GPS System 1200

GPS1200

RTK Quick Guide
Version 2.0
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Leica Geosystems

1.0 RTK Quick Guide System 1200 Introduction

In This Chapter

The following sections describe the layout of this quick guide and the directory structure on the PCMCIA card used in a GPS1200 GPS receiver.

Section	Topic
1.1	Quick Guide Overview
1.2	Controller Access
1.3	Icons
1.4	CompactFlash (CF) Card Directory Structure
1.5	Job Management: Creating a Job
1.6	Job Management: Selecting a Job
1.7	Configuration Sets Management: Selecting a Configuration Set

1.1 Quick Guide Overview

About This Quick Guide

This manual is designed as a supplement to the GPS1200 manuals available on the System 1200 firmware CD. The intent of this quick guide is to provide a step-by-step guide through the more common procedures used in RTK (Real-time Kinematic) GPS surveying.

This quick guide
- assumes that the user is familiar with general GPS surveying procedures and real-time applications,
- uses the term “***sensor***” interchangeably with “System 1200 GPS receiver”,
- assumes that your sensor has no optional internal memory but instead stores data onto a CompactFlash (CF) card,
- assumes that you are using a touch screen (RX1210T).

Overview

This RTK Quick Guide contains the following chapters.

Chapter	Topic
1.0	RTK Quick Guide System 1200 Introduction
2.0	Configuration Sets
3.0	The Real-Time Reference Configuration Set
4.0	The Real-Time Rover Configuration Set
5.0	Starting the Real-Time Reference
6.0	Real-Time Rover Surveying
7.0	Stakeout
8.0	Coordinate System Management
9.0	Onestep Transformations
10.0	RTK Communications
11.0	Utilities

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1.1 Quick Guide Overview, Continued

Firmware Version 2.0

This quick guide has been written for System 1200 Firmware Version 2.0. If you are using a different firmware version, you may notice slight differences in the menu commands.

User Manuals

A number of user manuals are available on the Firmware CD. These manuals are provided in Adobe Acrobat format along with the Adobe Acrobat reader. The user manuals contain a wealth of information on System 1200, including system specifications and operation procedures for real-time as well as post-processed static, rapid static, and kinematic surveys.

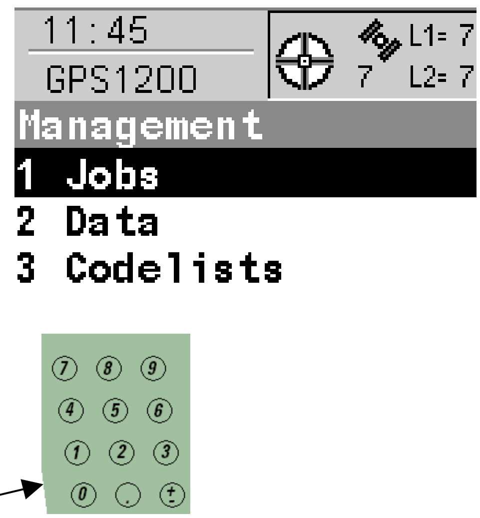
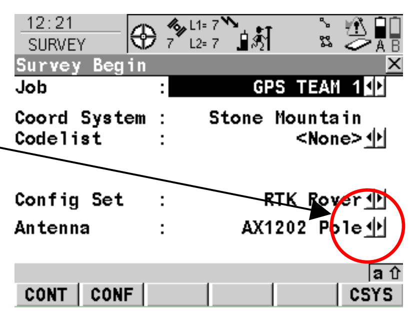
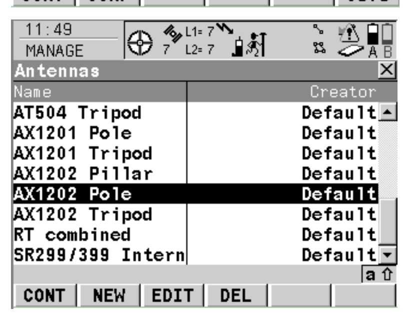
More detailed information on System 1200 and real-time surveying can be found in the following Leica manuals:

- ***GPS1200 User Manual*** – provides an overview of the system together with technical data and safety directions.
- ***GPS1200 System Field Manual*** – Describes the general working of the system in standard use. It is intended to be a quick-reference field guide.
- ***GPS1200 Application Programs Field Manual*** – Describes specific onboard application programs in standard use. It is intended to be a quick-reference field guide.
- ***GPS1200 Technical Reference Manual*** – This comprehensive manual provides detailed information on nearly all aspects of System 1200 including many of the procedures mentioned in this quick guide.

1.2 Controller Access

Access Below you will find methods for accessing menu choices. These conventions are held throughout all operations on the controller.

Keyboard and Touch Screen The user interface is operated either by using the keyboard or the touch screen using the supplied stylus.

Item	Display
Accessing a Menu Option There are three ways to access a menu option. 1. Probably the most convenient way to access the menu options is to utilize the touch-screen functionality of the RX1210T controller. Simply tap on the item using the stylus provided. 2. Use the up/down arrow buttons to move the focus on the menu option and then press the **F1** **(CONT)** button or press the **ENTER** button. 3. Enter the complete number corresponding to the menu item. For instance, press the number "**1**" on the controller's keypad to access the "**Jobs**" screen.	
Left/Right Arrow Buttons When you see the left/right arrow buttons by a field, this means that there are more choices available in a list box for that particular field. To access all the choices in the list box, either put focus on the field (highlight) and press the **ENTER** button or simply tap on the field with the stylus. **In the list box:** To select an item, put focus on the item and either: • Press the **F1 (CONT)** button or • Press the **ENTER** button.	 

Continued on next page

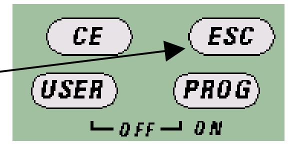
1.2 Controller Access, *continued*

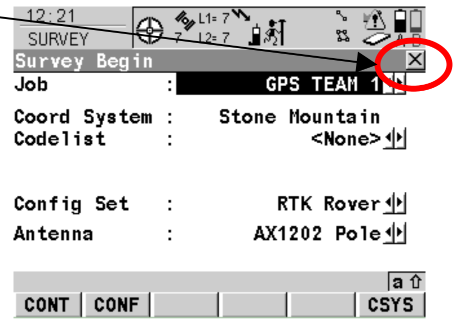
<table>
<tr><th>Item</th><th>Display</th></tr>
<tr><td>

To exit a list box without making a change, either:

- Press the **ESC** escape button or
- Tap on the  icon.

</td><td>





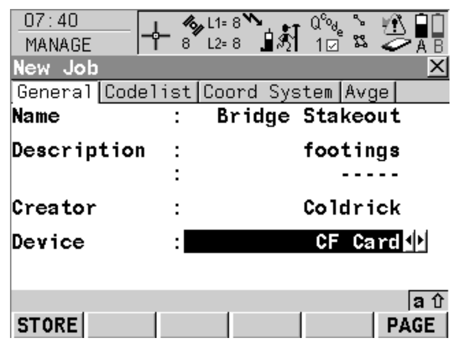
</td></tr>
<tr><td>

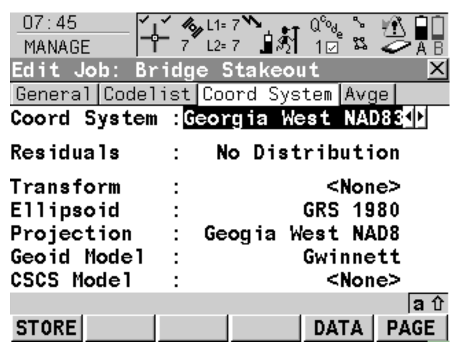
Accessing Another Page

To access another page either tap on the tab associated with the page you wish to access using the stylus or press the **F6 (PAGE)** button.

For example, if you wanted to access the “Coord System” page from the “General” page in the “New Job” screen and did not wish to use the stylus to tap on the “Coord System” tab, you could press the **F6 (PAGE)** button twice to arrive at the “Coord System” page.

</td><td>





</td></tr>
</table>

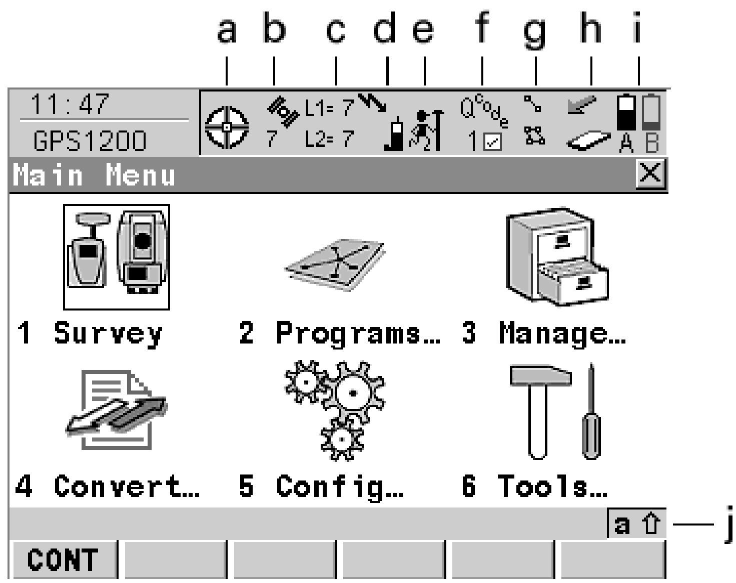
1.3 Icons

Description

The icons provide information related to basic receiver functions. The icons that appear depend upon which GPS1200 receiver is used and the current receiver configuration.

Below is a description of the icons displayed.

Allocation of Icons



a) Position status
b) Number of visible satellites
c) Contributing satellites
d) Real-time device and real-time status
e) Position mode
f) Quick coding
g) Line/area
h) CompactFlash/internal memory
i) Battery
j) SHIFT

Continued on next page

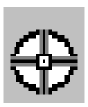
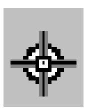
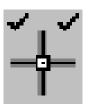
1.3 Icons, *Continued*

Icon Descriptions

Below is a list of the icons and their descriptions.

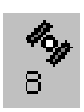
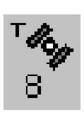
Position Status

Displays the status of the current position. Tapping on these icons using the touch screen will access the Status Position screen.

Icon	Description
No icon	A position is not available.
	Autonomous position is available. This is the navigated position (i.e. no corrections are applied to this position). Positional accurcy is typically under 20 metres (60 feet).
	Code only solution. This appears when the rover receiver is receiving code-based corrections from a reference. Positional accuracy is typically sub-metre (under 3 feet) with repsect to the reference.
	Phase fixed solution. This means that the phase ambiguities have solved. positional accuracy is 1cm + 1ppm (part per million) and vertical accuracy is 2cm + 1ppm. The two check marks indicate that an ambiguity check is being made.

Number of Visible Satellites

Displays the number of theoretically visible satellites above the configured cut off angle according to the current almanac. Tapping on these icons using the touch screen will access the “Status Satellites” screen.

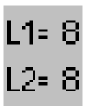
Icon	Description
	This icon displays the number of satellites available according to the almanac. MaxTrack mode is not active.
	This icon displays the number of satellites available according to the almanac. MaxTrack mode is active.

Continued on next page

1.3 Icons, *Continued*

Contributing Satellites

These icons display the number of satellites contributing to the currently computed position solution.

Icon	Description
	When a position status icon is displayed, the number of satellites currenlty used for the position computation is shown. If no position is currenly available but satellites are being tracked, then the L1 and L2 values show how many satellites are being tracked. **Note:** The number of contributing satellites can differ from the number of visible satellites. This may be either because satellites can not be viewed or the observations to these satellites are considered to be too noisy in the position solution.

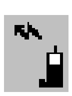
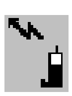
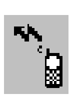
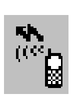
Real-Time Device and Real-Time Status

These icons display the real-time device configured to be used and its status. Tapping on this icon accesses the “Real-Time Input Status” screen.

Real-Time Mode: Reference

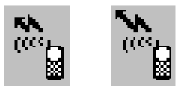
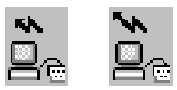
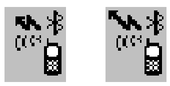
An arrow pointing upwards indicates that the current configuration is a real-time reference configuration, it does not indicate if the device is working or not. The arrow pulsates when a real-time message is sent to the configured port. This does not mean that the radio has transmitted the message – it just means that the receiver has sent a message to one of its ports. You must check to see if the radio has indeed transmitted a message or not. For more information on RTK communications, see chapter *10.0 RTK Communications*.

When two real-time devices are configured, the icon for real-time **1** is shown.

Icon	Description
 	These icons represent a radio is transmitting.
 	These icons represent a digital cellular telephone is connecting.

Continued on next page

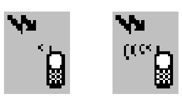
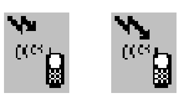
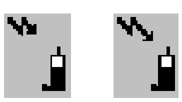
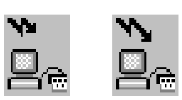
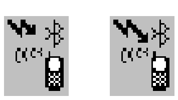
1.3 Icons, *Continued*

Icon	Description
	These icons represent a digital cellular telephone is transmitting.
	These icons represent an RS232 is transmitting.
	These icons represent a bluetooth enabled device is attached and transmitting. A digital cellular phone is shown as an example.

Real-Time Mode: Rover

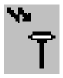
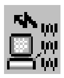
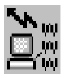
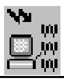
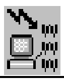
An arrow pointing downwards indicates a Rover configuration. The arrow pulsates when real-time messages are received.

For more information on real-time rover configuration sets, see chapter *4.0 The Real-Time Rover Configuration Set*.

Icon	Description
	These icons represent a digital cellular telephone is connecting.
	These icons represent a digital cellular telephone is receiving.
	These icons represent a radio is receiving.
	These icons represent an RS232 device is receiving.
	These icons represent a bluetooth enabled device is attached and receiving. A digital cellular is shown as an example.

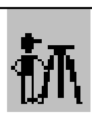
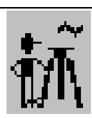
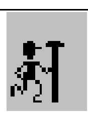
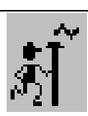
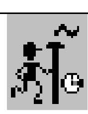
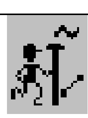
Continued on next page

1.3 Icons, *Continued*

Icon	Description
 	These icons represent either a WAAS (Wide Area Augumentation System), EGNOS (European Geostationary Navigation Overlay Service), or MTSAT (Satellite-based Agumentation System) is being used.
 	**And available for the GRX1230 Pro**
 	These icons represent an ethernet device is being used.

Position Mode

These icons display the current position mode depending on the configuration defined. Symbols are added to the basic position mode icon when raw data logging or logging of auto recorded points is configured. As soon as this icon becomes visible, the receiver is in a stage where practical operation can commence. Tapping on this icon accesses the Status Logging screen.

Icon	Position Mode	Point Occupation	Raw Data Logging	Logging of Auto Points	Move Antenna
	*Static*	*Yes*	*No*	*No*	*No*
	*Static*	*Yes*	*Yes*	*No*	*No*
	*Moving*	*No*	*No*	*No*	*Yes*
	*Moving*	*No*	*Yes*	*No*	*Yes*
	*Moving*	*No*	*Yes*	*By Time*	*Yes*
	*Moving*	*No*	*Yes*	*By Distance or Height*	*Yes*

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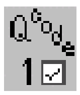
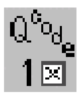
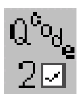
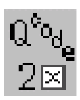
1.3 Icons, *Continued*

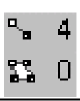
Quick Coding

Quick coding is the storing of a point plus a thematical or free code using a minimum number of keystrokes. Quick codes can be one, two, or three digits in length. You can use the touch screen to turn quick codes on and off.

Icon	Description
	Quick coding is turned on. Quick codes with one digit are used from the active codelist.
	Quick coding (with one digit) is turned off.
	Quick coding with two digits is turned on.
	Quick coding with two digits is turned off. You can see the pattern here. Quick codes can be as large as three digits.

Lines and Areas

The number of currently open lines and areas is displayed. Tap on the Lines and Areas icon to access the “MANAGE Data: Job Name” screen. Accessing the lines or areas tab will enable you to view, create, edit, and delete lines or areas.

Icon	Description
	The number of lines and areas in the active job are shown. In this example there are four lines open and no areas are open.

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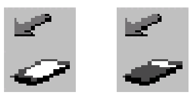
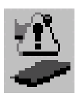
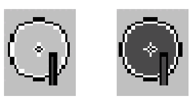
1.3 Icons, *Continued*

CompactFlash (CF) Card/Internal Memory

These icons display either the CompactFlash (CF) card or the internal memory. For the CompactFlash card, the capacity of used space is shown in seven levels. The internal memory capacity is shown in nine levels. Tapping on this icon accesses the "STATUS Battery & Memory, Memory" screen.

Icon	Description
	The CF card is inserted in the sensor and can be removed. Here we see two different capacity levels: the first icon shows the memory card to be almost empty and the second shows the memory card to be almost full. The arrow indicates that it is permissible to remove the card, i.e. the card is not in use by the sensor.
	The CF card is inserted in the sensor and should not be removed. The sensor is using the card. It is strongly recommended that the CompactFlash card not be removed from the sensor to avoid data loss.
	The internal memory is the active memory device. Note: internal memory is not standard on System 1200 receivers; it is an option.
No icon	The CF card is the active memory device but it is not inserted in the receiver.

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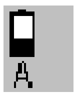
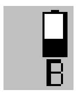
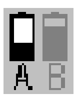
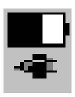
1.3 Icons, *Continued*

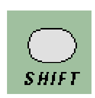
Battery

The status and source of the battery is displayed. The remaining power in the battery is displayed in six different levels.

If two internal batteries are inserted, the battery with the lowest voltage is used first. If an external power supply is used and one of the two internal batteries is inserted, then the external power supply in used. If two external power supplies are attached, then the system uses the one that is configured as the preferred power supply. Tapping on this icon accesses the “STATUS Battery & Memory, Battery” screen.

Icon	Description
	One internal battery in battery compartment A is in use.
	One internal battery in battery compartment B is in use.
	There are two internal batteries inserted, one in each battery compartment (A & B). The darker colored battery image (A in this example) represents the current battery in use.
	There is an external battery attached and in use.

Shift

The status of the **SHIFT**  button is displayed by this icon (see below for icon image). Tapping on this icon displays other available softkeys.

Icon	Description
	Additional softkeys are available in the currently visible screen.
	The **SHIFT** button has been pressed.

1.4 CompactFlash (CF) Card Directory Structure

What Goes Where?

The CF card directory structure for Leica System 1200 sensors is explained below.

All items marked as *"(*System RAM*)"* must ultimately be transferred to the receiver's system RAM. These items may be copied to the CF card using the Data Exchange Manager function in LGO and then transferred to system RAM of the sensor.

- **CODE** — Code Lists – various files
- **CONFIG** — GPS configuration files (*.xfg)
- **CONVERT** — Format files (*.frt)
- **DATA** — ASCII files for import/export to/from job (*.*)
  - **GPS** — Almanac files – (Almanac.sys)
    - **RINGBUF** — Ring buffer files
    - **GEOID** — Geoid field files (*.gem)
    - **CSCS** — CSCS field files (*.csc)
- **DBX** — Job files, various files
DTM jobs, various files
System 1200 coordinate system file (Trfset.dat)
- **GPS** — Antenna file (List.ant)
GSM/Modem station list (Stations1200.fil)
- **GSI** — GSI files (*.gsi)
- **System** — Application program files (*.a*)
Firmware files (*.fw)
Language files (*.s*)
License file (*.key)
System files (System.ram)

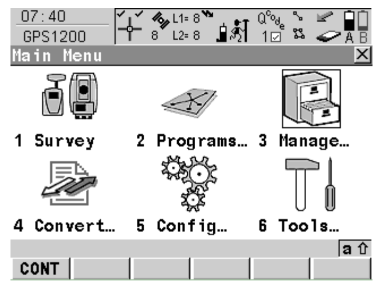
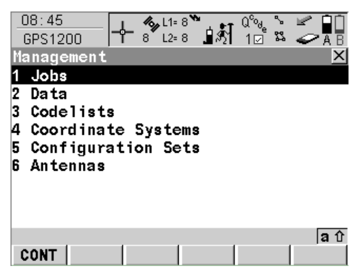
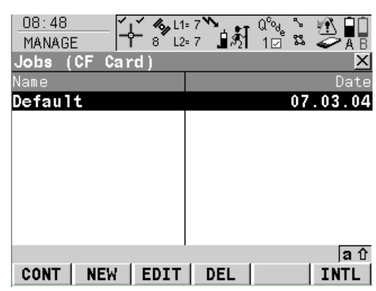
1.5 Job Management: Creating a Job

Jobs

Jobs exist in order for you to be able to structure and organize your work. They define a common location within the System 1200 file system for points.

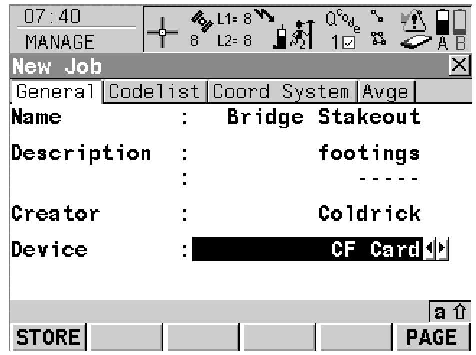
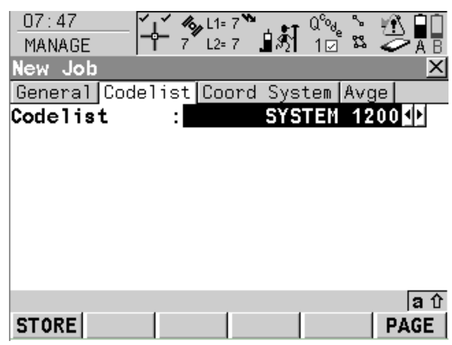
All points, lines, and areas that are recorded will be stored within a particular job. Jobs normally reside on the CF card unless you have purchased internal memory (not internal RAM) for your GPS receiver.

A copy of the coordinate system that was used with the last active job will also be stored.
For more information on coordinate systems, see chapter *8.0 Coordinate Systems Management*.

Step	Action	Display
1	In the Main Menu: • Tap on the **3 Manage…** icon. This takes you to the GPS1200 Management screen.	
2	In the GPS1200 Management screen: • Tap on **1 Jobs** from the selection list. This takes you to the MANAGE Jobs (CF Card) screen.	
3	In the MANAGE Job (CF Card) screen: • Press the **F2** (**New)** button. This takes you to the MANAGE New Job screen.	

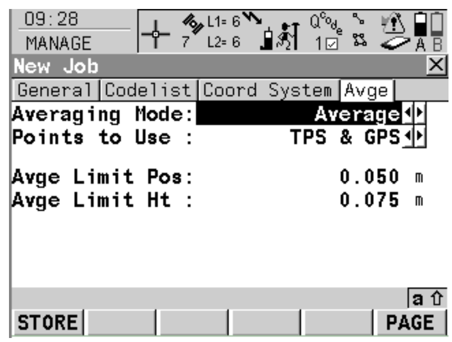
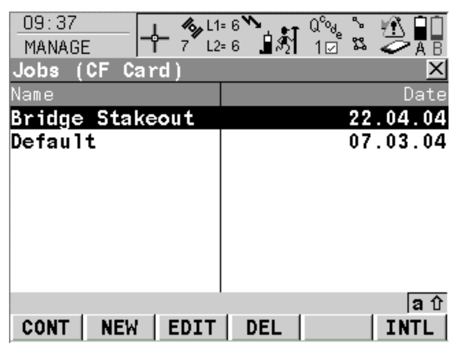
Continued on next page

1.5 Job Management: Creating a Job, Continued

Step	Action	Display
4	In the MANAGE New Job screen: **General (Tab) Page** **Name** The job name may contain up to 16 characters and may include spaces. • Enter a name for the job in the **Name** field. • Press the **ENTER** button when finished. **Description and Creator** You may enter a description for the job in the **Description** field (two lines available for text entry) and enter who created the job in the **Creator** field, but both of these are optional and not required. **Device** Enter the device where the job will be stored. Typically it is stored on the CompactFlash (CF) card. • Access the "Codelist" page. **Codelist Page** Here you can select a codelist for the job. This copies the codes to the job. **Note**: In this example we are using a codelist titled **SYSTEM 1200**". You can find more information on codelists and coding in the *GPS1200 Technical Reference Manual* chapter *9 "Manage…\Codelists"* pages 180 – 201 and chapter 10 "*Coding*" pages 202 – 229. Additional information can be found in the LEICA Geo Office help menu under "*Codelist Management*". This step is continued on the following page.	 

Continued on next page

1.5 Job Management: Creating a Job, Continued

Step	Action	Display
5	Continuing in the MANAGE New Job screen: • Tap on the “Coord System” page. **<u>Coord System Page</u>** Choosing a coordinate system attaches it to the job. If you are not sure which coordinate system to use, select **WGS 1984**. For more information on coordinate systems, refer to the *GPS 1200 Technical Reference Manual* Section *11.4* pages 240 – 244 and LEICA Geo Office Help topic heading “*Coordinate System Management*”. • Access the “Avge” page. **<u>Avge Page</u>** In order to check measurements, the same point can be measured more than once. If activated, an averaged or an absolute difference is calculated. For more information on averaging, please refer to the *GPS 1200 Technical Reference Manual Chapter* Section *8.3.4* pages 145 – 151. • Press the **F1 (STORE)** button when finished. This creates the new job and returns you to the MANAGE Jobs (CF Card) screen. • Press the **F1 (CONT)** button. This returns you to the Main Menu.	  

1.6 Job Management: Selecting a Job

Introduction

There are two ways to select a job.

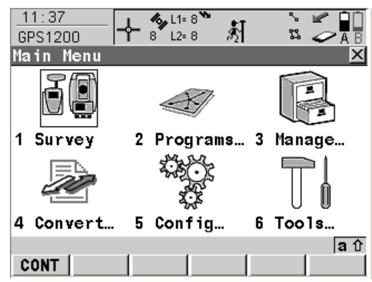
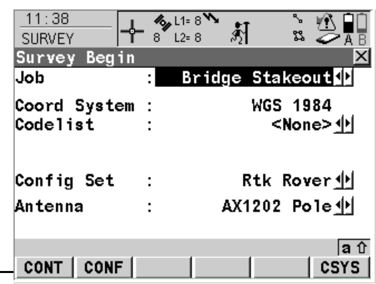
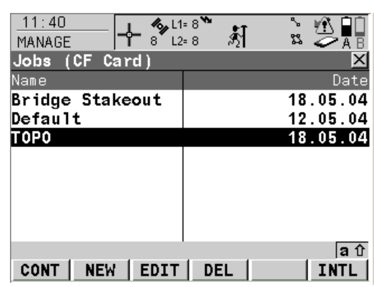
1. Via the Survey screen.
2. Via the Management Jobs screen.

This section describes both ways.

1. Via the Survey Screen

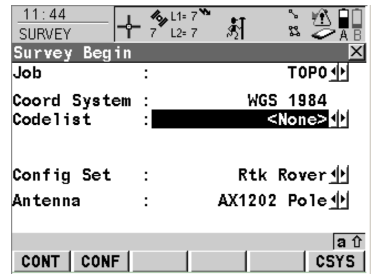
In this example we will select a job via the Survey screen. This is the most common way to select a job.

Note: In the example below, the current job selection is “**Bridge Stakeout**” and we will change it to “**TOPO**”.

Step	Action	Display
1	In the Main Menu: • Tap on the **1 Survey** icon. This takes you to the SURVEY Survey Begin screen.	
2	In the SURVEY Survey Begin screen: • Tap on the **Job** field. This takes you to the MANAGE Jobs (CF Card) list box screen.	
3	In the MANAGE Jobs (CF Card) list box screen: The list of all the jobs currently stored on the CF Card is displayed. • Tap on the job you wish to use. (In this example it is **TOPO**). • Press the **F1 (CONT)** button. This returns you to the SURVEY Survey Begin screen.	

Continued on next page

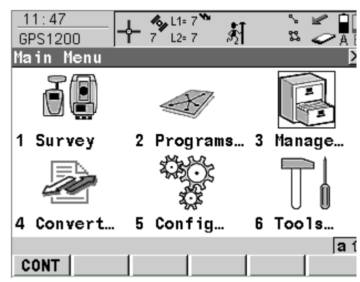
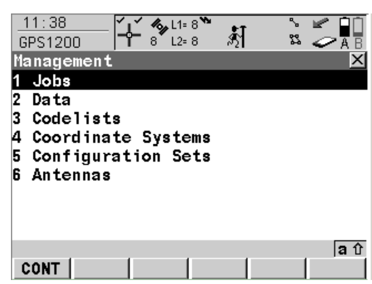
1.6 Job Management: Selecting a Job, *Continued*

Step	Action	Display
4	In the SURVEY Survey Begin screen: We now see the newly selected job in the **Job** field and we can continue with the survey.	

2. Via the Job Screen

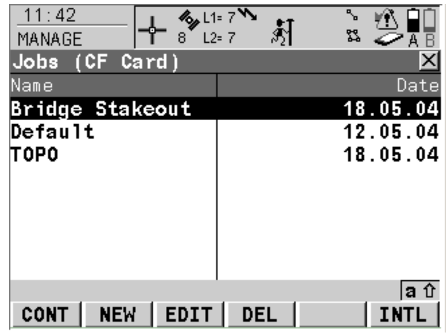
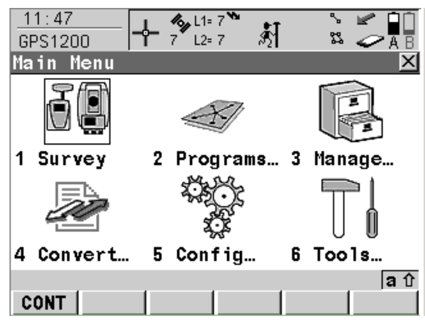
In this example we will select a job using the “Management Jobs” screen.

Note: In the example below we will change the current job to “**Bridge Stakeout**”.

Step	Action	Display
1	In the Main Menu: • Tap on **3 Manage….** This takes you to the GPS1200 Management screen.	
2	In the GPS1200 Management screen: • Tap on **1 Jobs**. This takes you to the MANAGE Jobs (CF Card) screen.	

Continued on next page

1.6 Job Management: Selecting a Job, *Continued*

Step	Action	Display
3	In the MANAGE Jobs (CF Card) screen: • Tap on the job you wish to select (in our example it is the **Bridge Stakeout** job). • Press the **F1 (CONT)** button. This returns you to the Main Menu.	
4	In the Main Menu: The “Bridge Stakeout” job is now the active job. You would see this job in the job field if you started a survey.	

1.7 Configuration Set Management: Selecting a Configuration Set

Introduction

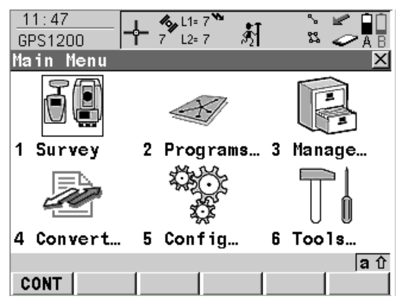
A configuration set is a set of parameters that defines a mode of operation. The configuration set in use by the GPS receiver/sensor will control the behavior of the system.

For more information on configuration sets, see chapter *2.0 Configuration Sets*, chapter *3.0 The Real-Time Reference Configuration Set*, and chapter *4.0 The Real-Time Rover Configuration Set*.

The sensor will not operate without a configuration set selected.

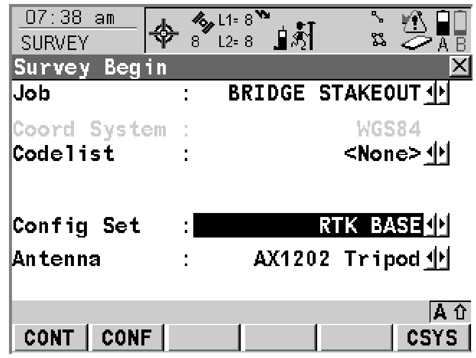
The procedure for selecting a configuration set is the same for all System 1200 GPS surveys.

Note: In the example below, we will select an RTK rover configuration set.

Step	Action	Display
1	From the Main Menu: • Tap on the **1 Survey** icon. This takes you to the SURVEY Survey Begin screen.	

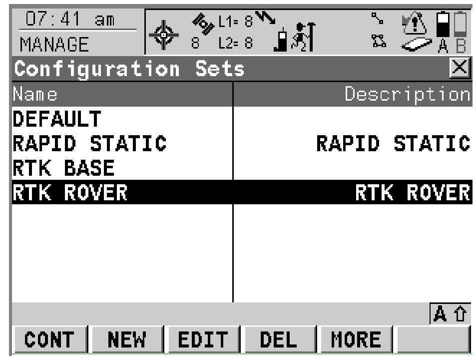
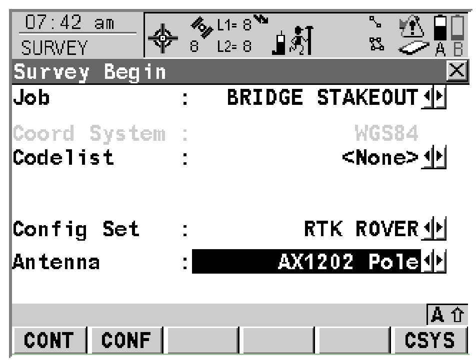
Continued on next page

1.7 Configuration Set Management: Selecting a Configuration Set, Continued

Step	Action	Display
2	In the SURVEY Survey Begin screen: In this example, the **RTK BASE** configuration is selected. We want to change this to the **RTK ROVER** configuration. There are two ways of changing the configuration set. 1. Highlight the **Config Set** field and use the left/right arrow buttons to toggle through the list of configuration sets until we find the correct set or 2. Highlight the **Config Set** field and press the **ENTER** button to bring up a list box of configuration sets. In this example we will review the list of configurations sets. • Select the **Config Set** field. • Press the **ENTER** button. This takes you to the MANAGE Configuration Sets screen.	

Continued on next page

1.7 Configuration Set Management: Selecting a Configuration Set, Continued

Step	Action	Display
3	In the MANAGE Configuration Sets screen: • Tap on the configuration set (in this example we are using the **RTK ROVER** configuration set). • Press the **F1 (CONT)** button. **Note**: In the display on the right there are many user-defined configuration sets that you may not have in your list. Do not worry. These were created on a demo receiver and normally do not come with the receiver. To learn more about creating configuration sets, see chapter *2.0 Configuration Sets* This takes us back to the SURVEY Survey Begin screen.	
4	In the SURVEY Survey Begin screen: We now see the **RTK ROVER** configuration set in the **Config Set** field. We are ready to continue our survey.	

2.0 Configuration Sets

In this Chapter

This small chapter explains what a configuration set is, how to access Configuration Set Management, how to reset the default configuration sets, and how to create a new configuration set containing the same settings as a default configuration.

Section	Topic
2.1	Accessing Configuration Sets Management
2.2	Default Configuration Sets
2.3	Creating a Configuration Set

What is a Configuration Set?

The receiver has numerous user configurable parameters and functions. The configuration of the parameters and functions for an individual measuring technique are combined in a configuration set. The configuration in use by the sensor will control the behavior of the system. Typical configuration set names are RAPID STATIC, RTK BASE, RTK ROVER, etc.

Default Configurations

Default configurations exist on the sensor. Default configurations are intended to be used as templates for creating customized configurations. Default configurations can be edited and deleted. They can also be recalled and restored back to their default settings.

User Defined Configurations

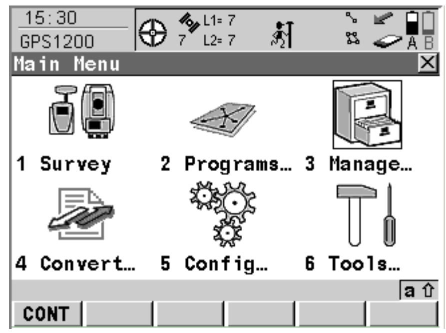
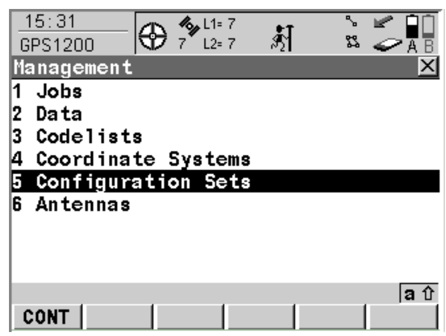
New configuration sets can be created and customized to perform different surveying tasks. These configurations can be tailored specifically for the user's operational requirements.

The configuration set wizard assists in editing a configuration set. You can also edit a configuration set without using the wizard.

2.1 Configuration Sets Management

Accessing Configuration Sets Management

Follow the steps below to access Configuration Sets Management.

Step	Action	Display
1	From the Main Menu: • Tap on **3 Manage…** This takes you to the GPS1200 Management screen.	
2	From the GPS1200 Management screen: • Tap on **5 Configuration Sets**. This takes you to the MANAGE Configuration Sets screen.	

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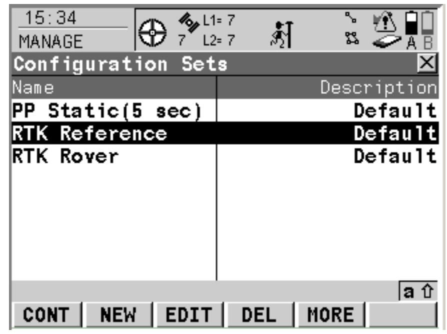
2.1 Configuration Sets Management, *Continued*

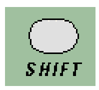
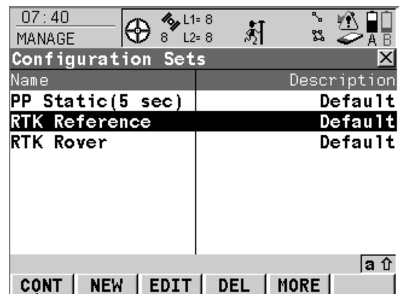
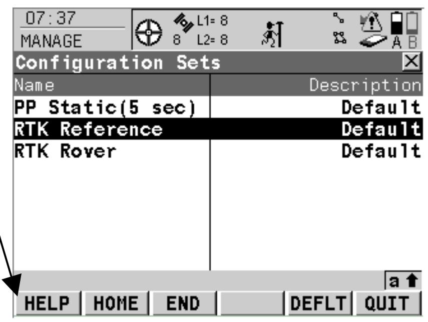
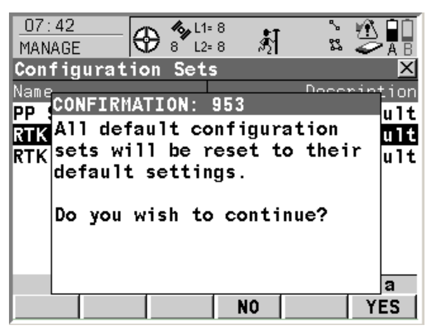
Step	Action	Display
3	In the MANAGE Configuration Sets screen: Here you can select, create, edit, delete, and see more information about the configuration sets. **F1 (CONT)** selects the highlighted configuration set to be the current one. **F2 (NEW)** creates a new configuration set based on a copy of the highlighted configuration set. (See section *2.3 Creating A Configuration A Set*.) **F3 (EDIT)** initiates the configuration set edit wizard. **F4 (DEL)** deletes the highlighted configuration set. **F5 (MORE)** allows you to see more information about the configuration set such as the creator, date created, and its description.	

2.2 Default Configuration Sets

Restoring the Default Configuration Sets

Default configurations are intended to be used as templates for creating customized configurations.

Follow the steps below to restore the three default configuration sets

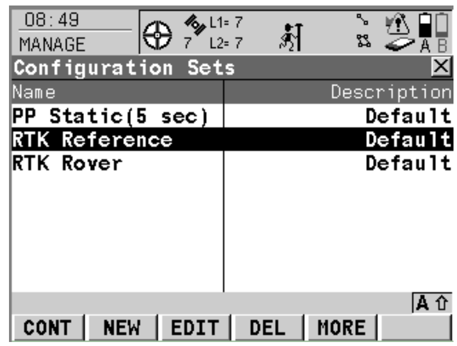
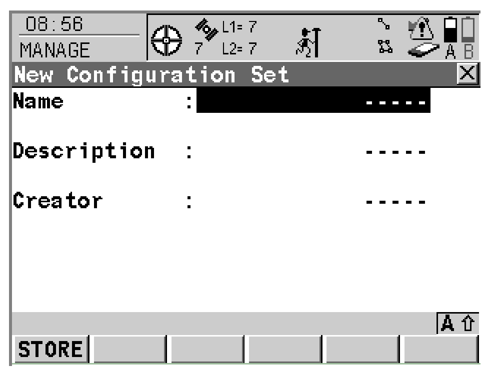
Step	Action	Display
1	From the MANAGE Configuration Sets screen: • Press the  button. This allows you to access more options via the function buttons. To set the default configuration sets back to their original state: • Press the **F5 (DEFLT)** button. This opens a confirmation window.	 
2	From the confirmation window: • Either tap on the **F6 (YES**) button or the **F4 (NO)** button to accept or reject restoring the default configurations.	

2.3 Creating a Configuration Set

Creating a Configuration Set

The best way to create a new configuration set is to make a copy of a default configuration set and then edit it to suit your particular requirements.

Follow the steps below to create a new configuration set using an existing configuration set as a template.

Step	Action	Display
1	From within the MANAGE Configuration Sets screen (see section *2.1 Configuration Set Management*): • Select a configuration set to copy. **Note**: In this example we will copy the **RTK Reference Default** configuration set. • Press the **F2 (NEW)** button. This creates a copy of the **RTK Reference Default** configuration set and takes you to the MANAGE New Configuration Set screen.	
2	From the MANAGE New Configuration Set screen: • Enter a name (16 character maximum) for the new configuration set. **Note**: In this example we will call the configuration set **RTK BASE**. • Enter a description (16 character maximum) for the configuration set. The description aids in informing you of the configuration set's purpose. **Note**: In this example we will enter a description of **RTK Reference**. • Enter the name of the person who created the configuration set. This is optional. This step is continued on the next page.	

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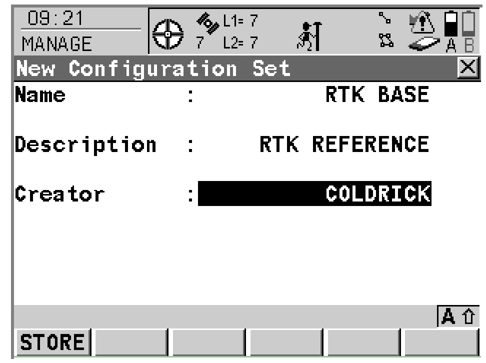
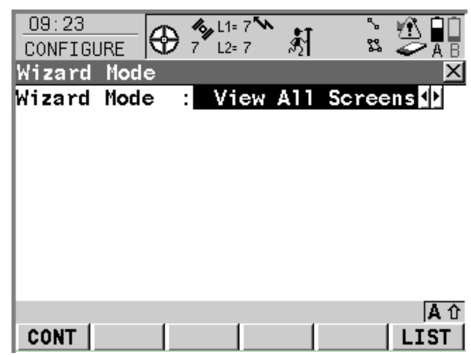
2.3 Creating a Configuration Set, *Continued*

Step	Action	Display
2	Continuing in the MANAGE New Configuration Set screen: • Press the **F1 (STORE)** button once data entry is completed. This creates a new configuration set called **RTK Base** that has all the settings that the **RTK Reference Default** configuration set had. This then opens the Configuration Set editing Wizard.	
3	You are now ready to edit a new configuration set. To edit the **RTK BASE** configuration set, proceed to chapter *3.0 The Real-Time Reference Configuration Set*. If you wish to edit a real time rover configuration set, proceed to chapter *4.0 The Real-Time Rover Configuration Set*.	

Conclusion

In this chapter you have learned what a configuration set is, how to access Configuration Set Management, how to reset the default configuration sets, and how to create a new configuration set containing the same settings as a default configuration set.

3.0 The Real-Time Reference Configuration Set

In this Chapter

The following sections of this chapter explain the procedures for configuring a real-time reference (base station) configuration set.

Section	Step	Topic
3.1	-	Editing a Real-Time Reference Configuration Set
3.1	3-6	Units & Formats
3.1	7-13	Real-Time Mode
3.1	14	Configure Antenna
3.1	15	Coding
3.1	16	Logging Raw GPS Observations
3.1	17	ID Templates
3.1	18	Seismic
3.1	19	Hot Keys & User Menu
3.1	20-22	Display, Beeps, Text
3.1	23-24	Start Up & Power Down
3.1	25	Satellite Settings
3.1	26	Local Time Zone
3.1	27	Instrument ID

About this Configuration

The Real-Time Reference Configuration Set controls the operation of the receiver to behave as a real-time base station.

Real-time operations are possible with a GX1230. It provides real-time measurements to centimetre level.

If you wish to use a GX1210 or a GX1220 for real-time reference operations, the RTCM v3 options must be activated. A GX1210 or GX1220 provides DGPS to 0.25-1 metre level accuracy.

This paper assumes you are configuring a GX1230 for RTK reference operations.

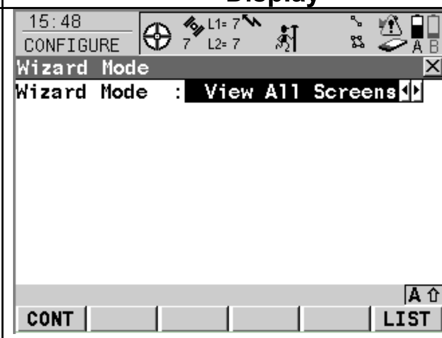
The following steps describe how to edit a RTK reference configuration set. These steps continue from chapter *2 Configuration Sets*, section *2.3 Creating a Configuration Set*.

3.1 Editing the Real-Time Reference Configuration

Edit Parameters

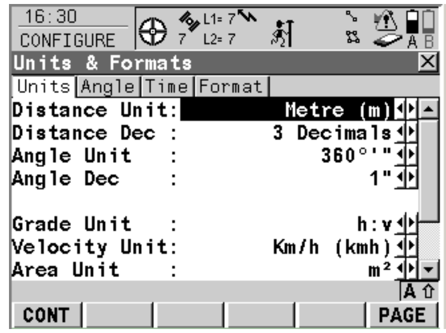
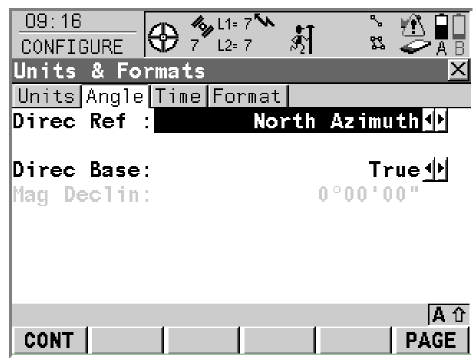
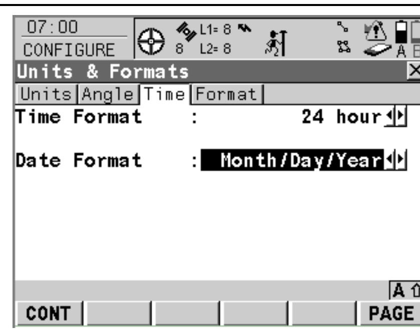
This section describes the steps in editing the parameters for a user-defined RTK Reference configuration set.

Note: These steps continue from chapter *2 Configuration Sets*, section *2.3 Creating a Configuration Set*.

Step	Action	Display
1	Continuing in CONFIGURE Wizard Mode screen: In the Wizard mode we have the option of viewing all screens available, a reduced amount of screens, or going to an individual parameter screen by pressing the **F6 (LIST)** button and selecting a screen to access. In this example we will view all screens. • Leave the **Wizard Mode** field to the default **View All Screens**. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Languages on Instrument screen.	
2	In the CONFIGURE Languages on Instrument screen: • Select a language. **Note**: You can delete any language that you may never require by highlighting the specific language and pressing the **F4 (DEL)** button. In all likelihood your receiver did not come with these additional non-North American languages. When finished: • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Units & Formats screen.	

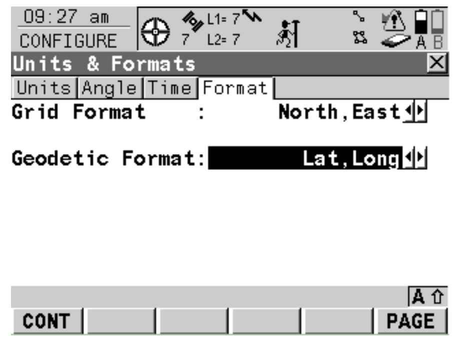
Continued on next page

3.1 Editing the Real-Time Reference Configuration,
Continued

Step	Action	Display
3	In the CONFIGURE Units & Formats screen: • Set the units you prefer to use. (Refer to chapter 1, section *1.1.1 Controller Access* to learn how to access other field selections.) When finished: • Tap on the "Angle" tab to access the next page. This takes you to the "Angle" page of the CONFIGURE Units and Formats screen.	
4	In the "Angle" page of the CONFIGURE Units & Formats screen: • Ignore this screen because there is nothing that is useful to a RTK base here. • Tap on the "Time" tab to access the next page. This takes you to the "Time" page of the CONFIGURE Units and Formats screen.	
5	In the "Time" page of the CONFIGURE Units and Formats screen: • Set the time format you prefer. In this example we chose **24 hour**. • Select the data format you prefer. In this example we choose **Month/Day/Year**. • Tap on the "Format" tab to access the next page. This takes you to the "Format" page of the CONFIGURE Units & Formats screen.	

Continued on next page

3.1 Editing the Real-Time Reference Configuration,
Continued

Step	Action	Display
6	In the “Format” page of the CONFIGURE Units & Formats screen: • Set the Grid and Geodetic formats to your preference. • Press the **F1 (CONT)** button when finished. This takes you to the CONFIGURE Real - Time Mode screen.	

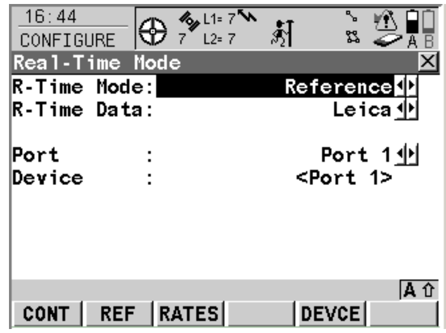
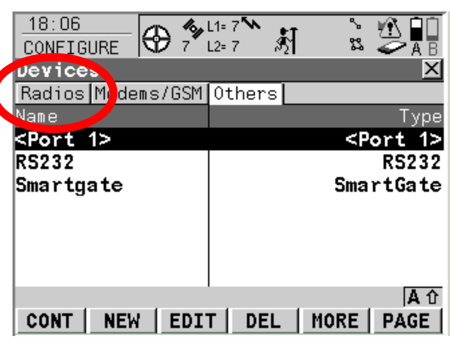
Real – Time Mode: Radio Devices

Here is where you select a communication device. In this example we will be selecting a Pacific Crest PDL radio. If you would like to use Intuicom spread-spectrum radios, see chapter *10 RTK Communications* on creating an Intuicom radio device.

We also assume that you will be using Leica GPS1200 receivers exclusively. If you are mixing Leica and non-Leica receivers, please refer to the *GPS1200 Technical Reference Manual, chapter 19.3.3* for more information on setting the proper data format.

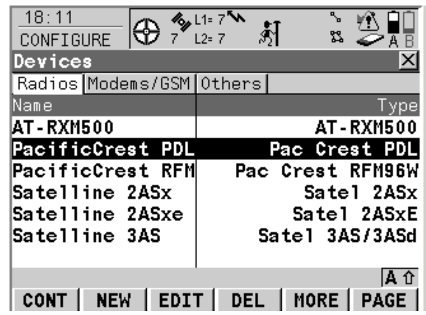
Continued on next page

3.1 Editing the Real-Time Reference Configuration,
Continued

Step	Action	Display
7	In the CONFIGURE Real - Time Mode screen: Set the format for the following: • Set the **R-Time Mode** field to **Reference**. • Set the **R-Time Data** field to **Leica**. • Set the **Port** field to either **Port 1** or **Port 3**. **Note**: Typically we set Port 1 as the real-time port. It is important to remember to attach whichever real-time communication device you are using to the port you have assigned here. For sanity's sake, let's assign the communication device to "Port 1" and you should remember this when you physically connect your communication device (in this example a Pacific Crest PDL radio) to the receiver. • Press the **F5 (DEVCE)** button. This takes you to the Devices screen.	
8	In the CONFIGURE Devices screen: • Tap the "Radios" tab. This takes you to the CONFIGURE Devices "Radios" page.	

Continued on next page

3.1 Editing the Real-Time Reference Configuration,
Continued

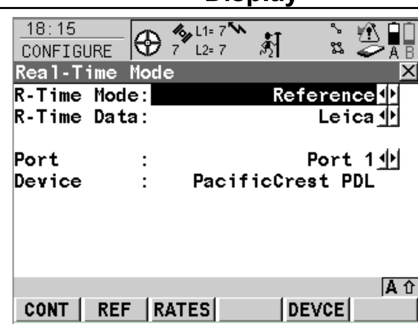
Step	Action	Display
9	In the CONFIGURE Devices "Radios" page: • Select a communication device. **Note:** Remember in this example we are selecting a **Pacific Crest PDL** radio. • Press the **F1 (CONT)** button. This returns us to the CONFIGURE Real – Time Mode screen.	

Setting a Reference ID

There will be instances when you are working in an area where another surveyor in the vicinity is transmitting RTK data on the same frequency that your radios are on. If this goes undetected, you at least run the risk of introducing whatever errors the other surveyor has accepted in their reference station coordinates. If you set a reference station ID and then configure your rover (s*ee chapter 4 for configuring a RTK Rover)* to only accept RTK data from this reference station ID, you will have dramatically minimized the possibility of receiving any other surveyor's GPS-reference station transmissions.

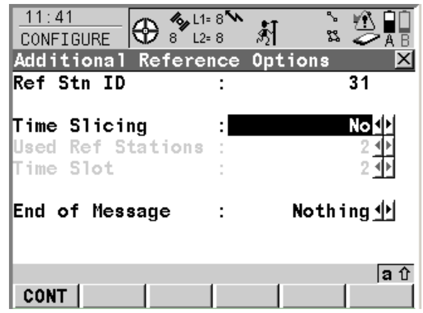
In this example we will set a Reference Station ID.

Important Note: A reference station ID is not the same as the reference station's point ID.

Step	Action	Display
10	In the CONFIGURE Real – Time Mode screen: • Press the **F2 (REF)** button. This takes you to the CONFIGURE Additional Reference Options screen.	

Continued on next page

3.1 Editing the Real-Time Reference Configuration,
Continued

Step	Action	Display
11	In the CONFIGURE Additional Reference Station Options screen: • Enter a number between 0 and 31 in the **Ref Stn ID** field. • Press the **Enter**  button to complete the entry. **Note**: You can only enter a number between 0 and 31. Remember this in **not** the reference station's point ID. For this example we will use "31". **Time slicing** is used when you have more than one reference station using the same frequency. It adds a delay to the transmitted signal. We will not be using Time Slicing in this example so we leave this set to "NO". **End of Message** adds a carriage return at the end of the message. We will not be using End of Message so leave it as the default "Nothing". • Press the **F1 (CONT)** button. This returns you to the CONFIGURE Real – Time Mode screen.	

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3.1 Editing the Real-Time Reference Configuration,
Continued

<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr><td>12</td><td>

Continuing in the CONFIGURE Real – Time Mode screen:

Note: The real-time data output rate on the reference receiver can now be set as high as 10Hz (0.1 seconds); 5Hz and 2Hz are also available. All RTK message types can be transmitted at these faster data rates.

Increasing the real-time data output rate may slightly increase the accuracy of positions computed on the rover but there will be a power consumption increase of the reference station.

Unless you have a specific need to alter the default rates, leave these default settings.

If you press the  button, you'll see the screen to the right.

The **F2 (RT-2)** button is used for configuring a second real-time device. Please refer to the *GPS1200 Technical Reference Manual Chapter 19.3.3* for more information.

The **F5 (SBAS)** button stands for **S**pace-**B**ased **A**ugmentation **S**ystem. This is where you would enable WAAS, for example. Please refer to the *GPS1200 Technical Reference Manual* chapter *19.3.3 Configuration of a Reference Real-Time Interface* for more information.

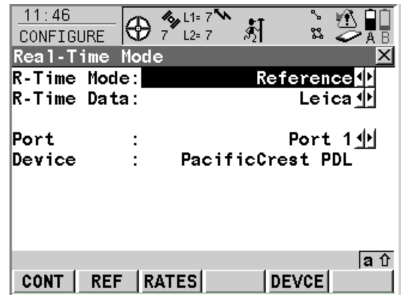
- Press the **Shift** button again.

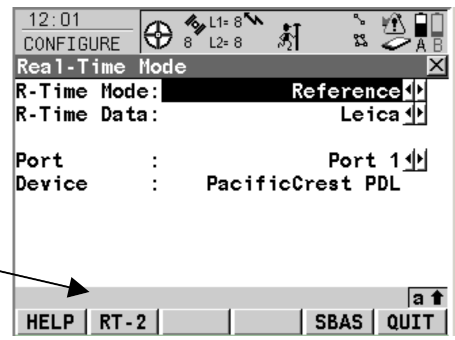
This returns us to CONFIGURE Real-Time Mode screen.

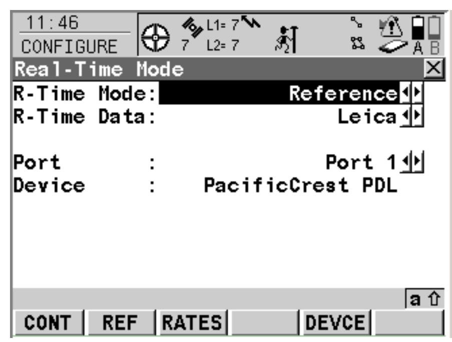
- Press the **F1 (CONT)** button.

This takes us to the CONFIGURE Radio Channel screen.

</td><td>







</td></tr>
</table>

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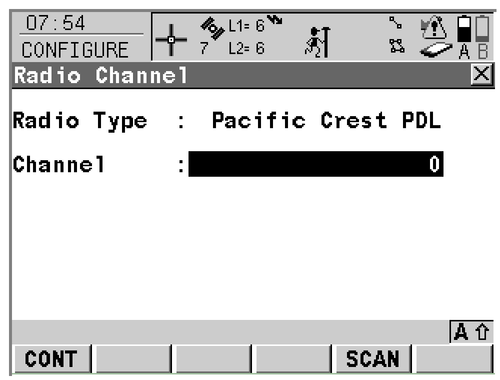
3.1 Editing the Real-Time Reference Configuration,
Continued

Important Note

Is very important that you acquire a federal license for the radio frequencies programmed on your radios. If you do not license your radios, you run the risk of paying hefty fines. After you have received a list of your licensed frequencies from your licensing agency, you will need to program these frequencies into your Pacific Crest radios. Use the Pacific Crest radio programming software called PDLCONF to program your licensed frequencies.

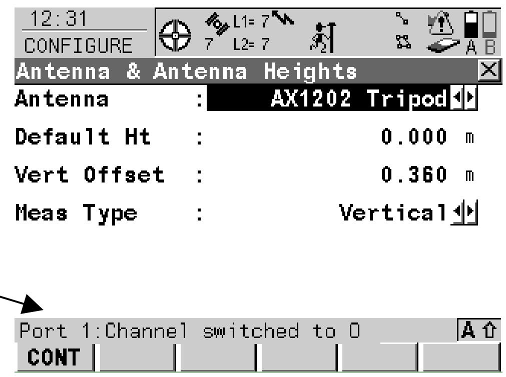
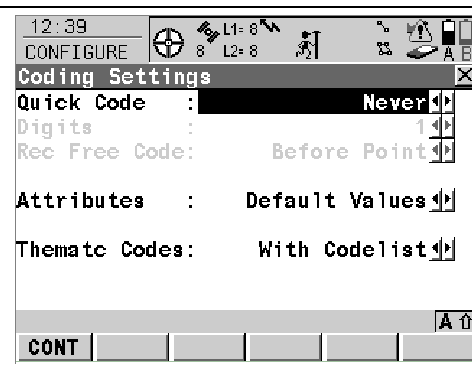
The radio channels on your GPS1200 receiver correspond to the licensed frequencies you programmed into the radios.

Note: In the United States of America, the FCC does not require Intuicom radios to be licensed. See chapter *10 RTK Communications* for information on using Intuicom radios.

Step	Action	Display
13	In the CONFIGURE Radio Channel screen: • Select a radio channel in the **Channel** field. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Antenna & Antenna Heights screen.	

Continued on next page

3.1 Editing the Real-Time Reference Configuration,
Continued

Step	Action	Display
14	In the CONFIGURE Antenna & Antenna Heights screen: **Note**: After you pressed the **F1 (CONT)** button in *Step 13*, and came to this screen, a message at the bottom of the screen reported that the radio has been changed to "0". If you receive a message warning that there was **no response from radio**, this indicates the receiver was unable to communicate with the radio. Check to see if the radio is connected to the correct port on the receiver (remember it was Port 1 from *Step 7*). For more information on radio problems, see chapter *10 RTK Communications*, section *10.3 Radio Communication Trouble Shooting*. • Select an Antenna. Unless you are using a different antenna, leave this as the default "AX1202 Tripod" and leave the remaining fields as shown as well. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Coding Settings screen.	
15	In the CONFIGURE Coding Settings screen: Since there is no coding at the reference station, we can leave this page at the default settings and continue to the next page. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Logging of Raw Obs screen.	

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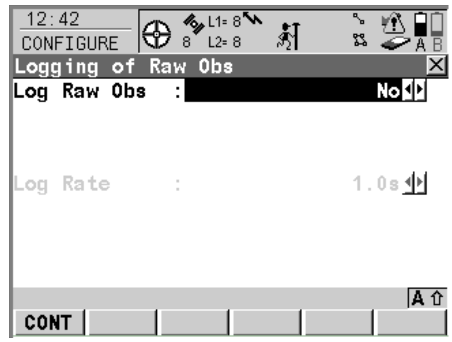
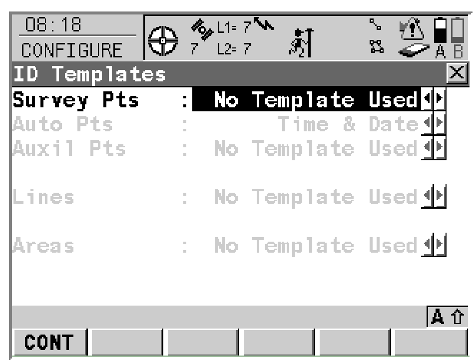
3.1 Editing the Real-Time Reference Configuration,
Continued

Step	Action	Display
16	In the CONFIGURE Logging of Raw Obs screen: System 1200 allows you to collect raw unprocessed GPS satellite observation data at the reference station while you perform an RTK survey. This is very useful if you do not know the true WGS84 coordinates of the point you are setting your reference station over. If you have access to other GPS data that has been collected over control monuments such as CORS (Continuously Operating Reference Stations) data provided by NGS (National Geodetic Survey) of the United States, you can download this CORS data and post-process it with your data in LEICA Geo Office (LGO). In this example we will assume that we already know the true coordinates for the reference station point and will not need to collect raw GPS data to post process later. • Set the **Log Static Obs** field to **No**. • Press the **F1 (CONT)** button. This takes you back to the CONFIGURE ID Templates screen.	
17	In the CONFIGURE ID Templates screen: ID Templates allow you to define how your point, line, and area IDs will look. Since this is a reference station, ID Templates are irrelevant so we will leave this page as displayed on the left and continue to the next screen. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Seismic Recording screen.	

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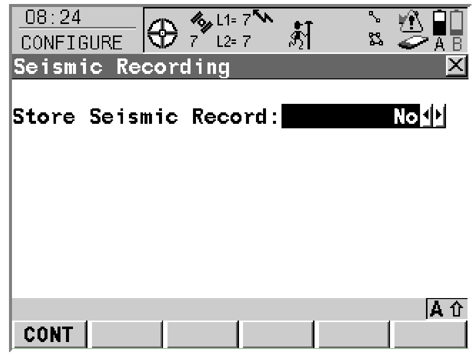
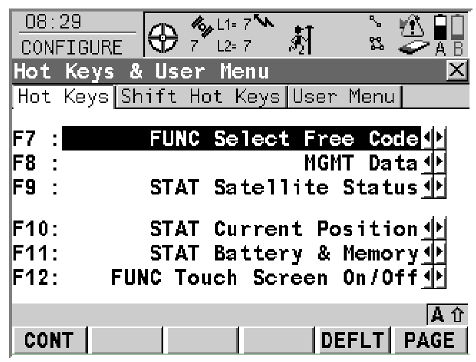
3.1 Editing the Real-Time Reference Configuration,
Continued

Step	Action	Display
18	In the CONFIGURE Seismic Recording screen: Certain information needs to be documented for seismic surveying. Since this does not apply at the reference station and we are not doing a seismic survey, we will leave this screen as displayed on the right and continue on to the next screen. • Press the **F1 (CONT)** button. This takes us to the CONFIGURE Hot Keys & User Menu screen.	
19	In the CONFIGURE Hot Keys & User Menu screen: Your GPS1200 receiver has many timesaving features. Being able to configure hot keys is one of them. Hot keys provide a shortcut for quickly and directly carrying out functions or starting application programs assigned to the keys. Since there are very few applications that we would need to quickly access at the reference station, we will leave this screen as the default settings and continue on to the next screen. **Note**: We will explore hot keys in greater detail in chapter *4.0 The Real-Time Rover Configuration Set*. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Display, Beeps, Text screen.	

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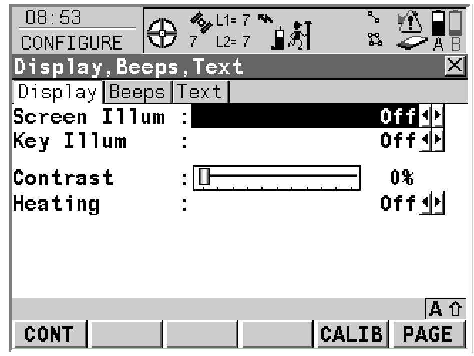
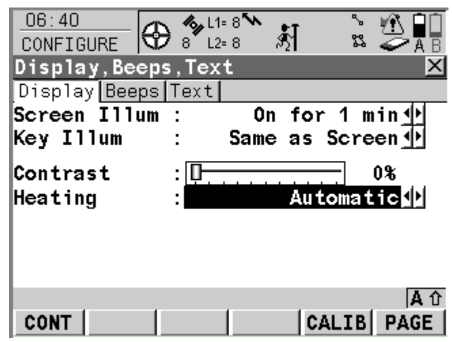
3.1 Editing the Real-Time Reference Configuration,
Continued

<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr><td>20</td><td>
In the CONFIGURE Display, Beeps, Text screen:
Here you can define how you would like the appearance of the screen to be, configure the notification sounds, and configure the behavior of the buttons.
The F5 (CALIB) button allows you to calibrate the touch screen.
The Screen Illum field controls the illumination of the screen. This provides a backlighting of the screen. This can be useful in dark situations. In this example we have set the screen illumination to remain on for 1 minute after the last time the screen or button has been touched.
The Key Illum field controls the keypad buttons illumination. In this example we have set the buttons to behave as the screen.
The Contrast field adjusts the contrast of the screen.
The Heating field controls the heating of the touch screen. When set to “Automatic”, the heating turns on at 5ºC and shuts off when the outside temperature reaches 7ºC. We have set the heating to “Automatic”.
Note: When you turn heating on, a warning message alerts you that heating will consume power.

Decide whether you want heating off or on and press the F4 (NO) button or the F6 (YES) button accordingly.
Tap on the “Beeps” tab.

This takes you to the Beeps page of the CONFIGURE Display, Beeps, Text screen.
</td><td>




</td></tr>
</table>

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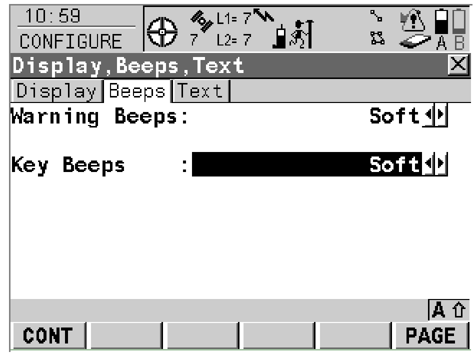
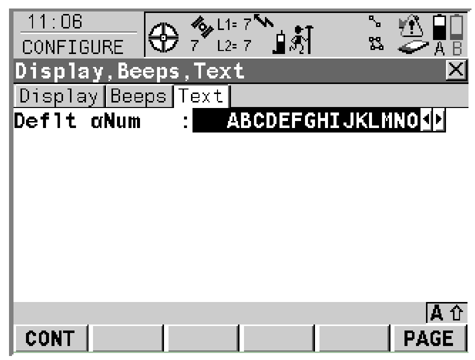
3.1 Editing the Real-Time Reference Configuration,
Continued

Step	Action	Display
21	In the Beeps page of the CONFIGURE Display, Beeps, Text screen: Here you can adjust if the receiver will emit sounds and how loud they will be. • Adjust the settings to your preference. • Tap on the “Text” tab. This takes you to the Text page of the CONFIGURE Display, Beeps, Text screen.	
22	In the Text page of the CONFIGURE Display, Beeps, Text screen: Here you can adjust the different character sets used to define how numbers and letters in your text will appear. Most likely you will leave this as the default setting and continue. • Press the **F1 (CONT)** button. This takes you to the Start Up page of the CONFIGURE Start Up & Power Down screen.	

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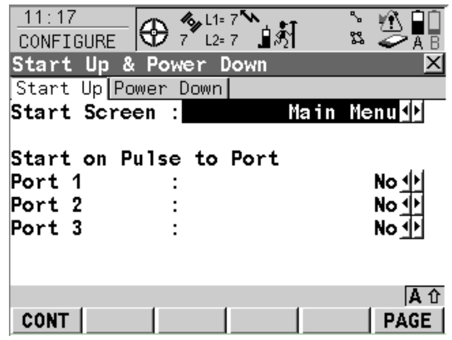
3.1 Editing the Real-Time Reference Configuration,
Continued

Step	Action	Display
23	In the Start Up page of the CONFIGURE Start Up & Power Down screen: The settings on the Start Up screen define the behavior of the instrument for a general start up and start up after a power loss. The Power Down screen defines the receiver's behavior after there has been either a sudden loss of power or a gradual loss of power. In the "Start Up" page: The **Start Screen** field provides a choice of which screen will appear first once the receiver has been powered on. Typically we leave this as "Main Menu". The **Start on Pulse to Port** field defines if the receiver will turn on after it has received a pulse into one of its ports. We will leave this as it appears on the display on the right. • Tap on the "Power Down" tab. This takes you to the Power Down page of the CONFIGURE Start Up & Power Down screen.	

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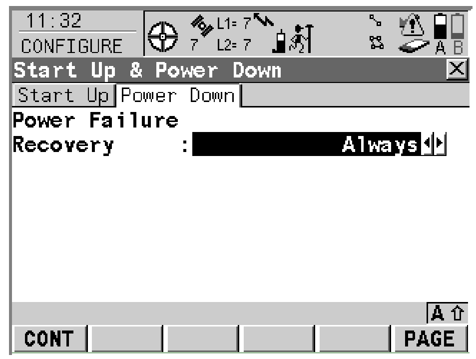
3.1 Editing the Real-Time Reference Configuration,
Continued

Step	Action	Display
24	In the Power Down page of the CONFIGURE Start Up & Power Down screen: Here you can set the behavior of the receiver after there has been a power failure and power has been restored. Setting the **Power Failure Recovery** field to "Always" sets the receiver to power back on and return to the screen it was previously on when the power failure occurred. • Set the **Power Failure Recovery** field to **Always**. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Satellite Settings screen.	

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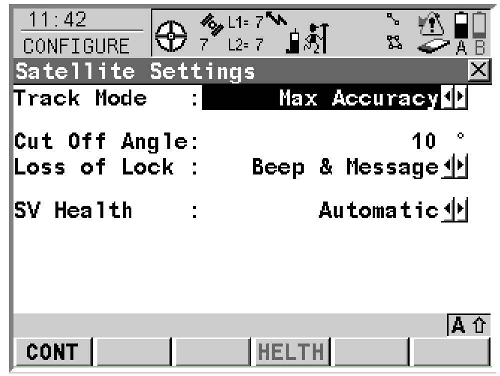
3.1 Editing the Real-Time Reference Configuration,
Continued

Step	Action	Display
25	In the CONFIGURE Satellite Settings screen: The settings on this screen define which satellites and satellite signals will be used by the receiver. Setting the **Track Mode** to “Max Accuracy” enables the receiver to track satellites in a manner that is best for normal surveying operations. This is used for RTK and post processing. • Leave the **Track Mode** field set to **Max Accuracy**. The cut off angle sets the elevation in degrees below which satellite signals are not recorded and are not shown to be tracked. For real-time, the recommended setting is “10º”. • Leave the **Cut Off Angle** field to **10º**. The **Loss of Lock**: “Beep & Message” provides a warning beep when the receiver does not have enough satellites (under 4) to compute a position. • Leave the **Loss of Lock** field set to **Beep & Message**. This step is continued on the following page.	

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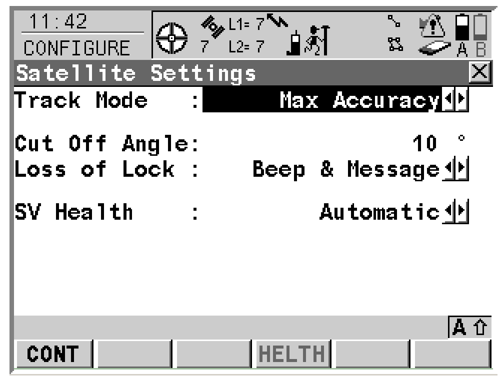
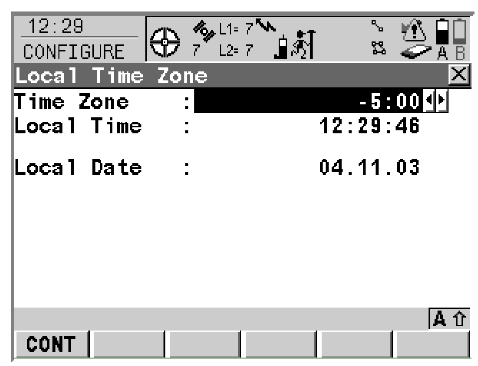
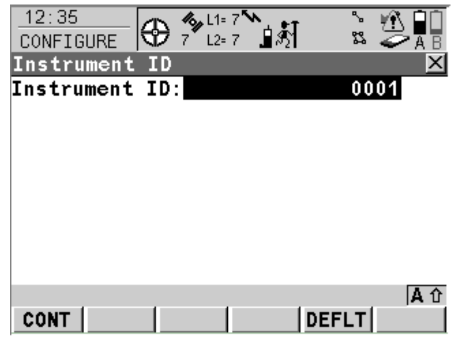
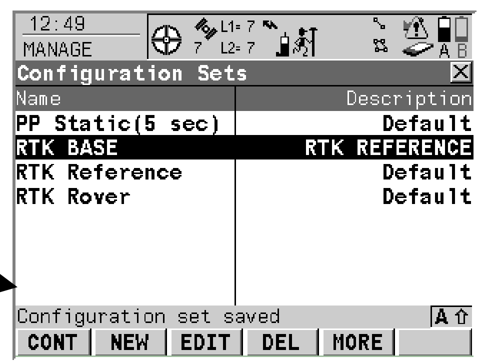
3.1 Editing the Real-Time Reference Configuration,
Continued

Step	Action	Display
25	This step is continued from the previous page. Continuing in the CONFIGURE Satellite Settings screen: The **SV Health** field sets the satellite tracking behavior. If it is set to “Automatic”, the incoming satellite signals are then monitored by the receiver. Data from signals that are flagged as unhealthy are neither recorded nor used. • Set the **SV Health** field to **Automatic**. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Local Time Zone screen.	
26	In the CONFIGURE Local Time Zone screen: Here you can set your local time. • Set the local time zone. You will see the time on the receiver adjust as you change the time zone. Adjust the zone so that the receiver matches your local time. **Note**: GPS is one of the best ways to acquire very accurate time. Once you have the time zone set on your receiver, start your RTK survey and, once your receiver has computed a position, you can use your GPS receiver to set your watch to one of the most accurate times available. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Instrument ID screen.	

Continued on next page

3.1 Editing the Real-Time Reference Configuration,
Continued

Step	Action	Display
27	In the CONFIGURE Instrument ID screen: The settings on this screen define the instrument's identification number. This number is used for the generation of file names. You can create your own ID number (either alpha or numeric) or use the default ID number which is the last 4 digits of the receiver's serial number. • Leave the default ID or create your own. **Note**: To avoid confusion, do not label all your receivers with the same instrument ID. The **F5 (DEFLT)** button allows you to reset the instrument ID number back the receiver's default ID number. • Press the **F1 (CONT)** button. This saves the settings we have just made to our new RTK reference configuration set and returns us to the MANAGE Configuration Sets screen.	
28	In the MANAGE Configuration Sets screen: Congratulations you have just edited an RTK reference configuration set. Notice the message alerting us that the configuration set has been saved. Pressing **F1 (CONT)** will make the newly edited configuration set the active configuration set and return you to the Main Menu. • Press the **F1 (CONT)** button. This returns you to the Main Menu.	

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3.1 Editing the Real-Time Reference Configuration,
Continued

Summary

You have just completed editing a real-time reference configuration set. This real-time reference receiver is now ready to be set up in the field (see chapter *5.0 Starting the Real-Time Reference*).

4.0 The Real-Time Rover Configuration Set

In this Chapter

The following sections of this chapter explain the procedures for configuring a real-time rover configuration set and also explain what CQ is.

Section	Step	Topic
4.1	-	Editing a Real-Time Rover Configuration Set
4.1	2	Languages
4.1	3-6	Units & Formats
4.1	7-17	Real-Time Mode
4.1	18	Configure Antenna
4.1	19-21	Display Settings
4.1	22	Coding
4.1	23	Logging of Raw Observations
4.1	24-26	Point Occupation Settings
4.1	27	Quality Control Settings
4.1	28	ID Templates
4.1	29	Seismic Recording
4.1	30-31	Hot Keys
4.1	32-34	Display, Beeps, Text
4.1	35	Start Up and Power Down
4.1	37	Satellite Settings
4.1	38	Local Time Zone
4.1	39	Instrument ID
4.2	-	Coordinate Quality
4.3		Additional Information

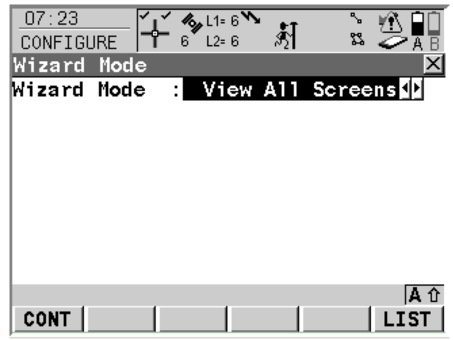
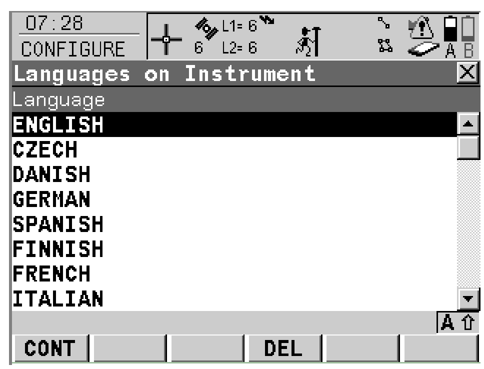
About This Configuration Set

The real-time rover configuration set controls the operation of the real-time rover receiver. Please note that these settings are not the only possible configuration settings for this type of operation. This example should be used as a template for designing your own rover configuration sets.

4.1 Editing a Real-Time Rover Configuration Set

New Configuration Set

This section lists the steps in editing a user-defined Real-Time Rover Configuration Set. These steps continue from chapter *2 Configuration Sets,* section *2.3 Creating a Configuration Set*.

Step	Action	Display
1	Continuing in the CONFIGURE Wizard Mode screen: In the Wizard mode we have the option of viewing all screens available, a reduced amount of screens, or going to an individual parameter screen by pressing the **F6 (LIST)** button and selecting a screen to access. In this example we will view all screens. • Leave the **Wizard Mode** field to the default "View All Screens". • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Languages on Instrument screen.	
2	In the CONFIGURE Languages on Instrument screen: • Select a language. **Note**: You can delete any language that you may never require by highlighting the specific language and pressing the **F4 (DEL)** button. In all likelihood your receiver did not come with these additional non-North American languages. When finished: • Press the **F1 (CONT)** button. This takes you to the Units page of the CONFIGURE Units & Formats screen.	

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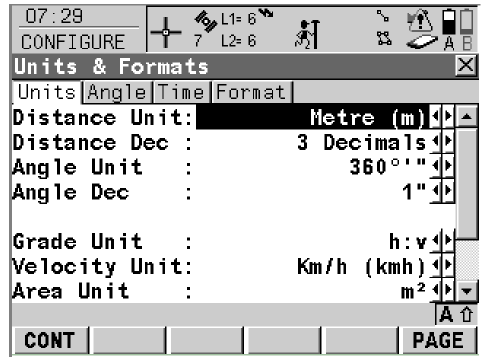
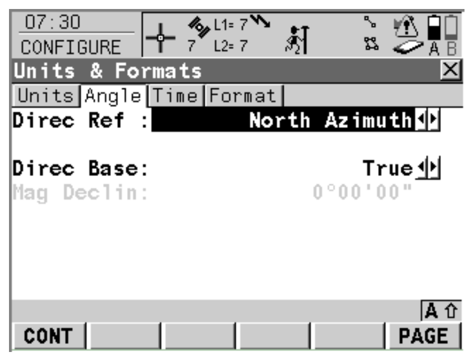
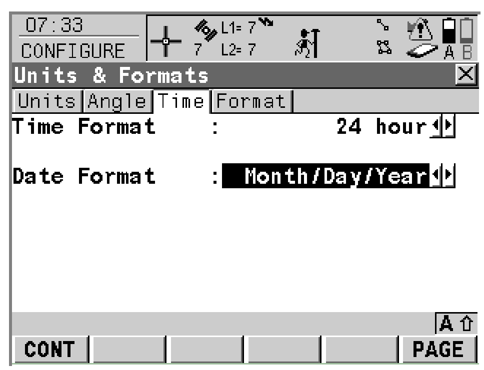
4.1 Editing a Real-Time Rover Configuration Set, *Continued*

Step	Action	Display
3	In the “Units” page of the CONFIGURE Units & Formats screen: • Set the units you prefer to use. (Refer to chapter section *1.1.1 Controller Access* to learn how to access other field selections.) When finished: • Tap on the “Angle” tab to access the next page. This takes you to the “Angle” page of the CONFIGURE Units and Formats screen.	
4	In the “Angle” page of the CONFIGURE Units and Formats screen: • Decide how you would like to see angles displayed. • Tap on the “Time” tab to access the next page. This takes you to the “Time” page of the CONFIGURE Units and Formats screen.	
5	In the “Time” page of the CONFIGURE Units and Formats screen: • Set the time format that you prefer. In this example we selected “24 hour”. • Select the data format that you prefer. In this example we selected “Month/Day/Year”. • Tap on the “Format” tab to access the next page. This takes you to the “Format” page of the CONFIGURE Units and Formats screen.	

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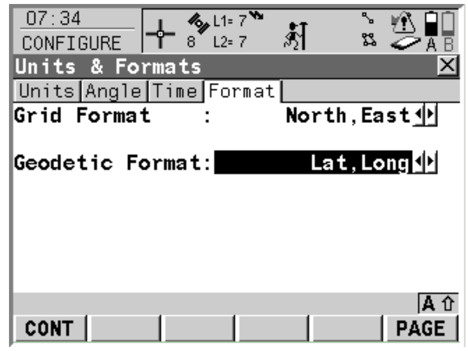
4.1 Editing a Real-Time Rover Configuration Set, *Continued*

Step	Action	Display
6	In the “Format” page of the CONFIGURE Units and Formats screen: • Set the Grid and Geodetic formats to your preference. • Press the **F1 (CONT)** button when finished. This takes you to the CONFIGURE Real - Time Mode screen.	

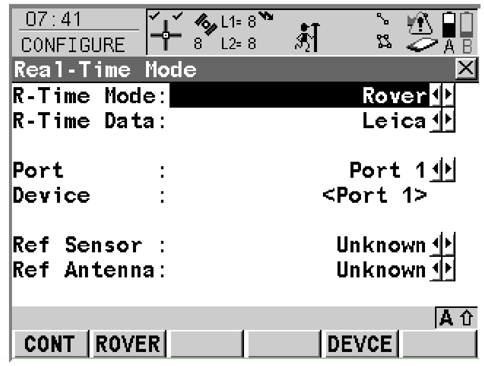
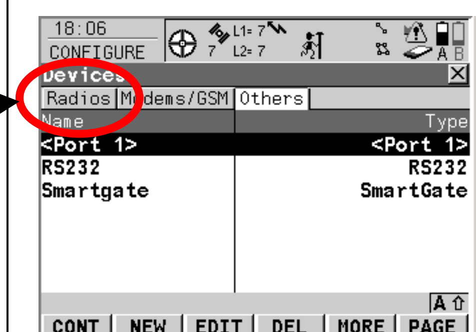
Real – Time Mode: Radio Devices

Here is where you select a communication device. In this example we will be selecting a Pacific Crest PDL radio. If you would like to use an Intuicom spread-spectrum radio, see chapter *10 RTK Communications* to learn how to add the Intuicom radio as a radio device.

We also assume that you will be using Leica GPS1200 receivers exclusively. If you are mixing Leica and non-Leica receivers, please refer to the *GPS1200 Technical Reference Manual, Chapter 19.3.3* for more information on setting the proper data format.

Continued on next page

4.1 Editing a Real-Time Rover Configuration Set, *Continued*

Step	Action	Display
7	In the CONFIGURE Real - Time Mode screen: Set the following: • Set the **R-Time Mode** field to **Rover**. • Set the **R-Time Data** field to **Leica**. • Set the **Port** field to either **Port 1** or **Port 3**. **Note**: Typically we set Port 1 as the real-time port. It is important to remember to attach whichever real-time communication device you are using to the port that you have assigned here. For sanity's sake, let's assign the communication device to "Port 1" and you should remember this when you physically connect your communication device (in this example a Pacific Crest PDL radio) to the receiver. • Press the **F5 (DEVCE)** button. This takes you to the CONFIGURE Devices screen.	
8	In the CONFIGURE Devices screen: • Tap on the "Radios" tab. This takes you to the Radios page of the CONFIGURE Devices screen.	

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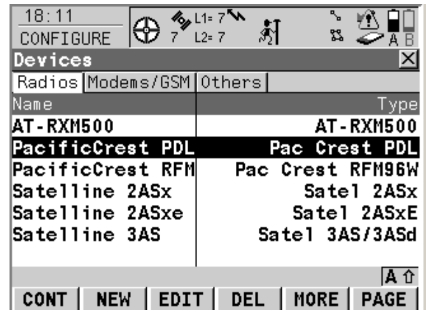
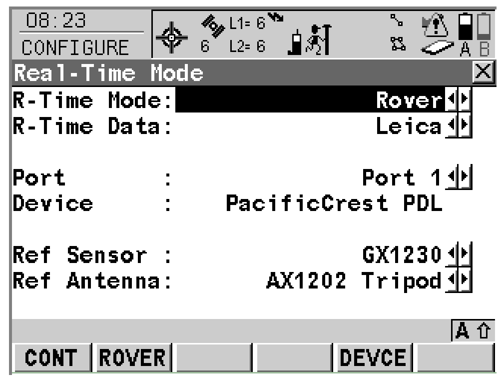
4.1 Editing a Real-Time Rover Configuration Set, *Continued*

Step	Action	Display
9	In the Radios page of the CONFIGURE Devices screen: • Select a communication device. **Note:** Remember in this example we are selecting a **Pacific Crest PDL** radio. • Press the **F1 (CONT)** button. This returns you to the CONFIGURE Real – Time Mode screen.	
10	In the CONFIGURE Real – Time Mode screen: The two fields described below are referring to the reference receiver **not** the rover receiver. • Set the **Ref Sensor** field to **GX1230.** • Set the **Ref Antenna** field to **AX1202 Tripod**. • Press the **F2 (ROVER)** button. This takes you to the CONFIGURE Additional Rover Options screen.	

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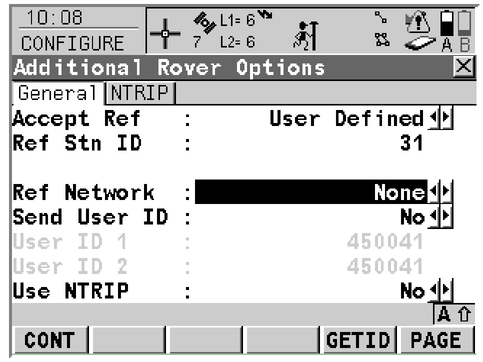
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
11	In the CONFIGURE Additional Rover Options screen: From *Step 11* of chapter *3 The Real-Time Reference Configuration Set* in section *3.1 Editing a Real-Time Reference Configuration Set*, we instructed the RTK reference receiver to transmit its Reference Station ID as "31". We now need to instruct the rover to only accept RTK transmissions that have this ID in their messages (hopefully this will be the only reference receiver in the area using this particular reference ID number). • Set the **Accept Ref** field to **User Defined**. • Set the **Ref Stn ID** field to **31**. The **Ref Network** field defines the type of reference network to be used. • Leave the **Ref Network** field as **None**. The **Send User ID** field activates the sending of a Leica proprietary NMEA message defining the user. • Leave the **Send User ID** field as **No**. NTRIP (Network Transport of RTCM via Internet Protocol) is the protocol for streaming of GPS RTK data over the internet. This means that it is now possible to connect to the Internet and receive RTK corrections. See section *4.4* at the end of this chapter to learn where to find more information on NTRIP. In this example we will not be using NTRIP. • Leave the **Use NTRIP** field as **No**. • Press the **F5 (GETID)** button. This takes you to the CONFIGURE Scan Reference Station screen.	

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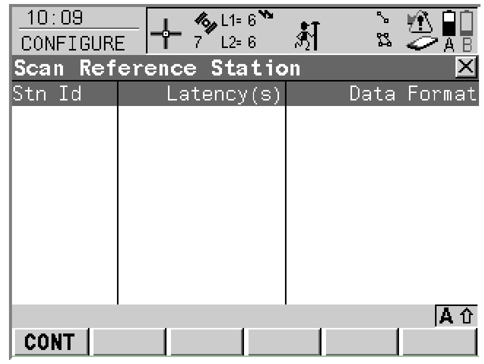
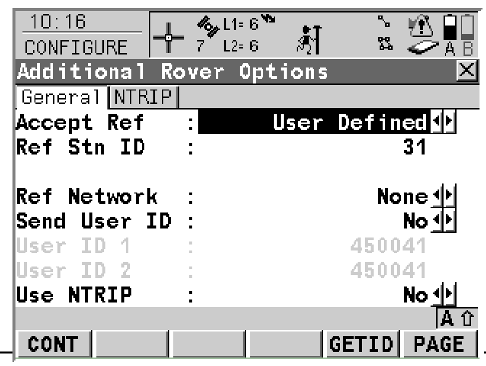
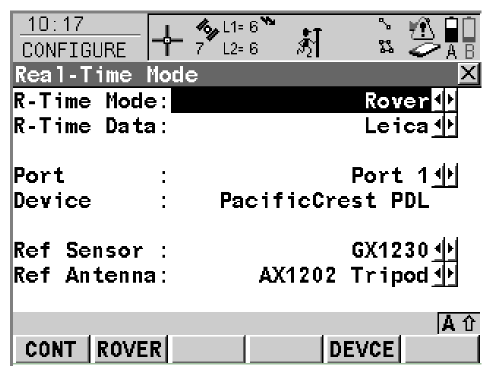
4.1 Editing a Real-Time Rover Configuration Set, *Continued*

Step	Action	Display
12	In the CONFIGURE Scan Reference Station screen: This is where you see if you are receiving data from your base. Your base's station ID would be displayed in the **Stn Id** field along with any programmed latency and data format and they would be found in their respective columns. • Press the **F1 (CONT)** button. This returns you to CONFIGURE Additional Rover Options screen.	
13	In the CONFIGURE Additional Rover Options screen: • Press the **F1 (CONT)** button. This returns you to the CONFIGURE Real-Time Mode screen.	
14	In the CONFIGURE Real-Time Mode screen: • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Radio Channel screen.	

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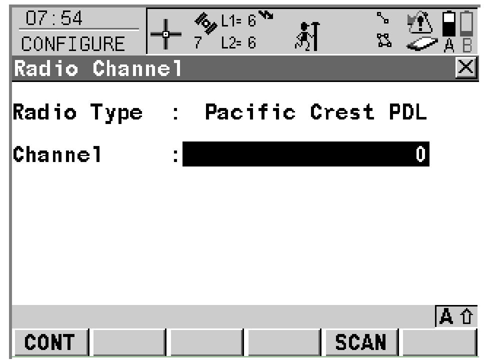
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
15	In the CONFIGURE Radio Channel screen: The sensor queries the radio and returns the current channel number of the radio. If you receive a message warning that there was no response from radio, this indicates the receiver was unable to communicate with the radio. Check to see if the radio is connected to the correct port on the receiver (remember it was Port 1 from *Step 7* above). For more information of radio issues, see chapter *10 RTK Communications*, section *10.3 Radio Communication Trouble Shooting*. To see which reference station you are receiving from: • Press the **F5 (SCAN)** button. This takes you to the CONFIGURE Scan Reference Station screen.	

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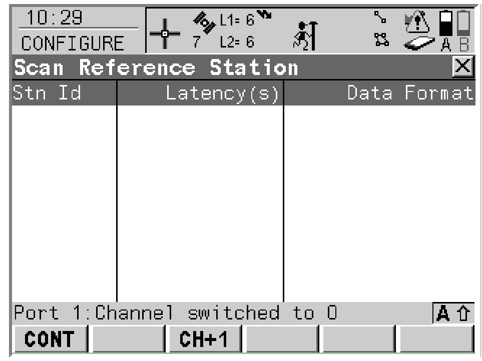
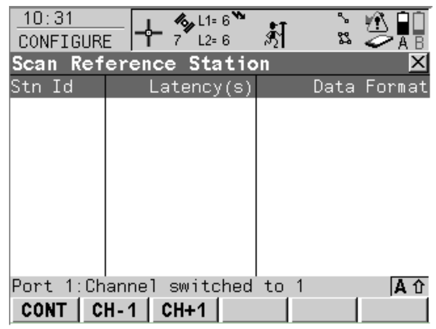
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
16	In the CONFIGURE Scan Reference Station screen: This screen is similar to the screen we saw in *Step 6* except now the **F3 (CH+1)** button is available. Remember from *Step 6* that this is where you would see if you are receiving data from your base. Your base's station ID would be displayed in the **Stn Id** field along with any programmed latency and data format and they would be found in their respective columns. Notice that the sensor changes the radio's channel to what was selected in the previous step. If we press the **F3 (CH+1)** button, the sensor changes the channel of the radio and then lists the station IDs from whatever reference-station message it is receiving on that channel. We also see a message alerting us that the radio's channel has been changed. The **F2 (CH-1**) button has now become active. If you have pressed the **F3 (CH+1)** button, press the **F2 (CH-1**) button to set the radio back to the channel we had initially set it to in *step 15*. **Remember** we set the reference receiver's radio to channel "0" in chapter *3, Step 13* so we must set the rover radio's channel to be the same as the reference's channel. • Press the **F1 (CONT)** button. This returns you to the CONFIGURE Radio Channel screen.	 

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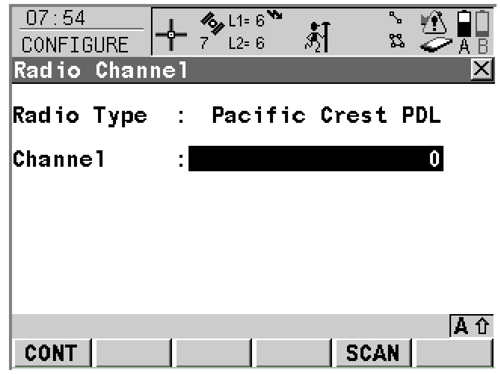
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
17	In the CONFIGURE Radio Channel screen: • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Antenna & Antenna Heights screen.	

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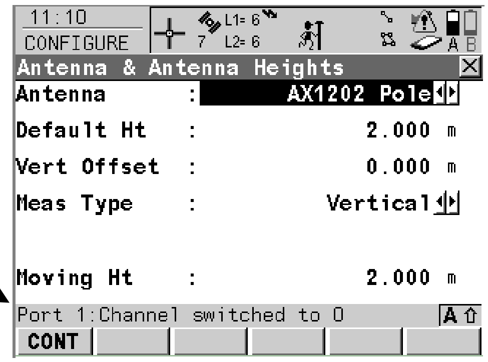
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
18	In the CONFIGURE Antenna & Antenna Heights screen: **Note**: After you pressed the **F1 (CONT)** button in s*tep 17*, and came to this screen, notice that a message at the bottom of the screen reports that the radio has been changed to 0. • Select an Antenna. Unless you are using a different antenna, leave this as the default **AX1202 Pole** and leave the remaining fields as shown as well. The **Default Height** field sets the antenna height for the current Configuration Set. This becomes the default antenna height during the use of application programs. The antenna height can be changed during a survey. The initial value depends on the selected antenna. • Leave the **Vert Offset**, **Meas Type**, and **Horiz Offset** fields as the defaults. The **Moving Ht** field sets the default antenna height for auto points and for the moving part of a track when logging raw observations. Since we are not doing either, leave it as the default 2 metres. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Display Settings screen.	

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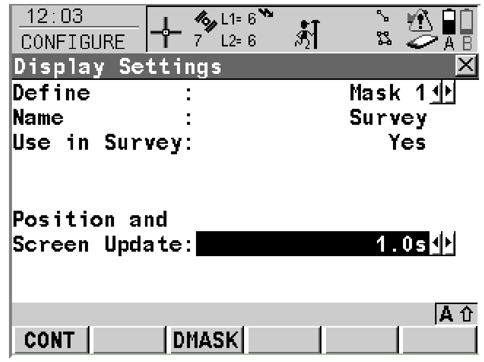
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
19	In the CONFIGURE Display Settings screen: Display settings define the parameters shown on a Survey screen. There are 4 display masks available. **Mask 1** is always shown on the Survey screen. **Masks 2** and **3** can be shown or hidden on the Survey screen. **Mask 4** is never shown on the Survey screen and is reserved for application programs. The **Use in Survey** field indicates if the page is shown or hidden as a page in the rover survey. The **Position and Screen Update** field (ranging between 0.05 seconds and 1.0 seconds) determines how often positions are computed and the screen display is updated. You can set this to be as fast as 20 times a seconds but for most work this appears to be too fast and the numbers are often blurred. In this example we will define the look of the Survey screen. With **Mask 1** displayed in the **Define** field: • Press the **F3 (DMASK)** button. This takes you to the CONFIGURE Define Display Mask 1 screen.	

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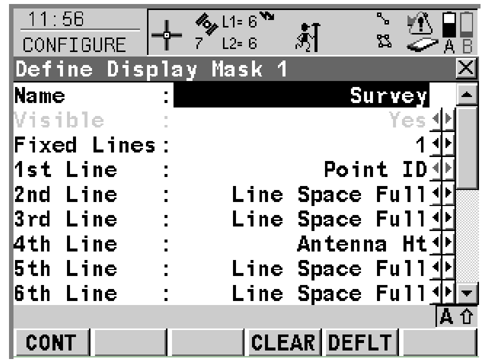
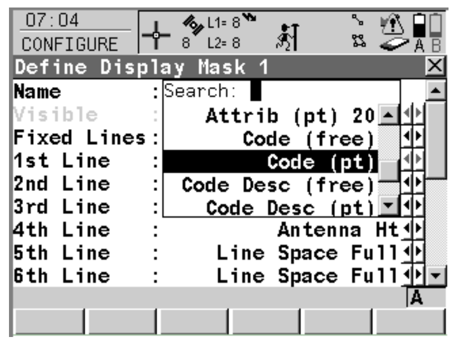
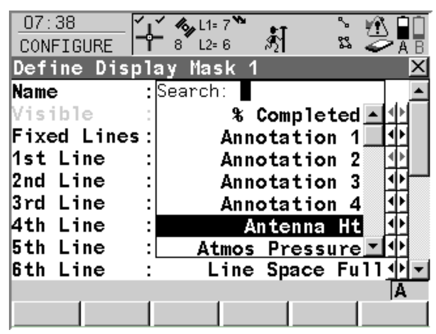
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
20	In the CONFIGURE Define Display Mask 1 screen: Here we can define which fields will appear in the Survey screen. **Note**: The choices that have been selected in this example are only suggestions. To change a field selection, tap on the particular field and scroll to the entry that would you like to see appear, tap on the entry and it is now selected. Continue until you are satisfied with what will be displayed. The **Name** field is **Survey** and cannot be changed. The **Visible** field is grayed out because the Survey screen is always visible. The **Fixed Lines** field defines how many lines do not scroll in the Survey screen. The **1st Line** field is fixed with **Point ID**. The **2nd Line** field we will leave as **Line Space Full**. • Set the **3rd Line** field to **Code (pt)**. **Hint**: You can easily jump to a selection by typing the first letter of the selection choice you wish to make. For "Code" type a "c" and you will see the highlighted selection become the first entry in the choice list that begins with a "c". • Set the **4th Line** field to **Line Space Full**. • Set the **5th Line** field to **Antenna Ht**. • Set the **6th Line** field to **Line Space Full**. • Set the **7th Line** field to **RTK Positions**. • Set the **8th Line** field to **Line Space Full**. This step continues on the following page.	  

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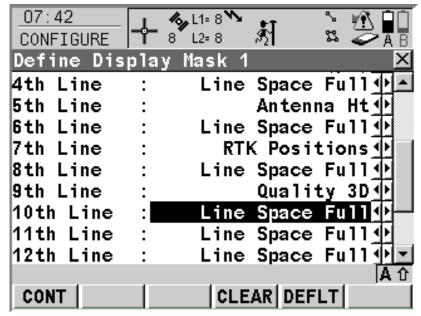
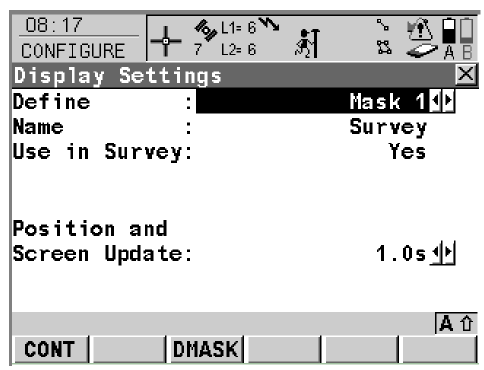
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
20	Continuing in the CONFIGURE Define Display Mask 1 screen: • Set the **9th Line** field to **Quality 3D**. • Set the remainder to **Line Space Full**. The **F4 (CLEAR)** button sets all fields to “Line Space Full”. The **F5 (DEFLT)** button recalls the default settings for the display mask. After you have selected which items you prefer to have displayed in the Survey screen, • Press the **F1 (CONT)** button. This returns you to the CONFIGURE Display Settings screen.	
21	In the CONFIGURE Display Settings screen: You may continue editing the remaining display masks by selecting another mask to edit in the **Define** field and pressing the **F3 (DMASK)** button again. In this example we will skip that step and continue on to Coding Settings screen. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Coding Settings screen.	

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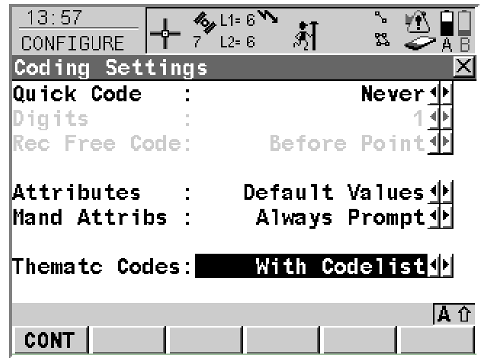
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
22	In the CONFIGURE Coding Settings screen: The settings on this screen define the method of coding. Quick coding is the storing of a point plus a thematical or free code using a minimum number of keystrokes. The choices for quick coding are “Never”, “On”, “Off”. In this example we will leave it as “Never”. • Set the **Quick Code** field to **Never**. The **Attributes** field allows you to select which attribute values are displayed under certain circumstances. This is applicable to both the storing and displaying of attribute values. Here you have two choices: “Default Values” – when available, the default attribute values, as stored in the job, are displayed and stored. “Last Used” – when available, the last used attribute values as stored in the job are displayed and stored. In this example we will use “Default Values”. • Select **Default Values** in the **Attributes** field. The **Mand Attributes** field allows you to always be prompted to enter attribute values for mandatory attributes or you can set it to prompt you only when the attribute does not have a value (e.g. default values or last entered). • Select **Always Prompt** in the **Mand Attributes** field. This step continues on the following page	

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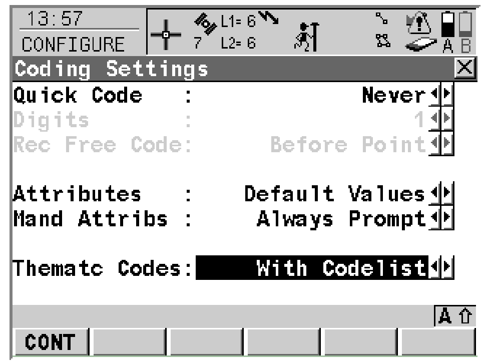
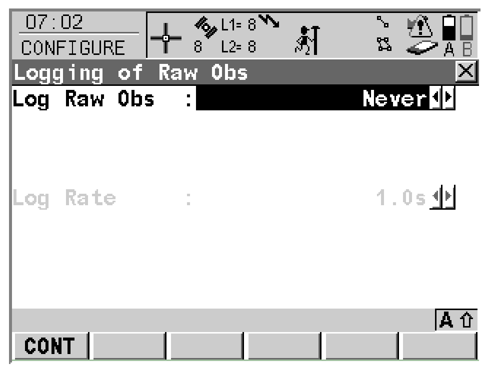
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
22	Continuing in the CONFIGURE Coding Settings screen: The **Thematc Codes** field sets the coding method. If you select “With Codelist”, codes stored within the job codelist can be selected to code points, lines, and areas. If you select “Without Codelist”, codes stored within a job codelist cannot be selected to code points, lines, and areas. Each code must be entered manually. • Select **With Codelist** in the **Thematc Codes** field. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE\ Logging of Raw Obs screen.	

23	In the CONFIGURE Logging of Raw Obs screen:
	
	Logged raw observations are used for
	• Static and kinematic operations. With these operations, raw data is always post-processed in the office. Raw data must therefore be logged at both the reference and rover receivers.
	• Real-time operations
	  • to check the work in the office by post-processing or
	  • to fill in the gaps when a real-time position could not be calculated in the field. This can happen due to problems with the real-time data reception.
	
	Since we are not logging static data at the reference (see chapter *3 The Real-Time Reference Configuration Set*) we will not change this setting.
	
	• Leave the **Log Raw Obs** field to **Never**.
	
	• Press the **F1 (CONT)** button.
	
	This takes you to the CONFIGURE Point Occupation Settings screen.
		

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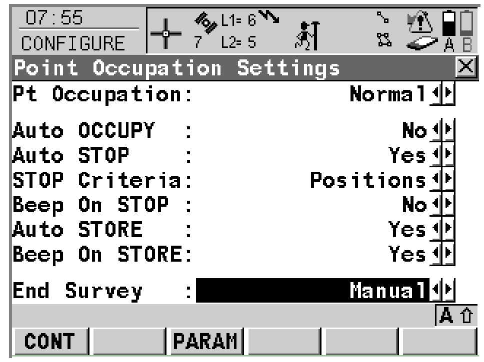
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
24	In the CONFIGURE Point Occupation Settings screen: The settings on this screen define the way in which points are occupied and recorded. In the **Pt Occupation** field you have two choices: **Normal** – Records observations between pressing the **F1 (OCUPY)** button and the **F1 (STOP)** button. This is the recommended setting for normal RTK operations. **Instantaneous** – records the time tag when **F1 (OCUPY)** is pressed. A coordinate is interpolated between the positions at the two neighboring epochs to filter out effects of slight movement. This is recommended when measuring positions at a high speed e.g. in a moving vehicle. • Set the **Pt Occupation** field to **Normal**. The **Auto OCCUPY** field allows you to define when an automatic observation will occur. Since none of these apply to our RTK survey we will leave this field to "No". • Leave the **Auto OCCUPY** field as **No**. The **Auto STOP** field allows you to control how the measurement will stop automatically once the stop criteria has reached 100%. • Set the **Auto STOP** field to **Yes**. The **STOP Criteria** field defines the method used for **Auto Stop** when it is set to "Yes". The setting determines the computation and value to be shown for the **% Completed** field in the display mask and **STATUS Occupation Information** field. This step continues on the following page.	

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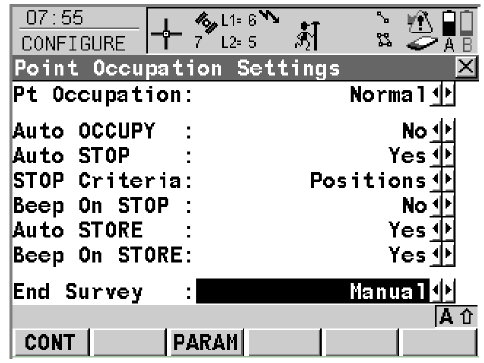
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
24	Continuing in the CONFIGURE Point Occupation Settings screen: Parameters for the selected method are defined in the **PARAM** screen. The choices are “Accuracy” and “Positions”. “Accuracy” will not allow you to complete a measurement unless the coordinate quality of the measured positions is better than a predefined tolerance. “Positions” completes the measurement once a predefined amount of positions has been reached. • Set the **STOP Criteria** field to **Positions**. It would seem like setting the **STOP Criteria** field to “Accuracy” would make more sense, that is, the field operator would not be able to complete a measurement unless the receiver’s accuracy was better than, say, 3cm. But what if you needed an “edge of woods” coded shot and you really only needed to know this to an accuracy of, say, 10-20cm but because of the woods you could only achieve an accuracy of 6cm? If you had set your receiver to “Accuracy” you would never achieve this accuracy thus never getting the shot. But if you had it set to “Positions” you could get the shot and then be warned that the measurement tolerance has been exceeded (See *Step 28*) and then you would be prompted “do you wish to keep the shot?”. So let’s set the **STOP Criteria** field to **Positions**. The **Beep On STOP** field defines that a beep will be emitted after the measurement has been stopped. Since we will be setting the **Beep On STORE** field to “Yes” we will set the **Beep On STOP** field to “No” to reduce the beeping noises will we hear in a work day. • Set the **Beep On STOP** field to **No**. This step continues on the following page.	

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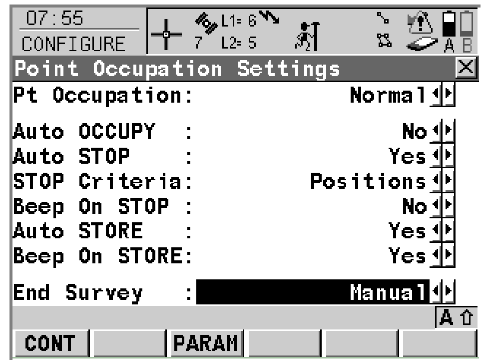
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
24	Continuing in the CONFIGURE Point Occupation Settings screen: The **Auto STORE** field sets the receiver to automatically store the point after the measurement has completed. This will increase productivity by avoiding having to press the **F1 (STORE)** button after every measurement. • Set the **Auto STORE** field to **Yes**. The **Beep On STORE** field allows you to set if an audible beep will sound when the point has been stored. It is useful to know when the measurement is completed so let's set this to "Yes". • Set the **Beep On STORE** field to **Yes**. The **End Survey** field defines the instrument's behavior once a point is stored. For our purposes we are only concerned with ending the survey manually so • Set the **End Survey** field to **Manual**. • Press the **F3 (PARAM)** button. This takes you to the CONFIGURE Real-Time Stop Criteria screen.	

Continued on next page

4.1 Editing a Real-Time Rover Configuration Set, Continued

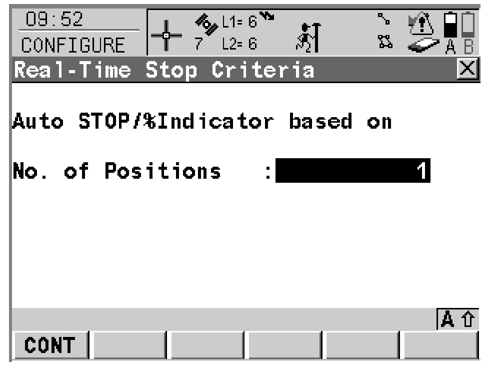
<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr><td>25</td><td>In the CONFIGURE Real-Time Stop Criteria screen:

• Set the No. of Positions field to 1.

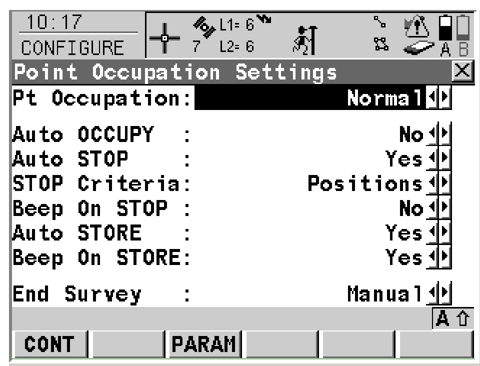
Although setting the number of positions to a number higher than “1” will improve measurement accuracy, typically RTK surveys forfeit accuracy for speed so let’s set this to “1”. You can always choose to increase this number if you desire.

Remember the specified accuracy of Leica’s GPS1200 RTK is 1cm + 1ppm horizontally and 2cm + 1ppm vertically.

• Press the F1 (CONT) button.

This returns you to the CONFIGURE Point Occupations Settings screen.</td><td>
</td></tr>
<tr><td>26</td><td>Continuing in the CONFIGURE Point Occupations Settings screen:

• Press the F1 (CONT) button.

This takes you to the CONFIGURE Quality Control Settings screen.</td><td>
</td></tr>
</table>

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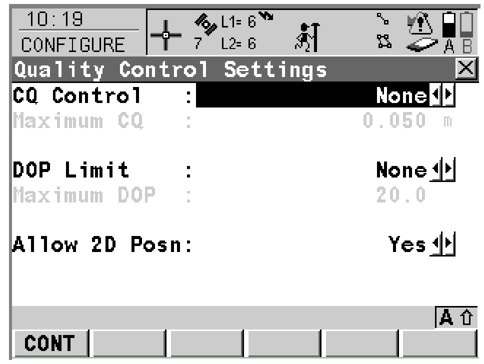
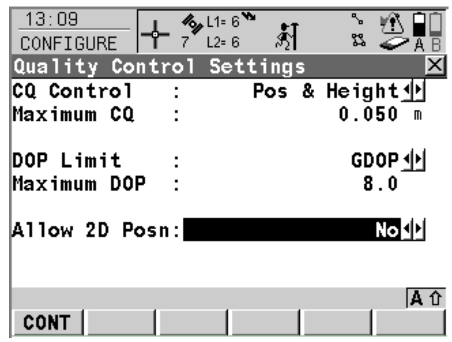
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
27	In the CONFIGURE Quality Control Settings screen: The settings on this screen define the limits for coordinate quality and DOP values accepted for point occupations. The **CQ Control** field defines the type of coordinate quality to be checked before storing a point. If activated, the limit defined in the **Maximum CQ** field is checked before storing a point. A warning signal is given when the limit is exceeded. For more information on CQ see section *4.2 Coordinate Quality* at the end of this chapter. In this example we are setting the Maximum CQ value to be "0.050 metres". This means that if a point is measured but its CQ is above this 0.050 metre tolerance, a warning will appear asking you if you wish to keep this point. You can choose a different value if you think it would be appropriate. • Select **Pos & Height** in the **CQ Control** field. • Set the **Maximum CQ** to a suitable value. This step continues on the next page.	 

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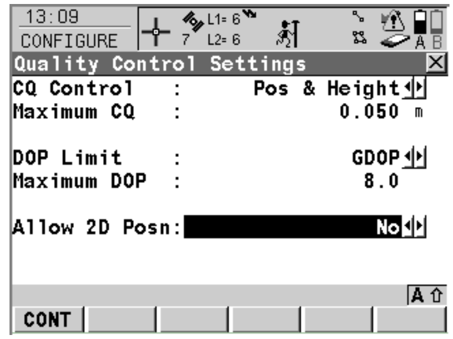
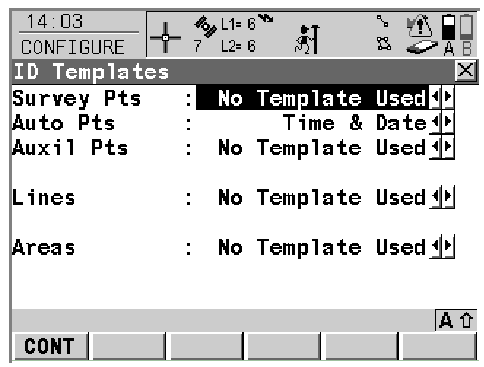
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
27	Continuing in the CONFIGURE Quality Control Settings screen: When the DOP (Dilution Of Precision) limit has been exceeded, GPS positions are unavailable. • Set the **DOP Limit** field to **GDOP**. • Set the **Maximum DOP** field to **8.0**. • Set the **Allow 2D Posn** field to **No**. • Press the **F1 (CONT**) button. This takes you to the CONFIGURE ID Templates screen.	
28	In the CONFIGURE ID Templates screen: ID templates are predefined templates for point, line, or area identification numbers. ID templates save you from having to type in the ID for each object. Although there may be times when creating an ID template saves time, the system is clever enough to know that normally want our point IDs to increment by “1”. So when you are in the Survey screen and you type a number in the **Point ID** field, the system will automatically increment that number after storing the previous point. In this example we will not create any templates. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Seismic Recording screen.	

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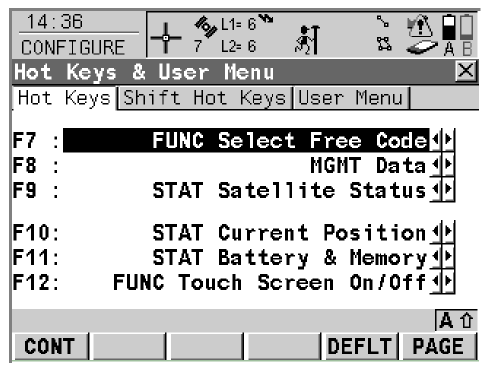
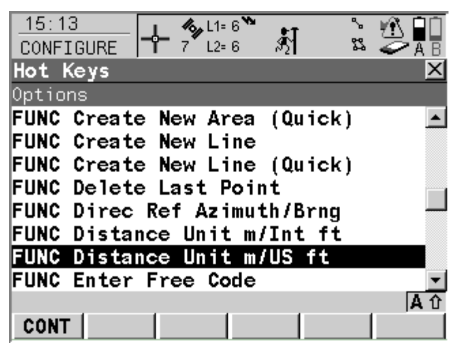
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
29	In the CONFIGURE Seismic Recording screen: Certain information needs to be logged for seismic surveying. In our example we will not be storing seismic information. • Leave the **Store Seismic Record** field as **No**. • Press the **F1 (CONT**) button. This takes you to CONFIGURE Hot Keys & User Menu screen.	
30	In the CONFIGURE Hot Keys & User Menu screen: Your GPS1200 receiver has many timesaving features. Being able to configure hot keys is one of them. Hot keys provide a shortcut for quickly and directly carrying out functions or starting application programs assigned to the keys. The Hot keys' primary level is function buttons **F7-F12**. The secondary level is **SHIFT F7-F12**. In this example we will be just defining the **F7-F12** buttons. • Tap on the **F7** field. • Using the scroll bar, scroll to and highlight the "FUNC Distance Units m/US ft" menu choice • Press the **F1 (CONT)** button. This returns you to the CONFIGURE Hot Keys & User Menu screen.	 

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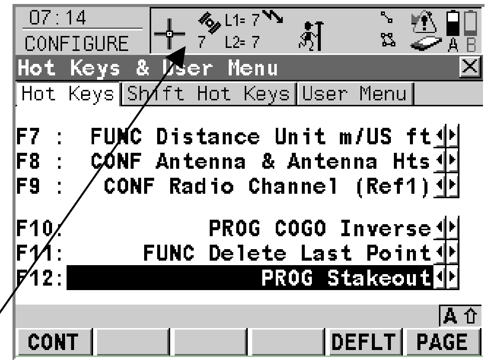
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
31	Continuing in the CONFIGURE Hot Keys & User Menu screen: • Continue assigning functions to the function buttons **F8-F12**. You may want to use our example on the right as a starting point and later decide if there are other functions or applications that you access frequently and need to assign a function button to. We purposely avoided assigning status functions to the function keys because many of these status functions are available via the icons at the top of any screen (see chapter *1* section *1.1.1 Icons* for a description of each icon's function). • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Display, Beeps, Text screen.	

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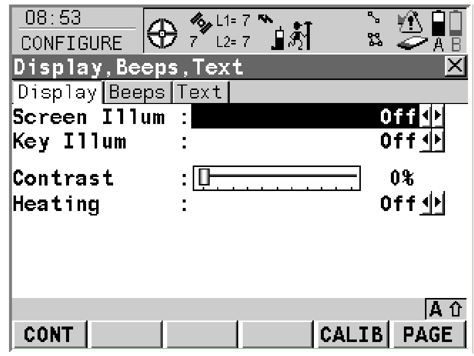
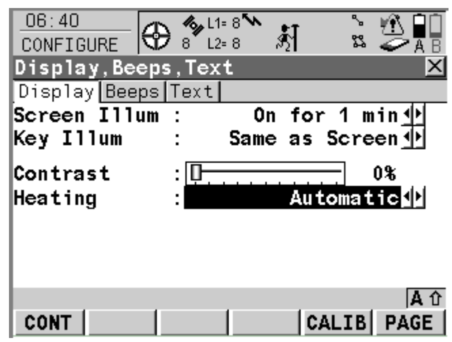
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
32	In the CONFIGURE Display, Beeps, Text screen: Here you can define the appearance of the screens, configure the notification sounds, and configure the behavior of the buttons. The **CALIB** button allows you to calibrate the touch screen. The **Screen Illum:** field controls the illumination of the screen. This provides a backlighting of the screen. This can be useful in dark situations. In this example we have set the screen illumination to remain on for 1 minute after the last time the screen or button has been touched. The **Key Illum :** field controls the keypad buttons illumination. In this example we have set the buttons to behave as the screen. The **Contrast** field adjusts the contrast of the screen. This step continues on the following page.	 

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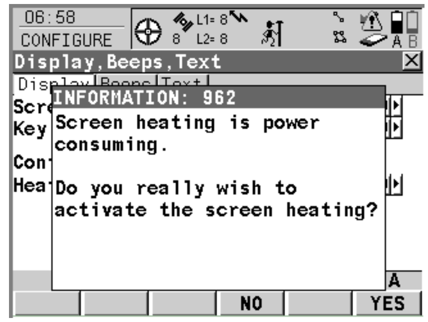
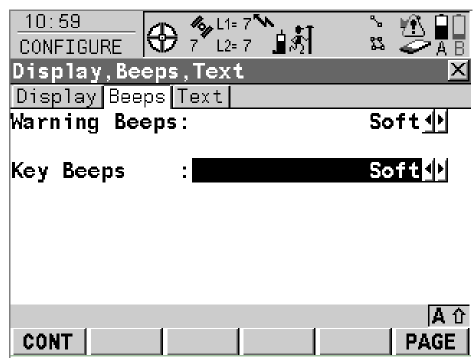
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
32	Continuing in the CONFIGURE Display, Beeps, Text screen: The **Heating** field controls the heating of the touch screen. When set to "Automatic", the heating turns on at 5ºC and shuts off when the outside temperature reaches 7ºC. We have set the heating to **Automatic**. **Note**: When you turn heating on, a warning message alerts you that heating will consume power. • Decide whether you want heating off or on and press the **F4 (NO)** button or the **F6 (YES)** button accordingly. • Tap on the "Beeps" tab. This takes you to the Beeps page of the CONFIGURE Display, Beeps, Text screen.	
33	In the Beeps page of the CONFIGURE Display, Beeps, Text screen: Here you can adjust if the receiver will emit sounds and how loud they will be. • Adjust the settings to your preference. • Tap on the "Text" tab. This takes you to the Text page of the CONFIGURE Display, Beeps, Text screen.	

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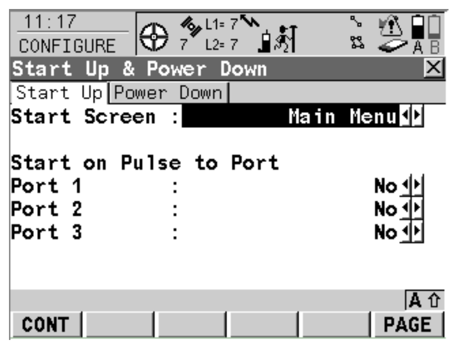
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
34	In the Text page of the CONFIGURE Display, Beeps, Text screen: Here you can adjust the different character sets used to define how numbers and letters in your text will appear. Most likely you will leave this as the default setting and continue. • Press the **F1 (CONT)** button. This takes you to the Start Up page of the CONFIGURE Start Up & Power Down screen.	
35	In the Start Up page of the CONFIGURE Start Up & Power Down screen: The settings on the Start Up screen define the behavior of the instrument for a general start up and start up after a power loss. The Power Down screen defines the receiver's behavior after there has been either a sudden loss of power or a gradual loss of power. In the "Start Up" page: The **Start Screen** field provides a choice of which screen will appear first once the receiver has been powered on. Typically we leave this as "Main Menu". The **Start on Pulse to Port** field defines if the receiver will turn on after it has received a pulse into one of its ports. We will leave this as it appears on the display on the right. • Tap on the "Power Down" tab. This takes you to the Power Down page of the CONFIGURE Start Up & Power Down screen.	

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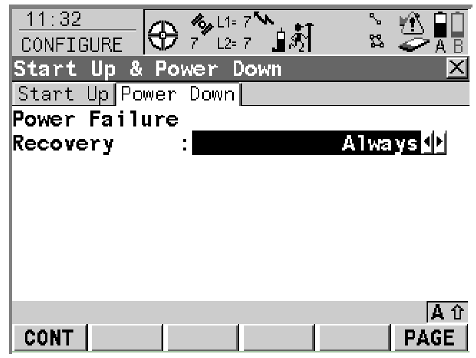
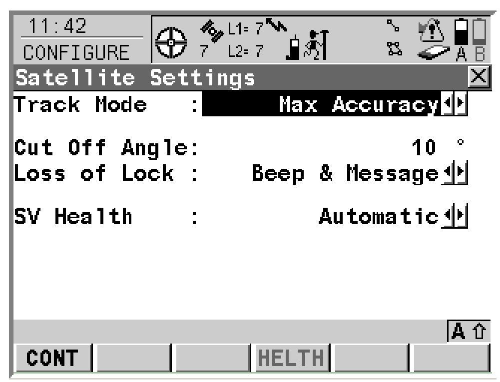
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
36	In the Power Down page of the CONFIGURE Start Up & Power Down screen: Here you can set the behavior of the receiver after there has been a power failure and power has been restored. Setting the **Power Failure Recovery** field to "Always" sets the receiver to power back on and return to the screen it was previously on when the power failure occurred. • Set the **Power Failure Recovery** field to **Always**. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Satellite Settings screen.	
37	In the CONFIGURE Satellite Settings screen: The settings on this screen define which satellites and satellite signals will be used by the receiver. Setting the **Track Mode** to "Max Accuracy" enables the receiver to track satellites in a manner that is best for normal surveying operations. This is used for RTK and post processing. • Set the **Track Mode** to **Max Accuracy**. This step is continued on the following page.	

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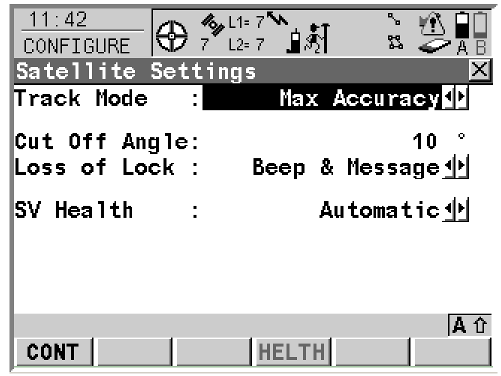
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
37	Continuing in the CONFIGURE Satellite Settings screen: The cut off angle sets the elevation in degrees below which satellite signals are not recorded and are not shown to be tracked. For real-time, the recommended setting is "10º". • Leave the **Cut Off Angle** set to **10º**. The **Loss of Lock**: "Beep & Message" provides a warning beep when the receiver does not have enough satellites (less than 4) to compute a position. • Leave the **Loss of Lock** set to **Beep & Message**. The **SV Health** field sets the satellite tracking behavior. If it is set to "Automatic", the incoming satellite signals are then monitored by the receiver. Data from signals that are flagged as unhealthy are neither recorded nor used. • Set the **SV Health** to **Automatic**. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Local Time Zone screen.	

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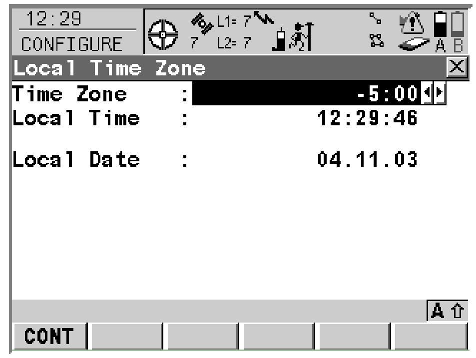
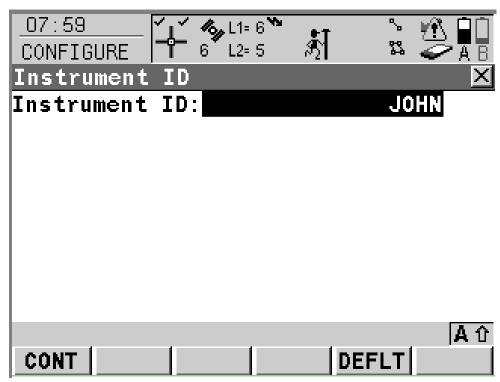
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
38	In the CONFIGURE Local Time Zone screen: Here you can set your local time. • Set the local time zone. You will see the time on the receiver adjust as you change the time zone. Adjust the zone so that the receiver matches your local time. **Note**: GPS is one of the best ways to acquire very accurate time. Once you have the time zone set on your receiver, start your RTK survey and once your receiver has computed a position, you can use your GPS receiver to set your watch to one of the most accurate times available. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Instrument ID screen.	
39	In the CONFIGURE Instrument ID screen: The settings on this screen define the instrument's identification number. This number is used for the generation of file names. You can create your own ID number (either alpha of numeric) or use the default ID number which is the last 4 digits of the receiver's serial number. • Leave the default ID or create your own. **Note**: To avoid confusion do not label all your receivers with the same Instrument ID. The **F5 (DEFLT)** button allows you to reset the Instrument ID number back the receiver's default ID number. • Press the **F1 (CONT)** button. This saves the settings we have just made to our new RTK reference Configuration Set and returns us to the MANAGE Configuration Sets screen.	

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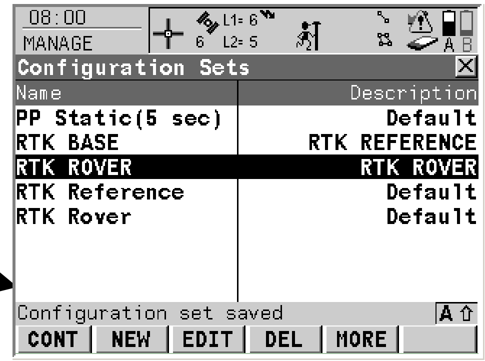
4.1 Editing a Real-Time Rover Configuration Set, Continued

Step	Action	Display
40	In the MANAGE Configuration Sets screen: Congratulations you have just edited a RTK reference configuration set. Notice the message alerting us that the configuration set has been saved. Pressing the **F1 (CONT)** button will make the newly edited configuration set the active configuration set and return you to the Main Menu. • Press the **F1 (CONT)** button. This returns you to the Main Menu.	

Conclusion You have completed editing an RTK rover confirmation set.

4.2 Coordinate Quality

What does CQ Mean?

CQ stands for Coordinate Quality.

Coordinate Quality is:
- computed on the rover for code solutions and phase fixed solutions,
- an indicator for the quality of the observations,
- an indictor for the current satellite constellation,
- an indictor for different environmental conditions,
- derived such that there is at least a two third probability that the computed position deviates from the true position by at least the CQ value, and
- different from the standard deviation.

CQ versus standard deviation
The standard deviation as CQ would often be too optimistic. This is why the computation of the CQ in GPS1200 is not simply based on the basic standard deviation algorithms. For the standard deviation, there is, statistically, 39.3% probability in 2D that the computed position deviates from the true position by less than the standard deviation. This is not enough for a reliable quality indicator. This is particularly true for low redundancy situations such as a constellation of four satellites. In such a case the RMS converges to zero and the standard deviation would show an unrealistically small value.

4.3 Additional Information

More Information

For more information on NTRIP, access the following web site: http://igs.ifag.de/index_ntrip.htm.

5.0 Starting The Real-Time Reference

Introduction

The RTK reference (also known as the RTK base station) can be placed on an existing control point with known coordinates or on a station where approximate reference station coordinates are known. This chapter provides directions for both methods.

Setup on Existing Control

If setting up on an existing control point, the coordinate values for this station must be available prior to starting the reference station occupation. The reference station's coordinate values may be manually entered using **Point Management**, called from a job that was created in SKI-Pro and transferred to the CF card, or called from an ASCII file (see chapter *11 Utilities*, section *11.1* for instructions on how to import an ASCII file).

The default coordinate format for the reference station is WGS84 geodetic (Latitude, Longitude, & Ellipsoid Height). However, grid coordinate values may be used if the proper coordinate system is available on the reference station sensor and attached to the job.

Setup Using Approximate Coordinates

If "known" coordinates are not available, you may use the **HERE** function. The **HERE** function is used to select an approximate (autonomous) WGS84 starting coordinate for the reference station. This is accomplished using only one epoch of the code message received from the GPS satellites.

Alternatively, a **Single Point Position (SPP)** may be performed to get a slightly more accurate starting position. This procedure averages the code positions over time. Since Selective Availability (SA) has been turned off, it is no longer necessary to do a Single Point Position although that option is still available if you wish to use it. Single Point Positions will not be covered in this quick guide.

Whether reference station coordinates are determined using the **SPP** or **HERE** functions, these coordinates (WGS84 – Latitude, Longitude, & Ellipsoid Height) are approximate.

Important Note:

These procedures (**HERE** or **SPP**) must only be performed **once per project**, since any local transformation parameters will be based on this approximate WGS84 position. From this point on, the reference station must always be setup either on this original station, or some other station in the project that has been surveyed in relation to this reference position.

Continued on next page

5.0 Starting The Real-Time Reference, *Continued*

In this Chapter

The following sections of this chapter explain the procedures for starting and ending the reference station survey, as well as selecting the reference station coordinates.

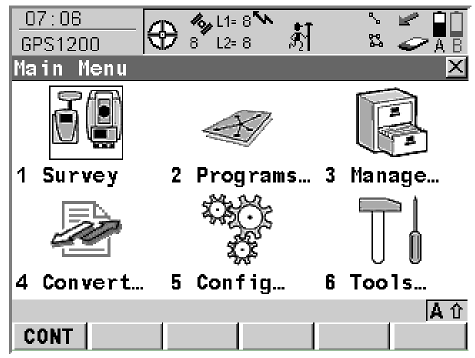
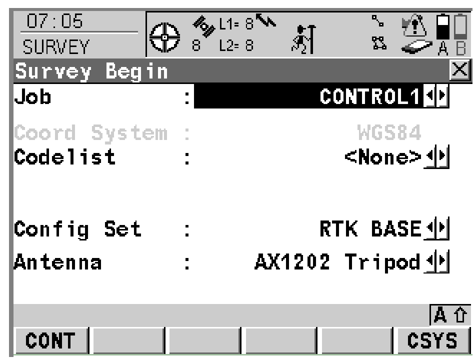
Continued on next page

5.1 Starting the Real-Time Reference Station Survey

Introduction

To start a real time reference station survey, you must have:

- a Configuration Set (See chapter *3 The Real-Time Reference Configuration*),
- a job to store your data (See chapter *1, Section 1.3 Creating a Job*), and
- a coordinate system if you wish to work in any other coordinate system other than WGS84 (See chapter *8.0 Coordinate Systems Management*).

Step	Action	Display
1	From the Main Menu: • Tap on **1 Survey**. This takes you to the SURVEY Survey Begin screen.	
2	In the SURVEY Survey Begin screen, select: • the job that contains your reference station point, • the Real-Time Reference configuration set, and • the correct antenna type. **Note**: Use the **F6 (CSYS)** button to access a list of coordinate systems. Here you can choose the coordinate system for the job. Once all parameters are correct, • Press the **F1 (CONT)** button. This takes you to the SURVEY Set Up Reference Station screen.	

Important Note:

You must now choose one of the following procedures for selecting the reference station coordinates.

- 5.1.1 – Selecting an Existing Control Point
- 5.1.2 – Using the **HERE** Function.

5.1.1 Selecting an Existing Control Point

Entering Known Coordinates

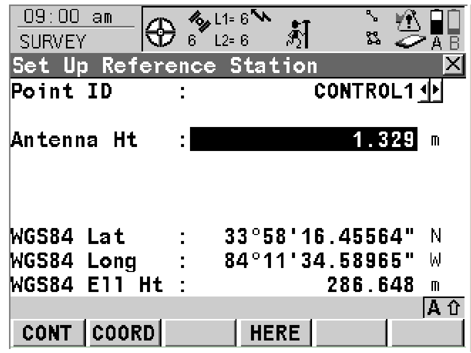
The coordinate values for the reference station must be available in the job prior to starting the reference station survey. If the coordinates do not already exist in the job, the values may be entered manually, using Point Management, or you can use the procedures described in S*ections 5.1.2* and *5.1.3*.

The default format for the reference station coordinates is WGS84 geodetic (Latitude, Longitude, & Ellipsoid Height).

If grid coordinate values are to be used, the proper coordinate system must be available on the reference sensor.

Continued on next page

5.1.1 Selecting an Existing Control Point, *Continued*

Step	Action	Display
1	Continuing in the SURVEY Set Up Reference Station screen (from *Step 2 of 5.1 Starting the Real-Time Reference Station Survey):* • Tap on the **Point ID** field to open a list box containing all the existing points in the current job or use the left/right arrow buttons to toggle through the list of points. Choose the reference station's Point Id from this list. • Tap on the **Antenna Ht** field. • Enter the measured antenna height. When using the Leica height hook, this is the measurement to the **white** mark on the height hook. Notice the coordinates for the point in the **Point ID** field are displayed at the bottom of the screen. The **F2 (COORD)** button changes the coordinate type. **NOTE**: To learn more about the **F4 (HERE)** button, go to the following section, *5.1.2 Using the HERE Function.* • Press the **F1 (CONT)** button to start the survey. This takes you to the SURVEY Survey: screen.	

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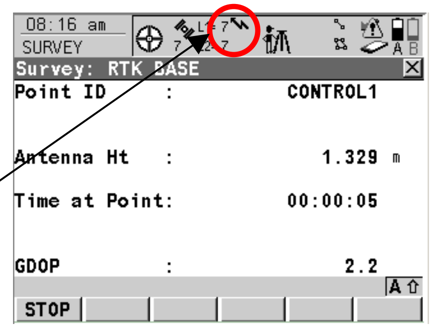
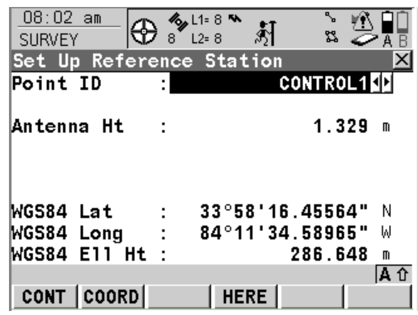
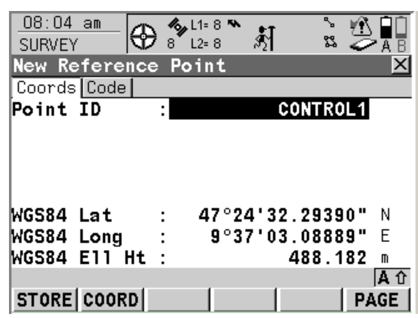
5.1.1 Selecting an Existing Control Point, *Continued*

Step	Action	Display
2	Once the survey is started: Pay attention to the satellite tracking status and radio port status. At least 5 satellites (L1 & L2) are required for RTK initialization and the arrow symbol should now be pulsating upwards. This arrow indicates that the receiver is now sending GPS data to the port (Port 1) that we defined in chapter *3.0 The Real-Time Reference Configuration Set.* The **F1 (STOP)** button will stop the survey and return you to the Main Menu.	

5.1.2 Using the HERE Function

HERE Function

The **HERE** function is used to derive an approximate (autonomous) position for the reference station. Coordinates are in the WGS84 (Latitude, Longitude, & Ellipsoid Height) format. As soon as the GPS1200 receiver has computed its position, it continuously averages its subsequently collected positions. In previous families of GPS, we called that a Single Point Position (SPP). It is no longer necessary to perform a SPP since the receiver is already doing one.
It is recommended that you set up the RTK reference receiver, turn it on but don't start your RTK reference survey until the rover receiver has been set up and turned on. Then go back to the reference receiver and start the Reference survey. By this time the receiver has had time to average a pretty good position.

Step	Action	Display
1	Continuing in the SURVEY Set Up Reference Station screen (from Step 2 of 5*.1 Starting the Real-Time Reference Station Survey):* • Enter the antenna height in the **Antenna Ht** field. • Press the **F4 (HERE)** button to execute the **HERE** function. This takes you to the SURVEY New Reference Point screen.	
2	In the SURVEY New Reference Point screen: • Tap on the **Point Id** field and enter a new point ID. **Note**: In this example we have called our new point "CONTROL1". • Press the **F1 (STORE)** button to store the new reference point. This takes you to the SURVEY Set Up Reference Station screen.	

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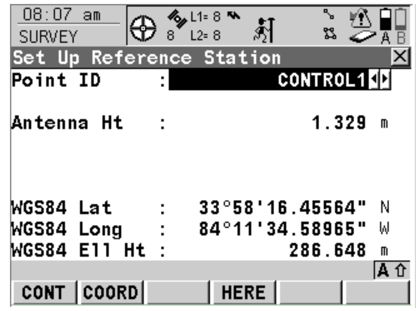
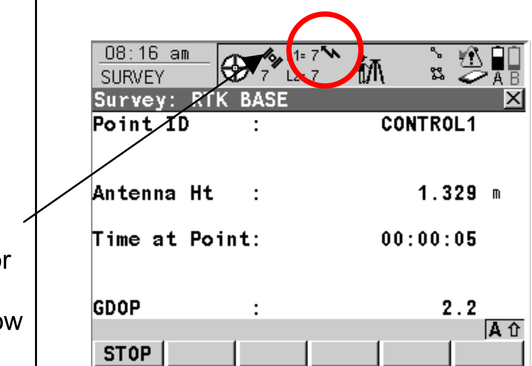
5.1.2 Using the HERE Function, *Continued*

Step	Action	Display
3	In the SURVEY Set Up Reference Station screen: • Press the **F1 (CONT)** button to start the reference station survey. This takes you to the SURVEY Survey: screen.	
4	Once the survey is started: Pay attention to the satellite tracking status and radio port status. At least 5 satellites (L1 & L2) are required for RTK initialization and the arrow symbol should now be pulsating upwards. This arrow indicates that the receiver is now sending GPS data to the port (Port 1) that we defined in chapter *3.0 The Real-Time Reference Configuration Set.* The **F1 (STOP)** button will stop the survey and return you to the Main Menu.	

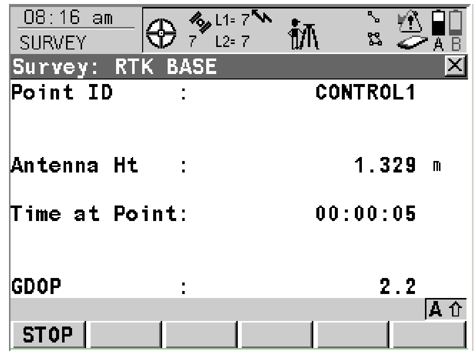
5.2 Ending the Real-Time Reference Station Survey

Stopping the Survey

Prior to ending the reference station survey, the antenna height should be measured and verified against the value entered in the sensor. The tribrach should also be checked to make sure the antenna is still over the point and level.

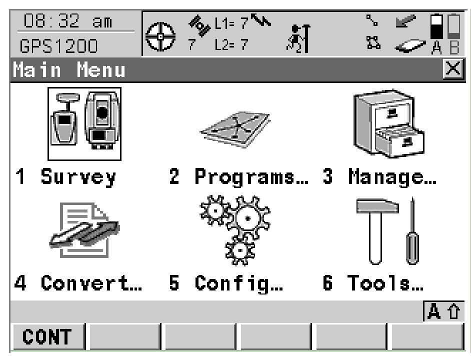
<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr><td>1</td><td>In the SURVEY Survey: RTK Base screen:

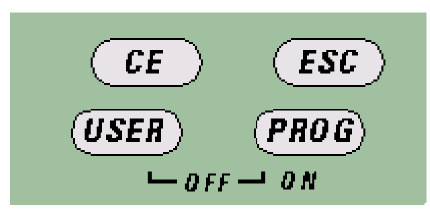
• Press the F1 (STOP) button.

This will end the survey, and return you to the Main Menu.</td><td>
</td></tr>
<tr><td>2</td><td>In the Main Menu:

The sensor can now be turned off. To turn off the sensor:

• Press the USER and PROG button simultaneously or hold the ESC button down for 2 seconds.

Note: The sensor can only be turned off from the Main Menu screen.</td><td>


</td></tr>
</table>

Continued on next page

5.2 Ending the Real-Time Reference Station Survey, *Continued*

Conclusion

You have completed starting a Real-Time Reference survey. You have learned how to either call up an existing control point from a job or create an autonomous point using the **HERE** function to be used as a reference point. You then learned how to correctly stop an RTK reference survey.

6.0 Real-Time Rover Surveying

In this Chapter

The following sections of this chapter explain the procedures for starting and ending the rover survey as well as performing the Real-Time survey operations.

Section	Topic
6.0.1	RTK Position Accuracies
6.1	Starting the Real-Time Rover Survey
6.1.1	Receiving Radio Communication
6.2	Occupy Points – Manual Stop and Store
6.3	Occupy Points – Automatic Stop and Store
6.4	The Automated Point Id Template
6.5	Using a Code List
6.5.1	Coding Using the Survey Page
6.5.2	Coding Using the Code Page
6.6	Adding Point Annotations (Notes)
6.7	Automatically Recorded Positions
6.8	Automatically Recorded Positions With Offset Points

Introduction

The Real-Time rover configuration can be used for a number of surveying applications, including:

- boundary surveys,
- volume surveys,
- topographic surveys,
- staking lines or grids,
- staking out points on construction sites,
- vehicle mounted kinematic surveys for road profiling, or rough topo,
- etc.

Baseline Length

Real-Time surveys can be performed over relatively large distances, up to approximately 30 kilometers (20 miles), depending upon the communication link.

- A practical limit for radio communication is approximately 10 kilometers (6 miles) depending on topography and obstructions between reference and rover radios.

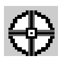
- Using cell phones or modems as the data link and Leica's System 1200 GPS receivers, RTK ranges of 30+ kilometers are easily achieved.

6.0.1 RTK Accuracies

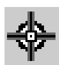
RTK Position Icons

There are three RTK position-accuracy levels. Each level is represented by its own icon.

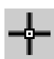
The position icon is located here.



This icon represents an autonomous position. This means that no RTK-radio transmissions are being used to compute the rover's position. This position is derived using only uncorrected information from the NAVSTAR (GPS) satellites. You can expect accuracies to be 20 meters or better.



This icon represents a code-corrected position also known as DGPS. This icon appears when the rover receiver is receiving code-based corrections from a reference. You can expect accuracies in the sub-meter range.



This icon represents a phase-fixed solution. This means that the phase ambiguities have solved and we are working in true RTK mode. Positional accuracy is 1cm + 1ppm (part per million), vertical accuracy is 2cm + 1ppm.

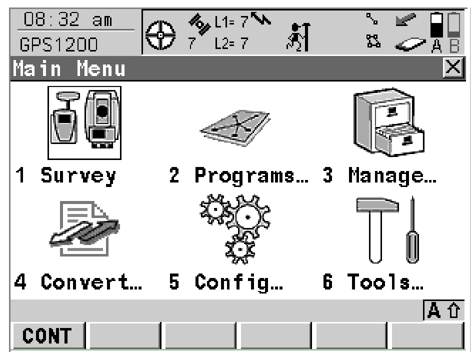
No icon means that a position is not available (maybe from not enough satellites being tracked).

6.1 Starting the Real-Time Rover Survey

Introduction

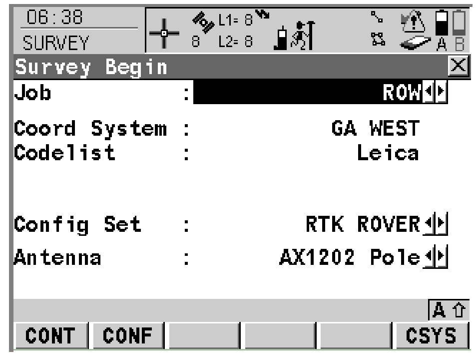
To begin a Real-Time rover survey, you must have:

- a configuration set (See *Chapter 2.0 Configuration Sets* and *Chapter 4.0 The Real-Time Rover Configuration Set*),
- a job to store your data (See *Chapter 1, Section 1.3 Creating a Job* and *Section 1.4 Selecting a Job*), and
- a coordinate system if you wish to work in any coordinate system other than WGS84 (See *Chapter 8.0 Coordinate Systems Management and Chapter 9.0 Onestep Transformations*).
- a codelist to include additional thematical information about the points collected.

Step	Action	Display
1	From the Main Menu: • Tap on **1 Survey**. This takes you to the SURVEY Survey: Begin screen.	

Continued on next page

6.1 Starting the Real-Time Rover Survey

Step	Action	Display
2	In the SURVEY Survey Begin screen: Select the following parameters: • a job, • a coordinate system, • a codelist, • the Real-Time Rover configuration set, and • the antenna type. **Note**: Use the **F6 (CSYS)** button to access a list box of all the coordinate systems in the system RAM. In this example we are using the Georgia West state plane coordinate system. The **F2 (CONF)** button accesses the SURVEY Configuration Auto Points and Hidden Points screens. • Press the **F1 (CONT)** button. This takes you to the SURVEY Survey: screen.	

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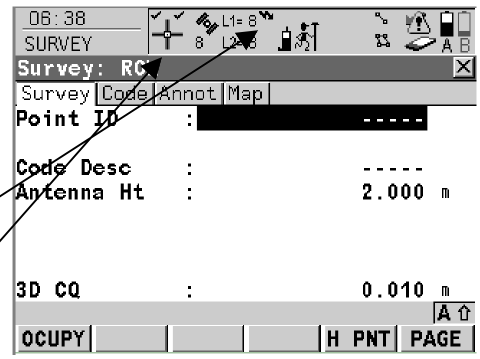
6.1.1 Receiving Radio Communication

Introduction

Receiving appropriate RTK transmissions from the correct reference station's radio is imperative for an RTK survey to be completed with the highest accuracy.

When starting an RTK rover survey, the first thing we need to verify is that we are receiving proper transmissions from our reference receiver's radio.

Step	Action	Display
1	Continuing from the previous section. From the SURVEY Survey: screen: To see if we are receiving RTK transmissions from our reference receiver after we have completed the steps in *Section 3.1.1*: • Check for the pulsing down arrow. This indicates that we are receiving correct RTK transmissions. The arrow will steadily pulse downwards. • Look for the "fixed" icon. This shows that the phase ambiguities have solved. • Notice the two check marks. This indicates that the receiver has completed a check on the ambiguities.	

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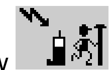
6.1.1 Receiving Radio Communication, *Continued*

Trouble Shooting

When the rover receiver does not solve phase ambiguities you must investigate why. The table below lists RTK problems and possible reasons for the problems.

Problem	Potential Reason
No down arrow.	If you do not have a down arrow  then you do not have a Real-Time rover configuration set selected and you must switch configuration sets. See chapter *1, Section 1.4*.
Down arrow is not pulsing.	This means the rover receiver is either not receiving or understanding the transmissions from the reference receiver's radio. There are many reasons why this may occur. The major possibilities to investigate are: • Reference radio is not transmitting. • Rover and Reference radios are not on the same channel. • Either the reference or rover's radio is on the wrong port. • The receiver's port has been assigned to use an incorrect radio type. • The reference is configured to transmit one data format and the rover is configured to receive another format. • The battery level on either the reference or rover is not adequate. • The rover radio is outside the range of the reference radio's transmissions (approximately 10km with no obstructions).

Radio Trouble Shooting

For more information on radio problems, see chapter *10 RTK Communications*, section *10.3 Radio Communication Troubleshooting*.

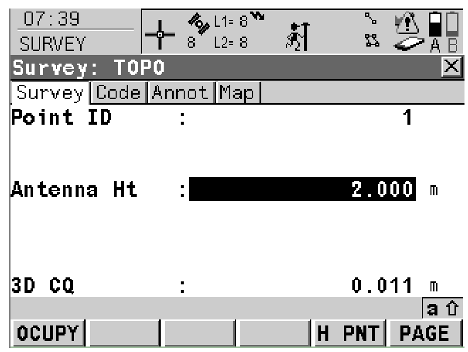
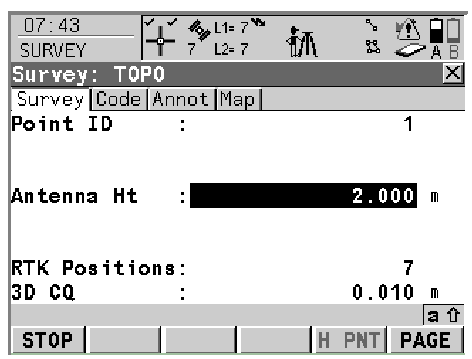
6.2 Occupy Points - Manual Stop and Store

Manual Point Occupation

Individual points may be surveyed using manual occupation settings. This is where the operator decides how long to occupy a point. This is a three-step process where the operator will instruct the instrument to start, stop, and store the point coordinates.

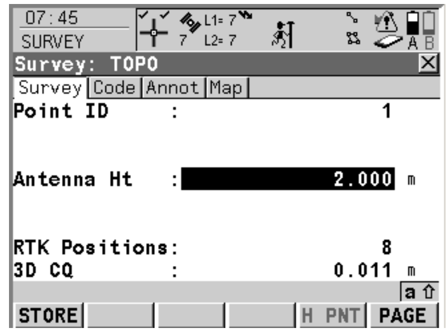
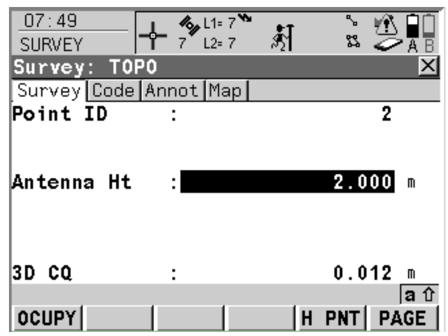
Note: Although we configured the real-time rover configuration set to auto stop and store (see chapter *4.0 The Real-Time Rover Configuration Set*), the steps below describe how to measure a point not having auto stop and store set.

See the following section *6.3 Occupy Points - Automatic Stop and Store* to learn about how to use the automatic settings that we programmed in chapter *4.0 The Real-Time Rover Configuration Set*

Step	Action	Display
1	In the SURVEY Survey: screen: Enter the Point ID (Identification) and check the following: • Antenna Height, • Coordinate Quality (3D CQ), and • Initialization Status icon: . • Press the **F1 (OCUPY)** button to survey the point.	
2	Continuing in the SURVEY Survey: screen: The sensor will record the real-time measurements until the operator chooses to stop the occupation. Ensure that: • Coordinate quality is within tolerance. • Initialization status is OK. • Press the **F1 (STOP)** button to stop the occupation.	

Continued on next page

6.2 Occupy Points - Manual Stop and Store, *Continued*

Step	Action	Display
3	Continuing the SURVEY Survey: screen: The operator must now store the surveyed point as follows: • Press the **F1 (STORE)** button.	
4	Continuing the SURVEY Survey: screen: The Point ID has incremented and you are ready to survey another point.	

6.3 Occupy Points - Automatic Stop and Store

Automated Occupation Settings

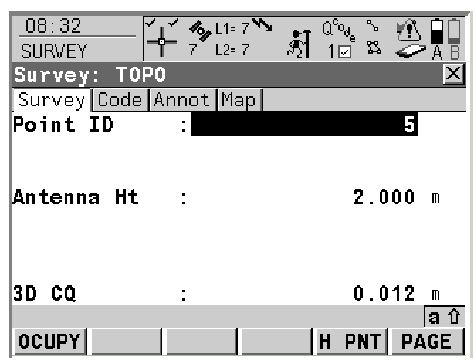
Points may be occupied using automated parameters. This is where the sensor uses predefined settings to stop the occupation and store the point coordinates. See chapter *4.0 The Real-Time Rover Configuration Set, Steps 24-26* for setting the point occupation settings.

If the sensor's Point Occupation Setting is configured to use **Accuracy**, the occupation will stop when the coordinate quality (CQ) is within the specified accuracy parameters. The point coordinates will be stored automatically.

If the sensor's Point Occupation Setting is configured to use **Positions**, the sensor will average the specified number of measurements, stop the occupation, and then store the point coordinates.

Which is better? I prefer **Positions** because let's say you have set your 3D CQ tolerance to be 0.05m (0.164 US ft) and you want to get a point that is immediately beside a large obstruction (such as a tall tree line). Say you don't mind that the CQ reaches 0.10m because all you want is the general location of the tree line. If the sensor is set to **Accuracy**, you will not get the shot until the CQ drops to 0.05m but if you have the sensor set to **Positions**, you will be allowed to take the shot. It is possible to program the sensor to warn you if you exceed a tolerance so the receiver would then alert you that you have measured a point that has exceeded the specified tolerance and ask you if you wish to keep the point.

Note: To learn more about CQ (coordinate quality) see chapter *4.0 The Real-Time Rover Configuration Set,* section *4.2 Coordinate Quality*.

Step	Action	Display
1	In the SURVEY Survey: screen: Enter the Point ID and check the following: • Antenna Height, • Coordinate Quality (CQ), and • Initialization Status icon: . • Press the **F1 (OCUPY)** button to survey the point.	

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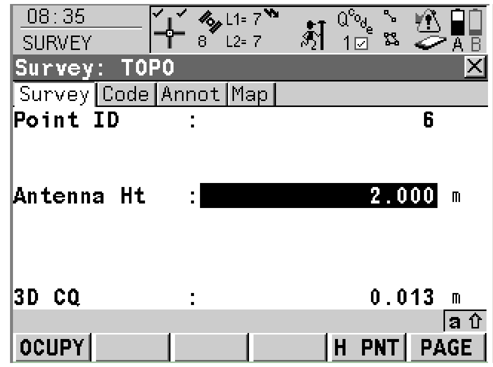
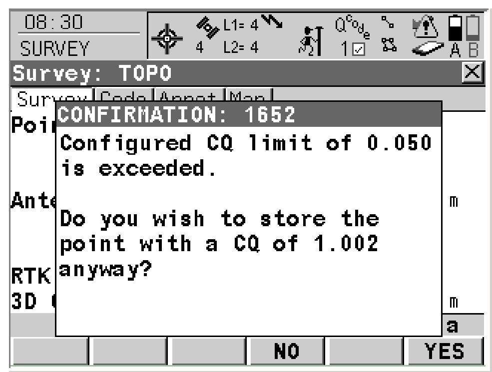
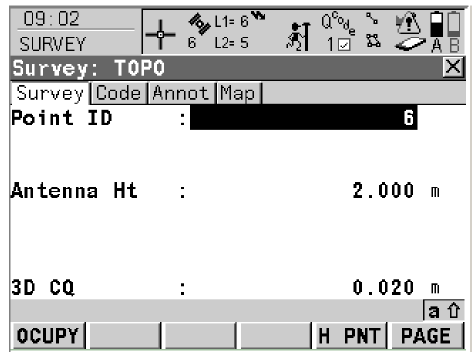
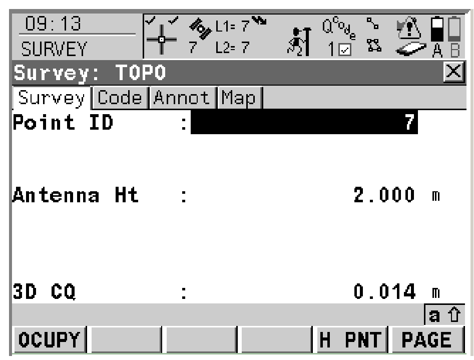
6.3 Occupy Points - Automatic Stop and Store, *continued*

Step	Action	Display
2	Continuing in the SURVEY Survey: screen: The sensor will automatically stop the occupation according to the parameters set in the configuration set. The point coordinates is automatically stored, the Point ID is automatically incremented, and the receiver is ready to measure the next point. To survey another point, repeat *Step 1* above.	
3	Continuing in the SURVEY Survey: screen: If the sensor's Point Occupation Settings had been set to **Positions** and the sensor's Coordinate Quality (CQ) Limit had been set to a certain tolerance and that CQ tolerance had been exceeded, a warning such as the one on the right would have been displayed. You are given a choice whether to keep this measurement or to discard it and attempt another. • Press the **F6 (YES)** button to keep the point. • Press the **F4 (NO)** button to discard the measured point.	

6.4 The Automated Point Id Template

Automatic Increment of Point ID

The sensor can be set to automatically increment point numbers based on the point ID (Identification) that you enter. This is useful when surveying a series of points with incrementing point numbers.

Step	Action	Display
1	In the SURVEY Survey: screen: • Enter a point ID in the **Point ID** field. The Sensor will automatically create a new point ID series based on that point number. The point ID will automatically increment with each new point surveyed. • Press the **F1 (OCUPY)** button to survey the point.	
2	Continuing in the SURVEY Survey: screen: Once the point coordinates are stored, the display returns to the SURVEY Survey: screen. You will notice that the point number has incremented automatically.	

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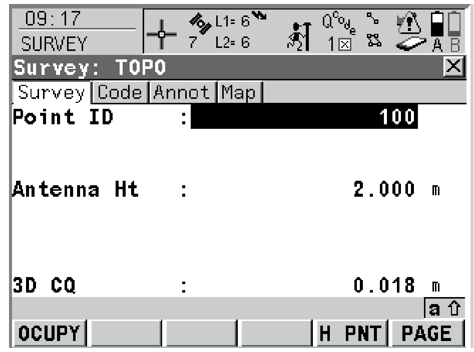
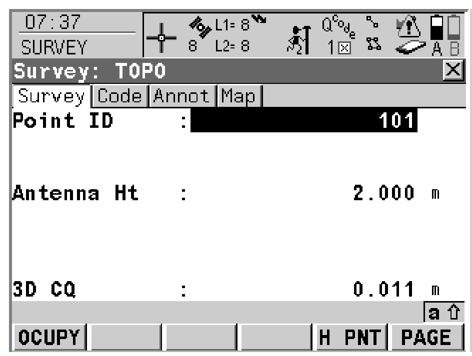
6.4 The Automated Point ID Template, Continued

Step	Action	Display
3	Continuing in the SURVEY Survey: screen: • Enter another point number to start a new point ID template. The Sensor will automatically create a new series based on that point ID. • Press the **F1 (OCUPY)** button to survey the point.	
4	Continuing in the SURVEY Survey: screen: Once the point coordinates are stored, you will notice that the point ID has incremented automatically using the new point series. You are ready to survey another point.	

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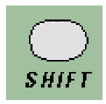
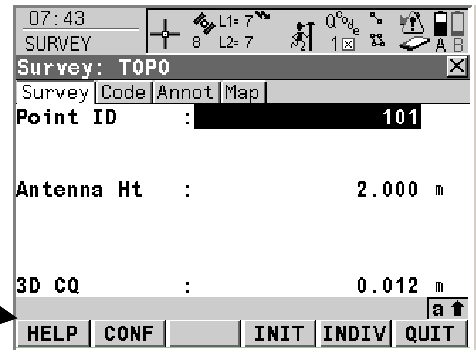
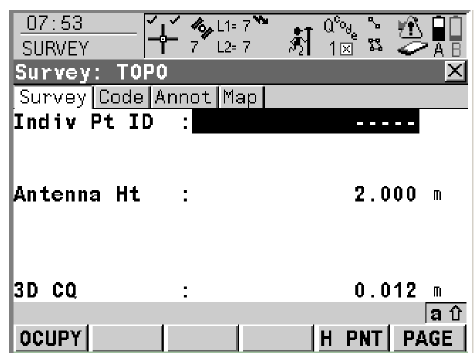
6.4 The Automated Point ID Template, Continued

Individual Point IDs

It is possible to step outside of the point ID sequence (to survey an individual point) without creating a new series of points.

Step	Action	Display
5	In the SURVEY Survey: screen: • Press the  button. This will bring up a new set of function-button options as shown. • Press the **F5 (INDIV)** button to switch to individual point occupation.	
6	Continuing in the SURVEY Survey: screen: Notice the **Point ID** field has changed to **Indiv Pt ID**.	

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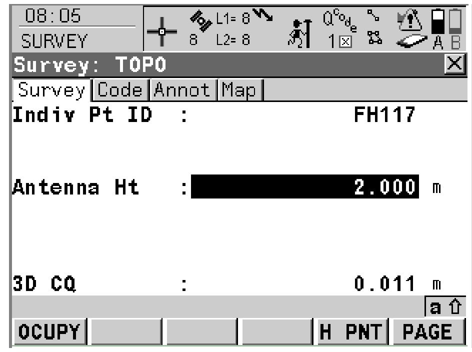
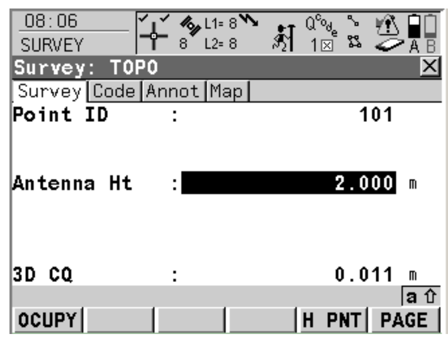
6.4 The Automated Point ID Template, Continued

<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr><td>7</td><td>Continuing in the SURVEY Survey: screen:

• Enter the new point ID.

This can be any point Id or number outside the previous series.

• Press the F1 (OCUPY) button to survey the point.</td><td>
</td></tr>
<tr><td>8</td><td>Continuing in the SURVEY Survey: screen:

Notice that the point number has defaulted back to the previous series.</td><td>
</td></tr>
</table>

6.5 Using a Code List

Codes

A code is a description that can be stored with a point, line, area, or alone. Point, Free, and Quick codes are available.

A **Point** code is a code that is stored together (attached) with the point. Alternatively, a **Free** code is a code that when stored, is attached to the time when the code was recorded. A **Quick** code completes a measurement and attaches itself to the occupation.

A code can be up to 16 characters long and may include spaces.

A display mask with an input field for point codes must be configured. See section *4.1 Editing a Real-Time Rover Configuration Set* steps *19-21* for more information on defining a display mask.

To learn how to attach a code list to a job, see chapter *1.0 RTK Quick Guide System 1200 Introduction,* section *1.3, Step 4*.

Detailed information on codes and code lists can be found in the Technical Reference Manual included on the firmware CD.

Survey Pages and Display Masks

System 1200 offers different ways to access coding during a survey. For example you can design a display mask for the Survey page to include a **Code** field or you can design a display mask for the “Code” page to include fields you’d prefer to see during data collection.

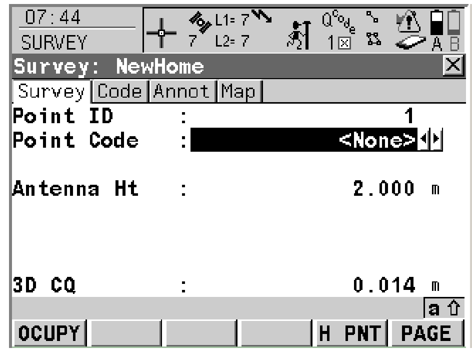
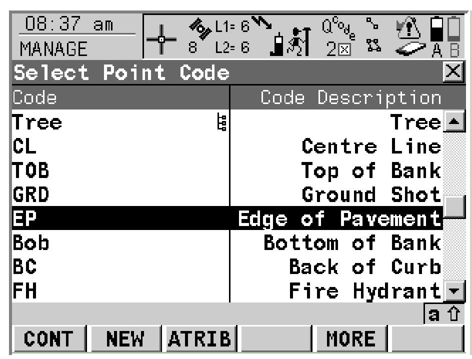
Section *6.5.1 Coding Using the Survey Page* will show coding using the “Survey” page. Section *6.5.2 Coding Using the Code Page* will demonstrate coding using the “Code” page.

Attributes

Some codes have attributes attached. An attribute is an additional block of information that provides greater detail about the code. In the code list, these are marked with a  symbol.

A code can have up to 20 attributes associated with it.

6.5.1 Coding Using the Survey Page

Step	Action	Display
1	**Coding Using the Survey Page.** **Note**: This example uses a display mask created for the “Survey” page that includes the “Code (pt)” selection. **Note**: This example uses a codelist created in LGO and transferred onto the system RAM of the GPS1200. To learn more about transferring objects from LGO to the sensor, please *FAQ 3 Transferring a Coordinate System From LGO to the GPS1200* (page 167 of this quick guide). In the SURVEY Survey: “Survey” page: • Enter a Point ID. • Tap on the **Point Code** field. This takes you to the MANAGE Select Point Code list box.	
2	In the Select Point Code list box: • Tap on the code you wish to select. • Use the scroll bar on the far right to access more codes. • Or enter the first letter of the code and the search function will automatically go to the first code starting with that letter. • Press the **F1 (CONT)** button. This takes you back to the SURVEY Survey: screen.	

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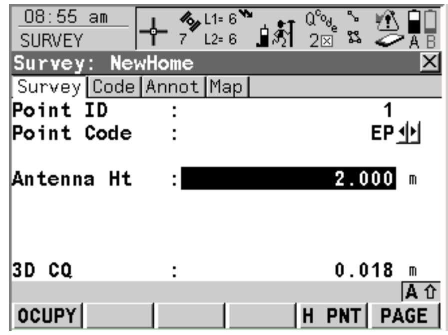
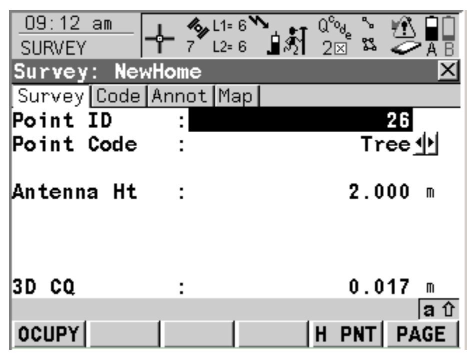
6.5.1 Coding Using the Survey Page, *continued*

Step	Action	Display
3	In the SURVEY Survey: "Survey" page: • Press the **F1 (OCUPY)** button to measure the point and store the code.	

Codes with Attributes

Using a code that has attributes associated with it enables the user to provide additional specific information along with the code.

The following example uses a code that has three mandatory attributes associated with it. This means that the measurement cannot be completed until data has been entered into those attribute fields.

Step	Action	Display
4	In the SURVEY Survey: "Survey" page: • Enter a Point ID. • Select a code with an attribute. • Press the **F1 (OCUPY)** button to measure the point and store the code.	

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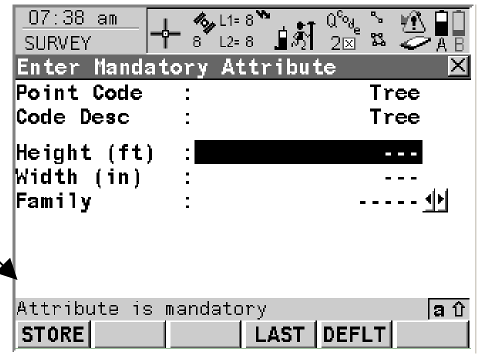
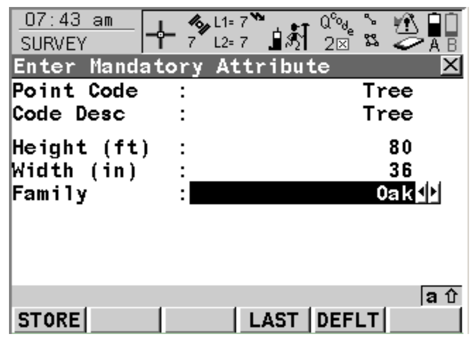
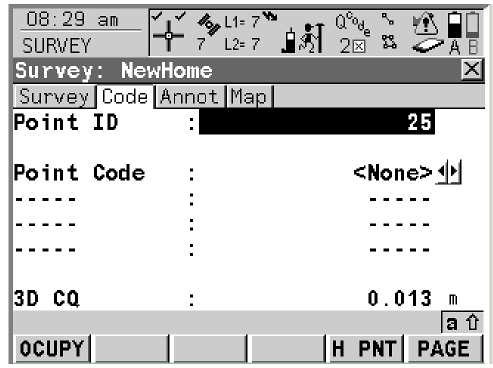
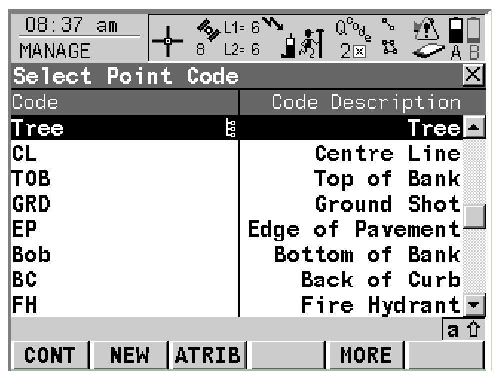
6.5.1 Coding Using the Survey Page, *continued*

Step	Action	Display
5	Continuing in the SURVEY Survey: screen: Since this code has mandatory attributes, the warning message “Attribute is mandatory” and the “SURVEY Enter Mandatory Attribute” screen is displayed. For this particular code, three mandatory attributes were created. You must complete the mandatory attribute fields to finish the measurement In the “SURVEY Enter Mandatory Attribute” screen: • Complete the required attribute fields. The **F4 (LAST)** button will fill in all the attribute fields with the values that were entered in the previous measurement. The **F5 (DEFLT)** button will fill in the attribute fields with any default values that may have been assigned to that particular attribute. • Press the **F1 (STORE)** button. This stores the point, code, and attributes and then returns you to the SURVEY Survey: “Survey” page.	 

6.5.2 Coding Using the Code Page

Code Page The “Code” page is another page where we can measure points but this page puts the emphasis on coding.

Step	Action	Display
1	In the SURVEY Survey: “Survey” page: This example uses a display mask (Mask 2 from the choice list – see Chapter *4.0 The Real-time Configuration Set* Steps *19-21* for configuring a display mask) created for the “Code” page that includes the “Code (pt)” selection. • Tap on the **“**Code” tab. • Select a Point ID. • Tap on the **Point Code** field. This takes you to the MANAGE Select Point Code list box.	
2	In the MANAGE Select Point Code list box: • Tap on the code you wish to select. • Use the scroll bar on the far right to access more codes. • Or enter the first letter of the code and the search function will automatically go to the first code starting with that letter. **Note**: In this example we have selected the code “Tree”. The signifies that the code has attributes. • Press the **F1 (CONT)** button. This takes you back to the SURVEY Survey: “Code” page.	

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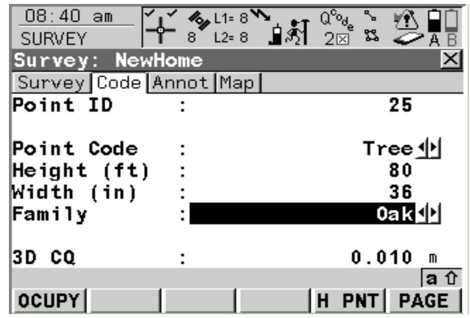
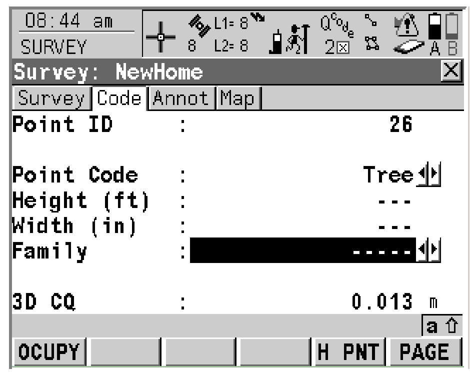
6.5.2 Coding Using the Code Page, *continued*

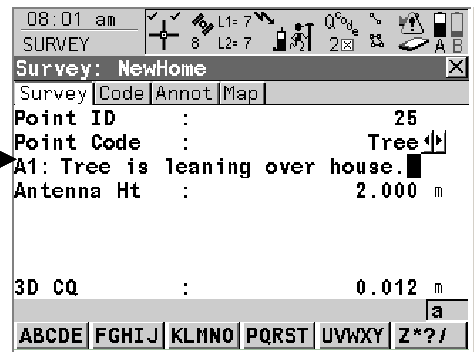
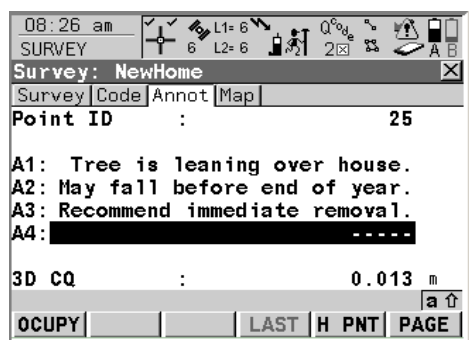
Step	Action	Display
3	In the “Code” page of the SURVEY Survey: screen: • Press the **F1 (OCUPY)** button to measure the point and store the code. **Note**: Notice that this code has attributes.	
4	Continuing in the “Code” page of the SURVEY Survey: screen: The measurement is stored with the code and attribute information. The Point ID has incremented and the **Point Code** field defaults to the last code entered. The receiver is ready to measure the next point.	

6.6 Adding Point Annotations (Notes)

Point Annotations

A point annotation is additional text that is tied to a measurement that may be entered in the field. A maximum of four lines of text 28 characters long may be attached to a point.

Annotations may be added to a display mask, or the "Annot" page view is available to enter annotations.

Step	Action	Display
1	In the SURVEY Survey: "Survey" page: In the image to the right, an annotation field **A1** has been added to the "Survey" display mask (See Chapter *4.0 The Real-time Configuration Set* Steps *19-21* for configuring a display mask). The annotation field enables you to enter additional information that is not available in the code list or attribute fields. • Tap on the "Annot" tab. This takes you to the SURVEY Survey: "Annot" page.	
2	In the SURVEY Survey: "Annot" page: Here you can add up to four lines of text to the annotation. Notice that the text that was entered into the **A1** field in *Step 1* was carried over to this page. • Press the **F1 (OCUPY)** button to record the point, code, and annotation.	

6.7 Auto Recorded Positions

Auto Points

The receiver can be configured to perform automatic positioning by time, horizontal distance, vertical distance, or a combination of horizontal and vertical distances. Here you can set the receiver to record a position at a certain time interval such as every second for example. Or you could have the receiver record a position after traveling a certain horizontal distance such as every metre or record a position after a specific change in elevation such as every one-foot change in height.

Auto points are logged between starting and stopping of auto points. A new chain of auto-logged points is created each time logging of auto points is started.

Auto points can be very useful if you have to measure a vast sum of points. An example would be having to create a topographic survey of a cow pasture. You could just mount a receiver to a 4-wheeler and set the auto points to record every 3 metres. You would then drive a grid pattern over the pasture. The time savings would be enormous!

Coding

Coding of auto points is similar to coding manually occupied points. The differences are:

- quick codes are not available,
- codes of auto points overwrite the codes of points existing in the active job with the same point ID but with a different code as the auto point,
- codes of auto points can be changed when no points are being logged,
- up to three attributes can be stored with a code.

Averaging of auto points

An average is never calculated for auto points even if a manually occupied point class of “measured” already exists with the same point ID.

Point ID Template

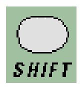
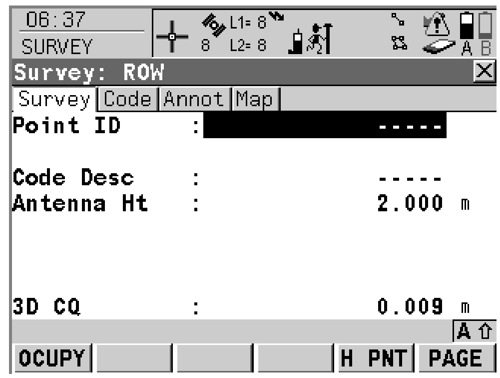
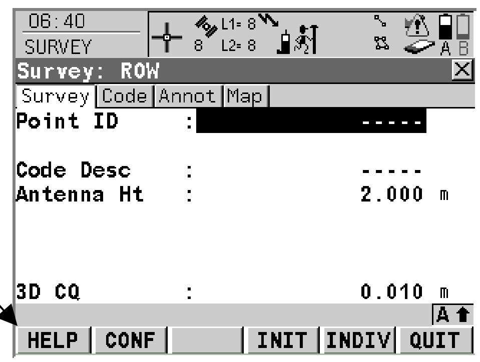
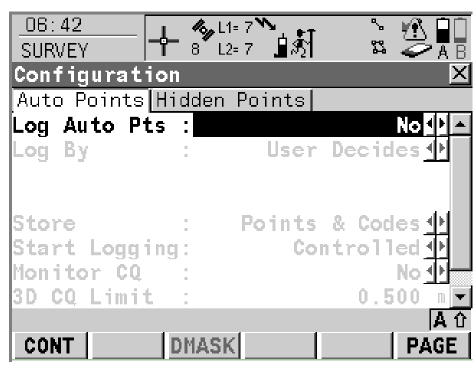
This example uses the “time and date” format as a point Id for the auto positioned points. However, user-defined point Id templates can be created for use with this function.

Continued on next page

6.7 Auto Recorded Positions, Continued

Configure Auto Points

To configure auto points, we must access the SURVEY Configuration "Auto Points" screen

Step	Action	Display
1	From the Survey page of the SURVEY Survey: screen: • Press the  button. Notice additional function keys are available. • Press the **F2 (CONF)** button. This takes you to the "Auto Points" page of the SURVEY Configuration screen.	 
2	In the "Auto Points" page of the SURVEY Configuration screen: • Toggle the **Log Auto PTS** field to **YES**. Notice that the other fields now become active. This step is continued on the following page.	

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6.7 Auto Recorded Positions, Continued

<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr><td>2</td><td>
Continuing in the SURVEY Configuration “Auto Points” page:

There are various ways to define auto points logging. The two most popular ways are via time or distance.

Log By Time: An auto position is recorded after a certain time interval. If you set this to be, say, 20 seconds, the receiver will record an auto point every 20 seconds. Warning: if you stop moving for a moment, the receiver will continue to log points until you physically stop it.

Log by Distance: The receiver will record an auto point after a defined distance has been traveled from the last auto point.

Note: In our example we will set the auto points to log by distance and define that distance to be ten metres.

• Set Log Auto Pts to Yes.

• Set Log By to Distance.

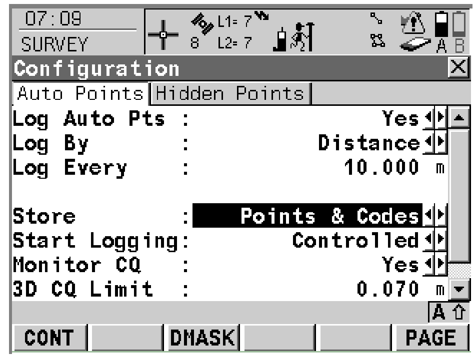
• Set Log Every to 10 metres.

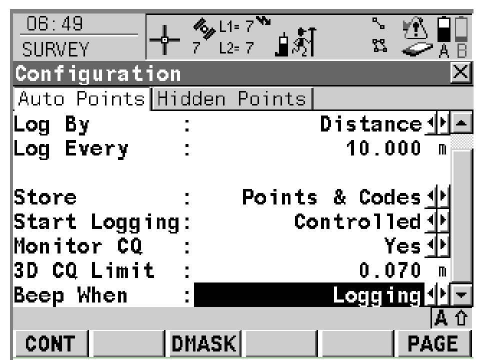
• Set Store to Points and Codes.

The Store field has two choices: Points Only and Points and Codes.

Points Only: This setting logs auto points to the measurement database. Auto points can be logged up to 20 Hz. Coding and logging of offset points is not possible.

Points and Codes: This logs auto points to the DBX and can be logged up to 1 Hz. Coding and logging of offset points is possible.

This step is continued on the following page.
</td><td>




</td></tr>
</table>

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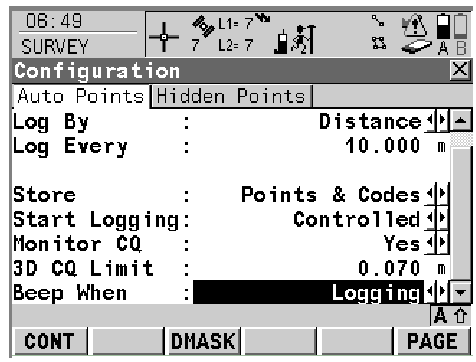
6.7 Auto Recorded Positions, Continued

Step	Action	Display
2	Continuing in the SURVEY Configuration “Auto Points” page: The **Start Logging** field controls how the auto logging will start. There are two choices: **Immediately**: Logging of auto points starts immediately when the SURVEY screen is accessed. **Controlled**: Logging of auto points starts upon pressing the **F1 (START)** button on the “Auto” page in SURVEY. • Set **Start Logging** to **Controlled**. The **Monitor CQ** field activates the monitoring of coordinate quality. (See Chapter 4 Section *4.2 Coordinate Quality* for an explanation of CQ.) Auto points are stored when the coordinate quality is within the defined limit. For example, only phase-fixed solutions can be logged by defining a CQ limit. • Set the **Monitor CQ** field to **Yes**. • Notice that the **3D CQ Limit** field now becomes active. The **3D CQ Limit** value is the limit for the coordinate quality above which an auto point is no longer automatically stored. When the CQ of the auto point falls again below the defined value then the storing of auto points begins again. In this example we have set the limit to 0.07m but you may select another value if you desire. This step is continued on the following page.	

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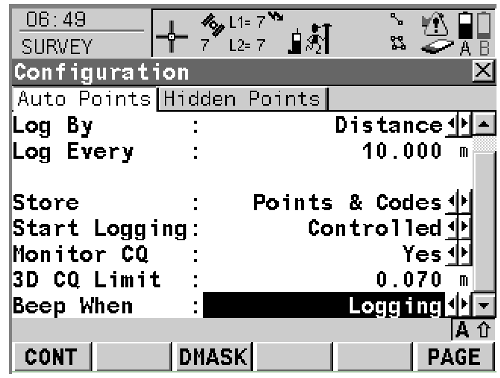
6.7 Auto Recorded Positions, Continued

Step	Action	Display
2	Continuing in the SURVEY Configuration “Auto Points” page: The **Beep When** field provides three choices: **Logging**: The instrument will beep when storing an auto point. **Not Logging**: This is available when the **Monitor CQ** field has been set to **Yes**. The receiver will emit a single alarm beep each time an auto point is not recorded because the limit for the coordinate quality is exceeded. **Never**: The instrument will never beep about information concerning auto points. In this example we are setting the **Beep When** field to **Logging** because it is reassuring to be alerted that auto points are being stored. • Set the **Beep When** field to **Logging**. The **F3 (DMASK)** button accesses the display mask configuration for the auto points page. (See chapter *4.0 The Real-time Configuration Set,* Steps *19-21* for configuring a display mask.) • Press the **F1 (CONT)** button. This returns you to the SURVEY Survey: “Auto” page.	

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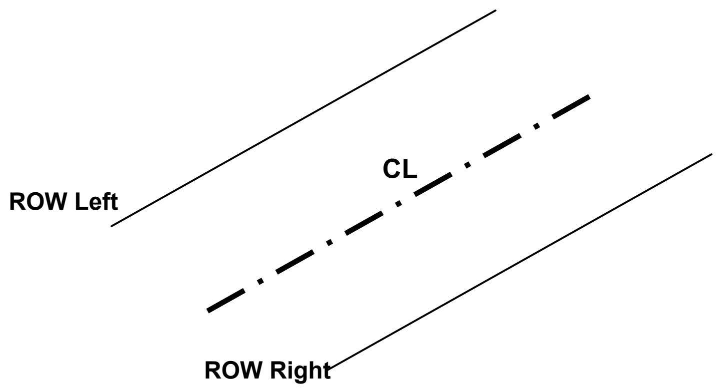
6.8 Auto Recorded Positions With Offset Points

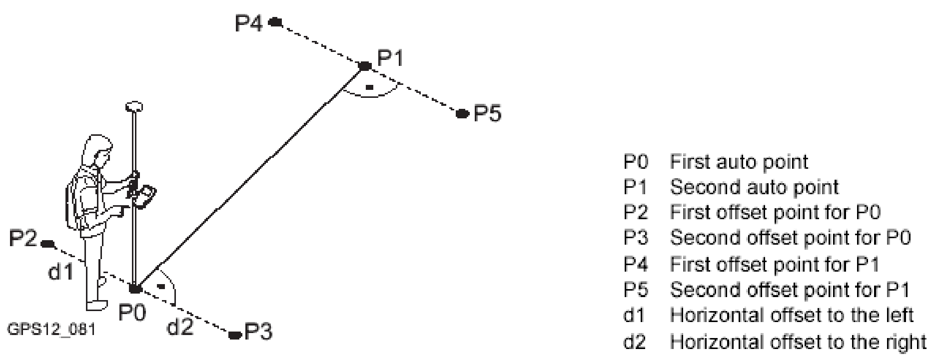
Auto Points with Offset Points

We are about to use auto points to measure the centerline (**CL**) and right-of-way of an existing road all in one pass.



Computation of offset points

The computation of offset points depends on the number of auto points in one chain.



One auto point: No offset points are computed or stored.
Two auto points: The configured offsets are applied perpendicular to the line between two auto points.
Three or more auto points: The first offset points are computed perpendicular to the line between the first and the second auto point.
The last auto point is computed perpendicular to the line between the last auto point and the one before.

All other offset points are computed on a bearing. The bearing is half the angle between the last and the next measured auto point.

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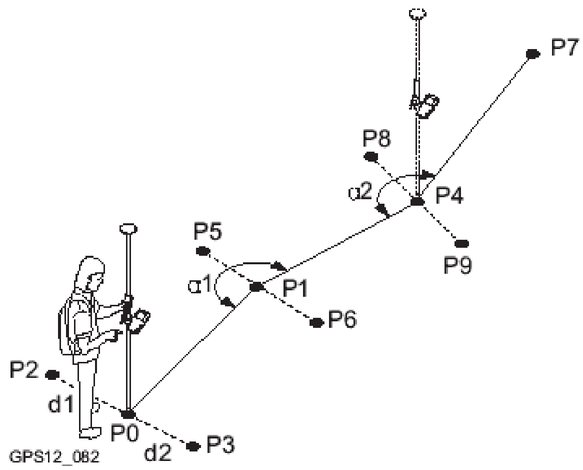
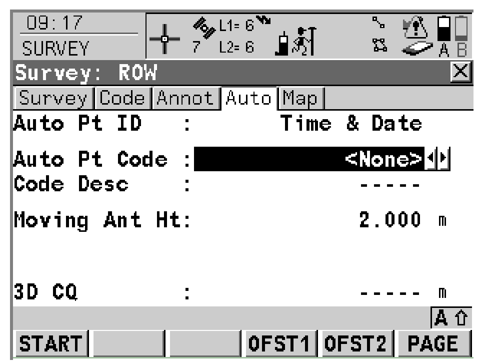
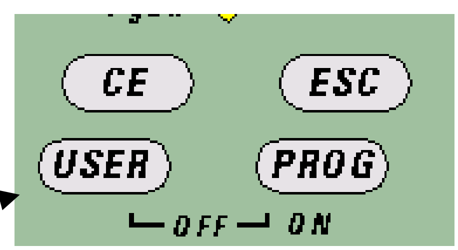
6.8 Auto Recorded Positions With Offset Points, Continued

Computation of offset points continued



P0 First auto point
P1 Second auto point
P2 First offset point for P0
P3 Second offset point for P0
P4 Third auto point
P5 First offset point for P1
P6 Second offset point for P1
P7 Fourth auto point
P8 First offset point for P4
P9 Second offset point for P4
d1 Horizontal offset to the left
d2 Horizontal offset to the right
á1 Angle between P0 and P4
á2 Angle between P1 and P7

Step	Action	Display
1	Continuing in the SURVEY Survey: “Auto” page from the previous section: Notice that the **Auto Pt ID** field has been set to **Time & Date**. We have just decided that we would rather have a point ID format that would have more meaning to us so let’s change it. We could go back to the Main Menu and select **3 Manage…** and then edit the RTK rover configuration set like we did in chapter *4.0 The Real-Time Rover Configuration Set* **or** we could use the  button to change this parameter. • Press the **USER** button. This takes you to the GPS1200 User Menu.	 

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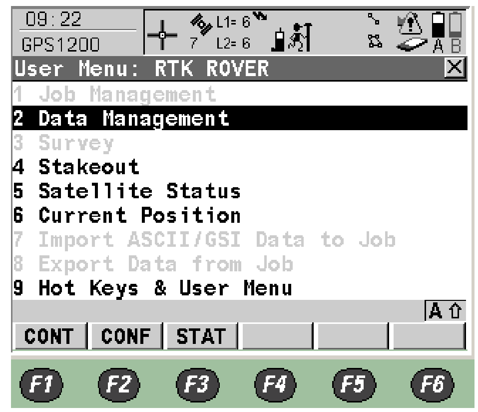
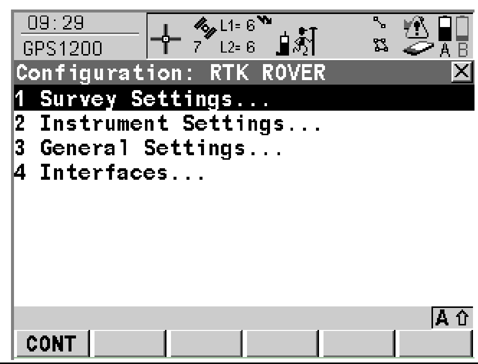
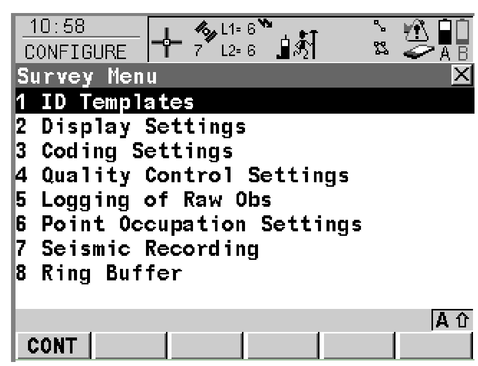
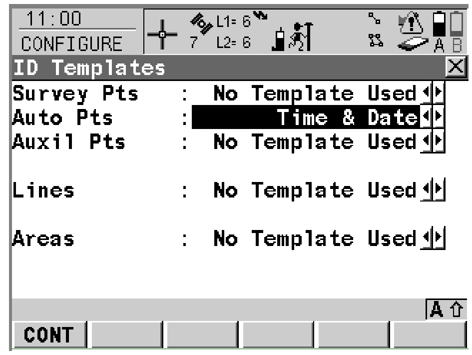
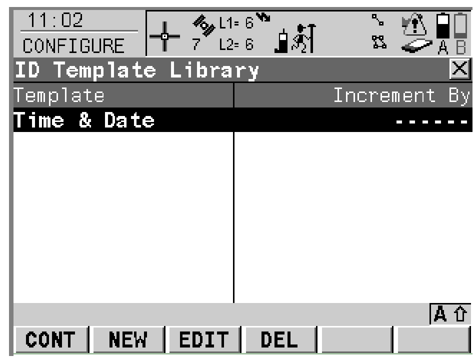
6.8 Auto Recorded Positions With Offset Points, Continued

Step	Action	Display
2	In the GPS1200 User Menu: screen: • Press the **F2 (CONF)** button. This takes you to the GPS1200 Configuration: screen.	
3	In the GPS1200 Configuration: screen: • Tap on **1 Survey Settings**. This takes you to the CONFIGURE Survey Menu: screen.	
4	In to the CONFIGURE Survey Menu screen: • Tap on **1 ID Templates**. This takes you to the CONFIGURE ID Templates screen.	

6.8 Auto Recorded Positions With Offset Points, Continued

Step	Action	Display
5	In the CONFIGURE ID Templates screen: Notice the **Auto Pts** field has Time & Date set. This is what we wish to change. • Tap on the **Auto Pts** field. This takes you to the CONFIGURE ID Template Library screen.	
6	In the CONFIGURE ID Templates Library screen: This is where we will create a template for our auto points. • Press the **F2 (NEW)** button. This takes you to the CONFIGURE New ID Template screen.	

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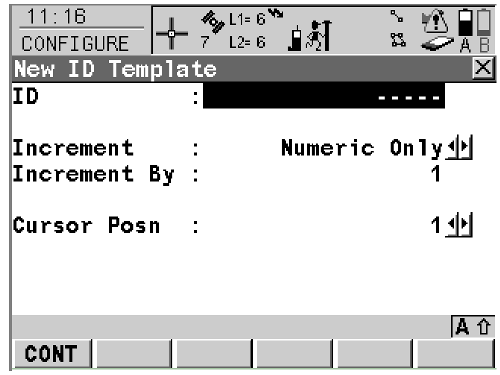
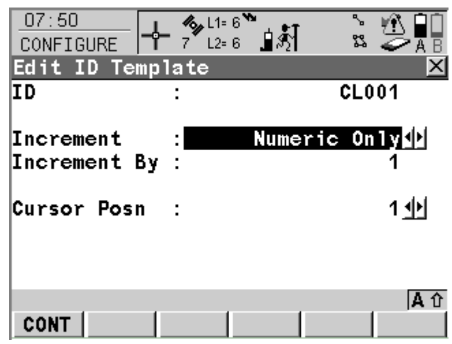
6.8 Auto Recorded Positions With Offset Points, Continued

Step	Action	Display
7	In the CONFIGURE New ID Template screen: The **ID** field is where the name of the ID template and the format of the ID object. This means that if we named the ID Template “John” all of the auto points would be start with the letters: John. Any characters including spaces are permitted, **but** you cannot start an ID template name with a space. • Enter an ID Template name. In this example we will call our template “CL” for center line. The **Increment** field sets how the IDs are incremented, either numerically or alphanumerically. The **Increment By** field defines the amount by which the point IDs are incremented. In this example we will set the **Increment** to “Numeric Only”. • Set the **Increment** field to **Numeric Only**. • Set the **Increment By** field to **1**. The **Cursor Posn** field allows you to define where the cursor’s position in the point ID will be. In this example we will set the **Cursor Posn** to **1**. • Press the **F1 (CONT)** button. This stores the new ID template and returns you to the CONFIGURE ID Template Library screen.	 

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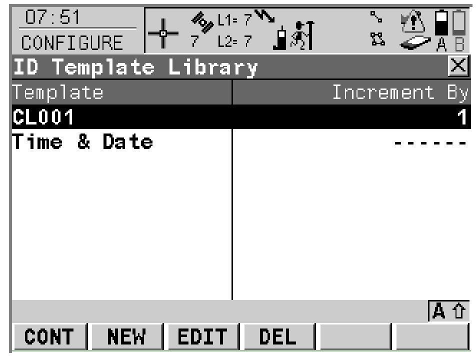
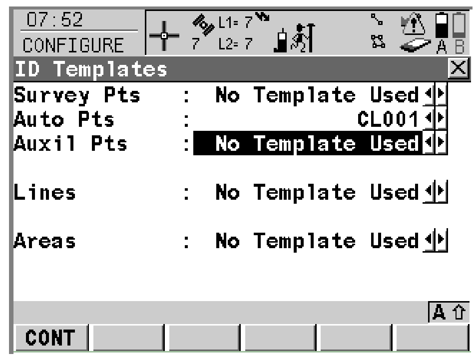
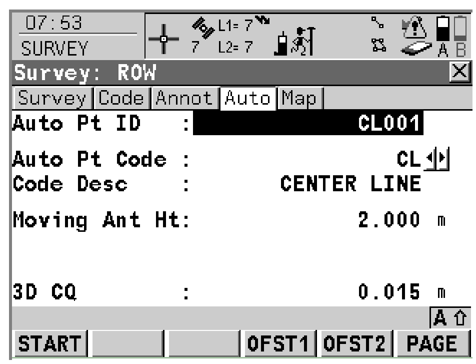
6.8 Auto Recorded Positions With Offset Points, Continued

Step	Action	Display
8	In the CONFIGURE ID Template Library screen: We now can see the newly created ID template called "CL001". • Press the **F1 (CONT)** button. This returns you to the CONFIGURE ID Templates screen.	
9	In the CONFIGURE ID Templates screen: We now see our ID template as the current template in the **Auto Pts** field. • Press the **F1 (CONT)** button. This returns us to the "Auto" page of the SURVEY Survey: screen.	
10	In the "Auto" page of the SURVEY Survey: screen: We now see our newly created point ID "CL001" set in the **Auto Pt ID** field. Now when we start logging auto points, all of our points will start with those characters. To add a code to the auto points: • Tap on the **Auto Pt Code** field. This takes you to the MANAGE Select Point Code screen.	

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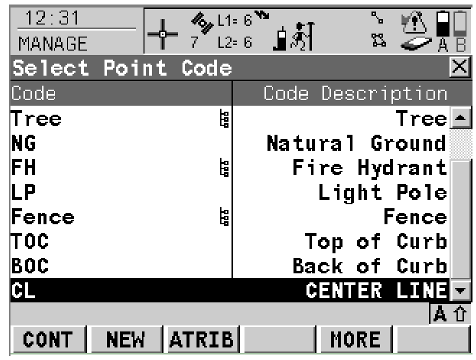
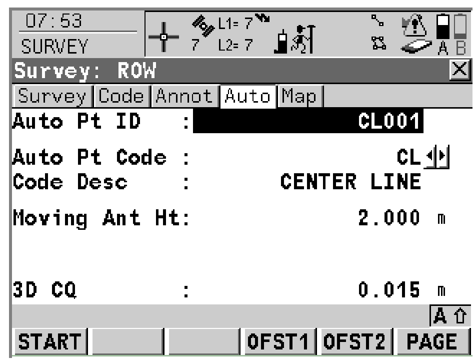
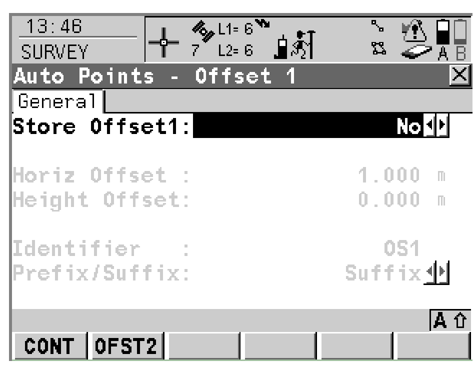
6.8 Auto Recorded Positions With Offset Points, Continued

Step	Action	Display
11	In the MANAGE Select Point Code screen: • Select a code for the auto points. In this example we will be using the point code “CL”. • Press the **F1 (CONT)** button. This returns you to the Auto page of the SURVEY Survey: screen.	
12	In the Auto page of the SURVEY Survey: screen: The **F1 (START)** button starts the logging of auto points. The **F4 (OFST1)** and **F5 (OFST2)** buttons access the configuration of the offset points. • Press the **F4 (OFST1)** button. This takes you to the SURVEY Auto Points – Offset 1 “General” screen.	
13	In the SURVEY Auto Points – Offset 1 “General” screen: • Tap on the **Store Offset1** field and set it to **Yes**. This activates the offset fields. This step is continued on the following page.	

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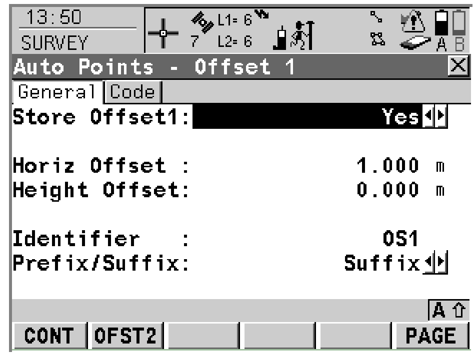
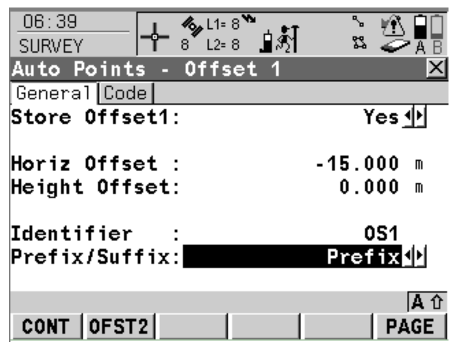
6.8 Auto Recorded Positions With Offset Points, Continued

Step	Action	Display
13	This step is continued from the following page. The **Horiz Offset** field defines the horizontal offset distance. This can range from –1000m to 1000m from where the auto point was collected. The **Height Offset** field defines the vertical offset distance. This can range from –100m to 100m related to the auto point. Since in our example, the right-of-way has a 15m offset, we'll set the horizontal offset to 15m and since the ground is mostly flat we will leave the height offset to 0.0m. • Set the horizontal and height offsets. **Note**: Enter a negative value for offsets on the left-hand side of the line. The **Identifier** field allows you to add up to four characters at the beginning or end of the ID of the auto point. This ID is then used as the point ID for the related offset point. Therefore the offset point ID is a combination of the auto point ID and an identifier (as either a prefix or suffix). The right-most part of the auto point ID is incremented within the point ID. The auto point ID is truncated from the left if the length of the auto point plus identifier prefix or suffix is greater than 16 characters. The **Prefix/Suffix** field defines where the identifier goes. In front of the auto point ID (Prefix) or behind the auto point ID (Suffix). • Set the Prefix/Suffix identifier. • Tap on the Code tab. This takes you to the SURVEY Auto Points – Offset 1 "Code" page.	 

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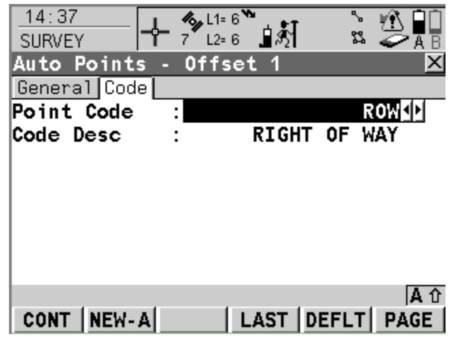
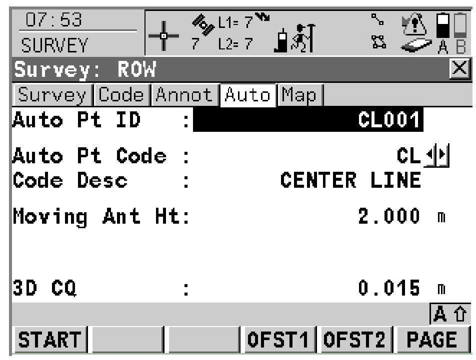
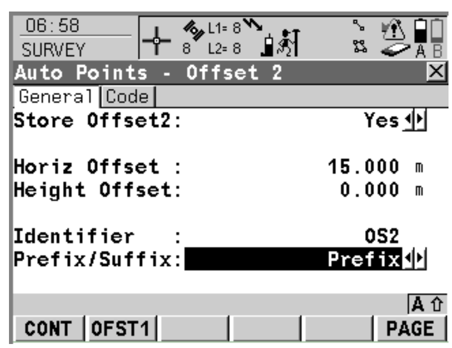
6.8 Auto Recorded Positions With Offset Points, Continued

Step	Action	Display
14	In the Code page of the SURVEY Auto Points – Offset 1 screen: • Select a code for the first offset point. In this example we are using the code "ROW". • Press the **F1 (CONT)** button. This returns you to the Auto page of the SURVEY Survey: screen.	
15	In the Auto page of the SURVEY Survey: screen: Now let's repeat these same settings for the second offset. • Press the **F5 (OFST2)** button. This takes you to the SURVEY Auto Points – Offset 2 "General" page.	
16	In the SURVEY Auto Points – Offset 2 "General" page: • Repeat steps *13-15* for Offset 2. • Return to the SURVEY Survey: screen when finished.	

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6.8 Auto Recorded Positions With Offset Points, *Continued*

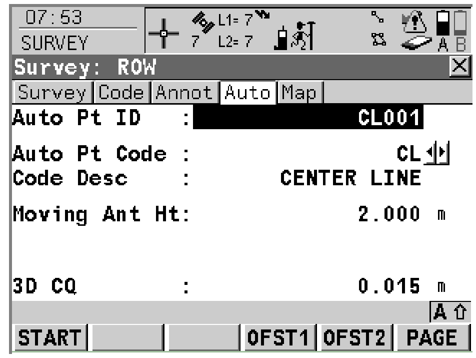
<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr>
<td>17</td>
<td>In the SURVEY Survey: screen:

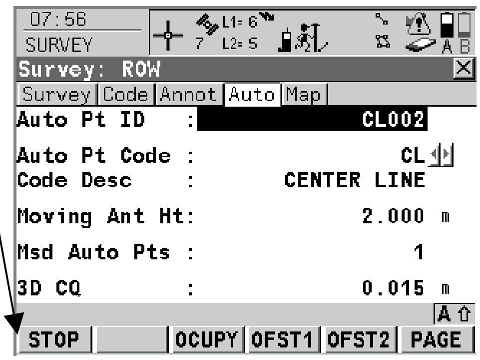
We are now ready to start our centerline/right-of-way survey.

• Press the F1 (START) button to start the logging of auto points.

Notice that the F1 (START) button has now become the F1 (STOP) button and a new field has appeared called Msd Auto Pts. The Msd Auto Pts is a counter alerting you to how many auto points have been measured.

The F3 (OCUPY) button allows you to record an auto point at any time.

The F1 (STOP) button stops the logging of auto points.</td>
<td>


</td>
</tr>
</table>

Conclusion

In this chapter you have learned how to:

- Start an RTK rover survey.
- Verify if you are receiving radio communications.
- Understand what the position icons represent.
- Measure points with manual start, stop, and store.
- Measure points with automatic stop and store.
- Understand the automated point ID template and jump outside of the point ID sequence.
- Use a code list with point measurements.
- Use point annotations.
- Record automatically recorded positions (with and without offset points).

7.0 Stake Out

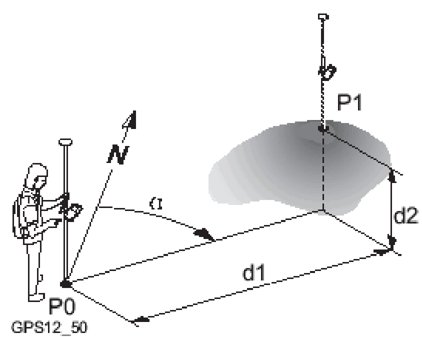
In this chapter The following sections of this chapter explain the procedures for staking out points and lines.

Introduction The Stakeout application program is used to place marks in the field at predetermined points. These predetermined points are the points to be staked. The points to be staked may

- have been uploaded to a job on the receiver using LGO,
- already exist in a job on the receiver, or
- have been uploaded from an ASCII file to a job on the receiver using the Convert…Import ASCII/GSI Data to Job function.

Stakeout can be used to stake:

- position only points (northings and eastings, latitudes and longitudes, etc.)
- height only points or
- a combination of position and height points.



P0 Current position
P1 Point to be staked
d1 Stake out distance
d2 Height difference between current position and point to be staked
α Stake out direction

Continued on next page

7.0 Stake Out, Continued

Target Points

Points to be staked (target points) must be stored on the CompactFlash (CF) card, in a job.

Coordinate System

Points cannot be staked if the active coordinate system is different to that in which the points to be staked are stored. For example, the points to be staked are stored in local coordinates and the active coordinate system is WGS 1984.

Jobs

The Stakeout job is the job that contains the points that you would like to stakeout. This is also called the Stake job or Design job.

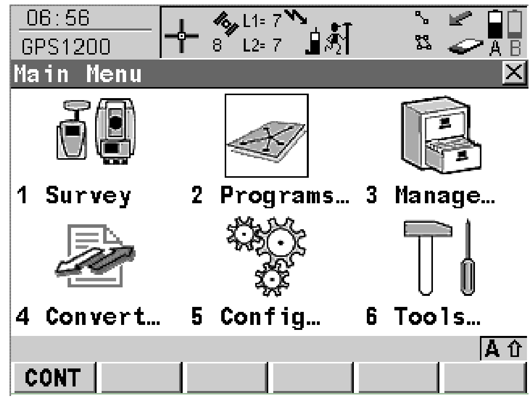
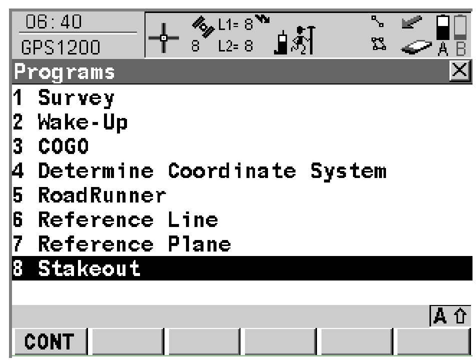
If staking from a job (**Stakeout** job) and storing surveyed positions for the staked points, it is recommended that you store the surveyed coordinates in another job. This is called the **Store** job. Storing the coordinates to a separate job allows you to download only the surveyed points without having to download the target point file (Design job).

The configuration for staking from one job and storing in another is shown in *Step 3* of section *7.1.*

7.1 Accessing Stakeout

Accessing stakeout

There are many ways to access stakeout. In this example we will access stakeout by doing the following:

Step	Action	Display
1	From the Main Menu: • Tap on **2 Programs….** This takes you to the GPS1200 Programs screen.	
2	In the GPS1200 Programs screen: • Tap on **Stakeout**. **Note**:In this example Stakeout is under number “8” but it may not be the same number with your receiver. This number depends upon how many programs you have installed on your receiver. This takes you to the STAKEOUT Stakeout Begin screen.	

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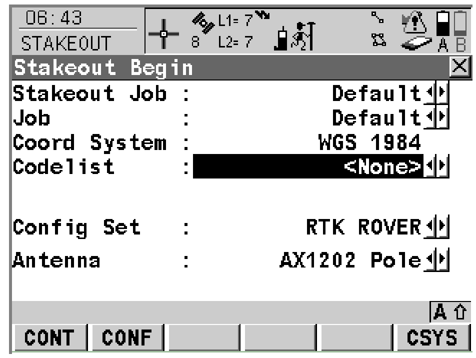
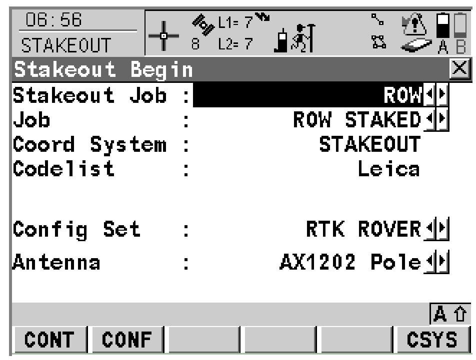
7.1 Accessing Stakeout, *Continued*

Step	Action	Display
3	In the to the STAKEOUT Stakeout Begin screen: Here we select the stakeout job, store job, coordinate system, codelist, config set, and antenna. • Select your stake job from the **Stakeout Job** list field. • Select a job to store your measured points in the **Job** field. This can be called the **store** job. • Select the coordinate system that your Stakeout job points are in. • Select a codelist if you are using one. If not then leave this field as **None**. • Select a config set (this should a RTK rover config set similar to the one we configured in *Chapter 4 The Real-Time Rover Configuration Set*). • Select an antenna type. Typically this would be an **AX1202 Pole**. **Note**: The stakeout and store jobs, coordinate system, and codelist are ones that we created for this example. Yours will differ. This is the same config set that we created in chapter *4.0 The Real-Time Configuration Set*. Once this information has been entered we will now configure the Stakeout application program. • Press the **F2 (CONF)** button. This takes you to the STAKEOUT Configuration screen.	 

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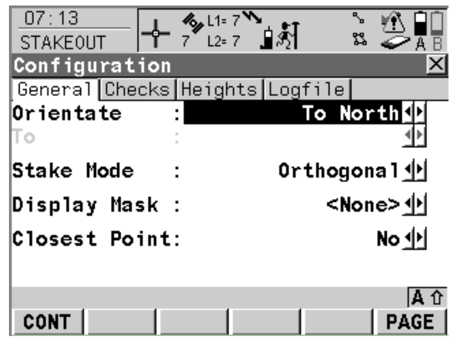
7.2 Configuring Stakeout

Stakeout Configuration

The STAKEOUT Configuration screen provides a means of configuring the stakeout program to behave in a way that is most suited to your preferences.

Step	Action	Display
4	In the STAKEOUT Configuration “General” page: The **Orientate** field sets the reference direction to be used to stakeout points. The stakeout elements and the graphical display shown in the Stakeout program are based on this selection. The choices are: • **To North**. The North direction shown in the graphical display is based on the active coordinate system. • **To Sun**. The position of the sun calculated from the current position, the time, and date. This is fine unless it’s noon and the sun is directly above you (or an overcast day). • **To Last Point**. Time wise this is the last recorded point. If no points are yet staked, the “To North” orientation is used for the first point to be staked. • **To Point (Stake or Store)**. This is an existing point that can either be in the stakeout or store job. • **To Line (Stake or Store)**. The direction of the orientation is parallel to a reference line. This reference line can reside either in the stakeout or store job. • **To Arrow**. The direction of the orientation is from the current position to the point to be staked. The graphical display shows an arrow pointing in the direction of the point to be staked. This step is continued on the following page.	

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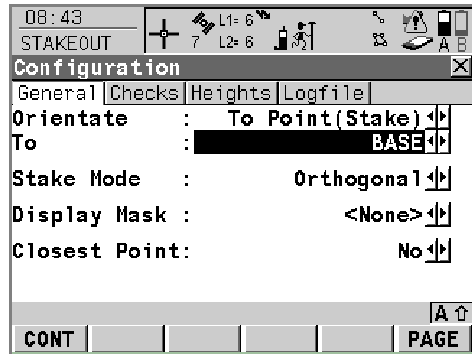
7.2 Configuring Stakeout, *Continued*

Step	Action	Display
4	Continuing in the STAKEOUT Configuration “General” page: **Note**: In this example we will choose the **To Point (Stake)**. The reference station point is always transmitted to the rover receiver and is stored in the Stakeout job. We will use our reference (Base) station as the orientation point. You may select another orientation if you find that easier to use. You may want to try “To Arrow”. • Select **To Point (Stake)**. Notice that the **To** field has now become active. This where we select which point we wish to use as our reference point. • Select a **To** point. **Note**: In our example the **To** point is called “Base”. **Stake Mode** defines the method of staking out. There are two choices: **Polar**: The direction from the orientation reference, the horizontal distance and the cut/fill are displayed. **Orthogonal**: The distance forwards to/backwards from the point, the distance right/left to the point, and the cut/fill are displayed. This step is continued on the following page.	

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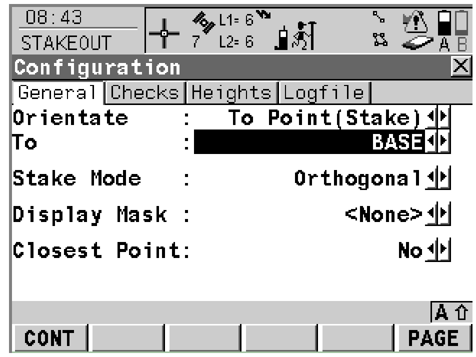
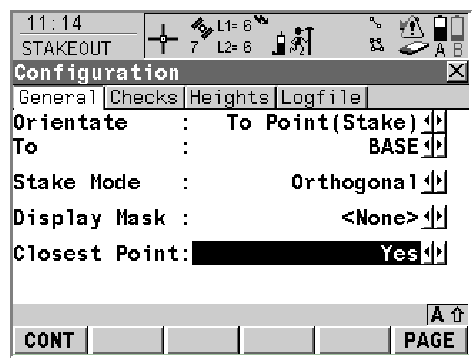
7.2 Configuring Stakeout, *Continued*

<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr>
<td>4</td>
<td>
This step is continued from the previous page.
Select a Stake Mode.
Note: In this example we are selecting “Orthogonal”.
Display Masks define the parameters displayed. Here you can select a user defined display mask that will be shown when you use the stakeout application. All display masks of the active configuration set (RTK Rover) defined when configuring the display settings can be selected. (See section 4.1 Editing a Real-Time Rover Configuration Set, steps 19-21 for defining a Display Mask.)
Select a Display Mask or leave this field as None.
Closest Point sets the order of the points for staking out. The two choices are:
Yes: After staking out and storing a point, the next point suggested for staking out is the point closest to the point which was staked. If there are many points in the stakeout job, the search may take a few seconds.
No: After staking and storing one point, the next point suggested for staking out is the subsequent one in the stakeout job.
Select a Closet Point method.
Tap on the “Checks” tab.
This takes you to the STAKEOUT Configuration “Checks” page.
</td>
<td>




</td>
</tr>
</table>

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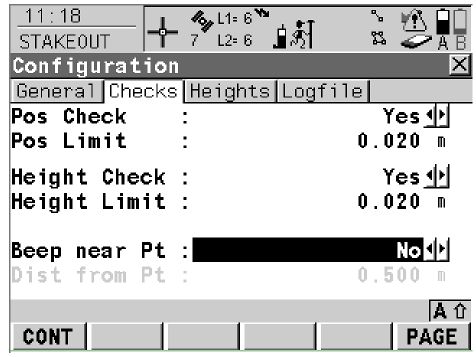
7.2 Configuring Stakeout, *Continued*

Step	Action	Display
5	In the “Checks” page of the STAKEOUT Configuration screen: **Pos Check** allows a comparison to be made on the horizontal coordinate difference between the manually occupied stake point and the point to be staked (i.e. the point in the stakeout job). **Pos Limit** defines the maximum horizontal coordinate difference accepted in the position check. If this value is exceeded, the stakeout can be repeated, skipped, or stored. **Height Check** allows a comparison to be made on the vertical coordinate difference between the manually occupied stake point and the point to be staked (i.e. the point in the stakeout job). **Height Limit** defines the maximum vertical coordinate difference accepted in the height check. If this value is exceeded, the stakeout can be repeated, skipped, or stored. This step is continued on the following page.	

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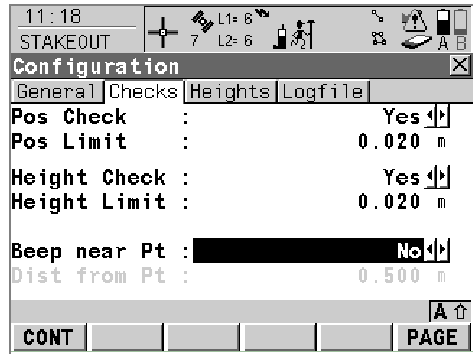
7.2 Configuring Stakeout, *Continued*

Step	Action	Display
5	Continuing in the “Checks” page of the STAKEOUT Configuration screen: In this example we are setting the **Pos Check** to **Yes** **Pos Limit** to **0.02m**. **Height Check** to **Yes**. **Height Limit** to **0.02m**. **Beep near Pt** sets the receiver to beep when the horizontal distance from the current position to the point to be staked is equal to or less then the distance defined in the **Dist from Pt** field. Although the tool can be a very useful feature, after staking many points the beeping can become bothersome so in this example we are setting **Beep near Pt** to “No”. • Set the **Beep near Pt** to your preference. • If you set **Beep near Pt** to **Yes** then set the tolerance in the **Dist from Pt** field. • Tap on the “Heights” tab. This takes you to the “Heights” page of the STAKEOUT Configuration screen.	

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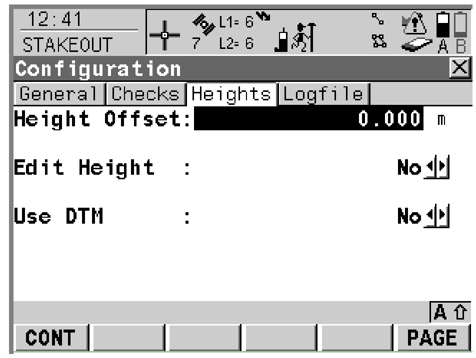
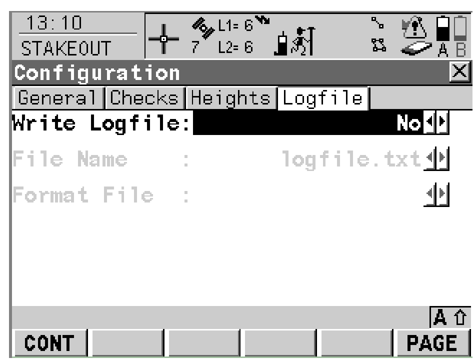
7.2 Configuring Stakeout, *Continued*

Step	Action	Display
6	In the STAKEOUT Configuration "Heights" page: The **Height Offset** function allows you to apply a constant height offset to all heights of points or the DTM being staked. In our example we will not use a height offset. • Leave the height offset settings as on the screen to the right. If you wish to use a height offset, please refer to page *33-14* of the *GPS1200 Technical Reference Manual*. • Tap on the "Logfile" tab. This takes you to the STAKEOUT Configuration "Logfile" page.	
7	In the STAKEOUT Configuration "Logfile" page: A logfile is a file to which data from an application program is written. The logfile is generated when the application program is exited. In this example we will not be using a logfile. For more information on logfiles, see the *GPS1200 Technical Reference Manual* page *33-15*. • Press the **F1 (CONT)** button to store the settings. This returns you to the STAKEOUT Stakeout Begin screen.	

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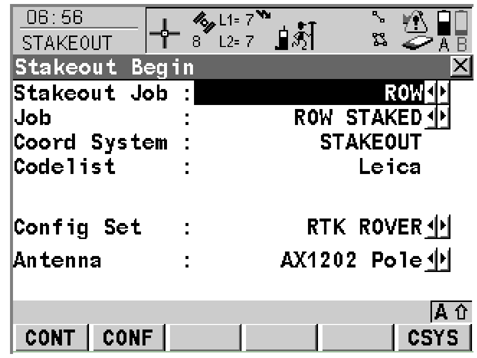
7.2 Configuring Stakeout, *Continued*

Step	Action	Display
8	In the STAKEOUT Stakeout Begin screen: We are now ready to begin our stakeout job. • Ensure that the settings on this screen are correct. **Remember**: Your jobs, coordinate system, and codelist may not match the example on the right. • Press the **F1 (CONT)** button. This takes you to the STAKEOUT Orthogonal Stakeout screen.	

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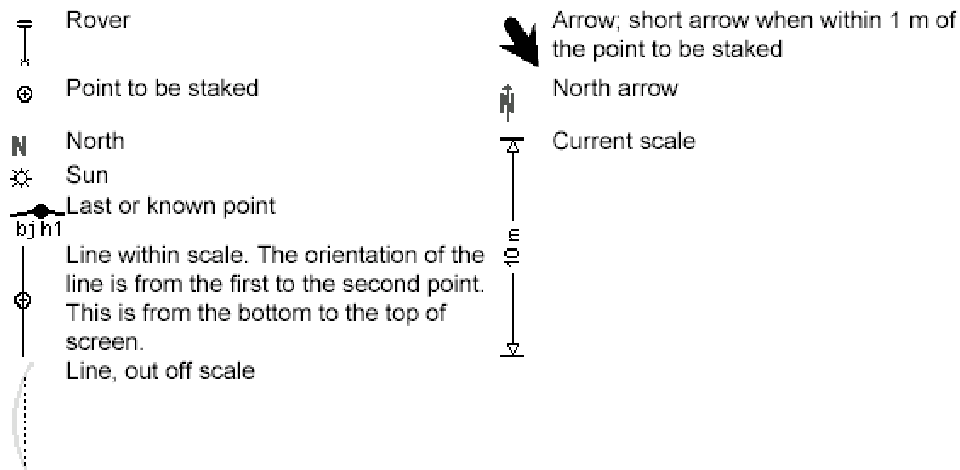
7.3 Staking Out Points

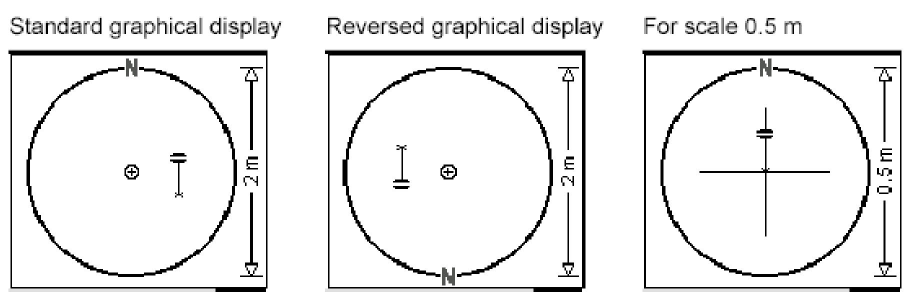
Graphical Display

The graphical display provides a guide to find the point to be staked out. The map page provides an interactive display of the data.

Below is a listing of the elements used in the graphical display.



If the antenna is too far away and the scale is >1000m, the antenna is not shown and the point-to-be-staked circle is gray.



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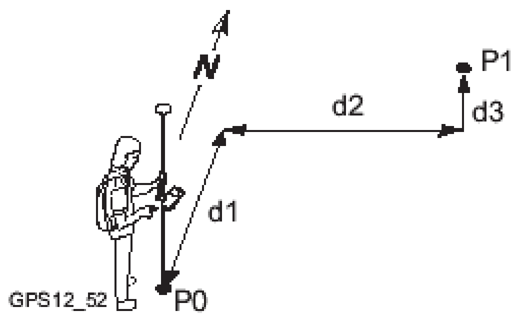
7.3 Staking Out Points, *Continued*

Orthogonal Stakeout

The stakeout elements are
- a horizontal distance forwards/backwards,
- a horizontal distance right/left and
- a cut/fill.

The values of these elements are calculated from the current position to the point to be staked.

The diagram below shows an example for stakeout in orthogonal mode with orientation set to "To North".



P0 Current position
P1 Point to be staked
d1 **<FORW:>** or **<BACK:>**
d2 **<RGHT:>** or **<LEFT:>**
d3 **<FILL:>** or **<CUT:>**

Note:

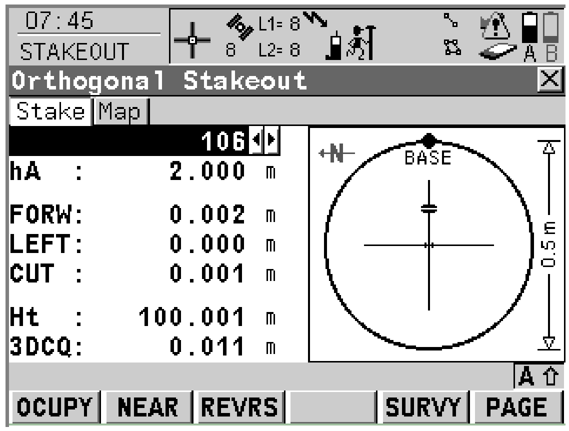
"Polar" is the other stakeout mode. If you would like to learn more about staking out using Polar mode, please see the *GPS1200 Technical Reference Manual*, page 33-30.

Continued on next page

7.3 Staking Out Points, *Continued*

Stakeout Display

Below is a typical display of the stakeout screen.



hA: The default antenna height as defined in the active configuration set is suggested. This can be changed during a stakeout job.

FORW/**BACK**: This is the horizontal distance from the current position to the point to be staked out in either the direction of the orientation (FORW) or in the reverse direction of the orientation.

RGHT/LEFT: This is the horizontal distance from the current position to the point to be staked out orthogonal to the direction of the right (or left) of the orientation direction.

CUT/**FILL**: The negative height difference (CUT) or the positive height difference (FILL) from the height of the current position to the height of the point being staked.

Ht: This is the height of the current position displayed as an orthometric height. If the orthometric height cannot be displayed, the ellipsoidal height is displayed. If it is not possible to display the ellipsoidal height then the WGS84 height is displayed. This height takes into account if you applied a height offset (remember from *Step 7*).

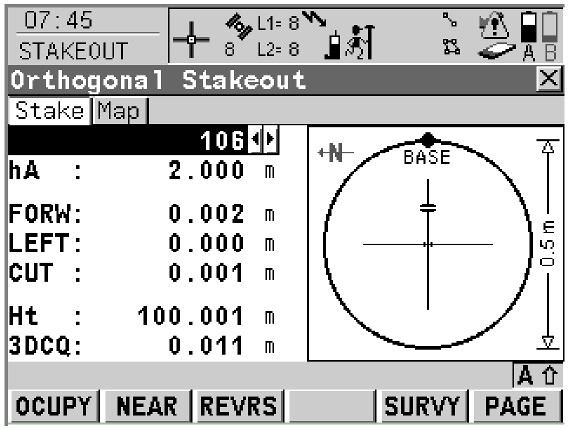
3DCQ: Available for code and phase fixed solutions. This is the current 3-dimensional quality of the current position.

Continued on next page

7.3 Staking Out Points, *Continued*

Stakeout Display

Continuing from the previous page:



F1 (OCUPY): This starts measuring the point being staked. The position mode icon changes to the static icon (see chapter 1 section *1.1.1 Icons* for more information on icons). The difference between the current position and the point being staked is still displayed.

F2 (NEAR): This initiates a search of the Stakeout job for the point that is nearest to the current position when the button is pressed. The point is selected as the point to be staked and is displayed in the first field on the screen. After staking and storing the nearest point, the next point suggested for staking out is the one that was suggested before the **NEAR** button was pressed.

F3 (REVRS): This button reverses the graphical display top to bottom. A reversed graphical display can be used when the point to be staked lies behind the current position.

F5 (SURVY): This allows you to survey additional points that you may need to pick up during a stakeout survey. To return to the Stakeout application, press the **ESC** button.

SHIFT F2 (CONF): This takes you to the Stakeout program configuration program just as what we did in step 4.

SHIFT F4 (INIT): This allows you to select an initialization method and force a new initialization.

Continued on next page

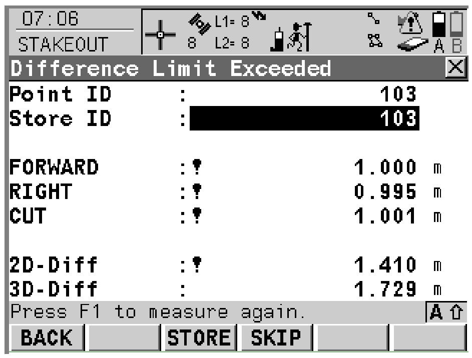
7.3 Staking Out Points, *Continued*

Stakeout Difference Limit Exceeded

We configured the receiver to do a check of the horizontal and vertical coordinate differences between the manually occupied point (the point that was just staked out and stored) and the point to be staked out (from the stakeout job) [see section *4.2 Configuring Stakeout*].

The screen below is accessed automatically when the point is stored and if either of the configured difference limits are exceeded.

Limits that have been exceeded are shown in bold and indicated by a .



Point ID: This is the point that was staked (from the Stakeout job).
Store ID: This is the unique number that is used to store the manually occupied staked point (from the store job). A different point ID is allowed if needed.
FORWARD/BACK: The horizontal distance from the manually occupied staked point to the point that was staked in the direction (FORWARD) /reverse direction (BACK) of the orientation.
LEFT/RIGHT: The horizontal distance from the manually occupied staked point to the point that was staked orthogonal to the left/right of the orientation direction.
CUT/FILL: The negative/positive height difference from the height of the manually occupied staked point to the height of the point to be staked.
2D-Diff: This displays the horizontal difference from the manually occupied staked point to the point to be staked.
3D-Diff: This displays the spatial difference from the manually occupied staked point to the point to be staked.

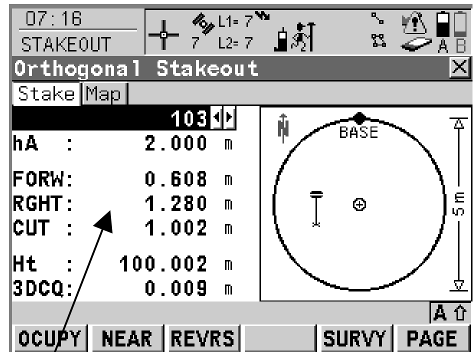
Use the **F1 (BACK)** button to not accept this stored point and return to stake the same point again.

Use the **F3 (STORE)** button to accept this point, store it, and move on to the next point.

Use the **F4 (SKIP)** button to not accept the stored point and return to the Stakeout screen.

Continued on next page

7.3 Staking Out Points, *Continued*

Step	Action	Display
1	Continuing from where we left off in Configuring Stakeout: In the STAKEOUT Orthogonal Stakeout screen: In this example we are staking out point “103”. As you can see from the display, we need to move forward towards our reference direction which is where our reference receiver is located (remember this was set in section *4.2 Configuring Stakeout, Step 4*) a distance of 0.608 metres and we need to move to our right (while facing our reference point) a distance of 1.280 metres. We also need to go down in elevation 1.002 metres to reach our design stakeout location. You can also see from the graphical display that our rover’s antenna needs to move towards the right and towards our Base point.	

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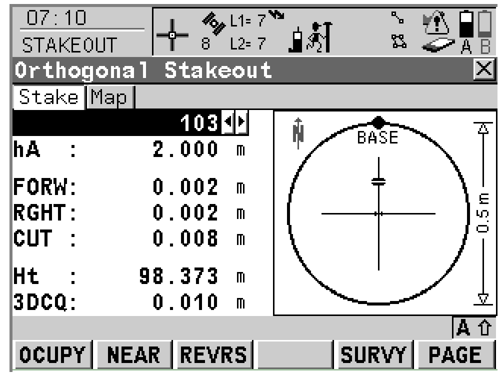
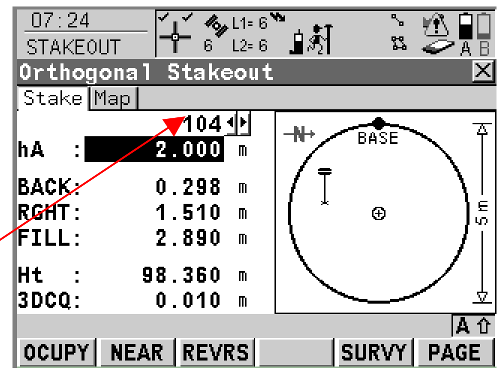
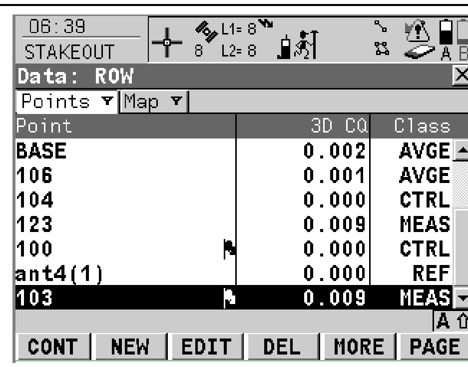
7.3 Staking Out Points, *Continued*

Step	Action	Display
2	Continuing in the STAKEOUT Orthogonal Stakeout screen: We've moved over to the right and forward toward the Base point and now we are directly on top of the point to be staked. We are ready to store this point. • Press the **F1 (OCUPY)** button. The point is stored in the store job and the next closest point, "104", is presented and ready to be staked out. Remember we configured the receiver to show the next closest point after manually occupying a staked out point. To review our stake out job: • Tap on the field where the point numbers are. This takes you to the STAKEOUT Data: screen.	 
3	In the STAKEOUT Data: screen: On the right is a display of our ROW (stakeout) job. Notice the two points with the  symbol. This indicates that these points have already been staked out. • Tap on the "Map" tab (or press the **F6 (PAGE)** button). This takes you to the "Map" page of the STAKEOUT Orthogonal Stakeout screen.	

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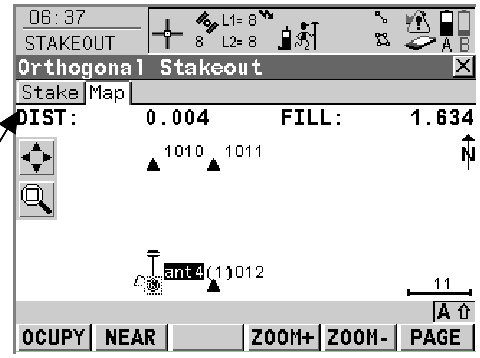
7.3 Staking Out Points, *Continued*

Step	Action	Display
4	In the "Map" page of the STAKEOUT Orthogonal Stakeout screen: Active points can be selected, using the touch screen, as points to be staked. An arrow indicating the direction from the current position to the point to be staked is provided. A box provides information such as the distance to the stakeout point and the CUT/FILL value so the point to be staked can be found. **F2 (NEAR)** searches the stakeout job for the point nearest to the current position when the button is pressed. **F4 (Zoom+)** zooms into the map. Pressing the **ESC** button stops the zooming process. **F5 (Zoom-)** zooms out of the map. Pressing the **ESC** button stops the zooming process. **SHIFT F2 (CONF)** access the Mapview Configuration page. **SHIFT F3 (FIT)** fits all displayable data in the screen area. **SHIFT F4 (CENTR)** centers the screen around the rover.	

Summary

In this chapter you learned how to stakeout a point by first accessing the Stakeout program and then configuring how you would like the Stakeout program to behave.

8.0 Coordinate Systems Management

In this Chapter

The following sections of this chapter describe creating coordinate systems and its components.

Section	Topic
8.1	Coordinate System Elements
8.2	Managing Coordinate Systems
8.3	Coordinate Systems (Including State Plane)

Introduction

GPS measured points are always stored based on the global geocentric datum known as WGS 1984. Most surveys require coordinates in a local grid system, for example, based on a country's official mapping datum or an arbitrary grid system used in a particular area such as a construction site. To convert the WGS 1984 coordinates into local coordinates, a coordinate system is required.

Coordinate systems, as defined on the GPS receiver, may consist of the following 5 components:
- Map Projection,
- Ellipsoid,
- Transformation,
- Geoid Model, and
- Country Specific Coordinate System (CSCS) model.

A coordinate system can be:
- Attached to jobs,
- Manually defined,
- Computed in the field,
- Downloaded to LGO (LEICA Geo Office), and
- Uploaded from LGO.

☞ **Important Concept To Remember**: All GPS surveyed points are always stored as WGS 1984 geodetic coordinates regardless of the coordinate system being used. Using a different coordinate system converts the coordinates displayed on the screen, but does not convert and restore the coordinate values in the DBX database.

☞ One coordinate system can be attached to a job at one time. This coordinate system remains attached to the job unless it is changed.

Continued on next page

8.1 Coordinate System Elements

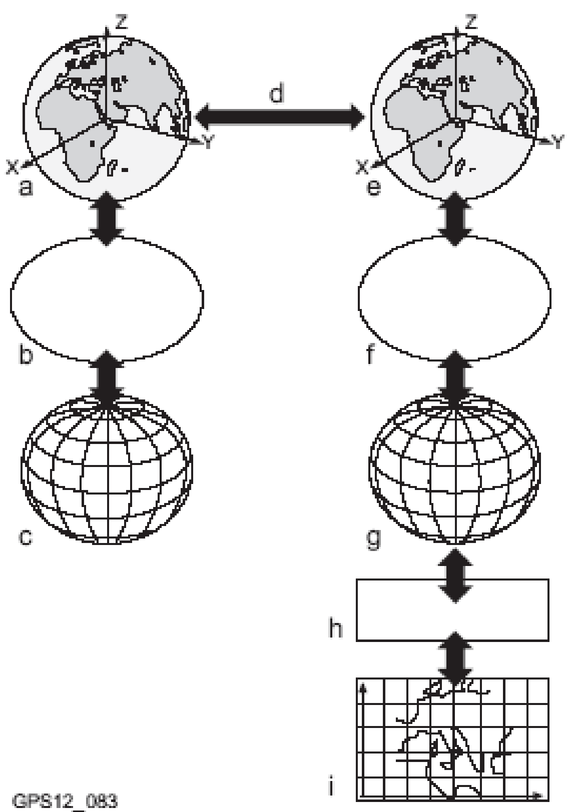
Coordinate Systems

Normally we want to get from (GPS) geodetic coordinates to local grid coordinates.

The diagram below shows how the different coordinate system elements transform GPS coordinates to grid and vice versa.

The a-b-c sequence of images shows how we get from Cartesian WGS 1984 coordinates to geodetic and back.

The a-d-e-f-g-h-i sequence of images shows how we get from Cartesian WGS 1984 coordinates to our local grid coordinate system and back again.



GPS12_083

a) WGS 1984 cartesian: X, Y, Z
b) WGS 1984 ellipsoid
c) WGS 1984 geodetic: Latitude, longitude, ellipsoidal height
d) 7 parameter transformation: dX, dY, dZ, rx, ry, rz, scale
e) Local cartesian: X, Y, Z
f) Local ellipsoid
g) Local geodetic: Latitude, longitude, ellipsoidal height
h) Local projection
i) Local grid: Easting, Northing, orthometric height

Continued on next page

8.1 Coordinate System Elements, *Continued*

Transformations

When a coordinate system uses an ellipsoid other than WGS 1984, we may define a transformation to account for the shifts in origin and rotations between the two ellipsoids.

Map Projections

Map projections are used to project a curved surface (earth's surface) onto a plane (map).

Map projection examples include:

- Lambert,
- Transverse Mercator (TM), and
- Universal Transverse Mercator (UTM).

State Plane NAD 83

State Plane (NAD 83) coordinate systems are based on pre-defined map projections and the GRS 1980 ellipsoid. The GRS 1980 and WGS 1984 ellipsoids are considered to be the same. Typical State Plane coordinate system components are:

- **Ellipsoid:** GRS 1980.
- **Projection:** Typically Lambert or Transverse Mercator, as defined for each State Plane Zone.
- **Geoid Model:** Optional – required for conversion from ellipsoidal to orthometric heights.
- **Transformation:** None.

UTM Coordinates

UTM coordinate systems are created in a similar fashion to the state plane coordinate systems. The user must select the ellipsoid, map projection, and geoid model (if required). A transformation is necessary only when converting to an ellipsoid other than WGS84.

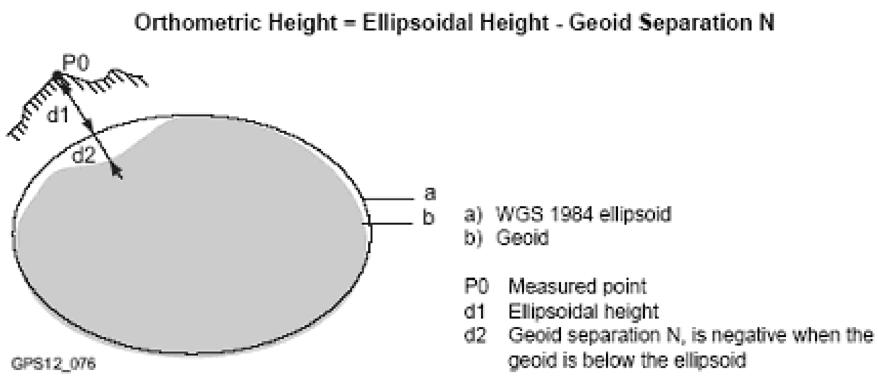
Continued on next page

8.1 Coordinate System Elements, *Continued*

Geoid Models

Geoid models may also be included in the coordinate system when conversion from ellipsoidal to orthometric heights is required.

As we learned from the previous page, GPS operates on the WGS 1984 ellipsoid and all heights are ellipsoidal heights. Existing heights are usually orthometric heights, also called “height above mean sea level”, “height above the geoid”, or “leveled height”. “Mean sea level” corresponds to a surface as the geoid. The relation between ellipsoidal height and orthometric heights is



The geoid separation (N value) is the distance between the geoid and the reference ellipsoid. It may refer to WGS 1984 or to a local ellipsoid. It is not a constant except over maybe small flat areas such as 5km x 5km (3miles x 3miles). Therefore it is necessary to model the N value in order to obtain accurate orthometric heights. The modeled N values form a geoid model for an area (Geoid03 for the US). With a geoid model attached to a coordinate system, N values for the measured points can be determined. Ellipsoidal heights can be converted to orthometric heights and back.

Geoid field files may be used in the field to calculate orthometric heights out of ellipsoidal heights and vice versa. You must generate the geoid model field files in LGO.

Continued on next page

8.1 Coordinate System Elements, *Continued*

CSCS Model

Country Specific Coordinate System models:

- are tables of correction values to directly convert coordinates from WGS 1984 to local grid without the need of transformation parameters,
- take the distortions of the mapping system into account, and
- are an addition to an already defined coordinate system.

CSCS field files may be used in the field. They are extracted from the main CSCS model that may be too big to fit on the instrument.

Default Coordinate Systems

The default coordinate system is WGS 1984. It cannot be deleted.

Coordinate System WGS 1984

WGS 1984 is the global geocentric datum to which all GPS positioning information is referred. WGS 1984 is the default coordinate system on the GPS1200 receiver. It is not possible to create a coordinate system called "WGS 1984".

Coordinate System "None"

None is the default coordinate system on a TPS1200 instrument. It is not possible to manually create a coordinate system called "None".

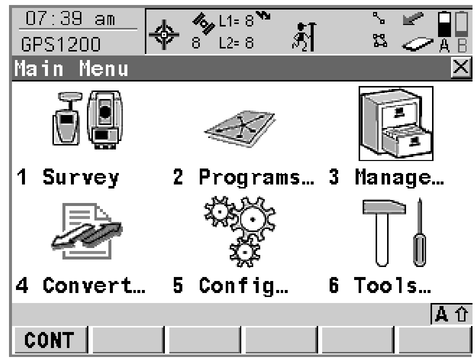
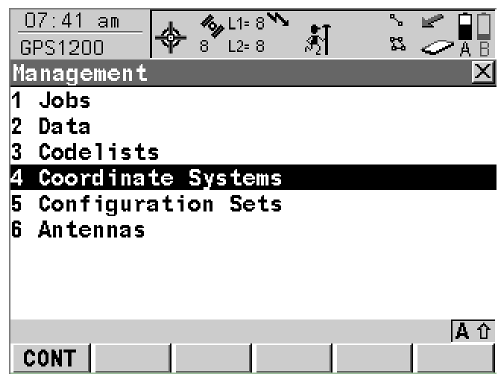
Active Coordinate System

The active coordinate system is the one attached to the job currently being used. One coordinate system is always considered as the active coordinate system.

8.2 Managing Coordinate Systems

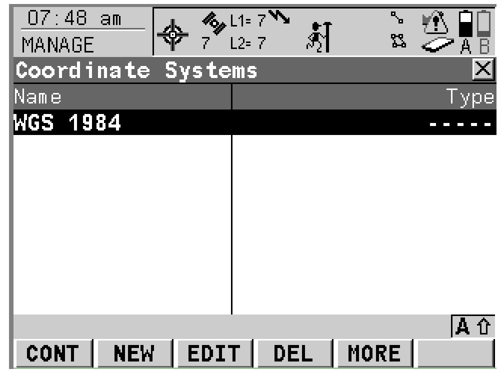
Coordinate Systems Management

The following steps describe how to access and manage coordinate systems.

Step	Action	Display
1	From the Main Menu: • Tap on **3 Manage…** . This takes you to the GPS1200 Management screen.	
2	In the GPS1200 Management screen: • Tap on **4 Coordinate Systems**. This takes you to the MANAGE Coordinate Systems screen.	

Continued on next page

8.2 Managing Coordinate Systems, *Continued*

Step	Action	Display
3	In the MANAGE Coordinate Systems screen: Here you may edit or delete an existing coordinate system or create a new coordinate system. **F1 (CONT)** Press this button to select the highlighted coordinate system and return to the previous screen. **F2 (NEW)** This button creates a coordinate system manually. See the next section, *8.3 Creating a State Plane Coordinate System* to learn how to create a coordinate system. **F3 (EDIT)** This button accesses the editing of the highlighted coordinate system. For more information on editing coordinate systems, see the *GPS1200 Technical Reference Manual* section *11.4.1 Editing a Coordinate System*. **F4 (DEL)** This deletes the highlighted coordinate system. **F5 (MORE)** This displays information about the type of transformation used, the type of heights computed, the number of control points used for the determination and the date when the coordinate system was created. **SHIFT F4 (SET-D)** This is available unless a default coordinate system is highlighted. This turns the highlighted coordinate system into a user defined default coordinate system stored on the receiver. **SHIFT F5 (DEFLT)** This recalls the deleted default coordinates systems.	

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8.3 Coordinate Systems (Including State Plane)

Creating A Coordinate System

The easiest and recommended way to have a coordinate system (such as state plane or UTM) reside on your receiver is to transfer one that was created in LGO. The following four FAQs (Frequently Asked Questions) have been taken from the Advantage web site and describe:

- how to create a geoid model in LGO,
- how to create a coordinate system in LGO and attach it to a project,
- how to transfer a coordinate system from LGO to the GPS1200 receiver, and
- how to create and attach a geoid model field file to a coordinate system on the GPS1200 receiver.

These FAQs describe the steps necessary to have a coordinate system reside on your GPS1200 receiver. This coordinate system will enable you to work in local coordinates such as state plane and work in orthometric heights.

FAQ	Topic
FAQ 1	Installing a Geoid Model in LGO
FAQ 2	Creating a Coordinate System (State Plane)
FAQ 3	Transferring a Coordinate System From LGO to the GPS1200
FAQ 4	Attaching a Geoid Model Field File to a Coordinate System On the GPS1200

These FAQs have been edited to serve the purpose of this chapter. The full versions of these FAQs can be found at: http://www.leicaadvantage.com/support/GPS1200/GPS_LGO_SKI-Pro_FAQs.html

Continued on next page

FAQ 1 Installing a Geoid Model in LGO

Question How do I install a geoid model in LGO/SKI-Pro?

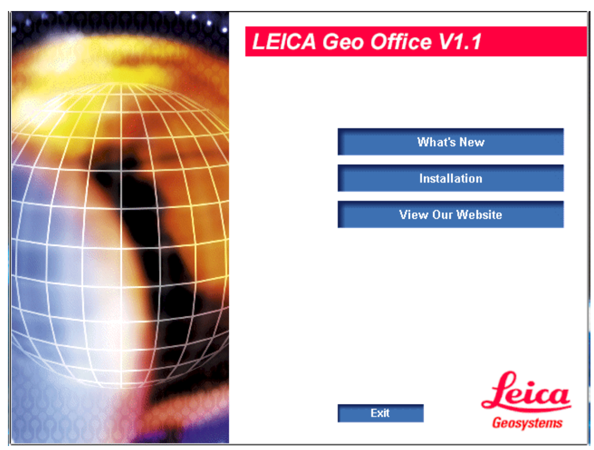
Background A geoid model is required to compute geoid separations which enables LGO to derive orthometric heights.

You must attach a geoid model to a coordinate system and then attach that coordinate system to your project.

First we must copy Geoid03 from the LGO or SKI-Pro (version 3.0) CD to our computer's hard drive. Then in LGO or SKI-Pro we'll create a geoid model from the files we copied from the CD, attach it to a coordinate system, and then attach that coordinate system to a project.

Answer Follow the directions below to install a geoid model in LGO or SKI-Pro.

For the remainder of this document, we will be using the term "LGO" as a replacement for the term "LGO or SKI-Pro".

Step	Action	Display
1	From within Microsoft Windows: • Insert the LGO CD into your CD drive. The auto-run software installation process will begin. When you have an opportunity to stop or cancel this, do so. • Press the **Exit** button. This stops the installation procedure and closes the window.	

Continued on next page

<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr><td>2</td><td>From within Windows Explorer:

• Navigate to your CD drive.

In this example it is the “D” drive

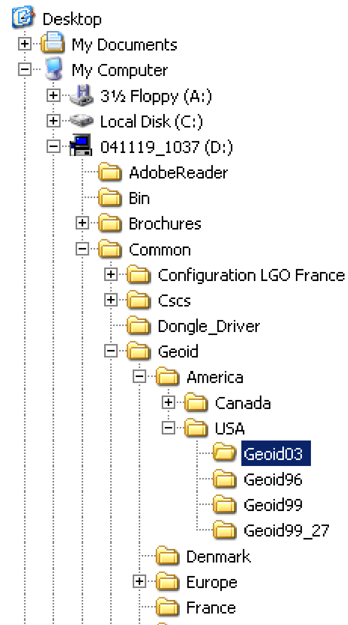
• Open the Common folder.

• Open the Geoid folder.

• Open the America folder.

• Select the GEOID03 folder.

• Copy this folder.

We now want to paste this folder into the Leica Geosystems folder on your computer’s hard drive.</td><td>
</td></tr>
<tr><td>3</td><td>Continuing in Windows Explorer:

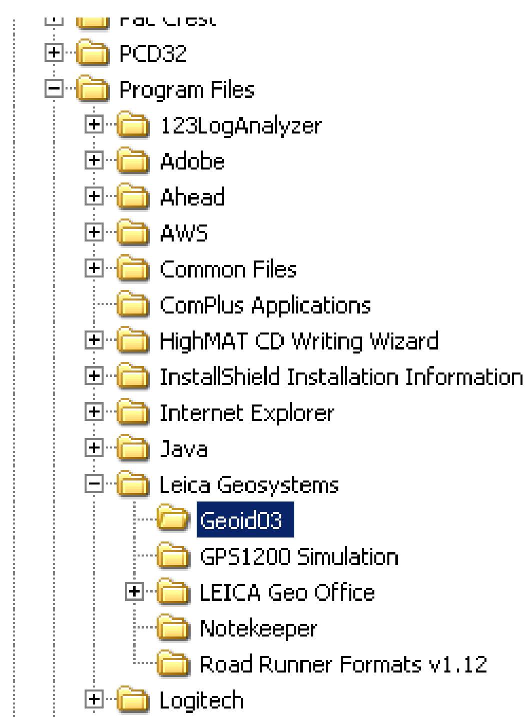
• Navigate to your C: drive.

• Open the Program Files folder.

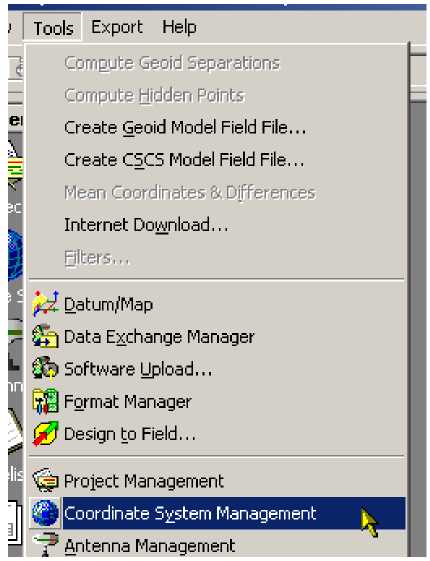
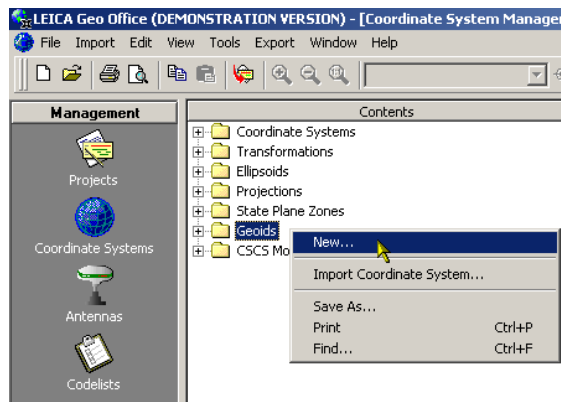
• Open the Leica Geosystems folder.

• Paste the GEOID03 folder into the Leica Geosystems folder.

Note: Do not be concerned if you do not have the same folders in your Leica Geosystems folder as in the image on the right, but you should have the newly copied GEOID03 folder.

We have copied the Geoid03 geoid model folder to your hard drive. Now we must create a geoid model in LGO and attach it to a coordinate system.</td><td>
</td></tr>
</table>

Continued on next page

Step	Action	Display
4	From within Microsoft Windows: • Start LGO. • Click on the “Tools” pull-down menu within LGO. • Select “Coordinate System Management”. This opens the “Coordinate System Management” view.	
5	From within the “Coordinate System Management” view: • Right-click on the **Geoids** folder. • Select “New…” from the pop-up window. This opens the “New Geoid Model” window.	

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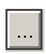
<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr>
<td>6</td>
<td>

From within the “New Geoid Model” window:

- Enter a name for the new Geoid model.
- Select **GRS 1980** as the ellipsoid.

Note: We are using the GRS 1980 ellipsoid for this particular geoid model because this model will then be attached to a NAD83 state plane coordinate system that uses a GRS 1980 ellipsoid. **It is imperative that the ellipsoid for the geoid model match the ellipsoid for the coordinate system!**

- Select **Geodetic** as the coordinate type.
- Click on the  button.

This opens the “Select Program” window.

- Navigate to where the **GEOID03** folder is stored.
- Open the “GEOID03” folder.
- Select **Geoid03.exe**.
- Press the **OK** button.

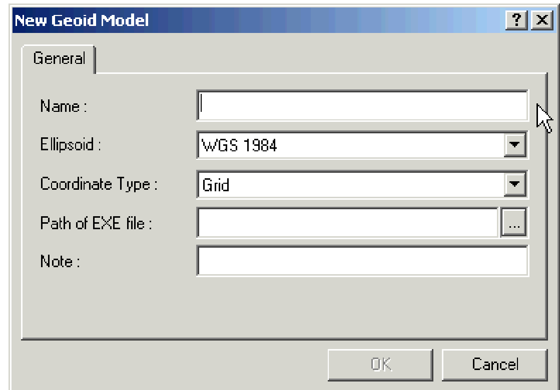
This closes the “Select Program” window and returns you to the “New Geoid Model” window.

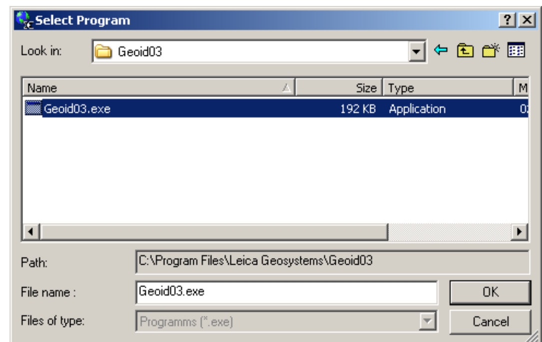
You have the option of entering a note, but it is not required.

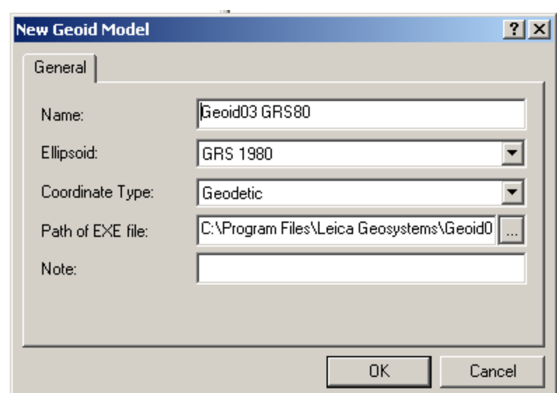
- Press the **OK** button.

This closes the “New Geoid Model” window and creates the geoid model.

</td>
<td>

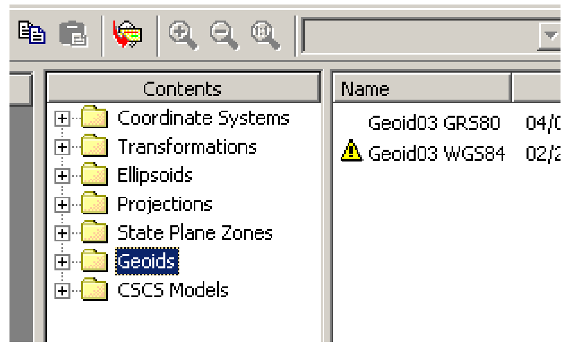






</td>
</tr>
</table>

Continued on next page

Step	Action	Display
7	Continuing within the “Coordinate System Management” view: We can now see the newly created geoid model in the **Geoids** folder.	

Conclusion of 1st FAQ

This section described how to create a geoid model in LGO.

Continued on next page

FAQ 2 Creating a Coordinate System (State Plane)

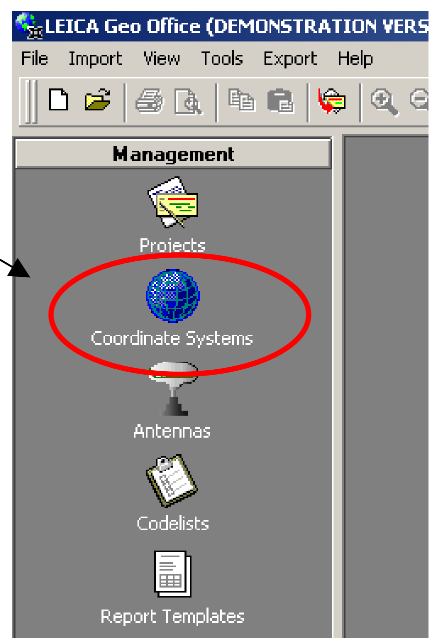
Question How do I create a state plane coordinate system (or any coordinate system) in SKI-Pro/LGO and attach it to an existing project?

Background Coordinate Systems are used to convert WGS 1984 coordinates into “local” coordinates. The term “local” is used to describe any coordinate type other than WGS 1984 coordinates. For example, “local” coordinates could be UTM, state plane NAD83, NAD27, etc.

Coordinate systems may consist of transformations, a map projection (which includes state plane zones), an ellipsoid, and a geoid model (if you wish to have orthometric heights).

Answer Follow the steps below to create and then attach a state plane coordinate system to an existing project in LGO. In this example we will be creating a Georgia West NAD83 coordinate system.

Note For the remainder of this document, we will use LGO and SKI-Pro interchangeably, that is both names will mean the same.

Step	Action	Display
1	From the main menu of LGO: • Click on the Coordinate Systems icon under the Management tab. This takes you to the “Coordinate Systems Management” screen.	

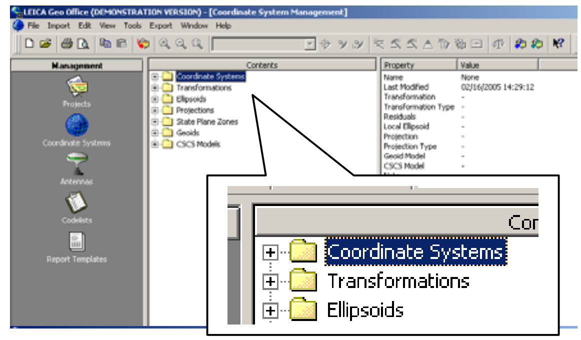
Continued on next page

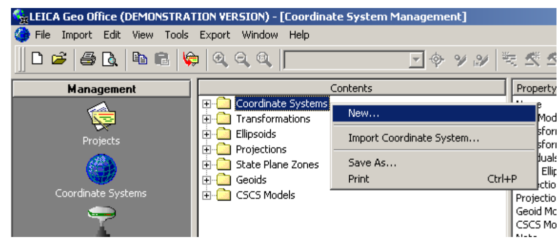
<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr><td>2</td><td>In the Coordinate Systems Management screen:

• Right-click on the Coordinate Systems folder.

This opens a pop-up window.

• Select (left-click) on “New…”.

This opens the “New Coordinate System” dialogue box.</td><td>


</td></tr>
<tr><td>3</td><td>In the “New Coordinate System” dialogue box:

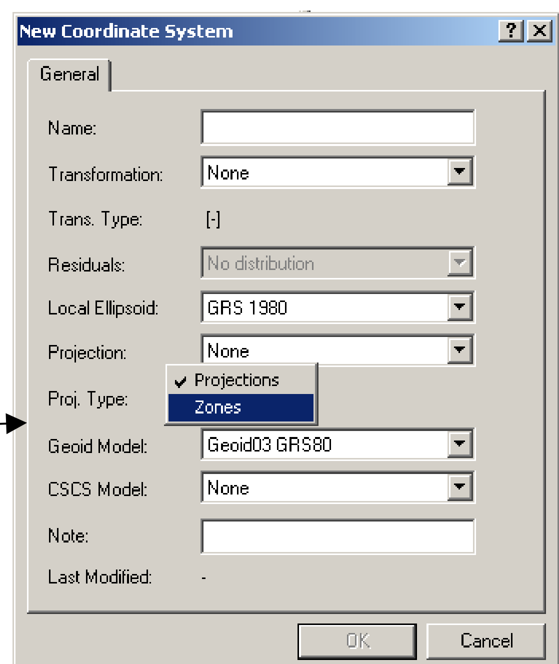
• Look for the word “Zones” here.

If it says “Projection” as it does on the image on the right, then we must change it to “Zones”. If it already says “Zones” then you need to do nothing in this step.

• Right-click on top of the word Projection and select Zones from the pop-up box.

This will change the dialog box to enable us to access state plane zones.

Note: You will only need to do this once. LGO’s default mode is “Projection ”. Once you change this to “Zones”, it will remain “Zones”.

This step is continued on the following page.</td><td>
</td></tr>
</table>

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<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr><td>3</td><td>
Continuing in the “New Coordinate System” dialogue box:

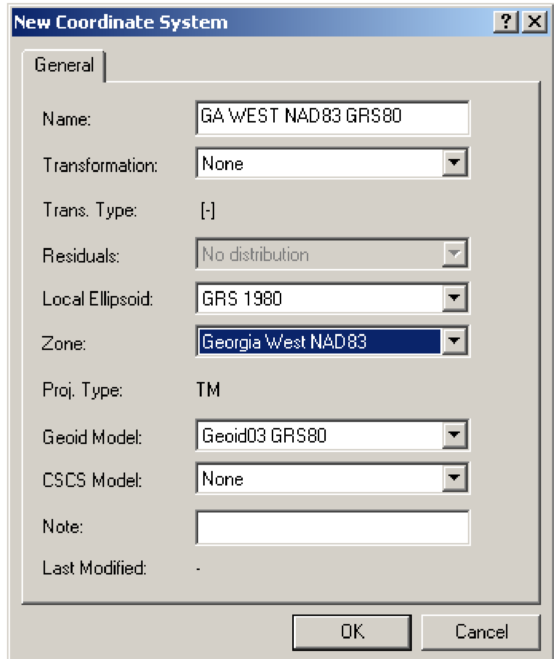
In this example we are creating a Georgia West NAD83 state plane coordinate system. The NAD83 state plane zones were created using the GRS 1980 ellipsoid. A Geoid03 geoid model will be attached to this coordinate system.

• Fill in the appropriate fields.

Name: We recommend that you name the coordinate system a similar name as the state plane zone. In this example we are providing even more information in the name such as which ellipsoid was used.
Transformation: Leave this as “None”.
Local Ellipsoid: To be “geomatically” correct, the proper ellipsoid to use is GRS 1980. WGS 1984 has been recommended in the past and does work but to be absolutely correct, GRS 1980 should be used.
Zone: Select your state plane zone from the pull-down menu’s list.
Geoid Model: If you wish to work with orthometric heights, a geoid model is required. In this example a geoid model had already been created from the previous FAQ. Select a geoid model.

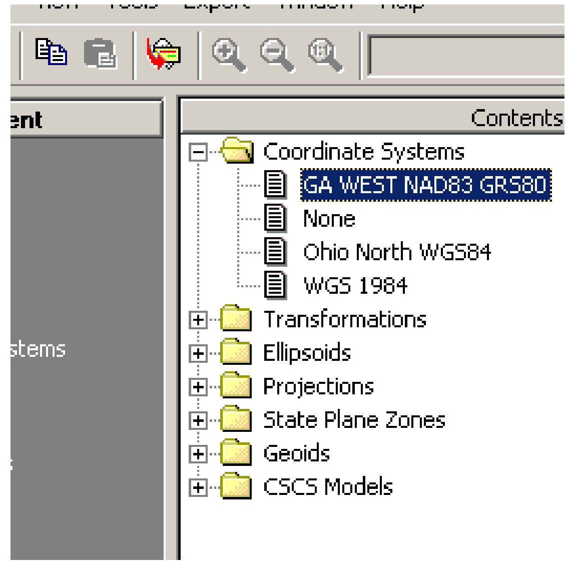
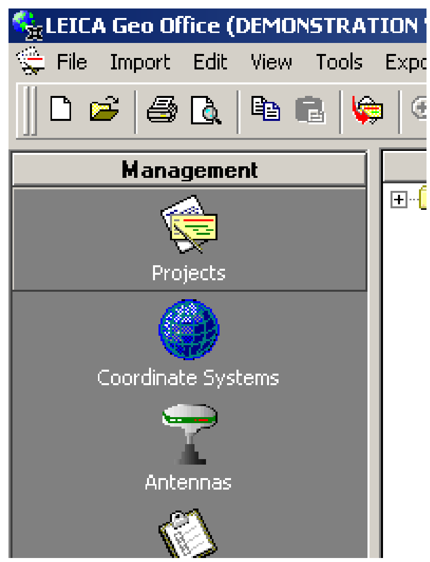
Important Note: The ellipsoid used in the geoid model MUST match the geoid model used in the coordinate system.

• Press on the OK button when finished entering the fields.

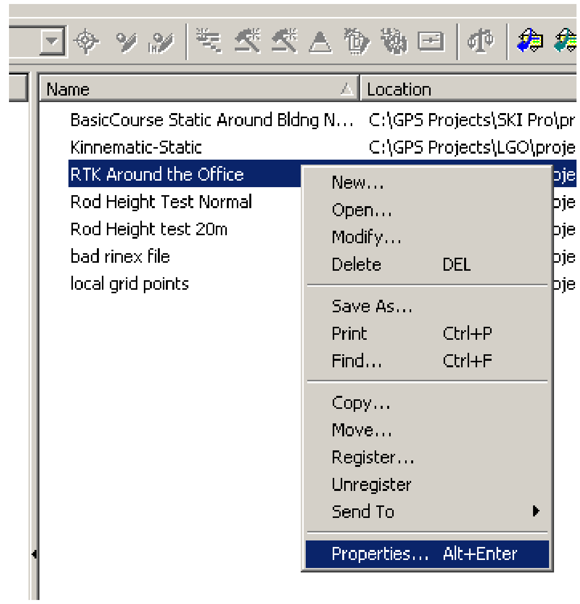
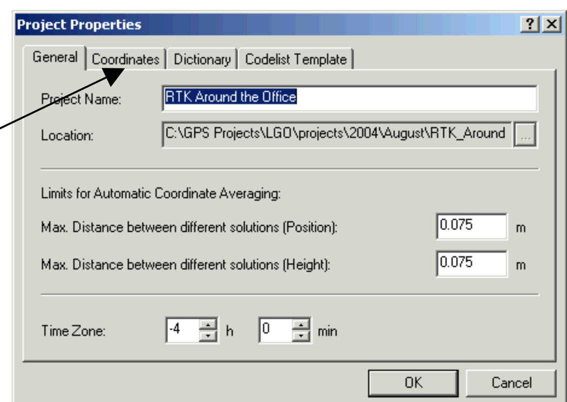
This creates the state plane zone and closes the dialog box.
</td><td>


</td></tr>
</table>

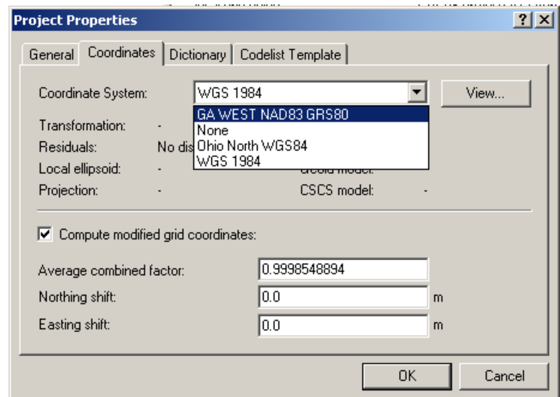
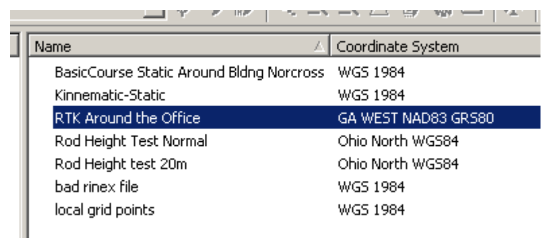
Continued on next page

Step	Action	Display
4	Continuing in the “Coordinate System Management” screen: We can now see the newly created coordinate system in the Coordinate Systems folder. Now we will attach this coordinate system to an existing project.	
5	From the Management tab view: • Click on the **Projects** icon: This takes you to the “Management Projects” screen.	

Continued on next page

Step	Action	Display
6	In the "Management Projects" screen: • Right-click on the project that you wish to attach the newly created state plane coordinate system to. • Scroll down the pop-up box and click on "Properties". This takes you to the "Project Properties" dialog box.	
7	In the "Project Properties" dialog box: • Click on the "Coordinates" tab. This takes you to the "Coordinates" screen.	

Continued on next page

Step	Action	Display
8	In the “Coordinates” tab screen: • Click on the down arrow besides the **Coordinate System** field. This opens a pull-down menu that lists all coordinate systems existing in LGO. • Scroll down the list and select the newly created state plane zone. • Press the **OK** button. This attaches the coordinate system to the project. You can now see in Management Projects view that the project is now listed with the coordinate system attached.	 

Conclusion of 2nd FAQ

You have just learned how to create a coordinate system in LGO using a state plane zone map projection and attach this coordinate system to an existing project.

Continued on next page

FAQ 3 Transferring a Coordinate System From LGO to the GPS1200

Question

How do I transfer a coordinate system such as a state plane zone coordinate system from LGO to my System 1200 receiver?

Background

The Data Exchange Manager enables you to convert LGO database objects (e.g. projects) into objects for the instruments (e.g. jobs) and then transfer them onto the Compact Flash (CF) card.

Answer

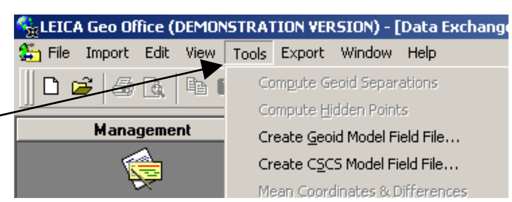
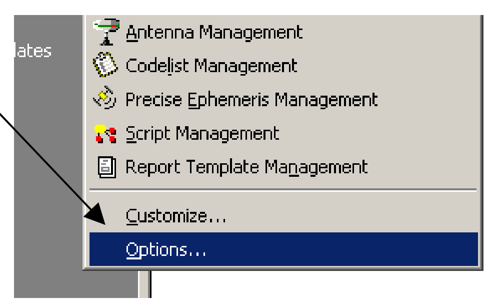
Follow the steps below to transfer a coordinate system to the System 1200's compact flash card. In this example we will be transferring a Georgia West NAD83 coordinate system that was already created in LGO.

Note

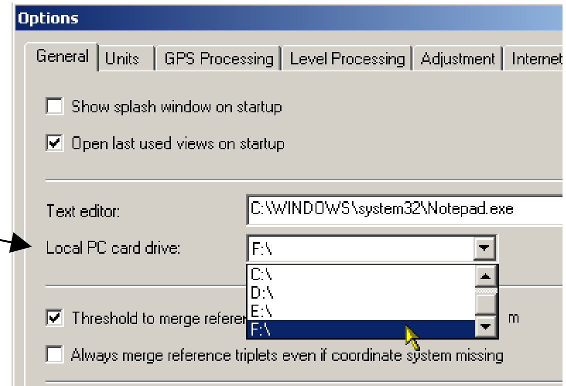
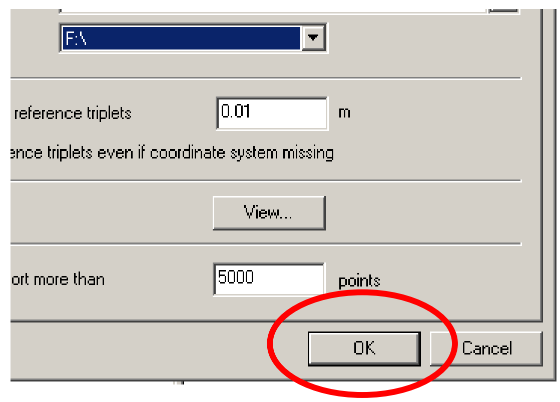
For the remainder of this document, we will use LGO and SKI-Pro (version 3.0) interchangeably, that is both names will mean the same.

PC Card Drive Letter

Before we begin, we must make sure that LGO knows which drive letter your card reader has been assigned by Windows. To verify which letter it is, use **Windows Explorer** to see which drive letter has been assigned to the card reader drive. In this example the drive letter that will be used is "**F**".

Step	Action	Display
1	From the main menu of LGO: • Click on the "Tools" pull-down menu and scroll down to the "Options…" selection and left-click on it. This opens the "Options" pop-up window, General tab page.	

Continued on next page

Step	Action	Display
2	From the “Options” pop-up window, “General” tab page: • Click on the **Local PC card drive:** field and select the correct drive letter by left clicking on it. • Press the **OK** button when finished. This sets the drive letter and closes the “Options” pop-up box.	 

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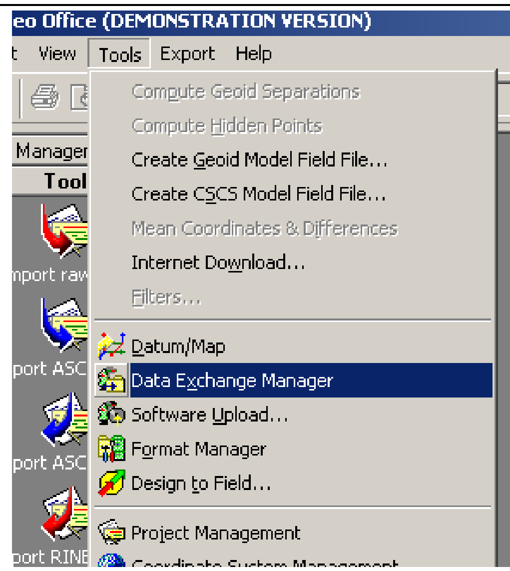
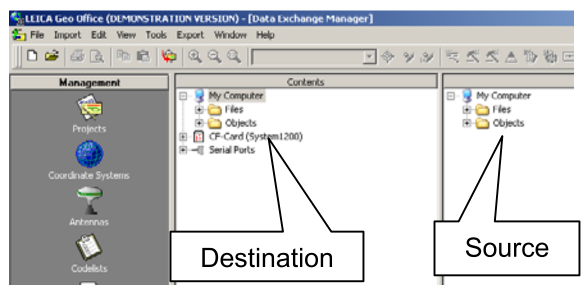
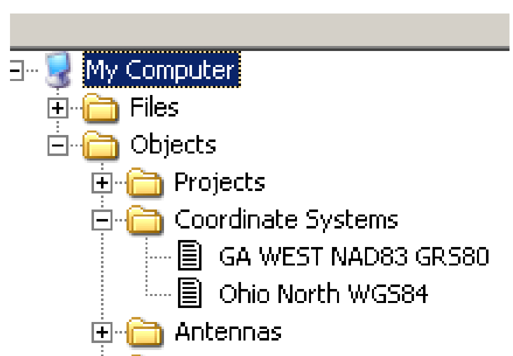
Data Exchange Manager

Now let's transfer a coordinate system to the compact flash card.

Step	Action	Display
1	From the main menu of LGO: • Click on the "Tools" pull-down menu and select "Data Exchange Manager". This takes you to the "Data Exchange Manager" view.	
2	In the "Data Exchange Manager" view: Notice that the screen is split into two sections (Destination and Source). As you can see in the image on the right, the right side of the screen is the data source and the left side is the data's destination (usually a compact flash card). The **Objects** folder is where LGO items such as projects, coordinate systems, antennas, codelists, etc. exist. • On the "Source" side, left click on the plus sign on the left side of the **Objects** folder. This opens the objects folder. • Open the **Coordinate Systems** folder that is in the **Objects** folder. With the **Coordinate Systems** folder open we can see its contents.	 

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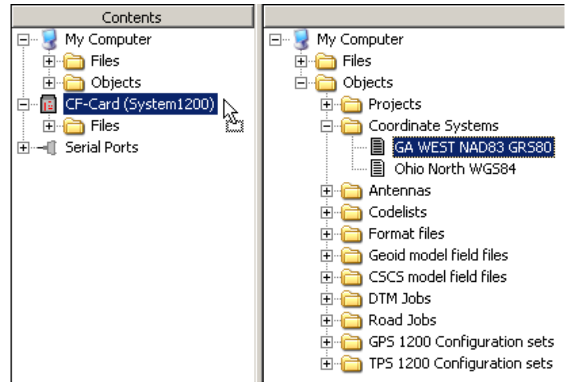
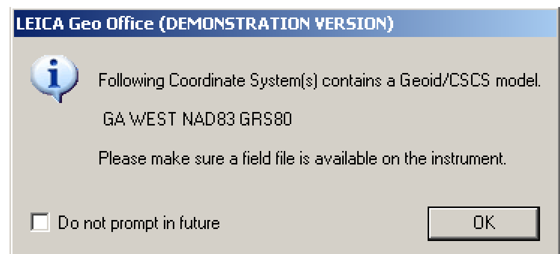
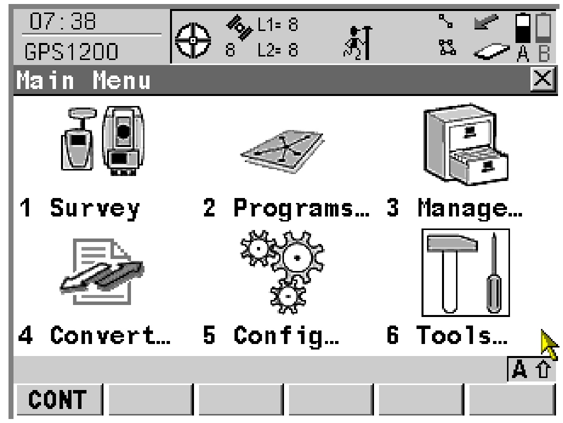
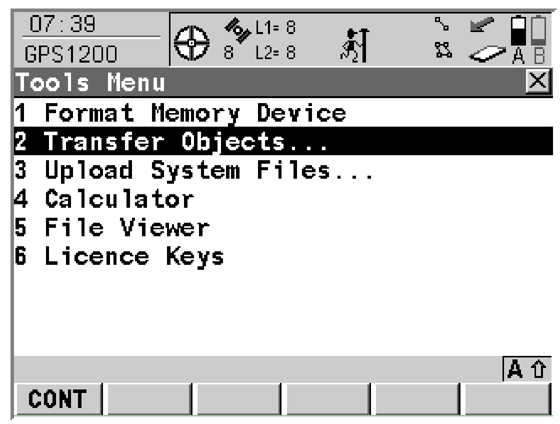
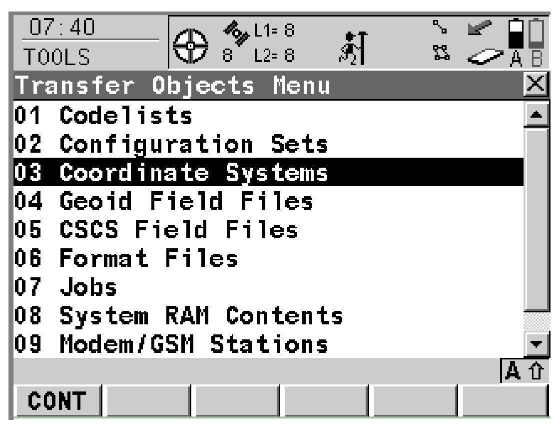
Step	Action	Display
3	In the opened **Coordinate Systems** folder: • Left click on the coordinate system you wish to transfer and drag it over until your mouse pointer is on top of the CF Card name and release the mouse's left button. This automatically copies the coordinate system file into the proper folder (DBX) on the CF card. A warning pop-up message alerts us that this coordinate system has a geoid model attached to it and the geoid model does not get copied over to the card. A geoid model field file must be created in order to work with orthometric heights when using this coordinate system on the GPS1200 receiver. The coordinate system has now been copied onto the compact flash card. Now we need to transfer the coordinate system from the card to the GPS1200 receiver. • Remove the compact flash card from the computer's card reader and insert it into your GPS1200 receiver. We will now move over to the GPS1200 receiver and transfer the coordinate system from the CF card to the receiver.	 

Continued on next page

Step	Action	Display
4	From the Main Menu on the GPS1200 receiver: • Tap on the **6 Tools…** icon. This takes you to the "GPS1200 Tools Menu" screen.	
5	In the "GPS1200 Tools Menu" screen: • Tap on the **2 Transfer Objects…** menu option. This takes you to the "TOOLS Transfer Objects Menu" screen.	
6	In the "TOOLS Transfer Objects Menu" screen: • Tap on the **03 Coordinate Systems** menu option. This takes you to the "TOOLS Transfer Coord Systems" screen.	

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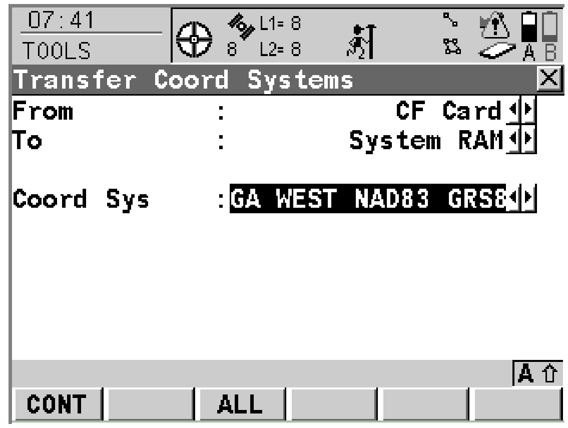
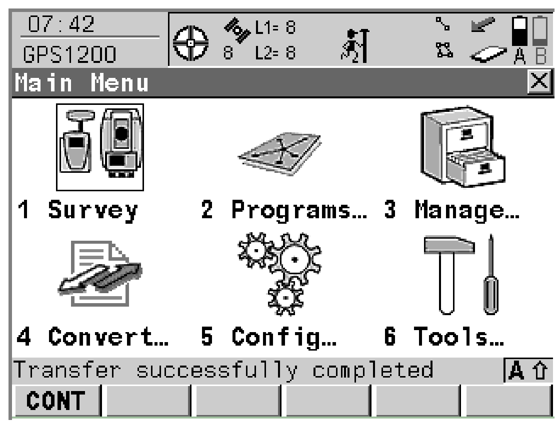
<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr><td>7</td><td>
In the “TOOLS Transfer Coord Systems” screen:

- Ensure that the **From** field contains **CF Card** and the **To** field contains **System RAM**.
- Use the left or right arrow buttons in the **Coord Sys** field to find the coordinate system to transfer.
- Press the **F1 (CONT)** button to complete the transfer.

This returns you to the Main Menu.
</td><td>


</td></tr>
<tr><td>8</td><td>
In the Main Menu:

A “Transfer successfully completed” message is displayed.
</td><td>


</td></tr>
</table>

Conclusion of 3rd FAQ

You have just learned how to set the PC card drive letter in LGO, transfer a coordinate system from LGO to a compact flash card, and then transfer that coordinate system from the card to the GPS1200 receiver.

FAQ 4 Attaching a Geoid Model Field File To A Coordinate System On The GPS1200

Question

Can I work in orthometric heights in the field when I'm working with RTK using a GPS1200 receiver?

Background

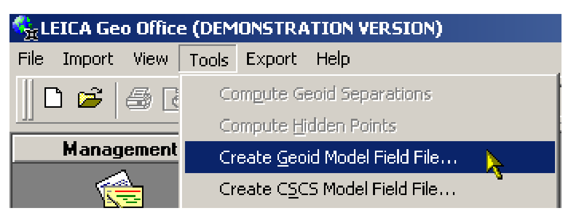
Geoid separations are needed to compute orthometric heights. Geoid separations are derived from geoid models. The relationship between ellipsoidal and orthometric height is given by

Ellipsoidal Height (h) = Orthometric Height (H) + Geoid Separation (N)

Your GPS receiver will provide the ellipsoidal heights and the geoid model will provide the geoid separations. With a geoid model attached to a coordinate system, orthometric heights can be computed.

Answer

Yes you can work in orthometric heights. First you must create a geoid model field file in LGO (LEICA Geo Office) and then transfer it to the compact flash (CF) card. Then create a geoid model on your GPS1200 receiver using the newly created geoid model field file and attach it to an existing coordinate system.

Step	Action	Display
1	From the main menu in LGO: • Select "Tools" from the pull-down menu at the top of the screen. • Select "Create Geoid Model Field File…" from the drop-down list. This opens the "Geoid field file generation" window.	

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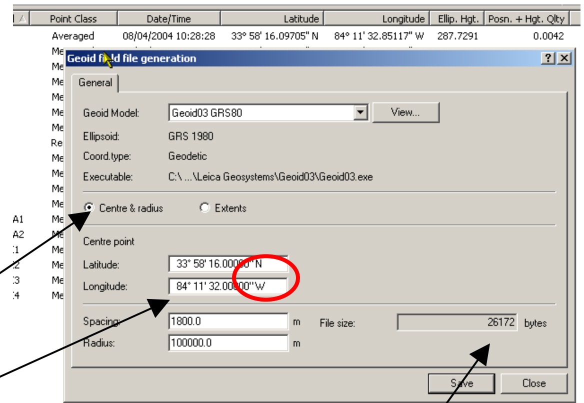
Step	Action	Display
2	In the “Geoid field file generation” window: • Select a geoid model from the **Geoid Model** list. In this example we are using Geoid03 GRS80. • Decide on how you wish to describe the dimensions of your geoid model field file. In this example we are going to use the **Centre & radius** method. • Enter the latitude and longitude of the centre point of the geoid model. **Remember** to change the **E** to **W** in the longitude field. • Enter the spacing of the geoid model grid. **Note**: It is futile to make your grid spacing any smaller than 1850 metres (6080 feet) because Geoid03’s grid spacing is no tighter than that. Making the grid spacing smaller than 1850 metres will not improve the accuracy of your field file but makes your geoid model field file larger than necessary. • Enter a radius that will encompass your work area. In this example we are creating a 100-kilometre field file. • Notice the size of your new field file. • Press the **Save** button to create your field file. This opens the “Save geoid field file…” window.	

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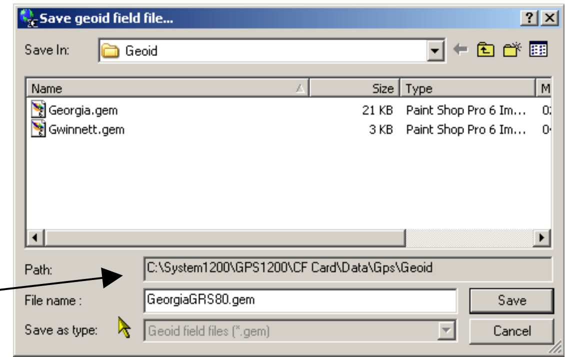
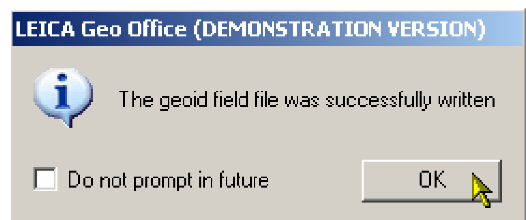
Step	Action	Display
3	In the “Save geoid field file…” window: • Choose a destination folder in the **Save in** field. **Note**: In this example, the RTK rover’s CF card was in the computer’s PCMCIA card reader so the destination “Local Disk (F:)\Data\Gps\Geoid” was navigated to and the field file was saved directly to the CF card. • Enter a name for the field file. The file must have the **.gem** extension. In this example we are creating the “GeorgiaGRS80” geoid field file. • Press the **Save** button. This saves the geoid model field file on the CF card. When the file has been successfully created, an alert pop up message appears alerting you of this. • Press the **OK** button. This closes the alert pop up, “Save geoid field file…”, and “Geoid field file generation” windows. **Note**: There are other ways to transfer a geoid model field file to the CF card. For example you can use the Sensor Transfer function in LGO. See the LGO help menu for more information on this topic.	 

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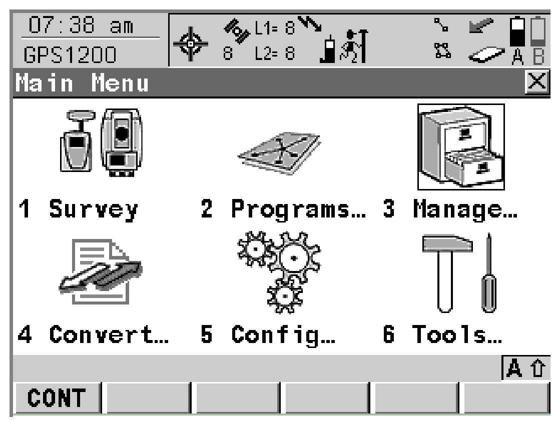
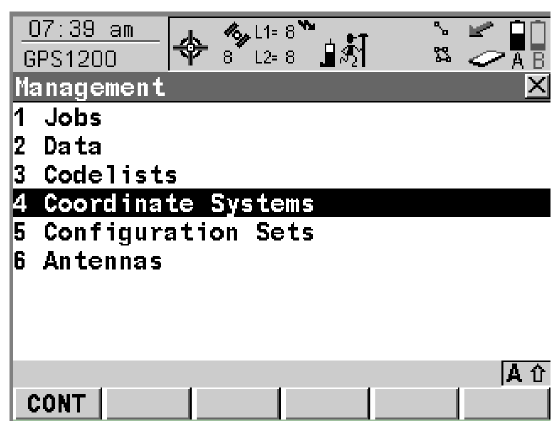
Switching to the receiver

The geoid model field file is now on the CF card. In the receiver we must create a geoid model and attach it to a coordinate system.

Place the CF card into the GPS1200 receiver and turn the receiver on.

Note: You have the option of either transferring the geoid model field file to the receiver's system RAM or letting it remain in the card. The GPS1200's system RAM is 1MB and if your geoid model field file is greater than 500KB then it is advisable to leave the geoid model field file on the card. If your geoid model field file is less than 500KB, it is advisable to transfer it into the system RAM of the receiver using the Transfer Objects tool. To learn more about transferring objects, see chapter *11 Utilities*, section *11.2 Transfer Objects* (**note**: section *11.2* specifically address transferring geoid model field files), or consult the GPS1200 Technical Reference manual.

Remember: If you leave the geoid model field file on the card and you do a full format of the card, the geoid model will be deleted!

Step	Action	Display
4	The geoid model field file is stored on the CF card. In the receiver we must create a geoid model and attach it to a coordinate system. From the Main Menu: • Tap on **3 Manage….** This takes you to the GPS1200 Management screen.	
5	In the GPS1200 Management screen: • Tap on **4 Coordinate Systems**. This takes you to the MANAGE Coordinate Systems screen.	

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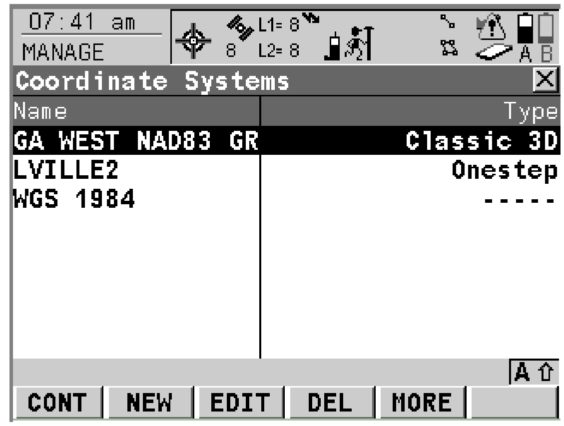
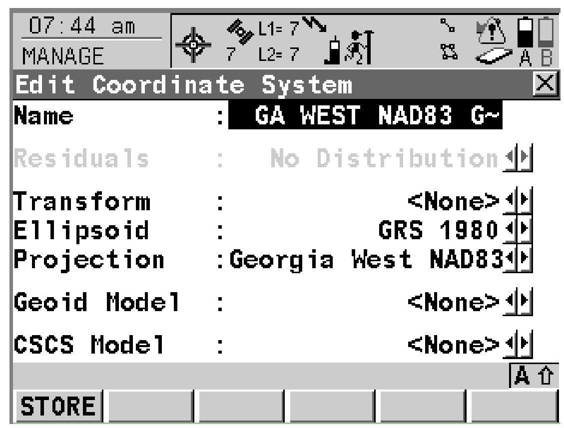
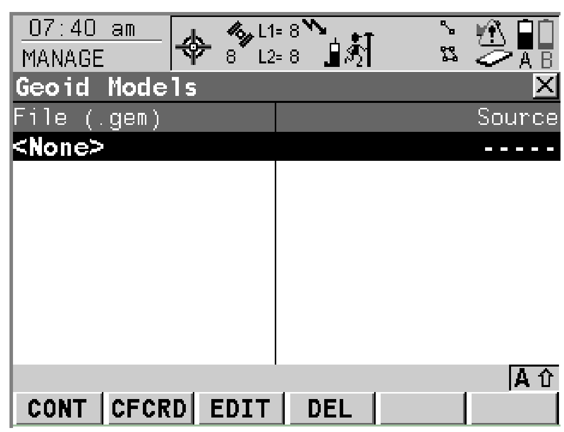
Step	Action	Display
6	In the MANAGE Coordinate Systems screen: • Select the coordinate system to which you wish to add the geoid model. In this example we are editing the coordinate system “GA WEST NAD83 GRS80”. • Press the **F3 (EDIT)** button. This takes you to the MANAGE Edit Coordinate System screen.	
7	In the MANAGE Edit Coordinate System screen: • Tap on the **Geoid Model** field. This takes you to the MANAGE Geoid Models screen.	
8	In the MANAGE Geoid Models screen: • Press the **F2 (CFCRD)** button. This displays all geoid models (.gem files) stored in the Geoid folder.	

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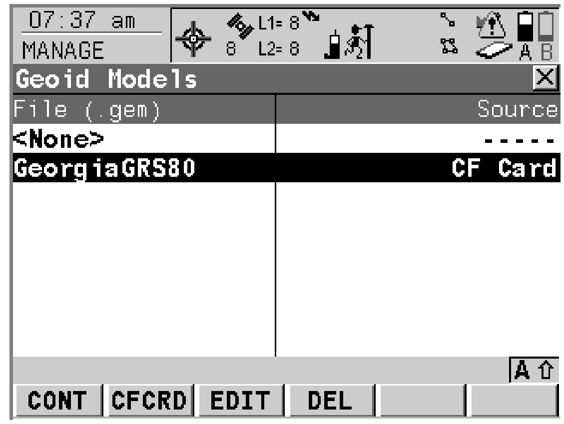
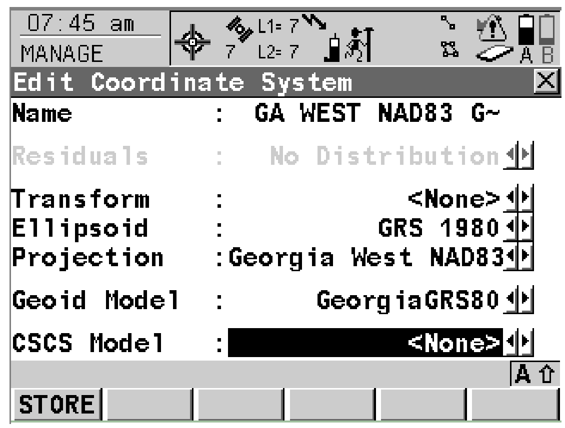
Step	Action	Display
9	Continuing in the MANAGE Geoid Models screen: We now see the geoid model that we stored on the CF card. • Select the geoid model. • Press the **F1 (CONT)** button. This returns us to the MANAGE Edit Coordinate System screen.	
10	In the MANAGE Edit Coordinate System screen: We now see our geoid model in the **Geoid Model** field. • Press the **F1 (STORE)** button. This stores the coordinate system with the new geoid model and returns you to the MANAGE Coordinate System screen.	

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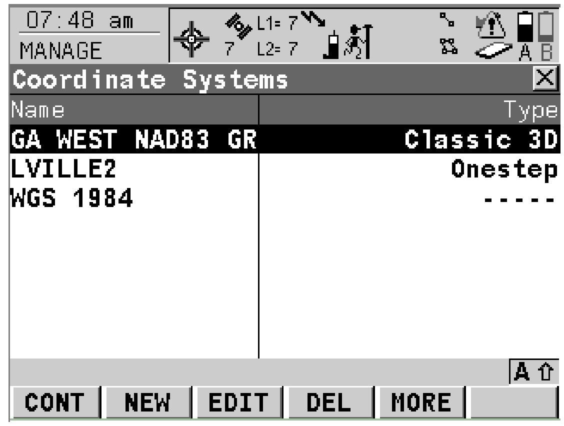
Step	Action	Display
11	In the MANAGE Coordinate System screen: • Press the **F1 (CONT)** button to return to the Main Menu.	

Conclusion of 4th FAQ

A geoid model is needed to work with orthometric heights in the field during an RTK survey.

In this section we created a geoid model field file in LGO and saved it on the CF card. We then placed the card in the receiver and created a geoid model based on the newly created field file. We then attached that geoid model to an existing coordinate system.

Summary

These four FAQs described the following tasks:

1. How to install a geoid model into LGO.
2. How to create a new coordinate system in LGO. We also were able to attach the geoid model we created in the first FAQ to this coordinate system.
3. How to transfer that coordinate system from LGO to the GPS1200 receiver.
4. With the newly created geoid model attached to the newly created coordinate system we were able to create a geoid model field file in LGO and save it directly on the CF card. We then attached that geoid model field file to the coordinate system we transferred to the GPS1200.

Therefore, these four FAQs described the steps to get a coordinate system with a geoid model on to the GPS1200 receiver. With this coordinate system we can now work with local coordinates such as state plane and work with orthometric heights.

9.0 Onestep Transformations

In this Chapter

The following sections of this chapter describe creating local coordinate systems using the Onestep transformation.

Section	Topic
9.1	Onestep Transformation
9.2	Onestep Transformation Method: One Point Localization
9.3	Onestep Transformation Method: Normal

Introduction

GPS measured points are always stored based on the global geocentric datum known as WGS 1984. Most surveys require coordinates in a local grid system, for example, based on a country's official mapping datum or an arbitrary grid system used in a particular area such as a construction site. To convert the WGS 1984 coordinates into local coordinates, a coordinate system is required. Part of the coordinate system is the transformation used to convert coordinates from the WGS 1984 datum to the local datum.

The Determine Coordinate System application program allows:
- the parameters of a new transformation to be determined, and
- the parameters of an exiting transformation to be recomputed.

Transformations

A transformation is the process of converting coordinates from one geodetic datum to another.

Requirements:
- Transformation parameters.
- In some cases a local ellipsoid.
- In some cases a map projection.
- In some cases a geoid model.

Transformation Parameters:
A transformation consists of a number of shifts, rotations, and scale factors, depending on the type of transformation used. Not all of these parameters are always required. These parameters may already be known, or may be computed.

Continued on next page

9.1 Onestep Transformation

Principle

The principle of this transformation is to transform coordinates directly from WGS 1984 to local grid and vice versa without knowledge about the local ellipsoid or the map projection.

The WGS 1984 coordinates are projected onto a temporary Transverse Mercator projection. The central meridian of this projection passes through the center of gravity of the common points. The results are preliminary grid coordinates for the WGS 1984 points. These preliminary grid coordinates are matched with the local grid control points in order to compute the easting and northing shifts, the rotation, and the scale factor between these two sets of points. This is known as a classic 2D transformation. The height transformation is a single dimension height approximation.

Position and height transformations are separated.

Use

Use this transformation when measurements are to be forced to tie in with local existing control. An example would be where you arrive at a project area where there are existing control monuments on the ground but the control is in an arbitrary 10,000N 5000E 100H local grid. The best way to be able to work in this client's existing coordinate system is to create a Onestep transformation based on their coordinates.

Requirements

Requirements for a Onestep transformation are:

- The position is known in WGS 1984 and in the local system for at least one control point. Three or more points are recommended in order to obtain redundancy. The control points used for the transformation should surround the area for which the transformation is to be applied. It is not good survey practice to survey or convert coordinates outside of the area covered by the control points or extrapolation errors may be introduced.
- Additional height information for one point enables the transformation of heights.
- Parameters of the local geoid (this is not compulsory). When a geoid model field file (or a CSCS field file) is used in the determination of a coordinate system, the control points for the calculation must fall within the areas of the field files.

Area

The Onestep transformation is limited to about 10km X 10km (6 X 6 miles) because no projection scale factor is applied and a standard Transverse Mercator projection is used to compute the preliminary WGS 1984 grid coordinates. It should also be contained in areas without large height differences.

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9.1 Onestep Transformation, *Continued*

Advantages

- Errors in height do not propagate into errors in position since the height and position transformations are separated.
- If local heights have low accuracy or do not exist, a transformation of position can still be calculated and vice versa.
- The height points and position points do not have to be the same points.
- No parameters of the local ellipsoid and map projection are required.
- Parameters may be computed with a minimum of points. Care should be taken when computing parameters using just one or two local points as the parameters calculated are valid only in the vicinity of the points used for the transformation.

Disadvantages

- You are restricted in the area over which the transformation can be applied. This is mainly because there is no provision for a scale factor in the projection.
- The accuracy in height depends on the undulation of the geoid. The bigger the geoid variations, the less accurate the results are.

Continued on next page

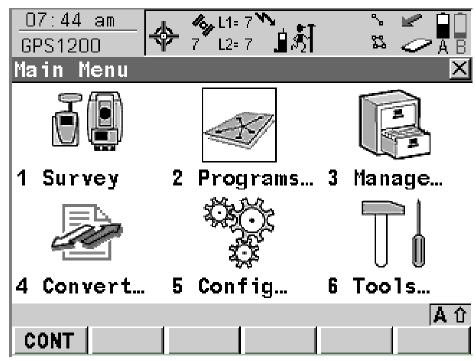
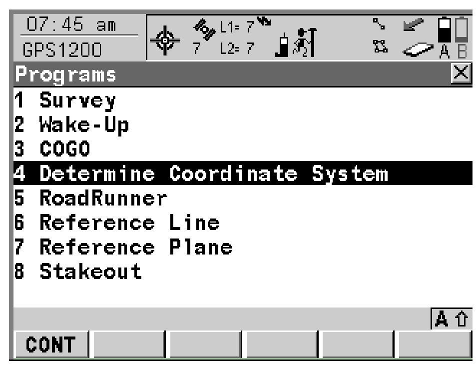
9.2 Onestep Transformation Method: One Point Localization

Onestep Transformation Method: One Point Localization

The following steps describe how to create a coordinate system by creating a Onestep transformation using the One Point Localization method.

In This Example

In this example we have created two jobs. The job named “WGS84 PT” contains one point with WGS 1984 coordinates. The job named “LOCAL GRID PT” contains no points. We will create one point in this job with the coordinates: 10000 North, 5000 East, and 100 in height.

Step	Action	Display
1	From the Main Menu: • Tap on **2 Programs….** This takes you to the GPS1200 Programs screen.	
2	In the GPS1200 Programs screen: • Tap on **4 Determine Coordinate System**. This takes you to the DET C SYS Determine Coord System Begin screen.	

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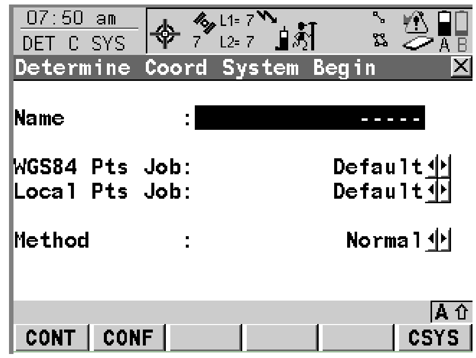
9.2 Onestep Transformation Method: One Point Localization, *Continued*

Step	Action	Display
3	In the DET C SYS Determine Coord System Begin screen: **Input Field Explanations:** **Name:** This is where you enter a unique name for the coordinate system. The name can be up to 16 characters in length and may include spaces. A name must be entered. **Note**: Entering the name of an existing coordinate system will allow that existing coordinate system to be updated. See *Section 44.3 Updating a Coordinate System* in the *GPS1200 Technical Reference Manual*. **WGS84 Pts Job:** This is where you select from which job the WGS 1984 points will be taken. Opening the choice list accesses the Manage Jobs screen. Refer to chapter *1*, section *1.6 Job Management: Selecting a Job*. **Local Pts Job:** This is where you select from which job the points with the local coordinates will be taken. Opening the choice list accesses the Manage Jobs screen. **Method:** This is where you select which transformation method to use. The two choices are **Normal** and **One Pt Localistn**. **F1 (CONT)**: Press this button to confirm the selections and to continue with the subsequent screen. **F2 (CONF)**: Press this button to configure the coordinate system determination method selected in **Method** field. **F6 (CSYS)**: This is available for the **Normal** method. This accesses the list of coordinate systems to select one to edit. This step is continued on the following page.	

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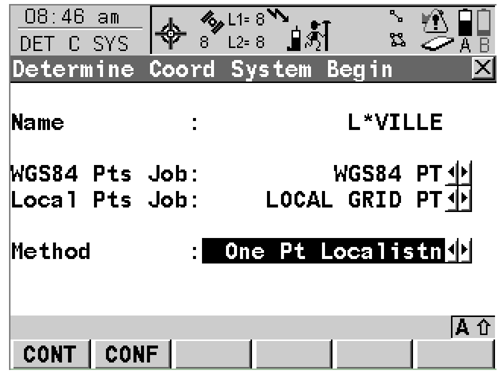
9.2 Onestep Transformation Method: One Point Localization, *Continued*

Step	Action	Display
3	Continuing in the DET C SYS Determine Coord System Begin screen: • Enter a name for the coordinate system. For this example we are naming it "L*VILLE". • Select the jobs containing the WGS 1984 and local points. • Select the **One Pt Localistn** method. • Press the **F2 (CONF)** button. This takes you to the DET C SYS Configuration screen.	

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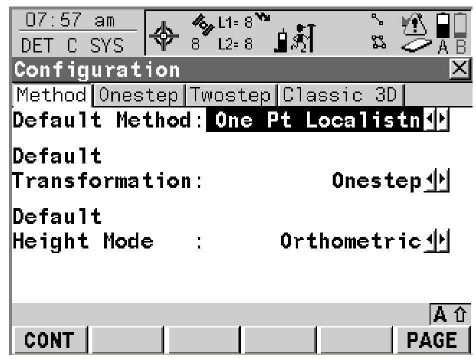
9.2 Onestep Transformation Method: One Point Localization, *Continued*

Configuring Determine Coordinate System

The configuration of the "Determine Coordinate System, One Point Localization" method, allows options to be set which are used as the default options within the Determine Coordinate System application program when using the one point localization method. These settings are stored within the active configuration set.

Step	Action	Display
4	In the DET C SYS Configuration screen: • Select **One Pt Localistn** as the default method. • Select **Onestep** as the default transformation. • Select **Orthometric** as the default height mode. **Note**: The only instance where you would select "Ellipsoidal" as the height mode would be when you did not have a height for the local point and you were willing to use the WGS 1984 height as the local height but you are better off setting this to "Orthometric" and entering a arbitrary height. • Press the **F1 (CONT)** button. **Note**: We will configure the Normal Onestep transformation method in the following section. This returns you to the DET C SYS Determine Coord System Begin screen.	

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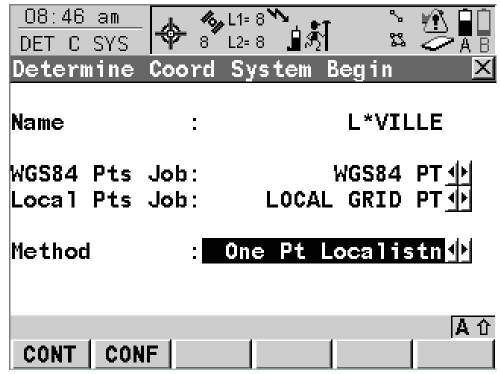
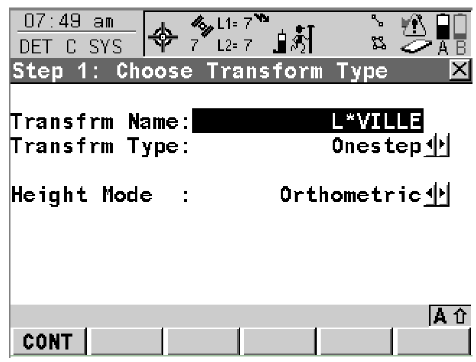
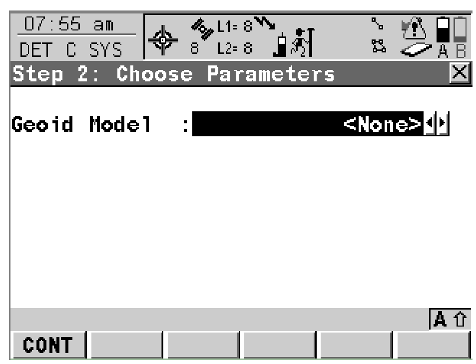
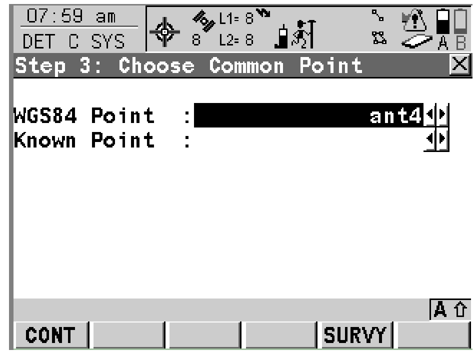
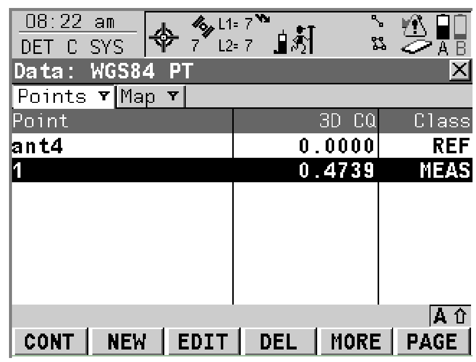
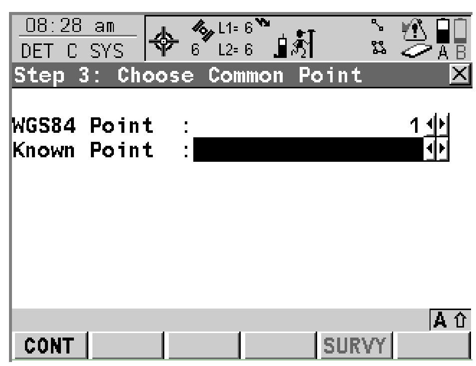
9.2 Onestep Transformation Method: One Point Localization, *Continued*

Step	Action	Display
5	Continuing in the DET C SYS Determine Coord System Begin screen: • Ensure that the input fields are properly filled. • Press the **F1 (CONT)** button. This takes you to the DET C SYS Step 1: Choose Transform Type screen.	
6	In the DET C SYS Step 1: Choose Transform Type screen: • Ensure that the input fields are properly filled. • Press the **F1 (CONT)** button. This takes you to the DET C SYS Step 2: Choose Parameters screen.	
7	In the DET C SYS Step 2: Choose Parameters screen: In the US we use Geoid03 as our current geoid model. Unfortunately this geoid model is strictly a geodetic model and not a grid model, therefore we **cannot** use it in our transformation. • Ensure that the **Geoid Model** field is set to **None**. • Press the **F1 (CONT)** button. This takes you to the DET C SYS Step 3: Choose Common Point screen.	

Continued on next page

9.2 Onestep Transformation Method: One Point Localization, *Continued*

Step	Action	Display
8	In the DET C SYS Step 3: Choose Common Point screen: Here we select our common point between the WGS 1984 job and the local job. If we do not have a point with WGS 1984 coordinates we can press the **F5 (SURVY)** button and measure one. In this example we already have a WGS 1984 point so we'll select it from our job. • Tap on the **WGS84 Point** field. This takes you to the DET C SYS Data: WGS84 PT (this is the name of our WGS 1984 point job) screen.	
9	In the DET C SYS Data: WGS84 PT screen: • Select the WGS 1984 point that is common with the local point in the local point job. In this example it is point ID "1". • Press the **F1 (CONT)** button. This returns you to the DET C SYS Step 3: Choose Common Point screen.	
10	Continuing in the DET C SYS Step 3: Choose Common Point screen: • Tap on the **Known Point** field. This takes you to the DET C SYS Data: LOCAL GRID PT (the name of our local point job) screen.	

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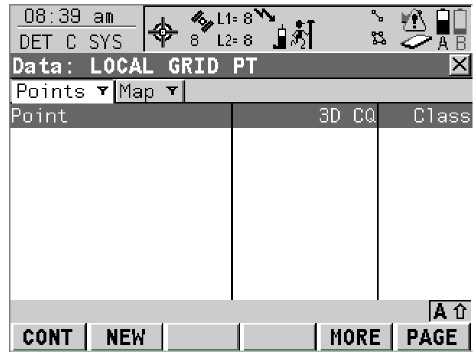
9.2 Onestep Transformation Method: One Point Localization, *Continued*

<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr><td>11</td><td>In the DET C SYS Data: LOCAL GRID PT (the name of our local point job) screen:

In this example there are no points in this job so we will create one.
Note: We would select a point from the list if there were points in this job.

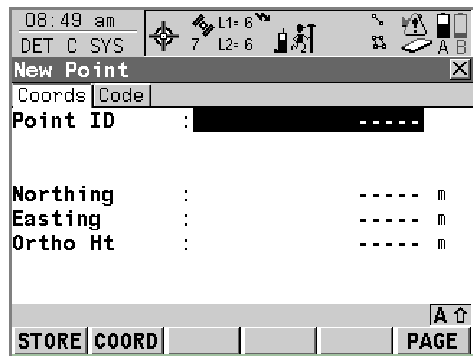
• Tap on the F2 (NEW) button.

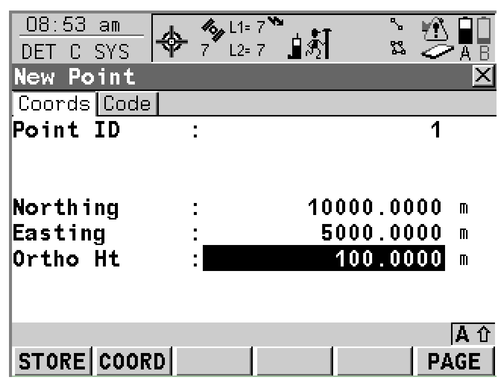
This takes you to the DET C SYS New Point screen.</td><td>
</td></tr>
<tr><td>12</td><td>In the DET C SYS New Point screen:

• Enter a point ID. In this example the ID is 1.

• Enter coordinates for this point. Remember in this example we are using
Northing: 10000m,
Easting: 5000m, and
Ortho Height: 100m.

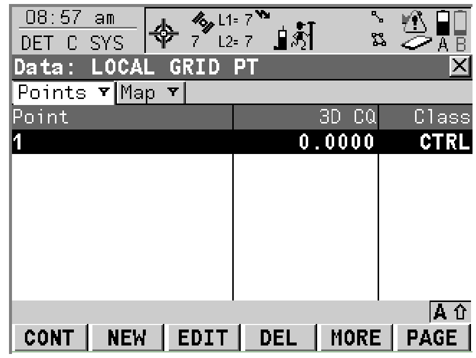
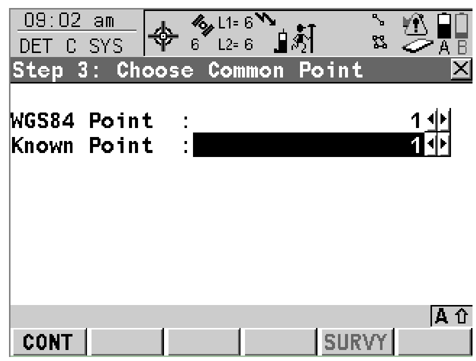
• Press the F1 (STORE) button when finished.

This returns you to the DET C SYS Data: LOCAL GRID PT screen.</td><td>


</td></tr>
</table>

Continued on next page

9.2 Onestep Transformation Method: One Point Localization, *Continued*

Step	Action	Display
13	In the DET C SYS Data: LOCAL GRID PT screen: • Notice the new point is listed. • Press the **F1 (CONT)** button. This returns you to the DET C SYS Step 3: Choose Common Point screen.	
14	Continuing in the DET C SYS Step 3: Choose Common Point screen: We have now selected our two common points and they are displayed in the **WGS84 Point** and **Known Point** fields. • Press the **F1 (CONT)** button. This takes you to the DET C SYS Step 4: Determine Rotation screen.	

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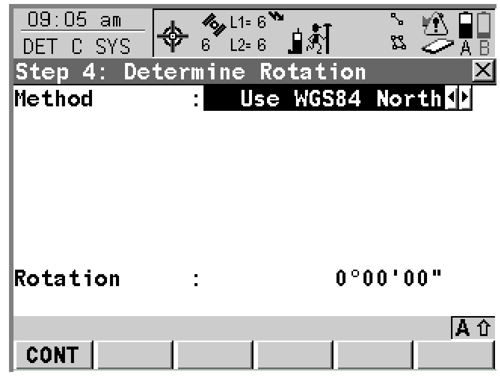
9.2 Onestep Transformation Method: One Point Localization, Continued

Step	Action	Display
15	In the DET C SYS Step 4: Determine Rotation screen: This screen allows you to design how you would like the transformation to be rotated. An example of when you might want to alter the rotation would be if you were attempting to make a transformation fit an existing coordinate system that had a known rotation but did not align with geodetic north. Here you would add the additional rotation to account for the non-alignment. To learn more about the additional rotation methods, see the *GPS1200 Technical Reference Manual* section *37.3.2.* • Leave the fields as displayed on the right and press the **F1 (CONT)** button. This takes you to the DET C SYS Step 5: Determine Scale screen.	

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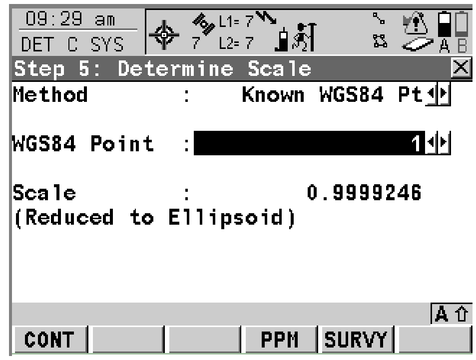
9.2 Onestep Transformation Method: One Point Localization, *Continued*

Step	Action	Display
16	In the DET C SYS Step 5: Determine Scale screen: This screen enables us to select a method for determining a height scale factor for the transformation. The scale is calculated using the formula **(r+h)/r** where **r** is the distance from the center of the ellipsoid to the WGS 1984 point (selected in *step 9* above) and **h** is the height of this point above the WGS 1984 ellipsoid. In this example we will use the **Known WGS84 Pt** method. For more information on height scale factors see the *GPS1200 Technical Reference Manual* section *39.2*. **F4 (PPM)** or **F4 (Scale)** toggles between displaying the true scale and displaying the ppm (parts per million) **F5 (SURVY)** enables you to survey in a WGS 1984 point. In this example the scale is computed for us and we will accept it. • Press the **F1 (CONT)** button. This takes you to the DET C SYS Step 6: Store Coord System screen.	

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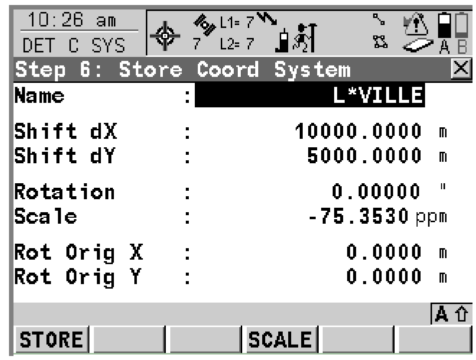
9.2 Onestep Transformation Method: One Point Localization, Continued

Step	Action	Display
17	In the to the DET C SYS Step 6: Store Coord System screen: In the **Name** field we have an opportunity to give the coordinate system another name up to 16 characters in length, but we won't. The **F4 (SCALE)** or **F4 (PPM)** button displays either the computed scale or ppm. The **F1 (STORE)** button stores the coordinate system to the DBX, attaches the coordinate system to the WGS84 Pts job that was selected in *step 3* above and returns you to the GPS1200 Main Menu. • Press the **F1 (STORE)** button.	

9.3 Onestep Transformation Method: Normal

Onestep Transformation Method: Normal

The Onestep transformation normal method is used to map the GPS derived WGS84 coordinates onto an existing local-grid coordinate system.

This is a two-stage transformation:

- 2-D Helmert for the horizontal transformation and a
- 1-D vertical height shift.

The Onestep transformation is the only component required in creating this coordinate system. No ellipsoid, map projection, or geoid model is required.

To minimize scale distortions, the project area for Local TM and Onestep Transformations must not exceed a maximum size of 10 kilometers (6 miles) in length and width.

Transformation Parameters

To compute this transformation, you must have a number of control stations on the project with pre-existing grid coordinates and elevations.

The Onestep transformation employs a UTM projection to derive temporary grid coordinates for each of the WGS 1984 positions. The transformation is then computed in two stages:

1. **Horizontal transformation** uses a 2-D Helmert transformation to map the UTM (X,Y) components onto the existing grid. The transformation parameters are: 2 shifts, 1 rotation, and scale.

   - A minimum of two points must be matched in position (X,Y) in order to compute the scale and rotation parameters.

   - ***Three or more points are recommended*** so that residuals in (X,Y) can be examined to determine how well the GPS coordinates fit the existing grid control.

2. **Vertical transformation** is accomplished using a 1-D height shift to accommodate the difference in vertical datum. Transformation parameters can also include rotations in X and Y (vertical tilt) depending on the number of points matched in height.

   - If 1 or 2 points are matched, an average height shift is computed. If 3 or more points are used, the transformation computes a best-fit plane through these points.

   - ***Four or more points are recommended*** so that residuals can be examined to determine how well the GPS heights fit the existing benchmarks.

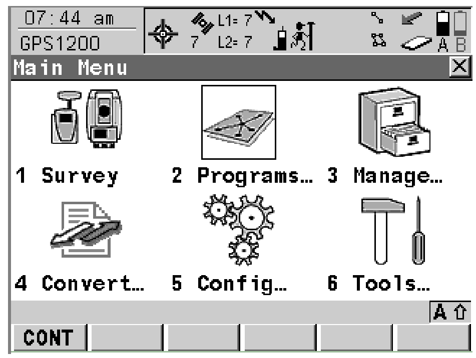
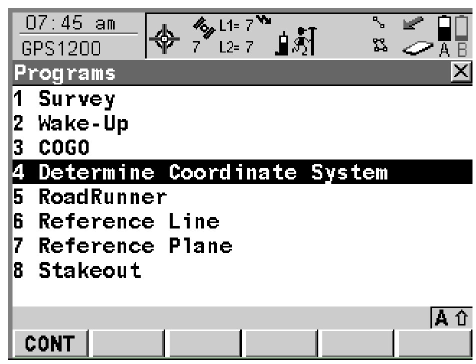
Continued on next page

9.3 Onestep Transformation Method: Normal, *Continued*

In This Example

The following steps describe how to create a coordinate system using the Normal method.

In this example we have created two jobs. The job named “WGS84JOB” contains five points with WGS 1984 coordinates. The job named “LOCALJOB” contains the same five points but with the local coordinates.

Step	Action	Display
1	From the Main Menu: • Tap on **2 Programs….** This takes you to the GPS1200 Programs screen.	
2	In the GPS1200 Programs screen: • Tap on **4 Determine Coordinate System**. This takes you to the DET C SYS Determine Coord System Begin screen.	

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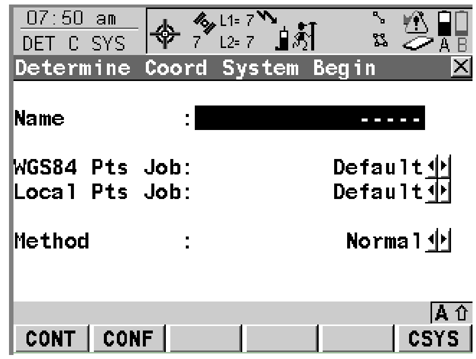
9.3 Onestep Transformation Method: Normal, *Continued*

Step	Action	Display
3	In the DET C SYS Determine Coord System Begin screen: **Input Field Explanations:** **Name:** This is where you enter a unique name for the coordinate system. The name can be up to 16 characters in length and may include spaces. A name must be entered. **Note**: Entering the name of an existing coordinate system will allow that existing coordinate system to be updated. See *Section 44.3 Updating a Coordinate System* in the *GPS1200 Technical Reference Manual*. **WGS84 Pts Job:** This is where you select from which job the WGS 1984 points will be taken. Opening the choice list accesses the Manage Jobs screen. **Local Pts Job:** This is where you select from which job the points with the local coordinates will be taken. Opening the choice list accesses the Manage Jobs screen. **Method:** This is where you select which transformation method to use. The two choices are **Normal** and **One Pt Localistn**. **F1 (CONT)**: Press this button to confirm the selections and to continue with the subsequent screen. **F2 (CONF)**: Press this button to configure the coordinate system determination method selected in **Method** field. **F6 (CSYS)**: This is available for the Normal method. This accesses the list of coordinate systems to select one to edit. This step is continued on the following page.	

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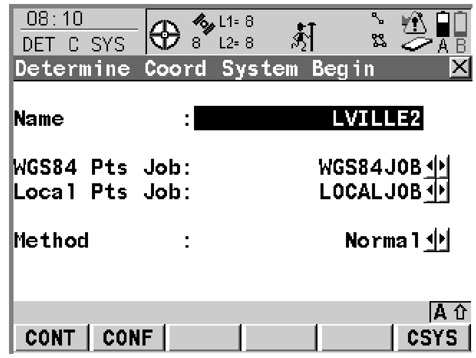
9.3 Onestep Transformation Method: Normal, Continued

Step	Action	Display
3	Continuing in the DET C SYS Determine Coord System Begin screen: • Enter a name for the coordinate system. For this example we are naming it “LVILLE2”. • Select the jobs containing the WGS 1984 and local points. • Select the **Normal** method. • Press the **F2 (CONF)** button. This takes you to the GPS1200 Programs screen.	

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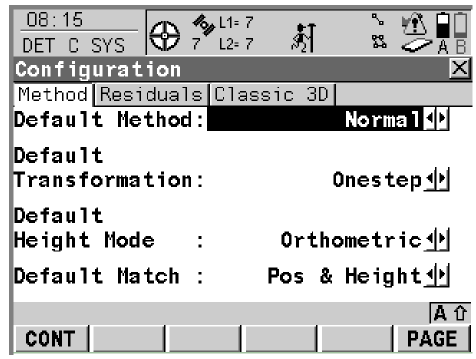
9.3 Onestep Transformation Method: Normal, *Continued*

Configuring Determine Coordinate System

The configuration of the “Determine Coordinate System, Normal” method, allows options to be set which are used as the default options within the Determine Coordinate System application program when using the Normal method. These settings are stored within the active configuration set.

Step	Action	Display
4	Continuing in the DET C SYS Configuration screen: • Select **Normal** as the default method. • Select **Onestep** as the default transformation. • Select **Orthometric** as the default height mode. **Note**: The only instance where you would select “Ellipsoidal” as the height mode would be when you did not have a height for the local point and you were willing to use the WGS 1984 height as the local height but you are better off setting this to “Orthometric” and entering a arbitrary height. • Tap on the “Residuals” tab. This takes you to the “Residuals” page of the DET C SYS Configuration screen.	

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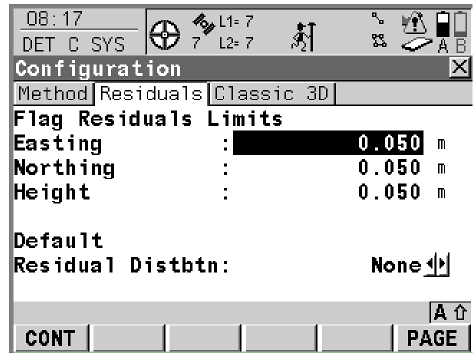
9.3 Onestep Transformation Method: Normal, *Continued*

Step	Action	Display
5	In the “Residuals” page of the DET C SYS Configuration screen: The “Residuals” page provides us with the ability to define the limits when there will be a flag if the residuals of the transformation exceed this criteria. We can also define how the residuals will be distributed. **Flag Residuals Limits** You can change these values to your preference but in this example we will leave the defaults as they are of 0.050m for the Northing, Easting, and Height. • Leave the residual limits as they are displayed. **Default Residual Distbtn** Here we can define the method by which the residuals of the control points will be distributed throughout the transformation. For more information on residual distribution, please see the *GPS1200 Technical Reference Manual* page 43-21. • Leave the **Default Residual Distbtn** as **None**. Since we are not doing a Classic 3D transformation, we will ignore the “Classic 3D” page. • Press the **F1 (CONT)** button. This returns you to the DET C SYS Determine Coord System Begin screen.	

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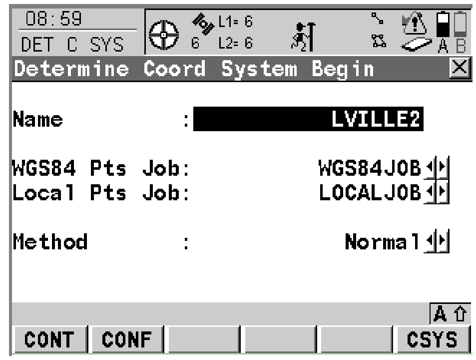
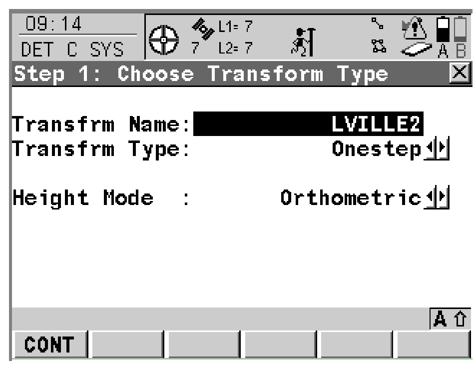
9.3 Onestep Transformation Method: Normal, *Continued*

Step	Action	Display
6	In the DET C SYS Determine Coord System Begin screen: The **F5 (CSYS)** button is available if we want to edit a coordinate system but since we are creating a new coordinate system, we will ignore this button. For more information on editing coordinate systems, see the *GPS1200 Technical Reference Manual* section *11.4.1 Editing a Coordinate System*. • Ensure that the input fields are properly filled. • Press the **F1 (CONT)** button. This takes you to the DET C SYS Step 1: Choose Transform Type screen.	
7	In the DET C SYS Step 1: Choose Transform Type screen: • Ensure that the settings are defined as they are in the image on the right. • Press the **F1 (CONT)** button. This takes you to the DET C SYS Step 2: Choose Parameters screen.	

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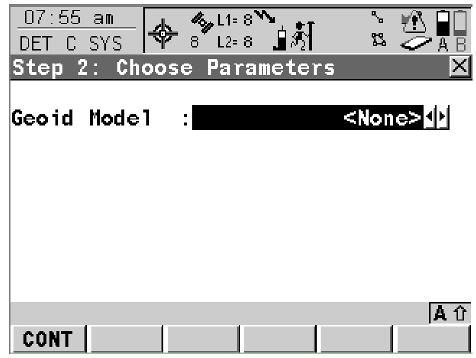
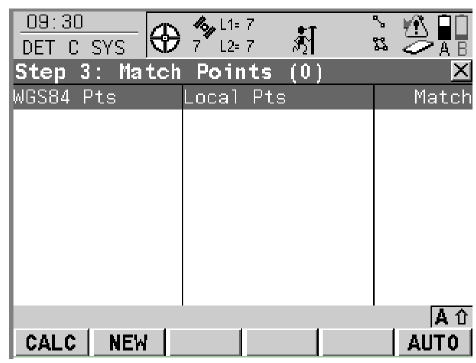
9.3 Onestep Transformation Method: Normal, *Continued*

Step	Action	Display
8	In the DET C SYS Step 2: Choose Parameters screen: In the US we use Geoid03 as our current geoid model. Unfortunately this geoid model is strictly a geodetic model and not a grid model therefore we **cannot** use it in our transformation. • Ensure that the **Geoid Model** field is set to **None**. • Press the **F1 (CONT)** button. This takes you to the DET C SYS Step 3: Match Points screen.	
9	In the DET C SYS Step 3: Match Points screen: This screen provides a list of points chosen from the WGS84 and Local points job. The number of control points matched between both jobs is indicated in the title. **F1 (CALC)** confirms the selections, computes the transformation and continues to the subsequent screen. **F2 (NEW)** is used to match a new pair of points. The pair is then added to the list. A new point can be manually occupied as well. **F6 (Auto)** scans both jobs for points that have the same point ID. Points with matching point ID's are added to the list. • Press the **F6 (AUTO)** button. This takes you to the DET C SYS Step 3: Match Points (5) screen.	

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9.3 Onestep Transformation Method: Normal, *Continued*

<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr><td>10</td><td>In the DET C SYS Step 3: Match Points (5) screen:

The Match Points tool found 5 points that match in point ID.

Note: You may have more or less points when you create your Onestep transformation. It is recommended to have at least 3 points in position and 4 points in height.

Notice we now have more function buttons to access.

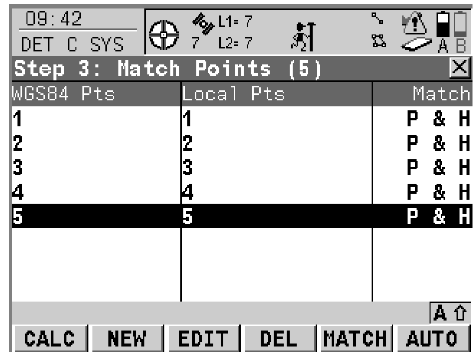
F3 (EDIT) allows you to edit the highlighted pair of matched points. Here you can change which points you wish to match and you can select if they are matching in either position only, height only, or position and height.

F4 (DEL) deletes the highlighted pair of matched points from the list.

F5 (MATCH) changes the type of match for a highlighted pair of matched points.

Since we are happy with the points that matched we will compute the transformation.

• Press the F1 (CALC) button.

This takes you to the DET C SYS Step 4: Check Residuals screen.</td><td></td></tr>
</table>

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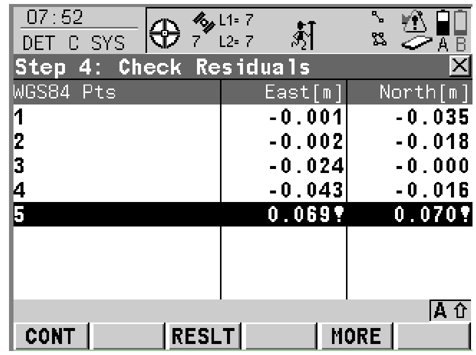
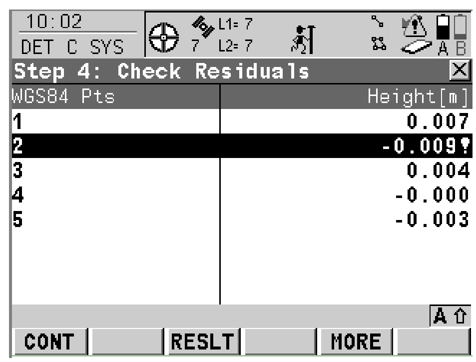
9.3 Onestep Transformation Method: Normal, Continued

Step	Action	Display
11	In the DET C SYS Step 4: Check Residuals screen: This screen displays a list of the matched points used in the transformation calculation and their associated residuals. **F1 (CONT)** accepts the residuals and continues to the subsequent screen. **F3 (RESLT)** allows you to view the results of the transformation. **F5 (MORE)** displays more information about height residuals. Indicates that the residuals exceed the residual limit we set back in *Step 5*. Indicates the largest residual in North, East, and height. Notice that point "5" has residuals that exceed the residual limits in both Northing and Easting. • Press the **F5 (MORE)** button. Notice that point "2's" height residuals also exceed the residual limit. In our example we will change point "5" to match in *position only* and see how that helps our transformation. • Press the ESC button. This takes you back to the DET C SYS Step 3: Match Points (5) screen.	 

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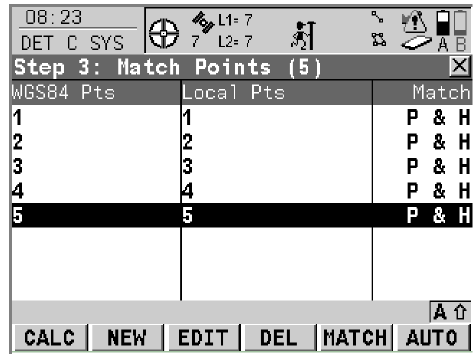
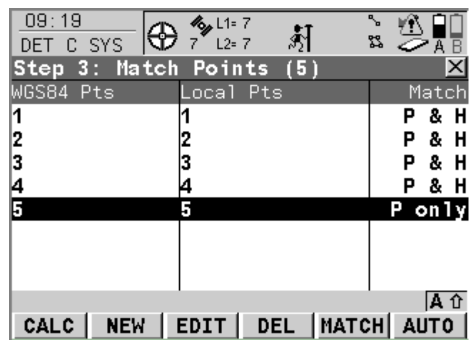
9.3 Onestep Transformation Method: Normal, *Continued*

Step	Action	Display
12	In the DET C SYS Step 3: Match Points (5) screen: Remember from *Step 12* that point number "5's" residuals were too large so we will change the matching components to see if that improves the transformation. • Tap on the matching pair numbered "5" to select it. • Press the **F5 (MATCH)** button until the entry in the Match column reads "P only" (for position only). • Press the **F1 (CALC)** button. This recalculates the transformation but does not attempt to match the height component of the matching pair for point "5". This takes you to the DET C SYS Step 4: Check Residuals screen.	 

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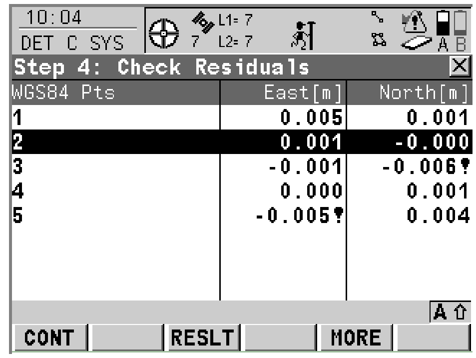
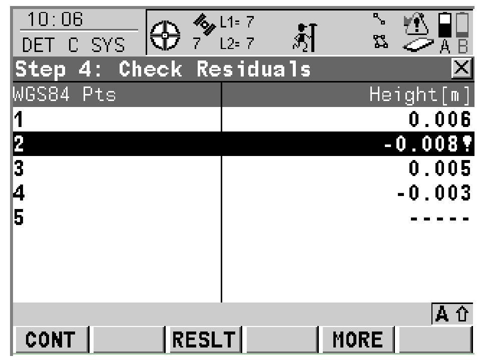
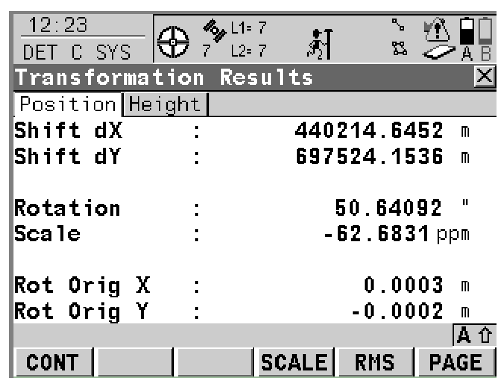
9.3 Onestep Transformation Method: Normal, *Continued*

Step	Action	Display
13	In the DET C SYS Step 4: Check Residuals screen: We now see that the residuals look much better. • Press the **F5 (MORE)** button. Here we can see that the height component was not used for point "5". This is indicated by the symbol ----- . Although point number "2" now has the largest residual (8mm), we will accept it and move forward with the transformation calculation. • Press the **F5 (RESLT)** button. This takes you to the DET C SYS Transformation Results screen.	 
14	In the DET C SYS Transformation Results screen: The results of the transformation between the WGS 1984 datum and the local datum are shown for each of the transformation parameters. This screen consists of the "Position" page and the "Height" page. **F4 (SCALE)** is used to switch between displaying the true scale or ppm (parts per million). **F5 (RMS)** is used to switch between displaying the RMS (Root Mean Square) values of the parameters and the actual parameters. • Press the **F1 (CONT)** button. This returns you to the DET C SYS Step 4: Check Residuals screen.	

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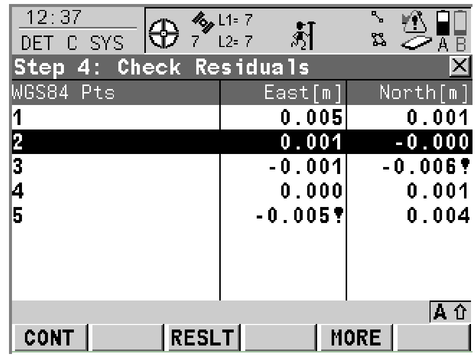
9.3 Onestep Transformation Method: Normal, *Continued*

<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr><td>15</td><td>In the DET C SYS Step 4: Check Residuals screen:

We have reviewed the results and can proceed with the transformation.

• Press the F1 (CONT) button.

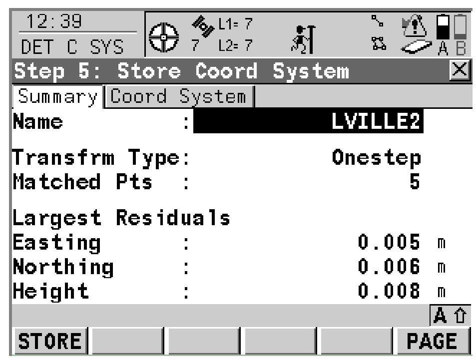
This takes you to the DET C SYS Step 5: Store Coord System screen.</td><td>
</td></tr>
<tr><td>16</td><td>In the DET C SYS Step 5: Store Coord System “Summary” page:

In the “Summary” page we are given one last opportunity to name this new transformation and we can review the largest residuals before storing the transformation.

The “Coord System” page allows us to define how we want the residuals to be distributed

The F1 (STORE) button stores the coordinate system to the DBX, attaches the coordinate system to the WGS84 Pts job that was selected in step 3 above and returns you to the GPS1200 Main Menu.

• Press the F1 (STORE) button.

This stores the transformation and takes you back to the Main Menu.</td><td>
</td></tr>
</table>

10.0 RTK Communications

Introduction

For successful real-time GPS surveying (RTK), the roving receiver must receive discernable transmissions from the reference (base station) receiver.

This chapter describes configuring and trouble-shooting RTK communications using Intuicom Data Link 1200 Spread Spectrum and Pacific Crest PDL radios. Then we explore the possibilities why the radios may not be communicating with each other followed by making your life easier by assigning a hot key to speed up changing the radio's channel.

In this Chapter

Section	Topic
10.1	Intuicom Radios
10.2	Pacific Crest PDL Radios
10.3	Radio Communication Trouble Shooting
10.4	Assigning A Hot Key For Changing The Radio Channel
10.5	Changing The Radio Channel Using The **F7** Hot Key

Important Note:

In the United States it is the law that you must have an FCC license for radios that transmit over 1 watt of power. This applies to the Pacific Crest radios but not the Intuicom radios.

10.1 Intuicom Radios

Introduction

In this section we will configure the receiver to work with the Intuicom 1200 Data Link spread spectrum radio that is housed in the GFU15 integrated housing. We must also program the radio itself to behave as either a base station (reference) radio or a rover radio. This can all be done from the GPS1200 receiver.

At this time there is no selection for Intuicom radios within the GPS1200 receiver so we will create one based on the Pacific Crest PDL radio parameters. The Intuicom **reference** and **rover** radios need to be programmed differently and this can all be done from the GPS1200 receiver.

First described is the method for programming a reference receiver's radio followed by instructions describing how to program the rover receiver's radio.

Chapter 3 The Real-Time Reference Configuration Set and chapter *4 The Real-Time Rover Configuration Set* describe how to define a radio within editing a configuration set, (maybe in greater detail) but this chapter will access editing a radio interface from a different way.

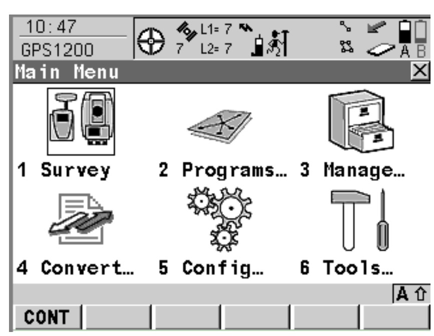
Intuicom Radios

The Intuicom 1200 Data Link is a high-performance, license-free, spread-spectrum wireless transceiver for use with the GPS1200 GPS receiver. The Intuicom Data Link 1200 uses frequency-hopping spread spectrum to avoid interference. By default, the unit hops on 112 different frequencies, hopping many times a second. The unit can be configured to be a base station (reference) radio, a rover radio, a rover-repeater, and just a repeater. This section describes the steps to make an Intuicom 1200 Data Link a reference radio and a rover radio. See the section titled *Repeaters and Rover-Repeaters* at the end of this section to learn how to configure your Intuicom radios to be either a rover-repeater or repeater.

Real-Time Reference Radio

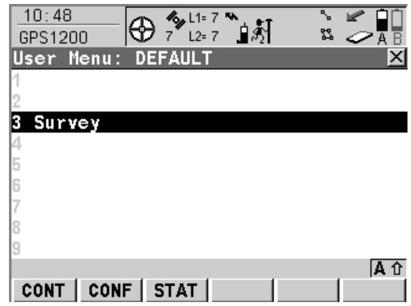
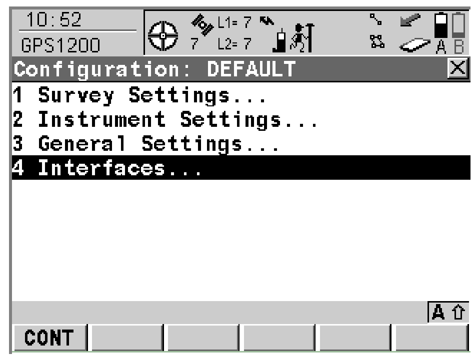
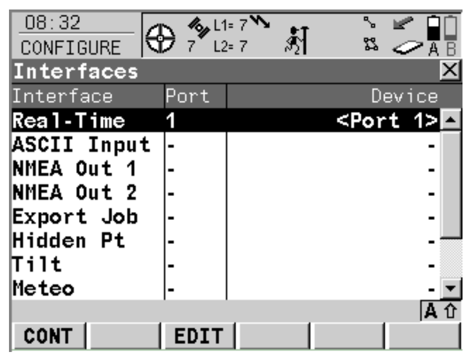
Turn on your reference receiver with the Intuicom radio plugged into port 1.

Follow the steps below to configure the Intuicom radio to behave as a real-time reference (base station) radio.

Step	Action	Display
1	From the Main Menu: • Press the USER button. This takes you to the GPS1200 User Menu: Default screen.	

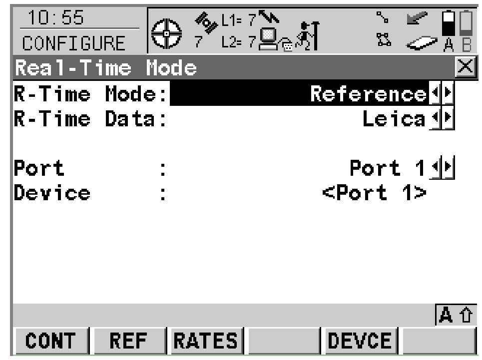
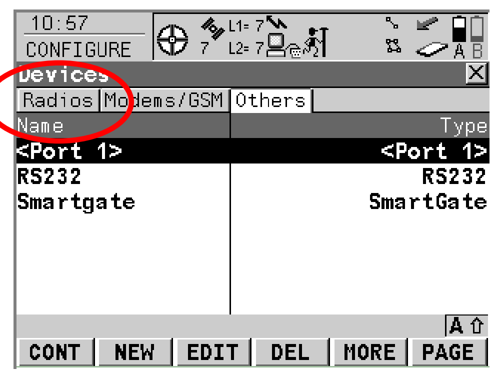
Continued on next page

10.1 Intuicom Radios, *Continued*

Step	Action	Display
2	In the GPS1200 User Menu: DEFAULT screen: **Note**: The word “DEFAULT” indicates that the “DEFAULT” configuration set is the active configuration set. • Press the **F2 (CONF)** button. This takes you to the GPS1200 Configuration: DEFAULT screen.	
3	In the GPS1200 Configuration: DEFAULT screen: • Tap on **4 Interfaces….** This takes you to the CONFIGURE Interfaces screen.	
4	In the CONFIGURE Interfaces screen: • Ensure that the **Real-Time** interface is selected. • Press the **F3 (EDIT)** button. This takes you to the CONFIGURE Real-Time Mode screen.	

Continued on next page

10.1 Intuicom Radios, *Continued*

Step	Action	Display
5	In the CONFIGURE Real-Time Mode screen: • Tap on the left/right arrow buttons to set the **R-Time Mode** field. Set it to **Reference**. (Remember the instructions for setting up the rover will follow.) • Set the **R-Time Data** format to **Leica**. • Set the **Port** to **Port 1**. **Important Note**: Ensure you have your Intuicom radio plugged into port "1". • Press the **F5 (DEVCE)** button to change the device. This takes you to the Others page of the CONFIGURE Devices screen.	
6	In the Others page of the CONFIGURE Devices screen: • Tap on the "Radios" tab. This takes you to the CONFIGURE Devices "Radios" page.	

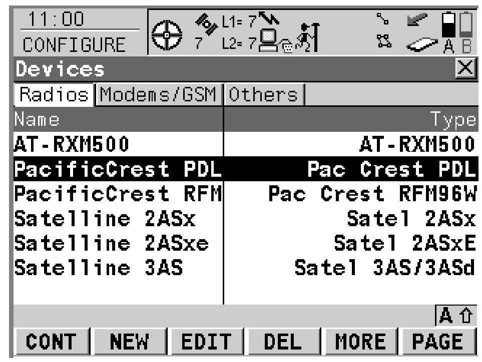
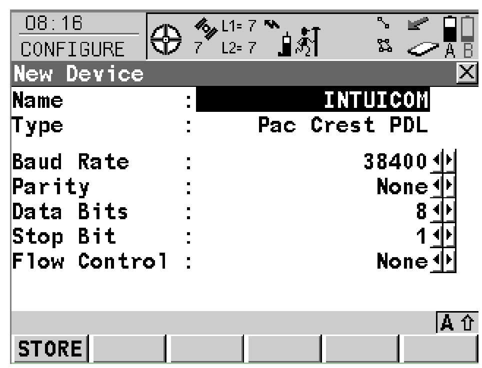
Continued on next page

10.1 Intuicom Radios, Continued

New Radio

At this moment there is not a listing for the Intuicom radio in the radios list. So we will create a new radio device by copying the parameters of an existing radio (Pacific Crest PDL) that uses the same parameters as the Intuicom radio.

Then we will change the radio's channel first to 0 (zero) and then to 14. This configures the radio to behave as a reference (base station).

Step	Action	Display
7	In the CONFIGURE Devices "Radios" page: • Tap on the **PacificCrest PDL** radio to select it. • Press the **F2 (NEW)** button. This makes a copy of the parameters of the Pacific Crest PDL radio and takes you to the CONFIGURE New Device screen.	
8	In the CONFIGURE New Device screen: • Enter a name for the new radio device in the **Name** field. In this example we called the device "INTUICOM". • Leave the other parameters as they are in the image on the right. • Press the **F1 (STORE)** button. This creates a new radio device called "Intuicom" with the same parameters as the PDL radio and returns you to the CONFIGURE Devices "Radios" page.	

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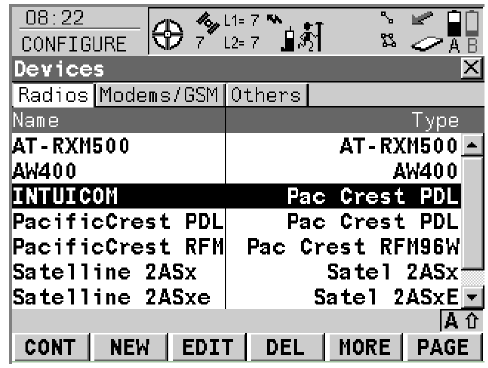
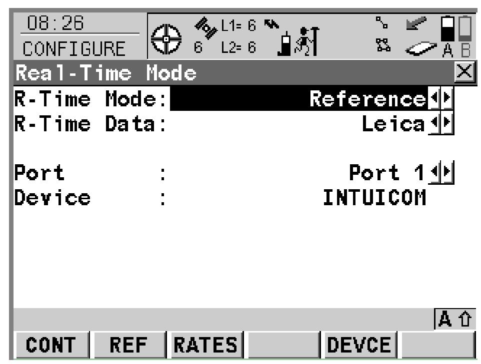
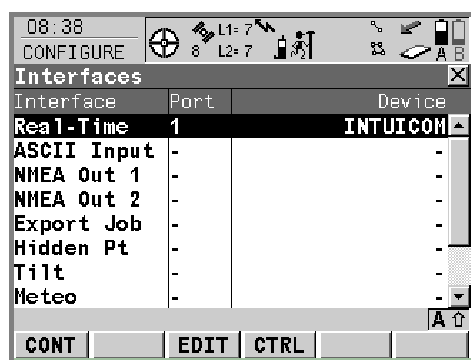
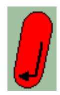
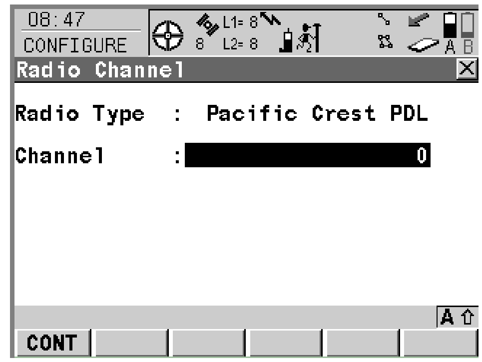
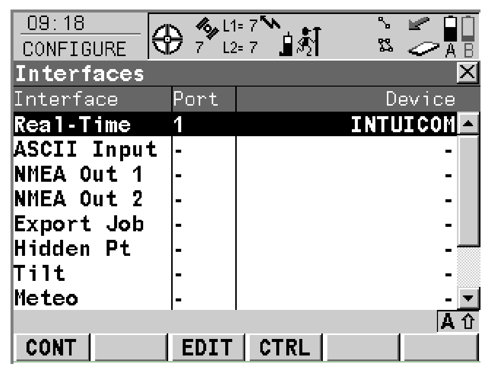
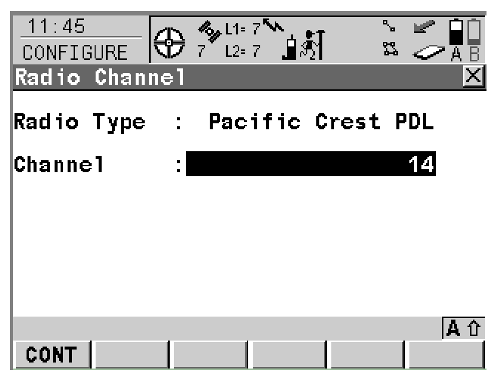
10.1 Intuicom Radios, Continued

Step	Action	Display
9	In the CONFIGURE Devices “Radios” page: We now see our newly created Intuicom radio device. • Ensure the **INTUICOM** radio device is selected. • Press the **F1 (CONT)** button. This returns you to the CONFIGURE Real-Time Mode screen.	
10	In the CONFIGURE Real-Time Mode screen: You can now see the INTUICOM radio in the **Device** field. • Press the **F1 (CONT)** button. This returns us to the CONFIGURE Interfaces screen.	
11	In the CONFIGURE Interfaces screen: We now need to program the radio to behave as a reference radio. • Press the **F4 (CTRL)** button. This takes you to the CONFIGURE Radio Channel screen.	

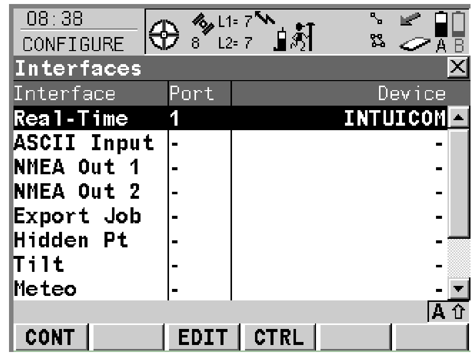
Continued on next page

10.1 Intuicom Radios, Continued

Step	Action	Display
12	In the CONFIGURE Radio Channel screen: First we need to set the radio channel to **0** (zero). • Enter **0** (zero) in the **Channel** field. • Press the **ENTER** button  to complete the data entry. • Press the **F1 (CONT)** button. This returns you to the CONFIGURE Interfaces screen.	
13	In the CONFIGURE Interfaces screen: We now need to configure the radio to behave as a reference radio. This is done by changing the radio's channel to **14**. • Press the **F4 (CTRL)** button. This takes you to the CONFIGURE Radio Channel screen.	
14	In CONFIGURE Radio Channel screen: • Enter **14** in the **Channel** field. • Press the **ENTER** button to complete the data entry. • Press the **F1 (CONT)** button. This returns you to the CONFIGURE Interfaces screen.	

Continued on next page

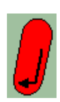
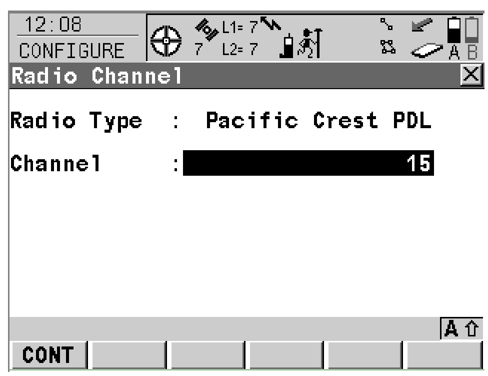
10.1 Intuicom Radios, Continued

Step	Action	Display
15	In the CONFIGURE Interfaces screen: We have just programmed the radio to behave as a reference radio. • Press the **F1 (CONT)** button. This returns you to the Main Menu.	

Real-time Rover Radio

You have just configured your Intuicom radio to behave as a real-time reference radio (See *Steps 1-15* above). Now it is time to program the rover's Intuicom radio to behave as a rover. Turn your rover receiver on with the Intuicom radio plugged into port 1.

Repeat the *Steps 1-15* with the rover's radio but when you reach *Step 14* enter **15** into the **Channel** field instead of **14**. (See below).

Step	Action	Display
14	In CONFIGURE Radio Channel screen: • Repeat *Steps 1-13* and come back here once *Step 13* is completed. • Enter **15** in the **Channel** field. • Press the **ENTER** button  to complete the data entry. • Press the **F1 (CONT)** button. This returns you to the CONFIGURE Interfaces screen. (See *Step 15* above).	

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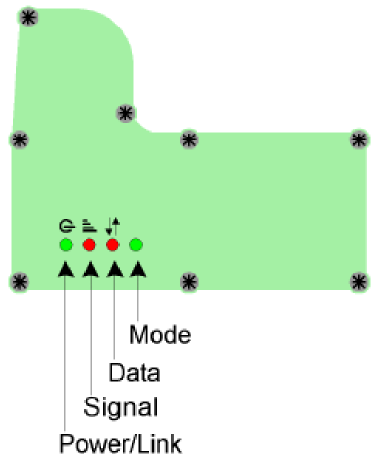
10.1 Intuicom Radios, Continued

What do those lights mean?



LED	Rover	Base
Power/Link	Solid Green	Solid Red
Signal	Solid Red	Solid Red
Data	Flashing Green	Light Red/ Flashing Red
Mode	Solid Green	Solid Red

Repeaters and Rover-Repeaters

The Intuicom Data Link radio can also be programmed to behave as either a repeater or a rover-repeater. We saw from the steps above that to make the Intuicom radio behave as a base radio we changed the channel to 14 and we changed the radio's channel to 15 when we wanted the radio to behave as a rover. To make the radio behave as a rover-repeater, change the radio's channel to 12 and to make the radio act as a repeater only, change the channel to 13. See the table below.

Channel	Operation Mode
12	Rover-Repeater
13	Repeater
14	Base (Reference)
15	Rover

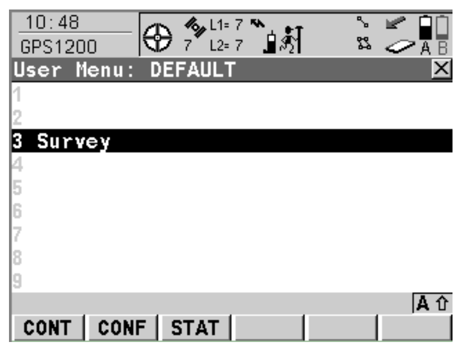
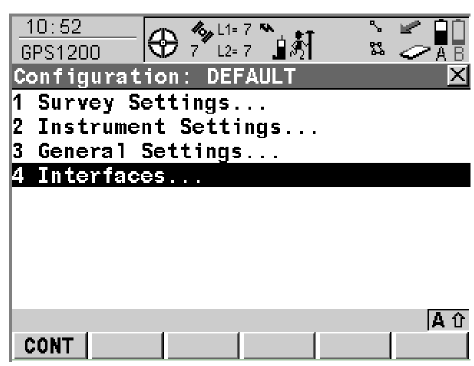
Continued on next page

10.2 Pacific Crest PDL Radios

Real-Time Reference Radio

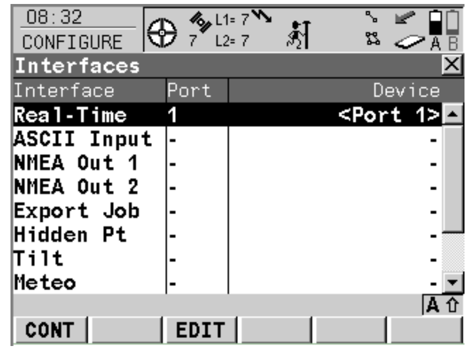
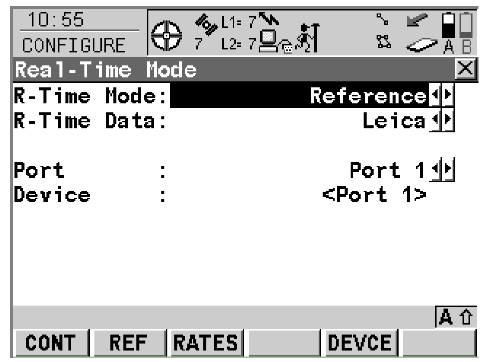
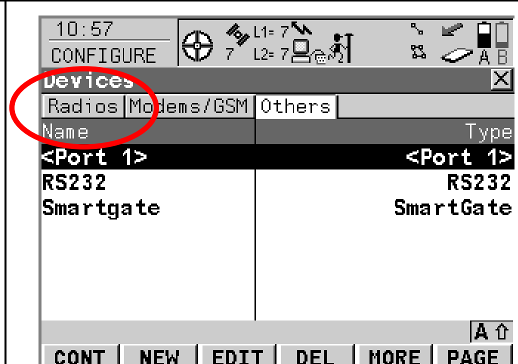
The following steps describe how to configure the radio interface of the GPS1200 to use the Pacific Crest PDL radio as a real-time reference radio.
The steps for configuring the rover radio follow.

Important Note: Unlike the Intuicom radios, the Pacific Crest radios **do** require a FCC license.

Step	Action	Display
1	From the Main Menu: • Press the  button. This takes you to the GPS1200 User Menu: Default screen.	
2	In the GPS1200 User Menu: DEFAULT screen: **Note**: The word "DEFAULT" indicates that the default configuration set is the active one. • Press the **F2 (CONF)** button. This takes you to the GPS1200 Configuration: DEFAULT screen.	
3	In the GPS1200 Configuration: DEFAULT screen: • Tap on **4 Interfaces…**. This takes you to the CONFIGURE Interfaces screen.	

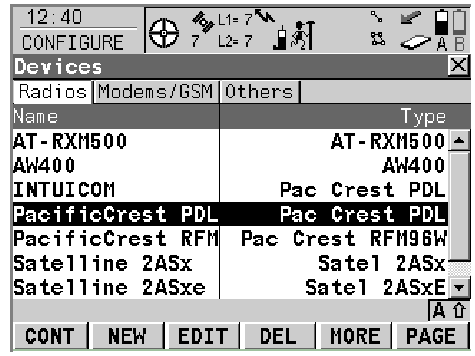
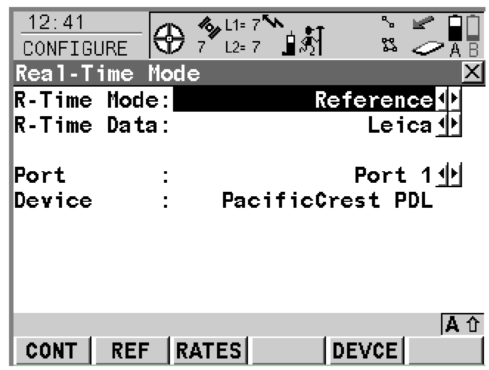
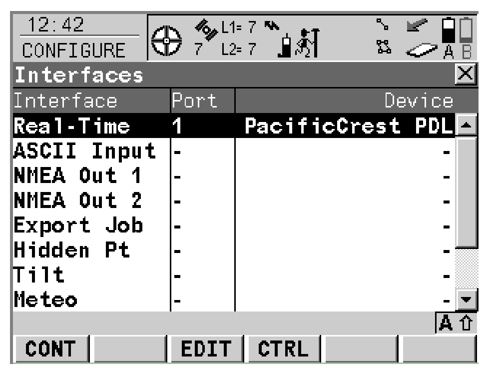
Continued on next page

10.2 Pacific Crest PDL Radios, Continued

Step	Action	Display
4	In the CONFIGURE Interfaces screen: • Ensure that the **Real-Time** interface is selected. • Press the **F3 (EDIT)** button. This takes you to the CONFIGURE Real-Time Mode screen.	
5	In the CONFIGURE Real-Time Mode screen: • Tap on the left/right arrow buttons to set the **R-Time Mode** field to **Reference**. (Remember the instructions for setting up the rover will follow.) • Set the **R-Time Data** format to **Leica**. • Set the **Port** to **Port 1**. **Note**: Ensure you have your PDL radio plugged into port "1". • Press the **F5 (DEVCE)** button to change the device. This takes you to the CONFIGURE Devices "Others" page.	
6	In the CONFIGURE Devices "Others" page: • Tap on the "Radios" tab. This takes you to the CONFIGURE Devices "Radios" page.	

Continued on next page

10.2 Pacific Crest PDL Radios, Continued

Step	Action	Display
7	In the CONFIGURE Devices "Radios" page: • Tap on the **PacificCrest PDL** radio to select it. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Real-Time Mode screen.	
8	In the CONFIGURE Real-Time Mode screen: You can now see **PacificCrest PDL** in the **Device** field. • Press the **F1 (CONT)** button. This takes you to the CONFIGURE Interfaces screen.	
9	In the CONFIGURE Interfaces screen: We can see that under the interface "Real-Time", for port "1", "PacificCrest PDL" has been selected. • Press the **F1 (CONT)** button. This returns you to the Main Menu.	

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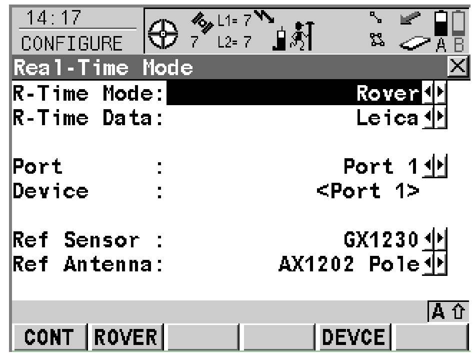
10.2 Pacific Crest PDL Radios, Continued

Real-Time Rover Radio

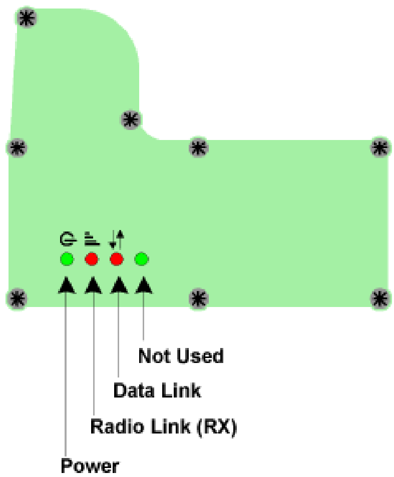
The configuration for setting a rover radio is the same for a reference radio except you must change the **R-Time Mode** field to **Rover**. Repeat the above *Steps 1-9* except when you reach *Step 5*, see below.

Step	Action	Display
5	In the CONFIGURE Real-Time Mode screen: • Tap on the left/right arrow buttons to set the **R-Time Mode** field to **Rover**. • Set the **R-Time Data** field to **Leica**. • Set the **Port** to **Port 1**. **Important Note**: Ensure you have your PDL radio plugged into port "1". • Press the **F5 (DEVCE)** button to change the device. This takes you to the Others page of the CONFIGURE Devices screen. (Return to *Step 6* above.)	

Continued on next page

10.2 Pacific Crest PDL Radios, Continued

What do those lights mean?



Power LED	Indicates that the radio is powered.
RX LED	Indicates that the PDLGFU16 is receiving an RF carrier signal. If the RX LED is lit for extended periods of time, or continuously, then another radio station may be operating on the same frequency.
Data Link	Indicates when the PDLGFU16 is communicating with the GPS1200.

10.3 Radio Communication Trouble Shooting

Base and Rover Not Communicating

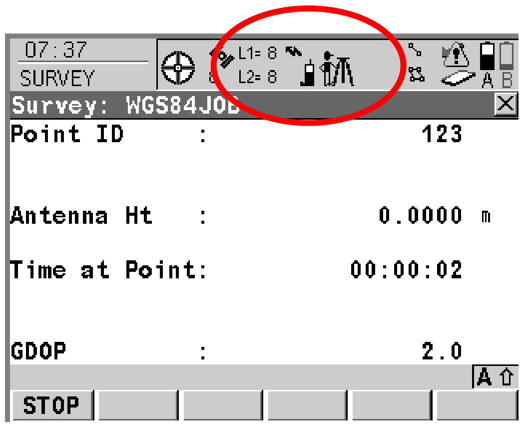
There will be times when you start up the reference GPS receiver and radio and then the rover receiver and radio and the rover does not receive the reference's transmitted data. You then must investigate why the two are not communicating.

The following sections describe the different possibilities you should investigate first.

Reference Receiver Not Using Correct Configuration Set

The reference receiver must be using the real-time reference configuration set. (See chapter *3 The Real-Time Reference Configuration Set* and chapter *5 Starting The Real-Time Reference*.)

The fastest way to determine if the reference receiver is using the reference configuration set is to look at the icons on the top of the display.

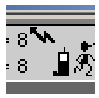


If the arrow is pointing **upwards** and "pulsating" back and forth then you know the reference receiver is using the correct configuration set and the receiver is sending data to a port.

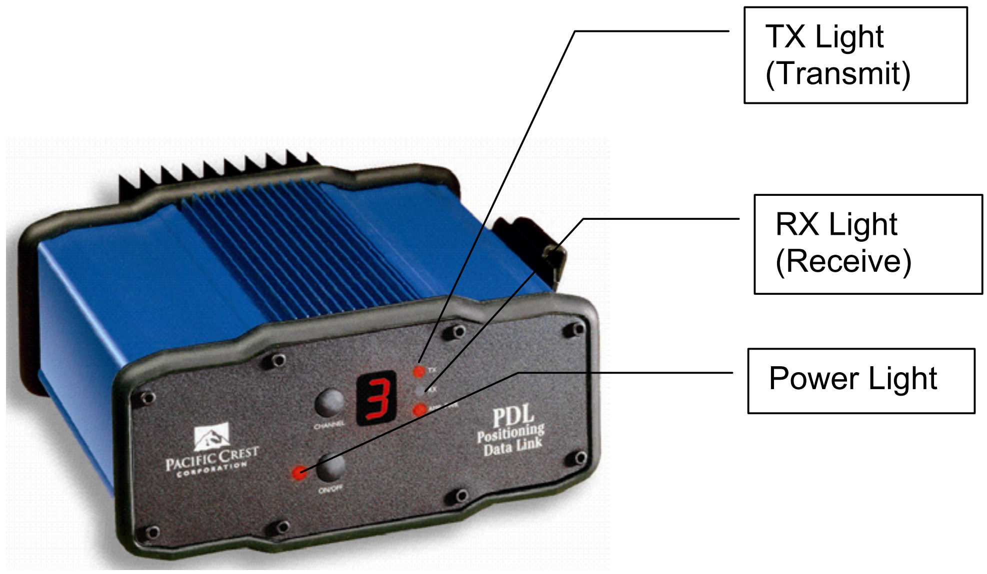
Continued on next page

10.3 Radio Communication Trouble Shooting, Continued

Reference Radio Lights



Even though the arrow is pointing upwards and "pulsating" back and forth does not mean that the reference radio is transmitting anything. We must look at the radio itself to make sure it is transmitting.



TX Light: First look at the TX light to see that it is flashing. It should flash at a steady rate of 1 pulse per second. This means that the radio is transmitting what the reference receiver is sending to it.

RX Light: If the RX light is flashing then you are receiving someone else's transmissions. **This is a BAD thing!!** If the RX light is flashing then you must change both of your radios to another channel.

Power Light: This should be a solid red light. If the Power light is flickering or dim then you should investigate the power supply's voltage.

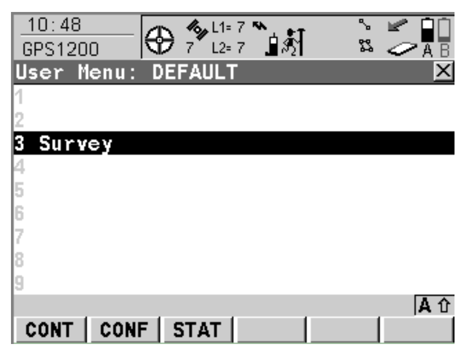
Continued on next page

10.3 Radio Communication Trouble Shooting, Continued

Base And Rover Radio Not On Same Channel

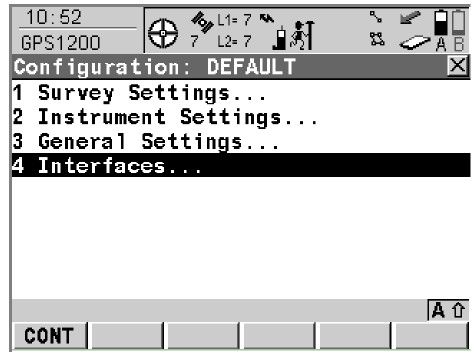
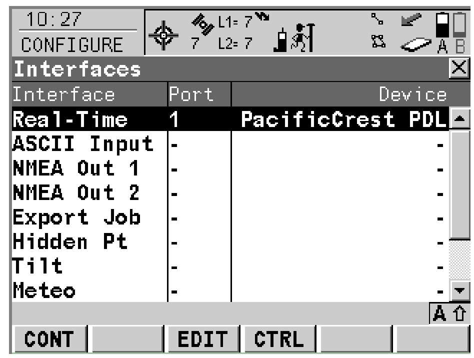
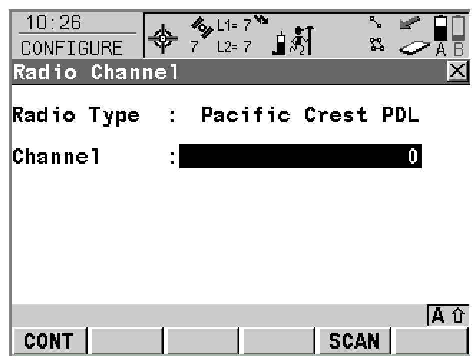
Both the reference receiver's radio and the rover receiver's radio must be on the same frequency for RTK to work. The following steps describe how to check the reference receiver's radio channel using the GPS1200 (checking the rover's radio channel is done in exactly the same way).

This section assumes that the frequencies assigned to each channel programmed into both the rover and reference radios match. That is, if channel "0" (zero) on the reference receiver's radio is 454.55KHz then channel "0" (zero) on the rover receiver's radio must also be 454.55KHz.

Step	Action	Display
1	From the Main Menu: • Press the  button. This takes you to the GPS1200 User Menu: Default screen.	
2	In the GPS1200 User Menu: DEFAULT screen: **Note**: The word "DEFAULT" indicates that the default configuration set is the active one. • Press the **F2 (CONF)** button. This takes you to the GPS1200 Configuration: DEFAULT screen.	

Continued on next page

10.3 Radio Communication Trouble Shooting, Continued

Step	Action	Display
3	In the GPS1200 Configuration: DEFAULT screen: • Tap on **4 Interfaces….** This takes you to the CONFIGURE Interfaces screen.	
4	In the CONFIGURE Interfaces screen: **Note**: In this example we are using a Pacific Crest PDL radio. • Press the **F4 (CTRL)** button. This queries the radio for its channel and takes you to the CONFIGURE Radio Channel screen.	
5	In the CONFIGURE Radio Channel screen: We see here that the radio channel is "0" (zero). We must now repeat this same procedure on the rover to ensure that both radio channels match. If they do not match, change one radio's channel to match the other. • Press the **F1 (CONT)** button twice. This returns you to the Main Menu.	

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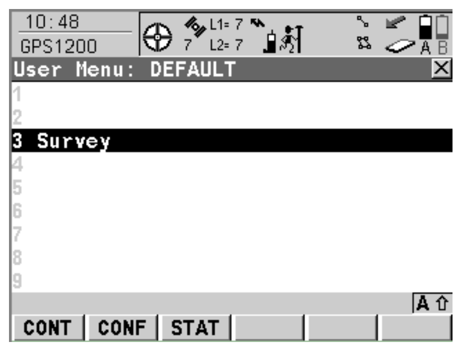
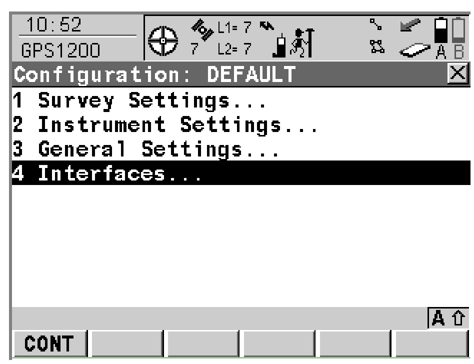
10.3 Radio Communication Trouble Shooting, Continued

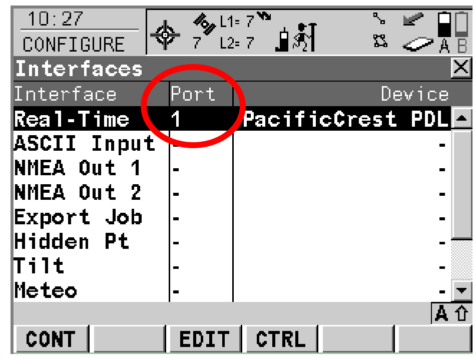
Radio Plugged Into Wrong Port

There are times when a radio has been plugged into one port but the receiver has been programmed to look for the radio in another port. First we must verify what port has a radio assigned to it and then see which port the radio is plugged into.

Step	Action	Display
1	From the Main Menu: • Press the  button. This takes you to the GPS1200 User Menu: Default screen.	
2	In the GPS1200 User Menu: DEFAULT screen: **Note**: The word “DEFAULT” indicates that the default configuration set is the active one. • Press the **F2 (CONF)** button. This takes you to the GPS1200 Configuration: DEFAULT screen.	
3	In the GPS1200 Configuration: DEFAULT screen: • Tap on **4 Interfaces…**. This takes you to the CONFIGURE Interfaces screen.	

Continued on next page

10.3 Radio Communication Trouble Shooting, Continued

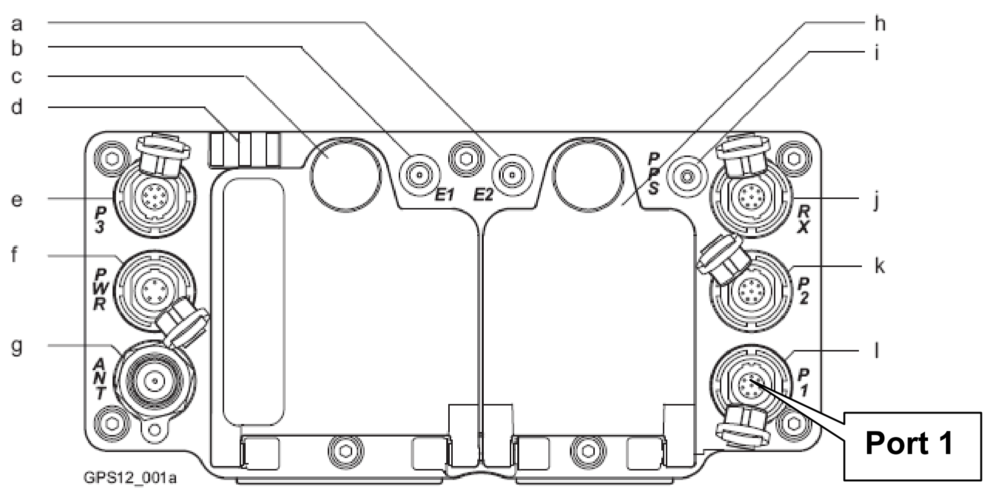
Step	Action	Display
4	In the CONFIGURE Interfaces screen: Here we see that the radio has been assigned to port "1". • Press the **F1 (CONT)** button. This returns you to the Main Menu.	

What Port Is The Radio Plugged Into?

We have just verified that the radio has been assigned to port 1. Now we must look to the receiver itself to see which port has the radio plugged into it. If you are not clear on how the receiver's ports are numbered or their function, see below.

Which Port is Which?

Below is a diagram with an explanation of each port on a GPS1200 receiver.



a) Port E2: Event input 2, on GX1200 with PPS/Event option
b) Port E1: Event input 1, on GX1200 with PPS/Event option
c) Battery compartment A with CompactFlash card compartment
d) LED indicators
e) Port P3: Power out, data in/out, or remote interface in/out. 8 pin LEMO
f) Port PWR: Power in. 5 pin LEMO
g) Port ANT: GPS antenna in. 8 pin LEMO for GTX1230.
h) Battery compartment B, not for GRX1200 Pro
i) Port PPS: PPS output, on GX1200 with PPS/Event option
j) Port RX: RX1200 in/out or remote interface in/out. 8 pin LEMO
k) Port P2: Power out, data in/out, or remote interface in/out. 8 pin LEMO
l) Port P1: Power out, data in/out, or remote interface in/out. 8 pin LEMO

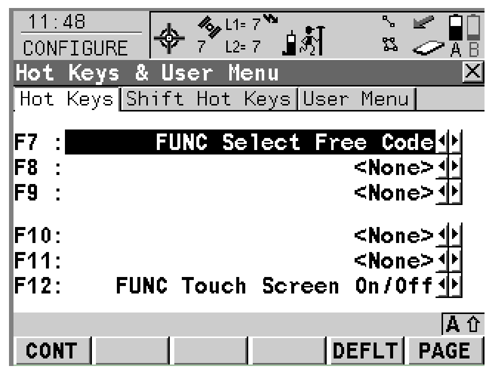
Continued on next page

10.4 Assigning A Hot Key For Changing The Radio Channel

Hot Keys

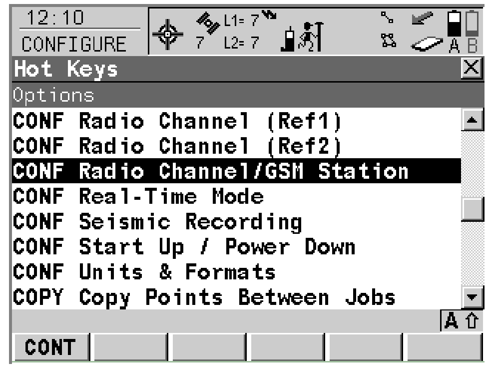
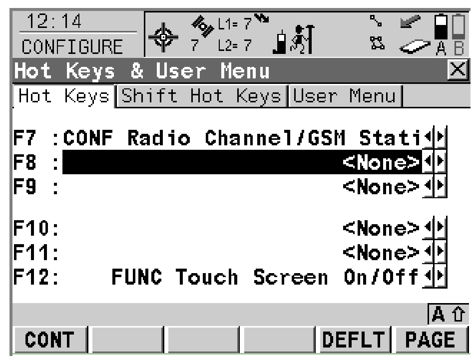
Hot keys provide a shortcut for quickly and directly carrying out functions or starting application programs assigned to the keys.

The following steps describe how to assign the ability to change the reference and rover's radio channel to a hot key. First we will describe how to assign the rover's function button.

Step	Action	Display
1	From the Main Menu: The easiest way to access the CONFIGURE Hot Keys & User Menu is to press any of the function buttons between the numbers of F7 and F12 and hold it down for 3 seconds. • Press and hold the **F7** button until the CONFIGURE Hot Keys & User Menu appears. In the CONFIGURE Hot Keys & User Menu: Here we can assign the **F7 – F12** function buttons, the **Shift F7 - F12**, and you can program what's available in the User Menu. Although there are many buttons to program here, we will only program one button (**F7**) to enable us to quickly change the radio's channel. • Select a button to which you wish to assign a function to and tap on it's associated field. In this example we will program the **F7** button that already has the "FUNC Select Free Code" assigned to it. Tapping on a function button field opens the CONFIGURE Hot Keys Options screen.	 

Continued on next page

10.4 Assigning A Hot Key For Changing The Radio Channel, Continued

Step	Action	Display
2	In the CONFIGURE Hot Keys Options screen: • Scroll up (or down) using the scroll bar and up/down arrows on the right side of the display to locate **CONF Radio Channel/GSM Station** and highlight it. • Press the **F1 (CONT)** button. This returns you to the CONFIGURE Hot Keys & User Menu screen.	
3	In the CONFIGURE Hot Keys & User Menu screen: We now can see that the **F7** button will change the radio channel for our rover's radio. You can either continue assigning function buttons or stop here and assign more buttons later. To return to the Main Menu: • Press the **F1 (CONT)** button. This returns you to the Main Menu.	

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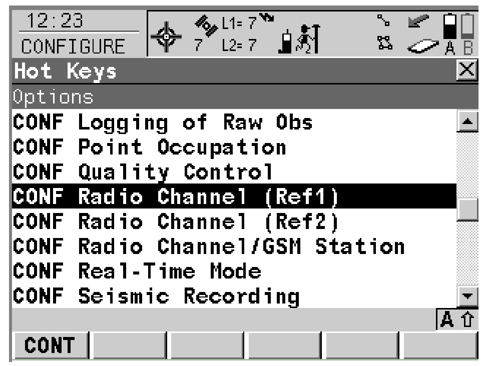
10.4 Assigning A Hot Key For Changing The Radio Channel, Continued

The Reference Radio

The steps to program the reference radio's **F7** button are exactly the same as the rover radio's steps except when you get to *Step 2*, see below.

Step	Action	Display
2	In the CONFIGURE Hot Keys Options screen: • Scroll up (or down) using the scroll bar and up/down arrows on the right side of the display to locate **CONF Radio Channel (Ref1)** and highlight it. • Press the **F1 (CONT)** button. This returns you to the CONFIGURE Hot Keys & User Menu screen.	

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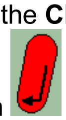
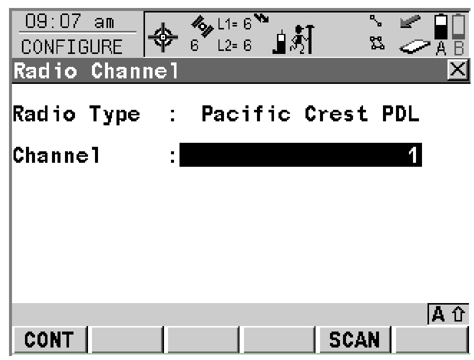
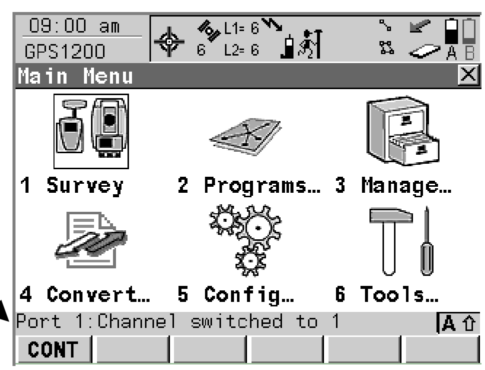
10.5 Changing The Radio Channel Using The F7 Hot Key, Continued

Changing The Radio's Channel

In the previous section we programmed the **F7** button to quickly access the screen to change the radio's channel. This section describes the steps to follow to change the radio's channel.

Step	Action	Display
1	From the Main Menu: • Press the  button. This takes you to the CONFIGURE Radio Channel screen.	
2	In the CONFIGURE Radio Channel screen: • Enter a radio channel in the **Channel** field. • Press the **ENTER** button  to complete the data entry. • Press the **F1 (CONT)** button. This returns you to the Main Menu.	
3	In the Main Menu: The radio's channel has been switched and we see a message alerting us to this.	

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10.5 Changing The Radio Channel Using The F7 Hot Key, Continued

Remember

You must exit a survey before you can change the radio's channel.

The reference and rover's radio channel must be the same for RTK to work.

Now all you have to do when you want to change the radio's channel is press the **F7** button and you will be taken directly to the CONFIGUIRE Radio Channel screen.

11.0 Utilities

Introduction

This chapter contains various important functions that are not large enough to have their own chapter but still important enough to include in this quick guide.

In this Chapter

Section	Topic
11.1	Import ASCII/GSI Data to Job
11.2	Transfer Objects

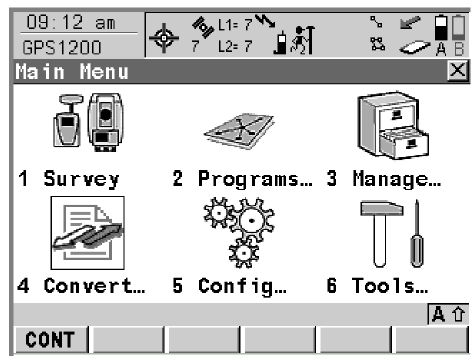
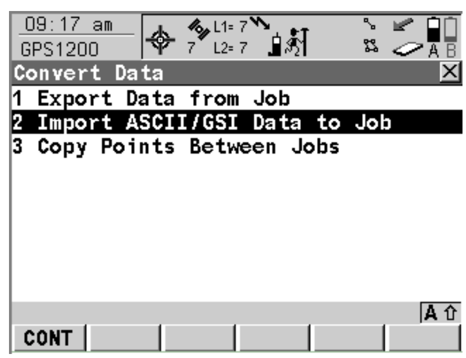
11.1 Import ASCII/GSI Data to Job

Introduction

There will be instances when you are given an ASCII file containing points that you must stake out. You can import these points in the GPS1200 and create a job out of the ASCII file.

The ASCII file must have a **.txt** extension and be stored in the Data directory on the Compact Flash (CF) card.

In this section we will convert a text file into a System 1200 job using the Import ASCII/GSI to Job tool.

Step	Action	Display
1	From the Main Menu: • Tap on **4 Convert….** This takes you to the GPS1200 Convert Data screen.	
2	In the GPS1200 Convert Data screen: • Tap on **2 Import ASCII/GSI to Job**. This takes you to the IMPORT Import ASCII/GIS Data to Job screen.	

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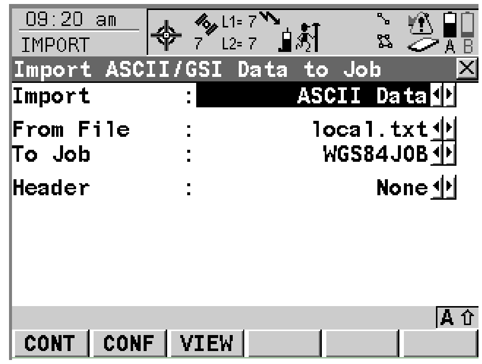
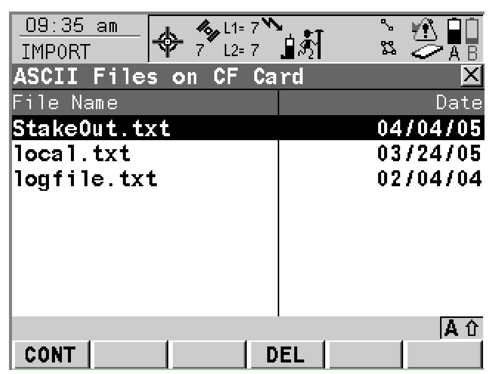
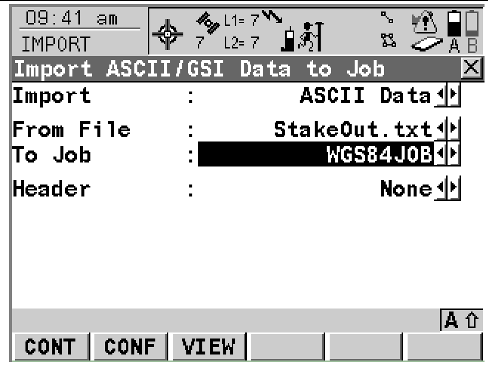
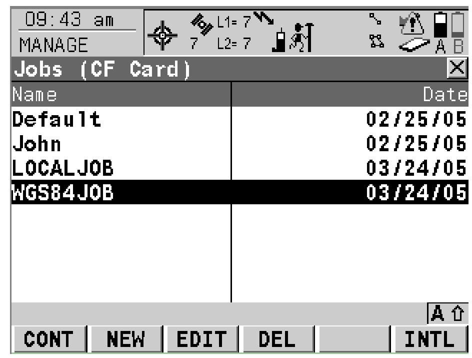
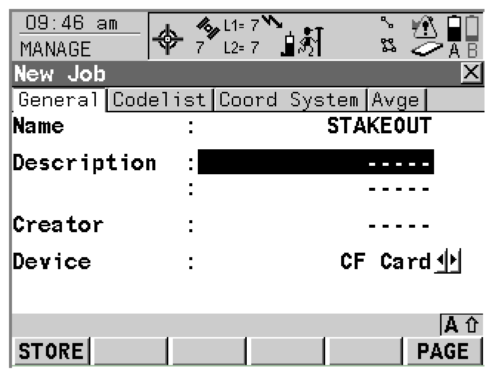
11.1 Import ASCII/GSI Data to Job, Continued

Step	Action	Display
3	In the IMPORT Import ASCII/GIS Data to Job screen: The **Import field** allows you to choose between importing an ASCII file or GSI file. In this example we will be importing an ASCII file. The **From File** field is where you select which file to import. The **To Job** field is where you assign a job to receive the ASCII data. The **Header** field allows up to ten header lines that may exist in an ASCII file to be skipped. The **F2 (CONF)** button allows you to define the file being imported. The **F3 (VIEW)** button allows you to view the file. • Tap on the **From File** field to select a file to import. This takes you to the IMPORT ASCII Files on CF Card screen:	
4	In the IMPORT ASCII Files on CF Card screen: • Tap on the file to select it. In this example we will be importing the ASCII file “StakeOut.txt”. • Press the **F1 (CONT)** button. This returns you to the IMPORT Import ASCII/GIS Data to Job screen.	

Continued on next page

11.1 Import ASCII/GSI Data to Job, Continued

Step	Action	Display
5	In the IMPORT Import ASCII/GIS Data to Job screen: • Tap on the **To Job** field. This takes you to the MANAGE Jobs (CF Card) screen.	
6	In the MANAGE Jobs (CF Card) screen: • Press the **F2 (NEW)** button to create a new job. This takes you to the MANAGE New Job screen.	
7	In the MANAGE New Job screen: • Enter a job name in the **Name** field. **Note**: For more information on creating a job, see chapter 1, section *1.3 Creating a Job*. In this example we will create a job titled “STAKEOUT”. • Press the **F1 (STORE)** button when finished. This returns you to the MANAGE Jobs (CF Card) screen.	

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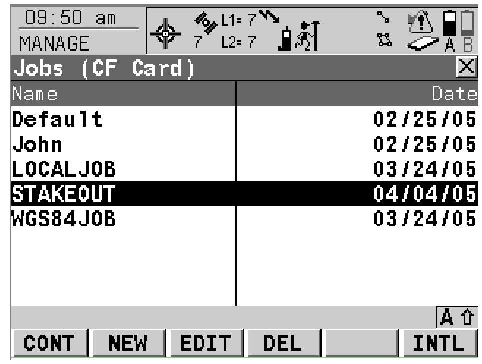
11.1 Import ASCII/GSI Data to Job, Continued

<table>
<tr><th>Step</th><th>Action</th><th>Display</th></tr>
<tr><td>8</td><td>In the MANAGE Jobs (CF Card) screen:

We can now see our newly created job.

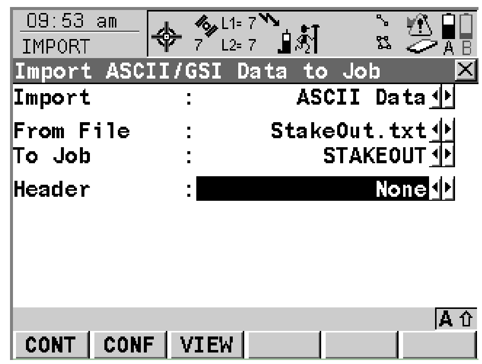
• Press the F1 (CONT) button.

This returns us to the IMPORT Import ASCII/GIS Data to Job screen.</td><td>
</td></tr>
<tr><td>9</td><td>In the IMPORT Import ASCII/GIS Data to Job screen:

In this example, the ASCII file we are importing:
• has no header,
• is in metres,
• is comma delimited, and
• has the format: point ID, northing, easting, and orthometric height.

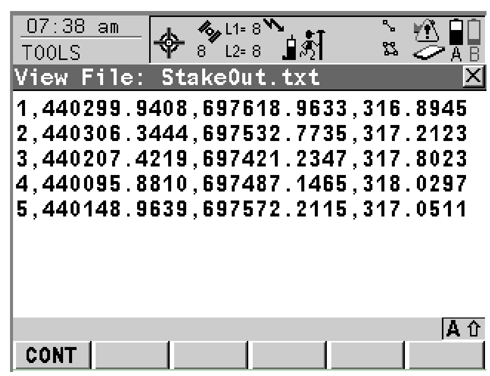
We now see our newly created job in the To Job field. Let's look at the ASCII file to see what it looks like.

• Press the F3 (VIEW) button.

This takes you to the TOOLS View File: StakeOut.txt screen.</td><td>
</td></tr>
<tr><td>10</td><td>In the TOOLS View File: StakeOut.txt screen:

We can see that there are five points in this file and as it states in Step 9, the file is comma delimited, and is in the format of point ID, northing, easting, and height.

• Press the F1 (CONT) button.

This returns us to the IMPORT Import ASCII/GIS Data to Job screen.</td><td>
</td></tr>
</table>

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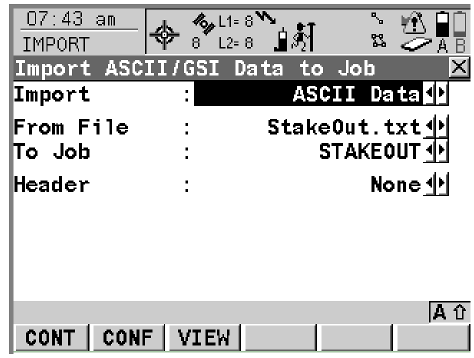
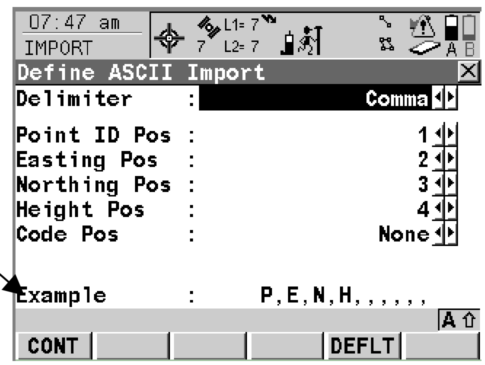
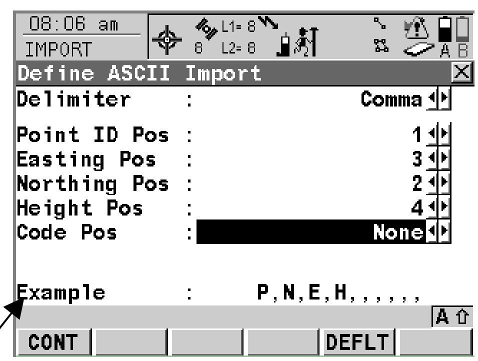
11.1 Import ASCII/GSI Data to Job, Continued

Step	Action	Display
11	In the IMPORT Import ASCII/GIS Data to Job screen: Since we now know the format of the file, we can configure the GPS1200 receiver to import the file correctly. • Press the **F2 (CONF)** button. This takes you to the IMPORT Define ASCII Import screen.	
12	In the IMPORT Define ASCII Import screen: We can see from the **Example** line that the receiver is expecting the format: point ID, easting, northing, and height, with no codes. But we know the file's format is point ID, northing, easting, and height so we must change the import parameters. • Leave the **Delimiter** field as **Comma**. • Leave the **Point ID Pos** field as **1**. • Change the **Easting Pos** field to **3**. • Change the **Northing Pos** field to **2**. • Leave the **Height Pos** field as **4**. • Leave the **Code Pos** field as **None**. After you make these changes you can see the result of these changes in the **Example** line. Once you have finished changing the import parameters, • Press the **F1 (CONT)** button. This returns you to the IMPORT Import ASCII/GIS Data to Job screen.	 

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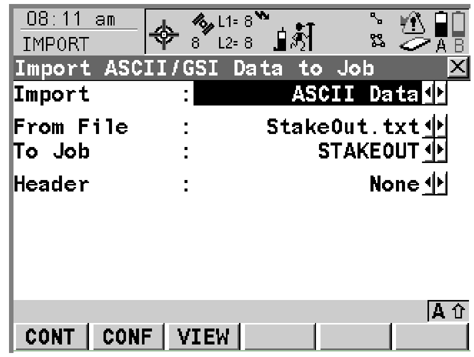
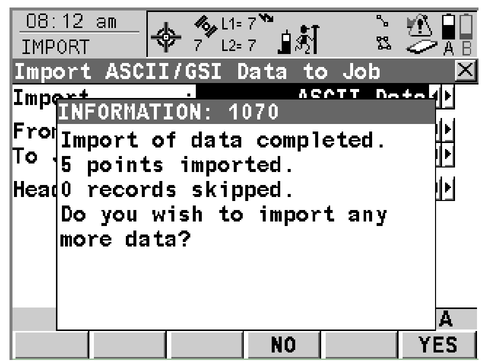
11.1 Import ASCII/GSI Data to Job, Continued

Step	Action	Display
13	In the IMPORT Import ASCII/GIS Data to Job screen: We are now ready to import the ASCII file. • Press the **F1 (CONT)** button. This imports the ASCII file, changes the format of the data into a System 1200 job, and displays a results alert screen.	
14	In the IMPORT Information screen: You are presented with a choice of importing more data. Since we have no other points to import, • Press the **F4 (NO)** button. This returns you to the Main Menu.	

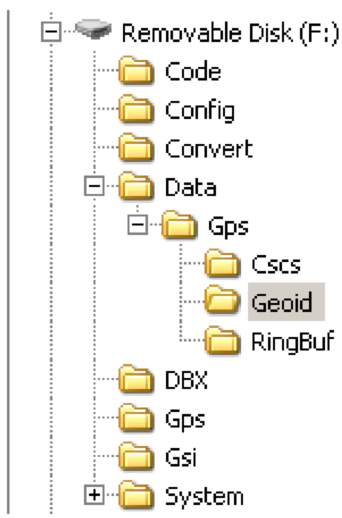
11.2 Transfer Objects

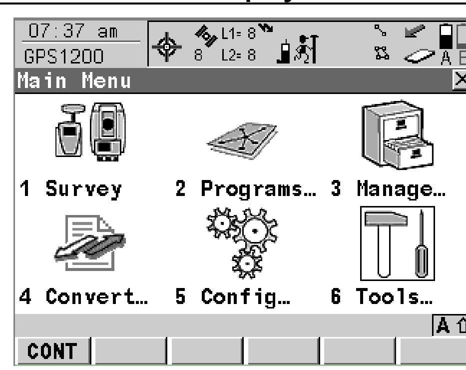
Introduction

This section describes how to use the Transfer Objects tool to transfer objects from the CF card to the system RAM of the sensor.

In this example we will transfer a geoid model field file from the CF card to the System RAM of the receiver. The file is titled **GeorgiaGRS80.gem**.

Geoid model field files reside in the Geoid directory on the CF Card. See the image below for where the Geoid folder can be found on the System 1200 CF Card. See chapter 1, section *1.2 CF Card Structure* to see where other System 1200 objects are stored.



Step	Action	Display
1	From the Main Menu: • Tap on **6 Tools….** This takes you to the GPS1200 Tools Menu.	

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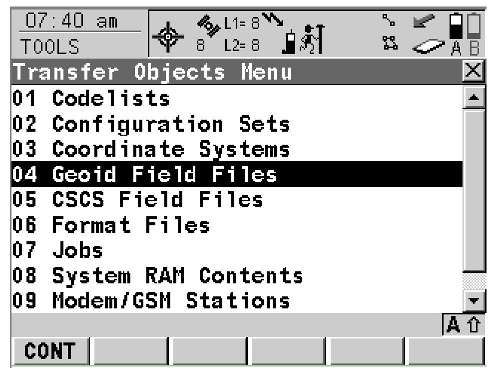
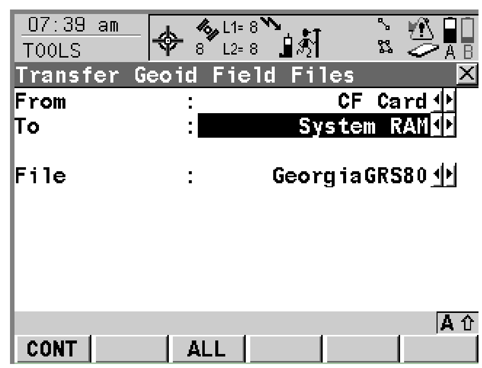
11.2 Transfer Objects, Continued

Step	Action	Display
2	In the GPS1200 Tools Menu: • Tap on **2 Transfer Objects…**. This takes you to the TOOLS Transfer Objects Menu.	
3	In the TOOLS Transfer Objects Menu: • Tap on **04 Geoid Field Files**. This takes you to the TOOLS Transfer Geoid Field Files screen.	
4	In the TOOLS Transfer Geoid Field Files screen: • Ensure the **From** field is **CF Card**. • Ensure the **To** field is **System RAM**. • Tap on the **File** field to select a geoid model field file. The **F3 (ALL)** button will transfer every geoid model field file stored in the **Geoid** folder. • Press the **F1 (CONT)** button. This transfers the geoid model field file and returns you to the Main Menu.	

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11.2 Transfer Objects, Continued

Step	Action	Display
5	In the Main Menu: A “Transfer successfully completed” message appears to alert you of the transfer status.