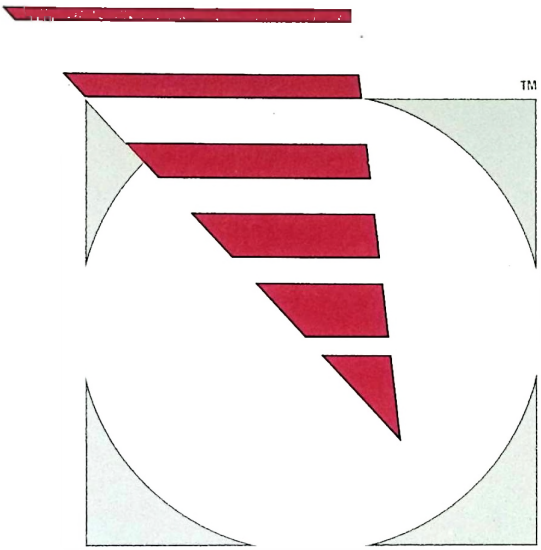


MAGELLAN

SYSTEMS CORPORATION

Magellan NAV 1000 PLUS™

User Guide

READ THIS GUIDE COMPLETELY TO INSURE PROPER AND SAFE USE OF THE MAGELLAN NAV 1000 PLUS.

THIS SYMBOL IS USED TO POINT OUT IMPORTANT SAFETY INFORMATION. WHEN YOU SEE THIS SYMBOL, PLEASE READ AND CONSIDER THE MESSAGE.

MAGELLAN NAV 1000 PLUS™

USER GUIDE

Magellan Systems Corporation
260 East Huntington Drive
Monrovia, California 91016
(818) 358-2363
FAX (818) 359-4455

CONTENTS

PREFACE

Magellan Systems is the world's leading manufacturer of GPS receivers for the boating market. In the NAV 1000 PLUS you have the most versatile and sophisticated GPS receiver on the market today.

At the touch of a button, your NAV 1000 PLUS can harness the full capabilities of the US Government's $10 billion Global Positioning System (GPS). GPS is truly the first 24-hour, worldwide, three-dimensional navigation system. GPS is also the world's most precise positioning system.

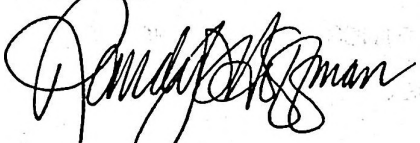
The NAV 1000 PLUS was designed to be highly versatile. It can be easily mounted at your nav station, or it can be completely portable. Through its NMEA 0183 interface the NAV 1000 PLUS can be connected to your autopilot, plotter, sounder, or radar.

The NAV 1000 PLUS is the only GPS receiver to integrate the cutting edge technology of gallium arsenide microcircuitry. Gallium arsenide enables electrons to move five times faster, yet draw only one quarter the electrical power of silicon circuitry.

With a two-and-a-half second position update rate, multi-leg route capability, NMEA 0183 interface, waypoint projection, and a full complement of navigation features, the NAV 1000 PLUS will greatly enhance your cruising pleasure.

After you have had the opportunity to put the NAV 1000 PLUS through its paces, please write me. I'd like to hear from you.

Sincerely,



Randy D. Hoffman
President &
Chief Executive Officer
Magellan Systems Corporation

WARNINGS ⚠

Knowledge by the user is required for proper and safe use of the **Magellan NAV 1000 PLUS**. PLEASE READ THE USER GUIDE & WARRANTY COMPLETELY.

Use Good Judgment

This product is an excellent navigation aid, but it does not replace the need for careful charting and good judgment. Never rely solely on one device for navigating.

Use Care to Avoid Inaccuracies

The Global Positioning System (GPS) is operated by the U.S. government which is solely responsible for the accuracy and the maintenance of GPS. Certain conditions such as changes in the satellite's orbit, signal,or health may make the system less accurate.

Accuracy can also be affected by poor satellite geometry. WHEN THE ACCURACY WARNING APPEARS ON THE SCREEN, USE THIS DATA WITH EXTREME CAUTION.

THE GLOBAL POSITIONING SYSTEM IS STILL IN THE DEVELOPMENTAL PROCESS. The government may make changes to the system which could affect the performance of GPS receivers.

Set the Correct Mode

AMONG THE MOST IMPORTANT THINGS YOU MUST KNOW IS WHETHER YOUR UNIT IS SET FOR TWO DIMENSIONAL (2D) OR THREE DIMENSIONAL (3D) MODE OF OPERATION.

Using only three satellites for obtaining a position, 2D mode gives a latitude and longitude position. Altitude must be entered by the user in the 2D mode. To ensure maximum accuracy in a position, the altitude entered should be correct to within +/-5 meters.

The recommended mode for land use is 3D. That means the unit will require four satellites to obtain a position fix; thereby determining altitude as well as latitude and longitude. (This insures the accuracy of the fix where exact altitude is not available.)

Section 1

ABOUT YOUR NAV 1000 PLUS

Thank you for your purchase of the Magellan NAV 1000 PLUS, the leading GPS receiver in the world. The NAV 1000 PLUS uses the precise and accurate, and continuously operating, Global Positioning System (GPS). The NAV 1000 PLUS contains numerous innovations, including state of the art Gallium Arsenide integrated circuits, to bring to you a revolutionary GPS product that is compact, lightweight, and low in price.

The NAV 1000 PLUS features an NMEA dataport so you can interface with various autopilots, plotters, radars, and sounders. Also, you may enter and follow multi-leg routes. The NAV 1000 PLUS is waterproof, weighs 30 ounces, and it floats.

Although the NAV 1000 PLUS uses state-of-the-art technology, it is designed to be easy to use with no double function keys, and with clear and simple displays.

THE USER GUIDE

The User Guide is arranged in the following order:

Section 1: About Your Magellan NAV 1000 PLUS is an overview of the NAV 1000 PLUS, the guide, accessories, how to use the keypad, and specifications.

Section 2: Setting Up Your NAV 1000 PLUS explains how to use the unit for the best overall performance, how to load and replace the batteries, how to connect the unit to external power sources, and external NMEA devices, how to initialize the unit and collect an almanac.

Section 3: Tutorial to familiarize you with using the NAV 1000 PLUS.

Section 4: Function Keys provide procedures for using the receiver's function keys. Refer to this section whenever you have questions on how to perform a function.

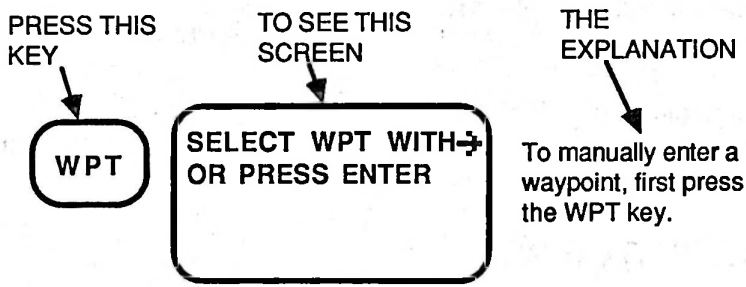
Section 5: Plus Functions cover the functions available under the PLUS key.

Section 6: Trouble Shooting and Tips

We have written **All About GPS** which appears in the Appendix, to give you an overview of the Global Positioning System.

INSTRUCTIONAL APPROACH

The following editorial conventions have been used in this guide:



▲ THIS SYMBOL IS USED TO POINT OUT IMPORTANT SAFETY INFORMATION. WHEN YOU SEE THIS SAFETY SYMBOL, PLEASE CAREFULLY READ AND FOLLOW THE MESSAGE.

MESSAGE DISPLAY SYMBOLS

The following symbols appear in the various message displays:

Warning - This appears in all position messages if either the Geometric Quality (GQ) or the Signal Quality (SQ) falls below four. If the GQ, a measure of the geometric quality of the fix, falls below 4, do not use the position for navigating.

Satellite - This appears as each satellite is located during search and data collection.

Bell - This appears when the unit's internal alarm has been set to "Wake-Up for Position Fix."

Battery Warning - This appears when the batteries are low and need to be replaced.

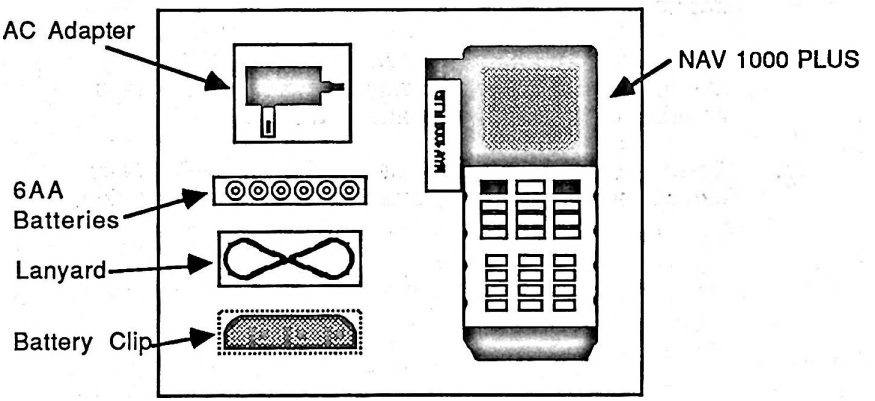
Right Arrow - This appears when the RIGHT ARROW key can be pressed to toggle to another selection, or there is another item to view, like another waypoint.

Down Arrow - This appears when the DOWN ARROW key can be used to scroll down and view additional information.

PACKING LIST

The contents of your **Magellan NAV 1000 PLUS** basic package includes:

- Magellan NAV 1000 PLUS unit
- AC Adapter
- Data/Power Connector
- Lanyard
- 6 AA Alkaline Batteries
- Battery Clips (2)
- User Guide
- Field Card
- Warranty
- Registration



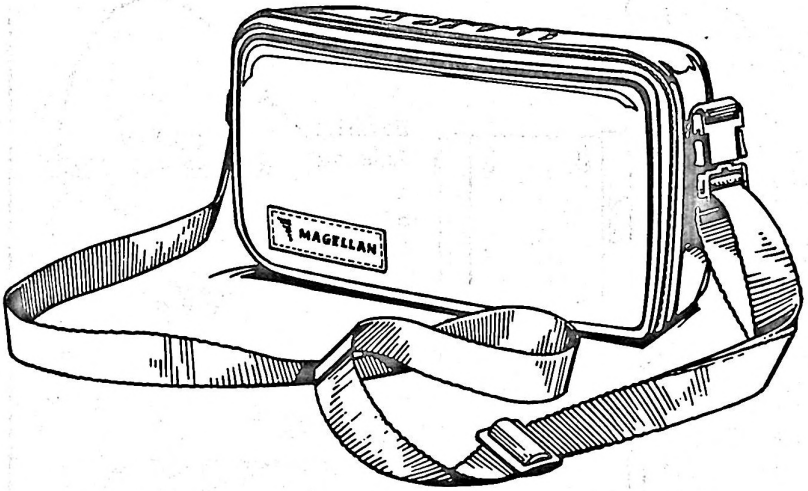
Magellan GPS NAV 1000 PLUS
Basic Package
PN 00-11001

ACCESSORIES

The NAV 1000 PLUS has several optional accessories.

Carrying Case

A durable Cordura™ carrying case is available for transporting your NAV 1000 PLUS. The case can be worn over your shoulder or on your belt. You may also use the case for safely storing the unit. The field card and an extra battery clip fit into a specially designed pocket.

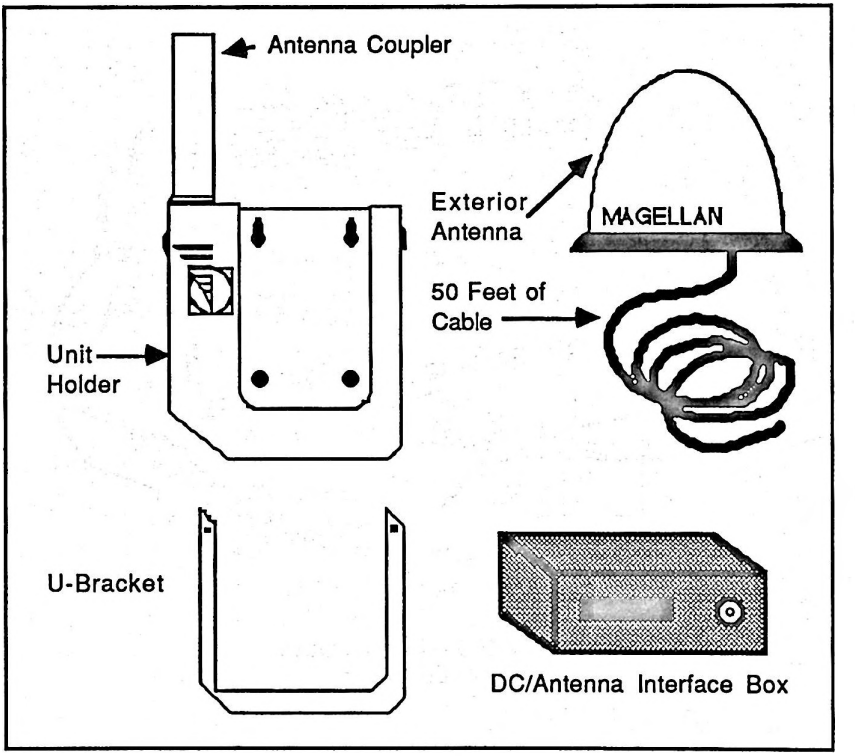


NAV 1000 Carrying Case
PN 00-19005

Quick-Release Bracket Mounting Kit

The quick-release bracket mounting kit allows you to operate your NAV 1000 PLUS inside a wheel house or cabin. It consists of:

- Unit Holder
- "U"-Bracket with Screws
- Exterior Antenna
- Cable (50 feet)
- DC/Antenna Interface Box
- GPS Antenna Coupler



Quick-Release Bracket Mounting Kit PN 00-19001

Unit Holder

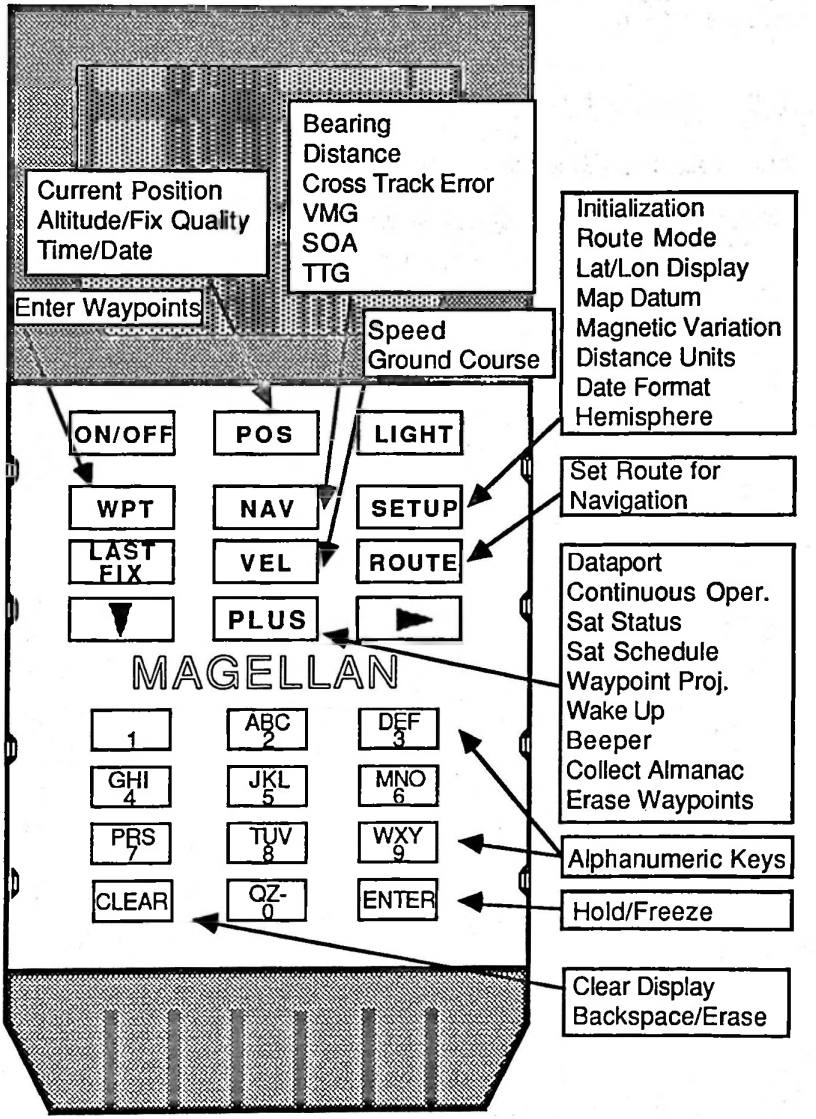
Unit Holders (PN 00-19004) are available to provide several snug berths for the NAV 1000 PLUS on deck, in a skiff, or in a lifeboat.

Other Accessories

Also available are Replacement Battery Clips (PN 00-19004), DC Power Adapters (23-10010), International AC Power Adapters (43-00002 includes specific countries), and U-Brackets (PN 00-19003) which may be purchased individually.

THE KEYPAD

The unit's keypad has 12 function keys and an alphanumeric keypad.



Key Function

CLEAR — Clear the display, backspace, or erase stored information.

DOWN ARROW — Use as a scroll key to display additional information.

ENTER — Accept information for storage or freeze a position to be saved as a waypoint.

LAST FIX — Display the last five position fixes.

LIGHT — Turn the display light on and off.

NAVIGATION — Display the bearing and distance to destination, cross track error. Also available are steering, estimated time to go, speed of advance, and velocity made good, if on continuous power.

ON/OFF — Turn the unit on and off.

PLUS — Access various miscellaneous functions (see section four).

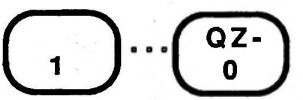
POSITION — Display your current position, antenna altitude, accuracy indicators, current date, and current time.

RIGHT ARROW — Use as a toggle switch and to scroll to the right for the next item of information.

ROUTE — Establish a route between two waypoints consisting of up to 10 legs, switch legs in manual mode.

VELOCITY — Display your current velocity, and ground course.

WAYPOINT — Enter and retrieve waypoint positions.



ALPHANUMERICS — Ten alphanumeric keys laid out in an easy-to-use telephone keypad style.

SPECIFICATIONS

Physical Characteristics

Unit Size:	8.75" x 3.5" x 2.13" (excluding antenna); 9.0" x 5.0" x 2.5" (bracket mounted)
Weight:	30 ounces with batteries
Display:	4 line, 16 character, alphanumeric, backlit LCD
LCD Dimension:	6.5 cm X 4.5 cm; 0.70 cm high digits (with cursor)
LCD Operating Temperature:	-10° C. to 60° C.
Waterproof.	
Buoyancy:	Specific gravity compared to seawater = 0.8 (it floats)
Safe Storage Temperature:	-40°C. to 70°C.
GPS Exterior Antenna:	3.5" diameter x 3.5" height, 50 feet of cable (See Instructions for the Quick Release Bracket Mounting Kit.)

Data Characteristics

Accuracy:	Position - 25 meters RMS in 2D (Accuracy of fixes can be affected by the periodic adjustments to GPS satellites by the US Government, and is subject to change in accordance with the Department of Defense civil GPS user policy) Velocity - ±0.2 Knots (HDOP<2, $C/N_0 \geq 47$ dB-Hz, 2D)
Velocity:	0 to 200 Knots
Time to First Fix:	2.5 minutes (2D) typical
Update Rate:	3 seconds (2D) typical
Memory:	100 user-stored waypoints 5 automatic waypoints
Modes of Operation:	2D (solves for LAT, LON, and time with a user-entered altitude using best 3 satellites) or 3D (solves for LAT, LON, altitude, and time using best 4 satellites)

Electrical Characteristics

Power Requirements:	6 AA alkaline batteries (internal) 10 to 15 volts DC with adapter 115 volts AC ±10% with adapter
Power Consumption:	260 MA without light 310 MA with light

Section 2

SETTING UP YOUR NAV 1000 PLUS

LOADING THE ALKALINE BATTERIES

Follow these steps to load the six AA alkaline batteries into your unit.

1. Load the extra battery clip with six AA alkaline batteries following the placement instructions in the clip. We recommend Eveready Energizer® batteries.

2. Turn the unit off.

3. If the unit is being operated on external power, turn the unit off, and remove the connector from the power jack.

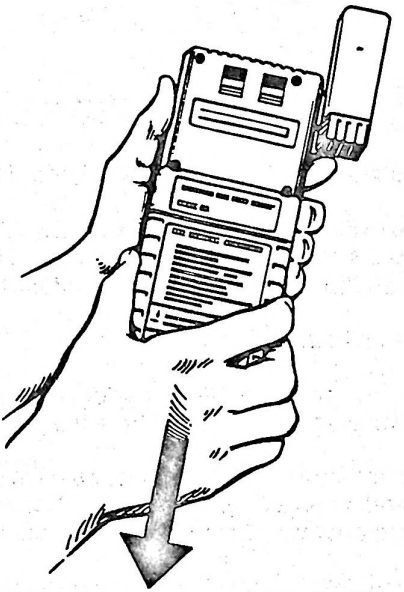
4. Grip the battery compartment door on each side as shown in the illustration on the following page. Remove the door by pulling the door very firmly toward the bottom of the unit.

5. Replace the old battery clip with the new battery clip making certain that the open side of the clip, with batteries exposed, faces outward.

▲ **WARNING: The open side of the clip must face outward. You have two minutes to exchange battery clips before the unit will lose its memory.**

6. Remove any dirt, sand, or other foreign matter from the battery compartment seal.

7. Replace the battery compartment door by pushing up until it is firmly in place.



Opening the Battery Door

EXTERNAL POWER OPERATION

When you provide external power to the NAV 1000 PLUS, the unit always operates in continuous mode.

Your NAV 1000 PLUS can operate using AC or DC power as follows:

For AC
(115 volts AC ±10%, 50/60 Hz)
Use the Magellan AC Adapter (PN 00-19006) furnished with the NAV 1000 PLUS unit, or the Magellan International AC Adapter (PN 43-00002).

For DC
(12 volts DC, negative ground)
Use the Magellan DC/Antenna Interface Box available in the Magellan Quick-Release Bracket Mounting Kit (PN 00-19001), or the Magellan DC interface (PN 23-10010).

Connecting to an External Power Supply

The jack on the side of the NAV 1000 PLUS acts as both the unit's connector for external power, and for NMEA interface support. You must plug the Magellan adapter cable into the 1000 PLUS. On the other end of the adapter cable is a connector with two receptacles. One is for connecting to external power, the other is for attaching a connector to your external NMEA devices. See the appendix section on pin assignments for further information on connecting NMEA.

WARNING: Use only Magellan power adapters to connect your unit to an external power supply. Other adapters may severely damage the unit. To avoid the possibility of losing your memory or freezing up the NAV 1000 PLUS, make sure the unit is always turned off before connecting or disconnecting the external power supply.

CONTINUOUS VS PUSH-TO-FIX

The NAV 1000 PLUS may be set to operate in a push-to-fix (non-continuous), or in continuous operation. When on battery power, use PLUS 2 to select continuous on or off.

In push-to-fix mode, the unit will take only one fix when the POS key is pressed, and will turn off after two minutes if no keys are pressed. When using the unit for positioning, set continuous operation off when you wish to conserve the internal AA alkaline batteries.

In continuous operation, the unit is set so that it will stay on and take fixes every 3 seconds. This data may then be used to calculate velocity and update the navigational data. Continuous operation is also essential to supporting an external device through the NMEA dataport.

When using external power, continuous operation cannot be turned off.

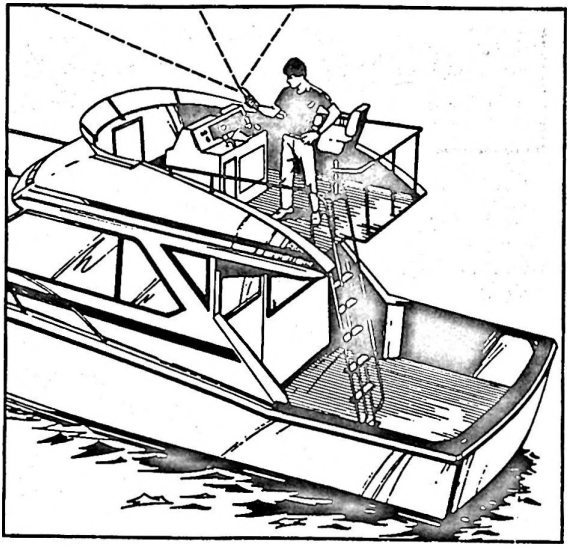
BATTERY OPERATION

When not attached to an external power source, the **Magellan NAV 1000 PLUS** is powered by six AA alkaline batteries.

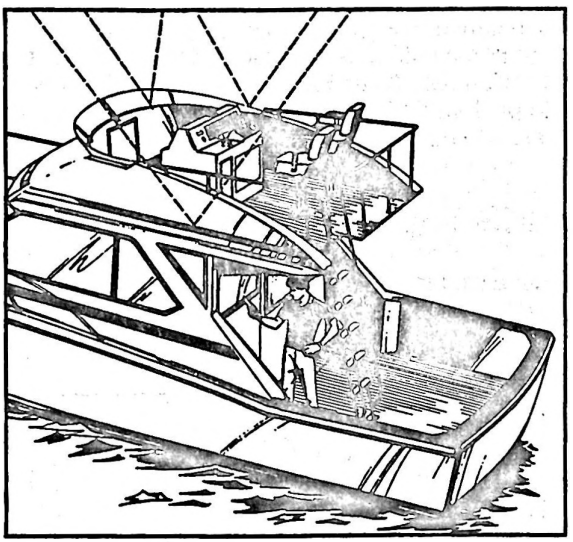
In push-to-fix operation, the PowerSaveR™ design will store the last fix, and turn itself off if none of the keys have been pressed for two minutes. If the batteries should run low while you operate the NAV 1000 PLUS in continuous operation, the PowerSaveR™ function will revert back to non-continuous operation. You can expect approximately 7 hours of position data (over 5000 fixes) on a fresh set of alkaline batteries. In push-to-fix (non-continuous) operation, you can expect to obtain at least 140 individual position fixes.

ORIENTING THE ANTENNA

In order to get a fix, the unit must be held or placed in direct view of the satellites with the antenna pointing straight up (simply rotate the antenna up) as shown in the figure below.



The unit will not receive signals if its view of the satellites is blocked by objects or people, or if you attempt to use it inside without an exterior antenna. Note that a sail, by itself, should not block the signal.



Obstructions will block the signal.

▲ BATTERY WARNING SYMBOL 

When the internal batteries get low, the battery warning appears on every display.

When the second low battery warning level is reached, you will see the message: "Replace batteries or lose data." Replace the batteries!

When the second battery symbol appears, there is generally enough power to save your memory for another four weeks. You must now change the batteries. The NAV 1000 PLUS will not take additional fixes until the batteries are changed.

Rechargeable batteries are not recommended for two reasons. First, their life is considerably shorter than fresh alkaline batteries. Second, the sharp drop in power near the end of their charge cycle can jeopardize the unit's memory without warning.

CONNECTING TO AN EXTERNAL DEVICE (NMEA)

Your NAV 1000 PLUS can interface with various autopilots, plotters, sounders, and radars through its National Marine Electronics Association (NMEA) interface.

The jack on the side of the NAV 1000 PLUS acts as both the unit's connector for external power, and for NMEA support. You must plug the Magellan adapter cable into the NAV 1000 PLUS. On the other end of the adapter cable is a connector with two receptacles. One is for the connection to external power, the other is for attaching a connector to your external device.

Plug in the connector to hook up the NAV 1000 PLUS with your external equipment.

ACTIVATING NMEA SUPPORT

To support an external device you must have the NAV 1000 PLUS set to continuous operation, with the dataport on, and have a Route set. The continuous (automatic if external power is being used) operation may be set in PLUS 2 . The dataport is turned on in PLUS 1 (see section 5). The route is set by pushing the ROUTE key (see section 4). Also, you may select to follow the route in automatic or manual mode (see section 4).

NMEA output is activated by pushing either the POS, NAV, or VEL keys.

NOTE: Pressing any other function key, like ROUTE, SETUP, LASTFX, or WPT, will turn the dataport off after 60 seconds.

When starting out do not turn on your external device until you are sure that the NAV 1000 PLUS is emitting data. Data is produced only after the unit has obtained its first fix (usually about 2 1/2 to 3 minutes). After that the data will update every 3 seconds. To obtain data, push the POS, NAV, or VEL keys.

For successful NMEA support of external devices ensure that the following parameters are set:

	Where to access
Cables connected	
Route set	ROUTE key
Continuous Oper.	PLUS 2
Dataport ON	PLUS 1 (and correct baud rates)
Unit is getting positions	POS, or NAV, or VEL keys

The NAV 1000 PLUS emits navigational data that conforms to the National Marine Electronics Association (NMEA) standard 0183. You may select from three different message types that are designated 0183A, 0183B, and 0183C. It may take some experimentation on your part to determine which message and baud rate is appropriate for your equipment. For more information on the types of NMEA messages, or to troubleshoot any problems that you may have, please refer to the "PLUS 1" in section 5.

Section 3
TUTORIAL

This Tutorial is designed to show you how to use the Magellan NAV 1000 PLUS. You may conduct the tutorial inside a building; the tutorial does not need information from satellites.

The Tutorial will teach you how to:

- enter and recall waypoints
- set a route
- navigate
- check the satellite schedule
- locate PLUS features.

NOTE: The Tutorial will not work properly if the unit is in continuous operation. If you are plugged into external power, you must disconnect the adapter.

For the tutorial, the NAV 1000 PLUS must be set to its default values. If you have not yet used SETUP, except to initialize your position, you are all right, and you may proceed.

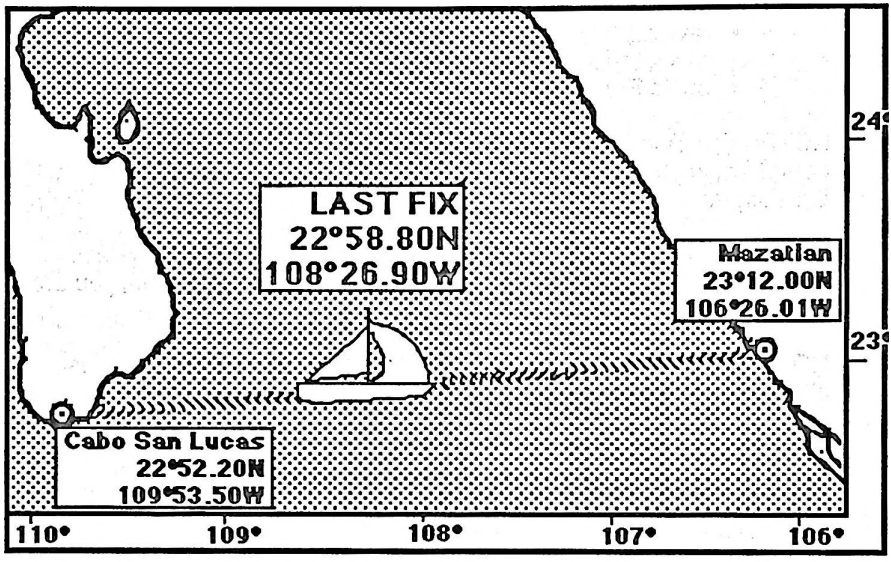
NOTE: If you have changed your settings through SETUP, you must change the values back to their defaults of WGS-84, Nautical Miles, Magnetic Heading, and altitude in feet, then set continuous operation to off. The units should appear as follows:

Lat/Lon Display	Deg/Min
Map Datum	WGS84
Magnetic Var.	Auto Mag (M)
Dist/Speed	Naut.Mi., Knots
Alt	feet
Set Hemisphere	N/W

The Tutorial simulates a cruise in the Gulf of California roughly half way between Cabo San Lucas and Mazatlan (see the chart). PLUS 20 will be used to produce a simulated last fix for this position.

To Begin

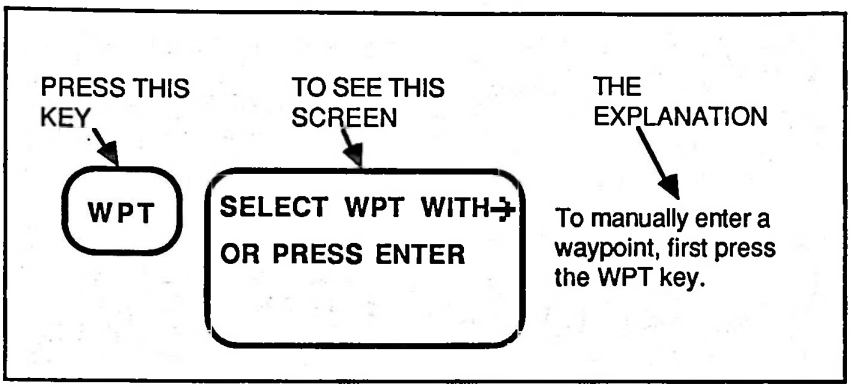
1. Turn the NAV 1000 PLUS on by pressing the ON/OFF key.
2. Initialize the unit (SETUP), if you have not already done so (see the Faststart for help in this area).
3. Now have the unit create a last fix. Press PLUS 20 and ENTER. The last fix the unit creates is depicted as the position of the boat on the chart.



Tutorial "Cruise"

To Work the Tutorial

To use the Tutorial, all you must remember is to press the key shown at the left of the page to obtain the display next to it. The explanation for the key pressed appears on the right of the page.



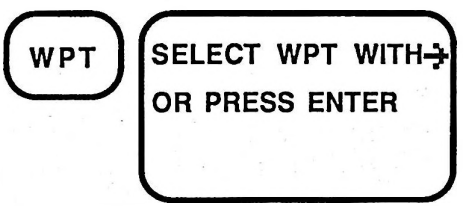
Tutorial Instructions

The down and right arrows indicate that you can obtain additional information.

NOTE: With continuous operation set to off, the NAV 1000 PLUS is designed to cycle off if you press no key for two minutes. Press ON and the appropriate function key to reactivate operation.

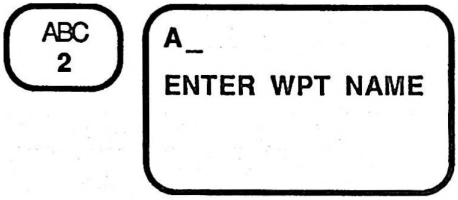
1. Entering Waypoints

Your first task will be to enter two waypoints: Cabo San Lucas and Mazatlan. The NAV 1000 PLUS stores up to 100 waypoints by the names you give them. These names can be up to six characters long.

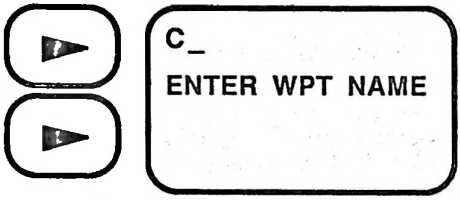


To manually enter a waypoint, begin by pressing the WPT key.

First, you will enter the waypoint CABO. Press the ENTER key to get the first entry message.

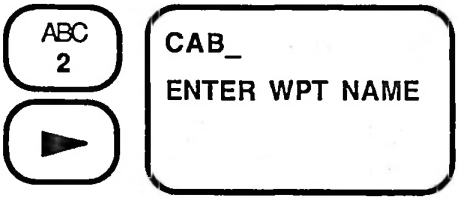


Using the alphanumeric telephone-style keypad, press the 2 key. Note that the letter "A" appears on the screen.

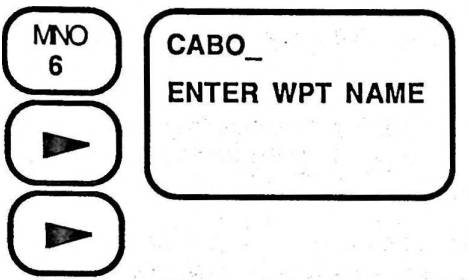


Press the RIGHT ARROW twice to change the "A" to "C." (Continued toggling with RIGHT ARROW would reveal an endless loop of "ABC2ABC2...")

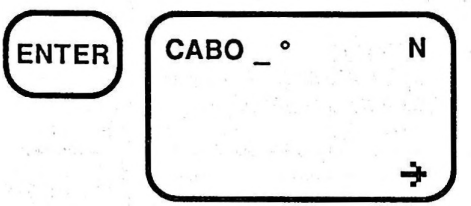
Press the "2" key again. The first two letters of "CABO" are now entered. If you make a mistake, press CLEAR to erase the letter.



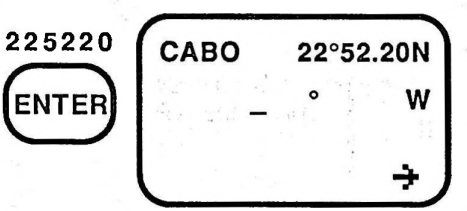
Pressing the "2" key and the RIGHT ARROW once creates the "B."



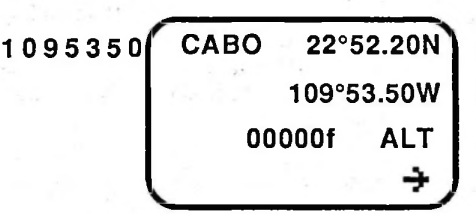
"O" is created by pressing "6," followed by two RIGHT ARROWs.



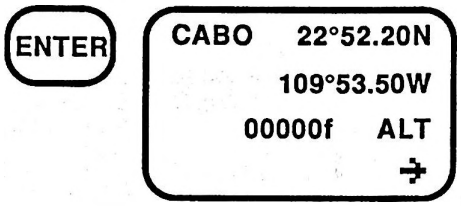
Press ENTER and you can begin entering the latitude.



Press the number keys 2 2 5 2 2 0 in that order. (If you press RIGHT ARROW, you can toggle between "N" (northern hemisphere) and "S" (southern hemisphere). Press ENTER, and you will see where to enter the longitude.



Press the keys 1 0 9 5 3 5 0. (The RIGHT ARROW key will toggle between "W" west and "E" east.)



Press ENTER. The Antenna Altitude entered in Initialization will appear automatically. (You can enter another altitude here, if you choose.)

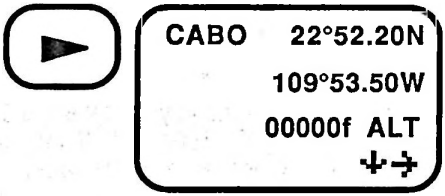
You must press ENTER again to save this waypoint. Repeat this process entering the waypoint for Mazatlan. Remember, first press WPT, then ENTER to begin the entry procedure.

NOW ENTER MAZATLAN ==> MAZTLN

23°12.00	N
106°26.01	W
00000 FT	ALT

2. Viewing Waypoints

To begin viewing waypoints, press the WPT key.



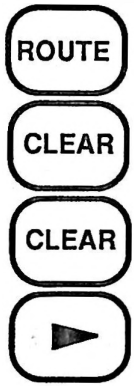
To view the waypoints just entered, press the RIGHT ARROW until CABO appears.

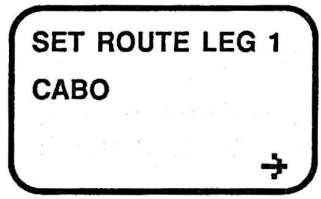
Waypoints are stored in alphabetic order. You may also retrieve a waypoint by entering a letter, followed by ENTER. By pressing the RIGHT ARROW key you can view all waypoints beginning with that letter through the end of the alphabet.

3. Setting Your Route

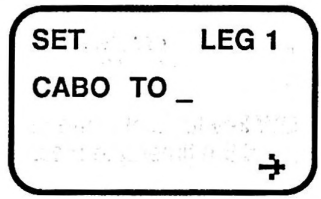
When you want to navigate between two places, or waypoints, your NAV 1000 PLUS will allow you to set a route between any two waypoints. In fact, your unit will also let you create multi-leg routes. For more information about routes, refer to section 4 under the ROUTE button.

Now you will set a route from CABO (Cabo San Lucas) to MAZTLN (Mazatlan) using the two waypoints you have just created.



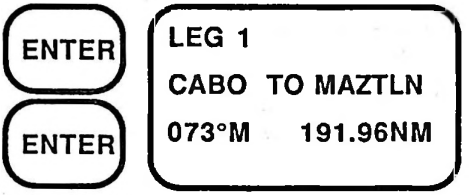


To set the course, press the ROUTE key, then the CLEAR key twice, then press RIGHT ARROW until the waypoint "CABO" appears.



Press ENTER. A destination waypoint can now be selected using the RIGHT ARROW or...

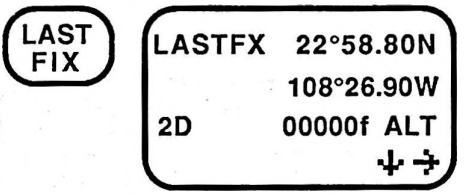
By entering the first letter of the waypoint name, "M," and ENTER, the first waypoint starting with "M" will appear. Use the RIGHT ARROW key, if necessary, to scroll to the desired waypoint.



Press the ENTER key twice, and the unit calculates and displays the bearing and great circle distance from your course start to destination.

4. Last Fix

The LAST FIX key provides temporary access to previous position fixes. These fixes will update each time you take a new fix in push-to-fix mode, and every few fixes in continuous mode.

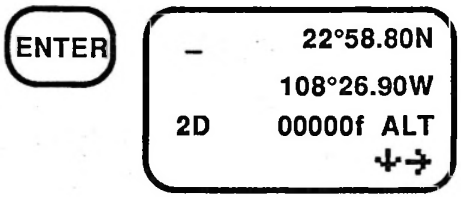


When you press the LAST FIX key, the last recorded position's latitude and longitude displays. This particular position was created when you pressed PLUS 20.

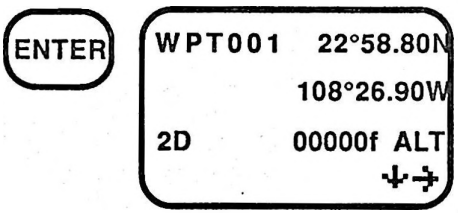
You may press the DOWN ARROW key to display the antenna altitude, the signal and geometric quality, and the time/date messages for this fix.

5. Saving Positions as Waypoints

You may save any position fix—a current position, a last fix, or its related backups—as a waypoint. You save the position by pressing the ENTER key while viewing that position. The ENTER key acts like a "HOLD" key, freezing the position while you name it.



When you press the ENTER key while viewing a current position, a last fix, or its related backups, latitude/longitude information continues to display. The cursor is now in the upper-left corner of the message display. You can give the waypoint a name using the alphanumeric keypad...



Or simply press ENTER again and the NAV 1000 PLUS will automatically generate a name using the format WPT001, WPT002, etc.

NOTE: Waypoints cannot be saved from the NAV function. Press POS or LAST FIX before trying to save waypoints.

6. Navigating

If you are following a route to get a destination, you would use the NAV key to obtain navigation information.

To navigate toward your first destination, push the NAV button.

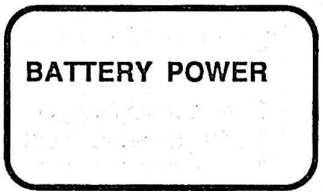
SECTION 4
FUNCTION KEYS

ON/OFF KEY

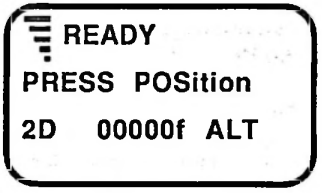
Press the ON/OFF key to turn the NAV 1000 PLUS on. Press it again to turn the unit off. If you do not press any keys for two minutes in push-to-fix operation, the unit will automatically shut off.

Power-Test

Every time you turn on the NAV 1000 PLUS, it performs a self-test.

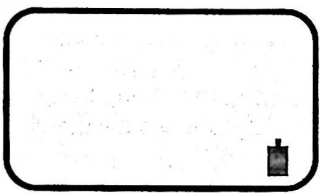


The power status temporarily displays on the screen. When the external power is being used, the display will temporarily show the message "EXTERNAL POWER."



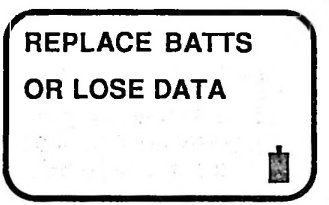
The READY message indicates that the NAV 1000 PLUS is ready to use.

Power Warning



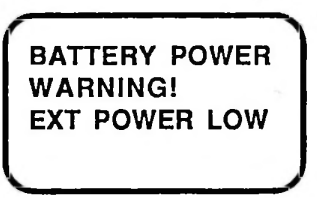
If the batteries are low, the battery warning symbol appears and will be present on all displays until the batteries are replaced.

WARNING: Replace the batteries when you see this display.



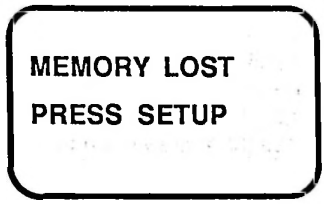
If the batteries become dangerously low, a second power warning will appear. The batteries must be replaced or crucial information stored in memory may be lost.

NOTE: If you have been operating continuously on the 6 AA internal batteries, the unit will revert to push-to-fix operation. After replacing the batteries, continuous operation will need to be restored using PLUS 2.



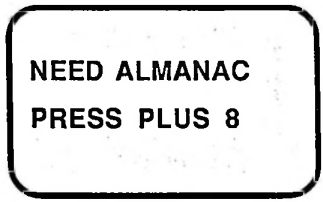
If external power is used, this message will appear if the level of external power is below minimum.

Memory Warning



If the unit's memory has been lost, you must press SETUP to reenter an initial position, and press PLUS 8 to collect an Almanac.

Almanac Warning

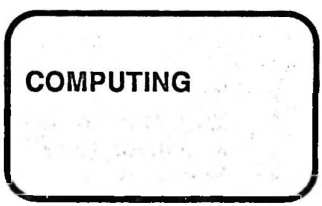


If this message displays. **You must collect an Almanac.** (See *PLUS 8* in Section 4.)

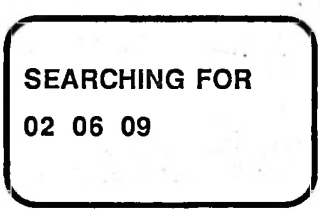
POSITION (POS) KEY

The POSITION (POS) key activates the unit's receiver to get a position fix. After obtaining the initial position, the unit will continuously update your current position, the current time, and the navigation solutions every 3 seconds. Normally, it will take less than three minutes to obtain the first position.

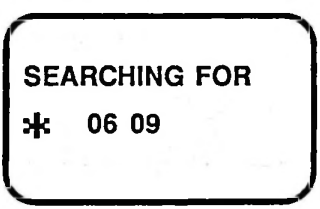
Search and Acquisition



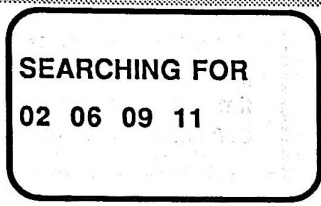
Press the POS key to get a fix. The NAV 1000 PLUS will begin by computing which satellites are available and among those which would give the best geometry.

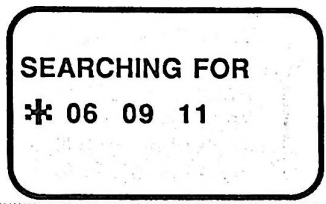


The first screen shows the mode (2D or 3D) and the ID number of the satellites selected by the unit.

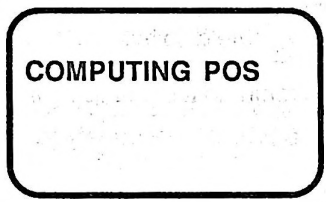


As the satellites are located, the "*" symbol appears over the satellite number.





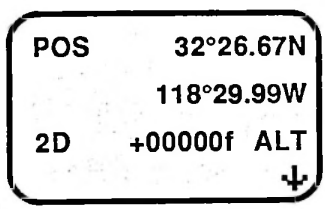
In 3D mode, the screens will look like this.



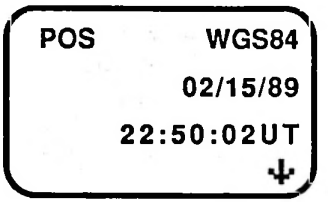
After all data has been collected from the satellites, this message displays.

Position Solution

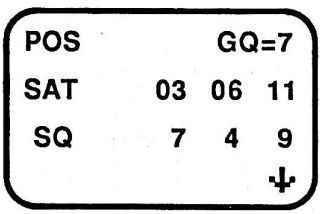
The NAV 1000 PLUS will emit a beep to indicate that the position solution has been calculated.



The coordinates of your position will display. The mode -- 2D or 3D -- appears on the lower left of the display. In 3D, altitude is also computed; in 2D, it is a user entered value.



Press the DOWN ARROW key to display the date and time, and the datum currently selected.



Press the DOWN ARROW key to see information about each of the satellites being used and the signal quality being received from each. The GQ of the resulting fix appears on the top right of the display.

Press the DOWN ARROW key again to return to the first position display.

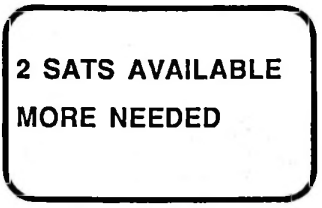
Difficulties in Obtaining a Position Fix

Several conditions may interfere with successfully obtaining your position:

- An insufficient number of satellites.
- An inability to acquire satellites.
- An incorrect initialization.

Insufficient Number of Satellites

The NAV 1000 PLUS consults its Almanac before beginning its search for satellites overhead. The receiver will not turn on when the unit knows that according to its schedule, not enough satellites are available.



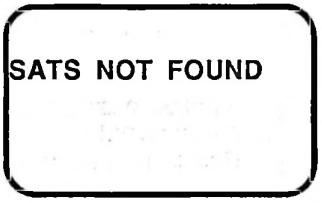
When an insufficient number of satellites are available, a message indicates the number of satellites currently available.

Press PLUS 4, Satellite Schedule, to compute a satellite schedule for the next 24 hours. Also remember to check Sat Status in PLUS 3 to make certain that no satellites have been set to "OFF."

Inability to Acquire Satellites

In continuous operation, the unit will continue to look for satellites temporarily blocked from view by continually searching the sky until it knows that the satellites have set below 5° on the horizon. The time between fixes may lengthen in difficult signal environments.

In push-to-fix (non-continuous) operation, the unit will look three times for satellites it has determined should be available.



In push-to-fix operation, the NAV 1000 PLUS displays this message after three unsuccessful attempts to find satellites.

Difficulty in locating satellites may be due to the following conditions:

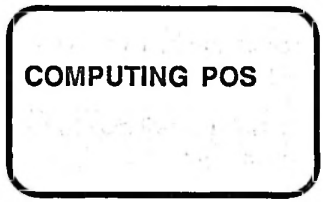
- The NAV 1000 PLUS has been moved more than 300 miles from the last fix or the wrong date or time was entered when the unit was initialized.
- The antenna is not properly positioned.
- The satellites are blocked from view by buildings, mountains, vessels, or the foliage is too dense.
- There are satellite outages.

- There are signal reflections that can be corrected by moving the antenna.

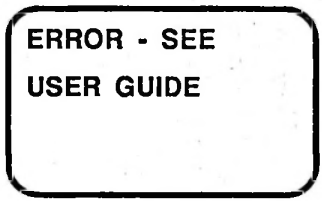
For more information, consult the checklist of possible problems provided in *Trouble Shooting* in Section 6.

Incorrect Initialization

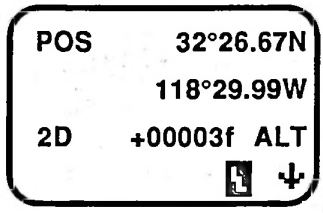
When the unit computes a position that it detects is more than 600 miles from the initialization information, it will not display the position. In conditions when the satellite geometry is not good, that is when the GQ is less than 4, the unit will require you to initialize the position within 300 miles.



Whether continuous power is on or off, you will see the unit make three attempts at collecting data and computing.



If unsuccessful, this message will appear. Reinitialize and check the time. If that doesn't solve the problem, read *Trouble Shooting* in Section 5.



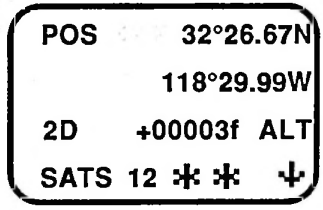
The warning symbol will display on all fix messages if the GQ reaches 3 or less. It will also appear when the signal quality (SQ) falls below 4.

WARNING: Always check your position fixes. If the accuracy warning appears, do not use this data for navigating; especially when the GQ falls below four. Read *Quality of the Fix* in Section 2.

Receiver Activity Message

After obtaining your first position in continuous operation, the unit will provide you with new position fixes every 3 seconds. The unit will occasionally change satellites, as one goes down and others rise, or when the geometry can be improved.

The unit will always inform you of this kind of activity on the bottom line of the display.



In this example, the unit is indicating that it is selecting one more new satellite to use.

If you have turned your unit to push-to-fix operation (continuous off) by using PLUS 2, you will not see all these receiver activity messages. The

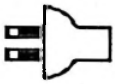
unit will take one fix, save it as the Last Fix , and turn off if none of the keys are pressed within 2 minutes.

Receiver Activity Messages

SATS **	The unit has located the satellite(s) selected.
DATA **	The unit has collected data from the new satellite(s).
SATS DOWN	The satellites have set. Not enough are now in view to get a position fix.
TRY 2D	Three satellites are in view, but the unit is set for 3D operation which requires four satellites.
CLOSE	When navigating a route leg, this message appears when you have arrived within the 600 foot arrival radius.
ARRIVED	When navigating a route leg, this message appears when you have arrived at your waypoint destination by crossing the imaginary perpendicular to that waypoint.
LEG	This message tells you what leg of your route you are currently navigating on.
COMPLETE	This message tells you that you have completed an entire multi-leg route.
INVALID LEG	This message displays when a route leg is selected that is before the range of your current position, or is after the range of your current position, or your cross track error exceeds 10 knots.

LIGHT KEY

The LIGHT key illuminates the message display. Press the LIGHT key to turn the light on and off.

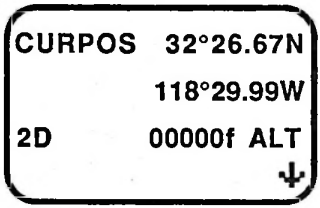


The light will increase the drain on your batteries.

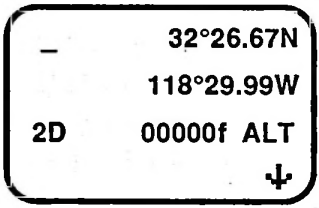
WAYPOINT (WPT) KEY

The WAYPOINT key lets you view, save, or enter waypoints (positions that have been saved in the unit's memory). If desired, you can also rename or erase these positions with this function. The NAV 1000 PLUS lets you store up to 100 waypoints. This is done by saving a position (your current position, a last fix, or the fix backups) or by manually entering one.

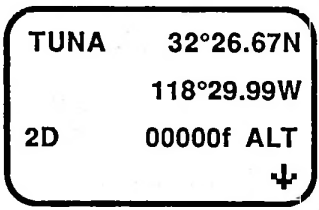
Saving Positions as Waypoints



To save a waypoint, first locate a current position or a last fix .

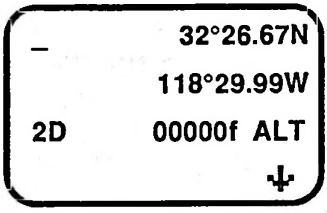


Press the ENTER key. The cursor is in the upper-left corner of the message display.



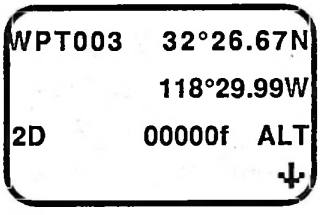
Enter the waypoint name. Then, press the ENTER key to save the position.

ENTER



If you decide not to name the waypoint, the NAV 1000 PLUS will automatically generate a name using the format WPTXXX, such as WPT001, WPT002, WPT003 in available sequence..

ENTER



Simply press the ENTER key again. The unit will create the name.

NOTE: In continuous operation, you will not see the name of the waypoint when it is given a name automatically.

TIPS:

- Maintain a log book of waypoints. This provides a quick reference for waypoints that you may want to use again. A sample log book page is located in the Appendices.
- Give waypoints names that make them easy to remember.

Once the position has been saved, you can access the altitude and date/time messages by pressing the DOWN ARROW key. Also, the RIGHT ARROW key will display the next sequential waypoint.

Waypoint Key Sequences:

To View Waypoints:

WPT ► OR

WPT | ENTER WPT NAME OR 1ST LETTER OF NAME | ENTER

To Save a Position as a Waypoint:

POS | ENTER | ENTER WPT NAME | ENTER

To Enter Waypoints:

WPT | ENTER | ENTER WPT NAME, LAT, LON, ALT DATA | ENTER

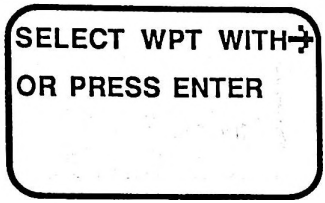
To Rename Waypoints:

WPT | RIGHT ARROW OR ENTER WPT NAME | ENTER | ENTER NEW WPT NAME | ENTER

To Erase Waypoints:

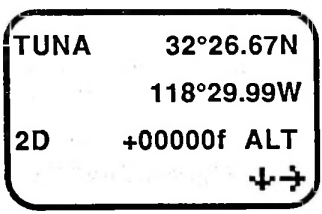
WPT | RIGHT ARROW OR ENTER WPT NAME | CLEAR | CLEAR

Viewing Waypoints

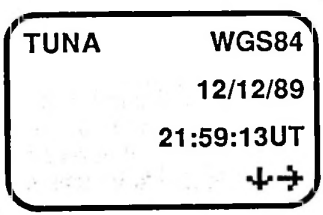


To select the waypoint you want to view, you may:

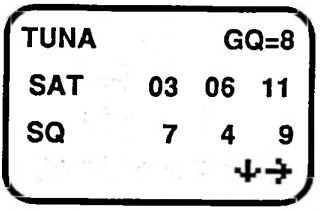
First press the WPT key. Then press the RIGHT ARROW key to display waypoints in alphanumeric order.
OR
Enter the waypoint name, then press the ENTER key.
OR
Enter a portion of the waypoint name, then press the ENTER key (the unit will scan to the first waypoint that matches your entry).



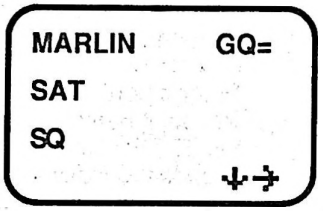
Here the RIGHT ARROW key was used to select a position saved as a waypoint named "TUNA". You would press the RIGHT ARROW key again to scroll to the next waypoint, or...



Press the DOWN ARROW key to display the current datum, and the date and time of the position fix.

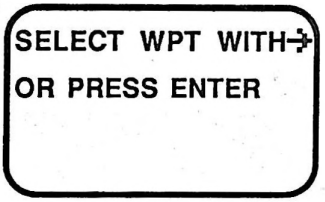


Press the DOWN ARROW key to display information about each of the satellites used, the signal qualities, and the geometric quality of the fix.

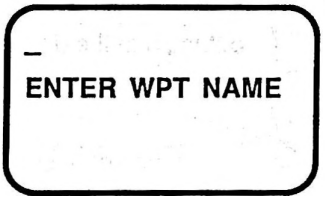


If you enter a waypoint manually, the geometric and signal quality fields will be blank.

Entering Waypoints

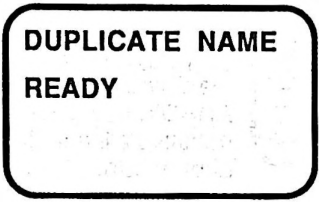


To manually enter a waypoint, press the WPT key.



Press the ENTER key. Enter a one- to six-character waypoint name or press the ENTER key again to automatically name this waypoint.

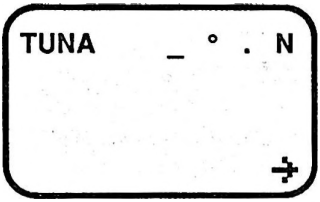
ENTER



If a waypoint with the same name already exists, this message will display.

TUNA

ENTER

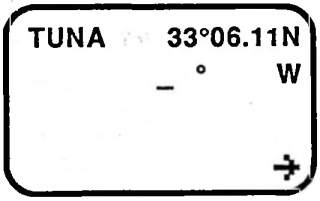


Press the ENTER key to put in the latitude. Press the RIGHT ARROW key to toggle to N (northern hemisphere) or S (southern hemisphere).

NOTE: Remember to enter numbers in each of the six numeric spaces, using leading zeros if required. For example, to enter a latitude of 9°18.00, you must enter 0 9 1 8 0 0, then press the ENTER key.

330611

ENTER



Press the ENTER key to put in the longitude. Press the RIGHT ARROW key to toggle to W (west) or E (east).

1185943

ENTER

00000

TUNA 33°06.11N
118°59.43W
+00000f ALT

Working with a longitude of 118°59.43W, press the ENTER key again to put in the altitude. Use the RIGHT ARROW key to toggle a negative altitude, if appropriate.

ENTER

TUNA 33°06.11N
118°59.43W
00000f ALT

Press the ENTER key again to save this information.

ENTER

CLEAR WAYPOINT
TO CONTINUE

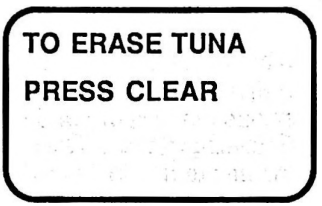
If all 100 waypoints have been used, this message will display. You must clear a waypoint (see *Clearing Waypoints* below) from the memory prior to making any more waypoint entries.

Renaming Waypoints

To rename a waypoint, locate the appropriate waypoint and press the ENTER key at any of the three message displays. Enter the new waypoint name. Then, press the ENTER key.

NOTE: Waypoints assigned to a route cannot be renamed.

Clearing Waypoints



To clear a waypoint, locate the appropriate waypoint and press the CLEAR key. This message will display.

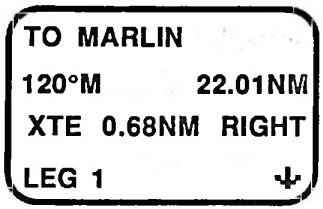
If you want do not want to erase a waypoint, press any function key.

If you want to continue erasing the waypoint, press the CLEAR key.

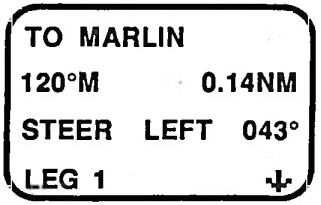
NOTE: Waypoints assigned to a route cannot be erased.

NAVIGATION (NAV) KEY

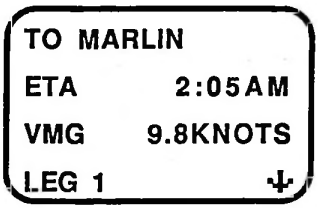
The NAVIGATION (NAV) key provides bearing, distance, steering, time to go, and cross track error data. Navigation calculations are based on the current position (or last fix, if continuous mode is off) and requires that you first set a route. You must be traveling at least 0.2 knots to get any velocity related data, like steering or time to go. In this example you are navigating along leg 1 of your route which is indicated by the message at the bottom left corner of the screen.



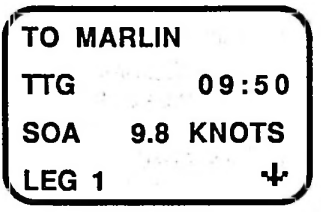
To navigate toward your first destination, push the NAV button. The first screen shows you the bearing and distance to the destination waypoint, cross track error, if you are right or left of your route leg, and what leg you are on.



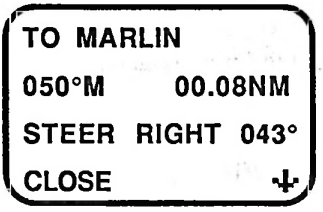
Press the DOWN ARROW key once to see your steering.



Press the DOWN ARROW key to see estimated time of arrival (ETA), and velocity made good (VMG).



Press the DOWN ARROW key to see time to go (TTG), and speed of advance (SOA).



When you are within 500 feet of your destination, the NAV 1000 will beep, present the default NAV key screen, and display the message "CLOSE."

NOTE: When you are within a sixty feet of your destination only distance to destination is available.

SETUP KEY

The SETUP key allows you to customize the features of the NAV 1000 PLUS, and allows you to initialize the unit with a position and time.

The following features are available in the SETUP:

- Initialize a Position
- Position Mode (2D vs. 3D)
- Time Set
- Time Display
- Choose between an automatic or manual Route Mode
- Select the Lat/Lon Display
- Select a Map Datum
- Enter a Magnetic Variation
- Select Distance and Speed Units
- Select Altitude Units
- Select the Date Order

Press the SETUP key and then the DOWN ARROW key to sequentially display the features.

Use the RIGHT ARROW key to toggle the selections within each feature.

Customizing Your NAV 1000

Before using the Set Up option, take a moment to fill out the following worksheet and keep it as a record. In the event that your unit loses memory, you can simply refer to it when you set up the NAV 1000 PLUS to meet your needs.

SETUP WORKSHEET

SELECT ONE OPTION FOR EACH SET UP FEATURE
(Factory defaults are shown in bold)

TIME DISPLAY
- ☐ **UT (24 HOUR)**
- ☐ LOCAL (AM/PM)

MODE
- ☐ **2D**
- ☐ 3D

ROUTE MODE
- ☐ **Automatic**
- ☐ Manual

LAT/LON DISPLAY
- ☐ **DEGREES/MINUTES**
- ☐ DEGREES/MINUTES /SECONDS

MAP DATUM
- ☐ **WGS84**
- ☐ AUSTR
- ☐ EUROP
- ☐ NAD27
- ☐ ALSKA
- ☐ MAUI
- ☐ OAHU
- ☐ KAUAI
- ☐ GBRIT
- ☐ TOKYO
- ☐ WGS72
- ☐ USER

MAGNETIC VARIATION

- ☐ **M (Auto Magnetic)**
- ☐ T (TRUE)
- ☐ U (User Set)
  __°__E or W
  (SPECIFY)

DISTANCE/SPEED

- ☐ **NM (nautical miles) and KNOTS (knots)**
- ☐ Km (kilometers) and Km/HR (kilometers per hour)
- ☐ MI (statute miles) and MPH (miles per hour)

ALTITUDE UNITS

- ☐ **feet**
- ☐ meters

DATE ORDER

- ☐ **MONTH/DAY/YEAR**
- ☐ DAY/MONTH/YEAR

SET HEMISPHERE

- ☐ **N/W**
- ☐ N/E
- ☐ S/W
- ☐ S/E

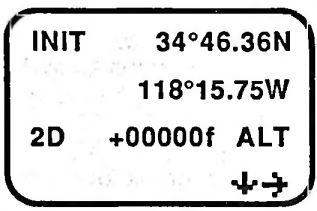
Notes on the SETUP Features

When you change a setting, all related displays will be affected.

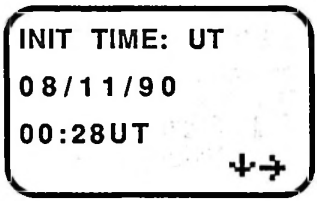
For example, once you select a coordinate system, that system will appear in all of the following screens:

- Current Position
- Last Fixes
- Waypoints
- The Initialization Position

Viewing the Initialization Information



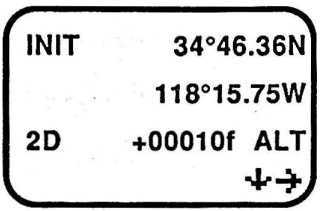
When you select the first screen in SETUP, the initial position and mode is displayed. This does not appear if there has been memory loss.



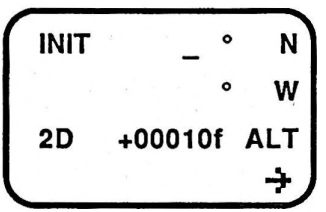
The second message in the initialization is time display (with date) in Universal Time or local (AM/PM or 24 hour) time.

Resetting the Initial Position

The NAV 1000 PLUS must be initialized within 300 miles of its true position. Note that in good satellite geometry conditions, when the GQ is greater than or equal to 4, the unit relaxes the requirement to a 600 mile radius.



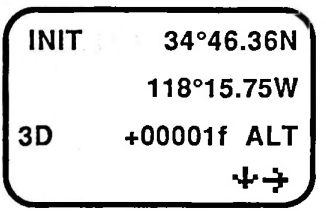
If you want to reset your initial position, begin with the first SETUP display.



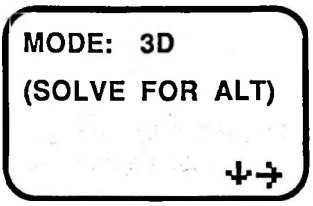
Press the CLEAR key ,or enter a number, and the old initialization position clears.

Enter the new coordinates, first the latitude (or easting). Toggle the hemisphere from N (north) to S (south), if needed, by using the RIGHT ARROW key, then press the ENTER key. Now enter the longitude (or northing) and press ENTER again.

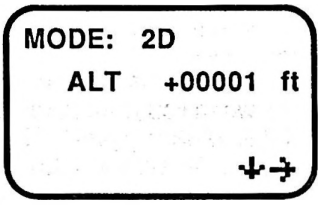
Resetting the Mode and Antenna Altitude



Begin with the first SETUP display for resetting mode.

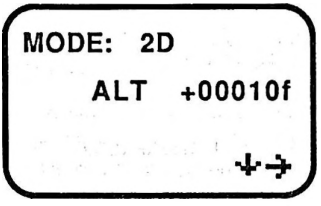


Press the RIGHT ARROW key to change modes.



The antenna altitude default for 2D operation is the last one set in 2D operation.

00010



To change the antenna altitude in 2D press the CLEAR key, or enter the new altitude. Toggle to a negative altitude with the RIGHT ARROW key.

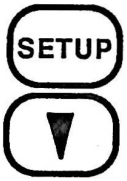
Resetting Time

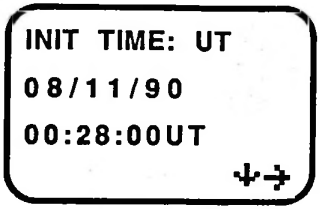
The unit can be operated in both Universal Time (UT) or local time, but must be initialized in Universal Time (UT) before switching to local time.

Since the GPS satellite system provides more accurate time than is usually available to you, you may collect time directly from the satellites using PLUS 8, Almanac Collect. As soon as time appears, the process is complete.

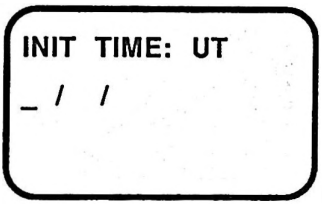
The NAV 1000 PLUS's internal clock may drift if it has not received satellite information in quite a while. You can refresh the PLUS time display by simply taking a position fix.

Should you manually want to reset the time, proceed as follows:

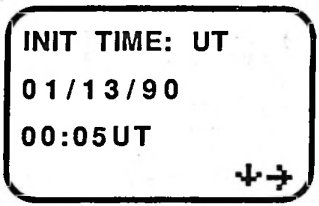




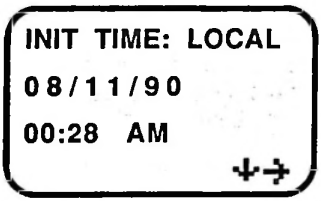
Press the SETUP key, then the DOWN ARROW key. The UT time and date display. When there has been a recent memory loss, this data will appear.



In those circumstances when you want to reset the time, simply press CLEAR to reenter UT time. Enter the date first. Then the time field will appear.



To initialize local time, start from the SETUP Time display.



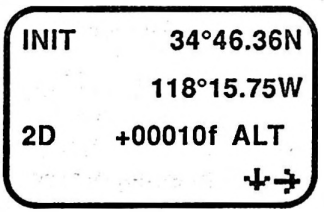
Push the RIGHT ARROW key to select local time (AM/PM). Time is changed in the same manner as shown above.

Selecting Route Modes

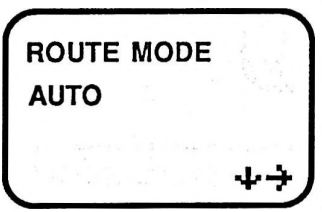
A route may be followed in either automatic or manual mode.

In automatic mode, the NAV 1000 PLUS will continually update the navigation screen until you have arrived within 500 feet of your destination in a particular leg. The NAV 1000 PLUS will then display the "CLOSE" message. When you eventually pass an imaginary line perpendicular to your courseline, and that runs through your destination waypoint, the NAV 1000 PLUS will then automatically switch to the next leg of your route.

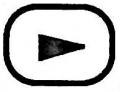
In manual mode, the NAV 1000 PLUS will continually update a route leg until you have arrived within 500 feet of your destination. The NAV 1000 PLUS will then display the "CLOSE" message. When you eventually pass an imaginary line perpendicular to your courseline, and that runs through your destination waypoint, the NAV 1000 PLUS will then display "ARRIVED" and wait for you to press ROUTE then the RIGHT ARROW key to switch to the next leg of your route.

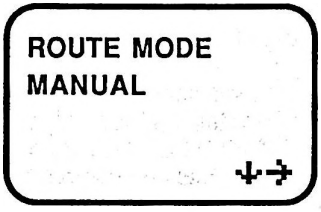


Press the SETUP key.



Press the DOWN ARROW key to reach the Route Mode screen.

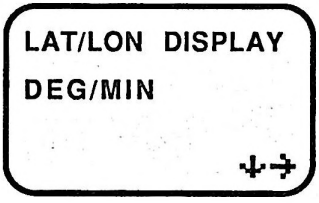




Press the RIGHT ARROW key to toggle between Automatic or Manual mode.

Lat/Lon Display

The position can be displayed in degrees and minutes (DEG/MIN) or degrees/minutes/seconds (DEG/MIN/SEC).



After pressing the SETUP key, push the DOWN ARROW key to reach the Lat/Lon screen.

Push the RIGHT ARROW key to choose between Deg/Min, or Deg/Min/Sec.

Enter Datum

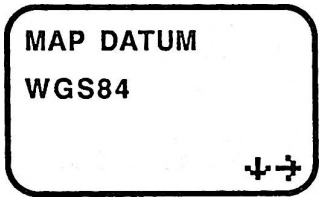
The NAV 1000 PLUS provides 11 geodetic map datums for use with charts and maps worldwide.

A datum refers to a mathematical model of the earth. Your latitude and longitude will differ with different models or datums of the earth. Thus it

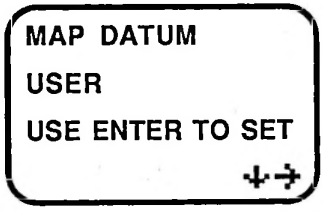
is very important to know the map datum that you want to work with. Map datums are important if you want to relate your position information with a chart.

Selecting a Datum

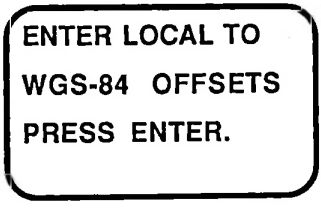
The Enter Datum option lets you select the datum that corresponds to the map you are using. In the legend of your chart, you should find reference to the datum upon which the chart is based. In the event that your particular map datum is not covered by one of the NAV PLUS selections, we have provided you a way to enter your datum using the following procedure. Refer to the appendix for datum constants.



After pushing the SETUP key, press the DOWN ARROW key to reach this display. At this display, you can use the RIGHT ARROW key to scroll to the datum that corresponds to the one used in your chart, or...



set up your own datum conversion using the User Set datum.



Press the ENTER key to set the constants.

0251
000
ENTER

LOCAL TO WGS84
DELTA a, meters
-0251.000m

First you will enter the Δa, or the difference in the semi-major axis from the local datum to WGS84.

In this example, we are entering the constants for Old Hawaiian, Maui. Change + to - with the RIGHT ARROW key.

ENTER

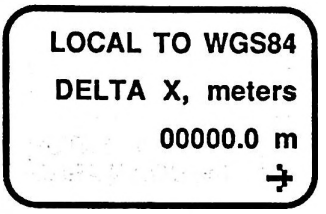
LOCAL TO WGS84
DELTA f * 10,000
+_. m

Press ENTER to see the Δf display where you will put in...

01419
2702
ENTER

LOCAL TO WGS84
DELTA f * 10,000
0.14192702

the constant which represents the difference in the ellipsoid flattening between WGS84 and the local datum.



Now add the ΔX using the Table of Constants.

Press the ENTER key. Now add the ΔY and ΔZ.

Using the TUTORIAL DEMO point, PLUS 20, the transformation to Old Hawaiin, Maui should be...

33°46'07 N

117°45'19 W

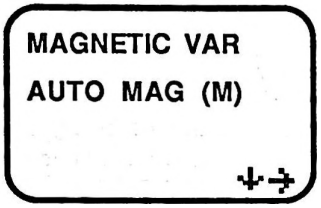
00000f ALT

Magnetic Variation Display

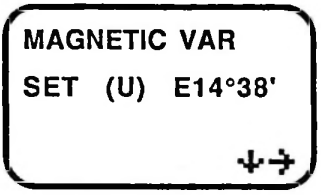
You can select one of the three available heading and bearing types for all displays and entries.

Auto Mag (M)	Includes an automatic adjustment for variation by the NAV 1000 PLUS. (The default.)
True (T)	No magnetic adjustment in readouts.
Set (U)	A constant user-entered adjustment.

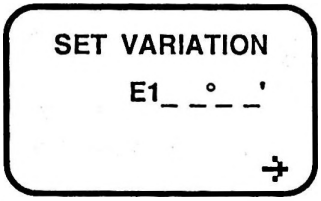
Magnetic Variation Settings



Press the SETUP key, then the DOWN ARROW key until you reach this screen. To select your heading display, press the RIGHT ARROW key to toggle to the magnetic variation choice.

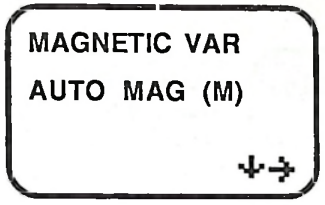


If you select User Set (U), this message will display with the last entered value.



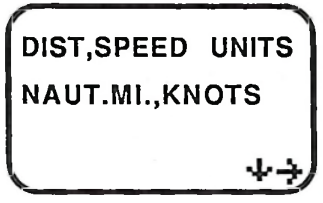
Begin entering numbers as shown here or press the CLEAR key to see this display. Enter the constant compass error in degrees and minutes. To change the East/West setting, press the RIGHT ARROW to toggle to East (E) or West (W).

Press ENTER when the entry is complete.

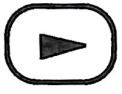


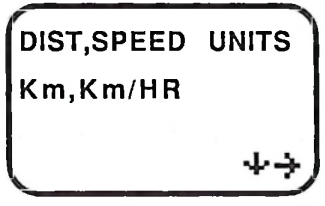
After you press the ENTER key, you will return to the magnetic variation screen.

Units

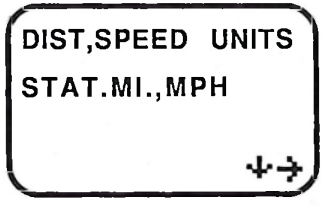


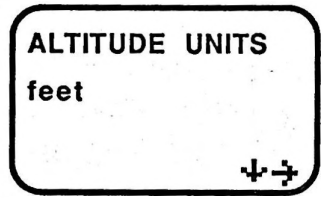
Press the SETUP button, then push the DOWN ARROW key to see the distance and speed units.



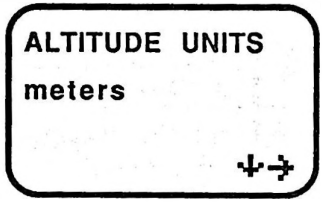


Push the RIGHT ARROW key to select from the different units available.



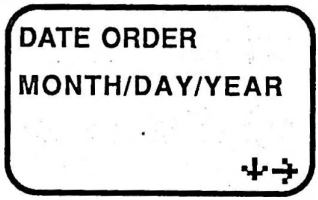


Push the DOWN ARROW to view the altitude units.

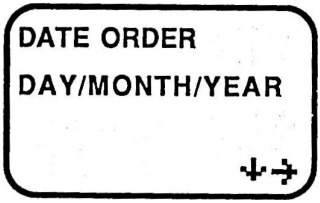


Push the RIGHT ARROW key to select the units.

Date Order



Push the DOWN ARROW key to view the date order.

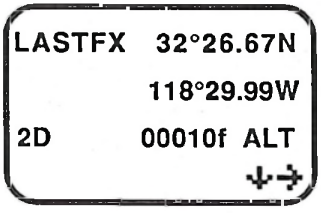


Push the RIGHT ARROW key to change the order.

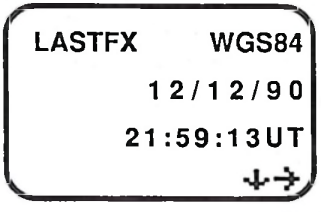
LAST FIX KEY

The LAST FIX key allows you to look at your last 5 position fixes in push-to-fix mode, or 5 recent fixes in continuous mode.

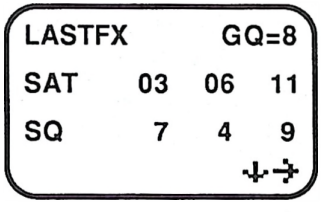
These fixes will update each time you take a new fix. Using the ENTER key, any last fix can be saved as a waypoint. Also, the last fix can be used to set a course.



The coordinates of your most recent position fix will display. The mode -- 2D or 3D -- appears on the lower left of the display. Altitude is also given.



Press the DOWN ARROW key to display the Date and Time of the fix and the datum currently selected.



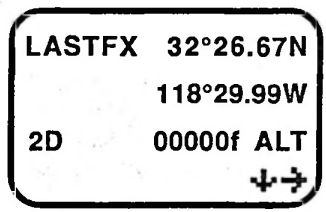
Press the DOWN ARROW key to display the information about each of the satellites used for the fix.

NOTE: The warning symbol displays on the first message, and the unit beeps when the LAST FIX key is pressed if the GQ or SQ was less than four.

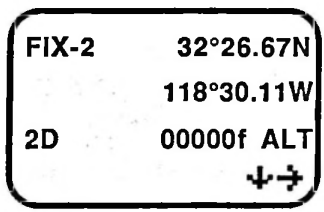
WARNING: Do not use the position fix if the GQ<4. Read *Quality of the Fix* in Section 2.

Backups to the Last Fix

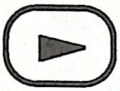
In addition to the last fix, the unit will store the four previous fixes. These are identified as FIX-2, FIX-3, FIX-4 and FIX-5 with FIX-5 being the oldest. In push-to-fix mode, when a new fix is taken, it becomes the LAST FIX, the previous last fix becomes FIX-2, the remaining backup fixes advance sequentially, and the old FIX-5 is eliminated. In continuous mode, when a new fix is taken, it becomes the last fix every ten minutes.

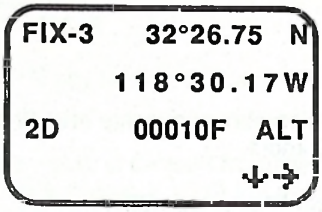


To view the backup fixes, start at the LAST FIX message display.



Press the Right Arrow key to obtain the latitude/ longitude for FIX -2. Press the DOWN ARROW key to display GQ/SQ, altitude, and time/date information.





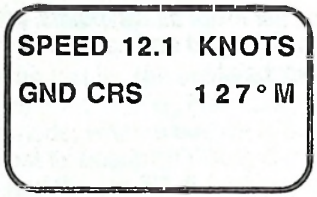
Press the RIGHT ARROW key to scroll through the same displayed information for the remaining backup fixes.

NOTE: *To save any of these back up Last Fixes as waypoints*, press the ENTER key when the appropriate fix is displayed and name it as you would any position being saved as a waypoint.

VELOCITY (VEL) KEY

The VELOCITY key contains information about your rate and direction of travel when your speed exceeds 0.2 knots.

This information is available only in continuous operation.



To obtain speed and ground course, simply press the VEL key.

NOTE: You **must** be moving at least 0.2 knots to obtain velocity related information.

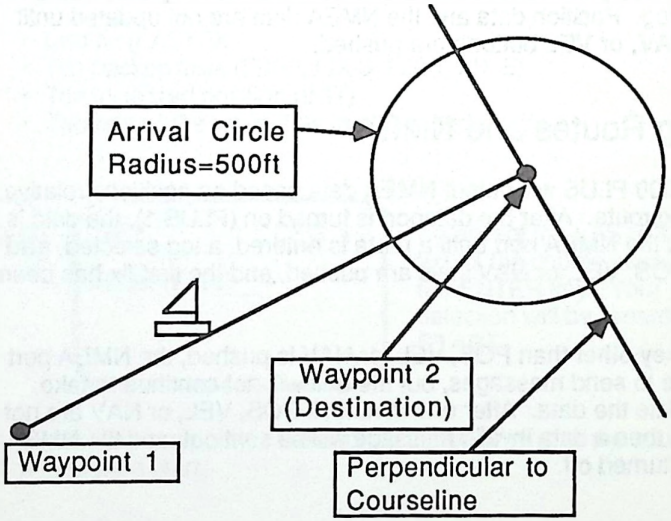
ROUTE KEY

The ROUTE key is used to enter and follow a multi-leg route with up to 10 legs.

Because a route is created from the existing waypoints in the NAV 1000 PLUS's memory, all of the necessary waypoints must be entered and saved before a multi-leg route may be developed.

A route may be followed in either automatic or manual mode which is selected in SETUP.

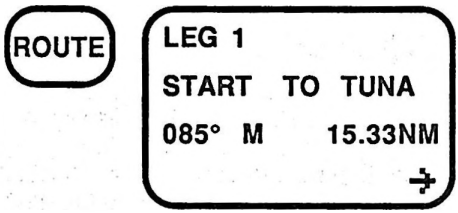
In automatic mode, the NAV 1000 PLUS will continually update the navigation screen. When you have arrived within 500 feet of your destination in a particular leg, The NAV 1000 PLUS will then display the "CLOSE" message. When you eventually pass an imaginary line perpendicular to your courseline, and that runs through your destination waypoint, the NAV 1000 PLUS will then automatically switch to the next leg of your route.



In manual mode, the NAV 1000 PLUS will continually update. When you have arrived within 500 feet of your destination, The NAV 1000 PLUS

will then display the "CLOSE" message. When you eventually pass an imaginary line perpendicular to your courseline, and that runs through your destination waypoint, the NAV 1000 PLUS will then display the "ARRIVED" message. To move to the next leg, press ROUTE and the RIGHT ARROW key.

Automatic and Manual modes are selected in the menu under the SETUP key.



When you push the ROUTE key the screen will display a leg of a route.

The ROUTE key provides a method of entering a multi-leg route, and selecting a leg. Position data and the NMEA data are not updated until the POS, NAV, or VEL buttons are pushed.

Multi-Leg Routes and NMEA

The NAV 1000 PLUS will output NMEA data based on positions relative to a multi-leg route. After the dataport is turned on (PLUS 1), the data is not sent out the NMEA port until a route is entered, a leg selected, **and** either the POS, VEL, or NAV keys are pushed, and the first fix has been made.

When any key other than POS, VEL, or NAV is pushed, the NMEA port will continue to send messages, but the unit will not continue to take fixes to update the data. After one minute, if POS, VEL, or NAV are not reactivated, then a data invalid message will be sent out, and the NMEA port will be turned off.

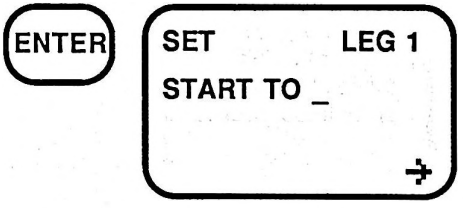
Creating a Route

To create a route, press the CLEAR button twice after you have pressed the ROUTE button.

You may then press the RIGHT ARROW key to select the starting position for your route leg, or press the first letter of your desired waypoint, then ENTER, then push the RIGHT ARROW key to your desired waypoint.

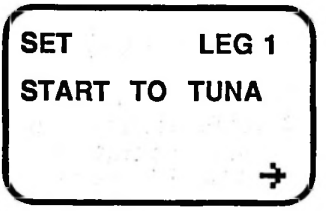
The selection of positions appear in the following sequence:

- Last fix (LASTFX)
- The backup fixes (FIX-2, FIX-3, FIX-4, FIX-5)
- The initialized position (INIT)
- The rest of the waypoints in alphabetical order.

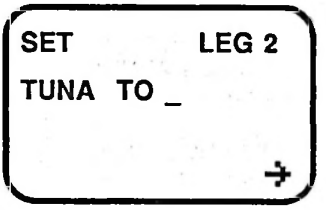


To accept the LASTFX (last fix) as the course start, press the ENTER key. Your selection will be renamed START.

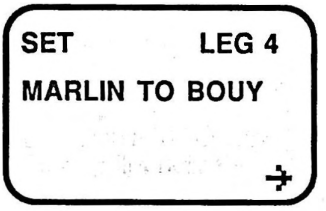
NOTE: If a named waypoint is used to set the beginning of the course, it will not be renamed start.



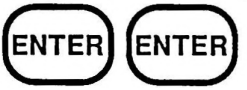
You then select the destination waypoint for the first leg of your route from your waypoints. Press the RIGHT ARROW key to select your destination, or press the first letter of your destination, then press the ENTER key, then scroll using the RIGHT ARROW key.



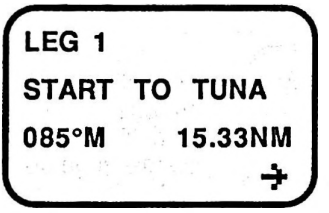
Press the ENTER key to continue to the next leg. This procedure is then repeated for each successive leg.



You may continue to enter route segments until you reach the maximum ten legs available, or until you have completed your route.



When you have entered all the route legs, press the ENTER key twice to exit.

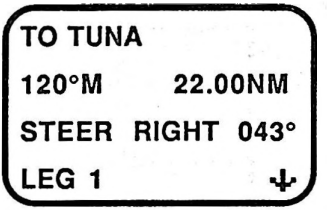


The screen will then display leg 1 of your newly entered route.

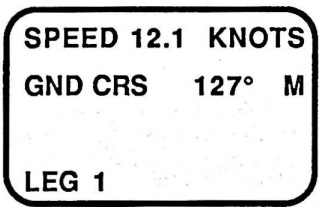
You may now view your route, and scroll through the various legs by pushing the RIGHT ARROW key. When you find the leg that you wish to navigate on, you then press NAV, POS, or VEL to see navigation data relative to your route leg, and destination.

In this example leg 1 was selected by pushing the RIGHT ARROW key until that leg was displayed, then pushing the NAV, POS, or VEL keys.

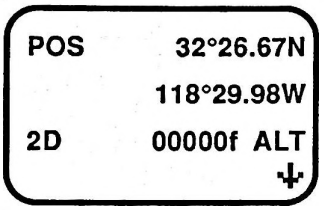
Once a leg is invoked, the NAV, VEL, or POS keys may be pushed, and the dataport will continue to emit data:



The fourth line of all NAV screens tells you what leg you are currently navigating on.



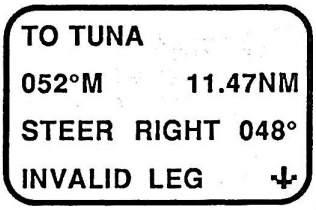
The fourth line of the VEL screen also displays the leg.



The POS key will update your position and give you a recent last fix (LASTFX). You may then press Nav to see how you are doing relative to your desired route leg.

NOTE: The fourth line of the display will constantly tell you what leg you are navigating on, as well as indicate your arrival to the destination for that leg. Note that the NMEA port is not active if you are using the NAV 1000 PLUS in push-to-fix mode.

If you are not within range of your selected route leg and the NAV 1000 PLUS cannot compute a cross track error, the "invalid leg" message will be shown:



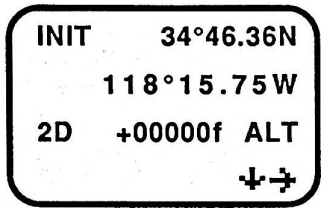
Resetting a Route

Routes may be reset by pressing the ROUTE key, selecting a new leg, then pushing POS, NAV, or VEL, **or** entering a new route, selecting a leg, then pushing POS, NAV, or VEL.

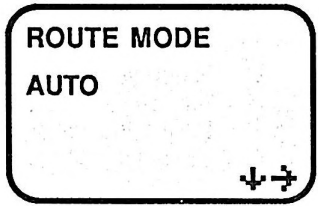
Modes

Select between automatic and manual mode by using the SETUP key.

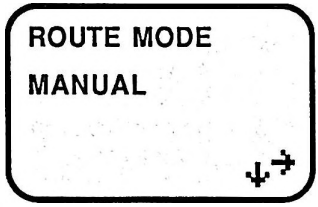
Selecting Modes



When you press the SETUP button this message displays.



Push the DOWN ARROW key until you reach the Route Mode screen.

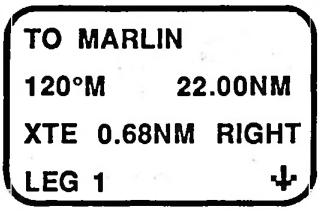


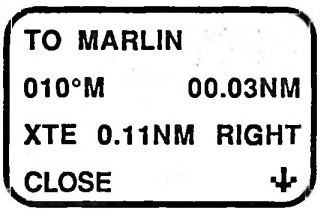
Press the RIGHT ARROW key to toggle between Automatic or Manual mode.

NOTE: If the dataport function is on, the unit will begin to output data only when a route has been set, the POS, NAV or VEL button is pressed, and after the first fix is calculated (about three minutes). If you would like to change your route, it is recommended that you turn off, or place in standby the device that you are supporting with the NMEA data, reset your route, activate the dataport (POS, NAV, or VEL), and reactivate the external device.

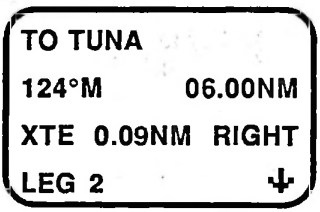
Automatic Mode

Press the NAV key after setting a route and selecting the leg.



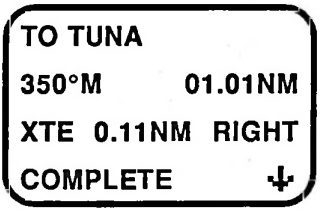


When you are within 500 feet of your destination, the NAV 1000 will display the message "CLOSE."



As you pass the imaginary line denoted as the perpendicular to your course line at the destination, the NAV 1000 PLUS will automatically switch to next leg of your route.

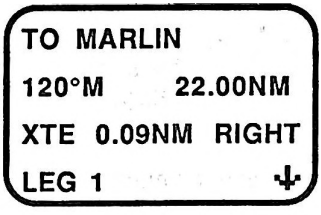
NOTE: If you should cross the imaginary perpendicular before you enter the arrival circle, the unit will move you to the next leg without displaying the "CLOSE" message.



When you have reached the final destination of your last route leg, the NAV 1000 PLUS screen will inform you that you have completed your route.

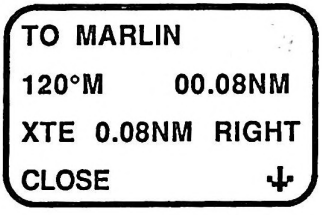
Manual Mode

NAV



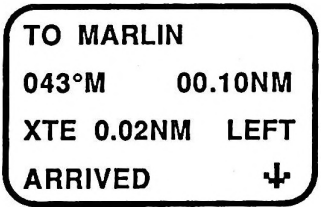
Press the NAV key after setting a route and selecting the leg.

NAV



When you are within 500 feet of your destination, the NAV 1000 PLUS will display the message "CLOSE."

NAV



When you cross the perpendicular line to your course at the destination, this message will display to tell you that you have arrived. Press the ROUTE key, then the RIGHT ARROW key to change to your next leg.

NOTE: If you do not push the ROUTE and RIGHT ARROW key within a minute after your arrival, the NAV 1000 PLUS will send an NMEA invalid output message after the minute has elapsed. If you are supporting an autopilot with your NAV 1000 PLUS NMEA output, then the invalid output will tell the autopilot to sound an alarm. However, if you are using a plotter, or radar, you may continue to navigate.

When you have reached the final destination of your last route leg, the NAV 1000 PLUS will sound a beeper, and the screen will inform you that you have completed your route.

The "invalid leg" message appears when you are more than 10 miles from your courseline. It indicates that certain NMEA messages are marked as invalid as prescribed by NMEA specifications. You may get rid of the message by using the ROUTE key to select a more appropriate leg, or by clearing the route completely.

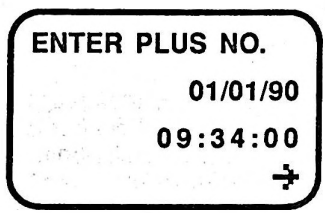
SECTION 5
PLUS KEY

The PLUS key is used to access a series of supplementary functions. To access these functions press the PLUS key, then press the RIGHT ARROW key to scroll through the options, or type in the related PLUS code, then press the ENTER key. PLUS 13, CLEAR MEMORY, and PLUS 20, TUTORIAL POSITION, can only be accessed by entering their code numbers.

The PLUS functions are:

Code	Display Name	Plus Function
1	DATAPORT	Activates the dataport and selects output format and the data transmission rate.
2	CONTINUOUS OPER	Toggles the NAV 1000 PLUS between continuous operation on and off (push-to-fix).
3	SAT STATUS	Displays a list of the satellites in the Almanac, the satellites in view, their angle and elevation, and which satellites are in use along with their SQs.
4	SAT SCHEDULE	Tells you when the satellites are available for a position fix.
5	WAYPOINT PROJECTION	Estimates the latitude and longitude of a remote position given your position, and the relative distance and bearing.
6	WAKE-UP	Sets the NAV 1000 PLUS to wake up for a position fix.
7	BEEPER CONTROL	Sets the beeper on or off.
8	COLLECT ALMANAC	Collects an Almanac

9	ERASE WAYPOINTS	Erases all of the waypoints and the route.
13	CLEAR MEMORY	Erases the Almanac and waypoints from memory.
20	TUTORIAL POSITION	Creates a position fix for use with the Tutorial.



When the PLUS key is pressed, the date and time are displayed. Press the RIGHT ARROW key to scroll to the desired functions.

OR

Type in the PLUS code number. Then press the ENTER key.

NOTE: Time in hours and minutes appears on the main PLUS display. The time display is in Universal Time (UT) unless it has been set up for local time or 24-hour time in SETUP.

PLUS 1 - Dataport

PLUS 1 allows you to activate the dataport, and to select the output message that you want to use. By emitting an output signal, the NAV 1000 PLUS can provide navigational data to be used by various autopilots, plotters, and radars in accordance with the National Marine Electronics Association (NMEA) standard.

The NAV 1000 PLUS has been designed to accommodate a wide range of devices. Despite efforts in the industry to standardize the outputs, there are still marine electronics devices that interpret the standard in a peculiar way. Should you have problems with your hookup, consult your autopilot, plotter, or radar manual for instructions on how to properly connect the NAV 1000 PLUS with your output device, and check to see which set of messages and baud rates are appropriate. You may have to experiment with the messages to determine which set is appropriate for you.

For troubleshooting purposes the NMEA messages that the NAV 1000 PLUS messages are as follows:

0183A - BWC, APA, GLL, and VTG

0183B - RMC, and RMB

0183C - BWC, XTE, GLL, and VTG

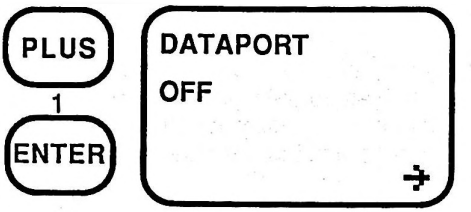
Baud rates

1200, 2400, 4800, and 9600

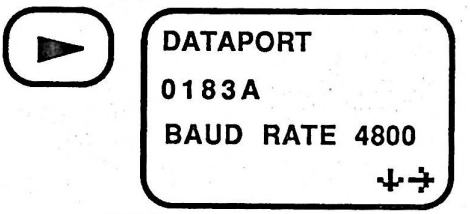
NOTE: The default is 4800 as designated in the industry standard.

These messages are standard "sentences" that other devices should recognize as outlined in the NMEA standard. These sentences are given here for comparison to the sentences that may be listed in your users' manual for the device you are trying to support.

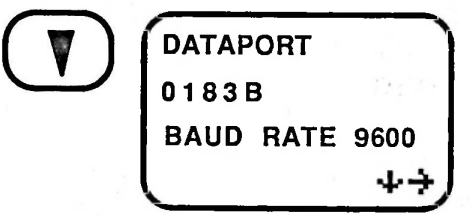
NOTE: Experiment ***before you are actually navigating*** to see which set of messages is appropriate.



Press the PLUS key, then 1 (or PLUS and one press of the RIGHT ARROW key) then ENTER to bring you to the function.



Push the RIGHT ARROW key to select the type of message that you wish to output: 0183A, 0183B, 0183C, or off.



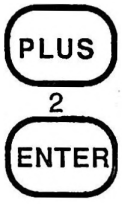
Push the DOWN ARROW key to select the baud rate that you wish to output. The default value of 4800 should be adequate for most interfaces.

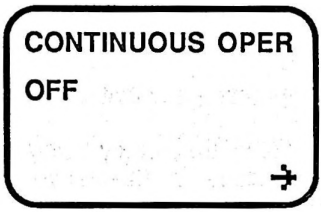
NOTE: You must be in continuous operation to use the dataport.

PLUS 2 - Continuous Operation

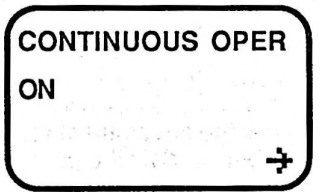
When not using external power, PLUS 2 lets you set the unit for continuous operation. When the POS key is pressed during continuous operation, the unit will continuously update the position, and allow you to obtain velocity related information.

When the batteries get low, the unit will restore all of the PowerSaveR™ design options. You must change batteries at this point or use external power.





Press the PLUS key, then 2 (or PLUS and two presses of the RIGHT ARROW key) then ENTER to bring you to the function.



Press the RIGHT ARROW key to switch the unit to continuous operation. When the unit is in push-to-fix operation using its 6 AA batteries, the default is OFF.

NOTE: Using external power, the unit remains in continuous operation and cannot be set to push-to-fix operation. If you set the NAV 1000 PLUS in continuous operation, and you turn the unit off, the NAV 1000 PLUS will be in continuous mode when you turn it back on. Incidentally, a unit will only operate continuously (24 hours/day) for 24 days. It will then shut itself off. You may then turn it back on.

PLUS 3 - Sat Status

PLUS 3 is used to determine:

- the satellites that are listed in the Almanac as healthy by the GPS system operators,
- the elevation and azimuth of each satellite that are above the horizon,
- the signal qualities of the satellites used in the last fix,
- the satellites with weak SQs, or set temporarily unusable.
- the status of every satellite in the system.

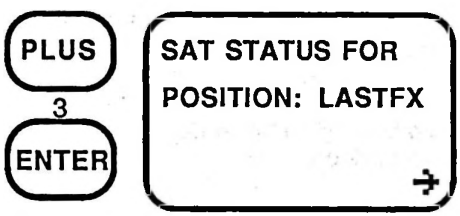
The satellite status will have one of three messages:

ON Indicates the satellite is operating and that it is healthy.

TEMP OFF Means the satellite is temporarily being ignored by the unit because it is having difficulty with the signal. For example, there may be an obstacle between the satellite and the unit.

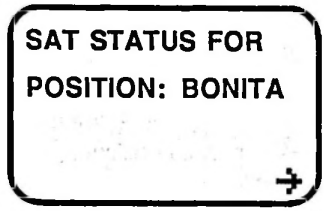
OFF An option that can be selected by the user when he does not wish to use a particular satellite, due to its being blocked by land or an obstacle.

Satellites set unhealthy in the almanac by the government are not listed in Sat Status. The PRN number, a number used by the government, is used to identify the satellites.

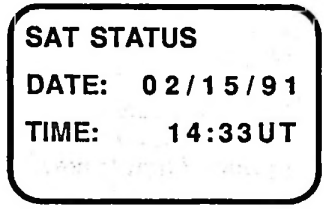


Press the PLUS key, then 3, or PLUS and three presses of the RIGHT ARROW key, then ENTER to bring you to this function.

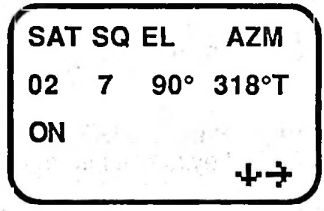
PLUS



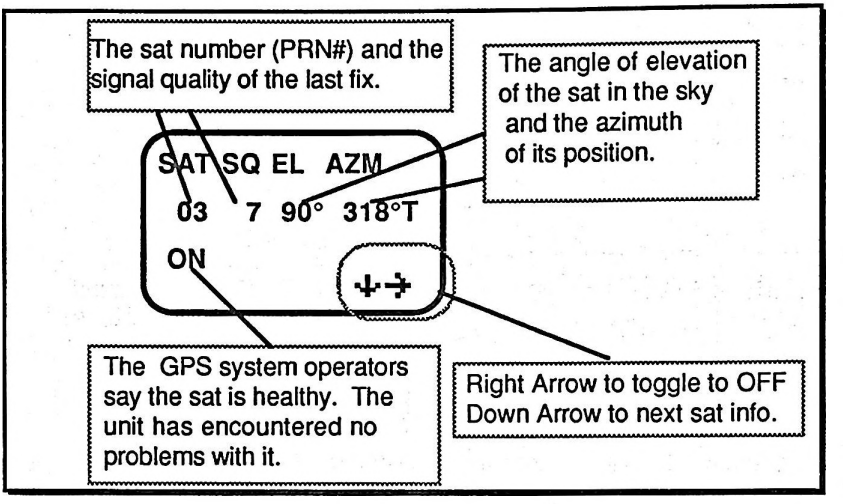
Press the RIGHT ARROW key to select a saved position.



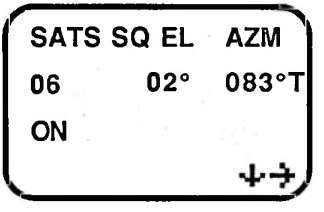
Press ENTER. The default is the current date and time. You may enter another date and time.



Press ENTER. The first screen display shows information about a satellite.



Interpreting the Sat Status Information

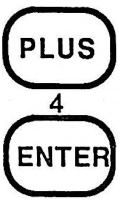


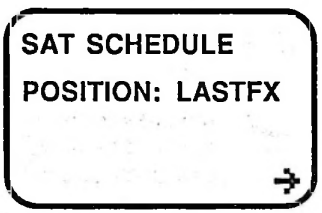
Press the DOWN ARROW key to see information on the next satellite. In this example, Satellite 6 is just above the horizon (02°) at an azimuth of 83° True. The RIGHT ARROW key can be used to ignore individual satellites by telling the unit to disregard them.

NOTE: The unit will not attempt to use a satellite until it reaches an elevation of 5°, and then only if there are insufficient satellites above 10°. It will continue using a satellite until it sets or is blocked by obstacles on the horizon.

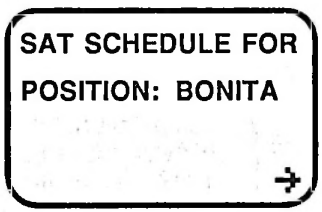
PLUS 4 - Sat Schedule

The PLUS 4 key computes a schedule for when you will be able to use the unit on a date you choose (based on 2D or 3D set up). The unit computes and displays the satellite schedule beginning at midnight of the date indicated.





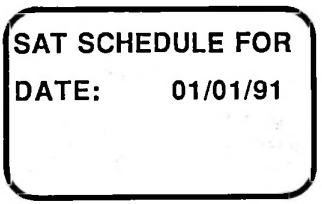
Press the PLUS key, then 4 and ENTER, or PLUS and four presses of the RIGHT ARROW key, to get to this function.



Press the RIGHT ARROW key to select a position.

The positions from which you may choose to get a schedule are presented in the following order:

- Last Fix (LASTFX)
- Initialized Position (INIT)
- Waypoints (in alpha/numerical order)

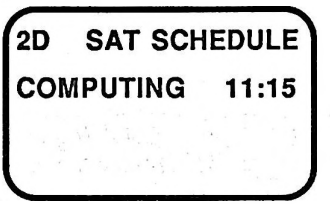


Enter the date that you require the schedule, then press the ENTER key.

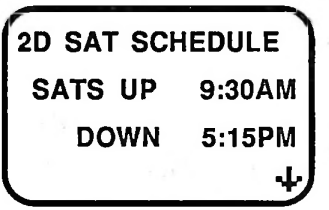
OR

Press the ENTER key to accept the current date.

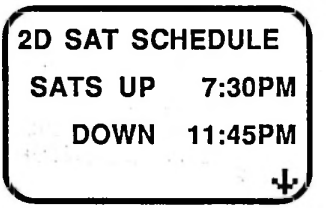
NOTE: You may enter any date that is within 9 months of the date of your current Almanac.



Press the ENTER key to begin computing. As the unit calculates the satellite schedule for a 2D or 3D solution, time ticks off in 15 minute intervals at the top right of the display as the unit computes a 24-hour schedule. (See *2D vs. 3D Mode* in Section 2.)



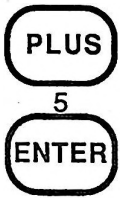
After completing its computation, the "window of availability appear." These are the times when there are enough satellites available to get a position fix. If there is more than one "window" when the satellites will be available, a Down Arrow will appear on the screen.

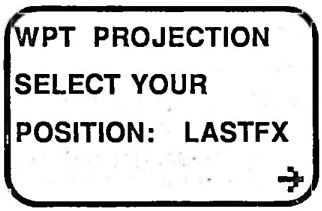


Press the DOWN ARROW key to display the remaining satellite schedule.

PLUS 5 - Waypoint Projection

The NAV 1000 PLUS will calculate the latitude and longitude of a remote destination based on a relative distance and bearing that you enter.





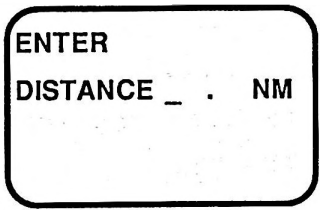
Press the PLUS key, then 5 (or PLUS and five presses of the RIGHT ARROW key) then the ENTER key to bring you to this function.

Press the RIGHT ARROW key to select a saved position.

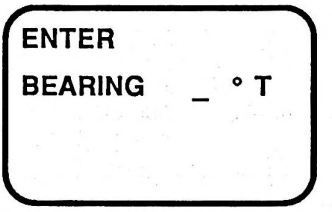
Warning: LASTFX is not your current position if you have moved since taking the latest position fix.

The selection of positions you may select appear in this sequence:

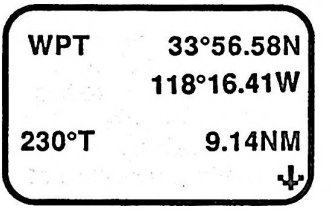
- Last fix (LASTFX)
- The backup fixes (FIX -2, FIX -3, FIX -4, FIX -5, INIT)
- The initialized position (INIT)
- Waypoints (in alphabetical order).



Enter your estimated distance to the destination.



Enter your estimated bearing to the target.



The destination waypoint position is calculated and displayed along with the bearing and distance entered.

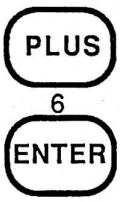
NOTE: In order to use this waypoint, you must write it down then enter it in using the WAYPOINT key. Remember that this information is an estimate and while accurately calculated, it is based on the data that you provide.

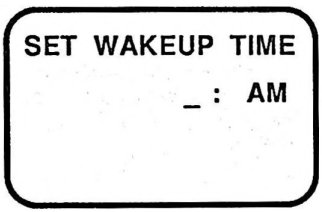
PLUS 6 - Wake Up for Position Fix

The Wake Up for Position Fix function lets you set the NAV 1000 PLUS to wake-up and take a single fix, even if you are not on watch. This may be set up to 24 hours in advance. The fix that is taken is stored as the protected waypoint, "WAKEUP." This feature can also be used to take a fix during a short window of coverage.

If a wake-up time has been set, a bell symbol will display on the upper right of the display. Once the position fix is successfully taken, or if 24 hours elapses, the wake-up will automatically turn itself off.

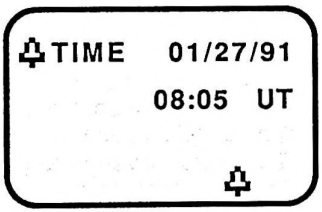
NOTE: If you are using external power, or have the unit set to continuous operation, the wake-up feature will turn on the NAV 1000 PLUS at the designated time in continuous mode. The unit will wake itself up and provide continuous position updates.





Press the PLUS key, then 6 (or PLUS and six presses of the RIGHT ARROW key) then the ENTER key to bring you to the function.

When you press the ENTER key, this message displays if the wake-up has not already been set. Enter the wake-up time (in hours and minutes). Press the RIGHT ARROW key to toggle to AM or PM, if you are working in local time.

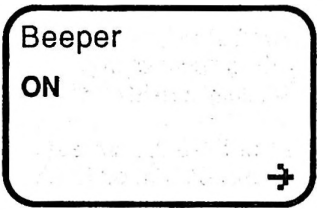


The time and date for the wake-up setting will display. The wake-up bell will be displayed on all screens. Press any key to continue.

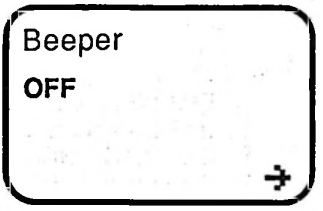
NOTE: The time must be set at least ten minutes in the future.

PLUS 7 - Beeper

PLUS 7 will allow you to turn the beeper on or off. The beeper is used to give a positive response to the keypad, and to indicate a fix has been taken.



Press the PLUS key, then 7 (or PLUS and seven presses of the RIGHT ARROW key) then the ENTER key to bring you to the function.



Press the RIGHT ARROW key to turn the beeper on or off.

PLUS 8 - Collect Almanac

An Almanac is like a bus schedule for the satellites which the NAV 1000 PLUS stores in its memory, and uses to determine which satellites are available. It must be collected from one of the GPS satellites if your unit has lost its memory. The unit will automatically attempt to collect an Almanac when the POS key is pressed after memory loss.

Since each of the satellites in the constellation transmits the entire Almanac, *only one satellite needs to be available to perform this function.* It takes approximately 12 1/2 minutes to collect the Almanac after a satellite has been found. We recommend that you connect the unit to external power for this function since it may be a while before a satellite comes into view of the unit.

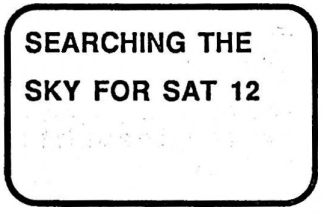
The PLUS 8 - Collect Almanac function can also be used to update the Almanac, collecting the most recent information from the satellites. You can use this to refresh your current Almanac without losing data in the event Almanac Collect is interrupted. We recommend collecting a new Almanac each week or so just in case there has been a new satellite launched or one whose orbit has been changed. In fact, you will be required to collect one if the stored Almanac is more than six months old.

Press the PLUS key, then 8 (or PLUS then eight presses of the RIGHT ARROW key). After a brief "computing" message, this screen displays with the date of the latest Almanac, if memory has not been lost.

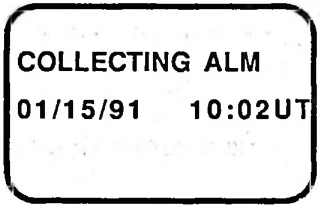
If you are refreshing a current Almanac, the first satellite shown will be the one that is highest in the sky. If your NAV 1000 PLUS has lost its memory and you don't have a satellite schedule available, the unit will search for satellites using its "last resort" list. It is recommended that you use external power. Press the RIGHT ARROW key to select a satellite to begin your search. Selecting a satellite will more quickly obtain your Almanac if you choose a satellite that is overhead.

WARNING: When possible, use external power when collecting an Almanac.

NOTE: Upon loss of memory, the "PRESS ENTER TO COLLECT ALMANAC" is the first display in PLUS 8.



To start the Almanac Collect process press the ENTER key . At this point the unit begins to search the sky until it locates a single satellite.



When the unit locates and locks onto a satellite, this message displays with the current date and time.

When you press PLUS 8 again, the date on the new Almanac will be a couple of days in the future. This is the way the GPS system date stamps the Almanac information.

If POS rather than PLUS 8 is used to obtain the Almanac, the unit will take one fix (if in push-to-fix operation) before cycling off, if enough (three or four) satellites are visible. If the unit is merely updating previously stored almanac information, an interruption caused by turning the unit off or driving through a tunnel, will not erase the old information. It will simply update what it can.

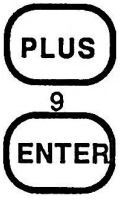
When the unit has no memory, it takes roughly two hours to search the sky for all possible satellites. If none are found, the unit will cycle off.

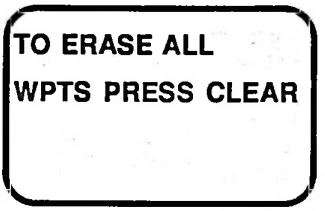
NOTE: On external power or batteries, the unit will continue its search until a satellite has been found. After collecting an Almanac, the unit will continue to take position readings until satellites are unavailable.

When POS is pushed and the unit does not have an almanac, the unit will automatically start searching the sky for satellites. When a satellite is found, an almanac will be collected. In this case, the user cannot manually specify the satellite with which to begin the search.

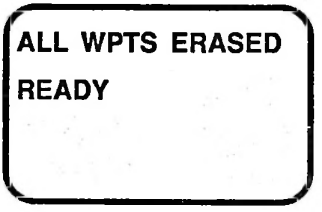
PLUS 9 - Erase Waypoints

PLUS 9, Erase Waypoints automatically erases all waypoints, and your route.





Press the PLUS key, then 9 (or PLUS and nine presses of the RIGHT ARROW key) then ENTER bring you to this function.



Press the CLEAR key to erase your waypoints.

PLUS 13 - Clear Memory

If the need arises that you must erase all memory, including last fixes, your Almanac, and waypoints, use PLUS 13.

Clearing memory is the best way to correct malfunctions related to the data. The PLUS 13 function will also delete the Almanac, erase the time and initialization position.

PLUS

13

ENTER

TO CLEAR MEMORY
PRESS CLEAR

To locate the clear memory function press the PLUS key, then 13 and ENTER. (Pressing the RIGHT ARROW key will not access this function from the main PLUS display).

WARNING: Record all waypoints in a log book before performing this function.

CLEAR

MEMORY CLEARED
PRESS ON/OFF

This display will then appear.

PLUS - Position for Tutorial

PLUS 20, the Tutorial Position function, creates a Last Fix position for the tutorial. After performing this function, the Last Fix of 22°58.80N, 108°26.90W (in WGS-84), with a GQ=7 and an antenna altitude at sea level will appear when you press the LAST FIX key. The time and date on that position will be the time and date when you pressed PLUS 20.

Section 6

TROUBLESHOOTING AND TIPS

ERROR MESSAGES

The **Magellan NAV 1000 PLUS™** has many helpful messages to assist you in trouble shooting.

"SATS NOT FOUND"	The Almanac has determined that enough satellites are available for taking a position fix, but the unit cannot locate the signals.
Try this:	**1.** Make sure the antenna is straight up. Remove obstructions or move the unit. (The antenna needs a clear view of the sky.) **2.** Check the initialization position and time (SETUP). **3.** If using an exterior antenna, check connections. **4.** If these fail, collect a new Almanac.
"2 SATS AVAILABLE MORE NEEDED"	There are insufficient satellites visible for taking a position fix. In other words there are less than 3 satellites in 2D mode or less than 4 satellites in 3D mode.
Try this:	Check **1, 2** and **3** above. Contact other users or Magellan to determine when satellites will be available at your location. Make certain that all the sats in PLUS 3 are set to "ON". Use PLUS 4 to determine when enough satellites will be available.

"SEE USER GUIDE"	Usually this occurs when the unit has been moved more than 300 miles from your last position. The unit will collect data and attempt to compute a position three times before giving this error message. This message will also appear when the GQ is less than 1.
Try This:	Re-initialize unit using the SETUP key.
"MEMORY LOST PRESS SETUP"	The unit has lost all of its memory Several conditions can cause the NAV 1000 PLUS to display the memory warning message: (1) if you fail to replace batteries at the second low battery warning, (2) if you have cleared all memory by pressing PLUS 13, or (3) if you have purposely caused the unit to lose its memory by removing batteries.
Do this:	Replace the 6 AA cell batteries. Reinitialize the unit (SETUP). Collect a new Almanac (PLUS 8).
"NEED ALMANAC PRESS PLUS 8"	The Almanac is either erased or too old. If the Almanac is more than 6 months old, this message will appear.
Try this:	Check the initialization time and date. Collect a new Almanac (PLUS 8).

When the 6 AA cell alkaline batteries are getting low, this symbol displays. The unit will run up to another 30 minutes in continuous operation or take about 10 more single fixes with no danger of losing memory. We recommend that you be prepared to load the spare battery clip with fresh batteries.

"REPLACE BATTS OR LOSE DATA"

Turn the unit OFF. As long as you do not operate the unit, the memory will be protected for up to four weeks with the power remaining in the batteries. Change the batteries by inserting a fresh battery clip.

PROBLEMS

No Power

Always turn the unit off before inserting or removing power jacks.

If the unit fails to power on, make certain the battery clip is in place and that it has fresh batteries. The battery compartment should be clean and dry. Check that the clip is touching the contacts on the unit.

If you are using external power, make certain that the power jack is fully inserted and power is being supplied to the unit. Test this by removing the power jack to determine if the unit will work without external power.

The Position Fix Is Not Changing

The satellites may temporarily be low on the horizon or the antenna may have become obscured. The search status will appear on the lowest line of the display during these outages. Check the time message on the POS display. If the unit beeps informing you that you are locked out of the keypad, this is because the unit is busy searching, or collecting data from the satellite.

Follow the same instructions for the "SATS NOT FOUND" error message.

The Unit Collects Data But Goes Back To Search

An incorrect initialization will give this symptom. Refer to *SETUP* in Section 4 and *Tips* later in this section.

Unit Will Not Stay On When You Have It Connected To An External Power Source

The unit will automatically switch to push-to-fix (non-continuous) operation when the external power is interrupted. You are probably operating on the unit's internal batteries. Turn the unit off, and then immediately on watching the self-test displays to confirm this. Check the external power source.

The External Devices Aren't Responding To Your NMEA Output

Use PLUS 1 to turn the Dataport ON.

Use PLUS 2 to ensure that your NAV 1000 PLUS is set to continuous mode.

Check the users' guide for the external device to determine what NMEA message that it requires. Refer to the dataport section (see section 5, PLUS 1) to determine which NAV 1000 PLUS message output is appropriate.

Make sure that all cables and adapters are securely connected.

Check to ensure that the NAV 1000 PLUS is taking fixes. Even though you may have turned the dataport on and you are in continuous mode, you must press POS, NAV, or VEL to get fixes. If you have the beeper on (PLUS 7), you will hear a faint beep as each fix is obtained. The NAV 1000 PLUS must be taking fixes to output data.

Your Autopilot Is Not Responding

Refer to the steps outlined above in the dataport, and NMEA sections above.

To get data for your autopilot, you must first set a route using the ROUTE key, and the NAV 1000 PLUS must be taking fixes. The NMEA data message goes out only after you press either the POS, NAV, or VEL keys.

The Fixes Seem To Vary A Great Deal

The position accuracy of the NAV 1000 PLUS is affected by many variables, the most important of which is the GQ (geometric quality). Because of this variability, the specified accuracy of 25 meters RMS in 2D is a statistical rather than an absolute accuracy, and further assumes that GQ is greater than 7, and SQ is at least 7. This means that even under good conditions, not all fixes will be within 25 meters of the true position. However, a good rule of thumb is that approximately two-thirds of the fixes will be within 25 meters of the true position and about 95% of the fixes will be within 50 meters under good conditions, and assuming that the government is not "adjusting" the satellites.

Since 20 meters is approximately 0.01 minute of latitude (and 0.01 minute of longitude at the equator), it is normal to see variations as large as ±0.03 minutes of latitude/longitude from fix to fix under good conditions and even larger variations under less favorable conditions.

From time to time, the government degrades the accuracy of the system. Check with military officials or the U.S. Naval Observatory for more information about this (719-550-2115).

Receiver or NMEA data Is Turning Off

Entering certain functions, like PLUS functions, or WPT, will turn the receiver off. To reactivate it, you must press POS, NAV or VEL. About 2 minutes will elapse before your position updates again. Unless you are in continuous operation or on external power, the receiver will turn itself off after obtaining a single fix. The NMEA messages are unavailable in non-continuous (push-to-fix) operation.

The NAV And VEL Keys Will Not Work

1. Navigation requires that you enter a route (ROUTE key) with a start and destination. (You can select your present position as the course start.)

2. If you are not in continuous operation, only distance, bearing, and XTE are available to you.

3. Bearings are not displayed when you are within ±20 meters of your destination.

4. You must be travelling at least 0.2 Knots to get speed (SOG), ground course (COG) and steering, speed of advance (SOA), ETA, TTG, or velocity made good (VMG).

5. Despite the speed of your vehicle, velocity related data is not available until the unit has taken three fixes.

The Unit Beeps When You Press A Key

You are locked out of the keypad. Be patient a moment and try again. The unit was receiving important information from the satellite and did not want to be interrupted. To turn the receiver off, thereby freeing the keypad, simply turn the unit off.

Dashes Appear In The Position And Navigation Or Velocity Displays

Dashes will display when your speed is too slow for providing velocity related information. The unit must be moving 0.2 Knots to obtain speed, ground course and steering. When you are 20 meters or less from your destination, distance is not displayed and bearing will vary considerably.

The Satellites' Availability Does Not Seem Consistent With Your Expectations

There is a very good chance that the U.S. Government may have changed the position or health of a satellite, or even launched a new satellite. There is also a possibility that you collected an Almanac on a day when one or more satellites were set "unhealthy". Check your initialized position, the time, and the numbers of satellites listed in *PLUS 3, Sat Status.* Collect a new Almanac using PLUS 8, Almanac Collect. Note whether there are more or less satellites now listed. For more information on satellite availability, call the Naval Observatory at 719-550-2115.

EQUIPMENT MALFUNCTION

Most malfunctions can be avoided by remembering these rules:

- Turn the unit off before inserting or removing the power jack.
- Do not leave the unit face up in the direct sun.
- Do not try to operate the unit above 60° C. or below -10° C.
- Do not store the unit at temperatures above 70° C. or below -40° C.
- If the unit gets dropped in water, rinse the unit, including the battery compartment, with fresh water and dry it carefully.

Maintain a waypoint log—always "backing up" your favorite waypoints—just in case.

If the equipment malfunctions, try this procedure:

First, turn the unit OFF and ON. This will "cure" a great number of errors. If the unit will not turn on, refer to *No Power* under Problems.

Second, if the problem persists, write down all your waypoints and clear the unit's memory using PLUS 13. Refer to *PLUS 13* in Section 4.

Or, if the display is "frozen" and the keypad will not work, remove the battery clip for at least 1/2 hour. This too will erase the memory, just like PLUS 13.

TIPS

Using The Unit Near The Poles

Note that all meridians of longitude converge at the North and South poles. Near the poles, a nautical mile can span many degrees of longitude, so small changes in position can cause large variations. While the inherent measurement accuracy of the NAV 1000 PLUS does not change near the poles, this basic mathematical sensitivity problem can cause position and velocity related data to appear unstable when the unit is operated at latitudes exceeding 85 degrees north or south. In these regions, caution must be exercised in interpreting displayed data.

When The Almanac Is More Than 6 Months Old

If your Almanac is a few days too old, you can trick the unit into giving you a fix by reinitializing the unit to time a few days in the past.

When You Can't Figure Out Your Initialization Position

When you have no map to refer to and you simply don't know your initialization, try this: Look at your last fix. Think how far you have moved since then. Each 60 nautical miles is approximately equivalent to 1° of latitude. Guess an approximate new position and enter it as the initialization. If your initial position was 40°N and 100°W and you had moved about 600 miles north, your new position would be 50°N and 100°W. You may also use the waypoint projection function (PLUS 5) to aid you in projecting a new position.

Choosing The Right Datum

All charts are created using a system that includes the scale, type of projection, and a map datum. There are hundreds of map data throughout the world, but fortunately most charts in common use today employ one of a select few of these datums.

The Magellan NAV 1000 PLUS provides positions in 11 different map datums plus it gives the user the facility to define 1 datum. If your chart or other electronic navigation equipment is created using a different datum, you must take this into account before comparing positions. A position in WGS 84 could differ by 300 meters or more from one calculated using another datum. Check the datum in the legend of your chart and the manuals of your other navigation equipment. Use SETUP in your NAV 1000 PLUS to enter the correct datum. If the datum you need is not available, create the one you need as explained in SETUP section 4.

The National Oceanic and Atmospheric Administration (NOAA) is presently changing its charts to NAD-83 (which is the same as WGS84 for most purposes). The bulk of NOAA charts in present use are NAD-27. USGS maps are generally in NAD-27.

If You Can't Figure Out The Correct Datum To Use

First, if you are not using a chart or other electronic navigation equipment, it is unnecessary to be concerned with datums. It is important simply to use the same datum at all times.

However, if you must work with a map or chart with an unknown datum, simply go to a reference point on the map and take a few fixes. (Make certain the GQ is 7 or more for best results). Compare the position you obtained to the chart. If it doesn't match, try another datum in the NAV 1000 PLUS that you suspect is correct. Now compare the positions. If they match, you've probably located the right datum.

STORING THE UNIT

On occasion, you may need to store your unit for a long period of time. These precautions should be taken to ensure that you will continue to get the very best performance from your unit.

If You Are Storing The Unit For More Than Three Months:

1. Manually record all waypoints.
2. Remove the battery clip from the unit.
3. Place the unit in the NAV 1000 PLUS carrying case or the original box.

When you take the unit out of storage, reload the battery clip and collect a new Almanac and key in any desired waypoints. Reinitialize.

If You Are Storing The Unit For Less Than Three Months:

1. Load new batteries in the unit. This will preserve the stored waypoints, Almanac, and custom settings.
2. Place the unit in the NAV 1000 PLUS carrying case or the original box.
3. If you store it in the carrying case, place the field card in the front pocket to prevent accidental pressing of the keys.

Appendices

ALL ABOUT THE GLOBAL POSITIONING SYSTEM

GPS — WORLDWIDE NAVIGATION FROM A NEW PERSPECTIVE

The concept of a highly accurate, worldwide navigation and positioning system that could be used continuously at any time of the day began with the Department of Defense. It envisioned radio signals transmitted from a satellite constellation, a system that would not be fraught with the limitations of existing navigation technologies.

Their vision was realized with the Global Positioning System which was made possible by rapid advancements in aerospace technology, a firm financial commitment from the U.S. government, and the intense participation of individuals and corporations with communications expertise.

The heart of the Global Positioning System is a constellation of satellites which will eventually consist of 21 satellites and 3 working spares in six orbital planes. Circling the Earth twice daily, each satellite is in a fixed orbit, approximately 10,900 nautical miles above the surface of the earth, inclined at 55 degrees from the equator.

This new navigation infrastructure, though primarily designed for the U.S. military, is available to a variety of worldwide users including recreational boaters, fishing and shipping fleets, general and commercial aviation aircraft, and surveyors and engineers. Recent technological innovations have made GPS worldwide navigation an affordable reality.

The information provided is precise and transmitted in real time. The most accurate, on-demand worldwide navigation system, GPS is extremely resistant to interference from weather and earth-based radio signals.

All of these advantages make GPS greatly superior to any other navigation system.

Satellite Navigation Made Simple

Navigation by Satellite on Demand.
Each GPS satellite continuously transmits two types of orbit data used to calculate a position: Almanac and Ephemeris. Listening to only one satellite, a GPS receiver can gather the Almanac information, which contains the approximate location of every satellite in the system. From the Almanac, the receiver determines which set of satellites will give the best geometries. The better the geometry, the more accurate the position fix. The Ephemeris data is more precise and is used in obtaining the exact position of each satellite.

In addition to this information, two codes are transmitted: a protected code (P-Code) and an unprotected code (C/A Code). The P-Code is more accurate and is reserved for military use; the C/A Code while intended for public access is also used by the military.

The C/A code has two purposes. It provides immunity of the signal to interference from undesired signals. Secondly, the C/A code is used in determining the precise range of the user from each satellite—the first stage in calculating a position fix.

"Reading" Satellite Information.

While the Global Positioning System may appear complex, navigation with GPS can be amazingly simple. A well-designed GPS receiver uses the signal information in a fundamental geometric equation. It solves the equation and presents it in easy-to-use navigation displays.

To obtain a position fix, a minimum of three satellites are "read" (2D). First the receiver determines the time of transmission and reception of the signal from each satellite. It then multiplies the difference in these times by the speed of light (186,000 miles per second) to arrive at an estimate of the satellite's distance from the receiver.

Using the calculated distance and the calculated orbital position of each satellite, the receiver determines and displays a position fix in degrees of latitude and longitude. Exact time of that fix, accurate to one ten-millionth of a second can also be determined. Although accuracy varies somewhat with satellite constellation geometry, a position fix accuracy of 25 meters or better is typical with C/A code receivers.

Monitoring and Controlling GPS.

A master control station operated by the Air Force in Colorado, USA gathers pertinent navigation data from the satellite constellation. This dedicated facility is especially equipped for satellite monitoring, telemetry, tracking, command and control, data uploading, and navigation message generation.

Monitor stations and ground antennas strategically located around the world passively track the GPS satellites relaying data to the master control station. Through the monitor stations, exact satellite position and signal-data accuracy are constantly updated and maintained.

The master control station routinely adjusts minor discrepancies between where the satellite "thinks" it is and where the monitor stations "know" it is. The compensations are relayed to a ground antenna which then transmits the correction to the appropriate satellite.

If for any reason a satellite emits erroneous data or is otherwise not operating properly, a ground station will mark it "unhealthy" and the satellite will broadcast this fact to the user. Receivers are programmed to ignore the unhealthy satellites, "reading" instead the next best satellite for determining the user's position. The master control station also has the ability to degrade the satellite data. Such degradation, called SA for Selective Availability, would cause positioning errors to increase beyond the 25 meter level.

GPS Brings New Navigation Horizons.
GPS is the technology of the future. Based on ingenuity and vanguard capabilities, GPS will replace systems based on technologies developed decades ago. GPS is superior to other systems in its accuracy, coverage, and resistance to interference.

Accuracy.
The most remarkable feature of the Global Positioning System is its accuracy. Position accuracies of 25 meters or better are commonly obtained from C/A code GPS receivers. Repeatable accuracy, that is being able to return to the same spot, is a hallmark of GPS navigation.

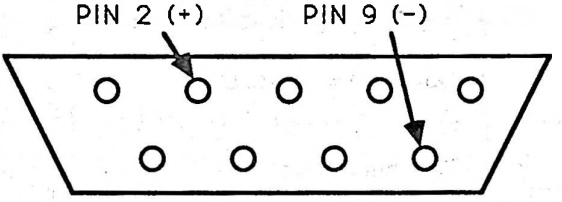
Coverage.
The completed GPS constellation of 21 satellites plus spares will provide 24-hour continuous 3D coverage world-wide. It is not necessary to wait for the full constellation since, theoretically, only 12 satellites are needed for 24-hour coverage for boaters who already know their altitude. Also, unlike other electronic navigation systems, the signal never weakens because of distance from the broadcast source, or the number of users.

Interference.
Another remarkable feature of GPS is its resistance to interference from conditions which disturb other electronic navigation systems: thunder, lightning, heavy weather, other radio signals, on-board electronics, passing ships, on-shore electronic installations, ignition of the boat engines, portable radio receivers, and so forth, do not, in general, affect the GPS signal.

The high frequency (1575MHz) used by GPS means that it operates in a wave environment where there is less interfering radiation. More important, GPS uses spread spectrum technology which greatly reduces any possible interference in its navigation signal.

NMEA Pin Assignments

To connect your NMEA 0183 devices to the NAV 1000 PLUS adaptor cable, you will have to purchase a 9-pin connector (male) that is readily available at any electronics store. The wires should be soldered to the connector in the following configuration (see diagram): Pin 2 - High, and Pin 9 - Low.



Other Navigation Systems

Most of the current means of electronic navigation are land based, like Omega, Decca, radio beacons, and Loran C. These systems have inherent limitations in coverage area, accuracy, and/or susceptibility to interference.

Transit (Sat/Nav), the other U.S.satellite-based system, does not provide continuous navigation information, only periodic position fixes once every one to three hours. In addition, the user must already have a close approximation of his position and velocity to make use of the system.

Omega, Loran C and Transit are all destined to be replaced by GPS.

TRANSIT	• Sometimes hours between fixes. • Requires user to know rough position, and accurate velocity. • 15 minutes for a fix. • Coverage = 100% of earth.
LORAN C & DECCA	• Accuracy highly dependent on geometry, where vessel is in relation to the transmitters. • Highly suseptible to interference. • May require user input. • Coverage = 10% of earth.
OMEGA	• Disrupted by storms. • Requires time, date input. • Requires pre-voyage initialization. • Intolerant of power failures. • Coverage = 90% of earth.
CELESTIAL	• Accuracy 1 to 5 miles. • Requires complex and recurrent training. • Clear weather only. • Error prone. • At most, 3 fixes per day.

WAYPOINT LOG

KEEP A WRITTEN RECORD OF ALL WAYPOINTS. COPY THESE PAGES FOR THE NOTEBOOK YOU KEEP.

WAYPOINT NAME: _ _ _ _ _ _	DATE: _ / _ / _
LAT _ _ ° _ _ . _ _ N or S	ALTITUDE:
LON _ _ _ ° _ _ . _ _ E or W	_ _ _ _ _ f or m
NOTE: _____	DATUM: _____

WAYPOINT NAME: _ _ _ _ _ _	DATE: _ / _ / _
LAT _ _ ° _ _ . _ _ N or S	ALTITUDE:
LON _ _ _ ° _ _ . _ _ E or W	_ _ _ _ _ f or m
NOTE: _____	DATUM: _____

WAYPOINT NAME: _ _ _ _ _ _	DATE: _ / _ / _
LAT _ _ ° _ _ . _ _ N or S	ALTITUDE:
LON _ _ _ ° _ _ . _ _ E or W	_ _ _ _ _ f or m
NOTE: _____	DATUM: _____

WAYPOINT NAME: _ _ _ _ _ _	DATE: _ / _ / _
LAT _ _ ° _ _ . _ _ N or S	ALTITUDE:
LON _ _ _ ° _ _ . _ _ E or W	_ _ _ _ _ f or m
NOTE: _____	DATUM: _____

WAYPOINT NAME: _ _ _ _ _ _	DATE: _ / _ / _
LAT _ _ ° _ _ . _ _ N or S	ALTITUDE:
LON _ _ _ ° _ _ . _ _ E or W	_ _ _ _ _ f or m
NOTE: _____	DATUM: _____

WAYPOINT NAME: _ _ _ _ _ _	DATE: _ / _ / _
LAT _ _ ° _ _ . _ _ N or S	ALTITUDE:
LON _ _ _ ° _ _ . _ _ E or W	_ _ _ _ _ f or m
NOTE: _____	DATUM: _____

WAYPOINT NAME: _ _ _ _ _ _	DATE: _ / _ / _
LAT _ _ ° _ _ . _ _ N or S	ALTITUDE:
LON _ _ _ ° _ _ . _ _ E or W	_ _ _ _ _ f or m
NOTE: _____	DATUM: _____

WAYPOINT NAME: _ _ _ _ _ _	DATE: _ / _ / _
LAT _ _ ° _ _ . _ _ N or S	ALTITUDE:
LON _ _ _ ° _ _ . _ _ E or W	_ _ _ _ _ f or m
NOTE: _____	DATUM: _____

Map Datum

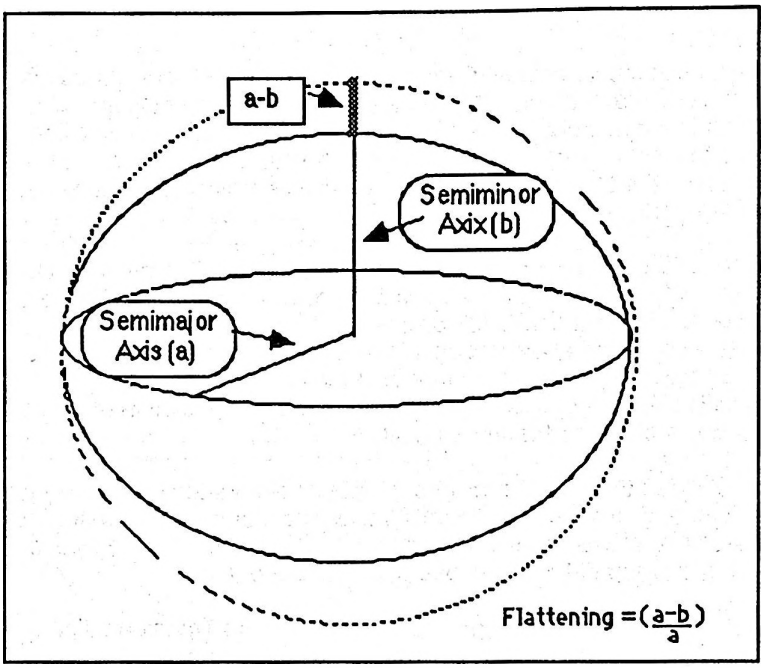
Maps and charts consist of lines, like meridians and parallels, which represent the earth on a flat surface. Each chart and map is based on a particular model of the earth's surface which consists of an ellipsoid and the distance of that ellipsoid from the center of the earth. In addition, the chart is made using a particular projection of the surface of the earth onto paper.

The GPS system is based on the World Geodetic Survey of 1984 (WGS84); therefore, best accuracies from the NAV 1000 PLUS are obtained using the WGS84 datum. Altitude presented on the display is height above mean sea level based on the height above the geoid, an equipotential model of the earth's surface based on gravity. This model, like a model of the magnetic variation around the globe, is contained within the unit.

The NAV 1000 PLUS provides geodetic coordinates (LAT/LON) and a map projection referred to as a transverse mercator. To work with maps and charts around the world, the NAV 1000 PLUS provides 11 geodetic map datums and one user defined datum.

Magellan uses the abridged Molodenskiy Datum Transformation algorithms for these calculations. The constants used in the equations are based on averaged information obtained by geodocists and is generally closer than five meters to most local control points.

The Map Datum option lets you select the datum that corresponds to the chart you are using. In the legend of your chart, you will find reference to the datum upon which the chart is based. We provide only eleven pre-programmed transformations. But we provide a list of constants you may program yourself. Just remember that a given position can be accurately placed on a chart only when you have the unit's datum setting matched to that of the chart.



Ellipsoid Model of the Earth

TABLE OF CONSTANTS
MOLODENSKIY TRANSFORMATION CONSTANTS
LOCAL DATUM TO WGS '84

Datum	ELLIPSOID	Δa	Δf x 10000	ΔX(m)	ΔY(m)	ΔZ(m)
Adindan (Ethiopia, Sudan)	Clarke 1880	-112.145	0.54750 714	-162	-12	206
Arc 1950 (Lesotho,Zaire, Zambia)	Clarke 1880	-112.145	0.54750 714	-143	-90	-294
Australian Geodetic (Australia)	GRS 67	-23	-0.00081 204	-133	-48	148
Bukit Rimpah (Indonesia)	Bessel	739.845	0.10037 483	-384	664	-48

Datum	ELLIPSOID	Δa	Δf x 10000	ΔX(m)	ΔY(m)	ΔZ(m)
Camp Area Astro (Antarctica)	International	-251	-0.14192 702	-104	-129	239
Djakarta (Indonesia)	Bessel	739.845	-0.10037 483	-377	681	-50
European 1950 (Federal Republic of Germany, Norway, Spain)	International	-251	-0.14192 702	-87	-98	-121
Geodetic Datum 1949 (New Zealand)	International	-251	-0.14192 702	84	-22	209
Ghana (Ghana)	War Office	163.58	0.25567 714	NOT AVAILABLE		
Guam 1963 (Guam)	Clarke 1866	-69.4	-0.37264 639	-100	-248	259
Gunung Segara (Borneo (Southeast))	Bessel	739.845	0.10037 483	-403	684	41
Gunung Serindung 1962	Bessel	739.845	0.10037 483	NOT AVAILABLE		
Herat North (Afghanistan)	International	-251	-0.14192 702	-333	-222	114
Hjorsey 1955 (Iceland)	International	-251	-0.14192 702	-73	46	-86
Hu-Tzu-Shan (Taiwan)	International	-251	-0.14192 702	NOT AVAILABLE		
Indian (India)	Everest	860.655	0.28361 368	173	750	264
Ireland 1965 (Eire 1965) (Ireland)	Mod. Airy	796.811	0.11960 023	506	-122	611

Datum	ELLIPSOID	Δa	Δf x 10000	ΔX(m)	ΔY(m)	ΔZ(m)	
Kertau 1948 (Malayan Revised Triangulation) (Malaysia)	Mod. Everest	832.937	0.28361	368	-11	851	5
Liberia 1964 (Liberia)	Clarke 1880	-112.145	-0.54750	714	-90	40	88
Luzon (Phillipines)	Clarke 1866	-69.4	-0.37264	639	-133	-77	-54
Merchich (Morocco)	Clarke 1880	-112.145	-0.54750	714	31	146	47
Montjong Lowe	Bessel	739.845	0.10037	483	NOT AVAILALBE		
Nigeria (Nigeria)	Clarke 1880	-112.145	-0.54750	714	-92	-93	122
North American 1927 CONUS (California, Michigan, Texas, Virgina, Kansas)	Clarke 1866	-69.4	-0.37264	639	-8	160	176
North American 1927 Alaska and Canada (Alaska, British Columbia, Ontario, Quebec)	Clarke 1866	-69.4	-0.37264	639	-9	151	185
Ola Hawaiian, Maui (Maui)	International	-251	-0.14192	702	210	-230	-357
Old Hawaiian, Oahu (Oahu)	International	-251	-0.14192	702	201	-224	-349
Old Hawaiian, Kauai (Kauai)	International	-251	-0.14192	702	190	-230	-341
Ordnance Survey of Great Britain 1936 (Scotland, England, Wales)	Airy	573.604	0.11960	023	375	-111	431

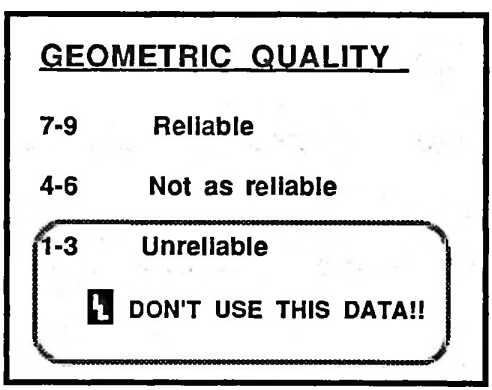
Datum	ELLIPSOID	Δa	Δf x 10000	ΔX(m)	ΔY(m)	ΔZ(m)
Qornoq (Greenland)	International	-251	-0.14192 702	164	138	-189
Sierra Leone 1960	Clarke 1880	-112.145	-0.54750 714	NOT AVAILABLE		
South America (Campo Inchauspe) (Columbia, Chile, Guyana, Peru)	International	-251	-0.14192 702	-148	136	90
South America (Chua Astro) (Brazil)	International	-251	-0.14192 702	-134	229	-29
South America (Corrego Alegre) (Argentina)	International	-251	-0.14192 702	-206	172	-6
South America (Provinsional South American 1956) (Paraguay)	International	-251	-0.14192 702	-288	175	-375
South America (Yacare) (Uraguay)	International	-251	-0.14192 702	-155	171	37
Tananarive Obsv. 1925 (Madagascar)	International	-251	-0.14192 702	-189	-242	-91
Timbalai 1948 (Malaysia)	Everest	860.655	0.28361 368	-689	691	-46
Tokyo	Bessel	739.845	0.10037 483	-128	481	664
Voirol	Clarke 1880	-112.145	-0.54750 714	NOT AVAILABLE		
Special Datums (SD) MGRS related, Indian Special (Thailand, Laos)	Everest	860.655	0.28361 368	173	750	264

Datum	ELLIPSOID	Δa	Δf x 10000	ΔX(m)	ΔY(m)	ΔZ(m)
SD, Luzon Special (Phillipines)	Clarke 1866	-69.4	-0.37264 639	-133	-77	-54
SD, Tokyo Special (Japan)	Bessel	739.845	0.10037 483	-128	481	664
Default Datum, WGS 84	WGS 84	0.0	0.0	0	0	0
WGS 72	WGS 72	2.0	0.00031 211	0	0	4.5

ΔX, ΔY, ΔZ are the differences in height from the center of the earth from the WGS model of the earth's surface to the local datum's model of the earth's
Δa = the difference from the WGS semi-major axis to that of the local datum.
Δf (x 10,000) = the difference in flattening from the WGS84 model to the local datum. Flattening = (a-b)/a, where a = semi-major axis and b = semi-minor axis.

Geometric Quality

Position accuracy is affected by geometric quality (GQ). The GQ value appears on the third position displays of current position, last fixes and waypoints (saved fixes).



Geometric Quality (GQ) is based on the Position Dilution of Precision (PDOP). This is a measurement of the geometry of the satellites used for triangulating the position. Roughly speaking, the more "spread out" the satellites are, the better the accuracy of the fix. When the satellites are bunched together in the sky, the position solution may not be as accurate.

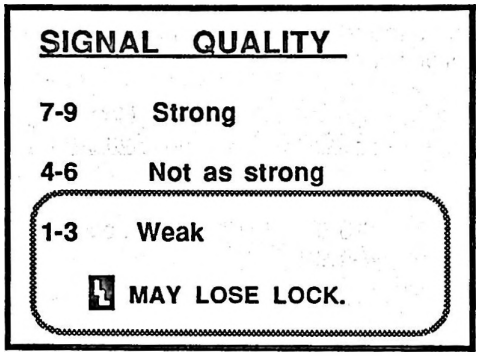
The NAV 1000 PLUS converts PDOP into easy-to-interpret ratings. The GQ ranges from 1 (lowest quality) to 9 (highest quality). A GQ of 7 or better indicates the PDOP is good enough that geometry should not be a significant cause of position errors.

GQ Level	~PDOP	How to Evaluate
9	1-2.9	
8	3-3.9	Good accuracy
7	4-4.9	
6	5-5.9	
5	6-7.9	Fair accuracy
4	8-9.9	
3	10-14.9	
2	15-24.9	Poor accuracy
1	25-50	
0	50-75	

The unit will not report a position which has a PDOP > 75. A message will display, indicating that not enough satellites are available.

Signal Quality

Signal Quality (SQ) gives an indication of the carrier-to-noise ratio (C/N_0) of each satellite signal being used. Each satellite being used and it's signal are reported on the third message of position displays. The SQ level ranges from 0 (lowest quality) to 9 (highest quality). An SQ of 4 or better on a position fix indicates the C/N_0 is strong enough that you will not lose lock on that signal. SQ has almost no bearing on accuracy.



NOTE: You can often improve the SQ by moving the antenna into a more favorable area. Even moving a few inches can often make a great difference in SQs. (See *Hand-Held Battery Operation* in Section 2.)

SQ Level	C/N_0 of Weakest Signal (dB-Hz)*	How to Evaluate
9	≥ 45	
8	44	Strong
7	43	
6	42	
5	41	Not as strong
4	40	
3	39	
2	38	Weak
1	37	
0	<37	*C/No at antenna

GLOSSARY

ACQUISITION — Referring to signal acquisition, when the NAV 1000 PLUS locates and receives data from the GPS satellites.

ALMANAC — Information the NAV 1000 PLUS obtains from a single satellite, containing data on the general location and health of all satellites in the GPS constellation.

ANTENNA ALTITUDE — The sum of the elevation (zero at sea level) and the antenna height.

ARRIVED — This message displays when you reach your destination while you are navigating along a route leg in manual mode.

BEARING — The direction the vessel is moving in relation to a destination or target.

C/N_0 — Carrier-to-noise ratio is an absolute means of specifying signal-to-noise ratio (SNR) that is independent of band width.

CLOSE — This message displays when you are navigating along a route, and you are within 500 feet of your leg destination.

CROSS TRACK ERROR — The perpendicular distance between the present position and the courseline, given as right or left of course (as facing in the direction of the course).

DEFAULT	The displayed or system selected choice. If you do not want to use the default (automatic) value, you can erase it and enter your own choice.
ELLIPSOID	The idealized mathematical model of the earth's surface used in developing charts.
ETA	Your estimated time of arrival to your destination waypoint.
FIX	A single position with latitude, longitude, altitude, time, and date. When recorded on a chart, it may include speed and ground course.
GEOMETRIC QUALITY (GQ)	This is a measurement of the geometry of the satellites used for triangulating the position. The more spread out the satellites are, the better the accuracy of the fix. When the satellites are bunched together in the sky, the position solution may not be as accurate as normal. The GQ ranges from 1 (lowest quality) to 9 (highest quality). A GQ of 7 or better indicates the GQ is good enough that geometry should not be a cause of accuracy problems.
GQ	See Geometric Quality.

GREAT CIRCLE	The shortest distance between any two points. Can be viewed as a circle on the earth's surface that is described by a plane cutting through the earth's center. Also see Rhumb Line.
GROUND COURSE	The direction your vehicle is actually moving. Also called course over ground (COG).
HEADING	The direction your vessel is oriented specified as an angle from North.
LAST FIX	A fix stored in temporary memory, a record of an earlier position fix.
LATITUDE	The distance north or south of the equator, measured in an arc with the equator being 0° and the poles being 90°.
LONGITUDE	The distance east and west, measured in an arc from the prime meridian (0°) which intersects with Greenwich England. The range is 0°-180°E moving east and 0°-180°W moving west of the Prime Meridian.
MAP DATUM	A coordinate system with an associated ellipsoid upon which a given chart is based (as noted on each individual chart).
NMEA	A standard for allowing navigational devices to "talk" to each other that was developed by the National Marine Electronics Association (NMEA).

PDOP

Position Dilution of Precision is a measurement of possible error related to the geometry of the satellites; it includes both the horizontal (Lat/Lon) and the vertical (altitude) aspect of the error.

POSITION

The current position (CURPOS) obtained in real time expressed in a coordinate system (also called a fix) or a waypoint position obtained from a chart or other source.

RECEIVER

The electronic components of the NAV 1000 PLUS that receive the satellite signals.

RHUMB LINE

The straight line between two points on a chart. Over long distances, the rhumb line is actually longer than a great circle course since the chart projection does not entirely account for the curvature of the earth.

ROUTE LEG

The great circle line connecting two points between which the vessel intends to travel.

SEARCH

The task of the NAV 1000 PLUS that locates the GPS satellite signals in the sky overhead.

SIGNAL QUALITY (SQ)

An indication of the carrier to noise ratio (C/No) of each satellite signal being used. The SQ level ranges from 0 (lowest quality) to 9 (highest quality). An SQ of 4 or better on a position fix indicates the C/No is strong enough that you will not lose lock on that

	signal. SQ has almost no bearing on accuracy.
SPEED	The speed over ground (SOG) is the distance you have moved over the ground divided by the time required to move that distance. This is an instantaneous measurement.
SPEED OF ADVANCE (SOA)	Using the speed and ground course, the unit calculates the speed of advance directly to the destination. When the cross track error is equal to zero, then the SOA is equivalent to the VMG.
S Q	See Signal Quality.
TOGGLE	To switch back and forth between two settings (for example, north and south). Information is toggled with the RIGHT ARROW key.
TTG	Time to Go to reach the destination of the next waypoint on current leg based on speed of advance (SOA).
3 D	Three dimensional, referring to a latitude/longitude and altitude position, requiring four satellites in view.
2D	Two dimensional, referring to a latitude/longitude position, requiring a user entered antenna altitude and three GPS satellites in view.

UT	Universal Time, formerly GMT or Greenwich Mean Time.
VELOCITY MADE GOOD	Using the speed and ground course, the unit calculates the speed of advance along the course line, that is the component of the velocity vector which is parallel to the course line.
WAYPOINT	A position stored in the unit's memory.
XTE	Cross Track Error (See cross track error).

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