FURUNO

OPERATOR'S MANUAL

GPS NAVIGATOR

MODEL GP-90

FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN

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9-52 Ashihara-cho,
Nishinomiya 662-8580, JAPAN

Telephone : 0798-65-2111
Fax : 0798-65-4200

FURUNO Authorized Distributor/Dealer

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0001474641 5

OME44270F30

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⚠ SAFETY INSTRUCTIONS

⚠ WARNING

Do not open the cover of the equipment.

This equipment uses high voltage electricity which can shock, burn or cause death. Only qualified personnel should work inside the equipment.

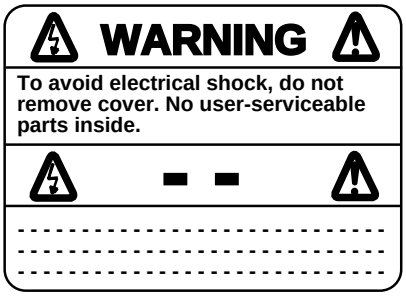
Do not dissasemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Immediately turn off the power at the ship's mains switchboard if water or foreign object falls into the equipment or the equipment is emitting smoke or fire.

Continued use of the equipment can cause fire, electrical shock or serious injury.

WARNING Label attached



Name: Warning Label (1)
Type: 86-003-1011-1
Code No.: 100-136-231

⚠ CAUTION

Do not place liquid-filled containers on the top of the equipment.

Fire or electrical shock can result if a liquid spills into the equipmtnt.

Do not place heater neat the equipment.

Heat can melt the power cord, which can result in fire or electrical shock.

Do not operate the unit with wet hands.

Electrical shock can result.

Use the correct fuse.

Use of the wrong fuse can cause fire or equipment damage.

No single navigation aid (including this unit) should ever be relied upon as the exclusive means for navigating your vessel.

The navigator is responsible for checking all aids available to confirm his position. Electronic aids are intended to assist, not replace, the navigator.

Use of an autopilot with this unit, to provide automatic steering to destination, does not eliminate the need to maintain a watch.

Always maintains a vigilant watch to prevent collision or grounding.

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Declaration of conformity

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FOREWORD

A Word to GP-90 Owners

Congratulations on your choice of the FURUNO GP-90 GPS Navigator. We are confident you will see why the FURUNO name has become synonymous with quality and reliability.

For over 50 years FURUNO Electric Company has enjoyed an enviable reputation for innovative and dependable marine electronics equipment. This dedication to excellence is furthered by our extensive global network of agents and dealers.

Your navigator is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless operated and maintained properly. Please carefully read and follow the recommended procedures for operation and maintenance.

We would appreciate hearing from you, the end-user, about whether we are achieving our purposes.

Thank you for considering and purchasing FURUNO equipment.

Features

The GP-90 GPS Navigator is a totally integrated GPS receiver and video plotter consisting of a display unit and an antenna unit. The high sensitivity receiver tracks up to 12 satellites simultaneously. An 8-state Kalman filter ensure optimum accuracy in determination of vessel position, course and speed.

In most cases the operator needs to do is to turn on the power to find position.

The main features of the GP-90 are

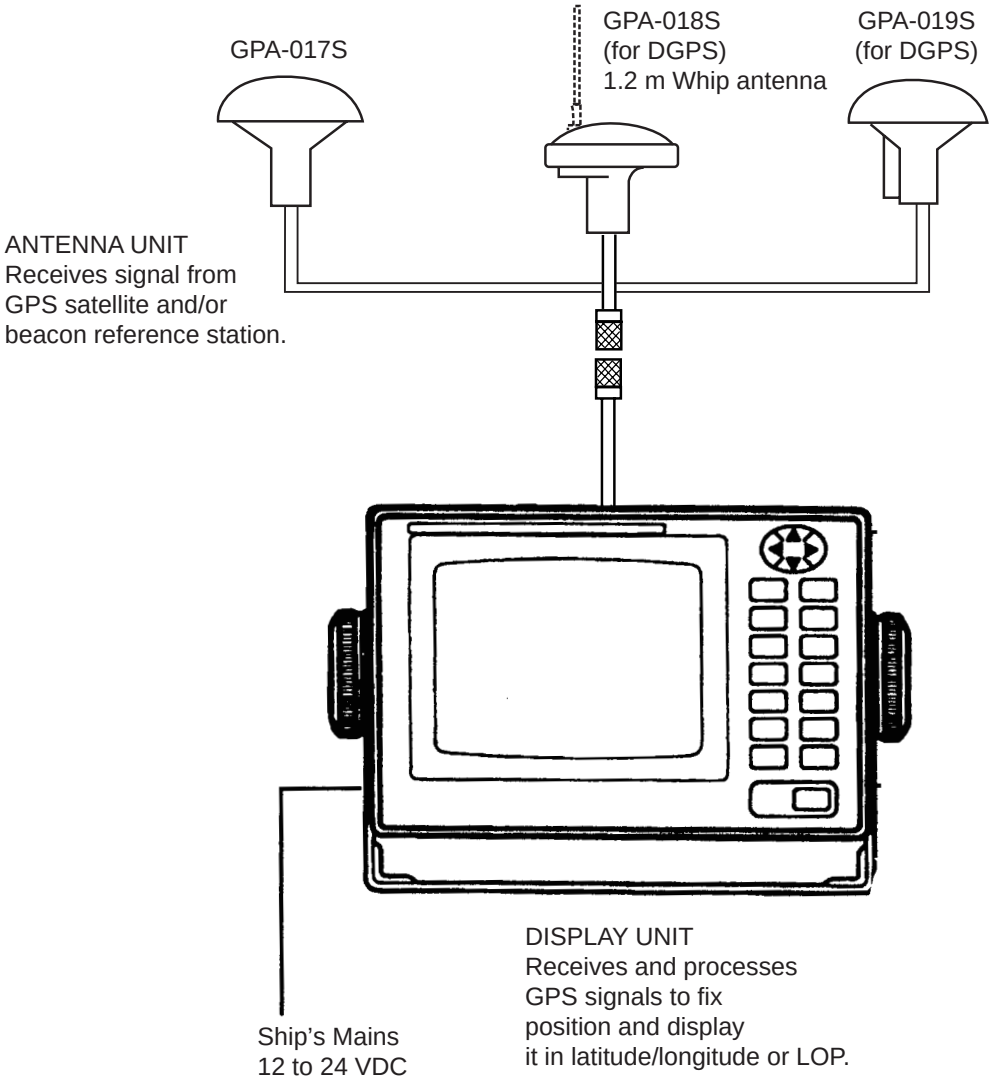
- Comprehensive navigation data displays
- Storage for 999 waypoints and 30 routes
- Alarms: Waypoint Arrival, Anchor Watch, Cross-track Error, Ship's Speed, Water Temperature, Depth and Trip
- Man overboard feature records latitude and longitude coordinates at time of man overboard and provides continuous updates of range and bearing to that point.
- DGPS capability - with built-in DGPS beacon kit, or accepts DGPS correction data from external DGPS beacon receiver
- Menu-driven operation
- Bright 122 x 92 mm LCD with temperature compensated tone and brilliance adjustment
- Power consumption is a low 10 W.
- Provision for connection of autopilot (option) - steering data output to autopilot
- Digital display of water temperature and depth with connection of video sounder (with NMEA input)
- Memory stores 2,000 points of track and marks.
- "Highway" display provides perspective view.
- Position may be shown in latitude and longitude or LOP (Loran or Decca).
- Four connectors for optional equipment two IEC 61162-1/NMEA 0183 I/O, one IEC 61162-1/NMEA 0183 (or log) output and one DGPS for personal computer I/O
- Fully meets the following regulation: IMO MSC. 112(73) and IEC 61108-1.

Program No.

2051511-05.01 (September 2004)

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SYSTEM CONFIGURATION



CATEGORY OF UNITS

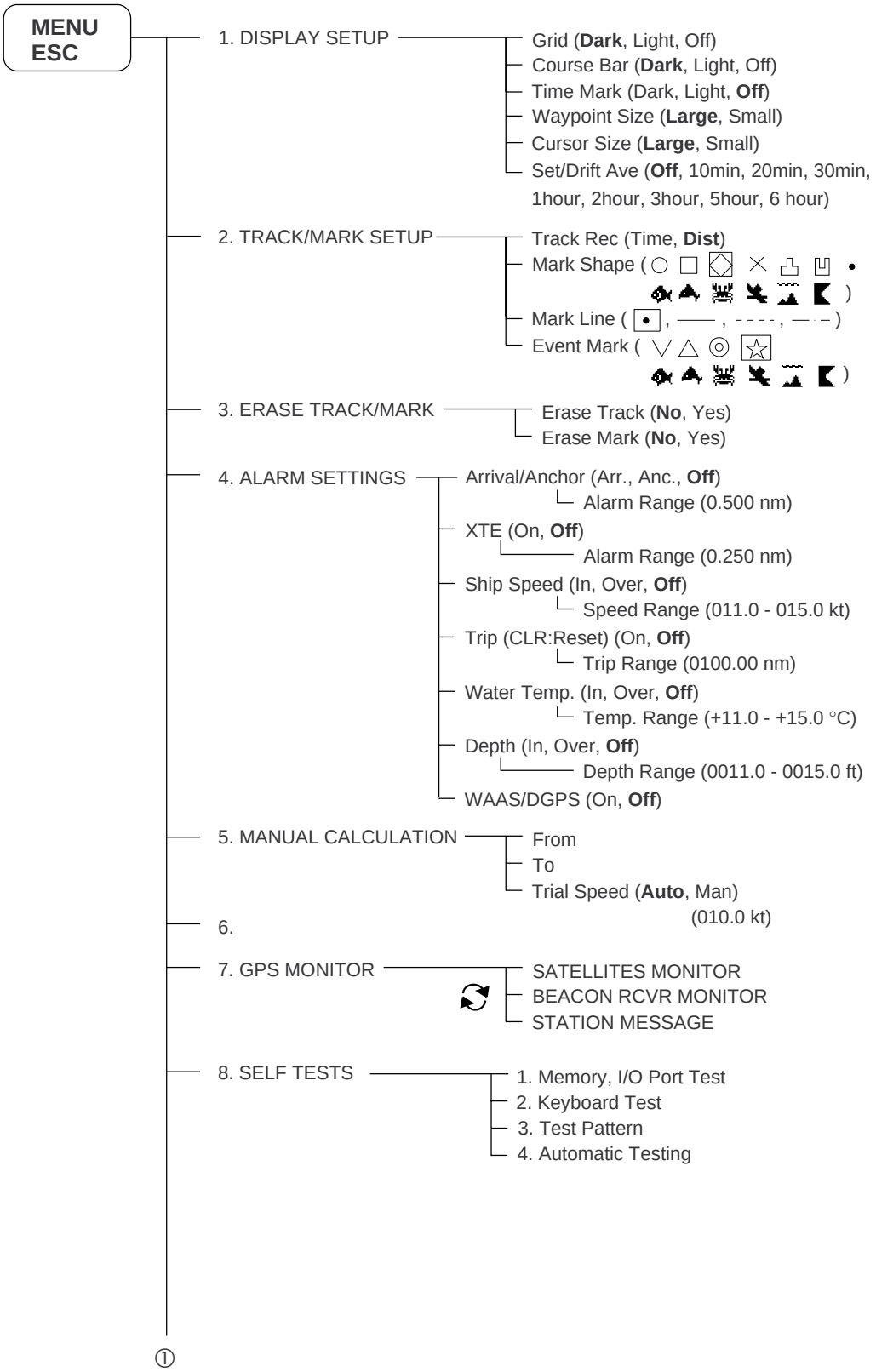
Unit	Category
ANTENNA UNIT	Exposed to weather
DISPLAY UNIT	Protected from weather

This GPS receiver complies with Canadian standard RSS-210 (Low Power License-Exempt Radio communication Devices).
Operation is subject to the following two conditions:
(1) this device may not cause interference, and
(2) this device must accept any interference, including interference that may cause undesired operation of the device.

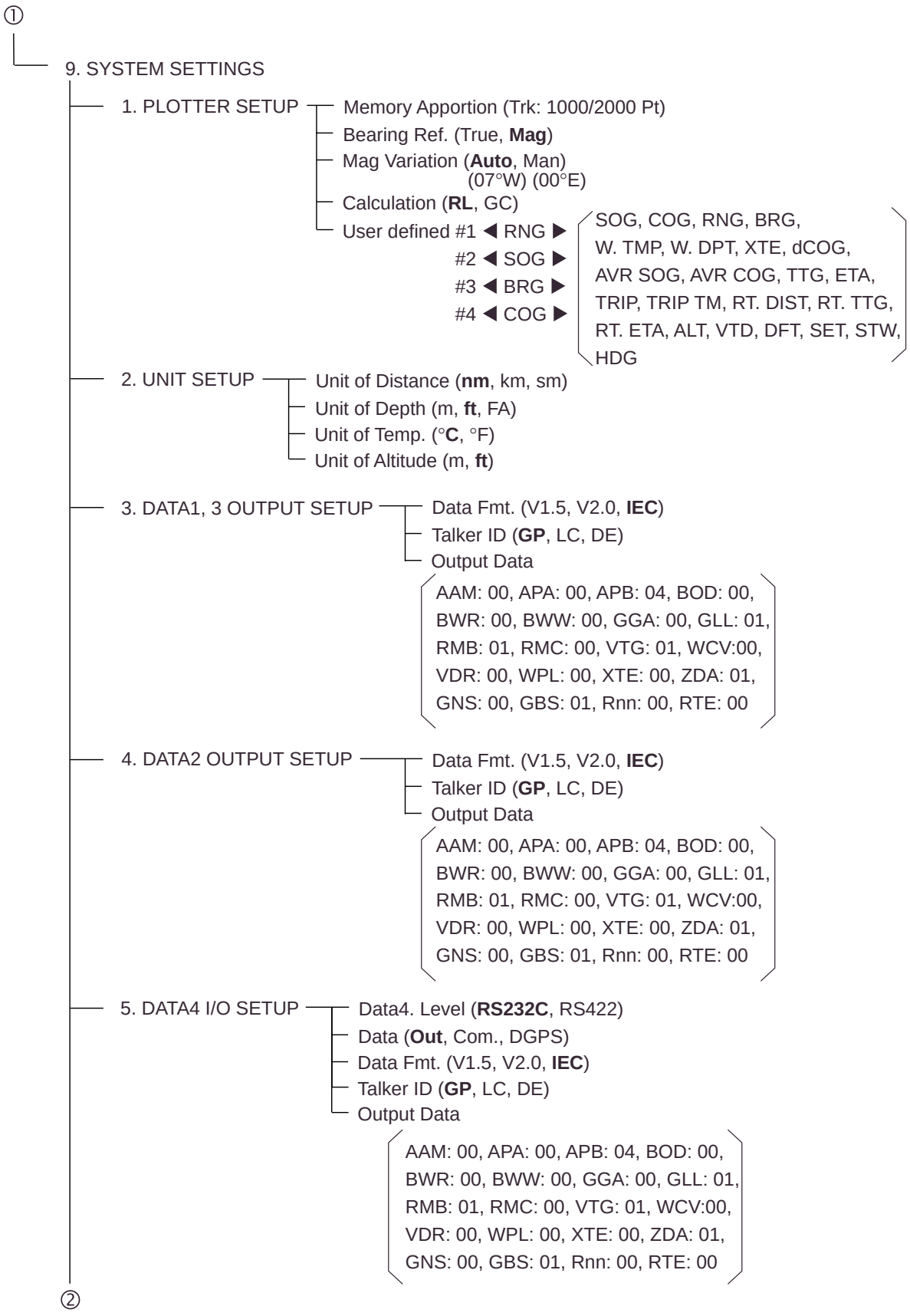
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MENU TREE

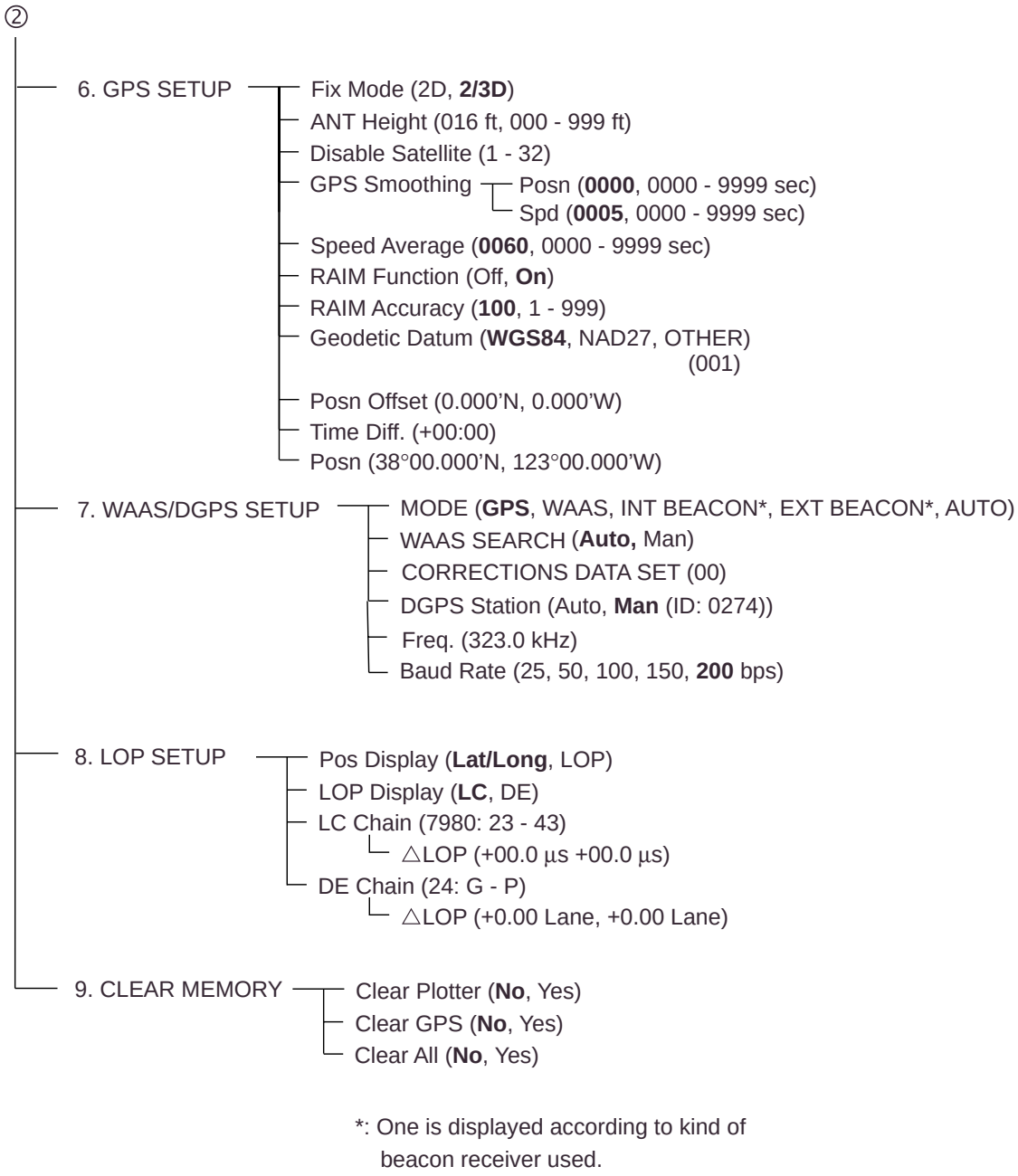
Main menu



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*: One is displayed according to kind of beacon receiver used.

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1. OPERATIONAL OVERVIEW

1.1 Control Description

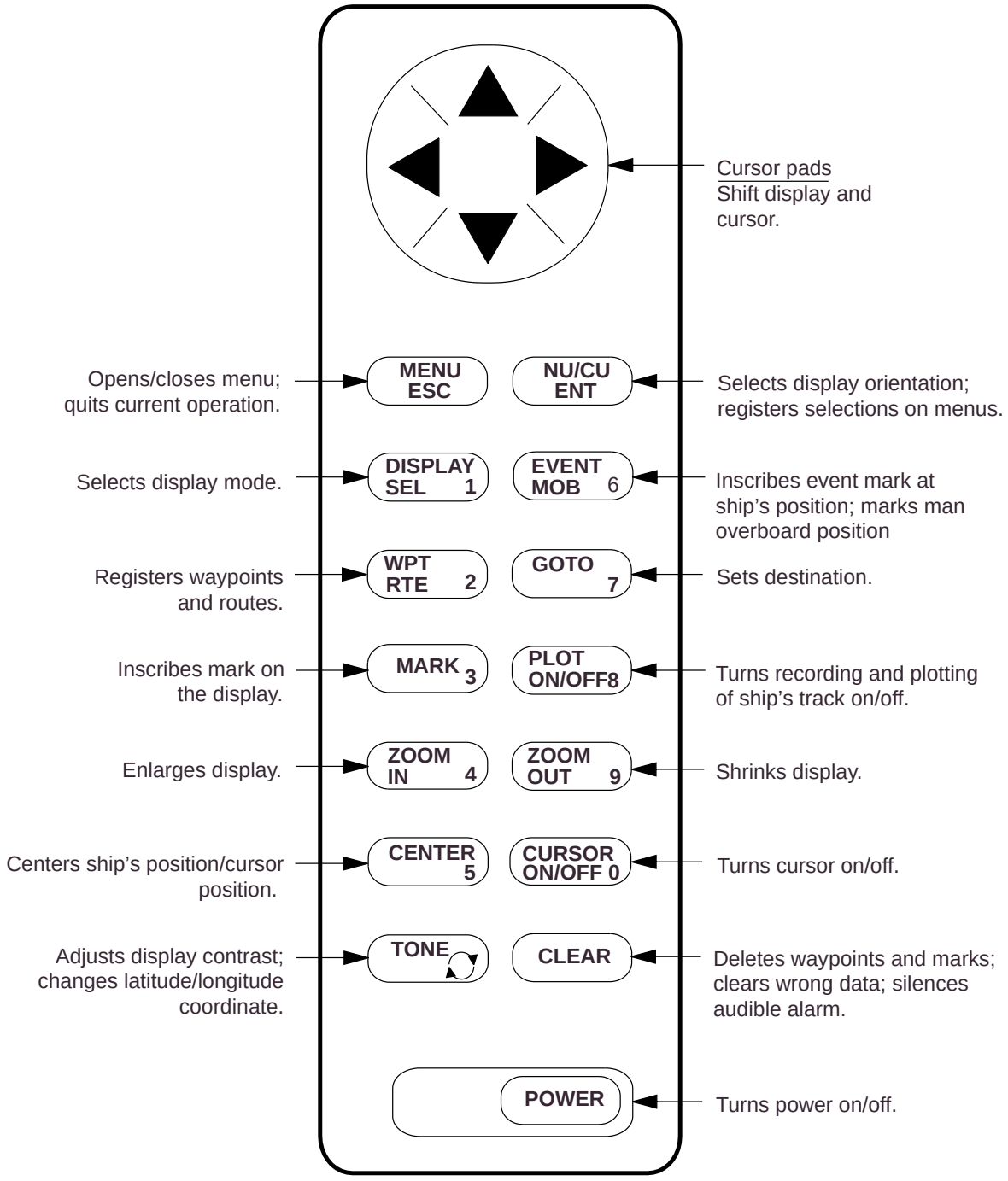


Figure 1-1 Control Panel

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1.2 Turning On and Off the Power

The GP-90 takes about 90 seconds to find position when turned on for the very first time. Thereafter it takes about 12 seconds to find position each time the power is turned on.

Turning on the power

Press the [POWER] key.

The unit tests the PROGRAM MEMORY, SRAM and battery for proper operation and shows the results on the display. If equipped with the internal beacon receiver, "BEACON RCVR INSTALLED" appears at the bottom of the display. The unit starts up with the last used display mode.

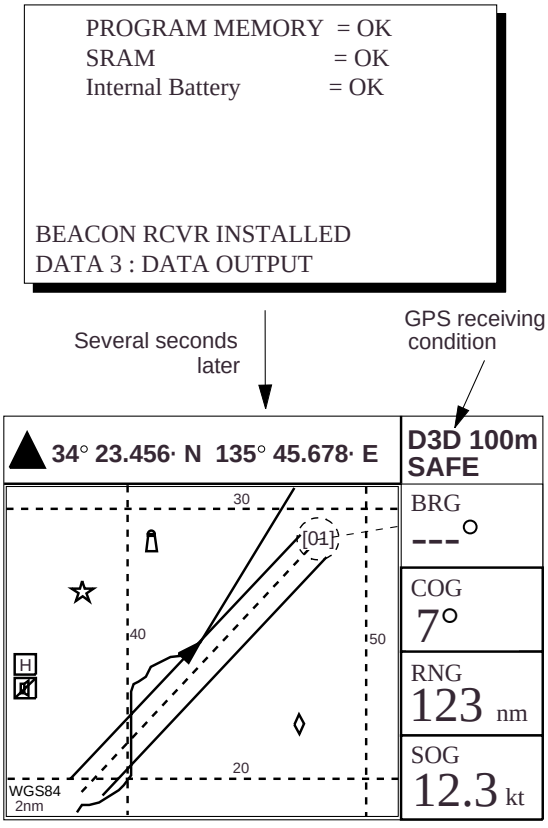


Figure 1-2 Appearnace of display when turning on the power

When turning on the power the following occurs:

12 seconds after turning on the power, accurate position (in latitude and longitude) appears on the display.

If position could not be found, "NO FIX" appears at the GPS receiving condition window. When PDOP value exceeds 6 in the 3D mode or HDOP value exceeds 4 in the 2D mode, "DOP" appears to indicate abnormal fixing and the position indication could not be updated.

When the satellite signal is being received normally, one of the indications shown in Table 1-1 appears depending on equipment setting and GPS receiver state.

Table 1-1 GPS receiver indication

Equipment setting	GPS receiver state indication
2D	**2D (normal)**
3D	**3D (normal)**
Differential 2D	**D2D (normal)**
Differential 3D	**D3D (normal)**
WAAS 2D	**W2D (normal)**
WAAS 3D	**W2D (normal)**

Note 1: When PDOP value exceeds 6 in the 3D mode, the position fixing method is automatically changed to 2D.

Note 2: The "DEMO" icon appears when the display is in the demonstration mode. To return to normal mode, turn off the power and turn it on while pressing and holding down the [NU/CU ENT] key.

Turning the power off

Press the [POWER] key.
The next time you turn on the power the unit starts up with the last used display mode.

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1.3 Adjusting Display Contrast and Brilliance

1) Press the [TONE] key. The display shown in Figure 1-3 appears.

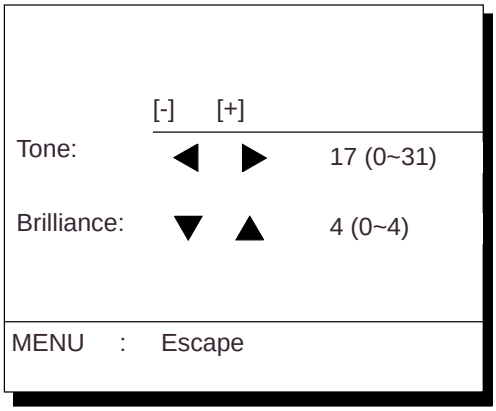


Figure 1-3 Screen for adjustment of display contrast and brilliance

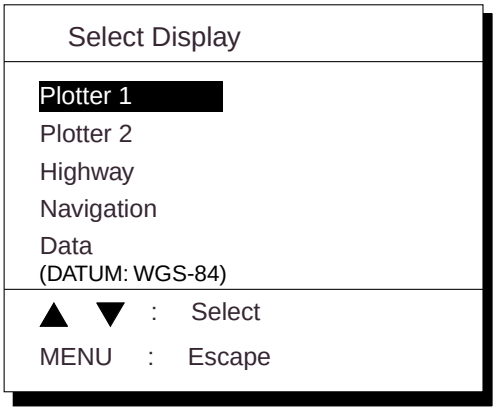
2) To adjust contrast, press ◀ or ▶. Current setting and setting range (0-31) are shown to the right of "▶".
To adjust brilliance, press ▲ or ▼. Current setting and setting range (0-4) are shown to the right of "▲".

Note 1: Operate cursor keys within 10 seconds after pressing the [TONE] key. Otherwise, the screen for adjustment of contrast and brilliance will be cleared.

Note 2: If the display is turned off with minimum tone the display will be blank at the next power up. When this occurs press the [TONE] key continuously to adjust tone.

1.4 Selecting the Display Mode

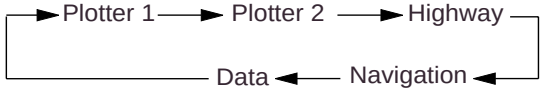
1) Press the [DISPLAY SEL] key. The display shown in Figure 1-4 appears.



* Shows currently selected geodetic chart datum.

Figure 1-4 Screen for selection of display mode

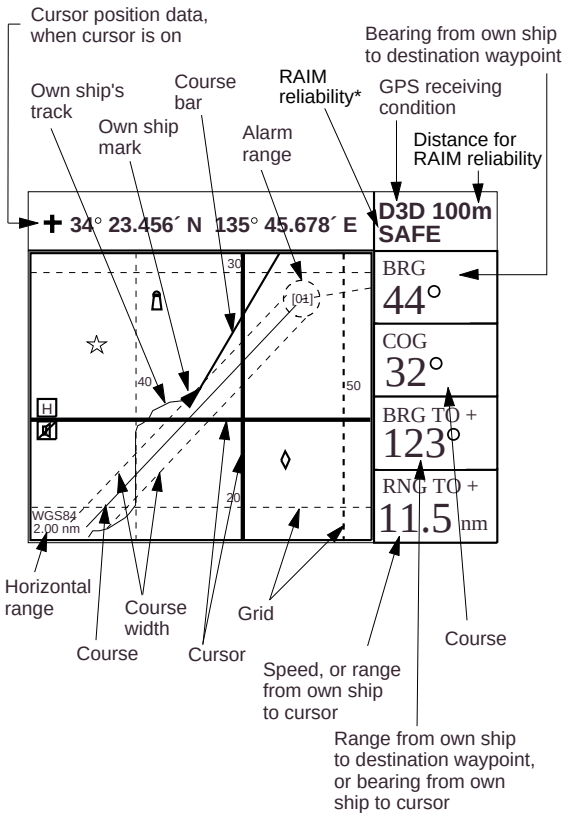
2) Press the [DISPLAY SEL] key, ▲ or ▼ to select display mode. (When the [DISPLAY SEL] key is pressed, the display mode changes in sequence shown below.) Selected display mode appears about 15 seconds later.



Sample displays of each display mode are shown in the figures on the next several pages.

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Plotter 1 display



*: For RAIM function, refer to page 8-1.

Figure 1-5 Plotter 1 display

Plotter 2 display

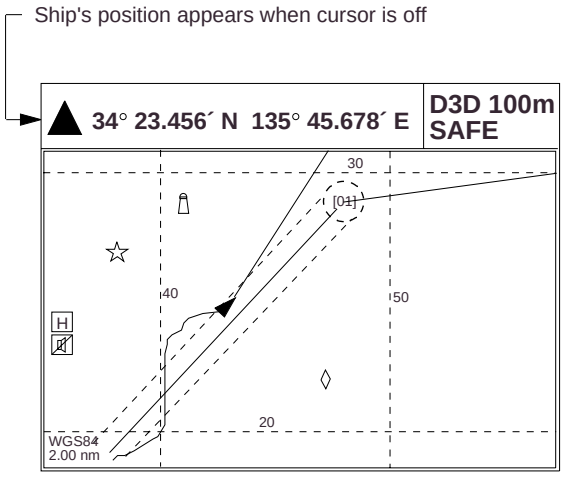


Figure 1-6 Plotter 2 display

Highway display

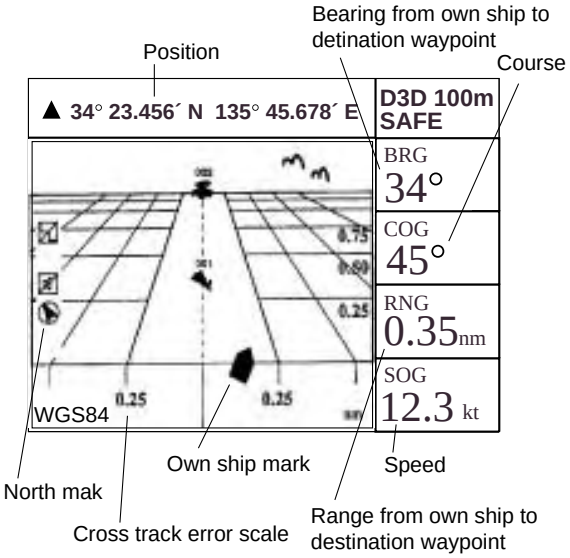


Figure 1-7 Highway display

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Navigation display

1) No autopilot connection

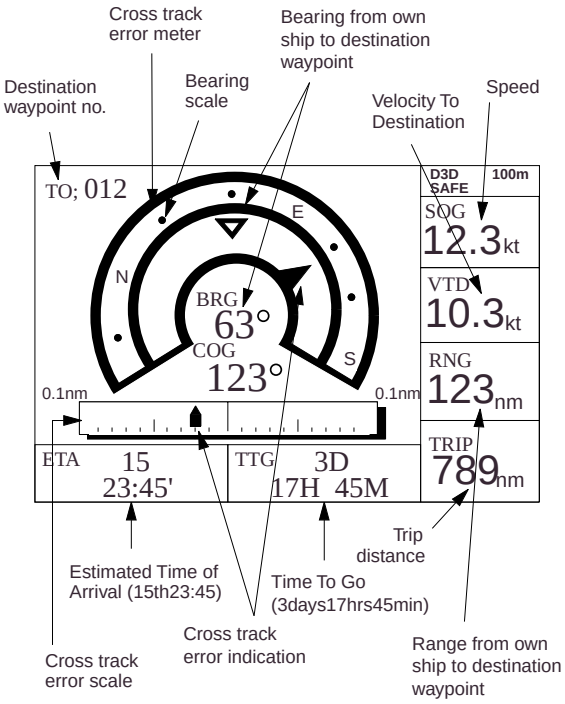


Figure 1-8 Navigation display, no autopilot connection

2) With autopilot connection, automatic mode

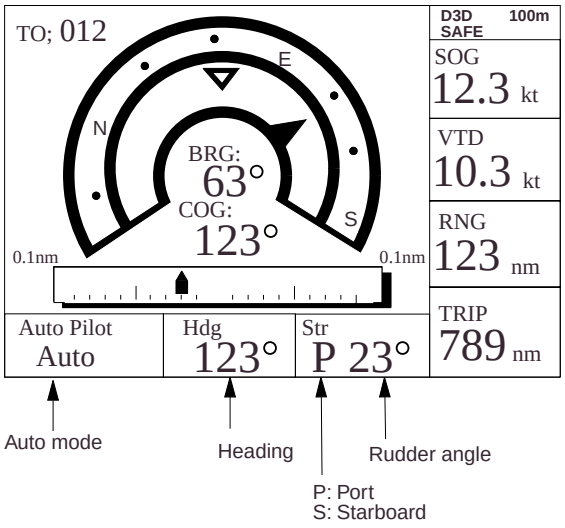


Figure 1-9 Navigation display, with autopilot connection, automatic mode

3) Autopilot connection, modes other than automatic mode (manual, nav, etc.)

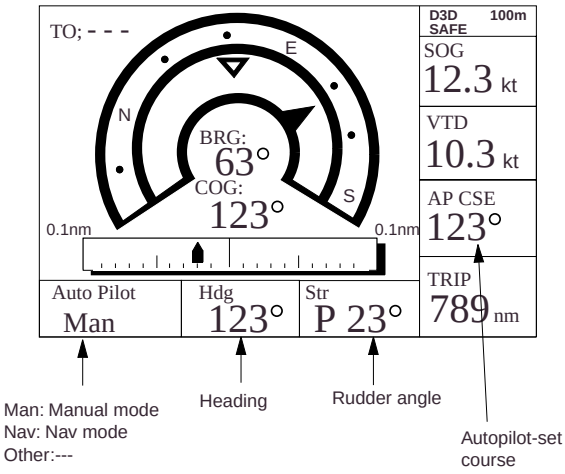


Figure 1-10 Navigation display, with autopilot connection, modes other than the automatic mode

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Data display

(Window assignment and size of characters are user-definable)

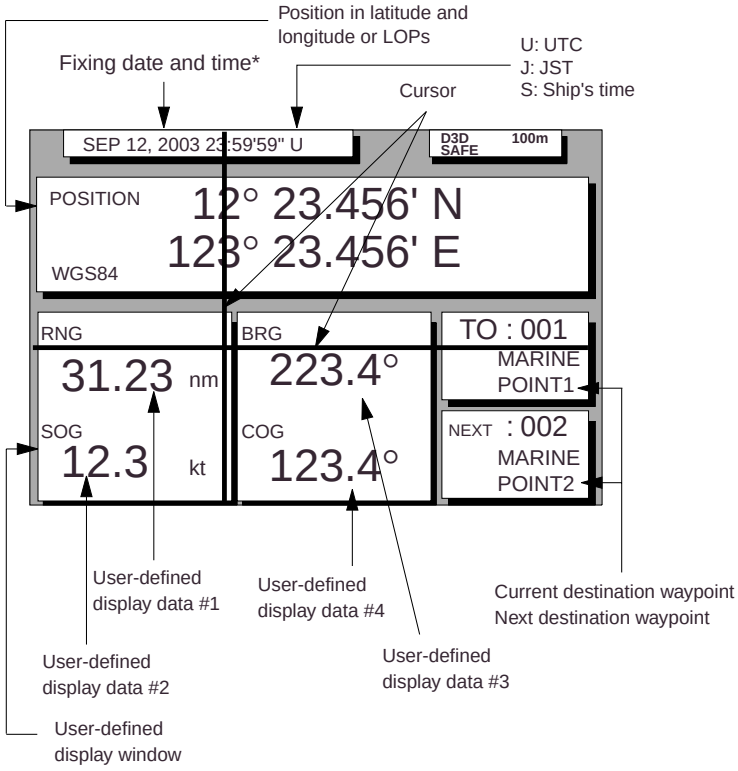


Figure 1-11 Data display mode

*: "- -" appears until calculating position after turning on the power. If fixing error occurs this indication stops.

1.5 Chart Icons

Various icons appear on the display to alert you to equipment status.

: L/L position offset applied.
: Track recording turned off.
: Alarm is violated.
: North mark.
: Demonstration display.

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2. TRACK

2.1 Enlarging/Shrinking the Display

You may enlarge and shrink the display on the Plotter 1 and Plotter 2 displays, with the [ZOOM IN] and [ZOOM OUT] keys. The horizontal range is available among 0.25, 0.5, 1, 2, 4, 8, 16, 32, 64, 128 and 192 nautical miles for plotter 1 and 0.36, 0.71, 1.42, 2.84, 5.69, 11.38, 22.76, 45.51, 91.02, 182.04, 273.07 nautical miles for plotter 2 display. The [ZOOM IN] key enlarges the display and the [ZOOM OUT] key shrinks it. Each time a zoom key is pressed the display range appears at the center of the display for about three seconds.

2.2 Selecting Display Orientation

Display orientation can be selected on the Plotter 1, Plotter 2 and Highway displays, with the [NU/CU ENT] key. Two display orientations are available: north-up and course-up.

North-up display

In the north-up display, true north (0°) is at the top of the display. Own ship moves on the display in accordance with true speed and true motion. Land is stationary.

Course-up display

Destination set

The destination is at the top of the display and the north mark (⏃) appears at the left side of the display.

Destination not set

Ship's heading or course is at the top of the display. The north mark appears at the left side of the display.

2.3 Shifting the Cursor

The cursor can be shifted with the cursor pads.

1) Press the [CURSOR ON/OFF] key to turn on the cursor.
2) Press the cursor pads.

The cursor moves in the direction of the cursor pads pressed. When the cursor reaches the edge of the display, the display shifts in the direction opposite.

Data and cursor state

Cursor state determines what data are shown on the display.

Cursor turned on, cursor data

Cursor position is displayed in latitude and longitude or LOPs (depending on menu setting) at the top of the display. The range and bearing from own ship to the cursor appear at the right hand side of the display, when in the Plotter 1 display.

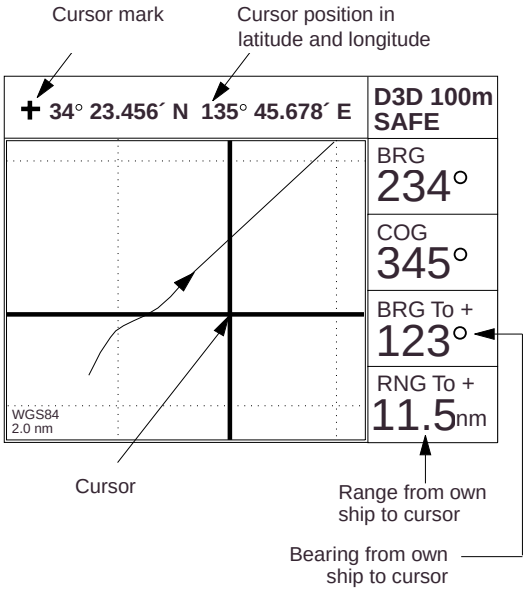


Figure 2-1 Data displayed when the cursor is turned on

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Cursor turned off

Ship's position (in latitude and longitude or LOPs), speed and course appear on the display.

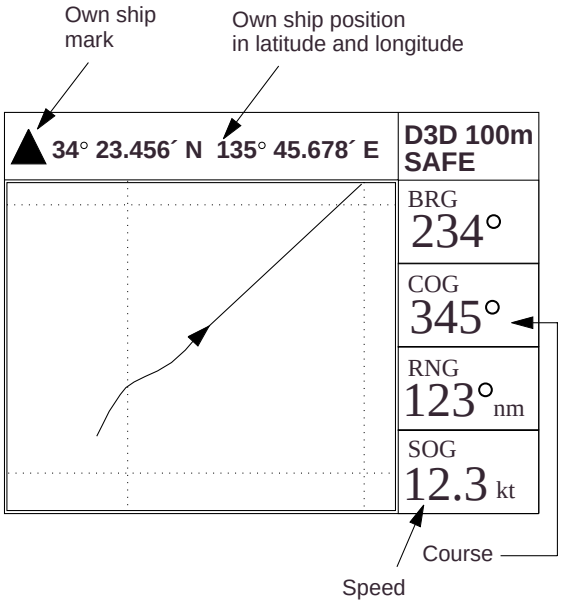


Figure2-2 Data display when the cursor is turned off

2.4 Shifting the Display

The display can be shifted on the Plotter 1 and Plotter 2 displays, with the [CURSOR ON/OFF] key. When own ship tracks off the display it is automatically returned to the screen center.

1) Press the [CURSOR ON/OFF] key to turn off the cursor.
2) Press the cursor pads. The display shifts in the direction of the cursor pads pressed.

2.5 Centering Cursor Position

1) Press the [CURSOR ON/OFF] key to turn on the cursor.
2) Press the cursor pad to position the cursor.
3) Press the [CENTER] key.

2.6 Centering Own Ship's Position

1) Press the [CURSOR ON/OFF] key to turn off the cursor.
2) Press the [CENTER] key.

2.7 Stopping/Starting Plotting and Recording of Track

The GP-90 stores 2,000 points of track and marks. When the memory becomes full the oldest track is erased to make room for the latest.

Procedure

Press the [PLOT ON/OFF] key to start/stop recording and plotting of track.

When plotting is resumed

"Resuming track plot" appears at the center of the display for about three seconds.

When plotting is stopped

"Stopping track plot" appears at the center of the display for about three seconds and "H" appears at the left side of the display. ("H" does not appear on the Navigation and Data displays.)

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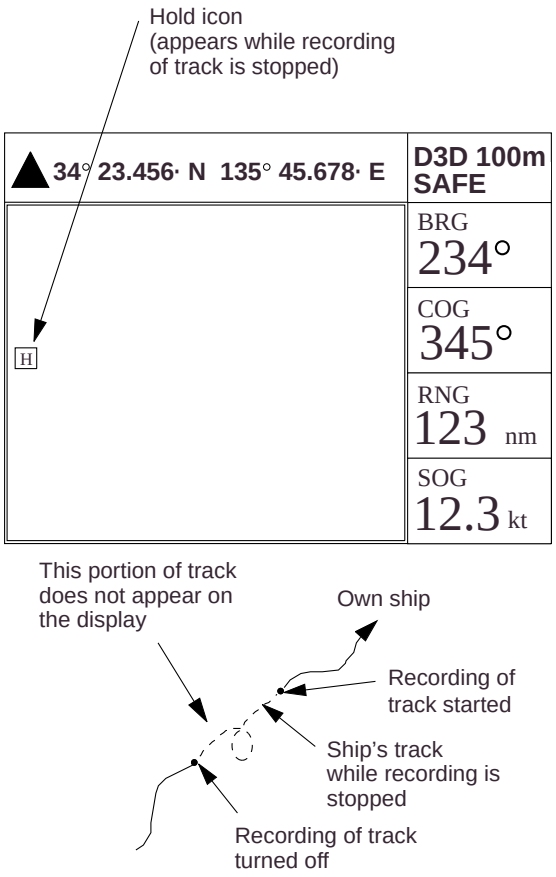


Figure 2-3 Track not plotted or recorded when plotting is stopped

2.8 Erasing Track

The track stored in the memory and displayed on the screen can be erased.

CAUTION

Track cannot be restored once erased. Be absolutely sure you want to erase all track.

1) Press the [MENU ESC] key. The MAIN MENU appears.

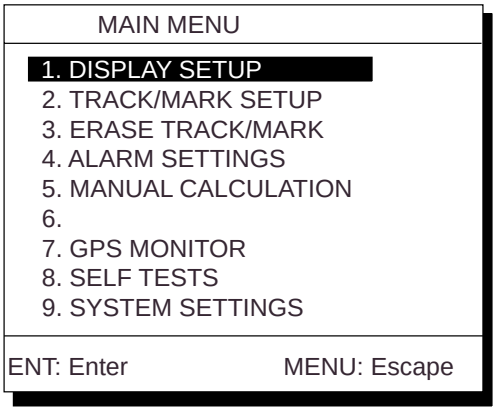


Figure 2-4 MAIN MENU

2) Press [3] to select ERASE TRACK/MARK.

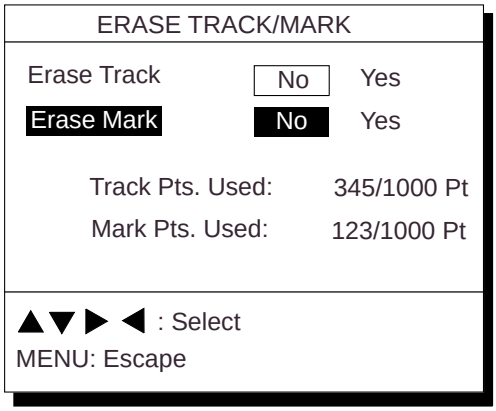


Figure 2-5 ERASE TRACK/MARK menu

3) Press ▲ or ▼ to select Erase Track.
4) Press ▶ to select Yes. The message shown in Figure 2-6 appears.

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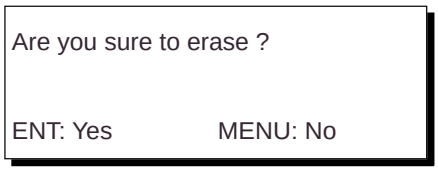


Figure 2-6 Prompt for erasure of track

5) Press the [NU/CU ENT] key.

2.9 Selecting Track Plotting Interval

The plotting interval determines both how the track will be reconstructed on the display and track storage time. A shorter interval provides more accurate reconstruction of track line, however total storage time is reduced. The plotting interval can be selected by time or distance. Plotting by distance offers the advantage that the track is not stored when the vessel is anchored.

Plotting interval by time

The setting range for plotting by time is 00 to 60 minutes.

1) Press the [MENU ESC] key.
2) Press [2] to display the TRACK/MARK SETUP menu.

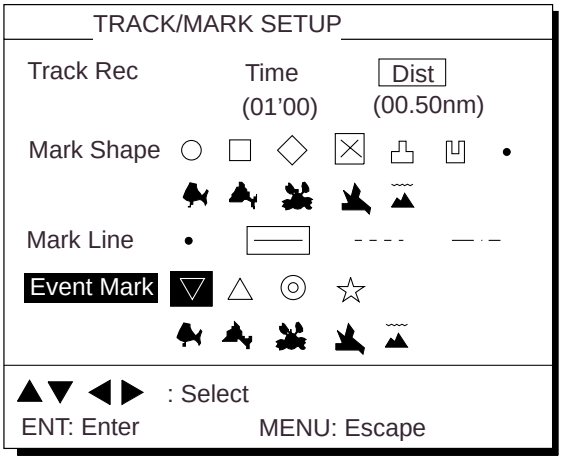


Figure 2-7 TRACK/MARK SETUP menu

3) Press ▲ or ▼ to select Track Rec.
4) Press ◀ to select Time.
5) Enter plotting interval in four digits. To enter 30 seconds, for example, press [0] [0] [3] [0].
6) Press the [NU/CU ENT] key.
7) Press the [MENU ESC] key.

Plotting interval by distance

The setting range for plotting by distance is 0.01 to 99.99 nautical miles. To plot all track, enter 00.00.

1) Press the [MENU ESC] key.
2) Press [2] to display the TRACK/MARK SETUP menu.
3) Press ▲ or ▼ to select Track Rec.
4) Press ▶ to select Distance.
5) Enter plotting interval. To enter 0.1 nautical miles, for example, press [0] [0] [1].
6) Press the [NU/CU ENT] key.
7) Press the [MENU ESC] key.

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2.10 Apportioning the Memory

The memory holds 2,000 points of track and marks and may be apportioned as you like. The default memory setting stores 1,000 points each of track and marks.

CAUTION

All data are erased whenever the memory apportion setting is changed, even when the previous value is re-entered.

To store 1,500 points of track and 500 marks, for example, do the following:

1) Press the [MENU ESC] key.
2) Press [9] to display the SYSTEM SETTINGS menu.

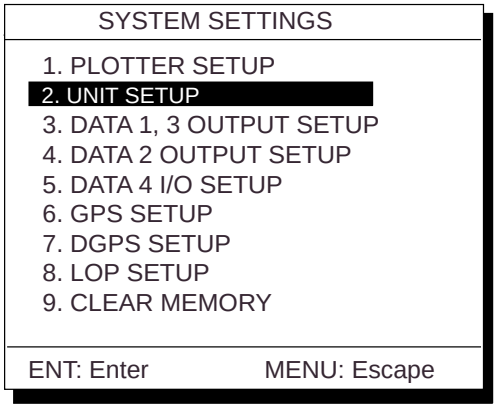


Figure 2-8 SYSTEM SETTNGS menu

3) Press [1] to display the PLOTTER SETUP menu.

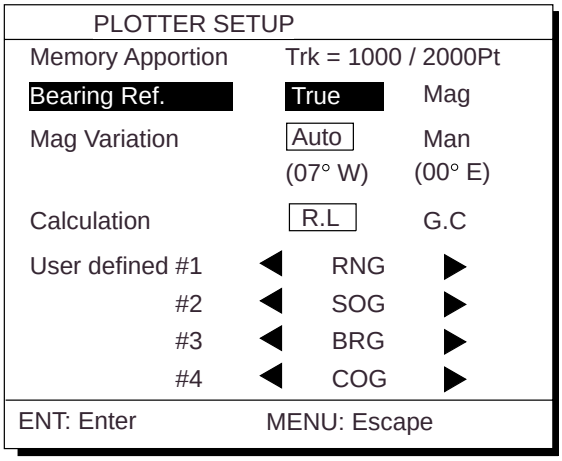


Figure 2-9 PLOTTER SETUP menu

4) Press ▲ or ▼ to select Memory Apportion.
5) Enter amount of track to store, in four digits. To store 1,500 track points, for example, press [1] [5] [0] [0].
6) Press the [NU/CU ENT] key, ▲ or ▼. You are asked if it is all right to erase all data.

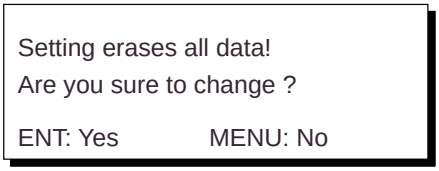


Figure 2-10

7) Press the [NU/CU ENT] key.
8) Press the [MENU ESC] key.

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2.11 Selecting Bearing Reference

Ship's course and bearing to waypoint may be displayed in true or magnetic bearing. Magnetic bearing is true bearing plus (or minus) earth's magnetic deviation.

Displaying true or magnetic bearing

The default setting displays magnetic bearings.

1) Press the [MENU ESC] key.
2) Press [9] to display the SYSTEM SETTINGS menu.
3) Press [1] to display the PLOTTER SETUP menu.
4) Press ▲ or ▼ to select Bearing Ref.
5) Press ◀ or ▶ to select True or Mag.
6) Press the [NU/CU ENT] key, ▲ or ▼.
7) Press the [MENU ESC] key.

Entering magnetic variation

The location of the magnetic north pole is different from the geographical north pole. This causes a difference between the true and magnetic north direction. This difference is called magnetic variation, and varies with respect to the observation point on the earth. Magnetic variation may be entered automatically or manually.

1) Press the [MENU ESC] key.
2) Press [9] to display the SYSTEM SETTINGS menu.
3) Press [1] to display the PLOTTER SETUP menu.
4) Press ▲ or ▼ to select Mag Variation.
5) Press ◀ or ▶ to select Auto or Man. For automatic, current variation appears in parentheses.
6) **For manual entry,** enter variation in two digits, referring to a nautical chart (00-30°). If the variation is 10°, for example, press [1] [0].
7) If necessary, press the [◯] key to change coordinate from east to west or vice versa.
8) Press the [NU/CU ENT] key.
9) Press the [MENU ESC] key.

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3. MARKS

3.1 Entering/Erasing Marks

Marks can be inscribed on the Plotter 1 and Plotter 2 displays. You may inscribe a mark anywhere, in one of 13 shapes. Further, can be connected with lines, to denote net location, etc.

Note 1: When the mark memory becomes full no marks can be entered. When this occurs, the buzzer sounds and the message shown below appears on the display for three seconds to alert you. To enter a mark when the mark memory is full, erase unnecessary marks.

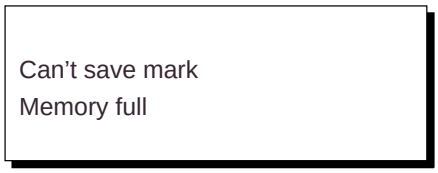


Figure 3-1

Entering marks

At own ship position

1) Press the [CURSOR ON/OFF] key to turn off the cursor.
2) Press the [MARK] key.

At cursor intersection

1) Press the [CURSOR ON/OFF] key to turn on the cursor.
2) Operate the cursor keys to place the cursor on the location for the mark. Select a mark shape you want. Refer to section 3.2.
3) Press the [MARK] key.

Erasing marks

CAUTION

All marks, including event marks and the MOB mark, are erased on the ERASE MARK menu. Be absolutely sure you want to erase all marks; erased marks cannot be restored.

Erasing individual marks

1) Place cursor on the mark to erase.
2) Press the [CLEAR] key.

Erasing all marks

1) Press [MENU ESC] and [3] to display the ERASE TRACK/MARK menu.

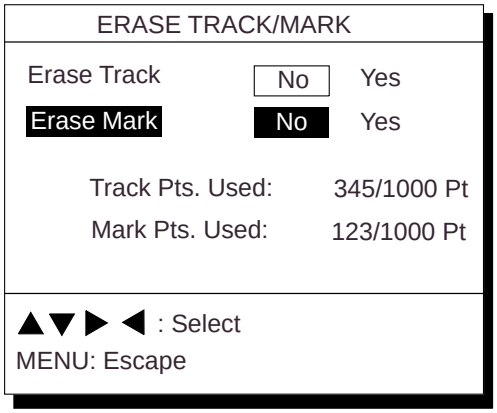


Figure 3-2 ERASE TRACK/MARK menu

2) Press ▲ or ▼ to select Erase Mark.
3) Press ▶ to select YES.

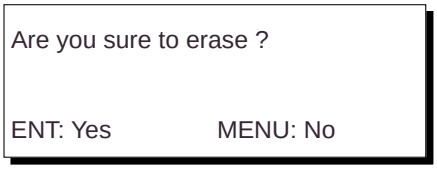


Figure 3-3

4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

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3.2 Selecting Mark Shape

13 mark shapes are available. Select mark shape as follows:

1) Press [MENU ESC] and [2] to display the TRACK/MARK SETUP menu.

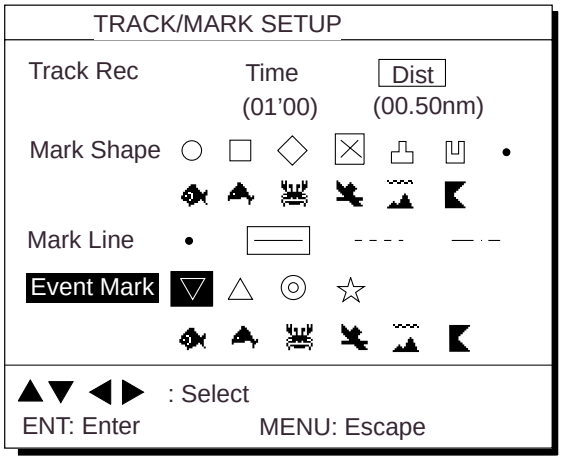


Figure 3-4 TRACK/MARK SETUP menu

2) Press ▲ or ▼ to select Mark Shape.
3) Press ◀ to ▶ select mark shape desired.
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

The next mark entered will be inscribed in the shape selected here.

3.3 Connecting Marks (selecting mark connection line)

Marks can be connected with lines to denote net location, fishing spot, etc. Three types of connection lines are available and the "•" setting disables connection of lines.

1) Press [MENU ESC] and [2]
2) Press ▲ or ▼ to select Mark Line.
3) Press ◀ to ▶ to select mark line desired other than "•".
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

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3.4 Entering Event Marks

Event marks can denote any important present position; for example, a good fishing spot. Event marks can be saved as ordinary marks and the unit automatically numbers them from 01 to 99.

Note 1: When the mark memory becomes full no event marks can be entered. When this occurs, the buzzer sounds and the message shown below appears on the display for three seconds to alert you. To enter an event mark when the mark memory is full, erase unnecessary event marks.

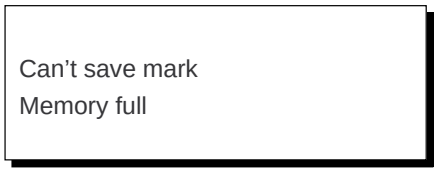


Figure 3-5

Entering event marks

1) Press the [EVENT MOB] key less than three seconds. The position at the exact moment the key is pressed is saved as an event position.

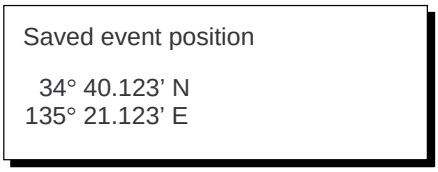


Figure 3-6

To erase event marks, see "3.1 Entering/Erasing Marks".

3.5 Selecting Event Mark Shape

Event marks are available in 10 shapes. Select event mark shape as follows.

1) Press [MENU ESC] and [2] to display the TRACK/MARK SETUP menu.
2) Press ▲ or ▼ to select Event Mark.
3) Press ◀ or ▶ to select event mark shape desired.
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

The next event mark entered will be inscribed in the shape selected here.

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3.6 Entering the MOB Mark

The MOB mark denotes man overboard position. To mark man overboard position, press the [EVENT MOB] key. When the key is pressed, the position at the exact moment the key is pressed automatically becomes the destination. Further, the Plotter 1 display replaces the display in use when it is other than a plotter display.

Only one MOB mark may be entered, and each time the MOB mark is entered the previous MOB mark and its position data are written over.

1) Press the [EVENT MOB] key for at least three seconds.
   The MOB mark ("M") is entered at the MOB position and the message shown in Figure 3-7 appears.

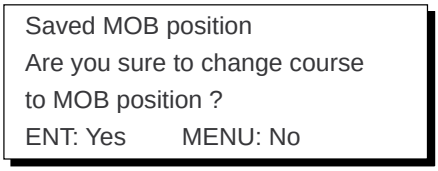


Figure 3-7

2) Press the [NU/CU ENT] key. If the display in use is Highway, Navigation or Data, they are automatically replaced by the Plotter 2 display.

Note: You may cancel MOB position as destination by pressing the [MENU ESC] key instead of the [NU/CU ENT] key at step 2. Note that the MOB mark remains on the display.

Erasing MOB mark

To erase a MOB mark, you must first cancel it as a GOTO waypoint and then erase all marks.

1) Press the [GOTO] key.
2) Press the [5] key to choose 5. Cancel.
3) You are prompted to release GOTO; press the [NU/CU ENT] key.
4) Press the [MENU ESC] key to open the menu.
5) Press the [3] key to choose 3. ERASE TRACK/MARK.
6) Press ▼ to choose Erase Mark.
7) Press ▶ to choose Yes.
8) Press the [NU/CU ENT] key.
9) Press the [MENU ESC] key.

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4. NAVIGATION PLANNING

4.1 Registering Waypoints

In navigation terminology a waypoint is a particular location on a voyage whether it be a starting, intermediate or destination waypoint.

The GP-90 can store 999 waypoints, numbered from 001-999. Waypoints can be registered five ways:

- by cursor
- by MOB position or event position
- at own ship's position
- by range and bearing from position, and
- through the waypoint list.

Registering waypoints by the cursor

1) Press the [WPT RTE] key. The Waypoint/Route menu appears.

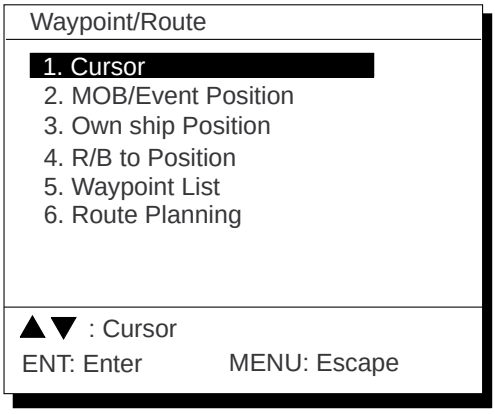


Figure 4-1 Waypoint/Route menu

2) Press [1] to select Cursor. The following display appears.



Figure 4-2

The display changes to Plotter 2 when the Highway, Navigation or Data mode is in use.

3) Press the cursor keys to place the cursor on the location desired for the waypoint.
4) Press the [NU/CU ENT] key.

A window similar to the one shown in Figure 4-3 appears. The waypoint's position and date and time registered appear on the first and second lines. Waypoints are automatically given the youngest empty waypoint number and this number appears on the third line. You may, however, assign a different number. If the waypoint shares the same position with a mark, the mark's position and date and time entered are registered as waypoint data.

If the waypoint memory is full, the waypoint number line in the window is blank. In this case waypoints cannot be entered unless a waypoint is written over or deleted.

To assign waypoint number, go to step 5. If you do not want to change the waypoint number, go to step 6 to select mark shape and enter comment.

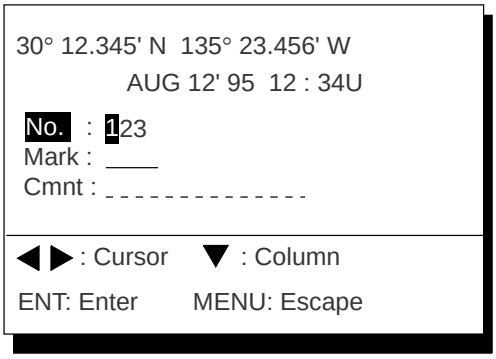


Figure 4-3

5) Enter waypoint number, in three digits (000-999). (000 is own ship position.)

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6) Press ▼ to select waypoint mark shape. The following display appears.



Figure 4-4 Screen for selecting waypoint mark shape

7) Press ◀ or ▶ to select mark shape.
8) Press the [NU/CU ENT] key. The display shown in Figure 4-5 appears.

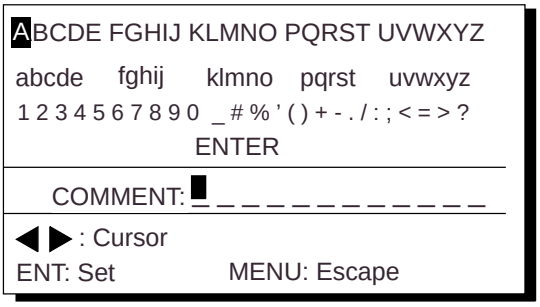


Figure 4-5 Screen for entry of comment for waypoint

9) You may enter a comment, as shown in the procedure which follows, or skip to step 10 to finish. The comment may consist of up to 12 alphanumeric characters.
   ① Press the cursor keys to select alphanumeric character.
   ② Press the [NU/CU ENT] key. Selected character appears on the COMMENT line.
   - To create a space, select "_".
   - Numeric data can be input directly by pressing numeric keys.
   - To clear wrong data, press the [CLEAR] key.

   ③ Repeat steps 1 and 2 to complete the comment.
   ④ Select ENTER and press the [NU/CU ENT] key.

10) Press the [NU/CU ENT] key.
    Control is returned to the last used display mode.
    When the waypoint number entered at step 5 already exists, the message shown in Figure 4-4 appears if the waypoint is part of the current destination or route or is part of a route. If it is alright to write over the waypoint and its data, press the [Y] key. To change waypoint number, press the [N] key.

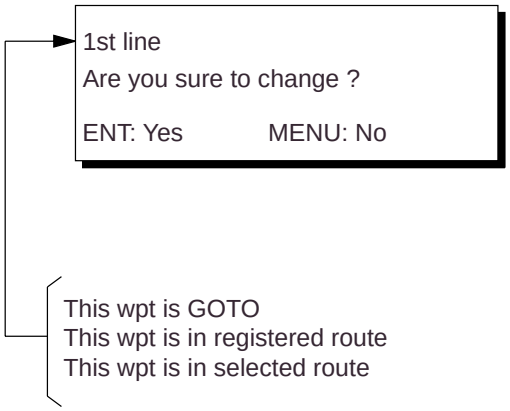


Figure 4-6

Note: If you fail to enter waypoint number, "Enter waypoint number" appears on the display for three seconds.

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Registering waypoints by MOB position/event position

The MOB position or an event position can be registered as a waypoint. Event marks are numbered from 01 to 99; 01 is the latest event mark.

Note: You cannot register a MOB position or event position when there are no MOB positions or event positions saved. The buzzer sounds and the message shown in Figure 4-7 appears for three seconds to alert you.



Figure 4-7

1) Press the [WPT/RTE] key.
2) Press [2] to select MOB/Event Position. The display shown in Figure 4-8 appears.

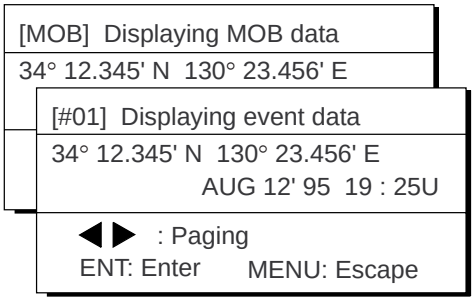


Figure 4-8

3) Press ◀ or ▶ to display the MOB position or event position to register as a waypoint.
4) Press the [NU/CU ENT] key.
5) Follow steps 5 through 11 in "Registering waypoints by the cursor" on page 4-1.

Registering waypoints by own ship's position

Note: When there is no position data, you cannot register a waypoint at own ship's position. The buzzer sounds and the following message appears.



Figure 4-9

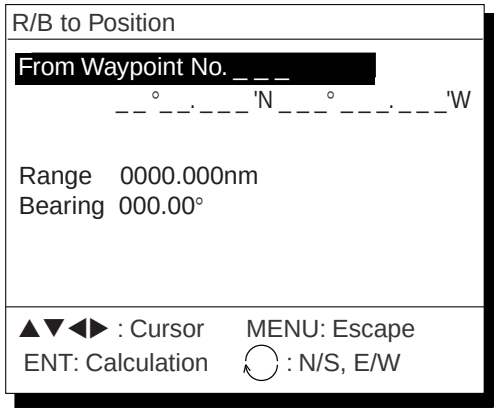
1) Press the [WPT/RTE] key.
2) Press [3] to select Own Ship Position.
3) Follow steps 5 through 11 in "Registering waypoints by the cursor" on page 4-1.

Registering waypoints using range and bearing from a position

This method is useful for entering a waypoint using range and bearing from a pre-registered waypoint.

Range and bearing to a position are calculated according to the sailing method (rhumb line or great circle) chosen on the PLOTTER SETUP menu. You may choose the unit of range on the UNIT SETUP menu.

1) Press the [WPT/RTE] key.
2) Press the [4] key to display the R/B to Position display.



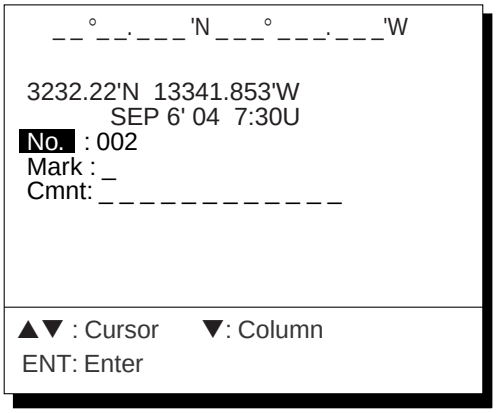
R/B to Position display

3) Enter waypoint (000-999) from which to reference range and bearing. (000 is own ship position.)

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Note: Alternatively, you may enter position, leaving the waypoint number blank.

4) Enter range and bearing you wish to use to calculate position of new waypoint.
5) Press the [NU/CU ENT] key. The display now looks something like the one below.



6) If necessary, change waypoint number and add a comment. For how to enter a comment see page 4-2.
7) Press the [CU/NU ENT] key to finish.

Note: If waypoint number entered at step 6) is an existing number, a part of a registered route, a part of a currently selected route, or a GOTO waypoint, a prompt asks if it is OK to write over the waypoint. Follow the instructions in the prompt to write over the mark number or escape.

Registering waypoints through the waypoint list

1) Press the [WPT/RTE] key.
2) Press [5] to display the waypoint list.
3) Press [↻] to select position format; latitude and longitude or LOP.

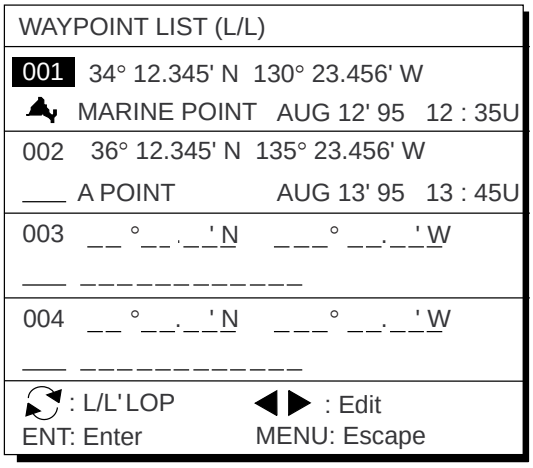


Figure 4-10

4) Press ▲ or ▼ to select waypoint number.
5) Press ◀ or ▶ to enter position. The display should now look something like Figure 4-11.

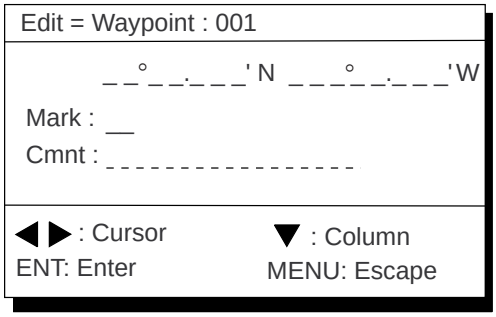


Figure 4-11

6) Enter latitude and longitude. To enter 34° 12.345' N 135° 23.456' E, for example, press;
([↻]) [3] [4] [1] [2] [3] [4] [5]
([↻]) [1] [3] [5] [2] [3] [4] [5] [6]
To change N to S or E to W, press [↻].
7) Press ▼.
8) Press ◀ or ▶ to select mark.
9) Press the [NU/CU ENT] key.
10) Enter comment.
11) Press the [NU/CU ENT] key twice. The waypoint list reappears. Waypoint position and date and time the waypoint was entered appear on the list.
12) To enter another waypoint through the waypoint list, return to step 4.
13) Press the [MENU ESC] key to finish.

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4.2 Editing Waypoints

1) Press [WPT RTE] and [5].
2) Press ▲ or ▼ to select waypoint to edit.
3) Press ▶.
4) Edit the contents of the waypoint.
5) Press the [NU/CU ENT] key. The message shown in Figure 4-12 appears if the waypoint is currently selected as destination, is part of a route, or is in the route currently selected as destination.

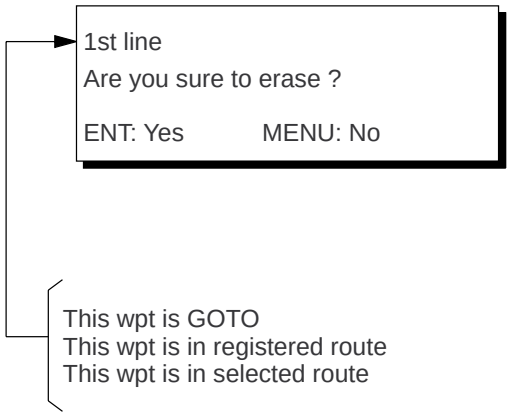


Figure 4-12

6) Press the [NU/CU ENT] key.
   The waypoint and its data are deleted. Enter new data, referring to "4.1 Registering Waypoints".
7) Press the [MENU ESC] key.

4.3 Deleting Waypoints

Deleting waypoints by the cursor

1) Place the cursor on the waypoint to delete.
2) Press the [CLEAR] key.

Deleting waypoints through the waypoint list

1) Press [WPT RTE] and [5].
2) Press ▲ or ▼ to select waypoint to delete.
3) Press the [CLEAR] key. The message shown in Figure 4-13 appears if the waypoint is currently selected as destination, is part of a route, or is in the route currently selected as destination.

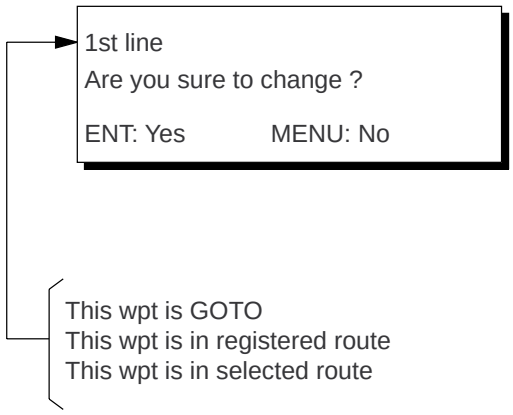


Figure 4-13

Note: All waypoint marks (as well as all other marks) and their data can be cleared collectively by clearing the Plotter memory. For further details, see page 9-1.

4) Press the [NU/CU ENT] key.

Note: To cancel erasure, press the [MENU ESC] key instead of the [NU/CU ENT] key. The waypoint list appears.

5) Press the [MENU ESC] key.

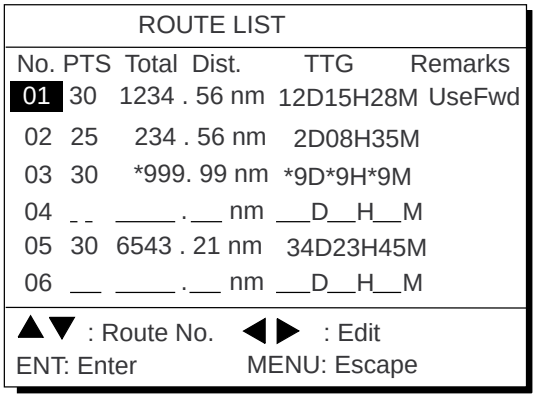
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4.4 Registering Routes

Often a trip from one place to another involves several course changes, requiring a series of route points which you navigate to, one after another. The sequence of waypoints leading to the ultimate destination is called a route. The GP-90 can automatically advance to the next waypoint on a route, so you do not have to change the destination waypoint repeatedly.
The GP-90 can store 30 routes and each route may contain up to 30 waypoints.
Routes can be registered while in the Plotter 1 or Plotter 2 display mode.

Registering routes

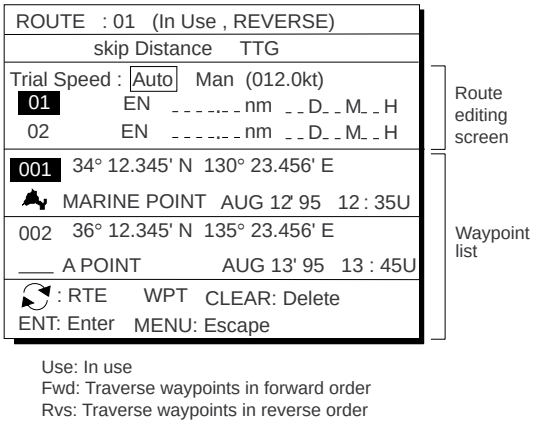
1) Press the [WPT/RTE] key.
2) Press [6] to select Route Planning. The route list appears.



Remarks
Use: In use
Fwd: Traverse waypoints in forward order
Rvs: Traverse waypoints in reverse order

Figure 4-14 Route list

3) Press ▲ or ▼ to select route number.
4) Press ▶.
The route planning/waypoint list window appear as shown in Figure 4-15. The waypoint list window lists the position and data for each registered waypoint. No position or data appears for empty waypoints.



Use: In use
Fwd: Traverse waypoints in forward order
Rvs: Traverse waypoints in reverse order

Figure 4-15 Route editing screen

5) If required, press ▲ to enter the speed by which to calculate time-to-go.
6) Press ◀ or ▶ to select Auto or Man.
Auto: Current average speed is used to calculate the time-to-go.
Manual: Entered speed is used to calculate the time-to-go. Enter speed and press ▼.

Route waypoints may be registered two ways: entering waypoint number directly or through the route editing screen. Follow ① or ② below.

① Entering waypoint number directly

7) Enter waypoint number, in three digits. The cursor shifts to the "Skip" window. The procedure for skipping a waypoint is shown on page 5-4. For now, go to the next step.
8) Press ▼to continue. If the waypoint entered in step 7 does not exist, you are informed that the waypoint does not exist and entry is cancelled.
9) Enter other route waypoints by repeating steps 7 and 8.
10) Press [MENU ESC] to finish.

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② **Using previously registered waypoints**

Enter waypoints in the order they will be traversed; not by waypoint number order.

7) Press [↻]. The reverse video on the waypoint on route planning screen disappears.
8) Press ▲ or ▼ to select waypoint number.
9) Press the [NU/CU ENT] key. Selected waypoint number appears on the route editing screen. The distance and time-to-go indications to the first waypoint entered are blank.
10) To enter other route waypoints, repeat steps 8 and 9.
11) Press the [MENU ESC] key to finish.

Note: To return to the route editing screen, press [↻].

4.5 Deleting Route Waypoints

1) Press [WPT RTE] and [6] to display the route list.
2) Press ▲ or ▼ to select route.
3) Press ▶ to display route editing screen.
4) Select the waypoint to delete.
5) Press the [CLEAR] key.
6) Press the [NU/CU ENT] key.
7) Repeat steps 4 through 6 to continue deleting waypoints.
8) Press the [MENU ESC] key. The route is rearranged to reflect the change.

4.6 Replacing Route Waypoints

1) Press [WPT RTE] and [6] to display the route list.
2) Press ▲ or ▼ to select route.
3) Press ▶ to display route editing screen.
4) On the route editing screen, place the cursor on waypoint number to replace.
5) Enter new waypoint number.
6) Press the [NU/CU ENT] key. The message shown in Figure 4-16 appears.

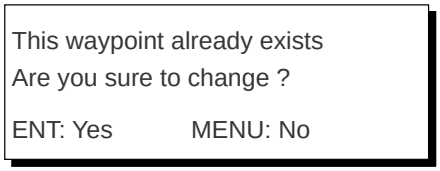


Figure 4-16

7) Press the [NU/CU ENT] key.
8) Press the [MENU ESC] key twice.

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4.7 Deleting Routes

1) Press [WPT RTE] and [6] to display the route list.
2) Press ▲ or ▼ to select route to delete.
3) Press the [CLEAR] key. The display shown in Figure 4-17 appears if the route is in use.

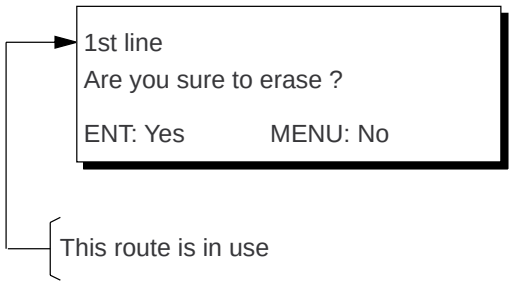


Figure 4-17

4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

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5. STARTING FOR DESTINATION

5.1 Setting Destination

There are four ways by which you can set destination:

- By cursor
- By MOB position or event position
- By waypoint, and
- By route.

Note 1: Destination cannot be set when there is no GPS position data. When there is no position data, the buzzer sounds and the message shown in Figure 5-1 appears.



Figure 5-1

Note 2: Previous destination is cancelled whenever a destination is set.

Setting destination by cursor

Using the cursor you may set a destination consisting of 30 points. When all 30 points are entered, the GP-90 automatically disables further entry.

Setting single destination

1) Press the [GOTO] key. The menu shown in Figure 5-2 appears.

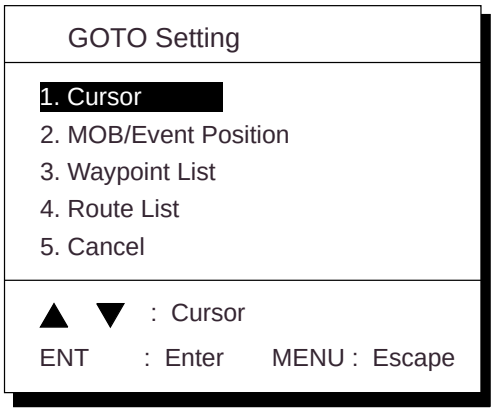


Figure 5-2 GOTO setting menu

2) Press [1] to select Cursor. The display shown in Figure 5-3 appears.

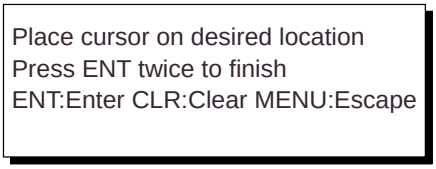


Figure 5-3

If the display in use is other than Plotter 1, the Plotter 2 display is automatically selected.

3) Place the cursor on the location desired for destination.
4) Press the [NU/CU ENT] key.

Note: To clear selection, press the [CLEAR] key.

5) Press the [NU/CU ENT] key to finish. Control is returned to the display mode in use before you set destination. A dashed line connects own ship and the destination, which is marked with a flag, as shown in Figure 5-4.

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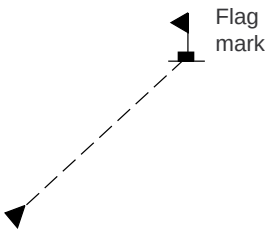


Figure 5-4 Single destination set by cursor

Setting multiple destinations

1) Press [GOTO] and [1].
2) Place the cursor on the location desired for waypoint.
3) Press the [NU/CU ENT] key.
4) Repeat steps 2 and 3 to enter other points. Waypoints are connected with a line.
5) Press the [NU/CU ENT] key to finish. The route number entry display appears as shown in Figure 5-5. If no route number appears or you want to change the route number shown, go to step 6 to enter route number. To register the route under the number shown, go to step 8.

Note: For the simple route, press the [CLEAR] key and then go to step 8. The simple route is not registered in the route list.

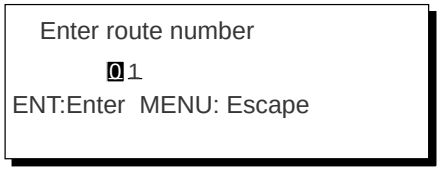


Figure 5-5

6) Key in route number.
7) Press the [NU/CU ENT] key. Waypoints are marked with flags and are connected with a dashed line.

   If the route number entered already exists the message shown in Figure 5-6 appears.

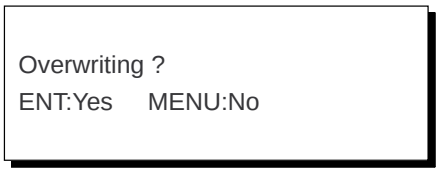


Figure 5-6

8) Press the [NU/CU ENT] key. The waypoints do not have waypoint numbers, however you can attach waypoint numbers by doing the following.

① Press [WPT RTE] and [**6**] to display the route list.
② Press ▲ or ▼ to select route number entered.
③ Press ▶.
④ Enter waypoint number, in three digits.
⑤ Press ▼. If the waypoint number already exists the message shown in Figure 5-7 appears.

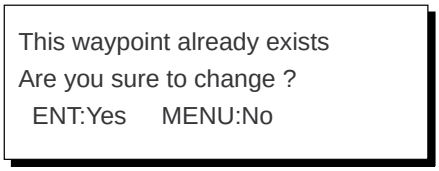


Figure 5-7

⑥ Press the [NU/CU ENT] key. The waypoint entered here replaces previously entered waypoint.

Note: To cancel replacement of waypoint, press the [MENU ESC] key at step 6.

⑦ Repeat steps ④ and ⑤ to enter other waypoint numbers.
⑧ Press the [MENU ESC] key twice to finish.

When destination is cancelled, dashed lines are erased but flags remain on the screen.

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Setting destination by MOB position or event position

Note: This operation cannot be performed when there is no MOB position or event position. The buzzer sounds and the message shown in Figure 5-8 appears to alert you when there is no MOB position or event position.



Figure 5-8

1) Press the [GOTO] key.
2) Press [2] to select MOB/Event Position. The display shown in Figure 5-9 appears.

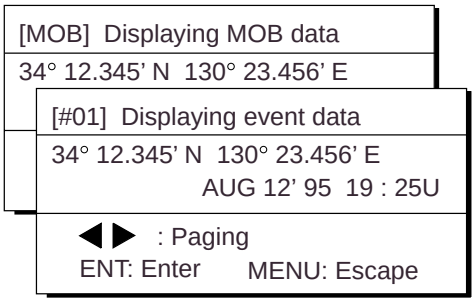


Figure 5-9

3) Press ◀ or ▶ to select MOB position or event position. The MOB position appears first. To select event position, press ▶. If selected position is within the current display range, the cursor marks the position. (The cursor does not appear on the Highway, Navigation and Data displays.)
4) Press the [NU/CU ENT] key. A flag appears at position selected if it is within the current display range. A dashed line connects between own ship and MOB position or event position.

When destination is cancelled, dashed lines are erased but flags remain on the screen.

Setting destination through waypoint list

Note: A waypoint must exist to set it as destination. When a waypoint does not exist, the buzzer sounds and the message shown in Figure 5-10 appears.



Figure 5-10

Destination waypoint can be set through the waypoint list two ways:

- By entering waypoint number, and
- By selecting waypoint by cursor

1) Press the [GOTO] key.
2) Press [3] to display the Waypoint List.

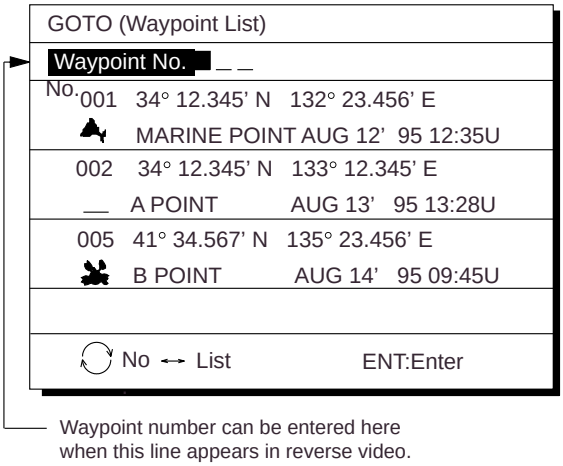


Figure 5-11 Waypoint list

Set destination by following ① or ② on the next page.

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① **Setting destination by waypoint no.**

3) Enter waypoint number, in three digits. You can clear entry by pressing the [CLEAR] key.
4) Press the [NU/CU ENT] key.

Own ship position becomes starting point and a dashed line runs between it and the waypoint selected.

② **Setting destination by selecting wpt.**

3) Press [↻]. Each press of the key alternately enables manual entry of waypoint number and selection of waypoint number by cursor (through the waypoint window).
4) Press ▲ or ▼ to select waypoint.
5) Press the [NU/CU ENT] key.

Own ship position becomes starting point and a dashed line runs between it and the waypoint selected.

Setting route as destination

Note: Route entered must exist to set it as destination. The buzzer sounds and the message shown in Figure 5-12 appears if you set enter a route which does not exist.



Figure 5-12

A route to set as destination may selected through the route list two ways:

- By entering route number, and
- By selecting route.

1) Press the [GOTO] key.
2) Press [4] to display the Route List. Then, follow ① or ② in the adjacent column.

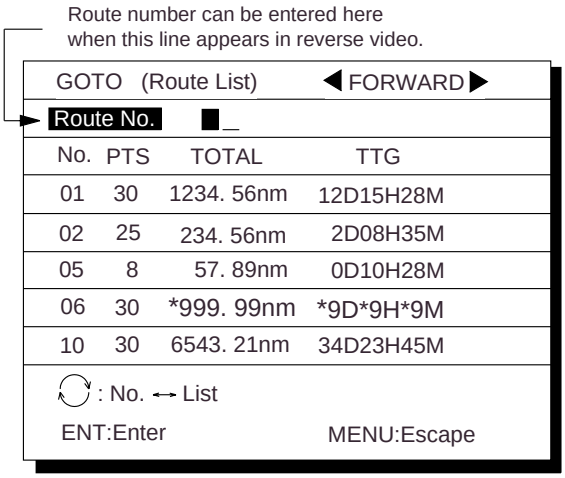


Figure 5-13 Route list

① **By entering route number**

3) Press ◀ or ▶ to select direction which to traverse the route waypoints; forward or reverse.
4) Enter route number.
5) Press the [NU/CU ENT] key.

Current position becomes starting point. A solid line connects between the starting point and first route waypoint and a dashed line connects all other route waypoints.

② **By selecting a route**

3) Press [↻]. Each press of the key alternately enables manual entry of route number and selection of route number (through the route window)
4) Press ▲ or ▼ to select route.
5) Press ◀ or ▶ to select direction in which to traverse the route waypoints; forward or reverse.
6) Press the [NU/CU ENT] key.

Current position becomes starting point. A solid line connects between the starting point and first route waypoint and a dashed line connects all other route waypoints.

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Skipping route waypoints

You may skip route waypoints by displaying "DI" (DIsable) next to the route waypoint in the route list. Using Figure 5-14 as an example, your ship is currently heading toward waypoint 04 but is to switch course and head to waypoint 03. In this case you would want to skip waypoint 04.

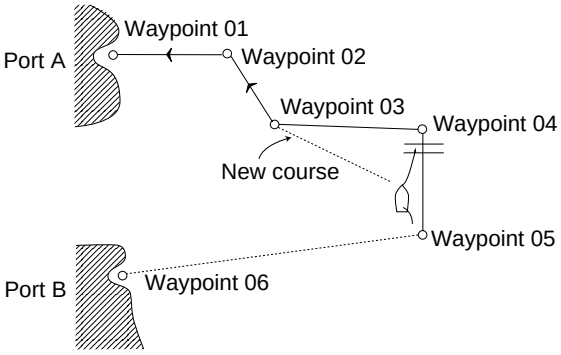


Figure 5-14

1) Press [WPT RTE] and [6] to display the route list. Press the cursor keys to select route.

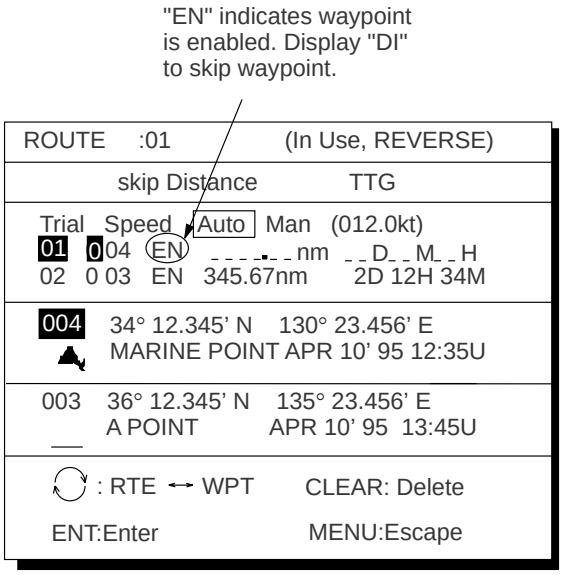


Figure 5-15 Route list

2) Press ▲ or ▼ to select route waypoint to skip.
3) Press ◀ or ▶ to shift the cursor to the right of the waypoint number.
4) Press [↻] to change "EN"(ENable) to "DI"(DIsable).
5) Press the [NU/CU ENT] key.

To reselect the waypoint, select it on the route list and press [↻] to change "DI" to "EN".

5.2 Canceling Destination

1) Press the [GOTO] key.
2) Press [5] to select Cancel. The message shown in Figure 5-16 appears.



Figure 5-16

3) Press the [NU/CU ENT] key.

Note: If you are using the simple route, it will be erased when the destination is canceled.

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5.3 Erasing Rout Waypoints (flags)

1) Place the cursor on the flag to erase.
2) Press the [CLEAR] key. The message shown in Figure 5-17 appears if the waypoint is currently selected as destination, is part of a registered route, or is part of the route currently being navigated.

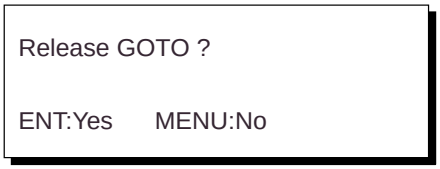


Figure 5-17

3) Press the [NU/CU ENT] key.

Note: Flags can be erased collectively by clearing the Plotter memory or both the Plotter memory and GPS memory. See page 9-1 for further details.

When flags are erased

When the origin waypoint is erased the waypoint before it becomes the origin waypoint. If there is no waypoint before the origin waypoint, current position becomes the origin waypoint.

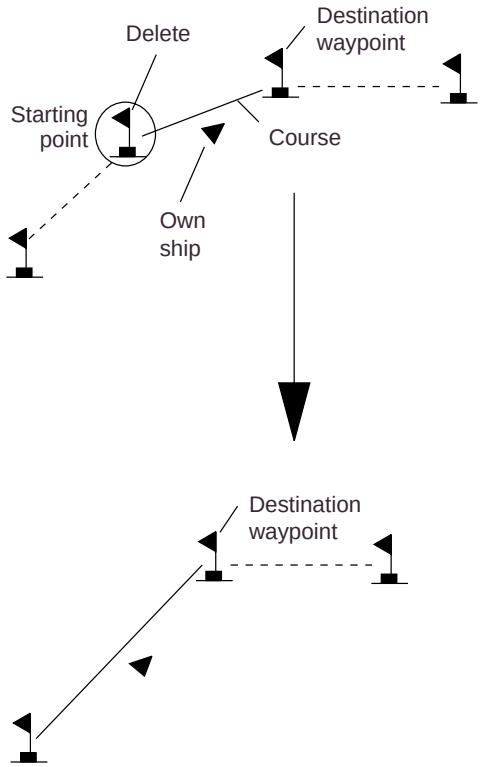


Figure 5-18 Route rearranged after erasing flag

When a destination is erased, the waypoint which follows it becomes the destination. If there is no waypoint after the destination waypoint erased, route navigation is cancelled.

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5.4 Finding Range and Bearing Between Two Points

Selecting Course Sailing Method

The range and bearing to a destination are calculated by two ways: Great Circle or Rhumb Line. However, cross track error is calculated by rhumb line only.

Great Circle: The great circle courseline is the shortest course between two points on the surface of the earth. (Imagine stretching a piece of yarn between two points on the earth.) However, this course requires frequent change of heading to follow course faithfully.

Rhumb Line: The rhumb line courseline is the straight line drawn between two points on a nautical chart. This course does not require frequent changes of heading however it is not the shortest since it follows the earth's curvature.

1) Press [MENU ESC], [9] and [1] to display the PLOTTER SETUP menu.

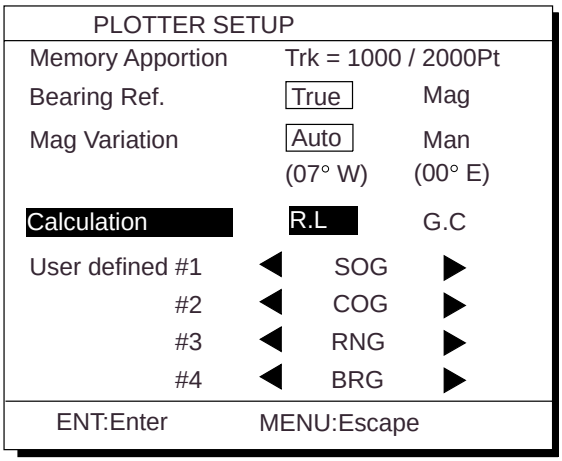


Figure 5-19 PLOTTER SETUP menu

2) Press ▲ or ▼ to selection Calculation.
3) Press ◀ or ▶ to select R.L (Rhumb Line) or G.C (Great Circle).
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

Calculation Procedure

You can find the range and bearing between two points by two waypoints or two latitude and longitude positions.

1) Press [MENU ESC] and [5]. The MANUAL CALCULATION menu appears.

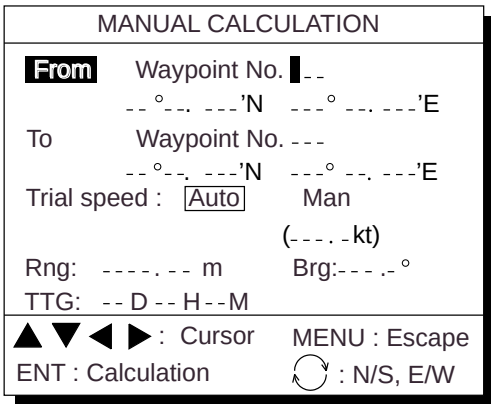


Figure 5-20 MANUAL CALCULATION menu

2) Choose two points by one of the methods below.

Latitude and longitude positions

1) Press ▼.
2) If necessary press to switch from North latitude and to South latitude vice versa.
3) Key in latitude.
4) If necessary press to switch from West longitude to East longitude and vice versa.
5) Key in longitude.
6) Press ▼.
7) Repeat 2-5 to enter other point.

Waypoints

1) Key in first waypoint number (001-999). (000 is reserved for own ship position.)
2) Press ▼ twice.
3) Key in other waypoint number (001-999).

(Continued on next page)

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4) Press ▼ to shift the cursor to the Trial Speed line.
5) Press ◀ or ▶ to select Auto or Man. Auto uses ship's average speed to calculate time-to-go.
6) If you selected Man, enter speed.
7) Press the [NU/CU ENT] key.

The range, bearing and time-to-go between two points appear on the display. If data entered is wrong or insufficient the buzzer sounds and the message "INCOMPLETE DATA" appears. If the data contains error, and all nines appear as the calculation results.

8) Press the [MENU ESC] key.

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6. SETTING UP VARIOUS DISPLAYS

6.1 Selecting Data to Display on the Data Display

The user may select what data to display in four locations on the data display.

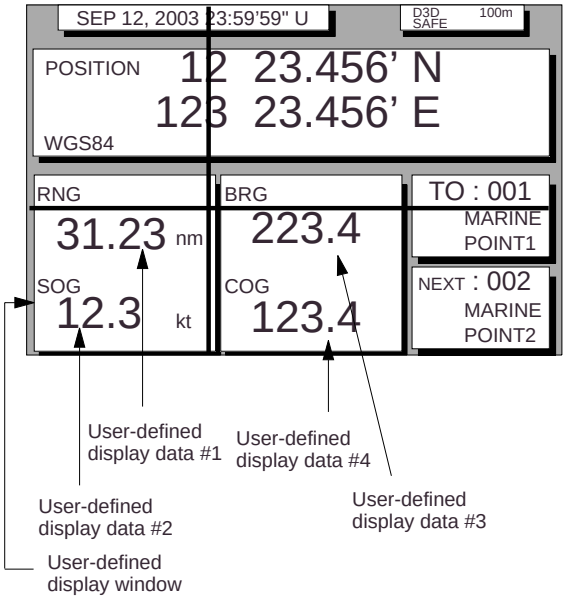


Figure 6-1 Data display

The data the user may select to display are;

- Altitude (ALT)*
- Average course (AVR COG)
- Average speed (AVR SOG)
- Course (COG)
- Course error (ΔCOG)
- Cross track error (XTE)
- Depth (W.DPT)#
- Drift (DFT)
- ETA to waypoint (ETA)
- Heading (HDG)
- Range to waypoint (RNG)
- Route time-to-go (RT.TTG)
- Set (SET)
- Speed over ground (SOG)
- Speed thru water (STW)
- Time-to-go to waypoint (TTG)
- ETA to route
- Total route distance (RT.DIST)*
- Trip distance (TRIP)
- Trip elapsed time (TRIP TM)
- Water temperature (W.TMP)#, and
- Velocity to destination (VTD)*

***ALT:** Displayed only in 3D position fixing.
***RT. DIST:** Total distance from current position to ultimate destination. Appears when following a registered route or a cursor-created route.
***VTD:** When following a route, plus or minus appears next to indication to denote which direction the route is being traversed.

Requires external sensor.

1) Press [MENU ESC], [9] and [1] to display the PLOTTER SETUP menu.

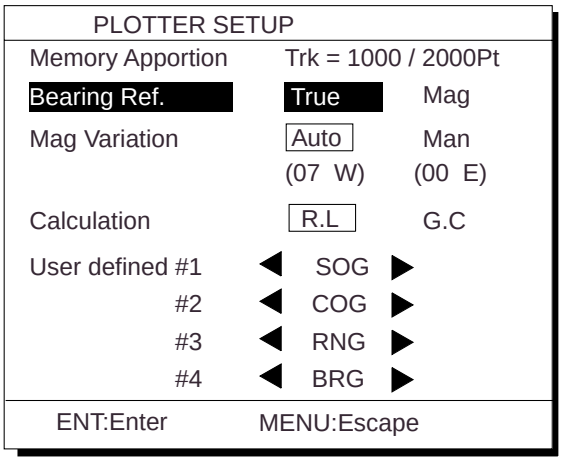


Figure 6-2 PLOTTER SETUP menu

2) Press ▲ or ▼ to select one of four of "User defined" (#1, #2, #3, #4).
3) Press ◀ or ▶ to select data to display.
4) Press the [NU/CU ENT] key. To select the data to display at other user defined displays, repeat steps 2 and 3.
5) Press the [MENU ESC] key.

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6.2 Selecting Position Format

Position can be displayed in latitude and longitude, Loran C LOPs, or Decca LOPs, and the default format is latitude and longitude.

Selecting position format (L/L or LOPs)

1) Press [MENU ESC], [9] and [8] to display the LOP SETUP menu.

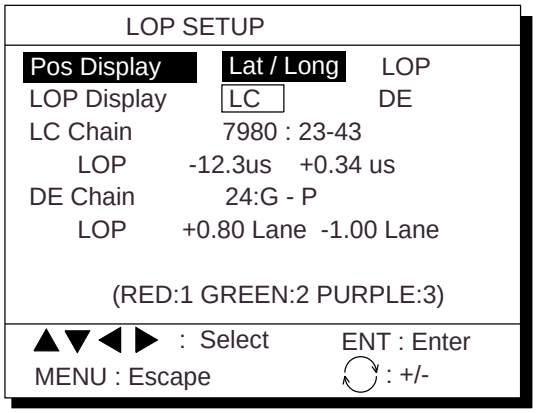


Figure 6-3 LOP SETUP menu

2) Press ▲ or ▼ to select Pos Display.
3) Press ◀ or ▶ to select Lat/Long or LOP.
4) Press the [NU/CU ENT] key.

Displaying LOPs

1) Press [MENU ESC], [9] and [8].
2) Press ▲ or ▼ to select Pos Display.
3) Press ◀ or ▶ to select LOP.
4) Press ▼ to select LOP Display.
5) Press ◀ or ▶ to select LC (Loran C) or DE (Decca).

Follow ① or ② in the adjacent column according to selection in step 5.

① For Loran LOPs

6) Press ▼ to select LC Chain.
7) Key in GRI code referring to the Loran C chain list appears in the Appendix. If the GRI code is 9970, for example, press [9], [9], [7], [0].
8) Key in secondary code pair referring to the Loran C chain list in the Appendix.
9) Press ▼.
10) Key in correction value.
11) If necessary, press [↻] to switch from plus to minus or vice versa.
12) Press the [NU/CU ENT] key.
13) Press the [MENU ESC] key.

② For Decca LOPs

6) Press ▼ to select DE Chain.
7) Key in Decca chain number referring to the Decca chain list in the Appendix. For the Europe chain, for example, press [0] [1].
8) Key in Decca lane pair. Red, [1]; Green [2], and Purple [3].
9) Press▼.
10) Key in lane correction value.
11) If necessary, press [↻] to switch from plus to minus or vice versa.
12) Press the [NU/CU ENT] key.
13) Press the [MENU ESC] key.

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Registering waypoints using LOPs

1) Press [WPT RTE] and [5].
2) Press [↻] to display LOPs.

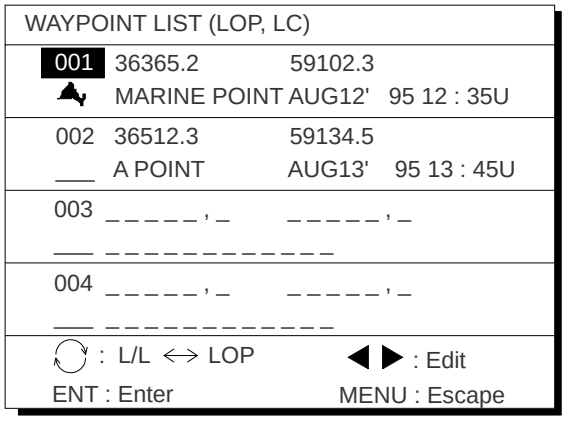
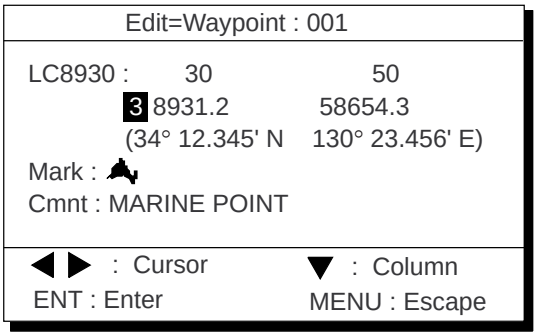
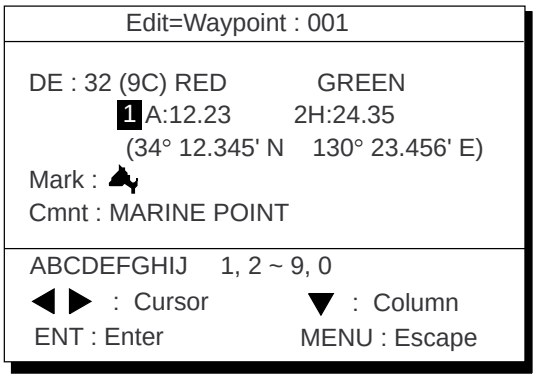


Figure 6-4 LOP display on the waypoint list

3) Press ▲ or ▼ to select waypoint number.
4) Press ◀ or ▶. Your display should look like one of the displays in Figure 6-5.



Loran C LOP input screen



Decca LOP input screen

Figure 6-5 LOP input screens

5) Key in LOP1 and LOP2, to enable calculation.
6) Press ▼ to calculate LOPs. "Calculating" appears between parentheses during the calculation. Actual LOPs replace "Calculating" upon completion of the calculation.
   If the conversion fails, the message "Failed in Conversion" appears for three seconds.
   Press the [CLEAR] key and reenter the right LOP1 and LOP2.
7) Press ◀ or ▶ to select mark.
8) Press the [NU/CU ENT] key.
9) Enter comment, if desired.
10) Press the [NU/CU ENT] key twice.
    Waypoint data and date and time registered appear.

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6.3 Demo Display

The demo display provides simulated operation of this unit. Own ship tracks, at the speed selected, a figure eight course, starting from position entered. All controls are operative; you may change course, enter marks, etc.

1) While pressing and holding down [NU/CU ENT], turn on the power. After the test results appear, the Simulation Mode menu appears.

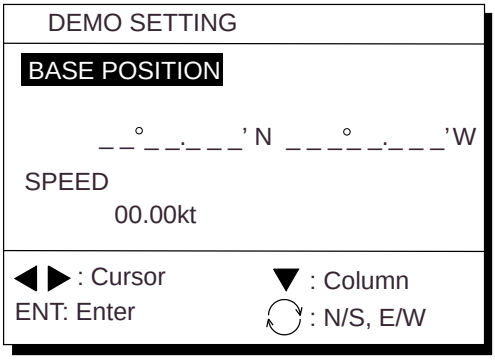


Figure 6-6 Simulation mode menu

2) Key in latitude of initial position.
3) If necessary, press [ ] to switch from north latitude to south latitude or vice versa.
4) Key in longitude.
5) If necessary, press [ ] to switch from east longitude to west longitude or vice versa.
6) Press ▼ key.
7) Key in speed.
8) Press the [NU/CU ENT] key to start the simulation mode.

   The icon DEMO appears in the plotter 1, 2, and highway display. All controls are operative.

   Note: The return to the normal mode, turn off the power and then turn it on while pressing and holding down [NU/CU ENT] key.

Note: When the memory is cleared while in the demonstration mode, the equipment starts up in the normal mode.

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7. ALARMS

There are seven alarm conditions which generate both audible and visual alarms. When an alarm setting is violated, the buzzer sounds and the name of the offending alarm appears on the display. The alarm icon also appears on the Plotter 1, Plotter 2 and Highway displays.

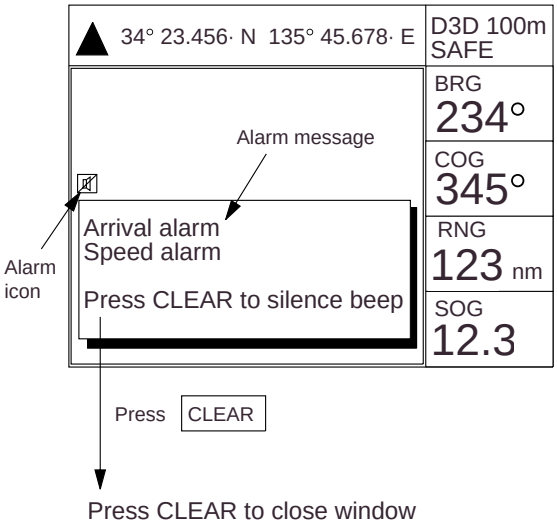


Figure 7-1 Location of alarm messages and alarm icon

7.1 Arrival Alarm, Anchor Watch Alarm

Arrival alarm

The arrival alarm informs you that own ship is approaching a destination waypoint. The area that defines an arrival zone is that of a circle which you approach from the outside of the circle. The alarm will be released if own ship enters the circle.

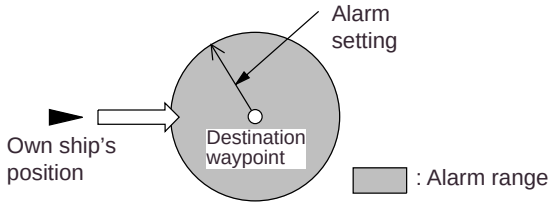


Figure 7-2 How the arrival alarm works

1) Press the [MENU ESC] key.
2) Press [4] to display the ALARM SETTINGS menu.

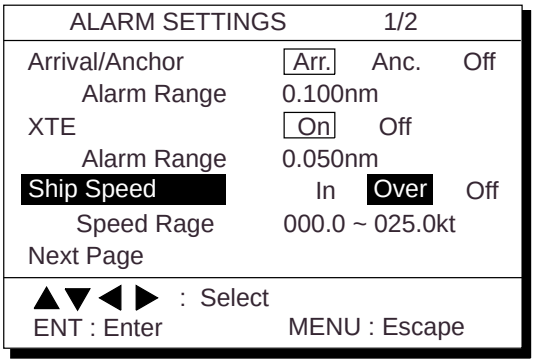


Figure 7-3 ALARM SETTINGS menu, page 1/2

3) Press ▲ or ▼ to select Arrival/Anchor.
4) Press ◀ or ▶ to select Arr.
5) Press ▼ to select Alarm Range.
6) Key in alarm range (0.001-9.999 nm).
7) Press the [NU/CU ENT] key.
8) Press the [MENU ESC] key.

When own ship nears a waypoint by the range set here, the buzzer sounds and the message "Arrival alarm" appears. You can silence the audible alarm by pressing the [CLEAR] key. To erase the visual alarm, press the [CLEAR] key again.
To disable the alarm, select Off at step 4.

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Anchor watch alarm

The anchor watch alarm sounds to warn you that own ship is moving when it should be at rest.

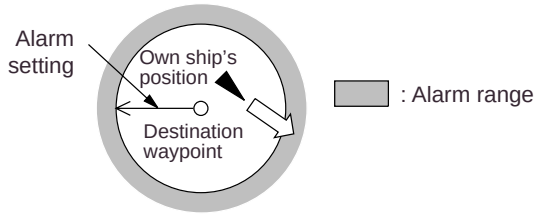


Figure 7-4 How the anchor watch alarm works

Before setting the anchor watch alarm, set present position as destination waypoint, referring to chapter 5.

1) Press [MENU ESC] and [4].
2) Press ▲ or ▼ to select Arrival/Anchor.
3) Press ◀ or ▶ to select Anc.
4) Press ▼ to select Alarm Range.
5) Key in alarm range (0.001-9.999 nm).
6) Press the [NU/CU ENT] key.
7) Press the [MENU ESC] key.

When own ship drifts by the range set here, the buzzer sounds and the message "Anchor alarm" appears. You can silence the audible alarm by pressing the [CLEAR] key. To erase the visual alarm, press the [CLEAR] key again.

To disable the alarm, select Off at step 3.

7.2 Cross Track Error (XTE) Alarm

The XTE alarm warns you when own ship is off its intended course.

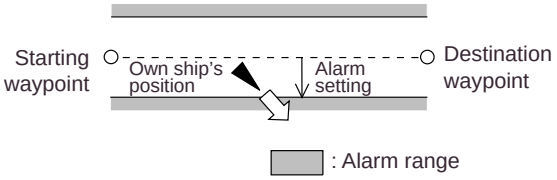


Figure 7-5 How the XTE alarm works

1) Press [MENU ESC] and [4].
2) Press ▲ or ▼ to select XTE.
3) Press ◀ or ▶ to select On.
4) Press ▼ to select Alarm Range.
5) Key in alarm range (0.001-9.999 nm).
6) Press the [NU/CU ENT] key.
7) Press the [MENU ESC] key.

When own ship strays from the intended track by the range set here, the buzzer sounds and the message "Cross track error alarm" appears. You can silence the audible alarm by pressing the [CLEAR] key. To erase the visual alarm, press the [CLEAR] key again.

To disable the alarm, select Off at step 3.

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7.3 Ship's Speed Alarm

The ship's speed alarm sounds when ship's speed is lower or higher (or within) the alarm range set.

1) Press [MENU ESC] and [4].
2) Press ▲ or ▼ to select Ship Speed.
3) Press ◀ or ▶ to select In (or Over).
   In: Alarm sounds when speed is within range set.
   Over: Alarm sounds when speed is higher or lower than range set.
4) Press ▼ to select Speed Range.
5) Key in low speed.
6) Key in high speed.
7) Press the [NU/CU ENT] key.
8) Press the [MENU ESC] key.

When speed is higher or lower (or within) than the speed set here, the buzzer sounds and the message "Speed alarm" appears. You can silence the audible alarm by pressing the [CLEAR] key. To erase the visual alarm, press the [CLEAR] key again.

To disable the alarm, select Off at step 3.

7.4 Trip Alarm

The trip alarm sounds when the distance run is greater than the trip alarm setting.

1) Press [MENU ESC] and [4].
2) Press ▲ or ▼ to select Next Page. The menu shown in Figure 7-6 appears.

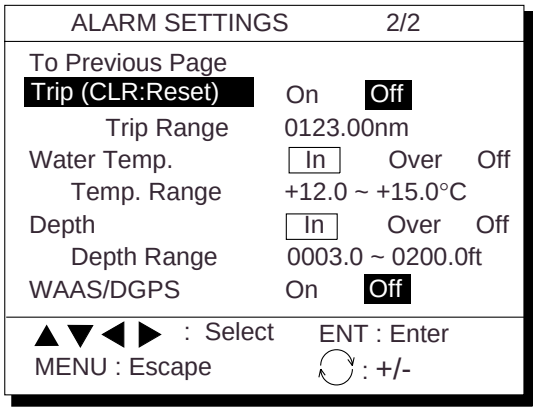


Figure 7-6 Alarm settings menu, page 2/2

3) Press ▲ or ▼ to select Trip.
4) If necessary, press [CLEAR] to reset the trip distance and trip elapsed time (see page 6-1).
5) Press ◀ or ▶ to select On.
6) Press ▼ to select Trip Range.
7) Key in trip range.
8) Press the [NU/CU ENT] key.
9) Press the [MENU ESC] key.

When the ship's distance run is higher than the trip range set here, the buzzer sounds and the message "Trip alarm" appears. You can silence the audible alarm by pressing the [CLEAR] key. To erase the visual alarm, press the [CLEAR] key again.

To disable the alarm, select Off at step 4.

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7.5 Water Temperature Alarm

The water temperature alarm sounds when the water temperature is higher or lower (or within) the preset temperature. This alarm requires temperature signal from external equipment.

1) Press [MENU ESC] and [4].
2) Press ▲ or ▼ to select Water Temp.
3) Press ◀ or ▶ to select In (or Over).
4) Press ▼ to select Temp. Range.
5) Key in low temperature.
6) Key in high temperature.
7) Press the [NU/CU ENT] key.
8) Press the [MENU ESC] key.

When the water temperature is higher or lower (or within) the preset value, the buzzer sounds and the message "Water temp alarm" appears. You can silence the audible alarm by pressing the [CLEAR] key. To erase the visual alarm, press the [CLEAR] key again.

To disable the alarm, select Off at step 4.

7.6 Depth Alarm

The depth temperature alarm sounds when the depth is higher or lower (or within) the preset depth. This alarm requires video sounder connection.

1) Press [MENU ESC] and [4].
2) Press ▲ or ▼ to select Depth.
3) Press ◀ or ▶ to select In (or Over).
4) Press ▼ to select Depth Range.
5) Key in low depth.
6) Key in high depth.
7) Press the [NU/CU ENT] key.
8) Press the [MENU ESC] key.

When the depth is higher or lower (or within) the preset value, the buzzer sounds and the message "Depth alarm" appears. You can silence the audible alarm by pressing the [CLEAR] key. To erase the visual alarm, press the [CLEAR] key again.

To disable the alarm, select Off at step 4.

7.7 WAAS/DGPS Alarm

The WAAS/DGPS alarm sounds when the WAAS/DGPS signal is lost. This alarm may be enabled or disabled as below.

1) Press [MENU ESC] and [4].
2) Press ▲ or ▼ to select WAAS/DGPS.
3) Press ◀ to select On, or ▶ to select off.
4) Press the [NU/CU/ENT] key.
5) Press the [MENU ESC] key.

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8. MENU SETTINGS

8.1 GPS Menu

Menu description

Fix mode

Two position fixing modes are available: 2D and 2/3D. The 2D mode provides two dimensional position fixes (latitude and longitude only) and is used when three satellites are in line of sight of the GPS receiver.

The 2/3D mode switches between two and three dimension position fixing automatically depending on how many satellites (three or four) are in light of sight of the GPS receiver.

ANT Height

Enter the height of the antenna unit above sea surface (000-999 ft, 000-304 m). The default setting is 16 ft.

Disable satellite

Every GPS satellite is broadcasting abnormal satellite number(s) in the Almanac. Using this information, the GPS receiver automatically eliminates any malfunctioning satellite from the GPS satellite schedule. However, the Almanac sometimes may not contain this information. You can disable an inoperative satellite manually on the GPS SETUP menu.

GPS smoothing, position

When the DOP or receiving condition is unfavorable, the GPS fix may change greatly, even if the vessel is dead in water. This change can be reduced by smoothing the raw GPS fixes. A setting between 0 and 9 is available. The higher the setting the more smoothed the raw data, however too high a setting slows response time to change in latitude and longitude. This is especially noticeable at high ship's speeds. "0" is the normal setting; increase the setting if the GPS fix changes greatly.

GPS smoothing, speed

During position fixing, ship's velocity (speed and course) is directly measured by receiving GPS satellite signals. The raw velocity data may change randomly depending on receiving conditions and other factors. You can reduce this random variation by increasing the smoothing. Like with latitude and longitude smoothing, the higher the speed and course smoothing the more smoothed the raw data. If the setting is too high, however, the response to speed and course change slows. For no smoothing, enter "0." "5" is suitable for most conditions.

Speed average

Calculation of ETA and TTG, etc. is based on average ship's speed over a given period. The default setting is one minute.

RAIM function/RAIM accuracy

RAIM (Receiver Autonomous Integrity Monitoring) is a diagnostic function which tests the accuracy of the GPS signal within the range set with "RAIM Accuracy" on the GPS SETUP 2/2 menu. The receiver displays (provided the RAIM function is active) three levels of position confidence according to the results of the test as shown below. "CAUTION" indicates that RAIM could not be assessed. In this case, if the GPS signal is normal, GPS position is safe to use.

SAFE: GPS signal is safe to use.
CAUTION: RAIM accuracy is shorter than protected level or RAIM measurement not possible.
UNSAFE: GPS signal is not safe to use.

Enter the range for which you want to know position confidence.

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Geodetic datum

Select the geodetic chart system you are using. WGS-84 (standard GPS chart system) and NAD 27 can be directly selected. For other charts, select "OTHER" and enter chart number referring to the geodetic chart list in the Appendix.

To output position data to ECDIS (Electronic Chart Display and Information System), turn on the power while holding down the [0] key. This disables access to the Geodetic Datum menu. Then, "Cannot be changed" is shown in the Geodetic Datum menu as in Figure 8-2 on the next page. To stop outputting position data to ECDIS, turn on the power while holding down the [0] key.

Position offset

You may apply an offset to position generated by the internal GPS receiver, to compensate for difference between GPS position and chart position.

Time difference

The GPS system uses UTC time. If you would rather use local time, enter the difference in hours between local time and UTC. Use the [+] and [-] keys for times later or earlier than UTC, respectively.

Position

When executing cold start there is no satellite information in the unit's memory, thus it may take some time to find position. To fix position faster, enter estimated position.

Selecting fix mode

1) Press [MENU ESC], [9] and [6] to display the GPS SETUP menu.

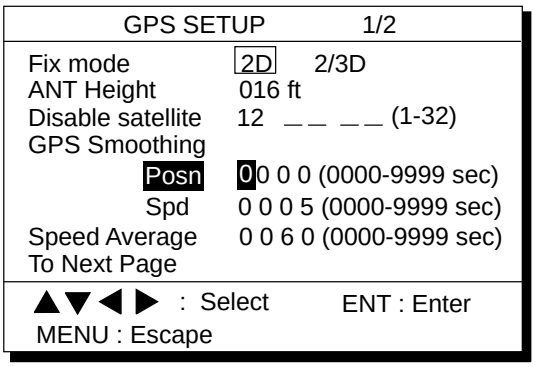


Figure 8-1 GPS SETUP menu, page 1/2

2) Press ▲ or ▼ to select Fix mode.
3) Press ◀ or ▶ to select fix mode desired.
4) Press ▼ to change other settings, or press [MENU ESC] to register settings and escape.

Disabling satellites

1) Press [MENU ESC], [9] and [6].
2) Press ▲ or ▼ to select Disable satellite.
3) Key in satellite number, in two digits (01-32). Three sets of satellite numbers may be entered.
4) Press the [NU/CU ENT] key. If an invalid number is entered the buzzer sounds.
5) Press the [MENU ESC] key.

Note: To enable all disabled satellites, press the [CLEAR] key at step 3. All satellite numbers on the Disable satellite line are erased.

Entering GPS position smoothing

1) Press [MENU ESC], [9] and [6].
2) Press ▲ or ▼ to select Posn.
3) Enter smoothing factor in three digits (001-999).
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

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Entering GPS speed smoothing

1) Press [MENU ESC], [9] and [6].
2) Press ▲ or ▼ to select Spd.
3) Enter smoothing factor in three digits (001-999).
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

Entering speed averaging

1) Press [MENU ESC], [9] and [6].
2) Press ▲ or ▼ to select Speed Average.
3) Enter smoothing factor in two digits (00-99).
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

Selecting RAIM Function

1) Press [MENU ESC], [9] and [6].
2) Press ▲ or ▼ to select RAIM Function on page 2/2.

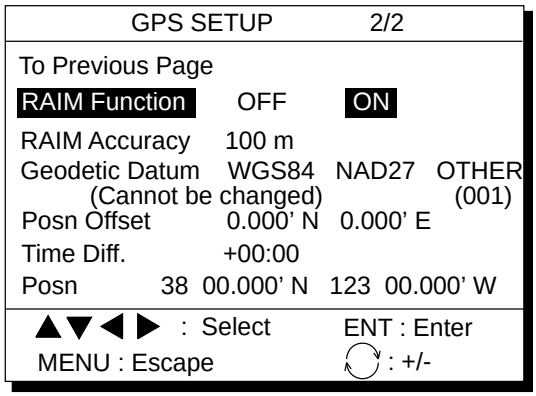


Figure 8-2 GPS SETUP menu, page 2/2

3) Press ▲ or ▼ to select RAIM Function desired.
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

Entering RAIM Accuracy

1) Press [MENU ESC], [9] and [6].
2) Press ▲ or ▼ to select RAIM Accuracy on page 2/2.
3) Key in the range for which you want to know RAIM Accuracy (1 to 999 m).
   Note: Unit is meter only.
4) Press the [NU/CU ENT] key.
   Press the [MENU ESC] key.

Entering geodetic datum

1) Press [MENU ESC], [9] and [6].
2) Press ▲ or ▼ to select Geodetic Datum on page 2/2.
3) Press ◀ or ▶ to select geodetic datum to use. For geodetic datum other than WGS-84 or NAD-27, select OTHER and key in chart number (001-173) referring to the geodetic chart list in the Appendix.
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

Entering position offset

If you do not know the type of chart you are using, GPS position may be wrong. Note the difference in position when moored to a pier and enter it on the GPS SETUP menu, to get correct position.

1) Press [MENU ESC], [9] and [6].
2) Press ▲ or ▼ to select Posn Offset on page 2/2.
3) If necessary press [↻] to switch from north latitude to south latitude or vice versa.
4) Key in latitude correction.
5) If necessary press [↻] to switch from east longitude to west longitude or vice versa.
6) Key in longitude correction.
7) Press the [NU/CU ENT] key.
8) Press the [MENU ESC] key.

Entering time difference

1) Press [MENU ESC], [9] and [6].
2) Press ▲ or ▼ to select Time Diff on page 2/2.
3) Key in time difference (-14:00 to +14:00).
4) Press [↻] to change from plus to minus or vice versa.
5) Press the [MENU ESC] key.

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Entering position

After the unit is installed you may enter position to shorten the time it takes to find position. (It takes about two minutes when there is no position data entered.)

1) Press [MENU ESC], [9] and [6].
2) Press ▲ or ▼ to select Posn on page 2/2.
3) If necessary, press [↻] to switch from north latitude to south latitude or vice versa. Key in latitude.
4) If necessary, press [↻] to switch from east longitude to west longitude or vice versa. Key in longitude.
5) Press the [NU/CU ENT] key.
6) Press the [MENU ESC] key.

8.2 Selecting Units of Measurement

Unit of distance

Distance can be displayed in nautical mile, kilometer or statute mile as follows.

1) Press [MENU ESC], [9] and [2]. The UNIT SETUP menu appears.

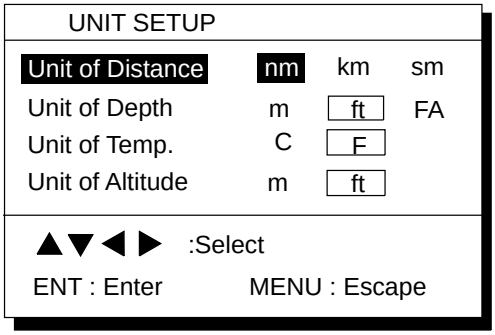


Figure 8-3 UNIT SETUP menu

2) Press ▲ or ▼ to select Unit of Distance.
3) Press ◀ or ▶ to select unit; nm, km or sm.
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

Unit of depth

1) Press [MENU ESC], [9] and [2].
2) Press ▲ or ▼ to select Unit of Depth.
3) Press ◀ or ▶ to select unit; meter, feet, or fathom.
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

Unit of water temperature

1) Press [MENU ESC], [9] and [2].
2) Press ▲ or ▼ to select Unit of Temp.
3) Press ◀ or ▶ to select unit; Centigrade or Fahrenheit.
4) Press [NU/CU ENT] and [MENU ESC].

Unit of altitude

Available only in 3D mode.

1) Press [MENU ESC], [9] and [2].
2) Press ▲ or ▼ to select Unit of Altitude.
3) Press ◀ or ▶ to select unit.
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

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8.3 Mark, Character Size and Brilliance

The DISPLAY SETUP menu lets you select the size and brilliance of various markers.

Grid tone

The grid can be displayed in light or dark tone, or turned off.

1) Press [MENU ESC] and [1]. The DISPLAY SETUP menu appears.

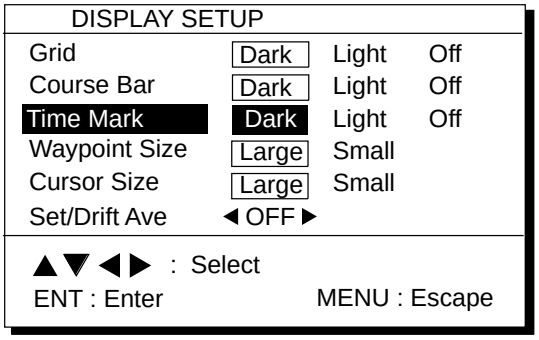


Figure 8-4 DISPLAY SETUP menu

2) Press ▲ or ▼ to select Grid.
3) Press ◀ or ▶ to select brilliance.
4) Press [NU/CU ENT] and [MENU ESC].

Course bar tone

The course bar can be displayed in light or dark tone, or turned off.

1) Press [MENU ESC] and [1].
2) Press ▲ or ▼ to select Course Bar.
3) Press ◀ or ▶ to select brilliance.
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

Time mark tone

The time mark can be displayed in light or dark tone, or turned off.

1) Press [MENU ESC] and [1].
2) Press ▲ or ▼ to select Time Mark.
3) Press ◀ or ▶ to select brilliance.
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

Waypoint mark size

The size of the waypoint mark can be selected to large or small.

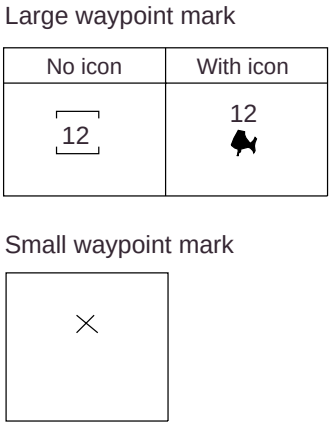


Figure 8-5 Waypoint mark size

1) Press [MENU ESC] and [1].
2) Press ▲ or ▼ to select Waypoint Size.
3) Press ◀ or ▶ to select Large or Small.
4) Press [NU/CU ENT] and [MENU ESC].

Cursor size

The size of the cursor can be selected to large or small.

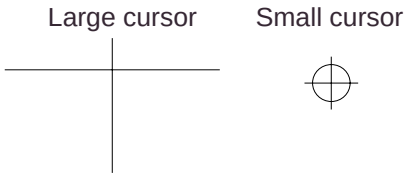


Figure 8-6 Cursor size

1) Press [MENU ESC] and [1].
2) Press ▲ or ▼ to select Cursor Size.
3) Press ◀ or ▶ to select Large or Small.
4) Press the [NU/CU ENT] key.
5) Press the [MENU ESC] key.

Set/Drift Ave

Set smoothing value to apply to set and drift data. The higher the value the more smoothed the data.

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Enlarging characters

The size of the indications of position or user defined display areas can be enlarged on the Data display.

1) On the Data display, with no enlarged characters, press the [CURSOR ON/OFF] key to turn on the cursor.
2) Operate the cursor keys to select data to enlarge in the window.
3) Press the [ZOOM IN] key.

To switch character size from enlarged to normal, press the [ZOOM OUT] key at step 3.

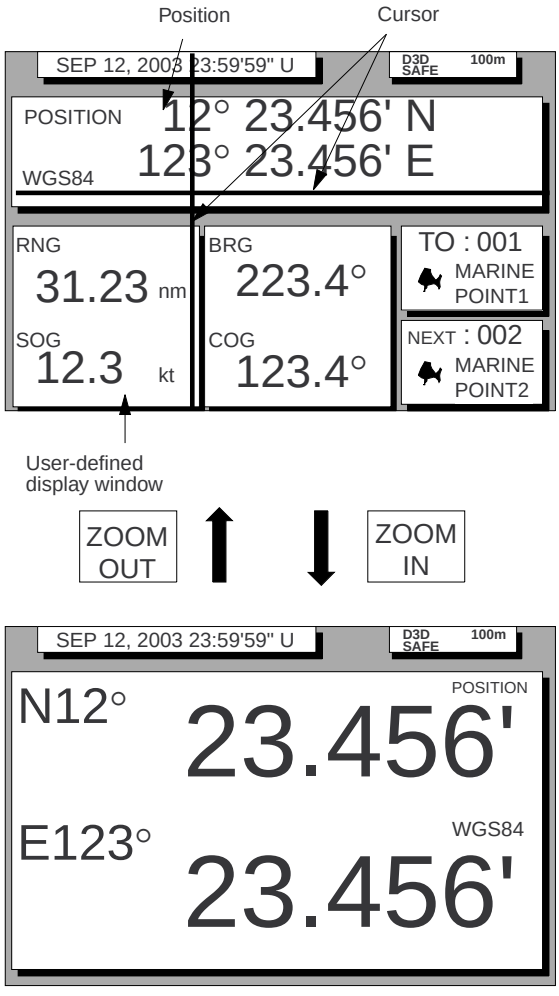


Figure 8-7 How to enlarge indications on the data display

8.4 Settings for Connection of Navigator

Besides its fundamental function of displaying position, the GP-90 can also output various data to external equipment. Before outputting data to external equipment, first determine what data the external equipment requires. Output only necessary data to ensure data will be output correctly.

All data transmitted by marine electronics equipment are prefixed with a two character code called a talker. The same talker must be shared by the transmitting and receiving equipment to transmit and receive data successfully. The GP-90 transmits data using the GP (GPS talker), however it can also transmit using the Loran (LC) or Decca (DE) talker.

Because the GP talker is a relatively new system some early model equipment may not recognize this talker.

DATA 1 output setting

1) Press [MENU ESC], [9] and [3]. The DATA 1, 3 OUTPUT SETUP menu appears.

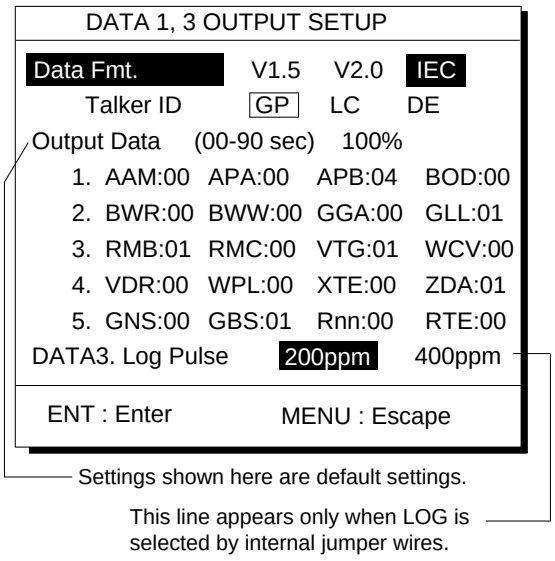


Figure 8-8 DATA 1, 3 OUTPUT SETUP menu

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2) Press ▲ or ▼ to select Data Fmt.
3) Press ◀ or ▶ to select NMEA 0183 (V1.5 or V2.0) or IEC 61162-1.
4) Press the [NU/CU ENT] key. Talker ID appears in reverse video.
5) Press ◀ or ▶ to select GP, LC or DE.
6) Press the [NU/CU ENT] key.
7) Enter Tx interval for each output data sentence in line 1. Tx interval is available in 00, 01, 02, 03, 04, 05, 06, 10, 15, 20, 30, 60 and 90 (seconds).
8) Press the [NU/CU ENT] key.
9) Enter Tx interval for each output data sentence in lines 2 through 5. Press the [NU/CU ENT] key after setting each line.

For detailed information about Tx interval see the installation manual. However, the settings entered by the installer of the equipment should not be changed unless absolutely necessary.

BWC is for great circle navigation; BWR is for rhumb line navigation.

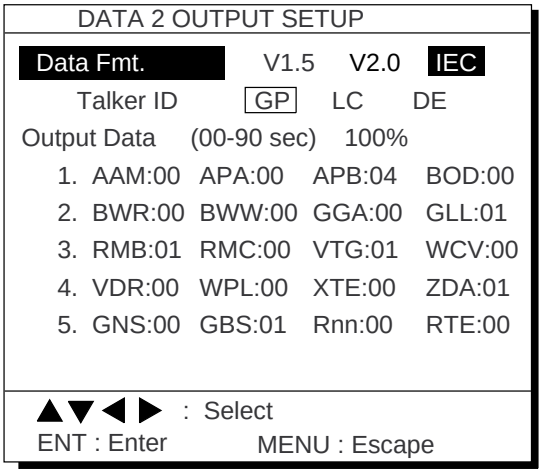
The total data output are shown by percentage on the third line. For best results the total output should not exceed 90%; lengthen the Tx interval of less important data to make the total output less than 90%.

When the external equipment cannot display correct data input from the GP-90, the rate of operation should be lowered.

For example, set a rate of operation less then 60% for the Temperature Indicator TI-20.

DATA 2 output setting

1) Press [MENU ESC], [9] and [4]. The DATA 2 OUTPUT SETUP menu appears.



Settings shown here are default settings.

Figure 8-9 DATA 2 OUTPUT SETUP menu

2) Follow the procedure for setting DATA 1 output.

DATA 3 output setting

The DATA 3 connector can output IEC 61162-1/NMEA 0183 data or log pulse. (For details, see the Installation Manual.) For NMEA 0183, IEC 61162-1 the same data output by DATA 1 is output from DATA 3.

For log pulse, select 200 or 400 pulse per second depending on the device connected.

1) Press [MENU ESC], [9] and [3].
2) Press ▲ or ▼ to select DATA 3. Log Pulse.
3) Press ◀ or ▶ to select log pulse of external equipment; 200ppm or 400ppm.
4) Press the [NU/CU ENT] key twice.

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Setting DATA 4 to NMEA

The DATA 4 port connects to a personal computer, DGPS receiver or YEOMAN equipment.

1) Press [MENU ESC], [9] and [5]. The DATA 4 I/O SETUP (1/2) menu appears.

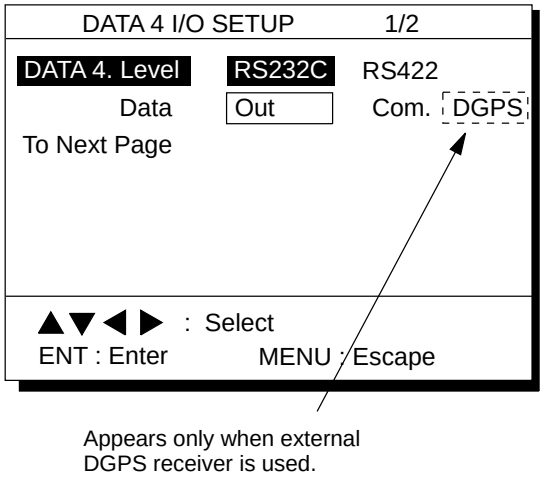


Figure 8-10 DATA 4 I/O SETUP menu (1/2)

2) Press ▲ or ▼ to select Level.
3) Press ◀ or ▶ to select level of external equipment; RS232C or RS422.
4) Press the [NU/CU ENT] key.
5) Press ◀ or ▶ to select Out.
6) Press ▼ to select To Next Page. The DATA 4 I/O SETUP (2/2) menu appears.

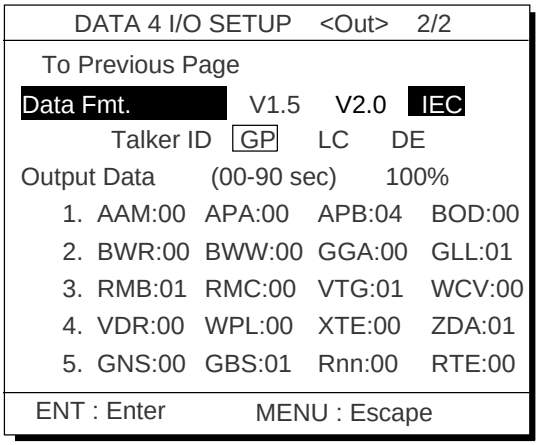


Figure 8-11 DATA 4 I/O SETUP menu (2/2)

7) Follow "DATA 1 output setting" from step 2.

8.5 Receiving Data from Personal Computer

Loading Waypoints/Routes data

Waypoints and Routes data can be downloaded from a personal computer, through the DATA 4 connector.

1) Press [MENU ESC], [9] and [5].
2) Press ▲ or ▼ to select Level.
3) Press ◀ or ▶ to select level of personal computer; RS232C or RS422.
4) Press the [NU/CU ENT] key.
5) Press ▶ to select Com.
6) Press ▼ to select To Next Page. The DATA 4 I/O SETUP menu appears.

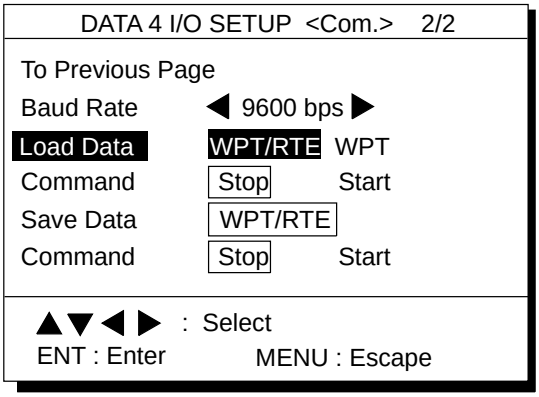


Figure 8-12 DATA 4 I/O SETUP menu (2/2)

7) Press ▲ or ▼ to select Baud Rate.
8) Press ◀ or ▶ to select baud rate; 4800bps, 9600bps, or 19200bps.
9) Press the [NU/CU ENT] key.
10) Press ◀ to select WPT/RTE.
11) Press ▼ to select Command. Stop, on the same line as Command, appears in reverse video.
12) Press ▶ to select Start. The message shown in Figure 8-13 appears.

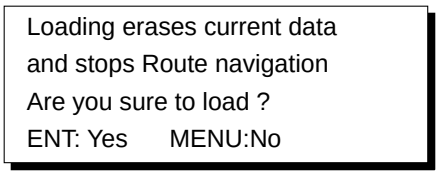


Figure 8-13

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13) Press the [NU/CU ENT] key. The message shown in Figure 8-14 appears while data is being loaded.

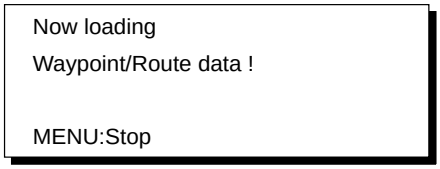


Figure 8-14

14) Operate the computer to output data. When data is loaded, the cursor shifts to Stop.
15) Press the [MENU ESC] key. When data is loaded successfully, The message in Figure 8-15 appears.

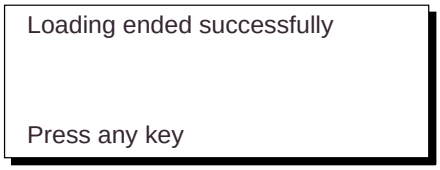


Figure 8-15

If data could not be loaded, the message shown in Figure 8-16 appears.

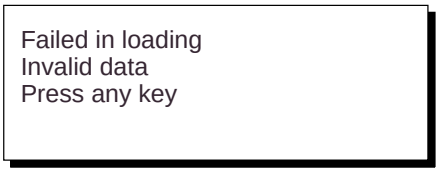


Figure 8-16

Stopping loading of data

1) Press the [MENU ESC] key. The message shown in Figure 8-17 appears.

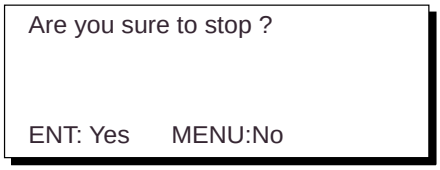


Figure 8-17

2) To quit loading, press the [NU/CU ENT] key. The cursor shifts to Stop.
3) To start loading, select Start.
4) Press the [NU/CU ENT] key.

Loading waypoint data from YEOMAN equipment

1) Do steps 1 through 9 in "Loading lighthouse data."
2) Press ◀ or ▶ to select WPT.
3) Press t to select Command.
4) Press ▶ to select Start. The message shown in Figure 8-18 appears.

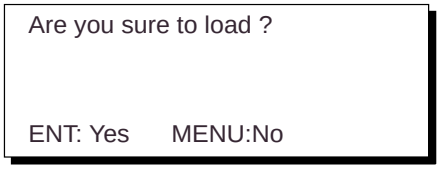


Figure 8-18

5) Press the [NU/CU ENT] key. The message shown in Figure 8-19 appears.

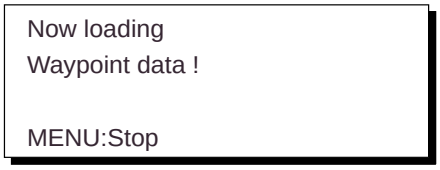


Figure 8-19

6) Operate the YEOMAN to output data. When data is loaded, the cursor automatically shifts to "Stop". Waypoints are loaded into empty areas. When the waypoint area becomes full, the message shown in Figure 8-20 appears.

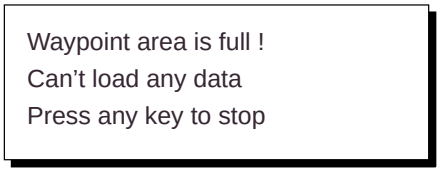


Figure 8-20

7) When the data is loaded, press [CU/NU ENT] and [MENU ESC]. The message shown in Figure 8-21 appears.
The number of valid and invalid waypoints appears in the message.

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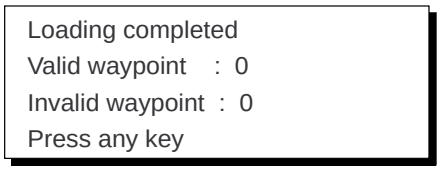


Figure 8-21

8) Press the [MENU ESC] key twice.

Saving data to personal computer

Waypoint and route data can be saved to a personal computer.

1) Press [MENU ESC], [9] and [5].
2) Press ▲ or ▼ to select Level.
3) Press ◀ or ▶ to select level; RS232C or RS422.
4) Press the [NU/CU ENT] key. "Data" appears in reverse video.
5) Press ▶ to select Com.
6) Press ▼ to select Next Page.
7) Press ▲ or ▼ to select Baud Rate.
8) Press ◀ or ▶ to select baud rate; 4800bps, 9600bps, or 19200bps.
9) Press ▼ to select Command (under the Save Data line). Stop, on the same line as Command, appears in reverse video.
10) Press ▶ to select Start. The message shown in Figure 8-22 appears.

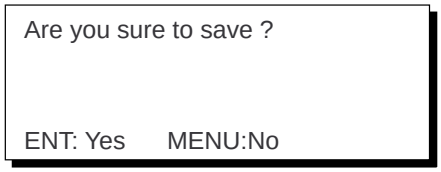


Figure 8-22

11) Press the [NU/CU ENT] key. The message shown in Figure 8-23 appears while data is being saved.

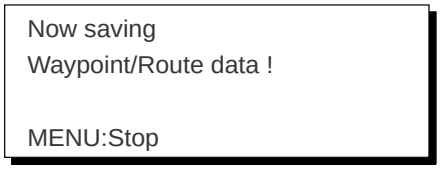


Figure 8-23

12) Save data at the computer.
13) Press the [MENU ESC] key. When data is saved, the cursor shifts to Stop.
14) Press the [MENU ESC] key.

8.6 WAAS/DGPS Setting

This menu sets the using WAAS or when the DGPS beacon receiver GR-80 is connected. The default setting is “GPS”.

WAAS

1) Press [MENU ESC], [9] and [7] to display the WAAS/DGPS SETUP menu.

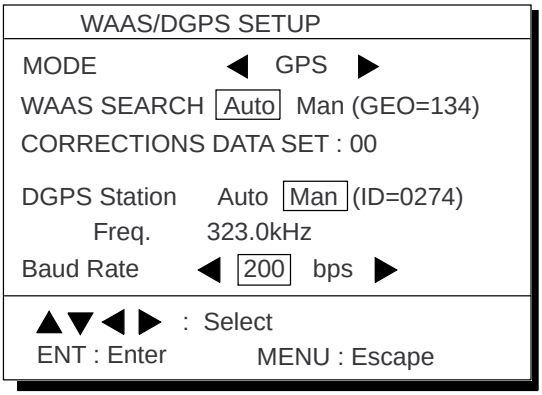


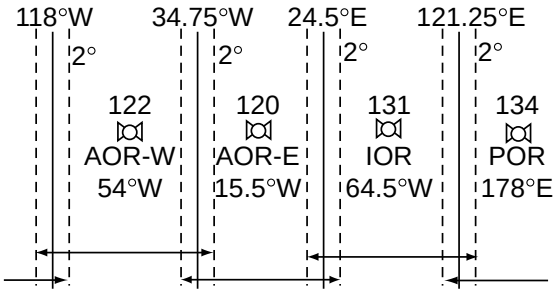
Figure 8-24 WAAS/DGPS SETUP menu

2) Press ◀ or ▶ to select WAAS or AUTO.
3) Press ▼ to select WAAS SEARCH.
4) Press ◀ or ▶ to select Auto or Man.
   For automatic search, the GP-90 automatically search GEO satellite depending on own longitude.
   For manual search, enter appropriate WAAS satellite number, referring to the illustration below.

AUTO mode and GEO satellite (in Jan 2004)

Provider	GEO Satellite	Longitude
WAAS	POR (134)	178˚E
	AOR-W (122)	54˚W
EGNOS	AOR-E (120)	15.5˚W
	IOR (131)	64.5˚E

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One-degree threshold

Longitude Range	Satellite
120.25°E to 117°W	134
119°W to 33.75°W	122
35.75°W to 25.5°E	120
23.5°E to 122.25°E	131

Figure 8-25 GEO satellite and coverage area

DGPS

1) Press [MENU ESC], [9] and [7] to display the WAAS/DGPS SETUP menu.

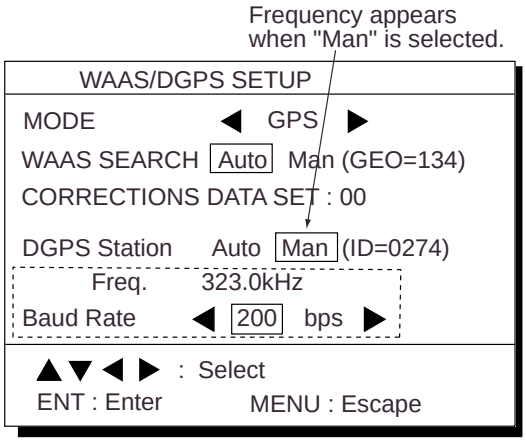


Figure 8-26

2) Press ▼ to select DGPS Station.
3) Press ◀ or ▶ to select Auto or Man.
   For automatic search, the GP-90 automatically search DGPS reference station.
   For manual search, select frequency of DGPS reference station and select the transmission rate of that.

Reference

- ID number: Appendix at end of this manual
- Frequency, baud rate: "DGPS REFERENCE LIST"

1) Press [MENU ESC]. [9] and [7] to display the DGPS SETUP menu.
2) Set DGPS MODE On.
3) Press ▲ or ▼ to select DGPS Station.
4) Press ◀ or ▶ to select Man.
5) Enter four digit ID number. You can clear an entry by the [CLEAR] key. If the number entered is invalid, the buzzer sounds and the message "INVALID ID" appears on the display for three seconds. If there is no ID number, press the [CLEAR] key.
6) Press the [NU/CU ENT] key.
7) Enter frequency in four digits (283.5kHz to 325.0kHz).
8) Press the [NU/CU ENT] key. "Baud Rate" appears in reverse video.
9) Press ◀ or ▶ to select baud rate; 25, 50, 100 or 200bps.
10) Press the [MENU ESC] key.

Setup for external DGPS beacon receiver

When an external DGPS beacon receiver is connected to the DATA 4 connector, set up the GP-90 according to specification of DPGS beacon receiver connected as follows.

1) Press [MENU ESC], [9] and [5].
2) Press ▲ or ▼ to select Level.
3) Press ◀ or ▶ to select level; RS232C or RS422.
4) Press the [NU/CU ENT] key.
5) Press ◀ or ▶ to to select DGPS.
6) Press ▼ to select To Next Page.

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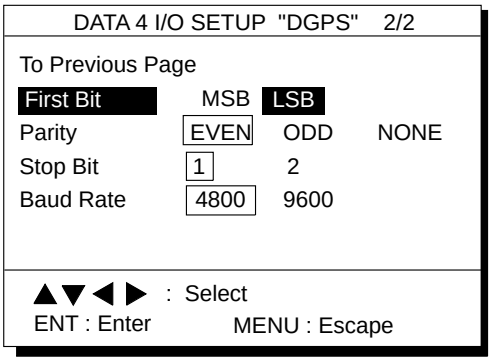


Figure 8-27 DATA 4 I/O SETUP "DGPS" 2/2 menu

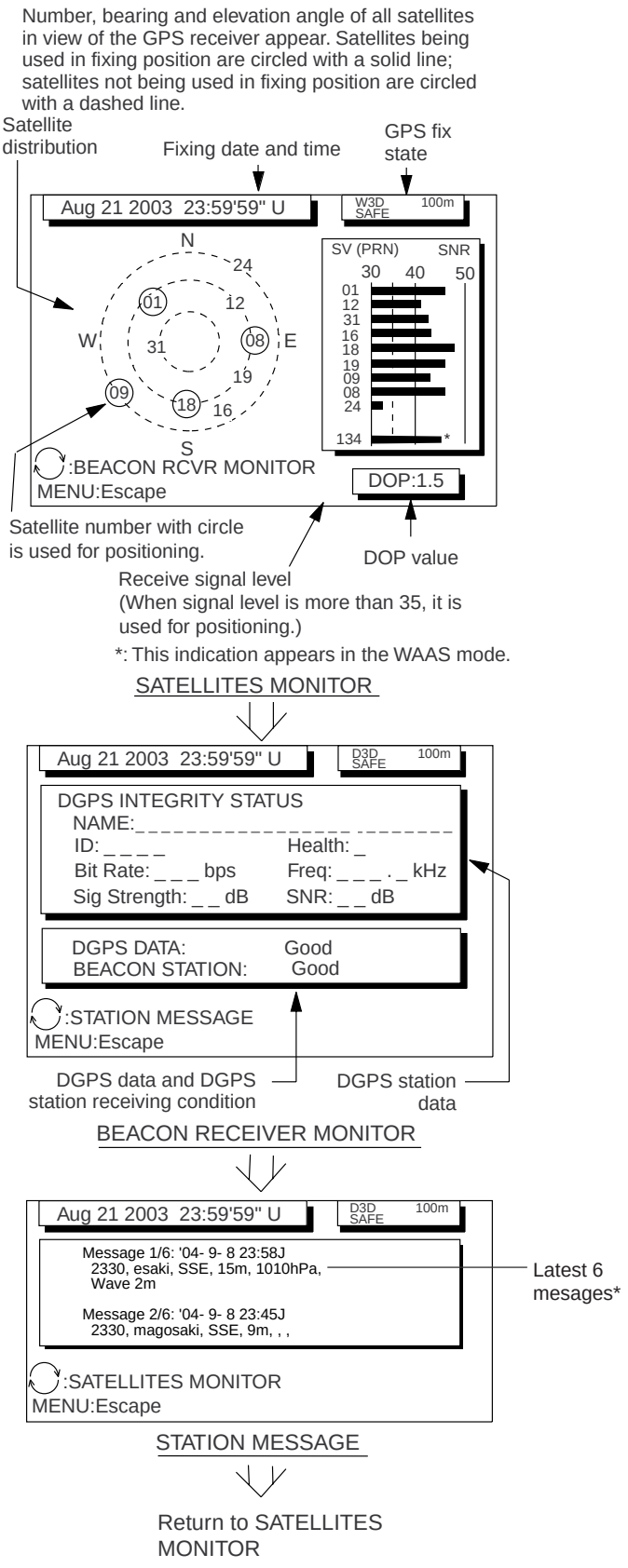
7) Press ▲ or ▼ to select First Bit.
8) Press ◀ or ▶ to select first bit; MSB or LSB.
9) Press ▼ to select Parity.
10) Press ◀ or ▶ to select parity bit; EVEN, ODD or NONE.
11) Press ▼ to select Stop Bit.
12) Press ◀ or ▶ to select stop bit; 1 or 2.
13) Press ▼ to select Baud Rate.
14) Press ◀ or ▶ to select baud rate; 4800 or 9600.
15) Press the [MENU ESC] key.

8.7 Displaying GPS Monitor Displays

Three GPS monitor displays provide GPS information:

- **Satellite monitor** which shows position of GPS satellites
- **Beacon receiver monitor** which displays DGPS beacon station information
- **DGPS beacon station message monitor** which displays messages received from beacon stations. The GP-90 stores the latest six such messages.

To display the GPS monitor displays;
1) Press [MENU ESC] and [7].
2) Press [↻] to display the GPS monitor you want to view.
3) Press the [MENU ESC] to escape.



* Format and content of messages depends on beacon reference station. The example shown here is from a Japanese beacon reference station.

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9. MAINTE-NANCE & TROUBLE-SHOOTING

9.1 Clearing the Memory

The GP-90 has two memories: GPS memory and plotter memory.

Clearing the plotter memory

The plotter memory holds plotted track and mark data. When you clear the plotter memory, all track and marks are cleared and all corresponding defaults settings are restored.

1) Press [MENU ESC] [9] and [9] to display the CLEAR MEMORY menu.

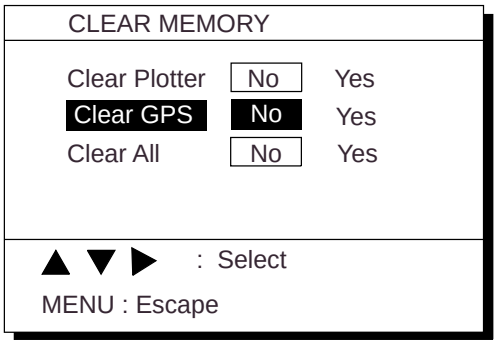


Figure 9-1 CLEAR MEMORY menu

2) Press ▲ or ▼ to select Clear Plotter.
3) Press ▶ to select Yes. The following message appears.

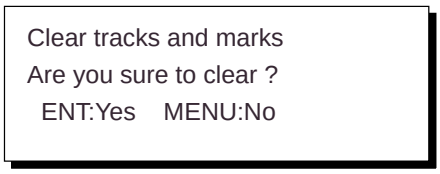


Figure 9-2

4) Press the [NU/CU ENT] key.

Clearing the GPS memory

The GPS memory stores GPS information, including the Almanac. When you clear the GPS memory, all GPS information is erased.

1) Press [MENU ESC] [9] and [9] to display the CLEAR MEMORY menu.
2) Press ▲ or ▼ to select Clear GPS.
3) Press ▶ to select Yes. The following message appears.

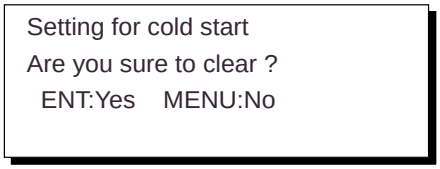


Figure 9-3

4) Press the [NU/CU ENT] key.

Clearing GPS and plotter memories

To clear both GPS and plotter memories;

1) Press [MENU ESC] [9] and [9] to display the CLEAR MEMORY menu.
2) Press ▲ or ▼ to select Clear All.
3) Press ▶ to select Yes. The message shown in Figure 9-4 appears.

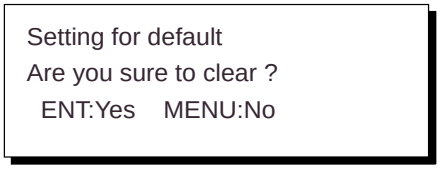


Figure 9-4

4) Press the [NU/CU ENT] key.

Note: The equipment may lock after clearing the GPS and plotter memories. Reapply power to the equipment to restore normal operation.

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9.2 Preventive Maintenance

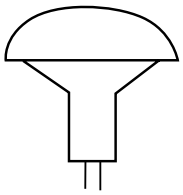
Regular maintenance is necessary to maintain performance. Check the items mentioned below monthly to keep the equipment in good working order.

Antenna unit

Check for fixing bolts for tightness.

Antenna cable

Check connector for tightness, rust, damage and water leaks.



Power cable

Check for tight connection.
Ground terminal
Check for rust and tight connection.

Fuse

The 2A fuse in the power cable protects the unit from overvoltage and equipment fault. If the fuse blows, find out the cause before replacing the fuse. If the fuse blows after replacement, request service.

⚠ WARNING

Use only a 2A fuse in the power cable.

Use of different fuses may cause fire.

9.3 Error Messages

Error messages appear on the display to alert you to possible trouble.

⚠ WARNING

Do not open the display unit cover.
High voltage exists inside.

If the unit is not working properly, contact your dealer.

GPS error

When GPS signal is suddenly lost and position cannot be calculated within one minute the message shown in Figure 9-5 appears.

GPS No fix

Figure 9-5 GPS error message

This message may appear when there is an interfering object between the satellite and GPS receiver (for example, mast) or the antenna cable is disconnected.

Press the [CLEAR] key to silence the buzzer. If the [CLEAR] key is not pressed, several beeps sound every three minutes.

DOP error

When PDOP value exceeds 6 in the 3D mode, or HDOP value exceeds 4 in the 2D mode, this error occurs and following indication appears.

DOP Error

Figure 9-6 DOP error message

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Press the [CLEAR] key to silence the buzzer. If the [CLEAR] key is not pressed, several beeps sound every three minutes.

DGPS error

When DGPS data contains errors or the DGPS beacon station is experiencing transmitting problems, the message shown in Figure 9-7 appears.



Figure 9-7 DGPS error message

Self test error message

If the self test (conducted when turning on the power) finds equipment error, the message shown in Figure 9-8 appears.

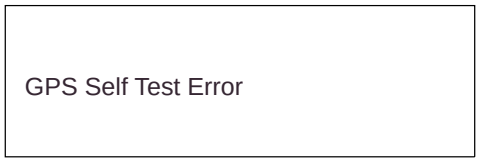


Figure 9-8 Self test error message

If the self test error message appears, consult your dealer for advice.

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9.4 Troubleshooting

The table which follows provides troubleshooting procedures which you can follow to restore normal operation. If normal operation cannot be restored, ask your dealer for advice.

Table 9-1 Troubleshooting table

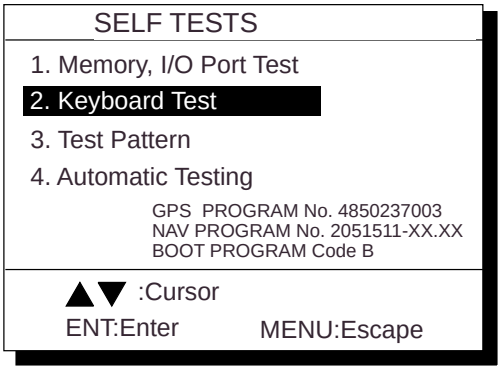
If…	**Them…**
You cannot turn on the power	• Check power connector for tight connection. • Check if ship's main is off. • Check for blown fuse.
Position cannot be fixed	• Check antenna cable for tight connection and water leakage. • Check if functional satellite has been disabled: [MENU ESC] [9] [6]
Position is wrong	• Check if correct geodetic chart is entered: [MENU ESC][9][6] • Apply position correction to GPS position: [MENU ESC][9][6]
Data cannot be transmitted to external equipment	• Check if data format is correct: [MENU ESC][9][3][4][9][5] See the installation manual for further details. • Tx interval may be set to "0". Select proper interval. [MENU ESC] [9][3][9][4][9][5] See the installation manual for further details. • Check appropriate settings on external equipment. • Check connections: GP-90 external equipment TD-A RD-A TD-B RD-B

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9.5 Diagnostic Tests

Memory and I/O circuits test

1) Press [MENU ESC] and [8] to display the SELF TESTS menu.



XX.XX: Version no.

Figure 9-9 Diagnostic TESTS menu

2) Press [1].

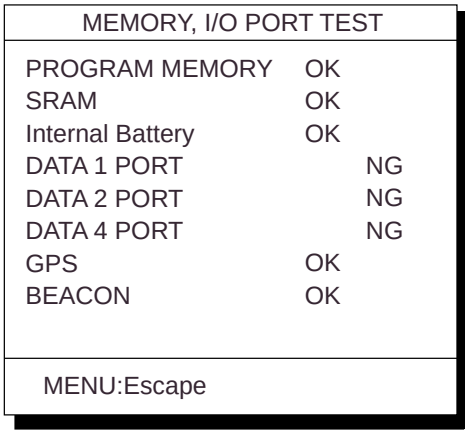


Figure 9-10 MEMORY, I/O PORT TEST display

3) When testing is finished, press the [MENU ESC] key to escape and return to the Self Test menu. (Testing continues if the key is not pressed.)
OK appears to the right of PROGRAM, SRAM and Internal Battery when those devices are normal; NG (No Good) appears when an abnormality is found.
OK appears to the right of GPS and BEACON when they are normal; NG and 16 hexadecimal figure appear when an abnormality is found.
Whenever NG or 16 hexadecimal figure appears contact your dealer for advice.

DATA 1 PORT, DATA 2 PORT and DATA 4 PORT show results of communication interface test. A special test connector is required to test those ports. NG appears as the results of the self test when there is no test connector attached.

4) Press the [MENU ESC] key to escape.

Note: The life of the internal battery is approximately 5 years.

Name	Type	Code No.
Lithium	CR2450-F2SST2L	000-144-941

Keyboard test

1) Press [MENU ESC], [8] and [2] to display the KEYBOARD TEST screen.

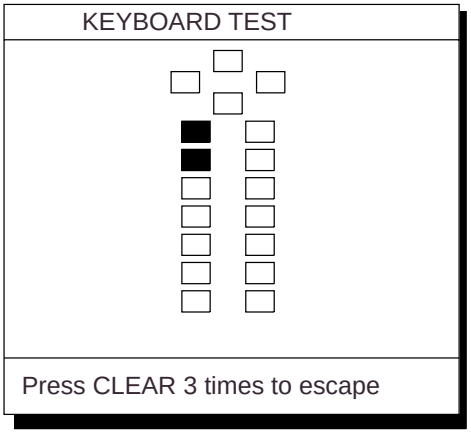


Figure 9-11 KEYBOARD TEST screen

2) Press each key one by one. A key's corresponding location on the screen lights in reverse video if the key is normal.
3) To quit the keyboard test, press the [CLEAR] key three times. Control is returned to the SELF TESTS menu.
4) Press the [MENU ESC] key.

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Display test

1) Press [MENU ESC] [8] and [3] to display the test pattern screens.
2) To change the test pattern, press the [NU/CU ENT] key. Each time the key is pressed one of the patterns shown in Figure 9-12 appears.

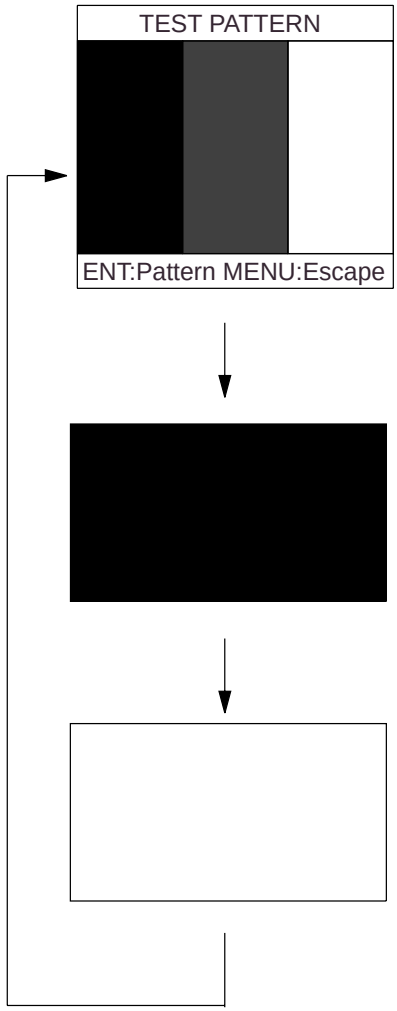


Figure 9-12 Test patterns 1 and 2

3) To quit the test pattern, press the [CLEAR] key three times. Control is returned to the SELF TESTS menu.
4) Press the [MENU ESC] key.

Automatic testing

This feature conducts all self tests continuously.

1) Press [MENU ESC] [8] and [4]. Self tests are conducted continuously in the order of memory, I/O test, keyboard test and test pattern.
2) To stop testing, press the [MENU ESC] key.
3) Press the [MENU ESC] key.

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SPECIFICATIONS

GPS Receiver

Number of receiving channels	12 channels parallel, 12 satellite tracking
Rx frequency	1575.42MHz
Rx code	C/A code
Position fixing system	All in view, 8-state Kalman filter
Position Accuracy	Approx. 10m, 95% of the time, Horizontal dilution of position (HDOP)≤4 **Note:** All GPS receiver are subject to degradation of position and velocity accuracies under the U.S. Department of Defence. Position may be degraded. DGPS: Approx. 5 m, 95% of the time
SOG Accuracy	0.2 kt (Ship's speed ≤ 10 kt) 2% of ship's speed (Ship' s speed > 10 kt)
COG Accuracy	±3° (SOG 1-17 kt) ±1° (SOG >17 kt)
Tracking velocity	900 kts
Position-fixing time	Warm start: 12 seconds Cold start: 90 seconds
Position update interval	1 second
Integrity indication	Safe, Unsafe, Caution at accuracy level of 10 m or 100 m

Display Section

LCD	122 x 92 mm (320 x 240 dot matrix)
Display mode	Plotter modes 1 and 2, Highway, Navigation, Data
Display	Mercator projection Track recording and mark capacity: 2,000 pts.
Waypoint storage capacity	999 pts. with comment (12 character)
Route storage capacity	30 routes (30 waypoints per route) Simple route: 1 route/30 waypoints
Alarms	Waypoint arrival, Anchor watch, Cross track error, Speed, Trip, Water temperature, depth

Data Input/Output

Number of ports	Four I/O ports
Data format	IEC 61162-1 Edition 2 (2000-07)/NMEA 0183 Ver. 1.5/NMEA Ver. 2.0
Input data	• NMEA 0183: DBT, DPT, HDG, HDM, HDT, MTW, TLL, VBW, VHW • DPGS; RTCM SC104 Ver. 2.1 • Universal data from personal computer.

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Output data	IEC 61162-1/NMEA 0183 (Ver. 1.5/Ver. 2.0): AAM, APB, BOD, BWC, BWR, BWW, GGA, GLL, GNS, RMB, RMC, VTG, WCV, VDR, WPL, XTE, ZDA, GBS, Rnn, RTE (IEC 61162-1)

Power Supply & Environmental Conditions

Power supply and power consumption	12-24 VDC, 0.8-0.4 A	
Useable environment	Antenna unit: -25°C to +70°C	
	Receiver unit: -15°C to +55°C	
Humidity	95% (40°C)	
Waterproofing specification	Antenna unit:	IEC 60529 IPX6
	Display unit:	IEC 60529 IPX5 (USCG CFR-46)
Vibration	IEC 60945	

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DIGITAL INTERFACE
(IEC 61162-1 EDITION 2 (2000-07))

Output sentences of channel 1, 2, 3, 4 (DATA 1, DATA 2, DATA 3, DATA 4)

AAM, APB, BOD, BWC, BWR, BWW, GBS, GGA, GLL, GNS, RMB, RMC, VTG, WCV, VDR, WPL, XTE, ZDA, RTE, DTM

Input sentences of channel 1 (DATA 1, DATA2, DATA4)

DBT, DPT, HDG, HDT MTW, TLL, VBW VHW

Transmission interval

All sentences output at the interval selected (00-90 s).
Load requirements as listener
Isolation: Optocoupler
Input impedance: 470 ohms
Max. voltage: ±15V
Threshold: 3 mA (in case of connection of FURUNO device talker)

Data transmission

Data is transmitted in serial asynchronous form in accordance with the standard referenced in 2.1 of IEC 61162-1. The first bit is a start bit and is followed by data bits.

The following parameters are used:

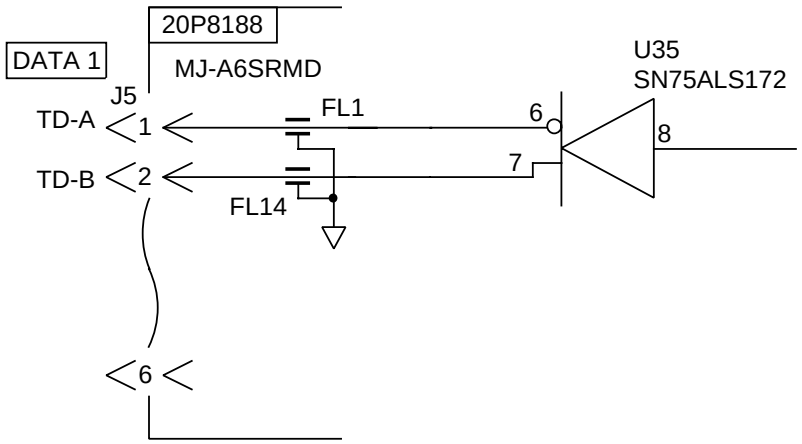
Baud rate: 4800
Data bits: 8 (D7 = 0), parity none
Stop bits: 1

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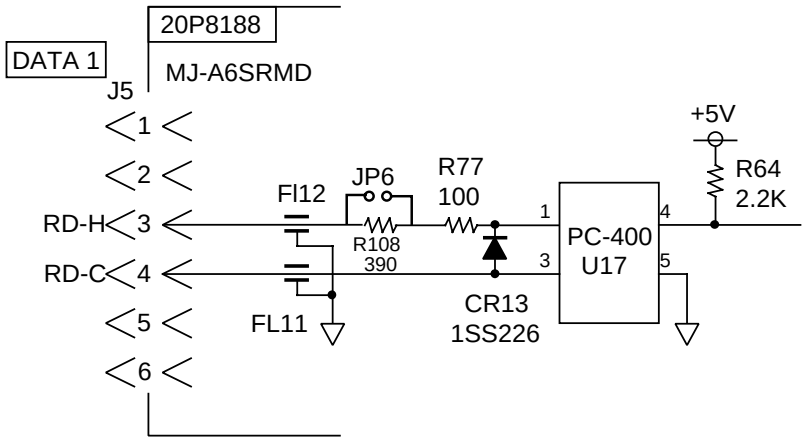
Schematic diagrams

DATA1 port (output)

Output drive capability: Max. 15mA



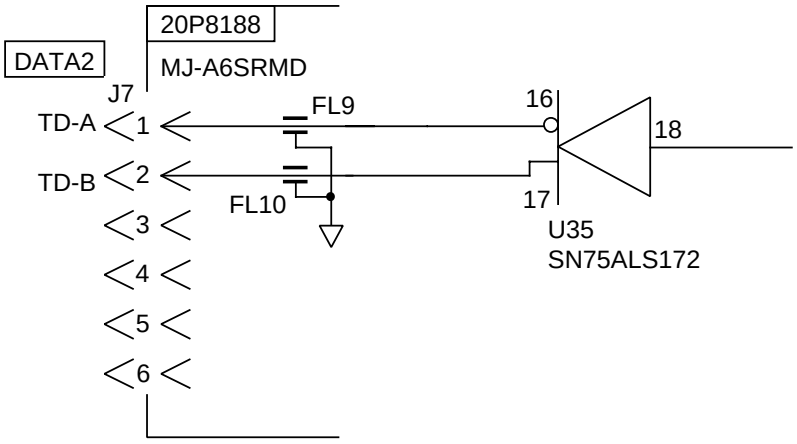
DATA 1 port (input)



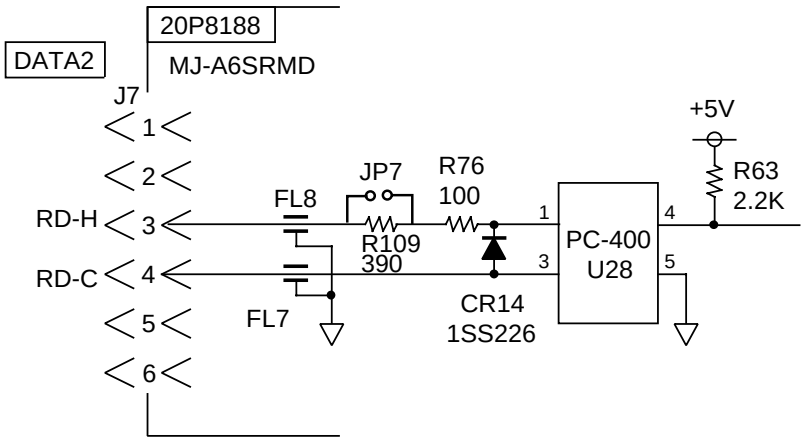
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DATA 2 port (output)

Output drive capability: Max. 15mA



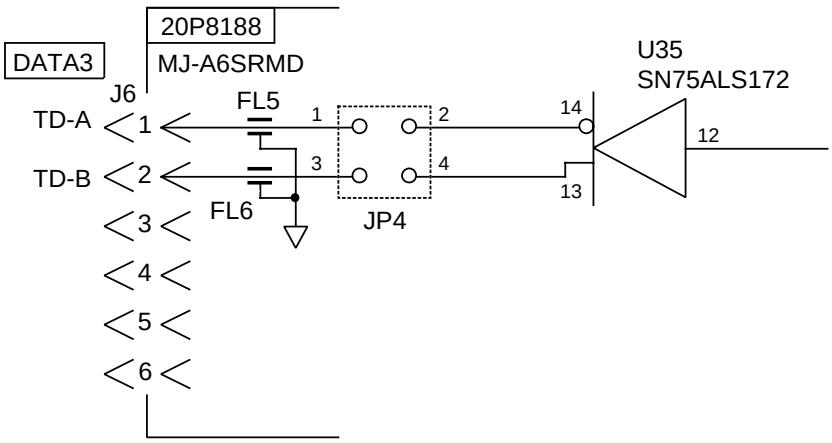
DATA 2 port (input)



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DATA 3 port (output)

Output drive capability: Max. 15mA



DATA 4 port

IN/OUT signal is selected by the menu among the output of IEC 61162-1, NMEA Ver. 1.5/2.0, PC input/output and DGPS signal.

Sentence description

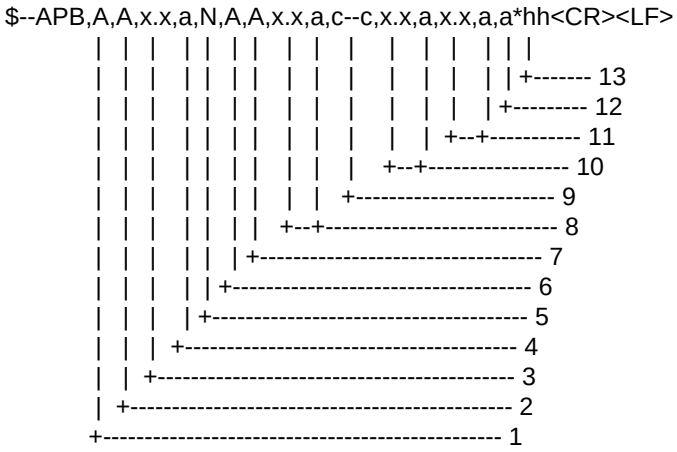
AAM - Waypoint arrival alarm

```
$--AAM,A,A,x.x,N,c--c*hh<CR><LF>
       | |   |   |   |   |
       | |   |   |   |   +--------- 5
       | |   |   |   +------------- 4
       | |   |   +----------------- 3
       | +---------------------------- 2
       +------------------------------ 1
```

1. Status: A=arrival circle entered
2. Status: A=perpendicular passed at waypoint
3. Arrival sircle radius, nautical miles
4. Waypoint ID
5. Checksum

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APB - Autopilot sentence data



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

NOTE Positioning system Mode indicator:
A = Autonomous mode
D = differential mode
S = Simulator mode
N = Data not valid

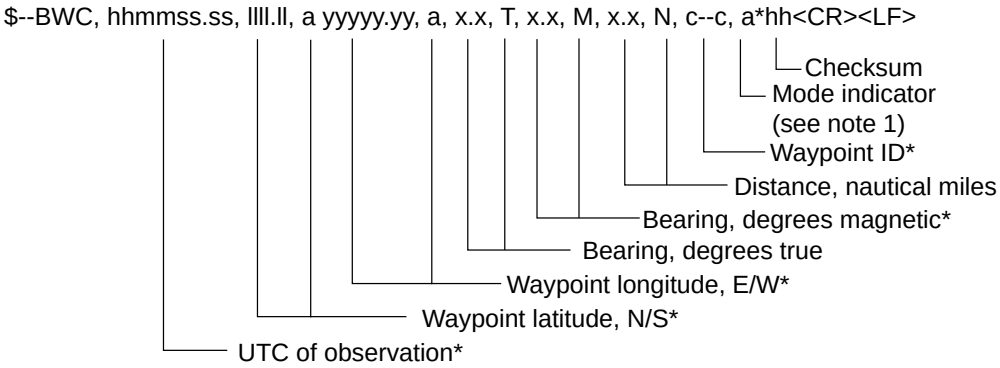
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BOD - Bearing, origin to destination

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

1. Bearing, degrees true
2. Bearing, degrees magnetic
3. Destination waypoint ID
4. Origin waypoint ID
5. Checksum

BWC - Bearing and distance to waypoint

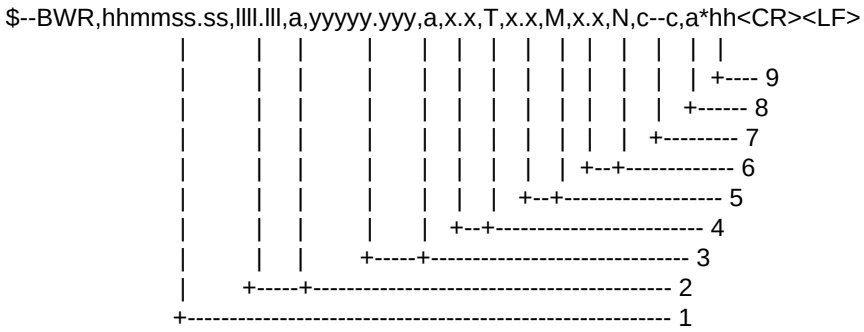


*: Not used

NOTE 1: Positioning system Mode indicator:
A= Autonomous mode
D= Differential mode
S= Simulator mode
N= Data not valid
The Mode indicator field shall not be a null field.

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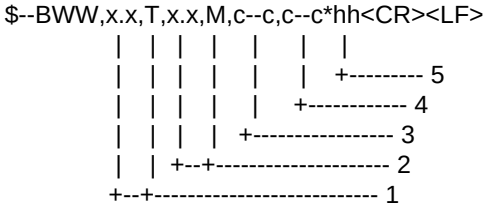
BWR - Bearing, waypoint to range



1. UTC of observation
2. Waypoint latitude, N/S
3. Waypoint longitude, E/W
4. Bearing, degrees true
5. Bearing, degrees magnetic
6. Distance, nautical miles
7. Waypoint ID
8. Mode indicator(see note)
9. Checksum

NOTE Positioning system Mode indicator:
A = Autonomous mode
D = differential mode
S = Simulator mode
N = Data not valid
The Mode indicator field shall not be a null field.

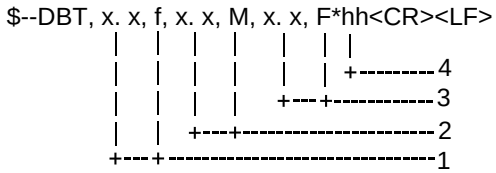
BWW - Bearing, waypoint to waypoint



1. Bearing, degrees true
2. Bearing, degrees magnetic
3. TO waypoint ID
4. FROM waypoint ID
5. Checksum

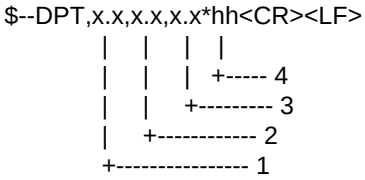
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DBT - Depth below transducer



1. Water depth, feet
2. Water depth, m
3. Water depth, fathoms
4. Checksum

DPT - Depth

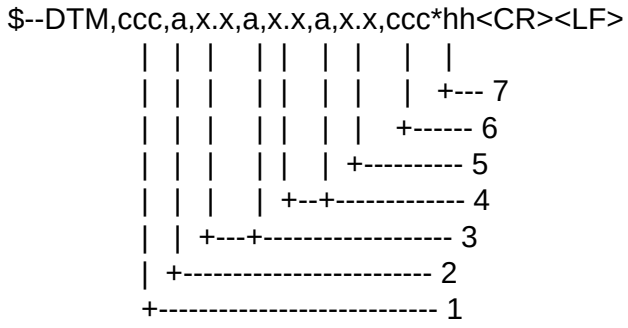


1. Water depth relative to trancsducer, in meters
2. Offset from transeducer, in meters(see notes 1 and 2)
3. Maximum range scale in use
4. Checksum

NOTE1 "positive"=distance from transeduser to water-line.
"-"=distance from transducer to keel.
NOTE2 For IEC applications the offset should always be applied so as to provide depth relative to the keel.

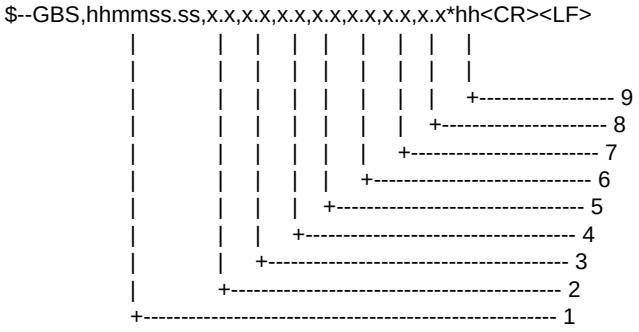
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DTM - Datum reference



1. Local datum W84 - WGS84
   W72 - WGS72
   S85 - SGS85
   P90 - PE90
   999 - User defined
   IHO datum code
2. Local datum subdivision code
3. Lat offset, min, N/S
4. Lon offset, min, E/W
5. Altitude offset, m
6. Reference dattum W84 - WGS84
   W72 - WGS72
   S85 - SGS85
   P90 - PE90
7. Checksum

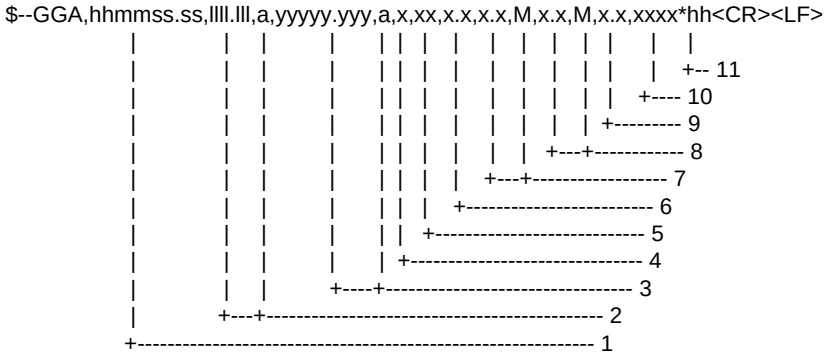
GBS -GPS satellite fault detection



1. UTC time of the GGA fix addociated with this sentence
2. Expected error in latitude
3. Expected error in longitude
4. Expected error in altitude
5. Most likely failed satellite
6. Probability of missed detection for most likely failed satellite
7. Estimate of bias on most likely failed satellite
8. Standard deviation on bias estimate
9. Checksum

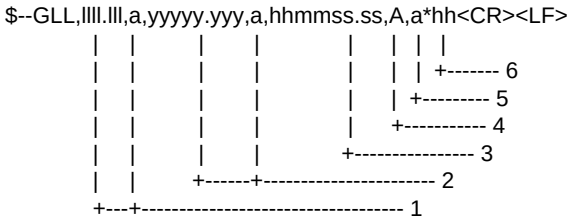
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GGA -Global positioning system fix data



1. UTC of position
2. Latitude, N/S
3. Longitude, E/W
4. GPS quality indicator (0: No fix, 1: GPS, 2: Differential, 8: Demo mode)
5. Number of satllite in use,00-12, may be different from the number in view
6. Horizontal dilution of precision
7. Antenna altitude above/below mean sealevel, m
8. Geoidal separation, m
9. Age of differential GPS data
10. Differential reference station ID, 0000-1023
11. Checksum

GLL - Geographic position, latitude and longitude



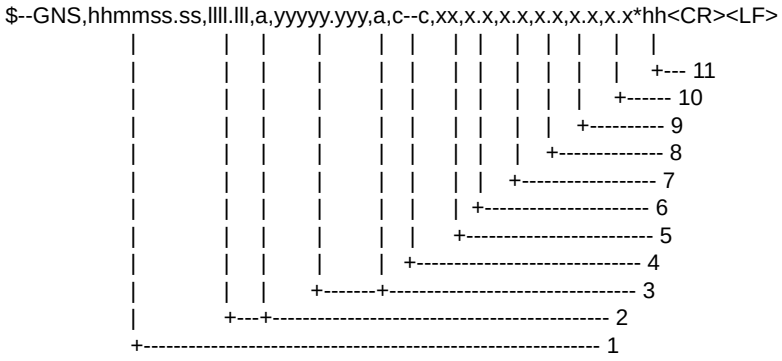
1. Latitude, N/S
2. Longitude, E/W
3. UTC of position
4. Status: A=data valid, V=data invalid
5. Mode indicator(see note)
6. Checksum

NOTE Positioning system Mode indicator:
A = Autonomous
D = Differential
S = Simulator
N = Data not valid

The Mode indicator field supplements the Status field. The Status field shall be set to V=invalid for all values of Operating Mode except for A=Autonomous and D=Differential. The positioning system Mode indicator and Status field shall not be null fields.

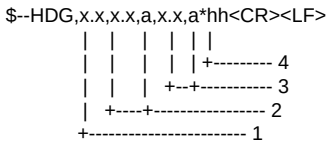
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GNS - GNSS fixed data



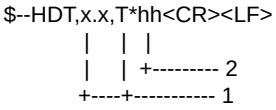
1. UTC of position
2. Latitude, N/S
3. Longitude, E/W
4. Mode indicator
5. Total number of satllite in use,00-99
6. HDOP
7. Antenna altitude, metres, re:mean-sea-level(geoid)
8. Geoidal separation
9. Age of differential data
10. Differential reference station ID
11. Checksum

HDG – Heading, deviation and variation



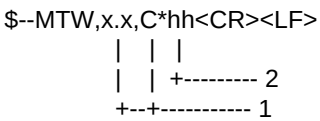
1. Magnetic sensor heading, degrees
2. Magnetic deviation, degrees E/W
3. Magnetic variation, degrees E/W
4. Checksum

HDT - Heading, true



1. Heading, degrees true
2. Checksum

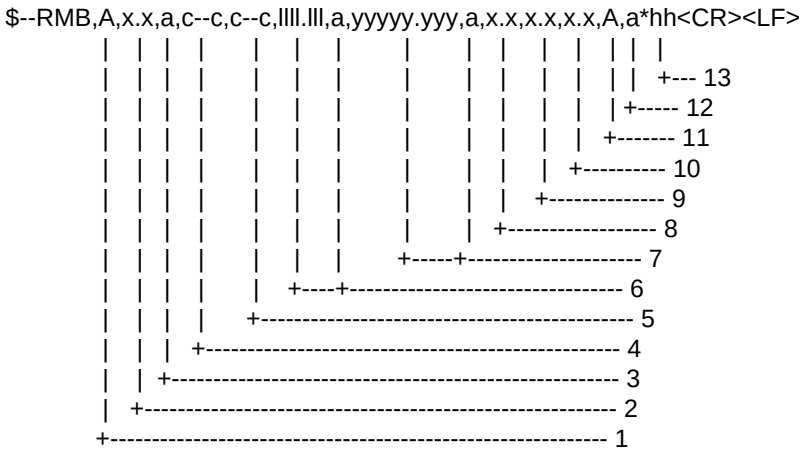
MTW- Water temperature



1. Temperature, degrees C
2. Checksum

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RMB - Recommended minimum navigation information



1. Data status: A=data valid, V=navigation receiver warning
2. Cross track error(see note 2) n.miles
3. Direction to steer L/R
4. Origin waypoint ID
5. Destination waypoint ID
6. Destination waypoint latitude,N/S
7. Destination waypoint longitude,E/W
8. Range to destination, n.miles(see note 1)
9. Bearing to destination, degrees true
10. Destination closing velocity, knots
11. Arrival status: A=arrival circle entered or perpendicular passed
12. Mode indicator(see note 3)
13. Checksum

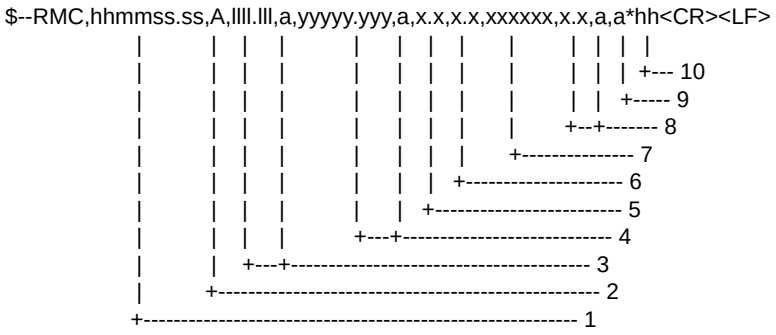
NOTES
1 If range to destination exceeds 999.9 nautical miles, display 999.9.
2 If cross track error exceeds 9.99 nautical miles, display 9.99.

3 Positioning system Mode indicator:
A = Autonomous
D = Differential
S = Simulator
N = Data not valid

The Mode indicator field supplements the Status field. The Status field shall be set to V=invalid for all values of Operating Mode except for A=Autonomous and D=Differential. The positioning system Mode indicator and Status field shall not be null fields.

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RMC- Recommended minimum specific GPS/TRANSIT data

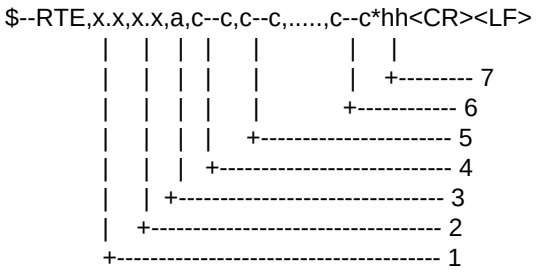


1. UTC of position fix
2. Status: A=data valid, V=navigation receiver warning
3. Latitude, N/S
4. Longitude, E/W
5. Speed over ground, knots
6. Course over ground, degrees true
7. Date: dd/mm/yy
8. magnetic variation, degrees E/W
9. Mode indicator(see note)
10. Checksum

NOTE Positioning system Mode indicator:
A = Autonomous
D = Differential
S = Simulator
N = Data not valid

The Mode indicator field supplements the Status field. The Status field shall be set to V=invalid for all values of Operating Mode except for A=Autonomous and D=Differential. The positioning system Mode indicator and Status field shall not be null fields.

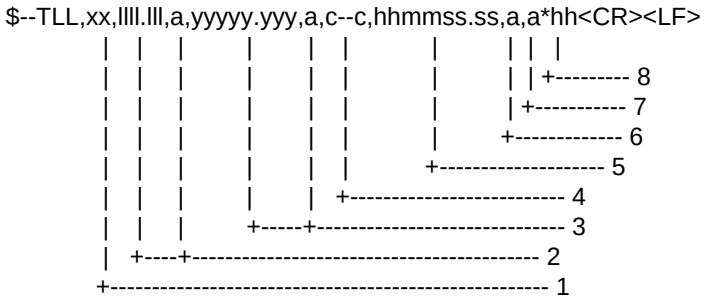
RTE - Routes



1. Total number of messages being transmitted
2. Message number
3. Message mode:
   c=complete route, all waypoints
   w=working route, first listed waypoint is "FROM",
   second is "TO" and remaining reset of route
4. Route identifier
5. Waypoint identifier
6. Waypoint "n" identifier
7. Checksum

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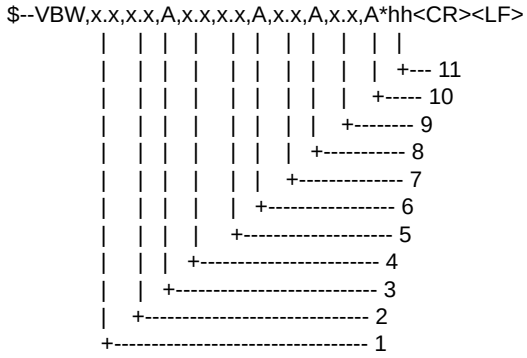
TLL - Target latitude and longitude



1. Target number 00 - 99
2. Latitude, N/S
3. Longitude, E/W
4. Target name
5. UTC of data
6. Target status(see note)
7. Reference target=R,null otherwise
8. Checksum

NOTE - Target status
L = lost,tracked target has beenlost
Q = query,target in the process of acquisition
T = tracking

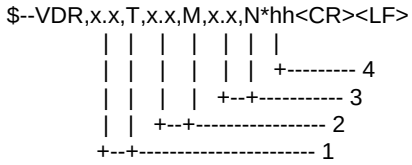
VBW – Dual ground/water speed



1. Longitudial water speed, knots
2. Transverse water speed, knots
3. Status: water speed, A=data valid V=data invalid
4. Longitudial ground speed, knots
5. Transverse ground speed, knots
6. Status: ground speed, A=data valid V=data invalid
7. Stern transverse water speed, knots
8. Status: stern water speed, A=data valid V=data invalid
9. Stern transverse ground speed, knots
10. Status: stern ground speed, A=data valid V=data invalid
11. Checksum

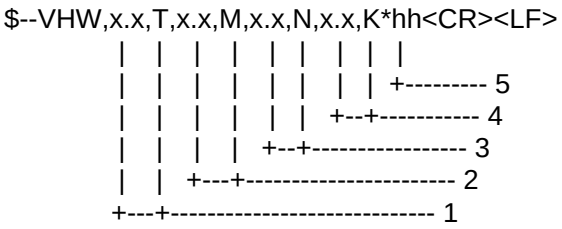
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VDR – Set and drift



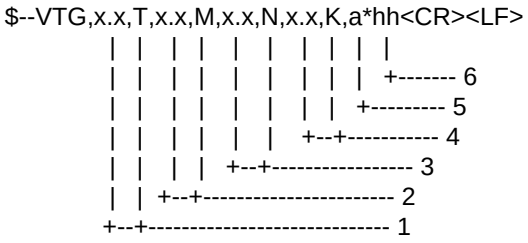
1. Direction, degrees true
2. Direction, degrees magnetic
3. Current speed, knots
4. Checksum

VHW – Water speed and heading



1. Heading, degrees true
2. Heading, degrees magnetic
3. Speed, knots
4. Speed, km/h
5. Checksum

VTG - Course over ground and ground speed



1. Course over ground, degrees true
2. Course over ground, degrees magnetic
3. Speed over ground, knots
4. Speed over ground, km/h
5. Mode indicator(see note)
6. Checksum

NOTE Positioning system Mode indicator:
A = Autonomous
D = Differential
S = Simulator
N = Data not valid
The positioning system Mode indicator field shall not be a null field.

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WCV - Waypoint closure velocity

```
$--WCV,x.x,N,c--c,a*hh<CR><LF>
       |   |  |   ||  |
       |   |  |   ||  +------- 4
       |   |  |   |+---------- 3
       |   |  +---+----------- 2
       +---+------------------ 1
```

1. Velocity component, knots
2. Waypoint identifier
3. Mode indicator(see note)
4. Checksum

NOTE Positioning system Mode indicator:
A = Autonomous
D = Differential
S = Simulator
N = Data not valid
The positioning system Mode indicator field shall not be a null field.

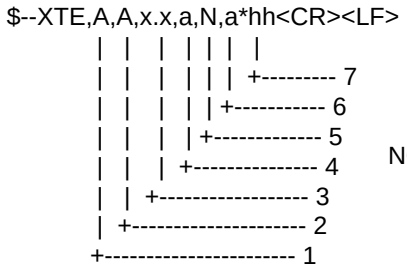
WPL - Waypoint location

```
$--WPL,llll.lll,a,yyyyy.yyy,a,c--c*hh<CR><LF>
       |    |        |      |   |    |
       |    |        |      |   |  +---------- 4
       |    |        |      |   +------------- 3
       |    |        +------+------------------ 2
       +----+-------------------------------- 1
```

1. Waypoint latitude, N/S
2. Waypoint longitude, E/W
3. Waypoint identifier
4. Checksum

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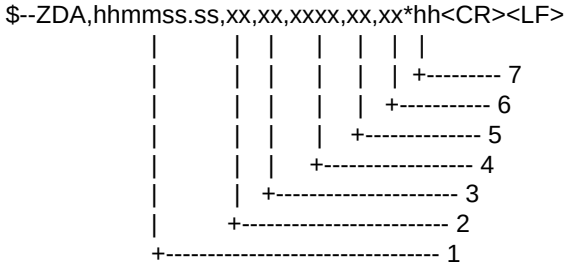
XTE - Cross-track error, measured



NOTE Positioning system Mode indicator:
A = Autonomous mode
D = differential mode
S = Simulator mode
N = Data not valid

1. Status: A=data valid
   V=LORAN-C blink or SNR warning
   V=general warning flag or other navigation systems
   when a reliable fix is not available
2. Status: A=data valid
   V=LORAN-C cycle lock warning flag
3. Magnitude of cross-track error
4. Direction to steer, L/R
5. Units, nautical miles
6. Mode indicator(see note)
7. Checksum

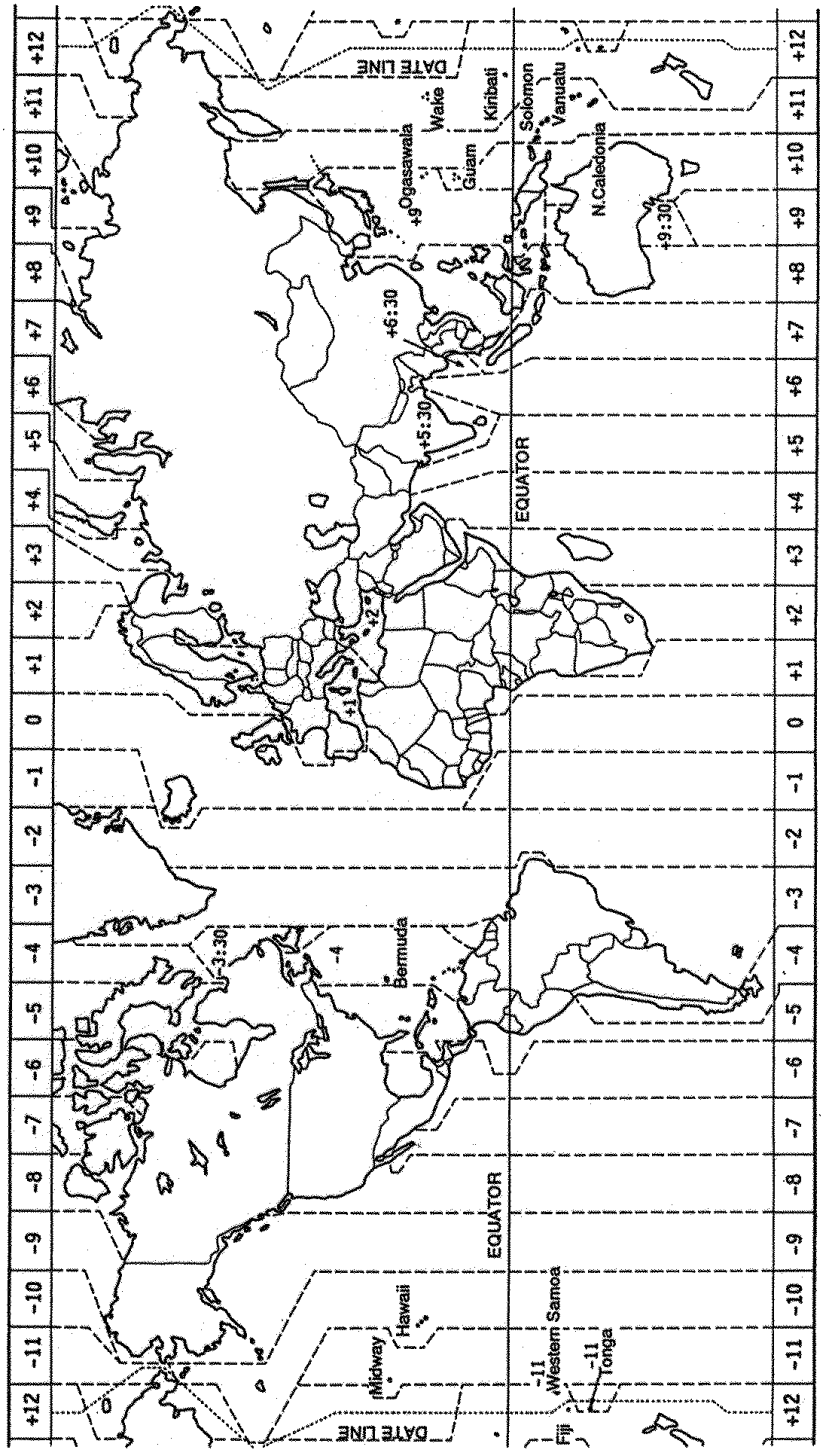
ZDA - Time and date



1. UTC
2. Day, 01 to 31(UTC)
3. Month, 01 to 12(UTC)
4. Year(UTC)
5. Local zone hours, 00h to +-13h
6. Local zone minutes, 00 to +59
   as local hours
7. Checksum

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TIME DIFFERENCES



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GEODETIC CHART LIST

001: WGS84
002: WGS72
003: TOKYO : Mean Value (Japan, Korea & Okinawa)
004: NORTH AMERICAN 1927 : Mean Value (CONUS)
005: EUROPEAN 1950 : Mean Value
006: AUSTRALIAN GEODETIC 1984 : Australia & Tasmania
007: ADINDAN-MN : Mean Value (Ethiopia & Sudan)
008: ADINDAN-E : Ethiopia
009: ADINDAN-MA : Mali
010: ADINDAN-SE : Senegal
011 ADINDAN-SU : Sudan
012: AFG : Somalia
013: AIN EL ABD 1970 : Bahrain Is.
014: ANNA 1 ASTRO 1965 : Cocos Is.
015: ARC 1950-MN : Mean Value
016: ARC 1950-B : Botswana
017: ARC 1950-L : Lesotho
018: ARC 1950-M : Malawi
019: ARC 1950-S : Swaziland
020: ARC 1950-ZR : Zaire
021: ARC 1950-ZM : Zambia
022: ARC 1950-ZB : Zimbabwe
023: ARC 1960-MN : Mean Value (Kenya & Tanzania)
024: ARC 1960-K : Kenya
025: ARC 1960-T : Tanzania
026: ASCENSION IS. 1958 : Ascension Is.
027: ASTRO BEACON "E" : Iwo Jima Is.
028: ASTRO B4 SOR. ATOLL : Tern Is.
029: ASTRO POS 71/4 : St. Helena Is.
030: ASTRONOMIC STATION 1952 : Marcus Is.
031: AUSTRALIAN GEODETIC 1966 : Australia & Tasmania
032: BELLEVUE (IGN) : Efate & Erromango Islands
033: BERMUDA 1957 : Bermuda Islands
034: BOGOTA OBSERVATORY : Columbia
035: GAUPO INCHAUSPE : Argentina
036: CANTON IS. 1966 : Phoenix Islands
037: CAPE : South Africa
038: CAPE CANAVERAL : Mean Value (Florida & Bahama Islands)
039: CARTHAGE : Tunisia
040: CHATHAM 1971 : Chatham Is. (New Zealand)
041: CHUA ASTRO : Paraguay
042: CORREGO ALEGRE : Brazil
043: DJAKARTA (BATAVIA) : Sumatra Is. (Indonesia)
044: DOS 1968 : Gizo Is. (New Georgia Is.)
045: EASTER IS. 1967 : Easter Is.
046: EUROPEAN 1950-WE : Western Europe
047: EUROPEAN 1950-CY : Cyprus
048: EUROPEAN 1950-EG : Egypt
049: EUROPEAN 1950-ESC : England, Scotland, Channel & Shetland Islands
050: EUROPEAN 1950-EIS : England, Ireland, Scotland, & Shetland slands
051: EUROPEAN 1950-GR : Greece
052 EUROPEAN 1950-IR : Iran
053: EUROPEAN 1950-SA : Italy, Sardinia
054: EUROPEAN 1950-SI : Italy, Sicily
055: EUROPEAN 1950-NF : Norway & Finland
056: EUROPEAN 1950-PS : Portugal & Spain
057: EUROPEAN 1979 : Mean Value
058: GANDAJIKA BASE : Republic of Maldives
059: GEODETIC DATUM 1949 : New Zealand
060: GUAM 1963 : Guam Is.
061: GUX 1 ASTRO : Guadalcanal Is.
062: HJORSEY 1955 : Iceland
063: HONG KONG 1363 : Hong Kong
064: INDIAN-TV : Thailand & Vietnam
065: INDIAN-BIN : Bangladesh, India & Nepal
066: IRELAND 1965 : Ireland
067: ISTS 073 ASTRO 1969 : Diego Garcia
068: JOHNSTON IS. 1961 : Johnston Is.
069: KANDAWALA : Sri Lanka
070: KERGUELEN IS. : Kerguelen Is.
071: KERTAU 1948 : West Malaysia & Singapore
072: LA REUNION : Mascarene Is.
073: L. C. 5 ASTRO : Cayman Brac Is.
074: LIBERIA 1964 : Liberia
075: LUZON : Philippines (excl. Mindanao Is.)
076: LUZON-M : Mindanao Is.
077: MAHE 1971 : Mahe Is.
078: MARCO ASTRO : Salvage Islands
079: MASSAWA : Eritrea (Ethiopia)
080: MERCHICH : Morocco
081: MIDWAY ASTRO 1961 : Midway Is.
082: MINNA : Nigeria
083: NAHRWAN-O : Masirah Is. (0man)
084: NAHRWAN-UAE : United Arab Emirates
085: NAHRWAN-SA : Saudi Arabia
086: NAMIBIA : Namibia
087: MAPARIMA, BWI : Trinidad & Tobago
088: NORTH AMERICAN 1927WU : Western United States
089: NORTH AMERICAN 1927EU : Eastern United States
090: NORTH AMERICAN 1927AK : Alaska
091: NORTH AMERICAN 1927BH : Bahamas (excl. San Salvador Is.)
092: NORTH AMERICAN 1927SS : Bahamas, San Salvador Is.
093: NORTH AMERICAN 1927CN : Canada (incl. Newfoundland Is.)
094: NORTH AMERICAN 1927AB : Alberta & British Columbia
095: NORTH AMERICAN 1927EC : East Canada
096: NORTH AMERICAN 1927MO : Manitoba & Ontario
097: NORTH AMERICAN 1927NE : Northwest Territories & Saskatchewan
098: NORTH AMERICAN 1927YK : Yukon
099: NORTH AMERICAN 1927CZ : Canal Zone
100: NORTH AMERICAN 1927CR : Caribbean
101: NORTH AMERICAN 1927CA : Central America
102: NORTH AMERICAN 1927CU : Cuba
103: NORTH AMERICAN 1927GR : Greenland
104: NORTH AMERICAN 1927MX : Mexico
105: NORTH AMERICAN 1983AK : Alaska
106: NORTH AMERICAN 1983CN : Canada
107: NORTH AMERICAN 1983CS : CONUS
108: NORTH AMERICAN 1983MX : Mexico, Central America
109: OBSERVATORIO 1966 : Corvo & Flores Islands (Azores)
110: OLD EGYPTIAN 1930 : Egypt
111: OLD HAWAIIAN-MN : Mean Value
112: OLD HAWAIIAN-HW : Hawaii
113: OLD HAWAIIAN-KA : Kauai
114: OLD HAWAIIAN-MA : Maui
115: OLD HAWAIIAN-OA : Oahu
116: OMAN : Oman
117: ORDNANCE SURVEY OF GREAT BRITAIN 1936-MN: Mean Value
118: ORDNANCE SURVEY OF GREAT BRITAIN 1936-E: England
119: ORDNANCE SURVEY OF GREAT BRITAIN 1936-IM: England, Isle of Man & Wales
120: ORDNANCE SURVEY OF GREAT BRITAIN 1936-SSI: Scotland, & Shetland Islands
121: ORDNANCE SURVEY OF GREAT BRITAIN 1936-WL: Wales
122: PICO DE LAS NIVIES : Canary Islands
123: PITCAIRN ASTRO 1967 : Pitcairn Is.
124: PROVISIONS SOUTH CHILEAN 1963: South Chile (near 53°S)
125: PROVISIONAL SOUTH AMERICAN 1956MN: Mean Value
126: PROVISIONAL SOUTH AMERICAN 1956BO: Bolivia
127: PROVISIONAL SOUTH AMERICAN 1956NC: Chile-Northern Chile (near 19°S)
128: PROVISIONAL SOUTH AMERICAN 1956SC: Chile-Southern Chile (near 43°S)
129: PROVISIONAL SOUTH AMERICAN 1956CO: Columbia
130: PROVISIONAL SOUTH AMERICAN 1956EC: Ecuador
131: PROVISIONAL SOUTH AMERICAN 1956GY: Guyana
132: PROVISIONAL SOUTH AMERICAN 1956PR: Peru
133: PROVISIONAL SOUTH AMERICAN 1956VN: Venezuela
134: PUERTO RICO : Puerto Rico & Virgin Islands
135: QATAR NATIONAL : Qatar
136: QORNOQ : South Greenland
137: ROME 1940 : Sardinia Islands
138: SANTA BRAZ : Sao Maguel, Santa Maria Islands (Azores)
139: SANTO (DOS) : Espirito Santo Is.
140: SAPPER HILL 1943 : East Falkland Is.
141: SOUTH AMERICAN 1969MN : Mean Value
142: SOUTH AMERICAN 1969AG : Argentina
143: SOUTH AMERICAN 1969BO : Bolivia
144: SOUTH AMERICAN 1969BR : Brazil
145: SOUTH AMERICAN 1969CH : Chile
146: SOUTH AMERICAN 1969CO : Columbia
147: SOUTH AMERICAN 1969EC : Ecuador
148: SOUTH AMERICAN 1969GY : Guyana
149: SOUTH AMERICAN 1969PA : Paraguay
150: SOUTH AMERICAN 1969PR : Peru
151: SOUTH AMERICAN 1969TT : Trinidad & Tobago
152: SOUTH AMERICAN 1969VZ : Venezuela
153: SOUTH ASIA : Singapore
154: SOUTHEAST BASE : Porto Santo & Madeira Islands
155: SOUTHWEST BASE : Faial, Graciosa, Pico, Sao Jorge, & Terceira Is.
156: TIMBALAI 1948 : Brunei & East Malaysia (Sarawak & Sadah)
157: TOKYO JP : Japan
158: TOKYO KP : Korea
159: TOKYO OK : Okinawa
160: TRISTAN ASTRO 1968 : Tristan da Cunha
161: VITI LEVU 1916 : Viti Levu Is. (Fiji Islands)
162: WAKE-ENIWETOK 1960 : Marshall Islands
163: ZANDERIJ : Surinam
164: BUKIT RIMPAH : Bangka & Belitung Islands (Indonesia)
165: CAMP AREA ASTRO : Camp Mcmurdo Area, Antarctica
166: G. SEGARA : Kalimantan Is. (Indonesia)
167: HERAT NORTH : Afghanistan
168: HU-TZU-SHAN : Taiwan
169: TANANARIVE OBSERVATORY 1925 : Madagascar
170: YACARE : Uruguay
171: RT-90 : Sweden
172: Pulkovo 1942 : Russia
173: Finish KKJ : Finland

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LORAN C CHAINS

Chain	GRI	S1	S2	S3	S4	S5
Central Pacific	4990	11	29	–	–	–
Canadian East Coast	5930	11	25	38	–	–
Commando Lion (Korea)	5970	11	31	42	–	–
Canadian West Coast	5990	11	27	41	–	–
South Saudi Arabia	7170	11	26	39	52	–
Labrador Sea	7930	11	26	–	–	–
Eastern Russia	7950	11	30	46	61	–
Gulf of Alaska	7960	11	26	44	–	–
Norwegian Sea	7970	11	26	46	60	–
Southeast USA	7980	11	23	43	59	–
Mediterranean Sea	7990	11	29	47	–	–
Western Russia	8000	10	25	50	65	–
North Central USA	8290	11	27	42	–	–
North Saudi Arabia	8990	11	25	40	56	69
Great Lakes	8970	11	28	44	59	–
South Central USA	9610	11	25	40	52	65
West Coast USA	9940	11	27	40	–	–
Northeast USA	9960	11	25	39	54	–
Northwest Pacific (old)	9970	11	30	55	81	–
Icelandic	9980	11	30	–	–	–
North Pacific	9990	11	29	43	–	–
Suez	4991	10	24			
England, France	8940	12	30			
Northwest Pacific	8930	11	30	50	70	
Newfoundland East Coast	7270	11	25			
Lessay	6731	10	39			
BØ	7001	11	27			
Sylt	7499	11	26			
Ejde	9007	10	23	38		
Saudia Arabia North	8830	11	25	39	56	
Saudia Arabia South	7030	11	25	37	55	

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DECCA CHAINS

Chain No.	Chain	Chain code	Location	Chain no.	Chain	Chain code	Location
01	South Baltic	0A	Europe	34	Kanto	8C	Japan
02	Vestlandet	0E	"	35	Shikoku	4C	"
03	Southwest British	1B	"	36	Hokuriku	2C	"
04	Northumbrian	2A	"	37	Kita Kyushu	7C	"
05	Holland	2E	"	38	Namaqualand	4A	Southern Africa
06	North British	3B	"	39	Cape	6A	"
07	Lofoten	3E	"	40	Eastern Province	8A	"
08		3F	"	41	South West Africa	9C	"
09	North Baltic	4B	"	42	Natal	10C	"
10	North West	4C	"	43	Dampier	8E	Australia
11	Trondelag	4E	"	44	Port Headland	4A	"
12	English	5B	"	45	Anticosti	9C	Northern America
13	North Bothnian	5F	"	46	East Newfoundland	2C	"
14	Southern Spanish	6A	"	47	Cabot Strait	6B	"
15	North Scottish	6C	"	48	Nova Scotia	7C	"
16	Gulf of Finland	6E	"				
17	Danish	7B	"				
18	Irish	7D	"				
19	Finnmark	7E	"				
20	French	8B	"				
21	South Bothnian	8C	"				
22	Hebridean	8E	"				
23	Frisian Islands	9B	"				
24	Helgeland	9E	"				
25	Skagerrak	10B	"				
26	North Persian Gulf	5C	Persian Gulf & India				
27	South Persian Gulf	1C	"				
28	Bombay	7B	"				
29	Calcutta	8B	"				
30	Bangladesh	6C	"				
31	Saliyah	2F	"				
32	Hokkaido	9C	Japan				
33	Tohoku	6C	"				

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GLOSSARY

Almanac

Each GPS satellite broadcasts its own orbital data as well as general orbital data of all other GPS satellites. This general orbital data is called the Almanac. The GPS receiver receives the Almanac and decodes it to calculate the quantity and elevation angle of satellites in view, to know when it can receive the GPS signal. If there is no Almanac in the receiver it cannot fix its position. The receiver is shipped with no Almanac, thus when it is turned on for the first time it starts receiving the Almanac. Each time the unit is turned on the previous Almanac is erased and the latest received.

Beacon receiver

The DGPS (Differential GPS) station transmits a beacon signal which contains information about GPS error. The device which receives the beacon signal is called a beacon receiver.

Cold start

When the GPS receiver is turned on for the very first time, it starts receiving the Almanac. This condition is called cold start. In this condition it takes about two minutes to find position. Once the Almanac is stored in the GPS navigator, it takes only about 20 seconds to find position. (The normal start-up condition is called warm start.)

Destination

A destination can be either a single destination waypoint or a series of waypoints leading to the ultimate destination. When you set a destination, the GPS receiver provides range and bearing data to the destination, to help you steer to the destination along the shortest past possible.

Differential GPS (DGPS)

The differential GPS system, consisting of DGPS land stations and DPGS beacon receiver-equipped marine vessels, further refines the accuracy of the GPS measured position.
A DGPS land station knows its exact position. If there is a difference between GPS position and DGPS land station's position this is called GPS error. The DPGS station transmits GPS error data to a beacon receiver which relays the data to the GPS receiver. The GPS receiver uses this data to refine the accuracy of the GPS position (within about 5 meters under ideal conditions).
DGPS stations are strategically located throughout America (including Hawaii and Alaska), Europe, Canada, Bermuda and Brazil.

Estimated time of arrival (ETA)

The time at which you arrive at the ultimate destination.

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Geodetic datum

A nautical chart is usually made by either trigonometrically survey or astronomical survey and according to the geodetic chart standards of the country where it is used. The GPS standard chart system is WGS-84. Thus if you are using a chart different from WGS-84, there will be error between GPS position and nautical chart position. To get correct position, the GPS receiver must know what chart system you are using, to apply an offset to GPS position.

GPS measured position

GPS measured latitude and longitude position.

Intermediate waypoint

A waypoint in a route.

Magnetic bearing

Bearing relative to magnetic north, with the compass bearing corrected for deviation.

Magnetic variation offset

The location of the magnetic north pole is different from the geographical north pole. This causes a difference between the true and magnetic north direction. This difference is called magnetic variation, and varies with respect to the observation point on the earth. This variation may be entered automatically or manually.

Navigation calculation

The GPS receiver calculates the range, bearing and cross track error to next waypoint when you select a destination. The calculation of that data is called navigation calculation. The calculation itself is done using one of two methods (selectable): Great circle (straight line between two points) or Rhumb line (straight line between two points on nautical chart).

NMEA 0183

The National Marine Electronics Association's signal format which enables connection of electronic equipment of different marine electronics manufacturers.

Plotting interval

The plotting interval determines both how the track will be reconstructed on the display and track storage time. The shorter the interval the more accurate the reconstruction of track line, however total storage time is reduced. The plotting interval can be selected to time or distance. Plotting by distance offers the advantage that the track is not stored when the vessel is anchored.

Route

A series of waypoints leading to the ultimate destination.

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Route navigation

Following a stored route.

S/A

GPS was developed by the US Department of Defense mainly for use by its marine vessels and aircraft. For civil users the accuracy of the system is purposely downgraded for national security reasons. This intentional accuracy reduction is called S/A. Because GPS position error may be greater than 100 meters any GPS position should be double checked against other sources to confirm position.

Skip

This means to bypass a waypoint in a route.

Storage capacity

Storage capacity defines how many points of track and marks a memory can hold. The GP-90's storage capacity is 2,000 points.

Time-to-go (TTG)

The amount of time necessary to get to a destination, maintaining current speed and course.

Time differences

Time differences (or TDs) are the position information generated by the Loran C and Decca position-fixing systems. TDs are the time in microseconds between the transmission of pulsed signals in the Loran C and Decca systems.

Total distance

Total distance is the number of miles form starting point to end point in a route.

Trip distance

The distance run from starting position.

Trip elapsed time

The amount of time passed since departing a starting point.

True bearing

Bearing relative to North; compass bearing corrected for magnetic deviation. The GPS receiver can display true or magnetic bearing.

Velocity to destination

The amount of speed in the direction (course) of the desired destination.

Waypoint

A waypoint is a particular location on a voyage whether it be a starting, intermediate or destination waypoint.

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PARTS LIST

This equipment contains complex modules in which fault diagnosis and repair down to component level are not practical (IMO A.694(17)/8.3.1). Only some discrete components are used. FURUNO Electric Co., Ltd. believes identifying these components is of no value for shipboard maintenance; therefore, they are not listed in the manual. Major modules can be located on the parts location photos on the next page.

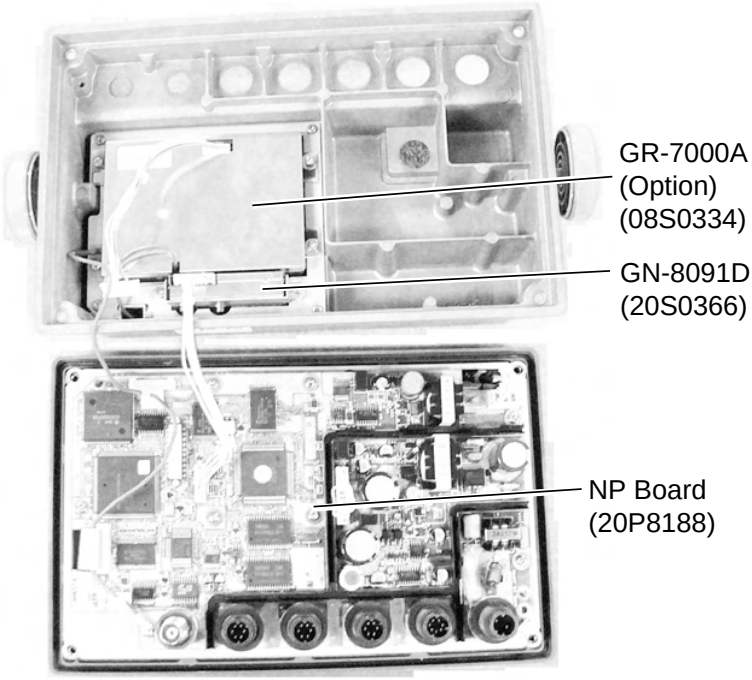
F U R U N O	Model	GP-90	
	Unit	DISPLAY UNIT GP-90	
ELECTRICAL PARTS LIST			
May-03	Blk.No.		

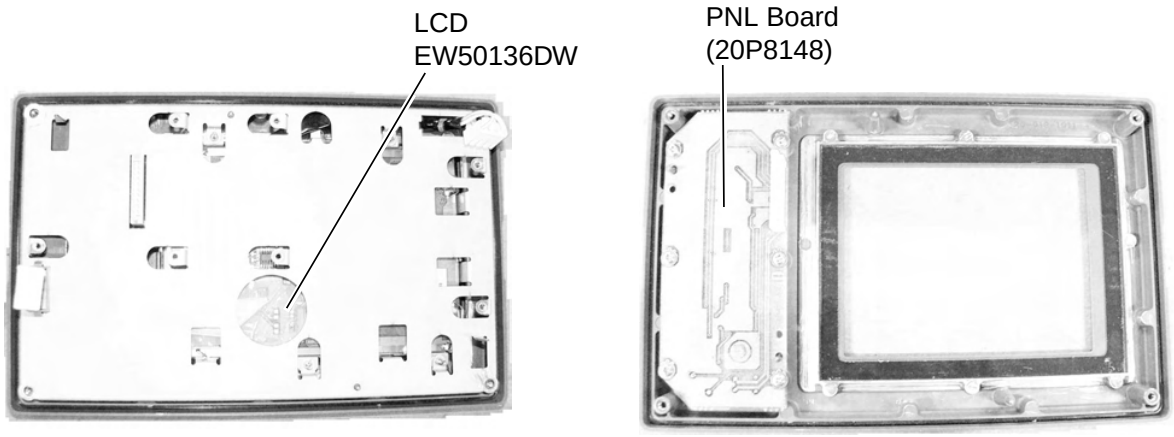
SYMBOL	TYPE
DISPLAY UNIT GP-90	
	PRINTED CIRCUIT BOARD
	20P8148, PNL
	20P8188, NP
	ASSEMBLY
	20S0366, GN-8091
	08S0334, GR-7000A (option)
	LCD
	14S4623, EW50136FDW

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Parts Location

Display unit





Display unit, cover opened, GR-7000A installed

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FURUNO ELECTRIC CO., LTD.
9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan
Tel: +81 798-65-2111 Fax: +81 798-65-4200

Pub NO. DOC-841

Declaration of conformity 0560

We FURUNO ELECTRIC CO., LTD.

(Manufacturer)

9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan

(Address)

hereby declare under our sole responsibility that the product

Marine GPS navigator with WAAS function Types GP-90 and GP-90-DUAL consisting of Display unit GP-90 (for GP-90) and GP-90-DUAL (for GP-90-DUAL: Different software from GP-90 is incorporated), Antenna unit GPA-017S, GPA-018S or GPA-019S, DGPS Beacon receiver board GR-7000A, Interface unit IF-2500 (for GP-90-DUAL) and GPS/Beacon multi-distributor MD-GB2 (for GP-90-DUAL)

(Model names, type numbers)

to which this declaration relates conforms to the following standard(s) or normative document(s)

Standards	Test standards
IMO Resolution A.819(19)	EN 61108-1: 1996-06 (IEC 61108-1: 1996-06)
IMO Resolution MSC.112(73)	IEC 61108-1 Ed.02 80/371/FDIS: 2003-05
IMO Resolution A.694(17)	EN 60945: 1997-01 (IEC 60945 Ed.03: 1996-11)
	EN 60945: 2002-11 (IEC 60945 Ed.04: 2002-08)
	IEC 61162-1: 2000-07

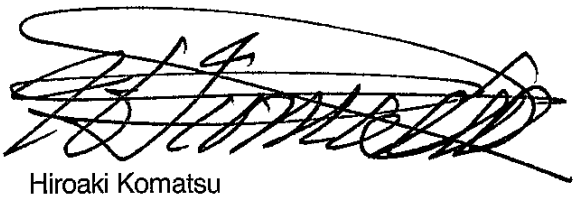
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For assessment, see

- EC type-examination (Module B) certificate N°: 03212001/AA/03 of 2 August 2005 issued by Telefication, The Netherlands
- Product Quality System (Module D) certificate No. P 112 of 20 May 2005 issued by Telefication, The Netherlands
- Test report 99383230 of 2 July 2003 issued by Telefication, The Netherlands
- Test Report FLI 12-03-014 of 12 June 2003, FLI 12-03-040 of 29 August 2003 and FLI 12-03-065 of 19 December 2003 prepared by Furuno Labotech International Co., Ltd.
- Experiment test report K20-17-413 of June 24 and 24, 2004 prepared by Furuno Electric Co., Ltd.

This declaration is issued according to the provisions of European Council Directive 96/98/EC on marine equipment modified by Commission Directive 2002/75/EC.

On behalf of Furuno Electric Co., Ltd.



Hiroaki Komatsu
Manager,
International Rules and Regulations

Nishinomiya City, Japan
September 1, 2005

(Place and date of issue)

(name and signature or equivalent marking of authorized person)

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