Service Manual

PT500 Maintenance mode Operation manual

YOKOGAWA
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In this manual, the function and the operation of the maintenance mode of the PT500 series autopilot are described. As for these maintenance modes, it is a prohibition of use and the miss-operation prevention by the crew is achieved by the password.

Any operation described in this manual must be carried out by personnel of Yokogawa authorized service station or with the assistance of our service engineer.

Contents

【NOTE】This maintenance mode manual is applied for revision 10 of PT500A Version “K” (CR155K10).

Chapter 1. Normal / Maintenance mode

1. Maintenance mode

How to access the maintenance mode.

(1) Press the [ADJUST] key. The LCD display becomes ready condition for adjusting mode.

(2) Press the [△ +] or [▽ −] key and select the "ADJUST MODE 99❖"

```
 ADJUST MODE 99❖
MAINTENANCE MODE
```

(3) Press [ENTER] key. The LCD display become PASSWORD mode.

```
MAINTENANCE MODE
PASSWORD [     ]
```

(4) Input the password

PT500A :

OPERATION MODE	→	RATE RADIUS	→	SPEED	→	RUDDER LIMIT

PT500D :

RUDDER LIMIT	→	RUDDER LIMIT	→	OPERATION MODE	→	OFF CRS ALARM

SUB AUTO :

RUDDER LIMIT	→	RUDDER LIMIT	→	OFF CRS ALARM	→	RUDDER LIMIT

(5) Press [ENTER] key after input the password. Software mode is changed Normal to Maintenance mode.

```
MAINTENANCE   1 ❖
MAINTENANCE MODE
```

Note) When you selected the Maintenance mode, you can use all operation in Normal mode and maintenance mode.

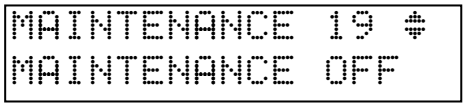
2．Normal mode（Release the maintenance mode）
Normal mode means to prohibit the maintenance mode

（1）Press the [△ +] or [▽ −] key when the maintenance mode is selected.

In case of the PT500A type, you select the "MAINTENANCE 19 ⇳"

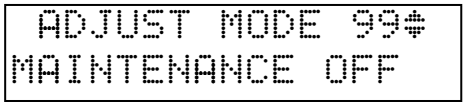
In case of the PT500D and SUBAUTO type, you select the "MAINTENANCE 17 ⇳"

PT500A：



PT500D・SUBAUTO：

（2）Press [ENTER] key. Software mode is changed to Normal mode



Note）The maintenance mode is automatically released by selecting the normal mode or when the operator has kept the condition without key operation more than 1 hours.

3．Selection of the maintenance mode

（1）Display the "MAINTENANCE 1 ⇳"on the data display then Press the **ENTER** key.
The data display is displayed I/F SET-UP mode.

（2）You can change the each maintenance item by pressing the **△ +** or **▽ −** key.
PT500A：
①↔②↔③↔④↔⑤↔⑥↔⑦↔⑧↔⑨↔⑩↔⑪↔⑫↔⑬↔⑭↔⑮↔⑯↔⑰↔⑱↔⑲↔①

① MAINTENANCE 1 ⇳
I/F SET-UP

② MAINTENANCE 2 ⇳
MEM ACCESSS-FIX

③ MAINTENANCE 3 ⇳
MEM ACCESSS-FLX

④ MAINTENANCE 4 ⇳
AUTO RUDDER OUT

⑤ MAINTENANCE 5 ⇳
RDA OUT

⑥ MAINTENANCE 6 ⇳
CDV OUT

⑦ MAINTENANCE 7 ⇳
ADC POINT DISP

⑧ MAINTENANCE 8 ⇳
PROGRAM VERSION

⑨ MAINTENANCE 9 ⇳
PROG.COLD START

⑩ MAINTENANCE 10 ⇳
SHIP PARA. CALC

⑪ MAINTENANCE 11 ⇳
IDENT. DISP

⑫ MAINTENANCE 12 ⇳
OFFCRS ALARM SW

⑬ MAINTENANCE 13 ⇳
BARGRAPH SW

⑭ MAINTENANCE 14 ⇳
KEY CLICK SW

⑮ MAINTENANCE 15 ⇳
OVERRIDE COURSE

⑯ MAINTENANCE 16 ⇳
LINK-SLAVE DATA

⑰ MAINTENANCE 17 ⇳
Option Set

⑱ MAINTENANCE 18 ⇳
Special Data

⑲ MAINTENANCE 19 ⇳
MAINTENANCE OFF

Press **ENTER** key after you selected the maintenance number. Then the maintenance function become valid mode .

P T 5 0 0 D ・ S U B A U T O :

①⇔②⇔③⇔④⇔⑤⇔⑥⇔⑦⇔⑧⇔⑨⇔⑩⇔⑪⇔⑫⇔⑬⇔⑭⇔⑮⇔⑯⇔⑰⇔①

① MAINTENANCE 1 ⇳
I/F SET-UP

② MAINTENANCE 2 ⇳
MEM ACCESSS-FIX

③ MAINTENANCE 3 ⇳
MEM ACCESSS-FLX

④ MAINTENANCE 4 ⇳
AUTO RUDDER OUT

⑤ MAINTENANCE 5 ⇳
RDA OUT

⑥ MAINTENANCE 6 ⇳
CDV OUT

⑦ MAINTENANCE 7 ⇳
ADC POINT DISP

⑧ MAINTENANCE 8 ⇳
PROGRAM VERSION

⑨ MAINTENANCE 9 ⇳
PROG.COLD START

⑩ MAINTENANCE 10 ⇳
OFFCRS ALARM SW

⑪ MAINTENANCE 11 ⇳
BARGRAPH SW

⑫ MAINTENANCE 12 ⇳
KEY CLICK SW

⑬ MAINTENANCE 13 ⇳
OVERRIDE COURSE

⑭ MAINTENANCE 14 ⇳
LINK-SLAVE DATA

⑮ MAINTENANCE 15 ⇳
Option Set

⑯ MAINTENANCE 16 ⇳
Special Data

⑰ MAINTENANCE 17 ⇳
MAINTENANCE OFF

Press **ENTER** key after you selected the maintenance number. Then the maintenance function become valid mode .

Chapter 2 I/F SET-UP

Set the protocol of the each input and output serial ports for corresponding with each equipment. Setting items is as follows.

NOTE

In case of you changed setting item, please carry out the settlement of ③ I/F SET-UP.

① Hardware setting (Set the Protocol)
② Software setting (Set the input and output condition)
③ Settlement of I／F set-up

1. Select the I/F set-up data

(1) Press the **ENTER** key after displayed "MAINTENANCE 1 ⇳"on the data display.
The data display is displayed I/F SET-UP mode.

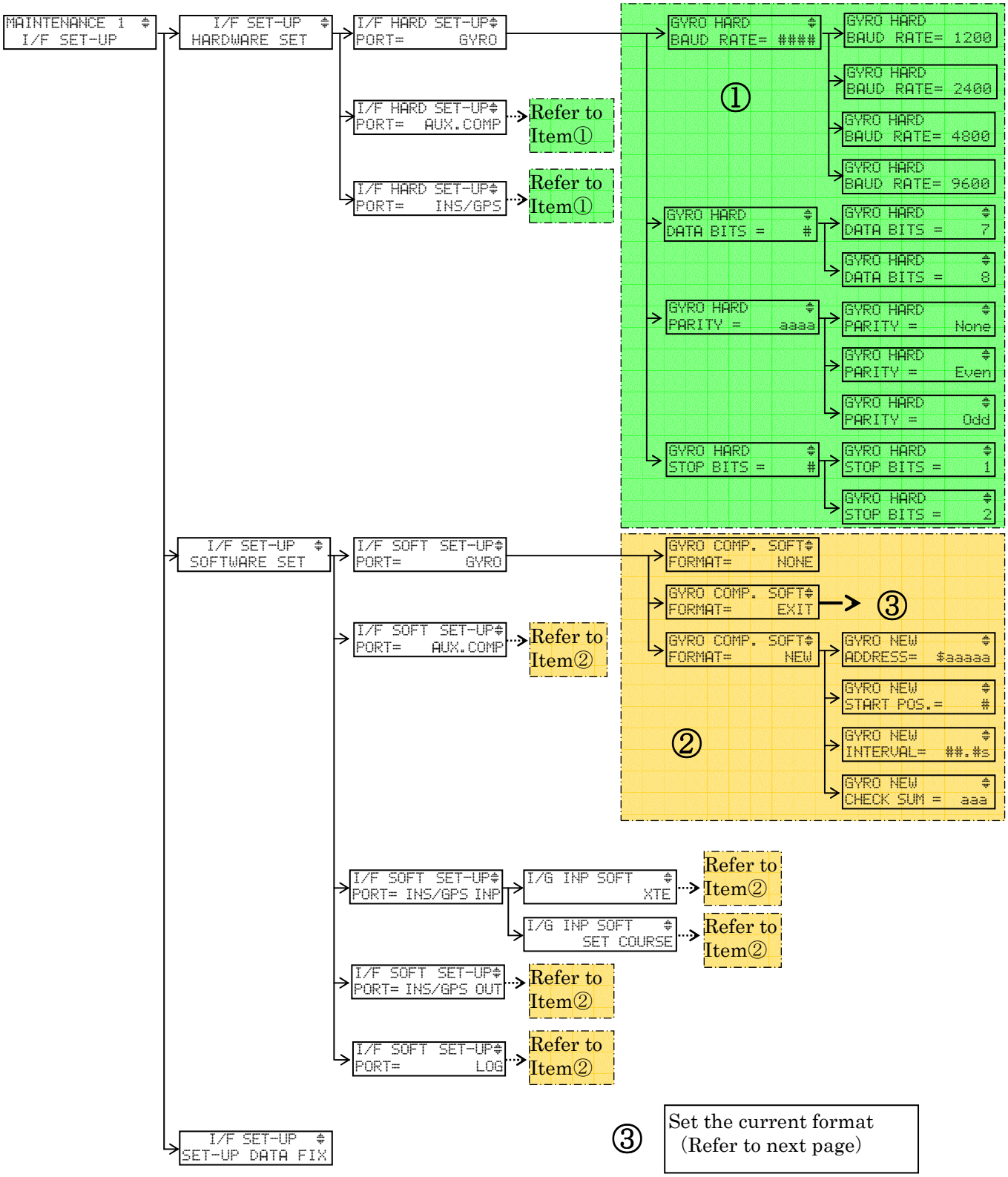
(2) Press **Δ +** or **∇ −** key to change the item.

①⇔②⇔③⇔④⇔①

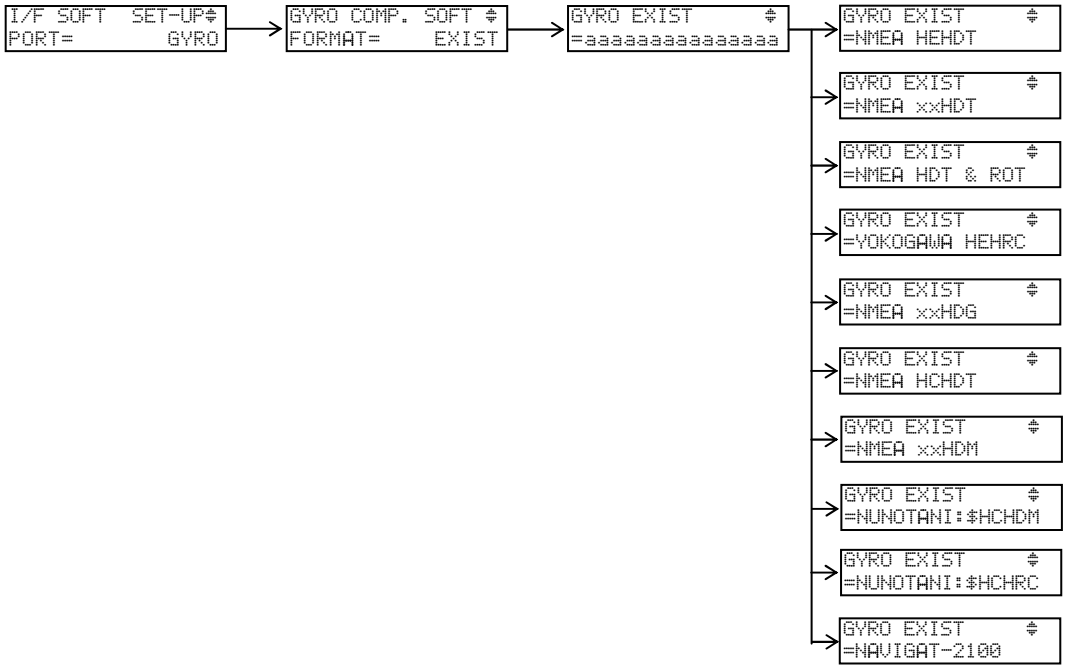
①	I/F SET-UP ⇳ HARDWARE SET	Set the protocol of each setting port
②	I/F SET-UP ⇳ SOFTWARE SET	Set the input /output condition of each setting port
③	I/F SET-UP ⇳ SET-UP DATA FIX	Settlement of the data inputs
④	I/F SET-UP ⇳ <EXIT>	

Press **ENTER** key after selected the item. The function of the item becomes valid mode.
Please refer to the tree of I/F SET-UP

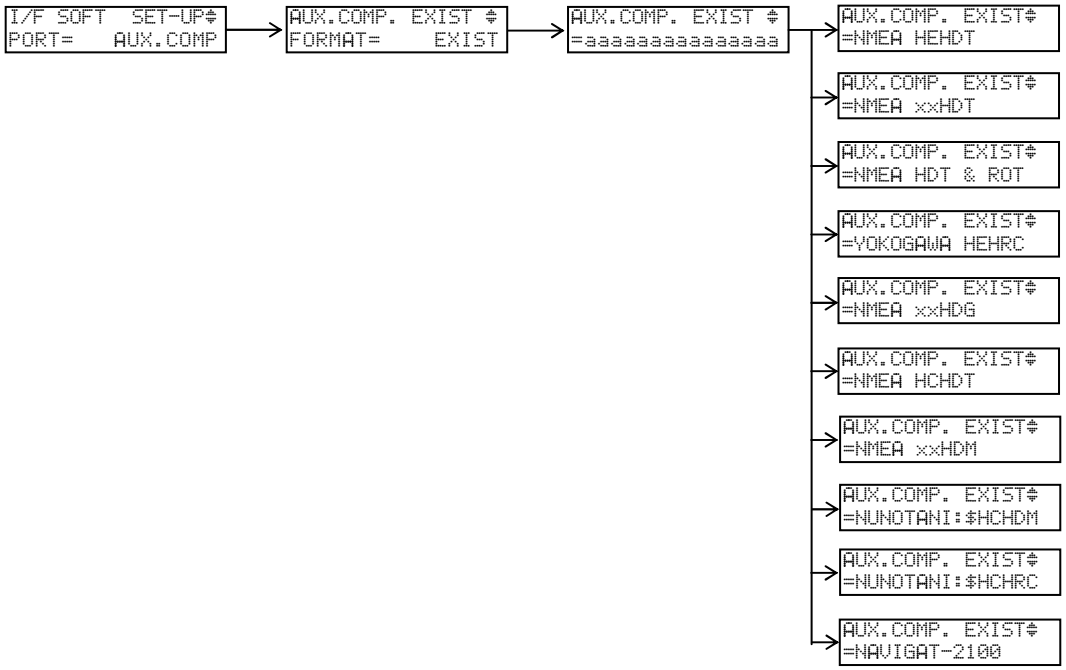
＜The tree of the I/F SET-UP＞



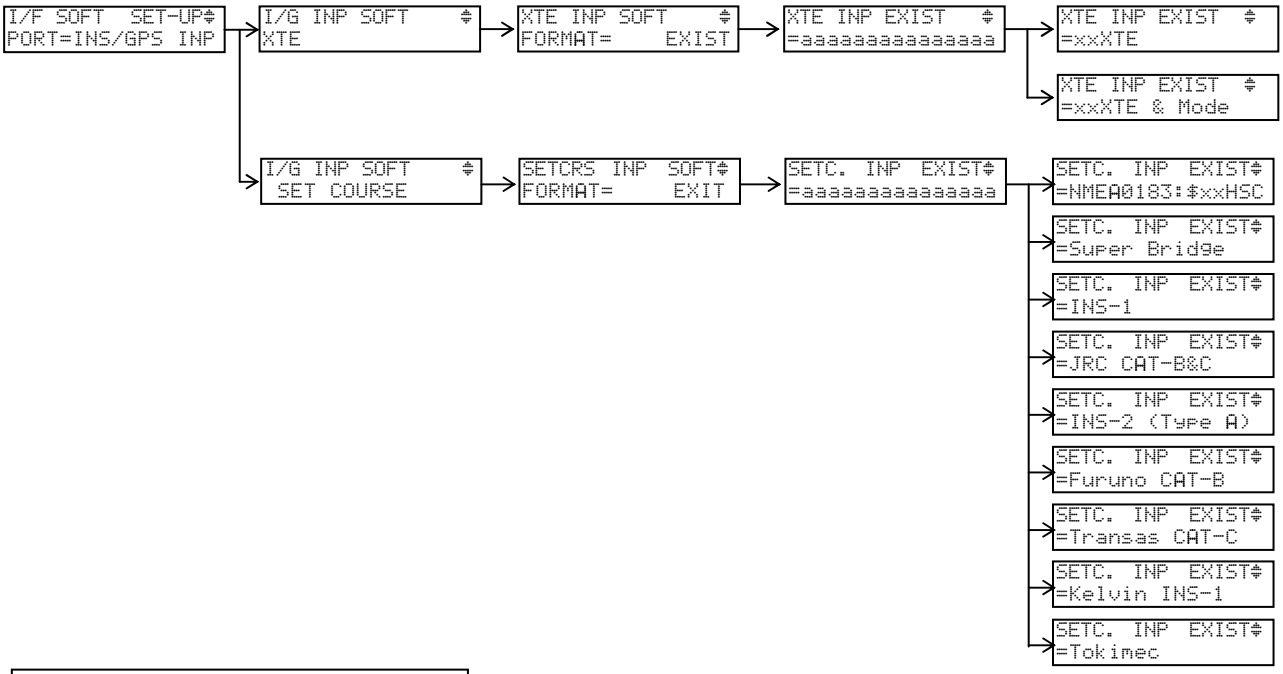
Setting of the Gyrocompass input format



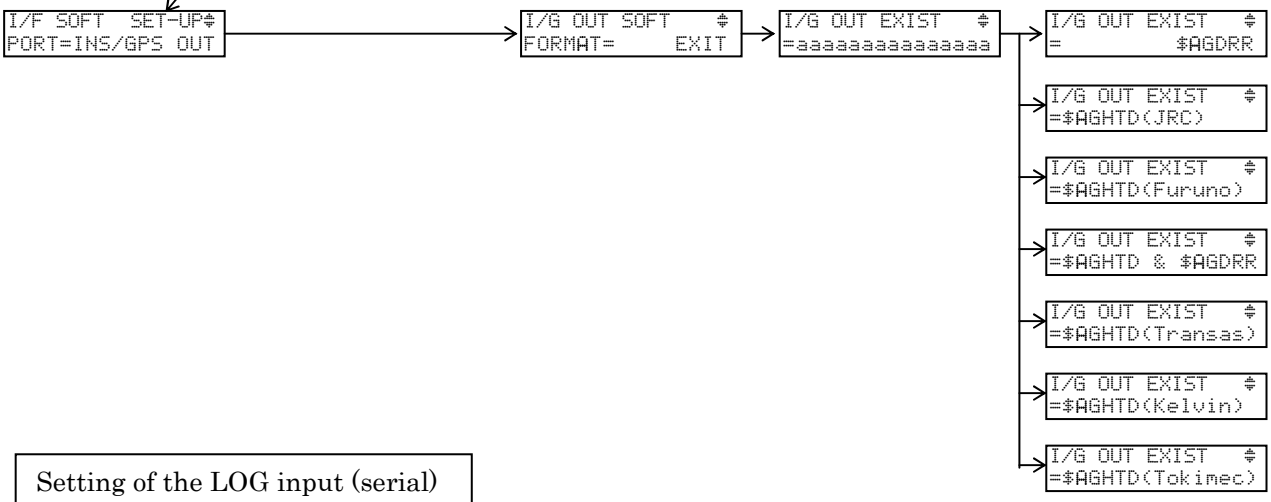
Setting of the Aux. compass input format



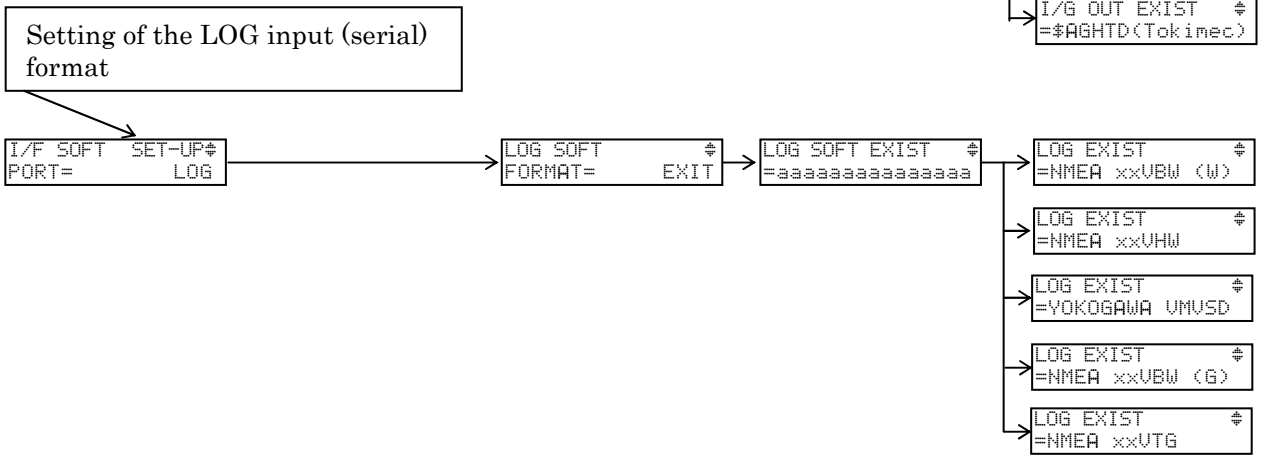
Setting of the INS/GPS input format



Setting of the INS/GPS output format



Setting of the LOG input (serial) format



2. Hardware setting

Set the protocol for Gyro compass and Auxiliary compass ,INS/GPS.
Setting item is as follows.

① Hardware setting of the Gyrocompass
② Hardware setting of the Auxiliary compass
③ Hardware setting of the INS/GPS
④ Hardware setting of the LOG

(1) Set the 

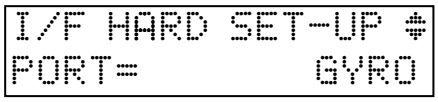
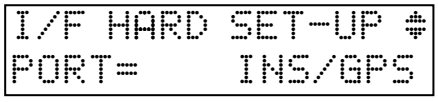
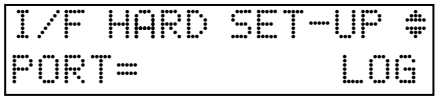
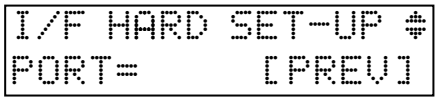
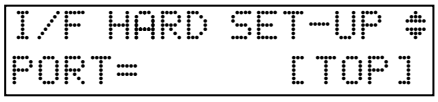
→ 

,then press **ENTER** key.

Data display becomes a Hardware setting ready mode for each input port.

(2) Change the setting mode by using the **△ +** or **▽ −** Keys.

①⇔②⇔③⇔④⇔⑤⇔⑥⇔①

①		Set the protocol of the Gyro compass port.
②		Set the protocol of the Auxiliary compass port.
③		Set the protocol of the INS/GPS port.
④		Set the protocol of the LOG port.
⑤		Back to the previous mode.
⑥		Back to the I/F setup top menu mode.

Press the **ENTER** key after you selected the setting mode. It become the each protocol setting mode .

2．1　Hardware setting of the Gyrocompass

Set the protocol of the Gyrocompass. Setting item is as follows.

①Baud rate
②Length of the character
③Parity check
④Length of the stop bit

（1）Set the

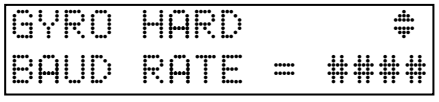
mode,

then press **ENTER** key.

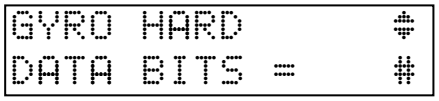
Data display becomes a Hardware setting ready mode for Gyrocompass protocol port.

（2）Change the setting mode by using the **△ +** or **▽ −** key.

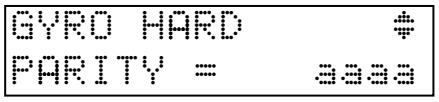
①⇔②⇔③⇔④⇔⑤⇔⑥⇔①

① 

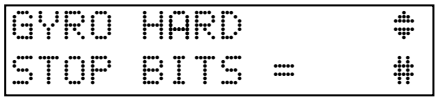
Baud rate

② 

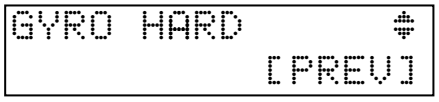
Length of the character

③ 

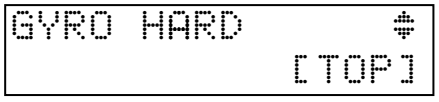
Parity check

④ 

Length of the stop bit

⑤ 

Back to the previous mode.

⑥ 

Back to the I/F setup top menu mode.

Press the **ENTER** key after you selected the setting mode. It become the each protocol setting mode .

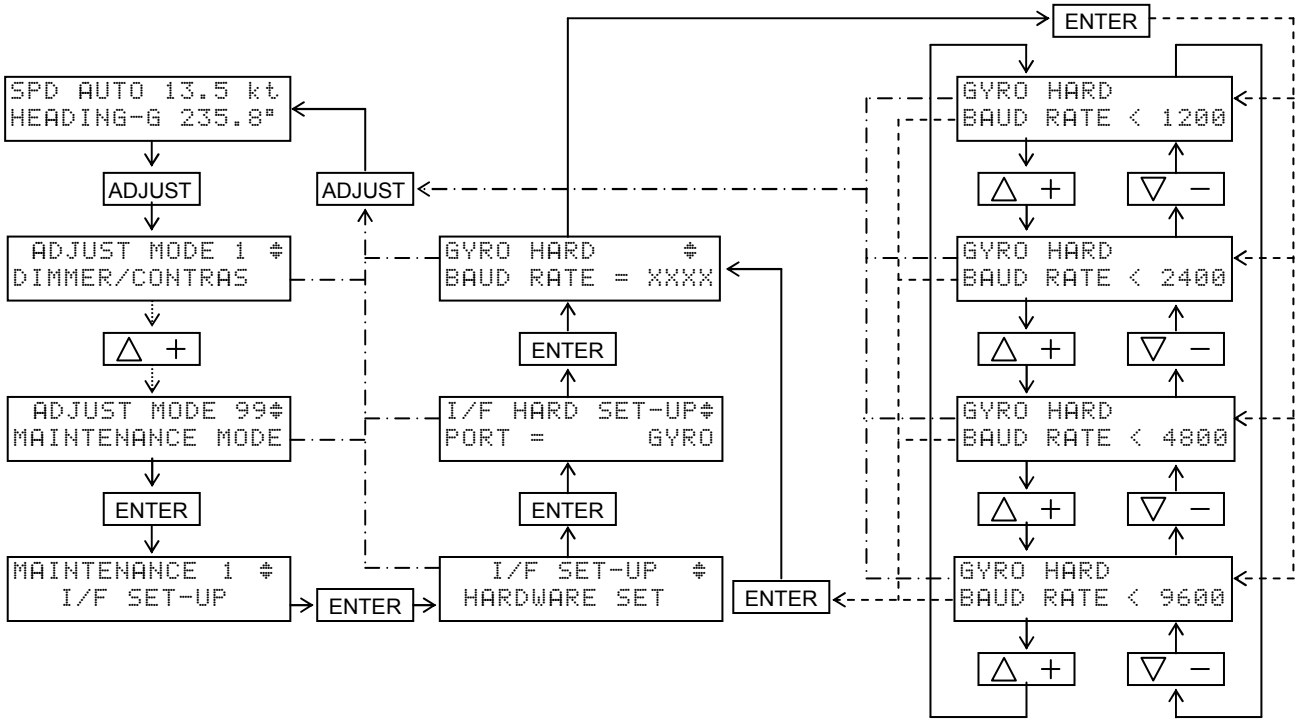
2．1．1 Baud rate

（1）Press **ENTER** key when it is displayed the "BAUD RATE = ####" on the data display.

Data display become under setting mode.

```
GYRO HARD
BAUD RATE < 2400
```

（2）Press the **△ +** or **▽ −** key to select the baud rate value. Then press **ENTER** key.



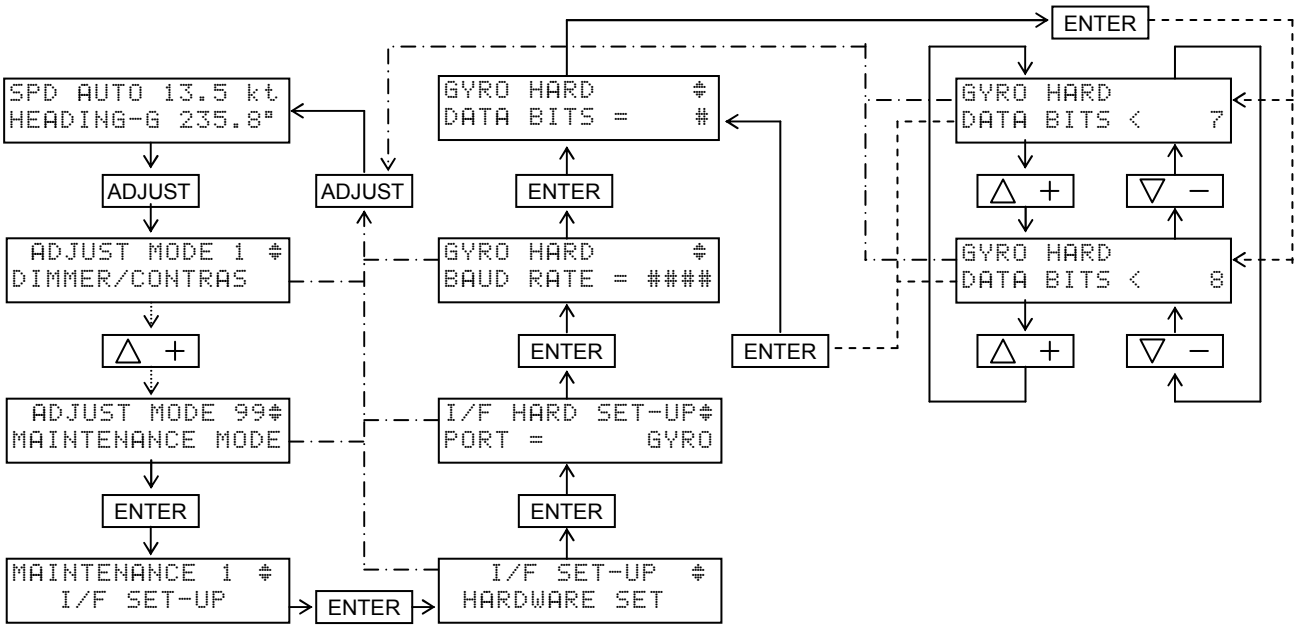
2．1．2 Length of the character

（1）Press **ENTER** key when it is displayed the "DATA BITS = #" on the data display.

Data display become under setting mode.

```
GYRO HARD
DATA BITS <    7
```

（2）Press the **△ +** or **▽ −** key to select the character length. Then press **ENTER** key.



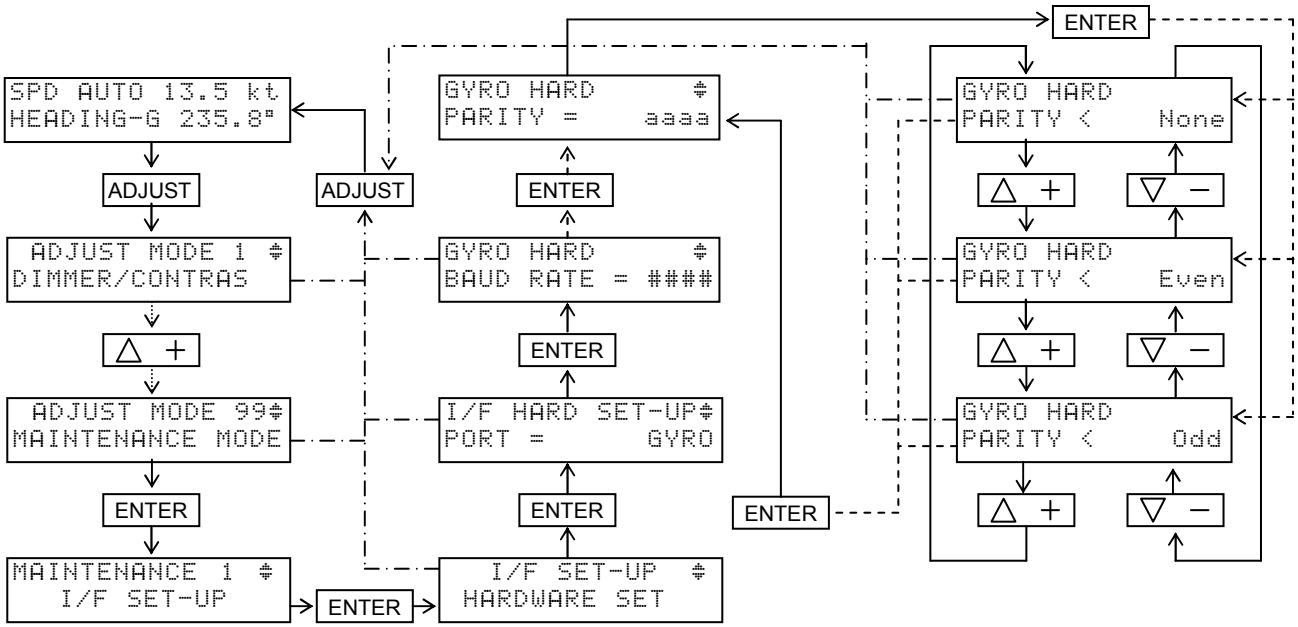
2．1．3 Parity check

（1）Press **ENTER** key when it is displayed the "PARITY = aaaa" on the data display.

Data display become under setting mode.

```
GYRO HARD
PARITY <     None
```

（2）Press the **△ +** or **▽ −** key to select the parity check. Then press **ENTER** key.



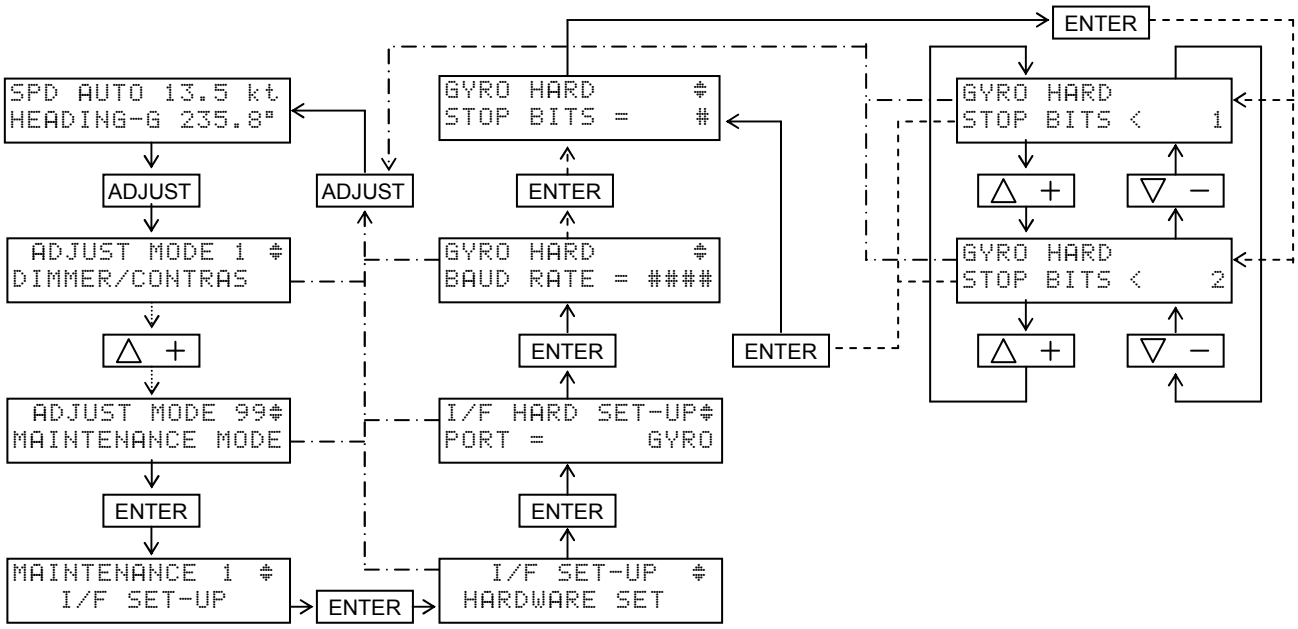
2．1．4 Stop bit

（1）Press **ENTER** key when it is displayed the "STOP BITS = #" on the data display.

The data display become under setting mode.

```
GYRO HARD
STOP BITS <     1
```

（2）Press the **△ +** or **▽ −** key to select the stop bit. Then press **ENTER** key.



2．2　Hardware setting of the Auxiliary compass

Set the protocol of the Auxiliary compass.　Setting item is as follows.

①Baud rate
②Length of the character
③Parity check
④Length of the stop bit

（1）Set the

mode.

Then press **ENTER** key.

Data display becomes a Hardware setting ready mode for Auxiliary compass protocol port.

（2）Change the setting mode by using the **△ +** or **▽ −** Keys.

①⇔②⇔③⇔④⇔⑤⇔⑥⇔①

①	AUX. COMP. HARD⇕ BAUD RATE = ####	Baud rate
②	AUX. COMP. HARD⇕ DATA BITS = #	Length of the character
③	AUX. COMP. HARD⇕ PARITY = aaaa	Parity check
④	AUX. COMP. HARD⇕ STOP BITS = #	Length of stop bit
⑤	AUX. COMP. HARD⇕ [PREV]	Back to the previous mode.
⑥	AUX. COMP. HARD⇕ [TOP]	Back to the I/F setup top menu mode.

Press the **ENTER** key after you selected the setting mode. It become the each protocol setting mode .

Following setting item is the same as Gyrocompass hardware setting
Refer to Gyrocompass hardware setting.

2．3　Hardware setting of the INS/GPS

Set the protocol of the INS/GPS.　Setting item is as follows.

①Baud rate
②Length of the character
③Parity check
④Length of the stop bit

（1）Set the

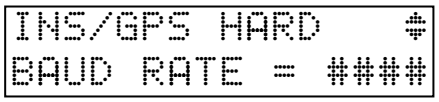
mode.

Then press **ENTER** key.

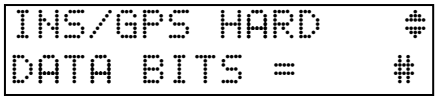
Data display becomes a Hardware setting ready mode for INS/GPS protocol port.

（2）Change the setting mode by using the **△ +** or **▽ −** Keys.

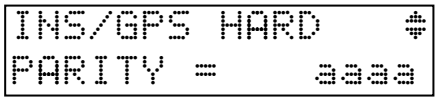
①⇔②⇔③⇔④⇔⑤⇔⑥⇔①

① 

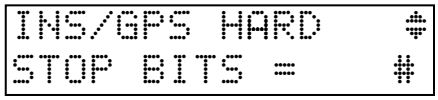
Baud rate

② 

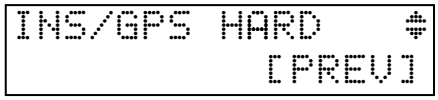
Length of the character

③ 

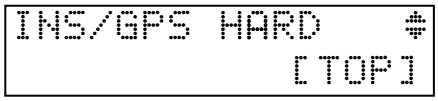
Parity check

④ 

Length of stop bit

⑤ 

Back to the previous mode.

⑥ 

Back to the I/F setup top menu mode.

Press the **ENTER** key after you selected the setting mode. It become the each protocol setting mode .

Following setting item is the same as Gyrocompass hardware setting
Refer to Gyrocompass hardware setting.

2．3　Hardware setting of the LOG

Set the protocol of the LOG.　Setting item is as follows.

①Baud rate
②Length of the character
③Parity check
④Length of the stop bit

（1）Set the

mode.

Then press **ENTER** key.

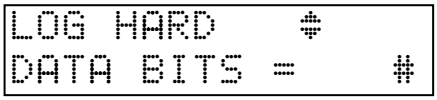
Data display becomes a Hardware setting ready mode for LOG protocol port.

（2）Change the setting mode by using the **△ +** or **▽ −** Keys.

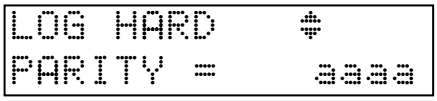
①⇔②⇔③⇔④⇔⑤⇔⑥⇔①

① 

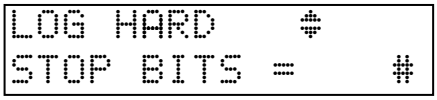
Baud rate

② 

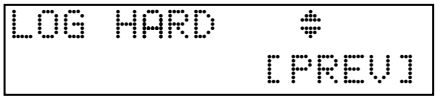
Length of the character

③ 

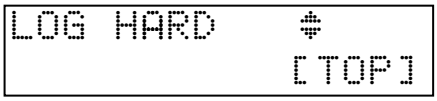
Parity check

④ 

Length of stop bit

⑤ 

Back to the previous mode.

⑥ 

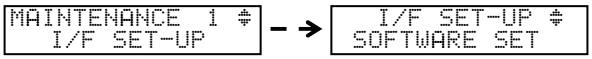
Back to the I/F setup top menu mode.

3. Software setting

Set the protocol for Gyro compass input and Auxiliary compass input , INS/GPS input and output. Setting item is as follows.

① Software setting of the Gyrocompass input
② Software setting of the Auxiliary compass input
③ Software setting of the INS/GPS input
④ Software setting of the INS/GPS output
⑤ Software setting of the LOG input

（1）Set the



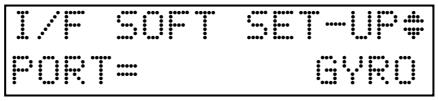
key.

Then press **ENTER** key.

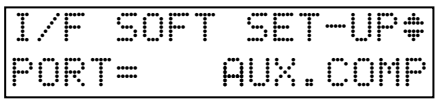
Data display become a Hardware setting ready mode for each inputting port.

（2）Change the setting mode by using the **△ +** or **▽ −** Keys.

①⇔②⇔③⇔④⇔⑤⇔⑥⇔⑦⇔①

① 

Set the Input signal of the Gyrocompass data

② 

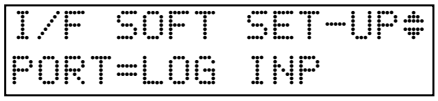
Set the Input signal of the Auxiliary compass data

③ 

Set the Input signal of the INS/GPS data

④ 

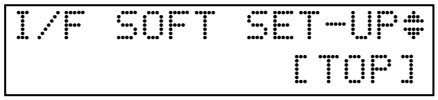
Set the output signal of the INS/GPS data

⑤ 

Set the Input signal of the LOG data

⑥ 

Back to the previous mode.

⑦ 

Back to the I/F setup top menu mode.

Press the **ENTER** key after you selected the setting mode. It become the each protocol setting mode .

3．1　Software setting of the Gyrocompass input

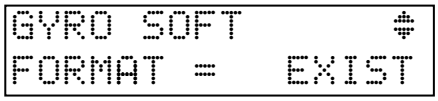
Set the input data of the Gyrocompass data

（1）Set the

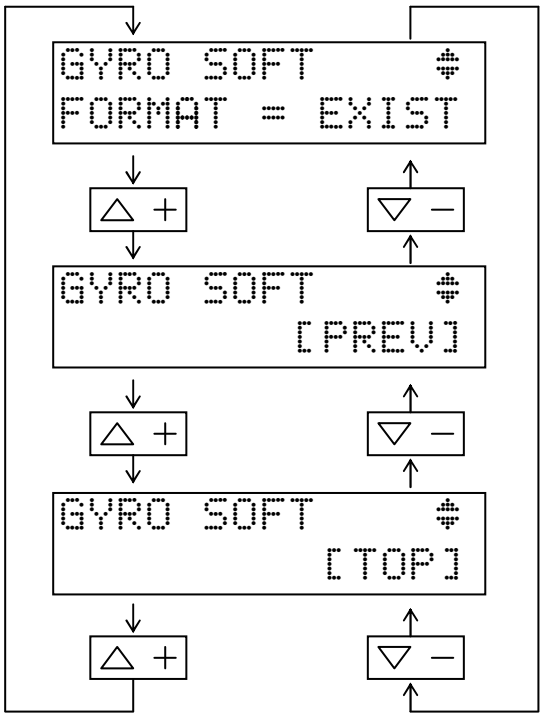
mode.

Then press the **ENTER** key.

Display the current setting item for Gyrocompass heading data on the Data display.



（2）Press the **△ +** or **▽ −** key to select the Gyrocompass format. Then press **ENTER** key.



（3）In case of you change the input data. Back to（1）item , then Press **ENTER** key.

Data display become under setting mode

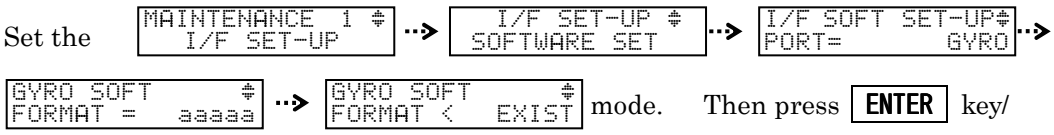
（4）Press the **△ +** or **▽ −** key. Alter the display, NONE ⇔ EXIST ⇔ NEW ⇔ NONE.

After selected the setting mode , Press **ENTER** key..

If you choose the EXIST or NEW mode, move to the 3.1.1 or 3.1.2 setting item.

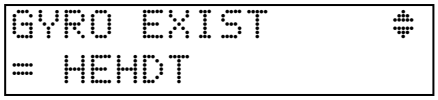
3．1．1　Set the existing gyrocompass heading input format

（1）Set the

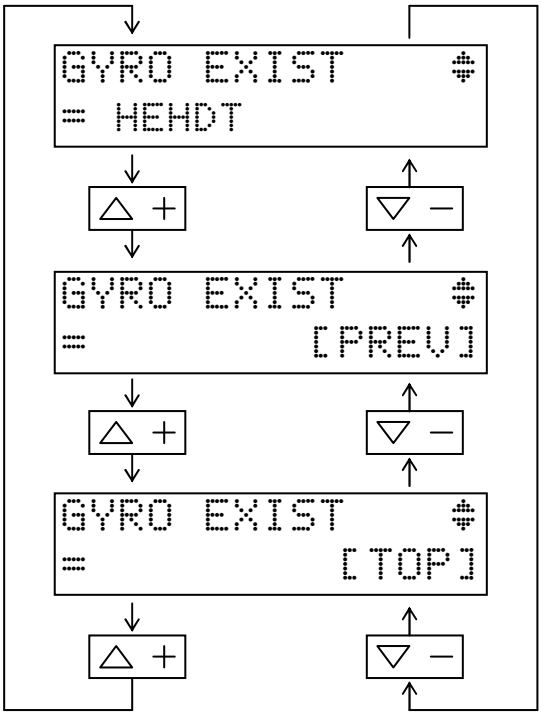


mode.　Then press **ENTER** key/

Display the current existing format on the data display.



（2）Press the **△ +** or **▽ −** key to select the existing Gyrocompass format.



（3）In case of you choose the existing gyrocompass format. Back to （1）item , then Press **ENTER** key.
The data display become under setting mode

The part of a....a is displayed setting condition.
Refer the contents to next page.

（4）Press the **△ +** or **▽ −** key.　Alter the display of the existing format.

After selected the setting mode , Press **ENTER** key..

Selection Data	Contents
NMEA HEHDT	NMEA0183 $HEHDT (Taker ID should be only “HE”.) Check-sum is required.
NMEA xxHDT	NMEA0183 $xxHDT (Taker ID “xx” is not checked) Check-sum is required.
NMEA HDT&ROT	NMEA0183 $xxHDT and $xxROT messages are required. (Taker ID “xx” is not checked) Check-sum is required.
YOKOGAWA HEHRC	CMZ300X format $HEHRC/$HCHRC (The name was changed to YOKOGAWA HEHRC.)
NMEA xxHDG	NMEA0183 $xxHDG (Taker ID “xx” is not checked) Check-sum is required.
NMEA HCHDT	NMEA0183 $HCHDT (Taker ID should be only “HC”.) Check-sum is required.
NMEA xxHDM	NMEA0183 $xxHDM (Taker ID “xx” is not checked) Check-sum is not required.
NUNOTANI:$HCHDM	MUNOTANI’s TMC format $HCHDM(Taker ID should be only “HC”.) Check-sum is required.
NUNOTANI:$HCHRC	MUNOTANI’s TMC format $HCHRC(Taker ID should be only “HC”.) Check-sum is required.
NAVIGAT-2100	NAIGAT-2100 format -$HEHDT(GYRO) or $HCHDT(MAG) -$HEROT Heading and ROT data are used. When $HEHDT is received, the data is used as GYRO input. When $HCHDT is received, the data is used as Magnet input.

3.1.2 New format setting of the gyrocompass heading format

Setting item is as follows.

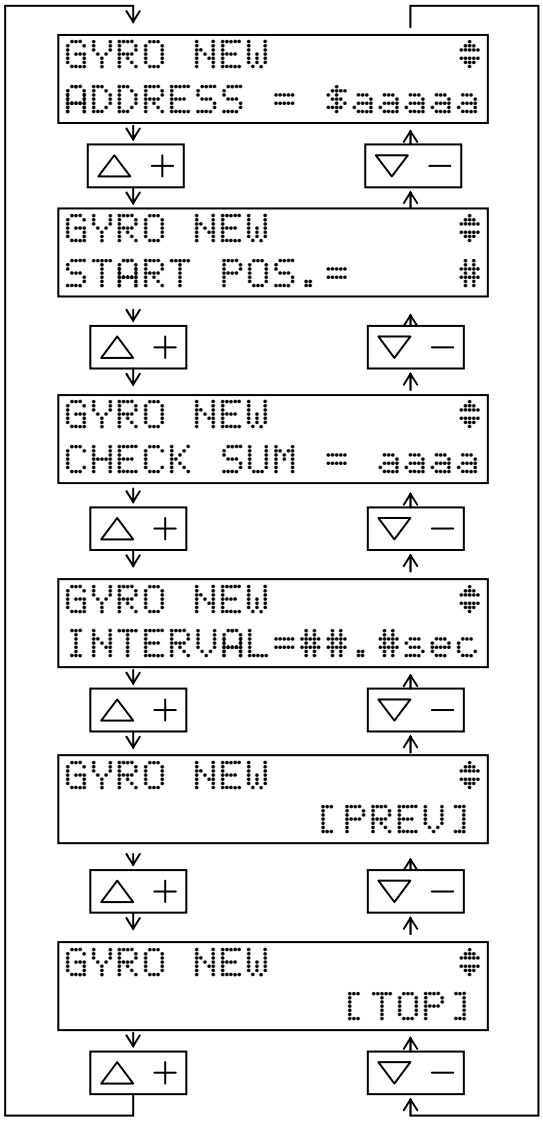
① Reception Header
② Position of the input field
③ Check sum Valid/Invalid
④ Transmission data output interval

3.1.2.1 Select the GYRO SOFT FORMAT＜NEW

（1）Set the

mode. Then press the **ENTER** key.

（2）Press the **△ +** or **▽ −** key to select the setting item.



After selected the setting mode , Press **ENTER** key..

3.1.2.2 Setting of the reception header

Set the reception header
The Header consists of five character from $ to reception discrimination data.

（1） When you are displayed "ADDRESS = $aaaaa" on the data display ,then press **ENTER** key.

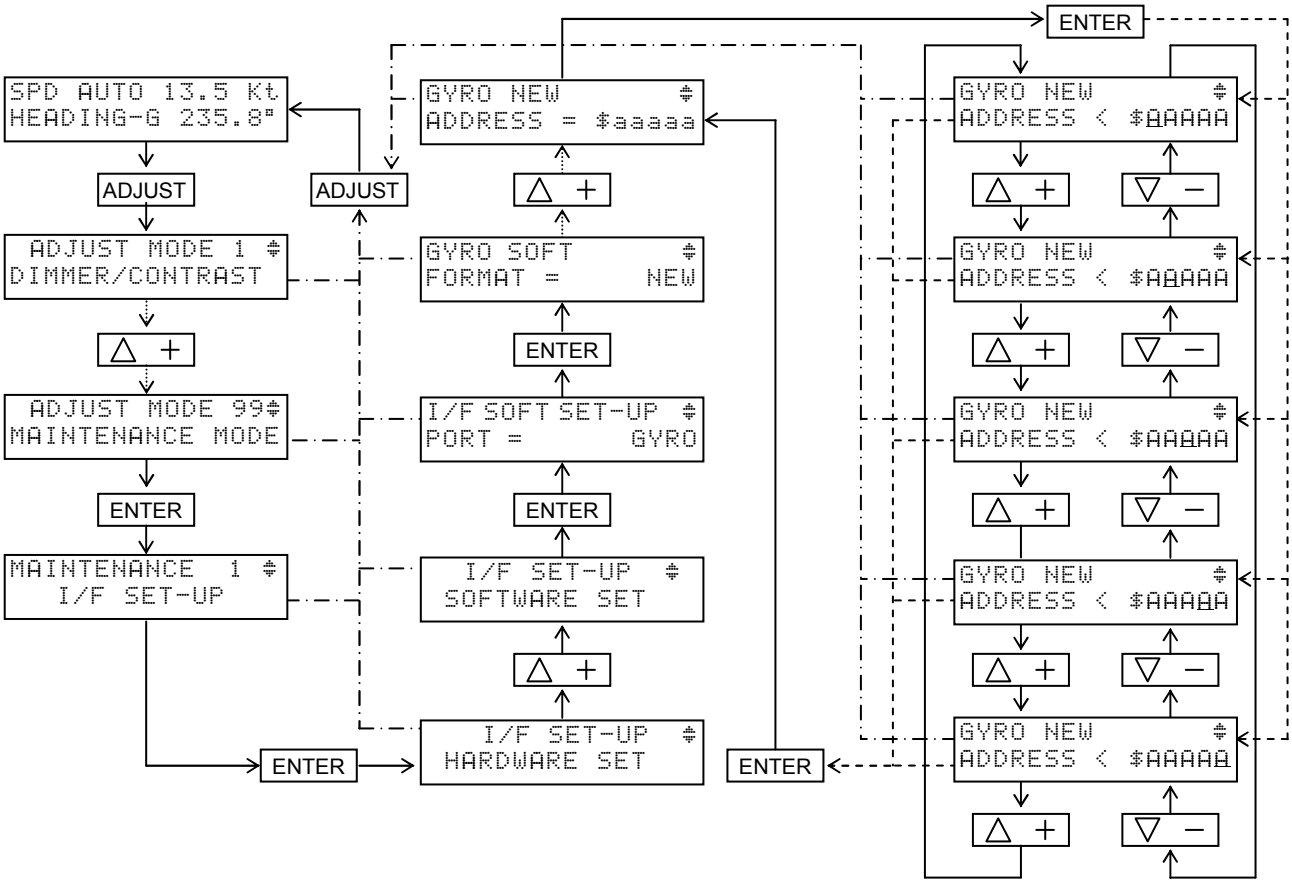
The data display become under setting mode.

```
GYRO NEW
ADDRESS < $AAAAA
```
←Cursor position is inputting point

（2）Press **△ +** or **▽ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction , data is increased and turn to the counter clockwise direction ,data is decreased. (Data is A to Z alphabet)

```
GYRO NEW
ADDRESS < $GPABC
```

（3）After input the header , then press **ENTER** key.



3.1.2.3 Setting of the data field position

Set the data field position of the reception data

Example)

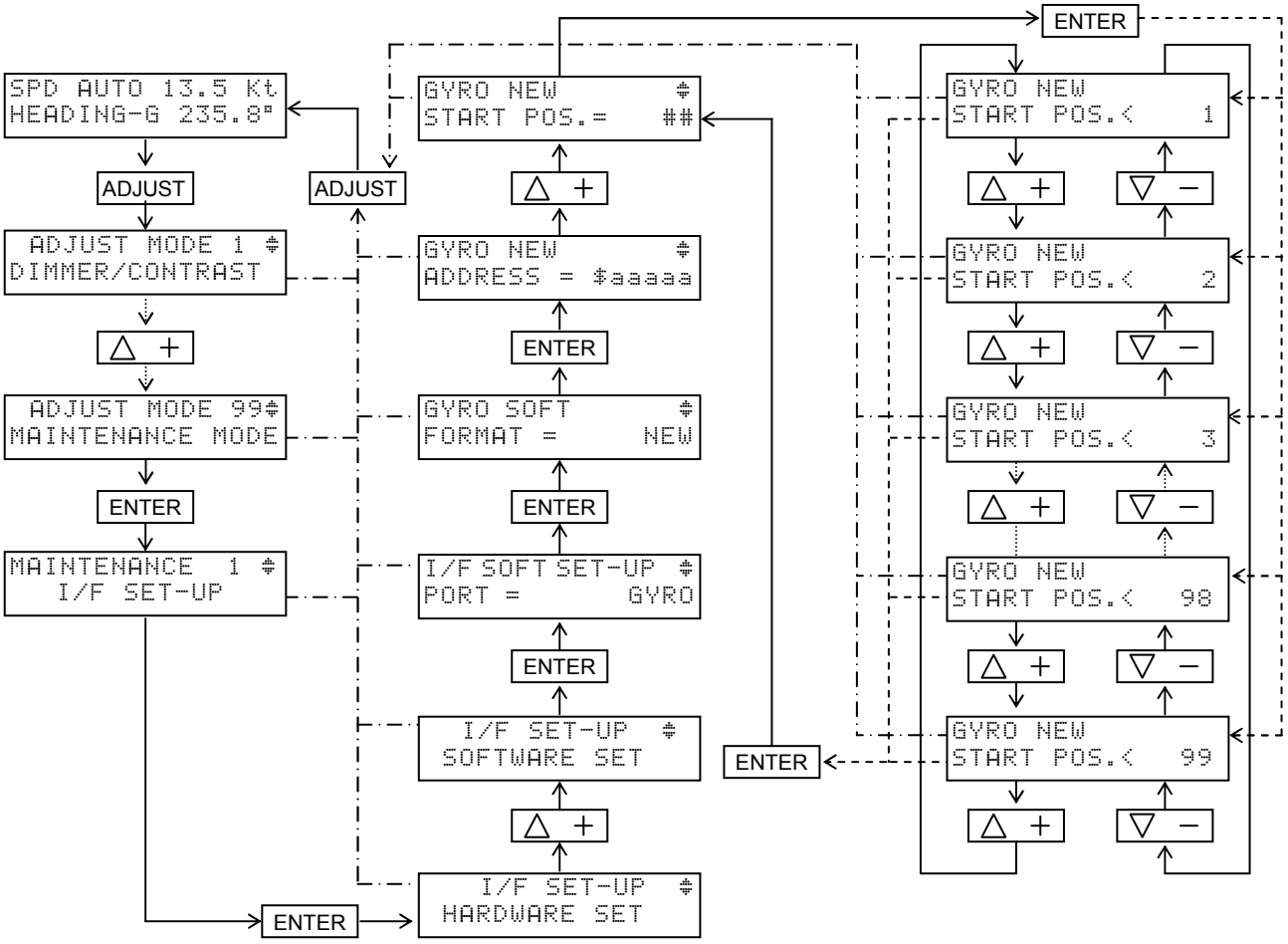
" $ A B C D E , 1 2 3 . 3 , 4 5 6 . 7 , 8 9 0 . 1 , 2 3 4 . 5 *"

In case of set the data field at "3" above text data ,reception data become "890.1" .

（1） When you displayed the "START POS.= ##" on the data display, press **ENTER** key.
The data display become under setting mode.

```
GYRO NEW
START POS.<      1
```

（2） Press the **Δ +** or **∇ −** key to select the setting mode. Then press **ENTER** key.



3.1.2.4 Set the valid /invalid condition of the check sum

Select the valid / invalid condition of the check sum

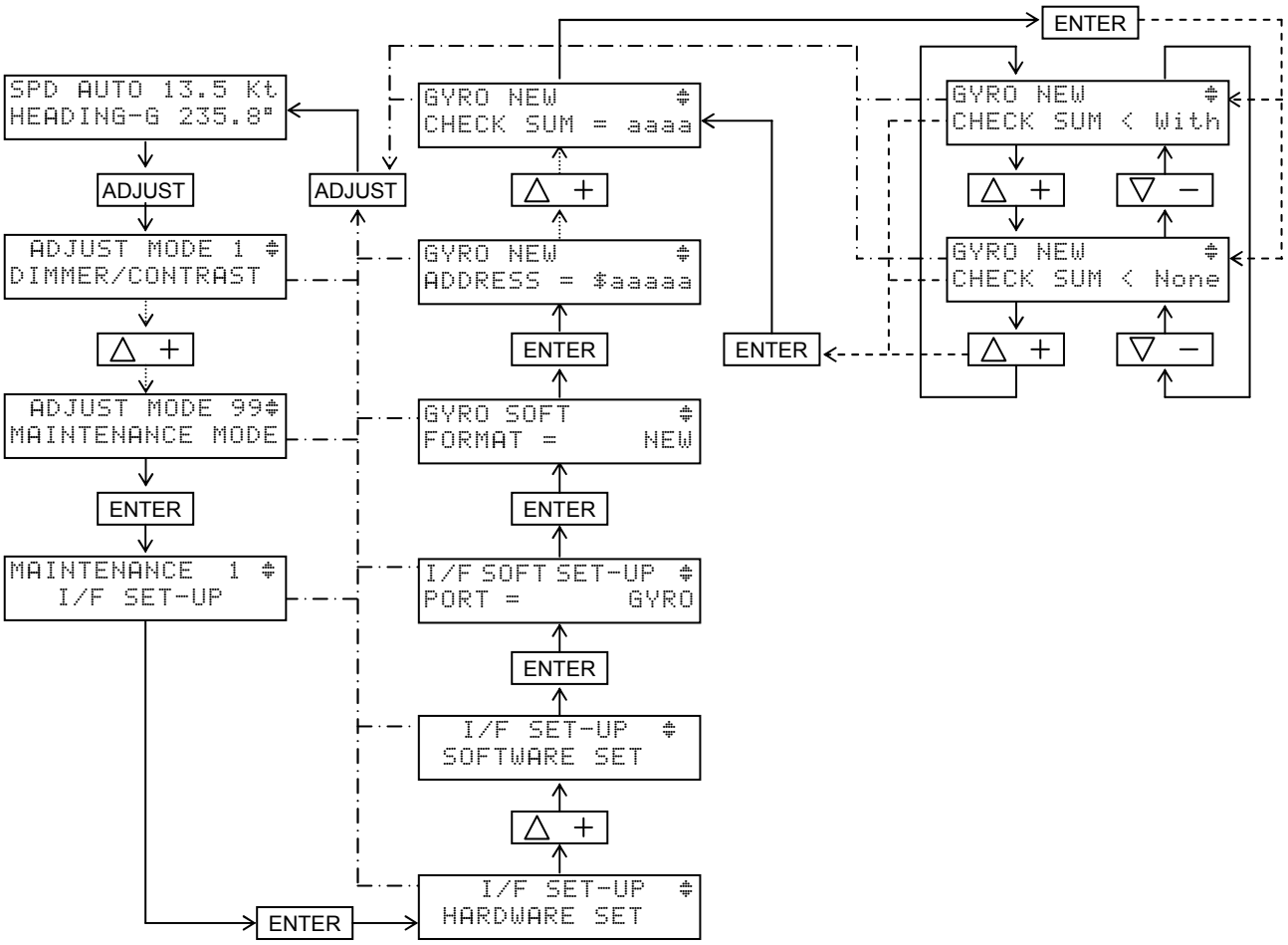
When occurred the check sum error as the valid condition , communication become no reception condition.

（1）When displayed the "CHECK SUM = aaaa", press **ENTER** key.

The data display become under setting mode

```
GYRO NEW
CHECK SUM < WITH
```

（2）Press the **△ +** or **▽ −** key to select the setting mode. Then press **ENTER** key.



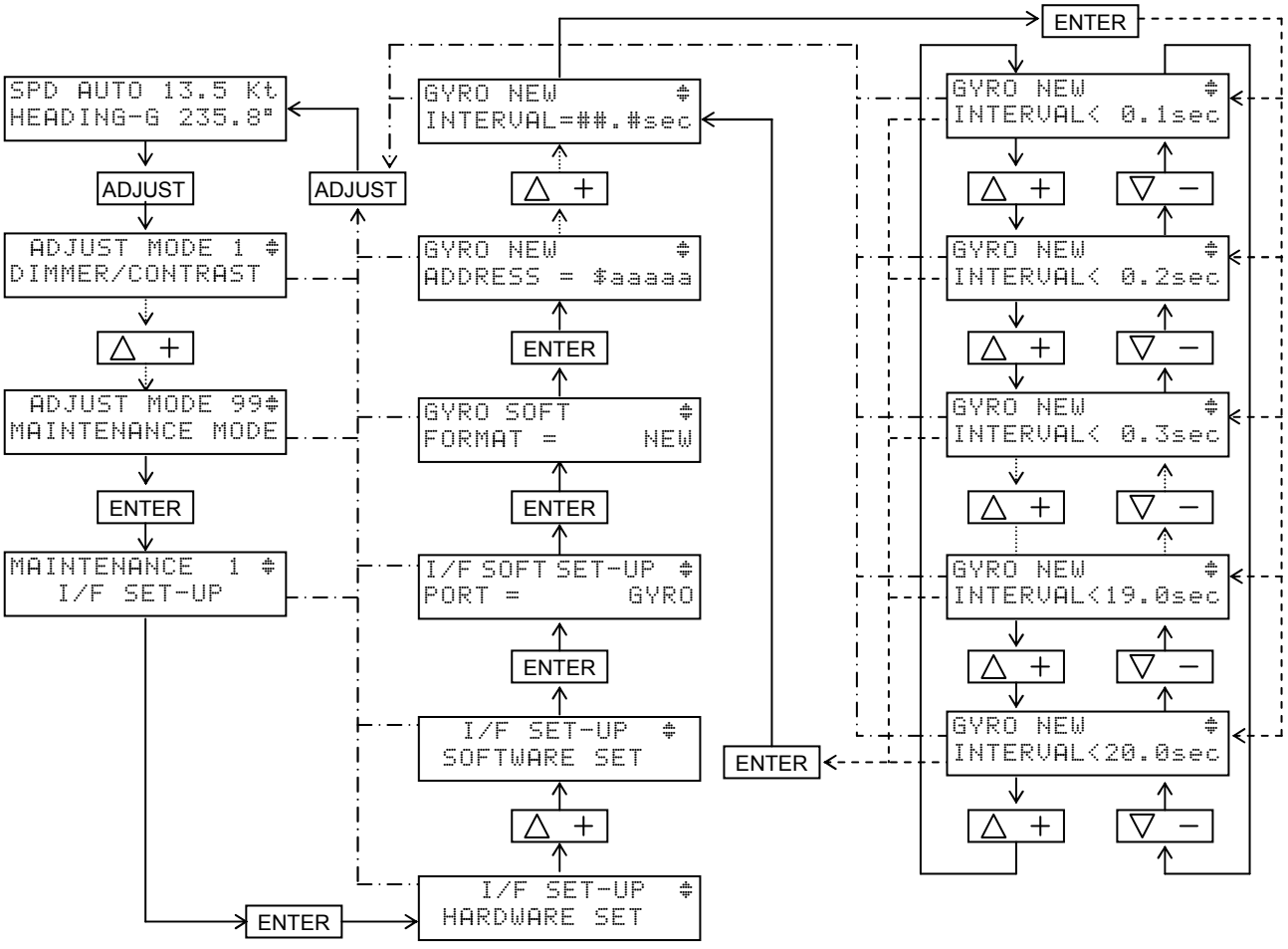
3.1.2.5 Set the transmission data output interval

Time out of the reception data is selected the longer time value either 3 second or 3 times of the data output interval time

（1）When displayed the "INTERVAL= XX.Xsec", press **ENTER** key.
The data display become under setting mode

```
GYRO NEW
INTERVAL<##.#sec
```

（2）Press the **△ +** or **▽ −** key to select the setting mode. Then press **ENTER** key.



3．2　Software setting of the Auxiliary compass input

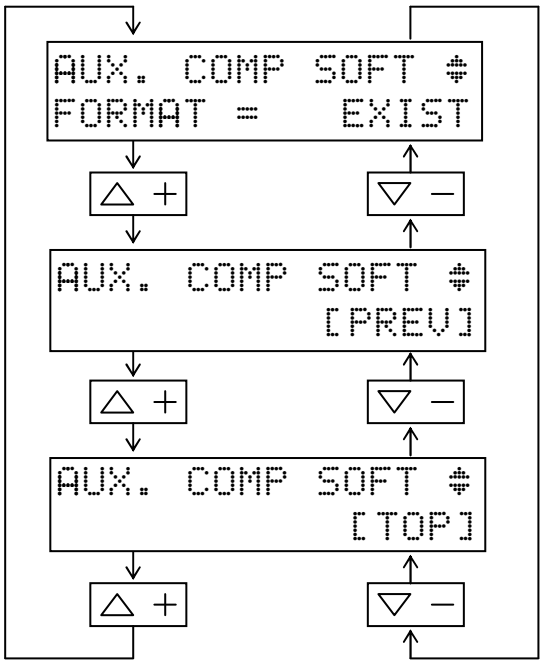
（1）Set the

key.

Then press **ENTER** key.

The data display become under setting mode

（2）Press the **△ +** or **▽ −** key to select the setting item.



（3）In case of you choose the existing Aux. compass format. Back to （1） item , then Press **ENTER** key.

The data display become under setting mode

（4）Press the **△ +** or **▽ −** key. Alter the display “NONE ⇔ EXIST ⇔ NEW ⇔ NONE”

After selected the setting mode , Press **ENTER** key..

EXIST and NEW setting item is the same as Gyrocompass software setting
Refer to 3.1 Soft ware setting of the Gyrocompass setting input .

3．3　Software setting of the INS/GPS input

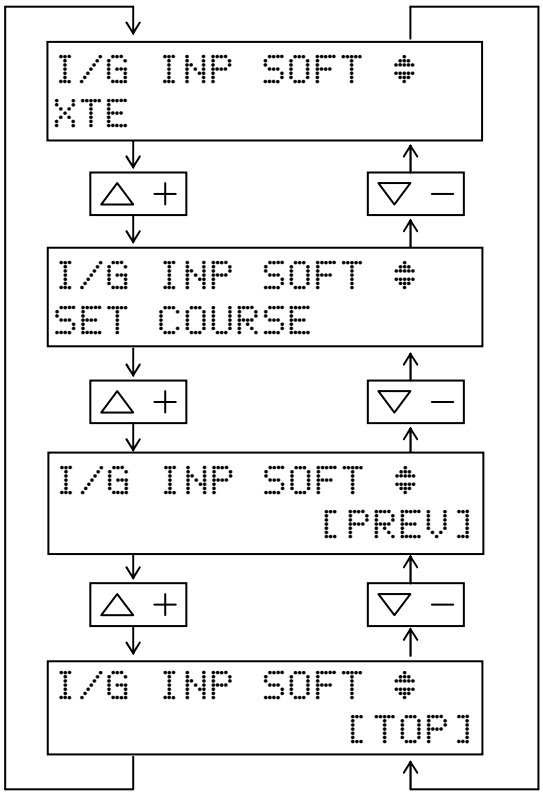
（1）Set the MAINTENANCE 1 ⇕ / I/F SET-UP → I/F SET-UP ⇕ / SOFTWARE SET → I/F SOFT SET-UP⇕ / PORT=INS/GPS INP key.

Then press **ENTER** key.

The data display become under setting mode

```
I/G INP SOFT   ⇕
XTE
```

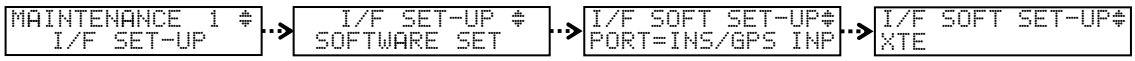
（2）Press the **△ +** or **▽ −** key to select the setting item.



After selected the setting mode , Press **ENTER** key..

3．3．1　Software setting of the XTE input

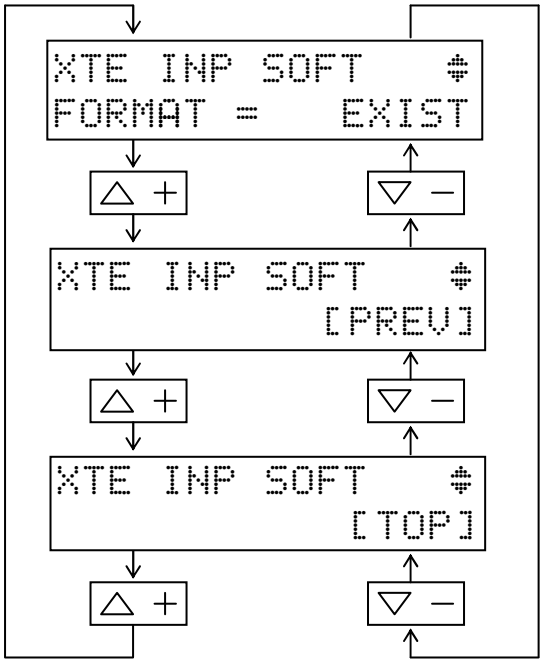
（1）Set the



key.　Then press **ENTER** key.

The data display become under setting mode

（2）Press the **△ +** or **▽ −** key to select the setting item.



（3）In case of you choose the existing format. Back to（1）item , then Press **ENTER** key.

The data display become under setting mode

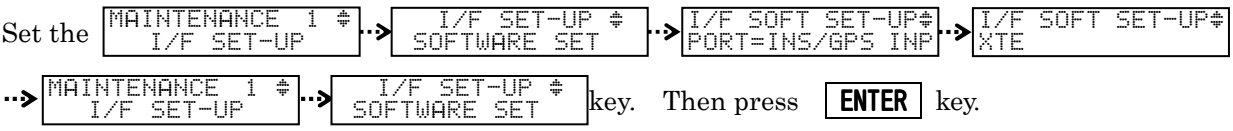
（4）Press the **△ +** or **▽ −** key.　Alter the display　"NONE ⇔ EXIST ⇔ NEW ⇔ NONE"

After selected the setting mode , Press **ENTER** key..

3．3．2　Software setting of the XTE existing format

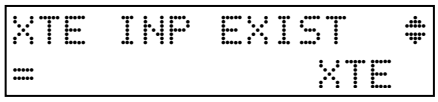
Set the NMEA0183 format of XTE (Cross track error)

（1）Set the

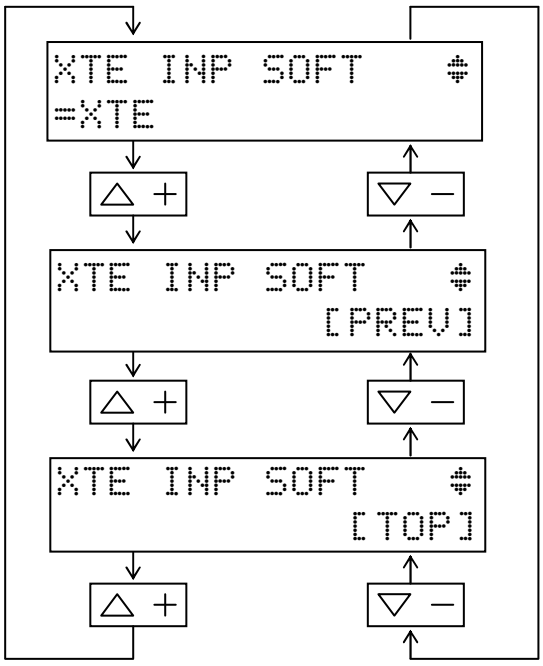


key. Then press **ENTER** key.

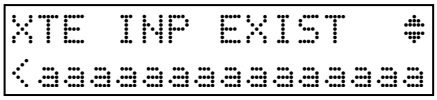
The data display become under setting mode



（2）Press the **△ +** or **▽ −** key to select the setting item.



In case of you choose the existing format. Back to （1） item , then Press **ENTER** key.
The data display become under setting mode



The part of a....a is displayed setting condition.
Refer the contents to next page.

（4）Press the **△ +** or **▽ −** key. Alter the display of the existing format.

After selected the setting mode , Press **ENTER** key..

Selection Data	Contents
xxXTE	NMEA0183 $xxXTE (Taker ID “xx” is not checked) Check-sum is required.
xxXTE & Mode	NMEA0183 Ver. 2.30 $xxXTE (Taker ID “xx” is not checked) Check-sum is required. Mode indicator of XTE message is checked.

３．３．３　New format setting of the XTE format

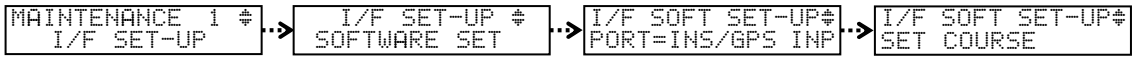
Setting item is as follows.

① Reception Header
② Position of the input field
③ Check sum Valid/Invalid
④ Transmission data output interval

Setting item and a way is the same as Gyrocompass software setting
Refer to 3.1.2 Gyrocompass software setting.

3．3．4　Software setting of the Set course input format

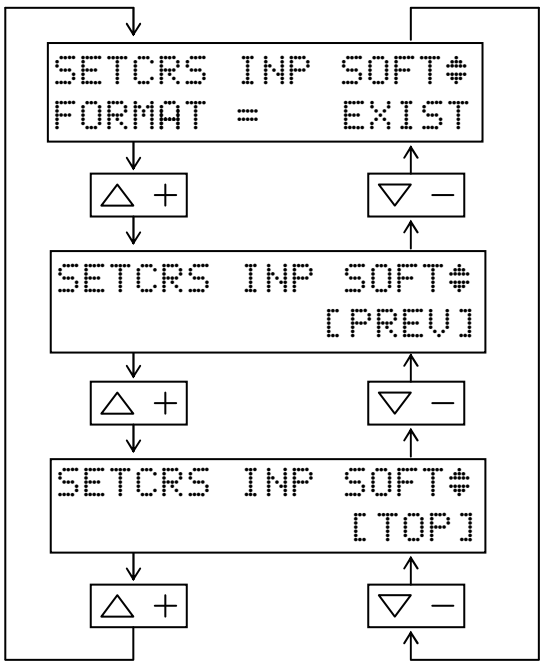
（1）Set the



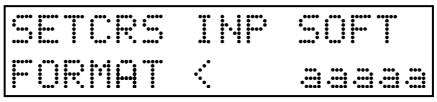
key. Then press **ENTER** key.

The data display become under setting mode

（2）Press the **△ +** or **▽ −** key to select the setting item.



（3）In case of you choose the existing format. Back to（1）item , then Press **ENTER** key.
The data display become under setting mode

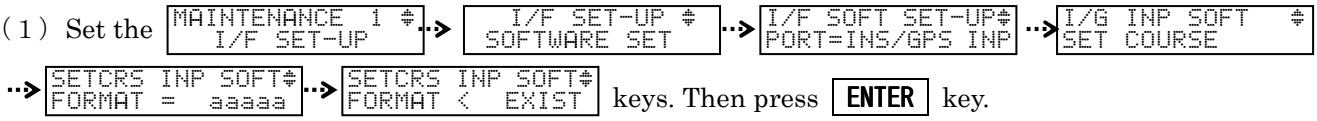


（4）Press the **△ +** or **▽ −** key.　Alter the display of the existing format.

After selected the setting mode , Press **ENTER** key..

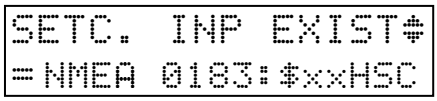
3．3．5　Set the set course input of the existing format

（1）Set the

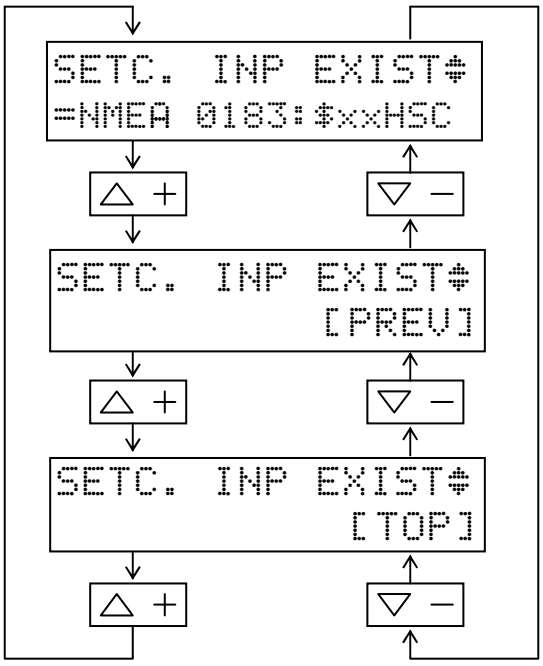


keys. Then press **ENTER** key.

The data display become under setting mode



（2）Press the **△ +** or **▽ −** key to select the setting item.



（3）In case of you choose the existing format. Back to （1）item , then Press **ENTER** key.
The data display become under setting mode

The part of a....a is displayed setting condition.
Refer the contents to next page.

（4）Press the **△ +** or **▽ −** key.　Alter the display of the existing format.

After selected the setting mode , Press **ENTER** key.

Selection data	Contents
NMEA 0183:$xxHSC	$xxHSC (Taker ID "xx" is not checked) The first field data is used as the set course data. The second field data should be "T".
Super Bridge	For MITSUBISHI super bridge I/F $xxTRC format Taker ID "xx" should be either EC, EI, II or IN.
INS-1	For interfacing with ECDIS made by JRC (Correspondence to a style approval previous ATOS version) ① $xxHTC ② $xxXTE Taker ID "xx" should be either EC, EI, II or IN.
JRC CAT-B&C **(for MED TCS type approval)**	For interfacing with ECDIS made by JRC The following four(4) messages are required. ① $xxHTC ② $xxXTE (set by XTE setting) ③ $xxHSC ④ $xxVDR Taker ID "xx" should be either EC, EI, II or IN.
INS-2 (Type A)	For interfacing with ECDIS made by FURUNO (At present, not used.) $xxHTC Taker ID "xx" should be either EC, EI, II or IN.
Furuno CAT-B **(for MED TCS type approval)**	For interfacing with ECDIS made by FURUNO The following two(2) messages are required. ① $xxHTC ② $xxVTG Taker ID "xx" should be either EC, EI, II or IN.
Transas CAT-C **(for MED TCS type approval)**	For interfacing with ECDIS made by TRANSAS $xxHTC Taker ID "xx" should be either EC, EI, II or IN.
Kelvin INS-1	For interfacing with ECDIS made by KELVIN HUGHES The following two(2) messages are required. $xxHTC Taker ID "xx" should be either EC, EI, II or IN.
Tokimec	For interfacing with ECDIS made by TOKIMEC $xxHTC Taker ID "xx" should be either EC, EI, II or IN.

3．3．6　New format setting of the set course format

Setting item is as follows.

① Reception Header
② Position of the input field
③ Check sum Valid/Invalid
④ Transmission data output interval

Setting item and way is the same as Gyrocompass software setting
Refer to 3.1.2 Gyrocompass software setting.

3．4　Software setting of the ＩＮＳ／ＧＰＳ output

Set the ＩＮＳ／ＧＰＳ output specification

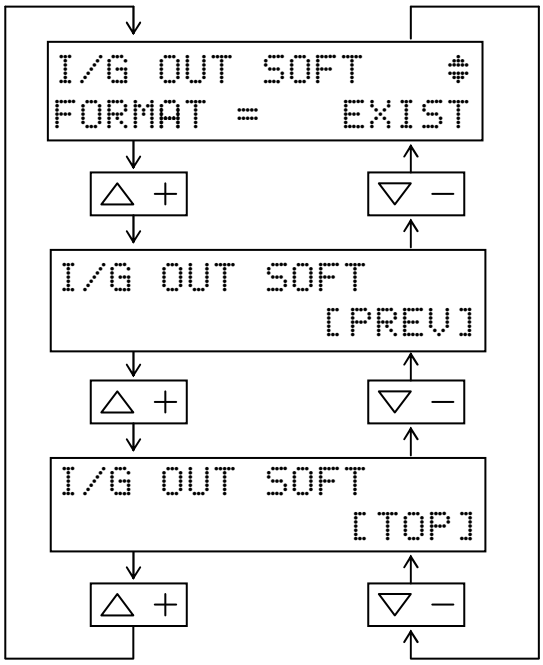
（1）Set the MAINTENANCE 1 ⇕ / I/F SET-UP --> I/F SET-UP ⇕ / SOFTWARE SET --> I/F SOFT SET-UP⇕ / PORT=INS/GPS OUT key.

Then press **ENTER** key.

The data display become under setting mode

```
I/G OUT SOFT    ⇕
FORMAT =    EXIST
```

（2）Press the **△ +** or **▽ −** key to select the setting item.



（3）In case of you change the input data. Back to（1）item , then Press **ENTER** key.
The data display become under setting mode

```
I/G OUT SOFT    ⇕
FORMAT <    EXIST
```

（4）Press the **△ +** or **▽ −** key.　Alter the display　“NONE ⇔ EXIST ⇔ NEW ⇔ NONE”

After selected the setting mode , Press **ENTER** key..

Note）NEW setting is not available. It is not able to access to NEW.

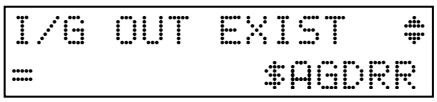
3．4．1　Software setting of the INS/GPS existing output format

（1）Set the

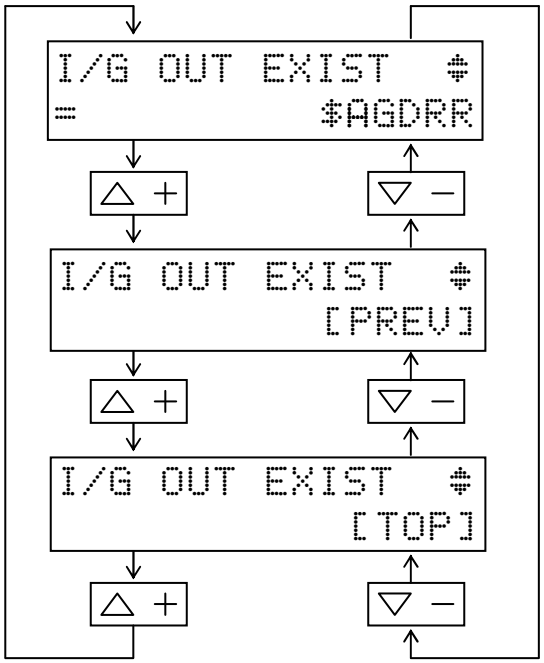
keys.

Then press **ENTER** key.

The data display become under setting mode



（2）Press the **△ +** or **▽ −** key to select the setting item.



（3）In case of you change the format. Back to （1） item , then Press **ENTER** key.
The data display become under setting mode

The part of a....a is displayed setting condition.
Referto the contents to next page.

（4）Press the **△ +** or **▽ −** key.　Alter the display of the existing format.

After selected the setting mode , Press **ENTER** key..

Data	Contents
$AGDRR	12345678901234567890123456789012345678 $AGDRR,axx.x,axx.x,axx.x,aa*hh<CR><LF> 8:Course deviation P=Port , S=Stbd 9..12:Course deviation(deg) 14:Rudder P=Port , S=Stbd 15..18:Rudder (deg) 20:Rate of turn P=Port , S=Stbd 21..24:Rate of turn(deg/min) 26:H=HAND mode , R=R/C , F=N.F. , C=Alter the course(AUTO) , K=Course keeping(AUTO) , O=Override 27:N=NOT NAVI , E=NAVI 29..30:Check sum
$AGHTD(JRC)	JRC ECDIS tracking format or VDR format Send the 3 formats (for TCS-B & C Type approval) ① $ AGHTD format ② $ AGRSA format ③ $ PYDKS format
$AGHTD(Furuno)	FURUNO ECDIS comply with TCS interface format or VDR (for TCS-B Type approval) Send the 2 format ① $ AGHTD format ② $ AGRSA format
$AGHTD & $AGDRR	FURUNO ECDIS comply with Simplify tracking control or VDR Send the following 3 format ① $ AGHTD format ② $ AGRSA format ③ $ AGDRR,axx.x,axx.x,axx.x,aa*hh<CR><LF> (Refer to the above contents for detail information)
$AGHTD(Transas)	TRANSAS ECDIS interface format or VDR (for TCS-C Type approval) ① $AGHTD format ② $AGRSA format ③ $PYDKD,CRA format (for INS)
$AGHTD(Kelvin)	KELVIN HUGHES ECDIS interface format or VDR Send the 2 format ① $ AGHTD format ② $ AGRSA format (It is during developing.)
$AGHTD(Tokimec)	TOKIMEC ECDIS interface format or VDR Send the 2 format ① $ AGHTD format ② $ AGRSA format

3．5　Software setting of LOG input format

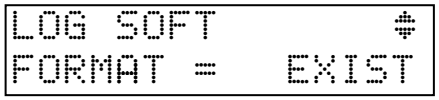
Set the input data of the LOG data

（1）Set the

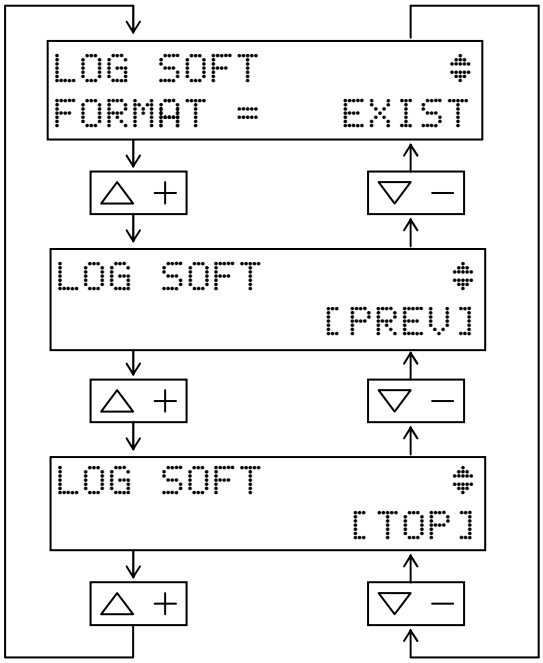
mode.

Then press the **ENTER** key.

Display the current setting item for LOG data on the Data display.

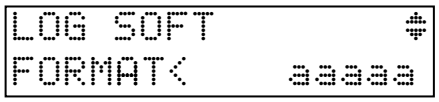


（2）Press the **△ +** or **▽ −** key to select the LOG format. Then press the **ENTER** key.



（3）In case of you change the input data. Back to (1) item, Then press the **ENTER** key.

Data display become under setting mode



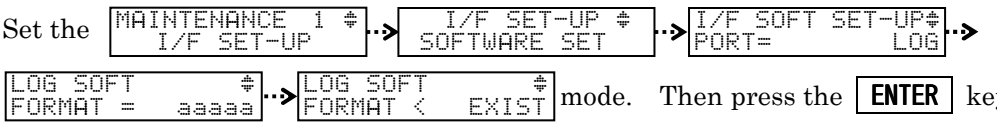
（4）Press the **△ +** or **▽ −** key. After the display, NONE ⇔ EXIST ⇔ NEW ⇔ NONE .

After selected the setting mode, press the **ENTER** key.

If you choose the EXIST or NEW mode, move to the 3.5.1 or 3.5.2 setting item.

3．5．1 Set the existing LOG input format

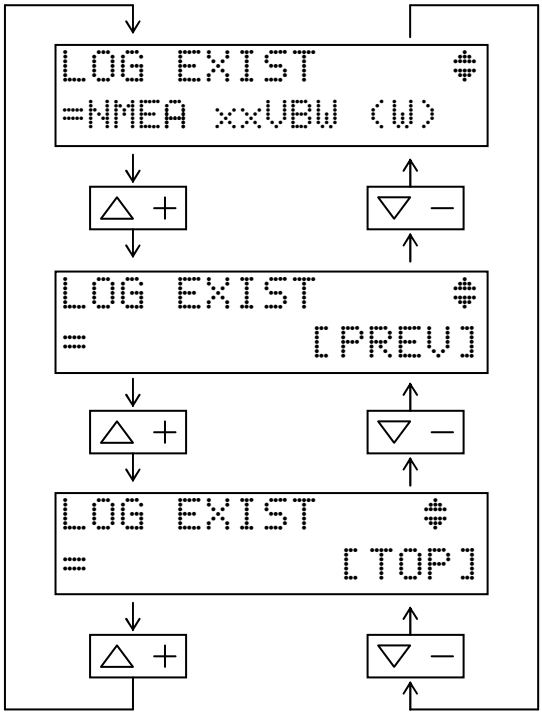
（1） Set the



mode. Then press the **ENTER** key.

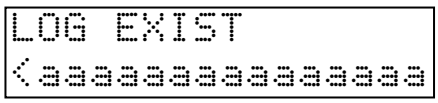
Display the current existing format on the data display.

（2） Press the **△ +** or **▽ −** key to select the existing LOG format.



（3） In case of you change the existing LOG input data. Back to (1) item, Then press the **ENTER** key.

The data display becomes under setting mode



The part of a….a is displayed setting condition.
Refer to the contents to next page.

（4） Press the **△ +** or **▽ −** key. After the display, of the existing format.

After selected the setting mode, press the **ENTER** key.

Selection Data	Contents
NMEA xxVBW(W) (speed through the water : STW)	NMEA0183 $xxVBW (Taker ID “xx” is not checked) Check-sum is required. Fore-Aft STW speed is used. The data valid status is checked.
NMEA xxVHW (speed through the water : STW)	NMEA0183 $xxVHW (Taker ID “xx” is not checked) Check-sum is required. The speed data is used. The status of [kt] is checked.
YOKOGAWA VMVSD (speed through the water : STW)	EML201 format $VMVSD (The name was changed to YOKOGAWA VMVSD.)
NMEA xxVBW(G) (speed over the ground : SOG)	NMEA0183 $xxVBW (Taker ID “xx” is not checked) Check-sum is required. Fore-Aft SOG speed is used. The data valid status is checked.
NMEA xxVTG (speed over the ground : SOG)	NMEA0183 $xxVTG (Taker ID “xx” is not checked) Check-sum is required. The speed data is used. The status of [kt] is checked.

３．５．２ New format setting of the LOG input format

Setting item is as follows;

① Reception Header
② Position of the input field
③ Check sum Valid/Invalid
④ Transmission data output interval

Setting item and way is the same as Gyrocompass software setting
Refer to 3.1.2 Gyrocompass software setting.

Chapter 3　Memory access-FIX (1 bite)

This is the function for changing the contents in the RAM. You can change the contents and address number in the RAM by inputting the HEX code
The data of the display is refreshed every 1 second.

（1）Select the "MAINTENANCE 2 ⇳" mode on the data display. Then press **ENTER** key.
The data display become under setting mode.

```
ADDRESS< 000000
FIX[   ] =
```

←Cursor position is inputting point

（2）Press **Δ +** or **∇ −** key to alter the cursor position. Then change the address by turning the course setting dial .
Turn to the clockwise the course setting dial, data is increased . Turn to the counterclockwise it ,data is decreased. (HEX data is from o to F.)

```
ADDRESS< 012DF5
FIX[   ] =
```

←Data is changed by course setting dial.

（3）Press **ENTER** key. Display the contents of the address

```
ADDRESS= 012DF5
FIX[AA] = AA
```

Flicker the data every 1 second

（4）Press **Δ +** or **∇ −** key to alter the cursor position. Then change the data by turning the course setting dial .
Turn to the clockwise the course setting dial, data is increased . Turn to the counterclockwise it ,data is decreased. (HEX data is from o to F.)

```
ADDRESS= 012DF5
FIX[AA] = 84
```

（5）Press **ENTER** key, data is refreshed .

```
ADDRESS< 012DF5
FIX[84] = 84
```

Note 1) It is not possible to refresh the data except the RAM, Backup RAM,NVRAM.
Note 2) When you change the some contents, it has potential that the program become hang-up
Note 3) You couldn't change the I/O Device data.
Note 4) It is not possible to refresh the data when you pressed the **ENTER** key only.

Chapter 4　Memory Access－ＦＬＸ（4 bite）

This is the function for changing the contents in the RAM. You can change the contents and address number in the RAM by inputting the HEX code

（1）Select the "MAINTENANCE 3 ⇳" mode on the data display. Then press **ENTER** key.
The data display become under setting mode.

```
ADDRESS< 000000
FIX = [          ]
```
←Cursor position is inputting point

（2）Press **△ +** or **▽ －** key to alter the cursor position. Then change the address by turning the course setting dial .
Turn to the clockwise the course setting dial, data is increased . Turn to the counterclockwise it ,data is decreased. (HEX data is from o to F.)

```
ADDRESS< 012DF5
FIX = [          ]
```
←Data is changed by course setting dial.

（3）Press **ENTER** key. Display the contents of the address

```
12DF5=[3E99999A]
FIX <   00000000
```

（4）Press **△ +** or **▽ －** key to alter the cursor position. Then change the data by turning the course setting dial .
Turn to the clockwise the course setting dial, data is increased . Turn to the counterclockwise it ,data is decreased. (HEX data is from o to F.)

```
12DF5=[3E99999A]
FIX <   3E12345E
```

（5）Press **ENTER** key, data is refreshed .

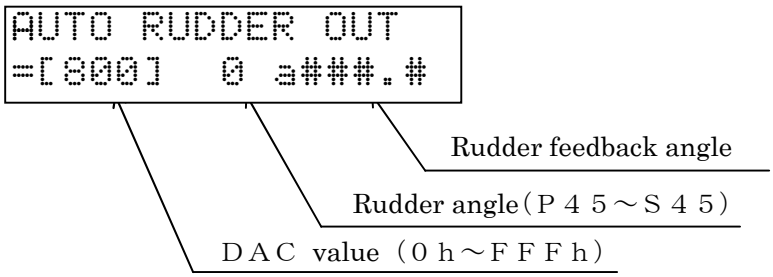
```
ADDRESS< 012DF5
FIX = [          ]
```

Note 1) It is not possible to refresh the data except the RAM, Backup RAM,NVRAM.
Note 2) When you change the some contents, it has potential that the program become hang-up
Note 3) In case of you change the real number value, it is necessary to change the floating point style.
Note 4) It is not possible to refresh the data when you press the only **ENTER** key.

Chapter 5　DAC Output

Output the rudder value based on the DAC and display the Rudder feedback angle value at every 0.5 second. Output value can select the Rudder angle（P 4 5～S 4 5） or DAC value （0～FFF） .
The actual control routine is bypassed under this operation.

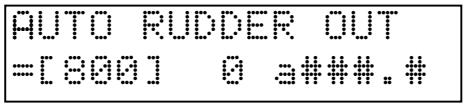
（1） Select the "MAINTENANCE 4 ⇳" mode on the data display. Then press **ENTER** key.
Rudder output become Mid ship position.
The data display become under setting mode.



（2） Press **△ +** or **▽ −** key to alter the cursor position.

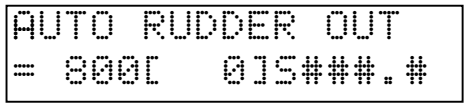
①⇔②⇔③⇔①

①



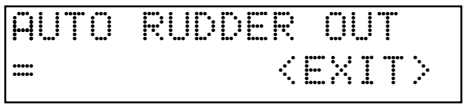
←DAC value input

②

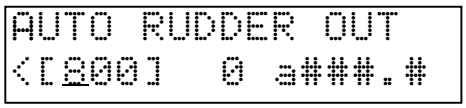


←Rudder value

③

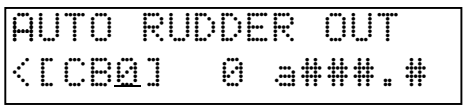


（3） Select the AUTO RUDDER OUT of DAC value input, then press the **ENTER** key.
The data display become under setting mode.



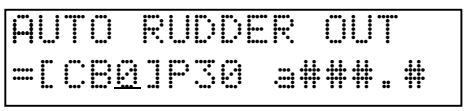
←Cursor position is inputting point

（4） Press **△ +** or **▽ −** key to alter the cursor position. Then change the address by turning the course setting dial .
Turn to the clockwise the course setting dial, data is increased . Turn to the counterclockwise it ,data is decreased. (HEX data is from o to F.)



←Cursor position is inputting point

（5） Press **ENTER** key. Rudder order from the DAC value shall be supplied.



←Cursor position is inputting point

（6）Press [△ +] or [▽ −] key to select the AUTO RUDDER OUT. Then press [ENTER] key.

The data display become under setting mode.

```
AUTO RUDDER OUT
< 800[   0] a###.#
```
←Rudder value

（7）Press [△ +] or [▽ −] key ,the data increase and decrease.

Press [ENTER] key after setting the data. Then auto steering unit outputs the rudder value.

```
AUTO RUDDER OUT
< 418[S25] a###.#
```

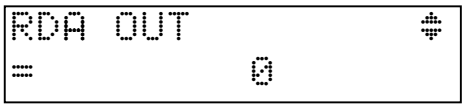
ADC value MSB←→LSB	HEX	Voltage [V]	Rudder Value [°]
1 1 1 1 1 1 1 1 1 1 1 1	0 x F F F		
1 1 1 1 1 1 1 1 1 1 1 0	0 x F F E		
⋮	⋮	⋮	⋮
1 1 1 1 1 1 0 1 0 0 0 0	0 x F D 0	+5.0	S 50.0
⋮	⋮	⋮	⋮
1 0 0 0 0 0 0 0 0 0 0 1	0 x 8 0 1	+0.0025	S 0.025
1 0 0 0 0 0 0 0 0 0 0 0	0 x 8 0 0	0.0	0.0
0 1 1 1 1 1 1 1 1 1 1 1	0 x 7 F F	-0.0025	P 0.025
⋮	⋮	⋮	⋮
0 0 0 0 0 0 1 1 0 0 0 0	0 x 0 3 0	-5.0	P 50.0
⋮	⋮	⋮	⋮
0 0 0 0 0 0 0 0 0 0 0 1	0 x 0 0 1		
0 0 0 0 0 0 0 0 0 0 0 0	0 x 0 0 0		

Chapter 6　Actual rudder angle output

Output the DAC value based on rudder order
The actual control routine is bypassed under this operation.

（1）Select the "MAINTENANCE 5 ⇳" mode on the data display. Then press **ENTER** key.

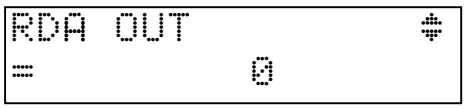
①



（2）Press **△ +** or **▽ −** key to alter the item

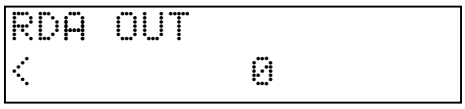
①⇔②⇔①

①



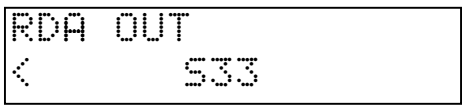
②

（3）Select the RDA OUT , then press **ENTER** key.
The data display become under setting mode.



（4）Press **△ +** or **▽ −** key ,the data increase and decrease.

Press **ENTER** key after setting the rudder value.
Then auto steering unit outputs the DAC value.

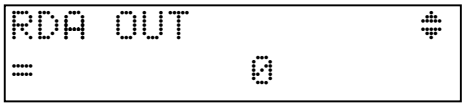


Chapter 7 Course deviation output

Output the DAC value based on course deviation value
The actual control routine is bypassed under this operation.

（1）Select the "MAINTENANCE 6 ⇳" mode on the data display. Then press **ENTER** key.

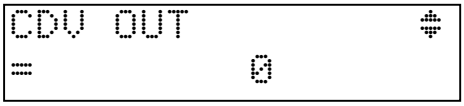
①



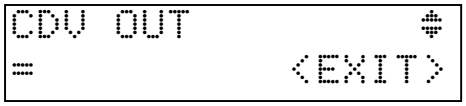
（2）Press **△ +** or **▽ −** key to alter the item

①⇔②⇔①

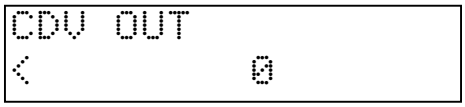
①



②



（3）Select the CDV OUT , then press **ENTER** key.
The data display become under setting mode.



（4） Press **△ +** or **▽ −** key ,the data increase and decrease.

Press **ENTER** key after setting the course deviation value.

Then auto steering unit outputs the DAC value.

Chapter 8　Display of the analogue input

Display the ADC value of the each analogue input
ADC value is refreshed every 0.5 second .

（1））Select the "MAINTENANCE 7 ⇳" mode on the data display. Then press **ENTER** key.

①

```
ADC POINT DISP ⇳
POINT:A-1=   ####
```

←ADCValue

（2）Press **△ +** or **▽ −** key to alter the item
①↔②↔③↔④↔⑤↔⑥↔⑦↔⑧↔①

①

```
ADC POINT DISP ⇳
POINT:A-1=   ####
```

②

```
ADC POINT DISP ⇳
POINT:A-2=   ####
```

⇕

⑧

```
ADC POINT DISP ⇳
POINT:A-8=   ####
```

（3）Point number

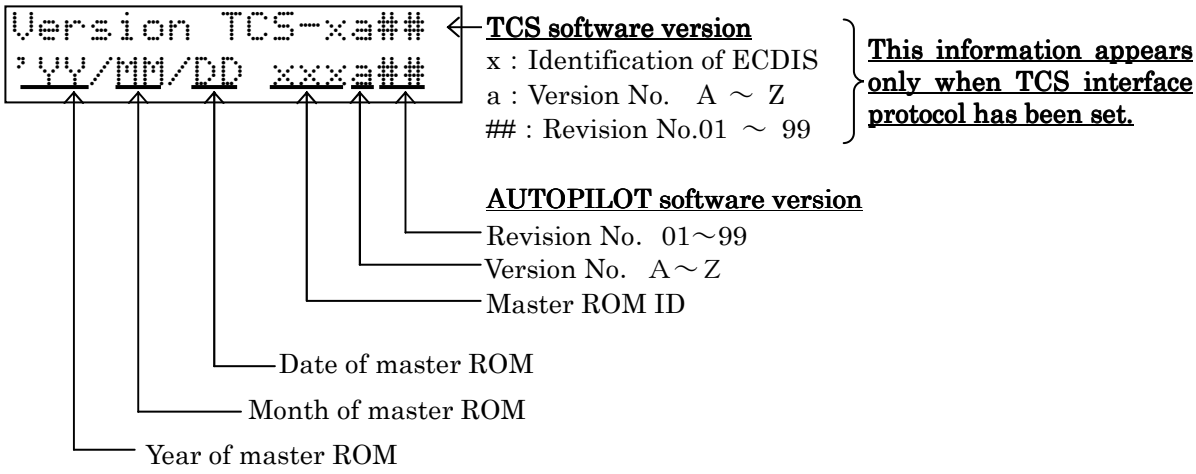
A－1 : No. 1 Rudder feedback angle
A－2 : No. 1 Rudder order value
A－3 : No. 2 Rudder feedback value
A－4 : No. 2 Rudder order value
A－5 : No. 3 Rudder feedback value
A－6 : No. 3 Rudder order value
A－7 : No. 4 Rudder feedback value
A－8 : No. 4 Rudder order value

（Note） ADC value is 0.10/deg = 40

Chapter 9　Program version number

Display the current program version number

（1）Select the "MAINTENANCE 8 ⇳" mode on the data display. Then press **ENTER** key.



Identification of ECDIS	Contents
0	Tracking interface with other maker's ECDIS
1	TCS IF for JRC ECDIS
2	TCS IF for FURUNO ECDIS
3	Interface with MITSUMISHI Super Bridge
4	TCS IF for TRANSAS ECDIS
5	Interface with Kelvin Huge ECDIS
6	Interface with TOKIMEC ECDIS

Example of indication

Auto steering unit	ID, Version and Revision of Autopilot	ID, Version and Revision of TCS	Application
PB343	CR155J23	TCS-1A01	For JRC TCS IF
PB343	CR155K10	TCS-2A01	For FURUNO TCS IF
PB343	CR155K10	TCS-4A01	For TRANSAS TCS IF

（2）Press **ENTER** key.　Back to the maintenance item mode.

Chapter 10　Program cold start

Program cold start means the reset function of RAM area.

（1）Press the **ENTER** key after displayed "MAINTENANCE 9 $"on the data display.
Data display become resetting item of RAM area.

（2）Change the setting mode by using the **△ +** or **▽ −** Keys.

①⇔②⇔③⇔④⇔⑤⇔⑥⇔⑦⇔①

① PROG.COLD START$ / PARAM.SW=UNINIT.　Ship's parameter（NVRAM）

② PROG.COLD START$ / D-PARAM = INIT.　Ship's Parameter of each draft mode（NVRAM）

③ PROG.COLD START$ / KEY SET = INIT.　Key input value（Back up RAM）

④ PROG.COLD START$ / I/Fsetup= INIT.　I/F set up data（Back up RAM）

⑤ PROG.COLD START$ / ERR.LOG = INIT.　Error log （Back up RAM）

⑥ PROG.COLD START$ / <C-START:[ENTER]　Start the cold start mode

⑦ PROG.COLD START$ / <EXIT>

（3）If you want to reset some data in RAM.　Press **ENTER** key after selected the reset item.

（4）Press the **△ +** or **▽ −** key.　Alter the display INIT. ⇔ UNINTIT. ⇔ INIT

Press **ENTER** key after selected the setting mode ,..

（5）In case of you do the cold start　Press **ENTER** key after selected the item ⑥.

Chapter 11 Input and Calculate the ship's parameter (PT500A)

Input the following item for calculating the ship's parameter

① Kind of vessels
② Length between perpendiculars (LPP)
③ Molded breadth (B-mld)
④ Designed full load draft (D-Full load)
⑤ Designed full load displacement (Full load displacement)
⑥ Block coefficient (Cb)
⑦ Area pf rudder (Ar)
⑧ Navigation speed (VS)
⑨ Ship's maneuverability (T,K)
⑩ Display of the ship's maneuverability

1. Select the ship's parameter

(1) Press the **ENTER** key after displayed "MAINTENANCE 10 ⇳"on the data display.
The data display is displayed ship's parameter mode.

(2) Press **△ +** or **▽ −** key to change the item.

①⇔②⇔③⇔④⇔⑤⇔⑥⇔⑦⇔⑧⇔⑨⇔⑩⇔①

① SHIP PARA. CALC⇳
SHIP'S Type= #

② SHIP PARA. CALC⇳
LPP= ###.##

③ SHIP PARA. CALC⇳
B-mld= ##.##

④ SHIP PARA. CALC⇳
D-Full= ##.##

⑤ SHIP PARA. CALC⇳
Full Disp=######

⑥ SHIP PARA. CALC⇳
Cb= #.####

⑦ SHIP PARA. CALC⇳
Rud-Area=###.##

⑧ SHIP PARA. CALC⇳
Speed= ##.#

⑨ SHIP PARA. CALC⇳
CALCULATION

⑩ SHIP PARA. CALC⇳
CALC PARA. DISP

⑪ SHIP PARA. CALC⇳
<EXIT>

Press **ENTER** key after selected the item. The function of the item become valid mode .

1．1 Kind of ship

Set the kind of the ship

（1）Press **ENTER** key when it is displayed the "SHIP'S Type=" on the data display.

Data display become under setting mode.

```
SHIP PARA. CALC
SHIP'S Type<  #
```

is kind of the ship

（2）Press the **△ +** or **▽ −** key to select the Setting No. . Then press **ENTER** key.

Kind of the ship

Kind of the ship		Setting No.
PASSENGER SHIP	PASSENGER SHIP CARGO PASSENGER SHIP PASSENGER CAR FERRY CRUSING SHIP	1
GENERAL CARGO SHIP	LINER TRAMPER MULTI-PURPOSE CARGO SHIP : MPC	1
UNIT LOAD CARRIER	CONTAINER CARRIER BARGE CARRIER	1
BULK CARRIER	BULK CARRIER ORE CARRIER COAL CARRIER	2
COMBINATION CARRIER	ORE/OIL CARRIER : O/0 ORE/BULK/OIL CARRIER : O/B/O	2
SPECIAL CARGO SHIP	LUMBER CARRIER,TIMBER CARRIER CHIP CARRIER HEAVY LIFTER PEFRIGERATED CARGO SHIP PURE CAR CARRIER :PCC CAR BULK CARRIER	1
TANKER	CRUDE OIL CARRIER ＶＬＣＣ(VERY LARGECRUDE OIL CARRIER ＵＬＣＣ(ULTRA LARGECRUDE OIL CARRIER) PRODUCTS CARRIER	2
SPECIAL TANKER	ＬＰＧ(LIQUEFIED PETROLEUM GAS CARRIER) ＬＮＧ(LIQUEFIED NATURAL GAS CARRIER) CHEMICAL TANKER	1

1．2 Input the Length between perpendiculars（ＬＰＰ）

Refer to fig.1 for LPP

（1）When you are displayed "LPP= ###.##" on the data display ,then press **ENTER** key. The data display become under setting mode.

```
SHIP PARA. CALC
LPP<       ###.##
```

←Cursor position is inputting point

（2）Press **Δ +** or **∇ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction , data is increased and turn to the counter clockwise direction ,data is decreased. (Data is 0 to 9 Numerical value)

```
SHIP PARA. CALC
LPP<       123.45
```

（3）After input the LPP data , then press **ENTER** key.

1．3 Input the Molded breadth（Ｂ－ｍｌｄ）

Refer to fig.1 for B-mld.

（1）When you are displayed "B-mld= ##.## " on the data display ,then press **ENTER** key. The data display become under setting mode.

```
SHIP PARA. CALC
B-mld<     ##.##
```

←Cursor position is inputting point

（2）Press **Δ +** or **∇ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction , data is increased and turn to the counter clockwise direction ,data is decreased. (Data is 0 to 9 Numerical value)

```
SHIP PARA. CALC
B-mld<     65.65
```

（3）After input the B-mld data , then press **ENTER** key.

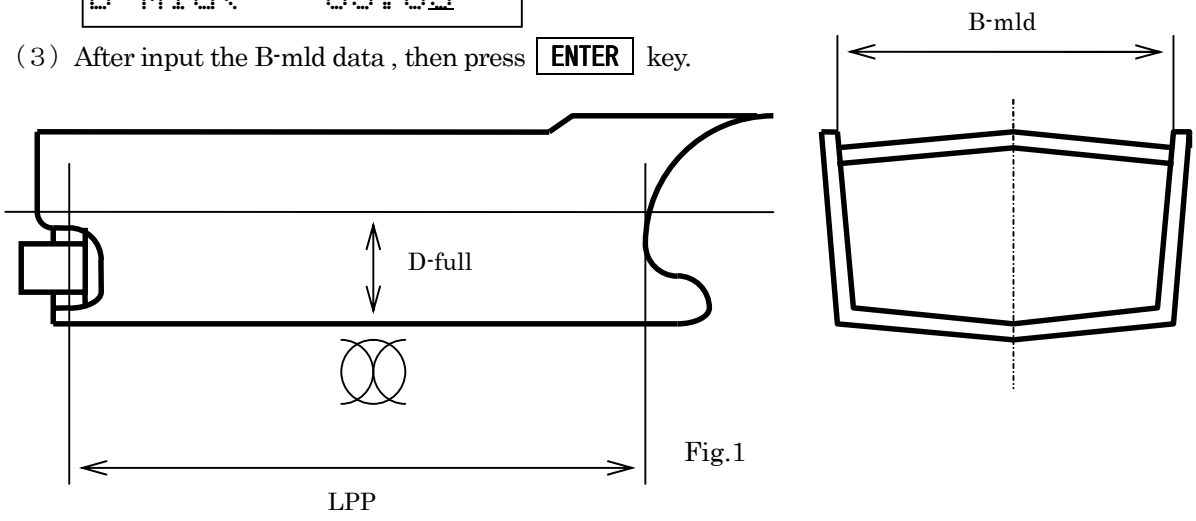


Fig.1

1．4　Input the Designed full load draft (D-Full load)

Refer to fig2. for D-Full load

（1）When you are displayed "D-Full= ##.## "on the data display ,then press **ENTER** key. The data display become under setting mode.

```
SHIP PARA. CALC
D-Full<   ##.##
```

←Cursor position is inputting point

（2）Press **△ +** or **▽ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction , data is increased and turn to the counter clockwise direction ,data is decreased. (Data is 0 to 9 Numerical value)

```
SHIP PARA. CALC
D-Full<   02.33
```

（3）After input the D-Full data , then press **ENTER** key.

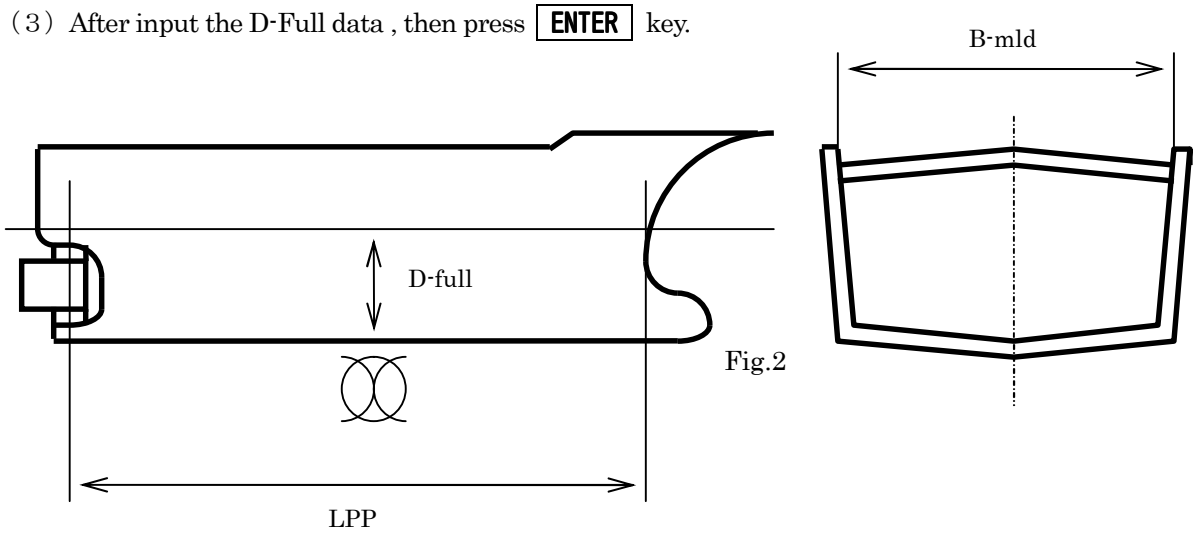


Fig.2

1．5　Input the Designed full load displacement (Full load displacement)（Full Disp.）

（1）When you are displayed "Full Disp=###### on the data display ,then press **ENTER** key. The data display become under setting mode.

```
SHIP PARA. CALC
Full Disp<######
```

←Cursor position is inputting point

（2）Press **△ +** or **▽ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction , data is increased and turn to the counter clockwise direction ,data is decreased. (Data is 0 to 9 Numerical value)

```
SHIP PARA. CALC
Full Disp<001700
```

（3）After input the Full Disp data , then press **ENTER** key.

1．6　Input the Block coefficient (Cb)

Block coefficient means ship's shape is whether slim or not.
For example

- Ferry ,container ship : 0.50 ～ 0.60
- Bulk carrier, Tanker : 0.65～0.75
- VLCC, Large Bulk carrier : 0.78～0.85

（1）When you are displayed "Cb=　　X.XXXX" on the data display ,then press **ENTER** key.
The data display become under setting mode.

```
SHIP PARA. CALC
Cb<          #.####
```

←Cursor position is inputting point

（2）Press **Δ +** or **▽ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction , data is increased and turn to the counter clockwise direction ,data is decreased. (Data is 0 to 9 Numerical value)

```
SHIP PARA. CALC
Cb<          0.5400
```

（3）After input the Cb data , then press **ENTER** key.

1．7　Input the Area pf rudder (Ar)

Unit of the area is ㎡

（1）When you are displayed "Rud-Area=XXX.XX" on the data display ,then press **ENTER** key.
The data display become under setting mode.

```
SHIP PARA. CALC
Rud-Area<###.##
```

←Cursor position is inputting point

（2）Press **Δ +** or **▽ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction , data is increased and turn to the counter clockwise direction ,data is decreased. (Data is 0 to 9 Numerical value)

```
SHIP PARA. CALC
Rud-Area<053.00
```

（3）After input the Ar data , then press **ENTER** key.

1．8 Input the Navigation speed (V S)

（1）When you are displayed "Speed= ##.#" on the data display ,then press **ENTER** key. The data display become under setting mode.

```
SHIP PARA. CALC
Speed<    ##.#
```
←Cursor position is inputting point

（2）Press **△ +** or **▽ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction , data is increased and turn to the counter clockwise direction ,data is decreased. (Data is 0 to 9 Numerical value)

```
SHIP PARA. CALC
Speed<    24.3
```

（3）After input the VS data , then press **ENTER** key.

1．9 Ship's maneuverability (T,K)

（1）When you are displayed "CALCULATION "on the data display ,then press **ENTER** key. Start the calculation of ship's maneuverability.

（2）The data display become under mode.

```
SHIP PARA. CALC
CALCULATION OK!!
```

（3）Press **ENTER** key. Then go to Display of the ship's maneuverability

2. Display of the ship's maneuverability

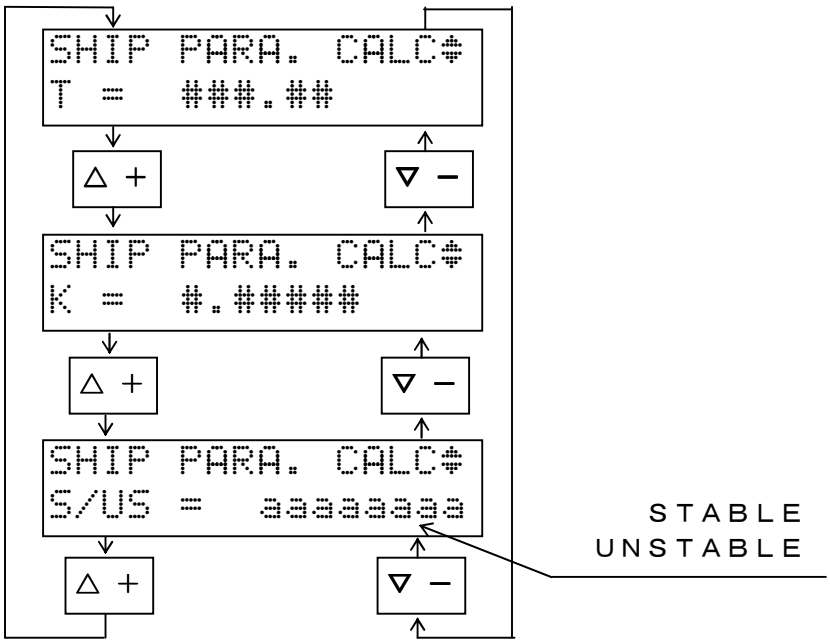
Item of the ship's maneuverability is as follows.

① Time constant（T）
② Gain constant（K）
③ Stable／Unstable（S／US）

（1）When you are displayed "CALC PARA. DISP" on the data display ,then press **ENTER** key. The data display become under mode..

```
SHIP PARA. CALC$
T =   ###.##
```

（2）Press **△ +** or **▽ −** key to show the each data..



（3）Press **ENTER** key. Back to the ship's parameter input mode.

Chapter 12　Display of result of identification　（P T 5 0 0 A）

Ship's dynamic characteristics which are calculated by maneuvering on adjust mode 8 can be displayed on this function.

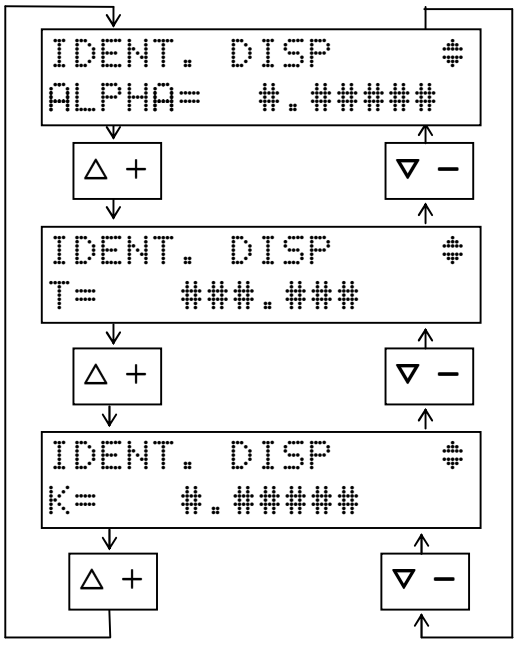
Display item is as follows.

① Non linear component（A L P H A）
② Ship's time constant（T）
③ Ship's gain constant（K）

（1）Press the **ENTER** key after displayed "MAINTENANCE 11 ⇳"on the data display.
Data display become ALPHA.

```
IDENT. DISP      ⇳
ALPHA=   #.#####
```

（2）Change the setting mode by using the **△ +** or **▽ −** Keys.



（3）Press **ENTER** key.　Back to the top menu.

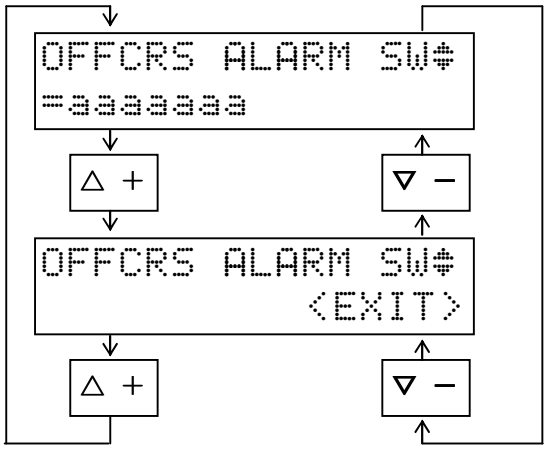
Chapter 13　Off course alarm SW

Select the valid or invalid of Off course alarm function.

（1） Press the **ENTER** key after displayed "MAINTENANCE 12$"(PT500A) or "MAINTENANCE 10 $ "(PT500D･SUBAUTO) on the data display.
Data display becomes current setting mode.

```
OFFCRS ALARM SW$
=aaaaaaa
```
←Current setting value

（2）Change the setting mode by using the **△ +** or **▽ −** Keys.



（3）If you want to change the setting data of Off course alarm, Press **ENTER** key at when the display is (1).
Data display become under setting mode.

```
OFFCRS ALARM SW
<aaaaaaa
```
←Current setting value

a....a means setting item
U S E ：Off course alarm valid
N O T　U S E ：Off course alarm invalid

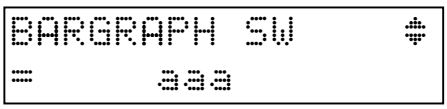
（3）Press **△ +** or **▽ −** key to alter the item USE ⇔ NOT USE ⇔ USE

Press **ENTER** key to set the USE or NOT USE..

Chapter 14　Bar-graph SW

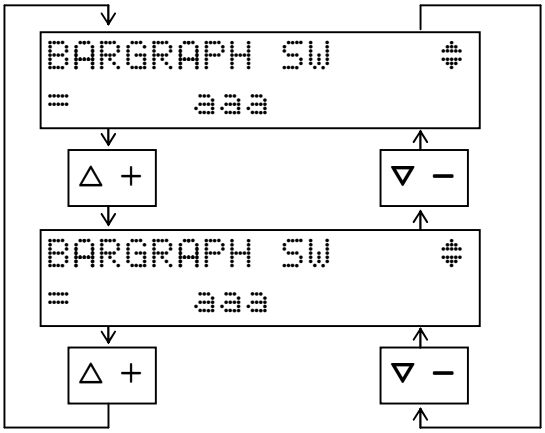
Select the valid or invalid of each display item (Rudder, Rate of turn, Course deviation) on the Bar-graph

（1） Press the **ENTER** key after displayed "MAINTENANCE 13⇳"(PT500A) or "MAINTENANCE 11 ⇳ "(PT500D･SUBAUTO) on the data display.
Data display becomes current setting mode.

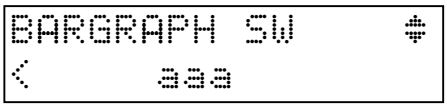


←Current setting item

（2）Change the setting mode by using the **△ +** or **▽ −** Keys.



（3）If you want to change the setting data of Off course alarm, Press **ENTER** key at when the display is (1).
Data display become under setting mode.



←Current setting item

a....a means setting item
ON : Bar-graph valid
OFF : Bar-graph invalid

（3）Press **△ +** or **▽ −** key to alter the item ON ⇔ OFF ⇔ ON

Press **ENTER** key to set the ON or OFF.

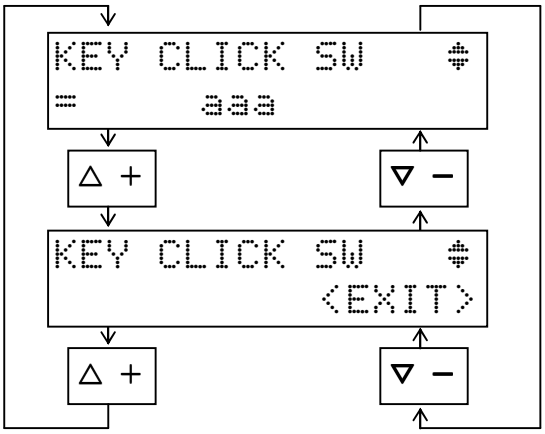
Chapter 15　Beep of the key operation SW

Select the valid or invalid for beep of the key operation.

（1） Press the **ENTER** key after displayed "MAINTENANCE 14⇕"(PT500A) or "MAINTENANCE 12 ⇕ "(PT500D･SUBAUTO) on the data display.
Data display become current setting mode.

←Current setting item

（2）Change the setting mode by using the **△ +** or **▽ −** Keys.



（3）If you want to change the setting data of beep of the key operation, Press **ENTER** key at when the display is (1).
Data display become under setting mode.

←Current setting item

a....a means setting item
ON : Beep of the key operation valid
OFF : Beep of the key operation invalid

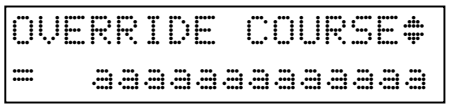
（3）Press **△ +** or **▽ −** key to alter the item ON ⇔ OFF ⇔ ON

Press **ENTER** key to set the ON or OFF.

Chapter 16　Select the course after auto override steering

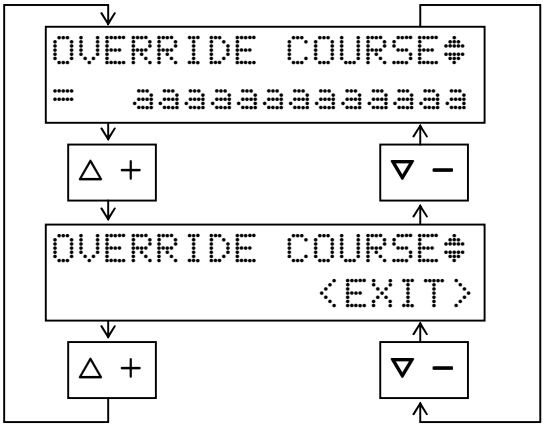
In this function, course for auto steering after override steering can be selected either compass Heading value at that time or set course value on set course display.

（1） Press the **ENTER** key after displayed "MAINTENANCE 15$"(PT500A) or "MAINTENANCE 13 $ "(PT500D･SUBAUTO) on the data display.
Data display become current setting mode.



←Current setting item

（2）Change the setting mode by using the **△ +** or **▽ −** Keys.



（3）If you want to change the selection of course after override steering , Press **ENTER** key at when the display is (1).
Data display become under setting mode.

←Current setting item

a....a means setting item
COMP. HEADING : Set the compass heading as the course
SET COURSE : Set the set course value as the course

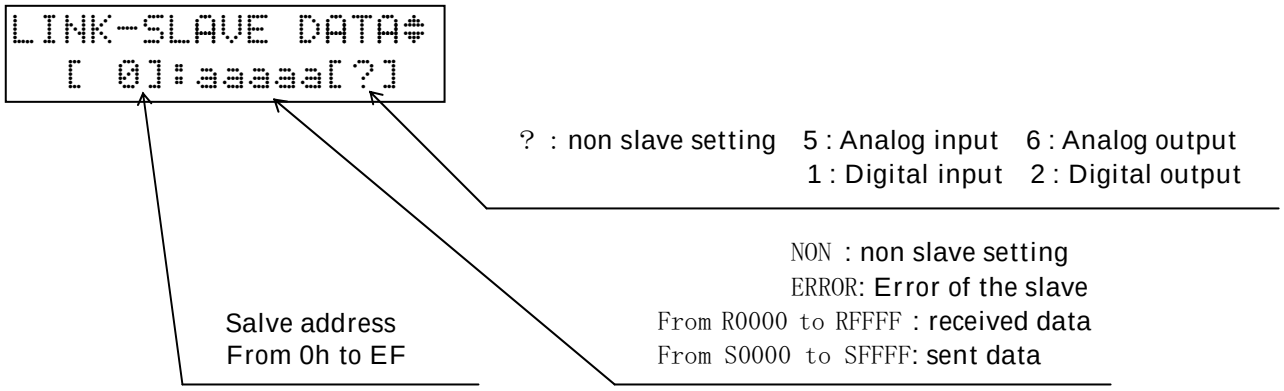
（3）Press **△ +** or **▽ −** key to alter the item COMP. HEADING⇔SET COURSE⇔ COMP. HEADING

Press **ENTER** key to set the COMP HEADING or SET COURSE.

Chapter 17　Display analog voltage value

Monitor the input/output data of the slave data. Data is refreshed every 0.5 second.

（1）Press the **ENTER** key after displayed "MAINTENANCE 16⇕"(PT500A) or "MAINTENANCE 14⇕"(PT500D･SUBAUTO) on the data display.
Data display is indicated the slave address 000.



（2）Press **△ +** or **▽ −** key to alter the slave address for changing the display item

（3）Press **ENTER** key ,return to the top menu of the maintenance mode.

Chapter18　Option setting mode

Set the option function

（1）Press the **ENTER** key after displayed "MAINTENANCE 17⇳"(PT500A) or "MAINTENANCE 15 ⇳ "(PT500D･SUBAUTO) on the data display.

（2）Change the option setting mode by pressing the **ENTER** key.

```
Option Set    1 ⇳
Servo Loop Err.
```

（3）Change the setting mode by using the **△ +** or **▽ −** Keys.

PT500A：

①⇔②⇔③⇔④⇔⑤⇔⑥⇔⑦⇔⑧⇔①

①
```
Option Set    1 ⇳
Servo Loop Err.
```

②
```
Option Set    2 ⇳
CMZ EXT. Ave.
```

③
```
Option Set    3 ⇳
Wide Angle Mode
```

④
```
Option Set    4 ⇳
Heading Monitor
```

⑤
```
Option Set    5 ⇳
Rud. Erroneous
```

⑥
```
Option Set    6 ⇳
HDG. Erroneous
```

⑦
```
Option Set    7 ⇳
Speed Status
```

⑧
```
Option Set    8 ⇳
             <Exit>
```

PT500D・SUBAUTO：

①⇔②⇔③⇔④⇔⑤⇔⑥⇔⑦⇔⑧⇔⑨⇔①

①
```
Option Set    1 ⇳
Servo Loop Err.
```

②
```
Option Set    2 ⇳
CMZ EXT. Ave.
```

③
```
Option Set    3 ⇳
Wide Angle Mode
```

④
```
Option Set    4 ⇳
Low Speed Gain
```

⑤
```
Option Set    5 ⇳
Heading Monitor
```

⑥
```
Option Set    6 ⇳
Rud. Erroneous
```

⑦
```
Option Set    7 ⇳
HDG. Erroneous
```

⑧
```
Option Set    8 ⇳
Speed Status
```

⑨
```
Option Set    9 ⇳
             <Exit>
```

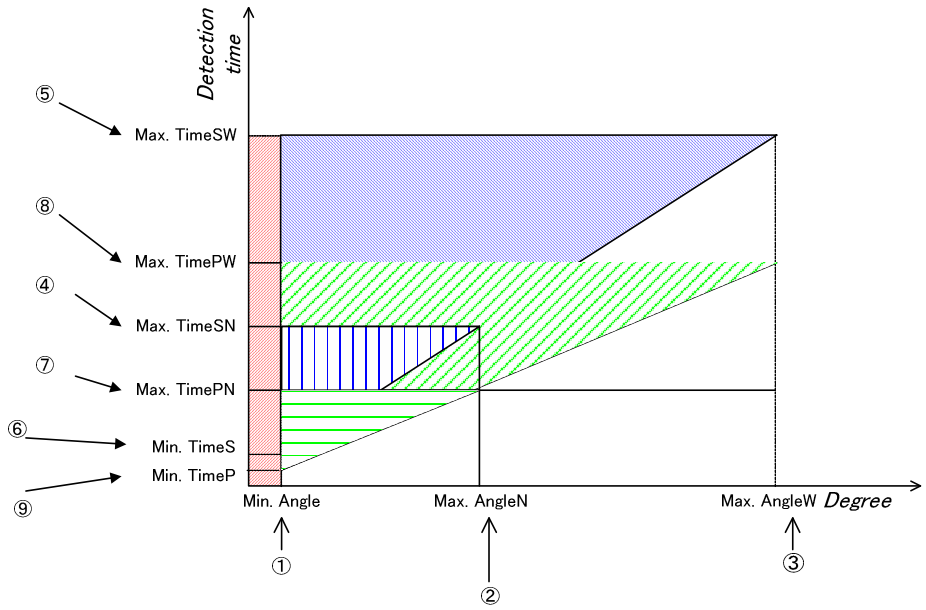
Press **ENTER** key. Return to the top menu .

Maintenance 17 : Option setting

Chapter 19　Alarm threshold of servo loop failure

Set the alarm threshold. of the Servo loop failure for corresponding the rudder angle

① Min. rudder angle for alarm detection of the variation angle (Min.Angle)
② Max. rudder angle for alarm detection of the variation angle (Max. Angle N)
(For normal rudder angle:P/S Max.rudder order from 35 to 45degrees.)
③ Max. rudder angle for alarm detection of the variation angle (Max. Angle W)
(For wide rudder angle: P/S Max. rudder order from70 to 210 degrees)
④ Max. time for alarm detection during one steering gear pump operation(Max.Time SN)
(For normal rudder angle:P/S Max.rudder order from 35 to 45degrees.)
⑤ Max. time for alarm detection during one steering gear pump operation(Max.TimeSW)
(For wide rudder angle: P/S Max. rudder order from70 to 210 degrees)
⑥ Min. time for alarm detection during one steering gear pump operation. (Min. Time S)
⑦ Max. time for alarm detection during parallel steering gear pump operation(Max.Time PN)
(For normal rudder angle:P/S Max.rudder order from 35 to 45degrees.)
⑧ Max. time for alarm detection during parallel steering gear pump operation(Max.Time PW)
(For wide rudder angle: P/S Max. rudder order from70 to 210 degrees)
⑨ Min. time for alarm detection during parallel steering gear pump operation. (Min. Time P)



S W : Single pump operation and Wide rudder angle
P W : Parallel pump operation and Wide rudder angle
S N : Single pump operation and Normal rudder angle
P N : Parallel pump operation and Normal rudder angle
S : Single pump operation
P : Parallel pump operation
N : Normal rudder angle
W : Wide rudder angle

1. Change the item.

（1） Press the **ENTER** key after displayed "Option Set 1⇕" on the data display.
Data display becomes setting mode of Servo loop failure alarm.

（2） Change the setting mode by using the **△ +** or **▽ −** Key
①⇔②⇔③⇔④⇔⑤⇔⑥⇔⑦⇔⑧⇔⑨⇔⑩⇔①

① Servo Loop Err.⇕
Min.Angle= # #°

② Servo Loop Err.⇕
Max.AngleN= # #°

③ Servo Loop Err.⇕
Max.AngleW= ###°

④ Servo Loop Err.⇕
Max.TimeSN= ##s

⑤ Servo Loop Err.⇕
Max.TimeSW= ###s

⑥ Servo Loop Err.⇕
Min.TimeS= ##s

⑦ Servo Loop Err.⇕
Max.TimePW= ##s

⑧ Servo Loop Err.⇕
Max.Time PW= ###s

⑨ Servo Loop Err.⇕
Min.TimeP= ##s

⑩ Servo Loop Err.⇕
<EXIT>

Press **ENTER** key to select the setting item.

2. Change the Min. rudder angle for alarm detection of the variation angle
Set the Min. rudder angle for alarm detection of the variation angle

（1） Press the **ENTER** key after displayed "Min.Angle= # #°" on the data display.
Data display become under setting mode.

Servo Loop Err.
Min.Angle< ##°

Setting range: from 2 to 10
(Initial value is set 5 degrees)

（2） Press **△ +** or **▽ −** key to alter the Min. rudder angle for alarm detection of the variation angle.

Press **ENTER** key to set the Min. rudder angle..

3． Change the Max. rudder angle for alarm detection of the variation angle
(For normal rudder angle:P/S Max.rudder order from 35 to 45degrees.)

（1） Press the **ENTER** key after displayed "Max.AngleN= # #°" on the data display.
Data display become under setting mode.

Servo Loop Err.
Max.AngleN< ##°

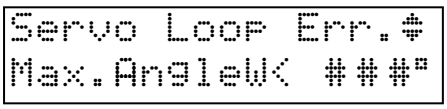
Setting range: from 70 to 90
(Initial value is set 70 degrees)

（2） Press **△ +** or **▽ −** key to alter the Max. rudder angle for alarm detection of the variation

angle.
Press **ENTER** key to set the Max. rudder angle.

4. Change the Max. rudder angle for alarm detection of the variation angle
(For wide rudder angle: P/S Max. rudder order from70 to 210 degrees)

(1) Press the **ENTER** key after displayed "Max.AngleW= # #° "on the data display.
Data display become under setting mode.



Setting range: from 70 to 210
(Initial value is set 70 degrees)

(2) Press **△ +** or **▽ −** key to alter the Max. rudder angle for alarm detection of the variation angle.

Press **ENTER** key to set the Max. rudder angle.

5. Change the Max. time for alarm detection during one steering gear pump operation
(For normal rudder angle:P/S Max.rudder order from 35 to 45degrees.)

(1) Press the **ENTER** key after displayed "Max.TimeSN= ##s" on the data display.

Data display become under setting mode.

Setting range: from 15 to 70
(Initial value is set 30 seconds)

(2) Press **△ +** or **▽ −** key to alter the Max. time for alarm detection during one steering gear pump angle.

Press **ENTER** key to set the Max. time for alarm detection.

6. Change the Max. time for alarm detection during one steering gear pump operation
(For wide rudder angle: P/S Max. rudder order from70 to 210 degrees)

(1) Press the **ENTER** key after displayed "Max.TimeSW= ###s" on the data display.

Data display become under setting mode.

Setting range: from 15 to 160
(Initial value is set 30 seconds)

(2) Press **△ +** or **▽ −** key to alter the Max. time for alarm detection during one steering gear pump operation.

Press **ENTER** key to set the Max. time for alarm detection.

7. Change the Min. time for alarm detection during one steering gear pump operation

(1) Press the **ENTER** key after displayed "Min.TimeS= ##s" on the data display.

Data display become under setting mode.

Setting range: from 3 to 12
(Initial value is set 7 seconds)

(2) Press **△ +** or **▽ −** key to alter the Min. time for alarm detection during one steering gear pump operation.

Press **ENTER** key to set the Min time for alarm detection.

8. Change the Max. time for alarm detection during parallel steering gear pump operation
(For normal rudder angle:P/S Max.rudder order from 35 to 45degrees.)

(1) Press the **ENTER** key after displayed "Max.TimePN= ##s" on the data display.

Data display become under setting mode.

Setting range: from 15 to 70
(Initial value is set 15 seconds)

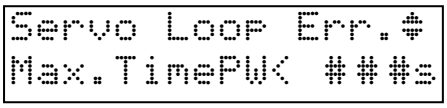
(2) Press **△ +** or **▽ −** key to alter the Max. time for alarm detection during parallel steering gear pump operation

Press **ENTER** key to set the Max time for alarm detection.

9. Change the Max. time for alarm detection during pararelle steering gear pump operation
(For wide rudder angle: P/S Max. rudder order from70 to 210 degrees)

(1) Press the **ENTER** key after displayed "Max.TimePW= ###s" on the data display.

Data display become under setting mode.



Setting range: from 15 to 160
(Initial value is set 15 seconds)

(2) Press **△ +** or **▽ −** key to alter the Max. time for alarm detection during pararelle steering gear pump operation

Press **ENTER** key to set the Max time for alarm detection.

10. Change the Min. time for alarm detection during parallel steering gear pump operation

(1) Press the **ENTER** key after displayed "Min.TimeP= ##s" on the data display.

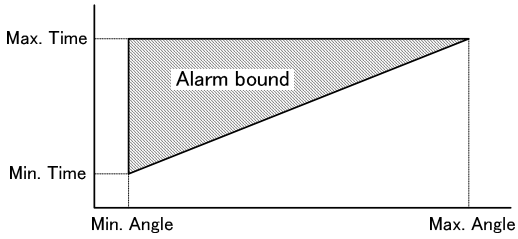
Data display become under setting mode.

Setting range: from 3 to 12
(Initial value is set 4 seconds)

(2) Press **△ +** or **▽ −** key to alter the Min.time for alarm detection during parallel steering gear pump operation

Press **ENTER** key to set the Max time for alarm detection.

The setting of Servo Loop Err. can be adapted individually according to SINGLE or PARALLEL operation of the steering gear pumps.



SETTING VALUE FOR SERVO LOOP FAILURE

ITEM	STATE OF S/G PUMP OPERATION		Setting range
	SINGLE	PARALLEL	
Min. Angle	5 degrees		2° ~5°
Max. Angle	Maximum rudder angle × 2		70° ~160°
Min. Time	7 s	6 s	3s~12s
Max. Time	30 s	22 s	15s~160s
	In case that Max. angle is 70 degrees.		

The recommendation setting according to WIDE ANGLE MODE

<NORMAL-1 MODE> ±35° to ±40°

	SINGLE	PARALLEL	Setting range
Min. Angle	5°	5°	2° ~ 10°
Max. AngleN	70°	70°	70° ~ 90°
Max. AngleW			70° ~ 160°
Max. TimeSN	30s		15s ~ 160s
Max. TimeSW			
Min. TimeS	7s		3s ~ 12s
Max. TimePN		22s	7s ~ 80s
Max. TimePW			
Min. TimeP		6s	3s ~ 12s

<NORMAL-2 MODE> ±45°

	SINGLE	PARALLEL	Setting range
Min. Angle	5°	5°	2° ~ 10°
Max. AngleN	90°	90°	70° ~ 90°
Max. AngleW			70° ~ 160°
Max. TimeSN	38s		15s ~ 160s
Max. TimeSW			
Min. TimeS	7s		3s ~ 12s
Max. TimePN		25s	7s ~ 80s
Max. TimePW			
Min. TimeP		6s	3s ~ 12s

<NORMAL-3 MODE>±35° ／±45°

	NORMAL ANGLE MODE		WIDE ANGLE MODE		Setting range
	SINGLE	PARALLEL	SINGLE	PARALLEL	
Min. Angle	5°	5°	5°	5°	2° ~ 10°
Max. AngleN	70°	70°			70° ~ 90°
Max. AngleW			90°	90°	70° ~ 160°
Max. TimeSN	30s				15s ~ 160s
Max. TimeSW			40s		15s ~ 160s
Min. TimeS	7s		7s		3s ~ 12s
Max. TimePN		22s			7s ~ 80s
Max. TimePW				25s	7s ~ 80s
Min. TimeP		6s		6s	3s ~ 12s

<WIDE-1 MODE> ±35° ／±60° 、±65° 、±70°

	NORMAL ANGLE MODE		WIDE ANGLE MODE		Setting range
	SINGLE	PARALLEL	SINGLE	PARALLEL	
Min. Angle	5°	5°	5°	5°	2° ~ 10°
Max. AngleN	70°	70°			70° ~ 90°
Max. AngleW			140° (In case of 70° steering)	140°	70° ~ 160°
Max. TimeSN	30s				15s ~ 160s
Max. TimeSW			60s		15s ~ 160s
Min. TimeS	7s		7s		3s ~ 12s
Max. TimePN		22s			7s ~ 80s
Max. TimePW				45s	7s ~ 80s
Min. TimeP		6s		6s	3s ~ 12s

<WIDE-2 MODE> ±35° ／±105°

(NOTE: The monitoring of Servo loop error is available within P/S70 degrees.)

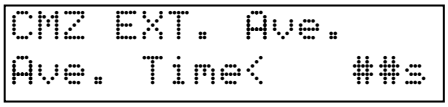
	NORMAL ANGLE MODE		WIDE ANGLE MODE		Setting range
	SINGLE	PARALLEL	SINGLE	PARALLEL	
Min. Angle	5°	5°	5°	5°	2° ~ 10°
Max. AngleN	70°	70°			70° ~ 90°
Max. AngleW			140° (In case of 70° steering)	140°	70° ~ 160°
Max. TimeSN	30s				15s ~ 160s
Max. TimeSW			60s		15s ~ 160s
Min. TimeS	7s		7s		3s ~ 12s
Max. TimePN		22s			7s ~ 80s
Max. TimePW				45s	7s ~ 80s
Min. TimeP		6s		6s	3s ~ 12s

Maintenance 17 : Option setting

Chapter 20 Gyrocompass moving average time of CMZ300X format

There are two kind of CMZ300X format for discriminating the Gyrocompass heading and external compass heading. The format of $HEHRC is gyrocompass and $HCHRC is external compass heading. In case of you select the EXT heading mode, this function means to add the moving average time value.

(1) Press the **ENTER** key after displayed "Option Set 2#" on the data display.
Data display become under setting mode.



Setting scale OFF、from 1 to 30
(Initial setting : 14 *1)

*1) This value is usable when the external heading sensor of gyrocompass is TMC device.
If other heading sensor is connected, set according to follow-up speed of the sensor.

(2) Change the time constant value by using the **Δ +** or **∇ −** Key
Press **ENTER** key to set the time constant value.
Display of the time constant value is changed OFF⇔1·····30⇔OFF.
The OFF position means it doesn't add the gyrocompass moving average time on the actual gyrocompass heading data.

Maintenance 17 : Option setting

Chapter 21　Analog recorder output for wide rudder angle mode

You can choose the following rudder angle mode

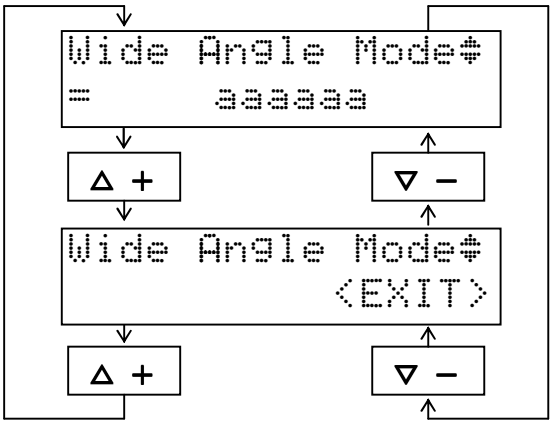
① Normal rudder angle mode-1 (Steering angle:±35deg. Recorder out put :0 to 5VDC/±40deg.)
② Normal rudder angle mode-2 (Steering angle:±35deg. Recorder out put: 0 to 5VDC/±45deg).
② Normal rudder angle mode-3 (Steering angle:±35/45deg. Recorder out put: 0 to 5VDC/±45deg).
③ Wide rudder angle mode-1 (Steering angle:±35/70deg. Recorder out put :0 to 5VDC/±80deg).
④ Wide rudder angle mode-2 (Steering angle:±35/105deg. Recorder out put: 0 to 5VDC/±120deg).

（1）Press the **ENTER** key after displayed "Option Set 3$" on the data display.
Data display become current setting mode.

```
Wide Angle Mode$
=       aaaaaa
```

← Current setting wide rudder angle mode

（2）Select the rudder angle mode by using the **△ +** or **▽ −** Key



（3）If you want to change the setting data of Wide angle mode, Press **ENTER** key at when the display is (1).
Data display become under setting mode.

```
Wide Angle Mode$
<       aaaaaaaa
```

←Current setting mode

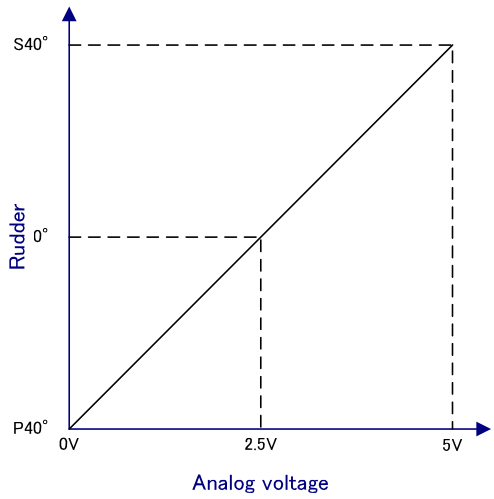
a.....a means setting item
Normal -1 : Normal rudder angle mode-1. . .　Recorder range±40deg.
Normal -2 : Normal rudder angle mode-2. . .　Recorder range±45deg
Normal -3 : Normal rudder angle mode-3. . .　Recorder range±45deg
Wide-1 : Wide rudder angle mode-1. . .　Recorder range±80deg
Wide-2 : Wide rudder angle mode-2. . .　Recorder range±120deg

（4）Press **△ +** or **▽ −** key to alter the item ,Normal-1⇔Normal-2⇔Wide-1⇔Wide-2⇔Normal-1

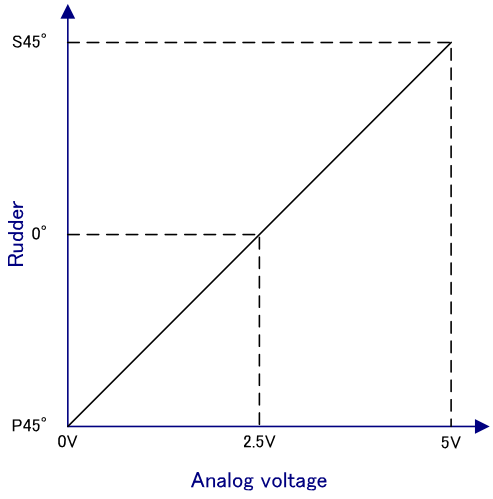
Press **ENTER** key to set the setting item.

Relation of the Analog voltage and wide angle value

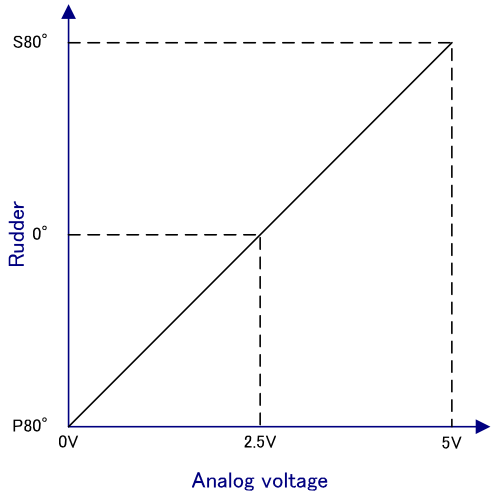
＜Normal-1＞



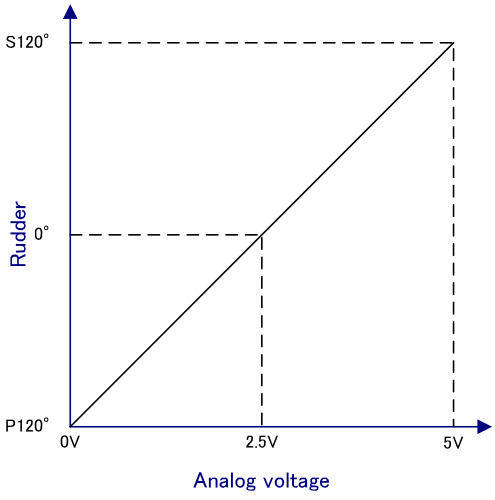
＜Normal-2,Normal-3＞



＜Wide-1＞



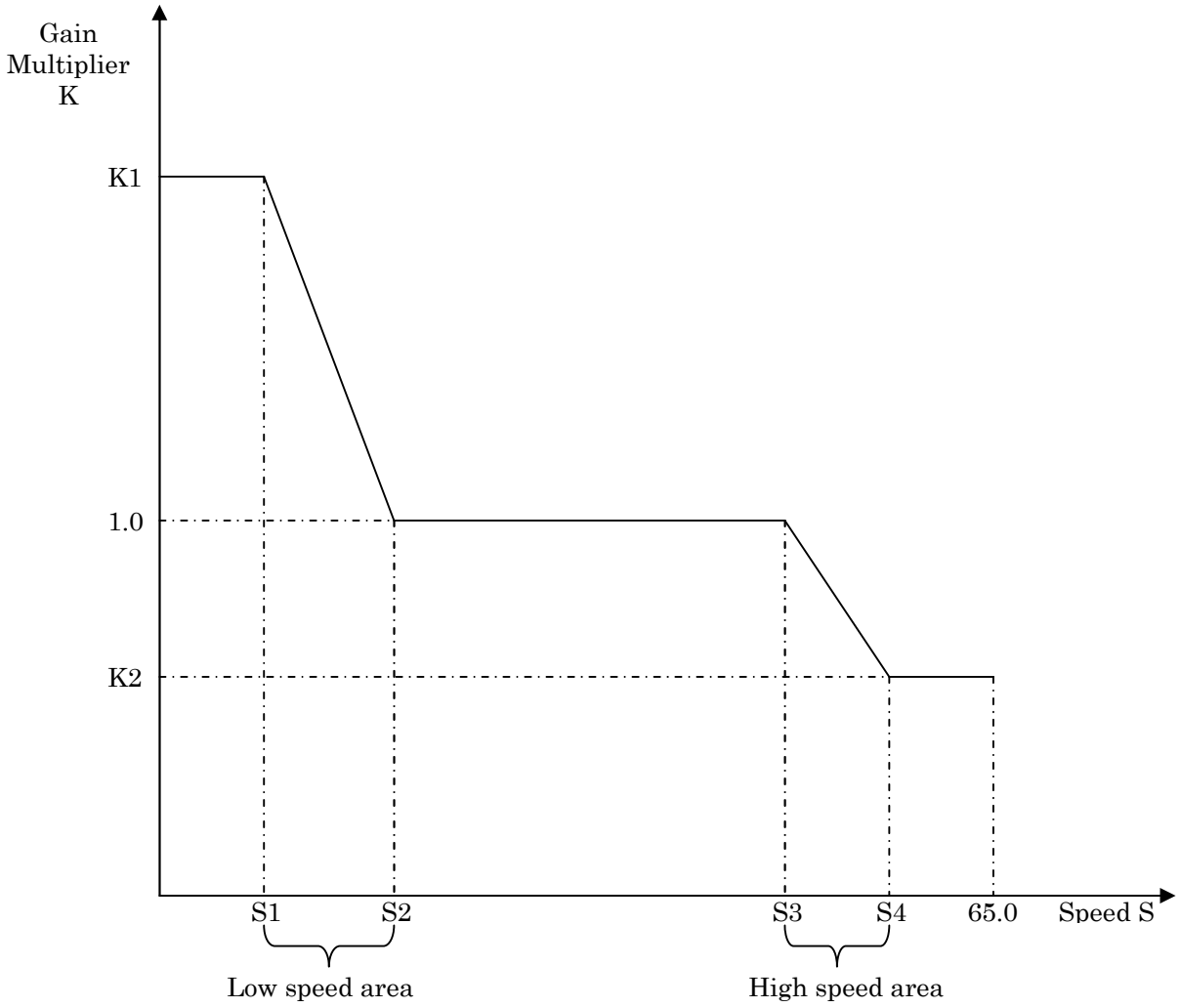
＜Wide-2＞



Chapter 22　Speed gain compensation　　（PT500D・SUB AUTO）

This function means to improve the accuracy of course keeping at the low speed area.
Set the gain constant for compensation of Low speed and High speed area.
Setting item is as follows.

① Lower limit of Low speed area （S1）
② Upper limit of Low speed area （S2）
③ Lower limit of High speed area （S3）
④ Upper limit of Low speed area （S4）
⑤ High gain multiplier （K1）
⑥ Low gain multiplier （K2）



1. Change the each setting item

（1） Press the **ENTER** key after displayed "Option Set 4 ⇳" on the data display.

The data display become low speed gain setting mode.

（2） Press **Δ +** or **▽ −** key to change the item.

①⇔②⇔③⇔④⇔⑤⇔⑥⇔⑦⇔①

① Low Speed Gain ⇳
Speed-L1= ## Kt

② Low Speed Gain ⇳
Speed-L2= ## Kt

③ Low Speed Gain ⇳
Speed-H1= ## Kt

④ Low Speed Gain ⇳
Speed-H2= ## Kt

⑤ Low Speed Gain ⇳
High Gain= #.#

⑥ Low Speed Gain ⇳
Low Gain= #.#

⑦ Low Speed Gain ⇳
<Exit>

Press **ENTER** key after selected the item. The function of the item become valid mode .

2. Set the lower limit of Low speed area (S1)

(1) When you are displayed "Speed-L1= ## Kt" on the data display ,then press **ENTER** key.
The data display become under setting mode.

```
Low Speed Gain
Speed-L1=  ## Kt
```

Setting range: from 3 to 30

(2) Press **△ +** or **▽ −** key to alter the value of lower limit of Low speed area.

Press **ENTER** key to set the value of lower limit.
The display of lower limit of Low speed area is changed 3⇔4·····30⇔3 .

3. Set the Upper limit of Low speed area (S 2)

(1) When you are displayed "Speed-L2= ## Kt" on the data display ,then press **ENTER** key.
The data display become under setting mode.

```
Low Speed Gain
Speed-L2=  ## Kt
```

Setting range: from 3 to 30

(2) Press **△ +** or **▽ −** key to alter the value of upper limit of Low speed area.

Press **ENTER** key to set the value of upper limit.

The display of upper limit of Low speed area is changed 3⇔4·····30⇔3 .

4. Lower limit of High speed area (S 3)

(1) When you are displayed "Speed-H1= ##Kt" on the data display ,then press **ENTER** key.
The data display become under setting mode.

Low Speed Gain
Speed-H1= ## Kt.

Setting range: from 3 to 30

(2) Press **Δ +** or **∇ −** key to alter the value of Lower limit of High speed area.

Press **ENTER** key to set the value of Lower limit.

The display of Lower limit of High speed area is changed 30⇔31·····60⇔30 .

5. Upper limit of Low speed area (S4)

(1) When you are displayed "Speed-H2= ##Kt" on the data display ,then press **ENTER** key.
The data display become under setting mode.

Low Speed Gain
Speed-H2= ## Kt.

Setting range: from 3 to 30

(2) Press **Δ +** or **∇ −** key to alter the value of Upper limit of High speed area.

Press **ENTER** key to set the value of Upper limit.

The display of Upper limit of High speed area is changed 30⇔31·····60⇔30 .

6. High gain multiplier (K1)

(1) When you are displayed "High Gain= #.#"on the data display ,then press **ENTER** key.
The data display become under setting mode.

```
Low Speed Gain
High Gain=   #.#
```

Setting range: from 10 to 50

(2) Press **△ +** or **▽ −** key to alter the high gain multiplier.

Press **ENTER** key to set the value of the high gain multiplier.

The display of High gain multiplier is changed 1.0⇔1.1·····5.0⇔1.0 .

7. Low gain multiplier (K2)

(1) When you are displayed "Low Gain= #.#"on the data display ,then press **ENTER** key.
The data display become under setting mode.

```
Low Speed Gain
Low Gain=    #.#
```

Setting range: from 0.1 to 1.0

(2) Press **△ +** or **▽ −** key to alter the Low gain multiplier.

Press **ENTER** key to set the value of the Low gain multiplier.

The display of Low gain multiplier is changed 0.1⇔0.2·····1.0⇔0.1.

Maintenance 17：Option setting

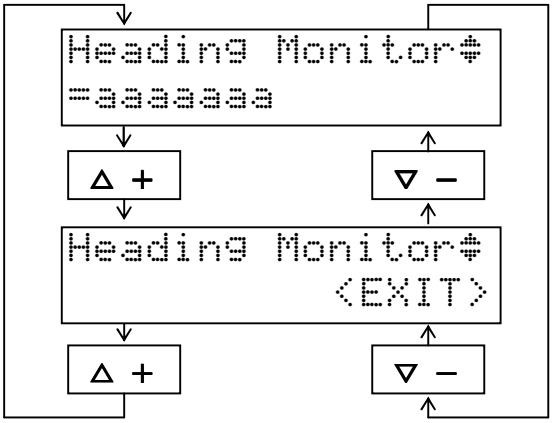
Chapter 23　Select the Heading monitor function

In case of the second heading sensor is connected with the Aux. Compass input port, you select whether you make use of the heading monitor function.

（1）Press the **ENTER** key after displayed "Option Set. 4 ⇕ "(PT500A) or "Option Set. 5 ⇕ " (PT500D･SUBAUTO) on the data display.
Data display become current setting mode.

```
Heading Monitor⇕
=aaaaaaa
```
←Current setting item

（2）Change the setting mode by using the **△ +** or **▽ −** Keys.



（3）If you want to change the selection of heading monitor , Press **ENTER** key at when the display is (1).
Data display become under setting mode.

```
Heading Monitor⇕
=aaaaaaa
```
←Current setting item

a.....a means setting item
ＮＯＴ　ＵＳＥ：Not use the heading monitor function
ＵＳＥ　　：Use the heading monitor function

（3）Press **△ +** or **▽ −** key to alter the item NOT USE⇔USE⇔NOT USE .

Press **ENTER** key to set the USE or NOT USE.

Maintenance 18 : Option setting

Chapter 24　Alarm threshold of Rudder Erroneous

① Set the detection limit angle (deviation value)
② Set the detection time

1. Select the item

（1）Press the **ENTER** key after displayed "Option Set 5 ⇕ "(PT500A)" or "Option Set 6 ⇕ "(PT500D･SUBAUTO) on the data display.
Data display become under setting mode.

（2）Change the setting item by using the **Δ +** or **▽ −** Key

①⇔②⇔③⇔④⇔①

① Rud. Erroneous ⇕
Limit Angle= ##°

② Rud. Erroneous ⇕
Time= ##s

③ Rud. Erroneous ⇕
<EXIT>

Press **ENTER** key to set the setting item..

2. Set the detection limit angle

（1）Press the **ENTER** key after displayed "Limit Angle= ##°"" on the data display.
Data display become under setting mode.

Rud. Erroneous
Limit Angle< ##°

Setting range: from 0 to 20
(Initial value is set 5 degree)

If you set the 0 , it means no monitor of rudder erroneous.

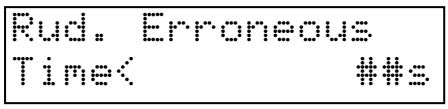
（2）Press **Δ +** or **▽ −** key to select the limit angle value .

Press **ENTER** key to set the limit angle value.

3. Set the detection time

（1）Press the **ENTER** key after displayed "Time= ##s" on the data display.

Data display become under setting mode.



Setting range: from 1 to 10
(Initial value is set 3 second)

（2）Press **△ +** or **▽ −** key to select the detection time.

Press **ENTER** key to set the detection time.

Maintenance 17 : Option setting

Chapter 25　Alarm threshold of the Heading erroneous

Heading erroneous function is monitored the rate of turn between the Gyrocompass and Aux. port sensor , In case of the heading sensor is connected to the Aux. port.

① Set the detection of the rate of turn
② Set the detection time

1．　Select the item

（1）Press the **ENTER** key after displayed "Option Set 6 ⇳ "(PT500A)" or "Option Set 7 ⇳ "(PT500D･
SUBAUTO) on the data display.
Data display become under setting mode.

（2）Change the setting item by using the **△ +** or **▽ −** Key

①⇔②⇔③⇔④⇔①

①
```
HDG. Erroneous  ⇳
Check RoT=   ##°/s
```

②
```
HDG. Erroneous  ⇳
Time=          ##s
```

③
```
HDG. Erroneous  ⇳
                <EXIT>
```

Press **ENTER** key to set the setting item..

2．　Set the detection of the rate of turn

（1）Press the **ENTER** key after displayed "Check RoT= ##°/s " on the data display.
Data display become under setting mode.

```
HDG. Erroneous  ⇳
Check RoT<   ##°/s
```

Setting range: from 0 to 20
(Initial value is set 0 deg./sec)
If you set the 0 , it means to cancel the monitor of heading erroneous.

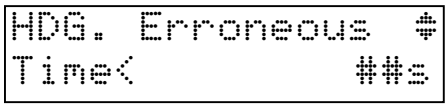
（2）Press **△ +** or **▽ −** key to select the detection value of the rate of turn .

Press **ENTER** key to set the detection value.

3. Set the detection time

(1) Press the **ENTER** key after displayed "Time= ##s" on the data display.

Data display become under setting mode.



Setting range: from 1 to 10
(Initial value is set 3 second)

(2) Press **△ +** or **▽ −** key to select the detection time.

Press **ENTER** key to set the detection time.

Maintenance 17 : Option setting

Chapter 26 Boundary of speed status output

This speed status output is used for changing over the max. rudder angle automatically. For example Max. rudder angle 35deg. to 70deg.
Boundary control function can change around the boundary line smoothly by adding hysteresis

Setting item is as follows.
①Select Enable or Disable of the speed status output
②Set the threshold of low speed boundary
③Set the threshold of high speed boundary

1. Change the item

(1) Press the **ENTER** key after displayed "Option Set 5⇕"(PT500A) or "Option Set 6⇕" (PT500D・SUBAUTO) on the data display.
Data display becomes setting mode of speed status output.

(2) Change the setting mode by using the **△ +** or **▽ −** Key

①⇔②⇔③⇔④⇔①

① Speed Status ⇕
Function= aaaaaaa

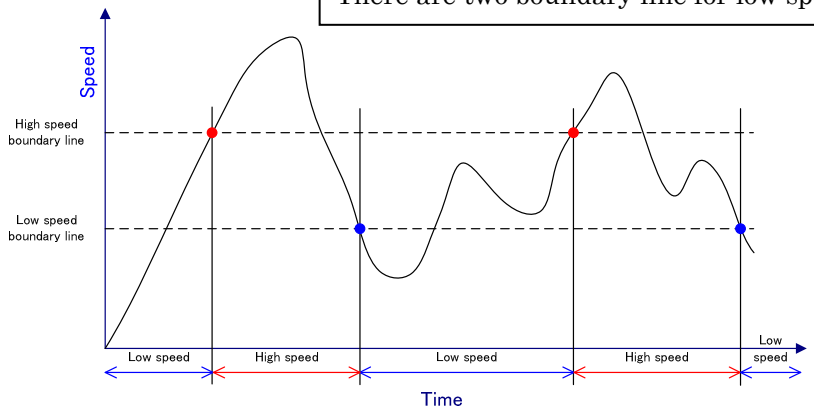
② Speed Status ⇕
Low Speed= ##kt

③ Speed Status ⇕
High Speed= ##kt

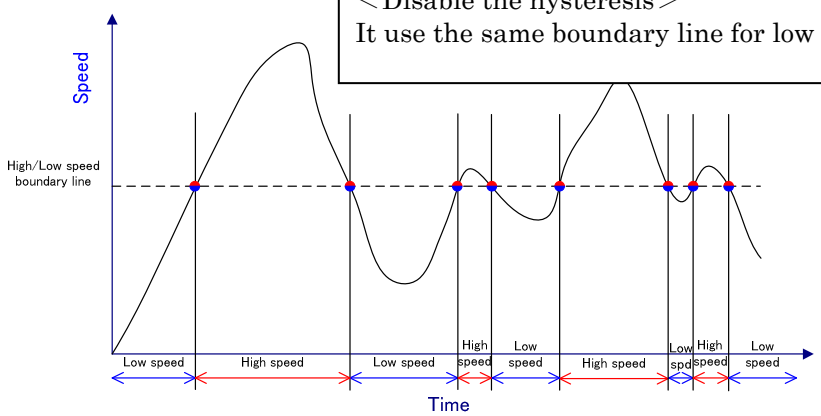
④ Speed Status ⇕
<EXIT>

Press **ENTER** key to select the setting item.

＜Enable the hysteresis＞
There are two boundary line for low speed and high speed band



＜Disable the hysteresis＞
It use the same boundary line for low speed and high speed band



2. Select Enable or Disable of the speed status output

(1) Press the **ENTER** key after displayed "Function= " on the data display.
Data display become current setting mode.

```
Speed Status    ⇳
Function= aaaaaaa
```

a....a means setting item
Enable : Valid
Disable : Invalid

(2) Press **Δ +** or **▽ −** key to alter the item "Enable" ⇔ "Disable"

Press **ENTER** key to set the Enable or Disable.

(NOTE)
Speed status output driver is used to the same OFF HEADING status output driver.
If you selected the 'Enable',OFF HEADING status output is prohibited by software.
It is not possible to output the both Speed status and OFF HEADING status.

3. Set the threshold of low speed boundary

(1) Select the "Low Speed= ##kt." mode on the data display. Then press **ENTER** key.
The data display become under setting mode.

```
Speed Status    ⇳
Low Speed=   ##kt
```

Setting range 3 to 40
(Initial value is set 10 knots)

(2) Press **Δ +** or **▽ −** key to alter the speed value.

Press **ENTER** key after setting the low speed boundary.

4. Set the threshold of high speed boundary

(1) Select the "High Speed= ##kt." mode on the data display. Then press **ENTER** key.
The data display become under setting mode.

```
Speed Status    ⇳
High Speed=  ##kt
```

Setting range 10 to 40
(Initial value is set 10 knots)

(2) Press **Δ +** or **▽ −** key to alter the speed value.

Press **ENTER** key after setting the high speed boundary.

Chapter 27 Special flag setting

These settings are used for adjustment of Track Control or Special function.
Setting item is as follows.

【In case of PT500A】

① Option flag-0 (for Track control)
② Option flag-1 (for DNV application)
③ Derivative gain multiplier setting for Track Control
④ Integral gain multiplier setting for Track Control
⑤ Integral gain multiplier setting during the course keeping control(AUTO)
⑥ The multiplier of turn rate to output initial rudder order for starting turn.
⑦ Rate down check setting (Setting of timing for reducing rate of turn in the turning)
⑧ Pilot operation mode
⑨ Option data-0
⑩ Option data-1
⑪ Option data-2
⑫ Option data-3
⑬ Option data-4
⑭ Option data-5

1. Change the item

Press the **ENTER** key after displayed "MAINTENACE 18⇕"(PT500A) on the data display.
Data display becomes setting mode of [Flag-0(Hex)].

(1) Change the setting mode by using the **△ +** or **▽ −** Key.

①⇔②⇔③⇔④⇔⑤⇔⑥⇔⑦⇔⑧⇔⑨⇔⑩⇔⑪⇔⑫⇔⑬⇔①

① Special Data ⇕ / Flag-0(Hex)= ##
② Special Data ⇕ / Flag-1(Hex)= ##
③ Special Data ⇕ / Track GainD=#.##
④ Special Data ⇕ / Track GainI=#.##
⑤ Special Data ⇕ / Gain I= #.##
⑥ Special Data ⇕ / Turning Chk=#.##
⑦ Special Data ⇕ / RateDownChk=#.##
⑧ Special Data ⇕ / Mode(Hex) =##
⑨ Special Data ⇕ / Data-0(Hex)=####
⑩ Special Data ⇕ / Data-1(Hex)=####
⑪ Special Data ⇕ / Data-2(Hex)=####
⑫ Special Data ⇕ / Data-3(Hex)=####
⑬ Special Data ⇕ / Data-4(Hex)=####
⑭ Special Data ⇕ / Data-5(Hex)=####
⑮ Special Data ⇕ / <Exit>

Press **ENTER** key to select the setting item.

【In case of PT500D・SUBAUTO】

① Option flag-0 (for Track control)
② Option flag-1 (for DNV application)
③ Pilot operation mode
④ Option data-0
⑤ Option data-1

2. Change the item

（2） Press the **ENTER** key after displayed "MAINTENACE 16 ⇳ "(PT500D・SUBAUTO) on the data display.
Data display becomes setting mode of [Flag-0(Hex)].

（3） Change the setting mode by using the **Δ +** or **∇ −** Key.

①⇔②⇔③⇔④⇔⑤⇔⑥⇔①

① Special Data ⇳
Flag-0(Hex)= ##

② Special Data ⇳
Flag-1(Hex)= ##

③ Special Data ⇳
Mode(Hex)= ##

④ Special Data ⇳
Data-0(Hex)=####

⑤ Special Data ⇳
Data-1(Hex)=####

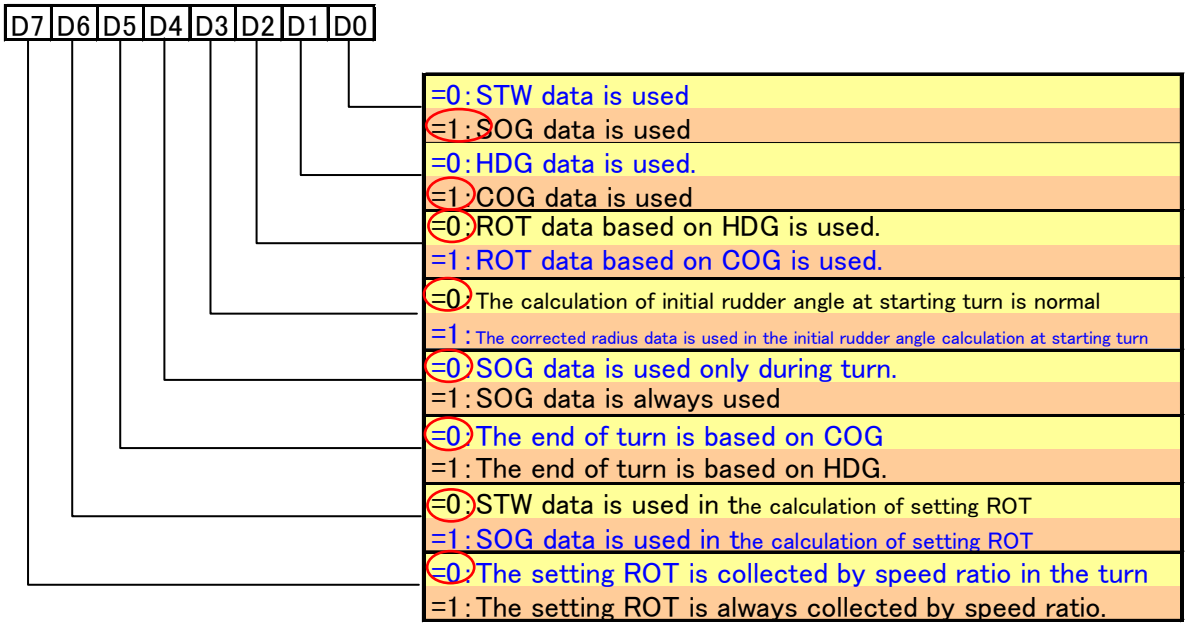
⑥ Special Data ⇳
<Exit>

Press **ENTER** key to select the setting item.

3. Option flag-0 setting

Various setting is prepared for adjustment of Track control. Although, these settings are usually used in developing of interface with ECDIS, the default setting is standard in the present condition. This flag is composed of 8 bits and the setting is done by the hexadecimal number

The contents of each bit are as follows;



<Exp.> STW data is used ... 0
HDG data is used ... 0
ROT data based on COG is used. ... 1
The corrected radius data is used in the initial rudder angle calculation at starting turn ... 1
SOG data is used only during turn. ... 0
The end of turn is based on COG ... 0
SOG data is used in the calculation of setting ROT ... 1
The setting ROT is collected by speed ratio in the turn ... 0

Set [4C] as this setting, since each falgs become [01001100].

Default : [03] (refer to mark ◯ in above table.)

[03] : The actual rate of turn is used for turning control.

[4C] : The estimated rate of turn by Kalman filter is used for turning control.

(1) Press the **ENTER** key after displayed "Flag-0(Hex)="on the data display. Data display becomes current setting mode.

```
Special Data
Flag-0(Hex)<   ##
```

←Cursor position is inputting point

The part of a ## is displayed current setting condition.

(2) Press **△ +** or **▽ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction, data is increased and turn to the counter clockwise direction, data is decreased. (Data is 0 to F hexadecimal number)

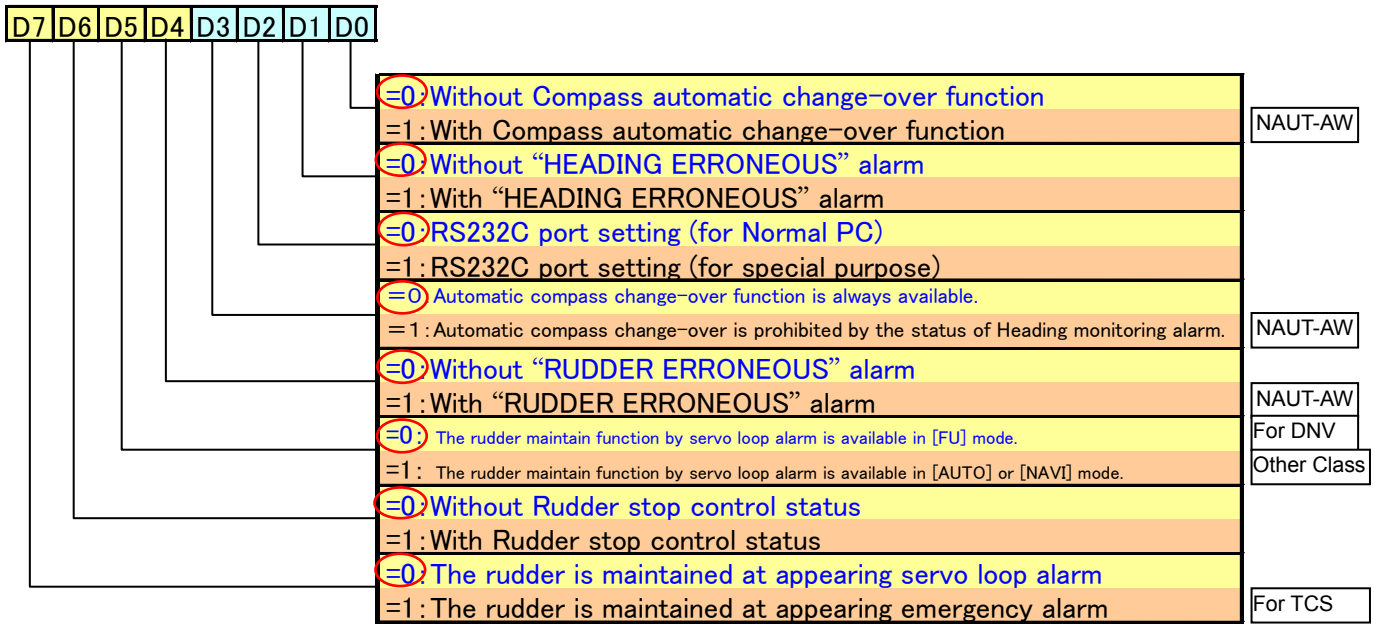
```
Special Data
Flag-0(Hex)<   4C
```

(3) After input the hexadecimal number , then press **ENTER** key.

4. Option flag-1 setting

Various setting is prepared for corresponding DNV's rule.
This flag is composed of 8 bits and the setting is done by the hexadecimal number

The contents of each bit are as follows;



＜Exp.＞Without Compass automatic change-over function ... 0
Without "HEADING ERRONEOUS" alarm ... 0
RS232C port setting (for Normal PC) ... 0
Automatic compass change-over function is always available... 0
Without "RUDDER ERRONEOUS" alarm ... 0
The rudder maintain function by servo loop alarm is available in [FU] mode. ... 0
Without Rudder stop control status ... 1 (for DNV's feed-back failure scenario)
The rudder is maintained at appearing servo loop alarm ... 0

Set [40] as this setting, since each falgs become [01000000].

Default	: 00000000	= [00] (refer to mark ○ in above table.)
DNV class(Without TCS)	: 01000000	= [40]
TCS (other class)	: 11100000	= [E0]
DNV class(With TCS)	: 11000000	= [C0]
DNV class NAUT-AW	: 11011001	= [D9]

(1) Press the **ENTER** key after displayed "Flag-1(Hex)="on the data display.
Data display becomes current setting mode.

```
Special Data
Flag-1(Hex)<   ##
```
←Cursor position is inputting point

The part of a ## is displayed current setting condition.

(2) Press **△ +** or **▽ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction, data is increased and turn to the counter clockwise direction, data is decreased. (Data is 0 to F hexadecimal number)

```
Special Data
Flag-1(Hex)<   40
```
Default : [00] (refer to mark ○ in above table.)

(3) After input the hexadecimal number , then press **ENTER** key.

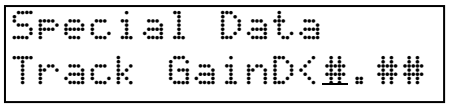
5． Derivative gain multiplier setting for Track Control

The multiplier of derivative gain for Track Control[=NAVI mode] can be set in this setting mode.

Actual Derivative gain = Original gain based on gain table. x Multiplier value

Setting range：0.00 to 9.99
Initial value ：1.00
【Caution】The [0.00] should not be set for this setting because the setting range is not checked.

（1）Press the **ENTER** key after displayed "Track GainD=#.## "on the data display.
Data display becomes current setting mode.



←Cursor position is inputting point

（2） Press **△ +** or **▽ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction, data is increased and turn to the counter clockwise direction, data is decreased. (Data is 0 to 9 numbers)

（3）After input the multiplier, then press **ENTER** key.

6. Integral gain multiplier setting for Track Control

The multiplier of integral gain for Track Control[=NAVI mode] can be set in this setting mode.

Actual integral gain = Original gain based on ship's model x Multiplier value

Setting range : 0.00 to 9.99
Initial value : 1.00
【Caution】The [0.00] should not be set for this setting because the setting range is not checked.

(1) Press the **ENTER** key after displayed "Track GainI=#.## "on the data display.
Data display becomes current setting mode.

```
Special Data
Track GainI<#.##
```
←Cursor position is inputting point

(2) Press **△ +** or **▽ -** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction, data is increased and turn to the counter clockwise direction, data is decreased. (Data is 0 to 9 numbers)

```
Special Data
Track GainI<1.00
```

(3) After input the multiplier, then press **ENTER** key.

7． Integral gain multiplier setting during the course keeping control (AUTO)

The multiplier of integral gain for course keeping control [=AUTO mode] can be set in this setting mode.

Actual integral gain = Original gain based on ship's model x Multiplier value

Setting range：0.00 to 9.99
Initial value ：1.00
【Caution】The [0.00] should not be set for this setting because the setting range is not checked.

（1）Press the **ENTER** key after displayed "GainI=#.## "on the data display.
Data display becomes current setting mode.

```
Special Data
Gain I<       #.##
```
←Cursor position is inputting point

（2） Press **Δ +** or **∇ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction, data is increased and turn to the counter clockwise direction, data is decreased. (Data is 0 to 9 numbers)

```
Special Data
Gain I<       1.00
```

（3）After input the multiplier, then press **ENTER** key.

8. The multiplier of turn rate to output initial rudder order for starting turn.

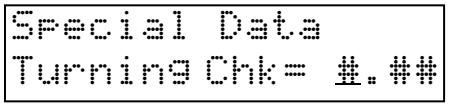
The rudder angle has to be controlled larger than calculated value in order to increase rate of turn at the starting of the turn during Track Control.
(This rudder angle is called the initial rudder angle.)
The output of initial rudder angle is decided by the multiplier and the setting rate due to ship's control parameter.
The multiplier to judge of output initial rudder angle can be set in this setting mode.

Present ROT(A) ≦ [Setting rate × multiplier](B)

If (A) value is (B) or less than (B) value, the initial rudder angle is output.
If (A) value is more than (B) value, the initial rudder angle is cot output and the rudder angle calculated by ship's control parameter.

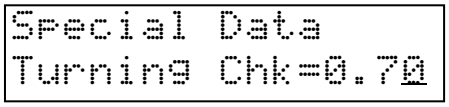
Setting range : 0.00 to 9.99
Initial value : 0.70
【Caution】 The [0.00] should not be set for this setting because the setting range is not checked.

(1) Press the **ENTER** key after displayed "Turning Chk=#.## "on the data display.
Data display becomes current setting mode.



←Cursor position is inputting point

(2) Press **Δ +** or **▽ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction, data is increased and turn to the counter clockwise direction, data is decreased. (Data is 0 to 9 numbers)



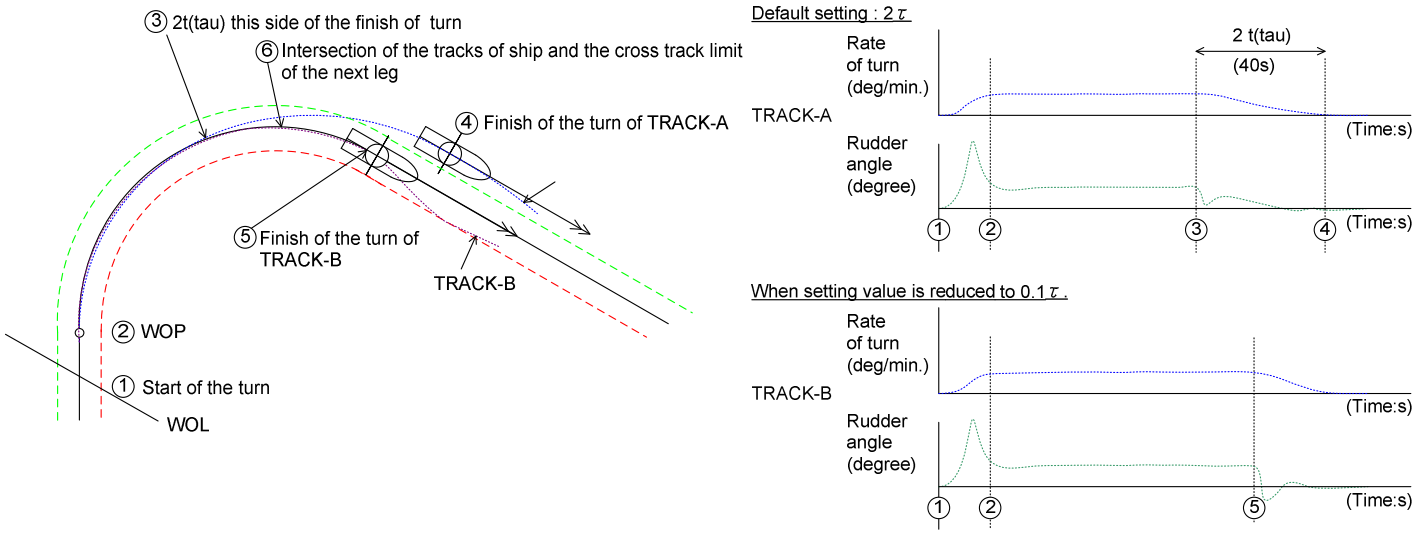
(3) After input the multiplier, then press **ENTER** key.

9. Rate down check setting (Setting of timing for reducing rate of turn in the turning)

In Constant radius or Constant rate of turn control mode, Autopilot controls the rudder angle in order to decrease ROT in 2 τ (default) short of the finish of turn.

τ = L/V (L= Lpp:m, V= Vessel speed:m/s)
(This parameter depends on Lpp and Vessel speed.)
<Exp.> When Lpp is 200m and Vessel speed is 10m/s, τ is 20.
So, 2 τ is 40 seconds.

Comparison between 2.0 τ (TRACK-A) and 0.1 τ (TRACK-B)



τ value can be set in this setting mode.

Setting range : 0.00 to 9.99
Initial value : 2.00

【Caution】 The [0.00] should not be set for this setting because the setting range is not checked.
If this value is too small, the counter rudder might be large at near next course.
And then the overshoot might become also large.

(1) Press the **ENTER** key after displayed "RateDownChk=#.##" on the data display.
Data display becomes current setting mode.

```
Special Data
RateDownChk=#.##
```
←Cursor position is inputting point

(2) Press **△ +** or **▽ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction, data is increased and turn to the counter clockwise direction, data is decreased. (Data is 0 to 9 numbers)

```
Special Data
RateDownChk=2.00
```

(3) After input the multiplier, then press **ENTER** key.

１０． Pilot operation mode

The display method of set course during Manual mode can be set in this setting.

Setting value:

Mode(Hex)=[00] : The value of set course display is changeable by the course setting devices (Course setting dial or Course setting keys) during the manual steering mode.
⇒This setting is used for "the stand alone type Autopilot" or when Auto steering unit is located in close of Hand steering unit.

Mode(Hex)=[02] : The present heading value is indicated in the set course display during manual steering mode.
⇒This setting is used when the Autopilot is separated from Hand steering unit, like IBS layout.

Setting range : 0 to 9

Initial value : [00]

NOTE) Autopilot read in the actual heading as preset heading during HAND mode and when the steering mode is switched from manual to automatic steering mode, and then starts Heading control.
In previous software, the indication of preset heading has been blinked for 20 seconds after changing from manual to automatic steering and if the ENTER key was pressed within 20 seconds, the blinking value has been used as the preset heading.
However, above function was removed because the user operation should be made more easily and the display of the preset heading should be made more clearly.

（1）Press the **ENTER** key after displayed "Mode(Hex)=##" on the data display.
Data display becomes current setting mode.

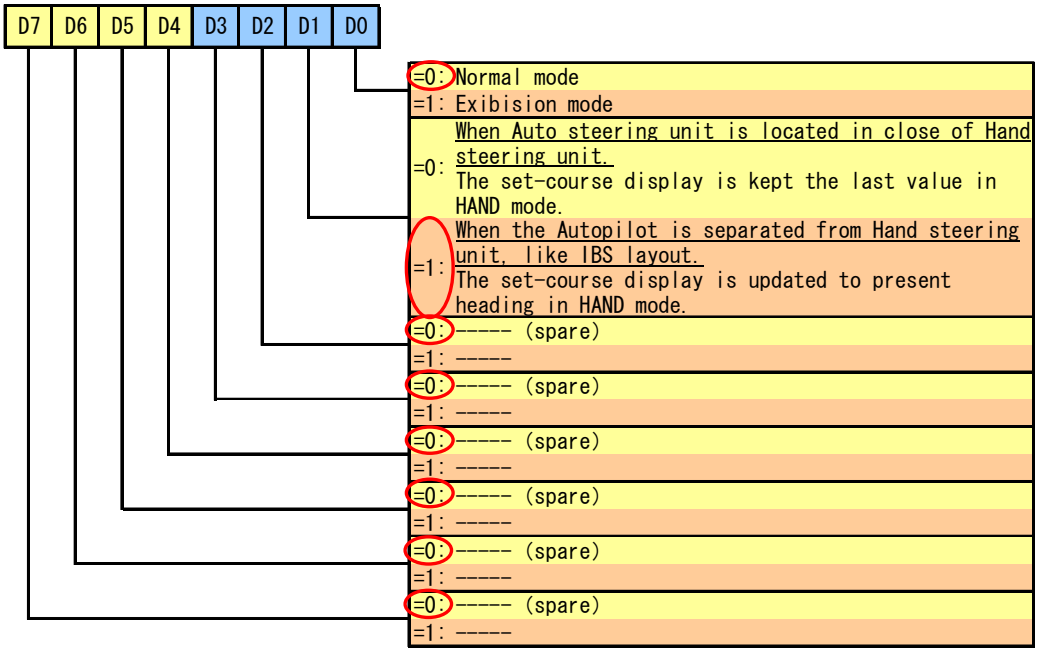
```
Special Data
Mode(Hex)     <##
```

←Cursor position is inputting point

（2） Press **△ +** or **▽ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction, data is increased and turn to the counter clockwise direction, data is decreased. (Data is 0 to 9 numbers)

```
Special Data
Mode(Hex)     <02
```

（3）After input the flag, then press **ENTER** key.



１１． Option(Special) Data-0 setting

Various setting is prepared for special function and interface.
This data is composed of 16 bits and the setting is done by the hexadecimal number.

The available setting range is from [0000] to [FFFF].
Default setting : [0000]

If Digital remote controller(PT162) is connected with the system this setting should be [1xxx].
In case of TCS-C, if the Set & Drift data from ECDIS are used in Autopilot, this setting should be [xx1x].
(As the example of above, this setting is [1010].)

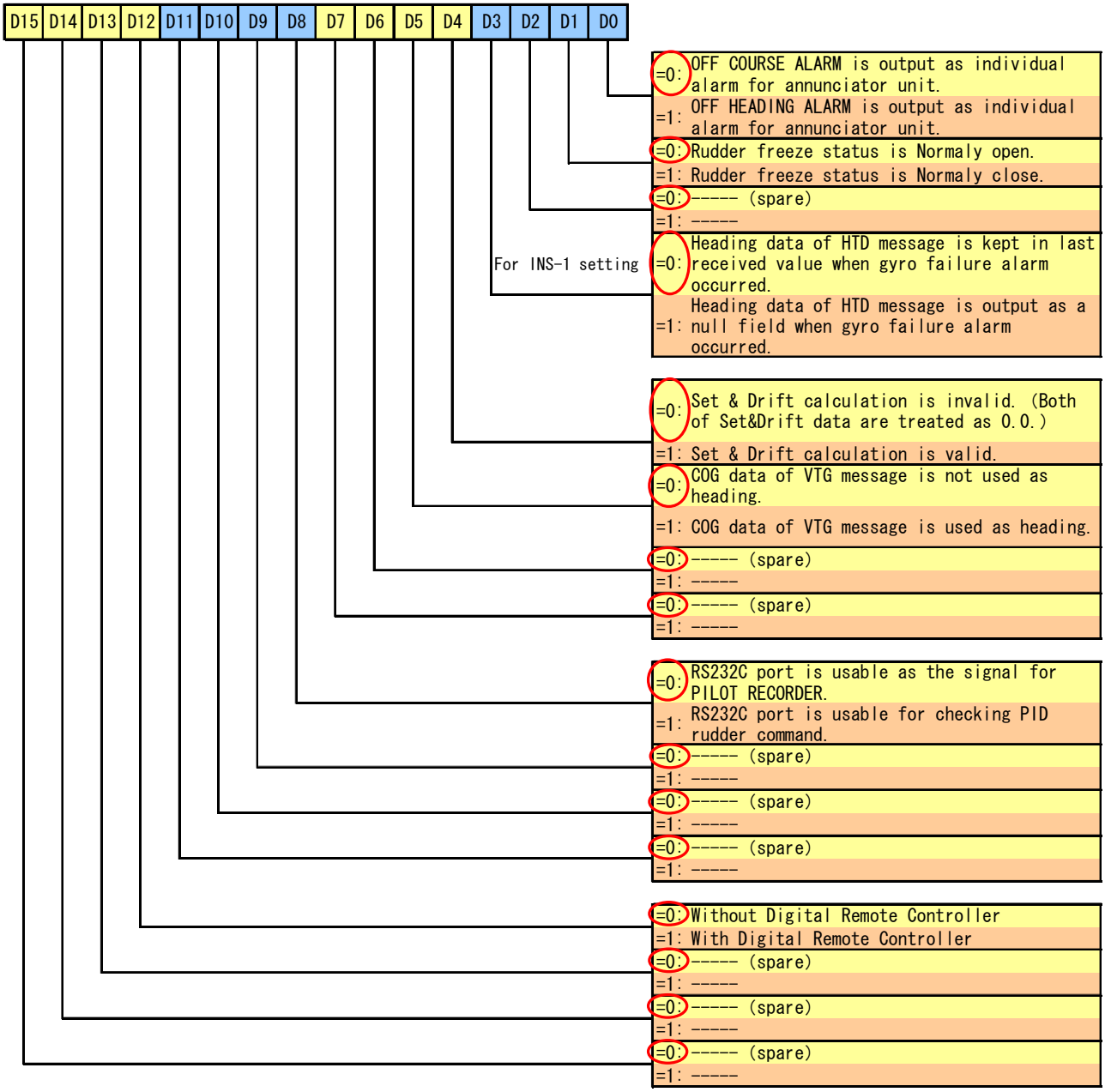
（1）Press the **ENTER** key after displayed "Data-0(Hex)=####" on the data display.
Data display becomes current setting mode.

```
Special Data
Data-0(Hex)<####
```
←Cursor position is inputting point

（2）Press **Δ +** or **∇ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction, data is increased and turn to the counter clockwise direction, data is decreased. (Data is 0 to 9 numbers)

```
Special Data
Data-0(Hex)<0001
```

（3）After input the flag, then press **ENTER** key.


D15 D14 D13 D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 D1 D0
=0: OFF COURSE ALARM is output as individual alarm for annunciator unit.
=1: OFF HEADING ALARM is output as individual alarm for annunciator unit.
=0: Rudder freeze status is Normaly open.
=1: Rudder freeze status is Normaly close.
=0: ----- (spare)
=1: -----
For INS-1 setting
=0: Heading data of HTD message is kept in last received value when gyro failure alarm occurred.
=1: Heading data of HTD message is output as a null field when gyro failure alarm occurred.
=0: Set & Drift calculation is invalid. (Both of Set&Drift data are treated as 0.0.)
=1: Set & Drift calculation is valid.
=0: COG data of VTG message is not used as heading.
=1: COG data of VTG message is used as heading.
=0: ----- (spare)
=1: -----
=0: ----- (spare)
=1: -----
=0: RS232C port is usable as the signal for PILOT RECORDER.
=1: RS232C port is usable for checking PID rudder command.
=0: ----- (spare)
=1: -----
=0: ----- (spare)
=1: -----
=0: ----- (spare)
=1: -----
=0: Without Digital Remote Controller
=1: With Digital Remote Controller
=0: ----- (spare)
=1: -----
=0: ----- (spare)
=1: -----
=0: ----- (spare)
=1: -----

１２． Option(Special) Data-1 setting

This data is composed of 16 bits and the setting is done by the hexadecimal number.

The available setting range is from [0000] to [FFFF].
Default setting : [0001]

In this setting, if gyrocompass failure alarm occurs during automatic steering (=NAVI or AUTO), the rudder angle is maintained until steering mode is changed to manual mode (=HAND, RC or NFU).

（1）Press the **ENTER** key after displayed "Data-1(Hex)=####" on the data display.
Data display becomes current setting mode.

```
Special Data
Data-1(Hex)<####
```
←Cursor position is inputting point

（2）Press **Δ +** or **∇ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction, data is increased and turn to the counter clockwise direction, data is decreased. (Data is 0 to 9 numbers)

```
Special Data
Data-1(Hex)<0001
```

（3）After input the flag, then press **ENTER** key

１３． Option(Special) Data-2 setting

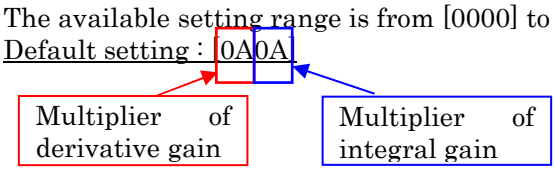
The multiplier of derivative gain and integral gain for turning control during Track control are adjustable by the hexadecimal number.
The setting value is able to convert according to following method.

(a) Setting gain	(b) Ten times of setting gain	(c) hexadecimal number of (b)
1.0	10	0A
1.5	15	0F
2.0	20	14
2.5	25	19
3.0	30	1E
3.5	35	23
4.0	40	28
4.5	45	2D

(a) Setting gain	(b) Ten times of setting gain	(c) hexadecimal number of (b)
5.0	50	32
5.5	55	37
6.0	60	3C
6.5	65	41
7.0	70	46
7.5	75	4B
8.0	80	50
8.5	85	55

Their multipliers are used for turning control during Track control despite the setting of "Track GainD" and "Track GainI". Please see page 27-4 and 27-5.

The available setting range is from [0000] to [FFFF].
Default setting : 0A0A



（1） Press the **ENTER** key after displayed "Data-2(Hex)=####" on the data display.
Data display becomes current setting mode.

←Cursor position is inputting point

（2） Press **Δ +** or **∇ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction, data is increased and turn to the counter clockwise direction, data is decreased. (Data is 0 to 9 numbers)

The above setting means that;
- Multiplier of derivative gain = 2.0
- Multiplier of integral gain = 3.0

（3） After input the flag, then press **ENTER** key

１４． Option(Special) Data-3 setting

The multiplier for calculation of rudder angle to freeze when gyro failure alarm has occurred in turning control is adjustable by the hexadecimal number.

The available setting range is from [0000] to [FFFF].
Default setting : [0064]

Multiplier for calculation of rudder angle to freeze

The properly(theoretical) rudder angle to freeze when gyro failure alarm has occurred in turning control is calculated by following formula.

$$\text{Theoretical rudder angle in radius control} = \frac{3 \times V}{60 \times \pi \times R \times K} \times k1$$

V=Ship's speed(kt)
π =the circular constant
R=radius(nm)
K=ship's rate constant
k1= Multiplier

(a) k1= Multiplier	(b) Ten times of setting gain	(c) hexadecimal number of (b)	(a) k1= Multiplier	(b) Ten times of setting gain	(c) hexadecimal number of (b)
0.70	70	0046	3.00	300	012C
0.80	80	0050	3.50	350	015E
0.90	90	005A	4.00	400	0190
1.00	100	0064	4.50	450	01C2
1.10	110	006E	5.00	500	01F4
1.20	120	0078	5.50	550	0226
1.30	130	0082	6.00	600	0258
1.40	140	008C	6.50	650	028A
1.50	150	0096	7.00	700	2BC
2.00	200	00C8	7.50	750	2EE
2.50	250	00FA	8.00	800	320

（1）Press the **ENTER** key after displayed "Data-3(Hex)=####" on the data display.
Data display becomes current setting mode.

```
Special Data
Data-3(Hex)<####
```
←Cursor position is inputting point

（2）Press **Δ +** or **∇ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction, data is increased and turn to the counter clockwise direction, data is decreased. (Data is 0 to 9 numbers)

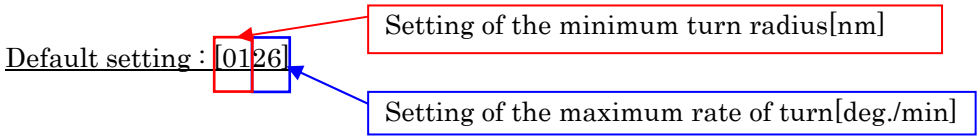
```
Special Data
Data-3(Hex)<0064
```

The above setting is [1.00]. (If you want to set 1.50 as Multiplier, input [0096] in this display.)

（4） After input the flag, then press **ENTER** key.

14. Option(Special) Data-4 setting

The minimum turn radius[nm] and the maximum rate of turn[deg./min] can be set by this setting mode.
Each setting value is decided by the rate of turn that results when the ship has turned with the rudder angle of 35 degrees.



Example) When the maximum rate of turn is 58[deg./min.] at 20kt, the radius value is calculated by following formula.

$$\text{Radius[nm]} \fallingdotseq \frac{\text{Vs[kt]}}{\text{Rate of turn[deg./min.]}} = \frac{20}{58} = 0.34\text{[nm]} \rightarrow \text{Setting radius } 0.40\text{[nm]}$$

Observed rate of turn 58[deg./min.] → Setting rate of turn 55[deg./min.]

(1) Press the **ENTER** key after displayed "Data-4(Hex)=####" on the data display.
Data display becomes current setting mode.

```
Special Data
Data-4(Hex)<####
```
←Cursor position is inputting point

(2) Press **Δ +** or **∇ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction, data is increased and turn to the counter clockwise direction, data is decreased. (Data is 0 to 9 numbers)

```
Special Data
Data-4(Hex)<0126
```

Above setting means that the minimum radius is 0.1[nm] and the maximum rate of turn is 200[deg./min.].

(5) After input the flag, then press **ENTER** key.

Setting table

Setting table for Min. Turning radius (Set No. ,Hex value and Radius value)

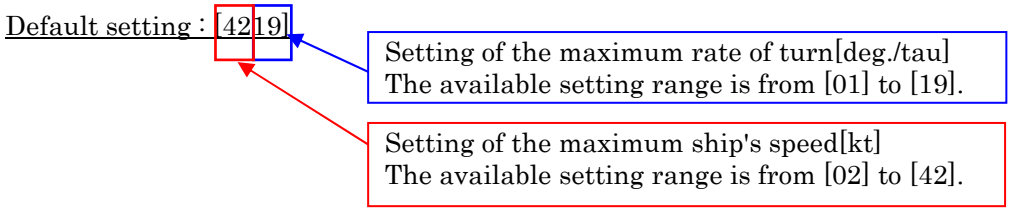
No.	(Hex)	Radius [nm]	No.	(Hex)	Radius [nm]	No.	(Hex)	Radius [nm]	No.	(Hex)	Radius [nm]
1	01	0.1	11	0B	1.1	21	15	2.5	31	1F	7.5
2	02	0.2	12	0C	1.2	22	16	3.0	32	20	8.0
3	03	0.3	13	0D	1.3	23	17	3.5	33	21	8.5
4	04	0.4	14	0E	1.4	24	18	4.0	34	22	9.0
5	05	0.5	15	0F	1.5	25	19	4.5	35	23	9.5
6	06	0.6	16	10	1.6	26	1A	5.0	36	24	10.0
7	07	0.7	17	11	1.7	27	1B	5.5			
8	08	0.8	18	12	1.8	28	1C	6.0			
9	09	0.9	19	13	1.9	29	1D	6.5			
10	0A	1.0	20	14	2.0	30	1E	7.0			

Setting table for Max. Rate of turn (Set No. ,Hex value and ROT value**[deg/min]**)

No.	(Hex)	Rot [° /min]	No.	(Hex)	Rot [° /min]	No.	(Hex)	Rot [° /min]	No.	(Hex)	Rot [° /min]
1	01	1	11	0B	15	21	15	65	31	1F	130
2	02	2	12	0C	20	22	16	70	32	20	140
3	03	3	13	0D	25	23	17	75	33	21	150
4	04	4	14	0E	30	24	18	80	34	22	160
5	05	5	15	0F	35	25	19	85	35	23	170
6	06	6	16	10	40	26	1A	90	36	24	180
7	07	7	17	11	45	27	1B	95	37	25	190
8	08	8	18	12	50	28	1C	100	38	26	200
9	09	9	19	13	55	29	1D	110			
10	0A	10	20	14	60	30	1E	120			

１５．　Option(Special) Data-5 setting

The maximum rate of turn[deg./tau] and the maximum ship's speed can be set by this setting mode.
The max. ROT setting value is decided by the rate of turn that results when the ship has turned with the rudder angle of 35 degrees.
The max. ship's speed setting value is decided by ship's specification.



The rate of turn[deg./tau] is calculated by following formula.
Example) The maximum rate of turn is 58[deg./min.] at 20kt and the ship's length is 200m

$$\text{Rate of turn[deg./tau]} = \frac{\text{ROT[deg./min.]} \times \text{Lpp} \times 60}{\text{Vs[kt]} \times 1852} = \frac{58 \times 200 \times 60}{20 \times 1852} = 18.8\text{[deg/tau]} \rightarrow \text{Setting radius } 18\text{[deg./tau]}$$

（1）Press the **ENTER** key after displayed "Data-5(Hex)=####" on the data display.
Data display becomes current setting mode.

←Cursor position is inputting point

（2）Press **△ +** or **▽ −** key to set the cursor point. Then change the data by turning the Set course dial. Turn to the clockwise direction, data is increased and turn to the counter clockwise direction, data is decreased. (Data is 0 to 9 numbers)

Above setting means that the max. ROT is 18[deg./tau] and the max. ship's speed is 25[kt].

（3）After input the flag, then press **ENTER** key

Setting table

Setting table for Max. ship's speed (Set No. ,Hex value and ship's speed value**[kt]**)

No.	(Hex)	Ship's speed[kt]	No.	(Hex)	Ship's speed[kt]	No.	(Hex)	Ship's speed[kt]	No.	(Hex)	Ship's speed[kt]
1	01	prohibited	21	15	20	41	29	40	61	3D	60
2	02	1	22	16	21	42	2A	41	62	3E	61
3	03	2	23	17	22	43	2B	42	63	3F	62
4	04	3	24	18	23	44	2C	43	64	40	63
5	05	4	25	19	24	45	2D	44	65	41	64
6	06	5	26	1A	25	46	2E	45	66	42	65
7	07	6	27	1B	26	47	2F	46			
8	08	7	28	1C	27	48	30	47			
9	09	8	29	1D	28	49	31	48			
10	0A	9	30	1E	29	50	32	49			
11	0B	10	31	1F	30	51	33	50			
12	0C	11	32	20	31	52	34	51			
13	0D	12	33	21	32	53	35	52			
14	0E	13	34	22	33	54	36	53			
15	0F	14	35	23	34	55	37	54			
16	10	15	36	24	35	56	38	55			
17	11	16	37	25	36	57	39	56			
18	12	17	38	26	37	58	3A	57			
19	13	18	39	27	38	59	3B	58			
20	14	19	40	28	39	60	3C	59			

Setting table for Max. Rate of turn (Set No. ,Hex value and ROT value**[deg/tau]**)

No.	(Hex)	ROT [° /τ]
1	01	1
2	02	2
3	03	3
4	04	4
5	05	5
6	06	6
7	07	7
8	08	8
9	09	9
10	0A	10

No.	(Hex)	ROT [° /τ]
11	0B	11
12	0C	12
13	0D	13
14	0E	14
15	0F	15
16	10	16
17	11	17
18	12	18
19	13	19
20	14	20

No.	(Hex)	ROT [° /τ]
21	15	21
22	16	22
23	17	23
24	18	24
25	19	25

Chapter 28 Notice

① It is possible to use the normal operation during maintenance mode.
② In case of no key operation condition has kept more than one hour, maintenance mode is released automatically.