MC-V® Asset Surveyor™

Software User's Guide

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Revision Notice

This is revision B of the MC-V Asset Surveyor Software User's Guide, Part Number 28380-05, March 1996. This manual applies to version 3.00 of the Asset Surveyor software.

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MC-V Asset Surveyor User's Guide

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Chapter 3   *Installing Asset Surveyor* contains instructions for the installation and upgrading of the Asset Surveyor software on your MC-V.

Chapter 4   *Getting Started* describes the basic concepts you require before being able to make use of the Asset Surveyor system, such as how to select from menus, how to manage data files, etc.

Chapter 5   *Before Collecting Data* provides a brief check list which you should follow each time you are about to use the Asset Surveyor system, to be assured of capturing high quality GPS positions and GIS attribute data.

Chapter 6   *Using Asset Surveyor* describes how to operate the major functions of the Asset Surveyor software.

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Chapter 7   *The Asset Surveyor Menu Structure* provides a detailed description of each element in the full Asset Surveyor menu 'tree'. Refer to this chapter if you have a question about how a particular aspect works.

Chapter 8   *Troubleshooting* describes common problems and how to solve them.

Appendix A   *Messages* lists, in alphabetic order, the various error, warning and information messages which the Asset Surveyor software may display, and describes each in detail. Refer to this appendix if you do not fully understand what is meant by a certain message.

Appendix B   *GPS Systems* describes in detail each of the Trimble GPS receivers with which the Asset Surveyor software works, and provides equipment lists and diagrams showing how to arrange this equipment. Any special features of a particular GPS receiver are also mentioned in this appendix. For additional information on specific Trimble GPS receivers, consult your receiver's *Operation Manual*.

Appendix C *PC Utility Programs* describes a number of PC-based utility programs which are used in conjunction with the Asset Surveyor software.

Appendix D *Asset Surveyor Limits* lists the few practical limitations under which the Asset Surveyor software operates.

Appendix E *NMEA Output* provides details of the various NMEA-0183 output packets which are available from selected Trimble GPS receivers.

Glossary Briefly describes a number of GIS, GPS and data capture terms which are used in this manual.

How to Use this Manual

Please read the release notes which accompany this manual. They contain last-minute information regarding the Asset Surveyor software and your Trimble GPS receiver.

Check the Trimble Bulletin Board System (BBS) on a regular basis for application notes and new software release information.

Before using the Asset Surveyor software, you should also read the GPS Mapping Systems *General Reference* manual and the *Operation Manual* for your Trimble GPS system.

If you wish to interface an external sensor or laser range-finder to your Asset Surveyor system, you should also read the companion *External Sensors with MC-V Asset Surveyor* manual.

Symbols

The following symbols are used in this manual:

⊠ **Note -** Indicates a general piece of information to which your attention is drawn.

💣 **Caution -** Indicates a potential difficulty or troublesome area. You should pay particular attention to such warnings.

☆ **Tip -** Indicates a shortcut or other time- or labor-saving hint that can help you to make better use of your Asset Surveyor system.

Key Symbols

The Asset Surveyor GPS/GIS data collection software uses both *hard* (i.e. physical) keys on a keypad and *soft* (i.e. visual) keys on the datalogger's screen. This manual illustrates these two classes of keys using different symbols:

Hard (physical) keys on the MC-V keypad are indicated as follows:

ENTER, ⬅ , F1 , etc.

Soft keys on the MC-V screen are indicated as follows:

CREAT, **DEL**, **ALL**, etc.

A soft key is activated by pressing the corresponding function key (F1 ... F5) on the MC-V's keypad.

Instructions

Throughout this manual, sequences of instructions are given in the following manner:

1. First step.

Information that clarifies or further explains the first step.

2. Second step.

etc.

How to Avoid Reading this Manual

While you are strongly encouraged to thoroughly read this manual in order to get the best performance from your GIS/GPS data collection system, we realize that you will be very keen to take your new GPS receiver out and 'test drive' it immediately. The following paragraphs should enable you to do just that.

Once you have connected your MC-V to your GPS receiver and connected charged batteries, you can just turn on your GPS receiver and your MC-V. If you have installed your Asset Surveyor software and connected your GPS equipment correctly, the Asset Surveyor software will start to communicate with the GPS receiver. If not, check the receiver's *Operation Manual* or Appendix B, *GPS Systems*, for cabling diagrams and equipment lists.

Once the Asset Surveyor software is communicating with your GPS receiver, you can use the system for capturing geographic data. Asset Surveyor acts as a control panel for the GPS receiver, and can be used to configure the way in which the GPS receiver operates, as described in Chapter 7. You can record positions or navigate using the GPS receiver.

In order to record interesting features and attributes, you will need to load a data dictionary onto your MC-V. See the *PFINDER User's Guide* for details of how to create a data dictionary, and Chapter 7 of this manual for a description of how to transfer a data dictionary to your MC-V.

Although the Asset Surveyor software is largely self-explanatory, it is a very versatile and flexible software system, and you will probably only be able to take full advantage of its power after reading this manual thoroughly. Once you have given your Trimble Asset Surveyor and GPS receiver a test-drive, you are encouraged to make a cup of coffee, find a comfortable chair where you won't be disturbed and read this manual. You may find it useful to refer to your MC-V as you read.

⊠　　**Note -** Even if you are unable to read the whole manual, you are encouraged to always carry the Asset Surveyor Quick Reference Guide with you when you are using the Asset Surveyor software . The Quick Reference Guide provides an overview of the system as well as describing a number of important details which may be difficult to remember.

Chapter 1   Introduction to Asset Surveyor™

Congratulations on your purchase of the Trimble Asset Surveyor GIS/GPS data collection system. The combination of sophisticated data collection software and GPS positioning hardware will enable you to efficiently collect high quality GIS data.

1.1   What is the Asset Surveyor Software?

Asset Surveyor is a software system (i.e. a computer program) produced by Trimble Navigation Limited, for a wide range of Geographic Information System (GIS) data capture applications.

The Asset Surveyor software works with a range of Global Positioning System (GPS) receivers produced by Trimble Navigation Limited.

1.2   Which Computers does Asset Surveyor run on?

The Asset Surveyor software runs on three powerful hand-held computers:

- Trimble's TDC1™ data collector, which is a lightweight, compact and rugged hand-held computer. The TDC1 also runs Trimble's 'Survey Controller' software, and a single TDC1 can be shared between GIS and Land Survey applications. The TDC1 comes in two 'sizes': the standard TDC1 has 1MB of memory for captured data, while the expanded TDC1 has 4MB of memory. Until recently, the standard TDC1 had 640kB of memory.

- The Trimble TDC2™ data collector. This is an even more rugged hand-held computer than the TDC1, and is completely waterproof. The TDC2 can be used for GIS data capture applications in the most hostile environments. The TDC2 is available with 570kB or 3MB of data storage memory.

- The Corvallis Microtechnology MC-V® hand-held computer. The MC-V has recently been replaced by the TDC2 as Trimble's preferred data collector for harsh environments. The MC-V has either 1MB or 2MB of memory for storage of captured data.

1.3   What does Asset Surveyor do?

The primary function of the Asset Surveyor software is the automated capture of information related to geographic features. Together with a Trimble GPS receiver, the Asset Surveyor software can quickly and accurately capture the attributes and GPS position of geographic points, lines and areas. This information is stored in one or more data files, which can be loaded into Trimble's PFINDER™ software suite. After post-processing and editing, data can then be output in a wide range of GIS-compatible formats.

Applications for the Asset Surveyor software include forestry mapping, environmental and resource management, disaster assessment, utility inventories and urban asset management. For example, a power company could build an asset register of all its power poles, recording their position to within a few meters and the condition and structure of the poles and any attached hardware. A maintenance crew may later use the Asset Surveyor software's navigation functions in order to locate any poles requiring repair.

Data which has been captured with the Asset Surveyor software can be reviewed, edited or deleted, right there in the field. This ensures that the data which you capture and take back to the office is correct and complete.

The Asset Surveyor software provides you with convenient and powerful control of your Trimble GPS receiver, enabling you to take full advantage of the potential offered by GPS.

The Asset Surveyor software can be operated as a temporary GPS Base Station, in situations where a more permanent Base Station is impossible or impractical to set up.

The Asset Surveyor software allows you to use your Trimble GPS receiver for navigation to a waypoint or to a previously-recorded geographic feature.

The Asset Surveyor software provides integrated support for a number of laser range-finders, which can be used to record offsets to geographical features. The use of offsets makes is possible to capture data in circumstances where the use of GPS alone might be inconvenient or even impossible.

The Asset Surveyor software allows you to record information from external sensors, using Trimble's 'External Sensor Potential' (ESP™) system. The Asset Surveyor software can capture data from a wide range of sensors equipped with an RS232 port. Each reading from the external sensor can be

stored as an attribute of a feature, or can have a GPS position associated with it, allowing you to correlate information from depth sounders, Geiger counters, tree calipers, etc. with GPS positions.

The Asset Surveyor software has been translated into a number of languages. For each supported language, all text displayed by Asset Surveyor appears in that language, rather than in English.

1.4   Which GPS Receivers does Asset Surveyor work with?

The Asset Surveyor software, running on one of its supported computers, will work with the following two families of Trimble GPS receivers:

- The Pathfinder GPS receiver family, which includes the Pathfinder Basic™ series, the Pathfinder Professional™, the Pathfinder Pro XL™, the Pathfinder ProLite™, and the military-grade Trimble Centurion™ and Trimpack III™ receivers.

- The 4000 Series GPS receiver family, which includes the 4000SE™, 4000SSE™ and the 4000SSi™. Trimble's 'GIS Surveyor™' package comprises a 4000SE and an Asset Surveyor system, and is part of Trimble's mapping product line, along with the GPS Pathfinder products.

Contact your local Trimble Support Center for details of new GPS receivers with which the Asset Surveyor software can be used.

⊠   **Note -** The combination of an MC-V datalogger and a 4000 Series GPS receiver is not supported. Only the Pathfinder family of GPS receivers can be used with an MC-V datalogger.

Chapter 2   Introduction to the MC-V

2.1   What is the MC-V?

The Corvallis Microtechnology MC-V® is a powerful hand-held computer with a full alphanumeric keypad, an eight line LCD (liquid crystal display) and two serial communications ports. The MC-V supports a number of optional accessories such as a barcode wand, external headphones (for operating in very noisy environments) and an external heater (for extremely cold operating conditions).

All specifications and information on the MC-V provided in this manual refer to the MC-V-TD-RD model, which is the model distributed by Trimble with Pathfinder GPS systems. This model has a high-speed 10MHz Intel 8088-compatible processor. It has either 1MB or 2 MB of memory allocated as data space. The MC-V also has 256kB of memory allocated to program space, and this is where the Asset Surveyor program resides.

✉   **Note -** The Asset Surveyor software does ***not*** support older 5MHz models of the MC-V. You can only use Asset Surveyor on the MC-V-TD-RD model, or other MC-V models which have been upgraded to MC-V-TD-RD compatibility.

The MC-V has an internal rechargeable NiCd battery which enables it to operate for up to six hours on a single charge. The MC-V is normally distributed with a 120V AC battery charger, but a 220V charger (TNL part number 14550-00) is available as a purchased option.

For additional information on the MC-V, refer to the *CMT MC-V Operator's Manual* included in the Trimble Pathfinder manual set.

2.2   Turning the MC-V On and Off

To turn the MC-V on, press the ⌐ON⌐ key.

To turn the MC-V off, press ⌐SH2⌐ then ⌐ON⌐.

When the Asset Surveyor software is running, you can, in most situations, turn the MC-V off. When you turn the MC-V on again, Asset Surveyor will continue where it left off.

⊠   **Note -** You will not be allowed to turn the MC-V off when Asset Surveyor has a data file open, or when transferring files to a PC. You must first close the data file or exit file transfer mode and then turn the MC-V off.

2.3   Rebooting the MC-V

If the MC-V ever locks up and will not respond to keypad commands, you can reset the MC-V (and restart the Asset Surveyor software) by pressing the ⌐F3⌐ and ⌐ON⌐ keys at the same time. If the MC-V still does not respond, perform a hard reset by carefully inserting the tip of a ball-point pen into the opening on the top of the MC-V, labeled 'RST'.

The reset methods described above perform what is known as a *warm boot* of the MC-V hardware. When the hardware is warm booted, it should restart without losing or damaging any of the system, program or data files held in its memory. If you were ever to remove the MC-V's internal battery, or open its case and unplug memory chips, etc., the MC-V will perform what is known as a *cold boot* when it is restarted. A cold boot will result in the loss of all Asset Surveyor data and program files. For this reason, you should never service the MC-V without first extracting all important data files. You will need to re-install the Asset Surveyor software after cold booting the MC-V.

If the Asset Surveyor software does not restart after a reset, the program or some of its auxiliary files may have been lost or corrupted. In this situation, reformat Drive B: of the MC-V and re-install the Asset Surveyor software as described in the following chapter, *Installing Asset Surveyor*.

2.4   Data Capacity

The MC-V supplied by Trimble with GPS Pathfinder systems comes in two configurations:

- The 1MB MC-V, which has enough memory for Asset Surveyor to store approximately 36000 GPS positions. If you log data at one position per second, this will be enough for 10 hours of continuous operation.

- The 2MB MC-V, which has enough memory for Asset Surveyor to store approximately 73000 GPS positions. If you log data at one position per second, this will be enough for 20 hours of continuous operation.

Since most applications do not require such a high data logging rate, you will probably be able to collect data for several days before you run out of room in the MC-V's memory by logging at a lower rate.

⊠   **Note -** Even though the MC-V can hold a large amount of data, Trimble recommends that you transfer any data files in the MC-V to your PC daily.

☆   **Tip -** To increase the length of time for which you can log data to the MC-V's memory, increase the GPS logging intervals (as described later in this manual).

2.5   Operating Temperature and Humidity Ranges

The MC-V should not be operated when the temperature or humidity exceeds the following ranges:

Normal operating temperature range: -10°C to 40°C (14°F to 104°F)

Operating temperature range with heater: -40°C to 40°C (-40°F to 104°F)

Storage temperature range: -20°C to 45°C (-4°F to 113°F)

Humidity range: up to 95% non-condensing

2.6   Power Sources

A fully charged MC-V will run continuously off its internal NiCd battery for 5 to 6 hours, and longer if it is switched off when not actually collecting data. When the MC-V is operated in colder temperatures, operating time is

reduced. An internal lithium battery acts as a backup battery and serves to preserve the contents of the MC-V's memory if the main NiCd battery becomes fully discharged.

For maximum battery life, the NiCd battery in the MC-V should not be charged until it drops below 30% of charge. When it gets low, fully recharge it. Do not partially charge the NiCd battery.

2.6.1 Power Specifications

MC-V:	DC Input Voltage:	6-13V
	DC Input Current:	< 0.3A @ 12.6V DC
MC-V battery charger:	AC Input Voltage:	120V, +10% or - 20%,
		48-66Hz, 5W
	AC Output Current:	0.3A @ 12V DC

2.6.2 Alternative Power Sources

The MC-V can draw power from the GPS receiver's power source if the MC-V internal battery becomes low during operation. The MC-V model supplied by Trimble will automatically switch to the receiver's power source, if available, when its internal battery falls below 30% charge. When this happens, the MC-V's internal battery will actually be slowly recharged by the GPS receiver's battery.

When the MC-V is low on power, plugging it into the AC adapter will recharge the internal battery. The MC-V can be run from the AC adapter when the battery is too low to power the hand-held computer in its own.

💣☀ **Caution -** When using a vehicle power adapter to power your GPS receiver and/or your MC-V, do *not* start or stop the vehicle's engine when the GPS receiver and/or the MC-V is plugged in. Always plug in the receiver and/or the MC-V after you have started the vehicle. Starting or stopping the engine while the receiver is plugged in could interrupt power to the system.

2.6.3 Recharging Batteries
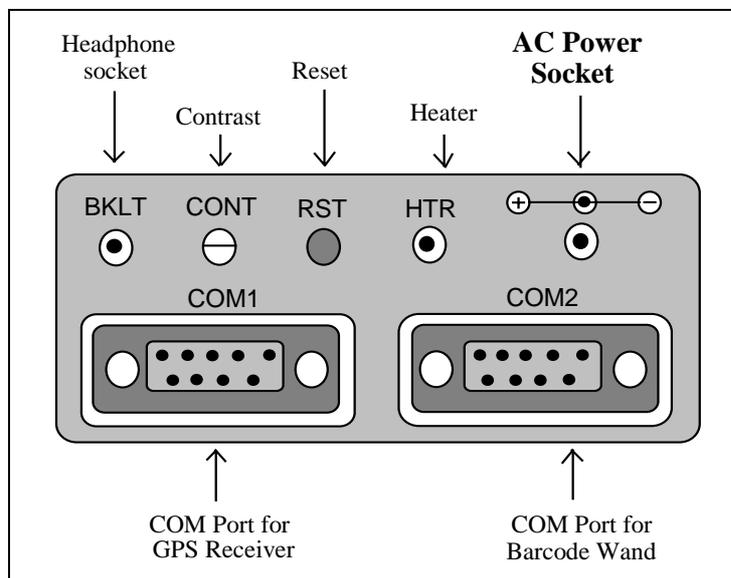
Figure 2-1   The MC-V's End Panel

To recharge the MC-V's internal NiCd battery, plug it into the external AC adapter for at least 12 hours, but not more than 17 hours.

 Caution - Do not leave the unit charging for more than 17 hours. The MC-V has no overcharge protection. After the battery is fully charged, additional charging will actually *reduce* the life of the battery and may eventually destroy it.

Charge the battery after every use, provided it has fallen to below 30% charge, but be very careful not to overcharge; plugging the MC-V into the AC adapter when it is already sufficiently charged will not provide it with more power and may even damage the battery.

At least once per week, discharge the unit's batteries to below the 30% level and then recharge it for 12-15 hours. If the batteries are never discharged to the 30% level, the batteries may acquire a 'battery memory' and many never subsequently achieve a full charge.

You can operate the MC-V while it is recharging, but recharging will take longer if the MC-V is switched on.

Both the internal NiCd battery and the internal lithium battery which backs up the MC-V's memory require periodic replacement. The lithium battery cannot be recharged and supplies power to the RAM (memory) drives so that if the NiCd battery runs down, data files are protected. Symptoms of lithium battery backup failure include loss of program or data files when the NiCd battery runs down. Symptoms of NiCd battery failure include the inability to recharge or hold a charge for the normal length of time. Contact Trimble Navigation Limited for instructions if either of these symptoms occur.

Asset Surveyor will warn you if it detects that the level of either battery is low or the battery has failed, e.g.

```
┌─────── Warning ───────┐
│The main internal      │
│ battery is low        │
└───────────────────────┘
```
and
```
┌─────── Warning ───────┐
│The internal backup    │
│ battery is dead       │
└───────────────────────┘
```
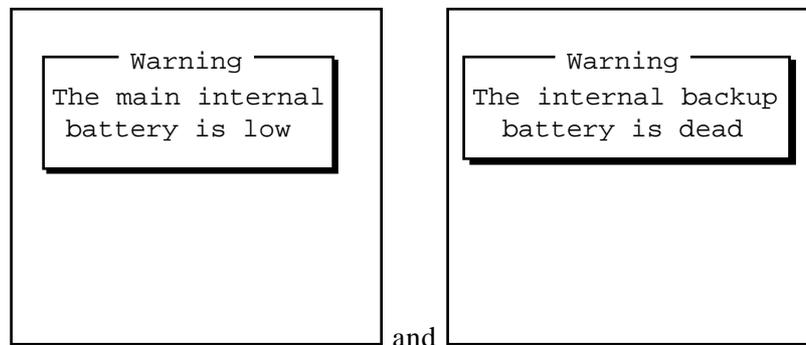
2.6.4 Storing the MC-V

If the MC-V is not used for three months or more, the internal NiCd battery may become permanently damaged and require replacement. To avoid having to replace the battery, recharge the MC-V once per month while it is not being used.

2.7   Keypad

The MC-V's keypad contains function keys, a full set of alphanumeric keys, cursor motion keys, shift keys and a number of other special keys. For a full description of the keypad, refer to the CMT *MC-V Operator's Manual*.
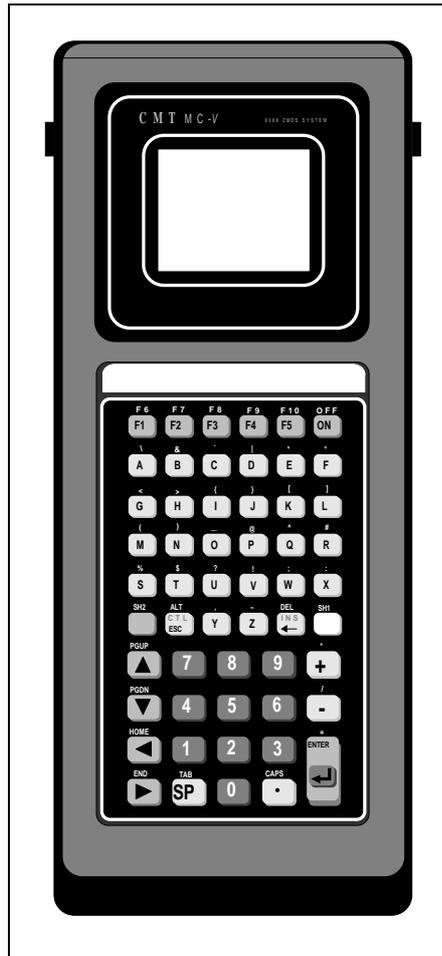
Figure 2-2   The MC-V's Keypad

Usually, when operating the MC-V, single keystrokes perform single actions. Sometimes, however, two keystrokes are required to perform a

specific action. When an operation requires two keys, the keys are pressed either sequentially or simultaneously.

- To enter a sequential key combination, press and release the first key and then press and release the second key. Sequential keystrokes are indicated in this manual by listing the two keys sequentially, e.g. '[SH2] [ON]'. Most key combinations are sequential.

- To enter a simultaneous key combination, press and continue to hold down the first key, then press and release the second key. Simultaneous keystrokes are rarely required, and will always be indicated explicitly in this manual by the word *simultaneously*, e.g. 'Press [F3] and [ON] simultaneously'.

2.8   Screen

The MC-V has an LCD screen with eight lines, each of these lines being 21 characters wide.

The MC-V's LCD screen responds to heat, so exposure to direct sunlight will blacken the entire screen. The screen will return to normal when it is turned away from direct light. Repeated exposure to direct sunlight will degrade the quality of the screen.

2.8.1   Backlight

The MC-Vs supplied by Trimble have a built-in backlight. To turn on the backlight, press [SH1] [SP]. Repeat the sequence to turn off the backlight. The backlight can put a significant drain on the MC-V's battery (and that of the GPS receiver, if the MC-V is being powered from the receiver's battery). It is recommended that the backlight only be used occasionally for short periods.

⊠   **Note -** The MC-V backlight can only be controlled by the Asset Surveyor software when the MC-V is running CMT-ROS version 1.06 or 2.06 and later.

2.8.2   Contrast

The screen contrast on the MC-V can be changed by pressing [SH1] [+] to increase the contrast or [SH1] [-] to decrease the contrast.

2.9   Operating System

The MC-V's operating system is called CMT-ROS. You will not normally need to access the operating system, but if you choose to and require more information, refer to the CMT *MC-V Operator's Manual*.

To access CMT-ROS, you must exit from the Asset Surveyor program. You can do this by pressing the $\boxed{\text{ESC}}$ soft key on the Asset Surveyor software's main menu. To return to the Asset Surveyor program from CMT-ROS, you can either warm boot the MC-V (as described earlier in this chapter) or you can run the program AUTOEXEC.S.

The Asset Surveyor software will run on CMT ROS versions 1.05 and later. A small number of functions are restricted or are not available on certain ROS versions, as detailed in this manual. Contact Corvallis Microtechnology if you wish to upgrade your MC-V to the latest version of CMT ROS.

2.10 Accessories

2.10.1 Barcode Wand

The optional barcode wand can read codes backwards (i.e. right-to-left) or forwards (i.e. left-to-right). Be careful not to drop the barcode wand or scratch the glass tip. When packing it in the carrying case, position it so the cord is not crimped and the glass tip is not touching a hard surface.

You can plug in the barcode wand (to the MC-V's 'COM2:' port) and use it whenever you wish, unless you are already using the COM2: port to communicate with an ESP sensor or laser range-finder.

You do not have to initialize the barcode wand, but in order for the MC-V to recognize the presence of the barcode wand, you must plug in the wand when the MC-V is turned off, then turn the MC-V back on.

The MC-V's barcode reader (an HBCR-8300 from Hewlett Packard®) is capable of decoding a number of common barcode formats:

- Interleaved 2 of 5

- UPC/EAN/JAN

- Codabar

- Code 128

- Code 11

- MSI code

- Code 3 of 9

This last format (which is also referred to as 'Code 39') is the format in which barcodes are printed by Trimble's PFINDER software.

For additional information, refer to the *Bar Code Input to the MC-Series* manual.

2.10.2 Headphones

The MC-Vs supplied by Trimble have the backlight (BKLT) jack re-wired for headphones. A set of headphones is available as an option with the MC-V, and allows you to hear the MC-V's beeper when operating in a noisy environment.

2.10.3 Keypad Cover Release Valve

The MC-Vs supplied by Trimble have a black rubber keypad cover with a flat silver pressure release valve on the back of the unit. With the valve closed, the unit is virtually air- and water-tight. However, when the atmospheric pressure decreases (at high altitudes, for example), the keypad cover may bulge out. Under increasing atmospheric pressure, the keypad cover may compress so much that the keys cannot be pressed.

Under these circumstances, you should loosen the valve on the back of the MC-V. Unscrew it slowly just until the keypad cover lies flat against the keys. Leave it slightly open during operation. When the atmospheric pressure has returned to normal, re-tighten the valve.

💣 **Caution -** With the pressure release valve open or loosened, the MC-V is considerably less water-tight. Do not immerse it under such circumstances.

2.11 Servicing the MC-V

For replacement parts, service information, hardware operating questions, or repair, contact Trimble Navigation Limited at the address and telephone number listed in the Warranty section of the Mapping Systems *General*

Reference manual.

Chapter 3   Installing Asset Surveyor

When you receive an MC-V from Trimble, the MC-V will already have the Asset Surveyor software loaded into its memory. You will only have to install the Asset Surveyor software onto your MC-V under one of the following conditions:

- You have received or purchased an upgrade to your existing Asset Surveyor software.

- You purchased your MC-V without the Asset Surveyor software installed (perhaps your MC-V had one of Trimble's older data collection programs, such as PathLog, installed).

- Your MC-V was stored for an extended period without its batteries being charged, and/or its memory was erased or corrupted.

- You used your MC-V for some other purpose (e.g. to run some software which you had purchased or written yourself), and had to delete the Asset Surveyor software from the MC-V to make room.

- Your MC-V was sent to CMT for servicing, modification or repair, and was returned with its memory emptied.

3.1   Equipment Required for Installation

Firstly, your MC-V must be equivalent to the model distributed by Trimble. It must have:

- The Trimble EPROM

- 256kB of static RAM (program space)

- Either 1MB or 2MB of RAM (data storage space)

There are three stages to the installation procedure, described in detail in sections 3.2 to 3.4. It is necessary to perform all three:

1. Format the MC-V's B: and C: RAM drives (128kB each) into a single 256kB RAM drive. This is used for Asset Surveyor program space.

2. Initialize and format the 1MB or 2MB RAM drive, which is used for data storage.

3. Load the Asset Surveyor software onto the MC-V.

In order to load the Asset Surveyor software onto the MC-V, you will require the following equipment:

- The MC-V Datalogging Software diskette.

- A null-modem 9-pin-to-9-pin cable.

- An IBM-compatible PC with at least one serial RS232 port and at least one high density (1.44MB) 3½" diskette drive.

- Optionally, a 9-pin to 25-pin converter. This is required if your PC has a 25-pin serial port connector.

3.2   Formatting the RAM Drives

If your MC-V is brand new, and has not been used before, do not continue with this procedure until you have charged its battery for approximately 15 hours. Alternatively, you can plug the MC-V into the AC adapter or OSM, power it from the adapter for the rest of the installation procedure, and then charge it for approximately 15 hours before operating it again.

✉   **Note -** Corvallis Microtechnology (CMT), who manufacture the MC-V datalogger, recommend that you charge its internal battery for at least 15 hours, but not more than 17 hours, and that you only recharge it when it has less than 30% of charge remaining, in order to achieve maximum battery life

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These instructions assume that the 1MB or 2MB RAM drive is installed in the MC-V. If it is not, you must install it before continuing.

1. **Press** ☐ON☐ **to turn on the MC-V.**

2. **Enter the MC-V's CMT-ROS operating system.**

   If the Asset Surveyor software is running, exit to Asset Surveyor's 'Main menu' and then exit the Asset Surveyor program itself (by pressing the ☐ESC☐ soft key one more time). When asked whether you really wish to exit the Asset Surveyor program, press ☐Y☐ or the **YES** soft key.

You should now be in CMT-ROS, and can proceed to format the RAM drives.

🕭 **Caution -** Reformatting the RAM drives will result in the loss of any data files currently stored on those drives. You should transfer all data files to your PC before reformatting the MC-V's RAM drives.

3. **Type 'F:' and then press** ⌷ENTER⌷.

4. **Press** ⌷ENTER⌷ **twice more.**

   The screen should now look like this:

   ```
   Current dev = F:
   A: - Memory
   B: - Files
   C: - joined with B:
   D: -
   E: -
   F: - Files
   ```

   The first line of this screen indicates that your current drive is F:. The other lines indicate the status of all drives on the MC-V.

✉ **Note -** In order to format the B: drive (as described in the following steps) your current drive **must** be any drive **other** than B:.

✉ **Note -** Even though the screen is displaying information, you may type any CMT-ROS command on the MC-V's keypad. When the first character is typed, the display will change to show the command as you type it.

5. **Type the following command:**

   ```
   format b: 256
   ```

   and press ⌷ENTER⌷. The MC-V asks:

   ```
   Are you sure (Y/N)?
   ```

Press 'Y' and then press ENTER again. Press any key once the MC-V displays:

```
<any key to continue>
```

Finally, press ENTER once more. Line C: should now read

```
C: - joined with B:
```

If line C: does ***not*** display this text, then the 128kB RAM drive may not be installed. Install the 128kB RAM drive according to the instructions in the CMT *MC-V Operator's Manual*, and repeat steps 1 to 5.

3.3   Initializing and Formatting the 1MB or 2MB RAM Drive

1. **Initialize the 1MB or 2MB RAM drive.**

   Type the following command:

   ```
   EDISK
   ```

   and press ENTER. A message like the following should appear on the screen:

   ```
   CMT EDISK DRIVER
   # of buffers : 4
   I:EDISK
   ```

   Alternatively, the MC-V may simply display the following message:

   ```
   EDISK installed
   ```

   If, however, the MC-V displays a message like:

   ```
   ERROR:
    Bad command or file
    not found
   ```

   then the 1MB or 2MB RAM drive is not working or has not been installed. Install or replace the drive and repeat this step.

2. **Type the following command:**

   ```
   format i:
   ```

   and press ENTER. The following question will be displayed:

   ```
   Are you sure (Y/N)?
   ```

   Answer Y and press ENTER. Formatting will take about 20 seconds.

When the MC-V asks for any key to be pressed, press $\boxed{\text{ENTER}}$. The screen may display:

```
I:\            size:
Bytes free = 1036288
```

Under some versions of CMT-ROS, no message is displayed at all after formatting of the I: drive. Provided no error message appears, you can continue with the installation.

The MC-V is now ready to have the Asset Surveyor software loaded onto it.

3.4   Loading the Asset Surveyor Software onto the MC-V

☆   **Tip -** You are advised to make a backup copy of the MC-V Datalogging Software diskette, and to use this backup copy for installation of the Asset Surveyor software. Store the original diskette in a safe place.

1. **Insert the MC-V Datalogging Software diskette into your PC's floppy drive.**

2. **On the PC, log to the diskette drive (A: or B:). Type**

   ```
   A:
   ```
   $\boxed{\text{ENTER}}$

3. **Connect the MC-V to your PC.**

   Use the 9-pin null-modem cable. Plug one end of the 9-pin null-modem cable into the COM1 port on the MC-V, and plug the other end into the COM1 serial port on your PC, as indicated in Figure 3-1.

   If the COM1 port on your PC is a 25-pin serial port instead of a 9-pin serial port, attach the 9-to-25-pin adapter to the PC end of the null-modem cable.
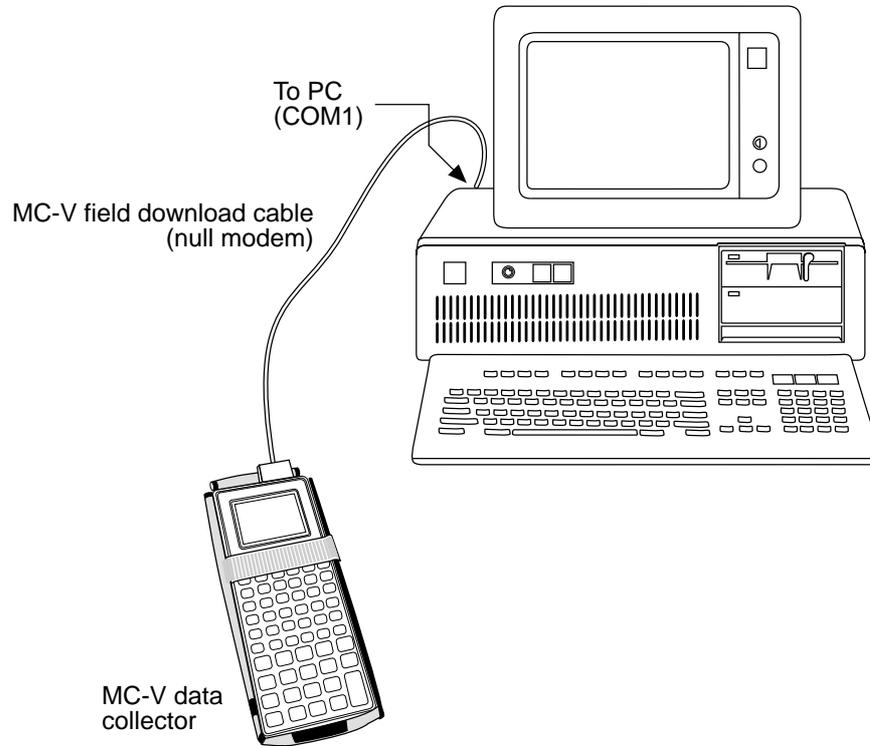
Figure 3-1   Cabling for Installation of the Asset Surveyor Software

4. Copy the AUTOEXEC.S, ASSET.X and GENERIC.DBD files from the PC to the MC-V's 'B:' drive, as follows:

On the MC-V, type the following commands:

```
B:                ENTER ENTER
KERMIT X          ENTER
```

On the PC, type the following command:

```
ASSETB            ENTER
```

Transferring these files to the MC-V's 'B:' drive will take between 10 and 15 minutes. When the PC indicates that the file transfer is complete, press any key on the MC-V.

If an error message appears on the MC-V or the PC:

- Repeat the step. The PC or the MC-V may have automatically ended the file transfer attempt because the other machine was not ready when it tried to access it. The PC will disconnect after 15 tries. The MC-V will disconnect after 10 tries.

- Check that the cable is connected to 'COM1:' on both the PC and MC-V.

- Check the cable connections. They may be loose.

- Verify that `MSKERMIT.INI` is in the same directory as `KERMIT.EXE` on the MC-V Datalogging Software diskette.

- The null-modem cable may be faulty. Try another null-modem cable.

5. **Copy the ENGLISH.LNG and ASCOORD.DAT files from the PC to the MC-V's 'I:' drive, as follows:**

   On the MC-V, type the following commands:

   `I:`   ⸢ENTER⸣⸢ENTER⸣

   `KERMIT X`   ⸢ENTER⸣

   On the PC, type the following command:

   `ASSETI`   ⸢ENTER⸣

   When the PC indicates that the file transfer is complete, press any key on the MC-V.

6. **Restart the Asset Surveyor software by running the AUTOEXEC.S batch file.**

   On the MC-V, type the following command:

   `B:`   ⸢ENTER⸣⸢ENTER⸣

   This will make the MC-V's 'B:' drive the current drive. Now use the ⸢↑⸣ or ⸢↓⸣ arrow keys to highlight the file named 'AUTOEXEC.S'. Press the **RUN** soft key to run the Asset Surveyor software.

Chapter 4   Getting Started

This chapter introduces you to the Asset Surveyor software, its user interface and data entry concepts.

4.1   Starting and Stopping the Asset Surveyor Software

You generally won't have to stop or start the Asset Surveyor software, as you can just turn off the MC-V when you have finished using it and turn it on again when you next want to use it.

4.1.1   Starting the Asset Surveyor Software

When you turn the MC-V on (by pressing ⌷ON⌷), the Asset Surveyor software will normally continue running where it left off. However, if, when you turn the MC-V on, the Asset Surveyor software is *not* running, you can start it from the MC-V's CMT-ROS operating system by running the AUTOEXEC.S program, as described in Chapter 3, or by rebooting the MC-V, as described in Chapter 2.

4.1.2   Stopping the Asset Surveyor Software

You can stop the Asset Surveyor software by exiting to the 'Main menu' and pressing the ⌷ESC⌷ key once more. Typically, however, you will not need to stop the Asset Surveyor software; you can just turn the MC-V off (using ⌷SH2⌷ ⌷ON⌷) and turn it on again when you next wish to use it.

✉   **Note -** You cannot turn the MC-V off while Asset Surveyor is logging data to a file, or while transferring files between the MC-V and the PC.

4.2   The Asset Surveyor Menu Structure

The Asset Surveyor 'Main menu' entries are as follows:

```
┌─ Main menu ─┐
│ Data capture │────────── Create and delete data files, capture data, check file statistics and manage data dictionaries.
│ Navigation   │────────── Navigate to and from waypoints.
│ File transfer│────────── Transfer files to and from PFINDER.
│ Utilities    │
│ Base station │────────── Operate a Pathfinder GPS base station.
│ Info for new users│────── Information for new users of Asset Surveyor.
│ INFO         │
└──────────────┘
          ┌─ Utilities ─┐
          │ Waypoints       │────────── Create, delete and measure between waypoints.
          │ Factory defaults│────────── Reset to factory default configuration.
          │ External sensors│────────── Test ESP external sensors and laser range-finders.
          │ Almanac         │────────── Check the date of the stored GPS almanac.
          │ Reset GPS receiver│──────── Reset the GPS receiver's battery-backed memory.
          └─────────────────┘
```

Asset Surveyor's 'GPS operations' menu appears when you press SH2 *and then the* GPS *soft key.*

```
┌─GPS operations ─┐
│ Position        │────────── View the current (or most recent) GPS position (and perhaps create a waypoint for it).
│ Receiver status │────────── View the GPS receiver's status, including DOPS, SVs in use, battery levels, etc.
│ Satellite info  │────────── View the position and status of each GPS satellite being tracked.
│ Navigation      │────────── Navigate to and from waypoints.
│ Waypoints       │────────── Create, delete and measure between waypoints.
│ 2D altitude     │────────── Enter a new 2D altitude.
│ Disconnect      │────────── Deactivate the GPS receiver.
│                 │
│ SETUP           │────────── Configure the GPS receiver.
└─────────────────┘
```

Asset Surveyor's 'Configuration' menu appears when you press SH2 *and then the* CNFG *soft key.*

```
┌─ Configuration ─┐
│ GPS             │────────── Configure GPS rover options and/or base station options.
│ Coordinate system│───────── Select coordinate systems, zones and datums.
│ Units and display│───────── Configure units, language and other display options.
│ Time and date   │────────── Set the MC-V's internal clock, and configure time and date display options.
│ Quickmarks      │────────── Configure quickmark options.
│ Offsets         │────────── Configure constant offsets for each class of feature.
│ External sensors│────────── Configure an ESP external sensor or laser range-finder.
│ Hardware (MC-V) │────────── Configure the MC-V hardware.
└─────────────────┘
```

Press SH2 *and then the* VIEW *soft key to review and/or edit a data file. When reviewing, you can also delete features and notes, view the position(s) of features and make waypoints from these positions.*

4.3   User Interface Components

You can interact with the Asset Surveyor software in a variety of ways, each of which is described below:

4.3.1   Hard Keys

These are the physical keys on the MC-V's keypad, and include alphabetic and numeric keys as well as special-purpose keys such as ENTER, SP, etc.

4.3.2   Soft Keys

When the MC-V is on, the bottom line of the screen shows a number of *soft* keys, so-called because they vary depending on context. Each of these soft keys corresponds to one of the (hard) *function* keys, numbered F1 to F5. Pressing the corresponding function key activates the function indicated by the soft key label. For example, on the following screen:

```
┌Start feature┐
│▐City street▌ │
│ Highway     │
│ Car park    │
│ Town        │
│ Hydrant     │
│             │
└─────────────┘
 PAUSE REPEAT QUICK EXT ESC

  F1    F2    F3    F4    F5
```
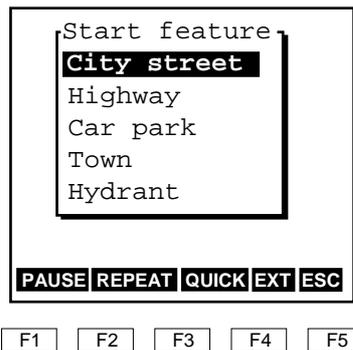
pressing F1 activates the 'Pause' function, pressing F2 activates the 'Repeat' function, etc. There are five 'special' soft keys which are always available by pressing the SH2 key and then choosing a soft key. These five soft keys are as shown below:

GPS   **VIEW**   **NOTE**   **CNFG**   **ESC**
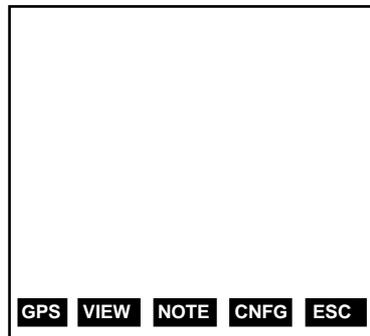
Note that F5 will always correspond to either ESC or **OK**, depending on the context.

Occasionally, there will be too many soft keys on a particular form or menu to fit onto the MC-V's screen. When this happens, the 4th soft key appears as →. You can press → to step from one 'page' of soft keys to the next. Press the soft key you require when its 'page' appears.When there are less than four soft keys, the remaining function key(s) perform no action.

4.3.3 Pop-up Messages

Occasionally, messages will 'pop up' on the MC-V's screen. For example:


```
        ── Warning ──
         The external
        battery is low.
```
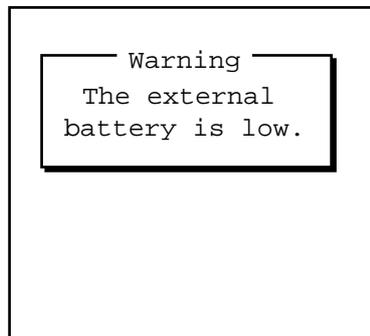
Messages with a 'Warning' or 'Error!' title should be noted and can then be dismissed from the screen by pressing ESC. Other messages will automatically disappear after four seconds, but can also be dismissed manually by pressing ESC.

When Asset Surveyor is performing a lengthy task (anything longer than about two seconds), it will pop up a message. For example:

```
┌────────────────────────────┐
│   ┌─ Please wait ─┐         │
│   │ Searching ... │         │
│   └───────────────┘         │
│                             │
│                             │
│                             │
│                             │
│                             │
└────────────────────────────┘
```

When this message appears, you should wait until Asset Surveyor has completed the task and removed the message itself. If you do not wish to wait for Asset Surveyor to complete the task, you can abort the task by pressing ⌴ESC⌴. There are a few critical tasks which cannot be aborted. If Asset Surveyor is performing a critical task and you press ⌴ESC⌴ to abort it, Asset Surveyor will simply beep and continue with the task.

4.3.4   Pop-up Menus

When there is a choice of actions or answers to a question, Asset Surveyor pops up a *menu*, showing you the possible choices, and allowing you to pick one of them. For example:

```
┌──── Main menu ────┐
│ Data capture      │
│ Navigate          │
│ File transfer     │
│ Utilities         │
│ Base station      │
│ Info for new users│
├───────────────────┤
│ INFO              │
└───────────────────┘
```
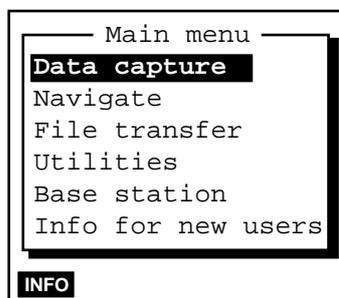
A menu has a 'current' entry, which is highlighted (e.g. **Data capture**). You can choose a different entry from the menu by moving the highlight to your preferred entry and *selecting* it. You can move the highlight in a number of ways:

- The ⌴↑⌴ and ⌴↓⌴ keys move the highlight up or down the menu a single entry at a time.

If you have positioned the highlight on the first (i.e. top) entry in the menu, and then press ▲, the highlight will move to the last (i.e. bottom) entry in the menu. This is a convenient way to travel quickly to the bottom of the menu, and allows you to browse through a menu circularly. Similarly, if you have positioned the highlight on the last entry in the menu, and then press ▼, the highlight will move to the first entry in the menu.

- The PGUP and PGDN keys move the highlight up or down a 'page' at a time. The length of a page is normally 4 entries when GPS is connected and 5 entries without GPS.

  The PGUP and PGDN keys do not behave circularly. Once you are less than a page from the top of the menu, pressing PGUP again will just take you to the first entry in the menu. Pressing it yet again will have no effect. Similarly, once you are less than a page from the bottom of the menu, pressing PGDN again will just move the highlight to the last entry in the menu. Pressing it yet again will have no effect.

- The HOME and END keys move the highlight to the first and last entries in the menu, respectively.

- Pressing an alphanumeric key corresponding to the first letter of a menu entry will move the highlight directly to that entry. If there is more than one entry in the menu starting with that letter, pressing that alphanumeric key repeatedly will step through the entries beginning with that letter.

Once your chosen menu entry has been highlighted, you can *select* it by pressing ENTER. If you highlight a menu entry by typing the first letter of its name, and it is the only entry in the menu which starts with that letter, the entry will be selected automatically.

☆ **Tip -** This 'first-letter' method is often the fastest way of selecting an entry from a menu.

If a menu has more entries than will fit onto the MC-V's screen at one time, the entries in the menu will scroll up and down within the visible pop-up menu. The fact that there are entries which you cannot currently see is indicated by the presence of ↑ and/or ↓ characters on the right-hand border of the menu. For example:

```
┌─── Height ───┐
│Less than 1m  █│
│1-2m          │
│3-5m          │
│6-10m         │
│11-20m       ↓│
└──────────────┘
```
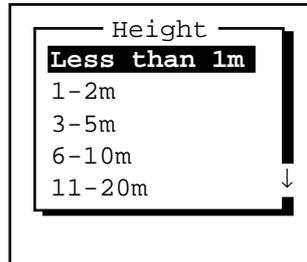
is a menu which has further entries below those which can currently be seen, while

```
┌─── Height ───┐
│1-2m         ↑│
│3-5m          │
│6-10m         │
│11-20m        │
│21-30m       ↓│
└──────────────┘
```
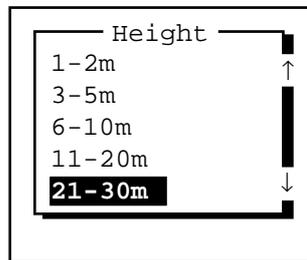
is a menu which has entries both above and below those which can currently be seen.

4.3.5 Questions

Whenever Asset Surveyor asks you a question, it will pop up a message and two soft keys for you to press in response. An example of a question is:

```
┌─Please confirm─┐
│ Clear waypoints │
│file, deleting all│
│current waypoints?│
└──────────────────┘




 NO   YES
```
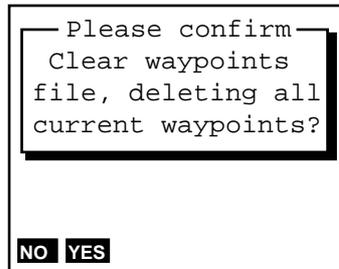
You can answer 'Yes' to a question in a number of ways:

• By pressing YES

• By pressing Y .

Similarly, you can answer 'No' in a number of ways:

- By pressing **NO**
- By pressing N
- By pressing ESC.

4.3.6 Forms

Data entry in the Asset Surveyor software takes place in *forms*. These are like paper forms, in that they are made up of a *title* and a sequence of lines or *fields*. An example of a small Asset Surveyor form is the following:

```
            Tree
Variety:          Pine
Height:           3.4
Girth:               ?
Date:    09/03/93 Fri
Comments: Needs to …
```

Fields

Each field generally has two parts, a *prompt* (or name) and a *value*. Each field's prompt is usually followed by a colon (:), to clearly separate it from the field's value. Some fields are *caption* fields, which have no value and serve simply to divide a form into sections.

The example form shown above has a title ('Tree') and five other fields, each with a prompt (on the left) and a value (on the right).

One field of every form is the *current* field, and is distinguished by being highlighted. Any editing operations on a form apply to the current field. If the field's value can be edited, then the value is highlighted. Otherwise, the field's prompt is highlighted. In the example above, the current field is the second field, with the 'Height' prompt.

If a field's value cannot be shown in its entirety, due to the limited width of the MC-V's screen, ellipses ('…') are used to indicate that part of the field's value is not currently visible. For example, the full value of the 'Comment' field in the example above is 'Needs to be pruned'.

⊠   **Note -** There is a special field value, called the *null* value, which
        denotes no value at all. This is often supplied as the default value for a
        field, to *force* you to enter a real value. The null value is usually
        displayed as a '?' character, but Asset Surveyor allows you to
        configure the null value if you wish.

Windows

The contents of an Asset Surveyor form are displayed in a *window* on the
MC-V's screen. Windows are separated by horizontal lines drawn across the
screen.

Windows vary in size, and often a form will have too many fields (lines) to
fit entirely in its window. When this happens, you can scroll the fields in the
form up and down, by moving the highlight, in order to see the other fields
on the form.

If a form contains too many fields to fit on the MC-V's screen at one time, a
'↓' character will appear on the right-hand-side of the form's title line, as
shown in the following example:

```
     Title line    ↓
Field 1:      Value 1
Field 2:     ▉Value 2▉
Field 3:      Value 3
Field 4:      Value 4
Field 5:      Value 5
Field 6:      Value 6
Field etc: Value etc
```

Moving Between Fields

A form's *current* field is distinguished by having its prompt or value
highlighted. If the field can be edited, then the value is highlighted, but if
the field is purely informative, and cannot be edited, then the prompt is
highlighted instead.

You can move the highlight from field to field using the following keys:

⬆	Moves the highlight up one field.
⬇	Moves the highlight down one field.
PGUP	Moves the highlight up one page.
PGDN	Moves the highlight down one page.
HOME	Moves the highlight to the first field in the form.
END	Moves the highlight to the last field in the form.

A *page* of a form is the same size as the form's window. This means that you can see every field in a form by paging through it pressing PGDN repeatedly.

Some forms are divided into *sections*, where each section starts with a caption field. Typically, the prompts for the fields following a caption are indented slightly, as shown in the following example:

```
File start
 Time:    10:44:12 am
 Date:  09/14/93 Tue
File end
 Time:    06:23:05 pm
 Date:  09/15/93 Wed
```

where the two sections of the form follow the 'File start' and 'File end' captions.

As mentioned previously, all editing operations in a form apply to the current (highlighted) field, so you will want to move the highlight from field to field both to scroll the contents of the form within its window, and also to position the highlight on a field ready to edit that field's value. Fields can be edited in any order.

A caption field can never become the current field, and can never be edited (as it has no value).

Leaving a Form

When you have finished browsing through a form, or have finished editing a form's fields, you can choose to leave it with or without saving its (edited) contents.

You can leave a form without saving its contents by pressing ⌑ESC⌑. If the value of any of the form's fields has changed (i.e. been edited), Asset Surveyor will ask you the following question:
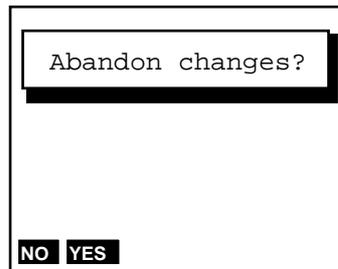
```
┌─────────────────────────────────┐
│   ┌─────────────────────────┐    │
│   │    Abandon changes?     │    │
│   └─────────────────────────┘    │
│                                  │
│                                  │
│                                  │
│                                  │
│                                  │
│                                  │
│ NO  YES                          │
└─────────────────────────────────┘
```

If you answer 'Yes', any changes which you have made to the form's fields will be discarded. If you answer 'No', you will be returned to the form.

You can leave a form and save its contents by pressing **OK**. When you do this, Asset Surveyor will validate the form, checking each field for consistency and completeness and then save the form's new contents.

Editing Fields

In general, each field's value can be changed or edited. Before you can change the value of a particular field, you must move the highlight to that field.

There are two ways of changing the value of the current (highlighted) field:

- *Type the complete new value into the field*. Once you have highlighted the appropriate field's value, you can just type in the new value. This will replace the field's old value.

- *Edit the field's existing value*. You indicate that you wish to edit the current field's value by arrowing into it using ⌑→⌑ (which starts editing at the left-hand end of the original value) or ⌑←⌑ (which starts editing at the right-hand end of the original value).

Once you have started to enter a new value for a field, or to edit the existing one, the appearance of the field will change, and a flashing *cursor* will appear. For example, if you moved the highlight to the 'Height' field of the example 'Tree' form and pressed ⌑→⌑ to start editing the existing value of that field, the MC-V's screen would look as follows:

```
            Tree
Variety:          Pine
Height:   █.4
Girth:              ?
Date:   09/14/93 Tue
Comments: Needs to …
SV 4/6 PDOP 2.4 # 23
```

Each character you type will be inserted into the field at the location of the cursor, and the cursor will move one position to the right, ready for the next character to be typed.

You can move the cursor about within the field using ⬅ and ➡.

You can delete the character which is 'under' the cursor (e.g. the '3' in '3.4' in the example above) by pressing DEL. You can delete the character to the left of the cursor, and move the cursor one character to the left in the process, by pressing ←.

Insert and Overwrite Modes

The Asset Surveyor software usually operates in 'insert' mode, where each character you type is inserted at the cursor position and pushes the current character in that position to the right, after which the cursor moves one position to the right as well. You can put Asset Surveyor into 'overwrite' mode by pressing INS. In overwrite mode, each character you type overwrites the current character at that position, after which the cursor moves one position to the right. Pressing INS again will put Asset Surveyor back into 'insert' mode.

Leaving a Field

If you start editing a field and decide that you would rather not proceed, pressing ESC reverts back to the field's previous value and abandons the editing of that field.

When you have changed the field's value to your satisfaction, you can:

• Press ⬆ to move to the previous field in the form.

• Press ⬇ or ENTER to move to the next field in the form.

• Press OK to validate and save the entire form.

Before moving to another field, Asset Surveyor will *validate* the new value for the field which you have just changed. If the field's new value is inappropriate, you will be informed of this fact and asked to change it. The Asset Surveyor software will *not* accept an inappropriate value for a field.

Certain fields behave in special ways when being edited, and have special validation rules, as explained in the following section.

Field Types

Each field belongs to a particular *type* or class, and the type of the field determines the kind of value it can have. The types of field supported by the Asset Surveyor software are:

- Captions, which are not editable and have no value.

- Alphanumeric character string fields, which allow the entry of any characters (i.e. letters, digits and punctuation characters), up to a certain maximum length. An example of an alphanumeric string is the comment 'Needs to be pruned'.

- Numeric fields, which allow the entry of numbers, with or without attached units. An example of a numeric value is '3.4'.

- Menu fields, which allow you to select one of a small set of specific values. For example, a menu field might allow you to choose between values of 'Yes', 'No' and 'Maybe'.

- Date fields, which allow the entry of a calendar date. An example of a date value is '09/03/93 Fri'.

- Time fields, which allow the entry of a time of day. An example of a time value is '10:44:12 am'.

The following sections discuss each of the Asset Surveyor field types in more detail.

Alphanumeric Fields

An alphanumeric field will accept values made up of almost any character you can type (and a few you can't). Such a field could be used for storing a

street address, a person's name, or a description of a fault in a piece of equipment.

When you are entering a value into an alphanumeric field, Asset Surveyor will make a **SYMB** soft key available. Pressing this soft key will cause a menu of special punctuation symbols to pop up, e.g.

```
 ┌Symbols┐
 │  SH2 D │
 } SH2 J
 ~ SH2 Z
 Ç
 ü              ↓
```
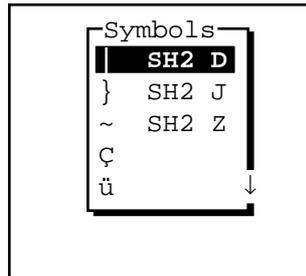
If you select an entry from this menu, the special character will be inserted into the alphanumeric field which you were editing, at the current cursor position. If you decide not to insert a special character after all, press `ESC` to dismiss the menu.

The pop-up menu of special symbols will highlight the entry that you last selected, for convenient re-selection.

✉ **Note -** The 'Symbols' menu also indicates which special characters can be typed directly using a `SH2` key sequence.

Numeric Fields

Numeric fields store and display numeric values in a range of formats, separated into two main classes:

- For *integer* (i.e. non-fractional) numeric fields, Asset Surveyor will only allow you to enter digits and a '-' sign. An integer field could be used to store the number of wheels on a vehicle, or the number of ducks on a pond. Examples of integer numeric values are:

  4, 123, -987, 0

- For *non-integer* numeric fields, Asset Surveyor will permit you to type digits, a '-' sign, a decimal point ('.'), and the 'E' (or 'e') convention for scientific notation. A non-integer field could be used to store a bank

account balance, or the length of a vehicle. Examples of non-integer numeric values are:

1.4, 0.005, -1.23, 1.2E10, 5.678e-3

⊠   **Note -**The notation employing 'E' (or 'e') to represent a power of 10 is called exponential or scientific notation, and is used to enter very large or very small values. For example, a value such as 12000000000.0 could either be entered as

'12000000000.0'   or, as   '1.2e10'.

Because scientific notation is very compact, it tends to be used by engineers and scientists, who often have to deal with very large and very small numbers.

Many non-integer numeric values represent a measurement of a physical phenomenon and have associated *units*. Such values belong to physical domains such as distance, speed, time, etc. Asset Surveyor knows about each of the base domains, and can convert values from one unit to another within a domain.

If a non-integer numeric data field has an associated units domain, Asset Surveyor will prohibit the entry of values or units which are inappropriate for that domain. Each field displays its contents in a specific unit or sequence of units, but you can enter values in the most convenient unit, provided you use a unit appropriate for the domain of the field. For example, you can type a value into an 'Antenna height' field in meters, feet or inches, but not in °C or kilograms. If the 'Antenna height' field's display units are meters, then values entered in feet or inches will be converted to meters and displayed that way once they have been validated.

The Asset Surveyor software allows you to configure the units used for most numeric fields to suit your application or preference, as described in Chapter 7.

Some examples of numeric fields with units are as follows:

- If a field represents a *distance*, and Asset Surveyor has been configured to display distances in meters, entry of the values:

    54.5,

    54.5m,

    0.0545km,

    0.0339029mi,

    178.82ft, or

    2145.84in

    would all yield the final value 54.5m in the field.

⊠   **Note -** You do not have to specify units if the field's display units are the same as the units of the value you enter into that field. In the above example, entering '54.5' was the same as entering '54.5m'.

- If a field represents an *angle*, and Asset Surveyor has been configured to display angles in degrees, minutes and seconds, entry of the values

    20.332777778,

    20.332777778°,

    20 19 58, or

    0.354873918299 rad

    would all yield the final value 20°19'58" in the field.

⊠   **Note -** Some numeric values can be displayed using more than one unit (e.g. degrees, minutes and seconds for angular values). You can enter values using a sequence of units (e.g. 20°19'58"), or you can just separate values with spaces (e.g. 20 19 58), in which case Asset Surveyor applies each display unit in sequence to successive values.

- The location of a geographic entity on the earth's surface can be specified as a latitude and a longitude. Asset Surveyor will display latitudes and longitudes in degrees, minutes and seconds, so you can enter the location of Trimble's headquarters in Sunnyvale, California, by

typing the following values into appropriate latitude and longitude fields:

37°23'40.09" N

122°02'16.77" W

where the 'N' and 'W' denote latitude North of the equator and longitude West of the Greenwich meridian. When entering a latitude or longitude, the letters N, S, E, W (for North, South, East or West) may be entered before or after the actual latitude or longitude value.

⊠ **Note -** '+' or '-' signs may be used instead of the letters N, S, E or W, where positive latitude is North of the equator and positive longitude is East of Greenwich. The sign may be entered before or after the value.

☆ **Tip -** If you enter a position as a latitude and longitude, and do not explicitly specify the hemisphere, the Asset Surveyor will presume that you intend the position to be in the hemisphere in which you are currently operating, as determined by your most recent GPS position.

To assist with the entry of units, Asset Surveyor provides a **UNITS** soft key whenever you are entering a value into a numeric field which has units. Pressing this soft key causes a menu of available units to pop up, from which you can select the unit(s) you wish to attach to the value you are entering.

For example, if you press the **UNITS** soft key when entering a 'Distance' value, the pop-up menu of available units will appear as follows:

```
 ┌──── Distance ────┐
 │ Meters (m)       │
 │ Feet (ft)        │
 │ Inches (in)      │
 │ Yards (yd)       │
 │ Kilometers (km)↓ │
 └──────────────────┘
```
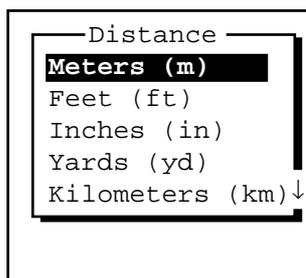
You can select a suitable unit for the 'Distance' value you are entering from this list.

⊠   **Note -** The list of available units indicates the abbreviation for each unit in parentheses (). You can enter the abbreviation for a unit directly using the keypad, if you prefer.

Menu Fields

The Asset Surveyor software uses pop-up menus to provide you with a choice between a number of alternatives. Sometimes, fields in a form can also take one of a number of discrete values, and Asset Surveyor also uses a pop-up menu to allow you to choose a value for such a field.

In our example form, the first field (the tree's 'Variety') could be a menu field:

```
            Tree
Variety▉           Pine
Height:            3.4
Girth:               ?
Date:   09/14/93 Tue
Comments: Needs to …
SV 4/6 PDOP 2.4 # 23
```

⊠   **Note -** A menu field is indicated by a menu symbol (▉) in place of the colon, when that field is highlighted.

There are a number of ways of selecting a new value for a menu field:

* Pop up the menu and select a value, as described for normal Asset Surveyor pop-up menus. You can pop up the menu for a menu field by positioning the highlight on that field and pressing ENTER.

* Select a value immediately by typing its first letter. This is a very quick way to select a value for a menu, once you know the possible values for that menu field. If the key you press does not correspond to the first letter of any entry in the menu, the menu will pop up so that you can see the list of possible values and then select one. Similarly, if the key you

press corresponds to the first letter of more than one entry in the menu, the menu will pop up and allow you to see the various choices.

- Step forward through the values in the menu using the [→] key and backward through the values in the menu using the [←] key. Using this method, the menu is circular, so that if you reach the first element in the menu and press [←], you will step to the last element in the menu. Similarly, if you reach the last element in the menu and press [→], you will step to the first element.

The latter two methods of selecting values for menu fields are provided for the convenience of experienced Asset Surveyor users. You will probably begin by popping up each menu and selecting from the displayed list of values, but as time goes by you will start to use these shortcuts to make selecting values for menu fields even faster.

Date Fields

A date field can be used to record any calendar date since the Gregorian calendar came into being (on Friday the 15th of October, 1582). Dates prior to this cannot be entered, as the Asset Surveyor software does not support the previous (Julian) calendar.

Different countries use different conventions for the entry and display of calendar dates. The Asset Surveyor software may be configured to display dates in

- MM/DD/YYYY,

- DD/MM/YYYY, and

- YYYY/MM/DD

formats, where MM represents the month, DD the day, and YYYY the year. For example, in MM/DD/YYYY format, the 4th of July 1976 would be displayed as:

07/04/1976

Note that if the year is entered as two digits it is presumed to be in the current century as determined by the MC-V's internal clock. Thus, 76 would be interpreted as 1976. If you wish to enter a date from a different century, type the year in full.

When you are entering a value into a date field, Asset Surveyor makes two soft keys available to assist you, e.g.

```
            Tree
Variety:             Pine
Height:               3.4
Girth:                  ?
Date:      09/14/93 Tue
Comments: Needs to …
SV 4/6 PDOP 2.4 # 23
  /    TODAY
```

Asset Surveyor makes a ▮ / ▮ soft key available.

✉ **Note -** The Asset Surveyor software also accepts dates entered with spaces between the components, e.g. '7 4 76', but will always format and display dates itself with the '/' character as a separator.

The TODAY soft key can be pressed to fill in the field with the current date (as determined from the MC-V's internal clock). Many Asset Surveyor date fields are filled in with the current date automatically, and you only need to enter the date manually if this automatic date is incorrect.

Asset Surveyor automatically works out the day of the week from the date that you have entered, and displays it as a means of checking that you have entered the correct date.

Time Fields

A time field is used to store the time of day, and may either be filled in automatically from the MC-V's clock, or entered manually.

✉ **Note -** A time field is not used for storing *elapsed* time (e.g. the amount of time taken for an athlete to complete a race); this is better represented as a numeric field.

Hours, minutes and seconds are delimited by a colon (':') character. Times are displayed using either 12- or 24-hour clock format. In the 24-hour clock format, '4:30pm' would be displayed as '16:30'. Asset Surveyor allows the entry of time in either format. If the entered time is less than '12:00' and 'p.m.' is not specified then 'a.m.' is assumed. The Asset Surveyor software can be configured to display times in either format.

When you are entering a value into a time field, Asset Surveyor makes four soft keys available to assist you:

- Because the ':' character is inconvenient to type on the MC-V's keypad Asset Surveyor makes a ▮:▮ soft key available.

✉   **Note -** The Asset Surveyor software also accepts times entered with spaces between the components, e.g. '4 30 00', but will always format and display times itself with the ':' character as a separator. Neither minutes nor seconds need be entered, but if minutes are desired then hours must be present, and if seconds are desired then both hours and minutes are required. For example, 10 o'clock in the evening could be entered as '10pm', '22', '10:00pm', '22:00', '10:00:00pm', '22:00:00', or '10:0:0pm'.

- The **NOW** soft key can be pressed to fill in the field with the current time (as determined from the MC-V's internal clock, which will be precisely aligned to UTC time if a GPS receiver is currently connected). Many Asset Surveyor time fields are filled in with the current time automatically, and you only need to enter the time manually if this automatic time is incorrect.

- The **AM** soft key can be pressed to insert the character sequence 'am' into the field. This is generally unnecessary, as Asset Surveyor will presume that a time less than 12:00 falls in the morning, in the absence of any explicit 'pm' indication.

- The **PM** soft key can be pressed to insert the character sequence 'pm' into the field. This is necessary if you wish to enter a time after noon in 12-hour format.

4.3.7 Barcodes

A barcode wand can be used to enter GIS attribute data. You must use Trimble's PFINDER software to print a list of barcodes corresponding to a particular data dictionary. These barcodes can then be used for entry of menu field values whenever you are capturing data to a file which uses that data dictionary. When the barcode for a particular menu value is swiped, the new value for that menu field is decoded from the barcode.

Attribute entry and data dictionaries are described in more detail in Chapters 6 and 7.

4.4   File Naming Conventions

The Asset Surveyor software is designed primarily for the capture of GIS and GPS data and the storage of this data in files on the MC-V. These files can be individually named, but because you may need to capture a vast quantity of data which is all very similar in nature, it can be difficult to think of meaningful yet distinct names for data files. Asset Surveyor automatically suggests a name for each new data file when it is created.

For the purposes of automatic naming, Asset Surveyor data files are divided into two classes, called *rover* and *base station* files. Most data files will be rover files. The Asset Surveyor software allows you to capture GIS feature and attribute information to rover files, along with GPS positions, etc. Asset Surveyor also allows you to use your Trimble GPS receiver as a GPS base station, which results in the creation and recording of base station files. Operating an Asset Surveyor base station is described in detail in Chapter 7.

When a rover data file is created, Asset Surveyor suggests a default file name according to the following formula:

R MM DD HH x

where the initial letter 'R' identifies the data file as being a rover file, MM is the current month, DD is the current day of the month, and HH is the current hour of the day. The final letter 'x' will increment within this hour, starting at 'a' for the first file in that hour, then going to 'b' for the second file and 'c' for the third file, etc.

✉   **Note -** The date and time used for naming of data files is, by default, UTC (GMT) time. You can specify that Asset Surveyor should use local time to name rover files by pressing the **TIME** soft key and selecting 'Local' from the pop-up menu. If the default file name looks odd, check that the MC-V's internal time and date are set correctly.

☆ **Tip -** The initial letter 'R' can be changed, in which case subsequent
rover data files will be given the new initial letter. This allows you to
uniquely name data files from a fleet of Asset Surveyor rovers, using
initial letters like 'X', 'Y', 'Z'. To change the initial letter of a file
name to 'X', simply type 'X' and then press ENTER to move on to the
next field in the form. Asset Surveyor will automatically regenerate
the default file name with an 'X' prefix.

Some examples of default rover file names for the morning of the 15th of
September are:

    R091510a,

    R091510b, and

    R091511a.

Remember that the default file name suggested by Asset Surveyor is simply
a *suggestion*. You can change the suggested name or enter an entirely
different name. You can use such file names as:

    SURVEY1,

    SC0090, and

    RONALD

if you wish. File names can be at most eight characters long, and are
composed of letters and digits only (i.e. no spaces or punctuation characters
are permitted).

Trimble suggests, however, that unless you will be dealing with a small
number of data files at a time, you should consider using the automatic file
names, as these assist with identifying files by time and date.

Asset Surveyor suggests default names for base files which are formatted
slightly differently from those suggested for rover files. They follow the
formula:

    B Y MM DD HH

where the initial letter 'B' identifies the file as being a base station file, Y is
the last digit of the current year, MM is the current month, DD is the current
day of the month and HH is the current hour of day. This is the format used
by Trimble's Pathfinder Community Base Station™ software.

⊠   **Note -** As with rover files, the default base file name can be
constructed using either local or UTC (GMT) time, the default being
UTC. Press the **TIME** soft key to select which time system you wish to
be used for base station file names.

☆   **Tip -** As with default rover file names, the initial character 'B' of a
default base file name can be changed, in which case subsequent base
data files will be given the new initial character. This allows you to
conveniently name data files from a number of base stations
separately, e.g. Bases A to C could use the initial letters 'A', 'B' and
'C'.

Some examples of default base file names for the morning of the 25th of
January 1995 are:

    B5012510

    B5012511

    B5012512.

As with rover files, you can edit the suggested file name or replace it
entirely, but Trimble suggests that you use the default names for base files
so that they will be consistent with base files from other Trimble products,
and because the time and date of a base file is crucial to its use for
differentially correcting rover files.

⊠   **Note -** Trimble's Pathfinder Community Base Station software can be
configured to use either local time or UTC (GMT) time to construct
base file names. Trimble's Universal Reference Station software uses
local time when constructing base file names. When matching base
and rover files for differential correction, it is important to be aware of
the naming conventions and time scales used by these software
systems.

4.5   Software and Firmware Version Numbers

In order to determine the version of the Asset Surveyor software you are running, turn your MC-V off and on again. When it is turned on it will briefly display a screen showing the Trimble logo, a copyright message, and the software version number.

If you ever need to call Trimble Navigation Limited with questions about the Asset Surveyor software, you should first determine the software version you are currently running, using the above procedure.

You can also determine which firmware version is installed in your GPS receiver, as described in Chapter 7 (in the GPS 'Receiver status' form).

Chapter 5   Before Collecting Data

Before you take your MC-V out into the field and use it to collect data, there are a number of actions you should perform. These include checking the critical configuration settings in the Asset Surveyor software itself, creating and/or loading a data dictionary onto the MC-V, checking the prevailing GPS conditions, and checking your GPS equipment.

5.1   Configuration Settings

The Asset Surveyor software can be configured in a large number of ways; the configuration settings are divided into three classes:

- *Critical settings*. A configuration setting is considered *critical* if it affects the quality and usability of GPS positions logged by Asset Surveyor. It is *crucial* that you check all critical settings before capturing data or navigating with Asset Surveyor.

- *Non-critical settings*. Settings which affect the behavior of Asset Surveyor but do not have a potentially detrimental impact on GPS positions are termed *non-critical*. You should still check each non-critical setting before capturing data or navigating with your Asset Surveyor, but forgetting to do so will not affect the quality of GPS positions logged.

- *Display settings*. Many settings have no impact on the data which is captured, but merely alter the way data is displayed. You need not alter any display settings unless you prefer to have data displayed in a way which differs from Asset Surveyor's default settings.

The next three sections briefly outline the three classes of settings, and refer you to the appropriate pages of Chapter 7, the *Reference Guide*, which provide detailed descriptions of each setting.

5.1.1 Critical Settings

The critical configuration settings are listed in the table below. For each setting, the default (and suggested) value is indicated, and a page reference to a detailed description of that setting in Chapter 7 is provided.

All critical settings can be checked or changed by selecting GPS 'Rover options' or GPS 'Base stn options' from the 'GPS' menu, which is accessed from the 'Configuration' menu. You can pop up the 'Configuration' menu by pressing ⌷SH2⌷ then **CNFG**.

Setting	Default value	See page
Logging intervals		
Point feature	1 second	7-4
Line and area features	5 seconds	7-4
Not in feature	None	7-4
Velocity	None	7-4
Measurements	5 seconds (for a base)	7-36
Carrier phase measurements	Off	7-23
Minimum positions (point feature)	180	7-6
Position mode	Manual 3D	7-8
Elevation mask	15° (for a rover) 10° (for a base)	7-11 7-38
Signal-to-noise ratio mask	6.0 (for a rover) 4.0 (for a base)	7-12 7-38
PDOP mask and switch	6.0 (for a rover) 8.0 (for a base)	7-13 7-38

The settings noted above are critical for the following reasons:

- If a *Logging interval* is set incorrectly, Asset Surveyor will not log data as often as you require, and may possibly not log certain data at all.

- If the *Minimum positions* setting is incorrect, you may not log sufficient GPS positions for point features to achieve your desired level of accuracy.

- If the *Position Mode* setting is incorrect, Asset Surveyor may log 2D positions (which are generally much less accurate than 3D positions) when 3D positions are required. If it is necessary to log only *overdetermined* positions (5 or more satellites) to achieve a desired level of accuracy, then 'Overdet. 3D' mode should be used.

- If the *Elevation mask* is set too low, your GPS rover may use satellites which are not visible or usable by the base station. This may make it impossible to differentially correct the data you have logged.

- If the *SNR mask* is set too low, your GPS rover may log positions which are inaccurate due to low signal quality.

- If the *PDOP mask* is set too high, your GPS rover may log inaccurate positions due to poor satellite geometry.

For further details about each critical setting, consult the referenced pages of Chapter 7, the *Reference Guide*.

> ☆ | **Tip -** When using a Pro XL or GIS Surveyor system, you can obtain sub-meter accuracy with a single position, and can therefore reduce the 'Minimum posns' setting to 1 if you wish to minimise the amount of time spent recording each point feature.

5.1.2 Non-critical Settings

The non-critical configuration settings are listed in the table below. For each setting, the default (and suggested) value is indicated, and a page reference to a detailed description of that setting in Chapter 7 is provided.

All non-critical settings can be found under one of the entries in the 'Configuration' menu. The table below also indicates under which entry in the 'Configuration' menu you will find each setting. You can pop up the 'Configuration' menu by pressing ⌷SH2⌷ then **CNFG**.

Setting	Default value	Configuration Menu Entry	See page
Antenna options	Compact dome, 0.0m	GPS Rover options and GPS Base station options	7-25 7-38
Initial position	?	GPS Rover options	7-17
Audible click	Yes	GPS Rover options	7-15
Log DOP data	Yes	GPS Rover options and GPS Base station options	7-16 7-37
Dynamics code	Land	GPS Rover options	7-18
RTCM input options	Auto mode, 9600,N,8,1	GPS Rover options	7-29
Receiver output options	None	GPS Rover options	7-31
P(Y) options	On/Query	GPS Rover options	7-28
Time	N/A	Time and date	7-64
Date	N/A	Time and date	7-65
Quickmark options	Defaults, No confirmation	Quickmarks	7-66
Offsets	Off	Constant offset	7-68
LCD contrast	32%	Hardware (MC-V)	7-72
Backlight	Off	Hardware (MC-V)	7-72
Auto shutoff	20 minutes	Hardware (MC-V)	7-73
Key click	On	Hardware (MC-V)	7-73

5.1.3 **Display Settings**

The display configuration settings are listed in the table below. For each setting, the default (and suggested) value is indicated, and a page reference to a detailed description of that setting in Chapter 7 is provided.

All display settings can be found under one of the entries in the 'Configuration' menu. The table below also indicates under which entry in the 'Configuration' menu you will find each setting. You can pop up the 'Configuration' menu by pressing ⌑SH2⌑ then **CNFG**.

Setting	Default value	Configuration Menu Entry	See page
Coordinate system	Lat/Long WGS-84	Coordinate system	7-39
Units			
Coords units	Meters	Units and display	7-51
Height units	Meters	Units and display	7-51
Distance units	Meters	Units and display	7-52
Velocity units	Km/hour	Units and display	7-52
Angle units	Degrees	Units and display	7-52
Angles format	DD.MMSSss	Units and display	7-54
Coordinate order	North/East (Lat/Long)	Units and display	7-55
Altitude reference	Mean Sea Level	Units and display	7-56
North reference	True North	Units and display	7-57
Magnetic declination	Automatic	Units and display	7-58
Null string	?	Units and display	7-60
Language	English	Units and display	7-61
24-hour clock	No	Time and date	7-63
Date format	MM/DD/YYYY	Time and date	7-64

5.2   Data Dictionary Creation and Loading

A *data dictionary* is 'data about data', and is used by PFINDER and Asset Surveyor to describe the data you collect. Before capturing data with Asset Surveyor, you should create a data dictionary in PFINDER and define the features, attributes and attribute values that are appropriate for your particular application or project.

A comprehensive discussion of data dictionaries can be found in the *PFINDER User's Guide*.

Once a data dictionary has been created in PFINDER, it should be loaded into your MC-V before you proceed to capture data.

$\boxtimes$ **NOTE -** You do not need to define a data dictionary if you just wish to capture GPS positions, but it makes sense to add value to the positional data you collect by recording as much relevant attribute information as you can.

The Asset Surveyor software allows you to load many data dictionaries onto the MC-V, so you can easily set up your Asset Surveyor system to capture data for as many different projects as you like.

The procedure for transferring a data dictionary to a datalogger running the Asset Surveyor software is as follows:

1. **In PFINDER:**

   - Set the current project according to the instructions in the PFINDER manual.

   - Create the data dictionary according to the instructions in the PFINDER manual.

   - Under the 'Co<u>mm</u>' menu, select the serial port on the PC to which the MC-V will be connected.

2. **On the MC-V:**

   - Turn on the MC-V.

   - Connect 'COM1' on the MC-V to the selected COM port on the PC, using the null-modem 9-pin to 9-pin cable (part number 18532). If your PC has a 25-pin COM port, use the supplied 9-to-25 adapter (part number 14283).
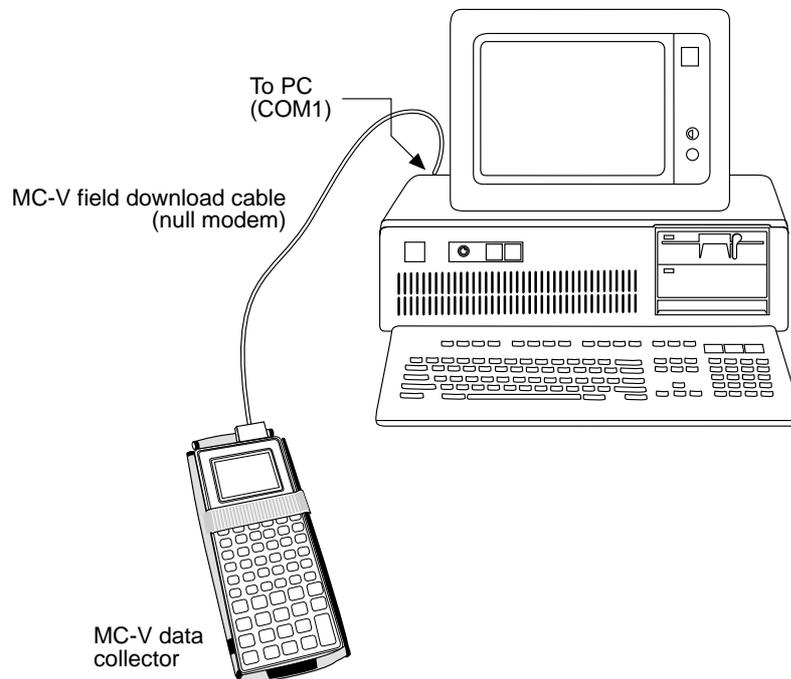
Figure 5-1   Cabling for Data Dictionary Transfer

- From Asset Surveyor's 'Main menu', select 'File transfer'.

3. In PFINDER:

- Select the '<u>D</u>ata Dictionary to Data Logger' entry from the 'Co<u>m</u>m' menu.

- PFINDER will then display a list of data dictionaries in the current project. Select the data dictionary you wish to send to the MC-V and press ⌊Okay⌋ on the PC.

The selected data dictionary will be transferred to the MC-V. You may then disconnect the cables and quit PFINDER. The most recent data dictionary loaded onto the MC-V will be treated as the *current* data dictionary by Asset Surveyor, and will be offered as the default data dictionary when you next create a data file on the MC-V. Whenever you create a data file, you can choose which of the available data dictionaries will be associated with the new file.

5.3   Checking GPS Conditions

Before setting out to use Asset Surveyor and your Trimble GPS receiver to capture data or navigate, you should check the GPS conditions which will prevail during your survey.

> **Tip -** Perhaps the most frustrating thing that can happen to a user of GPS is to find themselves at a specific location at a time when there are insufficient GPS satellites available to record positions. With the GPS constellation essentially complete, this situation occurs far less frequently than it did even one or two years ago, but even when the full complement of GPS satellites are operational there will be times when the satellite constellation and local geography will be such that there are insufficient satellites (subject to your configured masks) to obtain a GPS position. You should use Trimble's *Mission Planning* software to ensure that you do not waste valuable field time waiting for satellites to rise or move into view.

Trimble's PFINDER software includes two Mission Planning software suites, PROPLAN and QUICKPLAN. PROPLAN is a DOS-based Mission Planning program which has been distributed with earlier versions of the PFINDER software, and is described in the *PFINDER Users Guide*. QUICKPLAN is a new Microsoft Windows-based program which is supplied with PFINDER versions 2.5 and later, and is also distributed with Trimble's GPSurvey software.

To ensure that Mission Planning provides you with an up-to-date prediction of GPS conditions you should frequently update the GPS almanac to be used by PROPLAN or QUICKPLAN.

- If you have a Pathfinder GPS receiver, Asset Surveyor will record an almanac every time you use the receiver. You can extract this almanac from the MC-V as described in Chapter 7.

- If you have a 4000 Series GPS receiver, you can start a survey on the receiver in order to record an almanac into its memory. This almanac can then be extracted as described in the *GIS Surveyor Operation Manual*.

5.4   GPS Hardware Check List

Before setting out to collect data with Asset Surveyor and your Trimble GPS receiver, you should check that you have all the necessary GPS hardware, batteries, cables, etc. It is very easy to forget a crucial piece of equipment, and this can be frustrating or costly if you have driven or flown to a remote site before setting up your system and discovering the missing item.

Your GPS receiver's *Operation Manual* and Appendix B, *GPS Systems*, provide full equipment checklists and cabling diagrams for the Trimble GPS systems of which the Asset Surveyor software is a component.

☆	**Tip -** Trimble suggests that you always set up your entire GIS/GPS data collection system and test it, to ensure that everything is connected correctly, that your batteries are charged, and that your Asset Surveyor and GPS receiver are communicating correctly, *before* you leave your office.
💣	**Caution -** After testing the system, remember to turn off the MC-V, the GPS receiver and any other equipment (such as radios) before proceeding to the start point of your survey. Leaving equipment powered on is likely to waste battery life, especially if it will be some time before you need to use the equipment.

Finally, you are encouraged to take with you the Asset Surveyor Quick Reference Guide; this provides an overview of the system as well as a number of important details which may be difficult to remember.

Chapter 6   Using the Asset Surveyor Software

This chapter provides instructions and examples of capturing data, navigating and performing other tasks with the Asset Surveyor software. It provides a general description of each aspect, and defers all details to Chapter 7, the *Reference Guide*.

6.1   An Asset Surveyor Check List

The following is a general check list which you should follow when using the Asset Surveyor software to capture data or navigate:

1. **Run PFINDER on your PC and transfer any data dictionaries you will require to your MC-V.**

   You may also wish to transfer a coordinate system file, language file or set of waypoints to the MC-V.

2. **Check all critical settings.**

   You should also check non-critical and display settings, especially if your MC-V has been used by someone else recently.

3. **Check that you have all of the equipment you will require, and that it is all operational.**

   Check that all batteries are charged, and that the Asset Surveyor software and GPS receiver are communicating correctly. Turn everything off and pack it into carrying cases if you have to travel a significant distance to the survey site. Pack spare sets of batteries if you expect to be operating for any length of time.

4. **Travel to the survey site, remembering to carry all of the required equipment with you.**

5. **Assemble the system as shown in Appendix B.**

6. **Turn on the GPS receiver (if it has a separate power switch) and then turn on the MC-V.**

If the Asset Surveyor software is not running, restart it as described in Chapter 2.

7. Go to the Asset Surveyor Software's 'Main menu'.

If, when you turned the MC-V on, the Asset Surveyor software established communications with the GPS receiver, wait until the receiver has acquired sufficient satellites (3 in 2D mode, 4 in 3D mode, 5 in Overdetermined 3D mode) to compute positions. If Asset Surveyor failed to connect to the GPS receiver, check all of your cabling and batteries and then press **GPS** to cause Asset Surveyor to retry GPS.

8. Once the GPS receiver has acquired enough satellites to start computing GPS positions, you can start work.

You can now create a new rover data file, or re-open an existing one. Asset Surveyor will then begin to log data to it.

Alternatively, if your application involves navigation, you can select a waypoint and begin navigating.

You can change configuration settings while you are using Asset Surveyor. Altered configuration settings usually take effect immediately.

9. When you have finished logging data, close the data file by exiting data capture.

You can now repeat steps 7 and 8, recording a number of different data files (each possibly being associated with a different data dictionary).

10. When you have finished logging data, and have closed the last data file, turn off the MC-V.

Remember to turn off the GPS receiver if it has a separate power switch (and has not automatically been turned off by Asset Surveyor).

11. Disconnect the components of your system and re-pack them in traveling cases before returning to your office.

12. When you reach your office, run PFINDER on your PC and transfer all data files from your MC-V to the PC.

13. Recharge the MC-V and GPS receiver batteries if necessary.

6.2   Starting the Asset Surveyor Software

As you read this chapter, you may like to follow the description of the Asset Surveyor software's capabilities on your MC-V. You will require your GPS receiver to be connected and operational, although you needn't be outdoors.

This chapter describes the Asset Surveyor software as it is pre-configured. If you have re-configured various Asset Surveyor settings, its behavior may differ from the text of the manual.

As described in Chapter 2, you normally start the Asset Surveyor software by simply turning your MC-V on. If, when you turn your MC-V on, the Asset Surveyor software is not running, follow the instructions in Chapter 2 to start the Asset Surveyor software.

When you first start the Asset Surveyor software, the Main menu will appear on the MC-V's screen:

```
┌──── Main menu ────┐
│ Data capture      │
│ Navigation        │
│ File transfer     │
│ Utilities         │
│ Base station      │
│ Info for new users│
└───────────────────┘
 INFO
```
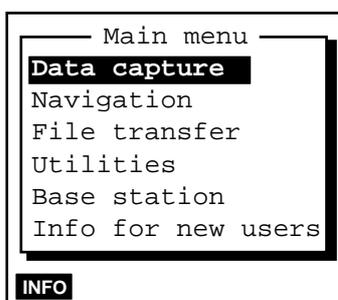
From this menu, you can choose one of the five main Asset Surveyor operations. The sixth entry in the menu ('Info for new users', also accessible using INFO) provides access to information for new users of the software (see page 7-160).

You can configure the Asset Surveyor software by pressing CNFG . The Asset Surveyor software's 'Configuration' menu is as follows:

```
┌── Configuration ──┐
│ GPS               │
│ Coordinate system │
│ Units and display │
│ Time and date     │
│ Quickmarks        │
│ Constant offset   │
│ External sensors  │
│ Hardware (MC-V)   │
│                   │
└───────────────────┘
```
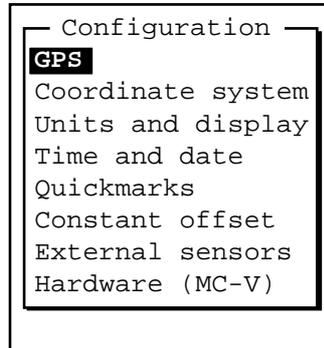
6.3   Using GPS

6.3.1   Activating GPS

If you connect a supported Trimble GPS receiver to your MC-V using the correct cabling and batteries, Asset Surveyor will start to communicate with the GPS receiver immediately after the MC-V is turned on.

If, for some reason, Asset Surveyor cannot communicate with the GPS receiver, it will display the following message:
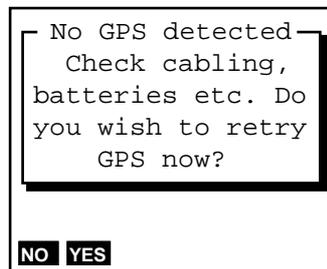
```
┌─ No GPS detected ─┐
│  Check cabling,   │
│ batteries etc. Do │
│ you wish to retry │
│    GPS now?       │
│                   │
└───────────────────┘

  NO  YES
```

In this case, check that the cabling is connected firmly and correctly, that the batteries are connected and charged, and that your GPS receiver is switched on (if appropriate). Then answer 'Yes' to the above question.

If Asset Surveyor and GPS receiver still do not establish communication, consult your receiver's *Operation Manual* or Appendix B for cabling and configuration details specific to the GPS receiver you are trying to use.

The GPS Status Line

Once communication with a GPS receiver is established, Asset Surveyor beeps and displays the GPS status line. This single line (just above the line of soft keys) provides you with up-to-date information regarding the status of the GPS receiver:

```
+----------------------------+
|                            |
|                            |
|                            |
|                            |
|                            |
|                            |
| _____   |
| SV 4/6 PDOP 2.4 # 23       |
|                            |
+----------------------------+
```
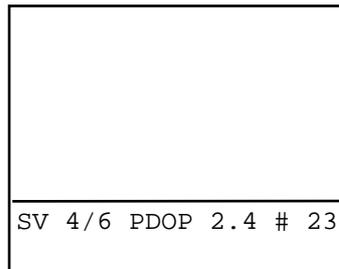
The components of the GPS status line are described in detail on page 7-76.

Various messages will periodically flash on the GPS status line. If you are indoors and have your MC-V and GPS receiver operating, the GPS status line will probably be flashing the message:

```
+----------------------------+
|                            |
|                            |
|                            |
|                            |
|                            |
|                            |
| _____   |
|        Too few SVs         |
|                            |
+----------------------------+
```
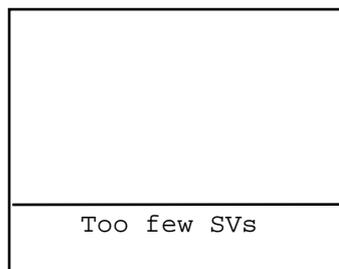
because the GPS receiver is tracking fewer satellites (probably none) than it needs to compute positions.

Most messages flashed on the GPS status line inform you of a *condition* which is preventing the computing or logging of GPS positions. When such a condition arises, Asset Surveyor emits a warning beep and starts to flash the appropriate message. When the condition ceases, Asset Surveyor emits a success beep to indicate that you can proceed with your survey, and removes the flashing message from the status line.

6.3.2 Controlling GPS

The Asset Surveyor software acts as a *control panel* for your Trimble GPS receiver. Some receivers are even switched on and off by Asset Surveyor. A GPS receiver is controlled primarily by the way it is configured (see pages 7-3 and 7-35 for details). The GPS 'Rover options' configuration form looks as follows:

```
        Rover options
Logging intervals
 Point feature: 1.0s
 Line/area:     5.0s
 Not in feature:None
 Velocity:      None
Minimum posns:   180
Pos mode:  Manual 3D
Elev. mask:      15°
SNR mask:        6.0
PDOP mask:       6.0
PDOP switch:     6.0
Audible click:   Yes
Log DOP data:    Yes
Initial position
 Lat:              ?
 Lon:              ?
Dynamics code:  Land
RTCM PHASE ANTEN P(Y) OUTPUT
```

✉ **Note -** The entire contents of this form will not fit onto the MC-V's screen at once; you will need to move through the form (using ⬇ or PGDN) in order to check all of the fields in the form.

Once Asset Surveyor is communicating with a Trimble GPS receiver, your interaction with the GPS receiver takes place through the 'GPS operations' menu. You can press GPS to pop up this menu:

```
┌─GPS operations ─┐
│ Position        │
│ Receiver status │
│ Satellite info  │
│ Navigation      │
│ Waypoints       │
│ 2D altitude     │
│ Disconnect      │
│                 │
│ SETUP           │
└─────────────────┘
```
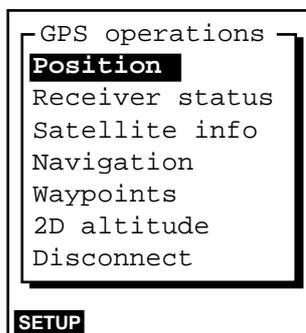
Configuring GPS

The **SETUP** soft key on the 'GPS operations' menu provides a shortcut means to configure your GPS receiver. It leads to the 'Rover options' and 'Base stn options' configuration forms described on pages 7-2 and 7-35, respectively.

Your Current GPS Position

If you select the 'Position' entry from the 'GPS operations' menu, Asset Surveyor will display the current GPS position, if available, or the most recent GPS position, if none is currently available.

```
┌─────────────────────┐
│       Position      │
│North:    5180062.44m│
│East:      630610.61m│
│Alt (MSL):    74.17m │
│Datum:     NZGD 1949 │
│Zone:    UTM Zone 59 │
│                     │
│ WAYPT               │
└─────────────────────┘
```
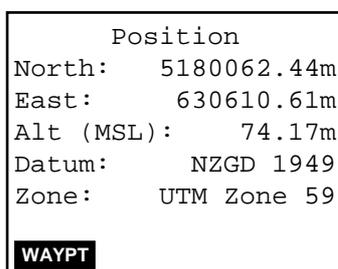
When Asset Surveyor is unable to obtain a current GPS position from the GPS receiver (e.g. due to a high PDOP value, or insufficient satellites), the title of this form changes to 'OLD position', and flashes on and off.

You can press the **WAYPT** soft key to create a waypoint for the current position.

See page 7-84 for further details of the GPS 'Position' form.

Current GPS Status

If you select the 'Receiver status' entry from the 'GPS operations' menu, Asset Surveyor will display information regarding the status of the GPS receiver. For example:

```
       Receiver status
Mode:         Manual 3D
SVs:  04,06,22,25,15
PDOP  2.1 HDOP   1.6
VDOP  1.3 TDOP   0.3
Receiving RTCM:   Yes
Receiver info
 Receiver:      ProXL
 Nav version:   2.07
 Sig version:   2.07
 Battery:       12.3V
 Status: Doing fixes
```

See page 7-86 for further details of the GPS 'Receiver status' form.

Satellite Information

If you select the 'Satellite info' entry from the 'GPS operations' menu, Asset Surveyor will display information for each satellite in the GPS receiver's *tracking set*:

```
PRN SNR Ele Br(T)URA
✓14  21 51° 312°  32
 18 0.0 25° 236°   -
 25 3.6 23° 112°  32
✓29 7.1 67° 229° 4.0
✓03 8.6 68°  77° 2.8
```

This form displays five columns of information, and spans as many pages as required to display information for all satellites in the receiver's current tracking set.

See page 7-90 for further details of the GPS 'Satellite info' form.

Deactivating GPS

Normally, you will not need to explicitly 'Disconnect' the GPS receiver; you can just turn the MC-V off when you have finished using it.

If you wish to use the Asset Surveyor software for a while without using GPS (e.g. reviewing and editing data) and wish to preserve the GPS receiver's batteries, you may choose to deactivate the receiver. You must also physically disconnect the receiver before transferring files to or from the PC, as Asset Surveyor uses the same serial port for these operations as it uses to communicate with the GPS receiver.

When you select 'Disconnect' from the 'GPS operations' menu, Asset Surveyor will cease communications with the GPS receiver and will shut down all GPS logging operations. Before doing so, it will confirm that you haven't selected this option by mistake:
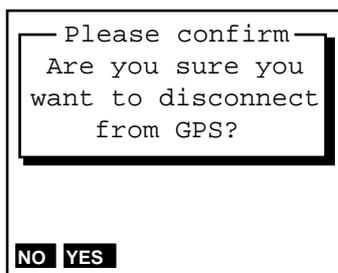
```
┌─── Please confirm ───┐
│   Are you sure you   │
│  want to disconnect  │
│      from GPS?       │
└──────────────────────┘



  NO  YES
```

If you answer 'Yes', the GPS receiver will be turned off, if possible, and Asset Surveyor will close down its GPS operations.

☆   **Tip -** To re-activate the GPS receiver, press ⎣SH2⎦ **GPS** .

6.3.3 An Accurate Clock

Each of the GPS satellites contains a number of very precise atomic clocks, and your GPS receiver uses timing information transmitted by the satellites to determine its position. Your own GPS receiver can therefore also serve as a very accurate time source.

Asset Surveyor aligns the internal clock of the MC-V datalogger to UTC (GMT) time while you are connected to a GPS receiver, so it can display the current time to the precise second, anywhere on earth. When not connected to GPS, the MC-V's clock will drift somewhat, but will still be reasonably

accurate. Whenever you next connect to a GPS receiver, Asset Surveyor will immediately realign the MC-V's clock to UTC time.

To view the local time to GPS accuracy, select the 'Time and date' entry from the Asset Surveyor software's 'Configuration' menu. You can access the 'Configuration' menu itself by pressing **CNFG**. The 'Time and date' configuration form is as follows:

```
        Time and date
24-hour clock:    No
Time:    09:23:34 pm
Date fmt: MM/DD/YYYY
Date: 03/28/1993 Sat
```

Until you have connected to a GPS receiver and obtained an accurate time, Asset Surveyor will simply be using the MC-V's internal clock. Additionally, Asset Surveyor does not know the time zone of the area in which you are operating. When you set the time and date to within 7½ minutes of the actual local time (some time zones are only 15 minutes 'wide'), Asset Surveyor will automatically align it precisely using GPS time (and the known offset to UTC time). From this point on, the Asset Surveyor software, together with your GPS receiver, can serve as the most precise timepiece you're ever likely to own.

6.4   Logging Data to a File

The Asset Surveyor software logs GPS positions, offsets, ESP data and attributes for GIS features to *data files*. You can have a number of data files on your MC-V at once, but you can only log data to one data file at a time. Data files are classified as either *rover* or *base* files. A rover file contains feature and attribute information, together with the GPS, offset and ESP data associated with each feature. A base file contains only GPS base station data. Base files are created by selecting the 'Base station' entry from Asset Surveyor's 'Main menu'.

If you select 'Data capture' from the Main menu, Asset Surveyor will display the data file management menu:

```
  ┌── Data capture ──┐
  │ Create rover file│
  │ Reopen rover file│
  │ File statistics  │
  │ Delete file(s)   │
  │ Data dictionaries│
  └──────────────────┘
```
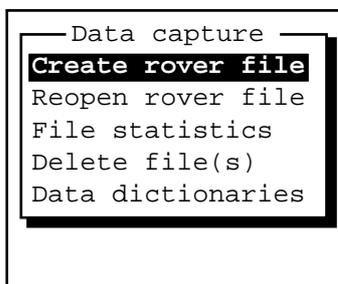
You can perform a variety of operations from this menu, including:

- Creating a new rover file and opening it for logging of data,

- Reopening a previously-created rover file for further logging of data,

- Viewing statistics for existing data files,

- Deleting one or more existing data files,

- Selecting or deleting one or more data dictionaries.

See page 7-101 for details of the latter four operations. The following section describes how to create a new data file.

6.4.1   Creating a New Data File

When you select 'Create rover file', Asset Surveyor will display the 'Create file' form:

```
  ┌─────────────────────┐
  │     Create file     │
  │ File:      R020315a  │
  │ Data dict:   Generic │
  │ Free space:    490kB │
  │                      │
  │                      │
  │ TIME                 │
  └─────────────────────┘
```
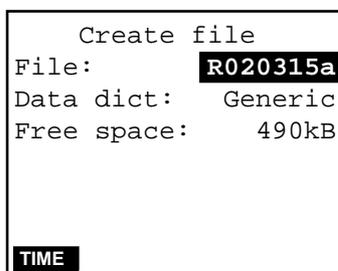
You can accept the default file name suggested by Asset Surveyor or type a new name into the 'File' field. You can also select the data dictionary which will be associated with the data file, then press **OK** to create the new data file. Asset Surveyor will automatically open this data file for logging.

You can use the **TIME** soft key to switch between UTC and local time for the default file name, as described in Chapter 4.

See page 7-99 for more details of rover data file creation.

6.4.2   Reopening a Data File

You can reopen an existing data file by selecting 'Reopen rover file' from
the 'Data capture' menu and selecting from the list of available rover files:

```
┌Reopen rover file┐
 R092918a
 ▐R092918b▌
 ROVER112
```
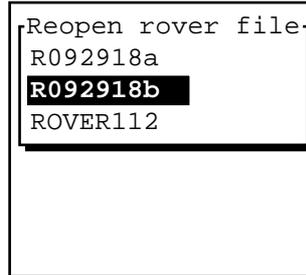
6.4.3   Starting to Log Data

When you create a new data file or reopen an existing one, Asset Surveyor
starts to log data to this file. It displays a menu of geographic features which
can be recorded; these features are determined by the data dictionary
associated with the data file.

An example of a menu of features is the following:

```
┌Start feature┐
 ▐City street▌
 Highway
 Car park
 Town
 Hydrant
```

PAUSE **REPEAT** **QUICK** **EXT**

6.4.4   Starting a Feature

When you select a feature from the 'Start feature' menu, Asset Surveyor will
start to capture data for the feature. A feature's data includes:

• Its GPS position(s),

• An optional offset to the GPS position(s),

- Its attributes, which can be entered using the MC-V's keypad or using a barcode wand, and

- Any ESP (external sensor) data which might be recorded for that feature.

Provided a GPS receiver is connected and operational, Asset Surveyor will record GPS positions automatically for the feature, as determined by the way in which you have configured the GPS interface. It will start recording GPS positions when you select the feature, and will continue recording positions until you save the feature (see below).

If you have configured and activated an external sensor, ESP data will also be recorded automatically. ESP data will be recorded until you save the feature.

If you have configured and activated a laser range-finder, you can record an offset for the feature by aiming and firing the range-finder. Alternatively, you can measure and enter the offset manually.

By taking care of GPS and ESP data capture, and by integrating the recording of an optional offset to each feature, the Asset Surveyor software allows you to concentrate on entering attribute values for the feature.

Types of features

The Asset Surveyor software allows you to capture data for three types of geographic features: *points*, *lines* and *areas*. Examples of each type of feature are:
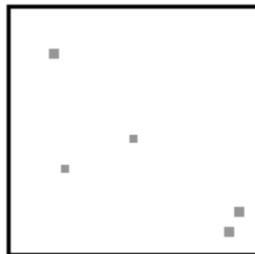
Points
- Well sites
- Power poles
- Accident sites

Lines
- Streams
- Roads
- Pipelines
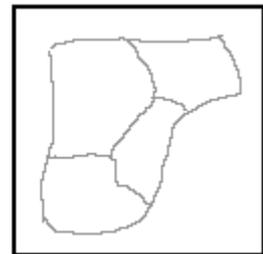
Areas
- Parks
- Wetlands
- Timber stands

Attributes for each type of feature can be recorded, but the way in which GPS positions are recorded for each type of feature differs.

- *Point features.* You can remain stationary at a point for a period of time. Asset Surveyor will record a number of GPS positions during this time, based on the configured logging intervals. After differential correction of these GPS positions, they can be averaged together (in PFINDER) to produce an accurate position for the point feature.

  For applications in which high accuracy is required, you can configure the Asset Surveyor software to record GPS carrier phase data, provided your GPS receiver is capable of computing such data. You can subsequently process this data with the optional Phase Processor Kit to yield accuracy of a few decimeters for point features.

  You can also record point features using a technique known as *quickmarking.* To record a quickmark, you press a key on the MC-V at the moment you travel past the feature. Asset Surveyor will compute a single instantaneous position for the feature. Positions obtained by quickmarking will be less accurate, even after differential correction, than averaging a number of GPS positions together, but quickmarking allows you to capture many features very quickly.

- *Line features.* In order to record a line feature, you travel along the line. As you do so, Asset Surveyor periodically records GPS positions. These positions are joined together to form a line.

- *Area features.* In order to record an area feature, you travel around the perimeter of the area. As you do so, Asset Surveyor periodically records GPS positions. These positions are joined together to form the perimeter of the area. The first and last GPS positions are joined together to close the area, so there is no need to return right to the start point.

In general, you must finish capturing one feature before you can record another. The exception to this rule is the ability to capture point features *within* line or area features, by either *nesting* or *quickmarking* point features.

Point Features

When you are capturing a point feature, there are a number of soft keys at the bottom of the attribute entry form. You can press these to perform

various operations while you are entering attribute values for the point feature, or while waiting for Asset Surveyor to complete the logging of GPS positions for that point feature.

An example of the attribute entry form for a point feature is the following:

```
            «Town»
Name:                  ?
Population:            ?
Gas stations:          ?
Any open 24 Hrs?: No
Banks:                 ?

 PAUSE  EXT  OFFSET
```

The '?' value is the configurable 'Null string', and indicates that no value has been entered or supplied as a default for the corresponding attributes.

The **EXT** soft key provides access to external sensor configuration and control, while the **OFFSET** soft key can be pressed to view, enter or edit the (optional) offset for this point feature. The **PAUSE** soft key is described on page 6-17.

Carrier Phase Mode

When recording a point feature in carrier phase mode, more care is necessary in order to obtain a good result. You must:

- Site the GPS receiver's antenna such that it is unlikely that at any stage there will be fewer than 5 satellites visible. If there are ever less than 4 satellites visible, Asset Surveyor will restart the occupation from the beginning.

- Mount the antenna on a tripod or pole which can be positioned and left completely immobile for the required occupation period (10 minutes, typically). You cannot record points reliably in carrier phase mode when the GPS antenna is mounted on a backpack. Even small movements can influence the eventual result.

- Finally, you must leave the antenna undisturbed for the full occupation period.

> 💣 **Caution -** You are unlikely to achieve high accuracy when operating
> in carrier-phase mode unless you mount the GPS receiver's antenna on
> a tripod, bipod, pole or other stable mounting.

Line Features

When you are capturing a line feature, there are a number of soft keys at the
bottom of the attribute entry form. You can press these to perform various
operations while you are entering attribute values for the line feature and
traveling to the end of the line, logging GPS positions.

An example of the attribute entry form for a line feature is the following:

```
            «Highway»
Name:                  ?
Number:                ?
Interstate?:          No
Lanes:                 6


 PAUSE  NEST  SEG  QUICK  EXT    OFFSET
```

If, while traveling along the line feature, you come across a point feature
which you wish to record, you can do so either as a nested point feature or
as a quickmark, by pressing NEST or QUICK, respectively. The nesting and
quickmarking of point features is described on page 6-18.

You can *segment* a line feature by pressing SEG. This will end the current
line feature and immediately start another line feature of the same type. The
new line feature will, by default, have the same attribute values as the
previous line segment and these can then be edited to reflect the properties
of the new line segment. The last GPS position of the first line will be the
same as the first GPS position of the second line, so that the two line
segments join up in PFINDER and your GIS. The offset of the new line
segment will default to the offset of the previous line segment, if any.

The Asset Surveyor software's SEG function makes it easy to record a line
as several segments, each with differing attribute values, without any
discontinuities between the segments.

The **OFFSET** soft key can be pressed to view, enter or edit the (optional) offset for this line feature.

Area Features

When you are capturing an area feature, there are a number of soft keys at the bottom of the attribute entry form. You can press these to perform various operations while you are entering attribute values for the area feature and traveling around the area's perimeter, logging GPS positions.

An example of the attribute entry form for an area feature is the following:

```
            «Car park»
Name:                   ?
Type:                Mall
Places:                 ?
Open 24 Hrs?:         Yes
Hourly fee:          0.00

PAUSE  NEST  QUICK  EXT  OFFSET
```

If, while traveling around the area feature, you come across a point feature which you wish to record, you can do so either as a nested point feature or as a quickmark, by pressing **NEST** or **QUICK**, respectively. The nesting and quickmarking of point features is described on page 6-18.

The **OFFSET** soft key can be pressed to view, enter or edit the (optional) offset for this area feature.

Pausing and Resuming

If you need to move away from a point feature (e.g. to see the top of a power pole more clearly) or need to avoid an obstacle when recording a line or area feature, press **PAUSE** to avoid recording inappropriate GPS positions. Logging of GPS positions for the feature halts, and the **PAUSE** soft key changes to **RESUME**. Return to the position you wish to record and press **RESUME** to continue logging GPS positions. Normally, Asset Surveyor will log GPS positions while you enter attributes, but you can separate these two activities and perform them in either order using **PAUSE** and **RESUME**.

> ☆ **Tip -** Each time you resume logging while capturing a line or area feature, Asset Surveyor will log a GPS position immediately (irrespective of the logging interval for line/area features). You can use this feature to explicitly force Asset Surveyor to log a GPS position when you come to a corner or a point of interest. Press `PAUSE` and then `RESUME` to cause the current GPS position to be logged. After `RESUME` is pressed, Asset Surveyor will continue to log GPS positions at the configured line/area logging interval.

Repeating Features

You normally start capturing a feature by *selecting* it from the menu of features (i.e. by highlighting it and pressing `ENTER`, or using a first-letter search).

You can also start capturing a feature by highlighting it on the menu and pressing `REPEAT`.

```
 ┌Start feature┐
 │ City street │
 │ Highway     │
 │ Car park    │
 │ Town        │
 │ Hydrant     │
 └─────────────┘

 PAUSE REPEAT QUICK EXT
```

The difference between normal selection of a feature and selecting using `REPEAT` lies in the default attribute values given to the feature. If you select the feature by the 'normal' method, the default attribute values are determined by the data dictionary, which specifies a default value for each attribute belonging to each feature. If you select a feature using `REPEAT`, the attribute values will be copied from the last recorded feature of that type.

☆ **Tip -** REPEAT enables you to record a sequence of similar features very efficiently. You don't have to re-enter the values for all of the attributes, but can just page through checking that each attribute value is correct for the current feature, and only changing those that differ.

For more details on repeating features, see page 7-118.

Nested Point Features

When you press NEST on the attribute entry form for a line or area feature, Asset Surveyor pops up a menu of point features which can be nested within that line or area. For example:

```
┌─ Nest feature ─┐
│ Town           │
│ Hydrant        │
│                │
└────────────────┘

PAUSE  REPEAT  EXT
```
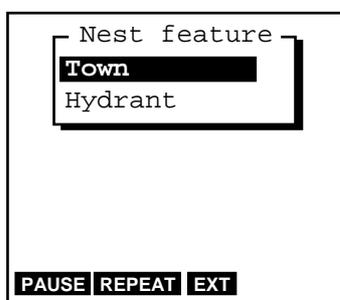
When you select a point feature from this menu, Asset Surveyor will allow you to enter attributes for the selected point feature, and all GPS positions which are logged will be associated with that point feature (rather than with the line or area feature within which the point is nested). When you save the point feature, Asset Surveyor will again log positions for the outer line or area feature.

You can nest as many point features within a line or area feature as you wish. See page 7-122 for further details of nesting, and for details of how to nest points which do not lie right on a line or area's perimeter.

Quickmarked Point Features

If you have a large number of point features to capture, and you do not require the best possible GPS position accuracy for these point features, you can record them by *quickmarking*. This technique does not require you to remain stationary at a feature at all; you simply travel past the feature (as near as possible) and just at the moment you pass each feature you press a

key on the MC-V. Asset Surveyor instantaneously computes a single GPS position for the feature.

Quickmarking is particularly useful when features lie along the roadside (e.g. street furniture, power poles, bridges, etc.).

When you press QUICK, Asset Surveyor pops up a menu of point features, for example:

```
          ┌─ Quickmark ─┐
          │ Town        │
          │ Hydrant     │
          │             │
          │             │
          │             │
          │             │
          │ SETUP       │
          └─────────────┘
```
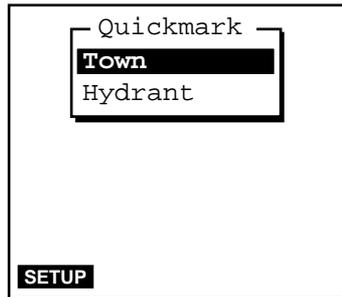
Each time you select a feature from this menu Asset Surveyor will record a quickmark position for that feature, along with default attribute values.

You can record quickmarks instead of normal (averaged) point features, and you can record quickmarks within line or area features. See page 7-119 for a further discussion of quickmarking, and for details of how to configure and edit attributes for quickmarked features.

✩ **Tip -** If you are typically unable to travel right over top of each feature, you should configure a constant offset for quickmark features, as described in the following section. You can then travel past each feature at the specified distance and record it as an offset quickmark.

Offsets and Laser Range-Finders

The Asset Surveyor's *offset* feature allows you to record the position of a geographical feature, without actually having to position your GPS receiver directly over that feature. You will often find this facility to be very useful because it may be difficult, inconvenient or even impossible to position a GPS receiver over a feature and obtain GPS positions.

Some examples where offsets might be used are:

- When capturing a tree feature, it is typically easier to stand some distance (e.g. 10 paces to the North) from the tree and record its attributes, firstly to ensure good GPS reception, and secondly so as to be able to see the tree itself clearly, and assess its condition. You can then specify an offset to the tree of '10m South'. This ensures that the tree is positioned correctly in your GIS. This is an example of an offset point feature.

- When driving along a road recording power poles using quickmarks, you can specify an offset of '3.5m to the right' (presuming that you drive on the right-hand-side of the road!), so that the poles will be positioned 3.5m off the right-hand-side of the road. This is an example of capturing offset quickmark features.

- When capturing road centerlines, it is generally easier (and safer) to specify an offset of '2m to the left' than to actually drive along the center line, especially in the case of a highway with a central dividing strip. This is an example of capturing offset line features.

- When capturing a building as an area feature, it is generally easier to ensure GPS coverage by walking around the building at a distance of 5m from the building, and to specify an offset of '5m to the right' (presuming that you walk clockwise around the building), so that in your GIS the outline of the building will be accurately recorded. This is an example of an offset area feature.

An offset for a point feature consists of a bearing (an angle from either true or magnetic north), a range (slope distance), and an inclination (angle above or below the horizon), as illustrated below:

```
         Point offset
Bearing:         0.0°T
Slope dist:    0.000m
Inclination:     0.0°




 RESET  FORMAT
```

A point feature offset can also be displayed and entered as a horizontal distance, a vertical distance (above the horizontal) and a bearing:
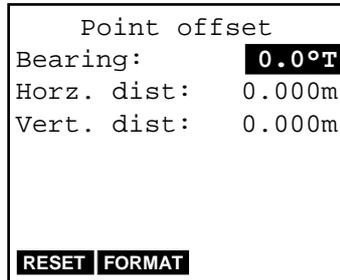
```
            Point offset
Bearing:              0.0°T
Horz. dist:       0.000m
Vert. dist:       0.000m



 RESET   FORMAT
```

You can toggle between these two modes of offset display and entry by pressing the FORMAT soft key.

An offset for a quickmark, line feature or area feature consists of a direction (left or right) relative to the direction of travel at the time the feature is recorded, a range (slope distance), and an inclination (angle above or below the horizon), as illustrated below:

```
            Line offset
Direction:            Left
Slope dist:       0.000m
Inclination:        0.0°



 RESET   FORMAT
```
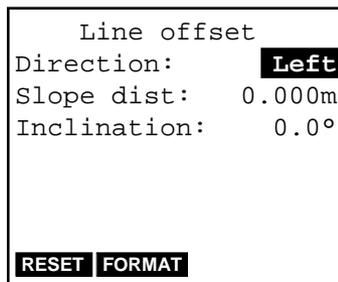
A line, area or quickmark offset can also be displayed and entered as a horizontal distance, a vertical distance (above the horizontal) and a direction:
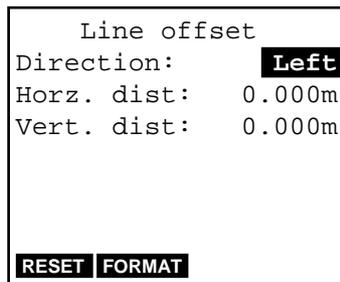
```
            Line offset
Direction:            Left
Horz. dist:       0.000m
Vert. dist:       0.000m



 RESET   FORMAT
```

You can toggle between these two modes of offset display and entry by pressing the FORMAT soft key.

⊠   **Note -** All Asset Surveyor features (be they points, lines, areas or quickmarks) can have only *one* offset associated with them. It is not possible to have two or more offsets for a single feature. In particular, this means that in order to record a line feature with a given offset and then to change the offset part-way through the line feature, it is necessary to segment the line at that point (each segmented line feature has its own offset). You must carefully plan how to capture an area feature using offsets, as the same offset value must apply to the entire area feature.

☆   **Tip -** An offset is a 3-dimensional modification to your GPS position, so you can use offsets to record the full 3-dimensional position of completely inaccessible features such as the top of a tree, a ledge part-way up a cliff, etc.

Every feature recorded with Asset Surveyor has an offset associated with it. If you are able to actually position your GPS receiver over the feature, as is generally the case, the offset will be 0.

If every feature which you record tends to be offset from your position at the time you record it, you can configure a *constant offset*, which will be automatically applied to that class of feature. You can always modify the constant offset for specific features which are exceptions to the general rule.

Offsets can be measured and entered manually using a compass and a tape measure, or simply by pacing out the distance from the feature to the point at which you are measuring it. Asset Surveyor also supports the capture of offsets for features using a laser range-finder. This allows very efficient capture of offsets without the need to manually enter distances, bearings or inclinations. The companion manual entitled *External Sensors with MC-V Asset Surveyor* discusses the various laser range-finders supported by the Asset Surveyor software, and describes how to configure the supported range-finders for use with your Trimble GPS system.

6.4.5 Entering Attributes

When you select a feature to capture, whether it is a point, line or area feature, Asset Surveyor will pop up the attribute entry form for that feature.

The default attribute values for the feature are derived either from the data dictionary, or from the previous feature of that type (if you selected it using **REPEAT**). You can enter new attribute values or edit existing values using the MC-V's keypad, and you can optionally enter values for menu attributes using a barcode wand.

You can also configure an ESP external sensor to automatically fill in one attribute value per feature. See *External Sensors with MC-V Asset Surveyor* for details.

6.4.6 Saving a Feature

As with a normal Asset Surveyor form, you save the attribute entry form's contents by pressing **OK**. You will probably not press **OK** the moment you finish entering attributes for the feature, because, while the feature is 'active', any GPS positions and ESP data which are logged will be associated with that feature. If this is a point feature, you should remain stationary at that feature until the configured minimum number of positions have been logged, before pressing **OK**. If it is a line or area feature you should continue to walk or drive along the feature (or around its perimeter, if it is an area feature). Only when you have traversed it completely should you press **OK**.

6.4.7 Entering a Note

Whenever you are capturing data to a file, you can press **NOTE** to enter a textual *note*. Asset Surveyor allows you to type any characters at all into a note, which can be up to 80 characters long.

```
                Enter note
  ▢████████████████████

 SYMB
```
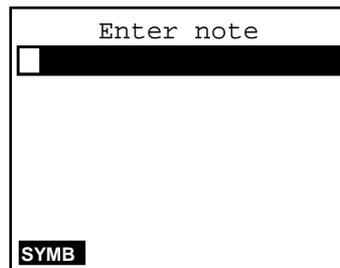
When you have finished entering the note, press **OK** and Asset Surveyor will store the note in the current data file. If you decide that you no longer wish to save the note, press ESC instead of **OK**.

See page 7-161 for a further details of the entry and review of notes.

6.4.8 Exiting Data Capture

When you have finished capturing data to a file, press ESC on the 'Start feature' menu. Asset Surveyor will confirm that you wish to exit data capture (and didn't just press ESC by accident) and then exit to the data file management menu. Once you have exited data capture, Asset Surveyor will cease logging GPS or ESP data.

6.5 Navigating with the Asset Surveyor Software

You can use the Asset Surveyor software together with a Trimble GPS receiver to determine and record your current position. You can also use Asset Surveyor and a GPS receiver to *navigate* to a position of interest.

Navigation is traditionally associated with ensuring that an aircraft or ship follows a prescribed course when traveling from A to B, but you can also use navigation to re-visit features which have been previously surveyed, and to identify a specific feature which may require maintenance.

You can navigate by selecting the 'Navigation' entry from either the Main menu or the 'GPS operations' menu.

The Asset Surveyor software provides three navigation forms, called **NAV1**, **NAV2** and **NAV3**, which present navigation information in three quite different ways. The following is an example of the **NAV2** form:

```
┌────────────────────────┐
│     → BASE CAMP        │
│ Go:    North 2.478km   │
│ Go:     East 1.276km   │
│ Heading:       34°T    │
│ Time: 00h42m    4km/h  │
│ Change course:   5°→   │
│                        │
│ NAV1 NAV2 NAV3 START END│
└────────────────────────┘
```

Each of the navigation forms also shows your current heading and velocity.

6.5.1 Waypoints

An Asset Surveyor waypoint is a named three-dimensional position. A waypoint can be used to record a geographic point of interest such as a survey mark, an excavation site, or a previously-surveyed feature.

The Asset Surveyor software maintains a single waypoint file, which contains a list of waypoints:

```
┌── Waypoints ──┐
│ BASE CAMP     ▓│
│ Fuel Dump     ▓│
│ Hydrant 133    │
│ Hydrant 145   ▓│
│ Hydrant 4331↓ ▓│
└───────────────┘
 CREAT MEASU DEL CLEAR EDIT
```
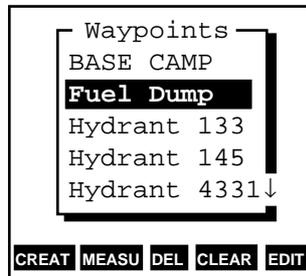
You can add waypoints to this list by typing in their coordinates, by loading them in from PFINDER, by creating a waypoint from the current GPS position, or by creating a waypoint from a feature in an Asset Surveyor data file.

Waypoints can be used for navigation, and can be output to PFINDER's waypoint manager. See page 7-142 for details of creating and managing waypoints, and how to measure the distance and bearing between them.

6.6   Reviewing and Editing Data

You can review and optionally edit an Asset Surveyor data file by pressing **VIEW**. If you press **VIEW** while capturing data to a file, you can review that data file. If you press **VIEW** outside of data capture, you can select any data file to review.

The Asset Surveyor software displays each feature and note in the data file on a single line of the review form, and begins by highlighting the *last* feature or note in the form. For example:

```
 Review «R100509a»
1: Logging started:…
2:           Town
3:      Gas station
4:           Bank
5:         Highway
6:        Car park
 SEARCH POS DEL UNDEL
```
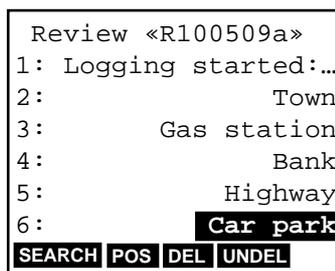
You can review (and optionally edit) any feature or note in this list by highlighting it and pressing ENTER.

⊠   **Note -** You can edit attribute information, offsets and the contents of notes, but you cannot edit the GPS position(s) of a feature.

You can also perform a variety of operations using the soft keys on the review form, such as searching, deleting and un-deleting features and notes. You can also view the recorded GPS positions of each feature, and can save a feature's position as a waypoint. See page 7-162 for further details of reviewing and editing data.

6.7   Transferring Data Files To PFINDER

You usually capture data with the Asset Surveyor software in order to transfer that data to another software system such as a GIS. After first transferring data files to PFINDER, then optionally post-processing and editing them, you use PFINDER's GIS or ASCII output capability to export the captured data to your GIS.

You can transfer data files to PFINDER by connecting your MC-V to your PC using the appropriate cable (part number 18532), and by selecting 'File transfer' from Asset Surveyor's Main menu.

File transfer mode uses the same serial port as the GPS interface, so you must disconnect GPS before selecting 'File transfer'. If you do not, Asset Surveyor pops up the message:

```
┌──── Error! ────┐
│ Disconnect GPS │
│ before selecting│
│  this option.  │
└────────────────┘
```
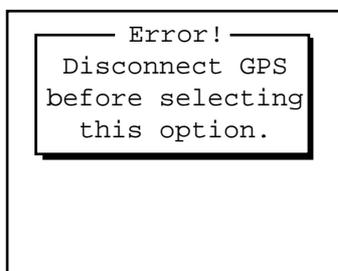
Deactivating the GPS receiver was described on page 6-8.

When you have deactivated GPS and then selected 'File transfer' from the Main menu, Asset Surveyor enters file transfer mode. In this mode, it displays the file transfer status form

```
        File transfer
   Connect cable to PC




```

and waits for PFINDER to initiate data transfer operations. Using the entries in PFINDER's 'Comm' menu, you can transfer data files, almanacs and waypoints from the MC-V to the PC, and you can transfer data dictionaries, waypoints and other special files from the PC to the MC-V. See page 7-136 of this manual and also the *PFINDER Software Reference* manual for further file transfer details.

6.8   Managing Data Files

Because the MC-V's data storage space is finite, you will eventually have to delete captured data files from the MC-V.

💣 **Caution -** You should always check that files which have been transferred to PFINDER were transferred correctly before deleting the original data files from the MC-V. Once a data file has been deleted from the MC-V, it cannot be recovered.

The 'Data capture' menu includes a 'Delete file(s)' entry. When you select this entry, Asset Surveyor will display a menu of data files:

```
   ┌─Delete file─┐
   │ R092918a    │
   │ R092918b    │
   │ B3102910    │
   │             │
   │             │
   │ DELALL      │
   └─────────────┘
```

You can select a particular data file from this menu to delete it, or you can press DELALL to delete all data files. Asset Surveyor always asks you to confirm that you really wish to delete one or more data files, and asks you to

confirm again for each data file which has not yet been transferred to PFINDER.

If you wish to delete data files to make space on your MC-V, it is useful to know how much storage space individual data files are consuming. Selecting 'File statistics' from the 'Data capture' menu provides some useful statistics on the highlighted data file, including its size and the amount of data storage space remaining on the MC-V.

6.9   Configuring the Asset Surveyor Software

Your Asset Surveyor system is extremely flexible, and can be configured to meet your precise needs in a number of ways. The many Asset Surveyor configuration settings are described in detail in Chapter 7.

Table of Contents - Reference Guide

Chapter 7   Reference Guide – The Menu Structure

This chapter of the Asset Surveyor manual provides a complete reference guide, describing each menu and screen in detail. In order to make it easier to navigate your way through this chapter, the heading of each page provides a summary of the menu structure described on that page.

This chapter describes firstly the 'Configuration' menu, followed by the 'GPS operations' menu. Then Asset Surveyor's 'Main menu' is described in detail, followed by each of its sub-menus. Finally, the method of entering notes is described, together with the data review and editing facility.

7.1   Configuring Asset Surveyor

As mentioned in Chapter 5, there are a number of critical aspects of Asset Surveyor's operation which must be configured before you proceed to capture data. There are also a large number of non-critical configuration options which you can set to suit your application or your preferences. This section describes each configurable option in the Asset Surveyor software in detail.

Although you should certainly check the Asset Surveyor configuration before embarking on a survey, you can (re)configure Asset Surveyor at any point, while it is being used. Press ⌷SH2 and then press **CNFG** to pop up Asset Surveyor's 'Configuration' menu, from which you can select the aspect(s) of the system you wish to check or change. The configuration menu has the following entries:

```
┌─ Configuration ─┐
│ GPS             │
│ Coordinate system│
│ Units and display│
│ Time and date   │
│ Quickmarks      │
│ Constant offset │
│ External sensors│
│ Hardware (MC-V) │
│                 │
└─────────────────┘
```
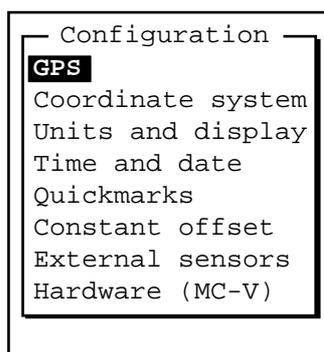
Configuration/GPS

When you select the 'GPS' entry from Asset Surveyor's 'Configuration' menu, you will usually have to choose between configuring aspects of a GPS rover or a GPS base station.

```
┌─ Configure GPS ─┐
│ Rover options   │
│ Base stn options│
└─────────────────┘
```
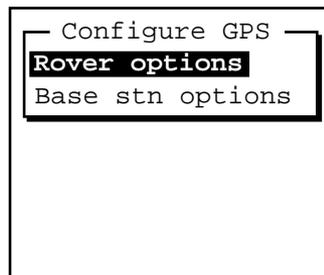
However, if you are connected to a Trimble GPS receiver and already operating as a rover or as a GPS base station, Asset Surveyor will anticipate which GPS options you wish to configure, and take you directly to either the GPS 'Rover options' configuration form or to the GPS 'Base stn options' configuration form.

> ✉ **Note -** The combination of an MC-V datalogger and a 4000 Series GPS receiver is not supported. Only the Pathfinder family of GPS receivers can be used with an MC-V datalogger.

> ✉ **Note -** The Asset Surveyor software cannot act as a base station for a 4000 Series GPS receiver, so if you select the 'GPS' entry from the 'Configuration' menu when connected to a 4000 Series receiver, you will proceed directly to the 'Rover options' configuration form.

> ✉ **Note -** If you are using the Asset Surveyor software and a Trimble GPS receiver to navigate with, use the GPS 'Rover options' to configure the GPS receiver.

Configuration/
GPS/Rover Options

If you select 'Rover options' from the 'Configure GPS' menu, or if you select the 'GPS' entry from the 'Configuration' menu when a rover data file is open, then the following configuration form will appear.

```
       Rover options
Logging intervals
 Point feature: 1.0s
 Line/area:     5.0s
 Not in feature:None
 Velocity:      None
Minimum posns:   180
Pos mode:  Manual 3D
Elev. mask:      15°
SNR mask:        6.0
PDOP mask:       6.0
PDOP switch:     6.0
Audible click:   Yes
Log DOP data:    Yes
Initial position
 Lat:              ?
 Lon:              ?
Dynamics code:  Land
RTCM  PHASE  ANTEN  P(Y)  OUTPUT
```

This entire form will not fit onto the MC-V's screen at once, so you should scroll through it to select the specific rover option(s) you wish to change.

The form above shows the default values for each configurable rover option. These will be the values configured in Asset Surveyor when you run it for the first time. You do not need to change any of these settings in order to test your Trimble GPS equipment, but you may want to change some of the options before setting out to capture data.

⊠   **Note -** The `PHASE` soft key will not appear if you are currently connected to a GPS receiver which does not support 'Carrier phase mode'. Similarly, neither will the `P(Y)` soft key appear when you are connected to a GPS receiver which does not support P(Y) mode.

The following sections describe each configurable rover option in detail.

Configuration/
GPS/Rover Options/
Logging Intervals

The 'Logging intervals' heading refers to the following four configuration options, which specify intervals (periods of time) between the logging of various types of information, in varying circumstances.

- *Point feature*. The interval between logged GPS positions when you are capturing a point feature. The default logging interval for point features is one second. This means that when you start a point feature, Asset Surveyor will log GPS positions once per second, until you end the feature.

- *Line / area*. The interval between logged GPS positions when you are capturing a line or area feature. The default logging interval for line and area features is five seconds. This means that when you start a line or area feature, Asset Surveyor will log positions once every five seconds, until you end the feature. Asset Surveyor will also log a GPS position immediately after starting the feature and just before ending it.

- *Not in feature*. Although most of the GPS data which you log will probably be associated with a feature (i.e. a point, line or area), you can use Asset Surveyor to log GPS positions *between* features, so that your final data file contains a trail showing where you went during the survey. By default, Asset Surveyor will not log positions unless in a feature, so the logging interval when 'Not in feature' has the default value 'None'.

- *Velocity*. You can request Asset Surveyor to log your velocity at regular intervals by setting the 'Log velocity' option to a value other than 'None' (the default).

Velocities might be logged in order to map and analyze traffic flow, or to show that you performed a survey at a constant velocity (e.g. when required to traverse a region at a certain optimal speed in order to conduct other experiments).

Recent enhancements to the Trimble office processing software enable the differential correction of velocities logged from Pathfinder GPS receivers. Velocities logged from 4000 Series receivers cannot currently be differentially corrected.

⊠   **Note -** You can change the logging intervals at any time, even when you are already logging a feature.

☆   **Tip -** When you are editing an interval field, Asset Surveyor makes two soft keys, `ALL` and `NONE`, available. Press `ALL` to specify that you want every available GPS position to be logged. Press `NONE` to indicate that you want no positions to be logged.

The position logging interval you specify has an impact on the accuracy of differentially corrected positions. Ideally, the position logging interval at the roving receiver should be identical to, or an exact multiple of, the measurement logging interval at the base station. This enables precisely *synchronized* differential corrections to be computed. If rover logging of positions is not synchronized with base station logging of measurements then interpolated differential corrections must be computed, with an associated loss of accuracy.

Configuration/
GPS/Rover Options/
Minimum Positions

In order to obtain the best GPS accuracy for a point feature, you should remain at that feature for some time, logging a number of GPS positions. If these positions are subsequently differentially corrected and averaged, the average position will be substantially better than a single GPS position. Trimble recommends certain occupation periods in order to obtain varying degrees of accuracy with a given GPS receiver (subject to prevailing GPS conditions). For example, the default of 180 positions per point feature, at the default logging interval of one second for point features, should yield 2m accuracy using a six channel Pathfinder GPS receiver such as the ProLite or Pathfinder Basic Plus.

⊠ | **Note -** When using a Pro XL or GIS Surveyor system, you can obtain sub-meter accuracy with a single position, and can therefore reduce the 'Minimum posns' setting to 1 if you wish to minimise the amount of time spent recording each point feature and maximise the number of point features which can be stored in your TDC1. For up-to-date information on recommended occupation times, refer to the most recent documentation or release notes associated with your specific Trimble GPS receiver.

When Asset Surveyor has logged the specified minimum number of positions for a point feature, it will beep to let you know that you have logged sufficient positions to achieve your required accuracy. If you attempt to save a point feature before the minimum number of positions have been logged, Asset Surveyor will warn you:

```
┌─Please confirm─┐
│ Insufficient GPS │
│positions: do you │
│want to store this│
│   feature now?   │
└                  ┘

 NO  YES
```
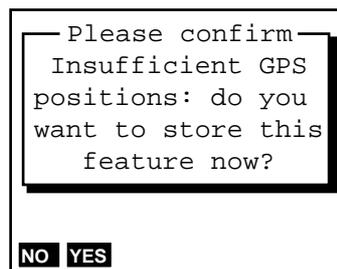
You can choose to store the feature anyway, accepting a possible loss of accuracy, or you can remain inside the feature until more positions have been logged.

In general, you will log positions for line and area features until you have traveled the length of the line or the perimeter of the area. There is no minimum number of positions for these feature types.

Configuration/
GPS/Rover Options/
Position Mode

The position mode in which your Trimble GPS receiver will operate is configured by selecting one of the four values 'Manual 3D', 'Auto 2D/3D', 'Manual 2D' or 'Overdet. 3D' from the 'Pos mode' menu. This mode will fundamentally affect the operation of your GPS receiver, and should only be modified after you have fully understood the consequences, as described below:

- *Manual 3D*. In Manual 3D mode, which is the default, your Trimble GPS receiver will use as many satellites as it is capable of using (but at least 4) to compute positions. This will usually yield the most accurate GPS positions and is the most flexible mode in which the receiver can be operated. If your GPS receiver is capable of computing *overdetermined* GPS positions, it will do so in Manual 3D mode when there are more than four satellites available.

  You should *always* use Manual 3D mode or forced Overdetermined 3D mode in order to achieve a high level of accuracy for logged positions.

- *Auto 2D/3D*. In Auto 2D/3D mode, your Trimble GPS receiver will use four satellites to compute GPS positions when it is able to, but when the number of visible satellites falls to three, it will continue to compute positions, using the last known altitude. A position computed when there are only three usable satellites is called a *two dimensional* position, and the accuracy of two dimensional positions is crucially affected by the accuracy of the altitude.

  In Auto 2D/3D mode, when the GPS receiver switches to 2D mode (i.e. when there are only three usable satellites), it will use the altitude of the last available 3D position, or any altitude which you have entered manually since the last 3D position was computed. You can manually enter a 2D altitude by popping up the 'GPS operations' menu and selecting '2D altitude'.

  If you are operating in conditions where satellite visibility is poor and you are able to determine your altitude above the WGS-84 ellipsoid *very accurately at all times*, then you may wish to try Auto 2D/3D mode. However there is a high probability that your data will not always be very accurate due to altitude input errors.

<table>
<tr>
<td>💣</td>
<td>Caution - If you use Auto 2D/3D mode and specify an inaccurate altitude, this will have a significant impact on the position computed by your GPS receiver. As a rule of thumb, every meter of error in the altitude you supply is likely to cause at least three meters of error in the position computed by your GPS receiver.</td>
</tr>
<tr>
<td>✉</td>
<td>Note - The 4000 Series GPS receivers support overdetermined 2D mode, meaning that they can use four or more satellites to compute a 2D solution. When the 'Posn mode' is set to 'Auto 2D/3D', this will occur in circumstances when the 3D PDOP exceeds the configured 'PDOP mask', but the overdetermined 2D PDOP is below the 'PDOP mask'.</td>
</tr>
</table>

- *Manual 2D*. In Manual 2D mode, a Pathfinder GPS receiver will *always* use the best three satellites available, even if there are four or more which could be used for computing positions. You must supply an accurate altitude above the WGS-84 ellipsoid before using Manual 2D mode. This mode is useful if you are absolutely sure of your altitude above the WGS-84 ellipsoid, as it avoids the inaccuracies experienced in Auto 2D/3D mode when the GPS receiver switches from using a 3D altitude obtained from GPS to using the 2D altitude which you supply. Unless you are operating exclusively at the same altitude, you *must* manually enter a new altitude whenever you move up or down.

<table>
<tr>
<td>💣</td>
<td>Caution - If you use Manual 2D mode and specify an inaccurate altitude, this will have a significant impact on the position computed by your GPS receiver. As a rule of thumb, every meter of error in the altitude you supply is likely to cause at least three meters of error in the position computed by your GPS receiver.</td>
</tr>
</table>

⊠   **Note -** As mentioned previously, the 4000 Series GPS receivers support *overdetermined 2D mode*, meaning that they can use *four or more* satellites to compute a 2D solution. When the 'Posn mode' is set to 'Manual 2D', the 4000 Series GPS receiver will use as many satellites as it can to compute an overdetermined 2D position.

- *Overdet. 3D*. In Overdetermined 3D mode, your Trimble GPS receiver will use as many satellites as it is capable of using to compute positions. These GPS positions will only be logged if there are *at least five* satellites available, so that all logged positions are forced to be *overdetermined*. This yields the most accurate GPS positions.

⊠   **Note -** Some Trimble Pathfinder GPS receivers cannot be used in overdetermined 3D mode, as they use a maximum of four satellites to compute GPS positions. If you configure Asset Surveyor to use 'Overdet. 3D' mode and connect to a receiver which is incapable of operating in overdetermined mode, the receiver will operate in Manual 3D mode instead. Contact your Trimble Support Center for details of which Trimble GPS receivers are capable of computing overdetermined positions.

Configuration/
GPS/Rover Options/
Elevation Mask

You can restrict your Trimble GPS receiver to using only those satellites above a certain elevation in the sky by imposing an *elevation mask*. The default elevation masks recommended by Trimble are 15° for rovers and 10° for base stations. This difference ensures that a base station can always 'see' all of the satellites which can be seen by any rovers. If you choose to alter the rover elevation mask, be very careful to ensure that your base station (if any) still has a lower mask, to ensure that you can still differentially correct data files collected by that rover. These days there is rarely a need to use an elevation mask lower than 15°, given the number of GPS satellites in service, but if you do decide to lower your elevation mask(s), you should be aware that the increased ionospheric noise associated with satellites low on the horizon can easily counter any improvement in PDOP given by a lower elevation mask. Additionally, the effects of multipath increase as lower satellites are used.

💣 **Caution -** You *must* ensure that the elevation mask for a rover is set sufficiently high that the base station can always track any satellites visible to each rover. Remember that as a rover gets further from the base station, the difference between the elevation mask of the rover and the base becomes more and more critical (due to the curvature of the earth). As a rule of thumb, the difference must be at least 1° for every 100km between the base and the rover.

Configuration/
GPS/Rover Options/
SNR Mask

The signal strength of a satellite is a measure of the information content of the signal relative to the signal's noise. As this proportion decreases, information gets lost in the noise. The typical signal strength of a satellite at 30° elevation is between 12.0 and 20.0. A value above 20.0 is very good. The quality of a GPS position is degraded if the signal level of one or more satellites in the constellation falls below 6.0.

Asset Surveyor allows you to set a mask, called the *Signal-to-noise ratio* mask (or SNR mask), the value of which is used to determine whether the signal strength of each satellite is sufficient for that satellite to be used by the GPS receiver. The default value for Asset Surveyor's SNR mask is 6.0.

⊠	**Note -** Trimble's 4000 Series GPS receivers have a fixed internal SNR mask (of 4.0). Asset Surveyor's 'SNR mask' configuration variable has no effect on the operation of 4000 Series receivers – it only influences the behavior of Pathfinder GPS receivers.
💣	**Caution -** If you lower the SNR mask, you will permit your GPS receiver to use satellites with weaker signals. While this may increase the GPS coverage you can obtain in environments where the GPS signal is weakened (such as forests), it will probably cause a reduction in GPS accuracy.

Configuration/
GPS/Rover Options/
PDOP Mask and PDOP Switch

The accuracy of a position computed by a GPS receiver is essentially a function of the geometry of the GPS constellation visible at that moment in time. When the visible satellites are well separated in the sky, your GPS receiver is able to compute accurate positions. If two or more satellites are close together in the sky, the small errors inherent in measuring their signals compound, reducing the accuracy of computed positions.

There are several *Dilution of Precision* (DOP) factors associated with GPS, and these DOP factors express an aspect of the expected accuracy of the GPS system. DOP factors are linear multipliers on the expected error, so a small DOP value is better than a large one. The best overall indicator of constellation geometry is known as *Position Dilution of Precision*, or PDOP.

A PDOP value of 4.0 or less tends to give excellent positional accuracy. A PDOP between 4.0 and 8.0 provides acceptable accuracy, while a PDOP of 8.0 or more implies poorer accuracy. When satellites nearly line up in the sky, the PDOP values can briefly go into the hundreds or even thousands, and for those periods computed GPS positions may be quite inaccurate.

Asset Surveyor allows you to specify a 'PDOP mask', which the GPS receiver uses as an upper bound on PDOP values. When the PDOP climbs above this mask, the receiver will cease computing GPS positions. This enables you to program a desired level of positional accuracy, and ensure that any positions which you log will be of a certain quality. The default PDOP mask value is 6.0.

💣 **Caution -** Increasing the PDOP mask will allow you to log positions for more of the time, but position quality may be seriously degraded. It is better to retain a lower PDOP mask and use Trimble's mission planning software to identify the brief times of high PDOP, and to schedule other activities (like lunch!) in these times, rather than to continue surveying and compromise the accuracy of your survey. Conversely, you should not reduce your PDOP mask too far below the value recommended for your particular Trimble GPS receiver, as this will significantly decrease the amount of time you can survey, without significantly increasing the accuracy of your survey.

> ✉ **Note -** Some Trimble GPS systems specify a maximum PDOP of 4.0 in order to achieve sub-meter accuracy.

The Mapping Systems *General Reference* manual provides a more detailed discussion of DOP values.

> ✉ **Note -** In 2D mode the PDOP mask ought to be set lower than in 3D mode, as two dimensional PDOP values are inherently smaller than PDOP values in three dimensions. Despite this difference, 3D positions will almost always be more accurate than 2D positions due to the difficulty of accurately specifying your 2D altitude above the WGS-84 ellipsoid.

In addition to the PDOP mask, Asset Surveyor provides a 'PDOP switch' configuration option for users of the 'Auto 2D/3D' position mode. Unlike the PDOP mask, which determines a cutoff value above which GPS positions will not be computed, the PDOP switch is the value at which the receiver will switch from 3D to 2D mode (the PDOP switch is therefore effectively a PDOP mask for 3D mode, with the PDOP mask being applied in 2D mode).

The default values of the PDOP mask and PDOP switch are the same (6.0), but by altering the value of the PDOP switch, you can force your GPS receiver to switch to 2D mode (and deliberately ignore one or more satellites in the process) in order to achieve a lower PDOP-induced error. Of course, your 2D altitude must be very accurately known and entered, otherwise it will induce a greater error in your GPS position than would a higher 3D PDOP.

Configuration/
GPS/Rover Options/
Audible Click

By default, Asset Surveyor will cause the MC-V to click audibly each time a GPS position is logged. This provides assurance that your system is operating normally, without you having to keep a constant eye on the MC-V's screen. If the ticking stops then it is likely that some significant event has occurred (such as a high PDOP value, too few satellites, etc.).

By setting the 'Audible click' configurable option to 'No', you can disable this clicking.

Remember that MC-Vs distributed by Trimble come with an external headset so that you can hear the MC-V beep and click even when operating in very noisy environments.

Configuration/
GPS/Rover Options/
Log DOP Data

You can choose to log dilution of precision (DOP) values, so that you have a record of the GPS conditions which prevailed during a survey. These DOP values can be used to provide a degree of quality assurance, especially if you are capturing data and supplying it under contract to a third party, who may require evidence that the data was surveyed carefully and under acceptable GPS conditions.

When the 'Log DOP data' configurable option is set to 'Yes', Asset Surveyor will log values of PDOP, HDOP, VDOP and TDOP (see page 7-87) whenever the PDOP value varies by 0.1 or more, provided the PDOP is below the configured PDOP mask. This provides a good record of each DOP situation which occurred throughout a survey period. The logging of DOP information will increase the size of the data file by up to 10%, depending on the number of constellation changes due to satellites being frequently obstructed (e.g. when driving near trees or buildings).

✉	**Note -** The Trimble 4000 Series GPS receivers do not provide TDOP information, so the TDOP values logged by Asset Surveyor will always be 0.0 when connected to a 4000 Series receiver.

By default, Asset Surveyor is configured to log DOP values.

Configuration/
GPS/Rover Options/
Initial Position

The 'Initial position' heading introduces two fields which together specify your approximate position as either a latitude and longitude pair, or as a north and east pair (depending on your selected coordinate system).

When GPS is operating, these fields will be kept up-to-date with the current GPS position. When GPS is not operating, you can consult these fields to see where you were (or more precisely, where your Asset Surveyor system was when it was last used).

The initial position has one important use. Some Trimble GPS receivers have no internal battery-backed memory of their own (to reduce their weight and to save you having to disassemble them periodically to change the battery). These receivers must be sent a GPS almanac when they are powered up, so that they can rapidly acquire signals from satellites and begin to compute GPS positions. Part of a GPS almanac is an approximate initial position, from which the GPS receiver can infer the set of satellites which should be visible at any point in time. With a reasonably accurate (i.e. ± 200-300km) initial position, the startup time of the GPS receiver should be very good (30 seconds to 90 seconds, presuming visibility to satellites). If the initial position is very inaccurate (e.g. the wrong side of the world), startup may take between five and 15 minutes.

If you travel a long way between survey locations (e.g. you fly from one state to another, or from one country to another), you can ensure a rapid GPS startup by entering an *approximate* initial position for your new survey site.

☆ | **Tip -** If you do not know your new survey site's position, even approximately, you needn't worry. Just set up your GPS receiver and start the Asset Surveyor software running. Once your GPS receiver has started to compute positions, its initial position will be updated, and subsequent restarts at or near that location will be rapid again.

Configuration/
GPS/Rover Options/
Dynamics Code

The 'Dynamics code' field allows you to configure the way in which your GPS receiver will behave by informing it of your usual mode of operation. The 'Dynamics code' helps to control the initial acquisition of satellites, the subsequent handling of satellite signal obstructions, and the receiver's behavior in high multipath situations. There are 3 available dynamics codes:

- *Land*. This is the default dynamics code, and is the best for most typical GIS data capture exercises. This mode informs the receiver that you are operating on land, where you may encounter canopy or other obstacles which might obscure satellite signals, and where you will be moving at a relatively low velocity.

- *Sea*. This dynamics code informs the receiver that you are on the water, at a constant altitude, where you might also encounter obstructions but are unlikely to be moving at a very high velocity. The receiver caters for the possibility that its antenna may be mounted on a mast and be moving backwards and forwards reasonably rapidly.

- *Air*. This dynamics code informs the receiver that you are in the air, where you are unlikely to suffer obstruction of satellite signals but where you are likely to be moving at a higher velocity.

These are, of course, general categories into which your application may not necessarily fit. For example, if operating from a balloon, you would be better to choose the 'Land' code (which caters for slow velocity, the occasional obstruction, and variations in altitude) than the 'Air' code.

⊠	**Note -** If you configure the 'Dynamics code' incorrectly, this will generally not cause significant harm. You may notice a slightly degraded initial acquisition of satellite signals, and slightly different behavior when satellite signals are obscured.
⊠	**Note -** The 4000 Series GPS receivers are configured to operate using the 'Land' dynamics code at all times. Asset Surveyor's 'Dynamics code' field is completely ignored when connected to a 4000 Series receiver.

Configuration/
GPS/Rover Options/
RTCM Input Options

The `RTCM` soft key on the 'Rover options' configuration form leads to the 'RTCM input options' form where you can configure the operation of your GPS receiver's RTCM link. An RTCM link is used to receive real-time differential corrections via a radio, modem or other telemetry link. Most Trimble GPS receivers can accept an RTCM input. You should consult Appendix B to determine whether your specific GPS receiver accepts RTCM input, and how to configure and connect a telemetry link to the receiver.

The RTCM input options form looks as follows:

```
 RTCM input options
RTCM input mode:Auto
RTCM version:    Auto
RTCM station:     Any
Warning time:     20s
Baud rate:       9600
Data bits:          8
Stop bits:          1
Parity:          None
```

The various fields in this form are described below:

- *RTCM input mode*. Trimble GPS receivers use an incoming RTCM signal in one of three ways, as determined by the 'RTCM input mode'. The three modes are:

  - *Off*. When the RTCM input mode is 'Off', the GPS receiver will ignore the RTCM link completely, even if it is operating correctly. The receiver will compute and emit positions without real-time corrections applied.

  - *Auto*. When the RTCM input mode is 'Auto', the GPS receiver will use the RTCM link when it is operating and emit positions which have been differentially corrected in real time. If the RTCM link is lost (e.g. due to a radio battery failure, or an obstruction of the telemetry link) then the GPS receiver will emit positions which have not had real-time corrections applied. Positions which have not been differentially corrected in real time can be subsequently differentially corrected by post-processing, providing you have access to a base station which is logging data for post processing.

− *On*. When the RTCM input mode is 'On', the GPS receiver will only compute and emit positions when the RTCM link is operating. All positions which it emits will have been differentially corrected in real time. None of the data which is logged will require post-processing.

Asset Surveyor's default value for the RTCM input mode is 'Auto', as this mode provides the greatest flexibility. If you require all logged positions to be corrected in real time, then you should set the mode to 'On'. If you want to temporarily disable real-time corrections, without having to physically disconnect your radio, you should set the RTCM input mode to 'Off'.

> ☆ **Tip -** If your RTCM link appears to be functioning correctly, but Asset Surveyor indicates that RTCM is not being used, check that you have not inadvertently set the RTCM input mode set to 'Off'.

- *RTCM version*. There are currently two main RTCM protocol versions in use, called RTCM Version 1 and RTCM Version 2. There is also a sub-versions of RTCM used by the U.S. Coast Guard. Most Trimble GPS receivers support the newer RTCM Version 2 protocol. Some Trimble GPS receivers support only Version 1 of the RTCM protocol, while some receivers support both main RTCM versions. The Trimble 4000 Series receivers are capable of supporting all three of these RTCM versions, which can be purchased as receiver firmware options. You should set the 'RTCM version' field appropriately for the RTCM signal which you plan to use. If you are unsure which RTCM version is being transmitted by your base station, try setting the 'RTCM version' to 'Auto' (the default). If you set the 'RTCM version' to 'Auto' when connected to a 4000 Series receiver, Asset Surveyor will configure the receiver to expect RTCM Version 2. If you set the RTCM version to one of the USCG formats when connected to a Pathfinder GPS receiver, Asset Surveyor will configure the receiver's RTCM version to 'Auto'.

> ☆ **Tip -** If your RTCM link appears to be functioning correctly, but your GPS receiver indicates that RTCM is not being used, check that you have selected the appropriate 'RTCM version'. If you are unsure as to which version of RTCM your radio/modem is receiving, select 'Auto'.

• *RTCM station*. Typically, there will only be one GPS base station broadcasting RTCM differential corrections at a particular frequency in the area where you operate. Occasionally, however, there will be more than one base station available, particularly as you move from one area to another. By default, your Trimble GPS receiver will attempt to choose the 'best' RTCM base station (based typically on the distance to the base station). You can, however, indicate that you wish to use a particular GPS base station by entering its *station ID* into the 'RTCM station' field. If you enter any value other than the default ('Any'), Asset Surveyor will instruct your GPS receiver to accept differential corrections only from the indicated base station. You should leave the 'RTCM station' field set to 'Any' unless you specifically require this functionality.

☆ | **Tip -** If your RTCM link appears to be functioning correctly, but Asset Surveyor indicates that RTCM is not being used, check that you either have the 'RTCM station' set to 'Any', or you have entered the correct 'RTCM station' ID for the GPS base station which you wish to use.

• *Warning time*. Most RTCM telemetry links broadcast RTCM corrections every few seconds. The more frequently you receive RTCM corrections, the more accurate your real-time corrected data will be. If a single correction is missed (e.g. due to a temporary telemetry glitch, or due to you passing behind some obstruction), your GPS receiver will continue to apply a projection of the most recent correction received to each new GPS position which it computes. If the 'Warning time' elapses and no new corrections have arrived over the RTCM link, the most recent correction is considered to be too old to provide accurate corrected positions, and the GPS receiver ceases to use it. At that point, you will be warned that your RTCM link has been lost.

You can change the 'Warning time' configuration option to suit the expected frequency of RTCM corrections arriving. If your RTCM base station is emitting corrections every five seconds, you may wish to set the warning time to 10 seconds, so that you accept the loss of a single RTCM correction, but will be warned if you miss two in a row.

> ✉ **Note -** Some Pathfinder GPS receivers have a built-in RTCM warning time of either 20 or 30 seconds which cannot be changed by Asset Surveyor. The 'Warning time' option is only applicable to newer Pathfinder GPS receivers and 4000 Series GPS receivers. Note, however, that you can manually alter the RTCM warning time on the Pathfinder Basic Plus (by changing the 'Stale' value on the receiver's front panel).

- • *Baud rate, Data bits, Stop bits, Parity.* The remaining four fields on the RTCM configuration form allow you to specify the serial parameters to be used by your telemetry link. This is necessary for your GPS receiver to understand and decode the RTCM data stream which is being carried over the telemetry link.

> 💣 **Caution -** It is very important that you determine the precise serial parameters used by your telemetry link and RTCM base station, and that you accurately enter them into these fields in Asset Surveyor's RTCM configuration form. Any errors made when specifying these serial parameters can cause the RTCM link to fail.

The GPS Status Line

When RTCM-corrected positions are being emitted by the GPS receiver, Asset Surveyor will indicate this fact by placing an 'R' on the GPS status line, in place of the '#' character. For example:

```
┌──────────────────┐
│                  │
│                  │
│                  │
│                  │
│ ──────────────── │
│ SV 4/6 PDOP 2.4 R 23 │
│                  │
└──────────────────┘
```

Configuration/
GPS/Rover Options/
Carrier Phase Options

The **PHASE** soft key on the 'Rover options' configuration form leads to a sub-form where you can configure the options to be used in 'Carrier phase mode'. This mode is supported by certain Trimble Pathfinder GPS receivers, and enables you to fix the position of a point feature to within a few decimeters (1 decimeter = 10cm), after a longer occupation time (10 minutes) at that point. Contact your Trimble Support Center for details of the Phase Processor software kit, and for a list of Pathfinder GPS receivers which support carrier phase mode.

When connected to a GPS receiver which does *not* support carrier phase mode, Asset Surveyor will not provide a **PHASE** soft key on the 'Rover options' configuration form.

The 'Carrier phase optns' configuration form looks as follows:

```
 Carrier phase optns
Carrier mode:     Off
Logging intervals
 Measurements:    15s
 Positions:      None
Minimum time:    10m
```

The various fields in this form are described below:

- *Carrier mode.* When you capture a point feature in carrier phase mode, Asset Surveyor will log *carrier phase* measurements to each GPS satellite, as well as optionally logging GPS positions. These measurements can be post-processed, in conjunction with an appropriate GPS base station, as a GPS baseline accurate to a few decimeters.

   The 'Carrier mode' field can take one of three values:

   − *Off.* Carrier phase mode is disabled, which is the default.

   − *On.* Subsequent point features will be captured in carrier phase mode.

   − *Query.* When you start each subsequent point feature you will be asked whether or not that feature should be captured in carrier phase mode.

- *Logging intervals*. The two intervals under this heading are for the logging of carrier phase 'Measurements' and GPS 'Positions', respectively.

  Although the Phase Processor software uses only carrier phase measurements to compute a solution, it is sometimes useful to log occasional GPS positions for carrier phase point features (e.g. in case you decide not to run your data through the Phase Processor). In any case, Asset Surveyor will ensure that at least one GPS position is logged per carrier phase point feature, regardless of the configured 'Positions' logging interval, as this is required by the Phase Processor software.

⊠ | **Note -** For some Pathfinder GPS receivers, the minimum carrier phase logging interval is 5 seconds, while for other Pathfinder GPS receivers the minimum is 1 second (consult the Operation Manual for your particular Pathfinder GPS receiver for further details).

- *Minimum time*. The minimum time for which you should remain at a point in order to record sufficient carrier phase data to process to maximal accuracy.

Changes made to the 'Carrier mode' field's value will take effect the *next* time you record a point feature. Changes to the logging intervals and 'Minimum time' fields take effect immediately, if made when capturing a point feature in carrier phase mode.

⊠ | **Note -** Trimble specifies a 'Measurements' logging interval of 15 seconds, for a continuous period of at least 10 minutes, to achieve optimal accuracy, provided your receiver is tracking at least 5 satellites at an elevation of 15° or more, and with a PDOP of less than 6.

💣 | **Caution -** You are unlikely to achieve high accuracy when operating in carrier-phase mode unless you mount the GPS receiver's antenna on a tripod, bipod, pole or other stable mounting.

Configuration/
GPS/Rover Options/
Antenna Options

The `ANTENNA` soft key on the 'Rover options' and 'Base stn options' configuration forms leads to a sub-form where you can configure GPS antenna options.

Typically, you will operate your Trimble GPS system with a GPS antenna on a pole, on a backpack, or mounted on top of a vehicle. If you are interested in capturing the *altitude* of geographic features, the altitude of the feature will usually be that of the base of the pole, or your feet, or the wheels of your vehicle. In order to accurately record the true altitude of surveyed features, Asset Surveyor lets you specify the height of the antenna above the point in which you are actually interested. The specified height will be written to the current data file when you commence data capture and whenever you change its value.

For precise location of a feature's altitude, you must specify the height from the point of interest (e.g. the ground) to the electronic center of the antenna (also called the 'Antenna Phase Center' or APC). Because you can't run a tape measure from the actual center of the antenna, it is usually most convenient to measure to a different part of the antenna and allow Trimble's Phase Processor software to apply a correction to the specified height which takes account of the antenna type to yield the true height to the center of the antenna.

A measured antenna height is said to be 'Vertical' if it is the true height from the point of interest to the center of the antenna, or 'Uncorrected' if it is the height from the point of interest to some designated measuring point on the exterior of the antenna.

The 'Antenna' options form is as follows:

```
            Antenna
Height:              0.000m
Measure:          Vertical
Type:                   EC



```

where the default values for each field are as shown. These fields are:

- The antenna 'Height' is the height from the point of interest (typically on the ground) to the antenna. Whether this is a 'Vertical' or 'Uncorrected' height is determined by the following field. The 'Height' field has attached units, which can be altered by changing the 'Height' units under 'Units and display' (see page 7-51). If you are working in one unit (e.g. meters) and your antenna pole is calibrated in another (e.g. feet), remember that you can enter a value in whatever units you like; this value will then be converted to the units in which you are working. For example, if you entered a height of '2ft 6in' when the configured 'Height' units are meters, Asset Surveyor will automatically convert '2ft 6in' into '0.762m'.

- The 'Measure' field indicates whether the height has been measured to the antenna's center ('Vertical') or to a point on the antenna's exterior ('Uncorrected').

- The 'Type' of the antenna is a two-letter code which identifies each distinct GPS antenna with which the Asset Surveyor software might be used. Specifying the antenna type enables Trimble's Phase Processor software to transform an 'Uncorrected' height to a true 'Vertical' height. The following table shows which 2-character 'Type' code you should enter for your specific GPS receiver's antenna.

Antenna	Type	Part #	Measure to ...
Unknown External	E	N/A	N/A
4000ST Internal	I	N/A	Reading from internal tape
4000ST Kinematic (Ext)	EK	14156-00	Bottom of antenna mount
Compact dome	EC	16741-00	Bottom of antenna mount
4000ST L1 Geodetic	EG	14177-00	Bottom of notch
4000ST/SSE L1/L2 Geodetic	E2	14532-00	Bottom of notch on ground plane
4000SE Internal	IE	N/A	Reading from internal tape
4000SSE Kinematic L1/L2	EF	14532-10	Bottom of antenna mount
Compact L1/L2 w Groundplane	G0	22020-00 23158	Bottom of notch on ground plane
Compact L1/L2 Antenna	K0	22020	Bottom of antenna
ProLite	M0	18636-32	Bottom of antenna

Asset Surveyor maintains two sets of antenna details, one for 'Rover options' and one for 'Base stn options', as you will typically set up your GPS system differently if you are planning to operate a GPS base station.

☆ **Tip -** You only need to measure your antenna height accurately if you wish to record accurate feature altitudes, or if you are using carrier phase mode to fix the position of features to the higher accuracy. Many GIS applications do not even store the altitudes of geographical features.

Configuration/
GPS/Rover Options/
P(Y) Options

The **P(Y)** soft key will only appear when not connected to any GPS receiver (for pre-configuration purposes) or when connected to a receiver with P(Y) capability (e.g. the Trimble Centurion).

A P(Y)-capable receiver uses the GPS P-code (or the Y-code, when the P-code is encrypted) to compute GPS positions. The P- and Y-codes are not susceptible to the effects of Selective Availability (SA). P(Y)-capable receivers are only available to certain approved customers (generally U.S. Federal agencies and specified foreign Governments). Most civilian GPS receivers use the GPS C/A-code, which is subject to the effects of SA. A common synonym for the GPS C/A-code is 'SPS' (for Standard Positioning System), while a synonym for the P(Y)-code is 'PPS' (for Precise Positioning System)

You can press **P(Y)** to pop up the 'P(Y) options' form:

```
       P(Y) options
P(Y) mode
 In feature:     Query
 Not in feature:   On
```

The 'P(Y) mode' can be configured separately when capturing a feature and when not in a feature. Outside data capture, Asset Surveyor will always request P(Y) (i.e. PPS) positions. The P(Y) modes can be reconfigured at any time. The P(Y) modes have the default values indicated above, which imply the following default behavior:

- Within data capture, but outside of a feature, all positions which are displayed and used for navigation will be P-code positions. Any positions logged at the 'Not in feature' interval ('None', by default) will also be P-code positions.

- Whenever you start a feature, Asset Surveyor will query as to whether or not you wish to use P(Y) mode. You should answer 'Yes' if you are happy with PPS accuracy (10-25m) and don't want to differentially correct your data, or 'No' if you require the ability to post-process your

data to 1-3m accuracy. If you always want to capture features either with P-code positions or with C/A-code positions, then you should set the 'In feature' P(Y) mode to either 'On' or 'Off', respectively, to avoid having to answer a question each time you start a feature.

The various P(Y) mode settings are:

- 'On'. When the mode is 'On' and the decryption key is active, Asset Surveyor will request P-code (i.e. PPS) positions. When the decryption key is inactive, Asset Surveyor will display the following message at startup and when entering data capture:

```
┌──── Warning! ────┐
 The P(Y) key is
 disabled. P-code
positions will not
   be available.
└──────────────────┘
```
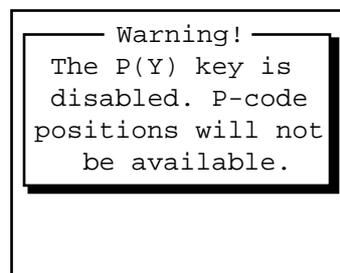
In this case the receiver will emit C/A (i.e. SPS) positions only.

- 'Off'. When the mode is 'Off' Asset Surveyor will request C/A-code (i.e. SPS) positions. These can be differentially corrected via post-processing.

- 'Query'. When the 'In feature' P(Y) mode is 'Query', you will be asked whether or not you wish to use P(Y) mode whenever you start a feature. If the 'Not in feature' P(Y) mode is 'Query', you will be asked whether or not you wish to use P(Y) mode only when you start data capture.

Switching between C/A and P(Y)

It takes several seconds for the receiver to switch between using C/A-code and using P(Y)-code. While switching, Asset Surveyor will display either:
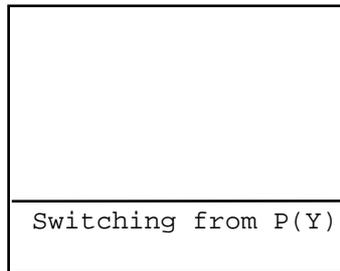
```
┌─────────────────────────┐
│                         │
│                         │
│                         │
│                         │
│                         │
├─────────────────────────┤
│   Switching from P(Y)   │
│                         │
└─────────────────────────┘
```

or
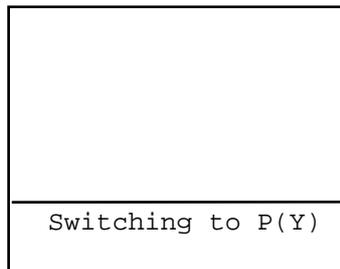
```
┌─────────────────────────┐
│                         │
│                         │
│                         │
│                         │
│                         │
├─────────────────────────┤
│    Switching to P(Y)    │
│                         │
└─────────────────────────┘
```

depending on the direction of the switch, on its GPS status line. During this switching phase, GPS positions will briefly be unavailable. Switching will only take place as you start and end features, and only then if the 'In feature' and 'Not in feature' P(Y) modes differ.

The GPS Status Line

When P(Y)-code (i.e. PPS) positions are being received from a P(Y)-capable receiver, Asset Surveyor will indicate this fact by placing a 'P' (for P-code) on the GPS status line, in place of the '#' or 'R' character. For example:
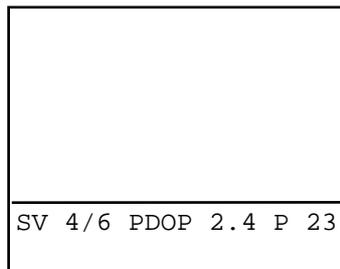
```
┌─────────────────────────┐
│                         │
│                         │
│                         │
│                         │
│                         │
├─────────────────────────┤
│  SV 4/6 PDOP 2.4 P 23   │
│                         │
└─────────────────────────┘
```

Configuration/
GPS/Rover Options/
Output Options

The **OUTPUT** soft key on the 'Rover options' configuration form leads to a sub-form where you can configure the output to be produced by your GPS receiver. Appendix B provides details of which outputs are supported by your specific GPS receiver, while Appendix E provides details of the NMEA output format in particular.

> ✉   **Note -** A range of output options can be purchased for the 4000 Series GPS receivers. Outputs from a 4000 Series receiver must be configured on the receiver's front panel; Asset Surveyor's 'Output options' apply only to Pathfinder GPS receivers.
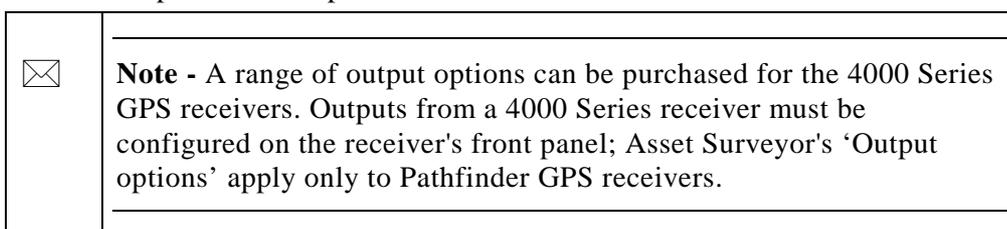
The 'Output options' form looks as follows:

```
        Output options
Output:               None
Baud rate:            9600
```

The two fields on this form are described below:

- *Output.* This can be 'None' (the default), 'NMEA' or 'TSIP'.

- *Baud rate*. The 'Baud rate' field allows you to configure the baud rate at which your selected output (if any) will be transmitted by the GPS receiver.

> ✉   **Note -** Although the baud rate for receiver outputs can be set in the 'Output options' form, the other serial communications parameters (i.e. 'Stop bits', 'Data bits' and 'Parity') must be shared with the incoming RTCM stream, if any. Return to the 'Rover options' form and press **RTCM** to check that these serial parameters are appropriate for your output device.
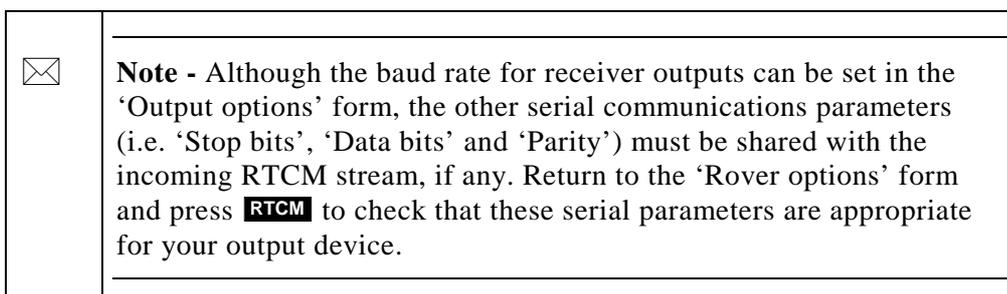
Whenever you change the 'Output options', Asset Surveyor will remind you to check the 'RTCM options' form and ensure that all of the serial communications parameters are set appropriately:

```
┌──── Warning! ────┐
│   Press "RTCM" to │
│ check other serial│
│    parameters.    │
└───────────────────┘
```

💣 **Caution -** If you wish to use a Trimble Pathfinder GPS receiver in conjunction with an RTCM radio and another output device, the radio/modem and output device *must* use the same Stop bits, Data bits and Parity.

💣 **Caution -** Some RTCM radio receivers may be confused or jammed if you attempt to 'transmit' data through them. Unless you are actually making use of a receiver output, and unless you have an appropriate splitter cable which separates the RTCM input line from the receiver's output line, you should leave the 'Output' field set to 'None'.

NMEA Output

The NMEA 0183 protocol is a widely used standard for communication with GPS devices and other navigational systems.

Trimble Pathfinder GPS receivers which support the NMEA 0183 protocol can be configured by Asset Surveyor to output NMEA messages at a specified rate, and a subset of the available messages can be selected.

When you set the 'Output' field in Asset Surveyor's 'Output options' configuration form to 'NMEA', Asset Surveyor will extend the 'Output options' form as follows:

```
┌─────────────────────────────┐
│      Output options         │
│ Output:            ▐NMEA▌    │
│ Baud rate:          9600     │
│ Output interval:    5s       │
│ NMEA-0183 messages           │
│  ALM:               No       │
│  GGA:               Yes      │
│  GLL:               No       │
│  GSA:               No       │
│  GSV:               No       │
│  VTG:               Yes      │
│  ZDA:               No       │
└─────────────────────────────┘
```

The additional fields on this form are:

- *Output interval*. The interval at which NMEA messages are to be emitted by the GPS receiver.

- *ALM*. Almanac information for each satellite.

- *GGA*. GPS time, position and fix-related data.

- *GLL*. GPS position fix, time of fix and status.

- *GSA*. GPS receiver operating mode, satellites used for navigation and DOP values.

- *GSV*. Number of visible satellites, satellite PRN numbers, elevation, azimuth and SNR values.

- *VTG*. Actual track made good and speed over ground.

- *ZDA*. UTC day, month, year and local time zone offset.

See Appendix E for a detailed description of each supported NMEA-0183 packet.

Once you save the contents of the 'Output options' form with the 'Output' field set to 'NMEA', your Pathfinder GPS receiver will begin to emit the selected NMEA-0183 messages at the configured 'Output interval', provided the receiver supports NMEA output.

TSIP Output

Trimble's Standard Interface Protocol (TSIP) is a complex binary protocol for controlling Pathfinder GPS receivers. This is the protocol which the

Asset Surveyor software uses to communicate with your Pathfinder GPS receiver.

When you set the 'Output' field in Asset Surveyor's 'Output options' configuration form to 'TSIP', your Pathfinder Series GPS receiver will start to output TSIP messages to its auxiliary serial port. You may require a special cable to make use of this information. You cannot control the frequency or nature of the TSIP messages which will be output by the receiver, as these are determined by Asset Surveyor itself.

> ⊠ **Note -** Certain Pathfinder GPS receivers, including the Pro XL, are capable of emitting an electronic pulse precisely on each GPS second. This stream of pulses can be used for precise synchronization of external devices, and for correlation of external events with GPS times and positions. The Pro XL System *Operation Manual* provides cabling details for the Pro XL, and indicates which pin carries 1 PPS output for that receiver. No configuration of the Asset Surveyor software is required to obtain this 1 PPS output; the Pro XL emits it at all times.

Configuration/
GPS/Base Station Options

If you select 'Base stn options' from the 'Configure GPS' menu shown
above, or if you select the 'GPS' entry from the 'Configuration' menu when
in base station mode, then the following configuration form will appear.

```
  Base stn options
Logging intervals
 Measurements:    5s
 Positions:      30s
Log DOP data:    Yes
Pos mode:  Manual 3D
Elev. mask:     10°
SNR mask:        4.0
PDOP mask:       8.0
PDOP switch:     8.0
Audible click:   Yes
ANTENNA
```

Note - Many of the fields in the 'Base stn options' configuration form
are similar to those in the 'Rover options' form. Remember that the
rover options will be used whenever you are not operating your Asset
Surveyor as a GPS base station (i.e. when capturing data to a rover
file, when outside 'Data capture', or when navigating). The base
station options will be used *only* when you are operating the Asset
Surveyor software as a GPS base station in conjunction with a
Pathfinder GPS receiver. See page 7-154 for details of using the Asset
Surveyor software as a GPS base station.

Note - The Asset Surveyor software cannot operate a 4000 Series GPS
receiver as a base station, so the 'Base stn options' configuration form
is unavailable when you are connected to a 4000 Series receiver.

Because many of the fields of the 'Base stn options' configuration form are
similar to those in the 'Rover options' form, only the fields which differ
significantly will be described here. Refer to the previous section on the
'Rover options' configuration form for details of fields not described below.

Measurements

The primary task of a GPS base station is to log raw GPS measurements from satellites for use when differentially correcting rover files. In order to provide accurate differential corrections, raw measurements should be logged reasonably often. The maximum permitted measurement logging interval is 15 seconds. You can reduce the interval to a minimum of one second, but as this will result in up to 15 times as much data being logged by Asset Surveyor, you may find that your MC-V's storage is consumed very quickly and that differential correction of rover files is slow. The default setting of five seconds provides a good compromise between the quality of post-processed positions and the storage space and processing time required.

✉	**Note -** For some Pathfinder GPS receivers, the minimum raw measurement logging interval is 5 seconds, while for other Pathfinder GPS receivers the minimum is 1 second (consult the *Operation Manual* for your particular Pathfinder GPS receiver for further details).
☆	**Tip -** For the best accuracy, you should ensure that the position logging interval for each GPS rover is an exact multiple of the measurement logging interval at the base station. If you set the position logging interval to a value which is *not* an exact multiple of the base station's measurement logging interval, the differential correction program will have to compute interpolated differential corrections. These will be less accurate than those computed when the logging intervals of the base station and rover(s) are synchronized.
✉	**Note -** If your GPS receiver is capable of supplying synchronized carrier phase measurements, the Asset Surveyor software will request these when operating as a base station; otherwise, the Asset Surveyor software will log (unsynchronized) raw pseudorange measurements. Only receivers capable of supplying synchronized carrier phase measurements can be used as base stations for rovers operating in carrier phase mode.

If your MC-V is running CMT-ROS version 1.05, Asset Surveyor should not be configured to log 'Measurements' at an interval less than 5 seconds, especially if you have configured the software to also log GPS positions and/or DOP data. If you configure the software to log data at a very high rate, the MC-V may be unable to process data from the GPS receiver quickly enough and a 'Communications error' may occur. Turn off the logging of data which is not required, or increase the interval at which data is logged, to avoid communications errors.

Positions

The logging of GPS positions by a base station is not essential for differential correction. You can, however, choose to log a few positions in order to be able to graphically display the position of the base station in PFINDER. If you set up a temporary base station on an unknown point, you may wish to log positions frequently to a base file. You can then differentially correct that base file against another (perhaps more distant) base station in order to discover the reference position for the temporary base station. Once this is known, you can use the local base file to correct local rover files.

Log DOP Data

You can choose to log dilution of precision (DOP) values when operating as a base station, so that you have a record of the prevailing GPS conditions.

When the 'Log DOP data' option is set to 'Yes', Asset Surveyor will log values of PDOP, HDOP, VDOP and TDOP (see page 7-87) whenever the PDOP value varies by 0.1 or more, provided the PDOP is below the configured PDOP mask. This provides a good record of each DOP situation which occurred throughout a survey period. The logging of DOP information will typically increase the size of a base file by approximately 2-3%.

Position Mode

You can operate a base station in any of the position modes which are permitted for a rover, i.e. Manual 2D, Auto 2D/3D, Manual 3D or Overdet. 3D. In general, however, you should be able to site a base station such that it is always able to track at least four satellites, so that there will be no need to use any mode other than Manual 3D (the default).

Elevation Mask

The default elevation mask for a GPS base station is 10° (as opposed to the default of 15° for rovers).

> **Caution -** You *must* ensure that the elevation mask for the base station is set sufficiently low that the base can always track any satellites visible to the rovers. Remember that as the rovers get further from the base station, the difference between the elevation mask of the rovers and the base becomes more and more critical (due to the curvature of the earth). As a rule of thumb, the difference must be at least 1° for every 100km between the base and the rover.

SNR Mask

The default signal-to-noise ratio mask for a GPS base station is four. The SNR mask does not influence the choice of satellites tracked by the base station, but does determine when the base station can log GPS positions. Note, however, that the logging of positions is not essential for differential correction.

PDOP Mask and PDOP Switch

The default PDOP mask and PDOP switch for a GPS base station are both slightly higher than their equivalents for rovers. This should ensure that the base station will always be able to log positions whenever a rover would be logging positions. Note, however, that the logging of positions is not essential for differential correction.

Antenna Options

You can press the `ANTENNA` soft key in the GPS 'Base stn options' configuration form to pre-configure the antenna details prior to setting up a base station. When you actually set Asset Surveyor into base station mode, you will be asked to re-confirm the pre-configured base station antenna details. It is important that you enter the antenna details for your base station correctly, as the PFINDER software uses these details to transform the reference position (on the ground) into the position of the GPS receiver's Antenna Phase Center (APC). This APC position is used by the differential correction software and the Phase Processor software.

Configuration/
Coordinate System

Trimble's GPS receivers provide you with your position anywhere on the earth's surface. GPS positions are normally expressed as latitudes and longitudes relative to a mathematical model called a *datum*. The datum used by GPS is called the World Geodetic System 1984 datum (or 'WGS-84'). A datum is defined by the relationship between an *ellipsoid* and an origin point. An ellipsoid is a three dimensional surface shaped like a squashed sphere, which approximately models the shape of the earth (either as a whole, or over a particular part of the earth). The WGS-84 datum is defined in terms of the GRS80 ellipsoid.

For some applications (e.g. marine navigation and aviation), GPS latitudes and longitudes can be used directly.

For most land-based GPS applications, and particularly for GIS data capture applications, latitudes and longitudes are much less convenient. Typically, a GIS will represent the coordinates of geographic features in a locality of interest using a rectangular grid (running North and East) and will presume that the earth is locally flat. A *local ellipsoid* can be defined to provide a good approximation to the shape of the earth in that locality. A *datum transformation* and a *map projection* are then used to transform coordinates from this local ellipsoid to the GIS's flat-earth model.

Heights can be displayed by Asset Surveyor relative to either a local ellipsoid, or an empirically defined surface known as the *geoid*. This is a surface of constant gravitational equipotential which approximates mean sea level.
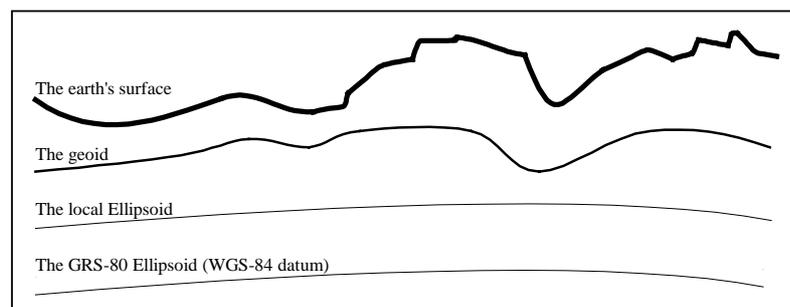
Figure 7-1   Coordinate System Models

In summary, there are three models for describing geographic locations:

- The flat North, East model of the GIS, possibly with Heights as well,

- The curved local ellipsoid, used by the GIS as a model of the earth's surface locally.

- The curved GRS-80 ellipsoid, used by GPS as a model of the earth's surface as a whole.

These models can describe heights as being relative to either:

- An ellipsoid.

- The geoid (mean sea level).

In order to capture the positions of features using GPS (and hence the WGS-84 datum) and then send them to a GIS as North, East coordinates, the GPS latitudes and longitudes need to be processed in a number of ways:

- They need to be transformed from latitudes, longitudes and altitudes on the WGS-84 datum into latitudes, longitudes and altitudes on the local datum. This operation is called a *datum transformation*.

- Once the coordinates are expressed as latitudes and longitudes on the local datum, they must then be projected into North and East values on a flat grid, using an operation called a *map projection*.

- Finally, if altitudes are to be stored by the GIS, they need to be transformed from heights above the GRS-80 ellipsoid to heights above some other reference level. The most common reference level is the geoid, more commonly referred to as *mean sea level*. The Asset Surveyor software and Trimble's PFINDER software both contain a *geoid separation model* which enables them to transform altitudes relative to GRS-80 into heights relative to mean sea level.

> ⊠ **Note -** The geoid separation models used by Asset Surveyor and PFINDER are necessarily approximate, and if you require altitudes relative to a different reference level, or relative to a more accurate (perhaps local) mean sea level model, you will have to process the heights produced by PFINDER before exporting them to your GIS.

Asset Surveyor allows you to specify a datum transformation and a map projection, so that you can see your GPS position (and the position of features you may have recorded) in your local coordinate system. This

makes it easy for you to check your position or navigate using a map produced by your GIS.

⊠ **Note -** Asset Surveyor allows you to specify that heights will be shown relative to your local ellipsoid, or relative to mean sea level. Configuration of the 'Altitude reference' is described on page 7-56.

For your convenience, Asset Surveyor bundles up the complexities of datum transformations and map projections, and hides these complexities behind the common names for the coordinate systems with which you may be familiar. Each named coordinate system has an associated datum (which encapsulates an ellipsoid) and a number of *zones* (each of which is a named instance of a particular map projection).

You can create your own coordinate systems using the ASSETED utility program described in Appendix C. With the set of pre-defined coordinate systems supplied by Trimble this should rarely be necessary.

Configuration/
Coordinate System/
Selection

When you select the 'Coordinate system' entry from Asset Surveyor's 'Configuration' menu, a menu of available coordinate systems will pop up:

```
┌─Coordinate system─┐
│ Latitude/Longitude │
│ UTM                │
│ US SPCS NAD-27     │
│ US SPCS NAD-83     │
│ NZMG 1949        ↓ │
├────────────────────┤
│ OVERUP             │
└────────────────────┘
```
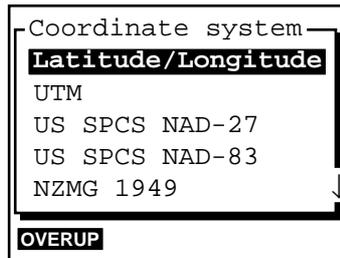
You can select a coordinate system from this menu by highlighting the entry and pressing ENTER (or by using a first-letter search). After selecting a coordinate system you can select a specific zone *within* that coordinate system.

☆	**Tip -** The Asset Surveyor software diskette contains a pre-defined coordinate system file (ASCOORD.DAT) which can be loaded into your MC-V using PFINDER. This file can be edited on your PC using the ASSETED utility described in Appendix C. Some of the pre-defined coordinate systems are described in the following sections. The creation and editing of coordinate systems, datums and zones using ASSETED is described in Appendix C.
✉	**Note -** The OVERUP soft key allows you to configure and enable display of coordinates using the Trimble 'Over and Up™' map referencing system.

Configuration/
Coordinate System/
Selection
Latitude / Longitude

The Asset Surveyor system supports a 'Latitude/Longitude' coordinate system, whether or not you have loaded the file of pre-defined coordinate systems.

When you select 'Latitude/Longitude' from the menu of available coordinate systems, you will be asked to select the datum relative to which latitudes and longitudes should be displayed.

```
  Latitude/Longitude
Datum:               ?



```

The 'Datum' field allows you to pop up a menu of available datums. Once you have selected a datum, press **OK** to save your selection of the 'Latitude/Longitude' coordinate system.

> ✉ **Note -** If you have not loaded the file of pre-defined coordinate systems, the only datum available will be WGS-84.

The 'Latitude/Longitude' coordinate system is unique in that it has no 'zones', as such. Once you have chosen this coordinate system and have selected a datum, all positions displayed by Asset Surveyor will be shown as latitudes and longitudes relative to the selected datum.

Configuration/
Coordinate System/
Selection/UTM

The Asset Surveyor system supports a 'UTM' coordinate system, whether or not you have loaded the file of pre-defined coordinate systems.

UTM is an abbreviation for 'Universal Transverse Mercator', a system which uses Transverse Mercator map projections and a set of country-wide datums to span most of the earth's surface. In order to use UTM at a specific location, you need to know which datum to use, which UTM *zone* you are in, and which hemisphere (north or south) you are in. There are 60 UTM zones, numbered 1 to 60, starting at the International Date Line and proceeding in an easterly direction around the earth, in steps of 6°.

When you select 'UTM' from the menu of available coordinate systems, Asset Surveyor displays a form where you can specify the zone, the datum, the hemisphere and the scale factor.
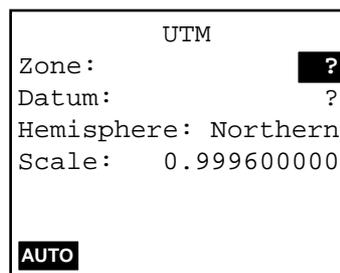
```
            UTM
Zone:                 ?
Datum:                ?
Hemisphere: Northern
Scale:     0.999600000


AUTO
```

When you first select a UTM coordinate system, Asset Surveyor will use the most recent GPS position (or the specified 'Initial position', if a current GPS position is unavailable) to 'guess' which UTM zone you are in. You should check that it has guessed correctly, and modify any field which is incorrect.

You can press **AUTO** to get Asset Surveyor to take a new guess at your UTM zone, based on the most recent GPS position (or the 'Initial position' if a current GPS position is unavailable).

If you wish to manually enter a zone, you should type a number between 1 and 60 (inclusive) into the 'Zone' field. You should then select a datum from the menu in the 'Datum' field, and select the appropriate 'Hemisphere'.

The 'Scale' field is used to specify the scale factor which should be used for this UTM zone. The default value of 0.9996 is very common for UTM zones, but certain zones and applications use different scale factors.

> **Caution -** It is very important that you specify the correct datum when using UTM. Traditionally, the NAD-27 datum has been used for UTM throughout the United States, but recently the NAD-83 datum has been used as the U.S. base for UTM in some applications. If you wish Asset Surveyor to display GPS positions which are compatible with UTM maps produced by your GIS, you must ensure that the UTM zone, datum and scale factor used by the GIS are all entered into Asset Surveyor correctly.

Once you have checked that Asset Surveyor's guess is correct, or entered the zone manually, press **OK** to save your choice of UTM zone. Once you have chosen the UTM coordinate system and accepted a zone, all positions displayed by Asset Surveyor will be shown in UTM coordinates.

> **Note -** Asset Surveyor will warn you if you to specify a UTM zone which is further than two zone widths (i.e. 12°) of longitude from the current GPS position. You can still save the configuration form, but before doing so you should check that the zone which you have specified is indeed correct.

Configuration/
Coordinate System/
Selection/Other

Apart from the special 'Latitude/Longitude' and 'UTM' coordinate systems, your Asset Surveyor system comes with a selection of pre-defined coordinate systems which can be loaded onto your MC-V, as described on page 7-138. You can also edit these pre-defined coordinate systems, or create new ones using the ASSETED utility program, as described in Appendix C.

The following examples presume a selection of Trimble's pre-defined coordinate systems have been loaded onto your MC-V:

```
┌Coordinate system┐
│Latitude/Longitude│▐
│UTM               │
│US SPCS NAD-27    │
│US SPCS NAD-83    │
│NZMG 1949        ↓│
│                  │
│ OVERUP           │
└──────────────────┘
```
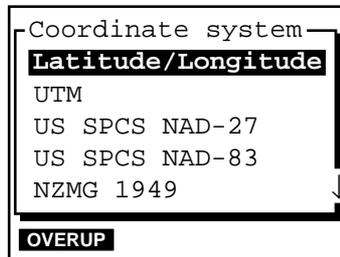
To select a coordinate system from this menu, move the highlight to the entry you require and press ENTER. If, for example, you wished to use a U.S. State Plane coordinate system under the NAD-83 datum, highlight 'US SPCS NAD-83' and select it. Once you have selected a coordinate system, Asset Surveyor will ask you to select a zone within that coordinate system, by popping up a menu of applicable zones. For the US SPCS NAD-83 coordinate system, these range from:

```
┌──── Zone ────┐
│Alabama, E    │▐
│Alabama, W    │
│Alaska 2      │
│Alaska 3      │
│Alaska 4     ↓│
│              │
└──────────────┘
```

to:

```
┌──────── Zone ────────┐
│ Wisconsin, S      ↑  │
│ Wyoming, E           │
│ Wyoming, E Cent      │
│ Wyoming, W Cent      │
│ Wyoming, W           │
│                      │
└──────────────────────┘
```
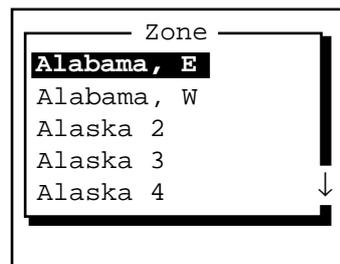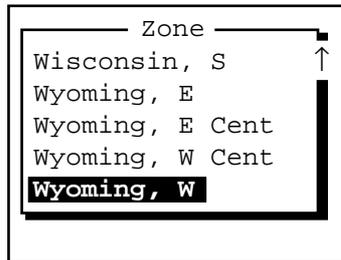
You should be able to easily identify the correct U.S. State Plane zone from this menu. Select it using ENTER, and from that point on Asset Surveyor will display positions as coordinates in the selected State Plane zone.

⊠   **Note -** After selecting the appropriate coordinate system and zone, you should also select the *units* in which you wish Asset Surveyor to display coordinates. Page 7-51 describes how to configure Asset Surveyor's 'Coords' units.

Configuration/
Coordinate System/
Selection/Over and Up

The Trimble 'Over and Up™' map referencing system is a very convenient way to represent coordinates on a paper map. Rather than viewing or entering coordinates as latitudes and longitudes, or as northings and eastings, all coordinates are expressed as paper distances from a reference position somewhere on your map.

If you press the `OVERUP` soft key *after* selecting a coordinate system, the 'Over and Up' configuration form will appear:

```
        Over and Up
Mode:              Off
Reference position
 North:              ?
 East:               ?
Scale (1:):          ?

WAYPT
```

By default, 'Over and Up' mode is disabled. You can enable it by changing the 'Mode' field from 'Off' to 'On'. Asset Surveyor will allow you to enable 'Over and Up' mode only if you supply non-null coordinates for the 'Reference position' and the map's 'Scale'.

> ✉ **Note -** The 'Reference position' coordinates must be entered in terms of the *currently selected* coordinate system. The `WAYPT` soft key can be used to select a pre-entered waypoint as the reference position for your map.

Once you have entered appropriate values, press `OK` to save the 'Over and Up' settings.

When you subsequently view positions (e.g. the current GPS position, the position of a captured feature, or that of a waypoint), Asset Surveyor will show these positions relative to the Over and Up reference position, in paper units. The position will be shown as 'Left' or 'Right' of the reference position, and either 'Up' or 'Down' from the reference position. If your configured distance units (see the 'Units and Display' configuration form)

are metric, the 'Over and Up' distances will be shown in centimeters (cm); otherwise they will be shown in inches (in).

✉	**Note -** Over and Up mode will only work with maps which are aligned to True north.
💣	**Caution -** Remember to change your 'Over and Up' settings whenever you change maps!

Configuration/
Units and Display

When you select the 'Units and display' entry from Asset Surveyor's 'Configuration' menu, the following configuration form will appear:

```
   Units and display
Units
 Coords:    Meters(m)
 Height:    Meters(m)
 Distance: Meters(m)
 Velocity: Km / Hour
 Angles:   Degrees(°)
Angle fmt: DD.MMSSss
Order:     North/East
Altitude ref:     MSL
North ref:       True
Magnetic decl:   Auto
Null string:        ?
Language:      English
Keypad:      ABC…XYZ
```

Asset Surveyor allows you to configure many of the ways in which it will display information on the MC-V's screen. The default values for each field are as illustrated above. The configurable unit and display style fields are described in detail in the following sections:

Configuration/
Units and Display/
Units

Asset Surveyor displays units on a number of fields, and permits the specification of units when values are entered into these fields. Five classes of units can be configured:

- 'Coords' units

- Vertical 'Height' units

- Horizontal 'Distance' units

- 'Velocity' units

- 'Angle' units.

If you position the highlight on any of these fields in the 'Units and display' configuration form and press ENTER, Asset Surveyor will pop up the menu of units available for that field.

For 'Coords' values, the permitted units are:

```
┌──── Coords ────┐
│Meters(m)       │
│Feet(ft)        │
│US Survey Ft(USft)│
│Yards(yd)       │
└────────────────┘
```
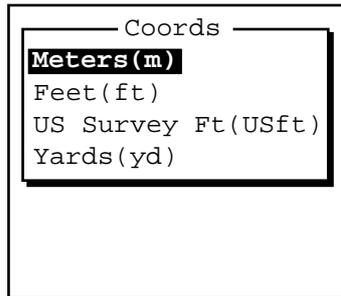
For 'Height' values, the permitted units are:

```
┌──── Height ────┐
│Meters(m)       │
│Feet(ft)        │
│Inches(in)      │
└────────────────┘
```
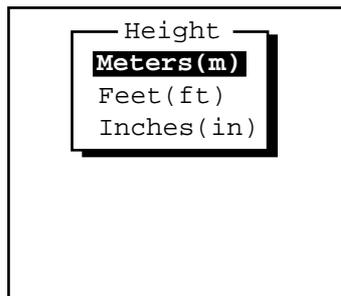
For 'Distance' values, the permitted units are:

```
┌─────── Distance ───────┐
│ Meters(m)              │
│ Feet(ft)               │
│ Inches(in)             │
│ Yards(yd)              │
│ Kilometers(km)         │
│ Miles(mi)              │
│ Nautical Miles(nm)     │
│ US Survey Ft(USft)     │
└────────────────────────┘
```
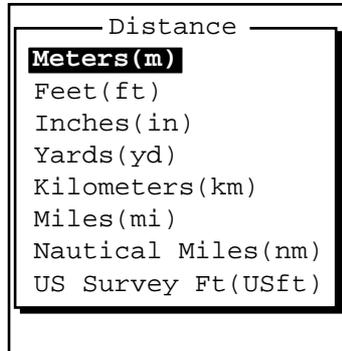
For 'Velocity' values, the permitted units are:

```
┌─────── Velocity ───────┐
│ Meters/Second(m/s)     │
│ Feet/Second(ft/s)      │
│ Km/Hour(km/h)          │
│ Miles/Hour(mph)        │
│ Knots(kt)              │
└────────────────────────┘
```
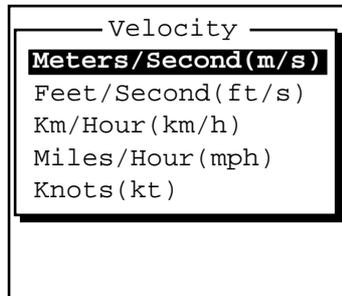
For 'Angular' values, the permitted units are:

```
┌─────── Angles ───────┐
│ Degrees(°)           │
│ Radians(rad)         │
│ Gons(gon)            │
│ Rhumbs(rh)           │
│ Mils(mil)            │
└──────────────────────┘
```
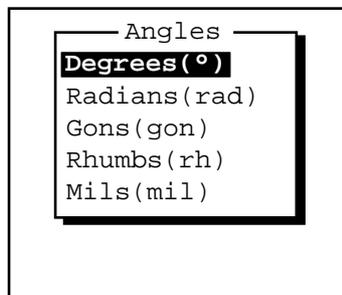
> ⊠ | **Note -** The configured units for 'Angles' affect only the angles displayed when navigating, measuring between waypoints and entering offsets. They do not affect the bearings shown in the GPS 'Satellite info' form and they have no effect on the entry or display of latitudes or longitudes (which are always entered and displayed in degrees with optional minutes and/or seconds).

You can select convenient units for 'Coords', 'Height', 'Distance', 'Velocity' and 'Angles', and then move on to the other 'Units and display' fields.

Configuration/
Units and Display/
Angle Fmt

You can configure the format for the entry of angles which use degrees (including latitudes and longitudes) into Asset Surveyor fields. The available formats are:

```
┌─── Angle fmt ───┐
│ DD°MM'SS.ss"    │
│ DD.MMSSss       │
│ DD MM.mmm       │
│ DD.ddd          │
│                 │
└─────────────────┘
```
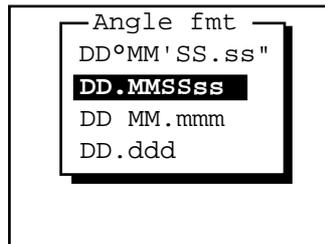
All full angles are *displayed* in the 'DD°MM'SS.ss"' format. Angles can also be entered in this format by typing each punctuation character, by selecting them from the **UNITS** menu, or by separating each of the components of the angle by a space.

The default 'DD.MMSSss' format allows you to enter a full angle in degrees, minutes and seconds with the minimum of additional punctuation.

The 'DD MM.mmm' format allows you to enter an angle as degrees and decimal minutes, with a space character as punctuation to separate the two components.

The 'DD.ddd' format allows you to enter an angle in decimal degrees.

☆ | **Tip -** When entering latitudes and longitudes, remember that these are signed values, with the sign being used to indicate the hemisphere (North or South for latitudes, East or West for longitudes). You can enter the sign as '+', '-', 'N', 'S', 'E' or 'W', at either the start or end of the field. If you do not specify a sign then Asset Surveyor will default to the hemisphere in which you are currently operating, as determined by your most recent GPS position.

Configuration/
Units and Display/
Order

Whenever Asset Surveyor displays a position, it will show 'North', 'East' and 'Altitude' fields (or 'Latitude', 'Longitude' and 'Altitude' fields, if the current coordinate system is 'Latitude/Longitude').

You can choose the order of the first two fields of each position (i.e. 'North/East' versus 'East/North', or 'Lat/Long' versus 'Long/Lat') by changing the value in the 'Order' field of the 'Units and display' configuration form:

```
┌─── Order ───┐
│ North/East  │
│ East/North  │
└─────────────┘
```

The default order is 'North/East' (or 'Lat/Long').

Configuration/
Units and Display/
Altitude Reference

When Asset Surveyor displays a position, the altitude component of that position will be displayed as a height above (or below) either the current ellipsoid (i.e. datum) or mean sea level. Altitudes relative to the ellipsoid are precise, but may be meaningless for many applications, as altitudes shown on maps are usually relative to mean sea level. When Asset Surveyor displays altitudes relative to mean sea level these are approximate, having been derived from Asset Surveyor's internal mean sea level model. This model is typically accurate to within 2-5 meters.

You can change the altitude reference by changing the value of the 'Altitude ref' field in the 'Units and display' configuration form:
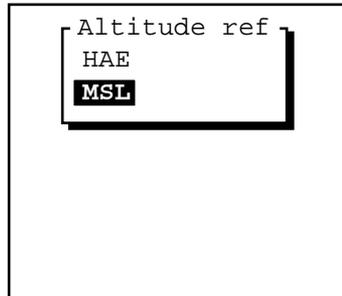
```
┌ Altitude ref ┐
  HAE
  MSL
```

The abbreviation for height above ellipsoid is HAE, and that for mean sea level is MSL. The default altitude reference is mean sea level.

Configuration/
Units and Display/
North Reference

Whenever Asset Surveyor displays a *bearing* (i.e. an angle other than a latitude or a longitude), it does so relative either to true north or to magnetic north. True north is more useful if you are navigating relative to a background map, while magnetic north is best if you are navigating with the assistance of a magnetic compass. You can change the north reference via the 'North ref' field in the 'Units and display' configuration form:

```
┌─ North ref ─┐
│ True        │
│ Magnetic    │
└─────────────┘
```
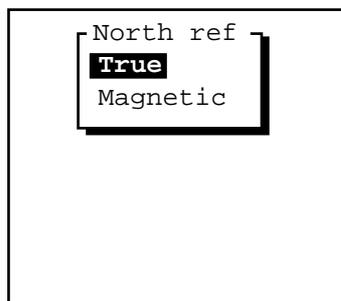
By default, the 'North ref' is 'True'. The difference between true and magnetic north depends on where you are on the earth's surface, and is called the magnetic declination. You can tell Asset Surveyor the current magnetic declination using the following field on the 'Units and display' form.

💣 | **Caution -** Remember to set the 'North ref' field to 'Magnetic' before using a magnetic compass to enter offsets for features manually.

Configuration/
Units and Display/
Magnetic Declination

If you know the magnetic declination for your area (it is printed on most accurate maps), you can type it into the 'Magnetic decl' field of the 'Units and display' configuration form.

⊠ | **Note -** If you move a significant distance you may need to update a manually-entered magnetic declination.
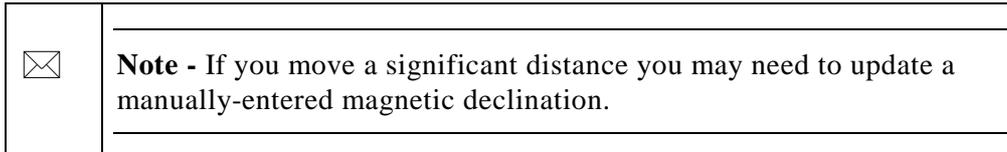
Because you may not always know your magnetic declination, or may prefer not to have to update it as you move about, Asset Surveyor provides an **AUTO** soft key when you are entering a value into the 'Magnetic decl' field, for example:

```
   Units and display
Units
 Coords:    Meters(m)
 Height:    Meters(m)
 Distance: Meters(m)
 Velocity: Km / Hour
 Angles:   Degrees(°)
Angle fmt: DD.MMSSss
Order:     North/East
Altitude ref:     MSL
North ref:       True
Magnetic decl:▯▮▮▮
Null string:        ?
Language:     English
AUTO  ─  UNITS
```
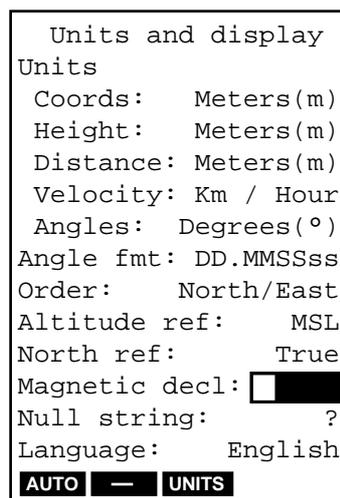
When you press **AUTO**, Asset Surveyor inserts the special value 'Auto' into the 'Magnetic decl' field. From then on, whenever Asset Surveyor requires the magnetic declination, it will consult its internal magnetic declination table, based on your current location.

☆   **Tip -** You should only need to enter explicit declinations when you are navigating over reasonable distances, entering magnetic offsets for features (with or without a laser range-finder) or when there is a local variation in the earth's magnetic field. Asset Surveyor's declination table models the earth's overall magnetic field. It does not take any account of local variations due to such things as mineral deposits, etc. If you need to temporarily enter a precise declination for a particular area, remember to change back to 'Auto' when you leave that area.

✉   **Note -** In order to compute your magnetic declination automatically, Asset Surveyor needs to know where in the world you are. It uses the most recent GPS position, or the configured Initial Position, if no GPS positions are currently available. Until Asset Surveyor knows your Initial Position, it will treat True and Magnetic north as being identical.

Configuration/
Units and Display/
Null String

Whenever Asset Surveyor has no value for a particular field in a form, it displays the 'Null' character string, which by default is the single character '?'. Usually, you will not be permitted to save a form if one or more of its fields still have the null value, but occasionally a field will be permitted to remain null.

You can change the null character string by editing the 'Null string' field in the 'Units and display' configuration form. You can use any character string for the null value, but the null string should be distinctive and preferably brief.

When you are editing the 'Null string' field, Asset Surveyor displays two soft keys:

- You can press **SPACE** to change the 'Null string' to a single space character.

- You can press **SYMB** to insert a special character into the 'Null string'.

Configuration/
Units and Display/
Language

The Asset Surveyor software has been translated into a number of European languages, and once these languages have been loaded onto the MC-V, the language can be changed as desired. With the 'Language' field highlighted, press ENTER to pop up the menu of languages available on your MC-V:

```
        ┌─ Language ─┐
        │ English    │
        │ Française  │
        │ Deutsch    │
        │ Español    │
        │ Russian    │
        │            │
     DEL│            │
```
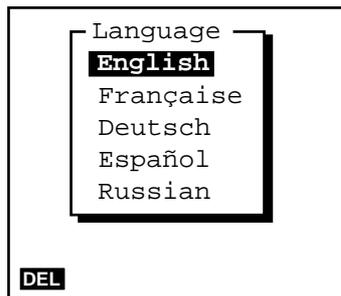
You can change languages by selecting another language from this menu.

The distribution diskette for the Asset Surveyor software contains each of the language files supported at the time of purchase. If the language you require is not on that diskette, please contact your Trimble distributor, as new translations of the Asset Surveyor software may be available. See page 7-138 for instructions on how to load new language files into your MC-V.

To delete an unwanted language, highlight it and press DEL. Asset Surveyor will not allow you to delete the default language, which is English.

Configuration/
Units and Display/
Keypad

The Asset Surveyor software can be translated into languages which do not use the normal Roman alphabet (i.e. A, …, Z). For example, the Russian language uses the Cyrillic alphabet.

In order to use Asset Surveyor when running in a language such as Russian, it is necessary to map the MC-V's ⌷A⌷, ⌷B⌷, ⌷C⌷, ..., ⌷Z⌷ keys to letters in the Cyrillic alphabet. The Asset Surveyor release notes illustrate the mapping from Roman to Cyrillic letters. Your Trimble distributor can supply keypad overlays for the Cyrillic alphabet if required.

When running Asset Surveyor in Russian, you will generally wish to enter all information using the Cyrillic alphabet. Occasionally, however, it will be necessary to enter Roman letters (e.g. when entering attributes for certain features, perhaps).

If you select a language such as Russian which uses an alphabet other than the normal 'Roman' one, the Asset Surveyor software will add a 'Keypad' field to the 'Units and display' configuration form. The 'Keypad' field takes one of two values, the first being 'ABC...XYZ', and the second being the alphabet used by the selected language. In the case of the Russian language, this is **АБВ...ШЮЯ**.

You can switch between the Roman alphabet and the native alphabet of your selected language by changing the value of the 'Keypad' field. This allows you to mix the Roman and native alphabets freely when entering information on your MC-V's keypad.

Configuration/
Time and Date

When you select the 'Time and date' entry from Asset Surveyor's 'Configuration' menu, the following configuration form will appear:

```
        Time and date
24-hour clock:      No
Time:      09:23:34 pm
Date fmt: MM/DD/YYYY
Date: 03/28/1993 Sat
```

Asset Surveyor allows you to check or set the local time and date, which is maintained by the clock hardware inside your MC-V. In addition, you can configure the formats in which times and dates will be displayed and entered.

> **Note -** GPS time is extremely accurate, and Asset Surveyor will use GPS time to correct any errors in the MC-V's internal clock. It also applies an offset to obtain UTC (or GMT) time. Because Asset Surveyor doesn't know which time zone you are using, the MC-V's date will be aligned to within one day of the local date. Because some time zones are only 15 minutes 'wide', the MC-V's clock will be aligned to within 7½ minutes of true local time. Once you have set the local time to within 7½ minutes of true local time, Asset Surveyor will use precise GPS time to keep the MC-V's clock perfectly accurate. If you do not use the MC-V with GPS for a long period, the MC-V's clock will drift away from the correct time; when you eventually reconnect to GPS, Asset Surveyor will realign the MC-V's clock again.

24-hour Clock

Asset Surveyor can operate either using a 24-hour clock or a 12-hour clock (where 'am' and 'pm' are used to distinguish times in the morning from those in the afternoon). By default, Asset Surveyor will operate in 12-hour mode, but if you wish to view and enter times in 24-hour format, you can change the value of the '24-hour clock' field to 'Yes'.

$\boxtimes$ **Note -** Remember that even if you view times in 12-hour format, you can enter them in 24-hour format. Asset Surveyor will automatically convert them to 12-hour format before displaying them

Time

The 'Time' field is used for setting the *local* time of the MC-V. When you arrive in the 'Time and date' configuration form, this value will be ticking over in pace with the MC-V's internal clock. If you *change* the time it will cease to tick over, and whatever time you have entered will be used to set the MC-V's clock hardware, *but not until the form is saved*.

When you are entering a new time Asset Surveyor will make a number of useful soft keys available (see the *Time Fields* section in Chapter 4).

💣   **Caution -** Take care that you enter the time correctly. If you are using a 12-hour clock, ensure that you have specified 'pm' if appropriate.

$\boxtimes$ **Note -** You can either configure the 'Time' and 'Date' fields to show the *local* time and date, or you can configure these fields to show *UTC time* (also known as GMT). Local time and date are generally more useful, especially if you wish to record the current time and date as attribute values. You can choose whether to name data files using local or UTC time by pressing the **TIME** soft key in any of the 'Create file' forms.

Date Format

The three supported date formats are:

- MM/DD/YYYY
- DD/MM/YYYY
- YYYY/MM/DD

Asset Surveyor's default format is MM/DD/YYYY. You can change Asset Surveyor's date format by editing the 'Date fmt.' field of the 'Time and date' configuration form.

Date

The 'Date' field is used for setting the *local* date of the MC-V.

When you are entering a new date Asset Surveyor will make a number of useful soft keys available (see the *Date Fields* section in Chapter 4).

Configuration/
Quickmarks

When you select the 'Quickmark' entry from Asset Surveyor's 'Configuration' menu, the 'Quickmark options' configuration form will appear:

```
 Quickmark options
Attributes:  Default
Confirm:          No



```

These two configurable fields are used to determine how the capture of point features using quickmarks should proceed.

Attributes

The 'Attributes' field takes one of the values 'Default' or 'Repeat'. This field determines the source of the attribute values associated with the quickmarked feature. They will either be the default values specified when the data dictionary was defined ('Default'), or they will be the attributes of the most recent feature of that type ('Repeat').

Confirm

Often when capturing point features using quickmarks you will not be able to enter attributes for these features at all (as you will be moving too rapidly). Sometimes, however, there are few enough attributes and the features can be clearly seen at speed, and it then becomes practical to record one or more attributes for quickmarked features. If the 'Confirm' field's value is 'Yes', then just after each quickmark is recorded you will be given an opportunity to review and possibly edit the feature's attributes. If the 'Confirm' field's value is 'No' (the default), the quickmark will be immediately saved with default attributes determined solely by the 'Attributes' field described above.

⊠

Note - When capturing point features by quickmarking them, Asset Surveyor will have fixed the feature's position and saved its default attributes *before* allowing you to edit these attributes (if the 'Confirm' field's value is 'Yes'). If, you then press ESC to exit the attribute review/editing form, the feature will not be abandoned or deleted. It will simply retain its default attributes.

Configuration/
Constant Offsets

When you select the 'Constant offset' entry from Asset Surveyor's 'Configuration' menu, the following menu of configurable constant offsets will appear:

```
┌Constant offset┐
│ Point offset  │
│ Quickmark offset│
│ Line offset   │
│ Area offset   │
└               ┘
```
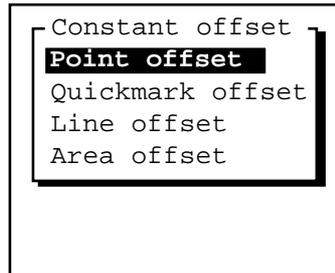
Asset Surveyor allows you to specify a constant offset for point features, quickmarks, line features and area features.

You should configure a constant offset if most or all of the features you intend to capture can most conveniently be recorded by standing or moving past the feature at a distance. You can easily override the constant offset for the few features which may differ from the norm.

Point Features

A constant offset for a point feature consists of a bearing (an angle from either true or magnetic north), a range (slope distance), and an inclination (to the horizontal). If you select 'Point offset' from the above list, the 'Point offset' configuration form will appear:

```
      Point offset
Bearing:        0.0°T
Slope dist:    0.000m
Inclination:     0.0°



 RESET  FORMAT
```

A constant offset can also be displayed and entered as a bearing, a horizontal distance, and a vertical distance:

```
            Point offset
Bearing:            0.0°T
Horz. dist:       0.000m
Vert. dist:       0.000m




 RESET  FORMAT
```

You can toggle between these two modes of offset display and entry by pressing the FORMAT soft key.

The default offset, as always, will be essentially no offset at all (i.e. zero). Once a non-zero 'Constant offset' has been configured for point features, this will be automatically applied to each (normal, nested or carrier phase) point feature which is subsequently recorded.

☆ | **Tip -** You can use a laser range-finder to fill in the three fields for a constant point feature offset, provided you configure constant offsets when the laser interface is active (i.e. under the 'External sensors' entry in the 'Utilities' menu, or under the EXT soft key in data capture).

Quickmarks, Lines and Areas

A constant offset for a quickmark, line feature or area feature consists of a direction (left or right) relative to the direction of travel at the time the feature is recorded, a range (slope distance) and an inclination. If you select one of the 'Quickmark offset', 'Line offset' or 'Area offset' entries from the 'Constant offset' menu then the following configuration form (with an appropriate heading) will appear:

```
            Line offset
Direction:           Left
Slope dist:       0.000m
Inclination:        0.0°




 RESET  FORMAT
```

A constant offset can also be displayed and entered as a direction, a
horizontal distance and a vertical distance:

```
        Line offset
Direction:        Left
Horz. dist:     0.000m
Vert. dist:     0.000m



 RESET  FORMAT
```

You can toggle between these two modes of offset display and entry by
pressing the FORMAT soft key.

As with normal point features, once a non-zero offset has been configured,
this will be applied to each feature of the corresponding type which is
subsequently recorded.

☆	**Tip -** You can use a laser range-finder to fill in the last two fields for a line, area of quickmark constant offset, provided you configure constant offsets when the laser interface is active (i.e. under the 'External sensors' entry in the 'Utilities' menu, or under the EXT soft key in data capture). You must always enter the 'Direction' field manually.
✉	**Note -** Although a constant offset determines the *default* offset value which will be stored for a feature, this default offset can always be edited, either during the capture of that feature or later, when reviewing data.

The RESET soft key can be used to reset a configured constant offset to the
default value (a zero offset).

💣	**Caution -** If you forget to reset a constant offset when it ceases to be required, you may inadvertently record features which are offset when they should not be.

Configuration/
External Sensors and
Laser Range-finders

Refer to *External Sensors with MC-V Asset Surveyor* for details of how to configure and use external sensors. This companion manual also provides a list of supported laser range-finders and details of how to configure and use a laser range-finder with Asset Surveyor.

Configuration/
MC-V Hardware

If you select 'Hardware (MC-V)' from the 'Configuration' menu, Asset
Surveyor displays the hardware configuration form:

```
        Hardware (MC-V)
LCD contrast:      32%
Backlight:         Off
Auto shutoff:       20
Key click:          On
ROS version:      2.08
Free space:      986kB
MC-V batteries
 Internal:         70%
 Backup:           95%
 External:       12.3V
```

The various configurable aspects of the MC-V hardware are described in
detail in the following sections.

LCD Contrast

You can vary the contrast of the MC-V's LCD by changing the value of the
'LCD contrast' field. You can also increase the contrast using [SH1] [+]
and [SH1] [-] key sequences. Each time you press [SH1] [+] the contrast
will increase by approximately 6%, and each time you press [SH1] [-] the
contrast will decrease by 6%.

> ✉ **Note -** If your MC-V is running CMT ROS version 1.05, the
> [SH1] [+] and [SH1] [-] key sequences cannot be used to alter the
> LCD contrast. You can only change the LCD contrast via the 'LCD
> contrast' field in the MC-V hardware form.

Backlight

You can turn the MC-V's backlight on or off by changing the value of the
'Backlight' field. You can also turn the backlight on or off by pressing [SH1]
[SP].

⊠ | **Note -** The MC-V backlight can only be controlled by the Asset Surveyor software when the MC-V is running CMT-ROS version 1.06 or 2.06 and later.

Auto shutoff

In order to maximize battery life, the MC-V will switch off if no key is pressed for a period of time (unless it is operating as a GPS base station, or capturing data to a rover file, in which case it will *not* turn off automatically). The value of the 'Auto shutoff' field determines how long the MC-V will wait after you last pressed a key on its keypad, before turning off. The minimum value permitted for 'Auto shutoff' is one minute, and the maximum is 60 minutes.

⊠ | **Note -** The 'Auto shutoff' setting will not cause the MC-V to turn off in 'File transfer' mode, but after 10 minutes of inactivity Asset Surveyor will exit 'File transfer' mode and return to the Main menu. Once 'File transfer' mode has been exited, the 'Auto shutoff' setting again becomes active and will switch off the MC-V after the specified time has elapsed unless you press a key.

Key click

Whenever you press a key on the MC-V's keypad, the MC-V will emit a 'click' to provide audible feedback. You can turn key clicks off by changing the value of the 'Key click' field to 'Off'.

ROS version

The 'ROS version' field shows the version of CMT's ROS (ROM Operating System) currently installed on your MC-V. This field cannot be edited.

Free space

The 'Free space' field shows you how much data file storage space remains on your MC-V. You cannot edit this field.

MC-V Batteries

The remaining fields of the MC-V hardware configuration form are not editable. They provide information regarding the battery levels currently detected by the MC-V hardware.

The 'Internal' and 'Backup' fields indicate the levels of charge remaining in the MC-V's main internal and lithium backup batteries, respectively.

⊠	**Note -** If your MC-V is running a CMT ROS version prior to 2.05 (and other than 1.06), Asset Surveyor is unable to determine the internal and backup battery levels. In this case it will display 'N/A' for both the 'Internal' and 'Backup' fields. You can determine the levels of the internal and backup batteries by exiting the Asset Surveyor program and then typing ⌐SH1⌐ ⌐ENTER⌐ to access the CMT ROS 'System Status' display. Press **SYS** to see the level of the internal battery or press **BAKUP** to see the level of the backup battery.
💣	**Caution -** If the level of the lithium backup batteries is ever shown as '15%' or lower, there is a risk of data loss should the main or external batteries fail. You should download all data in the MC-V and replace the backup batteries as soon as possible, to avoid the possibility of data loss.

The 'External' field indicates the level of charge remaining in the external GPS receiver's battery, if applicable. This may be a percentage or a voltage, or a discrete value such as 'Good' or 'Low', depending on the connected GPS receiver.

GPS/
Activating

7.2   Using a Trimble GPS Receiver

This section describes the use of the Asset Surveyor software with Trimble GPS receivers. There are a number of variations between specific GPS receivers, some of which are noted here and others of which are described in Appendix B, *GPS Systems* or in your receiver's *Operation Manual*.

Activating GPS

If you connect a supported Trimble GPS receiver to your MC-V using the correct cabling and batteries, Asset Surveyor will start to communicate with the GPS receiver immediately after the MC-V is turned on.

When communication with a GPS receiver is not already established, you can press ⌷SH2⌷ and then press **GPS** to cause Asset Surveyor to begin communicating with the GPS receiver.

If, for some reason, the Asset Surveyor software cannot communicate with the GPS receiver, it will display the following message:
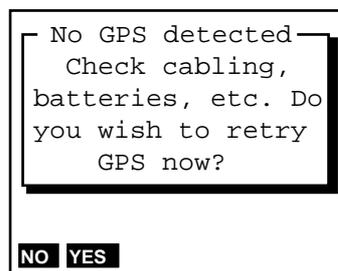
```
┌── No GPS detected ──┐
    Check cabling,
 batteries, etc. Do
 you wish to retry
     GPS now?


 NO  YES
```

In this case, check that the cabling is connected firmly and correctly, that the batteries are connected and charged, and that your GPS receiver is switched on (if appropriate). Then answer 'Yes' to the above question.

If the Asset Surveyor software and GPS receiver still do not establish communication, consult Appendix B or your receiver's *Operation Manual* for cabling and configuration details specific to the GPS receiver you are trying to use.

GPS/
Status Line

Once communication with a GPS receiver is established, Asset Surveyor beeps and displays the GPS status line. This single line (just above the line of soft keys) provides you with up-to-date information regarding the status of the GPS receiver:

```
SV 4/6 PDOP 2.4 # 23
```
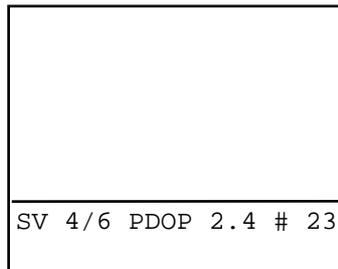
The various components of the GPS status line are as follows:

- 'SV *n*/*m*' at the left of the status line shows the number of GPS satellites ('space vehicles', or SVs) being used to compute positions (*n*) and the number of satellites from which signals are being received (*m*). The number *m* is always at least as great as the number *n*.

> ⊠   **Note -** Older Pathfinder GPS receivers use only the best 4 satellites for computing positions, so for those receivers *n* could be at most 4. Even with newer Pathfinder receivers and 4000 Series receivers which generally use all available satellites for computing positions, there are circumstances under which one or more satellites will be unused. The most likely circumstance is when the signal from a particular satellite is weak (i.e. below the SNR mask), or when a satellite has been marked as 'unhealthy' by the GPS Control Segment.

- 'PDOP *xx.x*' in the middle of the status line shows the current value of the PDOP heuristic. As discussed in the *Mapping Systems General Reference*, this provides an approximation to the accuracy of the GPS system, based on the geometry of the GPS constellation at any point in time. The smaller the PDOP value the more accurate GPS positions tend to be.

- '# *yyy*' at the right of the status line shows the number of GPS positions that have been logged by Asset Surveyor for the current feature (if you

are currently capturing data to a point, line or area feature), or the number logged since the end of the last feature (if you are logging data when not in a feature). When you are capturing a point feature and the number of logged positions for that feature ticks past the configured 'Minimum posns' value, Asset Surveyor will emit a success beep.

⊠	**Note -** When RTCM differential corrections are being received, the '#' character on the status line changes to an 'R'. When P(Y)-code (i.e. PPS) positions are being received from a P(Y)-capable GPS receiver such as the Trimble Centurion, the '#' character on the status line changes to a 'P' (for P-code).
⊠	**Note -** When capturing a point feature in carrier phase mode, the right-hand field of the GPS status line will display a ticking timer showing the period of time for which you have been at that point with a minimum of 4 satellites and a PDOP below the configured mask. If the number of satellites drops below 4, the timer restarts. If the PDOP is too high, the timer is stopped until the PDOP drops below the mask again. When the timer ticks past the configured 'Minimum time', Asset Surveyor will emit a success beep and display the message 'Carrier data logged' on the GPS status line to indicate that you can end the feature and move on. See page 7-23 for details of configuring carrier phase options.

The GPS status line will also periodically flash messages such as:
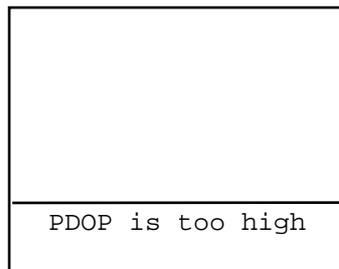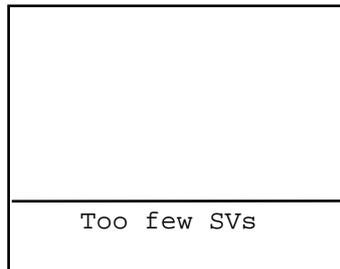
```



                      PDOP is too high
```

or:

```
┌─────────────────────┐
│                     │
│                     │
│                     │
│─────────────────────│
│    Too few SVs      │
│                     │
└─────────────────────┘
```

Most messages flashed on the GPS status line inform you of a *condition* which is preventing the computing or logging of GPS positions. When these conditions arise, Asset Surveyor will emit a warning beep and start to flash the appropriate message. When the condition ceases, Asset Surveyor emits a success beep to indicate that you can proceed with your survey and removes the flashing message from the status line.

⊠ | **Note -** There can be more than one message flashing alternately with the regular contents of the GPS status line. Often conditions like high PDOP and insufficient satellites occur together, for example when driving beneath trees.

GPS/
2D Altitude

If you activate the GPS receiver and have configured Asset Surveyor to use a two-dimensional position mode such as 'Auto 2D/3D' or 'Manual 2D', Asset Surveyor will ask you to provide a 2D altitude before it proceeds to establish communications with the GPS receiver.

```
        2D altitude
Alt (MSL):      25.3m
Entered at
 Time:   11:15:23 am
 Date:03/02/1993 Wed
```

You must either enter a new 2D altitude or accept the previous value. Press OK to accept the 2D altitude and proceed with the GPS connection.

See page 7-8 for a description of configuring Asset Surveyor to use a 2D mode, and page 7-94 for a further description of entering 2D altitudes.

GPS/
Almanac

Most Trimble GPS receivers have internal battery-backed memory, in which is stored a current GPS *almanac.* This almanac describes the orbits of each of the GPS satellites in fine detail, and is used by the GPS receiver to determine which satellites it can expect to receive signals from at any point in time, and where these satellites will be in the sky at that time. Even now that the GPS satellite constellation is essentially complete, satellites are regularly removed from operation for servicing and testing, and it is important that your GPS receiver has an up-to-date almanac to ensure rapid acquisition of signals from all available satellites on startup.

Some supported Trimble Pathfinder GPS receivers, notably the ProLite, do *not* have internal battery-backed memory. They rely on an external computer or datalogger to load an almanac into their memory when communication is established with the GPS receiver. Without an almanac, a GPS receiver can still acquire satellites and compute positions, but the initial acquisition of satellites will be slower (3-15 minutes) than it will be with an up-to-date almanac (30-45 seconds or less).

When operating with a Pathfinder GPS receiver, Asset Surveyor will record an almanac each time a GPS session takes place. When Asset Surveyor is subsequently used with a Pathfinder GPS receiver that does not have an almanac, it will load the pre-recorded almanac into the receiver's memory at the start of the session, thereby enabling the receiver to rapidly acquire satellites. While sending the almanac to a GPS receiver, Asset Surveyor will flash the message

```
┌──────────────────────────┐
│                          │
│                          │
│                          │
│                          │
│                          │
│ ──────────────────────── │
│    Sending almanac       │
│                          │
└──────────────────────────┘
```
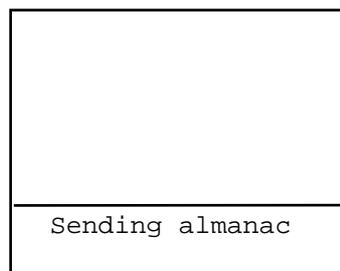
on the GPS status line.

Asset Surveyor will not record an almanac from a Pathfinder GPS receiver until it can be sure that the receiver has a complete and up-to-date almanac. With a ProLite receiver, this takes approximately 15 minutes if the receiver

is receiving signals constantly from at least one satellite. While it is recording an almanac from the receiver, Asset Surveyor will flash the message:

```
┌─────────────────────┐
│                     │
│                     │
│                     │
│                     │
│ ─────────────────── │
│  Recording almanac  │
│                     │
└─────────────────────┘
```
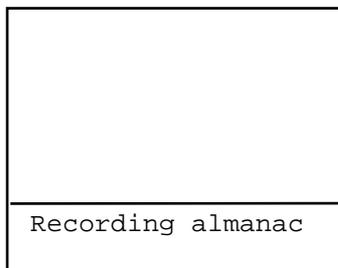
on the GPS status line.

Tip - You can continue to use Asset Surveyor while it is recording an almanac; there is no need to stop and wait for the procedure to complete.

Note - Almanacs recorded by Asset Surveyor when operating with a Trimble Pathfinder GPS receiver can be transferred to PFINDER for use in mission planning. See page 7-137 for details.

Initial Position

In addition to an almanac, a GPS receiver requires an approximate initial position and an accurate time if it is to rapidly acquire satellites on startup. Asset Surveyor can use the MC-V's accurate clock to ensure that it sends an accurate time to the GPS receiver, but it cannot determine your position without the aid of a GPS receiver. In order to avoid a Catch-22 situation, Asset Surveyor maintains an 'Initial position' as part of the GPS configuration form (see page 7-17). The most recent GPS position obtained by Asset Surveyor will be stored as the initial position, and will be used when Asset Surveyor next starts communicating with a GPS receiver. If you travel a considerable distance (200km or more) between GPS sessions, you might wish to enter a new initial position, in order to ensure a rapid GPS

startup in your new location. The initial position need only be approximate, so even a position in the right State is better than nothing.

If you have traveled a considerable distance since last using GPS, and don't have any idea of your approximate position, don't worry. Your Trimble GPS receiver will still be able to initialize itself and acquire satellites, but may take up to 15 minutes to do so.

> **Note -** A reasonable initial position should be entered *before* the GPS receiver is activated. Once the almanac, time and initial position have been sent to the receiver, it immediately starts searching for satellites on the basis of that information.

GPS/
Operations

The Asset Surveyor software acts as a control panel for your Trimble GPS receiver. Some receivers are even switched on and off by Asset Surveyor. The GPS receiver is controlled primarily by the way it is configured (see page 7-2).

Apart from the GPS status line, which will be visible whenever a GPS receiver is active and communicating with Asset Surveyor, your interaction with the GPS receiver will take place through the 'GPS operations' menu, described below.

The GPS Operations Menu

When the Asset Surveyor software and a GPS receiver have established communications, you can press `GPS` to pop up the 'GPS operations' menu:

```
┌GPS operations┐
│ Position     │
│ Receiver status │
│ Satellite info │
│ Navigation   │
│ Waypoints    │
│ 2D altitude  │
│ Disconnect   │
│              │
├──────────────┤
│ SETUP        │
```

Each of the entries in the 'GPS operations' menu is described in the following section.

Configuring GPS

The `SETUP` soft key on the 'GPS operations' menu allows you to conveniently configure your GPS receiver. It leads to the 'Rover options' and 'Base stn options' configuration forms described on pages 7-3 and 7-35 of this chapter, respectively.

GPS/
Operations/
Position

If you select the 'Position' entry from the 'GPS operations' menu, Asset Surveyor will display the current GPS position, if available, or the most recent GPS position, if none is currently available.

```
          Position
Lat:   43°31'12.134"S
Lon: 172°36'59.202"E
Alt (MSL):      55.00m
Datum:       WGS 1984
Zone:             N/A
 WAYPT
```

When Asset Surveyor is unable to obtain a current GPS position from the GPS receiver (e.g. due to a high PDOP value, or insufficient satellites), the title of this form changes to 'OLD position', which will flash on and off.

If you have selected a local coordinate system, the GPS position form might look more like:

```
          Position
North:   5180062.44m
East:     630610.61m
Alt (MSL):      74.17m
Datum:      NZGD 1949
Zone:     UTM Zone 59
 WAYPT
```

If you are using 'Over and Up™' mode, the GPS position form will display paper units, and might look like:

```
          Position
Left:           5.6cm
Up:            12.4cm
Alt (MSL):      74.17m
Datum:         NAD-83
Zone:     Over and Up
 WAYPT
```

When current GPS positions are available, Asset Surveyor updates the contents of the GPS position form every 1-2 seconds. This is independent of the interval at which GPS positions might be logged to a data file.

☆ **Tip -** You cannot edit any of the fields in the GPS position form; it is for viewing only. If you wish to change your coordinate system, press **CNFG** and select 'Coordinate system' from the 'Configuration' menu. If you wish to change your altitude reference from mean sea level (MSL) to height above ellipsoid (HAE), or vice versa, select 'Units and display' from the 'Configuration' menu. The order of the 'Lat/Long' or 'North/East' fields can also be configured under 'Units and display', as can the units in which 'North/East' coordinates are displayed (see pages 7-55 and 7-51).

The **WAYPT** soft key can be pressed to save the current GPS position (or an old one, if no current one is available) as a waypoint. See page 7-143 for details of creating a new waypoint.

✉ **Note -** The GPS 'Position' form takes the currently configured antenna details into account, and subtracts the height of the GPS antenna from the GPS positions supplied by your receiver before displaying them. The displayed positions apply therefore to the ground beneath the antenna, rather than to the Antenna Phase Center itself.

GPS/
Operations/
Receiver Status

If you select the 'Receiver status' entry from the 'GPS operations' menu, Asset Surveyor will display information regarding the status of the connected GPS receiver:

```
        Receiver status
Mode:          Manual 3D
SVs:   12,13,22,29,31
PDOP   3.6 HDOP    1.8
VDOP   3.1
Receiving RTCM:    Yes
Receiver info
 Receiver:      4000SE
 Nav version:    5.60
 Sig version:    1.24
 Battery:          12%
 Status: Doing fixes
```

The contents of the 'Receiver info' section of the form describes the actual GPS receiver which is currently connected. The example above illustrates status for a 4000 Series receiver, while the example below shows status for a Pro XL receiver:

```
        Receiver status
Mode:          Manual 3D
SVs:      4,6,22,25,15
PDOP   2.1 HDOP    1.6
VDOP   1.3 TDOP    0.3
Receiving RTCM:    Yes
Receiver info
 Receiver:       ProXL
 Nav version:    2.07
 Sig version:    2.07
 Battery:       12.3V
 Status: Doing fixes
```

The various fields of the 'Receiver status' form are described in the following sections. Their values will be updated periodically to ensure that they accurately portray the status of the GPS receiver.

You can press ⌈ESC⌉ at any time to exit the 'Receiver status' form and return to the 'GPS operations' menu.

Mode

The 'Mode' field shows the receiver's current position mode. This will remain constant if you have selected 'Manual 2D', 'Manual 3D' or 'Overdet. 3D' or may vary if you have configured your GPS receiver to use the 'Auto 2D/3D' position mode, depending on the number of available satellites.

When the mode value ends in '2D', the GPS receiver will compute two dimensional positions, and when it ends in '3D' the GPS receiver will compute three dimensional positions.

SVs

The 'SVs' field lists the satellites which are currently being used to compute positions. The abbreviation 'SV' refers to 'space vehicles', the official term for the physical GPS satellites. The numbers listed are the PRNs (Pseudo-Random Numbers) of the satellites. Satellite PRNs are described in the glossary to this manual, and in the Mapping Systems *General Reference*.

✉	**Note -** The number of satellite PRNs in this list is the number which appears in front of the '/' character at the left-hand side of the GPS status line (i.e. the number *n* in 'SV *n/m*').

PDOP, HDOP, VDOP and TDOP

These four dilution of precision (DOP) values are shown on the next two lines of the 'Receiver status' form.

The PDOP (position dilution of precision) value is a measure of positional accuracy, and PDOP values can generally be categorized by the following table:

PDOP level	Quality
1 to 4	Excellent
4 to 6	Good
6 to 8	Fair
8 to 12	Poor
12 and above	Unusable

The PDOP value also appears in the center of the GPS status line.

The VDOP (vertical dilution of precision) value is a measure of vertical accuracy; HDOP (horizontal dilution of precision) is a measure of horizontal accuracy. PDOP is a combination of VDOP and HDOP.

The TDOP (time dilution of precision) value is a measure of the accuracy of the GPS receiver's internal clock and those in the GPS satellites.

> ⊠ **Note -** When connected to a 4000 Series GPS receiver, the TDOP value will not be shown, as the 4000 Series receiver does not make a TDOP value available to Asset Surveyor. Also, whenever the current PDOP value is above the PDOP mask, the 4000 Series receiver ceases to supply up-to-date HDOP or VDOP values, which will then be shown as 0.0 by Asset Surveyor.

Refer to the Mapping Systems *General Reference* manual for a more detailed discussion of DOP values and their significance.

Receiving RTCM

The value of the 'Receiving RTCM' field indicates whether or not the GPS receiver is currently using RTCM input (from a telemetry link) to differentially correct positions in real time. When RTCM is being received, the '#' character on the GPS status line will change to an 'R'.

Receiver Info

The 'Receiver Info' section contains a number of fields describing the currently connected GPS receiver:

- The 'Receiver' field, which shows the name of the GPS receiver, e.g. '4000SE', 'ProXL', 'Pathfinder Basic Plus', etc. Do not be disconcerted if the name shown here does not precisely match the name which you might use to refer to the receiver. Asset Surveyor shows the receiver's *internal* name.

- The 'Nav version' field shows the GPS receiver's navigation firmware version number. If you call a Trimble Support Center, you will probably be asked for the navigation firmware version of your GPS receiver, as this can often assist Trimble's support staff to diagnose and fix a problem.

- The 'Sig version' field shows the GPS receiver's signal processor firmware version number.

- The 'Battery' field shows the current level of charge in the GPS receiver's battery, if available. This value may appear as a voltage, a percentage, or as a discrete value such as 'Good' or 'Low', depending on the connected GPS receiver.

- The 'Status' field shows, the current status of the GPS receiver. This field can take one of the following values:

  - *No GPS time*. The GPS receiver has not yet acquired a signal from one GPS satellite, and has therefore not acquired accurate GPS time.

  - *PDOP too high*. The current PDOP value is in excess of the PDOP mask, and consequently the GPS receiver will not compute GPS positions.

  - *No usable satellites*. The GPS receiver is unable to find any usable (both visible and healthy) satellites, or has lost signals from all satellites (perhaps due to an obstruction).

  - *Too few SVs*. The GPS receiver has acquired satellites, but too few to compute a position in the current position mode (i.e. less than three satellites in a 2D mode, less than four satellites in Manual 3D mode, or less than five satellites in Overdetermined 3D mode).

  - *Satellite unusable*. The GPS receiver has just rejected a particular satellite, probably because it has become unhealthy.

  - *Doing fixes*. The receiver is computing GPS position fixes. The current satellite constellation is therefore acceptable.

GPS/
Operations/
Satellite Information

If you select the 'Satellite info' entry from the 'GPS operations' menu, Asset Surveyor will display information for each satellite in the GPS receiver's *tracking set*:

```
PRN  SNR  Ele  Br(T)URA
✓14   21  51°  312°   32
 18  0.0  25°  236°    –
 25  3.6  23°  112°   32
✓29  7.1  67°  229°  4.0
✓03  8.6  68°   77°  2.8

SV 3/4 PDOP 6.2 #
```

This form displays five columns of information, and spans as many pages as required to display information for all satellites in the receiver's current tracking set. The columns are:

- *PRN*. Each satellite's PRN is listed to identify that satellite uniquely. If the satellite is currently being used by the GPS receiver to compute positions, then a tick ('✓') character appears to the left of the PRN. In the example above, satellites 14, 29 and 3 are being used to compute positions.

- *SNR*. The current signal-to-noise ratio of each satellite is indicated in the SNR column. The number of satellites with a non-zero SNR is the number to the right of the '/' in the GPS status line (i.e. the number *m* in 'SV *n/m*'). These are the satellites which the GPS receiver could use for computing positions. A given satellite may not be used for a number of reasons, including:

  - The satellite's SNR is beneath the configured SNR mask.

  - Using this satellite to compute positions would increase the PDOP value, possibly to the point where it would exceed the PDOP mask.

  - The satellite's elevation is beneath the configured elevation mask.

  If a satellite has been marked as 'unhealthy' by the GPS Control Segment, the characters 'U/H' will appear in the SNR column for that satellite. The GPS receiver will not attempt to use unhealthy satellites for computing positions.

- *Ele*. This column shows the current *elevation* of each satellite above the horizon. Typically, satellites which are far below the configured elevation mask are dropped from the receiver's tracking set, so that the receiver can concentrate on satellites which are currently visible.

- *Br(T)*. This column, which can be labeled either 'Br(T)' or 'Br(M)', shows the current bearing to each satellite in the tracking set. This bearing is shown relative to either true north (T) or magnetic north (M), as determined by the currently configured 'North ref'.

> ☆ **Tip -** You can change the value of the 'North ref' field in the 'Units and display' configuration form, under the 'Configuration' menu.

- *URA*. This column shows the *User Range Accuracy* value for each satellite in the tracking set. URA is an estimate of the accuracy of the *pseudo-range measurement* to each satellite. It is based on a number of factors, including the age of the data, the type of clock in the satellite, the satellite orbit and clock behavior, and whether Selective Availability (SA) is activated for that satellite.

URA value	Interpretation
Below 6	Accuracy is good
6 to 15	Accuracy may be poor
16 to 30	SA may be activated
31 to 64	SA is activated
Above 64	SA is activated to an abnormal extent, or a problem exists with this satellite. (Satellite problems usually cause a satellite to be set 'unhealthy').

The contents of the 'Satellite info' form will be updated every 8 seconds.

If your MC-V is running CMT-ROS version 1.05, the 'Satellite info' form will take approximately 20 seconds to appear, and will be refreshed once every 20 seconds.

You can exit this form by pressing ESC at any time.

GPS/
Operations/
Navigation

You can use any Trimble GPS receiver for navigating. Together with Asset Surveyor you can use GPS to navigate to pre-recorded waypoints, features, or coordinates entered from maps or databases.

Navigation with the Asset Surveyor software is described in detail later in this chapter, on page 7-129.

GPS/
Operations/
Waypoints

A waypoint is a named 3-dimensional position, which you can record using GPS or enter from a map, for the purposes of navigating (back) to that point in the future.

Asset Surveyor's waypoint management facilities are described in detail later in this chapter, on page 7-142. The loading of waypoints from PFINDER's waypoint manager is described on page 7-139.

GPS/
Operations/
2D Altitude

When you operate a GPS receiver in either 'Auto 2D/3D' or 'Manual 2D' position mode, Asset Surveyor will ask you to provide a 2D altitude before it activates the GPS receiver. When operating in one of these modes, you can view the current 2D altitude or enter another by selecting '2D altitude' from the 'GPS operations' menu.

```
        2D altitude
Alt (MSL):      25.3m
Entered at
 Time:   11:15:23 am
 Date:08/22/1995 Tue


```

You can press ESC to continue with the previous 2D altitude, or you can enter a new altitude and press OK to send that new altitude to the GPS receiver.

Only the first field on this form is editable. The other fields show when the last 2D altitude was recorded, and whether it was entered manually ('Entered at') or computed by the GPS receiver ('Computed at').

The 2D altitude which is sent to the receiver will be converted to an altitude above or below the WGS-84 datum. The value which you enter will be relative either to mean sea level ('MSL') or the local ellipsoid ('HAE').

💣	**Caution -** You must ensure that any 2D altitude which you enter is accurate, otherwise it will have a detrimental effect on the accuracy of positions computed by your GPS receiver when operating in a 2D mode.
☆	**Tip -** You can change the value of the 'Altitude ref' field in the 'Units and display' configuration form, accessible from the 'Configuration' menu.

> **Note -** The altitude you specify is that of the ground, not the altitude to the GPS receiver's antenna. Asset Surveyor will take the currently configured antenna height into account when converting the altitude you supply into an altitude above the WGS-84 datum.

GPS/
Operations/
Disconnect

When you select 'Disconnect' from the 'GPS operations menu', Asset
Surveyor will cease communications with the GPS receiver and will shut
down all GPS logging operations, etc. Before doing so, it will ask you to
confirm that you haven't selected this option by mistake:
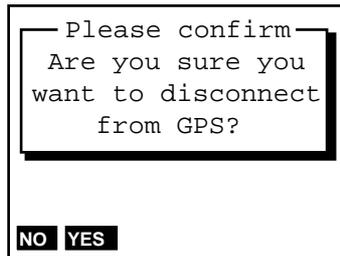
```
┌─Please confirm─┐
│ Are you sure you │
│ want to disconnect │
│    from GPS?     │
│                  │
└──────────────────┘

 NO  YES
```

If you answer 'Yes', the GPS receiver will be turned off, if possible, and
Asset Surveyor will close down its GPS operations.

Normally, you will have no need to 'Disconnect' (deactivate) the GPS
receiver; you can just turn the MC-V off when you finish using it. If you
wish to use the Asset Surveyor software for a while without needing GPS
and wish to preserve the GPS receiver's batteries, you may choose to
deactivate the receiver. You must physically disconnect the receiver before
transferring files to or from the PC, as Asset Surveyor uses the same serial
port for these operations as it uses to communicate with the GPS receiver.

☆	**Tip -** To re-activate the GPS receiver, press ⌷SH2⌷ **GPS**.
✉	**Note -** When Asset Surveyor deactivates and turns off a 4000 Series GPS receiver, it will not be able to turn the receiver back on remotely. You will have to turn the 4000 Series receiver on by pressing the POWER button on the receiver's front panel, before Asset Surveyor can re-establish communications with the receiver.

Main Menu

7.3   The Asset Surveyor Main Menu

The heart of the Asset Surveyor system is its 'Main menu':

```
┌──── Main menu ────┐
│ Data capture      │
│ Navigation        │
│ File transfer     │
│ Utilities         │
│ Base station      │
│ Info for new users│
├───────────────────┘
│ INFO
```
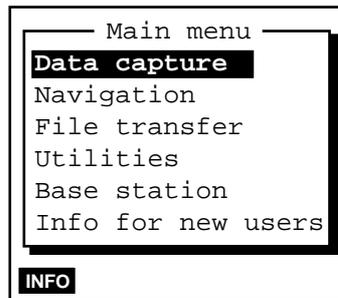
Although you will spend very little time at the 'Main menu', you will occasionally return here to switch between major operations such as data capture and file transfer.

When the Asset Surveyor software is first started, it will display the 'Main menu' and await your choice of operation. You can generally return to the 'Main menu' from wherever you are in the system by pressing ESC several times (possibly answering questions along the way).

The following sections describe each entry in the 'Main menu' in detail.

Main Menu/
Data Capture

If you select 'Data capture' from the Main menu, Asset Surveyor displays the data file management menu:

```
┌──── Data capture ────┐
│ Create rover file    │
│ Reopen rover file    │
│ File statistics      │
│ Delete file(s)       │
│ Data dictionaries    │
└──────────────────────┘
```
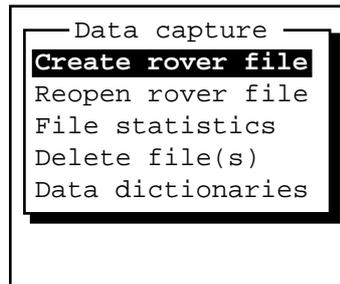
The following sections describe in detail each operation which can be performed from this menu.

Main Menu/
Data Capture/
Creating Rover Files

When you select 'Create rover file', Asset Surveyor will display the 'Create file' form:

```
        Create file
File:         R020315a
Data dict:     Generic
Free space:      490kB



 TIME
```

Asset Surveyor suggests a default file name, as described in the *File Naming Conventions* section of Chapter 4. The default name appears in the 'File' field. You can accept this default name, edit it, or type in a new name altogether. File names can be at most eight characters long, and can be composed of letters and digits only (i.e. no spaces or punctuation characters).

After accepting the default file name or entering a new one, you can select a data dictionary from the menu of data dictionaries which have been loaded onto your MC-V. The default 'Data dict' is the data dictionary which was most recently used to create a data file. There is always a 'Generic' data dictionary available, which allows you to record point, line and area features, each with a simple description attribute.

> ⊠ | **Note -** The data dictionary you choose when you create a data file will be associated with that file for the duration of its 'life'. The data dictionary determines the types of features which can be recorded to this file, as well as the attributes these features will have.

The third field of the form, 'Free space', reminds you how much data file storage space remains on your MC-V. You cannot edit this field.

You can use the **TIME** soft key to switch between UTC and local time for the default file name, as described in Chapter 4.

Once you have accepted a file name and data dictionary, press `OK` to create the new data file. Asset Surveyor will check to see that the file's name is unique before creating the file. If it is not (i.e. a file with that name already exists), Asset Surveyor will display the following message:

```
┌──── Error! ────┐
│ Duplicate file │
│ names are not  │
│    allowed     │
└────────────────┘
```

You will have to think of another name for your new file, or if you are happy to append to the existing file with the same name then you can exit the 'Create file' form by pressing `ESC` and just select the file with that name from the 'Restart rover file' menu.

> ⊠ **Note -** The data dictionary associated with the existing file will be the data dictionary which was selected when that file was created. It will not necessarily be the data dictionary which you selected when attempting to create a data file with the same name.

If there is insufficient data space to create a new file, or if Asset Surveyor cannot create the new file for some other reason, the program will display a message and then reboot the MC-V. If the problem is simply one of insufficient space, you should transfer some or all data files to your PC, then delete them from the MC-V before attempting to create any new data files.

When you create a new rover file and press `OK`, Asset Surveyor will automatically open the newly created file, ready to log data to it.

Main Menu/
Data Capture/
Reopening Rover Files

You can reopen an existing data file by selecting 'Reopen rover file' from the 'Data capture' menu and selecting from the list of available rover files:

```
┌Reopen rover file┐
│R092918a          │
│R092918b          │
│ROVER112          │
│                  │
└──────────────────┘
```
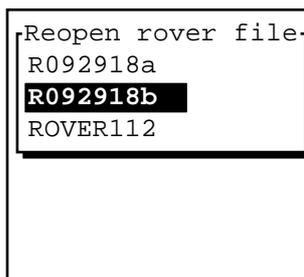
If a data file was created more than seven days ago, Asset Surveyor will not allow you to reopen that file for further logging of data (although you will be allowed to review and edit it). This is due to a technical limitation related to the way in which GPS times are stored. In order to maintain full accuracy of storage, it is necessary to limit the time-span of a data file to seven days. If Asset Surveyor displays the following message:

```
┌──── Sorry ────┐
│ Unable to append │
│to a file over one│
│    week old.     │
└──────────────────┘
```
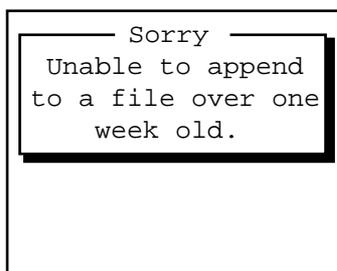
then you should create a new data file and capture data to that instead.

Main Menu/
Data Capture/
Data File Statistics

If you select 'File statistics' from the 'Data capture' menu, Asset Surveyor will display a list of existing rover and base files:

```
┌File statistics┐
 R092918a
 R092918b
 B3102910

```

To view statistics for a particular data file, select it from this list:

```
    File statistics
 File:        R020315a
 Data dict:    Generic
 No. of features    34
 File size:       54kB
 Free space:     445kB
 File start
  Time:    08:08:33 am
  Date:02/13/1995 Mon
 File end
  Time:    12:48:02 pm
  Date:02/13/1995 Mon
```

This form provides a variety of interesting statistics about the data file which was highlighted when **STATS** was pressed:

- The 'File' field shows the data file's name.

- The 'Data dict' field shows the name of the data dictionary which is associated with this data file.

- The 'No. of features' field shows the number of point, line and area features in the data file.

- The 'File size' field shows the size of this data file in kilobytes.

- The 'Free space' field shows the remaining amount of data space, in kilobytes, on the MC-V.

- The 'File start' fields show the time and date when this file was created. This is not the same as the time when the file first had data logged to it, but these two events normally occur one after the other.

- The 'File end' fields show the time and date when this file last had data logged to it.

⊠	**Note -** If you select 'File statistics' when there are no data files in the MC-V's memory, the 'File statistics' form will be immediately displayed with only the 'Free space' field visible.

Main Menu/
Data Capture/
Deleting Data Files

If you select 'Delete file(s)' from the 'Data capture' menu, Asset Surveyor displays a menu of rover and base files:

```
┌─Delete file─┐
 R092918a
 R092918b
 B3102910



 DELALL
```

To delete a single data file, select it from the 'Delete file' menu by highlighting the file's name and pressing ENTER. To delete all data files at once, press DELALL.

When you select a single data file to delete, Asset Surveyor will ask you to confirm that you wish to delete the file:

```
┌─Confirm deletion─┐
 File: "R093008a"






 NO  YES
```
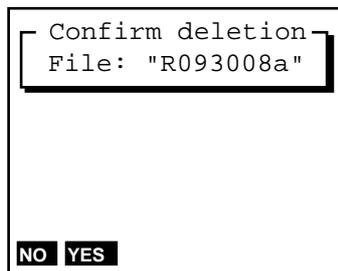
When you press DELALL, Asset Surveyor will beep and ask you to confirm that you wish to delete all data files:

```
┌── Warning ──┐
 Do you want to
 delete ALL data
     files?




 NO  YES
```

For each data file which it is about to delete, Asset Surveyor will check whether the file has been transferred to your PC. If it has not yet been transferred, Asset Surveyor warns you of that fact and asks you confirm once more that you wish to delete it:

```
┌─ Confirm deletion ─┐
│ This file has not  │
│ been transmitted   │
│    to the PC:      │
│    "R093008a".     │
└────────────────────┘

NO  YES
```
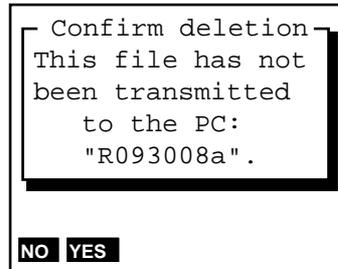
If you answer 'Yes' to this question, or if the file had previously been transmitted to your PC, Asset Surveyor will delete the data file and recover the space which had been consumed by it.

Main Menu/
Data Capture/
Data Dictionaries

If you select 'Data dictionaries' from the 'Data capture' menu, Asset Surveyor will display a menu of data dictionaries:

```
┌Select data dict┐
 Generic
 Power poles
 Asset register



 DEL
```
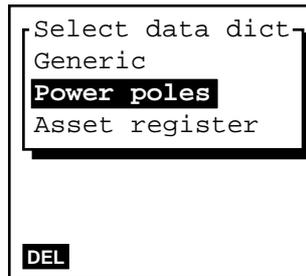
The currently highlighted data dictionary is that which was used when you last created a data file. If you select a different data dictionary from this menu, the new data dictionary will become the *current* data dictionary, and will be offered as the default when you next create a data file.

The Asset Surveyor software allows you to have a number of data dictionaries available for performing different kinds of surveys. You can maintain two or more current data files, with possibly different associated data dictionaries, and can swap between them very easily.

You can press the DEL soft key to delete the currently highlighted data dictionary from the MC-V. If you attempt to delete a data dictionary which is still associated with a data file on the MC-V, Asset Surveyor will refuse to delete that dictionary:

```
┌──── Error! ────┐
 Data dict. cannot
 be deleted unless
 files using it are
   deleted first.


```
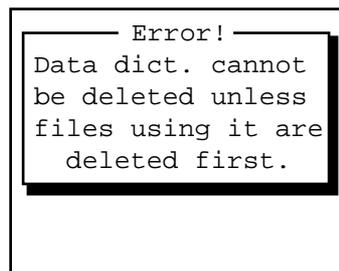
You must delete all data files associated with a data dictionary before you can delete the data dictionary itself.

$\boxtimes$ **Note -** You cannot delete the 'Generic' data dictionary, which is always available in Asset Surveyor. This is the data dictionary associated with base station data files, and it can also be used for creating rover files for off-the-cuff data capture.

Select a new data dictionary from the menu or press $\boxed{\text{ESC}}$ to return to the 'Data capture' menu.

Main Menu/
Data Capture/
Starting to Log Data

When you create a new data file or reopen an existing one, Asset Surveyor will prepare to log data to that file, as described in this section.

When a data file is opened, Asset Surveyor will spend a few seconds writing initial data to the file, and reading its associated data dictionary, before displaying a menu of features (as determined by the data dictionary) which can be captured to this file.

If you open a data file and have previously configured 'Carrier mode' (in the Carrier phase options configuration form) to either 'On' or 'Query', Asset Surveyor will pop up the antenna options form:

```
           Antenna
Height:         0.000m
Measure:       Vertical
Type:               EC
```

You should verify that the configured antenna height and type are correct before pressing `OK` to proceed to capture data to this file. See page 7–26 for a list of antenna types.

☆ | **Tip -** Remember that you should enter a new antenna height, via the `ANTENNA` soft key in the GPS 'Rover options' configuration form, whenever you alter the height of your GPS antenna.

✉ | **Note -** When a data file is opened, Asset Surveyor will activate any external sensor or laser range-finder interfaces which have been configured to automatically connect.

Main Menu/
Data Capture/
Logging Notes

When logging to a data file commences, Asset Surveyor writes a *note* to the data file recording the time and date, e.g.

```
      Review note
Logging started:
09:16:20 am
09/30/1993 Thu
(Local time)
```

When you exit data capture and logging to that data file stops, Asset Surveyor writes another note, e.g.

```
      Review note
Logging stopped:
11:52:01 am
09/30/1993 Thu
(Local time)
```

Main Menu/
Data Capture/
GPS Configuration Record

If Asset Surveyor is communicating with a GPS receiver when you commence data capture, a COL record, which describes the configuration of the data collector and GPS receiver, is written to the data file. A COL record is also written to the current data file whenever the GPS configuration is modified during data capture, and whenever GPS is (re)activated inside data capture.

You can use PFINDER's SSF file editor to view these COL records, e.g.

```
 File    Info   Edit  Filter Search  Help   Quit          EDITOR 2.60-0H


                        ┌─────── More Info ───────┐
                        │                         │
                        │  COL: Data Collector  2.02  07/27/94
           TXT: Loggi   │  Masks: elev 15, snr  6, pdop  6, pdop sw  6
           ▶            │  Pos Mode: Manual 3D, Land
           PRN: 07  0   │  Intervals: Pos  1, vel  1, raw 5, sync 15, clk  0
           IOD: PRN 0   │  RTCM Type1:  0, RTCM real time out:  0       0o U
           NAU: PRN 0   │  Heed Health: 1,  UTC Ofsset: 13             0o w
           IOD: PRN 0   │  I/O Settings: 12 01 02 01                    0o U
           NAU: PRN 0   │                                              0o w
           IOD: PRN 0   │  Record: 189 of 22808                        0o U
           NAU: PRN 0   │                                              0o w
           IOD: PRN 1   │  PDOP: Unknown                               0o U
           NAU: PRN 1   │  Mode: Unknown                               0o w
           IOD: PRN 2   │  Time: Dec 18 23:12:28 1994                  4o U
                        │                                         │
                        │            ┌ Okay ┐                     │
                        │            └──────┘                     │
                        └─────────────────────────────────────────┘


 File: C:\PFINDER\DATA\HALSWELL\HALSWELL.SSF
```

Main Menu/
Data Capture/
Starting Features

A Menu of Features

The menu of available features might look as follows:

```
┌─Start feature─┐
│ City street   │
│ Highway       │
│ Car park      │
│ Town          │
│ Hydrant       │
│               │
└───────────────┘

 PAUSE  REPEAT  QUICK  EXT
```

You can choose a feature to capture by selecting it from the menu. You can also perform a number of other operations using the four soft keys.

> ⊠   **Note -** Features are captured one at a time; you normally end a feature before starting the next. A useful exception to this rule is the embedding of point features within line or area features using the nesting (see page 7-122) and quickmarking (see page 7-119) techniques.

Selection of a Feature to Capture

When you select a feature from the menu above, Asset Surveyor will start to capture data for the feature. A feature's data includes:

- Its GPS position,

- An optional offset to the GPS position,

- Its attributes, which can be entered using the MC-V's keypad or using a barcode wand, and

- Any external sensor data which might be recorded for that feature.

Provided a GPS receiver is connected and operational, Asset Surveyor will record GPS positions automatically for the feature, according to the way in

which you have configured the GPS interface. If you have configured and activated an external sensor, ESP data will also be recorded automatically. If you have configured and activated a laser range-finder, you can record an offset for the feature by aiming and firing the range-finder. Alternatively, you can measure and enter the offset manually.

By taking care of GPS and ESP data capture, and by integrating the recording of an optional offset to each feature, the Asset Surveyor software enables you to concentrate on entering attribute values for the feature.

The attributes describing each feature are determined when you create your data dictionary using PFINDER. The following diagrams illustrate attributes for three of the features in the menu shown above. They are a point feature:

```
             «Town»
Name:                    ?
Population:              ?
Gas stations:           ?
Any open 24 Hrs?: No
Banks:                   ?


 PAUSE  EXT  OFFSET
```

a line feature:

```
            «Highway»
Name:                    ?
Number:                  ?
Interstate?:        No
Lanes:                   6


 PAUSE  NEST  SEG  QUICK  EXT    OFFSET
```

and an area feature:

```
            «Car park»
Name:                    ?
Type:               Mall
Places:                  ?
Open 24 Hrs?:     Yes
Hourly fee:       0.00


 PAUSE  NEST  QUICK  EXT  OFFSET
```

Main Menu/
Data Capture/
Entering Attribute Values

The attribute entry form for a feature behaves identically to other Asset Surveyor forms. You enter values for each field, according to its type (menu, numeric, character string, time or date), and move from field to field using ENTER, ⬆, ⬇, PGUP and PGDN keys.

You can also enter attribute values (for menu attributes) using a barcode wand.

When you have finished entering attribute values, press OK to save the feature. You can press ESC to abandon the feature without saving it, but Asset Surveyor will always ask you to confirm this:
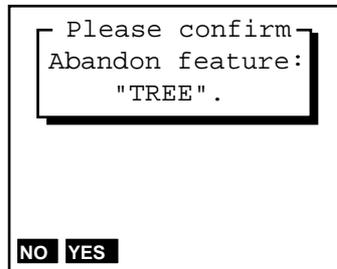
```
┌─ Please confirm ─┐
│ Abandon feature: │
│      "TREE".     │
│                  │
│                  │
│                  │
│                  │
└──────────────────┘
NO  YES
```

💣 | **Caution -** When you abandon a feature, Asset Surveyor will discard not only the partially entered attribute values but also any GPS positions and/or ESP data records which have been recorded for that feature. The only exception to this rule is a line or area feature, in which case the GPS positions are not discarded, but are treated as not-in-feature positions. These provide a trail showing the path which you traveled.

Main Menu/
Data Capture/
Saving Features

As with a normal Asset Surveyor form, you can press `OK` to save the attribute entry form's contents, but you will probably not press `OK` the moment you finish entering attributes for the feature. This is because, while the feature is 'active', any GPS positions and ESP data which are logged will be associated with that feature. If this is a point feature, you should remain stationary at that feature until the configured minimum number of positions have been logged before pressing `OK`. If it is a line or area feature you should continue to walk or drive along the feature (or around its perimeter, if it is an area feature). Only when you have traversed it completely should you press `OK`.

☆   **Tip -** Because, when traversing a line or area feature, you can often pass points of interest, Asset Surveyor allows a number of convenient ways to capture point features *within* a line or area feature. These are discussed under the titles of *Quickmarking Point Features* and *Nesting Point Features*, on pages 7-119 and 7-122, respectively.

If you are capturing a point feature and press `OK` before the configured 'Minimum posns' have been logged, Asset Surveyor will warn you:

```
┌─Please confirm─┐
│ Insufficient GPS│
│ positions; do you│
│ want to store this│
│   feature now?  │
└                └
```

`NO` `YES`
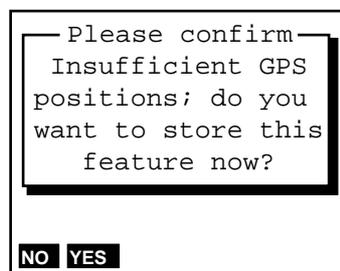
Press `YES` to store the point feature with fewer than 'Minimum posns' GPS positions, or press `NO` to return to the feature and wait for more positions to be logged.

If you are capturing a point feature in carrier phase mode and press `OK` before the configured 'Minimum time' has elapsed, Asset Surveyor will warn you:

```
┌─ Please confirm ─┐
│    Insufficient  │
│ carrier data; do │
│ you want to store│
│ this feature now?│
│                  │
│                  │
│ NO  YES          │
└──────────────────┘
```
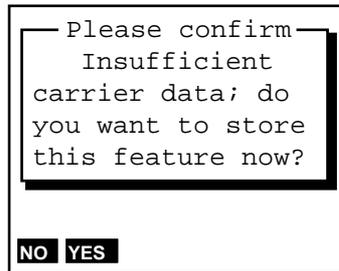
Press **YES** to store the point feature now, or press **NO** to return to the
feature and wait for further carrier phase data to be logged.

The various other operations which can be performed, by pressing soft keys
during the capture of features and/or the entry of attributes, are described in
the following sections.

Main Menu/
Data Capture/
Pause and Resume Logging

When you are entering attributes for a feature or are at the 'Start feature' menu, Asset Surveyor provides a `PAUSE` soft key. When you press `PAUSE`, Asset Surveyor will cease to log GPS positions (or, if in carrier phase mode, will cease to log carrier phase measurements). While logging is paused, the message

```
┌─────────────────────────┐
│                         │
│                         │
│                         │
│  ─────────────────────  │
│     Logging paused      │
└─────────────────────────┘
```
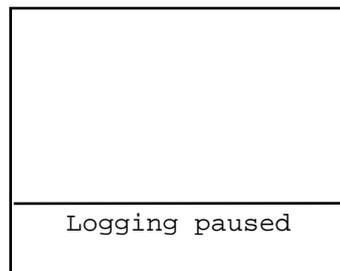
will be displayed periodically on the GPS status line, and the `PAUSE` soft key will change to `RESUME`. When you press `RESUME`, Asset Surveyor will resume logging and the soft key will revert back to `PAUSE`.

☆ | **Tip -** Press `PAUSE` whenever you want to stop briefly, or if you are capturing a line or area feature and have to travel around some obstacle before picking up the line or area perimeter again. You should also use `PAUSE` if you want to **nest** a point feature within a line or area, and the point lies some way off the line or area perimeter. You can then nest the point without ending up with a 'spike' in the line or area.

When GPS logging is paused, Asset Surveyor will not record GPS positions, velocities or raw GPS measurements, but it will continue to record certain critical GPS information which is required for post-processing. This additional information is quite small, and will be recorded infrequently, but it is possible that even when logging is paused your MC-V may eventually run out of data storage space.

Each time you resume logging while capturing a line or area feature, Asset Surveyor will log a GPS position (irrespective of the logging interval for line/area features).

☆ | **Tip -** You can use this feature to explicitly force Asset Surveyor to log a GPS position when you come to a corner or a point of interest while capturing a line or area feature. Press `PAUSE` and then `RESUME` to cause the current GPS position to be logged. After `RESUME` is pressed, Asset Surveyor will continue to log GPS positions at the configured line/area logging interval.

Main Menu/
Data Capture/
Repeating Features

Usually, you select a feature to capture using normal menu selection techniques (i.e. highlighting a feature and pressing ENTER, or using a first-letter selection method). You can also select the currently highlighted feature on the 'Start feature' menu by pressing REPEAT.

The difference between normal selection of a feature and selecting using REPEAT lies in the default attribute values given to the feature. If you select the feature by the 'normal' method, the default attribute values are determined by the data dictionary, which specifies a default value for each attribute belonging to each feature. If you select a feature using REPEAT, the attribute values will be copied from the last recorded feature of that type.

☆ | **Tip -** REPEAT enables you to record a sequence of similar features very efficiently. You don't have to re-enter the values for all of the attributes, but can just page through checking that each attribute value is correct for the current feature, and change only those that differ.

If you press REPEAT and a feature of the currently highlighted type has not yet been recorded to the current data file, Asset Surveyor will inform you that it cannot repeat this feature type:

```
——— Error! ———
This feature has
  not yet been
   captured.
```
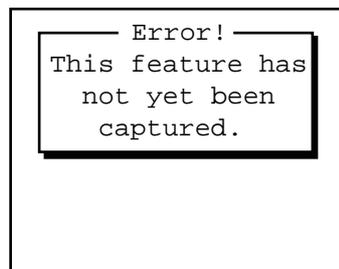
You must first capture a feature using the normal method before you can REPEAT it.

Main Menu/
Data Capture/
Quickmarking

The Asset Surveyor software provides two ways to capture the GPS position of a point feature. The regular way is to select a point feature from the 'Start feature' or 'Nest feature' menus, and to stay at that feature for long enough to log sufficient GPS positions or carrier phase measurements. Another way is to record a *quickmark*.

A quickmark is recorded by simply pressing a button on the MC-V as you drive, fly or move past a feature. With quickmarks, Asset Surveyor cannot record a number of positions to average together, and in fact cannot necessarily even record a *single* GPS position at exactly the moment that you pass the feature. It therefore records an accurate time (using the very precise GPS satellite timers to keep the MC-V's clock perfectly synchronized), which is used to compute an interpolated position for the quickmark based on two GPS positions, one logged before you passed the feature and one logged after.

The accuracy of quickmarks will not be as good as you can achieve by standing at a point and logging positions for some time, but you can use quickmarks to rapidly record reasonably accurate GPS positions for a large number of features. Quickmarking is especially useful if the features all lie along a road or path, and are a reasonable distance apart, so that even with quickmark accuracy, their interpolated positions clearly identify them.

You can record quickmarked point features when not capturing any other feature, or you can nest them within line or area features. To gain access to the quickmark recording menu, press QUICK. Asset Surveyor pops up a menu containing only point features:

```
      ┌─ Quickmark ─┐
      │ Town        │
      │ Hydrant     │
      │             │
      │             │
      │             │
      │             │
 SETUP│             │
```
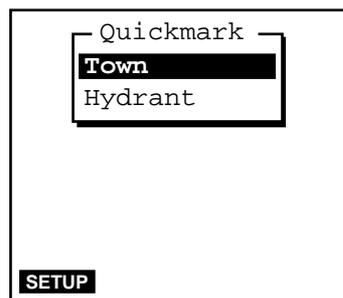
⊠ | **Note -** You can only quickmark point features. It makes no sense to instantaneously record a single position for a line or area feature.

The **SETUP** soft key provides a short-cut to the 'Quickmark' configuration form. As described on page 7-66, you can choose whether quickmarked features should be assigned default attribute values based on the data dictionary, or whether their attributes should be repeated from previous features, and you can also choose whether or not Asset Surveyor should permit you to confirm or edit the attribute values associated with each quickmark as it is recorded.

When you select a point feature from the 'Quickmark' menu, Asset Surveyor records the precise time at which you selected that feature, and ensures that bracketing GPS positions will be logged for use when interpolating. It will determine the appropriate source for default attribute values (the data dictionary or a previous feature) and will log the feature's default attributes (if any).

Finally, if the 'Confirm' configurable field has been set to 'Yes', Asset Surveyor will automatically allow you to review and possibly edit these attributes. By default, the 'Confirm' field's value is 'No', and Asset Surveyor will simply beep and display a message on the GPS status line, such as:

```
Quickmark: Hydrant
```
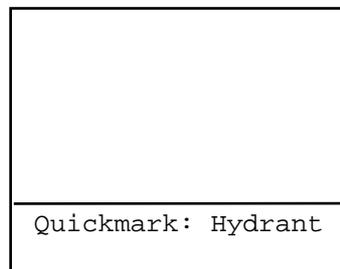
to confirm that it has recorded the quickmark.

✉	**Note -** If you choose to confirm and edit attribute values for quickmarks, remember that even though it takes time to confirm or edit the attribute values, the quickmark position for the feature was recorded the instant you selected the feature. The fact that you have traveled some distance from that point by the time you press **OK** to save the edited attributes has no bearing on the feature's position.
✉	**Note -** The quickmark and its attributes are saved the moment you select the feature from the menu. If you have 'Confirm' set to 'Yes' but then press ESC on the attributes form, the feature will still have been recorded (but with unedited default values for its attributes). If you wish to delete the feature (perhaps because you selected it at the wrong moment), you must review the data file and delete it from the list of recorded features (see page 7-172).
☆	**Tip -** It is often not possible to drive directly over a feature, so when capturing data in a vehicle you may wish to configure a constant offset for quickmarks. You can then drive past each feature at the pre-specified distance and record offset quickmarks.

Main Menu/
Data Capture/
Nested Features

When recording a line or area feature, you will often come across point features which you would like to record. You do not have to complete the whole line or area before returning to record the point features; you can just *nest* the point *within* the line or area.

When you are capturing a line or area feature, press `NEST` to pop up a menu of point features which can be nested within that line or area feature.

```
┌─ Nest feature ─┐
│ Town           │
│ Hydrant        │
│                │
└────────────────┘



 PAUSE  REPEAT  EXT
```

Until you actually select a point feature to nest, any GPS positions which are logged will belong to the outer line or area feature. If you wish to nest a point feature which lies off the line or area feature's perimeter, follow this procedure:

1. **Pause logging to the line or area by pressing** `PAUSE`.

2. **Travel to the point feature in question.**

3. **From the 'Nest feature menu' select the appropriate point feature .**

    When you are ready to record GPS positions for this feature, press `RESUME`. Logging will commence and continue until you save the nested feature or until you press `PAUSE` again.

4. **When you have finished recording attributes for the point feature and have logged sufficient GPS positions, press** `OK` **to save the feature.**

    Asset Surveyor will *automatically* pause logging and will return you to the attribute entry form for the outer line or area feature. You can now press `NEST` again to nest another point feature (and repeat steps 2 to 4) or you can walk back to the line or area's perimeter and press `RESUME` to resume logging of GPS positions for the line or area.

You can nest as many point features within a line or area as you wish (limited only by storage space on the MC-V).

When you eventually complete the traversal of the line or area's perimeter, press **OK** to save that feature.

☆ | **Tip -** If you are traveling rapidly along a line or area's perimeter, and the points you wish to nest have few attributes, and their positions need not be quite as accurately recorded as averaged point features, you should consider quickmarking them instead of nesting them, as the recording of quickmarks is very rapid and time-efficient.

If you select a point feature to nest from the menu, it will have default attribute values as defined in the data dictionary. You can nest a point feature with the same default attributes as the previously-recorded feature of that type by highlighting the feature in the 'Nest feature' menu and pressing **REPEAT**.

Main Menu/
Data Capture/
Segmented Line Features

When capturing line features, it is often convenient to divide a line into a number of *segments.* Segmentation of lines allows you to specify differing attribute values for parts of the same physical line. Segmentation also enables you to end one line feature and immediately start another (of the same type), while you are still moving. This is very useful if you are mapping roads or highways where it can be difficult or even illegal to stop at a point where one feature ends and the next feature starts.

To segment a line feature, press the **SEG** soft key. The current line feature will be saved and another line feature of the same type will be immediately started, with the same attribute values as the previous feature. The last GPS position of the first segment will be identical to the first GPS position of the second segment, so that adjacent segments will be joined end-to-end in your GIS.

Caution - When you press **SEG**, Asset Surveyor will validate the first line feature's attributes. If you have not finished entering the attributes for that line segment, Asset Surveyor will not allow you to save the feature. You will be required to complete attribute entry before pressing **OK** or **SEG** again to save that feature and possibly start another. In the meantime, you will have to come to a halt until the first feature has been completed.

Caution - If, when you press **SEG** there is no current GPS position available (due, for example, to a high PDOP situation), then Asset Surveyor will *not* start the new line segment with the last GPS position of the previous line segment. Instead, the new line segment will start from the first GPS position which becomes available *after* **SEG** is pressed. Asset Surveyor may also start the new line segment at a position other than the precise end of the previous line segment if a satellite constellation change occurs at the moment **SEG** is pressed.

Main Menu/
Data Capture/
Offsets

The attribute entry forms for each type of feature include an **OFFSET** soft key. You can press this to view or enter the offset for the feature being captured. If you have configured a non-zero constant offset for the class of feature being captured, then the default offset value for that feature will be as configured.

For example, the attribute entry form for a point feature might look like:

```
         «Tree»
Type:              ?
Height (m):      24.5
Condition:       Poor
Age:                6
Access:       Private

PAUSE EXT OFFSET
```

Pressing **OFFSET** will pop up the 'Point offset' form as follows:

```
      Point offset
Bearing:        21.4°T
Slope dist:    46.230m
Inclination:     3.4°




RESET FORMAT
```

You can press the **FORMAT** soft key to toggle between the slope distance/inclination method of display and the horizontal/vertical distance method, e.g.

```
         Point offset
Bearing:          21.4°T
Horz. dist:    46.149m
Vert. dist:     2.742m



RESET  FORMAT
```

You can change the configured constant offset for the current feature by measuring and entering a new offset, or by pressing the `RESET` soft key to indicate that there is no offset to apply to this feature.

> ✉ **Note -** All Asset Surveyor features (be they points, lines, areas or quickmarks) can have only *one* offset associated with them. It is not possible to have two or more offsets for a single feature. In particular, this means that in order to record a line feature with a given offset and then to change the offset part-way through the line feature, it is necessary to segment the line at that point (each segmented line feature has its own offset). You must carefully plan how to capture an area feature using offsets, as the same offset value must apply to the entire area feature.

You can fill in the three offset fields for a point feature using a laser range finder. In the case of a line, area or quickmark feature, a laser range finder can only be used to fill in the last two fields; the first field ('Direction') must always be filled in manually.

> ✉ **Note -** When using a laser range finder, you do not have to visit the offset form for a point feature; simply use the laser to record the offset and watch for an 'Offset received' message on the GPS status line. For line, area and quickmark features, however, you must visit the offset form before you can record an offset using a laser range finder. This is because of the need for you to specify the 'Direction' of the offset relative to your current direction of travel.

Main Menu/
Data Capture/
External Sensors

When capturing data to a file, you can press **EXT** at any time to pop up the menu of external sensors. You can activate or deactivate a sensor, check the status of a sensor, or manually initiate a 'reading' from a sensor.

Activation and configuration of a laser range-finder is also accessed via the **EXT** soft key.

Refer to *External Sensors with MC-V Asset Surveyor* for details of how to configure and use external sensors. This companion manual also provides a list of supported laser range-finders and details of how to configure and use a laser range-finder with Asset Surveyor.

Main Menu/
Data Capture/
Exiting

When you have finished capturing features to a data file, you can exit data capture by pressing $\boxed{\text{ESC}}$ on the 'Start feature' menu. When you do, Asset Surveyor asks you to confirm your intentions:

```
┌─ Please confirm ─┐
│Exit data capture?│
└──────────────────┘




 NO  YES
```
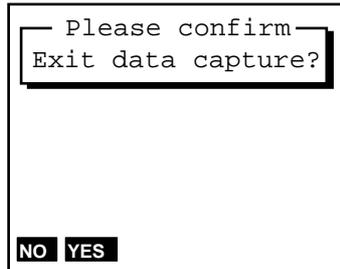
Main Menu/
Navigation

You can use the Asset Surveyor software together with a Trimble GPS receiver to determine and record your current position. You can also use Asset Surveyor and a GPS receiver to *navigate* to a position of interest. This can be a position which you have keyed in from a map, a waypoint which has been loaded into the MC-V from PFINDER, or the position of a feature in an Asset Surveyor data file.

Navigation is traditionally associated with ensuring that an aircraft or ship follows a prescribed course when traveling from A to B, but you can also use navigation to re-visit features which have been previously surveyed, and to identify a specific feature which may require maintenance.

As with other Trimble products, Asset Surveyor maintains a list of waypoints: positions which you can name for future reference and for navigating to or from.

Even if you are not wishing to navigate to a particular point, you can use Asset Surveyor's navigation screens to view your current speed and heading.

> **Note -** Navigation using GPS is effective only within the limits of real-time GPS accuracy. With RTCM real-time differential corrections, you can navigate to an accuracy of 1-10m (depending on your GPS receiver, GPS conditions, the frequency at which RTCM corrections are received, etc.). Without any form of real-time differential corrections, you are at the mercy of Selective Availability (SA), which means that you can only navigate to an accuracy of 15 to 100m or more. Autonomous navigation (without real-time corrections) can still be useful to get you to the right suburb, or the right end of a long street, but it may be less useful for locating a specific feature, especially if similar features are near to each other.

The NAV1, NAV2 and NAV3 Forms

The Asset Surveyor software provides three navigation forms, called **NAV1**, **NAV2** and **NAV3**. Whenever you enter Asset Surveyor's navigation system, by selecting the 'Navigation' entry in either the 'Main menu' or the 'GPS operations' menu, Asset Surveyor will display whichever of the three

navigation forms you were last using. When you first use Asset Surveyor to navigate, the default form is **NAV1**.

The three navigation forms differ only in their first two fields. The heading of each form shows the start and end waypoints, both of which are optional. The three navigation forms are:

NAV1:

```
┌─────────────────────────────┐
│    TOWN → BASE CAMP         │
│ Dist to go:            ?    │
│ Brng to go:            ?    │
│ Heading:           102°T    │
│ Time: ?         24km/h      │
│ Change course:         ?    │
│                             │
│ NAV1 NAV2 NAV3 START END    │
└─────────────────────────────┘
```

NAV2:

```
┌─────────────────────────────┐
│    TOWN → BASE CAMP         │
│ Go:         North 2478m     │
│ Go:          East 1276m     │
│ Heading:            34°T     │
│ Time: 00h47m     4km/h      │
│ Change course:      5°→     │
│                             │
│ NAV1 NAV2 NAV3 START END    │
└─────────────────────────────┘
```

NAV3:

```
┌─────────────────────────────┐
│    TOWN → BASE CAMP         │
│ Dist to go:       2492m     │
│ X-track go:        ←3m      │
│ Heading:           36°T     │
│ Time: 01h14m     2km/h      │
│ Change course:     ←2°      │
│                             │
│ NAV1 NAV2 NAV3 START END    │
└─────────────────────────────┘
```

You can use the **NAV1**, **NAV2** and **NAV3** soft keys to switch between the three navigation forms.

The **NAV1** and **NAV2** navigation forms are generally used as two alternative methods of navigating to an end waypoint; the optional start waypoint is not used by these two forms. The **NAV1** form is best when you are navigating

with a compass across open countryside; the **NAV2** form is best when you are navigating in a built-up area and your movement is restricted to rectangular city blocks. The **NAV3** navigation form shows cross-track error and enables you to travel along the shortest path between two waypoints without the need for a compass.

The fields of the three navigation forms are as follows:

- *Dist to go*. The distance remaining between the current GPS position and the end waypoint. This is the shortest *great-circle* distance to the end waypoint, computed on your local datum. If the end waypoint has not been selected this first field will be null.

- *Brng to go*. The bearing (angle) which you should follow in order to take the shortest path between the current GPS position and the end waypoint. The bearing will be displayed with a trailing 'T' if it is relative to true north or an 'M' if it is relative to magnetic north. If the end waypoint has not been selected this field will be null.

- *Heading*. Your current direction of travel. This is the angle between the last two GPS positions computed, and is therefore likely to be most accurate if you are receiving RTCM differential corrections or if you are traveling fast enough to nullify the effects of SA. This field is also shown with a trailing 'T' or 'M', which indicates that the heading is relative to either true or magnetic north. The heading will be displayed whether or not you have chosen any waypoints.

- *Time to go and Velocity*. The field labeled 'Time' shows both the expected time to reach the target waypoint (if any) and the current velocity across the ground. The time to go field takes your current heading into account and will show a larger value if you are not heading directly toward the target waypoint. The velocity is three-dimensional, taking into account change in altitude as well as horizontal velocity. The current velocity will be displayed whether or not you have chosen any waypoints.

- *Change course*. The modification to your current course which will bring you back onto the shortest path to the end waypoint. The ← and → arrows indicate whether you should veer to the left or to the right, while the numeric value indicates the magnitude by which your course should vary. As with the heading field, this value is susceptible to the effects of SA, and will be most useful if you are receiving RTCM differential corrections or are traveling at a reasonable speed.

- *Go North/South, Go West/East*. The first two fields of the **NAV2** form indicate the distance from the current GPS position to the end waypoint as two Cartesian distances, with directions as indicated. If the end waypoint has not been selected this field will be null.

- *X-track go*. The direction and distance to the shortest line between the start and end waypoints. The direction (left or right) is indicated by ← or → arrows; the numeric value indicates the distance you should travel in that direction to get back on line. Unless both start and end waypoints have been selected, this field will be null.

☆ | **Tip -** You can change any of the above units or the style of display in the 'Units and display' configuration form.

When GPS position information is temporarily unavailable (e.g. due to one or more satellites being obscured, or due to a high PDOP), Asset Surveyor will still display the most recent navigation information, but will flash the following message on the title of the navigation form:

```
 ┌─────────────────────────┐
 │     OLD Navigation      │
 │                         │
 │                         │
 │                         │
 │                         │
 │                         │
 │                         │
 └─────────────────────────┘
```

Main Menu/
Navigation/
Waypoints

Navigation and Waypoints

For a detailed description of how to create and manage waypoints in Asset Surveyor, refer to page 7-142 of this chapter. This section describes how to *select* waypoints for navigation purposes.

Selecting Waypoints

When navigating, you can select the start waypoint by pressing START and the end waypoint by pressing END.

When you press either START or END, Asset Surveyor pops up the menu of current waypoints, which includes (at the end of the menu) the *null* waypoint (designated by the currently configured null string: '?', by default).

You can select a waypoint from this menu or you can 'clear' the start or end waypoint by selecting the null waypoint.

When you first use Asset Surveyor to navigate, the start and end waypoints will be null. Once you have selected start and/or end waypoints, these remain the selected waypoints for subsequent navigation sessions, until you change them.

Navigating to a Waypoint from your Current Position

If you have neither start nor end waypoints selected (i.e. both are the null waypoint), the title of each navigation form will be:

```
 No END waypoint



 NAV1  NAV2  NAV3  START  END
```
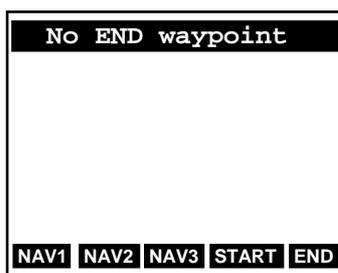
If you wish to navigate to a specific waypoint from wherever you happen to be at the time, press END and select that waypoint from the menu. The title of the navigation form will change to:

```
┌─────────────────────────────┐
│ →  WaypointName             │
│                             │
│                             │
│                             │
│                             │
│                             │
│ NAV1 NAV2 NAV3 START  END   │
└─────────────────────────────┘
```
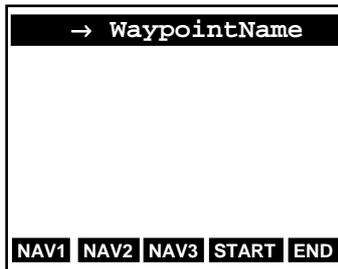
where the end waypoint's name is shown. Navigation using an end waypoint only is usually carried out using either the **NAV1** or **NAV2** navigation forms.
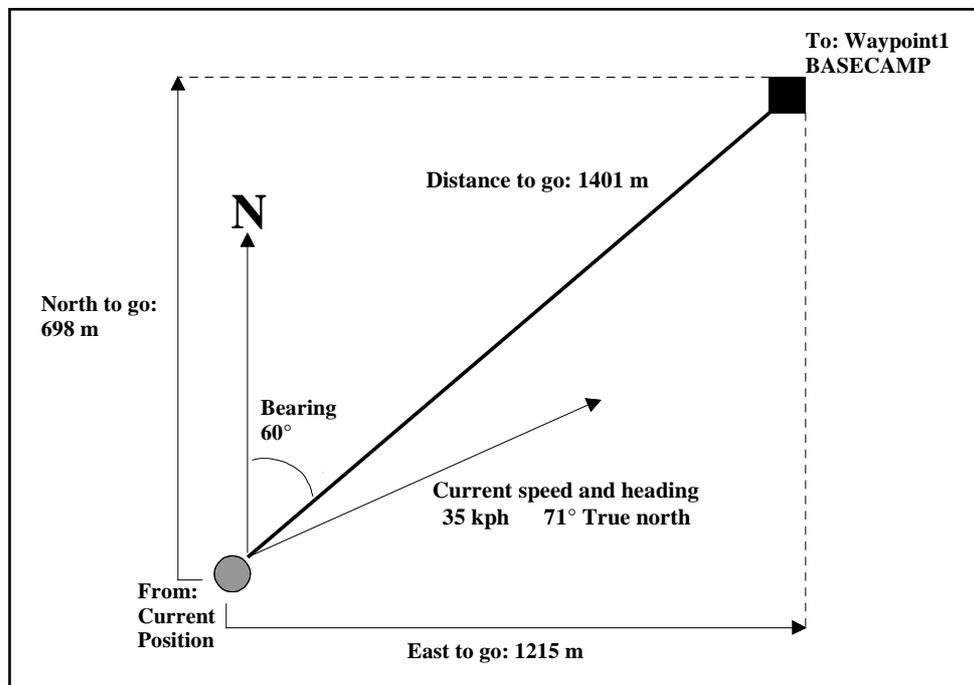
Figure 7-2   Navigation from your Current Position

Navigating from Waypoint to Waypoint

If you wish to navigate from a specific waypoint to another specific waypoint, select start and end waypoints from the menu (using START and END). The title of the navigation form will change to:

```
StartWaypt→ EndWaypt




NAV1  NAV2  NAV3  START  END
```
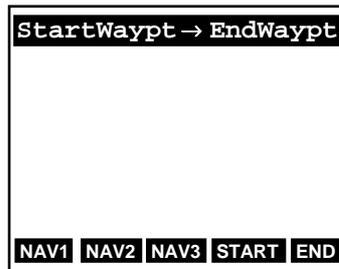
where both the start and end waypoints' names are shown. Navigation from waypoint to waypoint allows you to take advantage of the NAV3 form's cross-track error indicator.
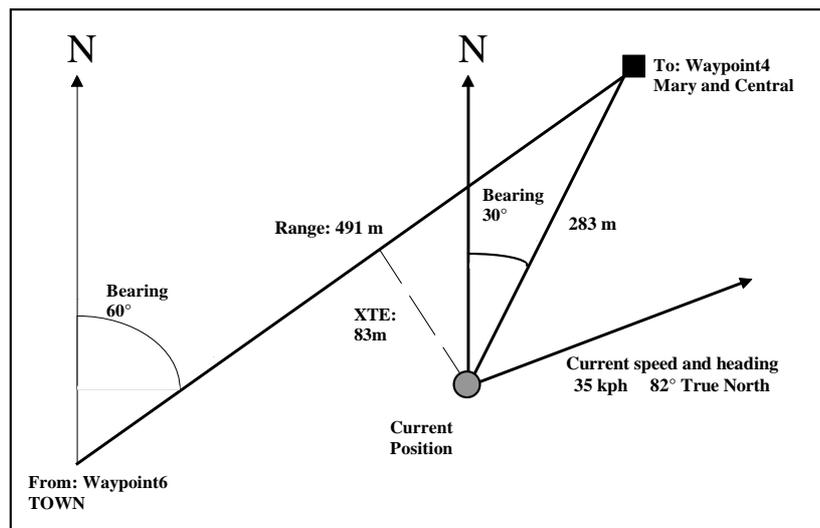
Figure 7-3   Navigation from Waypoint to Waypoint

Main Menu/
File Transfer

If you select the 'File transfer' entry from Asset Surveyor's 'Main menu', Asset Surveyor will enter file transfer mode. You can use this mode to transfer data files, data dictionaries, language files, waypoints, almanacs and coordinate system files between the Asset Surveyor software and PFINDER.

File transfer mode uses the same serial port as the GPS interface, so you must disconnect GPS before selecting 'File transfer'. If you do not, Asset Surveyor pops up the message:

```
┌──── Error! ────┐
│ Disconnect GPS │
│ before selecting │
│  this option.  │
└────────────────┘
```
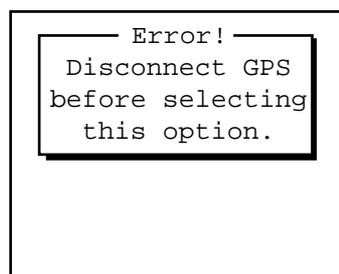
Once GPS is disconnected, ensure your MC-V is connected to your PC, and select 'File transfer' again. Asset Surveyor then displays the file transfer status form:

```
     File transfer
 Connect cable to PC
```
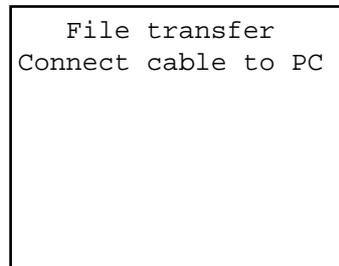
Throughout the file transfer session, Asset Surveyor will display status information on the second line of this form, indicating whether or not the file transfer operations are proceeding correctly.

All file transfer operations are controlled from PFINDER, using the entries under the 'Comm' menu. You can exit file transfer mode at any time by pressing ESC on the MC-V. If a transfer operation was in progress at the time, this will be aborted.

Transferring Data Files to the PC

Under the 'Co<u>mm</u>' menu in PFINDER, select the 'Data <u>F</u>iles to PC' entry. This allows you to select one or more data files in the MC-V to transfer to your PC. The data files will be transferred one at a time to the PC. Asset Surveyor's status form indicates how much of each file remains to be transferred.

Transferring Almanacs to the PC

Under the 'Co<u>mm</u>' menu in PFINDER, select the '<u>A</u>lmanac to PC' entry. The PC will request an almanac file from the MC-V. There will be an almanac file on your MC-V if it has been used with a ProLite GPS receiver for at least 15 minutes (the length of time it takes a Pathfinder GPS receiver to record a full almanac), or if it has been used with any other Pathfinder GPS receiver which has acquired an almanac.

If you have a 4000 Series GPS receiver, you can record an almanac in the 4000's internal memory, and extract it as described in the *GIS Surveyor Operation Manual*.

Once an almanac has been transferred to your PC, you can use it for Mission Planning. Refer to the *PFINDER Software User's Guide* or the *Quick Plan Software User's Guide* for details.

Transferring Data Dictionaries to the MC-V

Under the 'Co<u>mm</u>' menu in PFINDER, select the '<u>D</u>ata Dictionary to Data Logger' entry. This allows you to select a single data dictionary on your PC and transfer it to your MC-V. As the data dictionary is transferred to the MC-V, Asset Surveyor's status form indicates the amount of the file which has been received, and confirms that the data dictionary was received correctly when the transfer completes.

⊠ | **Note -** You can load a number of data dictionaries onto the MC-V, but Asset Surveyor will not permit you to transfer a data dictionary with the same name as a dictionary which is already on the MC-V. If you have updated a data dictionary on your PC and wish to transfer the updated dictionary to your MC-V, you will have to delete the dictionary with that name from your MC-V first.

Transferring Other Files to the MC-V

You can also transfer a range of special files to your MC-V, using the 'File to Data Logger' entry in PFINDER's 'Comm' menu. PFINDER allows you to enter the file name and directory path to the file on the PC, and also a name which will be assigned to the file on the MC-V. The Asset Surveyor software permits the transfer of files with the following names only:

- *ASCOORD.DAT*. A file containing coordinate system definitions. This can be edited on your PC using the supplied 'ASSETED.EXE' program (see Appendix C), and then loaded onto a fleet of MC-Vs to ensure that they all have the same coordinate systems (and only those coordinate systems which are required for your application).

- **.LNG*. A number of specific Asset Surveyor language files. You can load the language(s) you require onto your MC-V, and then change the language used by the Asset Surveyor software via the 'Language' menu in the 'Units and display' configuration form (see page 7-61).

The Asset Surveyor software supports the following languages, with corresponding language file names as indicated:

Language file	Language
ENGLISH.LNG	English (default language)
ESPANOL.LNG	Spanish
DEUTSCH.LNG	German
FRANCAIS.LNG	French
RUSSIAN.LNG	Russian

☆ **Tip -** You may experience difficulties transferring files directly from the Asset Surveyor diskette using PFINDER. If you create a new directory on your PC's hard disk drive and copy the contents of the Asset Surveyor diskette into this directory, you can transfer files from this directory to your MC-V more rapidly and more reliably.

⊠   **Note -** All of the language files except RUSSIAN.LNG reside in the
root directory of the Asset Surveyor software distribution diskette.
The Russian language file resides in the \RUSSIAN subdirectory of
the distribution diskette, together with release notes (RUSSIAN.TXT)
and a number of utility programs which specifically assist Russian
users of the Asset Surveyor software.

💣   **Caution -** Although PFINDER allows you to specify different names
for a file on the MC-V, Asset Surveyor will only accept files with
names as described above. You are encouraged not to change the
names of these files to avoid possible confusion.

Transferring Waypoints

You can transfer waypoints to and from your MC-V using PFINDER's
'Waypoint Manager', accessed under the 'Comm' menu. The waypoint
manager allows you to create waypoints from an SSF file, or to key in new
waypoints. It allows you to extract numbered waypoints from your MC-V, or
to send a range of numbered waypoints to your MC-V.

Transferring Waypoints from PFINDER to the MC-V

Under PFINDER's waypoint manager, select the 'To Data Logger' entry
from the 'Put' menu to send a selection of waypoints to your MC-V.

⊠   **Note -** Unlike some other Trimble products, Asset Surveyor treats the
name of each waypoint as being its identifying characteristic –
waypoints are not identified by a **number**. Waypoints transferred to
the MC-V will be added to the end of the list. If some of these
waypoints had already existed on the MC-V, you may first wish to
delete them or even clear the entire waypoint file.

Transferring Waypoints to PFINDER from the MC-V

Under PFINDER's waypoint manager, select the 'From Data Logger' entry from the 'Get' menu to receive a selection of waypoints from your MC-V.

☆ **Tip -** PFINDER will attempt to extract all waypoints held in the MC-V by requesting waypoints numbered 1 to 999. This takes quite some time, but typically you will only have recorded a few waypoints in your MC-V. You can use a 'filter' in PFINDER's waypoint manager to ensure that PFINDER only extracts waypoints within a certain numerical range, thereby speeding up the transfer operation significantly. You can tell how many waypoints are currently stored on the MC-V by popping up the menu of waypoints, pressing `END` to highlight the last waypoint in the menu, and then pressing **EDIT** to view it. The title of the waypoint editing form shows the number of that waypoint, which will be the total number of waypoints stored on the MC-V.

✉ **Note -** You cannot use post-processing to differentially correct the waypoints stored by the Asset Surveyor software. You can, however, differentially correct features captured by Asset Surveyor and then turn the positions of these features into waypoints in PFINDER.

Main Menu/
Utilities Menu

The 'Utilities' menu, which is accessed from the Asset Surveyor software's 'Main menu', provides a number of miscellaneous operations:

```
┌──── Utilities ────┐
│ Waypoints         │
│ Factory defaults  │
│ External sensors  │
│ Reset GPS receiver│
│ Almanac           │
│                   │
└───────────────────┘
 INFO
```
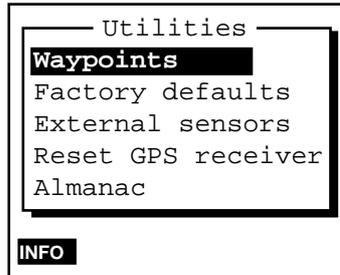
The following sections describe the entries in the 'Utilities' menu.

⊠ | **Note -** The **INFO** soft key on the 'Utilities' menu displays the same information as the corresponding soft key on the Asset Surveyor software's 'Main menu', and the 'Info for new users' entry in the 'Main menu' (see page 7-160).

Main Menu/
Utilities/Waypoints

An Asset Surveyor waypoint is a named three-dimensional position. A waypoint can be used to record a geographic point of interest such as a survey mark, an excavation site, or a previously-surveyed feature.

Waypoints can be specified in local coordinates (i.e. as north, east and altitude in a local coordinate system), but Asset Surveyor stores all waypoints as latitudes, longitudes and altitudes on the WGS-84 datum. This enables you to export and use waypoints in other coordinate systems.

The Asset Surveyor software maintains a single waypoint file, which contains a list of waypoints. There is no fixed limit to the number of waypoints you can record in Asset Surveyor, apart from the limit of available data storage space on the MC-V.

You can view the menu of waypoints and perform waypoint management operations in a number of ways:

- By selecting the 'Waypoints' entry from the 'Utilities' menu.
- By selecting the 'Waypoints' entry from the 'GPS operations' menu.
- Whenever you are selecting a start or end waypoint for navigation (see page 7-133).
- Whenever you are selecting a waypoint as a reference position for a GPS base station (see page 7-157).
- Whenever you are selecting a waypoint as a reference position for Over and Up mode (see page 7-48).

The menu of waypoints looks as follows:

```
┌─ Waypoints ─┐
  BASE CAMP
  Fuel Dump
  Hydrant 133
  Hydrant 145
  Hydrant 4331↓

 CREAT MEASU DEL CLEAR EDIT
```
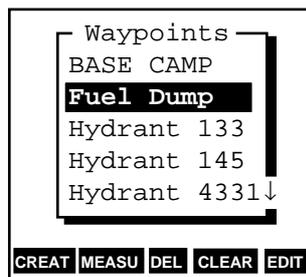
You can select a waypoint by using the normal menu selection methods described in Chapter 4. You can perform various waypoint management operations using the soft keys. These operations are described in the following sections.

Main Menu/
Utilities/Waypoints/
Creating

You can create a waypoint and add it to the 'Waypoints' menu in a number of ways:

- By pressing **CREATE** on the 'Waypoints' menu.

- By pressing **WAYPT** on the GPS 'Position' form. This creates a waypoint using the current GPS position and allows you to name the waypoint and possibly edit the position before saving it to the waypoints file and adding it to the 'Waypoints' menu.

- By pressing **WAYPT** on one of the position forms when reviewing data (see page 7-169). This creates a waypoint using a particular feature's position and allows you to name the waypoint and possibly edit the position before saving it to the waypoints file and adding it to the 'Waypoints' menu.

The waypoint creation form is as follows:

```
 Create waypoint 23
Name:               ?
North:              ?
East:               ?
Alt (MSL):          ?
Datum:      NZGD 1949
Zone:    UTM Zone 59
HERE
```

The title of the form indicates the number of this new waypoint. As waypoints are created, they are added to the end of the 'Waypoints' menu, so this number informs you how many waypoints are currently in the menu. However, the waypoint numbers will vary as waypoints are deleted, so you cannot rely on a particular waypoint retaining the same number.

You can enter the waypoint's name and location into the remaining fields on this form. You must supply non-null values for all fields before pressing **OK** to save the waypoint and add it to the 'Waypoints' menu.

> ✉ **Note -** When entering waypoints from a map, you may have to estimate the waypoint's altitude, using the map's contours, or using your knowledge of the area; you cannot leave the altitude field empty.

> ☆ **Tip -** If you normally use one coordinate system and wish to enter waypoints from a map which uses a different coordinate system, switch to the map's coordinate system (using the 'Coordinate system' entry of the 'Configuration' menu), enter the waypoints, then switch back to your normal coordinate system. Because Asset Surveyor projects all waypoints back to the WGS-84 datum, the positions can be used in any coordinate system defined for that area; although the actual coordinates of a waypoint will change when the coordinate system is changed, the physical position of the waypoint on the earth's surface will be preserved.

The 'Create waypoint' form supplies a **HERE** soft key which, when GPS is active, can be pressed to fill in the waypoint's location with your current GPS position.

> ✉ **Note -** Unless you are receiving RTCM differential corrections or are using a P(Y)-code receiver, the accuracy of the current GPS position will be subject to Selective Availability (SA).

Main Menu/
Utilities/Waypoints/
Editing

You can view the details of a particular waypoint, and optionally edit them, by highlighting that waypoint in the 'Waypoints' menu and pressing **EDIT**. The 'Edit waypoint' form is very similar to that for creating new waypoints, but is filled in with details of the selected waypoint:

```
    Edit waypoint 3
Name:     Hydrant 133
North:    5742765.70m
East:     2479077.53m
Alt (MSL):     41.32m
Datum:       NZGD 1949
Zone:     UTM Zone 59
HERE
```

When you have finished viewing or editing the waypoint, press **OK** to save it and return to the 'Waypoints' menu, or press [ESC] to return to the menu without saving any changes.

☆ | **Tip -** Selecting a waypoint from the menu is equivalent to pressing **EDIT**, if you have accessed the 'Waypoints' menu from the 'Utilities' or 'GPS operations' menu.

The 'Edit waypoint' form supplies a **HERE** soft key which, when GPS is active, can be pressed to fill in the waypoint's location with your current GPS position.

✉ | **Note -** Unless you are receiving RTCM differential corrections or using a P(Y)-code receiver, the accuracy of the current GPS position will be subject to Selective Availability (SA).

The 'Datum' and 'Zone' fields are displayed to remind you of the currently configured coordinate system; they are not edible in the 'Edit waypoint' form.

Main Menu/
Utilities/Waypoints/
Deleting

Deleting Single Waypoints

You can delete a particular waypoint from the 'Waypoints' menu (and the waypoints file) by highlighting that waypoint and pressing `DEL`. Asset Surveyor asks you to confirm your intention:

```
┌Confirm deletion┐
Waypoint: "BASE
        CAMP".
```

NO **YES**
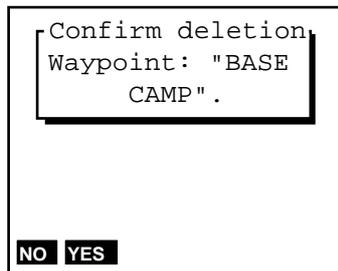
Answer 'Yes' to delete the waypoint, or 'No' to retain it.

Deleting All Waypoints

You can delete all waypoints from the 'Waypoints' menu (and the waypoints file) by pressing the `CLEAR` soft key. Asset Surveyor asks you to confirm your intention:

```
┌─ Please confirm ─┐
 Clear waypoints
file, deleting all
current waypoints?
```

NO **YES**
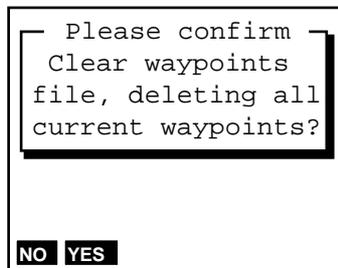
Main Menu/
Utilities/Waypoints/
Measuring Between

Asset Surveyor provides a facility for measuring the distance and bearing between selected waypoints. Press `MEASURE` to pop up the 'Measure' form:

```
            Measure
Start waypt:BASE CAM
End waypt: Fuel dump
Distance:   2500.51m
Bearing: 146°43'18"T



PREV  NEXT  STEP
```

When you select a waypoint for either the 'Start waypt' or 'End waypt' field, Asset Surveyor computes and displays the distance and bearing from 'Start waypt' to 'End waypt'.

You can change the value of the 'Start waypt' or 'End waypt' menu fields in the usual way, or by making use of the three soft keys provided by this form:

- You can press `PREV` to select the previous waypoint in the waypoint menu.

- You can press `NEXT` to select the next waypoint in the waypoint menu.

⊠   **Note -** If you press `PREV` or `NEXT` when the 'Start waypt' field is highlighted, it is this waypoint which will be changed. If you press `PREV` or `NEXT` when any other field of the 'Measure' form is highlighted, it is the 'End waypt' which will be changed.

- You can press `STEP` to put the 'End waypt' value into the 'Start waypt' field, and the next waypoint in the waypoint menu into the 'End waypt' field.

☆   **Tip -** You can use `STEP` to step through a route (a sequence of waypoints recorded in the order that you wish to visit them) and see the distance and bearing for each leg of the route.

☆ | **Tip -** You can change the units in which the 'Distance' field is displayed by changing the value of the 'Distance' units in the 'Units and display' configuration form (see page 7-52). In that same configuration form, you can also change the north reference from 'True' to 'Magnetic', or vice versa, by changing the value of the 'North ref' field (see page 7-57).

Main Menu/
Utilities/
Factory Defaults

You can reset all of the Asset Surveyor software's configurable aspects to the Trimble factory defaults by selecting the 'Factory defaults' entry from the 'Utilities' menu. If you select 'Factory defaults', Asset Surveyor will ask you to confirm that this is your intention:

```
┌ Please confirm ┐
  Reset to factory
     defaults?



 NO  YES
```
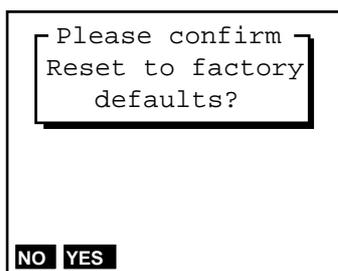
If you answer 'No', you will be returned to the 'Utilities' menu and the system configuration will remain as it is.

If you answer 'Yes', Asset Surveyor will delete its configuration files and rebuild them with factory default values, then it will reboot the MC-V to ensure that the factory default settings take effect. If Asset Surveyor has previously recorded an almanac from a Pathfinder GPS receiver, this will also be deleted.

> ⊠   **Note -** Resetting to factory defaults will *not* delete data dictionaries, data files, languages, coordinate systems or waypoints. However it *will* reset Asset Surveyor to the default language (English), the default coordinate system (latitude/longitude on the WGS-84 datum) and the default data dictionary (Generic).

Main Menu/
Utilities/
External Sensors and
Laser Range-finders

Refer to *External Sensors with MC-V Asset Surveyor* for details of how to configure and test external sensors. This companion manual also provides a list of supported laser range-finders and details of how to configure and use a laser range-finder with Asset Surveyor.

Main Menu/
Utilities/
Reset GPS receiver

You can reset the memory of a Pathfinder GPS receiver using the 'Reset GPS receiver' entry in the Asset Surveyor software's 'Utilities' menu.

It will normally be quite unnecessary to reset the GPS receiver's memory, but if for some reason the receiver firmware malfunctions, resetting its memory can often fix the problem.

💣☼   **Caution -** Resetting the GPS receiver's memory will force the receiver to perform a cold restart. The receiver may take up to 15 minutes to reacquire signals from the GPS satellites.

When you select 'Reset GPS receiver', Asset Surveyor will check the currently connected GPS receiver. Asset Surveyor will beep and return to the 'Utilities' menu if there is none, or if the connected GPS receiver is one of the following:

- a 4000 Series receiver,

- a Pathfinder Basic Series receiver, or

- a Centurion or Trimpack III.

If the currently connected GPS receiver does not appear in the list above, Asset Surveyor will ask you to confirm that you wish to reset its battery-backed memory:

```
 ┌ Please confirm ┐
  Reset GPS receiver




 NO  YES
```
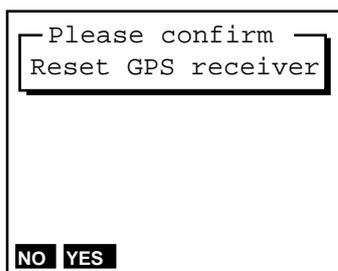
If you answer 'Yes', the receiver's memory will be reset. After answering this question, you will be returned to the 'Utilities' menu.

If, after resetting your GPS receiver's memory, the receiver still fails to acquire GPS satellite signals within 15 minutes, you should contact your nearest Trimble Support Center for advice.

✉	**Note -** If your GPS receiver is one of those listed above, consult the receiver's Operation Guide for instructions on how to manually reset the receiver's battery-backed memory.

Main Menu/
Utilities/
Almanac

You can check the date on which Asset Surveyor last recorded an almanac from a Pathfinder GPS receiver by selecting the 'Almanac' entry in the 'Utilities' menu. Asset Surveyor will display the following information form:

```
            Almanac
Date: 03/13/1995 Mon
```

If Asset Surveyor has never recorded an almanac (since the software was installed, or since you last reset it to 'Factory defaults'), it will display '?' instead of the almanac date.

⊠	**Note -** Asset Surveyor will not record an almanac from a 4000 Series GPS receiver.

Main Menu/
Base Station

If you select the 'Base station' entry from Asset Surveyor's 'Main menu', Asset Surveyor will act as a GPS base station in conjunction with a Pathfinder GPS receiver.

⊠	**Note -** The Asset Surveyor software cannot act as a base station with a 4000 Series GPS receiver. If you wish to use a 4000 Series receiver as a base station, you should contact Trimble and request information on the 'Universal Reference Station' PC software.
⊠	**Note -** The Asset Surveyor software cannot be used to control a real-time (RTCM) GPS base station.

When you select the 'Base station' entry from the 'Main menu', Asset Surveyor first checks that it is connected to and able to communicate with a Pathfinder GPS receiver. If it is connected to a 4000 Series GPS receiver, or is not connected to a GPS receiver at all, it will not continue with the Base Station session.

Configuring Base Station Options

The first step in setting up a GPS base station is to configure the GPS 'Base stn options', as described on page 7-35.

You can re-configure the base station options once the base station has started operating, but it is good practice to configure Asset Surveyor first, so that when a base station is started it can immediately log the data you require.

Main Menu/
Base Station/
Creating a File

After you have selected 'Base station' from the 'Main menu', and Asset Surveyor has confirmed that you have a Pathfinder GPS receiver connected, the 'Create file' form will appear:
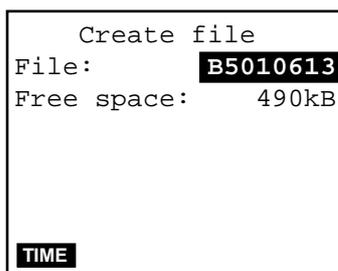
```
       Create file
File:        B5010613
Free space:      490kB




 TIME
```

Asset Surveyor suggests a default file name, as described in the *File Naming Conventions* section of Chapter 4. The default name appears in the 'File' field. You can accept this default name, edit it, or type in a new name altogether. File names can be at most eight characters long, and can be composed of letters and digits only (i.e. no spaces or punctuation characters).

The other field of the form, 'Free space', reminds you how much data file storage space remains on your MC-V. You cannot edit this field.

Press **OK** when you have entered a different file name, or to accept the default name. Asset Surveyor checks that the name of the new file is unique. If it is not, Asset Surveyor warns you:
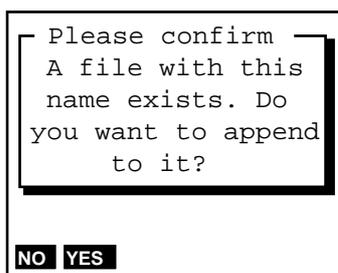
```
 ┌─ Please confirm ─┐
 │ A file with this │
 │ name exists. Do  │
 │you want to append│
 │     to it?       │
 └                  ┘

 NO  YES
```

If you answer 'Yes', Asset Surveyor will re-open the existing file and log base station information to it. If you answer 'No', you will be returned to the 'Create file' form where you can enter a new file name.

Main Menu/
Base Station/
Antenna Height

After creating or selecting a base station file, Asset Surveyor will pop up the antenna options form:

```
            Antenna
Height:          0.000m
Measure:       Vertical
Type:               EC
```

You should verify that the configured antenna height and type are correct before pressing OK to proceed. See page 7–26 for a list of antenna types.

Main Menu/
Base Station/
Reference Position

Once you have accepted a file name, Asset Surveyor allows you to enter a *reference position* for the base station. This is the known position at which the base station is situated. The default given is the value which was last specified as a reference position:

```
 Reference position
North:              ?
East:               ?
Alt (MSL):          ?
Datum:         NAD-83
Zone:    California-6

WAYPT UNKNOWN HERE
```

You can enter the reference position from a map, or from the results of a previously-conducted control survey. If you provide a reference position for the base station, you must enter values into all three fields in the 'Reference position' form. If you do not know the location of your base station, you can press ESC or **UNKNOWN** to proceed.

✉ **Note -** You can use PFINDER to *change* a base file's reference position once you return to the office.

✉ **Note -** The reference position you enter will typically be the position of some reference mark on the ground. Asset Surveyor combines this with the Antenna height which you previously specified to calculate the position of the GPS antenna's phase center (APC). This is the position which will be logged in the base station file.

If you have previously recorded the location of the base station as a waypoint, you can press **WAYPT** to pop up the menu of waypoints. Selecting a waypoint from this menu automatically fills in the 'Reference position' fields with the location of that waypoint.

☆ | **Tip -** If you regularly operate a base station on more than one location, you can set up waypoints for each base location. This makes selection of the reference position very easy.

You can press **HERE** to fill in the reference position with the current GPS position (if any).

⊠ | **Note -** Unless you are receiving RTCM differential corrections, the accuracy of the current GPS position will be subject to Selective Availability (SA).

⊠ | **Note -** If you choose to append to an existing data file, Asset Surveyor will not permit you to specify a new reference position. If you have moved to a different location, you *must* create a new base file.

Main Menu/
Base Station/
Status Form

Once you have created a base station file and (optionally) entered a reference position for the base station, Asset Surveyor will start logging base station information. When operating as a base station, Asset Surveyor displays the 'Base station' status form:

```
        Base station
Free space:      481kB
Start
 Time:    02:14:01 pm
 Date:10/06/1993 Wed
Logging for:    1h26m

SETUP
```

The fields on the 'Base station' status form are as follows:

- *Free space*. The amount of available data storage space remaining on the MC-V.

- *Start*. The time and date that the base station started logging to this data file.

- *Logging for*. The time, in hours and minutes, for which Asset Surveyor has been logging base station data to this data file (in the current session).

This form simply displays the status of the base station; none of these fields are editable.

You can press **SETUP** to reconfigure GPS 'Base stn options'.

You can press **GPS** to pop up the 'GPS operations' menu. The only entry missing from this menu when in base station mode is the 'Navigation' entry, which is unnecessary given that a base station must be stationary.

When you have finished operating the Asset Surveyor software as a GPS base station, you can exit base station mode by pressing **OK** or ESC.

Main Menu/
Information for New Users

The 'Info for new users' menu entry, and the **INFO** soft keys on the 'Main menu' and 'Utilities' menu, provide access to a page of information for new users of the Asset Surveyor software.

```
ESC  = Abandon form
Press SH2 for:
GPS  = GPS operations
VIEW = Review file
NOTE = Enter note
CNFG = Configuration
```

Other Operations/
Entering a Note

7.4   Other Operations

The following sections describe additional Asset Surveyor features which are *not* accessed using the 'Main menu'.

Entering a Note

Whenever you are capturing data to a file, you can press **NOTE** to enter a *note*. Asset Surveyor allows you to type any characters at all into a note, which can be up to 80 characters long.

```
        Enter note

 SYMB
```

You can make use of **SYMB** to enter any special characters. Pressing ENTER or ↓ moves the cursor to the next line of the note; pressing ↑ moves the cursor to the previous line of the note. Pressing HOME moves the cursor to the start of the current line, and END moves the cursor to the end of the current line.

When you have finished entering the note, press **OK** and Asset Surveyor will store the note at the end of the current data file. If you decide that you no longer wish to save the note, press ESC.

Notes can be reviewed and edited as described in the following section. When the data file is output to PFINDER, the resulting SSF file will contain any notes which you entered, as well as some which Asset Surveyor writes to the data file itself (e.g. 'Logging started' and 'Logging stopped').

⊠ | **Note -** If you use PFINDER's GIS Output capabilities to export data to a GIS, be aware that notes which are recorded while a feature is being captured may also be exported to the GIS.

Other Operations/
Reviewing and Editing Data

Unless you are already reviewing a data file, you can press ⌷SH2⌷ and then press ▮VIEW▮ to review (and optionally edit) an existing data file.

If you press ⌷SH2⌷ and then press ▮VIEW▮ outside of data capture, Asset Surveyor pops up a menu of data files:

```
┌Review file┐
 R100418a
 R100509a
 R100613a
 R100613b
 B3100615
```
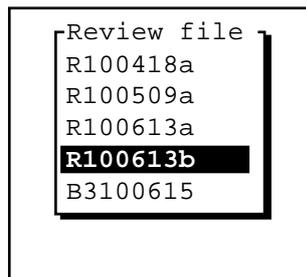
Select a file to review from this menu. The file in this menu which is highlighted initially is the file which was most recently reviewed or used for capturing data.

If you press ▮VIEW▮ while capturing data to a file, or select a specific file to review from the 'Review file' menu, Asset Surveyor scans the file for features and notes and then displays the following form:

```
 Review «R100509a»
1: Logging started:…
2:            Town
3:     Gas station
4:            Bank
5:         Highway
6:        Car park
SEARCH POS DEL UNDEL
```
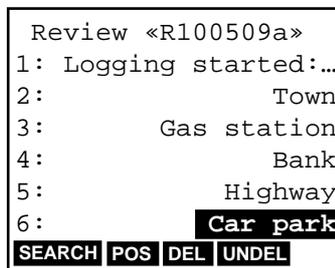
☆ | **Tip -** It may take Asset Surveyor some time to scan a large data file. If you intend to review and edit data files frequently, you should consider creating and maintaining smaller data files (perhaps starting a new one every few hours) in order to minimize the amount of time you must wait before reviewing your data.

Asset Surveyor will highlight the last feature or note which was recorded to the data file being reviewed. You can move the highlight up and down the list of features and notes.

You can view the attributes of a particular feature or the contents of a particular note by positioning the highlight on that feature or note and pressing ENTER. The forms for reviewing attributes and notes are very similar to the forms for originally entering attributes and notes, e.g.

```
        Review«Town»
Name:        Pottsville
Population:        1035
Gas stations:        2
Any open 24 Hrs?: No
Banks:               0

```

and

```
       Review note
Logging started:
09:16:20 am
09/30/1993 Thu
(Local time)

```

You can edit any attributes of a reviewed feature, or the contents of a note, then press OK to save the feature or note. If you are just viewing the feature or note, press ESC to return to the list of features and notes for the data file which is under review.

You can view the position(s) of a feature by pressing POS, and you can also view and/or edit a feature's offset by pressing OFFSET in the position review form.

⊠ | **Note -** If you review a file while you are capturing data to it, Asset Surveyor may continue to log GPS positions and/or ESP data to that file during the review session. This data will be associated with whichever feature was being captured at the time you pressed `VIEW`. *You cannot update the GPS position or ESP data associated with a previously-recorded feature*.

☆ | **Tip -** If you have entered a feature's attributes correctly but have recorded the wrong position, you can review that feature, then return to the list of features in data capture and press `REPEAT`. The attribute values of the incorrect feature will become the default values for the new feature, and you can then correctly record the feature's GPS position. The original feature should then be deleted as described on page 7-172.

You can press `ESC` to exit data review, or you can press a soft key to perform another operation. When you press `ESC`, Asset Surveyor asks you to confirm your intention.

```
┌Please confirm┐
  Exit review?




NO  YES
```
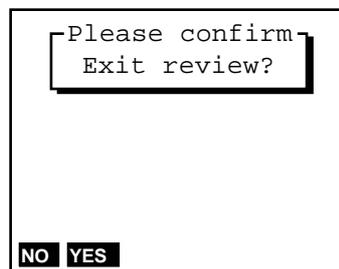
The four soft keys on the list of features and notes are described in the following sections.

Other Operations/
Review/Searching

The SEARCH soft key initiates a search through the current data file. Asset Surveyor asks you to specify a pattern to search for, and a direction:

```
            Search
Pattern:              ?
Direction: Backwards
```

The fields on this form are as follows:

- *Pattern*. A character string for which Asset Surveyor should search. This can contain any characters; a SYMB soft key is made available to assist with the specification of characters which are difficult to type on the MC-V's keyboard. You must specify a non-null pattern before Asset Surveyor will attempt a search.

- *Direction*. Because Asset Surveyor initially positions the highlight on the last feature or note in the data file, the default search direction is 'Backwards'. If you have re-positioned the highlight at or near the top of the data file, you may wish to change the direction to 'Forwards'.

When you have entered a pattern and a direction, press OK. The search will commence from the currently highlighted feature or note. Asset Surveyor searches through each feature and note in turn, comparing the specified 'Pattern' to each feature name, attribute value and note. Any *partial match* will result in Asset Surveyor highlighting the feature or note in which the match was found, and halting the search:

```
 Review «R100509a»
1: Logging started:…
2:              Town
3:       Gas station
4:              Bank
5:           Highway
6:          Car park
SEARCH POS DEL UNDEL
```

If Asset Surveyor searches right to the beginning of the data file (or the end, if the search direction is 'Forwards') without finding a match for the pattern, it pops up the following message:

```
        ┌─── Error! ───┐
Not found:
      "Memphis".
```

✉   **Note -** When searching, Asset Surveyor only requires a partial match, and you do not need to specify the case of the pattern correctly. For example, a pattern of 'pot' will match attribute values like 'Pottsville' and 'spotted'.

Press **SEARCH** again to continue the search, or to change the pattern or direction and search again.

✉   **Note -** Asset Surveyor will not search for a match in any deleted features or notes.

☆   **Tip -** Searching Asset Surveyor's database can take quite some time, especially if the features you have captured each have many attributes. If you decide not to continue with a search which has been running for a while, press ESC to abort the search.

Other Operations/
Reviewing/Positions

In the list of features and notes for a data file, you can view the GPS position(s) recorded for a feature by highlighting it and pressing **POS** .

⊠   **Note -** Unless you have used an RTCM link to differentially-correct your GPS positions in real time, or have used a P(Y)-code receiver, the positions displayed by Asset Surveyor will be subject to the effects of Selective Availability (SA).

Point Features

If you press **POS** when a regular point feature is highlighted, Asset Surveyor averages the GPS positions recorded for the feature and displays the averaged position:

```
 Averaged position
Feature:        Town
North:    5742788.71m
East:     2479065.09m
Alt (MSL):   381.27m
Datum:      NZGD 1949
Zone:     UTM Zone 59
WAYPT OFFSET
```

If the point feature was recorded as a quickmark, Asset Surveyor displays the interpolated position for the feature:

```
 Quickmark position
Feature: Gas station
North:    5742796.86m
East:     2479062.88m
Alt (MSL):   382.01m
Datum:      NZGD 1949
Zone:     UTM Zone 59
WAYPT OFFSET
```

Line Features

If you press **POS** when a line feature is highlighted, Asset Surveyor asks you to specify whether you wish to see the start or end position for the line feature:

```
┌Which position? ┐
 Start of line
 End of line
└                ┘




```

Once you have chosen either the start or end position of the line, Asset Surveyor displays that position, for example:

```
      Start of line
 Feature: City street
 North:    5742804.07m
 East:     2479065.37m
 Alt (MSL):   381.26m
 Datum:      NZGD 1949
 Zone:    UTM Zone 59
 WAYPT  OFFSET
```

Area Features

If you press **POS** when an area feature is highlighted, Asset Surveyor asks you to specify whether you wish to see the start, centroid or end position for that area feature:

```
┌Which position? ┐
 Start of area
 Centroid of area
 End of area
└                ┘




```

Once you have chosen one of these three positions, Asset Surveyor display that position, for example:

```
     Centroid of area
Feature:    City park
North:    5742877.58m
East:     2478978.38m
Alt (MSL):    360.52m
Datum:      NZGD 1949
Zone:     UTM Zone 59
WAYPT OFFSET
```

Waypoints from Features

Each of the above forms which displays a particular position supplies a
WAYPT soft key. You can press WAYPT to create a waypoint from the
displayed position (and therefore a waypoint can be created for a particular
feature):

```
   Create waypoint 8
Name:       Car park
North:    5742877.58m
East:     2478978.38m
Alt (MSL):     60.52m
Datum:      NZGD 1949
Zone:     UTM Zone 59
```

☆ | **Tip -** By creating a waypoint for a feature, you can navigate back to that feature at a later date. You can also create a waypoint for a feature in PFINDER after the feature's GPS position has been differentially corrected by post-processing, and then load this waypoint back into the MC-V.

✉ | **Note -** Asset Surveyor provides the type of feature as a suggested name for the waypoint, but you will probably want to enter a new name which identifies the feature more precisely.

Other Operations/
Reviewing/Positions/
Offsets

Each of the position forms which can be accessed to view the GPS position of a feature contains an **OFFSET** soft key. You can press this soft key to view and/or edit the offset for this feature.

⊠ | **Note -** If a feature has a non-zero offset then the position(s) displayed for that feature will have the feature's current offset applied to it. *All* features have an associated offset, but by default (and typically) this offset will be zero.

Point Feature Offsets

If you press **OFFSET** when viewing the position of a normal, carrier phase or nested point feature, Asset Surveyor displays the current offset for that feature, for example:

```
        Point offset
Bearing:          21.4°T
Slope dist:      6.230m
Inclination:      0.0°




 RESET   FORMAT
```

You can simply view this offset, or you can edit it if you wish.

⊠ | **Note -** Asset Surveyor allows you to record a new offset for this point feature automatically using a laser range-finder, provided you have activated the laser range-finder interface (i.e. via the 'External sensors' entry in the 'Utilities' menu, or via the **EXT** soft key in data capture). You must be viewing the feature's offset form when you record the new offset. If you are not, then Asset Surveyor will apply the newly recorded offset to the feature which is currently being *captured*, if any.

Quickmark Offsets, Line Offsets and Area Offsets

If you press `OFFSET` when viewing a position for a quickmark, line (start or end) or area (start, centroid or end) feature, Asset Surveyor displays the current offset for that position, for example:

```
        Line offset
Direction:      Right
Slope dist:    3.500m
Inclination:    -2.3°




 RESET  FORMAT
```

You can simply view this offset, or you can edit it if you wish.

⊠ **Note -** Asset Surveyor allows you to record a new offset for this point feature automatically using a laser range-finder, provided you have activated the laser range-finder interface (i.e. via the 'External sensors' entry in the 'Utilities' menu, or via the `EXT` soft key in data capture). You must be viewing the feature's offset form when you record the new offset.

Other Operations/
Review/Deleting and
Un-deleting

Deleting Features and Notes

You can delete a feature or a note by highlighting it and pressing `DEL`. Asset
Surveyor asks you to confirm your intention:

```
┌Confirm deletion┐
  Feature:
      "Car park".




 NO  YES
```
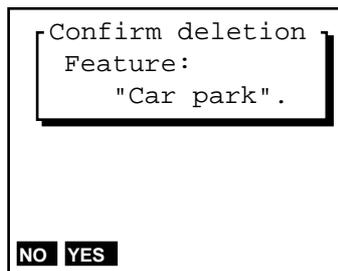
When a feature or note is deleted from an Asset Surveyor data file, it is not
physically deleted. It remains in the file and can be un-deleted. A deleted
feature or note will still be output to PFINDER when the data file is
transferred, and will appear in the resulting SSF file (where it will also be
marked 'Deleted'). PFINDER will not display deleted features or notes, and
they will not appear in any GIS output.

When a feature is deleted from an Asset Surveyor data file, it appears in the
review list as '`**Deleted Point**`', '`**Deleted Line**`', '`**Deleted
Area**`' or '`**Deleted Qmark**`'. Similarly, a deleted note appears as
'`**Deleted note**`'.

Un-Deleting Features and Notes

Because deleted features and notes are not physically removed from an
Asset Surveyor data file, you can reverse the deletion process. You can un-
delete a feature or note by highlighting it and pressing `UNDEL`.

Once a feature or note has been un-deleted, it is as if it had never been
deleted in the first place. The feature or note will be treated by both Asset
Surveyor and PFINDER as a normal feature or note, and can be displayed
and exported to a GIS.

If Asset Surveyor searches right to the beginning of the data file (or the end, if the search direction is 'Forwards') without finding a match for the pattern, it pops up the following message:

```
        ┌─── Error! ───┐
        │ Not found:   │
        │    "Memphis".│
        └──────────────┘
```

⊠   **Note -** When searching, Asset Surveyor only requires a partial match, and you do not need to specify the case of the pattern correctly. For example, a pattern of 'pot' will match attribute values like 'Pottsville' and 'spotted'.

Press **SEARCH** again to continue the search, or to change the pattern or direction and search again.

⊠   **Note -** Asset Surveyor will not search for a match in any deleted features or notes.

✩   **Tip -** Searching Asset Surveyor's database can take quite some time, especially if the features you have captured each have many attributes. If you decide not to continue with a search which has been running for a while, press ESC to abort the search.

Other Operations/
Reviewing/Positions

In the list of features and notes for a data file, you can view the GPS position(s) recorded for a feature by highlighting it and pressing `POS`.

⊠   **Note -** Unless you have used an RTCM link to differentially-correct your GPS positions in real time, or have used a P(Y)-code receiver, the positions displayed by Asset Surveyor will be subject to the effects of Selective Availability (SA).

Point Features

If you press `POS` when a regular point feature is highlighted, Asset Surveyor averages the GPS positions recorded for the feature and displays the averaged position:

```
 Averaged position
Feature:         Town
North:    5742788.71m
East:     2479065.09m
Alt (MSL):    381.27m
Datum:      NZGD 1949
Zone:     UTM Zone 59
WAYPT OFFSET
```

If the point feature was recorded as a quickmark, Asset Surveyor displays the interpolated position for the feature:

```
 Quickmark position
Feature: Gas station
North:    5742796.86m
East:     2479062.88m
Alt (MSL):    382.01m
Datum:      NZGD 1949
Zone:     UTM Zone 59
WAYPT OFFSET
```

Line Features

If you press **POS** when a line feature is highlighted, Asset Surveyor asks you to specify whether you wish to see the start or end position for the line feature:

```
┌Which position? ┐
│ Start of line  │
│ End of line    │
└                ┘
```

Once you have chosen either the start or end position of the line, Asset Surveyor displays that position, for example:

```
     Start of line
Feature: City street
North:    5742804.07m
East:     2479065.37m
Alt (MSL):   381.26m
Datum:      NZGD 1949
Zone:    UTM Zone 59
 WAYPT  OFFSET
```

Area Features

If you press **POS** when an area feature is highlighted, Asset Surveyor asks you to specify whether you wish to see the start, centroid or end position for that area feature:

```
┌Which position? ┐
│ Start of area  │
│ Centroid of area│
│ End of area    │
└                ┘
```

Chapter 8   Troubleshooting

Symptom	Possible Cause	Fix
The receiver has not acquired a satellite within 3 minutes of the MC-V being switched on.	The receiver is still looking for satellites.	Check the GPS 'Satellite Info' screen to see how many satellites are being tracked by the receiver.
	The expected satellites are being obstructed.	The obstruction may be a building, tree, large vehicle, etc. Identify the obstruction and move away from it. *Note: GPS will not work indoors!*
	Your GPS receiver's external antenna (or antenna cable) has not been connected, has been connected incorrectly, or is faulty.	Check that the external antenna is connected correctly. If your receiver still fails to acquire signals from a satellite then your antenna and/or antenna cable may require servicing.
	Your GPS receiver requires an almanac to be loaded from the MC-V, but Asset Surveyor has not yet recorded an almanac and stored it on the MC-V.	Wait (for up to 15 minutes) until the GPS receiver records an almanac and makes it available to Asset Surveyor. Asset Surveyor will record the almanac and store it on the MC-V. It will be re-loaded into your GPS receiver when you next turn the MC-V on.
	You have traveled a large distance (> 1000km) since using the GPS receiver, and you have not re-configured the 'Initial position'.	Reconfigure the 'Initial position' under 'Configuration/GPS/Rover options', then turn the MC-V off and on again to reinitialize communications with the GPS receiver.
	The receiver has not been used for a very long time, and an extreme change in the GPS constellation has out-dated the almanac stored in the receiver and/or the MC-V.	Wait (for up to 15 minutes) until a new almanac has been recorded. Subsequent restarts should then be rapid.

Symptom	Possible Cause	Fix
| ```
┌─ No GPS detected ─┐
│  Check cabling,   │
│ batteries, etc. Do│
│ you wish to retry │
│    GPS now?       │
└───────────────────┘
 NO   YES 
``` | The cable connecting the MC-V to the GPS receiver has not been connected, or has been connected incorrectly, or is faulty. | Check that the cable is connected correctly. If it appears to be correct and all other equipment appears to be correct, the cable may require servicing. |
appears on the MC-V.	The GPS receiver's battery is dead, or has not been connected correctly.	Check that the battery is correctly connected, and is charged, or connect to an external power source.
	The GPS receiver has not been switched on.	The Pathfinder Basic Series, 4000 Series, Centurion and Trimpack III GPS receivers must be manually turned on before Asset Surveyor can communicate with them.
The receiver is not able to compute a GPS position within 1 minute of you turning the MC-V on.	There are not enough satellites available. *3 SVs are required in 2D mode, 4 SVs in 3D mode and 5 SVs in overdetermined 3D mode*.	Use mission planning to check that there are sufficient satellites at this time.
		Under GPS 'Rover options' and/or 'Base stn options', check that the 'Elevation mask' is not too high.
		Under GPS 'Rover options' and/or 'Base stn options', check that the 'SNR mask' is not too high.
		Under GPS 'Rover options' and/or 'Base stn options', check that the 'Position mode' is correct.
	The current PDOP value is too high.	Use mission planning to check that the current PDOP value is below your configured mask.
		Under GPS 'Rover options' and/or 'Base stn options', check that the configured 'PDOP mask' and 'PDOP switch' are not too low.

Symptom	Possible Cause	Fix
The MC-V will not turn on, or turns off immediately after being turned on.	The main MC-V batteries are dead.	Replace or recharge the main MC-V batteries, or power the MC-V externally.
	The Asset Surveyor software has locked up.	Perform a *warm reboot* of the MC-V, as described in Chapter 2. If the problem recurs, contact your Trimble Support Center.
The display on the MC-V is dim, or washed-out.	The MC-V's LCD contrast needs adjusting.	Adjust the LCD contrast as described in Chapter 2.
	The main MC-V batteries are low.	Check the level of the main MC-V batteries in the 'Hardware (MC-V)' configuration form. If the battery level is low, recharge the batteries.
The MC-V does not accept a scanned barcode.	The barcode wand has not been connected correctly.	Connect the barcode wand correctly, as described in Chapter 2.
	The barcode is unreadable. The barcodes may be printed at the wrong size or with a low-quality printer. The barcodes may have been photo-reduced or smudged.	Reprint the barcodes. Refer to the *PFINDER User Reference Manual* for details of barcode printing options.
	The barcode is inappropriate in the current context.	You can only swipe a menu value when capturing a feature of the correct type. You can only swipe a feature name when a menu of features is displayed.
	The angle of the wand is wrong, or the barcode was swiped too quickly or too slowly.	Change the angle at which you swipe the barcode. Move the wand smoothly across the barcode. Vary the speed at which you swipe the barcode. Try re-printing the barcodes at a larger size.

Symptom	Possible Cause	Fix
The accuracy of recorded GPS positions is not as good as you expect.	You did not record sufficient positions to achieve the required accuracy (for a point feature).	For some GPS receivers, Trimble specifies that a certain minimum number of GPS positions be logged, differentially corrected and averaged to achieve a required level of accuracy for point features. You should configure the 'Minimum posns' option (under GPS 'Rover options') to ensure that Asset Surveyor records enough positions to meet your accuracy requirements.
	Your PDOP mask was too high.	If you record positions when the PDOP is high (i.e. the geometry of the GPS satellite constellation is poor), this will have a detrimental effect on the accuracy of these positions. You should lower your PDOP mask to ensure that Asset Surveyor only logs accurate positions.
	Your SNR mask and/or Elevation mask was too low.	The GPS receiver will select the satellite constellation with the best geometry (i.e. the lowest PDOP). This tends to mean that satellites low in the sky are chosen, but the closer a satellite is to the horizon the weaker its signal is. You should increase the SNR mask and/or the Elevation mask to preclude the use of satellites whose signals are weak.
	You used a 2D mode and failed to specify an accurate 2D altitude.	The accuracy of 2D GPS positions is critically dependent on the quality of the 2D altitude you supply. You must specify your altitude precisely in order to use a 2D mode and still obtain accurate GPS positions. You must also specify the 2D altitude relative to the correct reference level (i.e. mean sea level or the current ellipsoid)

Symptom	Possible Cause	Fix
Your RTCM real-time differential correction link does not appear to work.	Your telemetry link has been incorrectly installed, powered, cabled or configured.	Install the telemetry link as specified by the supplier. Consult the supplier if necessary.
	You have configured the RTCM serial parameters incorrectly.	Under GPS 'Rover options', press the **RTCM** soft key and check that the RTCM serial parameters match the telemetry link and the transmitted RTCM data stream.
	You have set the RTCM version or RTCM station ID incorrectly.	Under GPS 'Rover options', press the **RTCM** soft key and set the 'RTCM version' and 'RTCM station' fields correctly.
	You have set the RTCM input mode to 'Off'.	Under GPS 'Rover options', press the **RTCM** soft key and set the 'RTCM input mode' to either 'On' (which requires RTCM to always be present) or 'Auto' (which allows RTCM to be present or absent).
You are unable to differentially correct your rover GPS positions (either in real-time or when post-processing).	The GPS rover used satellites which were not visible to the GPS base station.	Ensure that the 'Elevation mask' on the GPS rover is set sufficiently high that the rover will only use satellites which are also visible to the GPS base station.

Symptom	Possible Cause	Fix
The coordinates displayed by Asset Surveyor appear to be incorrect.	You are using the 'Latitude / Longitude' coordinate system and have selected the wrong datum.	Under the 'Coordinate system' configuration menu, select 'Latitude/Longitude' and specify the correct datum.
	You are using the 'UTM' coordinate system and have selected the wrong UTM zone or datum.	Under the 'Coordinate system' configuration menu, select 'UTM' and specify the correct zone and datum. *Note: The traditional UTM datum for the U.S.A is NAD-27.*
	You have selected the wrong coordinate system or zone.	Under the 'Coordinate system' configuration menu, select the correct coordinate system and zone.
	You have selected the wrong coordinate units.	Under the 'Units and display' configuration menu, select the correct 'Coords' units.
	You have defined a custom coordinate system, datum and/or zone incorrectly in ASSETED.	Check the definition of the coordinate system, datum and/or zone carefully. Ensure that values such as the scale factor have been specified correctly (as a parts-per-million value), that rotations have been specified in the correct sense (a positive rotation is counter-clockwise), and that Latitudes and Longitudes have been specified in the correct hemisphere (North/South or East/West, respectively).
Automatically-generated 'Time' attributes are incorrect	The MC-V's internal clock has been set incorrectly.	Reset the MC-V's internal clock (under the 'Time and date' configuration menu entry). Check that the '24-hour clock' field is set correctly.

Symptom	Possible Cause	Fix
The Asset Surveyor software does not communicate with an external sensor.	The sensor has not been connected, or has been connected to the wrong serial port, or the cabling is faulty.	Connect the sensor correctly. Check that the cabling is appropriately wired.
	The configured external sensor has the wrong RS232 settings.	Check the configuration of the RS232 settings for that sensor (press **COMMS** in that sensor's configuration form).
	The configured sensor has the wrong 'Data request' string, the wrong 'Data received' settings, or the 'Interval' fields are 'None'.	Check that the configuration matches the requirements and specifications of the sensor in question.
Offsets recorded with a laser range-finder seem inaccurate.	You have not made allowance for the local magnetic declination.	In the 'Units and display' form, enter the correct local magnetic declination into the 'Magnetic decl' field.
	Your laser is attempting to apply its own magnetic declination, in addition to Asset Surveyor's.	Configure the laser to output uncorrected magnetic bearings only.
	The environment in which you are working is magnetically 'hostile', and is affecting the laser's compass.	Move away from all ferrous metal objects (e.g. vehicles, buildings, bridges, overhead cables, etc.). Calibrate the compass of your laser range-finder, if possible.
Asset Surveyor fails to communicate with a laser range-finder.	Your cabling is faulty and/or incorrectly connected.	Check the cabling.
	Your laser is configured incorrectly for operation with Asset Surveyor.	Configure the laser, if possible, as outlined in *External Sensors with MC-V Asset Surveyor*.
	Asset Surveyor has not been configured to work with your laser.	Select 'External sensors' from the 'Utilities' menu. Highlight the 'Laser' entry and press **SETUP**. Select from the list of supported laser range-finders.

Appendix A Asset Surveyor Messages

This appendix lists, in alphabetical order, the various error, warning and information messages which are displayed by the Asset Surveyor software. The cause(s) of each message is described, and suggestions of how to proceed are supplied where relevant.

⊠   **Note -** Error messages (which have the word 'Error!' as their title) remain on the MC-V's screen until you press ESC. Warning messages usually time out after 4 seconds and disappear, but can also be dismissed by pressing ESC.

\XX escape sequence is invalid

You have entered an invalid hexadecimal code into a field in the External Sensor configuration form. Each escape sequence must consist of a backslash ('\') character, followed by two hexadecimal digits.

To enter the backslash character itself into a field, type the following escape code: '\5C'.

4000 battery is low

The battery currently being used by the connected 4000 Series GPS receiver is low. A 4000 Series receiver can be connected to several batteries at once, and will emit the '4000 battery is low' message even if one or more batteries remain fully or partially charged. If the receiver is currently using its last battery, you should change or recharge the receiver's batteries as soon as possible after seeing this message.

4000 Nav. firmware needs upgrading

This message is displayed if the Navigation firmware in the connected 4000 Series GPS receiver is older than version 5.64. This is the earliest version of

the 4000 Series receiver firmware which works with the Asset Surveyor software.

Contact your Trimble Support Center to obtain an upgrade to the firmware in your 4000 Series GPS receiver.

A file with this name exists. Do you wish to append to it?

This message appears in 'Base station' mode, when you attempt to create a new base station file with the same name as a previous data file. Press **YES** if you wish to append base station data to the end of the existing data file or press **NO** if you wish to create a new base station file with a different name.

A NOTE may only be recorded during data capture

This error message appears if you press **NOTE** outside of 'Data capture'. You can only record a note when capturing data to a rover file.

Abandon changes?

This message warns you that changes you have made to a form will be lost if you continue. It is displayed if you press ESC on a form after changing the value of one or more fields. If you want to save changes to the form, press **NO**, followed by **OK**, otherwise press **YES** to abandon the changes.

Abandon feature?

This message appears if you press ESC on the attribute entry form for a feature in 'Data capture'. Press **YES** if you wish to abandon the feature. If you want to save the feature, press **NO** followed by **OK**.

If you abandon a feature, its attributes, GPS positions and any associated ESP data will be discarded by Asset Surveyor, and cannot be recovered.

An error was detected in the Pathfinder GPS receiver

An internal diagnostic inside the connected Pathfinder GPS receiver has detected an error. Try disconnecting the receiver from its power supply and/or removing any batteries, wait for a few minutes for any internal

capacitance to discharge, then reconnect the receiver and try using it again. If the above message reappears, contact your Trimble Support Center.

Are you sure you want to disconnect from GPS?

This message is displayed when you select the 'Disconnect' entry from the 'GPS operations' menu. Press **YES** if you want Asset Surveyor to cease communicating with the currently connected GPS receiver, or press **NO** if you want to continue using the GPS receiver.

When a GPS receiver is disconnected, Asset Surveyor will turn the receiver off if it is able to. If not, you should manually turn off the receiver to avoid draining its batteries. If the connected GPS receiver is a 4000 Series receiver, remember to turn the receiver back on before attempting to re-establish communications with Asset Surveyor.

Best results are obtained by using a receiver with 12 channels

If you start a base station file with an 8-channel Pro XL receiver connected, Asset Surveyor warns you that you will obtain better results using a 12-channel receiver. If you wish to upgrade an 8-channel Pro XL to 12 channels, contact your Trimble Support Center for up-to-date pricing details.

Cannot quickmark when logging is paused

This message will be displayed if you press **QUICK** to record a quickmark when logging is paused. The quickmark is not recorded. You will have to return to the position of the feature you tried to quickmark and re-record the feature after resuming logging of GPS positions.

If you want to record a point feature which lies off a line feature or off the perimeter of an area feature, you cannot record the feature as a quickmark (without inserting a spike in the line or area feature), unless you use an offset. It is usually easiest to use the **NEST** soft key to record point features lying off a line or area feature.

Cannot specify units in a unitless domain

This message is displayed if you type any non-numeric characters (apart from *sign* characters) into a numeric field which does not permit units to be specified.

Carrier data logged

This message appears on the GPS status line, accompanied by a success beep, when the configured 'Minimum time' elapses while capturing a point feature in carrier phase mode. Once the 'Minimum time' has elapsed you can save the current feature and move on to the next feature.

Carrier phase mode

This message appears on the GPS status line when you start capturing a point feature and carrier phase mode is enabled. The GPS status line will show the elapsed time, rather than the number of GPS positions logged, when in carrier phase mode.

Clear waypoints file, deleting all current waypoints?

The **CLEAR** soft key on the waypoints menu deletes all waypoints stored on the MC-V. This message is displayed when you press **CLEAR** to avoid the accidental deletion of all waypoints. Press **YES** to actually delete the waypoints or **NO** to return to the menu of waypoints.

Communications error

This error message indicates a break-down in communications between Asset Surveyor and an external sensor. This may be caused by incorrect or damaged wiring in the cable between Asset Surveyor and the sensor, or the sensor operating in an incorrect 'mode'. Check that the communications parameters (under the **COMMS** soft key, from the external sensor configuration form) are set correctly.

This message may also appear if an external sensor emits data at such a rate that the MC-V cannot process the incoming data fast enough to avoid a serial buffer overrun. In this situation, part or all of an incoming data record

may be lost. If it is critical that the datalogger be able to log every record emitted by the sensor, it may be necessary to run the sensor at a slower rate.

If your MC-V is running CMT-ROS version 1.05, you may also notice the occasional communications error when connected to GPS. A communications error occurs when the MC-V is unable to process data from the GPS receiver quickly enough. This problem may be particularly noticeable when typing rapidly, or if you configure Asset Surveyor to log large amounts of information (e.g. positions, measurements, velocity, DOP data, etc.) all at the same time. Asset Surveyor reinitialises communications with the GPS receiver whenever a communications error occurs.

Confirm deletion

Whenever you attempt to delete a data file, data dictionary, waypoint, coordinate system, datum, zone or language file, Asset Surveyor will ask you to confirm that it really is your intention to delete the indicated item. Press **YES** to delete the item or **NO** to indicate that you either selected the delete operation by mistake, or have decided not to delete the item.

Connect antenna/cable

This message appears on the GPS status line if Asset Surveyor detects that the receiver's antenna and/or cable is disconnected, improperly connected or faulty.

Connect cable to PC

This message is displayed when you select 'File transfer' from the Asset Surveyor software's Main menu. It serves as a reminder to connect the MC-V to the PC before attempting to transfer files between the two using PFINDER.

Constant offset(s) are active

Whenever you create a new rover file or re-open an existing file, Asset Surveyor checks to see if you had previously configured one or more constant offsets. If you had, Asset Surveyor warns you by displaying the 'Constant offset(s) are active' message. If you do not wish to apply constant

offsets to features which you record, select 'Offsets' from the 'Configuration' menu and `RESET` all of the configured offsets to zero.

Corrupt data dictionary file

Asset Surveyor has detected an error in the current data dictionary that you are using. Delete that data dictionary and try re-loading it from PFINDER to your MC-V. If the problem persists, contact your Trimble Support Center for assistance.

Data dict. cannot be deleted until files using it are deleted first

When you press `DEL` on the menu of data dictionaries, Asset Surveyor checks that there are no data files on the MC-V which are associated with this data dictionary. If one or more data files require(s) this data dictionary, the above message will appear and you will not be permitted to delete this dictionary. You must transfer the data files concerned to PFINDER and then delete these data files from the MC-V before you will be permitted to delete this data dictionary. The 'File statistics' screen shows which data dictionary is used by the selected data file.

DD read OK

This message is displayed on the 'File transfer' status form when a data dictionary has been transferred from PFINDER to the MC-V, and Asset Surveyor has verified that the data dictionary was transferred correctly and has been successfully stored on the MC-V.

Delete failed

An attempt to delete a data file has failed. This may be caused by a corrupted file system or faulty datalogger memory. Contact your Trimble Support Center for assistance.

Directory sent

This message appears on the 'File transfer' status form, and indicates that Asset Surveyor has transmitted a directory of data files to PFINDER.

Disconnect GPS before selecting this option

> This message is displayed if you select the 'File transfer' menu entry when the GPS receiver is still connected to (and communicating with) Asset Surveyor.
>
> You must physically disconnect the GPS receiver before attempting to perform one of these operations, as they use the same MC-V serial port as the GPS receiver. Select 'Disconnect' from the 'GPS operations' menu, or simply unplug the GPS receiver and wait until Asset Surveyor detects that the receiver is no longer present.

Doing fixes

> This message appears in the 'Status' field of the 'Receiver status' form when connected to a GPS receiver which is currently computing GPS positions (i.e. is tracking sufficient satellites, with a PDOP lower than the configured mask).

Do you want to delete all files?

> When you press **DELALL** on the 'Delete file' menu, Asset Surveyor asks you to confirm that you wish to delete *all* data files. You will be asked to reconfirm deletion for any file(s) which have not yet been transferred to the PC.

Duplicate data dictionary name not allowed

> Asset Surveyor has just received a new data dictionary from PFINDER. However, the data dictionary name is identical to the name of an existing data dictionary on the MC-V. Delete the old data dictionary from the MC-V before re-transferring the new dictionary.

Duplicate file names are not allowed

> Asset Surveyor insists that all data files have unique names. This message is displayed if you attempt to create a new rover data file with the same name as an existing data file. The case (upper or lower) of a letter in a file's name is ignored when comparing two names for equivalence.

Entry required

> If, when you create a Data Dictionary in PFINDER, you specify 'Entry Required' for an attribute of a feature, Asset Surveyor will not allow you to save a feature of that type without entering a value for that attribute. If you press **OK** on an attribute entry form when one or more attributes with the 'Entry required' flag still have the null value, Asset Surveyor will display this error message and direct you to the first attribute requiring an entry.

Error closing file

> Asset Surveyor encountered an error when attempting to close a file. This may indicate a corrupt file system or faulty datalogger memory. Contact your Trimble Support Center for assistance.

Error opening data dictionary

> Asset Surveyor is unable to open a data dictionary for use in association with a particular data file. It is possible that the data dictionary has become corrupted, and you should try deleting that dictionary and again transferring it from PFINDER to the MC-V.

> It is also possible that there is too little data storage space remaining on the MC-V to open and cache the data dictionary. In this case, try deleting one or more unwanted data files.

> If the problem persists, contact your Trimble Support Center for assistance.

Exit data capture?

> This message is displayed whenever you press ⌷ESC⌷ to exit 'Data capture'. Press **YES** to exit data capture, or press **NO** to return to the menu of features to capture.

Exit from data capture or file transfer before switching off

> You have tried to turn the MC-V off while inside 'Data capture' or 'File transfer'. You must complete the current operation and exit 'Data capture' or 'File transfer' (by pressing ⌷ESC⌷) before attempting to turn the MC-V off.

File error

An error has occurred while Asset Surveyor was performing a file-related operation (e.g. reading a file, writing a file, creating a new file, etc.).

This message may occur when Asset Surveyor attempts to write to a data file and the MC-V's data storage memory is full. In this case, you should press any key to restart Asset Surveyor and then download and delete sufficient data files before continuing to capture data.

First and second parallels are equal

This message is displayed by the ASSETED utility. You have entered the same latitude for the first and second parallel when defining a coordinate system zone using the '2-Parallel Lambert' map projection. Re-enter one or both of the 'parallel' latitudes for the zone with the correct values.

Floating point number too large

A numeric value which you have entered into a field is too large to be stored or displayed by Asset Surveyor.

Asset Surveyor can store and display quite enormous numeric values. When this message is displayed, it usually means that you have just miss-typed a value, or possibly that you have entered a coordinate using an inappropriate coordinate system (which cannot mathematically represent the point entered).

GPS in 2D mode

This message is displayed when a GPS receiver is connected and operating in the 'Auto 2D/3D' position mode, and the receiver switches from computing 3D GPS positions to computing 2D GPS positions.

Inaccurate UTM zone. Recalculate the zone from GPS?

The UTM zone that you have entered is at least two zones (i.e. 12° of longitude) away from your most recent GPS position. Press **NO** if you still want to save this zone. If you want Asset Surveyor to 'guess' the correct

UTM zone, press YES and the GPS receiver will use your most recent GPS position to automatically calculate the UTM zone.

Inappropriate for feature

You have scanned a barcode for an attribute that does not belong to the feature currently being captured. Check that you are using the correct page of barcodes.

Asset Surveyor can distinguish between identical values for different attributes (e.g. the attribute value 'Gold' for the color of an automobile is distinct from the attribute value 'Gold' for the type of metal found in a particular mine).

Inappropriate location for map projection

You have entered a coordinate (North / East) which is outside the bounds of the currently selected coordinate system zone. Check that you have selected the appropriate coordinate system and zone. Check that you have entered the coordinate correctly (paying particular attention to signed values). If you are using a custom coordinate system and/or zone, check that you have defined the coordinate system, datum and/or zone correctly.

Incorrect receiver type for base stations

This message appears if you select the 'Base station' entry from Asset Surveyor's Main menu while connected to a 4000 Series GPS receiver. Only Pathfinder GPS receivers can be used in base station mode in conjunction with the Asset Surveyor software.

Insufficient carrier data; do you want to store this feature now?

This question appears if you press OK while capturing a point feature in carrier phase mode, before the configured 'Minimum time' has elapsed. Press YES to store the point feature, or press NO and wait until Asset Surveyor has recorded enough carrier-phase data before pressing OK again.

Insufficient GPS positions: do you want to store this feature now?

You have pressed `OK` to store the details for the current point feature before Asset Surveyor has had time to record the required ('Minimum posns') number of GPS positions. Press `YES` to store the point feature, or press `NO` and wait until Asset Surveyor has recorded enough positions before pressing `OK` again.

Internal battery is dead

The main internal battery in the MC-V is dead.

Attach the MC-V to a charger to recharge the internal battery. You can still use the MC-V if you are connected to a GPS receiver that can power the MC-V.

Internal error

An unexpected error has occurred in the Asset Surveyor software. Record the current contents of the MC-V's screen and contact your Trimble Support Center for assistance.

Invalid date

The date you have entered is invalid. Check that you have entered the date in the correct format (subject to the 'Date fmt' field in the 'Time and date' configuration form).

Invalid file or version

A file on your MC-V has an invalid version number or corrupted contents. Be careful not to mix files from different versions of the Asset Surveyor software. If the problem persists, contact your Trimble Support Center for assistance.

Invalid time

The time you have entered is invalid. Remember to enter the time as up to three values separated by a space or a colon. You can enter times in either

the 12- or 24-hour clock format. If you are entering times using the 12-hour clock, remember to specify 'pm' if the time is after midday. You can configure the way in which times are displayed in the 'Time and date' configuration form.

Invalid units

The unit you have entered is not permitted in the context of the field into which it was typed. Specify the correct units (by pressing the **UNITS** soft key if necessary).

If you type an alphabetic character into a numeric field by mistake, Asset Surveyor will mistake it for a units designator. Edit the field and remove the spurious alphabetic character.

Laser offsets can only be recorded for features

You attempted to record a laser offset when you were not capturing a feature. Asset Surveyor only associates offsets with features, so you must start a feature *before* recording a laser offset.

Logging paused

When you press the **PAUSE** soft key while logging GPS positions for a point, line, or area feature, Asset Surveyor will display this message on the GPS status line. The message will continue to flash on the status line until you resume logging by pressing the **RESUME** soft key.

Maximum bytes includes the length of the prefix and suffix

The 'Max bytes' record length you have specified while configuring an external sensor is less than the combined length of the prefix and suffix strings. Remember that the maximum record length *includes* the length of the prefix and suffix strings.

Memory nearly full

This warning message is displayed once a minute whenever there is less than 20kb of data storage space left. If you are currently capturing data, free up

some space by deleting old data files. You can select 'File statistics' from the 'Data capture' menu to determine how much space a data file is using.

No almanac file available

This message is displayed on the MC-V if you try to transfer an almanac file from the MC-V to PFINDER, and no almanac file exists on the MC-V.

Asset Surveyor will record an almanac from any Pathfinder GPS receiver which has an up-to-date almanac. If you have a 4000 Series GPS receiver, Asset Surveyor will not record an almanac from the receiver, but you can record an almanac by logging data to the receiver's internal memory and then extracting it as described in the *GIS Surveyor Operation Manual*.

No corresponding data dictionary

There is no corresponding data dictionary for a particular data file. This situation can only occur if part of the data storage memory of the MC-V has been erased or corrupted. Contact your Trimble Support Center for assistance.

No END waypoint

This message is displayed whenever you are in a navigation form and have not selected a target waypoint to navigate to. To select an end waypoint press **END** and choose from the menu of defined waypoints.

No features found

If you capture data to a file whose associated data dictionary contains no features at all, this message will be displayed. You can still log GPS positions and ESP data from external sensors without any associated feature or attribute information.

This message is also displayed if you attempt to review a file which does not contain any features (e.g. a base station file).

No files

> This message is displayed in place of the menu of available data files when the MC-V does not contain any data files.

No GPS detected. Check cabling, batteries etc. Do you wish to retry GPS now?

> You have either just turned the MC-V on, or have pressed **GPS**, and have not connected, powered or turned on your GPS receiver. If you do not wish to use GPS, press **NO**. If you wish to use GPS, check that the receiver is connected to the MC-V (refer to the cabling diagrams in Appendix B), that the receiver is connected to its batteries (which must be charged) and that the receiver is turned on (if it has an external power button) before pressing **YES** to retry the GPS connection.

> If the Asset Surveyor software again fails to communicate with the GPS receiver, you may have a faulty cable, battery pack or receiver. Contact your Trimble Support Center to have your GPS equipment serviced.

No GPS positions for feature

> This message is displayed when you press the **POS** soft key in data review and the currently highlit feature has no recorded GPS positions.

No GPS positions recorded. Do you want to store this feature now?

> You have pressed **OK** on an attribute entry form while connected to a GPS receiver, but no GPS positions have been logged for the current feature. The GPS receiver will only log positions if there are sufficient satellites and the PDOP is low enough. You should press **NO** and return to the attribute entry form before allowing the GPS receiver to record GPS positions for that feature. If you press **YES**, Asset Surveyor will save the attributes you have entered for the feature, but PFINDER will ignore the feature entirely (unless you can process the resulting data in such a way as to ascribe a position to that feature).

No GPS time

> The GPS receiver has not yet obtained GPS time from a GPS satellite.

No index file

> This error message indicates that part of a data file has been erased or
> corrupted on the MC-V. Contact your Trimble Support Center for assistance.

No more files permitted

> You have reached the maximum limit on the number of data files, data
> dictionaries and language files permitted on the MC-V. Transfer your data
> files to the PC and delete from the MC-V any that are no longer needed.

No usable SVs

> This message appears in the 'Status' field of the 'Receiver status' form
> when connected to a GPS receiver and the receiver is tracking no GPS
> satellites. In this situation, the receiver is unable to compute a GPS position.
> The GPS receiver may have an old, inaccurate or missing almanac, or the
> receiver's antenna may be obscured.

OLD Navigation

> The heading of the 'Navigation' form will change to 'OLD Navigation'
> whenever a current GPS position is unavailable (e.g. when there are too few
> satellites, the PDOP is too high, or the RTCM link is down).

OLD Position

> The heading of the GPS 'Position' form will change to 'OLD Position'
> whenever a current GPS position is unavailable (e.g. when there are too few
> satellites, the PDOP is too high, or the RTCM link is down).

Out of range

> The value you have entered is outside the permitted range of values allowed
> for this field. Most numeric fields have tight bounds on the range of values
> that may be entered. The bounds on numeric attribute values are specified
> when a data dictionary is created using PFINDER.

PDOP is too high

> The current PDOP is higher than the configured 'PDOP mask', and the GPS
> receiver is no longer computing GPS positions. See Chapter 7 of this
> manual, and the *Pathfinder General Reference* manual for a discussion of
> the effect of satellite geometry on the accuracy of GPS positions.

Please configure the current time and date

> Asset Surveyor displays this message every five minutes if the MC-V's
> internal clock is set to a time or date which is known to be incorrect because
> it is set prior to the release date of the Asset Surveyor software. You can
> reset the MC-V's internal time and date in the 'Time and date' configuration
> form.

Press OFFSET before using the laser

> You attempted to record a laser offset while capturing a line or area feature.
> Asset Surveyor requires you to be viewing the 'Offset' form for this feature
> are the time you record the laser offset (so that it can be sure that you
> remember to enter a value into the 'Direction' field). The 'Offset' form is
> accessible by pressing `OFFSET`.

Press RTCM to check other serial parameters

> After configuring receiver outputs (under `OUTPUT`), Asset Surveyor will
> display this message to remind you that other serial communications
> parameters (i.e. data bits, stop bits and parity) are configured in the 'RTCM
> input options' form, which you can access by pressing `RTCM`.

Quickmark position outside five second limit

> When you press `POS` to review the position of a quickmark feature, Asset
> Surveyor will display the above message if the GPS positions which bracket
> the quickmark feature are not within 5 seconds of the quickmark. This will
> have occurred because GPS positions were unavailable just after the
> quickmark was recorded (e.g. due to insufficient satellites, high PDOP or
> RTCM link loss).

Recording almanac

Asset Surveyor is currently recording an up-to-date almanac from the connected Pathfinder GPS receiver. The almanac contains satellite orbital information which can be sent to the receiver at a later date to ensure rapid acquisition of satellites, and can also be transferred to the PC for use in Mission Planning.

Recording ephemeris

Asset Surveyor is recording the most up to date satellite information for a particular satellite (which has either just been acquired by the receiver, or has just transmitted updated ephemeris information). Asset Surveyor briefly stops recording GPS positions while it receives and logs the up-to-date ephemeris information. This information is crucial to high-accuracy differential correction.

When you start capturing data to a file, Asset Surveyor will record ephemeris information for all visible satellites. This takes a few seconds, after which GPS positions can be logged.

RTCM link lost

Real-time RTCM differential corrections are not being received by the GPS receiver, or have not been received for a period in excess of the configured RTCM 'Warning time'. Check that the telemetry link is still attached to the GPS receiver, is turned on, and is still being powered. It is possible that the telemetry link has been obstructed (e.g. by a hill, a building or other physical obstructions), that the base GPS receiver or transmitter have ceased operating, or that your roving GPS receiver is using one or more satellites which are not visible to the base receiver.

Search aborted

You have interrupted an attribute value search in data review by pressing $\boxed{\text{ESC}}$.

Searching...

Asset Surveyor is searching through a data file for a particular feature or attribute value.

Sending almanac

This message appears on the status line when Asset Surveyor loads a pre-recorded almanac into a GPS receiver, to ensure that the receiver acquires satellites quickly.

Sorry, GPS time required before creating a data file

Before Asset Surveyor will allow you to create a data file for the first time (since installation or since you last reset the memory of your datalogger), it must align the datalogger's clock with GPS time. You should connect your GPS receiver and allow Asset Surveyor to record a GPS time before again attempting to create a new data file.

Storing data

Asset Surveyor is busy storing data for the feature which is being saved.

Switching from P(Y)

You are connected to a Trimble Centurion or Trimpack III GPS receiver which has a P(Y) decryption key installed and enabled. Asset Surveyor is monitoring the receiver as it switches from P(Y) mode to C/A mode. This switch may take a few seconds, during which GPS positions will be unavailable.

Switching to P(Y)

You are connected to a Trimble Centurion or Trimpack III GPS receiver which has a P(Y) decryption key installed and enabled. Asset Surveyor is monitoring the receiver as it switches from C/A mode to P(Y) mode. This switch may take a few seconds, during which GPS positions will be unavailable.

The external battery is dead

When the battery voltage being supplied to your GPS receiver drops below a specified level, it may begin to operate unreliably or to suffer internal damage. To avoid such problems, Asset Surveyor will cease communicating with the connected GPS receiver, and will power the receiver off, if possible.

The following table lists applicable GPS receivers and their threshold voltages. Other receivers have built-in protection from low voltages.

GPS Receiver	Threshold voltage
Pathfinder Basic Series	8.5V
Pathfinder ProXL	10.5V

The external battery is low

The external (GPS receiver) battery is low. You should complete your current operation as quickly as is practical, and then change the GPS receiver's batteries before pressing **GPS** to reactivate Asset Surveyor's GPS interface.

The internal backup batteries are dead

The lithium backup batteries are dead. These *must* be replaced immediately. Any loss of power to the MC-V caused by the removal of the main internal battery will result in the loss of all data files, waypoints and data dictionaries stored on the MC-V. Make sure you connect to external power while replacing the backup batteries.

The main internal battery is low

This warning message is displayed every two minutes when the power in the main MC-V battery is getting low. The battery should be recharged as soon as possible so that Asset Surveyor may continue to be used.

The P(Y) key is disabled. P-code positions will not be available

> When connected to a Trimble Centurion or Trimpack III GPS receiver which
> has a P(Y) decryption key installed, Asset Surveyor has determined that the
> key has been disabled or has expired. C/A-code positions will be available,
> but P-code positions will not.

This datum is currently referenced by a coordinate system

> This message is displayed by ASSETED when you try to delete a datum that
> is in use by a coordinate system. You must delete all coordinate systems
> which use a datum before the datum itself can be deleted.

This feature has not yet been captured

> This message is displayed when you try to repeat a feature in 'Data capture'
> and a feature of that type has not yet been recorded to the current data file.

This file has not been transmitted to the PC

> When you select a file from the 'Delete file' menu, Asset Surveyor checks
> that the file has been output to PFINDER. If not, it displays the above
> message. Press **YES** to delete the file if you really do not want to output it to
> the PC.

Timed out

> Communications with an external sensor or GPS receiver has timed out
> unexpectedly. This occurs when Asset Surveyor receives only part of a data
> record from the sensor or receiver. Check that the cabling is still connected
> and that the sensor or receiver is still powered and turned on.

Too close to the equator

> This message is displayed by the ASSETED utility. The latitude you have
> entered for the indicated parallel in the 1- or 2-Parallel Lambert map
> projection is too close to the equator. The Lambert Conformal map
> projections become distorted near the equator, and can cause computational

difficulties, so ASSETED imposes a limit on the distance of the parallel(s) from the equator.

Too close to the north or south pole

This message is displayed by the ASSETED utility. The origin latitude that you have entered for a zone using a Mercator map projection is too close to either the North or South pole.

Too few SVs

There are insufficient satellites (SVs) to compute a GPS position. At least four satellites are required for a 3D position, and three for a 2D position. If you have configured Asset Surveyor to use the 'Overdet. 3D' position mode, where only overdetermined positions will be logged, then at least five satellites are required to compute a position.

Transfer aborted

This message is displayed on the 'File transfer' status form if you cancel the transfer of a file in PFINDER.

Unable to append to a file over one week old

This error message is displayed if you attempt to capture data to a file which was created over one week ago. You must create a new data file (possibly using the same data dictionary as is associated with the older data file) and use it to capture data.

Unable to connect

Asset Surveyor was unable to connect to the indicated external sensor. Another sensor or a GPS receiver may already be connected on that serial port.

Unable to open index file

An internal file on the MC-V has been erased or become corrupted. Contact your Trimble Support Center for assistance.

Unable to open serial port. This port may already be in use

This message indicates that Asset Surveyor was unable to connect to the chosen sensor or GPS receiver, probably because that serial port is already in use by another external sensor or GPS receiver. Reconfigure the external sensor to use another MC-V serial port.

Unable to quickmark

Asset Surveyor displays this message on the GPS status line if you press the `QUICK` soft key at a time when there is no current GPS position available (e.g. due to a high PDOP situation). In these conditions, Asset Surveyor cannot record a quickmark.

You should return to the location of the feature in question and re-record it, either as a normal or nested point feature, or (if you have altered your masks or you believe that the GPS satellite visibility has improved) by attempting to quickmark the feature again.

Unsupported MC-V

The Asset Surveyor software will not run on your MC-V. Contact your Trimble Support Center for further information.

Use F6 (GPS) key to reconnect GPS

This message appears whenever you disconnect the GPS receiver as a reminder that you can press `SH2` and then `GPS` to cause Asset Surveyor to communicate with the GPS receiver again.

Use carrier phase mode?

You have configured the 'Carrier phase mode' to 'Query', and have then started a point feature. If you answer `YES` to this question, Asset Surveyor

will capture the point feature in carrier phase mode (logging both carrier-phase data and GPS positions); if you answer **NO** to this question then Asset Surveyor will capture the point feature as per normal, logging GPS positions only.

Validating

Asset Surveyor is busy validating the attribute values that you have entered prior to saving the feature into the data file. While most validation occurs while you are entering attributes, some checks are only possible once all the data has been entered. These checks are performed at this stage.

This message also appears when you have altered fields in a configuration form and then pressed **OK** to save the changes.

Value invalid for DD.MMSSss format

You have entered an invalid value into an angle or latitude/longitude field, and the current configured 'Angles' setting is 'DD.MMSSss'. This format for angles requires you to specify each of the components of the angle in sequence, remembering to precede values less than 10 with a 0. For example, the value '23°6'8.56"' would be entered as '23.060856'.

The 'DD.MMSSss' format for entry of angles should not be confused with the entry of angles as decimal degrees ('DD.ddd') or as degrees and decimal minutes ('DD MM.mmm').

Value with no associated unit

You have entered too many values, separated by spaces, into a numeric field with associated units. For example, entering '1 2 3 4' into a field that expects values as degrees, minutes and seconds will produce this error message; Asset Surveyor does not know what units to assign to the fourth value.

Wait until a range has been recorded before releasing the laser trigger

When using a ProSurvey 1000 laser range-finder, it is necessary to press and hold the trigger for 1-2 seconds to allow the laser to take a measurement to

the target. If you press and release the trigger too quickly, Asset Surveyor will warn you with the above message.

Waypoint received

This message is displayed on the 'File transfer' status form when a waypoint is transferred from PFINDER to the MC-V.

Waypoint sent

This message is displayed on the 'File transfer' status form when a waypoint is transferred from the MC-V to PFINDER.

You cannot review multiple files concurrently

This error message appears when you press **VIEW** while already reviewing a file. You can only review one data file at once. Exit data review of the first file before pressing **VIEW** to review another data file.

Appendix B GPS Systems

The Asset Surveyor GIS/GPS data collection system can be used with a range of Trimble GPS receivers. For each GPS receiver, the required auxiliary equipment (e.g. cabling, power supply, etc.) varies, and each system can be augmented with a number of accessories.

For each GPS receiver with which the Asset Surveyor software can be used, this appendix provides a complete list of equipment. You should use these lists to ensure that you have all of the required equipment before you commence a survey. This appendix also notes any significant differences between the behavior of each listed GPS receiver and that described in the body of this manual.

The Asset Surveyor software works with two main families of Trimble GPS receivers:

- The 'Pathfinder' family of GPS receivers. This family of GPS receivers communicates with a data collector using Trimble's *TSIP* protocol, and includes the following specific receivers:

    1. The GPS Pathfinder Basic series.

    2. The GPS Pathfinder Professional series, including the Pathfinder Pro XL.

    3. The GPS Pathfinder ProLite.

    4. The Centurion and Trimpack III, which are 'military' GPS receivers.

- The '4000 Series' family of GPS receivers. This family of GPS receivers is generally used for Survey-accuracy work, but can easily be adapted for use in a high-accuracy GIS data capture system. Provided the GPS receiver has an appropriate firmware version, the following subset of the 4000 Series receiver family can be used with the Asset Surveyor software:

1. The 4000SE (with Maxwell technology). Trimble's 'GIS Surveyor' package comprises a Maxwell 4000SE and an Asset Surveyor system.

2. The 4000SE (without Maxwell technology).

3. The 4000SSE, which is a dual-frequency receiver employing Maxwell technology.

4. The 4000SSi, which is a dual-frequency receiver employing Maxwell and Supertrak™ enhanced tracking technologies.

⊠   **Note -** Only the Pathfinder family of GPS receivers can be used with an MC-V datalogger. Each member of this family of supported GPS receivers is described separately in detail.

If you have a new Trimble GPS/GIS system which includes the Asset Surveyor software, and which is not described in this appendix, then refer to the *Operating Manual* for the system in question. For details of new Trimble GPS receivers which can be used with the Asset Surveyor software, contact your local Trimble Support Center.

B.1   The 'Pathfinder' Family of GPS Receivers

Trimble's 'Pathfinder' family of GPS receivers are designed for a wide range of GPS applications, and are particularly suitable for GIS data capture work. The members of this family of GPS receivers are outwardly very different in appearance, and the number of GPS channels varies from 3 to 12; the major feature these receivers have in common is the fact that they communicate with the Asset Surveyor software using Trimble's *TSIP* communications protocol. This common protocol ensures that, to an Asset Surveyor user, the various Pathfinder GPS receivers appear to behave in a very similar manner.

B.1.1 The Pathfinder Basic Series

The Trimble Pathfinder Basic and Basic Plus are high performance 3- and 6-channel hand held GPS receivers, which are battery-powered and ruggedized for field use.

Figure B-1   The Pathfinder Basic Front Panel

The Pathfinder Basic Series GPS receivers can be operated with or without an external antenna, and with or without a datalogger attached. Trimble specifies 2-5m post-processed differentially corrected accuracy (CEP) for the Pathfinder Basic and Basic Plus receivers.

The remainder of this section describes the use of a Pathfinder Basic Series receiver in conjunction with the Asset Surveyor software running on the MC-V. All comments refer to the Basic and Basic Plus except where explicitly stated. For brevity, all three receiver types will be referred to as the 'Pathfinder Basic'. Refer to the *GPS Pathfinder Basic Receivers Operating Manual* for further details of the Pathfinder Basic.

Turning the Receiver On

The Asset Surveyor software will not turn on the Pathfinder Basic. You must do so manually by turning the rotary knob on the front of the receiver clockwise from the 'Off' position.

Before the Asset Surveyor software can communicate with a Pathfinder Basic receiver, the receiver must be configured to communicate using the TSIP protocol, as described below.

Turning the Receiver Off

The Asset Surveyor software cannot turn off the Pathfinder Basic. When you turn off the MC-V or disconnect GPS, the Pathfinder Basic remains turned on (and consuming its battery). You must remember to also turn off the Pathfinder Basic, by rotating its rotary knob anti clockwise to the 'Off' position.

Configuring the Receiver to work with Asset Surveyor

The Asset Surveyor software configures all of the internal settings in the Pathfinder Basic, with the exception of the communications protocol itself. You should configure this yourself prior to using the Asset Surveyor software and Pathfinder Basic, as described below:

1. **Turn the rotary knob on the Pathfinder Basic to the 'SET UP' position.**

   The Pathfinder Basic displays the 'Set Up' screen:

   ```
   LAND/3D  HAE-  288ft
   TR/ENGLISH /DMS/999
   WGS-84
   LOC=UTC-8       <more>
   ```

2. **Press the '+/-' switch on the Pathfinder Basic's front panel.**

   The Pathfinder Basic displays the 'Comm' screen:

   ```
   COMM: TSIP
     9600,O,8,1
   RTCM: Auto GPS/GPD
   Stale: 020 Sec<more>
   ```

In order for the Asset Surveyor software to communicate with the Pathfinder Basic, the first two lines of the 'Comm' screen *must* be as displayed above. Not only must the communications protocol be 'TSIP' (as shown on line 1), but the RS232 parameters must be '9600,O,8,1' (as shown on line 2). The *GPS Pathfinder Basic Receivers Operating Manual* describes how to change the communications protocol and RS232 parameters.

Check that the first two lines of the 'Comm' screen match those shown above (or change them to match the illustrated screen).

3. **You can now use the Pathfinder Basic in conjunction with the Asset Surveyor Software.**

   Connect your GPS receiver and MC-V as described later in this section, then turn on the MC-V (or press the **GPS** key, if the MC-V is already turned on). The Asset Surveyor software and Pathfinder Basic will start to communicate, and the Asset Surveyor software will begin by configuring the Pathfinder Basic as specified in Asset Surveyor's GPS 'Rover options' configuration form.

Operational Aspects Specific to the Pathfinder Basic Series

Powering the MC-V

Unlike some Trimble GPS receivers, the Pathfinder Basic cannot power the MC-V from its own battery. When used with a Pathfinder Basic, the MC-V will draw all operating power from its own internal battery.

Minimum Voltage

Asset Surveyor will disconnect from the Pathfinder Basic when the receiver's battery falls below 8.5V.

RTCM Input

Although the Pathfinder Basic Plus is capable of accepting RTCM input, it cannot handle RTCM and communicate with a datalogger simultaneously.

Overdetermined Positions

The Pathfinder Basic and Basic Plus do not support the computation of overdetermined GPS positions.

Carrier Phase Mode

The Pathfinder Basic and Basic Plus cannot be operated in carrier phase mode.

Receiver Outputs

The Pathfinder Basic Series receivers support ASCII and TSIP output, however these outputs are not available when operating a Pathfinder Basic Series receiver in conjunction with a datalogger

Cabling Diagram

In order to use the Asset Surveyor software with a Pathfinder Basic, you should connect up the system as shown below:

1 P/N 16741-00 compact dome antenna (optional)
2 P/N 14563-10 antenna cable (optional)
3 P/N 14992 Pathfinder Basic or
   P/N 14992-80 Pathfinder Basic Plus
4 P/N 18964-00 MC-V datalogger cable
5 MC-V datalogger

Figure B-2   Cabling for the Pathfinder Basic

Full Equipment List

The following table lists the equipment which may be used in the field when operating a Pathfinder Basic Plus in conjunction with the Asset Surveyor software running on your MC-V. Standard parts for the Pathfinder Basic Plus which are also available as options for the Pathfinder Basic are indicated with a '†'.

Part Name	Part Number
GPS Pathfinder Basic Plus Receiver	14992-80
External antenna with magnetic mount, cable & pouch†	16788-00
Hard carry case†	13000-01
Black Trimble pouch	16201
Blue belt pouch†	13274
Shoulder strap	14909
AA battery pack with insert	14943-00
8 alkaline AA batteries	16197
Ni-Cd battery pack	14903-00
DC adapter pack	14934-00
Pathfinder Basic to MC-V cable	18964-00
CMT MC-V-TD-RD datalogger	
MC-V Asset Surveyor Quick Reference Guide	28382-05

The following table lists the equipment which may be used in the field when operating a Pathfinder Basic in conjunction with the Asset Surveyor software running on your MC-V.

Part Name	Part Number
GPS Pathfinder Basic Receiver	14992
Black Trimble pouch	16201
Shoulder strap	14909

AA battery pack with insert	14943-00
8 alkaline AA batteries	16197
Ni-Cd battery pack	14903-00
DC adapter pack	14934-00
Pathfinder Basic to MC-V cable	18964-00
CMT MC-V-TD-RD datalogger	
MC-V Asset Surveyor Quick Reference Guide	28382-05

B.1.2 The Pathfinder Professional

The GPS Pathfinder Professional is Trimble's original high-performance GPS receiver for GIS data capture. Pathfinder Professional GPS receivers have 2-, 3- or 6-channels. The Pathfinder Professional receiver is a 'black box' with no control panel, and an external GPS antenna and an external datalogger are required in order to use it.

Trimble specifies 2-5m post-processed differentially corrected accuracy (CEP) for Pathfinder Professional receivers.

⊠ **Note -** The 2- and 3-channel GPS Pathfinder Professional receivers are now considered obsolete, but can be upgraded to 6-channels for improved performance. Contact your Trimble Support Center for receiver upgrade details.

Turning the Receiver On

When the receiver and MC-V are connected as shown in the cabling diagram later in this section, there is no need to explicitly turn on the Pathfinder Professional; when the MC-V is turned on the Asset Surveyor software immediately turns on the Pathfinder Professional and starts communicating with it.

⊠ **Note -** The MC-V can draw power from the receiver's battery when the receiver is turned on.

Turning the Receiver Off

When you turn off the MC-V, or explicitly disconnect the GPS receiver, the Pathfinder Professional will be automatically turned off. It will cease drawing current from the system battery when turned off.

Configuring the Receiver to work with Asset Surveyor

No special configuration of the Pathfinder Professional is required, beyond the usual GPS 'Rover options' which should be configured in the Asset Surveyor software.

Operational Aspects Specific to the Pathfinder Professional

RTCM Input

The Pathfinder Professional supports RTCM input. Both RTCM versions 1 and 2 are supported. The RTCM Warning time cannot be configured, and is pre-set to 30 seconds.

Overdetermined Positions

The Pathfinder Professional does not support the computation of overdetermined GPS positions.

Carrier Phase Mode

The Pathfinder Professional cannot be operated in carrier phase mode.

Receiver Outputs

The Pathfinder Professional receiver supports TSIP output.

Cabling Diagram

In order to use the Asset Surveyor software with a Pathfinder Professional, you should connect up the system as shown below:

1 P/N 16741-00 compact dome antenna
2 System battery
3 P/N 17515-01 antenna cable
4 P/N 17644 multiport cable
5 P/N 17642-00 Pathfinder Professional
6 MC-V datalogger

Figure B-3   Cabling for the Pathfinder Professional

Full Equipment List

The following table lists the equipment which may be used in the field when operating a Pathfinder Professional in conjunction with the Asset Surveyor software running on your MC-V.

Part Name	Part Number
Pathfinder Professional 6-channel GPS receiver	17642-00
Hard carry case	13000-01
Compact dome antenna	16741-00
Compact dome antenna pouch	16789
Compact dome antenna spacer	18375
Magnetic antenna mount with 5/8" thread	12920-00
Vehicle power cable	12918-00
5 meter type N antenna cable	17515-01
Receiver and battery belt pouch with clips	12916-00
Accessory belt pouch	13274
5A 32V mini fuse for vehicle power adapter	10530
37-to-9-pin Receiver to MC-V cable	17664
9-to-9-pin Null Modem cable	18532
9-to-25-pin adapter	14283
CMT MC-V-TD-RD datalogger with barcode wand & accessories	17663-00
MC-V Asset Surveyor Quick Reference Guide	28382-05

B.1.3 The Pathfinder ProLite

The Trimble Pathfinder ProLite system is a compact and lightweight system which houses the GPS receiver inside the GPS antenna itself.

Figure B-4   The ProLite Antenna

Trimble specifies 2-5m post-processed differentially corrected accuracy (CEP) for Pathfinder ProLite receivers.

Turning the Receiver On

When the receiver and MC-V are connected as shown in the cabling diagram later in this section, there is no need to explicitly turn on the Pathfinder ProLite; when the MC-V is turned on the Asset Surveyor software immediately turns on the ProLite and starts communicating with it.

⊠   **Note -** The MC-V draws power from the receiver's battery when the receiver is turned on.

Turning the Receiver Off

When you turn off the MC-V, or explicitly disconnect the GPS receiver, the ProLite will be automatically turned off. It will cease drawing current from the system battery when turned off.

Configuring the Receiver to work with Asset Surveyor

No special configuration of the ProLite is required, beyond the usual GPS 'Rover options' which should be configured in the Asset Surveyor software.

Operational Aspects Specific to the Pathfinder ProLite

RTCM Input

The ProLite supports RTCM input. Both RTCM versions 1 and 2 are supported. Connect your RTCM link to the 'RTCM' port of the ProLite switching box.

The RTCM Warning time cannot be configured, and is pre-set to 30 seconds.

Overdetermined Positions

The ProLite does not compute overdetermined GPS positions.

Carrier Phase Mode

The ProLite cannot be operated in carrier phase mode.

Almanacs

Unlike most other Pathfinder GPS receivers, the ProLite receiver has no internal battery-backed memory. This means that it does not retain a copy of the GPS almanac when it is powered off. When Asset Surveyor starts communicating with the ProLite, it will send an almanac from the MC-V to the ProLite, to enable the receiver to rapidly acquire signals from the GPS satellites.

When you first receive your Asset Surveyor system, there will not be an almanac on your MC-V. You must connect to the ProLite receiver and stand outdoors with a clear view of the sky, then turn on the MC-V and wait for at least 15 minutes. After this time, the ProLite receiver will have compiled a complete and up-to-date almanac, and Asset Surveyor will have recorded this on the MC-V. When you next use the ProLite system, Asset Surveyor will send the almanac to the receiver which will then be able to rapidly acquire satellites. Each time you use the ProLite system, Asset Surveyor will record a new almanac (after approximately 15 minutes operation).

⊠   **Note -** In addition to an up-to-date almanac, your GPS receiver
      requires an accurate initial position in order to start up rapidly. If you
      have moved a significant distance since last using your GPS receiver,
      remember to update the 'Initial position' (in the GPS 'Rover options'
      configuration form), to ensure rapid acquisition of satellite signals.

☆   **Tip -** If a ProLite system is turned on indoors (or in a location where it
      will be unable to receive signals from *any* GPS satellites), and is not
      taken outdoors for at least five minutes, the almanac which has been
      loaded into the ProLite receiver by Asset Surveyor will be ignored,
      and the receiver will attempt to perform a 'blind search' for satellites.
      This can take up to 15 minutes. To ensure rapid startup, do not turn
      the ProLite system on indoors, or if you do then turn it off and on
      again when you eventually go outdoors. Asset Surveyor will (re)send
      an almanac to the ProLite receiver which will then rapidly acquire
      satellites.

Receiver Outputs

The ProLite supports TSIP output.

Cabling Diagram

In order to use the Asset Surveyor software with a Pathfinder ProLite
receiver, you should connect up the system as shown below:

1 P/N 18636-32 ProLite GPS receiver/antenna
2 P/N 20892 5ft ProLite antenna cable, or
   P/N 20893 20ft ProLite antenna cable
3 P/N 20628-00 ProLite switching box
4 P/N 17466 camcorder battery
5 P/N 22637 MC-V-to-switching-box cable
6 MC-V datalogger

Figure B-5   Cabling for the Pathfinder ProLite

Full Equipment List

The following table lists the equipment which may be used in the field when operating a Pathfinder ProLite in conjunction with the Asset Surveyor software running on your MC-V.

Part Name	Part Number
ProLite GPS Receiver/Antenna (Jupiter 6P)	18636-32
ProLite hard carry case	21164
Backpack with rigid frame	20966
ProLite switching box	20629-00
2 x 12V camcorder batteries	17466
ProLite battery pouch	20962
Magnetic antenna mount with 5/8" thread	12920-00
Mounting plate 3" diameter x 1/16" thick	18375
2 x Quick-release adapter	19487
Quick release mount	19493
5ft ProLite to switching box cable	20892
20ft ProLite to switching box cable	20893
Cigarette adapter power cable	20894
8in cable with battery clip and power jack	22740
MC-V to switching box cable	22637
CMT MC-V-TD-RD datalogger with barcode wand & accessories	17663-00
MC-V Asset Surveyor Quick Reference Guide	28382-05

B.1.4 The Pathfinder Pro XL

The Pathfinder Pro XL system is based around a high-performance GPS receiver employing Trimble's Maxwell Technology. The Pro XL GPS receivers have either 8 or 12 channels, and provide differentially corrected C/A code positions accurate to better than one meter on a second-by-second basis.

Turning the Receiver On

When the receiver and MC-V are connected as shown in the cabling diagram later in this section, there is no need to explicitly turn on the Pathfinder Pro XL; when the MC-V is turned on the Asset Surveyor software immediately turns on the Pro XL and starts communicating with it.

⊠   **Note -** The MC-V draws power from the receiver's battery when the receiver is turned on.

Turning the Receiver Off

When you turn off the MC-V, or explicitly disconnect the GPS receiver, the Pro XL will be automatically turned off. It will cease drawing current from the system battery when turned off.

Configuring the Receiver to work with Asset Surveyor

No special configuration of the Pro XL is required in order to get the Asset Surveyor software and Pro XL to communicate, beyond the usual GPS 'Rover options' which should be configured in the Asset Surveyor software. The following section describes the settings required to obtain sub-meter accuracy from your Pro XL.

Operational Aspects Specific to the Pathfinder Pro XL

Sub-Meter Accuracy

If order to achieve accuracy with the Pro XL of better than 1 meter (RMS) + 10 ppm times the distance between the base station and the rover, you must

use the following GPS 'Rover options' configuration settings in the Asset
Surveyor software:

Position mode	Overdet. 3D or Manual 3D
PDOP mask	4.0 or less
SNR mask	6 or more
Elevation mask	15 degrees or more

You must also be using a base station which is logging or transmitting (via
RTCM) synchronized measurements, and which is equipped with a Maxwell
Technology Pro XL or 4000 Series GPS receiver. Your roving receivers
must be within 50km of your base station. Finally, if you are performing
differential correction by post-processing your data, you must be using
MCORR300 version 3.43 or later (this version of the differential correction
program ships with the PFINDER software version 2.50 or later) or
MCORR400. Using MCORR400, the accuracy with the Pro XL is better than
than 1 meter (RMS) + 2 ppm times the distance between the base station and
the rover.

RTCM Input

The Pro XL supports RTCM input. Both RTCM version 1 and RTCM
version 2 are supported. Connect your RTCM link directly to the cable
labeled 'RTCM'.

Overdetermined Positions

The Pro XL supports the computation of overdetermined GPS positions.

Carrier Phase Mode

The Pro XL receiver can be operated in carrier phase mode. You enable
carrier phase mode via the 'Carrier options' configuration form, which is
accessed using the PHASE soft key from the GPS 'Rover options'
configuration menu.

Receiver Outputs

The Pro XL supports TSIP and (in firmware version 2.07 and later) NMEA output. It also supports (without any need for configuration of the Asset Surveyor software) 1 PPS output.

Cabling Diagram

In order to use the Asset Surveyor software with a Pathfinder ProXL receiver, you should connect up the system as shown below:

1 P/N 16741-00 compact dome antenna
2 P/N 17466 Camcorder batteries
3 P/N 24333 dual battery cable
4 P/N 17515-01 antenna cable
5 P/N 17644-31 Pro XL multiport cable
6 P/N 22850-00 12-channel Pro XL GPS receiver, or
   P/N 22850-10   8-channel Pro XL GPS receiver
7 MC-V datalogger

Figure B-6   Cabling for the Pathfinder Pro XL

Full Equipment List

The following table lists the equipment which may be used in the field when operating a Pathfinder Pro XL in conjunction with the Asset Surveyor software running on your MC-V.

Part Name	Part Number
Pouch Assembly for Pro XL System with MC-V	24491-00
Compact dome antenna	16741-00
Magnetic mount	12920-00
3 x 1/16" antenna spacing plate	18375
2 foot range pole	24287
Quick release adapter	19847
Quick release	19493
Vehicle power to TA3-F (battery) adapter	12918-00
Pathfinder pouch belt for accessories	13274
Pro XL hard travel case	13000-30
MC-V datalogger	
MC-V Asset Surveyor Quick Reference Guide	28382-05

B.1.5 The Centurion and Trimpack III

The Trimpack III and Centurion are 6-channel military-grade receivers which use a ruggedized version of the Pathfinder Basic case.

The Trimpack III can be operated as essentially a rugged alternative to the Pathfinder Basic Plus. There are no visible aspects of the Asset Surveyor's operation which have been modified to support the Trimpack III.

The Centurion is a dual-frequency P(Y)-code GPS receiver which, when fitted with an active cryptokey, is capable of delivering S/A-free P-code (or Y-code, when the P-code is encrypted) positions. The Trimble Centurion is only available to certain approved customers (generally Federal agencies and specified foreign Governments). A common synonym for C/A-code positions (which are subject to S/A) is 'SPS' (for Standard Positioning System), while a synonym for P(Y)-code positions (which are S/A-free) is 'PPS' (for Precise Positioning System).

Turning the Receiver On

The Asset Surveyor software cannot turn on the Centurion or Trimpack III. You must do so manually by turning the rotary knob on the front of the receiver clockwise from the 'OFF' position.

Before the Asset Surveyor software can communicate with a Centurion or Trimpack III receiver, the receiver must be configured to communicate using the SLGR protocol, as described below.

Turning the Receiver Off

The Asset Surveyor software cannot turn off the Centurion or Trimpack III. When you turn off the MC-V or disconnect GPS, the receiver remains turned on (and consuming its battery). You must remember to also turn off the receiver, by rotating its rotary knob anti clockwise to the 'OFF' position.

Configuring the Receiver to work with Asset Surveyor

The Asset Surveyor software configures most of the internal settings in the Trimpack III and Centurion, with the exception of the communications protocol itself. You should configure these yourself prior to using the Asset Surveyor software with your Trimpack/Centurion, as described below:

1. **Turn the rotary knob on the receiver's front panel to the 'DPORT' position.**

   The receiver displays the data port setup screen:

   ```
   Dataport: Trimpack3
    NORMin:x  NORMout:y
   Timing: OFF
   ```

   You must configure the data port protocol, the data port mode and the packet setup, as described in the following three steps.

2. **Use the 'CMD' and 'SEL' switches to select '<Protocol Type?>' from the data port setup menu. This leads to the following screen:**

   ```
   Protocol Type:
    TRIMPACK3          ←
   <default>      <quit>
   ```

   Press the '+' or '-' switch until the selected 'Protocol Type' is 'SLGR', e.g.

   ```
   Protocol Type:
    SLGR               ←
   <default>      <quit>
   ```

   Now press 'CMD' to confirm the selection of the 'SLGR' protocol, and return to the data port setup screen.

3. **Use the 'CMD' and 'SEL' switches to select '<Dataport Mode>' from the data port setup menu. This leads to the following screen:**

   ```
   Dataport:
    in:NORM  out:NORM
   <default>      <quit>
   Use CMD to proceed
   ```

   Ensure that both the 'in:' and 'out:' settings are 'NORM'. Then press 'CMD' to return to the data port setup screen.

4. **Use the 'CMD' and 'SEL' switches to select '<Packet Setup?>' from the data port setup menu. This leads to the following screen:**

```
Packet baudrate:
 9600
                  <quit>
Use CMD to proceed
```

Set the packet baud rate to 9600, then press 'CMD'. You will proceed to
the following screen:

```
 TSIP I/O Options:
P 01 V 01 T 00 Aux00
<clear>        <quit>
Use CMD to proceed
```

The Asset Surveyor software actually reconfigures these settings, so
their values are not important at this stage. You should just press 'CMD'
again to save them and return to the data port setup screen.

Provided you have followed the above instructions carefully, you will now
be able to use your Trimpack/Centurion in conjunction with the Asset
Surveyor software.

If you are using a Centurion receiver, remember to configure the 'P(Y)
Options' in the Asset Surveyor software, as described in Chapter 7.

Operational Aspects Specific to the Trimpack III

Powering the MC-V

Unlike some Trimble GPS receivers, the Trimpack III cannot power the MC-
V from its own battery. When used with a Trimpack III, the MC-V will draw
all operating power from its own internal battery.

RTCM Input

The Trimpack III does not support RTCM input when operated in
conjunction with a datalogger.

Overdetermined Positions

The Trimpack III does not compute overdetermined GPS positions.

Carrier Phase Mode

The Trimpack III cannot be operated in carrier phase mode.

Receiver Outputs

The Trimpack III does not support any receiver outputs when used with an external datalogger.

Operational Aspects Specific to the Centurion

Powering the MC-V

Unlike some Trimble GPS receivers, the Centurion cannot power the MC-V from its own battery. When used with a Centurion, the MC-V will draw all operating power from its own internal battery.

RTCM Input

The Trimble Centurion does not support RTCM input when operated in conjunction with a datalogger.

Overdetermined Positions

The Trimble Centurion does not compute overdetermined GPS positions.

Carrier Phase Mode

The Trimble Centurion cannot be operated in carrier phase mode.

Receiver Outputs

The Trimble Centurion does not support any receiver outputs when used with an external datalogger.

Disabling the Centurion's Anti-Spoof Protection

The Trimble Centurion is a Precise Positioning System (PPS) receiver. In order to use PPS, it is necessary for the receiver to download cryptovariables.

When cryptovariables have not been loaded or are invalid, or the satellite constellation is not set to 'Y' (encrypted) code, the Centurion is unable to provide a fix due to the startup default setting, 'Anti-Spoof Enabled'.

Anti-Spoof safety allows GPS navigation in the presence of spoofers provided there are 'Y'-code satellites available. In order to navigate using only P or C/A-code in an unspoofed environment, the Anti-Spoof safety

must be disabled, using the following procedure:

1. **Turn the rotary knob on the receiver's front panel to the 'SA/AS' position.**

   The following screen will appear:

   ```
   SA/A-S Security:
   -- A-S Safety OK
   -- Keys Loaded
   -- Mission Set
   ```

   This screen will then change to:

   ```
   SA/A-S Mission:

   -- Mission Set
   -- Keys Loaded
   ```

2. **Click the 'CMD' switch to '<Cancel A-S Safety?>'. Click 'CMD' again to cancel Anti-Spoof safety. At this point, the Centurion screen will look like:**

   ```
   SA/A-S Security:
   -- A-S Safety OK
   -- Keys Loaded
   -- Mission Set
   ```

   and this screen will change to:

   ```
   SA/A-S Mission:

   -- Mission Set
   -- Keys Loaded
   ```

   This procedure will be necessary once every 24 hours (GPS time). This allows the Centurion to use Y, P or C/A code without Anti-Spoof (A-S) protection.

Configuring P(Y) Mode

Configuration of the 'P(Y) mode' using the `P(Y)` soft key (which appears in the GPS 'Rover options' configuration form) is described in in Chapter 7 of this manual.

Cabling Diagram

In order to use the Asset Surveyor software with a Trimpack III or Centurion GPS receiver, you should connect up the system as shown below:

1 P/N 16741-00 compact dome antenna (optional)
2 P/N 17515-01 antenna cable (optional). An adapter from SMA (M) to N (F), P/N 12938, is also required
3 P/N 18154-00 Centurion GPS receiver or P/N 18154-10 Trimpack III GPS receiver
4 MC-V datalogger
5 P/N 24666 Centurion to MC-V datalogger cable

Figure B-7   Cabling for the Centurion or Trimpack III

Full Equipment List

The following table lists the equipment which may be used in the field when operating a Centurion or Trimpack III in conjunction with the Asset Surveyor software running on your MC-V.

Part Name	Part Number
Centurion or Trimpack III GPS receiver	18154-00 or 18154-10
Centurion to MC-V datalogger cable	24666

Compact dome antenna (optional)
If using a compact dome, you will also require:
   Antenna cable
   Adapter SMA(M) to N(F)
	16741-00
	
	17515-01
	12938

MC-V datalogger with barcode wand & accessories	
MC-V Asset Surveyor Quick Reference Guide	28382-05

Appendix C PC Utilities

This appendix describes the various PC-based utility programs which can be used in conjunction with the Asset Surveyor software.

C.1 PFINDER

The single most important PC program with which Asset Surveyor is associated is Trimble's PFINDER software. You can use PFINDER to create data dictionaries, transfer files to and from the MC-V, display and edit captured data, differentially correct data by post-processing, manage waypoints, output captured data to a GIS, etc.

In order to fully exploit the capabilities of Asset Surveyor, you should be familiar with the services provided by PFINDER. For a general introduction to the PFINDER software, read the *PFINDER Software User's Guide*. For in-depth details about specific aspects of the PFINDER software, read the *PFINDER Software Reference* manual.

C.2 PROPLAN

The original Trimble Pathfinder Mission Planning software, PROPLAN is a PC-based utility which runs under DOS™. It provides the following information:

- skyplots that show the satellite paths over any specified location in the world.

- the number of satellites which will be visible at a specified time.

- the azimuth and elevation of each visible satellite.

- times of 2D and 3D coverage.

- which satellites comprise each visible constellation.

- the PDOP of each visible constellation during a specified period.

The above data is displayed in graphical and chart forms, and can be saved as files on disk or printed from the PC screen.

PROPLAN also allows you to define 'curtains', in order to see how specific obstacles (e.g. mountain ranges, buildings, etc.) will effect satellite visibility.

The following is an example of a PROPLAN graph, showing satellite availability and PDOP:

C.3   QUICKPLAN

QUICKPLAN is a sophisticated Mission Planning suite, which provides all of the features of PROPLAN within the familiar environment of Microsoft® Windows™. In addition to the features provided by PROPLAN, the QUICKPLAN suite provides the following features:

• Graphical selection of a mission location, anywhere on the earth's surface.

• Convenient graphical definition of curtains.

• Multiple graphs and tables on the screen at once.

• Separate planning 'sessions' for different mission types or locations.

The following is an example of a QUICKPLAN graph, showing satellite availability and PDOP:

C.4 Phase Processor

The optional Pathfinder Phase Processor software can be used to process point features captured in carrier phase mode, to achieve higher accuracy than is possible with regular C/A-code GPS positions (albeit after an occupation of at least 10 minutes at each point).

⊠   **Note -** Carrier phase measurements can only be recorded by Asset Surveyor when connected to a Pro XL receiver.

The Phase Processor software runs under Microsoft® Windows™.

C.5   ASSETED

You can load the ASCOORD.DAT file of pre-defined coordinate systems onto your MC-V using PFINDER (see Chapter 7). This file contains definitions for most popular coordinate systems, datums and zones.

⊠   **Note -** You cannot create, edit or delete coordinate systems, datums or zones on your MC-V.

Before loading ASCOORD.DAT onto your MC-V, you can use the ASSETED utility to delete or edit pre-defined coordinate systems and to create further custom coordinate systems as required. You can easily set up the ASCOORD.DAT file for your field crew so that only the coordinate systems used in your area are contained in ASCOORD.DAT. Not only will this reduce the risk of confusion in the field, but it will ensure that the ASCOORD.DAT file is as small as possible, thereby maximizing data storage space on your MC-V.

C.5.1   Installation

💣   **Caution -** You cannot use a previous version of ASSETED with the ASCOORD.DAT file which ships with Asset Surveyor version 3. You must use the new ASSETED program (version 3).

The ASSETED program is supplied on the Asset Surveyor distribution diskette. To install it on your PC, follow these instructions:

1. **Insert the Asset Surveyor distribution diskette in your PC's 3½" diskette drive.**

2. **On your PC, log to your hard disk drive and create a new directory for ASSETED.**

    For example, to create a new directory called C:\ASSETED, type the commands:

                        C:

                        MKDIR \ASSETED

3. **Change to the newly-created directory.**

For example, type the command:

```
CD \ASSETED
```

4. To copy the required files from the distribution diskette, type the following commands:

```
COPY A:\ASSETED.*  .

COPY A:\*.LNG  .

COPY A:\ASCOORD.DAT  .
```

If your PC's 3½" diskette drive is drive 'B:', specify 'B:' instead of 'A:' in each of the above commands.

You can now run the ASSETED utility, as describe in the following section.

C.5.2 Basic Operation

Once you have installed ASSETED onto your PC, you can run the ASSETED program by changing to the ASSETED directory and typing the command ASSETED on your PC. For example:

```
C:

CD \ASSETED

ASSETED
```

The ASSETED program will execute, and will display its main 'Configuration' menu, which is as follows:

```
╔══ Asset Surveyor ═══════════════╦══════════════════════════════╗
║ ┌─Configuration─┐               ║   INFORMATION SCREEN FOR ASSETED ║
║ │Coordinate system│             ║                              ║
║ │Units and display│             ║  Check the "Coords" units (under ║
║ │Screen colors  │               ║  "Units and display") before    ║
║ │Exit           │               ║  deleting, creating or editing   ║
║ └───────────────┘               ║  coordinate systems, datums and/or║
║                                 ║  zones (under "Coordinate systems").║
║                                 ║  Any changes you make will be    ║
║                                 ║  reflected in the ASCOORD.DAT file.║
║                                 ║  You can then load this file into  ║
║                                 ║  your datalogger using PFINDER.  ║
║                                 ║                              ║
║                                 ║  Special keys                ║
║                                 ║  ────────────                ║
║                                 ║  Home: Move to the top of the screen║
║                                 ║  End:  Move to the end of the screen║
║                                 ║  PgUp: Move to the previous page   ║
║                                 ║  PgDn: Move to the next page     ║
║                                 ║  Esc:  CLEAR  - Cancel current screen║
║                                 ║  F6:   OK     - Accept current screen║
║                                 ║                              ║
║ F1     F2     F3     F4     F5  ║ F6 OK ═══════════════════════╝
```

The ASSETED program has a user interface which is similar to that of the
Asset Surveyor software, so you should find it reasonably familiar. The
panel to the right of the PC's screen provides information about special keys.
The most important keys to remember are the (Esc) key (which acts like the
ESC key on the MC-V) and the OK soft key (which acts like OK on the
MC-V).

The primary function of the ASSETED program is to allow you to customize
the ASCOORD.DAT file, which can then be loaded onto one or more MC-
Vs. Select 'Coordinate system' from the 'Configuration' menu to define and
manage coordinate systems. You can also configure ASSETED in a number
of ways, by selecting the 'Units and display' or 'Screen colors' entries from
the 'Configuration' menu. You can exit the ASSETED program by selecting
'Exit' from the 'Configuration' menu or by pressing the (Esc) key

C.5.3 Configuration

Screen Colors

If you select 'Screen colors' from the 'Configuration' menu, the screen color
configuration form will appear:

```
┌──────────────── Asset Surveyor ════════════════════════════════════┐
│                Screen colors          │ INFORMATION SCREEN FOR ASSETED │
│ Highlighted text◆          Yellow/Brown│                                │
│ Normal text:               White/Blue  │ Check the "Coords" units (under│
│                                        │ "Units and display") before    │
│                                        │ deleting, creating or editing   │
│                                        │ coordinate systems, datums and/or│
│                                        │ zones (under "Coordinate systems").│
│                                        │ Any changes you make will be    │
│                                        │ reflected in the ASCOORD.DAT file.│
│                                        │ You can then load this file into│
│                                        │ your datalogger using PFINDER.  │
│                                        │                                 │
│                                        │ Special keys                    │
│                                        │ ────────────                    │
│                                        │ Home: Move to the top of the screen│
│                                        │ End:  Move to the end of the screen│
│                                        │ PgUp: Move to the previous page │
│                                        │ PgDn: Move to the next page     │
│                                        │ Esc:  CLEAR - Cancel current screen│
│                                        │ F6:   OK    - Accept current screen│
│                                        │                                 │
│F1      F2      F3      F4      F5       │ F6 OK ══════════════════════════│
└─────────────────────────────────────────┘
```

You can configure the foreground and background colors to be used by
ASSETED, both for highlighted and 'normal' text.

⊠   **Note -** If you are running ASSETED on a PC with a monochrome
     screen, it may be necessary to configure the screen colors in order to
     clearly distinguish highlit text. If you are running ASSETED on a PC
     with a full color screen, you can just configure the colors to suit your
     tastes. The default ASSETED colors tend to be clearly distinguishable
     on most monochrome screens.

You can select a new foreground/background color combination for either
the 'Highlighted' or 'Normal' fields in the 'Screen colors' configuration
form. Each menu contains all of the foreground / background color
combinations supported by a standard IBM PC (in text mode). Once you
have selected suitable color combinations for both the 'Highlighted' and
'Normal' fields, press the ▐OK▌ soft key to save the 'Screen colors' form and
return to the 'Configuration' menu. The selected colors will take effect
immediately.

Units and Display

If you select 'Units and display' from the 'Configuration' menu, the
following configuration form will appear:

```
╔═════════════ Asset Surveyor ═════════════╗
║          Units and display     ║  INFORMATION SCREEN FOR ASSETED  ║
║ Units                          ║                                  ║
║  Coords◆              Meters(m) ║ Check the "Coords" units (under  ║
║  Height:             Meters(m)  ║ "Units and display") before      ║
║  Distance:           Meters(m)  ║ deleting, creating or editing     ║
║  Velocity:        Km/Hour(km/h) ║ coordinate systems, datums and/or ║
║  Angles:            Degrees(°)  ║ zones (under "Coordinate systems").║
║ Angle fmt:           DD.MMSSss  ║ Any changes you make will be     ║
║ Order:               Lat/Lon    ║ reflected in the ASCOORD.DAT file.║
║ Altitude ref:            MSL    ║ You can then load this file into  ║
║ North ref:              True    ║ your datalogger using PFINDER.   ║
║ Magnetic decl:          Auto    ║                                  ║
║ Null string:               ?    ║ Special keys                     ║
║ Language:            English    ║ -----------                      ║
║                                 ║ Home: Move to the top of the screen║
║                                 ║ End:  Move to the end of the screen║
║                                 ║ PgUp: Move to the previous page   ║
║                                 ║ PgDn: Move to the next page       ║
║                                 ║ Esc:  CLEAR - Cancel current screen║
║                                 ║ F6:   OK   - Accept current screen║
║                                 ║                                  ║
╚F1      F2      F3      F4      F5  F6 OK ═════════════════════════╝
```

This is identical to the 'Units and display' configuration form in the Asset Surveyor software. Only some of the fields in this form are relevant to the operation of the ASSETED program:

- The 'Coords' unit field is used to determine how certain coordinate system zone definition fields are displayed.

♠ **Caution -** If you create new datums or zones and specify coordinate values using the wrong units, the coordinate system definitions you create may be seriously inaccurate. It is important to configure the 'Coords' units correctly before creating datums or zones.

- The 'Angle fmt' field is used to determine how latitude and longitude angles are entered when defining certain coordinate system zones.

- The 'Order' field determines the order of 'North/East' and 'Lat/Long' fields when defining certain coordinate system zones.

- The 'Null string' field determines the way in which null (un-entered) values will be displayed by ASSETED.

- The 'Language' field determines which supported language the ASSETED program will display in.

The other fields on this form are completely ignored by the ASSETED program.

Once you have configured 'Units and display' fields to suit your
requirements, press the ▮ OK ▮ soft key to save the form and return to the
'Configuration' menu. Any changes will take place immediately. Refer to
Chapter 7 for further details of the various fields on the 'Units and display'
form.

⊠   **Note -** Changes made to 'Units and display' settings will only affect
      the operation of the ASSETED program. They will not have any effect
      on the operation of the Asset Surveyor software running on your MC-
      V.

C.5.4 Customizing Coordinate Systems

If you select the 'Coordinate system' entry from the 'Configuration' menu, a
menu of available coordinate systems will appear:

```
╔════════════ Asset Surveyor ═══════════════════════════════════════╗
║ ┌──────────Select coord sys──────┐ │                                ║
║ │ US SPCS NAD-83                 │ │   INFORMATION SCREEN FOR ASSETED║
║ │ US SPCS NAD-27                 │ │                                ║
║ │ OSGB (Airey 1936)              │ │ Check the "Coords" units (under║
║ │ New Zealand                    │ │ "Units and display") before    ║
║ │ Australia                      │ │ deleting, creating or editing   ║
║ │ Zones Françaises               │ │ coordinate systems, datums and/or║
║ └────────────────────────────────┘ │ zones (under "Coordinate systems").║
║                                     │ Any changes you make will be    ║
║                                     │ reflected in the ASCOORD.DAT file.║
║                                     │ You can then load this file into║
║                                     │ your datalogger using PFINDER.  ║
║                                     │                                ║
║                                     │ Special keys                   ║
║                                     │ ------------                   ║
║                                     │ Home: Move to the top of the screen║
║                                     │ End:  Move to the end of the screen║
║                                     │ PgUp: Move to the previous page ║
║                                     │ PgDn: Move to the next page     ║
║                                     │ Esc:  CLEAR - Cancel current screen║
║                                     │ F6:   OK    - Accept current screen║
║                                     │                                ║
║ F1CreateF2Datum F3 Del  F4     F5   │ F6 OK ═══════════════════════════║
╚═════════════════════════════════════════════════════════════════════╝
```

Initially, this is the full set of pre-defined coordinate systems in the supplied
ASCOORD.DAT file. If you delete unwanted coordinate systems, or create
further custom coordinate systems, these changes will be reflected in the
contents of the ASCOORD.DAT file. Once you have arranged the
coordinate systems appropriate to your application requirements, you can
use PFINDER to load the ASCOORD.DAT file onto your datalogger(s).

☆ **Tip -** If you delete a pre-defined coordinate system by mistake, you can re-copy the original ASCOORD.DAT file from the Asset Surveyor distribution diskette and start modifying it using ASSETED again.

Deleting Unwanted Coordinate Systems

The most common modification to the distributed ASCOORD.DAT file is to remove any unwanted coordinate systems. The reasons for doing so are as follows:

- A smaller ASCOORD.DAT file will consume less data storage space on your MC-V, thereby freeing up more space for storage of data files.

- By eliminating unwanted coordinate systems, there is less opportunity for a field crew to choose the wrong coordinate system by mistake.

- A smaller ASCOORD.DAT file makes selection of a coordinate system quicker and easier.

As an example, presume that the default ASCOORD.DAT file contains the coordinate systems shown in the diagram above. Presume that your applications all require only the U.S. State Plane coordinate systems based on the NAD-83 datum. You can delete the unwanted coordinate systems as follows:

Move the highlight to the first unwanted coordinate system (US SPCS NAD-27). Now press `DEL`. The ASSETED program asks you to confirm that you wish to delete this coordinate system, in case you pressed `DEL` by mistake:

```
┌═══════════════ Asset Surveyor ═══════════════════┐
│ ┌─────────Confirm deletion──────────┐ │ INFORMATION SCREEN FOR ASSETED │
│ │Coordinate system: "US SPCS NAD-27".│ │                                │
│ │                                    │ │ Check the "Coords" units (under│
│ │OSGB (Airey 1936)                   │ │ "Units and display") before    │
│ │New Zealand                         │ │ deleting, creating or editing  │
│ │Australia                           │ │ coordinate systems, datums and/or│
│ │Zones Françaises                    │ │ zones (under "Coordinate systems").│
│ └────────────────────────────────────┘ │ Any changes you make will be   │
│                                         │ reflected in the ASCOORD.DAT file.│
│                                         │ You can then load this file into│
│                                         │ your datalogger using PFINDER. │
│                                         │                                │
│                                         │ Special keys                   │
│                                         │ ────────────                   │
│                                         │ Home: Move to the top of the screen│
│                                         │ End:  Move to the end of the screen│
│                                         │ PgUp: Move to the previous page│
│                                         │ PgDn: Move to the next page    │
│                                         │ Esc:  CLEAR - Cancel current screen│
│                                         │ F6:   OK    - Accept current screen│
│                                         │                                │
│ F1 No F2 Yes F3      F4      F5      │ F6 OK                          │
└═════════════════════════════════════════╧════════════════════════════════┘
```

Press **YES** to delete the unwanted coordinate system. It will disappear from the menu of coordinate systems. Now move the highlight to the next unwanted coordinate system and press **DEL** again. Repeat this procedure until the only remaining coordinate systems are those required by your applications.

⊠   **Note -** When you delete a coordinate system, all of the zones for that coordinate system will also be deleted.

Press (**Esc**) to exit the 'Coordinate system' menu. When you exit the 'Coordinate system' menu and return to the ASSETED 'Configuration' menu, ASSETED will spend some time compressing the ASCOORD.DAT file so that it takes as little space as possible when loaded onto your MC-V.

Creating New Coordinate Systems

You can create a new coordinate system and add it to the menu of available coordinate systems by pressing the **CREATE** soft key on the menu of coordinate systems:

When you press **CREATE**, ASSETED displays the 'Create coord system' form, which requires you to name the new coordinate system and to select a datum for it:

```
 ╔══════ Asset Surveyor ═══════╗  ╔═══════════════════════════════╗
 ║          Create zone        ║  ║  INFORMATION SCREEN FOR ASSETED ║
 ║ Name:              US SPCS NAD-83║                              ║
 ║ Projn:                     ? ║  ║ Check the "Coords" units (under║
 ║                             ║  ║ "Units and display") before   ║
 ║                             ║  ║ deleting, creating or editing  ║
 ║                             ║  ║ coordinate systems, datums and/or║
 ║                             ║  ║ zones (under "Coordinate systems").║
 ║                             ║  ║ Any changes you make will be   ║
 ║                             ║  ║ reflected in the ASCOORD.DAT file.║
 ║                             ║  ║ You can then load this file into ║
 ║                             ║  ║ your datalogger using PFINDER.  ║
 ║                             ║  ║                               ║
 ║                             ║  ║ Special keys                  ║
 ║                             ║  ║ ───────────                   ║
 ║                             ║  ║ Home: Move to the top of the screen║
 ║                             ║  ║ End:  Move to the end of the screen║
 ║                             ║  ║ PgUp: Move to the previous page ║
 ║                             ║  ║ PgDn: Move to the next page    ║
 ║                             ║  ║ Esc:  CLEAR - Cancel current screen║
 ║                             ║  ║ F6:   OK   - Accept current screen║
 ║                             ║  ║                               ║
 ║F1    F2    F3    F4    F5   ║  ║ F6 OK ════════════════════════╝
```

✉   **Note -** An Asset Surveyor coordinate system is a collection of zones
    which all refer to the *same* datum. You cannot have two or more
    datums within a coordinate system.

Type in a name for your new coordinate system, and select the correct
datum. Press **OK** to save the form. The coordinate system which you have
created will be added to the menu of available coordinate systems. You
should now create one or more zones for that coordinate system, as
described in the following section.

C.5.5 Customizing Zones

Deleting Unwanted Zones

After deleting unwanted coordinate systems, you may also wish to delete
unwanted zones within a particular coordinate system. The reasons for doing
so are essentially the same as the reasons for deleting unwanted coordinate
systems:

* A smaller ASCOORD.DAT file will consume less data storage space on
  your MC-V, thereby freeing up more space for storage of data files.

- By eliminating unwanted zones, there is less opportunity for a field crew to choose the wrong zone by mistake. Zones within a U.S. State Plane have similar names, and it can be easy to confuse two zones.

- A smaller ASCOORD.DAT file makes selection of a particular zone quicker and easier.

As an example, presume that you have deleted all but the U.S. State Plane coordinate systems for NAD-83:

```
┌──────────── Asset Surveyor ════════════┐│┌─────────────────────────────────────┐
 ┌────────Select coord sys────────┐       │ │      INFORMATION SCREEN FOR ASSETED │
 │US SPCS NAD-83                   │       │ │
 │                                 │       │ │ Check the "Coords" units (under
 └─────────────────────────────────┘       │ │ "Units and display") before
                                            │ │ deleting, creating or editing
                                            │ │ coordinate systems, datums and/or
                                            │ │ zones (under "Coordinate systems").
                                            │ │ Any changes you make will be
                                            │ │ reflected in the ASCOORD.DAT file.
                                            │ │ You can then load this file into
                                            │ │ your datalogger using PFINDER.
                                            │ │
                                            │ │ Special keys
                                            │ │ ────────────
                                            │ │ Home: Move to the top of the screen
                                            │ │ End:  Move to the end of the screen
                                            │ │ PgUp: Move to the previous page
                                            │ │ PgDn: Move to the next page
                                            │ │ Esc:  CLEAR - Cancel current screen
                                            │ │ F6:   OK   - Accept current screen
                                            │ │
 F1CreateF2Datum F3 Del  F4        F5       │ │ F6 OK ═══════════════════════════
```

Presume that you usually work in the state of Oregon, but that you occasionally have call to work in any of the Western coastal states of the U.S. You can delete all of the NAD-83 State Plane zones apart from those for Washington, Oregon and California as follows:

Select the 'US SPCS NAD-83' coordinate system from the 'Coordinate system' menu. The menu of all NAD-83 State Plane zones will appear:

```
╔═════════════ Asset Surveyor ═══════════════════════════════════════╗
║┌───────────────Select zone─┐  ║ ┌──────────────────────────────────┐║
║│Alabama, E                 │  ║ │   INFORMATION SCREEN FOR ASSETED │║
║│Alabama, W                 │  ║ │                                  │║
║│Alaska 2                   │  ║ │ Check the "Coords" units (under  │║
║│Alaska 3                   │  ║ │ "Units and display") before      │║
║│Alaska 4                   │  ║ │ deleting, creating or editing    │║
║│Alaska 5                   │  ║ │ coordinate systems, datums and/or│║
║│Alaska 6                   │  ║ │ zones (under "Coordinate systems")║
║│Alaska 7                   │  ║ │ Any changes you make will be     │║
║│Alaska 8                   │  ║ │ reflected in the ASCOORD.DAT file.║
║│Alaska 9                   │  ║ │ You can then load this file into │║
║│Alaska 10                  │  ║ │ your datalogger using PFINDER.   │║
║│Arizona, E                 │  ║ │                                  │║
║│Arizona, Cent              │  ║ │ Special keys                     │║
║│Arizona, W                 │  ║ │ ───────────                      │║
║│Arkansas, N                │  ║ │ Home: Move to the top of the screen║
║│Arkansas, S                │  ║ │ End:  Move to the end of the screen║
║│California 1               │  ║ │ PgUp: Move to the previous page  │║
║│California 2               │  ║ │ PgDn: Move to the next page      │║
║│California 3               │  ║ │ Esc:  CLEAR - Cancel current screen║
║│California 4               │  ║ │ F6:   OK   - Accept current screen║
║│California 5              ↓│  ║ │                                  │║
║└───────────────────────────┘  ║ └──────────────────────────────────┘║
║F1CreateF2 Edit F3 Del  F4      F5    F6 OK ═══════════════════════════╝
```

For each unwanted zone, highlight that zone and press **DEL** . The ASSETED
program asks you to confirm your intentions. Press **YES** to delete the
unwanted zone. Continue to delete all of the other unwanted zones by
repeating the above procedure. When only the zones you require remain,
press (Esc) to return to the menu of coordinate systems.

Creating New Zones

Whenever you create a new coordinate system and select it, or whenever you
are looking at the menu of zones for a coordinate system, you can press
CREATE to create a new zone for that coordinate system.

```
┌──── Asset Surveyor ════════════╗┌────────────────────────────────┐
│         Create zone            ║│  INFORMATION SCREEN FOR ASSETED │
│Name:                US SPCS NAD-83│                              │
│Projn:                       ?  ║│ Check the "Coords" units (under│
│                                ║│ "Units and display") before    │
│                                ║│ deleting, creating or editing   │
│                                ║│ coordinate systems, datums and/or│
│                                ║│ zones (under "Coordinate systems").│
│                                ║│ Any changes you make will be    │
│                                ║│ reflected in the ASCOORD.DAT file.│
│                                ║│ You can then load this file into │
│                                ║│ your datalogger using PFINDER.  │
│                                ║│                                 │
│                                ║│ Special keys                    │
│                                ║│ ------------                    │
│                                ║│ Home: Move to the top of the screen│
│                                ║│ End:  Move to the end of the screen│
│                                ║│ PgUp: Move to the previous page │
│                                ║│ PgDn: Move to the next page     │
│                                ║│ Esc:  CLEAR - Cancel current screen│
│                                ║│ F6:   OK   - Accept current screen│
│                                ║│                                 │
│                                ║│                                 │
│F1      F2      F3      F4      F5║│ F6 OK ══════════════════════════│
└────────────────────────────────┘└────────────────────────────────┘
```

The 'Create zone' form requires you to name the zone and select the type of map projection to use for the zone. Then, depending on the projection selected, you may be required to enter a number of parameters defining that projection.

Asset Surveyor supports the following types of map projections:

- *None*
- *Transverse Mercator*
- *1-Parallel Lambert*
- *New Zealand Map*
- *Planar*
- *Spherical Mercator*
- *2-Parallel Lambert*

Once you have named the new zone and selected a projection type, entry of the zone's other fields proceeds as described in the following sections, one for each projection type.

✉ **Note -** The order and units for these fields depend on the settings in the 'Units and display' configuration form.

None Projection

For a 'None' projection, there are no further parameters:

```
┌──────── Asset Surveyor ═════╗║══════════════════════════╗
│            Create zone      ║║  INFORMATION SCREEN FOR ASSETED │
│ Name:                NewZone ║║                          │
│ Proj n↔             None     ║║ Check the "Coords" units (under │
│                              ║║ "Units and display") before │
│                              ║║ deleting, creating or editing │
│                              ║║ coordinate systems, datums and/or │
│                              ║║ zones (under "Coordinate systems"). │
│                              ║║ Any changes you make will be │
│                              ║║ reflected in the ASCOORD.DAT file. │
│                              ║║ You can then load this file into │
│                              ║║ your datalogger using PFINDER. │
│                              ║║                          │
│                              ║║ Special keys             │
│                              ║║ ───────────              │
│                              ║║ Home: Move to the top of the screen │
│                              ║║ End:  Move to the end of the screen │
│                              ║║ PgUp: Move to the previous page │
│                              ║║ PgDn: Move to the next page │
│                              ║║ Esc:  CLEAR - Cancel current screen │
│                              ║║ F6:   OK    - Accept current screen │
│                              ║║                          │
│F1      F2      F3      F4      F5  ║║F6 OK ════════════════════╝
```

Just press **OK** to save the new zone and return to the menu of zones for this coordinate system, to which the new zone will have been added.

If a zone defined on a 'None' projection is selected, Asset Surveyor will display all positions as latitudes and longitudes on the datum associated with that coordinate system. This is essentially the same as selecting the 'Latitude/Longitude' coordinate system and choosing the appropriate datum, but has the advantage that you can insert a zone with the 'None' projection into any coordinate system, and give it a specific name.

Planar Projection

A 'Planar' map projection provides a very simple way to compute inexact North and East coordinates where the coefficients of the official map projection for the area are not known. The 'Planar' projection defines an origin point, whose latitude, longitude, north and east are known. When given the latitude and longitude of a point of interest, it computes the distance and bearing from that point to the origin, using only latitudes and longitudes. It then applies this distance and bearing to the north and east coordinates of the origin to obtain north and east coordinates for the point of interest. These are then scaled and optionally rotated around the origin to yield the final north and east coordinates of the point.

✉   **Note -** A 'Planar' map projection takes no account of the earth's
     curvature, and should therefore only be applied to points which are
     relatively near the origin.

The fields required to fully define a zone using a 'Planar' map projection are
the following:

```
 ══ Asset Surveyor ══
       Create zone                   ║  INFORMATION SCREEN FOR ASSETED
  Name:                  NewZone      ║
  Projn:                  Planar      ║  Check the "Coords" units (under
  Scale:          1.000000000000      ║  "Units and display") before
  Origin                              ║  deleting, creating or editing
   North:             0.000000m       ║  coordinate systems, datums and/or
   East:              0.000000m       ║  zones (under "Coordinate systems").
   Lat:        0°00'00.000000"N       ║  Any changes you make will be
   Lon:        0°00'00.000000"E       ║  reflected in the ASCOORD.DAT file.
  Rotation:     0°00'00.000000"       ║  You can then load this file into
                                      ║  your datalogger using PFINDER.
                                      ║
                                      ║  Special keys
                                      ║  ────────────
                                      ║
                                      ║  Home: Move to the top of the screen
                                      ║  End:  Move to the end of the screen
                                      ║  PgUp: Move to the previous page
                                      ║  PgDn: Move to the next page
                                      ║  Esc:  CLEAR - Cancel current screen
                                      ║  F6:   OK   - Accept current screen
                                      ║
 F1      F2      F3      F4      F5    ║ F6 OK ═══════════════════════════
```

Once you have entered values for each of the fields in this form, press **OK**
to save the newly defined zone and return to the menu of zones for this
coordinate system, to which the new zone will have been added.

Transverse Mercator Projection

The 'Transverse Mercator' projection type provides a full Mercator map
projection from a local datum to the map plane. This type of projection is
widely used for intrastate maps. Country-wide maps are more likely to use
the Universal Transverse Mercator (UTM) projection.

The Transverse Mercator projection works best close to the equator, and
becomes greatly distorted near to the poles.

> $\boxtimes$ **Note -** To avoid computational problems, Asset Surveyor insists that the origin latitude be at least 2° from either pole.

Figure C-1   The Transverse Mercator Projection

The fields required to fully define a zone using a 'Transverse Mercator' map projection are the following:

```
╔═══════ Asset Surveyor ═══════╗╔═════════════════════════════╗
║           Create zone        ║║ INFORMATION SCREEN FOR ASSETED║
║ Name:                NewZone ║║                             ║
║ Projn:     Transverse Mercator║║ Check the "Coords" units (under║
║ Scale:        1.000000000000 ║║ "Units and display") before  ║
║ Origin                       ║║ deleting, creating or editing ║
║  North:           0.000000m  ║║ coordinate systems, datums and/or║
║  East:            0.000000m  ║║ zones (under "Coordinate systems").║
║  Lat:       0°00'00.000000"N ║║ Any changes you make will be  ║
║  CM:        0°00'00.000000"E ║║ reflected in the ASCOORD.DAT file.║
║                              ║║ You can then load this file into║
║                              ║║ your datalogger using PFINDER.║
║                              ║║                             ║
║                              ║║ Special keys                ║
║                              ║║ ────────────                ║
║                              ║║                             ║
║                              ║║ Home: Move to the top of the screen║
║                              ║║ End:  Move to the end of the screen║
║                              ║║ PgUp: Move to the previous page║
║                              ║║ PgDn: Move to the next page  ║
║                              ║║ Esc:  CLEAR - Cancel current screen║
║                              ║║ F6:   OK   - Accept current screen║
║                              ║║                             ║
║                              ║║                             ║
║ F1      F2      F3      F4      F5  ║║ F6 OK ═══════════════════════╝
```

After entering the 'Scale' factor, enter the location of the origin as 'North' and 'East'. Finally, enter the 'Latitude' of the origin and the longitude of the transformation's central meridian ('CM'). Press **OK** to save the new zone and return to the menu of zones for the current coordinate system, to which the new zone will have been added.

Spherical Mercator Projection

The 'Spherical Mercator' projection type provides a simplified Mercator projection from a sphere to a plane. This formula assumes that the earth is spherical, rather than ellipsoidal, and makes no allowance for the earth's equatorial bulge.

The fields required to fully define a zone using a 'Spherical Mercator' map projection are the following:

```
┌─────────── Asset Surveyor ═══════╗╔═══════════════════════════════╗
│             Create zone          ║║    INFORMATION SCREEN FOR ASSETED │
│ Name:                   NewZone  ║║                               │
│ Projn:        Spherical Mercator ║║ Check the "Coords" units (under│
│ Scale:         1.000000000000    ║║ "Units and display") before   │
│ Origin                           ║║ deleting, creating or editing  │
│ North:              0.000000m    ║║ coordinate systems, datums and/or│
│ East:               0.000000m    ║║ zones (under "Coordinate systems").│
│                                  ║║ Any changes you make will be   │
│                                  ║║ reflected in the ASCOORD.DAT file.│
│                                  ║║ You can then load this file into│
│                                  ║║ your datalogger using PFINDER. │
│                                  ║║                               │
│                                  ║║ Special keys                  │
│                                  ║║ ────────────                  │
│                                  ║║ Home: Move to the top of the screen│
│                                  ║║ End:  Move to the end of the screen│
│                                  ║║ PgUp: Move to the previous page│
│                                  ║║ PgDn: Move to the next page    │
│                                  ║║ Esc:  CLEAR - Cancel current screen│
│                                  ║║ F6:   OK    - Accept current screen│
│                                  ║║                               │
│                                  ║║                               │
│ F1      F2      F3      F4    F5 ║║ F6 OK ═══════════════════════ │
```

After entering the 'Scale' factor, and the location of the origin as 'North' and 'East', press **OK** to save the new zone and return to the menu of zones for the current coordinate system, to which the new zone will have been added.

1-Parallel Lambert Projection

There are two 'Lambert Conformal' map projections, called the 1- and 2-Parallel Lambert projections. Both of these projections map the surface of an ellipsoid to a conic surface; the difference between the two projections is that with the 1-Parallel projection the conic surface is tangential to the earth's surface, while with the 2-Parallel projection the conic surface actually slices through the earth.

Figure C-2   The 1-Parallel Lambert Projection

The Lambert map projections are most appropriate for use near the poles, and become greatly distorted near the equator.

✉   **Note -** To avoid computational problems, Asset Surveyor ensures that neither parallel is closer than 10° to the equator, and that (in the 2-Parallel case) the parallels are not coincident.

The fields which describe a 1-Parallel Lambert projection are as follows:

```
╔════════ Asset Surveyor ═══════╗╔═══════════════════════════╗
║          Create zone          ║║  INFORMATION SCREEN FOR ASSETED ║
║ Name:                 NewZone ║║                            ║
║ Projn:      1 Parallel Lambert║║ Check the "Coords" units (under ║
║ Scale:         1.000000000000 ║║ "Units and display") before ║
║ Origin                        ║║ deleting, creating or editing ║
║  North:             0.000000m ║║ coordinate systems, datums and/or ║
║  East:              0.000000m ║║ zones (under "Coordinate systems"). ║
║ Parallel:     0°00'00.000000"N║║ Any changes you make will be ║
║ Lon:          0°00'00.000000"E║║ reflected in the ASCOORD.DAT file. ║
║                               ║║ You can then load this file into ║
║                               ║║ your datalogger using PFINDER. ║
║                               ║║                            ║
║                               ║║ Special keys                ║
║                               ║║ ───────────                 ║
║                               ║║ Home: Move to the top of the screen ║
║                               ║║ End:  Move to the end of the screen ║
║                               ║║ PgUp: Move to the previous page ║
║                               ║║ PgDn: Move to the next page ║
║                               ║║ Esc:  CLEAR - Cancel current screen ║
║                               ║║ F6:   OK   - Accept current screen ║
║                               ║║                            ║
╚F1      F2      F3      F4      F5 ══╝╚F6 OK ══════════════════╝
```

Enter the 'Scale' factor and the 'North' and 'East' of the origin point.
Finally, enter the standard parallel (latitude) and the longitude of the origin.
Press **OK** to save the newly defined zone and return to the menu of zones
for the current coordinate system, to which the new zone will have been
added.

2-Parallel Lambert Projection

The second of the two 'Lambert Conformal' map projections is called the 2-
Parallel Lambert projection. It is similar in many ways to the 1-Parallel
Lambert projection (see above for details).

The fields which describe a 2-Parallel Lambert projection are as follows:

```
╔═══════════ Asset Surveyor ═══════════╗
║              Create zone             ║   INFORMATION SCREEN FOR ASSETED
║ Name:                       NewZone  ║
║ Projn:             2 Parallel Lambert ║  Check the "Coords" units (under
║ Scale:              1.000000000000   ║  "Units and display") before
║ Origin                               ║  deleting, creating or editing
║  North:                   0.000000m  ║  coordinate systems, datums and/or
║  East:                    0.000000m  ║  zones (under "Coordinate systems").
║  Lat:              0°00'00.000000"N  ║  Any changes you make will be
║  Lon:              0°00'00.000000"E  ║  reflected in the ASCOORD.DAT file.
║ Parallel                             ║  You can then load this file into
║  1st:              0°00'00.000000"N  ║  your datalogger using PFINDER.
║  2nd:              0°00'00.000000"N  ║
║                                      ║  Special keys
║                                      ║  ────────────
║                                      ║  Home: Move to the top of the screen
║                                      ║  End:  Move to the end of the screen
║                                      ║  PgUp: Move to the previous page
║                                      ║  PgDn: Move to the next page
║                                      ║  Esc:  CLEAR – Cancel current screen
║                                      ║  F6:   OK    – Accept current screen
║                                      ║
║                                      ║
║ F1      F2      F3      F4      F5    ║ F6 OK
╚══════════════════════════════════════╝
```

Enter the 'Scale' factor, then the 'North', 'East', 'Latitude' and 'Longitude'
of the origin point. Finally, enter the two parallels (as latitudes) and press
OK to save the newly defined zone and return to the menu of zones for the
current coordinate system, to which the new zone will have been added.

New Zealand Map Grid

The New Zealand Map Grid is a custom map projection designed to closely
model the geometry of the North and South islands of New Zealand.

For the 'New Zealand Map Grid' projection, no further fields need to be
entered:

```
            ══ Asset Surveyor ══
               Create zone                    INFORMATION SCREEN FOR ASSETED
 Name:                      NewZone
 Projn⁺                 New Zealand Map     Check the "Coords" units (under
                                            "Units and display") before
                                            deleting, creating or editing
                                            coordinate systems, datums and/or
                                            zones (under "Coordinate systems").
                                            Any changes you make will be
                                            reflected in the ASCOORD.DAT file.
                                            You can then load this file into
                                            your datalogger using PFINDER.

                                            Special keys
                                            ────────────
                                            Home: Move to the top of the screen
                                            End:  Move to the end of the screen
                                            PgUp: Move to the previous page
                                            PgDn: Move to the next page
                                            Esc:  CLEAR - Cancel current screen
                                            F6:   OK   - Accept current screen


 F1      F2      F3      F4      F5       F6 OK ═══════════════════════════════
```

Just press **OK** to save the new zone and return to the menu of zones for this coordinate system, to which the new zone will have been added.

Editing Zones

Whenever you are browsing through a menu of zones for a particular coordinate system, you can highlight a zone and press **EDIT** to view the definition of the zone and optionally edit it. ASSETED display the 'Edit zone' form, showing each of the fields for the zone and permitting you to change one or more of them. For example:

```
┌───── Asset Surveyor ═══════════╗╔════════════════════════════════╗
│          Edit zone            ║║ INFORMATION SCREEN FOR ASSETED  ║
│ Name:                  Alabama, E ║║                                ║
│ Projn:       Transverse Mercator  ║║ Check the "Coords" units (under ║
│ Scale:          0.999960000000    ║║ "Units and display") before    ║
│ Origin                        ║║ deleting, creating or editing   ║
│  North:            0.000000m  ║║ coordinate systems, datums and/or║
│  East:        200000.000000m  ║║ zones (under "Coordinate systems").║
│  Lat:      30°30'00.000000"N  ║║ Any changes you make will be    ║
│  CM:       85°50'00.000000"W  ║║ reflected in the ASCOORD.DAT file.║
│                               ║║ You can then load this file into ║
│                               ║║ your datalogger using PFINDER.   ║
│                               ║║                                ║
│                               ║║ Special keys                    ║
│                               ║║ ------------                     ║
│                               ║║ Home: Move to the top of the screen║
│                               ║║ End:  Move to the end of the screen║
│                               ║║ PgUp: Move to the previous page  ║
│                               ║║ PgDn: Move to the next page      ║
│                               ║║ Esc:  CLEAR - Cancel current screen║
│                               ║║ F6:   OK   - Accept current screen ║
│                               ║║                                ║
└F1     F2      F3     F4     F5 ╨╙ F6 OK ═════════════════════════╝
```

You can change any or all of the fields for a zone, including its name and
projection type. If you change one or more fields, press **OK** to save these
changes and return to the menu of zones.

If you are just viewing a zone's definition, press (Esc) to return to the menu
of zones (and to ensure that any changes made by accident will not be
saved).

💣 **Caution -** You should not change the values of pre-defined zones.

C.5.6 Customizing Datums

Deleting Unwanted Datums

After deleting unwanted coordinate systems and zones, you may also wish to delete unwanted datums to reduce the size of the ASCOORD.DAT file and avoid confusion when selecting a datum on the MC-V.

As an example, presume that you require no datums other than NAD-83. You can delete all other datums from the ASCOORD.DAT file (apart from the WGS-84 datum, which cannot be deleted) as follows:

Press the DATUM soft key on the menu of coordinate systems. The menu of datums will appear:

```
┌══════════ Asset Surveyor ═══════════┐
│          ─Select datum─              │  ┌─────────────────────────────┐
│ WGS 1984                             │  │ INFORMATION SCREEN FOR ASSETED│
│ NAD-83                               │  │                             │
│ NAD-27                               │  │ Check the "Coords" units (under│
│ OSGB (Airey 1936)                    │  │ "Units and display") before │
│ NZGD 1949                            │  │ deleting, creating or editing│
│ Australia                            │  │ coordinate systems, datums and/or│
│ Zones Françaises                     │  │ zones (under "Coordinate systems").│
│ Adindan                              │  │ Any changes you make will be│
│ Alaska/Canada                        │  │ reflected in the ASCOORD.DAT file.│
│ ARC 1950                             │  │ You can then load this file into│
│ Bukit Rimpah                         │  │ your datalogger using PFINDER.│
│ CampArea Astro                       │  │                             │
│ CampoInchauspe                       │  │ Special keys                │
│ Chua Astro                           │  │ ────────────                │
│ Corrego Alegre                       │  │                             │
│ Djakarta                             │  │ Home: Move to the top of the screen│
│ European 1950                        │  │ End:  Move to the end of the screen│
│ Ghana                                │  │ PgUp: Move to the previous page│
│ Guam 1963                            │  │ PgDn: Move to the next page │
│ Gunung Segara                        │  │ Esc:  CLEAR - Cancel current screen│
│ G. Serindung                         │  │ F6:   OK   - Accept current screen│
│                                      │  │                             │
├─F1CreateF2 Edit F3 Del  F4      F5───┤  │ F6 OK                       │
```

Highlight the first unwanted datum (NAD-27) and press DEL. ASSETED will ask you to confirm your intention. Press YES to delete the unwanted datum. Continue to delete all of the other unwanted datums by repeating the above procedure.

⊠   **Note -** ASSETED will not allow you to delete a datum which is
     currently referenced by one or more coordinate systems. You must
     first delete these coordinate systems before you will be permitted to
     delete the datum. Because Asset Surveyor's 'Latitude/Longitude'
     coordinate system, which cannot itself be deleted, uses the WGS-84
     datum, you will never be able to delete 'WGS-84' from the list of
     datums.

When only the datums you require remain, press (Esc) to return to the menu
of coordinate systems.

Creating New Datums

The supplied ASCOORD.DAT file contains most common datum definitions
and most of the coordinate systems commonly used in the North America,
Western Europe and Australasia. If you work outside of these areas, or if
you use a special-purpose local coordinate system, you may need to define
one or more coordinate systems or datums yourself.

A datum is defined by describing a datum transformation from the WGS-84
datum used by GPS to the desired datum. Asset Surveyor supports three
formulae for datum transformations:

- *None*. This is used simply to describe the WGS-84 datum itself. It
  represents no transformation at all.

- *7-Parameter*. This is a full datum transformation, consisting of a three
  dimensional translation, a three dimensional rotation and the application
  of a scale factor.

- *Molodensky*. This is an approximation to a full 7-parameter datum
  transformation which employs a scale factor of zero and performs no
  rotations. Molodensky transformations ignore height differences
  between datums.

☆   **Tip -** Sometimes datum transformations are described as having only
     three parameters (the translation in three dimensions). If you have
     figures for such a transformation, choose a 7-parameter transformation
     as your formula and then leave the other parameters null or 0.

☆ **Tip -** Your choice of datum formula will be influenced by the formula used by your GIS, or by the maps which you are referring to. If you have the choice of a 7-parameter datum transformation and a Molodensky transformation, you should always choose the 7-parameter transformation. The Molodensky transformation was originally developed to reduce the number and complexity of manual computation steps needed to perform approximate datum transformations. With the advent of computers, it is preferable to use the more accurate 7-parameter transformation whenever possible.

If you change the 'Formula' field, ASSETED will display the appropriate fields for the chosen formula. If the chosen formula is 'None', there will be only 'Name' and 'Formula' fields, as the null transformation requires no further description. The following two sections describe the further steps in creating a datum using the 7-parameter formula and the Molodensky formula.

Creating a Molodensky Datum

When you specify the Molodensky formula, the 'Create datum' form will expand to include the following fields:

```
┌──────── Asset Surveyor ════════════╥─────────────────────────────┐
│          Create datum              ║   INFORMATION SCREEN FOR ASSETED │
│ Name:                          ?   ║                             │
│ Formula:              Molodensky   ║ Check the "Coords" units (under │
│ Radius:             6378137.0000m  ║ "Units and display") before │
│ (1/f):              298.2572235630 ║ deleting, creating or editing │
│ Origin                             ║ coordinate systems, datums and/or │
│  X:                   0.000000m    ║ zones (under "Coordinate systems"). │
│  Y:                   0.000000m    ║ Any changes you make will be │
│  Z:                   0.000000m    ║ reflected in the ASCOORD.DAT file. │
│                                    ║ You can then load this file into │
│                                    ║ your datalogger using PFINDER. │
│                                    ║                             │
│                                    ║ Special keys                │
│                                    ║ ────────────                │
│                                    ║ Home: Move to the top of the screen │
│                                    ║ End:  Move to the end of the screen │
│                                    ║ PgUp: Move to the previous page │
│                                    ║ PgDn: Move to the next page │
│                                    ║ Esc:  CLEAR - Cancel current screen │
│                                    ║ F6:   OK   - Accept current screen │
│                                    ║                             │
│ F1     F2     F3     F4     F5     ║ F6 OK                       │
└────────────────────────────────────╨─────────────────────────────┘
```

The fields of this form are as follows:

- The 'Radius' you should enter is the radius of the ellipsoid which you are defining, in meters. The default value is the radius for the GRS-80 ellipsoid (which is used by both the WGS-84 and NAD-83 datums).

- The '(1/f)' field is where you specify the *flattening* of the ellipsoid which you are defining. This is a measure of the eccentricity of the ellipsoid (in relation to a perfect sphere). Because the earth is very nearly spherical, this flattening figure is quite small, and is therefore entered as the reciprocal of the true value. This flattening is a coefficient, rather than a measured value, and hence it has no associated units. The default flattening value applies to the GRS-80 ellipsoid (and hence to the WGS-84 and NAD-83 datums).

- The 'X', 'Y' and 'Z' coordinates of the 'Origin' define a transformation in 3D space from the origin of the WGS-84 datum to the origin of the datum which you are defining. These values will be displayed in meters, but can be entered in any other convenient distance units.

After entering the radius, flattening and origin of the Molodensky datum, press **OK** to save the datum and return to the menu of available datums, to which this new datum will have been added.

Creating a 7-Parameter Datum

When you specify the 7-parameter formula, the 'Create datum' form will expand to include the following fields:

```
══════════ Asset Surveyor ═══════════
          Create datum                     ║  INFORMATION SCREEN FOR ASSETED
Name:                             ?         ║
Formula:                7 Parameter         ║ Check the "Coords" units (under
Radius:              6378137.0000m          ║ "Units and display") before
(1/f):               298.2572235630         ║ deleting, creating or editing
Origin                                      ║ coordinate systems, datums and/or
  X:                     0.000000m          ║ zones (under "Coordinate systems").
  Y:                     0.000000m          ║ Any changes you make will be
  Z:                     0.000000m          ║ reflected in the ASCOORD.DAT file.
Rotation                                    ║ You can then load this file into
  X:              0°00'00.000000"           ║ your datalogger using PFINDER.
  Y:              0°00'00.000000"           ║
  Z:              0°00'00.000000"           ║ Special keys
Scale(ppm):            0.00000000           ║ ------------
                                            ║ Home: Move to the top of the screen
                                            ║ End:  Move to the end of the screen
                                            ║ PgUp: Move to the previous page
                                            ║ PgDn: Move to the next page
                                            ║ Esc:  CLEAR - Cancel current screen
                                            ║ F6:   OK   - Accept current screen
                                            ║
                                            ║
F1     F2     F3     F4     F5       ║ F6 OK ═══════════════════
```

The first eight fields of this form are identical to those for a Molodensky datum (although they may be treated slightly differently). Refer to the previous section for instructions on the entry of values for these fields.

After entering the radius, flattening and origin of the datum, you could press `OK` to save the datum. A datum transformation which defines no rotation or scale factor parameters is known as a 3-parameter datum transformation. If the datum you are defining does have rotation and scale factor parameters (i.e. it is a full 7-parameter datum), you should proceed to enter these before pressing `OK`.

The remaining fields are as follows:

- The angles of 'Rotation' along the X, Y and Z axes. These are the angles through which the Cartesian axes of the GRS-80 ellipsoid must be rotated to align it to the axes of the local ellipsoid being defined. ASSETED will check that the angles do not exceed 1° in any direction, but typically they will be far smaller than that (a few seconds at most).

✉ **Note -** The angle of rotation is positive for a counter-clockwise rotation about each axis, viewed from the positive end of the axis.

- The 'Scale factor' in parts per million. ASSETED verifies that the scale factor is between plus and minus 1000 parts per million, but usually this value will be between plus and minus 10 parts per million.

💣 **Caution -** Any error in the supplied scale factor will cause significant (but plausible) errors in the coordinates transformed to the new datum. Be very careful to ensure that the scale factor is entered as a parts-per-million value, and that it is correct.

Once you have entered each of the values defining your new datum, and have checked the values you have entered, press `OK` to save the new datum and return to the menu of datums, to which this new datum will have been added.

Editing a Datum

You can view the definition for a datum, and optionally edit any of its fields, by highlighting that datum in the menu of available datums and pressing

EDIT. ASSETED will display the 'Edit datum' form, showing the fields for the datum and permitting you to change one or more of them. For example:

```
╔══════════════ Asset Surveyor ══════════════╗
║               Edit datum      ║ INFORMATION SCREEN FOR ASSETED   ║
║  Name:                NAD-27  ║                                  ║
║  Formula:         7 Parameter ║ Check the "Coords" units (under  ║
║  Radius:         6378206.4000m║ "Units and display") before     ║
║  (1/f):          294.9786986000║ deleting, creating or editing   ║
║  Origin                       ║ coordinate systems, datums and/or║
║   X:                4.000000m ║ zones (under "Coordinate systems").║
║   Y:             -166.000000m ║ Any changes you make will be     ║
║   Z:             -183.000000m ║ reflected in the ASCOORD.DAT file.║
║  Rotation                     ║ You can then load this file into ║
║   X:           0°00'00.257000"║ your datalogger using PFINDER.   ║
║   Y:          -0°00'00.341000"║                                  ║
║   Z:           0°00'00.088000"║ Special keys                     ║
║  Scale(ppm):       -0.37230000║ ------------                     ║
║                               ║ Home: Move to the top of the screen║
║                               ║ End:  Move to the end of the screen║
║                               ║ PgUp: Move to the previous page   ║
║                               ║ PgDn: Move to the next page       ║
║                               ║ Esc:  CLEAR - Cancel current screen║
║                               ║ F6:   OK   - Accept current screen║
║                               ║                                  ║
║                               ║                                  ║
║F1      F2      F3      F4      F5 ║ F6 OK ══════════════════════════╝
```

💣 **Caution -** You should not need to change the values of pre-defined datums.

C.5.7 Loading ASCOORD.DAT onto the MC-V

Once you have configured the coordinate systems appropriate to your application requirements, you can use PFINDER to load the ASCOORD.DAT file onto your datalogger(s), as described in Chapter 7 of this manual.

C.6 ASTOSSF

Whenever you transfer an Asset Surveyor data file from your MC-V to PFINDER, the data file is converted to Trimble's *SSF* format. The file transfer operation actually takes place in two stages:

- The physical transfer of the Asset Surveyor data file across the RS232 link to the PC.

- The conversion from the Asset Surveyor software's raw file format to SSF format.

The conversion operation takes the raw Asset Surveyor file (with no extension) on the PC and produces a new file (with an '.SSF' extension), also on the PC.

For example, a data file named 'R102812A' on the MC-V is transferred to the PC and stored as a raw file called 'R102812A.' (no extension) on the PC. It is then converted to SSF format and stored as 'R102812A.SSF'.

If, due to some procedural error or problem with your PC, you manage to lose the SSF file, you should re-transfer the data file from your MC-V to your PC. If you have deleted the data file from your MC-V, but you have retained the raw data file on your PC, then you can reconvert it to SSF format using the ASTOSSF utility which is distributed with PFINDER.

C.6.1 Operation

If you have installed PFINDER correctly, you should be able to run ASTOSSF anywhere on your PC.

1. **Change to the directory in which the raw Asset Surveyor data file is stored.**

2. **Type the following command:**

   ASTOSSF *RawFileName*

   where *RawFileName* is the name of the raw Asset Surveyor data file. The ASTOSSF program will create a file with the same base name but with a '.SSF' extension.

Provided the raw data file has not itself become damaged, the ASTOSSF program will pass through the file, converting it to SSF format. While running, ASTOSSF indicates how much of the raw data file it has converted so far:

```
C:\PFINDER\DATA\TEST>  ASTOSSF R102812a
AStoSSF Ver 3.00
Copyright (c) Trimble Navigation Ltd, 1993-1995. All rights reserved
Conversion from Asset Surveyor raw file to SSF file
-------------------------------------------------

22% Converted.
```

When ASTOSSF has converted the entire raw data file to SSF format, it displays the following message and exits:

```
C:\PFINDER\DATA\TEST>  ASTOSSF R102812a
AStoSSF Ver 3.00
Copyright (c) Trimble Navigation Ltd, 1993-1995. All rights reserved
Conversion from Asset Surveyor raw file to SSF file
-------------------------------------------------

100% Completed.
C:\PFINDER\DATA\TEST>
```

Appendix D Asset Surveyor Limits

While the Asset Surveyor system is extremely flexible, it does operate within certain limits, imposed either by the computer on which it runs, or by its internal architecture. Most of these limits will not normally restrict your operation of the system. Even if your application stretches Asset Surveyor's capabilities to the limit, you can generally configure your Asset Surveyor system or your Data Dictionaries in such a way that you can avoid any operational restrictions.

Maximum Features per Data Dictionary

Each data dictionary can define up to 254 types of geographic feature.

Maximum Attributes per Feature

Each feature can have up to 254 attributes.

Maximum Values per Menu Attribute

Each menu attribute can have up to 254 values, not counting the optional *null* value.

A data dictionary defined by PFINDER can have a maximum of 300 entries in total, where an entry is a feature, an attribute or a menu attribute's value. Depending on your PC's memory configuration, the practical limit may be lower than 300 entries; see the PFINDER release notes for details.

Numeric Attribute Values

The magnitude of numbers which can be entered as attribute values can not exceed ±999,999,999,999,999. All numeric attributes actually impose a range of permitted values which may be more restrictive than this maximum range.

Character String Attribute Values

The maximum length of a character string attribute value is 100 characters. All character string attributes actually impose a limit on the length of that attribute value which may be shorter than the maximum length.

Length of Notes

A note entered in the Asset Surveyor software can be at most 80 characters long.

Data Storage Space

The MC-Vs distributed by Trimble have either a 1MB or 2MB RAM pack, the vast majority of which is available for data storage. A small amount of this RAM pack may be used by Asset Surveyor to store waypoints, data dictionaries, language files and coordinate system files, but typically 95% of this RAM drive is available for storage of data files.

> **Note -** When the MC-V's memory becomes completely full, Asset Surveyor will display a 'File error' message and wait for you to press a key. It will then reboot the MC-V to ensure that the Asset Surveyor software restarts cleanly. You should transfer your data file(s) to your office PC and delete them from your MC-V before using Asset Surveyor for further data collection.

Maximum Data Files

Apart from the restriction imposed by the finite data storage capacity of the MC-V, the MC-V's operating system permits a maximum of 62 data files at any one time.

Maximum Data Dictionaries

Apart from the restriction imposed by the finite data storage capacity of the MC-V, the MC-V's operating system permits a maximum of 124 data dictionaries at any one time.

*Each data file on the **MC-V** actually consists of two physical files. Each data dictionary consists of only one physical file. There is a limit of 124 physical file entries in the **MC-V**'s memory. This limited number of file entries must be shared between data files (two entries per data file) and data dictionaries (one entry per data dictionary).*

Maximum Waypoints

The Asset Surveyor software permits a theoretical maximum of 32767 waypoints to be defined at any time. In practice, Asset Surveyor's 'Waypoint manager' will begin to operate more slowly as you add more waypoints to its list. Operation of the 'Waypoint manager' with up to 1000 waypoints is typically quite acceptable. You should generally try to delete unused waypoints to keep the list to a manageable size.

You can transfer a maximum of 999 waypoints to or from PFINDER's waypoint manager in a single operation.

Maximum ESP External Sensors

The MC-V has two serial ports, but as one of these is used for connection to your GPS receiver, you can have at most one external sensor connected at a time. If you connect the optional barcode wand to the 'COM2:' port, then you cannot also connect an external sensor.

Maximum Coordinate Systems

There can be at most 32767 coordinate systems defined, including the two built-in coordinate systems ('Latitude/Longitude' and 'UTM').

Maximum Zones per Coordinate System

There can be at most 32767 zones for each coordinate system.

Maximum Datums

There can be at most 32767 datums defined.

The total number of coordinate systems, zones and datums cannot exceed 65535.

Maximum Language Files

The theoretical maximum number of languages which Asset Surveyor could support at one time is 254.

Maximum Age for a Data File

You can capture data to a file for up to seven days after the file was created. After seven days, Asset Surveyor will not allow you to capture further data to the file (although you are allowed to review and edit it). This restriction is due to a technical limitation related to the way in which GPS times are stored. In order to maintain full accuracy of storage, it is necessary to limit the time-span of a data file to seven days. If Asset Surveyor displays the following message:

```
┌──── Sorry ────┐
│ Unable to append │
│to a file over one│
│   week old.   │
│                  │
│                  │
│                  │
└──────────────────┘
```

you should create a new data file and capture data to that.

Appendix E NMEA Output

NMEA output is available from some Trimble GPS receivers; this appendix describes the NMEA messages which are available from the Pro XL receiver.

All messages conform to the NMEA-0183 Version 2.0 format. All begin with $ and end with a carriage return and a line feed. Data fields follow comma (,) delimiters and are variable in length. Null fields still follow a comma (,) delimiter but contain no information.

The optional checksum field is the last field in a message and follows the asterisk (*) delimiter. The checksum is the 8-bit *exclusive* OR of all characters in the message, including the commas, between but not including the $ and asterisk delimiters. The hexadecimal result is converted to two ASCII characters (0-9, A-F). The most significant character appears first.

The supported messages include:

- ALM: GPS week number, SV health, and complete almanac data for one SV. One message per SV, up to a maximum of 32

- GGA: Time, position, and fix related data

- GLL: Position fix, time of position fix, and status

- GSA: GPS receiver operating mode, SVs used for navigation and DOP values

- GSV: Number of visible SVs, PRN numbers, elevation, azimuth and SNR values

- VTG: Actual track made good and speed over ground

- ZDA: UTC day, month, year, and local time zone offset

E.1   Common Message Elements

Each message consists of:

- A message ID consisting of *$GP* followed by the message type. For example, the message ID of the ALM message is *$GPALM*

- A comma

- A number of fields that depends on the message type, separated by commas

- An asterisk

- A checksum

Here is an example of a simple message with six fields plus the message ID and checksum:

```
$GPZDA,004405.25,30,09,1994,00,00*6B
```

E.1.1 Latitude and Longitude

Latitude is represented as *ddmm.mmmm* and longitude is represented as *dddmm.mmmm*, where*:*

- *dd* or *ddd* is degrees

- *mm.mmmm* is minutes and decimal fractions of minutes

E.1.2 Direction

Direction; north, south, east, or west; is represented by a single character: *N*, *S*, *E*, or *W*.

E.1.3 Time

Time values are presented in Universal Time Coordinated (UTC) and are represented as *hhmmss*, where:

- *hh* is hours, from 00 to 23

- *mm* is minutes

- *ss* is seconds

E.2 Messages

When NMEA-0183 output is enabled, the following messages can be produced to aid integration with other sensors.

E.2.1   ALM: GPS Week, SV Health, & Almanac for One SV

```
$GPALM,1,1,21,768,00,5d94,08,08b7,fd4f,
a10d2e,747f49,57ab38,c0b629,ffa,000*43
```

The fields include:

- Total number of ALM messages for this cycle

- Message sequence number

- SV PRN number, 01 to 32

- GPS week number

- SV health status

- Eccentricity

- Almanac reference time

- Inclination angle

- Rate of right ascension

- Root of semimajor axis

- Argument of perigee

- Longitude of ascension node

- Mean anomaly

- a_{f0}, clock parameter

- a_{f1}, clock parameter

E.2.2 GGA: Time, Position, & Fix Related Data

```
$GPGGA,004407.00,3723.477595,N,12202.251222,
     W,2,07,1.2,19.1,M,-25.7,M,3,0003*55
```

The fields include:

- UTC of position fix

- Latitude

- Direction of latitude (N or S)

- Longitude

- Direction of longitude (E or W)

- GPS Quality indicator:

  - 0 = fix not valid

  - 1 = GPS fix

  - 2 = Differential GPS fix

- Number of SVs in use, 00 to 12

- HDOP

- Antenna height, MSL reference

- *M* is fixed text indicating that the unit of measure for altitude is meters

- Geoidal separation

- *M* is fixed text indicating that the unit of measure for geoidal separation is meters

- Age of differential GPS data record, Type 1 or Type 9, null when DGPS not used

- Differential reference station ID, 0000 to 1023, null when *any reference station ID* is selected and no corrections have been received

E.2.3 GLL: Position Fix, Time of Position Fix, & Status

`$GPGLL,3723.477595,N,12202.251222,W,004407.00,A*1E`

The fields include:

- Latitude

- Direction of latitude (N or S)

- Longitude

- Direction of longitude, (E or W)

- UTC of position

- Status: Fixed text A, indicates that data is valid

E.2.4 GSA: GPS Receiver Operating Mode, SVs used for Navigation, & DOP Values

`$GPGSA,A,3,25,15,01,14,29,21,20,,,,,,1.9,1.2,1.5*30`

The fields include:

- Fix Mode:
    - M = Manual, forced to operate in 2-D or 3-D
    - A = Automatic, 3-D/2-D

- Fix Status:
    - 1 = Fix not available
    - 2 = 2-D
    - 3 = 3-D

- Fields 3 to 14 = PRNs of SVs used in position fix (null for unused fields)

- Field 15 = PDOP

- Field 16 = HDOP

- Field 17 = VDOP

E.2.5 GSV: Number of Visible SVs, PRN Numbers, Elevation, Azimuth & SNR Values

```
$GPGSV,2,1,08,01,32,054,47,14,33,308,45,15,61,261,
                52,20,07,054,41*7F
```

The fields include:

- Total number of messages of this type in this cycle

- Message number

- Total number of visible satellites

- SV PRN number

- Elevation in degrees, 90º maximum

- Azimuth, degrees from true north, 000º to 359º

- SNR (C/N_0) 00 to 99 dB, null when not tracking

- 8 to 11 = Information about second SV, same format as fields 4 to 7

- 12 to 15 = Information about third SV, same format as fields 4 to 7

- 16 to 19 = Information about fourth SV, same format as fields 4 to 7

E.2.6 VTG: Actual Track Made Good & Speed Over Ground

```
$GPVTG,7.4,T,,,000.1,N,000.1,K*2E
```

The fields include:

- Track made good

- Fixed text *T* indicates that track made good is relative to true north

- Fields 3 and 4 are null, not used

- Speed over ground in knots

- Fixed text *N* indicates that speed over ground is in knots

- Speed over ground in kilometers/hour (km/h)

- Fixed text *K* indicates that speed over ground is in km/h

E.2.7 ZDA: UTC Day, Month, Year, & Local Time Zone Offset

```
$GPZDA,004405.25,30,09,1994,00,00*6B
```

The fields include:

- Time, in UTC
- Day, 01 to 31
- Month, 01 to 12
- Year
- Local time zone offset from GMT, 00 to ±13 hours
- Local time zone offset from GMT in minutes

Fields 5 and 6, together, yield the total offset. For example, if field 5 is -5 and field 6 is -15, local time is 5 hours and 15 minutes earlier than GMT.

Glossary

Almanac Information describing the orbit of each GPS satellite, including clock corrections and atmospheric delay parameters. An almanac is used by a GPS receiver to facilitate rapid satellite acquisition, and is also required by Trimble's Mission Planning software.

Alphanumeric Consisting of alphabetic and numeric characters.

Altitude (Alt) Altitudes are specified relative to either mean sea level (MSL) or an ellipsoid (HAE). Altitudes above an ellipsoid are distances from a precise mathematical model, whereas altitudes above Mean Sea Level are distances from a surface of gravitational equipotential which approximates the statistical average level of the sea.

Attribute A characteristic of a feature in a Geographic Information System (GIS). Each identifiable feature has attributes. One common attribute of all geographic features is its position. Other attributes depend on the type of feature, e.g. a road may have a name or designation number, pavement type, width, number of lanes, etc. Each attribute has a range of possible values called its *domain*.

Attribute value A particular value for an attribute of a feature, chosen from the domain of that attribute. For example, 'Pavement type' is an attribute, while 'Gravel' is an attribute value for the 'Pavement type' attribute.

Barcode wand An optical device for reading barcodes.

Base station Also called a GPS reference station. An antenna and GPS receiver set up on a known location specifically to collect data which will be used to differentially correct rover files. Trimble's GPS Pathfinder *Community Base Station* and *Universal Reference Station* Systems are examples of dedicated GPS base stations, while the Pathfinder Basic Plus, Pathfinder Professional, Pathfinder ProLite and Pathfinder Pro XL Systems can all be operated in base station mode. Most base stations just log data to post process against rover files, but some base stations can also output RTCM differential corrections in real time. A telemetry link can be used to transmit these real time corrections to rovers in the field.

Baud   A unit of data transfer speed used in digital communications. One baud generally equates to a transfer speed of one bit per second, for serial (RS232) communications.

Bearing   A direction from your current position to some other point of interest. Bearings are measured in degrees (360° in a full circle), clockwise from either true or magnetic north. See also *Heading*.

C/A code   Abbreviation for 'Coarse/Acquisition code'. This is the code modulated onto the GPS L1 signal. This code provides a sequence of 1023 1s and 0s arranged in a pseudo-random pattern, at a chip rate of 1.023 MHz, having a code repetition period of one millisecond. This code was selected to provide good acquisition properties. The C/A code is used exclusively my most mapping-grade GPS receivers. See also *P-code*.

Carrier   A radio wave having at least one characteristic (such as frequency, amplitude, phase) that can be varied from a known reference value by modulation.

Carrier phase   The difference between the carrier signal generated by the internal oscillator of the receiver and the carrier signal received from a satellite.

Central meridian   A zone constant used when defining a map projection. A meridian is an imaginary circle around the world that crosses both of the geographic poles. A particular meridian is defined by the angle it forms east or west of the meridian which runs through Greenwich, England, which has a value of 0°.

Circular Error Probability (CEP)

A statistical measure of precision defined as the 50th percentile value of the two-dimensional position error statistic. A CEP value determines the radius of a circle within which ½ of the GPS positions measured over a period of time will fall.

Constellation   1) A specific set of satellites used in calculating positions: 3 satellites for 2D fixes, 4 satellites or more for 3D fixes.

2) All of the satellites visible to a GPS receiver at one time. The optimum constellation is the constellation with the lowest PDOP.

Coordinate system

Any three-dimensional reference frame that can be used to describe the location of objects in space.

Cursor A movable point which identifies a specific position on a computer screen. Characters which you type on the keypad will be inserted at the cursor position.

Data capture The collection of attributes and position information for geographic features.

Data dictionary A description of the features and attributes relevant to a particular project or job. This description includes feature names, data type classification (point, line, area), attribute names, attribute types, and attribute values. After being created in PFINDER, a data dictionary can be transferred to a datalogger and used to control the capture of features and attributes.

Data file Captured feature and attribute data is stored in a data file, together with GPS and ESP (external sensor) data.

Datalogger Also called a data recorder. A hand-held, lightweight data entry computer. Dataloggers used by Trimble are the Omnidata Polycorder, the CMT MC-V and the Trimble TDC1 & TDC2.

Datum See *Geodetic Datum*.

Datum transformation
  See *Geodetic Datum* and *Transformation*.

Differential correction (DGPS)
  The process of correcting GPS positions recorded at an unknown location using data recorded simultaneously at a known location (by a GPS Base Station). A roving GPS receiver's location can be differentially corrected relative to a base station either in real time or by post processing.

Dilution of Precision (DOP)

An indicator of the quality of a GPS position which takes account of each satellite's location relative to the other satellites in the constellation and their geometry in relation to the GPS receiver. A low DOP value indicates a higher probability of accuracy.

Standard DOPs for GPS applications are:

PDOP Position (three coordinates).
HDOP Horizontal (two horizontal coordinates).
VDOP Vertical (height only).
TDOP Time (clock offset only).

Domain

The domain of a GIS attribute determines the set of possible values for that attribute. A domain can be a set of numbers, characters, or strings. For example the domain for the attribute 'Pavement type' may be the set of strings{'Gravel', 'Bitumen', 'Concrete'}.

DOP

See *Dilution of Precision*.

Elevation angle

The angle of a satellite above the horizon, measured from 0° (on the horizon) to 90° (directly overhead).

Elevation mask

The angle below which the GPS receiver will not track satellites. For rover files this is normally set to 15° to avoid interference problems caused by buildings and trees and multipath errors.

Ellipsoid

A mathematical model of the earth formed by rotating an ellipse around its minor axis. For ellipsoids which model the earth, the minor axis is the polar axis, and the major axis is the equatorial axis. An ellipsoid is completely defined by specifying the lengths of both axes, or by specifying the length of the major axis and the flattening. Two quantities define an ellipsoid; these are usually given as the length of the semimajor axis, *a*, and the flattening, $f = \dfrac{(a-b)}{a}$, where *b* is the length of the semiminor axis.

Ellipsoid height

The distance measured from a point in space and the surface of an ellipsoid, along the normal to that ellipsoid.

Ephemeris

Orbit prediction information which is periodically transmitted by each GPS satellite. The ephemeris provides up-to-the-minute modifications to the almanac.

Feature	In a GIS, a physical object or location of an event. Features can be points (a tree or a traffic accident), lines (a road or river), or areas (a forest or a parking lot).
Geodetic datum	A mathematical model designed to fit part or all of the geoid (the physical earth's surface), defined by the relationship between an ellipsoid and a point on the topographic surface established as the origin of a datum.

World geodetic datums are typically defined by the size and shape of an ellipsoid and the location of the center of the ellipsoid with respect to the center of the earth.

Various datums have been established to best suit particular regions. For example, European maps are often based upon the European datum of 1950 (ED-50). Maps of the United States are often based upon the North American Datum of 1927 or 1983 (NAD-27, NAD-83). All GPS coordinates are based upon the WGS-84 datum surface.

Geographic coordinates
Latitude, longitude, and height on an ellipsoid.

Geographic Information System (GIS)
A computerized system used to input, manage, manipulate, analyze, and display geographic data in digital form.

Geoid	The surface of gravitational equipotential which closely approximates mean sea level (MSL)
Geoid height	The distance from the geoid or mean sea level to a particular point on the ellipsoid. Also called the *geoid separation, geoidal undulation* or *orthometric height*.
GIS	See *Geographic Information System.*

GPS Control Segment
The component of the GPS system, currently administered by the US Air Force, which controls the operation of the NAVSTAR satellites.

Great Circle Arc	An arc formed on the surface of the earth by the intersection of a plane that passes through the center of the earth and two points on the surface of the earth, constituting the shortest distance on the earth's surface between those two points.

Greenwich Mean Time (GMT)
          See *Universal Time Coordinated (UTC)*.

GRS-80   The ellipsoid used by the WGS-84 and NAD-83 datums.

Grid   A two-dimensional horizontal rectangular coordinate system, such as a map projection.

HAE   Height above ellipsoid.

Heading   The current direction in which one is moving. See also *Bearing*.

Horizontal Dilution of Precision (HDOP)
          See *DOP* and *Position Dilution of Precision*.

Ionosphere   The band of charged particles 130 to 190 kilometers above the earth's surface.

Ionospheric delay The variable delay experienced by a wave propagating through the ionosphere. The duration of the delay depends on the electron content of the portion of ionosphere through which the wave travels. The variation in ionospheric delay induces a variable error in GPS positions.

kB (kbytes)   Kilobyte (1024 bytes or characters of data).

Latitude (Lat)   The north/south component of a location on the surface of an ellipsoid. Latitude is an angular measurement north or south of the equator. Traditionally latitudes north of the equator are considered as positive and those south of the equator as negative.

LCD   Liquid-crystal display. The screen of a datalogger.

Log   To store data in the memory of a datalogger, in the memory of a GPS receiver or on a computer disk.

Longitude (Lon)   The east/west component of a location on the surface of the earth. Longitude is usually measured as an angular value east or west of the Greenwich meridian (London, England). Traditionally longitudes east of Greenwich are considered as positive and those west of Greenwich as negative.

Major axis   See *Ellipsoid*.

Map projection   A rigorous mathematical expression of the curved surface of the ellipsoid on a rectangular coordinate grid.

MB   Megabyte. Approximately 1 million bytes or characters of data.

MHz	Megahertz; millions of times per second.
Minor axis	See *Ellipsoid*.
MSL	Mean Sea Level. See *Geoid*.
Multipath	Interference similar to 'ghosting' on a television screen which occurs when GPS signals arrive at an antenna having traversed different paths (e.g. after being reflected from buildings). The different paths yield different pseudo range estimates and introduce errors into computed GPS positions.
NAD-27	North American datum of 1927. Technically, only a horizontal datum employing the Clarke 1866 ellipsoid. Height values of this era are expressed in terms of the NGVD (National Geodetic Vertical Datum) of 1929.
NAD-83	North American datum of 1983. Like NAD-27, technically only a horizontal datum. Its geometric definition is almost identical to WGS-84. For GPS purposes, NAD-83 and WGS-84 datum are identical. Uses the GRS-80 ellipsoid.
NAVSTAR	The official name for the GPS satellites. NAVSTAR is an acronym for 'NAVigation Satellite Timing And Ranging'.
Nesting features	The ability of the Asset Surveyor software to record a point feature while already recording a line or area feature.
NMEA	Abbreviation for 'National Marine Electronics Association'. The NMEA have sponsored a number of standards for information interchange. One of these standards, called 'NMEA 0183', is used for interchange of GPS data, and can be output by Trimble Pro XL and 4000 Series GPS receivers.
Operating system	The software controlling a computer.
Origin	The intersection of axes in a coordinate system.
Orthometric Height	See *Geoid Height*.
Overdetermined Position	A 3D GPS position which was computed using more than four satellites. The extra satellite(s) in the solution provide a degree of mathematical redundancy in the solution which can be used to eliminate a number of errors in the GPS system, thereby producing more accurate positions.

P code The protected or precise code used on L1 and L2 GPS bands, which is only made available to authorized users. P code is a long (about 10^{14} bits) sequence of pseudorandom binary biphase modulations on the GPS carrier at a chip rate of 10.23MHz which does not repeat for about 38 weeks. Each satellite uses a one week segment of this code that is unique to the GPS satellite and is reset each week. See *Y code*.

Parity A form of error checking used in RS232 serial data transfer. Parity can be set to even, odd or none. A digital message is composed of 1s and 0s. The parity of a byte is the binary sum over the length of that byte. A parity error results when one of the bits in a byte is changed so that the parity of the byte changes during transmission.

PDOP See *DOP* and *Position Dilution of Precision*.

PDOP Mask The highest PDOP value at which a receiver will compute positions.

PDOP Switch The PDOP value at which a receiver will switch from computing 3D positions to computing 2D positions (used only in Auto 2D/3D mode).

Position Dilution of Precision (PDOP)
A unitless figure of merit expressing the relationship between the error in user position and the error in satellite position. Geometrically, PDOP is proportional to 1 divided by the volume of the pyramid formed by lines running from the receiver to four or more satellites observed. Thus, a small PDOP is associated with widely separated satellites. PDOP is related to horizontal and vertical DOPs by the formula:

$$PDOP^2 = HDOP^2 + VDOP^2.$$

Precise Positioning System (PPS)
See *Standard Positioning System* (SPS).

PRN See *Pseudo Random Noise* and *Pseudo Random Number*.

Projection See *Map Projection*.

Pseudo Random Noise (PRN)
A sequence of digital 1s and 0s which appears to be randomly distributed like noise, but which can be exactly reproduced.

Pseudo Random Number (PRN)
Each GPS satellite (SV) has a unique identifying PRN.

Pulse Per Second (PPS)
Some Trimble GPS receivers (e.g. the 4000 Series, and the Pro XL) emit a single pulse-per-second on a designated serial pin. This pulse can be used for precise timing and synchronization of external devices. Not to be confused with the *Precise Positioning System* (also abbreviated PPS)

RAM Random Access Memory.

ROM Read Only Memory.

Rotation In transformations, an angle through which a coordinate axis is moved around the coordinate system origin.

Rover Any mobile GPS receiver and datalogger collecting data in the field. A roving receiver's position can be differentially corrected relative to a stationary base GPS receiver.

RS232 A protocol for serial communications between computers and other types of hardware.

RTCM Radio Technical Commission for Maritime Services. A commission established to define a differential data link for real-time differential correction of roving GPS receivers. There are two types of RTCM differential correction messages, and all Trimble GPS receivers use the newer 'Type 2' RTCM protocol.

SA See *Selective Availability*.

Satellite geometry The current position and movement of GPS satellites relative to each other and to a particular GPS receiver.

Scale factor A map projection parameter which is used to convert ellipsoid distances to projection (grid) distances, and vice versa.

Selective Availability (SA)
A US Department of Defense program to control the accuracy of GPS pseudo range measurements, whereby each GPS receiver computes a false pseudo range which is in error by a controlled amount. In essence, this amounts to artificial degradation of the satellite signal by the US Department of Defense. The error in position caused by SA can be up to 100 meters, but differential GPS techniques can eliminate most of the errors introduced by SA.

Semimajor axis One-half of the major axis of an ellipse.

SEP   See *Spherical Error Probability.*

Signal to Noise Ratio (SNR)
Also called *Signal Level*. An arbitrary unit used to describe the strength of a satellite signal. SNR ranges from 0 (no signal) to around 35. Higher-elevation satellites have SNRs in the high teens to low 20s. SNRs lower than 4 are considered unusable. See also *SNR Mask*.

SNR Mask   The lowest signal strength at which a receiver will use a satellite for positioning.

Spherical Error Probability (SEP)
A statistical measure of precision defined as the 50th percentile value of the three-dimensional position error statistics. Thus, half of the results are within a 3-D SEP value. See *CEP*.

Spheroid   See *Ellipsoid.*

Standard Positioning System (SPS)
There are two positioning systems provided by GPS. The Standard Positioning System (or SPS) uses the C/A-code to compute positions which are subject to Selective Availability (SA). The Precise Positioning System (or PPS) uses P-code (or Y-code, when the P-code is encrypted) to compute positions which are SA-free. PPS is available only to approved US Federal agencies and designated foreign government agencies. This should not be confused with *Pulse Per Second* output (also abbreviated PPS).

State Plane Coordinates
Special definitions of Transverse Mercator and Lambert Conformal map projections adopted by statute in the USA. There is one set of such zones for the NAD-27 datum and another for NAD-83.

SV   Abbreviation for *Satellite Vehicle* or *Space Vehicle*. Each GPS satellite is an SV.

Time Dilution of Precision (TDOP)
See *DOP*.

Track   To make a pseudo range measurement to a GPS satellite.

Universal Time Coordinated (UTC)
The local solar mean time at the Greenwich Meridian. UTC is synonymous with GMT. There is a variable offset from UTC to GPS time, which in January 1995 was 15 seconds.

URA See *User Range Accuracy*.

US Survey Foot Defined as 1200/3937 meter. The official unit of linear measure for the NAD-27 datum.

User range accuracy (URA)

The contribution to the range-measurement error from an individual error source, assuming that the error source is uncorrelated with all other error sources. Values less than 6 are preferred. A value above 16 is an indication that Selective Availability is active on that satellite.

UTC See *Universal Time Coordinated*.

UTM The *Universal Transverse Mercator* Map Projection. A special case of the Transverse Mercator projection. Abbreviated as the UTM Grid, it consists of 60 north-south zones, each 6 degrees wide in longitude.

Vertical Dilution of Precision (VDOP)

See *DOP* and *PDOP*.

Y code The encrypted P code.

Waypoint A waypoint is a 3D point which can be given a name and a location either prior to field work or in the field. Waypoints are useful for navigation purposes and can be used as a reference for a particular site. This makes returning to the same site possible at a latter date.

WGS-84 World Geodetic System (1984); the mathematical ellipsoid used by GPS since January 1987.

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