ORIENTATION GUIDE

TerraSync™ Software and GPS Pathfinder® Office Software

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Version 5.3 GPS Pathfinder Office

Trimble®

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This is the May 2012 release (Revision B) of the *TerraSync Software and GPS Pathfinder Office Software Orientation Guide*. It applies to version 5.30 of the TerraSync software and version 5.30 of the GPS Pathfinder software.

The following limited warranties give you specific legal rights. You may have others, which vary from state/jurisdiction to state/jurisdiction.

Product Limited Warranty Information

For applicable product Limited Warranty information, please refer to Legal Notices in the *TerraSync Software Getting Started Guide* and the *GPS Pathfinder Office Getting Started Guide* or consult your local Trimble authorized dealer.

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CHAPTER

1

Introduction

In this chapter:

- Course objectives
- Course materials
- Internet resources
- Technical assistance
- Important GNSS contacts
- System components

Course objectives

The course objectives include learning to:

- Associate GNSS fundamentals with the criteria of a TerraSync software mapping project
- Identify TerraSync system components
- Configure your data collector with data collection parameters
- Record GNSS data with the TerraSync software
- Process your field data with GPS Pathfinder Office software

Course materials

Material provided for the TerraSync software training course includes this document, the *TerraSync Software and GPS Pathfinder Office Software Orientation Guide*. Use it during the training as well as on the job. It provides GNSS fundamentals, instruction for the classroom, and field exercises. A glossary of terms is included for your reference during and after the course.

Internet resources

The ***Trimble Knowledge Network Learning Center*** offers a portfolio of training courses for Mapping & GIS. A powerful, effective and interesting way to learn, courses are presented as web-based tutorials, webinars, on-demand training, and webcasts. To access the Trimble Knowledge Network Learning Center, go to www.trimble.com/tkn.

The ***Support*** page on the Trimble website provides access to the newest customer support tools. To access the Support page:

- Go directly to www.trimble.com/support.shtml
- Click **Support & Training** on the Trimble home page
- Click **Support** in the top navigation bar on the Trimble website

On the Support page, click a product name to access support resources for that product.

Support notes and FAQs

Support Notes and FAQs (Frequently Asked Questions) include product information, troubleshooting instructions, and answers to common questions. Trimble recommends that you check the Support Notes and FAQs before you seek direct assistance.

To view or download the available support documents for your product, go to the Support page on the Trimble website (www.trimble.com/support.html) and then click the product name.

Technical assistance

If you have a problem and cannot find the information you need in the product documentation, ***contact your local dealer***. The **Dealer Locator** page on the Trimble website (www.trimble.com/locator/sales.asp) provides contact details for your local dealer:

Dealer name: ______________________________________

Phone number: ____________________________________

Email: ____

Alternately, you can purchase Priority Support.

Priority Support

If time is crucial, and your staff field needs their technical GNSS questions answered quickly, you can purchase Priority Support. You will receive a direct dial phone number and an email address to contact dedicated Priority Support staff to access the help you need immediately.

Note – Priority Support is currently available only to customers who live in the USA. If you live outside of the USA, please contact your local Trimble Dealer to discuss the support options they offer.

There are two types of Priority Support:

- ***Annual Priority Support***. Purchase Annual Priority Support for each person who requires direct access to experienced Trimble support specialists. This option provides 12 months of unlimited technical support, covering all Trimble Mapping & GIS equipment. You will receive a free-phone number so you can communicate directly with GNSS/GIS support specialists from Monday to Friday, 9am - 7pm Eastern Time and have a "High priority" status for all your enquiries, ensuring your questions get answered first. Annual subscription rates begin at US$495.00.
- ***Pay as you go Priority Support***. Call 1-866-560-6200 to purchase Priority Support when you require it. You pay using a credit card when you make the call. Each call costs US$49.95.

Important GNSS contacts

The following contact numbers are useful for obtaining GNSS and control point information, primarily in the United States. For information about your region, ask your trainer.

U.S. Coast Guard

The U.S. Coast Guard is a source for current GNSS and satellite information. You can obtain information on the number of operational space vehicles (SVs) and the times and dates they will be available (the NANU status), as well as launch dates for new and replacement SVs. You can also get information on the U.S. Coast Guard beacons.

Recorded Message: 1-703-313-5907
Live Voice: 1-703-313-5900
Internet: www.navcen.uscg.gov

National Geodetic Survey (NGS)

Call the National Geodetic Survey department for the location of control points in your geographic area (within the United States).

Information Center: 1-301-713-3242
Internet: www.ngs.noaa.gov

System components

The TerraSync software with a GNSS receiver and a handheld data collector is a GIS data collection system.

There are a number of different system configurations available.

TerraSync software

The TerraSync software collects geographical data (GIS and spatial data) on a data collector. The TerraSync software acts as the *controlling software*. It communicates with a GNSS receiver, connected to the data collector, allowing you to set GNSS parameters in the receiver, record GNSS positions on the data collector, and collect and update existing GIS data.

The TerraSync software can be used with a wide variety of real-time sources of differential corrections, including:

- Integrated SBAS (Satellite Based Augmentation Systems) receiver
- Integrated beacon receiver
- Integrated OmniSTAR receiver
- External source connected to the GNSS receiver (for example, a GeoBeacon™ receiver, a DGPS radio, or a VRS™ server over the internet)

GPS Pathfinder Office software

Back in the office, you can process the information that you collected, and export it to your GIS, using the GPS Pathfinder Office software.

The GPS Pathfinder Office software provides the tools needed for data dictionary creation, differential correction, and export to a Computer Aided Design (CAD) system or Geographic Information System (GIS).

With the GPS Pathfinder Office software you can:

- Create data dictionaries that describe the features you want to collect
- Create TerraSync Studio files that define the viewable TerraSync functionality
- Import data from your GIS for update
- Transfer files between a field computer and your office computer
- Differentially correct your data
- Edit attributes and offsets, and delete erroneous positions
- Export your data to a GIS or CAD

The GPS Pathfinder Office software makes exporting GNSS data to your GIS a simple process. Parameters for exporting data can be set up in the software and saved for use on future projects. The GPS Pathfinder Office software exports files to most GIS and CAD systems.

CHAPTER

2

GPS and GNSS Fundamentals

In this chapter:

- GNSS Segments
- Why Satellites
- Satellite ranging
- Differential GNSS
- Sources of Error

The Global Positioning System (GPS) is a constellation of at least 24 NAVSTAR satellites that provide worldwide accurate position coordinates. Uses satellites and computers to compute positions anywhere on Earth. The system is owned, operated and controlled by the United States Department of Defense (DoD). It can be used worldwide by any civilian free of charge.

GNSS segments

GNSS is divided into three segments: control, space, and user.

Control

The control segment is the “brain” of GNSS. A controller monitors the satellites’ transmission of navigation messages and sends adjustments, if necessary. The DoD operates this segment from Falcon Air Force Base in Colorado Springs, Colorado, USA. The segment also includes four monitoring and upload stations distributed throughout the world. Each satellite passes over a monitoring station twice a day.

Space

The space segment is the NAVigation Satellite Timing And Ranging (NAVSTAR) constellation of satellites that broadcast GNSS signals. When the system is at full operational capacity, there are a minimum of 24 operational satellites. This number changes constantly as satellites are commissioned (put into operation) and decommissioned (removed from operation). The satellites orbit approximately 20,200 km above the Earth and make one orbit approximately every 12 hours.

User

Many applications use GNSS to calculate positions. Civilian users currently outnumber military users worldwide. Applications include agriculture, aviation, emergency services, recreation, and vehicle tracking. For more information about GNSS applications, visit the Trimble website (www.trimble.com).

Why satellites?

GNSS is an effective mapping tool because:

- Line of sight between the unknown and a known location is *not* necessary. You only need line of sight to the sky.
- When used properly, GNSS satellites provide accurate positioning, user mobility, and rapid data collection.

While satellite-based positioning has revolutionized the GIS mapping data collection industry, it is important to note that GNSS is only a useful tool. You cannot use it to perform every mapping task.

Satellite ranging

GNSS is based on satellite ranging. This measurement is determined by timing how long it takes a radio signal to reach the GNSS receiver from a satellite, and using that time to calculate the distance.

Measuring satellite distance

Two factors are involved in measuring the distance from a satellite:

- The *speed* of the radio signal, which equals the speed of light (300,000 km per second)
- The *time* it takes the signal to travel from the satellite to the GNSS receiver

The GNSS receiver compares digital codes generated at precisely the same time by a GNSS satellite and the GNSS receiver. Identical “pseudorandom” codes are generated by all GNSS equipment (satellites and receivers) every millisecond. The travel time is calculated as the difference between when the satellite generated the code and when the receiver receives the code.

Trilateration refers to measuring the distance from at least three satellites to establish a position on Earth. Trigonometry requires three perfect measurements to define a point in three-dimensional space. However, the accuracy of a measurement based on three satellites may be diminished due to non-synchronization of clocks in the GNSS satellites and the receiver.

Calculating an accurate position

Four imperfect measurements can eliminate timing offsets. The microprocessor in the GNSS receiver recognizes a timing offset when it receives a series of measurements that it cannot intersect at one point. It automatically starts subtracting the same amount of time from all of the measurements until one point is determined.

An accurate position is calculated by using four satellites. Currently, all Trimble mapping receivers have at least twelve parallel channels to receive radio transmissions.

Almanac information

Some GNSS receivers have an almanac programmed into their microprocessor’s memory. The almanac specifies where each GNSS satellite will be at any given moment in the future. It is a set of parameters used to calculate the *general* location of each satellite. Almanacs are used while planning a work project, and for quick acquisition of satellite positions by the receiver. Preprogrammed almanacs suffer over time, as SVs are set operational and not operational, and as SVs' orbits drift. Each NAVSTAR satellite transmits the current almanac for all satellites continuously, taking approximately 12 minutes to complete.

Ephemeris information

The orbits of all GPS satellites are measured constantly by the DoD. They determine satellite ranging and calculate the *exact* location of each satellite. The adjusted measurement is transmitted from the DoD to the satellites. These minor corrections are then transmitted by the satellites as ephemeris information.

The ephemeris information is a data file that contains orbit information for one particular satellite. This information is used by the GNSS receivers along with their internal almanac to establish precisely the position of the satellite.

Differential GPS

Differential GPS is the precise measurement of the relative positions of two receivers tracking the same GPS signals. This requires a receiver to be placed as a base station over a known coordinate. The base station determines what errors the satellite data contains. Other receivers (rovers) then use this corrected GPS information to eliminate error in their measurements.

Differential GPS measurements are much more accurate than standard GPS measurements. When taking measurements in the differential mode, you can achieve accuracy of better than one meter. These measurements are based on the accuracy of the reference position (coordinate) used at the antenna of the base station.

Sources of error

Ultimately, the accuracy of a GNSS position is determined by the sum of several sources of error. The contribution of each source varies depending on atmospheric and equipment conditions.

There are several sources of error that affect the results of GNSS data collection. Environmental factors, such as physical objects causing obstructions and reflected signals, cause errors in data collection. Errors are minimized by applying rigorous data collection techniques to equipment setup and obtaining satellite lock.

Obstruction

In general, GNSS signal reception is better in an open field than under tree canopy or in a natural or urban canyon. If the GNSS receiver is tracking four satellites and then loses lock on a satellite that passes behind an obstruction, then you must wait for the receiver to regain that satellite before you can continue to log 3D positions.

Therefore, try to avoid obstructions caused by buildings or vegetation during data collection. If you cannot avoid them, plan to collect data at these locations when there are a maximum number of satellites in the sky. Greater sky visibility at the antenna location provides more accurate data.

Multipath

Multipath error occurs when the GNSS signal is reflected off an object before it reaches the GNSS antenna. Multipath error occurs without warning. The error can be minor, or can result in several meters of accuracy degradation. High multipath surfaces include urban canyons and dense foliage.

Currently, there is no way to prevent multipath from occurring. However, field techniques and receiver firmware can reduce its effects. Serious multipath errors are usually recognizable and easily edited in the office processing software.

Atmospheric delay

GNSS signals bounce around when traveling through the ionosphere and troposphere. As the signal bounces, the amount of time it takes to reach the Earth is altered. This can change the calculated position.

Atmospheric delay is largest during the heat of the day when ionospheric activity is greatest. Furthermore, weather patterns in the troposphere can be different at the base and rover receivers. Although atmospheric delay is a solvable error, differences in atmospheric conditions over large distances may not be totally resolved in a differential solution.

Note – GNSS works in all weather conditions.

CHAPTER

3

Configuring the TerraSync Software

In this chapter:

Before collecting your field data, it is important to set up the equipment correctly. This includes configuring the TerraSync software settings and assembling the hardware.

In this section, you will learn the recommended settings when working in optimal conditions and with obstructed views. An appropriate TerraSync software configuration can make your data collection session easier and your data more accurate.

Configure these settings in the office, or in the field. You can also set other (non-critical) settings to suit your application or preferences.

TerraSync system components

A TerraSync system has three components:

- Data collector (field computer)
- GNSS receiver
- TerraSync software

To transfer the TerraSync software version 5.00 files between a data collector and an office computer, you need one of the following installed on the office computer:

- Version 5.00 or later of the GPS Pathfinder Office software
- The Trimble Data Transfer utility, which is available for free download from the Trimble website at www.trimble.com/datatransfer.html.

You also need one of the following installed on the office computer:

- ActiveSync technology, version 4.5 or later, if you are running a Microsoft Windows operating system other than the Windows Vista operating system.
- Windows Mobile Device Center, if you are running the Windows 7 or Windows Vista operating system.

Connecting to ActiveSync technology

When the data collector is physically connected to the office computer, it usually initiates connection automatically. To force a data controller to re-initiate connection, remove it from the support module and then replace it in the support module.

For more information on using ActiveSync technology, refer to the *ActiveSync Help*.

Connecting to the Windows Mobile Device Center

When the data collector is physically connected to the office computer running the Windows Vista operating system, it usually initiates connection automatically.

Note – If the Autoplay window appears, you must close the window.

For more information on the Windows Mobile Device Center, refer to the *Windows Mobile Device Center Help*.

Using the TerraSync software

The TerraSync software consists of five sections:

Section	Function
Map	View features, background files, and the GNSS trail graphically. ***Note** – Some options in the Map section may be hidden. This customization is done using the TerraSync Studio utility in the GPS Pathfinder Office software.*
Data	Work with data files: • create a new data file or open an existing data file • collect new features or maintain existing features • move, copy, delete, or rename data and background files ***Note** – Some options in the Data section may be hidden. This customization is done using the TerraSync Studio utility in the GPS Pathfinder Office software.*
Navigation	Navigate to features using the *Direction Dial* and *Close-up* screen. Create and edit waypoints. ***Note** – The Navigation section, and all navigation options, may be hidden. This customization is done using the TerraSync Studio utility in the GPS Pathfinder Office software.*
Status	View information about: • the satellites the TerraSync software is tracking, their relative positions in the sky, and your current position • the GNSS receiver and real-time correction source • the TerraSync software version and trademark information ***Note** – Some options in the Status section may be hidden. This customization is done using the TerraSync Studio utility in the GPS Pathfinder Office software.*
Setup	Configure the TerraSync software. ***Note** – The Setup section may be hidden. This customization is done using the TerraSync Studio utility in the GPS Pathfinder Office software.*

One of these sections is always active and visible. The *Section list button* shows the section that is currently active. You can move between sections at any time without closing any open forms or screens. To switch to a different section, tap the Section list button and then select the section you want from the drop-down list. For example, to switch from the *Map* section to the *Data* section, tap the Section list button and then select *Data*. The button now shows **Data** and the *Data* section becomes the active section. When you return to the *Map* section, the screen or form that was open when you left appears again.

Configuring critical settings in the TerraSync software

There are some critical settings in the TerraSync software that you should configure before collecting data (for example, the GNSS settings). In this section you will learn the recommended settings to make your data collection session easier and your data more accurate.

Configure these before leaving the office, or in the field. You can also set other (non-critical) settings to suit your application or preferences.

Configuring GNSS settings

Using Smart Settings available with the GeoExplorer 6000 for instance, the GNSS receiver generates the best possible position for any given environment, without the need for you to adjust receiver settings to match the conditions. Regardless of whether you are working under canopy, in wide open spaces, or somewhere in between, Smart Settings automatically generates the best solution possible.

Using traditional mask techniques in open conditions, weak signals can accidentally degrade the accuracy of the position if masks are too relaxed, whereas in obstructed conditions, more satellites are needed to help maintain optimum accuracy if masks are set too strictly. Using Smart Settings, the receiver uses all available GNSS information to determine which combination of satellites to use to deliver the best position. Once you set the receiver to use Smart Settings, the receiver does the rest.

By default, the receiver is configured to use Smart Settings as show in the top example to the right. In this mode, the receiver will track all visible satellites, and determine which to use in the position solution to automatically generate the most accurate position possible.

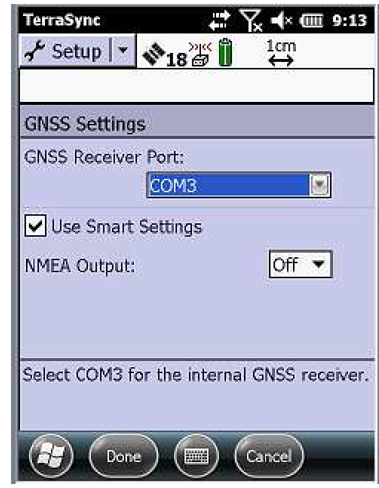
To open the GNSS Settings form, do one of the following:

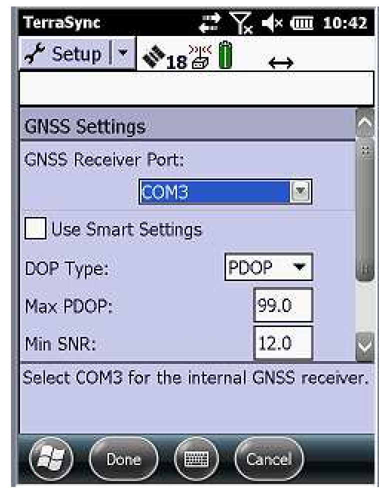
- Tap **GNSS Settings** in the Setup section.
- Tap in the Skyplot, Satellite Info, or Plan section.

To enable Smart Settings, select the Use Smart Settings check box.

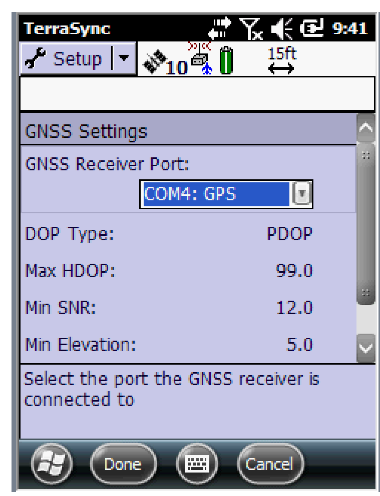
To define custom GNSS settings, clear the *Use Smart Settings* check box as shown in the middle example to the right. You can now enter values in the editable fields to specify the required GNSS quality settings.

Other receivers, such as the Juno 3 Series do not permit any alteration of the GNSS settings on the receiver itself, as shown in the lower example to the right, in order to simplify and maximize high yield GNSS collection capabilities.





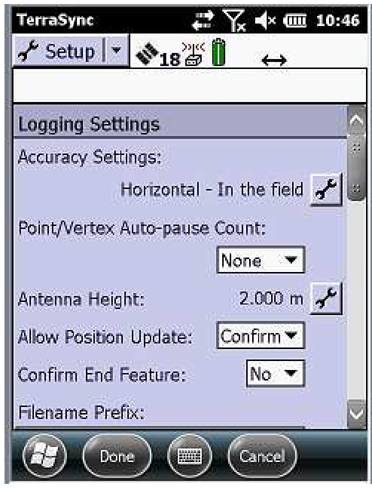
Examples above: GeoExplorer 6000 Series



Example above: Juno 3 Series

Configuring the logging settings

To open the *Logging Settings* form, tap **Logging Settings** in the *Setup* screen. Use this form to configure settings that control what data is stored, and how.



Use the *Logging Settings* form to configure how additional data is collected:

- *Accuracy Settings*. This read-only field displays the parameters that the TerraSync software will use to determine the estimated accuracy of the current GNSS position. If you are using accuracy-based logging, the required accuracy is also displayed in this field.

  To specify the accuracy settings, tap the Setup button beside this field. The Accuracy Settings form appears.

- *Point/Vertex Auto-pause Count*. This field specifies the number of positions that the software will log for a point feature or an averaged vertex in a line or area feature, before automatically pausing logging. When the number of positions specified in this field is reached, the *Minimum Positions Stored* event sounds and logging is paused. You can resume the feature to continue logging positions, or close the feature.

- *Antenna Height*. The height of the GNSS antenna. This field is read-only. To specify antenna details, such as the height and correct type of external antenna if using one, tap the **Setup** button beside this field. The *Antenna Settings* form appears.

Note – Configuring an incorrect antenna type may degrade the accuracy of your postprocessed GNSS data (particularly H-Star or Carrier data). Ensure that you select the correct antenna type.

- *Allow Position Update*. The conditions where updating of feature position information is allowed. The options are:
  - *Yes* - Position information for existing features can always be updated.
  - *No* - Positions cannot be updated.

  - *Confirm* - Confirmation is required before you are allowed to update the position.

- *Confirm End Feature* - The options are:
  - *Yes* - Select this option to display a confirmation message when you close an updated feature. The message asks you to confirm that you want to end the current feature and save any changes to the attributes or position information of the feature.
  - *No* - Select this option to disable the confirmation message.
- *File Prefix* - The prefix to be included at the beginning of the default name of each new data file. The prefix may be any alphanumeric string between 1 and 30 characters long.

Note – The prefix that you define in this field is for rover files only. The default filename prefix for base files is Base. You cannot change this default prefix. However, when you create a new base file, you can edit the default filename.

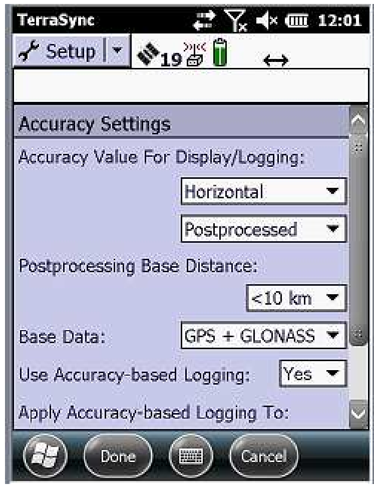
- *Waypoint Filename Prefix* - The prefix to be included at the beginning of the default name of each new waypoint file. The prefix may be any alphanumeric string between 1 and 30 characters long.
- *Style* - The method of measurement for between feature positions. The options are:
  - *Time* - A position is logged after a specified time has elapsed since the last position logged.
  - *Distance* - A position is logged once you have traveled a specified distance from the last position logged.
- *Interval* - The logging interval for the between feature positions:
  - If you selected *Distance* from the *Style* list, enter the distance between logging positions, or select an existing value from the list.
  - If you selected *Time* from the *Style* list, enter the number of seconds between logging positions, or select an existing value from the list.
  - Select *Off* to turn off between feature logging.
- *Style* - The method of measurement for the specified feature type. The options are as for Style above. This field only appears if a data file is open. It is repeated for each feature type in the file.

Note – If the feature is a point feature, this field is set to Time and cannot be changed.

- *Interval* - The logging interval for the specified feature type. The options are as for Interval above. This field only appears if a data file is open. It is repeated for each feature type in the file.

Configuring Accuracy settings

1. To open the *Accuracy Settings* dialog, tap the **Setup** button beside the *Accuracy* field in the *Logging Settings* dialog:



2. In the *Accuracy Value for Display / Logging* field, select the parameters that the TerraSync software will use to determine the estimated accuracy of the current GNSS position. The value is displayed by the Estimated Accuracy icon on the status bar. Select two out of four available parameters. The options are:

   – Horizontal - Use the horizontal estimated accuracy of the current GNSS position.

   – Vertical - Use the vertical estimated accuracy of the current GNSS position.

   – In the field - Use the current estimated accuracy of the current GNSS position. The value calculated depends on several factors, including satellite geometry and the type of GNSS receiver that is connected.

   – Postprocessed - Use the predicted estimated accuracy of the current GNSS position, which is the estimated accuracy that is likely to be achieved after the field data has been postprocessed.

3. In the *Postprocessing Base Distance* field, select the estimated distance to the base station that will be used during postprocessing.

4. In the *Use Accuracy-based Logging* field, select whether the calculated estimated accuracy determines whether the GNSS position is logged. The options are:

   – No - GNSS positions are always logged if they can be calculated.

   – Yes - GNSS positions are only logged if they can be calculated and they meet the estimated accuracy specified in the *Required Accuracy* field. The *Required Accuracy* field appears at the bottom of this form once you select Yes in this field.

The following two fields only appears if you select Yes in the *Use Accuracy-based Logging* field above.

5. Select the feature types that the accuracy requirements will apply to in the *Apply Accuracy-based Logging To* field. Features of the selected type will only contain GNSS positions that meet the estimated accuracy specified in the *Required Accuracy* field above. The options are all features, point features and averaged vertices, or line and area features.

6. In the *Required Accuracy* field, select or enter the estimated accuracy that is required before the current GNSS position is logged. If the current GNSS position has a poorer estimated accuracy than the value specified in this field, the GNSS position is not logged.

Note – The estimated accuracy of a GNSS position depends on several factors, including the satellite geometry, the type of GNSS receiver that is connected, and whether you are using real-time differential corrections.

Configuring real-time settings

To open the *Real-Time Settings* form, in the Setup screen tap *Real-time Settings*. Use this form to configure settings that control the sources of real-time differential GPS that you use, if any, and how your system communicates with each source:

The TerraSync software always uses the highest priority real-time source available, according to your list of preferences. If the source it is currently using becomes unavailable, the TerraSync software switches to the next choice. Whenever the TerraSync software acquires a higher priority real-time source, it switches back to this source. For example, the TerraSync software will not use your second choice if your first choice is available.

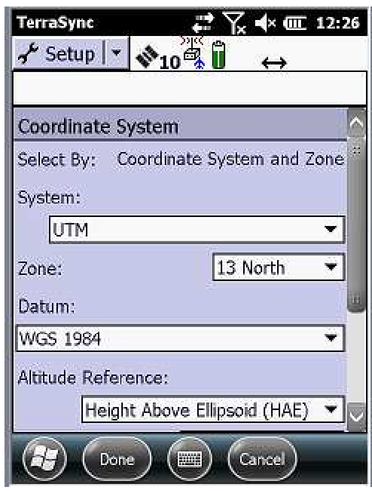
Real-time Datum selection. The real-time correction source must be in the same coordinate system, datum, and reference frame as the GIS database you are using. For example, if a base station has coordinates in terms of ITRF2000 but your GIS is in terms of NAD83, this can introduce up to a meter of error.

Tip – To record uncorrected GNSS positions only, without using any real-time corrections, select Use Uncorrected GNSS from the Choice 1 field. You can correct these positions back in the office using the GPS Pathfinder Office software.

For more information on real-time settings, refer to the *TerraSync Software Getting Started Guide*.

Configuring coordinate settings

To open the Coordinate System form, in the Setup screen tap Coordinate System. Use this form to specify the coordinate system that you want the TerraSync software to use to display foreground and background files:



A coordinate system is a three-dimensional frame of reference that can be used to describe the location of objects. Many different coordinate systems can be chosen. Each is appropriate depending upon the map projection and region in which you are collecting data.

Setting your coordinate system in the TerraSync software for postprocessed data collection is a display setting only. All GNSS data is collected in the World Geodetic Datum of 1984, the latitude/longitude coordinate system, and the Height Above Ellipsoid altitude reference. Configuring the TerraSync software to a different coordinate system only affects the display of your coordinates. It does not convert the data. However, this setting is critical when navigating. If you are navigating or looking for a location on a paper map, the coordinates will not match unless the TerraSync software is configured to the same coordinate system as the paper map.

Datums are fundamental to GNSS. To compare GNSS data with locations from an existing map, both must be referenced to the same datum. Different datums provide different coordinates for any location. GIS users choose to convert their data to a datum matching their existing GIS database during the export process. Each datum has a unique point of origin, which is why one point displayed in two different datums yields two different sets of coordinates.

Examples of datums:

- WGS-84 – worldwide
- NAD-83 – region-wide
- EUROPEAN 1950

Examples of coordinate systems:

- Latitude, Longitude, Altitude – 3D-based
- UTM – Grid Squares – 2D-based
- State Plane - each US state has created its own grid system

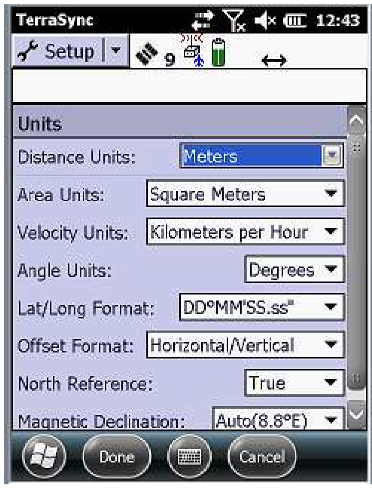
Height values can be expressed as a height above the ellipsoid (HAE) or as a height above mean sea level (MSL). GNSS works in HAE, but many Geographical Information Systems are set up using MSL. You can convert between the two for display in the TerraSync software, and for map display and map export in the GPS Pathfinder Office software:

- Ellipsoid – a mathematical model of the Earth's size and shape. HAE equals the distance from the ellipsoid to the geoid (MSL) surface.
- Geoid – considers the gravitational pull to model the Earth's "true" size and shape. The Earth is not uniformly dense. Gravity is a function of mass; therefore, gravitational pull varies from place to place.

Note – The geoid height equals the separation between the geoid and the ellipsoid. This distance approximates mean sea level (MSL).

Configuring unit settings

To open the Units form, in the Setup screen tap Units. Use this form to specify the units used for measurements and display.



The following fields are available:

- Distance Units
- Area Units
- Velocity Units
- Angle Units
- Lat/Long Format
- Offset Format
- North Reference
- Magnetic Declination

Change the units as appropriate. Changing unit settings does not affect data quality. However, unit settings are critical when specifying an accurate antenna height, or when navigating.

Exercise 3.1: Assemble the equipment

Before assembling the equipment, confirm the following:

1. Data dictionary is transferred to the TerraSync software.
2. Satellite availability is optimal.
3. The TerraSync software settings have been configured and tested.

Before going out into the field with the TerraSync software, you should check that you have all the necessary GNSS hardware, batteries, and cables. Trimble recommends that before you leave the office you:

- Set up your entire GIS/GNSS data collection system and test it to make sure that everything is connected correctly
- Make sure that the data collector's battery is charged

CAUTION *– After testing the system, remember to turn off the data collector and any other equipment (such as radios) before proceeding to the start point of your field work. Leaving equipment powered up wastes battery life, especially if it will be some time before you need to use the equipment.*

CHAPTER

4

Field Session

In this chapter:

After the Trimble TerraSync software is configured and the hardware is assembled, you are ready for the field. Upon your arrival at the field site, first check the status of your receiver to see which satellites it is tracking. This section will show you how to view this information in the field. Then it will teach basic and advanced data collection techniques.

GNSS status

Upon arriving at the field site, start the TerraSync software to allow it to begin satellite tracking. Before data collection, it is useful to check the status of your receiver. Make sure that the receiver is tracking at least four satellites for data collection. Check that all precision standards are met.

Starting the TerraSync software

When you get outside, switch on your data collector and start the TerraSync software: The GNSS receiver should activate automatically.

To start the TerraSync software, do one of the following:

- Tap the *GNSS Application Launcher*
- Tap **GNSS** (bottom of screen)

While the software is loading, a Trimble identification screen appears. The software always opens at the *Skyplot* subsection of the *Status* section.

Getting a clear view of the sky

Move to a location where you have a clear view of the sky.

Signals can be received from any direction. Satellite signals can be blocked by people, buildings, heavy tree cover, large vehicles, or powerful transmitters. Anything that blocks light also blocks signals. GNSS signals can go through leaves, plastic, and glass, but these all weaken the signal.

Checking the GNSS status

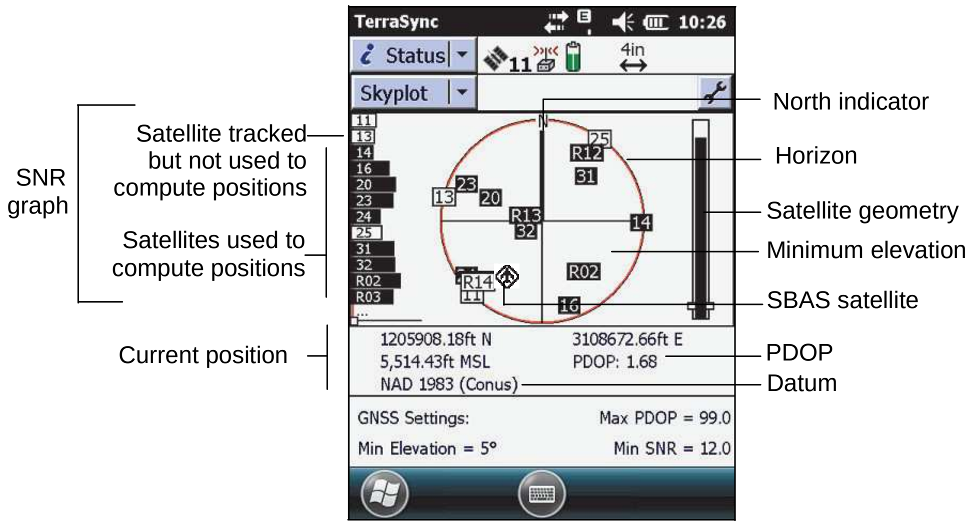
When you start the TerraSync software, it automatically connects to the GNSS receiver, and begins to track visible satellites and to calculate its current position. Use the satellite icon on the status bar to check whether the receiver is computing GNSS positions. It provides information about the geometry of the satellites that are being used to compute GNSS positions.

Use the *Status* section to view the satellites currently tracked and those that are being used to calculate the current position.

Note – For a further explanation of satellite geometry and how this can affect GNSS data collection, refer to the Mapping Systems General Reference.

To view the GNSS status:

1. The *Skyplot* screen appears when you start up the TerraSync software. If this screen is not visible, tap the Section list button and select *Status*, then tap the Subsection list button and select *Skyplot*. The following figure shows the elements of the *Skyplot* screen:



2. Use Skyplot to check the satellites that are being tracked and to see your current position.

Filled black boxes represent satellites that the receiver is using to compute its current GNSS position. White boxes represent satellites that the receiver is getting signals from but is not using because the signals are too weak, or because real-time corrections are required and none are being received for that particular satellite. In the example above, eight GNSS satellites and one SBAS satellite are being tracked, and seven of these satellites are being used to compute GNSS positions.

If a SBAS satellite is being tracked, its location is indicated by this icon: 

Satellites that have an “R” prefix are GLONASS satellites. These satellites appear only if the receiver you are using can track GLONASS satellites (for example, the GeoExplorer 6000 receiver), and the *Use GLONASS* option is enabled in the *GNSS Settings* form.

Note – Numbers without a box indicate that the almanac tells TerraSync software that there are satellites available, but that the TerraSync software is not receiving signals from them.

Your current GNSS position is displayed at the bottom of the screen.

Tip – For detailed information on satellite positions and signal strengths, use the *Satellite Info* subsection of the *Status* section.

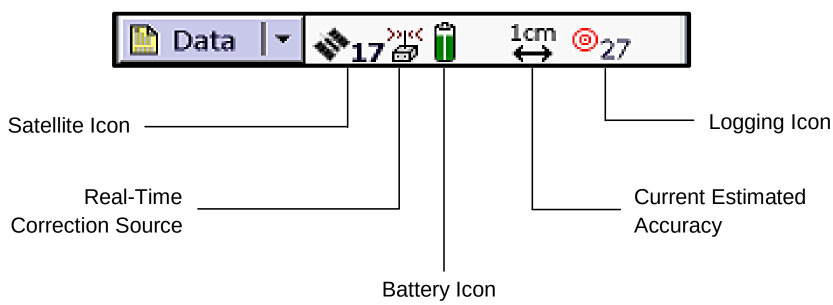
You need a minimum of four satellites, with good geometry, to compute a 3D GNSS position. When you turn on the GNSS receiver, it automatically starts to track visible satellites and to calculate its current position. Use the satellite icon in the status bar to check whether the receiver is computing satellite positions. If the satellite icon and the number below it are solid (not flashing), the receiver is computing GNSS positions.

- Required Accuracy. You can choose to use the *Accuracy Settings* dialog in the TerraSync software (select *Setup / Logging Settings/Accuracy Settings*) to prevent the logging of GNSS positions that do not meet your accuracy requirements.

If the estimated accuracy of any GNSS position is greater than the configured value, the software will not log the position. If the satellite geometry is poor or there are too few satellites available to compute GNSS positions, adjust the GNSS slider or wait until conditions are more favorable.

Status bar

The status bar appears in the top row of the TerraSync screen. It is always visible, but the icons displayed depend on the current status of the system. The status bar provides basic information about the status of the TerraSync software. The following figure shows the icons in the status bar:



The status bar is always visible, but the icons displayed depend on the current status of the system. Table 4.1 shows the icons that can appear.

Table 4.1 Status bar: Icons

Icon	Name	Description
8	Satellite icon	Shows whether the geometry of the satellites is good or bad, as configured in the GNSS settings area of the software. The satellite icon flashes when the geometry of the satellites (their PDOP or HDOP) is poor. The number next to the icon indicates how many satellites are being used to compute GNSS positions. The number flashes when not enough satellites are available. You need at least four satellites to compute GNSS positions.
	Connect icon	When the TerraSync software is trying to connect to a receiver, the connect icon appears instead of the satellite icon. If the TerraSync software cannot connect to the GNSS receiver, the connect icon flashes.
	Antenna icon	If the TerraSync software connects to the receiver but cannot find a GNSS antenna, the antenna icon appears instead of the satellite icon. This icon flashes to warn you that there is a problem. If no icon appears in this position, no GNSS receiver is connected.
	Real-time external icon	Shows that the TerraSync software is receiving real-time corrections from an external source, such as a radio.
	Integrated RTK radio icon	Shows that the TerraSync Centimeter edition software is receiving RTK corrections through the GNSS receiver's integrated radio.
	External RTK icon	Shows that the TerraSync Centimeter edition software is receiving RTK corrections through an external radio.
	Real-time external beacon icon	Shows that the TerraSync software is receiving real-time corrections from an external beacon receiver such as a GeoBeacon receiver.
	Real-time beacon icon	Shows that the TerraSync software is receiving real-time corrections from a beacon.
	Real-time satellite icon	Shows that the TerraSync software is receiving real-time corrections from a satellite differential service.
	Real-time SBAS icon	Shows that the TerraSync software is receiving real-time corrections from an SBAS satellite.
***Note** – If the real-time signal is lost, the current real-time icon flashes. If the icon is flashing and the number of satellites being used is greater than 0, the TerraSync software is using autonomous (uncorrected) GNSS to calculate its position. If no icon is visible, the TerraSync software has not been configured to use a real-time correction source.*		
	Battery icon	The left half of this icon indicates the charge level of the GNSS receiver battery, if one is connected. If the connected receiver does not provide battery status information to TerraSync, the left half of the battery icon is empty. The right half indicates the charge level of the field computer battery. When the battery of the GNSS receiver or field computer is fully charged, the corresponding half of the battery icon appears green. The level of green drops as the corresponding battery charge level drops. When the power level is low, the corresponding half of the battery is yellow. When the power level is critical, the corresponding half of the icon is red and the icon flashes. If the GNSS receiver is powered by the field computer or is integrated with the field computer (for example a GeoExplorer series handheld), both halves of the battery icon show the same level and indicate the battery status of the field computer.
	Filter icon	Indicates that a filter has been applied to the open data file. When this icon is not displayed, no filter has been set up.

Table 4.1 Status bar: Icons (Continued)

Icon	Name	Description
71cm ↔	Estimated Accuracy icon	Shows the estimated accuracy of the current GNSS position. The type of estimated accuracy value shown depends on the settings in the *Accuracy Settings* form. The estimated accuracy value may be the estimated accuracy in the field, or it may be the predicted accuracy after postprocessing. To show the predicted postprocessed accuracy, there must be a data file open and the software must be logging GNSS positions. By default, this icon shows the estimated accuracy in the field. The direction of the arrow indicates whether the estimated accuracy shown is for the horizontal or the vertical accuracy of the current GNSS position. ***Note –*** *The value shown depends on several factors, including satellite geometry and the type of GNSS receiver that is connected.* The estimated accuracy value flashes if the required accuracy set in the *Accuracy Settings* form is not met. An arrow with no estimated accuracy value indicates that the software is unable to calculate the estimated accuracy. Tap the icon for more information.
8	Logging icon	Shows that the TerraSync software is logging a feature with code accuracy. The number at the bottom of the icon indicates the number of positions logged. The number above the icon indicates the predicted postprocessed accuracy in the configured distance unit. The width of the pen indicates code or carrier logging.
1	Logging static icon	Shows that the TerraSync Centimeter edition software is logging a point feature or vertex in ***static mode***, which is available only when the TerraSync software is receiving RTK corrections. In static mode, only the GNSS position with the best precision estimate is logged. All other positions are discarded. The number to the right of the icon indicates whether a position has been logged. If the required precision has not been achieved, the number is 0 and no position is logged. If a position with the required precision has been logged, the number is 1. If a position with a better precision is received, it replaces the previously logged position.
4	Logging vertex icon	Shows that the TerraSync software is logging GNSS position information for an averaged vertex (including point features). The number to the right of the icon indicates the number of positions logged for this vertex or point feature.
	Base logging icon	Shows that the TerraSync software is logging positions to a base data file, or that is generating correction messages.
3	Digitizing icon	Shows that the TerraSync software is in Digitize mode and GNSS logging is paused, so tapping the map will result in a digitized position being recorded for the open feature. The number to the right of the icon indicates the number of digitized positions logged for this feature.
	Pause icon	When logging is paused, the pause icon flashes.
	Memory icon	When storage space is low, the memory icon appears. If memory gets low while you are logging positions, the memory icon flashes alternately with the logging icon. If you are not logging, the memory icon appears alone and flashes. ***Note –*** *When no icon appears in this position, memory space is sufficient, and the TerraSync software is not logging position data.*

Tooltips

A tooltip is a yellow message that contains information about an item on the screen, or about the current system status.

Tooltips appear:

- When you tap on an icon in the status bar
- As transient messages in the status bar
- When you tap on an item on the map
- When you measure distances and areas on the map

To close a tooltip, tap it, or tap anywhere else on the screen.

Table 4.2 shows the status bar icons and the tooltips that describe them.

Table 4.2 Status bar: Tooltips

Icon	Behavior	Tooltip
	Solid	GNSS is calculating positions
	Flashing	Poor satellite geometry (PDOP) ***or*** Poor satellite geometry (HDOP).
	***Note** – The message that appears depends on whether a maximum PDOP or HDOP value is configured.*	
	Flashing satellite count	Too few satellites.
	Solid	Estimated accuracy in the field and estimated accuracy after postprocessing.
	Flashing	The estimated accuracy value flashes if the required accuracy set in the *Accuracy Settings* form is not met.
	Animated	Attempting to connect to GNSS receiver.
	Flashing	No GNSS detected. Check cables and batteries.
	Flashing	Antenna is not connected to GNSS receiver.
	Solid	Applying real-time corrections from external source.
	Flashing	Waiting for real-time corrections.
	Solid	Applying real-time corrections from VRS™.
	Flashing	Waiting for real-time corrections.
	Solid	Applying RTK corrections from an external RTK source.
	Flashing	Waiting for RTK corrections.
	Solid	Applying RTK corrections from a VRS.
	Flashing	Waiting for RTK corrections.
	Solid	Applying real-time corrections from the external beacon receiver.
	Flashing	Waiting for real-time corrections.
	Solid	Applying real-time corrections from the receiver's integrated beacon differential receiver.
	Flashing	Waiting for real-time corrections.

Table 4.2 Status bar: Tooltips (Continued)

Icon	Behavior	Tooltip
	Solid	Applying real-time corrections from the receiver's integrated OmniSTAR receiver.
	Flashing	Waiting for real-time corrections.
	Solid	Applying real-time corrections from the receiver's integrated SBAS differential receiver.
	Flashing	Waiting for real-time corrections.
	Solid	Applying RTK corrections from the receiver's integrated RTK radio.
	Flashing	Waiting for RTK corrections.
	Solid	GNSS receiver battery is good (75%). Field computer battery is good (75%).
	Solid	GNSS receiver battery is low (25%). Field computer battery is low (25%).
	Flashing	GNSS receiver battery is critical (10%). Field computer battery is critical (10%).
***Note –** The battery icons and tooltips in this table show both batteries at the same level of charge. However, each half of the battery icon can appear in green, yellow, or red, independently of the color and level of the other half.*		
	Solid	Filter is applied.
	Animated pen, and number increments	Positions are being logged.
	Flashing pen	GNSS is not available.
	Animated circle decreases in size	Vertex/point feature capture in progress.
	Solid	Ready to digitize.
	Flashing	Position logging is paused.
	Flashing	Memory is full.

Tip – A tooltip also appears when you tap a graphical item in the *Skyplot* screen.

Data collection guidelines

Observing a few simple practices in the field can save you time and effort in the long run. To get good results first time, Trimble recommends that you do the following when using the TerraSync software in the field:

- If you are using a handheld GNSS receiver, make sure it is clear of your body. As with any GNSS receiver, the antenna requires a clear view of the sky.
- Whenever possible, collect good GNSS measurements for 30-60 seconds before and after collecting a feature. For example, stay in an open environment on the way to the next feature, and do not drop the handheld to your side. These measurements will be used by the processing engine in the GPS Pathfinder Office software to improve the positions captured within the feature.
- Use the Log Now / Log Later function to pause and resume logging when appropriate. It is useful to control GNSS logging to prevent unwanted positions being logged to the feature. For example, you can pause to go around an obstacle when logging a line, then resume once you are back on track. Pausing when stationary - at traffic lights for example - will prevent a small drift from being recorded as part of the feature.
- Minimize constellation changes. Each constellation of satellites gives a slightly different position solution. Provided the PDOP values fall within the default values, then no solution is significantly more accurate than any other. However, there is often a relative shift between one constellation and another. Therefore, within a feature, try to avoid objects that block the view of the sky intermittently and cause constellation changes.

Basic data collection

The primary objective of this exercise is to become familiar with basic data collection techniques. You will revisit the field and perform these techniques a second time for practice and perfection. During this exercise, just concentrate on logging point, line, and area features, using a data dictionary.

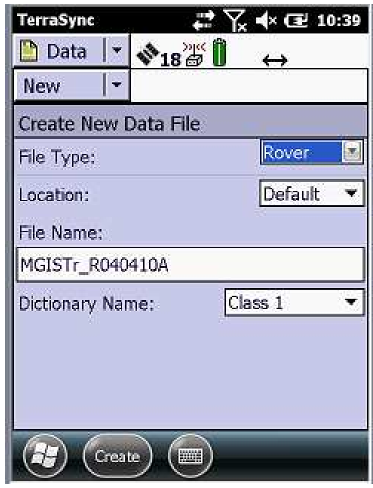
This exercise shows you how to collect point, line, and area features.

Creating a new data file

Before starting the data collection session, you need to create a new data file to store the new features and attributes you collect. Use the *Data* section to do this.

To create a new file:

1. Tap the Section list button and then select *Data*.
2. Tap the Subsection list button, select *New*. The *Create New Data File* screen appears:

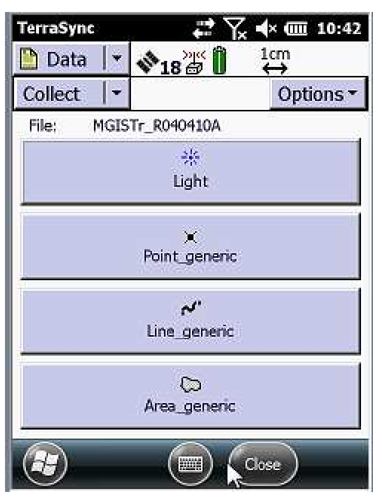


3. The TerraSync software automatically enters a default name in the *File Name* field. Replace the default name with an appropriate name.
4. In the *Dictionary Name* field, select the appropriate data dictionary.

Note: The data dictionary may vary by trainer and not follow the examples shown

5. Tap **Create**.
6. The *Confirm Antenna Height* form appears. If necessary, enter the correct antenna height, antenna type and measurement point and then tap **OK**.

   The *Collect Features* screen appears. This screen shows a list of all the features in the data dictionary:



You have now created a new data file and can start collecting features.

Log Now, Log Later and QuickPoint

The TerraSync software provides two closely-related options for logging GNSS data. These options differ in their timing of GNSS data collection relative to the start of a feature. The options are:

- Log Now – start a feature and simultaneously start collecting GNSS positions.

  If you select the *Log Now* option, the TerraSync software begins logging positions for a new feature as soon as you select the feature type and tap **Create**. You can enter attribute values while positions are being recorded.

  Log Now is the default logging option. When Log Now is selected, a bullet (•) appears beside it in the option list.

  To select Log Now, tap **Options** in the *Collect Features* screen and then select *Log Now* from the option list.

Note – Log Now applies only to new features. When you open an existing feature for update, logging is paused and the pause icon flashes in the Status bar. New positions are logged for an existing feature only after you tap Log in the attribute entry form and select the Update position option

- Log Later – start a feature, and start collecting GNSS positions later.

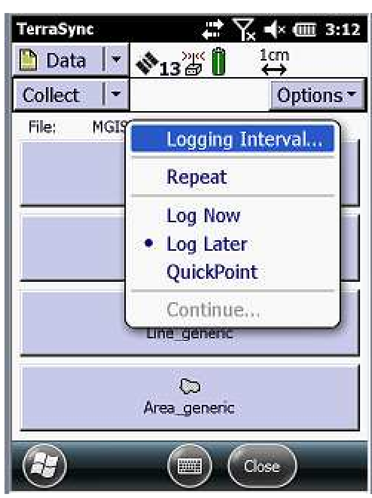
  If you select the Log Later option, the TerraSync software begins logging positions for a new feature only after you tap Log in the attribute entry form. Until you begin logging, the pause icon flashes in the Status bar.

  When Log Later is selected, a bullet (•) appears beside it in the option list.

  To select Log Later, tap **Options** in the *Collect Features* screen and then select *Log Later* from the drop-down list.

TerraSync also allows you to use the QuickPoint button and the QuickPoint Feature Capture button to capture QuickPoints from the Map screen. The TerraSync software must be in QuickPoint data collection mode. When you tap the QuickPoint button, a drop-down list appears, showing each point feature type that is defined in the data dictionary of the open file. Select a point feature type from this list to enable you to quickly log features of this type. To log each feature, tap the QuickPoint Feature Capture button.

Each of the feature collection options detailed above may be accessed through the Options found in the Collect Features screen:



Collecting a point feature with Log Now

To record a point feature, remain stationary while the TerraSync software logs GNSS positions. These GNSS positions are averaged to compute the final feature position of the point feature.

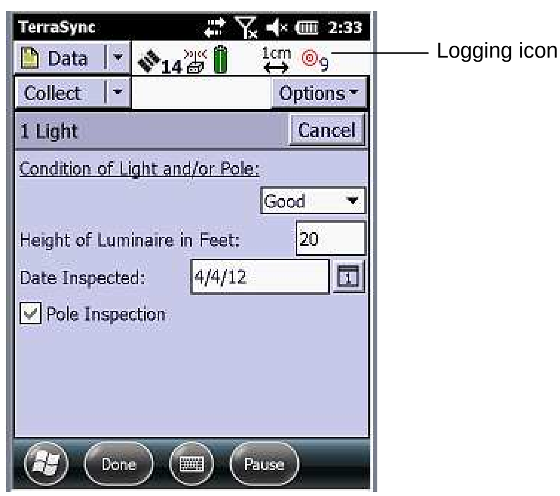
When the TerraSync software is logging GNSS positions, the logging icon appears in the status bar. The number beside the icon indicates how many positions have been logged for the selected feature.

To record a point feature:

1. If the *Collect Features* screen is not already open:
   a. Tap the Section list button and then select *Data.*
   b. Tap the Subsection list button and then select *Collect Features*.
2. To make sure that the default logging option is selected, tap **Options** and then select *Log Now*.
3. Move close to the feature.
4. From the *Choose Feature* list, select the appropriate point feature. The attribute entry form for the Light feature type appears.

Note – Try to keep the antenna still during these next steps.

As the software logs GNSS positions, the counter beside the logging icon increments, as shown below:



5. Enter all the required attribute information.
6. Once you finish entering the attributes, tap **OK** to save the feature and return to the *Collect Features* screen.
7. Later you can navigate back to a sign that needs to be replaced, and update its attributes. You need to collect this light feature now. Repeat Step 1 through Step 5 to log another light feature. When you reach Step 4, change the *Condition* field to *Needs replacing*.

Collecting a line feature with Log Later

The next feature you need to record is a line feature – for example, an irrigation main trench. To record a line feature, you must travel along the line. As you travel, the TerraSync software records a GNSS position at the configured logging interval, which defaults to the value that was set when the feature was created in the data dictionary. These positions are joined together to form a line.

By default the TerraSync software begins logging GNSS positions as soon as you open a new feature. For this feature you will use the Log Later option to delay logging of positions until you have entered the attributes for the feature and you have reached the start of the feature.

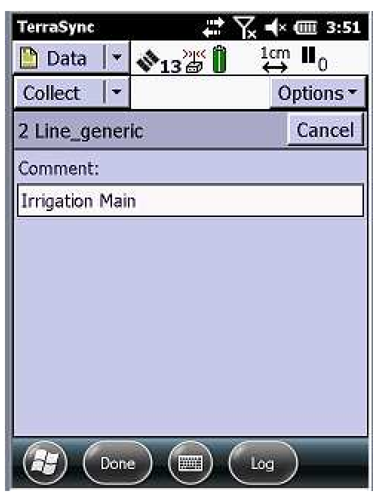
To record a line feature with the Log Later option:

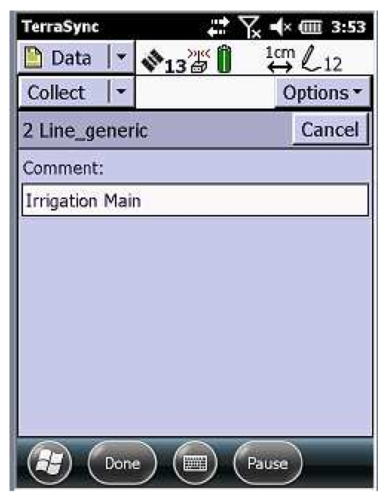
1. If the *Collect Features* screen is not already open:
    a. Tap the Section list button and then select *Data.*
    b. Tap the Subsection list button and then select *Collect Features*.
2. Tap **Options** and then select *Log Later*.
3. From the *Choose Feature* list, select the appropriate line feature.

   The attribute entry form appears.

Note – When you use the Log Later option, the pause icon ▮▮ flashes in the status bar to let you know that the TerraSync software is not logging GNSS positions.

4. Fill out the required attributes.
5. Move to the start of the feature and then tap **Log** to begin logging GNSS positions for the feature.



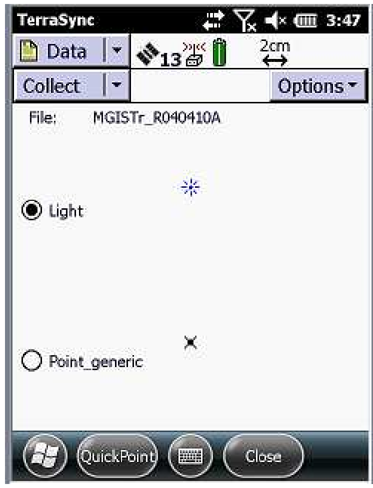


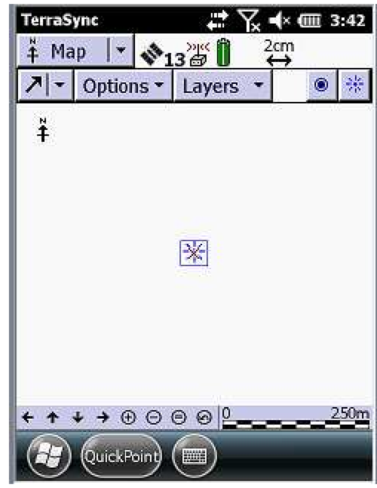
   The pause icon disappears from the status bar and the number on the logging icon increments as each position is recorded.

Continue down the irrigation line trench. When you reach the end of the line you are logging, tap **OK** to save the feature and return to the *Collect Features* screen.

Collecting a point with QuickPoint

If the TerraSync software is in QuickPoint data collection mode, the Collect Features screen shows only point features. To log a QuickPoint, select the required point feature, and then tap QuickPoint.





Tip – The Map screen also has a QuickPoint button

Collecting an area feature

Similar to the examples above, to record an area feature, you must travel around the perimeter of the area. As you travel, the TerraSync software logs GNSS positions at the logging interval set in the data dictionary. The first and last GNSS positions are joined together to form the perimeter of the area, so there is no need to return to the exact start point.

To collect an area feature:

1. If the *Collect Features* screen is not already open:
   a. Tap the Section list button and then select *Data.*
   b. Tap the Subsection list button and then select *Collect Features*.
2. Tap **Options** and then select *Log Now*.
3. Move to where you want to record the first perimeter position.
4. From the *Choose Feature* list, select an appropriate area feature.

   The attribute entry form opens, and the TerraSync software starts to log positions.

   You can pause logging at any time. For example, if you are driving around the perimeter of the park and you want to stop to examine a sign some distance from the park, you can stop logging positions for the park boundary. You can also pause logging if you want some time to enter attribute values.
5. To pause logging, tap **Pause**. The TerraSync software stops logging positions and a pause icon flashes in the status bar. To continue collecting the feature, tap **Resume** to resume logging. The pause icon disappears.

6. To view the map while collecting features, tap the Section list button and then select *Map*. The features that you have collected are displayed on the map, along with the feature that you are currently collecting.

7. If you cannot see your current position or a selected feature on the map, tap **Options** and then select *Auto Pan to GNSS Position* or *Auto Pan to Selection*:

To view the map at different scales, tap the Zoom In or Zoom Out button on the Command bar.

Alternately, tap the Map Tools list button, select Zoom In or Zoom Out and then select the point on the map that you want to zoom in to or out from.

8. Tap the Section list button and then select *Data* to go back to the Data section. The attribute entry form is still active and the TerraSync software is still logging positions.

9. Enter the attributes of the feature.

10. When you have travelled around the perimeter of the area, tap **OK** to save the feature and return to the *Collect Features* screen.

11. Tap **Close** in the *Collect Features* screen.

Ending the data collection session

When the data collection or update session is completed, exit the TerraSync software. You will be prompted to confirm that you wish to close the (data) file and exit TerraSync.

Logging H-Star data

By connecting the TerraSync software to a receiver with H-Star technology, you can collect high-accuracy GNSS data. You can achieve horizontal accuracies (RMS) of up to 10cm (4 inches) + 1ppm.

A receiver capable of real-time H-Star technology uses base station data from a VRS or a nearby single base station (within 80 km) to generate H-Star positions in the field.

- For real-time H-Star operation, a wireless data link is required between the roving GNSS receiver and either a nearby base station or a VRS network.

- For postprocessed data, three or more good quality dual-frequency (L1/L2) base stations within 200 km are required. Alternatively, one good quality dual-frequency base station within 80 km is required.

The coordinate of each base station must be in the same coordinate system, datum, and reference frame, as one another, and as the GIS database you are using. For example, if a base station has coordinates in terms of ITRF2000 but your GIS is in terms of NAD83, this can introduce up to a meter of error. Also, if one base station has coordinates in terms of ITRF2000 but another is in terms of NAD83, this can also introduce significant error.

Note – Accuracy estimates for GNSS positions logged while moving may be larger than 10 cm (dual frequency) or 30 cm (single frequency).

Data collection best practices

Trimble recommends the following to help ensure successful high accuracy data collection:

- Collect good quality GNSS measurements between features. For example:

    a. Collect good measurements in the open, while walking towards the ‘tough’ feature under a tree.

    b. Collect the feature.

    c. Collect more good measurements while walking away towards the open.

    Collecting good measurements requires orienting the GNSS antenna to have a good view of the sky; do not drop it to your side, or point along or down, as you walk.

    There are several reasons for this practice. The good measurements can help to smooth out poor quality measurements at the feature. In postprocessing, this effect applies both forwards and backwards in time, so good measurements after the feature are important. Ideally you should aim for 30 to 60 seconds of good measurements between more difficult locations.

- Log a point feature for 5 seconds in good conditions. This is enough data when the accuracy estimate is sufficient, as indicated by the CEA (Current Estimated Accuracy) or PPA (Predicted Postprocessed Accuracy) values. This assumes you have collected good data before the feature. It is also an efficient workflow - there is no point taking longer to log a feature when the accuracy does not improve.
- In difficult conditions, or if the accuracy is less than desirable, log for 15 or 30 seconds, or even longer if necessary, until the estimated accuracy is good enough. Or you could cancel the existing feature, and try walking into the open and carefully back to recollect the GNSS measurements for the feature.
- Position the antenna appropriately over the target:
    - Set the correct antenna height if there is an offset.
    - Hold the antenna directly over the target feature.
    - Use a range pole for accurate vertical measurements.
- Avoid blocking satellites (five or more satellites are recommended):
    - Avoid harsh GNSS environments when collecting H-Star data.
    - Use a range pole and an external antenna to get the antenna above your body.

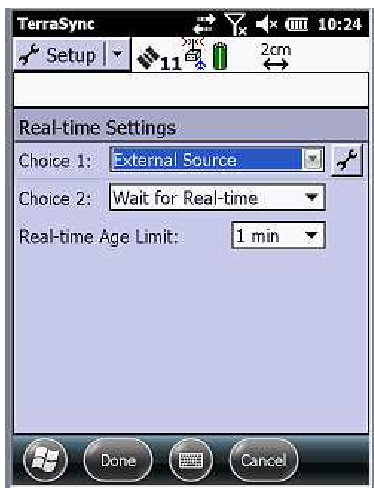
Status information

When collecting data, the TerraSync software provides additional status information - an estimated in-the-field or postprocessed accuracy value for the feature appears on the status bar.

Note – The estimated accuracy value is only an indicator of accuracy that can be achieved with H-Star postprocessing. The accuracy indicated is not guaranteed.

Configuring the TerraSync software to collect H-Star data for real-time H-Star technology

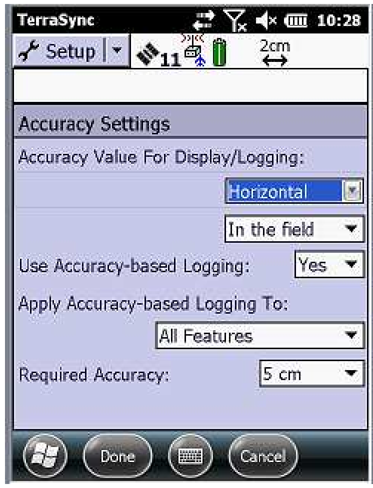
1. Tap the Section list button and then select *Setup*.
2. Tap **Real-time Settings**. The *Real-time Settings* form appears.
3. From the *Choice 1* field, select *External Source*.
4. Tap the Setup button  beside the *Choice 1* field to configure the correction source and then select the appropriate settings depending on the correction source and the communication method used. When you have finished configuring the external source, tap **OK**.
5. From the *Choice 2* field, select *Wait for Real-time*.



6. Tap **OK** to confirm the real-time settings and return to the main *Setup* screen.
7. Tap **Logging Settings**. The *Logging Settings* form appears.

8. To use accuracy-based logging:

   a. Tap the Setup button in the *Accuracy Settings* field. The *Accuracy Settings* form appears:



   b. From the *Accuracy Value for Display/Logging* fields, select *In the Field* and whether the TerraSync software should calculate the estimated horizontal or vertical accuracy.

   c. From the *Use Accuracy-based Logging* field, select *Yes*.

   d. From the *Apply Accuracy-based Logging To* field, select the feature types that will use accuracy-based logging — select *All Features*.

   e. In the *Required Accuracy* field, enter the accuracy you require.

Note – Check that your receiver is capable of this accuracy in the field. Consult your Trainer if required.

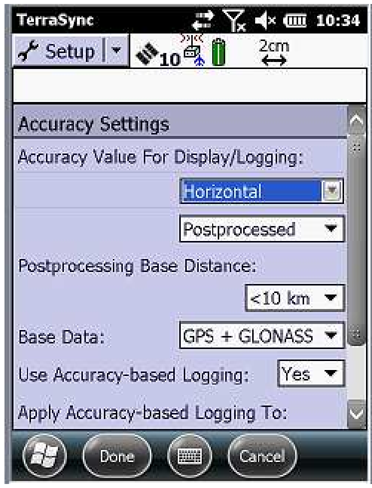
   f. Tap **OK** to save the accuracy-based logging settings and return to the *Logging Settings* form.

9. Tap **OK** to close the *Logging Settings* form and confirm the changes you have made.

Configuring the TerraSync software to collect H-Star data for postprocessed H-Star technology

1. Tap the Section list button and then select *Setup*.
2. Tap **Logging Settings**. The *Logging Settings* form appears.
3. To use accuracy-based logging:

   a. Tap the Setup button in the *Accuracy Settings* field. The *Accuracy Settings* form appears:



   b. From the *Accuracy Value for Display/Logging* fields, select *Postprocessed* and whether the TerraSync software should calculate the estimated horizontal or vertical accuracy.

   c. If you selected In the office, select the distance to the base station from the *Postprocessing Base Distance* field.

   d. From the *Use Accuracy-based Logging* field, select *Yes*.

   e. From the *Apply Accuracy-based Logging To* field, select the feature types that will use accuracy-based logging — select *All Features*.

   f. In the *Required Accuracy* field, enter the accuracy you require.

Note – Check that your receiver is capable of this accuracy in the field. Consult your Trainer if required.

   g. Tap **OK** to save the accuracy-based logging settings and return to the *Logging Settings* form.

4. Tap **OK** to close the *Logging Settings* form and confirm the changes you have made.

Collecting features

As you log a feature, the estimated accuracy value appears in the status bar. The value of the estimated accuracy correlates directly with the length of time that you have continuously collected data. To collect H-Star data you must:

- be connected to a receiver that has H-Star technology
- maintain carrier lock on the required number of satellites

When using a real-time correction source, configure the Estimated Accuracy icon to show an estimate of the accuracy being achieved for that position in the field. When the value shown in the Estimated Accuracy icon reaches the accuracy you require for the feature, you can stop logging. Collect 30 to 60 seconds of good GNSS measurements before and after a feature. When estimated accuracies are good, collect 5 to 10 positions at the feature, and then pause GNSS logging and move away if there are obstructions.

When you are logging data for subsequent processing, configure the Estimated Accuracy icon to show a prediction of the accuracy that will be achieved after postprocessing. For carrier-capable GNSS receivers, the longer the duration of carrier lock, the better the accuracy, which is indicated by a decreasing estimate. The predicted accuracy applies to all positions logged since you acquired carrier lock on the required number of satellites. The accuracy estimate has a 68% confidence level, which means that 68% of the time the position will be within the estimated value shown when the position was collected, providing that the data is processed against base stations that meet H-Star technology requirements

Note – If you lose carrier lock while collecting a feature, the accuracy estimate increases, and you must reacquire satellites and remain at the feature until the estimated accuracy value decreases to the required accuracy, or cancel the feature and move away from obstructions and then move back in once you have recorded 30 to 60 seconds of good GNSS measurements.

When collecting data for postprocessing, you do not have to remain at the same feature until the required predicted accuracy value is reached. If you are collecting a series of features, attempt to maintain a clear view of the sky between features.

Exercise 4.1: Field data collection

You can now go out into the field to collect data with the TerraSync software. Make certain that you have the required GPS hardware, batteries, and cables.

CHAPTER

5

Data Processing with the GPS Pathfinder Office Software

In this chapter:

Postprocessed differential correction in the GPS Pathfinder Office software is the most accurate way to process GNSS data. In the field, you collected autonomous and/or real-time corrected data, while base data was stored at base stations nearby. The data sets are loaded into the GPS Pathfinder Office software where corrections are applied. Any real-time data that has been collected can be "recorrected" in the GPS Pathfinder Office software to achieve the best possible results. After you display your corrected data file, you can:

- Edit any unwanted positions
- Verify that the feature information is correct, and edit any attributes
- Export your data to a format that integrates with your software requirements

Exercise 5.1: Transfer field data

Use this exercise to practice transferring field data to the GPS Pathfinder Office software. You can transfer:

- Data files
- Base data
- Waypoint files
- Data dictionaries
- Almanacs

This exercise shows you how to transfer a field data file to the GPS Pathfinder Office software.

Connect the data collector to the office computer

To connect the data collector to the office computer:

1. Switch on your data collector and your office computer and connect the two computers.

   The Microsoft ActiveSync technology (for all Windows operating systems except the Windows 7 and Windows Vista operating system) or the Windows Mobile Device Center (for the Windows 7 and Windows Vista operating systems) should automatically establish a connection with the data collector. When ActiveSync or the Windows Mobile Device Center is connected to a data collector, the message Connected appears in the relevant window, and its taskbar icon is green.

2. If ActiveSync or the Windows Mobile Device Center does not connect automatically, remove and then re-insert the USB connection. For information on connecting with the different technologies, refer to the relevant Help.

Transfer a rover file to the office computer

To transfer the rover file from your data collector to the office computer:

1. In the GPS Pathfinder Office software, select *Utilities* / *Data Transfer*.

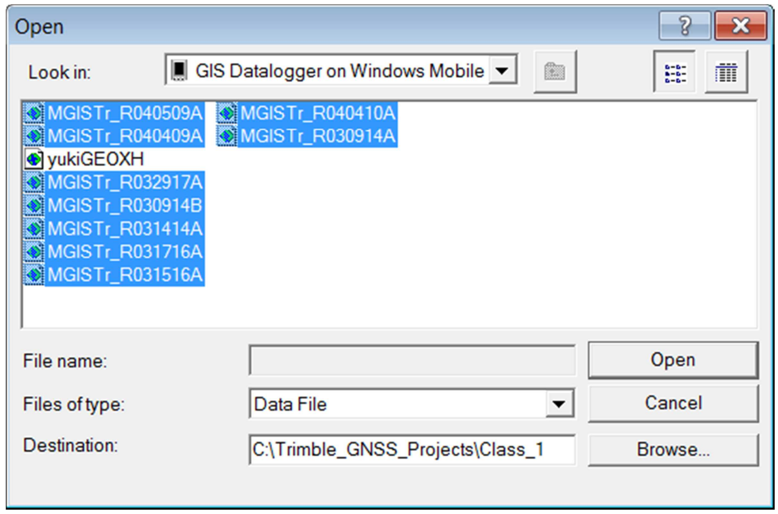
   The *Data Transfer* dialog appears.

2. From the *Device* list, select *GIS Datalogger on Windows Mobile*. Alternatively, if you have set up a device definition for your data collector, select that device name from the list.

   The Data Transfer utility automatically connects to the data collector.

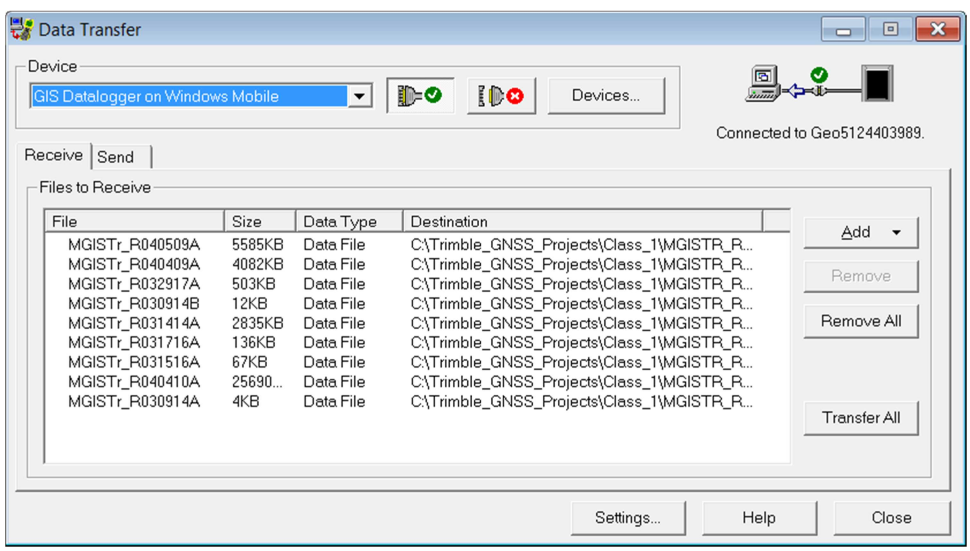
3. Select the *Receive* tab.

4. Click **Add** and select Data File from the drop-down list. The *Open* dialog appears:



Note – The files that appear are the files in the TerraSync software data folder on the data collector. Files that are highlighted have not been previously transferred from the datalogger.

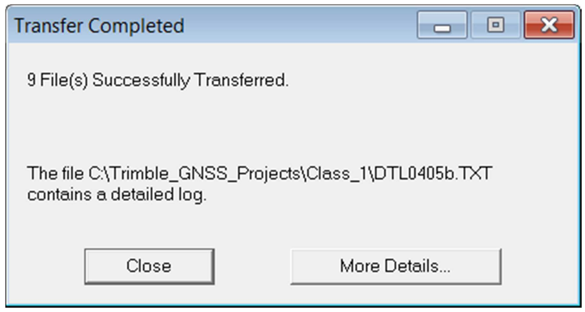
5. Highlight the rover file, and then click **Open**. The *Open* dialog disappears and the selected file appears in the *Files to Receive* list:



6. Click **Transfer All**.

   The data file is transferred to the office computer.

7. A message box showing summary information about the transfer appears. Click **Close** to close it:



8. Click **Close** to exit the Data Transfer utility.

For more information, refer to the *GPS Pathfinder Office Help*.

Differential correction

Differential correction reduces atmospheric errors; therefore, it is necessary for achieving submeter accuracy for a C/A code position and decimeter accuracy for a H-Star processed position. Differential correction can be performed in real time, or back in the office with the GPS Pathfinder Office software. For optimal results, you can use both.

For a differential correction to be performed, a dual-frequency base station must be running at the same time as a rover in the same vicinity. Both base and rover must track the same satellites at the same time and therefore record the same errors from regional atmospheric conditions. The base station is set up over a known reference position and can compare positions computed with errors to “truth”. Differential correction then adjusts for errors in the rover file, based on a time tag for each position.

You can use real-time differential corrections from the following sources:

- Integrated SBAS receiver
- Integrated beacon receiver
- Integrated OmniSTAR receiver
- External source connected to the GNSS receiver (for example, a GeoBeacon receiver or a DGPS radio, or a VRS correction)

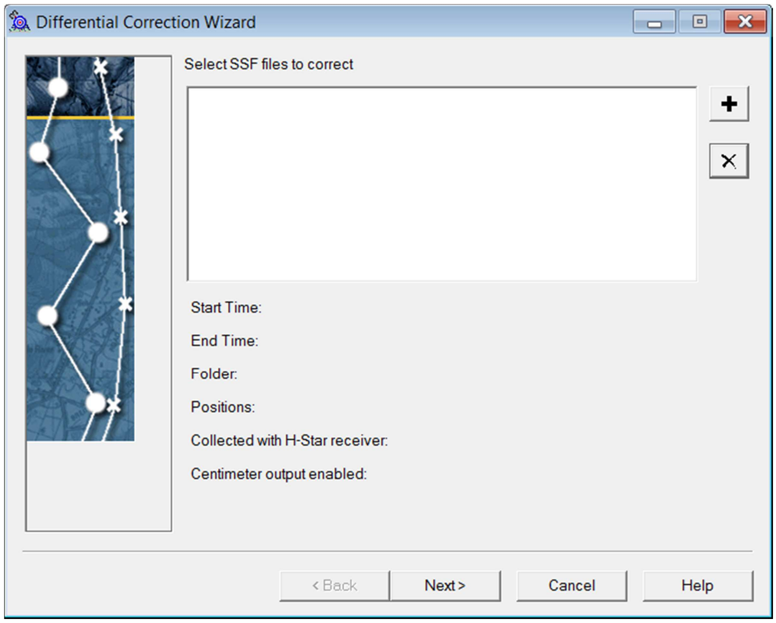
For *postprocessing*, corrections are logged in a base file that is transferred when you return from the field.

Note – With high accuracy data collection, it is very important to understand how error can be introduced through incorrect datum transformations. Please inquire with your Trimble Dealer or Trimble Certified Trainer to learn more about typical correction workflows in your region – or visit Pathfinder Office Technical Support http://www.trimble.com/mappingGIS/PathfinderOffice.aspx?dtID=technical_support for more information about reference frames and their current status.

Exercise 5.2: Differential Correction Wizard

To start the Differential Correction Wizard from the main GPS Pathfinder Office menu bar, select *Utilities / Differential Correction*.

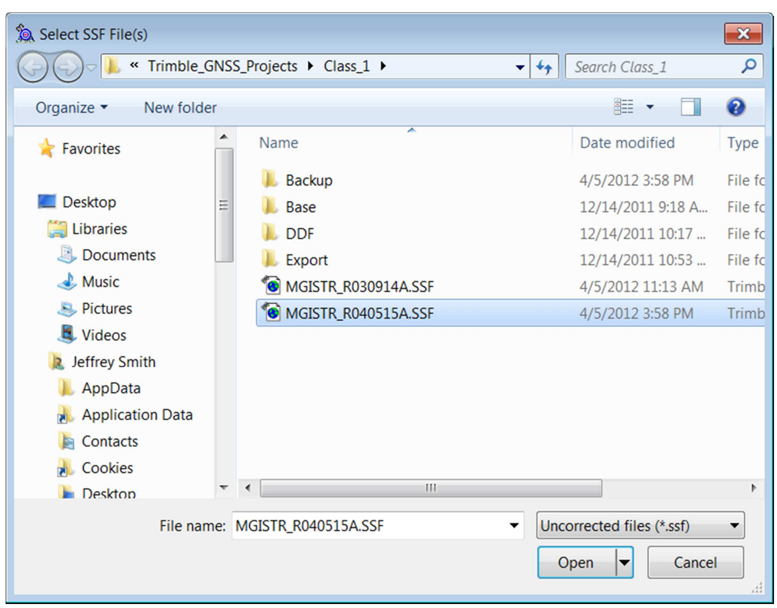
The *Differential Correction Wizard*:



Select rover files

The *Select SSF files to correct* list will be empty, or it will show the SSF files that were created the last time you downloaded rover files. To remove any SSF files that are listed, select them and then click ×. To select the SSF files you want to differentially correct click +.

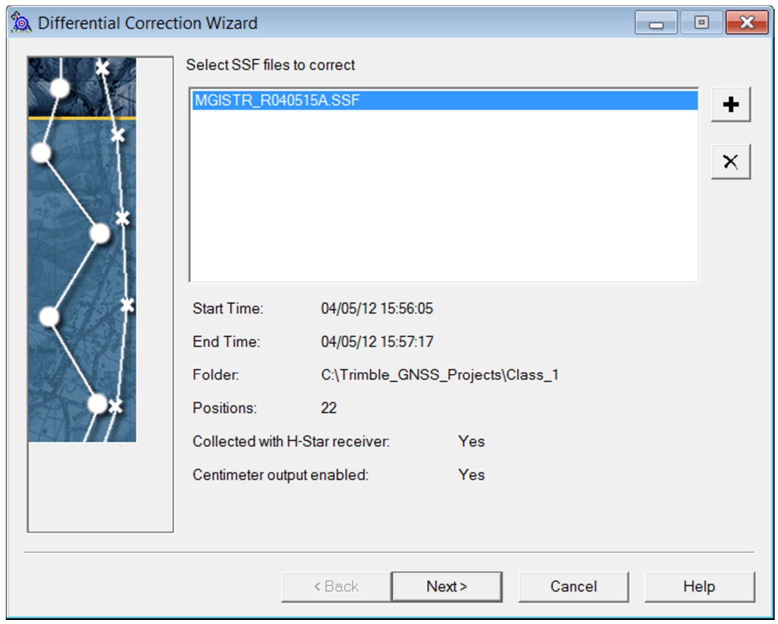
a. Click +. The *Select SSF Files* dialog appears:



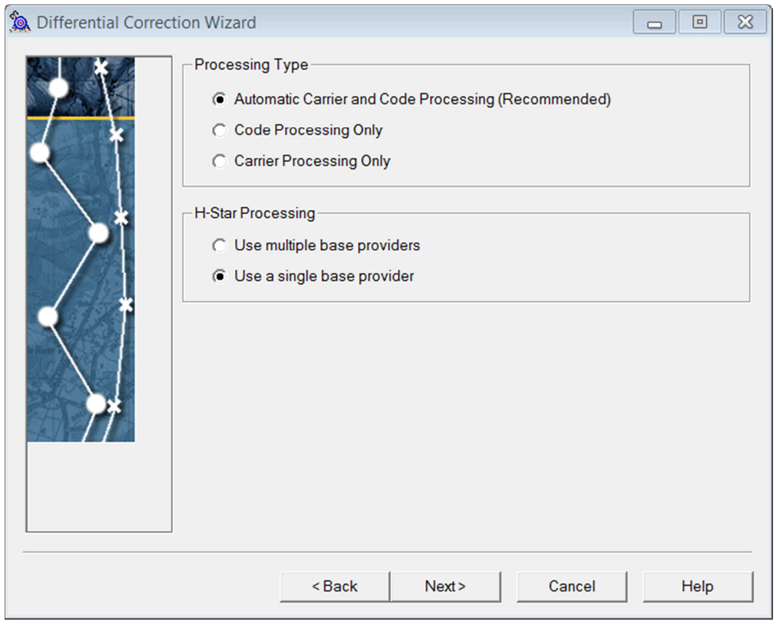
Select the rover file, or hold down the **Shift** key to select multiple files to be corrected. By default the uncorrected files (*.ssf) are shown.

b. Click **Open**.

The fields below the selection list display information about the selected file. The *Collected with H-Star receiver* field indicates whether the rover file contains data collected using a receiver with H-Star technology. The *Centimeter output enabled field* indicates whether the rover file was collected using a centimeter optioned GNSS receiver and TerraSync Centimeter Edition. The options displayed in the rest of the Differential Correction Wizard are dynamic: H-Star processing options are only displayed if the value for this field is Yes:



3. Click **Next**. The *Processing Type* page of the wizard appears:



This screen displays the processing options available for processing the GNSS data in the selected rover files. If the data was not collected with an H-Star receiver, the *H-Star Processing* options will not be available.

Select type of processing

Use the *Processing Type* step of the Differential Correction Wizard to specify the type of processing you want to use for the selected SSF files. There are three standard processing options. If the receiver that is used to collect the data uses H-Star technology, an additional two H-Star processing options are available.

Standard processing types

Standard processing corrects the GNSS data in the selected SSF files using data from a single base station. The standard processing options are always available whether the selected files were collected using an H-Star receiver or not. The options are:

- *Automatic Carrier and Code Processing* - The GNSS data is both carrier-processed and code-processed using data from a single base station. The position with the best precision estimate is used as the corrected position.
- *Code Processing Only* - The GNSS data is code-processed using data from a single base station.
- *Carrier Processing Only* - The GNSS data in the session is carrier-processed using data from a single base station to produce a carrier float solution.

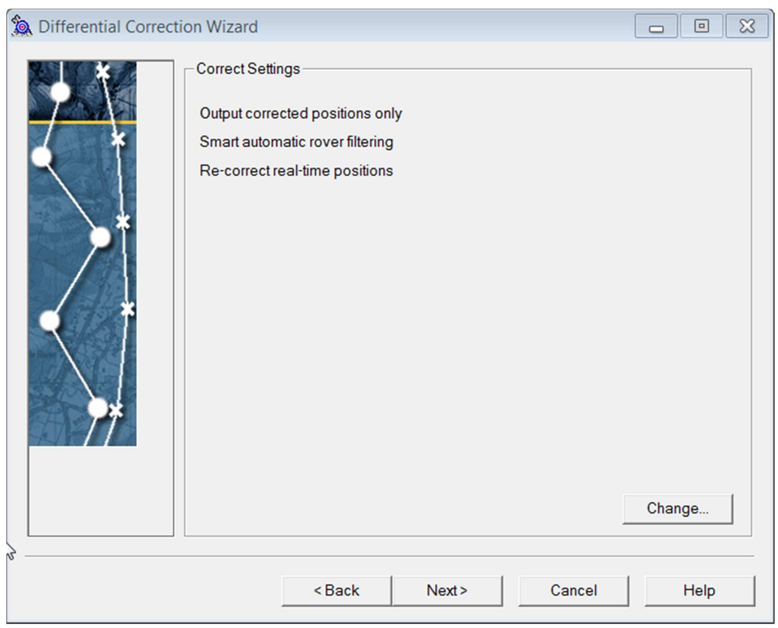
H-Star processing types

H-Star processing enables GNSS data in the selected SSF files to be corrected using data from a group of base stations. The files are corrected using data from each base station in the group, and then the results are averaged to produce a single corrected position for each original position. The averaging calculation gives more weight to base stations that are closer to where the original GNSS positions were collected, and can result in a better solution than a correction from a single base station. The options are:

- Use multiple base providers, if a network of base stations is available and within 200 km.
- Use a single base provider if a base station is within 80 km, and there is not a suitable network of base stations within 200 km.

To select the type of processing:

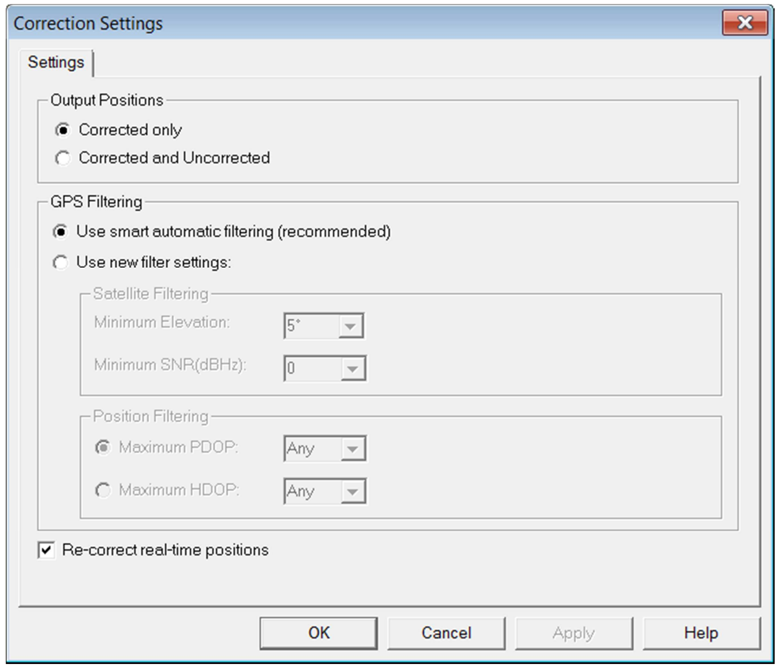
1. Select one of the processing types for differential correction. The options are explained above.
2. Click **Next.** The *Correction Settings* page of the 'Wizard appears:



Select appropriate settings

Use the options in the *Correction Settings* dialog to customize differential corrections.

1. Click **Change** to open the *Correction Settings* dialog:



2. Select an option from the *Output Positions* group, which determines the data to be stored in the corrected file:
   - *Corrected only* – stores only corrected positions and velocity records.
   - *Corrected and uncorrected* – stores corrected and uncorrected positions and velocity records.
3. Select the *Re-correct realtime code positions* check box to improve the accuracy of real-time corrected positions. Clear this check box to leave real-time corrected positions unprocessed.
4. Select which filters to apply to the data as it is differentially corrected. You can let the postprocessing smart filtering work out the best results for your GNSS measurements (recommended), or you can apply your own elevation, SNR, and DOP settings.
   - Select the *Use smart automatic filtering* option and process files with the processing engine having access to all the GNSS measurements (this is the recommended option).
   - Select the *Use new filter settings* option to process files using the settings specified in this tab.

The system uses files containing carrier or pseudorange data to increase the accuracy of positional calculations. Data collected using real-time correction sources such as SBAS can be postprocessed, as can data from rover positions using satellites not seen by the base station. (Rover data is recomputed using the satellites common to both rover and base station.)

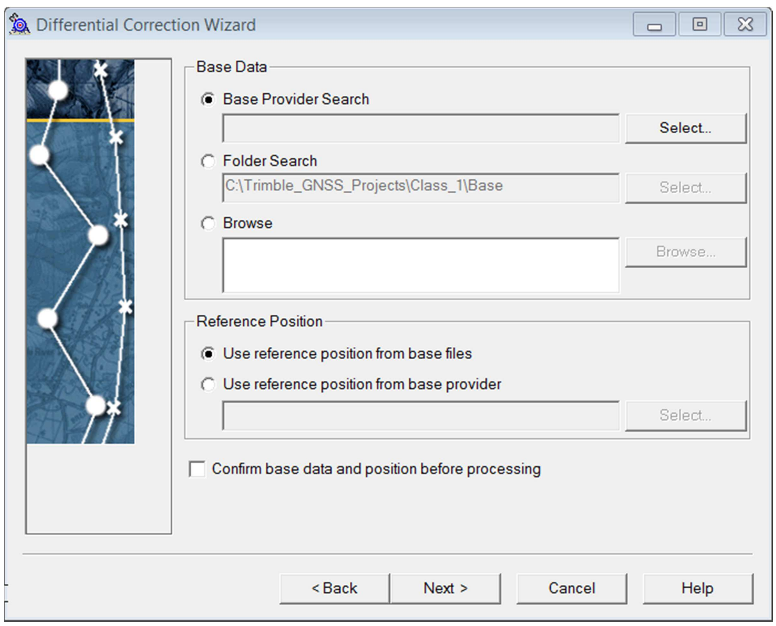
5. Click **OK** to save differential correction settings.
6. Click **Next.** The *Select Base Data* page of the wizard appears.

Select base files

The interface that appears will depend on whether your rover files contain H-star data.

Rover files without H-star data

If your rover files do not contain H-star data, the following page appears:

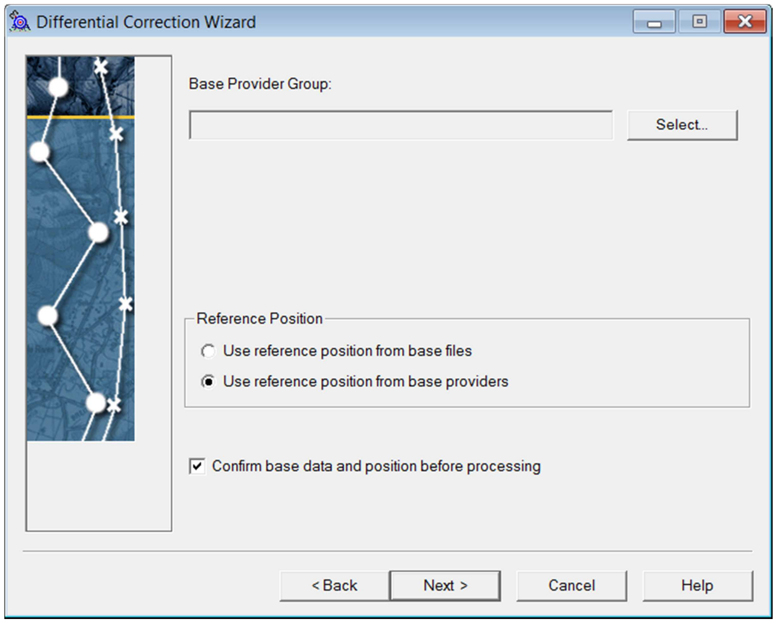


1. Select base files:
   - If you are going to download files from the Internet select the *Base Provider Search* option, and click **Select**.
   - If the base files are in the base folder for the current project select the *Folder Search* option. If the wrong folder is displayed, click Select and choose the correct folder.

– If you want to manually select the base files, select the *Browse* option and then click **Browse**. In the *Open* dialog, navigate to the folder where the base files are stored, select the files you want to use and click **OK** to return to the Differential Correction Wizard.

Rover files with H-star data

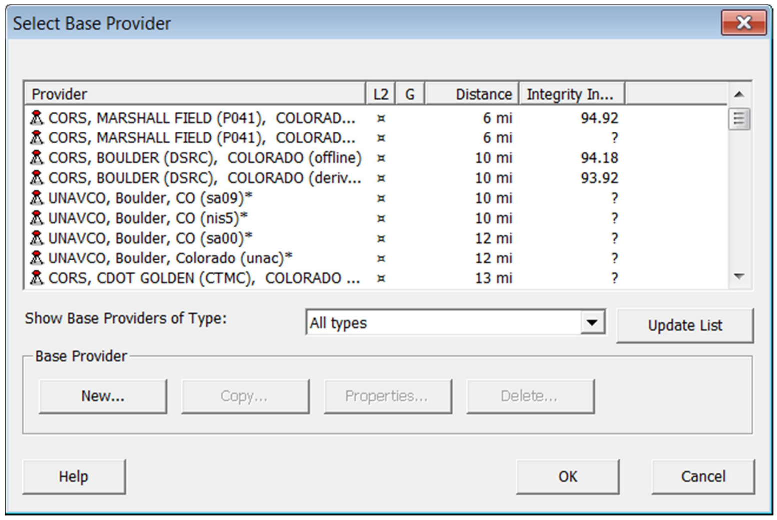
If your rover files contain H-star data the following page appears:



With H-star processing you can select more than one base station to correct your data with. It is important to make sure that all the base stations in a H-Star group use the same coordinate system and datum to represent their coordinates in.

To do this, select a number of base stations and save them as a group:

1. Click the **Select** button next to the *Base Provider Group* field. The *Base Provider Group* dialog appears:



The *Base Provider Group* dialog displays information about the selected base provider group. Each member of the group is displayed in the group provider list, which displays the presence of L2 and GLONASS data, distance, and integrity index records for the base provider. These details are the same as those in the parent *Base Provider* list displayed in the *Select Base Provider* dialog. The type of integrity index shown in the group member list depends on the type of data contained in the GNSS sessions currently selected for differential correction. To display integrity index values of a different type, select a different type from the drop-down list.

Note – The Integrity Index value is an indicator of the quality of the data provided by the base station. A poor Integrity Index value can indicate that the base provider is unreliable or often off line. Good stations may be displayed with "?" as the Index value. For example, password protected stations and private stations may not be able to have a value calculated, so treat the value as an indication.

2. Click **New** to open the *New Base Provider Group* dialog and create a new base provider group.

3. Click ➕ to open the *Select Base Provider* dialog and select a base provider to add to the group. Repeat this process until you have added all the required base stations to your group.

   Next to the list of base provider group members, a map displays the approximate positions of the base providers, in relation to the rover.

4. Click **OK** to return to the Differential Correction Wizard.

Reference Position settings

1. Select what you want to use as the source of the base station reference position.
   From the *Reference Position* option select one of the following:

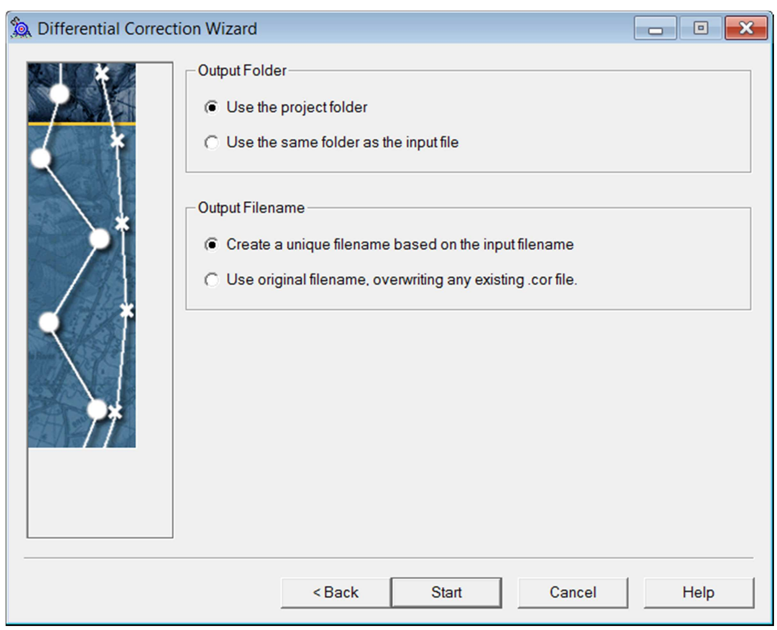
   – *Use reference position from base files* - If you know the reference position for the base provider is incorrect select this option to use the reference position specified in the selected base files. By default, these coordinates are taken from the first selected base file.

   – *Use reference position from base provider* - Select this option to use the recorded reference position of a selected base provider. This option is recommended, as the reference position recorded for a base provider is generally more accurate than the reference position provided in base files.

*Note – If there is no H-star data in the selected rover files, or a single base provider was selected for H-Star processing, the name of the base provider selected to provide the reference position is displayed in the text box below this option. Click **Select** to select a different base provider.*

2. Confirm base data and position before postprocessing. Select the check box to confirm the co-ordinates of the reference position and the availability of the base files to be used. This information appears in the *Differential Correction Processing* window on the last page of the wizard before you start the correction process. If the check box is not selected, clicking **Start** on the last page of the Differential Correction Wizard will automatically start the correction process without first checking that base data is available.

3. Click **Next.** The *Output* page of the wizard appears:



Select output options

1. Select the folder that you want to store the output files in from the following options:

   – Use the same folder as the input file - Output files will be stored in the same folder as the input folder. This allows you to select rover files from different folders, process them, and to store the corrected files with their corresponding input files.

   – Use this folder - All output files will be stored in the same folder. By default, this is the current project folder.

2. Select how you want the output files named from the following options:

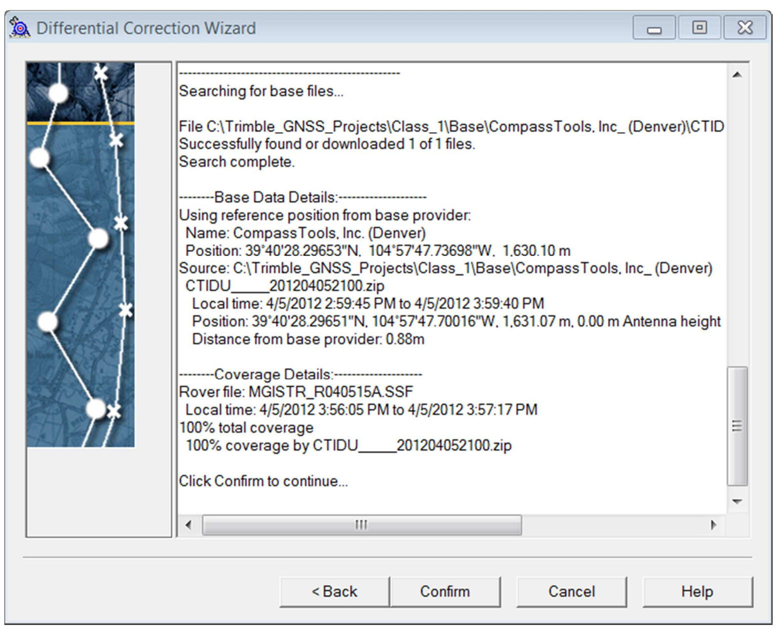
   – Create a unique filename based on the input filename - Automatically creates a unique filename, based on the input filename. The format for automatically created names is <input rover file>_<n>.cor, where n denotes the number of subsequent processing of the same rover file.

   – Use original filename, overwriting any existing .cor file - The output file has the same name as the input rover file, with a .cor extension. Subsequent processing of the same input file results in previous output files being overwritten.

Differentially correct your data

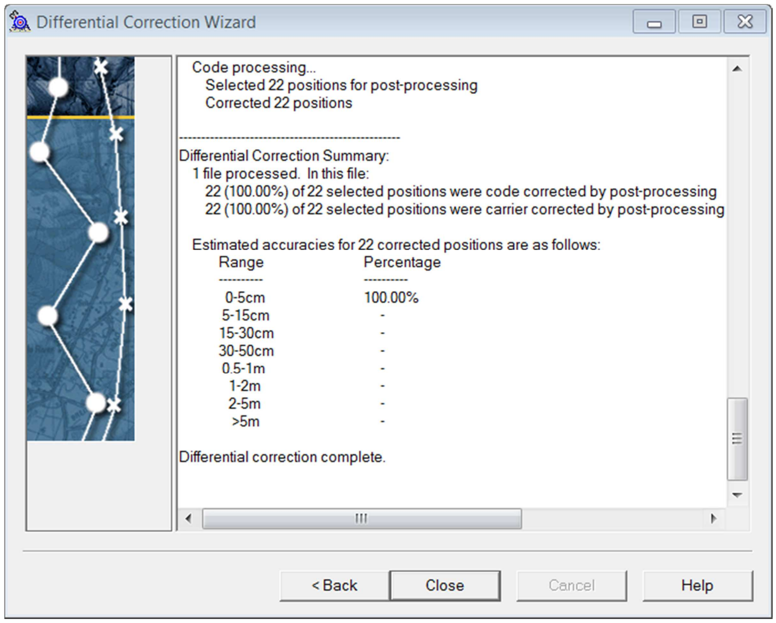
1. Select **Start**. The differential correction process starts.

   If you have chosen to *Confirm base data and position before processing* a dialog similar to the following will appear:



2. If the base data coverage and reference positions are correct, click **Confirm**. The data is processed.

As the GPS Pathfinder Office software begins differentially correcting the selected SSF files, the *Correct processing* page of the wizard appears:



It displays details about the status of the differential correction process. The SSF files are processed sequentially. The Correct Processing page displays the number of corrected positions for each SSF file.

When the last SSF has been processed, the message Differential correction complete and a summary of the estimated accuracy values gained for the corrected GNSS positions appears at the bottom of the Correct Processing page.

This summary provides immediate feedback as to the quality of the corrected GNSS positions. For example, if too few base providers have been selected for multi-base processing, the results will indicate this by showing large estimated accuracy values.

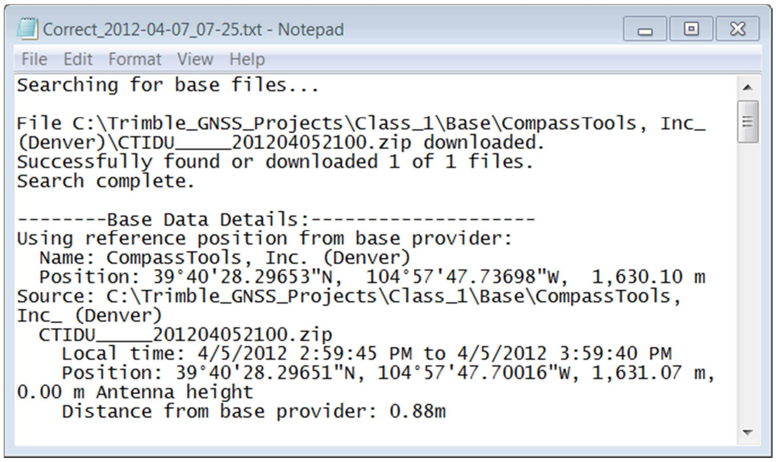
3. Click **Close**.

Note – The most common reason for differential correction failure is choosing the wrong base files.

View differential correction reports

The Summary - Correct_DATE_TIME.txt reports are created upon conclusion of processing. These reports detail processing settings, files used, files created, and include a processing summary.

You can view generated reports in a text editor, such as Microsoft Notepad:




```
Searching for base files...

File C:\Trimble_GNSS_Projects\Class_1\Base\CompassTools, Inc_
(Denver)\CTIDU_____201204052100.zip downloaded.
Successfully found or downloaded 1 of 1 files.
Search complete.

--------Base Data Details:--------------------
Using reference position from base provider:
  Name: CompassTools, Inc. (Denver)
  Position: 39°40'28.29653"N,  104°57'47.73698"W,  1,630.10 m
Source: C:\Trimble_GNSS_Projects\Class_1\Base\CompassTools,
Inc_ (Denver)
  CTIDU_____201204052100.zip
    Local time: 4/5/2012 2:59:45 PM to 4/5/2012 3:59:40 PM
    Position: 39°40'28.29651"N, 104°57'47.70016"W, 1,631.07 m,
0.00 m Antenna height
    Distance from base provider: 0.88m
```

Creating GIS export setups

Many types of GNSS data can be exported to a GIS, including features, attributes, not in feature positions, notes, velocity records, and external sensor records. This exercise defines options to convert this information to a format that matches an existing GIS or CAD database.

Exercise 5.3: Create your own GIS export setup

In this exercise, you will create a customized export setup, configure the format setup options, and export your corrected data file. Make sure you clearly understand the options offered to perform a GIS export. After completing this exercise, create an export setup that meets the requirements of your company's GIS.

This exercise shows you how to use the Export utility to match GNSS data to your GIS database.

To create an export setup:

1. Select *Utilities / Export*.
2. In the *Export* dialog, click **New** to open the *New Setup* dialog.
3. Rename the New Setup to match your project name and/or export specifics – for example Class 1 ESRI Shapefile Setup. Select OK to exit the New Setup dialog.
4. In the *Create* group, select the *New setup* option and then select ESRI Shapefile from the list.
5. Click **OK**.

Configure the format

To configure the format of an export setup:

1. In the *Type of Data to Export* group in the *Data* tab, select the *Features / Positions and Attributes* option:

   – *Features / Positions and Attributes* – exports features and attribute information.

   – *Include Not in Feature Positions* – exports not in feature positions as either *one point per Not in Feature position* or as *one line per group of Not in Feature positions*.

   – *Positions Only* – exports positions as either one point per GNSS position, one point per file (mean position), one line per input file, or one area per input file.

2. In the *Create Point Features From* group, you can export the following as point features:

   – Notes

   – Velocity records

   – Sensor records

   A position for each note, velocity record, or sensor record is interpolated from GNSS positions within the input file.

3. The *Starting Feature ID* group is only available for export formats that require a unique ID. The *Value* field specifies the starting feature ID for the session:

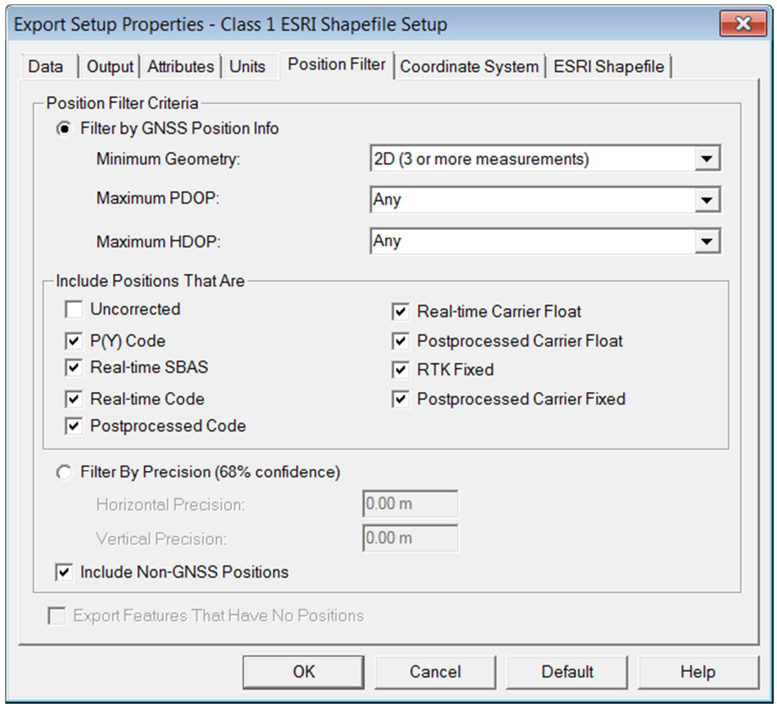
   – *Start Each Session with this Value* – specifies that the starting feature ID always starts at the value shown.

   – *Continue Increment from Previous Session* – the value field defaults to 1 plus the last feature ID exported in the previous session.

Include certain filters

To include position filters:

1. Select the *Position Filter* tab:



2. Select the *Filter by GNSS Position Info* option.

   a. From the *Minimum Satellites* list, select 3D (4 or more SVs). This option only exports positions collected with a specified number of satellites. It does not filter out positions created manually (without GNSS).

   b. From the *Maximum PDOP* list, select 6. This option filters out positions above a particular PDOP. Only positions with a PDOP less than or equal to this value are exported.

   c. From the *Maximum HDOP* list, select 12. This option filters out positions above a particular HDOP. Only positions with an HDOP less than or equal to this value are exported.

d. In the *Include Positions That Are* group, select any of the following:

- *Uncorrected* – the uncorrected positions are exported.

CAUTION – If you have uncorrected data in your GIS you may be compromising the accuracy standards of your existing GIS database.

- *P(Y) Code* – positions collected using P- or Y-code are exported. Only military receivers can log positions using these codes.
- *Real-time SBAS* – positions collected using SBAS real-time DGPS are exported.
- *Real-time Code* – positions collected using real-time differential GPS and computed using a code phase solution are exported.
- *Postprocessed Code* – positions corrected in the Differential Correction utility using the code-processing options are exported.
- *Real-time Carrier Float* – (for RTK systems only.) Positions collected using real-time differential GPS and computed using a carrier float solution are exported.
- *Postprocessed Carrier Float* – positions that have a carrier float position. These positions were corrected using either the *H-Star processing* option in the Differential Correction Wizard, or using the *Smart Code and Carried Phase Processing* option or the *Carrier Phase Processing* option in the Differential Correction utility.
- *RTK Fixed* – (for RTK systems only.) Positions collected using real- time kinematic techniques and computed using a carrier fixed solution are exported.
- *Postprocessed Carrier Fixed* – positions corrected in the Differential Correction utility using the Centimeter Processing option, and having a carrier fixed solution, are exported.

e. Select the *Include Non-GNSS Positions* check box to export positions that were collected manually, were originally imported from a GIS or CAD system using the *Import* utility, or were created with the *Create Feature* tool in the GPS Pathfinder Office software.

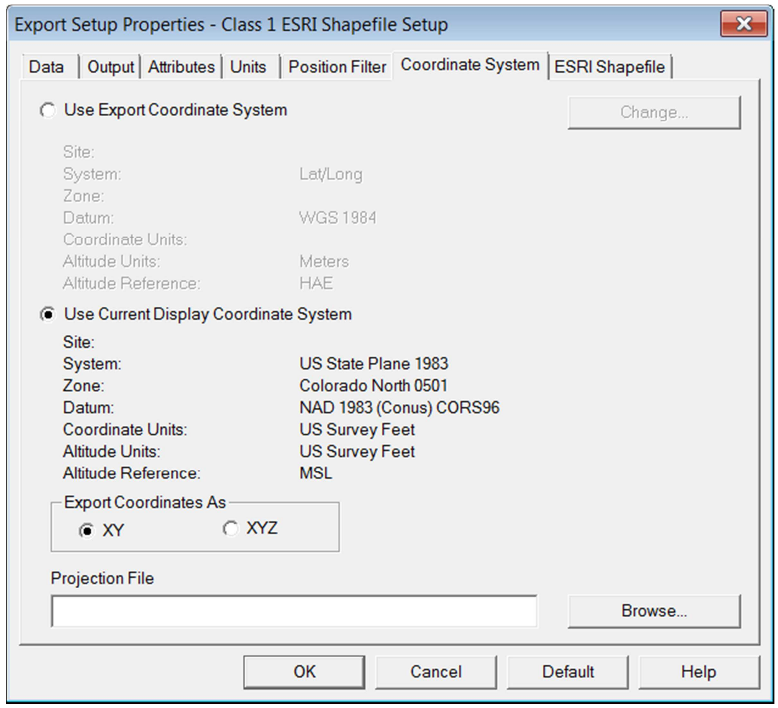
3. Select the *Filter by Precision (68% confidence)* option to filter a data set based on horizontal and vertical precision tolerances.

4. Select the *Export Features That Have No Positions* check box to include features that have no positions in the GIS or CAD output. This is useful when attribute information about a feature is gathered but GNSS positions were unavailable.

Reference graphic data

To reference graphic data:

1. Select the *Coordinate System* tab:



2. Select the *Use Export Coordinate System* option to export data in the coordinate system and zone configured in this tab.

   The *Use Current Display Coordinate System* option exports data as specified under *Options / Coordinate System* in the main GPS Pathfinder Office program.

3. Click **Change** to set the appropriate datum, coordinate system, and altitude reference.

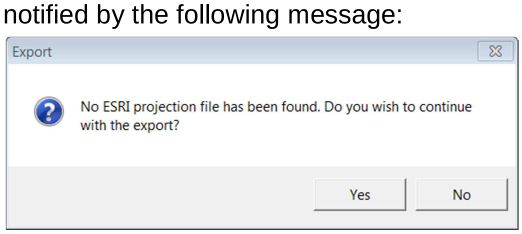
4. Click **OK**.

5. The options in the *Export Coordinates As* group are available for formats that accept either two-dimensional or three-dimensional coordinates.

   – *XY* – exports two-dimensional coordinates.

   – *XYZ* – exports three-dimensional coordinates.

6. Browse to an existing ESRI projection (*.prj) file, if available, to establish the final spatial reference for your project data. This setting is an optional setting and will not prohibit the final export. However, if a file is not selected you will be notified by the following message:

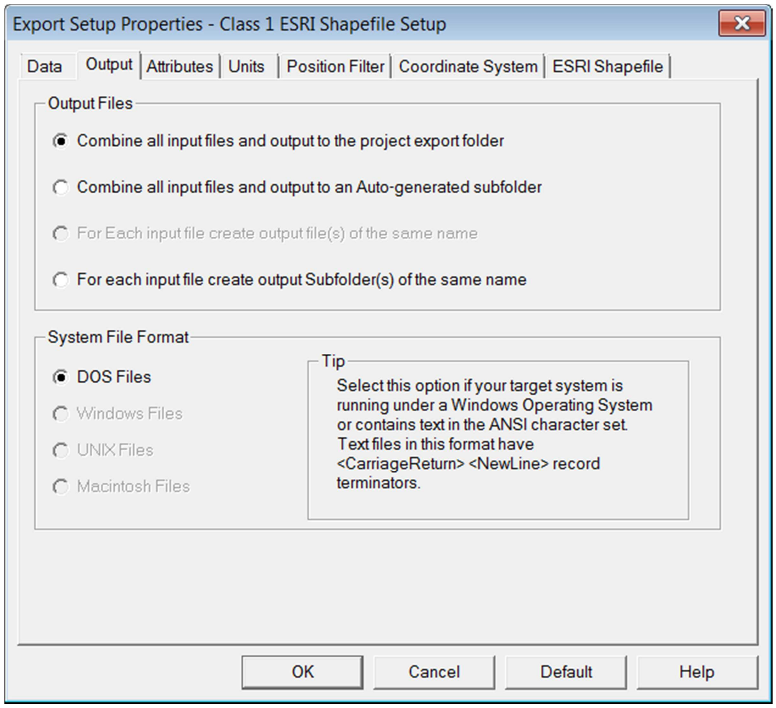


Select *Yes* to proceed or *No* to return to the Export set up.

Choose the output options

To set output options:

1. Select the *Output* tab:



2. From the *Output Files* group, select one of the following:

   – *Combine all input files and output to the project export folder* – a single output file (or set of output files) is created in the export folder.

   – *Combine all input files and output to an auto-generated subfolder* – a single output file (or set of output files) is created in a subfolder of the export folder.

   – *For each input file create output file(s) of the same name* – for each input file, an output file (or set of output files) with the same filename as the input file is created in the export folder.

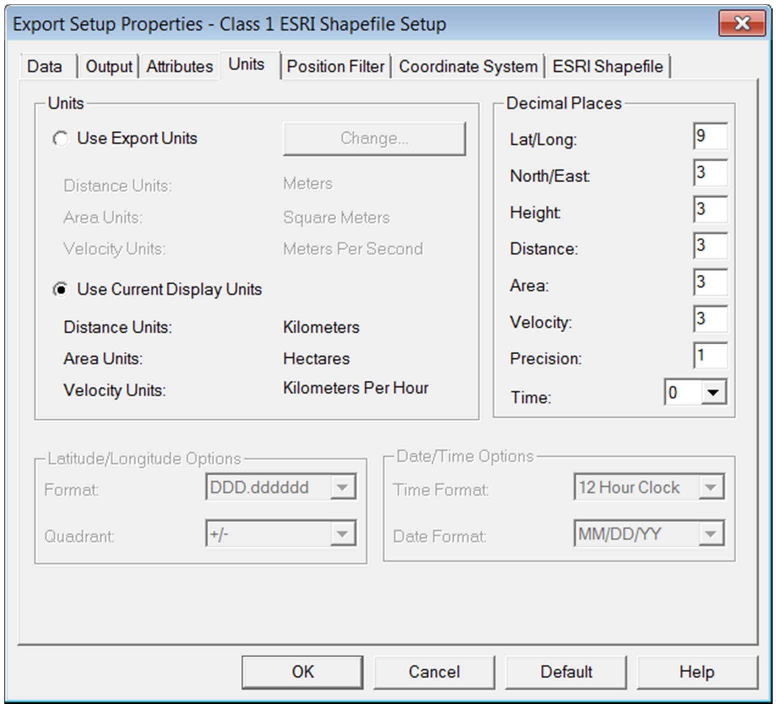
   – *For each input file create output subfolder(s) of the same name* – for each input file, an output file (or set of output files) is created in a subfolder of the export folder.

3. From the *System File Format* group, select the operating system of the computer for your GIS or CAD program.

Configure the units

To configure the units:

1. Select the *Units* tab:



2. In the *Units* group, select *Use Export Units*. Data is exported in the units set in this tab. Click **Change** to reset the export units.

3. Choose the *Distance*, *Area*, and *Velocity Units*, and click **OK**.

4. Decimal Places – these fields control the number of decimal places exported.
   The decimal places fields apply only to data exported in ASCII formats.

5. Select the *Latitude/Longitude Options*, if they are available:

   – *Format* – controls the style of exported Latitude and Longitude coordinates.

   – *Quadrant* – determines how the quadrant or hemisphere component of a Latitude/Longitude coordinate is exported. Select +/– to export Northern hemisphere latitudes and Eastern hemisphere longitudes as positive numbers, and Southern hemisphere latitudes and Western hemisphere longitudes as negative numbers. Select NS/EW to export hemisphere letters.

6. Choose from the following *Date/Time Options*, if available:

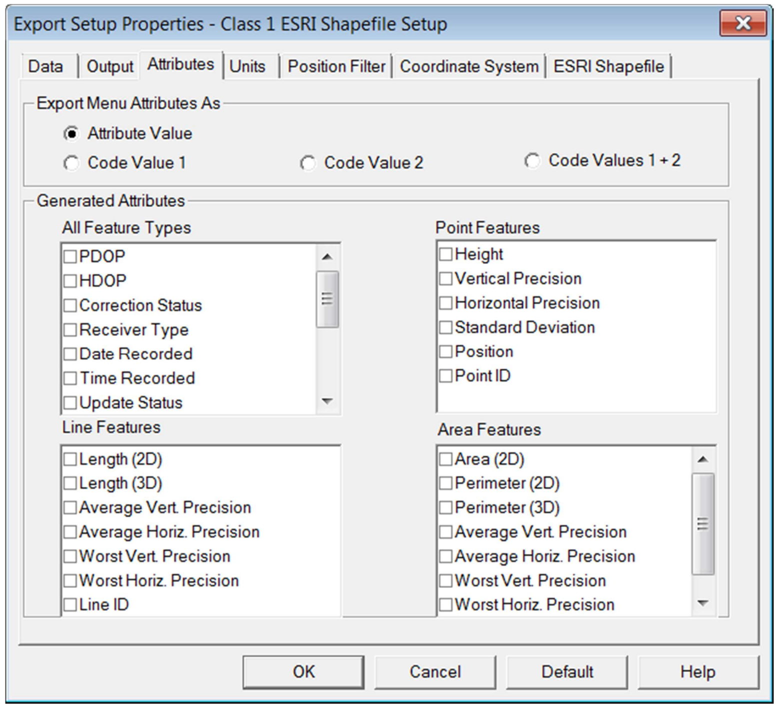
   – Time Format

   – Date Format

Include attributes

To include attributes:

1. Select the *Attributes* tab:



2. In the *Export Menu Attributes As* group, select the *Attribute Value* option.

   – *Attribute Value* – exports the attribute value that was entered while collecting data.

   – *Code Value 1* – exports the first predefined code in the data dictionary.

   – *Code Value 2* – exports the second predefined code in the data dictionary.

   – *Code Values 1 + 2* – exports both predefined codes.

3. The *Generated Attributes* group includes additional attributes for documentation. Select any for your output file.

   For all feature types and their exported attribute names, include:

   – PDOP – MAX_PDOP

   – Correction Status – CORR TYPE

   – Receiver Type – RCVR_TYPE

   – Date Recorded – GPS_DATE

   – Time Recorded – GPS_TIME

   – Feature Name – FEAT_NAME

   – Data File Name – DATAFILE

   – Total Positions – UNFIL_POS. Total number of positions of the feature in the SSF file.

- Filtered Positions – FILT_POS. Total number of positions of the feature after position editing.

4. For *Point Features*, and their exported attribute name, include:
   - Height – GPS_CALC_HEIGHT. Elevation of the point features.

     Use this attribute if your GIS or CAD system does *not* accept three-dimensional coordinates. Do not select this if your GIS or CAD system stores three-dimensional positions.
   - Standard Deviation – STD_DEV. The spread of positions averaged for the point feature.

     Standard deviation is not a measure of accuracy of a point feature's position. It indicates the spread of positions from the mean.
   - Horizontal Precision – HORZ_PREC
   - Vertical Precision – VERT_PREC
5. For *Line Features*, include:
   - Length – GPS_LENGTH

     If your GIS or CAD system computes lengths internally, results may vary due to algorithmic processing.
   - Average Horizontal Precision – AVG_HORZ_P
   - Average Vertical Precision – AVG_VERT_P
   - Worst Horizontal Precision – WORST_HORZ
   - Worst Vertical Precision – WORST_VERT
6. For *Area Features*, and their exported attribute names, include:
   - Area – GPS_AREA
   - Perimeter – GPS_PERIMETER

     If your GIS or CAD system computes area and perimeter internally, results may vary due to algorithmic processing.
   - Average Horizontal Precision – AVG_HORZ_P
   - Average Vertical Precision – AVG_VERT_P
   - Worst Horizontal Precision – WORST_HORZ
   - Worst Vertical Precision – WORST_VERT
7. Click **OK** to save settings and return to the main *Export* dialog.

Export data

1. In the *Input Files* group, click **Browse**.
2. Select the corrected file to be exported (if it does not appear in the *Select Data Files* dialog), and click **Open**.

   You can export multiple files that use the same data dictionary.
3. In the *Choose an Export Setup* group, verify that the newly created export setup is selected, and click **OK**.

   Processing begins.

   An *Export Completed* dialog informs you of the number of positions and features exported.
4. Click **More Details** to view the text file created from the export.
5. Click **Close** to exit the Export utility.

When you return to the office, create an export setup to match your company's GIS. If you are unsure of the settings that your GIS requires, write down the settings here and speak to your GIS specialist.

Glossary

This section explains some of the terms used in this manual.

almanac - An almanac is data transmitted by a GPS satellite, which includes orbit information on all the satellites, clock corrections, and atmospheric delay parameters. The almanac is stored on the field computer. It is used to facilitate rapid acquisition of GPS signals when you turn on the TerraSync software, or when you have lost track of satellites and are trying to regain GPS signals.

attribute - An attribute is information about a geographic feature in a GIS or database, usually stored in a table and linked to the feature by a unique identifier. Every identifiable feature has attributes. One common attribute of all mapped features is geographic position. Other attributes depend on the type of feature. For example, attributes of a road might include its name, surface type, and number of lanes. Each attribute has a range of possible values, called a domain. The value selected is called the attribute value.

attribute value - An attribute is the particular value for a feature, chosen from the domain of an attribute. For example, for a road feature, surface type is an attribute; bitumen, gravel, and concrete are domains; and gravel is an attribute value.

base station - Also called a reference station. A base station is a GPS antenna and receiver positioned on a known location specifically to collect data for differential correction. Base data needs to be collected at the same time as you collect data on a rover unit. A base station can be a permanent station that collects base data for provision to multiple users, or a rover unit that you locate on known coordinates for the duration of the datalogging session.

baud rate - A baud is a unit used to measure the speed of electronic code transmissions, generally one bit per second. The higher the baud rate, the faster the transfer of data. However, both the input and output device must be configured to the same baud rate for data to be successfully transferred.

bearing - A bearing is the direction from one point to another, usually measured clockwise from north. In the TerraSync software, the bearing indicates the direction from your current position to the target.

broadcast server - A broadcast server is an Internet server that manages authentication and password control for differential correction sources such as virtual reference station (VRS network) networks, and relays corrections from the source that you select. An NTRIP server is an example of a broadcast server.

C/A code - See code phase.

carrier phase - Carrier phase is the time taken for the L1 or L2 carrier signal generated by the satellite to reach the GPS receiver. Measuring the number of carrier waves between the satellite and receiver is a very accurate method of calculating the distance between them.

Cartesian coordinates - The Cartesian coordinate system is a system of coordinates that defines the location of a point in space in terms of its perpendicular distance from each of a set of mutually perpendicular axes. The X direction is 0° latitude (the Greenwich meridian) and the Y direction is 90°east longitude.

centroid - The calculated center of an area feature.

CMR - (Compact Measurement Record) A real-time message format developed by Trimble for broadcasting corrections to other Trimble receivers. CMR is a more efficient alternative to RTCM correction messages, but is not supported by all non-Trimble receivers.

Coarse Acquisition code - See code phase.

code phase - (also known as Coarse Acquisition code, or C/A code) The difference between the pseudo-random number code generated by the TerraSync software and the pseudorandom number code coming in from the satellite. The code phase data is used to quickly compute the distance to a satellite and therefore calculate your position.

coordinate system - A set of transformations that allow GPS positions (in the WGS-84 ellipsoid) to be transformed to projection coordinates with elevations above the geoid. Essentially, a coordinate system consists of a datum transformation, a geoid model allocation, and a projection definition.

cross-track error - The amount and direction by which your current heading differs from the cross-track line.

cross-track line - The shortest direct path from the navigation start to the navigation target.

data dictionary - A data dictionary is a description of the objects to be collected for a particular project or job. It is used in the field to control the collection of the spatial and attribute information about these objects. The elements of a data dictionary could include point, line, and area features.

datum - A datum is a mathematical model of the earth's surface. World geodetic datums are typically defined by the size and shape of an ellipsoid and the relationship between the center of the ellipsoid and the center of the earth. Because the earth is not a perfect ellipsoid, any single datum will provide a better model in some locations than others. Therefore, various datums have been established to suit particular regions. For example, maps in Europe are often based on the European datum of 1950 (ED-50). Maps in the United States are often based on the North American datum of 1927 (NAD-27) or 1983 (NAD-83). All GPS coordinates are based on the WGS-84 datum and GRS80 ellipsoid.

datum transformation - A datum transformation defines the method and parameters that are used to transform the coordinates of a point defined in one datum to coordinates in a different datum. Trimble software supports several methods of datum transformation including Seven-Parameter, Three-Parameter (also referred to as Molodensky), and grid-based transformations. Typically, you use datum transformations to convert data collected in terms of the WGS-84 datum using GPS methods onto datums used for mapping purposes in individual regions and countries.

declination - See magnetic declination.

DGPS - See real-time differential GPS.

differential correction - Differential correction is the process of correcting GPS data collected on a rover with data collected simultaneously at a base station. Because it is on a known location, any errors in data collected at the base station can be measured, and the necessary corrections applied to the rover data. Differential correction can be done in real time, or after the data has been collected by postprocessing.

differential GPS - See real-time differential GPS.

digitizing - The process of creating positions manually by selecting a point on a map.

Dilution of Precision - (DOP) A measure of the quality of GPS positions, based on the geometry of the satellites used to compute the positions. When satellites are widely spaced relative to each other, the DOP value is lower, and position accuracy is greater. When satellites are close together in the sky, the DOP is higher and GPS positions may contain a greater level of error. PDOP (Position DOP) indicates the three-dimensional geometry of the satellites. Other DOP values include HDOP (Horizontal DOP) and VDOP (Vertical DOP), which indicate the accuracy of horizontal measurements (latitude and longitude) and vertical measurements respectively. PDOP is related to HDOP and VDOP as follows: PDOP2 = HDOP2 + VDOP2

DOP - See Dilution of Precision.

EGNOS - (European Geostationary Navigation Overlay Service) A satellite-based augmentation system (SBAS) that provides a free-to-air differential correction service for GPS. EGNOS is the European equivalent of WAAS, which is available in the United States.

ellipsoid - An ellipsoid is the three-dimensional shape that is used as the basis for mathematically modeling the earth's surface. The ellipsoid is defined by the lengths of the minor and major axes. The earth's minor axis is the polar axis and the major axis is the equatorial axis.

feature - A feature is a physical object or event that has a location in the real world, which you want to collect position and/or descriptive information (attributes) about. Features can be classified as points, lines, or areas. For example, a road sign is a point feature, a road is a line feature, and a park is an area feature. Features are defined in a data dictionary.

field computer - In the TerraSync software documentation, a field computer is any portable computer such as a handheld device, a laptop, or a Tablet PC running the TerraSync software. See also Windows Mobile powered device.

geoid - A geoid is an imaginary three-dimensional surface representing Mean Sea Level (MSL) if it was projected to extend through the continents. Unlike an ellipsoid or datum, which have a symmetrical surface, the geoid undulates perpendicular to the force of gravity.

geoid height - (Also known as geoid separation and geoidal undulation.) The geoid height is the distance of the geoid (MSL) above or below the reference ellipsoid.

geoid model - A geoid model is a mathematical representation of the geoid for a specific area, or for the whole earth.

great-circle distance - The great-circle distance is the shortest distance between two points on the surface of a sphere.

guest - A guest connection lets a Windows Mobile powered device exchange and share information with a desktop computer. You need a guest connection or a partnership to transfer data between the TerraSync software on the device and the GPS Pathfinder Office software on the desktop computer. When you connect as a guest, you can:

- move or copy files between the two computers
- back up files on the Windows Mobile powered device
- install or uninstall programs on the Windows Mobile powered device

However, you cannot synchronize data between the two computers when you connect as a guest. To synchronize data you must set up a partnership. A guest connection is temporary. When the guest Windows Mobile powered device is disconnected from the desktop computer, any settings for the guest connection are lost. The next time you connect the device to the desktop computer, you must set the guest connection again. For more information, refer to the ActiveSync Help.

HAE - See Height Above Ellipsoid.

HDOP - See Horizontal Dilution of Precision.

heading - The heading is the direction you are facing or traveling, usually measured clockwise from north.

Height Above Ellipsoid - (HAE) HAE is a method for referencing altitude. Altitudes expressed in HAE are actually giving the height above the datum, not the ellipsoid. GPS uses the WGS-84 datum and GRS80 ellipsoid and all heights are collected in relation to this surface. It is important to use the same datum when comparing altitudes in HAE.

horizon - The line at which the earth and sky seem to meet.

Horizontal Dilution of Precision - (HDOP) Dilution of Precision (DOP) is a measure of the quality of GPS positions, based on the geometry of the satellites used to compute the positions. When satellites are widely spaced relative to each other, the DOP value is lower, and position accuracy is greater. When satellites are close together in the sky, the DOP is higher and GPS positions may contain a greater level of error. HDOP is a DOP value that indicates the accuracy of horizontal measurements. Other DOP values include VDOP (vertical DOP) and PDOP (Position DOP). The TerraSync software lets you specify either a maximum HDOP value or a maximum PDOP. It uses this maximum value as an upper bound on DOP values. You can configure the desired level of accuracy, and make sure that the positions logged are of a certain quality. When the DOP exceeds this maximum, the TerraSync software stops computing GPS positions. Using a maximum HDOP is ideal for situations where vertical precision is not particularly important, and your position yield would be decreased by the vertical component of the PDOP (for example, if you are collecting data under canopy).

H-Star technology - H-Star technology is a Trimble-patented technology allowing the collection of high accuracy GPS data. A GPS receiver that has H-Star technology logs L1 data or, if used with an external dual-frequency antenna, logs L1 and L2 data. Real-time H-Star technology uses corrections from an external source to provide decimeter accuracy in the field. Postprocessed H-Star technology uses base data from multiple base stations to obtain better postprocessed accuracy for the collected data once back in the office.

IMS - See Web map server.

International Terrestrial Reference Frame - (ITRF) A reference frame defined by the International Earth Rotation Service (IERS), with its origin at the Earth’s center of mass. The WGS-84 datum is aligned with the current realization of ITRF, ITRF 2000 (also called ITRF00).

Internet Map Server - (IMS) See Web map server.

ionospheric noise - Ionospheric noise is the effect that the ionosphere has on GPS signals. The ionosphere is the band of charged particles 100 to 200 kilometers (60 to 125 miles approximately) above the surface of the earth.

ITRF - See International Terrestrial Reference Frame.

L1 - The primary L-band carrier used by GPS satellites to transmit satellite data. The frequency is 1575.42 MHz. It is modulated by C/A code, P-code, or Y-code, and a 50bps navigation message.

L2 - The secondary L-band carrier used by GPS satellites to transmit satellite data. The frequency is 1227.6 MHz. It is modulated by P-code or Y-code, and a 50bps navigation message.

laser rangefinder - An instrument that uses a laser beam to accurately measure the distance to a target. Some rangefinders also measure the bearing to the target. Use a laser rangefinder to measure offsets when you are unable to record positions at the exact location of the feature.

latitude - Latitude is an angular measurement made from the center of the earth to north or south of the equator. It comprises the north/south component of the latitude/longitude coordinate system, which is used in GPS data collection. Traditionally, north is considered positive, and south is considered negative.

local datum - The datum chosen for use in a particular region. Positions on a local datum are commonly called local geodetic coordinates. Coordinates are traditionally given in terms of the local datum. When you survey using the satellite-based Global Positioning System (GPS), however, the coordinates you collect are based on the World Geodetic System 1984. These coordinates are given in terms of the WGS-84 datum. Before you can use WGS-84 coordinates with coordinates measured in terms of the local datum, you must perform a datum transformation.

local ellipsoid - The ellipsoid specified by a coordinate system. The WGS-84 coordinates are first transformed onto this ellipsoid, then converted to grid coordinates.

lock - To track sufficient satellites for logging carrier phase or H-Star data. 'Loss of lock' occurs when the number of available satellites drops below four when logging a static GPS position, or below five when logging a streaming GPS position. Loss of lock can also occur during H-Star data collection if the PDOP rises above 6.

longitude - Longitude is an angular measurement made from the center of the earth to the east or west of the Greenwich meridian (London, England). It comprises the east/west component of the latitude/longitude coordinate system, which is used in GPS data collection. Traditionally, east is considered positive, and west is considered negative.

magnetic declination - Magnetic declination is the difference between magnetic north and true north. Declination is expressed as an angle and differs between locations.

magnetic north - A bearing that is relative to magnetic north uses the north magnetic pole as its north reference.

Mean Sea Level - (MSL) Mean Sea Level is a method of altitude reference. Altitudes expressed in relation to MSL actually give a height above the geoid. It is important to use the same geoid when comparing altitudes in MSL.

MSAS - (MTSAT Satellite-Based Augmentation System) MSAS is a satellite-based augmentation system (SBAS) that provides a free-to-air differential correction service for GPS. MSAS is the Japanese equivalent of WAAS, which is available in the United States.

MSL - See Mean Sea Level.

MTSAT Satellite-Based Augmentation System - See MSAS.

Multipath - Multipath is interference that occurs when GPS signals arrive at the receiver having traveled different paths. For example, this may happen if some signals are reflected off a building before reaching the receiver. If a signal takes a longer path it will show a larger distance to the satellite and therefore decrease position accuracy.

NAD-27 - (North American Datum of 1927) A horizontal datum employing the Clarke 1866 ellipsoid. Height values of this era are expressed in NGVD (National Geodetic Vertical Datum) of 1929.

NAD-83 - (North American Datum of 1983) A horizontal datum employing the GRS-80 ellipsoid. The original realization of NAD-83 was almost identical to WGS-84. The current realization NAD-83 (CORS96) differs from WGS-84 by up to a meter.

NMEA – (National Marine Electronics Association) NMEA 0183 defines the standard for interfacing marine electronic navigational devices. This standard defines a number of strings referred to as NMEA sentences that contain navigational details such as positions. Most Trimble GPS receivers can output positions as NMEA sentences.

NTRIP - (Networked Transport of RTCM via Internet Protocol) NTRIP enables the streaming of DGPS or RTK correction data via the Internet. Data is usually received using a modem and/or a cellphone. An NTRIP server is an Internet server that manages authentication and password control for differential correction sources including base stations and VRS networks, and relays corrections from the source that you select. An NTRIP server can be accessed by a number of users at the same time.

office computer - An office computer is any computer running Trimble postprocessing software. Usually the office computer is a desktop computer located in the office, but if you are running your data collection software on a laptop or Tablet PC then the office computer may actually be the same computer as the field computer.

parity - A digital message is composed of 0's and 1's. Parity is a form of error checking that sums the 0's and 1's of the digital message. A parity error results when one of the bits is changed so that the parity calculated at message reception is not the same as it was at message transmission. Options for parity checking include even, odd, and none. Typically you should have the same parity setting on the Windows Mobile powered device as on the external device you are communicating with.

partnership - A partnership lets a Windows Mobile powered device exchange and share information with a desktop computer. You need a partnership or a guest connection to transfer data between the TerraSync software on the device and the GPS Pathfinder Office software on the desktop computer. A partnership stores information about:

- how to connect to the device
- what types of files you can send and receive
- what files you can synchronize, and how to manage synchronization
- how to convert files for transfer

Unlike a guest connection, a partnership is stored on the desktop computer and remains when the device is disconnected from the desktop computer. For more information, refer to the ActiveSync Help.

PC - In TerraSync software documentation, a field computer that is running a supported Windows desktop operating system.

PDOP - See Position Dilution of Precision.

Position Dilution of Precision - (PDOP) Dilution of Precision (DOP) is a measure of the quality of GPS positions, based on the geometry of the satellites used to compute the positions. When satellites are widely spaced relative to each other, the DOP value is lower, and position accuracy is greater. When satellites are close together in the sky, the DOP is higher and GPS positions may contain a greater level of error. PDOP is a DOP value that indicates the accuracy of three-dimensional measurements. Other DOP values include VDOP (vertical DOP) and HDOP (Horizontal DOP). The TerraSync software lets you specify either a maximum HDOP value or a maximum PDOP. It uses this maximum value as an upper bound on DOP values. You can configure the desired level of accuracy, and make sure that the positions logged are of a certain quality. When the DOP exceeds this maximum, the TerraSync software stops computing GPS positions. Using a maximum PDOP value is ideal for situations where both vertical and horizontal precision are important.

postprocessing - Postprocessing is the processing of satellite data after it has been collected in order to eliminate error. This involves using PC software to compare data from the rover to data collected at the base station. Because the base station is on a known location, any errors can be determined and removed from the rover data.

predicted postprocessed accuracy - The predicted postprocessed accuracy is a prediction of the accuracy that will be achieved after postprocessing. When logging H-Star or carrier data, the predicted postprocessed accuracy value applies to all the positions collected since you achieved lock on the required minimum number of satellites. For all other receivers, this value applies only to the current position. The predicted postprocessed accuracy has a 68% confidence level, which means that 68% of the time the postprocessed position will be within the predicted postprocessed accuracy value shown when the position was collected.

PRN - See pseudo-random number.

projection - A mapping of a set of coordinates from a datum to a plane; or a set of mathematical rules for performing such a translation. Projections are used to create flat maps that represent the surface of the earth or parts of it.

Pseudo-Random Number - (PRN) The pseudo-random number is the code of 0s and 1s transmitted by GPS satellites, which appears to be random “noise”, but is actually a complex pattern that can be exactly reproduced. Each satellite has its own unique PRN code, which together are used by the GPS receiver to calculate code phase positions.

raster - A raster graphic is a graphical image consisting of rows and columns of dots. The color of each dot is represented by the value of one or more data bits in the image file. A bitmap (.bmp file) is a type of raster image.

Real-Time Differential GPS - (also known as real-time differential correction, DGPS) Real-time differential GPS is the process of correcting GPS data as you collect it. This is achieved by having corrections calculated at a base station sent to the receiver via a radio link. As the rover receives the position it applies the corrections to give you a very accurate position in the field. Most real-time differential correction methods apply corrections to code phase positions. RTK uses carrier phase measurements.

Real-Time Kinematic - See RTK.

rover - A rover is any mobile GPS datalogger collecting or updating data in the field, typically at an unknown location. Data collected on a rover can be differentially corrected relative to base station data.

roving mode - During RTK data collection, TerraSync logs line and area features, and between feature positions, in roving mode. Point features and vertices are logged in static mode. In roving mode, the TerraSync software records all RTK-corrected positions that meet the precision tolerances you have specified. All other positions are discarded.

RTCM correction messages - (Radio Technical Commission for Maritime Services) This is a commission established to define a differential data link for the real-time differential correction of roving GPS receivers. There are two types of RTCM differential correction message. All Trimble GPS receivers use the version 2.1 or later RTCM protocol.

RTK - (real-time kinematic) A real-time differential GPS method that uses carrier phase measurements for greater accuracy.

SBAS - (Satellite-Based Augmentation System) SBAS is based on differential GPS, but applied to wide area (WAAS, EGNOS, MSAS). Networks of reference stations are used and corrections and additional information are broadcast via geostationary satellites.

Signal-to-Noise Ratio - (SNR) The signal strength of a satellite is a measure of the information content of the signal, relative to the noise of the signal. The typical SNR of a satellite at 30° elevation is between 47 and 50 dB Hz. The quality of a GPS position is degraded if the SNR of one or more satellites in the constellation falls below 39 dB Hz. The TerraSync software lets you set a minimum SNR value. This value is used to determine whether the signal strength of a satellite is sufficient for that satellite to be used by the GPS receiver. If the SNR of a satellite is below the configured minimum SNR, that satellite is not used to compute positions.

site - A site consists of an existing coordinate system plus an extra set of parameters for horizontal and vertical adjustments. Together these provide the best fit of GPS data to a specific area or site. Because the additional corrections are only valid for a limited area, that area is called a site, or local site. A coordinate system is designed to apply over a large area and does not provide for variations that occur in local coordinates. When you create a site, you shift coordinates obtained using GPS so that they better fit coordinates in the existing map grid that were obtained using traditional surveying methods.

SNR - See signal-to-noise ratio.

SSF - (Standard Storage Format) A Trimble file format. SSF files store GPS data from a Trimble GPS receiver. Usually these files have the filename extension .ssf. A corrected SSF file has a .cor or .phs extension; an SSF file created by importing data has the extension .imp.

static GPS position - A static GPS position is a GPS position logged when the GPS receiver is stationary, as when logging a point feature or an averaged vertex in a line or area feature.

static mode - During RTK data collection, TerraSync logs point features and vertices in static mode. Line features, area features, and between feature positions are logged in roving mode. In static mode, the TerraSync software records only the RTK-corrected position with the best precision. All other positions are discarded.

streaming GPS position - (Also known as dynamic GPS positions) Streaming GPS positions are GPS positions logged when the GPS receiver is moving. When you are moving along a line feature, or around the perimeter of a polygon feature, you log streaming GPS positions. Your application logs a new vertex for every GPS position received from the GPS receiver.

synchronize - Synchronization is the process where ActiveSync technology compares information on a Windows Mobile powered device with the corresponding information on the desktop computer, and then updates either computer with the latest information. The data stored by the TerraSync software is not synchronized by ActiveSync technology. Use the Trimble Data Transfer utility to transfer data to and from the TerraSync software. For more information, refer to the ActiveSync Help and the Data Transfer Utility Help.

tracking - The process of receiving and recognizing signals from a satellite.

true north - A bearing that is relative to true north uses the north celestial pole as its north reference.

UTC – (Universal Time Coordinated) UTC is a time standard based closely on local solar meantime at the Greenwich meridian (GMT). GPS time is directly related to UTC.

UTM – (Universal Transverse Mercator) A special case of the Transverse Mercator map projection. Abbreviated as UTM, it consists of 60 north/south zones, each 6 degrees wide in longitude.

vector - A vector graphic is a graphical image consisting of mathematical descriptions of lines, points, and areas. When you transfer an SSF data file to the TerraSync software as a background file, its attribute information is removed, leaving only the vector information. You can view the features in the map, but you cannot select them, view their attributes, or edit them.

velocity - Velocity is essentially a measure of speed that takes into account direction of travel as well as the distance traveled over a period of time.

Vertex - A point on a line or area feature where two adjacent segments of the feature join. Each position that you collect for a line or area feature is a vertex of that feature.

VRS network - A VRS network consists of GPS hardware, software, and communication links. It uses data from several base stations to provide corrections to roving receivers that are more accurate than corrections from a single base station. Unlike other real-time correction sources, using corrections from a VRS network requires two-way communication between the VRS network and the roving receiver. The roving receiver must send its position to the server, so that the server can calculate corrections for that position, and select the closest base station if necessary. The server generates a unique virtual reference station for each roving receiver that connects to it.

WAAS - (Wide Area Augmentation System) WAAS is a satellite based augmentation system (SBAS) that provides a free-to-air differential correction service for GPS. WAAS was established by the Federal Aviation Administration (FAA). Its coverage area includes the continental United States and outlying parts of Canada and Mexico.

waypoint - A waypoint is a geographical point that, unlike a feature, holds no attribute information beyond a name and location. Typically, waypoints are used to denote objects whose locations are of primary interest, such as a survey mark. Waypoints are most often used for navigation.

web map server - An Internet site that lets users download GIS data, background, and other files for a specified geographical area. The TerraSync software can download raster background files from a web map server.

WGS-84 – (World Geodetic System 1984) WGS-84 has superseded WGS-72 as the datum used by GPS since January 1987. The WGS-84 datum is based on the ellipsoid of the same name.

Windows Mobile powered device - A small handheld device powered by the Windows Mobile operating system. A Windows Mobile powered device usually has a small screen, and limited memory and storage space.