Survey Control II
User's Guide

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1

Introduction

Survey Control II is a software productivity tool that enhances the user interface of your Magellan GPS receiver. Running on a handheld computer, Survey Control II assists and guides you through your GPS survey, enabling you to collect more data, faster, with fewer chances for error.

With the added receiver control provided by Survey Control II, more productive GPS data collection can be realized. In addition to the basic Static and Rapid Static modes of data collection using the native receiver on-board user interface, Survey Control II provides the highly productive Stop&Go Kinematic and Continuous Kinematic modes. These modes transform your GPS system from a surveying tool limited to establishing control points, to a tool capable of performing topographic, planimetric, volumetric, and as-built surveys.

Survey Control II is the successor to Locus Handheld. Utilizing the input and feedback provided by Locus Handheld users, Survey Control II includes many new features to ensure a successful GPS survey. Survey setup and execution proceed in a logical, step-by-step workflow. Point descriptors are saved to a list where they can be selected the next time they are used. Blunder detection tools have been added to help you avoid common data collection mistakes. Data memory has been drastically increased, removing the problem of running out of memory in the middle of a survey.

Table 1.1 lists the components of the Survey Control II package.

Table 1.1 Survey Control II Components

Component	For Locus GPS System	For Z-Xtreme/Z-Surveyor System
Handheld computer	x	x
Survey Control II Program card	x	x
Pouch	x	
Pouch with cable		x
Bracket	x	x
Open clamp	x	x
Cable, handheld to PC	x	x
Cable, handheld to receiver		x
Compact disk containing User Guide (this document)	x	x

The preferred handheld controller is a Compaq iPAQ pocket PC. The Survey Control II software is stored on the program card, and the card must be physically in place in the handheld before data can be logged.

Operating in conjunction with an Ashtech Locus, Ashtech Z-Xtreme, or Ashtech Z-Surveyor GPS receiver, Figure 1.1, Survey Control II provides the means to collect precision survey and point attribute data in minimum time.

Figure 1.1 Ashtech Locus, Z-Xtreme, and Z-Surveyor Receivers

The Survey Control II package provides three modes of GPS surveying: **static, stop-and-go kinematic,** and **continuous kinematic**. In static mode, two or more GPS receivers are placed at the ends of the baselines being measured, and each receiver collects data for a period of time (usually 15 - 60 minutes, depending upon baseline length). The recorded data are processed using Ashtech Solutions to yield a precision baseline measurement. This process is repeated for a number of lines yielding a set of baselines forming a survey network. The static mode of operation is used for control surveys and boundary surveys.

In the stop-and-go kinematic mode, the receiver is moved through the survey area with a brief stop at each point. The data collected while stationary and in motion are processed together to yield a set of baseline measurements for every point where the receiver was in a fixed position. This mode allows for high productivity, since many points can be quickly surveyed, and is useful for topographic, as-built, and other types of surveys involving a large number of points over a local region.

In the continuous kinematic mode, operation is similar to stop-and-go kinematic, except that it is not necessary to stop at a point to collect data. However, since less data is collected, accuracy is not as good as stop-and-go.

Where to Find Information

This manual is designed to guide you through the operational procedures as well as provide general reference. You can find additional information in the following documents:

- **GPS Receiver Manual:** This manual is supplied with your GPS receiver, and provides detailed instructions for setting up and operating the receiver.
- **Ashtech Solutions Manual:** This manual provides detailed instructions for post-processing and presenting the data collected by Survey Control II.

Obtaining Technical Assistance

If you encounter problems, Magellan recommends that you begin by reading through Appendix D, *Troubleshooting*. The troubleshooting section addresses common difficulties encountered by surveyors new to GPS and those unfamiliar with the Survey Control II product. If you require further assistance, then contact our technical support group.

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Magellan Corporation is committed to providing top technical support and service to our customers worldwide. You can contact Magellan as follows.

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2

Getting Started

This chapter describes handheld computer operations specifically related to Survey Control II, including basic information for setting up and using your Survey Control II package. First, you must insert the Survey Control II program card into the handheld computer, and start the program. Next, you must establish communication between the handheld computer and your GPS receiver. When this is done, you use the handheld and the GPS receiver to collect data at the survey site; the GPS receiver collects and stores raw GPS data for each point, while the handheld lets you add attribute information for each point; detailed data collection procedures are presented in the next chapter.

Following data collection, you must download the collected data from the handheld and GPS receiver to an office computer for post-processing and analysis.

Handheld Computer Basics

The manufacturer of your Windows CE handheld computer provides detailed documentation on its features and functionality. Please take the time to review this documentation prior to taking your handheld computer out for your first survey. The following paragraphs include excerpts from the manufacturer's documentation to assist you in getting started and to ensure you are made aware of certain operational features that could impact the success of your survey.

Figure 2.1 shows the operating controls and indicators. Table 2.1 briefly describes each item.

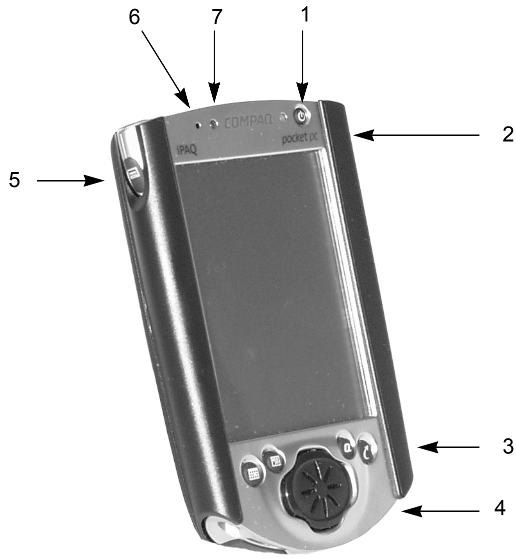

Figure 2.1 Handheld Operating Controls and Indicators

Table 2.1 Handheld Operating Controls and Indicators

Item	Component	Function
1	Power button	Turns the handheld on or off. Press and hold for one second to turn backlight on or off.
2	Alarm/charge light	Battery charge indicator and visual alarm indicator. Flashing green: Alarm notification Flashing amber: Battery is charging Steady amber: Battery is fully charged
3	Application buttons (4)	Allow quick access to four applications: Calendar, Contacts, QMenu, and QStart.
4	Speaker	Sounds alarm
5	Record button	Activates record function in Notes.
6	Microphone	Allows you to record voice message.
7	Light sensor	Detects ambient light level to adjust backlight intensity.

Figure 2.2 shows the top and bottom edge components. Table 2.2 describes each component.

Figure 2.2 Edge Components

Table 2.2 Edge Components

Item	Component	Function
1	DC input jack	Connector for external 12VDC input
2	Communication port	Connects handheld to Z-Xtreme or Z-Surveyor GPS receiver via serial data cable
3	Reset switch	Resets handheld. Lets you clear all data and resets handheld if password is forgotten. Clearing memory deletes all data and restores handheld to default settings.
4	Stylus	Use to activate functions displayed on screen. Press stylus against function displayed on screen.
5	Stylus release button	Press to eject stylus
6	Infrared port	Allows handheld to communicate with Locus GPS receiver via infrared port on Locus

Disabling Handheld Timeout

The handheld incorporates a timeout function that blanks the display after a user-set interval. You can disable the timeout as follows.

1. In the **Start** menu, press **Settings**, then **System**, then **Power** (the icon in the lower left corner of the display).
2. Uncheck the box labeled **On battery power**.

Adjusting Handheld Contrast

The handheld contrast can be adjusted to your preference as follows.

1. In the **Start** menu, press **Settings**, then **System**, then **Contrast**. The **Contrast** menu appears, displaying a contrast slider.
2. Place the stylus on the slider and move the slider left or right to get the desired contrast.

Battery Maintenance

The handheld operates on an internal lithium polymer battery. The battery is charged by plugging the 12 VDC adapter into the handheld DC input receptacle. Charge the battery for 3 to 4 hours before you use the unit the first time. After that, a short charge before each usage should be sufficient to keep the battery operating.

The handheld displays a warning when the battery is nearing discharge. If the warning occurs, you can continue logging data, but you should finish as soon as possible and download your data as described on page 23. If the handheld does shut down due to low battery, it retains the data for about 24 hours. After that, you will lose your data.

Installing Program Card

The Survey Control II software is contained in the 8 MB flash memory program card, Figure 2.3, that is supplied with the system; be aware that your survey data is NOT stored on this card, but in the handheld internal memory. The program card must be physically present in the handheld in order to log point attribute data. Install the card as follows.

Figure 2.3 Program Card Containing Survey Control II Software

Insert the program card into the slot on the top edge of the handheld. Push the card into the slot until the card snaps into position. If the card does not insert easily, do not force it - it is keyed so that it can only go in one way.

Program Operation

1. Turn on the handheld and press the **Start** icon, at the upper left corner of the handheld display. A drop-down menu should appear, similar to Figure 2.4. The list that appears on your screen may differ from that shown in Figure 2.4, but **Survey Control II** should be in the list.

Today
Calendar
Contacts
Inbox
Internet Explorer
Locus
Notes
QLaunch
Survey Control II
Tasks
Programs
Settings
Find....
Help

Figure 2.4 The Start Drop-down Menu

Note: A function is identified by a dark labeled area on the screen. To start a function, press or tap the function with a stylus, a pencil eraser, the tip of your finger, etc. To return to the Start menu from any menu, press the icon to the left of Start in the upper left corner of the display.

2. Press **Survey Control II** on the display.
3. The words "Survey Control II" appear for a few seconds, followed by the **Survey Control II** main menu, Figure 2.5.

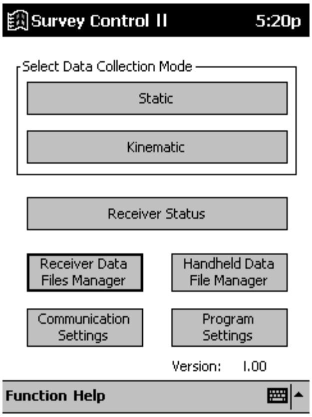

Figure 2.5 Survey Control II Main Screen

The handheld is now running the Survey Control II software, and the screen is displaying your options. These options are data selection mode, receiver status, receiver data management, handheld data management, communication settings, and program settings.

Note:If you install a future updated version of Survey Control II, be sure to delete all .sav and D-files in the handheld before inserting the new program card.

Quick Tour of Survey Control II Software

The following quick tour of the Survey Control II software presents all of the screens found in Survey Control II in a sequence similar to the steps you would follow in utilizing the software to perform a survey. By the time you have reached the end of this tour, you will already have a good understanding of how the software works and when to exercise certain functions.

The user interface of Survey Control II is designed to guide you through the process of performing a GPS survey. Upon execution of the software, you are presented with the **Survey Control II** main screen, Figure 2.6.

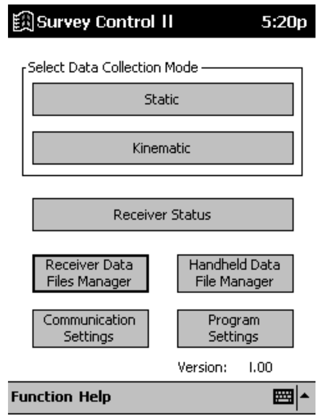

Figure 2.6 Survey Control II Main Screen

On the **Main** screen, only those functions which are pertinent to the current stage of your survey are presented.

> **Note: To demonstrate all the functions in Survey Control II, the handheld must be in communication with a GPS receiver via the infrared port (Locus) or data cable (Z-Xtreme or Z-Surveyor). If this is not the case, some of the screens will display no information - all fields will show N/A.**

To begin, examine the **Communication Settings** screen, Figure 2.7, and **Program Settings** screen, Figure 2.8, to ensure parameters are set to your liking:

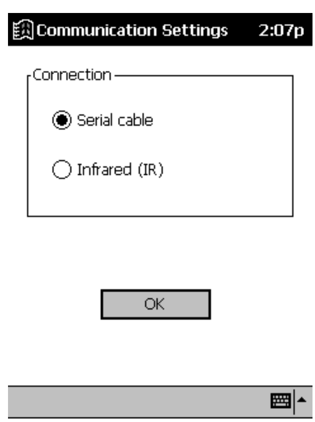

Figure 2.7 Communication Settings Screen

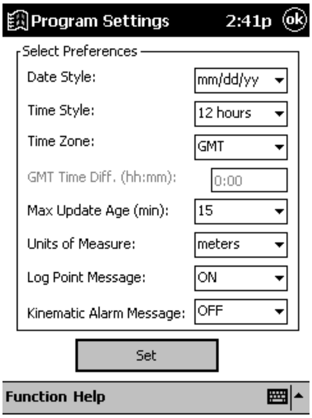

Figure 2.8 Program Settings Screen

Next, review the **GPS Receiver Status** screen, Figure 2.9 to ensure battery power and available memory are sufficient to perform your survey.

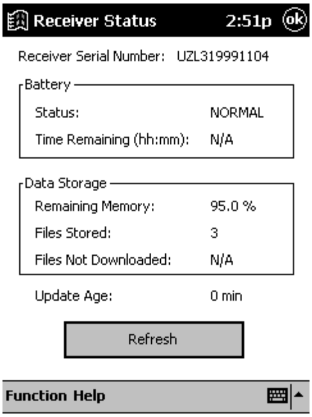

Figure 2.9 GPS Receiver Status Screen

As final preparation prior to beginning a survey, you would use the **Receiver Files Manager** screen, Figure 2.10, and **Handheld File Manager** screen, Figure 2.11, to delete data files from a previous survey which are no longer needed.

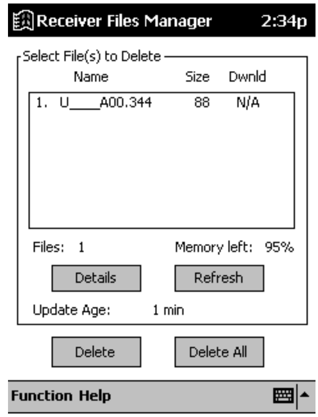

Figure 2.10 Receiver Files Manager Screen

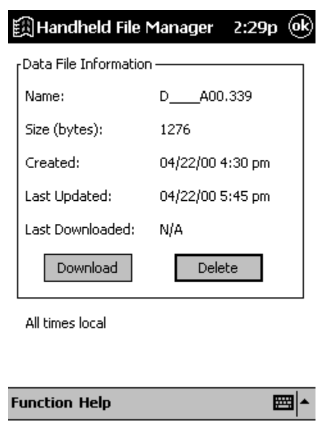

Figure 2.11 Handheld File Manager Screen

With basic system preparation complete, the last remaining task on the **Main** screen is to select the mode of GPS data collection you wish to use for your survey. Following your selection, you will be presented with a series of screens which will assist you in preparing for and executing your survey.

Selecting the **Static** or **Kinematic** mode of data collection presents the **Static Survey**

Setup screen, Figure 2.12, or the **Kinem. Survey Setup** screen, Figure 2.13. Once again, you are provided only with functions pertinent to your present stage in your survey execution and to the survey mode you have selected.

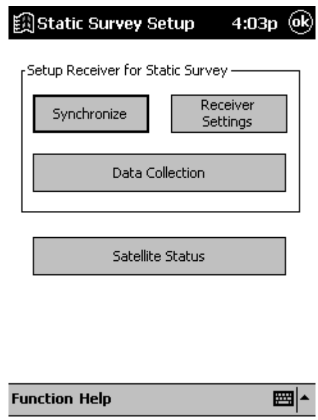

Figure 2.12 Static Survey Setup Screen

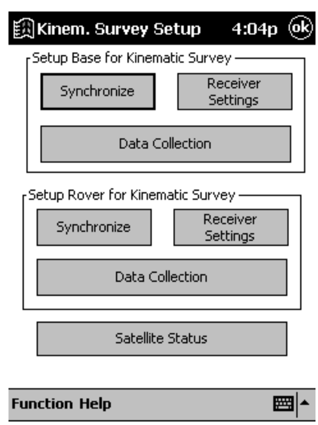

Figure 2.13 Kinem. Survey Setup Screen

With both survey modes, you are presented with the same basic steps for preparing the system to perform the survey, the difference being that with the **Kinematic** survey mode, you perform the preparation steps twice, first on the **Base** receiver, and second on the **Rover** receiver.

Prior to beginning the survey setup processes, you should examine the **Satellite Status**, Figure 2.14, to verify that a sufficient number of satellites have been acquired to successfully execute the survey. This display shows the number of satellites that the GPS receiver is tracking at any particular time. You have the choice of a tabular listing, or a plot display.

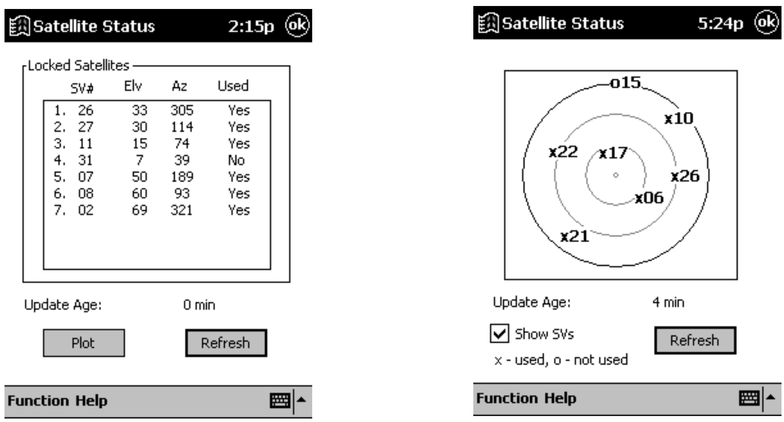

Figure 2.14 Satellite Status Screen - Table or Plot

The survey setup process begins with **Synchronization**, Figure 2.15, of your handheld computer and GPS receiver clocks. Synchronization is necessary so that the post-processing software can correlate point attribute data from the handheld with raw position data from the GPS receiver.

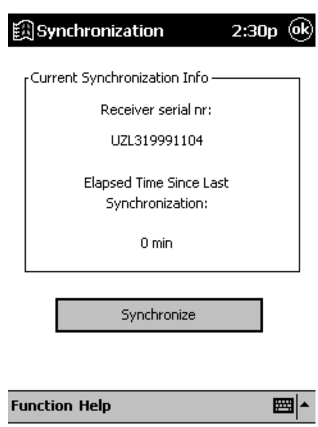

Figure 2.15 Synchronization Screen

Next, set the GPS **Receiver Settings**, Figure 2.16, to the appropriate values for the survey mode being utilized.

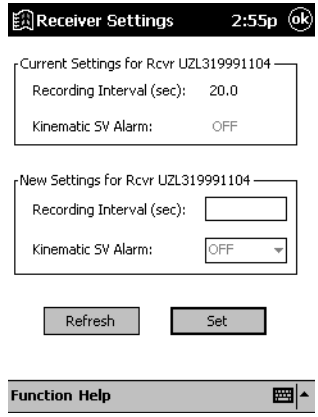

Figure 2.16 Receiver Settings Screen

Finally, you can start collecting data, Figure 2.17, Figure 2.18, or Figure 2.19, depending upon the mode of data collection you want to use.

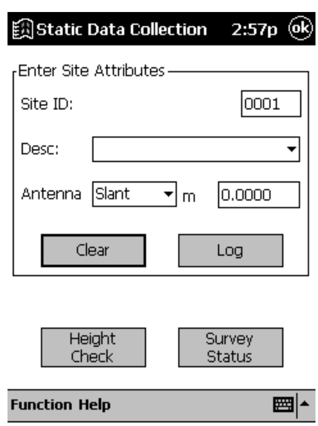

Figure 2.17 Static Data Collection Screen

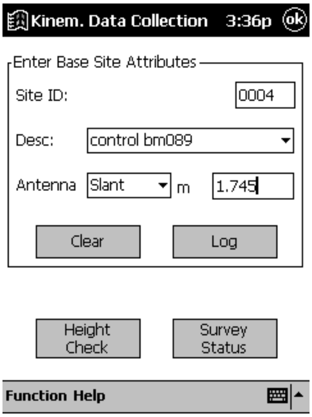

Figure 2.18 Base Kinem. Data Collection Screen

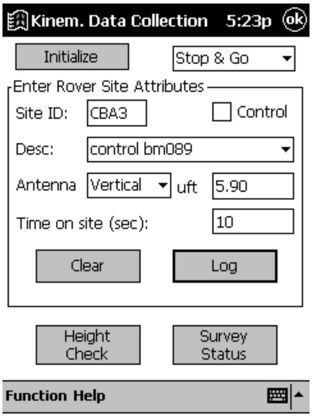

Figure 2.19 Rover Kinem. Data Collection Screen

Using the **Data Collection** screen, enter and log survey point attribute information for each survey point . An **Antenna Height Check** utility, Figure 2.20, is provided to help avoid the costly mistake of recording an incorrect antenna height. Also, **Survey Status**, Figure 2.21, can be viewed at any time.

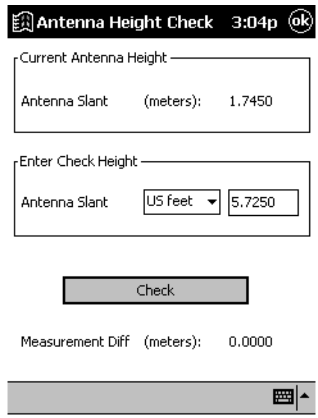

Figure 2.20 Antenna Height Check Screen

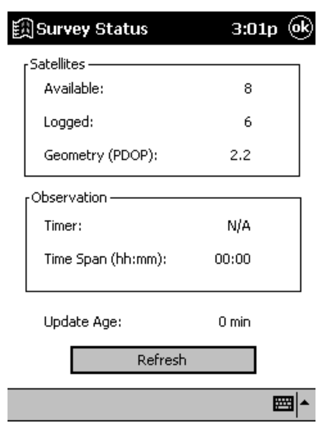

Figure 2.21 Survey Status Screen

In support of the requirement to initialize a kinematic survey, the **Kinematic Initialization** screen, Figure 2.22, is accessible from the **Rover Kinematic Data**

Collection screen. This screen supports all forms of kinematic initialization.

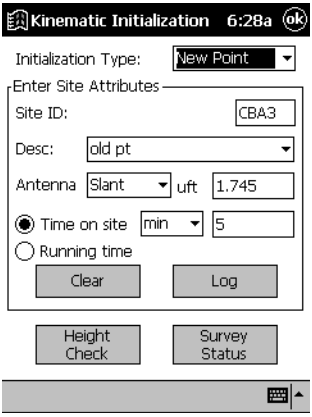

Figure 2.22 Kinematic Initialization Screen

This concludes the quick tour of the Survey Control II software.

Communicating with the GPS Receiver

Some of the functions of Survey Control II require communication with the GPS receiver. Examples are synchronization, displaying receiver battery and memory status, managing receiver data files, etc. These functions are distributed among six different screens within the Survey Control II software:

Synchronization, page 94
Receiver Status, page 88
Receiver Files Manager, page 86
Receiver Settings, page 84
Satellite Status, page 95
Survey Status, page 93

The method and timing of the communication with the GPS receiver is characterized in the following manner:

- When you enter any one of these screens for the first time, Survey Control II automatically attempts to communicate with the GPS receiver to acquire the needed information (receiver status) or to perform a specific function (synchronize).

- The next time you enter the same screen, Survey Control II does not automatically attempt communication with the GPS receiver, but rather shows the same information acquired earlier along with the age of the information (update age). Updated information is obtained by pressing the **Refresh** button on the screen.
- If the age of the information exceeds the maximum update age set in **Program Settings**, Survey Control II once again automatically attempts to communicate with the GPS receiver when you enter the screen.

Communicating with the Locus GPS Receiver

If you are using a Locus GPS receiver, the Locus communicates with the handheld through an infrared port, as shown in Figure 2.23.

Infrared Port

Infrared Port

Figure 2.23 Handheld and Locus Infrared Ports

To illustrate the process of communicating with a Locus receiver, one of the Survey Control II functions that requires communication with the receiver will be exercised, namely the **Receiver Status** function found on the **Main** screen of the software.

> **Note: In order to communicate with the Locus receiver, the receiver must be turned on and locked onto at least one satellite. Therefore, to complete this exercise, you may need to move outside or close to a window.**

1. From the **Survey Control II** main screen, select **Communication Settings**. Select **IR** and press **OK**.

2. From the **Survey Control II** main screen, select the **Receiver Status** function. The GPS **Receiver Status** screen appears. Within a moment or two, a message box appears indicating a connection error has occurred. Upon entry into the GPS **Receiver Status** screen, Survey Control II tried to establish communication with the Locus receiver to retrieve status information. The error message indicates that this attempt failed. If you happened to have the handheld infrared port pointed at the infrared port of the Locus receiver, the handheld and receiver are able to establish communication, and this message will not appear.
3. To establish communication between the handheld and the Locus receiver, point the handheld infrared port toward the Locus infrared port. The distance between ports is not critical, and may work up to several feet, however a closer distance of several inches to a foot is recommended, especially in bright sunlight (Figure 2.24).

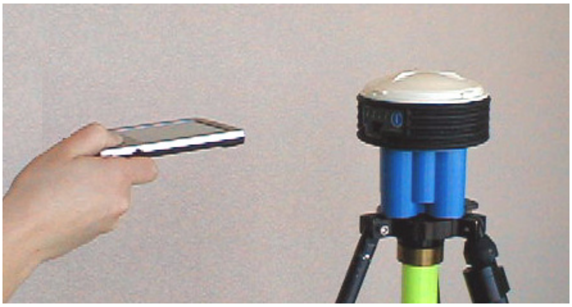

Figure 2.24 Communication between Handheld and Locus IR Ports

4. Now, press the **Retry** button found on the error message box encountered in step 2 above. Communication should now be established with the Locus receiver. Battery and data storage status information should now be available.

   Note: If another communication error occurred or status information did not appear, but rather only the receiver serial number, then either the GPS receiver has not yet locked onto a satellite, the handheld and Locus receiver IR ports are not properly aligned, or the distance between the handheld and the Locus receiver is too great.

   Also, be aware that communicating via IR is slower than via cable, so the handheld will have to be pointed at Locus longer, especially in screens where a lot of files are shown (e.g., receiver data files).

Communicating with the Z-Xtreme/Z-Surveyor Receiver

If you are using a Z-Xtreme/Z-Surveyor GPS receiver, the handheld and receiver communicate through a serial data cable, Figure 2.25, included with the Survey Control II package.

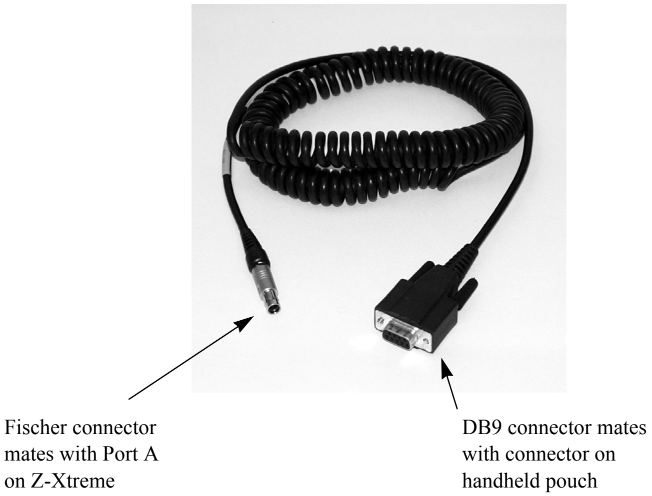

Figure 2.25 Serial Data Cable - Handheld to Z-Xtreme/Z-Surveyor

Figure 2.26 shows the serial data port on the handheld.

Figure 2.26 Handheld Serial Data Port

A short cable inside the handheld pouch mates with the serial data port on the handheld. The other end of the cable projects outside the pouch, with a DB9 connector at the end.

1. Insert the DB9 connector of the serial data cable into the DB9 connector on the handheld pouch cable.
2. Connect the other end of the serial data cable, a Fischer connector, to serial data port A on the Z-Xtreme/Z-Surveyor receiver.

Downloading Collected Data to PC

After you have finished your survey, you must download the collected data to an office computer where the data will be post-processed using the Ashtech Solutions software. The collected data comprises the raw GPS data stored in the GPS receiver, and the attribute data (the D-file) stored in the handheld. The download procedure for the raw data stored in the GPS receiver is covered in the Ashtech Solutions documentation. Please read the entire section on downloading in the Ashtech Solutions documentation before proceeding with the download of your handheld. The following steps define the download procedure for the handheld attribute data (D-file).

Note: You must have Ashtech Solutions 2.1 or later to download an attribute file generated by Survey Control II; earlier versions will not work for this handheld.

The data files from both the GPS receivers and handheld(s) must reside in the same directory in the office computer prior to loading the data into an Ashtech Solutions project. If the GPS receiver files are loaded into a project prior to downloading the handheld attribute file (D-file), the attribute information will not be properly associated with the GPS receiver files. If this happens, delete the data files for the project, and load them again using **Add Raw Data Files From Disk**.

To avoid encountering the above mentioned problem, it is recommended that the GPS receiver files and the handheld attribute file(s) are downloaded together in the same download session. The steps provided below for downloading the handheld attribute data (D-file) assume that you have just completed the download of the GPS receivers, following the procedure outlined in the Ashtech Solutions docummentation, and the Download module is still running on your PC.

Note: For the handheld download operation, you can use the serial data cable supplied with Survey Control II, or a standard infrared device, Figure 2.27, not supplied.

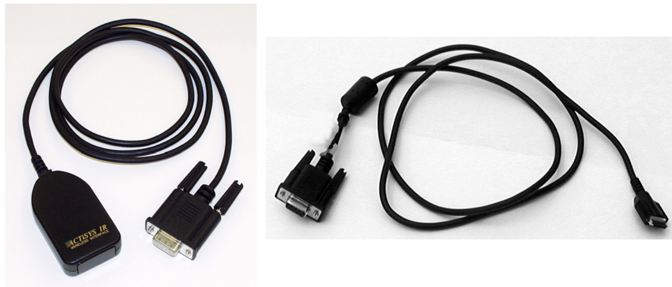

Figure 2.27 Infrared Device (left) and Handheld Serial Data Cable (right)

If You Are Still Communicating with the Last GPS Receiver

If you are currently still communicating with the last GPS receiver downloaded, follow this procedure for downloading the handheld:

1. On the office computer, select **Switch Data Source** from the **File** drop-down menu of **Download**. A dialog box appears instructing you to remove the current device (in this case, GPS receiver) and connect another (in this case, handheld computer).
2. If using the serial data cable, disconnect the cable from the last GPS receiver downloaded and connect the handheld to the office computer using the handheld-to-PC serial data cable supplied with Survey Control II. If using the infrared device, position the handheld and the infrared device so that their infrared ports are facing each other, and are fairly close together (one foot is a good working distance).
3. Turn on the handheld.
4. Disable the handheld timeout as described on page 7.
5. On the handheld, start Survey Control II. From the **Main** screen, select **Handheld Data File Manager**. The display should show the details of the D-file stored in the handheld.
6. Press **Download** and select **IR** or **Serial**, as applicable.
7. On the office computer, select the appropriate connection type in the **Switch Data Source** dialog box currently on the screen. The office computer should now show the handheld D-file in the left pane of the display.
8. Verify that the destination directory in the right pane is the same directory containing your GPS receiver files. If this is not the case, change the destination drive and directory to the one containing your GPS receiver files.

9. With the left mouse button, highlight the D-file and drag it to the appropriate directory in the right pane of the display. A progress display should show the status of the file transfer. Transfer should take about a minute, depending upon the size of the D-file. When transfer is complete, the D-file should be listed in the right pane of the display.

This completes the D-file download procedure for this handheld. Follow the same procedure for downloading additional handhelds.

If No Longer Communicating with Last GPS Receiver

If you are no longer communicating with the last GPS receiver downloaded, follow this procedure for downloading the handheld:

1. If you are using a serial data cable, disconnect the cable from the last GPS receiver downloaded and connect the handheld to the office computer using the handheld-to-PC serial data cable supplied with Survey Control II. If you are using an infrared device, position the handheld and the infrared device so that their infrared ports are facing each other, and are fairly close together (one foot is a good working distance).
2. Turn on the handheld.
3. Disable the handheld timeout as described on page 7.
4. On the handheld, start Survey Control II. From the Survey Control II main screen, select **Handheld Data File Manager**. The display should show the details of the D-file stored in the handheld.
5. Press **Download** and select **IR** or **Serial**, as applicable.
6. On the office computer, select **Connect** from the **File** drop-down menu, then **Handheld**, then **IR** or **Serial**, depending upon which method of connection you are using.
7. Select **COM** port, then select a baud rate; see note below. Click **OK**. The office computer should now list the handheld D-file in the left pane of the display.

   Note: Some handheld computers do not communicate well at the 57,600 baud rate. If you find that the download time seems excessive at this rate, try the 19,200 baud rate. Also note that IR is sensitive to ambient light. Bright ambient light could slow communication.

8. Verify that the destination directory in the right pane is the directory that contains your GPS receiver files. If this is not the case, change the destination drive and directory to the one containing your GPS receiver files.

9. With the left mouse button, highlight the D-file and drag it to the appropriate directory in the right pane of the display. A progress display should show the status of the file transfer. Transfer should take about a minute, depending upon the size of the D-file. When transfer is complete, the D-file should be listed in the right pane of the display.

This completes the D-file download procedure for this handheld. Follow the same procedure for downloading additional handhelds.

3

Field Procedures

Survey Control II's primary function is to assist you in the process of performing GPS surveys using the static and kinematic modes of data collection. In this chapter you will find step-by-step instructions on using Survey Control II to execute static and kinematic surveys.

Note: In the procedures presented in this chapter, you will be instructed to position the GPS receiver or GPS antenna over the point or feature to be positioned. Ashtech recommends the use of fixed-height GPS tripods for this purpose. Fixed-height GPS tripods eliminate field measurement errors of the instrument height, which is the most common blunder in GPS surveying. If HI (height of instrument) is incorrectly recorded, there is no way to recover the observation. If fixed-height GPS tripods are not available, the next best solution is a conventional tripod and tribrach.

Field Procedures for a Static Survey

In the static data collection mode, the GPS systems simultaneously collect raw data from all available satellites while remaining stationary on their respective points. Data collection continues at these locations for a duration dependent upon the distance between the receivers, the satellite geometry, and the obstruction conditions at the data collection locations (i.e., trees or buildings blocking some of the sky). You use the handheld to add attribute information to the points observed by the GPS receiver. When data collection is complete at these specific points, you move the GPS systems to a new set of points to begin another data collection session. In most cases, one GPS system will remain on its current point (pivot point) in order to link the previous set of points to the new set of points, in leap-frog fashion. After data collection is complete, data is downloaded from the GPS receiver and handheld to an office computer for post-processing. The post-processing activity computes vectors to determine the position of all observed points.

The static data collection method produces the most accurate and reliable results due to the amount of data collected during each observation. The disadvantage is in productivity, that is, the long observations required at each point reduce the number of points that can be collected in a day.

Performing a Static Survey

For a static survey, Survey Control II provides the tools to perform the following tasks:

- Change GPS receiver operating parameters if the default values are not acceptable.
- Manage data files in the GPS receiver and handheld computer.
- Enter pertinent survey point attribute information required for data processing.
- Monitor the progress of the static survey.

The nature of GPS surveying requires that data be collected simultaneously by two or more GPS receiver systems. The following procedures apply to each GPS receiver system operating as part of the survey.

1. Set up your GPS receiver system hardware in the static survey configuration. The setup procedure is dependent upon which GPS system you are using.
   a. If you are using the Locus system, position the receiver over the survey point. Figure 3.1 shows a typical setup.

Figure 3.1 Typical Locus Setup

   b. If you are using the Z-Xtreme/Z-Surveyor system, position the GPS antenna over the point. The GPS receiver remains in a pack on the ground, as shown in Figure 3.2.

Figure 3.2 Z-Xtreme/Z-Surveyor Setup

Refer to your receiver manual for more details on setup of the GPS hardware.

Turn on the GPS receiver. As soon as the GPS receiver is turned on, it begins to acquire satellites and store GPS data for the point being surveyed.

2. Turn on the handheld. Start the Survey Control II program by selecting **Survey Control II** from the **Start** menu of the handheld computer. The **Main** screen, Figure 3.3, should appear. If the program begins at a screen other than the **Main** screen, the program was already running in the background; press OK in the upper-right corner until you reach the **Main**

screen.

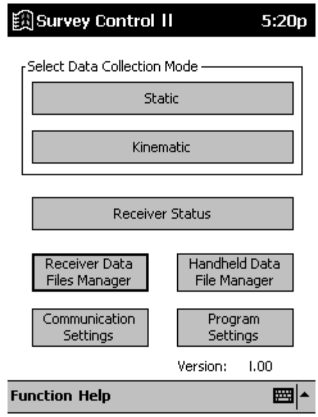

Figure 3.3 Survey Control II Main Screen

The next five steps cover general GPS receiver and Survey Control II software status review. These steps are executed from the **Main** screen. For details on any screen used in these procedures, go to Chapter 4, ***Detailed Screen Descriptions***, and then locate the description for the particular screen of interest.

3. Select **Communication Settings**, Figure 3.4, to determine if Survey Control II and the handheld computer are configured properly to communicate with the GPS receiver. If you are using Locus, select **Infrared (IR)**; if you are using Z-Xtreme/Z-Surveyor, select **Serial Cable**. Make any changes required, and press **OK** to save. The display automatically returns to the **Main** Screen.

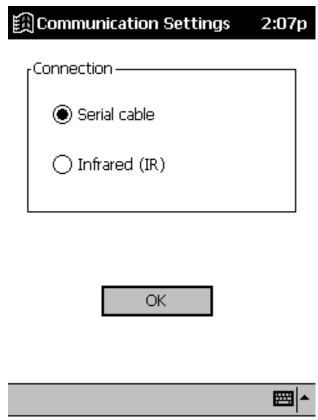

Figure 3.4 Communication Settings Screen- Serial for Z-Xtreme, IR for Locus

4. Select **Program Settings**, Figure 3.5, to determine if Survey Control II is configured to operate in the manner you wish during data collection. Make any changes required, press **Set** to save, and return to the **Main** Screen.

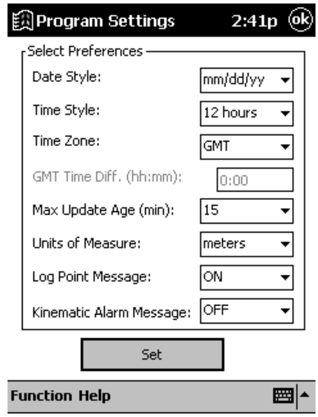

Figure 3.5 Program Settings Screen

5. Select **Receiver Status**, Figure 3.6, to examine the status of the GPS receiver battery and memory. Determine if enough battery power and free memory are available to complete the survey. Return to the **Main** screen.

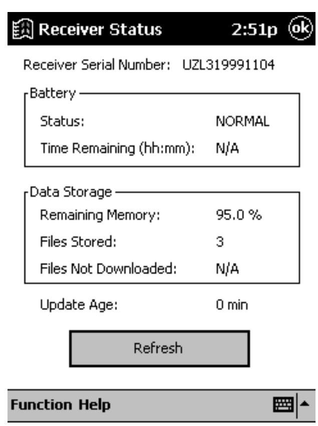

Figure 3.6 Receiver Status Screen

6. If free memory is too low to complete the survey of this point, select **Receiver Data Files Manager**, Figure 3.7. This screen lets you delete receiver data files that are no longer required. Delete as necessary, then return to the **Main** screen.

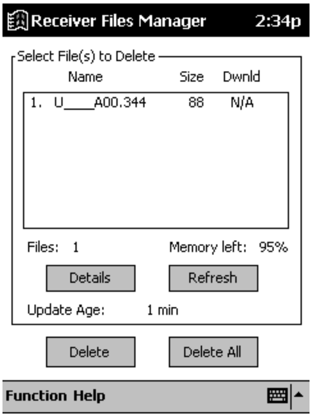

Figure 3.7 Receiver Files Manager Screen

7. Select **Handheld File Manager**, Figure 3.8, to examine the details of the point attribute data file (D-file) stored in the handheld computer.

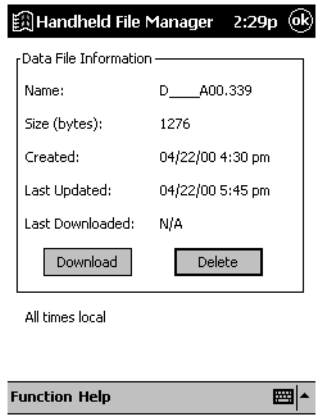

Figure 3.8 Handheld File Manager Screen

The handheld computer stores only one D-file. If a D-file exists in the handheld computer at the start of your survey, new point attribute data is appended to it. Eventually, the D-file will expand beyond the memory capacity of the handheld. To avoid this, delete the D-file if the data has already been downloaded and processed. This can be determined by examining the **Last Updated** and **Last Downloaded** fields. Return to the **Main** screen when finished.

The next steps define the process of setting up the GPS receiver and handheld computer for data collection.

8. Select **Static** from the **Main** screen, bringing up the **Static Survey Setup** screen, Figure 3.9.

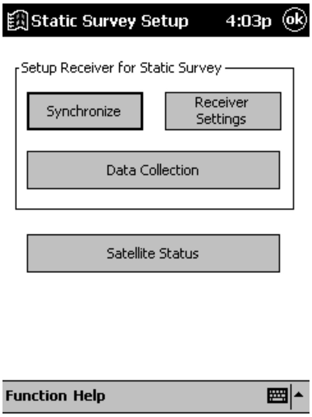

Figure 3.9 Static Survey Setup Screen

9. Before you can perform any survey functions with Survey Control II, you must synchronize the clock in your handheld computer with the clock in the GPS receiver, and store the serial number of the GPS receiver. This procedure later allows the post-processing software to link point attribute data stored in the handheld with raw GPS data stored in the GPS receiver. Still in the **Static Survey Setup** screen, Figure 3.9, select **Synchronize,** calling the **Synchronization** screen, Figure 3.10.

Figure 3.10 Synchronization Screen

Press **Synchronize**. Synchronization should occur virtually instantaneously. Verify that the display shows a receiver serial number, and an elapsed time of 0 min; these are the indications that the synchronization was successful. Press **OK** to return to the **Static Survey Setup** screen.

10. Select **Receiver Settings,** Figure 3.11**,** to examine the current settings for receiver data recording interval and receiver kinematic SV alarm.

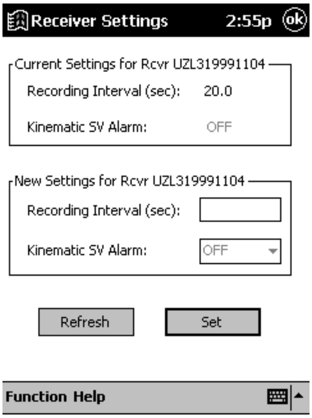

Figure 3.11 Receiver Settings Screen

Since this is a static survey, there is no need to activate the kinematic SV alarm. For a static survey, the receiver data recording interval should be set to 10 – 20 seconds if observation times are expected to be 15 minutes or longer (this is normally the case with a Locus receiver), or 5-10 seconds if the observation time is expected to be less than 15 minutes (usually the case with a Z-Xtreme/Z-Surveyor receiver).

Be aware that all GPS receivers involved in the survey must be set to the same recording interval. For example, if one receiver is set to a recording interval of 10 seconds and the other is set to 15 seconds, the processing software attempting to process the vector between these two receivers will only find common data every 30 seconds (every second data sample in one and every third data sample in the other). This could cause a poor solution for this vector.

Return to the **Static Survey Setup** screen.

11. By this time, your GPS receiver should have acquired all satellites in view, and should be logging data from at least four healthy satellites, which is the required minimum number for data processing. This can be confirmed through the user interface on your GPS receiver, or by selecting **Satellite**

Status on the handheld (Figure 3.12).

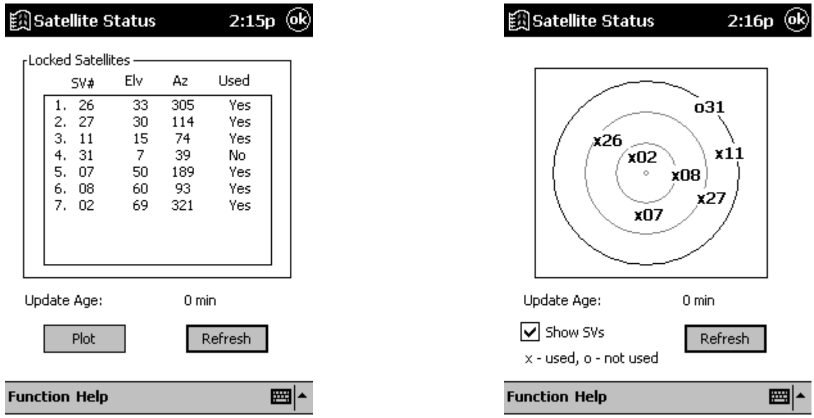

Figure 3.12 Satellite Status Screens - Table (left) or Plot (right)

The next steps guide you through point attribute data entry and storage. For static surveys, this is considered the data collection process. GPS satellite data collection began when you first turned on the GPS receiver, and continues as long as the receiver is powered up, regardless of the procedure currently underway in Survey Control II. The data collection process in Survey Control II simply stores the point attribute information that will later be assigned to the GPS satellite data during data processing.

12. Select **Data Collection** from the **Static Survey Setup** screen, Figure 3.13, to access the **Static Data Collection** screen, Figure 3.14.

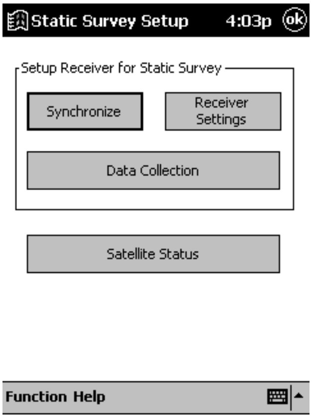

Figure 3.13 Static Survey Setup Screen

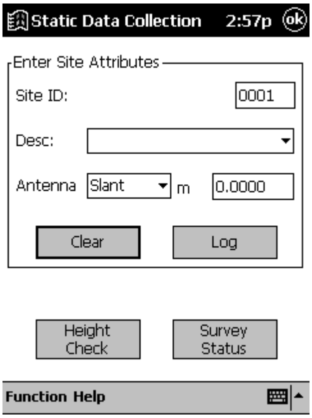

Figure 3.14 Static Data Collection Screen

13. Enter the point attribute information for the point being surveyed. The attribute information comprises the following parameters:
    - A 4-character site ID. You must assign a unique site ID to each point surveyed in your project. If you observe the same point more than once,

you need to assign this point the same site ID for each data collection session.

- Optional, a narrative description of this point.
- The antenna height parameters for this point. Select **Slant** if you are measuring the antenna height to the outside edge of the GPS antenna or **Vertical** if you are measuring the antenna height to the bottom of the GPS antenna. Enter the measured antenna height value in the units of measure you selected previously using **Program Setting** in the **Main** screen.

14. Select the **Antenna Height Check** screen**,** Figure 3.15**,** to perform a test on your entered antenna height, ensuring the correct value has been entered. **Antenna Height Check** compares the entered antenna height values in two units of measure - US feet and meters. Using the antenna height measurement device included with your GPS receiver system, measure the antenna height in both US feet and meters. Enter both values in **Height Check**. The difference between the two measurements is displayed. A large difference indicates one of the two measurements are incorrect. If it is determined the antenna height measurement entered in the **Static Data Collection** screen is incorrect, enter the correct value and again press the LOG button.

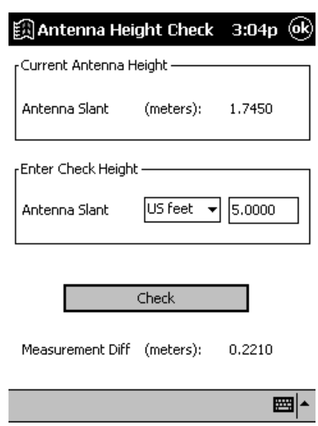

Figure 3.15 Antenna Height Check Screen

15. Select **Survey Status,** Figure 3.16**,** to monitor the status of your static survey. The **Survey Status** screen presents information on GPS satellites

and observation times.

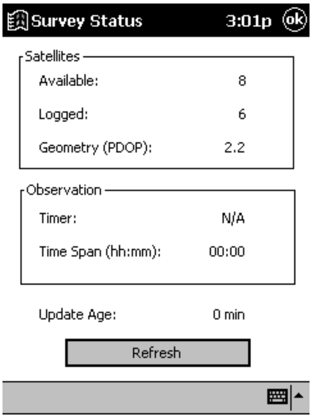

Figure 3.16 Survey Status Screen

16. When you are satisfied that enough data has been collected by all GPS receiver systems currently collecting data, turn off the handheld computer and the GPS receiver (unless you intend to use the receiver as a pivot point).

You have completed this session of your static survey. You can now move to the next point, remain as the pivot point for the next session, or pack up for the day. After data collection is complete, take all GPS receivers and handheld computers used in the survey to the office and download the data to an office computer as described elsewhere in this manual. This data will then be processed to produce coordinates and attributes for all features.

Field Procedures for A Kinematic Survey

With kinematic data collection, one of the GPS systems is designated as the base and remains stationary throughout the survey. All surveyed points are determined relative to the base. Once operational, the base system simply collects and stores raw data from all the available satellites.

The other simultaneously operating GPS receiver(s) in a kinematic survey is designated as the rover. As the name implies, kinematic data collection is dynamic in nature. You move the rover system around the project site, collecting position data for items of interest. While moving around the project site, you stop for a short period of time to position a specific item, such as a manhole. Occupation time of the point can range from 6 seconds to 60 seconds. Once finished, you move to the next point of interest. Also, you can position linear features, such as the centerline of a road, by walking along the centerline and instructing the rover system to store a position every 5 seconds, for example. The result is a trail of points defining the centerline.

To facilitate the mobility required to utilize the kinematic method of data collection, the rover system is designed to be man-portable, usually carried in a backpack or all on a pole. You interface with the rover system through a handheld computer/data collector, using the handheld to add attribute information to each point.

While it is obvious that kinematic data collection has the advantage of high productivity, there are disadvantages to kinematic data collection. Accuracies are not as good as with static data collection. In addition, the rover system **must** maintain lock on GPS satellites as it moves from point to point. If lock is lost, you must return to one of the last successfully established points for initialization.

Finally, kinematic surveys are most successful when the kinematic base receiver is close to the kinematic rover. Accuracies of GPS-derived positions are distance-dependent. The greater the distance between the GPS receivers, the larger the uncertainty. In an ideal case, the kinematic base should be on the same project site as the kinematic rover. Kinematic surveys with a separation of more than 10 kilometers (6 miles) between the kinematic base and rover should be avoided. Such a separation makes kinematic initialization more difficult, increasing the chances of poor results.

When performing a kinematic survey, Survey Control II provides you with the tools to perform the following tasks:

- Change GPS receiver operating parameters if the default values are not acceptable.
- Manage data files in the GPS receiver and handheld computer.
- Enter pertinent survey point attribute information required for data processing.
- Monitor the progress of the kinematic survey.

Kinematic Base

When selecting the location for your kinematic base, be sure the location is as free of satellite obstructions as possible. The more open the area, the better your chances of a successful survey. If obstructions, such as trees or buildings, at the base station cause the GPS receiver to not maintain lock on at least 5 satellites throughout the kinematic data collection period, there is a good chance some of the points observed by the rover will be lost. Take great care in selecting the base location.

1. Set up your GPS receiver system in the kinematic base configuration. The setup procedure depends upon the GPS system you are using.
   a. If you are using the Locus system, position the Locus over the survey point. If you intend to use the initializer bar for kinematic initialization,

be sure to incorporate the bar as part of your base setup as shown in Figure 3.17. The initialization bar gives you an accurate baseline of 0.2 m (0.656 ft) for initialization purposes. Refer to *Appendix A* for further details.

Figure 3.17 Locus with Initializer Bar

b. If you are using a Z-Xtreme or Z-Surveyor system, position the GPS antenna over the survey point, as shown in Figure 3.18. The GPS receiver remains in a pack on the ground.

Figure 3.18 Z-Xtreme or Z-Surveyor Setup

Refer to the GPS system manual for more details on setup of the GPS hardware.

Turn on the GPS receiver to begin data collection. At this time, the GPS receiver acquires all satellites in view and begins storing GPS data for the point being surveyed.

2. Start the Survey Control II program by selecting **Survey Control II** from the **Start** menu of your handheld computer. The handheld will display the **Main** screen titled **Survey Control II**. If you find that the software begins at a screen other than the **Main** screen, the software was already running in the background from previous activity. Simply press **OK** in the upper right corner of the display, until you reach the **Main** screen, Figure 3.19.

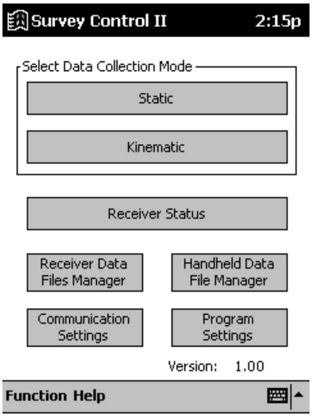

Figure 3.19 Survey Control II Main Screen

The next 5 steps cover general GPS receiver and Survey Control II software status review. These steps are performed from the Survey Control II main screen. For details on any screen discussed in this procedures, refer to Chapter 4, *Detailed Screen Descriptions*.

3. Select **Communication Settings,** Figure 3.20**,** to determine if Survey Control II and the handheld computer are configured properly to communicate with the GPS receiver. If using Locus, select **IR**; if using Z-Xtreme/Z-Surveyor, select **Serial Cable**. Make any changes required and press **OK** to save and return to the **Main** screen.

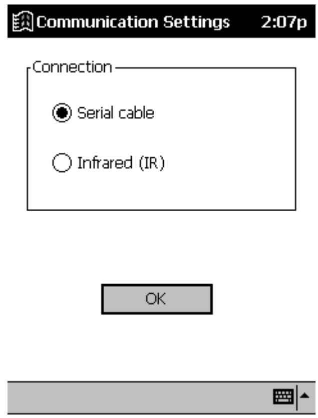

Figure 3.20 Communication Settings Screen

4. Select **Program Settings,** Figure 3.21**,** to determine if Survey Control II is configured to operate in the manner you wish during data collection. Make any changes required, press **Set** to save changes, and return to the **Main** screen.

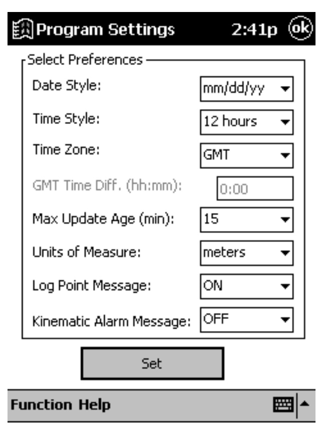

Figure 3.21 Program Settings Screen

5. Select **Receiver Status,** Figure 3.22**,** to examine the status of the GPS receiver battery and memory. Determine if enough battery power and free

memory are available to complete the survey. Return to **Main** screen.

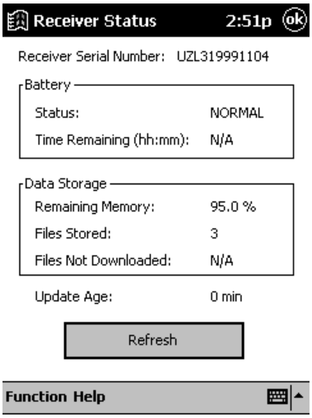

Figure 3.22 Receiver Status Screen

6. If free memory is too low to complete the survey of this point, select **Receiver Data Files Manager,** Figure 3.23**,** and delete receiver data files that are no longer required. Return to the **Survey Control II** main screen when finished.

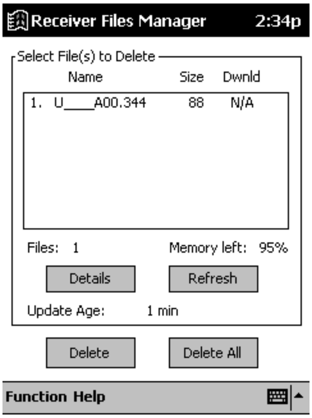

Figure 3.23 Receiver Files Manager Screen

7. Select **Handheld File Manager,** Figure 3.24**,** to examine the details of the point attribute data file (D-file) stored in the handheld computer. The handheld computer stores only one D-file. If a D-file exists in the handheld

computer at the start of your survey, new point attribute data will be appended to it. Eventually, the D-file will expand beyond the memory capacity of the handheld. To avoid this, delete the D-file if the data contained within it has already been downloaded and processed. This can be determined by examining the **Last Updated** and **Last Downloaded** fields. Return to the **Main** screen when finished.

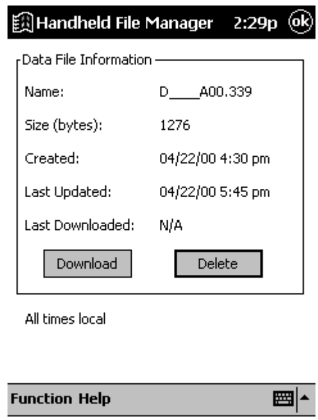

Figure 3.24 Handheld File Manager Screen

The next steps walk you through the process of setting up the GPS receiver and handheld computer for data collection.

8. Select **Kinematic** from the **Main** screen. The **Kinem. Survey Setup** screen appears, as shown in Figure 3.25. The screen displays two groups of functions. The first group is **Setup Base for Kinematic Survey**. The second group is **Setup Rover for Kinematic Survey**. For this operation, you will use only those functions in **Setup Base for Kinematic Survey**.

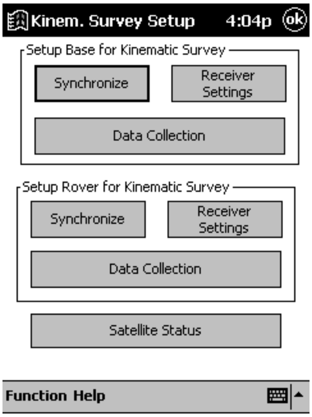

Figure 3.25 Kinem. Survey Setup Screen

9. Before you can perform any survey functions with Survey Control II, you must synchronize the clock in your handheld computer with the clock in the GPS receiver, and also store the serial number of the GPS receiver. This procedure later allows the post-processing software to correctly link point attribute data stored in the handheld with raw GPS data stored in the GPS receiver. Still in the **Kinem. Survey Setup** screen, select **Synchronize** to call the **Synchronization** screen**,** Figure 3.26. Synchronization is automatic and virtually instantaneous. Check the display for a receiver serial number and an elapsed time of 0 min; these are the indications that synchronization was successful. Return to the **Kinem. Survey Setup** screen after synchronization.

Field Procedures

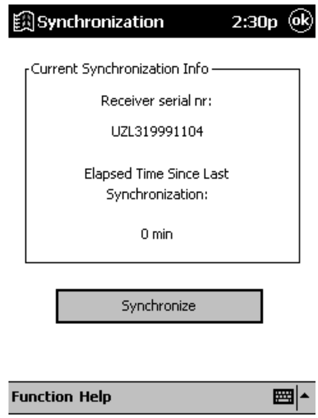

Figure 3.26 Synchronization Screen

10. In the **Kinem. Survey Setup** screen, select **Receiver Settings.** The **Receiver Settings** menu appears, as shown in Figure 3.27**.** This screen lets you examine the current settings for receiver data recording interval and receiver kinematic SV alarm.

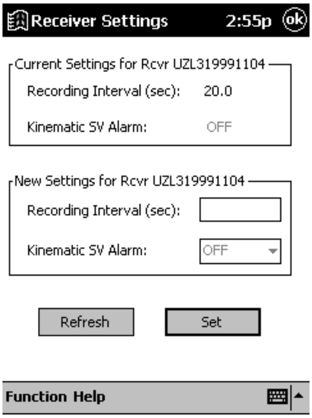

Figure 3.27 Receiver Settings Screen

For a kinematic survey, the receiver data recording interval should be set to 2 seconds for most situations. If there is a concern about having enough receiver memory to complete the survey, it is acceptable to use a recording interval as slow as 5 seconds; however, a slower recording interval may impact your required observation time for each point observed by the kinematic rover. At least 3 data samples should be logged to memory for each point observed to meet kinematic survey accuracy specifications. With a 5-second recording interval, an observation time of at least 15 seconds is required.

Since the kinematic SV alarm is designed to warn you when the kinematic initialization has been lost due to satellite obstructions, there is no need to activate the alarm at the kinematic base. In most cases, there will be no one at the kinematic base to hear the alarm. And since the kinematic base is set up in an open area and not moving, it should not be an issue. There is no harm though in activating the Kinematic SV Alarm at the base.

Return to the **Kinem. Survey Setup** screen when receiver setup is complete.

11. By this time, your GPS receiver should have acquired all usable satellites in view, and should be logging data from at least 4 healthy satellites, which is the minimum number required for data processing. This can be confirmed through the user interface on your GPS receiver, or by selecting the **Satellite**

Status function, Figure 3.28, which indicates the satellites that are being tracked.

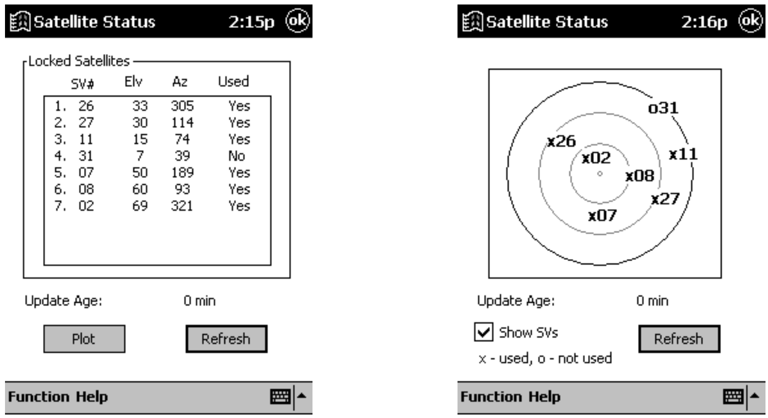

Figure 3.28 Satellite Status Screens - Table (left) and Plot (right)

The remaining steps guide you through point attribute data entry and storage for the kinematic base.

12. In the **Kinem. Survey Setup** screen, in the **Setup Base for Kinematic Survey** group, select **Data Collection.** The **Kinem. Data Collection** screen appears (Figure 3.29).

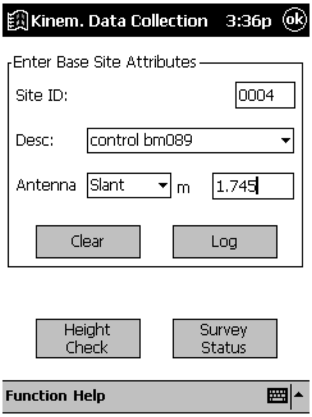

Figure 3.29 Kinem. Data Collection Screen

13. Enter the point attribute information for the kinematic base point.
    - A 4-character site ID. You must assign a unique site ID to each point surveyed in your project. If you observe the same point more than once, you need to assign this point the same site ID for each data collection session.
    - Optional, a narrative description of this point.
    - The antenna height parameters for this point. Select **Slant** if you are measuring the antenna height to the outside edge of the GPS antenna or **Vertical** if you are measuring the antenna height to the bottom of the GPS antenna. Enter the measured antenna height value in the units of

measure you selected previously using **Program Setting** in the **Main** screen.

14. Select **Height Check,** Figure 3.30**,** to perform a test on your entered antenna height, ensuring the correct value has been entered. The **Height Check** function compares antenna height values entered in two units of measure, US feet and meters. Using the antenna height measurement device included with your GPS receiver system, measure the antenna height in both US feet and meters. Enter both values in the **Height Check** function. The difference between the two measurements is displayed. A large difference indicates one of the two measurements is incorrect. If it is determined the antenna height measurement entered in the **Kinem. Data Collection** screen is incorrect, enter the correct value and press the **LOG** button.

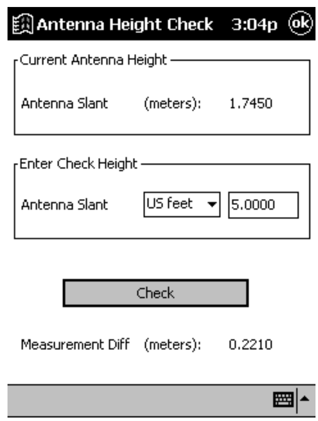

Figure 3.30 Antenna Height Check Screen

15. In the **Kinem. Data Collection** screen, press **O**K in the upper right corner of the screen to return to the **Kinem. Survey Setup** screen. This is where you will begin your setup of the kinematic rover system.

Your kinematic base is now prepared for the kinematic survey. No further interaction will be required with the kinematic base until the end of the survey.

Kinematic Rover

With your kinematic base up and running, the next step is to prepare the kinematic rover. If multiple rovers are to be involved in the survey, the steps outlined below should be followed for each rover system.

1. Set up your GPS receiver system hardware in the kinematic rover configuration. The setup procedure is dependent upon which GPS system you are using.
    a. If you are using Locus, place the rover Locus receiver on top of the kinematic range pole using a quick release mount. Attach the handheld to the pole with a specially designed bracket, as shown in Figure 3.31.

Figure 3.31 Locus System on Pole

    b. If you are using a Z-Xtreme/Z-Surveyor receiver, place the GPS antenna on top of the kinematic range pole. Attach the handheld to the pole with a special bracket, as noted previously. Finally, mount the GPS receiver on the pole along with the other components, as shown in Figure 3.32, or place it in a backpack.

Figure 3.32 Z-Xtreme Setup

Turn on the GPS receiver to begin data collection for your survey. At this time, the GPS receiver will acquire all satellites in view and begin storing GPS data.

2. Since you have just completed the setup and execution of your kinematic base, the Survey Control II **Kinem. Survey Setup** screen should be currently active (Figure 3.33). This is where you will begin your setup of the kinematic rover system.

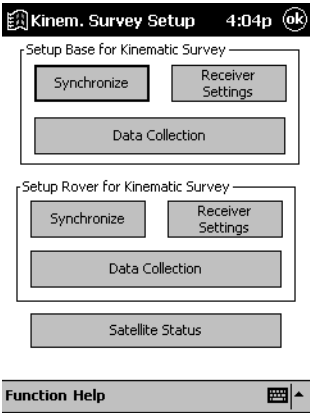

Figure 3.33 Kinem. Survey Setup Screen

The **Communication Settings**, **Program Settings**, and **Handheld File Manager** have already been completed during the kinematic base setup, therefore they do not need to be repeated.

An exception to the above would be when more than one kinematic rover system is to be used during the kinematic survey. Each kinematic rover system will have its own handheld computer. Only one will be used to set up the kinematic base. For each additional kinematic rover, review **Communication Settings**, **Program Settings**, and **Handheld File Manager**. Then select the **Kinematic** function from the **Main** screen. Each rover is now at the same stage.

3. Access **Receiver Status** by first selecting **Function** at the bottom left corner of the screen, and then selecting **Receiver Status** from the list, calling the **Receiver Status** screen, Figure 3.34.

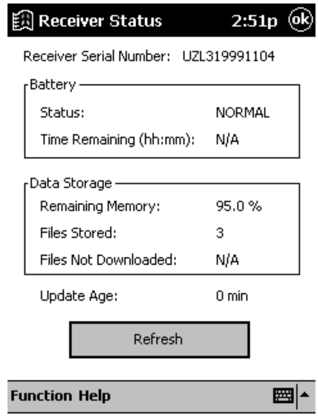

Figure 3.34 Receiver Status Screen

Examine the status of the GPS receiver battery and memory. Determine if enough battery power and free memory are available to complete the survey of this point. Select **OK** from the top right corner to return to the **Kinem. Survey Setup** screen.

4. If free memory is too low to complete the survey, from **Function** select **Receiver Files Manager,** Figure 3.35**,** to delete receiver data files that are no longer required. Return to the **Kinem. Survey Setup** screen when finished.

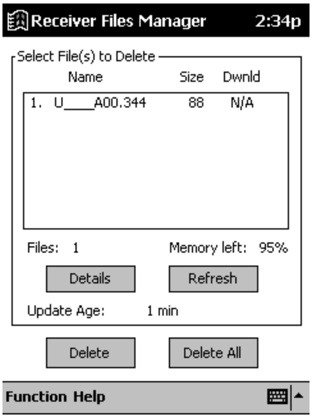

Figure 3.35 Receiver Files Manager Screen

The next steps walk you through the process of setting up the kinematic rover GPS receiver and handheld computer for data collection. The following steps utilize the functions in the the **Kinem. Survey Setup** screen in the group '**Setup Rover for Kinematic Survey**'.

5. Select **Synchronize** from the **Setup Rover for Kinematic Survey** group to once again synchronize the clocks (Figure 3.36).

Figure 3.36 Synchronization Screen

The main reason for performing this task again is not for clock synchronization (clock remains synchronized from the kinematic base setup), but rather to record the serial number of this new receiver. This will enable the post-processing software to assign point attribute information to the appropriate GPS receiver raw data file. Synchronization is automatic and virtually instantaneous. Check for a receiver serial number and an elapsed time of 0 min. These are indications that the synchronization was successful. Return to the **Kinem. Survey Setup** screen when synchronization is complete.

6. Select **Receiver Settings** to examine the current settings for receiver data recording interval and receiver kinematic SV alarm (Figure 3.37).

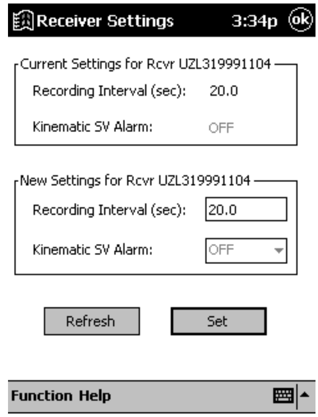

Figure 3.37 Receiver Settings Screen

The data recording interval for the kinematic rover must be set to the same interval as the kinematic base. If not, this could ruin the entire survey. For example, if the kinematic base receiver is set to a recording interval of 5 seconds and the kinematic rover is set at 2 seconds, when the processing software attempts to process the vectors between these two receivers, it will only find common data every 10 seconds (every 2^{nd} data sample in one and every 5^{th} data sample in the other). If the observation on each point was only 8 seconds, processing will fail for most points observed.

The kinematic SV alarm should be enabled for the kinematic rover. The kinematic SV alarm will warn you when the GPS receiver thinks it has lost it's kinematic initialization. This occurs if the GPS receiver is unable to maintain lock on at least 5 satellites, even momentarily. More on the kinematic SV alarm is presented below.

Return to the **Kinematic Survey Setup** screen when receiver setup is complete.

7. By this time, your GPS receiver should have acquired all usable satellites in view and should be logging data from at least 4 healthy satellites, which is the required minimum number for data processing. This can be confirmed through the user interface on your GPS receiver, or by selecting the **Satellite Status** function as noted previously (Figure 3.38).

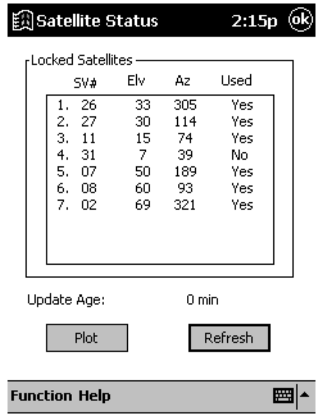

Figure 3.38 Satellite Status Screen - Table Format

Your kinematic rover system is now prepared to execute your kinematic survey. The remaining steps guide you through the data collection process.

8. Select **Data Collection** in the **Setup Rover for Kinematic Survey** group from the **Kinem. Survey Setup** screen to access the rover **Kinem. Data Collection** screen.

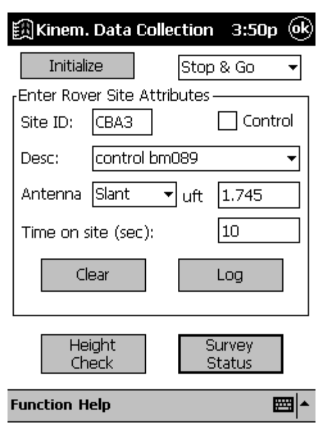

Figure 3.39 Kinem. Data Collection Screen

9. A unique aspect and an absolutely essential step for a successful kinematic survey is the initialization process. The kinematic rover must be initialized prior to surveying any points. Select **Initialize** from the **Kinematic Data Collection** screen to accomplish this (Figure 3.40).

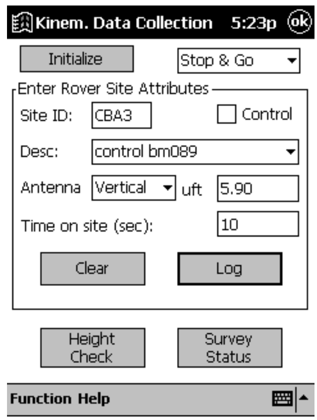

Figure 3.40 Kinem. Data Collection Screen - Initialize

There are three primary methods to initialize your kinematic survey: **Bar Point**, **Known Point**, and **New Point**. You must select which method you wish to use. The Bar Point method is exclusive to the Locus system. For more details on kinematic initialization including recommendations on when to use each method, refer to Appendix A, *Kinematic Initialization*.

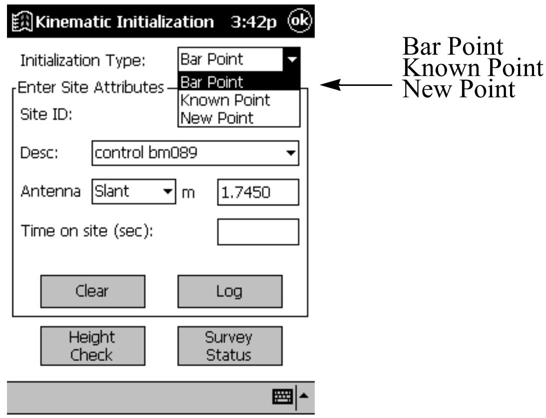

Figure 3.41 Select Type of Point

The steps for initialization differ slightly depending on the method selected, as described in the following paragraphs.

Bar Point Method

If using the Bar Point method:

a. Place the kinematic rover GPS receiver onto the vacant end of the initializer bar. Be careful not to disturb the base setup. Also be careful not to rotate the bar.

b. Enter a **Site ID** different from the **Site ID** entered for the kinematic base. This is not the same point as the base, and is offset from the base by 0.200 meters (0.656 ft).

c. Enter the same antenna height parameters as the kinematic base. The initializer bar places the kinematic rover at the same height as the kinematic base.

d. The **Time on Site** parameter is automatically set to 300 seconds (5 minutes). This is the recommended amount of time for initialization on the bar.

e. Select the **Log** function. A screen will appear, counting down the remaining time. When 0 seconds is reached, you will be prompted that the initialization is complete.

f. Select **OK** from the upper-right corner to return to the **Kinematic Data Collection** screen.

Known Point Method

If using the Known Point method:

a. Enter the **site ID** for this point, description, and antenna height parameters. When using the standard 2-meter kinematic pole, the antenna height parameters will be Vertical and 2.000 meters.

b. Enter an observation time in the **Time on Site** parameter field. Initialization on a known point can be accomplished with a short observation time. Utilize the same observation time planned for each new point to be surveyed. For example, if you plan to observe each kinematic point for 10 seconds, use 10 seconds as the observation time for your **Known Point** initialization.

c. Level the kinematic rover system over the known point.

d. Select the **Log** function. A screen will appear, counting down the remaining time. When 0 seconds is reached, you will be prompted that the initialization is complete. From the **Kinematic Initialization** screen, select **OK** from the upper-right corner to return to the **Kinematic Data Collection** screen.

New Point Method

If using the New Point method:

a. Enter the **Site ID**, description, and antenna height parameters for this point. When using the standard 2-meter kinematic pole, the antenna height parameters will be **Vertical** and **2.000 meters**.

b. Select **Time on Site** and enter a time in the field. Or, if you prefer, select **Running Time**. The **Running Time** option counts up from the time the **Log** function is selected.

c. Level the kinematic rover system over the new point. Since the New Point initialization method requires an extended observation period, you will need to use a tripod or a set of bipod legs on your kinematic pole.

d. Select the **Log** function. A screen will appear, counting down the remaining time. When 0 seconds is reached, you will be prompted that the initialization is complete. If **Running Time** was selected, the time will count up. When you have determined enough data has been collected to successfully establish this point, select the **Stop** function. From the **Kinematic Initialization** screen, select **OK** from the upper-right corner to return to the **Kinematic Data Collection** screen.

A New Point initialization is the same as performing a static survey of the new point. At the end of the survey, you are initialized and can begin roving with the kinematic rover system. Observation times for

New Point initialization are the same as observation times for a static survey.

This completes the initialization process. You should now be back at the rover **Kinematic Data Collection** screen.

10. With the completion of the initialization process, you are ready to begin positioning features. Survey Control II supports two different modes of kinematic data collection, **Stop&Go** and **Continuous**, each requiring a slightly different procedure for execution. For details on how each mode works and recommendations on when to use a specific mode, refer to Appendix B, *Kinematic Survey Modes*.

    Steps for each mode of kinematic data collection are presented below.

Stop&Go

Use the following procedure to perform a Stop&Go survey.

a. Select **Stop&Go** from the kinematic mode selection list.

b. Enter the **Site ID**, description, and antenna height parameters for this point. When using the standard 2-meter kinematic pole, the antenna height parameters will be **Vertical** and **2.000 meters**.

c. Enter an observation time in the **Time on Site** parameter field.

d. Level the kinematic rover pole over the feature to be positioned.

e. Select the **Log** function. A screen will appear, counting down the remaining time. When time reaches 0, you will be informed that data collection is complete. Select **OK** in the upper-right corner of the message box. You have now completed data collection at this location. You are free to move to the next feature to be positioned.

f. As you move about the project site, positioning features of interest, you must maintain lock on at least 5 satellites at all times in order to retain the kinematic initialization. The Kinematic SV Alarm is designed to monitor satellite lock in the GPS receiver. If the rover receiver detects fewer than 5 satellites at any given time, the Kinematic SV Alarm sounds, indicating loss of initialization. To continue with your kinematic survey, you must first re-initialize, using any one of the three initialization methods, Bar Point, Known Point, or New Point, as outlined in step 9 above. It is important to remember that loss of initialization has no adverse effects on features positioned prior to initialization loss. Those features have been successfully positioned regardless of what happens later on in the survey. Refer to Appendix C for more details on the functionality of the Kinematic SV Alarm.

   Note: The most convenient method for re-initialization of your kinematic survey is the Known Point method. To facilitate this, consider establishing a re-initialization point as you move about the project site. Set a nail in the ground and position the point. Then, if you need to re-initialize, a point will be available close by. To assist

with this process, a feature has been added to the Kinematic Data Collection screen to help remember which Site ID was assigned to the re-initialization point (you must use the same Site ID used previously to establish the point). When you first establish the re-initialization point, select the Control check box prior to logging the data. This will place the re-initialization point Site ID in a known point list. Later, when you return to the re-initialization point to re-initialize, the Site ID of the point will appear in a Site ID list under Known Point initialization. Simply select the Site ID and initialize. This feature removes the need to remember what Site ID was assigned to the re-initialization point.

Continuous

Use the following procedure to perform a Continuous Kinematic survey.

a. Select **Continuous** from the kinematic mode selection list.

b. Enter the **Site ID**, description, and antenna height parameters for this point. When using the standard 2-meter kinematic pole, the antenna height parameters will be **Vertical** and **2.000 meters**.

c. Enter an interval in the **Site Log Interval** parameter field. For example, if you wish to log a data sample every 6 seconds as you move along the linear feature, enter 6.

d. Select the **Start** function. A screen appears showing the current site ID. Every time a data sample is logged, the **Site ID** automatically increments by 1.

e. When you have completed delineating the linear feature, select **Stop**. You will return to the **Kinematic Data Collection** screen. At this point, you can continue positioning features in either mode of kinematic data collection.

The same initialization requirements and recommendations outlined above under Stop&Go also apply to the Continuous mode of kinematic data collection. It is also recommended that a known point be occupied at the end of the continuous kinematic survey, if at all possible.

Feature location continues in this manner until all features on the project site have been positioned. When finished, turn off all equipment.

After data collection is complete, take all GPS receivers and handheld computers used in the survey to the office for data downloading. This data will then be processed to produce coordinates for all features surveyed.

4

Detailed Screen Descriptions

This chapter presents detailed descriptions of the Survey Control II screens.

Survey Control II Main Screen

When you run the Survey Control II software, the handheld presents the **Survey Control II main** screen, Figure 4.1. From this point, a survey can be initiated, the GPS receiver can be queried for status information, data files can be managed, or communication and program settings can be modified. Selection of any one of these functions will either present you with the information you desire, or provide you with the next level of actions required to execute the function. Functions requiring multiple steps, such as performing a static survey, are presented in a logical step-by-step manner, guiding you through the process of performing the function. At times, you may wish to jump straight to a function rather than be led to it through the structured user interface. This can be accomplished through the **Function** list found in the lower left corner of the screen. For example, to access satellite status information, you must first either select **Static** or **Kinematic** from the **Survey Control II** screen before you are have access to the **Satellite Status** function. A faster alternative is to select **Satellite Status** from the **Function** list. With few exceptions, the **Function** list is available from any point within the software, allowing easy access to all functionality. Table 4.1 summaries the functions accessible through this screen.

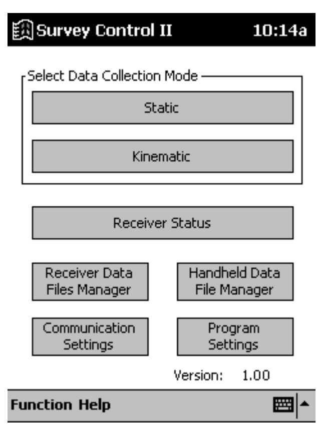

Figure 4.1 Survey Control II Main Screen

Table 4.1 Survey Control II Main Screen Calls

Parameter	Description
Select Data Collection Mode - Static	Calls the Static Survey Setup screen, page 73.
Select Data Collection Mode - Kinematic	Calls the Kinem. Survey Setup screen, page 76.
Receiver Status	Calls the Receiver Status screen, page 88.
Receiver Data File Manager	Calls the Receiver Files Manager screen, page 86
Handheld File Manager	Calls the Handheld File Manager, page 90
Communication Settings	Calls the Communication Settings screen, page 81.
Program Settings	Calls the Program Settings screen, page 82
Version	Displays release version of Survey Control II software.
Function	Calls the Function menu, page 71.
Help	Calls the Help menu, page 71

Figure 4.2 is a map showing access paths through the various screens.

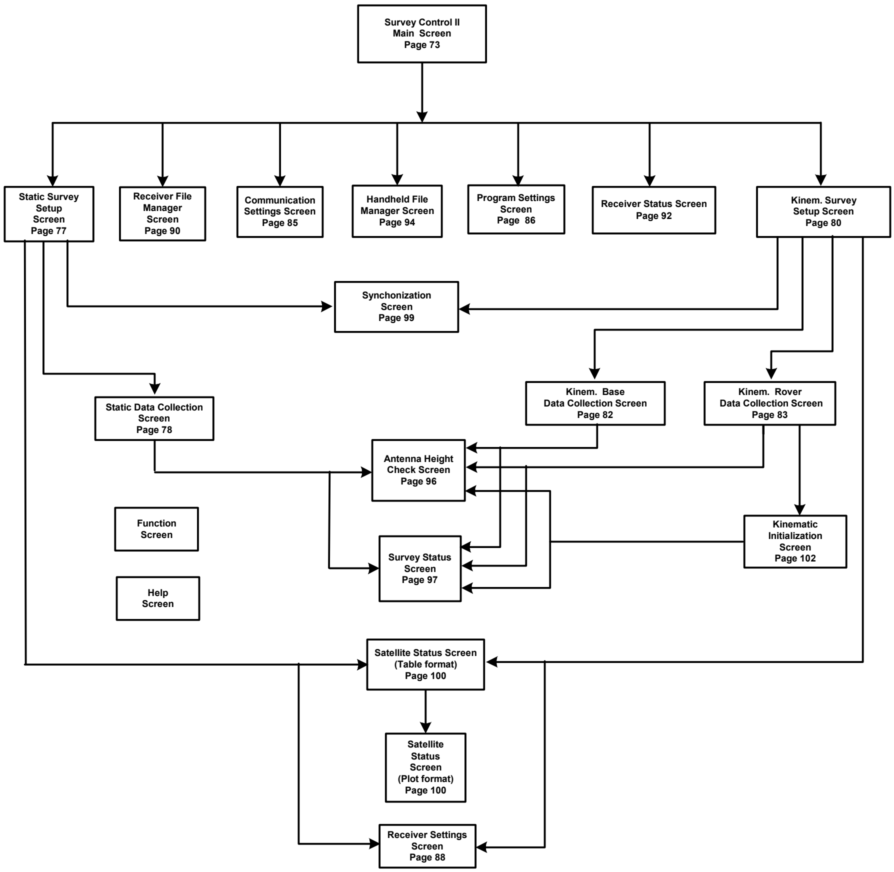

Figure 4.2: Screen Map

Function and Help Menus

If you prefer to go immediately to a function, rather than walk to it through the user interface; you can do this through the **Function** list (Figure 4.3) found in the lower left corner of the screen. For example, using the **Main** screen to access satellite status information, you must first either select **Static** or **Kinematic** before you have access to the **Satellite Status** function.

With few exceptions, the **Function** list is available from any point within the software, allowing easy access to all functionality.

Information regarding the version of Survey Control II can be accessed through the **Help** menu, also located at the bottom of the window (Figure 4.3).

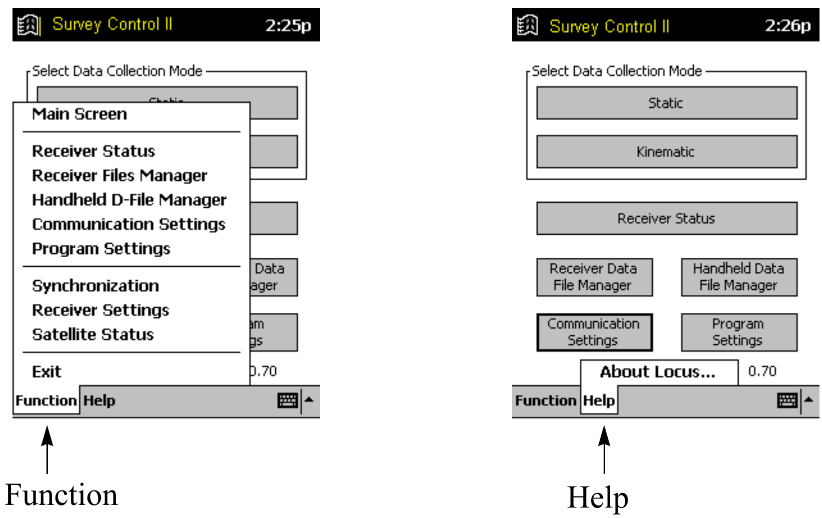

Figure 4.3 Function and Help Menus

Static Survey Setup Screen

Selecting the **Static** function form the **Survey Control II** screen brings up the **Static Survey Setup** screen, Figure 4.4. This screen is the starting point for preparing the GPS system (GPS receiver and handheld) to perform a static survey. After executing the setup functions on this screen, the GPS system is ready to begin data collection using the static survey mode. Table 4.2 summarizes the setup functions that are accessible from the **Static Survey Setup** screen.

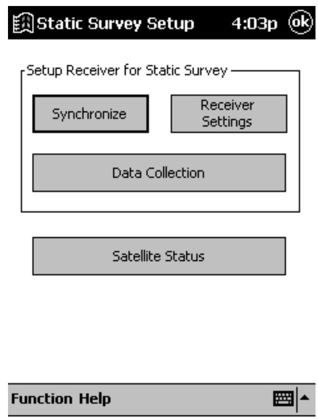

Figure 4.4 Static Survey Setup Screen

Table 4.2 Static Survey Setup Screen Calls

Setup Parameter	Description
Synchronize	This button calls the Synchronization screen, described in detail on page 94.
Receiver Settings	This button calls the Receiver Settings screen, described in detail on page 84.
Data Collection	This button calls the Static Data Collection screen, described in detail on page 73.
Satellite Status	This button calls the Satellite Status screen, described in detail on page 95.

Static Data Collection Screen

Selecting the **Data Collection** function in the **Static Survey Setup** screen brings up the **Static Data Collection** screen, Figure 4.5. This is the screen from which you execute your static survey. Using this screen, you enter and store point attribute information for later use during data processing. Each point will have unique attribute information entered here. Table 4.3 summarizes the items shown on the screen.

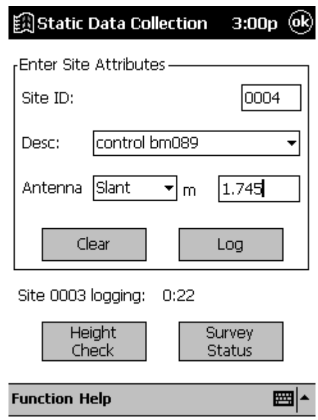

Figure 4.5 Static Data Collection Screen

Table 4.3 Static Data Collection Screen Parameters

Parameter	Description
Site ID	**Site ID** allows you to enter a four-character alpha-numeric site identifier; be aware that the site ID <u>must</u> be four characters. **Site ID** automatically increments to the next value in the **Site ID** field after the current site observation is started. This is in preparation for the next observation. No symbols are accepted. If the **Site ID** reaches 9999, it automatically increments to AOOO; and AOOZ increments to A010. The same **Site ID** should not be used twice in the same session; this will put up the caution message “Site ID already exists.” If OK is tapped on the message, the point will be logged. **Site ID** is not cleared by the **Clear** button.
Desc	**Desc** allows you to enter an alpha-numeric description of the site, up to 20 characters. Descriptions from previous sites may be selected from the pull-down menu.

Table 4.3 Static Data Collection Screen Parameters (continued)

Parameter	Description
Antenna	**Antenna** allows you to enter the antenna measurement type as slant or vertical, and enter a value for the antenna height. The abbreviated units of measure are shown adjacent to the antenna type field.
Clear	The **Clear** button clears the description and antenna height fields.
Log	Pressing the **Log** button stores the point attribute information, along with a time tag, to the attribute file (the D-file) in the handheld computer. All raw GPS data collected by this receiver from this time forward will be assigned this attribute information. This continues until a new set of point attribute information is logged. After the **Log** button is pressed, the site ID and running time of the observation are shown on the screen.
Height Check	The **Height Check** button calls the **Antenna Height Check** screen. This screen is described in detail on page 92.
Survey Status	The **Survey Status** button calls the **Survey Status** screen. This screen is described in detail on page 93.

Kinem. Survey Setup Screen

Selecting **Kinematic** from the **Main** screen brings up the **Kinem. Survey Setup** screen, Figure 4.6. This is the starting point for preparing the handheld and GPS receiver to perform a Stop&Go or Continuous Kinematic survey. After executing the setup functions found on this screen, the GPS system is ready to begin data collection in the kinematic survey mode.

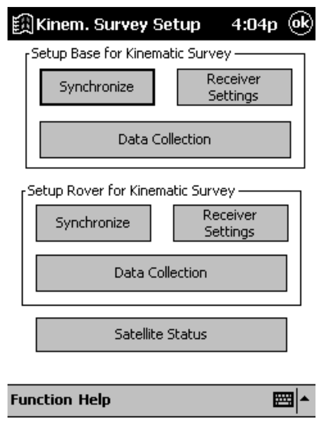

Figure 4.6 Kinem. Survey Setup Screen

The **Kinem. Survey Setup** screen allows you to configure your base and rover GPS receivers to perform a kinematic survey. The various buttons move you to screens which synchronize the handheld computer to the GPS receiver; review and change the GPS receiver settings; move to the **Kinem. Base Data Collection** screen or the

Kinem. Rover Data Collection screen, and review satellite status, as detailed in Table 4.4.

Table 4.4 Kinem. Survey Setup Screen Parameters

Group	Parameter	Description
Setup Base for Kinematic Survey	Synchronize	Calls Synchronization screen, page 95
	Receivrer Settings	Calls Receiver Settings screen, page 84
	Data Collection	Calls Kinem. Base Data Collection screen, page 78
Setup Rover for Kinematic Survey	Synchronize	Calls Synchronization screen, page 95
	Receiver Settings	Calls Receiver Settings screen, page 84
	Data Collection	Calls Kinematic Rover Data Collection screen, page 79
	Satellite Status	Calls Satellite Status screen, page 96.

Kinematic Base Data Collection Screen

The **Data Collection** button in the **Setup Base for Kinematic Survey** group calls the **Kinematic Base Data Collection** screen, Figure 4.7. This is the screen from which you execute your Stop&Go and/or Continuous kinematic survey. Using this screen, point attribute information of the base point for your kinematic survey is entered and stored for use during data processing. Table 4.5 describes the screen parameters accessible from this screen.

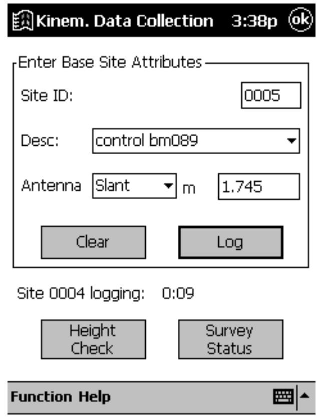

Figure 4.7 Kinem. Base Data Collection Screen

Table 4.5 Kinem. Base Data Collection Screen Parameters

Parameter	Description
Site ID	**Site ID** allows you to enter a four-character alpha-numeric site identifier; be aware that the site ID <u>must</u> be four characters. **Site ID** automatically increments to the next value in the **Site ID** field after the current site observation is started. This is in preparation for the next observation. No symbols are accepted. . If the site ID reaches 9999, it automatically increments to AOOO; and AOOZ increments to A010. The same site ID should not be used twice in the same session; this will put up the caution message "Site ID already exists." If OK is tapped on the message, the point will be logged. Site ID is not cleared by the **Clear** button.
Desc	**Desc** allows you to enter an alpha-numeric description of the site, up to 20 characters. Descriptions from previous sites may be selected from the pull-down menu.
Antenna	**Antenna** allows you to enter the antenna measurement type as slant or vertical, and enter a value for the antenna height. The abbreviated units of measure are shown adjacent to the antenna type field.
Clear	The **Clear** button clears the description and antenna height fields.
Log	Pressing the **Log** button stores the point attribute information, along with a time tag, to the attribute file (the D-file) in the handheld computer. All raw GPS data collected by this receiver from this time forward will be assigned this attribute information. This continues until a new set of point attribute information is logged. After the **Log** button is pressed, the site ID and running time of the observation are shown on the screen.

Table 4.5 Kinem. Base Data Collection Screen Parameters (continued)

Parameter	Description
Height Check	The **Height Check** button calls the **Antenna Height Check** screen. This screen is described in detail on page 92.

Kinem. Rover Data Collection Screen

Selecting the **Kinematic Rover Data Collection** function from the **Kinem. Survey Setup** screen brings up the **Kinematic Rover Data Collection** screen, Figure 4.8. This is the screen from which you start your Stop&Go and/or Continuous kinematic survey. Using this screen, you enter point attribute information for the points being surveyed. This information is stored for later use during data processing. Each surveyed point has unique attribute information entered here. Table 4.6 describes the parameters accessible from this screen.

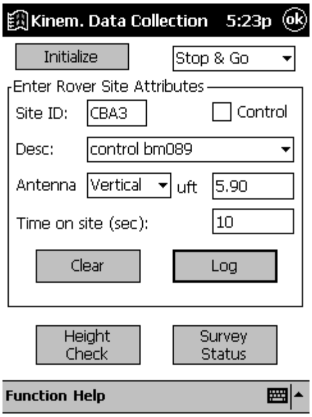

Figure 4.8 Kinematic Rover Data Collection Screen

Table 4.6 Kinematic Rover Data Collection Screen Parameters

Parameter	Description
Initialize	This button calls the **Kinematic Initialization** screen. This screen is described in detail on page 97.

Detailed Screen Descriptions

Table 4.6 Kinematic Rover Data Collection Screen Parameters (continued)

Parameter	Description
Stop&Go/ Continuous	Allows you to choose between two methods of data collection. Select **Stop&Go** when you want to use the Stop&Go kinematic mode of data collection. Select **Continuous** when you want to use the continuous kinematic mode of data collection. See *Appendix B* for more details on the various kinematic data collection modes.
Desc	**Desc** allows you to enter an alpha-numeric description of the site, up to 20 characters. Descriptions from previous sites may be selected from the pull-down menu.
Antenna	**Antenna** allows you to enter the antenna measurement type as slant or vertical, and enter a value for the antenna height. The abbreviated units of measure are shown adjacent to the antenna type field.
Time on Site (Stop&Go only)	In the **Time on Site** field, enter the amount of time, in seconds, that you want to observe each point. When performing a Stop&Go kinematic survey, observation times can range from as little as 8 seconds to 60 seconds or more. The longer the observation time, the tighter the solution. A 10-second observation time is commonly used.
Site Log Interval (Continuous only)	In the **Site Log Interval** field, enter the amount of time, in seconds, between each point to be computed. For example, to have a point, defining a linear feature, computed every 6 seconds, enter 6 here.
Clear	The **Clear** button clears the description and antenna height fields.
Log (Stop&Go only)	Pressing the **Log** button brings up the **Logging** screen showing a countdown of the time remaining to complete the observation of this point. During this countdown, point attribute information entered in the **Kinem. Data Collection** screen, along with a time tag, is stored in the attribute file (D-file) in the handheld computer. At the end of the countdown, the **Kinem. Data Collection** screen reappears. During the periods between attribute logging, no point attribute information is associated with the raw GPS data stored in the GPS receiver. These periods appear with "????" as the site ID in the processing software.
Start (Continuous only)	Pressing the **Start** button begins the logging of site attribute information for your continuous kinematic survey. The **Logging** screen appears, showing a time countdown based on the **Site Log Interval**. When the countdown reaches 0, the site attribute information is logged to the attribute file (D-file). At this time, the site ID is automatically incremented. When the countdown reaches 0 again, the new site attribute information is logged to the attribute file. This continues until the **Stop** button is pressed.
Height Check	**Height Check** calls the **Antenna Height Check** screen. This screen is described in detail on page 92.
Survey Status	Calls the Survey Status screen. This screen is described in detail on page 93.

Table 4.6 Kinematic Rover Data Collection Screen Parameters (continued)

Parameter	Description
Site ID	**Site ID** allows you to enter a four-character alpha-numeric site identifier; be aware that the site ID must be four characters. **Site ID** automatically increments to the next value in the **Site ID** field after the current site observation is started. This is in preparation for the next observation. No symbols are accepted. If the **Site ID** reaches 9999, it automatically increments to AOOO; and AOOZ increments to A010. The same **Site ID** should not be used twice in the same session; this will put up the caution message “Site ID already exists.” If OK is tapped on the message, the point will be logged. **Site ID** is not cleared by the **Clear** button.
Control	Check the Control box when you are observing a point that will be used in the future as an initialization point. All points flagged as control in this manner appear in a selection list when performing a Known Point initialization.

Communication Settings Screen

The **Communications Settings** screen, Figure 4.9, can be accessed by selecting the **Communication Settings** function on the **Main** screen. The **Communication Settings** screen is used to configure the handheld to communicate with the GPS receiver: by serial data cable for the Z-Xtreme/Z-Surveyor GPS receiver, or infrared wireless link for the Locus GPS receiver.

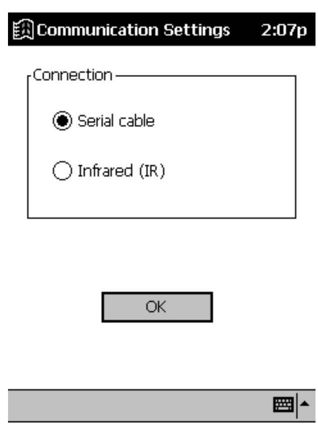

Figure 4.9 Communications Settings Screen

Table 4.7 Communications Settings Screen Parameters

Parameter	Description
Serial Cable	Click this button if you are using a Z-Xtreme or Z-Surveyor receiver.
Infrared (IR)	Click this button if you are using a Locus receiver.
OK	Saves settings.

Note: When you change communication settings, the receiver information (serial number, etc.) will be cleared and will show as N/A.

Program Settings Screen

Selecting the Program **Program Settings** function from the Survey Control II main screen accesses the **Program Settings** screen, Figure 4.10. The Program Settings screen is used to select user preferences for displaying and accepting information. Table 4.8 describes the screen parameters.

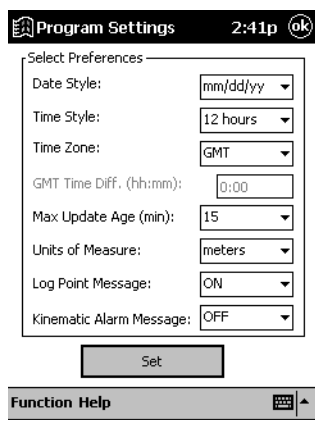

Figure 4.10 Program Settings Screen

Table 4.8 Program Settings Screen Parameters

Parameter	Description
Date Style	The **Date Style** preference offers two formats: mm/dd/yy or mm/dd/yy.
Time Style	The **Time Style** preference offers two formats: 12 hours or 24 hours.

Table 4.8 Program Settings Screen Parameters (continued)

Parameter	Description
Time Zone	The **Time Zone** preference offers two formats: GMT (Greenwich Mean Time) or Local.
GMT Time Diff.	The **GMT Time Difference** is used when the Time Zone preference is Local. The local time displayed is the GMT time with the GMT time difference applied. Values may range from –24:00 to +24:00.
Max Update Age	The **Maximum Update Age** preference is the time limit that receiver and file status information will be displayed. When the time limit set in **Maximum Update Age** is exceeded, **N/A** is displayed in the receiver and file status information fields in various display fields of the program.
Units of Measure	The **Units of Measure** preference offers 3 formats: meters, US feet, Int feet.
Log Point Message	The **Log Point Message** preference offers two settings: ON and OFF. OFF allows you to disable the **Point Logged** message. The **Point Logged** message is displayed after a point has been logged and you must acknowledge the message by pressing the **OK** button. **ON** enables the **Point Logged** message.
Kinematic Alarm Message	The **Kinematic Alarm Message** button lets you enable (ON) or disable (OFF) the kinematic alarm message. This function is only available on Z-Xtreme/ Z-Surveyor receivers.
Set	The **Set** button applies the preferences as displayed.

Receiver Settings Screen

The **Receiver Settings** screen, Figure 4.11, is accessible from the **Static Survey Setup** and the **Kinem. Survey Setup** screens. This screen lets you review and if necessary change receiver settings prior to collecting survey data . The receiver settings found on this screen are most often changed when changing modes of data collection between static and kinematic.

Table 4.9 describes the receiver settings.

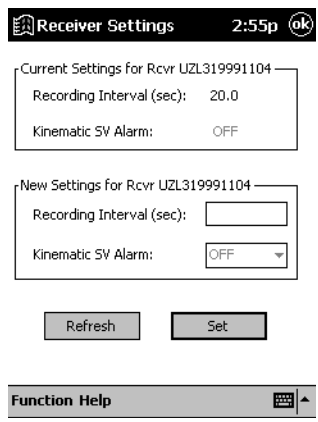

Figure 4.11 Receiver Settings Screen

Table 4.9 Receiver Settings Screen Parameters

Parameter	Description
Current Recording Interval	The current GPS receiver recording interval is displayed in seconds. Be aware that the recording interval should be the same between all GPS receivers within a recording session.
Current Kinematic SV Alarm	The current GPS receiver Kinematic SV Alarm setting is displayed. Either ON or OFF is displayed.
New Recording Interval	Lets you set a new recording interval; the interval is in seconds. Note that the recording interval should be the same between all GPS receivers within a recording session.
New Kinematic SV Alarm	The Kinematic SV Alarm can be enabled or disabled.

Table 4.9 Receiver Settings Screen Parameters (continued)

Parameter	Description
Refresh	The Refresh button initiates communications with the GPS receiver to access and display the current recording interval and kinematic SV alarm settings.
Set	The Set button initiates communications with the GPS receiver to set the recording interval and kinematic SV alarm settings entered in the new settings fields.

Receiver Files Manager Screen

Selecting the **Receiver Files Manager** function from the **Main** screen accesses the **Receiver Files Manager** screen, Figure 4.12. From this screen, raw GPS data files stored in the GPS receiver can be managed, as described in Table 4.10. Use the functions found on the **Receiver Files Manager** screen when there is a need to delete receiver data files while in the field.

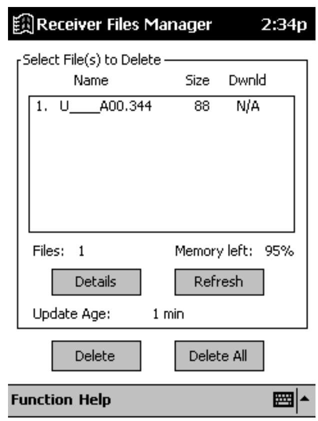

Figure 4.12 Receiver Files Manager Screen

Table 4.10 Receiver Files Manager Screen Parameters

Parameter	Description
File List	The files stored on the GPS receiver are displayed with filename, size, and download status. Download status will display N/A when using a Z-Xtreme/Z-Surveyor receiver (these receivers do not support this feature), YES when the file has been downloaded; and N/A when the file has not been downloaded. You must select a file to view details or delete.
Files	Displays the number of files stored in the GPS receiver.
Memory Left	Shows the amount of memory available for data storage in percentage relative to the maximum available memory.

Table 4.10 Receiver Files Manager Screen Parameters (continued)

Parameter	Description
Details	The **Details** button opens a window displaying file information including filename, size, download status, create date/time, and the date when the file was last modified.
Refresh	The **Refresh** button initiates communications with the GPS receiver to update the file information.
Update Age	Displays the time since the file information was retrieved from the GPS receiver .
Delete	The **Delete** button initiates the command to delete a file in the GPS receiver. As a precaution to accidentally deleting a file, a prompt is displayed asking if you want to proceed.
Delete All	The **Delete All** button initiates the command to delete all files in the GPS receiver. As a precaution to accidentally deleting all files, a prompt is displayed asking if you want to proceed.

The file naming convention for receiver files is as shown in Figure 4.13.

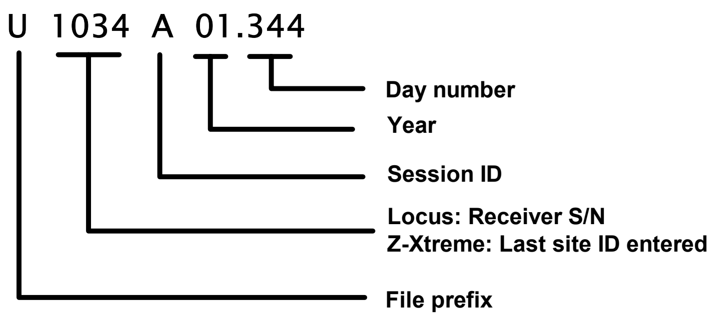

Figure 4.13 Receiver File Naming Convention

Receiver Status Screen

The **Receiver Status** screen, Figure 4.14, is accessed by selecting the **Receiver Status** function on the **Main** screen. This screen displays important information about the operational status of the GPS receiver, as detailed in Table 4.11; it is good practice to use this screen to review receiver status prior to the start of each survey.

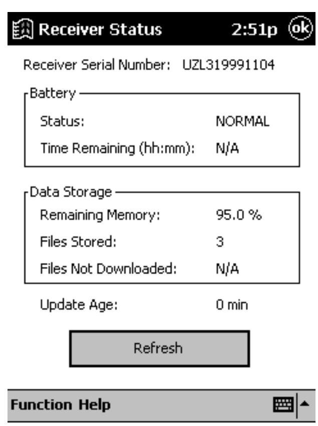

Figure 4.14 Receiver Status Screen

Table 4.11 Receiver Status Screen Parameters

Parameter	Description
Receiver Serial Number	The serial number of the GPS receiver currently synchronized to the handheld
Battery Status	Displays the battery condition of the Locus or Z-Xtreme/Z-Surveyor GPS receiver. **Locus Receiver**: Normal – 16 to 100 hours available for D-size batteries. Low – 3 to 16 hours available for D-size batteries. Critical – less than 3 hours available for D-size batteries. **Z-Xtreme/Z-Surveyor Receiver**: Normal – 16 to 100 hours available for D-size batteries. Low – 3 to 16 hours available for D-size batteries. Critical – less than 3 hours available for D-size batteries.
Battery Time Remaining	Displays the time remaining on the batteries in hours:minutes.
Remaining Memory	Displays the amount of memory available for data storage in percentage relative to the maximum available memory.
Files Stored	Displays the number of files stored in the GPS receiver.
Files Not Downloaded	Displays the number of files stored in the GPS receiver and not downloaded. Displays **N/A** when using Z-Xtreme/Z-Surveyor.
Update Age	Displays the time since the displayed status information was last retrieved from the GPS receiver. Displays **N/A** for Z-Xtreme/Z-Surveyor receivers.
Refresh	The **Refresh** button initiates communications with the GPS receiver to update the battery and data storage information.

Handheld File Manager Screen

Selecting the **Handheld Data File Manager** function from the **Main** screen accesses the **Handheld File Manager** screen, Figure 4.15. This screen displays information about the D-file (point attribute information) stored in the handheld. This file can be deleted. Use the functions in this screen when there is a need to delete the handheld data file while in the field. Table 4.6 describes the parameters accessible from this screen.

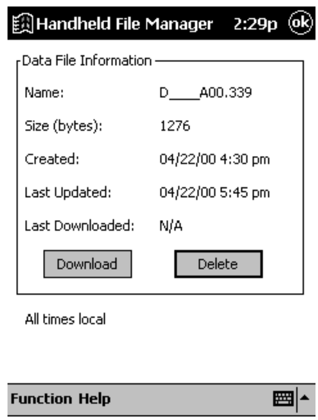

Figure 4.15 Handheld File Manager Screen

Table 4.12 Handheld File Manager Screen Parameters

Parameter	Description
Name	The name of the D-File stored on the handheld computer is displayed. The D-file naming convention is shown in Figure 4.16.
Size	The size of the D-File stored on the handheld computer is displayed in bytes.
Created	The date and time the D-File was created on the handheld computer is displayed in local time.
Last Updated	The date and time new data was stored in the D-File on the handheld computer is displayed in local time.
Last Downloaded	The date and time the D-File was last downloaded to a PC is displayed in local time.
Download	Download initiates communication with a PC to download the D-File via IR or cable.

Table 4.12 Handheld File Manager Screen Parameters (continued)

Parameter	Description
Delete	The Delete button initiates the command to delete the D-File in the handheld computer. As a precaution to accidentally deleting a file, a prompt is displayed asking if you want to proceed.

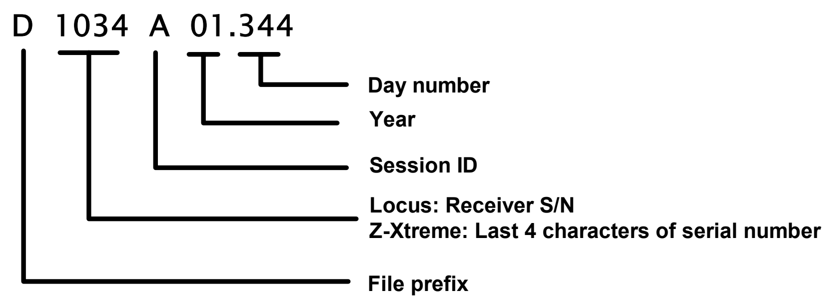

Figure 4.16 D-File Naming Convention

Detailed Screen Descriptions

Antenna Height Check Screen

The **Antenna Height Check** screen, Figure 4.17, is accessed from the **Static, Kinem. Base, or Kinem. Rover Data Collection** screens. This function helps eliminate one of the most common errors in GPS surveying: incorrect measurement and/or entry of antenna height values. The **Antenna Height Check** function allows you to easily identify height measurement errors by comparing measurements made in different units.

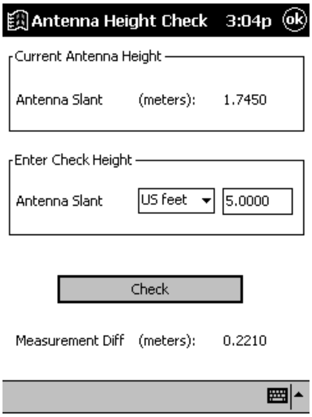

Figure 4.17 Antenna Height Check Screen

Table 4.13 Antenna Height Check Screen Parameters

Parameter	Description
Current Antenna Height - Antenna Slant/Vertical	Displays antenna height. The information that appears here depends upon the settings in the data collection screen shown on page 78 or page 79.
Enter Check Height - Antenna Slant/Vertical	Allows you to select the second measurement units for the antenna height and enter the measured value. The information that appears here depends upon the settings in the data collection screen shown on page 78 or page 79.

Table 4.13 Antenna Height Check Screen Parameters (continued)

Parameter	Description
Check	Checks for a difference between height measurements made in different units of measurement. Difference appears in a block at the bottom of the screen. If the difference exceeds your accuracy requirements, you should repeat the height measurements.

Survey Status Screen

The **Survey Status** screen, Figure 4.18, is accessible by selecting the **Survey Status** function from either the **Static Data Collection**, **Kinematic Base Data Collection** or **Kinematic Rover Data Collection** screens. The **Survey Status** screen displays important information about the status of the current static or kinematic survey. Examine the status information to determine the quality of the satellite coverage during data collection and to determine when enough data has been collected for a quality solution. Table 4.14 describes the status parameters.

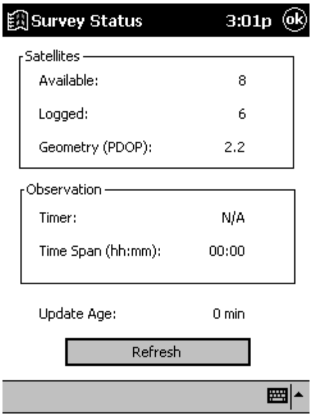

Figure 4.18 Survey Status Screen

Detailed Screen Descriptions

Table 4.14 Survey Status Screen Parameters

Parameter	Description
Satellites Available	Displays the total number of satellites currently available at your current location.
Satellites Logged	Displays the total number of satellites logged.
Satellite Geometry (PDOP)	Displays the current PDOP value based on the logged satellites.
Observation Timer	Displays the current state of the observation timer. A value of 5 KM is displayed when the GPS receiver believes it has collected enough data to successfully process a 0-5 KM baseline. A value of 10 KM is displayed when the GPS receiver believes it has collected enough data to successfully process a 0-10 KM baseline. Values of 15 KM and 20 KM are displayed when the GPS receiver believes it has collected enough data to successfully process a 15 KM and 20 KM baseline, respectively. **NOT DONE** is displayed when insufficient data has been collected. **N/A** is displayed when working with a Z-Xtreme or Z-Surveyor receiver, since they do not yet support this feature.
Observation Time Span	Displays the elapsed time since the GPS receiver began storing data for this observation.
Update Age	Displays the time since the presented status information was last retrieved from the GPS receiver.
Refresh	The **Refresh** button initiates communication with the GPS receiver to access and display the current survey status information.

Synchronization Screen

The **Synchronization** screen, Figure 4.19, is accessible from the **Static Survey Setup, Kinem. Survey Setup**, and **Kinem. Survey Setup** screens. Performing a synchronization is one of the setup functions required prior to survey data collection. When executed, the synchronization procedure synchronizes the clock in the GPS receiver with the clock in the handheld. At the same time, the serial number of the GPS receiver is stored. This procedure allows for storage of time-tagged point attribute data in the handheld which can later be correlated during data processing with the time-tagged raw GPS data in the receiver. The **Synchronization** screen displays current synchronization information, including receiver serial number and elapsed time since the last synchronization, as detailed in Table 4.15.

Figure 4.19 Synchronization Screen

Table 4.15 Synchronization Screen Parameters

Parameter	Description
Receiver serial Nr	The serial number of the GPS receiver currently synchronized to the handheld. For Locus only, 4 characters are displayed. For Z-Xtreme and Z-Surveyor, the entire serial number is displayed.
Elapsed Time Since Last Synchronization	Displays the minutes since the last synchronization to the GPS receiver.
Synchronize	The **Synchronize** button initiates communication with the GPS receiver to perform synchronization. Successful synchronization is indicated by the display of a receiver serial number and elapsed time of 0 min.

Satellite Status Screen

The **Satellite Status** screen, Figure 4.20, is accessible by selecting the **Satellite Status** function from either the **Static** or **Kinematic Survey Setup** screens. The **Satellite Status** screen displays detailed information about each satellite locked onto by the GPS receiver during the survey, including satellite vehicle number, elevation, azimuth, and used status. Satellite information is presented in either tabular form or in graphical form using a polar plot. Use the **Satellite Status** screen when survey status shows poor satellite geometry (PDOP) to determine why geometry is poor and determine when better geometry may be available.

The **Satellite Status Plot** screen, Figure 4.21, displays satellite information as of the last synchronization to the GPS receiver. A graphical representation of the satellite status table information is displayed. The concentric rings represent the elevation angle in 30 degree increments. The symbol (x) represents a satellite in use. The symbol (o) represents a satellite locked onto, but not in use. The number adjacent to the symbol is the satellite PRN number. The position of the satellite on the plot represents the azimuth angle with 0 degrees or north oriented to the top of the screen.

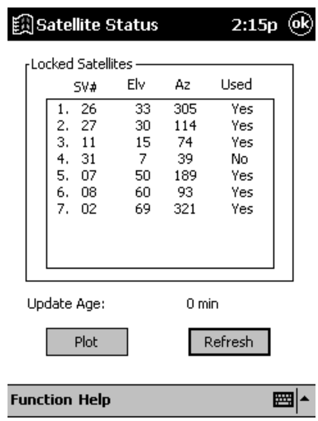

Figure 4.20 Satellite Status - Table Format

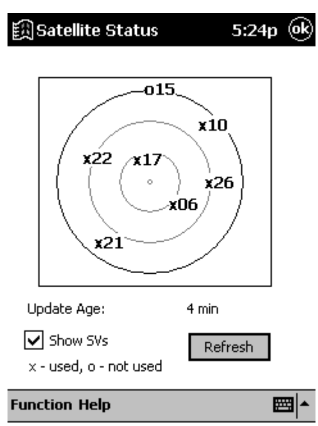

Figure 4.21 Satellite Status - Plot Format

Table 4.16 Satellite Status Screen Parameters

Parameter	Description
SV#	The two-digit satellite PRN number.
Elv	The two-digit satellite elevation angle, 0 – 90 degrees.
Az	The three-digit satellite azimuth angle, 0 – 360 degrees.
Used	**Yes** indicates that data from this satellite is being logged to memory. **No** indicates that data from this satellite is not being logged to memory. Reasons for data from a logged satellite not being logged to memory include satellite too near horizon or satellite is flagged unhealthy.
Update Age	Displays the time since the presented satellite status information was last received from the GPS receiver.
Plot	The **Plot** button calls the **Satellite Status Plot** window, Figure 4.21.
Refresh	The **Refresh** button initiates communications with the GPS receiver to access and display the current satellite status information.
Show SVs	The **Show SVs** button allows you to turn the display of the satellite number on or off (Plot display only).
X or O in plot	When you tap on an X or O in the plot area, the information about that particular satellite is displayed at the top of the screen.

Kinematic Initialization Screen

The **Kinematic Initialization** screen, Figure 4.22, is accessible by selecting the **Initialize** function from the **Kinematic Rover Data Collection** screen. Use the **Kinematic Initialization** screen to initialize your kinematic survey. Initialization is required at the start of each kinematic survey and any time during the survey when initialization is lost.

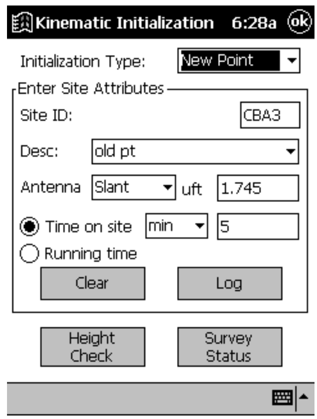

Figure 4.22 Kinematic Initialization Screen

Table 4.17 Kinematic Initialization Screen Parameters

Parameter	Description
Initialization Type	**Initialization Type** allows you to select between three methods of initialization: Bar Point, Known Point, or New Point. See *Appendix A* for details on each method of initialization.
Site ID	**Site ID** allows you to enter a four-character alpha-numeric site identifier; be aware that the site ID <u>must</u> be four characters. **Site ID** automatically increments to the next value in the **Site ID** field after the current site observation is started. This is in preparation for the next observation. No symbols are accepted. If the **Site ID** reaches 9999, it automatically increments to AOOO; and AOOZ increments to A010. The same **Site ID** should not be used twice in the same session; this will put up the caution message "Site ID already exists." If OK is tapped on the message, the point will be logged. **Site ID** is not cleared by the **Clear** button. For a known point initializaation, the **Site ID** will have a list box with an arrow which will contain all points logged as control points. When a point is selected it will be displayed in the **Site ID** field and its respective description will be displayed in the **Desc** field.

Table 4.17 Kinematic Initialization Screen Parameters

Parameter	Description
Desc	**Desc** allows you to enter an alpha-numeric description of the site, up to 20 characters. Descriptions from previous sites may be selected from the pull-down menu.
Antenna	**Antenna** allows you to enter the antenna measurement type as slant or vertical, and enter a value for the antenna height. The abbreviated units of measure are shown adjacent to the antenna type field.
Time on site	In the **Time on Site** field, enter the amount of time, in seconds, that you intend to observe the initialization point. When performing a Bar Point initialization, an observation time of 5 minutes is recommended. When performing a Known Point initialization, an observation time of 10 seconds is sufficient. When performing a New Point initialization, observation times are the same as those used for a static survey. Minimum time on site is the recording interval set in the receiver.
Running time	Use **Running Time** if you prefer to manually stop the observation for your New Point initialization.
Clear	The **Clear** button clears the description and antenna height fields.
Log	Pressing the **Log** button brings up the **Logging** screen, showing a countdown of the time remaining to complete the observation of this point (unless **Running Time** was selected, in which case elapsed time is displayed). During this period, point attribute information entered in the **Kinematic Initialization** screen, along with a time tag, is stored in the attribute file (D-file) in the handheld computer. At the end of the countdown (or when you select **Stop** for **Running Time**), the **Kinem. Data Collection** screen reappears.
Height Check	The **Height Check** button calls the **Antenna Height Check** screen. This screen is described in detail on page 92.
Survey Status	The **Survey Status** button calls the **Survey Status** screen. This screen is described in detail on page 93.

A
Kinematic Initialization

Overview

A unique aspect of the kinematic mode of data collection is the requirement to initialize the survey. The initialization process is required to produce highly precise positions. Prior to initialization, data collected by the kinematic rover system will produce positions at a degraded level of accuracy. The accuracy prior to initialization could be anywhere from 0.15 meters (0.5 ft) to a couple meters (several feet). The initialization process is required to fine-tune the rover system. Once initialized, the rover system will function at it's specificed level of accuracy until initialization is lost.

Let's devote a few sentences here to the technical aspects of the initialization process. In order to accomplish centimeter-level positioning with GPS, you must collect enough data to calculate a set of parameters termed Integer Ambiguities. During the initialization process, you are collecting the data required to calculate the Integer Ambiguities. Once the integer ambiguities have been calculated, your current location can be determined very precisely. Solving for the integer ambiguities is the most time consuming part of GPS data collection. Once solved, the position of your current location is instantly known. In addition, once you have calculated the integer ambiguities, they stay fixed as long as you maintain locked on at least 5 satellites. If you happen to loose lock on satellites due to an obstruction, and go below the 5 satellite threshold, the integer ambiguities will be lost and must be calculated again, i.e. you must initialize your kinematic survey again. If you do not, all data collected after loss of initialization will produce positions at the degraded level of accuracy discussed above. All data collected prior to loosing the initialization is not affected by your lost of initialization.

Survey Control II supports several methods to initialize your kinematic survey. Each method is described below along with recommendations on when to use them.

Bar Point Initialization

Bar Point initialization is specific to the Locus system and is performed using the supplied kinematic initializer bar. Bar Point initialization is the second quickest method of initializing a kinematic survey after initializing on a known point. Initialization time when using the bar is 5 minutes. The bar method is best used when there is no known point to utilize for initialization.

The concept of Bar Point initialization is similar to using a static survey to initialize your kinematic survey (discussed later). By performing a 5 minute observation on the bar, you are establishing the coordinates of the rover receiver on the other end of the bar. Once the coordinates of the rover location are established, the kinematic survey can be initialized. A 5 minute observation is all that is needed because we have some initial information regarding the short vector between the base and rover receivers. We know that the vector is exactly 0.200 meters long (the length of the bar). We also know that the delta height of the vector is 0.000 (base and rover receivers are at the same HI). Based on this given information, the coordinates of the rover location can be established with a short 5 minute observation.

Use the Bar Point initialization method under the following conditions:

- Your project area does not contain any control points that meet the requirements to perform a Known Point initialization. If such control does exist, use the Known Point method since it is a quicker initialization method.
- The kinematic base is located on the project site near the area to be surveyed. This is important since a Bar Point initialization must be performed at the kinematic base station. If the kinematic base must be positioned a distance from the project area, you may be better served using the New Point method of initialization.

Known Point Initialization

The quickest method to initialize a kinematic survey is Known Point initialization. In most situations, initialization on a known point can be accomplished in 10 seconds or less. It's very important to note that the relationship between the kinematic base point and the known point to be used to initialize must be very accurately established. For this reason, it is highly recommended that you only initialize on a known point that has been previously established with GPS either with a direct measurement between the base and known point or through a network including both the base and known point.

The Known Point method is a little misleading in it's name. It should truly be called the Known Vector method. The initialization is performed on a known vector between 2 known points (base point and rover point). Since the vector between the two points is already known, initialization using this method requires very little time. In a normal static survey between two points, the Integer Ambiguities must be found which then allows for the computation of a precise vector. This takes an extended period of time. If the vector between the two points is already known, the calculation of the Integer Ambiguities requires only a short observation period.

Use the Known Point initialization method when your project area contains control points that meet the requirements to perform a Known Point initialization. The requirements are stated above: a point whose position is known well with relation to the base point. Below are some scenarios where Known Point initialization is best used:

1. You are working on a landfill project where you are required to perform a topo once a week for 2 months. In perparation, you establish 6 control points around the landfill using the static survey method. With the kinematic base set up on any one of these 6 control points, the remaining 5 points are available for a Known Point initialization. For example, on the first day of your kinematic survey, you place your base on point 0001. You want to start your kinematic survey at the other end of the landfill near point 0003. So you drive to point 0003 and initialize your kinematic survey using the Known Point method.

   Don't forget that any one of these 5 control points are also available for re-initialization. For example, let's say that after your successful initialization on point 0003, you observe 53 new kinematic points. On your way to point 54, you trip and fall causing the rover to trigger the Kinematic SV Alarm, indicating a lose of initialization. At this time, you are very close to point 0004. Use the Known Point method to re-initialize your kinematic survey on point 0004.
2. You need to perform a kinematic survey in a project area with no control. You initialize your kinematic survey using the Bar Point method (Locus system only). After initialization, you successfully observe 16 new points. While attempting to position yourself for point 0017, you get too close to the building causing the Kinematic SV Alarm to sound, indicating lose of initialization. You must re-initialize. You return to the initializer bar. If you were careful not to move (rotate) the bar, you can treat the bar point as a known point and perform a Known Point initialization. The bar point is considered known because you successfully positioned it when you performed your Bar Point initialization. During processing, the coordinates of the bar point will be determined prior to your subsequent loss of initialization. But, this is only true if you were careful not to rotate the bar. If the bar moved, the position at the end of the bar is no longer known. In this case, you must perform a Bar Point initialization once again.
3. In this third scenario, you are in the middle of performing a kinematic survey which you initialized in any available manner (it is not important which method was used). You have now successfully established 172 new points.

You are about to attempt to observe some points in an area where there are some trees. You suspect that you may loose initialization while attempting to get close to the trees. You are not close to the kinematic base nor close to any known points. As a pre-caution, you put a PK nail in the ground at your current location and observe it. This point is called 0173 and now can be considered a known point. You move into the obstructed area and successfully establish points 0174 - 0181. As you are moving to the next point, the Kinematic SV Alarm sounds. You must re-initialize. Initialization can quickly be accomplished by performing a Known Point initialization on point 0173.

Scenario number 3 above illustrates the benefit of establishing convenient initialization points as you move about the project site. If you find that you have moved a considerable distance from the kinematic base or a control point, quickly set a new control point in your area for re-initialization. Do the same if you are about to move into an area where initialization may be lost due to obstructions. By following this procedure, you will always be close to a point that can be used for a Known Point initialization.

New Point Initialization

The New Point method of kinematic initialization is the most time consuming method. It should be used only when other methods are not feasible. Observation times for initialization using the New Point method range from 5-15 minutes when using the Z-Xtreme / Z-Surveyor system or from 15-30 minutes for a Locus System. The observation time depends on the distance between the kinematic base and kinematic rover during initialization.

The New Point initialization method is simply a static survey of the new point. Observation times should be consistant with those for performing a static survey. Processing of the data collected at the initialization point will produce a static vector between the kinematic base and rover, determining the precise position of the rover point. This in effect initializes the kinematic survey.

Use the New Point initialization method when no other method is available for initializing your kinematic survey or in situations where you do not mind the time required to execute this initialization method. If using the Z-Xtreme / Z-Surveyor system, this may be a commonly used initialization method. Using the New Point method with the kinematic base and rover within site of each other only requires a 5 minute observation with the Z-Xtreme / Z-Surveyor.

The most common scenario for using the New Point method of initialization is when the kinematic base must be positioned away from the project site where the kinematic rover will be operationg. For example, you need to perform your survey based on a control point located off the project site. In such a situation, you have two options. The first is to set up the kinematic base on the remote control site and initialize your kinematic rover on site using the New Point method. The second option is to first perform a static survey between the remote control point and a new control point on site. Then place the kinematic base on the new control point on site.

On-The-Fly Initialization

When using a dual-frequency GPS system such as the Z-Xtreme / Z-Surveyor, there is no requirement that initializations be performed while standing still at one location. It is possible to initialize your kinematic survey while moving about the project site (thus the term on-the-fly). Initialization times are about the same as with the static survey method. The advantage of the on-the-fly method over the static method is that during the 5 minute observation required to initialize, you can be moving about the project site productively locating points of interest. The post-processing software will use this data to initialize and, once initialized, will establish precision positions on the points observed during the initialization time period. There is a trick to this method though. You must collect clean data (no loss-of-lock) during the initialization period, i.e. the first 5 minutes of the observation. If loss-of-lock occurs some time during the initialization period, you run the risk of not being able to initialize the segment of data between the start and the loss-of-lock. Any points observed during this time period will have poor precision. For this reason, this method of initialization is best left for project sites where obstructions are a minimum.

Let's examine scenarios where this method of initialization would be useful.

1. You have a landfill that you need to topo. Being that the project site is a landfill, most of the area has no obstructions with the possible exception of trees along the perimeter of two sides. You set up your base station in an open area. You then set up your rover system. You turn on the rover system immediately. As you finish your preparation, the rover system is collecting data for initialization on some arbitrary location. Let's say that after two minutes, you are ready to begin locating topo points. You decide to start at the northeast corner of the landfill because it is wide open with no obstructions. It takes you approximately 1 minute to walk to the location of the first topo shot. By this time, you have already collected 3 minutes of data that will be used towards your initialization. You begin collecting topo points. In the next 2 minutes, you have collected 4 topo points without lose-of-lock. By this time, the system has collected 5 minutes of data, enough to initialize. Without hesitation, you continue with your survey. When this data is processed, the kinematic survey will initialize using the data collected

during the start of the survey. Even points collected prior to initialization will result in precise positions.

2. You successfully continue to collect topo points for approximately 30 minutes without loss-of-lock. You now are in the perimeter areas were there are trees close to the edge of the landfill. While attempting to locate topo points right on the edge of the trees, the Kinematic SV Alarm is triggered, indicating that you have lost your initialization. You must now re-initialize. You can move out of the obstructed area and collect data on other points where there are no obstructions for approximately 5 minutes, giving the system enough clean data to re-initialize. Then move back into the obstructed area to collect more points.

On-the-fly initialization is an effective method for initializing your kinematic survey since there is no time wasted waiting for the system to initialize. But, you must be careful to collect clean data during the initialization period or you run the risk of getting poor positions on some of your points.

Kinematic Survey Modes

After initialization of your kinematic survey, all data collected by the rover system will produce centimeter-level results, regardless if you are walking around the project site or positioned over a feature. All data samples written to memory are processed by the post-processing software to generate centimeter-level positions. For example, with a GPS receiver recording interval set to 2 seconds, a data sample is written to memory every 2 seconds. During data collection periods where you are walking around the project site, the post-processing software will calculate a position every 2 seconds, producing a crumb-trail of where you walked. If you stop and observe a feature of interest for 10 seconds, 5 data samples are observed for this feature, producing a more precise position than those produced while walking.

The ability to determine positions while observing a feature for a period of time and the ability to determine positions while moving around the project site results in two modes of positioning features of interest with the rover system. These two modes are termed Stop&Go Kinematic and Continuous Kinematic. Each is described below:

Continuous Kinematic

The Continuous Kinematic mode of data collection is best used when positioning linear features such as roads. The idea is to trace the feature to be positioned. As you are walking along this feature, positions are being determined at a specified interval, delineating the feature. Here is an example where this would be useful:

You have an as-built survey which includes a road approximately 100 feet in length. You need to position the centerline of the road and the edge of pavement on both sides. You walk out to the centerline with the rover system. Using the handheld software, you instruct the system to determine a position every 2 seconds (a point ID is generated automatically every 2 seconds). You then walk along the centerline from beginning to end. When this data is processed, you will see the centerline of the road delineated with a position every 2 seconds for the time period which you were walking along the centerline.

The Continuous Kinematic method is not as precise as the Stop&Go Kinematic method since, with Continous Kinematic, each position is determined with only one data sample, while with Stop&Go Kinematic, multiple data samples are combined to produce a position. With Continuous Kinematic, you can expect positions at the 0.03 – 0.05 meter (0.10 – 0.15 ft) level.

Stop&Go Kinematic

The Stop&Go Kinematic mode of data collection is best used when positioning point features. It can also be used to position linear features by collecting multiple points to delineate the feature. Here is an example of how the method works.

In the same as-built survey, you have a number of point features to locate, such as light poles and manhole covers. You position the rover pole over the point feature to be located. Using the handheld software, you instruct the system to collect 8 seconds of data at this location (the same point ID will automatically be assigned to each data sample collected). When this data is processed, all data samples collected at this location will be used to compute one position for the point feature.

The Stop&Go Kinematic method is more precise than the Continuous Kinematic method since multiple data samples are used to compute one position for a point feature. With Stop&Go Kinematic, you can expect positions at the 0.01 – 0.03 meters (0.03 – 0.10 ft) level, with observation times ranging from 8 to 60 seconds. The longer the observation, the tighter the solution.

If your linear features require the level of accuracy produced by the Stop&Go Kinematic method, this method can be used to position your linear features by used multiple Stop&Go observations to delineate the feature.

Kinematic SV Alarm

A crucial requirement for a successful kinematic survey is to maintain lock on at least 5 satellites as you move about the project site. The Kinematic SV Alarm is designed to warn you if loss of lock occurs for whatever reason (obstruction or low signal strength). With the Locus system, loss of lock is indicated by a distinct beep emitted from the GPS receiver. The beep is characterized as three rapid beeps in succession followed by a delay of about a second. This continues for approximately 30 seconds at which point it stops automatically. With the Z-Xtreme / Z-Surveyor, the audible alarm is accompanied with a message that appears on the screen of Survey Control II. Also, if, after the 30 seconds, the GPS receiver is still not observing at least 5 satellites, the kinematic SV alarm will trigger again.

Please note that the kinematic SV alarm may on occasion trigger even if conditions suggest that loss of lock should not have occurred, i.e. no obstructions in site. This is due to the method used to determine loss of satellite lock. Loss of lock is based on the satellite signal strength. Signal strength can be affected by events other than obstructions. For example, atmospheric conditions can cause satellite signal strength to weaken. The kinematic SV alarm has been designed to be conservative. If there is any doubt that signal loss has occurred, the alarm is triggered. It is better to get a false alarm than not be warned if loss of lock has occurred.

If the kinematic SV alarm is triggered, you are required to initialize the kinematic survey once again. Simple enter the **Initialize** function, select an initialization method, and re-initialize your kinematic survey.

Remember that all points positioned prior to the loss of lock are not affected. A successfully positioned point will always result in a quality position regardless of what happens later in the kinematic survey.

Troubleshooting

The following guidelines cover some problems that may occasionally be encountered in the field.

UNABLE TO SYNCHRONIZE

1. Verify that the receiver is tracking satellites.
2. Verify that all cable connections are tight.
3. Make sure that the handheld IR port is level with the Locus IR port and within range, a foot or so.
4. Make sure you have set the proper communication setting in the Communication Settings screen - serial for Z-Xtreme or IR for Locus.
5. Try another serial cable if available. Cables are frequently damaged in severe field environments.

UNABLE TO DOWNLOAD HANDHELD

1. Make sure all steps in the section “Download Collected Data to PC” are followed.
2. Try another serial cable if available.
3. Make sure all connections are tight.

NO SPACE ON HANDHELD

1. Make sure you have downloaded all data first.
2. Go to the **Receiver Data File Manager** screen, highlight **Files**, and press **Delete**.

CANNOT SEE THE SCREEN

1. Adjust the contrast by pressing the **Q** button, selecting **Contrast**, and moving the slider to obtain the desired contrast.
2. Make sure the backlight is set to come on using the Q menu backlight properties if you are operating in twilight. Be advised that backlight will draw considerable power from the battery.

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