

NAVCOM 48 HP-48 MARINE NAVIGATION LIBRARY

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CAUTION

The prudent mariner will not rely solely on any single aid to navigation. The NAVCOM system should be regarded as a single navigational aid and as such, should be backed up by a secondary means of navigation.

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GENERAL INFORMATION

The Navcom marine navigation system consists of the HP-48GX hand-held computer, the Navcom ROM Card, a keyboard overly to allow quick access to Navcom's routines, and this manual. Please check to make sure that you have all of the items listed above. If you don't, call AP Systems for assistance.

The Navcom 'card' is a 128 kilobyte Read-Only-Memory module that adds over 50 specialized marine navigation programs to the HP-48's set of built-in functions. These navigation programs are menu driven and look and act much like many Personal Computer programs. All prompts and answers are labeled, so it takes very little time to get familiar with the system.

You need not read the Hewlett-Packard owner's manuals to use the Navcom programs, but we do urge you to read through this manual carefully, many of Navcom's features are not readily discovered through random 'playing'.

When learning to use the system, don't be afraid to try anything; you cannot damage the module or the computer by 'experimenting'. The most damage that could be done would be to lose the current navigation data (Course, Speed, DR Position, etc.), but this can be easily re-entered if necessary.

How Navcom Works

Marine navigation is an exercise in which we start from a known position and move towards a destination along a pre-planned route. When we depart, we point our vessel in a direction to follow that route (compass heading) at an estimated speed (our best guess from previous attempts). If nothing changed, we would wind up where we wanted to be (the destination). Unfortunately, wind, currents, and shaky steering tend to move us away from our planned route.

When we become curious of our whereabouts, we can use visual or radio bearings, Radar ranges and bearings, celestial sights, soundings or electronics to determine our position. Once we have found where we are (a Fix), we can figure out how much we have moved away from our track (Set and Drift), set a new course towards our destination that compensates for this, and proceed along our way.

This process of navigation is the continual solution and refinement of the 'where are we?' and 'where are we going?' questions. Most navigation computers treat each of these questions as a separate, text-book type problem. This makes them very well suited for practicing navigation in our living room, but rather cumbersome when at sea.

Navcom is designed to integrate all of our navigational work into a single, continually refined solution. Its internal clock and route-following ability automatically keep our position current and allow us to quickly pre-plan celestial sights. After obtaining and reviewing a new Fix, this position information is again combined with the route functions to keep us advised of our location along our intended track.

Armchair Sailors don't despair! Navcom is flexible enough to easily compute 'stand alone' problems and can operate in 'text book' mode as well as 'sailing' mode. Each part of a celestial sight can be broken down and solved separately if you desire.

Having an understanding of what Navcom will do for us, let's find out how to make it do it.

How this Manual is Organized

This manual is divided into 8 sections:

I. GENERAL INFORMATION is the section you are reading now. It tells you how the system is organized and the terminology and conventions used within this manual.

II. GETTING STARTED tells you how to install, set up and initialize the Navcom system. It describes how to select routines from the menu system, and how to enter information into the computer and to read the results.

III. PILOTING FUNCTIONS describes all of the routines that help to determine the vessel's Dead Reckoned position, or to compute a position fix.

IV. ROUTE FUNCTIONS describes all of the routines that deal with planning a voyage: Course and Distance between points, route tracks, and the creation of named waypoints and voyages.

V. CELESTIAL FUNCTIONS is where all the fun is. This section tells you how to plan, shoot, review, plot, and compute fixes using celestial sights.

VI. OPTIONS explains the OPTION menu. This is a custom menu that allows you to install your personal programs so that they will work with the Navcom system.

VII. CONVERSION FUNCTIONS describes the many navigational conversion routines. Navcom can convert courses, times, distances, wind, mass, pressures, and temperatures.

VIII. APPENDICES contain information on accuracy, data structure, subroutines, batteries and other information helpful to the person interested in integrating their own HP-48 programs with the Navcom system.

The program's Main menu is organized exactly like sections III through VIII above (More about menus in the next section).

Conventions / Terminology

The following navigational conventions, terminology, and notations are used in this manual and in the prompts and displays of the computer.

System:

Main Menu.	The uppermost Navcom menu. Provides access to the 6 sub-menus: PILOT ROUTE CELES OPT CONV SETUP.
Sub-Menu.	Menus divided by subject content that provide direct access to the Navcom routines. For example, the PILOT sub-menu provides access to the Piloting routines.
Routine.	A Navcom sub-menu or keyboard selection that deals with a particular task (such as finding LAN, taking a sight, or setting the clock). Routines reside within the sub-menus.
Function.	A menu selection within a <i>routine</i> that does a specific task (such as selecting a date within the LAN routine).

Data Entry:	
ENTER	Capitalized Words are commands that correspond to keys or menu selections on the computer.
< ▶ ▲ ▼	Cursor Keys refer to the 4 arrow keys that are on rows 2 and 3 of the HP-48's keyboard. They are used to scroll through catalogs and lists.
EXIT	(Back-Arrow Key) refers to the left-facing arrow on row 5 of the keyboard. During entry of a number or name, it is used to delete the right-most character. If not entering a number, it returns you to the next higher window or menu.
ATTN / ON	Attention key. Exits the current Navcom routine and returns you to the Main navigation menu, and the standard calculator display. If pressed during number entry, it exits the number-entry box, but remains within the current routine window.
HH.mmss	Hour-Minutes-Seconds. Times are entered in 24 hour "military" format. For example, 7:07:35 PM is entered as 19.0735.
MM.ddyyyy	Month-Day-Year (American Format). If the date entered is in the current year, the year (yyyy) may be omitted. For example, July 12 of the current year is entered as 7.12. August 17, 1990 is entered as 8.171990.
DD.mmyyyy	Day-Month-Year (European Format). If the date entered is in the current year, the year (yyyy) may be omitted. For example, July 12 of the current year is entered as 12.07. August 17, 1990 is entered as 17.081990.
DD.mmt	Degrees-Minutes-Tenths. Latitude, Longitude, Sextant Altitude, GHA, Declination, and Index Error are entered in this format. NORTH and WEST entries are positive as default settings. Each default setting may be changed by using the MODES function. Negative numbers may be entered by pressing the (+/-) key after entering a number.
nm	All distances are expressed in Nautical Miles.
kts	All speeds are expressed in Knots (Naut. Miles per Hour)
DDD.t	All courses/headings are expressed in Degrees. Tenths.
"ABC"	Letters in quotes indicate ALPHA characters. Characters are used to name waypoints and voyages.
123	Numbers keyed in on the computer keypad.

Navigation:

Altitude.Angular distance of a body above the horizon. Used interchangeably with Height.
Measured in Degrees, Minutes, and Tenths.

Assumed Position (AP). Position used to plot celestial Lines of Position (LOP's). It is usually the closest whole degree of Latitude and Longitude to the vessel's DR Position.

Azimuth. Direction of a celestial body expressed in degrees from 0-360 measured clockwise from North. May be entered in True or Magnetic, but always displayed in True. An LOP is always plotted perpendicular to the Azimuth.

General Information

- **Body Number.** Number used to identify a celestial body in lieu of its catalog name. Corresponds to the body numbers used in the "Nautical Almanac"
- **Civil Twilight.** Time when the sun is 6 degrees below the horizon. This usually marks the beginning of star time in the morning and the end of star time in the evening.
- Course. Direction of intended travel of the vessel expressed in degrees from 0-360 measured clockwise from North. (See Heading)
- **Deviation (Dev).** Magnetic compass error due to the construction of the vessel. Deviation + Variation = Total compass error or the difference between True and Magnetic compass headings. Measured in degrees East or West. Varies depending on the heading of the vessel.
- **Dead Reckoned Position (DR, DR Pos).** Position of the vessel that is determined by applying the heading and speed of the vessel to the last Position Fix. May be combined with a known set and drift to arrive at the 'best guess' of the vessels position.
- FIX (Position Fix). Position of vessel as determined by visual, celestial, or electronic means. Used as a starting point from which to compute a DR Position.
- **GMT (Greenwich Mean Time).** World time standard. Also referred to as UTC (Universal Coordinated Time). Navcom's internal clock is set to GMT.
- Great Circle (GC). Shortest route between two points on a globe. On a mercator chart it appears as an arc between two points that curves toward the closest pole. Great Circle tracks are considerably shorter than Rhumbline tracks on east-west routes. For plotting purposes they are broken down into a series of short Rhumblines.
- Height of Eye (HE). Height in feet or meters of observer's eye above the surface of the water. Used to correct sextant altitudes.
- Height Calculated (Hc). The altitude of a body as computed by Navcom. This is compared with the Observed Height (Ho) to determine the 'intercept' (distance) of a celestial body's Line of Position from an Assumed Position. Measured in Degrees, Minutes, and Tenths.
- Height Observed (Ho). Altitude of a body corrected for Index, Height of Eye, Refraction, Semi-diameter and Parallax. This is compared with the Computed Height (Hc) to determine the 'intercept' (distance) of a celestial body's Line of Position from an Assumed Position. Measured in Degrees, Minutes, and Tenths.
- Height Sighted (Hs). Uncorrected Altitude of a body (as read from the sextant). Measured in Degrees, Minutes, and Tenths. Keyed in as DD.mmt.
- Index Correction (IC). Correction applied to sextant reading to compensate for errors in the sextant. Determined by taking a sight of the horizon. Altitude of horizon should be zero. If it is not, measure the sextant angle when the horizon is aligned with itself. If this angle is positive, then IC should be negative and vice versa. A known personal correction may be entered into Navcom and automatically added to the IC whenever a sextent altitude is entered.
- Intercept (a). Distance from the Assumed Position to the LOP of a celestial body. Measured in nautical miles as 'From' or 'To'. A 'To' intercept is plotted from the AP toward the Azimuth. A 'From' intercept is plotted from the AP, 180 degrees away from the Azimuth.
- Knot (kt). Measure of speed in nautical miles per hour. A nautical mile is 6076 feet vs. a statute mile's 5280 ft.

- Latitude (Lat). Angular Distance of a vessel's position measured north or south of the equator from 0-90 degrees. Measured as Degrees, Minutes, Tenths.
- Line of Position (LOP). A line derived plotted on a chart from a celestial sight that represents our position. If there is one LOP, you are 'somewhere' on that line. If there are two LOP's your position is where they intersect.
- Local Apparent Noon (LAN). Also known as Meridian Transit. Time that a celestial body passes through your meridian (longitude). At LAN, a body will bear directly north or south. A sight at this time yields an LOP of that represents latitude.
- Local Hour Angle (LHA). Angular distance between your longitude and a celestial body's GHA. The LHA of Aries is commonly used with star-finders as a reference. If you are using Navcom's star-finder, you will not be concerned with LHA.
- Longitude (Lon). Angular distance of a position measured east or west from the Greenwich meridian from 0-180 degrees. Measured as Degrees, Minutes, Tenths.
- Lower Limb. The lower edge of the Sun or Moon. Almost all Sun sights are shot using the Lower Limb, but many Moon sights must be shot using the Upper Limb due to the phase of the Moon. When shooting the Sun or Moon, Navcom will prompt you for which limb you used to sight the body.
- Nautical Twilight. Time when the Sun is 12 degrees below the horizon. It iss usually too dark to see the horizon for star sights at this time.
- Navpoint. A named position that is used as a reference point from which to compute a vessel's position using visual or Radar bearings. A navpoint's name may be from 1 to 5 characters and may include numbers except as the first character.
- Rhumbline. Course line between two points that is represented as a straight line with a constant course angle on a Mercator chart.
- Sight. The combination of a celestial body's altitude, and the exact time of that altitude. A single sight will yield a Line of Position (LOP). More that one sight will yield a fix.
- Star Time. Best time to shoot morning or evening stars. It is a compromise between seeing a clear horizon and seeing the stars. As a rule, the best star time is usually around civil twilight.
- Unknown Body. An unidentified star (or planet) that is taken like a sight except that instead of entering a star name, the approximate azimuth is entered. Navcom will then compute what star was sighted.
- **Upper Limb.** The upper edge of the Sun or Moon. Almost all Sun sights are shot using the Lower Limb, but many Moon sights must be shot using the Upper Limb due to the phase of the Moon. When shooting the Sun or Moon, Navcom will prompt you for which limb you used to sight the body.
- Voyage. A collection of waypoints. A voyage's name may be from 1 to 6 characters long and may include numbers except as the first character.
- Waypoint. A named position. Each waypoint contains a latitude, longitude and time zone description. A waypoint's name may be from 1 to 6 characters long and may include numbers except as the first character.

GETTING STARTED

Installing the NAVCOM ROM Card

The HP-48 has two *ports* for installing plug-in cards, designated port 1 and port 2. Port 1 is closest to the front of the computer; port 2 is closest to the back. The Navcom card can be installed in either port but will run much faster when installed in port 1.

CAUTION: The computer must be turned off while you are installing or removing a plug-in card.

To Install the Navcom ROM card:

- 1. Turn off the computer (Display should be blank).
- 2. Remove the port cover at the top of the computer by pressing down against the grip area and then pushing towards the top of the computer. Removing the cover exposes the plug-in ports.
- 3. Select an empty port for the card. Either port may be used.
- 4. Slide the card into one of the ports. The end of the card *without* the finger grip should be inserted first. The side of the card with the finger grip should be towards the bottom of the computer (away from the keyboard). Make sure the card is lined up properly with a port opening and not positioned half in one port and half in the other.
- 5. Slide the card firmly into the port until it stops. When you first feel resistance, the card has about 1/4" to go to be fully seated.
- 6. Replace the port cover by sliding it on until the latch engages.

For additional information on installing and removing ROM and RAM cards, see the HP Owner's manual.

Turning the Computer On and Off

The HP-48 is shipped with three AAA batteries already installed. When you take your computer out of the box, it's ready to turn on.

Press ON to turn the computer on (ON is located at the lower-left corner of the keyboard). To turn the calculator off, press the **RIGHT-SHIFT** (blue-green Arrow key) and then ON. Since the HP-48 has *continuous memory*, turning it off does not affect the information you've entered. To conserve power, the computer turns itself off 10 minutes after you stop using it.

The first time you turn the computer on with the Navcom card installed, the display will go blank for a few seconds. This is the Navcom system installing itself in the HP-48 and is normal.

Adjusting the Display Contrast

Any time the computer is on, you can adjust the display contrast by holding down the **ON** key and pressing the **PLUS** key (+) for darker or the **MINUS** (-) key for lighter. Try it now to get the contrast you like best.

The Menu System

The top row of keys on the HP-48 are blank. These are the menu keys. The HP-48 has hundreds of functions, but only a few dozen can fit on the computer's keyboard. The rest are accessed through the menu keys. Navcom's navigation functions are accessed through these keys just like the built-in HP-48 functions.

Menu labels are displayed on the bottom row of the computer's screen. Each one of the labels corresponds to the menu key directly below it. If the menu label above a key is dark with light letters, then that menu key is active and available for use. If the label is light with dark letters, it means the menu key is not available for use at the present time (For instance, Great Circle functions would not be active if the route selected was a Rhumbline).

Once the Navcom system has been installed and initialized (next section) the Main navigation menu is found by pressing the **CST** (Custom Menu) key.

Starting the Navcom System

If you are already familiar with entering information into Navcom, this checklist will step you through the start-up procedure. If you don't know how to enter information, skip this list for now, read the rest of this section, then come back to this list to setup your system.

Navcom Start-up Check List

-Press START from the LIBRARY menu. -Run the, CLOCK, MODE, and HDG routines that are in the SETUP menu. -Run the FIX routine that is in the PILOT menu to give Navcom an initial position. -Run the SETUP routine that is in the CELES (Celestial) menu.

To start the Navcom system for the first time, press the blue-green **RIGHT-SHIFT** key, then press the key marked **LIBRARY** (in green) on the eighth row of the keyboard; the **LIBRARY** menu will appear at the bottom of the screen. Press the menu key labeled **APSYS**. This will put you into the AP Systems navigation directory.

There are two menu choices in the **APSYS** directory; **MENU** will display the Main navigation menu, and **START** will initialize the system. Press **START** now and the computer will work for several seconds.

After the **START** routine has finished, it will display the **SETUP** menu. This menu allows you to customize Navcom's displays and perform chores like setting the computer's clock. We will use one of the routines, **HDG** (Heading / Speed entry) to demonstrate how the Navcom keyboard works.

To access Navcom's Main menu in the future, you can use either the **MENU** key (in the Library menu) or press **CST** (Custom Menu- located in the middle of the second row). You also have the option of by-passing the menu system altogether and running Navcom's routines directly from a customized keyboard (more about that later).

Entering / Displaying Information

To follow the examples listed in this section, press the HDG menu key located in the SETUP navigation menu.

The Keyboard

The HP-48 keyboard has several "levels". Each key has a primary key action that's shown on the key face; such as **ENTER**, +, 7 and **NXT**. Three of the primary keys are used to redefine the keyboard to match other sets of actions. The three keys are:

The violet LEFT-SHIFT key, which activates the violet key definitions above and to the left of each key.

The blue-green **RIGHT-SHIFT** key, which activates the green key definitions above and to the right of each key. All shifted functions in Navcom use the **RIGHT-SHIFT** key.

The **ALPHA** key, which activates the white, alphabetic key definitions to the lower-right of many of the keys. When Navcom requires alpha information (ie. the name of a waypoint) it will automatically activate the alpha keyboard.

The following primary keys are used to control the Navcom system:

CST	Custom Menu. Displays the top-level menu in Navcom (See below for menus).
< ► ▲ ▼	Cursor Keys. Scrolls through the various Navcom catalogs.
ENTER	Completes or confirms information you have entered. Tells Navcom to 'continue'.
+/-	Change Sign Key. Changes the sign (positive to negative) of a number that is currently in the number-entry window.
EXIT(←)	Back-Arrow Key. During number or Alpha entry, erases the right-most digit or character. If not in data entry mode, it quits the current window and moves up to the previous screen display or menu.
0-9	Digit keys. Places a digit in the number entry window.
÷ X - +	Arithmetic keys. Performs the operation on the two lowest numbers on the <i>stack</i> (more about the stack later).
ON	While the computer is on, ON acts as the ATTN (Attention) key; it exits any Navcom screen and restores the computer to normal (non-navigation) operation.

Alpha (Name) Entry

When prompting for the name of a waypoint, voyage, or celestial body, Navcom will ask you to key in the desired name or to select from a *catalog* or existing names.

When prompted for an alpha entry, the following keys are active:

A,B,C,	All of the upper-row keys have alpha characters marked to the lower right of the key. These keys temporarily loose the normal functions and act as a type-writer style keyboard to let you enter the name.	
ENTER	Completes the alpha entry and resumes the program. If there are no alpha character in the hi-lighted box, pressing ENTER activates the <i>catalog</i> (see below).	
EXIT (⊬)	Removes the right-most character from entry box. If the box is empty, exits alpha entry.	
ON (ATTN)	Exits alpha entry.	

Catalogs

When prompted for the name of a waypoint, voyage or celestial body, and the name already exits, you may select the name from a *catalog*. A catalog may be accessed from a **CAT** menu key, or from the alpha-entry prompt by pressing **ENTER** when there are no characters in the entry box.

When in a menu, the following keys are active:

A,B,C,	The alphabetic catalog keys will drop you into the catalog at the first selection beginning with that letter. All other catalog entries following that selection will also be displayed. For example, if selecting a star from the STAR catalog, pressing 'B' will display Bellatrix, Betelguese, Capella, etc. If there is no catalog entry that starts with the letter selected, it will display the next following entry.
EXIT (←)	Exits the current catalog. If the catalog is not at its upper-most lever, (as when selecting a celestial body) ← moves up to the preceding catalog.
▲ (UP)	Returns up to the A,B,C level of the catalog from the current catalog entry level.
ENTER	Exits the catalog and enters the alpha-prompt environment.
ON	Exits the catalog.
►NXT, PREV	Moves left or right through the current level of the catalog.

NOTE: In many Navcom routines, there will be a menu key that prompts for an alpha entry, but no key with which to call a catalog. In this case, just pressing **ENTER** will access the catalog.

Prompted Number Entry

Within the Navcom screen displays, when the program prompts you for information it will display a hi-lighted box with an underscore (cursor). (For our **HDG** routine example, press the **HDG** menu key to see the data-entry box.)

As you key in digits, you will see them displayed within the box. If you make an error, pressing the **BACK-ARROW** key will erase the right-most digit. Pressing **ENTER** completes the number entry. Press the **ON** (Attention) key to abort the number entry routine.

Direct Number Entry

In addition to prompting you for information when you press a menu key, in most cases Navcom allows you to key in a number *then* press a menu key. To do this, simply start typing in a number and a small working window will appear on the screen. (**HDG** example: Press **17.5** to see the direct number entry window, then press the **SPEED** menu key to store it as your speed).

You may add, subtract, multiply, and divide two numbers within this window. To terminate number entry and continue on with the program, press the desired menu key. To terminate number entry so that another number can be keyed in, press **ENTER** and then key in the second number. To abort the number entry routine, press **ON**.

The MAIN MENU

The Main menu is the "upper-most" menu in Navcom and allows you to select navigation functions by topic. This menu does not run any routines directly; it simply sends you to one of the sub-menus.

The menu is accessed by any of three means:

- 1. Press the LIBRARY key. Select APSYS from the menu. Select the MENU option.
- 2. If the custom navigation keyboard is not enabled, press the CST key on the second row.
- 3. If the custom navigaion keyboard is enabled, press the Navcom-keyboard **MENU** key (located under the **SPC** key at the bottom of the keyboard).

{ HOME }
4:
2
1 - Pilot Koute Geles Optn. Conv. Setup

KEY DESCRIPTION

- **PILOT Piloting Functions** are used to determine the vessel's DR position, control/access waypoint information and enter/compute fixes. See pg. 21.
- **ROUTE** Route Functions are used to plan voyages, create and edit waypoints, plot track lines, compute ETA's, and determine courses and distances between points. See pg. 37.
- **CELES** Celestial Functions help you to plan and shoot celestial sights, plot celestial LOP's, compute Lat/Lon fixes from sights, and access the computer's Nautical Almanac. See pg. 52.
- **OPTN** The **Option Menu** is initially empty. It allows you to integrate your own programs with the Navcom system. See pg. 67
- **CONV** Conversion Functions allow you to quickly convert Magnetic and True Courses, Time Zones, Distances, Weights, Temperatures and Pressures. See pg. 68.

SETUP Setup Functions are used to initialize and customize the Navcom system to suite your personal preferences. See pg. 11.

The SETUP Menu

The routines in the **SETUP** menu should be run when setting up the system for the first time or when you wish to change the default settings. As with most Navcom menus, there are 6 selections available:

{ HDME }	
4:	
2:	
ी : जनवस्त्र विद्यमन विद्यम्ब प्राप्तम्ब विद्यम्ब	1775-00

KEY DESCRIPTION

RESET

System Reset. Has the same function as the START routine in the HP-48 LIBRARY menu to initialize the Navcom system. The routine allows three options when resetting the system:

ENTER

The most 'severe' or complete reset. Erases all navigation data, waypoints, and voyages. This option literally gives you a "clean slate". Keep in mind that this option can erase a <u>lot</u> of information. Use it only as a last resort if you have a problem with the system.



Erases only the current sailing information (course, speed, zd, sextant correction, etc.). Leave all waypoint and voyage data intact. **EXIT** is a 'moderate' reset.



Leaves all navigation data intact. This is the 'mildest' form of reset.

MODE

Navigation Modes. Sets Heading, Lat/Lon, and Date entry preferences. Also accesses the Deviation Table if in Magnetic Heading. Mode. See pg. 13.



VERSI Version. Displays the version number of the program. See pg. 16.

KEYS Custom Keyboard. Turns on/off the custom Navcom keyboard. See pg. 17.

HDG Heading Routine. Enters information on Heading, Speed (or Log Dist), Time Zone Description, and Variation. See pg. 18.

MODE Mode Selection

The **MODE** routine allows you to change how Navcom prompts for, and displays, information. The routine controls Headings (True or Magnetic), Speed (Speed in knots or Log Distance in Nautical Miles), Latitudes (North or South as negative numbers), and Longitudes (East or West as negative numbers).

When in *speed* mode, Navcom computes your DR position using the last known position (Fix), the vessel's heading (as entered in the **HDG** routine), and the difference in time between the time you request and the time of the last fix, multiplied by the speed (also entered in the **HDG** routine).

When in *log* mode, Navcom computes your DR using the last fix, the heading and a fixed distance (entered as the Log Dist" in the **HDG** routine). To maximize use of Navcom's automatic features, it is recommended to use the *speed* mode.



KEY DESCRIPTION

- **HDG** Heading. Toggles between True and Magnetic headings.
- **DEV Deviation Table.** Allows you to enter/edit the magnetic deviation table that is applied to headings when in *magnetic* mode. Key is active only when in *magnetic* mode. See next page for explanation of the deviation table.
- **SPEED** Speed / Log Mode. Toggles between speed mode and log mode.
- **LAT** Latitude Entry. Toggles between North Lat=positive numbers and South Lat=positive. All latitude entries are based on the convention you choose here. Default is North=positive.
 - **LON** Longitude Entry. Toggles between West Lon=positive numbers and East Lon=positive. All longitude entries are based on the convention you choose here. Default is West=positive
 - **BEEP** Error Beep. Toggles between sounding a tone when an error occurs (such as an incorrect key press) and remaining silent. A check-box within the menu key is displayed when the beep is active. Default is active.



ATTN

Attention (ON). Returns to the Main menu.

DEV Deviation Table

The deviation table routine is a menu selection from the **MODE** routine (see pg. 13). It allows you to enter your vessel's deviation on the cardinal and inter-cardinal headings.

When operating Navcom in magnetic mode, when you key in a heading, Navcom first applies the local variation (which is entered in the **HDG** routine) and then applies your vessel's deviation (as entered in this table) to compute a true heading.

For headings that are between those entered in the deviation table, Navcom interpolates between the closest two headings within the table.

D	eviatio	n Tab	le
		nva	
000	0.0W	180	0.0W
045	0.0W	225	0.0W
135	0.0W	315	0.0W
SLCT H	IDG WITH C	URSOR, KE	Y IN DEV.

KEY DESCRIPTION

- **123** Number Keys. Enters the deviation for the selected magnetic heading. Follows East/West sign convention as chosen in the **MODE** routine.
- Curser Keys. Moves the hi-light box left/right and up/down
- **ENTER** Enter. Completes a number entry.
- **EXIT** Exit. Returns to the MODE screen.
 - ATTN Attention / ON. Returns to the Main menu.

CLOCK Clock Functions

The **CLOCK** function allows you to set the internal clock of the HP-48. The computer has built-in commands to do this, but Navcom provides it's own routine that is easier to use, and offers additional features that the built-in functions do not.

In addition to setting the time and date, you may choose the type of date display (USA or European), key in a manual time-rate correction, or have Navcom compute any clock error and set its own correction.

Clock Status
GMT: 03:06:35 Corr: 0 sec./day
Date: WED 06/16/93 Format: MM.ddyyyy Set Moust COSS MODES ONTE FISHT

KEY DESCRIPTION

SET

Set the Internal Clock. Time should be entered as HH.mmss, and the clock should be set to GMT. After keying in the time, press ENTER at the time-mark. SET is generally used to initially set the clock.

ADJST

Adjust Clock. Steps the clock up/down by either hours, minutes, or seconds. Pressing ADJST drops you into another menu marked HR+ HR- MIN+ MIN- SEC+ SEC-. Pressing one of these keys adjusts the clock by the specified amount. As you press a key, you will see the clock display change. To exit the menu, press EXIT. ADJST is most useful for making small changes to the clock setting.

CORR

Manual Correction Factor. Enter seconds-per-day correction (This is most useful if you already know the correction factor and are re-initializing the computer). Correction entry format is HH.mmss. A positive correction speeeds up the clock; negative slows it down. After keying in the correction, press **ENTER** to continue, or **EXIT** to escape with no change.

ACORR

Auto Correction Factor. Allows you to correct the clock from a time tick and automatically determine and enter a clock correction factor. After initially setting the clock using the **SET** function, it is best to wait 2 to 3 weeks before using the **ACORR** function to compute a correction factor. The longer the interval between corrections, the more accurate the correction will be.

Pressing ACORR will prompt for a time (HH.mmss) just a SET does. Press ENTER at the time mark. The clock will be updated to the time that you keyed in, and a correction factor will be computed, displayed, and stored. If you wish to disable the correction facor, use the CORR function and enter a correction of zero.

DATE

Set Date. Uses the currently selected date format (see F'MAT below). If in USA format, key in date as MM.ddyyyy (ex: Aug. 17 1990 is entered as 8.171990). If in European format, key in date as DD.mmyyyy. Remember to use GMT date and not your local date!

F'MAT Date Format. Toggles between USA date format and European date format. The currently selected format is displayed on the screen.

EXIT Exits the clock screen and returns to the previous screen or the SETUP menu.

ATTN Attention / ON. Returns to the Main navigation menu.

VERSI Software Version Display

The **VERSI** menu selection displays the version and creation date of the Navcom software. If you have a problem with your system and you contact AP Systems for help, have this version number handy so we know which system you're talking about.



To Clear the Display, Press Any Key.

Note:	The AP System's logo is displayed anytime you press the MENU key from the custom keyboard,
	and briefly when any routine exits to the Main or Sub menus.

KEYS Custom Navigation Keyboard

The **KEYS** menu selection from the **SETUP** menu acts as a toggle switch to enable/disable the custom keyboard. When enabled, an indicator appears within the menu label.

Navcom gives you the option of *assigning* (or renaming) all of the keys on the HP-48's keyboard. This allows you to skip past the menu system and access most navigation routines directly from the keyboard. Generally, if you use your HP-48 solely for navigation, enabling the custom keyboard makes operation faster and easier. If you use your HP-48 for other purposes as well as for navigation, it is easier to use the menu system and leave the keyboard unassigned.

The keyboard overlay supplied with the Navcom system is your guide to the reassigned keys. It attaches to the HP-48 with three tabs on each side edge of the overlay. To install it, slide one side of the overlay into the slots on the HP-48, bend the overlay slightly in the middle and insert the tabs on the opposite side.

The routines listed on the overlay are printed in two colors; black denotes routines that execute when you press the key below it, blue-green denotes functions that occur when the **RIGHT-SHIFT** key is pressed first. Note that there are no left-shifted functions on the Navcom overlay.

The labels on the overlay match the menu labels within the Navcom menu directory. The overlay is organized as follows:

Row Function

- 1 Reserved for menu selections.
- 2 Main menu (same as pressing CST or MENU in the APSYS directory). Pressing any of these key drops you to the associated sub-menu. Note that CST becomes the CELES menu when the keyboard is active. To see the Main menu, press MENU (located on the bottom row of the keyboard).
- 3 Piloting Functions (Same as **PILOT** in the Main menu).
- 4 Celestial Functions (Same as **CELES** in the Main menu).
- 5 Normal Key actions except for **WIND** and **TDS** routines.
- 6-9 Unshifted keys on these rows retain their normal functions. This allows you to still use the HP-48 as a calculator even when Navcom's keyboard is active. Many of Navcom's conversion routines are located as shifted functions on these rows.

It takes several seconds for Navcom to activate or deactivate the keyboard when KEYS is pressed.

HDG Heading / Speed Entry

The **HDG** routine is used to enter information about your vessel's heading, speed, variation, time zone description, and course changes. This information, along with position information entered in the **FIX** routine, allows Navcom to keep track of the vessel's Dead Reckoning position.

The HDG routine is found in both the PILOT and SETUP menus.



KEY DESCRIPTION

HDG

Heading. Vessel's heading in degrees (0-360). Heading may be True or Magnetic depending on the heading option selected in the **MODE** routine (**SETUP** menu).

TURN

Local time of the last turn. When a new heading is entered using HDG (see above), Navcom assumes that the new heading has been steered from the last fix position. When a new heading is entered using TURN, Navcom assumes that the previous heading was steered until the time-of-turn. It then computes a DR position for that time, and stores the position as a "turn point". From then on, Navcom computes its DR position based on the new course, speed, and *turn point* rather than the last fix.

The **TURN** function allows you to make unlimited course changes from the time of the last fix, and still maintain an accurate DR position. The function will first prompt for the time of turn. It is entered in local time as HH.mm. It will then prompt for the new heading.

The **TURN** function also lets you make speed changes. To do so, press **TURN** and enter the time of the speed change. When Navcom prompts for the new heading, make no number entry and press **ENTER**. Then select the **SPEED** function and enter the new speed.

VAR

Magnetic variation. Active only when magnetic headings are chosen in the **MODE** routine. Variation is combined with deviation (from the Deviation table in the **MODE** routine) and is added to the heading entered. Entered as degrees (DD.t) East or West. East/West sign convention depends on selection made in the MODE routine.



If in *Speed* mode, key in knots. In *Speed* mode, DR position is automatically updated for a selected time.

If in *Log* mode, key in nautical miles from last position fix. In *Log* mode, DR position is updated only by the log distance entered in this function.



Zone Description. Key in the Time Zone Description in HH.mm format. If you choose to navigate using GMT only, key in zero.



Set and Drift Routine. Allows you to enter a known set and drift, and to view or enable/ disable the set and drift that is automatically computed between fixes. Set and drift can be used to compute a more accurate DR position. See pg. 23 for details.

Using the HP-48 as a Calculator

Having the Navcom system installed in the HP-48 does not preclude its normal use as a calculator. The HP-48 is one of the most powerful hand-held calculators made, and it has literally hundreds of functions for your use.

When using the menu system to drive the Navcom system, you can execute any of the keyboard functions of the HP-48 by simply pressing the appropriate key. Most of the calculator's functions though, are accessed through menus just like those of the Navcom system's. The Hewlett-Packard Owner's manuals included with your calculator can guide you through the HP-48's functions.

To return to the Navcom system after using any of the HP-48's menus, press the **CST** key. This will return you to the Main Navigation menu. If for any reason that does not work, you may choose the **MENU** function from the **APSYS** directory, which is located in the **LIBRARY** directory of the HP-48.

When using re-assigned keys to control Navcom (see 'Navcom keyboard overlay'-pg. 17), you must first disable the Navcom keyboard before using the standard HP-48 functions. There are two ways to do this: using the HP-48 **USER** command or Navcom's **KEYS** function.

If you wish to disable the keyboard for a short period of time, you may press the **LEFT-SHIFT** (violet) key, then the key directly above it (the **ALPHA** key). The word "**USER**" will disappear from the top of the display, and the Navcom key assignments will be temporarily disabled.

To return to the Navcom keyboard, press LEFT-SHIFT, ALPHA, then LEFT-SHIFT, ALPHA again. The word "USER" will again appear in the display, and the keys will be assigned their navigation functions.

To disable the Navcom keyboard for an extended time, select the **KEYS** function from the navigation **SETUP** menu. This will disable the Navcom keyboard until the next time you press **KEYS**.

Using a Printer

Navcom's routines do not require the use of a printer. However, many routines may be more useful when using a printer, and any of Navcom's screens can be printed at any time to create a permanent record (or just to show your friends a picture of the 'perfect' pinwheel!). The HP-48 and Navcom were designed to operate with the Hewlett-Packard 82240 A/B infrared printer. It is a cordless, battery operated printer that prints on paper the size of adding machine tape.

To print the screen when running any Navcom routine, the USER keyboard must be enabled (see pg. 17). Simply press **RIGHT-SHIFT** then **MTH** (located on row two, column one; this key is labeled **PRINT** on the Navcom keyboard overlay) and the printer will print the current screen display. Many of Navcom's routines have dedicated print routines. If so, simply press the **PRINT** menu selection when displayed in a navigation routine's menu.

For further information on the Hewlett Packard infrared printer, contact your local Hewlett-Packard dealer or AP Systems.

In Case of Trouble

The Navcom system is designed to trap for as many error conditions as possible.

In the case of data-entry mistakes (ie. entering an impossible date), a message will appear in the screen and ask you to re-enter the information.

If a menu selection is not available, or you press a key that is not active, you will hear a warning beep to alert you of the wrong key press.

In a real-time program that has so many unpredictable operating conditions (such as Navcom), it is possible to run into errors that the system does not expressly trap for. If such an error occurs, a general-error message screen is displayed, and you are given three options to reset the system to correct the error condition:



Attention / ON. This is the lowest level reset and will not erase any navigation information. This will correct most error conditions.

EXIT

Exit (Back-arrow). This level of reset will cause the loss of your current navigational data (heading speed, zone description, clock correction, ht-of-eye, etc.) but will not alter any waypoint or voyage information. It will correct any error due to corruption of the navigation data. If you use this option, be sure to run the **CLOCK**, **MODE**, **HDG**, and **FIX** routines in that order to re-initialize the system.

ENTER

Enter. This is the third and most severe option. This will erase all navigation data including waypoints and voyages, and should only be done in the most stubborn cases. The program will re-initialize itself just as when you first installed Navcom. Follow the instructions starting on pg. 12 to re-enter all the required information.

If none of the above actions solve your problem, call or write AP Systems for help at:

Applied Programming Systems 5685 Balsam Street Las Vegas, Nevada 89130 USA Phone: (702) 361-7676

If possible, it is generally better to call us as we can usually solve your problem in just a few minutes, rather than having to wait days for the mail to arrive.

III PILOTING FUNCTIONS

The **PILOT** sub-menu is home to all of the routines that pertain to determining the position of the vessel. The sub-menu contains the following routines:

{ HOME }
4:
2
<u>]</u> :
FIX WPT POS TO GO HOG TOOS

KEY DESCRIPTION

- **FIX Position Fix.** Computes a position fix using: Direct lat/lon entry, celestial sights, Radar range and bearings, or visual bearings. See pg. 24.
- WPT Waypoint. Creates, edits, and selects waypoints and voyages. This routine is also located in the ROUTE menu. See pg. 27.
- **POS Position.** Displays the vessel's Dead Reckoned position and the range and bearing to a selected *navigation point*. See pg. 32.
- **Distance-to-Go.** Computes the distance-to-go and heading-to-steer to a waypoint or voyage destination. See pg. 33.
- **HDG** Heading. Enters information necessary to compute the vessels position. Includes the TURN and SET-DRIFT functions. See pg. 22.
- **TDS Time-Distance-Speed.** Solves Time-Distance-Speed problems. This routine is also located in the **ROUTE** menu. See pg. 36.

HDG Heading / Speed Entry

The **HDG** routine is used to enter information about your vessel's heading, speed, variation, time zone description, and course changes. This information, along with position information entered in the **FIX** routine, allows Navcom to keep track of the vessel's Dead Reckoning position.

The HDG routine is found in both the PILOT and SETUP menus.



KEY DESCRIPTION

HDG

Heading. Vessel's heading in degrees (0-360). Heading may be True or Magnetic depending on the heading option selected in the **MODE** routine (**SETUP** menu).

TURN

Local time of the last turn. When a new heading is entered using HDG (see above), Navcom assumes that the new heading has been steered from the last fix position. When a new heading is entered using TURN, Navcom assumes that the previous heading was steered until the time-of-turn. It then computes a DR position for that time, and stores the position as a "turn point". From then on, Navcom computes its DR position based on the new course, speed, and *turn point* rather than the last fix.

The **TURN** function allows you to make unlimited course changes from the time of the last fix, and still maintain an accurate DR position. The function will first prompt for the time of turn. It is entered in local time as HH.mm. It will then prompt for the new heading.

The **TURN** function also lets you make speed changes. To do so, press **TURN** and enter the time of the speed change. When Navcom prompts for the new heading, make no number entry and press **ENTER**. Then select the **SPEED** function and enter the new speed.

VAR

Magnetic variation. Active only when magnetic headings are chosen in the **MODE** routine. Variation is combined with deviation (from the Deviation table in the **MODE** routine) and is added to the heading entered. Entered as degrees (DD.t) East or West. East/West sign convention depends on selection made in the MODE routine.



If in *Speed* mode, key in knots. In *Speed* mode, DR position is automatically updated for a selected time.

If in *Log* mode, key in nautical miles from last position fix. In *Log* mode, DR position is updated only by the log distance entered in this function.



Zone Description. Key in the Time Zone Description in HH.mm format. If you choose to navigate using GMT only, key in zero.



Set and Drift Routine. Allows you to enter a known set and drift, and to view or enable/ disable the set and drift that is automatically computed between fixes. Set and drift can be used to compute a more accurate DR position. See pg. 23 for details.

SET-D Set and Drift Entry

Navcom has the capability to compute the set and drift between fixes, and apply course corrections based on that current. You may choose to apply a known set and drift, or the set and drift that is automatically computed by the computdisplays both the manually entered set and drift, and the automatically computed set and drift. You may select to apply either manual or automatic set and drift or apply no correction.



KEY DESCRIPTION

M. SET	Manual Set. Prompts for manual entry of current set direction. Set direction is entered as degrees (0-360) True (Current set is always displayed and entered in True Degrees regardless of the true/magnetic mode chosen in the MODE routine.
DRIFT	Manual Drift. Prompts for manual enty of current drift in knots.
MAN	Manual Set-Drift Mode. Enables/Disables Manual current set and drift correction. A block within the menu key indicates that the function is enabled.
AUTO	Automatic Set-Drift Mode. Enables/Disables Automatic current set and drift correction. A block within the menu key indicates that the function is enabled.

Note: Manual and Automatic set and drift corrections may not be enabled at the same time.

FIX Position Fix

FIX is one of the most extensive Navcom routines. It displays the results of the most recent fix, and allows you to compute a fix based on: Lat/Lon entries (from an external positioning device), Radar range and bearing, celestial LOP's, or running fixes from visual bearings.

After a fix is computed, the routine displays course and speed-made-good, and set and drift from the last fix, based on the heading and speed entered in the **HDG** routine.



KEY DESCRIPTION

LA-LO	Lat/Lon Fix. Allows direct Lat/Lon fix entry. Initially prompts for time (HH.mm), date (MM.dd or DD.mm; For current date, make no entry and press ENTER), then latitude (DD.mmt), and finally longitude (DD.mmt).
VSUAL	Visual Running Fix. Allows you to enter bearings, at two different times, to a known point and compute the vessels's position at the second time. See pg. 25.
RADAR	Radar Fix. Allows you to enter the range and bearing to a known point to compute the vessel's position. See pg. 26.
CELES	Celestial Fix. Accesses the celestial LOP catalog. From the catalog, you can plot, compute, and save a fix from your celestial LOP's. See pg. 57.
PREV	Previous Fix. Toggles between displaying the 'Last' (most recent) and 'Previous' fix. This is usually used to recover when an error is made while keying in a fix.
SET-D	Set and Drift Display. Displays current set and drift between the DR position and the fix position. A box within the menu key indicates that set and drift is enabled. See pg. 23.

See Next Page for Visual and Radar Fix Functions.

FIX-VSUAL Visual Fix Function

The VSUAL function (within the FIX routine) prompts you for two bearings from the same known object at different times to obtain a fix. The function takes heading and speed information from the HDG routine, so make sure the data in that routine is current. Navcom will display by default the selected *Navpoint* (see pg. 27) as the reference point for the bearings. You may change the Navpoint with the **NV.PT** menu option.

Running Visual Fi Time1: 2:00 MON 06/21 25°Ť Brg 1 2:45 ime2: MON 06/21 2: 85°T Bra Nv.Pt: HRGUEL 12100'W Fix: 34°25.2'N LOP 1 LOP 2 NV. PT +FIX | 2+1 +SAVE

KEY DESCRIPTION

LOP 1

First Line-of-Position. Prompts for time, date and bearing of the first LOP. All times are local. Bearing is true or magnetic (depending on the current mode) referenced from North (Do <u>not</u> use relative bearings).

LOP 2

Second Line-of-Position. Prompts for time, date and bearing of the second LOP. All times are local. Bearing is true or magnetic (depending on the current mode) referenced from North (Do <u>not</u> use relative bearings). After entry of the second bearing, Navcom will compute and display the fix position at the time of the second bearing.

NV. PT

Navpoint Entry. Allows entry of a navpoint using a named waypoint position or a lat/lon position. The function displays the following menu:

IDENT

Identifier. Prompts for entry of navpoint name. If selected name is not in Navcom's memory, a warning tone will sound and you will be prompted again. Navpoints and waypoints are created using the **WPT** routine (see pg. 27).



Identifier Catalog. Displays the available navpoints in a catalog. Choosing a navpoint from the catalog selects that navpoint as the reference point for determining a fix. See Section I, pg. 9 for catalog operation.



Latitude/Longitude Entry. Allows the entry of a non-named lat/lon point for use as a reference point in determining a fix.



View Lat/Lon. Displays the latitude and longitude of the currently selected navpoint.

Display course-made-good. After a fix is computed, you may view the course and speed-made good to help in determining if the fix is reliable. CMG appears where the lat/lon of the fix was displayed previously.

2 1 1

Swap LOP's. Replaces the first LOP with the second LOP. This is handy when computing several running fixes and allows the last LOP to be used as the first LOP for a new running fix.

► SAVE

Save/Update Fix. After a fix has been computed and displayed, this function is used to "accept" the fix, store it to memory, update the vessel's position and return to the **FIX** display screen. If a fix is determined to bad, press **EXIT** to return to the **FIX** screen without accepting the new fix.

RADAR Radar Fix Function

The **RADAR** function prompts you for a bearing and range to a known object. Navcom will display by default the selected *Navpoint* (see pg. 27) as the reference point for the object. You may change the Navpoint with the **NV.PT** menu option.



KEY DESCRIPTION



►SAVE

Save/Update Fix. After a fix has been computed and displayed, this function is used to "accept" the fix, store it to memory, update the vessel's position and return to the FIX display screen. If a fix is determined to be bad, press EXIT to return to the FIX screen without accepting the new fix.

WPT Waypoint Management

The **WPT** routine is used to create, edit, and control waypoints, navpoints and voyages. It is the "heart" of the automated route planning abilities of the Navcom system.

A *waypoint* is a named position that consists of a latitude, longitude and time zone description. It can be used to build voyages or can be used alone to give Navcom a place to "aim for". The name can consist of up to 6 characters; numbers may be part of the name as long as they are not used as the first character. **"TOKYO**" and **"BOUY2**" are examples of valid names.

A navpoint is a waypoint that is used as a reference for position fixing. See pg. 31.

A voyage is a named collection of waypoints that represents a complete route between two places. The name can consist of up to 6 characters; numbers may be part of the name as long as they are not used as the first character. "VOY3" and "LA2SF" are examples of valid names.

Navcom can store any combination of waypoints and voyages. The maximum number of each is determined only by the amount of RAM memory available in the HP-48. The computer comes standard with 128 kilobytes of RAM. This is sufficient to hold several hundred waypoints and dozens of voyages and still allow enough RAM for system operation. If needed, an additional 32K or 128K RAM card can be added to the HP-48.

The **WPT** screen shows the status of the voyage and waypoint in use, and allows you to scroll to any waypoint within the current voyage, or by-pass the current voyage and select any waypoint in memory.

Yoyage:	SF2LA
To Waypoint: VM GC/RL: Next Wpt: Navpoint: VOV RET GO	B7TL Rhumbline FERMIN ARGUEL MURDENNO FING GO

Display Meaning

Voyage: Displays the currently selected voyage.

To Waypoint: Displays the selected waypoint.

via GC/RL: Displays the selected route (either Great Circle or Rhumbline) to the waypoint.

Next Wpt: Displays the name of the next waypoint within the selected voyage.

Navpoint: Displays the name of the selected navpoint. Navpoints are independent of voyages and cannot be stored within a voyage.

See Next Page for Menu-Key Functions.

Waypoint Management (cont.) WPT

Yoyage:	SF2LR
To Waypoint: VMA GC/RL: Next Wpt: Navpoint: Nove Den Go	B7TL Rhumbline FERMIN ARGUEL MINOMINITO 50

KEY DESCRIPTION

VOY	Voyage Edit. Creates, edits, and selects voyages. See pg. 29.
WPT	Waypoint Edit. Creates, edits, and selects waypoints. See pg. 31.
GC/RL	Route Select. Selects a Great Circle or Rhumbline route from the vessel's present DR position to the selected waypoint. Routes between each waypoint within a voyage are chosen when creating the voyage; this option allows you to over-ride the voyage plan or to select a route to a waypoint that is not within a voyage.
DEST	To Destination. Selects the final waypoint within the selected voyage as the current waypoint. This is a shortcut key to avoid scrolling through all the waypoints within the current voyage.
NV. PT	Navpoint. Creates, edits, and selects navpoints. It is identical to WPT- EDIT, except that using the SELECT function acts on the selected navpoint instead of the selected waypoint.
TO GO	Distance to Go. Computes the distance-to-go to the selected waypoint. See pg. 33.

< Cursor Keys. Allow you to scroll through and select the waypoints within the currently selected voyage. To advance to, and select, the next waypoint in the voyage, press either the DOWN or RIGHT cursor key. To return to, and select, the previous waypoint, press either the UP or LEFT cursor key. To advance to the final waypoint (destination) press RIGHT-SHIFT, then either the DOWN or RIGHT cursor key. To return to the first waypoint (origin) press **RIGHT-SHIFT**, then either the **UP** or **LEFT** cursor key.

Exit. Quits the WPT routine and returns to the PILOT menu. EXIT

ATTN

Attention / ON. Returns to the Main Navigation menu.

Continued on the Next Page...

WPT-VOY Voyage Control

The **VOY** function allows you to create, edit and select voyages. Before filling a voyage with waypoints, those waypoints must already exist. To create waypoints, use the **WPT** function within the **WPT** routine.

The **VOY** screen displays the name of the currently selected voyage (if any) and helps identify it by showing its first and last waypoints.



Continued on the Next Page ...

WPT-VOY-EDIT Voyage Editing

The **EDIT** function allows you to insert or delete waypoints within a voyage and to select the route (GC or RL) between them. The hi-lighted box shows the current waypoint being edited within the voyage. The "From" line shows the previous waypoint, while the "Next" line displays the next waypoint. The departure waypoint is labeled "Wpt-00".

Edit Voyage: SF2LA From Wpt: SFLNB
To: <u>Npt-01</u> : CARMEL VA GC/RL: Rhumbline
Next Wpt: ARGUEL

KEY

DESCRIPTION

IDENT

Waypoint Identifier. Prompts for the name of waypoint to insert in the voyage. Waypoint names may consist of up to 6 characters, and the waypoint must already exist in memory to be included in the voyage. If the waypoint does not exist, use the **WPT** option in the **WPT** routine to create it. Pressing **ENTER** before keying in a name calls the waypoint catalog.

You may press ENTER without pressing IDENT to access the catalog.

Once a waypoint has been chosen, either by **IDENT** or the catalog, the waypoint is inserted <u>after</u> the waypoint currently displayed in the hi-lighted line. You may continue to add waypoints in this manner until your voyage is completed.

EDIT

Waypoint Edit. This option allows to view or edit the latitude, longitude, or time zone description of the hi-lighted waypoint. You may not change the waypoints name, or delete it, but you may change its attributes. Press **EXIT** to return to the Voyage-Edit screen.

>VIEW

View Voyage. Displays each of the waypoints within the voyage, the type of route (Rhumbline or Great Circle), and the course and distance between each waypoint. Press **EXIT** to return to the Voyage-Edit screen.

DELETE

Delete Waypoint. Removes the hi-lighted waypoint from the current voyage. The waypoint still remains in memory for later use. To delete an entire voyage, use the **PURGE** function in the **VOY** routine.

View Lat/Lon. Displays each the waypoints by name and latitude/ longitude. This is useful for viewing/plotting the voyage and confirming the position of the waypoints selected. The
VIEW option may also be accessed from this screen.

Accessing \triangleright VIEW from \triangleright LA-LO or vis-versa requires a considerable amount of memory, especially for a voyage with many waypoints. If you should see a low-memory error message when attempting this, re-run the desired function directly from the VOY or EDIT screen rather than from \triangleright LA-LO or \triangleright VIEW functions.

GC/RL

Great Circle / Rhumbline. Toggles between a Great Circle and Rhumbline route between waypoints. The voyage may consist of any combination of Rhumbline and Great Circle routes.

WPT-WPT Waypoint Edit

The **WPT** (Edit) function allows you to create, edit, and select waypoints. Though you may edit waypoints from other routines, this is the only place where you can create or delete waypoints.

Selected Waypoint
IDENT: B7TL
Lat: 33°38.2'N Lon: 118°28'W ZD: +07
IDENT LAT LON ZD PURGESELECT

KEY DESCRIPTION

IDENT

Waypoint Identifier. Prompts for the name of the waypoint to create, edit or select. Waypoint names may consist of up to 6 characters. If the name entered is not found in memory, Navcom creates a new waypoint with that name. Pressing **ENTER** before keying in a name calls the waypoint catalog (see pg. 9 for catalog instructions).

You may press ENTER without first pressing IDENT to access the catalog.

Once a waypoint has been called, it becomes the *working waypoint*. A working waypoint may then be edited (see below) or chosen as the *selected waypoint* (see **SELECT** below).

- **Latitude Entry.** Prompts for Latitude of the waypoint in the format DD.mmt. North/South sign (+/-) convention is as selected in the **MODE** routine.
- **LON I Longitude Entry.** Prompts for Longitude of the waypoint in the format DDD.mmt. East/West sign (+/-) convention is as selected in the **MODE** routine.



Time Zone Description. Prompts for the time zone description of the waypoint. Positive zones are west of Greenwich; negative zones are east of Greenwich.

PURGE Purge Waypoint. Deletes the working waypoint from memory. If the purged waypoint has been used in any voyage, that waypoint is also deleted from the voyage(s). If the purged waypoint is also the selected waypoint within a voyage, the next waypoint becomes the selected waypoint when you return to the waypoint-control menu. If the waypoint appears in several voyages, this operation may take several seconds.

```
SELECT
```

Select Waypoint. Makes the working waypoint the selected waypoint. This operation overrides the selected waypoint within the current voyage. If the waypoint selected exists within the current voyage, the voyage will remain in use (It is the same as if you had scrolled to that waypoint within the waypoint-control routine).

If the waypoint selected <u>does not</u> exist within the current voyage, the voyage will be *by*passed. Navcom will assume that you are heading directly for the selected waypoint and have abandoned the current voyage.

To re-select the voyage, use the VOY routine's SELECT function. See pg. 29.

POS Dead Reckoning Position

This routine displays Navcom's estimate of the vessel's position is based on the time location of the last fix, heading (true or magnetic), speed or log distance, and current set and drift (if enabled).

When *speed* mode is selected (see **MODES** pg. 12), you may enter a time and date and Navcom will display the corresponding DR position. When *log* mode is selected, the DR is computed using the log distance that is entered in the **HDG** routine, and the indicated time has no meaning.

When in *magnetic* mode, the magnetic variation (as entered in the **HDG** routine) and the vessel's deviation (as entered in the **MODES** routine), are applied to the heading that is entered in the **HDG** routine to compute the DR position.



KEY DESCRIPTION

TIME

Local time and date. Time is entered in the format HH.mm. Date is entered in the format chosen in the CLOCK routine.



Set and Drift. Displays a box in the menu key if Set/Drift is enabled and accesses the Set/Drift routine (See pg. 23).

NV. PT

Navigation Point. A navpoint is simply a waypoint that is designated as a point of reference for this routine as well as in the **FIX** routine. Within **FIX**, it is used with Radar or Visual bearings to compute a fix. The navpoint may also be a waypoint within your voyage. Pressing **NV.PT** displays the following sub menu:

IDENT

Navpoint Identifier. Prompts for the name of the navpoint to select. Navpoint (or waypoint) names may consist of up to 6 characters. If the navpoint is not found, it may be created within the **WPT** routine (See pg. 31). Pressing **ENTER** before keying in a name calls the navpoint catalog (same as pressing **ID CAT**).



Navpoint/waypoint catalog. See pg. 9 for catalog instructions.

LA-LO Latitude/Longitude. Prompts for a latitude/longitude to use as a temporary navpoint. Latitude of the navpoint is in the format DD.mmt. North/South sign (+/-) convention is asselected in the MODE routine. Longitude is in the format DDD.mmt. East/West sign (+/-) convention is as selected in the MODE routine.



View Navpoint. Displays the latitude/longitude of the selected navpoint.



Exit Navpoint Menu. Returns to the POS menu.



Magnetic Mode. If in *true* mode, toggles navpoint bearing to magnetic. If in *magnetic* mode, toggles navpoint bearing to true.



Estimated Time of Arrival. Accesses the **ETA** routine using the distance to the navpoint as the distance-to-go. See pg. 45.
TO GO Distance-to-Go

TO GO is one of Navcom's most powerful routines. It allows you to compute the distance, course, and heading to steer to:

-The next waypoint within the current voyage.

- -The final voyage destination via the route.
- -The final voyage destination-direct.
- -Any waypoint within the voyage via the route.
- -Any waypoint within the voyage-direct.
- -Any waypoint not within the current voyage.
- -Any latitude / longitude point.



In computing a distance, you may select your present position as:

- -A DR position at any selected time and date.
- -A named waypoint.
- -A latitude / longitude point.

In addition, you may choose a Rhumbline or Great Circle route to the selected "TO" position. The display shows both the *course* to the selected waypoint (ie. the track to make good), and the *heading-to-steer* (the course corrected for set and drift). If Set / Drift is disabled, these two numbers will be the same. Note that the course and heading to steer always refers to the first waypoint displayed as "To:".

KEY DESCRIPTION

FROM	FROM sub-menu. Selects the position from which a distance is computed. See pg. 34.
TO	TO sub-menu . Selects the position or route <i>to</i> which a distance is computed. See pg. 35.
►VOY	To Destination via Voyage. This option computes the distance to the voyage destination via the currently selected waypoint and all the waypoints in between (ie. it "follows" your voyage route to the destination). When pressed, the "To:" display changes to show the selected waypoint and the destination. The VOY key toggles with the WPT key. The WPT key
	returns to the default display showing the distance to the next waypoint.
GC/RL	Great Circle / Rhumbline. Toggles between a Great Circle and Rhumbline route between the position displayed in "From:" and the first waypoint displayed in "To:"
►MAG	Magnetic Mode. If in true mode, toggles waypoint bearing to magnetic.
►TRUE	True Mode. If in magnetic mode, toggles waypoint bearing to true.
ETA	Estimated Time of Arrival. Calls the ETA routine using the computed distance. See pg. 45.
EXIT	Exit. Quits the TO GO routine and returns to the PILOT menu.

Continued on the Next Page

TO GO Distance to Go (cont.)

FROM Sub-menu. Selects the position or route *from* which a distance is computed. When pressed, the "From:" display is hi-lighted.

By default, **TO GO** will display the distance from the current DR position to the next waypoint within the current voyage (if it exists).

Distance-to-Go <u>13:</u>22 06/23 DR From: 0 В GC/RL: Rhumbline 7°T Crs: Dist: 140.7 ΠM Steer: 11 Т 5. IDENTIID CATILA-LO ŪŔ

The following options are available:

KEY	DESCRIPTION
	Waypoint Identifier. Prompts for the name of a waypoint to select. If the waypoint is not found, it may be created within the WPT routine (See pg. 31).
ID CAT	Waypoint Catalog. See pg. 9 for catalog instructions.
	Latitude / Longitude. Prompts for a lat/lon point to use as a temporary <i>from</i> position. Latitude is in the format DD.mmt. North/South sign (+/-) convention is as selected in the MODE routine. Longitude entry is in the format DDD.mmt. East/West sign (+/-) convention is as selected in the MODE routine.
DR	Dead Reckoning Position . Prompts for the time and date of a DR position. Time is entered as HH.mm. Date is entered in the format selected in the CLOCK routine (ss pg. 14). The TO GO routine defaults to DR mode when first called.
ENTER	Enter. Exits the "From:" menu and re-computes the distance. Depending on the number of waypoints in the voyage, this may take several seconds.
EXIT	Exit . Exits the "From:" menu and re-computes the distance. Depending on the number of waypoints in the voyage, this may take several seconds.
ATTN	Attention / ON. Exits the TO GO routine and returns to the PILOT menu.

Continued on the Next Page ...

TO GO Distance to Go (cont.)

TO Sub-menu. Selects the position or route *to* which a distance is computed. When pressed, the "To:" display is hi-lighted.

By default, **TO GO** will display the distance to the next waypoint within the current voyage (if it exists).

The following options are available:

Distance-to-Go 06/22 DR 9:40 From: umbline R ^PT Crs: Dist: 6. ΠM Steer: IDENT ID CAT ÷γ0γ YIA... ..DEST LH-LD

KEY DESCRIPTION

IDENT

Waypoint Identifier. Prompts for the name of the waypoint to select. If the waypoint is not found, it may be created within the **WPT** routine (See pg. 31).

ID CAT

LA-LO

- Waypoint Catalog. See pg. 9 for catalog instructions.
- Latitude / Longitude. Prompts for a lat/lon point to use as a temporary to position. Latitude is in the format DD.mmt. North/South sign (+/-) convention is as selected in the MODE routine. Longitude entry is in the format DDD.mmt. East/West sign (+/-) convention is as selected in the MODE routine.
- >VOY_

To Destination via Voyage. This option computes the distance to the voyage destination via the currently selected waypoint and all the waypoints in between (ie. it "follows" your voyage route to the destination). When pressed, the "To:" display changes to show the selected

waypoint and the destination. The \triangleright VOY key toggles with the \triangleright WPT key. The \triangleright WPT key returns to the default display showing the distance to the next waypoint.

The following two keys are active only when ►VOY has been selected:



Via Next Waypoint. Activates the cursor keys and allows you to scroll through the current voyage to change the immediate waypoint being aimed for. For example, if you want to "cut the corner" and by-pass the current waypoint, simply scroll down to the next waypoint and press ENTER to see the new total distance to the destination.

DEST

Destination Waypoint. Activates the cursor keys and allows you to change the destination in the current voyage in the same manner as **VIA**...

ENTER

Enter. Exits the "To:" menu and re-computes the distance. Depending on the number of waypoints in the voyage, this may take several seconds.



Exit. Exits the "To:" menu and re-computes the distance. Depending on the number of waypoints in the voyage, this may take several seconds.

T-D-S Time-Distance-Speed

The **T-D-S** routine allows you to solve time-distance-speed problems by keying in any two known quantities. The unknown quantity will be computed and displayed in a hi-lighted line.

lime-Distance-Speed Time: Dist: Spd: TIME ONT SPEEDHMS: HIMS CLEMS

KEY DESCRIPTION



Time. Prompts for the time in HH.mm format.



Distance. Prompts for the distance. You may key in any unit of distance (nautical miles, yards, kilometers, etc.) you wish, as long as the units of speed are consistent.

SPEED Speed. Prompts for the speed. Units of speed should be the same as those used for the distance entered.

CLEAR CLEAR. Clears all entries.

The following two functions work only with Direct Number Entry (see pg. 10).

HMS+

Hours.MinutesSeconds addition. Adds two times in HH.mm format. For example, to add 8:37 and 2:45, use direct number entry and key in: 8.37, ENTER, 2.45, HMS+ and see "11:22" in the "Time" display.

HMS- Hours.MinutesSeconds subtraction. Subtracts two times in HH.mm format. For example, to subtract 2:45 from 8:37, use direct number entry and key in: 8.37, ENTER, 2.45, HMS- and see "5:52" in the "Time" display. The HMS- feature is particularly useful when figuring the time between fixes.



Exit. Exits the **T-D-S** routine and returns to either the **PILOT** or **ROUTE** menu (the routine is available in both).

ATTN

Attention / ON. Exits the T-D-S routine and returns to the Main navigation menu.

IV ROUTE FUNCTIONS

The **ROUTE** sub-menu contains all of the routines that deal with planning a voyage: Course and Distance between points, route tracks, and the creation of named waypoints and voyages. The menu is made up of the following routines:

{ HOME }	
4:	
3:	
2:	
1:	
CRS-D WPT	ETA PLOT PLAN T-D-S

KEY DESCRIPTION

- **CRS-D** Course and Distance. If given two positions, this routine will compute the true course and distance between them along either a Rhumbline or Great Circle. If given one position and an initial course and distance, it will compute the second position. See pg. 38.
 - **WPT** Waypoint. Creates, edits, and selects waypoints and voyages. This routine is also located in the **PILOT** menu. See pg. 40.
 - **ETA Estimated Time of Arrival.** If given a distance to go, time of departure, and speed, this routine will compute the local time of arrival. Alternately, it will compute the speed required for a particular ETA. See pg. 45.
- **PLOT** Track Plot. Given the endpoints of a Rhumbline or Great Circle track, this routine will compute the longitude for any given latitude along the track or the latitude for any given longitude. The routine is used to compute *match points* that allow for smooth track plotting from chart to chart. See pg. 46.
 - **PLAN** Track Plan. Given the endpoints of a Rhumbline, Great Circle, or composite track, and a longitude increment, this routine will display or print a complete route plan listing latitude, longitude, course and distance at each of the longitude increments. This routine is the fastest method to lay down a long track line over a series of charts or plotting sheets. See pg. 48.
- TDS

Time-Distance-Speed. Solves Time-Distance-Speed problems. This routine is also located in the PILOT menu. See pg. 51.

The **ROUTE** menu has a dedicated key on the custom Navcom keyboard, but there are no custom keys for any of the routines. All **ROUTE** routines must by accessed from the **ROUTE** menu.

CRS-D Course and Distance

This routine will compute the true course and distance between two positions along either a Rhumbline or Great Circle. If given one position and an initial course and distance, it will compute the second position. Positions may be entered as named waypoints or latitude/longitudes. All Rhumblines are computed using mercator sailings except when the *course angle* is between 85 and 95 degrees, where the mercator equations break down. Parallel sailing is used when the course angle is 90 degrees, and an interpolation routine is used to 'fair in' any errors between the two methods in the 85 to 95 degree range.



KEY DESCRIPTION FROM FROM Sub-menu. Selects the position from which a course and distance is computed. See the next page for **FROM** menu options. TO TO Sub-menu. Selects the position to which a distance is computed. See the next page for TO menu options. GC/RL Great Circle / Rhumbline. Toggles between a Great Circle and Rhumbline route between the two positions. CRS Course. Prompts for the course (or initial course if using a GC route) between the two positions. Entering a course causes the routine to discard an existing "To" position and compute a new "To" position using the "From" position and the course and distance. DIST Distance. Prompts for the distance between the two positions. Entering a distance causes the routine to discard an existing "To" position and compute a new "To" position using the "From" position and the course and distance. PLOT Track Plot. Calls the PLOT (Points along a track) routine using the existing "To" and "From" positions. PLOT allows you to compute the longitude from any latitude (and vis-versa) along a Rhumbline or Great Circle track. See pg. 46. Exit. Quits the CRS-D routine and returns to the ROUTE menu. EXIT ATTN Attention / ON. Quits the CRS-D routine and returns to the Main navigation menu.

Continued on the Next Page ...

CRS-D Course and Distance (cont.)

FROM / TO Sub-menu. Selects the position or route to or from which a course and distance is computed. When pressed, the "From:" or "To:" display is hi-lighted as appropriate.



KEY DESCRIPTION

	Waypoint Identifier. Prompts for the name of the waypoint to select. Waypoint names may consist of up to 6 characters. If the waypoint is not found, it may be created within the WPT routine (See pg. 40). Pressing ENTER before keying in a name calls the waypoint catalog (same as pressing ID CAT)
ID CAT	Waypoint Catalog. Calls the waypoint catalog (see pg. 9 for catalog instructions).
LA-LO	Latitude / Longitude. Prompts for lat / lon entry. Latitude is in the format DD.mmt. North/South sign (+/-) convention is as selected in the MODE routine. Longitude is in the format DDD.mmt. East/West sign (+/-) convention is as selected in the MODE routine.
VIEW	View Latitude / Longitude. Displays the latitude/longitude of the selected waypoint.
SWAP	Swap FROM / TO. Exchanges the contents of the "From" and "To" entries. This allows you to easily "connect the legs" of a voyage (When working with named voyages, there is a routine to compute leg courses and distances automatically. See pg. 48).
ENTER	Enter. Exits the "From / To" menu and re-computes the course and distance.
EXIT	Exit. Exits the "From / To" menu and re-computes the course and distance.
ATTN	Attention / ON. Quits the CRS-D routine and returns to the Main navigation menu.

WPT Waypoint Management

The WPT routine is used to create, edit, and control waypoints, navpoints and voyages. It is the "heart" of the automated route planning abilities of the Navcom system.

A *waypoint* is a named position that consists of a latitude, longitude and time zone description. It can be used to build voyages or can be used alone to give Navcom a place to "aim for". The name can consist of up to 6 characters; numbers may be part of the name as long as they are not used as the first character. **"TOKYO**" and **"BOUY2**" are examples of valid names.

A navpoint is a waypoint that is used as a reference for position fixing. See pg. 31.

A voyage is a named collection of waypoints that represents a complete route between two places. The name can consist of up to 6 characters; numbers may be part of the name as long as they are not used as the first character. "VOY3" and "LA2SF" are examples of valid names.

Navcom can store any combination of waypoints and voyages. The maximum number of each is determined only by the amount of RAM memory available in the HP-48. The computer comes standard with 128 kilobytes of RAM. This is sufficient to hold several hundred waypoints and dozens of voyages, and still allow enough RAM for system operation. If needed, an additional 32K or 128K RAM card can be added to the HP-48.

The **WPT** screen shows the status of the voyage and waypoint in use, and allows you to scroll to any waypoint within the current voyage, or by-pass the current voyage and select any waypoint in memory.



Display Meaning

- **Voyage:** Displays the currently selected voyage.
- To Waypoint: Displays the selected waypoint.
- via GC/RL: Displays the selected *route* (either Great Circle or Rhumbline) to the waypoint.
- **Next Wpt:** Displays the name of the next waypoint within the selected voyage.
- **Navpoint:** Displays the name of the selected navpoint. Navpoints are independent of voyages and cannot be stored within a voyage.

See Next Page for Menu-Key Functions.

WPT Waypoint Management (cont.)

Voyage:	SF2LR
To Waypoint: VM GC/RL: Next Wpt: Navpoint: Nov Det GC	B7TL Rhumbline FERMIN ARGUEL MINOSTINU PTTO GO

KEY	DESCRIPTION
VOY	Voyage Edit. Creates, edits, and selects voyages. See pg. 29.
WPT	Waypoint Edit. Creates, edits, and selects waypoints. See pg. 31.
GC/RL	Route Select. Selects a Great Circle or Rhumbline route from the vessel's present DR position to the selected waypoint. Routes between each waypoint within a voyage are chosen when creating the voyage; this option allows you to over-ride the voyage plan or to select a route to a waypoint that is not within a voyage.
DEST	To Destination. Selects the final waypoint within the selected voyage as the current waypoint. This is a shortcut key to avoid scrolling through all the waypoints within the current voyage.
NV. PT	Navpoint. Creates, edits, and selects navpoints. It is identical to WPT-EDIT , except that using the SELECT function acts on the selected navpoint instead of the selected waypoint.
TO GO	Distance to Go. Computes the distance-to-go to the selected waypoint. See pg. 33.
	Cursor Keys . Allow you to scroll through and select the waypoints within the currently selected voyage. To advance to, and select, the next waypoint in the voyage, press either the DOWN or RIGHT cursor key. To return to, and select, the previous waypoint, press either the UP or LEFT cursor key. To advance to the final waypoint (destination) press RIGHT-SHIFT , then either the DOWN or RIGHT cursor key. To return to the first waypoint (origin) press RIGHT-SHIFT , then either the UP or LEFT cursor key.
EXIT	Exit. Quits the WPT routine and returns to the PILOT menu.
ATTN	Attention / ON. Returns to the Main Navigation menu.

Continued on the Next Page

WPT-VOY Voyage Control

The **VOY** function allows you to create, edit and select voyages. Before filling a voyage with waypoints, those waypoints must already exist. To create waypoints, use the **WPT** function within the **WPT** routine.

The **VOY** screen displays the name of the currently selected voyage (if any) and helps identify it by showing its first and last waypoints.

	Selected Voyage					
	Voyage: SE2L8					
	From: SELNB To: LBEACH					
	IDENT EDIT +VIEW PURGE T. DIST SELECT					
KEY	DESCRIPTION					
IDENT	Voyage Identifier. Prompts for the name of the voyage to create, edit or select. Voyage names may consist of up to 6 characters. If the name entered is not found in memory, Navcom creates a new, empty voyage with that name. Pressing ENTER before keying in a name calls the voyage catalog (see pg. 9 for catalog instructions). Once a voyage has been called, it becomes the <i>working voyage</i> . A working voyage may then be chosen as the selected voyage (see SELECT below) or edited (see EDIT below).					
EDIT	Edit Voyage. Edits the working voyage. See next page.					
►VIEW	View Voyage. Displays each of the waypoints within the voyage, the type of route (Rhumbline or Great Circle), and the course and distance between each waypoint. Press EXIT to return to the voyage screen.					
PURGE	Purge Voyage . Purges the working voyage from memory. When a voyage is purged, the individual waypoints that made up the voyage remain in memory.					
T. DIST	Total Voyage Distance. Displays the total distance of the working voyage. Press EXIT to clear the distance display.					
SELECT	Select Voyage. Makes the working voyage the selected voyage.					
EXIT	Exit. Returns to the WPT routine.					
ATTN	Attention / ON. Returns to the Main Navigation menu.					

Continued on the Next Page ...

WPT-VOY-EDIT Voyage Editing

The **EDIT** function allows you to insert or delete waypoints within a voyage and to select the route (GC or RL) between them. The hi-lighted box shows the current waypoint being edited within the voyage. The "From" line shows the previous waypoint, while the "Next" line displays the next waypoint. The departure waypoint is labeled "Wpt-00".

Edit Voyage: SF2LA From Wpt: SFLNB
VIA GC/RL: Rhumbline
Next Wpt: ARGUEL

KEY DESCRIPTION

IDENT

Waypoint Identifier. Prompts for the name of waypoint to insert in the voyage. Waypoint names may consist of up to 6 characters, and the waypoint must already exist in memory to be included in the voyage. If the waypoint does not exist, use the **WPT** option in the **WPT** routine to create it. Pressing **ENTER** before keying in a name calls the waypoint catalog.

You may press ENTER without pressing IDENT to access the catalog.

Once a waypoint has been chosen, either by **IDENT** or the catalog, the waypoint is inserted <u>after</u> the waypoint currently displayed in the hi-lighted line. You may continue to add waypoints in this manner until your voyage is completed.

EDIT

Waypoint Edit. This option allows to view or edit the latitude, longitude, or time zone description of the hi-lighted waypoint. You may not change the waypoints name, or delete it, but you may change its attributes. Press **EXIT** to return to the Voyage-Edit screen.

►VIEW

View Voyage. Displays each of the waypoints within the voyage, the type of route (Rhumbline or Great Circle), and the course and distance between each waypoint. Press **EXIT** to return to the Voyage-Edit screen.

DELETE

>LA-LO

Delete Waypoint. Removes the hi-lighted waypoint from the current voyage. The waypoint still remains in memory for later use. To delete an entire voyage, use the **PURGE** function in the **VOY** routine.

View Lat/Lon. Displays each the waypoints by name and latitude/ longitude. This is useful for viewing/plotting the voyage and confirming the position of the waypoints selected. The

► VIEW option may also be accessed from this screen.

Accessing \triangleright VIEW from \triangleright LA-LO or vis-versa requires a considerable amount of RAM, especially for a voyage with many waypoints. If you should see a low-memory error message when attempting this, re-run the desired function directly from the VOY or EDIT screen rather than from \triangleright LA-LO or \triangleright VIEW functions.

GC/RL

Great Circle / Rhumbline. Toggles between a Great Circle and Rhumbline route between waypoints. The voyage may consist of any combination of Rhumbline and Great Circle routes.

Continued on the Next Page ...

WPT-WPT Waypoint Edit

The **WPT** (Edit) function allows you to create, edit, and select waypoints. Though you may edit waypoints from other routines, this is the only place where you can create or delete waypoints.



KEY DESCRIPTION

IDENT

Waypoint Identifier. Prompts for the name of the waypoint to create, edit or select. Waypoint names may consist of up to 6 characters. If the name entered is not found in memory, Navcom creates a new waypoint with that name. Pressing **ENTER** before keying in a name calls the waypoint catalog (see pg. 9 for catalog instructions).

You may press ENTER without first pressing IDENT to access the catalog.

Once a waypoint has been called, it becomes the *working waypoint*. A working waypoint may then be edited (see below) or chosen as the *selected waypoint* (see **SELECT** below).

LAT

Latitude Entry. Prompts for Latitude of the waypoint in the format DD.mmt. North/South sign (+/-) convention is as selected in the **MODE** routine.

LON Longitude Entry. Prompts for Longitude of the waypoint in the format DDD.mmt. East/West sign (+/-) convention is as selected in the MODE routine.



Time Zone Description. Prompts for the time zone description of the waypoint. Positive zones are west of Greenwich; negative zones are east of Greenwich.

PURGE Purge

Purge Waypoint. Deletes the working waypoint from memory. If the purged waypoint has been used in any voyage, that waypoint is also deleted from the voyage(s). If the purged waypoint is also the selected waypoint within a voyage, the next waypoint becomes the selected waypoint when you return to the waypoint-control menu. If the waypoint appears in several voyages, this operation may take several seconds.

SELECT

Select Waypoint. Makes the working waypoint the selected waypoint. This operation overrides the selected waypoint within the current voyage. If the waypoint selected exists within the current voyage, the voyage will remain in use (It is the same as if you had scrolled to that waypoint within the waypoint-control routine).

If the waypoint selected <u>does not</u> exist within the current voyage, the voyage will be *by*passed. Navcom will assume that you are heading directly for the selected waypoint and have abandoned the current voyage.

To re-select the voyage, use the VOY routine's SELECT function. See pg. 42.

ETA Estimated Time of Arrival

The **ETA** routine will compute the local time-of-arrival when given a distance-to-go and estimated speed. Alternately, it will compute the speed required for a given ETA. When this routine is called from within another routine (such as **TO GO** or **POS**), the distance-to-go computed from that routine is automatically transferred to the **ETA** routine.

Time Arrival of To Go: 06/25 1 +Й Speed: 18 kts D. ZD SPEED TO GO 052 ARR 1 A. 20

KEY DESCRIPTION

TO GO	To Go.	Prompts for	the distance-to-go
-------	--------	-------------	--------------------

- **DEP** Departure Time. Prompts for entry of the local time from which the distance-to-go is computed. Time is entered in the format HH.mm. Date is entered in the format as chosen in the **CLOCK** routine.
- D. ZD

Departure Zone Description. Prompts for the local zone description. The ZD entered in the **CRS** routine is used by default.

- **SPEED** Speed. If computing ETA, prompts for the estimated speed-of-advance to the destination. If computing speed required, it is displayed in this line after entering a desired ETA with the **ARR** menu selection (see below).
- **ARR** Arrival Time. If computing ETA, it is displayed in this line. If computing speed required, enter the planned local time and date of arrival, and speed required will be displayed in the line above. Time is entered in the format HH.mm. Date is entered in the format as chosen in the CLOCK routine.



Arrival Zone Description. Prompts for the zone description of the destination. The ZD entered in the CRS routine is used by default.



PLOT Track-line Plotting

The **PLOT** routine allows you to compute the longitude for any given latitude (or vis-versa) along a given Rhumbline or Great Circle track. This is most useful for plotting a track on a series of charts or plotting sheets. The track's end points may be defined by either a waypoint or a latitude/longitude.



KEY DESCRIPTION

		ł	÷	l		ł	C)		Y
m			r,	1	Ċ.	Ľ.	T	Ľ.	1	0

FROM Sub-menu. Selects the position *from* which a course and distance is computed. See the next page for **FROM** menu options.

```
ТО
```

TO Sub-menu. Selects the position *to* which a distance is computed. See the next page for **TO** menu options.



Great Circle / Rhumbline. Toggles between a Great Circle and Rhumbline route between the two positions.



Latitude Along Track. Prompts for a latitude along the track. Latitude is in the format DD.mmt. North/South sign (+/-) convention is as selected in the **MODE** routine. Entering a latitude will compute and display the corresponding longitude.

Longitude Along Track. Prompts for a longitude along the track. Longitude is in the format DDD.mmt. East/West sign (+/-) convention is as selected in the **MODE** routine. Entering a longitude will compute and display the corresponding latitude.



Great Circle Vertex. If track is a Great Circle, this option will display the latitude and longitude of the included vertex. Press any key to clear the vertex display.



ATTN Attention / ON. Quits the PLOT routine and returns to the Main navigation menu.

Continued on the Next Page

PLOT Track-line Plotting (cont.)

FROM / TO Sub-menu. Selects the position or route to or from which a course and distance is computed. When pressed, the "From:" or "To:" display is hi-lighted as appropriate.



KEY DESCRIPTION

IDENT	Waypoint Identifier. Prompts for the name of the waypoint to select. Waypoint names may consist of up to 6 characters. If the waypoint is not found, it may be created within the WPT routine (See pg. 40). Pressing ENTER before keying in a name calls the waypoint catalog (same as pressing ID CAT)
ID CAT	Waypoint Catalog. Calls the waypoint catalog (see pg. 9 for catalog instructions).
LA-LO	Latitude / Longitude. Prompts for lat / lon entry. Latitude is in the format DD.mmt. North/South sign (+/-) convention is as selected in the MODE routine. Longitude is in the formatDDD.mmt. East/West sign (+/-) convention is as selected in the MODE routine.
VIEW	View Latitude / Longitude. Displays the latitude/longitude of the selected waypoint.
SWAP	Swap FROM / TO. Exchanges the contents of the "From" and "To" entries. This allows you to easily "connect the legs" of a voyage (When working with named voyages, there is a routine to compute leg courses and distances automatically. See pg. 48).
ENTER	Enter. Exits the "From / To" menu and re-computes the track point.
EXIT	Exit. Exits the "From / To" menu and re-computes the track point.
ATTN	Attention / ON. Quits the PLOT routine and returns to the Main navigation menu.

PLAN Track Plan

The **PLAN** routine will break down a Great Circle or Rhumbline track into segments to allow for easy transfer to a chart or plotting sheet.

The track is defined by its starting and ending positions. These may be any combination of a named waypoint, a DR position, or a latitude/longitude position. The size of the segment to which the track is divided is defined by a longitude increment. For example, if you select 5 degrees as a Dlo (longitude increment), then **PLAN** will divide the track into even 5 degree segments, display the latitude at each selected longitude, and compute the course and distance of each segment. The results may be either displayed on the screen or sent to a printer.



KEY DESCRIPTION

FROM	FROM Sub-menu. Selects the position <i>from</i> which a course and distance is computed.	The			
	FROM menu options are described on the next page.				

- **TO Sub-menu.** Selects the position *to* which a distance is computed. The **TO** menu options are described on the next page.
- **GC/RL** Great Circle / Rhumbline. Toggles between a Great Circle and Rhumbline route between the two positions.
- **DLO** Longitude Increment. Prompts for the longitude increment by which to divide the track into even segments. The smaller the Dlo, the more segments the track will have. For an east-west voyage using standard plotting sheets, 5 or 10 degrees is a convenient interval to choose.
- **COMP** Composite Track. This feature is available only when using a Great Circle Track. It prompts for a limiting latitude. Latitude is in the format DD.mmt. When the track plan is computed, a Great Circle will be run from the *FROM* position, until it intersects the limiting latitude. A Rhumbline is then computed from that point until the Great Circle track is intercepted on the "far" side of the vertex. The track then again picks up the Great Circle to the *TO* position.
- VIEW View the Track Plan. Once the required information for the track has been entered, the VIEW menu becomes available. VIEW menu options are listed on pg. 50.



ATTN Attention / ON. Quits the PLOT routine and returns to the Main navigation menu.

Continued on the Next Page ...

PLAN Track Plan (cont.)

FROM / TO Sub-menu. Selects the positions from which the track plan is computed. When pressed, the "From:" or "To:" display is hi-lighted as appropriate.



KEY DESCRIPTION

IDENT	Waypoint Identifier. Prompts for the name of the waypoint to select. Waypoint names may consist of up to 6 characters. If the waypoint is not found, it may be created within the WPT routine (See pg. 40). Pressing ENTER before keying in a name calls the waypoint catalog (same as pressing ID CAT)
ID CAT	Waypoint Catalog. Calls the waypoint catalog (see pg. 9 for catalog instructions).
LA-LO	Latitude / Longitude. Prompts for lat / lon entry. Latitude is in the format DD.mmt. North/South sign (+/-) convention is as selected in the MODE routine. Longitude is in the format DDD.mmt. East/West sign (+/-) convention is as selected in the MODE routine.
VIEW	View Latitude / Longitude. Displays the latitude/longitude of the selected waypoint.
SWAP	Swap FROM / TO. Exchanges the contents of the "From" and "To" entries. This allows you to easily "connect the legs" of a voyage (When working with named voyages, there is a routine to compute leg courses and distances automatically. See pg. 48).
ENTER	Enter. Exits the "From / To" menu and re-computes the track point.
EXIT	Exit. Exits the "From / To" menu and re-computes the track point.
ATTN	Attention / ON. Quits the PLOT routine and returns to the Main navigation menu.

Continued on the Next Page ...

PLAN Track Plan (cont.)

VIEW Menu Option.

RL Track	Pg 1:6
#1: 34902'N Crs: 280.1°M	119 919' М 34.7 пм
#2: 34908.1'N Crs: 280.2°M	120900'W 252.3 nm NEXT

Once the required information for the track has been entered, the **VIEW** menu option becomes available. When selected, Navcom will compute the entire voyage plan and display it on a series of "pages". On long voyages with many segments, it may take several seconds to compute. When finished, the first page will be displayed and the menu will offer the following options:

KEY	DESCRIPTION				
PRINT	Print the Track Plan. This print routine differs from the normal keyboard PRINT command in that it is designed to print all of the track plan pages consecutively. You may use the RIGHT-SHIFT , PRINT command though, if you wish to only print one page.				
NEXT	Next Page. Advances to the next page of the track plan. NEXT is not available on the last page.				
PREV	Previous Page. Returns to the previous page of the track plan. PREV is not available on the first page.				
EXIT	Exit. Returns to the Track Plan entry screen.				
ATTN	Attention / ON. Exits the VIEW screen and returns to the Main navigation menu.				

T-D-S Time-Distance-Speed

The **T-D-S** routine allows you to solve time-distance-speed problems by keying in any two known quantities. The unknown quantity will be computed and displayed in a hi-lighted line.

lime-Distance-Speed
Time:
Dist:
Spd: Time dist speed(H.MS+(H.MS-) CLEAR

DESCRIPTION KEY TIME Time. Prompts for the time in HH.mm format. DIST Distance. Prompts for the distance. You may key in any unit of distance (nautical miles, yards, kilometers, etc.) you wish, as long as the units of speed are consistent. SPEED Speed. Prompts for the speed. Units of speed should be the same as those used for the distance entered. CLEAR Clear. Clears all entries. The following two functions work only with Direct Number Entry (see pg. 10). HMS+ Hours. Minutes Seconds addition. Adds two times in HH mm format. For example, to add 8:37 and 2:45, use direct number entry and key in: 8.37, ENTER, 2.45, HMS+ and see "11:22" in the "Time" display. HMS-Hours.Minutes Seconds subtraction. Subtracts two times in HH.mm format. For example, to subtract 2:45 from 8:37, use direct number entry and key in: 8.37, ENTER, 2.45, HMS- and see "5:52" in the "Time" display. The HMS- feature is particularly useful when figuring the time between fixes. EXIT Exit. Exits the T-D-S routine and returns to either the PILOT or ROUTE menu (the routine is available in both). ATTN Attention / ON. Exits the T-D-S routine and returns to the Main navigation menu.

V CELESTIAL FUNCTIONS

The **CELES** sub-menu contains routines that allow you to plan, shoot, review, plot, and compute fixes using celestial sights. It is the only menu to have more that six selections. To view the next *page* of celestial options, press the **NXT** key (located on row 2). To view the original page, press **NXT** again.

Page 1 Page 2	(HOME) 4: 3: 2: 1: SIGHT FIND CAT RASET LAN SETUP N.ALMIHSHA SET				
KEY	DESCRIPTION				
SIGHT	Celestial Sight. Used to shoot a celestial line-of-position or celestial azimuth. It is also the entry point from which to pre-compute selected stars. See pg. 55.				
FIND	Find a Body. Finds the altitude and azimuth for any celestial body contained in Navcom's almanac. Alternately, if given the Observed Altitude and Azimuth of a body, it will identify the body. See pg. 61.				
CAT	Celestial Catalog. Displays the names of celestial LOP's in Navcom's memory that can be used to plot or compute a fix. See pg. 57.				
R/SET	Time of Rise and Set. Computes the local time of rise and set for any celestial body in Navcom's almanac. See pg. 62.				
	Local Apparent Noon / Meridian Transit. Computes the local time and altitude of Meridian Transit for any celestial body in Navcom's almanac. See pg. 63.				
SETUP	Celestial Setup. Allows you to adjust the internal clock, time delay, ht. of eye, and sextant index error. See pg. 54.				
N. ALM	Nautical Almanac. Computes GHA, LHA, and Declination of a body. Useful when doing manual sight reductions or high-altitude sights. See pg. 64.				
Hs≻Ho	Sextant Corrections. Computes and applies Index error, Dip, and Apparent Altitude corrections to sextant observations. Useful when doing manual sight reductions or altitude sights. See pg. 65.				
SRT	Sight Reduction Table. Solves for the unknown of: LHA (or meridian angle), Declination, Latitude, and Altitude-Azimuth. Useful when doing manual sight reductions. See pg. 66.				

The Celestial Body Catalog

The *Body Catalog* is a menu function labeled **BODY** that appears within most celestial routines and is used to select a celestial object. When in the body catalog, the following keys are active:



KEY DESCRIPTION

•••	:	S	U	N
				1000

Selects the Sun. You will then be prompted for upper or lower limb. When prompted for limb, pressing ENTER is the same as choosing LOWER.

- **STAR** Selects the star catalog and displays the A,B,C ... menu line. Press the key whose letter begins the star's name. You may use the LEFT and RIGHT cursor keys to scroll through the alphabet. For example, if you shoot Sirius, scroll through the menu until you find "S". Press the "S" key and it will show you all the stars that begin with "S". Scroll through this menu using the LEFT and RIGHT cursor keys until you find SIRIUS. To move back up to the alphabet menu, press the UP cursor key. (*Note:* The star names in the menu are abbreviated. If you pick the wrong name, don't worry, you will be able to change it later.)
- **MOON** Selects the Moon. You will then be prompted for upper or lower limb. When prompted for limb, pressing ENTER is the same as choosing LOWER.
- **PLNET** Selects the *planet catalog*. This will display keys for Venus, Mars, Jupiter, and Saturn. Select the desired planet.
 - **ARIES** Selects Aries. Aries is available only in the Nautical Almanac (ALM) routine and is used as the reference point in most manual star finders.
 - **UNK?** Unknown Body. This is used in the SIGHT and FIND routines to shoot or identify an unknown body. When UNK? is pressed, Navcom prompts for the altitude and azimuth of the body (if it has not already been entered) and then searches for the correct celestial object. Since Navcom checks all of the objects in its almanac, the search can take a couple of minutes.
- **ENTER** Body Number. Leaves the *body catalog* and prompts for the almanac number of the body. If you are familiar with the body numbers of certain objects, this can be a faster way of selecting a body. The almanac numbers for stars are listed in the "Index of Selected Stars" in the *Nautical Almanac*. Navcom can also use numbers for the Sun, Moon, and Planets. These numbers are listed in Appendix B, pg. 76 of this manual.
- **EXIT I Exit.** If at the top menu level of the catalog, this will exit the catalog. If at a lower menu level, this will return to the previous menu.

SETUP Celestial Setup



The celestial **SETUP** routine sets the parameters for shooting celestial sights, and should be run before taking any sights. The settings include: the *sight-time delay*, height of eye, and sextant index correction. The routine also displays the current time and allows you direct access to the **CLOCK** routine to adjust or set the internal clock.

Do not confuse Celestial SETUP with the System SETUP routine located in the Main menu.

Sight-time delay is the amount of time Navcom assumes to have passed from the moment of taking a sight (the *mark*), and the time of pressing the **ENTER** key to record the time. For example, if you are taking sights from the bridge of a ship, and it takes you 20 seconds to walk back to the chart room and press the **ENTER** key to record the time-of-sight, you should set your time delay for 20 seconds. On the other hand, if you are taking sights from the cockpit of a sailboat, you may want a time-delay of only 5 or 10 seconds. Personal preference and experience will give you a feel for what is comfortable for you. When timing a sight, Navcom checks the time at the moment you press **ENTER**, and then subtracts the time-delay from that time. This time then becomes your time-of-sight.

The Height of Eye is used to compute the *dip* correction for sextant altitudes, and is applied to all sights. This number may be entered in feet or meters depending on the mode you have selected.

The Index Correction (Ic) is the sum of any known sextant error correction and any personal correction you may have. Personal error is generally found through shooting many sights from a known, fixed position (a dock, or at anchor), and comparing the computed Lines-of-Position (LOP) with the actual position. Once your personal correction (if any) is found, your sights can become very accurate.

KEY DESCRIPTION

CLOCK	Clock Control. Allows you to set and adjust the HP-48's internal clock. See pg. 14 for complete instructions.
DELAY	Time Delay. Prompts for the sigh-time delay. Delay format is HH.mmss. For example, a 15 second delay would be keyed in as 0.0015.
HT.EYE	Height of Eye. Prompts for meters or feet depending on the mode selected (see below).
	Index Correction. Prompts for index correction (Ic). Index format is DD.mmt. For example, an index correction of negative 3.5 minutes would by keyed in as -0.035.
HE: M	Selects Height of Eye as meters. When selected, a box is displayed in the menu key.
HE: F	Selects Height of Eye as feet. When selected, a box is displayed in the menu key.

SIGHT Celestial Sights

The SIGHT routine allows you to automatically or manually time, reduce, and edit celestial sights.



KEY DESCRIPTION

NEW

New celestial sight. A *new* sight is one that is not already stored in memory. When prompted for time-of-sight, enter the local time in the format HH.mmss and press **ENTER** (If the zone description entered in the **HDG** routine is set to zero, time is labeled and entered as GMT).

• To use the auto-time feature, when NEW prompts for time, press ENTER at the time-ofsight plus the time delay that was entered in the celestial SETUP routine. For example, if your time delay is set at 20 seconds, press the ENTER key 20 seconds after you shoot the sight, and the time-of-sight will be automatically recorded.

Key in date-of-sight and press ENTER. Date is entered in the format chosen in the CLOCK routine. If time-of-sight was entered automatically, date will not be prompted.
Key in Height Sighted (uncorrected sextant altitude). Key in sextant reading as DD.mmt,

and press ENTER.

• Select the name of the body sighted from the *body catalog*. (See **BODY** pg. 53 for information on the catalog.)

• After selecting the body, the routine will display the computed altitude (Hc), and the intercept/azimuth based on the displayed Assumed Position (AP). You should examine the intercept and confirm that it is "reasonable". By default, Navcom selects the closest whole degree of latitude/longitude to your DR position as an Assumed Position). If your DR position is reasonably accurate, then the intercept should be within about 40 miles. If the intercept appears to be off by a multiple of 60 miles, then you probably entered the wrong *whole degree* of sextant altitude. If it appears to be off by a multiple of 600 miles, then you probably entered a sextant altitude that was an even 10 degrees in error.

(b) If a mistake was made during sight entry, or you wish to change any parameter, you may select the **EDIT** function to make changes.

EDIT Edit LOP. Used to change any parameter affecting a celestial sight. See next page.

CAT

LOP Catalog. Displays all LOP's that are in memory, and allows access to the plotting, and fix computation routines. See pg. 57.

*FIND	Star Finder. Pre-computes up to 12 of the best available navigational stars. See pg. 61.
N. ALM	Nautical Almanac. Computes GHA, LHA, and Declination. See pg. 64.
SETUP	Celestial Setup. Changes celestial sight parameters. See pg. 54.

Continued on Next Page.

SIGHT Celestial Sight (cont.)

EDIT Menu Option

Edit Sight allows any parameter of the current sight to be changed. EDIT is only available immediately after the sight is taken. If you leave the SIGHT routine for any reason, the last sight is stored to the LOP catalog and may not be edited. This is done to avoid the temptation to change a sight to make it "fit" a plot. The menu allows for the following changes to be made:

Time: 19:04:59 07/01 A.Pos: 33°00'N 72°00'W Body: SUN Hs: 25°00'
HC a/Zn TIME A. POS BOOY HS 25 (DELETE

KEY DESCRIPTION

TIME

Time and date-of-sight. Enter the local time in the format HH.mmss and press ENTER. If the zone description entered in the HDG routine is set to zero, then the time is labeled and entered as GMT). Enter the date in the format that was chosen in the **CLOCK** routine (You may simply press ENTER if the date has not changed.)

Assumed Position. Allows you to change the position from which the LOP is plotted. The following options are available:

Waypoint Identifier. Prompts for the name of a waypoint to use as an Assumed Position. Waypoint names may consist of up to 6 characters. Pressing ENTER before keying in a name calls the waypoint catalog (same as pressing ID CAT).



Waypoint catalog (see pg. 9 for catalog instructions).



Latitude/Longitude. Prompts for a latitude/longitude to use as an Assumed Position. Latitude and Longitude is in the format DD.mmt. North/South and East/West sign (+/-) convention is as selected in the **MODE** routine.



Dead Reckoning position. Computes the DR position at the time-of-sight, and stores it as the Assumed Position. AP's entered here are not rounded to the whole degree.



Body Catalog. See pg. 53 for information on BODY.

depending on the mode selected in the MODE routine.



Zn



True Azimuth. If the sight taken was of an unknown body, then this functions allows the azimuth entry to be changed. Enter azimuth in the format DDD.t, either True or Magnetic

Height Sighted. Prompts for a new Observed Sextant Altitude. Enter Hs as DD.mmt.



Delete LOP. Deletes the current sight so that it will not be saved to memory. There is no confirmation for this delete; once the key is pressed, the sight is purged from memory.



ATTN Attention / ON. Quits the LOP Edit mode and returns to the Celestial menu.

CAT LOP Catalog

The LOP catalog is where all celestial sights are accessed, viewed, plotted, or combined into a lat/lon fix. The catalog can be called from the SIGHT and FIX routines, and the CELES menu. LOP's are displayed by the body name and time-of-sight. A hi-light bar scrolls through the list (using the cursor keys) to select a particular LOP to work with. LOP's with extremely large intercepts display a ***** next to the name of the Body.

	LOP Catalog 19:51 07/02 VENUS 09:48 07/02 SUN				
	VIEW SIGHT (DELETE)DEL AN) +PLOT +FIX				
KEY	DESCRIPTION				
VIEW	View LOP. Displays all information on the highlighted LOP. See next page.				
SIGHT	Celestial Sight. Calls or returns to the SIGHT routine. See pg. 55.				
DELETE	Delete LOP. Purges the displayed LOP from the Celestial Catalog. ONCE LOP'S ARE DELETED, THEY CANNOT BE RECOVERED. Navcom prompts with a confirmation message before purging the LOP.				
DELALL	Delete All LOP's. Purges <u>ALL</u> LOP's from the Celestial Catalog. ONCE LOP'S ARE DELETED, THEY CANNOT BE RECOVERED. Navcom prompts with a confirmation message before purging the LOP's.				
►PLOT	Plot LOP's. If two or more LOP's are in the catalog, Navcom will display the celestial plot. Although Navcom will directly compute the lat/lon of a celestial fix, the only safe way to determine the validity of a fix is the view or plot the LOP's.				
►FIX	 Compute Celestial Fix. Computes and displays the following: Latitude / longitude of the averaged fix position. The distance and direction from the DR position to the fix. The course and speed-made-good from the last fix. 				
	If the fix position is "reasonable", you may press the SAVE menu key and the fix will be saved as the "last fix", the vessel's position will be updated, and the routine will exit to the FIX				
	routine to display the status of the fix (See pg. 24). To exit the \blacktriangleright FIX screen without saving the computed fix, press EXIT .				
All LOP's are v	weighed equally when computing a fix. Use the PLOT routine before accepting a fix!				
ENTER	View LOP. Displays all information on the highlighted LOP. See next page.				
EXIT	Exit. Quits the LOP Catalog and returns to the calling routine or the CELES menu.				

Continued on Next Page.

CAT LOP Catalog (cont.)

VIEW View LOP Menu Option.

VIEW displays all information about the LOP currently hi-lighted in the LOP Catalog. The next and previous LOP's may be viewed by using the cursor keys (see below).

The following menu options are available within the **VIEW** function:

Yiew LOP 09:51:07 Time: A.Pos: 72900'W 35000.N Bodu: VENUS °28 ts: HC: ° 2 7 a∕Zn: 1 186.1° 6 H ADV = A. POS CAT |DELETE|Hs+Ha|+PLOT|

KEY DESCRIPTION

ADV

Advance LOP. When the ADV key displays the *selected-box* in the menu key ("on" is the default setting), intercept and azimuth of the displayed LOP are advanced to the time of the topmost LOP in the catalog. If the selected-box is not on, intercept and azimuth are computed for the actual time the sight was taken.

Selecting **ADV** "on" allows you to plot all LOP's from the same position, and is handy when manually plotting sights at sea. Turning **ADV** "off" is useful when plotting sights that were not shot in real-time (ie. "textbook problems").

A. POS

Assumed Position. Allows you to change the Assumed Position from which to plot the LOP. Navcom defaults to the closest whole degree of lat/lon to the DR position. You may select a waypoint, manually entered lat/lon position, or DR position from which to plot. If DR is chosen, Navcom does <u>not</u> round it the whole degree as it does when first entering VIEW.



Celestial Catalog. Returns to the Catalog (same as the EXIT key in this case).

DELETE

Delete LOP. Purges the displayed LOP from the Celestial Catalog. ONCE LOP'S ARE DELETED, THEY CANNOT BE RECOVERED. Navcom prompts with a confirmation message before purging the LOP.



Display Height Observed. Displays the corrected sextant altitude. Useful for checking questionable sights, or working with high-altitude sights.

▶ PLOT Plot LOP's. If two or more LOP's are in the catalog, Navcom will display the fix plot. See next page for more information on the ▶ PLOT function.

Cursor Keys. RIGHT or **DOWN** advances to the next LOP in the catalog. **LEFT** or **UP** returns to the previous LOP. Pressing **RIGHT-SHIFT** before any of these keys moves to the last or first LOP of the catalog respectively.

EXIT

Exit. Quits LOP VIEW and returns to the Celestial Catalog.

Continued on the Next Page.

CAT LOP Catalog (cont.)

PLOT Plot LOP Menu option.

When Navcom displays LOP's, the computed fix position is represented by a circle in the center of the display. The fix coordinates are displayed in the lower left corner. The LOP's are displayed on the screen as lines just as you would plot them on paper.



KEY DESCRIPTION

ATTN



Exit. Quits the **PLOT** routine and returns to the LOP catalog.

Attention / ON. Quits the PLOT routine and returns to the CELES menu.

There are two ways that LOP's may not plot correctly:

1) The "scale" of the plot screen is approximately 30 nm North/South by 60 nm East/West. If an LOP plots outside of this range, it will not be visible, although the computed fix position will still be displayed at the center of the screen.

2) Navcom always displays the fix position at the center of the screen, but plots the LOP's using the DR Position as the Assumed Position. If there is a difference between the DR position and the Fix position of more that about 80 miles, the LOP's may not plot correctly.

If your LOP's do not plot correctly, exit from the PLOT display and check the following:

1) The LOP's for reasonable intercepts. Sights with extremely large intercepts are marked with a ***** symbol next to the name of the Body in the LOP Catalog.

2) The computed fix position vs. the DR position. If there is any doubt, plot the LOP's on paper.

If only one or two LOP's are "bad", you may exit **>PLOT** and delete the offending sights. The easiest way to identify LOP's in the plot screen is to note their azimuth (remember that the plotted LOP's direction will be rotated 90 degrees from the azimuth displayed in LOP VIEW).

FIND Celestial Object Find / Identify

The **FIND** routine will compute the altitude and azimuth of a known celestial object, or it will identify an unknown object if given the altitude and azimuth.

		Fir Time: DRPos: Body: Hc:	nd/Ider 08:56: 99°20.8'N	ntify 31 06∕3 79¤24.7'µ	30	
		TIME POS	BODY Hs	2n X FIND SIG		
KEY	DESCR					
TIME	Local tim entry is ne routine is that was cl	e and date. Enter ccessary for defaul set to zero, then th hosen in the CLO	the local time t time displayed to time is labele CK routine (Si	in the format HH.n d. If the zone descr ed and entered as G mply press ENTER	nmss and ription er MT. En R if the d	I press ENTER. No intered in the HDG iter the date in the format ate has not changed.)
POS	Vessel's P computed	Position. Allows y . The following o	ou to change the ptions are avail	ne position from wh able:	hich the a	altitude / azimuth is
IDE	NT V P b	Waypoint Identifi Position. Waypoin before keying in a	er. Prompts for at names may contain the second sec	or the name of a wa onsist of up to 6 cha waypoint catalog (s	aypoint to aracters. same as p	o use as an Assumed Pressing ENTER pressing ID CAT).
	CAT V	Waypoint catalog	. Selects a way	point as a position.	. See pg.	9 for instructions.
LA-	LO I 1	Latitude / Longitu Latitude and Long	ide. Prompts for the formation of the	or latitude / longitu ormat DD.mmt.	ide to use	e as an Assumed Position.
D	<u>R</u> I "	Dead Reckoning DR" mode, the ve	oosition. Returnssel's DR posit	ns the routine to the	e default the time	"DR" mode. When in e indicated in the display.
BODY	Body Cat	alog. Selects the	celestial body.	See pg. 53 for info	ormation	on BODY.
Hs/Zn	Observed the Name, look for th	Altitude (Hs) an , Hc, and Zn of the ne Sun or Moon.	d True Azimu e closest body t	t h (Zn). Navcom w o the Hs and Zn giv	vill search ven. The	h its almanac and display search routine does not
* FIND	Star Find	er. Pre-computes	up to 12 of the	e best navigational s	stars. See	e pg. 61.
SIGHT	Celestial SIGHT ro	Sight. Temporari outine is accessed	ly exits the FIN in this manner,	D routine and runs you may return to I	the SIG FIND by	HT routine. When the pressing EXIT .
ENTER	Timed Co of-sight us	elestial Sight. Cal sing the Time Del	lls the SIGHT is an and that was entered	outine as above, an ered in the Celestial	nd automa 1 SETUR	atically enters the time- • routine.
EXIT	Exit. Qui	ts the FIND routin	ne and returns t	o either the calling	routine o	or the CELES menu.

***FIND** Star Finder (HO 249)

The ***FIND** routine searches Navcom's almanac for available stars at the time and position selected. The selected stars are chosen based on magnitude, altitude, and azimuth. First magnitude stars are selected where possible and their names are displayed in upper case. Lower magnitude star names are displayed in lower case. Selected altitudes are limited to between 15 and 70 degrees. Azimuths are chosen to provide two stars in every 30 degree sector when possible. The stars selected in this routine very closely match those printed in *the Air Almanac* (HO 249). The ***FIND** routine is available within the **SIGHT** and **FIND** routines.



KEY DESCRIPTION

- **Cursor Keys.** Scrolls through the star list, and selects the star to sight when **ENTER** is pressed (see below).
- NXT 1
- Next / Previous. Flip-Flops between the two pages of stars.
 - **ENTER** Sight the Selected Body. Automatically times the sight at the time the ENTER key is pressed, calls the SIGHT routine, and prompts for the Height Sighted (Hs) of the body. After entering the Hs, press ENTER to compute and view the LOP. To return to the ***FIND** routine, press EXIT after computing the LOP.

The time-delay entered in the Celestial SETUP routine is used when timing a sight with the ENTER key.

UPDTE 1 Update Star List. Re-computes the selected stars and updates their altitudes and azimuths. This operation is significantly faster than the original search (approx. 20 seconds).



Exit. Quits the Star Finder and returns to the calling routine.



Attention / ON. Quits the Star Finder and returns to the Main navigation menu.

R/SET Time of Rise / Set / Twilight

The **R/SET** routine will compute the time of rise and set for any body contained in Navcom's almanac. If the Sun is chosen, the times for Nautical and Civil twilight will also be displayed.

Tim Date:	e of Ris WED 06/3	e∕Set 30
DRPos:	33°27.7'N	73°36.6'W
Body:	SUN	
R/Set:	05:47	20:05
Civil:	05:19	20:34
Naut:	04:43	21:09
DATE PO:	EDDY N.ALP	1 LAN FIND

KEY DESCRIPTION

DATE

Local date. Default is current date. No entry is necessary for default date. Note that changing the date will also change the DR position. The DR position is advanced to the time of the first rise / set event.

POS

Vessel's Position. Allows you to change the position from which rise / set is computed. The following options are available:

IDENT

Waypoint Identifier. Prompts for the name of a waypoint to use as an Assumed Position. Waypoint names may consist of up to 6 characters. Pressing **ENTER** before keying in a name calls the waypoint catalog (same as pressing **ID CAT**).



Waypoint catalog. Selects a waypoint as a position. See pg. 9 for instructions.



Latitude/Longitude. Prompts for a latitude/longitude to use as an Assumed Position. Latitude and Longitude is in the format DD.mmt. North/South and East/West sign (+/-) convention is as selected in the **MODE** routine.

DR

Dead Reckoning position. Returns the routine to the default "DR" mode. When in "DR" mode, the vessel's DR position is computed for the time indicated in the display. Changing the selected time or date with the **TIME** menu key will update the DR position accordingly.

BODY Body Catalog. Selects the celestial body. See pg. 53 for information on BODY.

N. ALM Nautical Almanac routine. Computes GHA, LHA, and Declination. See pg. 64.

LAN

Local Apparent Noon (Meridian Transit) routine. See pg. 63.

FIND Body Finder routine. See pg. 60.

EXIT Exit. Quits **RISE/SET** and returns to the calling routine or to the Main navigation menu.

LAN Local Apparent Noon (Meridian Transit)

The LAN routine will compute the time of meridian transit and computed altitude at transit of any body contained in Navcom's almanac. If the Observed altitude at the time of transit is entered, latitude will be computed.



KEY DESCRIPTION

DATE

Local date. Default is current date. No entry is required for default date. Note that changing the date will also change the DR position. The DR position is advanced to the time of the meridian transit.

POS

Vessel's Position. Allows you to change the position from which LAN is computed. The following options are available:

 D	Eľ	T	•
10.010		14155	

1111

Waypoint Identifier. Prompts for the name of a waypoint to use as an Assumed Position. Waypoint names may consist of up to 6 characters. Pressing **ENTER** before keying in a name calls the waypoint catalog (same as pressing **ID CAT**).

Waypoint catalog. Selects a waypoint as a position. See pg. 9 for instructions.

- ID CAT
- LA-LO

Latitude / Longitude. Prompts for latitude/longitude to use as an Assumed Position. Latitude and Longitude is in the format DD.mmt. North/South and East/West sign (+/-) convention is as selected in the **MODE** routine.

DR

Dead Reckoning position. Returns the routine to the default "DR" mode. When in "DR" mode, the vessel's DR position is computed for the time indicated in the display.

Changing the selected time or date with the **TIME** menu key will update the DR position accordingly.

- **BODY** Body Catalog. Selects the celestial body. See pg. 53 for information on BODY.
- **N. ALM** Nautical Almanac routine. Computes GHA, LHA, and Declination. See pg. 64.



►LAT

Body Finder routine. See pg. 60.

LAN Sight-to-Latitude. Prompts for the Observed Altitude (Ho) at the time of transit. Computes and displays the corresponding latitude. Sextant corrections are applied based on the entries made in the Celestial SETUP routine. See pg. 54 for information on SETUP.



N.ALM **Nautical Almanac**

The N.ALM routine computed the Greenwich Hour Angle (GHA), Local Hour Angle (LHA), and Declination (Dec) of any celestial body within Navcom's almanac. The LHA is based on the position entered in the POS function within this routine. The N.ALM function is located on page 2 of the CELES sub menu. Page 2 is accessed by pressing the NXT key when viewing the CELES menu.



DESCRIPTION KEY

TIME	Local time and date. Enter the local time in the format HH.mmss and press ENTER. No entry is required for default time displayed. If the zone description entered in the HDG routine is set to zero, then the time is labeled and entered as GMT. Enter the date in the format that was chosen in the CLOCK routine (Simply press ENTER if the date has not changed.)				
POS	Vessel's Position. Allows you to change the position from which LHA is computed. The following options are available:				
IDE	NT	Waypoint Identifier. Prompts for the name of a waypoint to use as an Assumed Position. Waypoint names may consist of up to 6 characters. Pressing ENTER before keying in a name calls the waypoint catalog (same as pressing ID CAT).			
ID C	AT	Waypoint catalog. Selects a waypoint as a position. See pg. 9 for instructions.			
LA-	LO	Latitude / Longitude. Prompts for a latitude/longitude to use as an Assumed Position. Latitude and Longitude is in the format DD.mmt. North/South and East/West sign (+/-) convention is as selected in the MODE routine.			
DI	R	Dead Reckoning position. Returns the routine to the default "DR" mode. When in "DR" mode, the vessel's DR position is computed for the time indicated in the display. Changing the selected time or date with the TIME menu key will update the DR position accordingly.			
BODY	Body C	atalog. Selects the celestial body. See pg. 53 for information on BODY.			
R/SET	Rise / Set routine. See pg. 62.				
LAN	Local Apparent Noon (Meridian Transit) routine. See pg. 63.				
FIND	Body Finder routine. See pg. 60.				
EXIT	Exit. Q	uits N.ALM and returns to the calling routine or to CELES menu.			

Hs+Ho Sextant Corrections

The **Hs** • Ho routine is used to manually correct sextant altitudes. When using Navcom's celestial routines, sextant corrections are performed automatically, but this routine may be valuable for working such problems as circles-of-equal-altitude, or checking practice reductions. The **Hs** • Ho function is located on page 2 of the **CELES** sub menu. Page 2 is accessed by pressing the **NXT** key when viewing the **CELES** menu.



Hs: Height SightedIc: Index CorrectionHe: Height of EyeD: Dip CorrectionAcorr: Altitude CorrectionHo: Corrected Altitude

KEY DESCRIPTION

DATE Local date. Date is used to compute apparent altitude corrections. Default is current date. No entry is necessary for default date. New dates are entered in the format selected in the MODE routine. BODY Body Catalog. Selects the celestial body. See pg. 53 for information on BODY. Observed Altitude (Hs). Key in Hs as DD.mmt. Hs INDEX Index Correction. Key in index correction as DD.mmt. The default value is the Ic entered in the celestial SETUP routine. See pg. 54. HT. EYE Height of Eye. Key in HE in feet or meters. The units for HE are selected in the celestial SETUP routine. See pg. 54. 90-Ho Co-Altitude. The menu options subtracts the corrected sextant altitude from 90. Output is in the format DD.mmt. This feature is most useful when solving circles-of-equal-altitude sights. EXIT Exit. Quits the routine and returns to the CELES menu. Attention / ON. Quits the routine and returns to the Main navigation menu. ATTN

SRT Sight Reduction Table

The **SRT** routine is used to manually solve sight reductions. If LHA (Local Hour Angle), Declination, and Latitude are entered, the routine will display Hc (Computed Altitude) and Zn (True Azimuth). Alternately, if Latitude, Hc, and Zn are entered, LHA and Declination will be computed. The **SRT** function is located on page 2 of the **CELES** sub menu. Page 2 is accessed by pressing the **NXT** key when viewing the **CELES** menu.



KEY DESCRIPTION

LHA

Local Hour Angle. Prompts for the LHA in the format DDD.mmt. LHA is always measured westward as a positive value, but the routine will also accept Meridian Angle (t) with Westerly values positive and Easterly values negative.

The East / West sign convention selected in the **MODE** routine does not change how Meridian Angle is entered; West is always positive in this case.

DEC

Declination. Prompts for Declination in the format DD.mmt. North values are always entered as positive, and South values are entered as negative regardless of the mode selected in the **MODE** routine.

```
LAT
```

Latitude. Prompts for Latitude in the format DD.mmt. North values are always entered as positive, and South values are entered as negative regardless of the mode selected in the **MODE** routine.

- **HC** Computed Altitude. Prompts for Hc in the format DD.mmt. If an entry is made for Hc, the routine prompts for Zn and Latitude, and will compute LHA and Declination.
- **Zn True Azimuth.** Prompts for Zn in the format DDD.t. If an entry is made for Hc, the routine prompts for Zn and Latitude, and will compute LHA and Declination.
- **CLEAR** Clear Entries. Clears all entries and resets the routine for new data entry.
- EXIT BExit. Quits the SRT routine and returns to the CELES menu.
- Attention / ON. Quits the SRT routine and returns to the Main navigation menu.

VI THE OPTIONS MENU

The **OPTN** (OPTION) menu is designed to allow you to use your own custom programs within the Navcom menu system. It is basically a 'blank' menu to which you can assign programs. These programs may be ones that you have written yourself, acquired from other, or received from AP Systems. We anticipate releasing optional routines to enhance the features of Navcom in the future; these new routines may be placed in the **OPTN** menu.

The **OPTN** menu reads a list of program names from a variable named 'OPT' which is located in the NVAR directory. This list can be made up of program names, or the program itself. The HP Owner's Manual has complete details of the contents of this list starting on pg. 212 of Volume I (for the HP-48SX), or pg. 30-1 of the User's Guide (for the HP-48GX). Note that in the examples given by HP, you should substitute the Navcom variable 'OPT' for the 'CST' variable that they use.

AP Systems produces software that allows you to use the same display interface as the Navcom system for your own programs. Contact us at AP Systems for complete details.

VII CONVERSION FUNCTIONS

In addition to the dozens of built-in HP-48 conversions, Navcom performs many navigation-specific conversions within the **CONV** sub-menu. As with almost all Navcom routines, you may key in known information in any order; when Navcom has enough information to work with, it will compute and display the answer.

{ HOME }
4:
2:
1 : Time dist (Meteo)&mag kind mass

KEY DESCRIPTION

TIME	Time Conversions. Converts between Local Time, GMT, and a second Local Time Zone. See pg. 69.
DIST	Distance Conversions. Converts common navigational units of distance. See pg. 70.
METEO	Meteorological Conversions. Converts temperatures and barometric pressures. See pg. 71
MAG	Magnetic Compass Conversions. Solves "C D M V T" questions. See pg. 72.
WIND	Relative to True Wind. Solves any side of the wind triangle. See pg. 73.
MASS	Mass Conversions. Converts common maritime units of mass (weight). See pg. 74.
TIME Time Conversions

The **TIME** routine converts between Local Time, GMT, and a second Local Time Zone. Time zones are displayed both numerically, and by alpha designator. To convert times, key in the known or desired time, and the zone descriptions, and the other two time and dates will be displayed.



	Local Time. Prompts for local time and date. Time is entered in the format HH.mmss; Date is entered as MM.dd or DD.mm depending on the date format chosen in the MODE routine. The default time zone is recalled from the zone entered in the HDG routine.
L.ZD	Local Zone Description. Zone Description is entered in the format HH.mm. Positive zones are west of Greenwich; negative zones are east of Greenwich.
	Changing the Local Time Zone using this function does <u>not</u> change the default time zone that was entered in the HDG routine.
GMT	Greenwich Mean Time (UTC). Prompts for time at Greenwich (ZD 0 or zone ZULU).
A. TIME	Alternate Time. Prompts for Alternate time and date. Time is entered in the format HH.mmss; Date is entered as MM.dd or DD.mm depending on the date format chosen in the MODE routine
A. ZD	Alternate Zone Description. Zone Description is entered in the format HH.mm. Positive zones are west of Greenwich; negative zones are east of Greenwich.
EXIT	Exit. Quits the TIME routine and returns to the CONV menu.
ATTN	Attention / ON. Quits the TIME routine and returns to the Main navigation menu.

DIST Distance Conversions

The **DIST** routine provides common navigational conversions. To convert a distance, enter the known unit and all other units will be computed and displayed.



N. MILE	Nautical Miles. Prompts for entry of Nautical Miles.
SHOT	Shots. Prompts for entry of shots. A shot is equal to 15 fathoms or 90 feet.
FATM	Fathoms. Prompts for entry of fathoms. A fathom is equal to 6 feet.
YARD	Yards. Prompts for entry of yards.
FEET	Feet. Prompts for entry of feet.
METER	Meters. Prompts for entry of meters.
EXIT	Exit. Quits the DIST routine and returns to the CONV menu.
ATTN	Attention / ON. Quits the DIST routine and returns to the Main navigation menu

METEO Meteorological Conversions

The **METEO** routine converts temperatures and pressures commonly used in weather reporting. To convert a unit, enter the known temperature or pressure, and the unknown unit will be computed and displayed.



- **F**° **Fahrenheit Degrees.** Prompts for temperature in Fahrenheit.
- **C**[•] **Celcius Degrees.** Prompts for temperature in Celsius.
- **IN. HG** Inches of Mercury. Prompts for Barometric Pressure in Inches of Mercury.
 - **MBS** Millibars. Prompts for Barometric Pressure in Millibars.
 - **EXIT** Exit. Quits the METEO routine and returns to the CONV menu.
 - **ATTN** Attention / ON. Quits the **METEO** routine and returns to the Main navigation menu.

MAG Magnetic Compass Conversions

The **MAG** routine provides solutions for True-Magnetic compass conversions. As with all other Navcom conversion routines, simply enter the known parameters, and the routine will compute and display the unknown parameters.



COMP	Compass Heading. Prompts for the magnetic compass heading uncorrected for either variation or deviation.
DEV	Deviation. Prompts for magnetic deviation. This function does <u>not</u> call on the variation table that may be created in the MODE routine.
TABLE	Deviation Table. Recalls the deviation from the Deviation Table for the compass heading entered, and inserts it in the deviation entry. The Deviation Table interpolates between cardinal and inter-cardinal headings. If no compass or magnetic heading has been entered, the function will prompt for deviation (same as DEV above). See pg. 13 for information on the Deviation Table.
VAR	Variation. Prompts for magnetic variation. Variation is obtained from chart data or celestial observations.
TRUE	True Heading. Prompts for the True heading.
EXIT	Exit. Quits the MAG routine and returns to the CONV menu.
ATTN	Attention / ON. Quits the MAG routine and returns to the Main navigation menu.

WIND Relative / True Wind Conversions

The **WIND** routine solves Relative to True Wind problems. Key in the known parameters, and the routine will solve for the unknown.



KEY

DESCRIPTION

REL

Relative Wind Direction and Speed. Prompts for the relative wind direction from 0 to 360 degrees <u>as measured from the bow of the vessel</u>. Negative numbers may be entered for bearings on the port side of the vessel. For example, 330 degrees relative may be entered as -30 degrees.

Do not confuse Relative and Apparent winds:

Relative refers to the wind direction across-the-deck as measured from the bow of the vessel. *Apparent* refers to the wind direction across-the-deck as measured from North.

HDG

Ship's Heading. Prompts for the heading of the vessel. Ship's heading is displayed in True or Magnetic depending on the heading mode selected in the **MODE** routine. The routine defaults with the heading last entered in the **HDG** routine.



Ship's Speed. Prompts for the speed of the vessel. The routine defaults with the speed last entered in the HDG routine.

► SHIP

Compute Required Ship's Heading and Speed. Forces the routine to solve for ship's heading and speed. Key in the known wind direction and speed, and the desired relative wind, and the routine will display the required ship's heading and speed to obtain the desired relative wind.

Compute Relative or True Wind. This function key is displayed after the **SHIP** function has been selected. Returns the routine to its default status where ship's heading and speed are considered constants and relative or true wind is computed.



- **CLEAR** Clear Entries. Resets the routine and clears all previously entered information.
- **EXIT** Exit. Quits the WIND routine and returns to the CONV menu.
 - ATTN Attention / ON. Quits the WIND routine and returns to the Main navigation menu.

MASS Mass (Weight) Conversions

The MASS routine provides conversions for common units of measurement used aboard vessels.



L. TON	Long Tons. Prompts for Long Tons; a long ton is equal to 2240 lbs.
S. TON	Short Tons. Prompts for Short Tons; a short ton is equal to 2000 lbs.
LB	Pounds. Prompts for Pounds.
M. TON	Metric Tons. Prompts for Metric Tons; a metric ton is equal to 1000 kilograms or 2204 lbs.
KG	Kilograms. Prompts for Kilograms.
EXIT	Exit. Quits the MASS routine and returns to the CONV menu.
ATTN	Attention / ON. Quits the MASS routine and returns to the Main navigation menu.

VIII APPENDICES

Appendix A: Accuracy

Nautical Almanac

Navcom's nautical almanac is considered to accurate for marine navigation purposes until the year 2020. The accuracy of the almanac gradually degrades with time; it will still compute celestial positions for any date, but these positions will be less accurate than the limits listed below. The limits below are maximum errors; in most cases errors will be significantly less.

Accuracy by type of body:

-Sun and Stars:	GHA within 1 minute of arc, Declination within 1 minute of arc.
-Planets:	GHA within 3 minutes of arc. Declination within 3 minutes of arc.
-Moon:	GHA normally within 3 minutes of arc; maximum 5 minutes of arc. Declination normally within 3 minutes of arc, maximum 5 minutes of arc

In normal navigational practice, when shooting with multiple sights, average fix error has been found to be less than 1 nautical mile.

Courses / Distances

Navcom bases its computed Rhumbline courses and distances on the Mercator sailing using the WGS 72 datum. At *course angles* near 90 degrees, the Mercator formulas break down, and Navcom shifts to the parallel sailing equations. Navcom's algorithm shifts gradually between the two systems, so at course angles between 85 and 89.9 degrees, Navcom's computed distances may not exactly match those computed with any single method. It should be noted that *The American Practical Navigator* (Bowditch), does not adequately address the problem of near-parallel sailings, and distances computed with those equations may be significantly in error from the actual distance.

Distances measured on WGS 72 datum charts will match Navcom's computed distances exactly. Distances plotted on other chart datums may vary slightly, but differences will be on the order of 2-5 n.miles over a 4000 mile distance.

Internal Clock

The HP-48 internal clock is controlled by a quartz crystal oscillator and as such, its rate is affected by ambient temperature. For maximum accuracy, keep Navcom in as constant a temperature as possible.

Without using Navcom's auto-correct feature, the HP-48 clock may 'wander' by as much 1-2 minutes per month. When the auto-correct feature is engaged, and the clock has been auto-corrected over at least a two week period, the clock will usually be accurate to with 2-3 seconds per month. It is advisable to check the HP-48's clock against a standard reference time (WWV for example) once each week when actively navigating.

Appendix B: Celestial Body Numbers

Celestial Body numbers offer an alternative to selecting a body through the Body Catalog. The numbers listed for stars match the star reference numbers in the Nautical Almanac.

SUN	58		
MOON	59		
VENUS	60		
MARS	61		
JUPITER	62		
SATURN	63		
ACAMAR	7	FOMALHAUT	56
ACHERNAR	5	GACRUX	31
ACRUX	30	GIENAH	29
ADHARA	19	HADAR	35
ALDEBARAN	10	HAMAL	6
ALIOTH	32	KAUS ALSTRALIS	48
ALKAID	34	КОСНАВ	40
AL NA'IR	55	MARKAB	57
ALNILAM	15	MENKAR	8
ALPHARD	25	MENKENT	36
ALPHECCA	41	MIAPLACIDUS	24
ALPHERATZ	1	MIRFAK	9
ALTAIR	51	NUNKI	50
ANKAA	2	PEACOCK	52
ANTARES	42	POLARIS	0
ARCTURUS	37	POLLUX	21
ATRIA	43	PROCYON	20
AVIOR	22	RASALHAGUE	46
BELLATRIX	13	REGULUS	26
BETELGEUSE	16	RIGEL	11
CANOPUS	17	RIGEL KENTAURUS	38
CAPELLA	12	SABIK	44
DENEB	53	SCHEDAR	3
DENEBOLA	28	SHAULA	45
DIPHDA	4	SIRIUS	18
DUBHE	27	SPICA	33
ELNATH	14	SUHAIL	23
ELTANIN	47	VEGA	49
ENIF	54	ZUBENELGENUBI	39

Appendix C: Navigation Data Structure

All navigation data is stored in the directory NVAR. Within the NVAR directory, there are the subdirectories WP and VOY. The WP subdirectory contains all information about Waypoints, and the VOY subdirectory contains all information about Voyages. Except where noted, all Time, Latitude, Longitude, and Altitude angles are stored in the format DD.ttt; where DD is whole degrees, and ttt is minutes and tenths converted to decimal.

Variable	Description and Format
NVAR	Nav. Variable Directory. All of the variables below are in the NVAR directory
HDG	Heading (True)
VARI	Magnetic Variation
SPD	Speed (knots)
LD	Log Distance (n.miles)
ZD	Zone Description (HH.mm)
AZD	Arrival Zone Description
BN	Celestial Body Number (-1=None Selected)
HE	Ht. of Eye (feet)
TD	Time Delay (HH.mmss)
IC	Index Correction (DD.mmt)
DEV	Deviation Table at Headings:
MS	Mannually entered current Set (Degrees True) { 000, 045, 090, 135, 180, 225, 270, 315 }
MD	Mannually entered current Drift (Knots)
AS	Auto Computed Set (Degrees True)
AD	Auto Computed Drift (knots)
тс	Time Correction (seconds per day)
ТА	Auto Clock Adjust (Reference time ticks)
TS	Clock Set (Reference time ticks)
PF	Previous Fix (Auto Drift, Auto Set, SMG, CMG, Lon, Lat, Fix Type, Date, GMT}
	Fix Type: 0=La/Lo, 1=Visual, 2=Radar, 3=Celestial.
LF	Last Fix {SMG, CMG, Lon, Lat, Fix Type, Date, GMT}
LT	Last Turn (No Set/Drift) {Lon, Lat, Date, GMT}
LTS	Last Turn (With Set/Drift) {Lon Lat Date GMT}
VF	1st Visual LOP Data {Nav Pt. Lon, Lat, 1/0, Bearing, Date, GMT} 1=La/Lo pos replaces NvPt
т	Temporary Variable (used in Tds, Nes)
NFLG	Navigation Flag Status (Binary Number)
UFLG	User Flag Status (Binary Number)
NKEY	Navigation Key Assignments {Key Assignment List}
UKEY	User Key Assignments {Key Assignment List}
LOP	Celestial LOP List <-Newest Oldest-> {{ Body Number, Hs, Ho, Dec, GHA, Date, GMT}
OPT	User Supplied Program Names for OPTIONS menu { Program Names }
∑ PAR	Summation Parameters {1 2 0 0 LINFIT }
∑ DAT	Summation Data [[0 0]]

WP Directory

VOY Directory

\$	Working Waypoint Name (Edit Mode)	\$	Working Voyage Name (Edit Mode)
? 5	Selected Waypoint Name	?	Selected Voyage Name
\164 (Code 164)	Waypoint List (Alphabetized) { }	\164	Voyage List (alphabetized)
\162 (Code 162) \$	Selected Navpoint Name	\162	Selected WP pos. # in current voyage

Appendix D: Navigation System Flags

All flags used by Navcom are HP-48 system flags and their settings do not affect the User Flag set. When any Navcom routine finishes, the HP-48 system flags are reset to their original settings, so the Navcom's flag use should not affect any other software applications you may have.

Status Flags:

Flag	Description
-13	Auto Set/Drift Enabled
-14	Manual Set/Drift Enabled
-27	Navigation Flag Set Selected
-28	South Latitude = Positive
-29	East Longitude = Positive
-33	Ht. of Eye in Meters
-43	European Date Format (DD.mmyyyy)
-53	Log Distance Enabled
-54	Magnetic Headings Enabled

Temporary Control Flags:

Flag	Description / Routines Used In
-1	Loop Exit/Control Subroutines
-2	Loop Exit/Control Nep, Ned, Id subroutines
-4	Great Circle route in current voyage leg
-20	General Use
-21	Nep, Ned, Id, Cat: Local Return control
-23	General Use
-24	General Use
-25	General Use
-26	General Use
-30	General Use
-31	General Use
-32	General Use
-35	Tde: Date Entry Only
-36	Tde, Ddte, Gz: display Day of Week
-39	Wpt: Edit Navpoint; Other routines: General Use
-52	Cat, Id: Internal control
-59	Cat: Star Catalog / Vedt: Control Wedt (No new ID allowed)
-60	Sit: Return to Star Pre-compute

Appendix E: Batteries

When to Replace Batteries

In normal daily navigational use, the HP-48's batteries will last between 3 and 4 months.

When a low-battery condition exists, the $((\circ))$ annunciator remains on, even when the calculator is turned off. When the calculator is turned on during a low-battery condition, the message **Warning: LowBat (S)** is displayed for approximately 3 seconds.

Replace the calculator batteries as soon as possible after the low-battery annunciator and warning message appear. If you continue to use the calculator while the annunciator is on, the display will eventually dim and you may lose calculator data. The Navcom ROM card program is unaffected by loss of battery power.

Changing Batteries

The HP-48 uses any brand of size AAA batteries. *Be sure that all three batteries are of the same brand and type.* The use of rechargeable batteries is not recommended because of their lower capacity and short low-battery warning time.

To change the batteries:

1. Turn the calculator off. You may lose data in the calculator if the calculator batteries are removed when the calculator is on.

2. Have three, fresh, size AAA batteries (of the same brand and type) at hand. Wipe off both ends of each battery with a clean, dry cloth.

3. Remove the calculator battery-compartment door by pressing down and sliding it off away from the calculator. Be careful not to press the calculator's **ON** key.

4. Turn the calculator over and shake the batteries out. After the batteries are out, you should replace them with fresh batteries within 2 minutes to protect against memory loss.

5. Position the batteries according to the outlines in the bottom of the battery compartment. Avoid touching the battery terminals. Batteries are easier to install if the negative (plain) ends are inserted first, and if the center battery is installed last.

6. Replace the battery-compartment door by sliding the tabs on the door into the slots in the calculator case.

7. Press ON to turn the calculator on.