USER GUIDE

Trimble® Positions™ software suite: Trimble Positions ArcPad extension

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Release Notice

This is the November 2013 release (Revision A) of the *Trimble Positions ArcPad Extension User Guide*. It applies to version 10.2.0.1 of the Trimble Positions ArcPad extension.

Contents

CHAPTER

1

Introduction

In this chapter:

The *Trimble Positions ArcPad Extension User Guide* describes how to use the Trimble® Positions™ ArcPad extension.

Even if you have used other Global Navigation Satellite System (GNSS) products before, Trimble recommends that you spend some time reading this manual to learn about the special features of this product.

This guide assumes that you know how to use the Windows® Embedded Handheld or Windows Mobile® operating system that you are using.

What is the Trimble Positions ArcPad extension?

The Trimble Positions ArcPad extension for the Esri ArcPad software provides enhanced GNSS data collection and control of real-time differential correction sources.

The extension communicates with a Trimble Mapping & GIS receiver connected to a field computer, allowing you to:

- set GNSS parameters in the receiver
- collect postprocessable GNSS positions for features that you create in ArcPad

You can use the Positions ArcPad extension to receive differential corrections in real time from a variety of sources. You can connect to a cellular phone and receive corrections from an external source that delivers corrections over the Internet, such as a VRS™ network. Depending on your GNSS receiver, the Positions ArcPad extension also enables you to use real-time differential corrections received from the receiver's integrated Satellite-Based Augmentation System (SBAS) receiver.

When you have collected GNSS position data with the Positions ArcPad extension, you can use Trimble postprocessing software (the Trimble Positions Desktop add-in for the Esri ArcGIS for Desktop 10.2 software, or the Trimble GPS Pathfinder® Office software) to differentially correct the GNSS data and to apply those corrections to the AXF file or the Shapefiles collected in ArcPad.

Typical workflows

Figure 1.1 on page 7 and Figure 1.2 on page 8 show two typical workflows when using the Positions ArcPad extension. The workflows are slightly different, and depend on whether you are primarily working with AXF files or with Shapefiles.

You will be working with an AXF file if you check out data from ArcGIS for Desktop to ArcPad software.

Note – *To use an AXF file you must first create a Trimble Positions project in the Trimble Positions Desktop add-in.*

You will be working with Shapefiles if you create a new layer in the ArcPad software, for example, when you have created an ArcPad QuickProject.

Working with AXF files and the Trimble Positions ArcPad extension

When you check out data from the ArcGIS for Desktop software to use with ArcPad software, the data is checked out as an AXF file. All feature type information is contained in the AXF file. When you add features to an existing layer, the Trimble Positions ArcPad extension automatically creates an SSF (.ssf) file with the same name as the AXF file. If you are using a map file, the SSF file will be named TrimblePositions.ssf.

Tip – To log GNSS data in an SSF file with the same name as the AXF file, you must open a new, empty map in ArcPad, select *Add Layer*, and then select the AXF file.

Note – *If you create a new layer in the ArcPad software, the new data file is a Shapefile. For more information, see* *Working with Shapefiles and the Trimble Positions ArcPad extension, page 8*.

All GNSS position information for all feature types is stored in the SSF file. To merge the GNSS position data from the SSF file with feature data from the ArcPad AXF file, you need a compatible version of the Trimble Positions Desktop add-in for Esri ArcGIS for Desktop software, or of the GPS Pathfinder Office software. Refer to the Mapping & GIS Compatibility Matrix for a full list of compatible versions.

Note – *You must also have installed all relevant software updates for the office processing software to enable correct processing of the SSF file.*

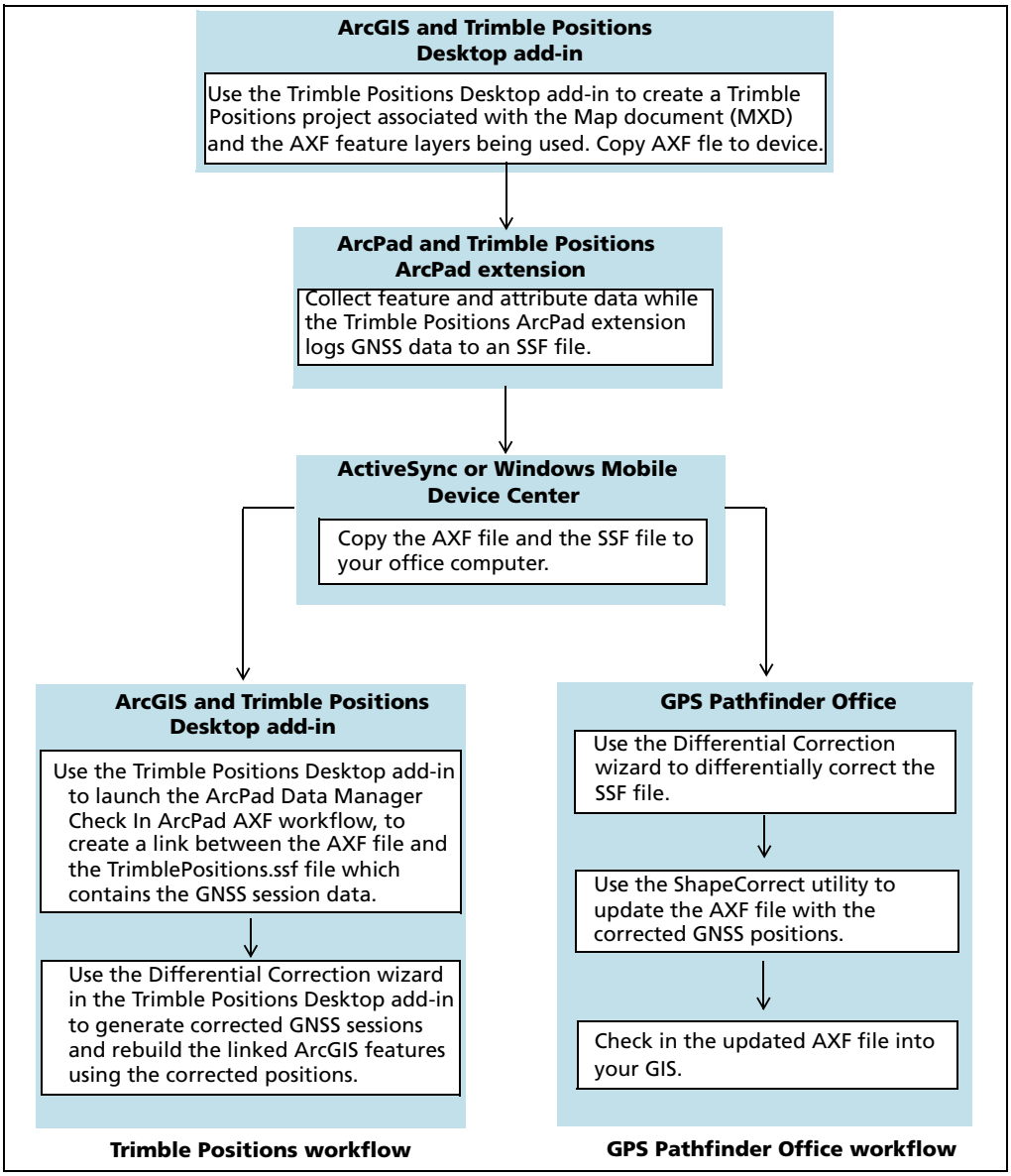


Figure 1.1 Typical workflows: Working with AXF files and the Trimble Positions ArcPad extension

Working with Shapefiles and the Trimble Positions ArcPad extension

You will be working with Shapefiles if you create a new layer in the ArcPad software, such as when you create a QuickProject.

Note – *If you add features to a layer that you checked out to the ArcPad software, the data is added to the AXF file, not to a Shapefile. For more information, see* *Working with AXF files and the Trimble Positions ArcPad extension, page 6*.

Each feature type has its own Shapefile. When you create a layer or add features to an existing layer, the Trimble Positions ArcPad extension automatically creates an SSF file called TrimblePositions.ssf. All GNSS position information for all feature types is stored in the SSF file. To merge the GNSS position data from the SSF file with feature data from the ArcPad Shapefiles, you need a compatible version of the Trimble Positions Desktop add-in for Esri ArcGIS for Desktop software, or of the GPS Pathfinder Office software. Refer to the Mapping & GIS Compatibility Matrix for a full list of compatible versions.

Note – *You must also have installed all relevant software updates for the office processing software to enable correct processing of the SSF file.*

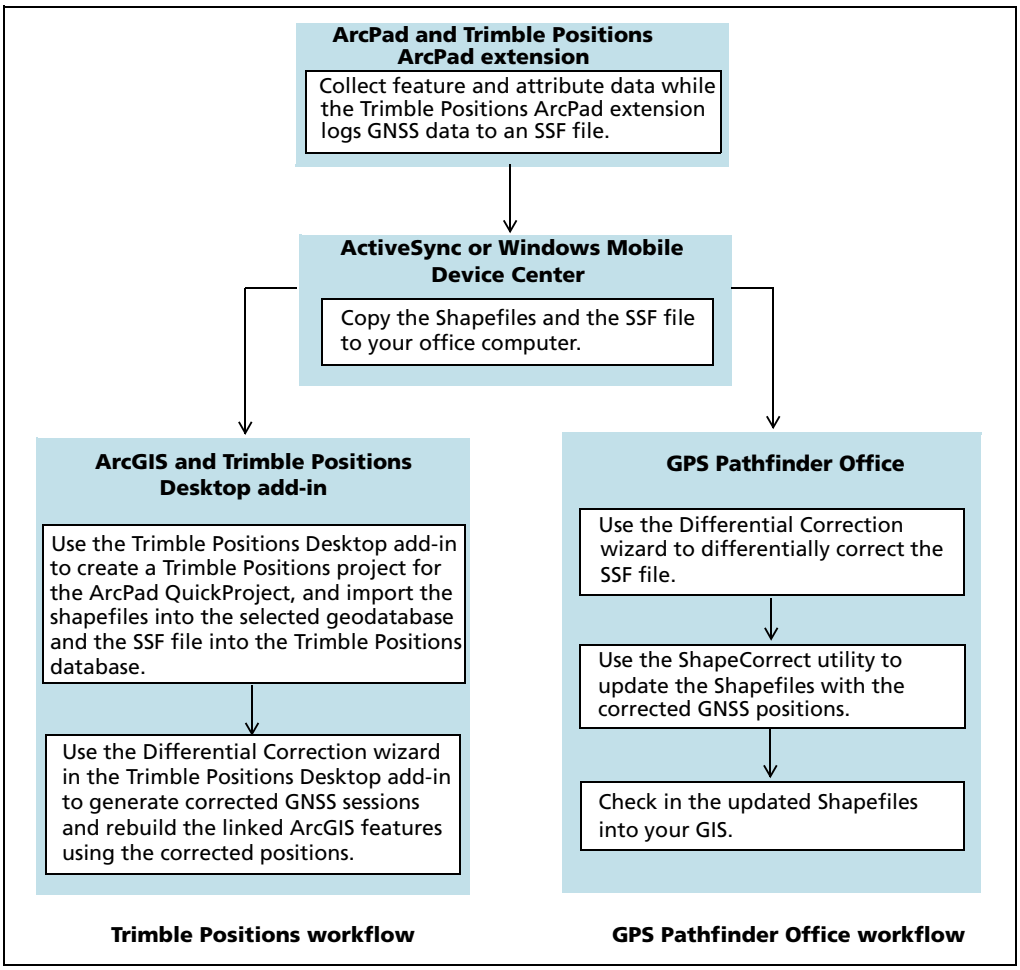
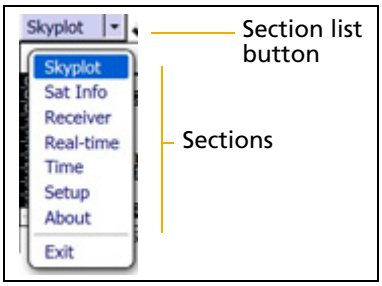


Figure 1.2 Typical workflows: Working with Shapefiles and the Trimble Positions ArcPad extension

Using the Trimble Positions ArcPad extension

The Trimble Positions ArcPad extension runs automatically in the background when you start ArcPad, and controls communication between the ArcPad software and the GNSS receiver.



Whenever the Trimble Positions ArcPad extension user interface (UI) is open, one of the 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 forms or screens. To switch to a different section, tap the Section list button and then select a section from the drop-down list. To close the Trimble Positions ArcPad extension UI and return to ArcPad, tap in the Status bar.

The Trimble Positions ArcPad extension continues to communicate with the GNSS receiver, using any settings you have configured in the UI.

The sections in the Trimble Positions ArcPad extension enable you to:

- View summary or detailed information about the GNSS receiver, configured real-time sources, and the location and health of the satellites your receiver is tracking. For more information, see:
  - Skyplot section, page 36
  - Satellite Information section, page 41
  - Receiver section, page 42
  - Real-time section, page 44

  Within these sections you can change GNSS settings or access GNSS and real-time settings in the Setup section. See GNSS settings area, page 40.
- Display the current UTC time. See UTC Time section, page 51.
- Control how the Trimble Positions ArcPad extension interacts with the GNSS receiver and any real-time differential correction sources, and define logging settings for postprocessing the data files that you collect in the ArcPad software. For more information, see Setup section, page 51.
- View copyright, licensing, and version information. See About section, page 65.

Related information

Installation and licensing

The *Trimble Positions ArcPad Extension Administration Guide* describes how the Positions ArcPad extension should be installed and licensed.

Release Notes

The *Trimble Positions ArcPad Extension Release Notes* describe new features in this version of the software and any changes to the documentation, and provide any information not included in the product documentation.

The release notes are provided as a PDF file on the Trimble website, www.trimble.com/mappingGIS/trimblepositions.aspx, under Documentation.

Technical assistance

If you have a problem and cannot find the information you need in the product documentation, contact your Trimble reseller.

Technical support

Go to the Trimble Positions ArcPad extension technical support page (www.trimble.com/mappingGIS/trimblepositions.aspx) for the latest support information about the software, including:

- support notes detailing the latest support issues
- documentation
- the latest files available for download

Windows error reporting

If for any reason a Windows Error Reporting dialog appears, indicating that the Trimble Positions ArcPad extension has encountered a problem and needs to close, you are asked whether you wish to send an error report to Microsoft.

Trimble recommends that you click **Send** and then click any subsequent links that are used to obtain additional information.

Trimble can access the report that is sent to Microsoft and use it to improve the Trimble Positions ArcPad extension.

CHAPTER

2

Connecting to a GNSS receiver

In this chapter:

This chapter describes how to start the Trimble Positions ArcPad extension on a handheld powered by the Windows Mobile® operating system or Windows Embedded Handheld operating system.

It also describes how to connect to and configure a supported Trimble GNSS receiver.

Compatible GNSS receivers

For a definitive list of supported receivers, refer to the Compatibility Matrix at http://trl.trimble.com/dscgi/ds.py/Get/File-160913/.

Connecting to a GNSS receiver

You can connect the GNSS receiver to a port on the field computer using one of the options described in the table below.

Port	Connection method
Bluetooth port	Use the Bluetooth management software provided with your field computer and the GNSS receiver to configure and then establish the Bluetooth wireless connection.
Standard RS-232 serial (COM) port	Connect the GNSS receiver cable to the curly straight-through cable. Trimble recommends that you use the cable with P/N 45052. Connect the curly straight-through cable to the field computer.

CHAPTER

3

Collecting and Processing Data

In this chapter:

This chapter provides step-by-step instructions for key tasks when preparing for data collection, collecting data, and processing data collected using the Trimble Positions ArcPad extension.

Note – *For detailed information on other tasks, refer to the documentation for the product used to perform the task.*

Preparing for data collection

Before you collect any data, configure the Esri ArcPad software to use the Trimble Positions protocol. Then use the Trimble Positions ArcPad extension to configure GNSS settings, select real-time correction sources if required, and enable GNSS logging to SSF.

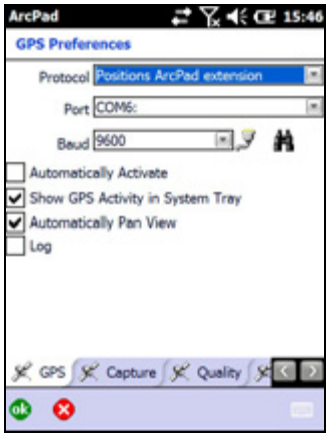
ArcPad settings

To connect to a Trimble GNSS receiver, you must specify the correct communications protocol and settings in ArcPad:

1. On the taskbar, tap and then tap the *ArcPad* *icon.*
2. On the main toolbar, tap the arrow beside the GPS Position Window button and then select *GPS Preferences.*

   The *GPS Preferences* dialog appears.

3. Select the *GPS* tab.
4. From the *Protocol* drop-down list, select Positions ArcPad extension.
5. In the *Port* field, select the port that the GNSS receiver is connected to.
6. If you want the Trimble Positions ArcPad extension to connect to the GNSS receiver whenever ArcPad starts, select the *Automatically Activate* check box.
7. Tap the *GPS Height* tab and then set the *Antenna Height* field to the height of the antenna that is connected to the GNSS receiver. The Trimble Positions ArcPad extension uses the value specified in this field.



Note – *To specify the antenna type and measurement location, use the Antenna Settings form in the Trimble Positions ArcPad extension.*

8. Tap **OK**.

Note – *To use the Trimble Positions ArcPad extension with ArcPad, only the settings detailed above are essential. However, other settings in this dialog either affect the way that the Trimble Positions ArcPad extension operates, or are overridden by settings in the Trimble Positions ArcPad extension. See* *Forms and Controls, page 33*.

Trimble Positions ArcPad extension settings

The Trimble Positions ArcPad extension lets you configure:

- GNSS quality control settings
- real-time differential correction sources
- the type of GNSS data you want to collect

Configuring GNSS settings and accuracy display settings

Use the Setup section in the Trimble Positions ArcPad extension to configure GNSS and real-time correction source settings:

1. In ArcPad, tap the arrow beside the GPS Position Window button and then select *GPS tools* > *Trimble Positions*, or tap the Trimble Positions ArcPad extension button . The Skyplot section of the Trimble Positions ArcPad extension appears.
2. To configure GNSS settings, do one of the following:
   - Use Smart Settings. Using Smart Settings, 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. Smart Settings increase the precision of your data, and minimize the effect of atmospheric interference and poor satellite geometry.

     To select Smart Settings, tap the Setup button in the Skyplot section, or tap the arrow on the Section button next to the status bar and from the drop-down list select *Setup* to open the Setup section. Then tap the **GNSS Settings** button and configure your settings. For more information, see GNSS Settings form, page 54.

     When the Smart Settings option is selected, all other fields in the form are hidden.

Note – *Trimble recommends that you use accuracy-based logging (**Accuracy Settings form, page 56**) and Smart Settings to control the quality of the GNSS positions logged and let the Trimble Positions ArcPad extension manage the logging of positions based on your required accuracy.*

   - Specify custom GNSS settings, including configuring accuracy display settings, tap the Setup button in the Skyplot section, or tap the arrow on the Section button next to the status bar and from the drop-down list select *Setup* to open the Setup section. Then tap the **GNSS Settings** button and configure your settings. For more information, see GNSS Settings form, page 54.

3. To change how the estimated accuracy is displayed in the status bar, tap the Setup button below the *Accuracy Settings* field. The *Accuracy Settings* form appears.

   a. In the *Accuracy Value For Display/Logging* fields, select the parameters that will be used to determine the estimated accuracy:

      –Select whether to use the horizontal or vertical accuracy of the current GNSS position.

      –Select *In the field* to use the current estimated accuracy (recommended if you are using a real-time correction source), or select *Postprocessed* to use the predicted accuracy that will be achieved after the field data has been postprocessed.

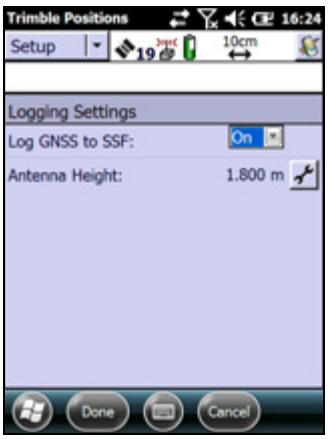
   b. If you selected *Postprocessed*, select the estimated distance to the base station that will be used for postprocessing from the *Postprocessing Base Distance* field. Also, specify if your base data is GPS only, or GPS and GLONASS.

   c. Tap **OK** to return to the *GNSS Settings* form.

Enabling SSF logging

To enable logging of GNSS data to an SSF file:

1. Tap the Section list button and then select *Setup*.
2. Tap the **Logging Settings** button. The *Logging Settings* form appears.
3. From the *Log GNSS to SSF* field, select On.
4. The *Antenna Height* field displays the antenna height set in the *GPS Preferences* dialog in ArcPad. Tap the Setup button beside this field to open the *Antenna Settings* form, where you can configure the antenna type and measurement settings. To configure the antenna height, use the ArcPad *GPS Preferences* dialog.
5. Tap **Done**.



Setting up a real-time differential correction source

GNSS positioning can be made more accurate either through postprocessed differential correction after data collection, (see Postprocessing the Data, page 31) or directly in the field using real-time differential correction.

If your data files contain autonomous (uncorrected) positions as well as real-time corrected positions, Trimble recommends that you postprocess the data. During postprocessing, you can choose whether to correct only autonomous positions, or all positions. In general, recorrecting positions corrected in real-time will have little effect on the accuracy of your data.

Use the real-time status screens in the Status section to check the status of any configured real-time correction source.

Use the *Real-time Settings* form to select the real-time differential GNSS sources that you use, if any, and to configure how your system communicates with each source:

1. Open the *Real-time Settings* form. To do this, do one of the following:
   - In the Setup section, tap **Real-time Settings**.
   - In any screen in the Real-time section, tap the Setup button .
2. In the Choice 1 field, select the real-time correction source that you would prefer to receive real-time corrections from. Depending on the type of GNSS receiver you are using, the options are:

Source	Description
External Source	Use corrections from an external correction source.
Integrated OmniSTAR	This option only appears if the connected GNSS receiver is a GPS Pathfinder ProXRT receiver. Use corrections from a satellite differential correction service, using the GNSS receiver's integrated OmniSTAR receiver.
Integrated SBAS	Use corrections from a Satellite Based Augmentation System (SBAS) using the GNSS receiver's integrated SBAS receiver.
Use Uncorrected GNSS	Log autonomous GNSS positions without applying real-time corrections.
Wait for Real-time	Suspend logging until a real-time correction source becomes available.

   To record ***uncorrected*** GNSS positions only, without using any real-time corrections, select Use Uncorrected GNSS in the *Choice 1* field. You can correct these positions using Trimble postprocessing software.
3. If a Setup button appears next to the Choice 1 field, click the Setup button to open the relevant dialog and set up options for the selected real-time correction source. For more information, see:
   - External Source Settings form, page 59
   - Integrated SBAS Settings form, page 64
   - Integrated OmniSTAR Settings form, page 65

Note – *No Setup button appears for the Use Uncorrected GNSS and Wait for Real-time selections. There are no settings to configure for these selections.*

4. If you want to configure a second source for real-time corrections if your first choice is not available, select the type of source in the Choice 2 field.

Note – *The Choice 2, Choice 3, and Choice 4 fields only appear if there are further options to choose from. For example, if you choose Use Uncorrected GNSS in the Choice 1 field, there are no further valid choices, and the Choice 2, Choice 3, and Choice 4 fields do not appear.*

5. Repeat steps 2 and 3 for all the choice fields that appear, or until you have selected all the real-time correction sources that you want to use. For information about valid combinations of real-time correction sources, see Table 3.1 on page 19.
6. If the *Real-Time Age Limit* field appears, select a maximum age at which a correction message will be used.
7. Click **OK**.

It is important that you set up all of the choices correctly, so that when the Trimble Positions ArcPad extension switches between choices it can continue to receive corrections.

The Trimble Positions ArcPad extension 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 Trimble Positions ArcPad extension switches to the next choice. Whenever the Trimble Positions ArcPad extension acquires a higher priority real-time source, it switches back to this source. For example, the Trimble Positions ArcPad extension will not use your third choice if your first choice is available.

Note – *When switching between real-time sources, the corrected position will be in terms of the reference coordinate datum of the correction source. ArcPad treats the real-time corrected GNSS positions as though they were in terms of WGS-1984, and this could cause issues when multiple real-time sources are used. For best results, always postprocess using base stations with coordinates specified in the same reference datum.*

Valid combinations of real-time correction sources

The Choice fields let you select up to four options for real-time corrections. However, there are restrictions on the correction combinations you can select. For example, External Source can only ever be selected in the Choice 1 field. Also, the last (least preferred) choice you make must be either Use Uncorrected GPS or Wait for Real-time.

Once you select either of these options in a Choice field, there are no further logical choices you can make, so the subsequent Choice fields disappear.

You do not have to remember which combinations are valid: the Trimble Positions ArcPad extension manages this for you by hiding invalid options or Choice fields depending on your previous choices.

The software also ensures that you do not select choices that are not valid for the connected receiver. For example, if the connected receiver is a GeoExplorer series handheld, only the External Source, Integrated SBAS, and Use Uncorrected GNSS options are available in the Choice 1 field. If you then select Integrated SBAS in the Choice 1 field, the only options available in the Choice 2 field are Use Uncorrected GNSS and Wait for Real-time.

If you have configured an invalid real-time combination before connecting the GNSS receiver, a warning message appears when you connect to GNSS, telling you to check your real-time settings. When you open the Real-time Settings form, the only changes you can make to your real-time settings are those that are compatible with the connected receiver.

Table 3.1 summarizes the valid combinations of real-time correction sources.

Table 3.1 Real-time Settings form: Valid real-time correction choices

Choice 1	Choice 2	Choice 3	Choice 4
External Source	Integrated OmniSTAR	Integrated SBAS	Use Uncorrected GNSS
			Wait for Real-time
		Use Uncorrected GNSS	–
		Wait for Real-time	–
	Integrated SBAS	Use Uncorrected GNSS	–
		Wait for Real-time	–
	Use Uncorrected GNSS	–	–
	Wait for Real-time	–	–
Integrated OmniSTAR	Integrated SBAS	Use Uncorrected GNSS	–
		Wait for Real-time	–
	Use Uncorrected GNSS	–	–
	Wait for Real-time	–	–
Integrated SBAS	Use Uncorrected GNSS	–	–
	Wait for Real-time	–	–
Use Uncorrected GNSS	–	–	–

Using corrections from a VRS network

A virtual reference station network consists of GNSS hardware, software, and communication links. It uses data from a network of base stations to provide roving receivers with corrections that are more accurate than corrections from a single base station.

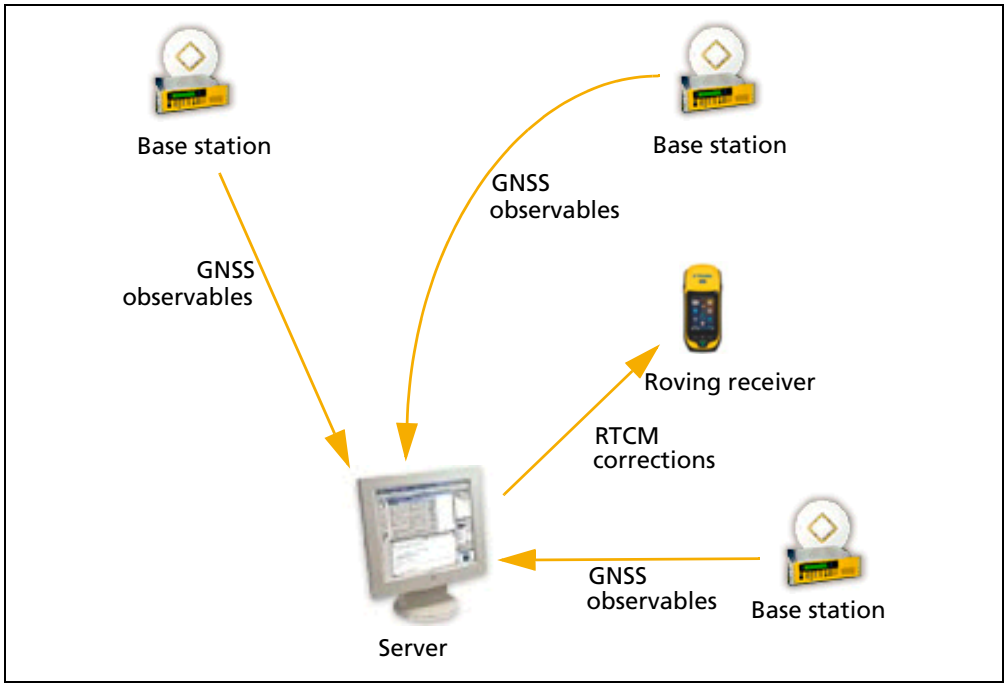


Figure 3.3 Parts of a VRS network

The server is a computer running VRS software such as the Trimble GPSNet™ software. The server uses the base station data to model systematic ephemeris, tropospheric, and ionospheric errors at the roving receiver's position. It then sends interpolated correction messages back to the roving receiver.

Depending on the VRS software, the server may also use the data from the base station network to simulate a base station (or virtual reference station) at the location of the roving receiver.

If no network corrections are available, the server may switch to raw mode. In raw mode the server simply relays the corrections from the single physical base station that is closest to the roving receiver.

Unlike other real-time correction sources, using corrections from a VRS network requires two-way communication between the server 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. Because the VRS network generates a unique virtual reference station for each roving receiver, the server must send separate corrections to each roving receiver.

You can use real-time corrections from a VRS network with:

- Geo 7 series handhelds

- GeoExplorer 3000 and 6000 series handhelds:
  - GeoXH handheld
  - GeoXT handheld
- Geo 5T handhelds
- Trimble Pro series receivers:
  - Pro 6T receiver
  - Pro 6H receiver
  - GPS Pathfinder ProXT receiver
  - GPS Pathfinder ProXH receiver
  - GPS Pathfinder ProXRT receiver

You can connect the roving receiver to the VRS network using an Internet connection or a direct dial connection.

Because an Internet connection is more commonly used, the following section describes how to connect to a VRS network using an Internet connection.

For more information on configuring a direct dial connection, see External Source Settings form, page 59.

Connecting to a VRS network using an Internet connection

You can use an existing Internet connection on the field computer to connect to a single base station or a VRS network that is transmitting corrections over the Internet.

You can connect to the Internet in a number of ways, including using the optional integrated modem, Wi-Fi (an 802.11b connection), or a Bluetooth wireless connection to a Bluetooth-enabled cellular phone.

Once connected, open an application, for example, Internet Explorer, to test the connection. Some applications automatically launch the connection when you start the application, if a current connection is not already established.

Note – *The Trimble Positions ArcPad extension does not control or configure the Internet connection. In the software, you only specify the IP address or URL of the VRS network, and the port on the server to connect to.*

Connecting to a cellular network from the modem

If the handheld you are using has an integrated cellular modem, use the modem to connect to a cellular network and access the Internet.

To connect to a cellular network using the modem:

1. Configure the connection to the network. This can be Automatic or Manual.
2. Connect to the cellular network.

Before you begin the steps below, Trimble recommends that you:

- make sure that a SIM card is inserted in the handheld.
- confirm that the modem can access the Internet directly. If necessary, contact your service provider and confirm whether you must enter a user name, password, and domain details when connecting.
- make sure that you have the correct APN (Access Point Name) from your cellular provider.

Step 1: Configure the connection

To set up an automatic configuration:

1. Tap / *Settings* / *Connections* / *Wireless Manager*. If the Phone is Off, tap Phone to turn it on.
2. Tap / *Settings* / *Connections* / *Connections*.
3. On the Connections screen, on the Tasks tab, tap *Automatically configure connection*.

   The device holds a database of the most common cellular providers and the correct connection settings. The handheld will attempt to identify the SIM vendor.
4. If the SIM vendor is recognised correctly, tap **Next** to continue. The connection settings are set up automatically. The process takes about 30 seconds.

   If the SIM is not automatically detected, or the vendor settings are not known you will need to set up the configuration manually.

To set up a manual configuration:

1. Tap / *Settings* / *Connections* / *Wireless Manager*. If the Phone is Off, tap Phone to turn it on.
2. Tap / *Settings* / *Connections* / *Connections*.
3. Under Tasks, tap *Add a new modem connection*.
4. Enter a name for the connection, for example **My Connection.**
5. In the *Select a modem* field, select **Cellular Line (WWAN)** and then tap **Next**.
6. Enter the APN provided by your cellular provider (check with your provider first for correct settings, some providers have multiple APN settings).
7. Tap **Next**.
8. Enter a username password and domain if required (check with your provider, these are often not required). If not required, leave these fields empty.
9. Tap **Finished**.

Step 2: Connect to the cellular network:

1. Tap / *Settings* / *Connections* / *Wireless Manager*. If the Phone is Off, tap Phone to turn it on.
2. Tap / *Settings* / *Connections* / *Connections*.
3. Under Tasks, tap *Manage existing connections*. The configured connections are listed.
4. Tap and hold the connection that you want to use. Tap *Connect* from the pop-up menu.

   The task bar shows the "connecting" icon, for example . When the connection is open/established, the task bar shows the "connected" icon, for example . The icons shown depend on the network. For more details, refer to the user guide for your handheld.

Connecting to a cellular network using the Bluetooth radio

If the handheld you are using does not have an integrated cellular modem, connect to the Internet using the Bluetooth radio to connect to a Bluetooth-enabled cellular phone and then connect to the Internet.

Note – *Some cellular phones support the Bluetooth PAN (Personal Area Networking) service as well as the Bluetooth DUN (Dialup Networking) service. Because DUN connections are more common, this section assumes you are making a dialup network connection with the Bluetooth-enabled phone.*

To connect to a Bluetooth-enabled phone using a Bluetooth DUN (Dialup Networking) connection, you must:

1. Connect the field computer to a Bluetooth-enabled phone and then configure the connection to the dialup network.
2. Connect to the Internet using the dialup network.

Note – *Before you begin the steps below, Trimble recommends that you confirm that the phone can access the Internet directly. If necessary, contact the cellular phone provider and confirm whether you must enter a user name, password, and domain details when connecting an external device to the phone using Bluetooth dialup networking.*

Step 1: Connecting the GNSS receiver to the field computer

If you are not using a field computer that has an integrated GNSS receiver, connect the GNSS receiver to the field computer. For more information, refer to the documentation provided with the receiver.

Step 2: Connecting the field computer to the phone and configuring the connection to the dialup network

1. Make sure that the field computer and the phone are within five meters of each other, and that the Bluetooth radio in each device is turned on.
2. On the field computer, tap / *Settings* / *Connections* / *Connections*.
3. Below ***Proxy Internet***, tap *Add a new modem connection*.
4. Enter the name for the connection. For example, enter the name of the phone or the VRS network that you will connect to.

5. From the *Select a Modem* drop-down list, select ***Bluetooth*** and then tap **Next**.
6. If the phone you want to connect to is:
   - listed, go to Step 7 below.
   - not listed:
     a. Tap *Add new device* or *New Partnership*. The field computer searches for other Bluetooth devices and displays them in the list.
     b. From the list of available devices, select the phone you want to connect to and then tap **Next** on the right softkey.
     c. To pair with the phone, enter a passcode of your choice that you will easily remember onto the field computer and then tap **Next** on the right softkey.
     d. When prompted by the phone, enter the same password and then accept the connection.
     e. On the field computer, in the *Partnership Settings* screen, make sure that ***Dialup Networking (DUN)*** is selected and then tap **Finish** on the right softkey.

     You have now created a partnership between the field computer and the phone so that they can communicate.
7. From the *My Connections* list, select the phone that you want to configure the connection to and then if required tap **Next** on the right softkey.
8. Enter the GPRS access number for the Internet.

   Two of the common GPRS access numbers for cellular phones on GSM networks are *99***1# and *99#. If these access numbers do not work, contact the cellular phone provider to obtain the appropriate number to use.

Note – *You do not need to set up dialing rules or change the Internet connection settings on the phone. The connection settings you enter on the field computer are passed to the phone to use for this connection.*

9. Tap **Next**.
10. Unless the phone provider confirmed that you must enter user name, password, and domain settings to access the Internet, tap **Finish** without entering any information in this screen.

    Otherwise:

    a. Enter the required information.

    b. If the phone provider has told you that you need to change the baud rate or other settings for the connection, tap **Advanced**, configure these settings and then tap **OK** .

    c. Tap **Finish**.

    You are returned to the *Connections* screen.

    You have now configured the dialup networking connection.

Step 3: Connecting to the Internet using the dialup network

1. On the field computer, go to the *Connections* screen, if it is not already open (tap / *Settings* / *Connections* / *Connections)*.
2. Below ***Proxy Internet***, tap *Manage existing connections*.
3. Tap and hold the connection you want to use and then select *Connect*.
4. Unless the phone provider confirmed that you must enter user name, password, and domain settings to access the Internet, tap **OK** without entering any information in this screen. Otherwise, enter the required information and then tap **OK**.
5. If the phone prompts you for confirmation to connect to the Internet, accept the connection.

   The phone dials the configured GPRS access number and then connects to the Internet.

   A Connectivity notification appears on the field computer as the connection is being made.

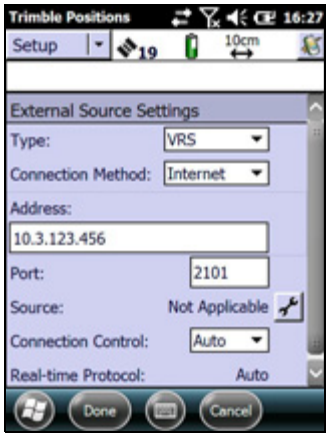
   After the connection is made you are returned to the *My ISP* screen.

To check the connection status at any time, tap the title bar and then tap the required connectivity icon on the pull-down list. To end the connection at any time, tap *Wireless Manager* and then tap the required connection to turn it off.

6. Tap **OK** to close the *Proxy Internet* screen.
7. Tap to close the *Connections* screen.
8. Tap to close the *Settings* screen.

Configuring the Trimble Positions ArcPad extension to use real-time corrections from the Internet source

1. On the field computer, start the Trimble Positions ArcPad extension and then open the *Setup* section.
2. Tap **Real-time Settings**. The *Real-time Settings* form appears.
3. From the *Choice 1* field, select ***External Source***.
4. Configure the external source:



   a. Tap the Setup button beside the *Choice 1* field. The *External Source Settings* form appears.

   b. From the *Type* field, select:

      – ***VRS*** if the real-time correction source is a VRS network.

      – ***Single Base*** if the real-time correction source is a single base station that broadcasts its corrections over the Internet.

   c. From the *Connection Method* field, select ***Internet***.

   d. In the *Address* field, enter the IP address or URL of the VRS network or the server that is supplying the corrections from the VRS network.

      Typically, the IP address or URL of a VRS network has the format 10.3.123.456:1234, where the digits before the colon (:) are the address, and the digits after the colon (:) are the port number.

   e. In the *Port* field, enter the port number that you will use to connect to the server.

   f. If you are connecting to a VRS network through an NTRIP server, tap the Setup button beside the *Source* field. The Trimble Positions ArcPad extension attempts to establish a connection to the NTRIP server. If the connection is successful, the *Select Server* form appears. Select the server that you want to use and then tap **OK** to return to the *External Source Settings* form.

   g. If you selected a VRS network that requires authentication, the *Name* and *Password* fields appear. Enter the user name and password that you obtained from the service provider.

   h. From the *Connection Control* field, select:

      – ***Auto*** if you want the Trimble Positions ArcPad extension to automatically establish and end connections to the VRS network as necessary.

– ***Manual*** if you want to connect or disconnect only when you tap **Ext Source** in the *Setup* screen.

i. Tap **OK** to confirm the settings and return to the *Real-time Settings* form.

5. Tap **Done** to confirm the real-time settings and return to the main screen of the Setup section.

   If you selected ***Auto*** in the *Connection Control* field, the **Ext Source** button is depressed and the software attempts to connect to the server.

6. If you selected ***Manual*** in the *Connection Control* field, tap the **Ext Source** button that appears below the Status bar in the Setup section to connect the Trimble Positions ArcPad extension to the Internet correction source.

Tip – To disconnect or reconnect to the server at any time, tap **Ext Source**. To view the status of the real-time correction source, open the Status section, select the Real-time subsection and then select *External* from the **Summary** list button.

Reconnecting to the Internet

To reconnect to the Internet at any time after setting up the connection, repeat steps 3 through 8 on page 25.

If you selected Auto in the *Connection Control* field of the Trimble Positions ArcPad extension, the extension automatically connects to the Internet source that is providing real-time differential corrections.

To ***manually*** reconnect the Trimble Positions ArcPad extension to the Internet source that is providing real-time differential corrections, open the software and then tap the **Ext Source** button that appears below the status bar in the Setup section.

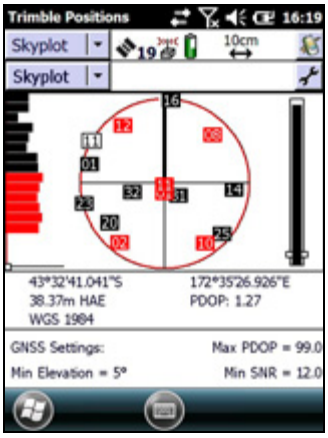
Collecting data

Once you are in the field, use the Trimble Positions ArcPad extension to check GNSS and real-time correction status. Then use ArcPad to collect data as usual.

Checking the GNSS status

When you activate GNSS in ArcPad, the Trimble Positions ArcPad extension connects to the GNSS receiver, and begins to track visible satellites and to calculate its current position.

You can configure ArcPad to activate GNSS automatically whenever it runs. See ArcPad settings, page 14.



To activate GNSS manually, tap the arrow beside the GPS Position Window button and then select *GPS Active*.

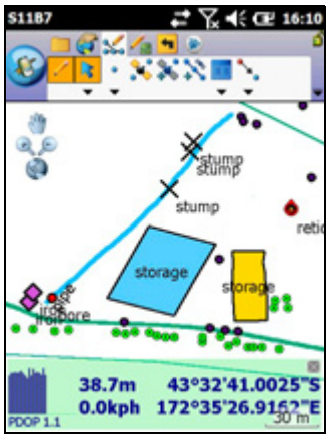
Move to a location where you have a clear view of the sky, and then use the satellite icon on the status bar to check whether the receiver is computing GNSS positions.

Note – *The number beside the icon indicates how many satellites are being used to compute GNSS positions. If the satellite geometry is too poor to compute positions, the icon flashes. You need at least four satellites to compute GNSS positions.*

The Skyplot section appears when you first run the Trimble Positions ArcPad extension. Use the skyplot to check the satellites that are being tracked and the GNSS solution quality, and to view your current position. See Skyplot section, page 36.

If you are using real-time differential corrections, use the Real-time section to check that you are receiving corrections from the selected source. See Real-time section, page 44.

Collecting data



In general, collecting data with the Trimble Positions ArcPad extension is exactly like collecting data with ArcPad alone. When you have enabled GNSS logging in the Trimble Positions ArcPad extension, GNSS data is logged to an SSF file. Simply create or edit layers and features in ArcPad as usual.

If the map document has been saved, the SSF file is stored, by default, in the same folder as the current ArcPad map (.apm) document. If the map document has not yet been saved, the SSF file is stored in the same location as the AXF file or the first edited Shapefile.

To log GNSS data to an SSF file with the same name as the AXF file, open a new empty map in ArcPad, select *Add Layer* and then select the AXF file. If you use map files, Shapefiles, or a combination of Shape and AXF files, you will be logging to a Positions.SSF file.

Estimated Accuracy icon

As you log features, the Trimble Positions ArcPad extension status bar displays a value in the Estimated Accuracy icon that provides information about the accuracy of the current GNSS position. This same value is also displayed in the status bar in the ArcPad software. The information shown by the Estimated Accuracy icon depends on the parameters configured in the *Accuracy Settings* form (see page 15).

The estimated accuracy value may be:

- the horizontal or the vertical accuracy of the current GNSS position
- the estimated accuracy in the field or the predicted accuracy after postprocessing the current GNSS position

Note – *The value shown depends on several factors, including satellite geometry and the type of GNSS receiver that is connected.*

To show the predicted postprocessed accuracy, there must be a data file open and the software must be logging GNSS positions. 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.

The direction of the arrow indicates whether the estimated accuracy shown is for the horizontal or the vertical accuracy of the current feature.

An arrow with no estimated accuracy value indicates that the software is unable to calculate the estimated accuracy. Tap the icon for more information.

Note – *Regardless of the accuracy indicator parameters set in the Accuracy Settings form, the EPE field in the GNSS Position window in ArcPad always shows the horizontal, in-the-field estimated accuracy.*

Use the Estimated Accuracy icon to help ensure that the features collected will meet your accuracy requirements, either in the field or after postprocessing. When the value shown on the icon reaches the accuracy required for the feature, you can stop logging.

Collecting offsets and traverses using reference points

Reference points are used to collect radial traverses, point feature offsets, and offsets for vertices in lines and polygons.

Note – *To ensure that vertices and features created from reference points can be differentially corrected, log a new GNSS reference point every time you start a new offset or radial traverse.*

To log reference points:

1. Move to the location where you want to log a reference point.
2. From the offset drop-down list, select the Offset Point option or the Radial Traverse option.
3. Use a laser rangefinder to shoot the required offset, or tap on the map at the location where the offset, traversed point feature, or vertex will be.

   The *Point/Vertex* dialog appears.
4. Do one of the following:

- To log a simple (bearing-distance) offset or radial traverse, select the *Offset* tab.
- To log a complex (bearing-bearing or distance-distance) offset, select the *2 Point Offset* tab.

5. Tap the Vertex button next to the required *Reference Point* field. The *Vertex* dialog appears.
6. Tap the GPS button to collect a new GNSS reference point. If you have enabled vertex averaging, a progress bar appears while the software logs the required number of positions.
7. When vertex logging is complete, tap **OK** to close the *Vertex* dialog and return to the *Point/Vertex* dialog.
8. If you are logging a complex offset, repeat steps 1 through 7 to log Reference Point B.
9. Edit the offset properties if necessary (for example, you may need to change the measurement method, offset values, or north reference).
10. Tap the **OK** button.

This is the end of the feature geometry collection for a ***point feature*** or ***offset vertex***. To offset another vertex in the current polyline or polygon feature, repeat the entire procedure, using a new reference point for each offset vertex.

Tip – If you want to log a line or polygon feature with the same offset amount on each vertex, use a simple polyline/polygon offset.

Tip – If you want to log a feature which has all of its vertices offset from the same reference point, use a radial traverse instead of complex offsets.

To log each remaining vertex in a radial traverse:

1. Remain at the same location.
2. There is no need to log a new reference point. To re-use the reference point you have logged, do one of the following:
   - shoot the offset to the vertex with the laser
   - tap the location of the reference point on the map
3. Verify the offset properties, and then tap **OK**.

Postprocessing the data

After you have collected GNSS data, use Trimble postprocessing software to differentially correct the SSF files and apply corrections to the ArcPad AXF file or Shapefiles. You will need to transfer the data to a computer where the software is installed.

Transferring the data

Use either Microsoft ActiveSync technology or the Windows Mobile Device Center to copy data files from the ArcPad folder on the field computer and paste them into a folder on the destination computer. You must copy the AXF and/or Shapefiles and any associated SSF files.

The Trimble Positions ArcPad extension records to a single SSF file, regardless of the number of features you have collected or updated in ArcPad. For example, if you collect two feature types called Roads and Lakes, the files you need to transfer are:

Roads	Lakes	GNSS
Roads.shp	Lakes.shp	TrimblePositions.ssf
Roads.shx	Lakes.shx	
Roads.dbf	Lakes.dbf	

The Trimble Positions Desktop add-in and the GPS Pathfinder Office software do not use the .shx or .dbf files, but you must transfer them anyway.

Postprocessing the Data

For information on importing or checking-in and then postprocessing Trimble Positions ArcPad extension data using the Trimble Positions Desktop add-in, refer to the *Trimble Positions Desktop Add-in User Guide*.

For information on postprocessing Trimble Positions ArcPad extension data and applying corrections to the AXF file or Shapefiles using the Trimble GPS Pathfinder Office software, refer to the *Trimble GPS Pathfinder Office Getting Started Guide*, or the *GPS Pathfinder Office Help*.

CHAPTER

4

Forms and Controls

In this chapter:

This chapter describes the user interface of the Trimble Positions ArcPad extension, and provides reference information about its forms and controls.

Common elements

This section describes the buttons and status bar that are common to all screens in the Trimble Positions ArcPad extension.

Section List button

To access the sections of the Trimble Positions ArcPad extension, tap the Section list button and then select the required section from the drop-down list.

Status bar

The status bar appears at the top of all the Trimble Positions ArcPad extension screens.

Use the ArcPad button in the Status bar to hide the Trimble Positions ArcPad extension user interface and return to ArcPad. Trimble Positions ArcPad extension continues to run when its UI is hidden.

The status bar is always visible, and the icons that are displayed reflect the current status of the system and provide basic information about the status of the GNSS receiver.

Table 4.1 Status bar: Icons

Icon	Name	Description
	Battery icon	The left half of this icon indicates the charge level of the GNSS receiver battery, if one is connected. 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 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.
	External antenna icon	Indicates that an optional external antenna is connected.

Table 4.1 Status bar: Icons (Continued)

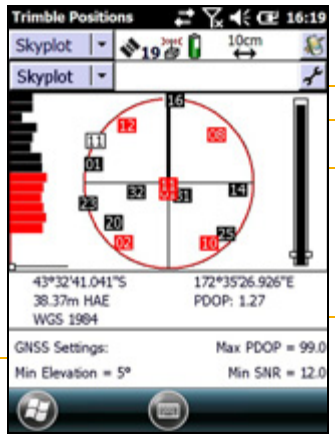
Icon	Name	Description
9	Satellite icon	Shows whether the geometry of the satellites is good or poor, as configured in the GNSS settings area (see GNSS settings area, page 40). The satellite icon flashes when the geometry of the satellites (their PDOP or HDOP) is poor. The number beside the icon indicates how many satellites are being used to compute GNSS positions. The number flashes when not enough satellites are available.
1.7m	Estimated Accuracy icon	Shows the estimated accuracy of the GNSS position. The type of estimated accuracy value shown depends on the parameters set in the *Accuracy Settings* form (see page 56). 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. 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. 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 feature. ***Note –*** *The value shown depends on several factors, including satellite geometry and the type of GNSS receiver that is connected.* An arrow with no estimated accuracy value indicates that the software is unable to calculate the estimated accuracy. Tap the icon for more information.
	Real-time external source icon	Shows that the GNSS receiver is receiving real-time corrections from an external source, such as a radio.
	Real-time VRS network icon	Shows that the Trimble Positions ArcPad extension is receiving real-time differential corrections from a VRS™ network.
	Integrated OmniSTAR icon	Shows that the GNSS receiver's integrated OmniSTAR receiver is receiving real-time corrections from an OmniSTAR satellite differential service.
	Integrated SBAS icon	Shows that the GNSS receiver is receiving real-time corrections from a Satellite Based Augmentation System (SBAS).

Note – *If the real-time signal is lost, the current real-time icon flashes. If no icon is visible, the GNSS receiver is using autonomous GNSS to calculate its position.*

Skyplot section

Use the Skyplot section to view a graphical display of the satellites available to the receiver. The Skyplot section is the default section displayed when you open the Trimble Positions ArcPad extension.

To access the Skyplot section when another section is visible, tap the arrow on the Section button next to the status bar and from the drop-down list select *Skyplot*.



The Skyplot section includes the following items:

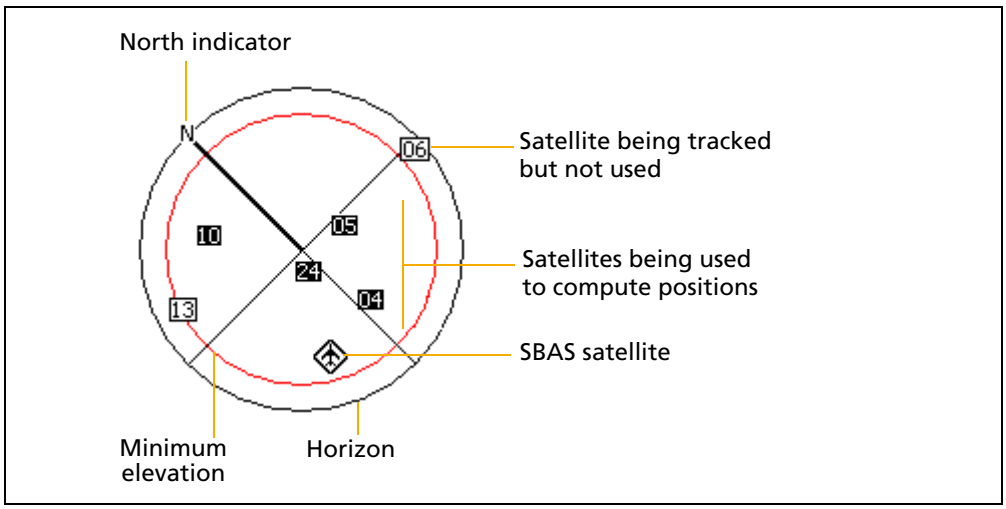
- Skyplot (see page 37)
- SNR graph (see page 38)
- Satellite geometry indicator (see page 38)
- Information fields (see page 39)
- Message line (see page 40)
- GNSS Settings area (see page 40)

The Skyplot section also has a Setup button (see page 46).

Skyplot

When you turn the receiver on, it begins to track visible satellites and to calculate the current position. Once the first position is displayed, subsequent positions are updated once per second.

Tip – If no positions are computed, look for obstructions that might be blocking satellite signals. Move away from any possible obstructions. If the receiver is still not computing positions, see Troubleshooting, page 67.



Numbered boxes represent the satellites currently available to the Trimble Positions ArcPad extension.

- Satellites shown as filled boxes are currently being used by the Trimble Positions ArcPad extension to compute GNSS positions. Supported satellites are GPS, GLONASS, Galileo, Beidou, and QZSS. Each are shown in a different color.
- Satellites shown as empty boxes are being tracked, but are not being used to compute positions (for example, if their elevation is too low).
- Satellites shown without boxes are available, but are not being tracked (for example, if their signal is blocked by a tall building).
- If an SBAS satellite is being tracked, its location is indicated by this icon: .

The black outer circle represents the horizon (at 0°).

The satellites near the center of the circle are higher in the sky (overhead), while those toward the edge are closer to the horizon. The location of a satellite can be determined by noting its direction (N, S, E, W) and its approximate elevation in the skyplot.

The inner circle, which is red on a color screen, represents the configured minimum elevation (see Min Elevation, page 56). When the minimum elevation value is changed, the inner circle of the skyplot changes diameter accordingly.

- If the minimum elevation is increased, the inner circle gets smaller and only those satellites higher in the sky are used to compute GNSS positions.
- If the minimum elevation is decreased, the inner circle gets larger, and satellites closer to the horizon are included when GNSS positions are computed.

The skyplot rotates (like a compass) to indicate the direction that you are travelling in. With most devices the direction is calculated from the last GNSS positions received. If no positions have been received recently, the direction shown may not be correct.

Note – *The skyplot only rotates if you are moving or if your device has orientation sensors that are enabled and calibrated.*

Tap the skyplot to display a tooltip showing details about the area you have tapped. See Tooltips, page 38.

SNR graph

The Signal-to-Noise Ratio (SNR) bar graph to the left of the skyplot is a graphical representation of the L1 frequency signal quality of each satellite that the GNSS receiver is currently using to calculate positions. The satellites being tracked for each GNSS constellation are grouped together and shown with a different color that matches the satellite icons in the Skyplot.

Note – *Satellites that are being tracked but not used to calculate positions are not included in the SNR graph. The signal strength of those satellites is shown under the Satellite Information screen.*

The vertical red line shows the configured minimum SNR value.

Tap the SNR graph to display a tooltip showing details about the area you have tapped. See Tooltips below.

Satellite geometry indicator

The satellite geometry indicator to the right of the skyplot is a graphical representation of the overall quality of the GNSS positions computed. The white horizontal bar shows the configured minimum quality value, and the level of black inside the indicator shows the current quality value.

Tap the satellite geometry indicator to display a tooltip showing details about the area that you tapped. See Tooltips below.

The quality of the computed positions is a function of the geometry of the visible satellites (how they are positioned in the sky relative to each other and you). When the satellites are well spaced, and cover a large portion of the sky, the GNSS receiver can compute accurate positions and the level inside the indicator is high. If satellites are grouped together in the sky, the precision of the computed positions is reduced, and the level inside the indicator is low.

Tooltips

When you tap an item in the Skyplot section, a tooltip appears. The tooltip provides detailed information about the item that you tapped.

Table 4.2 Skyplot section: Tooltips

Skyplot section item	Tooltip
Bar on SNR graph	Satellite pseudo-random number (PRN) and SNR value(s)
White box on indicator below SNR graph	Configured minimum SNR value
Geometry indicator	Current PDOP or HDOP value
Horizontal bar on geometry indicator	Configured maximum PDOP or HDOP value
Satellite on skyplot	Satellite system and PRN, SNR value(s), elevation and bearing
Inner circle on skyplot	Configured minimum elevation value

Information fields

Information fields show the current GNSS position and settings.

Note – *If the screen on the field computer uses a landscape orientation, the information fields appear on the right of the skyplot.*

Table 4.3 Skyplot section: Information fields

Field	Description
GNSS position	The current GNSS position is displayed in terms of the Latitude/Longitude coordinate system. ***Note –*** *Positions viewed on the screen are not saved. To save them, start a feature in ArcPad.*
PDOP	This field only appears if you have configured a maximum PDOP. The Position Dilution of Precision (PDOP) is a numeric value that represents the satellite geometry. If you set a maximum PDOP value (see Max PDOP, page 55), and the PDOP rises above the value you set, the GNSS receiver stops computing positions. To set the maximum PDOP value, tap the Setup button to open the GNSS Settings form (see page 54).
HDOP	This field only appears if you have configured a maximum HDOP. The Horizontal Dilution of Precision (HDOP) represents the horizontal component of the PDOP. If you set a Max HDOP value (see Max HDOP, page 55), and the HDOP rises above the value you set, the GNSS receiver stops computing positions. To set the maximum HDOP value, tap the Setup button to open the GNSS Settings form (see page 54).

Message line

The message line is displayed midway down the Skyplot section, below the skyplot. The message line displays error or warning messages.

Note – *The message line also appears below the table in the Satellite Information section (see page 41).*

Messages only appear when there is a problem or a condition you should be aware of. For example, if satellite geometry is good, no message appears; when it is poor, a message appears.

Table 4.4 Messages

Message	Meaning
GNSS disconnected	The GNSS receiver is not connected.
Attempting to connect to GNSS receiver	The Trimble Positions ArcPad extension is trying to establish a connection with the GNSS receiver. This message appears when you start the Trimble Positions ArcPad extension, and whenever you try to reconnect to GNSS.
Antenna is not connected to GNSS receiver	The GNSS receiver cannot detect the antenna, or the antenna cable is not connected to the GNSS receiver.
Heading locked	The GNSS receiver is stationary or is moving too slowly to calculate an accurate heading , or the integrated orientation sensors are not calibrated and being used. When the heading is locked, the skyplot does not rotate.
Poor satellite geometry	The PDOP or HDOP is higher than the level you specified in the GNSS Settings form (see page 54). ***Note –*** *When the geometry of the satellites is poor, the satellite icon in the Status bar flashes. This icon is always visible, regardless of which section you are in.*
Too few satellites	The receiver is not tracking enough satellites to compute a position. ***Note –*** *When there are too few satellites to compute positions, the number below the satellite icon in the Status bar flashes. This icon is always visible, regardless of which section you are in.*

GNSS settings area

The GNSS settings area appears at the bottom of the Skyplot section and the Satellite Information section (see page 41). It shows the current GNSS settings. GNSS settings can be defined using Smart Settings, or custom settings.

Using Smart Settings

To configure GNSS settings for the receiver to increase the precision of your data, and to minimize the effect of atmospheric interference and poor satellite geometry, select *Use Smart Settings*. All other fields in the form are hidden.

To select Smart Settings, tap the Setup button near the top of the screen to open the *GNSS Settings* form (see page 54). Then select the *Use Smart Settings* check box.

Custom mode

In Custom mode, the GNSS settings area shows the configured limits for PDOP or HDOP, elevation, and SNR. To change to Custom mode, tap the Setup button near the top of the screen to open the *GNSS Settings* form (see page 54). Then clear the *Use Smart Settings* check box.

Satellite Information section

Use the Satellite Information (Sat Info) section to view information about satellites in text form.

To display the Satellite Information section, tap the arrow on the Section button next to the status bar and from the drop-down list select *Sat Info*.

The table below describes the information in each column of the table that appears in the Satellite Information section.

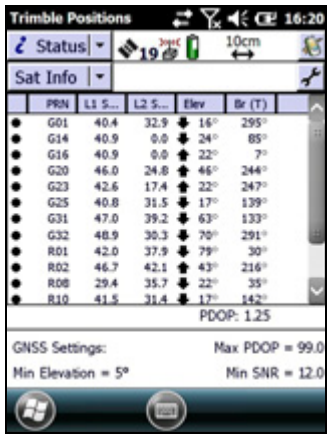


Table 4.5 Satellite Information section: Columns

Column	Description	
Use indicator	Filled circle (●)	Satellite is being used to calculate positions.
	Empty circle (○)	Satellite is being tracked but is not being used to calculate positions (for example, if the satellite's elevation is below the configured minimum elevation).
	No circle	Satellite is available, but is not being tracked by the GNSS receiver (for example, if the satellite's signal is blocked by a tall building).
PRN	The pseudo-random number of each satellite. A satellite is identified by a prefix for each GNSS constellation and its unique PRN.	
L1 SNR	The current signal-to-noise ratio of the L1 signal from each satellite, in dBHz. A satellite that is below the configured *Min SNR* (see page 55) is not used to compute positions.	
L2 SNR	The current signal-to-noise ratio of the L2 signal from each satellite, in dBHz.This column only appears if the connected GNSS receiver is a dual-frequency receiver with a dual-frequency antenna.	
	Note – *If a satellite is marked as "unhealthy" by the GNSS Control Segment, the characters* ***UIH*** *appear in the SNR columns for that satellite.*	
Elev	The current elevation above the horizon of each satellite. A satellite that is below the configured *Min Elevation* (see page 56) is not used to compute positions.	
Br(T)	The current bearing to each satellite. This bearing is shown relative to true north.	

As in the Skyplot section, the following appear at the bottom of the screen:

- Information fields (see page 39)
- Message line (see page 40)
- GNSS Settings area (see page 40)

Information fields

Information fields in the Satellite Information screen show the current GNSS position and settings.

Note – *If the field computer's screen uses the landscape orientation, the information fields appear to the right of the Satellite Information screen.*

Table 4.6 Satellite Information section: Information fields

Field	Description
Almanac	The date of the last almanac received from satellite broadcasts.
PDOP	The current PDOP value, see PDOP, page 55. This field only appears if you have configured a maximum PDOP.
HDOP	The current HDOP value, see Max HDOP, page 55. This field only appears if you have configured a maximum HDOP.

Receiver section

Use the Receiver section to view information about the connected GNSS receiver.

To display the Receiver section, tap the arrow on the Section button next to the status bar and from the drop-down list select *Receiver*.

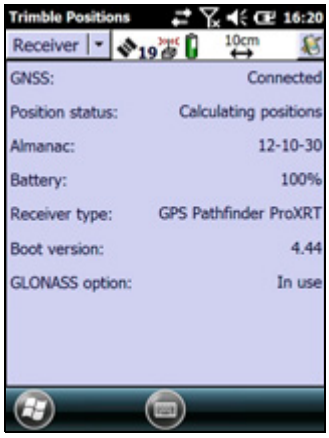


Table 4.7 Receiver section: Fields

Field	Description
GNSS	The current status of the GNSS receiver connection. The options are: • Connected — The Trimble Positions ArcPad extension is connected to the GNSS receiver. • Attempting to connect to GNSS — The Trimble Positions ArcPad extension is trying to connect to the receiver. If this message appears, no other fields appear. • GNSS is disconnected — The receiver has been disconnected from the Trimble Positions ArcPad extension. If this message appears, no other fields appear. • No GNSS detected. Check cables, batteries etc — The Trimble Positions ArcPad extension has failed to detect the receiver, because it is not connected to the port specified in the *GNSS Settings* form (see page 54), or has no power. If this message appears, no other fields appear.
Antenna	Shows Connected if the Trimble Positions ArcPad extension is connected to a GNSS receiver, and the receiver is connected to a GNSS antenna. The antenna icon also appears in the status bar If no antenna is connected, this does not appear on the screen.
Position status	An indicator of the GNSS status. The options are: • Calculating positions — The receiver is computing GNSS position fixes. The current satellite constellation is therefore acceptable. • Poor satellite geometry — The current PDOP or HDOP value is greater than the maximum value, so the GNSS receiver is not computing GNSS positions. • Too few satellites — The GNSS receiver has acquired satellites, but has not acquired enough satellites to compute a position. • Unavailable — No position is available. For example, there may be no antenna connected to the receiver.
Almanac	The date of the almanac.
Battery	The current level of charge in the GNSS receiver battery. This value appears as a percentage.
Receiver type	The name of the receiver model currently connected to the field computer.
Navigation version	The version number of the navigation firmware that is installed in the connected GNSS receiver.
Signal processor version	The version number of the signal processing firmware that is installed in the connected GNSS receiver.
GLONASS option	This field only appears if the connected receiver is able to receive GLONASS signals. Indicates whether the receiver has the GLONASS option installed. If it is installed, the receiver is able to track GLONASS satellites. To control whether the receiver tracks GLONASS satellites or only GPS satellites during your data collection session, set the Use GLONASS field to Auto in the GPS Settings form.

Real-time section

Use the screens in the Real-time section to view information about the real-time correction sources you have set up.

To view real-time information, tap the arrow on the Section button next to the status bar and from the drop-down list select *Real-time*.

By default, the real-time information screen that appears is the *Real-time Summary* screen. Depending on the real-time correction sources that you have set up, the following detailed status screens may also be available:

- *External Source* status screen (see page 46)
- *Integrated OmniSTAR* status screen (see page 47)
- *Integrated SBAS* status screen (see page 49)

Use the Summary list button to move between the real-time status screens. When you tap the Summary list button, a list of status screens appears. Select an option to open the corresponding screen.

Real-time Summary screen

The *Real-time Summary* screen contains a heading for each real-time correction source you have set up. The heading shows the name of the source. The heading shows the type of correction source. The order of the correction sources matches the order of the choices you have made in the Setup section using the *Real-time Settings* form (see page 57).

The correction source currently in use for real-time differential corrections has an icon beside its name. The icon used matches the icon that appears in the status bar.

If no icon is shown, the Trimble Positions ArcPad extension is either waiting for real-time corrections to resume, or is logging uncorrected positions. If real-time corrections are not available, the real-time icon in the status bar flashes.

For more information about the summary information provided for each real-time correction source in the *Real-time Summary* screen, see Table 4.8 through Table 4.10 on pages 45 through 46.

For full status information on any source you have configured, tap the Summary list button and select the source name. The screen also includes a Setup button below the status bar for quick access to real-time correction source settings in the *Real-time Settings* form (see page 57).

Table 4.8 Real-time Summary screen: External Source fields

Field	Description
External Source	The status of the External Source real-time correction source. The options are: • In use — This source is being used for real-time differential corrections. • Waiting — This source is configured but a lower-ranked choice is currently in use. The status of the source is being monitored and the Trimble Positions ArcPad extension will switch to this source if it becomes available and is the highest-ranked available source. • (none) — This source is configured but is not being monitored or used. When the GNSS receiver is using an external source for real-time corrections, the following icon appears to the left of this field: • if the external source is a single base • if the external source is a VRS network

Table 4.9 Real-time Summary screen: Integrated OmniSTAR fields

Field	Description
Integrated OmniSTAR	The status of the Integrated OmniSTAR real-time correction source. The options are the same as the options for the *External Source* status field (see Table 4.8). When the GNSS receiver is using an integrated OmniSTAR receiver for real-time corrections, the integrated OmniSTAR icon appears to the left of this field.
Service Provider	The name of the satellite differential service provider that the satellite in use belongs to.
Frequency	The current satellite frequency being tracked or locked on to.
State	The real-time operating status of the integrated OmniSTAR receiver.
Service Level	***Note –*** *This field only appears if the connected receiver is a GPS Pathfinder ProXRT receiver.* The current level of service. When you first connect to the OmniSTAR service, the Service Level field always shows VBS. If you have subscribed to a higher service level, this field is automatically updated to XP or HP once that service level is reached.
SNR	The signal-to-noise ratio of the satellite signal that is being monitored.

Table 4.10 Real-time Summary screen: SBAS fields

Field	Description
Integrated SBAS	The status of the Integrated SBAS real-time correction source. The options are the same as the options for the *External Source* status field (see Table 4.8), with the addition of • Not supported - The connected GNSS receiver does not support real-time differential corrections from this source. When the GNSS receiver is using an integrated SBAS receiver for real-time corrections, the integrated SBAS icon appears to the left of this field.
SNR	The signal-to-noise ratio of the SBAS satellite signal that is being monitored.

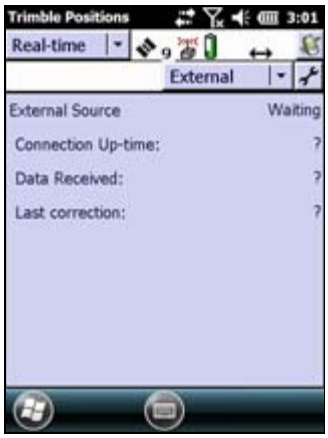
Setup button

A Setup button below the status bar in each screen in the Real-time section provides a shortcut to the *Real-time Settings* form (see page 57) in the Setup section.

To configure real-time settings, tap the Setup button. The *Real-time Settings* form appears. Make any changes you require, and then tap **OK** to return to the status screen for the real-time correction source.

External Source status screen

The *External Source* status screen shows detailed information about the external real-time correction source you have set up.



To display the *External Source* status screen, tap the arrow on the Section button next to the status bar and from the drop-down list select *Real-time* to open the Real-time section. Then tap the arrow on the Summary list button below the status bar, and from the drop-down list select *External*.

Table 4.11 External Source status screen: Fields

Field	Description
External Source	The status of the external real-time correction source. The options are: • In use — The external real-time correction source is currently being used to correct positions in real time. • Waiting — A lower-ranked choice is currently being used to correct positions in real time. The status of the external source is being monitored and the Trimble Positions ArcPad extension will switch to the external source if it becomes available and it is the highest-ranked available source. • Not in use — The external real-time correction source is set up but is not currently being used for real-time differential corrections.

Table 4.11 External Source status screen: Fields (Continued)

Field	Description
Correction Type	This field only appears if the external source is a VRS network. The type of correction being received from the VRS network. The options are: • Network — The VRS network is providing a network solution, using corrections from more than one base station to calculate the position of the roving receiver. • Single Station — The VRS network is operating in raw mode, and is using only one base station to provide real-time differential corrections.
Connection Up-time	This field only appears if the external source is a VRS network. The duration, in hours, minutes, and seconds, of the current connection to the VRS network.
Data Received	This field only appears if the external source is a VRS network. The amount of data, in megabytes, kilobytes, or bytes as appropriate, that has been sent and received since the connection was established.
Last correction	The time, in seconds, since the last correction message from this source was received by the GNSS receiver.

Integrated OmniSTAR status screen

The *Integrated OmniSTAR* status screen shows detailed information about the satellite differential service you have set up as a real-time correction source.

To display the *Integrated OmniSTAR* status screen, tap the arrow on the Section button next to the status bar and from the drop-down list select *Real-time* to open the Real-time section. Then tap the arrow on the Summary list button below the status bar, and from the drop-down list select *OmniSTAR*.

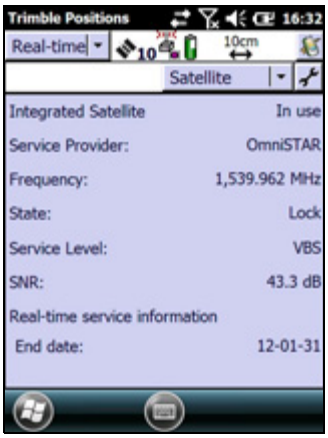


Table 4.12 Integrated OmniSTAR status screen: Fields

Field	Description
Integrated OmniSTAR	The status of this real-time correction source. The options are: • In use — A satellite differential service is being used to correct positions in real time. • Waiting — A lower-ranked choice is currently being used to correct positions in real time. The status of the satellite differential service is being monitored and the Trimble Positions ArcPad extension will switch to the satellite source if it becomes available and it is the highest-ranked available source. • Not in use — A satellite differential service is set up as a real-time correction source but is not currently being used for real-time differential corrections. • Not supported — The connected GNSS receiver does not support corrections from a satellite differential service.
Service Provider	The name of the provider of the OmniSTAR satellite differential service being used.
Frequency	The current satellite frequency being tracked or locked on to.
State	The operating state of the integrated OmniSTAR receiver. Select an option from the drop-down list.
Service Level	***Note –*** *This field only appears if the connected receiver is a GPS Pathfinder ProXRT receiver.* The current level of service. When you first connect to the OmniSTAR service, the Service Level field always shows VBS. If you have subscribed to a higher service level, this field is automatically updated to XP or HP once that service level is reached.
SNR	***Note –*** *This field does* ***not*** *appear if the connected receiver is a GPS Pathfinder ProXRT receiver.* The signal-to-noise ratio, in decibels, of the satellite signal being tracked. An SNR above 3.0 dBHz indicates that the signal is usable.
Last correction	The time, in seconds, since the last correction message from this source was received by the GNSS receiver.
Real-time Service Information	A heading used to group together fields that contain information about the satellite differential service subscription.
User access	Specifies whether the selected satellite differential service has been enabled for the GNSS receiver. The options are: • Enabled — The service is enabled. • Disabled — The activation has expired. • Unknown — The service has not yet been activated on this receiver, or the receiver has not yet determined the activation status.

Table 4.12 Integrated OmniSTAR status screen: Fields (Continued)

Field	Description
Decoder state	The current status of the satellite activation. The options are: • Initializing — The real-time correction decoder is initializing. • Receiving corrections — The decoder is providing corrections. • No recent data — Real-time correction data has not been received from the decoder in the last 10 seconds. • Decoder unavailable — The decoder is not available or is not operating correctly. • Decoder reset — A reset has been detected in the decoder. • Invalid link — The decoder is using a satellite link that is not valid for the subscription. • Invalid region — The decoder is being used in a region that is not covered by the current subscription. • Update required — The decoder requires an update from the master station before corrections can be provided. • No offshore — The decoder is being used in a marine area but the current subscription does not provide for offshore operation.
Expiration	The date on which the satellite differential service subscription expires, or the time remaining until the subscription expires.
Diagnostic Information	A heading used to group together fields that contain information for troubleshooting the satellite differential service.
Quality figure	The percentage of error-free data received from the satellite differential service in the last data block. This value should be 90% or higher.
Decoder version	The version number of the satellite decoder in the GNSS receiver.

Integrated SBAS status screen

The *Integrated SBAS* status screen shows detailed information about the SBAS correction service you have set up as a real-time correction source.

To display the *Integrated SBAS* status screen, tap the arrow on the Section button next to the status bar and from the drop-down list select *Real-time* to open the Real-time section. Then tap the arrow on the Summary list button below the status bar, and from the drop-down list select *SBAS*.

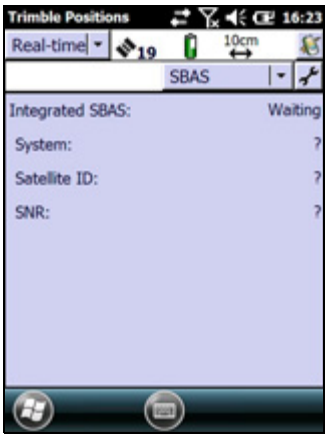


Table 4.13 Integrated SBAS status screen: Fields

Field	Description
Integrated SBAS	The status of this real-time correction source. The options are: • In use — The SBAS real-time correction source is being used to correct positions in real time. • Waiting — A lower-ranked choice is currently being used to correct positions in real time. The status of the SBAS is being monitored and the Trimble Positions ArcPad extension will switch to the SBAS source if it becomes available and it is the highest-ranked available source. • Not in use — The SBAS real-time correction source is set up but is not currently being used for real-time differential corrections. • Not supported — The connected GNSS receiver does not support corrections from an SBAS satellite.
SNR	The signal-to-noise ratio, in decibels, of the selected SBAS satellite signal. An SNR above 3.0 dBHz indicates that the signal is usable.
Last correction	The time, in seconds, since the last correction message from this source was received by the GNSS receiver.
Satellites corrected	***Note –*** *This field only appears if the connected GNSS receiver is a Juno® SA, SB, SC, SD, 3B, 3D, 5B, or 5D handheld, or a Trimble Nomad® 900 G series handheld.* Indicates how many of the GNSS satellites used have SBAS corrections applied to them (the first number), and how many satellites are being used to calculate your position (the second number). If more than 75 % of the satellites used have SBAS corrections, then the Trimble Positions ArcPad extension treats the current GNSS position as SBAS-corrected. Otherwise, the Trimble Positions ArcPad extension treats the position as an autonomous position, and the Integrated SBAS icon in the status bar flashes. If you are within the coverage area of the SBAS system you are using, and the receiver has a clear view of the SBAS and GNSS satellites, the number of SBAS-corrected satellites will usually be above the 75 % threshold.

UTC Time section

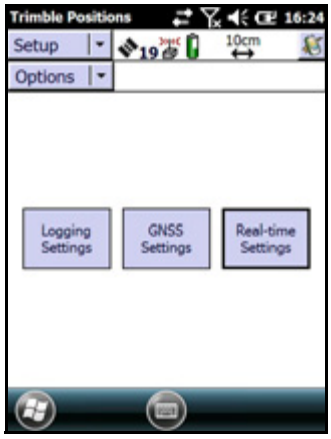
The UTC Time screen shows the current Universal Time Coordinated (UTC) time, calculated from the GPS time reported by the connected GNSS receiver.

To display the UTC Time section, tap the arrow on the Section button next to the status bar and from the drop-down list select *UTC Time*.

Whenever a GNSS receiver is connected, the Trimble Positions ArcPad extension synchronizes its UTC time display every five seconds with the time reported by the GNSS receiver. The UTC time is always up to date when the Trimble Positions ArcPad extension is connected to GNSS.

If the receiver is disconnected, the extension uses the field computer's internal clock to update the UTC time display. However, the internal clock is not as accurate as the GPS time from the receiver, so the time displayed becomes less and less accurate. After 24 hours without synchronization (that is, without reconnecting to GNSS), the UTC time displayed is no longer accurate and is replaced with the message Time not available. Connect to GNSS.

Setup section



Use the *Setup* section to perform common setup tasks, and to access the following forms:

- *Logging Settings* form (see page 52)
- *GNSS Settings* form (see page 54)
- *Real-time Settings* form (see page 57)

To open the Setup section, tap the arrow on the Section button next to the status bar and from the drop-down list select *Setup*. The Setup screen appears.

Table 4.14 Setup screen: Options

Option	Description
Reset GNSS receiver	Resets the GNSS receiver to its default settings. A reset clears the receiver memory, deletes the almanac and any configuration data, and returns the receiver to its default state. ***Note –*** *If the GNSS receiver does not operate as expected after it has been connected to another field computer or another data collection application, reset the receiver. This clears any settings that may prevent it from working properly with the Trimble Positions ArcPad extension.*

Table 4.14 Setup screen: Options

Option	Description
Connect to External Source	Establishes a connection with the configured VRS network. If the Trimble Positions ArcPad extension extension is already connected, this option is not available.
Disconnect from External Source	Disconnects the Trimble Positions ArcPad extension from the VRS network. If the extension is already disconnected, this option is not available.

Table 4.15 Setup screen: Buttons

Button	Description
Ext Source	This button only appears if you have configured a VRS network as the preferred real-time source, the connection method is set to Manual, and ArcPad is connected to GNSS. Connects to or disconnects from the VRS network. This button is a shortcut to the Connect and Disconnect from External Source options (see Table 4.14 below).
Logging Settings	Opens the *Logging Settings* form, see page 52.
GNSS Settings	Opens the *GNSS Settings* form, see page 54.
Real-time Settings	Opens the *Real-time Settings* form, see page 57.

Logging Settings form

Use the *Logging Settings* form to configure settings that control what data is stored, and how.

To open the *Logging Settings* form, tap the arrow on the Section button next to the status bar and from the drop-down list select *Setup* to open the Setup section. Then tap **Logging Settings**.

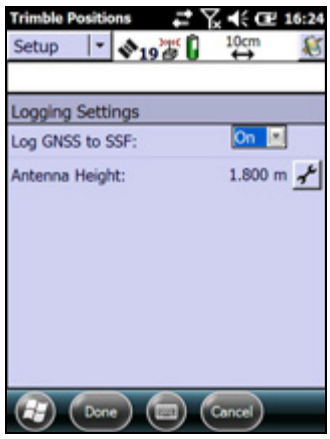


Table 4.16 Logging Settings form: Fields

Field	Default	Description
Log GNSS to SSF	On	This field specifies whether to log GNSS position data to an SSF file.
Antenna Height	0.00 m	This read-only field displays the antenna height set in the *GPS Preferences* dialog in ArcPad. To specify antenna details, tap the Setup button beside this field. The *Antenna Settings* form appears (see page 53).

Antenna Settings form

Use the *Antenna Settings* form to specify the antenna type you want to use, and the height of the antenna.

To open the *Antenna Settings* form, tap the Setup button beside the *Antenna Height* field on the *Logging Settings* form (see page 52).

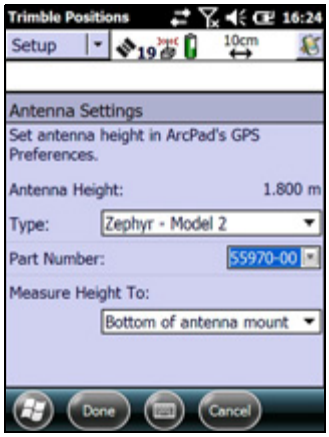
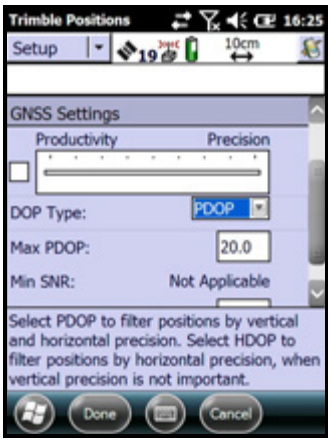


Table 4.17 Antenna Settings form: Fields

Field	Default	Description
Height	0.00 m	This read-only field displays the height of the GNSS antenna connected to the GNSS receiver, that you set in the *GNSS Preferences* dialog in ArcPad. This value is used as a vertical offset on each position.
Type	Unknown External	The type of antenna that is connected to the GNSS receiver. If the Trimble Positions ArcPad extension is connected to a receiver that can only connect to an internal antenna, this field automatically shows the correct antenna type. To specify the antenna that you are using, either select an option from this field, or select the correct part number in the *Part Number* field. When you change a value in one of these two fields, the other field updates accordingly.
Part Number	n/a	The part number of the antenna that is connected to the GNSS receiver. If the receiver can only connect to an internal antenna, this field automatically shows the correct part number. To specify the antenna that you are using, either select an option from this field, or select the correct antenna type in the *Type* field. When you change a value in one of these two fields, the other field updates accordingly.
Measure Height To	Bottom of antenna mount	The point on the antenna that you have measured to. The Trimble Positions ArcPad extension automatically adjusts the antenna height by the distance between the measurement location and the Antenna L1 Phase Center (APC).

GNSS Settings form



Use the *GNSS Settings* form to control the precision you require for GNSS positions.

To open the *GNSS Settings* form, tap the arrow on the Section button next to the status bar and from the drop-down list select *Setup* to open the Setup section. Then tap **GNSS Settings**.

Alternatively, tap the Setup button in the Skyplot section or the Satellite Information section.

Configuring accuracy display settings

The fields below the *Use Smart Settings* check box show the selected parameters for displaying and calculating the estimated accuracy.

To change how the estimated accuracy is displayed in the status bar, tap the Setup button below the *Accuracy Settings* field. The *Accuracy Settings* form appears (see page 56).

Using Smart Settings

Note – *If you are using a Juno SA, SB, SC, SD, 3B, 3D, 5B, or 5D handheld, or a Trimble Nomad G series handheld, you cannot configure GNSS settings. The GNSS slider does not appear, and the settings for these receivers are shown as read-only fields.*

Use Smart Settings to increase the precision of your data, and to minimize the effect of atmospheric interference and poor satellite geometry. When you select *Use Smart Settings*, all other fields in the form are hidden.

Note – *Trimble recommends that you use accuracy-based logging (see Accuracy Settings form, page 56) and Smart Settings to control the quality of the GNSS positions logged and let the Trimble Positions ArcPad extension manage the logging of positions based on your required accuracy.*

Using Smart Settings, 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.

Configuring GNSS settings in Custom mode

To configure GNSS settings in Custom mode, clear the *Use Smart Settings* check box. The remaining fields change to editable numeric fields. Enter values in these fields to specify the required GNSS settings..

Table 4.18 GNSS Settings form: Controls and fields

Field	Default	Description
Accuracy Settings	Horizontal; In the field	This read-only field displays the parameters for displaying and calculating the estimated accuracy set in the Accuracy Settings form. To change the parameters, tap the Setup button below this field. The *Accuracy Settings* form appears (see page 56).
DOP Type	PDOP	This field does not appear if *Use Smart Settings* is selected. To set a DOPtype, use Custom mode. The type of maximum DOP value to use. The options are: • PDOP Set a maximum PDOP. When you select this option, the *Max PDOP* field (see page 55) appears. • HDOP Set a maximum HDOP. When you select this option, the *Max HDOP* (see page 55) appears. A low DOP value indicates that the visible satellites are widely separated in the sky, which gives better position information. When the DOP value rises above the maximum value, the Trimble Positions ArcPad extension stops logging GNSS positions.
Max PDOP	20.0	The maximum PDOP value. A low PDOP value indicates that the visible satellites are widely separated in the sky, which gives better position information. When the PDOP value rises above the maximum value, the GNSS receiver stops logging GNSS positions. Specify a lower maximum PDOP to collect fewer, more precise positions. Specify a higher maximum PDOP to collect more, less precise positions.
Max HDOP	14.0	The maximum HDOP value. This field does not appear if *Use Smart Settings* is selected. To set a maximum HDOP, use Custom mode. Specifying a maximum HDOP can give greater productivity than filtering the solutions with a maximum PDOP. Setting a maximum PDOP rejects some positions that have an acceptable HDOP value, because their VDOP value is unacceptable. When you use a maximum HDOP, these positions are accepted. Use a maximum HDOP value when vertical precision is not particularly important, and productivity would be decreased by excluding positions with a high vertical component in the PDOP value. Do this, for example, when collecting data under canopy. ***Note –*** *To achieve the same precision horizontally as you would achieve with a given maximum PDOP, set this value to two-thirds of the maximum PDOP.*
Min SNR	33	The minimum L1 SNR value. The SNR is a measure of the quality of the signal from a satellite. When the SNR of a satellite falls below the minimum value, the Trimble Positions ArcPad extension stops using that satellite to calculate the GNSS position.

Table 4.18 GNSS Settings form: Controls and fields (Continued)

Field	Default	Description
Min Elevation	5°	The minimum elevation. Signals from satellites that have a low elevation from the horizon can be of poor quality. The Trimble Positions ArcPad extension does not use any satellite that is below the minimum value to calculate the GNSS position.
Velocity Filter	Off	Specifies whether to apply velocity filtering to GNSS positions. Velocity filtering reduces "spikes" in GNSS data that are caused by poor GNSS conditions. The options are: • Auto — Apply velocity filtering. If at least one valid real-time correction source is selected in the choice fields in the *Real-time Settings* form, and the last choice field is set to Wait for Real-time, only real-time positions are filtered. Otherwise, all positions are filtered. • Off — Do not apply velocity filtering to any positions. ***Note –*** *Trimble recommends that you do* ***not*** *use velocity filtering in good GNSS conditions.*
Receiver Power Output	Auto	This field only appears if the *Connection Method* field in the *External Source Settings* form is set to Receiver Port (see page 59). Enabling power output can damage some field computers. For all supported Mapping and GIS receivers, this is set to Auto, which corresponds to Off.

Accuracy Settings form

Use the *AccuracySettings* form to specify the parameters shown on the Estimated Accuracy icon and how the Trimble Positions ArcPad extension calculates the estimated accuracy of the current GNSS position.

To open the *Accuracy Settings* form, tap the Setup button below the *Accuracy Settings* field on the *GNSS Settings* form (see page 54).

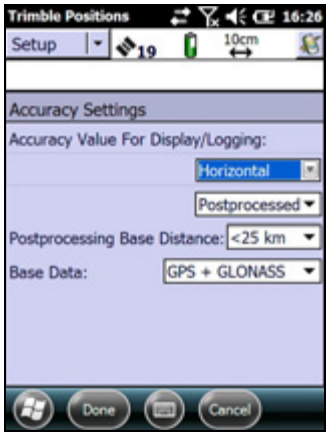
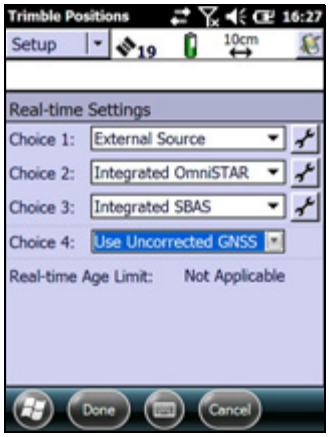


Table 4.19 Accuracy Settings form: Fields

Field	Default	Description
Accuracy Value for Display/Logging	Horizontal; In the field	The parameters that the Trimble Positions ArcPad extension 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.
Postprocessing Base Distance	Unknown External	The estimated distance to the base station that will be used for postprocessing. If you will use more than one base station (during H-Star processing), specify the estimated distance to the closest base station.
Base Data		Specify whether the data will be postprocessed against GPS data only from the base station, or GPS and GLONASS data. The option selected here affects the calculation of the predicted postprocessed accuracy; using GPS and GLONASS data enables a more accurate predicted postprocessed accuracy value to be calculated. For more information about the predicted postprocessed accuracy value, see Estimated Accuracy icon, page 28.

Real-time Settings form

Use the *Real-time Settings* form to select the real-time differential correction sources that you use, if any, and to configure how your system communicates with each source.



To open the *Real-time Settings* form, do one of the following:

- In the Setup section, tap **Real-time Settings**.
- In any screen in the Real-time section, tap the Setup button .

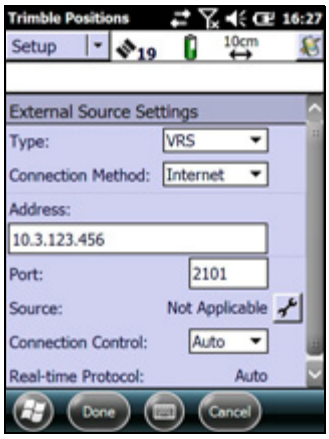
For detailed information about valid combinations of real-time correction sources, and how to set up a real-time correction source, including a VRS network, see Setting up a real-time differential correction source, page 17.

Table 4.20 describes the fields in the *Real-time Settings* form:

Table 4.20 Real-time Settings form: Fields

Field	Default	Description
Choice 1	Use Uncorrected GNSS	Your preferred source of real-time corrections. The options are: • External Source — Use an external correction source such as a VRS network, or data radio. • Integrated OmniSTAR — Use corrections from an integrated OmniSTAR receiver (ProXRT receiver only).
		• Integrated SBAS — Use corrections from an integrated SBAS receiver. The following receivers support SBAS corrections: • Geo 7 series handhelds • GeoExplorer 2008 / 3000 and 6000 series handhelds • Juno SA, SB, SC, SD, 3B, 3D, 5B, or 5D handhelds • Trimble Nomad 900G series handhelds • GPS Pathfinder ProXT and ProXH receivers • GPS Pathfinder ProXRT receivers • Pro 6T and Pro 6H receivers
		• Use Uncorrected GNSS — Log autonomous GNSS positions without applying real-time corrections.
Choice 2	Use Uncorrected GNSS	This field does not appear if you selected Use Uncorrected GNSS in the Choice 1 field. The source of real-time corrections that you want to use when your first choice is not available. The options are as for the *Choice 1* field except that External Source is not available, and the following additional option is available: • Wait for Real-time — Suspend logging until a real-time correction source becomes available.
Choice 3	Use Uncorrected GNSS	This field does not appear if you selected Use Uncorrected GNSS or Wait for Real-time in the Choice 2 field. The source of real-time corrections that you want to use when your first and second choices are not available. The options are: • Use Uncorrected GNSS • Wait for Real-time • Integrated SBAS
Choice 4	Use Uncorrected GNSS	This field does not appear if you selected Use Uncorrected GNSS in the Choice 3 field. The source of real-time corrections that you want to use when none of your other preferred real-time correction sources are available. The options are: • Use Uncorrected GPS • Wait for Real-time
Real-time Age Limit	50 seconds	The maximum age at which a correction message will be used. The age of a message is the time that has elapsed since it was received. Select an option from the drop-down list. *This field does not appear if you are using a Juno SA, SB, SC, SD, 3B, 3D, 5B, or 5D handheld, or a Trimble Nomad 900G series handheld. For these receivers, the real-time age limit is set to 18 seconds.*

External Source Settings form



Use the *External Source Settings* form to configure settings specific to an external real-time correction source, such as a VRS network.

Real-time differential correction from a VRS network is supported by the following GNSS receivers:

- Geo 7 series handhelds
- GeoExplorer series handhelds (GeoXM or GeoXT handhelds) with GNSS firmware version 1.03 or later installed
- Pro 6T and Pro 6H receivers
- GPS Pathfinder ProXH or ProXT receivers
- GPS Pathfinder ProXRT receivers

To open the *External Source Settings* form, open the *Real-time Settings* form and in the *Choice 1* field select External Source. Then tap the Setup button that appears beside the *Choice 1* field.

Note – *For step-by-step instructions for connecting to a VRS network using an Internet connection, see* *Connecting to a VRS network using an Internet connection, page 21*.

Table 4.21 External Source Settings form: Fields

Field	Default	Description
Type	Single Base	The type of source. The options are: • Single Base — Corrections are sent by a single base station. • VRS — Corrections are sent by a VRS network, which uses corrections from several base stations to compute corrections for your location.
Connection Method	Serial Port	How the Trimble Positions ArcPad extension connects to the external correction source. The options are: • Internet — The Trimble Positions ArcPad extension communicates with a VRS network over a TCP/IP connection, for example using a GSM or GPRS cellular phone. The connection must be configured and made outside the Trimble Positions ArcPad extension. • Direct Dial — The Trimble Positions ArcPad extension communicates with a VRS network using a dial-up modem connection. • Serial Port — RTCM corrections are received by a data radio, such as a TRIMTALK™ radio, connected to a serial port on the field computer. • Receiver Port — Corrections are received by a data radio that is connected to the GNSS receiver. This option is only available if the *Type* field is set to Single Base. To configure communication settings for the port, tap the Setup button beside this field. The *Receiver Port Settings* form (see page 63) appears.

Table 4.21 External Source Settings form: Fields (Continued)

Field	Default	Description
Address	(blank)	This field only appears if the *Connection Method* field is set to Internet. The IP address (for example, 255.255.255.255) or URL (for example, vrs.seaview.gov) of the server or NTRIP server that is supplying corrections from the VRS network. An NTRIP server manages authentication and password control for differential correction sources such as VRS networks, and relays corrections from the source that you select to the GNSS receiver.
Port COM1 (Serial Port) or 80 (Internet)	80 (Internet)	This field only appears if the *Connection Method* field is set to Serial Port or Internet. When the Connection Method field is set to: • Serial Port: specifies the serial (COM) port on the field computer that the external correction source is connected to. Tap the Setup button beside the Port field to open the Serial Port Settings form (see page 110), and configure the serial port settings. • Internet: specifies the port on the VRS network that the GPS receiver is to connect to.
Modem Type	(blank)	This field only appears if the *Connection Method* field (on this form) is set to Direct Dial. The type of modem you are using to connect to the VRS network.
Phone Number	(blank)	This field only appears if the *Connection Method* field (on this form) is set to Direct Dial. The telephone number of the VRS network.
Source	Not Applicable	This field only appears if the *Connection Method* field (on this form) is set to Internet. If you are connecting to a VRS network through an NTRIP server, this read-only field shows the selected server. If you are connecting directly to a VRS network, or have not yet selected a VRS network, this field shows the text Not Applicable. To select a server, tap the Setup button beside the *Source* field. The Trimble Positions ArcPad extensionattempts to establish a connection to the NTRIP server. If the connection is successful, the *Select Server* form (see page 61) appears. Select the server that you want to receive corrections from and then tap **OK** to return to the *External Source Settings* form.
User name	(blank)	This field only appears if the server you want to use requires authentication. Specifies the username that you use to log on to the server.
Password	(blank)	This field only appears if the server you want to use requires authentication. Specifies the password that you use to log on to the server.
Connection Control	Auto	Specifies how communication with the VRS network is controlled. The options are: • Auto — The Trimble Positions ArcPad extension automatically establishes a connection when it is needed, and reconnects if an existing connection is lost. • Manual — You must manually connect to the VRS network whenever you want to use real-time corrections from the network. To connect or disconnect, tap the **Ext Source** button in the main screen of the Setup section (see page 51).
Real-time Protocol	RTCM	The type of real-time correction messages that the external source is transmitting. This is RTCM (Radio Technical Commission for Maritime Services), a standard format for transmitting differential GNSS corrections from a base station to roving GNSS receivers.
Station ID	Any	This field is only displayed if the *Type* field (on this form) is set to Single Base. Specifies the reference station that you want to use real-time corrections from. Select Any to use any available station, or enter a station ID number between 0 and 1023.

Select Server form

Use the *Select Server* form to select the server that you want to receive VRS network corrections from.

To open the *Select Server* form, do one of the following in the *External Source Settings* form (see page 59):

- tap the Setup button beside the *Source* field
- change the value in the *Address* field or the *Port* field, and then move to another field

If the specified Internet address is an NTRIP server, the *Select Server* form appears, listing the servers that are available through the selected NTRIP server.

Tip – If you cannot find a server on the list, return to the *External Source Settings* form and make sure that the option that you require (VRS network or Single Base) is selected in the *Type* field.

The form contains a table of information about the available servers. You can drag each column heading to resize the column, or tap a column heading to sort by that column. If the list is already sorted by the column you tap, the sort order is reversed.

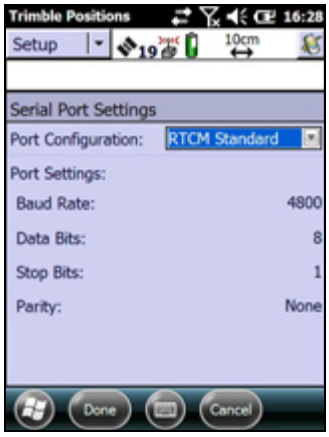
To select a server, highlight it in the list and then tap **OK**. You are returned to the *External Source Settings* form, where the selected server name is displayed in the *Source* field.

Table 4.22 Select Server form: Column

Field	Description
Server	The identification code of the server.
Name	A description of the server.
Country	The three-letter code for the country where the server is located.
Carrier	Indicates whether the data stream includes carrier phase data.
Format	The format of the data stream, such as RTCM, raw data, or CMR.
Details	Details of the message format, such as the RTCM message types generated.
Network	The network or service provider.
Generator	The hardware or software used to generate the data stream.
Solution	Indicates whether the data stream is generated from a single base station (Single Base) or a network of base stations (Network Solution).
Fee	Indicates whether there is a charge for use of the correction data.
Rate	The bit rate of the data stream, in bits per second.
Misc	Miscellaneous notes about the server.

Serial Port Settings form

Use the *Serial Port Settings* form to configure communication settings when an external correction source is connected to an external COM port.



To open the *Serial Port Settings* form, open the External Source Settings form (see page 59) and then tap the Setup button beside the *Port* field.

Note – *When an application opens the serial port, it controls that port. You cannot access the port or change its settings from another application until the port is closed again. Settings that you define in this form are only applied if the port is not in use by another application.*

Table 4.23 Serial Port Settings form: Fields

Field	Default	Description
Port Configuration	Custom	The communication settings for the port. There is an option for each communications protocol (NMEA, RTCM, and TSIP), and an option for each type of radio supported. These options define preset values which match the ***default*** settings of the radio. The values defined for each option appear in this form in read-only fields. If the external device allows you to configure port settings, the preset values may not match the device's current settings. If this is the case, or if the device you want to use is not listed, select the Custom option. The remaining fields become available and you can select customized port settings.
Baud Rate	9600	This field is read-only unless you select Custom in the *Port Configuration* field. The baud rate at which the GNSS receiver and external source communicate. Select the rate from the drop-down list.
Data Bits	8	This field is read-only unless you select Custom in the *Port Configuration* field. The number of data bits used when the external correction source and GNSS receiver communicate. The options are 7 or 8.
Stop Bits	1	This field is read-only unless you select Custom in the *Port Configuration* field. The number of stop bits used when the external correction source and GNSS receiver communicate. The options are 1 or 2.
Parity	None	This field is read-only unless you select Custom in the *Port Configuration* field. The parity setting used when the GNSS receiver and external source communicate. Select an option from the drop-down list.

Receiver Port Settings form

Use the *Receiver Port Settings* form to configure communication settings when an external correction source is connected to a port on the receiver.

To open the *Receiver Port Settings* form, open the External Source Settings form (see page 59) and then tap the Setup button beside the *Connection Method* field.

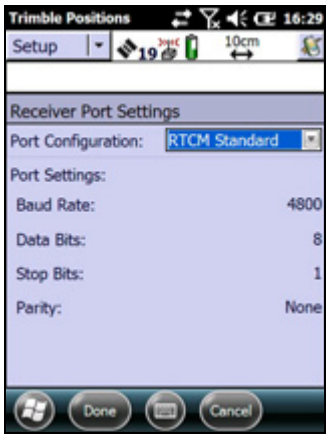


Table 4.24 Receiver Port Settings form: Fields

Field	Default	Description
Receiver Port	Port 1	The port on the GNSS receiver that the external device is connected to.
Port Configuration	Custom	The communication settings for the port. There is an option for each communications protocol (NMEA, RTCM, and TSIP), and an option for each type of radio supported. These options define preset values that match the ***default*** settings of the radio. The values defined for each option appear in this form in read-only fields. If the external device allows you to configure port settings, the preset values may not match the current settings on the device. If this is the case, or if the device you want to use is not listed, select the Custom option. The remaining fields become available and you can select customized port settings.
Baud Rate	9600	This field is read-only unless you select Custom in the *Port Configuration* field. The baud rate at which the GNSS receiver and external source communicate. Select the rate from the drop-down list.
Data Bits	8	This field is read-only unless you select Custom in the *Port Configuration* field. The number of data bits used when the external correction source and GNSS receiver communicate. The options are 7 or 8.
Stop Bits	1	This field is read-only unless you select Custom in the *Port Configuration* field. The number of stop bits used when the external correction source and GNSS receiver communicate. The options are 1 or 2.
Parity	None	This field is read-only unless you select Custom in the *Port Configuration* field. The parity setting used when the GNSS receiver and external source communicate. Select an option from the drop-down list.

Integrated SBAS Settings form

Use the *Integrated SBAS Settings* form to configure the SBAS satellite settings.

To open the *Integrated SBAS Settings* form, open the *Real-time Settings* form and from one of the *Choice* fields select Integrated SBAS. Then tap the Setup button that appears beside the *Choice* field.

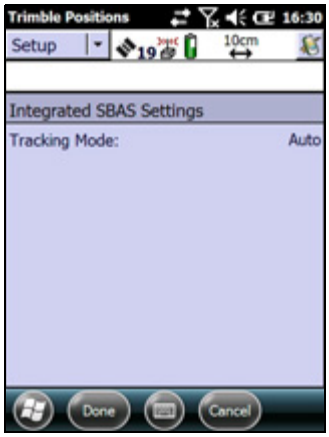


Table 4.25 Integrated SBAS Settings form: Fields

Field	Description	
Tracking Mode	Specify the tracking mode. The options are:	
	• Auto	The receiver tracks or locks on to the most powerful satellite signal. The receiver uses its longitude to determine which SBAS system to track: • Wide Area Augmentation System (WAAS) satellites are tracked in the Continental United States including Alaska, and in southern parts of Canada • European Geostationary Navigation Overlay Service (EGNOS) satellites are tracked in Europe • MTSAT Satellite-based Augmentation System (MSAS) satellites are tracked in Japan. • GAGAN
	• Custom	Select the Custom option to specify the satellites you want the receiver to track or to ignore.
State	When you select the custom tracking option, select specific SBAS satellites and then select the following options:	
	• Disabled	The satellite is disabled.
	• Enabled, Heed Health	The real-time information is only used if the signal is flagged as healthy.
	• Enabled, Override Health	The real-time information is used irrespective of the health flag in the signal. An unhealthy signal will still be tracked and used.

Integrated OmniSTAR Settings form

Use the *Integrated OmniSTAR Settings* form to configure settings that are specific to an integrated OmniSTAR real-time correction source.

To open the *Integrated OmniSTAR Settings* form, open the *Real-time Settings* form and from one of the *Choice* fields select Integrated OmniSTAR. Then tap the Setup button that appears beside the *Choice* field.

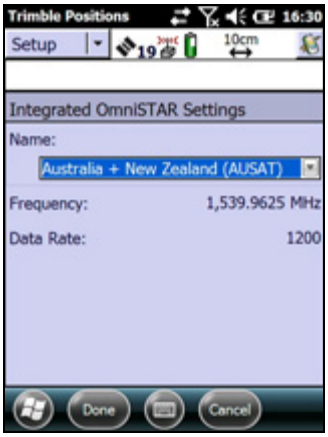


Table 4.26 Integrated OmniSTAR Settings form: Fields

Field	Default	Description
Service Provider	(blank)	The satellite differential service provider. Select an option from the drop-down list.
Name	Custom	The satellite used for satellite differential corrections. The options in this list depend on the satellite differential service provider that is selected.
Frequency	1538.053 MHz	The frequency used when you select Custom in the *Name* field.
Data Rate	600	The data rate used when you select Custom in the *Name* field. Select an option from the drop-down list

About section

Use the About section to view information about the installed version of the Trimble Positions ArcPad extension.

To display the About section, tap the arrow on the Section button next to the status bar and from the drop-down list select *About*.

Table 4.27 About section: Fields

Field	Description
Version number	The version and edition of the Trimble Positions ArcPad extension that is installed.
Installation code	The installation code for this installation of the Trimble Positions ArcPad extension. This is the installation code you entered during installation.
Software Expiry Date	The date until which you are entitled to telephone support, email support, and upgrades to later versions of the Trimble Positions ArcPad extension.
Copyright	Copyright information.
Acknowledgements	Acknowledgements for the parts of the Trimble Positions ArcPad extension that were developed by other companies.

CHAPTER

5

Troubleshooting

In this chapter:

This chapter lists possible causes of, and solutions to, problems you may encounter when using the Trimble Positions ArcPad extension.

GNSS

This table describes possible causes of problems with GNSS signals or your GNSS receiver.

Problem	Possible cause	Solution
The message No GNSS detected appears.	ArcPad is configured to connect to the wrong COM port.	Check that the COM port specified in the GNSS tab of the ArcPad Options dialog is the COM port that the GNSS receiver is connected to.
	ArcPad is configured to use the wrong GNSS protocol.	In the *Protocol* tab of the ArcPad Options dialog, select the Trimble Positions ArcPad extension option from the *Protocol* field.
	The GNSS receiver battery is dead, or is connected incorrectly.	Check that the battery is correctly connected and is charged, or connect to an external power source.
	The cable connecting the field computer to the GNSS receiver is not connected, is connected incorrectly, or is faulty.	Check that the cable is connected correctly. If it appears to be correct and all other equipment appears to be correct, the cable may require servicing.
	The COM port on the field computer is faulty.	Check that the COM port is undamaged. If it appears to be damaged, the field computer may require servicing.
The receiver has not acquired a satellite within three minutes of the Trimble Positions ArcPad extension starting.	The receiver is still looking for satellites.	Use the Satellite Info section to check how many satellites the GNSS receiver is tracking.
	The satellites are being obstructed.	The obstruction may be a building, a tree, or a large vehicle. Identify the obstruction and move away from it. ***Note –*** *GNSS does not work indoors.*
	Your GNSS receiver's external antenna (or antenna cable) is not connected, is connected incorrectly, or is faulty.	Check that the external antenna is connected correctly. If your receiver still fails to acquire signals from a satellite, then your antenna and/or antenna cable may require servicing.
	The receiver has not been used for a very long time, and the almanac stored in the receiver is outdated.	Wait for up to 15 minutes until a new almanac has been recorded. Subsequent restarts should then be rapid.
	The receiver has been set to Base mode by another application.	Reset the GNSS receiver.
The receiver cannot compute a GNSS position within one minute of the Trimble Positions ArcPad extension starting.	Too few satellites are available. Four satellites (SVs) are required to compute a position.	In the *GNSS Settings* form, check that the minimum elevation value is not too high, or select *Use Smart Settings*.
		In the *GNSS Settings* form, check that the minimum SNR value is not too high, or select *Use Smart Settings*
	The current DOP value is too high.	In the *GNSS Settings* form, check that the configured maximum PDOP or HDOP value is not too low. To increase productivity, enter a larger number in the *Max PDOP* or *Max HDOP* field, or select *Use Smart Settings*

Real-time differential correction

This table describes possible causes of problems with receiving real-time differential corrections or with real-time correction sources.

Problem	Possible cause	Solution
Not all positions are corrected in real time.	The Trimble Positions ArcPad extension is configured to log uncorrected GNSS positions if real-time corrections are not available.	In the *Real-time Settings* form, change the selection in the last *Choice* field from Use uncorrected GNSS to Wait for real-time. When the Wait for real-time choice is selected, and all real-time sources are unavailable, the Trimble Positions ArcPad extension suspends GNSS logging until real-time corrections are available again.
The Trimble Positions ArcPad extension is not using your first choice real-time correction source.	Your first choice correction source is not available, so your second or third choice is being used.	In the Real-time Summary screen, check the status of your preferred correction source. Change the configuration in the *Real-time Settings* form if necessary, or wait until this source is available again.
	The correction source you expected is not set up as your preferred source.	In the *Real-time Settings* form, select your preferred real-time correction source from the *Choice 1* field.
Your integrated OmniSTAR component (ProXRT receiver only) does not appear to work.	You set the real-time correction source incorrectly.	In the *Real-time Settings* form, set one of the *Choice* fields to Integrated OmniSTAR. If integrated OmniSTAR is your preferred correction source, set the *Choice 1* field to Integrated OmniSTAR.
	You have not enabled the integrated OmniSTAR component of your receiver.	For information on how to enable your integrated OmniSTAR component, refer to documentation provided with your receiver, or contact OmniSTAR (www.omnistar.com).
Your real-time differential correction link does not appear to work.	Your telemetry link is incorrectly installed, powered, cabled, or configured.	Install the telemetry link as specified by the supplier. Consult the supplier if necessary.
	You set the station ID incorrectly.	In the *External Source Settings* form, check that the *Station ID* field is set correctly.
	You configured the real-time correction settings incorrectly.	In the *External Source Settings* form, check that the settings match the telemetry link and the transmitted RTCM data stream.

GNSS position accuracy

This table describes possible causes of problems with the accuracy of GNSS positions.

Problem	Possible cause	Solution
The accuracy of recorded GNSS positions is not as good as you expect.	You did not record sufficient positions to achieve the required accuracy.	In ArcPad, make sure you collect enough positions to achieve the required accuracy before closing each feature.
	Your maximum DOP value was too high. If you record positions when the Dilution of Precision is high, this has a detrimental effect on the accuracy of these positions.	In the *GNSS Settings* form, enter a smaller value in the *Max PDOP* or *Max HDOP* field, to make sure that the Trimble Positions ArcPad extension logs more accurate positions. Or, select *Use Smart Settings.*
	Your minimum SNR or elevation value was too low. If you let the receiver use satellites with a low SNR or elevation, this may decrease the accuracy of positions calculated by the receiver.	In the *GNSS Settings* form, enter a larger value in the *Min SNR* and/or *Min Elevation* field, so that the receiver uses satellites with a strong signal. Or, select *Use Smart Settings.*
	You are operating in an area of high multipath interference.	Move to an area with better GNSS coverage and use offsets.
	No configured real-time source is available, so the Trimble Positions ArcPad extension is using uncorrected positions.	In the last *Choice* field in the *Real-time Settings* form, select Wait for real-time to use differentially corrected positions only.
You cannot differentially correct your GNSS positions (either in real time or in postprocessing).	The Trimble Positions ArcPad extension used satellites that were not visible to the GNSS base station.	Make sure the minimum elevation value in Trimble Positions ArcPad extension is high enough that the software only uses satellites that are also visible to the GNSS base station, or select *Use Smart Settings.*
		Try correcting your data using another base station file.

Positions SSF file location

The Trimble Positions ArcPad extension determines the location of the SSF file using the following rules:

- When you open an existing map document, or save a map document, the SSF file location is set to the location of the open map document. However, the SSF file is not created or opened until you add or edit features using GNSS.
- If the current map document is new and unsaved, then the SSF file is stored in the same folder as the AXF file or the first edited Shapefile in the map (this is the Shapefile containing the first feature that you create or update using GNSS).
- If there is already an SSF file with the same name in the required location, new GNSS data is appended to this existing file. However, to ensure that GNSS positions can be postprocessed, the Trimble Positions ArcPad extension does not append data to a file that is more than seven days old. Instead, the existing file is renamed with an underscore and a number added, and a new SSF file of the required name is created. For example, if the file named Positions.ssf is more than seven days old, the file is renamed Positions_1.ssf, and a new file called Positions.ssf is created.
- Once the SSF file location has been determined, it does not change unless the map document changes. For example, if you open a new map, add an existing AXF file or Shapefile, and then add a feature to the file, the SSF file is created in the same folder as the AXF file or Shapefile. If you then save the map to a different folder, the SSF file is not moved or duplicated; it remains in the same folder as the AXF file or Shapefile.

Positions SSF file naming

When you log GNSS data using the Trimble Positions ArcPad extension, the data is stored in an SSF file. The name of the SSF file depends whether you are using Shapefiles or AXF files.

The SSF file will be named Positions.SSF if you are using:

- a map file, whether the map file contains Shapefiles or AXF files, or a combination of both files.
- Shapefiles.
- a combination of Shapefiles and AXF files, if both of these filetypes were added to the map before starting GNSS logging.

The SSF file will have the same name as the AXF file name if you:

- add an AXF file or AXF layer to an empty map.
- open an AXF file, start GNSS logging and then open additional Shapefiles.

In the GPS Pathfinder Office software, the ShapeCorrect Utility supports SSF files named according to either convention. If you are using a combination of Shapefiles and AXF files, you must run the Shapecorrect Utility once for each file type.

The Trimble Positions Desktop add-in for Esri ArcGIS for Desktop software also supports SSF files associated with either Shapefiles or AXF files. To check in data collected using ArcPad and the Trimble Positions ArcPad extension, check in Shapefiles and AXF files (with their associated SSF files) separately using the relevant check in tool for each file type.

CHAPTER

6

Appendices

In this chapter:

Appendix A: Positions software suite workflow overview for ArcPad AXF

The following table provides an overview of the steps required to install and use the Trimble Positions software suite in an Esri ArcPad workflow using AXF files. The steps in bold are covered in detail in this guide. For all other steps, refer to the other Trimble Positions software suite documentation, as listed above.

Initial administration tasks	Install and license ArcGIS for Desktop 10.2 on each office computer.
	Install ArcPad 10.2 (this is to get the ArcPad Data Manager toolbox for ArcGIS for Desktop installed, and to install the ArcPad Datum Configuration tool) on each office computer and Windows Mobile device.
	Download Trimble Positions Desktop add-in 10.2.0.1.
	Optionally, install the Trimble Positions License Manager to a computer(s) that is/are accessible from the office computer (and field devices).
	On each office computer that has ArcGIS for Desktop 10.2 installed, install and license Trimble Positions Desktop add-in 10.2.0.1.
	Download Trimble Positions ArcPad extension 10.2.0.1.
	On each mobile device that has ArcPad 10.2 installed, install and license Trimble Positions ArcPad extension 10.2.0.1.
	Optionally, create a new Microsoft SQL Server or Oracle database, if an enterprise database is required and not yet created.
	Configure Trimble Positions Desktop database (*Start / All Programs / Trimble / Trimble Positions Tools / Desktop Configuration*).
	Start ArcGIS for Desktop and enable Trimble Positions Desktop add-in.
Setting up datum geotransformations	Open the Trimble Positions Desktop Administration Datum Transformations dialog.
	Associate default transformations to WGS-84 for the datums and projections you use in your work.
Desktop add-in tasks when enabling Map documents for AXF check-out	Open map document.
	Add feature layers to Map from geodatabase.
	Check Map for compatibility using Trimble Positions Desktop add-in.
Creating an ArcPad project and checking-out an AXF project	Create a new ArcPad Project in Trimble Positions Desktop add-in.
	Select the feature layers for the project.
	Configure each layer's accuracy threshold and metadata autofill fields for GIS update.
	Associate the Trimble Positions ArcPad project with the MXD document.
	Set the Trimble Positions ArcPad project to be the current project.

Regular transfer tasks between field and office	Check-out Trimble Positions ArcPad project.
	Copy AXF project folder to the field device.
	Collect data using Trimble Positions ArcPad extension 10.2.0.1 and ArcPad 10.2.
	Copy AXF project folder with TrimblePositions.SSF file(s) to the office computer.
Regular Desktop add-in user tasks	If not already created, in Trimble Positions Desktop add-in, create processing profile(s).
	In Trimble Positions Desktop add-in, check-in AXF project folder and associated SSF file(s) to Trimble Positions office database and the geodatabase.
	In Trimble Positions Desktop add-in, Manage devices and optionally associate with a processing profile.
	In Trimble Positions Desktop add-in:
	• Postprocess against chosen processing profile
	• Modify offsets, if required
	• Verify against required accuracy thresholds
	• Modify geometry (unlink, exception) if required
	• Update GIS geodatabase
	Save and close Map document.

Appendix B: Positions software suite workflow overview for ArcPad QuickProjects

The following table provides an overview of the steps required to install and use the Trimble Positions software suite in an Esri ArcPad workflow using QuickProjects. The steps in bold are covered in detail in this guide. For all other steps, refer to the other Trimble Positions software suite documentation, as listed above.

Initial administration tasks	Install and license ArcGIS for Desktop 10.2 on each office computer.
	Install ArcPad 10.2 (this is to get the ArcPad Data Manager toolbox for ArcGIS for Desktop installed, and to install the ArcPad Datum Configuration tool) on each office computer and Windows Mobile device.
	Download Trimble Positions Desktop add-in 10.2.0.1.
	Optionally, install the Trimble Positions License Manager to a computer(s) that is/are accessible from the office computer (and field devices).
	On each office computer that has ArcGIS for Desktop 10.2 installed, install and license Trimble Positions Desktop add-in 10.2.0.1.
	Download Trimble Positions ArcPad extension 10.2.0.1
	On each mobile device that has ArcPad 10.2 installed, install and license Trimble Positions ArcPad extension 10.2.0.1.
	Optionally, create a new Microsoft SQL Server or Oracle database, if an enterprise database is required and not yet created.
	Configure Trimble Positions Desktop database (*Start / All Programs / Trimble / Trimble Positions Tools / Desktop Configuration*).
	Start ArcGIS for Desktop and enable Trimble Positions Desktop add-in.
Setting up datum geotransformations	Open the Trimble Positions Desktop Administration Datum Transformations dialog.
	Associate default transformations to WGS-84 for the datums and projections you use in your work.
Regular transfer tasks between field and office	**Collect QuickProject data using Trimble Positions ArcPad extension 10.2.0.1 and ArcPad 10.2.**
	Copy ArcPad QuickProject folder with TrimblePositions.SSF file(s) to the office computer.

Regular Desktop add-in user tasks	If not already created, in Trimble Positions Desktop add-in, create processing profile(s).
	Open (blank) Map document.
	In Trimble Positions Desktop add-in, import ArcPad QuickProject and associated SSF file(s) to Trimble Positions office database and the geodatabase.
	Configure each layer's accuracy threshold and metadata autofill fields for GIS update.
	In Trimble Positions Desktop add-in, manage devices and optionally associate with a processing profile.
	In Trimble Positions Desktop add-in:
	• Postprocess against chosen processing profile
	• Modify offsets, if required
	• Verify against required accuracy thresholds
	• Modify geometry (unlink, exception) if required
	• Update GIS geodatabase
	Save and close Map document.

Appendix C: Geotransformations in the Trimble Positions Software Suite ArcPad Workflow

Overview

Autonomous GNSS positions are calculated in terms of World Geographic System 1984 (WGS84), at the epoch (time) they were collected. Sometimes, to improve the GNSS positions' instantaneous accuracy, you must use a real-time correction source (such as Satellite-Based Augmentation System, for example WAAS or EGNOS, VRS™ software, or a single base station), but this causes the achieved positions to be referenced to the spatial reference frame used to define the reference position of the correction source, which, for non-SBAS systems, is possibly a local coordinate system.

Feature classes in the GIS are likely to be defined in terms of a particular spatial reference (Projected Coordinate System (PCS) or Geographic Coordinate System (GCS)), other than WGS84, and referenced to a different, past, epoch, to maintain a consistent temporal-spatial environment within the GIS geodatabase(s). Simply put, a PCS usually provides the position coordinates in terms of a measurement unit East and North of a defined origin, and has an underlying GCS: a GCS provides its coordinates in terms of angular Latitude-Longitude measurements and the Height above Ellipsoid based on a defined spheroid or Height above Mean Sea-Level (hMSL) based on a defined geoid, or an XYZ measurement in define length units, referenced to the centre of the Earth.

To transform between a PCS and another PCS or GCS, the PCS coordinate is reduced to its GCS coordinate, and then a geographical transform is used to transform between the current GCS coordinate and the new GCS coordinate. If the final outcome is a PCS coordinate, the new GCS coordinate is re-projected to the new PCS coordinate.

When transforming between one GCS and another, or between different epoch realisations of a single GCS, a datum transformation is used. The types of datum transformation available are many and varied, but the most common use one of three methods, in order of least to most accurate resolution: Molodensky 3-parameter [XYZ shift]; Helmert 7-parameter transformation [XYZ shift, XYZ rotation, scale]; and, a datum grid [a file of coordinate pairs and vector shifts].

Important: *To retain consistency, it is imperative that when transforming between GCSs the same transformation method is used throughout the workflow.*

Geotransformations applied in the ArcPad workflow

The following figure shows the many geotransformations that could occur in a complicated ArcPad dataflow.

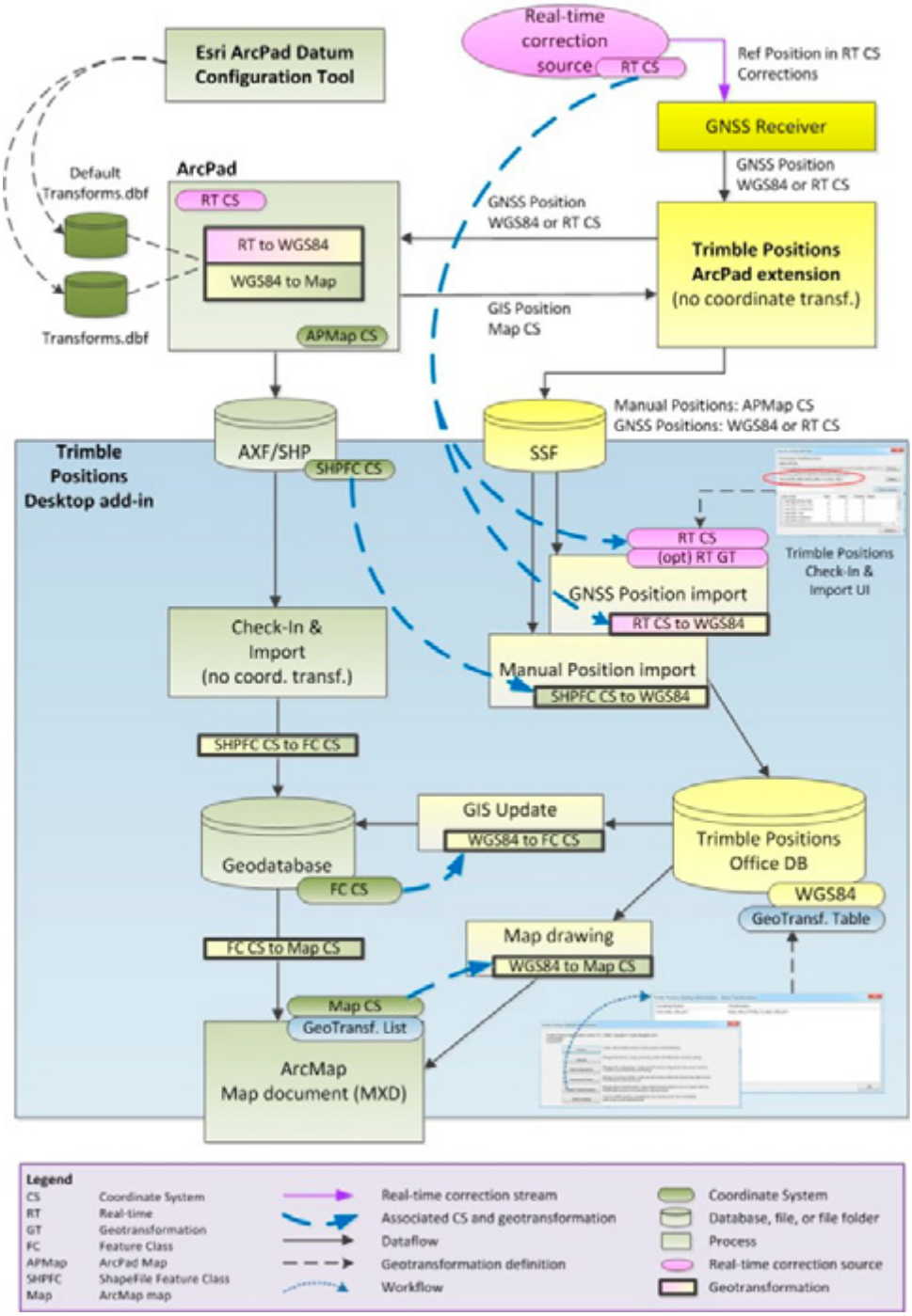


Figure 6.1 Spatial Reference frames (coordinate systems) and Geotransformations defined and applied during the ArcPad workflow

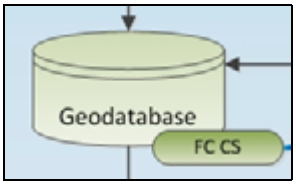
Spatial reference definition

To maintain high accuracy of collected positions, you must know the feature class, map, and correction source spatial reference frame, and define consistent transformations between them, as necessary.

Important: *Each spatial reference frame (coordinate system) used within the workflow should explicitly define the transformation to be used between itself and others, otherwise inconsistent transforms may be used. The Esri software uses a null transform if nothing else has been defined. Errors exceeding 100 meters can be introduced into the workflow if proper care is not taken.*

Feature class

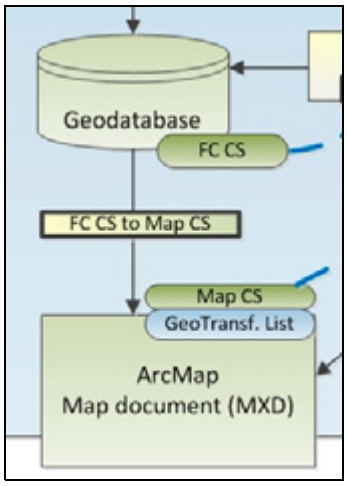
The GIS is made up of a collection of feature classes. These feature classes may come from different sources and do not always share the same spatial reference frame. If the data is static, it may be prudent to re-project the feature class from a third-party or archived source, however this might not be feasible if the feature class is continually being updated and republished.



ArcGIS map document

When the feature class is used in a map document, a transformation method from the feature class spatial reference frame and the map document spatial reference frame is defined. If you are creating a map document from the Blank template, you are prompted to specify the transformation to use between the map and feature class spatial reference frames (should they be different). If you are creating the map document from a template used by your organisation, or are opening an existing map document, the transformation method may have already been defined.

If one or more feature classes are defined in terms of WGS84, or an existing template defines a WGS84 to map spatial reference frame transformation, this is recorded in the transformation list in the MXD map document and is available for Trimble Positions to use (refer to the *Trimble Positions Desktop Add-in User Guide*, section *Testing the map document for compatibility*). If this is not the case, you must define the transformation between the feature class and WGS84 in the transformation table, using the Trimble Positions Datum Transformation utility.



When an AXF project is checked out of the geodatabase, the individual feature layers are re-projected to the spatial reference frame of the map document, and the AXF project uses the ArcMap map document spatial reference frame.

ArcPad datums and projections

Map datum

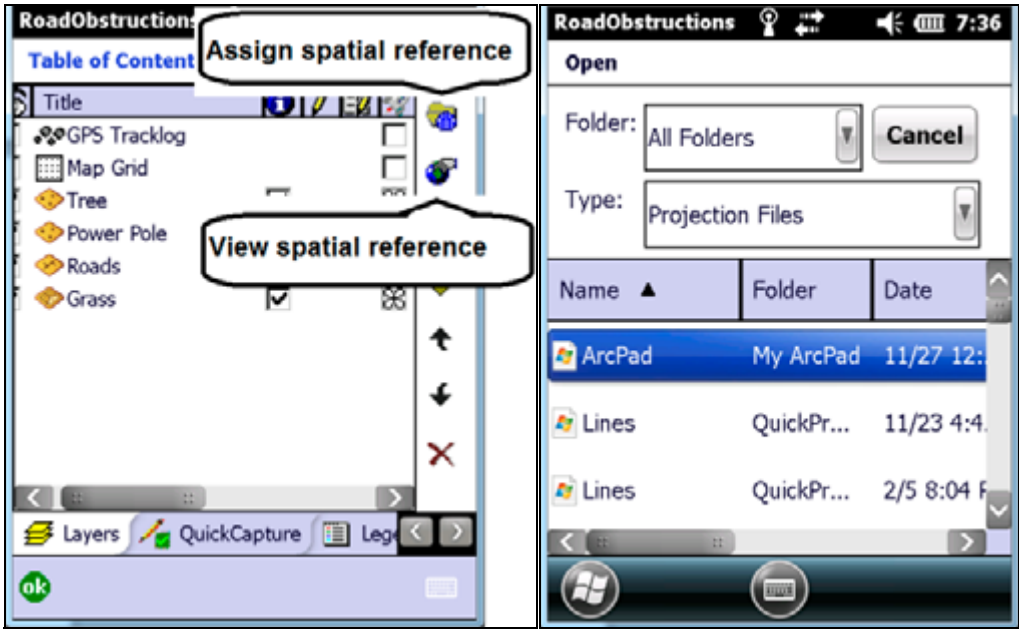
ArcPad's map spatial reference frame (datum and projection) is defined by one of the following:

- an empty map projection definition, defined in a reference .prj file
- an opened, checked-out AXF project, embedded in the .apm file
- the first data layer to be added to an empty map, defined in that feature layer's projection file (.prj)
- a QuickProject coordinate system definition, defined in a reference .prj file

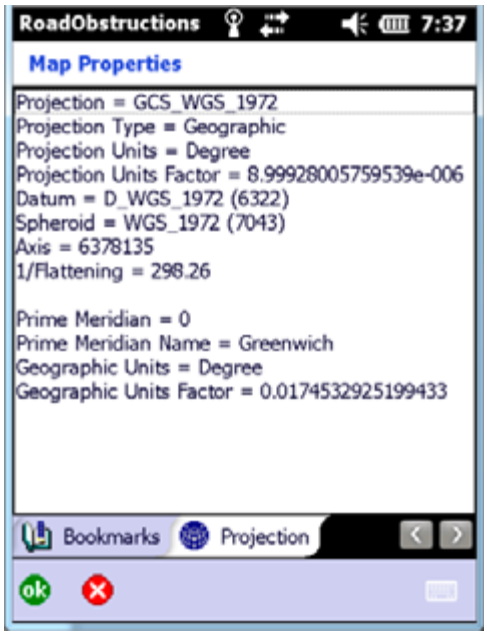
The default spatial reference frame for a newly-opened, empty ArcPad map is WGS84 latitude and longitude decimal degrees.

If a projection file named *arcpad.prj* is found in the ... / *My Documents* folder, its spatial reference frame becomes the default for a newly-opened, empty ArcPad map.

If a data layer or map with a defined spatial reference frame is added to a newly-opened, empty ArcPad map, that spatial reference frame replaces the default. If a map's first added data layer lacks a defined spatial reference frame, you can manually assign one—tap the first icon along the *Table of Contents'* right margin, and select one from a folder containing .prj files.



To view a map's current spatial reference frame, tap the second icon along the *Table of Contents'* right margin, or tap | *Map Properties...* | *Projection*.



Users should copy a projection (.prj) file suitable for their area of interest to the **.../My Documents** folder and rename it **ArcPad.prj**, or else, ensure that the first data layer or map added to a newly-opened, empty ArcPad map has a defined spatial reference frame that accurately reflects its feature's coordinates.

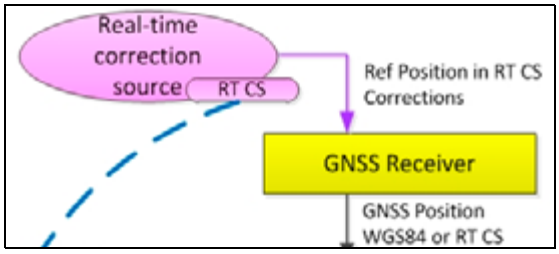
ArcPad transforms and projects on-the-fly from the feature class(es) spatial reference frame and the map document spatial reference frame.

GPS Datum

The datum of incoming GNSS latitude and longitude is established by making a selection from the *GPS Datum* dropdown list.

Once set, ArcPad treats GNSS coordinates as being referenced to this datum, and all subsequent processing is based on that expectation. D_WGS_1984 is the default datum.

The GPS datum should not be confused with the intended spatial reference frame of ArcPad's current map.



GNSS receivers operating in autonomous mode issue coordinates in WGS84. When GNSS positions are corrected by an external source, the coordinates are transformed into the correction source's spatial reference frame. For example, if the real-time correction source is a US Coastguard NDGPS station referenced to NAD83(CORS96), the corrected positions generated by the GNSS receiver are in terms of NAD83(CORS96). In this case, the *GPS Datum* setting should be set to NAD83(CORS96) and the appropriate NAD83(CORS96) to WGS84 transformation defined and applied.

ArcPad transformations

A datum-to-datum transformation is required when incoming GNSS coordinates are referenced to a different spatial reference frame than ArcPad's current map. This is because each datum is based on a different mathematical model of the Earth. Two transformation complications can arise, however:

- ArcPad may not support the transformation best-suited to a particular situation. For example, ArcPad does not currently support the NGS-sanctioned WGS84-to-NAD83 transformation.
- Multiple transformations may be available for any given datum pair. For example, ArcPad supports 21 WGS84-to-NAD27 transformations, and 5 WGS84-to-NAD83 transformations, each being suited to a particular geographic area.

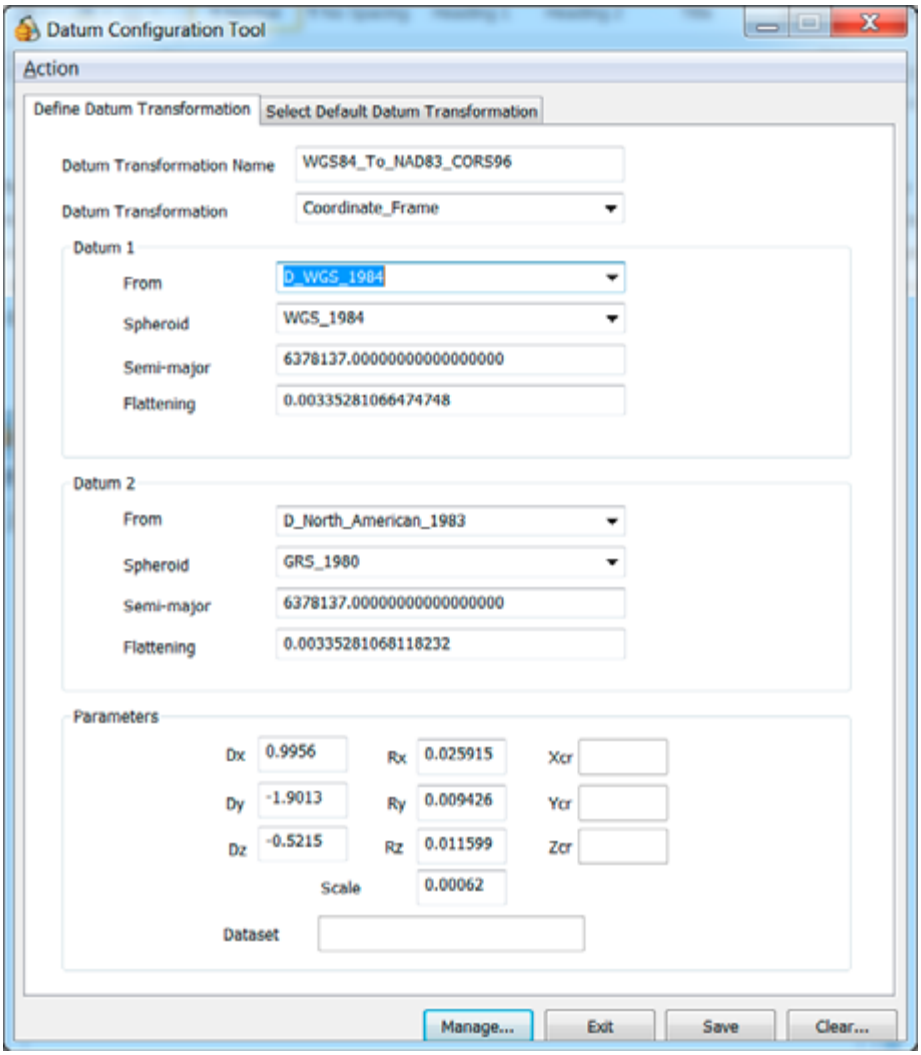
When ArcPad is installed on the office computer in readiness to deploy to Windows Mobile device(s), the Datum Configuration Tool utility is also installed. Each spatial reference frame used in your workflow[1] should also be managed by this utility, and the default transformation required to be used in ArcPad defined. This utility also enables custom spatial reference frame and transformation definitions to be uploaded to the ArcPad installation(s).

1. Click *Start* / *All Programs* / *ArcGIS* / *ArcPad 10.2* / *Datum Configuration Tool* to define a custom transformation, or to set the default transformation for a given datum pair.

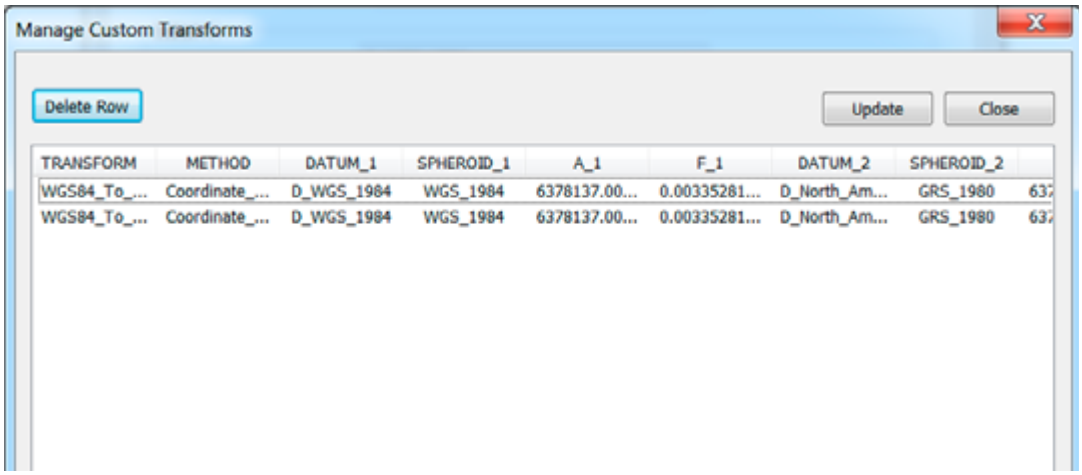
   In the example below, the current NGS-sanctioned WGS84-to-NAD83 transformation is defined on the *Define Datum Transformation* tab.

1. An Esri document titled Supported Geographic (Datum) Transformations list all supported transformations, as well as their intended area of use.

2. Enter the required parameters and then click **Save**.



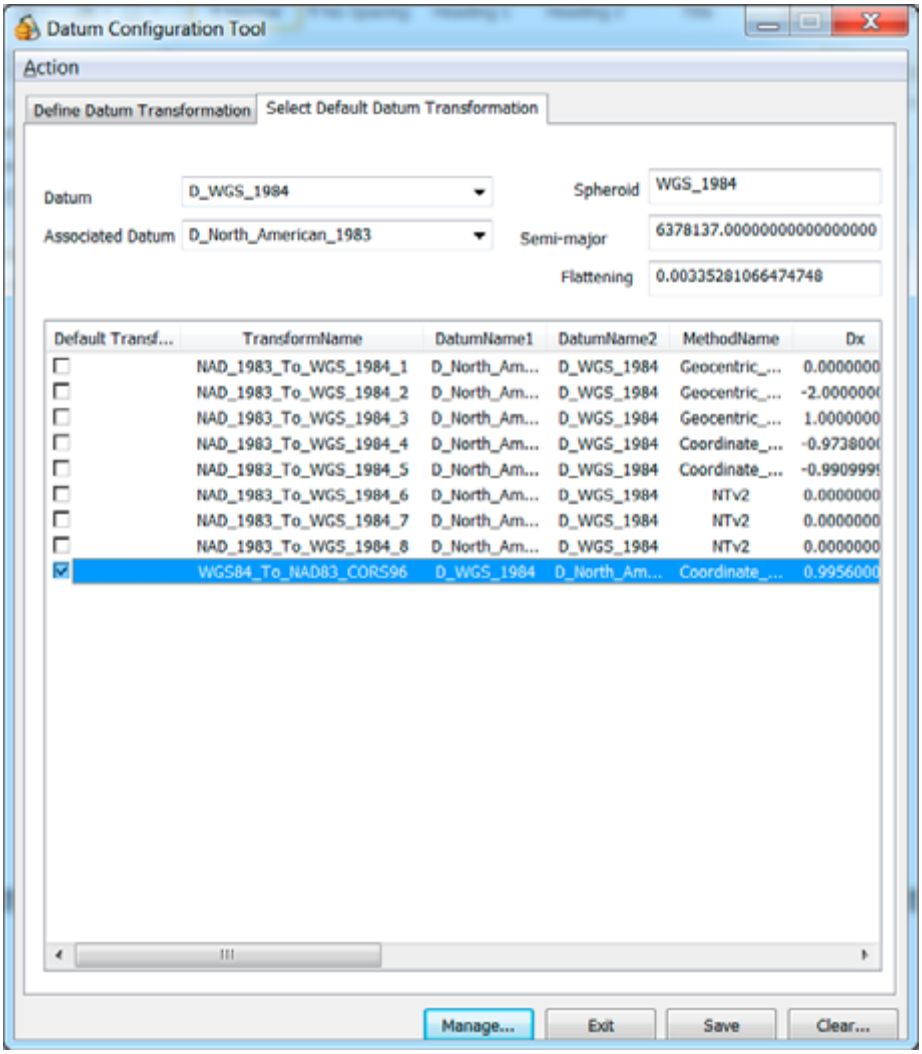
3. Click **Manage** to manage custom definitions.



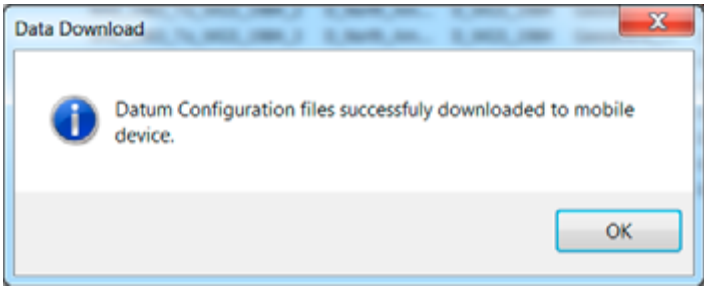
To delete a row, select it and click **Delete Row**, and then click **Update** to update the local database. Until you update the local database, the custom definition is not available for selecting the default transform. Click **Close** to continue.

To set a default transformation for the user-selected datum pair, select the *Select Default Datum Transformation* tab, and select the checkbox corresponding to the transformation you want to set as the default.

This list also includes ArcPad's internal transformations for the datum pair.

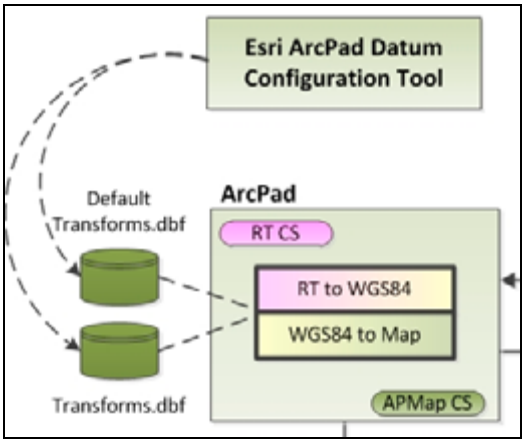


When you have saved the definitions, connect the ArcPad Windows Mobile device to the office computer, and select *Action / Download to Mobile Device* from the menu bar.



The Datum Configuration Tool utility creates and uploads two files to the ArcPad installation in the .../*ArcPad/System* folder:

- **DefaultTransforms.dbf** contains a user-selected default transformation for each datum pair of interest to the user. ArcPad interrogates DefaultTransforms.dbf before referring to its internal default transformation table, and uses the listed transformation if it finds a record matching ArcPad's current GPS datum and map datum. If no match is found, ArcPad uses its internal default transformation for the current datum pair.
- **Transforms.dbf** contains user-defined customized transformation parameters. ArcPad attempts to match each custom transformation's datum pair to ArcPad's current GPS datum and map datum, and applies the associated custom transformation parameters if a match is found. If no match is found, ArcPad uses its internal default transformation for the current datum pair.

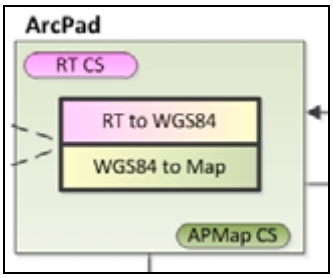


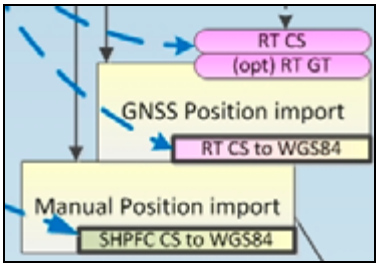
When generated, you can copy these files to other devices.

Note – *It is important to re-start ArcPad after these files have been transferred.*

Real-time correction source spatial reference frame

When using a real-time GNSS correction source that defines the reference coordinate in terms of a non-WGS84 spatial reference frame, the transformation ArcPad uses must be defined and also replicate in the geotransformation list or table in the office software.

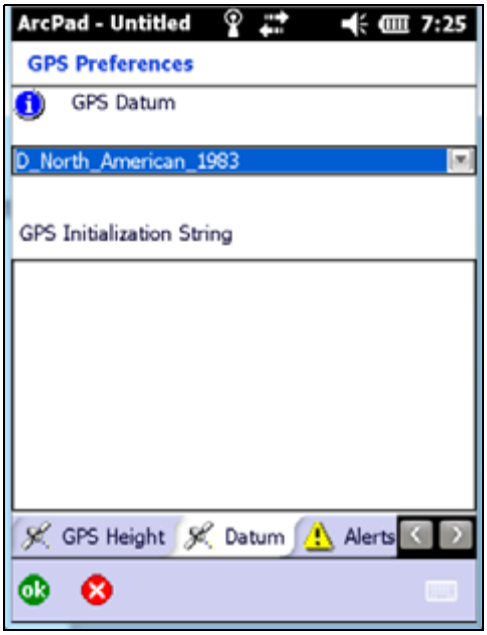


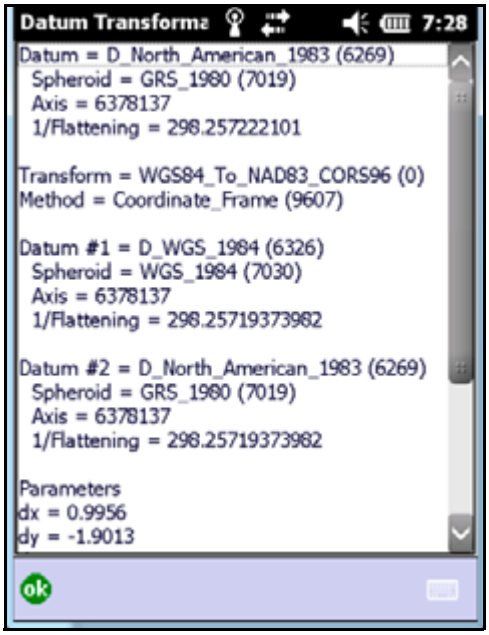


If the real-time correction source spatial reference frame is neither WGS84 nor that of the ArcPad map spatial reference frame, ArcPad performs a double datum transformation: Real-time CS -> WGS84 -> Map CS. Both the RT CS -> WGS84 and the WGS84 -> Map CS datums and transformation methods must be defined and configured on the ArcPad device, as well as replicated in the Trimble Positions geotransformation table or available in the ArcMap geotransformation list.

In ArcPad, tap / *GPS Preferences... / Datum* to select the datum.

For example, select *D_North_American_1983*. Click *GPS Datum* to confirm that the currently active transformation is appropriate for ArcPad's current datum pair.





Important: *It is imperative that the datum definition and transformation methods employed by ArcPad are identical to those used by ArcMap, otherwise inconsistencies will arise.*