

# Survey Control Software for Husky FS/2

## *User's Guide*





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# Survey Control Software for Husky FS/2 2.0

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# Introduction

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## General

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This manual contains two major sections, **Surveying** and **Reference**. The SURVEYING section begins with an explanation of the different methods of performing a GPS survey using the Survey Control software. Following this introduction is a detailed explanation of how to use the Survey Control software to perform each type of GPS survey described. For each survey method, a step-by-step procedure is given, showing how to use the software to perform each task. The REFERENCE section of the manual contains detailed explanations for each screen in the Survey Control software. The REFERENCE section should be used only after you have gone through the SURVEYING section and only for answering specific questions about a particular function.

Ashtech recommends that you take the time to completely read through the examples found in the SURVEYING section of the manual, with a Husky in hand, exercising the software. This will give you a good sense of what the Survey Control software, operating with a Z-12 or Super C/A based system, is capable of doing. It will show you what to expect and look for when performing the different types of GPS surveys. Every aspect of the software is exercised in the examples found in this section. Once completed, you will have a full grasp on the use of the Survey Control software for performing GPS surveys.

After reviewing the SURVEYING section of this manual, take the equipment outside to the parking lot or nearby field and attempt to perform a GPS survey. Experiment with each GPS surveying method you feel you are interested in utilizing. Become familiar with the system as a whole. Of course, if at any time you encounter what seems to be an insurmountable problem, feel free to contact Ashtech customer support for assistance.

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## Overview

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The Ashtech Survey Control software provides an interface between a Husky FS/2 handheld computer and an Ashtech GPS receiver. The Husky FS/2 is an MS-DOS computer designed to be carried and used in one hand. Its rugged, sealed construction ensures reliable operation in the most difficult working conditions. Combined with the Survey Control software, the Husky becomes an excellent interface to two of Ashtech's GPS systems, the Z-12, and the Super C/A (SCA-12 receiver). The combination enables you to remotely operate the GPS receiver while performing several different types of GPS surveys.

# Required System Components

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The minimum configuration required to use the Survey Control software for GPS surveying includes:

- 1 Husky FS/2 with minimum 512K memory
- 1 FS/2 - GPS receiver cable
- 2 or more Z-12 or Super C/A based systems

In addition, if you wish to connect the Husky to your PC, you will need:

- 1 FS/2 - PC cable
- 1 HCOM software to transfer files from Husky to PC

Connecting the Husky to a PC is required only for reloading the Survey Control software or upgrading the software.

## Installing the Survey Control software

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The Survey Control software comes installed in the Husky FS/2 handheld computer when shipped from the factory. Included will be a diskette containing the software for use if the software must be reloaded for any reason.

The Survey Control software is copy protected. Copy protection is based on the serial number of the Husky FS/2. Therefore, each Husky purchased with the Survey Control software will have its own diskette containing the Survey Control software configured for that Husky. The diskette label will include the serial number of the Husky for which the software is configured. Copying the Survey Control software from one Husky to another will result in the message “Serial number doesn’t match” and the program will not run. Loading the Husky with a diskette containing the Survey Control software for another Husky will have the same result.

If, for any reason, you should have to reload the Survey Control software onto a Husky or you wish to load the Survey Control software purchased to use on a Husky you already own, use the following procedure:

1. Connect the Husky port 1 to a PC using the appropriate cable. Port 1 is the connector on the top left side of the Husky.
2. On the Husky, execute the HCOM utility by typing **HCOM** and pressing **Yes (↵)**.
3. On the PC, execute HCOM by typing **HCOM** and pressing **Enter (↵)**. You must load HCOM onto your PC if you have not done so already. The HCOM utility can be found on a diskette included with the Husky. Copy all files from this diskette to a new directory on your PC and execute as instructed above.



Chapter 14 of the Husky manual contains the instructions for operating the HCOM utility.

4. Transfer to the Husky the following files contained on the Survey Control software diskette:
  - **SC.EXE**
  - LOGOSCA**
5. Press **ESC** on the Husky to return to the DOS prompt.

The software is now loaded on the Husky and ready for use.

## Upgrading the Survey Control software

On occasion, upgrades to the Survey Control software may become available. Either a diskette will be sent to you containing the upgrade or the software will be placed on our Bulletin Board System (BBS) available for download.

The upgrade software is not serialized. One copy of the upgrade software can be used to upgrade all Husky's which currently contain the Survey Control software.

To perform an upgrade, use the following procedure:

1. From the diskette or the BBS, copy the following files into a new directory:
  - **SCASURV.EXE**
  - UPGRADE.EXE**
2. On the Husky, execute the HCOM utility by typing **HCOM** and pressing **Yes (↵)**.
3. On the PC, execute HCOM by typing **HCOM** and pressing **Enter (↵)**. You must load HCOM onto your PC if you have not done so already. The HCOM utility can be found on a diskette included with the Husky. Copy all files from this diskette to a new directory on your PC and execute as instructed above.



Chapter 14 of the Husky manual contains the instructions for operating the HCOM utility.

4. Transfer the **SC.EXE** file from the Husky to the PC.  
This file should be transferred into the directory containing **SCASURV.EXE** and **UPGRADE.EXE**. If not, copy **SC.EXE** into this directory now.
5. Press **ESC** on the Husky to return to the DOS prompt.
6. Delete the old Survey Control software from the Husky by typing **DEL SC.EXE** and pressing **Yes (↵)**.

7. Execute the upgrade program on the PC by typing **UPGRADE** and pressing **ENTER** (↵).

The upgrade program will create an upgraded Survey Control software named **NEW\_SC.EXE**, using the Husky serial number found in **SC.EXE** downloaded from the Husky.

8. Use the **HCOM** program to transfer the **NEW\_SC.EXE** file from the PC to the Husky.
9. Rename the new Survey Control software on the Husky by typing **REN NEW\_SC.EXE SC.EXE** and pressing **Yes** (↵).

This completes the upgrade procedure. The upgraded version of the Survey Control software is now loaded on the Husky and ready for use.

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# Getting Started

Before you begin, be sure the batteries are installed in the Husky FS/2. Your Husky comes equipped with rechargeable NiCAD batteries and a charging unit. If the charge is low in the batteries, charge them at this time. A warning message will appear on the Husky screen when the charge is low. Refer to the Husky manual for instructions on battery installation and charging.

Also, check to ensure the Survey Control software has been loaded into the Husky. The Survey Control software is named **SC.EXE**. Type **DIR** and press **Yes (↵)** at the DOS prompt. If SC.EXE does not appear in the listing of files, please refer back to “Installing the Survey Control software” on page 2 and install the software.

---

## Interface to the GPS receiver

The interface between the Husky FS/2 and your GPS receiver is a simple one, requiring one cable. This RS-232 cable enables the serial communication between the Husky and the receiver.

To connect the Husky FS/2 to a Z-12 GPS system, use the following procedure:

1. Identify the interface cable. The cable is approximately 2 meters long with a circular 12-pin Amphenol plug on one end and a 16-pin Fischer 104 series plug on the other.
2. Connect the 12-pin plug to port 1 of the Husky. Port 1 is the connector on the top left side of the Husky.
3. Connect the 16 pin plug to port 1 of the Z-12. Port 1 is labeled on the Z-12.

The interface is now complete and ready for use.

To connect the Husky FS/2 to a Super C/A based GPS system, use the following procedure:

1. Identify the interface cable. The cable is approximately 1.2 meters long with a circular 12-pin Amphenol plug on one end and a 7-pin Fischer 102 series plug on the other.
2. Connect the 12-pin plug to port 1 of the Husky. Port 1 is the connector on the top left side of the Husky.
3. Connect the 7-pin plug to port A of the SCA-12 receiver. Port A is labeled on the SCA-12.

The interface is now complete and ready for use.

To connect the Husky FS/2 to a Step 1 GPS system, use the following procedure:

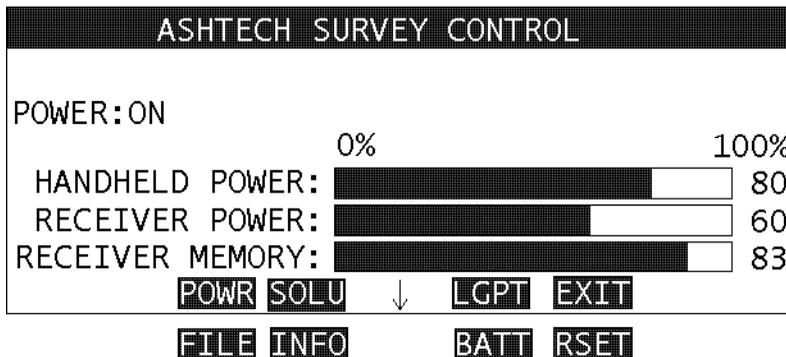
1. Identify the interface cable. The cable is a multi-purpose cable that is approximately 1.8M long. It has a 25-pin connector at one end (DB25) and several cables at the other end for the following:
  - Power
  - PC download
  - Radio
  - Husky
2. Connect the 12-pin plug to port 1 of the Husky (port 1 is the connector on the top-left-side of the Husky).
3. Connect the 25-pin connector to the receiver (ensure the battery is installed on the receiver).

The interface is now complete and ready for use.

## Survey Control Software Basics

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To start the Survey Control Software type **SC** at the DOS prompt and press **Yes (↵)**. You will see the Ashtech logo screen; you can press any key to bypass this screen. At this time, communication is established with the GPS receiver. After successfully establishing communication between the Husky and the receiver you will see following screen:

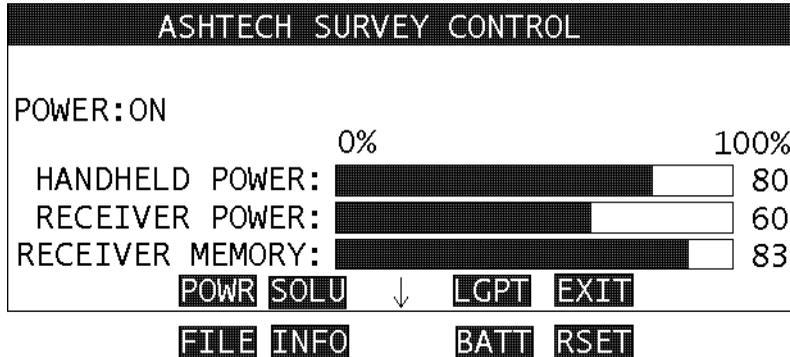


**Figure 2.1:** Survey Control screen - MAIN

POWER:ON indicates that communication with the receiver was established. On this screen you will see four black boxes labeled POWR, SOLU, LGPT, and EXIT. These boxes are located directly above function keys F1, F2, F3, and F4. Pressing one of

these keys initiates the action assigned to each key. For example, pressing the F2 key (labeled SOLU) will move you to the Solution Screen (current coordinates). Pressing F4 (EXIT) will exit the program.

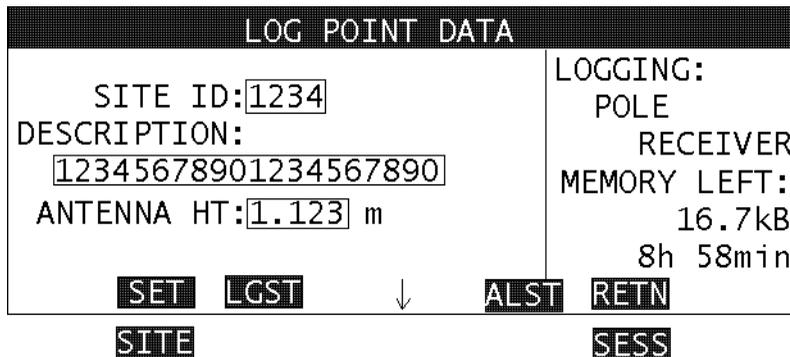
The small arrow pointing down indicates that a secondary set of functions is available. Pressing the shift key, which is labeled  $\uparrow$  on the keyboard, displays the secondary functions:



**Figure 2.2:** Survey Control - secondary functions - MAIN

In this screen, pressing  $\uparrow$ -F2 calls the Information Screen.

On some screens you will need to enter information. Below is an example of such a screen:



**Figure 2.3:** Log Point Data screen - LGPT

This screen presents three editable fields: SITE ID, DESCRIPTION, and ANTENNA HEIGHT. An editable field always has a surrounding box. A blinking cursor indicates

the current entry point. To move between fields, use the up or down arrow keys ↑ or ↓. Within the field you can change the position of the cursor using the left or right arrow keys ← or →. Each typed character overwrites the character under the blinking cursor, and the cursor moves one character to the right. The **DEL** key deletes the character under the cursor, and the remaining part of the string shifts left. The **CLR** key (backspace) deletes the character before the cursor, and the remaining part of the string shifts left. If you entered or changed the field contents, you can restore its previous state by pressing the **ESC** key. Pressing **YES** (↵) accepts the current contents of the field and moves the cursor to the next field. In some cases, the program validates the field data. For example, on the above screen, if you entered a negative number as antenna height, you will not be able to leave the field until a valid number is entered (use the **ESC** key to restore its previous value).

Sometimes you can select a value from a set of predefined values. This is called a toggle field. The following screen is an example:



The screenshot shows a terminal window titled "ALARM SETUP". The settings are as follows:

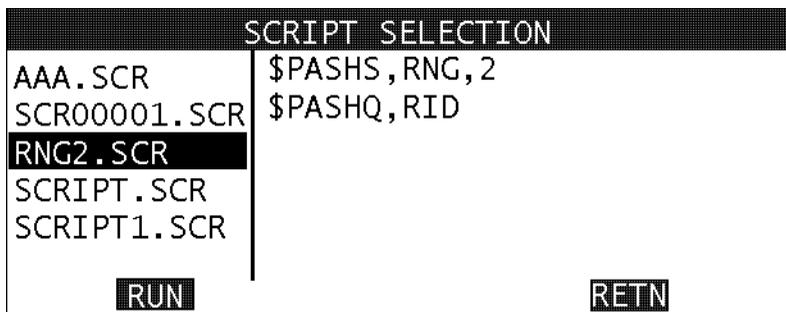
HANDHELD POWER:	<b>ON</b>	MIN SVs:	<b>0</b>
RECEIVER POWER:	<b>OFF</b>	HDOP ALARM:	<b>5</b>
MEMORY:	<b>10</b> %	VDOP ALARM:	<b>8</b>

At the bottom right, there is a **RETN** button.

**Figure 2.4:** Alarm Setup screen - ALST

Toggle fields are displayed as black boxes with white text. Set the blinking cursor in the field containing the ON string (right of the HANDHELD POWER description). Use **SP** to toggle between allowed values.

Other screens give you a choice from a list of items:



**Figure 2.5:** Script Selection screen - SCRP

The left pane of this screen presents a list of files. The currently selected item (RNG2.SCR) looks similar to a toggle field, the difference is this screen doesn't display a blinking cursor. To change the selection use the up or down arrow keys  $\uparrow$  or  $\downarrow$ . If this list does not fit on one screen, use the page up or page down keys **PgUp** or **PgDn**. To move to the first item on the list use the  $\uparrow\leftarrow$  (i.e. Home) combination of keys. To move to the last item on the list use the  $\uparrow\rightarrow$  (i.e. End) combination of keys.



---

# Surveying

## GPS Surveying Basics

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The Survey Control software takes advantage of several types of GPS surveying methods, namely **static**, **kinematic**, **pseudo-kinematic**, **rapid static**, and **real-time differential**.

The first four methods require at least two receivers collecting data simultaneously, usually one at a known point, the other at an unknown point. This is analogous to the conventional method of traversing, and is commonly termed differential positioning. Using GPS, the position of the unknown point is determined from the simultaneous data collected at this point and the known point. Using conventional methods, positions of unknown points are determined by measurements from stations with known positions.

In order to determine high-accuracy point positions with GPS, it is required to solve for a set of parameters termed carrier phase ambiguities. Solving the carrier phase ambiguities is the most significant step towards computing a high accuracy position. Once these ambiguities have been determined, very little time is required to determine the point position. The basic difference between the four methods of GPS surveying mentioned above revolves around the method used to determine the carrier phase ambiguities.

The Survey Control software functions with two distinctly different types of Ashtech GPS receivers: the Z-12 dual-frequency P-code receiver, and the SCA-12 single-frequency C/A code receiver. The methods you will use to perform a GPS survey depend on the type of GPS receiver you are using and the logistical conditions in the project area.

The different GPS surveying methods supported by the Survey Control software are explained below. Each explanation covers the advantages and disadvantages, explains under what conditions the different methods are best suited, and defines the methods available, depending on the type receiver.

### Static Method

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The **static** method utilizes long occupation times to solve the carrier phase ambiguities. During an extended survey period, the satellites being observed will move across the sky, changing the satellite geometry. This enables the post-processing software to determine the carrier phase ambiguities and accurately determine the position of the unknown point. The required occupation time depends upon the length of the baseline between the two points being observed (the longer the baseline, the longer the occupation time) and the condition of the atmosphere (namely the ionosphere) during the data collection period. On average, occupation times will range from 0.5 hours to 3 hours.

The static method of surveying is the most accurate method due to the large amount of data collected. The significant disadvantage of the static method is the amount of time needed to determine an accurate position for the unknown point. This method can be used with both the Z-12 and the SCA-12 receiver types, although it is more commonly used with the SCA-12. Due to the Z-12 dual-frequency capabilities, a Z-12 user will more commonly utilize the rapid static method. This is explained in detail later.

The static method should be used when the highest level of accuracy and reliability is required. The static method reduces the chances of having to return to the field to re-observe points, which, after post-processing, do not meet the accuracy expected or required. The static method is also best for baselines exceeding 10 kilometers when using the SCA-12 receiver, and 15 kilometers when using the Z-12. Other GPS surveying methods used on baselines exceeding these lengths will yield unpredictable accuracies.

## Rapid Static Method

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The **rapid static** method is used only with the Z-12 GPS receiver. The added capabilities of dual-frequency P-code found in the Z-12 make this method of GPS surveying possible. The procedure for a rapid static survey is identical to that for a static survey, the only difference being point occupation time, thus the name rapid static. The Z-12 receiver has access to much more information than the SCA-12, namely the L2 satellite frequency and access to the more precise P-code. This added information allows the Z-12 to solve for the carrier phase ambiguities in a significantly shorter period of time compared to the static method using the SCA-12. Point occupation times with a Z-12 performing a rapid static survey ranges from 2 to 10 minutes, depending on the baseline length. This compares to 30 to 60 minutes for a static survey using the SCA-12 on a similar length baseline.

The advantage of rapid static is increased productivity, in that occupation times are greatly reduced compared to the static method. A disadvantage is that this method requires a Z-12 receiver, and is not valid for the SCA-12. Also, since occupation times are so short, the risk of a failure (point occupation not resulting in the expected level of accuracy) is higher than with a static survey. Accuracies of the rapid static method are comparable to the static method.

Use the rapid static method when high productivity is required. Expect a higher failure rate compared to static methods due to the short occupation times. Limit the length of baselines to no more than 15 kilometers. As baseline lengths increase, so will the need for longer occupation times. At 15 kilometers, required occupation times will approach those of static surveys.

## Pseudo-Kinematic Method

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The **pseudo-kinematic** method is similar to static regarding its method of solving for carrier phase ambiguities. The pseudo-kinematic method also depends on the change in geometry of the satellites through time to allow for the determination of the carrier phase ambiguities. The difference lies both in the amount of time spent and the method of data collection. Where two receivers may collect one hour of continuous data on a baseline using the static method, with pseudo-kinematic, the same baseline would be measured with two 5-10 minute occupations separated in time by one hour. This totals only 10-20 minutes of data collection rather than 1 hour. Since the satellite geometry has changed significantly in the hour between the two short observations, the carrier phase ambiguities can be determined.

The advantage of the pseudo-kinematic method is the shorter occupation times. During the 1-hour gap between the short observations on a set of points, more data can be collected on a different set of points. The basic process is to collect short 5-10 minute observations on as many points as possible in 1 hour and re-observe the same set of points for the second 5-10 minute occupation. This increases productivity over the static method. The disadvantage is this method normally is not as accurate as the other methods. Also, the success rate of this method is not as high as with the other methods.

The pseudo-kinematic method can be used with both receiver types it is less productive to use with the Z-12 due to its rapid static capabilities, where one short observation is sufficient to obtain high accuracy positions. This method should never be used on baselines exceeding 10 kilometers. The longer the baseline, the higher the failure rate. The pseudo-kinematic method should be used when higher productivity is required over what the static method can produce but the user must expect to experience a 5-10% failure rate (unacceptable accuracies) resulting in re-occupation of points. The failure rate will vary depending upon on baseline length.

## Kinematic Method

---

The **kinematic** method of GPS surveying utilizes a completely different approach to determine the carrier phase ambiguities compared to the other three methods. With kinematic surveying, the carrier phase ambiguities are determined by occupying a previously measured baseline (occupying two known points). Since the positions of the occupied points are already known, the carrier phase ambiguities can be determined very quickly. This process is commonly termed the initialization of a kinematic survey and requires approximately 5 minutes to perform. **Once the carrier phase ambiguities are determined, they will not change unless the receiver loses lock on the satellites.** This is the key fact which defines kinematic surveying. Since

the carrier phase ambiguities are already known, an accurate position for unknown points can be determined in a very short time (seconds). **However, lock must be maintained on at least 4 satellites at all times.**



**A very effective procedure for high productivity is a combination of the rapid static and kinematic methods of surveying. If for some reason the number of satellites locked falls below 4, the kinematic survey must be re-initialized. This can simply be done by going back to a point observed prior to losing lock and performing the initialization procedure once again. Once initialized, continue with the survey.**

The advantage of the kinematic surveying method is increased productivity, with accuracies comparable to static surveys. Many points can be surveyed in a very short period of time when occupation times are very short. A significant disadvantage is the logistics problems of moving from point to point without losing lock on satellites. Trees, buildings, and other obstructions can make it difficult or impossible to maintain lock on at least 4 satellites as the receiver is transported from point to point. The danger lies in the situation where the user is not aware that while moving from one point to the next, loss of lock occurred momentarily. Without re-initialization, the data collected after loss of lock will be useless. This is why utmost care must be taken when performing a kinematic survey.

The kinematic method can be used with both GPS receiver types. Using kinematic with the Z-12 has advantages over the SCA-12. The first advantage is at the initialization stage. With the SCA-12, the kinematic survey must be initialized on a known baseline. If a known baseline does not exist, it must be established through a static or pseudo-kinematic survey, or by performing an antenna swap (explained later in the section “Performing a Kinematic Survey” on page 31. With the Z-12, a known baseline can be established very quickly with a rapid static survey, using a 5-minute occupation time. At the end of this occupation, the kinematic survey is initialized and the kinematic survey can begin. This same capability comes in very handy in the situation where loss of lock occurs while moving from one point to the next during the survey. With the SCA-12 receiver, you must backtrack to a point occupied prior to the loss of lock in order to re-initialize the survey. With the Z-12, you need only stop on the next point of interest and perform a rapid static survey by occupying this point for the required amount of time (5-10 minutes depending on baseline length). This re-initializes the kinematic survey and you can continue.

Use the kinematic method when high productivity is required. The best results will occur when the a kinematic survey is performed in an area with little obstruction of view to the sky and when points are relatively close together. Do not perform a kinematic survey on baselines longer than 10 kilometers. The longer the baseline, the more chances of failure.

## Real-Time Differential

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Real-time differential positioning involves a reference (base) station computing the SV range corrections and transmitting them to the remote (rover) stations. The reference station transmits these corrections in real time to the remote receivers via a telemetry link. Remote receivers apply the corrections to their measured ranges, using the corrected ranges to compute their position.

The base receiver determines range correction by subtracting the measured range from the true range, computed by using the accurate position entered in the receiver. This accurate position must have been previously surveyed using GPS or some other technique. The remote receivers subtract the received corrections from their measured ranges and use the corrected ranges for position computation.

As stand-alone, the receiver can compute a position of about 25 meters with Selective Availability (SA) off, and around 100 meters with SA on. Differential GPS can achieve sub-meter precision at the remote receivers even with SA on.

The communication link must exist between the base and remote receivers. The communication link can be a radio link, telephone line, cellular phone, communications satellite link, or any other medium that can transfer digital data.

## Sources of Error

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The major sources of error affecting the accuracy of GPS range measurements are space vehicle (SV) orbit estimation, SV clock estimation, ionosphere, troposphere, and receiver noise in measuring range. The first four sources of error are almost totally removed using differential GPS. Their residual error is in the order of one millimeter for every kilometer of separation between base and remote receivers.

Receiver noise is not correlated between the base and the remote receiver and is not canceled by differential GPS. However, in the SCA-12/12S, integrated doppler is used to smooth the range measurements and reduce the receiver noise.

At the instant a SV is locked, there is also RMS noise affecting the range measurement. This rms noise is reduced with the square root of  $n$  where  $n$  is the number of measurements. For example, after 100 seconds of locking to an SV, the rms noise in range measurement is reduced by a factor of 10 (one meter of noise is reduced to 0.1 meter). The noise is further reduced over time.

If the lock to a SV is lost, the noise level reverts to one meter and smoothing begins. The loss of lock to an SV is rare. Typically, it happens only when the direct path to the SV is blocked by an object.

Total position error (or error-in-position), is a function of the range errors (or errors-in-range) multiplied by the PDOP (three-coordinate position dilution of precision). The PDOP is a function of the geometry of the SVs.

## Performing a Static Survey

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A static survey uses at least two stationary GPS systems that collect data from several common satellites over a specific time period. One system is commonly centered over a known point while the other system(s) occupy unknown stations. In order to compute accurate baselines and establish accurate positions on the unknown points, the data collected in the field is post-processed. The following discussion tells how to utilize the static method of GPS surveying to collect data for post-processing.

### System Setup

This section describes how to set up the receiver in the field. At least two receivers are required to do a static survey.

1. Set up and level an antenna over a survey mark using either a tripod and tribrach combination, a bipod and pole system, or a fixed length GPS tripod. The survey point must provide line-of-sight reception of the GPS signals.
2. Connect the antenna to the receiver with an antenna cable.
3. Measure the antenna height. See the following section for more details on this process.

Record all antenna height measurements for each point observed in a field log. Present this information to the person processing the data

4. For the SCA-12 receiver, attach the camcorder battery to the back panel. If the Z-12 is being used, connect external battery or power source to one of the POWER sockets. Align the red dot of the connector with the red dot of the socket and push the connector until it seats.
5. Connect the handheld computer to the receiver serial port with the communication cable. Connect the cable to handheld port 1 and receiver port A (labeled PORT1 on Z-12 receivers). If you wish, you can use any other port combinations.
6. Turn on the receiver. To start the SCA-12 receiver, run the Survey Control Software while the handheld is connected to the receiver. This will automatically turn the receiver on. You can turn on/off the SCA-12 receiver from within Survey Control Software. To start the Step 1 SCA-12 based system, press the power button. The LED will flash red when the unit is powered on. To start the Z-12 receiver, set the receiver power switch to ON. Repeat this for all receivers participating in the survey.

7. Repeat these steps for all receivers participating in the survey.

At this stage, the GPS receivers are collecting data. No other interaction with the equipment is required. Turn off the receivers when the observation is complete.

To simplify post-processing, it is strongly recommended that further interaction with the system be undertaken as data is collected. Specifically, the station identifier and antenna height should always be entered into the receiver. It is also recommended the data collection be monitored throughout the survey to ensure that all is well. These tasks can be performed with the Survey Control software, as described below.

## Measuring Antenna Height

All data collected by GPS systems is referenced to the antenna location, namely the phase center of the antenna. In most surveying applications, the goal is to position the survey mark on the ground, not the location of the antenna some distance above the mark. Therefore, as part of the post-processing procedure, the GPS data collected must be reduced to ground level where the survey mark is located. This is done by accurately measuring and recording the distance from the antenna to the survey mark. This distance is referred to as the antenna height or **height of the instrument (HI)**.

One of the primary error sources encountered when performing any type of GPS survey is incorrectly measured or recorded antenna heights. Do **not** assume that an incorrectly measured HI will affect only the vertical accuracy of the survey. This is absolutely **not** true with GPS. To help minimize the effect of this error source, the following procedure for measuring and recording the antenna height is recommended.

1. Using the precision HI rod, place the pointed tip of the rod at the center of the survey mark.
2. Lean the rod up against the GPS antenna. If the antenna you are using has grooves to accept the HI rod, place the rod into the groove and read the height on the side of the rod closest to the center of the antenna. If the antenna does not have grooves to accept the HI rod, read the HI at the seam between the top and bottom halves of the antenna housing. This is the slant height of the antenna. The HI rod is graduated in two systems, feet and meters. Read and record the height in both systems. This can be used as a check to determine if the height was read correctly in case of a problem.
3. Repeat step 2 on the opposite side of the antenna. The two measurements should compare to 1 mm. If they do not compare, either the antenna is not level or one of the measurements is in error, or the optical plummet is out of adjustment.

4. Enter the HI into the receiver using the Survey Control software for storage in the GPS receiver. Note that for each data file stored in the receiver, the last entered HI is the only one recorded.

Record all antenna height measurements for each point observed in a field log. Present this information to the person processing the data.

5. At the end of the survey, prior to breakdown of the system, renames the HI to determine if any settling has occurred.



**If using a fixed length pole versus a tripod for set up of the GPS antenna, the antenna height needs only to be determined once, utilizing the same value each time a survey is performed.**

## Static Surveying with the Survey Control Software

As stated in “System Setup” on page 16, data collection begins as soon as the receiver is turned on and a sufficient number of satellites is acquired. In practice, no interaction with a receiver is required for static surveys. When the receiver is turned on, it automatically:

- searches and locks on all satellites available.
- makes GPS measurements and computes its position.
- opens a file and saves all data into this file.

When the receiver is turned off after a survey, it automatically closes the file containing data.

The Survey Control software should be used to

- monitor the progress of the survey
- change parameters if the defaults are not acceptable
- enter pertinent information needed during data processing

If such information is not entered during data collection, it must be entered manually during the processing of the data.

This section describes how to use the Survey Control software to perform the tasks listed above.

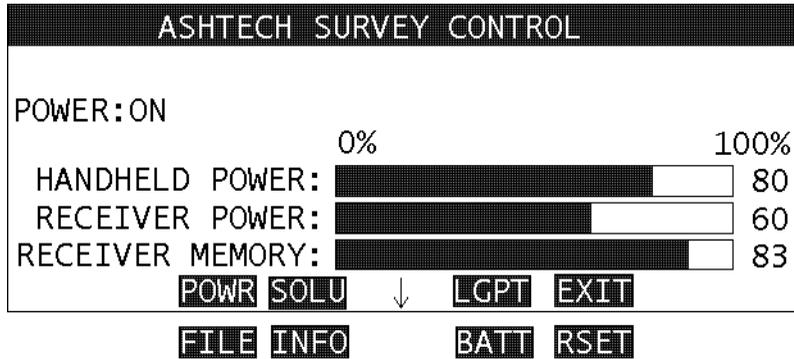
Prior to entering the Survey Control software, ensure that the handheld is correctly connected to the GPS receiver and that the GPS receiver is connected to a battery. If a Z-12 is used, ensure that it is turned on.

## Changing Parameters and Entering Site-specific Information

1. To start the Survey Control Software type in the letters **SC** on the handheld control unit and press Yes (↵). You can bypass the logo screen by pressing

any key. If the SCA-12 Surveyor receiver is being used, it should have powered on automatically at this time.

You will see the Survey Control main screen (MAIN):



**Figure 3.1:** Survey Control main screen - MAIN

The POWER field should display: ON. It means that communication with the receiver was established. If this field displays ???, check all connections, and press the F1 key (POWR) to re-establish communication with the receiver. Be careful: with the SCA-12, if you press the F1 key on this screen while communication is established, the receiver will be turned off!

A quick examination of this screen will show you the status of the handheld power, receiver power, and receiver memory available. If the handheld

power displays 0% or displays a value you feel is not correct, refer to the handheld manual to determine how to set the power status.

- Option 1: If the receiver power displays 0% or a value you feel is not correct, move to the Battery Management screen (BATT) by pressing  $\uparrow$ -F2, to set up the battery power parameters

The Battery Management screen (BATT) appears:

RECEIVER BATTERY MANAGEMENT	
BATTERY CAPACITY: <input type="text" value="3000"/> mAh	PREDICTED LIFETIME 3h 20min.
POWER REMAINING: <input type="text" value="80"/> %	
VOLTAGE: <input type="text" value="6.0"/> V	
WARNING LEVEL: <input type="text" value="10"/> %	
<input type="button" value="CNCL"/> <input type="button" value="OK"/>	

**Figure 3.2:** Battery Management screen - BATT

Fill in the parameters in this screen to enable the tracking of the receiver battery level of charge. Once entered, press **F4** to save and move back to the Survey Control main screen (MAIN). These values should be updated every time a new battery is connected to the receiver. The parameters shown here are representative of the camcorder battery found on the SCA-12.

- Option 2: If you are not comfortable with the remaining receiver memory reported on the Survey Control main screen (MAIN), move to the File

Management screen (FILE), by pressing  $\uparrow$ -F1, to remove files from the receiver. The File Management screen (FILE) appears as:

FILE MANAGEMENT				
FILES: 6	FREE MEM:	99%	4055	kB
1.AAAA	27kB	7481	16:15	
2.BBBB	20kB	7481	17:15	
3.CCCC	22kB	7481	18:15	
4.DDDD	29kB	7481	19:15	
5.EEEE	23kB	7481	20:15	
	<b>DEL</b>	<b>SEL</b>	<b>CLOS</b>	<b>RETN</b>

**SELECTED:**

3.CCCC

Figure 3.3: File Management screen - FILE

Each file is represented with a 4-character name, the size of the file in kilobytes, the GPS week and day number, and the time when the last epoch of data was written to this file. The file name is derived from the last site ID (defined below under STEP 2) entered in the receiver before the file was closed. A data file is closed when the receiver is turned off or when **F3** (CLOS) is pressed when the active file is selected. The last file in the list is always the active file. This new file is opened automatically whenever the receiver is turned on.

Use the up and down arrow keys to highlight a file to be deleted. Press **F2** (SEL) to select the file. The selected files will appear on the right. Once all files to be deleted are selected, press **F1** (DEL) to delete the files. Press **F4** (RETN) to return to the Survey Control main screen (MAIN).

2. Once you are satisfied with the information on the Survey Control main screen (MAIN), move to the Log Point Data screen (LGPT), by pressing **F3**, to begin the process of setting up the survey.  
The Log Point Data screen (LGPT) appears as:

LOG POINT DATA	
SITE ID: <input type="text" value="1234"/>	LOGGING:
DESCRIPTION:	POLE
<input type="text" value="12345678901234567890"/>	RECEIVER
ANTENNA HT: <input type="text" value="1.123"/> m	MEMORY LEFT:
	16.7kB
	8h 58min
<b>SET</b> <b>LGST</b> ↓ <b>ALST</b> <b>RETN</b>	
<b>SITE</b>	<b>SESS</b>

**Figure 3.4:** Log Point Data screen - LGPT

The Log Point Data screen (LGPT) allows you to attach site-specific information to the data being collected. This is accomplished by filling in the SITE ID and ANTENNA HEIGHT fields with the proper information and pressing **F1** (SET). This can be done at any stage of the data collection process.

Important status information can be found on the right side of this screen. This information is addressed in the monitoring section below.

- Option 1: Data is recorded to memory at a specified interval set in the Datalogging Setup screen (LGST). The default recording interval is 20 seconds. This means that every 20 seconds, data will be recorded to memory. This default value is standard for *static* surveys. If you wish to record data at

a different interval, access the Datalogging Setup screen (LGST) by pressing **F2**.

The Datalogging Setup screen appears as:

The screenshot shows the 'DATALOGGING SETUP' screen. It is divided into two columns. The left column contains the following fields: 'RECORD INT: 2.0 sec', 'OCCUP TIME: 1.00 min', 'MINIMUM SVs: 4', 'ELEVATION: 10 °', and 'DATA TO LOG: CODE & CARRIER'. The right column contains: 'RECEIVER MEMORY LEFT: 16.7kB' and '8h 58min'. At the bottom, there are several buttons: 'SSEL', 'SAVE', 'CNCL', 'OK', 'MODE', and 'SCRP'. A downward arrow is positioned between 'SAVE' and 'CNCL'.

**Figure 3.5:** Datalogging Setup screen - SCRP

Change the RECORD INT field to the interval you wish to record data. Press F4 (OK) when finished, to return to the Log Point Data screen (LGPT).

The OCCUP TIME field is not used in static surveys and should be set to 0.0. This will be discussed in detail later.

## Monitoring Survey Status

A number of screens exist for monitoring the status of the survey. This section will guide you to each screen and explain what to look for to determine the health of the survey in progress. Monitoring of the survey is completely optional. Therefore, all of the steps listed below are listed as optional and can be carried out in any order.

- Option 1: The Log Point Data screen (LGPT) contains important status information regarding the data logging. From the Ashtech Survey Control

main screen (MAIN), the Log Point Data screen is accessed by pressing **F3** (LGPT).

The Log Point Data screen (LGPT) appears as:

LOG POINT DATA	
SITE ID: <input type="text" value="1234"/>	LOGGING:
DESCRIPTION: <input type="text" value="12345678901234567890"/>	POLE
ANTENNA HT: <input type="text" value="1.123"/> m	RECEIVER
	MEMORY LEFT:
	16.7kB
	8h 58min
<input type="button" value="SET"/> <input type="button" value="LGST"/>	<input type="button" value="ALST"/> <input type="button" value="RETN"/>
<input type="button" value="SITE"/>	<input type="button" value="SESS"/>

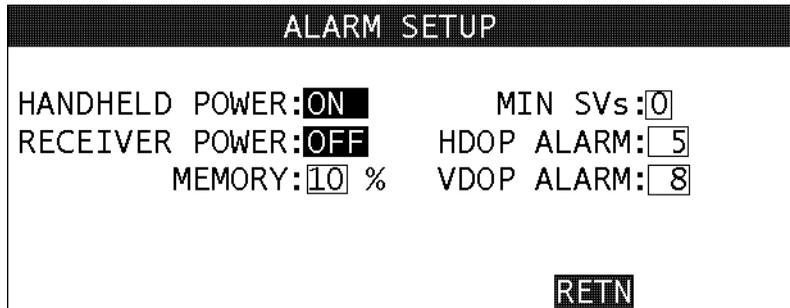
**Figure 3.6:** Log Point Data screen - LGPT

The LOGGING message is an indicator of data logging status. If a 4 character site ID is displayed under LOGGING, data is being logged in the receiver using this site ID. If ???? is displayed after LOGGING, then no site ID has been entered, and the data is being logged without a site ID. If !!NONE!! is displayed under LOGGING, no data is being logged to the receiver. Check to ensure the memory in the receiver is not full or sufficient satellites are being observed. The RECEIVER MEMORY LEFT field indicates available data storage memory in the receiver in both kilobytes and time. As data is logged, these values should decrease.

- Option 2: The Survey Control software uses alarms to help the user monitor the survey. These alarms are found on the Alarm Setup screen (ALST). This

screen can be accessed from the Log Point Data screen (LGPT) by pressing **F3** (ALST).

The Alarm Setup screen (ALST) appears as:



The screenshot shows the 'ALARM SETUP' screen with the following settings:

HANDHELD POWER:	ON	MIN SVs:	0
RECEIVER POWER:	OFF	HDOP ALARM:	5
MEMORY:	10 %	VDOP ALARM:	8

At the bottom right, there is a **RETN** button.

**Figure 3.7:** Alarm Setup screen - ALST

The **HANDHELD POWER** and **RECEIVER POWER** parameters allow you to enable or disable these alarms. When enabled, an alarm will sound when the power of either components falls below a threshold. The threshold value for the **RECEIVER POWER** is set on the Battery Management screen (**BATT**) accessed from the Ashtech Survey Control main screen (**MAIN**). To change the value of either power alarm parameters, simply toggle the **ON** value to **OFF** using the space key (**SP**).

The **MIN SVs**, **HDOP ALARM**, and **VDOP ALARM** are not as important to a static survey as they are to other methods due to the extended period of time occupying a point using the static method. Therefore, a discussion on the importance of these alarms will be left for the sections covering the other methods of GPS surveying.

When finished with this screen, press **F4** (**RETN**) to return to the Log Data Point screen (**LGPT**).

- Option 3: The number of satellites observed and the satellite geometry (where the observed satellites are in the sky) are important factors in determining an accurate position of the point being surveyed. Status

information on satellites observed and satellite geometry can be found on the Solution screen (SOLU).

The Solution screen (SOLU) can be accessed from the Ashtech Survey Control main screen (MAIN) by pressing **F2** (SOLU).

The Solution screen (SOLU) appears as:

<b>CURRENT POSITION</b>		<b>GPS 00:15:36</b>	
WGS-84			
LAT	29°27'23.12345"	SVs used	7
LNG	121°30'23.45627"	SVs locked	10
ELV	12.160m	PDOP	1.6 SYNC OK
REMOTE		HDOP	1.0 AGE 4
<b>RTCM DIFFERENTIAL</b>		VDOP	1.2 QA 100
<b>DOPS SATS</b>		<b>DATA</b>	<b>RETN</b>

**Figure 3.8:** Solution screen - SOLU

The left portion of the screen displays the **CURRENT POSITION** of the point being surveyed. The position is given in latitude, longitude, and elevation based on the WGS-84 datum. This is a stand alone position (using one receiver only, no differential). The accuracy of this position is within 100 meters (2DRMS) of truth. For a *static* survey, the **CURRENT POSITION** display should be used only as an indicator that a position is being computed. You will know a position is being computed if the position on the display is updating. If no position is being computed for the majority of the survey, this is an indicator of a problem, most frequently related to too few satellites being tracked. Check the connection to the antenna. Also, observe if any obstructions exist to block satellite reception. The point you are occupying may be too obstructed for data collection at this time. At least four satellites are required to determine a three-dimensional position for a surveyed point with GPS. If all looks well and the receiver is still not computing a position, reset the receiver (see “Receiver Reset Screen - RSET” on page 70) and try again.

The right side of the **SOLUTION** screen (SOLU) contains an indicator of satellites used and satellites locked (SVS 8 used/ 10 locked). The GPS receiver will lock to any satellite it sees. If a satellite is very low on the

horizon, it will not be used in computing the position. This is the difference in these two numbers.

The right side of the screen also contains Dilution of Precision (DOP) values, Position Dilution of Precision (PDOP), Horizontal Dilution of Precision (HDOP), and Vertical Dilution of Precision (VDOP). These values indicate the quality of the satellite geometry. Good satellite geometry is important for computing an accurate GPS position. A characteristic of good geometry is having the satellites spread throughout the sky versus all in one area. The better the satellite geometry, the lower the DOP values, i.e., low values are good.

The PDOP value corresponds to the error in the 3D position due to the satellite geometry. HDOP corresponds to the error in the horizontal component of the position. VDOP corresponds to the vertical component. PDOP, HDOP, and VDOP are related by the following equation:

$$PDOP = \sqrt{HDOP^2 + VDOP^2}$$

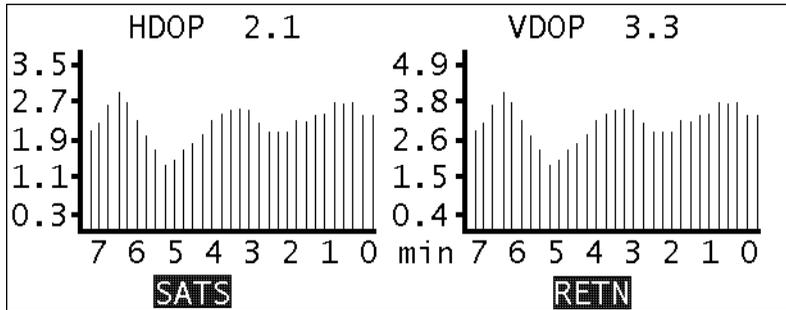
As can be seen in this equation, the larger the HDOP and VDOP get, the larger the PDOP value will be. VDOP values will always be greater (therefore worse geometry) than HDOP, approximately 1.7 times greater. This is due to the nature of the GPS satellite constellation. Since DOP values help predict accuracy, it can be determined from the previous statement that GPS surveys produce more accurate horizontal positions versus vertical positions, approximately 1.7 times more accurate. This is true for any type of GPS survey.

Ashtech recommends that the PDOP value be less than or equal to 5 for the majority of a static survey. It is not a problem to have time periods within a static survey where PDOP grows above 5. These periods should be a small portion of the entire survey. Periods of poor geometry (PDOP) may require increased observation times. When PDOP is near 5, you can expect the HDOP value to be approximately 2.5 and VDOP to be 4.25. If the vertical component of your survey is very important, it is recommended that a watchful eye is kept on the VDOP value. A VDOP greater than 4 for the majority of a *static* survey could result in poor vertical accuracy.

- Option 4: The DOP values found on the Solution screen (SOLU) are instantaneous values. To see an 8 minute history of HDOP and VDOP values, access the Horizontal and Vertical DOP Display screen (DOPS).

This screen can be accessed by pressing **F1** (DOPS) from the Solution screen (SOLU).

The Horizontal and Vertical DOP Display screen (DOPS) appears as:



**Figure 3.9:** Horizontal and Vertical DOP Display screen - DOPS

The HDOP graph on the left of the screen shows the HDOP values for the last 8 minutes. The value listed by the HDOP header shows the current HDOP value.

The VDOP graph on the left of the screen shows the VDOP values for the last 8 minutes. The value listed by the VDOP header shows the current VDOP value.

Again, extended periods of high values in either DOP can result in poor accuracies in the respective component.

- Option 5: It is useful at times to access more detailed information on the satellites. This information can be found on the Satellite Constellation screen



during the occupation. The mission planning software also will inform you of the DOP values at specific times, taking into consideration obstructed satellites.

With adequate preparation, the process of collecting the data for a *static* survey is extremely simple, requiring very little or no interaction from the user once started.

## Turning Off the Receiver

When you have determined that sufficient data has been collected, end the survey by turning off the GPS receiver. This will automatically close the data file. The data will remain in memory even after power is turned off, supported by internal lithium batteries.

Receiver power is manipulated from the Survey Control MAIN screen.

The Survey Control MAIN screen appears as:

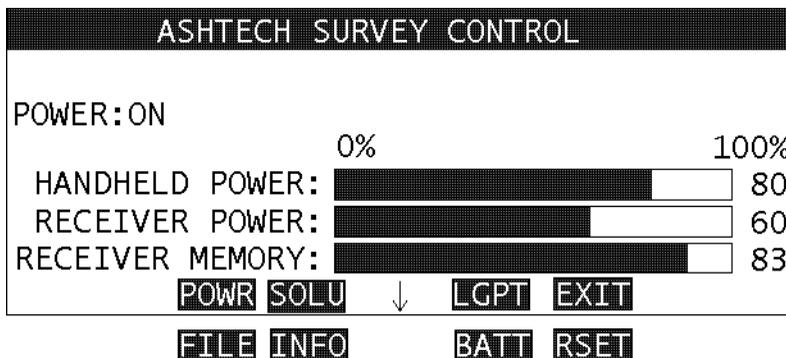


Figure 3.11: Survey MAIN screen - MAIN

To power off the GPS receiver, press **F1** (POWR). The effect of this action will differ depending on the type of GPS receiver being used. With the SCA-12, this action completely powers off the GPS receiver. With the Z-12, this action places the receiver in sleep mode. To completely turn off the Z-12, the POWER switch on the rear of the receiver must be switched off.

Follow this procedure whenever you are directed to turn off the GPS system anywhere in this manual.

## Moving to the Next Session

Thus far, we have discussed the process for collecting one session of data, establishing baselines between the known point and all unknown points. For instance,

if four receivers were used in the previously discussed survey, three unknown points would have been established. The fourth point occupied was a known point. If more points remain to be surveyed, the receivers must move to the next set of points and a new session of data collection must be performed. Keeping in mind that one receiver must remain on a known point, this is often accomplished by leaving one of the receivers on the previous session point. This point acts as the pivot point for all the other receivers. This point is now known because it was surveyed in the last session. When all the other receivers are again set up, the second session can begin. Normally, session start and stop times are determined prior to leaving the office. All operators are made aware of this schedule, along with the point assigned to them for occupation. Each operator follows this point and time schedule throughout the day, assuming all other operators are doing the same. If all is going well, each operator will be at the designated points at the designated time, and simultaneous data collection will occur, establishing the baselines between all points being observed.

## Performing a Kinematic Survey

The kinematic method of GPS surveying is the most difficult due to the requirement of maintaining the carrier phase ambiguities of at least four satellites at all times. The advantage is high productivity. Unlike the static method, user interaction, through the Survey Control software, is essential throughout the survey.

A kinematic survey requires at least two GPS systems that collect data simultaneously from several common satellites over a specific time period. One system, often referred to as the base, remains centered over a known point while the other system(s), often referred to as rovers, move to unknown stations collecting short data sets. In order to compute accurate baselines and establish accurate positions on the unknown points, the data collected in the field is post-processed. This section describes how to utilize the kinematic method of GPS surveying to collect the data necessary for post-processing.

### System Setup

Later on in this section, you will be instructed to set up the GPS system. Follow the same procedures found in Steps 1-7 of “System Setup” on page 16 in “Performing a Static Survey” on page 16 with one note. Normally, when using the kinematic methods, the roving GPS systems utilize fixed length pole and bipod systems or fixed length GPS tripods versus a standard tripod and tribrach combination. There are three reasons for this. 1) These systems are significantly easier and quicker to set up. Setup times are significant when observation times are measured in seconds, as is true with a kinematic survey. 2) Fixed length poles eliminate antenna height measuring errors. These errors become more prominent when the number of set ups increases. 3) Fixed height poles result in only one antenna height for the many points observed in a

kinematic survey. As mentioned earlier, only one antenna height is stored for each data file. In kinematic surveying, one data file may contain data for many points. If different antenna heights are measured at each point, they will not be stored. This means these antenna heights will have to be manually recorded in the field and entered manually during the data processing.

## **Measuring Antenna Height**

Later on in this section, you will be instructed to measure the antenna height of the GPS set up. Follow the same procedure found in Steps 1-5 of “Measuring Antenna Height” on page 17.

## **Kinematic Surveying with the Survey Control Software**

The Survey Control software plays a much larger role in the execution of a kinematic survey. As for a static survey, the Survey Control software should be used to 1) monitor the progress of the survey, 2) change parameters if the defaults are not acceptable, and 3) enter pertinent information needed during data processing. The difference is in the frequency of data entry and the importance of close monitoring. Unlike a static survey, site-specific information must be entered during data collection. It is inadvisable to enter this information in the office prior to data processing.

Following is a detailed, step-by-step, explanation on performing a kinematic survey. It is important that each step is followed precisely to ensure a successful survey.

## **Kinematic Initialization Requirements**

A unique procedure to kinematic surveying is the initialization of the survey in order to resolve the carrier phase ambiguities of all visible satellites. This is the very first step in performing a kinematic survey. If you have not yet read the section “GPS Surveying Basics” on page 11, do so now to learn more on the importance of carrier phase ambiguities.

Initializing the kinematic survey is done by occupying a known baseline (previously measured by GPS) with the base GPS system on one end and a rover on the other. If more than one rover is being used in the survey, each must be initialized on a known baseline with the base station. It is best that this baseline is not longer than 5 km. The longer the baseline, the more chance of an initialization error.

If a known baseline exists and is available for initializing the kinematic survey, jump forward to the section “Initialization and Execution of the Kinematic Survey” on page 39. If a known baseline does not exist, establish one using one of the methods described in the following section.

## Establishing a Known Baseline

If a known baseline does not exist, one must be established at this time before the kinematic survey can begin. Three methods are available to establish a known baseline; perform a static survey, perform a rapid static survey, or perform an antenna swap. Each one of these methods are explained below. One of these methods must be performed prior to moving on to the next step.

### Method 1

An initialization baseline can be established by performing a static survey. This procedure has the disadvantage of requiring an extended period of time normally associated with a static survey.

1. Set up the base system on a known point.
2. Set up the rover anywhere within 5 km of the base station.
3. Follow the procedures outlined in **Performing a Static Survey** to establish the baseline.
4. At the end of the data collection period, close the data file for the static survey by either turning off the GPS receiver or using the close function found on the File Management screen (FILE). The latter is the preferred method, eliminating the need to wait for the system to reacquire satellites prior to moving on to the next step. This should be done for both the base and rover receivers.

At this point, the initialization baseline has been established.

### Method 2

An initialization baseline can be established by performing a rapid static survey. This method is only valid when using a Z-12 receiver. The SCA-12 is not capable of performing a rapid static survey. The advantage of the rapid static survey is the short occupation time required to establish the baseline. A rapid static survey of a baseline requires approximately 5-10 minutes depending on baseline length.

1. Set up the base system on a known point.
2. Set up the rover anywhere within 5 km of the base station.
3. Follow the procedures outlined in “Performing a Rapid Static Survey” on page 46 to establish the baseline.
4. At the end of the data collection period, close the data file for the static survey by either turning off the GPS receiver or using the close function found on the File Management screen (FILE). The latter is the preferred method, eliminating the need to wait for the system to reacquire satellites

prior to moving on to the next step. This should be done for both the base and rover receivers.

At this point, the initialization baseline has been established.

### **Method 3**

An initialization baseline can be established by performing an antenna swap. The advantage of the antenna swap is the short time required to establish the baseline compared to the static method; an antenna swap process normally requires about 5 minutes. The disadvantage is that this method is more complex than the rapid static or the static methods.

In an antenna swap, the base system is set up on a known point. The rover is set up on a temporary point within a few meters of the base system. The two receivers collect data simultaneously for approximately 1 minute. The antennas are then swapped, maintaining lock on at least 4 satellites at all times. Swapping the antennas means the base antenna is placed on the rover point, and the rover antenna is placed on the base point. Another minute of data is collected. This concludes the antenna swap process. This process of each receiver collecting a small amount of data on both points determines the baseline between the points. To insure a successful initialization, it is recommended that this process be repeated.

Following is a more detailed procedure for performing the antenna swap determination of the initialization baseline:

1. Set up the base system over the known point. Following the procedures outlined in “Performing a Static Survey” on page 16 up to, but not including Step 2 of “Static Surveying with the Survey Control Software” on page 18.
2. The recommended recording interval for performing an antenna swap is 5 seconds. The factory default recording interval is 20 seconds. This value is changed in the Datalogging Setup screen (LGST). Access this screen by pressing **F3** (LGPT) from the Ashtech Survey Control main screen (MAIN).

This will lead you to the Log Point screen (LGPT). From this screen, access the Datalogging Setup screen (LGST) by pressing **F2** (LGST).

The Datalogging Setup screen (LGST) appears as:

DATALOGGING SETUP	
RECORD INT: <input type="text" value="2.0"/> sec	RECEIVER
OCCUP TIME: <input type="text" value="1.00"/> min	MEMORY LEFT:
MINIMUM SVs: <input type="text" value="4"/>	16.7kB
ELEVATION: <input type="text" value="10"/> °	8h 58min
DATA TO LOG: <b>CODE &amp; CARRIER</b>	
<b>SSEL</b> <b>SAVE</b> ↓ <b>CNCL</b> <b>OK</b>	
<b>MODE</b>	<b>SCRP</b>

**Figure 3.12:** Datalogging Setup screen - LGST

Change the RECORD INT (record interval) parameter to 5 seconds. When entry is complete, press **F4** (OK) to accept and return to the Log Point Data screen (LGPT).

- The SITE ID and ANTENNA HEIGHT of the base point should now be entered. This is done from the Log Point Data screen (LGPT), which is where you should currently be.

The Log Point Data screen (LGPT) appears as:

LOG POINT DATA	
SITE ID: <input type="text" value="1234"/>	LOGGING:
DESCRIPTION:	POLE
<input type="text" value="12345678901234567890"/>	RECEIVER
ANTENNA HT: <input type="text" value="1.123"/> m	MEMORY LEFT:
	16.7kB
	8h 58min
<input type="button" value="SET"/> <input type="button" value="LGST"/>	<input type="button" value="ALST"/> <input type="button" value="RETN"/>
<input type="button" value="SITE"/>	<input type="button" value="SESS"/>

**Figure 3.13:** Log Point Data screen - LGPT

Enter the site-specific information for the base point. Assume the point name is BASE for this example. When data entry is complete, press **F1** (SET) to accept the data and set the point values in the receiver.

- Set up the rover over the nearby unknown point. Place a marker for the point so it can be recovered later in the survey. Repeat 1 and 2 above for the rover.
- To help the processing software identify which point is the swap point, a special SITE ID is entered just prior to the first data collection on the swap point. The processing software assumes the first SITE ID found after the special ID is the swap point. Two special IDs can be used, ?SSS or ?SWP,

using the Log Point Data screen (LGPT) which is where you should currently be.

The Log Point Data screen appears as:

LOG POINT DATA	
SITE ID: <input type="text" value="1234"/>	LOGGING:
DESCRIPTION:	POLE
<input type="text" value="12345678901234567890"/>	RECEIVER
ANTENNA HT: <input type="text" value="1.123"/> m	MEMORY LEFT:
	16.7kB
	8h 58min
<input type="button" value="SET"/> <input type="button" value="LGST"/>	<input type="button" value="ALST"/> <input type="button" value="RETN"/>
<input type="button" value="SITE"/>	<input type="button" value="SESS"/>

**Figure 3.14:** Log Point Data screen - LGPT

Enter one of the special SITE IDs to identify the swap point. In this example, enter ?SWP. Press **F1** (SET) to accept the SITE ID. Allow the GPS system to store at least one epoch of data to memory. In this case, since the recording interval is set to 5 seconds, allow at least 5 seconds to pass before moving on to the next step.

- The SITE ID and ANTENNA HEIGHT of the rover point should now be entered. Entering a DESCRIPTION is optional. This is done from the Log Point Data screen (LGPT) which is where you should currently be.

The Log Point Data screen (LGPT) appears as:

LOG POINT DATA	
SITE ID: <input type="text" value="1234"/>	LOGGING:
DESCRIPTION:	POLE
<input type="text" value="12345678901234567890"/>	RECEIVER
ANTENNA HT: <input type="text" value="1.123"/> m	MEMORY LEFT:
	16.7kB
	8h 58min
<input type="button" value="SET"/> <input type="button" value="LGST"/>	<input type="button" value="ALST"/> <input type="button" value="RETN"/>
<input type="button" value="SITE"/>	<input type="button" value="SESS"/>

**Figure 3.15:** Log Point Data screen - LGPT

Enter the site-specific information for the rover point. Assume the point name is SWAP for this example. When data entry is complete, press **F1** (SET) to accept the data and set the values for this point in the receiver.

- With all site-specific information entered in both the base and rover systems, collect 1 minute of simultaneous data.
- After 1 minute of data collection, enter ???? for the SITE ID for both the base and rover systems. The ???? SITE ID indicates to the processing software that the antennas are about to move to a new location.
- Without disturbing the tripods, swap the antennas, being careful to maintain lock on the satellites throughout the process. To swap the antennas means to move the base system antenna to the rover system point and visa versa. Carefully place each antenna onto the tripod at its new location. If fixed length poles are used, move the poles along with the antennas when performing the swap.
- On the base system (now located on the rover point), enter the rover point SITE ID on the Log Point Data screen (LGPT) In this example, the ID is SWAP. Press **F1** (SET).
- On the rover system (now located on the base point), enter the base point SITE ID on the Log Point Data screen (LGPT). In this example, the ID is BASE. Press **F1** (SET).

12. Once the new SITE IDs have been entered, collect one minute of common data. At the end of the one minute occupation, change the SITE IDs for both the base and the rover to ????
13. Carefully swap the base and rover antennas back to their original positions.
14. If desired, repeat steps 3-13 to insure a successful initialization.

This concludes the antenna swap procedure. The baseline between the two points has now been determined.

## **Initialization and Execution of the Kinematic Survey**

At this stage, a known baseline exists, from which the kinematic survey can be initialized. This section will step you through the process of initialization and execution of the kinematic survey.

1. Set up the base unit on the base point at one end of the known baseline. This GPS system will not move throughout the survey. The operator of the base system will follow the same procedures for a static survey with two exceptions. The description of these exceptions follow.
  - a. Unlike a static survey, entering a SITE ID is not an option but a requirement for a kinematic survey, even at the base station. Therefore, follow the optional steps outlined in “Performing a Static Survey” on page 16 to enter the site-specific information.
  - b. It is recommended for a kinematic survey to log data at a 5-second recording interval. The factory default recording interval is 20 seconds. This value is changed in the Datalogging Setup screen (LGST). Access this screen by first pressing **F3 (LGPT)** from the Ashtech Survey Control main screen (MAIN). This will lead you to the Log Point screen

(LGPT). From this screen, access the Datalogging Setup screen (LGST) by pressing **F2** (LGST).

The Datalogging Setup screen (LGST) appears as:

DATALOGGING SETUP	
RECORD INT: <input type="text" value="2.0"/> sec	RECEIVER
OCCUP TIME: <input type="text" value="1.00"/> min	MEMORY LEFT:
MINIMUM SVs: <input type="text" value="4"/>	16.7kB
ELEVATION: <input type="text" value="10"/> °	8h 58min
DATA TO LOG: <b>CODE &amp; CARRIER</b>	
<b>SSEL</b> <b>SAVE</b> ↓ <b>CNCL</b> <b>OK</b>	
<b>MODE</b>	<b>SCRIP</b>

**Figure 3.16:** Datalogging Setup screen - LGST

Change the RECORD INT parameter to 5 sec. When entry is complete, press **F4** (OK) to accept and return you to the Log Point Data screen (LGPT).

Refer to “Performing a Static Survey” on page 16 for details on system setup, measuring antenna height, entering site-specific information, changing receiver parameters, and monitoring the survey.

The remaining steps below refer only to the rover system. No further action is required at the base system.

2. Set up a rover on the point at the other end of the known baseline. Follow the procedures outlined in “Performing a Static Survey” on page 16 up to, but not including, Step 2 of “Static Surveying with the Survey Control Software” on page 18.
3. It is critical throughout a kinematic survey to maintain lock on at least 4 satellites at all times. If loss of lock occurs, the kinematic survey must be reinitialized on a known point, otherwise all the data collected after the loss

of lock will be useless. Therefore, it is imperative that the user be warned if loss of lock occurs.

An alarm on the Alarm Setup screen (ALST) will warn you of loss of lock. To set this alarm, access the Alarm Setup screen (ALST) from the Log Point Data screen (LGPT) by pressing **F3** (ALST).

The Alarm Setup screen (ALST) appears as:

The screenshot shows the 'ALARM SETUP' screen with the following settings:

HANDHELD POWER:	ON	MIN SVs:	0
RECEIVER POWER:	OFF	HDOP ALARM:	5
MEMORY:	10 %	VDOP ALARM:	8

At the bottom right, there is a button labeled 'RETN'.

**Figure 3.17:** Alarm Setup screen - ALST

The MIN SVs parameter allows you to define the threshold of the minimum number of satellites locked. If fewer satellites are locked, the alarm will sound. The factory default for this parameter is 4, which is the minimum number of satellites required. You may wish to increase this to 5 as a precautionary measure.

Press **F4** (RETN) when you are finished with this screen.

4. For all methods of GPS surveying, data collection should occur with the same recording interval set in all receivers. The recording interval for the base is currently 5 seconds. The recording interval on the rover needs to be changed to match the base.

It is important for the data processing software to be made aware when the rover system is on a point and when it is moving between points. This is accomplished through the SITE ID parameter.

By default, the SITE ID parameter is set to ????. The ???? SITE ID indicates to the post processing software that the rover system is moving, about to move, or has moved and is preparing to collect data on a point. When a SITE ID other than ???? is entered, the post processing software assumes the rover system is stationary on a point.

When the SITE ID parameter is changed to something other than ????, for example PNT1, all of the data collected with the PNT1 SITE ID will be used

to establish the position of the new point. When data collection is completed on a point, the SITE ID parameter must be changed back to ??? prior to moving to the next point. If the SITE ID parameter is not changed to ??? prior to moving the rover system, the processing software will attempt to use the data collected while moving to determine the position of point PNT1. This will cause point PNT1 to be in error.

To minimize this possible error, the OCCUP TIME parameter should be used. When logging data at a point, the SITE ID will automatically change back to ??? after the set occupation time is complete. This eliminates the need for the user to change set the SITE ID to ???.

Both the RECORDING INT and OCCUP TIME parameters can be found on the Datalogging Setup screen (LGST), accessible from the Log Point Data screen (LGPT) by pressing **F2** (LGST).

The Datalogging Setup screen (LGST) appears as:

DATALOGGING SETUP	
RECORD INT: <input type="text" value="2.0"/> sec	RECEIVER
OCCUP TIME: <input type="text" value="1.00"/> min	MEMORY LEFT:
MINIMUM SVs: <input type="text" value="4"/>	16.7kB
ELEVATION: <input type="text" value="10"/> °	8h 58min
DATA TO LOG: <b>CODE &amp; CARRIER</b>	
<b>SSEL</b> <b>SAVE</b> ↓ <b>CNCL</b> <b>OK</b>	
<b>MODE</b>	<b>SCRP</b>

**Figure 3.18:** Datalogging Setup screen - LGST

Change the RECORD INT parameter to 5 seconds. Enter in the OCCUP TIME parameter the amount of time, in minutes, that you wish to collect data on each point during the kinematic survey. The recommend occupation time is 30 seconds. Enter 0.5 in the OCCUP TIME field.

Press **F4** (OK) when all data is entered, to accept and return to the Log Point Data screen (LGPT).

- Enter the site-specific information for the rover point, most importantly the SITE ID. This is done on the Log Point Data screen (LGPT). You should be at this screen at this time. The Log Point Data screen (LGPT) appears as:

The screenshot shows the 'LOG POINT DATA' screen. On the left, there are input fields for 'SITE ID: 1234', 'DESCRIPTION: 12345678901234567890', and 'ANTENNA HT: 1.123 m'. On the right, under 'LOGGING:', it shows 'POLE RECEIVER' and 'MEMORY LEFT: 16.7KB 8h 58min'. At the bottom, there are four buttons: 'SET', 'LGST', 'ALST', and 'RETN'. Below 'SET' is the label 'SITE', and below 'RETN' is the label 'SESS'. A downward arrow is positioned between 'LGST' and 'ALST'.

Figure 3.19: Log Point Data screen - LGPT

Notice that the **F1** key function has changed from SET to LOG. This occurs when an occupation time is entered in the OCCUP TIME field. Enter the SITE ID for the initialization point. In this example, we called it ROVE. When entered, press **F1** (LOG).

The following inset box appears:

The screenshot shows the 'LOG POINT DATA' screen with an inset box. The inset box contains the text: '60 Epochs left', 'HDOP VDOP SVs', 'WORST 1.3 2.1 7', 'CURRENT 1.3 2.1 7', and 'Press ESC to CANCEL'. The background of the screen shows the same fields as Figure 3.19, but they are partially obscured by the inset box.

Figure 3.20: Inset box - LGPT

At this time, data is being logged under the SITE ID ROVE. The epoch number is determined by the occupation time and the recording interval. With an occupation time of 30 seconds and a recording interval of 5 seconds, 6 epochs of data will be written to memory. The remaining information is useful to help qualify the quality of the data being collected. It is important

that good DOP values are maintained when collecting such short data sets on each point.

The number of epochs left will count down to 0 at which time this inset box will disappear, presenting the Log Point Data screen (LGPT). Logging can be interrupted by pressing ESC at any time. Interrupting the logging process does not remove any data already logged to memory, i.e., if any epochs count down prior to interruption, this data will remain in memory.

The Survey Control software should now be presenting the Log Point Data screen (LGPT).

The Log Point Data screen (LGPT) appears as:

LOG POINT DATA	
SITE ID: <input type="text" value="1234"/>	LOGGING:
DESCRIPTION:	POLE
<input type="text" value="12345678901234567890"/>	RECEIVER
ANTENNA HT: <input type="text" value="1.123"/> m	MEMORY LEFT:
	16.7kB
	8h 58min
<input type="button" value="SET"/>	<input type="button" value="LGST"/>
	↓
<input type="button" value="ALST"/>	<input type="button" value="RETN"/>
<input type="button" value="SITE"/>	<input type="button" value="SESS"/>

**Figure 3.21:** Log Point Data screen - LGPT

Examining the LOGGING field on the right side of the screen will show that the SITE ID has been automatically changed back to ????.

The initialization process is now complete. The system is ready to begin the kinematic survey by moving to unknown points to be determined. If more than one rover is being used, all rovers must perform the initialization process before beginning the kinematic survey.

6. Move the rover to the first unknown point to be determined. Be sure to maintain lock on at least 4 satellites at all times. If at any time loss of lock occurs, return to the previous point to reinitialize the survey by repeating Step 5.
7. Set up the rover system over the first unknown point. Enter a SITE ID for this point. In this example, let's use PT01. Enter PT01 in the SITE ID and press **F1** (LOG). This will cause a 30-second observation to commence tagged with the PT01 SITE ID. When data collection is complete, the Log Point Data screen (LGPT) will reappear.

Notice that the LOGGING field is once again set to ????. Also notice the SITE ID field has incremented the SITE ID to PT02. If this ID is good for you, on the next point all you need to do is press **F1** (LOG) when set up over the point.

A SITE ID will automatically increment if the end portion of the ID is numeric. For example, if the ID is PNT0, this ID will increment to PNT9. The next ID will be PT00

8. Repeat steps 6 and 7 for each point to be determined.

Ashtech recommends that you re-observe as many points as possible throughout the survey when convenient. As a rule of thumb, the initialization point should be re-observed at the end of the survey. When re-observing a point, enter the same SITE ID that entered the first time.

The re-observation of points serves two purposes. 1) Any point that has been re-observed can serve as an initialization point should a loss of lock occur without the user being aware. For instance, assume for this example that 8 points were observed in a kinematic survey. At the end of the survey, the initialization point was re-observed. Also assume that between points 5 and 6, loss of lock occurred without the operator's knowledge. The data will process from the initialization point up to point 5. When processing the data after point 5, the loss of lock will cause the software to compute low accuracy positions for the remaining points. But, since the initialization point was observed at the end of the survey, the processing can initialize at the end of the data set and process backwards from the initialization point to point 6. In this example, the re-observation of the initialization point allowed for the successful completion of the survey. 2) Re-observation of points, especially the initialization point, allows the processing software to perform a data closure check on the carrier phase ambiguities; it is a type of redundancy. The data processor will be made aware if a discrepancy is found pointing to a possible problem with the data.

One final note. The kinematic method has the significant disadvantage of not having any redundant observations of the points being established. It is similar to a radial survey, in that a bad baseline can go undetected.

Therefore, it is recommended that points established using the kinematic method be observed twice in independent surveys. Preferably, the resurvey would include the base system being located on a different control point. The results of the two surveys should be compared manually or, preferably, run through a least squares adjustment.

# Performing a Rapid Static Survey

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The procedure for performing a rapid static survey is nearly identical to that of a static survey. The key difference is the amount of time required for collecting data on a point. Since occupation times are much shorter in this method of GPS surveying, close monitoring of the survey is more important. This will be discussed in more detail later in this section. As mentioned in the “GPS Surveying Basics” on page 11, the rapid static method is reserved for the Z-12 receiver.

A rapid static survey requires at least two GPS systems that collect data simultaneously from several common satellites over a specific time period. One system, often referred to as the base, remains centered over a known point while the other system(s), often referred to as rovers, rove to unknown stations collecting two short data sets separated by an hour in time. In order to compute accurate baselines and establish accurate positions on the unknown points, the data collected in the field is post-processed. This section of the manual describes how to utilize the kinematic method of GPS surveying to collect the data necessary for post-processing.

## System Setup

Later on in this section, you will be instructed to set up the GPS system. Follow the same procedures found in Steps 1-7 of “System Setup” on page 16.

## Measuring Antenna Height

Later on in this section, you will be instructed to measure the antenna height of the GPS set up. Follow the same procedure found in Steps 1-5 of “Measuring Antenna Height” on page 17.

## Rapid Static Surveying with the Survey Control Software

A rapid static survey is similar to a kinematic survey where a base system remains stationary throughout the survey. Rovers move from point to point collecting short 5–10 minute data sets. The disadvantage of this method is all points will have only one baseline establishing them, like the kinematic method, since simultaneous data is being collected between the base and one rover only. The use of two base stations would result in two baseline measurements to each rover point, improving the reliability of this method.

As is true for a static survey, the Survey Control software should be used during a rapid static survey to 1) monitor the progress of the survey, 2) change parameters if the defaults are not acceptable and 3) enter pertinent information needed during data processing.

It is recommended with rapid static surveys to enter the site-specific information in the field using the Survey Control software rather than wait to do so later during data processing. Since the rapid static method allows you to survey many points in a short period of time, management of all these data files could become difficult if the site-specific information is not entered during data collection.

1. Set up the base GPS system over a known point. This GPS system will not move throughout the survey. Follow the procedures outlined in “Performing a Static Survey” on page 16 up to, but not including, Step 2 of “*Static Surveying with the Survey Control Software*” on page 18.
2. It is recommended for a rapid static survey to log data at a 5-second recording interval. The factory default recording interval is 20 seconds. This value is changed in the Datalogging Setup screen (LGST). Access this screen by pressing **F3** (LGPT) from the Ashtech Survey Control main screen (MAIN). This will lead you to the Log Point screen (LGPT). From this screen, access the Datalogging Setup screen (LGST) by pressing **F2** (LGST).

The Datalogging Setup screen (LGST) appears as:

DATALOGGING SETUP	
RECORD INT: <input type="text" value="2.0"/> sec	RECEIVER
OCCUP TIME: <input type="text" value="1.00"/> min	MEMORY LEFT:
MINIMUM SVs: <input type="text" value="4"/>	16.7kB
ELEVATION: <input type="text" value="10"/> °	8h 58min
DATA TO LOG: <b>CODE &amp; CARRIER</b>	
<b>SSEL</b> <b>SAVE</b> ↓ <b>CNCL</b> <b>OK</b>	
<b>MODE</b>	<b>SCRP</b>

**Figure 3.22:** Datalogging Setup screen - LGST

Change the RECORD INT parameter to 5 sec. When entry is complete, press **F4** (OK) to accept and return you to the Log Point Data screen (LGPT).

3. The base system SITE ID should be entered along with the antenna height. This is done through the Log Point Data screen (LGPT).  
The Log Point Data screen (LGPT) appears as:

LOG POINT DATA	
SITE ID: <input type="text" value="1234"/>	LOGGING:
DESCRIPTION:	POLE
<input type="text" value="12345678901234567890"/>	RECEIVER
ANTENNA HT: <input type="text" value="1.123"/> m	MEMORY LEFT:
	16.7kB
	8h 58min
<input type="button" value="SET"/> <input type="button" value="LGST"/>	<input type="button" value="ALST"/> <input type="button" value="RETN"/>
<input type="button" value="SITE"/>	<input type="button" value="SESS"/>

**Figure 3.23:** Log Point Data screen - LGPT

Enter the appropriate SITE ID and ANTENNA HEIGHT and press **F1** (SET).

At this time, the base system is set for the entire survey.

The remaining steps below refer only to the rover system. No further action is required at the base system.

4. Set up a rover system over an unknown point. Follow the procedures outlined in “Performing a Static Survey” on page 16 up to, but not including, Step 2 of “Static Surveying with the Survey Control Software” on page 18.
5. Follow the procedure outlined in Step 2 above to set the recording interval of the rover system to 5 seconds.

- The rover system SITE ID should be entered along with the antenna height. This is done through the Log Point Data screen (LGPT). The Log Point Data screen (LGPT) appears as:

LOG POINT DATA	
SITE ID: <input type="text" value="1234"/>	LOGGING: POLE
DESCRIPTION: <input type="text" value="12345678901234567890"/>	RECEIVER
ANTENNA HT: <input type="text" value="1.123"/> m	MEMORY LEFT: 16.7kB
	8h 58min
<input type="button" value="SET"/> <input type="button" value="LGST"/>	<input type="button" value="ALST"/> <input type="button" value="RETN"/>
<input type="button" value="SITE"/>	<input type="button" value="SESS"/>

**Figure 3.24:** Log Point Data screen - LGPT

Enter appropriate the SITE ID and ANTENNA HEIGHT and press **F1** (SET).

- When data collection is complete, turn off the rover and proceed to the next point. Repeat **Steps 4-7** for all points to be surveyed.

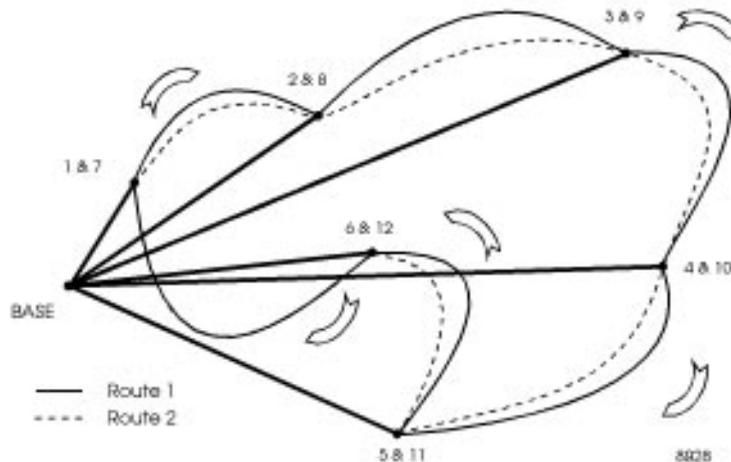
## Performing a Pseudo-Kinematic Survey

The pseudo-kinematic method is the least reliable in regards to success rate. It is not uncommon to encounter 1 failed baseline measurement out of 10. The good news is normally the failed measurement is so bad, it is easy to spot. To many people this failure rate is acceptable, since total production is increased (compared to static surveys) even with the failures. Although a pseudo-kinematic survey can be performed with a Z-12, this method is normally reserved for the SCA-12. The Z-12 user will normally utilize the rapid static method instead.

A pseudo-kinematic survey requires at least two GPS receivers and two antennas. In pseudo-kinematic surveying, you typically leave one receiver, the base system, at a known survey mark while you move another, the rover system, to successive sites, gathering data at each site for 5 to 10 minutes. After about an hour, you revisit each site again with the rover and gather data for 5 to 10 minutes. In this way, you create about an hour's observation for each position with the middle data missing.

The same receiver must visit each point twice. That is, one receiver cannot make the first observation while, an hour later, a different receiver makes the second observation. Both visits must be made by the same receiver.

As shown in Figure 3.25, the roving receiver starts at point 1/7 with a 5–10 minute observation. The rover then moves to point 2/8 for a 5-to-10-minute observation, and so on through point 6/12 until about an hour has passed and the cycle is repeated. The same points are then revisited for 5-10 minutes each, in the same order, by the same receiver. When the second observation at point 6/12 is finished, the survey session is complete.



**Figure 3.25:** Site Survey

This technique resembles kinematic in the way you obtain field observations. In contrast to kinematic, there is no initialization, each measurement is 5-10 minutes long, and each point is measured a second time at least 1 hour after the first observation. The hour span lets the satellite geometry change sufficiently to resolve the phase ambiguities. The two 5–10 minute observations separated by an hour are functionally equivalent to a static survey's hour-long baseline observation.

Before you start a pseudo-kinematic survey, you need to determine when at least three, preferably four, satellites will be common to both 5–10 minute observations at each site. The method needs to have some common satellites. It is a good idea to have an overall selection of 5 or more satellites available. In addition, note the driving time between points, and limit this type of survey to relatively small areas.

There is no requirement for maintaining lock as you move between sites. Although it is not recommended, the receiver may actually be turned off while moving. Turning it

off, however, will increase your housekeeping chores since you need to combine files prior to processing.

Incidentally, if several roving receivers are collecting data simultaneously and their operators are in radio contact, the baselines between the rovers may also be computed and there is no requirement that one site be a base. All receivers may move but data collection between receivers must be simultaneous. Processing these baselines may be done automatically using the post-processing software.

This section outlines the procedure for performing a pseudo-kinematic survey. The procedure assumes the use of a base system stationary throughout the survey.

## System Setup

Later on in this section, you will be instructed to set up the GPS system. Follow the same procedures found in Steps 1-7 of “System Setup” on page 16

## Measuring Antenna Height

Later on in this section, you will be instructed to measure the antenna height of the GPS set up. Follow the same procedure found in Steps 1-5 of “Measuring Antenna Height” on page 17.

## Pseudo-kinematic Surveying with the Survey Control Software

As is true for a static survey, the Survey Control software should be used during a pseudo-kinematic survey to 1) monitor the progress of the survey, 2) change parameters if the defaults are not acceptable and 3) enter pertinent information needed during data processing.

It is required with pseudo-kinematic surveys to enter the site-specific information in the field using the Survey Control software rather than wait to do so later during data processing.

1. Set up the base GPS system over a known point. This GPS system will not move throughout the survey. Follow the procedures outlined in “Performing a Static Survey” on page 16 up to, but not including, Step 2 of “Static Surveying with the Survey Control Software” on page 18.
2. It is recommended for a pseudo-kinematic survey to log data at a 5-second recording interval. The factory default recording interval is 20 seconds. This value is changed in the Datalogging Setup screen (LGST). Access this screen by first pressing **F3** (LGPT) from the Ashtech Survey Control main screen (MAIN). This will lead you to the Log Point screen (LGPT). From

this screen, access the Datalogging Setup screen (LGST) by pressing **F2** (LGST).

The Datalogging Setup screen (LGST) appears as:

DATALOGGING SETUP	
RECORD INT: <input type="text" value="2.0"/> sec	RECEIVER
OCCUP TIME: <input type="text" value="1.00"/> min	MEMORY LEFT:
MINIMUM SVs: <input type="text" value="4"/>	16.7kB
ELEVATION: <input type="text" value="10"/> °	8h 58min
DATA TO LOG: <b>CODE &amp; CARRIER</b>	
<b>SSEL</b> <b>SAVE</b> ↓ <b>CNCL</b> <b>OK</b>	
<b>MODE</b>	<b>SCRP</b>

**Figure 3.26:** Datalogging Setup screen - LGST

Change the RECORD INT parameter to 5 seconds. When entry is complete, press **F4** (OK) to accept and return you to the Log Point Data screen (LGPT).

- The base system SITE ID should be entered along with the antenna height. This is done through the Log Point Data screen (LGPT).  
The Log Point Data screen (LGPT) appears as:

LOG POINT DATA	
SITE ID: <input type="text" value="1234"/>	LOGGING:
DESCRIPTION:	POLE
<input type="text" value="12345678901234567890"/>	RECEIVER
ANTENNA HT: <input type="text" value="1.123"/> m	MEMORY LEFT:
	16.7kB
	8h 58min
<input type="button" value="SET"/>	<input type="button" value="LGST"/>
	↓
<input type="button" value="ALST"/>	<input type="button" value="RETN"/>
<input type="button" value="SITE"/>	<input type="button" value="SESS"/>

**Figure 3.27:** Log Point Data screen - LGPT

Enter the appropriate SITE ID and ANTENNA HEIGHT and press **F1** (SET).

At this time, the base system is set for the entire survey.

The remaining steps below refer only to the rover system. No further action is required at the base system.

- Set up a rover system over an unknown point. Follow the procedures outlined in “Performing a Static Survey” on page 16 up to, but not including, Step 2 of “Static Surveying with the Survey Control Software” on page 18.
- Follow the procedure outlined in Step 2 above to set the recording interval of the rover system to 5 seconds.

- The rover system SITE ID should be entered along with the antenna height. This is done through the Log Point Data screen (LGPT). The Log Point Data screen (LGPT) appears as:

LOG POINT DATA	
SITE ID: <input type="text" value="1234"/>	LOGGING:
DESCRIPTION:	POLE
<input type="text" value="12345678901234567890"/>	RECEIVER
ANTENNA HT: <input type="text" value="1.123"/> m	MEMORY LEFT:
	16.7kB
	8h 58min
<input type="button" value="SET"/> <input type="button" value="LGST"/>	<input type="button" value="ALST"/> <input type="button" value="RETN"/>
<input type="button" value="SITE"/>	<input type="button" value="SESS"/>

**Figure 3.28:** Log Point Data screen - LGPT

Enter the appropriate SITE ID and ANTENNA HEIGHT and press **F1** (SET).

- When data collection is complete, enter ??? in the SITE ID and press **F1** (SET). Move the rover system to the next point, leaving the receiver powered on. Repeat **Steps 4-7** for all points to be surveyed.
- Finally, resurvey each point, collecting another 5–10 minute observation. Follow the same procedure outlined in Steps 4–7 above. Be sure to enter the same SITE ID as entered previously when the point was first observed.
- When all surveying is completed, turn off the base and rover GPS systems.

## Performing a Real-time Differential Survey

Real-time differential positioning is used when meter level positioning accuracies are sufficient and positions are required in real-time. It is also the only differential positioning method that can be done with a code phase only receiver. Real-time differential positioning requires a base receiver that occupies a point where the position is known, and one or more remote receivers. Pseudorange corrections are computed by the base receiver by differencing the known position from the pseudorange position. These corrections are broadcast to the remote receiver via a telemetry link. This telemetry link is usually a UHF or VHF radio, but can also be a cellular phone or a communications satellite link, or any medium that can transfer digital data. The remote receiver receives these corrections and applies them to its

own pseudo-range position and outputs a differentially corrected position that is usually sub-meter in accuracy.

## System Setup

This section describes how to set up the receiver in the field. At least two receivers and a telemetry link are required to do a real-time differential survey.

1. Set up and level an antenna over a known point or survey mark using either a tripod/tribrach, a bipod, or a fixed length GPS tripod. The survey point must be relatively free of any obstructions to provide line-of-sight reception of the GPS signals.
2. Connect the antenna to the receiver with an antenna cable.
3. Measure the antenna height.
4. Connect the GPS receiver to the power source.
5. Connect the handheld computer to the receiver serial port with the communication cable. Connect the cable to handheld port 1 and receiver port A (labeled PORT1 on Z-12 receivers).
6. Setup the radio transmitter according to instructions in the receiver manual.
7. Turn on the receiver. Turn on the handheld power and start the Survey Control software by pressing SC at the DOS prompt.

At this point, the receiver is starting to track satellites and the software is ready to set up differential parameters. The setup for the rover receiver(s) is essentially the same, except the antenna may be mounted on a vehicle or a backpack.

## Base Station Setup

This section will take you through the steps required to set up the base station using the Husky FS/2 and the Survey Control software.

1. From the Main screen, press F3 to access the Log Point Data screen (LGPT). Press F2 to access the Datalogging Setup screen (LGST). Press Shift-F1 to enter the Differential Mode screen (MODE). Press F2 to enter the Base

Station Setup screen (BASE). Press F1 to enter the Base Station Coordinates screen (COOR).

```
BASE STATION COORDINATES
LAT: 37°22'22.60619''
LNG: 121°59'50.14823''
ELV: -5.045 m
ANT RADIUS: 0.230 m
ANT SLANT: 2.345 m
HERE CNCL OK
```

**Figure 3.29:** Base Station Coordinate screen - COOR

2. In this screen, the known position of the survey mark or point is entered. The coordinates should be in the WGS-84 coordinate system, and the height is the ellipsoidal height. The measured antenna slant height is also entered here along with the radius of the antenna. This allows the program to compute the vertical antenna height.
3. Once the parameters in the Base Station Coordinate screen are entered, press F4 to accept these parameters. This will also move you back to the Base Station Setup screen (BASE).

```
RTCM BASE STATION
BASE STATION ID: 1017
RADIO OUTPUT: PORT B
BAUD RATE: 9600
RTCM BIT RATE: 300
COOR RDIO CNCL OK
```

**Figure 3.30:** Base Station Setup screen - BASE

If the Ashtech or Pacific Crest UHF radio is being used for the data modem, the radio frequency must be selected. Survey Control Software has the capability to change the radio channels of the Ashtech or Pacific Crest UHF

radios. Before changing the channels, the system must be in autonomous mode.



**If spread spectrum transceivers are being used, ignore step 4.**

4. The UHF radio can be programmed from the Radio Setup screen (RDIO). Press F2 to access the Radio Setup screen. The program will prompt you to turn the radio off, then on. Depending upon the radio, either turn the radio off then on or disconnect/reconnect the data cable to the radio. “Checking radio settings” will be displayed on the screen.



**If this message does not appear after several minutes, the program will return to the Base Station Setup screen. Check that the system is in autonomous mode before continuing.**

After the “Checking radio settings” message, the Radio Setup screen will be displayed. The sensitivity should be set to low, the baud rate should be set to 9600, and the channel should be set to the proper frequency. Press F1 (SET) to save the parameters and program the radio. “Programming radio” will be displayed followed by “Checking radio settings”. The radio settings will be displayed.

RADIO SETUP		
RADIO S/N: 95010577		
MODEL: DDR-96		
SENSITIVITY: LOW		
	TX	RX
CHANNEL: 2	469.5500	469.5500 MHz
BAUD RATE: 9600		
SET		RETN

H0076

**Figure 3.31:** Radio Setup screen - RDIO

5. Press F4 (RETN) to accept the radio settings and return to the RTCM Base Station Setup screen to setup the base station parameters.

```
RTCM BASE STATION
BASE STATION ID: 1017
RADIO OUTPUT: PORT B
BAUD RATE: 9600
RTCM BIT RATE: 300
COOR RDIO CNCL OK
```

**Figure 3.32:** Base Station Setup screen - BASE

6. There are four parameters that can be set in the RTCM Base Station Setup screen.

The Base Station ID is an optional field that allows the user to set a unique number ID to the base station. Valid values are from 0-1023. This field should be set if you wish the rover to accept corrections from this base station only. The ID number is sent along with the corrections. If the remote receiver is set to a number different from the base station, then the corrections will not be used. Unless there is a specific need to set a base station ID, we recommend that this field be left at 0.

Radio Output is a toggle that tells the receiver which port to output corrections. This should be the port that is connected to the radio transmitter, usually port B.

Baud Rate is the speed that corrections are sent from the serial port. Corrections from the receiver cannot be sent to the radio transmitter faster than the transmitter can send them. The default of 9600 works for most radios.

RTCM Bit Rate is the speed that corrections are sent to the serial port. The higher this value is, the faster corrections are sent to the rover station. A setting of 300 is recommended.

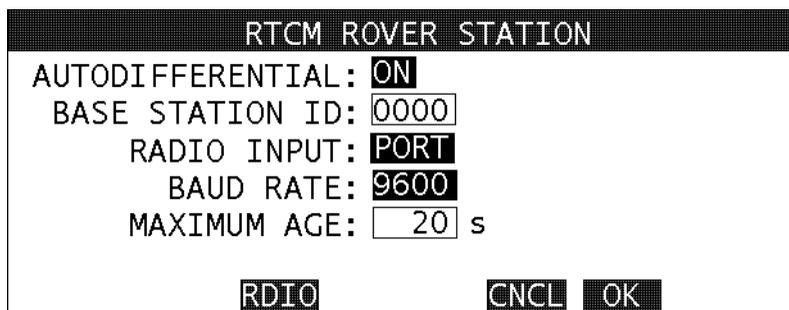
7. Once these parameters have been entered, press F4 to accept them and move back to the Differential Mode screen (MODE). This screen is a display screen that should reflect the parameters that were set.
8. Press F4 to return to the Datalogging Setup Screen (LGST). Press F4 to return to the Log Point Data screen (LGPT). Press F4 to return to the main screen (MAIN). Press F2 to enter the Solution Status screen (SOLU).

Assuming that the receiver is connected to an antenna, the receiver should be computing a position that should be displayed in the Current Position area of the screen. Below the position, the screen should indicate that the receiver is in RTCM Differential Base mode.

## Rover Station Setup

This section will take you through the steps required to set up the rover using the Husky FS/2 and the Survey Control software.

1. From the Main screen, press F3 to access the Log Point Data screen (LGPT). Press F2 to access the Datalogging Setup screen (LGST). Press Shift-F1 to enter the Differential Mode screen (MODE). Press F3 to enter the Rover Station Setup screen (ROVR).



```
RTCM ROVER STATION
AUTODIFFERENTIAL: ON
BASE STATION ID: 0000
RADIO INPUT: PORT
BAUD RATE: 9600
MAXIMUM AGE: 20 s
RDIO CNCL OK
```

**Figure 3.33:** Rover Station Setup screen - ROVR

If the Ashtech or Pacific Crest UHF radio is being used for the data modem, the radio frequency must be selected. Survey Control Software has the capability to change the radio channels of the Ashtech or Pacific Crest UHF radios. Before changing the channels, the system must be in autonomous mode.



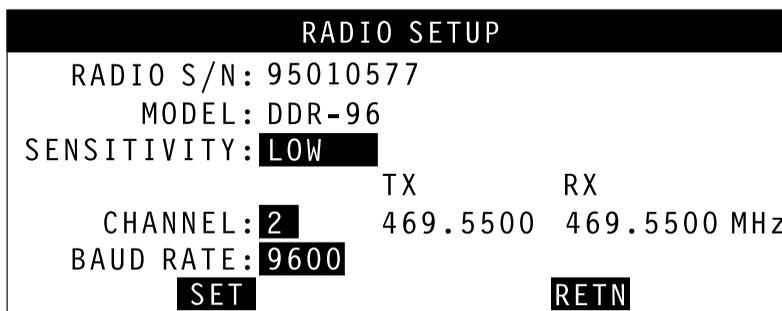
**If spread spectrum transceivers are being used, ignore step 2.**

2. The UHF radio can be programmed from the Radio Setup screen (RDIO). Press F2 to access the Radio Setup screen. The program will prompt you to turn the radio off, then on. Depending upon the radio, either turn the radio off then on or disconnect/reconnect the data cable to the radio. “Checking radio settings” will be displayed on the screen.



If this message does not appear after several minutes, the program will return to the Rover Station Setup screen. Check that the system is in autonomous mode before continuing.

After the “Checking radio settings” message, the Radio Setup screen will be displayed. The sensitivity should be set to low, the baud rate should be set to 9600, and the channel should be set to the proper frequency. Press F1 (SET) to save the parameters and program the radio. “Programming radio” will be displayed followed by “Checking radio settings”. The radio settings will be displayed.



H0076

Figure 3.34: Radio Setup screen - RDIO

3. Press F4 (RETN) to accept the radio settings and return to the RTCM Rover Station Setup screen to setup the rover station parameters.
4. There are 5 parameters that can be set in the RTCM Rover Station setup screen.

Autodifferential is a toggle that tells the receiver to compute an autonomous position if a differential correction is unavailable. If set to NO, no position will be available if corrections are lost.

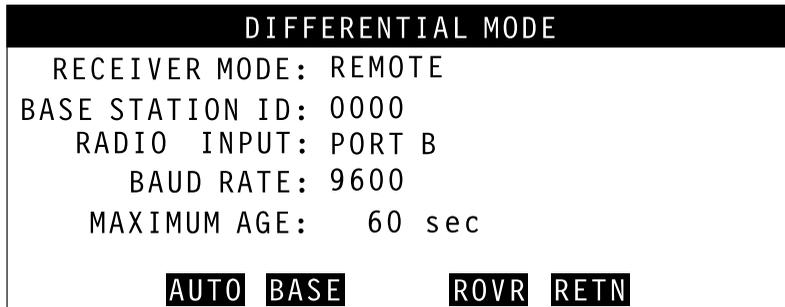
The Base Station ID is an optional field that allows the user to set a unique number ID to the base station. Valid values are from 0-1023. This field should be set to the same value as the base station from which this rover will receive corrections. If this field is 0, the receiver will accept corrections from any base receiver, regardless of the base station ID number.

Radio Input is a toggle that tells the receiver which port to input corrections. This should be the port that is connected to the radio receiver, usually port B.

Baud Rate is the speed that the GPS receiver communicates with the radio. The default of 9600 works for most radios.

Maximum Age is the maximum age of corrections (in seconds) allowable before the remote receiver discontinues position computation, i.e., a cutoff value. If the average age of corrections at the remote is running at 8 to 12 seconds, a fairly normal value, MAXIMUM AGE should be set to some higher value, say 25 seconds, in order to allow for the occasional missed correction. The setting depends upon how far you can allow your position accuracy to degrade before you consider it unacceptable.

5. Once these parameters have been entered, press F4 to accept them and move back to the Differential Mode screen (MODE). This screen is a display screen that should reflect the parameters that were set.



H0086

**Figure 3.35:** Differential Mode screen - MODE

6. Press F4 to return to the Datalogging Setup Screen (LGST). Press F4 to return to the Log Point Data screen (LGPT). Press F4 to return to the main screen (MAIN). Press F2 to enter the Solution Status screen (SOLU). Assuming that the receiver is connected to an antenna, the receiver should be computing a position that should be displayed in the Current Position area of the screen. Below the position, the screen should indicate that the receiver is in Remote RTCM Differential mode.

## Real-Time Differential Surveying with the Survey Control Software

Survey control software can be used to perform real-time differential surveys. There are several advantages to real-time differential surveying. The accuracy of the data is known as the survey is being performed. Position solution data can be stored in the receiver eliminating data post processing. This method of surveying is typically a mobile operation, so data collection can be done while walking, driving, boating, flying, etc.

This method of surveying requires that a base station be setup over a known WGS-84 coordinate and transmitting corrections through a data modem to at least one remote station.

1. Check that the remote GPS system is computing a RTCM differential position. Refer to the base and rover setup procedures earlier in this section to setup the base and rover systems. From the MAIN screen, select F2 (SOLU) to call the CURRENT POSITION screen. The current position should be displayed with number of SVs used and locked, current PDOP, HDOP, VDOP, and RTCM differential specific values. These include SYNC, AGE, and QA. If SYNC is OK, then the communication link is good. The closer the QA value is to 100, the better. The AGE value represents the age of the last received RTCM message in seconds.

<b>CURRENT POSITION</b>		<b>GPS 00:15:36</b>	
WGS-84			
LAT	29°27'23.12345"	SVs used	7
LNG	121°30'23.45627"	SVs locked	10
ELV	12.160m	PDOP	1.6 SYNC OK
REMOTE		HDOP	1.0 AGE 4
<b>RTCM DIFFERENTIAL</b>		VDOP	1.2 QA 100
<b>DOPS</b>	<b>SATS</b>	<b>DATA</b>	<b>RETN</b>

**Figure 3.36:** Solution Status Screen - SOLU

2. It is recommended for a real-time differential survey to log data at a 1-2 second recording interval with an occupation time of 10-30 seconds. The DATA TO LOG field should be set to POSITION ONLY. With this setting, the position solution will be stored in the receiver, not the raw measurements. This data cannot be post-processed at a later time. These values are changed in the Datalogging Setup screen (LGST). Access this

screen by first pressing F3 (LGPT) from the main screen and press F2 (LGST). The Datalogging Setup screen (LGST) appears as:

DATALOGGING SETUP	
RECORD INT: <input type="text" value="2.0"/> sec	RECEIVER
OCCUP TIME: <input type="text" value="1.00"/> min	MEMORY LEFT:
MINIMUM SVs: <input type="text" value="4"/>	16.7kB
ELEVATION: <input type="text" value="10"/> °	8h 58min
DATA TO LOG: <b>CODE &amp; CARRIER</b>	
<b>SSEL</b> <b>SAVE</b> ↓ <b>CNCL</b> <b>OK</b>	
<b>MODE</b>	<b>SCRP</b>

**Figure 3.37:** Datalogging Setup screen - LGST

When entry is complete, press F4 (OK) to accept and return you to the Log Point Data screen (LGPT).

- The rover system SITE ID should be entered along with the antenna height. This is done through the Log Point Data screen (LGPT). The Log Point Data screen (LGPT) appears as:

LOG POINT DATA	
SITE ID: <input type="text" value="1234"/>	LOGGING:
DESCRIPTION:	POLE
<input type="text" value="12345678901234567890"/>	RECEIVER
ANTENNA HT: <input type="text" value="1.123"/> m	MEMORY LEFT:
	16.7kB
	8h 58min
<b>SET</b> <b>LGST</b> ↓ <b>ALST</b> <b>RETN</b>	
<b>SITE</b>	<b>SESS</b>

**Figure 3.38:** Log Point Data screen - LGPT

Enter the appropriate SITE ID and ANTENNA HEIGHT and press F1 (LOG). An epoch counter windows will be displayed. The number of epochs remaining and Sv<sub>s</sub>; current HDOP and VDOP; and worst HDOP and VDOP,

and lowest number of SvS during the occupation is displayed. The occupation can be aborted by pressing (ESC).



The F1 button will be displayed as LOG when the occupation time is greater than 0. The F1 button will be displayed as SET when the occupation time is set to 0. LOG is used for timed occupations. During data logging, the data is stored with the entered site id. Once the occupation time has expired, the site id returns to (????). The SITE ID field will continue to display an entered site id, but the logging site id in the right window pane will display (????). SET is used for constant occupations. During data logging, the data is stored with the entered site id. To end datalogging with an entered site id, enter ????, in the site id field. In both LOG and SET modes, data with (????) is regarded as data between occupations.

4. When data collection is complete, move the rover system to the next point and repeat step 3.
5. Repeat step 3. Continue until the survey is completed.
6. When all surveying is completed, turn off the base and rover GPS systems.

## Downloading Data

---

Once field data acquisition is complete, the data must be downloaded from each GPS system to a PC for post-processing. The PC software required for downloading the GPS receivers can be found in the PC data processing software which you should have acquired along with your GPS hardware. Ashtech offers two processing software packages, PRISM and GPPS.

PRISM and GPPS both include a software module used to transfer data from the GPS receiver to the office PC. In PRISM, the module name is TRANSFER. In GPPS, it is called HOSE. To download your data, follow the procedure outlined below.

1. Attach battery or power supply to the receiver.
2. Turn the receiver's power switch to ON.
3. Connect the RS-232 cable from the receiver to COM1 on the computer.

If serial port A on the receiver is not available, any serial port may be used. (If COM1 on the computer is not available, COM2 may be used; if COM2 is used, remember to enter that information via the communication parameters option in the downloading software.)

4. Execute the TRANSFER module in PRISM.

Detailed instructions for installing and running the software are given in the software user's manuals.

---

# Reference

The screens described in this chapter have been designed for the Husky FS/2 handheld computer. This document supports all software interface requirements to a GPS receiver for static and kinematic surveying.

Small black boxes at the bottom of the screen indicate functions accessed by pressing one of the four **PF** keys, **F1**, **F2**, **F3**, or **F4**. A small down arrow in the bottom line of the screen indicates that shift functions are accessible.

If shift functions are available for that screen, you can change the functionality of the **PF** boxes (black boxes) by pressing the **SHIFT** key. The **PF** boxes will change at this time as described in the screen diagrams. To activate the new function of the **PF** key, the user must hold down the **SHIFT** key and press the appropriate **PF** key.

Small black boxes not located at the bottom of the screen indicate toggle boxes or highlight items selected from the list. Toggle box contents is changed using **SPACE** key.

Small white boxes (not filled) indicate editable fields where the user can enter information.

Figure 4.1 is a map of the Husky screens.

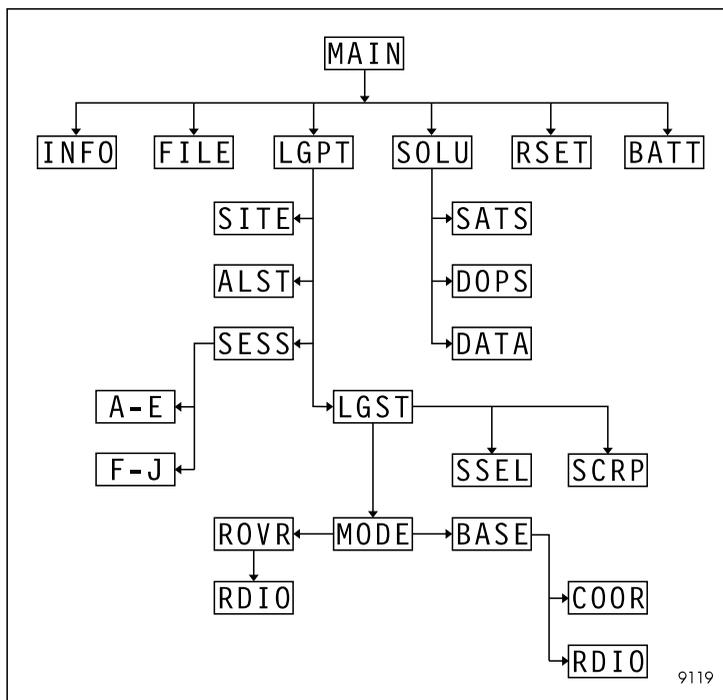


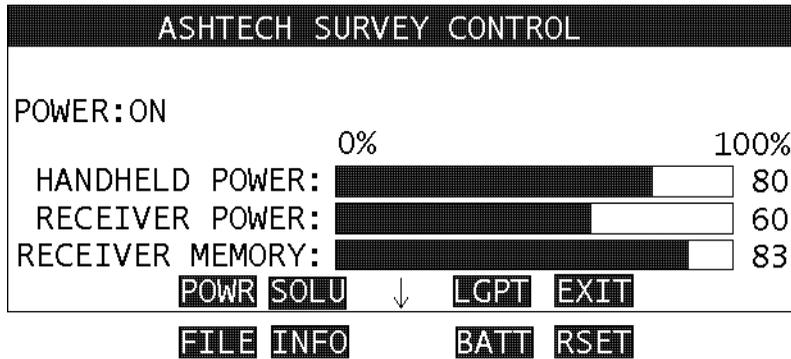
Figure 4.1: Map of Husky Screens

## Survey Control Software Screens

The following sections describe each of the Survey Control Software screens.

# Survey Control Software Screen -MAIN

The MAIN screen displays power and memory status of the system



**Figure 4.2:** Survey Control Software screen - MAIN

The following table describes the components of this screen:

**Table 4.1:** Survey Control Software Screen - MAIN

Component	Function
POWER	ON or OFF, indicates current power status of the receiver.
HANDHELD POWER	Displays (in percent) remaining handheld power.
RECEIVER POWER	Displays (in percent) remaining receiver power
RECEIVER MEMORY	Displays (in percent) remaining receiver memory
<b>POWR</b>	F1 turns receiver on or off
<b>SOLU</b>	F2 calls the Solution screen
<b>LGPT</b>	F3 calls the Log Point Data screen.
<b>EXIT</b>	F4 exits the program
<b>FILE</b>	SHIFT-F1 calls the File Management screen
<b>INFO</b>	SHIFT-F2 calls the Information screen
<b>BATT</b>	SHIFT-F3 calls the Battery Management screen
<b>RSET</b>	SHIFT-F4 calls the Receiver Reset screen

## Battery Management Screen - BATT

This screen allows you to set up parameters of the receiver battery.

RECEIVER BATTERY MANAGEMENT	
BATTERY CAPACITY: <input type="text" value="3000"/> mAh	PREDICTED LIFETIME 3h 20min.
POWER REMAINING: <input type="text" value="80"/> %	
VOLTAGE: <input type="text" value="6.0"/> V	
WARNING LEVEL: <input type="text" value="10"/> %	
<input type="button" value="CNCL"/> <input type="button" value="OK"/>	

**Figure 4.3:** Battery Management screen - BATT

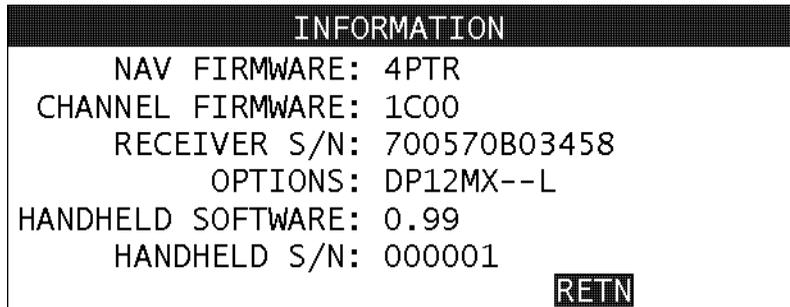
The following table describes the components of this screen:

**Table 4.2:** Battery Management screen - BATT

Component	Function
Battery Capacity	Editable field lets you enter the receiver battery capacity in mAh.
Power Remaining	Editable field allows you to set the power remaining in the receiver battery.
Voltage	Editable field allows you to enter the voltage of the receiver battery.
Warning Level	Editable field allows you to set the percentage of the battery power remaining when you are notified of low power level. The feature is also controlled on Alarm Setup screen (ALST).
<b>CNCL</b>	F3 recalls the previous screen without any changes in receiver settings.
<b>OK</b>	F4 accepts current settings and returns you to the Main screen.

## Information Screen - INFO

This screen displays information about receiver and handheld software versions.



**Figure 4.4:** Information screen - INFO

The following table describes the components of this screen:

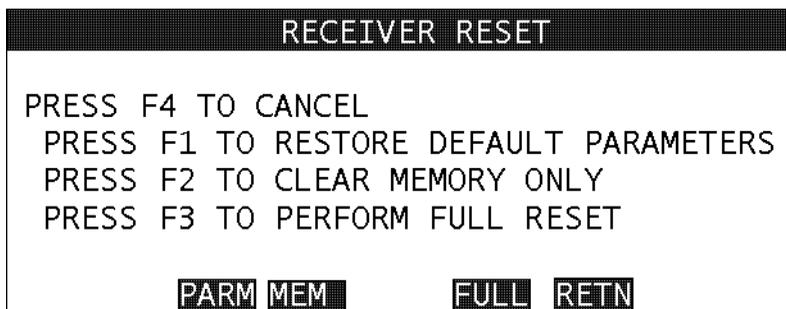
**Table 4.3:** Information screen - INFO

Component	Function
NAV Firmware	Displays the receiver firmware version number.
Channel Firmware	Displays the receiver channel firmware version number.
Receiver S/N	Displays the receiver serial number.
Options	Displays the firmware options installed in the receiver.
Handheld Software	Displays the handheld software version number.
Handheld S/N	Displays the handheld serial number.
RETN	F4 returns you to the Main screen.

## Receiver Reset Screen - RSET

---

This screen allows you to reset the receiver memory and restore default parameters.



**Figure 4.5:** Receiver Reset Screen - RSET

The following table describes the components of this screen:

**Table 4.4:** Receiver Reset screen - RSET

Component	Function
<b>PARM</b>	F1 restores default receiver parameters.
<b>MEM</b>	F2 clears the external memory of the receiver without resetting parameters.
<b>FULL</b>	F3 initiates a full reset of the receiver, clearing the receivers external memory, and resetting the default parameters.
<b>RETN</b>	F4 returns you to the Main screen.

## File Management Screen - FILE

This screen allows you to close and delete files stored in the receiver.

FILE MANAGEMENT			
FILES: 6	FREE MEM: 99%	4055	kB
1.AAAA	27kB	7481	16:15
2.BBBB	20kB	7481	17:15
3.CCCC	22kB	7481	18:15
<b>4.DDDD</b>	<b>29kB</b>	<b>7481</b>	<b>19:15</b>
5.EEEE	23kB	7481	20:15
<b>DEL</b>	<b>SEL</b>	<b>CLOS</b>	<b>RETN</b>

**SELECTED:**

3.CCCC

**Figure 4.6:** File Management Screen - FILE

The following table describes the components of this screen:

**Table 4.5:** File Management screen - FILE

Component	Function
FILES	Displays number of files stored in the receiver.
FREE MEM	Displays amount of memory left in the receiver: in percent and in kilobytes.
<b>DEL</b>	Pressing F1 will delete selected file. Only file selected and displayed in the right box will be deleted.
<b>SEL</b>	Pressing F2 will select highlighted file. If there is a file in the SELECTED box, this file will be deselected instead of selecting new one.
<b>CLOS</b>	Pressing F3 will close current file and open new one.
<b>RETN</b>	Pressing F4 will return the user to the screen previous to this one.

## Solution Status Screen - SOLU

This screen displays the user's current position and solution quality information.

<b>CURRENT POSITION</b>		<b>GPS 00:15:36</b>	
WGS-84			
LAT	29°27'23.12345"	SVs used	7
LNG	121°30'23.45627"	SVs locked	10
ELV	12.160m	PDOP	1.6 SYNC OK
REMOTE		HDOP	1.0 AGE 4
<b>RTCM DIFFERENTIAL</b>		VDOP	1.2 QA 100
<b>DOPS</b>	<b>SATS</b>	<b>DATA</b>	<b>RETN</b>

**Figure 4.7:** Solution Status screen - SOLU

The following table describes the components of this screen:

**Table 4.6:** Solution Status screen - SOLU

<b>Component</b>	<b>Function</b>
GPS	Displays the current GPS time.
WGS 84	Datum the current position is referenced to.
LAT, LNG, ELV	Displays current position (refer to Table 4.17).
REMOTE, BASE, or EMPTY	Displays the current differential mode of operation.
RTCM DIFFERENTIAL or AUTONOMOUS	Indicates if current position is differentially corrected or not.
SVs used	Indicates the number of satellites used in the computation of the displayed position.
SVs locked	Indicates the number of satellites locked.
PDOP	Displays current PDOP value.
HDOP	Displays current HDOP value.
VDOP	Displays current VDOP value.
SYNC	Synchronization status of the datalink for receiving RTCM corrections. Possible values are OK, NO, or OLD. Displayed in remote mode only, if at least one correction message was received. OLD is displayed when AGE>Max Age as set in Rover Setup screen.

**Table 4.6:** Solution Status screen - SOLU (continued)

Component	Function
AGE	Age of differential corrections in seconds. Displayed in remote mode only, if at least one correction message was received.
QA	Quality factor of differential corrections in percent. Displayed in remote mode only, if at least one correction message was received. Defined as the number of valid messages divided by the total number of messages divided by 100.
DOPS	Causes the display to change to the DOPS screen by pressing F1.
SATS	Causes the display to change to the SATS screen by pressing F2.
DATA	Causes the display to change to the DATA screen by pressing F3.
RETN	Pressing F4 will return the user to the screen previous to this one.

## Datalogging Status Screen - DATA

This screen provides information about data logged to the receiver for each available satellite.

DATA LOGGING STATUS	
01	*****
02	***** .....
04	***** .....
05	.*** .....
06	..... *****
07	..... *****
	<b>MORE</b> <b>RETN</b>

**Figure 4.8:** Datalogging Status screen - DATA

The following table describes the components of this screen:

**Table 4.7:** Datalogging Status screen - DATA

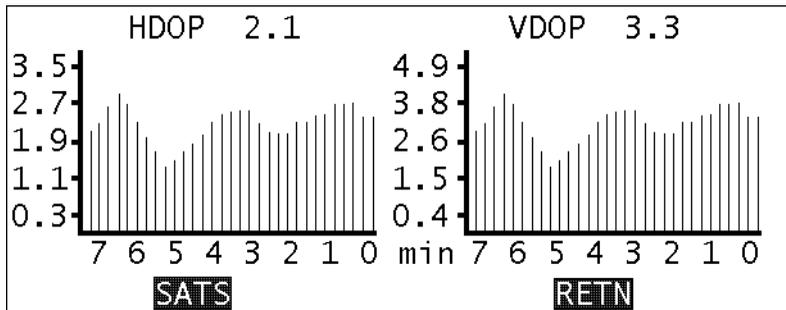
Component	Function
NUMBER	Satellite number.
STAR (*), DOT (.)	Each field on the right side of the satellite number represents 5 minute interval.

**Table 4.7:** Datalogging Status screen - DATA (continued)

Component	Function
STAR	Means that data was recorded for that satellite.
DOT	Means that data was not recorded for that satellite.
<b>MORE</b>	Pressing F1 will show information about next set of satellites.
<b>RETN</b>	Pressing F4 will return the user to the screen previous to this one.

## Horizontal and Vertical DOP Screen - DOPS

This screen displays an 8-minute history of the HDOP and VDOP values.



**Figure 4.9:** Horizontal/Vertical DOP screen - DOPS

The following table describes the components of this screen:

**Table 4.8:** Horizontal and Vertical DOP screen - DOPS

Component	Function
HDOP Graph	This graph behaves like a horizontal RMS graph. The X axis is time (minutes) while the Y axis is the horizontal DOP value.
VDOP Graph	This graph behaves like the vertical RMS graph. The X axis is time (minutes) while the Y axis is the vertical DOP value.
<b>SATS</b>	F1 calls the Satellite Constellation screen.
<b>RETN</b>	F4 returns you the SOLU screen.

## Satellite Constellation Screen - SATS

This screen allows you to monitor the satellite constellation information.

SATELLITE CONSTELLATION										
USED:	6			LOCKED:	8			AVAILABLE:	10	
PRN:	3	16	17	21	22	23	26	28		
ELV:	63	4	66	24	30	58	33	17		
AZM:	63	44	2	24	28	219	81	315		
USE:	Y00	N00	Y00	Y00	Y00	Y00	Y00	N3C		
S/N:	54	18	54	27	38	61	43	24		
	<b>DOPS</b>					<b>RETN</b>				

**Figure 4.10:** Satellite Constellation screen - SATS

The following table describes the components of this screen:

**Table 4.9:** Satellite Constellation screen - SATS

Component	Function
USED	Indicates number of satellites used in position fix.
LOCKED	Indicates number of satellites locked.
AVAILABLE	Indicates number of satellites available above the horizon.
PRN	Shows the PRN number of each satellite locked.
ELV	Indicates elevation angle of each satellite.
AZM	Indicates azimuth of each satellite.
USE	Can indicate the following: Y indicates that satellite is used in position computation. N - not used in position computation. XX (hexadecimal code)-If 0, satellite is healthy. If a number other than 0 is displayed, satellite is unhealthy.
S/N	Indicates signal to noise ratio for each satellite.
<b>DOPS</b>	Pressing F1 will change the screen to the DOPS screen.
<b>RETN</b>	Pressing F4 will return the user to the screen previous to this one.

## Log Point Data Screen - LGPT

This screen lets you change current site-specific parameters prior to logging data.

LOG POINT DATA	
SITE ID: <input type="text" value="1234"/>	LOGGING:
DESCRIPTION: <input type="text" value="12345678901234567890"/>	POLE
ANTENNA HT: <input type="text" value="1.123"/> m	RECEIVER
	MEMORY LEFT:
	16.7kB
	8h 58min
<b>SET</b> <b>LGST</b>	<b>ALST</b> <b>RETN</b>
<b>SITE</b>	<b>SESS</b>

**Figure 4.11:** Log Point Data screen - LGPT

The following table describes the components of this screen:

**Table 4.10:** Log Point Data screen - LGPT

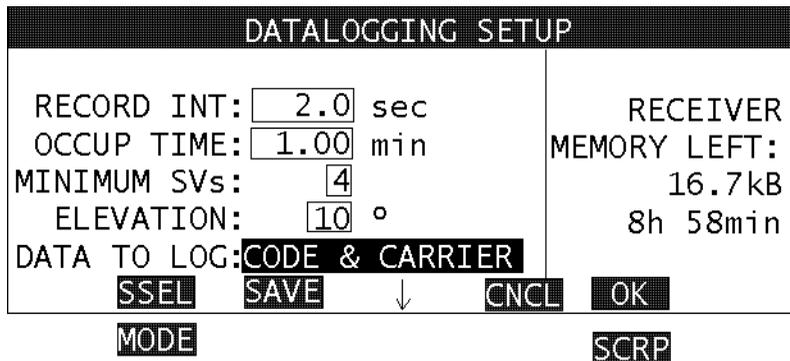
Component	Function
SITE ID	Editable field. Alphanumeric site ID. Letters, digits, and following characters are allowed: ?_-. The site ID will automatically increment if the last character is a number.
DESCRIPTION	Editable field where user enters description of point logged.
ANTENNA HT	Editable field. Height of the antenna which will be stored in the receiver memory. Valid values are from 0.0-6.4.
LOGGING	Shows current receiver's site ID. If data is not logged to the receiver, string <code>!NONE!</code> is displayed. If in session mode, string <code>SESSION MODE</code> is displayed.
RECEIVER MEMORY LEFT	Displays how much of memory is left for data collection. Number of hours depends on the number of satellites and recording interval.
<b>SET</b>	After pressing F1 site ID and description string will be stored in the receiver. Epoch interval is set on the Datalogging Setup screen (LGST). This key is visible only when occupation time is set to zero. This option is very useful when long occupation time is required. This function is not accessible if receiver is in session mode.

**Table 4.10:** Log Point Data screen - LGPT (continued)

Component	Function
<b>LOG</b>	After pressing F1, data will be logged to the receiver memory. Site ID and description string will be stored in the receiver. While data is being logged, a box with a count-down counter will be displayed on the screen. Data logging of the point may be stopped by pressing the Escape key. This key is visible when occupation time is set to non-zero value. This function is not accessible if receiver is in session mode. Time of observation and epoch interval is set on the Datalogging Setup screen (LGST).
<b>LGST</b>	Pressing F2 will move the user to the Datalogging Setup screen. This function is not accessible if receiver is in session mode.
<b>ALST</b>	Pressing F3 will move the user to the Alarm Setup screen. This function is not accessible if receiver is in session mode.
<b>RETN</b>	Pressing F4 will return the user to the screen previous to this one
<b>SITE</b>	Pressing SHIFT-F1 will move the user to the Site Information screen. This function is not accessible if receiver is in session mode.
<b>SESS</b>	Pressing SHIFT-F4 will move the user to the Session Programming screen.

## Data Logging Setup Screen - LGST

This screen sets up general parameters for logging data collected during a survey.



**Figure 4.12:** Data Logging Setup screen - LGST

The following table describes the components of this screen:

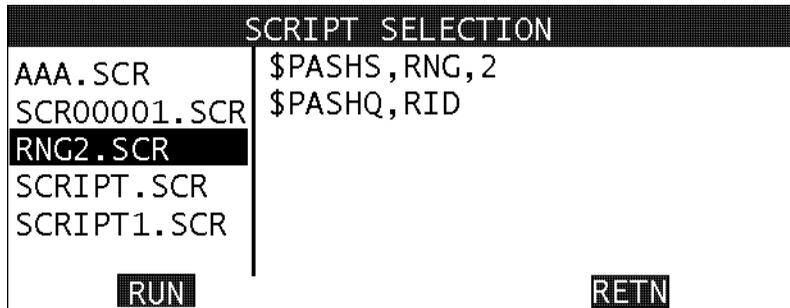
**Table 4.11: Datalogging Setup screen - LGST**

<b>Component</b>	<b>Function</b>
RECORD INT	Editable field to enter the data recording interval. Valid values are 0.5-655.0 seconds. Default is 20.0 seconds.
OCCUP TIME	Editable field allowing the user to enter the amount of time to spend on a static station. Valid values for this field are 0-999 minutes. The program will use the occupation time and the recording interval to compute the number of epochs to be collected at that point. The number of epochs collected should be rounded up to the nearest whole epoch and you should always collect at least one epoch. Default value is 1 minute. The number of epochs can not be greater than 999.  An occupation time of zero has a special meaning. In this case, the occupation time becomes indefinite. The <b>LOG</b> button on the LGST screen is replaced by <b>SET</b> button. This allows the user to perform long lasting sessions of data collection.
MINIMUM SVs	Minimum satellites required for data collection.
ELEVATION	Satellite elevation mask.
DATA TO LOG	Toggle field. Possible values are CODE & CARRIER or POSITION ONLY.
RECEIVER MEMORY LEFT	Displays how much of memory is left for data collection. Number of hours depends on the number of satellites and recording interval.
<b>SSEL</b>	Pressing F1 will move the user to the Satellite Selection screen.
<b>SAVE</b>	Pressing F2 will save current receiver parameters.
<b>CNCL</b>	Pressing F3 will return the user to the screen previous to this one without any changes in receiver settings.
<b>OK</b>	Pressing F4 will accept current settings and return the user to the screen previous to this one.
<b>MODE</b>	Pressing SHIFT-F1 will move the user to the Differential Mode screen.
<b>SCRP</b>	Pressing SHIFT-F4 will move the user to the Script Selection screen.

## Script Selection Screen - SCRIP

This screen allows you to view/run script files containing serial port commands. Script files are ASCII files containing receiver \$PASH commands. You can customize a script file to run certain commands and then upload the file into the

Husky via the HCOM utility. The script file must have the.SCR extension. See the receiver manual for information about \$PASH commands.



**Figure 4.13:** Script Selection screen - SCRP

The following table describes the components of this screen:

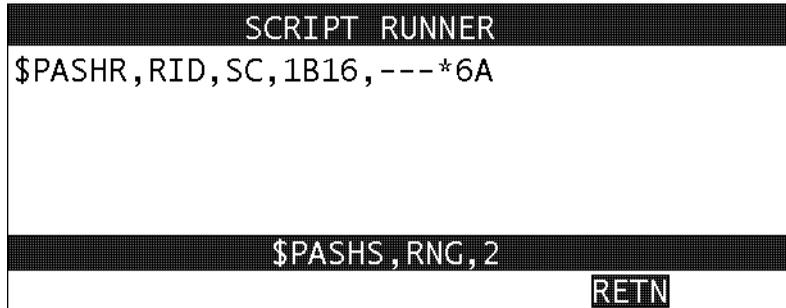
**Table 4.12:** Script Selection screen - SCRP

Component	Function
Left pane	Contains list of script files stored in the handheld. A script file is recognized by its extension *.SCR. Use up or down arrow key to move between scripts.
Right pane	Displays first six lines of the currently highlighted script file.
<b>RUN</b>	F1 runs the selected script file and calls the Script Runner screen.
<b>RETN</b>	F4 returns you to the LGST screen.

## Script Runner Screen - RUN

---

This screen allows you to monitor the script file as it is executing. One command (line) from the script file is sent to the receiver once each second.



**Figure 4.14:** Script Runner screen - RUN

The following table describes the components of this screen:

**Table 4.13:** Script Runner screen - RUN

Component	Function
Bottom Line	Displays the command currently being sent to the receiver.
Display area	Displays any data or information acquired from the receiver in response to the command.
<b>RETN</b>	F4 returns you to the SCRP screen.

## Differential Mode Screen - MODE

---

This screen provides information about the differential mode of the receiver. There are three versions of this screen dependent upon the current mode of operation of the receiver (Autonomous, RTCM Remote, and RTCM Base).



These screens are not accessible if the receiver is not equipped with differential options.

From this screen you can access RTCM differential setup screens.

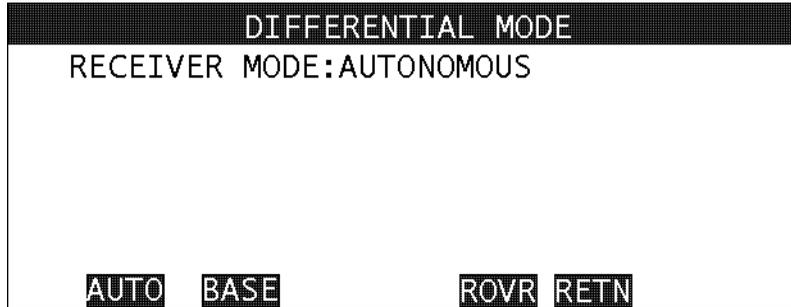


Figure 4.15: Differential Mode (Autonomous) screen - MODE

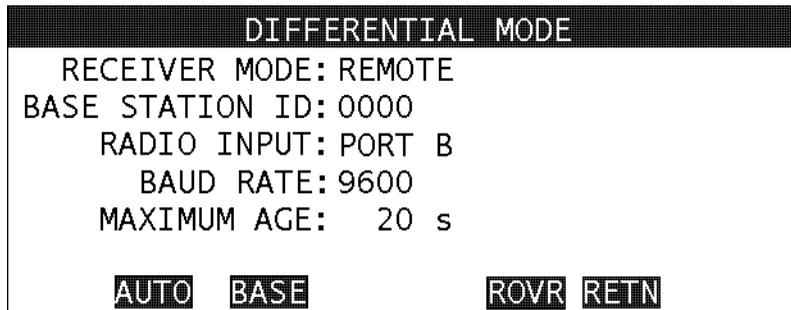
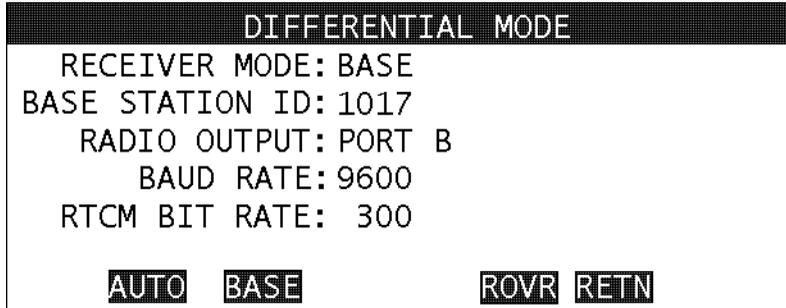


Figure 4.16: Differential Mode (RTCM Remote) screen -MODE



**Figure 4.17:** Differential Mode (RTCM Base) screen - MODE

The following table describes the components of this screen:

**Table 4.14:** Differential Mode screen - MODE

Component	Function
RECEIVER MODE	Mode of operation. Possible values are AUTONOMOUS, REMOTE and BASE.
BASE STATION ID	ID of the base station. If receiver operates as a base station this ID will be sent out along with differential corrections. If receiver operates as a remote station and this value equals zero, receiver will accept differential corrections from any base station. If receiver operates as a remote station and this value doesn't equal zero, receiver will accept differential corrections only from base station with this ID.
RADIO INPUT	Remote station only. Port selected for collection of differential corrections. Possible values are PORT A, PORT B, PORT C.
RADIO OUTPUT	Base station only. Port selected for output of differential corrections. Possible values are PORT A, PORT B, PORT C.
BAUD RATE	Baud rate for collection (remote station) or output (base station) of differential corrections. Possible values are 300, 600, 1200, 2400, 4800, 9600, 19200 and 38400.
MAXIMUM AGE	Remote station only. Maximum age of a correction at which time the correction will no longer be used. Possible values are 0 - 999 seconds.
RTCM BIT RATE	Base station only. Speed of RTCM messages. Possible values are 25, 50, 100, 110, 150, 200, 250, 300 and 1500.
<b>AUTO</b>	Pressing F1 will set the receiver autonomous mode.
<b>BASE</b>	Pressing F2 will move the user to the RTCM Base Station Setup Screen (BASE).

**Table 4.14:** Differential Mode screen - MODE (continued)

Component	Function
<b>ROVR</b>	Pressing F3 will move the user to the RTCM Rover Station Setup Screen (ROVR).
<b>RETN</b>	Pressing F4 will return the user to the screen previous to this one.

## RTCM Rover Station Setup Screen - ROVR

This screen allows you to set up parameters for the RTCM rover station.

**RTCM ROVER STATION**

AUTODIFFERENTIAL: **ON**

BASE STATION ID: **0000**

RADIO INPUT: **PORT**

BAUD RATE: **9600**

MAXIMUM AGE: **20** s

**RDIO**                      **CNCL**    **OK**

**Figure 4.18:** RTCM Rover Station Setup screen - ROVR

The following table describes the components of this screen:

**Table 4.15:** RTCM Rover Station Setup screen - ROVR

Component	Function
AUTODIFFERENTIAL	Toggle field. Possible values are ON, or OFF. If this field is ON, receiver will automatically switch to remote mode, when corrections are received, and will switch to autonomous mode, when there are no corrections.
BASE STATION ID	Valid values are 0 - 1023. Default value is 0. This ID will be sent out along with differential corrections from the base station. If this value equals zero, receiver will accept differential corrections from any base station. If this value doesn't equal zero, receiver will accept differential corrections only from base station with this ID.
RADIO INPUT	Toggle allowing the user to select the port for receiving differential corrections. Toggle values are PORT A, PORT B, PORT C and PORT D. Default is PORT B.

**Table 4.15: RTCM Rover Station Setup screen - ROVR (continued)**

<b>Component</b>	<b>Function</b>
<b>BAUD RATE</b>	Toggle allowing the user to select the baud rate for collection of differential corrections. Toggle values are 300, 600, 1200, 2400, 4800, 9600, 19200 and 38400. Default is 9600.
<b>MAXIMUM AGE</b>	Remote station only. Editable field allowing the user to enter the maximum age of a correction at which time the correction will no longer be used. Valid values are 0 - 999 seconds. Default value is 120.
<b>RDIO</b>	Pressing F2 will move user to Radio Setup screen.
<b>CNCL</b>	Pressing F3 will return the user to the screen previous to this one without any changes in receiver settings.
<b>OK</b>	Pressing F4 will accept current settings and return the user to the screen previous to this one.

## RTCM Base Station Setup Screen - BASE

This screen allows you to set up parameters for the RTCM base station.

**RTCM BASE STATION**

BASE STATION ID:

RADIO OUTPUT:

BAUD RATE:

RTCM BIT RATE:

**Figure 4.19: RTCM Base Station Setup screen - BASE**

The following table describes the components of this screen:

**Table 4.16: RTCM Base Station Setup screen - BASE**

<b>Component</b>	<b>Function</b>
BASE STATION ID	Editable field allowing the user to enter ID of the base station. Valid values are 0 - 1023. Default value is 0. This ID will be sent out along with differential corrections. If other receiver operates as a remote station and this value equals zero, receiver will accept differential corrections from any base station. If other receiver operates as a remote station and this value doesn't equal zero, receiver will accept differential corrections only from base station with this ID.
RADIO OUTPUT	Toggle allowing the user to select the port for output of differential corrections. Toggle values are PORT A, PORT B, PORT C. Default is PORT B.
BAUD RATE	Toggle allowing the user to select the baud rate for output of differential corrections. Toggle values are 300, 600, 1200, 2400, 4800, 9600, 19200 and 38400. Default is 9600.
RTCM BIT RATE	Toggle allowing the user to select the speed of RTCM messages. Toggle values are 25, 50, 100, 110, 150, 200, 250, 300 and 1500. Default is 300.
<b>COOR</b>	Pressing F1 will move the user to the Base Station Coordinates Screen (COOR).
<b>RDIO</b>	Pressing F2 will move user to Radio Setup screen.
<b>CNCL</b>	Pressing F3 will return the user to the screen previous to this one without any changes in receiver settings.
<b>OK</b>	Pressing F4 will accept current settings and return the user to the screen previous to this one.

## Base Station Coordinates Screen - COOR

This screen allows you to set up coordinates of the base station.

BASE STATION COORDINATES	
LAT:	<input type="text" value="37°22'22.60619"/>
LNG:	<input type="text" value="121°59'50.14823"/>
ELV:	<input type="text" value="-5.045"/> m
ANT RADIUS:	<input type="text" value="0.230"/> m
ANT SLANT:	<input type="text" value="2.345"/> m
<b>HERE</b>	<b>CNCL</b> <b>OK</b>

**Figure 4.20:** Base Station Coordinates screen - COOR

The following table describes the components of this screen:

**Table 4.17:** Base Station Coordinates screen - COOR

Component	Function
LAT	Editable field where user enters latitude of the base station. Eastern hemisphere is positive, western is negative.
LNG	Editable field where user enters the longitude of the base station. Northern hemisphere is positive, southern is negative.
ELV	Editable field where user enters the elevation of the base station (i.e. ellipsoidal height).
ANT RADIUS	Editable field where user enters the radius of the antenna.
ANT SLANT	Editable field where user enters the slant height of the antenna.
<b>HERE</b>	Pressing F1 will set LAT, LNG and ELV fields to current position.
<b>CNCL</b>	Pressing F3 will return the user to the screen previous to this one without any changes in base station coordinates.
<b>OK</b>	Pressing F4 will accept entered values, set coordinates of the base station, and return the user to the screen previous to this one.

## Alarm Setup Screen - ALST

This screen allows you to set up different alarm parameters.

The screenshot shows the 'ALARM SETUP' screen with the following parameters and values:

- HANDHELD POWER: ON
- RECEIVER POWER: OFF
- MEMORY: 10 %
- MIN SVs: 0
- HDOP ALARM: 5
- VDOP ALARM: 8
- RETN (button)

**Figure 4.21:** Alarm Setup Screen - ALST

The following table describes the components of this screen:

**Table 4.18:** Alarm Setup screen - ALST

Component	Function
HANDHELD POWER	Toggle values are ON and OFF. If HANDHELD POWER is ON, handheld will signal low power of the computer.
RECEIVER POWER	Toggle values are ON and OFF. If RECEIVER POWER is ON, handheld will signal low power of the receiver.
MEMORY	Editable field where the user enters a threshold value for receiver memory alarm (in percent). If remaining receiver memory is below this value, an alarm is sounded notifying the user. Valid values for this field are 0 - 99. Zero indicates no alarm.
MIN SVs	Minimum number of satellites used in position fix. Zero indicates no alarm. If the number of satellites drops below the specified number, an alarm is sounded.
HDOP ALARM	Editable field where the user enters a threshold value for horizontal DOP. If this value is reached or exceeded, an alarm is sounded notifying the user. Valid values for this field are 0 - 99. Zero indicates no alarm.
VDOP ALARM	Editable field where the user enters a threshold value for vertical DOP. If this value is reached or exceeded, an alarm is sounded notifying the user. Valid values for this field are 0 - 99. Zero indicates no alarm.
RETN	Pressing F4 will return the user to the screen previous to this one.

## Session Programming Screen - SESS

The Session Program feature allows you to preset up to 10 observation sessions in the receiver. This option can be useful for normal data collection and is particularly useful when used with the Remote Monitor program in your computer. With the Remote monitor program and a modem, you can operate a receiver that has been left in a remote location and download its data files from across the globe if necessary. For details, see the **REMOTE.EXE** module of the Post-processing System Manual. Initial settings can be made on the receiver and it can be left running.

This screen allows you to set up global session parameters.



**This screen is not accessible if receiver is not equipped with SLEEP/SESSION option.**

```
SESSION PROGRAMMING

MODE: SLEEP

TODAY: 327 20:08:47
REFERENCE DAY: 327
TIME OFFSET: 10:20
A-E F-J CNCL OK
```

**Figure 4.22:** Session Programming screen - SESS

The following table describes the components of this screen:

**Table 4.19:** Session Programming screen - SESS

Component	Function
MODE	Toggle allowing the user to select mode of session programming. Toggle values are DISABLED, SESSION, and SLEEP. Default is DISABLED.
TODAY	Displays day of the year obtained from the receiver following current GPS time.
REFERENCE DAY	Editable field where user enters reference day for applying time offsets.
TIME OFFSET	Editable field where user enters time offset. Every day after reference day, session start and end times will be offset by this value.

**Table 4.19:** Session Programming screen - SESS (continued)

Component	Function
<b>A-E</b>	Pressing F1 will move the user to the Sessions Setup screen (SSET) for sessions A-E.
<b>F-J</b>	Pressing F2 will move the user to the Sessions Setup screen (SSET) for sessions F-J.
<b>CNCL</b>	Pressing F3 will return the user to the screen previous to this one without applying changes made on this screen.
<b>OK</b>	Pressing F4 will accept entered values and, if enabled, start session mode of the receiver.

## Session Setup Screen - SSET

This screen allows you to set up sessions A through E, or F through J.

SESSION SETUP						
#	MOD	START	STOP	RCI	SVs	T
A	YES	18:25:45	18:45:05	10.0	10 3	0
B	YES	19:25:45	19:45:05	10.0	10 3	0 *
C	NO	20:25:45	20:45:05	10.0	10 3	0
D	YES	21:25:45	21:45:05	10.0	10 3	0
E	YES	22:25:45	22:45:05	10.0	10 3	0

CNCL OK

**Figure 4.23:** Session Setup screen - SSET

The following table describes the components of this screen:

**Table 4.20:** Session Startup screen - SSET

Component	Function
<b>#</b>	Session ID. Possible values are A through J.
<b>MOD</b>	Toggle. Session mode. Possible values are YES (collect data) or NO (don't collect data)
<b>START</b>	Editable field. Start time of the session. It might be offset if TIME OFFSET (on SESS screen) is not zero.
<b>STOP</b>	Editable field. Stop time of the session. It might be offset if TIME OFFSET (on SESS screen) is not zero.

**Table 4.20:** Session Startup screen - SSET (continued)

Component	Function
RCI	Editable field. Recording interval.
°	Editable field. Satellite elevation mask for data collection.
SVs	Editable field. Minimum number of satellites required for data collection.
T	Toggle. Data collection type. Possible values are 0-CODE AND CARRIER, or 2-POSITION ONLY.
<b>CNCL</b>	Pressing F3 will return the user to the screen previous to this one without applying changes made on this screen.
<b>OK</b>	Pressing F4 will accept entered values and return the user to the screen previous to this one.

## Site Information Screen - SITE

This screen allows you to set site specific information.

The screenshot shows a terminal-style interface for the 'SITE INFORMATION' screen. The title 'SITE INFORMATION' is at the top. Below it are several fields with their current values: OPERATOR: JIM, SESSION: J, RECEIVER #: 026, ANTENNA #: 011, DATE: 1206, DRY TEMP: 20 °C, WET TEMP: 18 °C, HUMIDITY: 50 %, and PRESSURE: 1010 mbar. At the bottom, there are two buttons labeled 'CNCL' and 'OK'.

**Figure 4.24:** Site Information screen - SITE

The following table describes the components of this screen:

**Table 4.21:** Site Information screen - SITE

Component	Function
OPERATOR	Editable field. ID of the operator.
SESSION	Editable field. Session identifier.
RECEIVER #	Editable field. ID of the receiver.
ANTENNA #	Editable field. ID of the antenna.
DATE	Editable field. Current date (mmdd)

**Table 4.21:** Site Information screen - SITE (continued)

<b>Component</b>	<b>Function</b>
DRY TEMPERATURE	Editable field. Temperature in C.
WET TEMPERATURE	Editable field. Temperature in C.
HUMIDITY	Editable field. Relative humidity in percent.
PRESSURE	Editable field. Barometric pressure in millibars.
<b>CNCL</b>	Pressing F3 will return the user to the screen previous to this one without applying changes made on this screen.
<b>OK</b>	Pressing F4 will accept entered values, and return the user to the screen previous to this one.

## Satellite Selection Screen - SSEL

This screen allows you to select/deselect satellites.

<b>SATELLITE SELECTION</b>					
01 Y	02 Y	03 Y	04 Y	05 Y	06 Y
07 Y	08 Y	<b>09 Y</b>	10 Y	11 Y	12 Y
13 Y	14 Y	15 Y	16 Y	17 Y	18 Y
19 Y	20 Y	21 Y	22 Y	23 Y	24 Y
25 Y	26 Y	27 Y	28 Y	29 Y	30 Y
31 Y	32 Y				
	<b>YES</b>	<b>NO</b>		<b>RETN</b>	

**Figure 4.25:** Satellite Selection screen - SSEL

The following table describes the components of this screen:

**Table 4.22:** Satellite Selection Screen - SSEL

<b>Component</b>	<b>Function</b>
<b>Yes</b>	F1 sets the highlighted satellite to Y (yes). Selection is made using the arrow keys.
<b>No</b>	F2 deselects the highlight satellite. Selection is made using the arrow key.
<b>RETN</b>	Pressing F4 will return the user to the screen previous to this one.

## Radio Setup screen - RDIO

This screen allows you to set up your radio.

RADIO SETUP		
RADIO S/N:	95010577	
MODEL:	DDR-96	
SENSITIVITY:	LOW	
	TX	RX
CHANNEL:	2	469.5500 469.5500 MHz
BAUD RATE:	9600	
	SET	RETN

H0076

**Figure 4.26:** Satellite Selection Screen - SSEL

The following table describes the components of this screen:

**Table 4.23:** Radio Setup screen - RDIO

Component	Function
Radio S/N	Serial number of the radio.
Model	Model of the radio.
Sensitivity	Input sensitivity. Can be Off, Medium, Low, or High
Channel	Radio channel.
TX	Displays the radio frequency used to receive the differential corrections.
RX	Displays the radio frequency used to send the differential corrections.
Baud Rate	The baud rate of the data transmission between the base and the remote.
<b>SET</b>	Sends the entered values to the radio.
<b>RETN</b>	Returns to the previous screen.

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