL BD ASSY) (*1)
071 [71]	Invalid data	• The defectiveness of wiring between the C.operation unit and the Master compass. • The malfunction by signal noise.	• Check the cable connections of each units. • Check the connection of FG line.
80's : Automatic Master compass alignment failure (Null point detection failure)			
080 [80]	Master compass alignment failure (Zero-point detection failure)	• Breakdown of photo sensor • Wiring failure of sensor connection	• Exchange the photo sensor assy. (*1) • Check the connection of sensor. **[Correspondence method under navigation]** If it is necessary to align the Master compass, operate the command 24 for manual alignment.

*1: Ask your nearest service agent of Yokogawa Denshikiki Co., Ltd. to repair or maintain. Only technicians of the Service department of Yokogawa Denshikiki Co., Ltd. are authorized to maintain. However, if for some reason the service department of Yokogawa Denshikiki Co., Ltd. permits you to perform maintenance or exchanging the parts , obey instructions and execute it.
*2: Take enough care to navigation in consideration of the characteristic of the external heading device.
*3: Repair the system as soon as possible.
*4: It is limited that this alarm is generated , when the external signal is input to Master compass.

Error code	Error Contents	Presumption Cause	Countermeasure
90's : External heading input failure			
090 [90]	External heading input Time out	More than 10 seconds interruption of external heading signal	• Check the activation and setting of the connected device. • Check the setting of the C.operation unit. • Check the wiring connection.
091 [91]	Protocol error of external signal (*4)	The overrun error , framing error, or parity error occurs in external signal.	• Check the wiring connection. (polarity of signal,etc) • Check the baud rate and hardware protocols.
092 [92]	Check sum error of external heading signal	• The Malfunction by signal noise. • The disagreement of calculation of check sum between gyro and connected device.	• Check the cable connections of each units. (Especially the connection of FG line.) • Check the setting of connected device.
093 [93]	Data invalid of external heading signal	The system failure of connected device.	Repair the connected device.
094 [94]	External ROT input time out	More than 10 seconds interruption of external ROT signal	• Check the activation and setting of the connected device. • Check the setting of the C.operation unit. • Check the wiring connection.
096 [96]	Check sum error of external ROT signal	• The Malfunction by signal noise. • The disagreement of calculation of check sum between gyro and connected device.	• Check the cable connections of each units. (Especially the connection of FG line.) • Check the setting of connected device.
097 [97]	Data invalid of external ROT signal	The system failure of connected device.	Repair the connected device.
100's: Ship's speed input failure		(It is limited that this alarm is generated , when automatic speed error correction)	
100	Speed signal time out	More than 10 seconds interruption of speed signal	• Check the activation and setting of the connected device. • Check the setting of the C.operation unit. • Check the wiring connection.
102	Check sum error of speed signal	• The Malfunction by signal noise. • The disagreement of calculation of check sum between gyro and connected device.	• Check the cable connections of each units. (Especially the connection of FG line.) • Check the setting of connected device.
103	Data invalid of speed signal	The system failure of connected device.	Repair the connected device.
110's: Ship's position input failure		(It is limited that this alarm is generated , when automatic speed error correction)	
110	Latitude signal time out	More than 10 seconds interruption of latitude signal	• Check the activation and setting of the connected device. • Check the setting of the C.operation unit. • Check the wiring connection.

*1: Ask your nearest service agent of Yokogawa Denshikiki Co., Ltd. to repair or maintain. Only technicians of the Service department of Yokogawa Denshikiki Co., Ltd. are authorized to maintain. However, if for some reason the service department of Yokogawa Denshikiki Co., Ltd. permits you to perform maintenance or exchanging the parts , obey instructions and execute it.
*2: Take enough care to navigation in consideration of the characteristic of the external heading device.
*3: Repair the system as soon as possible.
*4: It is limited that this alarm is generated , when the external signal is input to Master compass.

Error code	Error Contents	Presumption Cause	Countermeasure
112	Check sum error of latitude signal	• The Malfunction by signal noise. • The disagreement of calculation of check sum between gyro and connected device.	• Check the cable connections of each units. (Especially the connection of FG line.) • Check the setting of connected device.
113	Data invalid of latitude signal	The system failure of connected device.	Repair the connected device.
120's :Serial input port protocol error			
120	Protocol error of serial signal input port 1	The overrun error, framing error , or parity error occurs in serial input signal.	• Check the wiring connection. (polarity of signal, etc) • Check the baud rate and hardware protocols. (*1)
121	Protocol error of serial signal input port 2		
122	Protocol error of serial signal input port 3		
150's: Deviation alarm (See section 4.2.9 about the setting of threshold of deviation alarm.)			
151	Deviation alarm	The heading difference between gyro heading and external azimuth exceeded the alarm value.	• Check the propriety of threshold value. • Check the Master compass and external heading device. If gyrocompass outputs abnormal heading , ask your nearest service agent of Yokogawa Denshikiki Co., Ltd. If external heading outputs abnormal heading, ask the manufacture service department. **[Correspondence method under navigation]** If the Autopilot is used in auto navigation mode, switch to the hand navigation mode according to the situation.

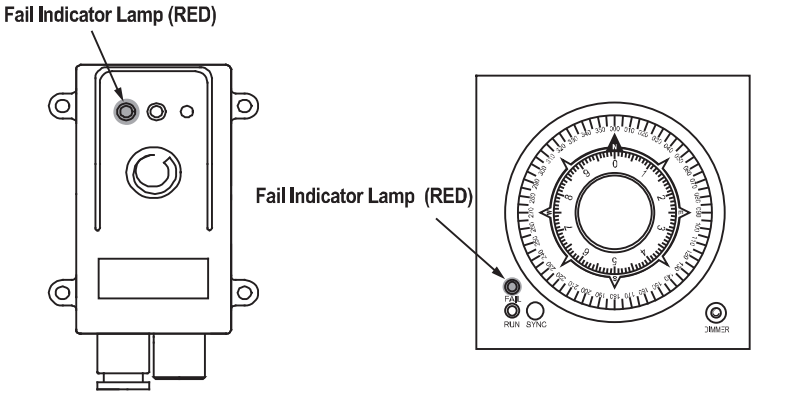
*1: Ask your nearest service agent of Yokogawa Denshikiki Co., Ltd. to repair or maintain. Only technicians of the Service department of Yokogawa Denshikiki Co., Ltd. are authorized to maintain. However, if for some reason the service department of Yokogawa Denshikiki Co., Ltd. permits you to perform maintenance or exchanging the parts , obey instructions and execute it.
*2: Take enough care to navigation in consideration of the characteristic of the external heading device.
*3: Repair the system as soon as possible.
*4: It is limited that this alarm is generated , when the external signal is input to Master compass.

5.3 Repeater Compass Error Contents and Countermeasures

5.3.1 The Display when Alarm has been Generated on the Repeater compass

The fail indicator lamp blinks or lights when Repeater compass detects failure.

The blink cycle of the fail indicator lamp indicates the error content of Repeater compass.



Junction Box (MKN019) Steering Repeater Compass (MKR056)

● Repeater compass error contents and countermeasure

Fail indicator lamp condition		Error contents	Causes	Countermeasure
Light off ○		Normal		
Light on ●		CPU RAM failure or ROM failure	Broken down CPU board in Junction Box	Exchange CPU board (*1)
Blink	Light on one time per 1.6 seconds.	Null point detection failure	Broken down optical sensor inside of Repeater compass	Exchange optical sensor (It is possible to adjust null point by manually) (*1)
	●○○●○○●○○ 1.6 sec		The snapping of a wire for Optical sensor	Restore connection (It is possible to adjust null point by manually) (*1)
	Light on two times per 1.6 seconds.	Communication failure between Master compass and Repeater compass	• Not connected signal wire • The snapping of signal wire • Connected signal wire inversely	Restore connection
	●●○●●○●●○ 1.6 sec			

●: Light on ○: Light off

*1: Ask your nearest service agent of Yokogawa Denshikiki Co., Ltd. to repair or maintain. Only technicians of the Service department of Yokogawa Denshikiki Co., Ltd. are authorized to maintain. However, if for some reason the service department of Yokogawa Denshikiki Co., Ltd. permits you to perform maintenance or exchanging the parts , obey instructions and execute it.

5.3.2 Procedure for Aligning Repeater compass Indication

The Repeater compass indication is automatically aligned with the Master compass indication when the power is turned on. In general, no other alignment is required. However, it is advisable to check the Master compass display and the Repeater compass indication before departing from a port to avoid possible accident. If the Master compass display and the Repeater compass indication match, alignment of indication is not necessary.

NOTE

Check the readings of the Repeater compass card when the ship's speed is set to "0." If a speed-error correction is performed, the Master compass card reading will not agree with the Repeater compass card reading.

● Procedure using the zero adjustment switch

If the Repeater compass indication shifts from the Master compass display, use the zero adjustment switch to align the indication.

Press this switch for 3 seconds or more. The Repeater compass card turns and the zero of the compass card is aligned with the pointer to correct the shift.

Then, the Repeater compass follows up the received value.

If an error due to zero point photo-sensor failure is generated, use the procedure described below to align the indication.

● Procedure in the case where the zero point photo-sensor fails

It is possible to adjust null point by manually when null point detection failure is occurred.

The procedure is as follows:

(1) Push Zero adjustment switch more than 2 seconds.

(The Repeater compass card will turn round and stop after 5 seconds.)

At this time Fail indicator lamp shows null point detection failure.

(2) Push Zero adjustment switch. (The Repeater compass card will turn round rapidly)

(3) Push Zero adjustment switch when the outer Repeater compass card (360 degrees/ revolution) value go below 10 degrees. (Rough adjustment)

The compass card will turn round slowly.

(4) Push Zero adjustment switch when the compass needle agree with the 0 scale of inner Repeater compass card.

After about 3 seconds the Fail indicator lamp will be turned off and the Repeater compass shows same heading as Master compass heading. (Fine adjustment)

If you failed manual null point adjustment, try again the above procedure.

5.4 Heading Signal Selection

If external heading signal is input, gyrocompass can select it. If master compass is damaged seriously, all output signals can be output by using the external signal.

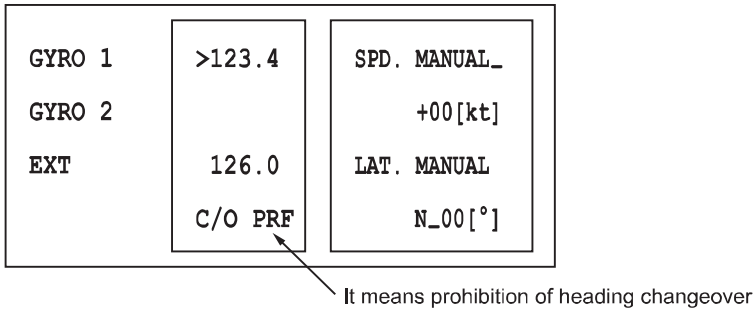
5.4.1 Prohibition of Heading Changeover

If there is large deviation between gyro heading and external heading, the switching of heading signal under the condition which Autopilot is auto navigation mode has the possibility of causing a rapid course change.

CMZ900 can be limited of heading selection.

CMZ900 can prohibit the switching of heading by using contact signal (*1). (*2)

When changeover of the heading is prohibited, C.operation unit displays "**C/O PRF**" at the system status display area.



*1: The contact signal for prohibition of heading changeover
*2: This function can be used if C.operation unit is equipped and connected Autopilot can output signal.

- **The commands that cannot be executed during prohibition of heading changeover**
  - Heading selection key (G1 / EXT)
  - Setting of speed signal (COMMAND 21)
  - Setting of latitude signal (COMMAND 22)
  - Automatic alignment of Master compass (COMMAND 23)
  - Manual alignment of Master compass (COMMAND 24)

5.4.2 Heading Changeover Method

The method of heading changeover is described in this section.

● Changeover to external heading

Press the EXT key over 2 seconds or more on the operation unit to switch the signal from gyrocompass to external device.

- C.operation unit : EXT key
- M.operation unit : EXT key

Press the G1 key to return to the gyro heading.

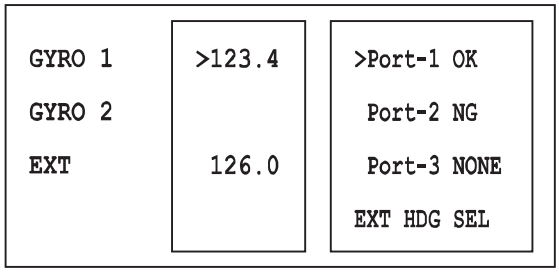
NOTE

G2 key is invalid in CMZ900B/S

● Selection of external heading device

C.operation unit can input the heading from three different devices or less.

One of them can be selected. Operate the COMMAND 20 to select the external heading device.



See section 4.2.1 for detail of COMMAND 20.

NOTE

The function that select the external heading device can not be executed at M.operation unit.

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6. Specifications

6.1 Performance and specifications

6.1.1 Power Supply

	CMZ900B	CMZ900S
Main power supply	24 V DC +30 %, -10 %	Same as the left
	100 /110/115/220 V AC 50/60 Hz (*1)	100 /110/115/220 V AC 50/60 Hz
Backup power supply	24 V DC +30 %, -10 % (*1)	24 V DC +30 %, -10 %
Power consumption (24 V DC)	At startup: Approx. 3.5 A + 0.35 A × number of Repeater compasses	At startup: Approx. 4.7 A + 0.35 A × number of Repeater compasses
	Steady sate: Approx. 2.3 A + 0.35 A × number of Repeater compasses	Steady sate: Approx. 3.5 A + 0.35 A × number of Repeater compasses
Power consumption (AC)	At startup: Approx. 125 VA + 12 VA × number of Repeater compasses (*1)	At startup: Approx. 125 VA + 12 VA × number of Repeater compasses
	Steady state: Approx. 90 VA + 12 VA × number of Repeater compasses (*1)	Steady state: Approx. 100 VA + 12 VA × number of Repeater compasses

*1: Optional: In the case of using with the MKR027.

6.1.2 Input Signal

		CMZ900B	CMZ900S
Ship's speed signal for speed-error correction	Number of circuits	1 circuit (*1)	1 circuit
	Signal form	200 pulses/n mile, or serial IEC61162-1	Same as the left
Latitude signal for speed-error correction	Number of circuits	1 circuit (*1)	1 circuit
	Signal form	Serial IEC61162-1	Same as the left
Heading signal	Number of circuits	1 circuit	3 circuit
	Signal form	Serial IEC61162-1	Same as the left
Alarm buzzer stop signal		1 circuit, contact	Same as the left
Bow swap contact input		1 circuit, contact (*1)	1 circuit, contact
C/O PRF singnal input		1 circuit, contact (*1)	1 circuit, contact

*1: Optional: The C.operation unit is necessary

6.1.3 Output Signal

		CMZ900B	CMZ900S
Repeater compass signal	Number of circuits	3 circuits	8 circuits
	Signal form	Serial IEC61162-1 sentence	Same as the left
Stepper heading signal	Number of circuits	1 circuit, capacity 1 A	4 circuit, capacity 1 A
	Signal form	24 V DC, 3-bit gray code, 1/6 degree/step	Same as the left
Serial heading/rate-of-turn signal	Number of circuits	3 circuits, individual generation possible	Same as the left
	Signal form	Serial IEC61162-1 / -2	Same as the left
Analog heading and quadrant signals	Number of circuits	1 circuit each	Same as the left
	Signal form	0 to 5 V DC	Same as the left

		CMZ900B	CMZ900S
Analog rate-of-turn signal	Number of circuits	3 circuits, individual range setting possible	Same as the left
	Signal form	0 to 5 V DC; 30, 100, and 300 °/min	Same as the left
Serial ship's speed input distribution Output	Number of circuits	1 circuit (*1)	Same as the left
	Signal form	serial IEC61162-1	Same as the left
Volt-free signal:	Number of circuits	1 circuit, contact	Same as the left
	Signal status	"Open" or "closed" when no voltage is applied	Same as the left
Gyro failure signal	Number of circuits	1 circuit, contact	Same as the left
	Signal status	"Open" or "closed" when gyro fails	Same as the left
Heading selection signal	Number of circuits	1 circuit, contact	1 circuit each, contact
	Signal status	Closed when Gyro is selected	Closed when each sensor is selected
Gyro running signal	Number of circuits	1 circuit , Contact (*1)	Same as the left
	Signal status	"Open" or "closed" when running	Same as the left
System fail signal	Number of circuits	1 circuit, contact (*1)	Same as the left
	Signal status	"Open" or "closed" when system fails	Same as the left
Deviation Alarm	Number of circuits	1 circuit, contact (*1)	Same as the left
	Signal status	"Open" or "closed" when abnormal	Same as the left
Buzzer stop	Number of circuits	1 circuit, contact	Same as the left

*1: Optional: The C.operation unit is necessary

6.1.4 Setting Time and Accuracy

Settling time	Within 5 hours (The gyro can actually be used after about 2 hours from start.)
North-pointing accuracy	Within ± 0.25 °/cos φ (φ being the latitude at that location)
Follow-up accuracy	0.1 ° or less
Maximum follow-up speed	30 °/s

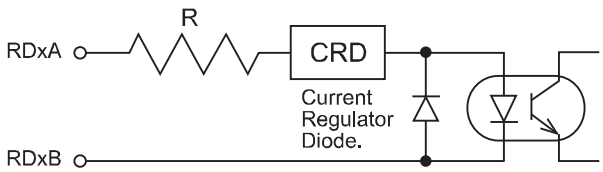
6.1.5 Environmental Specifications (Normal operating conditions)

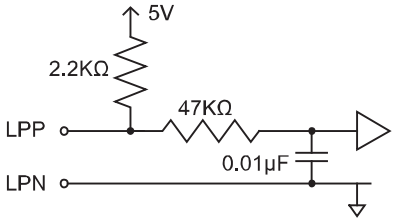
Allowable roll and pitch	40 ° for both rolling and pitching
Allowable vibration	3 mm p-p or less for 8 to 8.3 Hz
	0.35 mm p-p or less for 8.3 to 25 Hz
	0.1 mm p-p or less for 25 to 50 Hz
Operating temperature range	- 15 °C to + 55 °C - 10 °C to + 50 °C (Master compass) - 25 °C to + 55 °C (Bearing Repeater compass)

6.1.6 External Input /Output signal Specifications and Circuits

<table>
<tr><th>Signal Name</th><th>Abbreviation</th><th>Circuit / signal Specifications</th></tr>
<tr><td>Serial signal input</td><td>RD1A/RDMA
RD1B/RDMB

RD2A
RD2B

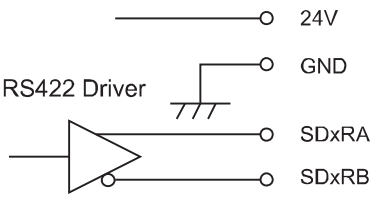
RD3A
RD3B</td><td> 

• Number of connectable circuits: 1 or 3 (The C.operation unit is necessary)
• Data contents: Heading, ship's speed (optional) and latitude (optional)
• Receiving circuit: Photo-coupler
• Transmission format: Start-stop serial signal
• Transmission rate: 4800 bps.
• Data format: See Appendix</td></tr>
<tr><td>Ship's speed
pulse input</td><td>LPP
LPN/BSC</td><td> 

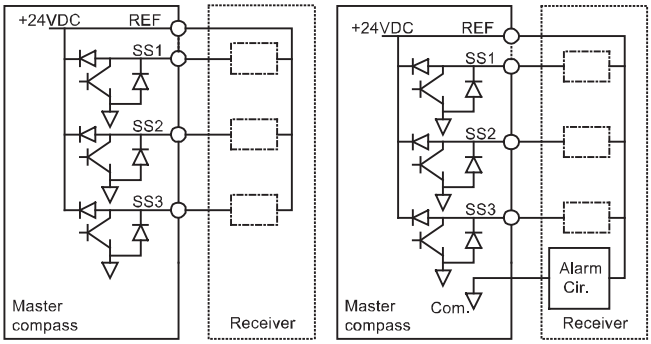
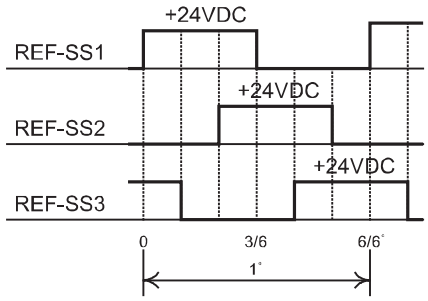
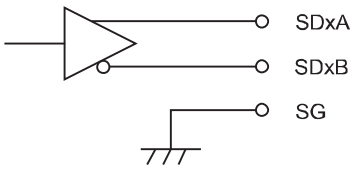
• Number of connectable circuits: 1 (The C.operation unit is necessary)
• Pulse rate: 200 pulses/n mile
• Signal format: Open collector (photo-coupler) or volt-free contact</td></tr>
<tr><td>Repeater compass
heading output</td><td>24VOUT
GND
SD1RA
SD1RB

24VOUT
GND
SD2RA
SD2RB

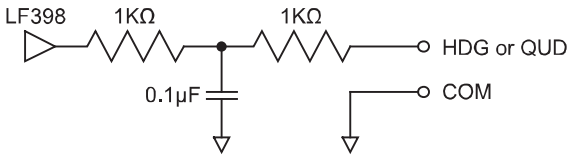
•
•
•

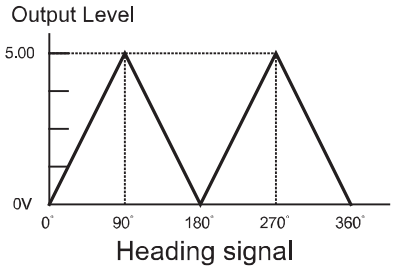
24VOUT
GND
SD8RA
SD8RB</td><td> 

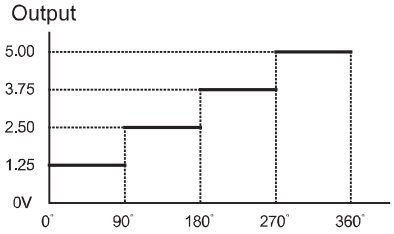
• Number of connectable circuits : 3 (B-Type)
8 (S-type)
• Transmission system : RS422 (use a driver circuit equivalent to RS422A or RS485)
• Transmission format : Start-stop serial signal
• Transmission rate : 4800 / 9600 bps
• Character configuration : Start bit 1,
Data bit 8,
Stop bit 1,
Parity None
• Data format and Transmission period:
<table>
<tr><th>Format</th><th>Transmission period</th><th>Remarks</th></tr>
<tr><td>PYDKH</td><td>1 sec</td><td>only at 9600 bps</td></tr>
<tr><td>**HRC</td><td>1 sec</td><td>only at 9600 bps</td></tr>
<tr><td>HEHDT</td><td>50 ms</td><td></td></tr>
</table></td></tr>
</table>

Signal Name	Abbreviation	Circuit / signal Specifications
Stepper heading output	REF 1SS1 1SS2 1SS3 1COM REF 2SS1 2SS2 2SS3 2COM REF 3SS1 3SS2 3SS3 3COM REF 4SS1 4SS2 4SS3 4COM	< 4 wiring > Control circuit < 5 wiring > Control circuit  Signal format  • Number of connectable circuits : 1 (CMZ900B) /4 (CMZ900S) • COM : 0 V (circuit GND) • REF output voltage : 24 V DC, 35 V DC (optional) • REF output current : 1 A max. • Output form : Open collector output (24 V DC 3-bit gray code)
Serial signal output	SD1A SD1B SG SD2A SD2B SG SD3A SD3B SG	RS422 Driver  • Number of connectable circuits : 1 (IEC61162-1), 2 (IEC61162-1/-2 selectable) • Transmission system : RS422 (use a driver circuit equivalent to RS422A or RS485) • Transmission format : Start-stop serial signal • Transmission rate : To be selected from 4800 / 38400 bps. • Data format : IEC61162-1 / -2

<table>
<tr><th>Signal Name</th><th>Abbreviation</th><th>Circuit / signal Specifications</th></tr>
<tr><td>Analog heading quadrant signal output</td><td>HDG
COM

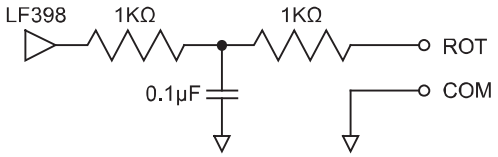
QUD
COM</td><td>


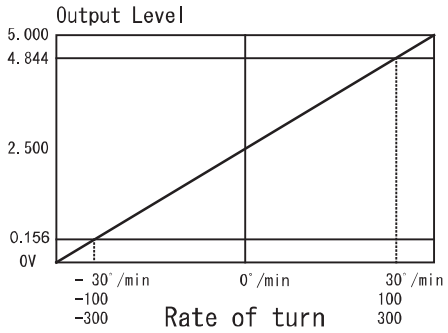
Signal format


Heading signal


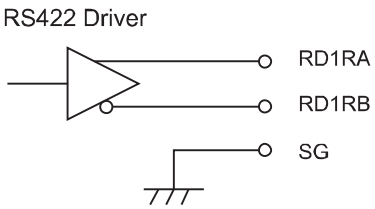
Quadrant signal
• Number of connectable circuits: 1 each
• COM: 0 V (circuit GND)
• Output voltage: 0 to +5 V DC
• Output resolution: 2.5 mV
• Output impedance: 2 kΩ max.
• Recommended input impedance of connected unit: 500 kΩ min.
• Output accuracy: ±1% FS (at 25°C)
</td></tr>
<tr><td>Analog rate-of-turn output</td><td>ROT1
COM

ROT2
COM

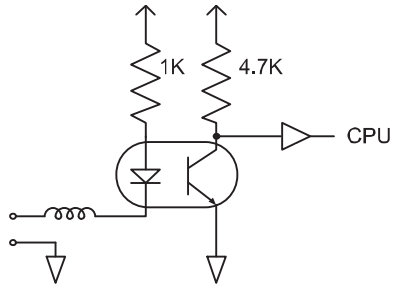
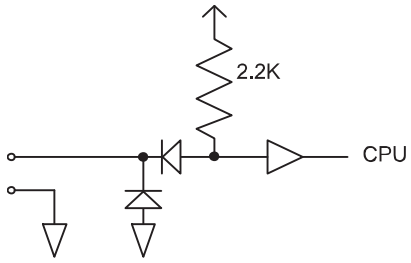
ROT3
COM</td><td>


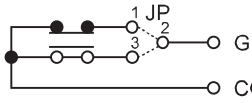
Signal Format


• Number of connectable circuits: 3
• COM: 0 V (circuit GND)
• Output voltage: 0 to + 5 V DC
• Output resolution: 2.5 mV
• Output impedance: 2 kΩ max
• Recommended input impedance of connected unit: 500 kΩ min
• Output accuracy: ±1 % FS (at 25 °C)
</td></tr>
</table>

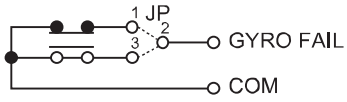
<table>
<tr><th>Signal Name</th><th>Abbreviation</th><th>Circuit / signal Specifications</th></tr>
<tr><td>Serial Ship's Speed Signal Distribution Output</td><td>RD1RA
RD1RB
SG</td><td> 

• Number of connectable circuits: 1
• Transmission system: RS422
(use a driver circuit equivalent to RS422A or RS485)
• Transmission format: Start-stop serial signal
• Transmission rate: 4800 bps.
• Data format: IEC611162-1 See Appendix</td></tr>
<tr><td>Master compass External Buzzer Stop Signal Input

(MKM026)</td><td>BSP
BSN</td><td>Contact closed at buzzer stop.</td><td rowspan="3"> 
</td></tr>
<tr><td>C.operation Unit External Buzzer Stop Contact Input (MKC326 / MKN018)</td><td>BSPIN
BSNIN</td><td>Contact closed at buzzer stop.</td></tr>
<tr><td>Bridge Selection Contact Signal Input (MKC326 / MKN018)</td><td>BRGSEL
LPN / BSC</td><td>Contact closed at AFT.
Contact open at FWD.</td></tr>
<tr><td>Prohibition Of Heading Changeover Contact Input (MKC326 / MKN018)</td><td>SELOF
SELOFC</td><td>Contact closed at C/O PRF.</td><td> 
</td></tr>
<tr><td>Master compass Heading Selection Contact Output

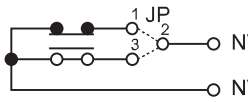
(MKM026)</td><td>GM
COM</td><td colspan="2"> 

<table>
<tr><th rowspan="2">Selected heading</th><th colspan="2">Contact</th></tr>
<tr><th>JP 1-2</th><th>JP 2-3</th></tr>
<tr><td>Power OFF</td><td>Open</td><td>Close</td></tr>
<tr><td>Gyro heading</td><td>Open</td><td>Close</td></tr>
<tr><td>External heading</td><td>Close</td><td>Open</td></tr>
</table></td></tr>
<tr><td>Gyro Fail Contact Output

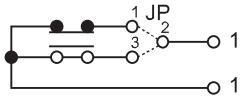
(MKM026)</td><td>GYRO FAIL
COM</td><td colspan="2"> 

<table>
<tr><th rowspan="2">State</th><th colspan="2">Contact</th></tr>
<tr><th>JP 1-2</th><th>JP 2-3</th></tr>
<tr><td>Power OFF</td><td>Open</td><td>Close</td></tr>
<tr><td>Normal</td><td>Open</td><td>Close</td></tr>
<tr><td>Fail</td><td>Close</td><td>Open</td></tr>
</table></td></tr>
</table>

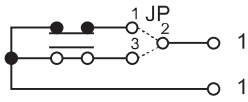
<table>
<tr><th>Signal Name</th><th>Abbreviation</th><th>Circuit / signal Specifications</th></tr>
<tr><td>Master compass Power fail Contact Output

(MKM026)</td><td>NV
NVC</td><td>


<table>
<tr><th rowspan="2">State</th><th colspan="2">Contact</th></tr>
<tr><th>JP 1-2</th><th>JP 2-3</th></tr>
<tr><td>Power OFF</td><td>Open</td><td>Close</td></tr>
<tr><td>Power ON</td><td>Close</td><td>Open</td></tr>
</table>
</td></tr>
<tr><td>Gyro Fail Contact Output

(MKC326)</td><td>1FAIL
1FAILC</td><td>


<table>
<tr><th rowspan="2">State</th><th colspan="2">Contact</th></tr>
<tr><th>JP 1-2</th><th>JP 2-3</th></tr>
<tr><td>Power OFF</td><td>Close</td><td>Open</td></tr>
<tr><td>Normal</td><td>Close</td><td>Open</td></tr>
<tr><td>Fail</td><td>Open</td><td>Close</td></tr>
</table>
</td></tr>
<tr><td>Power Fail Contact Output

(MKC326)</td><td>1PFO
1PFOC</td><td>


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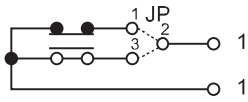
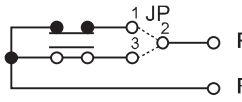
<tr><th>JP 1-2</th><th>JP 2-3</th></tr>
<tr><td>Power OFF</td><td>Close</td><td>Open</td></tr>
<tr><td>Normal</td><td>Close</td><td>Open</td></tr>
<tr><td>Fail</td><td>Open</td><td>Close</td></tr>
</table>
</td></tr>
<tr><td>Running Contact Output

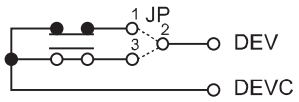
(MKC326)</td><td>1RUN
1RUNC</td><td>


<table>
<tr><th rowspan="2">State</th><th colspan="2">Contact</th></tr>
<tr><th>JP 1-2</th><th>JP 2-3</th></tr>
<tr><td>Power OFF</td><td>Close</td><td>Open</td></tr>
<tr><td>Running</td><td>Open</td><td>Close</td></tr>
<tr><td>Not running</td><td>Close</td><td>Open</td></tr>
</table>
</td></tr>
<tr><td>System Fail Contact Output

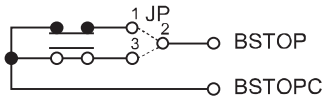
(MKC326)</td><td>FAIL
FAILC</td><td>


<table>
<tr><th rowspan="2">State</th><th colspan="2">Contact</th></tr>
<tr><th>JP 1-2</th><th>JP 2-3</th></tr>
<tr><td>Power OFF</td><td>Close</td><td>Open</td></tr>
<tr><td>Normal</td><td>Close</td><td>Open</td></tr>
<tr><td>Fail</td><td>Open</td><td>Close</td></tr>
<tr><td>Normal</td><td>Open</td><td>Close</td></tr>
<tr><td>Fail</td><td>Open</td><td>Close</td></tr>
</table>
</td></tr>
</table>

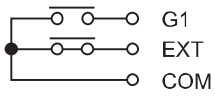
<table>
<tr><th>Signal Name</th><th>Abbreviation</th><th>Circuit / signal Specifications</th></tr>
<tr><td>Deviation Alarm
Contact Output

(MKC326)</td><td>DEV
DEVC</td><td> 

<table>
<tr><th rowspan="2">State</th><th colspan="2">Contact</th></tr>
<tr><th>JP 1-2</th><th>JP 2-3</th></tr>
<tr><td>Power OFF</td><td>Close</td><td>Open</td></tr>
<tr><td>Normal</td><td>Close</td><td>Open</td></tr>
<tr><td>Fail</td><td>Open</td><td>Close</td></tr>
</table></td></tr>
<tr><td>Buzzer Stop
Acknowledge

(MKC326)</td><td>BSTOP
BSTOPC</td><td> 

Contact closed at buzzer stop</td></tr>
<tr><td>Output Heading
Contact Output

(MKC326)</td><td>G1
EXT
COM</td><td> 

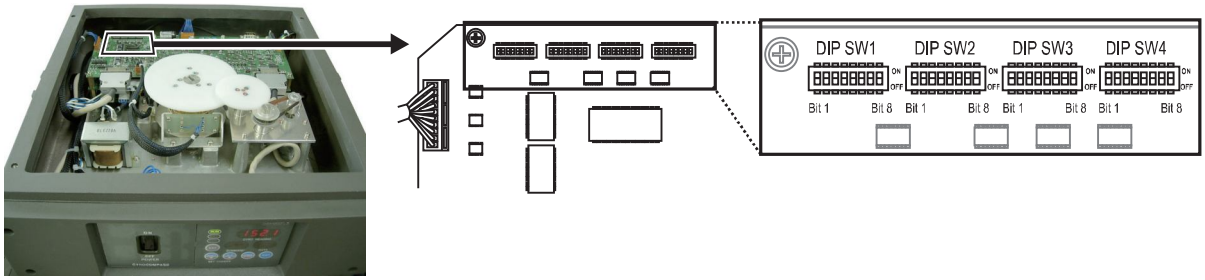
Contact is made when the sensor is selected.</td></tr>
</table>

6.2 Serial Input/Output Data Sentence

Input/output	Sentence	Specifications	Data
Input	VMVSD	YDK original	Ship's speed
	VBW	IEC61162-1	Ship's speed
	VHW	IEC61162-1	Ship's speed
	VTG	IEC61162-1	Ship's speed
	GGA	IEC61162-1	Latitude
	GLL	IEC61162-1	Latitude
	HDT	IEC61162-1	Heading
	HDG	IEC61162-1	Heading
	HDM	IEC61162-1	Heading
	HRC	YDK original	Heading / Rate of turn
	THS	IEC61162-1	Heading / Status
Output	HDT	IEC61162-1	Heading
	HDG	IEC61162-1	Heading
	HDM	IEC61162-1	Heading
	ROT	IEC61162-1	Rate of turn
	HRC	YDK original	Heading / Rate of turn
	PYDKH	YDK original	Heading / Rate of turn
	THS	IEC61162-1	Heading / Status

6.3 Setting Dip Switches

Remove the upper cover of the Master compass, and you will find the main assembly located in the deepest part with the dip switches positioned on its left. These dip switches determine the transmission rate ,the communication data format, and DAC output settings.



Master compass **M.MAIN BD ASSY** **DIP switch**

Each dip switch determines the following settings:

● Dip-switch settings and functions on Master compass

SW No.	Bit	Functions	ON	OFF	Default
DIP SW1	1	reserved	Set to "OFF" for operate		OFF
	2				OFF
	3	Setting of baud rate for serial port 2 (*1)	38400 bps	4800 bps	OFF
	4	Setting of baud rate for serial port 3 (*1)	38400 bps	4800 bps	OFF
	5	Setting of output sentence for serial port 1 (*1)	See (Table 1) Setting of output sentence for serial port 1 (page 6-10).		OFF
	6				ON
	7				ON
	8	Setting of output sentence for serial port 2 (*1)	See (Table 2) Setting of output sentence for serial port 2 (page 6-10).		OFF
DIP SW2	1				ON
	2				ON
	3	Setting of output sentence for serial port 3 (*1)	See (Table 3) Setting of output sentence for serial port 3 (page 6-10).		OFF
	4				OFF
	5				OFF
	6	Setting of external heading format (*1)	See (Table 4) Setting of external heading format (page 6-11).		OFF
	7				OFF
	8				OFF
DIP SW3	1	ROT selection for external heading (*1)	External	Internal	OFF
	2	Setting of analog ROT 1 output range	See (Table 5) Setting of analog ROT 1 output range (page 6-11).		OFF
	3				OFF
	4	Setting of analog ROT 2 output range	See (Table 6) Setting of analog ROT 2 output range (page 6-11).		OFF
	5				OFF
	6	Setting of analog ROT 3 output range	See (Table 7) Setting of analog ROT 3 output range (page 6-11).		OFF
	7				OFF
	8	Use C.operation unit	Used	Not Use	–

SW No.	Bit	Functions	ON	OFF	Default
DIP SW4	1	Serial output mode during system failure	Keep latest value	NULL	OFF
	2	Setting of baud rate for Repeater compass	4800 bps	9600 bps	OFF
	3	Reserved	Set to "OFF" for operate		OFF
	4				OFF
	5				OFF
	6	System Reserved	Set to "OFF" for operate		OFF
	7				OFF
	8				OFF

*1: If C.operation unit is connected, these dip switch position is not read.

(Table 1) Setting of output sentence for serial port 1

DIP SW 1			Data Format	Transmission Period
Bit 5	Bit 6	Bit 7		
OFF	OFF	OFF	HDT	200 ms
ON	OFF	OFF	ROT	200 ms
OFF	ON	OFF	HDT/ROT	200 ms
ON	ON	OFF	THS	200 ms
OFF	OFF	ON	THS/ROT	200 ms
ON	OFF	ON	PYDKH	200 ms
OFF	ON	ON	HRC	200 ms

(Table 2) Setting of output sentence for serial port 2

DIP SW 1	DIP SW 2		Data Format	Transmission Period	
Bit 8	Bit 1	Bit 2		at 4800 bps	at 38400 bps
OFF	OFF	OFF	HDT	200 ms	20 ms
ON	OFF	OFF	ROT	200 ms	20 ms
OFF	ON	OFF	HDT/ROT	200 ms	20 ms
ON	ON	OFF	THS	200 ms	20 ms
OFF	OFF	ON	THS/ROT	200 ms	20 ms
ON	OFF	ON	PYDKH	200 ms	20 ms
OFF	ON	ON	HRC	200 ms	200 ms

(Table 3) Setting of output sentence for serial port 3

DIP SW 2			Data Format	Transmission Period	
Bit 3	Bit 4	Bit 5		at 4800 bps	at 38400 bps
OFF	OFF	OFF	HDT	200 ms	20 ms
ON	OFF	OFF	ROT	200 ms	20 ms
OFF	ON	OFF	HDT/ROT	200 ms	20 ms
ON	ON	OFF	THS	200 ms	20 ms
OFF	OFF	ON	THS/ROT	200 ms	20 ms
ON	OFF	ON	PYDKH	200 ms	20 ms
OFF	ON	ON	HRC	200 ms	200 ms

(Table 4) Setting of external heading format

DIP SW 2			Data Format
Bit 6	Bit 7	Bit 8	
OFF	OFF	OFF	HDM
ON	OFF	OFF	HDG
OFF	ON	OFF	HRC
OFF	OFF	ON	HDT
ON	OFF	ON	THS

(Table 5) Setting of analog ROT 1 output range

DIP SW 3		Output Range
Bit 2	Bit 3	
OFF	OFF	± 30 deg/min
OFF	ON	± 100 deg/min
ON	OFF	± 300 deg/min

(Table 6) Setting of analog ROT 2 output range

DIP SW 3		Output Range
Bit 4	Bit 5	
OFF	OFF	± 30 deg/min
OFF	ON	± 100 deg/min
ON	OFF	± 300 deg/min

(Table 7) Setting of analog ROT 3 output range

DIP SW 3		Output Range
Bit 6	Bit 7	
OFF	OFF	± 30 deg/min
OFF	ON	± 100 deg/min
ON	OFF	± 300 deg/min

● Dip-switch settings and functions on MKR056 / MKN019

SW No.	Bit	Functions	ON	OFF	Default
DIP SW4	1	System Reserved	Set to "OFF" for operate		OFF
	2				OFF
	3				OFF
	4				OFF
	5	Setting of input sentence for serial port	See (Table 8) Setting of input sentence for serial port (page 6-12).		OFF
	6				OFF
	7	Setting of baud rate for serial port	9600 bps	4800 bps	OFF
	8	System Reserved	Set to "OFF" for operate		OFF

(Table 8) Setting of input sentence for serial port

DIP SW 1		Data Format
Bit 5	Bit 6	
OFF	OFF	$HEHDT
ON	OFF	$HCHDT
OFF	ON	$GPHDT

6.4 List of Initial Values

After Command 36 is executed, Initial values are set as follows:

● C.Operation Unit

Items			Value
Externalheading selection		Port-1	NONE
		Port-2	NONE
		Port-3	NONE
Speed input		AUTO / MANUAL	MANUAL
		Setting value	0 kt
Latitude input		AUTO / MANUAL	MANUAL
		Setting value	0 °
Threshold of deviation alarm		G1 / EXT	00.0°
External input format	Speed	Port No.	P (Pulse port)
		Already / New	–
		Format	–
	Latitude	Port No.	–
		Ready-made / New	–
		Data format	–
	External heading 1	Port No.	–
		Ready-made / New	–
		Data format	–
		ROT input	NONE
	External heading 2	Port No.	–
		Ready-made / New	–
		Data format	–
		ROT input	NONE
	External heading 3	Port No.	–
		Ready-made / New	–
		Data format	–
		ROT input	NONE

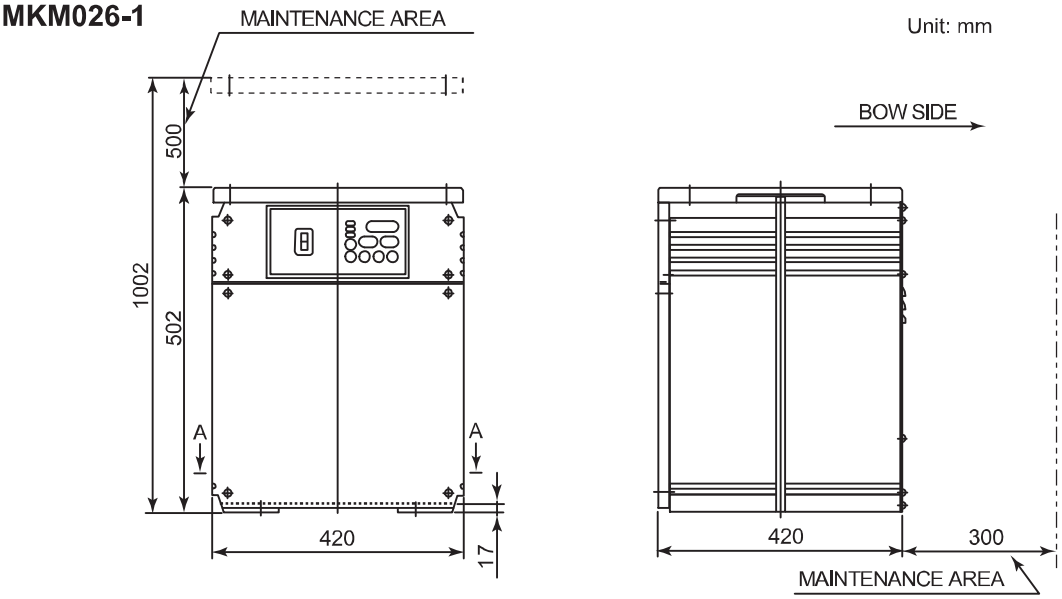
Master compass

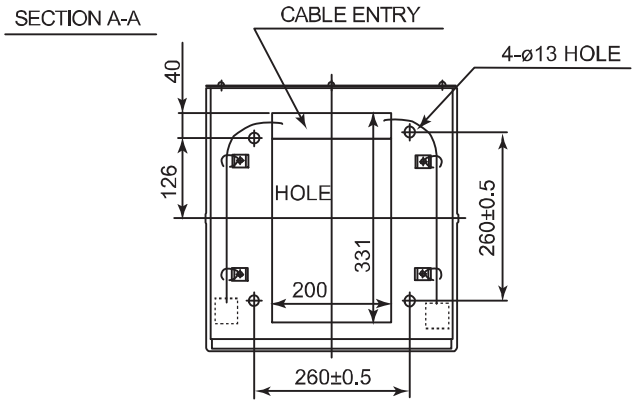
Items				Value
Follow-up gain		Gain		100 %
Master compass alignment		REL / ABS		–
		Correction value		0 °
Baud rate of output signal		PORT-1 baud rate		4800 bps
		PORT-2 baud rate		4800 bps
		PORT-3 baud rate		4800 bps
Output signal format	PORT-1	GYRO	REC 1	Output = HDG/ROT Format= HEHRC Period= 200 ms
			REC 2	–
			REC 3	–
		EXT	REC 1	–
			REC 2	–
			REC 3	–
	PORT-2	GYRO	REC 1	Output = HDG/ROT Format = HEHRC Period = 200 ms
			REC 2	–
			REC3	–
		EXT	REC 1	–
			REC 2	–
			REC 3	–
	PORT-3	GYRO	REC 1	Output = HDG Format = HEHDT Period = 1 s
			REC 2	Output = ROT Format = HEROT Period = 1 s
			REC 3	–
		EXT	REC 1	–
			REC 2	–
			REC 3	–
Stepper signal control		Maximum angular velocity		24 deg/s
		Maximum angular acceleration		140 deg/s^2

6.5 External Product View

Master compass

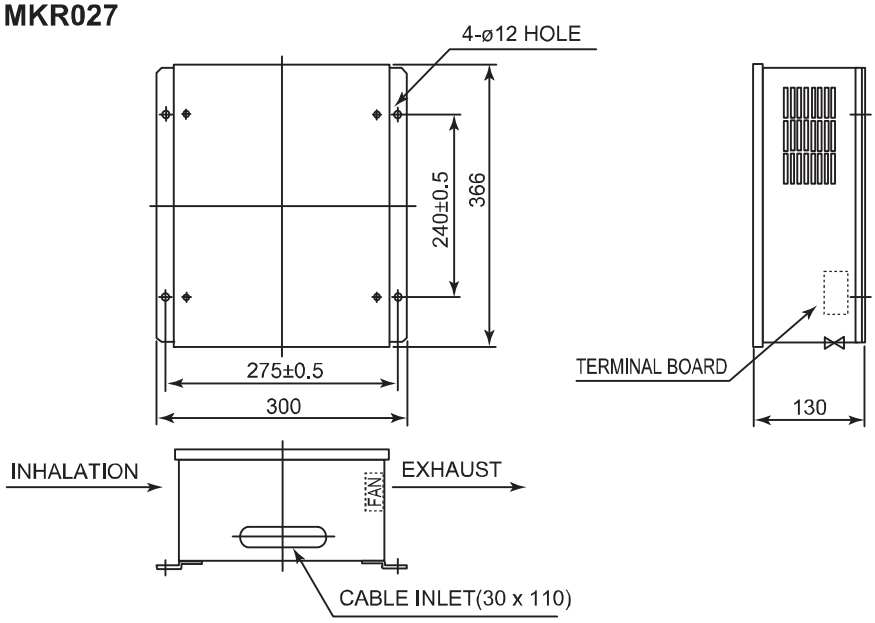
MKM026-1





AC Adapter

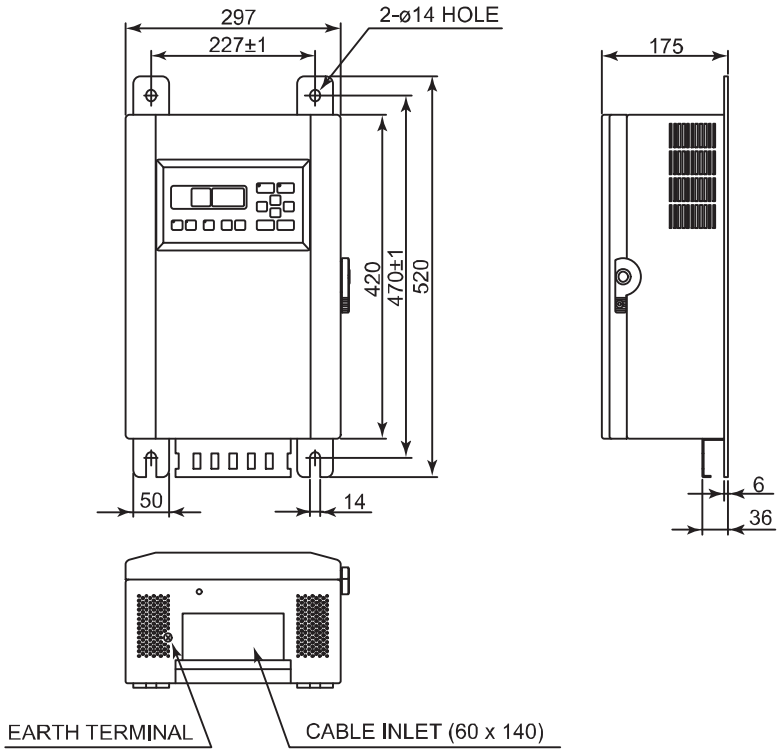
MKR027



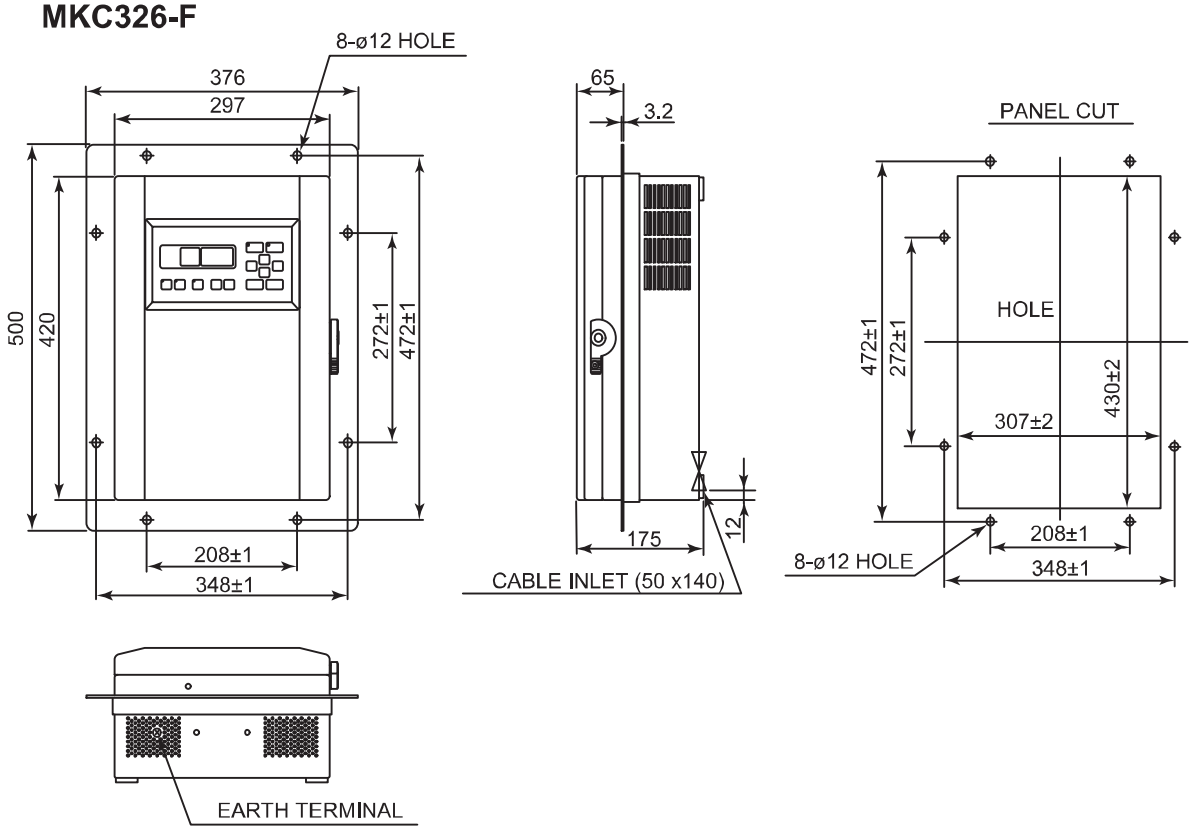
Control box

MKC326-W

Unit : mm



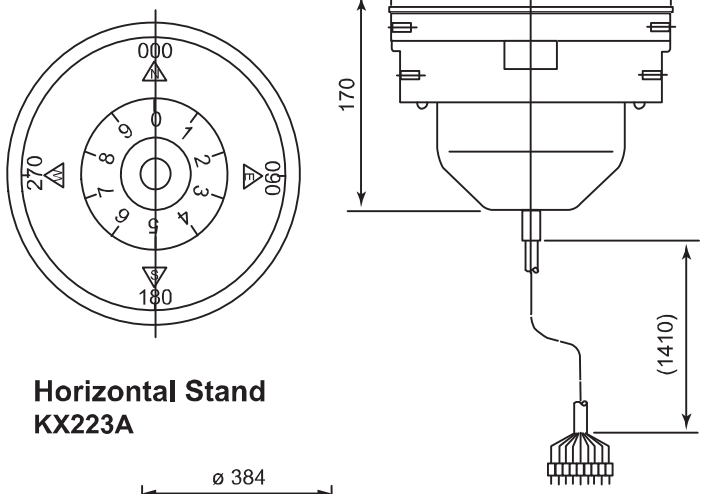
MKC326-F



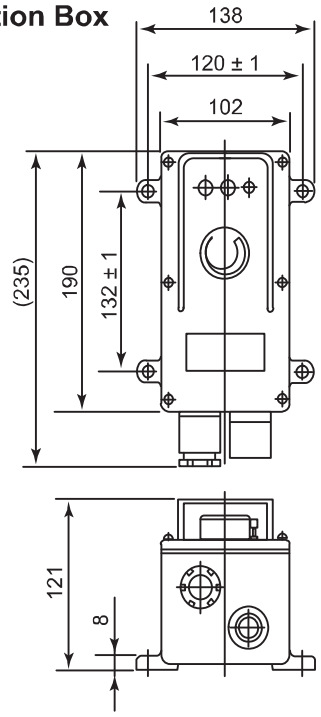
● Repeater compass / Junction Box / Stand & Bracket

Unit : mm

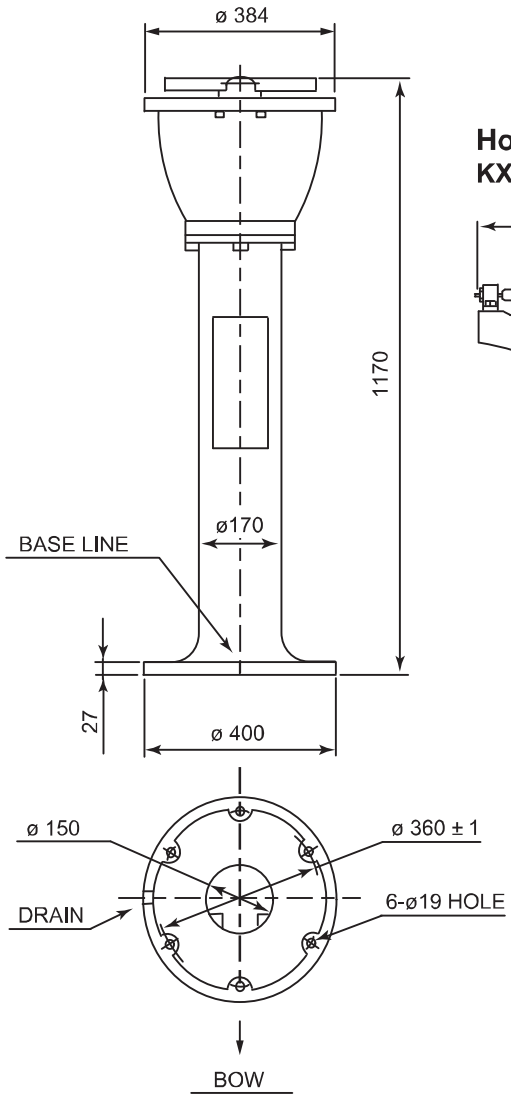
Repeater Compass
MKR050



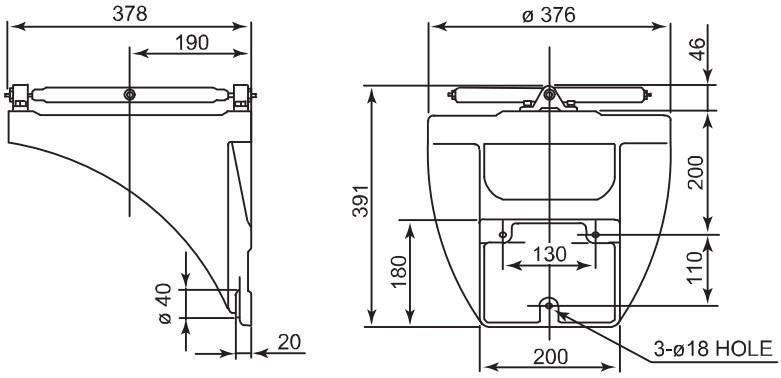
Connection Box
MKN019



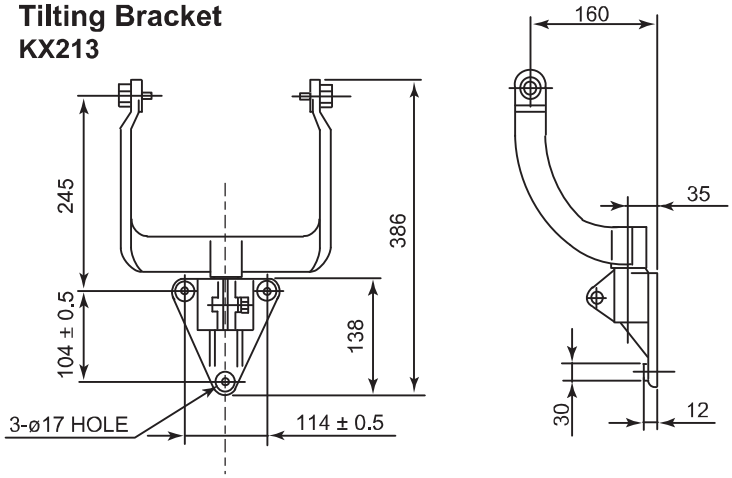
Horizontal Stand
KX223A



Horizontal Bracket
KX201A

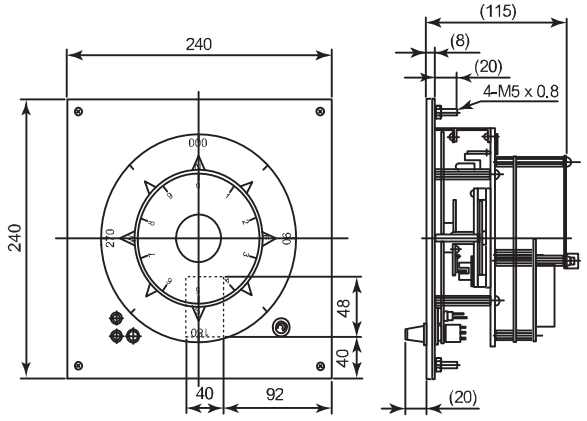


Tilting Bracket
KX213

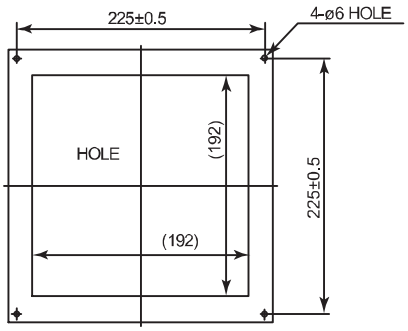


Steering repeater compass

MKR056-S/F2

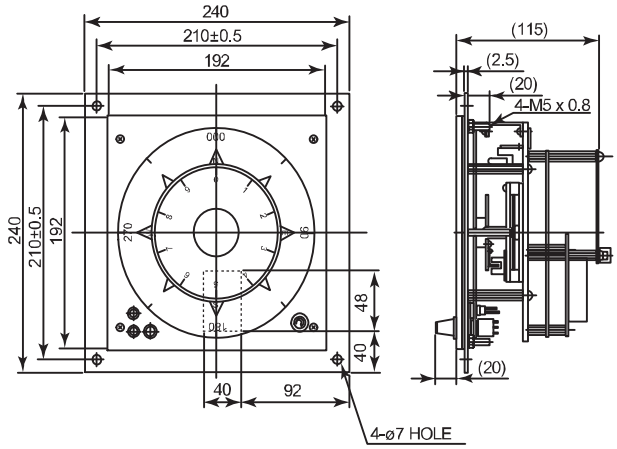


PANEL CUT

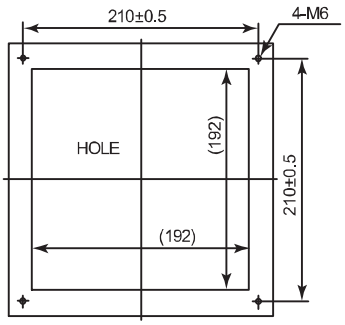


MKR056-P

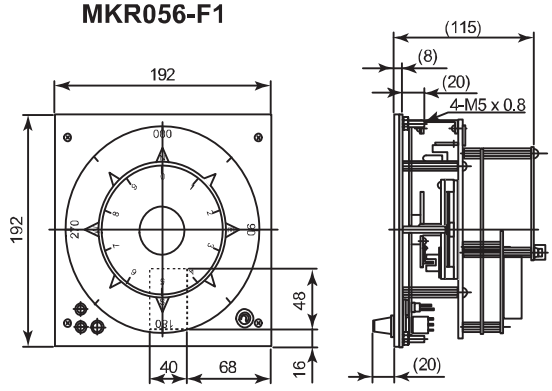
Unit : mm



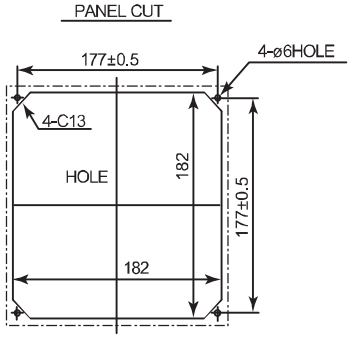
PANEL CUT



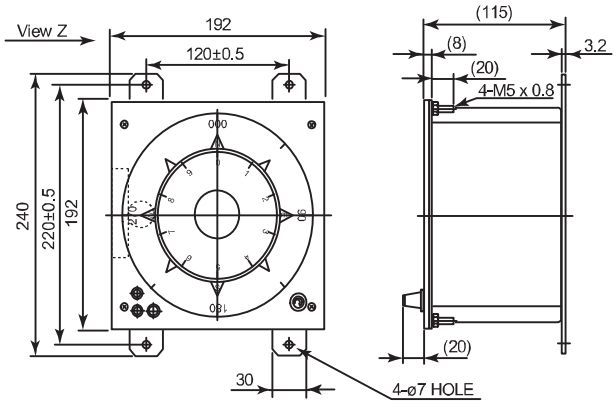
MKR056-F1



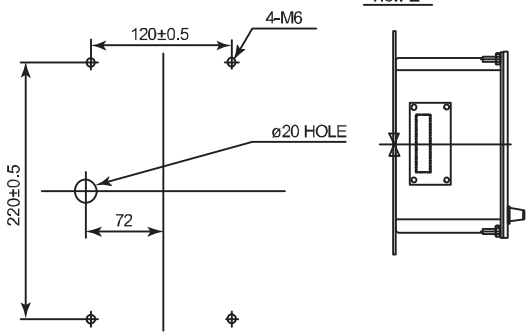
PANEL CUT



MKR056-W



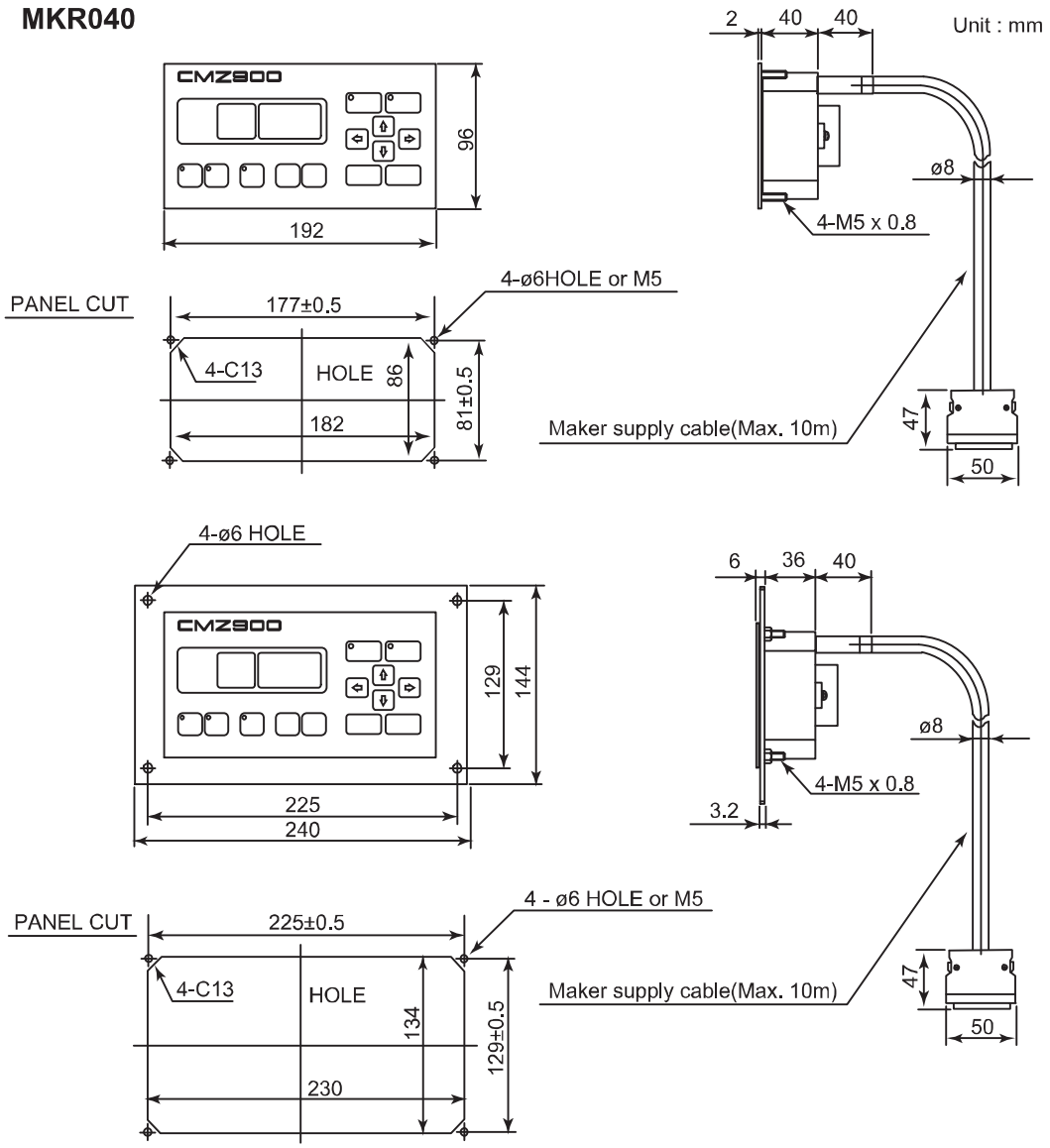
MOUNTING DIMENSION



View Z

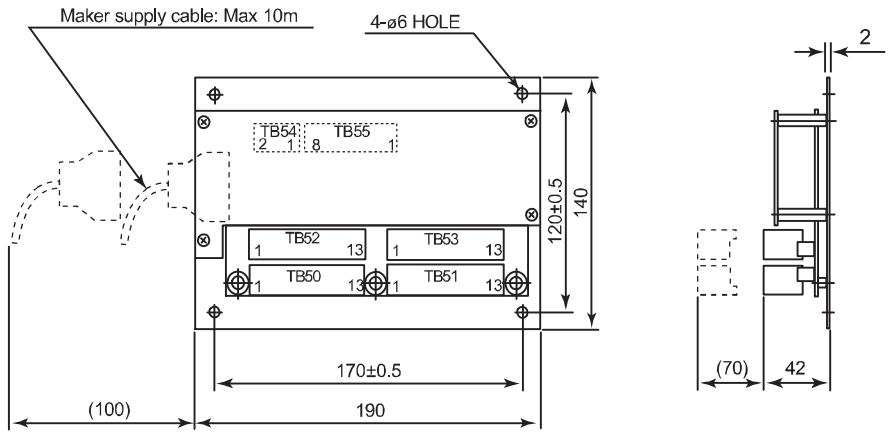
C.Operation Unit

MKR040



Junction Unit

MKN018



7. Maintenance, Inspection and Installation

7.1 Inspection

Implement the following procedures of the daily inspection and regular inspection to maintain the gyrocompass in a state of normal working order:

7.1.1 Daily Inspection

The inspection items are as follows.

Inspection Item		Inspection Contents and Procedure	Recommended Inspection Interval
1	Gyrosphere drive current	Check that the current is within the range 0.15 A to 0.35 A by executing the command code “15”. (See section 4.1.6)	Once/day (at an arrival)
2	Repeater compass alignment	Check that the heading of each Repeater compass agrees with that of the Master compass.	Once/departure
3	Ship’s speed value Latitude	Check that there are no errors in ship’s speed and latitude by executing the command codes “21” and “22”. (See section 4.2.2 and 4.2.3)	Once/day
4	Azimuth error	Check that there is no azimuth error using astronomical or physical target observation.	Once/day

NOTE

Check the readings of the Repeater compass card when the ship’s speed is set to “0.” If a speed-error correction is performed, the Master compass card reading will not agree with the Repeater compass card reading.

7.1.2 Regular Maintenance

Perform the following maintenance once a year.

Ask your nearest service agent of Yokogawa Denshikiki Co., Ltd. to repair or maintain.

Inspection Item		Procedure
1	Gyrosphere	Cleaning of lower electrode . Cleaning of band electrode.
2	Container	Cleaning of inside surface ,center pin (Exercise care when handling.) , lower electrode ,band electrode, follow-up electrode.
3	Supporting Liquid	Replace

7.2 Maintenance of the Gyrosphere

CAUTION

Only technicians of the Service department of Yokogawa Denshikiki Co., Ltd. are authorized to implement the operations and other work described in this chapter. However, if for some reason the service department of Yokogawa Denshikiki Co., Ltd. permits you to perform these operations, be sure to follow the instructions described in this chapter.

7.2.1 Precautions During Removal

- **The gyrosphere should not be removed from the Master compass until at least 1.5 hours has elapsed since the power has been turned.**
- **Make sure that the surrounding area of the Master compass is clean, there is ample lighting and prepare all required equipment and tools before beginning work. To avoid damaging the nuts and bolts, be sure to use the correct tools such as drivers and wrenches for each part.**
- **Be sure to do the following to ensure proper reinstallation of the gyrosphere:**
  - Provide mating marks to the required portions before disassembly.
  - Temporarily reinsert the bolts into the correct holes.
  - Place the disassembled parts in the correct order on a piece of clean paper or cloth.
  - If wires are to be disconnected, keep a record of the color of each wire and attach labels to them to ensure correct reconnection.
- **Do not remove any part that does not need to be disassembled.**
- **Never disassemble the gyrosphere.**

CAUTION

Precautions in handling the gyrosphere

- Hold the gyrosphere firmly with both hands so as not to subject it to any shock.
- Do not drop the gyrosphere. Dropping the gyrosphere may result in damage to the internal mechanism or lead to personal injury.
- Do not disassemble the gyrosphere.

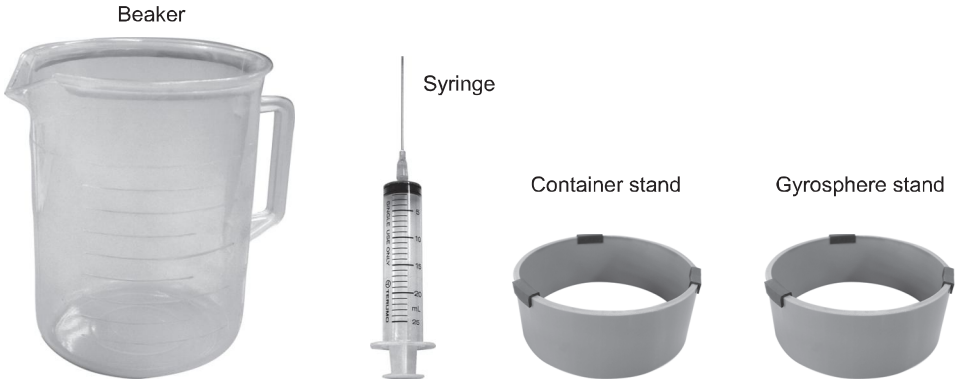
Precautions in handling the container

- Hold the container firmly with both hands.
- Do not drop it. Dropping the gyrosphere may result in damage to the internal mechanism or lead to personal injury.

7.2.2 Removing the Gyrosphere

● Equipment and tools to be prepared

Beaker, No.2 Phillips screwdriver, minus screwdriver, syringe , a bottle for waste liquid, gyrosphere stand and container stand.



● Removal of the container from the Master compass and take-out of the gyrosphere

① Remove the connectors connecting the Master compass and the container.

② Loosen the container bolts and remove the container from the Master compass.

③ Remove the screw from the vent hole.

④ Remove the cap from the center pin.

⑤ Pull out the center pin.

⑥ Place the beaker under the drain and remove the drain screw.

⑦ Disengage the connectors that connect the upper and lower containers.

⑧ Loosen the nut and rotate the hook to outer side.

⑨ Remove the upper container.

⑩ Remove the supporting liquid from within the funnel-shaped portion.

⑪ Take the gyrosphere out of the lower container.

CAUTION

Use the container stand so that the container should not fall while working.

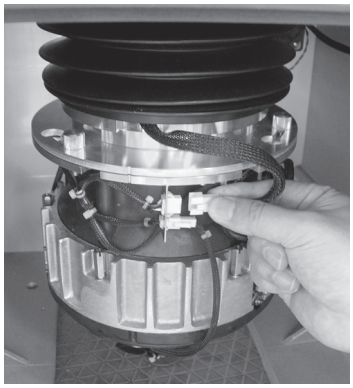
NOTE

Notes about disposal of the used supporting liquid.

- To dispose of used supporting liquid , please request processing to permitted industrial waste disposal trader.
- Or contact your nearest service agent of Yokogawa Denshikiki Co., Ltd.

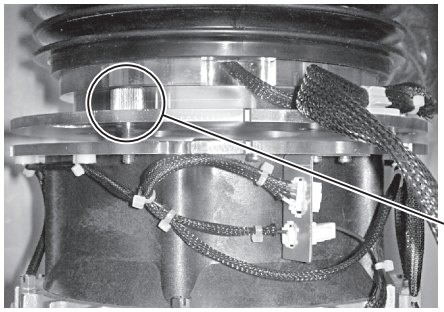
Procedure for removing the gyrospere

① Remove the connectors connecting the Master compass and the container.



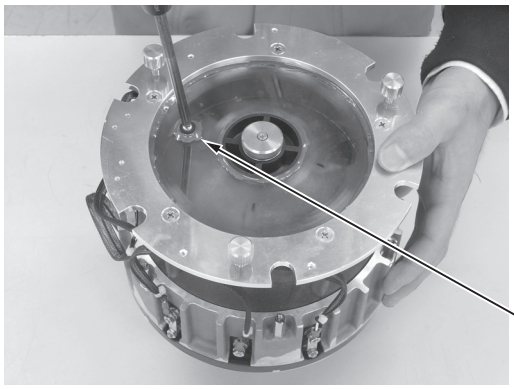
Disengage the connectors (4 terminals).

② Loosen the container bolts and remove the container from the Master compass.



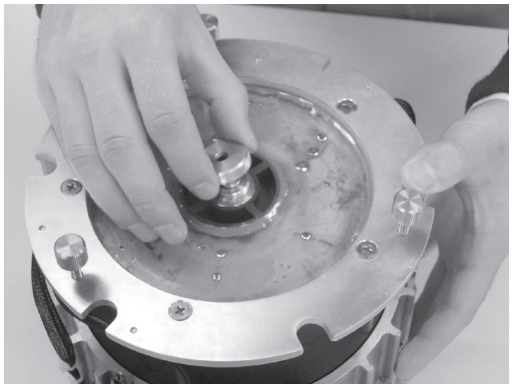
Loosen the three containe bolts.
Rotate counterclockwise while lifting the container and remove.
Be careful not to let the container hit the floor.

③ Remove the screw from the vent hole.



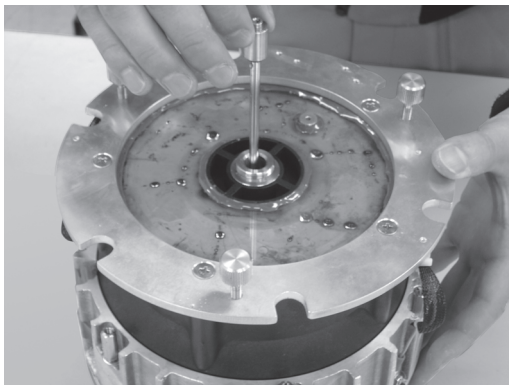
Remove the screw from the vent hole.

④ Remove the cap from the center pin.



Turn the cap of the center pin to remove it.

⑤ Pull out the center pin.



Pull out the center pin.

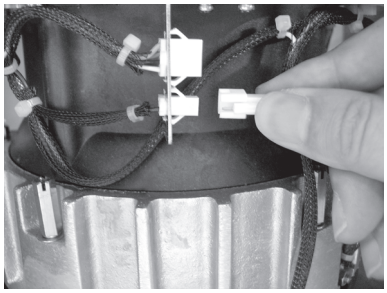
⑥ Place the beaker under the drain and remove the drain screw.

Remove the drain screw.

Drain all the supporting liquid from the drain hole while holding the container as horizontally as possible.

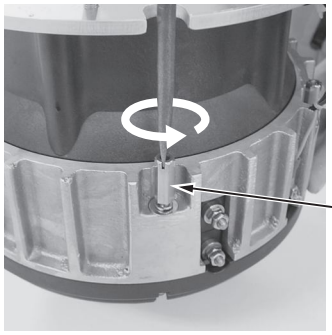
After draining, reinsert the screw in the drain hole.

⑦ Disengage the connectors that connect the upper and lower containers.

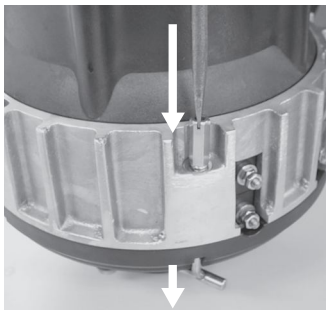


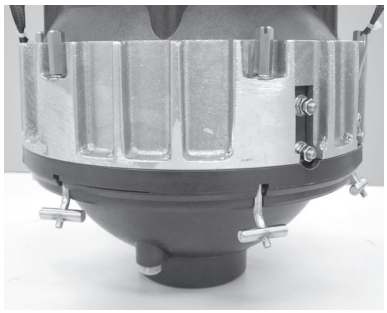
Disengage the connectors (two terminals).

⑧ Remove the hook that fasten the upper and lower containers together.



Loosen the long nut while pressing by minus driver until the hook rotates to outside.
Loosen all long nut in the same way.





⑨ Remove the upper container.

Lift the upper container and remove.
Take care in the direction of all hooks.

⑩ Remove the supporting liquid from within the funnel-shaped portion.

Remove the supporting liquid, from the funnel-shaped portion with a syringe (remove all liquids).

CAUTION

Do not upset the gyroshere.

⑪ Take the gyrosphere out of the lower container.

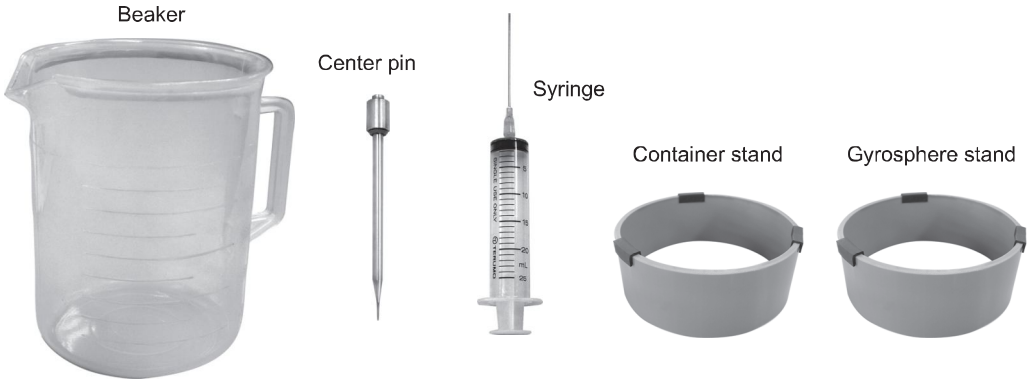
When taking out the gyrosphere, hold the side in a location with no gold line on it.

Place the removed gyroshpere on to a gyrosphere stand.

7.2.3 Installing the Gyrosphere

● Equipment and tools to be prepared

Prepare a gyrosphere, center pin, syringe, beaker, funnel, liquid, No.2 Phillips screwdriver,minus screwdriver, Gyrosphere stand and Container stand .



● Installing the gyrosphere and attaching the container to the Master compass

Installation of the gyrosphere in the container should be carried out on a flat surface and care should be taken not to knock the container over.

CAUTION

Replace the following parts at the maintenance.

- O ring of center pin
- O ring of drain screw
- O ring of container
- Seal washer of vent hole screw

① Cleaning.

Confirm that oil doesn't stick to the gyrosphere (side, lower and following electrode) and. top of the center pin. If oil sticks, get rid of it with gauze contain ethyl alcohol.

② Confirm that the drain screw in the lower container is tight and then put the gyrosphere in the lower container.

③ Attach the upper container to the lower containers.

④ Pour the supporting liquid into the container.

⑤ Insert the center pin and put the cap on.

⑥ Seal the vent hole.

⑦ Connect the connector.

⑧ Engage the container into position on the Master compass and tighten the bolts.

⑨ Fasten the connectors that connect the Master compass to the container.

CAUTION

Use the container stand so that the container should not fall while working.

Procedure for installing the gyrosphere

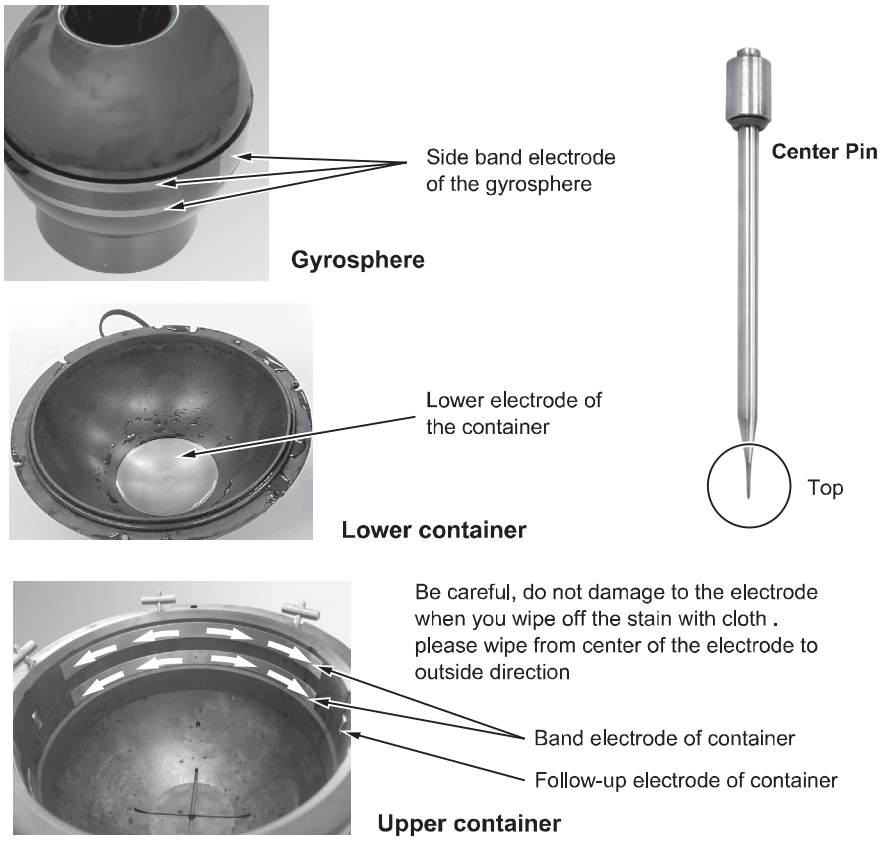
① Cleaning.

Confirm that oil doesn't stick to the gyrosphere (side, lower and following electrode) and top of the center pin. If oil sticks, get rid of it with gauze contain benzine.

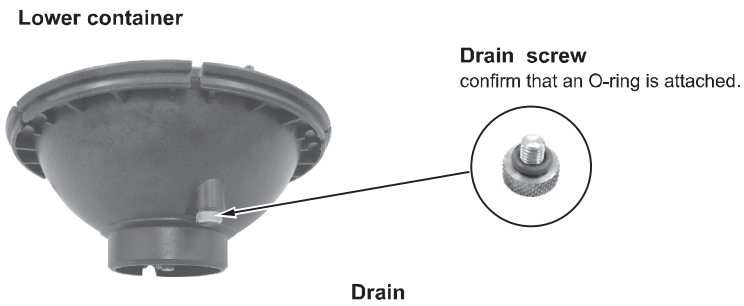
CAUTION

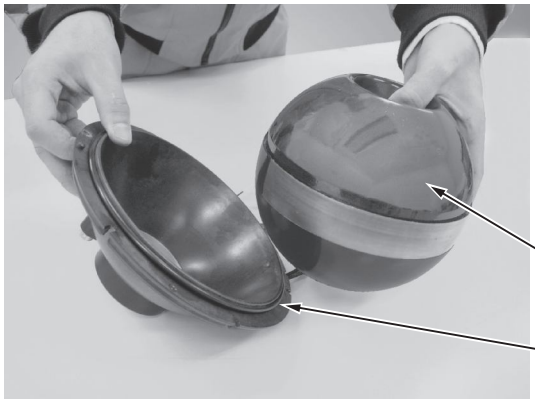
Wipe the electrode of gyrosphere and container with gauze which soaked benzine for cleaning. Take care as follows at cleaning.

- Do not flake off the painting of gyrosphere.
- Do not bend the electrode of container.
- Do not put benzine on glue of gyrosphere.
- Do not use the sponge with grinding.



② Put the gyrosphere in the lower container.





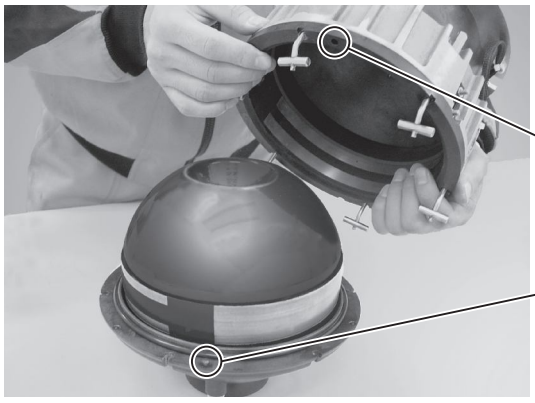
Confirm that there is an O-ring the lower container.

Hold the gyrosphere as shown in the photo, and with the container tilted, place it into the container. Hold the sphere on the opposite side of the gold line.

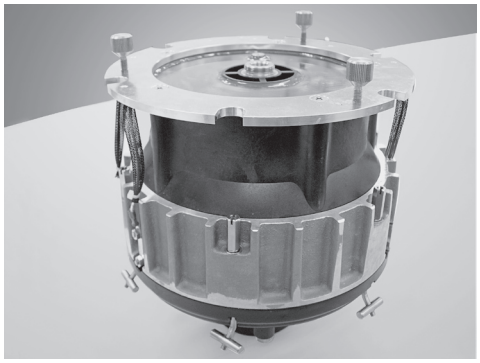
Do not tilt the gyrosphere beyond the required limit (30°).

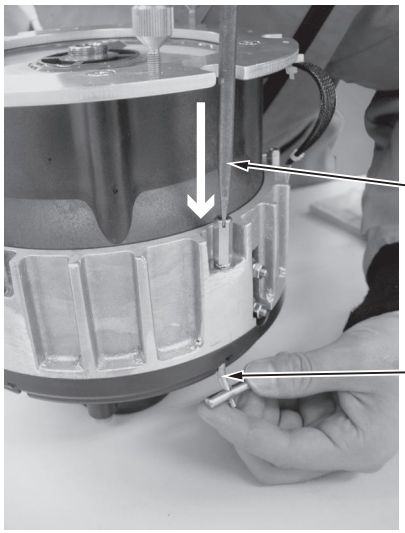
After placing the gyrosphere in the container, position the container and gyrosphere horizontally.

③ Attach the upper container to the lower containers.



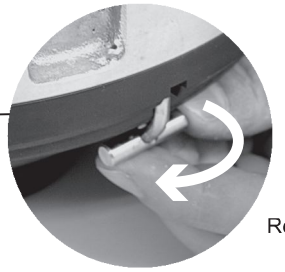
Confirm that there is an O-ring the lower container, then align the knock-pin and fit both the upper and lower containers to each other.





Rotate the hook to inside and tighten the log nut by driver until the upper container closes adherence to lower container.

Minus screwdriver



Rotate the hook to inside

Tighten six long nut. confirm that the upper container closes adherence to lower container.

④ Pour the liquid into the container.

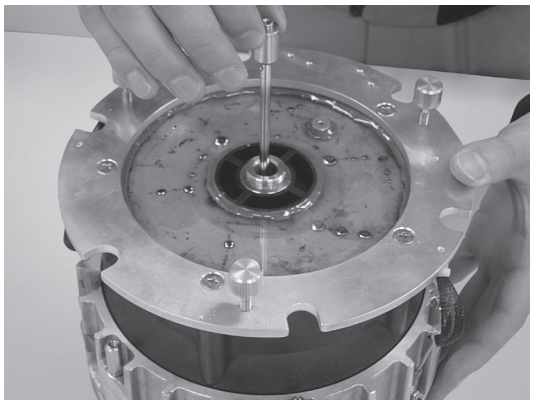
Prepare the supporting liquid in the beaker.

Insert the funnel into the hole of the center pin after put off the vent hole screw.

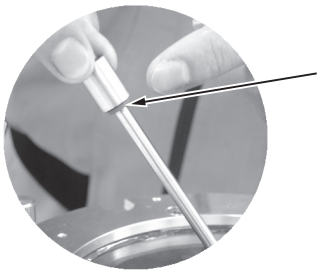
pour liquid slowly from the beaker into the funnel until it begins to overflow from the vent hole. (Liquid is used by 650 ml in total)

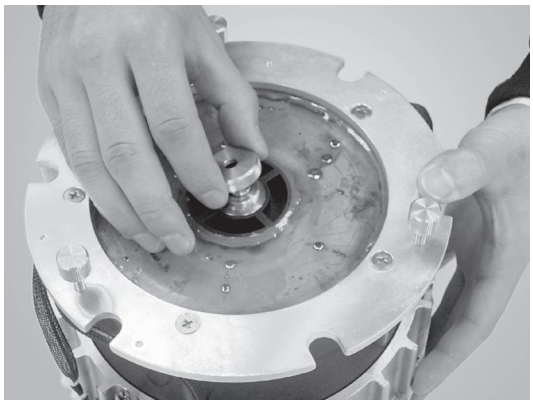
Vent hole

⑤ Insert the center pin and put the cap on.



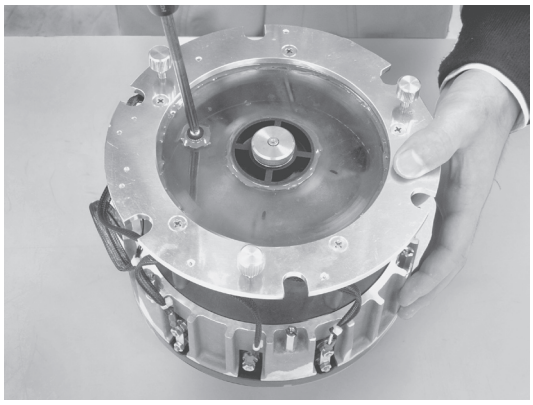
Confirm that there is an O-ring on the center pin and then insert the center pin.





Put the cap on.

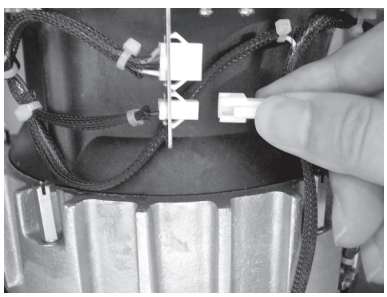
⑥ Seal the vent hole.



Seal the vent hole with screw.

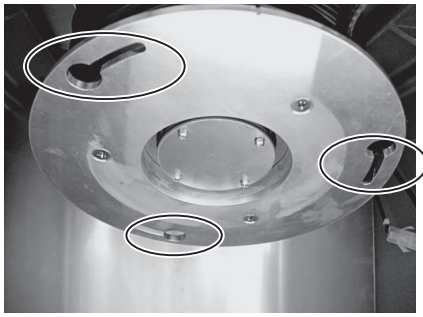
Wipe off any liquid that overflows from the vent hole with the rag.

⑦ Connect the connector.



Fasten the connectors (two terminals) that connect the upper and lower containers.

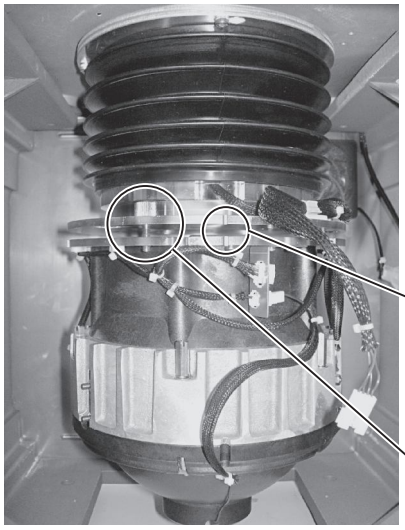
⑧ Engage the container into position on the Master compass and tighten the bolts.



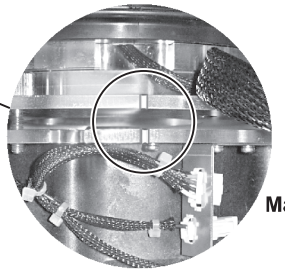
Insert the container bolts into the hanging slit of master compass and rotate clockwide the container.

Hanging slit

Container bolts



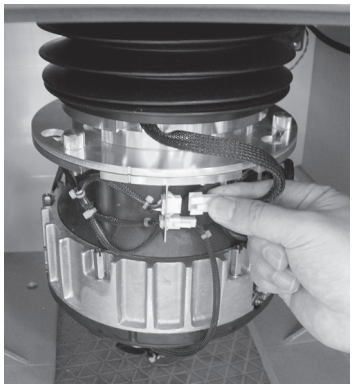
Align the mating marks when engaging the container.
Then tighten the container bolts.



Mating marks

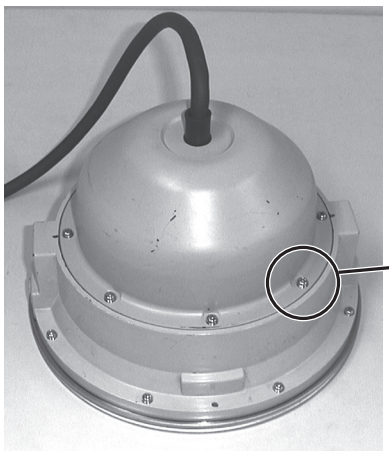
Container bolts

⑨ Fasten the connectors that connect the Master compass to the container.



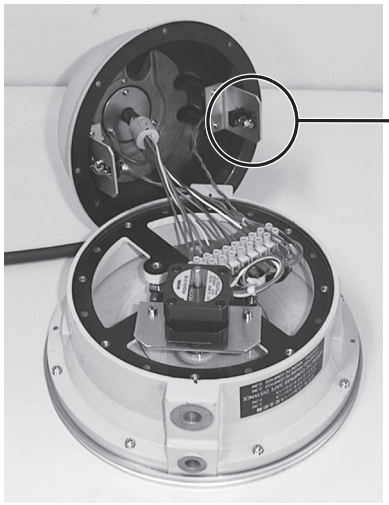
Connect the connector.

7.2.4 Replacement of Lamps in the Repeater compass



(1) Place the repeater compass on a stand with the repeater card face down and draw alignment marks on the lower cover and the body.

(2) Remove the eight mounting bolts from the lower cover.



(3) Raise the lower cover to separate it from the body.

(4) hold the lower cover in this position while replacing the illuminating lamp or lamps.

(5) Align the alignment marks, and then tighten the eight bolts.

Avoid disassembling the Repeater compass any further. When these procedures are to be carried out aboard a ship, close attention must be paid so that reassembling is carried out correctly. If these procedures cannot be carried out aboard, contact your nearest service agent of Yokogawa Denshikiki Co., Ltd..

7.2.5 Replacing the Fuse

The Control box (MKC326) and AC adapter (MKR027) use the fuses to protect the system.

If the fuse is fused, replace it.

Refer the appendix-4.2 to confirm the fuse position.

CAUTION

Turn off the power supply when replacing the fuse.

The capacity of fuse depends on system configuration. Select the fuse of appropriate capacity.

7.2.6 Confirmation of System Operation

CMZ900 system have the command to confirm the system operation.

- **Lamp test**

  It is possible to check the display and buzzer sound by operating the keys of the operation unit.

  See section 3.2.2

- **Repeater signal output**

  It is possible to output the repeater signals, serial signals and analog signals.

  See section 4.3.4

- **Analog signal output**

  It is possible to output the arbitrary analog voltage.

  See section 4.3.2

7.2.7 Preparation of Supporting Liquid

Approximately 650 mL of supporting liquid are used in the Master compass unit, and further 1 L of supporting liquid are provided for spare. Contact Yokogawa Denshikiki Co., Ltd. for further supplies. Supporting liquid should always be supplied by Yokogawa Denshikiki Co., Ltd., but in unavoidable circumstances, you may prepare supporting liquid as follows:

Put the each material in distilled water at the specified rate. Stir the mixture until the benzoic acid dissolves. If the benzoic acid does not melt easily, heat the mixture at less than 90 degrees. At then use the protection tool so as not to inhale.

Distilled water	1.8 L
Glycerin	145 mL
Benzoic acid	3.2 g

NOTE

If the specific gravity of the prepared liquid deviates from the value shown below, add glycerin or distilled water to make fine adjustment.

Temperature	Specific Gravity
15 °C	1.0230 ± 0.001
20 °C	1.0220 ± 0.001
25 °C	1.0208 ± 0.001
30 °C	1.0193 ± 0.001

7.3 Precautions During Installation

Exercise care with the following items when installing a gyrocompass.

7.3.1 Vibration Measures

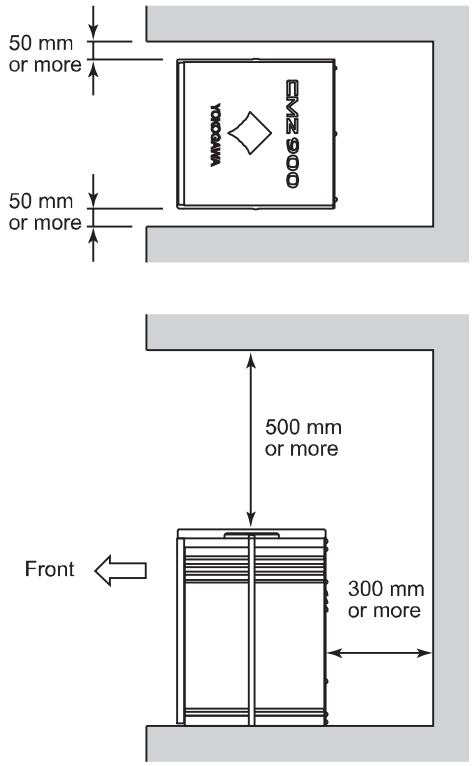
The floors on which the Master compass and the horizontal stands are installed, and the walls on which the remote unit, horizontal brackets, tilted brackets, course recorder, digital Repeater compass, etc. are installed, should be reinforced against vibrations from the hull.

7.3.2 Parallelism of Lubber's Lines

Install the Master compass, Repeater compasses for the horizontal stand and Repeater compasses for the horizontal bracket so that their lubber's lines are parallel with ship's fore-and-aft line. Since the accuracy of the parallelism of these lines is the basis of heading measurement, adjust them to within an accuracy of ± 0.5 °.

7.3.3 Service Area

Ensure that the dimensions of the running, operating and maintenance area of the Master compass are as specified below.



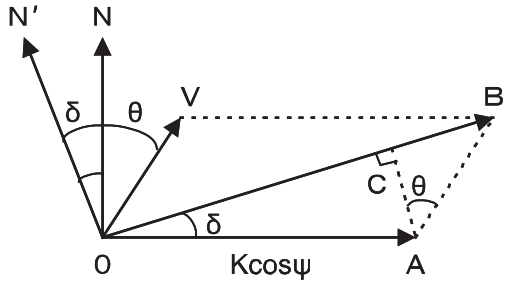
Appendix-1 Description of Speed Error and Speed Error Table

1.1 Speed Error

The speed error is an error generated when a ship in which a gyrocompass is installed sails a course other than east or west. Its value is determined depending on the ship's speed, course, and latitude. (It is not related to the kind or type of gyrocompass.)

The north-seeking tendency of a gyrocompass is based on the earth's rotation. When a ship sails, the resultant motion of the ship's motion and the earth's rotation acts on the north-seeking tendency of the gyro. If the course of the ship deviates towards the north or south, the direction of the resultant motion deviates north or south and thus an error occurs because the north-seeking force of the gyro acts perpendicular to this resultant motion. That is, the speed error is the angle of the difference between this resultant motion and the east-west direction.

1.2 Determining Speed Error



φ: Latitude

K: Speed of the earth's rotation at the equator (About 900 kt)

V: Ship's speed (kt)

θ: Gyrocompass course

δ: Speed error

In the figure above, AC = V cos θ = K cos φ • sin δ

Since δ is a small value,

sinδ = δ (radian) = 1 / 57.3 δ (unit: degree)

From these equations, δ = 57.3 V cos θ / 900 cos φ

If we assume, for example, that the ship is at the equator (φ = 0), the gyrocompass course is N (θ = 0), and the ship's speed is 30 kt, then

δ = 57.3 × 30 / 900 = 1.91 degrees = 1 ° 54 ’

When the value of θ is between 270 ° to 90 °, the compass indication increases. Therefore, the ship's true course is as shown below.

0 ° - 1 ° 54 ’ = 358 ° 6 ’

As seen above, if the compass course deviates towards the north, the true course can be obtained by subtracting the speed error from the compass course, and if the course deviates towards the south, the true course is obtained by adding the speed error to the compass course.

Next we will describe how to determine the speed error depending on ship's speed, course and latitude, using the following two procedures. The true course can be determined by referring to the following table and chart.

(1) Determining the speed error using the speed error calibration table (Table-1)

Refer to the speed error calibration table (Table-1) to determine the correction value and then correct the course either by subtracting the correction value if the course has deviated towards the north or by adding the correction value if the course has deviated towards the south. For example, assume that the ship is sailing near the latitude of 40 ° and the course is read at 30 ° and the speed at 16 knots (kt). The correction value under these conditions is shown as 1.1 in the table. Since the ship is sailing north, the true course of the ship is 30 ° - 1.1 ° = 28.9 °. Similarly, assume that the ship is sailing near the latitude of 40 ° and the course is read at 150° and the speed at 16 knots. In this case, the ship is sailing south, and so the true course is 150 ° + 1.1 ° = 151.1 °.

(2) Determining the speed error using the speed error calibration chart (Chart-1)

① Locate the ship's speed V on the horizontal axis.

② Draw a vertical straight line from the position of the ship's speed and determine the intersection with the line of gyrocompass course angle θ where the angle θ is the deviation towards the north if the ship is sailing north and towards the south if the ship is sailing south.

③ Next, draw a straight line that crosses that intersection and is parallel to the horizontal axis, and determine the intersection with the line of current latitude φ of the ship.

④ The speed error can now be read from this second intersection. The speed error thus obtained must be read as a negative value if the ship is sailing north and positive if the ship is sailing south.

Example:

Assume that the ship is sailing at a speed of 12 knots at the point of north latitude of 40 ° and the gyrocompass course reads 320 °.

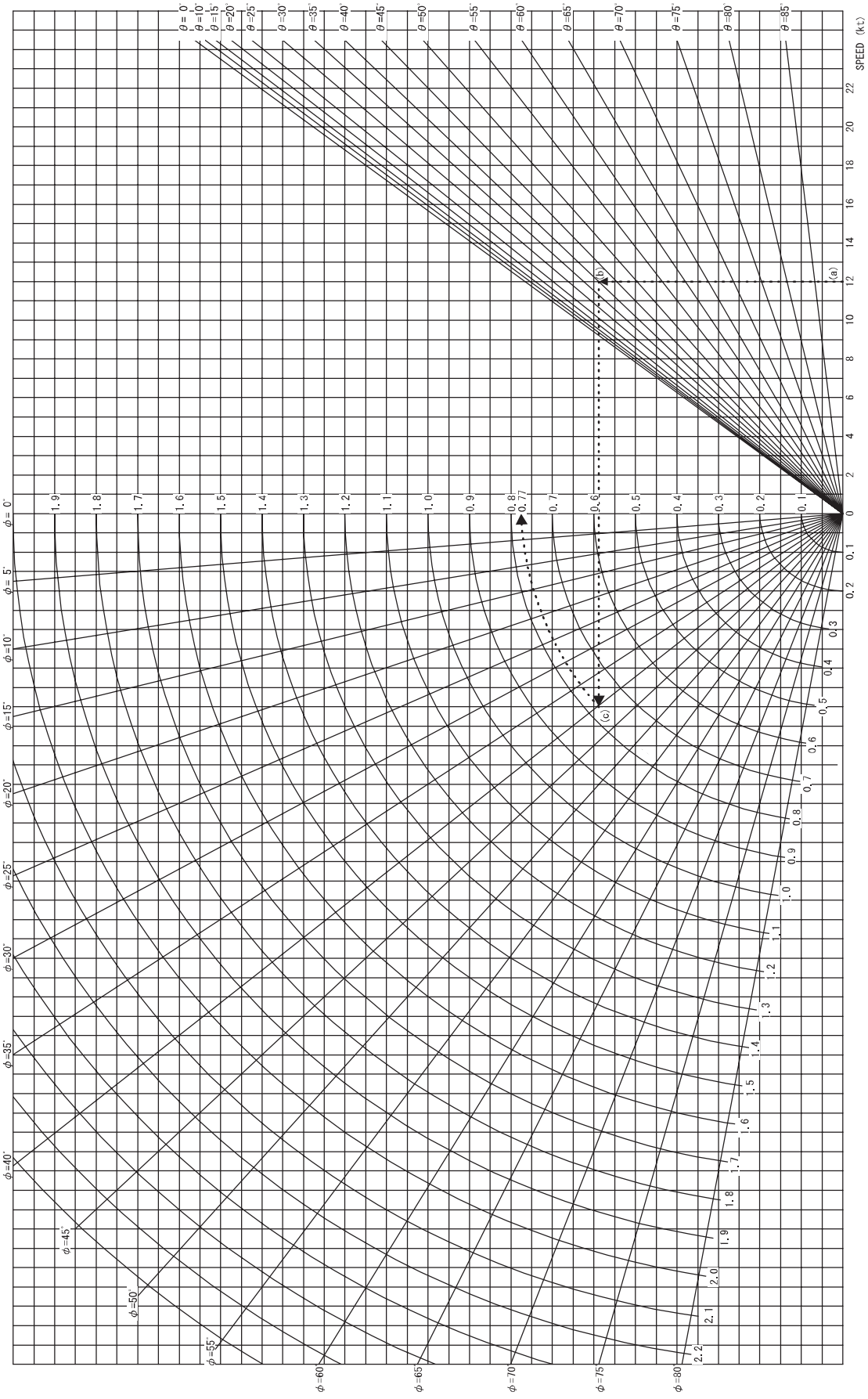
The course of 320 ° indicates that the course deviates by 40 ° from the north towards the west. Draw a vertical straight line from point (a), at 12 knots on the horizontal axis, and determine the intersection with the line of θ = 40 °, (b). Draw a horizontal straight line that crosses point (b) and determine another intersection with the line of φ = 40 °, (c). The speed error can now be read from this second intersection (c), which is 0.77. This gives the true course of the ship as 319.23 °.

Table-1 Speed Error Calibration Table

Determine the true heading by correcting the compass course using this table.

Lati-tude	Course(degrees)				Speed (kt)									
	Northward		Southward		4	8	12	16	20	24	28	32	36	40
0° ~ 20°	0	360	180	180	0.3	0.5	0.8	1.0	1.3	1.5	1.7	2.1	2.3	2.6
	15	345	165	195	0.3	0.5	0.8	1.0	1.3	1.4	1.7	2.0	2.2	2.5
	30	330	150	210	0.2	0.4	0.6	0.9	1.1	1.3	1.5	1.8	2.0	2.3
	45	315	135	225	0.2	0.4	0.5	0.7	0.9	1.1	1.2	1.4	1.6	1.8
	60	300	120	240	0.1	0.3	0.4	0.5	0.7	0.8	0.9	1.0	1.2	1.3
	75	285	105	255	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.6
	90	270	90	270	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30°	0	360	180	180	0.3	0.6	0.9	1.2	1.5	1.7	2.0	2.3	2.6	3.0
	15	345	165	195	0.3	0.6	0.9	1.1	1.4	1.6	2.0	2.3	2.5	2.3
	30	330	150	210	0.2	0.5	0.7	1.0	1.2	1.5	1.8	2.0	2.3	2.5
	45	315	135	225	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.2
	60	300	120	240	0.2	0.3	0.5	0.6	0.8	0.9	1.0	1.2	1.3	1.5
	75	285	105	255	0.1	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.7	0.7
	90	270	90	270	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40°	0	360	180	180	0.3	0.7	1.0	1.3	1.7	2.0	2.3	2.6	3.0	3.3
	15	345	165	195	0.3	0.7	1.0	1.2	1.5	1.9	2.2	2.5	2.8	3.2
	30	330	150	210	0.3	0.6	0.8	1.1	1.4	1.7	2.0	2.3	2.6	2.8
	45	315	135	225	0.2	0.5	0.7	0.9	1.2	1.4	1.6	1.8	2.2	2.3
	60	300	120	240	0.2	0.3	0.6	0.7	0.9	1.0	1.2	1.3	1.5	1.8
	75	285	105	255	0.1	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.8
	90	270	90	270	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45°	0	360	180	180	0.4	0.7	1.1	1.4	1.8	2.2	2.5	2.8	3.2	3.6
	15	345	165	195	0.3	0.7	1.0	1.4	1.7	2.1	2.4	2.8	3.2	3.5
	30	330	150	210	0.3	0.6	0.9	1.2	1.6	1.9	2.1	2.5	2.8	3.2
	45	315	135	225	0.3	0.5	0.8	1.0	1.2	1.5	1.7	2.0	2.3	2.5
	60	300	120	240	0.2	0.4	0.5	0.7	0.9	1.1	1.2	1.5	1.6	1.8
	75	285	105	255	0.1	0.2	0.3	0.4	0.5	0.6	0.6	0.7	0.8	0.9
	90	270	90	270	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50°	0	360	180	180	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0
	15	345	165	195	0.4	0.8	1.1	1.5	1.8	2.2	2.6	3.0	3.5	3.8
	30	330	150	210	0.3	0.7	1.0	1.3	1.6	2.0	2.3	2.6	3.0	3.4
	45	315	135	225	0.3	0.6	0.8	1.1	1.4	1.7	2.0	2.3	2.5	2.8
	60	300	120	240	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
	75	285	105	255	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
	90	270	90	270	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55°	0	360	180	180	0.4	0.9	1.3	1.8	2.2	2.7	3.2	3.5	4.0	4.4
	15	345	165	195	0.4	0.9	1.3	1.7	2.1	2.6	3.0	3.4	3.8	4.3
	30	330	150	210	0.4	0.8	1.1	1.5	1.9	2.3	2.7	3.2	3.5	3.8
	45	315	135	225	0.3	0.6	0.9	1.3	1.6	1.9	2.3	2.5	2.8	3.1
	60	300	120	240	0.2	0.4	0.7	0.9	1.1	1.3	1.5	1.7	2.0	2.2
	75	285	105	255	0.1	0.2	0.3	0.5	0.6	0.7	0.8	0.9	1.0	1.2
	90	270	90	270	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60°	0	360	180	180	0.5	1.0	1.5	2.0	2.5	3.1	3.6	4.2	4.6	5.0
	15	345	165	195	0.5	0.9	1.4	1.9	2.4	2.9	3.5	4.0	4.5	4.8
	30	330	150	210	0.4	0.8	1.3	1.7	2.1	2.6	3.0	3.5	4.0	4.3
	45	315	135	225	0.4	0.7	1.1	1.4	1.8	2.2	2.5	2.8	3.2	3.5
	60	300	120	240	0.3	0.5	0.8	1.0	1.3	1.5	1.8	2.0	2.3	2.5
	75	285	105	255	0.2	0.3	0.4	0.6	0.7	0.8	1.0	1.1	1.2	1.3
	90	270	90	270	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65°	0	360	180	180	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.5	6.1
	15	345	165	195	0.6	1.2	1.7	2.3	2.9	3.5	4.1	4.6	5.2	5.8
	30	330	150	210	0.5	1.0	1.6	2.1	2.6	3.1	3.6	4.2	4.6	5.2
	45	315	135	225	0.4	0.9	1.3	1.7	2.1	2.6	3.0	3.4	3.8	4.3
	60	300	120	240	0.3	0.6	0.9	1.2	1.5	1.8	2.2	2.4	2.7	3.0
	75	285	105	255	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.3	1.4	1.5
	90	270	90	270	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70°	0	360	180	180	0.7	1.5	2.2	3.0	3.7	4.5	5.2	6.0	6.8	7.5
	15	345	165	195	0.7	1.5	2.2	2.9	3.6	4.3	5.0	5.8	6.5	7.2
	30	330	150	210	0.6	1.3	1.9	2.6	3.2	3.9	4.5	5.2	5.8	6.5
	45	315	135	225	0.5	1.1	1.6	2.2	2.7	3.2	3.7	4.2	4.6	5.2
	60	300	120	240	0.4	0.7	1.1	1.5	1.9	2.2	2.6	3.0	3.3	3.6
	75	285	105	255	0.2	0.4	0.6	0.8	1.0	1.2	1.3	1.5	1.6	1.9
	90	270	90	270	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Chart-1 Speed Error Calibration Chart



Appendix-2 Principle of Gyrocompass

2.1 Gyro

The gyro is supported in a freely rotating manner around its longitudinal axis and transverse axis by supports and the center of gravity of the gyro and its supports is positioned at the intersection of both spinning axes, and the gyro is turned at a high speed (Figure 1). The direction of the gyro axes does not change even if the stand of the gyro is tilted or rotated. This is because the magnitude and direction of inertia of rotation (angular momentum) are maintained provided that neither friction nor external forces affect the rotating action. This is a characteristic of a gyro.

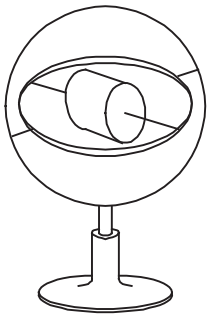


Figure 1

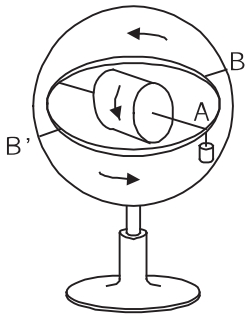


Figure 2

Hanging a weight from tip (A) of the spinning axis of the gyro (Figure 2), slightly lowers side (A) and this affects the spin of the gyro. The weight causes the gyro to spin around the BB' axis, which creates a torque around the transverse axis. This causes the gyro to spin in the direction of the arrow, which generates a torque around the BB' axis that supports the gravitational force of the weight. This phenomenon is called precession and is another typical characteristic of a gyro. Provided there is no friction at each axis, the gyro angular momentum (moment of inertia × rotating speed), applied torque, and resulting precession speed have the following relations:

(1) Quantitative: Angular momentum × precession speed = torque

(2) Direction: Vectors are shown in Figure 3.

2.2 North-seeking Tendency of Gyrocompass

Suppose that a weight is hanging under the supports as shown in Figure 3 such that the center of gravity for the entire gyro system, supports and weight is positioned directly under the intersection of two axes. If friction on both longitudinal and transverse supports is negligible at this time, the end of the longitudinal axis A oscillates up and down and right and left in an elliptical orbit due to the gravitational force and spinning action of the earth.

The spin of the ellipse orientates around north. By attaching an adequate damping device, the amplitude of oscillation gradually decreases and the longitudinal axis stabilizes in the northern orientation. This is the gyrocompass. This north-seeking tendency is further detailed below.

Figure 4 shows the earth's spin. The components of the angular velocity of the spin, ω, at point p on latitude φ can be expressed as:

$\omega \sin \varphi$ (spinning motion around the vertical axis)

$\omega \cos \varphi$ (tilting motion along the horizontal meridian)

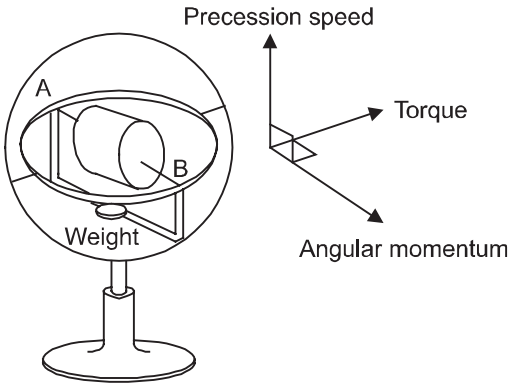


Figure 3

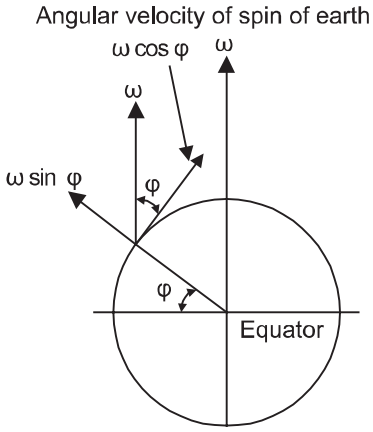


Figure 4

If the gyro shown in Figure 3 is placed on point p with A facing east and B facing west and with the A-B axis horizontal (Figure 5), the orientation of the gyro remains the same. However, since the inclination at this point on the earth remains the same as time elapses, the end-point A of the A-B axis rises and the end-point B goes down relative to the horizontal plane. Then, precession is carried out as the weight generates a torque to return the A-B axis to the horizontal position. When end-point A arrives at the meridian with the gyro tilted, the tilt is at its maximum and end-point A continues to turn towards the west. When end-point A enters on the west side of the meridian, the inclination starts acting so as to lower A. The torque caused by the weight gradually decreases and precession stops when end-point A reaches the west end. Then, likewise, end-point A goes down and begins pointing towards north. In such a manner, the orientation of the gyro spins around with north at its center in an elliptical motion as shown in Figure 6.

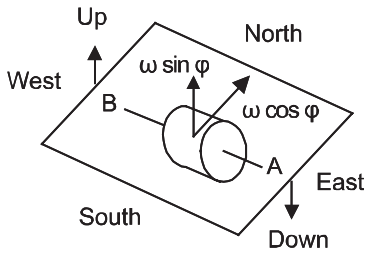


Figure 5

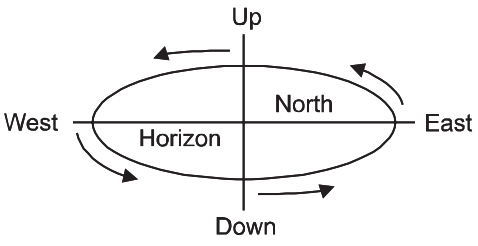


Figure 6

In a gyrocompass, this elliptical motion of the gyro is reduced and the orientation of the gyro stops at north. When the gyro axis is aligned with the meridian, end-point A stabilizes along the horizontal plane; however, when end-point A deviates either to the east or to the west, it lowers or rises away from the horizontal plane and starts moving towards north due to precession.

When the gyro axis is stable in a northern orientation, the precession force offsets the component, $\omega \cos \varphi$ (spinning motion), of the earth's spin.

The above describes the north-seeking principle. However, in reality, a gyro experiences rolling and pitching and other undesired influences. A single gyro cannot offset all these influences, and hence two gyros are linked together by a special mechanism to actively prevent rolling and pitching errors. This is performed by causing precession in each gyro as soon as the gyros are affected by an external force and thus canceling the external force just as with the aforementioned occurrence of a force offsetting the gravitational force of a weight. In this case, the resultant angular momentum of two gyros and the north-seeking tendency remain unchanged. Since the north-seeking force of a gyro is very small, the design of the gyro must be such that the frictions in the longitudinal and transverse axes are comparatively negligible, so as not to affect the north-seeking tendency.

2.3 Gyrocompass Errors

2.3.1 Speed Error

Refer to Appendix-1, "Description of Speed Error and Speed Error Table."

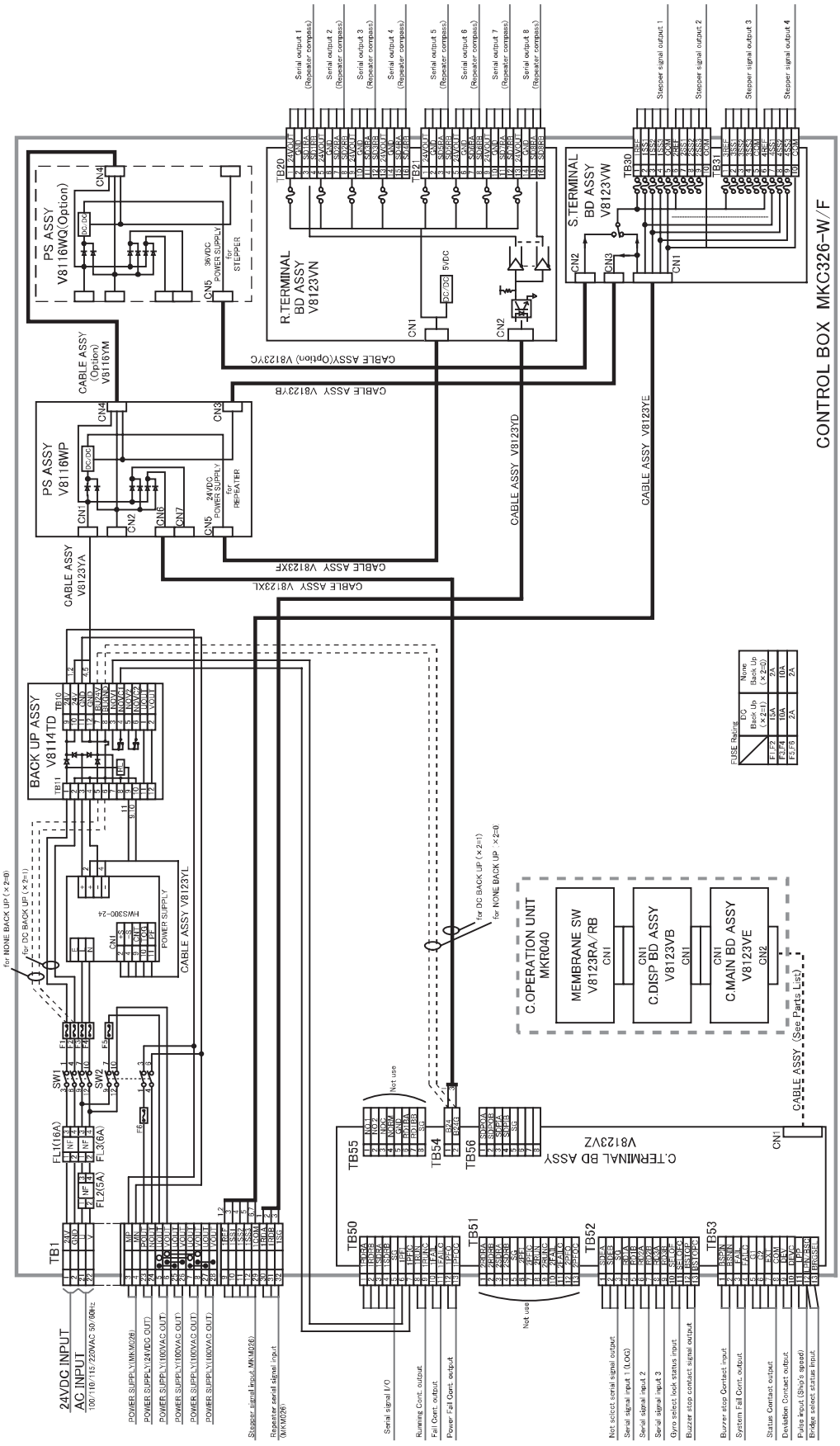
2.3.2 Acceleration Error

If there is a change in ship's speed or course, a torque occurs on the gyrosphere because the center of gravity of the gyrosphere falls below the center of buoyancy. This causes an error in the north-seeking reading of the gyrosphere. This error varies with the position of the center of gravity while the speed error also varies with the changes in the ship's course and speed. These errors in the reading can offset each other by adjustment of the position of the center of gravity. The optimum design of the center of gravity of the gyrosphere in the CMZ900 prevents the acceleration error from occurring. (As a result, the oscillation cycle of a gyrosphere when the damper is removed is about 85 minutes.)

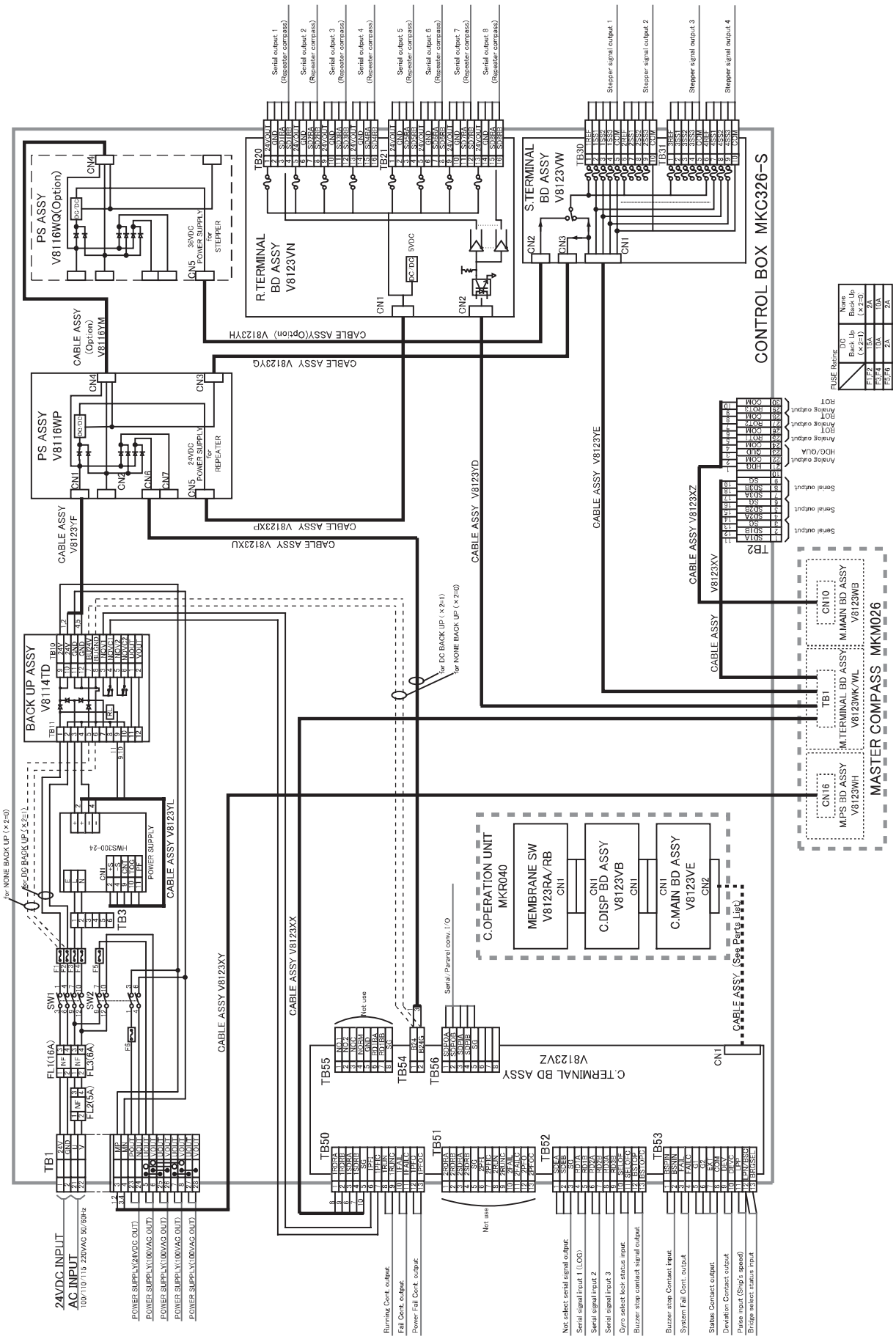
2.3.3 Rolling and Pitching Error

If the gyrosphere is continuously subjected to vibration from the ship's rolling and pitching and if the vibration cycles along the east-west axis and north-south axis of the gyrosphere greatly differ, this difference of vibration cycle between two axes causes an error. To compensate for this, two gyros are provided to reduce the differences between the vibration cycles along the north-south axis and east-west axis, thus preventing the rolling and pitching error. In addition, a damper mounted to the suspending mechanism damps vibration so as to gain stable reading.

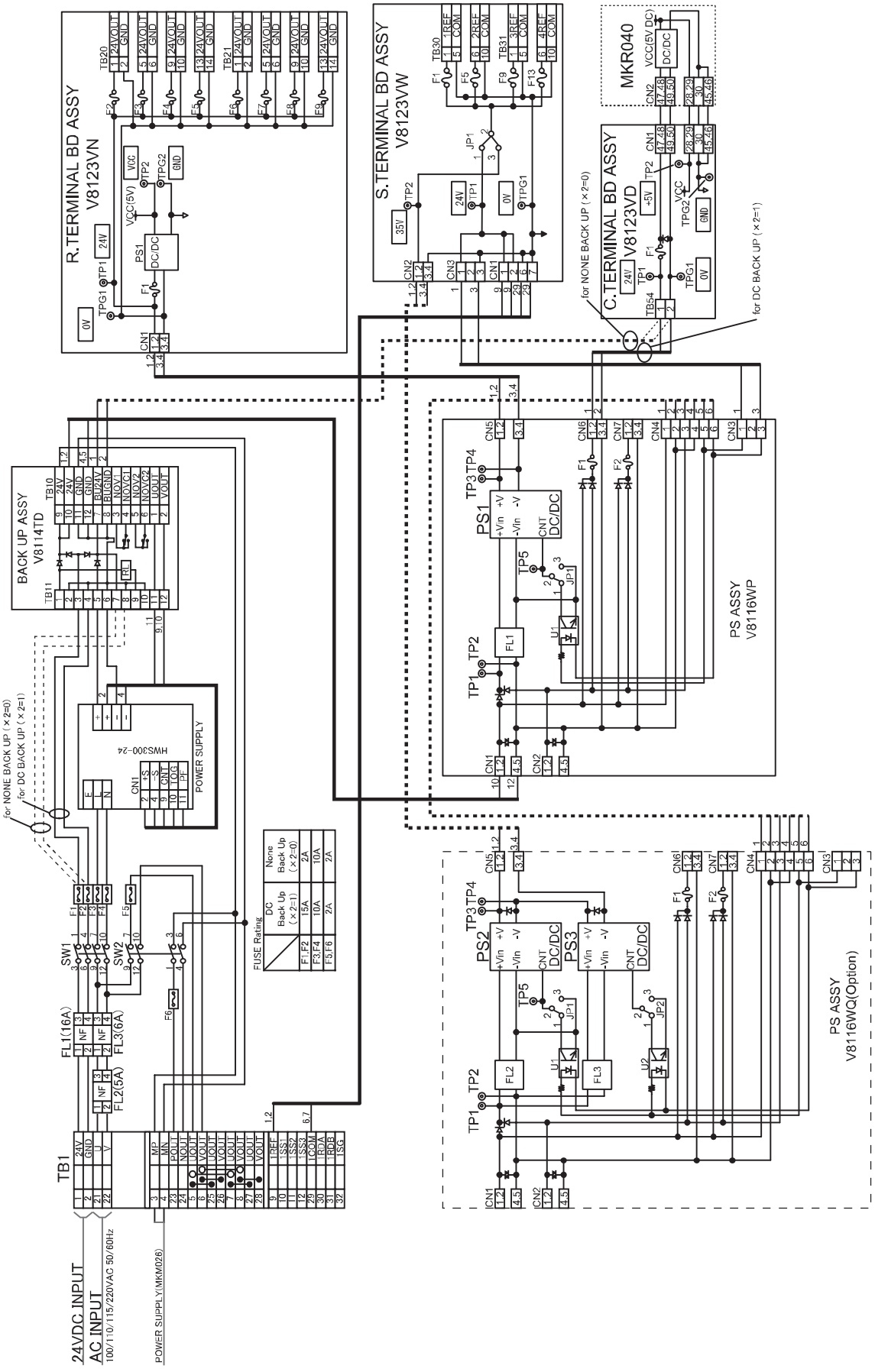
Appendix-3 Block Diagram



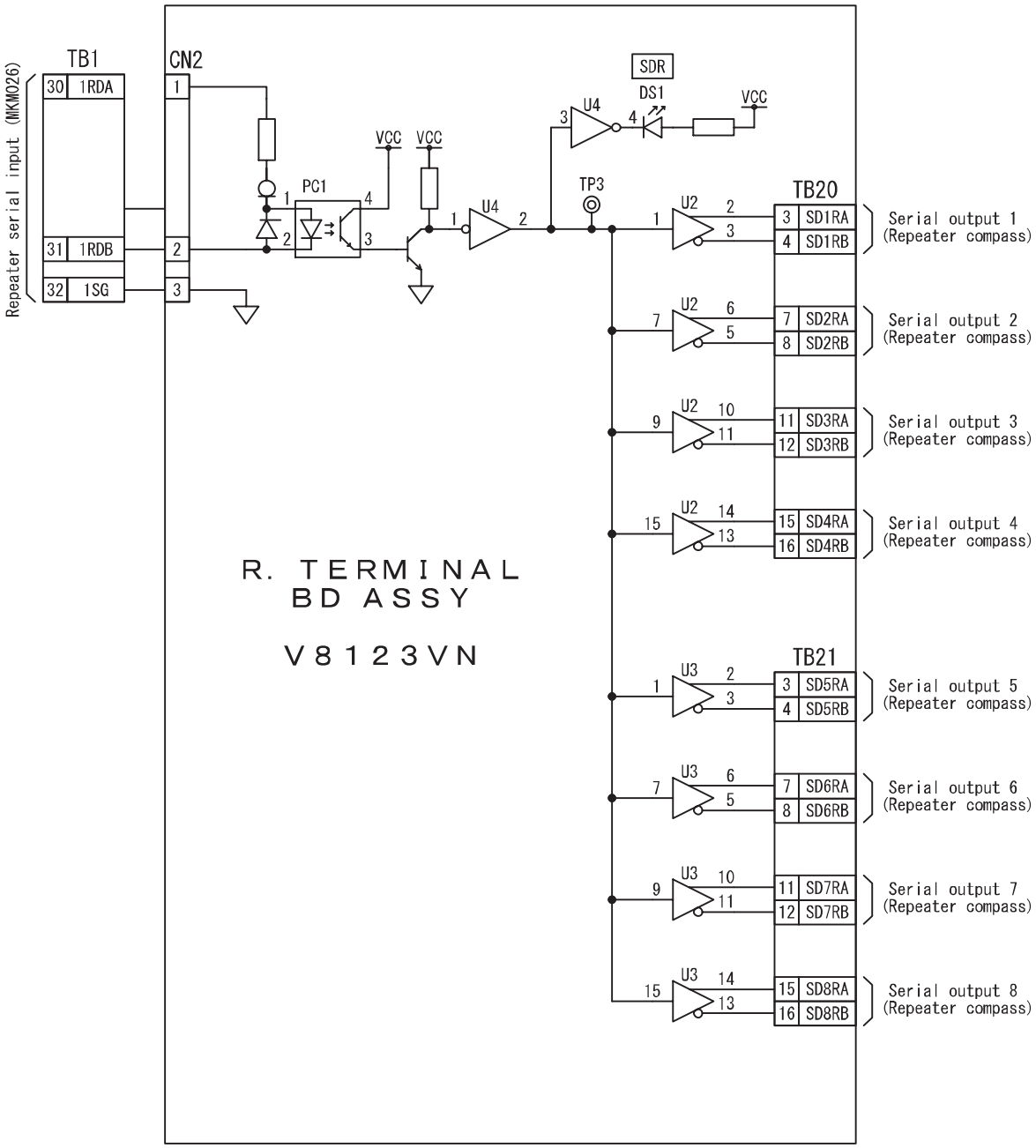
3.1 MKC326-F/-W Block Diagram



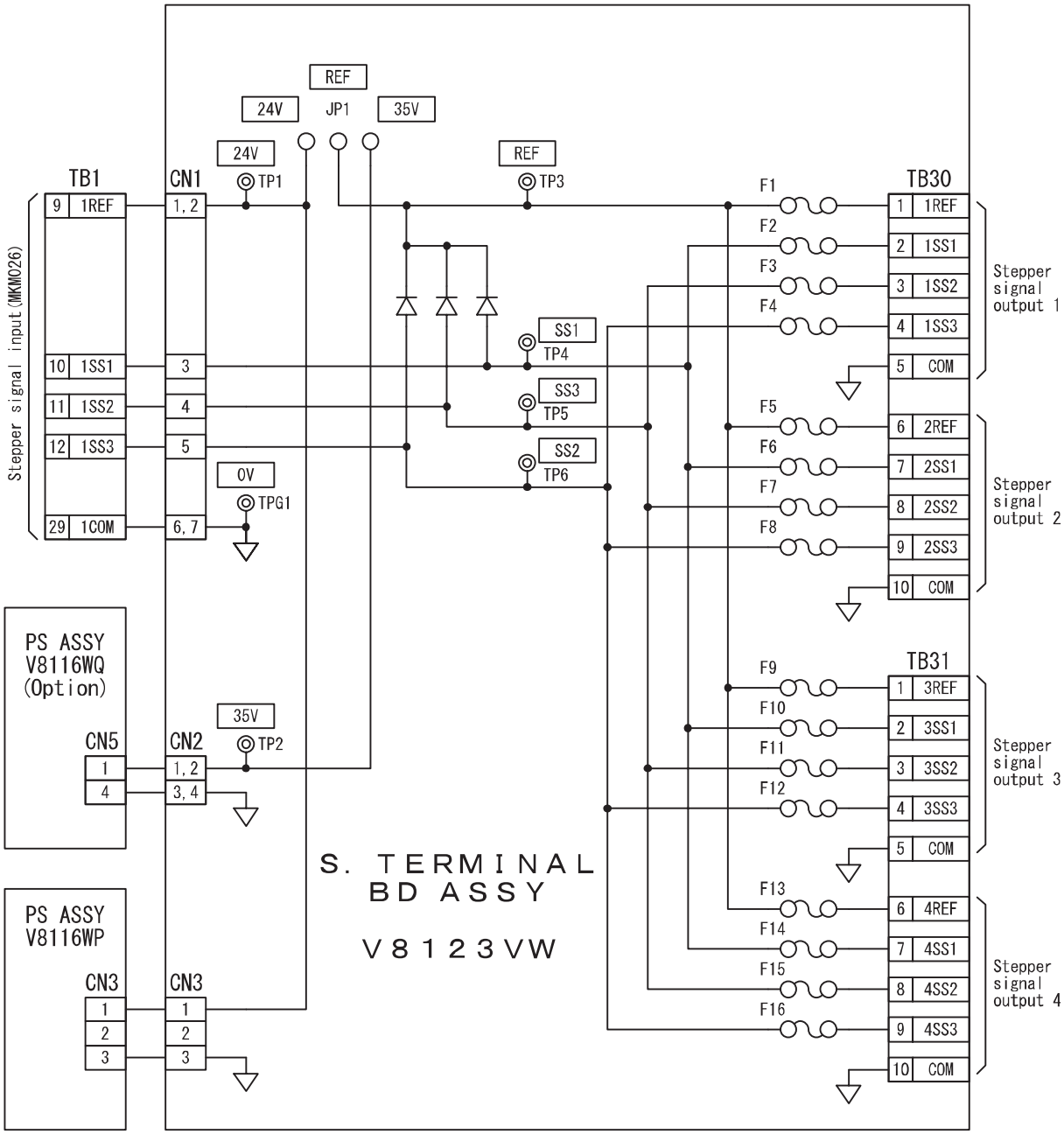
3.2 MKC326-S Block Diagram



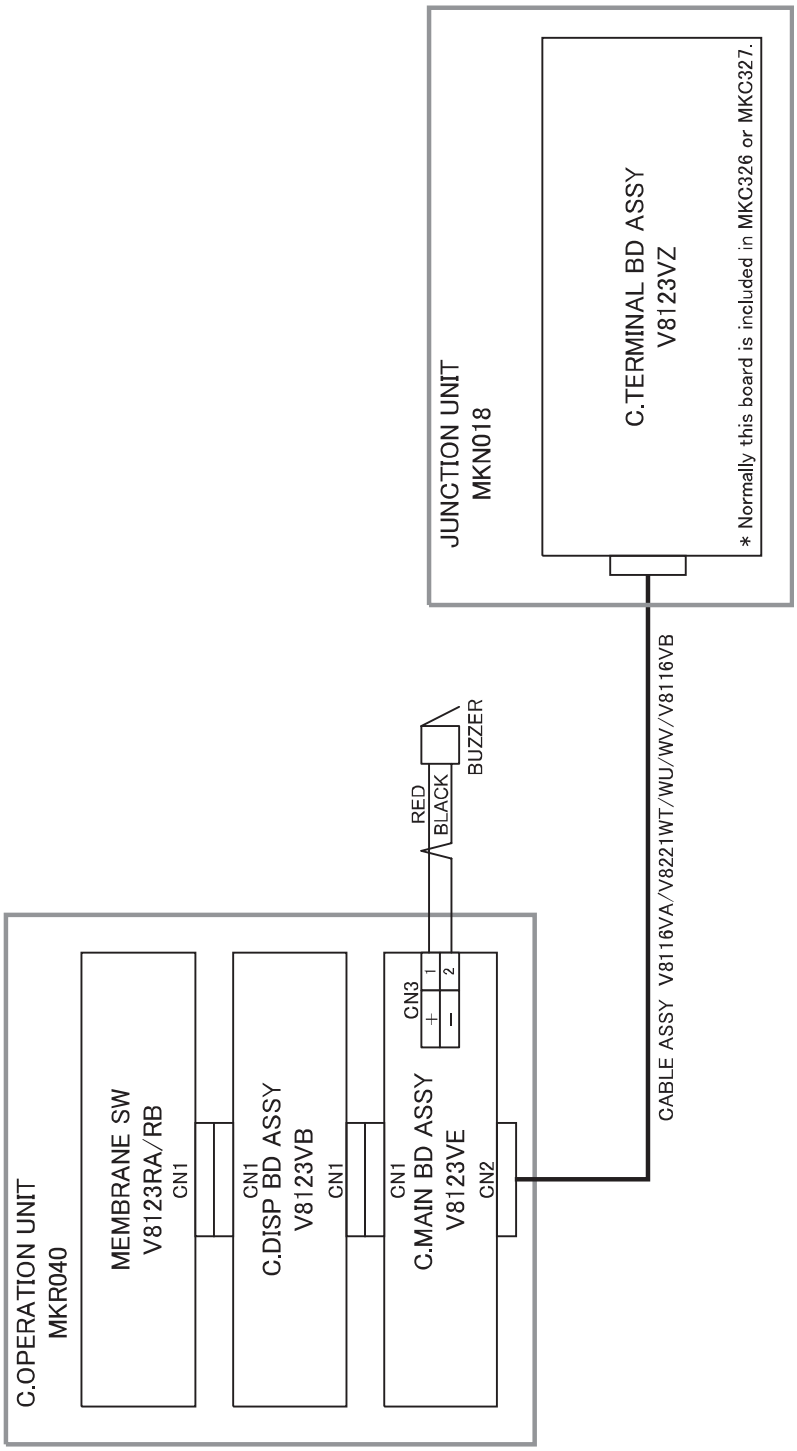
3.3 MKC326 Circuit Diagram (Power line)



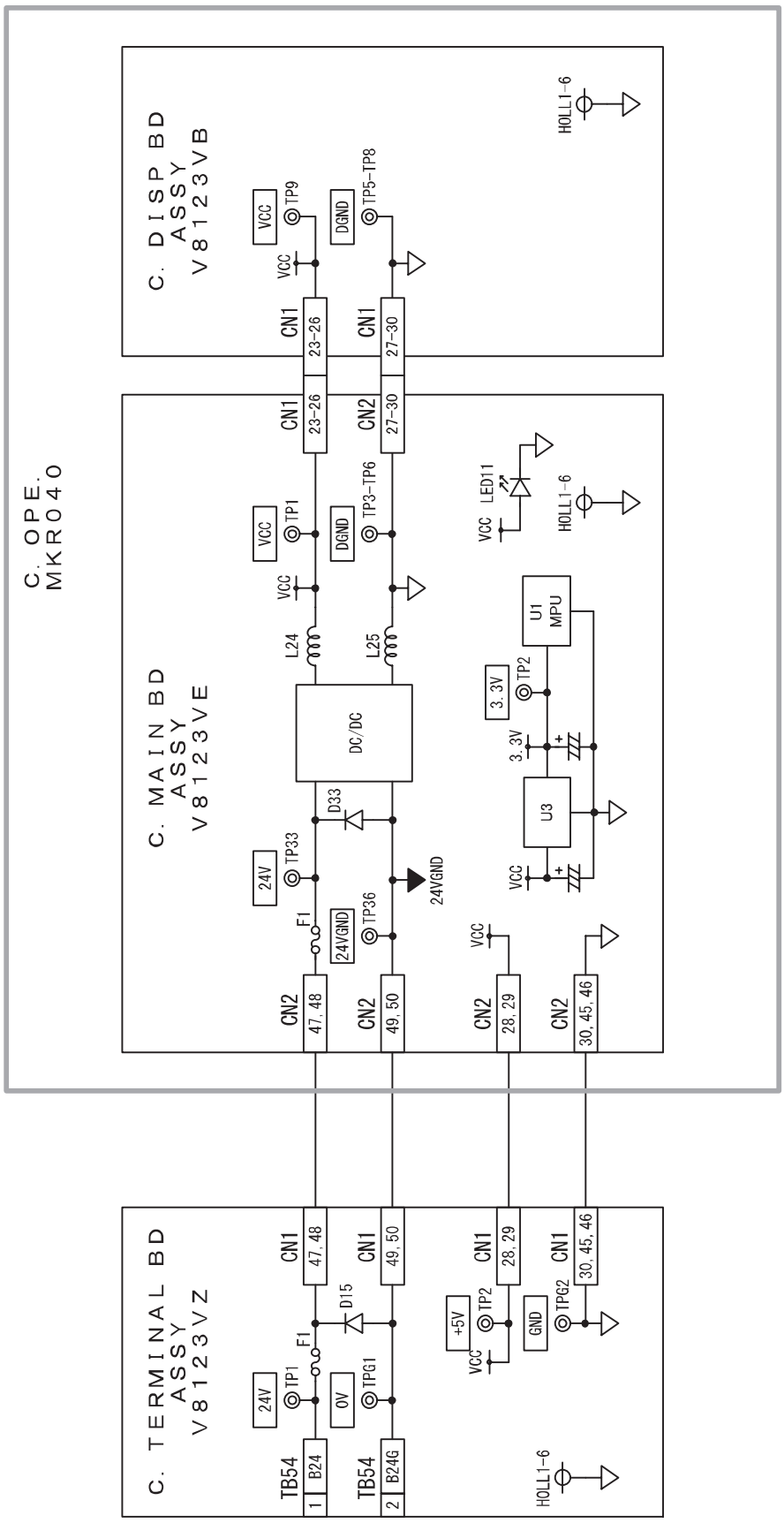
3.4 MKC326 Circuit Diagram (R.TERMINAL BD ASSY I/F)



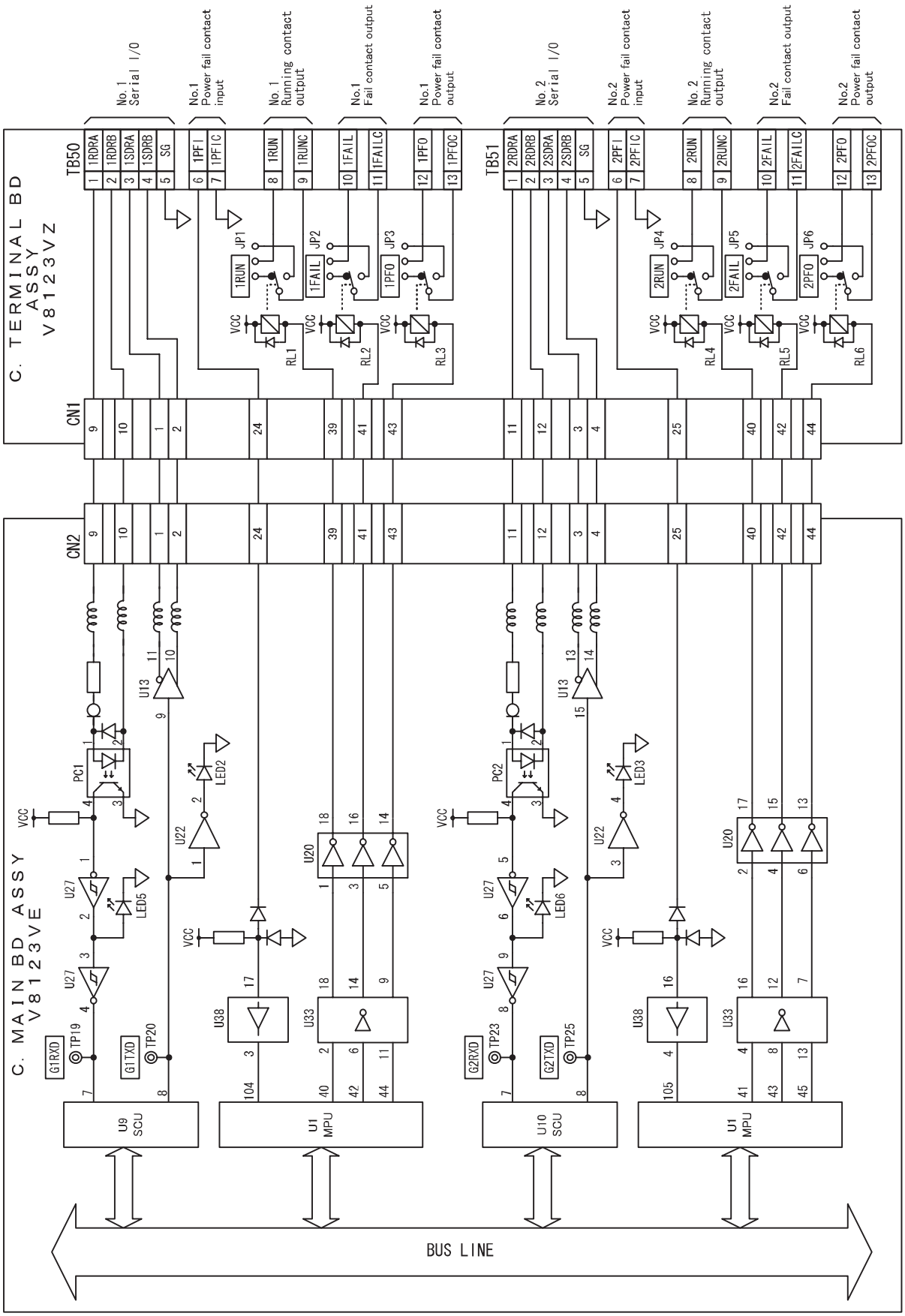
3.5 MKC326 Circuit Diagram (S.TERMINAL BD ASSY I/F)



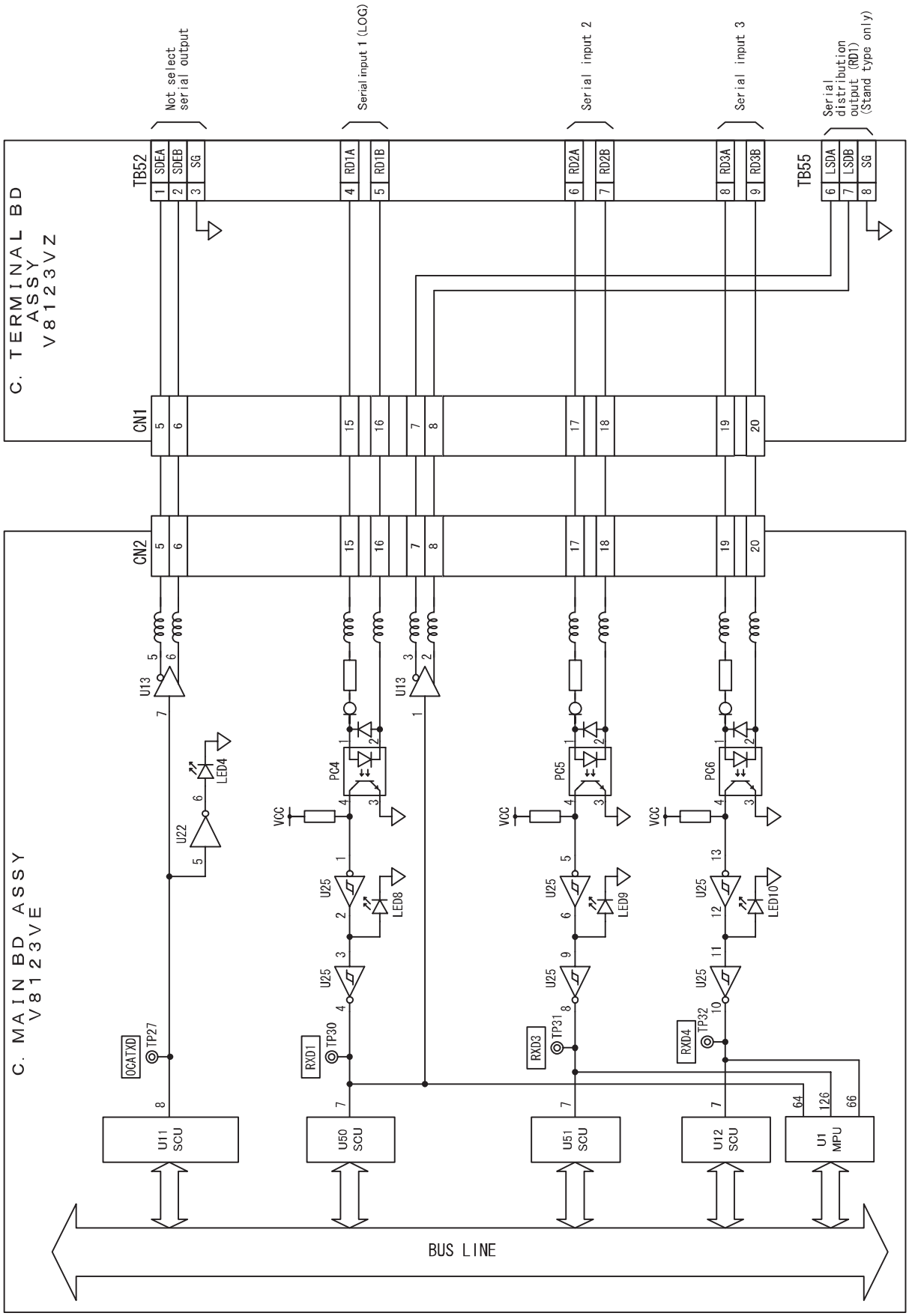
3.6 MKR040&MKN018 Block Diagram



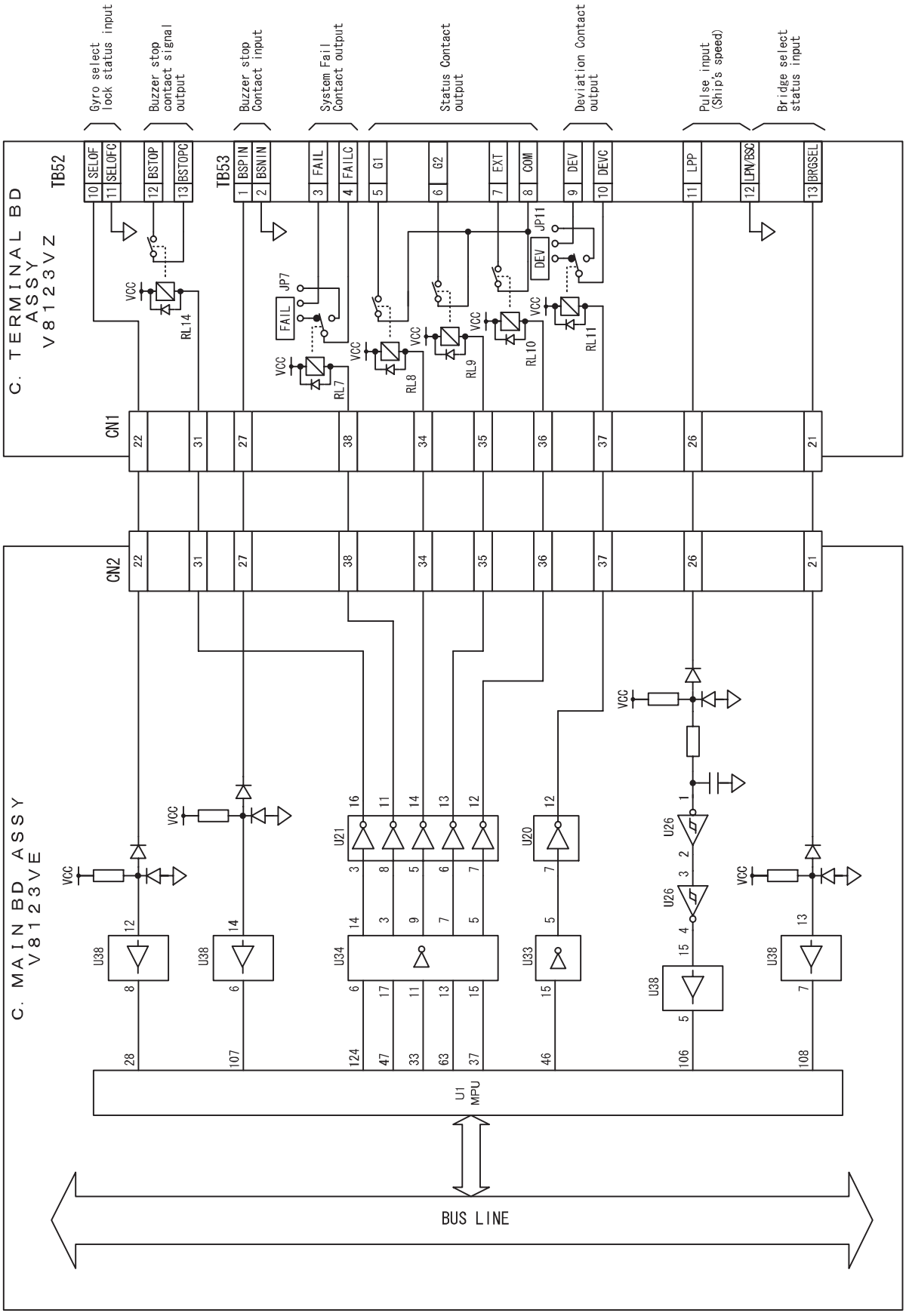
3.7 MKR040&MKN018 Circuit Diagram (Power line)



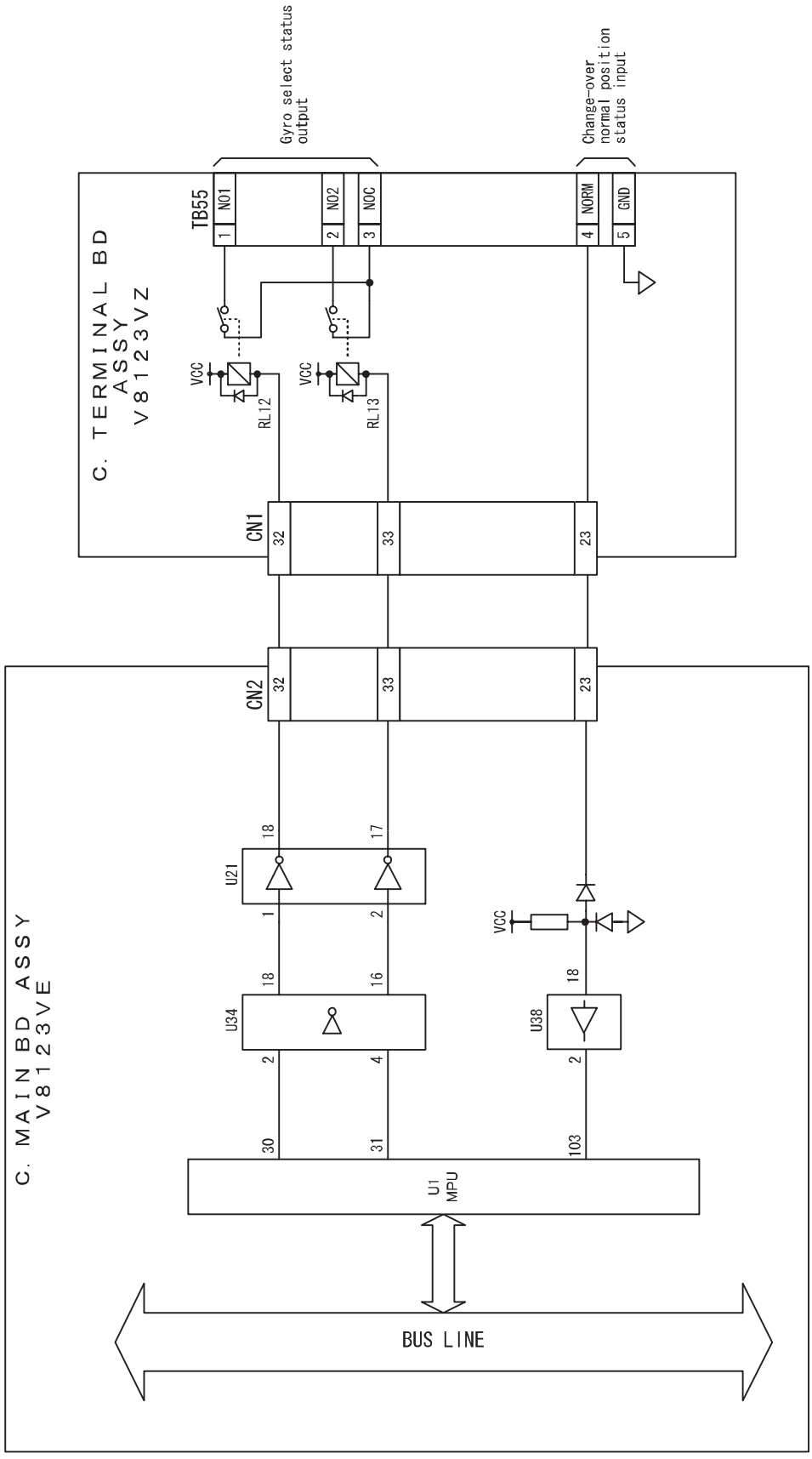
3.8 (1) MKR040&MKN018 Circuit Diagram (Signal I/F)



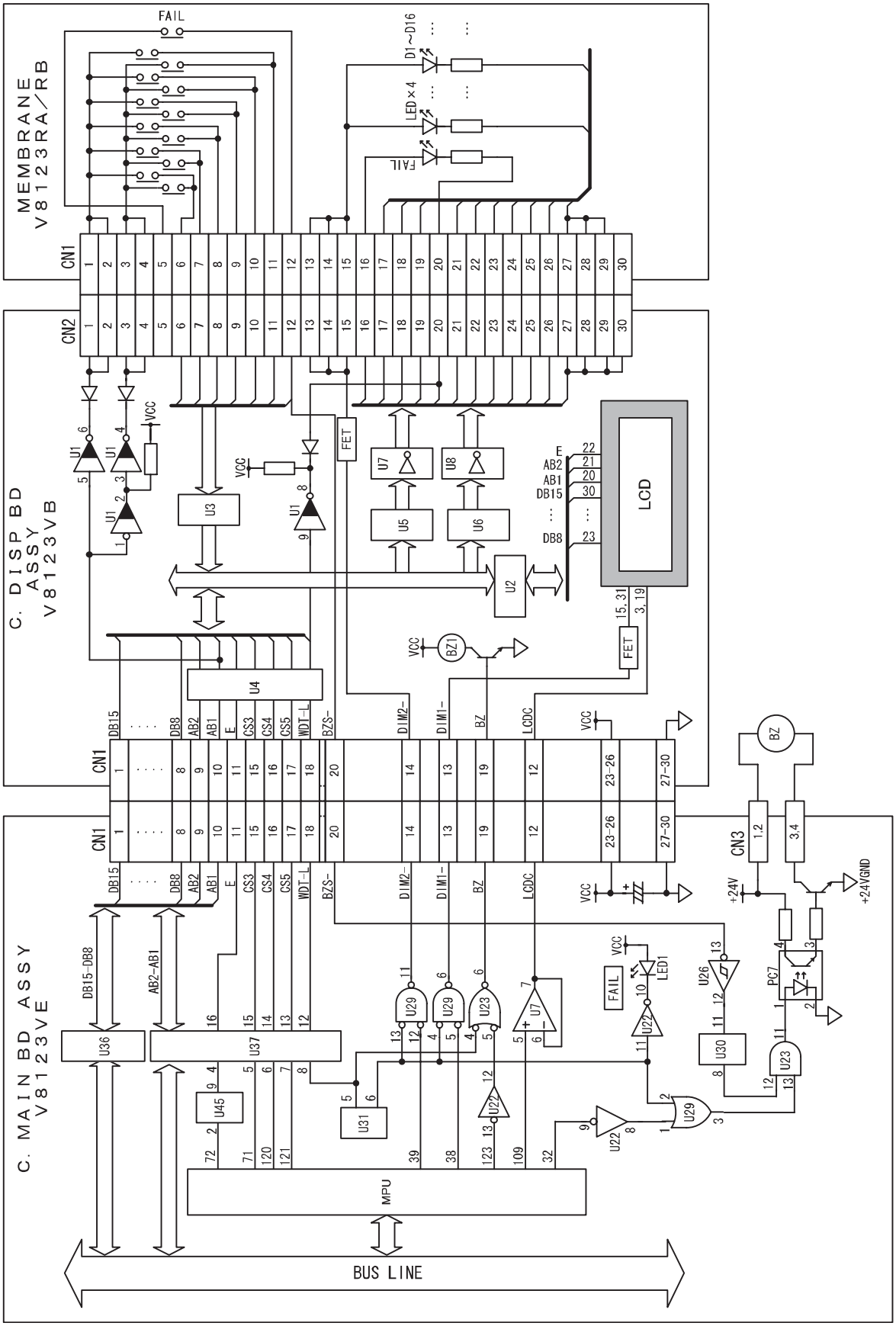
3.8 (2) MKR040&MKN018 Circuit Diagram (Signal I/F)



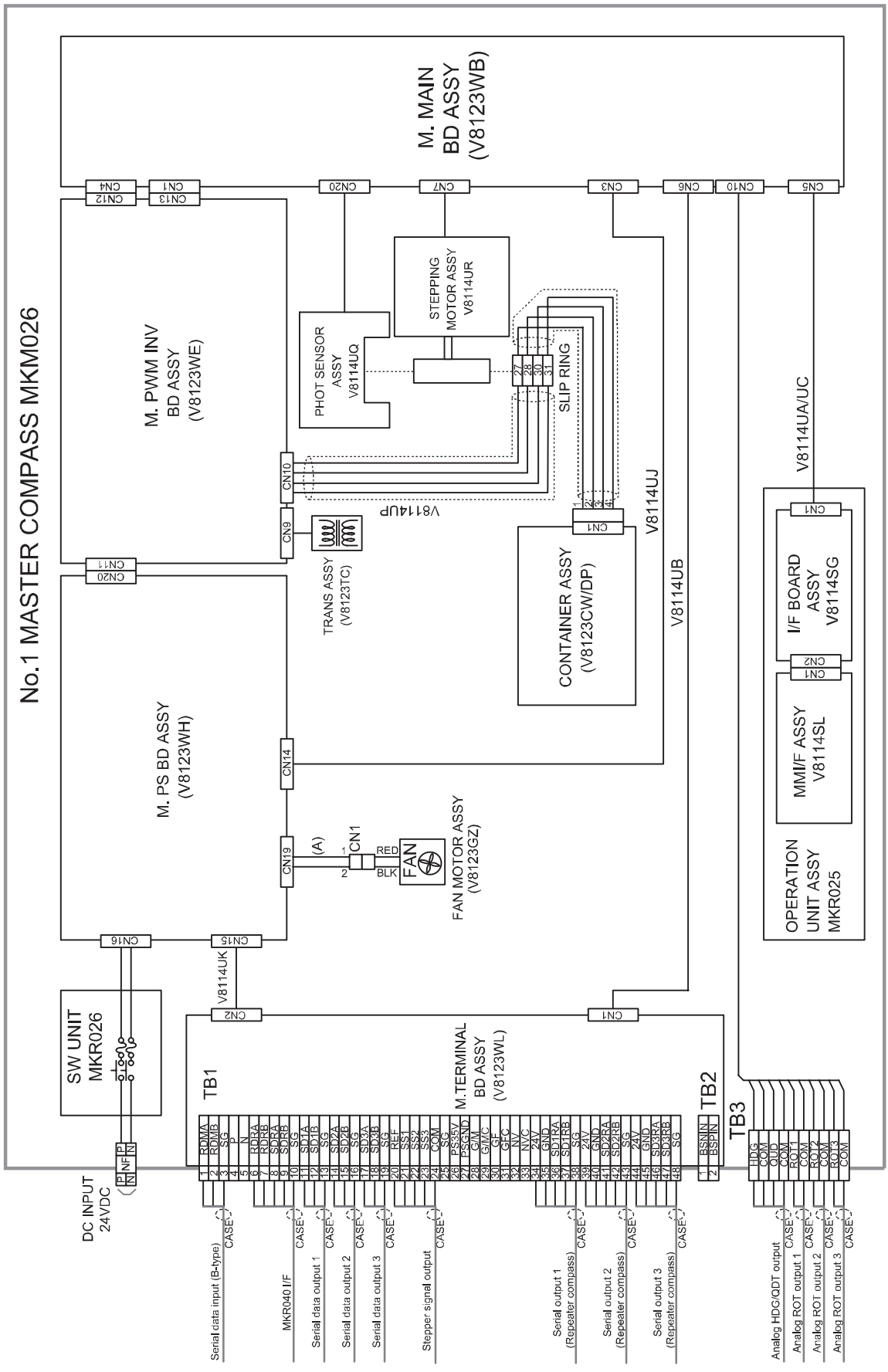
3.8 (3) MKR040&MKN018 Circuit Diagram (Signal I/F)



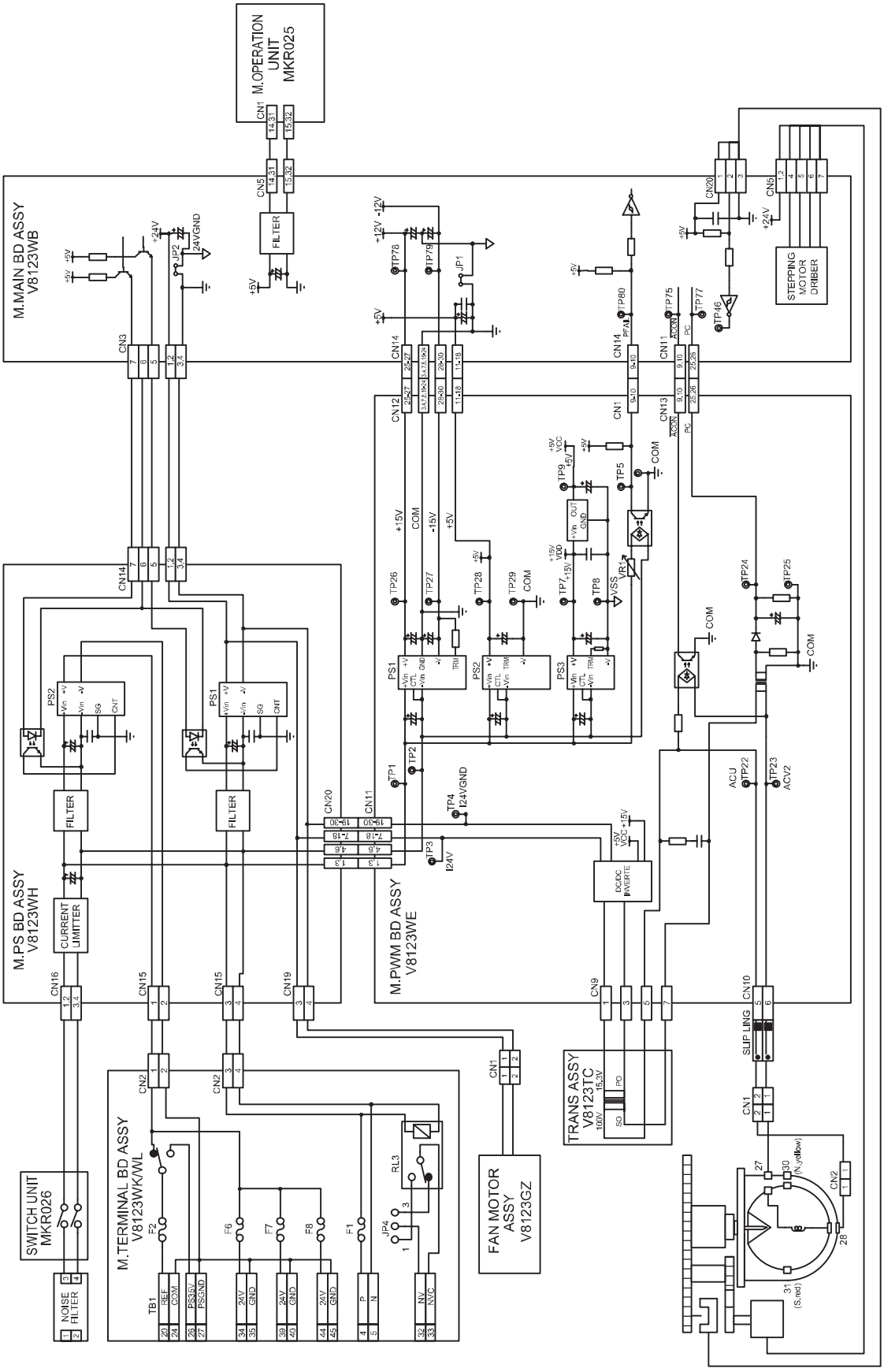
3.8 (4) MKR040&MKN018 Circuit Diagram (Signal I/F)



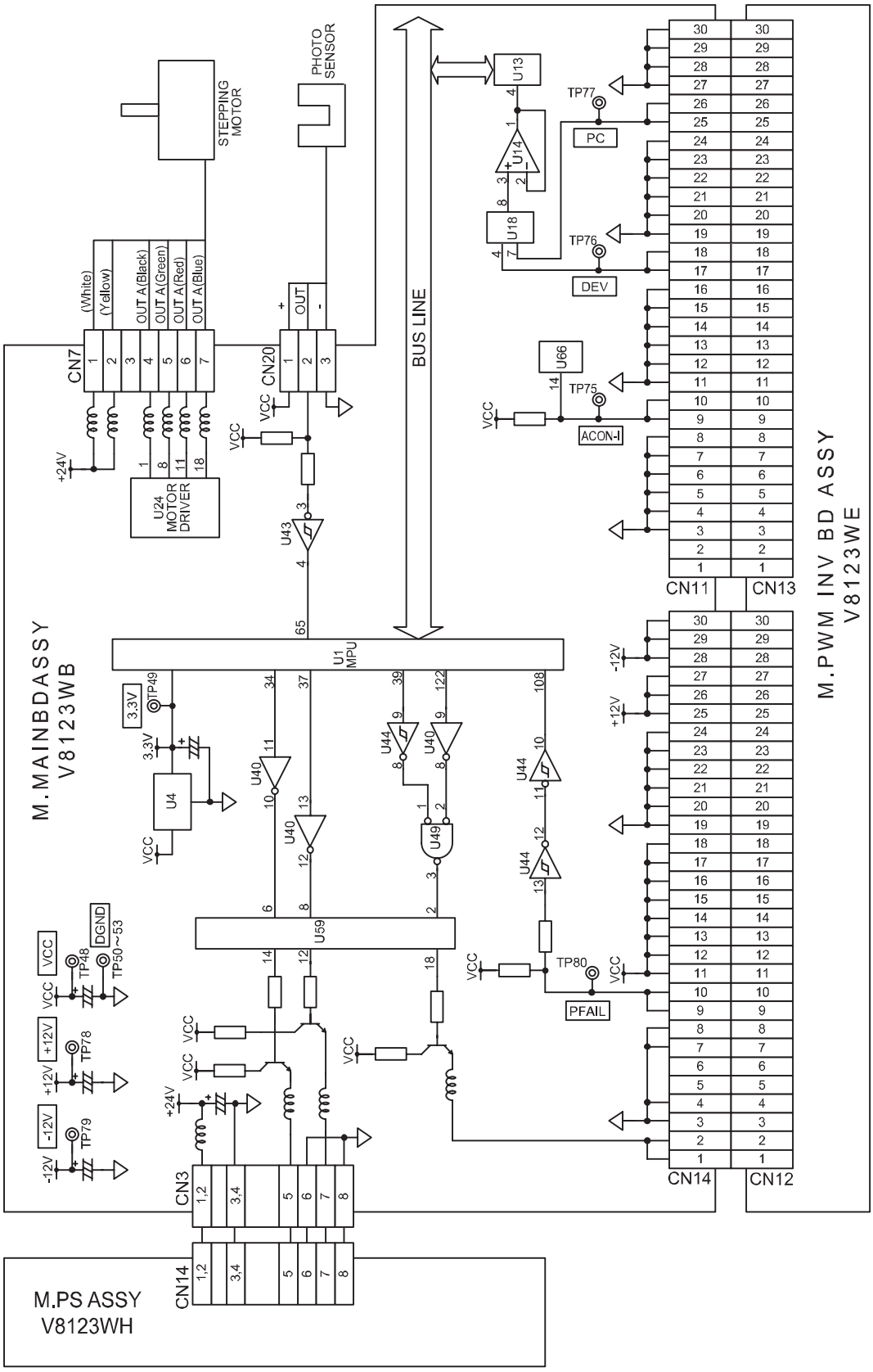
3.8 (5) MKR040&MKN018 Circuit Diagram (Signal I/F)



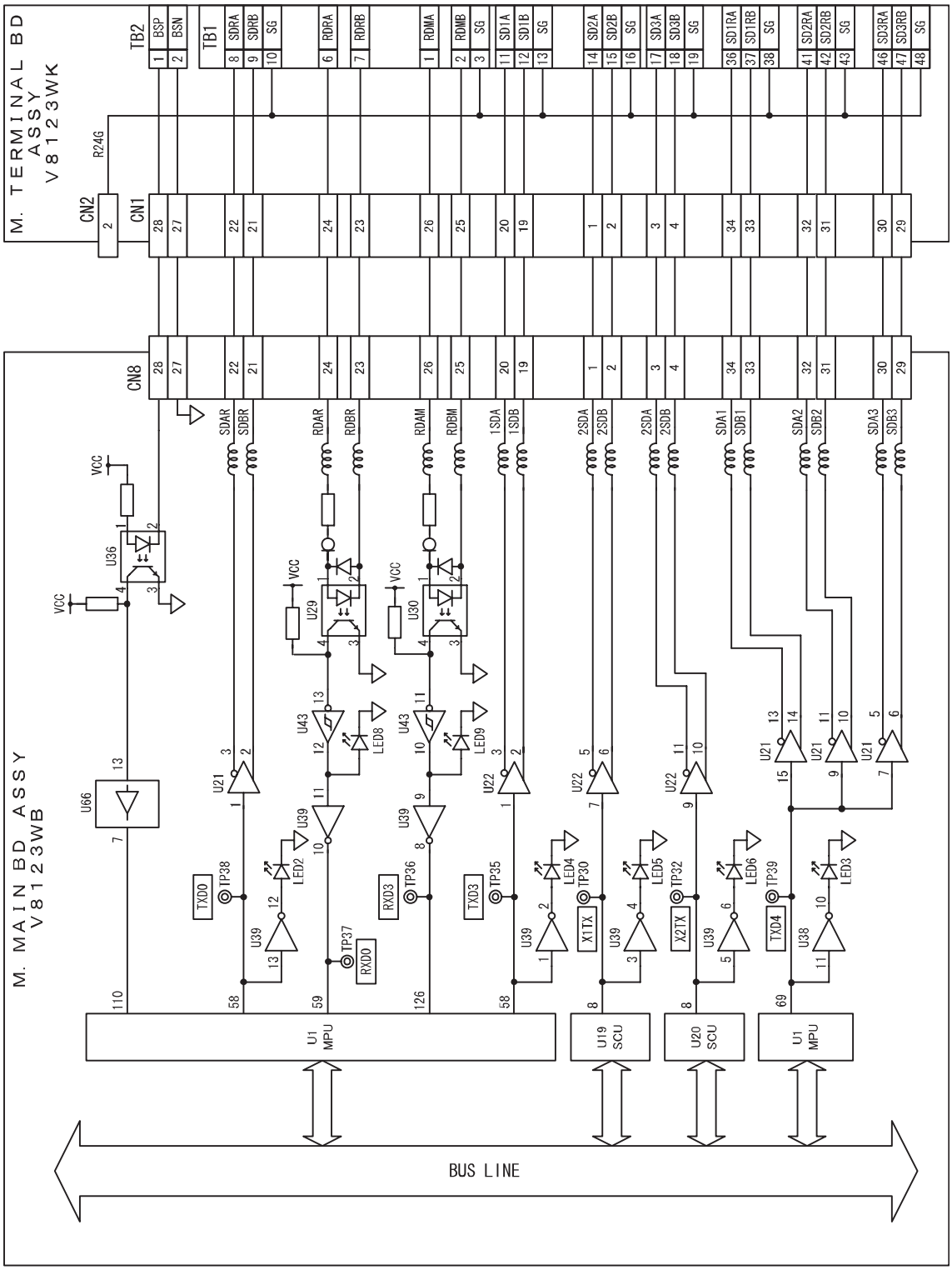
3.9 MKM026 Block Diagram



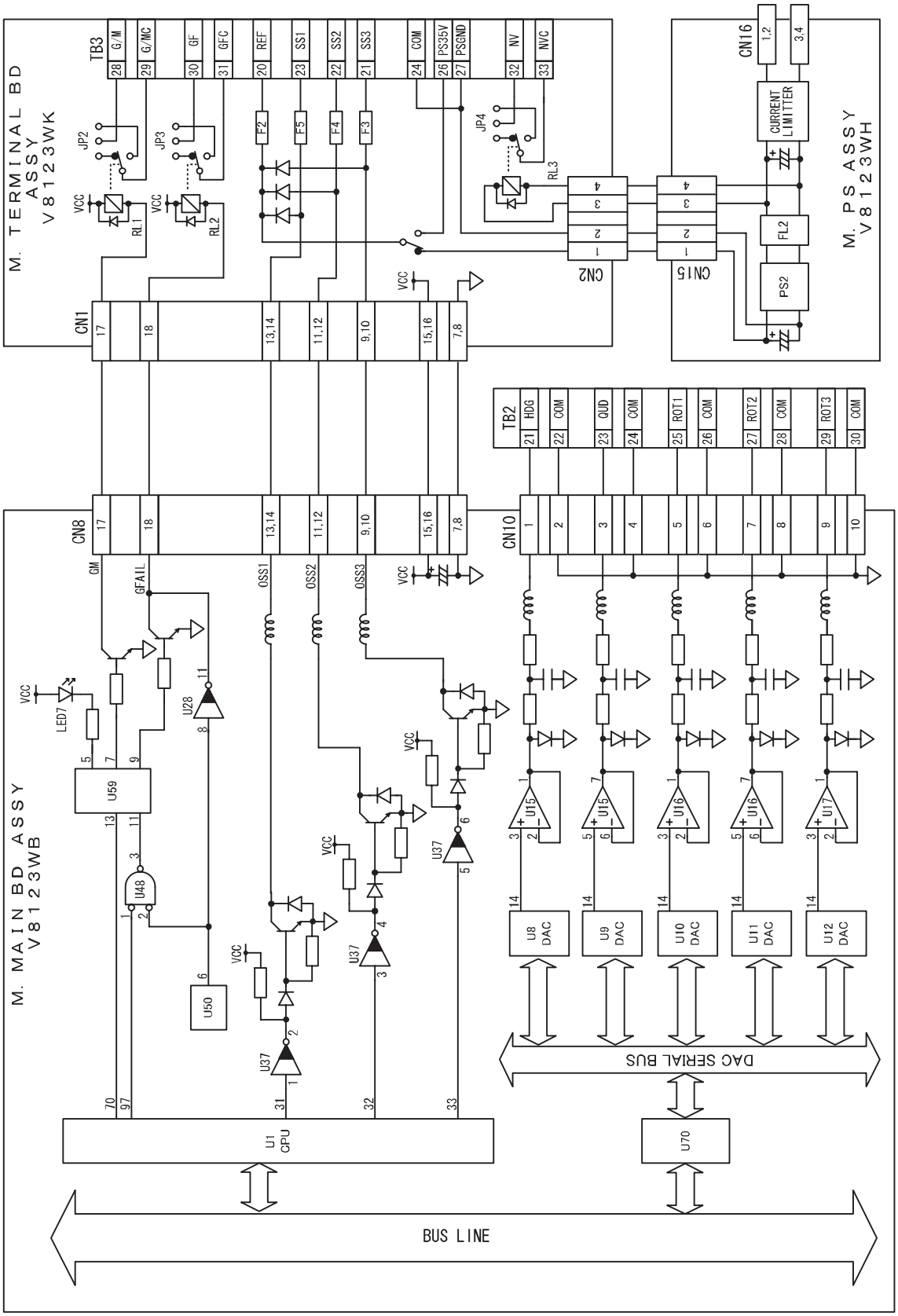
3.10 MKM026 Circuit Diagram (Power line)



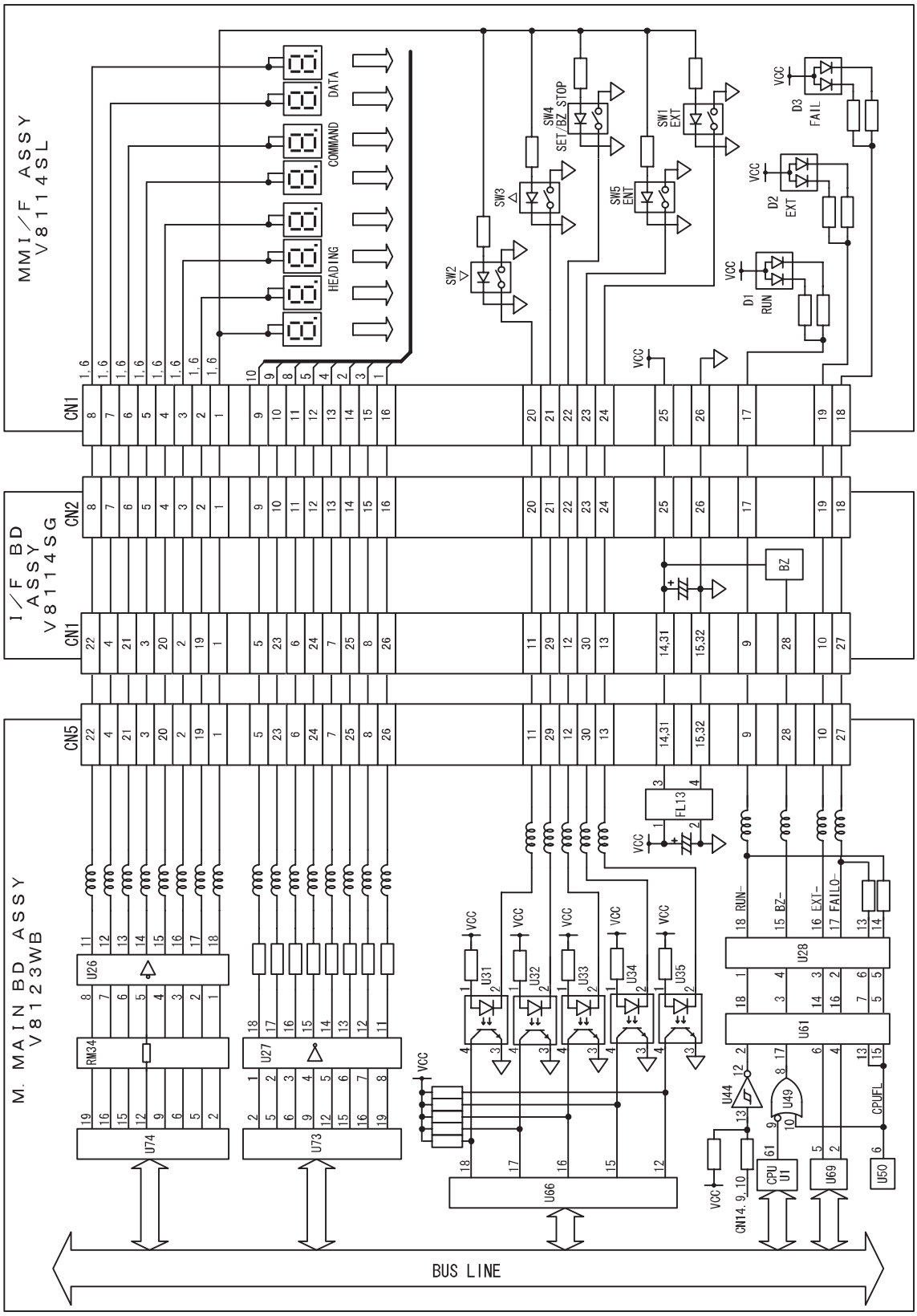
3.11 (1) MKM026 Circuit Diagram (Signal I/F)



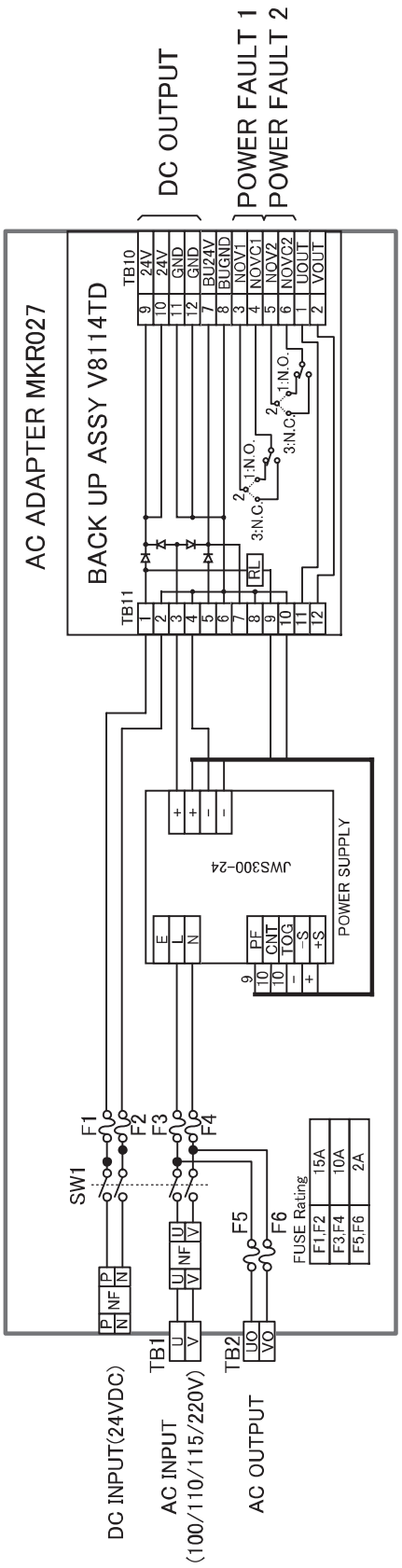
3.11 (2) MKM026 Circuit Diagram (Signal I/F)



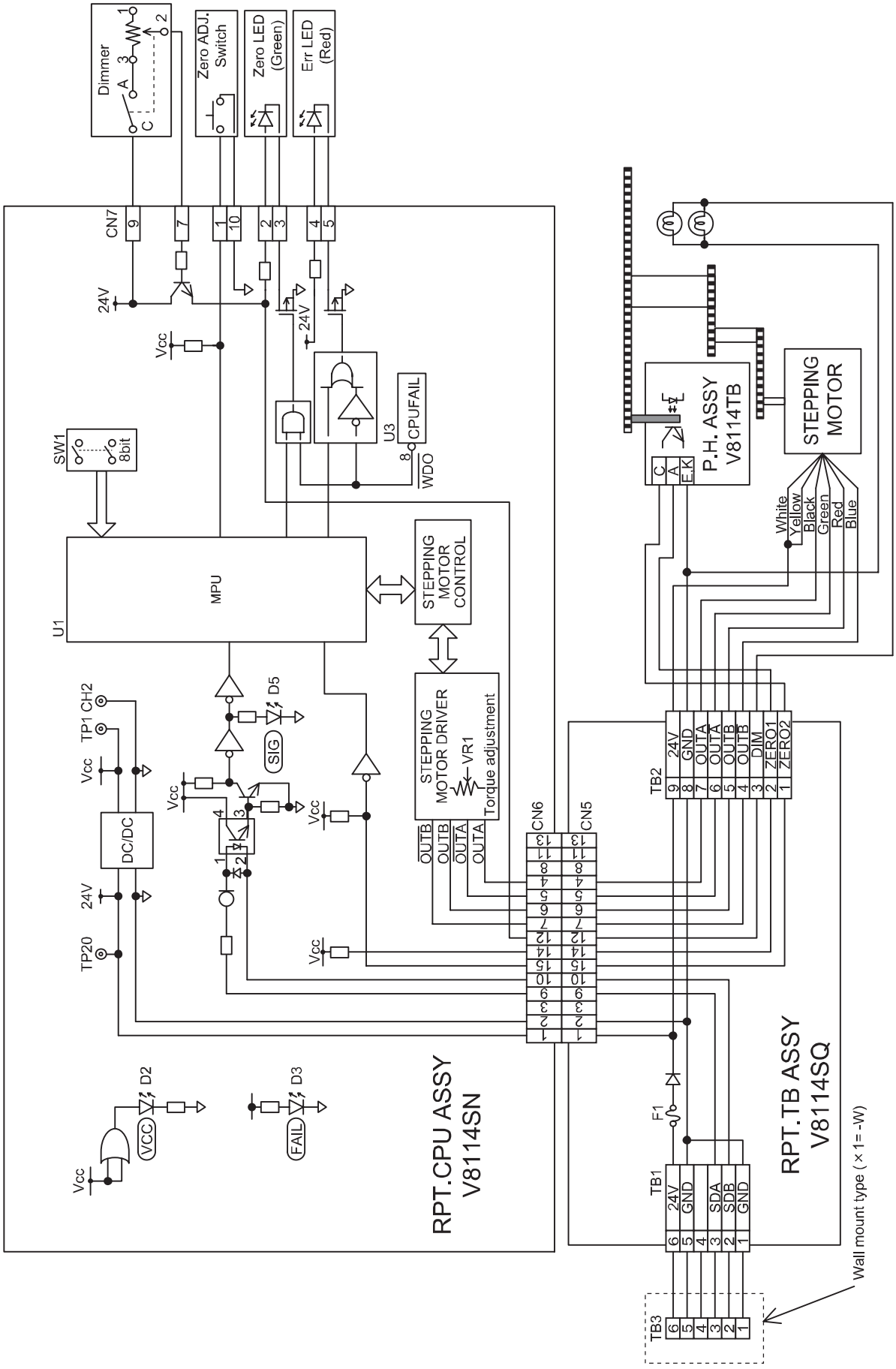
3.11 (3) MKM026 Circuit Diagram (Signal I/F)



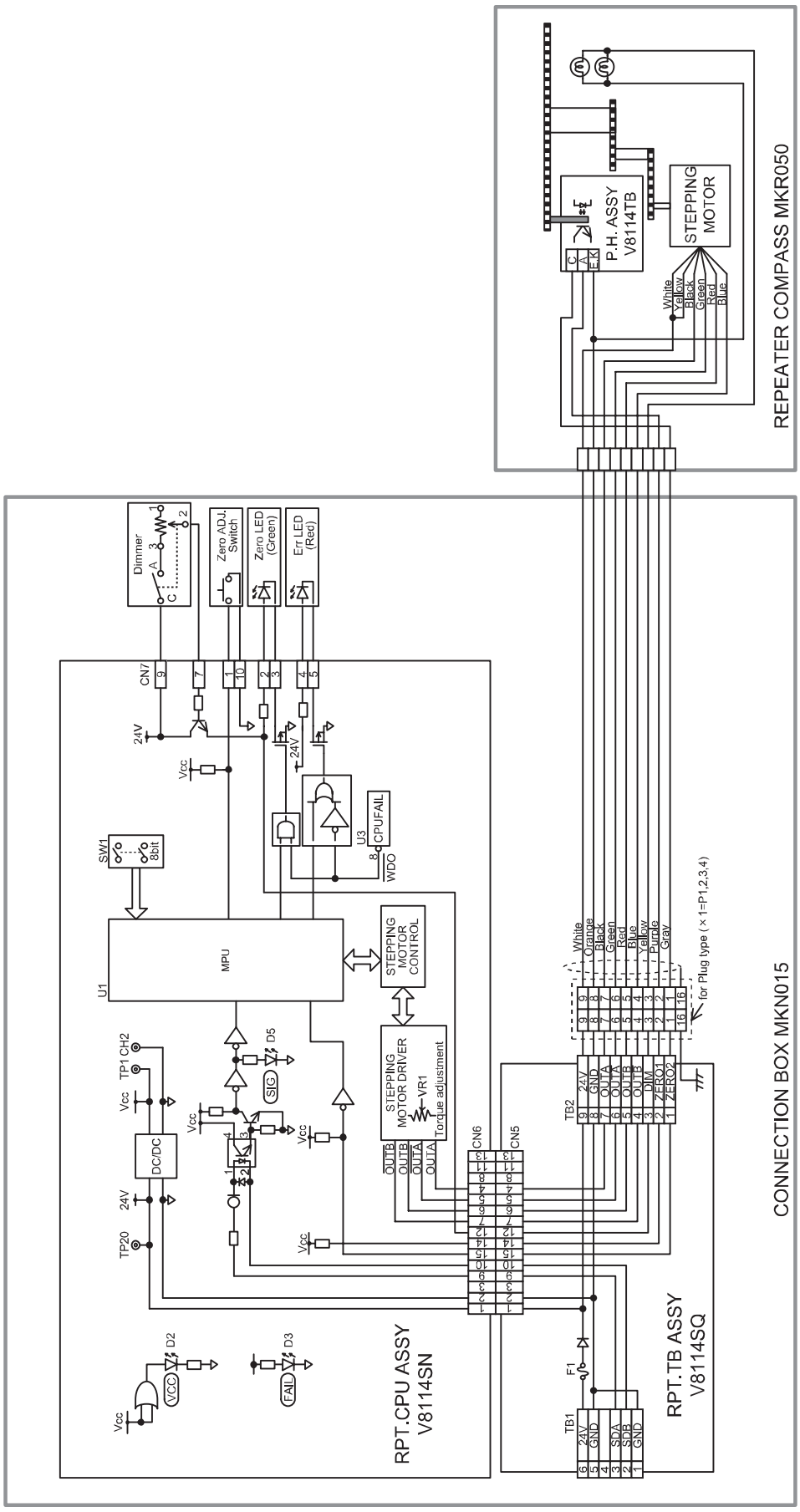
3.11 (4) MKM026 Circuit Diagram (Signal I/F)



3.12 MKR027 Block Diagram



3.13 MKR056 Block Diagram

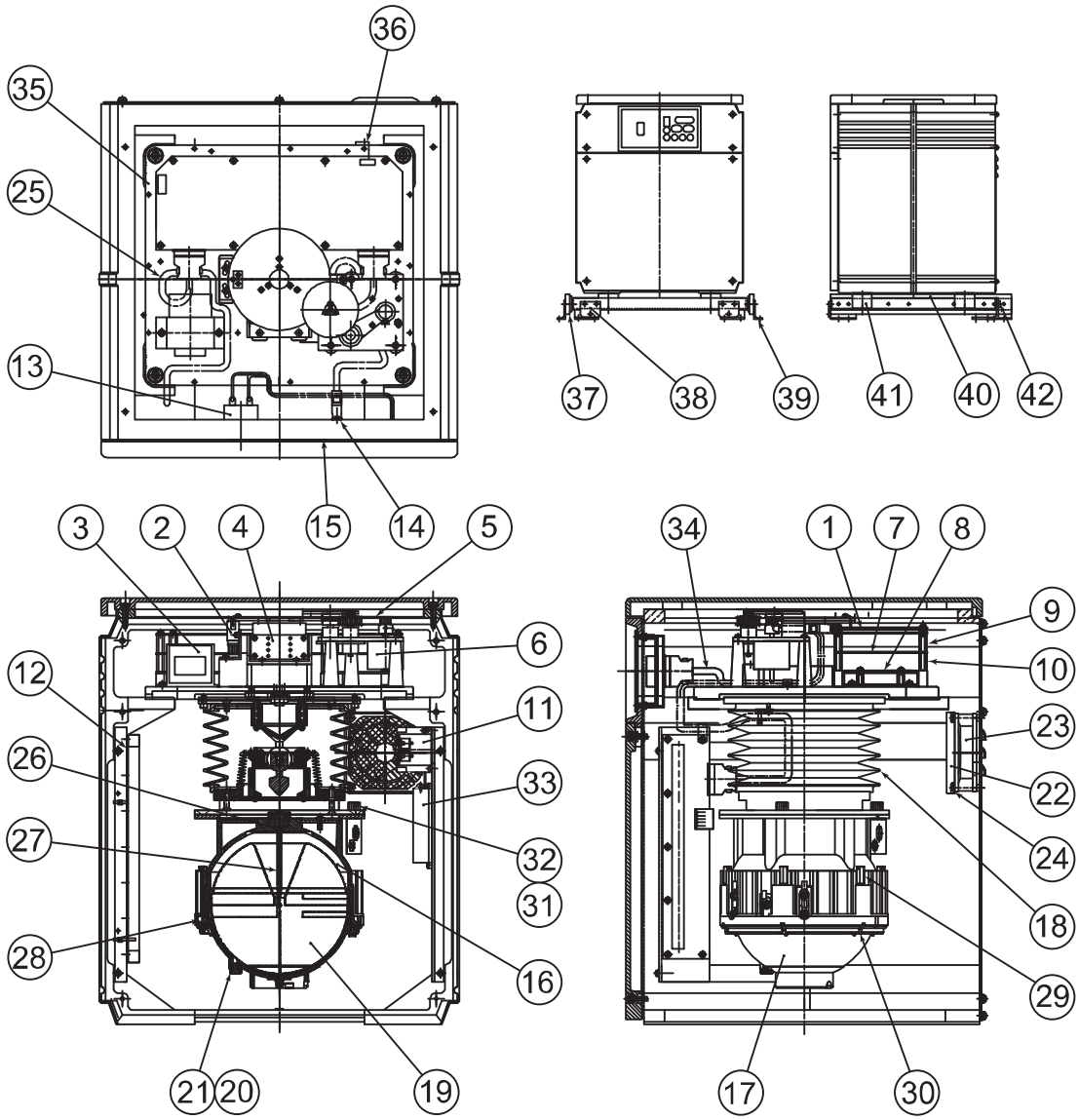


3.14 MKR050&MKN019 Block Diagram

Appendix-4 Components List

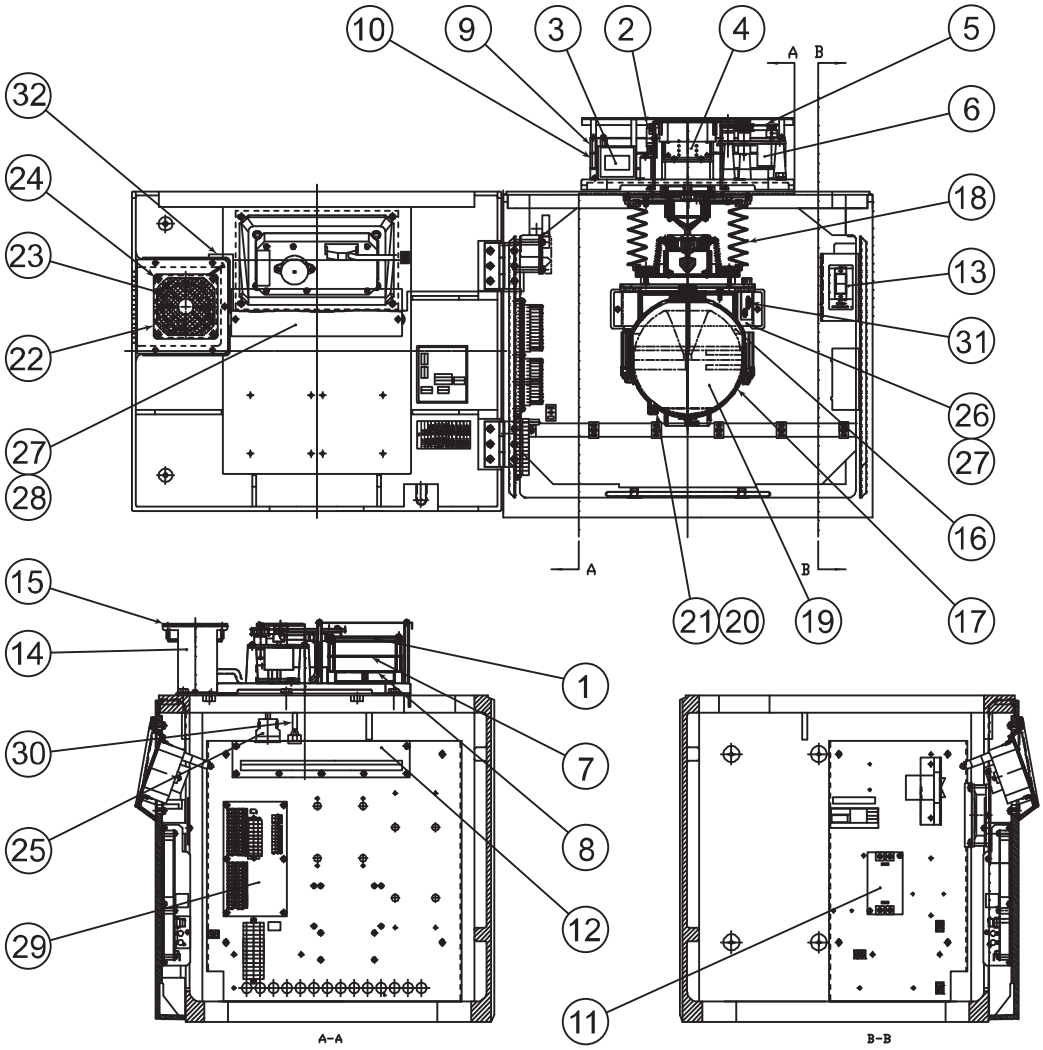
4.1 Master Compass

(1) MKM026-1,4



No	PARTS NAME	PART NO.	No	PARTS NAME	PART NO.
1	M.MAIN BD ASSY	V8123WB	22	FILTER KIT	V8817BF
2	PHOTO SENSOR ASSY	V8114UQ	23	FAN ASSY	V8123GZ
3	TRANS ASSY	V8123TC	24	SCREW	V8813CZ
4	BRUSH UNIT ASSY	V8114LP	25	CABLE ASSY	V8114UB
5	BELT	5T117G008-01	26	O RING (for CENTER PIN)	V8005BE
6	STEPPING MORTER ASSY	V8114UR	27	CENTER PIN	V8123DA
7	M.PWM INV BD ASSY	V8123WE	28	O RING (for CONTAINER)	V8810QZ
8	M.PS BD ASSY	V8123WH	29	LONG NUT	V8123CS
9	SPACER	V8114LR	30	HOOK ASSY	V8123CL
10	SPACER	V8114LS	31	SEAL WASHER	V8810NE
11	NOISE FILTER	V8817BH	32	SCREW	Y9303LU
12	M.TERMINAL BD ASSY	V8123WK	33	TERMINAL (TB3)	V8114VG
13	CIRCUIT PROTECTOR	5T108F017-14	34	CABLE ASSY	V8114UA
14	I/F BOARD ASSY	V8114SG	35	CABLE ASSY	V8114UU
15	MM I/F ASSY	V8114SL	36	CABLE ASSY	V8123GX
16	SUPPORTING LIQUID	V8114ML	37	SLIDE	1J124B038-04
17	CONTAINER	V8123DP	38	PLATE	1J355C497-01
18	DAMPER ASSY	V8123DQ	39	BRACKET	V8210NH
19	GYRO SPHERE	MKT007	40	BASE	V8801KV
20	DRAIN SCREW	V8114DH	41	SPACER	V8114EZ
21	O RING (for Drain)	V8005BE	42	BUSH	1J371D699-01

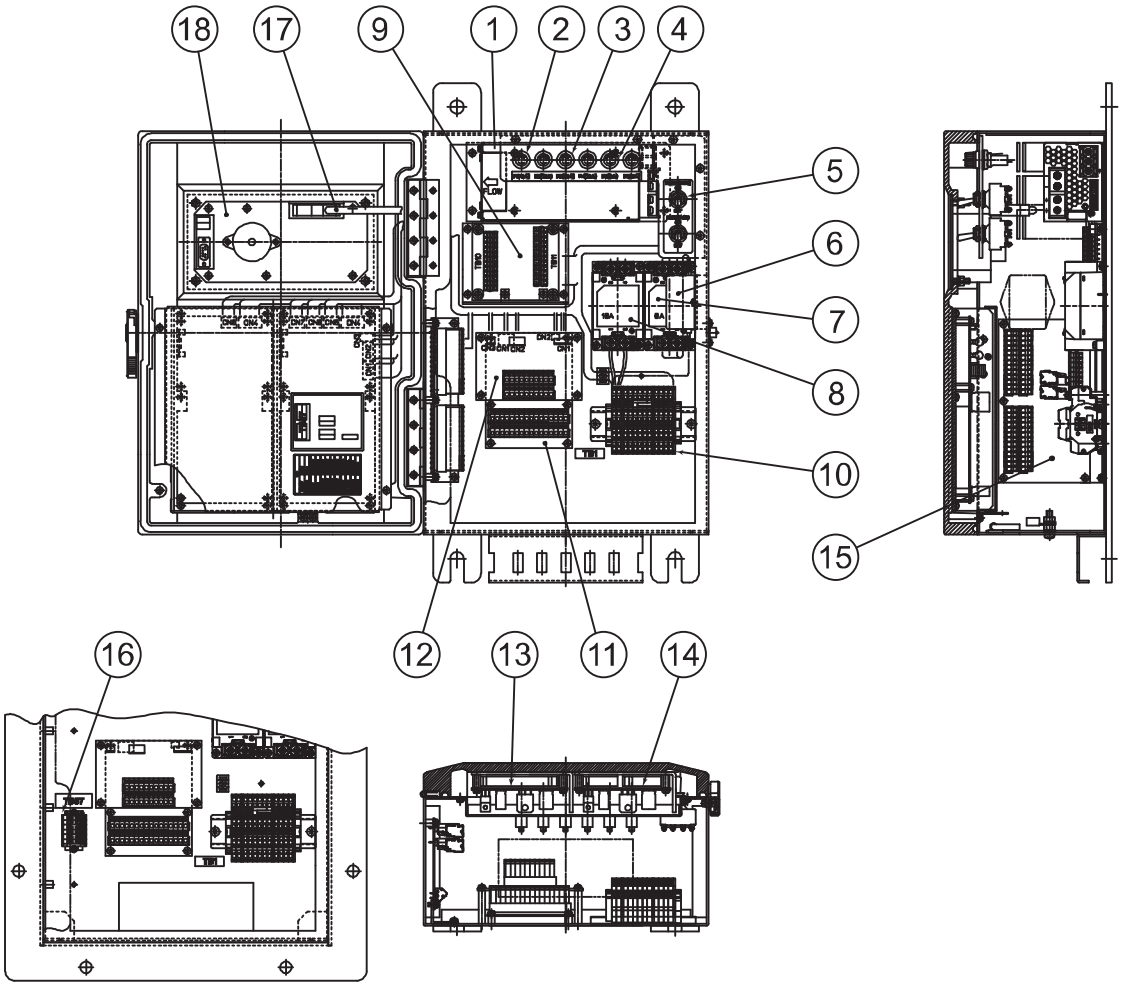
(2) MKM026-2,3



No	PARTS NAME	PART NO.	No	PARTS NAME	PART NO.
1	M.MAIN BD ASSY	V8123WB	17	CONTAINER	V8123DP
2	PHOTO SENSOR ASSY	V8114UQ	18	DAMPER ASSY	V8123DQ
3	TRANS ASSY	V8123TC	19	GYRO SPHERE	MKT007
4	BRUSH UNIT ASSY	V8114LP	20	DRAIN SCREW	V8114DH
5	BELT	5T117G008-01	21	O RING (for Drain)	V8005BE
6	STEPPING MORTER ASSY	V8114UR	22	FILTER KIT	V8817BF
7	M.PWM BD ASSY	V8123WE	23	FAN ASSY	V8123GZ
8	M.PS BD ASSY	V8123WH	24	SCREW	V8813CZ
9	SPACER	V8114LR	25	CABLE ASSY	V8114UB
10	SPACER	V8114LS	26	R-STOPPER	V8123HL
11	NOISE FILTER	V8817BH	27	CUSHION	V8123HN
12	M.TERMINAL BD ASSY	V8123WK	28	F-STOPPER	V8123HK
13	CIRCUIT PROTECTOR	5T108F017-14	29	C.TERMINAL BD ASSY	V8123VZ
14	I/F BOARD ASSY	V8114SG	30	CABLE ASSY	V8114UK
15	MM I/F ASSY	V8114SL	31	CABLE ASSY (for ANALOG output)	V8114VD
16	SUPPORTING LIQUID	V8114ML	32	CABLE ASSY (for FAN)	V8123GY

4.2 Control Box

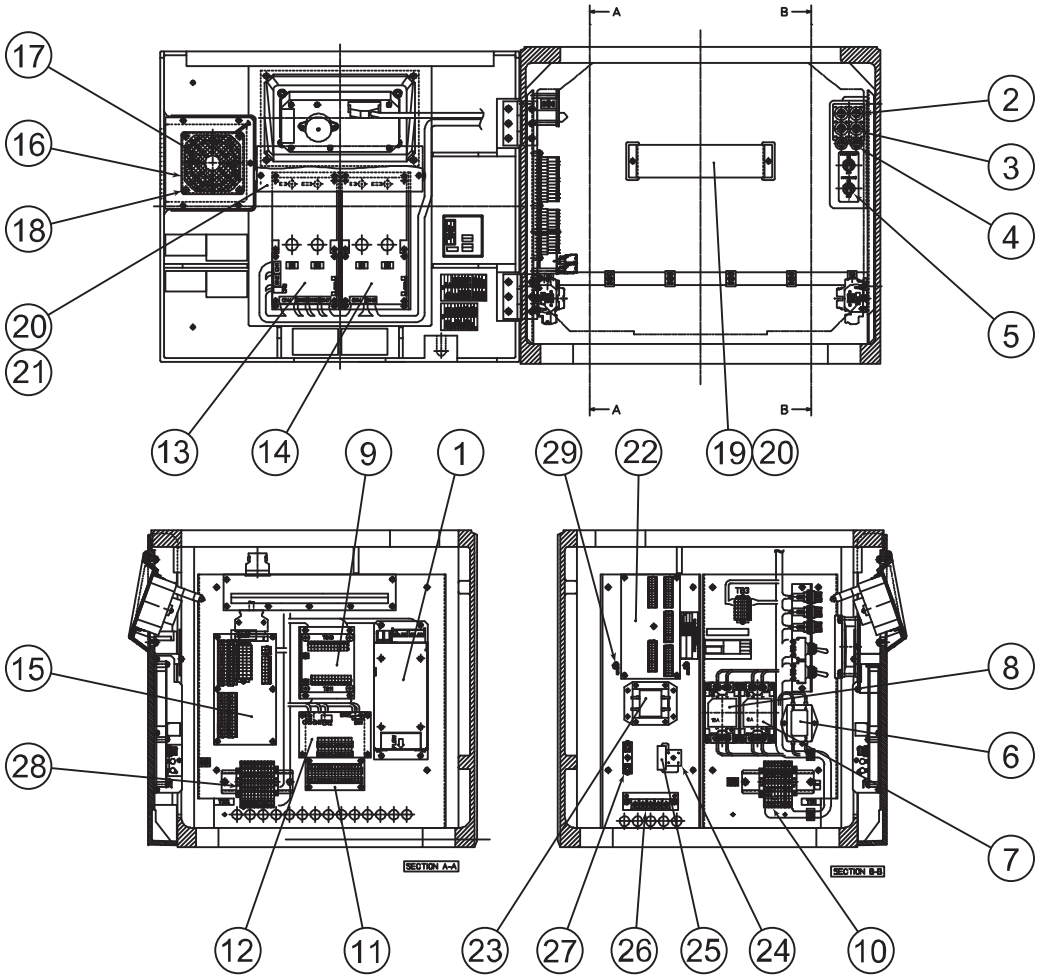
(1) MKC326-F,W



No	PARTS NAME	PART NO.	No	PARTS NAME	PART NO.
1	AC/DC POWER SUPPLY	V8817CC	10	TERMINAL ASSY	V8123MA
2	FUSE (15A / 2A) (*1)	5T151A040-02/ A1031EF	11	R.TERMINAL BD ASSY	V8123VN
3	FUSE (10A)	A1034EF	12	S.TERMINAL BD ASSY	V8123VW
4	FUSE (2A)	A1031EF	13	PS ASSY	V8116WP
5	TOGGLE SWITCH	A1351ST	14	PS ASSY (OPTION)	V8116WQ
6	NOISE FILTER	5T164E039-05	15	C.TERMINAL BD ASSY	V8123VZ
7	NOISE FILTER	V8817BH	16	TERMINAL (6-port) (10-port)	V8817CA V8817CB
8	NOISE FILTER	V8817BL	17	CABLE ASSY	V8116VA
9	BACKUP ASSY	V8114TD	18	MKR040	SEE APPENDIX 4.9

*1: with DC BACKUP : 5T151A040-02 (15 A) without DC BACKUP : A1031EF (2 A)

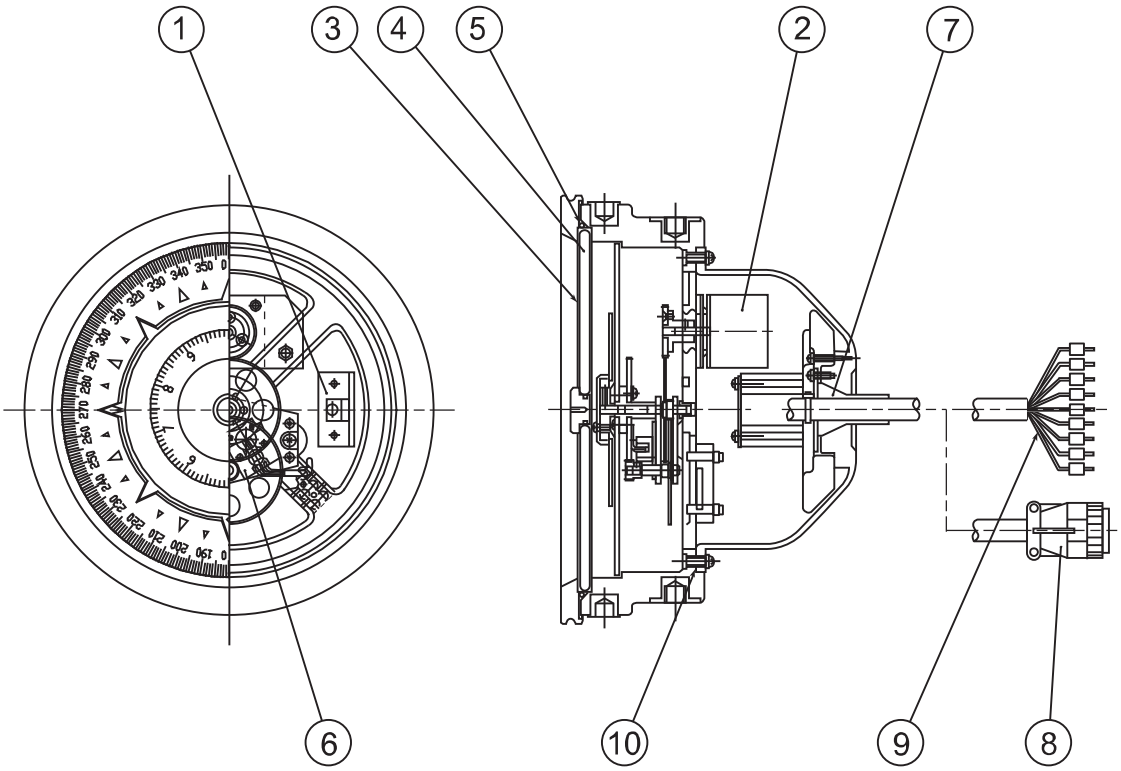
(2) MKC326-S



No	PARTS NAME	PART NO.	No	PARTS NAME	PART NO.
1	AC/DC POWER SUPPLY	V8817CC	16	FILTER KIT	V8817BF
2	FUSE (15A / 2A) (*1)	5T151A040-02/ A1031EF	17	FAN ASSY	V8123GZ
3	FUSE (10A)	A1034EF	18	SCREW	V8813CZ
4	FUSE (2A)	A1031EF	19	R-STOPPER	V8123HL
5	TOGGLE SWITCH	A1351ST	20	CUSHION	V8123HN
6	NOISE FILTER	5T164E039-04	21	F-STOPPER	V8123HK
7	NOISE FILTER	V8817BH	22	DISTRIBUTION BD ASSY (MHB306)	V8152AC
8	NOISE FILTER	V8817BL	23	TRANSFORMER (PS101)	1G164A044-01
9	BACKUP ASSY	V8114TD	24	DIODE MODULE (PS101)	A1207HL
10	TERMINAL ASSY(*2)	V8123MA / V8123MD	25	AL CAPACITOR (PS101)	A1299CA
11	R.TERMINAL BD ASSY	V8123VN	26	TERMINAL (PS101)	1G171Z152-05
12	S.TERMINAL BD ASSY	V8123VW	27	FUSE (2A) (PS101)	A1031EF
13	PS ASSY	V8116WP	28	TERMINAL ASSY	V8123MD
14	PS ASSY (OPTION)	V8116WQ	29	CONNECTION TOOL (MHB306)	V8810QH
15	C.TERMINAL BD ASSY	V8123VZ			

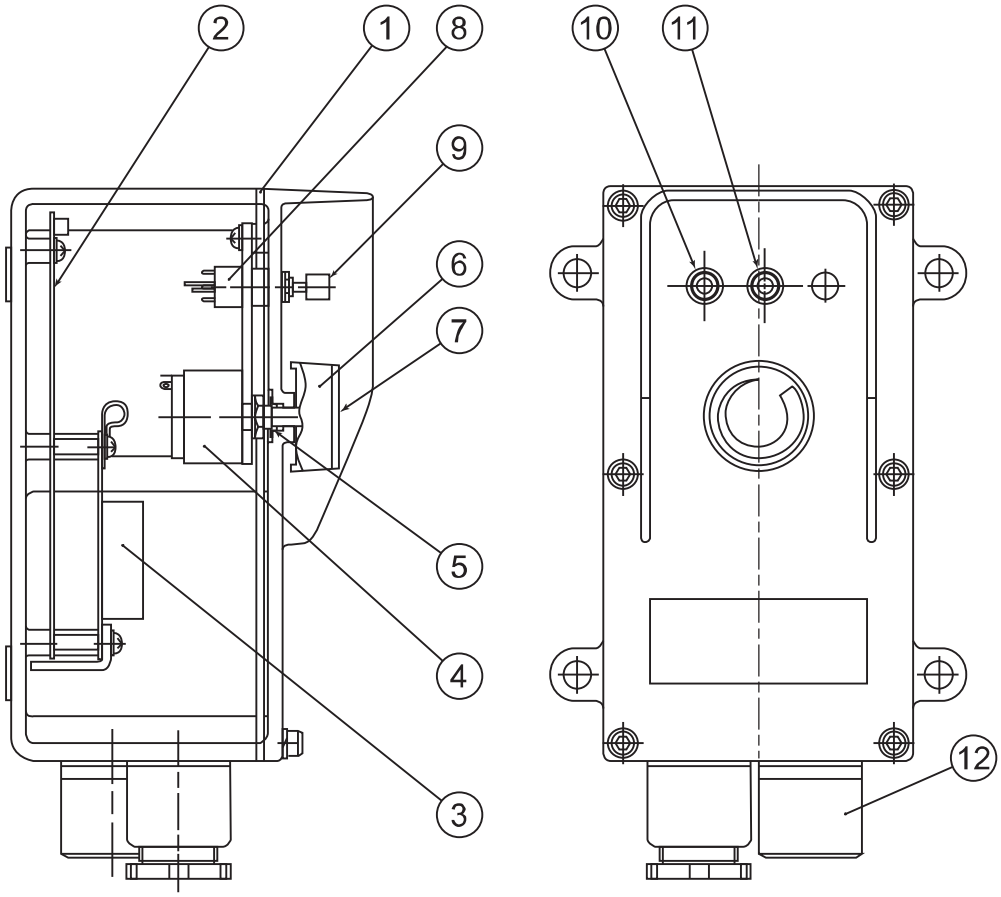
*1: with DC BACKUP : 5T151A040-02 (15 A) without DC BACKUP : A1031EF (2 A)
*2: Master compass INSIDE : V8123MA Master compass OUTSIDE : V8123MD

4.3 Repeater Compass (MKR050)



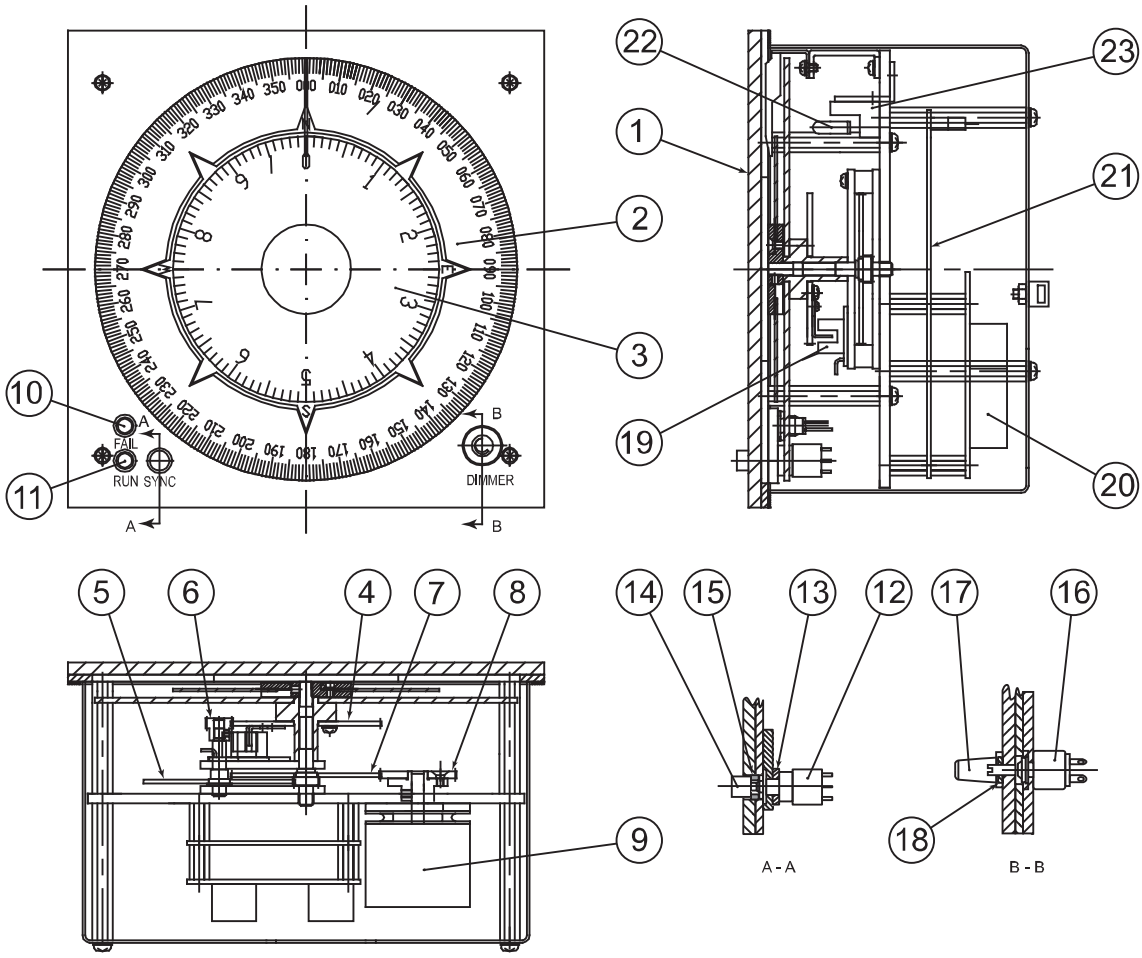
NO	PARTS NAME	PART NO.
1	LAMP	V8811AQ
2	MOTOR	5T165A165-01
3	WINDOW	V8114HP
4	PACKING	1G334C027-01
5	PACKING	1G116A008-01
6	PHOTO SENSOR ASSY	V8114UX
7	GASKET	1G333C041-01
8	CABLE ASSY	V8114UW
9	CABLE ASSY	V8114UV
10	PACKING	1G33E192-01

4.4 Junction Box (MKN019)



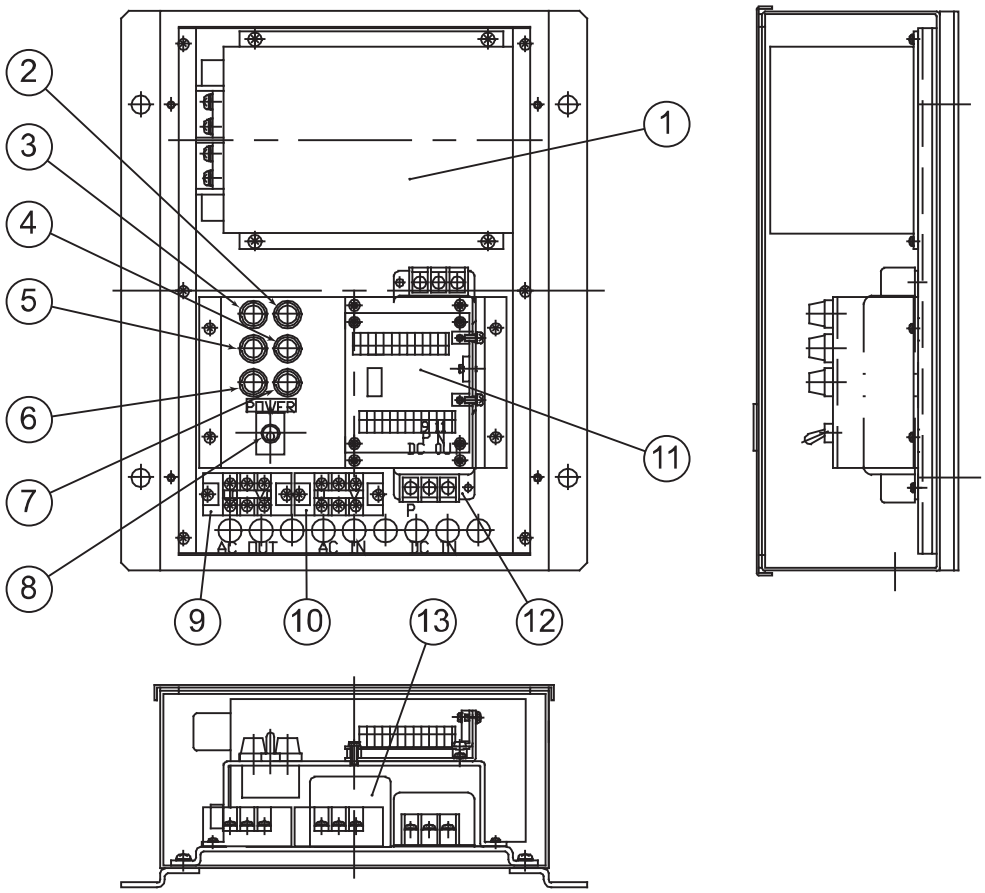
No	PARTS NAME	PART NO.
1	PACKING	V8114JP
2	RPT CPU BD ASSY	V8114SN
3	TERMINAL BOARD ASSY	V8114SQ
4	VARIABLE RESISTOR	5T162B015-02
5	O-RING	5T101Z005-04
6	KNOB	5T124A096-01
7	CAP	5T114A030-01
8	SWITCH	5T154A272-01
9	KNOB	5T124A104-01
10	FAIL INDICATOR LAMP (RED)	5T166F082-01
11	RUN INDICATOR LAMP (GREEN)	5T166F082-02
12	SOCKET	M8096JC

4.5 Steering Repeater Compass (MKR056)



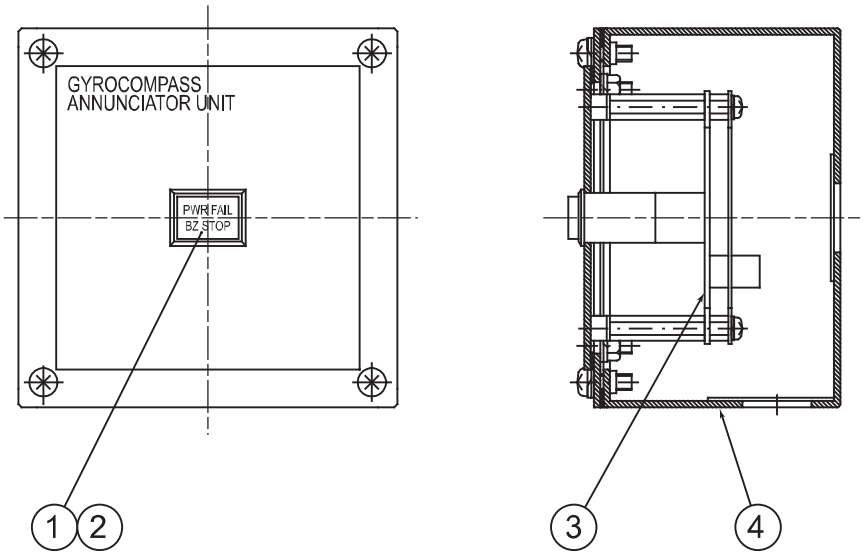
No	PARTS NAME	PART NO.	No	PARTS NAME	PART NO.
1	FRONT PANEL	V8118BA(□192) V8118BC(□144)	13	COLLAR	V8118BS
2	SCALE (36X)	V8219FV	14	BUTTON	5T124A104-02
3	SCALE (1X)	V8118DE	15	O RING	5T101Z005-09
4	GEAR	V8114HV	16	RESISTOR (VR)	5T162A167-01
5	GEAR	V8114HL	17	KNOB	5T124A043-02
6	GEAR	1G422A549-01	18	COLLAR	5T108F032-07
7	GEAR	V8114HN	19	PHOTO SENSOR ASSY	V8114UX
8	GEAR	V8114RR	20	RPT TB ASSY	V8114SQ
9	MOTOR	5T165A165-01	21	RPT CPU BD ASSY	V8114SN
10	FAIL INDICATOR LAMP (RED)	5T166F082-03	22	LAMP	V8811AQ
11	RUN INDICATOR LAMP (GREEN)	5T162F082-04	23	SOCKET	A1178VF
12	SWITCH	5T154A272-01			

4.6 AC Adapter (MKR027)



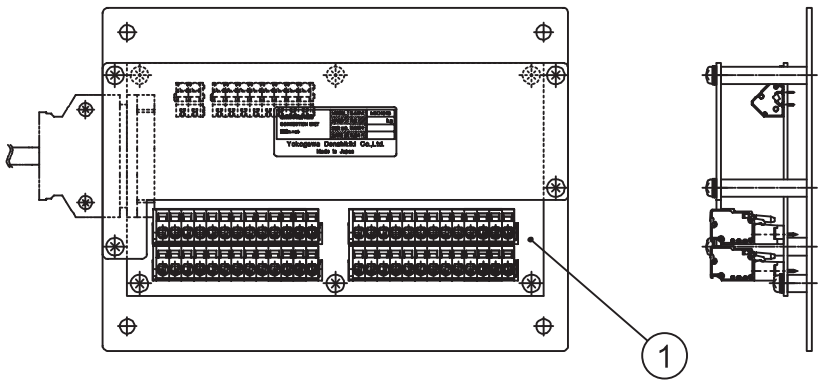
No	PARTS NAME	PART NO.	No	PARTS NAME	PART NO.
1	AC/DC POWER SUPPLY	5T164A255-01	8	SWITCH	5T154A123-01
2	FUSE (15 A)	5T151A040-02	9	TERMINAL BOARD	M8055JT
3	FUSE (15 A)	5T151A040-02	10	TERMINAL BOARD	M8055JT
4	FUSE (10 A)	A1034EF	11	BACK UP ASSY	A8114TD
5	FUSE (10 A)	A1034EF	12	NOISE FILTER	A1118EN
6	FUSE (2 A)	A1289EF	13	NOISE FILTER	5T164E043-01
7	FUSE (2 A)	A1289EF			

4.7 Annunciator (MKR028)



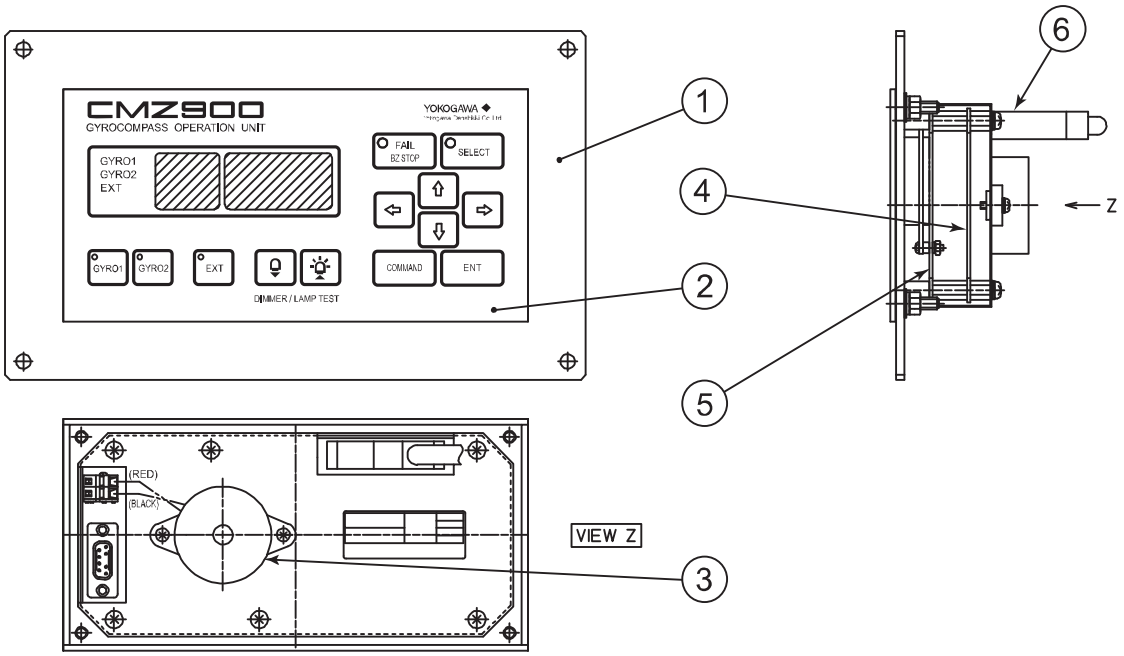
No	PARTS NAME	PART NO.
1	LED LAMP	K6012SB
2	PUSH SWITCH	K6011SB and K6015SB
3	ANNUNCIATOR ASSY	V8114TL
4	BOX	V8116LL

4.8 Junction Unit (MKN018)



No	PARTS NAME	PART NO.
1	C.TERMINAL BD ASSY	V8123VZ

4.9 C.Operation Unit (MKR040)



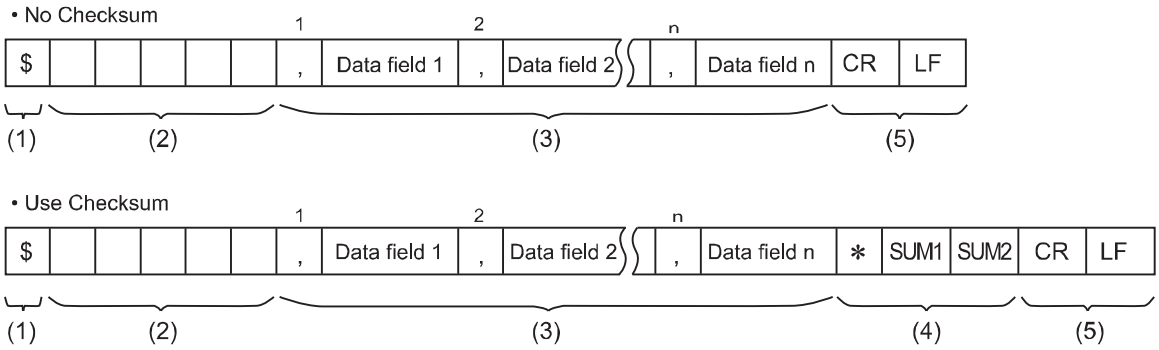
No	PARTS NAME		PART NO.
1	FRAME		V8116HA
2	MEMBRANE SWITCH		V8123RA
3	BUZZER		5T151E007-01
4	C.MAIN BD ASSY		V8123VE
5	C.DISP BD ASSY		B8123VB
6	CABLE ASSY	50cm	V8116VA
		1.5m	V8221WT
		3m	V8221WU
		5m	V8221WV
		10m	V8116VB

Appendix-5 Serial Signal Format

5.1 Basic Format

The basic serial signal format is as follows.

All transmitted and received data shall be interpreted as ASCII characters.



(1) "$":

Start of sentence.

(2) Address field:

This field serves to define the sentence. The first two characters are the talker identifier. The other three characters are the data identifier.

(3) Data field:

This field is described with regular format data.

Each data is delimited by ",".

(4) Check-sum field :

Check-sum value.

(5) <CR><LF> Terminator:

End of sentence.

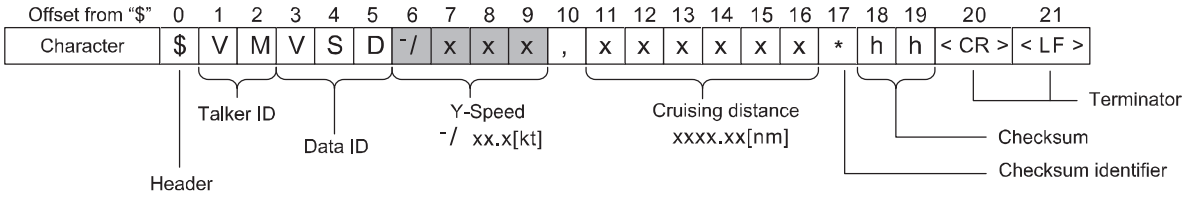
5.2 Existing Format

CMZ900 system has several regular data format to communicate with external units.

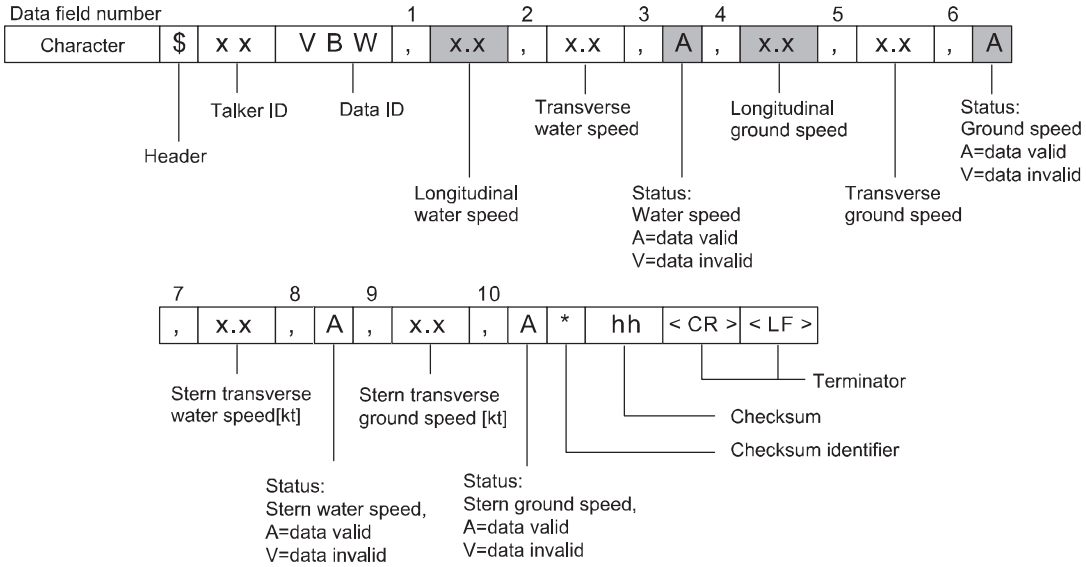
Regular Data Format

Data Type	Input	Output
Speed (SPD)	VMVSD VBW VHW VTG	–
Latitude (POS)	GGA GLL	–
Heading (HDG)	HDT HDG HDM HRC THS	HDT HDG HDM THS
Rate of turn (ROT)	ROT HRC	ROT
Heading / Rate of turn (HDG/ROT)	HRC	HRC PYDKH

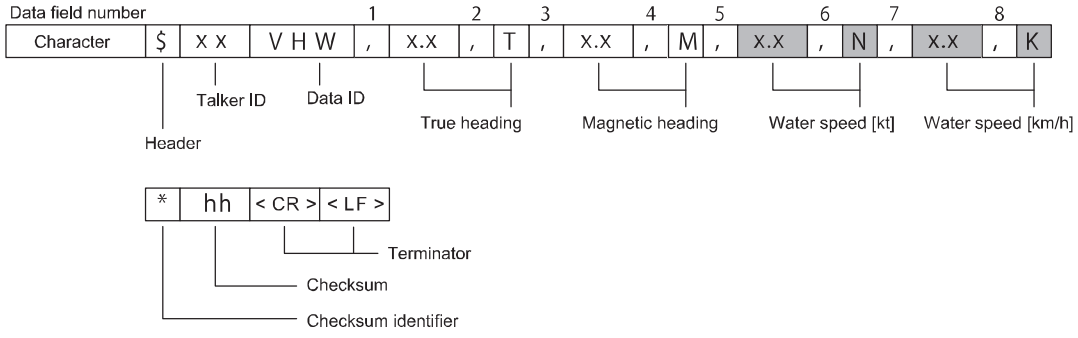
● VMVSD



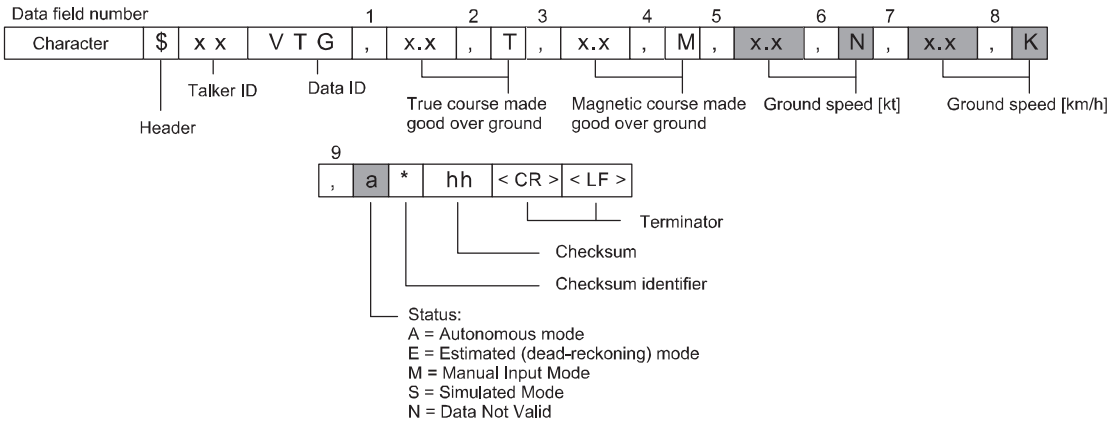
● VBW



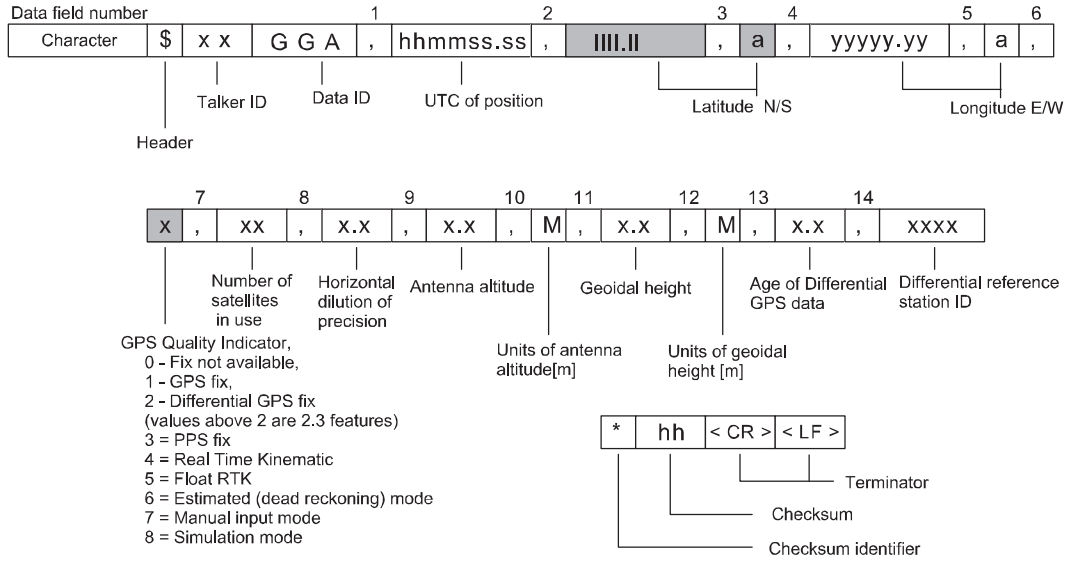
● VHW



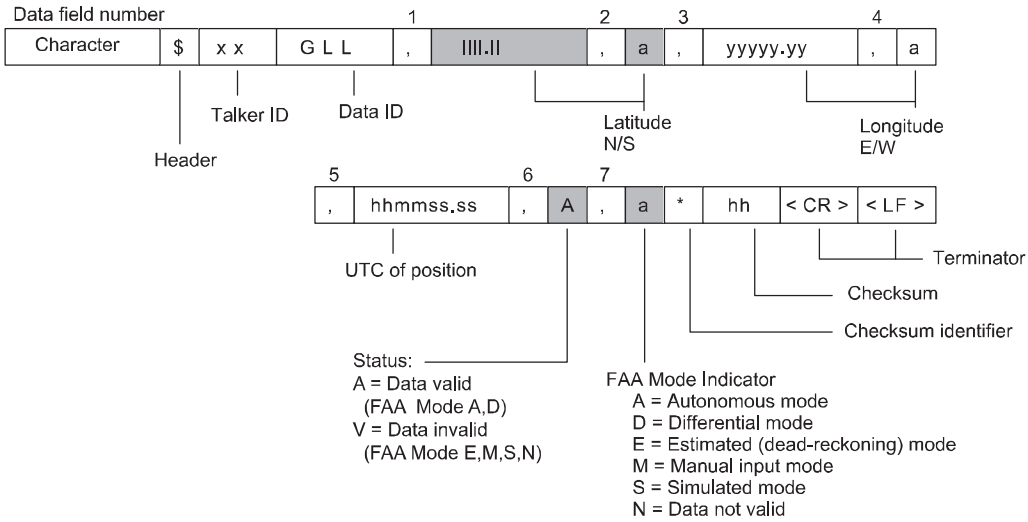
VTG


Data field number
1 2 3 4 5 6 7 8
Character $ x x V T G , x.x , T , x.x , M , x.x , N , x.x , K
Talker ID
Data ID
Header
True course made good over ground
Magnetic course made good over ground
Ground speed [kt]
Ground speed [km/h]
9
, a * hh < CR > < LF >
Terminator
Checksum
Checksum identifier
Status:
A = Autonomous mode
E = Estimated (dead-reckoning) mode
M = Manual Input Mode
S = Simulated Mode
N = Data Not Valid

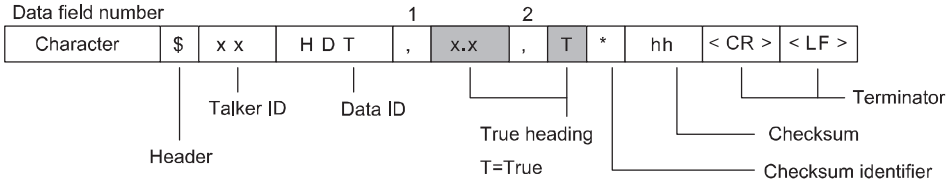
GGA


Data field number
1 2 3 4 5 6
Character $ x x G G A , hhmmss.ss , llll.ll , a , yyyyy.yy , a ,
Talker ID
Data ID
Header
UTC of position
Latitude N/S
Longitude E/W
7 8 9 10 11 12 13 14
x , xx , x.x , x.x , M , x.x , M , x.x , xxxx
Number of satellites in use
Horizontal dilution of precision
Antenna altitude
Geoidal height
Age of Differential GPS data
Differential reference station ID
GPS Quality Indicator,
0 - Fix not available,
1 - GPS fix,
2 - Differential GPS fix
(values above 2 are 2.3 features)
3 = PPS fix
4 = Real Time Kinematic
5 = Float RTK
6 = Estimated (dead reckoning) mode
7 = Manual input mode
8 = Simulation mode
Units of antenna altitude[m]
Units of geoidal height [m]
* hh < CR > < LF >
Terminator
Checksum
Checksum identifier

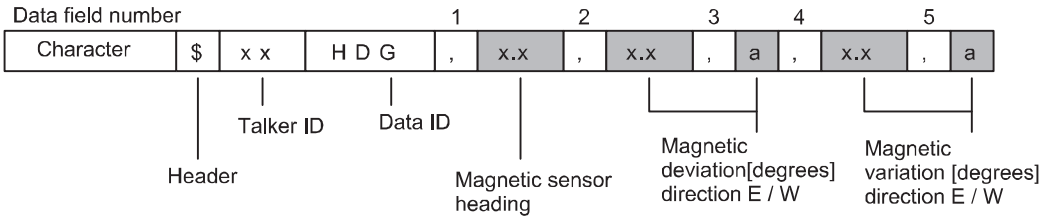
GLL

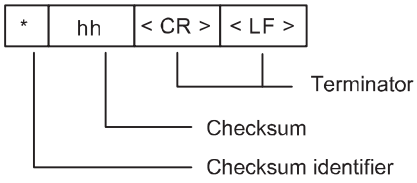

Data field number
1 2 3 4
Character $ x x G L L , llll.ll , a , yyyyy.yy , a
Talker ID
Data ID
Header
Latitude N/S
Longitude E/W
5 6 7
, hhmmss.ss , A , a * hh < CR > < LF >
UTC of position
Terminator
Checksum
Checksum identifier
Status:
A = Data valid
(FAA Mode A,D)
V = Data invalid
(FAA Mode E,M,S,N)
FAA Mode Indicator
A = Autonomous mode
D = Differential mode
E = Estimated (dead-reckoning) mode
M = Manual input mode
S = Simulated mode
N = Data not valid

HDT

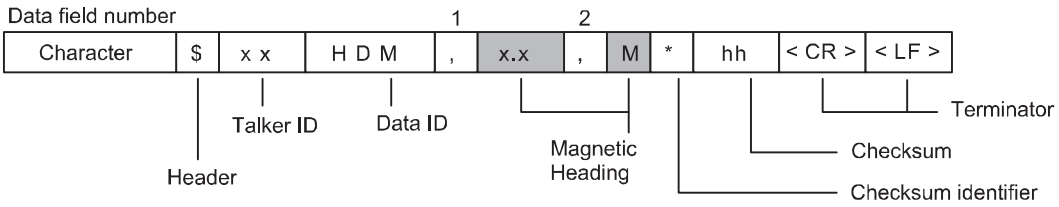


HDG

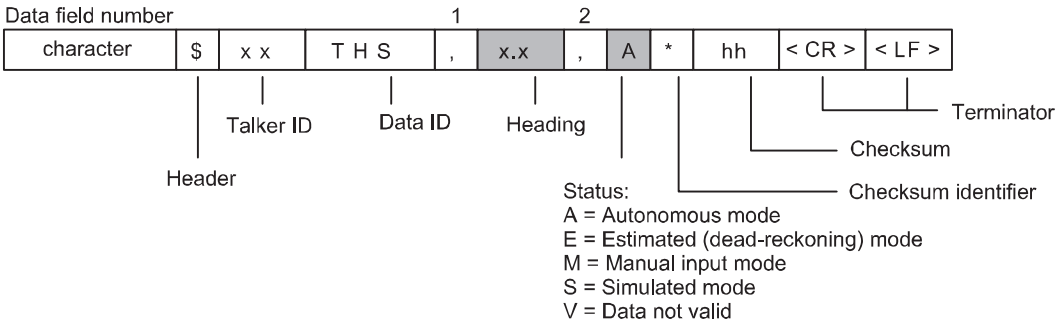




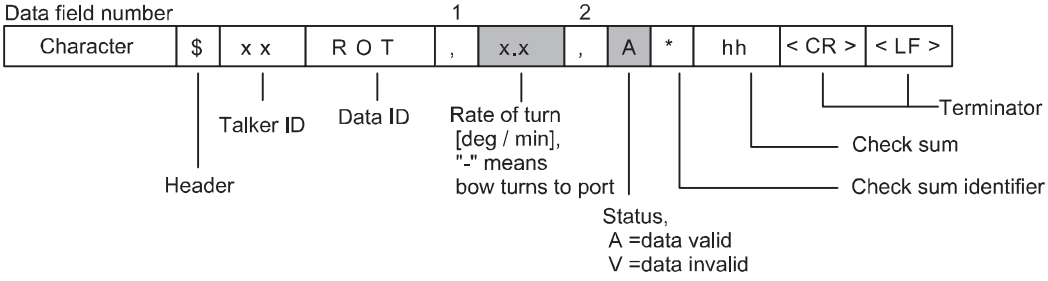
HDM



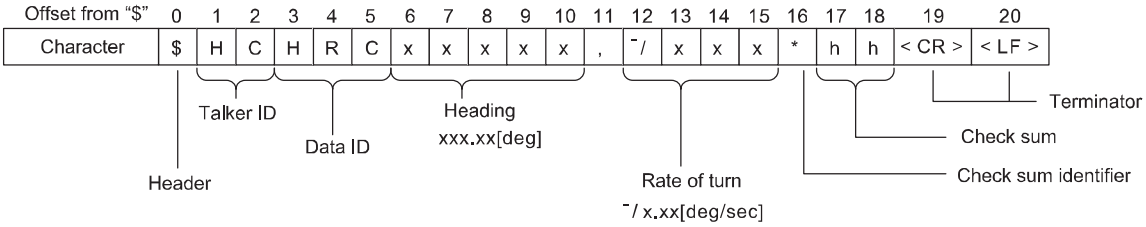
THS



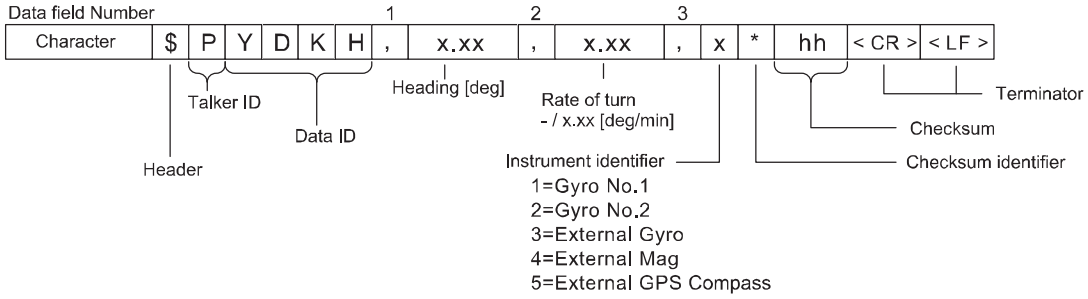
- **ROT**



- **HRC**

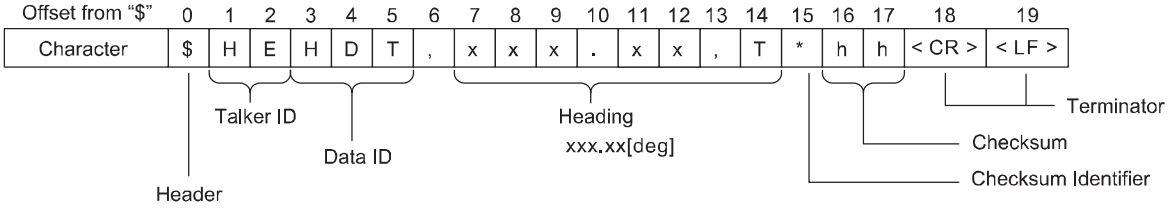


- **PYDKH**



5.3 Heading Output for Repeater compass

- **HEHDT (for Repeater compass)**



Revision Information

- Title : CMZ 900B / 900S
  Gyrocompass User's Manual
- Manual No. : IM 80B10M-16E

Sep, 2007 1st Edition

■ Inquiries
For inquiries about the content of this manual, please visit the following URL. Also visit the Yokogawa Denshikiki website at the following address for information on this product.
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