

# FURUNO

# OPERATOR'S MANUAL

**GPS PLOTTER**

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**MODEL GP-1600**

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**FURUNO ELECTRIC CO., LTD.**  
NISHINOMIYA, JAPAN

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-Your Local Agent/Dealer

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# SAFETY INSTRUCTIONS

"**DANGER**", "**WARNING**" and "**CAUTION**" notices appear throughout this manual. It is the responsibility of the operator of the equipment to read, understand and follow these notices. If you have any questions regarding these safety instructions, please contact a FURUNO agent or dealer.



## DANGER

This notice indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.



## WARNING

This notice indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



## CAUTION

This notice indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury, or property damage.




# WARNING



**Hazardous voltage. Do not open the equipment**

This equipment uses high voltage electricity which can shock. Only qualified personnel should work inside the equipment.



# CAUTION

**Use the proper fuse.**


Use of a wrong fuse can result in fire or permanent equipment damage.

**Power the equipment with the proper power supply.**

Powering the equipment with a wrong power supply can cause permanent equipment damage.

**GPS position may suddenly become very inaccurate.**

Always confirm position against other aids to navigation.



# WARNING

**Do not disassemble or modify the equipment.**

Fire, electrical shock or serious injury can result.

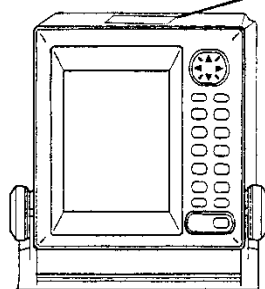
**Turn off the power immediately if water leaks into the equipment, or the equipment is emitting smoke or fire.**


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

**Keep heater away from equipment.**


Heat can alter equipment shape and melt the power cord, which can cause fire or electrical shock.

**WARNING Label attached**







## WARNING



To avoid electrical shock, do not remove cover. No user-serviceable parts inside.

Name : Warning Label (1)  
 Type : 86-003-1011-0  
 Code No. : 100-236-230

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# Menu Tree

## Display selection menu

<b>DISP SEL</b>	Select Display (Plotter, Data, Graphic, and Highway).....	Page 9
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## Main menu

<b>MENU ESC</b>	1. DISPLAY SETUP	<ul style="list-style-type: none"> <li>LAND PATTERN</li> <li>PLACE NAME</li> <li>GRID</li> <li>COURSE BAR</li> <li>TIME MARK</li> <li>WPT MARK SIZE</li> <li>CURSOR SIZE</li> <li>SECTOR INFO</li> <li>LIGHTS FLASH</li> </ul>	48
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	3. ERASE TRACK/MARK	<ul style="list-style-type: none"> <li>MARK ERASE</li> <li>TRACK ERASE</li> </ul>	<ul style="list-style-type: none"> <li>40</li> <li>16</li> </ul>
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	0. SYSTEM MENU		
	1. SELF TEST	<ul style="list-style-type: none"> <li>1. GPS MONITOR DISPLAY</li> <li>2. MEMORY, I/O PORT TEST</li> <li>3. PANEL TEST</li> <li>4. DISPLAY TEST</li> </ul>	<ul style="list-style-type: none"> <li>62</li> <li>60</li> <li>61</li> <li>61</li> </ul>
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# FOREWORD

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## A Word to GP-1600 Owners

Congratulations on your choice of the FURUNO GP-1600 GPS Plotter. We are confident you will see why the FURUNO name has become synonymous with quality and reliability.

For over 40 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 unit is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless properly installed and maintained. Please carefully read and follow the operation and maintenance procedures set forth in this manual and the installation instructions contained in the installation manual.

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-1600 is a totally integrated GPS Receiver and Video Plotter. It consists of an attractively styled antenna and a compact display unit.

Navigation information is displayed on a bright 6-inch LCD. On-screen information include present position, range and bearing to cursor position, range, bearing and TTG to waypoint, etc.

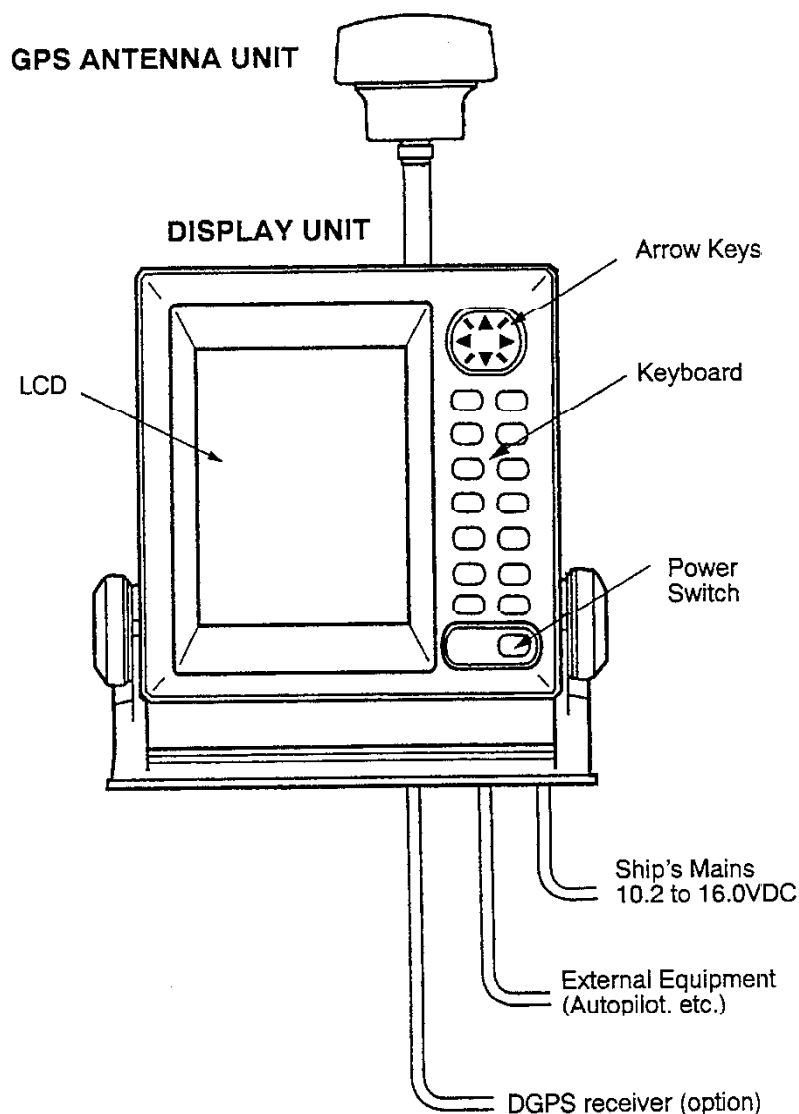
The main features of the GP-1600 are

- Receives and tracks eight GPS channels simultaneously to ensure highly accurate position fixing and high speed tractability.
- Bright 6-inch LCD with temperature compensated tone and brilliance control.
- Automatic coastline chart loading.
- Position display in latitude and longitude or Loran C or Decca LOPs
- Outputs steering information to FURUNO FAP-50/55/300/330 Autopilots.
- Provision for connection of autopilot, providing automatic steering.
- Improved position fixing accuracy by connection of DGPS beacon receiver (option).
- FURUNO and NAVIONICS chart cards can be used.
- Memory stores 2,000 points of track, 100 points of marks, 100 points of event marks, 200 waypoints and 20 routes.

# SYSTEM CONFIGURATION

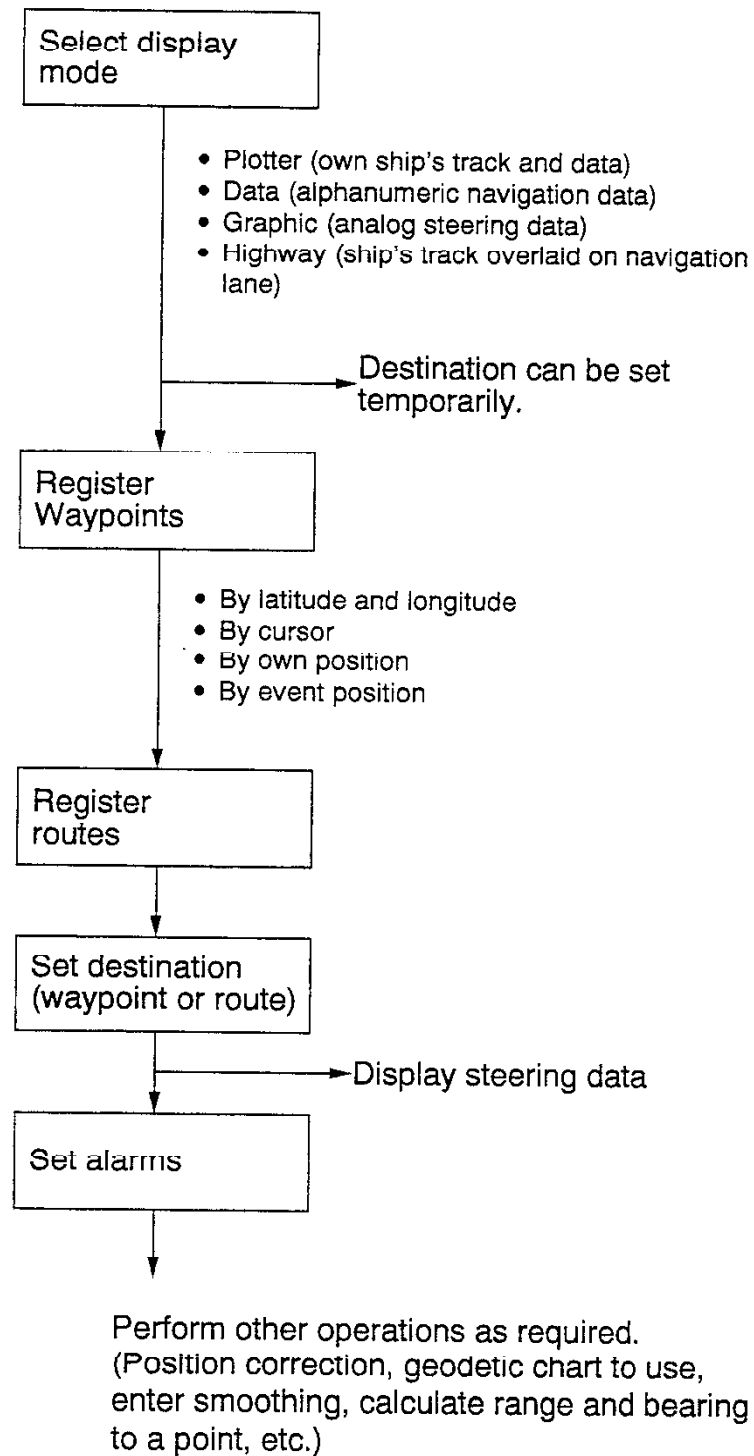
## Overview

The GP-1600 GPS Plotter mainly consists of a GPS antenna and a display unit, as shown in the figure below. All operations are carried out through the front panel keys. The memory card drive loads digitized charts (option). An autopilot can be connected for automatic steering to destination.



*System configuration*

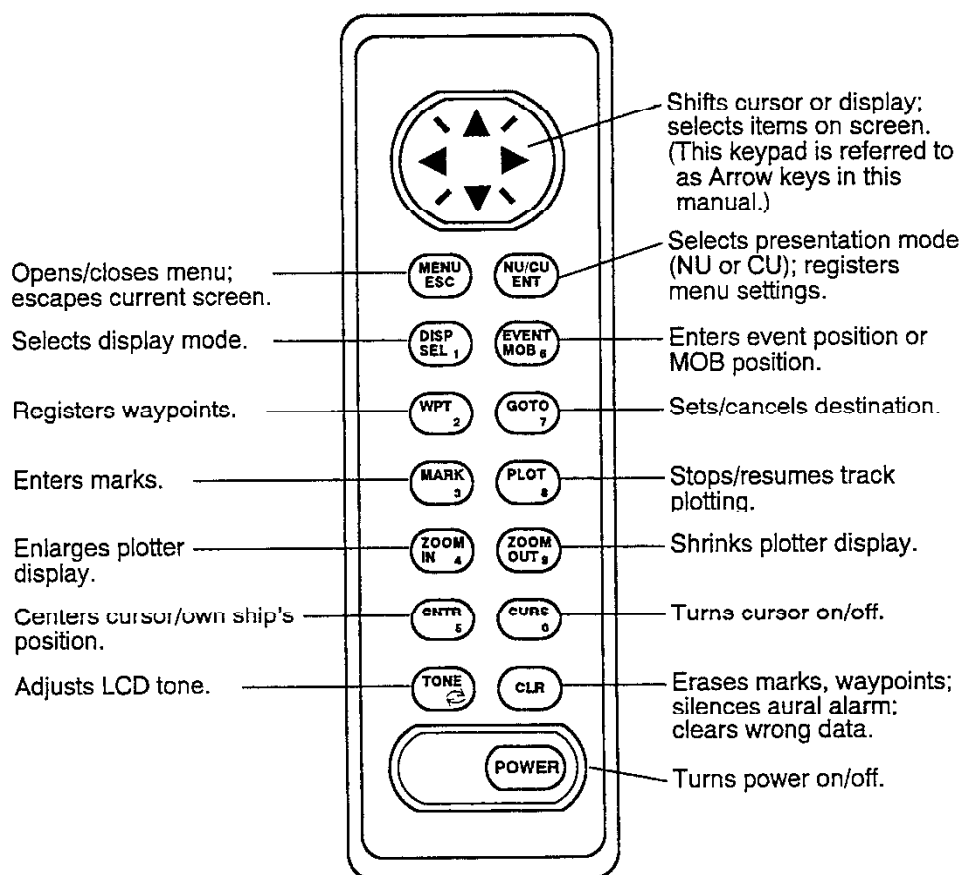
# Operation Flow Chart



# 1. CONTROLS

## Description of Controls

All operations of the GP-1600 are carried out with the controls on the front panel of the display unit. All controls respond immediately to your command and the unit emits a beep to signify it has accepted your command. (Invalid key input emits several beeps.)



*Figure 1 Front panel controls*

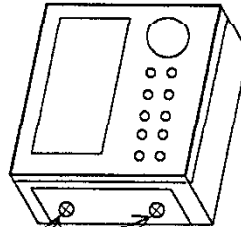
# 2. BASIC OPERATING PROCEDURE

## Overview

This section provides the information necessary for every-day start-up of the equipment.

## Inserting Coastline Data Card

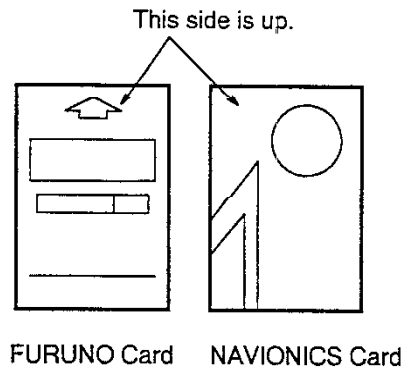
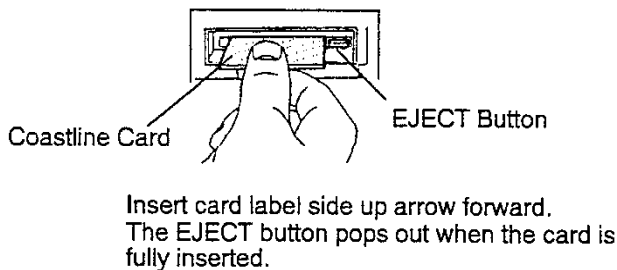
- 1) Open the memory card slot cover by unfastening two screws at the bottom of display unit.



Thumb Screws

*Figure 2(a) How to remove memory card slot cover*

- 2) Insert the card label side up arrow forward and close the cover.



*Figure 2(b) How to insert coastline data card*

■ **Note:** Always keep the lid completely closed. Foreign material or water may damage the drive and void the warranty.

■ **Note:** When replacing chart card, turn off the power.

## Turning On the Power

Press the **POWER** key. The unit proceeds in the sequence shown in Figure 3. About 20 seconds after the start-up procedure is completed, the ACQ indication changes to 2D (or 3D) at the bottom right-hand corner of the display. ACQ means the receiver is acquiring the GPS signal, and 2D (or 3D) means the ship's position is calculated correctly.

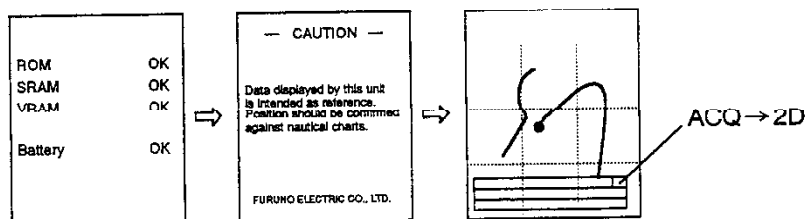


Figure 3 Start-up sequence

- **Note:** It takes 2 to 3 minutes to fix your position when the unit is first installed. In this case, GPS receiver status is indicated as CST, ACQ and 2D (or 3D) in sequence. 2D (or 3D) means position is calculated correctly.
- **Note:** The "DEMO" icon appears when the display is in the demonstration mode. To return to normal operation, turn off the power and then turn it on while pressing and holding down the ENT key.

## Adjusting Brilliance and Tone of the LCD

- 1) Press the **TONE** key.

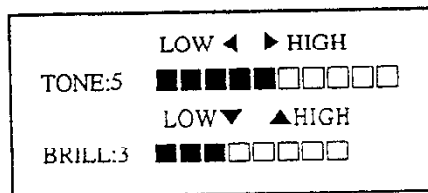


Figure 4 Display for adjustment of tone and brilliance

- 2) Operate the **Arrow** keys to adjust brilliance and tone.

## Turning Off the Power

- 1) Press the **POWER** key.

- **Note:** Wait for a couple of seconds to turn on the unit again.

# 3. THE CURSOR

## Function

The cursor functions to

- find latitude and longitude of a location
- find range and bearing from your boat to cursor position, and
- enter and erase marks and waypoints.

## Operation

The **CURS** key turns the cursor on/off alternately. You can shift the cursor by operating the **Arrow** keys. The cursor moves in the direction of the Arrow key pressed. When the cursor reaches an edge of the screen, the display is scrolled.

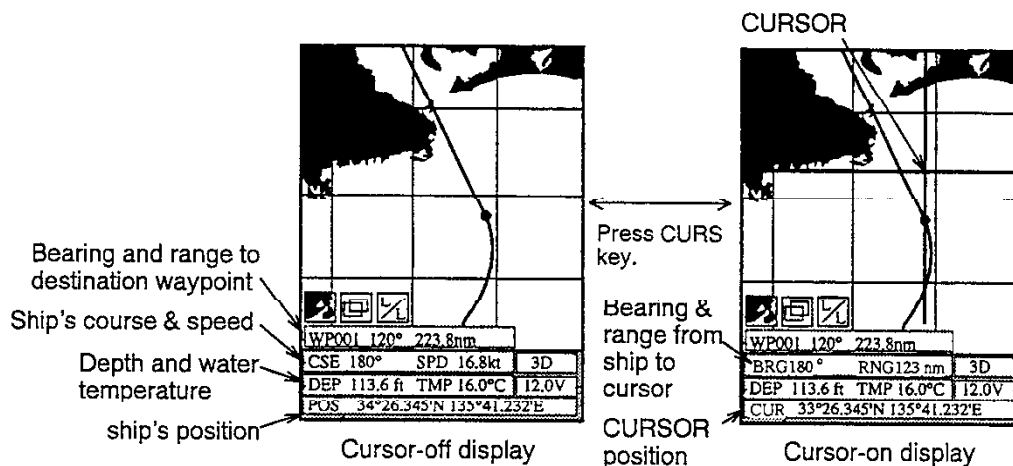


Figure 5 Cursor-on/cursor-off displays

■ **Note:** The size of the cursor can be set for large or small on the DISPLAY SETUP menu. For further details, see "16. Customizing Your Unit".



# 4. DISPLAYING CHARTS




## Overview

When a proper coastline data card is inserted into the memory card drive and a suitable chart scale is selected, a land-filled coastline of your area appears. If there is no land near your ship, or a proper display scale is not selected, coastline does not appear.

## Adjusting Display Scale

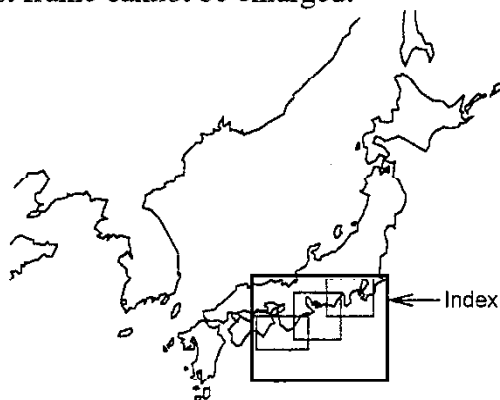
Press the **ZOOM IN** or **ZOOM OUT** keys to adjust display scale. One of three icons appears at the left side of the display to help you select suitable chart scale.

*Table 1 Chart scale icons and their meanings*

Icon	Meaning
	Proper card is not inserted or chart scale is too small (chart is overenlarged). Press the <b>ZOOM IN</b> key to adjust chart scale.
	Chart scale is too large. Press the <b>ZOOM OUT</b> key to adjust chart scale. (FURUNO chart only)
	Suitable chart scale is selected.

## Display Range (FURUNO chart only)

When the **ZOOM IN** or **ZOOM OUT** keys is pressed, you will see several frames. These frames are called indices and they show you what parts of the chart can be enlarged in the current chart scale. The areas circumscribed with smaller frames can be enlarged. The area enclosed by the largest frame cannot be enlarged.














*Figure 6 Sample chart (Japan and South Korea)*

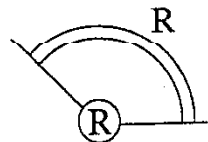
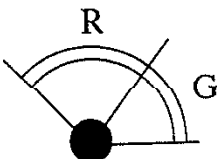
## Symbols on Chart

The table below shows chart symbols used on FURUNO digital charts and their meanings.

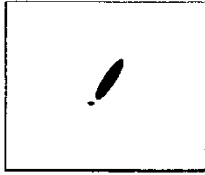
*Table 2 Symbols on FURUNO digital charts*

Symbol	Description	Symbol	Description
	Summit		Position of Sounding
	Wreck		Obstruction
	Lighthouse		Fishing Reef
	Lighted Buoy		Platform
	Buoy		Anchorage
	Radio Station		

*Table 3 Newly designed FURUNO digital chart symbols  
(Additional symbols)*

Type	Color	Symbol																
Lighthouse	Red	Ⓡ																
	Green	Ⓢ																
	White	Ⓦ																
	Othors	●																
Lighted-buoy	Red	⚓ <sub>R</sub>																
	Green	⚓ <sub>G</sub>																
	White	⚓ <sub>W</sub>																
	Others	⚓																
Foghorn		★																
Arc presentation (Lighthouse)		<div><p>The arc is viewable range and alphabet is lighting color.</p><table><tr><td>Red</td><td>R</td><td>Light blue</td><td>C</td></tr><tr><td>Green</td><td>G</td><td>Yellow</td><td>Y</td></tr><tr><td>White</td><td>W</td><td>Blue</td><td>B</td></tr><tr><td>Orange</td><td>O</td><td></td><td></td></tr></table></div> <div><p>For multiple colors</p></div>	Red	R	Light blue	C	Green	G	Yellow	Y	White	W	Blue	B	Orange	O		
	Red	R	Light blue	C														
Green	G	Yellow	Y															
White	W	Blue	B															
Orange	O																	

When using NAVIONICS chart cards, the lighthouse or buoy marks appear as follows;



*Figure 7 Lighthouse or buoy mark appearance shown on NAVIONICS CHART*

# Difference between FURUNO chart and NAVIONICS chart

*Table 4 FURUNO chart vs. NAVIONICS chart*

Item	FURUNO	NAVIONICS
Dot scrolling capability	YES	YES
Course-up display	YES	NO
Lighthouse data presentation	YES *3	YES
Zoom at cursor position	YES	*1
Range at Equator	1, 1.5, 2, 3, 4, 6, 8, 12...8192 nm	0.125, 0.25, 0.5, 1, 2, 4, 8...1024 nm
Chart offset data entry	YES	NO
Centering	YES	*2

\*1: The cursor may not be centered.

\*2: The own ship position may not be centered perfectly.


\*3: Using newly designed chart cards containing light-house data. Chart cards for North America area are completed, and others are under production.

## Notice on Chart Display

A chart will not be displayed in the following conditions:

- When the chart scale is too large or too small.
- When scrolling the chart outside the indices.

When this happens, the message "No Chart" appears for a couple of seconds.

The icon  also appears, at the bottom left corner on the screen.

# 5. SHIFTING THE DISPLAY

---

## Centering Ship's Position

- 1) Press the **CURS** key to turn off the cursor.
- 2) Press the **CNTR** key.

■ **Note:** The NAVIONICS chart may not center ship's position perfectly.

## Centering a Location

- 1) Press the **CURS** key to turn on the cursor.
- 2) Operate the **Arrow** keys to set the cursor on the location you want to center.
- 3) Press the **CNTR** key.

■ **Note:** The NAVIONICS chart may not center cursor perfectly.

## Scrolling the Display

- 1) Press the **CURS** key to turn off the cursor.
- 2) Operate the **Arrow** keys to scroll the display.

■ **Note:** The NAVIONICS chart may disappear for some time when scrolling the display.

# 6. SELECTING DISPLAYS

## How to Select a Display

There are four types of displays which you can select.

- 1) Press **DISP SEL** key. The following screen appears.

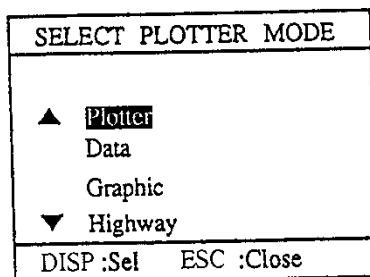


Figure 8 Screen for selection of display








■ **Note:** If a key is not pressed within 10 seconds, the menu screen disappears.

- 2) Press the **DISP SEL** key continuously to select display desired.
- 3) Press the **ESC** key.

## Plotter Display

This display shows chart (option) and ship's track. Two digital data display modes are available at the bottom of the graphic display: cursor-off display and cursor-on display. See page 4.

■ **Note:** Chart icons appear to alert the operator on the plotter display and highway display.

-  : Chart scale icons are explained on page 5.
-  : Chart position offset applied (Page 45)
-  : L/L position offset applied (Page 55)
-  : Track recording turned off (Page 14)
-  : Alarm is violated. (Page 44)
-  : Low voltage of internal battery
-  : Demonstration display (Page 67).

## Data Display

The data display shows numerical navigation data as follows.

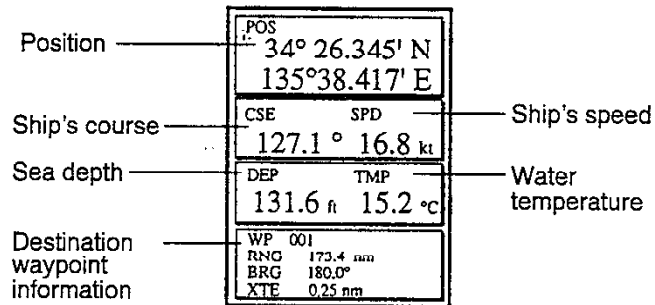


Figure 9 Data display

To enlarge characters;

- 1) Press the **CURS** key to turn on the cursor.
- 2) Operate the Arrow keys to select data to enlarge in the windows.
- 3) Press the **ZOOM IN** key.

To switch character size to normal, press the **ZOOM OUT** key.

## Graphic Display

This display shows analog course data.

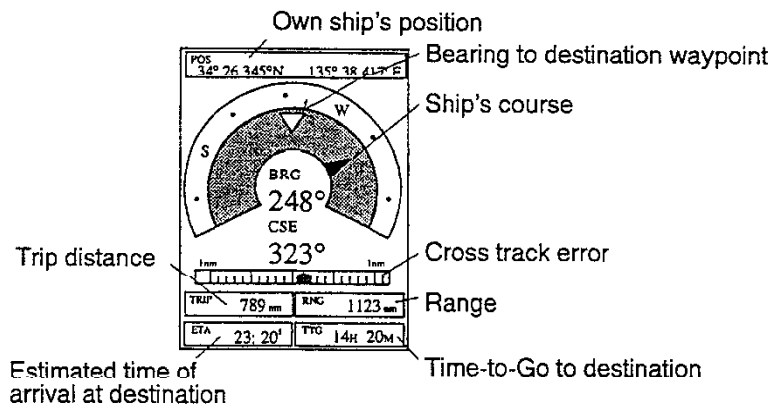


Figure 10 Graphic display



## Highway Display

The highway shows graphic presentation of ship's cross track error (XTE). The scale can be changed by the **ZOOM IN** or **ZOOM OUT** key. The width of the "highway" is changed by the setting of the XTE alarm (page 43).

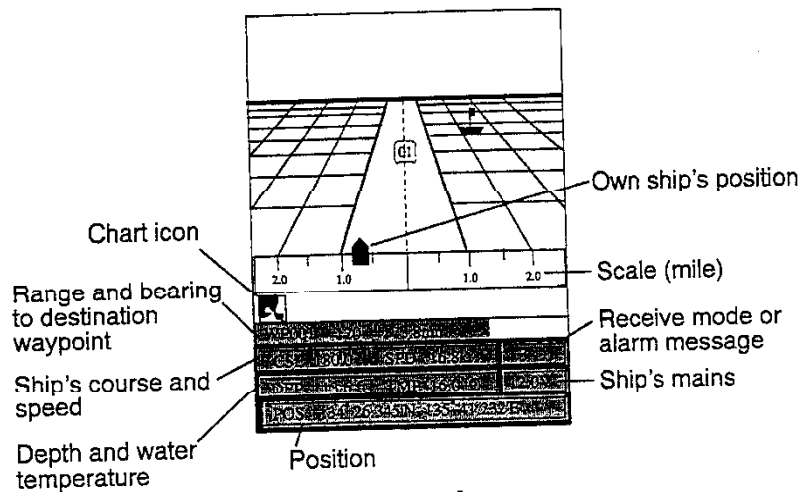


Figure 11 Highway display

## Presentation Mode of Plotter Display

### How to change presentation mode

Press the **NU/CU** key more than one second for the plotter display. The presentation mode changes from north-up to course-up or vice versa.

### North-up presentation

North is at the top of the display. This mode is useful for long-range navigation.

### Course-up presentation

Ship's course is at the top of the display. This mode is useful for finding course error and relation between own ship and waypoint.

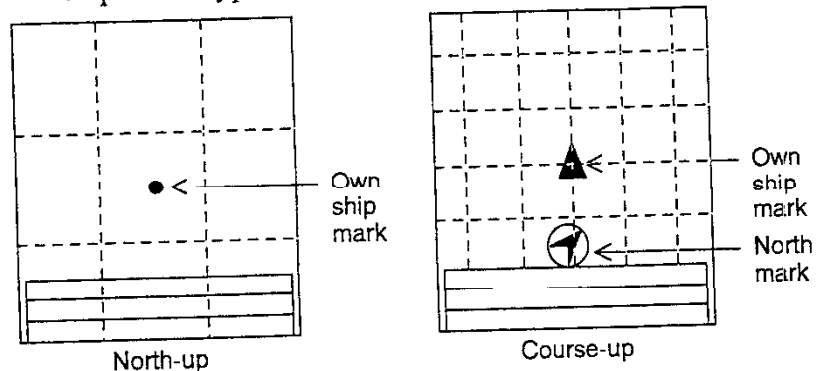


Figure 12 North-up and course-up presentations

■ **Note:** NAVIONICS chart does not provide course-up presentation display.

# 7. MENU OPERATION

## Overview

Many functions of this unit are carried out through the menu. The main menu consists of eight menus. You may display it by pressing the **MENU** key.

MAIN MENU	
1.	DISPLAY SETUP
2.	TRACK/MARK SETUP
3.	ERASE TRACK/MARK
4.	ROUTE/ROUTE LIST
5.	ALARM SETUP
6.	
7.	MEMORY SAVE/LOAD
8.	CLEAR MEMORY
0. SYSTEM MENU	
▲▼:Cursor    ESC:Esc	

*Figure 13 MAIN menu*

## Selecting Menus

You may select a menu two ways:

- by direct keyboard input of menu number, or
- operating the **Arrow** keys to display menu name in highlight and then pressing the **ENT** key.

For example, if you want to select the TRACK/MARK SETUP menu, you could press the **2** key, or operate the **Arrow** keys to highlight "TRACK/MARK SETUP" and then press the **ENT** key.

## Selecting Menu Items, Registering Options

Operate the **Arrow** keys to select both item and option.  
Press the **ENT** key to register selection and escape.  
Currently selected options are highlighted.













TRACK/MARK SETUP	
EVENT SHAPE	<input checked="" type="checkbox"/> ▴ ▽ ○ ☆
	<input checked="" type="checkbox"/>     
MARK SHAPE	<input checked="" type="checkbox"/> ○ <input type="checkbox"/> □ <input type="checkbox"/> ◇ <input type="checkbox"/> × <input type="checkbox"/>  <input type="checkbox"/> 
	<input checked="" type="checkbox"/> · <input type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/> 
LINE TYPE	<input checked="" type="checkbox"/> — <input type="checkbox"/> — <input type="checkbox"/> - - - -
MARK	<input checked="" type="checkbox"/> BRT <input type="checkbox"/> DIM
MARK SIZE	<input checked="" type="checkbox"/> L <input type="checkbox"/> S
PLOT	<input checked="" type="checkbox"/> ON <input type="checkbox"/> OFF
PLOT INTVL	<input checked="" type="checkbox"/> TIME <input type="checkbox"/> DIST <input type="checkbox"/> AUTO
	10 00.10nm
▲▼◀▶ :Cursor ESC:Esc	

Figure 14 TRACK/MARK SETUP menu

## 8. TRACK OPERATIONS

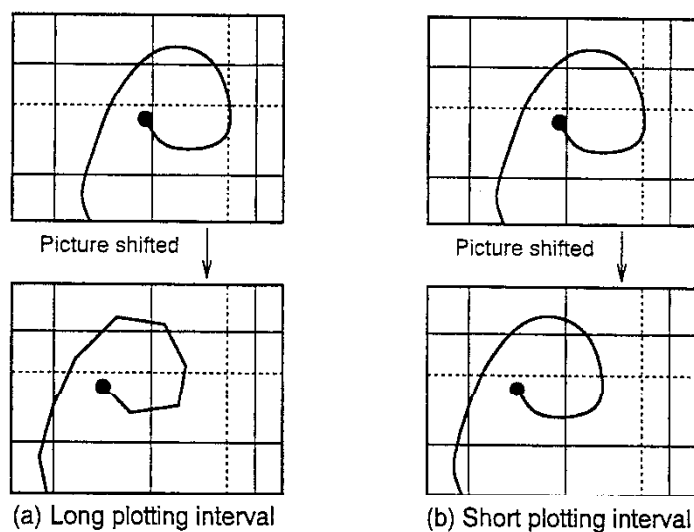
### Stopping/Resuming Recording of Ship's Track

When your boat is at anchor or returning to port you probably won't need to record its track. You can stop recording the track, to conserve the track memory, by pressing the **PLOT** key. The message "Stopping recording of track." appears momentarily, "H" is displayed at the left-hand side of the display and own ship mark becomes hollow. To resume recording, press the key again. The message "Resuming recording of track." appears momentarily.

### Setting Track Recording Interval

In drawing the track, first the ship's position is stored into this unit's memory at an interval of time, distance or automatic recording. A shorter interval provides for better reconstruction of the track, but the storage time of the track is reduced. When the track memory becomes full, the oldest track is erased to make room for the latest.












The AUTO position is set to store ship's track every 10 seconds or 0.1 nautical miles.



*Figure 15 Track reconstruction and plotting interval*

## Procedure

- 1) Press the **MENU** key.
- 2) Press the **2** key to select "TRACK/MARK SETUP."

TRACK/MARK SETUP	
EVENT SHAPE	   
MARK SHAPE	    
LINE TYPE	 
MARK	<b>BRT</b> DIM
MARK SIZE	<b>L</b> S
PLOT	<b>ON</b> OFF
PLOT INTVL	<b>TIME</b> DIST AUTO
	00' 0 00.10nm
▲▼◀▶ :Cursor    ESC:Esc	

*Figure 16 TRACK/MARK SETUP menu*

- 3) Operate the **Arrow** keys to select "Auto," "Time" or "Dist" on the "PLOT INTVL" line.
- 4) For time or distance, enter interval. (One advantage of setting the plotting interval by distance is that you won't use the track memory when your boat is dead in water.)
- 5) Press the **ENT** key.
- 6) Press the **ESC** key to close the menu.

## Erasing Track

When you have been cruising for a long time and retracing the same route many times the display may become full of track. You can erase all track to clear up the display.

- 1) Press the **MENU** key.
- 2) Press the **3** key to select "ERASE TRACK/MARK".

ERASE TRACK/MARK	
MARK ERASE	<b>NO</b> YES
TRACK ERASE	<b>NO</b> YES
MARK USED 0/100 PT	
TRACK USED 0/2000 PT	
▲▼:Cursor ►:Go ESC:Esc	

Figure 17 ERASE/TRACK MARK menu

- 3) Operate the **Arrow** keys to select "TRACK ERASE" line.
- 4) Press the **►** key to select "YES".

Are you sure?
ENT:YES
ESC:NO

- 5) If you are sure to erase, press the **ENT** key.
- 6) Press the **ESC** key to close the menu.

# 9. THE EVENT MOB KEY

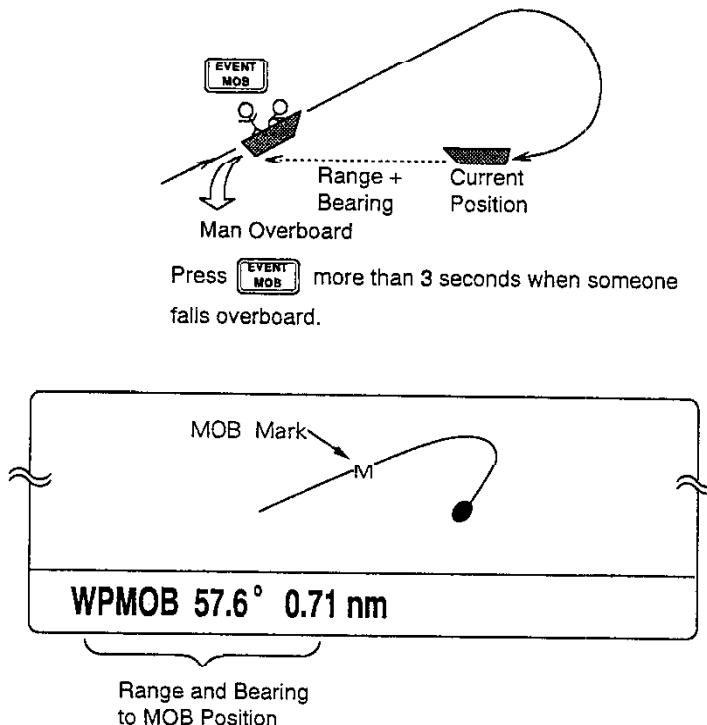
## Overview

### Basic function

The **EVENT MOB** key saves present position. When the key is pressed the GP-1600 saves present position at that moment and displays the event mark/MOB mark at that position. This key can function to save present position as either an “event position” or MOB (Man Over Board) position.

### MOB function

The range and bearing to the MOB position are continuously updated on the display, to help you navigate to the MOB position.



*Figure 18 The MOB function*

### Event/MOB storage capacity

You may enter 100 positions (Event points + Mark points + 1 MOB point = 100 points). The GP-1600 saves and numbers them from 001-100, 001 being the latest event/MOB position. When the position memory is full, no more point can be entered and the buzzer sounds to alert you. Delete unnecessary marks and enter a new one.

## Entering Event Position

Press the **EVENT MOB** key less than 3 seconds. The position is marked on the display in current event mark shape.

## Entering MOB Position

Press the **EVENT MOB** key more than 3 seconds. The position is marked with an "M" on the display. The range and bearing to it are shown at the bottom of the display.

## Viewing Past Event/MOB Positions

You can view past event mark position information as follows.

- 1) Press the **WPT** key.
- 2) Press the **▼** key to select "Event to WPT".
- 3) Press the **ENT** key.

EVENT LIST		
No	LAT	LONG
001	34° 45.678' N	135° 35.321' E
001	34° 45.231' N	135° 35.456' E
▲▼:Cursor		
ENT:Enter		MENU:Set Mode

*Figure 19 Event/MOB position display*

- 4) Press the **ESC** key twice to escape.



## Erasing Event Marks

Event marks can be erased individually as follows. If you want to erase collectively, refer to page 40.

- 1) Press the **CURS** key to turn on the cursor.
- 2) Press the **Arrow** keys to place the cursor on the event/MOB mark you want to erase.
- 3) Press the **CLR** key.

■ **Note:** MOB mark can not be erased.

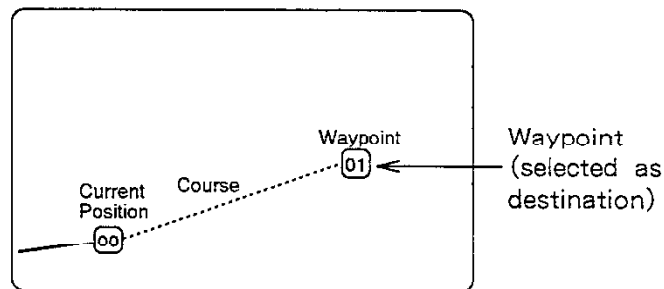
## Changing Event Mark Shape

- 1) Press the **MENU** key.
- 2) Press the **2** key to select "TRACK/MARK SETUP."
- 3) Press the **Arrow** keys to select "Event Shape" and select shape desired.
- 4) Press the **ESC** key to close the menu.

# 10. WAYPOINT NAVIGATION

## Overview

In navigation terminology, a **waypoint** is a particular location on a voyage whether it be a starting, intermediate or destination point. A waypoint is the simplest piece of information the GP-1600 requires to get you to a destination, in the shortest distance possible.



*Figure 20 Waypoint 01 selected as destination*

## Entering Waypoints

### About entry of waypoints

This unit has 200 waypoints into which you can enter position information. It numbers them 01 to 200. Waypoint "00" marks own ship's position when a destination is selected.

There are four methods by which you can enter a waypoint:

- By event position
- By the cursor
- Through the waypoint list (manual input of latitude and longitude), or
- By own ship's position.

### Entering waypoint by event position

- 1) Press the **WPT** key. The menu for selection of waypoint entry method appears.

SELECT WPT MODE	
▲	Own Position
	Cursor
	WPT List
▼	Event to WPT
ENT:Sel    ESC:Cansel	

*Figure 21 Display for selection of waypoint entry method*

- 2) Press the up ▲ or ▼ key to select “Event to WPT”.
- 3) Press the **ENT** key. The display shows the event data window.

EVENT LIST		
No	LAT	LONG
001	34° 45.678' N	135° 35.321' E
001	34° 45.231' N	135° 35.456' E
▲▼:Cursor ENT:Enter      MENU:Sel Mode		

*Figure 22 Display for selection of event position*

- 4) Press the ▼ or ▲ key to recall desired event data.
- 5) Press the **ENT** key. The display shows the event position.

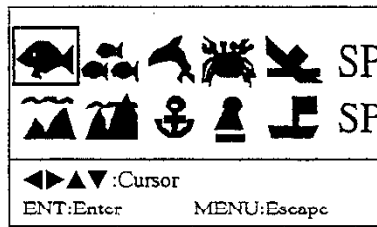
EVENT to WPT	
LAT:	34° 25.070' N
LONG:	136° 39.242' E
No:	123
MARK:	
CMNT:	22JUN95 00
◀▶:Cursor      ▼:Column ENT:Enter      MENU:Sel Mode	

*Figure 23 Display for entering waypoint number*

- 6) Enter waypoint number.

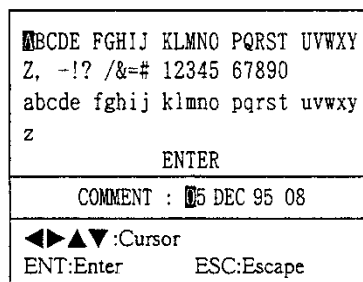
■ **Note:** You can let your unit automatically assign waypoint number, if desired. Simply press the ▼ key or **ENT** key. The unit saves waypoint position information to the youngest empty waypoint.

- 7) Press the ▼ key to enter mark if desired. The following display appears.



*Figure 24 Marks available for waypoint*

- 8) Press the **Arrow** keys to select mark desired.
- 9) Press the **ENT** key.



*Figure 25 Characters available for waypoint comment*

Date and time of entry are attached automatically. You may change it.

- 10) Operate the **Arrow** keys to select character. You can enter figures by direct keyboard input.
- 11) Press the **ENT** key.
- 12) Repeat steps 10 and 11 to complete comment.  
To correct wrong entry, press **CLR** to enter again.
- 13) Operate the **Arrow** keys to select "ENTER".
- 14) Press the **ENT** key.
- 15) Press the **ESC** key.

### Entering waypoints by the cursor

- 1) Press the **WPT** key.
- 2) Press the **▼** key to select "Cursor".
- 3) Press the **ENT** key.
- 4) Operate the **Arrow** keys to place the cursor on the position desired. Cursor position appears at the bottom of the display.
- 5) Press the **ENT** key.
- 6) Enter waypoint number, mark and comments as explained above, or enter waypoint number and press the **ENT** key to register waypoint.
- 7) Press the **ESC** key to escape.

### Entering waypoint at own ship's position

- 1) Press the **WPT** key.
- 2) Press the **▼** key to select "Own Position".
- 3) Press the **ENT** key.
- 4) Enter waypoint number mark and comments as explained above, or press the **ENT** key to register waypoint and escape.
- 5) Press the **ESC** key to escape.

### Entering waypoint through the waypoint list

- 1) Press the **WPT** key.
- 2) Press the **▼** key to select "WPT List".
- 3) Press the **ENT** key. The waypoint list appears.

WATPOINT LIST		
No	LAT/LONG	COMMENT
001	34°45.567' N 135°23.321' E	BUOY
002	34°45.231' N 135°33.456' E	ANK
...		
010	34°42.316' N 135°21.678' E	PORT
▲▼:Cursor      CLR:Delete WPT ENT:Edit        MENU:Sel Mode		

*Figure 26 Sample waypoint list*

- 4) Press the ▲ or ▼ key to select vacant waypoint number.
- 5) Press the **ENT** key.
- 6) Enter latitude and longitude. (For South latitude or East longitude, press the **TONE** key before entering latitude or longitude.)
- 7) Enter waypoint number mark and comments as explained above, or press the **ENT** key to register waypoint and escape.
- 8) Press the **ESC** key twice to escape.

## Changing Waypoint Data

You may change the position and comments of waypoints you have entered, through the waypoint list.

- 1) Press the **WPT** key.
- 2) Press the ▼ key to select "WPT List."
- 3) Press the **ENT** key. The waypoint list appears.
- 4) Operate the ▲ or ▼ key to select waypoint number.

5) Press the **ENT** key. The following display appears.

OVER WRITE
ENT: YES
ESC: NO

Figure 27

6) Press the **ENT** key.

Edit=Waypoint:001
44° 45.567' N 135° 23.321' E
MARK:
CMNT: 12 JUN 95 08
◀▶:Cursor      ▼:Column
ENT:Enter      ↻:N/S, E/W
ESC:Escape

Figure 28

7) Operate the ▶ or ◀ keys to select column in which to edit or add data.

8) Press the **ENT** key.

9) Press the **ESC** key twice to escape.

## Erasing Waypoints

The GP-1600 provides two ways by which you can erase waypoints:

- By the cursor, or
- Through the waypoint list.

Note that you can easily erase all waypoints by clearing the Plotter memory. More on this later.

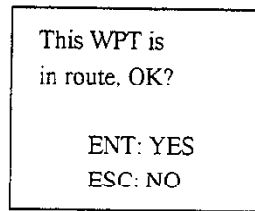
### Erasing waypoints by the cursor

1) Operate the **Arrow** keys to place the cursor on the waypoint you want to erase.

2) Press the **CLR** key.

When a waypoint is part of a route the following message appears..

**Erasing  
waypoints  
through the  
waypoint list**



3) Press the **ENT** key.

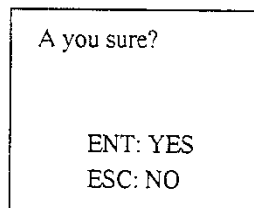
1) Press the **WPT** key.

2) Press the ▼ key to select "WPT List."

3) Press the **ENT** key. The waypoint list appears.

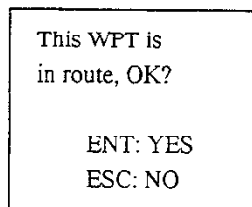
4) Operate the ▲ or ▼ Key to select waypoint number.

5) Press the **CLR** key.



*Figure 29*

If the waypoint you designated is used in route, the following display appears.



*Figure 30*

6) Press the **ENT** key.

7) Press the **ESC** key twice to escape.



## Setting Destination Waypoint

The GP-1600 offers four methods by which you can set destination waypoint:

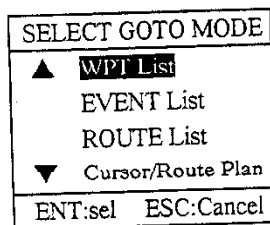
- By the cursor
- By waypoint number, or
- By route number (discussed in next chapter).
- By event position

When you select a destination waypoint, range and bearing from own ship to that point appear at the bottom of the display.

### Setting destination by the cursor

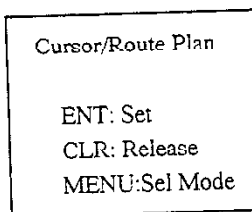
Setting a destination by the cursor allows you to enter multiple points leading to the ultimate destination. In the next section you will learn how to set multiple points, and store them as a route. The procedure which follows shows you how to set ultimate destination (single point).

- 1) Press the **GOTO** key.



*Figure 31 Display for setting destination*

- 2) Press the ▼ key to select "Cursor/Route Plan."
- 3) Press the **ENT** key. The following display appears.



*Figure 32*

- 4) Operate the **Arrow** keys to place set the cursor on destination.

5) Press the **ENT** key twice to set destination.  
The ROUTE/ROUTE LIST appears.

6) Press the **▼** key to select vacant route number.

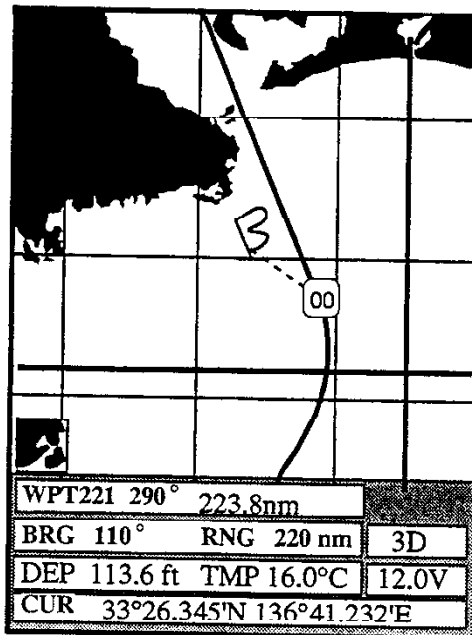
7) Press the **ENT** key.

**When a single destination point is selected by cursor;**

- The youngest waypoint number is assigned to the cursor point or a flag marks destination (see note below) and a dashed line runs between it and own ship's position.

■ **Note:** When 200 waypoints are registered, the cursor-defined point appears as flag.

- The range and bearing to the destination appear at the bottom of the display.



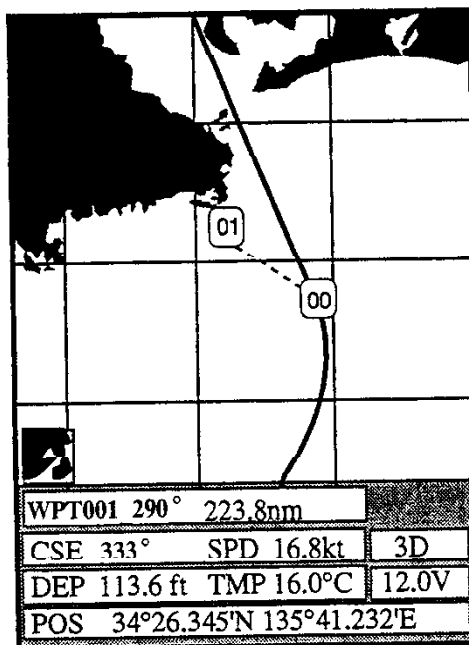
*Figure 33 Sample destination waypoint data*

**Setting  
destination by  
waypoint number**

- 1) Press the **GOTO** key.
- 2) Press the **▼** key to the select "WPT List".
- 3) Press the **ENT** key. The waypoint list appears.
- 4) Select waypoint number by the **Arrow** keys.
- 5) Press the **ENT** key.

### When destination is selected by waypoint number;

- A dashed line runs between waypoint selected and own ship's position.
- The range and bearing to the destination appear at the bottom of the display.



*Figure 34 Sample destination waypoint data*

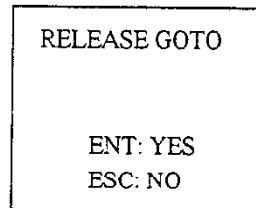
### **Setting destination by event position**

- 1) Press the **WPT** key.
- 2) Press the ▼ key to select "Event List".
- 3) Press the **ENT** key. The event list appears.
- 4) Press ▼ or ▲ key to select event point.
- 5) Press the **ENT** key.

## Cancelling Destination Waypoint

1) Press the **GOTO** key.

2) Press the **CLR** key.



*Figure 35*

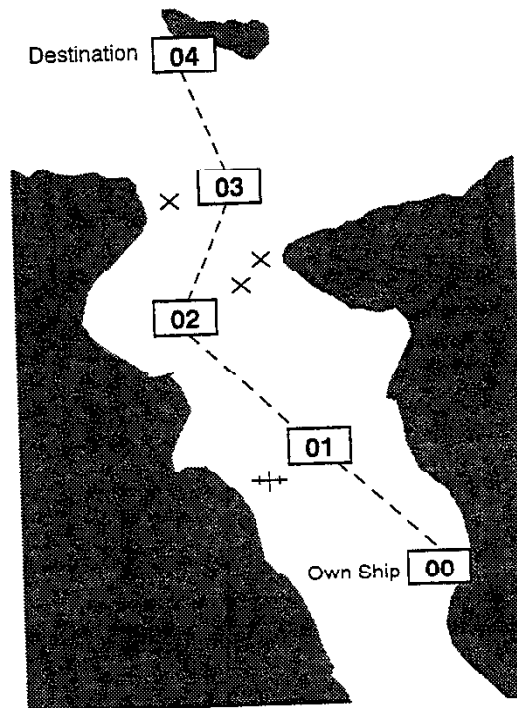
3) Press the **ENT** key.

4) Press the **ESC** key to escape.

# 11. ROUTE NAVIGATION

## Overview

Often a trip from one place to another involves several course changes, requiring a series of route points (waypoints) which you navigate to, one after another. The sequence of waypoints leading to the ultimate destination is called a **route**. The GP-1600 can automatically advance to the next waypoint on a route, so you do not have to change the destination waypoint repeatedly.



*Figure 36 Sample route*

## Entering Routes

You can store up to 20 routes. They are numbered from 01 to 20 on the route list. A route may consists of 30 points.

A route can be entered two ways: through the route list or by using the cursor. (For entry by cursor, see next section "Following a Route" on page 36.)

### Entering routes through the route list

One advantage of this method is you can use waypoints you have already entered.

- 1) Press the **MENU** key.
- 2) Press the **4** key to select "ROUTE/ROUTE LIST".

ROUTE/ROUTE LIST			
No	PTS	TOTAL	TTG
01	5	1234.56nm	10:40
02	20	2345.67nm	22:36
10	0	-----nm	-----
▲▼:Cursor   ENT:Sel   ESC:Esc			
CLR:Delete Route			
*:In Use			

*Figure 37 ROUTE/ROUTE LIST*

- 3) Press the ▲ or ▼ key to select vacant route number.
- 4) Press the **ENT** key.

ROUTE LIST		LEG: —. — nm
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—

WAYPOINT LIST		
No	LAT/LONG	COMMENT
001	34° 43.567'N 135° 23.321'E	BUOY
*002	34° 45.231'N 135° 33.456'E	ANK
⋮	⋮	
⋮	⋮	
005	34° 42.316'N 135° 21.678'E	PORT

◀▶:Cursor	ENT:Sel
⌂:	ESC:Esc

Figure 38 ROUTE/ROUTE LIST, waypoint entry display

■ **Note:** When previously entered route number is selected at step 3, the following display appears.

OVER WRITE
ENT: YES
ESC: NO

Figure 39

To overwrite the route selected, press the **ENT** key. The route list appears.

- 5) Press the **ENT** key. The highlighted cursor appears on the waypoint list.

ROUTE LIST LEG: — nm		
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
WAYPOINT LIST		
No	LAT/LONG	COMMENT
001	34°45.567'N 135°23.321'E	BUOY
*002	34°45.231'N 135°33.456'E	ANK
⋮	⋮	⋮
⋮	⋮	⋮
⋮	⋮	⋮
005	34°42.316'N 135°21.678'E	PORT
◀▶:Cursor		ENT:Sel
⌂:Page		ESC:Esc

Figure 40 Route list

- 6) Press the ▼ or ▲ key to select a waypoint number. To change the page of waypoint list, press the **TONE** key.
- 7) Press the **ENT** key. The waypoint enters to the route list.
- 8) Repeat steps 6 and 7 to complete the route.
- 9) To escape, press the **ESC** key. The highlighted cursor disappears.
- 10) Press the **ESC** key.  
The ROUTE/ROUTE LIST appears. Total distance of the route and TTG (Time-to-go based on trial speed 10.0 kt) are displayed.
- 11) To calculate TTG more precisely, press the ▲ or ▼ key until the following display appears. The TTG between legs on the route is calculated based on the trial speed.

ROUTE/ROUTE LIST			
No	PTS	TOTAL	TTG
TRIAL	TIME		10.0kt

Figure 41

- 12) Enter trial speed.
- 13) Press the ▼ or ▲ key again to read the TTG.
- 14) Press the **ESC** key to escape.

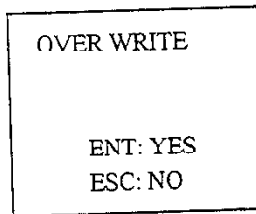


## Changing Route Contents


### **Skiping route waypoints**

To skip a route waypoint;

- 1) Press the **MENU** key.
- 2) Press the **4** key.
- 3) Press the **▲** or **▼** key to select route number.
- 4) Press the **ENT** key.



*Figure 42*

- 5) Press the **ENT** key again to change the route.
- 6) Press the **Arrow** keys to select the route waypoint you want to skip.
- 7) Press the  key to skip that point temporarily. The route waypoint becomes dimmer on the route list.
- 8) Repeat steps 6 and 7 to skip other point.
- 9) Press the **ENT** key.
- 10) Press the **ESC** key twice to close the menu.

### **Deleting route waypoints**

- 1) Press the **MENU** key.
- 2) Press the **4** key.
- 3) Press the **▲** or **▼** key to select route number.
- 4) Press the **ENT** key twice . The route list appears.
- 5) Press the **►** or **◄** key to select route waypoint which you want to delete.
- 6) Press the **CLR** key.
- 7) Press the **ESC** key twice to close the menu.

## Following a Route

Following a route is the process by which you use a previously entered route for navigation. This unit displays navigation information to guide you from one waypoint to the next, as it automatically switches from one waypoint to another in sequence.

### Following a route by cursor-created route


- 1) Press the **GOTO** key.
- 2) Press the **▼** key to select “Cursor/Route plan”.
- 3) Press the **ENT** key.
- 4) Press the **Arrow** keys to place the cursor on waypoint.
- 5) Press the **ENT** key to enter the first waypoint.
- 6) Repeat steps 5 and 6 to complete the route.
- 7) After entering final waypoint, press the **ENT** key.
- 8) Press the **▼** or **▲** key to select vacant route number.

■ **Note:** If you do not want to store the route permanently, press the **ESC** key to escape.

- 9) Press the **ENT** key.

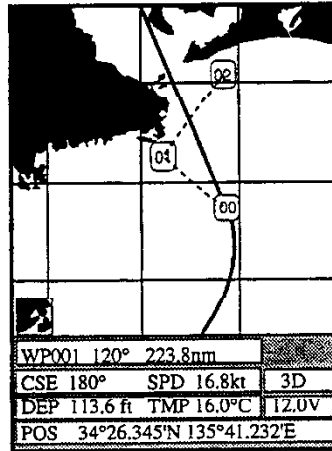
The cursor-created waypoints are assigned the youngest waypoints numbers. When the waypoints memory (max. 200 points) become full, the cursor-created waypoints become flag mark. Route waypoints and a dashed line connects all route waypoints including own ship's position. The range and bearing to the first waypoint appear at the bottom of the display.

### Following a previously entered route

- 1) Press the **GOTO** key.
- 2) Press the **►** key to select “ROUTE List”.
- 3) Press the **ENT** key.
- 4) Select route number by the **▼** or **▲** key.
- 5) If necessary, press  key to select direction which to traverse the route waypoints; forward or reverse.

6) Press the **ENT** key.

A dashed line connects all waypoints including own ship's position. Range and the bearing to the first waypoint appear at the bottom of the display.

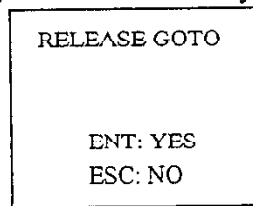


*Figure 43 Appearance of waypoint created route selected for navigation*

## Cancelling Route Navigation

1) Press the **GOTO** key.

2) Press the **CLR** key.



*Figure 44*

■ **Note:** For cursor-created registered routes, waypoint "flags" remain on the screen after cancelling route navigation. If you do not require the route and want to erase the flags, erase all route waypoints of the route through the route list.

3) Press the **ENT** key.

# 12. MARK OPERATIONS

## Overview

You can inscribe marks on the display to denote important locations; for example, buoy, fishing point, wreck. Further, marks can be connected with lines to mark important areas such as a hot fishing spot or danger area.

## Entering Marks

### At own ship position

- 1) Press the **CURS** key to turn off the cursor.
- 2) Press the **MARK** key.

### At cursor intersection

- 1) Press the **CURS** key to turn on the cursor.
- 2) Press the **Arrow** keys to place the cursor on location desired.
- 3) Press the **MARK** key.

## Changing Mark Attributes

You may change the size, shape and tone of marks.

- 1) Press the **MENU** key.
- 2) Press the **2** key to select "TRACK/MARK SETUP".

TRACK/MARK SETUP		
EVENT SHAPE	▲ ▼ ○ ☆	
MARK SHAPE	● ◻ ◇ × ◻ ◻	
LINE TYPE	— — — — —	
MARK	BRT	DIM
MARK SIZE	L	S
PLOT	ON	OFF
PLOT INTVL	TIME	DIST AUTO
	00° 10 00.10nm	
▲▼◀▶ :Cursor ESC:Esc		

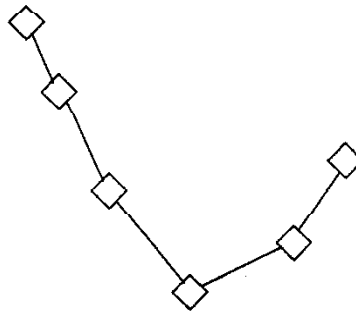
Figure 45 TRACK/MARK SETUP menu

- 3) Operating the **Arrow** keys, select “MARK SHAPE” and shape desired.
- 4) Operate the **Arrow** keys to select MARK” and “BRT”(bright) or “DIM”(dim).
- 5) Operate the **Arrow** keys to select “MARK SIZE” and “L”(Large) or “S”(Small).
- 6) Press the **ESC** key to escape.

## Connecting Marks

Marks can be connected with solid or dashed lines. This feature is useful for denoting important areas. You can even construct your own charts.

- 1) Press the **MENU** key.
- 2) Press the **2** key to select “TRACK/MARK SETUP”.
- 3) Operate the **Arrow** keys to select “LINE TYPE” to other than “single dot”.
- 4) Press the **ESC** key to close the menu.
- 5) Press the **Arrow** keys to place the cursor on location desired for mark.
- 6) Press the **MARK** key.
- 7) Repeat steps 5 and 6 to continue entering marks.



*Figure 46 Marks connected with lines*

To return to individual entry of marks, set “LINE TYPE” to “single dot” in step 3 of the above procedure.

# Erasing Marks

Marks can be erased individually or collectively.

## Erasing individual marks

- 1) Press the **CURS** key to turn on the cursor.
- 2) Press the **Arrow** keys to place the cursor on the mark to erase.
- 3) Press the **CLR** key.

## Erasing all marks

- 1) Press the **MENU** key.
- 2) Press the **3** key to select “ERASE TRACK/MARK.”

ERASE TRACK/MARK	
<b>MARK ERASE</b>	<b>NO</b> YES
TRACK ERASE	<b>NO</b> YES
MARK USED 0/100 PT	
TRACK USED 0/2000 PT	
▲▼:Cursor ►:Go ESC:Esc	

Figure 47 ERASE TRACK/MARK menu

- 3) Press the **Arrow** keys to select “MARK ERASE.”
- 4) Press the ► key to select “YES.”

Are you sure?
ENT: YES
ESC: NO

Figure 48

- 5) Press the **ENT** key.
- 6) Press the **ESC** key to close the menu.

# 13. ALARMS

## Description of Alarms

There are eight conditions which generate both aural and visual alarms in this unit.

### Arrival alarm, anchor watch alarm

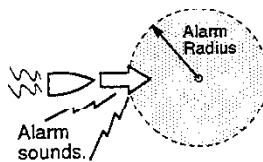
#### Arrival alarm

The arrival alarm informs you that your boat 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 your boat enters the circle.

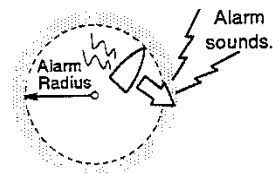
#### Anchor watch alarm

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

#### ■ Arrival Alarm



#### ■ Anchor Watch Alarm



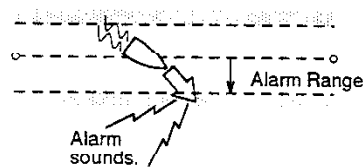
*Figure 49 How the arrival and anchor watch alarms work*

## **Cross track error (XTE) alarm**

### **XTE alarm**

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

#### **■ XTE Alarm**



*Figure 50 How the XTE alarm works*

## **Speed alarm**

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

## **Water temperature alarm**

The water temperature alarm sounds when the water temperature is within (or over) the preset temperature range. This alarm is useful for searching for specific species of fish, since each species of fish has its own habitable water temperature. (This alarm requires connection of a water temperature sensor.)

## **Trip alarm**

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



## Enabling the Alarms

- 1) Press the **MENU** key.
- 2) Press the **5** key to select "ALARM SETUP."

ALARM SETUP		1/2
<b>ARRIVAL</b>	ARRIVAL ANCHOR	<b>OFF</b>
	Range 00.50 nm	
XTE	ON	<b>OFF</b>
	Range 00.250 nm	
SPEED	WITHER OVER	<b>OFF</b>
	Speed 11.0-15.0 kt	
TEMP	WITHIN OVER	<b>OFF</b>
	Temp +11.0-+15.0 °C	
TRIP	ON	<b>OFF</b>
	Range 00.5.00 nm	
▲▼:Cursor		↺+/- ESC:Escape

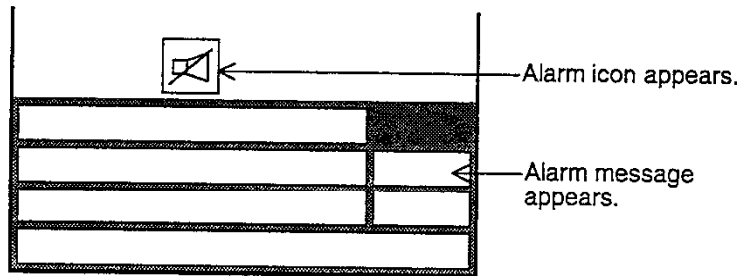
*Figure 51 ALARM SETUP menu*

- 3) Operate the **Arrow** keys to select alarm desired.
- 4) Press the ▼ key once.
- 5) Enter alarm range.
- 6) Press the **ENT** key.
- 7) Press the **ESC** key to close the menu.

■ **Note:** When menu item "TRIP" is selected, "CLR: TRIP RESET" appears at the bottom of the display. To reset the trip distance, press the **CLR** key.

## Deleting Aural and Visual Alarms

When an alarm setting is exceeded, both aural and visual alarms are released. You can silence the aural alarm by pressing the **CLR** key. The alarm icon remains on the display until the alarm setting is no longer violated.



*Figure 52 Location of alarm icon*

## Disabling Alarms

Select "OFF" in step 3 in "Enabling the Alarms" and then press the **ENT** and **MENU** keys.

# **14. CHART/POSITION OFFSET**

## **Chart Offset**

In some instances chart position may be off by a few minutes. For example, the position of own ship is shown to be at sea while it is in fact moored at a pier. You can compensate for this error by offsetting chart position.

**Note:** This function can not be available when using the NAVIONICS chart card.

- 1) Press the **MENU** key.
- 2) Press the **0** key to select "SYSTEM MENU."

SYSTEM MENU	
<b>1. SELF TEST</b>	
2. PLTR SETUP	
3.	
4. UNIT SETUP	
5.	
6. NMEA SETUP	
7. GPS SETUP	
8. DGPS SETUP	
9. CHART POSN CALB	
▲▼:Cursor	
ENT:Set	ESC:Esc

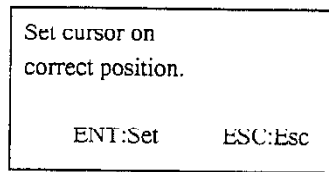
Figure 53 SYSTEM menu

- 3) Press the **9** key to select "CHART POSN CALIB."


CHART POSN CALIB	
POSN CALIB	OFF ◀▶ <b>ON</b>
CALIB	00.000' N 00.00' E
DATUM	WGS-84
ESC:Esc	

Figure 54 CHART OFFSET menu

- 4) Press the ► key to select “ON.”.



*Figure 55*

- 5) Set the cursor on correct position.
- 6) Press the **ENT** key. The calibration value appears.
- 7) Press the **ESC** key to escape.  
The chart offset icon (  ) appears on the display.

To remove the offset, select “OFF” in step 4 of the above procedure and press the **ENT** and **ESC** keys.

# 15. DISPLAYING LORAN C or DECCA LOPs

## Overview

Ship's position can be displayed in latitude and longitude, Loran C LOPs or Decca LOPs. To display position in Loran C or Decca LOPs, do the following.

- 1) Press the **MENU** key.
- 2) Press the **0** key to select "SYSTEM SETUP."
- 3) Press the **2** key to selected "PLTR SETUP."

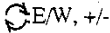

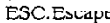

PLTR SETUP	
<b>NAVAID</b>	<b>OWN</b> LC DC ALL
SCALE	<b>SCALE</b> RANGE
SMOOTHING	00 (00-15)
SPD AVERAC	00 min
BEARING	TRUE <b>MAG</b>
MAG CALIB	<b>AUTO</b> MAN
	06.9° W 00.0° E
EVNT METHOD	<b>EVENT</b> MARK
POSITION	<b>L/L</b> LOP
DISP	<b>LC</b> DC
Chain:Sec	7970:11 - 26
LOP CALIB	+000.0 $\mu$ s
	+000.0 $\mu$ s
<div style="text-align: right;">  E/W, +/- </div> <div style="text-align: left;">  Cursor </div>	
<div style="text-align: right;">  ESC.Escape </div>	

Figure 56 PLTR SETUP menu

- 4) Operating the **Arrow** keys, select "POSITION" and "LOP."

- 5) Press the **ENT** key and select "LC" (or "DC").
- 6) Enter Loran C (or Decca) data with the numeral keys.

For Loran C, if you are currently in Osaka Bay, Japan, for example, enter 9970 and 30 and 55. See page A-3 for Loran C chains or page A-4 for Decca chains.

- 7) Press the **ENT** key.
- 8) Enter offset values if necessary. To enter negative value, press  key.
- 9) Press the **ENT** key.
- 10) Press the **ESC** to escape.

# 16. CUSTOMIZING YOUR UNIT

## Overview

This chapter shows you how to customize your unit to suit your needs. All customizing is done on the **DISPLAY SETUP** menu.

## Procedure

- 1) Press the **MENU** key.
- 2) Press the **1** key to select “DISPLAY SETUP.”

DISPLAY SETUP				
LAND PATTERN	<b>1</b>	2	3	OFF
PLACE-NAME	<b>BRT</b>	DIM	OFF	
GRID	<b>BRT</b>	DIM	OFF	
COURSE BAR	<b>BRT</b>	DIM	OFF	
TIME MARK	<b>BRT</b>	DIM	OFF	
WPT MARK SIZE	<b>L</b>	S		
CURSOR SIZE	<b>L</b>	S		
SECTOR INFO	<b>ON</b>	OFF		
LIGHTS FLASH	<b>ON</b>	OFF		
▲▼◀▶:Cursor ESC:Escape				

*Figure 57 DISPLAY SETUP menu*

- 3) Press the **Arrow** keys to both select item and set option.
- 4) Press the **ESC** key to close the menu.

## Description of DISPLAY SETUP Menu

### Land Pattern

Select land pattern: 1, 2, 3 or OFF.  
 Pattern 1: Completely filled  
 pattern 2: filled and low level brightness.  
 pattern 3: hatched

### Place Name

Select tone of place-name shown on chart.

### Grid

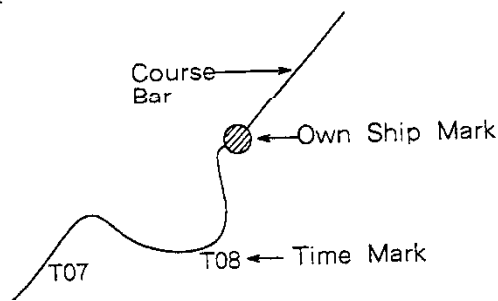
Select tone of grid.

### Course Bar

Select tone of ship's course bar.

### Time Mark

Select tone of time mark.



*Figure 58 Time mark*

### WPT Mark Size

Select size of waypoint mark to large or small.

Large:

Small: All waypoints appears as "X".

### Cursor Size

Select size of cursor to large or small.

### SECTOR INFO

Turn on/off graphic which shows viewable range for light-house.

### LIGHTS FLASH

Turn on/off blinking lights on screen, which shows light-houses or lighted buoys.

# 17. BUOY AND LIGHTHOUSE DATA DISPLAY

NAVIONICS chart cards display buoy and lighthouse data. You can find buoy and lighthouse data by doing the following.

- 1) Insert a NAVIONICS chart card. The buoy or lighthouse mark appears on the display as follows.

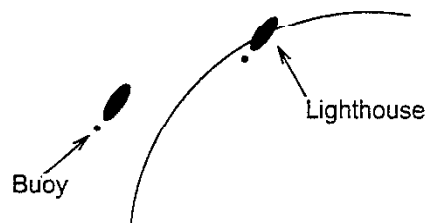


Figure 59

- 2) Place the cursor on a buoy or lighthouse mark. Data appears by the buoy or lighthouse mark selected.

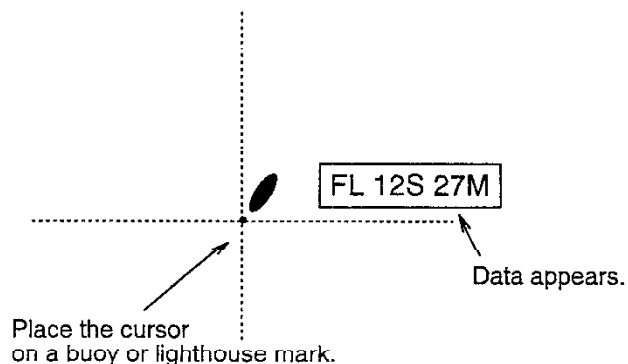
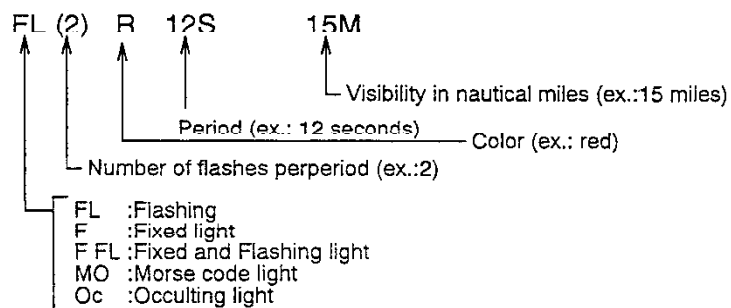


Figure 60

Lighthouse or buoy data is abbreviated on the display as follows.

## Example





# 18. SYSTEM SETTINGS

## Overview

The SYSTEM SETUP menu, menu 0, contains items which do not require frequent adjustment once set.

SYSTEM MENU	
1. SELF TEST	
2. PLTR SETUP	
3.	
4. UNIT SETUP	
5.	
6. NMEA SETUP	
7. GPS SETUP	
8. DGPS SETUP	
9. CHART POSN CALB	
▲▼:Cursor	
ENT:Sel	ESC:Esc

Figure 61 SYSTEM SETUP menu

## Description of PLOTTER SETUP Menu

### NAVAID

Select navaid which is to feed position data; internal GPS, Loran C, Decca, or All. Select "All" for multiple navaid connection. In this case position data is read in the order of GPS, Loran C, Decca, etc.

### SCALE/RANGE

Select chart scale display to scale or range.

### SMOOTHING

Even when the vessel is sailing in a straight line the track shown on the display looks irregular. This is due to signal variation of the external navaid. To smooth out this irregularity, change the smoothing factor here.

In the following figure, the actual ship's track is shown by a wide hatched arrow and the position being fed from the navaid is shown by black dots. If no smoothing is applied, the track shown on the display will look irregular due to signal variations.

- Figures 0-6 are raw position data fed from navaid

- Figures 0'-6' are position data with smoothing

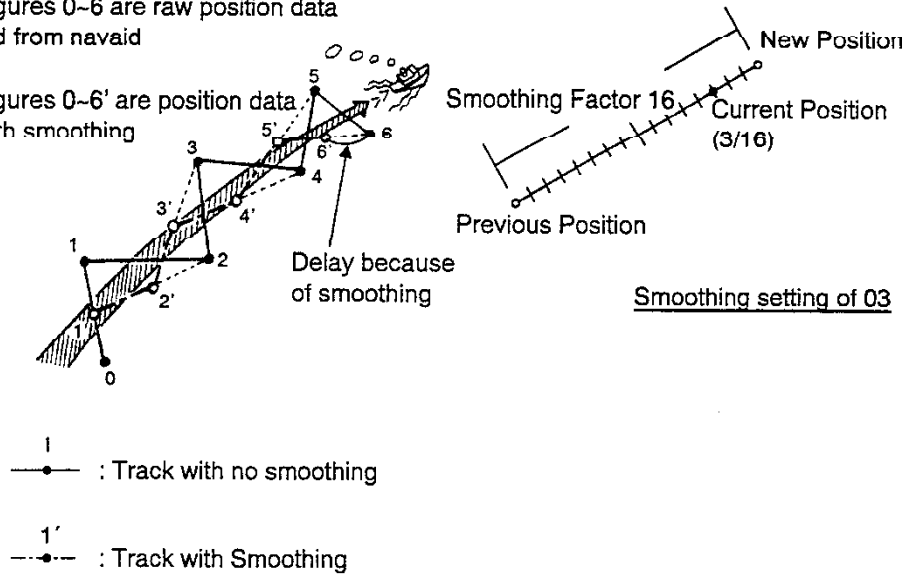


Figure 62 Comparing track with smoothing and no smoothing

For instance, number 03 provides a weighting factor of 13/16 for new data and 3/16 for previous data. The higher the smoothing number, the slower the position update becomes. In the following figure, the track shown by the broken line has a time delay more than the one shown by the dot-dash line, because of higher smoothing factor.

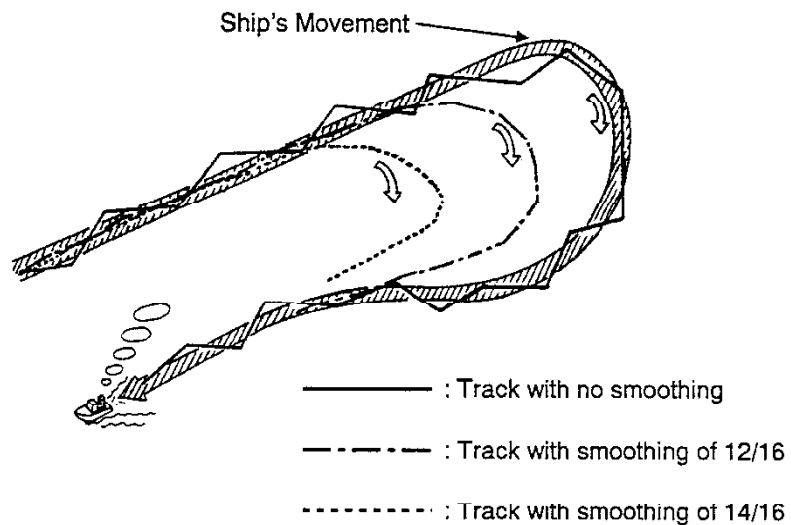


Figure 63 Comparing track and different smoothing factors

## SPD AVERAGE

Calculation of ETA and TTG, etc. is based on an average ship's speed over a given period. If the period is too long and the ship's speed is changed suddenly, calculation error will result. The default setting is "01." Increase the setting if time calculations are in error.

## BEARING

You may display bearing data in true bearing (relative to True North) or magnetic bearing (relative to magnetic North).

## MAG CALIBRATION

The location of the magnetic pole is different from the geographical North pole. This causes a difference between the true and magnetic North directions. The difference is called magnetic variation, and varies by the observation point on the earth.

This unit is programmed with the earth's magnetic variations. However, you may wish to further refine variation for a particular area. If you enter variation manually, be sure to change it when ship moves to a different area.

## POSITION DISP LOP CALIB

Explained on page 47.

## Description of UNIT SETUP Menu

UNIT SETUP		
<b>DISTANCE</b>	<b>nm</b>	km sm
DEPTH	m	<b>ft</b> fa
TEMP	<b>°C</b>	°F
▲▼◀▶:Cursor      ESC:Esc		

*Figure 64 Unit setup menu*

## DISTANCE

You may set the unit of distance measurement to nautical miles, kilometers, or statute miles.

## DEPTH

The unit of depth measurement can be set to meters, feet, or fathoms.

## TEMPERATURE

Select Centigrade or Fahrenheit.

## Description of NMEA SETUP Menu

NMEA SETUP		
FORMAT	183V1.5	183V2.0
EXT DEVICE	REM	PIOT
▲▼◀▶:Cursor      ESC:Esc		

Figure 65 NMEA setup menu

The NMEA SETUP menu is explained in the installation manual.

## Description of GPS SETUP Menu

GPS SETUP	
GPS SMOOTHING	
Posn	000 (000~999)
Spd	000 (000~999)
DATUM	WGS-84 OTHER (002)
POS CALIB	00.000' N 00.000' E
UNHEALTH RSTR	DISABLED (03)
TIME DIFF	+00:00
▲▼:Cursor ENT:Enter	↻N/S, E/W, +/- ESC:Escape

Figure 66 GPS setup menu

### GPS SMOOTHING POSN

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. Note however that 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.

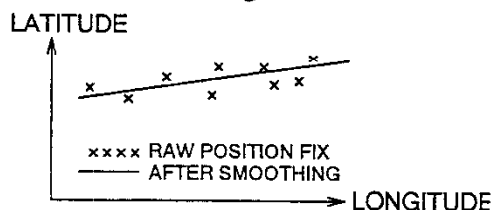
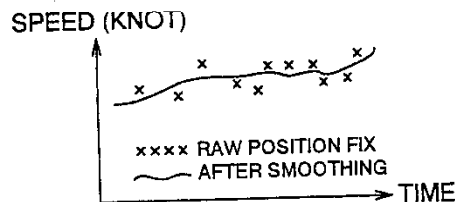


Figure 67 GPS position smoothing

## 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.



*Figure 68 GPS speed smoothing*

## GEODETTIC

Select the geodetic chart system you are using. WGS-84 (standard GPS chart system) can be directly selected. For other charts, select "Other" and enter chart number referring to the geodetic chart list on page A-1.

## POS CALIB

You may apply an offset to position generated by the internal GPS receiver, to further refine position accuracy. The L/L position offset icon (L/L) appears on the display.

## UNHEALTH

Every GPS satellite is broadcasting abnormal satellite number(s) in the Almanac. Using this information, the GPS receiver eliminates any malfunctioning satellite from the GPS satellite schedule. Once the malfunctioning satellite is returned to on-line status it is automatically restored to the satellite schedule when the Almanac is received. In some instances however the Almanac may not contain information which announces that a satellite is now back on line. If you hear of this through another source, you can manually restore the satellite to the satellite schedule. This is called "enable." Conversely, you can manually "disable" a healthy satellite if you hear it is "unhealthy."

## TIME DIFFERENCE

The GPS 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. Refer to "World Time Standards" on page A-4 for time differences.

## Description of DGPS SETUP Menu

DGPS SETUP			
DGPS	ON	OFF	
RTCM VER	1.0	2.0	
BYTE FORM	8-6	8-8	
FIRST BIT	MSB	LSB	
PARITY BIT	EVEN	ODD	NONE
STOP BIT	1	2	
BIT RATES	7	8	
BAUD RATES	300	600	1200
	2400	4800	9600
RS TYPE	422	232C	
▲▼:Cursor      ↺N/S, E/W, +/- ENT:Enter      ESC:Escape			

Figure 69 DGPS setup menu

### DGPS MODE

Select to ON if the GP-1600 is connected to a Differential GPS Receiver.

This menu is for use by service technicians. Do not change the settings.

## Description of CHART POSN CALIB Menu

CHART POSN CALIB	
POSN CALIB	OFF ◀▶ ON
CALIB	00.000' N 00.00' E
DATUM	WGS-84
ESC:Esc	

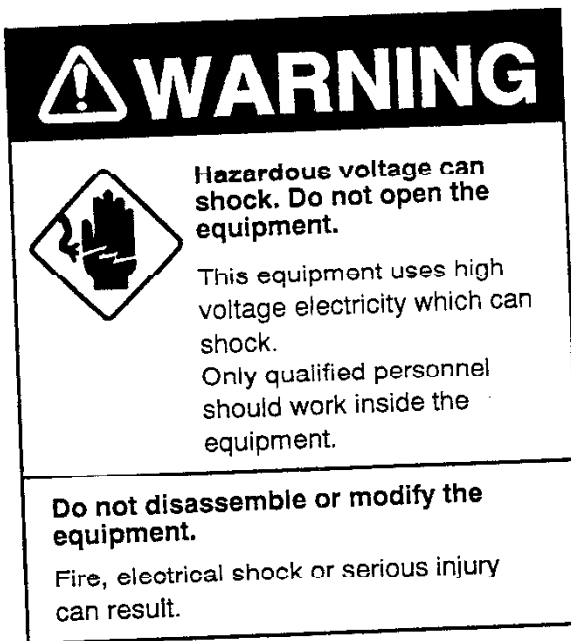
Figure 70 Chart position calibration display

See page 45.

# 19. MAINTENANCE AND TROUBLESHOOTING

## Overview

No machine can perform to the utmost of its ability unless properly maintained. This section provides maintenance and troubleshooting procedures for keeping your unit in good working order.



## Maintenance Program

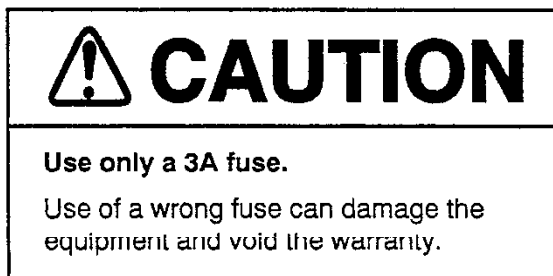
Regular maintenance is essential for good performance. A maintenance program should be established and should at least include the items listed in the Table 3 on the next page.

Table 4 Recommended maintenance program

Item	Check Point	Remedy
Antenna	Check for loosened and corroded mounting bolts.	Tighten loosened bolts. Replace heavily corroded bolts.
Antenna cable	Check connection point for watertightness. Check connector for tightness and corrosion. Check cable for damage.	Replace damaged parts.
Display unit connectors	Check for tight connection.	Tighten loosened connectors.
Ground terminal	Check for tight connection and corrosion.	Clean if necessary.
Display unit	Dust and foreign material on the display unit and display screen.	Dust on the display screen dims the picture. Remove dust with a soft cloth. The only recommended cleaning agent is anti-static spray. Never use chemical solvents to clean the display unit. They may remove paint and marking.

## Replacement of Fuse

The fuse on the power cable protects the system from reverse polarity of the ship's mains and equipment fault. If the fuse blows, find the cause before replacing the fuse. Be sure to use a 3A fuse. Using the wrong fuse will damage the unit and void the warranty.





# Troubleshooting Table

The table which follows provides common operating problems and the means with which to restore normal operation. If you cannot restore normal operation by following the recommended procedures, do not attempt to check inside the unit. There are no user-serviceable parts inside. Any repair work is best left to a qualified technician.

*Table 5 Troubleshooting table*

IF...	THEN...
you cannot turn on the power	<ul style="list-style-type: none"> <li>• check for blown fuse (3A) on power cable.</li> <li>• check that the power connector is firmly tightened.</li> <li>• check for corrosion on power cable connector.</li> <li>• check for damaged power cable.</li> </ul>
power is on but nothing appears	<ul style="list-style-type: none"> <li>• Ship's battery is too low. Check it. If the ship's battery goes down less than 10.0V during operation, the alarm sounds and "LOW BATTERY" flashes.</li> <li>• press the <b>TONE</b> key and then the ► or ◀ key to adjust tone.</li> <li>• press the <b>TONE</b> key several times to adjust display brilliance and tone.</li> </ul>
position is not fixed more than 3 minutes after power is applied	<ul style="list-style-type: none"> <li>• check that the GPS antenna is connected.</li> <li>• check for frequency deviation on the "GPS Monitor" display. (See "GPS Receiver Check." on page 63.)</li> </ul>
the display is showing wrong position	<ul style="list-style-type: none"> <li>• check that the geodetic chart system is properly set on the SYSTEM SETUP menu.</li> </ul>
ship's track is not plotted	<ul style="list-style-type: none"> <li>• plotting of track is stopped. Press the <b>PLOT ON/OFF</b> key to resume plotting, if "H" appears at the left-hand side of the display.</li> </ul>
wrong bearing appears	<ul style="list-style-type: none"> <li>• check that magnetic variation entered on the SYSTEM SETUP menu is correct.</li> </ul>
no Loran LOPs appear	<ul style="list-style-type: none"> <li>• check that proper Loran chains are entered.</li> </ul>
wrong Loran LOPs indicated	<ul style="list-style-type: none"> <li>• check that proper correction value is entered.</li> </ul>
ship's speed display is not zero after ship is stopped	<ul style="list-style-type: none"> <li>• try to decrease ship speed smoothing factor.</li> </ul>
nothing happens when keys are	<ul style="list-style-type: none"> <li>• turn off and on the power.</li> </ul>
you cannot save data to a memory card	<ul style="list-style-type: none"> <li>• the card may be write protected.</li> <li>• the card may be defective.</li> </ul>

# Self-Tests

This unit contains various self-tests which check the display unit and antenna unit for proper operation. Self-tests may be selected on the SELF-TEST menu.

- 1) Press the **MENU** key.
- 2) Press the **0** key to select "SYSTEM MENU."
- 3) Press the **1** Key to select "SELF-TEST."

SELF-TEST	
1. GPS MONITOR DISPLAY	
2. MEMORY, I/O PORT TEST	
3. PANEL TEST	
4. DISPLAY TEST	
▲▼:Cursor	
ENT:Enter	ESC:Escape

*Figure 71 SELF-TEST menu*

## Memory, I/O port test

This test conducts a general check of the display unit and the antenna unit.

- 1) Press the **2** key at the SELF-TEST menu to start the test. The unit displays the check results for each device or component checked as either "OK" or "NG" (No Good). The following figure shows sample memory, I/O port test results. Note that nothing appears for SIO AUX.

MEMORY, I/O PORT TEST	
*ROM	OK
RAM	OK
VRAM	OK
Battery	OK
SIO (GPS)	OK
SIO (NMEA)	OK*
SIO (DGPS)	OK*
MEMORY CARD	OK*
ESC:Escape	

\*:Connecting test connector or a memory card is needed for testing.

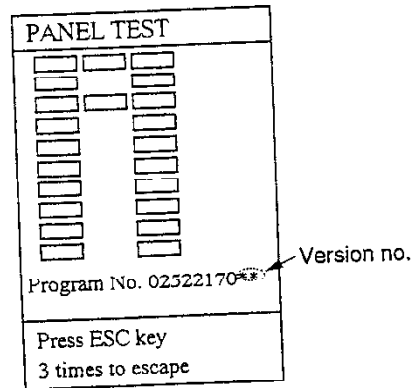
*Figure 72 Sample memory, I/O port test results*

- 2) Press the **ESC** key to return to the SELF-TEST menu.

## Keyboard test

This test checks each front panel key for proper operation.

- 1) Press the **3** key at the SELF-TEST menu to start the test.



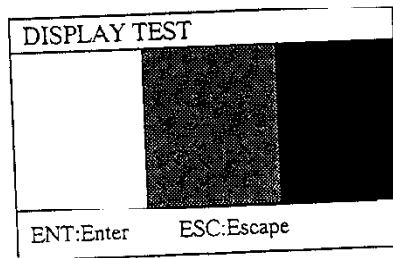
*Figure 73 Keyboard test*

- 2) Press a key. The key's location on the display "lights" in dark tone if the key is functioning normally.
- 3) To escape, press the **ESC** key three times.

## Test pattern

The test patterns check whether the display circuit is working properly or not.

- 1) Press the **4** key at the SELF-TEST menu to start the test.



*Figure 74 Display test*

- 2) Press the **ENT** key to display other test patterns.
- 3) Press the **ESC** key to return to the SELF-TEST menu.

## GPS Receiver Check

- 1) Press the **MENU** key.
- 2) Press the **0** key to select "SYSTEM MENU".
- 3) Press the **1** key to select "SELFTEST."
- 4) Press the **1** key to select "GPS MONITOR DISPLAY".

GPS MONITOR DISPLAY				
Fix Mode	3D	Alt	m	
DOP	**			
Date Rx	:OK			
Ref Sta	:OK			
Program No.	4850100	(**)	← Version No.	
Rx Status				
No.	ELV	AZM	SNR	
03	48	117	08	
--	--	---	--	
--	--	---	--	
ESC:Esc				

*Figure 75 Sample GPS monitor display*

## Description of GPS Monitor Display

Table 5 explains the meaning of the indications on the GPS monitor display.

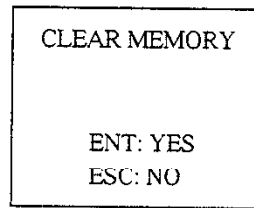
*Table 6 Description of GPS monitor display*

Indication	Description
Fix Mode	This shows current position – fixing mode; 2D, 3D, and D2D, D3D (DGPS mode turned on).
Altitude	Shows present altitude of GPS receiver when position fixing mode is set to 3D.
DOP (Dilution of Precision)	This is the index for position-fixing accuracy. The lower the value the higher the accuracy.
Data Rx	Shows external Nav device normal (OK) or abnormal (NG). If it is not connected, "--" is indicated.
Ref Sta	Shows status of DGPS transmitting station.
Program No.	Show program number. The lower 2 digits is version number.
Rx Status	This section shows elevation angle, azimuth and signal levels of receiving satellite.

## Clearing the Memory

There are times you may wish to clear the memory to start afresh. The memory stores marks, lines, waypoints, routes and settings of the **DISPLAY SETUP** and **SYSTEM SETUP** menu. Be absolutely sure you want to clear the memory; erased data cannot be restored.

- 1) Press the **MENU** key.
- 2) Press the **8** key. The following message appears.



*Figure 76*

- 3) Press the **ENT** to clear the memory.

The start-up display appears and cold start begins.

## Memory Card Operations (for technicians only)

When the battery icon (see page 9) appears, voltage of an internal battery is low. Replacement is necessary at earliest convenience.

Before changing an internal battery, save the contents of internal memory (waypoint, event, mark, track, route data and menu setting data) to a memory card (more than 256 KB capacity).

### Saving data

- 1) Press the **MENU** key.
- 2) Press the **6** key to select "SAVE/LOAD".

MEMORY SAVE/LOAD		
SAVE MEMORY	<b>NO</b>	YES
LOAD MEMORY	<b>NO</b>	YES
▲▼:Cursor   ►:Go   ESC:Eco		

Figure 77 MEMORY SAVE/LOAD menu

- 3) Operate the ▼ or ▲ key to select "SAVE MEMORY".
- 4) Press the ► key. The following message appears.

Over write memory card.
ENT: YES ESC: NO

Figure 78

- 5) Press the **ENT** key. The card is formatted and data are saved. When saving is completed, the cursor moves to "NO" at the "SAVE MEMORY" line.
- 6) Press the **ESC** to escape.

- **Note:** Error message appears when
- 1) a card is not inserted,
  - 2) a card is write-protected or
  - 3) a card is defective

## Loading data

- 1) Press the **MENU** key.
- 2) Press the **6** key to select “MEMORY SAVE/LOAD”.
- 3) Press the **▼** key to select “LOAD MEMORY”.
- 4) Press the **►** key to select “YES”.  
The following message appears.

Over write memory.  
Are you sure?

ENT: YES  
ESC: NO

*Figure 79*

- 5) Press the **ENT** key. Cold start begins.




## Demonstration Display

The demonstration 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 enter destination waypoint, enter marks, etc.

- 1) While pressing and holding down **ENT** key, turn on the power.

DEMO SETTING	
BASE POSITION	
____° ____' N ____° ____' W	
SPEED:	
00.0 kt	
◀▶:Cursor	▼:Column
ENT:Enter	⌚:N/S, E/W

*Figure 80 DEMO SETTING display*

- 2) Key in latitude and longitudes for base position. If necessary, press  to switch from north latitude to south or vice versa, or from west longitude to east or vice versa.
- 3) Press ▼ key.
- 4) Enter virtual ship's speed.
- 5) Press **ENT** key to start the simulation mode. All controls are operative.

■ **Note:** To return to the normal mode, turn off the power and then turn it on while pressing and holding down **ENT** key.

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

## Installation of New Program

- 1) Turn off the power.
- 2) Insert new program card supplied by FURUNO.
- 3) Turn on the power on. The beeps sound.
- 4) Wait about minutes to complete the program loading.
- 5) Turn off the power.
- 6) Replace the program card with a chart card.

## 20. SPECIFICATIONS

### DISPLAY UNIT

Display Type	6-inch monochrome LCD
Display Tone	Three levels

### GPS RECEIVER

Number of receiving channels	8 channels, 8 satellite tracking
Rx frequency	1575.42 MHz
Rx code	C/A code
Position fixing system	All in view, 8-state Kalman filter
Position Accuracy	Approx. 50 m, 95% of the time, Horizontal dilution of position (HDOP) $\leq 4$ (Approx.15 m if SA is not on)

■ **Note:** All GPS receiver are subject to degradation of position and velocity accuracies under the U.S. Department of Defence. Position may be degraded up to 100 meter.

	DGPS: 5 to 10 m, 95% of the time [Option]
Tracking velocity	900 kts
Position-fixing time	Warm start: 20 seconds Cold start: 02 minutes
Position update interval	1 second

### PLOTTER SECTION

Chart Projection	Mercator (85° latitude or below)
Track Capacity	2,000 points
Mark + Event Point Capacity	99 points

Waypoint Storage Capacity	200 points. + starting waypoint
Route Storage Capacity	20 routes, 30 points per route
Alarms	Arrival, anchor watch, XTE (cross track error), speed, water temperature, trip distance

## **EXT. NAVAID I/O DATA FORMAT**

Input/Output Format     NMEA 0183, Ver. 1.5 or 2.0

## **DIMENSIONS (mm) AND WEIGHT**

Display Unit: 182(W) × 188(H) × 105(D), 2.0 kg

Antenna Unit: 62 × 67(H), 0.1 kg

## **POWER SUPPLY AND POWER CONSUMPTION**

10.2—16.0 VDC, 15 W

## **USABLE TEMPERATURE**

Display Unit: 0 °C —50 °C

Antenna Unit: -30 °C —70 °C

## **WATERPROOFING SPECIFICATIONS**

IEC529 IPX5 (display unit), IPX6 (antenna unit)

# Geodetic Chart List

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

# Loran C Chains

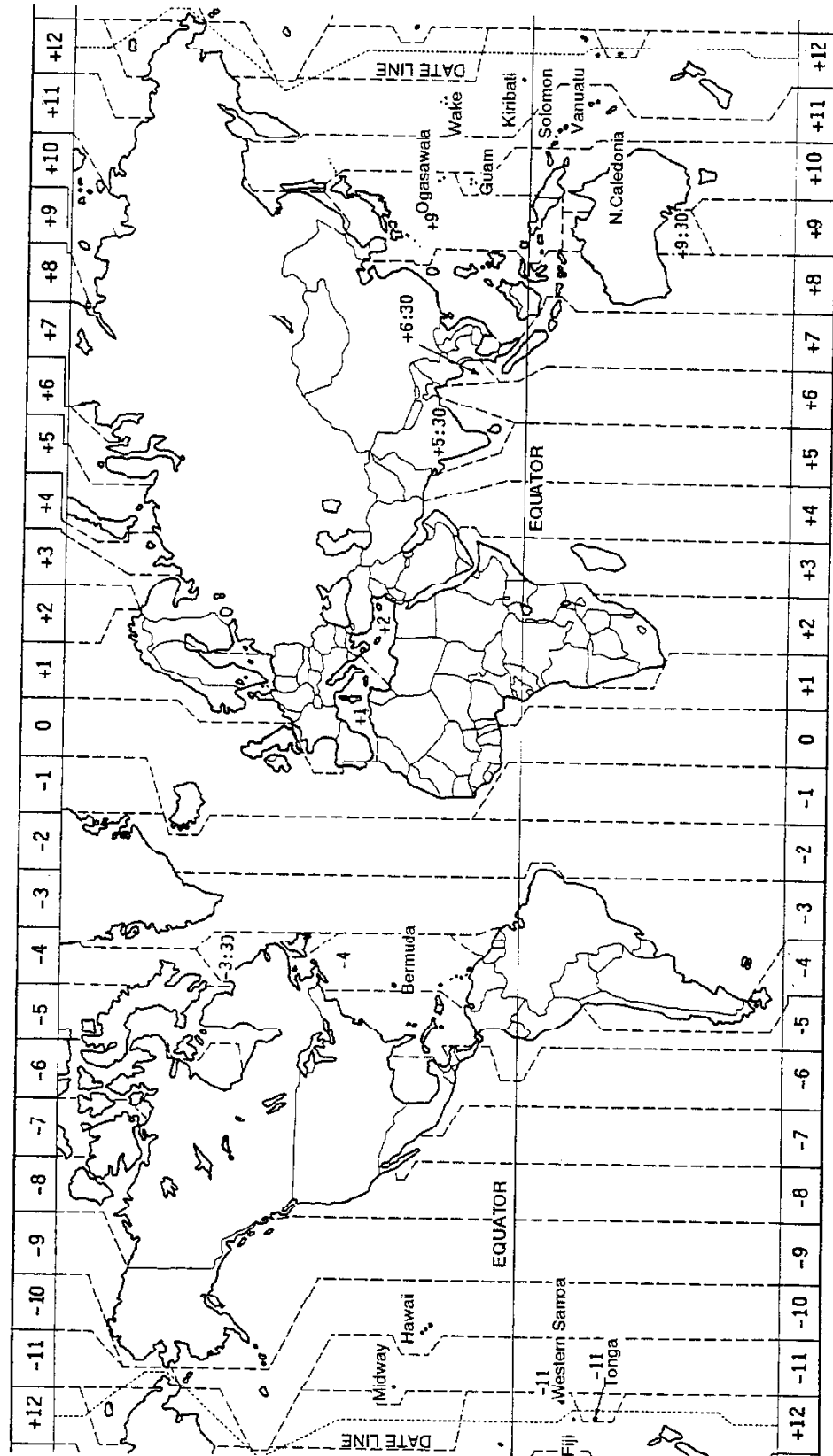
Chain	GRI	S1	S2	S3	S4	S5
Central Pacific	4990	11	29	--	--	--
Canadian East Coast	5930	11	25	38	--	--
Command Lion (Korea)	5970	11	31	42	--	--
Canadian West Coast	5990	11	27	41	--	--
South Saudi Arabia	7170	11	26	39	52	--
Labrador Sea	7930	11	26	--	--	--
Eastern Russia	7950	11	30	46	61	--
Gulf of Alaska	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	11	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	--
Northeast 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	

# Decca Chains

No.	Chain	Chain Code	Area
01	South Baltic	0A	Europe
02	Vestlandet	0E	"
03	Southwest British	1B	"
04	Northumbrian	2A	"
05	Holland	2E	"
06	North British	3B	"
07	Lofoten	3E	"
08		3E	"
09	North Baltic	4B	"
10	North West	4C	"
11	Trondelag	4E	"
12	English	5B	"
13	North Bothnian	5F	"
14	Southern Spanish	6A	"
15	North Scottish	6C	"
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	Sallyah	2F	"
32	Hokkaido	9C	Japan
33	Tohoku	6C	"

No.	Chain	Chain Code	Area
34	Kanto	8C	Japan
35	Shikoku	4C	"
36	Hokuriku	2C	"
37	Kita Kyushu	7C	"
38	Namaqualand	4A	South Africa
39	Cape	6A	"
40	Eastern Province	8A	"
41	South West Africa	9C	"
42	Natal	10C	"
43	Dampier	8E	Australia
44	Port Headland	4A	"
45	Anticosti	9C	North America
46	East Newfoundland	2C	"
47	Cabot Strait	6B	"
48	Nova Scotia	7C	"

# World Time Standards





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