Trimble® GPS Studio Application
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Introduction to Trimble GPS Studio

In this chapter:

- Features
- Technical assistance

The Trimble GPS Studio Application User Guide describes the Trimble® GPS Studio application, which you can use to configure GPS receivers. With a rich user interface and feature set, the Trimble GPS Studio has replaced earlier programs used for monitoring and interacting with Trimble Embedded Devices.

The application, which works with a serial connection, needs a virtual serial USB driver to work with the standard USB interface provided on GPS receiver starter kits.

Instructions for the virtual serial USB interface are included.
Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Connection with</td>
<td>Tests a GPS receiver port for protocol and baud rate so that you do not have</td>
</tr>
<tr>
<td>Auto-Detect Receiver</td>
<td>remember them when you connect the GPS Studio application to the GPS receiver.</td>
</tr>
<tr>
<td>Monitor</td>
<td>Shows time, velocity, position data, receiver mode and status, map functions,</td>
</tr>
<tr>
<td></td>
<td>and an auto-query function to report satellite data, and more.</td>
</tr>
<tr>
<td>Receiver Configuration</td>
<td>Enables you to configure a receiver and save its configuration.</td>
</tr>
<tr>
<td>Configurator</td>
<td>Enables you to load, modify, and save receiver configurations and then apply</td>
</tr>
<tr>
<td></td>
<td>them to additional receivers.</td>
</tr>
<tr>
<td>Data Logger</td>
<td>Logs the output of one or more GPS devices at the same time.</td>
</tr>
<tr>
<td>Data Converter</td>
<td>Converts logs from the data logger into formats used by other applications.</td>
</tr>
<tr>
<td>Generic Packets</td>
<td>Sends and views received raw data.</td>
</tr>
<tr>
<td>Flash Loader</td>
<td>Loads new firmware into the GPS receiver.</td>
</tr>
</tbody>
</table>

Technical assistance

If you have a problem and cannot find the information you need in the product documentation, contact the Trimble Technical Assistance Center at 800-767-4822 or email ctsupport@trimble.com.
This chapter describes how to install software and hardware needed for the Trimble GPS Studio application, and how to connect the Starter Kit to your computer.

In this chapter:

- Downloading and installing the application
- Extracting the Trimble GPS Studio application
- Installing the FTDI USB Virtual COM port driver
- Connecting the starter kit to the computer
- Assigning the USB virtual COM port
- Disabling the Microsoft serial ballpoint driver
Downloading and installing the application

Requirements

You need the following:

- A computer running one of the following Microsoft® operating systems:
  - Windows® 7
  - Windows Vista®
  - Windows XP with Service Pack 3
- A free USB port on the computer
- Internet access

Downloading the application

2. In the Support A-Z screen, scroll to and then click the GPS receiver that is included in your starter kit, for example the Condor Family of GPS Modules or the Copernicus® II.
3. Click the Support tab for the selected product.
4. In the Support tab, select the Support link.

The Support page shows all the software that is available for download.
5. Download the files you require and save them to a folder on the computer hard drive.
   - You must download:
     TrimbleStudio_vn-nn-nn.zip (where “vn-nn-nn” is the file version)
   - If you are not currently running the Windows 7 operating system, you may need:
     FTDI_USB-Serial_Driver.exe.

**Extracting the Trimble GPS Studio application**

1. Use Windows Explorer to browse to the TrimbleStudio_Vn-nn-nn.zip file you downloaded.
2. Extract the application to a location on the hard drive.

*Note* – The directory you select will also become the initial default directory for logs and reports from the application.

**Installing the FTDI USB Virtual COM port driver**

The starter kit uses a USB 2.0 dual serial port emulator interface chip from Future Technology Devices International (FTDI) Ltd. The GPS Studio application requires the FTDI driver.

- Installation is automatic if you are running the Windows 7 operating system, have granted Windows Update permissions, and are currently accessing the Internet. In this case, continue with the procedure described in Connecting the starter kit to the computer, page 8.

*Note* – The Windows 7 operating system automatically connects to the Windows Update website and to install the latest WHQL” (Microsoft Windows Hardware Quality Labs) Certified Available driver for the USB-to-serial emulator interface chip from FTDI. This happens when you plug in the USB cable, as long as you have an available Internet connection and if your update settings are set to allow this.

- If you are not running the Windows 7 operating system, you must manually install the driver that you downloaded from www.trimble.com. See below.

*Note* – The latest driver is available as a setup executable from the FTDI website at http://www.ftdichip.com/Drivers/VCP.htm.

**Manually installing the driver**

1. Use Windows Explorer to browse to the FTDI_USB-Serial_Driver.exe file you downloaded from the Trimble website (or the file from the FTDI website) and then double-click it.
2. The following message may appear: FTDI CDM Drivers have been successfully installed. Click OK.
3. Save any open files, close open programs and then click Restart Now.
Connecting the starter kit to the computer

1. Connect one end of the USB cable (supplied) to the USB connector on the Starter Kit:

2. Connect the other end of the USB cable to your computer. The USB cable now supplies power to the unit.

   *Note* – Depending on the starter kit product and the antenna supplied with it, you may need to connect power supply to the power connector on the starter kit. (One or more power supply accessories may be supplied with the starter kit; accessories vary by GPS receiver product.)

3. Connect the GPS antenna to the interface unit:

4. For the best GPS reception, place the antenna outside or near a window.

5. Optionally connect to the BNC connector on the rear of the interface unit for the PPS output:
6. Turn on the GPS Starter Kit (interface) unit. The power LED lights green.

Assigning the USB virtual COM port

After you have physically plugged in the USB connectors and turned on the Starter Kit, a dialog similar to the following appears on the desktop. It indicates that the FTDI driver has automatically assigned two virtual serial COM ports to the USB port. Click Close.

Note – When you later need to select a COM port within the GPS Studio application, these two USB Serial Ports appear in the application for selection.

Note – If the Windows 7 operating system did not automatically install a driver for the USB-to-serial emulator interface chip from FTDI, you may need to install the driver manually. See Installing the FTDI USB Virtual COM port driver, page 7.
Viewing the assigned COM ports in Windows Device Manager

Expand the Ports (COM & LPT) node and then find the two USB Serial Port COM numbers; in this example, COM10 and COM9.

*Note* – In general, the COM A port of the GPS device is the lower COM number; the COM B port is the higher number.

Disabling the Microsoft serial ballpoint driver

If the mouse pointer jumps around on the screen, check the system tray to see if the Microsoft serial ballpoint (mouse pointer) device has been enabled. If this is the case, do the following to disable it:

1. Turn off the Starter Kit to stop the pointer jumping.
2. On the computer, open the *Device Manager*:
Note – In the Windows 7 Start menu, enter Device Manager in the Search field and then select it from the results list under the Control Panel heading.

3. Expand the Mice and other pointing devices node.

4. If Microsoft Serial BallPoint is listed, right-click it and then select Disable.

5. Turn on the starter kit.
Running the Application

In this chapter:

- Starting the Trimble GPS Studio application
- Trimble GPS Studio screen
- Connecting the Trimble GPS Studio application to the GPS receiver
- Monitor screen

This chapter describes how to start the Trimble GPS Studio application and how to connect to the Starter Kit from the application. It also includes overview descriptions of the Trimble GPS Studio window and the Monitor window.
Starting the Trimble GPS Studio application

Double-click the icon in the folder where the application is stored.

Trimble GPS Studio screen

Note – Additional windows appear within the main Trimble GPS Studio window if you leave them open when you exit the application.

Menu bar

<table>
<thead>
<tr>
<th>Select ...</th>
<th>To access ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>File</td>
<td>Preferences and Exit</td>
</tr>
<tr>
<td>Connections</td>
<td>New Connection, Auto-Detect, Refresh Com List, and Device Manager</td>
</tr>
<tr>
<td>Tools</td>
<td>Data Logger, Data Converter, Flash Loader, and Configurator</td>
</tr>
<tr>
<td>Window</td>
<td>Window functions and a list of the open windows</td>
</tr>
<tr>
<td></td>
<td>Note – By selecting an open window this is brought into view.</td>
</tr>
<tr>
<td>Help</td>
<td>Current release information</td>
</tr>
</tbody>
</table>

Command bar

<table>
<thead>
<tr>
<th>Click ...</th>
<th>To ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version number</td>
<td>Open the About screen.</td>
</tr>
<tr>
<td>Connect to Device drop-down list</td>
<td>View the list of devices that you can connect to. Click an item on the list to select it.</td>
</tr>
<tr>
<td>New Connection drop-down list</td>
<td>View a list of connection features and COM ports. Click an item on the list to select it.</td>
</tr>
<tr>
<td>Data Logger</td>
<td>Log raw data from one or more connected devices.</td>
</tr>
<tr>
<td>Data Converter</td>
<td>Convert logged raw data to various formats</td>
</tr>
</tbody>
</table>

Note – This is the featured method for connection used in the user guide.
Running the Application

<table>
<thead>
<tr>
<th>Click</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferences</td>
<td>Configure various program settings.</td>
</tr>
<tr>
<td>Exit</td>
<td>Exit the Trimble GPS Studio application</td>
</tr>
</tbody>
</table>

**Status bar**

This contains the following display-only status items:

<table>
<thead>
<tr>
<th>Status item</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring</td>
<td>ON or OFF.</td>
</tr>
<tr>
<td>Logging</td>
<td>ON or OFF.</td>
</tr>
<tr>
<td>Time</td>
<td>Hours, minutes; AM or PM</td>
</tr>
</tbody>
</table>

**Connecting the Trimble GPS Studio application to the GPS receiver**

The *New Connection* feature enables you to connect to the GPS receiver and provides auto-detection of baud rates, parity, data bits, and stop bits settings.

1. Click *New Connection*...▼ and then select the required USB Serial Port (in this example, *USB Serial Port (COM 9)*) from the drop-down list:

![Image of Trimble GPS Studio application](image.png)

**Note** – If you know which port serves a particular protocol, select the port for the protocol you want.

**Note** – If you do not see the COM ports for the GPS receiver in the list, refresh the list as follows:
1. Select New Connections / Refresh COM List.
2. Click the information screen to close it.
3. If it is open, close the New Connection screen.
4. Click *New Connection*... ▼ again. The COM port should now appear in the list.
The *New Connection* dialog appears:

2. Select the *Auto-detect settings* check box. The Trimble GPS Studio application now auto-detects baud rate and other settings in turn for each protocol. A message **Checking for <PROTOCOL> using** appears on screen to show the auto-detect status:

*Note* – *If you clear the check box, only the settings selected in the bottom half of the dialog (for Baud Rate, Parity, Data Bits, and Stop Bits) are used.*
3. Click **OK**. The *Monitor* screen appears:

- If the receiver *is* detected, data appears in the *Monitor* screen, and a message screen appears. Click the message screen to close it:

![Successfully detected and connected to Copernicus II Receiver outputting TSIP data on COM 9.
The serial port settings are 38400 B-None-1.
Click here to close this window.]

- If the receiver is *not* detected, an error message appears. You can try to resolve the issue by doing the following:

  - If you cleared the *Auto-detect settings* check box, select it and then try again.
  - Select another COM port and then try again.
  - Refresh the COM port list, see page 15.
  - Use the On / Off switch to turn off the starter kit and then turn it on again.
Monitor screen

The Monitor screen indicates that the Trimble GPS Studio application is connected to the GPS receiver; use it to monitor the receiver performance.

Command bar

<table>
<thead>
<tr>
<th>Click ...</th>
<th>To ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor drop-down list</td>
<td>Access a menu that includes raw data, GPS receiver, and GPS system information.</td>
</tr>
<tr>
<td>Receiver drop-down list</td>
<td>Access a menu that includes GPS receiver configuration and reset options.</td>
</tr>
<tr>
<td>Port drop-down list</td>
<td>Select the appropriate port. When you select a port from the list, the Port Settings dialog appears.</td>
</tr>
<tr>
<td>Auto Query (ON or OFF)</td>
<td>Click, if ON, to request additional information from the GPS receiver (this information is not automatically sent by the receiver).</td>
</tr>
<tr>
<td>Map</td>
<td>Open the Position Map window.</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Read-only field with either “Outdoor” or “Indoor” as value.</td>
</tr>
</tbody>
</table>
**Status bar**

This contains the following display-only status items:

<table>
<thead>
<tr>
<th>Status item</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tx</td>
<td>If blinking green, this means that the application is transmitting to the GPS receiver. Mouse over Tx to view the <em>Incoming Serial Data Statistics</em>:</td>
</tr>
<tr>
<td>Rx</td>
<td>If blinking green, this means that the application is receiving from the GPS receiver.</td>
</tr>
<tr>
<td>Elapsed Time</td>
<td>The hours, minutes, and seconds that the application has been connected to the receiver.</td>
</tr>
<tr>
<td>Port</td>
<td>COM port settings</td>
</tr>
</tbody>
</table>
This chapter describes how to configure the GPS receiver. To do this, you will configure the GPS port, Outputs, PPS, and NMEA.

**Note** – GPS modules from the Condor family have a limit of 8 “Saves” in the Configure Receiver screen. After this, you must reflash the device. See Using the Flash Loader application, page 39.

**Note** – Change the settings that you require and then click Set. Only click Save Configuration when you are completely done.

**Note** – The options that are available from the Configure Receiver drop-down list depend on the device that is being configured.
Configuring the GPS port

1. From the Monitor window, click **Receiver** and then select **Configure** from the drop-down list:

*Note* – Options available within the Configure Receiver box depend on the device being configured.

2. In the **Receiver Configuration** dialog, select the **Port Configuration** tab:

3. Select:
   - The required **Receiver Port**, **Baud Rate**, **Parity**, **Data Bits**, and **Stop Bits**.
   - One **Input** and one **Output** protocol.

4. Click **Set** to save the settings on this tab.

*Note* – Do not click **Save Configuration** until you have completed changes on all tabs.

5. Continue with **Configuring outputs** or go to **Completing the configuration**
Configuring outputs

1. In the Receiver Configuration dialog, select the Outputs tab:

![Output Configuration](image)

2. Select the required setup options.
3. Click Set to save the settings on this tab.

*Note – Do not click Save Configuration until you have completed changes on all tabs as needed.*

4. Continue with Configuring PPS or go to Completing the configuration.

Configuring PPS

1. In the Receiver Configuration dialog, select the PPS Configuration tab:

![PPS Configuration](image)

2. Select an option from the Output list. The options are:
   - *Always ON.* PPS is present even without a GPS fix and will free-run until a fix is obtained.
   - *Fix-based.* The PPS is output only when the receiver has a fix.
3. Enter values or select settings for additional fields as required. The parameters and settings in this step are determined by the receiver being configured:
   – Enter a value in the Offset field (units are in nanoseconds).
   – Enter a value in the Pulse Width field (units are in nanoseconds).
   – Select an option in the Polarity field (positive or negative).
4. Click Set to save the settings on this tab.

Note – Do not click Save Configuration until you have completed changes on all tabs as needed.

5. Continue with Configuring NMEA or go to Completing the configuration

Configuring NMEA

1. In the Receiver Configuration dialog, select the NMEA tab:

2. Select the required setup options:
   – Sentences: Select one or more NMEA messages. The options are:

<table>
<thead>
<tr>
<th>Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GGA</td>
<td>GPS fix data</td>
</tr>
<tr>
<td>GSV</td>
<td>GPS satellites in view</td>
</tr>
<tr>
<td>RMC</td>
<td>Recommended minimum specific GPS/Transit data</td>
</tr>
<tr>
<td>GLL</td>
<td>Geographic position - Latitude/Longitude</td>
</tr>
<tr>
<td>GSA</td>
<td>GPS DOP and active satellites</td>
</tr>
<tr>
<td>VTG</td>
<td>Track made good and ground speed</td>
</tr>
<tr>
<td>ZDA</td>
<td>Time and date</td>
</tr>
<tr>
<td>TF</td>
<td>Receiver status and position fix</td>
</tr>
<tr>
<td>BA</td>
<td>Antenna status</td>
</tr>
<tr>
<td>GST</td>
<td>GPS Pseudo-range noise statistics</td>
</tr>
<tr>
<td>CHN</td>
<td>GPS channel status</td>
</tr>
</tbody>
</table>
– **General**: Enter an integer (between 1 and 255) to represent the output interval in seconds.

3. Click **Set** to save the settings on this tab.

**Note** – *Do not click Save Configuration until you have completed changes on all tabs as needed.*

4. If required, you can now click any other tab to set additional parameters or go to **Completing the configuration**.

### Completing the configuration

1. Once you have made all changes, in the last tab click **Set** and then click **Save Configuration**.

**Note** – GPS modules from the Condor family have a limit of 8 “Saves” in the Configure Receiver screen. After this, you must reflash the device. See Using the Flash Loader application, page 39.

2. Click **Close** to close the Configure Receiver dialog.
Using the Core Tools

In this chapter:

- Logging the GPS receiver output
- Converting output logs
- Sending raw data to the receiver
- Managing configurations
- Using the Flash Loader application

This chapter describes how to use the core tools of the Trimble GPS Studio application.

These tools are useful for a range of activities including debugging, testing new commands, systematically configuring GPS receivers, and updating receiver firmware.
Logging the GPS receiver output

1. In the command bar of the main Trimble GPS Studio screen, click **Data Logger**:

![Data Logger interface](image)

2. From the *Available Ports* list, select the COM port that connects to your device.
3. In the *Log File* field, enter a filename and path or click the **Browse** button to select the path.
4. If appropriate, select the *Use standard file naming* check box and then complete the *Unit ID* and *Test Case #* fields.
5. Select the correct protocol and logging options.
6. Click **Start Logging**.

*Note* – If you are working with more than one receiver, you can create additional logs on the other available COM ports.
Converting output logs

It is sometimes useful to convert the files from the Data Logger into formats used by other applications, for example Google Earth or the Microsoft Excel® spreadsheet software:

1. In the command bar of the main Trimble GPS Studio screen, click **Data Converter**:

   ![Data Converter](image)

2. In the *Select a file to convert* field, browse to and then select the file that you want to convert.

3. In the *Select output files to generate* section, select the check box next to each type of output file that you want to generate.

4. Click **Convert**. The converted files appear in the source file directory.
Sending raw data to the receiver

1. In the Monitor screen, select Monitor / Generic Packets:

   ![Monitor screen with Generic Packets selected]

2. In the Generic Packets window, in the first section:

   - Select the required Protocol to use for sending the raw data from the drop-down list.

   - Optional. Select an existing message from the Presets drop-down list. This message populates the Packet Data field (in the second section) with data in accordance with the selected protocol.
Tip – You can use Presets to see an example of how to enter a packet for the selected protocol. You can then edit the Packet Data field as required for your selected message.

3. If you did not select a Presets message, enter your own data in the Packet Data field.

Note – Enter the user data only, not the start and end bytes that appear to the left and right of the field.

4. Click View Raw Data. This opens the Raw Data Monitor screen where you can view data from the GPS receiver—by default, only the Show RX check box is selected, meaning that the window displays only data received by the application from the GPS receiver:
5. Press **Pause / Resume** as required so that you can examine the stream of data more easily:

6. To return to the *Generic Packets* window, close the screen.

7. To send the raw data to the receiver, in the *Generic Packets* window, click **Send**.
8. Click **View Raw Data** again—you can now see the packets that you specified for sending to the GPS receiver, and the packets returned in response:

![Raw Data Monitor](image)

**Note:** Red: Sent (by TGS) data; Blue: Received (from GPS module) data.

9. Return to the **Generic Packets** screen and then click **Close**.
Managing configurations

You can load receiver configurations into the GPS Studio application's Configurator and then edit the settings if required (optional). After you have finalized a configuration, you can then save it to a file. You can open this file later and use it to configure one or more receivers.

1. From the menu bar of the main Trimble GPS Studio window, select Tools / Configurator:

2. Select the product.
Loading the configuration from the receiver

1. From the Menu drop-down list, select Load from Receiver to load the settings from the receiver into the Configurator:

2. In the Configure Receivers dialog, select the required COM port from the drop-down list and then click Start:

This loads the configuration into the Configurator dialog:
Saving a configuration file

1. From the Menu drop-down list, select Save:

2. In the *Choose the receiver configuration file* dialog, browse to the required location, rename the file as appropriate and then click Save:
Opening a configuration file

1. From the Menu drop-down list, select Open:

2. In the Choose the receiver configuration file dialog, browse to the required location, select the required file and then click Open:
Configuring receivers using the Configurator settings

1. From the Menu drop-down list, select Configure Receiver(s):

Note – Alternatively, click Configure Receiver(s).

2. In the Configure Receivers dialog, select one or more COM ports from the top drop-down list and then click Start:

Note – You would select multiple COM ports if you are working with more than one receiver.
3. The receiver(s) are configured, and a message appears in the Configure Receivers window. Click Close:

4. Click Close in the Configurator window.

### Using the Flash Loader application

Use the Flash Loader application to load firmware onto the GPS receiver.

💡 **Tip** – To use the Flash Loader, your computer must be physically connected to the GPS receiver.

1. Download and extract the new firmware.
2. From the main Trimble GPS Studio window, select Tools / Flash Loader:
3. In the Flash Loader dialog, click **Browse**: 

![Flash Loader dialog](image)

4. In the *Choose the firmware file* dialog, navigate to the required firmware file and then click **Open**.

5. In the *Com Port Selection* list, select the required communications port and then click **Start**:

![Flash Loader dialog with selected port](image)

The current firmware is erased and the new firmware is loaded.

6. When the firmware has been successfully loaded, close the Flash Loader window.

7. Turn the GPS receiver off and then turn it on again.

8. Connect to the GPS receiver, see Connecting the Trimble GPS Studio application to the GPS receiver, page 15.

   The new firmware version appears in the Monitor screen, in the Firmware Info section.
Using the Position Map

In this chapter:
- Position Map tab
- Position Plot (Horizontal, 2D) tab

This chapter describes how to use the Position Map dialog, accessed from the Monitor window. The Position Map dialog has two tabs: The Position Map tab, and the Position Plot tab.
Position Map tab

If you are connected to the Internet, the Position Map screen enables you to view Google Maps for your location in the Position Map tab. In the Monitor window, click Map:

![Position Map screen](image)

The Position Map screen opens, showing the Position Map tab—wait for Google Map data to load. The default view is the Satellite view, and the screen shows the usual Google Map controls:

![Position Map screen](image)

You can now do the following:
- Mouse over the **Satellite** button to see the *Show labels* check box. Select or clear this check box to turn overlay map labels on or off:

- Click **Map** to show the street map view:
• Click **Terrain** to show the terrain view:

**Tip** – To use the screen features (such as **Zoom In**, **Zoom Out**, **Erase**, and **Measure Distance**), you can either use the screen controls, or select them from the **Menu** drop-down list. The following example shows how you can select a closer view by using the Zoom In feature:
Position Plot (Horizontal, 2D) tab

Click the Position Plot (Horizontal, 2D) tab:

Number in meters shows the scale for the graticule
Tip – To use the screen features (such as Zoom In, Zoom Out, and Erase), you can either use the screen controls, or select them from the Menu drop-down list. The following example shows the Position Plot tab using the Zoom In feature:

To erase the displayed plot, select Menu / Erase:
Using GPS Studio With GPS Timing Receivers

In this chapter:
- Overview of GPS timing receivers
- Connecting the GPS Studio application to the GPS timing receiver
- Configuring the timing receiver

This chapter describes how to use the Trimble GPS Studio application with GPS timing receivers. It includes descriptions of the Timing Receiver Status and Control window and the Timing Receiver Configuration window.
Overview of GPS timing receivers

GPS timing receivers are high-performance receivers that have been specially adapted for timing applications. Trimble GPS timing receivers feature the Trimble improved signal processing code, a high-gain RF section for compatibility with standard active gain GPS antennas, and a CMOS level pulse-per-second (PPS) output for timing and synchronization applications. Timing applications are assumed to be static.

GPS timing receivers operate in two main modes:

- Self-survey mode (position fix operating mode, at startup)
- Overdetermined Clock mode (timing mode, after reference position fix)

The special timing software used with a timing receiver configures the unit into an automatic self-survey mode at startup. The receiver will average position fixes for a specified time (one per second) and at the end of this period will save this reference location. The receiver then goes into an Overdetermined Clock mode, during which time the receiver no longer solves for position. Instead, it only solves for clock error and clock bias using all of the available satellites. This provides an accuracy of 15 ns RMS or better for the 1PPS output.

User settings such as port parameters and TSIP settings can be stored in the receiver’s non-volatile (Flash) memory. These settings are retained without mains power.

**Note** – *When customizing port assignments or characteristics, confirm that any changes do not affect the ability to communicate with the receiver.*

Self-Survey mode

At power-on, the unit performs a self-survey by averaging position fixes. The default number for position fixes (2000) is configurable in the GPS Studio application.

The default mode during self-survey is 2D/3D Automatic, where the receiver must obtain a 3D solution. If fewer than four conforming satellites are visible, the unit suspends the self-survey. 3D mode may not be achieved when the receiver is subjected to frequent obscuration or when the geometry is poor due to an incomplete constellation.

Overdetermined Clock mode

Overdetermined Clock mode is used only in stationary timing applications. This is the default mode for GPS timing receivers once a surveyed (or user-entered) position is determined. After the receiver self-surveys its static reference position, it automatically switches to Overdetermined Clock mode and determines the clock solution. The timing solution is qualified by a TRAIM algorithm, which automatically detects and rejects faulty satellites from the solution.
Connecting the GPS Studio application to the GPS timing receiver

The *New Connection* function enables you to connect to the GPS timing receiver, opening both the *Timing Receiver Status and Control* and the *Monitor* dialogs.

The *New Connection* function provides auto-detection of baud rates, parity, data bits, and stop bits settings.

To connect to the GPS receiver, see *Connecting the Trimble GPS Studio application to the GPS receiver*, page 15:

The Trimble GPS Studio application is now connected to the GPS timing receiver. You can use the application to configure and monitor the performance of the GPS timing receiver.

*Note – In the Monitor window, notice the Receiver Mode & Status section in the upper middle. After self-survey, the Mode will be "O-D only" (initially, it may be "2D, Auto" then "3-D, Auto").*
**Timing Receiver Status and Control dialog**

The *Timing Receiver Status and Control* dialog displays key GPS status information and status alerts that change during a self-survey of position fixes:

![ Timing Receiver Status and Control dialog](image)

The screen shows the following information:

<table>
<thead>
<tr>
<th><strong>Element</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timing Configuration</strong></td>
<td>Click to open the <em>Timing Receiver Configuration</em> dialog.</td>
</tr>
<tr>
<td>GPS Status</td>
<td>The options are:</td>
</tr>
<tr>
<td></td>
<td>- <em>Self-Survey Progress</em>: Shows the percentage of GPS fixes collected so far during the self-survey process. (Percentage of total fixes in the <em>Timing Receiver Configuration</em> dialog’s <em>Survey Length</em> field.) It shows 100% when a self-survey has been completed.</td>
</tr>
<tr>
<td></td>
<td>- <em>Rcvr Mode</em>: Shows the fix mode the GPS timing receiver is currently configured for. GPS timing receivers spend most of their time in the Overdetermined Clock (“O-D time only”) mode, in which they use all available satellites to perform the best time-only fix possible.</td>
</tr>
<tr>
<td></td>
<td>- <em>GPS Status</em>: “(0) Doing Fixes”, “(1) No Time”.</td>
</tr>
<tr>
<td>Timing Bias</td>
<td>In ns.</td>
</tr>
<tr>
<td>Bias Rate</td>
<td>In ppb.</td>
</tr>
<tr>
<td>PPS Quant Error</td>
<td>In ns.</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
</tr>
<tr>
<td>UTC Offset</td>
<td>In seconds.</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
</tr>
</tbody>
</table>
Status indicators

The status indicators are user alerts. They do not necessarily indicate impaired function.

- **Antenna Open:** If this indicator is yellow, the antenna input connection is open, that is, not drawing sufficient current. Normally, GPS timing receivers provide power to the antenna’s LNA (Low Noise Amplifier) through the center conductor of the antenna cable. On-board circuitry senses this current draw, and if it is low, this indicator is yellow.
  
  If the antenna is powered elsewhere (for example, when using a splitter) the antenna open condition is expected. This does not imply a fault condition, and does not impair operation.

- **Antenna Short:** If this indicator is yellow, the antenna input is shorted (drawing too much current).

- **Satellite Tracking:** If this indicator is yellow, no satellites are usable yet. For a satellite to be usable, it must be tracked long enough to obtain ephemeris and health data.

- **Self-Survey Active:** If this indicator is yellow, a self-survey procedure is in progress.

- **Stored Position:** If this indicator is yellow, no position is stored in Flash ROM.

- **Leap Second Pending:** If this indicator is yellow, the GPS system has alerted the timing receiver that a leap second transition is pending.

- **Test Mode:** If this indicator is yellow, the timing receiver unit is operating in one of its test modes.

- **Position Questionable:** If this indicator is yellow, the accuracy of the position used for time-only fixes is questionable. It may mean that the unit has been moved since it last completed a self-survey procedure. If this alarm persists, restart the self-survey of the unit. See Configuring the timing receiver, page 52.

- **Almanac:** If this indicator is yellow, means the Almanac is not current or complete.

- **PPS Generated:** If this indicator is yellow, the PPS was not generated this second. This could mean that there were not enough usable satellites to generate an accurate PPS output. It could also mean that the unit is generating an Even Second output (see Packet 8E-4E) and that the unit did not output a PPS on the odd second.

- **PPS Good:** If this indicator is green, the PPS is good.

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</thead>
<tbody>
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</tr>
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</tr>
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</tr>
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</tr>
<tr>
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<td>If this indicator is yellow, the PPS was not generated this second. This could mean that there were not enough usable satellites to generate an accurate PPS output. It could also mean that the unit is generating an Even Second output (see Packet 8E-4E) and that the unit did not output a PPS on the odd second.</td>
</tr>
<tr>
<td><strong>PPS Good</strong></td>
<td>If this indicator is green, the PPS is good.</td>
</tr>
</tbody>
</table>
Configuring the timing receiver

You can configure position, self-survey, and timing output.

To configure the timing receiver, click **Timing Configuration** in the command bar of the **Timing Receiver Status and Control** dialog:

The **Timing Receiver Configuration** dialog has two tabs:

- **Self-Survey, Position, General tab**, page 52
- **Timing Outputs tab**, page 54

Click **Query** to query the receiver for its current configuration settings.

Click **Close** to close the screen.

**Self-Survey, Position, General tab**

Use this tab to reset and restart the self-survey, and reset position and general options.

**Self-Survey**

The Self-Survey area is used to configure and restart a self-survey:

1. In the **Self-Survey** area, you can make the following changes if required:
   - **Survey Flag**: Enable or disable self-surveys.
   - **Position Flag**: Save (or do not save) the surveyed position when the self-survey is complete.

   *Note* – The survey flag and position flag are both enabled by default. If you disable them, there is the option to set your own position. See **Accurate Position**, page 53.
– **Survey Length:** To shorten the survey process, change the total number of fixes that are to be averaged together to form the self-surveyed position to be used for clock-only fixes.

2. If you changed any parameters, click **Set**.

3. Click **Restart**. In the **Timing Receiver Status and Control** window, the **Self-Survey Progress** field restarts at 0%.

### Accurate Position

The **Accurate Position** fields are used to specify and save the position used to perform time-only fixes. Use the WGS-84 datum to enter the coordinates.

1. Enter or edit the following coordinates:
   - **Lat (deg (+N, -S))**: Latitude of the accurate position, in decimal degrees. For a southern latitude, enter a minus sign before the value.
   - **Lon (deg (+E, -W))**: Longitude of the accurate position, in decimal degrees. For a western longitude, enter a minus sign before the value.
   - **Alt (m)**: Altitude of the accurate position (in meters).

   **Note** – Click the **Query** button at the bottom of the screen to populate the fields with any currently set coordinates.

2. Select the **Double Precision** check box (recommended) to send double-precision values of the position. If you do not do this, a single-precision packet is used.

3. Click **Set** to immediately set the receiver’s position to the specified coordinates and switch the receiver to Over Determined timing mode.

   **Note** – If a self-survey is in progress when you click **Set**, the self-survey is cancelled.

   **Note** – If you click **Set**, the position to not saved automatically to non-volatile (Flash) memory.

4. Wait at least two seconds and then click **Save** to save the receiver’s currently set position to non-volatile (Flash) storage.

   To delete saved coordinates from Flash storage, click **Delete**.

### General Options

In this area, you can do the following:

1. **SV for One-Satellite Mode:** Enter the satellite ID (1 to 32) that you want to use for the one-satellite, time-only fix mode and then click **Set**.

   **Note** – If you enter 0, the GPS receiver automatically selects the best satellite.

2. **Current Mode:** From the **Configure for** drop-down list, select the required mode (**Timing** or **PVT Mode**) and then click **Set**.
Using GPS Studio With GPS Timing Receivers

- **Timing Mode**: This is the timing receiver output mode. If you select this option, the receiver will automatically outputs timing packets only, for example, 0x8F-AB and 0x8F-AC.

- **PVT Mode**: This is the position/velocity/time mode. If you select this option, the receiver automatically outputs packets associated with positioning, for example, 0x56, 0x6D, and 0x84.

**Note** – Always use timing receivers in static applications in timing mode. Do not use them in PVT Mode before talking to Trimble Support.

3. Select the **Poll Timing Packets** check boxes to turn on polling of timing packets only if the product being monitored does not automatically output the particular timing packet. If you select Primary, you must also select Supplemental, but you may use Supplemental on its own:

- **Primary**: Select this option to turn on polling of the primary timing packet 0x8F-AB.
- **Supplemental**: Select this option to turn on polling of the supplemental timing packet 0x8F-AC.

Collectively, there are only three valid states for these check boxes:

![](Timing Outputs Tab.png)

**Timing Outputs tab**

Use this tab to change settings for Packet Masks, PPS Qualifier, PPS Output, and UTC GPS Timing.
Packet Masks (0x8E-A5)

The broadcast mask is bitwise encoded to allow you to turn on and off the broadcast of certain packets. The settings for Packet Masks are:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Select to automatically output ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Timing (8F-AB)</td>
<td>the primary timing packet 0x8F-AB.</td>
</tr>
<tr>
<td>(Bit 0)</td>
<td></td>
</tr>
<tr>
<td>Supplemental Timing (8F-AC)</td>
<td>the supplemental timing packet 0x8F-AC.</td>
</tr>
<tr>
<td>(Bit 2)</td>
<td></td>
</tr>
<tr>
<td>Auto Event Packets (Bit 6)</td>
<td>the position, velocity, and receiver mode packets 0x56, 0x6D, and 0x84.</td>
</tr>
</tbody>
</table>

Click **Set Masks** to set the packet broadcast masks according to the options.

*Note* – If broadcast packets have multiple formats, the receiver broadcasts only one of the formats. If more than one of the formats is masked on for broadcast, the format with the greatest precision of content masked on is sent and the rest is not sent.

PPS Output (0x8E-4A) / Width (-4F)

You can specify the PPS Output characteristics that apply to the receiver. The settings for PPS Output are:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Enable or Disable PPS output</td>
</tr>
<tr>
<td>Polarity</td>
<td>Set polarity positive (on time rising edge) or negative (on time falling edge).</td>
</tr>
<tr>
<td>Offset (in seconds)</td>
<td>Value for PPS offset or cable delay. Negative offset values advance the PPS, and are normally used to compensate for cable delay.</td>
</tr>
<tr>
<td>Width (in seconds)</td>
<td>Value for PPS pulse width. If this field is unavailable, the receiver does not support setting the PPS pulse width.</td>
</tr>
</tbody>
</table>

Click **Set PPS** to set the PPS Output characteristics according to the selected options.

PPS Qualifier (0x8E-4E)

The settings for PPS Qualifier are:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qual</td>
<td>When PPS is turned on:</td>
</tr>
<tr>
<td></td>
<td>• Always: PPS is always turned on.</td>
</tr>
<tr>
<td></td>
<td>• &gt;=1: PPS is output when at least one satellite is tracking.</td>
</tr>
<tr>
<td></td>
<td>• &gt;=3: PPS is output when at least three satellites are tracking.</td>
</tr>
<tr>
<td>Type</td>
<td>1PPS: PPS is generated every second (Qual setting applies).</td>
</tr>
<tr>
<td></td>
<td>Even Second: PPS is generated every even second (Qual setting applies).</td>
</tr>
</tbody>
</table>

Click **Set Qualifier** to set the PPS Qualifier according to the selected options.
UTC/GPS Timing (0x8E-A2)

You can specify the UTC/GPS time report alignment (time and date fields) in packet 0x8E-A2 and the temporal location of the output PPS. The settings for UTC/GPS Timing are:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date/Time Report (8F-AB) – GPS or UTC</td>
<td>Time report is to be aligned to the GPS time or UTC time.</td>
</tr>
<tr>
<td>PPS Output Alignment – GPS or UTC</td>
<td>PPS is to be aligned to the GPS time or UTC time.</td>
</tr>
</tbody>
</table>

Click Set Timing to set the time report alignment and the temporal location of the output PPS according to the selected options.