



MAGELLAN
SYSTEMS CORPORATION

Magellan GPS NAV 1000M™

User Guide

**READ USER GUIDE COMPLETELY TO
INSURE PROPER AND SAFE USE OF THE
MAGELLAN GPS NAV 1000M™.**



**THIS SYMBOL IS USED FOR IMPORTANT
SAFETY INFORMATION. WHEN YOU SEE
THIS SAFETY SYMBOL, CAREFULLY
READ AND FOLLOW THE MESSAGE.**

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Magellan GPS NAV 1000M™

USER GUIDE

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PREFACE

Our goal is to bring the Global Positioning System (GPS) down to earth! The **Magellan GPS NAV 1000M™** makes navigation with GPS easy to understand, easy to use, and affordable. To accomplish these goals...

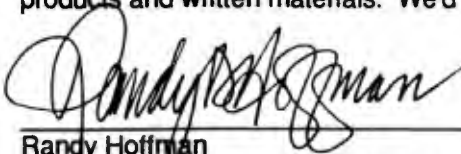
WE'VE KEPT THE UNIT SIMPLE: We know that a sensibly featured product is easier to understand than a unit cluttered with marginally useful features.

WE'VE KEPT THE OPERATION CONSISTENT: Each key does what it indicates; there are no double or hidden functions on the main function keys.

WE'VE MADE GPS INTUITIVE TO USE: The display prompts you to the next step. We hope our design enables you to use our unit with minimum use of this User Guide. To promote navigation safety, we've written the guide in clear language with illustrations.

WE WROTE A TRAINING GUIDE: Spend one or two hours with the accompanying simple-to-follow booklet and you'll be a GPS expert.

WE LISTEN: All comments are carefully considered for future products and written materials. We'd like to hear from you.



Randy Hoffman
President & Chief Executive Officer
Magellan Systems Corporation

WARNINGS ▲

A measure of knowledge by the user is required for proper and safe use of the **Magellan GPS NAV 1000M™**. **READ THE USER GUIDE & WARRANTY COMPLETELY.** Heed this safety warning symbol.

Use Good Judgment

This product is a navigation aid and does not replace the need for careful position 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 can make the system less accurate, such as changes in the position or health of a satellite.

Accuracy can also be affected by poor geometry with respect to the satellites. **WHEN THE ACCURACY WARNING APPEARS ON THE SCREEN, USE THIS DATA WITH EXTREME CAUTION.**

THE GLOBAL POSITIONING SYSTEM IS STILL DEVELOPMENTAL. The government can make changes to the system which could affect the performance of GPS receivers. Such a change could require a modification to your NAV 1000M. Magellan Systems will notify the purchasing agent of your NAV1000M of the opportunity to upgrade the unit to accommodate these changes.

Set the Correct Mode

AMONG THE MOST IMPORTANT THINGS YOU MUST KNOW IS WHETHER YOUR UNIT IS SET FOR TWO DIMENSION (2D) OR THREE DIMENSION (3D) MODE OF OPERATION. (REFER TO 2D VS. 3D IN SECTION 2.)

Using only three satellites for obtaining a position, 2D mode gives a grid or latitude and longitude position. HOWEVER, BEST ACCURACIES ARE OBTAINED WHEN THE CORRECT ALTITUDE IS ENTERED (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 grid or latitude and longitude. (This insures the accuracy of the fix where exact altitude is not available.)

INTRODUCTION TO THE GUIDE

Two breakthroughs in technology make the **Magellan GPS NAV 1000M™** the leading navigation product in the world.

First, the NAV 1000M uses the C/A (course acquisition) signal of NavStar Global Positioning System (GPS) currently being put in place by the United States Department of Defense. GPS will be the world's first truly global, 24-hour, continuous, precise, three-dimensional navigation system.

Second, the NAV 1000M makes use of the latest developments in electronics. Using custom chips and technologies at the cutting edge, like gallium arsenide, we have brought a revolutionary product in size, weight, flexibility and price, to the armed forces.

This user guide is divided into five sections for easy reference. The sections contain the following information:

Section 1: General Information, overviews the NAV 1000M unit and its available accessories.

Section 2: The Basics, covers basic information related to hand-held battery operation and external power operation of the unit, the keypad, and how to enter data.

Section 3: Function Keys, provides procedures for using the unit's function keys. Reference this section whenever you have questions on how to perform a function.

Section 4: Auxiliary Functions, covers the auxiliary functions available under the AUX key.

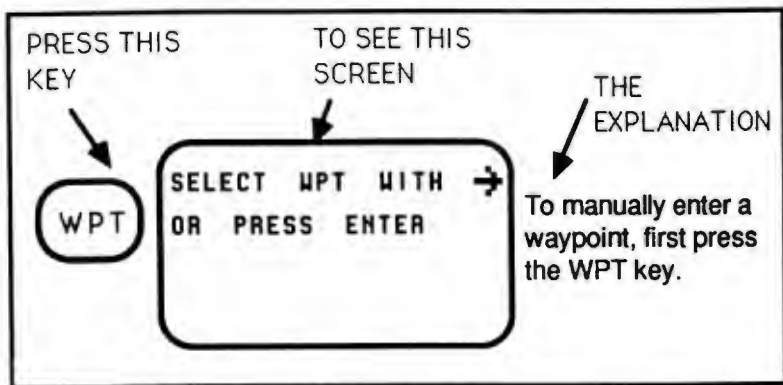
Section 5: Trouble Shooting and Tips, includes information for trouble shooting, instructions for maintaining your unit and tips.

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

The accompanying **Training Guide** is essential for learning to operate your unit quickly.

Editorial Approaches

The following editorial approaches have been used in this guide to make it easy to understand:

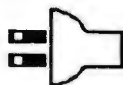


Reading the Guide



THIS SYMBOL IS USED FOR IMPORTANT SAFETY INFORMATION. WHEN YOU SEE THIS SAFETY SYMBOL, CAREFULLY READ AND FOLLOW THE MESSAGE.

Safety Symbols and Warning Messages



The NAV 1000M is designed to conserve power while operating on its six AA alkaline batteries and will turn off after two minutes if no keys are pressed. This battery-conserving operation is referred to as "push-to-fix."

The unit may be operated continuously by using external AC power (adapter supplied with the NAV 1000M), external DC power (with GPS Exterior Antenna kit), or its six internal AA alkaline batteries. Use AUX 2 to select continuous operation when the unit is powered by its internal batteries.

The NAV 1000M works somewhat differently in continuous operation. This power plug is used to note those differences.

Instructions for Continuous Operation

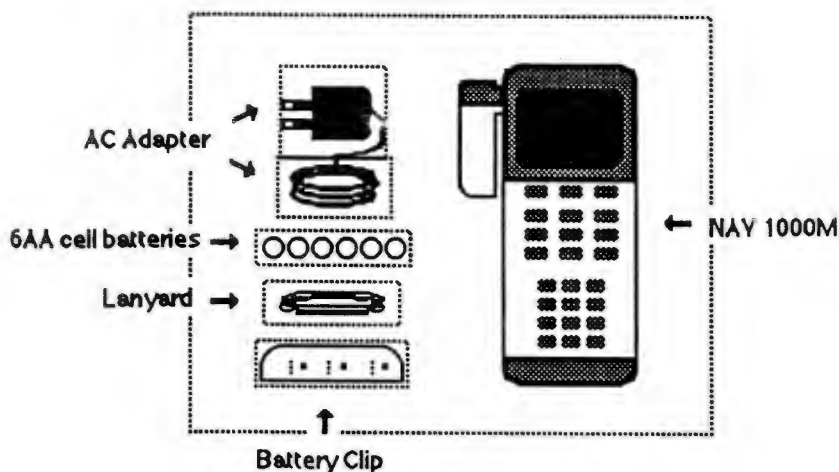
SECTION 1

GENERAL INFORMATION

PACKING LIST

The contents of your **Magellan GPS NAV 1000M™** basic package includes

- Magellan GPS NAV 1000M unit
- AC Adapter
- Lanyard
- 6 AA Alkaline Batteries
- Battery Clips (2)
- User Guide
- Training Guide
- Field Card
- Warranty



Magellan GPS NAV 1000M™
Basic Package
PN 00-21000

ACCESSORIES

The NAV 1000M has several optional accessories.

Carrying Case

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

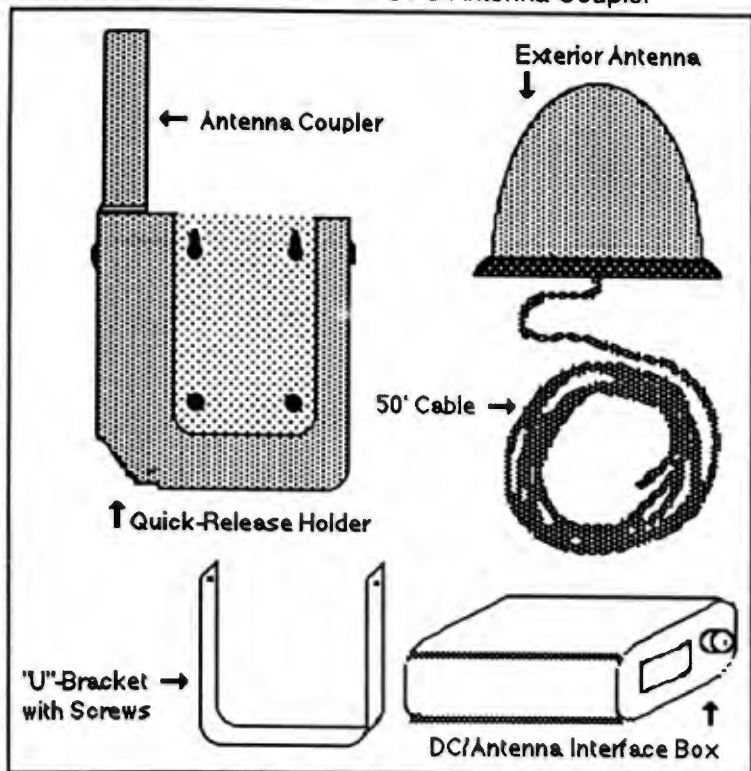


NAV 1000M Carrying Case
PN 00-21001

GPS Exterior Antenna Kit

The GPS Exterior Antenna kit allows you to operate your NAV 1000M inside a vehicle or anywhere that does not have a clear view of the sky. It consists of

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

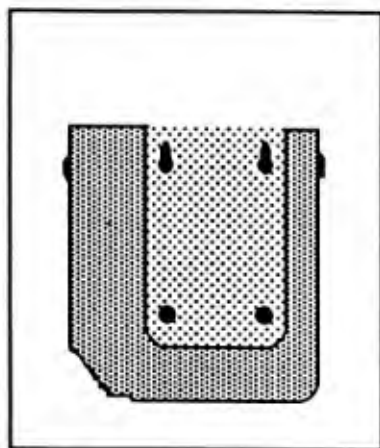


GPS Exterior Antenna Kit
with Quick-Release Holder
PN 00-22000

The GPS Antenna Coupler fits within the unit holder. Connection of the coupler to the exterior antenna is made through the interface box.

Unit Holder

Unit Holders are available to provide a safe resting place for the NAV 1000M in vehicles or boats.



Unit Holder
PN 00-22001

Other Accessories

Also available are Replacement Battery Clips (PN 00-19004). U-Brackets (PN 00-22002) can also be purchased individually.

SPECIFICATIONS

Physical Characteristics

Unit Size:	21.5 cm x 9.0 cm x 5.0 cm excluding antenna;
Weight:	0.85 kg with batteries
Display:	4 line, 16 character, alphanumeric, backlighted LCD
LCD Dimension:	6.5 cm x 4.5 cm; 0.70 cm high digits (with cursor)
Operating	-10°C to 60°C (typical)
Waterproof:	Unit waterproof; battery compartment water resistant
Buoyancy:	Specific gravity = 0.8 (it floats)
Safe Storage Temperature:	-40°C to 70°C
GPS Exterior Antenna:	9.0 cm x 9.0 cm, 15 meters of cable (See Instructions for the GPS Exterior Antenna Kit)

Data Characteristics

Accuracy:	(HDOP < 2, C/N ₀ ≥ 47 dB-Hz, 2D) POS - 25 meter RMS in 2D*; 30 meter RMS 3D (horizontal) VELOCITY - 0.3 Knots RMS
Speed:	0 to 320 Km/h (200 MPH)
Time to First Fix:	2.5 minutes (2D) typical; 3.0 minutes (3D) typical
Time to Subsequent Fix:	15 seconds (2D) typical 20 seconds (3D) typical
Almanac Collect:	12.5 minutes typical
Memory:	50 user-stored waypoints plus 5 last fixes.

Electrical Characteristics

Receiver:	Fast single channel
Power Requirements:	6 AA alkaline batteries (internal) or 12 (10 to 15) volts DC with adapter 115 volts AC ±10% with adapter
Power Consumption:	260 MA typical without light (9 volts) 310 MA typical with light (9 volts)



*Accuracy of position fixes can be affected by the periodic adjustments to GPS satellites by the U.S. Government and is subject to change in accordance with the Department of Defense civil GPS user policy.

Electrical Characteristics (cont.)

Battery Life: Up to 7 hours continuous typical;
75+ single fixes (push-to-fix) typical


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)


SECTION 2

THE BASICS


MESSAGE DISPLAY SYMBOLS


The following symbols appear in various message displays:

 **Accuracy Warning** - Appears in all position messages if the Geometric Quality (GQ) or Signal Quality (SQ) falls below four. If the GQ falls below 4, do not use the position for navigating.

 **Satellite** - Appears as each satellite is located during search and data collection.

 **Battery Warning** - Appears when the batteries are low and need to be replaced

 **Right Arrow** - Appears when the RIGHT ARROW key can be pressed to toggle another selection. It also appears when the RIGHT ARROW key will bring you another item, like another waypoint.

 **Down Arrow** - Appears when the DOWN ARROW key can be pressed to scroll down, to view additional information about that item, like the time/date screen of a particular waypoint.

HAND-HELD BATTERY OPERATION

In hand-held battery operation, the **Magellan GPS NAV 1000M™** is powered by six AA alkaline batteries. The operation and electrical design of the unit are intended to extend the life of the batteries. This is part of the unique PowerSaveR™ design. For example, when you press the POS key, the receiver turns on. The unit takes one position fix, stores the position as the last fix, and shuts the receiver off. The NAV 1000M automatically turns itself off within two minutes, if no keys are pressed.

The receiver can also be set up to remain on continuously while the unit is in hand-held battery operation. This feature is available under AUX 2. The unit will automatically revert to full PowerSaveR™ operation when the batteries reach the second low battery warning, or when the unit is turned OFF and ON again.

To obtain signals in hand-held operation, the unit must be held or placed in direct view of the satellites with antenna pointing directly upward as shown in the figure below.

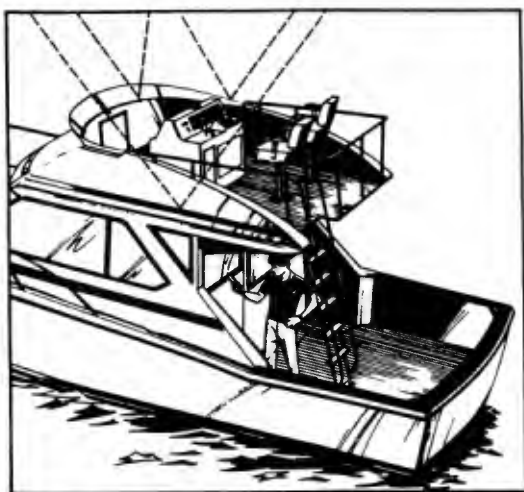


Give Antenna Direct View of Satellites

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.

For ease and comfort of operation, place the unit in a holder, prop it up on a rock, or support your arm, if you will be using the unit for several minutes.

You can expect to obtain roughly 75 or more position fixes from a fresh set of alkaline batteries in push-to-fix operation or about 7 hours of continuous operation.



Obstructions Will Block Signal

NOTE: The NAV 1000M can be operated continuously on its six AA cell batteries, thereby obtaining the velocity related navigation features. Use AUX 2 to select this feature.

Battery Warning Symbol

The battery warning symbol appears on each display when the batteries are low. You can continue operating with the battery warning symbol, but be prepared to change batteries by having a loaded battery clip handy.

NOTE: You can obtain approximately 15 more fixes after the first warning appears or operate continuously for another 40 minutes.

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

When the second low battery symbol appears, there is generally enough power to save your memory for another four weeks.

Rechargeable batteries are not recommended for two reasons. First, their life expectancy is considerably shorter than that of fresh alkaline batteries. Second, the sharp drop in power near the end of their charge cycle can jeopardize the unit's memory without warning. In hand-held operation, the alkaline batteries serve to both power the unit and protect critical memory, like stored waypoints.

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®.
2. Turn the unit off.
3. If the unit is being operated on external power, turn off the unit, remove the connector from the power jack.
4. Grip the battery compartment door on each side as shown. Remove door by pulling the door very firmly toward the bottom of the unit.



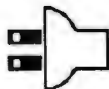
Opening the Battery Door



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.

5. Replace old battery clip with a fresh battery clip making certain that the open side of the clip, with batteries exposed, faces outward. Failure to follow this instruction will cause damage to the unit.
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.

EXTERNAL POWER AND CONTINUOUS OPERATION



The **Magellan GPS NAV 1000M™** can be operated using an external power supply. When the unit uses external power, the receiver remains on continuously after you press the Position (POS), Navigation (NAV) or Velocity (VEL) keys. It senses when the power jack is supplying current and switches to continuous operation automatically. Continuous operation is also available when the unit is powered by its internal 6 AA alkaline batteries. Use AUX 2 to establish continuous operation.

You must attain a speed of 0.3 Km/HR and be in continuous operation before the unit displays speed over ground (speed). Ground course and steering are also available once a speed of 0.3 Km/HR is reached. Until threshold speed is attained, dashes will appear. Dashes also appear in navigation data when you are within 20 meters of the destination.

Velocity related information is available after the second position fix. Refer to *VEL* in Section 3. After the second fix, navigation data is calculated using Magellan's doppler sensitive navigation filter. Information catches up to sudden changes of speed within two fixes.

This update rate may lag by a few seconds when the unit switches to a new satellite. Every 10 minutes the NAV 1000M evaluates the signal quality and geometric quality of the satellites overhead. You will know if the unit switches to one or more new satellites because a message will appear beneath the main display that says SATS, followed by DATA. During this time, your position does not update.

CURPOS	32°26.67N
	118°29.99W
2D	140m ALT
SATS *	↓→

CURPOS	4-08-101E
	11 37-78-174N
2D	140m ALT
SATS *	↓→

A Symbol Appears on the Screen for Each New Satellite Being Acquired.

Your NAV 1000M will operate using AC or DC power. Use only Magellan equipment for connecting to external power because all adapters and interfaces have been designed to supply the unit with the correct level of DC voltage. Any other equipment may cause harm to the NAV 1000M.

For AC
(115 volts AC \pm 10%,
50/60 Hz)

Use the Magellan AC Adapter
(PN 00-19006) furnished with
the basic NAV 1000M unit.

For DC
(12 volts DC,
negative ground)

Use the Magellan
DC/Antenna Interface Box
available in the Magellan GPS
Exterior Antenna kit with the
Quick Release holder (PN 00-
22000).

Connecting to an External Power Supply



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

Do not direct wire your NAV 1000M to a 12 volt battery.

The NAV 1000M external power jack is located on the side of the unit opposite the antenna. Pull back the rubber tab and insert the connector.



AC Power Jack and Adapter

AC ADAPTER:

Designed to be used with 115 AC ($\pm 10\%$) volt electrical outlets (50/60 Hz).

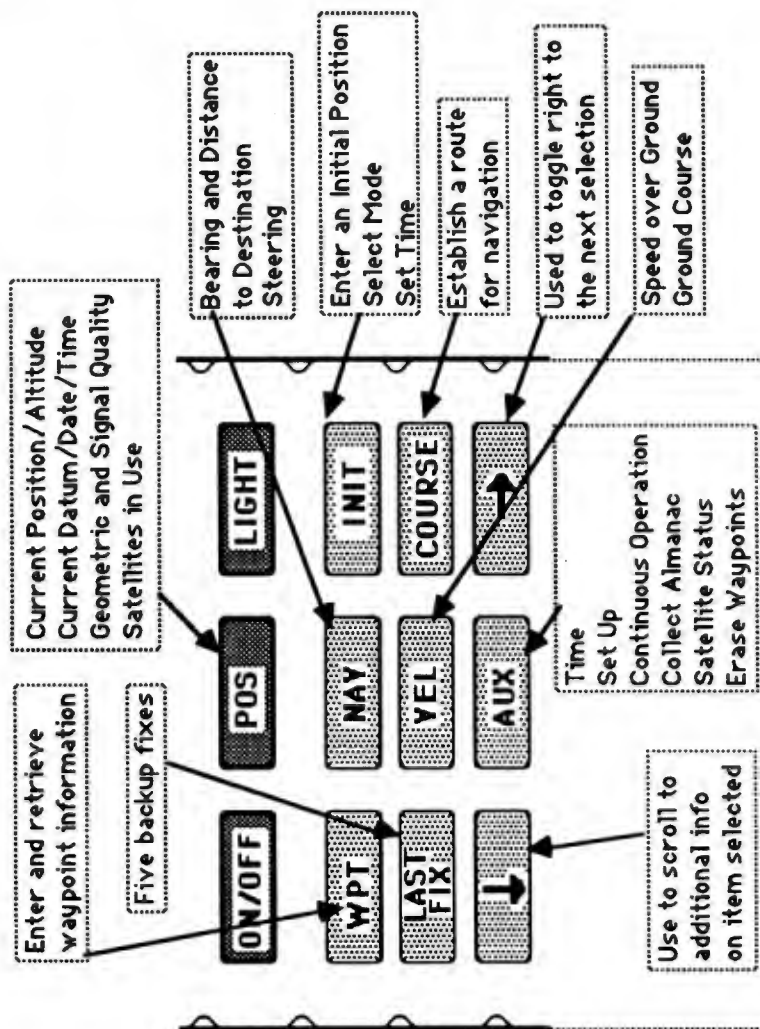
For electrical systems not conforming to U.S. standards, purchase a converter (approved for use in your specific location) to interface with the Magellan AC Adapter.

**DC/ANTENNA
INTERFACE BOX:**

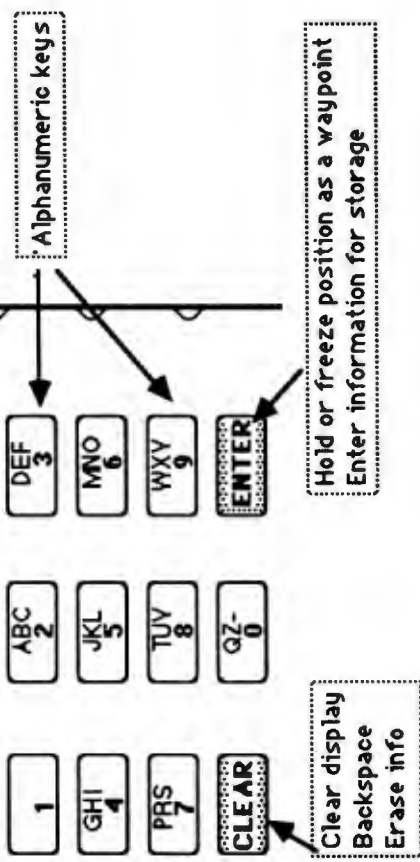
Designed to be used with a 12-volt power supply (10-15 VDC). (To use a DC power source, you will need the Magellan GPS Exterior Antenna kit with Quick Release holder (PN 00-22000)

THE KEYPAD

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



M A G E L L A N



ENTERING DATA

To enter or change data, like a waypoint, use the alphanumeric keypad. This is on the lower half of the keyboard; it looks like a telephone keypad.

Data entries are *always completed* by pressing the ENTER key which saves the information. Until then corrections can be made by pressing the CLEAR key.

Entering Waypoint Labels

Some entries, such as waypoint labels, let you enter alphabetic or numeric characters. To make alphanumeric entries:

1. Press the key that displays the letter or number you want to enter.
2. Press the RIGHT ARROW key to toggle to the desired letter.
3. To move the cursor one space to the right, press the key that has the next letter or number to be entered.
4. When you have completed your entry, press the ENTER key.

NOTE: If you make a mistake, you can erase one letter or number at a time by pressing the CLEAR key. If you cannot correct your error with the CLEAR key, start the entry from the beginning by pressing the function key again.

Entering Numbers Only

When a field requires a numeric entry, the data entry keys automatically input numbers only. The RIGHT ARROW does not toggle to alphas.

A number *must be entered* in each available space. For example, if you want to enter an altitude of 200 meters, you would press 00200.

INTERPRETING YOUR POSITION FIX

To use the NAV 1000M in a prudent manner, interpret the data wisely by evaluating your position fixes.

- Determine if you are in 2D (two dimensional or no altitude), or a 3D (three dimensional including altitude) mode.
- In 2D mode, enter your altitude correctly.
- Be aware of the factors affecting fix accuracy.



Read *Interpreting Your Position Fix* for safe operation of the NAV 1000M.

2D vs. 3D Mode

Two Dimension — Three Satellite — Mode

Two dimension (2D) mode is normally used to navigate on bodies of water, such as a lake or the ocean, where the elevation is known. In 2D mode, a minimum of three satellites must be in direct view of the unit's antenna.

In 2D mode, the unit solves only for latitude and longitude and *bases its solution on the antenna altitude you have entered*. Altitudes are referenced to mean sea level which the NAV 1000M knows from information stored within the unit. The altitude must be entered accurately for best accuracies. It is the sum of your elevation plus the antenna height.

If you are on a lake with an elevation of 300 meters and have an exterior antenna placed 6 meters above the water, your antenna altitude would be 306 meters (300 + 6). If you are on the ocean, the antenna altitude of this same boat would be 6 meters (0+6), since the elevation at sea level is zero.

For best results in 2D (three satellite) mode, the antenna altitude should be known as accurately as possible, because an incorrect antenna altitude entry will cause a corresponding error in the position solution. The amount of additional position error is roughly the same as the error in the entered antenna altitude when the geometric quality (GQ) is 6 or more, but can become considerably larger than this for poor GQ's (3 or less). For example, an error of 200 meters in the entered antenna altitude could be expected to cause a position error on the order of 200 meters for GQ's of 6 or more. (The exact amount of error depends on the specific satellite geometry). However, if the GQ were 3 or less, it might be possible for the position error to be much larger.

NOTE: Normal tidal fluctuations will cause no altitude errors.

The greatest amount of error in a position fix lies in the altitude part of the position fix. By entering in a known altitude, you can increase accuracy. This is why 2D is the recommended mode if you do know exact altitude.

▲ WARNING: Best accuracies are obtained when the correct altitude is entered (within ± 5 meters).

Three Dimension — Four Satellite — Mode


On land where altitude may not be known precisely, the unit needs four satellites in direct view. This is a 3D solution: it solves for latitude, longitude *and* altitude.

We suggest 3D mode be used when the unit is used on land, unless you are fairly certain of your altitude.

▲ WARNING: Use 3D If you are uncertain of your altitude.

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).

<u>GEOMETRIC QUALITY</u>	
7-9	Reliable
4-6	Not as reliable
1-3	Unreliable
 DON'T USE THIS DATA!!	

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 1000M 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.

<u>GQ Level</u>	<u>~PDOP</u>	<u>How to Evaluate</u>
9	1-2.9	Good accuracy
8	3-3.9	
7	4-4.9	
6	5-5.9	Fair accuracy
5	6-7.9	
4	8-9.9	
3	10-14.9	Poor accuracy
2	15-24.9	
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 its 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.

<u>SIGNAL QUALITY</u>	
7-9	Strong
4-6	Not as strong
1-3	Weak
 MAY LOSE LOCK.	

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.)

<u>SQ Level</u>	<u>C/N_0 of Weakest Signal (dB-Hz)*</u>	<u>How to Evaluate</u>
9	≥ 45	Strong
8	44	
7	43	
6	42	Not as strong
5	41	
4	40	
3	39	Weak
2	38	
1	37	
0	<37	* C/N_0 at antenna

Terrain Setting

The NAV 1000M™ allows you to set the unit for three satellite visibility conditions: Clear, Interrupted and Obscured.

CLEAR assumes a clear view of the sky in all directions. Each 10 minutes the unit re-evaluates the PDOP of the satellite it is using. In this terrain setting, the satellite which will give the best geometry (consequently, accuracy) will be used.

INTERRUPTED assumes a good view of the sky but that objects like trees or vehicles may temporarily interrupt the signal. It also assumes that you or objects around you are moving. Once the unit finds the best satellites possible in terms of accuracy, it is programmed to hold onto these satellites. At its 10 minute re-evaluation window, it will not switch satellites unless the PDOP is higher than 6 in 3D or 4 in 2D, which will still give you accuracies of about 30 meters RMS.

OBSURED means that you are in a valley, canyon, drainage, or are surrounded by objects, such as trees. When you select obscured, the unit will first look for satellites 20° above the horizon. If there are not enough satellites in that region of the sky, it lowers its search angle to below 20° but not lower than 10°. Once it "locks on" to those satellites, it will not switch satellites until the PDOP is greater than 15.

Time

The Magellan GPS NAV 1000M™ provides time in both universal time (UT) and local time (both 24 hour and AM/PM time). Universal time is essentially the same as Greenwich Mean Time (GMT).* Universal time is the same where ever you are in the world. It is the time at the prime meridian or longitude 0° which passes through the city of Greenwich, England, UK.

Each of the GPS satellites has the exact time in UT. When you take a position fix, your NAV 1000M corrects any error in its oscillator or "clock". If you made an incorrect entry when you initialized the unit (INIT), UT time will be corrected. Local time in minutes and seconds is also corrected.

When the unit saves position information, waypoints, and other time related data, it always saves the information in universal time, even if you have the unit set to display in local time.

Upon memory loss, the NAV1000M must first be initialized in UT. Once this is done, you can then set it to display in local time. When you set the local time, the NAV 1000M simply remembers the offset (difference) between UT and local time in days and half hours. It adds or subtracts this offset before displaying the time data.

If you travel into another time zone, it's up to you to reset the local time. Even if you forget to do so, it's not a problem because your NAV 1000M always works using UT*. If you are confused about time zone or the local offset, simply change the timeback to UT.

The time on the position fix is given in seconds. It is actually the mid point of data collection, roughly 8 - 10 seconds before the data appears on the display. It is the exact time of the fix and is rounded to the nearest second.

The time on the AUX screen is time in hours/minutes and it is truncated. In other words, if the time is 3:07:57, the time displayed on the AUX screen will be 3:07 rather than 3:08. It is accurate when the receiver is on; otherwise, it is correct to the nearest minute.

***NOTE:** While the GPS satellites keep very accurate time, GPS time differs from UT by up to 3 seconds.

SECTION 3

FUNCTION KEYS

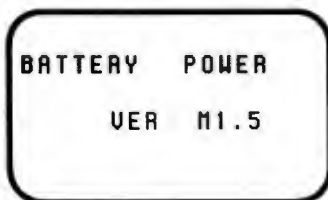
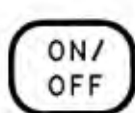


ON/OFF KEY

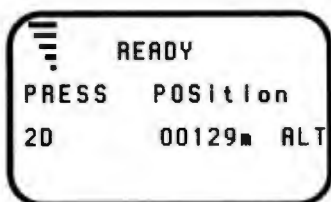
Press the ON/OFF key to turn the **Magellan GPS NAV 1000M™** on. Press it again to turn the unit off.

Power-Test

When you turn on the NAV 1000M, it performs a self-test of memory, Almanac and power.



The power status and version number temporarily displays on the screen.

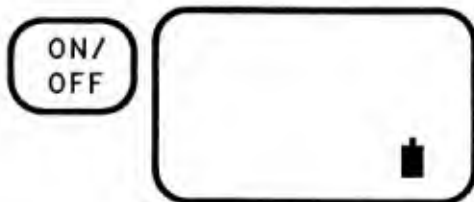


When the NAV 1000M is ready to use, the READY message displays showing the mode and antenna altitude.



If the external power is being used, the display will temporarily show the message "EXTERNAL POWER".

Power Warning



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

WARNING: Replace the batteries when you see this display.



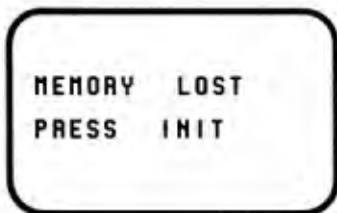
When the batteries become dangerously low, information stored in memory may be lost. A second power warning will appear.

NOTE: When the second battery warning appears, there is enough residual power in the 6 AA batteries to hold up memory for another month.



If external power is being used, the display will show the message "EXTERNAL POWER -- LOW," if the level of external power is below minimum.

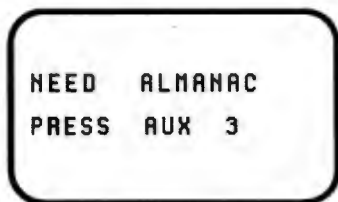
Memory Warning



If the unit's memory has been lost, you must reinitialize and collect an Almanac.

▲ **WARNING:** Read *Initializing Your Unit* in the TRAINING GUIDE and *INIT* in Section 3 before initializing your NAV 1000M.

Almanac Warning



If the Almanac has not been updated in over six months, this message displays. **You must collect an Almanac.** (See *AUX 3* in Section 4.)

POSITION (POS) KEY

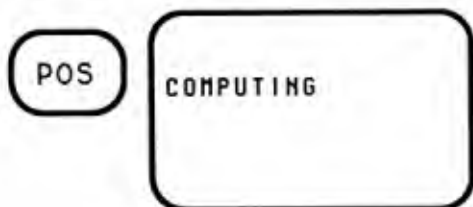
The POSITION (POS) key activates the unit's receiver.

Press the POS key each time you want to obtain a position fix. Under normal conditions, it will take three minutes or less to obtain a position. If you have taken a reading within the hour, it will take approximately two minutes.



In continuous operation (AUX 2) or while operating on external power, press the POS key to turn the receiver on. After obtaining the initial position, the unit will continuously update (continuous mode) your current position, the current time, and the navigation solutions.

Search and Acquisition



The NAV 1000M will begin by computing which satellites are available and among those which would give the most accurate information.

STARTING 3D
SATELLITE SEARCH

The NAV 1000M will begin its search for satellite signals. The initial message will indicate whether you have set the unit for a 2D or 3D search. (See *Interpreting Your Position Fix* in Section 2.)

SATELLITES
FOUND *

When the first satellite is located, this message displays. As each subsequent satellite is located, additional satellite symbols display.

COLLECTING
DATA

When the appropriate number of satellites have been located (three for 2D, four for 3D), this message displays.

COLLECTING
DATA * * * *

As the data is being collected, symbols appear until data is received from each satellite being tracked.

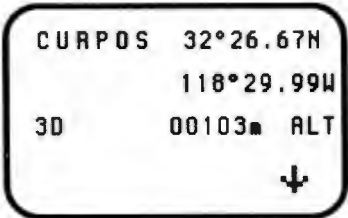


COMPUTING POS

After satellite data has been collected, this message displays. The position solution will display next (see *Position Solution* in this section).

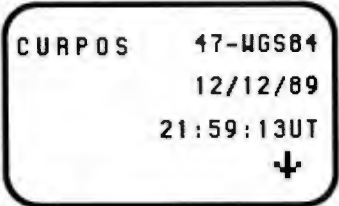
Position Solution

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



CURPOS 32°26.67N
118°29.99W
3D 00103m ALT
↓

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

CURPOS 47-WGS84
12/12/89
21:59:13UT
↓

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

POS



```
CURPOS          GQ-8
SAT 03 06 11 14
SQ  7  4  9  8
          ↓
```

Press the DOWN ARROW key to display information about each of the satellites being used and the signal quality being received from each. The geometric quality 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.

Continuous Operation

After obtaining your first position in continuous operation, the unit will provide you with new position fixes approximately every 15 seconds in 2D, and 20 seconds in 3D. On occasion, the unit will change satellites, as one sets and others rise. The signal from a satellite can become blocked. The unit will always inform you of its activity in the bottom line of the display.

```
CURPOS  32°26.67H
          118°29.99W
3D          103M ALT
SATS
          ↓
```

In this example, "SATS" indicates that the unit is locating one or more new satellites to use.

Real Time Messages

SATS	The unit has selected the sat(s). The number of satellites found will be displayed as "4".
DATA	The unit has collected data from the new sat(s).
COMPUTING	The unit is now computing a new position.
SATS DOWN	The satellites have set. Not enough are now in view to get a position fix.
TRY 2D	The unit is set for 3D operation which requires four satellites, but three satellites are in view. If the mode is changed to 2D, the unit may continue to give positions.


Search and Acquisition Errors

Certain conditions can interfere with successfully obtaining your position. The following error messages will indicate these conditions just prior to or during the search and acquisition of signals:

- Insufficient number of satellites.
- Inability to acquire satellites.
- Incorrect initialization.

Insufficient Number of Satellites

The NAV 1000M 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, determined from the Almanac information, not enough satellites are available within view.



2 SATS AVAILABLE
MORE NEEDED

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

Check AUX 4, Sat Status, to make certain that no satellites have been set to "OFF". Refer to *AUX 4* in Section 4.

Inability to Acquire Satellites



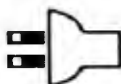
SATS NOT FOUND

When the NAV 1000M begins its search for satellites, but is unable to locate them, this message displays.

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

- The NAV 1000M 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, or other vessels.
- There are satellite outages.
- There are signal reflections that can be corrected by moving the antenna.

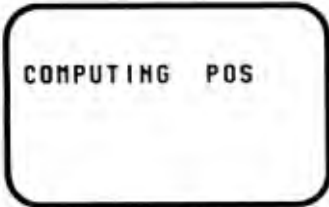
For more information, consult the checklist of possible problems provided in *Trouble Shooting* in Section 5.



In continuous operation and external power, the unit continues to search for satellites.

Incorrect Initialization

When the unit computes a position that it detects is more than 300 miles from the initialization information or last position fix, it will not display the position.



COMPUTING POS

A rounded rectangular display screen with a black border. The text "COMPUTING POS" is centered on the screen in a monospaced font.

Instead you will see it try three times, collecting data and computing.



ERROR

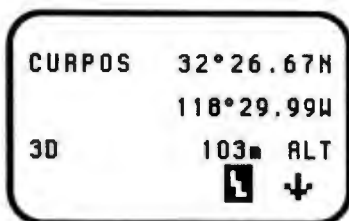
A rounded rectangular display screen with a black border. The text "ERROR" is centered on the screen in a monospaced font.

SEE USER GUIDE

This message will appear. Reinitialize and check the time. If that doesn't solve the problem, read *Trouble-shooting* in Section 5.

POS

Warning Symbol



The warning symbol will display on all fix messages if the Geometric Quality (GQ), or the Signal Quality (SQ) falls below four.

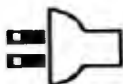


WARNING: Check the position fix if the accuracy warning appears. Do not use data when the GQ falls below four. Read *Quality of the Fix* in Section 2.

LIGHT KEY

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

The unit (including the display light) will automatically turn itself off if a key is not pressed within 2 minutes.



The light will remain on until you turn the unit or the light off.

WPT

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 1000M lets you store up to 50 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

CURPOS 32°26.67N
118°29.99W
3D 103m ALT
↓

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

ENTER

- 32°26.67N
118°29.99W
3D 103m ALT
↓

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

BRIDGE

ENTER

BRIDGE 32°26.67N
118°29.99W
3D 103m ALT
↓

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

ENTER

-	32°26.67N
	118°29.99W
30	103 ALT
	↓

If you decide not to name the waypoint, the NAV 1000M will automatically generate a name using the format WPTXX, like WPT01, WPT02, WPT03 in available sequence..

ENTER

WPT03	32°26.67N
	118°29.99W
30	103 ALT
	↓

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



In continuous operation, you will not see the waypoints name 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 use. For example, waypoints describing a path to a hilltop could be named HILL1 through HILL6.


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.

###

WPT

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

WPT

SELECT WPT WITH 
OR PRESS ENTER

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

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).



BRIDGE 32°26.67N
118°29.99W
30 00103 ALT
 

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

WPT



BRIDGE 47-WGS84
12/12/89
21:59:13UT
↓→

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



BRIDGE GQ=8
SAT 03 06 11 14
SQ 7 4 9 8
↓→

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



BRIDGE GQ=
SAT
SQ
↓→

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

Following this message display, you may:

Press the DOWN ARROW key to return to the latitude/longitude display.

OR

Press the RIGHT ARROW key to move to the same information for the next waypoint.

OR

Press any function key.

Entering Waypoints

WPT

SELECT WPT WITH →
OR PRESS ENTER

To manually enter a waypoint, press the WPT key.

ENTER

-
ENTER WPT NAME

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

For information on data entry, see *Tutorial* in Section 3 and *Entering Data* in Section 2.

ENTER

DUPLICATE NAME
READY

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

WPT

XING

ENTER

XING - . . N

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

XING 33°06.11N

- . . W



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

1185943

ENTER

00174

XING 33°06.11N

118°59.43W

+00174 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

XING 33°06.11H
 118°59.43W
 174m ALT
 ↓ →

Press the ENTER key again to save this information.

CLEAR

CLEAR WAYPOINT
 TO CONTINUE

If all 50 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.

###

WPT

Clearing Waypoints

CLEAR

TO ERASE XING
PRESS CLEAR

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

If you want to escape this function, press any function key.

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

###

NAVIGATION (NAV) KEY

The NAVIGATION (NAV) key provides bearing and distance to destination. Navigation calculations are based on the current position or the last fix (if a current position is not available) and require that you first set a course.

NOTE: Before you can use this function, you must enter a course (using the COURSE key). No data is entered using the NAVIGATION key.



When you press the NAV key, your bearing and distance to the destination waypoint (set in COURSE) displays.

NOTE: When you are within 20 meters of your destination, neither bearing nor ground course display.



When using external power or continuous operation (AUX 2), the NAV message displays are continuously updated. Steering information is available as soon as speed exceeds 0.2 MPH.

LAST
FIX

LAST FIX KEY

The LAST FIX key provides temporary access to the last 5 position fixes. If you use push-to-fix operation, this function is like a trail which records your path.

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

LAST
FIX

LASTFX 32°26.67N
118°29.99W
3D 00103 ALT
↓ →

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.

↓

LASTFX 47-WGS84
12/12/89
21:59:13UT
↓ →

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

↓

LASTFX GQ-8
SAT 03 06 11 14
SQ 7 4 9 8
↓ →

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

NOTE: The accuracy 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. See *Interpreting Your Position Fix* in Section 2 of the User Guide.



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



When the receiver is on (the POS, NAV or VEL key has been pressed), the Last Fix and its related backup are updated every ten minutes in continuous operation.

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. 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.

LAST
FIX

LASTFX	32° 26.67N
	118° 29.99W
3D	00103 ALT
	↕ →

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

**LAST
FIX**



FIX-2 32°26.71N
 118°30.11W
3D 00116m ALT
 ↓ →

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.



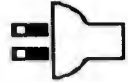
FIX-3 32°26.75N
 118°30.17W
3D 00119m ALT
 ↓ →

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

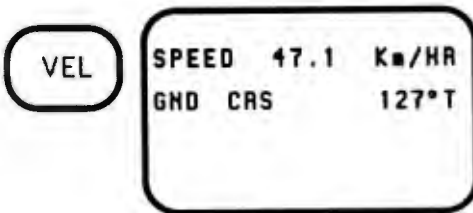
NOTE: *To save any of these back up Last Fixes as waypoints, press the ENTER key when the appropriate fix is displayed and name it as you would any position being saved as a waypoint.*

VEL

VELOCITY (VEL) KEY



The velocity key contains information about your speed and direction of travel. This information is available only in continuous operation or when the unit is on external power. You need not set a course to obtain this information.



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

NOTE: You must be travelling over 0.2 MPH to obtain speed and ground course.

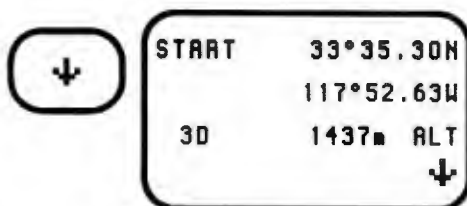
COURSE

COURSE KEY

The COURSE key displays the great circle bearing and distance of the course starting point to destination.



When you press the COURSE key, this message displays unless the last course set has been cleared.



To review the position you selected as the course start, press the DOWN ARROW key.

NOTE: If a waypoint had been used as the course start, the waypoint name, rather than "START", would appear on the display. There would be no DOWN ARROW.

Setting A Course



To reset the course, press the COURSE key and then the CLEAR key.

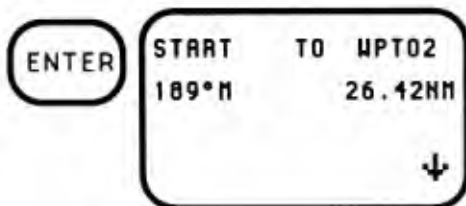
NOTE: If no course had been previously set, the above message would appear when the COURSE key was pressed.

To accept the LASTFX (last fix) as the course start, press the ENTER key. Your selection is renamed START or use the RIGHT ARROW key to select a saved position as the course starting point.

Remember, if a waypoint is used to set the course start, it will not be renamed start. To view the coordinate of the beginning of the course, in that case, you must view it in the Waypoint function.



The destination waypoint is selected from waypoints. Press the RIGHT ARROW key to select your destination. The previously set waypoint is the default.



Press the ENTER key to display your course, which is the great circle bearing and distance from the start to the destination waypoint.

HINT: To reset your course from your current position to the same destination, simply press these keys:

[COURSE] [CLEAR] [ENTER] [ENTER].



"Set Course From" defaults to the current position on continuous operation is called "LASTFIX".



WARNING: Consult local maps before setting a course. Check for obstacles or natural conditions which can make your chosen route impossible.

INIT

INITIALIZATION (INIT) KEY

The initialization position is a starting position that the NAV 1000M uses to find the satellites within direct view of the unit's antenna. Knowing its position, the unit consults information in the Almanac (which it keeps in memory) to begin its search for satellites overhead.

INIT is where you set universal time and date, the mode (2D or 3D), the initial search position, and your altitude, needed for the first position fix. An offset to local time, AM/PM or 24 hours, is set here.

The INIT key is used to initialize the unit. See *Initializing The NAV 1000M* in the Training Guide for another explanation of this process. Read Section 2 of the User Guide carefully before using the unit for the first time.

Refer to the *Tutorial* in Section 3 or *Entering Data* in Section 2, if you need help with entering position, date and time information.

INIT

CHOOSE TIME
DISPLAY: UTC



Press the INIT key to start. The RIGHT ARROW key can be used to select a local (AM/PM) or 24 hour time display. (Refer to "Working in Local Time" in this section.)

ENTER

21/08/90
18:23UT

The present time and date displays after the ENTER key is pressed. The date format is DD/MM/YY unless it has been changed in AUX 1, Set Up.

INIT

CLEAR

ENTER THE TIME
- : UT

Press the CLEAR key to reset time and date. (If you are initializing the NAV 1000M for the first time, or if memory has been lost, this display will appear. Enter the current time in UT in hours and minutes.

NOTE: Best results are achieved by collecting universal time from the satellites by using Almanac Collect, AUX 3. For proper operation, enter UT (or use AUX 3 to collect time) before changing to local time. Refer to *Time* in Section 2.

ENTER

ENTER THE DATE
- / /

Enter the corresponding UT date.

ENTER

APPROX 34°08.84N
POS 117°56.75W

Press the ENTER key. The Initialization position (Last Fix) will appear unless memory has been lost. If you want to reset the position, press CLEAR. Enter the new position.

INIT

ENTER

SOLVE FOR ALT?
NO (2D)



Press the ENTER key to select mode.

NOTE: 2D means two dimensions. In 2D mode, the NAV 1000M uses three satellites and does not solve for altitude. For best accuracies, the antenna altitude should be entered correctly (± 5 meters). Antenna altitude is your elevation plus the antenna height. 3D means three dimensions. The 2D satellite window is generally longer than the 3D window each day.

In 3D mode, the NAV 1000M uses four satellites and solves for altitude as well as latitude and longitude. For further information, See *2D vs. 3D Fixes* in Section 2.



SOLVE FOR ALT?
YES (3D)



Press the RIGHT ARROW key to select Yes, if you want a 3D solution. By selecting this option, you need not know your antenna altitude to obtain accurate position fixes.

ENTER

ANTENNA ALT
00000 ALT

If 2D mode is selected, you will be asked to enter the antenna altitude. Sea level is the default.



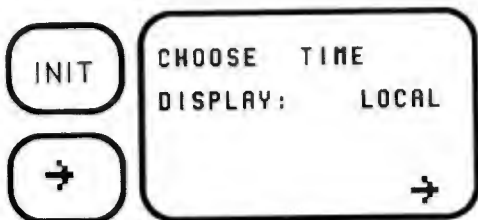
WARNING: For best accuracies in 2D mode, the antenna altitude should be entered correctly (± 5 meters).

Note whether your display is set for meters or feet when you make this entry. Change antenna altitude display from feet to meters in AUX 1 - Set Up.

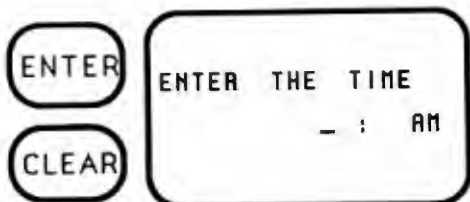
Multiply meters by 3.281 to convert to feet.
Multiply feet by 0.3048 to convert to meters.

Using Local Time

Once UT is set, you can then set the time display to read in Local Time (AM/PM) or 24 hour time (no symbol). The NAV 1000M remembers the difference between UT and Local Time and simply subtracts (or adds) that amount to give you the local time. (See *Time* in Section 2.)



Press the ENTER key to see the time display option. Using the RIGHT ARROW key, select Local or 24 hour.



Enter the correct local time for your time zone. Select AM or PM by pressing the RIGHT ARROW key.

INIT

ENTER

ENTER THE DATE

- / /

Enter the correct local date in the order day/month/year unless you have changed the date order in AUX 1, Set Up. Press the ENTER key or any other function to end the initialization process.

▲ WARNING: When you pass into a new time zone, you must remember to reset the local time if you have selected this option.

SECTION 4

AUXILIARY FEATURES

AUXILIARY (AUX) KEY

The AUXILIARY (AUX) key is a feature that contains a series of supplementary functions. To access each function, press the RIGHT ARROW key to scroll through the options or enter the related number code. Then, press the ENTER key. AUX 13, CLEAR MEMORY, and AUX 20, TUTORIAL POSITION, can be accessed only by entering their code numbers.

The AUXILIARY functions are:

<u>Code</u>	<u>Display Name</u>	<u>Auxiliary Function</u>
1	SET UP	Set up (customization).
2	CONTINUOUS OPER	Activate continuous operation using the internal batteries.
3	COLLECT ALMANAC	Collect an almanac.
4	SAT STATUS	Multi-featured function containing the list of satellites in the Almanac, the satellites in view, their angle and elevation, which satellites are in use, and their SQs.
5	ERASE WAYPOINTS	Automatically erases all waypoints, and the course.
13	CLEAR MEMORY	Erases the Almanac, waypoints and more from memory.
20	TUTORIAL POSITION	Automatically creates a Last Fix position for use with the Tutorial.



When you press the AUX key, this message displays. Press the RIGHT ARROW key to scroll to the desired functions.

OR

Enter the auxiliary code number. Then press the ENTER key.

NOTE: Time in hours and minutes appears on the Main Auxiliary display. Each time the AUX key is pressed, the time updates. The time display will be Universal Time (UT) unless it has been set up for local time (AM/PM or 24-hour) in INIT.

Auxiliary 1 - Set Up

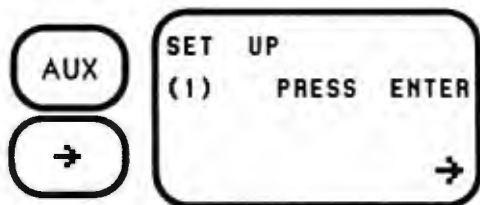
The Auxiliary 1 - Set Up function guides you through a number of customized features.

The following features are available in the Set Up:

- Terrain Setting
- Position Coordinates Displays
- Map Datum
- Magnetic Variation
- Distance and Speed Units
- Altitude Units
- Beeper
- Date Order
- Reset Factory Defaults

AUX

Displaying the Set Up Features



When you select AUX 1 - Set Up, this message displays.

- Press the ENTER and then the DOWN ARROW key to sequentially display the features.
- Use the RIGHT ARROW key to toggle the selections within each feature.



The ENTER key gets you into the auxiliary function. SET UP is the first AUX function.



The DOWN ARROW key then brings you to the next Set Up selection which in this case is Coordinates.

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 1000M to meet your needs.

SET UP WORKSHEET

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

TERRAIN SETTING

- INTERRUPTED
 OBSCURED
 CLEAR

COORDINATES

- MGRS
 LAT/LON
 UTM

GRID ACCURACY (If MGRS)

- 100M SQUARE
 1,000 M SQUARE
 10,000 M SQUARE
 10 M SQUARE

OR

LAT/LON DISPLAY (If LAT/LON)

- DEGREES/MINUTES
 DEGREES/MINUTES/SECONDS

MAP DATUM

- | | | | |
|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| <input type="checkbox"/> 25-NAD27 | <input type="checkbox"/> 37-YACAR | <input type="checkbox"/> 2-ARC50 | <input type="checkbox"/> 14-HJORS |
| <input type="checkbox"/> 26-ALASK | <input type="checkbox"/> 38-TANAN | <input type="checkbox"/> 3-AUSTR | <input type="checkbox"/> 15-HUTZU |
| <input type="checkbox"/> 27-MAUI | <input type="checkbox"/> 39-TIMBA | <input type="checkbox"/> 4-BUKIT | <input type="checkbox"/> 16-INDIA |
| <input type="checkbox"/> 28-OAHU | <input type="checkbox"/> 40-TOKYO | <input type="checkbox"/> 5-ASTRO | <input type="checkbox"/> 17-IRELA |
| <input type="checkbox"/> 29-KAUAI | <input type="checkbox"/> 41-VOIRO | <input type="checkbox"/> 6-DJAKA | <input type="checkbox"/> 18-KERTA |
| <input type="checkbox"/> 30-GRB36 | <input type="checkbox"/> 42-SDIND | <input type="checkbox"/> 7-EUROP | <input type="checkbox"/> 19-LIBER |
| <input type="checkbox"/> 31-QORNO | <input type="checkbox"/> 43-SDLUZ | <input type="checkbox"/> 8-GEO49 | <input type="checkbox"/> 20-USER |
| <input type="checkbox"/> 32-SIERR | <input type="checkbox"/> 44-SDTOK | <input type="checkbox"/> 9-GHANA | <input type="checkbox"/> 21-LUZON |
| <input type="checkbox"/> 33-CAMPO | <input type="checkbox"/> 45-SDWGS | <input type="checkbox"/> 10-GUAM | <input type="checkbox"/> 22-MERCH |
| <input type="checkbox"/> 34-CHUAA | <input type="checkbox"/> 46-WGS72 | <input type="checkbox"/> 11-GUNSG | <input type="checkbox"/> 23-MONTJ |
| <input type="checkbox"/> 35-CORRE | <input type="checkbox"/> 47-WGS84 | <input type="checkbox"/> 12-GUNSR | <input type="checkbox"/> 24-NIGER |
| <input type="checkbox"/> 36PROVI | <input type="checkbox"/> 1-ADIND | <input type="checkbox"/> 13-HERAT | |

SET UP WORKSHEET

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

- | | |
|-----------------------------------|---|
| MAGNETIC VARIATION | <input type="checkbox"/> M (AUTO MAGNETIC) |
| | <input type="checkbox"/> T (TRUE) |
| | <input type="checkbox"/> U (User Set ___ ° ___ 'E or W
(SPECIFY)) |
| DISTANCE/SPEED
DISPLAY | <input type="checkbox"/> Km (kilometers) and Km/HR
(kilometers per hour) |
| | <input type="checkbox"/> MI (statute miles) and MPH (miles
per hour) |
| | <input type="checkbox"/> NM (nautical miles) and KNOTS
(knots) |
| ALTITUDE UNITS | <input type="checkbox"/> meters |
| | <input type="checkbox"/> feet |
| BEEPER | <input type="checkbox"/> OFF |
| | <input type="checkbox"/> ON |
| DATE ORDER | <input type="checkbox"/> DAY/MONTH/YEAR |
| | <input type="checkbox"/> MONTH/DATE/YEAR |

Notes on the Set Up Features

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

Also pressing any function key while you are in the Set Up feature, the selection then displayed on the Set Up display will be implemented.

Position Coordinates Display

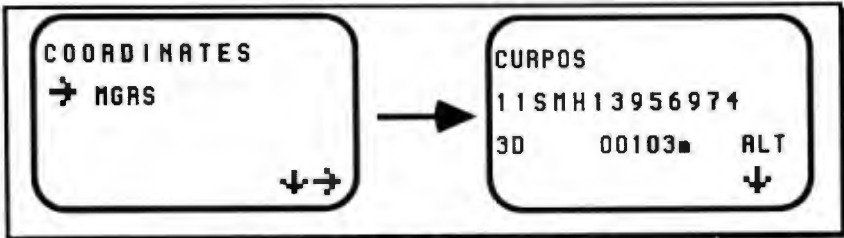
Three position coordinate options are available:

- MGRS (Military Grid Reference System)
- LAT/LON (Latitude/Longitude readings)
- UTM (Universal Transverse Mercator projections)

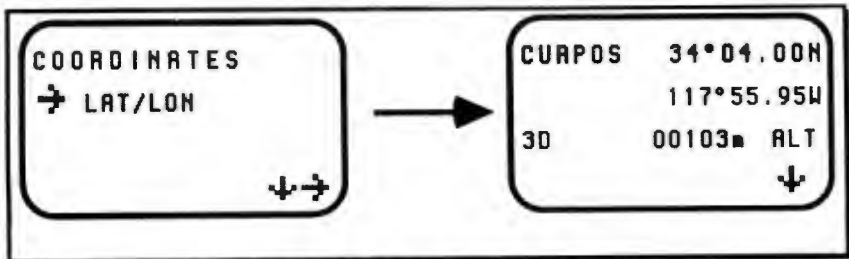
Once selected in AUX 1, the coordinates chosen will appear on all position displays:

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

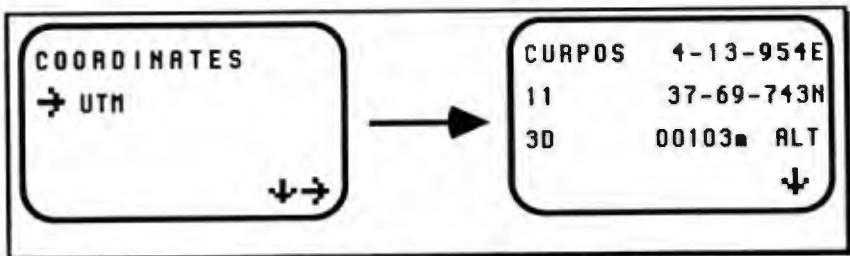
The options below are shown next to an example position display in that system.



Military Grid Reference System



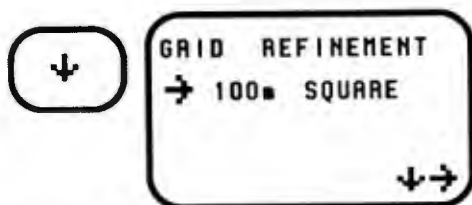
Latitude/Longitude



Universal Transverse Mercators

Grid Refinement

The military grid reference system permits readouts in four different display refinements.



Display options are shown in the table below.

GRID DISPLAY REFINEMENT OPTIONS	
Refinement	Example
10 Meter	10SER89543901
100 Meter	10SER895390
1,000 Meter	10SER9039
10,000 Meter	10SER94

NOTE: MGRS coordinates may be entered in any of these four refinements, regardless of the display refinement setting.

Lat/Lon Display

If latitude/longitude coordinates are chosen, the position can be displayed in degrees and minutes (DEG/MIN) or degrees/minutes/seconds (DEG/MIN/SEC).

DEG/MIN	34°05.85N
DEG/MIN/SEC	34°05'51N

Enter Datum

The NAV 1000M provides 47 geodetic map datums for use with charts and maps worldwide.

The Enter Datum option lets you select the datum that corresponds to the map you are using. In the legend of your map, you will find reference to the datum upon which the map is based. A given position can be accurately placed on a map only when you have the unit's datum setting matched to that of the map. See *Tips, Choosing the Right Datum* in Section 5 for more information on this subject.



At this display, you can use the Right Arrow to scroll to the datum that corresponds to the one used in your chart, or ...



Enter the number associated with that datum from the Set Up Worksheet and press ENTER.

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. (The default.)
Set (U)	A constant user-entered adjustment.
True (T)	No magnetic adjustment in readouts.

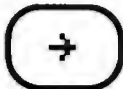
Magnetic Variation Settings



```

MAGNETIC  UAR
AUTO  MAG  (M)
                                     ↓ →
  
```

To select your heading display, press the RIGHT ARROW key to toggle to the magnetic variation choice.



```

MAGNETIC  UAR
SET  (U)  E14°38'
                                     ↓ →
  
```

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

AUX

1

SET VARIATION

E1_°_—'



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.

Beeper

The default for the NAV 1000M is silence. Use this feature to turn the beeper on. The unit will give you three types of beeper noises.

A Short Beep: Indicates key touch feedback or a completed fix.

A Long Beep: Indicates that you are locked out of the keyboard or that your fix has an accuracy warning.

Three Short Beeps when the batteries get low.

We recommend you turn the beeper on whenever possible to "hear" the unit's messages.

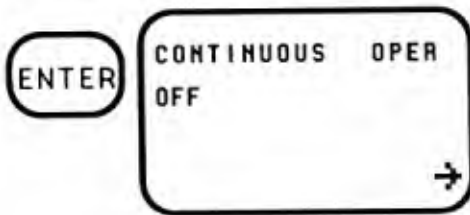
Auxiliary 2 - Continuous Operation

The AUX 2 - Continuous Operation function lets you temporarily set the unit for continuous operation when powered with its six internal AA cell alkaline batteries. The power plug symbol in the User Guide indicates how the unit works differently in continuous operation. For example, when the the POS key is pressed in continuous operation, the unit continuously updates the position and you can obtain velocity-related information.

When the unit is turned off or when the batteries get critically low (reach the second warning level), the unit will restore all of the PowerSaveR™ design options, like push-to-fix operation. This means when you push the POS key, you will get a single position fix.



When you select AUX 2 - Continuous Operation, this message displays.



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



Using external power, the unit remains in continuous operation

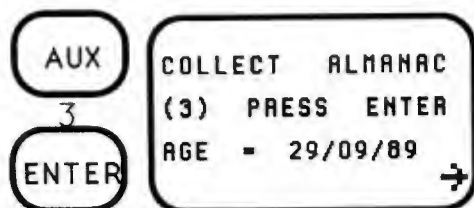
Auxiliary 3 - Collect Almanac

An almanac is like a bus schedule which the NAV 1000M stores in its memory. 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 AUX 3 - Collect Almanac function can also be used to update the Almanac, collecting the most recent information from the satellites. You can 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 Almanac is more than six months old.

For more information on the purpose and use of the Almanac, see *Collecting an Almanac* in the Training Guide booklet, and *All About GPS* in the Appendix.



When you select AUX 3 - Collect Almanac, this message displays. The date of the latest Almanac displays. If there is no Almanac, a date will not appear here.

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

ENTER

```
PRESS ENTER TO
COLLECT ALMANAC
AGE = 29/09/89
```

To start the Almanac Collect process ...

NOTE: Upon loss of memory, the "PRESS ENTER TO COLLECT ALMANAC" is the first display in AUX 3.

ENTER

```
SEARCHING
THE SKY
```

The ENTER key must be pressed one more time. At this point it begins to search the sky until it locates a single satellite.

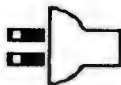
```
COLLECTING ALM
30/10/89 14:47UT
```

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

When you press AUX 3 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 AUX 3 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.



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

Updating Time with AUX 3

Universal Time must be correct within 15 minutes for the NAV 1000M to work properly. Occasionally, you may erase or change time in Universal Time. When this happens, you may restore correct time with confidence by using AUX 3.

Simply press AUX 3 and start the almanac collect. Once time appears on the "COLLECTING ALM" display, turn the unit off.

This process can be made more efficient by using AUX 4 to select a satellite directly overhead. Turn the others to OFF. Remember to reset the satellites to ON after completing this process.

Auxiliary 4 - Sat Status

AUX 4 is important for a variety of reasons. It can be used to determine:

- satellites listed in the Almanac as healthy by the GPS system operators,
- the elevation and azimuth of each satellite now above the horizon,
- the signal qualities of satellites used in the last fix,
- the satellites the unit is having difficulty using, those with weak SQs or set temporarily off.

The satellite status will have one of three messages:

ON which indicates the satellite is operating and that it is healthy.

TEMP OFF which means the satellite is temporarily being ignored by the unit because it is having difficulty with the signal, for example there is an obstacle (a mountain) between the satellite and the unit.

OFF is an option that can be selected by the user when he does not wish to use a particular satellite, for example when foliage makes the signal intermittent.

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

ON	Can be turned off
OFF	Can be turned on
TEMP OFF	Cycle power to turn ON again.

Rules for Changing Sat Status Messages

AUX

AUX

4

ENTER

SAT STATUS
(4) PRESS ENTER

AUX 4 or AUX and four Right Arrows bring you to this function.

ENTER

SAT SQ EL AZM
02 7 90° 318°T
0H

The first screen displays information about the satellite with the lowest number.

The sat number (PRN#) and the signal quality of the last fix.

The angle of elevation of the sat in the sky and the azimuth of its position.

SAT SQ EL AZM
03 7 90° 318°T
0H

The GPS system operators say the sat is healthy. The unit has encountered no problems with it.

Right Arrow to toggle to OFF
Down Arrow to next sat info.

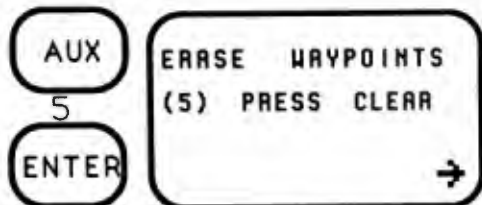
Interpreting the Sat Status Information



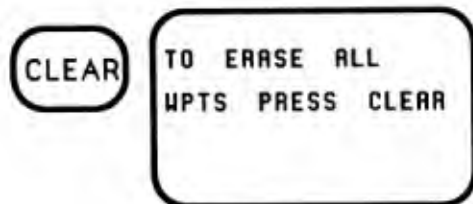
Down Arrow brings you to information on the next satellite. Sat 6 is just above the horizon (02°) at an azimuth of 83° True. It is not being used though it is healthy.

NOTE: The unit will not attempt to use a satellite until it reaches an elevation of 10°. It will continue using a satellite until it sets or is blocked by obstacles on the horizon. With a terrain setting of obscured, the unit first tries to select satellites above 20°.

Auxiliary 5 - Erase Waypoints



AUX 5, the Erase Waypoints function, automatically erases all waypoints, and your course.



The CLEAR key must be pressed twice to erase the waypoints.

AUX

CLEAR

ALL WPTS ERASED
READY

Auxiliary 13 - Clear Memory

If the need arises that you must quickly erase all memory, including last fixes and waypoints, use AUX 13.

Also there may be occasions when you think your NAV 1000M is behaving in a peculiar way, as indicated by an unusual symbol appearing in the display. (See *Trouble Shooting* in Section 5.)

Clearing memory is the best way to correct malfunctions related to the data. The AUX 13 function will delete the Almanac, erase the time and initialization position, remove all waypoints, clear the last fixes and course, and reset the factory settings.

AUX

13

ENTER

TO CLEAR MEMORY
PRESS CLEAR

To locate the clear memory function press AUX 13 and ENTER. (Right Arrow will not access this function.)

▲ WARNING: Record all waypoints before performing this function.



This intermediate display will appear.

Auxiliary 20 - Position for Tutorial

Auxiliary 20, the Tutorial Position function, creates a Last Fix position for the tutorial. After performing this function, the Last Fix of 22°58.77N, 108°26.87W (in NAD-27), 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 press AUX 20.

Refer to the *Tutorial* in the Training Guide for more information.

SECTION 5

TROUBLE SHOOTING AND TIPS

ERROR MESSAGES

The **Magellan GPS NAV 1000M™** has many helpful prompts to assist you in trouble shooting. These are a few:

"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. Turn the unit OFF and ON again thereby, resetting satellites set temporarily unhealthy.
2. Make sure the antenna is straight up. Remove obstruction or move the unit. (The antenna needs a clear view of the sky.)
3. Check the initialization position and time.
4. If using an exterior antenna, check connections.
5. Set the terrain setting to INTERRUPTED. Press POS again.
6. If these fail, collect a new Almanac.

"NOT ENOUGH SATS AVAIL"

There are insufficient satellites visible for taking a position fix, that is there are less than 3 satellites in 2D mode and 4 satellites in 3D mode.

Try this:

Check **1,2** and **4** above. Contact other users or the U.S. Naval Observatory to determine when satellites will be available at your location.

Make certain that all the sats in AUX 4 are set to "ON".

"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 POS three times before giving this error message.

Try This:

Re-initialize unit using the INIT key.
Collect Time using AUX 3.

"MEMORY LOSS"

The unit has lost all of its memory. Several conditions can cause the NAV 1000M to display the memory warning message: (1) before first use, (2) if you fail to replace batteries at the second low battery warning, (3) if you have cleared all memory by pressing AUX 13, or (4) 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 (INIT). Collect a new Almanac (AUX 3).

**"INITIALIZE -
PRESS INIT"**

The unit has detected something unexpected in the initialization position and time.

Try this:

Use INIT to reenter the correct information.

**"NEED ALMANAC
PRESS AUX 3"**

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 alamanac (AUX 3).



"REPLACE BATTS OR LOSE DATA"

When the 6 AA cell alkaline batteries are getting low, this symbol displays. The unit will run up to another 40 minutes continuously or take about 10 more single fixes with no danger of losing memory. We recommend that you be prepared at this point by loading the spare battery clip with fresh batteries.

Turn the unit OFF. As long as you do not operate the unit, the memory will be protected 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 position key. 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 *INIT* in Section 3 and *Tips* in Section 5.

Unit Will Not Stay On When You Have It Connected to an External Power Source

The unit will automatically switch to push-to-fix operation when the external power is interrupted. You are probably operating on the unit's internal batteries. Cycle power watching the self-test displays to confirm this. Check the external power source.

The Fixes Seem to Vary a Great Deal

The position accuracy of the NAV 1000M is affected by many variables, the most important of which is the GQ (geometric quality) and to some extent, the SQ (signal quality). Because of this variability, the specified accuracy of 30 meters RMS in 3D is a statistical rather than an absolute accuracy, and further assumes that GQ and SQ are both at least 7. This means that even under good conditions, not all fixes will be within 30 meters of the true position. However, a good rule of thumb is that approximately two-thirds of the fixes will be within 30 meters of the true position and about 95% of the fixes will be within 60 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 more under less favorable conditions.

When the Terrain setting (visibility) is turned to obscured, the unit only looks for satellites above 20° . It will choose the three (2D) or four (3D) that will give the best GQ (PDOP). Further, the NAV 1000M will hang on to the signals until the (GQ) drops to 1, at which time you may experience a substantial variation, e.g. ± 150 meters.

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

Receiver Is Turning Off

Entering certain functions, like SATS and AUXILIARY, will turn the receiver off after a few minutes. 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 NAV and VEL keys Will Not Work

There are several things you must know about the NAV function in addition to what is covered within *Navigation (NAV Key)* in Section 3.

1. Navigation requires that you enter a course 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 and bearing 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 0.3 Km/HR to get speed (SOG), ground course (COG), and steering.
5. Despite the speed of your vehicle, velocity related data is not available until the unit has taken two 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 0.3 kilometer per hour (Km/HR) 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 the numbers of satellites listed in AUX 4, Sat Status. Collect a new Almanac using AUX 3, 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 temperature 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 ON and OFF. 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 AUX 13. Refer to *AUX 13* in Section 4.

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

TIPS

Using the Unit Near the Poles

Only latitude, longitude readouts (not UTM or MGRS) are available north of 84°N and South of 80°S. Use AUX 1-Set Up-- to change to LAT/LON.

Note that all meridians of longitude converge at the North and South poles. Near the poles, a kilometer can span many degrees of longitude, so small changes in position can cause large variations. While the inherent measurement accuracy of the NAV 1000M 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 approximately 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 a few days back in time.

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° and 100°W and you had moved about 600 miles north, your new position would be 50°N and 100°W.

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 GPS NAV 1000 provides positions in 47 different map datums. 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 (47-WGS84) could differ by 300 meters or more from one calculated using another datum. Military grid 100,000 meter square references will change from one datum to another. Check the datum in the legend of your chart and the manuals of your other navigation equipment. Use AUX 1 in your NAV 1000M to select the correct datum.

Maps created by the U.S. Defense Mapping Agency can use one of 47 datums available in the NAV 1000M. The National Oceanic and Atmospheric Administration (NOAA) is presently changing its charts to NAD-83 which is the same as WGS-84 for all practical purposes. The bulk of NOAA charts remain in 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 9 for best results). Compare the position you obtained to the chart. If it doesn't match, try another datum in the NAV 1000M that you suspect is correct. Now compare the positions. If they match, you've probably located the right datum.

STORING YOUR 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 a NAV 1000M 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 desired waypoints. Reinitialize.

If you are storing the unit for less than three months:

1. Load new batteries (see *Loading Batteries* in this section) in the unit. This will preserve the stored waypoints, Almanac, and custom settings.
2. Place the unit in a NAV 1000M 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 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 which will eventually consist of 21 satellites and 3 spares in six 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.

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 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 NAV 1000M uses the C/A code.

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 30 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 ones, "reading" instead the next best satellite for determining the user's position.

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 30 meters or better are commonly obtained from C/A code GPS receivers. Repeatable accuracy, that is being able to return to the same spot, will also be experienced by GPS users.

Coverage.

The completed GPS constellation of 21 satellites plus spares will provide 24-hour continuous coverage world-wide. Unlike all other electronic navigation systems, the signal never weakens because of distance from the broadcast source.

Interference.

Another remarkable feature of GPS is its resistance to interference from conditions which disturb other electronic navigation systems: thunder, lightning, heavy weather, radio signals, on-board electronics, passing ships, on-shore electronic installations, ignition of the boat engines, portable radio receivers, and so forth.

The high frequencies (1227MHz and 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 the frequencies where it operates.

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. SatNav requires about 15 minutes even under good conditions to take a fix.

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 susceptible 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 - LAT/LON

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: _____

WAYPOINT LOG - UTM

WAYPOINT NAME: _____	DATE: __ / __ / __
EASTING __ - __ - __ E	ALTITUDE:
NORTHING __ - __ - __ N	_____ f or m
ZONE: __ NOTE: _____	DATUM: _____

WAYPOINT NAME: _____	DATE: __ / __ / __
EASTING __ - __ - __ E	ALTITUDE:
NORTHING __ - __ - __ N	_____ f or m
ZONE: __ NOTE: _____	DATUM: _____

WAYPOINT NAME: _____	DATE: __ / __ / __
EASTING __ - __ - __ E	ALTITUDE:
NORTHING __ - __ - __ N	_____ f or m
ZONE: __ NOTE: _____	DATUM: _____

WAYPOINT NAME: _____	DATE: __ / __ / __
EASTING __ - __ - __ E	ALTITUDE:
NORTHING __ - __ - __ N	_____ f or m
ZONE: __ NOTE: _____	DATUM: _____

WAYPOINT NAME: _____	DATE: __ / __ / __
EASTING __ - __ - __ E	ALTITUDE:
NORTHING __ - __ - __ N	_____ f or m
ZONE: __ NOTE: _____	DATUM: _____

WAYPOINT NAME: _____	DATE: __ / __ / __
EASTING __ - __ - __ E	ALTITUDE:
NORTHING __ - __ - __ N	_____ f or m
ZONE: __ NOTE: _____	DATUM: _____

WAYPOINT NAME: _____	DATE: __ / __ / __
EASTING __ - __ - __ E	ALTITUDE:
NORTHING __ - __ - __ N	_____ f or m
ZONE: __ NOTE: _____	DATUM: _____

WAYPOINT NAME: _____	DATE: __ / __ / __
EASTING __ - __ - __ E	ALTITUDE:
NORTHING __ - __ - __ N	_____ f or m
ZONE: __ NOTE: _____	DATUM: _____

WAYPOINT LOG - MGRS

WAYPOINT NAME: _____	DATE: __ / __ / __
COORDINATE: ZONE: _____	GRID _____
EASTING/NORTHING: _____	_____
ALTITUDE: _____ f or m	DATUM _____

WAYPOINT NAME: _____	DATE: __ / __ / __
COORDINATE: ZONE: _____	GRID _____
EASTING/NORTHING: _____	_____
ALTITUDE: _____ f or m	DATUM _____

WAYPOINT NAME: _____	DATE: __ / __ / __
COORDINATE: ZONE: _____	GRID _____
EASTING/NORTHING: _____	_____
ALTITUDE: _____ f or m	DATUM _____

WAYPOINT NAME: _____	DATE: __ / __ / __
COORDINATE: ZONE: _____	GRID _____
EASTING/NORTHING: _____	_____
ALTITUDE: _____ f or m	DATUM _____

WAYPOINT NAME: _____	DATE: __ / __ / __
COORDINATE: ZONE: _____	GRID_____
EASTING/NORTHING: _____	_____
ALTITUDE: _____f or m	DATUM_____

WAYPOINT NAME: _____	DATE: __ / __ / __
COORDINATE: ZONE: _____	GRID_____
EASTING/NORTHING: _____	_____
ALTITUDE: _____f or m	DATUM_____

WAYPOINT NAME: _____	DATE: __ / __ / __
COORDINATE: ZONE: _____	GRID_____
EASTING/NORTHING: _____	_____
ALTITUDE: _____f or m	DATUM_____

WAYPOINT NAME: _____	DATE: __ / __ / __
COORDINATE: ZONE: _____	GRID_____
EASTING/NORTHING: _____	_____
ALTITUDE: _____f or m	DATUM_____

GLOSSARY

ACQUISITION

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

ALMANAC

Information the NAV 1000 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.

BEARING

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

C/N₀

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

COURSE

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

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.

FIX

A single position with latitude, longitude, altitude, time, and date. When recorded on a chart, it may include speed and ground course.

GEOID

A model of the distortions of the earth's surface due to global gravity variation. Primarily used to establish sea level at specific locations.

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).

HDOP

Horizontal Dilution of Precision is a measurement of possible error related to the geometry of the satellites; it includes only the horizontal (Lat/Lon) aspect of the error.

HEADING

The direction your vehicle is oriented.

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).
MGRS	Military Grid Reference System is based on UTM data but presented in a form specific to U.S. military maps.
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 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.

SEARCH

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

SPEED

The speed over ground (SOG) is the distance you have moved over the ground floor divided by the time required to move that distance. This is an instantaneous measurement.

TERRAIN SETTING

A set up feature that lets the user program the NAV 1000M to pick the best satellite search strategy for the environment. Refer to *Terrain Setting* in Section 2.

3 D

Three dimensional, referring to a latitude, longitude, and altitude position, requiring four GPS satellites in view.

TOGGLE	To switch back and forth between two settings (for example, north and south). Information is toggled with the RIGHT ARROW key.
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. Refer to <i>Time</i> in Section 2.
UTM	Universal Transverse Mercator coordinate given in meters contains an easting (meter east) and a northing (meters north) within one of 60 zones. (Refer to <i>Position Display</i> in the Training Guide.)
WAYPOINT	A position stored in the unit's memory.

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