


LLNL Environmental Restoration Division (ERD) Standard Operating Procedure (SOP)																					
<b>ERD SOP 4.14: Mapping with the Trimble Pathfinder Pro XR GPS System</b>																					
REVISION: 0  	AUTHOR(S): R. Goodrich  REVIEWER(S): T. Carlsen, J. Bennett*, P. Althouse																				
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<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">APPROVAL</td> <td style="width: 40%;">Date</td> </tr> <tr> <td><u>Albert L. Samson</u></td> <td><u>4-19-99</u></td> </tr> <tr> <td>Division Leader</td> <td></td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td>APPROVAL</td> <td>Date</td> </tr> <tr> <td><u>[Signature]</u></td> <td><u>4/16/99</u></td> </tr> <tr> <td>Environmental Chemistry and Biology Group Leader</td> <td></td> </tr> </table>	APPROVAL	Date	<u>Albert L. Samson</u>	<u>4-19-99</u>	Division Leader				APPROVAL	Date	<u>[Signature]</u>	<u>4/16/99</u>	Environmental Chemistry and Biology Group Leader		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">CONCURRENCE</td> <td style="width: 40%;">Date</td> </tr> <tr> <td><u>[Signature]</u></td> <td><u>4/16/99</u></td> </tr> <tr> <td>QA Implementation Coordinator</td> <td></td> </tr> </table>	CONCURRENCE	Date	<u>[Signature]</u>	<u>4/16/99</u>	QA Implementation Coordinator	
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\*The Operations and Regulatory Affairs Division (ORAD)

## 1.0 PURPOSE

To describe general operating instructions for the usage of the Trimble Global Positioning System (GPS) Pathfinder Pro XR System. The GPS Pro XR is used to perform mapping or surveying type activities. Some uses of the system may include mapping of wildlife habitats, ecological preserves, archeological sites, and surveying of sampling locations.

## 2.0 APPLICABILITY

These guidelines provide general instructions for personnel conducting mapping or surveying projects using the Trimble GPS Pathfinder Pro XR and Pathfinder Office Software. A formal certified training class must be taken prior to using the Trimble Pathfinder Pro XR System and Pathfinder Office Software.

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### **3.0 REFERENCES**

- 3.1 Dana, H. Peter. (1998), The Geographer's Craft Project, Department of Geography, The University of Texas at Austin.
- 3.2 Trimble Navigation Limited Surveying and Mapping Division (1997), Pro XR System Training Manual
- 3.3 Trimble Navigation Limited (1997), Pathfinder Office Getting Started.
- 3.4 Trimble Navigation Ltd (1989), GPS A Guide to the Next Utility.

### **4.0 DEFINITIONS**

See SOP Glossary.

### **5.0 RESPONSIBILITIES**

#### **5.1 Division Leader**

The Division Leader's responsibility is to ensure that all activities performed by ERD at the Livermore Site and Site 300 are performed safely and comply with all pertinent regulations and procedures, and provide the necessary equipment and resources to accomplish the tasks described in this procedure.

#### **5.2 Environmental Chemistry and Biology Group Leader (ECBGL)**

The ECBGL's responsibility is to provide biological or chemical information and expertise (i.e., biological surveys, water supplies, chemical field instruments, etc.).

#### **5.3 Site Safety Officer**

The SSO's responsibility is to ensure the safety of ERD's ongoing operations and facilities and work performed.

### **6.0 PROCEDURES**

#### **6.1 Discussion**

When properly operated, the GPS system is superior to former navigational systems in that, the only requirement is line of sight to the sky for accurate positioning. Precise geographic coordinates can be computed by calculating the distance from a group of satellites to a GPS receiver on earth. There are three segments to the GPS system:

- 6.1.1 Space Segment. The space segment of the GPS is operated by the Department of Defense (DOD). It consists of 24 operational satellites (21 space vehicles (SVs) and 3 spares). The SVs orbit the earth in 12 hours. There are six orbital planes (with four SVs in each), equally spaced (60° apart), and inclined at approximately 55° relating to the equatorial plane. These SVs send radio signals from space and

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can be received by hand-held GPS receivers or rovers. At any given time there should be between five to eight available SVs from any point on earth.

- 6.1.2 Control Segment. The control segment consists of a system of monitoring stations located around the world. The main monitoring station is located at Schriever Air Force Base (formerly Falcon AFB) in Colorado. These stations measure signals from the SVs into orbital models for each satellite. These models compute precise orbital data (ephemeris) and SV clock corrections for each satellite. The corrected data is then uploaded to the SVs. The SVs then send subsets of the orbital ephemeris data to GPS receivers over radio signals. This segment is referred to as the “brain” of the GPS system.
- 6.1.3 User Segment. The user segment consists of GPS rovers and users. The GPS rover is used to receive signals from the SVs and are used to compute positions for multiple applications.

To compute position, the system is based on satellite trilateration or triangulation. A minimum of 4 satellites are needed to compute trilateration. Example: If the GPS rover measures the distance to the first satellite as 19,000 Km away, then your position is on the surface of a sphere within the radius of 19,000 Km from the satellite. A subsequent measurement is derived from a second SV which measures your position. Your position on earth is narrowed to the ellipse created by the intersection of the two spheres. A third measurement is the intersection of the three spheres, which narrows your position down to two points. A fourth measurement, which is based on time becomes the deciding factor between the two points which determines the GPS position.

To measure the distance to a satellite from our position on earth, we need to know how long a radio signal takes to reach us from that satellite. The GPS receiver determines when the signal left the satellite. This is accomplished by using pseudo-random code (PRC) that is generated at the same time in both the receiver and satellite. The GPS signal travels at the speed of light. The equation used to compute distance is: travel time (sec) x the speed of light (300,000 km or 186,000 mi/sec) = distance (km or mi).

The GPS signals are purposely scrambled by the government, which is referred to as selective availability. Other natural occurring phenomenon, such as atmospheric delay, multi-path error and receiver noise add inaccuracy to the computed position. Most errors can be recognized and easily corrected during the post-processing phase of the data.

## **6.2 Office Preparation**

All personnel conducting mapping or surveying activities using the Pro XR GPS System must participate in a certified training course provided by the Trimble Navigation Surveying & Mapping Training Department prior to using the instrumentation.

- 6.2.1 Pre-mission Planning. Perform a field reconnaissance of the area projected for mapping. Schedule mapping sessions when satellite availability are optimal to help ensure accuracy of field data. Trimble’s SatView website can be used to determine the availability of satellites at any given time of day. The website

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address is: <http://www.trimble.com/satview/>. Take note, Greenwich Mean Time (GMT) is used in SatView and must be converted to the Pacific Standard Time Zone (PST), which is 8 hours earlier to properly plan your field session.

- 6.2.2 GPS Hardware/Software Configuration. Become familiar with the GPS before using it during an actual mapping session. Use Attachment A “Equipment Checklist” to check for all necessary GPS components prior to use. Refer to Attachment B, “**GPS Hardware Configuration**” and Attachment C, “Introduction to Asset Surveyor Software” to familiarize yourself with the equipment.
- 6.2.3 Data Dictionary. Create a data dictionary using Pathfinder Office software (refer to instruction manual) for the specific project being mapped. In order to efficiently create a usable data dictionary some forethought must be given. Determine the features that you plan to map. Generate a list of point, line, and area features to be included in the data dictionary, then create a list of attributes and attribute values. Each feature should be uniquely identified, so that it can be independently labeled on the final map projection. Hint: You may want to include an ‘other’ attribute for every feature, since the data dictionary cannot be edited in the field. When satisfied with the data dictionary, connect the Trimble cable (see Attach A for cable number) to the PC and the GPS rover to transfer a data file. To transfer a file, you must do the following:
1. On the GPS rover select **File Transfer**, and press **Enter**.
  2. Select **Utilities/Data Transfer** in Pathfinder Office.
  3. In the **Data Transfer** box select **Data Dictionary** as the file type, **send** and **transfer** the dictionary to the GPS rover.
- 6.2.4 Configuring the Pro XR Rover Receiver. There are three types of settings when configuring the Rover: Critical, Non-Critical and Display. Critical settings must be configured prior to data capture. These are quality affective settings. Non-critical settings affect the behavior of the ASPEN software, but do not affect the usability of the GPS positions. Display settings are only used to create a more user friendly system, but are not quality effecting. Refer to Attachment D, “Configuring Rover Options” to properly configure the GPS rover receiver according to the manufacturer’s instructions.

### **6.3 Field Preparation**

- 6.3.1 Preparation for Data Capture. If working at Site 300 schedule access arrangements with the appropriate building coordinators before going to the field. Prior to the GPS data capture session make sure all batteries are fully charged. It is beneficial to conduct a mock mapping session before using the instrument to do your actual mapping project. This helps you to become familiar with equipment set-up and possibly trigger questions that you’ll need answered before the final data capture session.

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## 6.4 Operation

6.4.1 Data Capture. After configuring the GPS rover and proper field preparation has been made, you are ready to conduct a mapping or surveying session in the field. A file name will automatically be given to your data capture session when you create a new data file. The naming convention used is R032120A, in which the R identifies the file as a rover file, MM (Month), DD (Day), HH (Universal Coordinated Time (UTC) time by default), x (counter-increases a, b, c, within the hr.). Before creating a new data file, verify that you have a current position fix. To do this, refer to [Attachment E](#), "Data Capture". If the top line reads OLD POSITION do not begin data capture. Wait until a current position is displayed. During the field mapping session, if there is a nearby location that has been surveyed, collect a GPS point at this location. This will make it easier to match data points if the GPS field data are overlaid onto other map projections.

Tip: A rover file that is over 1 week old cannot be appended to. It is important to plan your mapping project, so that it can be completed in one session, if possible. Also, rover files that are over two months old cannot be post processed. The base files are not archived past two months.

## 6.5 Post Field Operation

### 6.5.1 Post-Processing in Pathfinder Office

A formal certified training class must be taken prior to using the Trimble Pathfinder Pro XR System and Pathfinder Office Software. Please refer to the ProXR instruction manual or the Pathfinder Office, software manual for detailed operating instructions.

Pathfinder Office software is used to transfer, correct, display, edit, plot and export your data. Please refer to the instruction manual to properly configure Pathfinder Office. Once the application has been configured, field data from the GPS Rover may be transferred to Pathfinder Office. To transfer a file you must do the following:

1. Select **File Transfer** on the datalogger and press **enter**.
2. Select **Utilities/Data Transfer** in Pathfinder office.

Tip: It should only take a few seconds for Pathfinder Office to connect to the datalogger. If it takes longer, check the cable to make sure it's properly connected to the PC and the datalogger. Once the connection has been made, continue using the Pathfinder Office menu:

3. In the **Data Type** box, select **Data**.
4. In the **Direction** field, select **receive**.
5. Select \*.\* as the file type.

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6. In the **Available Files** box double click on the file you want to download or select a file(s) and click **Add**.

7. Click **transfer**.

7. Click **close** to exit Data Transfer.

#### 6.5.2 Pathfinder Office Differential Correction

GPS data are captured in the field. Base data is stored at the base station. The two data sets are loaded into Pathfinder Office where corrections are processed.

1. Select **Utilities/Differential Correction**.

2. Click **browse** in the **Rover Files** box.

3. Select the rover file and click **OK**.

4. Click **Auto Select** in the **Base Files** box.

**Tip:** To use Auto Select, the base files must be in the C:\PFDATA\

5. Click **OK** to run the differential correction. The **Differential Correction Completed** box highlights success or failure of the differential correction.

6. If 100% of the positions did not correct click **More Details** to find out why.

7. Select **File/Exit**.

8. Click **Close**.

#### 6.5.3 Pathfinder Office Data Display

To view the corrected data file as a map:

1. Click **File/Open** and select a \*.COR file.

2. Select **View/Map** to visually display the data.

#### 6.5.4 Pathfinder Office Data Editing

The data editing feature provides the capability to delete unwanted GPS positions.

1. Select **Data/Query Position**.

2. In the **Map Display** click on a GPS position.

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3. In the **Query Position** box click **Delete**. If a mistake is made select **Undelete**.

Unwanted features and attributes may be deleted in the same manner as unwanted GPS positions.

Data may be exported into many formats, i.e., ARC/INFO, ASCII, AutoCAD DXF, Generic Database. Please refer to the instruction manual for data export.

## **7.0 QUALITY ASSURANCE RECORDS**

7.1 Electronic data file

7.2 Spatial data display

## **8.0 ATTACHMENTS**

Attachment A—Equipment Checklist

Attachment B—Turning the GPS Rover On & Off

Attachment C—Introduction to Asset Surveyor Software

Attachment D—Configuring Rover Options

Attachment E—Data Capture

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**Attachment A**

**Equipment Checklist**



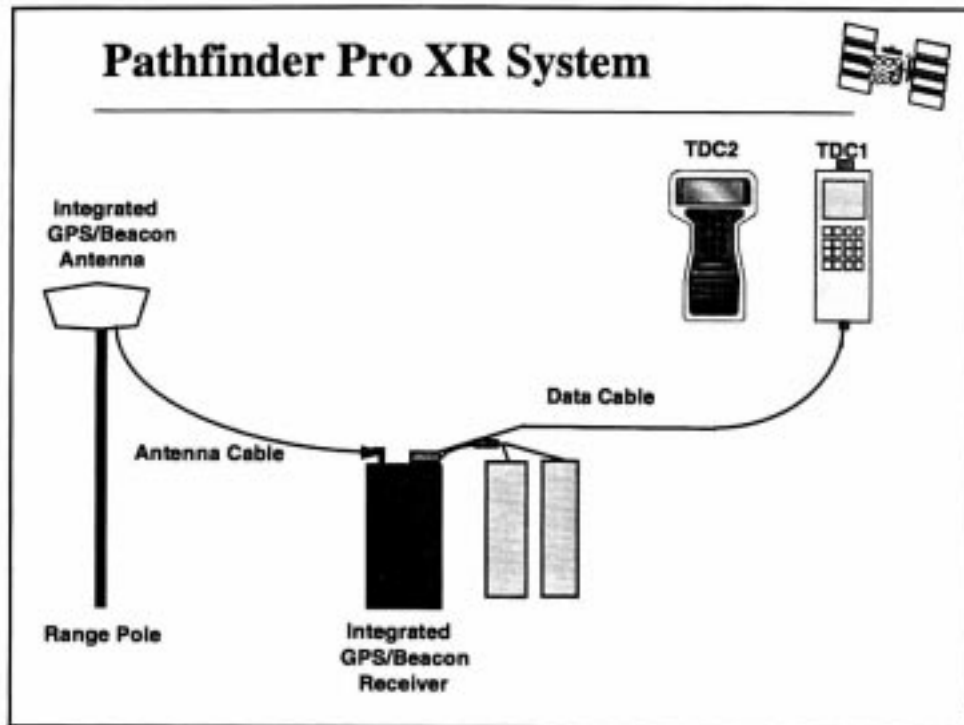
### Equipment Checklist

- Range Poles
- Integrated GPS/Beacon antenna
- Antenna cable
- Integrated GPS/Beacon receiver (8 or 12 channel)
- TDC1 or TDC2 multiport cable
- Datalogger, TDC1 or TDC2
- System battery - two 12V 2.3A camcorder batteries
- Drinking Water
- Hat
- Snake Guards
- Radio
- Trimble Cable (27997 REV B, DCA 9817) for Data Transfer

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**Attachment B**

**GPS Hardware Configuration**



## 1. Connecting the System

### A. The Pro XR

Equipment needed:

- Range poles
- Integrated GPS/Beacon antenna
- Antenna cable
- Integrated GPS/Beacon receiver (8 or 12 channel)
- TDC1 or TDC2 multiport cable
- Datalogger, TDC1 or TDC2
- System battery - two 12V 2.3A camcorder batteries



### B. Features of a TDC2 Data Collector

- Full alphanumeric keyboard
- 8 line liquid crystal display screen
- 2 serial ports at top of unit
- MS-DOS (version 3.30 or later) stored in ROM
- Memory:
  - Standard: 570 kb
  - Extended: 3 mb
- Fully waterproof: stands immersion up to 1 meter (3 feet)
- Rugged: dust and shock proof, vibration resistant

## Internal Power Source

- AA batteries (3):

Considered the internal battery in the **Configuration\Hardware** menu.

- Backup Batteries:

The TDC2 contains a trickle-charged internal battery which provides sufficient back up power to preserve the contents of the TDC2's memory for at least two weeks, if the main power source is removed.

## Storing the TDC2

A serious risk with long term storage is battery leakage causing damage to the TDC2. Use only the highest quality alkaline cells for storage and ensure that they are brand new when fitted.

## External Power Source

- External 12.5 volt lead acid:

External power for receiver. Data collector can draw power from this source. These batteries do not have memory, therefore, can be left on charge at all times.

- Power adapter:

Power adapter via cigarette lighter is also available. Do not turn vehicle off when GPS unit is on.

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# **Attachment C**

## **Introduction to Asset Surveyor Software**

## Introduction to Asset Surveyor Software

### C-1 Turning On/Off Data Collector

1. To turn on, press On/Off.
2. To turn off, press **Func**, then On/Off.

### C-2 Useful Key Combinations

- Enter is used to enter information on a given line.
- OK is used to validate information for an entire menu form.
- The **INFO** label on the screen (lower left corner) corresponds to the F1 key.
  - This option provides information for first-time users or for those who need a memory refresher. Scroll through the information pages. Try all the options listed.

**Note**—On a TDC-2 it is possible to exit the Asset Surveyor software. Exiting the program will take you to the DOS prompt. To re-enter Asset Surveyor, type **ASSET** at the command prompt.

### C-3 Asset Surveyor Menus

Asset Surveyor contains three principle menus. They are the Main, Configuration, and GPS Operation menus.

**GPS Operations**—Used to view the status of receiver and satellites tracked.

**Configuration**—Used to configure the receiver for data capture.

**Main Menu**—Used to capture data, navigate, and transfer files to the PC. The menu options of the Main Menu are described in the following:

**Data Capture**—Used to collect rover files.

**Navigation**—Used to create/edit waypoints, print text reports from data collector, upgrade software, and to configure external sensors.

**File Transfer**—Used to communicate with your PC.

**Utilities**—Used to create waypoints, print text reports from the data collector, upgrade software, and to configure external sensors.

**Base Station**—Used to collect data in base station mode.

**Info for New Users**—Contains useful key combinations.

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**Attachment D**

**Configuring Rover Options**



**Table Attachment D-1. Configuring rover options.**

Rover option	Recommended	Setting type
Point	1s <sup>a</sup>	critical
Line/Area	5s	critical
Not in feature	none	non-critical
Velocity	All	critical
Minimum Posn	5	non-critical
Pos. mode	Manual 3D	critical

Note:

When collecting 2D positions, you must enter the altitude.

## D-1 Configuring Rover Options

- **Logging interval**–Defines the frequency at which a position is stored.
  - **Point features**–Set at 1 second.
  - **Line/Area features**–Should match the base station logging interval. Logging intervals may also depend on speed of travel:
    - If walking–5 seconds.
    - If driving–1 second.
- **Not in feature**–Stores a position even though you are not collecting features.
- **Logging velocity**–Velocity records can be used for attaining better post-processed accuracies in high multipath areas.
- **Minimum Posns**–Minimum number of positions collected for a given point feature. If the point feature is closed before the minimum number of positions are collected, the Asset Surveyor software will provide a warning.
- **Position Mode:**
  - **Manual 3D**–Used 4 or more SvS to calculate a 3D position.
  - **Elevation Mask**–Rover should be set higher than base to ensure correction (recommended value = 15°).
  - **SNR Mask**–Signal-to-Noise ration or signal strength. The stronger the signal, the better (recommended value = 6.0).
  - **PDOP Mask**–SV constellation with PDOPs greater than the specified number are not used (recommended value = 6).
  - **PDOP Switch**– Only applicable in Auto 2D/3D Mode (recommended value = 6). When PDOP rises above 6, positions are recorded in 2D.

- **Audible Click**–If activated, the data collector beeps every time a position is logged (recommended value = Yes).
- **Log DOP Data**–If activated, changes in DOP are recorded in the rover file (recommended value = Yes).
- **Initial Position**–Useful entry when you have a brand new unit or when you travel from one geographic location to another. Provides the receiver with a head start on where to look for Svs.
- **Dynamic Code**–Helps control initial acquisition of satellites. Land, Sea, Air.

**Table Attachment D-2. RTCM configuration.**

<b>Rover option</b>	<b>Recommended</b>
<b>RTCM input mode</b>	<b>Auto</b>
<b>RTCM version</b>	<b>Auto</b>
<b>RTCM station</b>	<b>Any</b>
<b>Warning time</b>	<b>20 s</b>
<b>Log PP data</b>	<b>Yes</b>
<b>Baud rate</b>	<b>9600</b>
<b>Data bits</b>	<b>8</b>
<b>Stop bits</b>	<b>1</b>
<b>Parity</b>	<b>None</b>
<b>Mode</b>	<b>Auto range</b>
<b>Frequency</b>	<b>N/A</b>

**Note:**

Real-time data is referred to as **Radio Technical Commission for Maritime Services (RTCM)**. The RTCM established the format to relay GPS correction messages from one monitoring station to a field user.

## **D-2 RTCM Configuration**

### **RTCM input mode:**

- OFF If RTCM is not being used.
- ON Enables RTCM, positions will be collected, but only when RTCM is available.
- AUTO When RTCM is available, positions will be corrected in the field. when RTCM is not available, positions will be stored and available for postprocessing.

### **RTCM version:**

- Auto If you are unsure which RTCM version is being transmitted by your base station.

Ver. 2 Protocol: Most Trimble receivers receive version 2 protocol only.

USCG U.S. Coast Guard protocol.

**RTCM station:**

Any Enables the GPS receiver to accept RTCM from any base station; however, you can enter the identification of a particular station. The receiver will use the strongest RTCM signal available, if there are multiple bases broadcasting RTCM.

**Warning Time:**

If no new corrections have arrived over the RTCM link, the most recent correction is considered too old to provide accurate corrected positions. When warning time expires, the GPS receiver will warn you that your RTCM link has been lost.

**Log PP data:**

Must be configured to “Yes” in order to post process data.

Allows you to log additional data so that GPS positions corrected in real-time can be reprocessed in the Pathfinder Office software.

A setting of **Yes** will halve the number of RTCM connected positions you can store in the datalogger.

Press F1 Beacon, to receive beacon corrections.

**Mode:**

Off Pro XR will disable the beacon component.

Auto Range Pro XR will automatically lock to the closest beacon.

Auto Power Pro XR will automatically lock onto the most powerful beacon.

Manual Pro XR will use only the radiobeacon frequency you specify in the **Frequency** field.

**Frequency:**

Lists the frequency entered that the Pro XR is to track when in Manual mode.

**Table Attachment D-3. Carrier phase configuration.**

<b>Rover option</b>	<b>Recommended</b>
<b>Carrier mode</b>	<b>Query</b>
<b>Measurements</b>	<b>15 s</b>
<b>Positions</b>	<b>60 s</b>
<b>Minimum time</b>	<b>5 min.</b>

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### D-3 Carrier Phase Configuration

Use the carrier phase mode for surveying type activities. It is necessary to remain at a location for approximately 20 minutes to obtain an accuracy of 50 cm vertical and 10 cm horizontal. If your location is > 50 km from the base station then further inaccuracy is introduced. To configure for carrier phase measurements select F2 and set the following:

#### Career Mode:

- OFF Carrier phase mode disabled.
- ON Subsequent point features will be captured in carrier phase mode. (Used if all points will be collected 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. (Used if only some points will be collected in carrier phase mode).

#### Measurements–15s.

**Positions**–Positions are not required for carrier phase-processing. Set to *None*:

**Minimum Time**–The minimum time for which you should remain at a point in order to record sufficient carrier phase data to process in 5 minutes. Set to 5 minutes.

**Note**—An accurate antenna height is very important when operating in carrier phase.

Press F3 to change the antenna height.

**Height** = <user entered>

**Measure** = <uncorrected>

Measure from the bottom of the antenna.

**Type**–MB:

EC = Compact dome.

MB = Integrated GPS\MSK beacon.

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**Attachment E**

**Data Capture**

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## **E-1 Before Creating a New Data File**

Verify that you have a certain position fix. There are two options:

- Check the **Status Line**; it indicates the number of SvS tracked. You need 4 to collect a 3D position.
- Press GPS/Config to access the **GPS Operations** menu.

**Tip**—You must be connected to a receiver to access this menu.

To view the current position, do the following:

1. Press GPS/Config to access the **GPS Operations** menu.
2. Press Enter on **Position**.
  - Press Clear to escape back to the **GPS Operations** menu.
3. Arrow down, press Enter on **Receiver Status**.

Provides valuable information regarding critical settings such as, DOP, receiver firmware versions, and external battery voltages.

- Press Clear to exit.
4. Press Enter on **Satellite Info**.

Displays PRNs, SNR values, elevation, bearing, and URA (User Range Accuracy) information for individual satellites. URA (m) is an estimate of the accuracy of the pseudorange measurement to each satellite in meters.

- Other **GPS Operations** menu options;
    - **Navigation**—used to navigate from one location to another while collecting data.
    - **Waypoints**—used to view or create waypoints while collecting data.
    - **2D Altitude**—used to enter in altitude when operation in Manual 2D or Auto 2D/3D.
    - **Disconnect**—used to terminate communication with the GPS receiver.
5. Press Clear to return to the **Main** menu.

## **E-2 Creating a New Data File**

1. Select **Data Capture** from the **Main** menu.
2. To create a new file, select **Create rover file**.
3. Use the automatic filename or type a DOS filename in the space provided.
4. Select a data dictionary:
  - Generic (default) includes: point, like, and area generic features.

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- Custom data dictionary: Created in the Pathfinder Office and transferred to the data collector.
5. Check available space in the data collector.
  6. F1 softkey changes the time format from UTC to local for display purposes.
  7. Press OK to validate the screen.

### **E-3 Other Data Capture Options**

- **Reopen rover file**–Used to open existing rover files.
- **File statistics**–Lists information about the features, file size, free space, start/end times, etc.
- **Delete files**–Used to delete files.
- **Data Dictionaries**–Displays a list of data dictionaries stored in the data collector.

### **E-4 Recording Data**

1. Open a data file with the generic data dictionary.
2. Select **Point Generic**.

Notice the rate at which GPS positions are collected. The data collector beeps every time a position is collected, and the status screen provides a numeric counter.

- Softkeys:
    - F1, **PAUSE\RESUME**–Temporarily pauses data collection. When you press this key, the label changes to resume.
    - F2, **EXT**–Activates the external sensor.
    - F3, **OFFSET**–Activates a user defined current feature offset.
    - ENTER–Used to enter info on a given line.
    - OK–Used to validate info for an entire menu form.
3. Type a feature name for comment, press Enter. Once you have collected enough GPS positions, press OK to end the feature.
  4. Select **Line Generic**.
    - Softkeys:
      - F1, **PAUSE\RESUME**–Temporarily pauses data collection. When you press this key, the label changes to resume.
      - F2, **NEST**–You can **only** nest a point on a line or area. No other combination is acceptable.
      - F3, **SEG**–Ends the current line feature and immediately starts a new one (connects the endpoints). Change the attribute values for the new line.

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- F4, **QUICK**–Quickmark activation. A list of point features to quickmark appears.
  - -->, F5–Lets you access more options.
  - F1, **EXT**–Activates the external sensor.
  - F2, **OFFSET**–Activates a user defined current feature offset.
5. Select **Area Generic**.
- Softkeys:
  - F1, **PAUSE\RESUME**–Temporarily pauses data collection. When you press this key, the label changes to resume.
  - F2, **NEST**–Nesting features allows you to enter a point feature while you are collecting data for a line or area feature.
  - F3, **QUICK**–Quickmark activation. A list of point features appears.
  - F4, **EXT**–Activates the external sensor.
  - F5, **OFFSET**–Activates a user defined current feature offset.
6. Exit **Data Capture**, press **Clear** and conform exit.

At any time during data capture, you can enter and exit the following Asset Surveyor menus:

- **Configuration:** To change settings.
- **GPS Operations:** To check SV status or navigate.

**Warning**—If you alter critical settings during data capture, you affect the quality of the GPS resulting positions.