OM-24354-UP

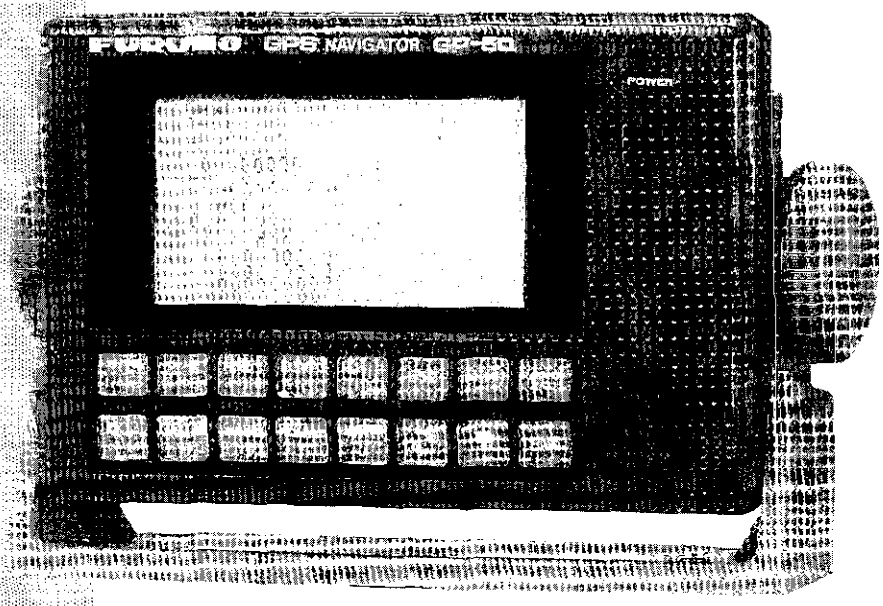
FURUNO

OPERATOR'S MANUAL

All-in-view, 8-channel parallel reception

GPS NAVIGATOR

Model GP-50



9310300T
(9310, TATA)

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FOREWORD

FURUNO Electric Company thanks you for considering and purchasing the FURUNO GP-50 GPS Navigator. We are confident you will discover why FURUNO has become synonymous with quality and reliability.

For over 40 years FURUNO Electric Company has enjoyed an enviable reputation for quality and reliability throughout the world. This dedication to excellence is furthered by our extensive global network of agents and dealers.

While this unit is designed and manufactured to provide the user with many years of trouble-free performance, no machine can perform its intended functions unless properly installed and maintained. Please carefully read and follow the recommended procedures for operation, installation and maintenance.

NOTICE

- **This unit is capable of performing many complex navigation functions. A function it is not capable of performing however is the role of the navigator. Navigation aids are intended to assist the navigator, not replace him. The navigator should always check the information provided by this unit against other sources to verify its reliability.**
- **This unit is not designed as a permanent data logger. All important data should be recorded in a log.**

Features

The GP-50 consists of two units: a sensor unit and a display unit. The high sensitivity, eight channel receiver tracks up to eight satellites simultaneously. An 8-state Kalman filter ensures optimum accuracy in determination of vessel position, course and speed.

Navigation data is presented on a 9 mm wide backlit LCD. On-screen navigation information include ship's position in latitude and longitude, speed and course, range and bearing to a waypoint, etc.

In most cases the operator need do no more than turn on the power to fix GPS receiver position.

The GP-50 operates from any 10—35 VDC power supply. 100, 115, or 220 VAC operation also is available by an optional rectifier. Power consumption is a minimal 7 W.

The GP-50's compact size belies the multitude of features contained inside. The main features are as follows.

- Ultra compact sensor unit and display unit permit installation where space is limited
- Fully watertight horizontal type sensor unit can be installed almost anywhere
- Comprehensive display of navigation data
- Storage for up to 150 waypoints
- Navigation planning from/to waypoint or routes
- Alarm functions—Arrival alarm, Anchor Watch alarm, Cross-track Error alarm, Border alarm, Ship's Speed alarm, Trip alarm
- Man overboard feature records latitude and longitude coordinates at time of man overboard and provides continuous updates of the range and bearing to that point
- Built-in self diagnosis
- Reception of data from DGPS beacon receiver in RS-232C or RS-422 (Option)

How to Use this Manual

This manual is laid out in as "user-friendly" a manner as possible. A sophisticated instrument such as this, with its many, many functions can be very intimidating to the first-time user. It is our intention to guide the user along in the use of the equipment as gently and as comfortably as possible in a series of sections that start a very basic level and proceed forward in complexity in a logical manner.

This manual is arranged as follows:

Chapter 1 provides an introduction to the GPS system.

Chapter 2 covers basic operations. In most cases all you need to do is turn on the power to find your position.

Chapter 3 explains waypoint navigation. A waypoint is the most basic information required to find information such as range and bearing from your ship to a point.

Chapter 4 provides the information necessary for route navigation. A route is a sequence of waypoints leading to your ultimate destination.

Chapter 5 covers miscellaneous functions such as finding the range and the bearing between two points.

Chapter 6 describes the alarm functions of the GP-50.

Chapter 7 provides maintenance and troubleshooting information. Whenever you feel your unit is not operating properly, refer to this chapter.

Chapter 8 explains how to install the unit. The installation of this unit can be done using simple hand tools, following the enclosed instructions. If the user has doubts about his or her technical ability, however, please have a qualified technician do the installation.

The **Appendix** contains GP-50 specifications, equipment lists, menu tree and waypoint log.

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INTRODUCTION TO GPS

This chapter provides an overview of GPS.

What is GPS?

GPS is an acronym meaning Global Positioning System. GPS (sometimes referred to as NAVSTAR) is a highly precise satellite navigation system developed by the U.S. Department of Defense.

When full global coverage becomes available, a constellation of 24 satellites (including three spares) emplaced in nearly 20,000-kilometer high 12-hour circular orbits will provide highly precise, continuous, worldwide, all-weather position plus time and velocity information to GPS receiver-equipped vehicles, vessels and aircraft.

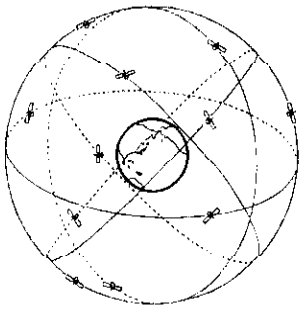

Figure 1-1 The orbits of GPS satellites

How the GPS Receiver Finds its Position

The GPS receiver's position is continuously fixed by receiving 3 (or 4) satellites in line-of-sight of the GPS receiver. The basic steps in position fixing are as below.

1. GPS satellites continually transmit their own precise orbital data called ephemeris. The GPS receiver computes satellites' position by this data.
2. The GPS receiver measures very accurate distance to the satellites.
3. Satellite locations and their distances from the GPS receiver are known. The GPS receiver fixes its own position by triangulation.

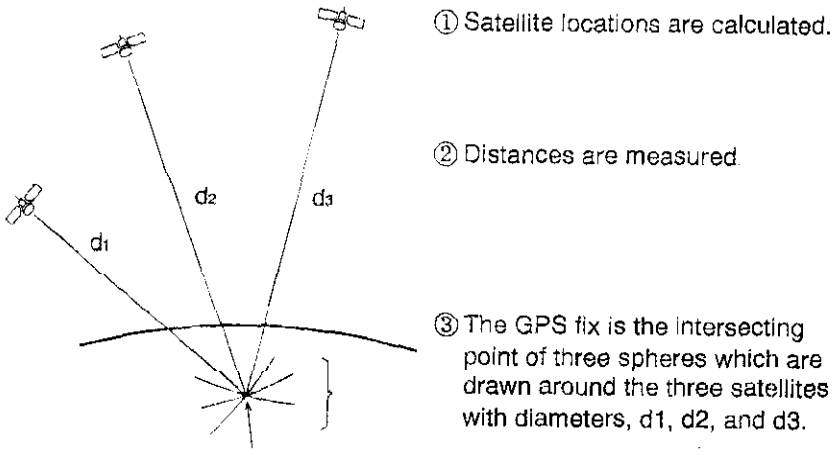

Figure 1-2 How the GPS receiver finds its position

Position-fixing accuracy (HDOP)

In radar position-fixing, most accurate position fixes are obtained when the targets used are spaced nearly 90 degrees from each other. Similarly, GPS position fixing accuracy is subject to satellite location. Generally, the further apart the satellites are from one another, the greater the position-fixing accuracy.

For example, take a look at Figure 1-3. In both situations a fix is obtainable in the Northern Pacific region because three satellites are in line-of-sight. However, position-fixing accuracy will be higher in the right-hand figure since the satellites are spread farther apart than the left-hand figure.

The Almanac

Every satellite is broadcasting its own orbital data plus estimated orbital data about all the GPS satellites. This estimated orbital data is called the **Almanac.** The GPS receiver acquires the Almanac each time it is turned on. Thus the GP-50 knows estimated satellite arrival time and elevation angle of all GPS satellites, by receiving a single satellite. Without the almanac the GP-50 cannot fix its position.

The GP-50 is shipped from the factory with no almanac. Therefore, the first thing to do after installation is turn on the unit to acquire the almanac.

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BASIC OPERATION

This chapter provides basic operating information, from turning on the power to saving present position.

The first time the GP-50 is turned on it needs about 15 to 45 minutes to fix its position. This is because there is no almanac stored in the unit. Subsequent power applications require less than 45 seconds.

Before Reading This Manual...

Before you start reading this manual, please familiarize yourself with the typographic conventions we use throughout this manual.

- Key names appear in a font different from the body text for emphasis. For example, the MENU key appears as **MENU** key.
- Two keys are labelled with a symbol rather than a name. In this instance we substitute the symbol for the name in the text. Below is a list of those keys.

Table 2-1 Key symbol and name in text

Key	Referred to in text as;
	**Arrow** key
	**Change** key

Turning the Power On and Off

First power application

On the first power application after installation the error indication "SER" appears. Turn the power off and on.

The GP-50 takes about 15 – 45 minutes to fix its position. This is because it contains no almanac when shipped from the factory. The almanac, transmitted by GPS satellites, contains orbit information about all the GPS satellites.

Cold start

The initial receiving of the almanac is called "Cold Start." To complete the cold start within 45 minutes, the estimated position shown on the display should be within 10°. If it is not, and you want to complete cold start more quickly, refer to the instructions for entering estimated position on page 2-12.

Warm start

Warm start is the normal start-up condition, with the almanac stored in the unit. In this condition it takes about 45 seconds for the receiver to find its position.

Turning on the power

Press the **POWER** switch.

Table 2-2 details the events which occur when turning on the power.

Table 2-2 Sequence of events at power on

Step	Event	Remarks
1	Press the **POWER** switch.	The buzzer sounds and a colon (:) blinks every second.
2	The indication "CST" (Cold Start) appears on the display.	This step does not occur in normal start-up.
3	About 15 – 45 minutes (cold start condition) after turning on the power, the indication "ACQ" (Acquired) replaces "CST", meaning the receiver has acquired the almanac.	Warm start begins with the indication ACQ.
4	Shortly after "ACQ" appears it is replaced by "2D" (two-dimensional position fixing).	Ship's position, speed and course indications are now reliable.

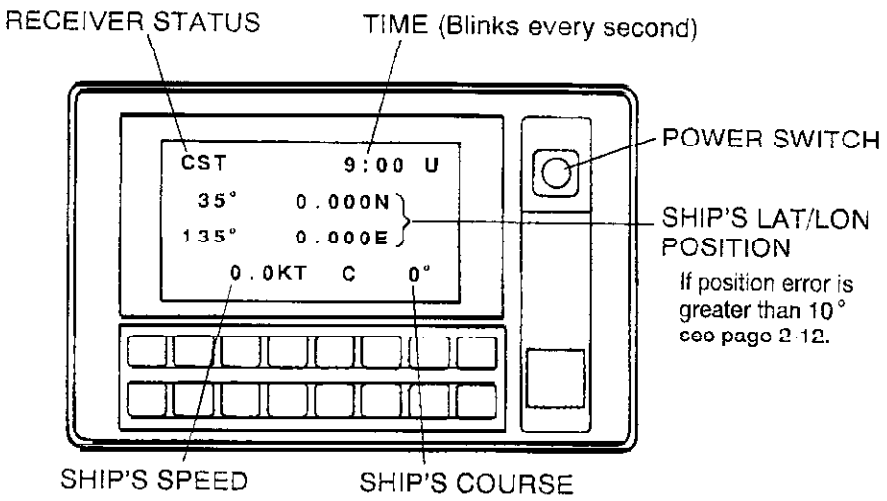


Figure 2-1 Display unit, showing position display (cold start)

Turning off the power

Press the **POWER** switch again. The display turns off.

Notes on operation

- Each time the unit is powered it begins operation with previous settings.
- The unit begins operation with cold start condition when
  - the unit is first powered
  - the display unit is removed from the vessel or vehicle
  - the sensor cable is reconnected, or
  - cold start is executed manually.

What You Will See on the Display

Position display

The position display, an example of which is shown in Figure 2-2, appears when turning on the power. It is the display you probably will be viewing when you are not executing GPS functions. The position display shows

- time (local or UTC)
- position-fixing method
- position in latitude and longitude
- course, and
- speed.

This display also appears by pressing the **POS** key.

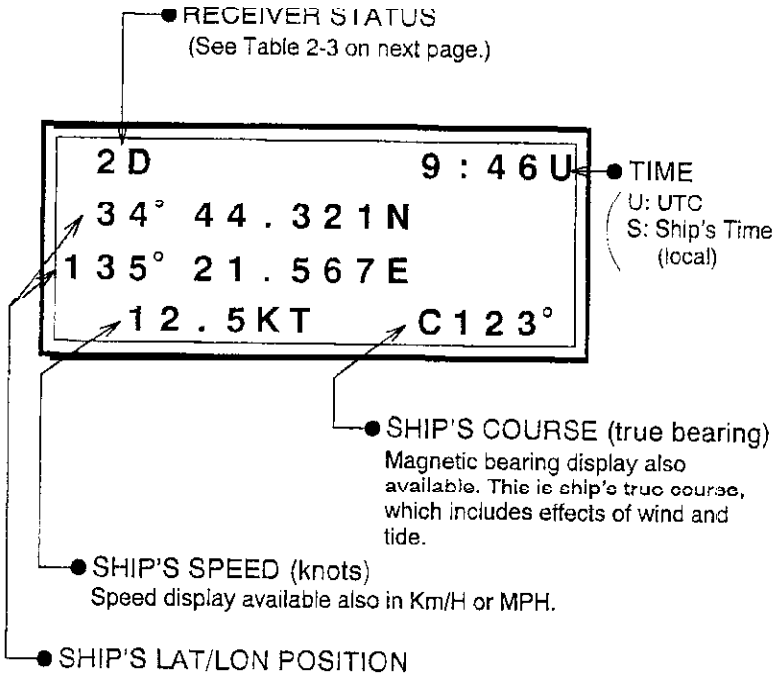


Figure 2-2 Position display

Abbreviations (receiver status)

The GP-50 displays various abbreviations (at the top left on the LCD) which show receiver status. Table 2-3 shows the abbreviations used and their meaning.

Table 2-3 Display abbreviations

Abbreviation	Meaning
CST	Cold Start
ACQ	Acquired; Almanac data acquired
2D	Two dimensional position fixing
IMP	Impossible; cannot receive GPS signal
INT	Interrupted; object interfering with reception of GPS signal
3D	Three dimensional position fixing

Symbols (operating information)

The display shows six symbols to provide operating information about a particular display. Table 2-4 shows the symbols and their meanings. You will see the symbols in the illustrations which accompany this manual.

Table 2-4 Display symbols and meanings

Symbol	Meaning
:	The blinking colon appears on display screens which are for display only; for example, the default display.
=	The equals sign shows current selection.
_	The blinking underline, referred to as **cursor**, prompts you to enter data or select a menu.
→	The right arrow appears to the left of current setting and means you can press the **Change** key to change setting.
▼	The down arrow means you can press the **Arrow** key to scroll or change the display.
#	The sharp mark appears to the left of menu number.

The Keyboard

The keyboard consists of 16 keys in two rows. Figure 2-3 shows the keyboard.

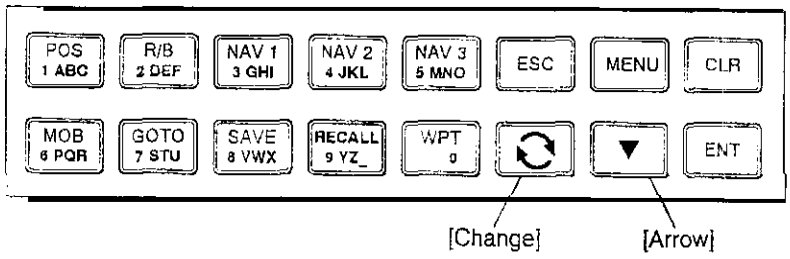


Figure 2-3 Keyboard

Key description

Table 2 5 describes the functions of the keys.

Table 2-5 Key description

Key	Main Function
POS	Displays position, course, speed, time and receiver condition.
R/B	Displays range and bearing between your ship and destination waypoint.
NAV 1 NAV 2 NAV 3	Display navigation information according to user preset.
ESC	Escapes from a function; returns control to default display.
MENU	Displays menu.
CLR	Readies the unit for data input; clears wrong data.
MOB	Executes man overboard feature.
GOTO	Selects destination waypoint.
SAVE	Saves present position.
RECALL	Displays saved positions.
WPT	Registers waypoints.
Change	Changes items on LCD.
Arrow ▼	Scrolls display.
ENT	Terminates keyboard input.

Dual function keys

The keys with two rows of labeling have two functions:

- execute the main function associated with the abbreviation which appears on the top line of the key, and
- enter alphanumeric data.

For example, the main function of the **POS 1 ABC** key is to display position information and its sub function is to enter a 1, A, B or C. Hereafter when you are asked to press a dual function key we refer to either the main function or numeral character, depending on the function you are to execute.

Entering data

Numeral

Simply press appropriate numeral key.

Alphabet

Two steps are necessary to enter a letter:

1. Press the numeral key which carries the letter you want to enter.
2. Press the **Change** key to display that letter.

For example, you want to enter the letter F. Press the **2** key, and then press the **Change** key three times.

Clearing wrong data

Press the **CLR** key.

Keyboard response conventions

Each time you press a key (including the power switch) the unit emits up to three beeps according to operation executed. Table 2-6 explains keyboard response.

Table 2-6 Keyboard response conventions

Keyboard Response	Occurrence
One beep	• When turning on the power. • Key input accepted.
Two beeps	• Invalid key input.
Three-beep continuous	• Alarm setting violated.
Three beeps	• **MOB** key pressed. • Route changed. • Heading changed on route navigation. • Receiver error lasting more than one minute. • Error found on self test.

The Menu

The menu contains less-often used functions such as the self test and initial settings. You may display the menu by pressing the **MENU** key. Figure 2-4 shows the menu.

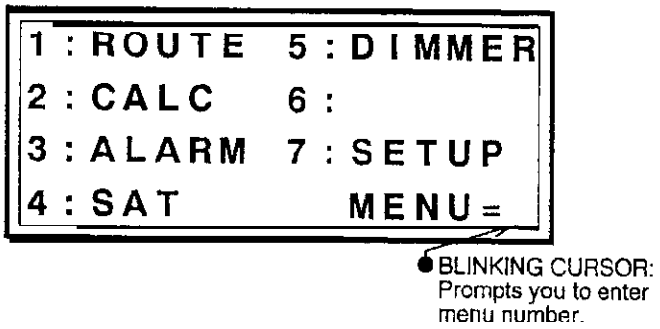


Figure 2-4 Menu

Menu description

Table 2-7 Menu description

Menu	Function
1: ROUTE	Plan/select route.
2: CALC	Calculate range and bearing to a point.
3: ALARM	Change alarm settings.
4: SAT	Satellite functions.
5: DIMMER	Adjust display brightness (including keyboard backlighting) and LCD contrast.
6:	
7: SETUP	Enter initial settings, execute self test, etc.

Selecting a menu

To select a menu, press appropriate numeral keys. In most cases you will press several numeral keys before reaching the display where you will enter data. The unit lets you know where you are in a menu by displaying menu number; that is, numeral keys pressed, adjacent to a sharp mark (#). Figure 2-5 illustrates this feature. (Complete menu appears on page A-6.)

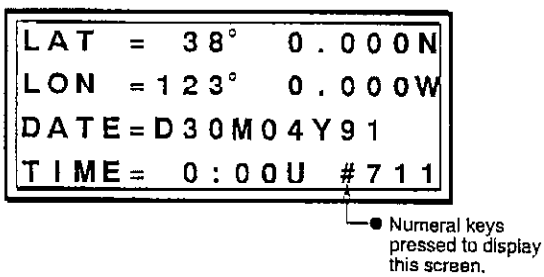


Figure 2-5 Estimated lat/lon display, showing location of menu number

Adjusting LCD Brightness and Contrast

You can adjust LCD brightness (including keyboard backlighting) and contrast to suit your needs and environment.

Brightness

To adjust both the brightness of the display and the backlighting of the keyboard;

1. Press the **MENU** key to display the menu.
2. Press the **5** key to display the DIMMER menu.

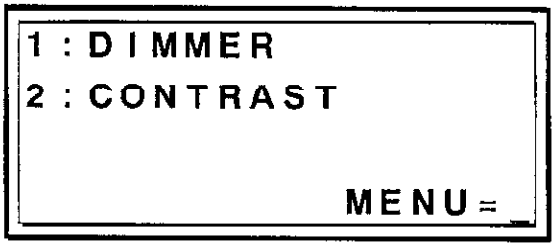


Figure 2-6 DIMMER menu

3. Press the **1** key to select DIMMER. The DIMMER display appears along with current dimmer setting. (6 is the factory setting.)

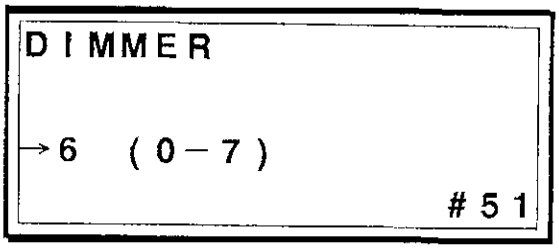


Figure 2-7 DIMMER display

4. Press the **CLR** key. A blinking cursor appears under the dimmer setting. (Hereafter we refer to the blinking cursor as cursor.)
5. Press the **Change** key to select dimmer setting desired; 7 for highest, 0 for lowest.
6. Press the **ENT** key. The cursor disappears. Press any key to escape.

Contrast

The procedure which follows shows how to adjust LCD contrast.

1. Press the **MENU** key to display the menu.
2. Press the **5** key to display the DIMMER menu.
3. Press the **2** key to select CONTRAST. The CONTRAST display appears along with current contrast setting. (4 is the factory setting.)

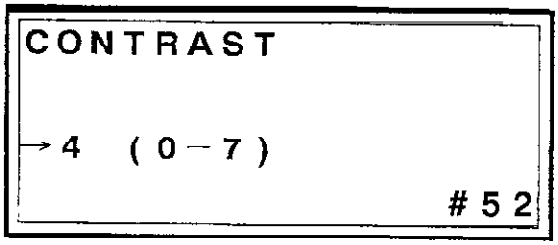


Figure 2-8 CONTRAST display

4. Press the **CLR** key. The cursor appears under the contrast setting.
5. Press the **Change** key to select contrast setting desired; 7 for highest, 0 for lowest.
6. Press the **ENT** key. The cursor disappears. Press any key to escape.

Initial Settings

Estimated position

When the latitude and longitude position displayed at power on is wrong by more than 10° (about 600 miles) you can enter estimated position to lessen the time required to execute cold start.

1. Press the **MENU** key.

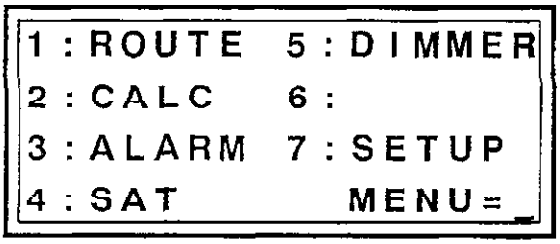


Figure 2-9 Menu

2. Press the **7** key to select the SETUP menu.

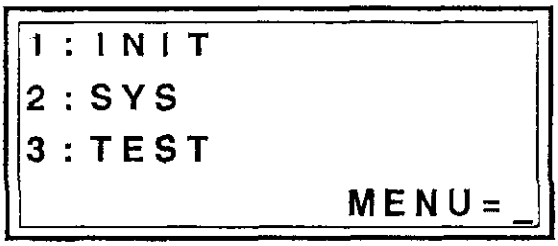


Figure 2-10 SETUP menu

3. Press the **1** key to select the INIT(ial) menu.

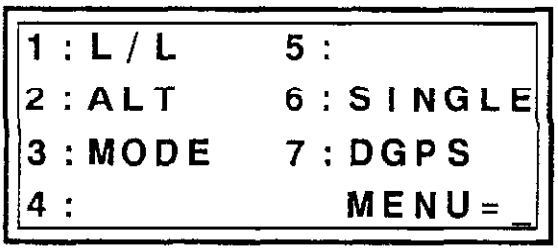


Figure 2-11 INITIAL menu

4. Press the 1 key to select L/L. The L/L display appears.

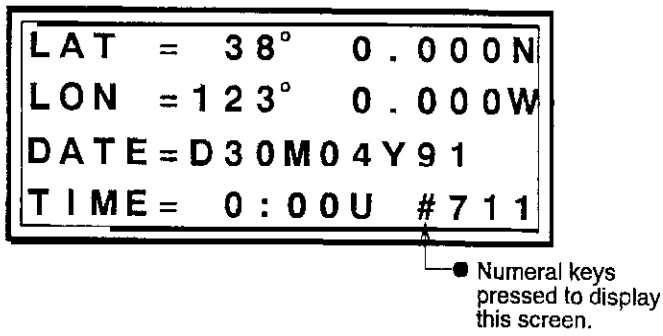


Figure 2-12 L/L display

5. Press the **CLR** key. The cursor appears on the LAT line.

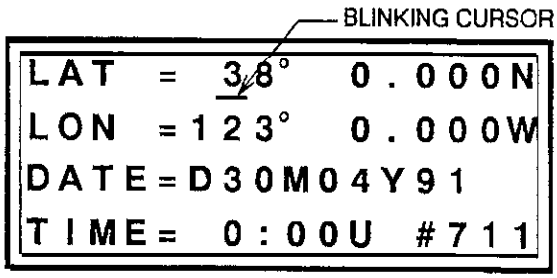


Figure 2-13 L/L display, showing cursor

6. Enter latitude. To enter 34°44'N, for example, press

[3] [4] [4] [4]

■ **NOTE:** *The* **CLR** *key clears wrong data. The* **Change** *key changes North latitude to South latitude, West longitude to East longitude and vice versa.*

7. Press **ENT**. The cursor moves to the LON line.

8. Enter longitude. To enter 135°21'E, for example, press

[1] [3] [5] [2] [1] [Change]

9. Press the **ENT** key. The cursor shifts to the DATE line. You need not enter the date; when the unit receives a satellite the date, as well as the time, is automatically corrected.

10. Press the **ESC** key. The latitude and longitude you entered appear on the display.

Time difference and sensor unit height

The GPS system uses UTC time. If you would rather display time in local time enter the time difference between UTC and local time. A world map which shows time differences is in the appendix. For time difference earlier than UTC enter a minus sign by pressing the **Change** key.

Accurate input of the sensor unit height above the waterline is essential for accurate determination of position.

1. Press **MENU**, **7** and **2** to display the INITIAL menu.
2. Press the **2** key to display the ALT display.

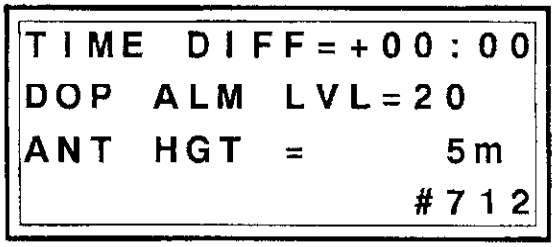


Figure 2-14 ALT display

3. Press the **CLR** key.
4. Enter time difference, if required. To enter a time difference of three hours, for example, press **0** and **3**.
5. Press the **ENT** key twice to advance the cursor to ANT HGT.
6. Enter sensor unit height above the waterline in meters (see note), using four digits. To enter 12 m, for example, press **0**,**0**,**1** and **2**.

   ■ **NOTE:** *If the sensor unit is below the waterline, press the* **Change** *key to display the minus sign. The unit of measurement for sensor unit height can be changed to feet. For further details, see page 5-11.*

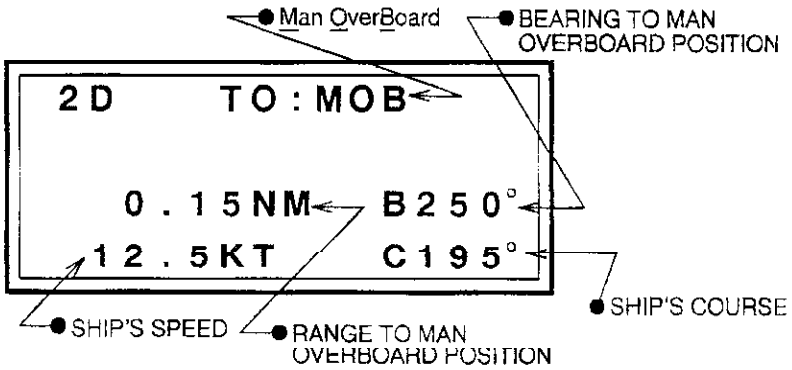
7. Press the **ENT** key.

■ **NOTE:** *The DOP ALM LVL setting (set to 20) should not be changed. This figure sets the DOP threshold for position fixing. For further details, see page 1-3.*

The MOB Key

The **MOB** (**M**an **O**ver**B**oard) key saves ship's position, date and time to mark man overboard. The range and the bearing from present position to that point are continually calculated, so you can easily return there. Figure 2-15 illustrates the man overboard feature.

Press the **MOB** key.



Press **RECALL** key.

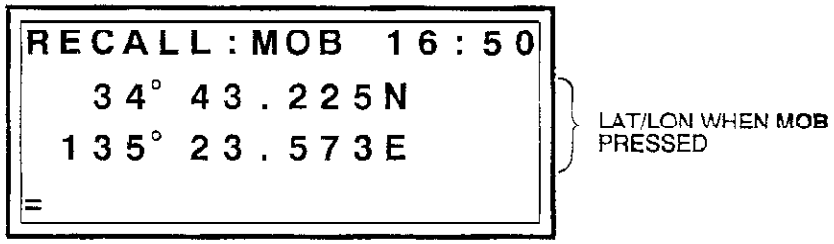


Figure 2-15 Viewing the man overboard feature information

When you want to observe the range and bearing to MOB position again, press the **R/B** key.

■ **NOTE:** *If you press the* **MOB** *key while in this display, the old MOB position data is deleted to make room for new MOB position.*

Saving Present Position

There will be times when you will want to save your present location on a temporary basis. (For permanent storage, register position as a waypoint. Waypoints will be dealt with in a later chapter.) For example, you have laid some crab pots, and want to return to the location at a later time.

Storage capacity for saved positions

You can save up to 20 present locations. The unit numbers the locations from S1 to S20. If you try to save more than 20 locations, the earliest locations will be deleted, one at a time, to make room for the latest positions.

Saving present position

Press the **SAVE** key. The moment the key is pressed the position of the vessel is stored in the memory. In Figure 2-16 the display shows the unit saved a location under S1.

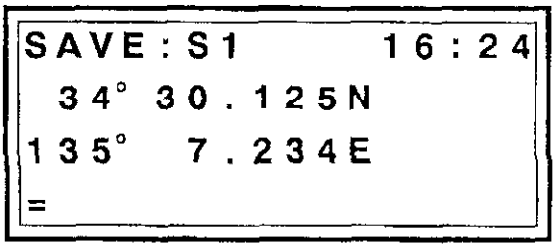


Figure 2-16 SAVE display

Automatic position saving

The GP-50 automatically saves the vessel's position on the hour. It numbers these locations from T1 to T5. You can view the vessel's position on the hour for each of the latest five hours on the RECALL display. The next section shows you how to view both manually and automatically saved positions.

Viewing Saved Positions

You may view both manually and automatically saved positions by pressing the **RECALL** key. The MOB position appears at the initial press of the key. Further pressing of the key shows the most recently manually saved position, other manually saved positions, and automatically saved ones in that order.

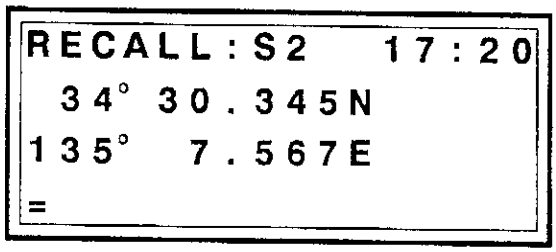


Figure 2-17 RECALL display, showing manually saved position

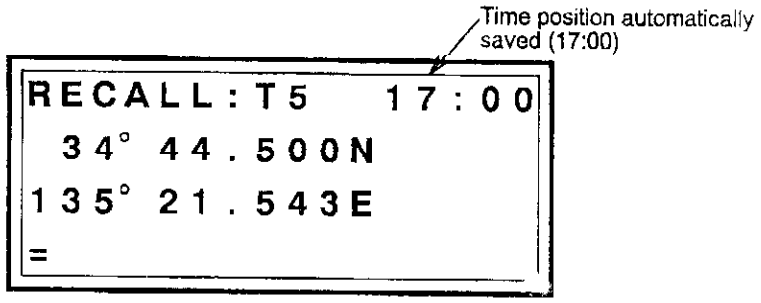


Figure 2-18 RECALL display, showing automatically saved position

WAYPOINT NAVIGATION

This chapter provides the information necessary for waypoint navigation. A waypoint is a particular location on a voyage, whether it be a starting point, an intermediate point or a destination point. Using a waypoint, the GP-50 can calculate various navigation information from the present position to the waypoint. These are

- range and bearing
- ideal course
- estimated time of arrival
- time-to-go, and
- cross track error.

Registering Waypoints

The GP-50 has 150 waypoints into which you can enter position information. You register a waypoint using up to seven alphanumeric characters. One method is to register a waypoint by geographic name; for example, Tokyo, Miami, etc.

Obviously, it's important that you write down your waypoints in a log so you have a permanent record of which waypoint is which. (A log for recording waypoints is provided in the Appendix.)

■ **NOTE:** *If you register a waypoint under a name which you've already used, all waypoint information for that waypoint will be overwritten.*

How to register a waypoint

There are three methods to enter a waypoint:

- by direct input of latitude and longitude
- by present position, and
- by previously saved position.

By direct input of latitude and longitude

For purposes of illustration try to enter the position of Kobe, Japan into a waypoint. The coordinates are: 34 degrees, 39.836 minutes North Latitude, and 135 degrees, 12.059 minutes East Longitude. The keying sequence would be as follows:

1. Press **WPT**. A destination waypoint appears. (More on the destination waypoint later.)

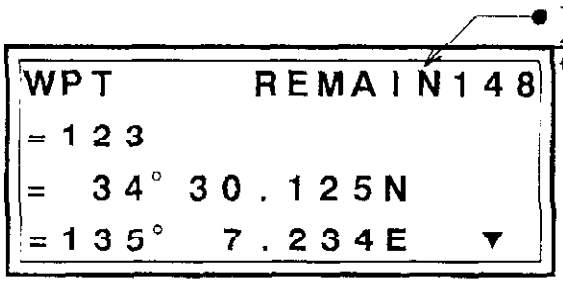


Figure 3-1 WPT display

2. Press **CLR**. The cursor is on the second line of the display. This is where you enter waypoint name. Using the example, enter K-O-B-E as follows.

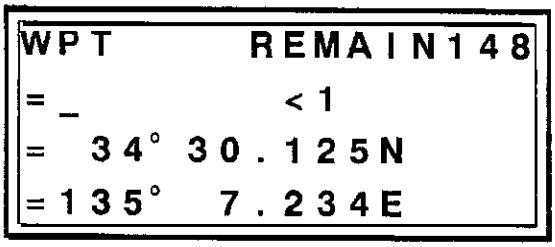


Figure 3-2 WPT display, ready for input of waypoint name

3. Press the **4** key.
4. Press the **Change** key twice to display K.
5. Press the **5** key.
6. Press the **Change** key three times to display O.
7. Press the **1** key.
8. Press the **Change** key twice to display B.
9. Press the **2** key.
10. Press the **Change** key twice to display E.
11. Press the **ENT** key. Any latitude and longitude data displayed disappears. The cursor advances to the third line of the display where you enter latitude.

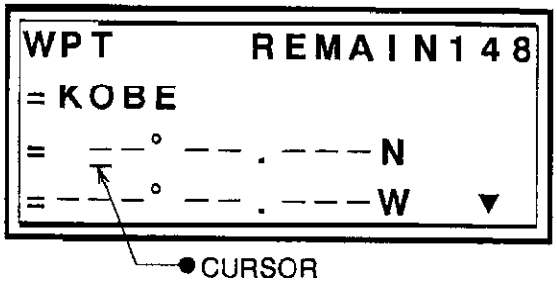


Figure 3-3 WPT display

12. Enter latitude (of Kobe, Japan). The keying sequence would be

[3] [4] [3] [9] [8] [3] [6]

■ **NOTE 1:** *The* **CLR** *key cancels wrong data.*

■ **NOTE 2:** *The* **Change** *key switches coordinate from North to South, East to West, or vice versa.*

13. Press the **ENT** key. The cursor advances to the fourth line of the display.

14. Enter longitude (of Kobe, Japan). The keying sequence would be

[1] [3] [5] [1] [2] [0] [5] [9] [Change]

15. Press the **ENT** key.

Then, the display shows

- the name of the waypoint, and
- the date and time the waypoint was registered.

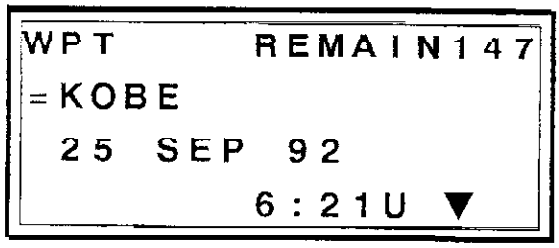


Figure 3-4 Appearance of WPT display after registering a waypoint

By present position

The procedure which follows shows you how to register a saved position as a waypoint, by entering waypoint name.

1. Press the **SAVE** key. The present position appears on the display.

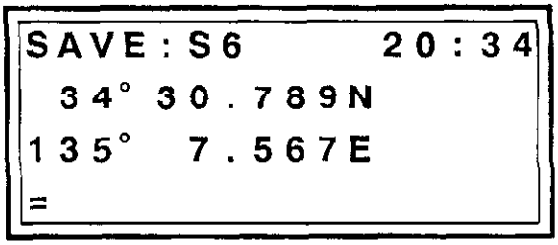


Figure 3-5 SAVE display

2. Press the **CLR** key. The cursor appears on the fourth line of the display.

3. Enter name desired;

   a) Press key having desired character.
   b) Press the **Change** key to display desired character.
   c) Repeat a) and b) to finish entering name.

   ■ **NOTE:** *To clear just entered wrong data press the* **CLR** *key. The cursor moves back one space.*

4. Press the **ENT** key.

By previously saved position

Follow the procedure below to register a waypoint by recalling a saved position (including automatically saved positions).

1 Press the **RECALL** key to display the position you want to register as a waypoint.

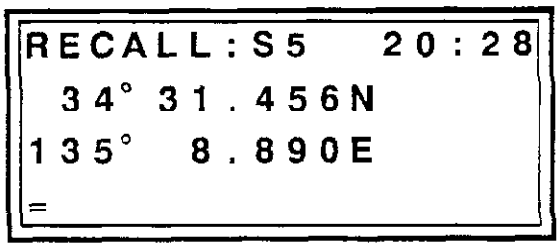


Figure 3-6 Typical RECALL display

2. Press the **CLR** key. The cursor appears on the fourth line of the display.

3. Enter name desired;

   a) Press key having desired character.
   b) Press the **Change** key to display desired character.
   c) Repeat a) and b) to finish entering name.

4. Press the **ENT** key.

Viewing the Waypoint List

The waypoint list stores the position information of waypoints. You may display the list by pressing the **WPT** key. The list can be scrolled by pressing the **Arrow** key. Waypoints are stored in numeric order followed by alphabet order. If you have many waypoints entered obviously it would take a long time to scroll the list to view a waypoint whose name begins with Z. By entering the first alphanumeric character of the waypoint name however you can view a desired waypoint much more quickly.

Displaying the waypoint list

The procedure which follows shows how to display both the waypoint list and waypoint desired.

1. Press the **WPT** key. The destination waypoint appears on the display.

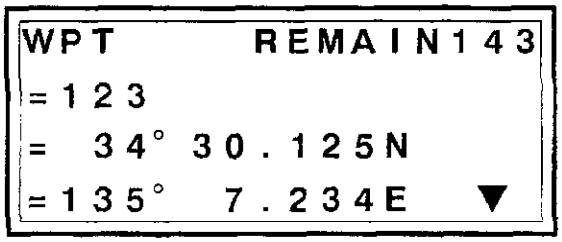


Figure 3-7 WPT display

2. Press the **CLR** key. The cursor appears.
3. Press the **Arrow** key. The waypoint which comes first in numeric then alphabet order appears to the right of the "<" mark.

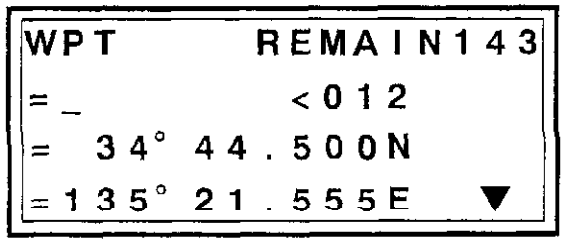


Figure 3-8 WPT display

4. Press the **Arrow** key to display the waypoint desired.

■ **SCROLLING THE LIST QUICKLY:** *To scroll the list more quickly, enter the first character of waypoint desired. For example, the waypoint name is FURUNO. Press the* **2** *key followed by the* **Change** *key three times to display F. Then, press the* **Arrow** *key to display FURUNO.*

Deleting Waypoints

The unit stores up to 150 waypoints. When the waypoint memory is full you cannot enter waypoints. In this case delete unnecessary waypoints to make room for new waypoints.

This procedure which follows shows you how to delete the waypoint "OSAKA".

1. Press the **WPT** key.
2. Press the **CLR** key.
3. Enter waypoint name you want to delete. To enter OSAKA, for example;

   a) Press the **5** key followed by the **Change** key three times to display O.
   b) Press **7** and **Change** to display S.
   c) Press **1** and **Change** to display A.
   d) Press the **4** key followed by the **Change** key twice to display K.
   e) Press the **1** key and **Change** to display A.

4. Press the **ENT** key. The waypoint name and its L/L coordinates appear on the display for your confirmation.

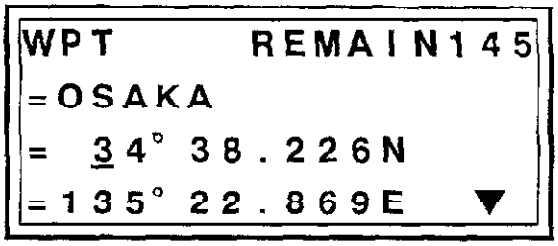


Figure 3-9 WPT display

5. Press the **CLR** key. The latitude figure disappears.

6. Press the **CLR** key again. The prompt DELETE? appears on the display.

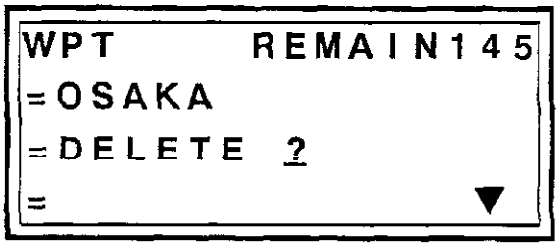


Figure 3-10 WPT display, showing DELETE prompt

7. Press the **ENT** key. The waypoint OSAKA is deleted. The next waypoint appears. If you take a look at the waypoints remaining indication on the first line you will notice that it is incremented by one.

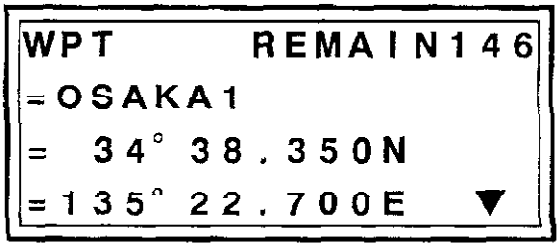


Figure 3-11 WPT display

Selecting a Destination Waypoint

A destination waypoint can be any waypoint you have previously registered. Using a destination waypoint you can find the following information from your present position to the destination waypoint:

- the range and bearing
- ideal course
- the estimated time of arrival
- the time-to-go to arrival, and
- cross track error.

The procedure which follows shows how to select waypoint KOBE as the destination waypoint.

1. Press the **GOTO** key.

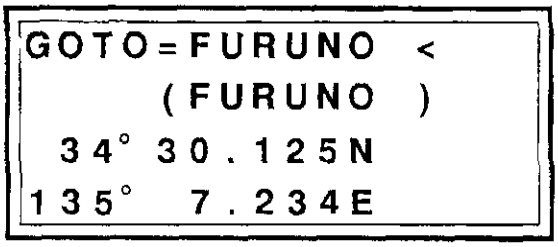


Figure 3-12 GOTO display

2. Press the **CLR** key.
3. Select waypoint. You can select it either manually, by entering the name yourself, or automatically. For automatic selection;
   - press numeral key which carries first character of waypoint name
   - press the **Change** key to display the first character, and
   - press the **Arrow** key to select waypoint.

   Using the waypoint KOBE as an example, press the **4** key followed by pressing the **Change** key twice to display K.

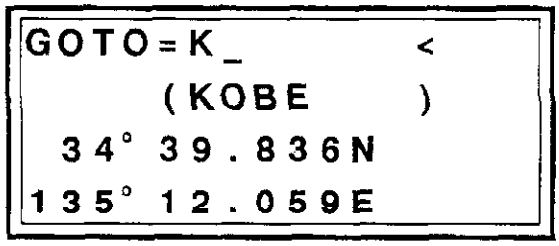


Figure 3-13 GOTO display, showing destination waypoint

4. Press the **Arrow** key to display waypoint desired (in the example, KOBE).
5. Press the **ENT** key.

Canceling the Destination Waypoint

Once you've arrived to your destination you probably won't need the destination waypoint. You can cancel it by following the procedure below.

1. Press the **GOTO** key.

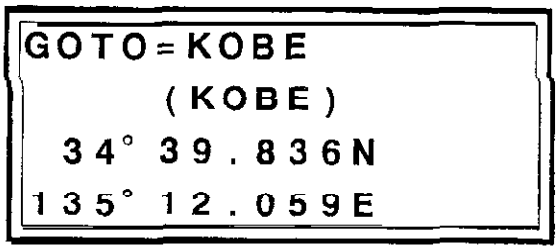


Figure 3-14 GOTO display

2. Press the **CLR** key. The destination waypoint name (on the first line) disappears.

3. Press the **CLR** key.

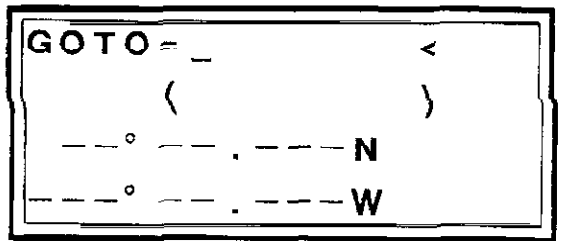


Figure 3-15 GOTO display appearance when deleting the destination waypoint

4. Press the **ENT** key.

Control is returned to previous display.

Destination Waypoint Information

The destination waypoint provides the following information:

- the range and the bearing from your ship to the destination waypoint
- ideal course to the destination waypoint
- cross track error to the destination waypoint
- velocity to the destination waypoint, and
- estimated time of arrival to the destination waypoint.

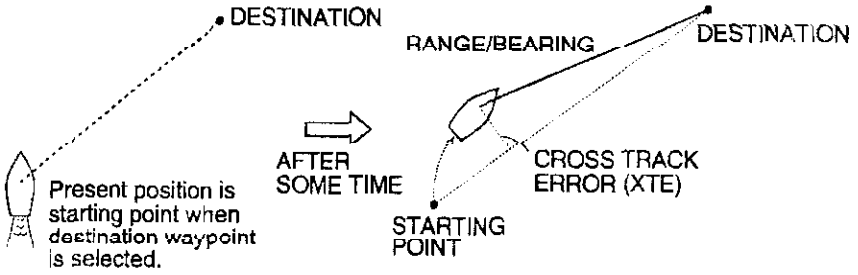


Figure 3-16 Graphic interpretation of information provided by the destination waypoint

Range and bearing

You can find the range and bearing from your vessel to the destination waypoint two ways: by the R/B key or NAV 1 display.

R/B key

Press the **R/B** key. If the destination waypoint selected is KOBE, for example, the display should look something like Figure 3-17.

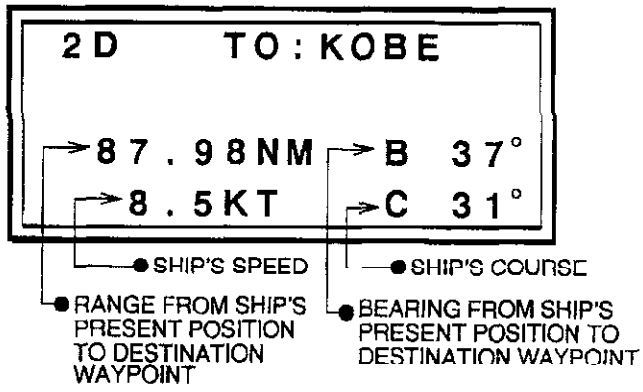


Figure 3-17 Range and bearing information display

■ **NOTE:** *If the point is on a route the route number appears on the second line. (More on route navigation in the next chapter.)*

NAV 1 display

In the default setting, range and bearing to a destination waypoint appears also on the NAV 1 display, which you can display by pressing the **NAV 1** key. In a later chapter you will learn how to preset the NAV 1 display, as well as the NAV 2 and NAV 3 displays, to your liking.

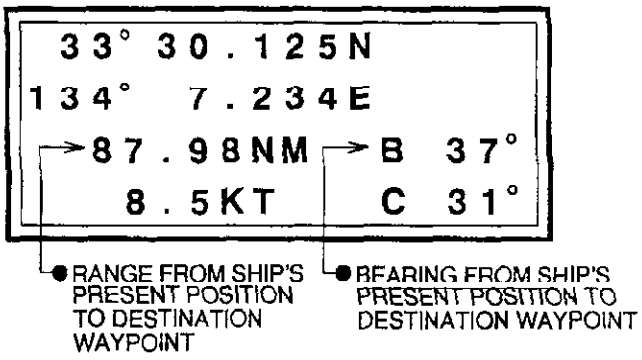


Figure 3-18 Typical NAV 1 display

Cross track error (XTE)

Wind, waves, currents, steering errors, vessel loading imbalance and other forces can combine to throw the vessel of its intended track.

The amount in nautical miles the vessel is straying from its intended course is called the cross track error or XTE. The GP-50 shows you how much your vessel is being thrown of its intended course.

Take a look at Figure 3-19. The perpendicular line for the intended track to the actual position of the vessel is the cross track error. In the figure, it is necessary to steer right to return to the intended track.

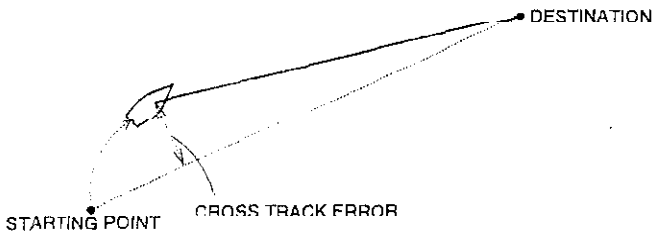


Figure 3-19 Graphic interpretation of cross track error

To find cross track error, press the **NAV 2** key. Figure 3-20 shows a typical cross track error display. On the top line of the display the amount of cross track error is shown by numeric figure and the direction of cross track error, as well as the

amount, by filled diamond marks. The double bar depicts intended track. Table 3-1 explains how to interpret the graphic cross track error display. The number and position of filled diamond marks show the range and direction of cross track error. In Figure 3-20 three filled diamond marks are to the left of double bar (intended track), so the vessel is off track to port side by 0.08 to 0.16 nautical miles. The numeric indication shows the cross track error to be 0.15 nautical miles.

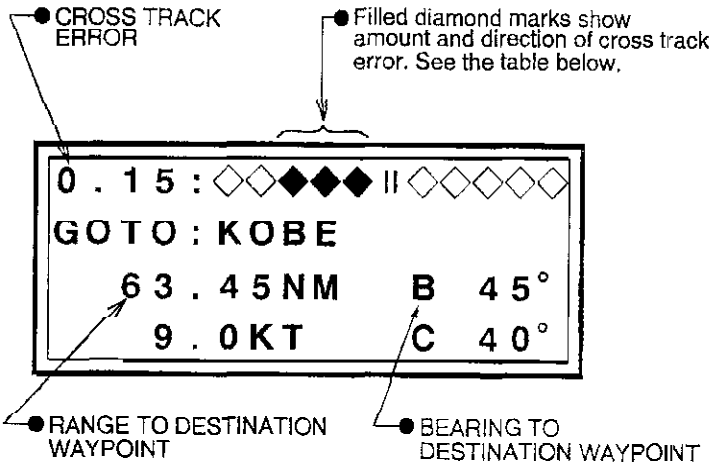


Figure 3-20 Typical cross track error display

Other information shown on the NAV 2 display includes

- name of destination waypoint (2nd line)
- range to destination waypoint (3rd line)
- bearing to destination waypoint (3rd line)
- ship's speed (4th line), and
- course (4th line).

Table 3-1 How to interpret the graphic cross track error display

Cross Track Error (XTE) *	Graphic Display
− 0.02 ≦ XTE ≦ 0.02	◆ ‖ ◆◇◇◇◇
0.02 < XTE ≦ 0.04	◇ ‖ ◆◇◇◇◇
0.04 < XTE ≦ 0.08	‖ ◆◆◇◇◇
0.08 < XTE ≦ 0.16	‖ ◆◆◆◇◇
0.16 < XTE ≦ 0.32	‖ ◆◆◆◆◇
0.32 < XTE ≦ 0.64	‖ ◆◆◆◆◆
0.64 < XTE ≦ 1.28	‖ ◇◆◆◆◆
1.28 < XTE ≦ 2.56	‖ ◇◇◆◆◆
2.56 < XTE ≦ 5.12	‖ ◇◇◇◆◆
5.12 < XTE	‖ ◇◇◇◇◆

* Range unit according to selection

VTD, TTG and ETA

VTD, TTG and ETA appear on the NAV 3 display. Press the **NAV 3** key to display this information.

VTD (Velocity to Destination)

Velocity to destination is the amount of velocity (speed) in the direction of the desired destination.

TTG (Time-To-Go)

This is the estimated time remaining to reach a waypoint, maintaining current speed and course.

ETA (Estimated Time of Arrival)

This is the estimated time you will arrive to a waypoint using current speed and course.

Figure 3-21 shows a typical NAV 3 display and an illustration which explains its indications.

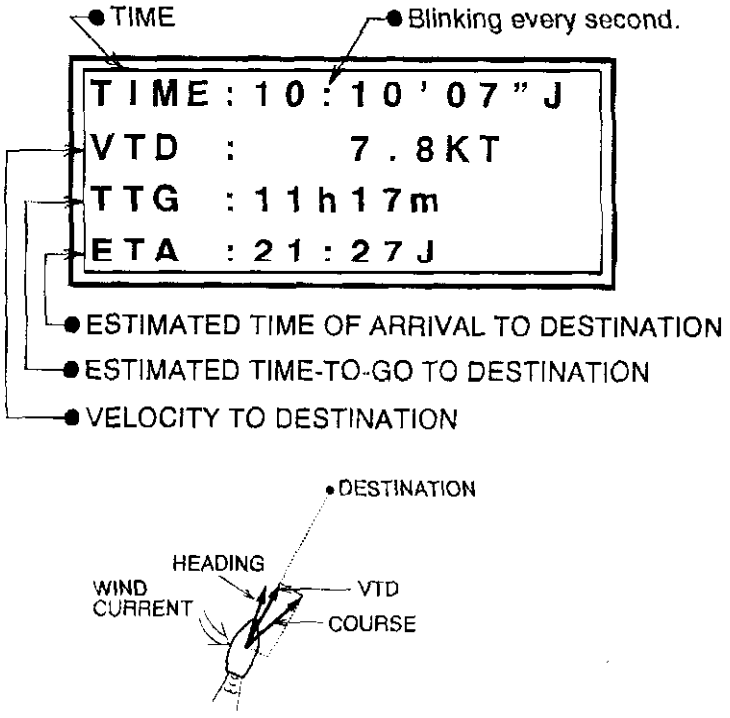


Figure 3-21 Typical NAV 3 display and graphic interpretation of VTD

ROUTE NAVIGATION

In many cases 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-50 can automatically advance to the next waypoint on a route, so you do not have to change the destination waypoint repeatedly.

■ **CAUTION:** *The route planning function is a very useful and beneficial function to have available. However, the ability to switch waypoints automatically during a voyage can lead to some very dangerous situations. The use of any navigational aid requires constant exercise of common sense and caution. FURUNO Electric Company will assume no responsibility for any damages associated with use of the route navigation function.*

Creating a Route

You can store up to 10 routes. The unit numbers them 0 to 9. Each route may consist of up to 10 waypoints.

■ **CAUTION:** *Be sure to record all important routes in a separate log. This unit is not a fail-safe record keeping device.*

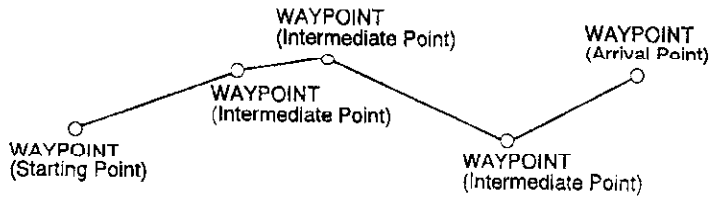


Figure 4-1 Sample route

Registering a route

The procedure which follows describes how to create a route from two waypoints in Japan, Kobe and Osaka, using the information tabulated in Table 4-1.

Table 4-1 Points on sample route

	Route Content	Waypoint Name
Route No. 1	Starting point	KOBE
	1st Intermediate point	1
	2nd Intermediate point	6
	3rd Intermediate point	12
	Arrival point	OSAKA

1. Press **MENU** to display the menu.

```
1 : ROUTE   5 : DIMMER
2 : CALC    6 :
3 : ALARM   7 : SETUP
4 : SAT       MENU=_
```

Figure 4-2 Menu

2. Press the **1** key to select ROUTE.

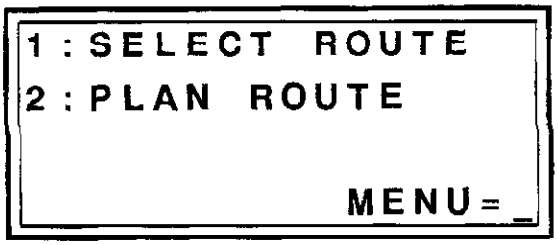


Figure 4-3 ROUTE menu

3. Press the **2** key to select PLAN ROUTE.

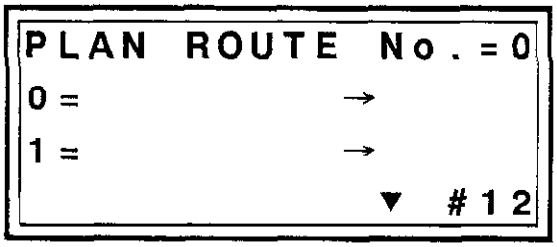


Figure 4-4 PLAN ROUTE display

4. Press the **CLR** key. The cursor appears on the first line of the display.

5. Enter route number. Using the example, press the **1** key to select route no. 1.

6. Press the **ENT** key. The cursor moves to the second line.

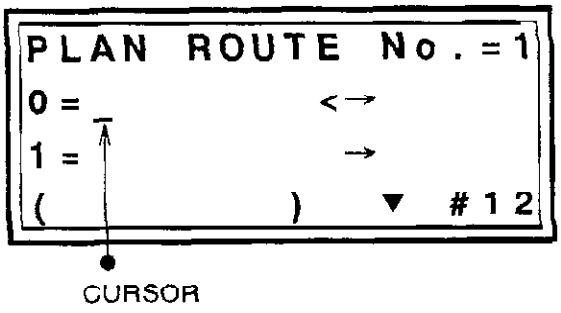


Figure 4-5 PLAN ROUTE display

7. Enter starting point. (In the example, KOBE.)

   a) Press **4** followed by pressing **Change** twice to display K.
   b) Press **5** followed by pressing **Change** three times to display O.
   c) Press **1** followed by pressing **Change** twice to display B.
   d) Press **2** followed by pressing **Change** twice to display E.

8. Press the **ENT** key.

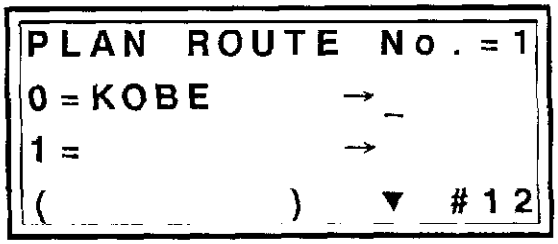


Figure 4-6 PLAN ROUTE display

9. Press the **ENT** key to advance the cursor to the third line.

10. Press the **1** key to register waypoint 1 as 1st intermediate waypoint.

11. Press the **ENT** key twice.

12. Press the **6** key to register waypoint 6 as 2nd intermediate waypoint.

13. Press the **ENT** key twice.

14. Press keys **1** and **2** in order to register waypoint 12 as 3rd intermediate point.

15. Press the **ENT** key twice.

16. Enter arrival point. (In the example, OSAKA.)

   a) Press **5** followed by pressing **Change** three times to display O.
   b) Press **7** followed by **Change** to display S.
   c) Press **1** followed by **Change** to display A.
   d) Press **4** followed by pressing **Change** twice to display K.
   e) Press **1** followed by **Change** to display A.

17. Press the **ENT** key several times until next display appears.

    Then, the display shows route number and total distance in the route.

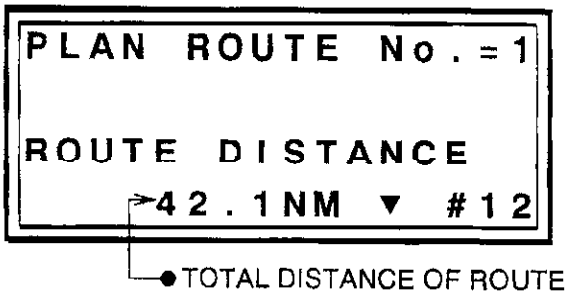


Figure 4-7 PLAN ROUTE display, showing total distance in a route

18. You can confirm route contents (waypoint names) by pressing the **Arrow** key.

To enter another route, repeat steps 4 through 17.

Changing a Route

Temporarily de-selecting a point

You can temporarily deselect an unnecessary point on route. Using the route created in Figure 4-1 as an example, deselect the 2nd intermediate point (waypoint 6).

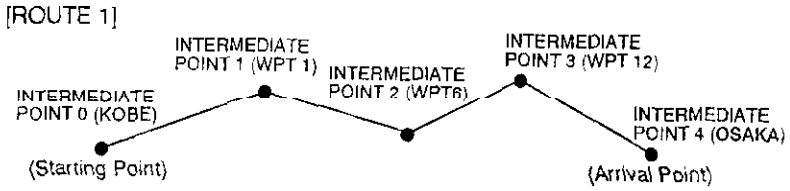


Figure 4-8 Sample route

If you reconstruct the route without the 2nd intermediate point it would look like Figure 4-9.

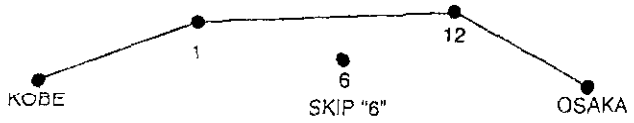


Figure 4-9 Sample route in Figure 4-8 reconstructed without 2nd intermediate point

1. Press **MENU**, **1** and **2** to select PLAN ROUTE.
2. Press **CLR**, **1** and **ENT** to designate route no. 1.
3. Press the **ENT** key five times to display the 2nd intermediate point.

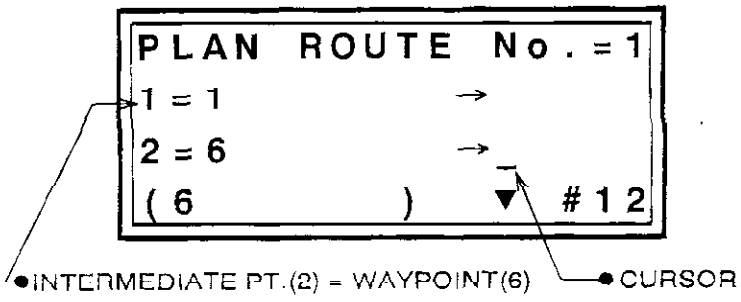


Figure 4-10 PLAN ROUTE display

4. Press the **Change** key. SKIP appears on the display. SKIP means the point is temporarily deselected from the route.

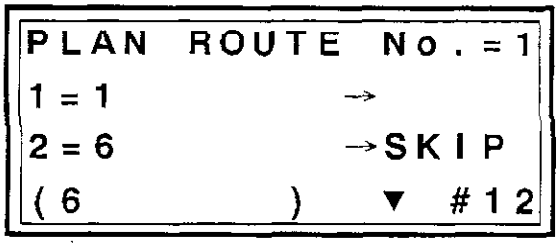


Figure 4-11 PLAN ROUTE display, showing a deselected route point

5. Press the **ENT** key. To temporarily deselect another point on the route, display the point you want to deselect, and then press the **Change** key followed by the **ENT** key.

Restoring a point to a route

When you want to restore a point to a route, do steps 1 through 3 in "Temporarily deselecting a point", and then press the **Change** key to erase SKIP, and then press the **ENT** key.

Permanently deleting a point

To permanently delete a point on a route;

1. Press **MENU**, **1** and **2** to select PLAN ROUTE.
2. Press the **CLR** key.
3. Enter route number.
4. Press the **ENT** key several times to display the point you want to delete. For example, you want to delete the 3rd intermediate point (waypoint 12) on route no. 1.

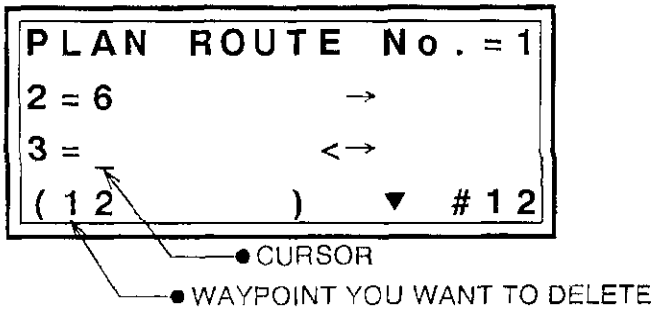


Figure 4-12 PLAN ROUTE display, showing a deselected route point

5. Press the **CLR** key. The third line displays "DELETE?".
6. Press the **ENT** key.

Replacing a point

To replace a point;

1. Press **MENU**, **1** and **2** to select PLAN ROUTE.
2. Press the **CLR** key.
3. Enter route number.
4. Press the **ENT** key. The cursor appears under "0=".
5. Press the **ENT** key several times to place the cursor underneath the point you want to replace.
6. Enter new waypoint.
7. Press the **ENT** key.

Deleting route contents

There are two ways to delete the contents of a route:

- delete points on the route one by one, or
- overwrite waypoints on the route.

■ **NOTE:** *Route number cannot be deleted.*

Following a Route

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

Selecting a route for navigation

The procedure which follows shows how to follow the route shown in Figure 4-13.

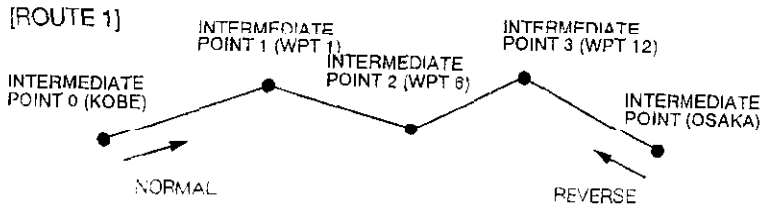


Figure 4-13 Sample route

1. Press **MENU**, **1** and **1** to display the SELECT ROUTE display.

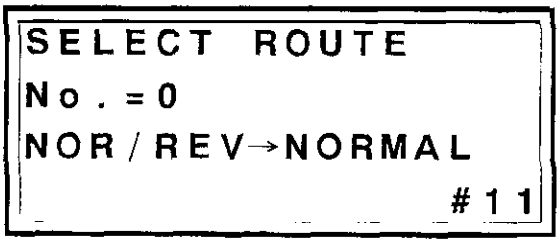


Figure 4-14 SELECT ROUTE display

2. Press the **CLR** key to advance the cursor to the second line.
3. Press the **1** key to select route no. 1.
4. Press the **ENT** key. The buzzer sounds three times to inform you the unit is going to follow a route.
5. If you want to change the direction of route points, normal (forward) or reverse, press the **change** key followed by the **ENT** key.

Route navigation information

The first thing to do after selecting a route for navigation is to steer the vessel in the direction of the starting point. Once the vessel is heading toward the starting point, the GP-50 shows various navigation information.

Range and bearing to intermediate point

Press the **R/B** key. The display shows the following information:

- route number
- waypoint name of next intermediate point
- range and bearing from present position to next intermediate point
- ship's speed, and
- ship's course.

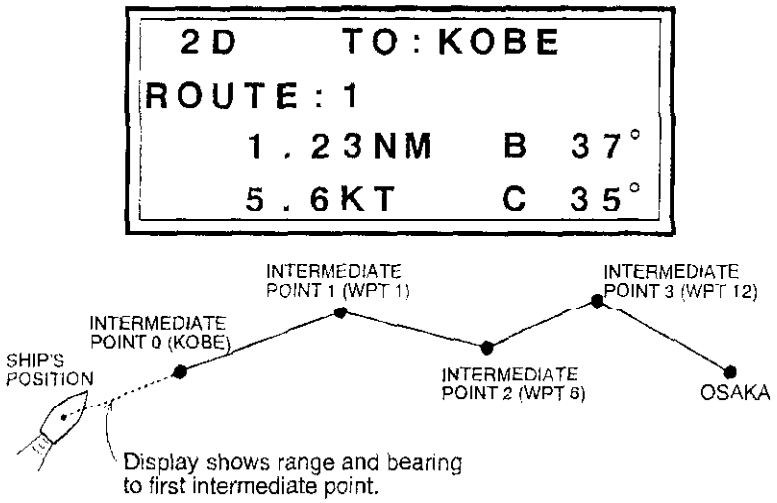


Figure 4-15 Typical R/B display and graphic interpretation of its indications

When the vessel reaches an intermediate point

When the vessel reaches an intermediate point the unit automatically switches to the next intermediate point and shows the range and bearing to that point.

The GP-50 confirms arrival at an intermediate point by using one of the following:

- the arrival range setting (factory setting: 0.5 nautical miles), or
- when the vessel crosses a perpendicular line intersecting intermediate points.

Figure 4-16 illustrates the methods of waypoint switching.

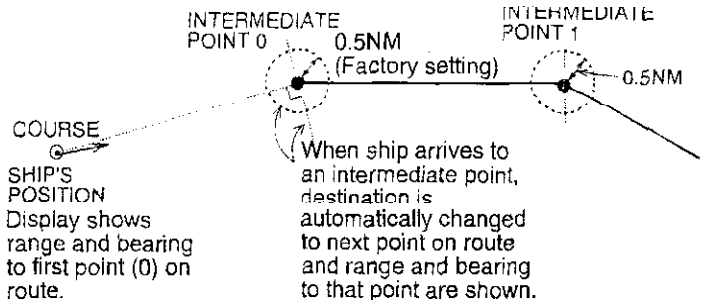
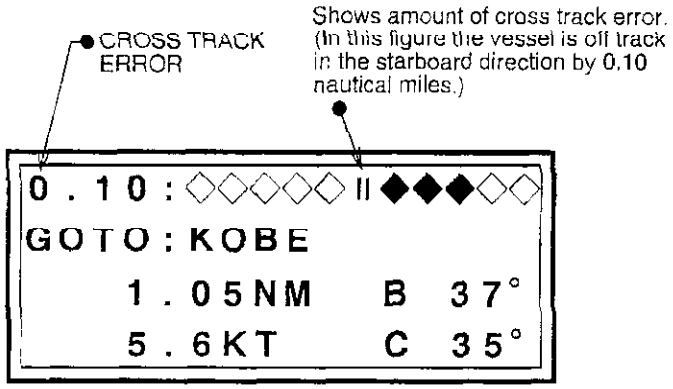


Figure 4-16 How the GP-50 determines arrival at an intermediate point

■ **NOTE:** *You can change the arrival alarm range on the Alarm menu. More on the alarms in a later chapter.*

Cross track error (XTE)

As noted earlier, the cross track error is the amount in nautical miles the vessel is straying from its intended course. Press the **NAV 2** key to display the cross track error display.



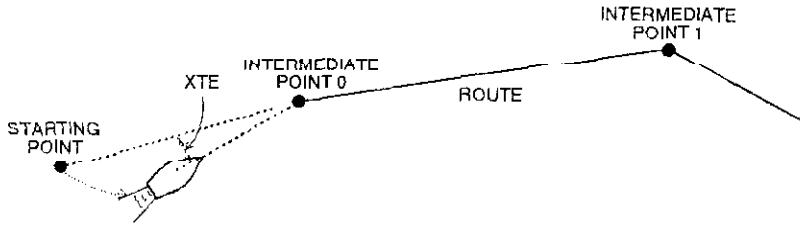


Figure 4-17 Typical cross track error display

Canceling Route Navigation

You can cancel route navigation by

- pressing the **GOTO** key and selecting a destination waypoint, or
- Press **GOTO**, **CLR** twice, and **ENT** to delete destination waypoint.

MISCELLANEOUS FUNCTIONS

This chapter covers miscellaneous functions. These are

- calculating range and bearing between two points
- calculating Time-To-Go (TTG) between two waypoints
- displaying and resetting distance run
- correcting chart system and position
- displaying magnetic bearing
- changing units of measurement
- presetting the NAV displays
- presetting smoothing
- the single menu mode, and
- presetting position fixing mode and elevation mask angle.

Calculating Range and Bearing Between Two Points

You can calculate the range and bearing between two waypoints or your vessel and a waypoint. The procedure which follows shows how to calculate the range and bearing between waypoints KOBE and OSAKA.

1. Press **MENU**, **2** and **1** to select display the CALCULATE R/B display.

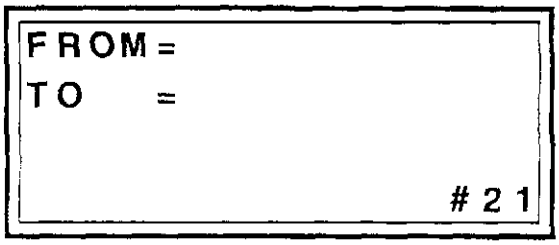


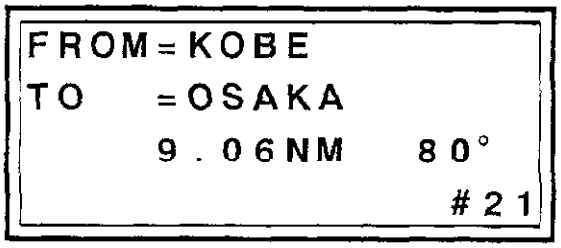
Figure 5-1 CALCULATE R/B display, default display

2. Press the **CLR** key. The cursor appears on the first line.

3. Select the starting point. If the starting point is your vessel, simply press **ENT**. Asterisks appear on the first line.
   In the example the starting point is KOBE. You would

   a) Press the **4** key.
   b) Press the **Change** key twice to display K.
   c) Press the **Arrow** key to display KOBE.
   d) Press the **ENT** key.

4. Enter the end point. In the example the end point is OSAKA. Select it and then press the **ENT** key. The range and bearing are shown on the display.



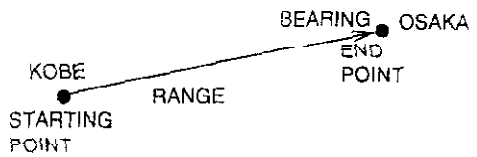


Figure 5-2 Typical range and bearing calculation

Time-To-Go (TTG) Between Two Waypoints

The GP-50 can estimate time required to go from one waypoint to another using ship's present speed. In addition it shows you estimated time of arrival. The procedure which follows shows how to calculate TTG from KOBE to OSAKA by ship's speed of 5.5 knots.

1. Press the **MENU** key, and then press the **2** key twice to display the MANUAL TTG display.

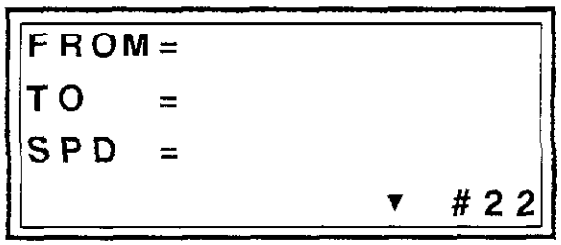


Figure 5-3 MANUAL TTG display, default display

2. Press the **CLR** key.
3. Enter the starting point. In the example it is KOBE.
4. Press the **ENT** key.
5. Enter the end point. In the example it is OSAKA.
6. Press the **ENT** key.
7. Enter ship's speed. In the example you would enter 5.5 knots as follows:

   0 **0** **5** **5**

(Continued)

8. Press the **ENT** key. Figure 5-4 shows what the display might look like using waypoints KOBE and OSAKA as the TO and FROM waypoints.

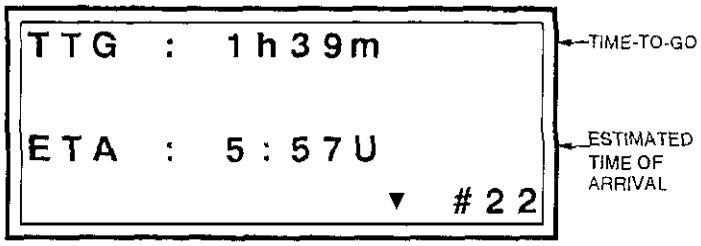


Figure 5-4 Typical TTG display

The arrow symbol on the display means you can alternate display of TTG and the FROM and TO waypoints (used for TTG calculation) by pressing the **Arrow** key.

■ **NOTE:** *ETA is the time from present position to a destination waypoint.*

Displaying Distance Run

1. Press **MENU**, **3** and **4** to display the TRIP ALARM display.

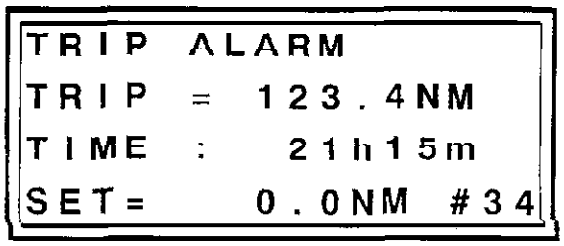


Figure 5-5 TRIP ALARM display

The total distance run and total time run appear on the second and third lines of the display. If you want to reset distance run and time display to zero proceed to step 2.

2. Press the **CLR** key.
3. Press the **CLR** key again.
4. Press the **ENT** key. The TRIP and TIME figures are now zero.

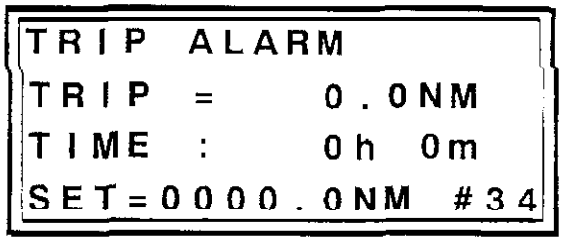


Figure 5-6 TRIP ALARM display, TRIP and TIME reset to zero

Chart System and Position

A nautical chart is usually made by either trigonometrical survey or astronomical survey and according to the geodetic chart standards of the country it is used in. For example, the USA uses the system called **NAD-83**; and Japan, **TOKYO**. Accordingly when you are getting position fixes by GPS in the USA, the system should be NAD-83 so you don't get a position fix which shows you're somewhere offshore when you're actually moored to a dock.

Standard GPS chart system

While the use of one category of chart systems is fine if you don't do transoceanic voyages, ocean-going vessels may require all categories to get reliable position information. To solve this inconvenience, a standard chart system was adopted by GPS: the WGS-84.

Chart systems stored in the GP-50

Although the WGS-84 system is now widely used other categories of charts still exist. Thus it is necessary to apply a correction value to the WGS-84 to match it to local geodetic systems.

This unit can perform this calculation automatically if you tell it what type of chart you're using. The GP-50 recognizes eight major charts. Select the chart system used, not the area where the boat is sailing. Below are the chart systems the GP-50 recognizes.

- WGS-84
- WGS-72
- Tokyo
- NAD-27
- European
- Australian
- New Zealand
- Great Britain

If the chart you are using is not programmed in this unit, you will have to enter latitude and longitude correction values manually. You will learn how to do this a little later.

Selecting chart system

To select chart system;

1. Press **MENU**, **7**, **2** and **1** to display the GEODETIC DATUM display.

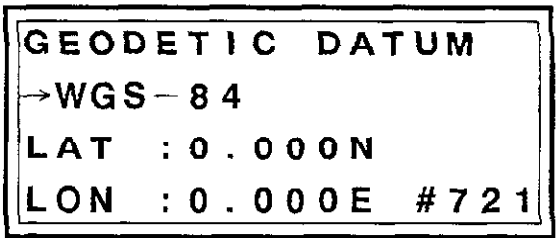


Figure 5-7 GEODETIC DATUM display

2. Press the **CLR** key.
3. Press the **Change** key several times to display chart system you are using.
4. Press the **ENT** key. The chart selected and latitude and longitude correction values appear on the display. If you selected the European chart system, for example, the display would look something like Figure 5-8.

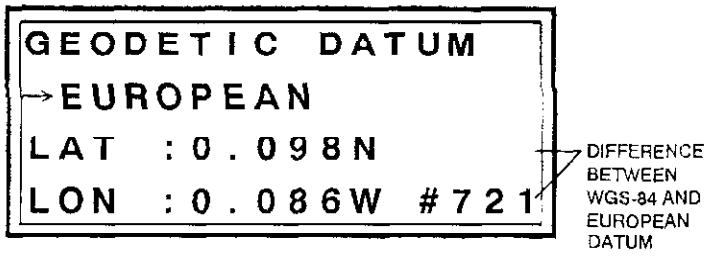


Figure 5-8 GEODETIC DATUM display, European chart selected

Entering chart correction value

If the chart you are using is not one of the eight charts preprogrammed in the GP-50, you will need to enter a latitude and longitude correction value.

Figure 5-9a shows the position measured by the GP-50 to be off by some degrees. To correct this error, mark your position measured by the GP-50 on your chart. Measure the difference between the actual position and GPS fix position on your chart.

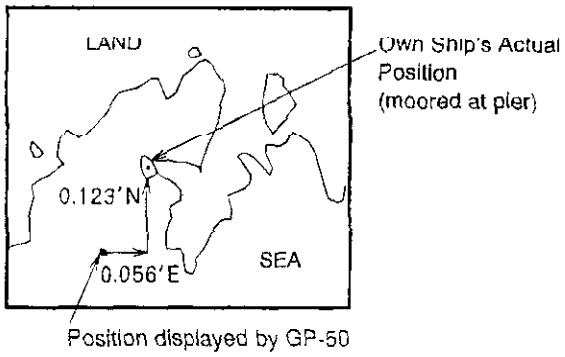


Figure 5-9a Nautical chart, showing error of 0.123 minutes North Latitude, and 0.056 minutes East Longitude

To enter correction value of 0.123 minutes North Latitude, 0.056 minutes East Longitude;

1. Press **MENU**, **7** and **2** twice to display the Δ L/L display.

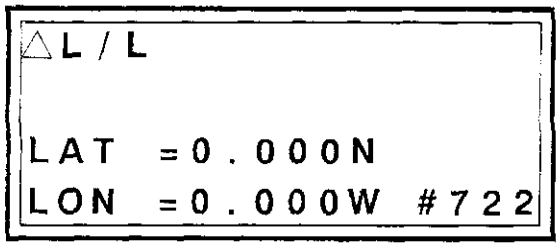


Figure 5-9b Δ L/L display

2. Press the **CLR** key.
3. Enter latitude correction value. Using the example of 0.123 minutes, press keys **0**, **1**, **2** and **3**.
4. Press the **ENT** key.
5. Enter longitude correction value. Using the example of 0.056 minutes, press keys **0**, **0**, **5**, **6**, and then press the **Change** key.
6. Press the **ENT** key.
   Then the GP-50 displays your correct position.

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. The difference is called magnetic variation, and varies with respect to the observation point on the earth. The GP-50 is programmed with the earth's magnetic variations. You can enter magnetic variation yourself or let the GP-50 do it for you.

Automatic

To get automatic magnetic variation;

1. Press **MENU**, **7**, **2** and **3** to display the MAGNETIC VAR(iation) display.

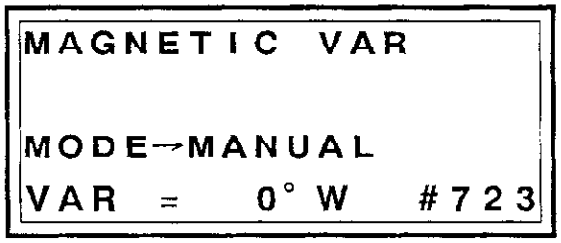


Figure 5-10 MAGNETIC VAR display

2. Press the **CLR** key.
3. Press the **Change** key to display AUTO.
4. Press the **ENT** key. The display should look something like Figure 5-11.

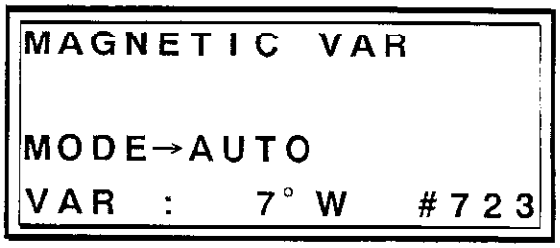


Figure 5-11 Sample Auto MAGNETIC VAR display

Manual

To manually enter magnetic variation;

1. Press **MENU**, **7**, **2** and **3** to display the MAGNETIC VAR display.

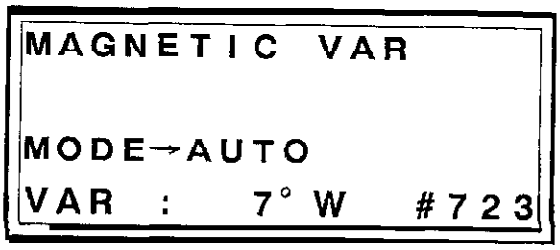


Figure 5-12 MAGNETIC VAR display

2. Press the **CLR** key.
3. Press the **Change** key to display MANUAL.
4. Consult a nautical chart and enter magnetic variation for your sea area.

   ■ **NOTE:** *For true bearing, enter 0 (degree).*

5. Press the **ENT** key.

■ **NOTE:** *Be sure to change the setting when the magnetic variation changes. Be sure to consult a recent nautical chart.*

Changing Unit of Measurement

The unit of measurement for speed, range and sensor unit height may be freely changed to suit your needs. Units of measurement are available as follows:

- Speed: knot (KT), kilometers/hour (Km/h), or miles per hour (MPH)
- Range: nautical miles (NM), kilometers (Km), or statute miles (SM)
- Height: meters (m) or feet (ft)

Follow the procedure below to change unit of measurement.

1. Press **MENU**, **7**, **2** and **5** to display the UNITS display.

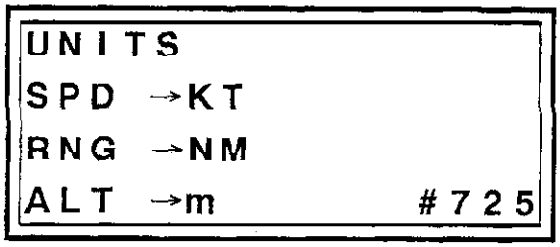


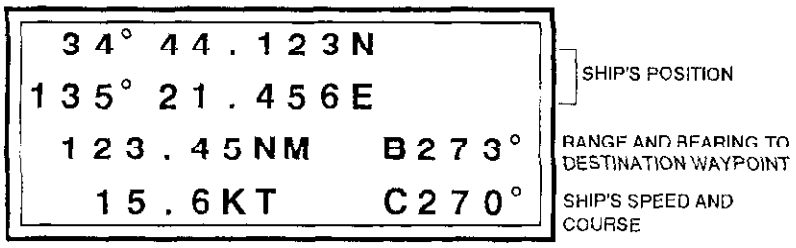
Figure 5-13 UNITS display

2. Press the **CLR** key.
3. Press the **Change** key to select desired speed indication; KT, Km/H or MPH.
4. Press the **ENT** key.
5. Press the **Change** key several times to select desired speed range indication; NM, Km or SM.
6. Press the **ENT** key.
7. Press the **Change** key several times to select desired (sensor unit) height indication; m or ft.
8. Press the **ENT** key.

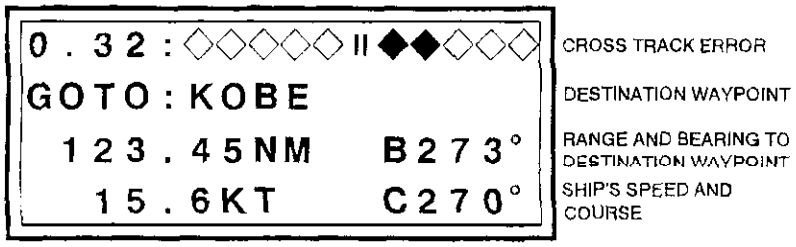
Presetting the NAV Displays

The three NAV keys on the top row of the keyboard display navigation information when pressed. The user may select what information he or she wants to display on those displays. Six different displays are available. NAV displays #1, #2 and #3 are the factory settings for the keys **NAV 1, NAV 2** and **NAV 3**.

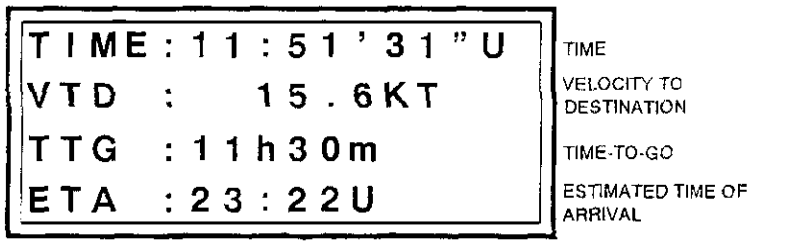
NAV DISPLAY #1



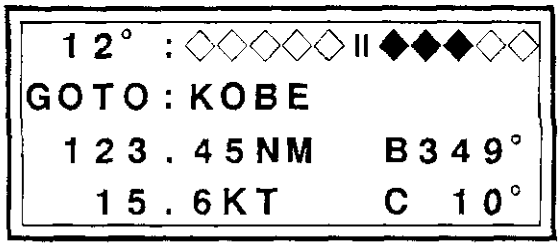
NAV DISPLAY #2

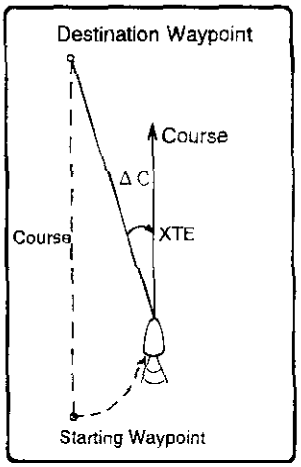


NAV DISPLAY #3



NAV DISPLAY #4

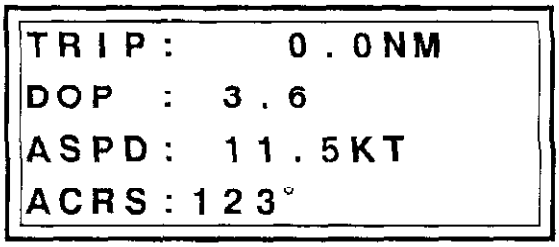




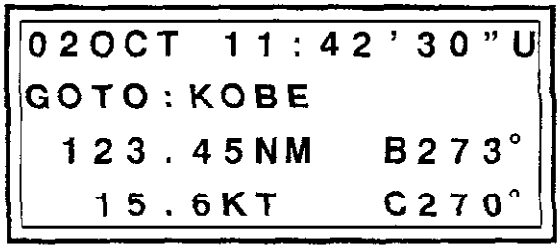
COURSE ERROR DISPLAY

XTE (Δ C)	Display
-1°~1°	◆II◆◇◇◇◇
2°~4°	◇II◆◇◇◇◇
5°~8°	II◆◆◇◇◇
9°~13°	II◆◆◆◇◇
14°~19°	II◆◆◆◆◇
20°~26°	II◆◆◆◆◆
27°~34°	II◇◆◆◆◆
35°~43°	II◇◇◆◆◆
44°~53°	II◇◇◇◆◆
54°~180°	II◇◇◇◇◆

NAV DISPLAY #5



NAV DISPLAY #6



How to preset the NAV displays

To preset the NAV displays;

1. Press **MENU**, **7**, **2** and **7** to display the NAV SELECT display.

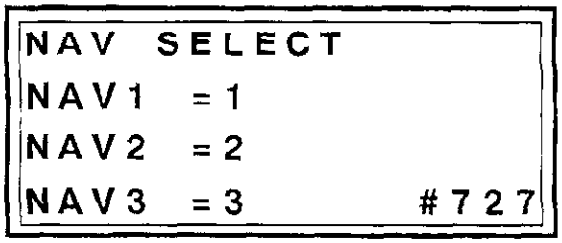


Figure 5-14 NAV SELECT display

2. Press the **CLR** key.
3. Press a numeral key among 1 to 6 to preset what navigation display to display on NAV 1, and then press the **ENT** key.
4. Enter navigation display number desired for NAV 2, and then press the **ENT** key.
5. Enter navigation display number desired for NAV 3, and then press the **ENT** key.

Smoothing

Latitude and longitude

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 phenomenon is especially noticeable at high ship's speeds. "0" is the normal setting; increase the setting if the GPS fix changes greatly.

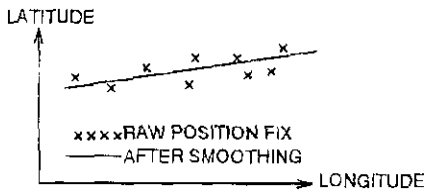


Figure 5-15 Latitude and longitude smoothing

Speed and course

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 setting the more smoothed the raw data. If the setting is too high, however, the response to speed and course changes slows. For no smoothing, enter "0". Setting "5" is suitable for most conditions.

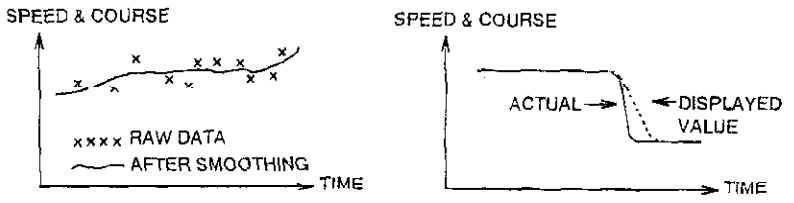


Figure 5-16 Speed and course smoothing

Setting smoothing values

The factory settings for smoothing are more than adequate for most conditions. If adjustment of the factory-set smoothing values is necessary;

1. Press **MENU**, **7**, **2** and **4** to display the SMOOTHING CONST display.

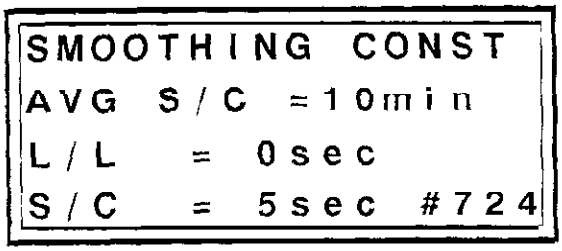


Figure 5-17 SMOOTHING CONST display

2. Press the **CLR** key.
3. Enter average ship's speed and course smoothing time from 0–99 minutes, using two digits.
   These values affect the average speed/course and TTG/ETA as shown in page 5-13 and page 3-16, respectively.
4. Press the **ENT** key.
5. Enter latitude and longitude smoothing time from 0–99 seconds, using two digits.
6. Press the **ENT** key.
7. Enter ship's speed and course smoothing time from 0–99 seconds, using two digits.
8. Press the **ENT** key.

Single Menu Mode

The menu contains mostly less-often used functions which once preset do not require frequent readjustment. If you normally do not require the use of the entire menu you can display only a frequently used menu when pressing the **MENU** key. This is called the single menu mode, and eliminates the need to press several numeral keys to get to the display desired.

Turning on the single menu mode

While pressing and holding down the **MENU** key turn on the power. Then, each press of the **MENU** key will display only one menu. The unit is set at the factory to display the DIMMER menu.

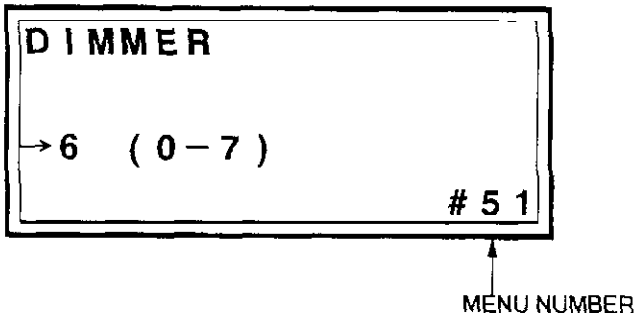


Figure 5-18 DIMMER display

Returning to full menu mode

Turn off the power. While pressing and holding down the **MENU** key turn on the power.

Changing single menu mode display screen

As noted earlier the GP-50 is set at the factory to display the DIMMER menu when in the single menu mode. If you require a different menu;

1. In the full menu mode, press **MENU**, 7, **1** and **6** to display the SINGLE MENU display.

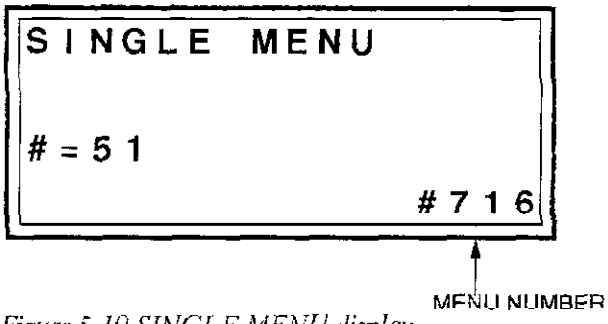


Figure 5-19 SINGLE MENU display

2. Press the **CLR** key.
3. Enter menu number desired. The menu number corresponds to numeral keys pressed after pressing the **MENU** key. For example, to display the DIMMER display you press keys **5** and **1**. Refer to Table 5-1 to find menu number.
4. Press the **ENT** key.

Table 5-1 Menu number and function

Menu No.	Menu Name	Function
11	SELECT ROUTE	Select route
12	PLAN ROUTE	Plan route; display total distance run
21	CALCULATE R/B	Calculate range and bearing between two waypoints
22	MANUAL TTG	Calculate time-to-go to destination
31	ARRIVAL/ANCHOR	Turn on or off arrival/anchor watch alarm
32	XTE/BORDER	Turn on or off cross track error/border alarm
33	SPEED	Turn on or off ship's speed alarm
34	TRIP	Turn on or off trip distance alarm
41	LEVEL	Display satellite signal level
42	ELV	Display DOP, satellite elevation angle
43	HEALTH	Display healthy and unhealthy satellites, receiver frequency deviation
44	FUTURE	Display position fixing schedule
45	ALMNAC	Display receiving time of almanac
51	DIMMER	Adjust LCD backlighting
52	CONTRAST	Adjust LCD contrast

Setting Position Fixing Mode and Elevation Mask

Position fixing mode

The position fixing mode determines the number of satellites necessary in line-of-sight to get a position fix. Table 5-2 shows the position fixing modes available.

Table 5-2 Position fixing modes

Position Fixing Mode	Application
2D (two-dimensional position fix)	Marine vessels; three satellites needed to fix position.
3D (three-dimensional position fix)	Land vehicles and aircraft; four satellites needed to fix position.
2D/3D	Automatic switching from 2D to 3D and vice versa according to how many satellites in line-of-sight.

Elevation mask angle

Elevation mask angle sets the minimum angle a satellite must be positioned above the horizon for the GP-50 to use it to fix its position. The factory setting is five degrees. This means the GP-50 will not use a satellite whose elevation angle above the horizon is less than five degrees.

■ **NOTE:** *Setting the elevation angle to more than 10 degrees greatly shortens available GPS position fixing time.*

Procedure

The factory settings for both position fixing mode and elevation mask angle are suitable for most conditions. If adjustment is absolutely necessary;

1. Press **MENU**, **7**, **1** and **3** to display the POSITIONING MODE display.

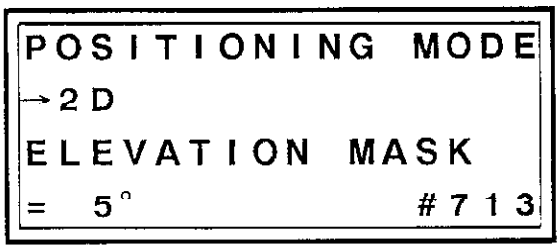


Figure 5-20 POSITIONING MODE display

2. Press the **CLR** key.

3. Press the **Change** key to select 2D, 3D or 2/3D.
4. Press the **ENT** key.
5. Enter elevation angle. The minimum angle is five degrees. A value lower than five degrees cannot be entered.
6. Press the **ENT** key.

ALARMS

This chapter provides the information necessary for setting the alarms. There are six conditions which can generate both audible and visual alarms in the GP-50:

- Arrival alarm
- Anchor watch alarm
- Cross track error (XTE) alarm
- Border alarm
- Ship's speed alarm, and
- Trip alarm.

■ **CAUTION:** *The alarms are useful for alerting you to possibly dangerous situations. However, the captain is always responsible for the safe operation of his ship. FURUNO Electric Company will assume no responsibility for any damages associated with the use of the alarms.*

Alarm Description

This section describes the function of each alarm and what occurs when an alarm setting is violated.

Arrival alarm

The arrival alarm warns you that your vessel is approaching a destination waypoint. The area that defines an arrival zone is that of a circle which you approach from outside the circle. The alarm will be released if the boat enters the circle.

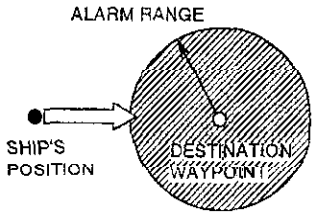


Figure 6-1 How the arrival alarm works

Anchor watch alarm

The anchor watch alarm sounds to warn you that your vessel has moved outside the anchor watch zone.

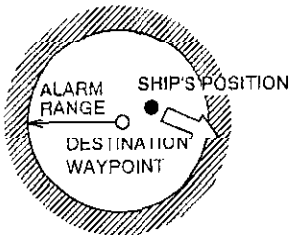


Figure 6-2 How the anchor watch alarm works

Cross track error (XTE) alarm

The cross track error alarm alerts you when your vessel is off its intended course. You may preset the alarm limit from 0.01 nautical miles to a maximum lane width of 99.99 nautical miles. The alarm will be released if you go out of the lane limits.

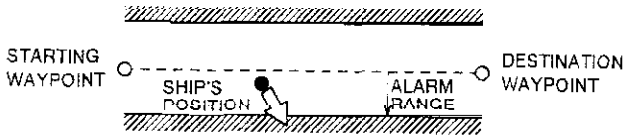


Figure 6-3 How the cross track error alarm works

Border alarm

The border alarm defines an area, comprised of two waypoints, starting waypoint and destination waypoint, which you do not want to cross. The alarm will sound when the boat crosses the area defined by the two waypoints.

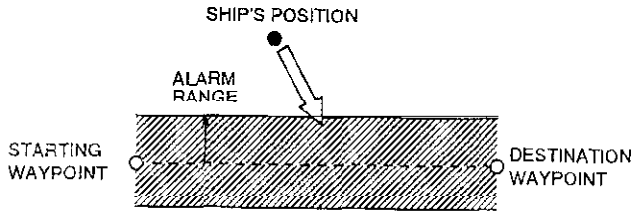


Figure 6-4 How the border alarm works

Ship's speed alarm

The ship's speed alarm sounds when the ship's speed is higher or lower than the preset speed alarm setting.

Trip alarm

The trip alarm sounds when the trip distance exceeds the trip alarm setting.

Silencing the audible alarm

Press the **CLR** key. Note that a visual alarm remains on the display until the reason for the alarm is removed.

Arrival and Anchor Watch Alarms

The arrival and anchor watch alarms cannot be set together. Choose one of them on the ARRIVAL/ANCHOR menu.

Arrival alarm

The arrival alarm alerts you when the vessel arrives at an intermediate waypoint or a destination.

1. Press **MENU** and **3** to display the alarm menu.

Figure 6-5 Alarm menu

2. Press the **1** key to display the ARRIVAL/ANCHOR display.

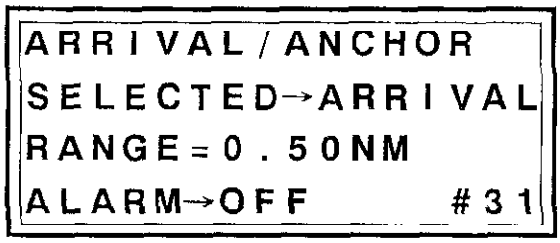


Figure 6-6 ARRIVAL/ANCHOR display

Figure 6-6 shows the factory-set arrival alarm settings: alarm range, 0.5 nautical miles, alarm off.

Using this setting while traversing a route, the unit will automatically switch to the next intermediate point (showing range and bearing to that point) when the vessel is 0.5 nautical miles from the intermediate point.

If you want to be alerted by audible and visual alarms when the vessel is 0.25 nautical miles from an intermediate point, for example, continue with step 3.

3. Press the **CLR** key.

4. Press the **ENT** key if the displays shows ARRIVAL. (If it shows ANCHOR, press the **Change** key to display ARRIVAL then press **ENT**.)
5. Enter arrival alarm range. In the example it is 0.25 nautical miles. Press **0**, **2** and **5**.
6. Press the **ENT** key.
7. Press the **Change** key to display ON.
8. Press the **ENT** key.

When the alarm setting is violated, the unit releases the audible alarm and displays "WCH "

Anchor watch alarm

The anchor watch alarm alerts you when the vessel is dragging anchor.

1. Press **MENU**, **3** and **1** to display the ARRIVAL/ANCHOR display.

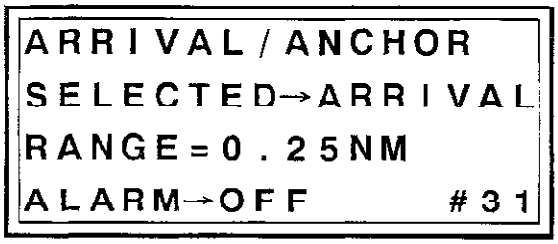


Figure 6-7 ARRIVAL/ANCHOR display

2. Press the **CLR** key.
3. Press the **Change** key to display ANCHOR if the display shows ARRIVAL.
4. Press the **ENT** key.
5. Enter anchor watch alarm range. To enter 0.1 nautical miles, for example, press **0** and **1**.
6. Press the **ENT** key.
7. Press the **Change** key to display ON.
8. Press the **ENT** key.

When the alarm setting is violated, the unit releases the audible alarm and displays "WCH."

Cross Track Error and Border Alarms

Both alarms cannot be turned on together. Select one on the XTE/BORDER display.

Cross track error alarm

This alarm alerts when your vessel strays off the intended track, due to wind, waves and other forces.

1. Press **MENU**, **3** and **2** to display the XTE/BORDER display.

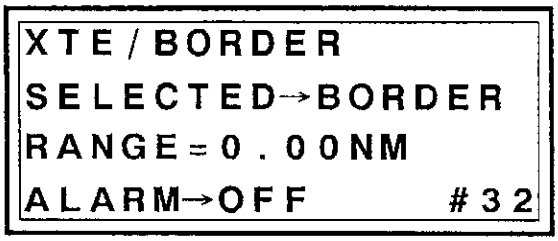


Figure 6-8 XTE/BORDER display

2. Press the **CLR** key.
3. Press the **Change** key to display XTE if it is not already displayed.
4. Press the **ENT** key.
5. Enter cross track error alarm range. To enter 0.25 nautical miles, for example, press **0**, **2** and **5**.
6. Press the **ENT** key.
7. Press the **Change** key to display ON.
8. Press the **ENT** key.

When the alarm setting is violated, the unit releases the audible alarm and displays "XTE."

Border alarm

This alarm sounds when the vessel crosses an imaginary line stretched between two waypoints.

1. Press **MENU**, **3** and **2** to display the XTE/BORDER display.

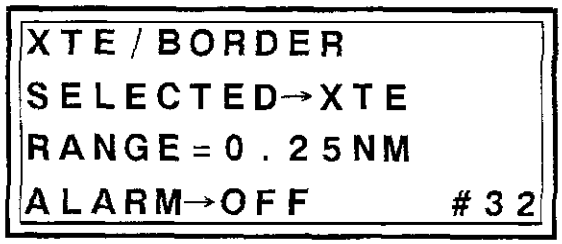


Figure 6-9 XTE/BORDER display

2. Press the **CLR** key.
3. Press the **Change** key to display BORDER if it is not already displayed.
4. Press the **ENT** key.
5. Enter border alarm range. To enter 0.3 nautical miles, for example, press **0** and **3**.
6. Press the **ENT** key.
7. Press the **Change** key to display ON.
8. Press the **ENT** key.

When the alarm setting is violated, the unit releases the audible alarm and displays "XTE."

Ship's Speed Alarm

This alarm sounds when the ship's speed is higher or lower than the preset speed alarm setting. The procedure which follows shows how to set the high and low alarm ranges for 30 knots and 5.5 knots.

1. Press **MENU**, **3** and **3** to display the SPEED display.

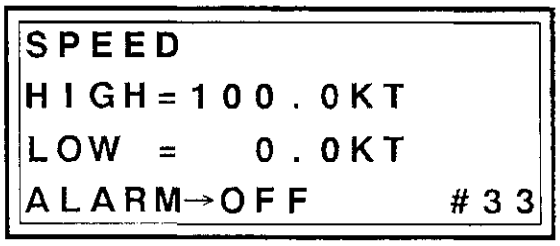


Figure 6-10 SPEED display

2. Press the **CLR** key.
3. Press **0**, **3** and **0** to enter 30 (knots).
4. Press the **ENT** key.
5. Press **0**, **0**, **5** and **5** to enter 5.5 (knots).
6. Press the **ENT** key.
7. Press the **Change** key to display ON.
8. Press the **ENT** key.

When the alarm setting is violated, the unit releases the audible alarm and displays "SPD."

Trip Alarm

The *trip alarm sounds* when the distance run exceeds the trip alarm setting. The procedure which follows shows how to set the trip alarm for 1234.5 nautical miles.

1. Press **MENU**, **3** and **4** to display the TRIP ALARM display.

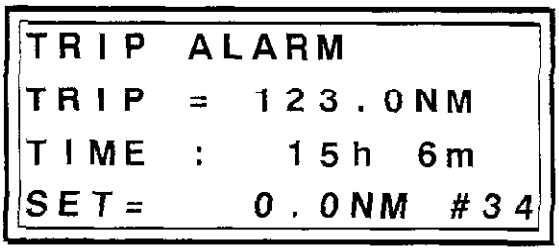


Figure 6-11 TRIP ALARM display

2. Press the **CLR** key.
3. Press the **CLR** key again.
4. Press the **ENT** key. All values are reset to zero and the cursor moves to the next line.
5. Enter trip alarm. In the example it is 1234.5 nautical miles. You would press

6. Press the **ENT** key.

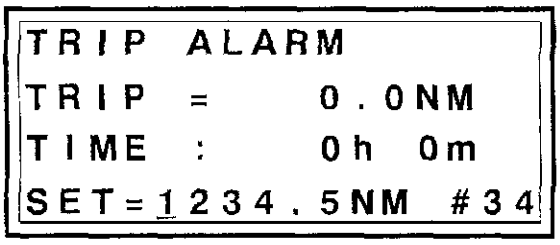


Figure 6-12 TRIP ALARM display, showing values set in above procedure

When the alarm setting is exceeded, the unit releases the audible alarm and displays "TRIP."

MAINTENANCE & TROUBLESHOOTING

This chapter covers maintenance and troubleshooting procedures. Without regular maintenance, no machine can perform its intended function.

Whenever you suspect the unit is not functioning properly follow the troubleshooting table to try to restore normal operation. If you cannot restore normal operation, the problem may lie with a GPS satellite. In this case check satellite information for suitability.

Maintenance

Regular maintenance

Proper care and maintenance of this unit are important for good performance. A regular maintenance schedule should be established and should at least include the items tabulated in Table 7-1.

Table 7-1 Items to be inspected on regular basis

Item	Checkpoint
Sensor unit	• Check for damage. Replace if damaged. • Wipe off ice droplets, snow, bird droppings, etc. to prevent reception problems.
Sensor cable	• Check for external damage. Replace if damaged. • Confirm it is firmly connected to sensor unit and there is no water leakage.
Display unit cabinet, LCD and keyboard	• Accumulated dust can be removed with a soft cloth. If necessary you may use a water-diluted mild detergent. DO NOT use chemical cleaners.
Power cable	• Check for damage and tight connection.
Ground	• Check for rust and tight connection. Clean or replace as necessary.

■ **NOTE:** *When the sensor cable connector (on rear of unit) is disconnected, the almanac is cleared from the memory. The unit begins operation with cold start, at next power on.*

Replacement of fuse

The fuse in the power cable protects the unit from overcurrent and equipment fault. If the fuse blows, find out the cause before replacing it. Use only the rated fuse (one is supplied). Use of a wrong fuse will damage the equipment and void the warranty.

Troubleshooting for the User

The table which follows provides simple troubleshooting procedures which the user may follow to restore normal operation. If you cannot restore normal operation 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 7-2 Troubleshooting table

IF...	THEN...	Remedy
you cannot turn on the power	• check for loosened connector.	• Tighten connector.
	• check that the ship's mains is on.	• Turn on ship's mains.
	• check for blown fuse.	• Replace fuse.
there is no position fix 45 minutes after turning on the power	• estimated position may be off by more than 10° from actual position; it takes more than 45 minutes to acquire a satellite in that condition.	• Go to menu #711 and enter estimated position
	• almanac data may be more than one year old.	• Go to menu #45 and execute cold start.
there is no position fixing whatsoever	• the sensor cable may be disconnected.	• Connect cable.
	• check for water leakage at sensor cable connector.	• Replace if water damaged.
	• healthy satellite may have been deselected.	• Display menu #43 to verify satellite selection.
	• check receiver for frequency deviation.	• Display menu #43. If deviation is more than ±3000 Hz, replace display unit.
position is wrong	• chart system selection may be wrong.	• Go to menu #721 and check selection.
	• latitude and longitude correction values are not entered.	• Go to menu #722 and enter them.
	• sensor unit height entered is wrong.	• Go to menu #712 and check sensor unit height for correctness.
position-fixing availability shorter than other vessels	• DOP setting may be too low. (The factory setting is 20.)	• Go to menu #712 and increase the DOP setting.

(Continued)

IF...	THEN...	Remedy
menu cannot be displayed	• you may be in the single menu mode.	• To restore full menu mode, press and hold down the **MENU** key while turning on the power.
data not output to external equipment	• wrong data I/O format selected.	• Select correct format referring to pages 8-16 through 8-20.
	• data Tx interval is set for "0".	• Select correct setting referring to pages 8-16 through 8-20.
	• wrong setting on external equipment.	• Check setting on external equipment.
	• wrong connection on GP-50.	• The correct connection is GP-50 Ext. Equip TXD-H ↔ RXD-H TXD-C ↔ RXD-C
"SER" appears	• the power is turned on after installation or the sensor cable is reconnected.	• Turn off the power and turn it on again.
	• there is memory IC error.	• Do self test to confirm faulty unit. (See next page.) Replace faulty unit (display or sensor) according to error readout.
"BER" appears	• (internal) battery voltage is low.	• Request replacement of battery.
"DER" appears	• Backup memory is corrupted.	• Do self test to confirm faulty unit. (See next page.) Replace faulty unit (display or sensor) according to error readout.

Checking Facilities

The GP-50 has several facilities which check it for proper operation, identify faulty devices, provide information or clear data. These facilities are mainly for use by service technicians, however the user may find them useful for identifying operation problems. The facilities are

- Self test
- Keyboard test
- Program no. display, and
- Data clear.

Self test

This test checks both the sensor unit and the display unit for proper operation. If the test results are satisfactory the GP-50 displays OK next to unit name. The test is continuously executed.

1. Press **MENU**, **7**, **3** and **2** to display the SELF TEST display.

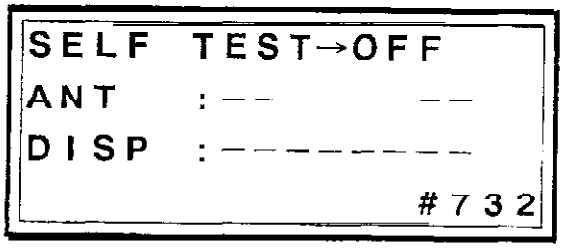


Figure 7-1 SELF TEST display

2. Press the **CLR** key.
3. Press the **Change** key to display ON.
4. Press the **ENT** key to start the self test.

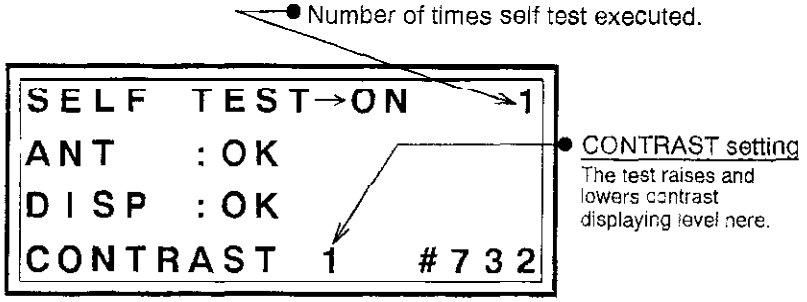


Figure 7-2 Self test results (normal)

5. Turn off the power to escape from the test.

Interpreting self test error display

The self test error display shows which devices on the antenna unit and display unit are faulty. For error, "1" appears in a column corresponding to offending device. The illustrations below show the device represented by each column.

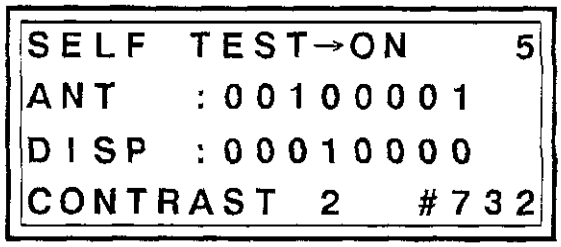
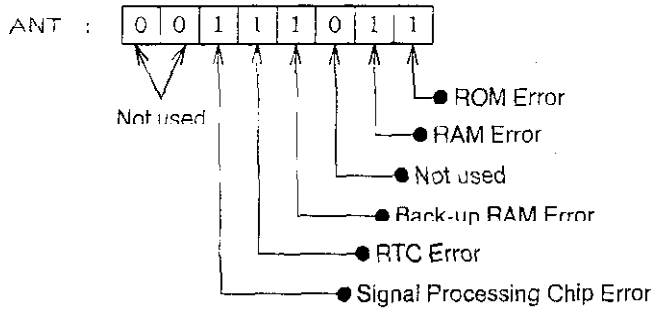
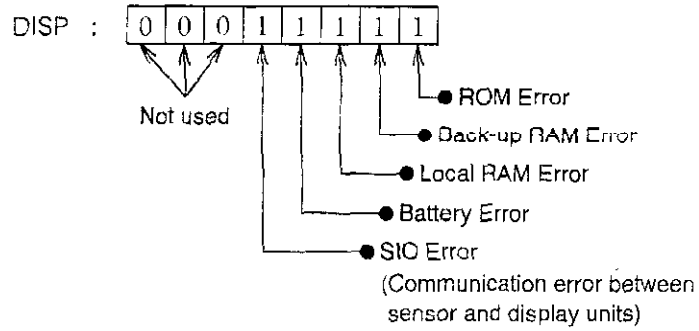


Figure 7-3 Self test results display, showing error for both sensor unit and display unit

- **Sensor unit error**



- **Display unit error**



ROM: Read Only Memory
RAM: Random Access Memory
RTC: Real-time Clock (clock integrated circuit)
SIO: Serial I/O control

Keyboard/LCD test

This test checks both each key and the LCD for proper operation.

1. Press **MENU**, **7**, and then press **3** twice to display the KEY/LCD TEST display.

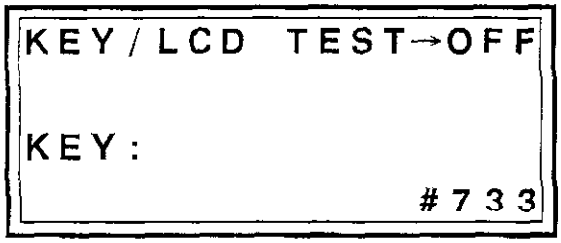


Figure 7-4 KEY/LCD TEST display

2. Press the **CLR** key.
3. Press the **Change** key to display ON.
4. Press the **ENT** key to start the self test.
5. Press each key one by one. The key name appears on the display if the key is functioning properly.
6. Press the **CLR** key twice. All LCD segments should light.
7. Press the **ESC** key to return to the default display.

Program no. display

This display shows the program version no. for both the sensor unit and the display unit.

Press **MENU**, **7**, **3** and **1** to display the PROGRAM VERSION display.

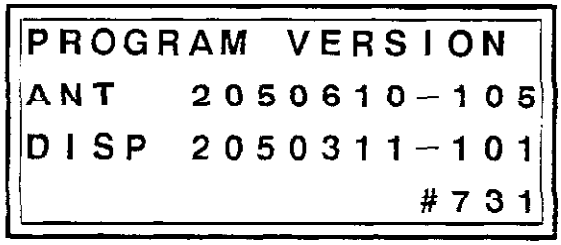


Figure 7-5 PROGRAM VERSION display

To escape, press the **ESC** key.

Clearing data

You will need to clear data in the following instances:

- when position fixing is not achieved and the self test indicates some error, or
- you want to delete all waypoints from the memory.

navigation data

The list which follows shows the items stored in the navigation data memory.

- temporarily stored positions
- waypoints
- routes
- alarm settings
- distance run setting
- single menu mode setting
- dimmer and contrast settings

1. Press **MENU**, **7**, **3** and **4** to display the MEMORY CLEAR display.

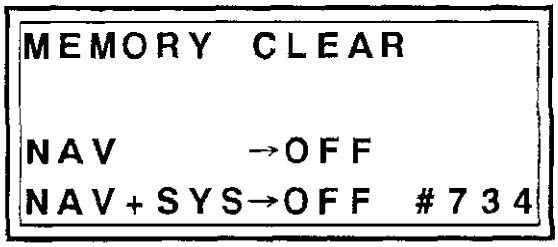


Figure 7-6 MEMORY CLEAR display

2. Press the **CLR** key. The cursor is under OFF on the NAV line.
3. Press the **Change** key to display ON.
4. Press the **ENT** key. The buzzer sounds to show it is clearing navigation data.

navigation data plus system data

This facility clears both navigation data and system data. System data includes

- estimated position, time and time difference
- settings of DOP, sensor unit height and elevation mask angle
- deselected satellites
- chart system setting, L/L correction values
- magnetic variation
- smoothing
- units of measurement for velocity, range and sensor unit height
- output port data selection, and
- NAV display setting.

1. Press **MENU**, **7**, **3** and **4** to display the MEMORY CLEAR display.
2. Press the **CLR** key. The cursor is under OFF on the NAV line.
3. Press the **ENT** key to move the cursor to the NAV+SYS line.
4. Press the **Change** key to display ON.
5. Press the **ENT** key. Then,
   - the buzzer sounds to show it is clearing navigation data,
   - factory settings are restored, and
   - cold start is executed.

Satellite Information

The SAT menu displays various information about the GPS satellites.

Signal level

This display shows the signal level of up to eight satellites. The display range is 0 to 999. A figure above 200 is considered normal. A figure less than 100 means malfunctioning satellite or satellite is in shadow sector.

1. Press **MENU** and **4** to display the SAT menu.

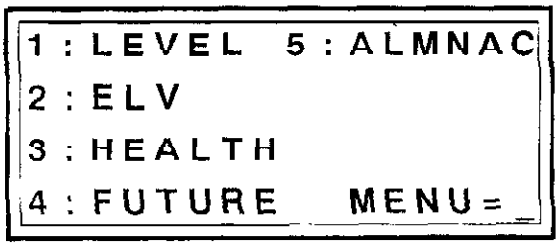


Figure 7-7 SAT menu

2. Press **1** to select LEVEL.

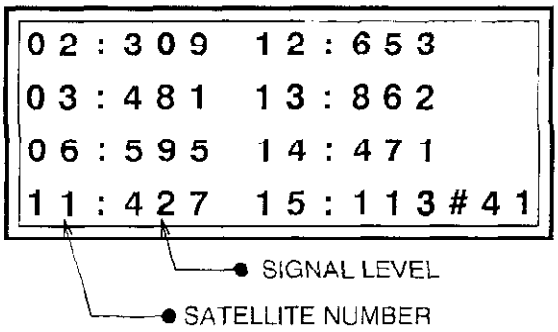


Figure 7-8 Satellite signal level display

DOP value and elevation angle

This display shows the DOP value and elevation angle of up to eight GPS satellites.

Press **MENU**, **4** and **2** to display the ELV display.

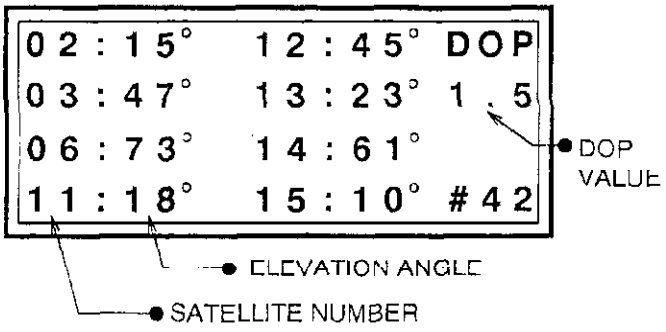


Figure 7-9 ELV display

The DOP alarm threshold is set to 20 at the factory. The DOP value on the ELV display changes with satellite movement. If the DOP is more than 20 the buzzer sounds and the indication "DOP" blinks on LCD. This is to alert you that position information is unreliable.

Deselecting satellites

When you hear of a malfunctioning GPS satellite deselect it on the HEALTH display.

1. Press **MENU**, **4** and **3** to call up the HEALTH display.

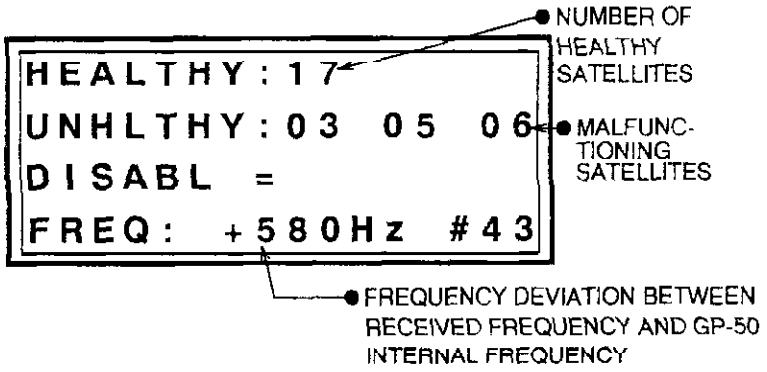


Figure 7-10 (Satellite) HEALTH display

2. Press the **CLR** key. The cursor blinks on the DISABL line. Any satellites previously deselected are restored.
3. Input satellite(s) you want to deselect. You can input up to three.

Other information displayed on the HEALTH display

- HEALTHY: Number of healthy satellites.
- UNHLTHY: Unhealthy satellites. (These are satellites deselected by GPS; they are automatically deselected from use in position fixing.)
- FREQ: Receiver frequency deviation between received frequency and GP-50 internal frequency. If the figure is more than ±3000 Hz replace the display unit.

Satellite schedule

This display shows the time range in which GPS position fixing is available.

Press **MENU**, and then press **4** twice to display the SATS IN VIEW display.

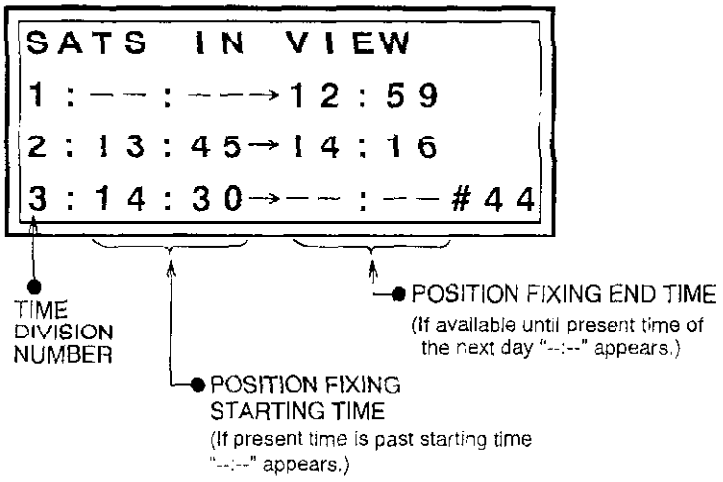


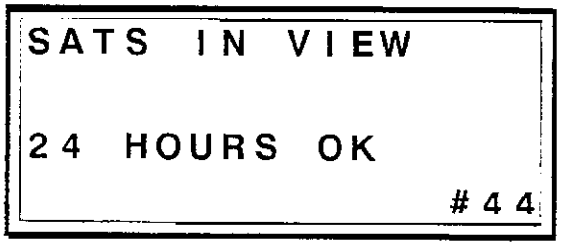
Figure 7-11 SATS IN VIEW display

Interpreting the SATS IN VIEW display

Using Figure 7-11 as an example, the following shows the meanings of the indications on the SATS IN VIEW display.

- The second line shows that from the present time to 12:59 position fixing is available.
- From 13:00 to 13:44 no position fixing is available.
- The third line shows that position fixing is available from 13:45 to 14:16.
- From 14:17 to 14:29 no position fixing is available.
- From 14:30 to present time of next day position fixing is available.

When position fixing is available round-the-clock the following display appears.



7-12 Display for round-the-clock position fixing availability

Almanac receiving time

You can view what time the almanac was received. If it is more than one year ago, execute cold start.

1. Press **MENU**, **4** and **5** to display the ALMANAC display.

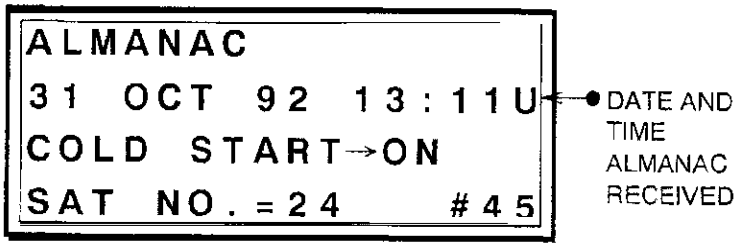


Figure 7-13 ALMANAC display

2. Confirm the date. If it is more than one year ago, proceed to step 3 to execute cold start.
3. Press the **CLR** key.
4. Press the **Change** key to display COLD START ON.
5. Press the **ENT** key.
6. To complete cold start quicker, input satellite (no.) which is in line-of-sight. (You could contact a nearby ship to find this information.)
7. Press the **ENT** key. It takes about 15 to 45 minutes to execute cold start.

■ **NOTE:** *Estimated position should be within ten degrees. If more than ten degrees it may take more than 45 minutes to fix position.*

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INSTALLATION

This chapter covers installation. Installation mainly consists of

- siting and mounting the display unit and the sensor unit
- connection of sensor cable
- connection of external equipment, and
- connection of power source.

Display Unit

Mounting considerations

Install the unit where the LCD can be easily viewed and the keyboard can be easily operated. Be sure to leave sufficient space on the sides and the rear of the unit for maintenance purposes. Leave a little slack in cables so the unit can be dismounted from the hanger with the connectors connected.

In addition to the aforementioned points, observe the following precautions.

- Locate the unit out of direct sunlight because of heat which can build up inside the cabinet.
- The temperature and humidity of the mounting location should be stable and moderate.
- Locate the unit away from exhaust pipes and vents.
- The mounting location should be well ventilated.
- Mount the unit where shock and vibration are minimal.

Mounting methods

The display unit can be mounted in a trunnion mount or flush mounted in a panel (two styles, optional mounting kits required). The trunnion mount offers mounting on a bulkhead, a tabletop, or on the overhead. Figure 8-1 illustrates the mounting methods.

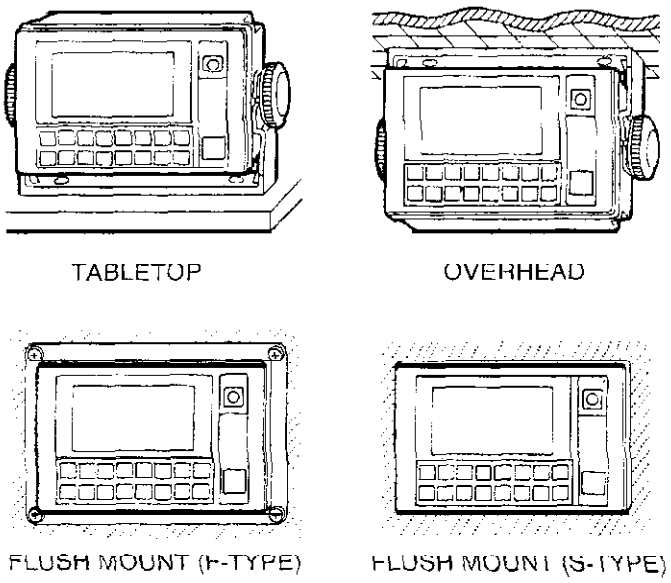


Figure 8-1 Display unit mounting methods

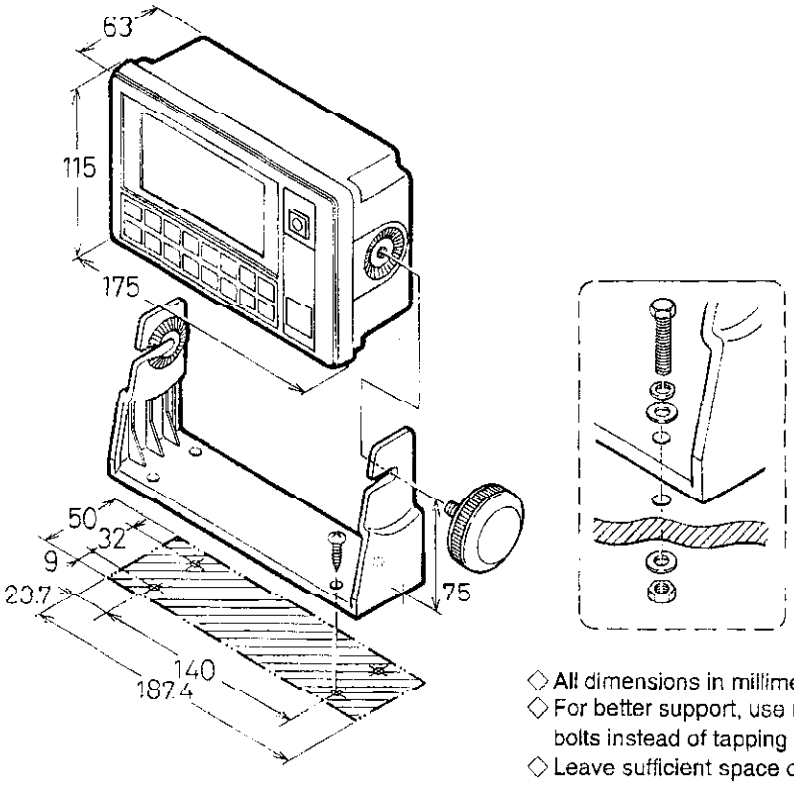
LCD viewing angle

The display unit employs an LCD to display navigation information. After mounting the display unit, adjust the contrast so the display can be easily seen.

Mounting

Tabletop and overhead mountings

Figure 8-2 gives the mounting dimensions for the tabletop and overhead mountings.



◇ All dimensions in millimeters.
◇ For better support, use nuts and bolts instead of tapping screws.
◇ Leave sufficient space on sides and rear of unit for maintenance. See outline drawing for recommended maintenance space.

Figure 8-2 Mounting dimensions for tabletop and overhead mountings

Flush mount (S-type)

This mounting method requires the S-type flush mount kit.

Name	Type	Code No.
S-type Flush Mount Kit	OP20-17	000-040-720

Figure 8-3 gives the mounting dimensions for the S-type flush mount.

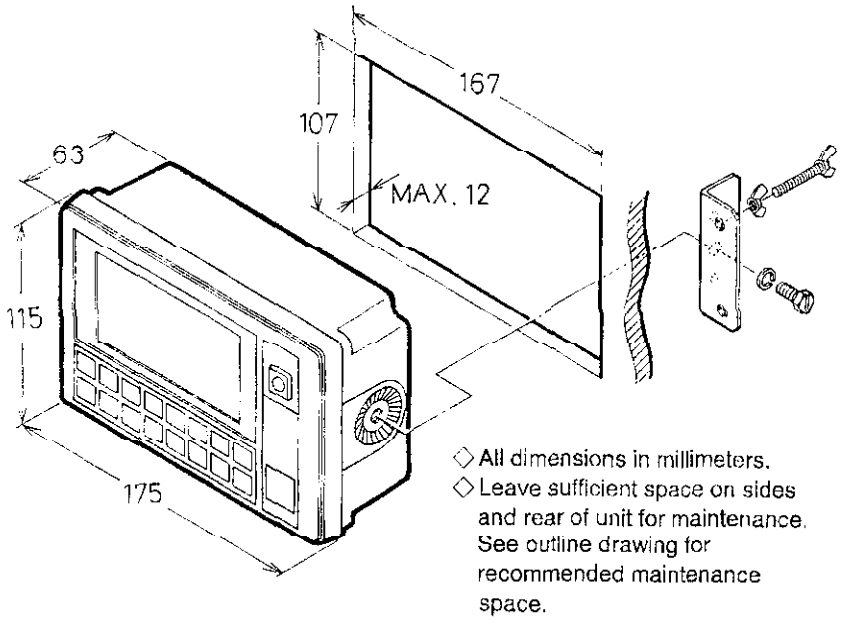


Figure 8-3 Mounting dimensions for S-type flush mount

Flush mount (F-type)

This mounting method requires the F-type flush mount kit.

Name	Type	Code No.
F-type Flush Mount Kit	OP20-18	000-040-721

Figure 8-4 gives the mounting dimensions for the F-type flush mount.

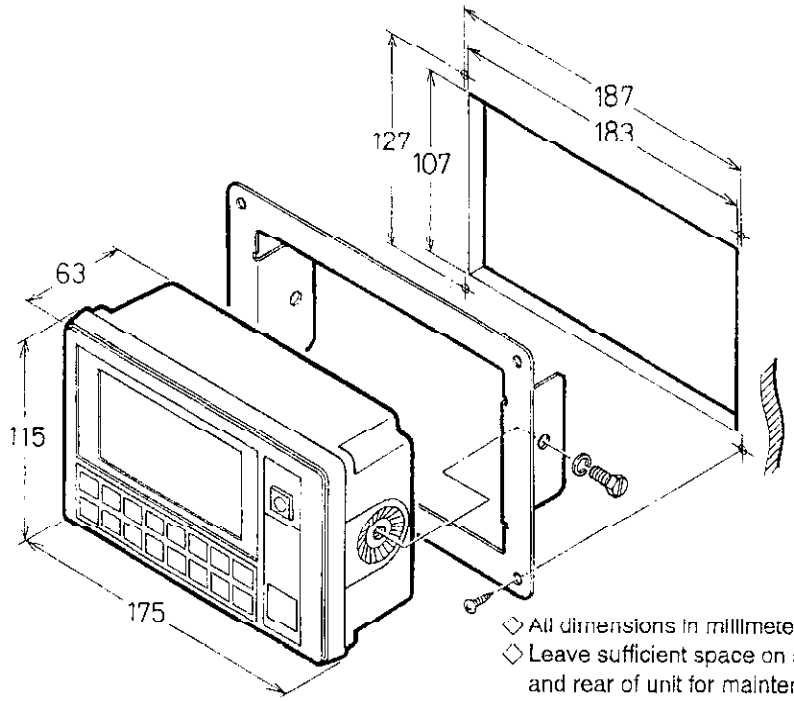


Figure 8-4 Mounting dimensions for F-type flush mount

Sensor Unit

Mounting considerations

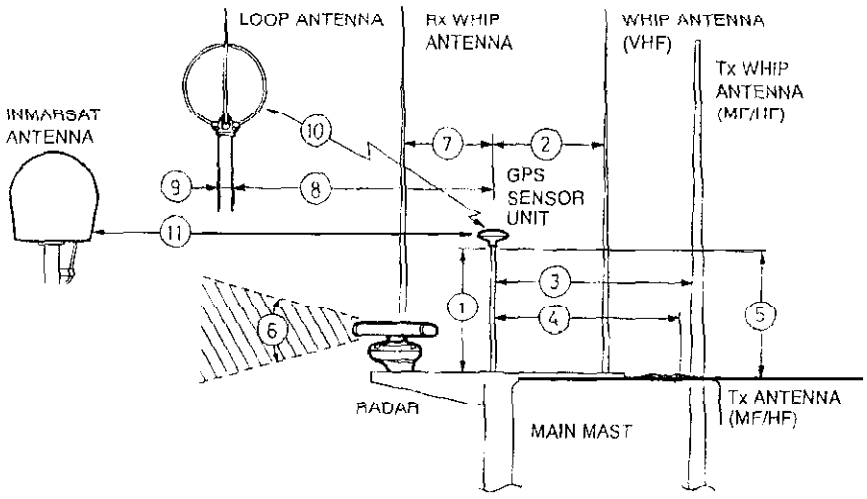
When selecting a mounting location for the sensor unit keep in mind the following points.

- **Install the unit out of the radar beam.** The radar beam will obstruct or prevent reception of the GPS satellite signal.
- **Be sure the location offers a clean line-of-sight to satellite.** Objects within line-of-sight to a satellite, for example, a mast or funnel, may prevent reception or result in long-lasting "Acquire" or "INT" (interrupt) condition.
- **Keep the sensor unit clean.** Ice, snow, bird droppings, etc. on the sensor unit can prevent or obstruct reception.

Mounting location

The figures which follow show example sensor unit mounting locations for various types of vessels.

Large vessel



No.	Distance	No.	Distance
①	more than 0.5m	⑦	more than 1m
②	more than 1m	⑧	Depending on mast diameter of ⑨
③	more than 4m		⑨ mast diameter 10cm = more than 1.5m
④	more than 4m		⑨ mast diameter 30cm = more than 3m
⑤	more than 1.5m	⑩	more than 3m
⑥	not within radar beam	⑪	more than 5m

Figure 8-5 Separation distances among GPS sensor unit and other antennas

Sport fisher

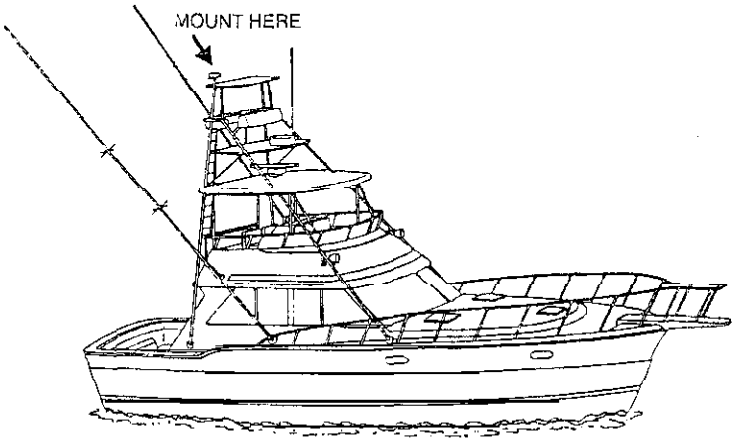


Figure 8-6 Sensor unit mounting location on a sport fisher, using the right angle mounting base

Power boat-flybridge

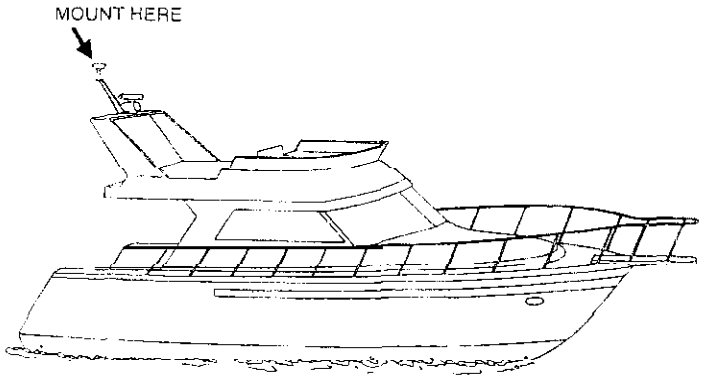


Figure 8-7 Sensor unit mounting location on a power boat-flybridge, using the right angle mounting base

Sailboat-permanent backstay

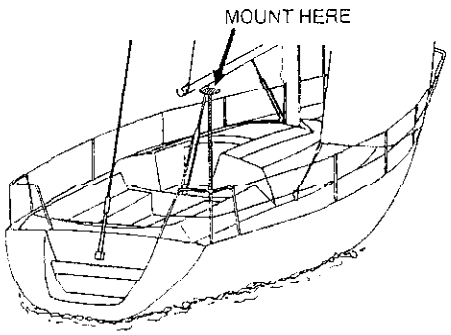


Figure 8-8 Sensor unit mounting location on sailboat-permanent backstay, using mast mount

Mounting

The sensor unit base is pre-threaded with Unify threads for screwing it into a mounting base. Table 8-1 gives the specifications of the threads.

Table 8-1 Specifications of sensor unit threads (mm)

Thread Name	Threads per 25.4 mm (1 inch)	Pitch	Outer Dimensions
1 × 14 UNS	14	1.8143	24.15

The unit can be installed three ways: fasten to a mast by mounting bracket and hose clamps, or using one of two types of sensor unit mounting bases.

■ **CAUTION:** *The sensor unit may crack if overtightened. Hand tighten then turn unit additional 1/4 turn.*

Mast mounting

This method uses a mounting bracket and two hose clamps to fasten the unit to a mast.

Name	Type	Code No.
Mast Mount Kit	CP20-0111	000-040-722

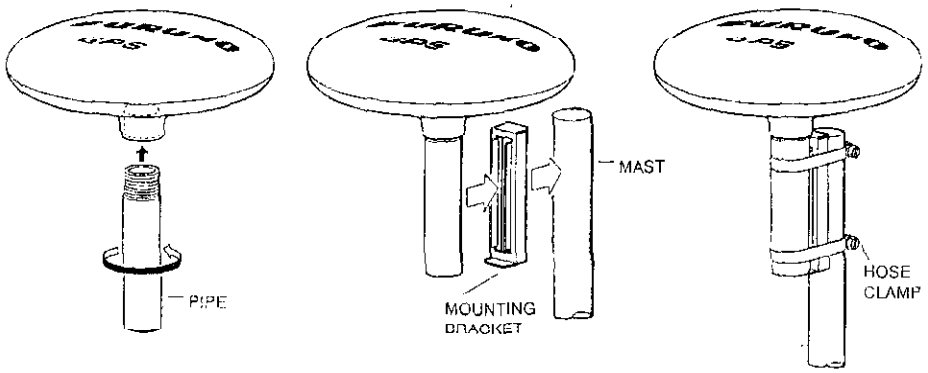


Figure 8-9 Mast mounting

Right angle mounting base (mounting angle -5° to +33°)

The right angle mounting base (option) is commonly used on power boats which have a flybridge. Fix the mounting base to the mounting location with tapping screws (supplied).

Name	Type	Code No.
Right Angle Antenna Mounting Base	No.13-QA300	000-803-239

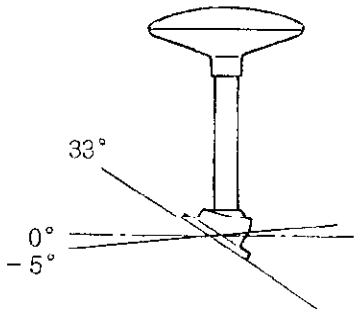


Figure 8-10 Right angle mounting base, showing available mounting angles

L-angle mounting base (mounting angle +32° to +98°)

The L-angle mounting base (option) is often installed on power boats with no flybridge and sailboats with running backstay. Fix the mounting base to the mounting location with tapping screws (supplied).

Name	Type	Code No.
L-angle Antenna Mounting Base	No.13-QA310	000-803-240

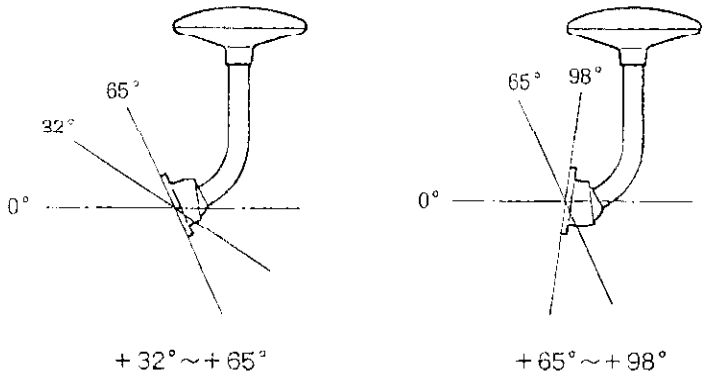


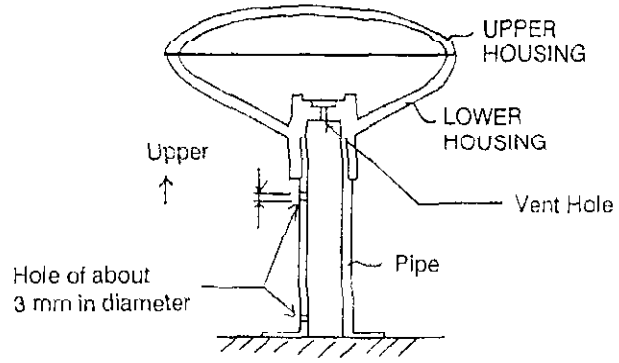
Figure 8-11 L-angle mounting base, showing available mounting angles

Maintaining vent hole function

There is a hole at the bottom of the lower housing. This hole prevents moisture from being drawn into the sensor unit during atmospheric changes and allows trapped humid air to escape. When the sensor unit is fixed to a threaded pipe this hole cannot perform its intended function. Therefore, do the following when the sensor unit is fixed to a threaded pipe.

Procedure

As shown in the figure below, drill two holes of 3 mm diameter through th pipe.



Theft protection

It is a regrettable fact of modern life that small electronic equipment attracts thieves. Because the sensor unit is simply screwed into a mast or mounting base it can be easily removed. For this reason you should consider removing the unit after you are finished for the day, or permanently fastening it to the mast.

Drill a hole of ø3.0 in diameter about 10 mm above the bottom of the sensor unit. Insert spring pin (supplied) into the hole by using a wooden hammer.

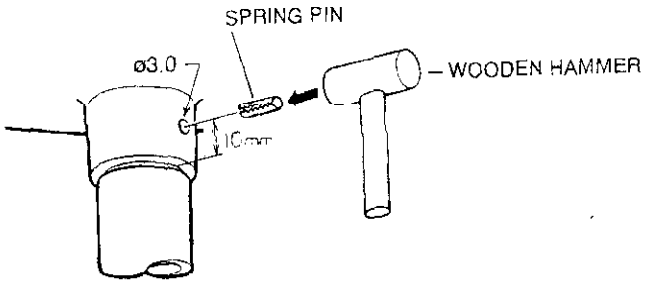


Figure 8-12 How to permanently fasten sensor unit to mast

Connection of sensor cable

Connect the sensor cable to the sensor unit. For mast mounting, secure the cable to the mast with cable ties, starting at the sensor unit. Leave slack in cable between first cable tie and connector to provide connector strain relief.

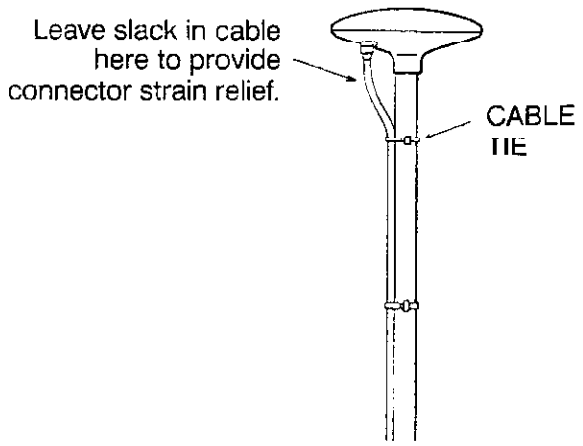


Figure 8-13 Securing cable to mast

Sensor cable length

The standard cable is 15 m long. Lengths of 30 m and 50 m are optionally available. **USE THE FULL LENGTH OF CABLE; NAMELY, NO SHORTENING OR SPLICING ALLOWED.** If necessary "loop" excess cable.

Name	Type	Code No.
Sensor Cable	20S0189 *30 m* 20S0190 *50 m*	000-129-013 000-129-014

Wiring

Figure 8-14 shows the basic connection method.

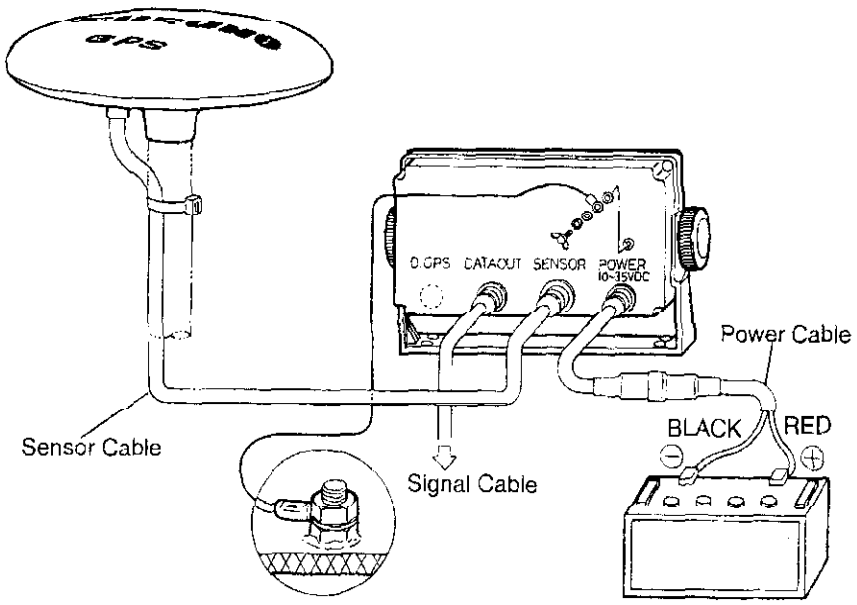


Figure 8-14 Connection of sensor unit, display unit, power cable, ground and external equipment

Sensor unit

The sensor cable is prefitted with a connector at each of its ends. Connect the sensor cable to the SENSOR connector on the rear of the display unit. As noted earlier use the full length of the cable. Any excess cable should be bound and placed where it will not be damaged.

Power cable

The display unit can be powered by any 10 to 35 VDC power supply (battery). Connect the end of the power cable with a connector to the POWER connector on the rear of the display unit. Connect the other end to the power supply; red wire to the plus (+) terminal and the black wire to the minus (-) terminal. For 100, 110, 200 or 220 VAC power supply, an optional rectifier (PR-62) is required.

Ground

The GP-50 contains several CPUs. When they are operating, they discharge noise, which can interfere with a direction finder and other radio equipment. If the GP-50 is interfering with radio equipment ground it as follows.

- The ground wire should be 1.25sq or larger.
- The length of the ground wire should be as short as possible.
- Connect ground wire to ship's ground by silver-alloy brazing.

External equipment

The DATA OUT connector outputs GP-50 data to external equipment such as radar, echosounder and plotter. A signal cable comes with the accessories for connection of external equipment. One end of the cable is prefitted with a connector. Connect it to the DATA OUT connector. Attach a connector (local supply) to the other end of the cable and connect the cable to external equipment. A cable with connectors prefitted to both ends of the cable is available as shown in the table below.

Name	Type	Code No.
Cable Assy.	20S0204 *15m*	000-129-015

Receiving the Almanac

After installing the unit, the first thing to do is turn on the power. At the first power on the error indication "SER" appears. Turn off the power and turn it on again. Then, the receiver starts looking for a satellite to receive the almanac. The first-time reception of the almanac takes from 15 to 45 minutes. Additional time is necessary if the position shown on the display is not within 10 degrees of actual position or there is no satellite in line-of-sight.

The procedure which follows shows how to receive the almanac and enter estimated position.

1. Turn on the power.
2. Press the **MENU** key. The buzzer sounds and the following display appears.

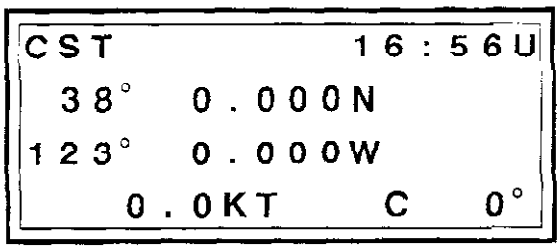


Figure 8-15 Default display, cold start condition

3. Press **MENU** and **7**, and then press **1** twice.

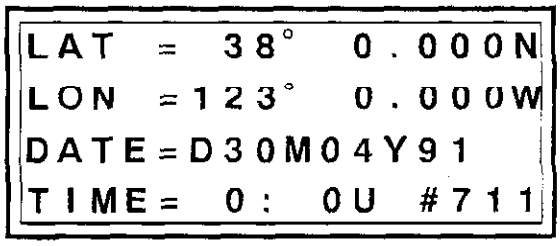


Figure 8-16 Estimated position setting screen

4. Press the **CLR** key.

5. Enter estimated latitude. If your latitude is 35 degrees 44 minutes North, for example, press

   [3] [5] [4] [4] [ENT]

   ■ **NOTE:** *The* **CLR** *key clears wrong data. The* **Change** *key changes North latitude to South latitude, West longitude to East longitude and vice versa.*

6. Enter estimated longitude. To enter 135 degrees 21 minutes East, for example, press

   [1] [3] [5] [2] [1] [Change] [ENT]

7. Press the **ESC** key. The latitude and longitude you entered appear on the display.

Connection of External Equipment

The GP-50 not only fixes its own position but also can output navigation information to external equipment. For example, it can output position data to a radar or echosounder for display on their display screen. You can convert a Loran Plotter to a GPS Plotter with position data from the GP-50. Efficient automatic steering with an autopilot is available by outputting data such as cross track error and range and bearing to waypoint.

Before selecting data to output, confirm what data the external equipment requires. Output necessary data only. Outputting unwanted data can cause receiving problems at the external equipment.

Output data format

The GP-50 can transmit data in CIF, NMEA0183 or NMEA0180S data formats. Table 8-1 describes the output data formats.

Table 8-1 Output data formats

Output Format	Remarks
CIF	FURUNO's own unique output data format. Select this format to output data to FURUNO equipment.
NMEA0183	Select this to output data to makes of equipment other than FURUNO. This format is the National Marine Electronics Association's industry standard.
NMEA0180S	This format is the predecessor to the NMEA0183. Select it if your autopilot uses this format.

Talker

All NMEA data transmitted by marine electronics equipment is prefixed with a two character code which tells external equipment what equipment is transmitting data. This two character code is called the talker. The GP-50 contains the talkers GPS, LC, LA, DEC, DR, and OMG.

Because GPS is a relatively new system some early equipment do not recognize the GPS talker name. In this case transmit data using a conventional talker, one the equipment recognizes, such as Loran C.

Data format and data output availability

The type of data which can be transmitted depends on format.

CIF

Time, latitude, longitude, ship's speed, course, range, bearing to waypoint, altitude

NMEA0183

AAM: Arrival alarm
APA: Autopilot format A
APB: Autopilot format B
BOD: Bearing to TO waypoint from FROM waypoint
BWC: Range and bearing to waypoint (great circle navigation)
BWW: Bearing to waypoint
GGA: GPS position fixing condition (time of fix, latitude, longitude, receiving condition, number of satellites used, DOP)
GLL: Latitude and longitude
RMB: Generic navigational information (cross track error, steering direction, starting waypoint no., destination waypoint no., latitude and longitude of starting waypoint, latitude and longitude of destination waypoint, range and bearing to waypoint, range and bearing from present position to destination waypoint, velocity to destination, arrival alarm)
RMC: Generic navigational information (UTC time, latitude, longitude, ground speed, true course, day, month, year)
VTG: Actual track and ground speed
WCV: Waypoint closure velocity
WNC: Range to TO waypoint in great circle
WPL: Waypoint position
XTE: Cross track error
ZDA: UTC, local zone time
ZLZ: UTC, day, month, year
ZTG: Time to go to waypoint

NMEA0180S

Cross track error data

Selecting CIF format

To output data in CIF format;

1. Press **MENU**, **7**, **2** and **6** to display the DATA FORMAT display.

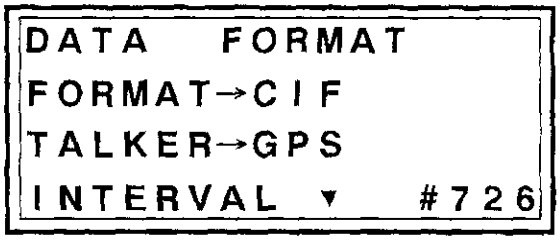


Figure 8-17 DATA FORMAT display

2. Press the **CLR** key.
3. Press the **Change** key to display CIF.
4. Press the **ENT** key.
5. Press the **Change** key to select talker name if different from GPS;
   - LC (Loran C)
   - LA (Loran A)
   - DEC (Decca)
   - DR (Dead Reckoning)
   - OMG (Omega)
6. Press the **ENT** key. The INTERVAL display appears. This screen is for setting data output transmission interval.

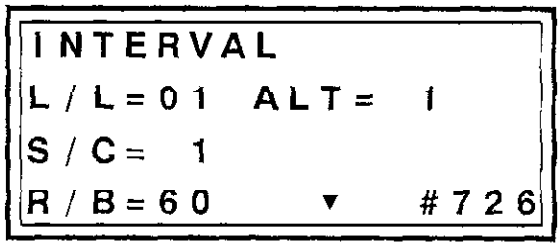


Figure 8-18 INTERVAL display

The factory setting is

- Latitude, longitude, speed, course and altitude: 1 second
- Range and bearing: 60 seconds

Output interval is available in 01, 02, 03, 04, 05, 10, 12, 15, 20, 30, 40, 50, 60 and 90 seconds.

■ **NOTE:** *To disable output enter 00.*

7. Enter transmission interval, and then press the **ENT** key.

Control is returned to the INTERVAL display. To confirm settings, press the **Arrow** key.

Selecting NMEA0183 format

To output data in NMEA0183 format;

1. Press **MENU**, **7**, **2** and **6** to display the DATA FORMAT display.
2. Press the **CLR** key.
3. Press the **Change** key to display NMEA0183.
4. Press the **ENT** key.
5. Press the **Change** key to select talker name if different from GPS.
6. Press the **ENT** key. The INTERVAL display appears. This screen is for setting data output transmission interval.

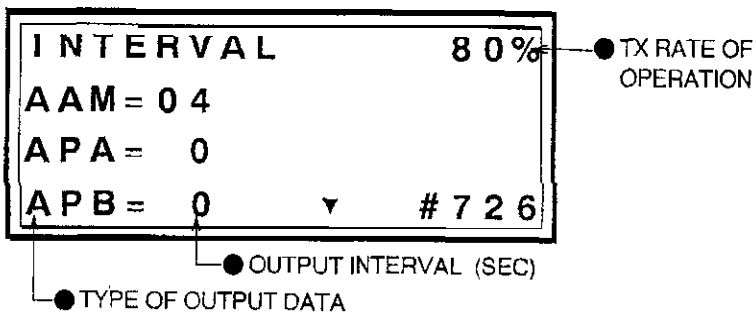
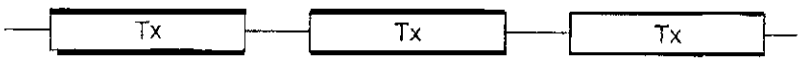


Figure 8-19 INTERVAL display

7. Enter transmission interval according to output data, and then press the **ENT** key. Enter 00 to disable output. If it is not necessary to change data, press **ENT** or the **Arrow** key.

Rate of operation

The TX rate of operation is the percentage of data output in one second, and it appears at the top right-hand corner on the screen. If short intervals are assigned to many sentences, the rate of operation increases as illustrated below. A rate of operation exceeding 100% is impractical. For better performance, the rate of operation should not exceed 84%, the factory setting.



Selecting NMEA0180S format

To output data in NMEA0180S format;

1. Press **MENU**, **7**, **2** and **6** to display the DATA FORMAT display.
2. Press the **CLR** key.
3. Press the **Change** key to display NMEA180S.
4. Press the **ENT** key.

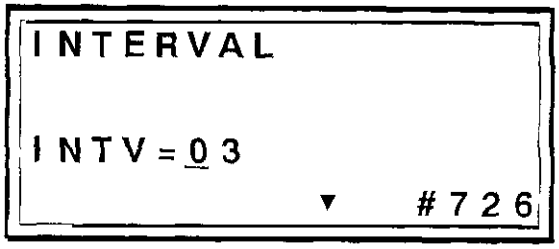


Figure 8-20 INTERVAL display

5. Enter transmission interval according to output data, and then press the **ENT** key.

APPENDIX

The appendix contains

- Specifications
- Equipment List
- Menu Tree
- Local Time Zones, and
- Waypoint Log.

ENVIRONMENTAL CONDITIONS

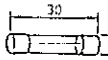
Temperature	Sensor unit: -30 to +70°C Display unit: -10 to 55°C
Humidity	95% at 45°C (both sensor and display units)
Watertightness	Conforms to IEC529IPX6 (both sensor and display units)
Shock	1 to 12.5 Hz—3.2mm pp 12.5 to 25 Hz—0.8mm pp 25 to 50 Hz—0.2mm pp (both sensor and display units)
Weight	Sensor Unit: 0.5 kg Display Unit: 0.7 kg

Equipment List

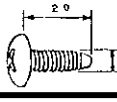
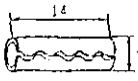
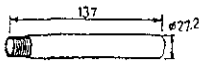
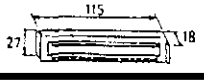
Complete Set

Name	Type	Qty	Wt. (kg)	Remarks
Sensor Unit	GPS-011	1	0.5	
Display Unit	GPD-011	1	0.7	w/hanger
Installation Materials	CP20-01100	1		no mast mounting kit
	CP20-01110			w/mast mounting kit
Spare Parts	SP20-00500	1		
Rectifier	PR-62	1		For 110/220 VAC, option

Spare parts (SP20-00500: Code No. 000-040-717)

管入りヒューズ FUSE		FGBO-A 2A AC125V 000-549-062	3

Installation Materials (CP20-01100: Code No. 000-040-712 (not included mast mounting kit) / CP20-01110: Code No. 000-040-723)

信号ケーブル組品 SIGNAL CABLE ASSY.		MJ型 6芯ケーブル付コネクタ (EV-SA 7/0.16-2P *5M*) 000-117-603	1	
電源コード POWER CABLE		MJ-A2SPF0014-030 (VV 0.75X2C *3M*) 000-128-522	1	
ケーブル組品 CABLE ASSY.		MJ-A10SPF0002-150 (VV 7/0.18(4P)+VV 12/0.18(1P)*15M*) 000-129-012	1	
+トラスタッピンタネジ +TAPPING SCREW		5X20 1種 SUS304 000-802-081	4	
波形スプリングピン WAVE SPRING PIN		3X14 SUS304 000-804-855	1	
バーカークランプ HOSE CLAMP		No.5856 SUS304 000-804-800	2	Mast Mounting Kit *1
パイプ PIPE		20-007-3011-2 SUS304 100-183-262	1	
取付補助金具 INSTALLING SPACER		20-007-3012-1 SUS304 100-183-271	1	

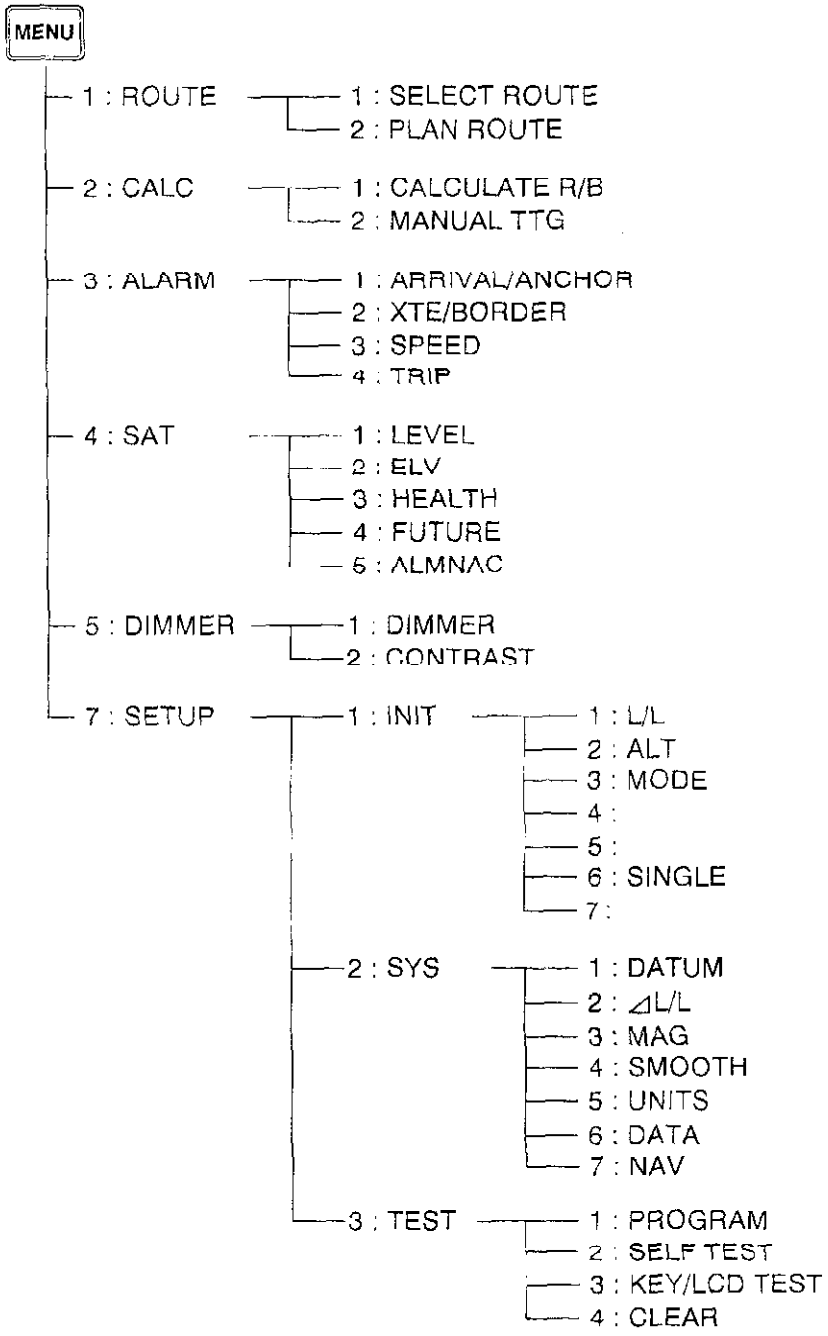
Optional Installation Materials

Name	Type	Code No.	Qty	Remarks
Sensor Cable Assy.	20S0189 *30m*	000-129-013	1	Select one of two
Sensor Cable Assy.	20S0190 *50m*	000-129-014	1	
Cable Assy.	20S0204 *15m*	000-129-015	1	
S-type Flush Mount Kit	OP20-17	000-040-720	1	For mounting display unit
F-type Flush Mount Kit	OP20-18	000-040-721	1	
Right Angle Antenna Mounting Base	No.13-QA300	000-803-239	1	*2
L-angle Antenna Mounting Base	No.13-QA310	000-803-240	1	*3
Mast Mounting Kit	CP20-01111	004-370-100	1	
D-GPS Kit	OP20-23	000-040-821		

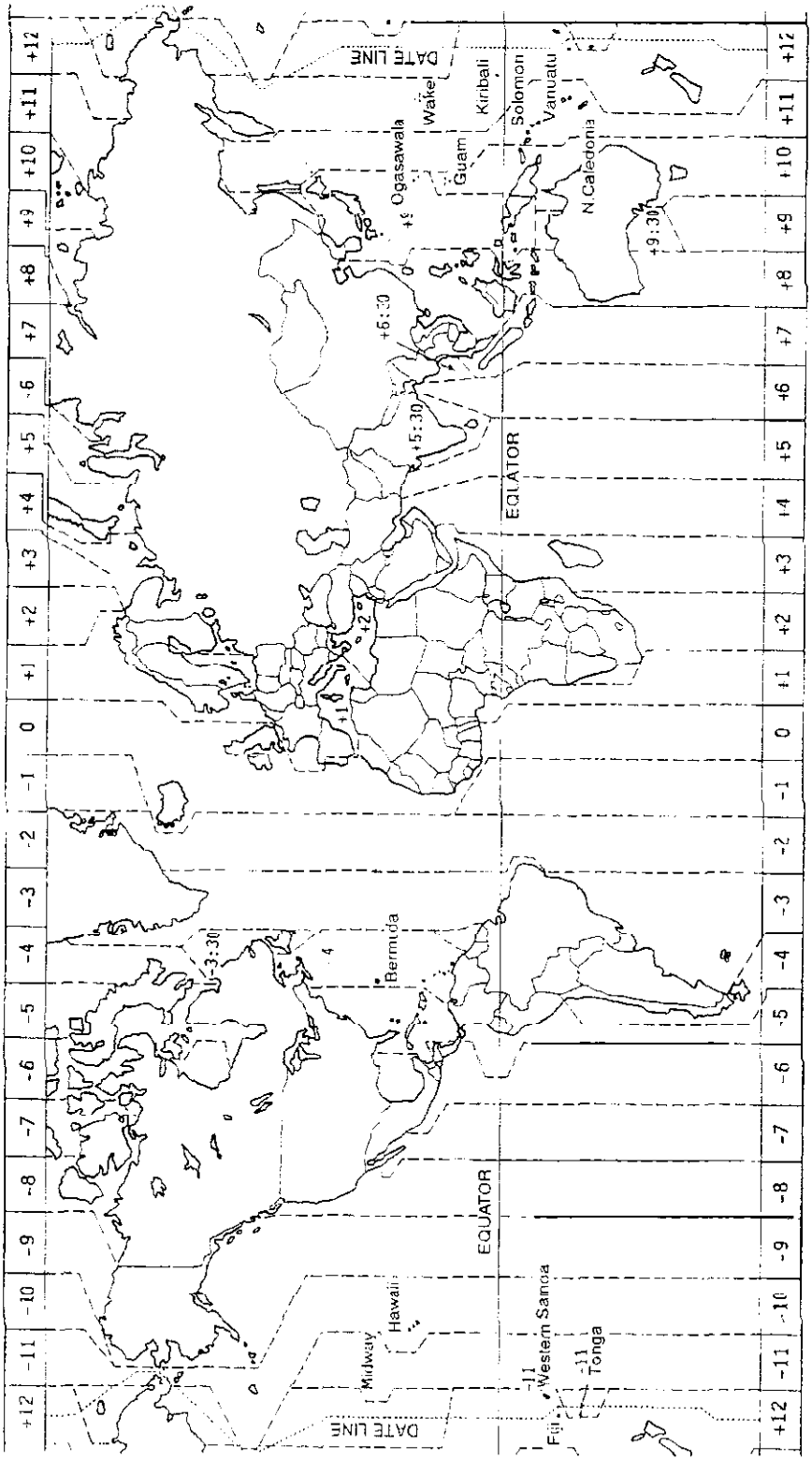
Select one of *1, *2, and *3.

Menu Tree

The menu tree helps you find a desired menu number quickly. The numbers in the tree are the numeral keys you press to display a menu. For example, if you want to test the keyboard, the menu number is 733.



Time Differences



Waypoint Log

WPT Name	Latitude	Longitude	Remarks
	° . '	° . '	
	° . '	° . '	
	° . '	° . '	
	° . '	° . '	
	° . '	° . '	
	° . '	° . '	
	° . '	° . '	
	° . '	° . '	
	° . '	° . '	
	° . '	° . '	
	° . '	° . '	
	° . '	° . '	
	° . '	° . '	
	° . '	° . '	
	° . '	° . '	
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	° . '	° . '	
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	° . '	° . '	
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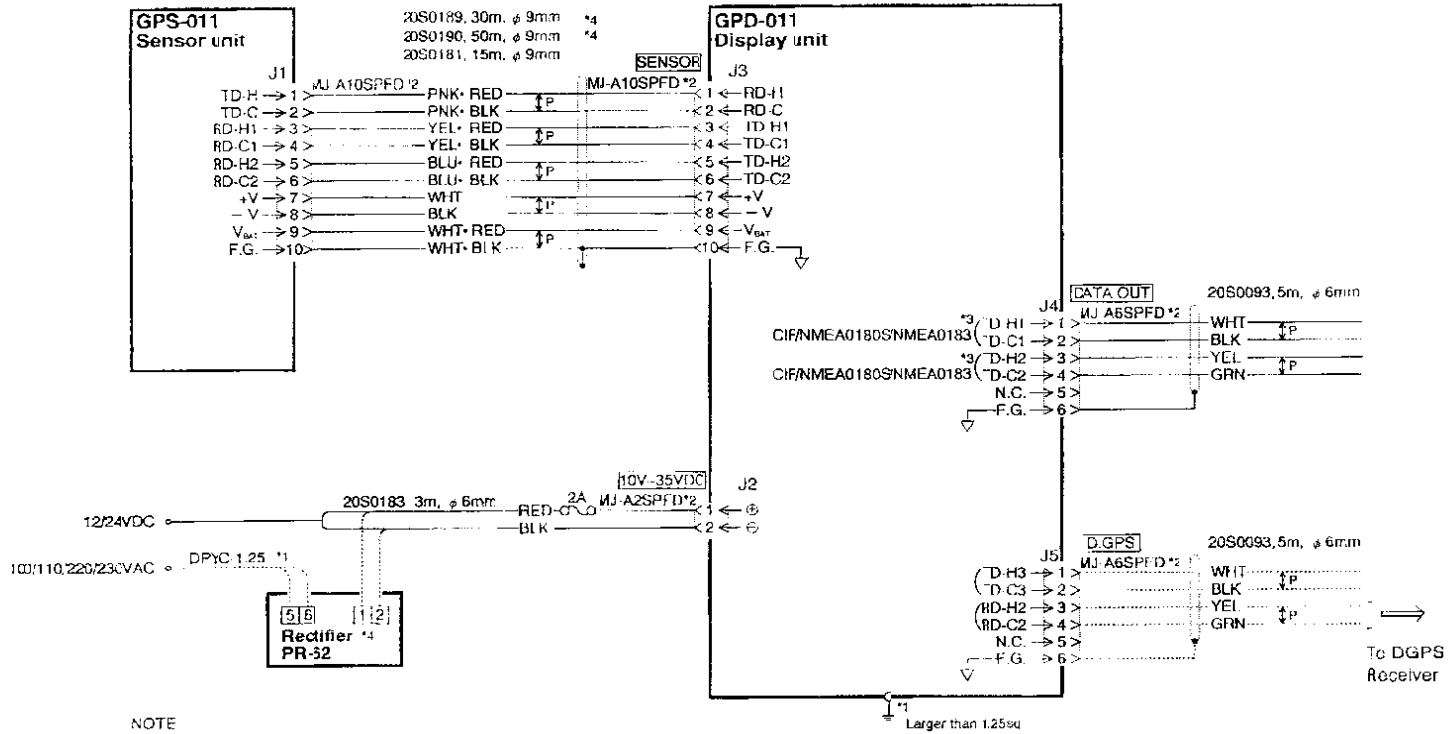
	° . '	° . '	
	° . '	° . '	

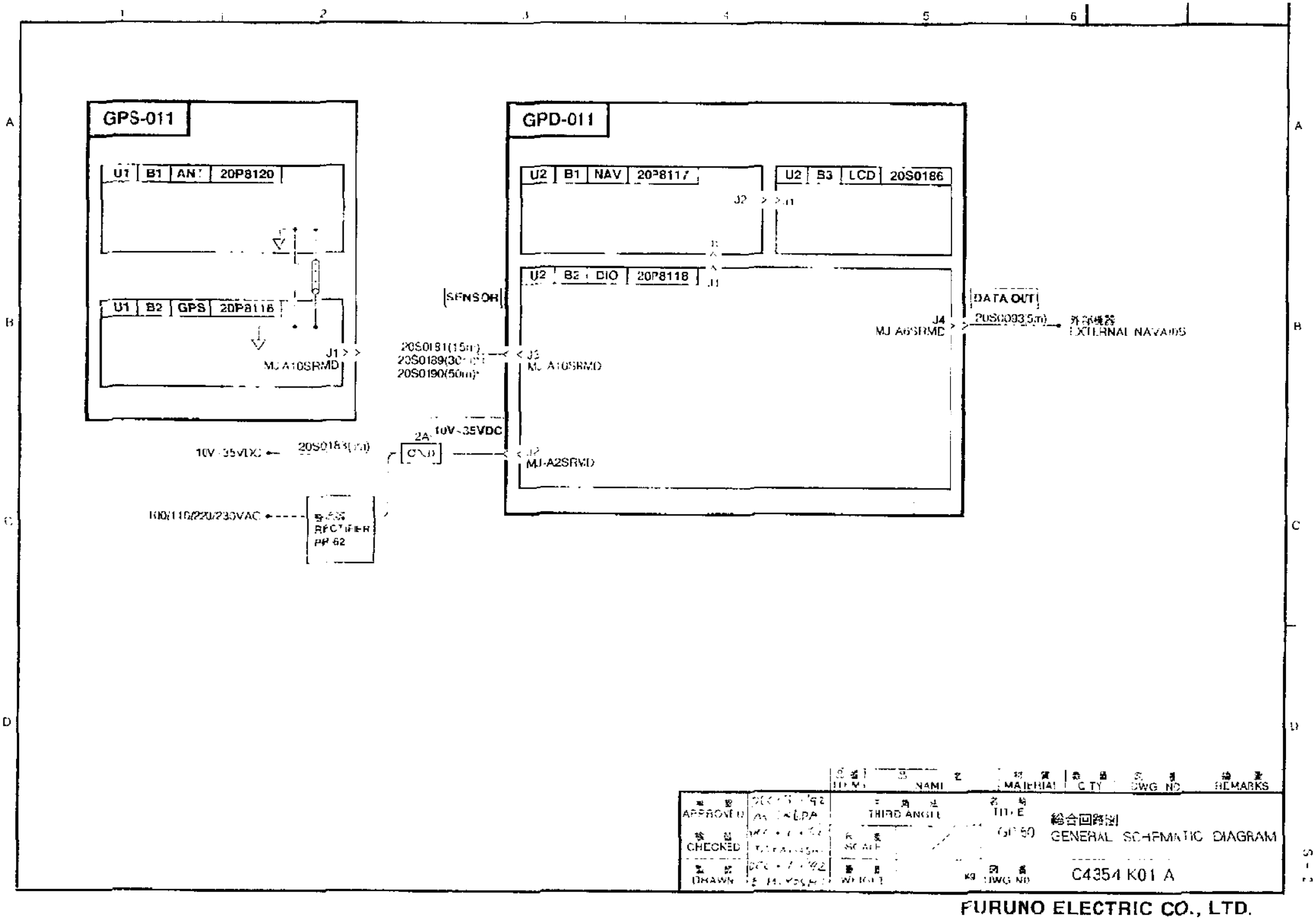
FURUNO



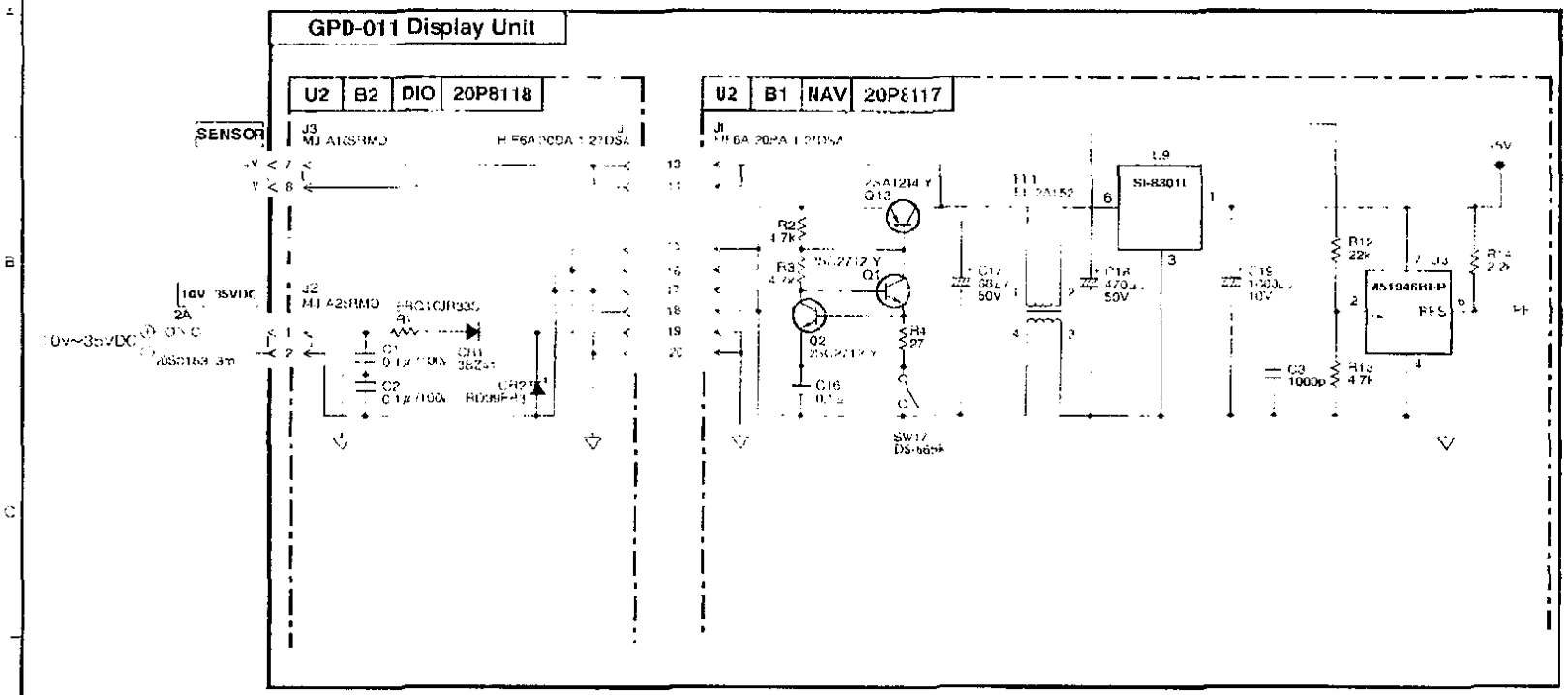
NOTE
*1 :To be supplied locally
*2 :Factory-wired
*3 :Selectable on MENU
*4 :Optional supply

APPROVED	DEC. 3. '92 M. IKEDA	THIRD ANGLE PROJECTION	TITLE: GP-50 INTERCONNECTION DIAGRAM
CHECKED	DEC. 1. '92 TAKAHASHI	SCALE	
DRAWN	DEC. 1. '92 E. MIYOSHI	WEIGHT kg	DWG.NO E4354-C01-C

FURUNO ELECTRIC CO., LTD.


GPS-011
U1 B1 ANT 20P8120
U1 B2 GPS 20P8116
J1
MJ-A10SRMD
GPD-011
U2 B1 NAV 20P8117
U2 B3 LCD 20S0186
U2 B2 DIO 20P8118
J2
J1
J3
MJ-A10SRMD
J2
MJ-A2SRMD
J4
MJ-A6SRMD
SENSOR
20S0181(15m)
20S0190(50m)
10V-35VDC
2A
20S0183
RECTIFIER
PR-62
DATA OUT
外部機器
EXTERNAL NAVAIDS
THIRD ANGLE
MATERIAL
REMARKS
APPROVED
CHECKED
DRAWN
SCALE
TITLE
DWG. NO.
総合回路図
GENERAL SCHEMATIC DIAGRAM
C4354-K01-A
FURUNO ELECTRIC CO., LTD.

FURUNO

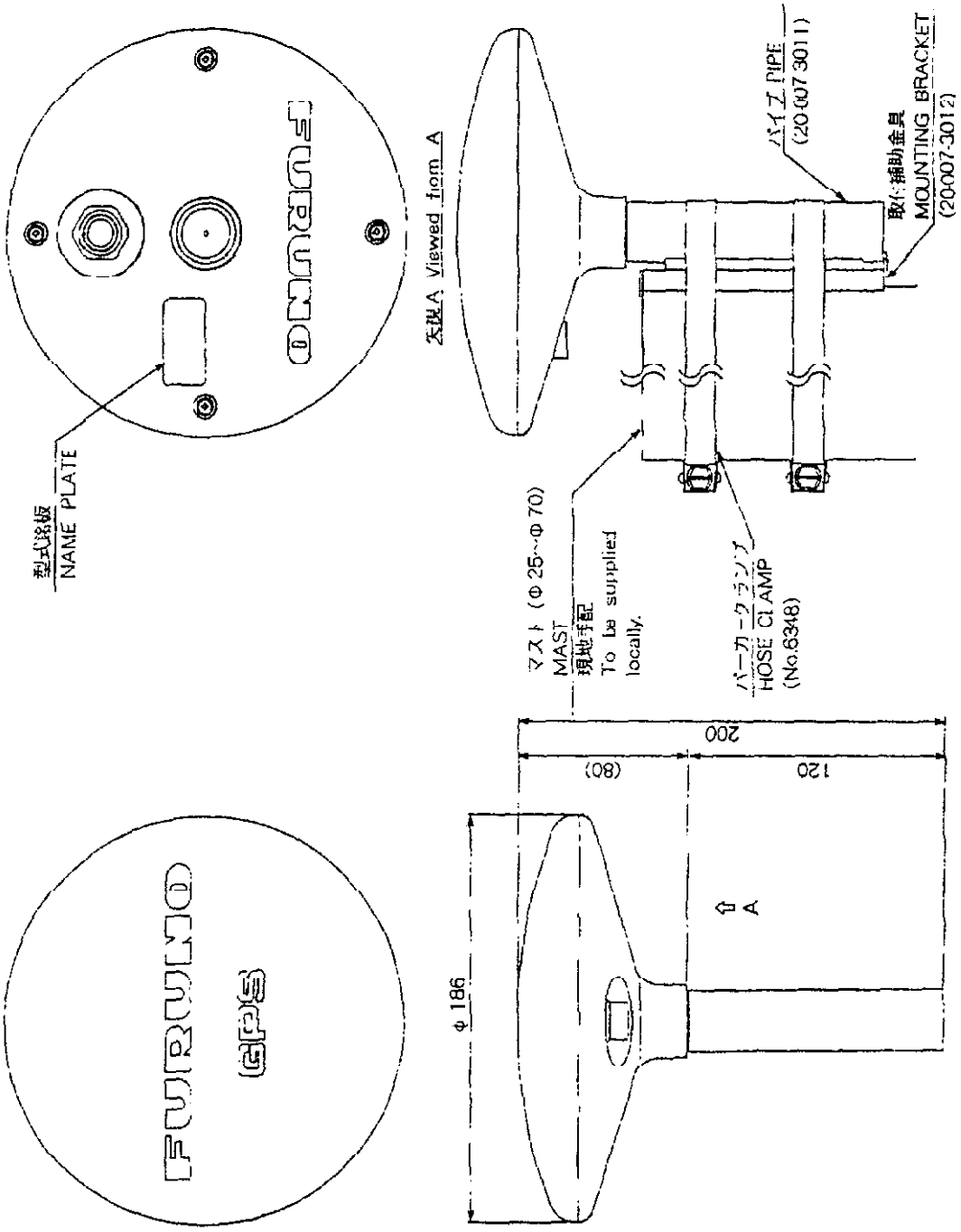


Note: Power supply circuit extracted from DIO board and NAV board.
注記：電源回路のみDIO基板とNAV基板から抜き出したもの。

ITEM	NAME	MATERIAL	Q'TY	DWG NO	REMARKS
APPROVED	THIRD ANGLE	TITLE	電源回路		
CHECKED	SCALE	GP-80	POWER SUPPLY CIRCUIT		
DRAWN	WEIGHT		DWG NO	C4354-K02 A	

FURUNO ELECTRIC CO., LTD.

FURUNO

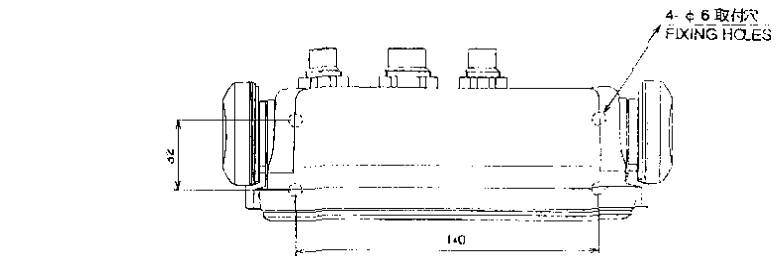


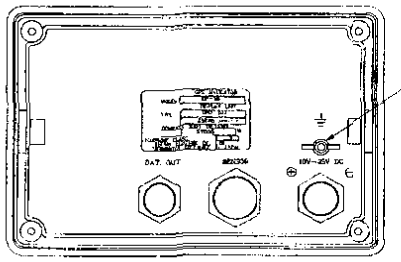
GP-50

承認 APPROVED	DEC・3・'92 M IKEDA	三角法 THIRD ANGLE		名称 TITLE	センサーユニット
検図 CHECKED	DEC・2・92 TAKAHASHI	尺度 SCALE	1/4	GPS-011	SENSOR UNIT
製図 DRAWN	DEC・1・'92 E. MIYOSHI	重量 WEIGHT	0.5 kg	図番 DWG.NO	C4354-G01-B

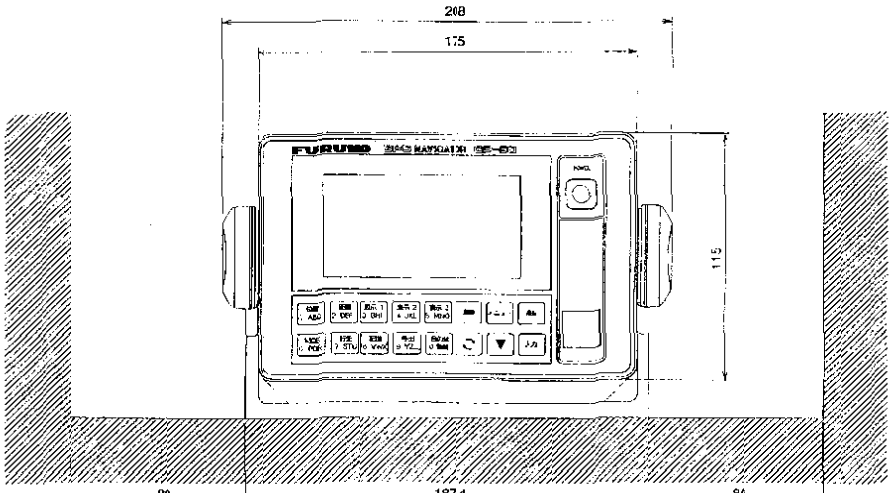
FURUNO ELECTRIC CO., LTD.

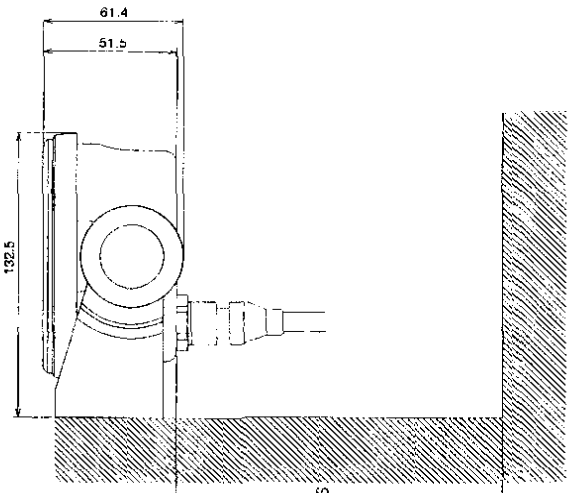
FURUNO





背面図 REAR VIEW



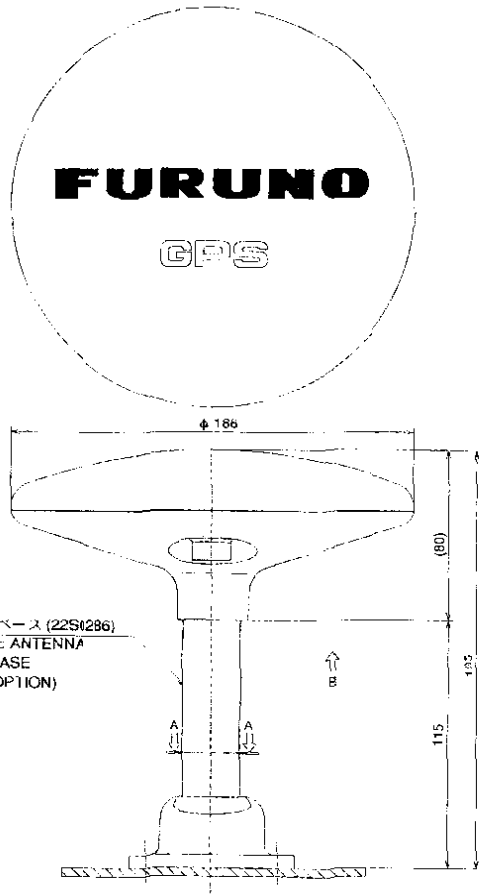


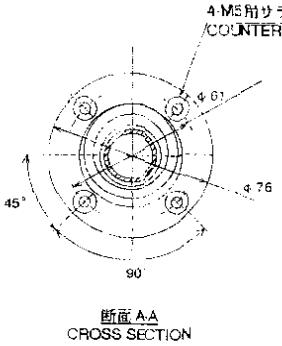
ITEM 品番	NAME 品名	MATERIAL 材質	Q'TY 数量	DWG. NO. 図番	REMARKS 摘要

APPROVED 承認	DEC. 1 '92 M. IKEDA	THIRD ANGLE 三角法		TITLE 名称	操作表示ユニット DISPLAY UNT
CHECKED 検図	DEC. 1 '92 T. KAWASHIMA	SCALE 尺度	1/1	GPD-011	
DRAWN 製図	DEC. 1 '92 E. MIYOSHI	WEIGHT 重量	0.7 kg	DWG NO 図番	C4354-G02-B

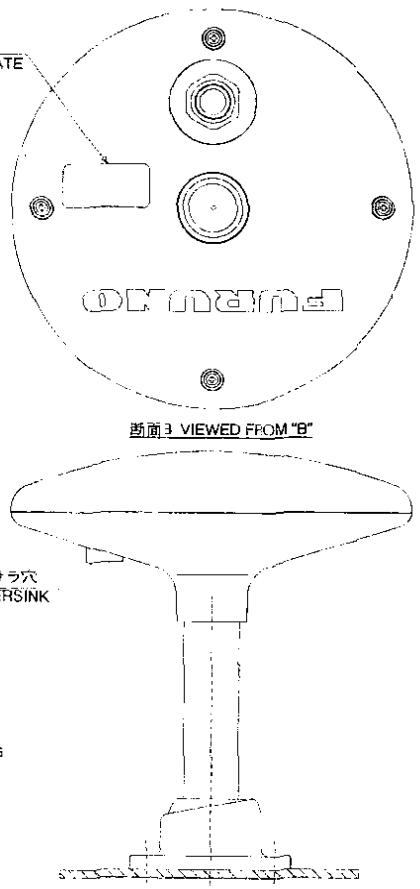
GP-50

FURUNO ELECTRIC CO., LTD.





断面 A-A
CROSS SECTION



断面 B VIEWED FROM "B"

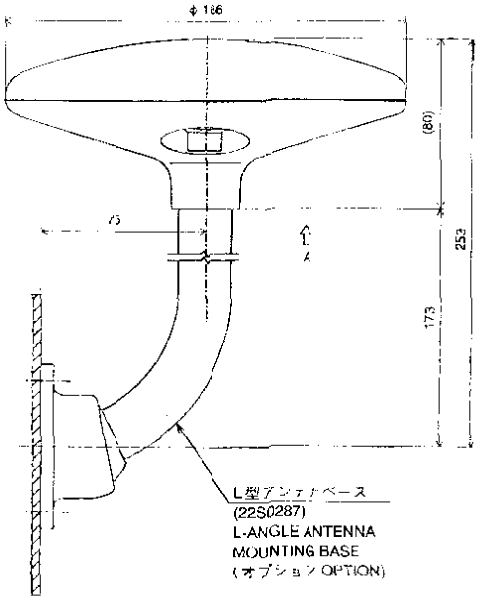
ITEM	NAME	MATERIAL	Q'TY	DWG. NO.	REMARKS

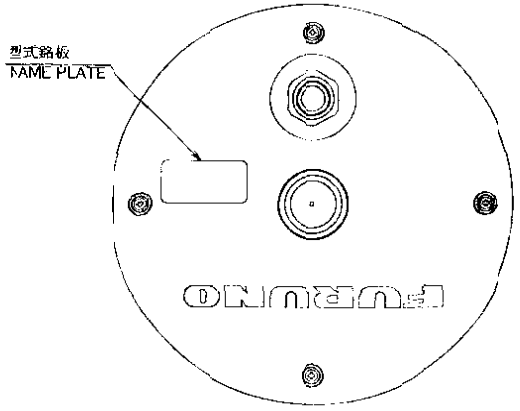
APPROVED	DEC・1・'92 M IKEDA	THIRD ANGLE	TITLE センサーユニット GPS-011 SENSOR UNIT (直型ベース RIGHT ANGLE BASE)
CHECKED	DEC・1・'92 TAKAHASHI	SCALE 1/4	
DRAWN	DEC・1・'92 E MIYOSHI	WEIGHT 0.5 kg	DWG.NO C4354-G03-A

GP-50

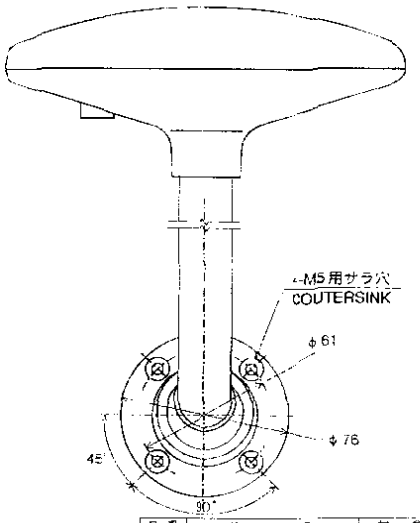
FURUNO ELECTRIC CO., LTD.

FURUNO





矢視A VIEW FROM "A"



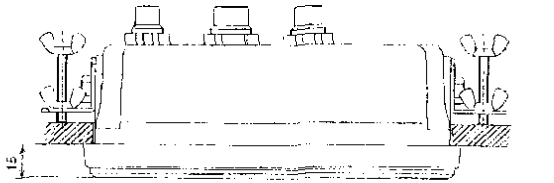
品番 ITEM	名称 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG. NO.	備考 REMARKS

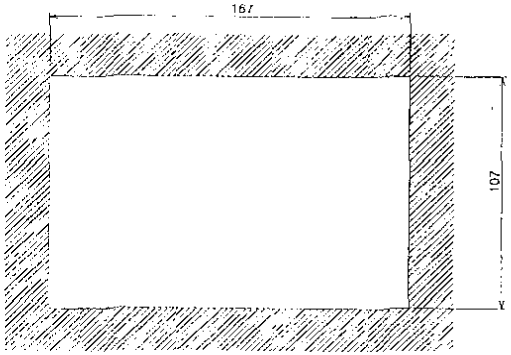
承認 APPROVED	DEC・1・'92 M. IKEGAMI	第三角法 THIRD ANGLE		名称 TITLE	センサーユニット GPS-011 SENSOR UNIT (L型ベース L-ANGLE BASE)
検図 CHECKED	DEC・1・'92 T. TAKEBAYASHI	尺度 SCALE	NS		
製図 DRAWN	DEC・1・'92 E. MIYOSHI	重量 WEIGHT	0.5 kg	図番 DWG NO	C4354-G04-A

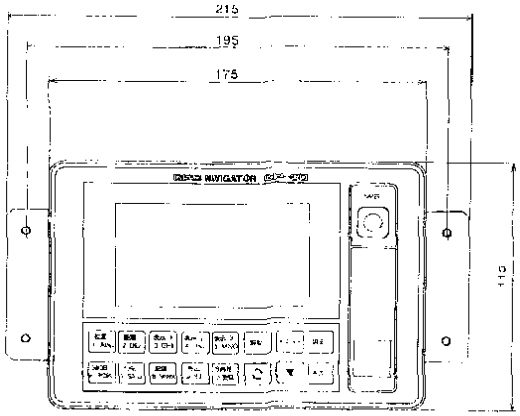
GP-50

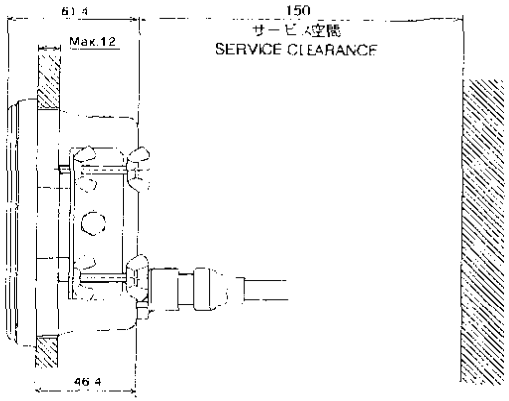
FURUNO ELECTRIC CO., LTD.

D-4









品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG. NO.	備考 REMARKS

承認 APPROVED	DEC・3 '92 M.IKEDA	三角法 THIRD ANGLE		名称 TITLE	操作表示ユニット DISPLAY UNIT (フラッシュマウントS S-TYPE FLUSH MOUNT)
検図 CHECKED		尺度 SCALE	NP	GPD-011	
製図 DRAWN	DEC・1・'92 E.MIYOSHI	重量 WEIGHT	0.7 kg	図番 DWG.NO	C4354-G05-A

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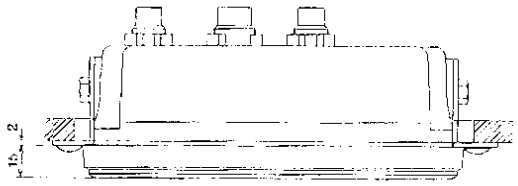

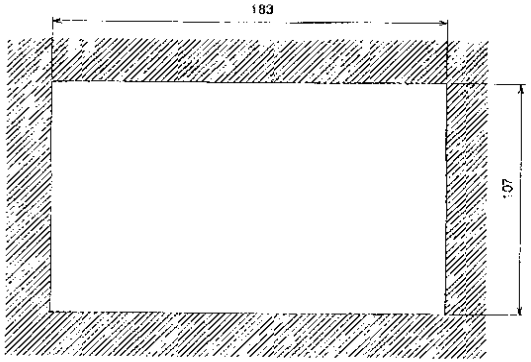

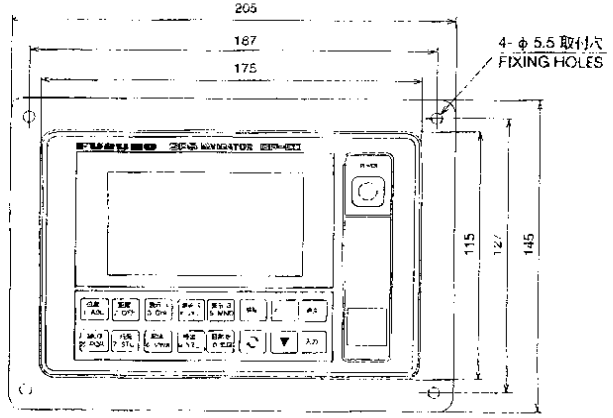

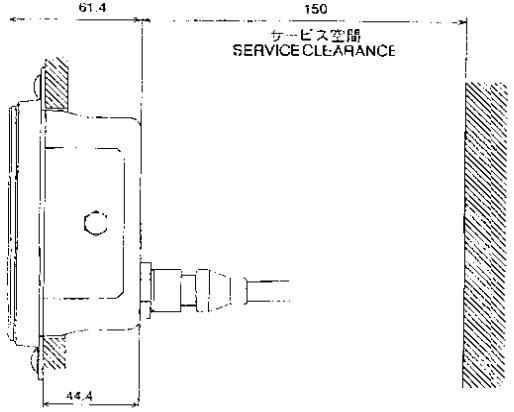

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG. NO.	摘要 REMARKS

承認 APPROVED	DEC.3.'92 M.IKEDA	第三角法 THIRD ANGLE		名称 TITLE	操作表示ユニット DISPLAY UNIT (フラッシュマウント F TYPE FLUSH MOUNT)
検図 CHECKED	DEC.7.'92	尺度 SCALE	NP	GPD-011	
製図 DRAWN	DEC.7.'92 E.MIYOSHI	重量 WEIGHT	0.7 kg	図番 DWG.NO	C4354-G06-A

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