Welcome to SI-TEX GPS-8

Welcome to the enjoyment and pleasure of operating your SI-TEX GPS-8 GPS Receiver.
In this manual, all the operational procedures are presented with example values or numbers for your convenience. Therefore, all you have to do is to replace them with your personal value or numbers. However, be sure to press blank area above letter or letters of each key for operation, otherwise the key does not response to your finger tip.

Table of Contents

Introduction

SI-TEX GPS-8 Receiver is a "state of the art" equipment for positioning accurately on sea, land, or in the air. The unit uses the radio message sent from the satellites launched into the orbit. The unit is very helpful when you would like to, for example:

- Know your boat position
- Store your boat position in the memory for later use.
- Recall your important previous boat position or fishing spot stored.
- Set waypoint position.
- Know the distance and bearing of waypoint from your boat.
- Create a route from your present position to the destination via waypoints.
- Hear the alarm sound when your boat arrives at your destination or leave the present anchored position, or goes off the preset course.
- Display other information for your navigation.

This operation manual will give you enough information so that you may well operate GPS-8 for your navigation.

In this manual, the **Mode Bar Position** illustration for each operation is placed on the upper-right hand corner of the page for your reference. The illustrations show you where you must place the bar for each operation. We, therefore, recommend you move the mode bar to the position shown by pressing the operation bar or navigational mode selection bar key.

What GPS (Global Positioning System) is

GPS is a navigation system using 24 satellites (21 plus 3 in reserve) orbiting the earth every 11 hours 58 minutes. When all the satellites are in orbit, your location will be accurately determined anywhere in the world 24 hours a day.

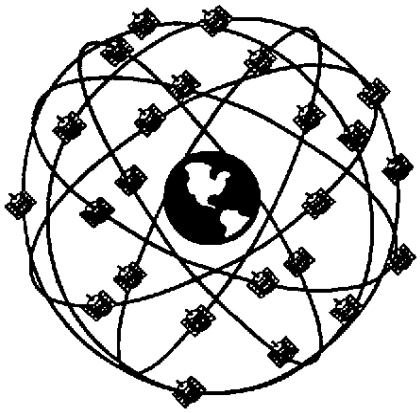


Fig. 1 GPS Satellites on the orbits

How your boat is positioned?

Your position is defined by calculating the distance from two satellites to your boat. Distance is determined by the time it takes a message to go from satellite to receiver (300,000 kilometers or 186,000 miles per second). However, it is not practical to have the clock on your boat synchronized precisely to the clocks on the satellites. Therefore, a third satellite is used to eliminate the time factor from the distance formula. The boat position is determined by the meeting point of three spheres formed by the three satellites. For calculating the altitude of your car, for example, as shown in Fig 3, another satellite is required. However, the accuracy of altitude is not always as precise as that of horizontal direction.

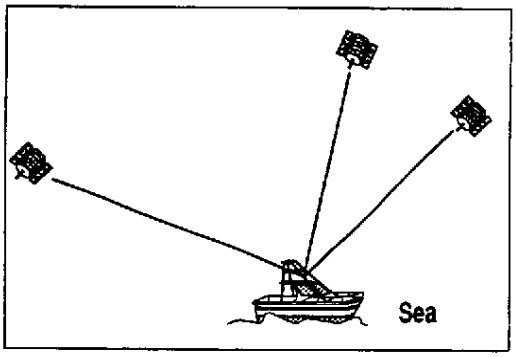


Fig. 2 Two-dimensional positioning on sea

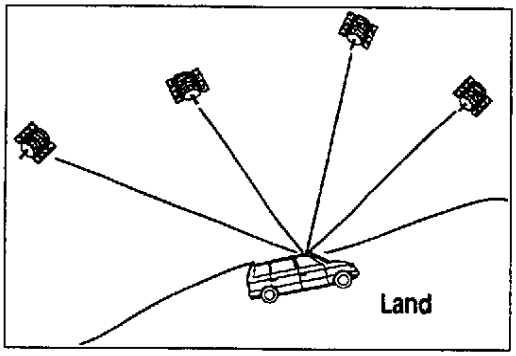


Fig. 3 Three-dimensional positioning on Land or in the air

HDOP (horizontal dilution of precision)

HDOP indicates the dilution of precision in a horizontal direction. The higher the number, the worse the positioning accuracy. The positioning accuracy varies considerably depending on the satellites your GPS is receiving. For example, if the satellite arrangement with an HDOP 9 is selected, the accuracy would be one third of an HDOP 3.

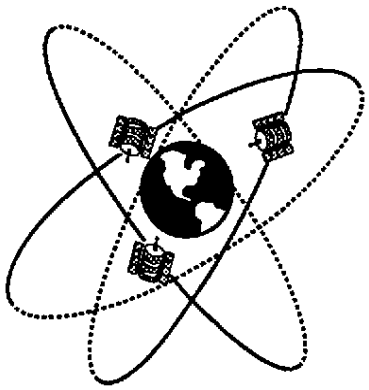


Fig. 4 Good HDOP satellites arrangement

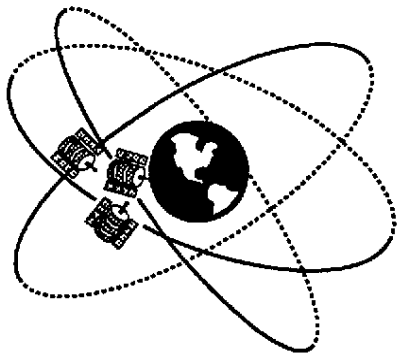


Fig. 5 Bad HDOP satellites arrangement

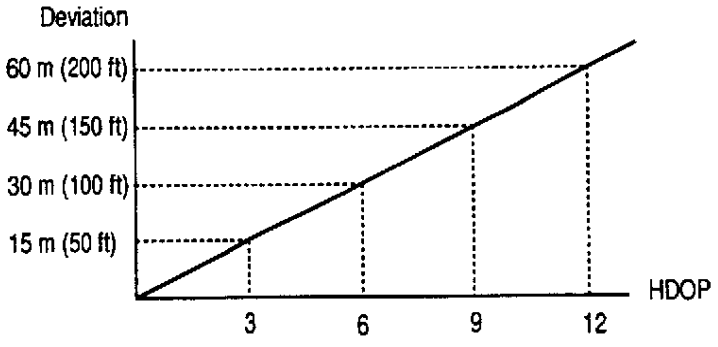


Fig. 6 HDOP and deviation

Note

■ Accuracy is subject to change in accordance with DOD civil users policy.

Names and function of items displayed

Memory bar: Indicates a position is stored or recalled.
Blinks: Recalled condition
Stays on: Stored condition

Operation Mode bar: Indicates selected Operation Mode.

Operation Mode: Abbreviated list of operation modes. **TIME** is available only when **V/CMG** is selected.

Note
■ Mode bar cannot be placed to the position of inoperable mode.

NO FIX marks: Blinks when position is not updated due to bad satellite status.

Compensation marks: Blink every 8 seconds when position and/or bearing is compensated.

Display Line 1: Displays position, XTE, satellite Number, time, etc. depending on the Operation Mode.

Display Line 2: Displays position, CDI, satellite Elevation or S/N, elapsed time, etc. depending on the Operation Mode.

Display Line 3: Displays navigational information selected by the Navigation Mode bars. (1 and 2)

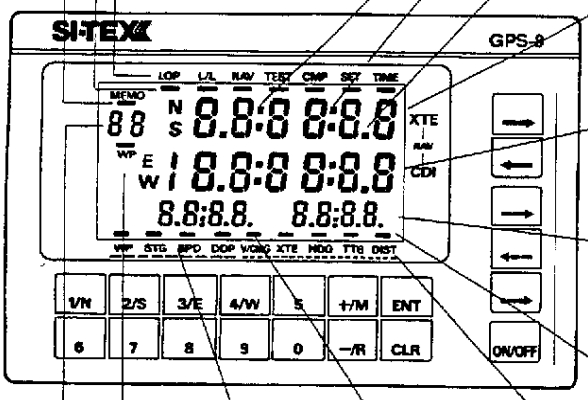


Fig. 7 Display Segments

Navigation Mode Bar 2: Shows what is displayed on the right half side of the Display Line 3.

Navigation Mode 2 : Abbreviated list of the display modes for the right half side of the Display Line 3.

Navigation Mode Bar 1: Shows what is displayed on the left half side of the Display Line 3.

Navigation Mode 1: Abbreviated list of the display modes for the left half side of the Display Line 3.

Waypoint Bar: Indicates Waypoint or route is set.
Blinks: Route is set.
Stays on: Waypoint is set.

Index Number: Indicates memory position number or setting Number.

Names and function of keys

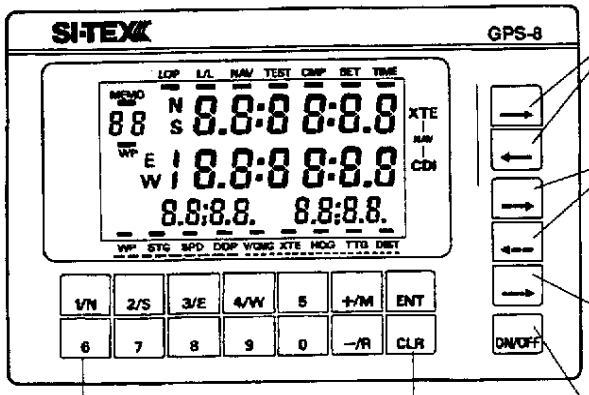


Fig. 8 Keyboard functions

Operation Mode key: Moves the Operation Mode bar left or right for selecting LOP, L/L, NAV, TEST, CMP, or SET.

Navigation Mode 1 key: Moves the Display Mode bar 1 left or right for selecting WP, STG, SPD, or DOP mode.

Navigation Mode 2 key: Moves the display Mode bar 2 for selecting V/CMG, XTE, HDG, TTG, or DIST mode.

Power/brightness key: Turns the unit ON/OFF and changes back light of the display and key brightness. A quick press turns on the unit and changes brightness while a 3-second press turns off the unit.

Number/function key: Used for entering data and giving function keys commands.

Quick reference of terms for navigation and operation modes

CDI Course deviation - Deviation angle between STG and HDG.
CLR Clear - Resets key entry display. Stops alarm sound momentarily.
CMP Compensation - Compensates or calibrates present position in L/L, bearing, time. Calculates bearing and distance between two points.
DIST Distance - Distance to the destination.
DOP Dilution of precision.
ENT Enter - Validates key entry.
HDG Heading - Moving direction of the vessel.
L/L Latitude/Longitude - Position in Latitude and Longitude coordinates.
LOP Line of Position - Position in Loran C time differences.
NAV Navigation - Automatically shows XTE, CDI, SPD, and HDG.
SET Set - Sets alarm ranges of arrival, anchor watch, and cross track error. Set antenna height from the mean-sea-level. Selects averaging factor, datum, the unit of measure, and fixing mode.
SPD Speed - Speed over the ground.
STG Steering to go - Direction of the destination point.
TTG Time to go - Estimated trip time to the destination.
V/CMG Velocity and course - Averaged speed and bearing since last reset of made good elapsed timer.
TEST Test - Shows entire display segments and satellite status.
TIME Time - Shows time of the day and elapsed time in V/CMG mode.
WP Waypoint - Sets a waypoint or route for navigation. Manages position memory storage.
XTE Cross track error - Distance and direction from the course line.
+/M Plus or memo - Provides plus sign. Stores positions into the memory.
-/R Minus or recall - Provides minus sign. Recalls positions from the memory.

Getting started

Turning the power on

ON/OFF

Press **ON/OFF** key to turn the power on, and the opening display as shown in Fig. 9 will appear. In a few seconds, the unit will start acquiring GPS satellite signals.

Mode Bar Position

LOP or L/L

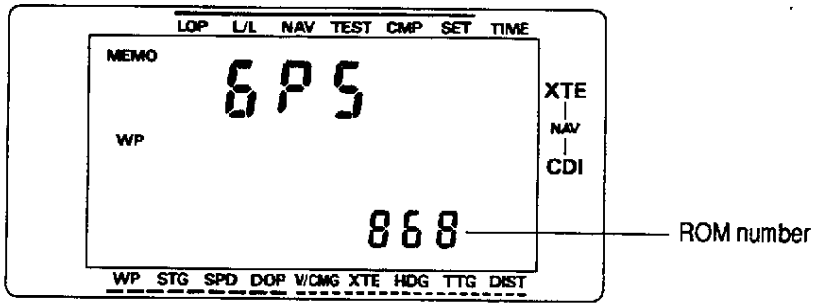


Fig. 9 Opening display

The unit will compute your position in less than a minute and indicate your position on the display as shown in Fig. 10. The position is valid when blinking **NO FIX** marks are out.

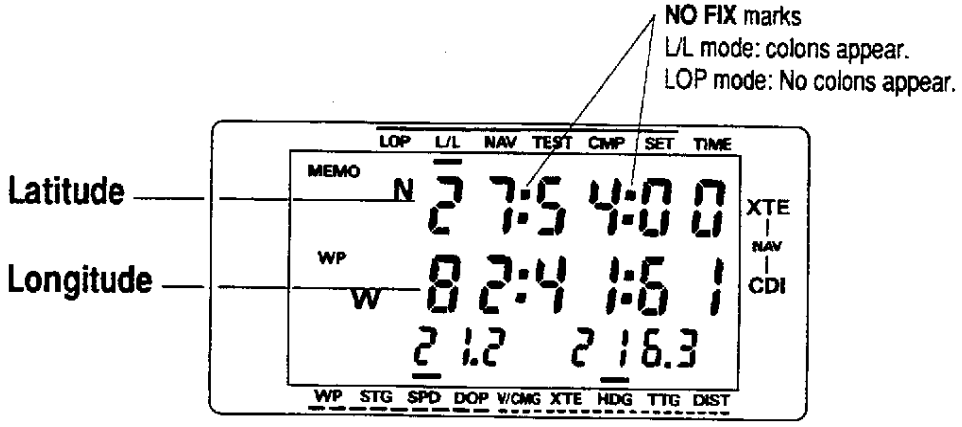


Fig. 10 Display example of L/L mode

Fig 10. indicates that your position is 27°54.00' north latitude, 82°41.61' west longitude.

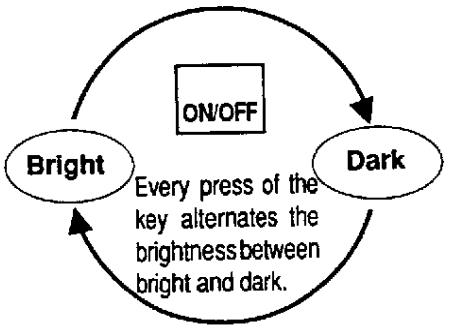
Notes

- In case the unit was previously used at a remote area or it has not been used for a long time, it may take about fifteen minutes to fix the first position because the unit must collect all the information necessary to calculate positions from satellites.
- The unit is designed to start either in L/L or LOP mode when it is turned on depending on the mode used in the previous operation. You may be required to move the operation mode bar to LL for Latitude/longitude position or LOP for converted LORAN C position by pressing Operation Mode key.
  Before using LOP mode, assign the chain and two secondary stations of the LORAN C. See Page 13.

Once the position is fixed on the display, HDG (moving direction), SPD (speed) and V/CMG (averaged speed and bearing) are now available. (The information about HDG, SPD, V/CMG is described later in this operation manual.)

Changing display brightness

ON/OFF —— Press **ON/OFF** key again to adjust the brightness of back light for both the LCD and keyboard. There are two brightness levels.



Turning the power off

ON/OFF —— Press **ON/OFF** key for a few seconds, and the unit will be turned off.

Storing present position (event memory)

As a handy feature, event memory is provided. Your present position is easily stored in the memory, and it will be also easily recalled on the display later. The positions stored can be used as waypoints on the route to destination. For more information about waypoint on the route, see ***Navigation Mode - Setting Waypoint (WP)*** on page 15.
Up to 10 present position can be stored.

Mode Bar Position

LOP , L/L or NAV

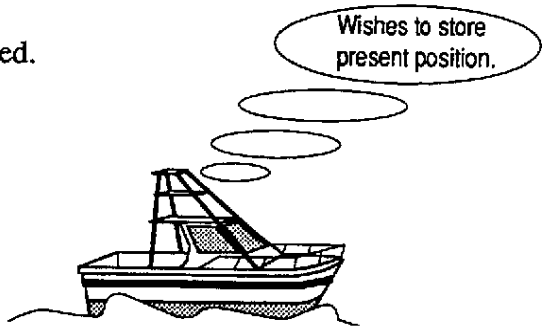


Fig. 11 Storing present position

Note

■ The event memory function is only available in Operation Mode **L/L**, **LOP**, or **NAV** except when Navigation mode is either **WP** or **V/CMG**.
If each bar is placed to wrong position, move the bar to other position by pressing Operation Mode key or Navigation Mode selection keys.

Storing present position

+/M —— Press **+/M** key, and the memory bar will be indicated with two-digit Index Number. The position display by the position Display Line 1 and 2 is frozen to show the position has just been memorized with the Index Number temporarily indicated.

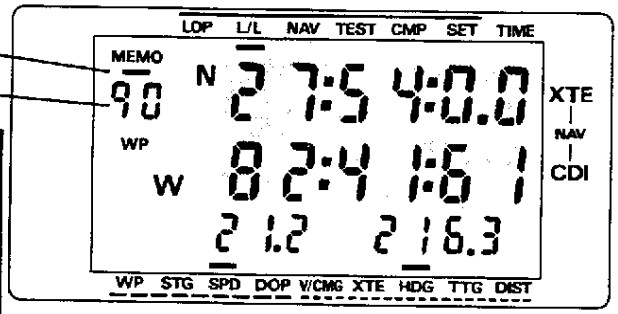


Fig. 12 Display example of Event memory

Note

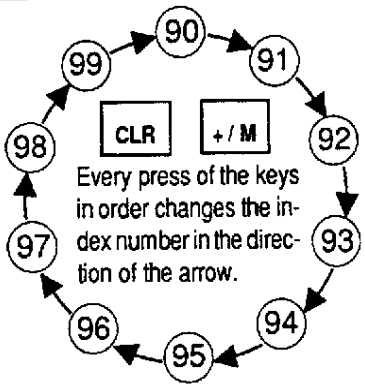
■ In **L/L** or **NAV** mode, the present position is stored in Latitude/longitude. On the other hand, in **LOP** mode, it is stored in Loran C LOP.

Fig. 12 indicates that your position 27°54.00' north latitude, 82°41.61' west longitude has just been stored in Memory number 90.

CLR —— Each press of **CLR** key to resume the normal updated position.

+/M —— Each press of **+/M** key increases the Index Number by one for the range of 90 to 99.
99 will return to 90 with the next press. The newer position will override the old one. 10 points can be put into memory.

Event memory Index Number Rotation



Note

■ If you have already stored a present position as event memory, we recommend you transfer points stored by Event memory to waypoint memory to prevent loss of precious positions.

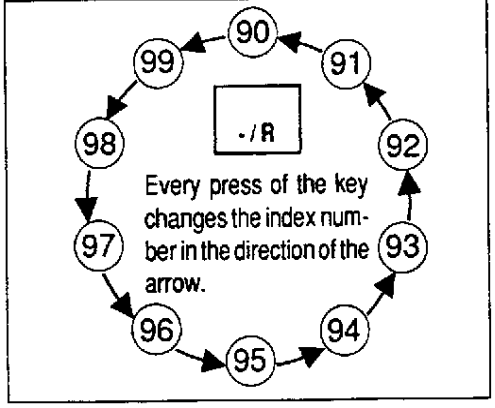
Recalling stored present position

The memorized position is always recalled whenever you want for later use.

-/R —— Press **-/R** key, and a memorised position will be displayed with the same Index Number used to store the position.
The memory mark brinks to show the position display is frozen. Each press of the **-/R** key decreases the Index Number by one for the range from 99 to 90. Next to 90 will be 99.

CLR —— Each press of **CLR** key to resume the normal updated position.

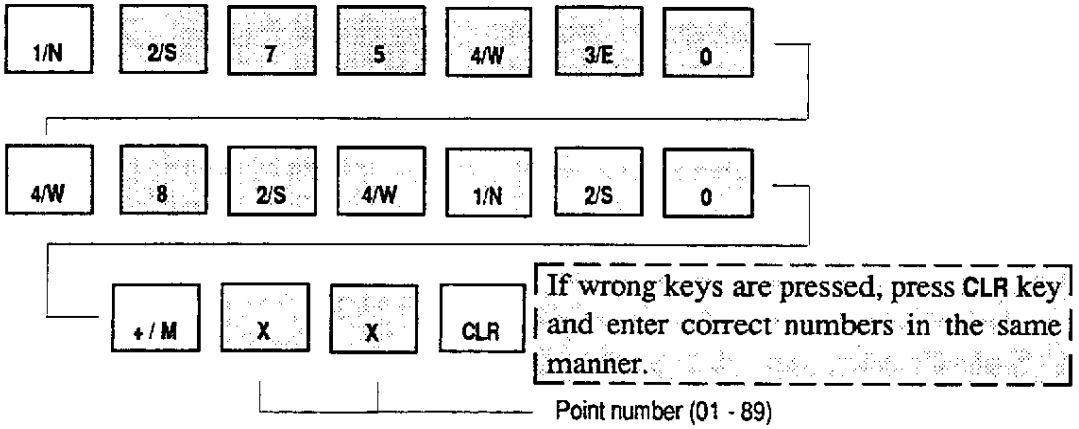
Rotation of Recalled Event memory Index Number



Storing position in L/L

Mode Bar Position

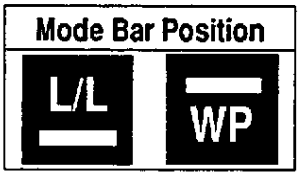
The position on the sea chart can be stored in lat/Lon with point number (01 to 89). For example, when you would like to store position at 27°54.30' north latitude and 82°41.20' west longitude as a waypoint memory, press the keys in the order of:



After **CLR** key is pressed, the position is stored with point number. The position stored can be used as a waypoint. (See page 16.)

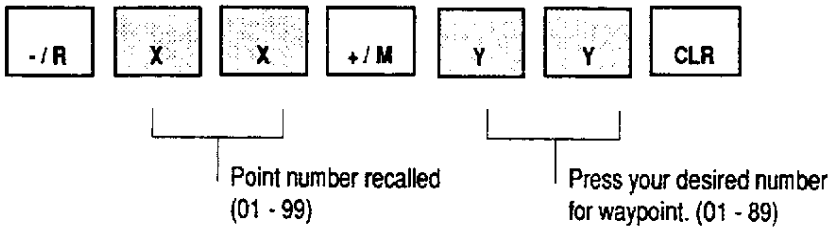
Changing a point number in L/L

Mode Bar Position



The event memory point can be transferred into waypoint memory and a point in the waypoint memory can be transferred from one point number to another point number.

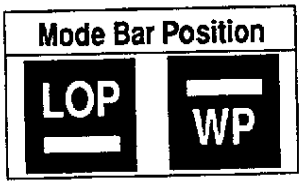
Press the keys in the order of:



If wrong keys are pressed, press **CLR** key and enter correct numbers in the same manner.

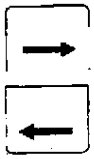
After **CLR** key is pressed, the position is transferred to other point with new number. The position stored can be used as a waypoint. (See page 16.)

Assigning LORAN C chain and secondary stations

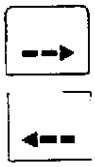


Positions in Latitude and Longitude fixed by the GPS system are converted into LORAN-C LOP's for those who are more familiar with LOP's rather than lat/lon positions.
Loran C chain and secondary stations must be assigned before using the unit in the Operation Mode LOP.

Directions:

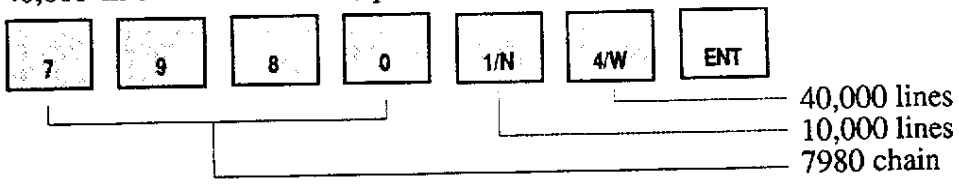


Press either arrow key to move Operation Mode bar to **LOP**.



Press either arrow key to move Navigation Mode bar to **WP**.

When your LORAN C secondary stations and chain is, for example, 10,000 and 40,000 lines in 7980 chain, press the keys in the order of:



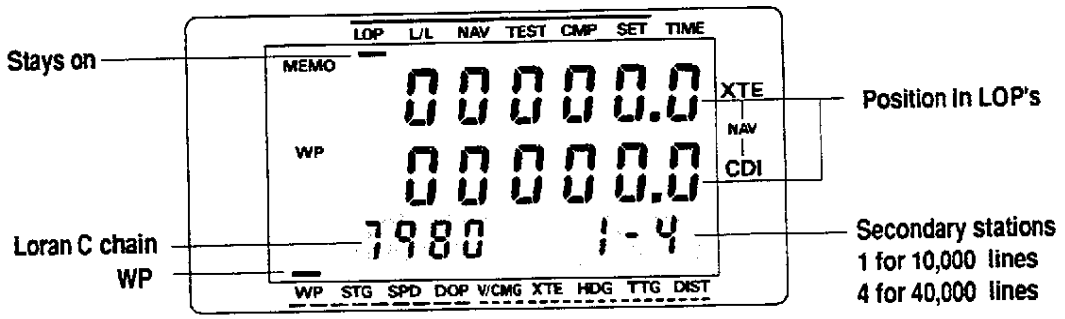


Fig. 13 Display example of LORAN C chain entry

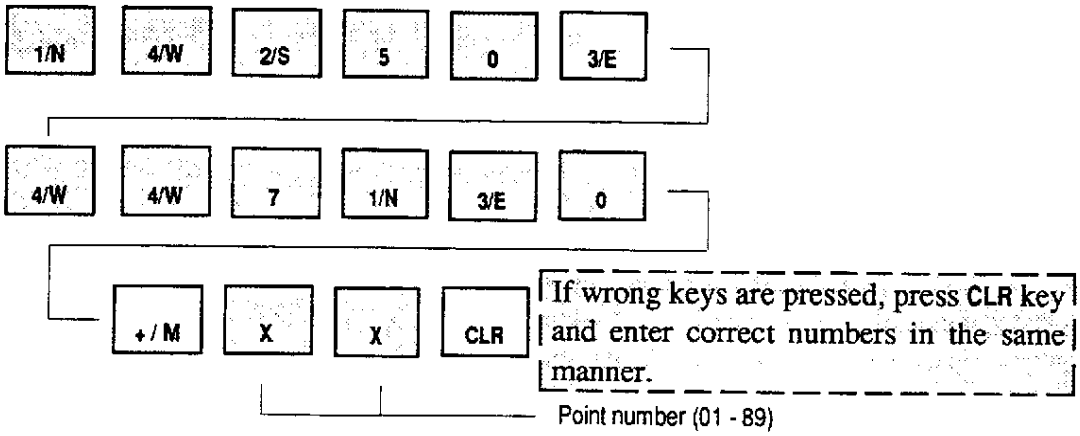
Press **CLR** key to clear the numbers on the display line 3.

Press **9** and **ENT** keys in order, and Loran C chain and secondary stations are displayed on the display line 3. When the chain and secondaries combination are not specified, all zeros are displayed. To resume normal display, press **9** and **ENT** keys in order again.

Storing position in LOP

Mode Bar Position: LOP WP

The position on the sea chart can be stored in LOP with point number (01 to 89). For example, when you would like to store position at LOP 14250.3 and 44713.0 as a waypoint memory, Press the keys in the order of:



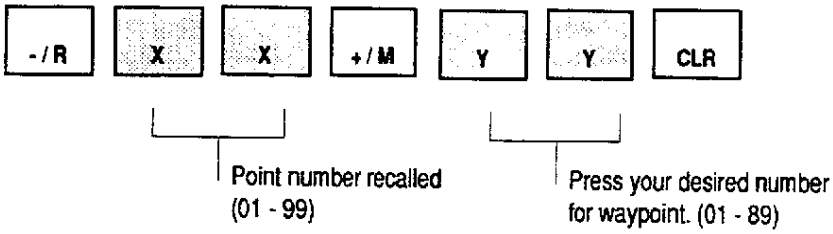
After **CLR** key is pressed, the position is stored with point number. The position stored can be used as a waypoint. (See page 16.)

Changing a point number in LOP

Mode Bar Position: LOP WP

The event memory point can be transferred into waypoint memory and a point in the waypoint memory can be transferred from one point number to another point number.

Press the keys in the order of:



If wrong keys are pressed, press **CLR** key and enter correct numbers in the same manner.

After **CLR** key is pressed, the position is transferred to other point with new number. The position stored can be used as a waypoint. (See page 16.)

Navigation mode - setting waypoint (WP)

Setting waypoint (WP)

Mode Bar Position	
LOP	WP
L/L	WP

When you would like to sail to the special fishing spot or another port in which the position is already know. You can easily create a route via positions stored as event memory or some waypoints. When you set a waypoint (destination) or a route, the unit automatically sets a course line to the waypoint from your present position, computes, and displays various information for your navigation.
It will help you navigate to the waypoint quickly and economically.
Prior to create route, you are required to store positions for waypoint or destination. Once these positions are installed in the unit, you can easily create a route by connecting waypoints. And, you can make use of Operation Mode - and various navigation information selectable in the Navigation Mode.
A waypoint can be set either by direct keyboard entry or recalling a point from previously stored positions in the memory. Memory capacity for storing 99 points is provided.

Memory Index Number Assignment	
Waypoint memory:	01 to 89
Event memory:	90 to 99

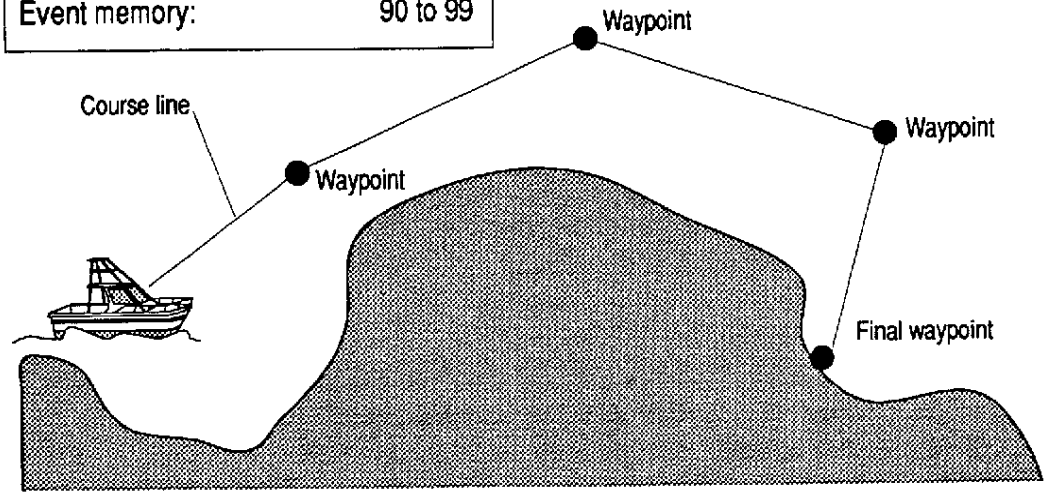


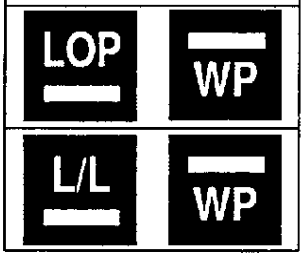
Fig. 14 Setting waypoint

Creating waypoint

Creating waypoint

The positions stored as waypoint memory can be used as a waypoint for your sailing.
In such a case, recall a position with point number XX. (XX: from 01 through 89), then press the keys in the order of:

Mode Bar Position



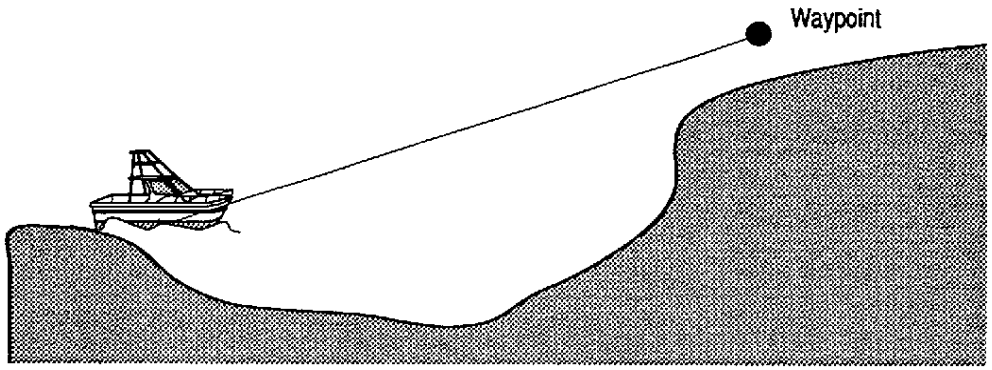
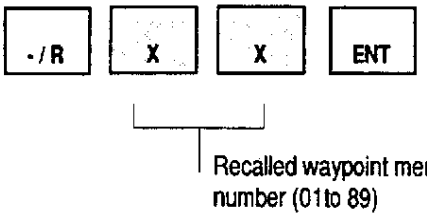


Fig. 15 Creating waypoint



After **ENT** key is pressed, the position of recalled point number **XX** is specified as a waypoint.

Note

- Press **CLR** key when you would like to cancel the waypoint already set and also clear key entry in process.

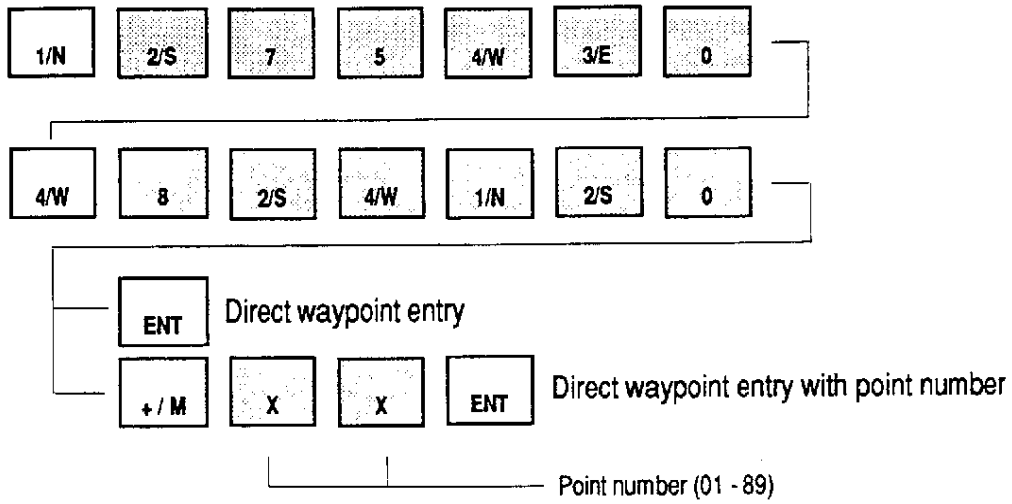
Notes

- The display of NAV(XTE, CDI), STC, XTE, TTG, and DIST and alarms of cross track error and arrival (proximity) become available when a waypoint is set.
- Setting of a waypoint resets anchor watch automatically.
- A new course will be established between the present position as the point of origin and the waypoint, every time a waypoint is set.
- During a trip along a route set, the waypoint is automatically switched to the next one when the vessel goes into the proximity alarm range from the current waypoint.
- The same point number cannot be used.

Entering waypoint in L/L

Mode Bar Position: L/L WP

For example, when you would like to enter the position at 27°54.30' north latitude and 82°41.20' west latitude as a waypoint, press the keys in the order of:

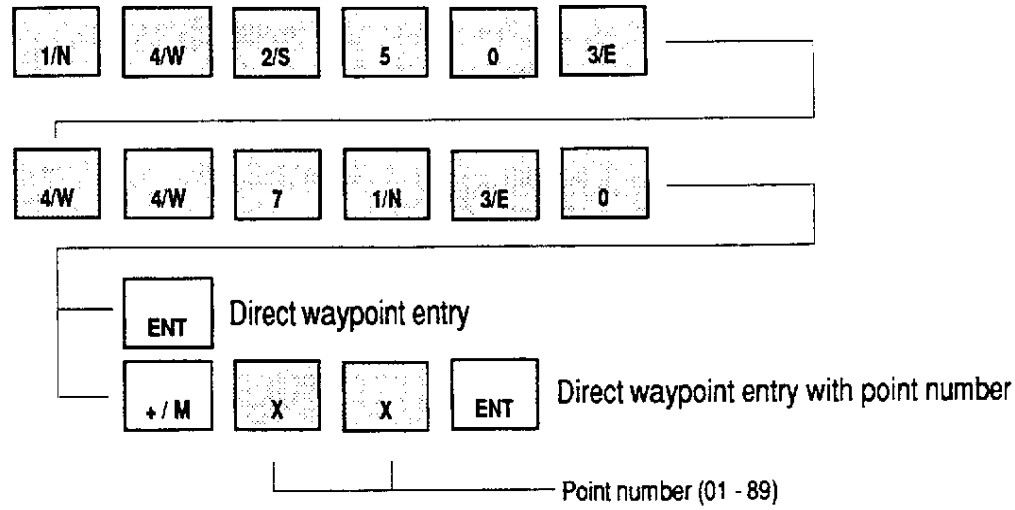


After **ENT** key is pressed, the position entered is specified as a waypoint.

Entering waypoint in LOP

Mode Bar Position: LOP WP

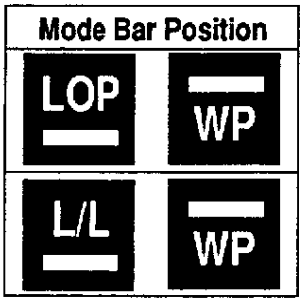
For example, when you would like to enter the position at LOP 14250.3 and 44713.0 as a waypoint, press the keys in the order of:



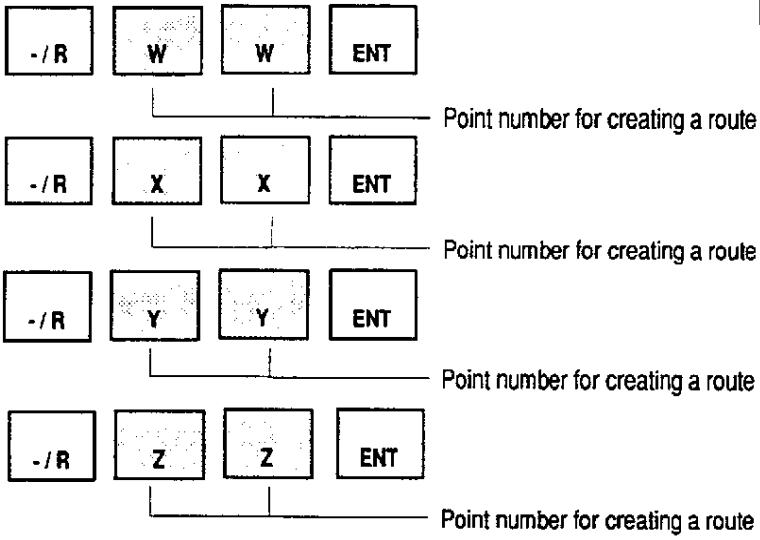
After **ENT** key is pressed, the position entered is specified as a waypoint.

Creating route

Creating route



The positions stored as waypoint memory can be used as waypoints on the route for your sailing.
In such a case, recall positions with point numbers **WW, XX, YY, ZZ**. (**WW, XX, YY, ZZ**: from 01 through 99). You can enter 10 points in maximum for placing waypoints on a route.
Press the keys in the order of:



After **ENT** key is pressed, the positions entered with point numbers **WW, XX, YY, ZZ** are connected as a route.

Note

■ Press **CLR** key when you would like to cancel the waypoint already set and also clear key entry in process. The position coordinate of stored positions for creating route must be the same each other.

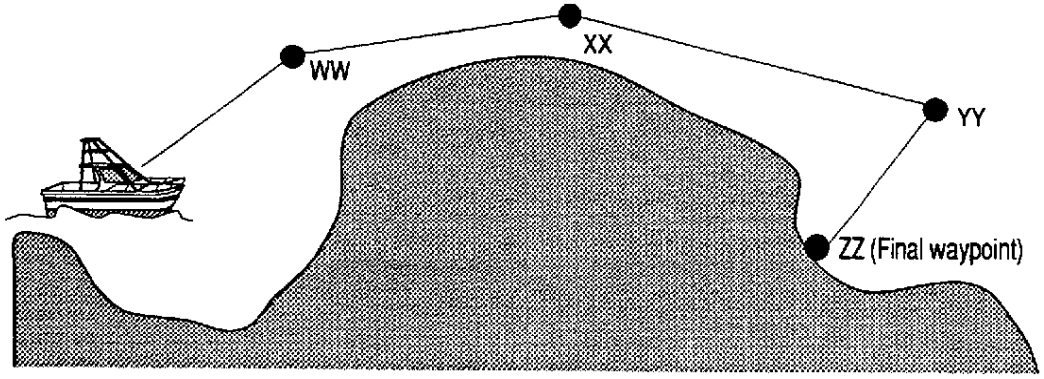


Fig. 16 Creating route

Reading WP mode display in L/L

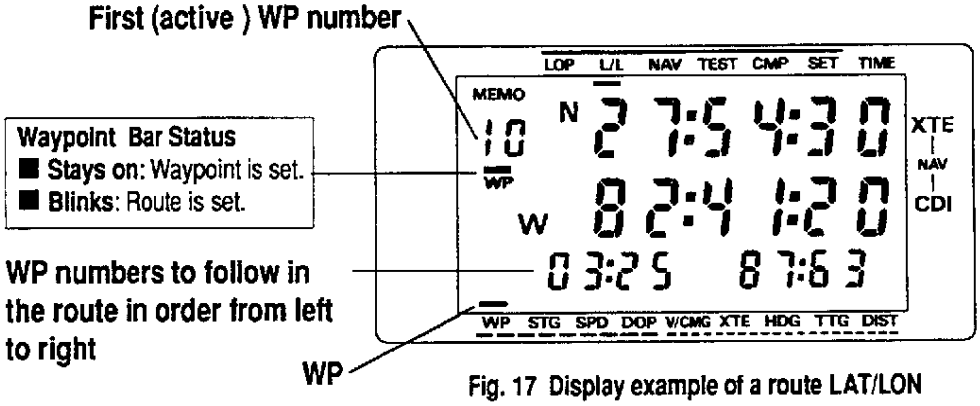
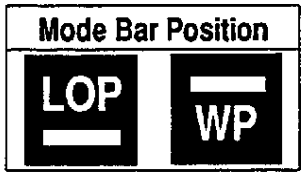


Fig. 17 Display example of a route LAT/LON

Fig. 17 indicates that the first waypoint is set with the memory point number 10 at 27°54.30' north latitude and 82°41.20' west longitude. Each number of 03, 25, 87, and 63 on the Display Line 3 represents waypoints to follow from left to right in the route. As the vessel approaches the first waypoint 10 and an audible proximity alarm sounds, all the numbers will be advanced and the point number 03 will be the next waypoint and it will be displayed at the index number location.

When only a single waypoint or no waypoint is set, there will be no display on the Display Line 3. All zeros will be displayed on the Display Line 1 and 2, when no waypoint is set.

Reading WP mode display in LOP



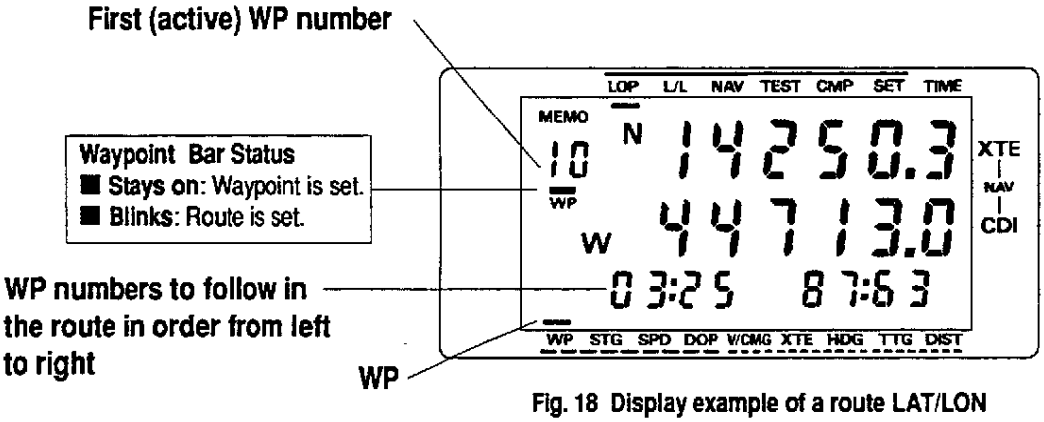


Fig. 18 Display example of a route LAT/LON

Fig. 18 indicates that the first waypoint is set with the memory point number 10 at LOP position 14250.3 and 44713.0. Each number of 03, 25, 87, and 63 on the Display Line 3 represents waypoints to follow from left to right in the route. As the vessel approaches the first waypoint 10 an audible proximity alarm sounds, all the numbers will be advanced and the point number 03 will be the next waypoint and it will be displayed at the index number location.

When only a single waypoint or no waypoint is set, there will be no display on the Display Line 3. All zeros will be displayed on the Display Line 1 and 2, when no waypoint is set.

Reversing route

Mode Bar Position

L/L WP
LOP WP

You can sail back to the start point of the current route via waypoints you have passed in the reverse order. When the route is reversed, the start point of previous route becomes the final waypoint and the latest waypoint you have passed becomes the first waypoint of the reversed route. This operation is recommended to be performed at the final waypoint.

Press the keys in the order of:

8 —— Press **8** key.

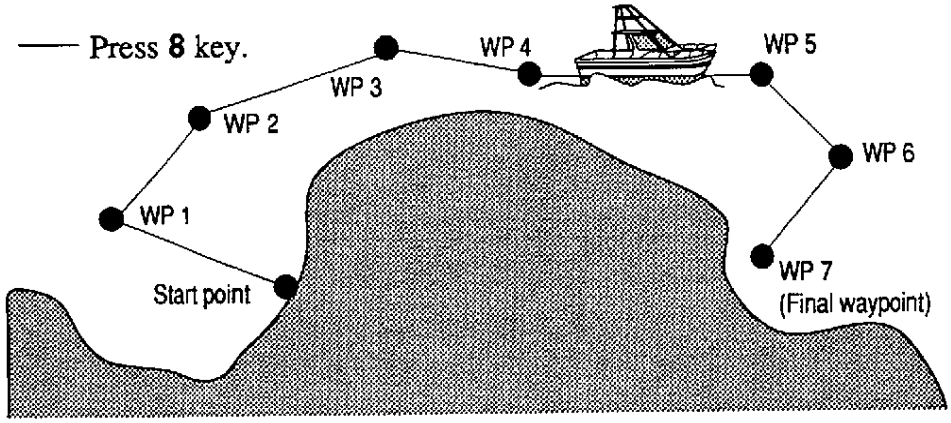


Fig. 18 Route previously set

ENT —— Press **ENT** key, and the waypoint order in the route is reversed for sailing back to the start point of the previous route.

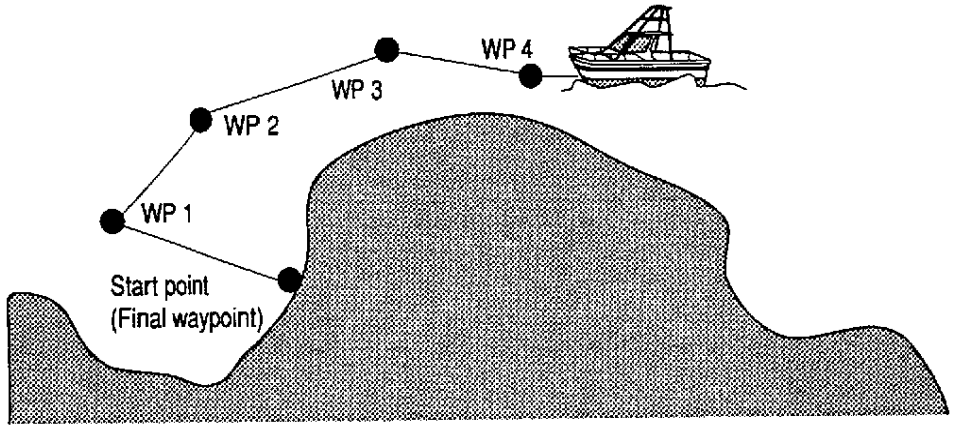
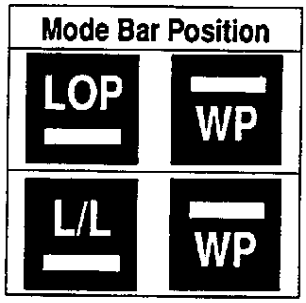


Fig. 19 Reversed route

Renewing point of origin

You may create a new course starting with present position to active waypoint.



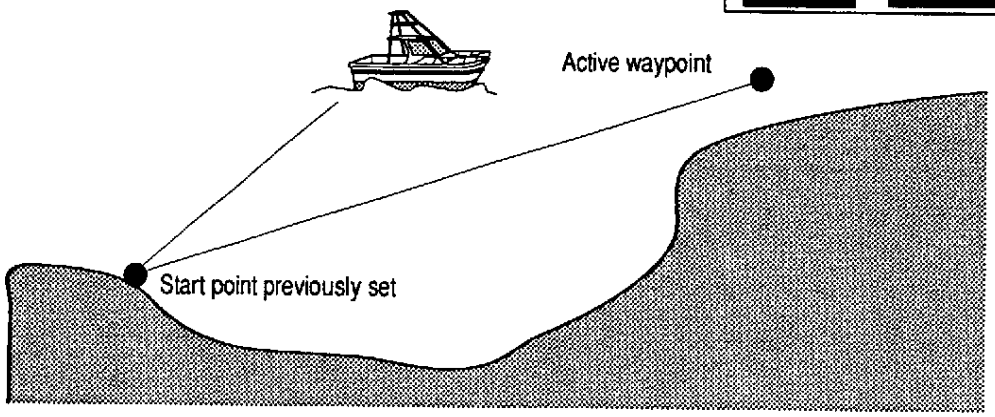


Fig. 21 Before renewing the point origin

Press the keys in the order of:

1/N —— Press **1** key.

ENT —— Press **ENT** key, and present position will be set as a point of origin.

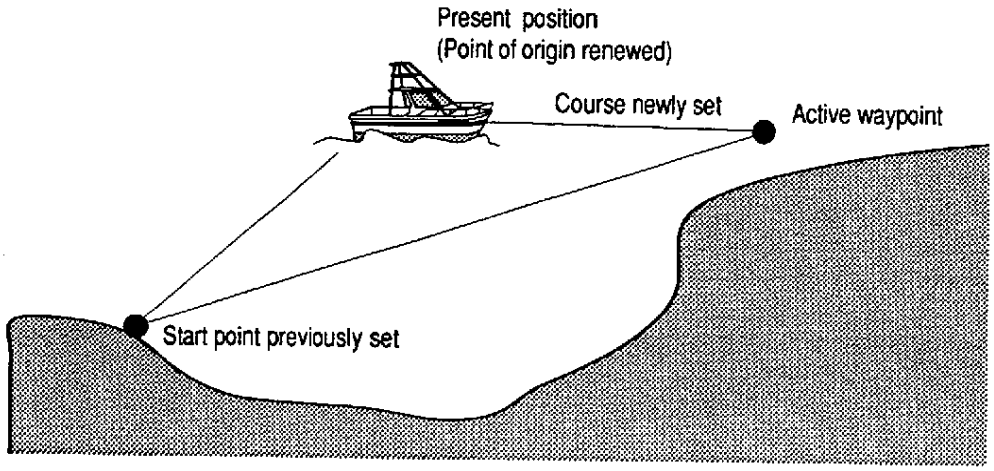


Fig. 22 After renewing the point origin

Skipping active waypoint

When you would like to sail to the next waypoint for some reason, you can easily skip the active waypoint.

Mode Bar Position

LOP	WP
L/L	WP

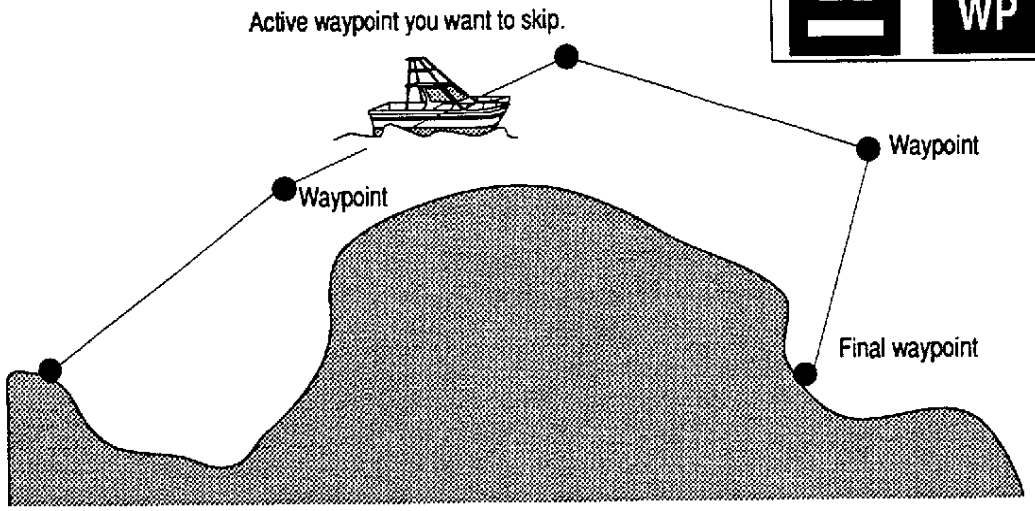


Fig. 23 Before skipping the active waypoint

Press the keys in the order of:

2/S —— Press **2** key.

ENT —— Press **ENT** key, and active waypoint will be skipped.

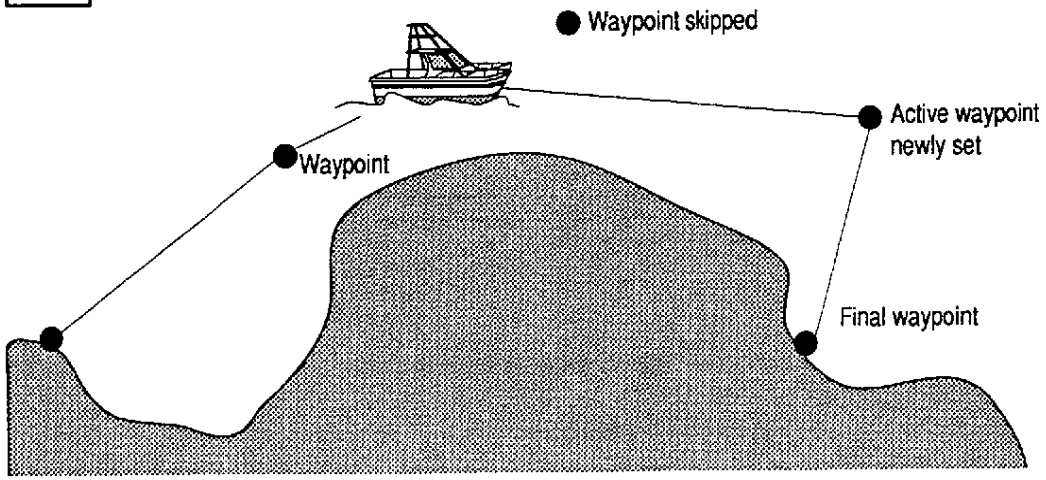


Fig. 24 After skipping the active waypoint

Displaying navigation modes

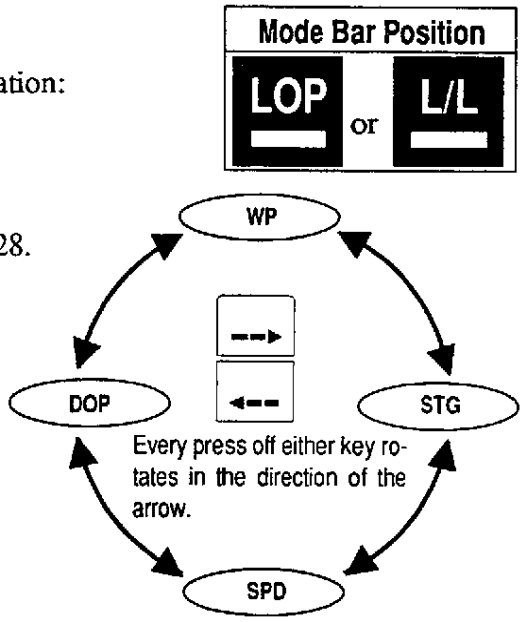
After setting a waypoint, various navigational information including **STG, SPD, V/CMG, XTE, HDG** and **DIST** becomes available. Two kinds of information, navigation modes 1 and 2, are selected and displayed for navigational use.

Selecting navigation mode 1

This mode provides the following information:

- **WP (Waypoint)** ... See page 12.
- **STG (Steering to go)** ... See page 26.
- **SPD (Speed)** ... See page 27.
- **DOP (Dilution of Precision)** ... See page 28.

Each item can be chosen by pressing either arrow key. (Navigation Mode bar 1 is placed to the active item.)
For more information about each item, see the descriptions starting after the next page.



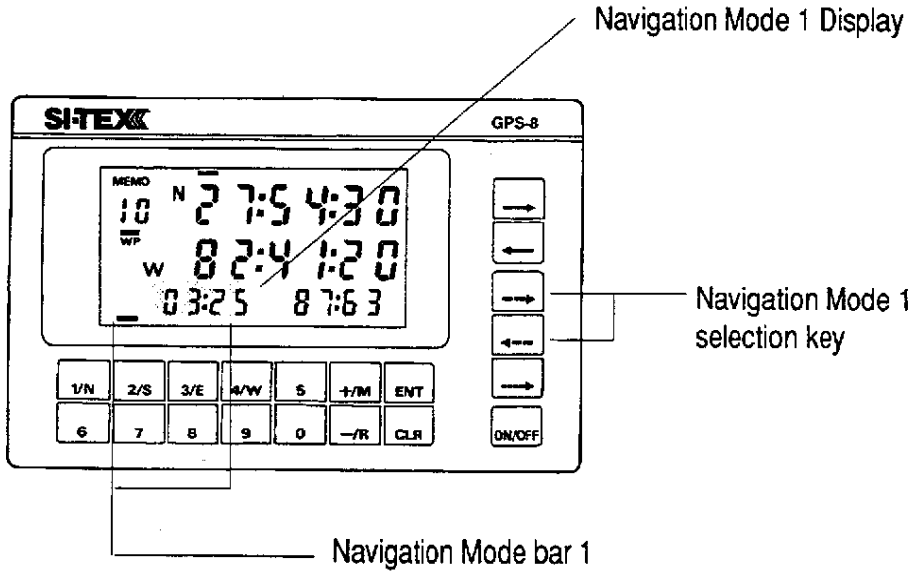


Fig. 25 Navigation mode 1

Selecting navigation mode 2

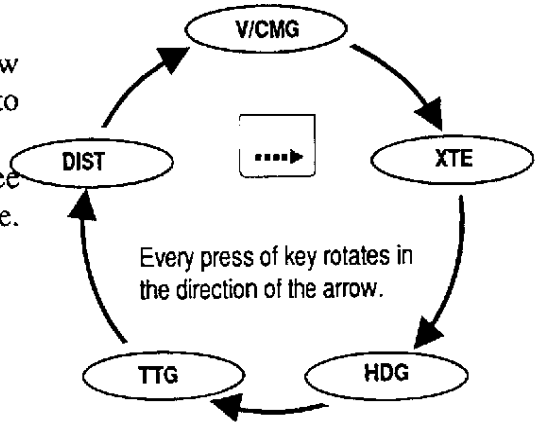
Mode Bar Position

LOP or L/L

This mode provides the following information:

- **V/CMG (Velocity/Course Made Good)** ... See page 29.
- **XTE (Cross Track Error)** ... See page 30.
- **HDG (Heading)** ... See page 31.
- **TTG (Time to Go)** ... See page 32.
- **DIST (Distance)** ... See page 34.

Each item can be chosen by pressing arrow key. (Navigation Mode bar 2 is placed to the active item.)
For more information about each item, see the descriptions starting with the next page.



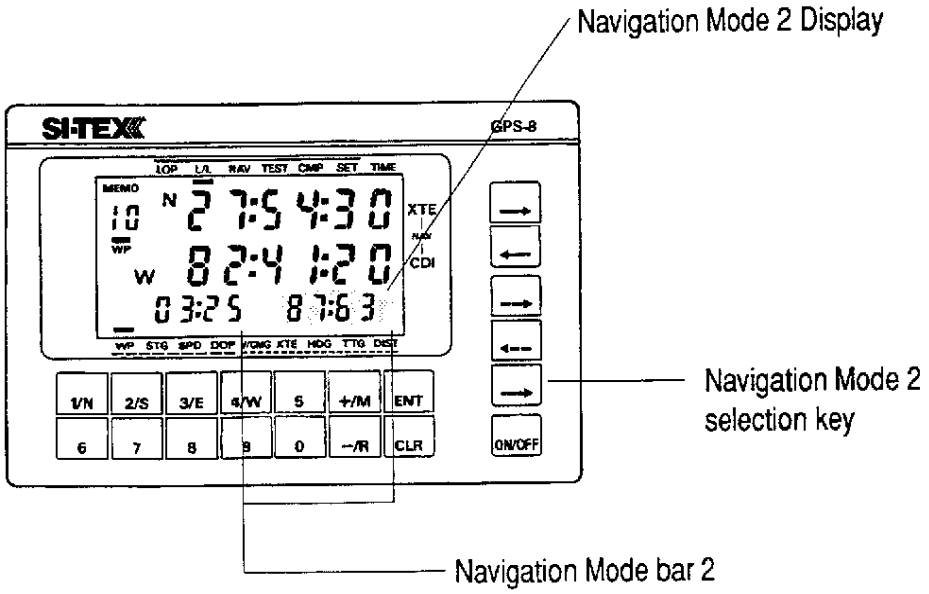
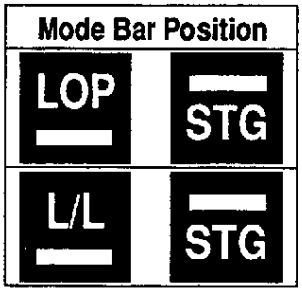


Fig. 26 Navigation mode 2

Displaying STG (steering to waypoint)

The bearing to the waypoint from the true north is displayed when a waypoint is active during navigation.



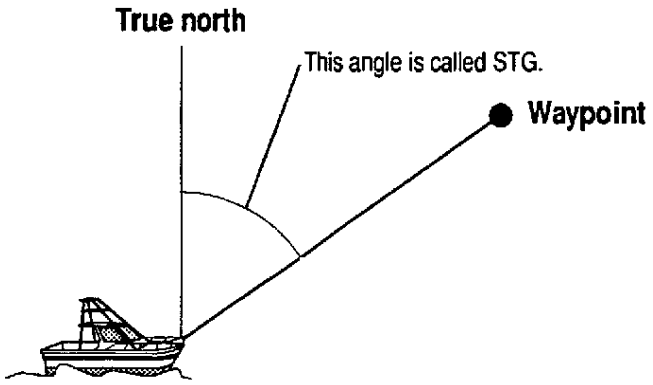


Fig. 27 STG

Directions:

Press either key to move the Navigation Mode bar 1 to **STG**, and the bearing to the waypoint will be displayed on the left side of Display Line 3.

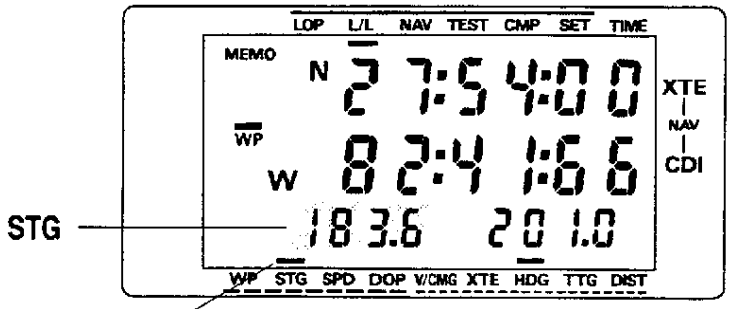
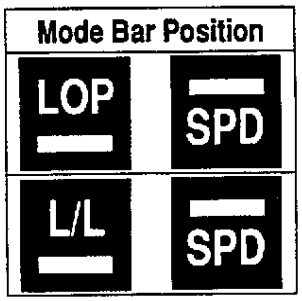


Fig. 28 Display example of STG

Fig. 28 indicates the bearing to waypoint (steering to go) is 183.6 degrees from the ship's moving direction.

Displaying SPD (speed)

The ship's speed relative to ground is displayed.



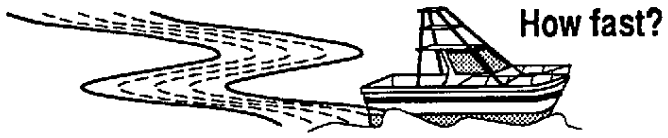
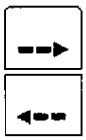


Fig. 29 HDG

Directions:



Press either key to move the Navigation Mode bar 2 to **SPD**, and the ship's speed absolute over the ground will be displayed on the left side of Display Line 3.

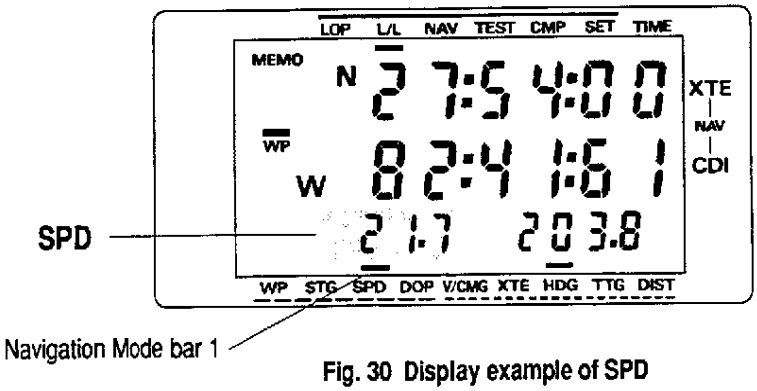
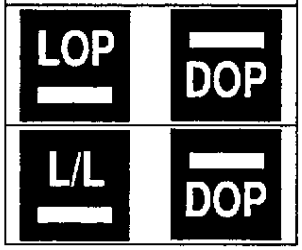


Fig. 30 Display example of SPD

Fig. 30 indicates the ship's speed is 21.7 knots over the ground.

Displaying DOP (dilution of precision)

Mode Bar Position



Merit of position accuracy (PDOP for three-dimensional and HDOP for two-dimensional position) is indicated on the left side of Display Line 3. On the other hand, the altitude above the sea level on the right side. (For more information about DOP, see ***HDOP*** on page 5 of this operation manual.)

When three-dimensional position fixing mode is selected or when three-dimensional position fixing is available, **P** is displayed; on the other hand, when two-dimensional position fixing is available **H** is displayed. In such a case, the previously measured altitude will be displayed during two dimensional measuring.

Remember that as long as you are using the unit for boat navigation, it does not make any difference whether H or P is displayed or not.

Note:
- H: HDOP for two-dimensional mode
- P: PDOP for three-dimensional mode

Directions:

Press either key to move the Navigation Mode bar 1 to **DOP**, and the DOP value and the altitude above the sea level will be displayed on Display Line 3.

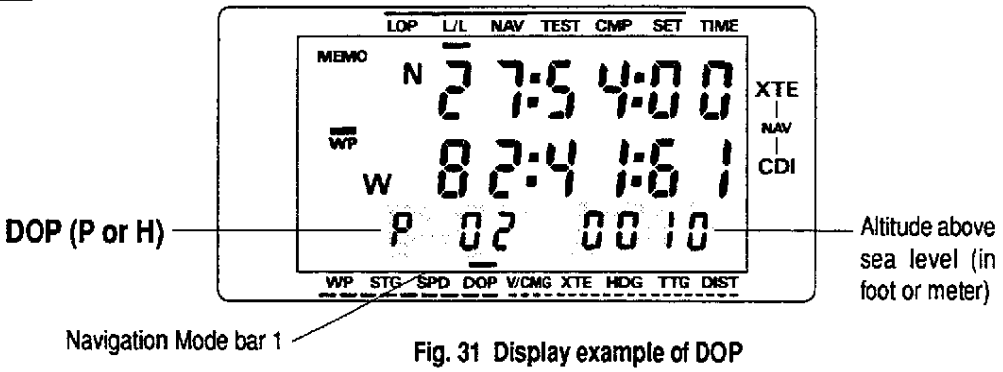


Fig. 31 Display example of DOP

Fig. 31 indicates the PDOP is 2 and altitude above the sea level is 10 meters. The covering range is 0 to 9999 meters or 9999 feet.

Notes
- HDOP or PDOP of 1 to 6 is preferable for satisfactory accuracy.
- Fixing becomes impossible when it is over 20. NO FIX marks will blink to show the position and Navigation displays are not updated.
- The altitude readout can be turned off by pressing **1** and **ENT** keys in order. To display it again, press the same keys in the same manner.
- The unit of altitude is selected from meter or feet. Meter applies to the unit selection for nm; feet for km.

Displaying V/CMG (velocity made good and course made good)

When the power is turned on, a velocity made good and a course made good are displayed. They are updated every minute. The timer can be reset by pressing **CLR** key. Average speed from the point where the timer was reset is usually called **Velocity Made Good (VMG)**; on the other hand, the bearing to the north from the point where the timer was reset is called **Course Made Good (CMG)**.

Mode Bar Position

LOP	V/CMG
L/L	V/CMG

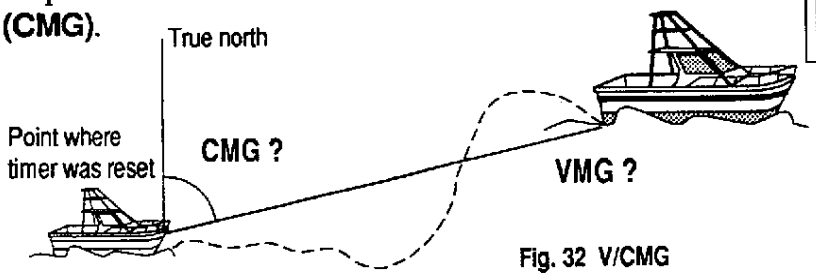


Fig. 32 V/CMG

Directions:

Press the key to move the Navigation Mode bar 2 to **V/CMG**, and the current time on Display Line 1 and elapsed time on Display Line 2 are shown. By this operation, the Mode bar under **TIME** automatically turns on. At this time, the Display Line 3 shows velocity made good on the left side and course made good on the right side.

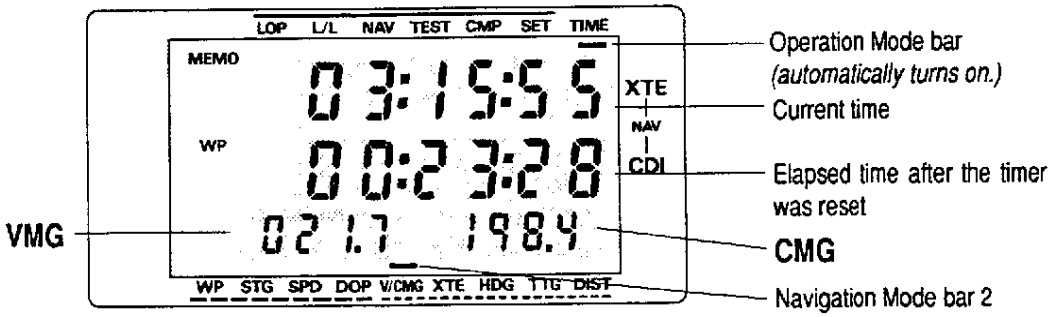


Fig. 33 Display example of V/CMG

Fig. 33 indicates
- Current time: 3rd day 15 hours 55 minutes
- Elapsed time: 23 hours 28 minutes
- VMG: 21.7 knots
- CMG : 198.4 degrees

Time display

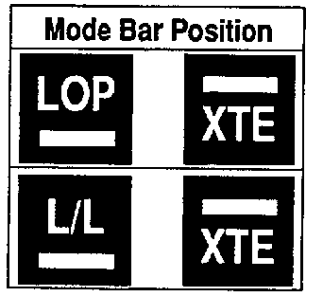
DD : HH : MM
- MM — Minute
- HH — Hour
- DD — Day (maximum 31)

Notes

- When you would like to reset the elapsed timer, press **CLR** key. It is also reset to all zeros every time the unit is turned on. CLR
- The current time can be displayed in either UTC (universal time coordinates) or in local time. (See page 48 of this operation manual.)

Displaying XTE (cross track error)

The distance and direction from the course line to the active waypoint is usually called **Cross Track Error (XTE)**. How far your boat deviates from the course is displayed.



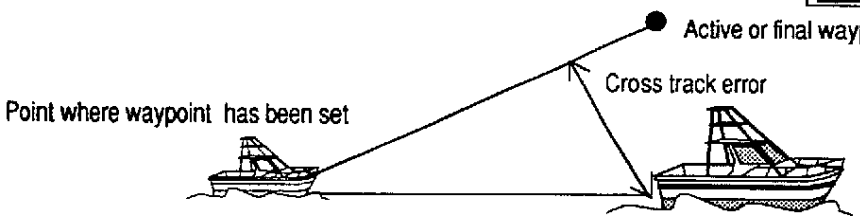


Fig. 34 XTE

Directions:

Press the key to move the Navigation Mode bar 2 to **XTE**, and the cross track error will be displayed on the right side of Display Line 3.

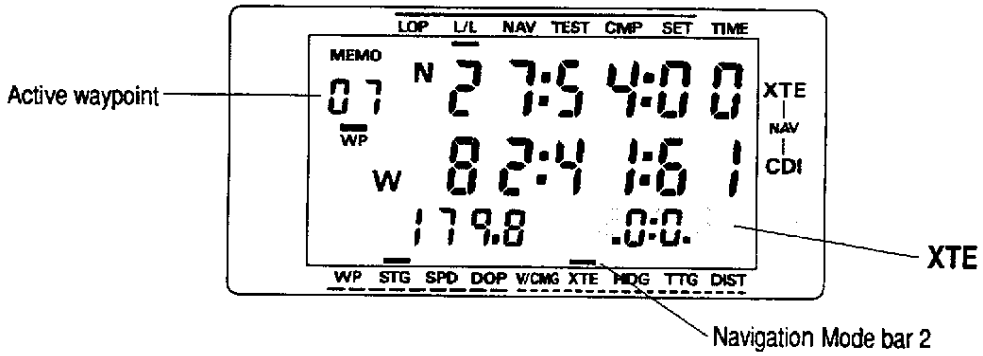


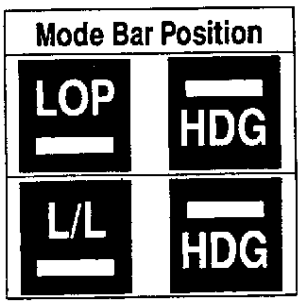
Fig. 35 Display example of XTE

2.5:	0:0	:25
Put the helm to port to be on the course. 2.5 nm off course	On course	Starboard the helm to be on the course. 0.25 nm off course

You may hear the alarm sound when your boat goes off the specified distance from the course. For information about XTE alarm, see ***Setting cross track error alarm range*** on page 56.

Displaying HDG (ship's moving direction)

The ship's moving direction (strictly speaking not necessarily ship's heading) is displayed.



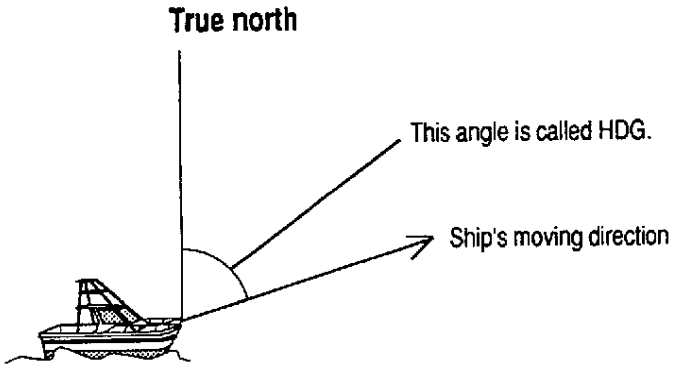


Fig. 36 HDG

Directions:

—— Press the key to move the Navigation Mode bar 2 to **HDG**, and the ship's moving direction to the true north will be displayed on the right side of Display Line 3.

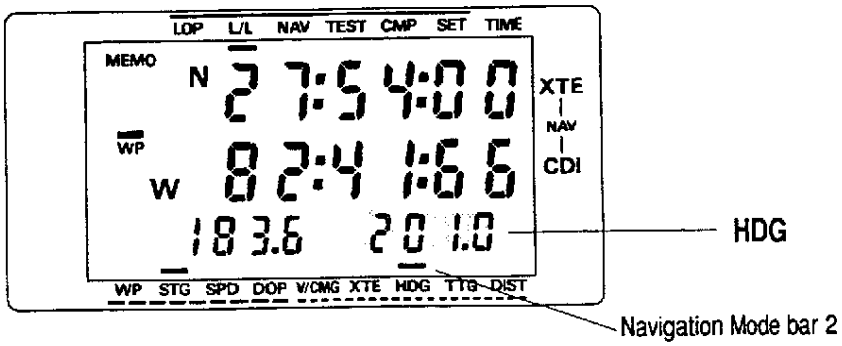
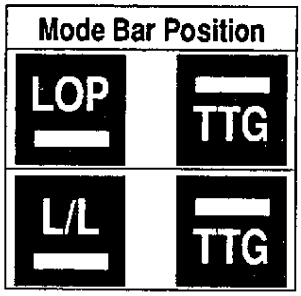


Fig. 37 Display example of HDG

Fig. 37 indicates the ship's moving direction is 201.0 degrees from the true north.

Displaying TTG (time to go)

Estimated trip time to either active or final waypoint is usually called **Time To Go (TTG)**. This time to go can be displayed.



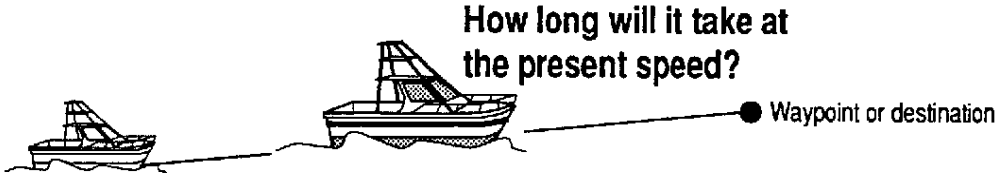


Fig. 38 TTG

Directions:

Press the key to move the Navigation Mode bar 2 to **TTG**, and the estimated trip time to the active or final waypoint will be displayed on the right side of Display Line 3.

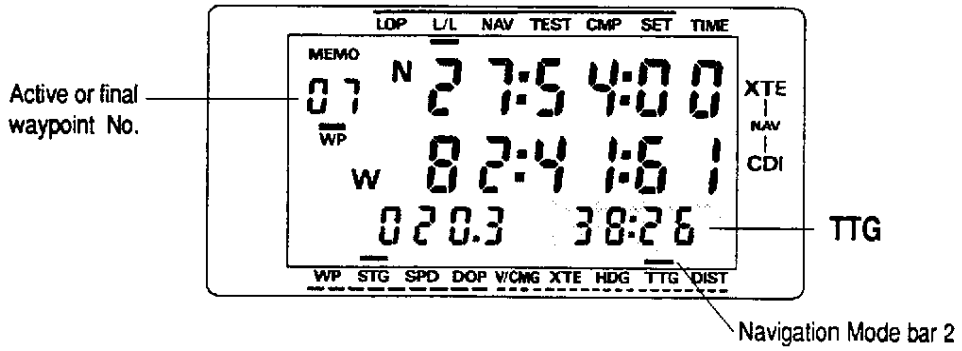


Fig. 39 Display example of TTG

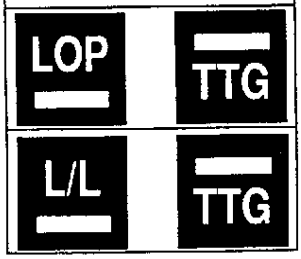
Fig. 39 indicates the estimated trip time to the active waypoint No. 07 is 38 hours 26 minutes.

Note

- When the trip time exceeds 99 hours 59 minutes, 99:99 will be displayed.

Changing contents of TTG indication

Mode Bar Position



You can display two kinds of estimated trip time information:

- Estimated time to the active waypoint (to **A** in the figure below)
- Estimated time to the final waypoint on the route. (**A** + **B** + **C** + **D** in the figure below)

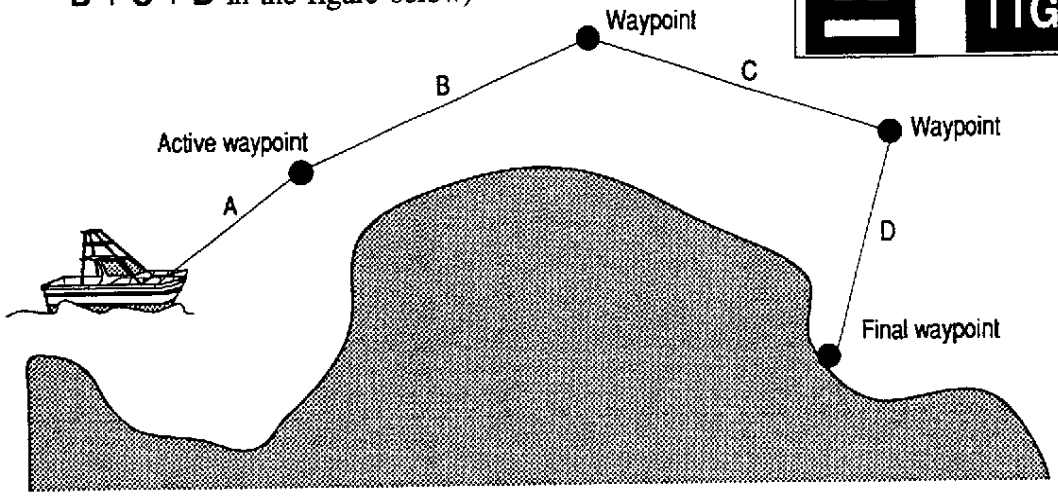


Fig. 40 Changing the contents of TTG indication

Directions:

The index number shows the number of either active or final waypoint. It will show the final waypoint number when the estimated trip distance of the route is assigned.

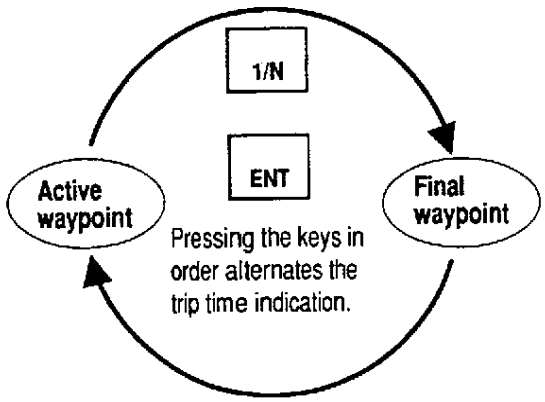
1/N —— Press **1** key.

ENT —— Press **ENT** key to alternate the display between time to go to the active and final waypoints.

Mode Bar 2 Status

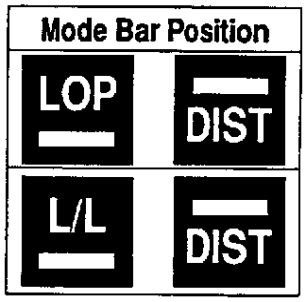
Blinks: Trip time to the final waypoint is selected
Stays on: Trip time to active waypoint is selected.

Rotation of TTG Indication



Displaying DIST (distance to waypoint)

Estimated trip distance to either active waypoint or final waypoint is displayed.



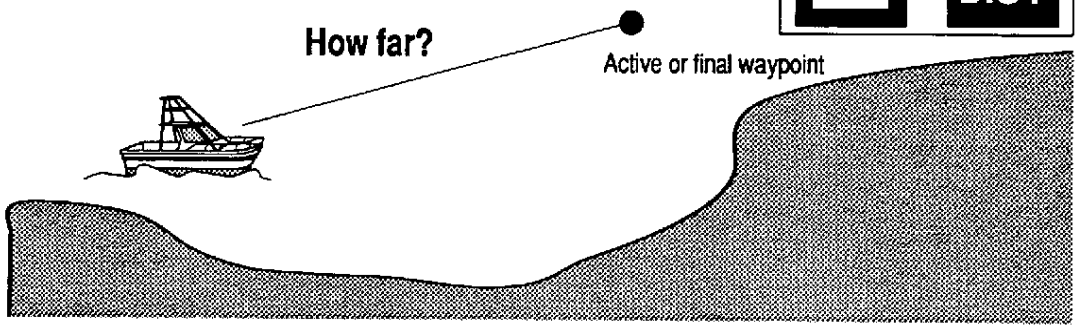


Fig. 41 DIST

Note

■ **Increment of distance**

Distance	Increment
10 nm or more	1/10 nm
Less than 10 nm	1/100 nm

Directions:

Press the key to move the Navigation Mode bar 2 to **DIST**, and the distance from the present position to the active waypoint or final waypoint will be displayed on the right side of Display Line 3.

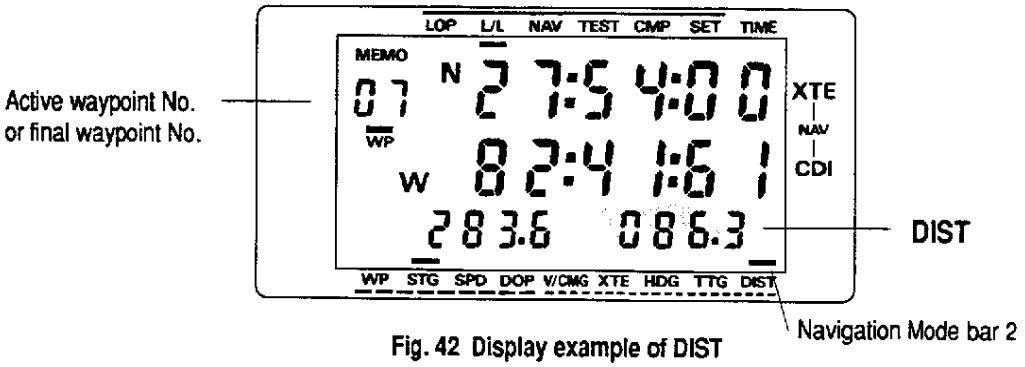


Fig. 42 Display example of DIST

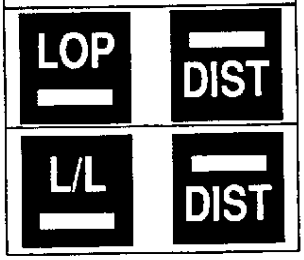
Fig. 42 indicates the distance to the waypoint with index number 07 is 86.3 nautical miles from the present position.

Note

■ When the trip distance exceeds 999.9 nm, 999.9 will be displayed.

Changing contents of distance indication

Mode Bar Position



You can display two kinds of distance information:

- Distance to the active waypoint (Distance **A** in the figure below)
- Distance to the final waypoint on the route. (Distance **A** + **B** + **C** + **D** in the figure below)

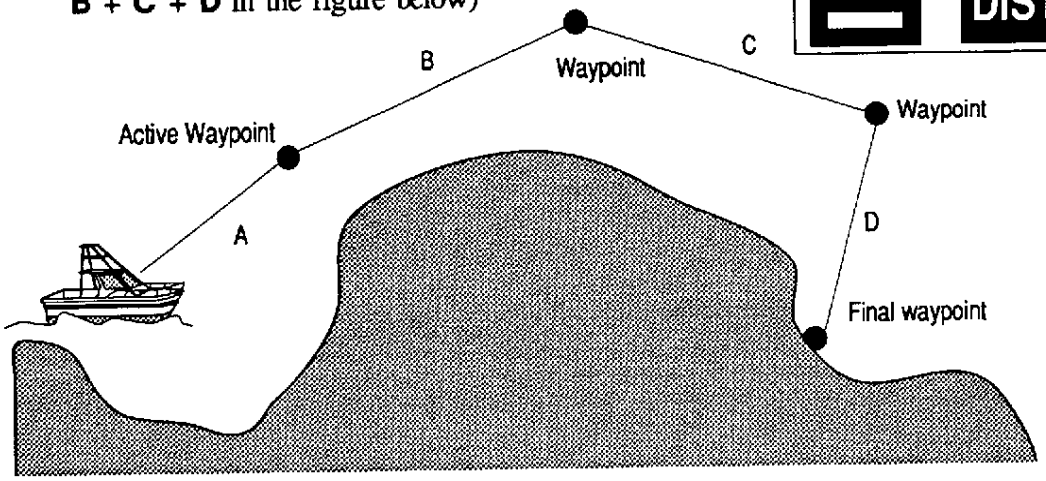


Fig. 43 DIST on route

Directions:

The index number shows the number of either active waypoint or final waypoint. It will show the final waypoint number when the estimated trip distance of the route is assigned.

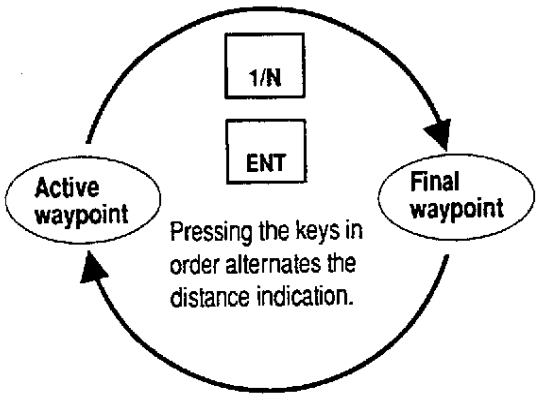
1/N —— Press **1** key.

ENT —— Press **ENT** key to alternate the display between trip distance to the active waypoint and the final waypoint.

Mode Bar 2 Status

Blinks: Trip distance to the final waypoint is selected
Stays on: Trip distance to active waypoint is selected.

Rotation of Distance Indication



Operating NAV mode

Displaying course deviation

Deviation angle and direction of your boat from the course is usually called Course Deviation. This course deviation can be displayed.

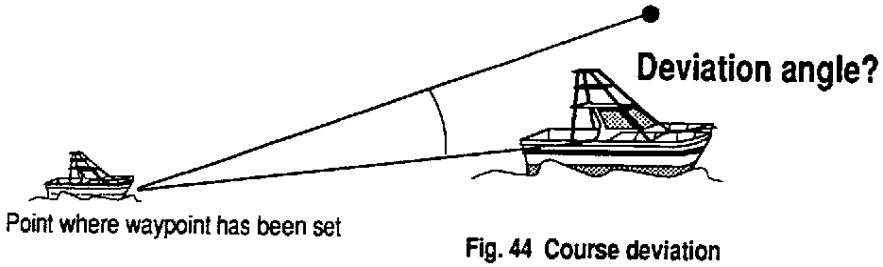


Fig. 44 Course deviation

Directions:

—— Press either key to move the Operation Mode bar to **NAV**, In this mode, SPD and HDG are automatically designated on Display Line 3. The Navigation Mode 1 and 2 selection keys become inoperable.

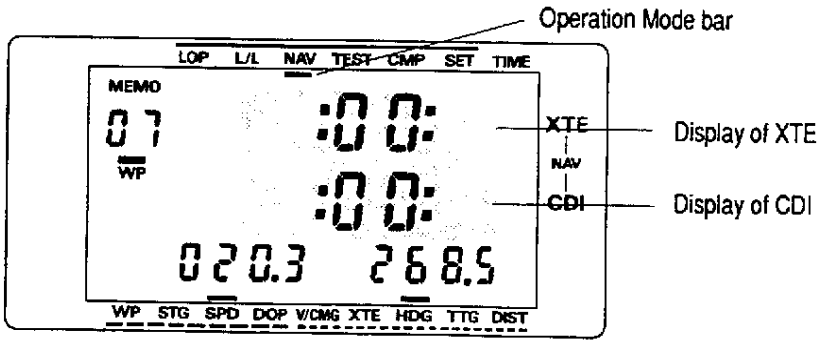
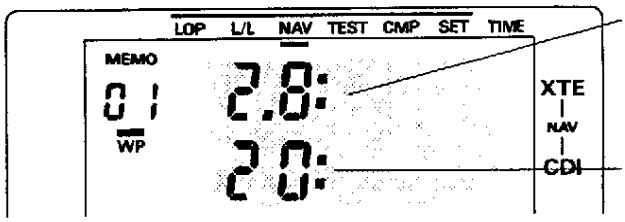


Fig. 45. a Display example of NAV. a

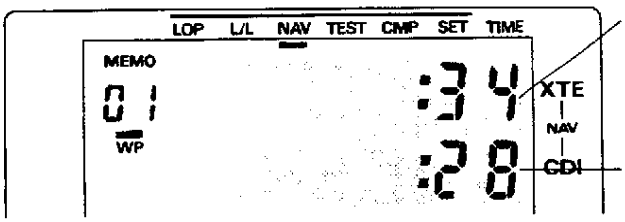
Reading course deviation indication (CDI)



Put the helm to port to be on the course.
2.8 nm off course

Put the helm to port to go to the active waypoint straight.
20 degrees from the course

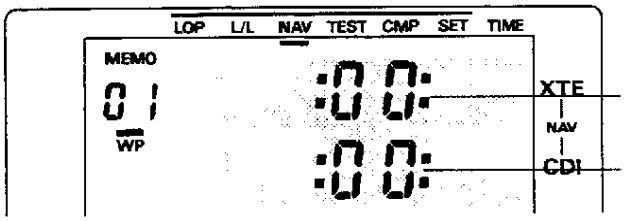
Fig. 45. b Display example of NAV b.



Starboard the helm to be on the course.
0.34 nm off course

Starboard the helm to go to the active waypoint straight.
28 degrees from the course

Fig. 45. c Display example of NAV c.



On course

On course

Fig. 45. d Display example of NAV d. (on course)

Notes

■ XTE alarm range and deviation

XTE alarm range	Deviation
00 to 0.9 nm	00 through 0.99 nm with the unit of 1/100 nm The display remains 0.99 for the distance of over 0.99 nm.
1.0 to 9.8 nm	1.0 through 9.8 nm with the unit of 1/10 nm The display remains 9.9 for the distance of over 9.9 nm.

■ Off course display of CDI

Course deviation is displayed with the range of 00 through 99 degrees.
The display remains 99 for the angle of over 99 degrees.
The event memory function is accessible.

Operating TEST mode

Operating TEST (Satellite monitor)

This mode provides the test of LCD segments and display the satellite signal condition.

Mode Bar Position

TEST

Press either key to move the Operation Mode bar to **TEST**.
All the Segments of the display devices are shown for a few second.
Then the display will be replaced with satellites monitor display.
The Navigation Mode 2 selection key becomes inoperable.

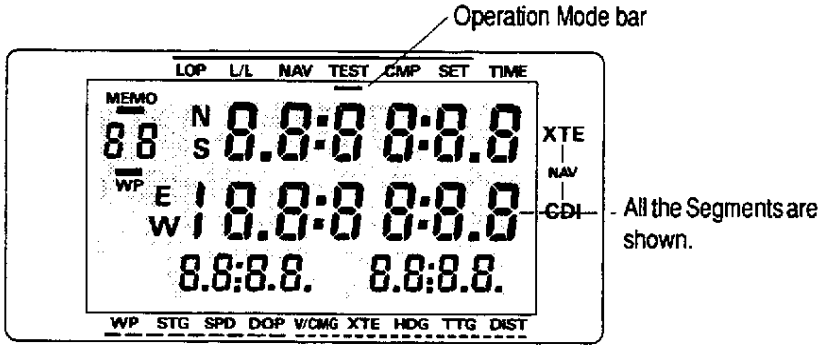


Fig. 46 Display example of entire display segments at TEST

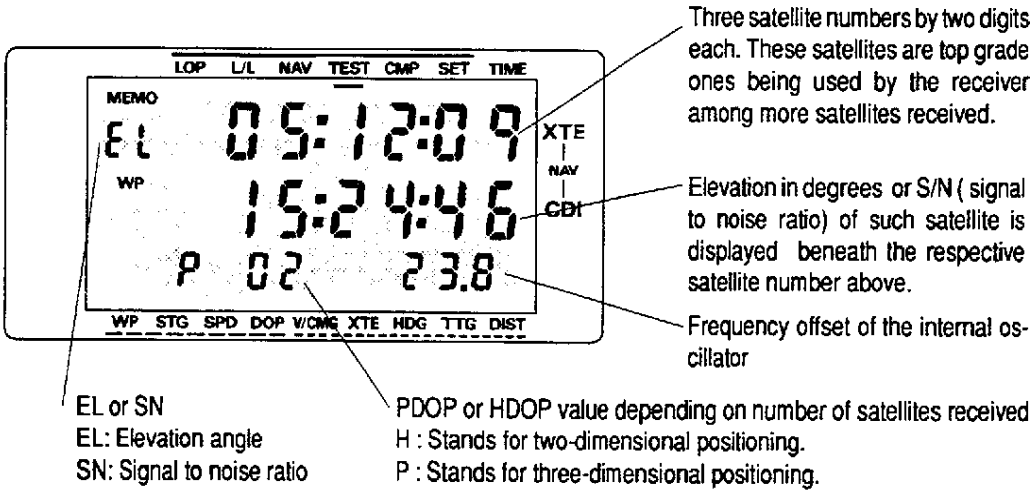
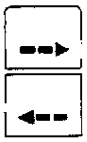


Fig. 47 Display example of satellites monitor in TEST

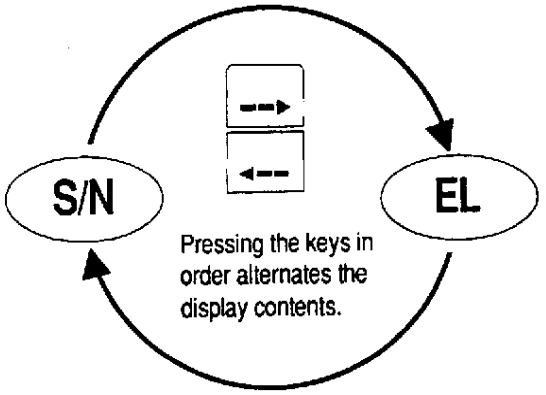
The display contents on Display line 2 can be alternated between S/N (Signal to noise) and EL (Elevation angle).

Directions:



Press either arrow key to alternate the display between S/N and EL.

Rotation of Display Contents



Notes

- The satellite numbers displayed represent three satellites used for getting two dimensional position.
- Satellites being received other than these three are not displayed.
- The receiver automatically changes to three-dimensional positioning from two-dimensional positioning depending on Satellites availability and vice versa. It is indicated by the left most letter displayed on Display Line 3. (P or H)
- When only one or two satellites with elevation angles of 5 degrees or more are visible, NO FIX marks will blink to show information update is suspended.
- When only one or two satellites with S/N value of 3 or more are visible, NO FIX marks will blink to show information update is suspended.
- When PDOP value cannot maintain 4 or less, positioning turns to HDOP automatically. When it exceeds 20, NO FIX marks will blink to show information update is suspended.
- Oscillator offset is preferred to be within 20 to 80. The offset out of this range may cause reception disability and needs adjustment. Call your authorized dealer or SI-TEX.

Operating CMP mode (compensation)

This mode provides the following compensation of data:

- **Present position in Lat/Lon ...** See below.
- **Present position in Loran C LOP's ...** See page 42.
- **Bearing ...** See page 44.
- **Local time ...** See page 48.

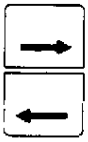
In addition, **Distance and bearing between two points** can be computed. For information about this feature, see page 46.
Display Line 3 is used to show compensation value in this mode and arrow keys for the Navigation Mode 2 selection are not functional.

Compensating present position in LAT/LON

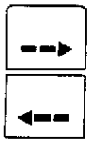
Mode Bar Position

When your boat position at the harbour is wrongly indicated, its value can be manually corrected within +/-9.99 minutes by referring to the sea chart. The correct position is entered by way of the keyboard. The compensated value is applied to the positioning hereafter.

Directions:



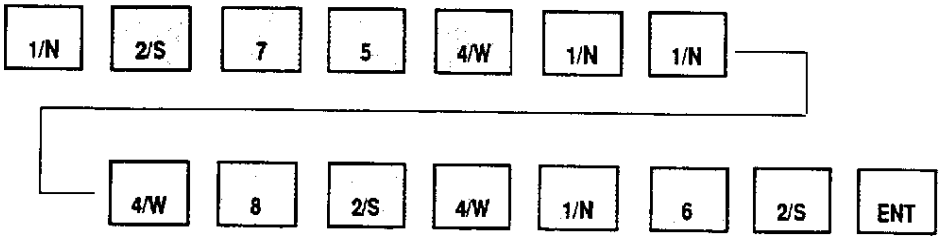
—— Press either key to move the Operation Mode bar to **CMP**.



—— Press either key to display **01** as Index number.

correct position is entered by way of the keyboard.

Example:
When present position is 27°54.00' north latitude, 82°41.66' west longitude and it is required to compensated to 27°54.11' north latitude, 82°41.62' west longitude, press the keys in the order of:



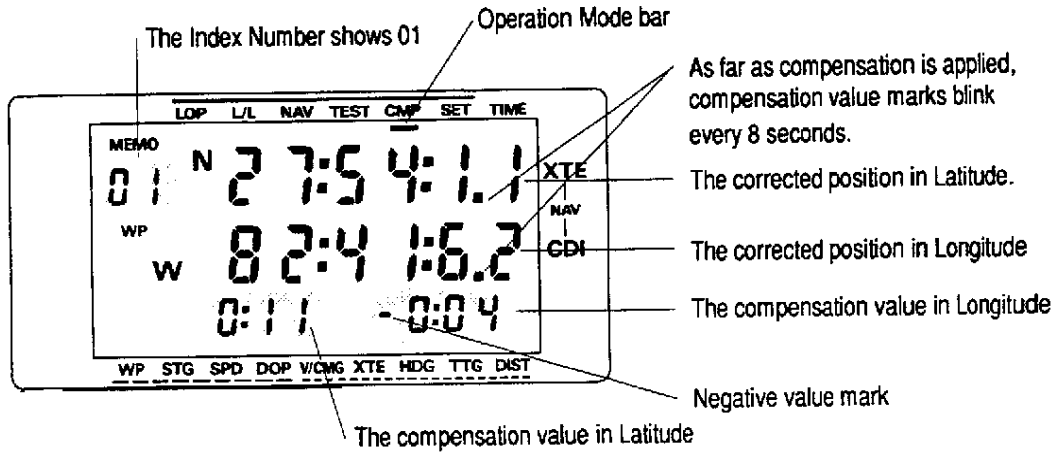


Fig. 48 Display example of latitude/longitude position in CMP

Resetting Compensation Value

When you would like to reset the compensation, press:.

0 ENT in order or CLR key.

Display Line 3 will show 0.00 and 0.00.

Note

■ The compensation is reflected on the data output by NMEA-0183 format.

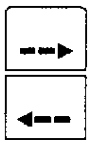
Compensating present position in LOP

Mode Bar Position

LOP positions are converted from lat/lon positions in the unit. They may not match with LOP's measured by LORAN-C receivers. LOP's can be compensated for a reference LOP at a reference position. The compensation is valid only locally. Different compensation may be needed in a different area. The maximum compensation is +/- 9.9 microseconds.
The correct position is entered by way of the keyboard.

Directions:

—— Press either key to move the Operation Mode bar to **CMP**.



—— Press either key to display **05** as Index number.

Example:
When Station 1 requires +0.5 microseconds and station 2 requires -5.5 microseconds of compensation, press the keys in the order of:

Pressing **+/M** key can be omitted.

Notes

- If position compensation is already applied to lat/lon present position, present position in LOP contains both compensation in LAT/LON and LOP.

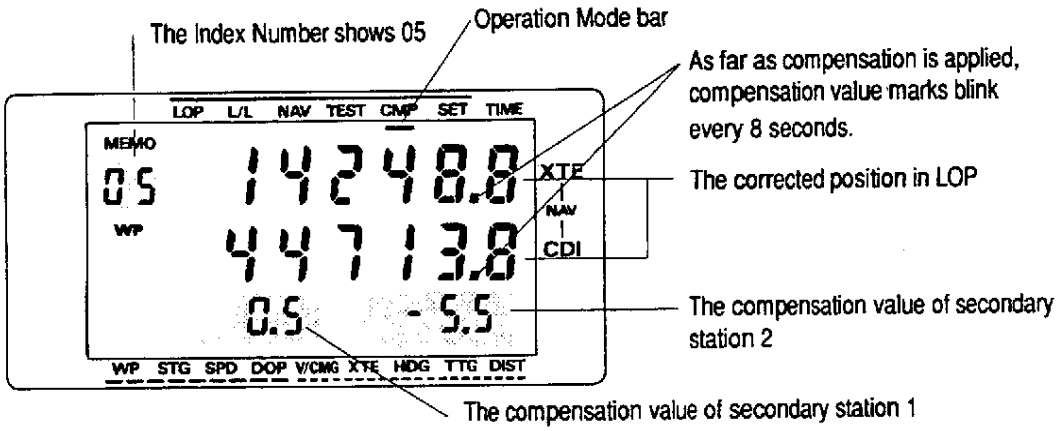


Fig. 49 Display example of LOP position compensation in CMP

Resetting Compensation Value

When you would like to reset the compensation, press:

0 ENT in order or CLR key.

Display Line 3 will show 0.00 and 0.00.

Note

■ The compensation is reflected on the data output by NMEA-0183 format.

Compensating bearing

Mode Bar Position

The main purpose of this compensation is to make bearing indication compensated to the magnetic compass bearing which is normally slightly different from true bearing computed by the receiver. The automatic compensation is also provided.

The maximum compensation value usable is +/-30.0 degrees.

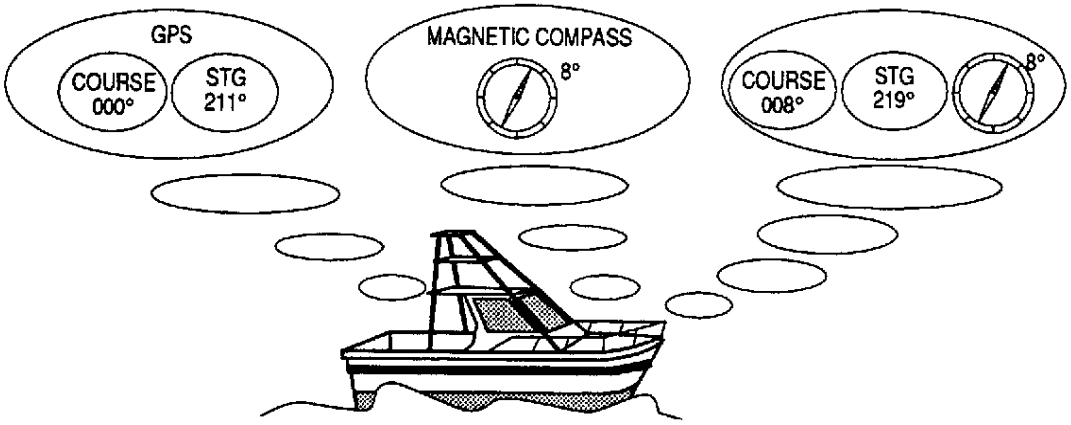


Fig. 50 Compensating bearing

Directions:

——Press either key to move the Operation Mode bar to **CMP**.

—— Press either key to display **02** as Index number.

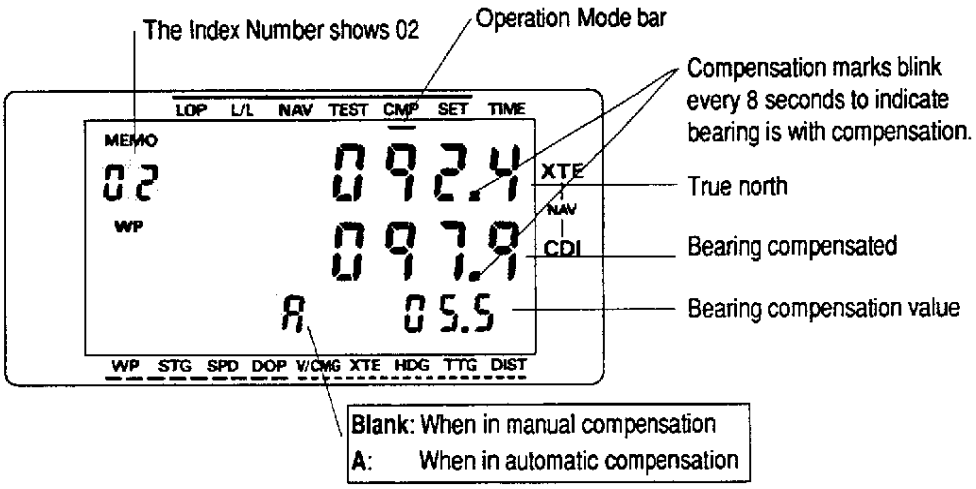


Fig. 51 Display example of bearing compensation in CMP

Applying +5.7 degrees compensation

Press the keys in the order of:

0 5 7 +/M ENT — Manual compensation

Applying -5.5 degrees compensation

Press the keys in the order of:

0 5 5 -/R ENT — Manual compensation

Applying automatic compensation

Press the keys in the order of:

1/N ENT — **A** is displayed on the left side of the Display Line 3.

Cancelling automatic compensation

Press the keys in the order of:

0 ENT or CLR

Note

■ This compensation is reflected to HDG, STG and bearing between two points as well as data Output by NMEA-0183 format.

Computing distance and bearing between two points

The distance between any two points stored as event memory or waypoint memory is displayed.
The maximum distance is 999.9 nm.

Mode Bar Position

CMP

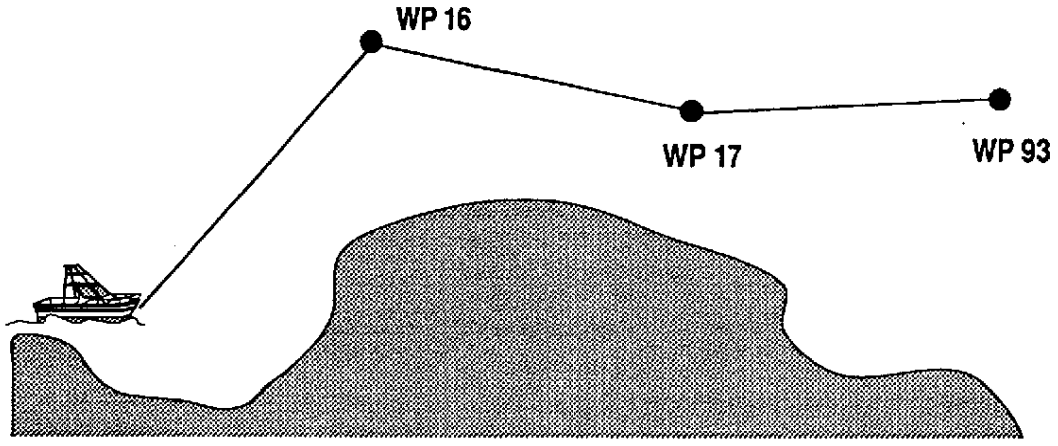


Fig. 52 Distance and bearing between two points

Directions:

Press either key to move the Operation Mode bar to **CMP**.

Press either key to display **03** as Index number.

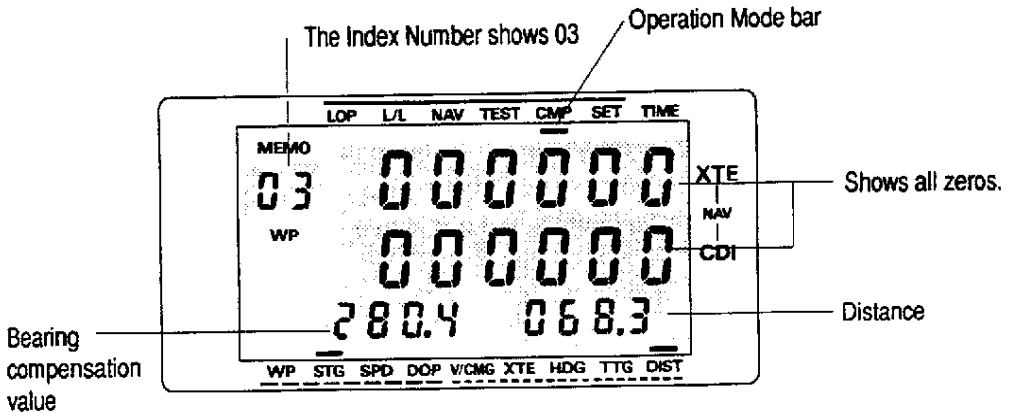


Fig. 53 Display example of distance calculation between two points in CMP

Displaying the distance and bearing from the memory point 16 to 17

Press the keys in the order of:

[-/R] [1/N] [6] ——— Position of memory point **16** is displayed.

[1/N] [7] [ENT] ——— After position of memory point **17** is displayed, the distance and bearing from the memory point 16 to 17 are displayed.

Displaying the distance and bearing on other points

[CLR] — Press **CLR** key, then repeat the procedure above in the same manner by replacing the point numbers.

Compensating local time

Mode Bar Position

CMP

The receiver obtains UTC (Universal Time Coordinates) or GMT (Greenwich Mean Time) from GPS satellites. This function is for applying the time difference to get local time at an interval of 00:30 hours. Refer to the time zones below. The Maximum compensation value is +/-13:30 hours.

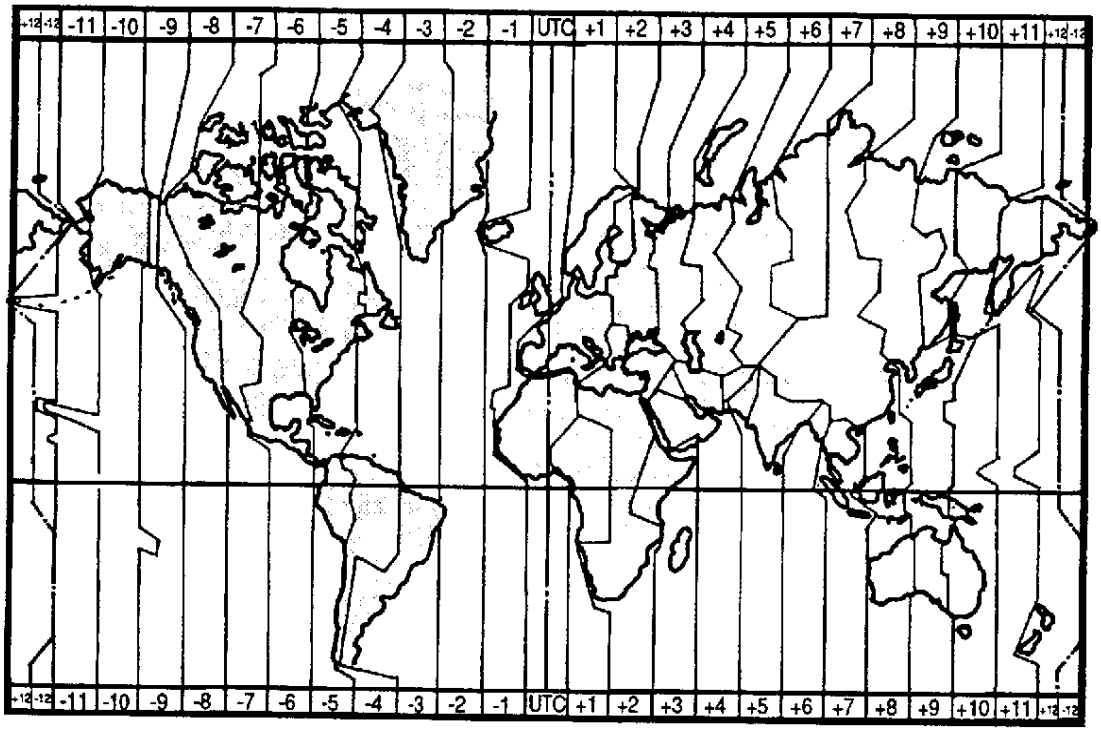


Fig. 54 Time zones

Directions:

Press either key to move the Operation Mode bar to **CMP**.

Press either key to display **04** as Index number, and the compensation time with polarity sign against UTC (GMT) is entered by the keyboard.

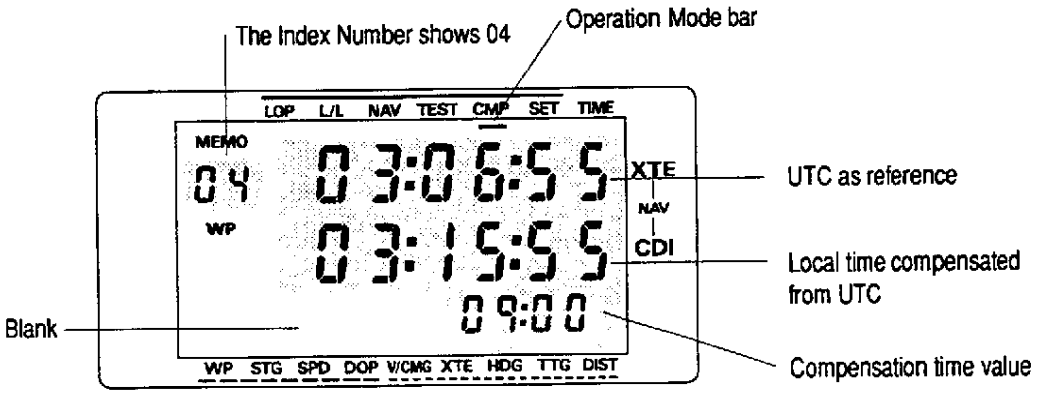


Fig. 55 Display example of time compensation in CMP

Negative mark ▬ appears when the compensation value is applied.

Example:

Adding 9:00 hours to the UTC

Press the keys in the order of:

The compensated local time will be displayed on the Display Line 2.

Subtracting 11:30 hours from the UTC

Press the keys in the order of:

The compensated local time will be displayed on the Display Line 2.

Resetting compensation

Press the keys in the order of:

Note

■ This compensation is reflected on display of present time in the Navigation mode V/CMG.

Operating SET mode

This mode provides:

- **Proximity (arrival) alarm range setting** ... See below.
- **Anchor watch alarm range setting** ... See Page 52
- **Cross track error alarm range setting** ... See Page 56.
- **Averaging factor settings of speed and heading (moving direction) computation** ... See Page 58.
- **Datum setting** ... See Page 60
- **Unit of measure setting** ... See Page 62
- **Positioning mode setting** ... See Page 64
- **Antenna height setting** ... See Page 66

Notes

- The Display Line 3 is used for setting the items left.
- Navigation Mode 1 selection key is used for selecting index number.
- Navigation Mode 2 selection key is kept inoperable.

Setting proximity (arrival) alarm range

Mode Bar Position

SET

Proximity alarm is the function that informs you the vessel is approaching the waypoint. Audible alarm sounds when it has entered the preset range. The proximity alarm range is factory-set to 0.5 nm; therefore, if you would like to change the alarm range, follow the direction below.

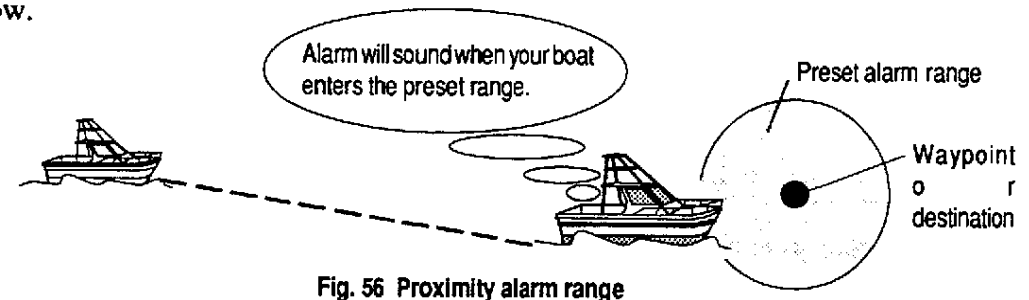
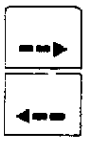


Fig. 56 Proximity alarm range

Directions:

—— Press either key to move the Operation Mode bar to **SET.**



—— Press either key to display **01** as Index number, and the arrival alarm range is entered by the keyboard.

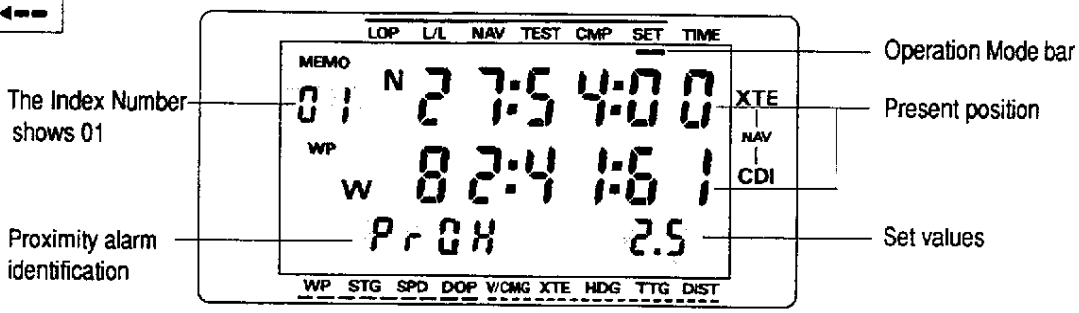
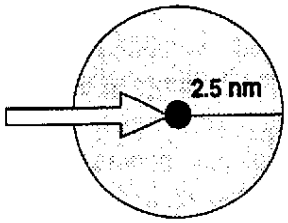


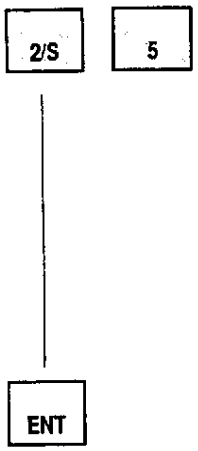
Fig. 57 Display example of proximity alarm range in SET

Example:

Setting proximity alarm range of 2.5 nm



Press the keys in the order of:



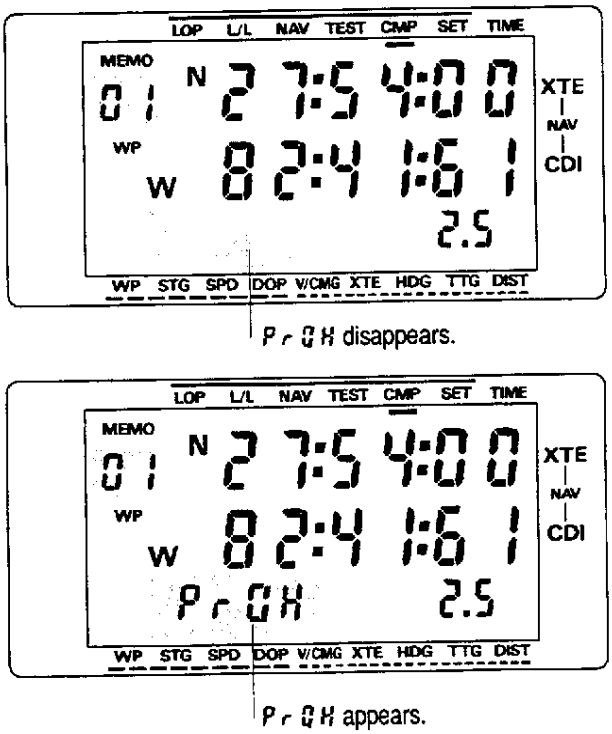


Fig. 58 Display example of setting proximity alarm range

Turning the alarm sound off.

CLR —— Press **CLR** key, and the alarm turns off; however, if alarm condition is met again, the alarm will turn on.

Notes

- Settable range is 0.0 to 9.9 nm. However, 0.0 or 9.9 nm setting inhibits the alarm. When the alarm is not sounding, pressing **CLR** key selects automatically 0.0.
- Alarm starts to beep when distance to a waypoint becomes 0.1 nm less than the range set and stops when it becomes 0.1 nm larger than the range.
- Alarm sounds with every 1.5-second pitch.
- The default value is 0.5 nm.

Setting anchor watch alarm range

Mode Bar Position

Anchor watch alarm is the function that informs you the vessel has drifted from the original anchoring point.
Audible alarm sounds when the drift becomes larger than the preset range. The anchor watch alarm range is factory-set to 0.5 nm; therefore, if you would like to change the alarm range, follow the direction below. (For activating Anchor watch alarm, see page 54.)

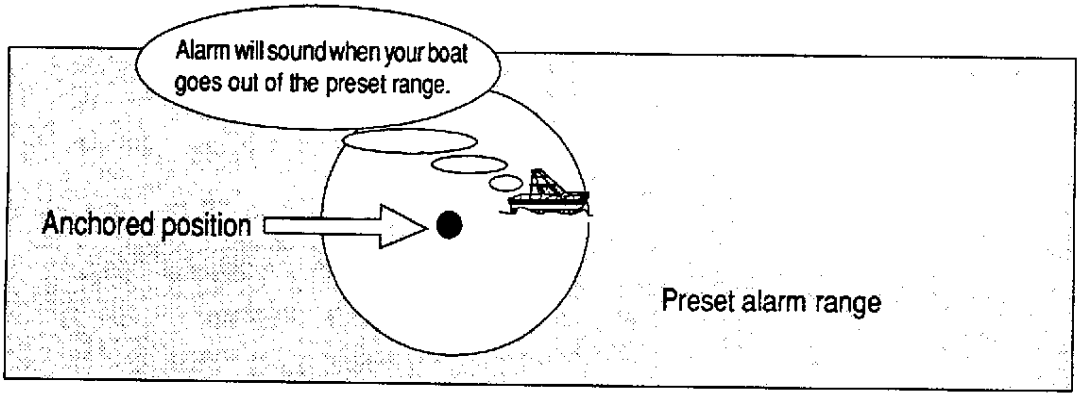
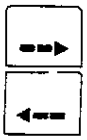


Fig. 59 Anchor watch alarm range

Directions:

—— Press either key to move the Operation Mode bar to **SET.**



—— Press either key to display **02** as Index number, and the anchor watch alarm range is entered by the keyboard.

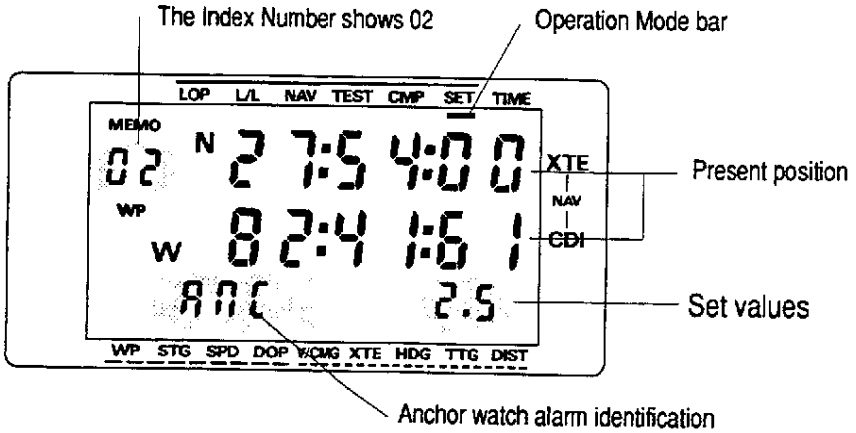
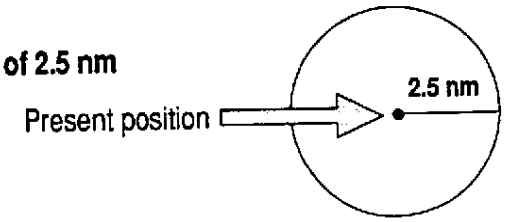


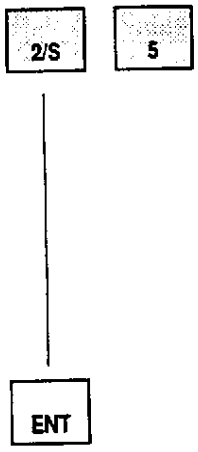
Fig. 60 Display example of anchor watch alarm range in SET

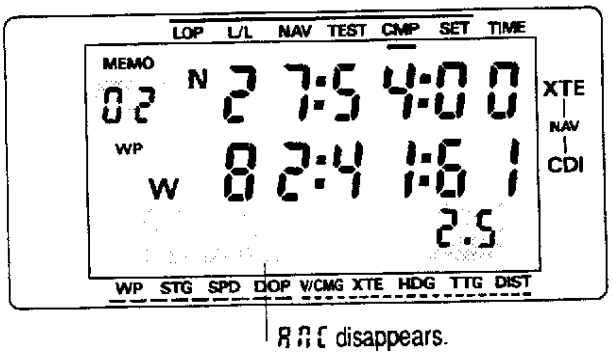
Example:

Setting anchor watch alarm range of 2.5 nm



Press the keys in the order of:





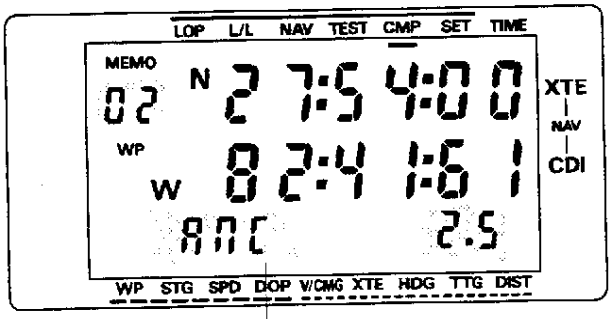


Fig. 61 Display example of anchor watch alarm range

Turning the alarm sound off.

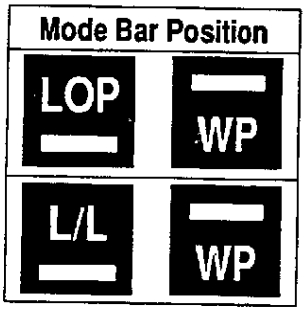
CLR —— Press **CLR** key, and the alarm turns off; however, if alarm condition is met again, the alarm will turn on.

Notes

- Settable range is 0.0 to 9.9 nm. However, 0.0 or 9.9 nm setting inhibits the alarm. When the alarm is not sounding, pressing **CLR** key selects automatically 0.0.
- Alarm starts to beep when distance to an anchoring point becomes 0.1 nm more than the range set and stops when it becomes 0.1 nm less than the range.
- Alarm sounds with every 1.5-second pitch.
- The default value is 0.5 nm.

Activating anchor watch alarm

The unit warns you when the drift exceeds the preset range from the anchored point by audible alarm by activating the anchor watch alarm.



Directions:

——Press either key to move the Operation Mode bar to **LOP** or **L/L.**

—— Press either key to move the Navigation Mode bar 1 to **WP**.

—— Press **0** key to select the anchor watch function.

—— Press **ENT** key, and the anchor watch alarm function will activate.

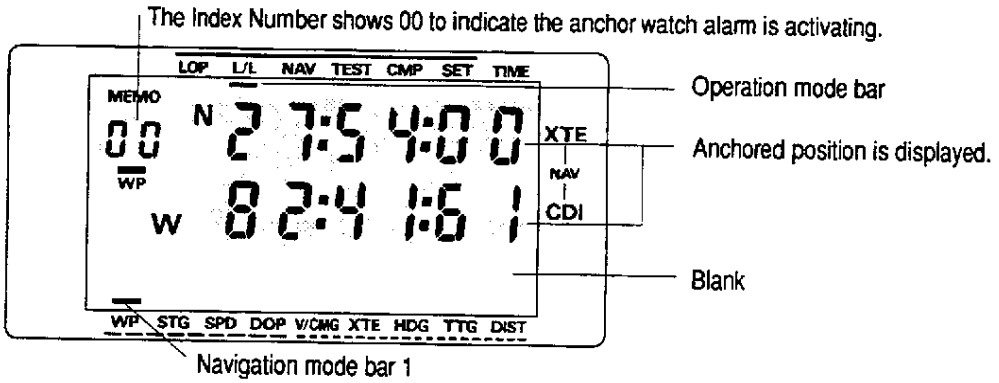


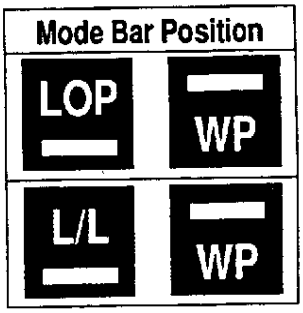
Fig. 62 Display example of anchor watch alarm set

Notes

- When the anchor watch is activated, displays of Operation Mode NAV and Navigation Mode STG and DIST can be used.
- Setting of the anchor watch or pressing **CLR** key on WP mode will reset the waypoint in use.

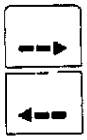
Resetting proximity and anchor watch alarms

The proximity and anchor watch alarm ranges preset can be reset.



Directions:

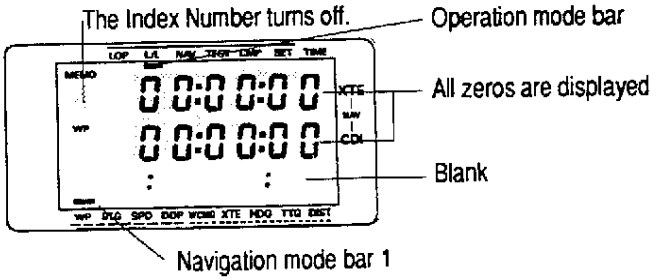
—— Press either key to move the Operation Mode bar to **L/L.**



—— Press either key to move the Navigation Mode bar 1 to **WP.**

—— Press **CLR** key, and all zeros are displayed on Display Line 1 and 2, no display on Display Line 3 , and no Index Number nor Waypoint bar.

In L/L mode



In LOP mode

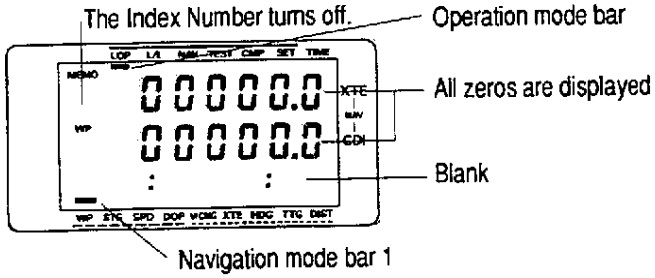


Fig. 63 Display example of Resetting proximity or anchor watch alarm

Setting cross track error alarm range

Mode Bar Position

SET

Cross track error alarm is a function that gives an audible alarm when the vessel has deviated from the course more than the preset range. The cross track error alarm range is factory-set to 5.0 nm; therefore if you would like to change the alarm range, follow the direction below.

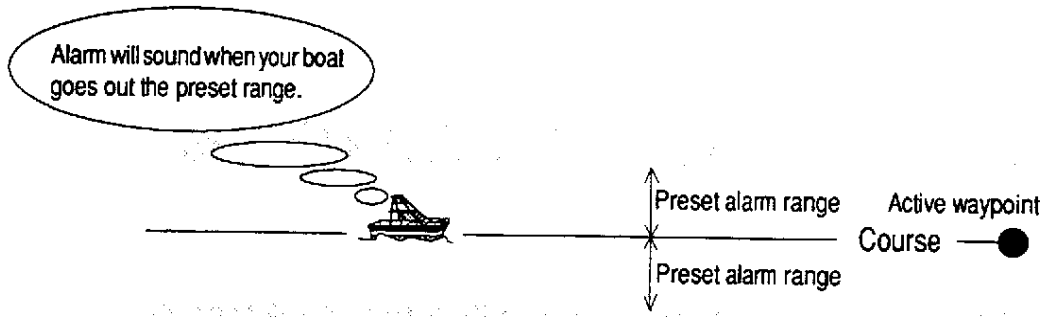
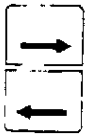
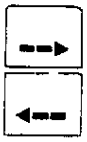


Fig. 64 Cross Track Error alarm range

Directions:



Press either key to move the Operation Mode bar to **SET.**



Press either key to display **03** as Index number, and the cross track error alarm range is entered by the keyboard.

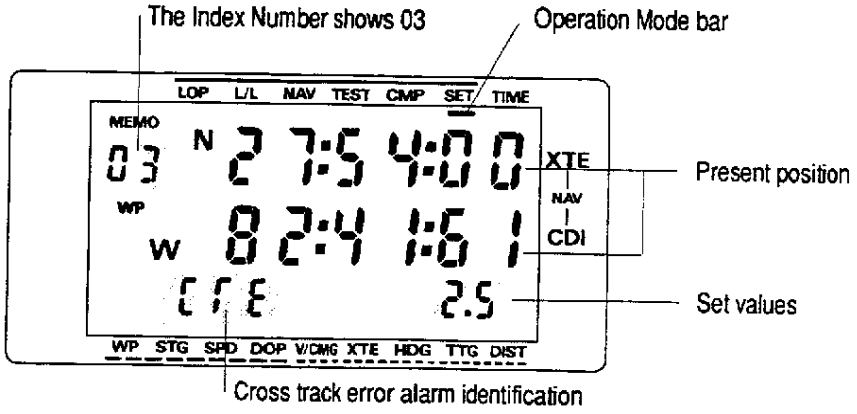
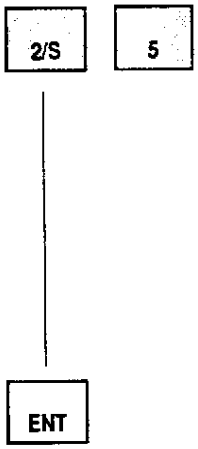


Fig. 65 Display example of Cross Track Error alarm range in SET

Example:

Setting cross track error alarm range of 2.5 nm

Press the keys in the order of:



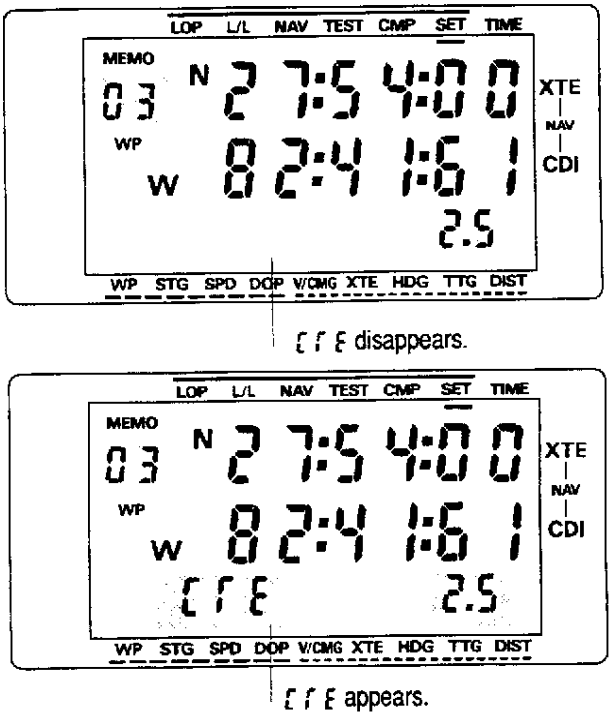


Fig. 66 Display example of cross track error alarm range

Turning the alarm sound off.

CLR — Press **CLR** key, and the alarm turns off; however, if alarm condition is met again, the alarm will turn on.

Notes

- Settable range is 0.0 to 9.9 nm. However, 0.0 or 9.9 nm setting inhibits alarm. When the alarm is not sounding, pressing **CLR** key selects automatically 0.0.
- Alarm starts to beep when the shortest distance to a course becomes 0.1 nm more than the alarm range and quits when it becomes 0.1 nm larger than the range.
- The alarm sound is continuous.
- The default value is 5.0 nm.
- The display of cross track error is affected by the alarm range value. When range is in the range of 0.0 through 0.9, the XTE Display shows cross track error by two-digit number 00 through 99 by unit of 1/100 nm. When the range is set to 1.0 to 9.8, The display shows 1.0 through 9.8 by unit of 1/10 nm.

Setting averaging factor

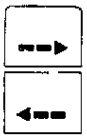
Mode Bar Position

SET

The selection of the averaging factor may be required to eliminate fluctuations in present position, speed and bearing. The higher the factor value, the less fluctuations. However, the information has the longer time delay and the lower maximum tracking speed. Five averaging factors are provided.

Directions:

—— Press either key to move the Operation Mode bar to **SET.**



—— Press either key to display **04** as Index number, and enter the average factor (1 to 5) through the number keys.

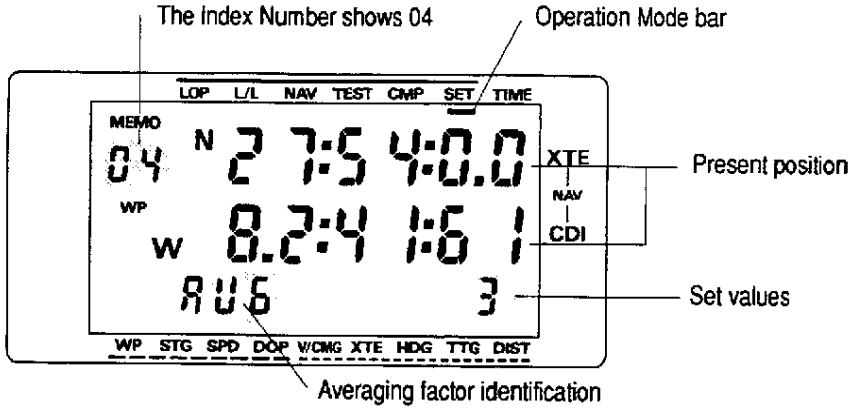


Fig. 67 Display example of averaging factor in SET

Example:

Setting Averaging factor 2

Press the keys in the order of:

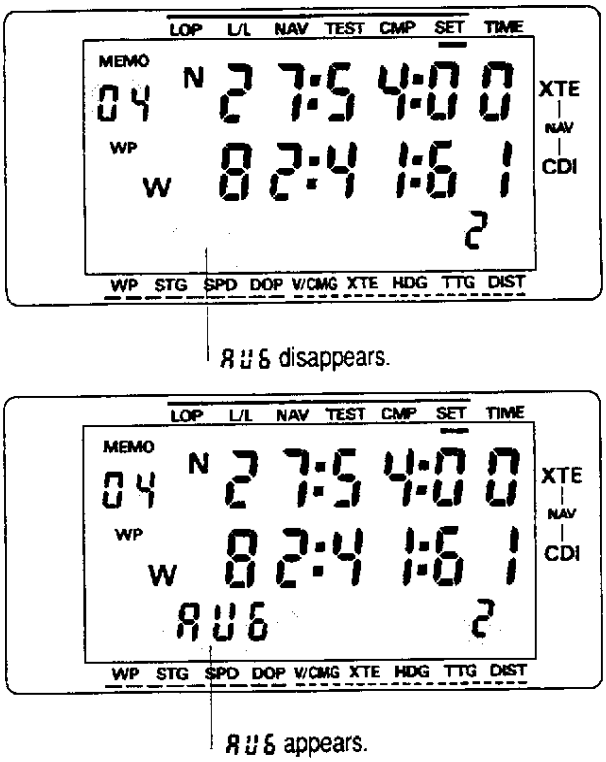


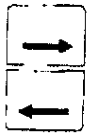
Fig. 68 Display example of averaging factor

Setting datum

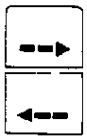
Mode Bar Position

The datum is factory-set to WGS-84 for positioning your position. However, various sea charts based on different datums are used all over the world.
When required, the same datum as your sea chart can be specified so that your position is displayed based on the newly specified datum and altitude can also be compensated.

Directions:



—— Press either key to move the Operation Mode bar to **SET.**



—— Press either key to display **05** as Index number, and enter the datum number (00 to 83) through the number keys. For datum number, refer to **APPENDIX C. Local Geodetic Systems** on Page 81.

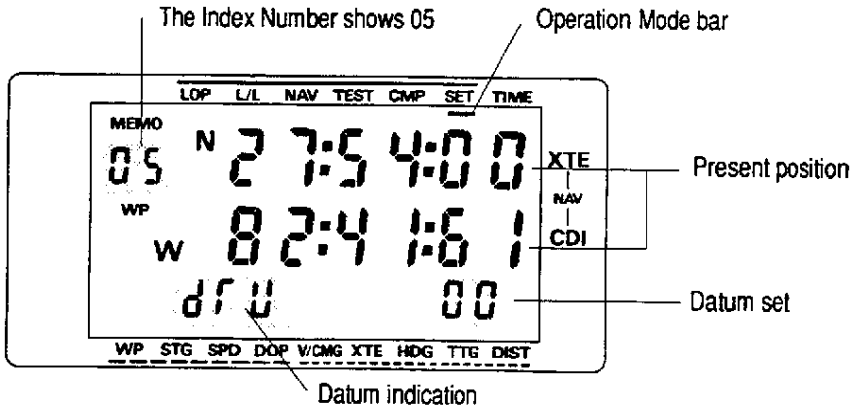
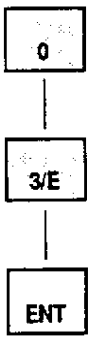


Fig. 69 Display example of Datum in SET

Example:

Setting Local geodetic system of NAD-27

Find the corresponding number to the NAD-27 from APPENDIX C (Local geodetic systems) on Page 81, then press the keys in the order of:



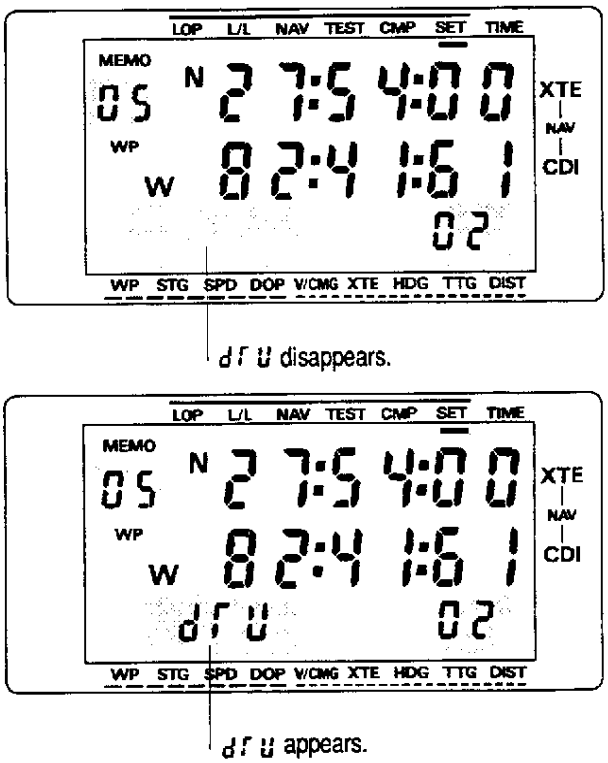


Fig. 70 Display example of datum setting

Setting the unit of measure

Mode Bar Position

SET

The unit of measure for navigational data calculation for the distance to waypoint, speed, antenna height, altitude, and cross track error can be changed.
Two units are selectable: nautical mile (nm) and kilo meter (km).

Unit selection	Speed	Altitude and antenna height
nm	kt	ft
km	km/h	m

Directions:

—— Press either key to move the Operation Mode bar to **SET.**

—— Press either key to display **06** as Index number, and enter the number 0 for nm or 1 for km through the number keys.

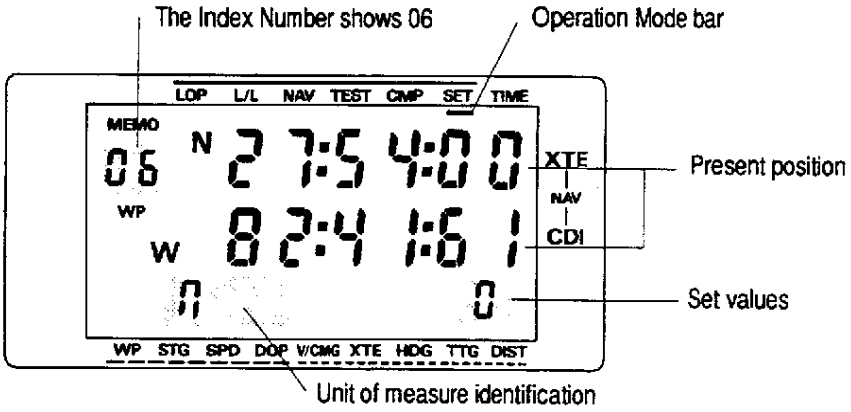


Fig. 71 Display example of unit of measure in SET

Example:

Setting the unit "kilo meter" (km)

Press the keys in the order of:

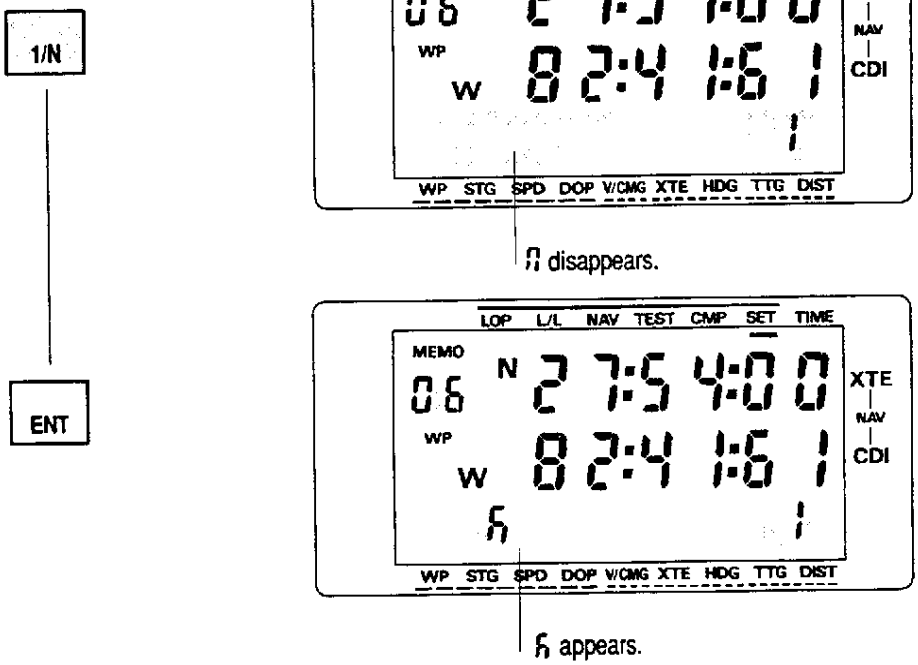


Fig. 72 Display example of setting the unit of measure

Note

■ Indication for the unit of measure

n : 0 ... nautical mile (nm)

n : 1 ... kilo meter (km)

Setting positioning mode

The priority of positioning mode can be specified; namely, 2- or 3-dimensional mode can be selected for your particular application.

Mode Bar Position

■ **2-dimensional positioning mode ... sea use mode**
Your position is position-fixed based on the antenna height entered by using three satellites.

■ **3-dimensional positioning mode ... land use mode**
Your position is position-fixed based by using four satellites.; therefore, the altitude is automatically calculated. However, when PDOP value exceeds 8 or when only three or less satellites are visible, the 2-dimensional mode is automatically selected. When HDOP value exceeds 15, the positioning is automatically stops.

Directions:

—— Press either key to move the Operation Mode bar to **SET.**

—— Press either key to display **07** as Index number, and enter the number 0 for 2-dimensional mode or 1 for 2-dimensional mode through the number keys.

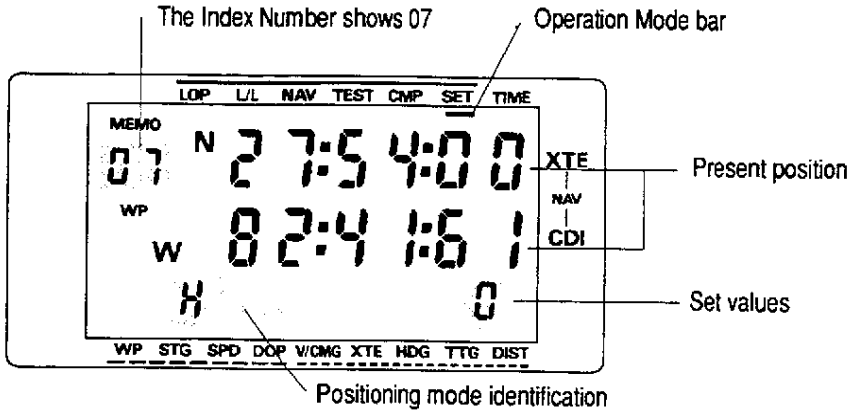


Fig. 73 Display example of positioning mode in SET

Example:

Setting the 3-dimensional positioning mode

Press the keys in the order of:

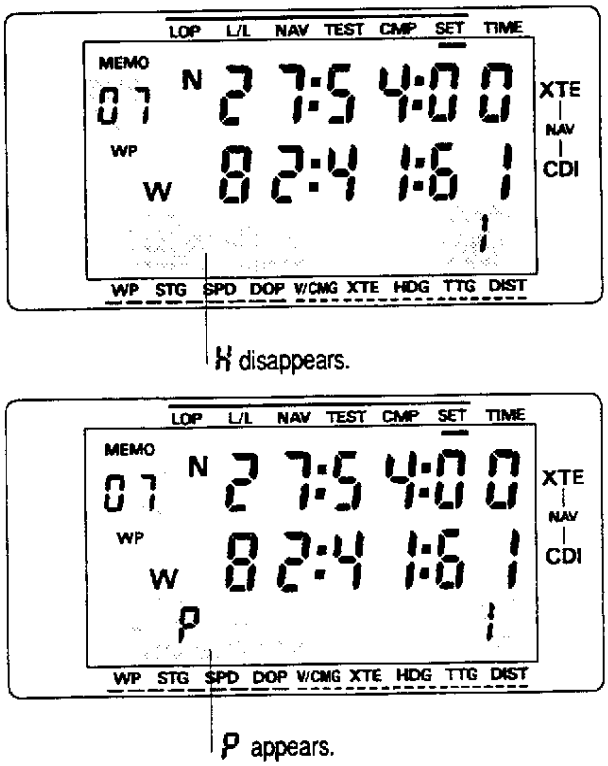


Fig. 74 Display example of setting positioning mode

Note

■ Indication for positioning mode

H: 0 ... 2-dimensional mode

P: 1 ... 3-dimensional mode

Setting antenna height

Mode Bar Position

SET

The antenna height above or below mean sea level for 2-dimensional positioning mode can be entered.
We recommend you enter the antenna height as accurately as possible; The error should be with in ±3 m (10 ft). The more the antenna height error is, the greater the positioning error is. The relationship between unit selection and the unit of antenna height is shown in Table below. The maximum antenna height is 9999 m (ft).

Table: Unit selection and antenna height

Unit selection	Antenna height
nm	ft
km	m

Directions:

—— Press either key to move the Operation Mode bar to **SET.**

—— Press either key to display **08** as Index number, and enter the antenna height through the number keys.

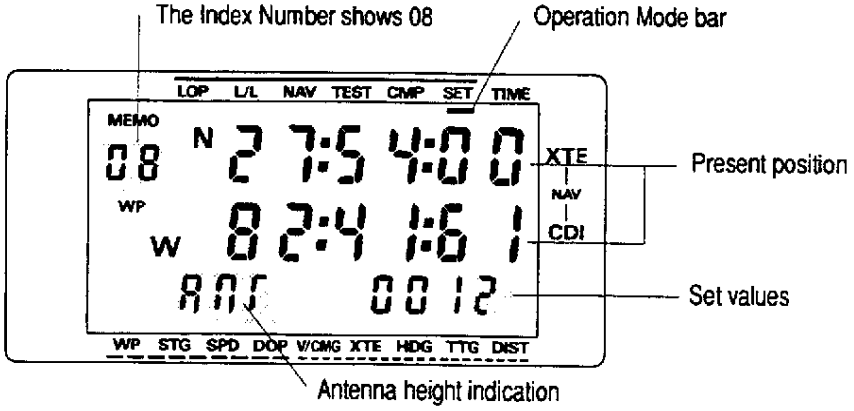
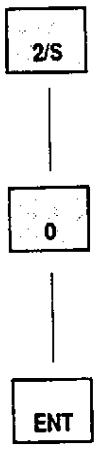


Fig. 75 Display example of setting antenna height in SET

Example:

Setting antenna height of 20 m (ft)

Press the keys in the order of:



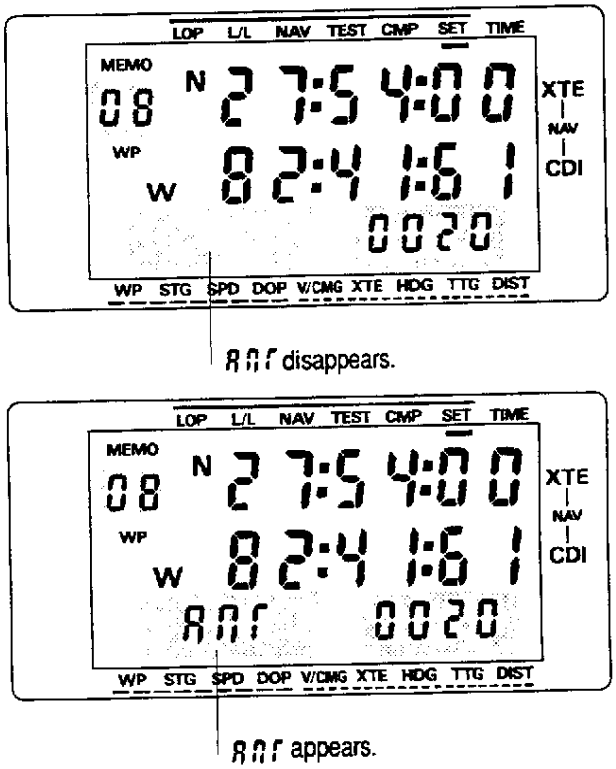


Fig. 76 Display example of setting antenna height

Note

■ Indication for the unit of measure

RNG: Kilo meter (km)is selected.
Antenna height is displayed in m.

RNG F: Nautical mile (nm) is selected.
Antenna height is displayed in ft.

Initializing unit

This operation resumes the default state of the unit. There are two kinds of operation shown below. If a track display is connected, make sure to turn on the power again while holding down **4/W** key after initializing the unit to interface with the track display.

Directions:

■ Initializing with the position point memory preserved.

1/N + ON/OFF — Press **ON/OFF** key to turn the power on while holding down the **1/N** key.

■ Initializing with the position point memory cleared.

2/S + ON/OFF — Press **ON/OFF** key to turn the power on while holding down the **2/S** key.

Both functions above leave the unit in Operation Mode **TEST** after conducting circuit test for receiver and control and performing the default setting.

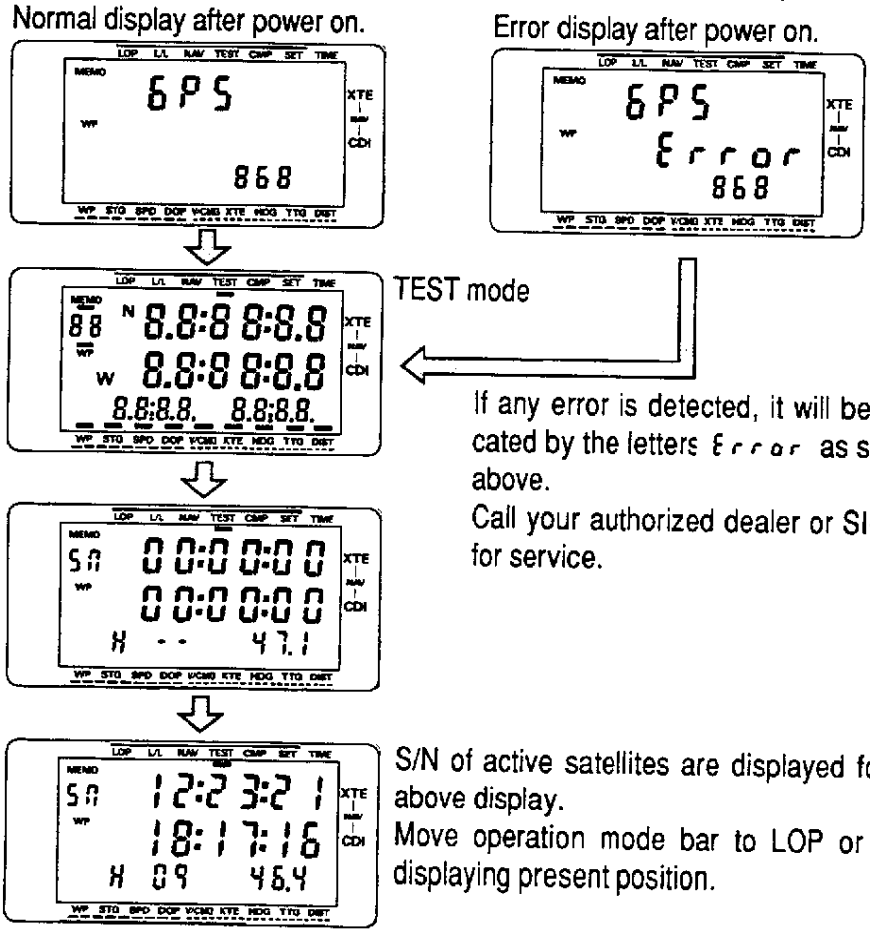


Fig. 77 Initializing mode display sequence

Power-on without initialization leaves the unit in either **LAT/LON (L/L)** or **LOP** mode depending on the mode used in the previous operation.

Specifications

Specifications subject to change without notice.

Receiver section

Receiving frequency		1575.42MHz±1MHz
Receiving channel		Digital 5-channel parallel
Receiving code		C/A code
Sensitivity		Better than -130 dBm (elevation angle: 5° or over)
Tracking speed		200 knots maximum
Accuracy	Position:	15 meters RMS
(HDOP≤3)	Velocity:	0.1 knot RMS

Note: Accuracy is subject to change in accordance with DOD civil GPS user policy.

Display section

Display	LCD backlit electroluminescent cell (86 x 44 mm)
Display mode	LOP, L/L, NAV, TEST, CMP, and SET
Position display (boat position, waypoint, and memory)	Latitude/longitude (in increments of 0.01 minute) or Loran C LOP's
Navigational data display	Speed, heading, velocity made good, course made good, distance to waypoint, steering to go, time to go, cross track error, course deviation (CDI), distance between any two waypoints
Event memory	10 points
Waypoint memory	89 points
Route memory	One temporary route with 10 points (forward or reverse)
Position update	Every one second in L/L
Navigational data update	Every three seconds
Alarm	Proximity, cross track error, anchor watch
Position compensation	Latitude/longitude or Loran C LOP's
Magnetic compensation	Automatic or manual
Output data format	NMEA-0183 (GGA, PKODA, GLL, VTG, GTD, SGR, AAM, BOD, BWC, WDC, XTE)
Setting items	PDOP mask (8, fixed), HDOP mask (15, fixed), S/N mask (3, fixed), elevation mask (5, fixed), Datum (84 selections), positioning mode (2-D or 3-D, automatic and manual selection), position averaging factor (1 to 5, default: 3), unit of measure (nm for distance, knot for speed, and feet for altitude), antenna height
Battery backup	By built-in lithium battery
Power supply	11 to 40 VDC
Power consumption	7 W (at 12 VDC) or less
Environmental condition	Display unit: 0° to +50°C (32° to 122°F) Antenna unit: -30° to +70°C (-22° to 158°F)

Equipment list

Standard equipment

Article	Remarks	Quantity
Display unit	With vinyl cover and mounting bracket	1
Antenna unit	GA-06	1
Antenna cable	CW-191, 10 m (33 ft) with a connector	1
DC power cable	CW-201, 1.8 m (5.9 ft) with a connector	1
Spare parts	Standard	1 set
Installation materials	Standard	1 set
Operation manual		1
Operation card		1

Option

Article	Type	Remarks
Remote display	UR-7	With power and connecting cables
Junction box	JB-10	1-IN/3-OUT
Connecting cable	KCW-14	5 m (16.5 ft) with BNC connectors
	CW-60	10 m (33 ft) with BNC connector and lugs
	CW-64	5 m (16.5 ft) with 5-pin and BNC connectors
	CW-154A	5 m(16.5 ft) with a 6-pin connector
	CW-155	5 m (16.5 ft) with BNC and 6-pin connectors
	CW-158	5 m (16.5 ft) with a 5-pin connector
Antenna holder	RAH-26	
Rectifier	PS-003A	With 2 fuses
AC power cable	VV-2D8	3 m (9.9 ft)

Spare parts

Article	Remarks	Quantity
Fuse	F7142, 1A	1

Installation materials

Article	Remarks	Quantity
Hose band	738-1015	2
Truss tapping screw	TPT5 x 20U	4

Outlines and dimensions

Scale differs among drawings.

Display unit

Unit: mm (inch)

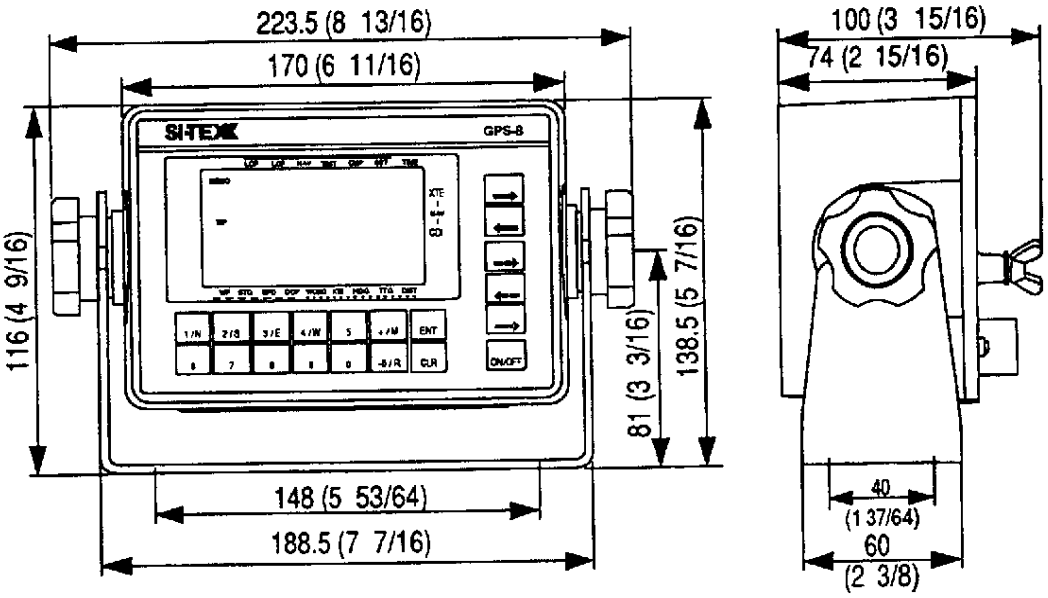


Fig. 78 Outlines and dimensions of display unit

Antenna unit

Unit: mm (inch)

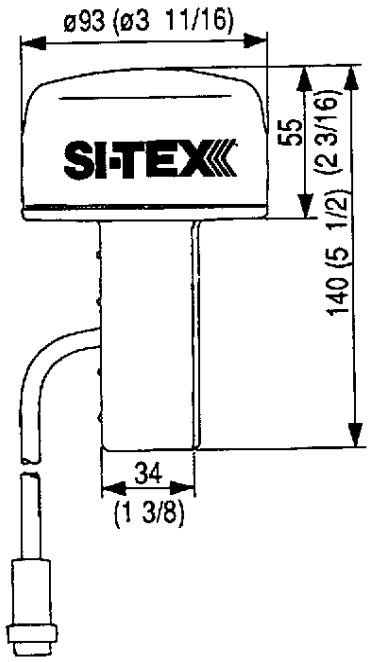


Fig. 79 Outlines and dimensions of antenna unit

Installation

Installing mounting bracket

The GPS receiver should be installed on a flat, solid surface for maximum stability. You can mount the bracket on a swivel mount which has the same mounting holes as your bracket. You can also mount your bracket overhead.

Position the bracket, mark and drill 6-mm holes. Secure it using four self-threading screws provided. Make sure that the bracket slot face forward.

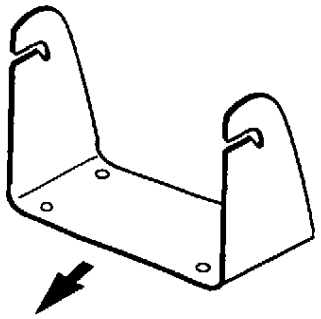


Fig. 80 Mounting bracket

Installing display unit

Place the unit in the bracket and secure it to the bracket using two bracket knobs as shown in Fig. 81.

And, Fig. 82 shows mounting dimensions for your reference.

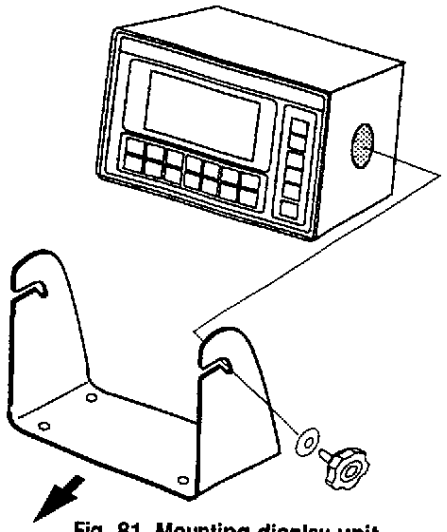


Fig. 81 Mounting display unit

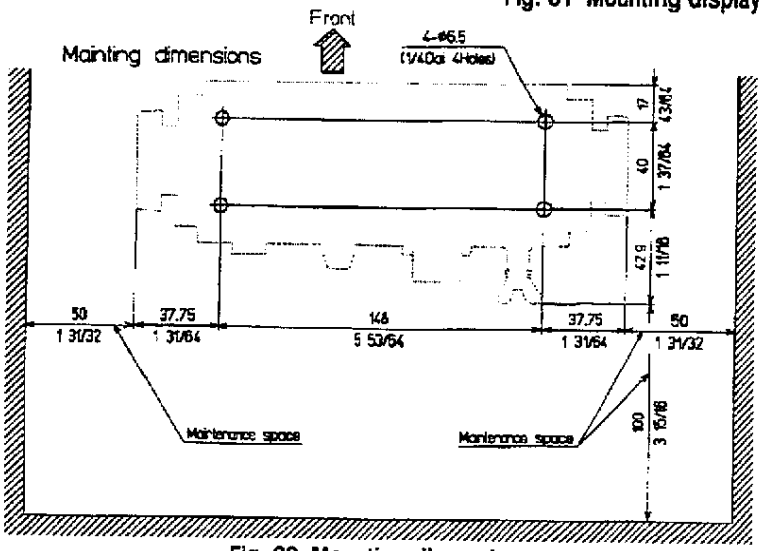


Fig. 82 Mounting dimensions

Installing antenna unit

Make sure to install antenna at the highest point on the boat where the minimum interruption of view above the horizon is achieved.
Objects placed above antenna or too close to the antenna will cause signal degradation and positioning will be intermittent.

Notice for installation

- As far away from the metallic object as possible.
- At least 4 meters (13.2 feet) away from the VHF/HF/MF transmitter antenna.
- Outside radar transmitting beam.
- At least 3 meters (9.9 feet) away from the loop antenna.
- At least 3 meters (9.9 feet) away from any object of 4 inches in diameter.

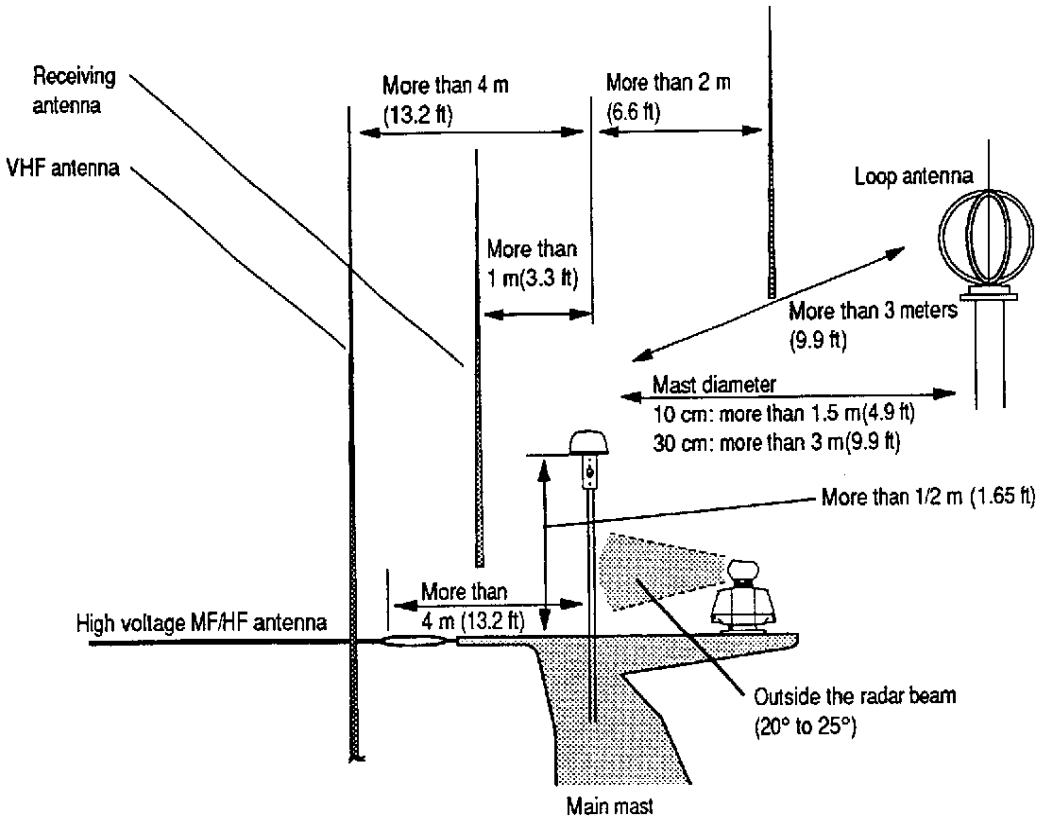


Fig. 83 Mounting antenna

Examples of antenna installation

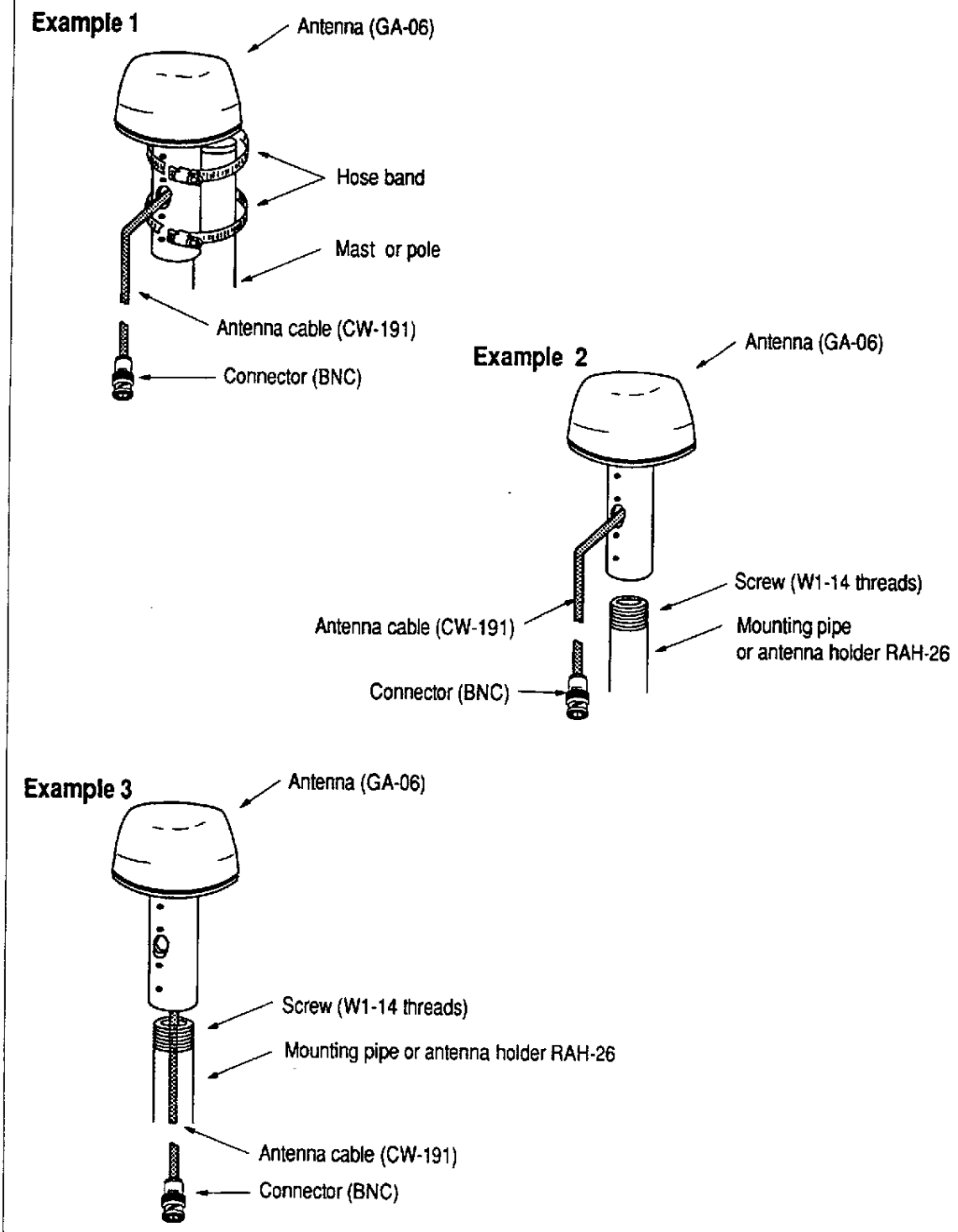
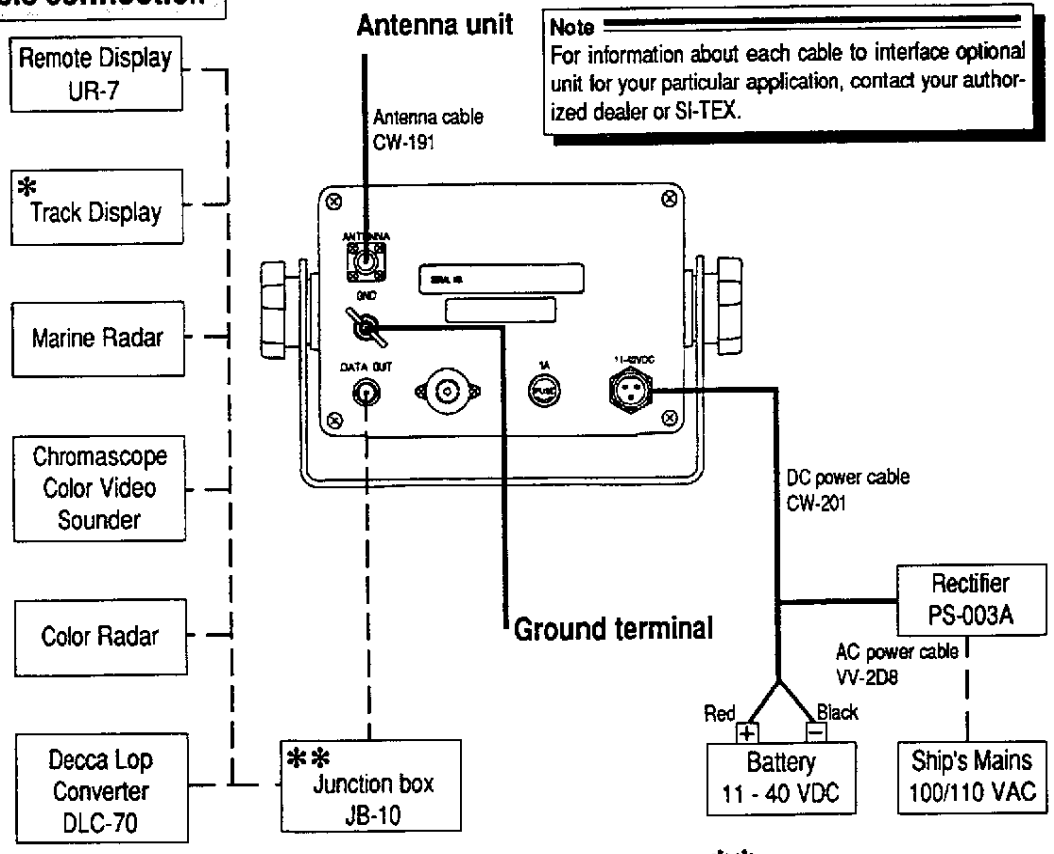


Fig. 84 Examples of antenna installations

Connecting cable

Cable connection



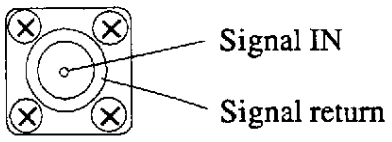
* For interfacing with track display, turn on the power while holding down the **4/W** key. This operation allows you to connect a track display.

** JB-10 is required for interfacing two or three units simultaneously so that you can use position output data for your particular application.

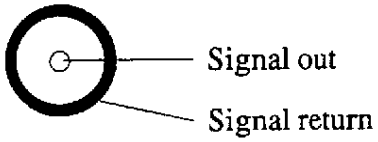
Fig. 85 Rear panel

Plug pin arrangement

ANTENNA — Antenna signal input port



DATA OUT — Serial data output port (BNC type)



GND — Ground terminal

11 - 40 VDC — Power input port

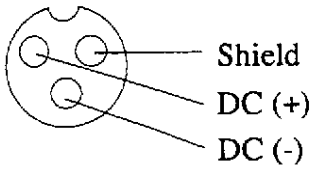


Fig. 86 Plug pin assignment

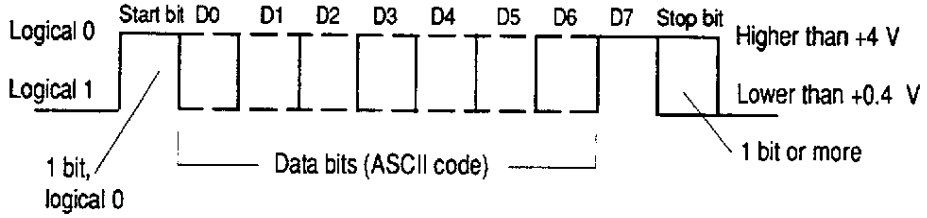
Appendix A ... NMEA-0183 output format

Output sentence descriptions

The following output formats are available from **DATA** port for your particular application.

Data conflagration

The bit configuration of one byte is as specified below.



Data specifications

Baud rate	Output level	Output current	Transmitting cycle
4800 baud	TTL level	Maximum 10 mA	3 seconds

Output sentences

GPGGA + PKODA + GPGLL + GPVTG + GPGTD +GPSGR +GPAAM + GPBOD + GPBWC + GPWDC + GPXTE

Descriptions	Contents of data field
GPGGA	Global Positioning System Fix Data

$ GP GGA, hhmmss, XXXX.XXX, N/S, XXXXX.XXX, E/W,

- Longitude
- Latitude (N or S)
- Latitude
- UTC at the position (hours, minutes, seconds)
- Sentence format
- Talker device
- Start code

X, X, XXX, 0/- XXX, M, 0/- XXX, M CR LF

- Terminator
- Meters
- Geoidal height
- 0 or - (0: positive, - : negative)
- Meters
- Antenna height
- 0 or - (0: positive, - : negative)
- DOP (P or H)
- Number of satellites being used
- GPS quality indicator (0: not available, 1: available)

PKODA	Satellites information (SI-TEX proprietary format)
	$ PKODA, P/H, XXX.X, XX, XX, XX, XX, XX, XX, XX, XX, P/H: PDOP or HDOP; XXX.X: DOP value; XX (4 fields): Satellites numbers (1ch - 4 ch); XX: S/N (1ch - 4 ch) **XXXX, M, XXX.X, N, XXX.X, 0/- XX.X, X, X CR LF** XXXX: Altitude; M: Meters; XXX.X: Speed; N: Knot per hour; XXX.X: Azimuth degree; 0/-: 0: positive, -: negative; XX.X: Deviation of oscillator frequency; X: 1/1000 minute of Lat.; X: 1/1000 minute of Lon.
GPGLL	**Geographic Position, Latitude/Longitude**
	$ GP GLL, XXXX.XX, N/S, XXXX.XX, E/W CR LF XXXX.XX: Latitude (N or S); N/S: Latitude (N or S); XXXX.XX: Longitude (E or W); E/W: Longitude (E or W)
GPVTG	**Track Made Good and Ground Speed**
	$ GP VTG, XXX, T, XXX, M, XX.X, N, XXX, K CR LF XXX, T: Course (true bearing); XXX, M: Course (compass value, same as true bearing); XX.X, N: Speed (knot); XXX, K: Speed (Km per hour)
GPGTD	**Geographical (LOP TD's)**
	$ GP GTD, XXXXX.X, XXXXX.X CR LF XXXXX.X: LOP of secondary station 1; XXXXX.X: LOP of secondary station 2
GPSGR	**Station GRI**
	$ GP SGR, XXXX CR LF XXXX: Loran C GRI

GPAAM	**Waypoint arrival alarm**
	$ GP AAM, A/V, A/V, X.XX, N, XXX CR LF Waypoint number Nautical mile Waypoint arrival alarm or anchor watch alarm range Cross track error alarm — A: alarm ON, V: alarm OFF Waypoint arrival alarm or anchor watch alarm
GPBOD	**Bearing , Origin to Destination**
	$ GP BOD, XXX, T, XXX, M, XXX, XXX CR LF Start point number Waypoint number Bearing to waypoint (magnetic) Bearing to waypoint (true)
GPBWC	**Bearing & Distance to Waypoint**
	$ GP BWC, XXXX.XX, N/S, XXXX.XX, E/W Latitude (N or S) Latitude (N or S) Longitude Longitude (E or W) **XXX, T, XXX, M, XXX.X, N, XXX CR LF** Waypoint number Distance to waypoint (nautical mile) Bearing (Magnetic) Bearing (True)
GPWDC	**Distance to Waypoint**
	$ GP WDC, XXX.X, N, XXX CR LF Waypoint number Distance to waypoint (nautical mile)
GPXTE	**Cross Track Error, Measured**
	$ GP XTE, A/V, A/V, X.XX, R/L, N CR LF Nautical mile Steer left or right (L: left, R: right) Cross track error (nautical mile) A: GPS signal is received. V: GPS signal is not received.

APPENDIX B ... Glossary

Antenna - A device that converts radio wave to electrical signal.

Bearing - Horizontal direction of one point to another. Measured from 000° through 360° clockwise.

Course - Horizontal direction in which boat is steered. Measured from 000° through 360° clockwise.

Course deviation (CDI) - Deviation angle between Steering to go (STG) and Heading (HDG).

Compensation (CMP) - Compensates or calibrates present position in L/L, bearing, time. Calculates bearing and distance between two points.

Cross track error (XTE) - The computed off-course deviation (perpendicular distance and direction) of the boat from the course line.

Distance (DIST) - Distance to the waypoint from the boat.

Heading (HDG) - Horizontally moving direction of the boat. Measured from 000° through 360° clockwise.

Latitude/Longitude (L/L) - Grid system used in Mercator projection charts.
Latitude ... The parallel lines running east and west from 0 degrees at the Equator to 90 degrees North or South at the poles.
Longitude ... The lines running north to south from 1 degree to 180 degrees east or west.

Line of Position (LOP) - A graphical plot of all observation points having the same constant measured time difference (TD) between the Master station and Secondary stations. The Graphical plot forms the Line of Position printed on the Loran C Chart.

Loran C System - A long range navigation system that operates at an assigned frequency of 100 kHz. It utilizes pulsed signals from widely spaced transmitting stations and measures the difference in arrival times of the pulses to determine position relative to the transmitting station.

Magnetic bearing - Bearing relative to magnetic north.

Magnetic Heading - Heading relative to magnetic north.

Point of Origin - A starting point of a navigational operation.

Route - A planed course to the final waypoint via some waypoint specified.

S/N (Signal to noise) ratio - The ratio of GPS signal strength to noise. Measured by decibels.

Speed (SPD) - Speed over the ground.

Steering to go (STG) - Direction of the waypoint.

Time to go (TTG) - Estimated trip time to the waypoint.

True bearing - Bearing relative to true.

True Heading - Heading relative to magnetic north.

Velocity and course (V/CMG) - Averaged speed and bearing since last reset of made good elapsed timer.

Waypoint (WP) - A waypoint or a reference point placed on a route.

APPENDIX C ... Local geodetic systems (datum)

Name	No.	Name	No.
ALASKA/CANADA	04	LIBERIA 64	57
ARC 50	29	MAHA 71	58
ARC 60	30	MALAYSIA	23
ARGENTIN	39	MALDIVE	48
ASCENSION	31	MARCUS	35
AUSTRALIAN 84	06	MARSHALL	82
BAHRAIN	27	MASCARENE	73
BERMUDA	37	MIDWAY 61	62
BRAZIL	45	MOROCCO	61
CANARY	68	NAD-27	03
CAYMAN BRAC	56	NAD-83	10
CHATHAM	43	NEW GEORGIA	46
COCOS	28	NEW ZEALAND	13
COLOMBIA	38	NIGERIA	63
CORVO/FLORES	65	OMAN	67
DIEGO GARCIA	52	PARAGUAY	44
DJAKARTA	22	PHILLIPPINES	19
EAST FALKLAND	76	PHOENIX	40
EAST MALAYSIA	79	PITCAIRN	69
EASTER	47	PORTO SANTO	77
EFATE	36	PUERTO RICO	71
EGYPT	66	QATAR	72
ENGLAND	20	ROME 40	15
ERITREA	60	SALVAGE	59
ETHIOPIA	25	SANTA MARIA	75
EUROPEAN 50	05	SANTO	74
EUROPEAN 79	14	SAUDI ARABIA	17
FAIAL	78	SOMALIA	26
FIJI	81	SOUTH AFRICA	16
FLORIDA	41	SOUTH AMERICA	08
GREENLAND	09	SOUTH ASIA	07
GUADALCANAL	50	SOUTH CHILE	70
GUAM 63	49	SRI LANKA	54
HAWAII	21	ST. HELENA	34
HONG KONG 63	51	SURINAM	83
ICELAND 55	11	TERN	33
IRELAND 65	12	TOKYO	02
INDIAN/NEPAL	18	TRINIDAD	64
IWO JIMA	32	TRISTAN	80
JAPAN	24	TUNISIA	42
JHONSTON	53	WGS-72	01
KELGUELEN	55	WGS-84	00

No.	Name	No.	Name
00	WGS-84	42	TUNISIA
01	WGS-72	43	CHATHAM
02	TOKYO	44	PARAGUAY
03	NAD-27	45	BRAZIL
04	ALASKA/CANADA	46	NEW GEORGIA
05	EUROPEAN 50	47	EASTER
06	AUSTRALIAN 84	48	MALDIVE
07	SOUTH ASIA	49	GUAM 63
08	SOUTH AMERICA	50	GUADALCANAL
09	GREENLAND	51	HONG KONG 63
10	NAD-83	52	DIEGO GARCIA
11	ICELAND 55	53	JHONSTON
12	IRELAND 65	54	SRI LANKA
13	NEW ZEALAND	55	KELGUELEN
14	EUROPEAN 79	56	CAYMAN BRAC
15	ROME 40	57	LIBERIA 64
16	SOUTH AFRICA	58	MAHA 71
17	SAUDI ARABIA	59	SALVAGE
18	INDIAN/NEPAL	60	ERITREA
19	PHILLIPPINES	61	MOROCCO
20	ENGLAND	62	MIDWAY 61
21	HAWAII	63	NIGERIA
22	DJAKARTA	64	TRINIDAD
23	MALAYSIA	65	CORVO/FLORES
24	JAPAN	66	EGYPT
25	ETHIOPIA	67	OMAN
26	SOMALIA	68	CANARY
27	BAHRAIN	69	PITCAIRN
28	COCOS	70	SOUTH CHILE
29	ARC 50	71	PUERTO RICO
30	ARC 60	72	QATAR
31	ASCENSION	73	MASCARENE
32	IWO JIMA	74	SANTO
33	TERN	75	SANTA MARIA
34	ST. HELENA	76	EAST FALKLAND
35	MARCUS	77	PORTO SANTO
36	EFATE	78	FAIAL
37	BERMUDA	79	EAST MALAYSIA
38	COLOMBIA	80	TRISTAN
39	ARGENTIN	81	FIJI
40	PHOENIX	82	MARSHALL
41	FLORIDA	83	SURINAM

APPENDIX D ... Position memory note

No.	Name	L/L or LOP		No.	Name	L/L or LOP	
01				51			
02				52			
03				53			
04				54			
05				55			
06				56			
07				57			
08				58			
09				59			
10				60			
11				61			
12				62			
13				63			
14				64			
15				65			
16				66			
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18				68			
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30				80			
31				81			
32				82			
33				83			
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46				96			
47				97			
48				98			
49				99			
50							