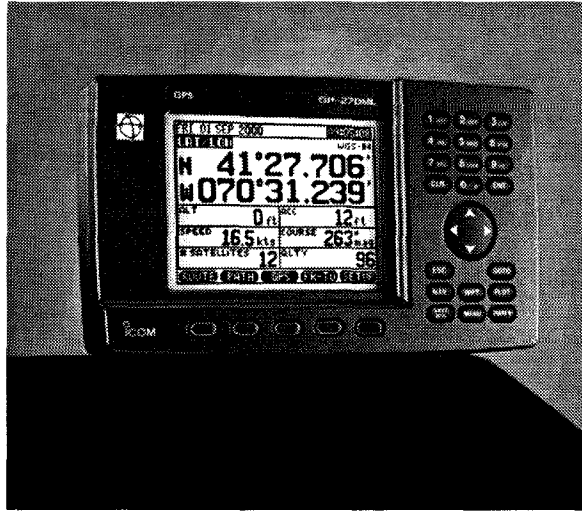# GP-270ML

HIGH RESOLUTION GRAPHIC RECEIVER

OPERATORS MANUAL

○ iCOM

WELCOME TO ICOM AMERICA'S FAMILY OF PRODUCTS

Thank you for purchasing your new ICOM GP-270ML GPS receiver. ICOM products are known around the world as the best in marine communications and navigation. If you have questions concerning other ICOM products, or if you still have unanswered questions about your new GP-270ML after reading this operators manual, please contact us or visit our Web site.

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The GP-270ML GPS receiver is only an aid to navigation and does not reduce the need for caution or judgement. No electronic navigation system is perfectly reliable; outputs may occasionally be incorrect. The prudent navigator should never rely solely on one device, to the extent of endangering life or property. Wherever possible, compare the GPS readings with other information, including LORAN, dead reckoning, visual sightings, and charts. Always resolve discrepancies before continuing your journey.

- When the warning display "NAV DATA MAY BE INACCURATE" is shown periodically, the outputs may be in error, and should not be used for navigation.

- GPS signals may become less reliable close to tall structures, under trees, and inside buildings or vehicles, when the view of the sky is obscured.

- Position and velocity accuracy change with time, as the satellites change their positions in the sky. Errors will occasionally be much larger than normal, when the satellite geometry is unfavorable.

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GETTING STARTED

1.1 NAVIGATION

The purpose of a GPS receiver is to help you with navigation, so we will start out by reviewing some of the terms used in this manual.

NAVIGATION is the process of determining your position, plotting a course over which you wish to travel, and steering your vessel over that course.

POSITION is your exact location on the Earth. For marine navigation, this is expressed as two coordinates, latitude and longitude.

LATITUDE is the number of degrees you are north or south of the Equator, and lines of latitude are sometimes called parallels.

LONGITUDE is the number of degrees you are east or west of the zero degrees longitude line, which passes through Greenwich, England. Lines of longitude are sometimes called meridians, and they all pass through both the North and South poles.
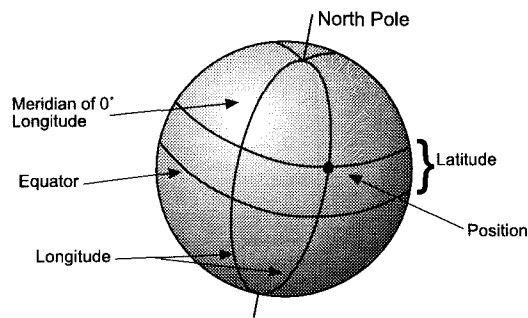
WAYPOINTS are precisely specified locations on the Earth. They can be used to mark your destination (where you want to go), or points along the route to your destination. Each waypoint can be specified by its latitude and longitude.

HEADING is the direction your boat is pointing.
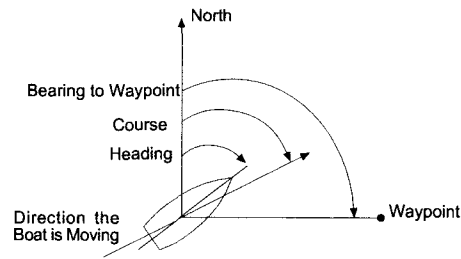
COURSE (sometimes called TRACK) is the direction your boat is moving over the surface of the Earth.

BEARING is the direction to a specific point, such as a waypoint or destination.

1.2   GPS

GPS is short for the Global Positioning System. It consists of 24 satellites, which transmit radio signals that can be used to compute position, course, and speed.

A GPS receiver receives the signals from the satellites, and computes position, course, and speed. After you turn power on, it takes anywhere from a few seconds to a few minutes to find the GPS signals, and compute the first position fix. The readings from a GPS receiver will have the following typical errors:

Position	50 meters (164 feet)
Speed	0.5 knots

Errors may sometimes be much larger, when the satellite positions in the sky are not favorable, or when the lines of sight from the satellites to the antenna are obstructed by masts, boat structure, trees, buildings, or bridges.

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PWR   The POWER key turns the GPS on, and controls the intensity of the keyboard/display lighting. Briefly pressing the POWER key several times will step through the available levels of keyboard/display lighting. To turn the GPS off, hold the POWER key down for three seconds.

NAV   Pressing the NAV key will step through the display pages showing position, course, speed, and steering information.

WPT   Pressing the WPT key will bring up the waypoint and light pages.

PLOT   The PLOT key brings up the plot of present position and previous ground track. Zooming out to a large scale will show coast lines, country, and state boundaries. Pressing the PLOT key again will expand the plot area by deleting the numerical information shown above the plot.

MENU   The MENU key brings up the main menu, from which submenus can be selected. The main menu and submenus allow for the selection of display pages that are not often used, as well as the control and setup of all of the choices and variables in the GPS.

SAVE   The SAVE key is used to save present position in a new waypoint. Saved waypoints are automatically given the names S001, S002, S003, etc. Pressing the SAVE key twice executes the MAN OVER-BOARD function, which saves present position and immediately provides a steering display back to the saved position.

GO TO   The GO TO key is used to go to a waypoint, a route, or a path. Bring up the page which shows the waypoint, route, or path, and press

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the GO TO key. The display will then give you steering instructions to go to the waypoint, or to the closest point of the route or path.

ESC   The ESCAPE key is used to go backward in the display sequence; That is, to escape from the currently displayed page to the previous page.

▲ ▼
UP/DOWN
    These keys are used to highlight a field, and to move the cursor UP and DOWN (panning) when in the plot display page.

◄ ►
LEFT/RIGHT
    These keys are used to pan the cursor to the LEFT or RIGHT in the plot display,and to move the character cursor to the left or right when entering waypoint names.

ENT   The ENT key is used to select a highlighted item, to start data entry, and to finish data entry.

CLR   The CLEAR key can be used to start data entry in a field, by first clearing the field. The ENT key can also be used, in which case the field will not be cleared.

0 – 9   The 10 numbered keys are used to key in numbers, just like an electronic calculator. They can also be used to key in letters, by pressing the key several times to step through the three letters shown on the key.

The five keys under the display, with no key legends, are called "soft" keys, because their functions are defined by software. Their function is shown on the display, just above each key.

1.4 TURNING POWER ON AND OFF

Power is turned on by briefly pressing the PWR key. The "ICOM GP-270ML" page will be displayed for a few seconds, followed by the satellite status page.

4
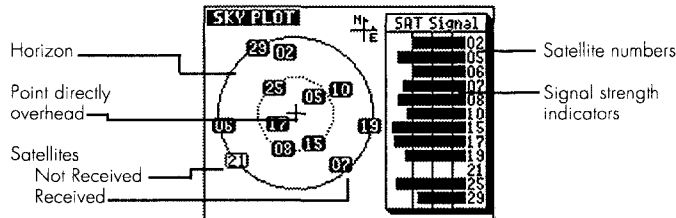
The satellite status page is shown until enough satellite signals are found to compute a position fix, when it will change to the position page.

Position
(latitude and
longitude)

Speed-over-the-ground

Number of satellites
received

```
SUN 24 SEP 2000        13:54:39
LAT/LON            WGS-84
N  41°32.451'
W070°36.784'
ALT        ft  ACC      12ft
SPEED  15.8kts  COURSE  000°mag
# SATELLITES  12  QLTY      96
ROUTE  PATH  GPS  FR-TO  SETUP
```

Date and local time

Expected accuracy of
position fix

Course-over-the-ground

Signal quality
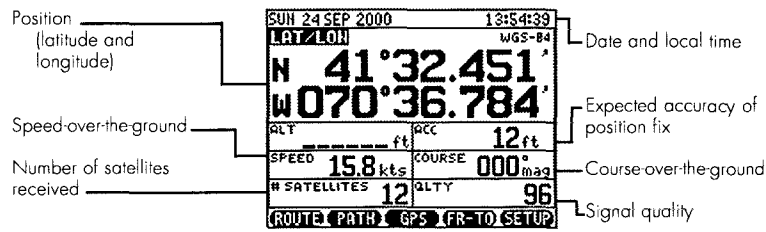
The number displayed after ACCURACY (ACC) is the expected accuracy of the position fix. The actual position error will be less than the accuracy number about half of the time, and greater about half of the time.

The QUALITY (QLTY) number shown on the bottom right part of the display tells you how reliable the position fix is likely to be.

QUALITY POSITION FIX RELIABILITY

40-99   Good position fix all the time

30-40   Occasional times of no position fix

20-30   Frequent times of no position fix

0-20   Usually no position fix

The GPS will start searching for the satellites immediately after it is turned on. The first time it is turned on, (or whenever it is moved more than 100 miles from where it was last operated) it will take two to five minutes to find the satellites and compute the first position fix. When it does, the display will shift automatically to the position page.

The GP-270ML is turned off by pressing the PWR key, and holding it down for three seconds.

1.5   ADJUSTING THE LIGHT

After power is turned on, the light intensity can be adjusted with the PWR key. Pressing this key a number of times will step the light intensity up to its maximum value, turn it off, and then increase it again.

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Position will be displayed automatically, as soon as it is first computed. The position page can be brought up at any time by pressing the NAV key.

The displayed latitude and longitude can be used to find your position on a marine chart.
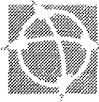
When navigation pages are selected before the GPS has had time to acquire enough satellites to compute an accurate position fix, a warning message "NAV DATA MAY BE INACCURATE" will be shown periodically. Whenever this message is shown, don't use the displayed information for navigation purposes.

1.7   SETTING TIME

The first NAV page shows the local time in the upper right hand corner. To set the local time:

1.   Press the NAV key once, to bring up the first NAV page.

2.   Press the UP or DOWN arrow keys to move the highlight to the time field, in the upper right corner of the display.

```
SUN 24 SEP 2000            13:54:39
LAT/LON                       WGS-84
N  41°32.451'
W 070°36.784'
ALT           ft  ACC        12ft
SPEED  15.8kts   COURSE  000°mag
# SATELLITES  12  QLTY       96
ROUTE  PATH  GPS  FR-TO SETUP
```

3.   Press CLR to begin the time entry.

4.   Determine your local time accurate to within ten minutes. It must be in a 24 hour form (IE, 2:00 pm is entered as 14:00).

5.   Key in the time using the numbered keys. For example, to key in 2:35 pm, press 1, 4, 3, 5.

6.   Press the ENT key to complete the time entry.

If the receiver is tracking any satellites, the approximate time you entered will jump immediately to the correct time, accurate to within one second, with hour and half hour time zones taken into account.

If you are in a time zone with 15 minute offsets from Greenwich time, read about GMT Offset in Section 9.1.
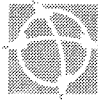
NOTE: When it is time to set clocks forward or back because of Daylight Savings Time, just enter the new time in the first NAV page.

You are now ready to begin navigating.

As soon as you are more familiar with the GP-270ML, you can review all of the SETUP possibilities, and customize your GPS to give you the most useful displays. For now, we will go on and learn more about using the GPS for navigation.

1.8   ENTERING A WAYPOINT

Suppose that you're starting out from Falmouth, Massachusetts, and want to go to the harbor entrance buoy at Edgartown, on Martha's Vineyard. You look up the latitude and longitude coordinates of the buoy on a chart, and find that they are:

Buoy   Latitude   n 41° 24.47'
            Longitude   w 070° 29.35'

To be able to navigate to the buoy, you'll first have to enter the buoy coordinates into a waypoint.

1. Press the WPT key to bring up the first waypoint page.

2. Press the NEW key, under the display.

3. A new waypoint will now be created. The highlight will be in the name field, which has been set to a default value of WP001. We want to name the new waypoint BUOY. Press CLR to begin entry of the waypoint name.

Name — `WAYPT` `WP001` ——— Comment field (16 characters)

Waypoint icon ┐ ▫ ――――――――――
Input as PP 24 SEP 00 13:54 —— Date and time of creation

How the waypoint was created ┘ `LAT/LON` **N 41°32.451'**

Waypoint lat/lon ┘ **W070°36.784'** ——— Fix accuracy when waypoint was
created from present position

`ALT` _____ ft `ACC` **12** ft

Range to waypoint from —— `RNG` **0.00** nm `BRG` **016°** mag —— Bearing to waypoint, from
present position present position

`NEAR` `Recall` `LIST` `NEW` `MORE`

4. To set B into the first character of the name, press the key with the desired letter on it (ABC1, in this case) a number of times until the desired letter appears on the display.

   A   Press once
   B   Press twice
   C   Press three times
   1   Press four times

5. Press the right arrow key once to move the highlight one space to the right.

6. To set up the letter U, press the STU 7 key a number of times until U appears on the display (three times, in this case).

7. Press the right arrow key once to move the highlight one space to the right.

8. Continue until the desired name is on the display. If you make a mistake, you can press the left arrow key to move the cursor to the left.

9. Press ENT to complete entry of the waypoint name.

`WAYPT` **BUOY**
▫ ――――――――――
Input as PP 24 SEP 00 13:54
`LAT/LON` **N 41°32.451'**
W070°36.784'
`ALT` __.__._ ft `ACC` **12** ft
`RNG` **0.00** nm `BRG` **016°** mag
`NEAR` `Recall` `LIST` `NEW` `MORE`
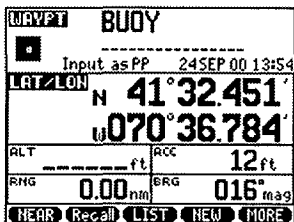
The highlight will move to the waypoint icon field. To enter an icon:

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1. Press ENT to begin entry of an icon.

2. Press the four arrow keys to highlight the icon you want. Then press ENT.
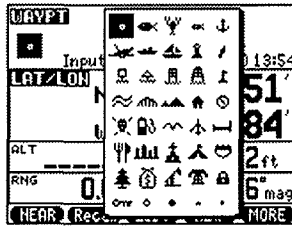
The highlight will move to a 16 character comment field, that can be used to store a note or comment about the waypoint. A comment is entered exactly the same as a waypoint name. Note that the comment field, or any other field, can be skipped by pressing the up or down arrow keys, to move the highlight to another field.

After the comment entry, the highlight will move to the latitude field. To enter the latitude:

1. Press CLR to start the entry process. The latitude field will be filled with zeroes, and the cursor will be on the first digit.

2. The default choice is north latitide. If you want to change this to south, press the left arrow key to move the cursor to the N/S field, and then press the 7 STU key. An S will be put in, and the cursor will move to the first number to be entered.

3. Key in the desired latitude, using only as many digits an you need. For example, to put in a latitude of n 41° 24.47', press 4, 1, 2, 4, 4, 7.

4. Press ENT to complete the latitude entry.

The highlight will be in the longitude field. Repeat steps 1-4 to enter the longitude.

You have now entered a waypoint, and are being shown the distance and

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magnetic bearing angle from your present position to the waypoint.
This corresponds to the following chart.
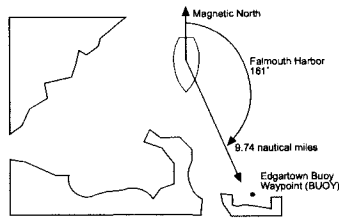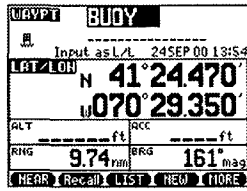
1.9   SAVING YOUR STARTING POSITION

Before starting your journey to the Edgartown buoy, which is in waypoint
BUOY, it's a good idea to save your starting position. Press the SAVE key.
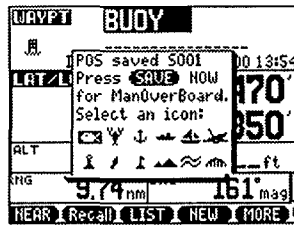
That's all there is to it! Your starting position from Falmouth Harbor is now
saved in waypoint S001. Let's change the name from S001 to HOME.

1.   Press WPT to bring up the waypoint page.

2.   Press RECALL to recall the last saved waypoint.

3.   Press the up arrow or down arrow keys to move the highlight to the
     name field.

4.   Press CLR, and then enter the name HOME, just as you entered the
     name BUOY a few minutes ago.

5.   Press ENT to complete the entry.

10
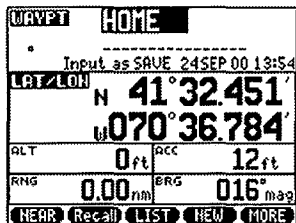
1.10 STEERING TO A WAYPOINT

To go to waypoint BUOY:

1. Bring up the first waypoint page by pressing WPT.

2. Press the left or right arrow keys a number of times, until waypoint BUOY is displayed.

3. Press the GO TO key. The GPS will now set up a courseline from your present position to waypoint BUOY, and switch to the steering page.
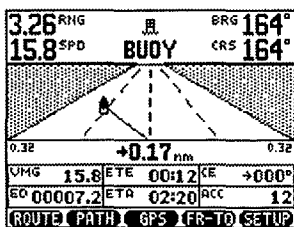
To steer to waypoint BUOY, start off on a compass course of about 161 degrees. Steer your vessel to keep the boat icon in the middle of the screen on the center line. This will keep you on a straight line from your starting point at Falmouth Harbor (HOME), to Edgartown buoy (BUOY).

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A little while later, the steering page reads as shown below:
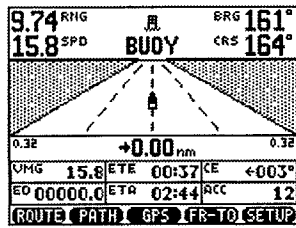
This corresponds to the following situation:
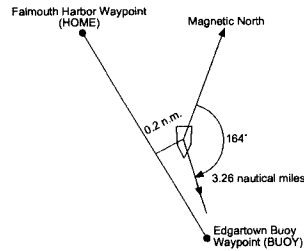
You have drifted about 0.2 miles to the left of the courseline from HOME to BUOY. Steer right to get back on course. The distance to the Edgartown buoy is 3.26 nautical miles.

Keep going until the distance shown is zero, and you will be at BUOY. (Edgartown buoy)

There is another, much simpler steering page that can be used to steer to a waypoint. While displaying the "highway" steering page shown above, press the NAV key once to get the simple "arrow" steering page.
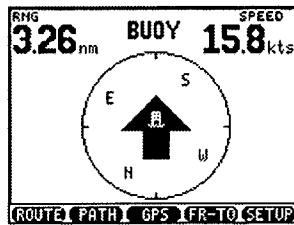
The arrow points toward the waypoint. If the arrow points to the right, turn to

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the right. If the arrow points to the left, steer to the left. You are on course when the arrow points straight up.

The "arrow" page also shows the distance to the waypoint, the four major compass directions, and speed over the ground.

1.11 RETURNING HOME

If you remember, you saved your position in waypoint HOME, when you began your journey at Falmouth Harbor. To return home:

1. Press GO TO.

2. A list of waypoint names will appear. Press the up or down arrow keys several times to put the highlight on HOME.

3. Press GO TO. (Pressing ENT will work, also.)

This will set up a courseline from present position to HOME, as shown below.
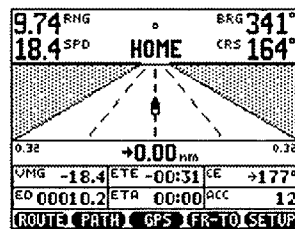
1.12 THE WORLD MAP

If you select the plot page, and press ZOOM ▲ a number of times to zoom out to a very large scale, you will see the world map. This shows all the coastlines of the world, as well as some country and state boundaries. This page is useful to show your rough progress along a coastline, to help you avoid large navigation errors.

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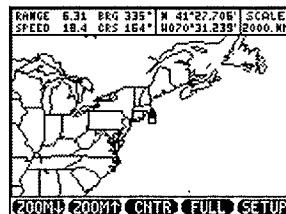
BASIC OPERATION

2.1   SUMMARY OF BASIC OPERATION

Turn power on by pressing the PWR key.
The ICOM GP-270ML screen will appear for approximately three seconds.
Then the "Satellite Status" page will appear until enough satellite signals are
found to compute a position fix, when the unit will automatically display the
position page.
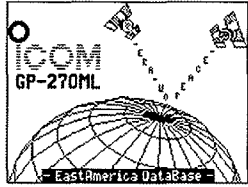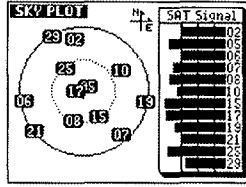
THREE SECONDS   ACQUIRING SATELLITES   WHEN POSITION FIX
                                               IS READY
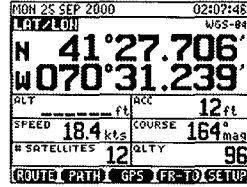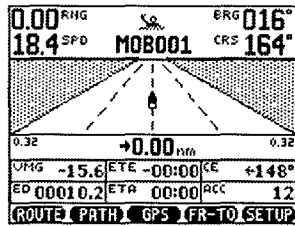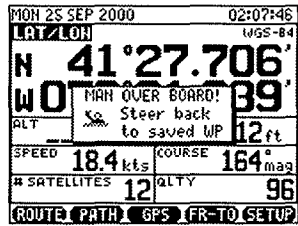
To save a positon, simply press the SAVE/MOB (man overboard) key.
In an emergency, to mark a man-overboard location, press the SAVE/MOB
key twice.

Plot Pages
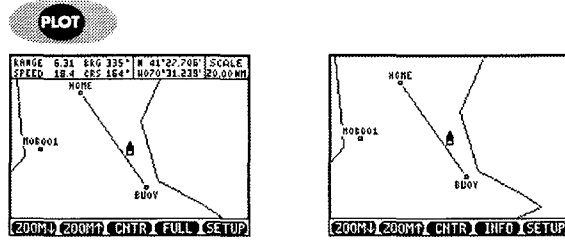
Navigation Pages
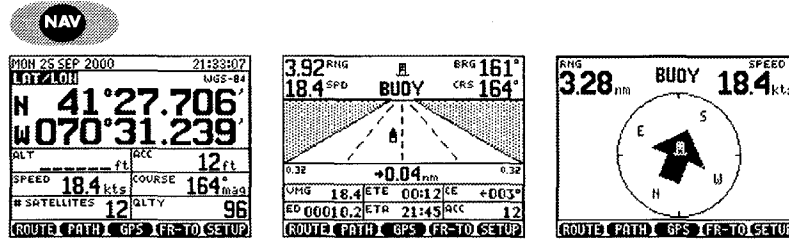
Menu Page
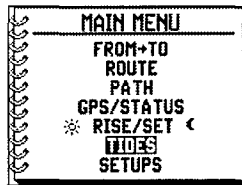
Waypoint Pages
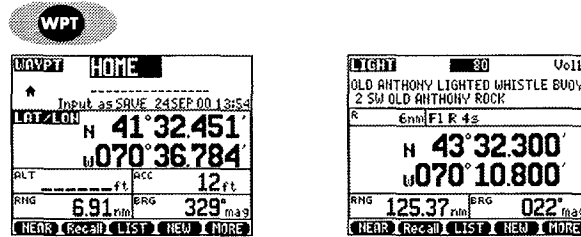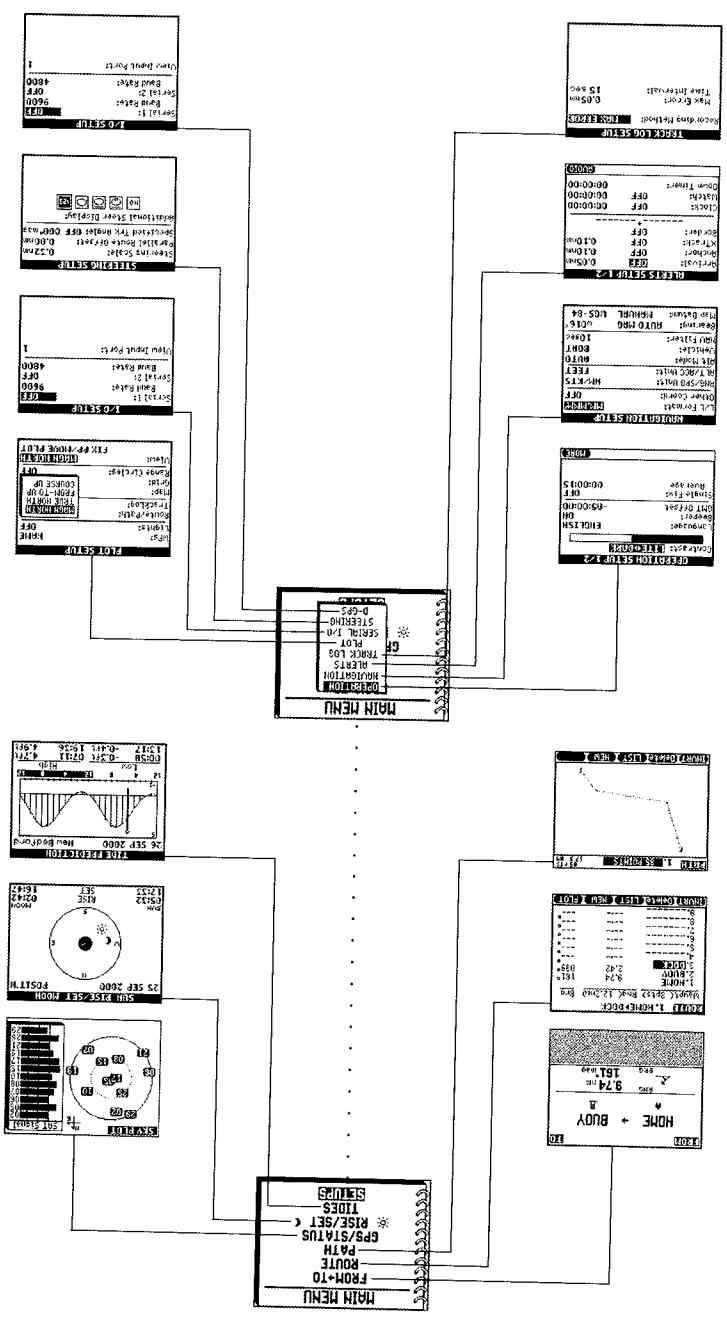
The operation of the GP-270ML can be customized to suit your needs, in the following ways:

1.   Display pages can be added and deleted.

2.   The coordinates used for input and display of position can be changed.

3.   The units used for input and display of navigation data can be changed.

4.   The parameters controlling navigation, steering, plotting, data logging, and waypoint navigation can be changed.

5.   Serial data input and output formats can be specified.

All of these things are controlled through the SETUP lists, which set up the operation of the GPS. All of the SETUP possibilities, and how to use them, are presented in Chapter 8.

If you have some special requirements, or if you are curious about the things that the GP-270ML can do, read Chapter 8. This will enable you to set up the GPS to best suit your needs.

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3.1   WAYPOINTS

While navigating, it is important to keep track of where you are going and where you have been. It is convenient to keep a list of important or often used locations, such as local buoys and places that you go to frequently.

That is the purpose of the waypoint storage in the GP-270ML – to keep a list of important locations, stored in your GPS.

The GP-270ML has room for 500 user-programable waypoints. For each waypoint, there is space for its latitude, longitude, and altitude; a seven character name; the date and time it was created; how it was created; and up to sixteen characters for comments.

3.2   CREATING A NEW WAYPOINT

To create a new waypoint:

1. Press the WPT key to bring up the first waypoint page.

2. Press the NEW key, under the display.

3. A new waypoint will now be set up with a default name of WP001, or a similar name. The lat/lon will be set to your present position, and the highlight will be on the name field.

```
┌─────────────────────────┐   ┌─────────────────────────┐
│ WAYPT  -START-          │   │ WAYPT  WP001            │
│ o    ----------------   │   │ o    ----------------   │
│    Input as PP  26SEP 00 00:30│  Input as PP  24SEP 00 13:54│
│ LAT/LON                 │   │ LAT/LON                 │
│      N 41°27.695'       │   │      N 41°32.451'       │
│     w070°35.178'        │   │     w070°36.784'        │
│ ALT         ft ACC   12ft│  │ ALT         ft ACC   12ft│
│ RNG  3.53nm BRG 182°mag │   │ RNG  0.00nm BRG 016°mag │
│ [NEAR][Recall][LIST][NEW][MORE]│ [NEAR][Recall][LIST][NEW][MORE]│
└─────────────────────────┘   └─────────────────────────┘
```

Now enter the following information:

A Name (up to 7 characters)
B Icon
C Comment (up to 16 characters)
D Latitude
E Longitude

If you do not remember how to key in the entries, read Section 1.9, which gives detailed instructions. If you are in a hurry, you can leave the waypoint name at the default value by pressing the down arrow key to skip over the name entry. You can also use the down arrow key to skip over any entry that you want to leave at the default value.

To change a waypoint name after the waypoint has been created:

1. Display the desired waypoint.
2. Press the down arrow key several times, until the highlight is in the name field.
3. Press CLR to start the name entry.
4. Key in the desired name.
5. Press ENT to complete the name entry.

If you do not want to enter an icon or a comment, press the down arrow key to skip over these fields.
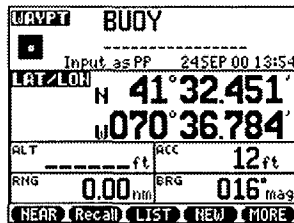
3.3   DATE AND TIME OF WAYPOINT CREATION

Each time a waypoint is created, all the data you entered for the waypoint are stored in the waypoint memory for future use. In addition to the data you entered, the GPS automatically stores:

1. The date and local time of waypoint creation.

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To look up a waypoint by name, press the WPT key to bring up the first waypoint page. Then press LIST to bring up the waypoint list.

You can now press the up or down arrow keys to scroll up or down through the alphabetical list of waypoint names. If you have a great many waypoints, you can press the right arrow key to move the highlight to the letter index, the up or down arrow keys to go the first letter of your waypoint name, and ENT to start the list with that letter. If you have several hundred waypoints, this can speed the process.

3.5   THE LIST OF NEAREST WAYPOINTS

Another way to look up waypoints is to display a list of the 20 waypoints closest to present position, or closest to a specified waypoint.

To do this, press the NEAR key to bring up the 20 nearest waypoints/lights page.

Now move the highlight to SELECT WAYPOINTs NEAREST TO PRESENT POSITION, and press ENT.

A list of the 20 closest waypoints will come up, arranged in order of nearness.

To select one of the waypoints in the list, press the up or down arrow keys to highlight the desired waypoint. You can then press ENT to show the data for that waypoint, or GO TO, to go to that waypoint.

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```
┌─────────────────────────┐   ┌─────────────────────────────┐
│ ▐Nearest 20▌             │   │▐NEAREST WAYPOINTs to POSIT'N▌│
│                         │   │  Waypoint   Range   Bearing  │
│ WAYPOINTs  to Present   │   │ 1. ▐BUOY▌    0.80    165°    │
│ LIGHTs     Position     │   │ 2. DOCK      1.80    345°    │
│                         │   │ 3. COVE      6.78    308°    │
│ WAYPOINTs  to Waypoint  │   │ 4. BIGTUNA   9.04    242°    │
│ LIGHTs     ▐BIGTUNA▌    │   │ 5. HOME     10.4     330°    │
│                         │   │ 6. _____   0.00    000°    │
└─────────────────────────┘   │ 7. _____   0.00    000°    │
                              │ 8. _____   0.00    000°    │
                              │ 9. _____   0.00    000°    │
                              │10. _____   0.00    000°    │
                              └─────────────────────────────┘
```

3.6   GOING TO A WAYPOINT

To go to a waypoint:

A   If the first waypoint page is on the display:

1. Press the left or right arrow keys to bring up the waypoint you want to go to.

2. Press GO TO.

B   If a waypoint list is on the display:

1. Press the up or down arrow keys to move the highlight to the waypoint you want to go to.

2. Press GO TO.

C   If neither the first waypoint page or a waypoint list is on the display:

1. Press GO TO to bring up the waypoint list. Then follow the instructions in B, above.

3.7   THE SAVE KEY

To save your present position, press the SAVE key. This will create a new waypoint, whose name is automatically assigned to be S001, S002, S003, etc. The number is increased by one each time your position is saved.

A new display page will appear which tells you that your present position has been saved, and the name of the waypoint in which it was saved. An icon can now be assigned from that page, or you can wait until later to

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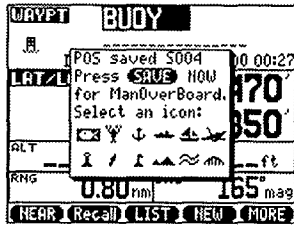
All you have to do to save your present position at any time is to press the SAVE key.

To find your saved waypoint later:

1. Press RECALL to bring up the last saved waypoint.

Pressing RECALL several more times will bring up the second last saved waypoint, third last saved waypoint, and so forth. The date and time each point was saved will be shown.

3.8   MAN OVERBOARD

If a person falls overboard, immediately press the SAVE key twice in quick succession. The first press will save your present position, and the second press will set up the steering display to show you how to steer back to the saved position.
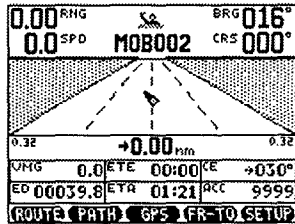
3.9   DELETING A WAYPOINT

To delete a waypoint:

1. Press WPT to bring up the first waypoint page.

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2. Press the MORE key.

3. A window with several choices will pop up. Press the DOWN arrow key to move the highlight to DELETE, and press ENT.

4. A window with a waypoint list will appear. Press the UP or DOWN arrow keys to move the highlight to the name of the waypoint you want to delete, and press ENT.

5. A window will appear, asking if you want to delete that waypoint. Press the DOWN arrow key to select YES, and then press ENT. The waypoint will then be deleted.

3.10 DELETING ALL WAYPOINTS

Instructions for deleting all waypoints are given in Section 8-1.

3.11 RANGE AND BEARING FROM ONE WAYPOINT TO ANOTHER
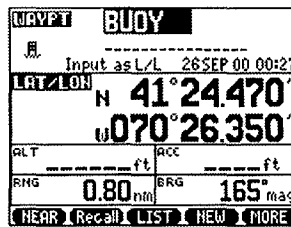
1. Press WPT to bring up the first waypoint page.

2. Press the the MORE key.

3. The bottom portion of the page shows a FROM and a TO waypoint.

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Press the DOWN arrow key to move the highlight to the FROM field, and press ENT.

4.   Press the UP and DOWN arrow keys to select the desired FROM waypoint, and press ENT.

5.   Press the DOWN arrow key to move the highlight to the TO field. Press the UP or DOWN arrow keys to select the desired TO waypoint, and then press ENT.

The display will now show the range and bearing from one waypoint to another. Setting up this page does not change the FROM and TO waypoints used for navigation.

3.12   OTHER METHODS OF CREATING WAYPOINTS

To create waypoints using MGRS coordinates, UTM coordinates, or LORAN TD coordinates, the SETUP controls that enable the GP-270ML to use these coordinate systems must be turned ON. The procedure for doing this is given in Section 8.2.

To create waypoints by methods other than lat/lon:

1.   Press WPT to bring up the first waypoint page.

2.   Press the MORE key.

3.   Press the down arrow key to move the highlight to MAKE NEW WAYPOINT. Press ENT.

4.   Press the up or down arrow keys to move the highlight to the desired method of waypoint creation, and press ENT. This will yield a display page showing the coordinates and information required for each method of creation.

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Data to be input for each method of waypoint creation:

1. LAT/LON
   name
   icon
   comment
   latitude
   longitude

2. MGRS
   name
   icon
   comment
   grid zone
   100,000 meter square designator
   easting
   northing

3. UTM
   name
   icon
   comment
   grid zone (Central Meridian is computed automatically)
   easting
   northing

4. LORAN TDs
   name
   icon
   comment
   GRI
   TD1
   TD2

5. REFERENCE RANGE/BEARING
   range
   bearing
   reference: present position, or waypoint. If waypoint, select waypoint
   from list
   name
   icon
   comment

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6. PLOTTER
    pan to desired location, press ENT
    name
    icon
    comment

7. LIGHT LIST
    scroll to desired light name, press ENT
    change name, if desired
    icon
    comment

8. PRESENT POSITION
    name
    icon
    comment

THE LIGHT LIST

4.1 BUILT-IN LIGHTS (AND BUOYS)

The GP-270ML memory contains information about most of the navigation lights and main harbor entrance buoys for one of the following regions;

Region	Number of lights (and buoys)
North/South America	22000
Europe/Asia/Africa/Australia	30000

Some buoys are not included because their position varies from year to year, or because their latitude and longitude are not published.

The lights and buoys are actually built-in waypoints – they are present without your having to program them into memory.

WARNING: Do not rely on the accuracy of the location of lights and buoys, to the extent of endangering life or property. Their positions and characteristics may be slightly or grossly in error, due to erros in the data, or changes since the memory was programmed. In addition, large numbers of buoys are moved each year from their published positions, by storms, vandalism, and other causes.

4.2 LOOKING UP THE NEAREST LIGHTS

When the WPT key is pressed the first time, waypoint information is shown. LIGHT information is shown on the second press.

To see the nearest lights;

1. Press the WPT key twice to bring up the LIGHT page.

2. Press the NEAR key.

A list of the 20 closest lights will appear, in order of nearness.

To see complete data from any light in the list, move the highlight to the desired light, and press ENT.
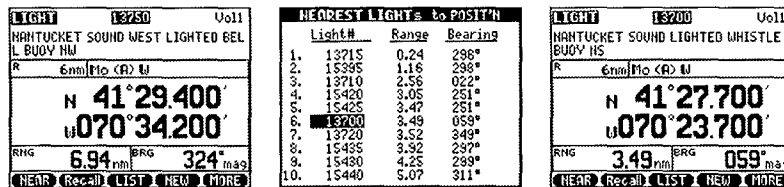
If you press WPT twice to bring up the light display, and then press the left or right arrow keys, you will step through the light list in the (somewhat arbitrary) order that they are stored in memory. They are generally nearby lights, but not in order of nearness.

The light *characteristic* shown in the middle of the page uses the same abbreviations are those used in the light lists, with the following meanings:

Al	Alternating	LNB	Large navigational buoy
bl	Blast	MHz	Megahertz
C	Canadian	Mo	Morse Code
ec	Eclipse	Oc	Occulting
ev	Every	ODAS	Anchored Oceano
F	Fixed		Graphic Data Buoy
FL	Flashing	Q	Quick (flashing)
FS	Fog Signal	Ra ref	Radar Reflector
Fl(2)	Group Flashing	R	Red
G	Green	RBN	Radio beacon
I	Interrupted	s	Seconds
Iso	Isophase (Equal Interval)	si	Silent
kHz	Kilohertz	SPM	Single Point Mooring Buoy
Lfl	Long Flash	W	White
lt	Light	Y	Yellow

The published location of the light is shown in the central portion of the display.

The light page gives you the range and magnetic bearing to look for the light. If it can be seen there, it serves as a partial confirmation of position.

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Remember that the geodetic L/L output of the GPS is typically a twentieth of a mile in error, and this error can be much larger when the satellite geometry is poor. (The estimated accuracy number in the position page will then be larger than normal).

You can set up a courseline directly to a light, by the following procedure:

1. Display the data page for the desired light.

2. Press the GO TO key. The GPS will then shift to the highway steering display, with the light as the destination. If you want to use a light in a route, it must be done indirectly. You must first move it into a waypoint, and then use the waypoint in the route.

To move a light into a waypoint, bring up the first waypoint page, and press the MORE key. Now move the highlight to MAKE NEW WAYPOINT, and press ENT. The resulting page will allow you to create a waypoint with the light data.

4.3 ADDING YOUR OWN LIGHTS

It is possible to add up to 100 lights to the light list. This can be done from the keyboard, and allows you to add small local channel buoys that are frequently used.

Example: There is a channel buoy where the GPS reads 42°46.314' north latitude, and 070°29.671' west longitude. It has a flashing green 2.0 second light that can be seen for about one mile. We want to name the new light CH-1.
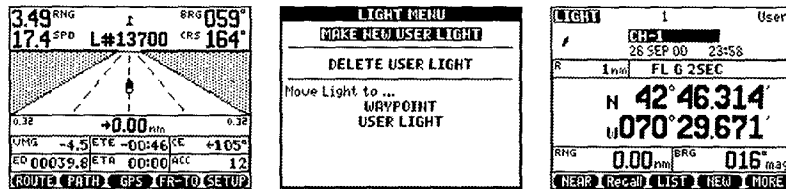
1. Press the WPT key twice to bring up the LIGHT page.

2. Press the MORE key.

3. Press the DOWN arrow key several times, to move the highlight to the MAKE NEW USER LIGHT field, and press ENT.

4. The highlight will now be in the name field. Press CLR to begin the entry of the new light name.

5. Key in the desired name (CH-1 in this case), and press ENT.

6. Now press the down arrow key to move the highlight to the latitude field. Press CLR to start the latitude entry, and the number keys to set up the desired latitude on the display. Press ENT to finish the latitude entry.

7. In a similar fashion, enter longitude.

8. Next, enter the light characteristic, in this case, FL G 2s.

9. Next, enter the nominal visible range, 1.0 miles.

This new user input light is now part of the light list, and will be processed for the NEAR light list. It will be shown in the PLOT display, when it is in the area plotted.

4.4 CORRECTING ERRORS IN BUILT-IN LIGHTS

Lights and buoys are occasionally moved, and there may be errors in the stored data. If you find an error in a light or buoy, it can be corrected by moving the light or buoy into the user entered light list, and then correcting the errors. The user entered light or buoy will then supersede the one in the database.

1. Press the WPT key twice to bring up the LIGHT page.

2. Press the ▼ key several times to move the highlight to the MORE field. Press ENT to select the MORE page for display.

3. Press the ▼ key several times, to move the highlight to the MOVE LIGHT TO USER LIGHT field, and press ENT.

4. Now press the ▼ key to move the highlight to a field you want to correct, such as position. Enter the corrected data, leave all the correct fields alone.

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The user light just entered will now supersede the original light in the built-in list. In this way, you can correct the position of frequently used lights. The government light lists usually provide position only to 0.1 minutes. With differential GPS, you can get the buoy position yourself to within 5 meters (0.003 minutes).

POSITION PLOTTING

5.1 AUTOMATIC POSITION RECORDING

The GP-270ML periodically records its position, along with the date and time of the recording, and the position fix accuracy.

The recorded track is the sequence of recorded points, connected by straight lines. The recording can be done so that the maximum error in the recorded track is kept below a specified value, or it can be done at equal time intervals. The default setting is to limit the maximum error in the recorded track to 0.05 nautical miles (92 meters). The controls for the data recording can be found under MENU, SETUP, TRACK LOG SETUP. The recording takes place only when the GPS has a good position fix (ACC less than 2000 feet).

There is space for 500 points of recorded data. After 500 points are recorded, each new point will be recorded over the oldest point, which is lost. The memory always contains the last 500 points recorded.

Thus you can go back and look at where you've been, even if you haven't saved any waypoints or written down any of the position fixes computed by the GPS.

MAIN MENU	MAIN MENU	TRACK LOG SETUP
FROM→TO	OPERATION	Recording Method: **MAX ERROR**
ROUTE	NAVIGATION	
PATH	ALERTS	Max Error: 0.05nm
GPS/STATUS	TRACK LOG	Time Interval: 15 sec
☼ RISE/SET ⟨	PLOT	
TIDES	SERIAL I/O	
SETUPS	STEERING	
	D-GPS	
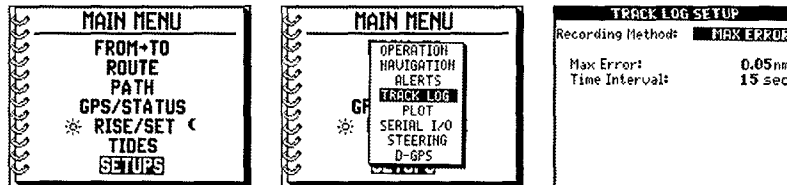
5.2 PLOT OF PREVIOUS TRACK

The plot of the previous track, ending in present position, can be displayed by pressing the PLOT key. Some numerical data are shown at the top of the page, above the plot. The plot area can be made larger by pressing the PLOT key again, which will cause the numerical data area to be dropped.

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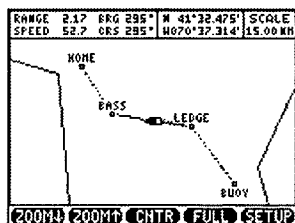
The plot scale (size of the plotted area) can be changed by *centering,* or *zooming.*

To center the plot, press the CNTR key. This will scale and center the plot to best show the FROM waypoint, the TO waypoint, and present position.

The plot scale can be increased or decreased by pressing the ▲ or ▼ keys, as indicated in the bottom portion of the page. This is called *zooming out* or *zooming in.*

The four arrow keys can be used to pan, or move the plot area up, down, right, or left.
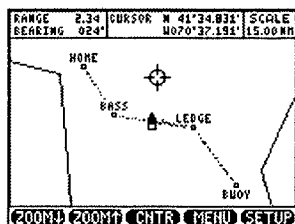
While in the pan mode, you can identify any waypoints, lights, or stored track points that are in the plot. To do this, pan the crosshairs to the point of interest. As soon as the crosshairs are close enough, they will snap to the point, and the point position, name, and other data will be shown in the numerical data area at the top of the page.

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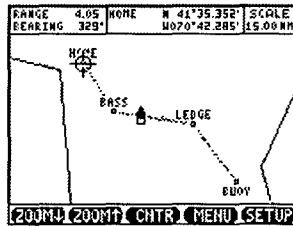
While in the pan mode, more functions can be accessed by pressing the MENU key.

To exit the pan mode, press the PLOT key.
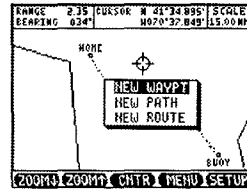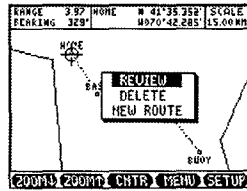
Suppose that you have been on a trip, and want to return home, going back the way you came. The plot of previous track can always be used to do this, even if you haven't saved any waypoints.

Simply press the PLOT key, and head back the way you came. The plot display will be shown as MAG NORTH UP, unless it has been changed from the default setting. (TRUE NORTH UP or FROM-TO UP or COURSE UP can also be selected in the PLOT SETUP menu.)

Now steer to stay close to the track you came in on, adjusting the zoom with the ▼ and ▲ keys to make the plot most convenient for steering.

Steering is generally easier, if the plot is changed to FROM-TO UP, or COURSE UP.

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Sections of the automatically recorded track can be picked out and stored permanently as paths. There is space for five paths in the GP-270ML, up to a maximum of 500 points.

To store a path:

1. Press MENU to display the menu page.

2. Press ▼ several times to put the highlight in the PATH field. Press ENT.

3. Press ▼ several times to put the highlight in the MAKE NEW PATH field, and press ENT.

4. Press ◄ a number of times, to step the cursor back along the recorded track, to the point which is to begin the path. Press ENT to start the path at that point.

5. Press ◄ or ► a number of times, to move the cursor along the recorded track, and to add points to the path.

6. Press ENT to end the path recording. A name can now be entered to identify the path.
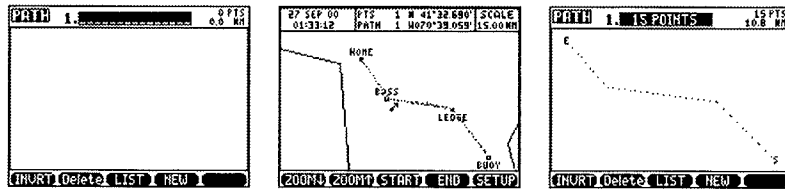
To follow a path:

1. Press MENU to display the menu page.

2. Press ▼ several times to put the highlight in the PATH field. Press ENT.

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3. Use the ▼ key to put the highlight in the LIST field, and press ENT.

4. Use the ▼ key to put the highlight on the desired path name, and press ENT to bring up the data page for that path.

5. To set up a courseline to the closest point in the path, press GO TO.

```
┌─────────────────────────────┐
│3.75ʀɴɢ      •      ʙʀɢ297°   │
│12.9ˢᵖᵈ  Path 01  ᶜʀˢ000°    │
│░░░░░░░\ ╱ | ╲ /░░░░░░░       │
│░░░░░░░ ╱  |  ╲ ░░░░░░░       │
│      ╱  ↕ |    ╲             │
│    ╱   ╱  |   ╲   ╲          │
│0.32      →0.00ɴᴍ      0.32   │
│ᵛᴹᴳ    5.8ᴱᵀᴱ 00:17ᶜᴱ  +063°│
│ᴱᴰ00031.8ᴱᵀᴬ 01:50ᴬᶜᶜ    12│
│(ROUTE)(PATH)(GPS)(FR-TO)(SETUP)│
└─────────────────────────────┘
```
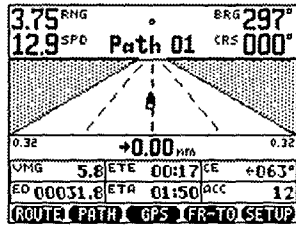
When you pass that path point, the destination will automatically be switched to the next point along the path, until the end is reached. The crosstrack error shown in the second NAV page and output to the autopilot will be your distance off the path.

5.6 PLOT OPTIONS

There are many ways to customize the plot display. These are listed in the plot setup menu. This can be brought up by MENU, SETUPS, PLOT, or by PLOT, PAN, MORE, PLOT SETUP.

The following choices are available: (The default choices are shown in parentheses.)

1. Waypoints - plot the name, icon, small dot, or nothing (NAME)

2. Lights - plot the first seven letters of the name, icon, small dot, or nothing (ICON)

3. Route/Path - route, path, or off (OFF)

4. TrackLog - NO PLOT, LAST 01 HOURS, LAST 02 HOURS, LAST 04 HOURS, LAST 06 HOURS, LAST 08 HOURS, LAST 10 HOURS, LAST 12 HOURS, PLOT ALL, START FROM NOW (LAST 04 HOURS)

5. Map - ON or OFF (ON)

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6. Grid - ON or OFF (OFF)

7. Range Circles - ON or OFF (ON)

8. View - MAG NORTH, TRUE NORTH, COURSEUP (COURSEUP)
   FIX PP/MOVE CHART, or FIX CHART/MOVE PP (FIX PP/MOVE CHART)

These choices and their use are more fully explained in Section 8.5.

6.1   COURSELINES, LEGS, AND ROUTES

A courseline is the line between two waypoints, along which you intend to travel. A leg is the same thing, a line joining two waypoints. A route is a number of legs connected together.

```
┌────────────────────────────┐
│ROUTE  1. HOME▶BUOY         │
│Waypt( Spts) Rng( 13.6nm) Brg│
│  1.HOME                    │
│  2.DIVE       2.44    168° │
│  3.LEDGE      5.45    132° │
│  4.BASS       2.33    226° │
│  5.BUOY       3.32    114° │
│  6.▬▬▬▬▬▬▬    --.--   ---° │
│  7._____   --.--   ---° │
│  8._____   --.--   ---° │
│  9._____    --.--   ---° │
│[INURT][Delete][LIST][NEW][PLOT]│
└────────────────────────────┘
```

The above route goes from waypoint 1 to waypoint 5, and consists of 4 legs.

6.2   PRESENT COURSELINE

Your present courseline (or leg) can always be seen in the FROM ⇨ TO page. To bring up this page, press MENU, ENT. (The highlight will be in the FROM ⇨TO field after you press MENU.)

```
┌────────────────────────────┐
│FROM                     TO │
│                            │
│    BUOY  →  HOME           │
│     🚩        ↑            │
│   ─────────────────────    │
│      RNG  10.84 nm         │
│   ⊿                        │
│      BRG  326°mag          │
│                            │
│                            │
└────────────────────────────┘
```

The display will always show the FROM and TO waypoint identification, and the range and bearing of the leg. Quite often, the FROM waypoint will not be a waypoint you have created, and put in the waypoint list. It will often be your position at the time you started on the leg. In this case, the FROM waypoint will be called START. The START waypoint is not kept in long term

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memory. It will be overwritten with a new location, every time you press GO TO set up a leg from present position to a waypoint. (Or to begin a route or path.) If you are on an active route, the route and leg information will be shown at the bottom of the page.

6.3 ROUTE NAVIGATION

The route function allows you to set up and follow a sequence of waypoints. Once the sequence is set up, it is kept in memory, and available for use at any time. The sequence of waypoints is called a route.

A route can contain up to 50 waypoints, and the GP-270ML can store up to 30 routes.

6.4 CREATING A ROUTE

A route can be created in two ways. It can be done by selecting a sequence of waypoints in the waypoint list, or by selecting a sequence of points in a plot.

To create a route from the waypoint list:

1. Press MENU to bring up the menu page.

2. Use the ▼ and ▲ keys to highlight ROUTE, and then press ENT. This will bring up the route page.

3. Press NEW. The highlight will now appear in the field for the first waypoint in the route.

    You are now ready to enter the sequence of waypoints that will make up the route.

4. To begin the waypoint selection, press ENT. This will bring up a list of waypoints, in alphabetical order.

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```
ROUTE  1. HOME▶BUOY
Waypt( 5pts)  Rng( 13.6nm)  Brg
  1.HOME           2.44      163°
  2.DIVE           5.45      132°
  3.LEDGE          2.33      226°
  4.BASS           3.32      114°
  5.BUOY                         °
  6._____       --'--     ---°
  7._____       --'--     ---°
  8._____       --'--     ---°
  9._____       --'--     ---°
[INVRT][Delete][LIST][NEW][PLOT]
```

5. Press ▲ or ▼ a number to times to put the highlight on the waypoint you want to be the next in the route. Then press ENT to make the selection. The waypoint will be entered in the route, and the high light will move to the next waypoint field.

6. Repeat steps 4 and 5 to add another waypoint to the route. Continue doing this until the route creation is finished.

The route will be given a default name including the first and last waypoint names, such as HOME ⟿ EDGAR. The route page will show the number of waypoints in the route, and the total length of the route.

To create a route from a plot:

1. Press PLOT to bring up the first PLOT page.

2. Press MENU softkey.

3. Move the highlight to NEW ROUTE, and press ENT.


```
RANGE    3.49  CURSOR N 41°34.585'  SCALE
BEARING  015°           W070°34.220' 20.00 NM
      HOME
        ▪
   DIVE       ⟡
        ▪
            NEW WAYPT
            NEW PATH
            NEW ROUTE
              BUOY
[ZOOM↓][ZOOM↑][CNTR][MENU][SETUP]
```
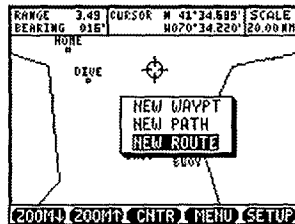
4. Press the four arrow keys to move the crosshairs to the first desired route point. If you want that point to be an existing waypoint or light, move the crosshairs to that point, until they "snap" to the point, and the waypoint or light data appear at the top of the page.

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5. Press ENT to bring up a sub-menu. Move the highlight to INSERT and press ENT.

    This will make the crosshairs location the first point in the new route.

6. Press the four arrow keys to move the crosshairs to the next desired route point, as in step 4.

7. Press ENT to bring up the sub-menu. Move the highlight to INSERT and press ENT to add the point to your route.

8. Repeat steps 6 and 7 to add more points to the route.

6.5   FOLLOWING A ROUTE

1. Bring up the route page, by pressing MENU, highlighting ROUTE, and pressing ENT.

2. If the route shown is not the one you want, press ◀ or ▶ several times until the desired route is displayed.

3. Check the direction of the route, which is going from the first to last waypoint shown. In you want to go in the opposite direction, press INVERT. This will invert the route.

4. Press the GO TO key.

The route is now activated, and the first leg will be from your present position to the route point closest to where you're starting from. When you pass each waypoint, the destination will automatically switch to the next waypoint along the route.

6.6   EDITING AND DELETING ROUTES

A route can be edited at any time, by moving the highlight to a waypoint in the route, and pressing ENT. A menu will appear, that will allow you to highlight one of the following choices:

REVIEW   Press ENT to review waypoint data.

DELETE   Press ENT to delete the waypoint from the route.

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INSERT   Press ENT to bring up a waypoint list. Highlight a waypoint in the list, and press ENT to insert the waypoint *before* the previously highlighted route point.

CHANGE   Press ENT to bring up a waypoint list. Highlight a waypoint in the list, and press ENT to insert the waypoint *in place of* the previously highlighted route point.

```
ROUTE  1.HOME▶BUOY
Waypt( Spts)  Rng( 13.6nm)  Brg
1.HOME           2.44        163°
2.DIVE           5.45        132°
3.LEDGE        ┌────────┐    226°
4.BASS         │ REVIEW │    114°
5.BUOY         │ DELETE │    ---°
6._____     │ INSERT │    ---°
7._____     │ CHANGE │    ---°
8._____     └────────┘    ---°
9._____       ---         ---°
 INVRT Delete  LIST   NEW   PLOT
```

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7.1   SUNRISE AND SUNSET

Press MENU, and then press the ▼ key to move the highlight to the RISE/SET field. Press ENT to bring up the SUN RISE/SET MOON page.

```
 ___MAIN MENU___
    FROM→TO
     ROUTE
      PATH
   GPS/STATUS
 ☼ RISE/SET  (
     TIDES
    SETUPS
```

```
  SUN RISE/SET MOON
02 SEP 2000    POSIT'N
          N

      W      E

          ☼   )
          S
SUN             MOON
05:09    RISE   09:42
18:13    SET    20:54
```
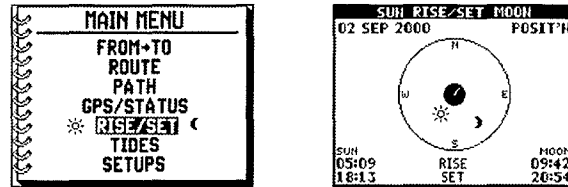
The sun and moon data are for the date and position shown at the top of the page. The default values are the present date and position. It is possible to key in another date, and select a waypoint instead of present position. In this way, the sun and moon display can be seen for any point on Earth, and any date (within 30 years of 1996).

The local times for rise and set of the sun and moon are shown at the bottom of the page.

The clock at the center of the page will step one hour each second, and the positions of the sun and moon are shown on the celestial hemisphere for every hour of the day. The clock will be dark to indicate pm. Up (the top of the circle) is true north.

7.2   24 HOUR TIDE PREDICTION

Press MENU, and then press the ▼ key several times to move the highlight to the TIDES field. Press ENT to bring up the 24 HR TIDE PLOT page.

TIDE PREDICTION

27 SEP 2000   Nantucket

| 05:03 | -0.1ft | 11:34 | 3.5ft |
| 17:23 | -0.1ft | 23:55 | 3.6ft |
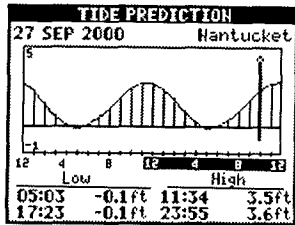
The tide plot is a prediction for the date and position shown at the top of the page. The default values are the present date and position. It is possible to key in another date, and select a waypoint instead of present position. In this way, the tide prediction can be seen for any point on Earth, and any date (within 30 years of 1996).

The plot shown is the predicted level of the free ocean tide (without the influence of land) over a 24 hour period. The plot shows the tide height, relative to the highest tides possible, which are when the sun and moon are aligned on one side of the Earth.

The shape of the tide plot will generally be accurate, and the times of high and low tides will generally be accurate to within a half hour. The actual tide height is affected by the shape of the local ocean floor, and can change considerably over a few miles along a coast. The tide height is also affected by wind and weather.

The tide prediction used by the GPS does not take these things into account, and does not predict the actual height of the tide on a seacoast. It does show the general shape of the tide, its height relative to the highest possible tide, and the times of high and low tide.

There are a large number of choices that can be made, to customize the operation of the GP-270ML. All of these choices are explained in this chapter.

8.1 OPERATION SETUPS

Press MENU to bring up the main menu. Press the ▲ or ▼ keys to put the highlight on SETUPS, and press ENT. The SETUPS submenu will be shown, with the highlight in the OPERATION field. Press ENT to bring up the OPERATION SETUP page.

```
┌─────────────────┐   ┌─────────────────┐   ┌─────────────────────┐
│    MAIN MENU    │   │    MAIN MENU    │   │ OPERATION SETUP 1/2 │
│                 │   │                 │   │ Contrast: LITE·DARK │
│    FROM→TO      │   │   OPERATION     │   │ ███████████         │
│    ROUTE        │   │   NAVIGATION    │   │ Language:    ENGLISH│
│    PATH         │   │   ALERTS        │   │ Beeper:           ON│
│    GPS/STATUS   │   │   TRACK LOG     │   │ GMT Offset  -05:00:00│
│  ☼ RISE/SET  ‹  │   │ GP  PLOT        │   │ Single Fix:      OFF│
│    TIDES        │   │ ☼  SERIAL I/O   │   │ Average     00:00:15│
│    SETUPS       │   │    STEERING     │   │                     │
│                 │   │    D-GPS        │   │              [MORE] │
└─────────────────┘   └─────────────────┘   └─────────────────────┘
```
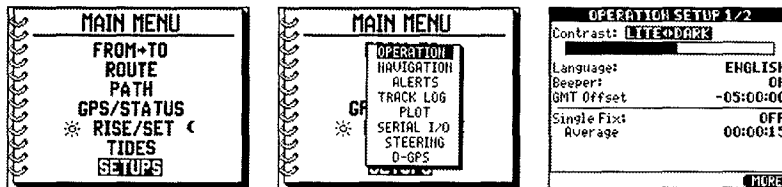
A number of operation setup choices are now shown. To change one of the operation setups:

1. Use the ▲ or ▼ keys to put to highlight in the field you want to change, and press ENT.

2. Use the ◄ or ► keys to step through all of the choices available. When you get to the selection you want, press ENT to make that selection.

When the field to be changed is a numerical field, use the number keys to key in the number you want, and press ENT, just as in any number entry.

The operation setups occupy two pages. To bring up the second page, press the softkey MORE at the bottom of the first page.

The following are the operation setups that can be selected, and the choices available. To make the choices, the highlight must be on the field to be changed.

DISPLAY CONTRAST – Use the ◀ and ▶ keys to adjust the display contrast. Move it across the full range, and leave it where the display looks the best.

LANGUAGE – Default = English. Choices: English, Spanish, French, German, Italian. . .

The language used in the major display pages can be selected. Display pages that are rarely used are always in English.

BEEPER – Default = ON. Choices: ON, OFF

The beeper can be turned off, if for some reason you want silent operation.

GMT OFFSET – Default = various. Choices: -12:00:00 to +12:00:00

Normally, local time is set by keying approximate time into the first NAV display. GMT offset is then automatically computed to the nearest half hour, which will account for all hour and half hour time zones. If you are in a time zone offset from GMT by a time that is not hours or half hours, you can key in any offset here. If you do this, don't key in local time into the first NAV display, or the offset you keyed in here will be lost.

Example: You are in Saudi Arabia, where the local time is offset minus two hours and forty-five minutes from Greenwich time. Key -2:45:00 into GMT offset, and you will display the correct local time.

SINGLE FIX MODE – Default = OFF. Choices: ON, OFF

The single fix mode is used to average your position over a period of time, and store the averaged position in a waypoint. To use it, set SINGLE FIX to ON, and key in the desired averaging time.

AVERAGE – Default = 15 seconds. Choices: 1 to 99,999 seconds (one day is 86,400 seconds).

Each time the GP-270ML is turned on, as soon as it has a good position fix, it will start averaging the position. When it has averaged for the specified time, it will store the averaged position in the save list, just as if you had pressed the SAVE key. The position can then be found as the last saved position.

Press MORE to bring up the second page of operation setups.

```
┌─────────────────────────────┐
│    OPERATION SETUP 2/2      │
│ NAV Simulator:              │
│   Mode:              OFF    │
│   Speed:          14.7 kts  │
│   Course:         000°mag   │
│                             │
│ Erase all ...               │
│                   ROUTES    │
│              USER LIGHTS    │
│         WAYPOINTS & ROUTES  │
│                             │
└─────────────────────────────┘
```
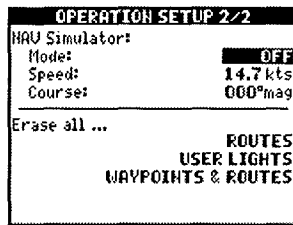
NAV SIMULATOR MODE – Default = OFF. Choices: OFF, AUTO STEER, MANU STEER, PAUSE

When the simulator is not OFF, the system lat/lon are not updated from the GPS signals. Desired initial lat/lon can be keyed into the first NAV page. With AUTO STEER, the simulated position will move toward the TO waypoint, at the SPEED you have input. With MANU STEER, the simulated position will move at the input SPEED and COURSE. With PAUSE, the NAV pages will show the input SPEED and COURSE, but position will not move.

SPEED – Default = 0.0 knots. Choices: 0.0 to 9999.9 knots

COURSE – Default = 0 degrees. Choices: 0 to 359 degrees

The simulator can be used to set up navigation examples, so that you can use all the displays just as if you were traveling. It can be used to practice navigation, and to become familiar with all of the capabilities of the GP-270ML.

ERASE ALL WAYPOINTS – Selecting this choice will enable you to erase all of the waypoints in the GPS.

8.2   NAVIGATION SETUPS

Bring up the NAVIGATION SETUP page, and make changes in the setup choices, in a manner similar to that described in the beginning of Section 8.1.

```
  MAIN MENU          MAIN MENU          NAVIGATION SETUP
  FROM→TO           OPERATION       L/L Format:      MM.MMM'
  ROUTE            NAVIGATION       Other Coord:         OFF
  PATH              ALERTS          RNG/SPD Unit:     NM/KTS
  GPS/STATUS        TRACK LOG       ALT/ACC Unit:       FEET
☀ RISE/SET ‹   GP    PLOT          Alt Mode:           AUTO
  TIDES         ☀  SERIAL I/O       Vehicle:            BOAT
  SETUPS           STEERING         NAV Filter:        10sec
                    D-GPS           Bearing:   AUTO MAG   w016°
                                    Map Datum:   MANUAL  WGS-84
```
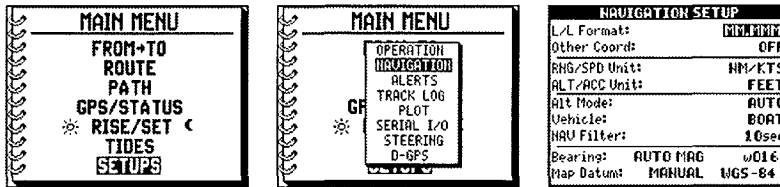
The available choices are:

> L/L FORMAT – Default = MM.MMM'. Choices: MM.MMM' or MM'SS.S

The choice of minutes and thousandths of minutes, or minutes, seconds, and tenths of seconds affects all position display, key entry, or serial data input and output.

> OTHER COORD – Default = OFF. Choices: OFF, MGRS, UTM, LORAN

If another coordinate system is chosen, that coordinate system and lat/lon will be displayed on successive pages, for all position displays. Waypoints can be input or displayed in the additional coordinates. MGRS, UTM, and LORAN coordinates are described in Appendices B and C.

> RNG/SPD UNITS – Default = nm/kts. Choices: nm/kts, mi/mph, km/kph

> ALT/ACC UNITS – Default = feet. Choices: feet, meters

> ALT MODE – Default = manual. Choices: manual, auto

In the manual mode, the altitude is input into the first NAV display, and is never changed. In the auto mode, it is computed whenever four or more satellites are available for navigation.

For a boat operating at a fixed altitude, the computed lat/lon are slightly more stable and accurate if the ALT MODE is manual.

> VEHICLE – Default = boat. Choices: boat, car, aircraft, walk

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The vehicle choice is used to estimate how fast the altitude is likely to be changing, when operated in the auto ALT MODE.

NAV FILTER — Default = 10 seconds. Choices: 1 - 255 seconds

The nav filter is used to filter the computed speed and course. For a powerboat, 5 seconds of filtering will normally give the best results. For a sailboat, a filter time of 20 seconds is better. If the filter time is too short, the display of speed and course will be jumpy. If it is too long, the displays will be slow to respond to a maneuver, and will lag behind what the boat is doing.

BEARING — Default = auto mag. Choices: manual mag, auto mag, true north

The displayed courses and bearings include magnetic variation, if manual mag or auto mag are chosen. With auto mag, the variation is computed based on your lat/lon, and is generally accurate to one degree anywhere on earth (with the exception of very near the magnetic pole). With manual mag, the variation is keyed into the VARIATION field.

VARIATION — Default (computed automatically). Choices: e 179° to w 179°

Key in the variation *only* if BEARING is set to manual mag.

MAP DATUM — Default = Manual. Choices: manual, auto

If auto is selected, the datum is automatically selected from the 12 most common datums, based on position. AUTO is only appropriate for land navigation.

DATUM — Default = WGS-84. Choices: 134 choices, including USER INPUT

For marine use, WGS-84 is used for almost all charts. Map datums is a complex subject, described in Appendix E.

8.3   ALERT SETUPS

Bring up the ALERTS SETUP page, and make changes in the setup choices, in a manner similar to that described in the beginning of Section 8.1. The available choices are:

MAIN MENU
FROM→TO
ROUTE
PATH
GPS/STATUS
☼ RISE/SET ‹
TIDES
SETUPS

MAIN MENU
OPERATION
NAVIGATION
ALERTS
TRACK LOG
PLOT
SERIAL I/O
STEERING
D-GPS

ALERTS SETUP 1/2
Arrival:	OFF	0.05nm
Anchor:	OFF	0.10nm
XTrack:	OFF	0.10nm
Border:	OFF	
Clock:	OFF	00:00:00
Watch:	OFF	00:00:00
Down Timer:		00:00:00

(AVOID)
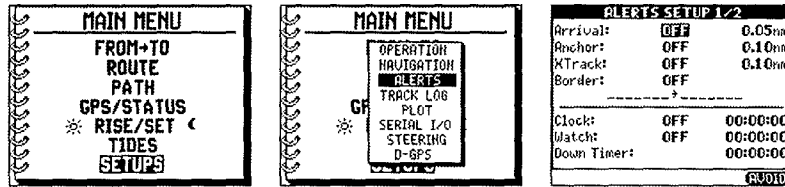
WAYPOINT ARRIVAL — Default = OFF. Choices: OFF, ON

RANGE — Default = 0.05 nm. Choices: 0.01 nm to 99.99 nm

When WAYPOINT ARRIVAL is ON, and your vessel comes within RANGE of the TO waypoint, or passes the TO waypoint, audio and visual alerts will be given. The alert is cancelled when the ENT key is pressed.

ANCHOR — Default = OFF. Choices: ON, OFF

RANGE — Default = 0.1 nautical miles. Choices: 0.01 nm to 99.9 nm

After your vessel has anchored, and come to a steady position, set ANCHOR to ON. Your vessel's position will be saved, and an alert will be given if you drift away from the anchor point, more than the allowed range. Note that setting the RANGE less than 0.10 nm is likely to result in false alarms, as the position indicated by the GPS can shift by as much as 0.15 miles over a period of time, even if you are not moving.

XTRACK — Default = OFF. Choices: ON, OFF

RANGE — Default = 0.10 nm. Choices: 0.01 to 9.99 nm

When the cross track error alert is ON, an alert will be given if the cross track error magnitude exceeds the RANGE number.

BORDER — Default = OFF. Choices: ON, OFF

FROM WAYPOINT TO WAYPOINT

To use the border alert, put the two end points of the border into the GPS, as two waypoints. Specify them as the FROM WAYPOINT and TO WAYPOINT, under the BORDER ON/OFF line.

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CLOCK — Default = OFF. Choices: ON, OFF
Time — Default = 00:00:00, Choices: 00:00:00 to 23:59:59

This is the alarm clock alert. When the time reached the specified time, and CLOCK is ON, an alarm will sound. A visual alert will also be given, which can be cancelled with the ENT key.

WATCH — Default = OFF. Choices: ON, OFF
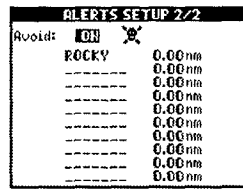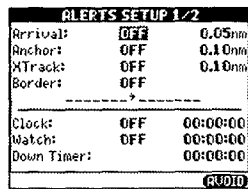Time — Default = 00:00:00. Choices: 00:00:00 to 11:59:59

This is the watch alert. When it is ON, an internal watch timer starts from zero, and counts up. When it reaches the watch time, an alert is sounded. When ENT is pressed, the watch timer resets to zero, and the process is repeated. The watch time is typically set to 5 or 10 minutes, and the need to periodically clear the alert will make sure the person on watch does not go to sleep.

DOWN TIMER — Default = OFF. Choices: ON, OFF
Time — Default = 00:00:00. Choices: 00:00:00 to 23:59:59

The DOWN TIMER is also called the yacht racing timer. It is typically set to 00:10:00, and turned ON exactly 10 minutes before a race. The timer will begin counting down, and will give 5 one second beeps with 5 minutes to go, 4 beeps with 4 minutes to go, etc. When it reaches zero, it will give one 5 second beep, and shut itself off.

AVOID — Default = OFF. Choices: ON, OFF

To set up and operate the avoid alert, press AVOID at the bottom of the page. This will bring up an AVOID page, which shows 10 waypoints, each with its own reference range.

ALERTS SETUP 1/2		
Arrival:	OFF	0.05nm
Anchor:	OFF	0.10nm
XTrack:	OFF	0.10nm
Border:	OFF	
	------ + ------	
Clock:	OFF	00:00:00
Watch:	OFF	00:00:00
Down Timer:		00:00:00
		AUDIO

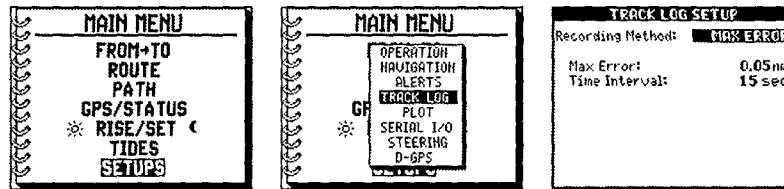| ALERTS SETUP 2/2		
Avoid:	ON	
ROCKY		0.00nm
-------		0.00nm
-------		0.00nm
-------		0.00nm
-------		0.00nm
-------		0.00nm
-------		0.00nm
-------		0.00nm
-------		0.00nm
-------		0.00nm

To use the avoid alert, put the coordinates of places you want to avoid (such as a barely submerged rock) into waypoints, and put the waypoint names into the AVOID list. After each waypoint name, enter the range from the avoid point, where you want to be given an alarm.

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After AVOID is turned ON, if you should get closer to any of the avoid points than its avoid range, an alarm will sound, and the display will give instructions on how to cancel the alarm.

8.4   TRACK LOG SETUPS

Bring up the TRACK SETUP page, and make changes in the setup choices, in a manner similar to that described in the beginning of Section 8.1. The available choices are:

MAIN MENU	MAIN MENU	TRACK LOG SETUP
FROM→TO	OPERATION	Recording Method: **MAX ERROR**
ROUTE	NAVIGATION	
PATH	ALERTS	Max Error: 0.05 nm
GPS/STATUS	**TRACK LOG**	Time Interval: 15 sec
☼ **RISE/SET** ⟨	PLOT	
TIDES	SERIAL I/O	
SETUPS	STEERING	
	D-GPS	

RECORD TRACK BY – Default = limit max track error. Choices: limit max track error, time interval

LIMIT MAX TRACK ERROR – Default = 0.05 nm. Choices: 0.01 to 1.00 nm

TIME INTERVAL – Default = 00:01:00. Choices: 00:00:01 to 01:00:00

If the track points are recorded to limit max track error, the recorded track points connected with straight lines will always be within the error tolerance of the actual track of the boat. If the boat travels along straight lines, this is very efficient, as only a few recorded points are necessary.

The track points can also be recorded at equal time intervals.

Track points will be recorded only if the GPS position fix is good (the accuracy number is less than 2000 feet).

8.5   PLOT SETUPS

Bring up the PLOT SETUP page, and make changes in the setup choices, in a manner similar to that described in the beginning of Section 8.1.

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The following choices select what information appears on the plot, and how it appears.
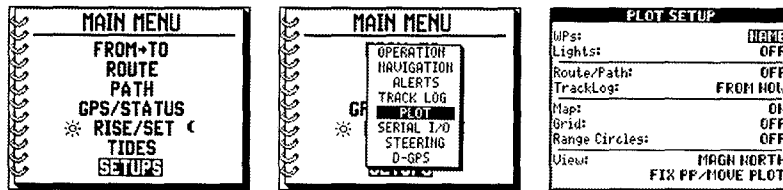
WAYPOINTS – Default = name. Choices: name, icon, dot, off

LIGHTS – Default = number. Choices: number, icon, dot, off

ROUTE/PATH – Default = off. Choices: off, route, path

TRACK LOG – Default = last 01 hr. Choices: off, last 01 hr.,
last 02 hrs., last 04 hrs, last 06 hrs., last 08 hrs.,
last 10 hrs., last 12 hrs., plot all, from now

MAP – Default = on. Choices: ON, OFF

GRID – Default = off. Choices: ON, OFF

RANGE CIRCLES – Default = off. Choices: ON, OFF

VIEW – Default = magn north up. Choices: magn north, true north,
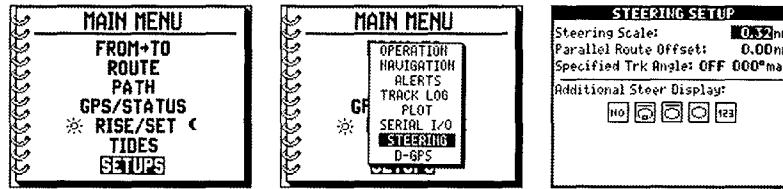from-to up, course up
    – Default = fix pp/move plot. Choices: fix pp/move plot,
fix plot/move pp

8.6   SERIAL I/O SETUPS

The setup of the serial input and output ports is normally done by an electronics technician, and involves some complicated choices. This is described in Appendix H.

Press MENU to bring up the main menu. Press the ▲ or ▼ keys to put the highlight on SETUPS, and press ENT. The SETUPS submenu will be shown. Use the ▼ and ▲ keys to put the highlight on STEERING. Press ENT, to bring up the STEERING SETUP page.

```
┌─────────────────┐   ┌─────────────────┐   ┌─────────────────────┐
│    MAIN MENU    │   │    MAIN MENU    │   │   STEERING SETUP    │
│                 │   │                 │   │Steering Scale:   0.32nm│
│    FROM→TO      │   │  ┌───────────┐  │   │Parallel Route Offset:  0.00nm│
│     ROUTE       │   │  │ OPERATION │  │   │Specified Trk Angle: OFF 000°mag│
│     PATH        │   │  │ NAVIGATION│  │   │                     │
│   GPS/STATUS    │   │  │  ALERTS   │  │   │Additional Steer Display:│
│  ☼ RISE/SET (   │   │GP│ TRACK LOG │  │   │                     │
│     TIDES       │   │☼:│   PLOT    │  │   │ [NO][◎][◎][◎][123] │
│    SETUPS       │   │  │ SERIAL I/O│  │   │                     │
│                 │   │  │ STEERING  │  │   │                     │
└─────────────────┘   │  │  D-GPS    │  │   └─────────────────────┘
                      │  └───────────┘  │
                      └─────────────────┘
```

STEERING SCALE − Default = 0.32 nm. Choices: 0.01 to 9.99 nm

The steering scale limits the maximum cross track error that can be shown on the "highway" steering page (second NAV page).
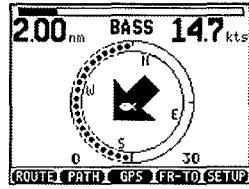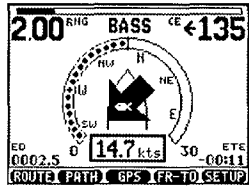
PARALLEL ROUTE OFFSET − Default = 0.00 nm. Choices: -9.99 to +9.99 nm

If parallel route offset is set to 0.20, then crosstrack error will be zero along a line 0.20 nautical miles to the *right* of the courseline from the FROM to the TO waypoints. In other words, your course is offset 0.20 miles to the right. If PRO is set to a negative number, the offset will be to the *left*.

PRO can be used to run search patterns, and to drag parallel paths in shrimp and clam dredging.

SPECIFIED TRK ANGLE − Default = off. 000° mag, Choices: ON, OFF, 000° to 359° mag

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When the specified track angle is ON, then crosstrack error then becomes the perpendicular distance away from a line going through the TO waypoint at the specified magnetic bearing. Steering to drive the crosstrack error to zero will then take the vessel to the TO waypoint, at the specified track (bearing) angle.

GLOSSARY

ALMANAC	The approximate description of the orbits of all of the GPS satellites. This is received periodically from each satellite.
BEARING	The angle between the direction to north, and the direction to another point. Bearings can be true or magnetic.
CONSTELLATION	All of the GPS satellites, about 24 in number.
COORDINATE	A number, typically about 7 digits long. (One of a pair of numbers, which define position.)
COORDINATE PAIR	Two numbers, which define a position, or waypoint.
COURSE	The angle from north to the direction you are traveling. Course can be true or magnetic. Note that this is not the same as heading. Course is sometimes called Course-Over-The-Ground.
COURSELINE	The line from the waypoint you're coming FROM to the waypoint you're going TO. It marks the course you're supposed to be on.
CROSSTRACK ERROR (CTE)	The distance you are off your courseline.
EPHEMERIS	The exact description of the orbit of one of the satellites, which is necessary to use the satellite for navigation. A GPS receiver gets the ephemeris by receiving signals from the satellite. (Plural, ephemerides)
GPS	The Global Positioning System, which consists of 24 satellites circling the Earth, transmitting radio signals which can be used to compute position, speed, and course.

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HEADING	The direction between north, and the direction the bow of your boat is pointing. Heading can be true or magnetic.
LAT/LON	Short for latitude and longitude, the coordinate system used for most marine navigation.
LEG	The line from one waypoint to another.
LORAN	A navigation system dating from 1957, using land based transmitters of 1000 mile range, and covering much of the settled coastal areas of the northern hemisphere.
MAGNETIC NORTH	The direction toward the north magnetic pole. This is the direction the needle of a magnetic points toward.
MAGNETIC VARIATION	The angular difference between true north and magnetic north. Magnetic bearing is the true bearing plus the variation, if the variation is west. If the variation is east, it is minus the variation.
MGRS	Military Grid Reference System, the coordinate system used for most modern land charts.
ROUTE	A path going from a starting waypoint to an ending waypoint, formed from a number of legs joined together.
SELECTIVE AVAILABILITY (SA)	A U. S. Government policy whereby the GPS navigation signals provided for civil use are deliberately made less accurate than those provided for military use. The degree of accuracy can be changed at will by the government.
TIME TO GO	The time it will take to reach your (TTG) destination, or TO waypoint.
TD	Time Differences, the coordinate system used by LORAN receivers, and on LORAN charts.

TRUE NORTH   The direction toward the north pole, shown as
                    up on most navigation charts.

UTM   Universal Transverse Mercator, a coordinate
   system used on some land charts.

MGRS AND UTM COORDINATES

The GP-270ML GPS can be used with Military Grid Reference System (MGRS) and Universal Transverse Mercator (UTM) coordinates. These coordinate systems are used for land navigation and charting. The GPS will display present position and waypoint position in these coordinates. Waypoints can be input in MGRS and UTM coordinates, also.

In order to use MGRS or UTM coordinates, the setup item OTHER COORD must be set to MGRS or UTM. This setup item is in the NAVIGATION SETUP page, accessed by MENU, SETUPS, NAVIGATION.

When OTHER COORD is set to MGRS, additional pages showing MGRS coordinates will appear under the NAV and WPT keys.
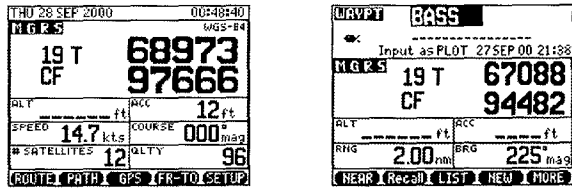
When OTHER COORD is set to UTM, additional pages showing UTM coordinates will appear under the NAV and WPT keys.
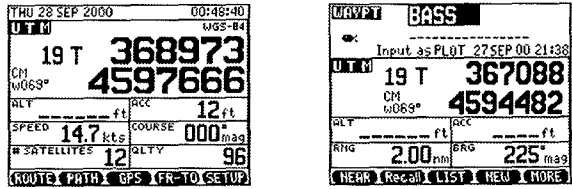
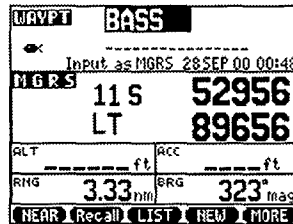## Creating a Waypoint in MGRS Coordinates

To create a waypoint in MGRS coordinates, perform the following steps:

1. Set the setup item OTHER COORD (in the NAVIGATION SETUP page) to MGRS.

2. Read the bottom margin of the chart you are using, and find the map datum that was used to make the chart. Set the GPS to the same map datum. Instructions for doing this are given in Appendix D.

3. Press the WPT key several times, until the MGRS page comes up.

4. Move the highlight to NEW at the bottom of the page, and press ENT.

5. Key in the waypoint name, just as when creating a waypoint in lat/lon.

6. Key in the desired MGRS coordinates. For example:

Grid Zone	11 S
100,000 meter square designator	LT
Easting	52956 meters
Northing	89656 meters

Any waypoint can be viewed in MGRS coordinates, regardless of how the waypoint was created. To do this, do steps 1-3, and use the ∞ and Ø keys to step through the waypoint list.

Creating a Waypoint in UTM Coordinates

To create a waypoint in UTM coordinates;

1. Set the setup item OTHER COORD (in the NAVIGATION SETUP page) to UTM.

2. Read the bottom margin of the chart you are using, and find the map datum that was used to make the chart. Set the GPS to the same map datum. Instructions for doing this are given in Appendix D.

3. Press the WPT key several times, until the UTM page comes up.
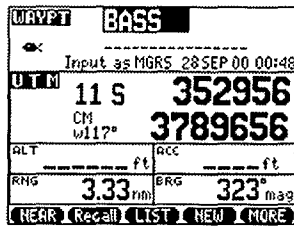
4. Move the highlight to NEW at the bottom of the page, and press ENT.

5. Key in the waypoint name, just as when creating a waypoint in lat/lon.

6. Key in the desired UTM coordinates. For example:

Grid Zone	11 S
Easting	352956 meters
Northing	3789656 meters

The Grid Zone is used to automatically compute the Central Meridian. (The Central Meridian cannot be input manually.)

Any waypoint can be viewed in UTM coordinates, regardless of how the waypoint was created. To do this, do steps 1-3, and use the ◄ and ► keys to step through the waypoint list.

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LORAN C COORDINATES

The GP-270ML GPS can be used with LORAN TD coordinates. This coordinate system is found on many marine charts, and has been extensively used to record the location of shipwrecks, underwater hangs, and fishing spots. The GPS will display present position and waypoint position in these coordinates. Waypoints can be input in LORAN TD coordinates, also.

In order to use LORAN TD coordinates, the setup item OTHER COORD in the NAVIGATION SETUP page must be set to LORAN.

When OTHER COORD is set to LORAN, additional pages showing LORAN TD coordinates will appear under the NAV and WPT keys.

Creating a Waypoint in LORAN Coordinates

If you usually use latitude and longitude, you might think to yourself "What am I going to use LORAN TDs for?". Well imagine you've invited some friends to go fishing, and one of them, crafty old fisherman that he is, has brought along his black book of neverfail fishing locations. The only problem is, they're all in TDs, since they were gathered long before the age of satellite navigation. With the GP-270ML, you can enter them directly into a waypoint and go directly there.

The truth is, you can go close to there. The GPS measurement of position converted to TDs doesn't have the landpath errors of the LORAN system of navigation, so the point you go to will not be exactly the same as with a LORAN. You can expect a hundred yards of error, or more if the LORAN geometry is not good.

To create a waypoint in LORAN coordinates, perform the following steps:

1. Set the setup item OTHER COORD (in the NAVIGATION SETUP page) to LORAN.

2. Make sure the map datum is set to WGS-84, which is used for essentially all marine charts.

3. Press the WPT key several times, until the LORAN page comes up.

4. Move the highlight to NEW at the bottom of the page, and press ENT.

5. Key in the waypoint name, just as when creating a waypoint in lat/lon.

6. Key in the desired LORAN coordinates. For example:

GRI   9960
TD1   16255.82 microseconds
TD2   27480.21 microseconds

Any waypoint can be viewed in LORAN coordinates, regardless of how the waypoint was created. To do this, do steps 1-3, and use the ◀ and ▶ keys to step through the waypoint list.
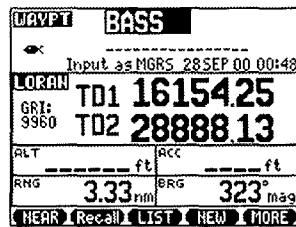
After the second TD is entered, the navigator will automatically convert the TD pair to latitude and longitude, and store it in memory.

NOTE

Not all TD pairs correspond to a geographic position! If you enter a TD pair that is not valid, or one that exists in a region of very poor loran geometry, the conversion will not take place, and you will get the following display:

TDs incorrect or have very poor geometry. Please check. Press ENT

If you get the above display, and you are trying to use a TD pair with poor geometry, you can sometimes get a successful conversion by entering a lat/lon that is close to the correct position, into the waypoint, before entering the TD pair.

For a TD pair entered by keyboard to be successfully converted to geographic position (so that it can be used by the GPS navigator), the following conditions must be satisfied:

1   The TD pair must correspond to an actual geographic location, and the LORAN geometry at that place must be adequate for a good position fix.

2   The four digit GRI number must correspond to the TD pair entered.

If any of these conditions are not met, the waypoint lat/lon field will be left alone and you will get a display of "TDs incorrect or have very poor geometry. Please check. Press ENT".

To display TD coordinates for an existing waypoint, you must enter the GRI and two 2 digit numbers, S1 and S2, into the TD display shown under the NAV key. S1 and S2 are the transmitter selector numbers, and are used to select the particular TDs that will be displayed under the NAV and WPT keys. The list on the next page gives the transmitter selector numbers for all transmitters active in 1996.

LORAN TRANSMITTER LIST

All channel numbers are in "bold" and are in kHz.

4990	**7960**	**8990**
Central Pacific	Alaska Gulf	N. Saudi Arabian
10 Upolo Pt.	10 Narrow Cape	10 Salwa
28 Kure	25 Shoal Cove	24 Ar Ruqi
	43 Port Clarence	39 Ash Shaykh Humayd
		55 Al Lith
		68 Al Muwassum

5930	**7970**	**9610**
East Canadian	Norwegian Sea	South Central US
10 Nantucket	10 Boe	10 Gillette
24 Cape Race	25 Sylt	24 Searchlight
37 Fox Harbor	45 Sandur	39 Las Cruces
	59 Jan Mayen	51 Raymondville
		64 Grangeville

5970
East Asian
10 Hokkaido
30 Hamp Yong
41 Gesashi

5990
West Canadian
10 Shoal Cove
26 George
40 Port Hardy

6780
South China
11 Unknown
24 Unknown

7170
S. Saudi Arabian
10 Salwa
25 Afif
38 Al Lith
51 Al Muwassum

7930
Labrador Sea
10 Cape Race
25 Angissoq

7950
Eastern Russia
10 Petropavlovsk
29 Ussuriysk
45 Kuril'sk
60 Okhotsk

7980
Southeast US
10 Grangeville
22 Raymondville
10 Grangeville
22 Raymondville
42 Jupiter
58 Carolina Beach

7990
Mediterranean Sea
10 Lampedusa
28 Kargabarun
46 Estartit

8000
Western Russia
9 Petrazavodsk
24 Slonim
49 Simferopol'
64 Syzran

8290
North Central US
10 Baudette
26 Gillette
41 Williams Lake

8970
Great Lakes
10 Malone
27 Seneca
43 Baudette
58 Boise City

9940
US West Coast
10 George
26 Middletown
39 Searchlight

9960
Northeast US
10 Caribou
24 Nantucket
38 Carolina Beach
53 Dana

9970
Northwest Pacific
10 Marcus
29 Hokkaido
54 Gesashi
80 Barrigida

9980
Icelandic
10 Angissoq
29 Ejde

9990
North Pacific
10 Attu
28 Port Clarence
42 Narrow Cape

MAP DATUMS

The following 11 datums are the first ones in the datum list, and are available for manual or automatic selection.

WGS-72	WORLD GEODETIC SYSTEM 1972
INT'L	INTERNATIONAL
GRS-67	GEODETIC REFERENCE SYSTEM 1967
CLARKE66	CLARKE 1866
CLARKE80	CLARKE 1880
EVEREST	EVEREST
MEVEREST	Modified EVEREST
AIRY	AIRY
Mod-AIRY	Modified AIRY
BESSEL	BESSEL 1841
WGS-84	WORLD GEODETIC SYSTEM 1984

The following datums are available only by manual selection. The first 12 are the most common, listed in alphabetical order. They are followed by 111 less commonly used datums, also in alphabetical order.

AUSTRLIA	AUSTRALIAN NATIONAL
FISCHE60	FISCHER 1960 (MERCURY)
MFISCH60	Modified FISCHER 1860 (SOUTH ASIA)
FISCHE68	FISCHER 1968
GRS-80	GEODETIC REFERENCE SYSTEM 1980
HELMERT	HELMERT 1906
HOUGH	HOUGH
KRASVSKY	KRASSOVSKY
SAD-69	SOUTH AMERICAN DATUM 1969
WGS-60	WORLD GEODETIC SYSTEM 1960
WGS-66	WORLD GEODETIC SYSTEM 1966
WAROFFIC	WAR OFFICE
ADINDAN	ADINDAN / ETHIOPIA,MALI,SENEGAL,SUDAN
AFGOOYE	AFGOOYE / SOMALIA
AINELABD	AIN EL ABD / BAHRAIN ISLAND
AN1ASTRO	ANNA 1 ASTRO 65 / COCOS ISLANDS

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ARC-1950	ARC 1950 / BOTSWANA, LESOTHO, MALAWI, SWAZILAND, ZAIRE, ZAMBIA, ZIMBABWE
ARC-1960	ARC 1960 / KENYA, TANZANIA
ASCNSION	ASCENSION ISLAND 1958
AUSTR-66	AUSTRALIAN GEODETIC 1966 / AUSTRALIA AND TASMANIA
AUSTR-84	AUSTRALIAN GEODETIC 1984 / AUSTRALIA AND TASMANIA
AZORES	OBSERVATORIO / CORVO AND FLORES ISLANDS (AZORES)
BELLEVUE	BELLEVUE (IGN) / EFATE AND ERROMANGO ISLANDS
BERMUDA	BERMUDA ISLANDS
BOGOTA	BOGOTA UNIVERSITY / COLOMBIA
BRAZIL	CORREGO ALEGRE / BRAZIL
BRITAIN	ORDNANCE SURVEY OF GREAT BRITAIN 1936 / MEAN VALUE (ENGLAND, ISLE OF MAN, SCOTLAND, SHETLAND ISLANDS, WALES)
BUKITRIM	BUKIT RIMPAH / INDONESIA
CANARYIs	PICO DE LAS NIEVES / CANARY ISLANDS
CANAVERL	CAPE CANAVERAL / FLORIDA AND BAHAMA
CARTHAGE	CARTHAGE / TUNISIA
CHATHAM	CHATHAM 1971 / CHATHAM ISLAND (NEW ZEALAND)
DJAKARTA	DJAKARTA (BATAVIA) / SUMATRA ISLAND (INDONESIA)
DOS-1968	DOS 1968 GIZO ISLAND (NEW GEORGIA ISLANDS)
EASTERIs	EASTER ISLAND 1967
EGYPTIAN	1906 OLD EGYPTIAN / EGYPT
EUROPE50	EUROPEAN 1950 MEAN VALUE / AUSTRIA, BELGIUM, DENMARK, FINLAND, FRANCE, FRG, GIBRALTER, GREECE, ITALY, LUXEMBOURG, NETHERLANDS, NORWAY, PORTUGAL, SPAIN, SWEDEN, SWITZERLAND, EUROPE 79 EUROPEAN 1979 MEAN VALUE / AUSTRIA, FINLAND, NETHERLANDS, NORWAY, SPAIN, SWEDEN, SWITZERLAND
FALKLAND	SAPPER HILL / FALKLAND ISLAND
GANDAJKA	GANDAJIKA BASE / REPUBLIC OF THE MALDIVES
GHANA	GHANA
GUAM-63	GUAM 1963

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GUNANGSG	GUNANG SEGARA / BORNEO
GUNANGSR	GUNANG SEGARA / BORNEO
GUX1ASTR	GUX 1 ASTRO / GUADALCANAL
HAWAIIAN	OLD HAWAIIAN MEAN VALUE
HAWAMAUI	OLD HAWAIIAN MAUI
HAWAOAHU	OLD HAWAIIAN OAHU
HAWAKAUA	OLD HAWAIIAN KAUAI
HJORSEY	HJORSEY 1955 / ICELAND
HONGKONG	HONG KONG 1963
HUTZUSHN	HU-TZU-SHAN / TAIWAN
INCHAUSP	CAMPO INCHAUSPE / ARGENTINA
INDIA	INDIAN / BANGLADESH, INDIA AND NEPAL
IRELAND	IRELAND 1965
ISTS-073	ISTS 073 ASTRO / DIEGO GARCIA
IWO-JIMA	ASTRO BEACON "E" /IWO JIMA ISLAND
JOHNSTON	JOHNSTON ISLAND 1961
KANDAWAL	KANDAWALA / SRI LANKA
KERGULEN	KERGUELEN ISLAND
KERTAU	KERTAU 1948 / WEST MALAYSIA AND SINGAPORE
LC5ASTRO	L. C. 5 ASTRO / CAYMAN BRAC ISLAND
LIBERIA	LIBERIA 1964
LUZON	LUZON PHILIPPINES (EXCLUDING MINDANAO ISLAND)
MAHE-71	MAHE ISLAND 1971
MARCO As	MARCO ASTRO / SALVAGE ISLANDS
MARCUSIs	ASTRONOMIC STATION 1952 /MARCUS ISLAND
MARSHALL	WAKE-ENEWETOK 1960 / MARSHALL ISLANDS
MASIRAH	NAHRWAN / MASIRAH ISLAND (OMAN)
MASSAWA	MASSAWA / ERITREA(ETHIOPIA)
MERCHICH	MERCHICH / MOROCCO
MIDWAY61	MIDWAY ASTRO 1961 / MIDWAY ISLAND
MINDANAO	MINDANAO ISLAND
MONTJONG	MONTJONG LOWE
NAD27ALA	NORTH AMERICAN DATUM 1927 / ALASKA
NAD27BAH	NORTH AMERICAN DATUM 1927 / BAHAMAS EXCLUDING SAN SALVADOR ISLAND
NAD27CAN	NORTH AMERICAN DATUM 1927 / CANADA (INCLUDING NEW FOUNDLAND)
NAD27CAR	NORTH AMERICAN DATUM 1927 / CARIBBEAN (BARBADOS, CAICOS, CUBA, DOMINICAN

	REPUBLIC, GRAND CAYMAN, JAMAICA, LEEWARD, TURKS ISLANDS)
NAD27CTR	NORTH AMERICAN DATUM 1927 / CENTRAL AMERICA (BELIZE, COSTA RICA, EL SALVADOR, GUATEMALA, HONDURAS, NICARAGUA)
NAD27CUB	NORTH AMERICAN DATUM 1927 / CUBA
NAD27GRN	NORTH AMERICAN 1927 / GREENLAND / HAYES PENINSULA
NAD27MEX	NORTH AMERICA 1927 / MEXICO
NAD27PAN	NORTH AMERICAN DATUM 1927/ CANAL ZONE (PANAMA)
NAD27SAL	NORTH AMERICAN DATUM 1927 / SAN SALVADOR
NAD27USA	NORTH AMERICAN DATUM 1927 / MEAN VALUE CONUS
NAD-83	NAD 1983 / ALASKA, CANADA, CENTRAL AMERICA, CONUS, MEXICO
NIGERIA	MINNA / NIGERIA
NAMIBIA	SCHWARZECK / NAMIBIA
NAPARIMA	NAPARIMA / TRINIDAD AND TOBAGO
NWZEALND	GEODETIC DATUM 1949 / NEW ZEALAND
OMAN	OMAN
PORTRICO	PUERTO RICO / PUERTO RICO AND VIRGIN ISLANDS
PARAGUAY	CHUA ASTRO / PARAGUAY
PHOENXIs	CANTON ASTRO 1966 / PHOENIX ISLANDS
PITCAIRN	PITCAIRN ASTRO 1967 / PITCAIRN ISLAND
QATAR	QATAR NATIONAL
QORNOQ	QORNOQ / SOUTH GREENLAND
REUNION	REUNION / MASCARENE ISLAND
ROME-40	ROME 1940 / SARDINIA ISLAND
S. AFRICA	CAPE / SOUTH AFRICA
S. ARABIA	NAHRWAN / SAUDI ARABIA
S. ASIA	SOUTH ASIA / SINAPORE
S. CHILE CHILE	PROVISIONAL SOUTH CHILEAN 1963 / SOUTH NEAR 53 DEGREES SOUTH
SAD-56	PROVISIONAL SOUTH AMERICAN 1956 / MEAN VALUE (BOLIVIA, CHILE, COLOMBIA, ECUADOR, GUYANA, PERU, VENEZUELA)
SAD-69	SOUTH AMERICAN 1969 / MEAN VALUE (AR GENTINA, BOLIVIA, BRAZIL, CHILE, COLOMBIA, ECUADOR, GUYANA, PARAGUAY, PERU,

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	VENEZUELA, TRINIDAD, TOBAGO
SantoDOS	SANTO (DOS) / ESPIRITO SANTO ISLAND
SAO BRAZ	SAO BRAZ / SAO MIGUEL SANTA MARIA ISLANDS (AZORES)
SE.BASE	SOUTHEAST BASE / PORTO SANTO AND MADERIA ISLANDS
SW.BASE	SOUTHWEST BASE / FAIAL, GRACIOSA, PICO, SAO JORGE, TERCEIRA ISLANDS (AZORES)
SRRLEONE	SIERRA LEONE
StHELENA	ASTRO DOS 71/4 / ST. HELENA ISLAND
TANANARV	TANANARIVE / OBSV. 1925, MADAGASCAR
TERN Is.	ASTRO B4 / TERN ISLAND
THAILAND	INDIAN / THAILAND, VIETNAM
TIMBALAI	TIMBALAI 1948 / BRUNEI AND EAST MALAYSIA (SARAWAK AND SABAH)
TOKYO	TOKYO / MEAN VALUE (JAPAN, KOREA, OKINAWA)
TRISTAN	TRISTAN ASTRO 1968 / TRISTAN DE CUNHA
U.ARAB E	NAHRWAN / UNITED ARAB EMIRATES
VITILEVU	VITI LEVU 1916 / VITI LEVU ISLAND (FIJI)
VOIROL	VOIROL
YACARE	SOUTH AMERICA / YACARE, URUGUAY
ZANDERJI	ZANDERJI / SURINAM
USER DEF	User defined datum. This is a special datum, which can be specified by keyboard, by entering five parameters. This feature allows the GPS to be used for surveying, using a highly specialized local datum.

USER DEFINED DATUM

The user defined datum can be input by selecting USER DEF. DATUM in the datum list.

```
┌─────────────────────────────┐
│      USER INPUT DATUM        │
│      WGS84-Loc Geodetic      │
│  da             -112.140 m   │
│  df            -0.54750714   │
│  dX                  -92 m   │
│  dY                  -93 m   │
│  dZ                  122 m   │
│                              │
│                      [DONE]  │
└─────────────────────────────┘
```

The five input parameters are as follows:

da	Delta a	This is the difference in the semi-major axis from WGS-84 to the local datum, in meters.
df	Delta f (x 10,000)	This is the difference in flattening from the WGS-84 model to the local datum. Flattening is $(a - b) / a$, where a is the semi-major axis, and b is the semi-minor axis.
dX	Delta X	These (dX, dY, dZ) are the differences in height from the center of the Earth from the WGS-84 model of the Earth's surface to the local datum's model of the Earth's surface in meters.
dY	Delta Y	
dZ	Delta Z	

EXAMPLE: For the MINNA / NIGERIA datum, the five parameters are as follows:

Delta a -112.14 meters
Delta f -0.54750714 (nondimensional)
Delta X -92. meters
Delta Y -93. meters
Delta Z 122. meters

To use the user defined datum just described, the datum selection USER DEF must be manually selected.

A manually selected datum will stay in memory until it is changed, or the selection is set to automatic. In the AUTO mode, the datum is reselected every time you change waypoints, or enter new coordinates into a waypoint.

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SPECIFICATIONS

SYSTEM DESCRIPTION

The GP-270ML is a fully automatic GPS receiver and navigator, providing exceptional accuracy and reliability for all navigation requirements. The standard model includes the following items:

GP-270ML GPS Navigator
Remote GPS antenna with 35 feet of cable
GP-270ML GPS Operator's Manual
Mounting Bracket with Knobs
Power / Data Cable
Gift Box
Warranty Card

SPECIFICATIONS

Maximum speed:		5000 knots
Maximum acceleration:		6 g
12 channel parallel receiver:		up to 12 satellites tracked
Position fix:		by Kalman filter, all satellites used
Time to first fix:	Hot start:	5 seconds
	Cold start:	40 seconds
First time global search:		2.5 minutes typical
Position update frequency:		approximately 1 / second

Typical error	Position	Speed
SA ON	50 meters	0.80 knots
SA OFF	10 meters	0.10 knots
Differential data, SA ON	5 meters	0.50 knots
Differential data, SA OFF	5 meters	0.05 knots

Construction: Water resistant, will withstand 1 foot submersion for 30 seconds

Width / height / depth: 6.25 x 4.25 x 2.30 in; 15.87 x 10.79 x 5.84 cm

Weight: 1.5 lbs; 0.68 kg

Operating temperature: +14 to +149 ° F; -10 to +65° C

Input power: 10 – 32 V DC, 7 watts

INSTALLATION AND ELECTRICAL WIRING

1. INSTALL THE RECEIVER UNIT

Although your ICOM is water resistant, it should be reasonably protected. Choose a receiver site free of moisture, weather, heat, shock, and vibration. The GPS should be at least 0.5 meter (20 inches) away from a magnetic compass. The receiver can be mounted on a bulkhead, overhead ceiling, or table top. Secure the tilt stand with screws or bolts.

2. HOOK UP THE POWER CABLE

A. Connect the RED wire of the power cable to +10 – 36 V DC through a circuit breaker or fuse block with a current rating of 2 amperes. Connect the BLACK wire to the power ground.

B. Connect the power cable to any devices using serial data input or out put, according to the following diagram. The serial output ports can drive up to three standardreceiving devices.

Output Port 1: Connect YELLOW to serial data input on the device receiving data from the GPS.

Connect WHITE to serial data ground on the device receiving datafrom the GPS.

Output Port 2: Connect GREY to serial data input on the device receiving data from the GPS.

Connect WHITE to serial data ground on the device receiving data from the GPS.

Input Port 1: Connect GREEN to serial data output on the device sending data to the GPS.

Connect WHITE to serial data ground on the device sending data to the GPS.

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	INLINE FUSE	CIRCUIT BREAKER	
RED 1			10 - 32 VDC
WHT 2		3A	SERIAL PORT GND
GRY 3			SERIAL DATA 2 OUTPUT (AUTO PILOT)
BLK 4			GND
YEL 5			SERIAL DATA 1 OUTPUT
GRN 6			SERIAL DATA 1 INPUT
BLUE 7			NO CONNECTION

PIN 7 - BLUE
(NO CONNECTION)

PIN 1 - RED
(10 - 32VDC)

PIN 6 - GREEN
(SERIAL DATA 1 INPUT)

PIN 2 - WHITE
(SERIAL PORT GND)

PIN 5 - YELLOW
(SERIAL DATA 1 OUTPUT)

PIN 3 - GREY
(SERIAL DATA 2 OUTPUT)

PIN 4 - BLACK
(GND)

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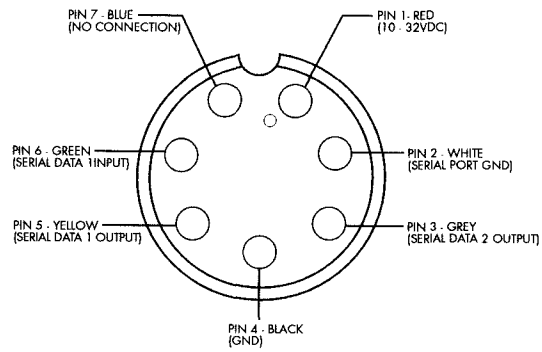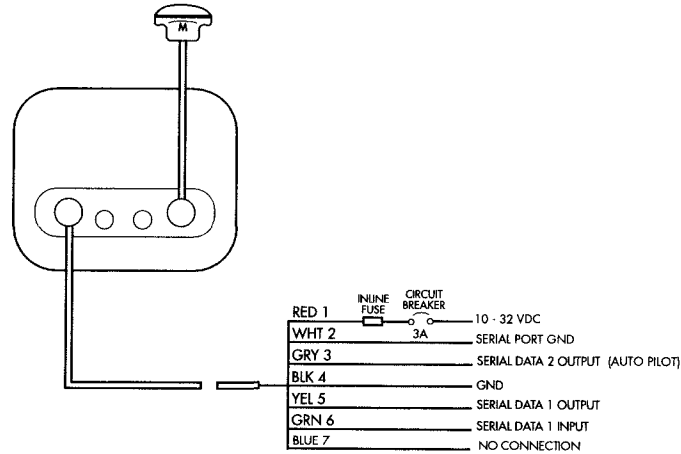
3. INSTALL THE ANTENNA

Mount the antenna vertically so it has as clear a view of the sky as possible. It should be AS LOW AS POSSIBLE while still getting a clear view of the sky, down to the horizon. If it is mounted high on the boat, the course and speed readings will respond to the antenna motion caused by pitching and rolling of the boat. If there is any question, do a temporary installation with duct tape. If performance is satisfactory, you can then install the antenna permanently. If there are problems, try another antenna location for better reception.

SUGGESTED ANTENNA LOCATIONS:

a) Two feet above the rail, at the bow or as far astern as possible.

b) Pilot house roof

c) Inside the pilot house close to the roof, if the roof is fiberglass and the antenna has a good view of the horizon from there, with no large metal structures above it.

The antenna can be mounted on a standard mast with 1" – 14 thread. It can also be mounted on a flat horizontal surface. To mount the antenna on a flat surface, remove the four nuts holding the antenna together, and mount the top half with the gasket on the flat surface. The antenna will then be 4.2 inches in diameter, and 0.7 inches tall. You will need four holes for the bolts or screws, and a half-inch hole for the connector and antenna cable. This is the usual method for mounting the antenna on aircraft or motor vehicles. Mount the antenna firmly to the gasket, to make the unit water resistant.
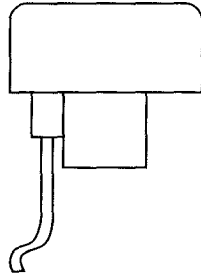
When it is necessary to cut the antenna cable to thread through a small hole, cut the connector end.
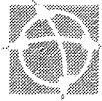
NOTE: Do not paint the GPS antenna.
Paint will reduce the GPS signals.

Connect the antenna cable to the BNC connector on the back of the GP-270ML.

Mount the unit to the bracket and tighten the knobs.

Connect the power plug to the back of the GP-270ML. Turn on the unit by pressing the PWR key for one second. To turn power off, hold the PWR key down for three seconds until the display goes off.

BULKHEAD MOUNTING

To mount the GP-270ML on a bulkhead, cut a rectangular hole in the bulkhead, slightly larger than the projecting rear part of the GPS.

The hole should be about 3.40 x 4.65 inches. (8.64 x 11.80 cm)

The GPS will be secured against the bulkhead with two 10 – 32 screws, which are tightened from behind the bulkhead. Mark the bulkhead for the screwholes by drawing a horizontal centerline, and marking the two screw holes symetrically on the centerline, 5.23 inches (13.28 cm) apart. The installation can be made waterproof by using a caulking material around the rectangular hole.

AUTOPILOT INTERFACE

To interface to an autopilot, follow these three points:

1. Connect the GREY wire in the power / data cable to the autopilot signal input; and the WHITE wire to the autopilot signal ground.

2. Turn the GPS on, and enter a "TO" and a "FROM" waypoint (as described below), in order to test the system.

3. Turn the SERIAL I/O SETUP item SERIAL 2 from OFF to NMEA 0180.

The BAUD rate is set at 4800, and the signal levels are "INVERSE TTL". If the autopilot gives a "NO DATA" or "BAD DATA" alarm, after the GPS has reached operating mode, check to make sure that steps 1-3 were done correctly.

AUTOPILOT OPERATION

1. Turn the GP-270ML ON and wait for lat/lon page to come up.

2. Enter the destination you want to go to into a waypoint, display the data for that waypoint, and press GO TO.

3. Read the bearing to your destination from the display, and steer your vessel to until steady on that bearing.

4. While looking at the "highway" display (under the NAV key), steer the vessel toward the center line until the indicated crosstrack error is at or near 0.00, and the ship's compass indicates the desired bearing.

5. Follow the autopilot manufacturer's instructions for engaging the GPS to autopilot interface.

6. Upon arrival at the destination, or when changing destination in mid-course, be sure to disengage the autopilot and repeat steps 2 through 5 to set your new course to a destination.
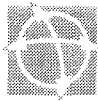
NOTE: Under the NMEA standards, 0.31 nautical miles is the largest crosstrack error that can be output through an autopilot interface. Although the GP-270ML will display up to 9.99 nm of cross track error, 0.31 nm is the largest error it can transmit to the autopilot.

The memory of waypoints and setup items is maintained by an internal lithium battery, with a life of 5 years. When this battery becomes exhausted, the GPS will lose memory of waypoints and present position.

ICOM recommends that the GP-270ML be returned to ICOM Customer Service after 5 years, for the installation of a new battery. The program and software can be upgraded at the same time.
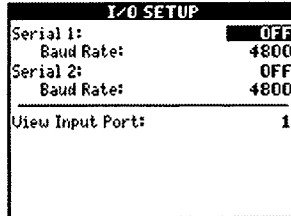
Call (425) 454-8115, fax (425) 451-1064, or see the ICOM America Website at <www.icomamerica.com> for instructions on how to return the unit for service.

The memory battery is the only item requiring maintenance.

SERIAL DATA INPUT AND OUTPUT

Serial data input and output are controlled from the I/O SETUP page.

Press MENU to bring up the main menu. Press the ▲ or ▼ keys to put the highlight on SETUPS, and press ENT. The SETUPS submenu will be shown. Use the ▼ and ▲ keys to put the highlight on SERIAL I/O. Press ENT, to bring up the I/O SETUP page.

```
        I/O SETUP
Serial 1:              OFF
   Baud Rate:         4800
Serial 2:              OFF
   Baud Rate:         4800

View Input Port:          1
```

This has choices to control the serial data formats and baud rates for two ports. Port 1 has input and output lines, while port 2 has only an output line.

SERIAL 1:   Default = off

BAUD RATE: Default = 4800

SERIAL 2:   Default = off

BAUD RATE: = 4800

The choices for the data formats and baud rates are as follows:

No data are transmitted or received.

This is the standard data format for interface to electronic charting systems, radars, and most other marine equipment. This is version 1.5 of the original NMEA 0183 specification.

NMEA183   This format is compatible with the new NMEA183 version 2 specification. It is similar to the older format, but has some additional sentences.

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NMEA-RMc	This is the short form - high repetition rate data output, which is preferred for some electronic charting systems.
7 x 40	This is designed for laptop personal computers, which can be used for remote displays.
24 x 80	This is a similar format, designed for using personal computers with a standard CRT display, to display data.
NMEA-RMa	This is similar to RMc, but with a LORAN label. Some older instruments won't work unless they see a LORAN label, so they will work with this.
NAVLINK	This is the NMEA0183 output, with a LORAN instead of a GPS label, provided for compatibility with older instruments that require a LORAN label.
WP-UPLOAD	When this format is selected, the entire waypoint memory will be transmitted, at a rate of two waypoints per second. It can be used to enter waypoints into a personal computer.
WPxUPLOAD	This is an extended waypoint upload, and includes name and binary data describing the datum. It is used for some specialized applications.
NMEA-0180	This is the standard autopilot output. 180 + CDX This is the standard autopilot output, with additional range data that can be displayed on a Datamarine CDX.
NMEA-USER	This format consists of ten NMEA sentences that are repeated about every five seconds. The sentences can be user selected, to provide compatibility with almost all equipment that use NMEA serial data input.
D-GPS	This sets up the serial data input format for the SC-104 differential data input, and the output format to NMEA-USER. This is compatible with standard 285 – 325 kHz radiobeacon differential GPS data receivers.

When the format is selected, the baud rate will be set to the standard rate for the format selected. If you want a different rate, move the highlight to the

baud rate field, and select one of the following rates: 150, 300, 600, 1200, 2400, 4800, 9600, and 19K2 (19,200).

When the NMEA-USER format is selected, ten different data sentences are sent in sequence, and repeated periodically about every five seconds. A display page will appear that shows the default selection for the ten sentences, and allows you to select a different ten if desired. The default sentences are GGA, BWC, APB, ZDA, VTG, GGA, BWC, APB, MLC, and VTG. The default selection will work with about 90 per cent of equipment that uses serial data from a GPS or loran.

If it is necessary that data be repeated more often than once per 5 seconds, selections can be repeated. For example, BWC and GGA are repeated in the default selection. If you wish to change the default selection, the following sentences are available.

APA	APB	BWC	BWW	GGA	GLC	GLL	GL1	GLP	GTD	MLC	RMA
RMB	RMC	SBK	SCY	SGD	SLX	SNU	SNV	VTG	WCV	XTE	ZDA
ZTG	ZZU	—	—								

The NMEA user selectable data output allows the GPS to be configured to interface with almost all equipment that uses serial data input. If you are having difficulty getting the receiving equipment to work properly, call your dealer or ICOM Customer Service at (425) 454-8155 (or FAX at (425) 451-1064) for advice and assistance.

WP UPLOAD

This feature allows waypoints to be saved in a personal computer. Select DATA 1 (or DATA 2) WP UPLOAD in the SETUP list after setting up your PC's communication software to the following: 4800 baud, 8 data bits, no parity, 1 stop bit and selecting ASCII download. The wiring from the GP-270ML power/data cable to the PC is as follows:

The waypoints are formatted in the following manner and sent at the rate of 2 waypoints per second.

$GPWPL, 3400.01, N, 11800.00, W, WPNAME1
$GPWPL, 3400.02, N, 11800.00, W, WPNAME2

WP DOWNLOAD

Transmission of waypoints can be done from a personal computer or Yeoman

video plotter to the GPS. This is done in background while the GPS is operating normally. The data format is the same as Upload except for the sender ID field (aa) in the header message which may contain any 2 ASCII characters. When using a personal computer please be aware of the following restrictions: Select ASCII format, make sure that the communications program sends both a carriage return and a line feed, and transmit waypoint data to the GPS at no more often then 1 line every 3 seconds, or the GPS may miss some of the waypoints.

$aaWPL, 3413.00, N, 11835.90, W, WPNAME1<CRLF>

SERIAL DATA INPUT TEST

The serial data input port is on the following wires of the power cable:

Serial data input port 1:	YELLOW Wire
Serial input port 1 return (ground):	WHITE Wire

The serial input data buffer is 200 characters long. It is possible to display the last 48 characters in the buffer.

The input data baud rate is 4800, and the data format is 8 bit no parity. The format is for NMEA 0183, and is not adjustable.

To display the last 48 characters in the input data buffer:

1. Display the I/O SETUP page.

2. Put the highlight on VIEW INPUT PORT: 1, and press ENT.

The last last 48 characters of the serial input buffer will now be shown. The display will be blank if no serial data have been received, or it will be filled with what may look like random characters.

Display characters: Characters 00h to 0fh may resemble the special characters used in the graphic cross track error display, except for 0dh (carriage return) which is shown as a left pointing arrow, and 0ah (line feed), which is shown as a - sign.

Characters above 7fh will show as the display driver's extended character set.

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