



**HarvestMaster™** a Campbell Scientific Company

**Agricultural Division**

Phone: 435-753-1881

FAX: 435-753-1896

E-mail: [hm@harvestmaster.com](mailto:hm@harvestmaster.com)

Web page: [www.harvestmaster.com](http://www.harvestmaster.com)



**Juniper Systems™** a Division of HarvestMaster, Inc.

**Natural Resource Division**

Phone: 435-753-1714

FAX: 435-753-1896

E-mail: [js@junipersys.com](mailto:js@junipersys.com)

Web page: [www.junipersys.com](http://www.junipersys.com)

**Mailing and Shipping Address:**

1740 N. Research Park Way  
Logan, UT 84341-1977 USA

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Editors: Jackie Litizzette  
Jan Jardine

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#### Warranty for LandMark GPS™ Accessories

HarvestMaster and Juniper Systems (referred to as HM/JS in this document) warrant that all LandMark accessories manufactured by HM/JS including cables, chargers, batteries, and backpacks shall be free from defects in materials or workmanship for a period of 90 days from the date of shipment. In the event a defect in materials or workmanship is discovered and reported to HM/JS within the specified warranty period, HM/JS will, at its option, repair the defect or replace the defective product. The customer has the responsibility to ship the defective equipment to HM/JS with all shipping costs prepaid. After repair or replacement, HM/JS will ship the replacement or repaired item at its cost by the same type of carrier used by the customer to ship the item to us. This warranty does not apply to products that have been damaged due to improper installation and operation, used for purposes other than those for which said hardware was designed, or operated outside of the product's environmental specifications.

#### LandMark GPS Software Warranty

HM/JS warrants the disk containing the LandMark GPS™ and LandMark PC™ Software to be free from defects in materials or workmanship for a period of 90 days from the date of delivery. If HM/JS receives notice of such defects during the warranty period, we shall, at our option, repair or replace the defective software media.

#### Disclaimer of Hardware and Software Warranties

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#### **FieldBook/Field Computer Warranty**

For warranty information on the *Pro2000* or *Pro4000* FieldBooks and Field Computers, refer to the User's Manual that came with the unit.

#### **Receiver Warranty**

For warranty information on receivers purchased from HM/JS but manufactured by Trimble Navigation Limited, refer to the warranty information that came with the receiver. We recommend that you return any warranty cards that came with the receiver to Trimble.

### **▲ Software License Agreement**

This Software License Agreement is between the end-user and HM/JS. Please read the following terms and conditions before using the LandMark GPS and LandMark PC Software. This agreement supersedes any prior agreement, written or oral.

#### **Granting of License**

HJ/JS grants, under the following terms and conditions, a non-exclusive license to use the LandMark GPS and LandMark PC Software.

#### **Ownership**

HJ/JS retains the title to and ownership of the LandMark GPS and LandMark PC Software plus any copies made of the software.

#### **Software Use**

LandMark GPS Software is authorized for use on *Pro2000* or *Pro4000* FieldBooks or Field Computers. It may only be used on a field computer provided by HM/JS or HarvestMaster, Inc. You can use the software on one field computer at a time per licensed copy. LandMark PC can be used on one PC at a time per licensed copy. You may make one copy of the software to be stored as a backup.

## **Copyright**

The LandMark GPS and LandMark PC Software are copyrighted by HarvestMaster, Inc. You may not rent, lease, lend, sub-license, modify, or disassemble these programs. The associated documentation may not be copied without written permission.

## **Term**

This License is in effect until terminated. It will be terminated under the following conditions:

- You destroy all copies of the software and documentation.
- You return all copies of the software and documentation to HJ/JS.
- You fail to comply with any provisions of the License Agreement.

## **Acceptance or Disagreement**

Use of the software in any manner indicates your acceptance and acknowledgement of the terms and conditions of this agreement. If you do not agree with any of the terms and conditions, do not use the software. Return the disk and documentation to HJ/JS. If LandMark GPS was installed on a field computer at the factory, you must delete it.

## **▲ Repairs**

### **Products Manufactured by HarvestMaster and Juniper Systems**

If you feel that your equipment needs to be repaired, contact our Customer Service Department by phone: 435-753-1881 or via email: techsupport@harvestmaster.com. If our Customer Service Representative determines that your equipment needs to be returned to our factory for repair, an Return Materials Authorization (RMA) number will be issued to you. This RMA number must be written on the outside of the shipping box. A written description of the problem should be included in the box with the equipment.

Please have the following information ready when you contact our Customer Service Department:

- Serial number of the Field Computer
- Your name
- Name of company/university/agency
- Shipping address
- Phone and Fax number
- Clear description of the problem encountered
- Purchase order number and billing address (for equipment that is not under standard or extended warranty)

Repairs are normally completed within ten working days unless special circumstances exist.

**Products Manufactured by Other Companies**

If a product manufactured by another company is in need of repair, you will save some time by calling the manufacturer directly. In some instances we can issue an RMA number from our office and contact the manufacturer for you. Keep in mind that this approach may add to the processing time for the repair.

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## **Index**



# Section 1

## Introduction

- 
- Welcome to LandMark GPS
  - GPS Overview



## Welcome to LandMark GPS

HarvestMaster and Juniper Systems have provided rugged field computing equipment for the agriculture and natural resource markets for many years. To enhance our product line and meet the geo-referencing needs of our customers, we developed the LandMark GPS™. With LandMark you can collect sub-meter, real-time differential GPS data.

### ▲ The LandMark System

The Landmark GPS is differential-ready with several receiver options. The following components are available:

- Rugged DOS-based Pro4000 or Pro2000 FieldBook™ or Field Computer™
- LandMark GPS™ Software that runs on the field computer
- LandMark PC™ File Management Utility
- Receivers from Trimble Navigation
- Telescoping Antenna Pole
- Backpack to carry the receiver, batteries, and antenna
- OmniSTAR™ Satellite Differential GPS Subscription
- GrafNav Lite post-processing software

These items are discussed in detail in *Section 2, Hardware Overview*, *Section 3, LandMark GPS Software*, and *Section 5, Post-Processing*.

### LandMark GPS Software

The LandMark GPS software features a unique screen carousel, making it simple to use and requiring a minimum of keystrokes. The software provides the following in-the-field GPS capabilities:

- Point, line, and area mapping with a graphical display
- Distance and area determination
- Waypoint creation, definition, and navigation with grid sampling feature
- Offset capability including laser rangefinder interface

### **Collect All Your Field Data With One System**

With LandMark, you can collect all of your field data with a single system. Map and navigation data are easily acquired using the LandMark GPS software. LandMark GPS can be used with a laser rangefinder for automatic input of point, line, and area offset information. Additional spreadsheet data can be entered into the Field Computer using DataPlus™ Application Development Software. You can also bring GPS data directly into a DataPlus spreadsheet for position tagged information.

### **LandMark PC Software**

LandMark PC is a file management utility that allows you to:

- View and edit map and waypoint files on a PC collected using the LandMark GPS
- Export LandMark GPS files into the formats required by ArcView GIS™, AutoCAD™, and database software packages
- Merge post-processed data with real-time data
- Transfer any file to or from a Field Computer™ and a PC
- Scale and print maps collected with LandMark GPS

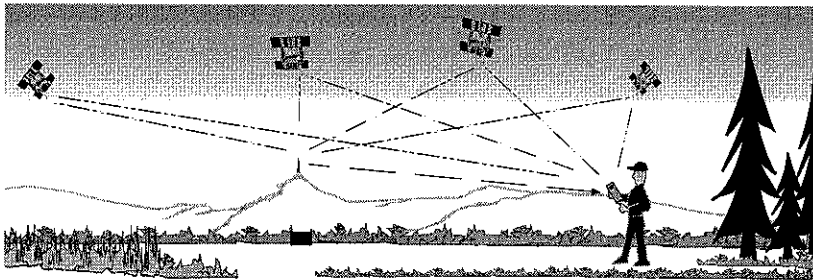
A full list of LandMark PC functions and details on how to use the software can be found in *Section 4, LandMark PC*.

We are confident that LandMark GPS will be a useful tool for your mapping and navigation application. If you have any questions after reviewing this manual, please feel free to contact us.

## GPS Overview

This manual is written with the assumption that you already have a working knowledge of GPS. A brief overview is given in this section.

The ability to log position information and perform calculations based on geographic movements is rapidly becoming a high priority in field data collection applications. A majority of natural resource and biological applications require an accurate location tag for each field sample. This is made possible by the Navstar Global Positioning System (GPS), a space-based worldwide navigation and positioning system implemented and maintained by the U.S. Department of Defense. The current constellation of 32 GPS satellites transmit digitally encoded signals that are available to anyone with an L-band receiver. GPS receivers calculate the time delay between transmission and reception for visible satellites to determine an accurate three-dimensional position location.



### ▲ Differential GPS

Degradation of the GPS signal can be caused by various error sources, including atmospheric effects, multipath errors, satellite clock and positioning errors, and receiver errors. Selective Availability, the intentional error created by the U.S. Department of Defense, has been turned off and is no longer an issue.

This degradation affects the accuracy of a receiver. By maintaining a fixed receiver at a known location in the vicinity of mobile GPS receivers, inaccuracies can be minimized. This process of reducing error through fixed stations is known as Differential GPS (DGPS) and can be implemented in real-time by DGPS receivers or via post-processing logged GPS data. The accuracy of DGPS position locations typically ranges from sub-meter to a few meters, depending on the quality of the receiver and the distance to the differential source.

Real-time DGPS is achieved by transmitting correction signals from a fixed station to roving GPS receivers via a radio link. The communication protocol used for transmitting correction signals was established by the Radio Technical Commission for Maritime Services and is thus commonly referred to as "RTCM." RTCM signals are available from a variety of sources, including radiobeacon stations, geostationary satellites, and local base stations, each of which establishes the RTCM radio link in a different manner.

### **Radiobeacon Stations**

These stations are maintained and operated by governments around the world. Correction signals are broadcast on kilohertz channels and are available to the public at no cost. A roving GPS receiver must be within 200 to 300 miles of a station in order to make use of radiobeacon RTCM broadcasts. At present, coverage is limited to coastal areas and major inland waterways. Some manufacturers have begun to integrate radiobeacon receivers and GPS receivers into a single package. Radiobeacon receivers are also available as separate units from a number of sources.

### **Geostationary Satellites**

Several companies have developed systems of ground stations that relay differential correction signals to geostationary satellites for re-broadcast to roving earth receivers. These services involve a monthly subscription fee in order to receive the correction signals. Coverage for satellite systems includes the entire continental United States and other locations around the world. Geostationary RTCM receivers generally come packaged with a GPS receiver as an integrated unit. We offer an OmniSTAR™ Satellite Differential GPS Subscription as an option.

### **Local Base Stations**

This option for achieving real-time DGPS requires that you set up and maintain an independent base station. Configuring a local base station requires a known location, a GPS receiver capable of outputting RTCM, and a radio link. The radio link typically involves low-power VHF/UHF radio modems and thus provides only line-of-site coverage.



### ▲ **Post-Processing Uncorrected Data**

GPS data can also be post-processed to achieve differential accuracy if real-time correction is unavailable. This technique involves combining base station files with roving files using post-processing software. See *Section 3, LandMark GPS Software, RINEX* and *Section 5, Post-Processing* for details on post-processing data with LandMark.

### ▲ **For More GPS Information**

For some excellent, detailed information about GPS, refer to Trimble Navigation's Web page: [www.trimble.com](http://www.trimble.com).



# Section 2

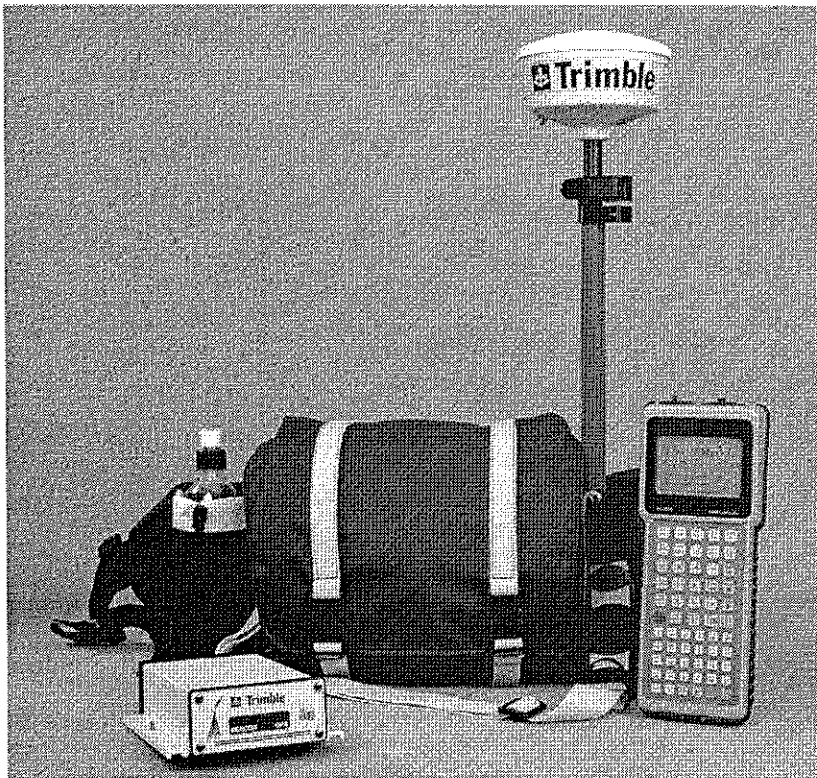
## LandMark GPS Hardware Overview

- 
- LandMark GPS Hardware Options
  - Advance System Preparations
  - Gearing Up the Hardware for Field Use



## LandMark GPS Hardware Options

Complete packages are available that allow you to receive differentially corrected GPS information from radiobeacon reference stations, local base stations, and geostationary satellites.



*Pictured from left to right: Trimble AgGPS 122 receiver, pack, Trimble AgGPS 122 antenna mounted on telescoping pole, and Pro4000 Field Computer (FieldBook)*

### ▲ Field Computer

Regardless of which package you are using, your LandMark system requires a Pro4000 or Pro2000 Field Computer™ or FieldBook™ (referred to generically as Field Computer in this manual). The Field Computer is ordered separately from the LandMark system, allowing you to choose the model and options you desire (data storage size, keyboard style, accessories, etc.).

## **User's Manual**

You should review the Field Computer User's Manual so you will understand the basic features and operating procedures. It is important that you understand how to maintain the batteries associated with the Field Computer.

## **Optional Uses for the Field Computers and FieldBooks**

Aside from the LandMark GPS application, the Field Computers and FieldBooks can be used to collect other types of field data. With DataPlus Application Development Software, you can easily collect spreadsheet data. If you are using the LandMark system, position can be included as a parameter in your DataPlus spreadsheet.

## **▲ Radiobeacon Receiver Package**

This LandMark GPS Package is capable of receiving differential corrections from radiobeacon reference stations. The package includes the following:

- Trimble Navigation's AgGPS 122 and 124 combine a GPS receiver with a radiobeacon receiver into a single, compact package with sub-meter accuracy. An antenna, a magnetic mount, and a 10 m antenna cable are included. (The AgGPS 124 also includes a built-in display and keyboard panel.)
- LandMark GPS Software
- Two Lead Acid Batteries for powering the receiver
- 110V AC Power Adapter/Charger
- Vehicle Power Adapter
- Telescoping Antenna Pole
- The Following Cables (pictured later in this section):
  - CA-22628 Antenna Cable
  - CA-30231 Data/Power Cable
  - CA-20240 Field Computer Cable
  - CA-20241 Battery Cable
- Backpack to carry the receiver, batteries, antenna, and radio (if a base station is used).

## ▲ Geostationary Satellite Receiver Package

This LandMark GPS Package has the capability of receiving differential corrections from geostationary satellite or radiobeacon receivers. The package includes the following components:

- ❑ Trimble Navigation's AgGPS 132 which combines a GPS receiver, a radiobeacon receiver, and a geostationary satellite RTCM receiver into a single, compact package. An antenna, a magnetic mount, and a 5 m antenna cable are included.
- ❑ LandMark GPS Software
- ❑ Two Lead Acid Batteries to provide power to the AgGPS 132
- ❑ 110V AC Power Adaptor/Charger
- ❑ Vehicle Power Adaptor
- ❑ Telescoping Antenna Pole for the AgGPS 132 Antenna
- ❑ The Following Cables (pictured later in this section):
  - CA-22628 Antenna Cable
  - CA-30231 Data/Power Cable
  - CA-20240 Field Computer Cable
  - CA-20241 Battery Cable
- ❑ Backpack to carry the receiver, batteries, antenna, and radio (if a base station is used).

An OmniSTAR™ Satellite Differential GPS Subscription is available as an option.

## ▲ Local Base Station Option

Both Trimble receivers can receive differential corrections from local base stations. If you have a local base station and would like to use it with a LandMark System, contact us for information on the hardware and set up requirements. If you want to set up a base station, contact us for references on where to obtain the necessary equipment.

## ▲ Optional Charging Accessory

An optional Dual Stage Battery Charger for lead acid batteries is available. This charger allows you to charge a lead acid battery in 3 to 4 hours. Refer to the *Appendix, Dual Stage Battery Charger* for details about this charger.

## Advance System Preparations

### ▲ Batteries

#### Field Computer Battery Pack

Make sure that the Field Computer has a fully-charged battery pack before you go into the field. Refer to the Hardware Section in the User's Manual that came with your unit.

#### GPS Receiver Batteries

The lead acid batteries that power the GPS receiver also need to have an adequate charge. If both batteries are fully charged, you can run the AgGPS 122 and 124 Receivers for approximately 10 hours and the AgGPS 132 Receiver for approximately 7 hours.

The following power/charging options are available for the lead acid batteries:

- AC Power Adaptor/Charger: charges fully discharged batteries in 12 to 14 hours (can charge two at once)
- Vehicle Power Adaptor: runs LandMark from a 12 V power supply
- Dual Stage Battery Charger (optional accessory): charges a fully discharged battery in 3 to 4 hours

For details about the lead acid batteries and the power/charging options, refer to the *Appendix, Battery Power/Charging Accessories*. Make sure you review the "Battery Maintenance Tips" in the *Appendix, GPS Receiver Batteries*.

### ▲ Software

You must install the LandMark GPS Software on the Field Computer. Refer to *Section 3, LandMark GPS Software, Installing the Software* for instructions.

### ▲ Base Station

If you are setting up a base station, please refer to the instructions included with the base station you are going to use.



### ▲ **Satellite Differential GPS Subscription Service**

If you have subscribed to the OmniStar satellite subscription service or a service provided by another company, refer to the instructions given to you when you ordered the service. Your subscription must be activated before you attempt to receive differential information from a geostationary satellite system.

❖ *Note: Before the AgGPS 132 receiver will turn on, it must be connected to the Field Computer and the LandMark GPS software must be running.*

## Gearing Up the Hardware for Field Use

To properly prepare the LandMark hardware for use in the field, complete the following tasks:

- 1) Fill the backpack with the equipment that goes inside (receiver, batteries, cables).
- 2) Connect the cables to the hardware (first to the hardware inside the pack, then to the hardware outside of the pack).
- 3) Set up the equipment that is attached to the outside of the backpack (antenna and pole, Field Computer).
- 4) Put the pack on.

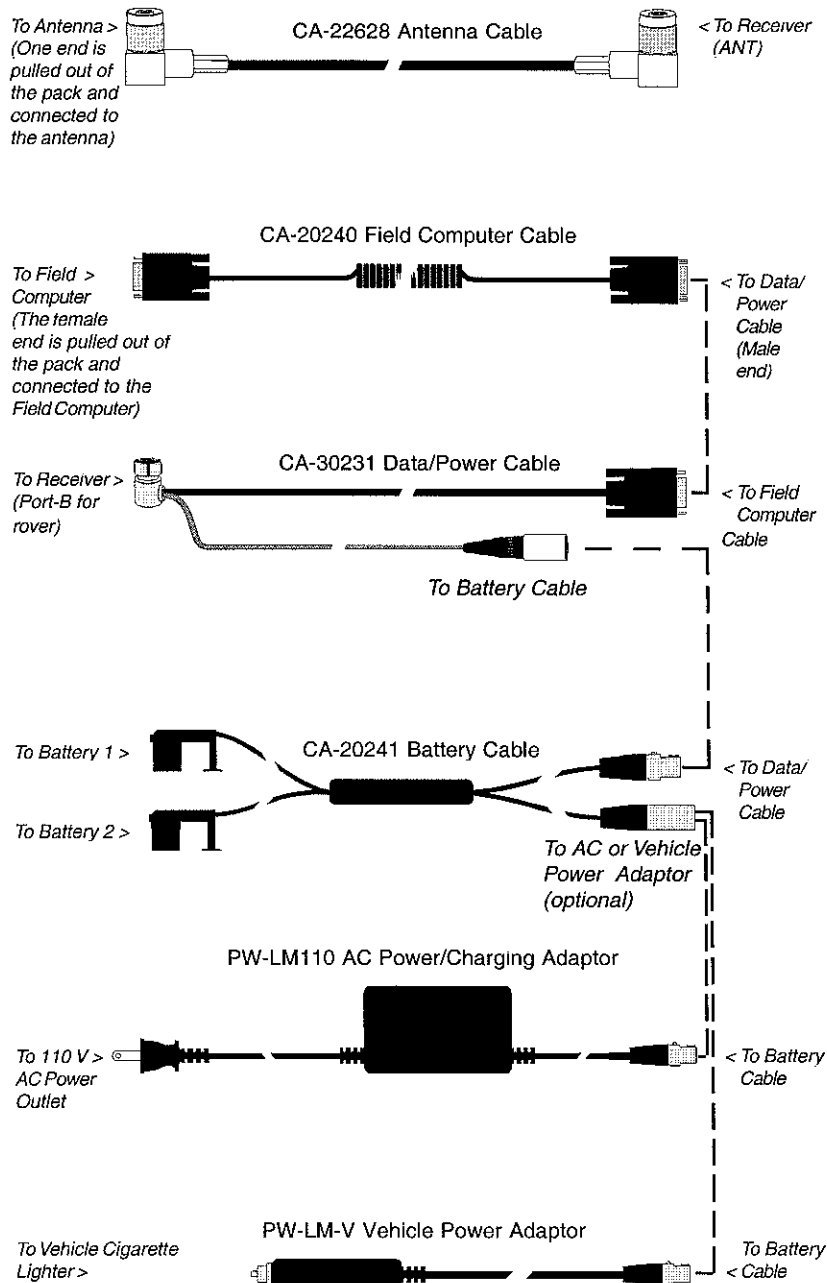
### ▲ Setting up the Inside of the Backpack

The backpack is made of durable, rain-resistant nylon. It is designed to carry the receiver, batteries, antenna, radio, and cables. The Field Computer can be placed in the holster attached to the waist strap when not in use. There are slots on both the right side and the left side of the pack for the antenna pole. Four reinforced holes are available to insert cables through.

The receiver, batteries, and cables are stored inside the pack. Arrange the components using the padding and straps to suit your needs. Instructions on how to connect the cables to the components is shown on the following page.

## ▲ Connecting the Cables

Refer to the diagram below for instructions on how to connect the cables to the equipment and to each other (make sure all the cable connections are secure).



### ▲ Setting up the Outside of the Backpack

- 1) Locate the following cable ends from the inside of the pack:
  - Field Computer cable, Field Computer end
  - antenna cable, antenna end

On the back of the pack are four reinforced holes to insert the cables through. There are two holes on the left side of the pack and two holes on the right. The holes near the bottom of the pack are for the Field Computer cable. The holes near the top of the pack are for the antenna cable. Decide which side of the pack you want to install the antenna pole on (see step 4 below). Pull the antenna cable through the hole on that side. Pull the Field Computer cable through the hole on the side that will be most comfortable for you when you are holding the Field Computer in the field.

- 2) Zip up the pack.

3) Attach the Field Computer to the Field Computer cable. You can store the Field Computer in the holster.

4) There is a slot on both the right side and the left side of the pack for the antenna pole. Select the side you want to use and put the antenna pole into the slot (see step 1 above).

5) Attach the antenna cable to the antenna (make sure the cable is securely attached). Screw the antenna onto the antenna pole.

6) The antenna pole is telescoping. Adjust it to the desired height.

You are now ready to go into the field. *Section 3, LandMark Software*, describes how to use the LandMark software.

# Section 3

## LandMark GPS Software

- 
- Introduction
  - Setup Carousel
  - Information Carousel
  - Verifying Operation of the System
  - Map Carousel
  - Navigation Carousel



## Introduction

The LandMark GPS™ Software runs on a Field Computer or FieldBook (referred to generically as Field Computer in this manual). The program is powerful and versatile, yet easy to use even for inexperienced users. The unique revolving carousel design keeps keystrokes to a minimum (details follow later in this section).

In-the-field capabilities include:

- ❑ **Point Mapping:** For mapping discrete point objects such as trees, utility poles, plot centers, etc. A point averaging capability is included.
- ❑ **Line Mapping:** For mapping a line feature and calculating the length of the line. A graphical depiction of the line is shown on the display. Examples include: mapping the length of a fence line, ditch, river, road, or path. Individual points within a line map can be labeled.
- ❑ **Area Mapping:** For mapping a closed space and calculating the area of the space. A graphical depiction of the area is shown on the display. Examples include: mapping and calculating the area covered by a field, weed patch, stand of trees, or wetland. Individual points within an area map can be labeled.
- ❑ **Navigating:** Allows you to navigate from one point to another. Examples: Navigating to a previously marked tree stand, flood area, or permanent plot.
- ❑ Mapping offsets to a GPS point
- ❑ Mapping or delineating waypoints
- ❑ Grid sampling

### ▲ Installing the LandMark GPS Software

A disk containing the LandMark GPS and the LandMark PC software is included with this manual. You can use LandMark PC to transfer the LandMark GPS software onto the Field Computer. A utility on the *Pro4000* called ProShell (or PolyShell on the *Pro2000*) is used to receive the file. Refer to your User's Manual, *Section 5, Utility Programs, File Transfer Programs* for detailed instructions on how to transfer files to the Field Computer.

To install LandMark GPS, follow the steps outlined below:

On the PC:

- 1) Install LandMark PC on your computer. Instructions on how to do this are located in *Section 4, Introduction to LandMark PC*.
- 2) Connect the Field Computer to your PC.
- 3) In LandMark PC, select Transfer/Select Port. Select the communication port you used to connect the Field Computer to your PC.

On the Field Computer:

- 4) Turn on the Field Computer and type PS <Enter> to get into ProShell (refer to the Field Computer User's Manual).
- 5) Create or edit the CONFIG.SYS file in the root directory of your C: drive (*Pro4000*) or D: drive (*Pro2000*) and insert the line FILES=30 into the file.
- 6) Change to the drive you want to store the LandMark software on.
- 7) Create a new directory named LM.
- 8) Put the Field Computer into receive mode.

On the PC:

- 9) In LandMark PC select Transfer/Send File. A dialog box appears. Use "Look in" to locate the LandMark GPS program (LM.EXE). Select the file and press "Send." A status message lets you know whether or not the Field Computer and PC are communicating. A progress bar gives you the status of the file transfer.

When transmission of the program is complete, LM.EXE is listed in the new directory created on the Field Computer.

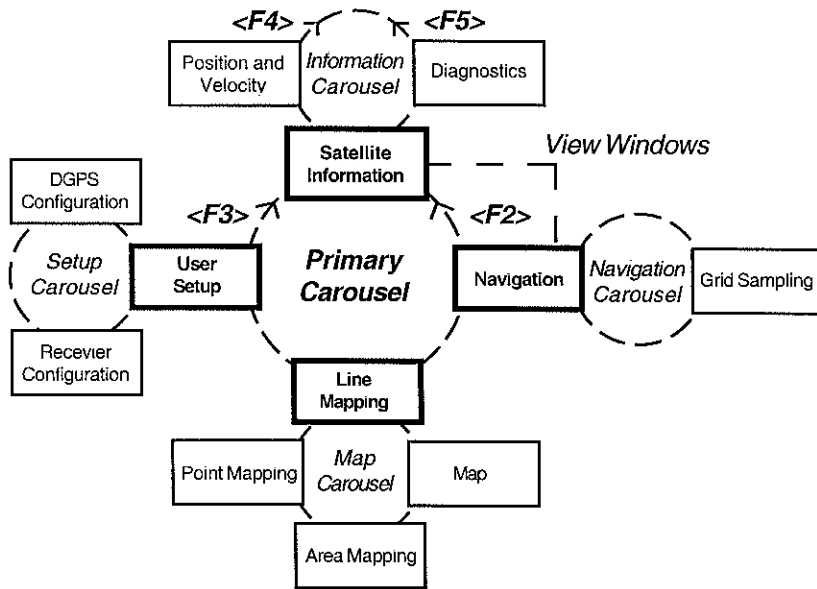
### **Running the Program**

To run the LandMark GPS Program from ProShell or PolyShell, highlight the file *LM.EXE* and press <ENTER> twice. LandMark should always be run from the directory where the executable file resides.



## ▲ Screen Carousels

The Landmark GPS Software is based on the concept of revolving carousels. The Primary Carousel serves as a window to the Secondary Carousels: Setup, Information, Map, and Navigation. A graphical depiction of the carousel structure is shown below.



### Rotating the Carousels

Screens are accessed using the function keys as described below:

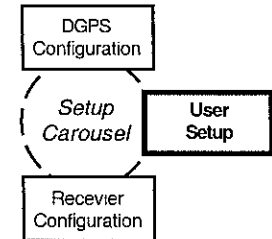
<u>Key</u>	<u>Function</u>
<F2>	Rotates the Primary Carousel counter-clockwise
<F3>	Rotates the Primary Carousel clockwise
<F4>	Rotates the Secondary Carousels clockwise
<F5>	Rotates the Secondary Carousels counter-clockwise

Try moving around the Primary and Secondary Carousels using the function keys to familiarize yourself with the way they work. Some examples are shown on the following pages.

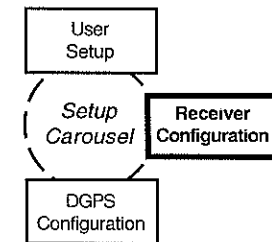
## Setup Carousel

The User Setup screen (shown in bold type on the carousel graphics) automatically returns to the main position (view window) on the Primary Carousel, even if its carousels have been rotated. Here is an example:

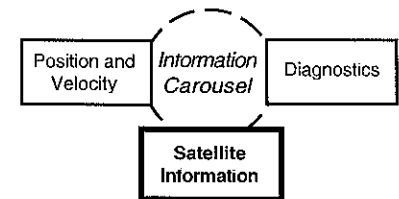
1) Rotate the Primary Carousel to the Setup Carousel, User Setup screen.



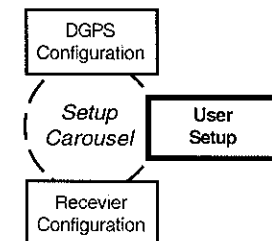
2) Rotate the Setup Carousel to the Receiver Configuration screen <F4>.



3) Rotate the Primary Carousel to the Information Carousel, Satellite Information screen <F3>.



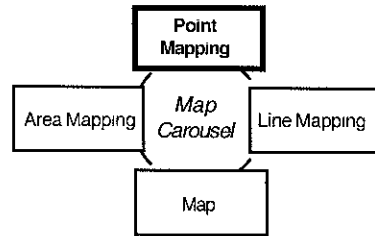
4) Rotate back to the Setup Carousel <F2>. The User Setup screen is back in the view window, even though the Receiver Configuration screen was the last screen viewed on this carousel.



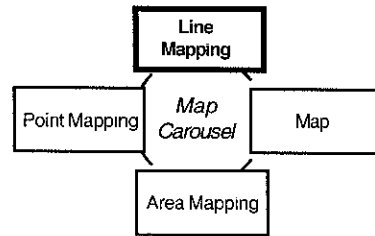
## Information, Navigation and Map Carousel

On the Information, Navigation and Map Carousel, the screen you last viewed remains in the main position (view window) on the Primary Carousel. Here is an example:

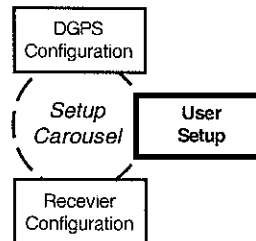
1) Rotate the Primary Carousel to the Map Carousel, Point Mapping screen.



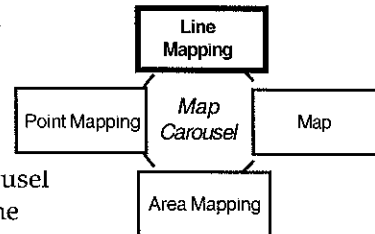
2) Rotate the Map Carousel to the Line Mapping screen <F5>.



3) Rotate the Primary Carousel to the Setup Carousel, User Setup screen <F3>.



4) Rotate back to the Map Carousel <F2>. The Line Mapping screen is shown because it was the last screen viewed. The Line Mapping screen remains in the main position on the Primary Carousel until you change it by rotating to the Map, Point or Area Mapping screen.



This feature allows you to keep the Map screen you view most in the main position for easy access.

## ▲ Function & Cursor Key Assignments

The function and cursor key assignments for the LandMark GPS screens are shown in the chart below (letters are not case sensitive).

<u>Key</u>	<u>Description</u>
F1	Provides descriptive help for "hot key" functions (HELP) or a drop down menu for user input (HLP▼)
F2	Rotates the Primary Carousel counter-clockwise
F3	Rotates the Primary Carousel clockwise
F4	Rotates the Secondary Carousels counter-clockwise
F5	Rotates the Secondary Carousels clockwise
F6	Toggles RINEX on and off on the Map Carousel
F7	Toggles the "rubber band" on the Map screen on and off
F8	Lets you select autoscale on, autoscale off, or autopan on
F9	Toggles an audible signal indicating incoming position fixes on and off
F10	Exits the program
ESC	Exits pop-up menus or dialog boxes such as help screens
U	Pans the Map screen up
D	Pans the Map screen down
L	Pans the Map screen left
R	Pans the Map screen right
O	Zooms out on the Map screen
I	Zooms in on the Map screen
Up Arrow	Move to the previous field
Down Arrow	Move to the next field
Left Arrow	Moves the cursor within a field
Right Arrow	Moves the cursor within a field
Tab ->	Hot key for logging your current position to a waypoint. This function is available from any screen.

## Screen Function Key Labels

Function key labels are located at the bottom of each screen above the corresponding function keys. The labels indicate which screen will appear upon pressing the corresponding function key. For example, the function key labels that appear on the Line Mapping screen are shown below:



Pressing <F3> from this screen rotates the Primary Carousel to the User Setup screen.

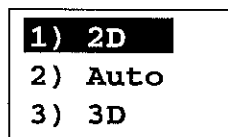
## ▲ Keyboard Data Entry

Data can be entered from the keyboard for any field. For fields with discrete lists of entries, select the desired value from a help list using the HLP▼ <F1> key. For all other fields, type in the entry from the keyboard.

If a field requests entry of a filename, a list of existing files is displayed when the HLP▼ <F1> key is pressed. The desired file can be chosen from this list or a new filename can be entered from the keyboard.

## ▲ Help Screens

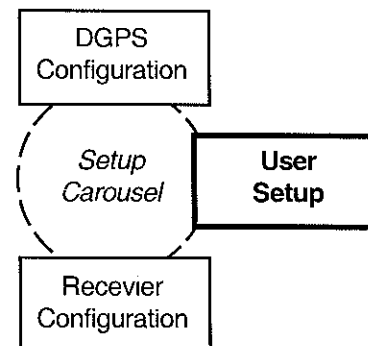
Help screens may be accessed at any time by pressing <F1>. If there is a discrete list of entries associated with a particular field, the Help “soft-key” is displayed as HLP▼ rather than HELP at the bottom of the display. An example help screen is shown below for Fix Mode (a field on the Receiver Configuration screen).



The up and down arrow keys move the highlight bar up and down the selection list. Pressing the <ENTER> key selects the value and closes the help list. You can also press the number corresponding to the desired selection in the list. For example, in the above window, to select “Auto” you would press <2>.

## Setup Carousel

The Setup Carousel includes the following screens:



The Receiver Configuration and User Setup screens are used to set up parameters, such as units of measure, based on your particular application. The DGPS Configuration screen shows the source of your differential correction information.

### ▲ User Setup Screen (USRS)

From the Satellite Information screen, rotate the Primary Carousel to the User Setup screen <F2>. This screen is shown below:

```

User Setup
Units
Altitude: meters
Distance: meters
Speed: meters/sec
Coordinates: Lat/Lon
GPS
Port: COM1
Protocol: TSIP
Baud: 9600
Sensor
Port: COM2
Baud: 9600
Time Offset: -6
Data Path: C:\LM
HLP▼ MAP INFO DGPS REC
```

## **Units (Default: Metric)**

For Units of Measurement, your options are as follows:

- Altitude: meters (default) or feet
- Distance: meters (default), feet, miles, or kilometers
- Speed: meters/second (default), feet/second, kilometers/hour, or miles/hour

To change a unit of measurement:

- 1) Highlight the unit you want to change.
- 2) Press <F1> to access the drop-down menu.
- 3) Use the arrow keys to highlight your selection.
- 4) Press <ENTER> to confirm the selection.

Note: You should be consistent and select either metric or English units of measure for all units.

## **Coordinates**

Use this screen to select either Latitude/Longitude or UTM coordinate systems to display.

To change the coordinate system:

- 1) Highlight the coordinate you want to change.
- 2) Press <F1> to access the drop-down menu.
- 3) Use the arrow keys to highlight your selection.
- 4) Press <ENTER> to confirm the selection.

## **GPS**

Set up the following GPS communication parameters:

- Port: You can select COM1 or COM2 for connection to the GPS receiver. The other port automatically becomes the sensor port for a laser rangefinder to take offset point with. (We have tested the Impulse™ and Criterion™ laser rangefinders from Laser Technology, Inc. for use with the LandMark System. If you are using another brand and experience problems, contact our Customer Service Department.)
- Protocol: This option sets up the communication protocol between the GPS receiver and the Field Computer. The choices are TSIP which stands for Trimble Standard Input Protocol (default) or NMEA which stands for National Marine Electronics Association Protocol. If you are using a receiver that is not manufactured by Trimble, select NMEA.

- Baud Rate: This option sets the speed at which the Field Computer receives information from the receiver. Choices range from 110 to 38,400. The receiving baud rate should match the sending baud rate. The default rate for Trimble receivers (TSIP) is 9,600 (the default rate for the Field Computer). The default setting for NMEA is 4,800.

To change the GPS communication parameters:

- 1) Highlight the current value.
- 2) Press <F1> to access the drop-down menu.
- 3) Highlight the value you wish to select.
- 4) Press <ENTER> to confirm the selection.

### **Sensor**

Set up the following sensor communication parameters:

- Port: By default, the sensor port is the port not selected for connection to the GPS receiver. For example, if COM1 is selected for connection to the receiver, COM2 is the sensor port. LandMark GPS currently supports laser rangefinders on the sensor port for offset points.
- Baud Rate: This option sets the speed at which the Field Computer receives information from the sensor. Choices range from 110 to 38,400. The default setting is 9,600. The receiving baud rate should match the sending baud rate.

To change the Sensor Port or Baud Rate:

- 1) Highlight the current value.
- 2) Press <F1> to access the drop-down menu.
- 3) Highlight the value you wish to select.
- 4) Press <ENTER> to confirm the selection.



### Time Offset (Default: -7)

To display the correct time-of-day on the LandMark screen, you must enter the offset from Greenwich Mean Time for your particular time zone. For example, Mountain Standard Time is seven hours behind Greenwich Mean Time. If you are in the MST zone, you would set the Time Offset to -7 (or -6 during Daylight Savings time).

<u>Time Zones (U.S.A.)</u>	<u>Offset</u>	<u>Offset (Daylight Savings)</u>
Eastern	-5	-4
Central	-6	-5
Mountain	-7	-6
Pacific	-8	-7

To change the Time Offset:

- 1) Highlight the current Time Offset.
- 2) Key in the new Time Offset.
- 3) Press <ENTER> to confirm the selection.

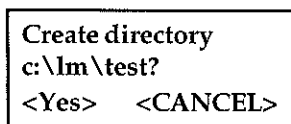
### Data Path (Default: Directory from which LandMark is executed)

The Data Path is the location where data files are stored on the Field Computer. Use this option to define where you want to store your LandMark files on the Field Computer. Refer to the User's Manual, *Section 3, Memory Configuration and Data Storage Options* for more details.

To change the Data Path:

- 1) Use the arrow keys to highlight Data Path.
- 2) Key in the new Data Path.
- 3) Press <ENTER> to confirm the selection.

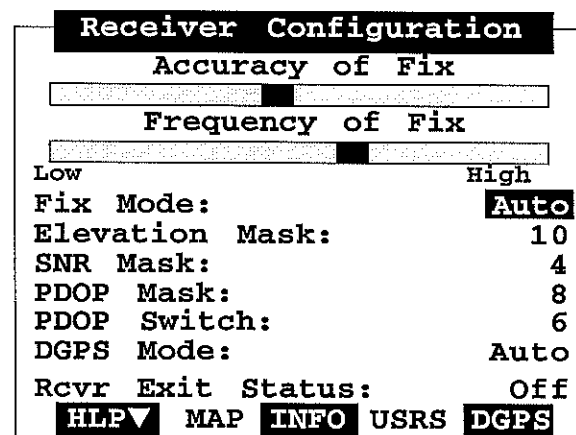
If you type in a Data Path that does not exist, for example c:\lm\test, the following dialog box appears:



Select <YES> if you want to create the new directory. Select <CANCEL> if you do not want to create the directory or entered the information incorrectly.

## ▲ Receiver Configuration Screen (RECV)

The Receiver Configuration screen is used to set critical parameters affecting the function of Trimble AgGPS 122, AgGPS 124 or AgGPS 132 receivers using TSIP protocol. These parameters effect both the conditions under which the receiver obtains a position fix and the accuracy of each fix. (The Receiver Configuration screen is also functional for Ashtech receivers using NMEA protocol. If you are not using a Trimble or Ashtech receiver, refer to the user's manual that came with your receiver for information on how to set up these parameters.) The receiver must be connected to the Field Computer and turned on before you can access this screen.



### Accuracy and Frequency of Fix

Bar graphs at the top of the screen show how each parameter affects the frequency and accuracy of position fixes. In general, you want to balance the accuracy of the position fix with the frequency by setting the configuration parameters accordingly.

### Fix Mode (Default: Auto)

The Fix Mode parameter determines whether the receiver computes 3-D fixes, 2-D fixes, or automatically switches between 2-D or 3-D fixes dependent on the satellite reception (Auto). In 3-D mode the receiver only computes three dimensional fixes. Three dimensional fixes require a minimum of four usable satellites. In 2-D mode, the receiver can compute a two dimensional fix when as few as three satellites are usable. In Auto mode, the receiver switches between 2-D and 3-D position fixes depending on the number of usable satellites and the value set for the PDOP Switch.

The effect of each setting is described in detail below:

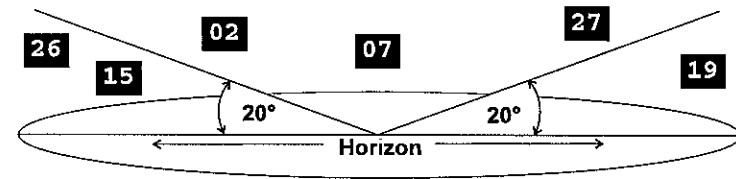
<u>SETTING</u>	<u>EFFECT</u>
2D	Displays and logs position in terms of latitude and longitude only (altitude is not calculated).
3D	Displays and logs position in terms of latitude, longitude and altitude at all times. If there are not enough satellites available for a 3D position fix, no positions are calculated. ( <i>Note: At least 4 satellites must be available for a 3D fix.</i> )
Auto	The receiver automatically determines whether or not there are enough satellites available for a 3D fix. If four or more satellites are available and PDOP is below the level set for the PDOP Switch, a 3D fix is calculated (displayed "Auto/3D"). If there are not enough satellites available for a 3D fix or PDOP is above the level set for the PDOP Switch, a 2D fix is calculated (displayed "Auto/2D").

To change the Fix Mode status:

- 1) Highlight the existing Fix Mode status.
- 2) Press <F1> to access the drop-down menu.
- 3) Highlight the desired setting: 2D, 3D, or Auto.
- 4) Press <ENTER>.

### Elevation Mask (Default: 10)

The Elevation Mask parameter determines how high above the horizon a satellite must be before it can be used in a position fix. For example, an elevation mask value of 20 would mean that the satellite must be at least 20° above the horizon in order for its signal to be used in the position calculation (see the illustration below). Satellites that are low on the horizon may be intermittently obstructed by buildings or mountains and can contribute to accuracy degradation via signal multipath.



In the above illustration, the satellites that are more than 20° above the horizon (02, 07, and 27) could be used in a position fix. Satellites that are below this elevation could not be used (26, 15, and 19).

To edit the Elevation Mask, move the cursor to the Elevation Mask field and key in the desired number.

### Signal-to-Noise Ratio (SNR) Mask (Default: 4)

The Signal-to-Noise Ratio Mask establishes how strong a satellite signal must be before it is used in a position fix. Weak or noisy signals can result in accuracy degradation. A higher SNR Mask number will yield more accurate position fixes because the receiver requires stronger satellite signals.

To edit the SNR Mask, move the cursor to the SNR Mask field and key in the desired number.

### Position Dilution of Precision (PDOP) Mask (Default: 8)

PDOP is an index of expected accuracy based on current satellite geometry. A high PDOP value indicates poor satellite geometry which can result in accuracy degradation. A low PDOP value indicates a satellite geometry conducive to accurate position fixes. A PDOP value of 4 or less is highly accurate, 5 to 8 is acceptable, and above 8 is poor.

The PDOP Mask allows you to select a PDOP value above which position fixes will not be computed thereby limiting accuracy degradation.

To edit the PDOP Mask, move the cursor to the corresponding field and key in the desired number.

#### **PDOP Switch (Default: 6)**

The PDOP Switch establishes a PDOP value above which the receiver automatically switches to 2-D mode if Fix Mode is set to Auto.

To edit the PDOP Switch, move the cursor to the corresponding field and key in the desired number.

#### **DGPS Mode (Default: Auto)**

The DGPS Mode parameter determines whether or not real-time differential correction information is used in a position fix. When DGPS Mode is Off, no differential correction information is used in the position fix, even if the information is available. If DGPS Mode is On, only differentially corrected positions are output by the receiver. In Auto Mode, position fixes are differentially corrected if an RTCM signal is available (displayed as Auto/On). If no RTCM signal is available, the receiver outputs uncorrected fixes (displayed as Auto/Off).

To change the DGPS Mode:

- 1) Highlight the existing DGPS Mode.
- 2) Press <F1> to access the drop-down menu.
- 3) Highlight the desired setting: Off, Auto, or On.
- 4) Press <ENTER>.

#### **Rcvr Exit Status (Default: Off)**

The Receiver Exit Status field determines whether or not the GPS receiver is turned off or left on when you exit from the LandMark software. You might want to leave it on if you are going to use another software package, such as DataPlus, that also accesses the receiver. (Note: the cables must remain connected to the receiver and the Field Computer for the receiver to remain on.)

To change Rcvr Exit Status:

- 1) Highlight the existing Receiver Cntrl setting.
- 2) Press <F1> to access the drop-down menu.
- 3) Highlight the desired setting: Off (turn receiver off) or On (leave receiver on).
- 4) Press <ENTER>.

## ▲ DGPS Configuration Screen (DGPS)

The DGPS Configuration screen is used to select the source of your differential correction information.

```

DGPS Config
DGPS Source:      Beacon
Mode:             Manual
Channel 0:        304.0 kHz
Channel 1:        296.0 kHz

HLP▼ MAP INFO RECV USRS

```

### DGPS Source

The DGPS Source can be set to either Beacon or Satellite. If you are using a Radiobeacon for your DGPS correction information, set this field to Beacon.

- 1) Beacon
- 2) Satellite

With Beacon selected, you can set the beacon mode to Manual, Auto Range, or Auto Power. If you select Manual mode, you can enter beacon frequencies for Channel 0 and Channel 1. In either Auto Range or Auto Power modes, you cannot set these frequencies, but you can view the current channel settings. (See your Trimble receiver manual for a full description of the different beacon modes).

- 1) Manual
- 2) Auto Range
- 3) Auto Power

If you are using a geostationary satellite for your DGPS correction information, set this field to Satellite. In Satellite mode, you can set the satellite signal frequency. Refer to your OmniStar or Racal subscription documentation to determine the correct frequency setting for your location.

```

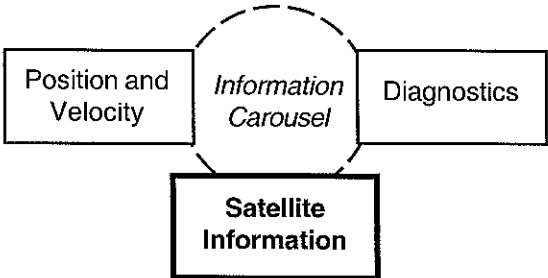
DGPS Config
DGPS Source:  Satellite
Service:      Omnistar
Frequency:    1551.489MHz
Exp. date:    08/11/2000

HELP MAP INFO RECV USRS

```

# Information Carousel

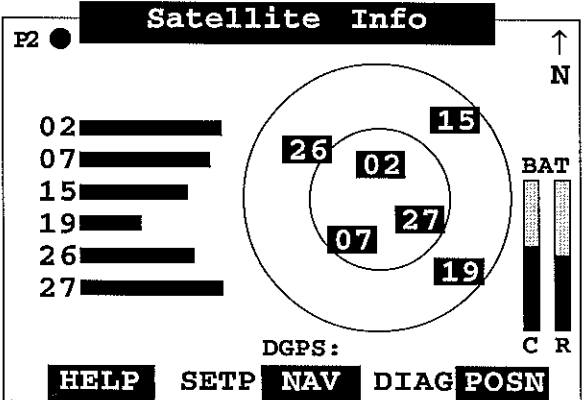
There are three screens on the Information Carousel as shown below:



## ▲ Satellite Information Screen (SATL)

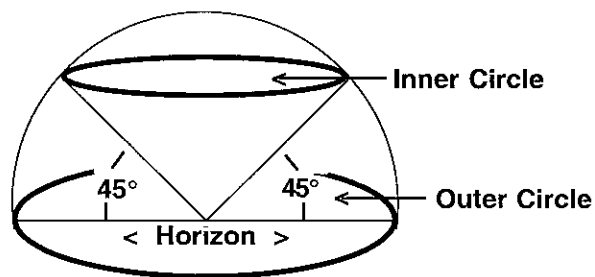
### Satellite Information

The Satellite Information screen shows a graphical depiction of the satellites currently being tracked. Numbers identifying the satellites are shown. The numbers appear in reverse video if the satellite signal is being used for the GPS position fix. On the left side of the screen is a bar graph indicating the signal strength of each satellite. The bar is solid black for those satellites being used for a fix.





The two concentric circles indicate the angle from the horizon. The inner circle represents a 45° angle and the outer circle represents the horizon. Graphically, this arrangement looks like this:



*Angle From the Horizon*

The arrangement of the satellites on these concentric circles shows a representation of each satellite's elevation in the sky and its position relative to the other usable satellites. Refer back to the Satellite Information screen discussed previously. Satellite 15 is close to the horizon with an elevation of about 20°. Satellite 02 has an elevation of about 70°. The PDOP is low (2) because the usable satellites are well-spaced in the sky.

#### **Position Fix Indicator: P2 ●**

On the upper-left corner above the bar graph is a P followed by a number and a circle. The number is the current PDOP value. The circle is the indicator that position fixes are being received by Land-Mark. The circle blinks with every new position fix received. The circle is filled in (black) when the position fix is differentially corrected. It is not filled in when position is uncorrected. You can also turn on an audio indicator of incoming fixes by pressing the <F9> key. A single beep indicates uncorrected fixes while a double beep indicates differentially corrected fixes. Pressing <F9> again turns off the audio indicator.

The Position Fix Indicator is also displayed on the Map Carousel screens and the Navigation screen.

### Battery Voltage Indicators

Two battery voltage level indicators are shown as vertical bars on the right side of the screen. The bar on the right refers to the receiver batteries. As a general guideline, if the black bar is below the halfway point and you are going into the field for the day, you should fully charge the receiver batteries first (refer to the battery charging instructions in *Section 2, Hardware Overview, Advance System Preparations*). The bar on the left refers to the Field Computer battery pack. (Please refer to the *Pro4000* or *Pro2000* User's Manual for battery charging and maintenance information.)

### DGPS

The DGPS field displays the frequency of the current DGPS signal (satellite or beacon).

### ▲ Position and Velocity Screen (POSN)

The Position & Velocity screen is useful as a reference when mapping or navigating. It displays your current position, course, speed, the current time, PDOP status, DGPS status, and position fix mode.

```
Position & Velocity
Lat: 41°45'44.15"  N
Lon: 111°49'09.90"  W
Alt: 4524.9  ft
Course: 147°
Speed: 3.4
Date/Time:
      10/09/97      10:50:14
PDOP: 2.7
DGPS: Auto/On
MODE: Auto/3D
HELP  SETP  NAV  SATL  DIAG
```

## Altitude

Regarding altitudes reported by LandMark, keep in mind that GPS determines altitude by the height above the WGS-84 ellipsoid, which is a mathematical model of the shape of the Earth. The actual shape of the Earth, the geoid, is a much more complex surface that depends on minor fluctuations in the Earth's gravitation. Thus, you may notice significant differences between altitudes reported by LandMark and known altitudes that are measured with respect to mean sea level. (Note: The LandMark PC program allows you to use different datums. Refer to *Section 4, LandMark PC.*)

## Time

The displayed time is the UTC time offset by the number of hours in the time offset (set in the User Setup screen described earlier).

## ▲ Diagnostics Screen (DIAG)

The top section of the Diagnostics screen tells you the version number and release date of the LandMark GPS software. Below this information are two fields that can be used for diagnostic purposes. You can use these diagnostics to determine whether or not the Field Computer and the GPS receiver are communicating correctly.

```

Diagnostics

LandMark Version 2.0
 1/31/99
Copyright 1997
HarvestMaster, Inc.

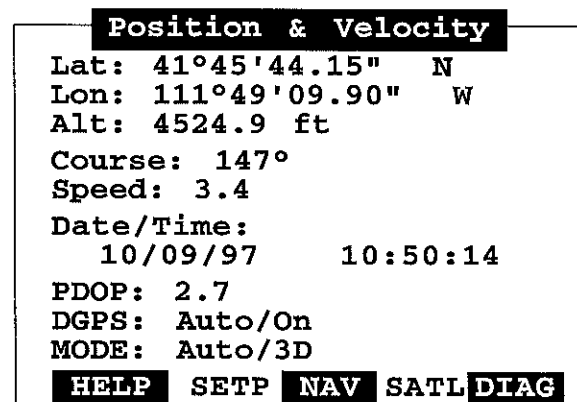
Packet Count: 196
Last Packet: 84

SETP NAV POSN SATL
```

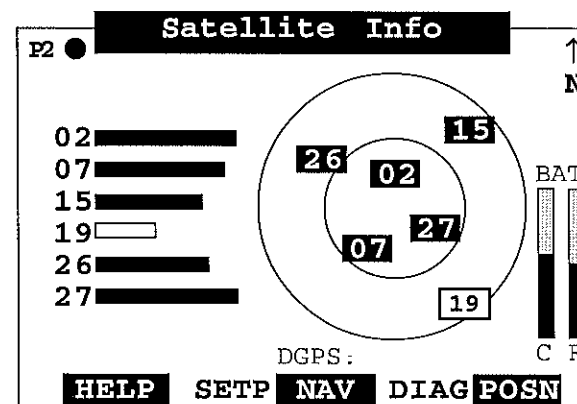
Information comes in from the receiver as packets. Each packet has a code that identifies the type of information contained within the packet. The code for the most recent packet is shown on the Last Packet line. The number of packets received is shown as Packet Count. The Packet Count rolls over to zero from 255. If the receiver is receiving packets, you see the Packet Count and Last Packet numbers changing. If these numbers do not change, make sure the wiring is connected correctly and check the settings on the User Setup screen and the Receiver Configuration screen.

## Verifying Operation of the System

LandMark first shows the Satellite Information screen, then automatically switches to the Position & Velocity screen when an initial fix has been acquired. This process takes a few seconds to a few minutes, depending on the type of GPS receiver you are using. A sample Position and Velocity screen is shown below (as described earlier in this section):



Press <F4> to return to the Satellite Information screen. This screen displays each satellite, its approximate location, signal strength, and the battery level of the Field Computer and receiver. Satellites used for a position fix are shown in reverse video. Satellites that are being tracked but are not being used for a position fix are displayed in normal video (see satellite 19 on the screen shown below).



## ▲ Troubleshooting

*Problem: The receiver will not turn on.*

The receiver must be connected to the Field Computer and the LandMark GPS software must be running in order for the receiver to be powered up.

*Problem: You cannot get an initial position fix.*

Check the following items:

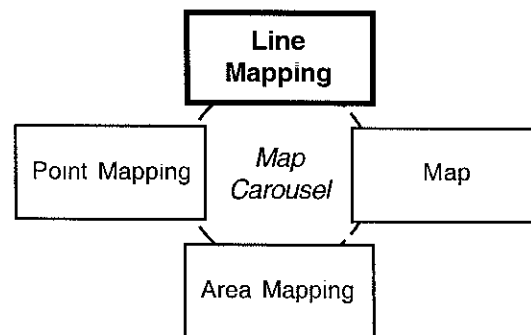
- 1) Input Protocol: Make sure the correct Input Protocol is selected. On the User Preferences screen, the Input Protocol should be set to TSIP or NMEA for Trimble receivers and NMEA for all others.
- 2) Input Baud Rate: Make sure the receiver output baud rate is the same as the input baud rate set in LandMark. Refer to the receiver manual for more information about the receiver baud rate.
- 3) Communication Port: Make sure the GPS Port (COM1 or COM2) selected on the User Setup screen matches the port the GPS receiver is connected to.
- 4) Wiring Connections: Make sure that the hardware is connected correctly.
- 5) Antenna: Make sure the antenna cable is connected properly and that the antenna is clear of obstructions to the sky.
- 6) Battery Power: Make sure the Field Computer battery pack and the receiver batteries have an adequate charge.
- 7) Diagnostics Screen: Check the Diagnostics Screen to determine whether or not you are receiving GPS packets.

After you have checked these items, reboot the Field Computer. If you are still unable to acquire an initial position fix, contact our Customer Service Department.

Once you have confirmed that the LandMark GPS hardware and software are working correctly, you are ready to begin using the mapping and navigation functions of the LandMark System.

## Map Carousel

The Map Carousel has four screens as shown below:



Using LandMark, you can map a point or group of points with the Point Mapping Screen, a linear feature with the Line Mapping screen, or an area with the Area Mapping screen. The Map screen displays a graphical representation of the point, line or area that is being logged. To access a Map screen on the Map Carousel, rotate the carousel using the <F4> or <F5> key.

### ▲ Point Mapping Screen (PNT)

The Point Mapping screen is used to map individual points. Groups of points can be averaged to create single points. The fields on the map screens are described later in this section.

```
Point Mapping P2 ●
RINEX
Filename: POST
Point Averaging: 35
Open: Append
Offset
  Direction: 90.0°
  Slope Dist: 45.3m
  Incl: 0.0°
Feature:
Posns Recrd: 0
Bytes Free: 219645
<Log Pt>
HLP NAV SETP AREA LINE
```

### ▲ Line Mapping Screen (LINE)

The Line Mapping screen is used to map a linear feature. The length of the feature is calculated as you log points.

```
Line Mapping P2 ●
RINEX
Filename: FENCE
Log Rate:      3 ft
Open:         Append
Offset
  Direction:   Left
  Slope Dist:  45.3m
  Incl:        0.0°
Feature:
Posns Recrd:  0
Bytes Free:   219645
<Start>
HLP▼ NAV SETP PNT MAP
```

### ▲ Area Mapping Screen (AREA)

The Area Mapping screen is used to map an enclosed area. The size of the enclosed area is calculated as you log points.

```
Area Mapping P2 ●
RINEX
Filename: WATER
Log Rate:      50 ft
Open:         Append
Offset
  Direction:   Left
  Slope Dist:  45.3m
  Incl:        0.0°
Feature:
Posns Recrd:  0
Bytes Free:   219645
<Start>
HLP▼ NAV SETP MAP PNT
```

### ▲ Mapping Screen Fields

To map a point, area, or line, you must first enter a name for the file where the map points will be stored, and describe how points are going to be logged. You can describe a feature that applies to a point or group of points in the map. The fields on the mapping screens that must be set up before mapping are described on the following pages.

## RINEX

The Receiver Independent Exchange (RINEX) format is a file format that allows post-processing of your GPS data. If for any reason you are unable to obtain real-time differential correction, you can create RINEX files with LandMark and differentially correct your data when you return to the office using GrafNav Lite software.

Collecting RINEX data with LandMark is easy. Simply press the <F6> key from any of the mapping carousel screens to turn RINEX recording on. The RINEX indicator at the top of the screen will highlight so you know that RINEX data is currently being recorded. Press <F6> again to turn RINEX recording off. This can be done at any time during the mapping process. If your real-time differential signal is interrupted for a short period, you need only collect RINEX data during that time.

❖ *Note: You must be receiving TSIP packets in order to create RINEX files (see Setup Carousel, User Setup Screen, GPS). GrafNav Lite requires a minimum of three epochs, or data points, per RINEX file.*

During RINEX recording, LandMark is actually writing information to four different files. Two of these are the standard LandMark "map object" files (see *Filename* on the following page). The other two files, an "observation" file and a "navigation" file, are specific to the RINEX format. LandMark automatically creates names for the two RINEX files based on the name you have typed into the filename field. These filenames conform to RINEX filename conventions as follows:

ssssdddf.yyt      where:

ssss    is the first four characters of the map object filename

ddd    is the day of the year for the first record in the file

f        is a file sequence number (this will always be 1 for LandMark files)

yy      is the year

t        is the file type: O=observation file, N=navigation file,

For example, if your map object filename is PLOTEXP1 and you are collecting data on October 15, 1999 (the 288<sup>th</sup> day of the year), then your RINEX files will be named PLOT2881.99O and PLOT2881.99N. When you return to the office, you should upload these files as well as your map object files to your PC for post-processing.



For more information about how to post-process RINEX files, refer to *Section 5, GrafNav Lite Post-Processing Software*.

### Filename

Select the type of map that you are going to use. Rotate the Map Carousel until the appropriate map description screen is shown: Point, Line, or Area. The first field you need to set up is Filename. If you are creating a new map, type in the desired name using up to 8 characters and press <ENTER>. Do not enter a filename extension. LandMark uses default extensions for files (see the chart below).

❖ *Note: LandMark automatically displays the last filename used for a map as a default. Delete this name or write over it to create a new filename.*

There are two data files associated with each map. They are saved in the data path under the name assigned in the map description screens with the extensions described below:

<u>Map Type</u>	<u>Extension</u>	<u>Description</u>
Point	.APO	ASCII point map data
Point	.BPO	Binary point map data
Line	.ALO	ASCII line map data
Line	.BLO	Binary line map data
Area	.AAO	ASCII area map data
Area	.BAO	Binary area map data

### *Opening an Existing File*

To open an existing map file, press <F1> to view a list of existing filenames, highlight the desired file, and press <ENTER>. The following message is shown while LandMark is opening the file:

Please wait . . .

Do not press the keys while you are waiting. If the file has a large number of points, it may take several seconds to open.

### **Point Averaging (Point Mapping Screen Only, Default = 1)**

The point averaging field allows you to average the specified number of position fixes into a single point.

Enter the desired number of points you want to collect to compute an average. When you start to log positions into the Point file, the LandMark program averages the positions from the group of points and stores the average of these points in the file. If you want to stop the process, select <Cancel!>.

If you do not want to average a group of points, use the value 1 for this field (the default).

### **Log Rate and Units (Line and Area Mapping Screens)**

The Log Rate field is used to set up how data points are logged into the map file. There are three choices for units:

- Distance Interval
- Time Interval
- Keypress

If you select a distance or time interval, data points are automatically logged based on the rates entered (every 100 feet for example). If you select keypress, a data point is logged each time you press <ENTER> on the Field Computer's keyboard.

When you select the log rate, keep in mind that as the total number of points logged on a map becomes large (100 points or more), it takes longer for the graphical Map screen to update. There will be a slight delay when you access the Map screen.

To change the Log Rate and Units:

- 1) Highlight the existing Log Rate number (this applies to distance and time intervals only).
- 2) Key in the desired number for the Log Rate.
- 3) Press <ENTER> to confirm the new Log Rate.

The Units field is now highlighted.

- 4) To select Units, press <F1> to view the help menu. Select the desired unit (time, distance, or keypress) and press <ENTER>.

*If you select distance as the desired unit, note that distance units are set up in the User Setup screen to either meters, kilometers, feet, or miles.*

## Open

The Open field indicates whether or not you are starting a new file, appending an existing file, or viewing an existing file.

- When you enter a new filename in the Filename field, the word "new" automatically appears in the Open field. No adjustments to the Open field are required.
- To add additional points to an existing file, go to the Filename field, press <F1>, and select the file from the list. The word "append" automatically appears in the Open field.
- To overwrite an existing file, go to the Filename field, press <F1>, and select the file from the list. Go to the Open field and change the word "append" to "new." Please note that your old map will be overwritten.
- To view an existing file, go to the Filename field, press <F1>, and select the file from the list. Go to the Open field, Press <F1>, and select "view." Points cannot be added to a file in view mode. (Note: This function is useful if you travel a long distance from your original map and you want to view the map at the new location.)

## Offset

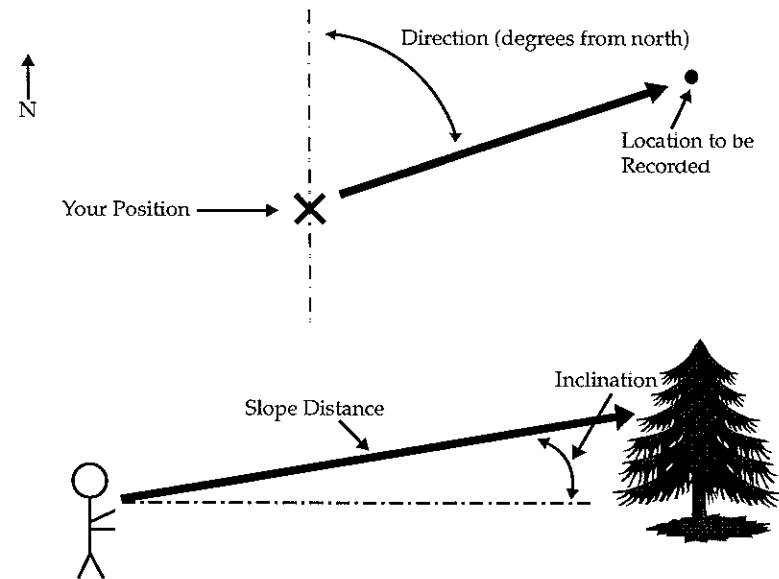
Offsets are used to log points at locations other than your current position. For example, you may wish to log a location you do not have access to such as a utility pole inside a fence. Or, you may wish to record the position of a fence line by driving down a road that runs parallel to the fence. Both of these goals can be achieved through the use of Offsets.

To collect an Offset point, you must enter information into the Direction, Slope Distance, and Inclination fields as defined below.

Offset parameters can be entered manually from the keyboard or automatically using a laser rangefinder.

- Direction (Point Mapping): the compass direction to the offset point (0 to 359°).
- Direction (Line and Area Mapping): enter either "Left" or "Right" for direction. The direction of the offset is assumed to be perpendicular to your current velocity vector in the direction specified.
- Slope Distance is the total line-of-sight distance to the offset point. For no Offset, set Slope Distance to zero.
- Inclination is the angle defined by the horizontal plane passing through your current position and the vector from your position to the offset point. The inclination should be in the range of -60 to 60°.

The following drawings illustrate the Offset point parameters:



### Feature

The Feature field allows you to label specific points, sections of a line or an area on a map. Feature descriptions can be up to 20 characters long. You can start a new feature at any time. A feature stays in effect until a new one is entered. To enter a feature, stop mapping, go to the appropriate map description screen (point, line, or area) if you are on the Map screen, enter the desired feature description, then start mapping again.

*Example: You wish to map a trail that is made up of a steep upper section and a relatively flat lower section. Assuming you are starting at the lower section and working your way up, type in a descriptive feature name (such as "lower") for your current map section. When you reach the upper section of the trail, you can stop logging data and type in a new descriptive name for the upper section of the trail (such as "upper").*

*When the ASCII data is viewed, every position has a feature name associated with it (in this example, either "lower" or "upper"), allowing you to differentiate between the two sections of the same trail.*

### **Positions Recorded and Bytes Free**

These fields are automatically updated by the software as you are mapping. The number of positions recorded increases with every data point logged. The Bytes Free field reflects the amount of memory remaining on the Field Computer where the data are being stored.

### **Start, Stop, or Cancel Logging**

You can start mapping from the Point, Line, and Area Mapping screens or from the Map Screen if you want to see a graphical representation of the map as it is being logged (discussed later in this section). At the bottom of each Mapping screen is a <Start> button. To start logging, highlight the <Start> button and press <ENTER>. When you have started mapping, the <Stop> button is highlighted. (Note: if you are point mapping, <Cancel> is shown instead of <Stop>.) To stop mapping, press <ENTER>.

When you are logging based on time or distance, you can add a point to the map between the intervals by pressing <CTRL> <ENTER>. This option is useful for marking corners that fall between your selected intervals.

If you are mapping a line or area and the Log Unit field is set to keypress, a <Log Pt> button is shown at the bottom of the Map screen. Press <ENTER> each time you want to log a point.

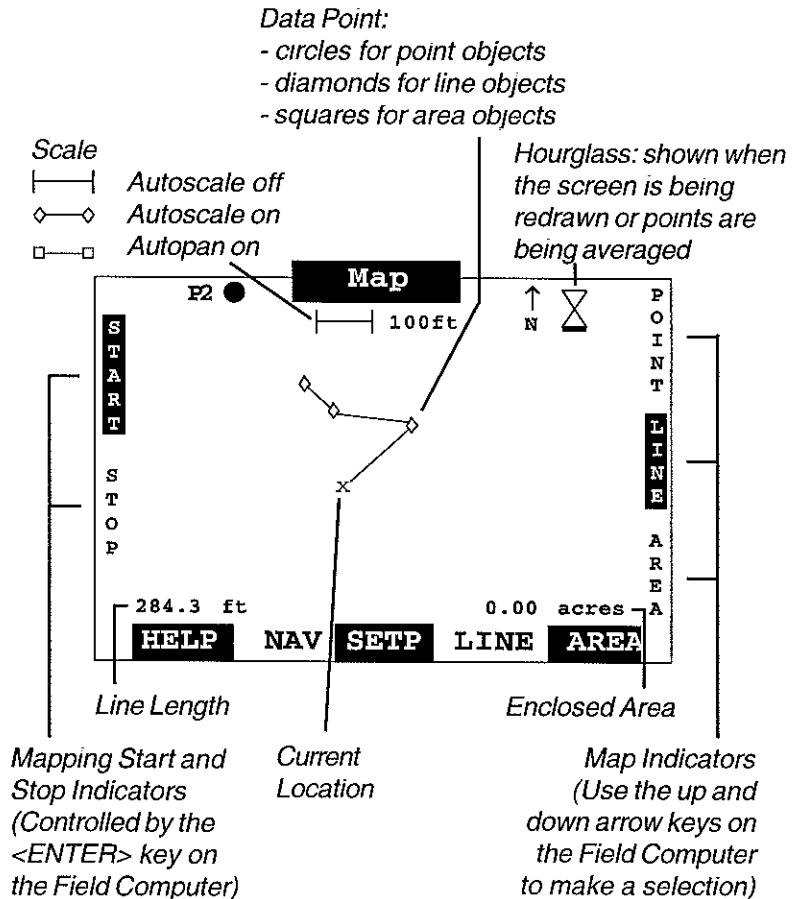
*Note: If you want to change a feature, log rate, log unit, or point averaging you must stop logging then start again.*

## ▲ Map Screen (MAP)

The Map screen displays a graphical representation of the point, line or area map that is being logged or viewed. The length of a line map or the size of an enclosed area map are displayed at the bottom of the screen. Start and Stop buttons are located on the left side of the screen. To start or stop logging, press <ENTER> on the Field Computer keyboard when the appropriate word is highlighted.

Buttons allowing you to select which map you want to view (point, line, or area) are shown on the right side of the screen. Use the up and down arrow keys on the Field Computer keyboard to highlight the desired map.

Points logged to a point object appear as circles on the graphical display, line objects appear as diamonds, and area objects appear as squares. A sample line map is shown below:



The following keys enable you to adjust map viewing (both upper and lower case letters work):

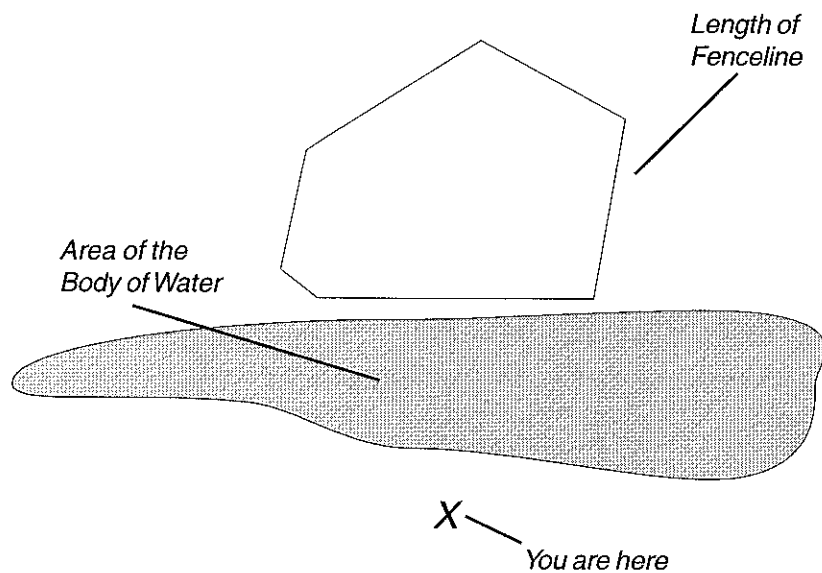
- F7 Toggles Rubber Band on/off
- F8 Toggles Auto-panning on/off
- R Pans Map screen right, turns Autoscale off
- L Pans Map screen left, turns Autoscale off
- U Pans Map screen up, turns Autoscale off
- D Pans Map screen down, turns Autoscale off
- I Zooms in, turns Autoscale off
- O Zooms out, turns Autoscale off

If you turn Autoscale off while on the Graphic screen, it will be off for any mapped object shown on the display until it is turned on again.

❖ *Note: If you create a map on the order of 100 points or more, you may notice that an hourglass is shown and LandMark becomes slow to update the Map screen and does not respond to keystrokes immediately. If this occurs, be patient! Do not push additional keys in an effort to force a response. As soon as LandMark has completed its current update of the Map screen, it will respond to whatever key was pressed last.*

### ▲ Mapping Example

Suppose you need to calculate the area of a body of water and the length of a fenceline (see illustration below). In order to do so, you create two maps: a line map named "FENCE" and an area map named "WATER."



## Mapping the Body of Water

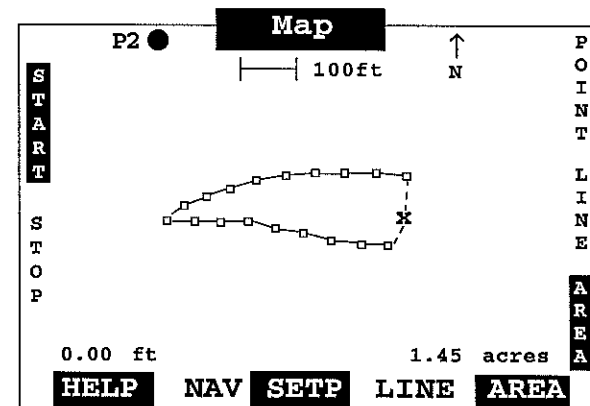
Before you begin mapping the body of water, enter the Filename where the data points are to be stored, the Log Rate, and the Units for the map of the water.

```

Area Mapping P2 ●
RINEX
Filename: WATER
Log Rate:          50 ft
Open:             Append
Offset
  Direction:      Left
  Slope Dist:     45.3m
  Incl:           0.0°
Feature:
Posns Recrd:      0
Bytes Free:       219645
<Start>
HLP NAV SETP MAP PNT

```

Highlight the <Start> button and press <ENTER> to begin mapping. You can switch to the Map screen by pressing <F4> (MAP) to see a visual representation of the points being logged.



A dotted "rubber band" line extends from your current location to the first and last points logged. (The <F7> key toggles the rubber band line on and off.) The area calculation shown at the bottom right corner of the screen includes the area enclosed by the rubber band line and the logged points. If you turn the rubber band line off, the area calculation includes only logged points (the first point is assumed to be connected to the last point).



## Mapping the Fence Line

Suppose you reach the opposite side of the lake where the fence line starts. You can temporarily stop mapping the WATER area and begin mapping the FENCE line. Once the fence line is mapped, you can continue mapping the body of water.

To stop logging area map points, press <ENTER> when the Area STOP button is highlighted (as shown on the previous screen).

Before you begin mapping the fence line, return to the Line Mapping screen by pressing <F4>. Enter the Filename where the logged points are to be stored, the Log Rate, and the Units for the fence line map.

```
Line Mapping P2 ●
RINEX
Filename: FENCE
Log Rate:      3 ft
Open:         Append
Offset
  Direction:   Left
  Slope Dist:  45.3m
  Incl:        0.0°
Feature:
Posns Recrd:  0
Bytes Free:   219645
<Start>
HLP▼ NAV SETP PNT MAP
```

Press <F5> to return to the Map screen. Highlight the START button then press <ENTER> to begin mapping the line.

```
Map P2 ●
|-----| 100ft ↑
| START | N | POINT
|       |   | LINE
|       | x | AREA
| STOP  |   | AREA
|       |   |
0.00 ft 0.00 acres
HELP NAV SETP LINE AREA
```

When you have completed the fence line map, press <ENTER> with the STOP button highlighted.

To resume mapping the enclosed area of the water, move the highlighter to the AREA button by pressing the down arrow key and press <ENTER>. The area map is displayed. When you are finished mapping the water area, press <ENTER> with the STOP button highlighted.

### ▲ Appending Map Files

After a map file has been created, you can add positions to the map by appending the positions to an existing file.

#### Selecting a Map

To select a line or an area map file:

- 1) Rotate the carousel to the Point, Area, or Line Mapping screen.
- 2) With the Filename highlighted, press <F1> to access the drop-down menu list. Use the arrow keys to select the desired map and press <ENTER> to confirm the selection.

#### Appending a Map

After selecting the map, the word "Append" appears in the File field (as shown below). Make sure the Log Rate and Units are correct for this map. When these parameters are set as desired, you can begin logging additional points for the selected map.

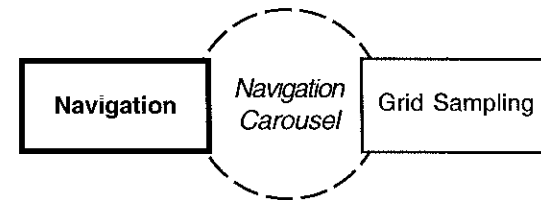
```
Line Mapping P2 ●
RINEX
Filename: FENCE
Log Rate:          3 ft
Open:              Append
Offset
  Direction:      Left
  Slope Dist:    45.3m
  Incl:          0.0°
Feature:
Posns Recrd:      0
Bytes Free:       219645
<Start>
HLP▼ NAV SETP PNT MAP
```

## ▲ Viewing a Map

To view an existing map, select the map file, move down to the File field (which by default says Append), press <F1>, and select View from the list. Points cannot be added to an existing map while in View mode.

# Navigation Carousel

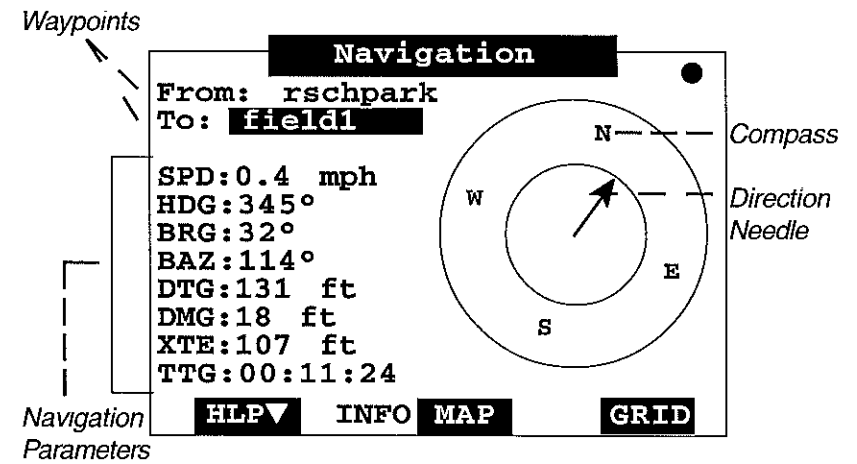
The Navigation Carousel has two screens as shown below:



The LandMark Navigation screen is used to navigate from one point to another. These points are referred to as waypoints. The Grid Sampling screen allows you to navigate through a series of pre-defined waypoints.

## ▲ Navigation Screen (NAV)

A sample Navigation screen is shown below:



## Waypoints

A navigation waypoint is a location recorded in terms of latitude and longitude or UTM (depending on your coordinate choice). Entering a navigation waypoint allows you to precisely navigate back to that location. Before you can use the navigation feature, you must set up your waypoints.

You can create waypoints in the following ways:

- 1) With the LandMark GPS Software "Define Waypoint" option (described below)
- 2) Using LandMark PC as follows (refer to "Creating Waypoints" in Section 4 for detailed instructions):
  - a) Create an ASCII text file on your PC containing the required waypoint parameters and convert the file into a waypoint file using the "Export" function
  - b) Convert a map file into a waypoint file using the "Export" function
  - c) Enter waypoints directly in the Waypoint screen
- 3) By creating a grid file on your PC consisting of pre-defined waypoints (described later in this section)

### Creating Waypoints with the Define Waypoint Feature

New waypoints can be created using the Define Waypoint window. This window is accessed by pressing the <TAB> key from any screen. A sample screen is shown below:

Define Waypoint	
ID	Name
W0005	0005
<Here>	
Lat:	41 45 46.22 N
Lon:	111 49 11.35 W
Esc=Exit	

Waypoints are set up as follows:

- 1) New waypoints are automatically assigned the next consecutive waypoint number (0005 in our example). Up to 9999 waypoints are available. If you want to change the number, press the up arrow to move the cursor to the ID field and key in the desired number. Press the down arrow to move the cursor to the name field.
- 2) Waypoints are named automatically based on the waypoint ID number, e.g. W0005 is automatically given the name 0005. If you want to change this name, highlight the Name field, key in the desired waypoint name and press <ENTER>. Waypoint names can have up to 12 characters.

- 3) Your coordinates at the time you pressed <TAB> are displayed. If these are the coordinates you wish to store, press <ESC> to save the coordinates and exit the Define Waypoint window.

If you wish, you can change the coordinates as follows:

- A) To record the coordinates of your current location as the new waypoint, highlight <Here> and press <ENTER>. The coordinates of your current location are automatically entered. Press <ESC> to exit the Define Waypoint window.

*To record your current position as a waypoint, highlight <Here> and press <ENTER>. The current Lat. and Lon. are recorded as the waypoint position.*

Define Waypoint	
ID	Name
W0005	Field1
<b>&lt;Here&gt;</b>	
Lat:	41 45 47.45 N
Lon:	111 49 13.62 W
<b>Esc=Exit</b>	

- B) If you know the latitude and longitude (or UTM coordinates) of the waypoint you wish to define, you can enter the waypoint manually by typing the known coordinates into the appropriate fields. (Note: the coordinate system is selected in the User Setup screen.) Latitudes and longitudes are entered in the following format: ddd mm ss.ss followed by a single character designating the appropriate hemisphere (i.e. N, S, E, or W). UTM coordinates are entered as Northing, Grid Zone, and Easting. The Grid Zone field should contain both a number and a letter (order is unimportant) indicating the appropriate UTM Grid Zone.

Use the arrow keys to move to the "Lat" field and key in the latitude coordinate. Move down to the "Lon" field and key in the longitude coordinate. Press <ESC> to save these coordinates and to exit the Define Waypoint screen.

### Overwriting/Editing Waypoints

LandMark allows you to overwrite a waypoint by editing an existing waypoint and re-assigning the name and/or position coordinates.

To overwrite (erase) a waypoint:

- 1) From the Navigation screen, press <F1> to bring up the current list of waypoints.
- 2) Use the up and down arrow keys to highlight the

Waypoints	
ID	Name
W0000	<Here>
W0001	rschpark
W0002	batt
W0003	t1
W0004	pond
F1=Edit TAB=New	

waypoint you wish to overwrite and press <F1> (Edit).

- 3) Key in the new waypoint name and press <ENTER>. The Define Waypoint screen is shown.
- 4) Enter the new coordinates of the waypoint.
- 5) Press <ESC> to exit the Define Waypoint window. A dialog box is displayed allowing you to confirm the overwriting of an existing waypoint.

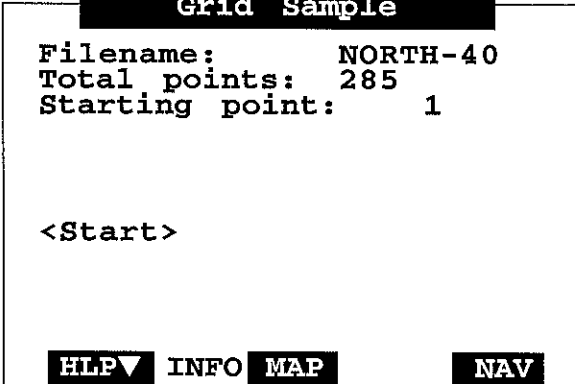
### Waypoint Files

LandMark GPS stores waypoint information in the file called waypnt.wpt. This file is located in the drive and directory you specified as the Data Path during set up. To use more than one waypoint file, you must store each file in a separate path. Each file is named waypnt.wpt. When you want to change from one waypoint file to another, you must change the Data Path in the User Setup Screen (see *User Setup Screen, Data Path* located earlier in this section).

## ▲ Grid Sampling Screen (GRID)

The LandMark grid sampling feature allows you to navigate through a series of pre-defined waypoints called grid points. For example, you may want to grid a large field for soil sampling and then navigate to each grid point to collect your soil sample.

A sample Grid Sample screen is shown below:



```
Grid Sample
Filename:      NORTH-40
Total points:  285
Starting point: 1

<Start>

HLP▼ INFO MAP NAV
```

### Setting up a Grid Sampling File

A grid file is an ASCII text file with three columns. Each column is delimited by a tab or space. Column one is the grid point number, column two is the grid point longitude (in decimal degrees), and column three is the grid point latitude (in decimal degrees).

For example, your grid file might look like the following:

```
1 -111.354637 41.364736
2 -111.336473 41.373635
3 -111.328657 41.384122
```

Save your grid file with a .grd extension and download it to the Field Computer into the directory specified by the Data Path (refer to the User Setup Screen).

Note: You can create a grid file with LandMark PC by using the Export function. Refer to *Section 4, LandMark PC* for details.



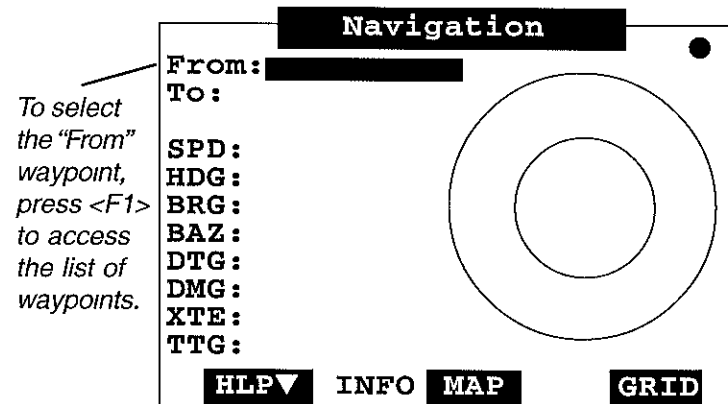
## ▲ Navigating

### Selecting the Desired Waypoints from a Waypoint File (.wpt)

To navigate from one point to another, you need to define the "From" and "To" waypoints. Both are selected in the same manner.

To select the waypoint from where you are traveling:

- 1) Rotate to the Navigation screen.
- 2) With "From" highlighted, press <F1> to access the list of existing waypoints.

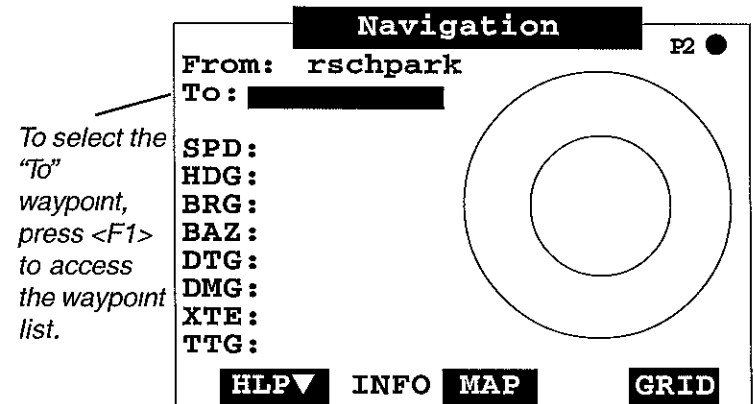


- 3) Use the up/down arrow keys to select the waypoint from where you are traveling. Press <ENTER> to confirm your selection.

*Note: The waypoint <Here> is always your current location.*

Waypoints	
ID	Name
W0000	<Here>
W0001	rschpark
W0002	field1
W0003	t1
W0004	pond
F1=Edit TAB=New	

- 4) Move the highlighted cursor to the "To" field on the Navigation screen and press <F1> to access the waypoint list.



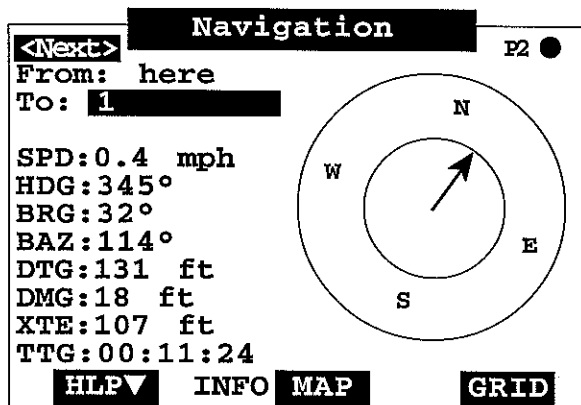
- 5) Select the "To" waypoint from the menu list the same way you selected the "From" waypoint. Press <ENTER> to confirm your selection.

#### Selecting Waypoints from a Grid File (.grd)

If you are going to navigate using a grid file, rotate the Navigation Carousel to the Grid Sampling screen and follow these steps:

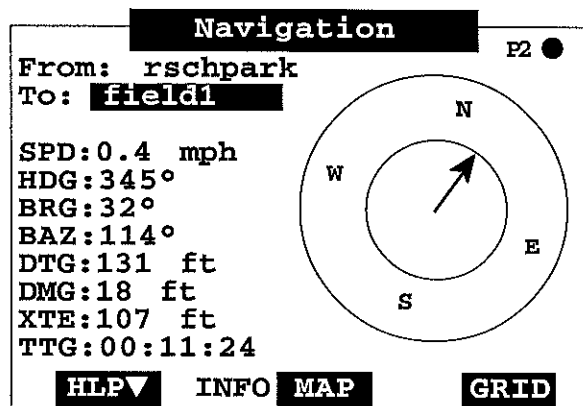
- 1) Highlight the "Filename" field and press <F1>. A list of grid files (.grd) is shown. Select the desired file and press <ENTER>.
- 2) Grid sampling is an iterative process. Once you start grid sampling, the "To" and "From" grid points are automatically assigned based on the grid sampling file. To start grid sampling you need to define the starting point. The cursor automatically moves to the "Starting point" field. Enter the grid point number you want to navigate to first and press <ENTER>. This point is defined as the "To" waypoint. The "From" waypoint is automatically assigned to the grid point preceding the starting point defined above or "here" if the "To" waypoint is the first waypoint number (as illustrated in the graphic on the following page).

- Highlight the "Start" button and press <ENTER>. The screen automatically switches to the Navigation screen which begins directing you to the first point in your grid sample. In the upper left-hand corner is a highlighted button named <Next>. To advance to the next grid point simply press <ENTER> and navigate to the point according to the Navigation screen.



### Reading the Navigation Screen

After selecting the waypoints, the navigation screen displays information for navigating from one waypoint to another. When you are not moving, the north indicator (N) is at the top of the compass. If you are facing north, the arrow points in the direction of the "To" waypoint. The heading (HDG) reads \*\*\*\*\*. When you begin moving, the top of the compass rotates to indicate your current heading and the arrow points to your current bearing (i.e. the destination waypoint). To reach your destination, walk in the direction that moves the arrow to the top of the screen.



### *Navigation Screen Parameters*

**Speed (SPD):** Your current rate of travel. Speed units are displayed according to the "Speed Units" selected in the User Setup screen.

**Heading (HDG):** The direction (in degrees) you are currently traveling.

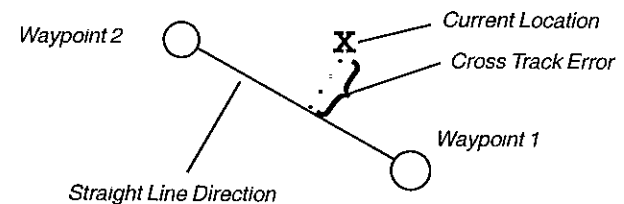
**Bearing (BRG):** The direction (in degrees) from your current location to the "To" waypoint.

**Back Azimuth (BAZ):** The direction (in degrees) from your current location to the "From" waypoint.

**Distance To Go (DTG):** The distance from your current location to the "To" waypoint.

**Distance Made Good (DMG):** The distance you have travelled from the "From" waypoint in the direction of the "To" waypoint.

**Cross-Track Error (XTE):** The distance you have deviated from the line between the two waypoints. Positive numbers indicate that you are to the right of the line. Negative numbers indicate that you are to the left. For example, suppose you are travelling from waypoint 1 to waypoint 2 as illustrated below:



The Cross-Track Error is the shortest distance from the line between the two waypoints to your current location.

**Time To Go (TTG):** The time it will take, given your current speed, to arrive at the destination waypoint. This value is displayed in a HR:MIN:SEC format.

# Section 4

## LandMark PC File Management Utility

- 
- Introduction to LandMark PC
  - LandMark PC Menu Options



## Introduction to LandMark PC



LandMark PC™ is a Windows 95/98/NT program included with the LandMark GPS software. LandMark PC is a file management utility that allows you to:

- Transfer any file to or from a Field Computer and a PC
- View and edit both map and waypoint files collected using the LandMark GPS
- Scale and print LandMark GPS map files
- Export LandMark GPS files into the formats required by ArcView GIS™, AutoCAD™, and database software packages
- Export a map or ASCII file into a LandMark waypoint file
- Merge post-processed GPS data with real-time data.
- Convert a map to another datum
- Create or convert a grid sample file
- Convert latitude and longitude information collected using DataPlus™ into a format compatible with software packages such as ArcView GIS

❖ *Note: This manual was written with the assumption that you have a working knowledge of other software packages you are using such as ArcView GIS or DataPlus. Please refer to the software User's Manual or contact the manufacturer if you have questions or problems.*

### ▲ Installing the Software

Included with this User's Manual is a disk containing the LandMark GPS software and the LandMark PC software. Follow the steps outlined below to install LandMark PC on your computer:

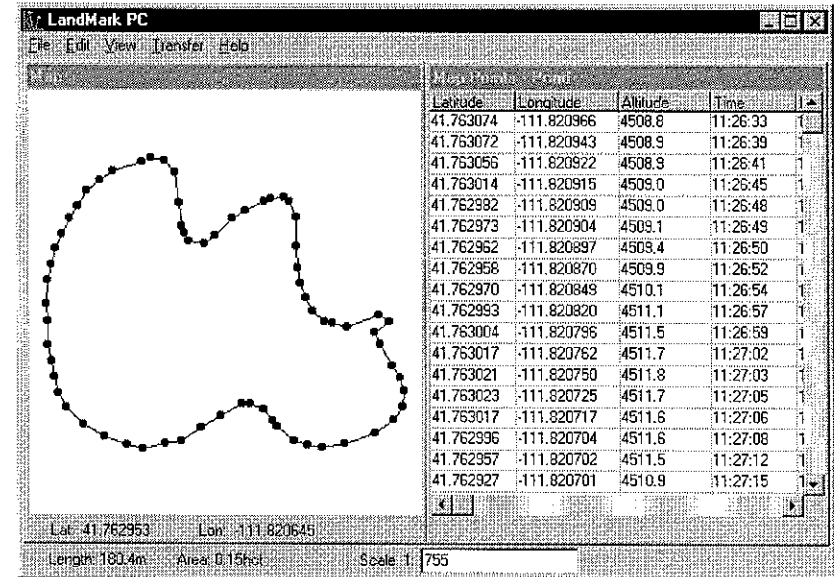
1. Insert the LandMark GPS software disk into your disk drive.
2. Go to the Windows "Start" menu and select "Run."
3. Type in the following information: A:Setup
4. Follow the instructions given from Setup.
5. When the program is installed, LandMark PC is listed in Start/Program.

### On-Line Help

On-line help is provided for LandMark PC in addition to the instructions given in this section of the User's Manual.

## ▲ LandMark PC Screen Description

A sample LandMark PC screen is shown below:



*Map Window  
(Area Map is Shown)*

*Map Points or Waypoints Window  
(Map Points Window is Shown)*

A basic description of the screen elements follows. More details about the screen and instructions on how to use LandMark PC are given throughout *Section 4*.

### Main Menu Options

Across the top of the screen are the LandMark PC pull-down menu options: File, Edit, View, Transfer, and Help. The functions under each menu option are described in detail later in this section.

### Windows

The LandMark PC screen is made up of two windows. On the left side of the screen is the Map window. On the right side of the screen is the Map Points/Waypoints window.

#### *Map Window*

Point, Area, or Line maps and selected waypoints are shown in the Map window. The circles on the map represent individual map points (also called nodes). Solid circles ● indicate differentially corrected positions while hollow circles ○ indicate uncorrected positions. A waypoint is represented as an x. At the bottom of this window, the latitude and longitude of the cursor position within the



Map window and the length and area of the map are shown. A map scale edit box is located at the bottom of the screen in the center. When the cursor is in the Map window, it appears as a (+) symbol.

#### *Map Points /Waypoints Window*

Information about either an opened map file (Map Points) or an opened waypoint file (Waypoints) is shown in this window. One of each type of file can be opened, but you can only view one at a time. You can toggle between Map Points and Waypoints from the "View" menu option. When the cursor is in the Map Points/Waypoints window it appears as a diagonal arrow.

- Map Points Window: When you select View/Map Points, the parameters associated with each point on the currently opened map are shown in the window, including: Latitude, Longitude, Altitude, Time, Fix, PDOP, and Feature. Latitude and longitude are given in decimal degrees. The units for altitude will be in either feet or meters, depending on which units were used to collect the data.
- Waypoints Window: When you select View/Waypoints, the parameters associated with each waypoint in the currently opened waypoint file are shown in the window, including: Name, Latitude/Degrees, Latitude/Minutes, Latitude/Seconds, Latitude/North or South, Longitude/Degrees, Longitude/Minutes, Longitude/Seconds, and Longitude/East or West. Waypoints can also be entered directly into the waypoints file in UTM coordinates using the East, North, and Grid Zone columns. Otherwise, these columns are blank.

#### **Resizing the Windows**

The Map window and Map Point/Waypoints window can be resized. The windows can be resized individually or you can resize the entire screen. Place the cursor in the lower right corner of the screen or the window you want to resize, hold down the left mouse button until a diagonal line with arrows on each end appears, and drag the window or screen to the desired size.

#### **Using the Cursor to Select Map Points**

To select a point from the Map window, position the cursor on the point you wish to select and press the left mouse button. Selected points change from black to red in this window. From the Map Points/Waypoints window, move the cursor to the line of information you want to select and drag it. The selected text is highlighted. You can de-select highlighted map points by pressing the right mouse button.

## ▲ Working With LandMark GPS Files

Once you have collected map or waypoint data using the LandMark GPS, LandMark PC allows you to view and manipulate the files as needed and convert them into formats required by GIS, CAD or database software package. A quick overview of the steps required to use LandMark PC follows (details are found under the main menu options: File, Edit, View, and Transfer).

### Transferring Files from the Field Computer to the PC

1. Prepare the Field Computer to send the map or waypoint file/files to your PC using ProShell or PolyShell (refer to the User's Manual that came with your Field Computer for details). Make sure that the Field Computer is set to the default baud rate of 115,200.
2. Connect the Field Computer to your PC.
3. Run LandMark PC.
4. Select Transfer/Select Port. Select the communication port you used to connect the Field Computer to your PC.
5. Select Transfer/Receive File. A dialog box asks you to select the location where you want the file/files to be stored on your PC. When you have chosen the location, select "Receive." A status bar tracks the progress of the file transfer from the Field Computer to the PC.

### Opening a File in LandMark PC

1. To open a file in LandMark PC, select File/Open. Locate the file you want to open using the "Look in" feature or by typing in the path and filename. Double-click on the name or select "Open."
2. If you open a map file, the map is shown in the Map window and the parameters pertaining to the map are shown in the Map Points window. If you open a waypoint file, details about the waypoints are shown in the Waypoints window.

### Working with Map and Waypoint Files

1. To edit a file, select "Edit" from the main menu to see what options are available.
2. To convert LandMark data into the format required by software packages such as ArcView, select File/Export to see which formats are available. To convert DataPlus files, select File/Convert.
3. Once the file is the way you want it, you can:
  - Save and close the file
  - Open the file in another program such as ArcView.

## LandMark PC Menu Options

The LandMark PC pull-down menu options include: File, Edit, View, Transfer, and Help as shown below:



The functions in the pull-down menus that are available to you vary depending on which window is currently selected. Available functions appear in black lettering while functions that are not available appear in gray lettering. Each menu option is described in detail on the following pages.

### ▲ File Menu Option

The functions in the "File" menu option let you:

- Open* a map or waypoint file
- Save* a file in the current file format
- Save a copy of a file under a different name while maintaining the original file with *Save As*
- Close* a file without exiting from LandMark PC
- Merge* post-processed data with real-time data
- Select the appropriate *Datum* for use during file export.
- Export* a file into another format
- Convert* DataPlus GPS files for use in GIS software
- Print* a Map screen
- Exit* from LandMark PC

File
Open
Save
Save As
Close
Merge
Datum >
Export >
Convert
Print
Exit

### Open

File/Open: This function allows you to open the following files:

- Point map files (extension .apo)
- Area map files (extension .aao)
- Line map files (extension .alo)
- Waypoint files (extension .wpt)

Select "Open" and a dialog box appears. If the file you want to open is not displayed in the selection window, use the "Look in" feature to locate the file or type in the path and the filename. Double click on the filename or click on "open."

One map file and one waypoint file can be open at a time. If you open a map file, the map is shown in the Map window and the information pertaining to the map is shown in the Map Points window. If you open a waypoint file, details about the waypoints are shown in the Waypoints window.

### **Save**

File/Save: This function saves the currently selected file. If the file you are saving was newly created using LandMark PC, a dialog box is shown which asks you to enter a name for the new file. The saved file and LandMark PC remain opened. To close LandMark PC, use the "Exit" function.

### **Save As**

File/Save As: This function lets you save a copy of a file under a different name while maintaining the original file. When you select "Save As" a dialog box is shown. Select the location where you want to store the file using "Save in." Enter the new name for the file under "Filename" and press "Save."

### **Close**

File/Close: This function closes the currently selected file. If the file was modified, a dialog box asks you whether or not you want to save the changes. If both a map and a waypoint file are opened, only the currently selected file is closed. When all files are closed, LandMark PC is still running. To close LandMark PC, use the "Exit" function.

### **Merge**

File/Merge: This function merges post-processed data with real-time data. Use "Open" first to select your real-time map object file. Then use "Merge" to select your LAT file (see *Section 5*). LandMark PC compares time stamps in the two files and substitutes available post-processed points for uncorrected points in the map object file.

### **Datum**

File/Datum: Datums are mathematical models of the surface of the Earth. Because the Earth is not a perfect ellipsoid, datums can only approximate the actual shape of the Earth, and different datums will provide a better fit to the actual surface in different regions of the world. LandMark PC allows you to select an appropriate datum for use during file export. This is important if you need to overlay your GPS data with data from other sources. If the two sets of data are referenced to different datums, they will not overlay correctly.

LandMark PC provides the following datum options:

- File/Datum/WGS-84 (default)
- File/Datum/NAD-83
- File/Datum/NAD-27
- File/Datum/Custom

Once you select a datum, all subsequent export operations use this datum until you change it or you close the program, returning it to the default WGS-84.

If the datum you need is not one of the three predefined datums, you can export to other datums if you know the following datum parameters: DX, DY, DZ, major axis (in meters), and  $e^2$  (or flattening). Select the Custom menu option to open a window that allows user entry of datum parameters. You do not need to enter both  $e^2$  and flattening; LandMark PC computes one from the other.

### **Export**

File/Export: This function allows you to translate map and waypoint files into the format required by ArcView, AutoCAD, or database programs. It also lets you export map files into waypoint files. When you translate a file into another format, the original file is preserved.

Open the map, waypoint, or text file you want to translate. If you are translating a waypoint file, you must first select the waypoints you want to export by double-clicking the left mouse button in the column labeled D.

Select one of the following options:

- File/Export/Shape: Saves the currently selected map or waypoint file as an ArcView point, multipoint, arc, or polygon shape. When you convert a file into a shape, three files are created. The new files have the same root name as the selected file with the shapefile extensions .shp, .shx, and .dbf added. All three of these files are used by ArcView.
- File/Export/DXF: Saves the currently selected map or waypoint file in the AutoCAD DXF point format or DXF line format. The new file has the same root name as the selected file with the .dxf extension added.
- File/Export/DBF: Saves the currently selected map or waypoint file in a database DBF format. The new file has the same root name as the selected file with the .dbf extension added.

- File/Export/ WPT: Exports a map or ASCII text file into a waypoint file. The new file has the same name as the selected file with the .wpt extension added. This function allows you to create waypoint files on your PC and export them into LandMark GPS. (See *Waypoints* later in this section for details.)
- File/Export/Grid: Allows you to save a file as a grid file.

### **Convert**

File/Convert: This function is for users of DataPlus application generation software. DataPlus captures and stores latitude/longitude information from GPS receivers using the NMEA 0183 protocol. Latitude and longitude values from this protocol are given in decimal minutes. To make these stored values more compatible with software packages such as ArcView, the "Convert" function changes the latitude and longitude coordinates from decimal minutes to decimal degrees.

In order for "Convert" to function properly, the fields used to store latitude and longitude information in your DataPlus files must be labeled "Latitude" and "Longitude," respectively. See your DataPlus manual for information on setting up field labels.

When you select "Convert" a dialog box appears. Select the DataPlus directory or folder containing the files you want to convert using the "Look in" feature then press "Ok." All the files in that directory are converted. The new filenames begin with a C and have a .dbf extension. For example, if the old filename was L1N.00K, the new filename will be C1N.DBF.

### **Print**

File/Print: This function allows you to print the current Map screen. The map can be printed to scale. Enter the desired scale in the "Scale edit box" located at the bottom of the screen. When you select "Print" a dialog appears. Select the desired printer, number of copies, etc. then press "OK." You cannot print the information in the Map Points/Waypoints window from LandMark PC. The Map Points information is an ASCII text file that can be opened and printed in a text editor. The Waypoints information cannot be printed.

❖ *Note: You might experience problems if you are printing to a postscript printer. If you do, try printing to a non-postscript printer or changing your printer to non-postscript mode if that option is available.*

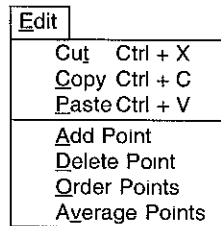
## Exit

File/Exit: This function closes the open files and LandMark PC. If a file has been modified, a dialog box asks you whether or not you want to save the changes.

## ▲ Edit Menu Option

The functions in the "Edit" menu option let you edit a map file as follows:

- Cut* points
- Copy* points
- Paste* points
- Add* points
- Delete* points
- Order* points
- Average* points



## Cut

File/Cut: This function allows you to remove map points from a map file. You can use the shortcut Ctrl+X to access it from the keyboard.

Select the points you want to cut from either the Map window or the Map Points window as follows:

- Map Points window: Select the point you want to cut by pointing to the associated line of text with the cursor, pressing the left mouse button, and dragging the cursor.
- Map window: Place the cursor on the point you want to cut and press the left mouse button. The selected points are highlighted in the Map Points window. In the Map window the selected map points change from black to red. To de-select the points, press the right mouse button. When you select "Cut" the points are removed from the file and stored in the clipboard. The map automatically reflects the change. Information stored in the clipboard can be pasted back into the current file or into another file.

## **Copy**

File/Copy: This function allows you to copy map points from a map file onto the clipboard. You can use the shortcut Ctrl+C to access it from the keyboard.

Select the points you want to copy from either the Map window or the Map Points window as follows:

- Map Points window: Select the point you want to copy by pointing to the associated line of text with the cursor, pressing the left mouse button, and dragging the cursor.
- Map window: Place the cursor on the point you want to copy and press the left mouse button.

The selected points are highlighted in the Map Points window. In the Map window the selected map points change from black to red. To de-select the points, press the right mouse button. When you select "Copy" the information is copied and stored in the clipboard. Information stored in the clipboard can be pasted back into the current file or into another file.

## **Paste**

File/Paste: This function allows you to paste map points stored in the clipboard into a map file. You can use the shortcut Ctrl+V to access it from the keyboard.

Select the line of text in the Map Points window where you want to insert the point/points stored in the clipboard by pointing to the line of text and pressing the left mouse button. When you press "Paste" the point/points are inserted above the selected text. The map automatically reflects the change.

## **Add Point**

Edit/Add Point: This function allows you to add points to a map or waypoint file. First select "Add Point" then select the location for the new point. This can be done one of two ways:

- Place the cursor on the map at the desired location for the new point and press the left mouse button.
- Type in the required information for the new point in the Map Points window.



You must select "Add Point" for each point you want to add. New points are added at the end of the Map Points/Waypoint window. You can move points using the "Cut" and "Paste" functions located under the "File" menu option.

A line is automatically drawn from the last point on the map to the new point unless the "Lines" function in the "View" menu is turned off.

If you decide you do not want to use the "Add Point" function, you can turn it off by placing the cursor in the Map window and pressing the right mouse button.

### **Delete Point**

Edit/Delete Point: This function allows you to delete points from a map file. Select "Delete Point" first, then select the point you want to delete. This can be done in one of two ways:

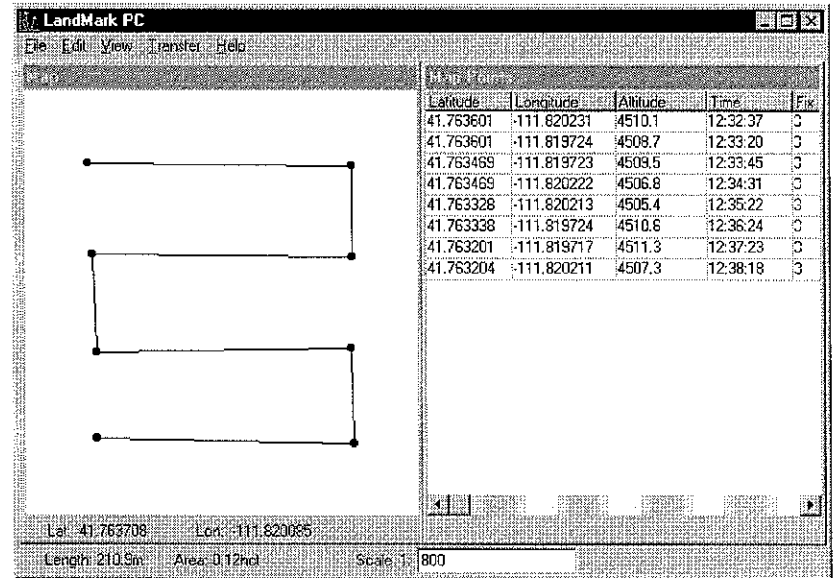
- Select the point on the map to be deleted by placing the cursor on the point and pressing the left mouse button.
- Select the line of information corresponding to the point in the Map Points window by pointing to the line of text with the cursor, pressing the left mouse button, and dragging the cursor.

The selected point turns from black to red in the Map window and is highlighted in the Map Points window. A dialog box asks you to confirm that you want to delete the selected point. If you select "ok", the point is deleted. Both windows automatically update to reflect the change. You can only delete one point at a time. If you want to delete several points, you can use the "Cut" function found in the "File" menu option.

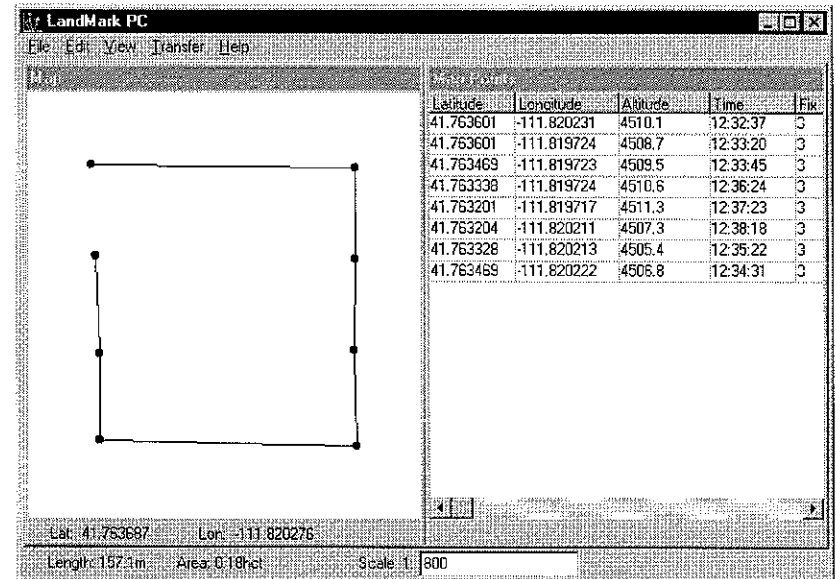
❖ *Important Note: Once you delete a point, you cannot get the point back. If you change your mind after deleting a point, you will have to re-open the original map file or add the deleted point using the "Add Point" function.*

### **Order Points**

Edit/Order Points: This function allows you to obtain meaningful area measurements in cases where points were sampled out of order. For example, forest cruise inventory data are often taken in a manner depicted in the example shown on the following page. The algorithm for calculating area will attempt to make sense out of this shape, but the reported area will not approximate the true area bounded by the points because of the point order.



By re-ordering the points as shown in the figure below, a more accurate indication of the true bounded area is obtained.



After selecting "Order Points," select each point on the map in the correct order required to define the perimeter of the mapped area. A point is selected by placing the cursor on it and pressing the left mouse button. The map updates after each point is selected showing the new order. The information in the Map Points window also updates to reflect the new order once the last point is selected.

❖ *Important Note: Before you select the last point, double check the map and make sure it is what you want. If you change your mind, right-click in the map window and the points will return to their original order. If the map is correct, select the final map point. Once you select the final point, you cannot get the original map back.*

It is not recommended that you attempt to re-order a file containing a large number of points because each point in the file must be selected before the re-order process is complete.

### Average Points

Edit/Average Points: This function allows you average a group of points to create a single point, increasing the accuracy of your locations. To use this function, you must collect several points (>20) while remaining stationary at each location using LandMark GPS. You can then average each group of points using LandMark PC. Follow these steps:

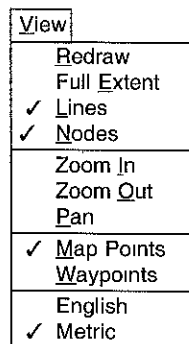
- Select Edit/Average Points.
- Select the desired group of points by holding down the left mouse button and dragging a rubber band box around them.
- After a confirmation, the selected points are averaged to a single point on the map window. The text window reflects this update.

❖ *Important Note: Once you average a group of points, you cannot recover the individual points.*

### ▲ View Menu Option

The functions in the "View" menu option allow you to view a map as follows:

- Redraw* draws the map on the screen
- Full Extent* draws the map to fit the Map window
- Lines* can be turned on or off between nodes
- Nodes* (individual map points shown as circles on the map) can be turned on or off
- Zoom In* lets you take a closer look at a specific area of the map
- Zoom Out* lets you view more of the map screen
- Pan* allows you to move around the map screen
- Map Points* toggles the right side of the screen to the Map Points window
- Waypoints* toggles the right side of the screen to the Waypoints window
- English* toggles units of measurement for the map to English
- Metric* toggles the units of measurement for the map to Metric



## Redraw

View/Redraw: This function redraws the map in the Map window. The map disappears if the screen saver on your PC is activated or another window overlays the Map window. To redraw the map, select the "Redraw" function. The map is redrawn in the same size it was before it disappeared and includes any changes made to the original map.

## Full Extent

View/Full Extent: This function redraws the map to fit the current Map window size. This is useful after using the "Zoom In" and "Zoom Out" functions on the map. You can also use "Full Extent" to redraw the map after you have resized the Map window. For example, if you enlarge the Map screen, the map stays the same size. By selecting "Full Extent," the map is redrawn to fit the larger screen. If you make the Map screen smaller, the map stays the same size and does not fit within the map window. When you select "Full Extent," the map is redrawn to fit the smaller window

## Lines

View/Lines: The default is to have lines connecting the nodes (points) on the map. This function allows you to toggle between "on" (lines) and "off" (no lines) A sample map with lines and without is shown below.



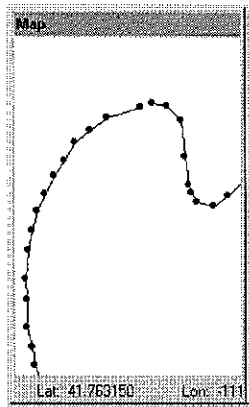
## Nodes

Nodes are the individual points shown on a map represented as circles (as shown above). This function allows you to toggle between "on" (nodes, the default) and "off" (no nodes). If you turn "Nodes" off and "Lines" is turned on, a solid line is shown. If "Lines" is turned off as well, no map is shown.

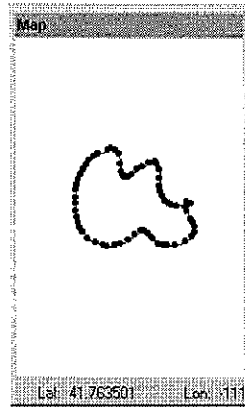
## Zoom In

View/Zoom In: This function allows you to zoom in on the map. When you select "Zoom In," the cursor changes to a magnifying glass with a +. You can click anywhere on the map with the icon. The map scale increments by one step each time you press the left mouse button and the location of the cursor becomes the new center of the map. The cursor remains in "Zoom In" mode until you press the right

mouse button in the Map window or select another function. The current scale is displayed in the Scale edit box.



*"Zoom In" Function*



*"Zoom Out" Function*

When you are using the "Zoom In" function the map may move off the Map window. Move the magnifying glass to the center of the window to keep the desired portion of the map visible in the window as you zoom in. You can also use the "Pan" function to

move the map around the window. An example of a map viewed with the "Zoom In" function is shown above.

### **Zoom Out**

**View/Zoom Out:** This function allows you to zoom out from the map. When you select "Zoom Out," the cursor changes to a magnifying glass with a —. You can click anywhere on the map with the icon. The map scale decrements by one step each time you press the mouse button and the location of the cursor becomes the new center of the map. The cursor remains in "Zoom Out" mode until you right-click in the Map window or select another function. An example of a map viewed with the "Zoom Out" function is shown above. The current scale is displayed in the Scale edit box.

### **Pan**

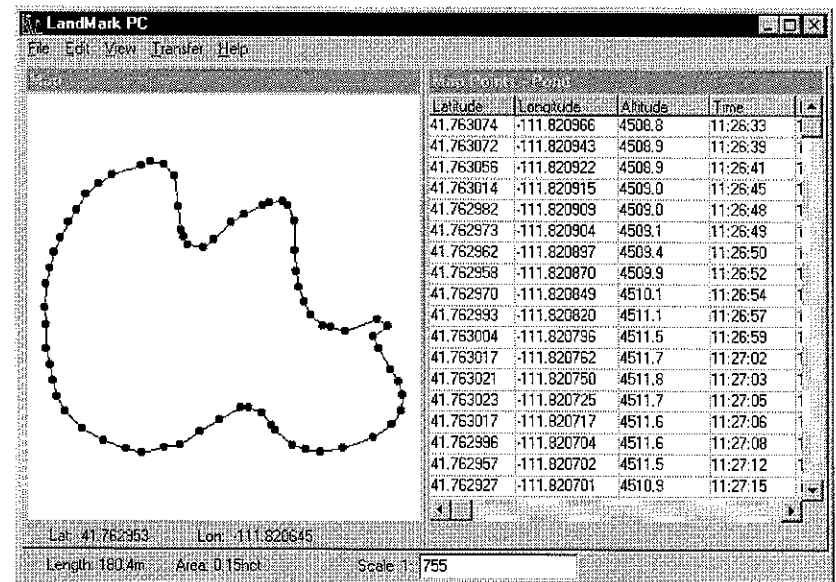
**View/Pan:** This function allows you to move the map around within the current Map window. When you select "Pan," the cursor changes to a hand. To reposition the map, follow these steps:

- Select the "Pan" function.
- Grab the map by pressing the left mouse button.
- Move the map by dragging it to the desired location.
- Release the mouse button when the map is in the desired position. "Pan" is no longer active after the mouse button is released.

## Map Points

View /Map Points: When this function is selected, the Map Points window is shown on the right side of the LandMark PC screen. Information about either an opened map file (Map Points) or an opened waypoint file (Waypoints) is shown here. One of each type of file can be opened, but you can only view one at a time. You can toggle between "Map Points" and "Waypoints" from the "View" menu option. A sample Map Points window is shown below. Information pertaining to each point on the open map file is displayed, including latitude, longitude, altitude, time, fix, PDOP, and feature. Latitude and longitude are given in decimal degrees. The units for altitude will be in either feet or meters, depending on which units were used to collect the data. The map is shown in the Map window on the left side of the screen.

From the Map Points window you can cut, copy, paste, add, or delete map points. These functions are found in the "Edit" menu. When the cursor is in the Map Points window it appears as a diagonal arrow.



Latitude	Longitude	Altitude	Time	
41.763074	-111.820966	4506.8	11:26:33	1
41.763072	-111.820943	4506.9	11:26:39	1
41.763056	-111.820922	4506.9	11:26:41	1
41.763014	-111.820915	4509.0	11:26:45	1
41.762982	-111.820909	4509.0	11:26:48	1
41.762873	-111.820904	4509.1	11:26:49	1
41.762962	-111.820897	4509.4	11:26:50	1
41.762958	-111.820870	4509.9	11:26:52	1
41.762970	-111.820849	4510.1	11:26:54	1
41.762993	-111.820820	4511.1	11:26:57	1
41.763004	-111.820796	4511.5	11:26:59	1
41.763017	-111.820762	4511.7	11:27:02	1
41.763021	-111.820750	4511.8	11:27:03	1
41.763023	-111.820725	4511.7	11:27:05	1
41.763017	-111.820717	4511.6	11:27:06	1
41.762996	-111.820704	4511.6	11:27:08	1
41.762957	-111.820702	4511.5	11:27:12	1
41.762927	-111.820701	4510.9	11:27:15	1

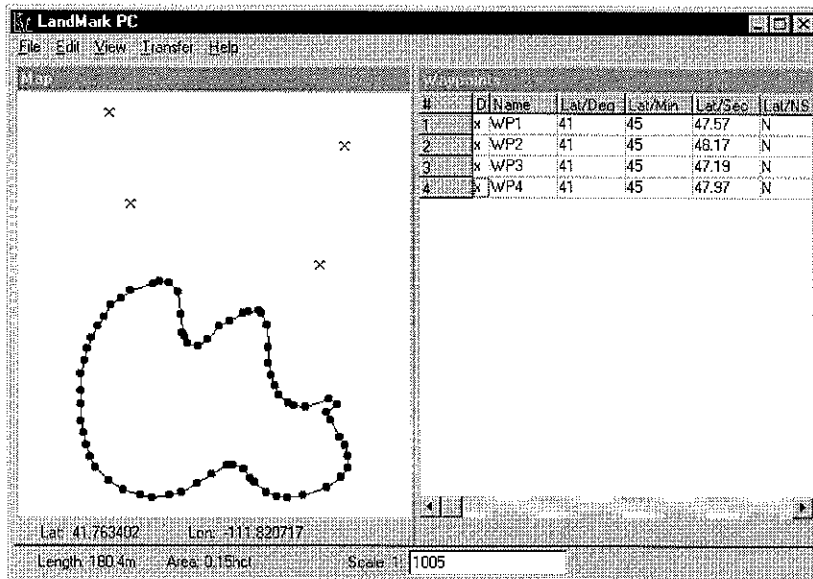
Lat: 41.762953 Lon: -111.820645  
Length: 180.4m Area: 0.15ha Scale: 1:755

Map Points Window

To select a line of information, point to the line of text with the cursor, press and hold down the left mouse button, and drag the cursor. The information is highlighted. To de-select information, press the right mouse button.

## Waypoints

View/Waypoints: When View/Waypoints is selected, the WayPoints window is shown on the right side of the LandMark PC screen. Information about either an opened map file (Map Points) or an opened waypoint file (Waypoints) is shown here. One of each type of file can be opened, but you can only view one at a time. You can toggle between "Map Points" and "Waypoints" from the "View" menu option. A sample Waypoint window is shown below:



*Map Window (Scaled Map and 4 Selected Waypoints are Shown)*

*Waypoints Window*

If a map file is also opened, the map appears in the Map screen on the left side of the screen as shown in the example above. The parameters associated with each waypoint are shown in the Waypoints window, including: Name, Latitude/Degrees, Latitude/Minutes, Latitude/Seconds, Latitude/North or South, Longitude/Degrees, Longitude/Minutes, Longitude/Seconds, and Longitude/East or West. Waypoints can also be entered directly into the waypoints file in UTM coordinates using the East, North, and Grid Zone columns (see details on the following page). Otherwise, these columns are blank.

You can also view waypoints on the Map window. Select the waypoints you want to view from the Waypoint window by double-clicking the left mouse button in the column labeled D (when the cursor is in the Waypoints window it appears as a diagonal arrow).

Selected waypoints are displayed as X marks on the Map window (see the sample window on the previous page). The map automatically scales as needed to fit all of the selected points in the window. You may have to use the "Pan," "Zoom In," or "Zoom Out" functions to show the map and selected waypoints in the Map Window as desired.

#### *Creating Waypoints*

With LandMark PC you can create waypoints on a PC in the following ways:

- Create an ASCII text file containing the waypoint information. The text must be space or tab delimited with latitude listed in column 1 and longitude listed in column 2. You can also include a label for each waypoint. To do this, the text should be set up like the Map Point screen with seven columns. List zeros for columns 3 through 6 (Altitude, Time, Fix, PDOP). List the label in column 7 (Feature). For example, your text file should look similar to the following:

41.12346, -111.654321, 0, 00:00:00, 0, 0, pond

Open the file in LandMark PC as a map file and use the function File/Export/WPT to convert the file to a waypoint file.

- You can also enter waypoints directly in the Waypoints screen as either latitude/longitude pairs (degrees, minutes, seconds) or as Universal Transverse Mercator (UTM) coordinates. To use UTM's, enter Easting, Northing, and Grid Zone information in the last three columns on the Waypoints screen. Easting and Northing coordinates should be in meters. Valid UTM coordinates will be translated into latitude and longitude, and the corresponding columns on the Waypoints screen will be filled in automatically.

#### **English**

View/English: This function allows you to select English units of measurement for the map. The length is shown in feet and the area is shown in acres. This information is shown underneath the Map window. You can toggle between "English" and "Metric" from the "View" menu option.

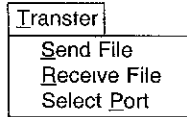
#### **Metric**

View/Metric: This function allows you to select metric units of measurement for the map. The length is shown in meters and the area is shown in hectares. This information is shown underneath the Map window. You can toggle between "Metric" and "English" from the "View" menu option.



## ▲ Transfer Menu Option

The functions in the "Transfer" menu option facilitate the sending and receiving of files between a PC and a Field Computer:

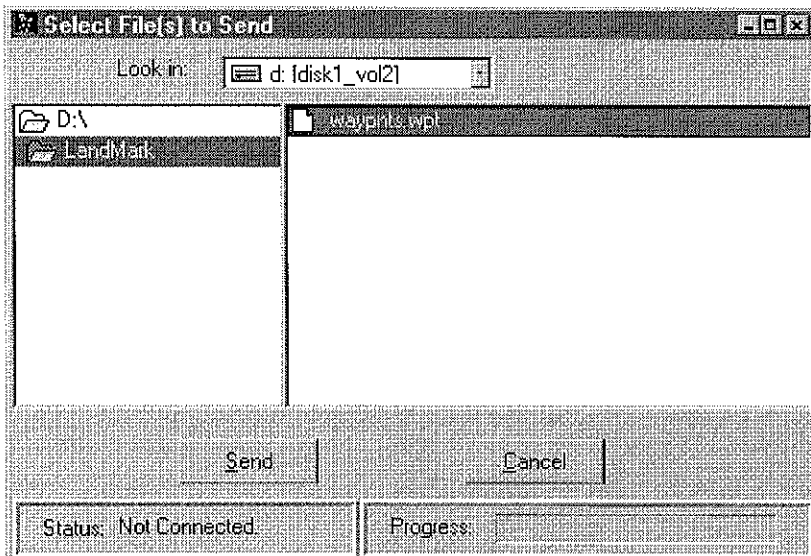


- Send File* allows you to send a file from a PC to a Field Computer
- Receive File* allows you to receive a file from a Field Computer
- Select Port* lets you select the PC communication port

### Send File

Transfer/Send File: LandMark PC can be used to send a file from a PC to the Field Computer. Follow these steps:

1. Prepare the Field Computer to receive a file/files using ProShell or PolyShell (refer to the User's Manual that came with your Field Computer for details). Make sure that the Field Computer is set to the default baud rate of 115,200.
2. Connect the Field Computer to your PC.
3. In LandMark PC, select Transfer/Select Port. Select the communication port you used to connect the Field Computer to your PC.
4. In LandMark PC select Transfer/Send File. A dialog box appears. Use "Look in" to locate the file/files you want to send. Select the file/files then press "Send." A status message lets you know whether or not the Field Computer and PC are communicating. A progress bar gives you the status of the file transfer. A sample dialog box is shown below:

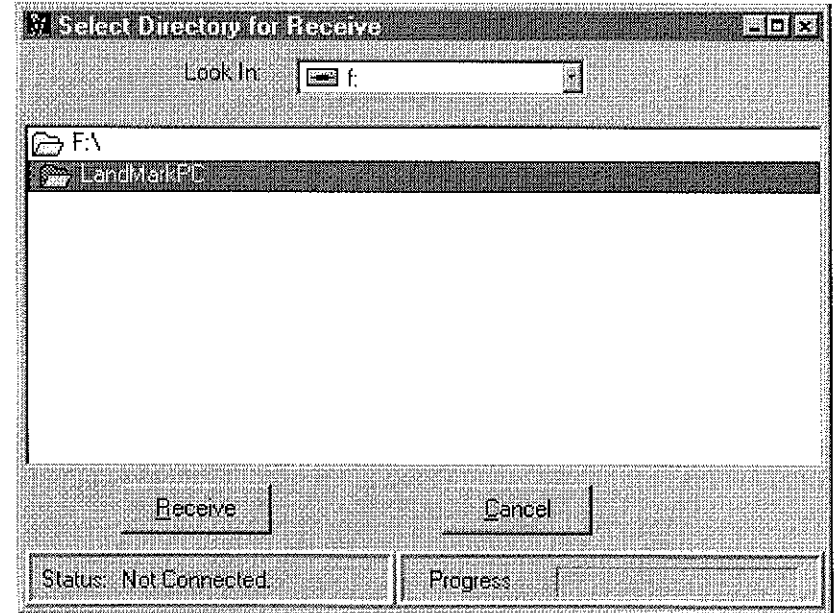


5. Once the Field Computer receives the file/files, they will be listed in the directory shown on the screen in ProShell (or PolyShell).

#### Receive File

Transfer/Receive File: LandMark PC can be used to transfer a file from the Field Computer to a PC. Follow these steps:

1. Prepare the Field Computer to send a file/files using ProShell or PolyShell (refer to the User's Manual that came with your Field Computer for details). Make sure that the Field Computer is set to the default baud rate of 115,200.
2. Connect the Field Computer to your PC.
3. In LandMark PC, select Transfer/Select Port. Select the communication port you used to connect the Field Computer to your PC.
4. Select Transfer/Receive File. A dialog box appears. Use "Look in" to select the location where you want the file/files to be stored and press "Receive." A status message lets you know whether or not the Field Computer and PC are communicating. A progress bar gives you the status of the file transfer. A sample dialog box is shown below:



## Select Port

Transfer/Select Port: When you choose the "Select Port" function, a dialog box appears listing the communication ports available for serial data transfer. Select the port on the PC you used to connect the PC to the Field Computer.

## ▲ Help Menu Option

The functions in the "Help" menu options provide you with the following

- *Contents* is a table of contents for "Help"
- *Index* is an index for "Help"
- *Using Help* describes how to use "Help"
- *About LandMark* gives you information about LandMark PC

Help
Contents
Index
Using Help
About LandMark

### Contents

The "Contents" function is a table of contents for the online Help. For instructions on how to use "Contents" refer to "Using Help."

### Index

The "Index" function is an index for the on-line "Help." For instructions on how to use "Index" refer to "Using Help."

### Using Help

The "Using Help" function provides information on how to use the on-line "Help." For example, "Using Help" tells you how to find, print, and copy a topic. It also gives you instructions on how to customize "Help."

### About LandMark

The "About LandMark" function gives you information pertaining to LandMark PC including the version number, release date, and a copyright statement.



# Section 5

## Post-Processing

- 
- Post-Processing LandMark Files
  - GrafNav Lite Post-Processing Software



## Post-Processing LandMark Files

If you are unable to obtain real-time differential correction while collecting data with LandMark GPS, you can create RINEX files and differentially correct your data when you return to the office. For details on how to collect RINEX files, refer to *Section 3, LandMark GPS Software, Map Carousel, RINEX*.

To post-process RINEX files collected with LandMark you need the following:

- GrafNav Lite post-processing software (available from Juniper Systems) or another program that can use the RINEX format (only GrafNav Lite is supported by Juniper Systems)
- A base station near your location that records RINEX files and to which you have access
- Access to the internet if you are going to download base station files from it

Information on how to use GrafNav Lite to post-process RINEX files is located on the following pages.

## GrafNav Lite Post-Processing Software

GrafNav Lite is a post-processing package from Waypoint Consulting, Inc. Refer to your GrafNav Lite documentation for an overview of post-processing and GrafNav capabilities. This section was written with the assumption that you have a basic understanding of post-processing and can be used as a “quick-start” for post-processing RINEX files with GrafNav.

Post-processing with GrafNav Lite can be broken down into the following steps:

- 1) Obtain the correct base station RINEX files for your data collection times.
- 2) Convert both your RINEX files and the base station files to GrafNav’s GPB format.
- 3) If necessary, perform a re-sampling operation on the base station GPB files.
- 4) Open a GrafNav project and post-process your data.
- 5) Output your post-processed data to a LAT file.
- 6) Use LandMark PC to merge your post-processed data with your real-time data.

Each of these steps is discussed in detail in this section.

### ▲ Obtaining Base Station Files

The procedure for obtaining base station files will be specific to your location and the base station that you are accessing. The National Geodetic Survey (NGS) maintains a web page of continually operating reference stations (CORS) that can be accessed at <http://www.ngs.noaa.gov/CORS/cors-data.html>. This is a good place to start if you need information on RINEX base stations in your area. Many CORS can be accessed directly from this web site. The site also contains useful information on each station listed, including the station coordinates (required for post-processing), and contact information for the station coordinator. We recommend that you contact the station coordinator for the base station you intend to use to learn more about the accessibility of the data.



When downloading base station files, it is important to make sure you are accessing data that covers the correct time period. The base station file that you use for post-processing must contain data for the same period of time that you were in the field collecting data. Some base stations post an entire day's data in a single file. Most stations post data hourly as well.

To insure that you are downloading the correct data you should take a look at the time stamps in your RINEX files. RINEX files are ASCII-based, so you can view them in any available text editor, for example Notepad or Wordpad. Below is an example of what you will see when you open a RINEX file in a text editor.

```

2      OBSERVATION DATA  G (GPS)          RINEX VERSION / TYPE
LandMark      HarvestMaster, Inc.10/15/99 15:27  PGM / RUN BY / DATE
                                                MARKER NAME
                                                OBSERVER / AGENCY
                                                REC # / TYPE / VERS
                                                ANT # / TYPE
                                                APPROX POSITION XYZ
                                                ANTENNA: DELTA H/E/N
1      1      1
3      C1  L1  D1
1999   10   15   15   27   59.000000
                                                # / TYPES OF OBSERV
                                                TIME OF FIRST OBS
                                                END OF HEADER
99 10 15 15 27 59.000000 0 8G 3G 8G 9G17G21G23G29G31 -0.000015496
22106851.237 -212912.270 -1729.590
22705228.452 181870.211 1429.316
22978425.147 -54257.871 -470.464
22219464.892 -412404.691 -3241.094
20851379.276 66568.699 511.821
21500066.933 -221629.340 -1742.373
20819889.587 183579.215 1449.702
22909098.840 56685.813 423.135
99 10 15 15 28 1.000000 0 8G 3G 8G 9G17G21G23G29G31 -0.000015917
22107509.398 -216372.223 -1730.449
22704684.417 184728.141 1428.482
22978604.348 -55199.781 -471.685
22220698.511 -418887.273 -3241.577
20851184.566 67592.203 511.504
21500730.168 -225114.113 -1742.485
20819338.214 186478.152 1449.082
22908938.304 57530.914 422.065

```

Notice that the eleventh line of the file header contains information on the time of first observation. In this example, the first data point was written at 15:27:59 on 10/15/99. All time stamps in RINEX files are based on Greenwich Mean Time (GMT). Use this information to obtain the correct base station file for post-processing your data.

### ▲ Converting RINEX Files to GPB Format

You must convert both the RINEX files collected on the Field Computer (remote) and the base station (master) to GPB format using the GrafNav convert option. To convert your RINEX files to GPB format, follow these steps:

1. Start GrafNav and select File/Convert/Raw GPS to GPB from the menu. This opens the Convert window.
2. From the Receiver type list box select "Rinex"
3. Click the "Get Folder" button and select the folder that contains your RINEX files. NOTE: Convert the observation file from the Field Computer and the base station file.
4. In the Source Files list box, select the files (Field Computer and base station) to be converted and click the "Add" button.
5. Click the "Options" button. In the Options window, under Doppler Source, click the "D1 value from file" radio button. If your data, is kinematic (i.e. if you were moving during data collection), click the "Make all epochs Kinematic" check box under General Options. Click the "OK" button to close the Options window.
6. Click the "Convert" button. Your RINEX files are now converted to GPB format.

### ▲ Re-Sampling Base Station Files

Most base stations record data on fairly long time intervals, such as every 30 seconds, to minimize data storage requirements. In order to match base station epochs (data points) with the times at which your data points were collected, you will usually need to re-sample the base station files. (If your base station records data every second, this step can be skipped.) To re-sample your base station files, start GrafNav and follow these steps:

1. Select File/GPB Utilities/Concatenate, Slice and Resample from the menu.
2. Click the "Add" button and select the base station (GPB) file to be re-sampled.
3. Enter an output path and filename in the Output File box.
4. Click the "Resample to higher interval" radio button. Click the "Go" button; this opens the Resample to a Higher Interval window.
5. Under Data Mode click the "C/A code only" radio button. Under General Options enter "1.0" in the New Data Interval box.
6. Click the "Resample" button. The base station file is now re-sampled to 1 second intervals.

## ▲ Post-Processing Your Data

To post-process your data, start GrafNav and follow these steps:

1. Select File/New Project/Auto Start from the menu. Under New Project, enter a project name and select the Master (base station GPB) file and Remote (GPB) file to be post-processed. Click the "OK" button. This brings up the Master Station Position window.
2. Enter the coordinates of your master (base) station. (Note: For accurate results these coordinates must be correct. Make sure you have entered the actual coordinates of the base station; do not rely on the approximate coordinates that GrafNav retrieves from the base station GPB file.) Click the "OK" button. This brings up the Remote Antenna Height window.
3. Enter the height above ground level for your remote antenna during data collection. Click the "OK" button. You will now see the Process Options window.
4. Under Process Data Type click the "C/A code only" radio button.
5. Click the "Process" button. Your data is now post-processed. The output is written to <Project Filename>.FWD.

## ▲ Creating a LAT File

If you plan to open or merge your post-processed data using Land-Mark PC, you will need to create a LAT file. After post-processing follow these steps:

1. Select Output/Write Coordinates from the GrafNav main menu. Under Source, click the "Epochs" radio button. Then click the "Time Format" button.
2. In the Epoch Output Time Format window, click the "GMT Hours, Minutes, Seconds" radio button. Click "OK" to close the window.
3. Under Output format, select "ASCII (space separated)." Under Coordinate type, click the "Geographic" radio button. Under Horizontal coordinate units, click the "Decimal deg" radio button.
4. Click the "OK" button. This creates a <Project Filename>.LAT file.

### ▲ Using Post-Processed Data with LandMark PC

If you have created a LAT file from GrafNav, you can open or merge your data using LandMark PC. To merge real-time and post-processed data, start LandMark PC and open a map object file (\*.APO, \*.ALO, or \*.AAO) that contains both real-time corrected and uncorrected data. Select *File | Merge* from the main menu and open the corresponding \*.LAT file. LandMark PC matches time stamps in the two files and substitutes available post-processed points for uncorrected points. If necessary, you can then perform additional editing or format conversions on the merged data.

# Appendix

## Battery Power/Charging Accessories

- 
- GPS Receiver Batteries
  - AC Power Adaptor/Charger
  - Vehicle Power Adaptor
  - Dual Stage Battery Charger



## GPS Receiver Batteries

The GPS receiver is powered by two lead acid batteries. If both batteries are fully charged, you can run the AgGPS 122 and 124 Receivers for approximately 10 hours and the AgGPS 132 Receiver for approximately 7 hours.

The shelf life of fully-charged lead acid batteries is approximately one year. Batteries that have been stored for an extended period of time should be charged before they are used.

Instructions on how to use the following power/charging options are given in this section of the manual:

- AC Power Adaptor/Charger: charges fully discharged batteries in 12 to 14 hours (can charge two at once)
- Vehicle Power Adaptor: runs LandMark from a 12 V power supply
- Dual Stage Battery Charger (optional accessory): charges a fully discharged battery in 3 to 4 hours

### Battery Maintenance Tips

Regardless of which charger you are using, keep the following points in mind:

- *Ventilate the Backpack:* If you are charging the lead acid batteries while they are in the pack, unzip and expose the main compartment to avoid possible heat build-up.
- *Keep the Batteries Charged:* Be sure to keep the lead acid batteries charged. If they are stored in a deeply-discharged state for more than a week, the batteries can be damaged.
- *Charge the Batteries Before Storing Them:* If you won't be using the batteries for a week or more, we recommend that you charge them fully before storing them.
- *Avoid Overcharging the Batteries:* Overcharging the batteries can damage them. (This isn't a concern when you are using the Dual Stage Battery Charger.)
- *Recycle the Batteries:* The lead acid batteries used with LandMark are recyclable (see the following page for details).

### *Recycling Lead Acid Batteries*

The lead acid batteries used with LandMark are recyclable. The RBRC (Rechargeable Battery Recycling Corporation) Battery Recycling Seal on the battery pack indicates that Juniper Systems is voluntarily participating in an industry program to collect and recycle these batteries at the end of their useful life, when taken out of service in the United States or Canada. The RBRC program provides a convenient alternative to placing these batteries into the trash or the municipal waste stream, which is illegal in some areas. Our involvement in this program is part of our commitment to preserving our environment and conserving our natural resources.



Some stores provide recycling bins for public use (Wal-Mart, Ace Hardware, Circuit City, and Radio Shack, for example). Please call 1-800-8-BATTERY for information on battery recycling in your area. You are also welcome to return your spent battery packs to Juniper Systems and we will recycle the batteries for you. If you plan to do this, please contact us for information on how to properly package and ship the batteries.

Refer to *Section 2, Hardware Overview, Advance System Preparations, Batteries* for more information about the lead acid batteries.



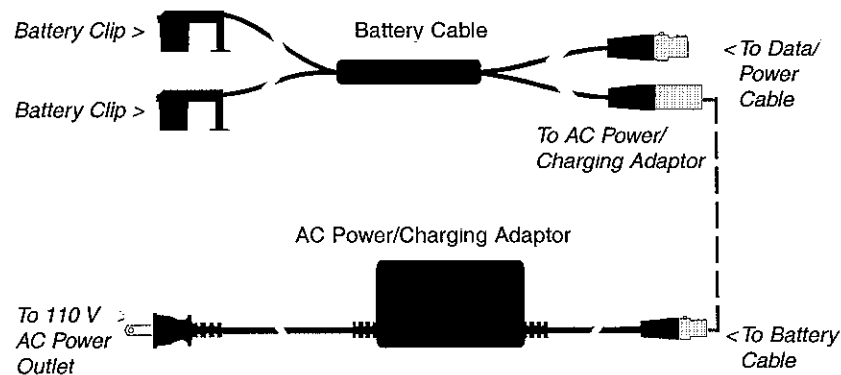
## AC Power Adaptor/Charger

The AC Power Adaptor/Charger charges the lead acid batteries that power the LandMark receiver. It also powers the receiver while the batteries are being charged. Two batteries can be charged at once.

### ▲ How to Use the AC Power Adaptor/Charger

These instructions assume that the pack is geared up and wired as instructed in *Section 2*. (Read the information on page 3 in this section of the manual before using this charger.)

1) Attach the Battery Cable to the AC Power Adaptor/Charger as shown in the diagram below.



2) Plug the AC adaptor into a 110 V AC power outlet. It takes 12 to 14 hours to charge two fully discharged batteries.

3) Disconnect the Power/Charging Adaptor from the Battery Cable after the batteries are charged.

### Avoid Overcharging the Batteries

Do not leave batteries connected to this charger for more than 24 hours or the batteries will be overcharged. Overcharging the batteries can damage them.

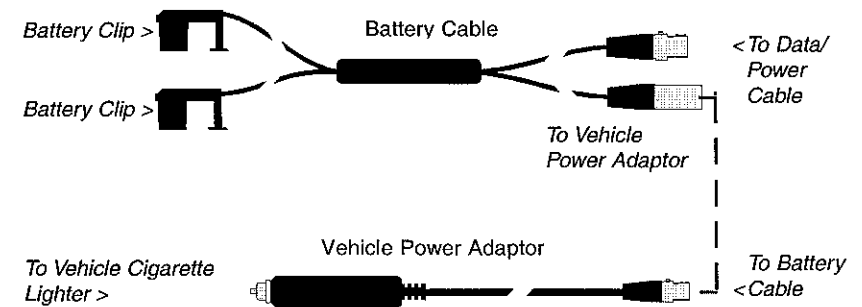
## Vehicle Power Adaptor

The Vehicle Power Adaptor is used to power LandMark from a 12 V supply, such as a vehicle battery.

### ▲ How to Use the Vehicle Power Adaptor

These instructions assume that the pack is geared up and the cables are attached as instructed in *Section 2*. (Read the information on page 3 in this section of the manual before using this charger.)

1) Attach the Battery Cable to the Vehicle Power Adaptor as shown in the diagram below.



2) Plug the Vehicle Power Adaptor into a vehicle cigarette lighter.

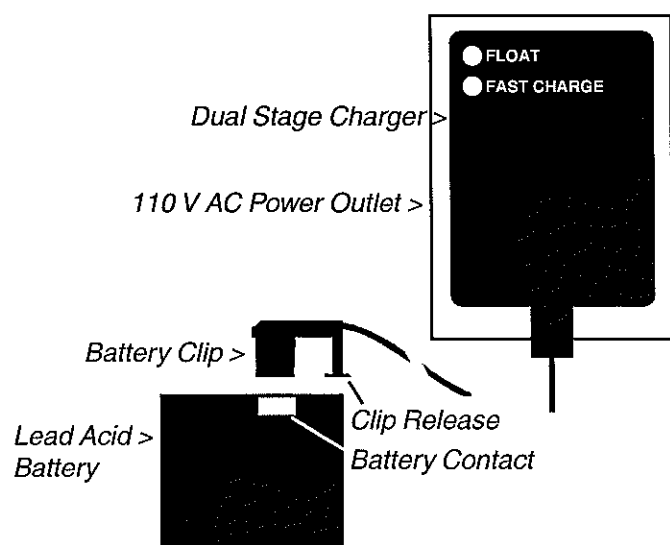
This adaptor provides external power to LandMark from a 12 V supply. It has limited usefulness as a battery charger. With the vehicle running, it takes 12 to 14 hours to fully charge a battery pack.

## Dual Stage Battery Charger

The Dual Stage Battery Charger quick-charges the lead acid batteries that power the LandMark receiver using a 110 V AC power source. One battery is charged at a time. (Read the information on page 3 in this section of the manual before using this charger.)

### ▲ How to Use the Dual Stage Battery Charger

- 1) Attach the battery clip to the end of the battery where the negative and positive contact points are located.
- 2) Plug the AC adaptor into a 110 V AC power outlet.
- 3) The charger has two modes (indicated on the AC adaptor):
  - Fast Charge: when the orange light is on, the battery is charging. It takes about three hours to charge a fully discharged battery. The charger senses when the battery is full and automatically switches to float mode.
  - Float: when the green light is on, the battery is fully charged and the charger has switched to float mode. The charger maintains the battery at its peak charge as long as it is plugged in. The float mode protects the battery from being overcharged.
- 4) To remove the battery clip from the battery, push up on the clip release (shown in the illustration below).





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