SE-1DY Sky Force,

SKYMAP™ AND TRACKER™ INSTALLATION & OPERATING INSTRUCTIONS

WARNING

The GPS system is operated by the government of the United States which is solely responsible for its accuracy and maintenance. The system is under development and is subject to changes which could affect the accuracy and performance of all GPS equipment.

Although Skymap™ and Tracker™ are precision navigation aids, any navaid can be misused or misinterpreted, thereby becoming unsafe.

Use Skymap™ and Tracker™ at your own risk. To reduce the risk, carefully review and understand all aspects of this owners manual and thoroughly practice operation using the DEMO mode prior to actual use.

When in actual use, carefully compare indications from your Skymap™ or Tracker™ to all available navigation sources including the information from other navaids, visual sightings, charts, etc.

For safety, always resolve any discrepancies before continuing navigation.

The altitude calculated by Skymap™ is geometric height above mean sea level and could vary significantly from altitude displayed by pressure altimeters.

NEVER use GPS altitude for vertical navigation or terrain clearance.

This equipment is not a replacement for your chart and is intended as an aid to VFR navigation only. The database within the equipment has been compiled from the latest official information available, and although every care has been taken in the compilation, the manufacturers will not be held responsible for any inaccuracy or omissions therein.

CONTENTS

INTRODUCTION

Congratulations, you are now the owner of one of the most sophisticated yet simple-to-use Navaids available today. Naturally, you can't wait to get it working, but before you do, please spare a few moments to read through this manual.

The time you spend reading through it and familiarising yourself with the features of your unit will be repaid by trouble-free operation and even greater satisfaction at successful navigation.

No matter which key you activate, your unit cannot be damaged. Try out all functions and features without worrying. If you get into a mess, simply switch off and back on again to reset all functions.

SPECIAL FEATURES

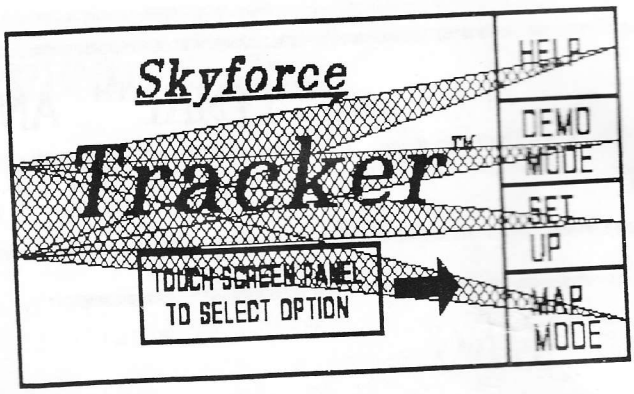
This equipment features a unique and very special switching system called Litetouch™.

Litetouch™ has been pioneered in avionics by Skyforce who set out to revolutionise the man-machine interface in the cockpit, bringing extreme ease of use to a sophisticated navigation system for the overworked pilot.

The principle is very simple. One key for each function. This is not however as easy as it sounds since there are many different functions associated with a sophisticated moving map navigation system, and using a conventional keypad would result in a very large number of keys.

Litetouch™ gets over the problem of having large numbers of keys, each labelled differently, by having only four keys with labels that change depending on the available functions in each display mode.

The keys are actually drawn on the display, down the right hand side, and are activated by lightly touching the relevant part of the display screen.



Hidden within the display bezel are four infrared emitters that sequentially shoot beams of invisible light across the face of the display to a single receiver.

When you touch the screen, your finger breaks one of the beams of light and the computer can determine which function key your finger is on.

This system completely removes the need for any mechanical switches (with their inherent unreliability) and ensures the correct functions are always available, when needed, at the touch of a single key.

The other really special feature of this equipment is the display screen.

The screen used is a brand new kind of liquid crystal display (LCD) which gives TV tube type clarity and viewing angle thanks to a bright white backlight combined with a black/white compensating film to enhance contrast. This display gives excellent clarity in most lighting conditions.

In addition the display can be run in two modes. Either black characters on a white background, ideal for daytime use, or white characters on a black background.

White characters on a black background, known as reverse mode, is ideal for night time operation because the amount of light emitted by the display is reduced to an absolute minimum, hence enhancing night vision.

Whether you own Skymap™ or Tracker™, we at Skyforce are sure you will be pleased with the performance of your unit and would like to take this opportunity to thank you for your custom and wish you many happy and safe hours flying.

1. INSTALLATION

The first thing to be considered is establishing a power supply to your unit. Primary power should be derived from an external source (10V - 30V DC). Internal batteries, if fitted, should be regarded as being suitable for temporary or emergency use only.

With Tracker™ there is a choice of disposable or rechargeable batteries. A fresh set of LithEon batteries can give up to three times more operating life than a fully charged set of ni-cads. Internal dry cells can not be used in Skymap™.

If you have a Tracker™ and choose dry cells, **UCAR LithEon L91 high energy lithium batteries must be used. Ordinary alkaline types such as Duracell are not capable of supplying the current required for more than a few minutes at a time.**

If you have a Tracker™, we recommend you fit a fully charged set of ni-cad batteries and wire the power input connector to allow a continuous trickle charge (see wiring diagram on page 4). In the event of an external power supply failure, the ni-cads will be ready for use and automatically take over. A kit containing six high capacity cells (part No. SMP 516), and a purpose made mains adaptor/battery charger (part No. SMP 517) are available from your Skyforce dealer.

If you have a Skymap™, ni-cad batteries are already fitted and should be fully charged (15 hours) using the mains adaptor supplied. The trickle charge link within the DC power lead is already connected.

PLEASE NOTE: With both Skymap™ and Tracker™, the trickle charge derived from the aircraft supply is sufficient only to maintain the charge level of the batteries, NOT to actually charge them. The batteries must be fully charged before the unit is fitted in the aircraft.

If internal batteries are being used, the display brightness should be reduced to an absolute minimum in order to get any useful life out of the batteries.

When the batteries become low, a warning message will be given across the screen. When this message appears, switch off as soon as possible.

TRACKER BATTERIES

1. Ensure the unit is switched off and the external power lead is disconnected.

2. Open the cover on the back of the unit by rotating the recessed screw anti-clockwise.

3. Snap six AA cells into the spring loaded battery holders, negative end of each battery to the spring terminal.

4. Ensure the batteries are inserted the correct way round then replace the battery cover and tighten the screw.

Please note: If you have a Tracker™ and intend to use it in conjunction with a GPS that relies on the external supply to produce a data output (such as a rack mounted Garmin 100), fitting batteries is a waste of time as the GPS will stop sending data in the event of a power failure.

EXTERNAL SUPPLY

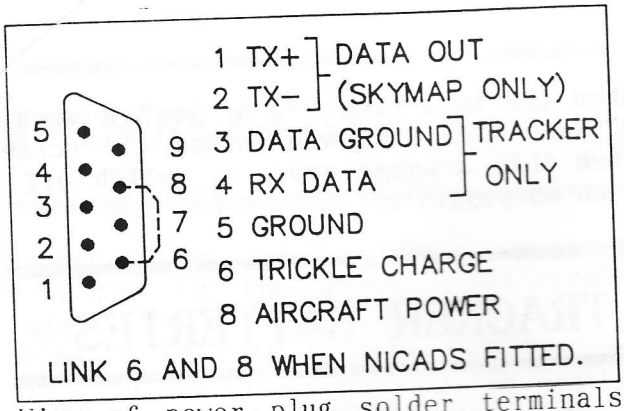
Supplied with your unit is a pre wired connector. If your unit is a Skymap™, the cable will have two cores and no screen. If your unit is a Tracker™, the cable will have four cores and a screen.

The red and blue cores of either cable type are for connection to any DC supply between 10 and 30 volts, capable of supplying 1 Amp.

* connect the RED lead via a **2 Amp fuse** to the positive (+) side of a 10 - 30 volt DC power source.

* connect the BLUE lead to the negative (-) side of the same power source.

You may also power your unit using a 12 or 24 volt automobile type cigar lighter adapter using the same principle as above.



View of power plug solder terminals showing link to be made if using ni-cad batteries (Tracker™ only).

WARNING (Tracker™ only): ONCE THE TRICKLE CHARGE LINK HAS BEEN MADE, DRY CELLS MUST NOT BE FITTED WITHOUT FIRST REMOVING THE LINK.

DATA INPUT

(Tracker™ only).

Tracker™ requires a data input from another GPS unit in order to function, whilst Skymap™ is a full GPS receiver and generates a data output to drive other equipment (data output connection for Skymap™ is covered in Appendix A).

If you are installing a Tracker™ unit, you will have two extra cable cores, coloured yellow and green, and a braided screen. These are the data input cables for connection to your GPS.

To operate fully, Tracker™ requires an 4800 baud NMEA 0183 data sentence containing latitude, longitude, track, ground speed and variation information with an RMC header. Alternatively a 9600 baud Trimble TranspakII, Trimble TNL, Garmin AIU or King equivalent ARNAV R-30 sentence may be used. If in doubt about the output of your GPS, contact your dealer or the GPS manufacturer for advice.

Strip the outer cable insulation back a short way and pull back the screening braid to reveal the four inner plastic covered cores. The screening braid of the cable should be twisted into a single core. The red and blue cables should be connected as described in the previous section. You are now ready to make data connection to your GPS unit.

The yellow and green cores are the data input lines. Yellow is DATA and green is DATA GROUND. The input is RS232, RS422 and NMEA 0183 compatible.

When connecting to an RS232 or NMEA device, yellow should go to DATA (A line) and green and screen to ground (B line). When connecting to an RS422 device, yellow should go to TX- and green to TX+. The screen should go to ground.

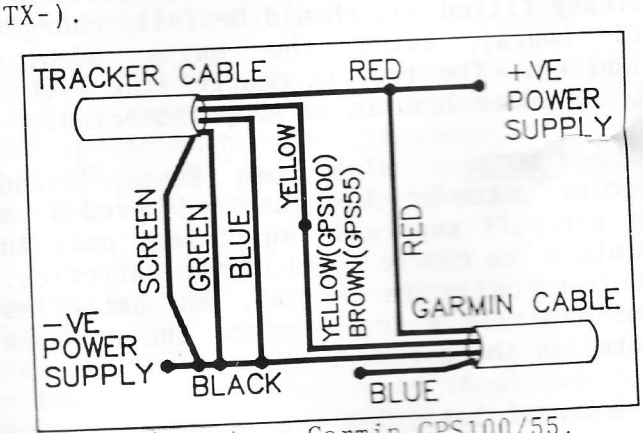
Example 1: To connect to a stand alone Pronav or Garmin GPS 100 (NMEA), connect the green core and screen of the Tracker™ lead to the black core of the power/data cable of the GPS. Connect the yellow core of the Tracker™ lead to the yellow core of the power/data cable.

Example 2: To connect to a Garmin Aviation Interface Unit (AIU) (RS232), connect the green core and screen to pin 15 (chassis ground) of the AIU. Connect the yellow core to pin 13 (TX).

Example 3: To connect to a Garmin GPS 55 (NMEA), connect the green core and screen of the Tracker™ lead to the black core of the power/data cable of the GPS. Connect the yellow core of the Tracker™ lead to the brown core of the power/data cable.

Example 4: To connect to a Trimble Flightmate PRO (NMEA), connect the green core of the Tracker™ cable to the green core of the Flightmate PC cable, and the yellow core of the Tracker™ cable to the yellow core of the Flightmate PC cable.

Example 5: To connect to a Trimble TNL 2000/2100/3000 (RS422), connect the green core to pin 15 (TX+), the screen to pins 13/14 (0v) and the yellow core to pin 3 (TX-).



Connections to a Garmin GPS100/55.

Example 6: To connect to a Magellan SKYNAV 5000 (RS232), connect the green core and screen to pin 7 (RS232 ground). Connect the yellow core to pin 12 (RS232 Port 1 TXD).

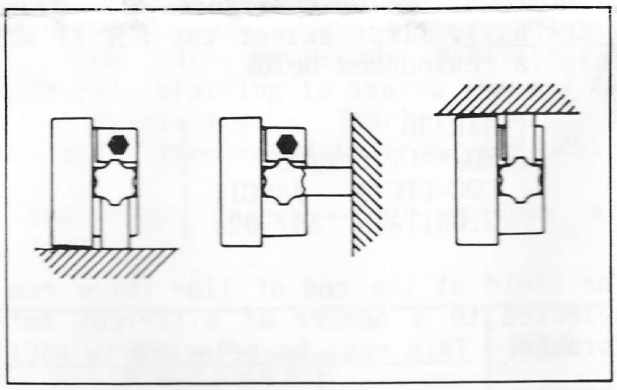
MOUNTING THE UNIT

Your unit has been supplied complete with a gimbal bracket for fixed installations.

For those installing a Skymap™ unit, an external blade antenna (part No. SMP 512) is available.

The gimbal bracket has been designed for easy insertion and removal of your unit in order to facilitate use in another aircraft or vehicle, home programming and to prevent theft.

The gimbal bracket supplied may be mounted on a flat horizontal, vertical or overhead surface.



When choosing the position for your unit, areas of direct sunlight must be avoided as glare will make the display difficult to read and sunlight can cause overheating and damage to the display.

The other major consideration, if you are installing a Skymap™, is to ensure the antenna, which attaches vertically to the rear of the unit, can see a large area of the sky, preferably right down to the horizon. In order to operate fully, Skymap™ needs to receive signals from at least four satellites at once.

At any time there may be up to eight satellites in view but they could be absolutely anywhere in the sky.

To ensure uninterrupted navigation it is essential that the antenna has direct line-of-sight contact with as much sky as possible.

Radio signals transmitted by the satellites are of an extremely high frequency and can be regarded as having approximately the same penetration capabilities as light.

That is to say, satellite radio signals will penetrate only very thin materials and will be shielded by most material that will block light.

If the position you have chosen is shielded from the sky, there are several options for remote antenna siting.

The simplest is to use the Skyforce 1.8 meter remote antenna extension accessory (supplied as standard).

This accessory allows the standard antenna to be mounted up to 1.8 meters away from the main unit, held in place by a rubber suction cup. This is ideal for temporary use in vehicles and light aircraft.

Other options include an external magnetic mount antenna kit for ground vehicles and an external blade or low profile type aircraft antenna. Contact your Skyforce dealer for further details.

Once the mounting position has been decided, fix the gimbal bracket securely using good quality nuts, bolts and shake proof washers.

IT IS ESSENTIAL IN MOVING VEHICLES, ESPECIALLY AIRCRAFT, TO ENSURE THE GIMBAL BRACKET IS FIRMLY FIXED DOWN.

Both Tracker™ and Skymap™ have a reasonable mass and could do considerable damage if they were to break loose under high G loads or in turbulence.

Once the gimbal bracket has been securely fixed in place, insert the power/data plug (being careful to observe there is a right and a wrong way round), tighten the plug fixing screws, slide the unit onto the bracket and fit the two side knobs. Be careful not to trap your fingers between the side knobs and the back of the case, it hurts.

2. TRACKER SETUP

After establishing a suitable power supply for your unit, you may switch on using the on/off switch located on the left side of the case. The down position is on.

Touch the panel marked SET UP. Screen four will be displayed.

RETURN TO MAIN MENU.	MAIN MENU
PROGRAM WAYPOINTS AND ROUTES.	BANK
CUSTOMIZE AND DECLUTTER MAP SELECT DATA INPUT	MAP DISP
ADJUST DISPLAY MODE, CONTRAST AND BRIGHTNESS.	LCD

Tracker screen four.

Now touch the MAP DISP panel. Screen five will be displayed with the current data format setting shown at the bottom of the screen beside the DATA INPUT: legend.

RETURN TO SETUP MENU.	SET UP
Map units: NAUT MILES Orientation: NORTH UP A'field Names: ENGLISH A'field Names: ON Town Names: ON Airspace: ON Launch Sites: ON Helipads: OFF Data Input: NMEA 0183	UP DOWN SET

Tracker screen five.

The factory default setting is NMEA 0183 format. Configure your GPS to output a valid data format then select the appropriate data type on your Tracker™ by touching the DOWN key repeatedly until the cursor bar is over the DATA INPUT: legend. Next touch the SET key. The cursor will move to the right. Use the UP and DOWN keys to scroll through the various data input options then touch SET again to select the desired data input type.

Most stand alone GPS receivers will need to be configured to give an output on their data lines. This is usually done via the keypad. The GPS should be configured to give data at a repetition rate of two seconds. It is not always possible to select repetition rates, but if your unit allows this, it is important to get the data output as near to every two seconds as possible.

Examples for popular brands follow.

Example 1: To configure the Pronav or Garmin GPS 100, first select the Map Datum/Interface page. Next move the cursor over the cyclic field to the right of "OUTPUT" and press the CLR key to select the NMEA 0183 output format. Now move the cursor over "OK?" and press the ENT key.

Now select NMEA 0183 on your Tracker™

If the GPS 100 is rack mounted with an Aviation Interface Unit (AIU), the AVIATION output format must be selected on the GPS and ARN R30 format selected on your Tracker™.

Example 2: To configure the Trimble TransPakII, first select the SET UP menu. This is reproduced below.

```
[ AIR/3D                ]
[ MG/NAUTICAL/DMD       ]
[ LOC=UTC+1    /ASCII   ]
[ G.BRITAIN '36/ 02s    ]
```

The field at the end of line three can be selected to a number of different output formats. This must be selected to ASCII.

The field at the end of line four is the output interval rate. this must be set to 02s (the s means seconds). In order to output correct track information, the TranspakII must be used in NAV mode. In other modes, track will not be output correctly. This is a quirk of the Trimble software. Now select TRIM ASC on your Tracker™.

If your Tracker™ is connected to a Trimble TNL2000/2100/3000 or a Magellan SkyNav5000, select ARN R30.

Data format selected will be held in memory, even with the unit switched off. It is only necessary to set the data input type up once.

3. OPERATION

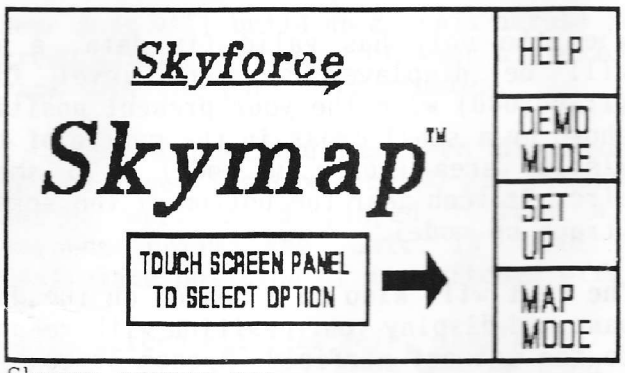
After establishing a suitable power supply for your unit, ensure the antenna is connected and pointing straight up (Skymap™ only), then switch on using the on/off switch located on the left side of the case. Down is on. Remember, GPS will not work indoors. The antenna must have a clear view of most of the sky.

When switched on, the unit will display a title screen and wait for you to touch one of the screen panels (also referred to in this text as keys). The screen will take a few minutes to come up to full brightness, especially in cold conditions.

No matter which key you activate, your unit cannot be damaged. Try out all functions and features without worrying but please touch only the switch panels. TOUCHING OTHER PARTS OF THE DISPLAY WILL CAUSE UNWANTED SWITCH FUNCTIONS TO OCCUR.

From the moment of switch on, Skymap™ will be trying to establish position by immediately starting to search the sky for active satellites. Tracker™ will be looking for incoming data from your GPS.

On the title screen, four options are available.



Skymap screen one.

If the panel marked HELP is touched, screen two will be displayed giving instructions and help on each function.

If whilst in screen two the panel marked MORE is touched, screen three (not illustrated) will be displayed.

Touching the panel marked MAIN MENU will return the display to screen one.

THIS SCREEN GIVES INFO ON EACH FUNCTION. TOUCH PANEL FOR MORE.	MORE
DEMO ALLOWS YOU TO USE MAP MODE WITH THE BUILT IN SIMULATOR.	DEMO MODE
SETUP ALLOWS YOU TO SET OPTIONS, PROGRAM WAYPOINTS AND ROUTES.	SET UP
MAP MODE IS THE NORMAL OPERATING MODE OF SKYMAP.	MAP MODE

Skymap screen two.

DEMO MODE is covered on page 19.

If the panel marked SET UP is touched on screens one, two or three, screen four will be displayed.

RETURN TO MAIN MENU.	MAIN MENU
PROGRAM WAYPOINTS AND ROUTES.	BANK
CUSTOMIZE AND DECLUTTER MAP	MAP DISP
ADJUST DISPLAY MODE, CONTRAST AND BRIGHTNESS.	LCD

Skymap screen four.

MAIN MENU panel returns to screen one. If the MAP DISP panel is touched, screen five will be displayed with the current setting shown down the right hand side of the screen.

RETURN TO SETUP MENU.	SET UP
Map units: NAUT MILES Orientation: NORTH UP A'field Names: ENGLISH A'field Names: ON Town Names: ON Airspace: ON Launch Sites: ON Helipads: OFF	UP DOWN SET

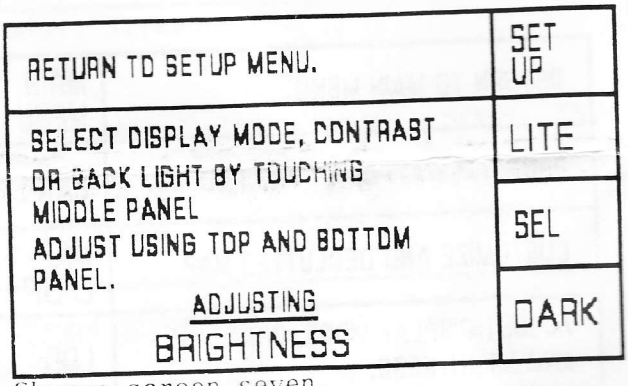
Skymap screen five.

The desired measurement units for your map (nautical miles, statute miles or kilometres), the map display orientation (north at the top of the screen or track at the top of the screen when moving) and the use of plain English airfield names or ICAO codes throughout may be selected by moving the cursor bar up and down, touching the SET key then using the UP and DOWN keys to select various options.

In order to declutter the map display, airfield names, town names, airspace boundaries, launch sites (glider, microlight and parachute/parascend) and helipads may be turned on or off.

Once you have customised your map display, touch the SET UP panel and the display will revert to screen four.

From screen four if the LCD panel is touched, screen seven will be displayed.



Skymap screen seven.

The second panel from the bottom shows SEL. This stands for SELECT and allows you to choose between adjusting backlight intensity, display contrast and display mode. The text at the bottom of the screen shows what has been selected for adjustment.

If you wish to adjust brightness or contrast, select BACKLIGHT or CONTRAST. The LITE and DARK keys can be used to adjust the brightness or contrast to one of sixteen levels. Use contrast adjustment to optimise viewing angle. Reduce brightness if running on battery power to prolong life.

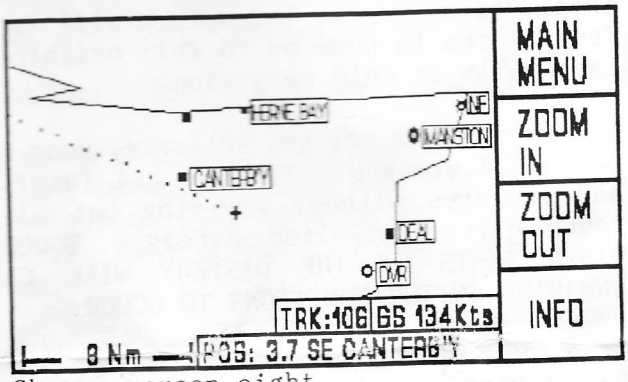
If you wish to change display mode, select DISPLAY MODE. The LITE and DARK keys will change to RVSE and STD. Use these keys to change between reverse and standard display mode.

Standard mode shows black characters on a white background. Reverse mode shows white characters on a black background and is usually preferred for night use.

When all display related adjustments have been made, touch the SET UP panel and the display will revert to screen four.

Contrast adjustment will be saved in memory and be the same next time the unit is used. Brightness level and display mode are not saved in memory. The unit will switch on at full brightness in normal mode.

From screen one if the MAP MODE panel is touched the display will show screen eight.



Skymap screen eight.

If the GPS has been unable to obtain a fix due to lack of time or lack of satellites, no map will be shown, the words NO FIX POSSIBLE will be seen across the middle of the screen.

When the unit has valid fix data, a map will be displayed at zoom level five (1:500,000) with the your present position shown by a small cross in the centre of the display area (north up mode) of a small aircraft icon near the bottom of the screen (track up mode).

The unit will also do a search on the data base and display your position with respect to the nearest airfield, beacon or town in the bottom right hand corner of the display (in the selected units) along with track and ground speed information if you are moving. If you have selected track up mode and you are not moving, the map will be drawn with north at the top.

NOTE: Ground speed will be in the units specified during set up. If nautical miles were selected, GS will be in knots.

If statute miles were selected, GS will be in MPH. If kilometres were selected, GS will be in KPH. Track will be magnetic with local variation taken into account.

The position reporting message displayed on screen is prioritised. If your position is within five miles of an airfield, range and bearing from that airfield will be displayed, even if there is a beacon or town nearer. **All airfield names are shown preceded by a * in order to distinguish them from towns with similar names.**

If your position is found to be within five miles of a VOR beacon and more than five miles from an airfield, position will be shown with respect to the VOR beacon, even if there is an NDB or town nearer. NDBs have next priority and towns last.

Also at the bottom left hand corner of the display is a scale bar showing a measurement.

The measurement may be in nautical miles, statute miles or kilometres depending on the selection made on screen five.

The display will be updated every two - six seconds (depending on the amount of data being displayed), keeping your present position still and moving the map around it one pixel at a time. As the display updates, the previous position will be shown on screen in the form of a single dot.

These dots will build up a trail across the screen giving a display of your historical track over the past five minutes.

If, after a position has been displayed, the GPS loses its fix, the NO FIX POSSIBLE message will be displayed. This will continue until the unit is able to recalculate position or is switched off.

Whilst screen eight is being displayed, the ZOOM IN and ZOOM OUT keys may be used to alter the scale of the map.

There are ten levels of zoom. As the zoom level is increased, more information will be shown on the map. The table opposite details this.

Zoom level 1. Scale bar 90Nm. Shows coast outlines only.

Zoom level 2. Scale bar 50Nm. Shows coast outlines, airfield icons, helipad icons and VOR icons.

Zoom level 3. Scale bar 30Nm. Shows coast lines, airfield icons, helipad icons, VOR icons and controlled airspace.

Zoom level 4. Scale bar 15Nm. Shows coast lines, icons for airfields, helipads VORs, NDBs & user waypoints, airfield, helipad, VOR & use waypoint names and controlled airspace.

Zoom level 5. Scale bar 8Nm (scale 1:500,000). Shows coast lines, airfield icons & names, helipad icons & names, VOR icons & names, NDB icons & names, town icons & names, user waypoints icons & names and controlled airspace.

Zoom levels 6 - 10. Show all information as level 5 but without controlled airspace.

The icons shown on the map are the published centres for each item in the database and when displayed on screen with their corresponding names, overlaps are bound to occur, especially at high zoom levels.

If a clash is likely, i.e. at an airfield where there is a VOR and NDB, the order of priority is airfield names first, then VORs, then NDBs, then user waypoints and towns.

Airfield icons have two small stubs to indicate the orientation of the main runway. **These stubs are not to scale and do not represent the actual position of the main runway.** They are intended as an aid to airfield recognition and circuit joining only.

PLEASE NOTE: The coast line shown on the map is for general reference only to indicate whether you are over land or sea. It is impossible to show every twist, turn, cove and island due to memory size limitations.

At any time whilst displaying screen eight, the INFO panel may be touched. This will cause the display to show screen nine. All INFO screens are printed in a large font to afford high visibility when flying.

ROUTE OR GOTO MODE.		NAV
GPS RECEIVER STATUS.		GPS
FIVE NEAREST ITEMS.		AREA
POS: N5115.14 E00111.52	RETURN TO MAP.	MAP

Skymap screen nine.

Geographic latitude and longitude is shown at the bottom of this screen for reference.

The second key down (GPS) is not present on Trackers. This function concerns the internal GPS receiver and is dealt with later.

If the AREA panel is now touched, screen ten will be displayed with the five nearest airfields shown along with the BRG (bearing FROM the aircraft TO the airfield) and distance to each in the selected units.

FIVE NEAREST AIRFIELDS

NAME	BRG	RNG
MANSTON	051 M	8
LYDD	210 M	20
LASHENDEN	259M	21
STONEACRE	286M	22
SOUTHEND	320 M	26

POS: 4.5 ESE CANTERB'Y

TRACK 134M | GS 137 | ALT 2500

MORE INFO | VOR INFO | NDB INFO | MAP

Skymap screen ten.

Below this information the position, track, ground speed and altitude (if available) are displayed.

From screen ten you can select MORE INFO, VOR INFO, NDB INFO or MAP. MAP will return to screen eight at the same zoom level as it was left.

If NDB INFO is selected, screen eleven will be displayed with the five nearest NDBs shown along with the BRG (bearing FROM the aircraft TO the beacon) and distance to the beacon in the selected units.

FIVE NEAREST NDBs

ID	BRG	RNG
NF	056 M	12
DU	206 M	21
SND	321 M	26
ING	141 M	30
CLN	002 M	35

POS: 4.5 ESE CANTERB'Y

TRACK 134M | GS 127 | ALT 2500

GOTO | A/D INFO | VOR INFO | MAP

Skymap screen eleven.

Below this information the position, track, ground speed and altitude (if available) are displayed.

From screen eleven, you can select MAP, A/D INFO or VOR INFO. MAP will return to screen eight at the same zoom level as it was left.

If VOR INFO is selected, screen twelve will be displayed with the five nearest VORs shown along with the bearing to (BRG), the radial (RAD) from and the distance (DME) to each VOR.

FIVE NEAREST VORs

ID	BRG	RAD	DME
DVR	134M	314M	8.2
LYD	222M	042M	19
DET	282M	102 M	22
CLN	002M	182 M	35
MAY	255M	075 M	42

POS: 4.5 ESE CANTERB'Y

TRACK 134M | GS 127 | ALT 2500

GOTO | A/D INFO | NDB INFO | MAP

Skymap screen twelve.

The radial displayed with each VOR is the bearing FROM the VOR, TO your present position. i.e. if you are on the 180 radial, you are directly south of the VOR.

The DME displayed with each VOR is the distance over the ground (not slant distance) in the selected units from the beacon to your present position.

At the bottom of the screen the present position, track, ground speed and altitude (if available) will be displayed.

From screen ten, if the panel marker MORE INFO is touched, a cursor bar will appear over the first airfield name. The two middle keys (now marked UP and DOWN) may now be used to move the cursor up and down the list of airfields.

If the bottom key (now marked SET) is touched, an airfield information screen will be displayed giving information on airfield name, ICAO code, main runway elevation in feet, main runway designation, main runway length in metres, main runway surface (soft or hard) and whether the main runway is lit or not.

From this screen you may return to the map by touching the top panel or initiate GOTO mode with this airfield as the destination by touching the bottom panel.

If you are already in GOTO or NAV mode, selecting GOTO from this screen will cancel any other NAV instructions displayed on the main map screen.

Similarly, when in screens eleven or twelve, one of the list of five items may be selected as a direct GOTO destination by touching the GOTO key.

On screen nine, apart from AREA and MAP, there are two other options. These are NAV and GPS. NAV will be dealt with in the next section. If you have a Tracker™ jump over this section.

If the GPS panel is touched (Skymap™ only), screen thirteen will be displayed.

RETURN TO MAP.	MAP
RECEIVER STATUS: 3D NAV EPE: 123 METRES GPS TIME: HH:MM LOCAL OFFSET: +1:00 LOCAL TIME: HH:MM	OFF SET
SATS: 01 02 03 04 05 06 07 08 SNR: 99 99 99 99 99 99 99 99	

Skymap screen thirteen.

Screen thirteen shows GPS receiver status information and time. Line three shows GMT or universal time. Line four shows the offset between GMT and local time.

This should be set to give actual local time on line five. It is important to set local time correctly to ensure ETAs given in NAV mode are correct.

To adjust the local offset, touch the OFFSET panel. The LOCAL OFFSET field on the display will now be highlighted and can be adjusted using the panels marked UP and DOWN. When the correct offset has been selected, touch the SET panel to save the value.

Other information given on screen thirteen is receiver status, estimated position error and a list of the satellites being received with their signal-to-noise ratios.

Initially all information fields except time will be blank. Allow a few seconds for the unit to calculate GPS status and satellite information.

Status can be SEARCHING, 2D NAV or 3D NAV. Searching means the unit is either looking for satellites to use or is reading data in from a satellite.

2D NAV means the unit has a current fix in two dimensions only, i.e. no altitude is being calculated. 3D NAV Means the unit has a full three dimensional fix.

Estimated error, shown on the second line, is the error, in meters, that the unit has calculated may be present in the fix due to satellite signal quality, satellite geometry or selective availability (S/A) (see page 23).

A list of the satellites expected to be in view is printed along the bottom of the display with their associated signal to noise ratios below.

The numbers shown opposite the SATS: legend are the PRN (pseudo random noise) numbers or identifiers assigned to each satellite.

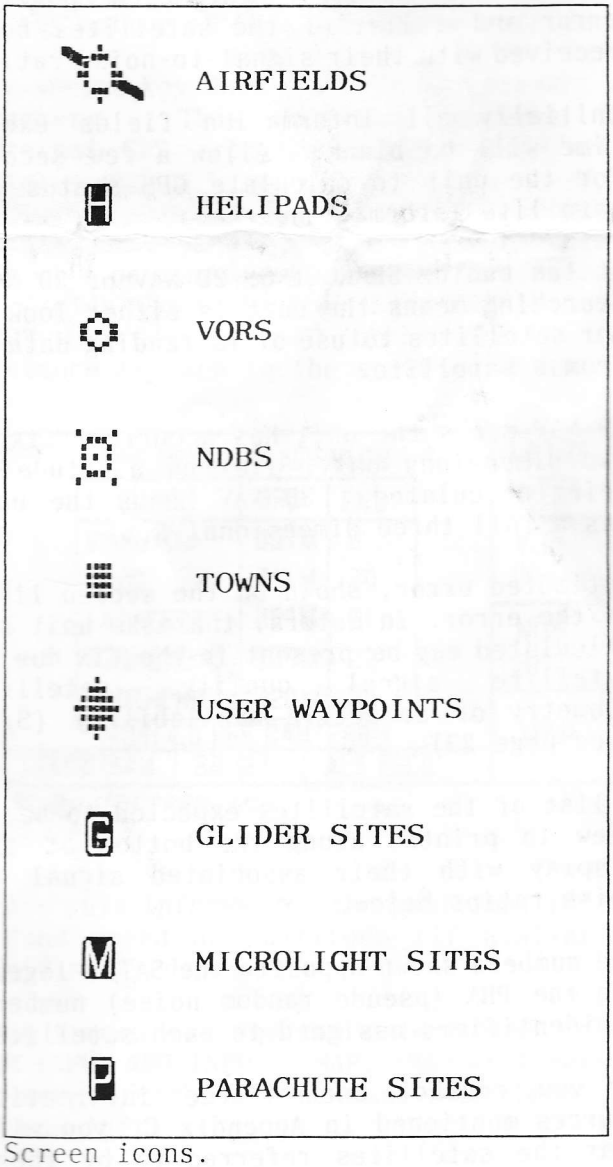
If you contact one of the information sources mentioned in Appendix C, you will hear the satellites referred to by these PRN numbers.

The two digit number under each PRN number is the signal-to-noise ratio or quality of the signal being received from that satellite.

Best is 99, worst is 00. These numbers can be used for finding and eliminating electrical interference.

DISPLAY ICONS

When showing screen eight, airfields, beacons, helipads, glider sites, microlight sites, parachute and parascending sites, towns and user waypoints are represented by different symbols or icons. These are illustrated below.



Screen icons.

NAVIGATION

In order to navigate along pre planned routes, Skymap™ and Tracker™ have facilities to allow you to program up to 250 user waypoints, then using these waypoints plus the enormous built-in database, plan up to 20 routes, each containing a start point and up to 20 turning points.

There is also a simple GOTO navigation mode which allows you to fly from your present position, directly to any point in the database or the user waypoint library.

All waypoints and routes are normally programmed on the ground and stored in the waypoint and route BANK or library.

Waypoints are specific locations, anywhere in the world, defined by a name (up to nine letters or numbers), a latitude and longitude.

In Skymap™ and Tracker™, waypoints serve two functions.

Firstly they can be used to build routes for conventional waypoint navigation and to add personalised points to your map.

Secondly, if flying outside the limit of the built in database, the unit will use the waypoints you have programmed to create the map.

For instance, if you are going on holiday to the West Indies and plan to do some flying, program all the airfields, beacons, towns and landmarks you can find on the chart within the area you plan to visit, as waypoints.

When you use the unit in the specified area, all your waypoints will be shown on screen in the same way the built in data is normally displayed. The only thing missing will be the coast line.

STORING WAYPOINTS

To begin storing waypoints, enter BANK mode via SET UP from screens one, two or three. Screen fourteen will be displayed.

RETURN TO SETUP MENU.	SET UP
VIEW AND EDIT WAYPOINTS.	WPTS
VIEW AND EDIT ROUTES	RTE
GO DIRECTLY TO MAP MODE.	MAP MODE

Skymap screen fourteen.

Now touch the WPTS panel. The display will show screen fifteen. This mode allows you to create, view and edit up to 250 waypoints.

RETURN TO MAIN BANK MENU.	BANK
WPT: 001 NAME: AWAYPOINT LAT: N 5120.84 LONG: W 00123.45 POS: 2.4 SSE HASTINGS	UP DOWN
EDIT THIS WAYPOINT.	EDIT

Skymap screen fifteen.

Screen fifteen shows the first of the user waypoints with the waypoint number highlighted.

If the waypoint has not been previously set, the NAME field will be blank and the LAT and LONG fields full of zeros with defaults of N and E.

The POSITION field is calculated based on the LAT and LONG of the waypoint. If the LAT and LONG are all zeros, the POSITION field will read OUTSIDE DATABASE.

The UP and DOWN keys can now be used to show the next or previous waypoint.

If WPT 001 is showing and the UP key is touched, WPT 002 will be displayed, if the DOWN key is touched, WPT 250 will be displayed etc.

If the EDIT key is touched, screen sixteen will be displayed with the word NAME highlighted.

EXIT EDIT MODE, RETURN TO WPTS.	WPTS
WPT: 001 NAME AWAYPOINT LAT: N 5120.84 LONG: W 00123.45 POSITION: 2.4 SSE HASTINGS	UP DOWN
SELECT ITEM OR ENTER DATA.	SET

Skymap screen sixteen.

AUTOMATIC WAYPOINT CAPTURE.

If the waypoint you have selected was empty (i.e. both Lat and Long set to 0), and the GPS has a fix, the present position will be written automatically to the LAT and LONG fields and the time will be written to the NAME field (Skymap™ only). With Tracker™, because time is not always known, the name field will have the waypoint number written in.

If you want to store the present position as a waypoint, simply touch the SET key. This will lock the present position in the chosen waypoint location. You may then edit the name etc. using the technique described below.

Using the UP and DOWN keys, you may now move the cursor between NAME, LAT and LONG to edit the chosen waypoint.

When the field you wish to alter is highlighted, touch the SET key and the first digit of the chosen field will then be highlighted. The UP and DOWN keys can now be used to alter that digit.

If it is the first character of the NAME then it can be set to any character between A and Z and 0 to 9. If the highlighted digit is part of a numeric field (i.e. Lat or Long) it can only be set between 0 and 9. The UP and DOWN keys will auto repeat if you hold your finger on them.

The last two digits in the Lat and Long fields, to the right of the decimal point, are one hundredths of a minute.

Once each character has been selected, touch the SET key. The cursor will then move on to the next character of the chosen field.

When the last character in the field has been set, the cursor will go to the next line heading, i.e. from the last character of the LAT field to the word LONG. When the last character of the LONG field has been entered, the unit will revert to screen fifteen.

As the last character of the LAT or LONG is entered, the POSITION field will be recalculated and updated. Use this to verify the waypoint entered is where you intended it to be. If not, repeat the editing procedure to correct the coordinates.

Whilst actually editing the waypoint name or coordinates, the top key will change to backspace (<<<). Use this to move the cursor to the left.

When you are satisfied the waypoint is correctly set, touch the WPTS key. The display will revert to screen fifteen.

This procedure may be repeated for any or all of the 250 waypoints. When finished, touch the BANK key to revert to screen fourteen, the main BANK screen.

PLEASE NOTE. If the waypoint you wish to edit is being used as part of a route, you will not be allowed to edit that waypoint until it has been removed from the route. This is a safety feature to prevent unintentional alterations to existing routes.

BUILDING A ROUTE

From screen fourteen if the ROUTE key is touched, the unit will display screen seventeen.

RETURN TO MAIN BANK MENU.	BANK
ROUTE: 01 THIS TP: START	UP
DATABASE: FIELDS NAME: MANSTON LAT: N 5120.84 LONG: W 00123.45	DOWN
ABCDEFGHIJKLMNOPQRSTUVWXYZ	SET
SELECT ITEM OR ENTER DATA.	

Skymap screen seventeen.

The object of the route function is to allow you to set up to 20 routes, each with a start point and up to 20 turning points (TPs). These routes can be called up and flown in NAV mode. The turning points can be chosen from the built in database, which is subdivided and arranged alphabetically for ease of use, or from your user defined waypoints.

Screen seventeen is shown with the route number highlighted. This can be adjusted between 01 and 20 using the UP and DOWN keys.

Once the required route number has been selected, the SET key should be touched. The word START beside the THIS TP legend will then be highlighted.

The UP and DOWN keys can now be used to move up and down the list of turning points (START to TP01 to TP20) i.e. START is turning point 00. The word RVSE may also be selected in this field. This is for reversing the order of the waypoints in the route and is dealt with later on this page.

If creating a new route, choose START. This is the point from which you intend to depart. TPs must be programmed in numerical order.

Now touch the SET key to move the cursor down opposite the DATABASE legend. This is the database field and can be selected between FIELDS, VORS, NDBS, TOWNS, WPTS, HELIPADS or CLEAR using the UP and DOWN keys.

Choose the database from which you want to select your start point or CLEAR if you want to blank out an existing turning point (see across the page). Let us assume we want to fly from Manston to user waypoint No. 125 via DET VOR.

Use the UP or DOWN keys to select FIELDS, then touch the SET key. A list of countries will be displayed in the middle of the screen. Use the UP and DOWN keys to select UK, then touch SET. If you have selected English airfield names on the MAP DISP page, an alphabet list will now appear at the bottom of the screen with a pointer under the letter A.

Now use the UP or DOWN keys to move the pointer along the alphabet until it is under the letter M. Touch the SET key.

All names in the UK FIELDS database beginning with M can now be scrolled through using the UP or DOWN keys. In order to allow quick access, the UP and DOWN keys will auto repeat if you hold your finger on them.

When you have found MANSTON, touch the SET key to select the item.

If you selected airfield names in ICAO CODE on the MAP DISP page, instead of selecting the airfield by name you will be given the first two letters of the ICAO code (EG for the UK) and you will have to fill in the other two letters. So to choose Manston from the database, you would select EGMH.

Once an airfield has been selected as a turning point in a route, you will be show the airfield information page and be asked to confirm your selection.

Now the START point has been selected, the cursor will go back to the THIS TP: field to allow the next turning point to be selected. Using the UP or DOWN keys, select TP01 and touch SET.

This time select the VORS database, select D then find DET using the technique just described.

When DET is showing, touch SET and select TP02.

This time select WPTS database and find WPT 125 using the UP or DOWN keys. Note: WPTS are found numerically not alphabetically. When WPT 125 is showing, touch SET.

This process can be used to select a start point and up to 20 turning points in each of 20 routes.

You will notice that as each turning point is selected, the individual leg distance and the total route distance is displayed at the bottom of the screen.

Touching the BANK key will revert the display to screen fourteen. You are now fully programmed and ready to navigate along your route.

EDITING OR CLEARING AN EXISTING ROUTE.

If a route has been previously programmed, it may be edited or overwritten using the technique just described. Simply select the TP to be altered and allocate a new position to it.

If you want to overwrite a long route (say 15 turning points) with a shorter route (say 5 turning points), the unwanted TPs from the existing route must be cleared down by selecting each unwanted TP in turn followed by the CLEAR option opposite the DATABASE legend.

REVERSING AN EXISTING ROUTE.

If a route has been previously programmed, it may be reversed to accommodate a return journey.

Select the desired route and touch SET. The word START beside the THIS TP legend will then be highlighted. The UP and DOWN keys can now be used to select the word RVSE.

Once RVSE is showing, touch SET and the waypoints within the selected route will reverse in order.

FLYING A ROUTE

In order to fly along one of the twenty preset routes, your unit must first have a valid position fix (or be in DEMO mode).

To commence flying along a route, select the NAV screen by touching the NAV panel on screen nine.

RETURN TO MAP.	MAP
ROUTE: 01 GOTO	UP
LEG: START > TP01	
MANSTON > SOUTHEND BRG 300T RNG 28	DOWN
SELECT ITEM OR ENTER DATA.	SET

Skymap screen eighteen.

Screen eighteen, the main NAV screen, will be displayed with the ROUTE numeric field highlighted.

The UP and DOWN keys are used to scroll the ROUTE between 00 and 20 in order to choose the desired route. If 00 is selected, no route is to be flown and NAV mode is off. Route 00 will always be selected when the unit is first switched on and should be left at 00 if GOTO mode is required.

When the desired ROUTE has been selected, the SET key should be touched. The cursor will now move on to the words LEG.

You may now use the UP and DOWN keys to move between the words LEG, ROUTE and GOTO. GOTO is covered in the next section.

The object is to select a route number, then select the leg within that route you wish to fly. You do not have to start at the beginning of the [illegible] route but can pick up anywhere along it.

Assume you wish to fly route 01 from [illegible] to finish. You would first select [illegible] opposite the ROUTE heading.

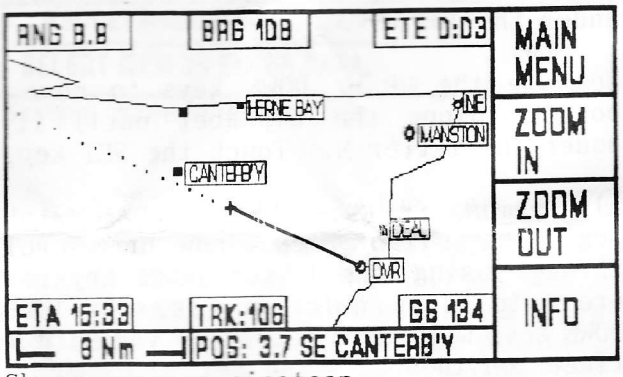
After touching SET, the LEG heading will be highlighted.

Touch SET again and using the UP or DOWN keys, select START > TP01 meaning that you wish to fly to TP01. The unit assumes you are starting from the previous turning point in the route, in this case START.

If you had chosen to fly to say TP06, the unit would assume you wanted to start at TP05 and fly to TP06.

The two lines below ROUTE and LEG show the full names of the TPs and the bearing (BRG) and range (RNG) between them.

Once the desired route and leg have been selected, touch the MAP panel to return to the main map screen.



Skymap screen nineteen.

If the unit has a current fix, you will notice more information has now been added to the map to allow you to fly along your route to the chosen turning point.

The route between the start and destination turning points will be shown on screen with the turning points joined together by a line.

If GOTO is being used, the destination point will be shown connected by a line to the point the aircraft was situated when GOTO mode was entered.

Extra navigation information is shown above and below the map. Starting at the top of the screen on the left hand side, the RNG, range or distance to run to the destination [illegible]rning point from your present position. [illegible]s in the units selected during set up

In the centre of the screen at the top, the BRG or magnetic heading to steer (assuming no wind) to the turning point is shown.

Beside the BRG on the right is the ETE or Estimated Time Enroute. This is the estimated time, in hours and minutes, it will take to get to the destination turning point from the present position at the present speed.

At the bottom of the screen on the left is the ETA (Skymap™ only). This is the estimated time of arrival at the turning point. **Ensure you have set the local time offset correctly to get correct ETAs.** **See page 11.**

Tracker™ does not give an ETA because real time is not always known.

In the centre of the screen at the bottom is TRK. This is the actual magnetic track the aircraft is travelling over the ground. Compare this to your magnetic heading to estimate cross wind component.

Beside TRK is GS. This is the actual ground speed of the aircraft and is displayed in Knots if map units are set to nautical miles, MPH if map units are set to statute miles or KPH if the map units are set to kilometres.

Compare the GS to your ASI to estimate head or tailwind component.

If ground speed is less than 0.5 Kts, the ETA, ETE, TRK and GS fields will be blank and the map will revert to north up if track up is selected.

To exit NAV MODE before the full route has been flown, select screen eighteen (NAV), select ROUTE 00, then touch MAP key.

GOTO MODE

From screen eighteen if GOTO is selected, the active route will automatically be set to 00 and screen twenty will be displayed.

RETURN TO MAP.	MAP
SELECT GOTO DESTINATION	UP
FIELD: MANSTON LAT: N 5120.00 LONG: E 00123.45	DOWN
ABCDEFGHIJKLMNOPQRSTUVWXYZ	
SELECT ITEM OR ENTER DATA.	SET

Skymap screen twenty.

Screen twenty allows you to fly directly from your current position to any point from any database.

You must first select the database, then the item from the database, in the same way as items were selected when building a route.

When entering screen twenty, the word FIELDS will be highlighted and can be changed to VORS, NDBS, TOWNS, WPTS or HELIPADS by using the UP or DOWN keys.

Touch SET to selected the required database, the alphabet list will now appear along the bottom of the screen with a pointer under the A. The start letter may then be selected followed by SET. The destination may now be selected from the chosen database with the UP and DOWN keys.

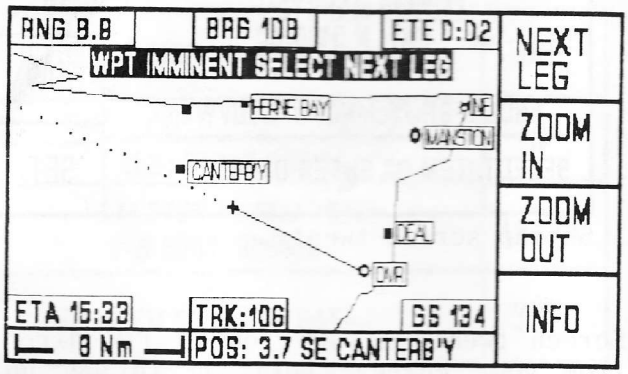
The LAT and LONG fields will update automatically as the database is scrolled through for your reference.

Once the desired destination has been found, touch SET to activate GOTO mode. Screen nineteen will be displayed with all the NAV information as detailed in the FLYING A ROUTE section.

To exit GOTO MODE before the full leg has been flown, select screen eighteen (NAV) then select GOTO OFF. Touch SET then MAP to return to screen eight.

APPROACHING A TURNING POINT

In either NAV or GOTO mode, when the ETE drops to two minutes or below, an extra message will be printed across the top of the screen.



Skymap screen twenty one.

If you are in NAV mode, the label on the top key will change to NEXT LEG. If you are in GOTO mode, the label will change to NAV OFF.

If the unit is in GOTO mode, touching the top key will revert the unit to normal MAP mode without any NAV information displayed and the GOTO function turned off.

If the unit is in NAV mode, i.e. flying a route, touching the top key will return the unit to screen nineteen with the next turning point in the current route active, all the NAV information updated for the new destination turning point, and the IMMINENT message gone.

If you do not want to continue with the route, touch INFO followed by NAV and from screen eighteen, select CURRENT ROUTE to 00 thus cancelling NAV mode.

If the turning point just reached was the last one in the route, the message at the top of the screen will read:

LAST WPT IMMINENT: HIT NAV OFF

and the top key will be labelled NAV OFF. You should acknowledge the end of the route has been reached by touching NAV OFF.

Once a new turning point has been selected or the NAV / GOTO mode cancelled, the label on the top key will revert to MAIN MENU.

If no new turning point is selected and the turning point is passed, the warning message at the top of the screen will read:

TURNING POINT PASSED: SELECT NEXT LEG

BRG will show the heading back to the turning point, DIST will show distance back to the turning point, the ETA and ETE will show a revised arrival time at the turning point and time to run back to the turning point just passed.

The TURNING POINT PASSED message will stay on screen until either a new turning point is selected or NAV or GOTO modes are cancelled, or the unit is switched off.

DEMO MODE

From screens one, two or three it is possible to select DEMO MODE. If selected, the display will allow the full use of MAP MODE but with simulated data, based on a user entered start position and ground speed.

All functions will be exactly the same as for live data but the words DEMO MODE in big letters will be shown across the screens and all bearings will be true, not magnetic.

When DEMO is entered screen twenty two will be shown with the words DEMO MODE highlighted.

RETURN TO MAIN MENU.	MAIN MENU
DEMO MODE: OFF LAT: N 5120.00 LONG: W 00123.45 GROUND SPEED: SLOW	UP DOWN
SELECT ITEM OR ENTER DATA.	SET

Skymap screen twenty two.

The last known position will be displayed along side the LAT and LONG legends. A default ground speed of SLOW (144 knots) will also be displayed. If you do not want the demo to start at this position or run slowly, you can change it.

Use the UP or DOWN keys to move the cursor to the LAT legend.

Touch SET. The highlight will move to the right. Enter the latitude of the point you wish to start the demo running from using the same technique detailed for inputting waypoints.

When the last digit of the LAT has been entered, the cursor will move down to LONG. Touch SET and enter the longitude of your revised starting point.

Once the last digit of the longitude has been entered, the cursor will move down to GROUND SPEED.

Touch SET then enter the ground speed you wish to run the demo at (FAST or SLOW). Fast is 720 knots, slow is 144 knots.

Once set, the cursor will move back up to DEMO MODE.

If you are ready to run the demo, touch SET. The cursor will move to the right. Use the UP or DOWN keys to toggle demo mode ON or OFF.

TO run demo mode, select ON and touch SET.

The unit will immediately jump to MAP MODE and display screen eight with the position set up as per the position entered in screen twenty two.

The map will now sit still until NAV or GOTO mode is entered.

Once a destination turning point has been entered in either NAV or GOTO modes, the unit will fly to the destination at the preset speed.

To exit DEMO MODE, return to the main menu, select DEMO, then toggle DEMO MODE to the OFF position. Alternatively, switch the unit off then back on again.

DEMO MODE will always be off on power up and should never be used in the air for safety reasons.

DEMO MODE should be used with the antenna (Skymap™) or external data (Tracker™) detached. If the unit detects incoming satellite data, DEMO MODE will be automatically disabled for safety reasons.

4. TECHNICAL SPECIFICATION

DIMENSIONS

MAIN UNIT

Unit front:	179mm x 114mm
Unit back:	155mm x 96mm
Overall depth:	76mm
Front depth:	36mm
Back depth:	40mm
Screen:	125mm x 70mm
Tracker™ weight:	0.9 Kg.
Skymap™ weight:	1.1 Kg.

(both including batteries)

PORTABLE ANTENNA
(Skymap™ only)

Length:	124mm
Diameter:	25mm
Weight:	0.05 Kg

EXTERNAL FIN ANTENNA
(optional, Skymap™ only)

Fin height:	120mm
Fin weight:	0.23Kg.
Max air speed:	Subsonic

(structural rating for antenna)

CAA APPROVAL:
Skymap™ is approved by the CAA for light aircraft radio class 3. Number LA301031.

TECHNICAL

Both Skymap™ and Tracker™

DISPLAY TYPE:
240 x 128 pixel black/white compensating film supertwist with cold cathode fluorescent backlight.

DISPLAY UPDATE RATE:
Every 2 seconds (subject to data availability).

POWER SUPPLY:
10V - 30V external DC with internal batteries fo emergency use.

TEMPERATURE RANGE:
Operating: 0°C to +50°C.
Storage: -20°C to +60°C.

STANDARD AREA COVERAGE:
Austria, Belgium, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, U.K. and Yugoslavia.

Tracker™ only.
DATA INPUT REQUIRED:
NMEA 0183 (4800 baud) or ARNAV R-30 (RS232 or RS422 9600 baud).
MAXIMUM POWER CONSUMPTION:
4.0 Watts.
BATTERY LIFE:
2 Hrs ni-cad 4 Hrs LithEon (assuming minimum brightness and intermittent use).
COMPATIBILITY:
Skyforce Skymap™, Garmin GPS100 & GPS55, Trimble TransPakII, TNL 2000/3000 & Flightmate Pro, Magellan NAV1000+, NAV5000 & SKYNAV5000 and any other brand of GPS, DECCA or LORAN with compatible output.
PC INTERFACE:
PC upload/download interface cable and waypoint/route planning map software available.

Skymap™ only.
RECEIVER SENSITIVITY:
-166dBW minimum.
SATELLITES TRACKED:
Up to eight simultaneously.
ACQUISITION TIMES:
15 seconds warm (all data known).
2 minutes cold (position, time & almanac known, ephemeris unknown).
7 minutes auto location (almanac known, position & time unknown).
15 minutes search the sky (no data known).
POSITION ACCURACY:
15 meters RMS (100 meters with Selective Availability on).
VELOCITY ACCURACY:
0.2m/s (0.39 knots) RMS steady state (subject to S/A).
DYNAMICS:
1000 knots velocity, 3g dynamics.
MAXIMUM POWER CONSUMPTION:
4.8 Watts.
BATTERY LIFE:
1.25 Hrs ni-cad. (assuming minimum brightness and intermittent use).
DATA OUTPUT:
NMEA 0183 data format, or Skyforce PC data format (automatically selected).
PC INTERFACE:
PC upload/download interface cable and waypoint/route planning map software available.

APPENDIX A.

SKYMAP™ DATA OUTPUT

Skymap™ will output two sentences every two seconds whilst in MAP mode with a fix in the National Marine Electronics Association's NMEA 0183 ASCII format.

This output is intended for use with equipment such as data loggers.

The first sentence is the Recommended Minimum Specific GPS/Transit Data (RMC) sentence.

The second sentence is the Global Positioning System Fix Data (GGA) sentence.

The sentence protocol is 8 data bits, one stop bit and no parity. Baud rate is 4800. Output is electrically equivalent to RS422.

The sentence structures are as follows:

$GPRMC,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,<10>,<11>*hh<CR><LF>

<1> UTC time of position fix,hhmmss format.
<2> Status, A= Valid position, V=warning
<3> Latitude,ddmm.mmm format.
<4> Latitude hemisphere, N or S.
<5> Longitude, dddmm.mmm format.
<6> Longitude hemisphere, E or W.
<7> Speed over ground (000.0-999.9 knots).
<8> Course over ground (000.0-359.9 true).
<9> Date of fix ddmmyy format.
<10> Magnetic variation 000.0-180.0°.
<11> Variation direction E or W.

$GPGGA,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,M,<10>,M,,*hh<CR><LF>

<1> UTC time of position fix, hhmmss.
<2> Latitude, ddmm.mmm format.
<3> Latitude hemisphere, N or S.
<4> Longitude dddmm.mmm format.
<5> Longitude hemisphere, E or W.
<6> GPS quality. 0 = no fix, 1 = fix good.
<7> Number of sats in use, 00 to 08.
<8> Horizontal DOP, 01.0 to 99.0.
<9> Antenna height above MSL (metres).
<10> Geoidal height in metres.

Each sentence is followed by a checksum (*hh), carriage return (CR) and a line feed (LF).

ELECTRICAL CONNECTION

Data is presented across pins 1 and 2 of the 9 way D type connector located on the rear of the unit.

Pin 1 is TX+ and pin 2 is TX-. These should be used as follows.

If connecting to an NMEA input device, connect pin 2 of the Skymap™ to the Rx data or data input line of the receiving device.

Connect pin 5 (ground) of the Skymap™ to the data ground input line of the receiving device.

If connecting to an RS232 input device such as a personal computer, connect pin 2 of the Skymap™ to the RXD (data input) line of the receiving device.

Connect pin 1 of the Skymap™ to the data ground line of the receiving device.

NOTE: If connected in this way, the ground of the Skymap™ and the ground of the receiving device MUST BE ISOLATED from one another.

CLEARING DOWN MEMORY

On both Skymap™ and Tracker™ it is possible to initiate a memory clear routine that will erase all user waypoints and routes and reset all variables to default values.

To initiate the memory clear routine, switch the unit off, cover all four keys simultaneously by laying one finger down the right side of the screen, then switch on and remove your finger.

The unit will ask you to confirm memory clear twice during which time you may change your mind by touching the NO key.

If you confirm twice by touching the YES key, all user defined data will be lost and all variables will be reset to default values.

APPENDIX B.

WHAT IS GPS?

GPS (Global Positioning System) is the American Department of Defense navigation programme that has been designed to take the place of the existing Transit satellite system.

The full system is based on a constellation of 21 active satellites orbiting the earth at a very high altitude (typically 11,000 miles).

In addition to the 21 active satellites there are three spare satellites that may be quickly manoeuvred into place in the event of the failure of one of the active units.

HOW DOES IT WORK?

Each satellite is placed in a very careful orbit such that it circles the earth covering the same path every twelve hours. The orbits are arranged in such a way that at any point in time, from any point on the globe, at least four satellites will be visible.

The technique for actually establishing position from these satellites is one of simple ranging, ie position is calculated from distance measurements to each satellite.

The exact position of each satellite at any given time is known. This information is actually transmitted by each satellite every few minutes. The exact time (with respect to universal time) that each satellite starts to transmit its coded signal is also known.

Given this information and the speed of radio waves through space, we can establish our exact distance from each satellite by simple mathematics. For example, if a car leaves point A at exactly 1 o'clock and travels at sixty miles an hour to point B which it reaches at exactly 2 o'clock, we know the distance between points A and B must be sixty miles.

In order to achieve any sort of accuracy from this technique it would normally be necessary to have an extremely accurate atomic clock built into the receiver. This would cost tens of thousands of pounds and is just not viable.

To make the system work accurately on only reasonably accurate and therefore low cost clocks, two very important techniques are used.

1) Code matching or synchronization. Each satellite transmits, for civilian use, a unique 1023 bit code. This code is repeated every millisecond (one thousandth of a second).

In the receiver, circuitry generates an identical code that is then slid back and forth in time until it matches the code being received from the satellite.

When a perfect match is achieved, the time at which the receiver is generating the start bit of the code is recorded. The difference in time (or offset) between the receiver generating the code and the satellite generating the code is therefore measurable because the time at which the satellite should have generated the code is known.

This gives a very accurate way of measuring the time differences between transmission and reception of the signals generated by the satellites, but does not help with the need for an absolute time reference (bear in mind that if the clock in the receiver were only 100 milliseconds (one tenth of a second) out with respect to universal time, the calculated distance from the satellite would have an error of 1,860 miles).

This problem is overcome by a second technique.

2) Making use of an extra satellite. In order to obtain a positional fix in three dimensional space, it is necessary to know the exact distance to each of three satellites. The exact distance is however not known because of the presence of an offset or error in the receiver's clock with respect to universal time.

A fix is nevertheless calculated using the three satellites, all be it erroneous.

Once this fix is calculated, a second fix is calculated using satellites 2 and 3 in conjunction with a forth satellite. This is repeated for satellites 3, 4 and 1 then 4, 1 and 2. This gives four calculated points in space.

If the four calculated points do not overlap, there must be a timing error present.

A slight correction is then fed into the receiver's clock and the points are calculated again. They move closer to each other.

This process is repeated until all the calculations tie up correctly at the same point. The exact position in three dimensional space is then known and the offset in the clock eliminated.

Similarly, a two dimensional fix can be established from three satellites.

As a result of this technique the receiver does not need to know absolute universal time initially, all that is needed is a reasonably stable clock for taking relative measurements over short periods between the signals received from each satellite.

A rough knowledge of universal time is needed in order to know which satellite to expect in which part of the sky, this is usually given by the first satellite acquired after switch on.

The exact universal time is transmitted as part of the almanac and health status data by each satellite. This is then corrected by the receiver for signal transition delay as part of the position fix calculations.

ACCURACY AND RELIABILITY.

All GPS satellites transmit two separate pseudo-random codes on two different frequencies.

The most accurate is the P code which is transmitted at both 1.2276 GHz (1.2276 thousand million cycles per second) and 1.57542 GHz.

The P code is extremely complex and has a repetition rate of one week. This code is restricted to military use only, is capable of supreme accuracy and is supposedly unbreakable.

The signal available to civilian users is transmitted on 1.57542 GHz only and is called the C/A code. C/A stands for Coarse Acquisition.

This code is relatively simple compared to the P code and has a repetition rate of one millisecond.

The present maximum accuracy for receivers using the C/A code is 15 meters.

There is the possibility however of this being intentionally degraded (by feeding random errors into the satellite clocks) to 100 meters for strategic reasons. This is called Selective Availability or S/A and is implemented at will by the D.O.D.

Day to day accuracy is monitored by Falcon Air Force Base, Colorado, who receive information from a group of ground stations positioned at Ascension Island, Diego Garcia, Kwagale and Hawaii.

These stations receive the satellite signals and check them for timing accuracy. If any errors are detected, error information is transmitted back to the satellite, which then corrects itself.

Reliability should be good when the full constellation of 24 satellites are in orbit.

Each satellite has three separate clocks on board (one in use and two standby) and in the event of the total failure of a satellite, a replacement can be manoeuvred into position within a few hours.

The only time the D.O.D. can predict there may be a substantial break in coverage for civilian users, is at a time of National emergency, when the whole system may be reverted to P code (military) operation only, for strategic reasons.

Having said this, the system remained fully available to civilian users during the Gulf conflict.

FURTHER INFORMATION.

Information on the day to day status of the GPS constellation is available from a number of sources. See Appendix C for full details.

APPENDIX C.

Information on current GPS satellite status is available daily from a number of sources.

BY TELEPHONE:

The United States Coast Guard offer a recorded message, updated daily, giving full status information on the GPS constellation. The USA telephone number to dial from the U.K. is 0101 703 866 3827.

BY FAX:(from within the UK only)

For those who have access to a fax machine with a poll mode feature, there is a weekly GPS newsletter available from the Met. Office. The U.K. fax number to dial in poll mode is 0336 400599. The newsletter is approximately five and a half minutes long and is compiled by the Royal Institute of Navigation.

BY MODEM USING A PC OR HOME COMPUTER:

The Unites States Coast Guard also offer a computer bulletin board service for anyone who has a computer and modem. The USA number to call from the U.K. is 0101 703 866 3890. Modem speed can be anything between 300 and 14,400 baud with a data format of 8 data bits, 1 stop bit and no parity.

APPENDIX D.

SERVICE AND GUARANTEE

Due to the Company's policy of continual development, new versions of software will become available from time to time.

As a registered owner of a Tracker™ or Skymap™, you will be informed by mail when new software becomes available.

At this time you may choose to return your unit to the factory or a dealer for upgrading.

At the time of purchase you should fill in and return the enclosed postcard so that a record of your name and address, along with the serial number of your unit can be made for the purpose of establishing the guarantee period and as a means of contacting you with information on software upgrades.

Failure to do this may result in loss of guarantee.

If you have a change of address or sell your unit on to someone else, please inform us so that we may update our records and keep track of the unit.

Your unit is guaranteed for a period of one year from date of purchase on a return to factory basis. In the unlikely event of repairs being necessary, please return the complete unit, including antenna, in it's carrying case, carriage paid to address below.

Skyforce PEA
School Lane
Wingham
Kent
CT3 1BD

This guarantee does not cover call out or on-site maintenance of the equipment.

If you require further help or advice on installing or operating your unit, please contact the dealer from whom you bought the equipment.