

# USB GPS Dongle with PPS\*

## *Navigation & Timing*



## ***z050 Starter Kit***

# Installation Guide

*\* The **Pulse Per Second (PPS)** is an electrical signal that very precisely indicates the start of a second. The z050 GPS chipset delivers the PPS signal with an accuracy  $\pm 25$  nanoseconds.*

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Revision 6

## Product Overview

The z050 USB dongle provides an L1 Frequency GPS receiver, with NMEA protocol from a USB port and a **PPS timing output**. The z050 unit is based on a GPS receiver from Trimble with 22-channel continuous tracking and high sensitivity (tracking -160dBm).

With its higher sensitivity, performance and faster startup times, the z050 module is a complete GPS receiver that generates position fixes with high accuracy in extremely challenging environments and under poor signal conditions (down to -160dBm), velocity and time data with leading edge acquisition times. In addition, the GPS receiver provides a configurable 1 PPS synchronized to GPS/UTC, typically within 25 nanoseconds (one sigma) and an update rate up to 5Hz.

The z050 module is capable of receiving Satellite Based Augmentation System (SBAS) corrections, including the U.S. Wide Area Augmentation System (WAAS) and the European Geostationary Overlay Service (EGNOS). GPS assistance (aGPS) is also supported.

## Key Features

- Trimble chipset, GPS L1 Frequency C/A code receiver with high sensitivity, 22 channels
- NMEA output and input
- SBAS (WAAS, EGNOS, MSAS) capable
- aGPS capable
- Update rate up to 5 Hz
- **PPS timing output**
- **Built in GPS Ceramic Patch Antenna** (18x18x4mm) or use of an external active GPS Antenna
- Compact Design with a size of a USB key (USB 2.0 Interface)
- Suitable for Laptop, Desktop, Mobile Device, UMPC, Eee PC, Notebooks and Netbooks
- RoHS Compliance

Use with Built in GPS Antenna	Use with External GPS Antenna
	

*Note: ZTI Communications is not responsible for the operation or failure of operation of GPS satellites or the availability of GPS satellite signals.*

## GPS Performance Specifications

GPS performance statistics are clear view, stationary. Sensitivity based on signals measured at the antenna.

Parameter	Value
Update Rate	1 Hz (default), up to 5 Hz
Number of channels	22
Accuracy	
Position (autonomous)	<2.5 m 50%, <5 m 90%
Position (SBAS)	<2 m 50%, <4 m 90%
Altitude (autonomous)	<5 m 50%, <8 m 90%
PPS	< $\pm 25$ ns @ 50%
Acquisition time	
Re-Acquisition	2 s 50%
Hot Start	2 s 50%
Warm Start	35 s 50%
Cold Start	38 s 50%
Sensitivity	
Tracking	-160 dBm
Acquisition	-146 dBm
Dynamics	
Acceleration	2 g
Operational Limits	Altitude <18,000m (60,000 ft.) or velocity <515m/s (1,151 mph). Either limit may be exceeded but not both (COCOM limit)

## GPS Communication Parameters

GPS output is available from a USB Interface. The output adheres to NMEA 0183 protocol with the following characteristics.

Parameter	Value(s)
Protocol	NMEA 0183
Baud Rate	
Default	57600
Other	4800, 9600, 19200, 38400, 115200
Message Output Rate	Up to 5 Hz
Number of message types restricted by Baud Rate	

## NMEA 0183 Messages

Message	Default	Description
GGA	Default	GPS fix data
GSA	Default	GPS DOP and active satellites
GSV	Default	GPS satellites in view
RMC	Default	Recommended minimum specific GPS/Transit data
CHN	Other	GPS channel status
GLL	Other	Geographic position – Latitude/Longitude
VTG	Other	Track Made Good and Ground Speed
ZDA	Other	Time and date

## Mechanical and Environmental

Dimensions (including USB connector)	78.3mm L x 22.3mm W x 14.1mm H
High Speed USB 2.0 (480 Mbit/s)	USB A-type Male Plug for connection to a USB host or Hub port. The maximum cable length is 5 meters according to the USB 2.0 specification.
External Aerial Connector	MCX
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +105°C
Humidity	5% to 95% non-condensing @ 60°C
Weight	20g
Warranty	1-Year
Environmental	RoHS
Power	Voltage DC 5V via USB port, Current < 55mA (tracking)

## Use and care

The z050 USB GPS dongle is a high-precision electronic instrument and should be treated with reasonable care.

## Technical assistance

If you have a problem and cannot find the information you need in the documentation, please contact ZTI Communications Technical Assistance Center:

- Phone: +33 2 9613 4003
- Email [support@zti-communications.com](mailto:support@zti-communications.com)

## System Requirements

### Hardware

- z050 USB GPS Dongle with USB extension cable
- Optional: GPS patch antenna 3V 27dB with MCX connector

### Computer

- Computer running Windows operating system (Seven, Vista, 2000 or XP) or MAC OS X or Windows CE or Linux.

### Software

- Trimble GPS Studio software (TGS). The software is used to monitor the GPS performance of the z050 USB GPS dongle and to change its settings. The software is compatible with Windows 2000, Windows XP, Windows Vista and Seven operating systems.
- Time Service Software (TSS-P) compatible with Windows XP, Vista and Seven. The software is used to synchronize the clock of the computer with a guaranteed accuracy of 1 millisecond.

## z050 Starter Kit

The starter kit is composed of several items:



## Setting up the z050 Starter Kit

1. We recommend to not directly plug the z050 USB GPS dongle into the USB port of the target machine, but to plug first the USB extension cable and then the z050 USB GPS dongle.

Directly plug-in the USB GPS Dongle into the USB port may degrade GPS performance due to RF interference from your equipment.

Four configurations are possible depending on the conditions of GPS signal reception (indoor or outdoor use). For indoor use, we recommend placing the GPS dongle or GPS patch antenna near a window with a clear view of the sky.

Configuration #1	Configuration #2
<p>USB Dongle connected directly to the equipment (use of the Built in GPS Ceramic Patch Antenna)</p>  <p><i>Note: GPS performance degradation due to RF interference from the laptop</i></p>	<p>USB Dongle + USB extension cable connected to the equipment (use of the Built in GPS Ceramic Patch Antenna)</p>  <p><i>Note: configuration recommended for use without external GPS antenna</i></p>
<p>Configuration #3</p> <p>External GPS patch antenna + USB Dongle connected directly to the equipment</p> 	<p>Configuration #4</p> <p>External GPS patch antenna + USB Dongle + USB extension cable connected to the equipment</p>  <p><i>Note: optimal configuration for receiving GPS signals</i></p>

2. Use one of the configurations described above with the GPS USB dongle, and then install the USB driver by using the CD-ROM software of the starter kit if the operating system doesn't install automatically the FTDI driver.

When the USB dongle is connected to your equipment (desktop, laptop, netbook, UMPC ...), a virtual serial port is available after installation of the driver by the operating system - for example: USB Serial Port (Com x).

Drivers are available which allow the z050 USB GPS dongle to work with the following operating systems:

- Windows Server 2008 R2, Windows Server 2008, Windows Server 2008 x64
- Windows 7, Windows 7 x64
- Windows Vista, Windows Vista x64
- Windows Server 2003, Windows Server 2003 x64
- Windows XP, Windows XP x64
- Windows 2000, Windows ME, Windows 98
- Windows CE.NET (Version 4.2 and greater)
- Linux
- Mac OS X, Mac OS 9, Mac OS 8

For most of these operating systems two types of driver are available: Virtual COM Port (VCP) drivers and direct (D2XX) drivers. The VCP driver emulates a standard PC serial port such that the USB device may be communicated with as a standard RS232 device. The D2XX driver allows direct access to a USB device via a DLL interface.

Virtual COM port (VCP) drivers cause the USB device to appear as an additional COM port available to the PC. Application software can access the USB device in the same way as it would access a standard COM port.

Please refer to the documentation in the CD-ROM to install the FTDI driver related to your operating system (XP, 2000, Vista or Seven) or visit <http://www.ftdichip.com/Drivers/VCP.htm> (FTDI Drivers) and <http://www.ftdichip.com/Support/Documents/InstallGuides.htm> (installation guides) for more information (FTDI chipset: FT232R).

3. Once the FTDI driver is installed, you can check that the GPS dongle is operational by using "Trimble GPS Studio Application" application (Copyright Trimble Navigation Limited) - Supported operating systems: Windows 7, Windows Vista, Windows XP SP 3, or Windows 2000 SP 4.

## Use of Trimble GPS Studio to monitor the z050 USB GPS Dongle

### Configuration by default for z050 USB GPS Dongle:

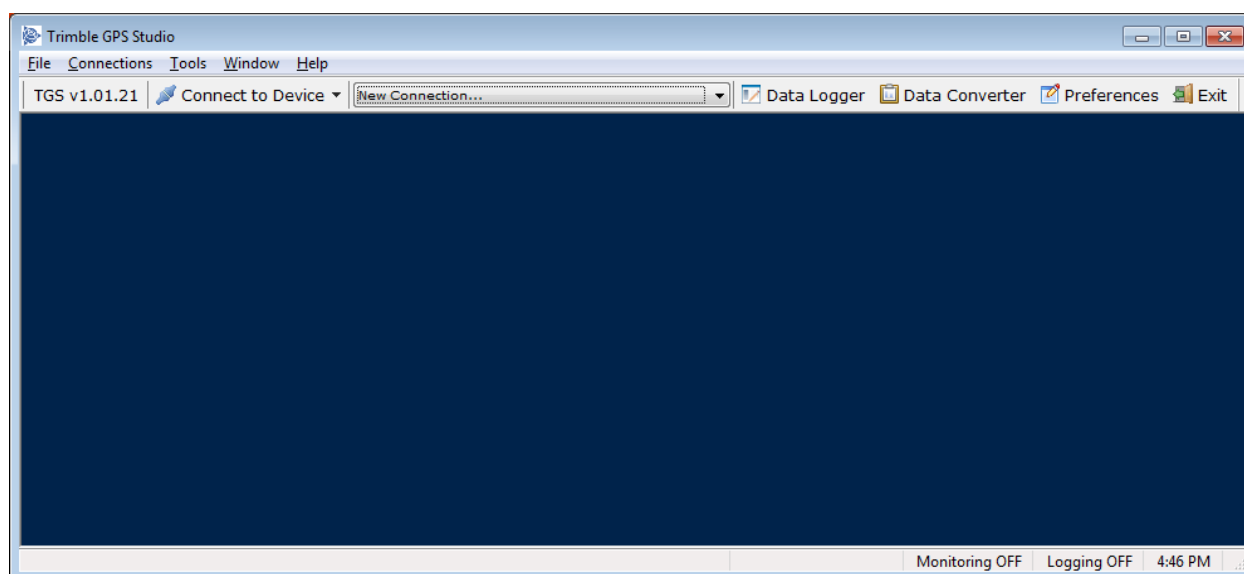
- Baud Rate: 57600, N, 8, 1
- PPS Pulse Width: 100040 ns (rounded to a multiple of 61ns)
- Update rate: 1Hz
- NMEA messages:
  - RMC (Recommended minimum specific GPS/Transit data)
  - VTG (Track Made Good and Ground Speed)
  - GGA (GPS fix data)
  - GSA (GPS DOP and active satellites)
  - GSV (GPS satellites in view)

The CD-ROM provided with z050 Starter kit contains the following files:

- TrimbleStudio\_Vxxxxx.exe (Trimble GPS Studio) software)
- GPSStudio User Guide xxxx.pdf (User Guide for TGS software)

Install first TGS (Trimble GPS Studio) software. Be sure to have the USB GPS dongle plugged in before launching the software.

To start the Trimble GPS Studio application, double-click the icon in the folder where the application is stored. The main Trimble GPS Studio window opens.



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

### Connecting GPS Studio to the GPS Receiver

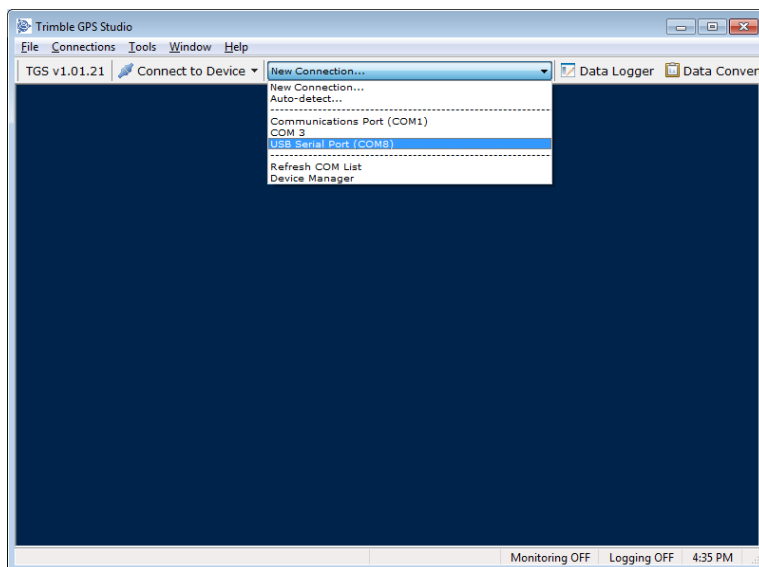
The New Connection function enables you to connect to the GPS Receiver, opening the Monitor window.

**Tip** – The following New Connection feature provides auto-detection of baud rates, parity, data bits, and stop bits settings.



To perform New Connection:

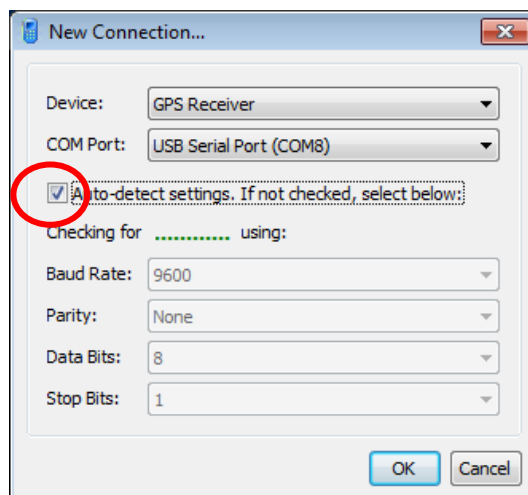
1. Click the **New Connection...** ▼ chooser.
2. Choose the **USB Serial Port (COM x)** you want from the drop-down list.



**Note** – If you happen to know which port serves which 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. Select *Connections / Refresh COM List*, click the information bubble (to close it), close the *New Connection* box if it is open, and then click **New Connection...** ▼ again. Now select the COM port.

This opens the *New Connection...* box with the port already selected.



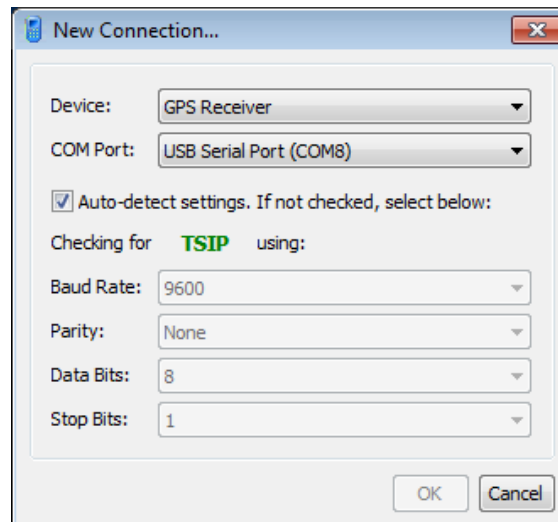
3. Select the checkbox for Auto-detect settings

**Tip** – When you select the checkbox, GPS Studio tries each baud rate and other settings as applicable in turn. After you check the checkbox, a “Checking for ..... using:” line is added to provide auto-detect status.

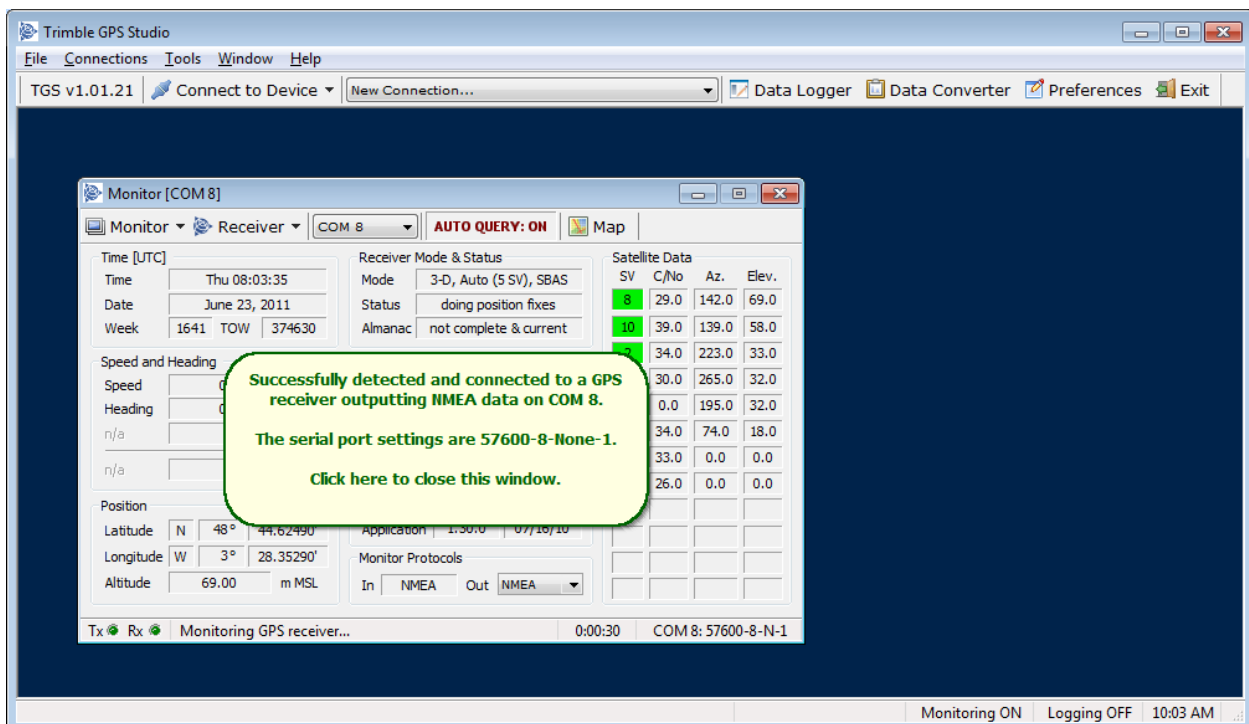
**Note** – If you leave the checkbox unselected, only the settings selected in the bottom half of the New Connection... box for Baud Rate, Parity, Data Bits, and Stop Bits will be used.

4. Click OK.

The “Checking for ..... using:” line in the box reports each protocol and baud rate as they are checked.

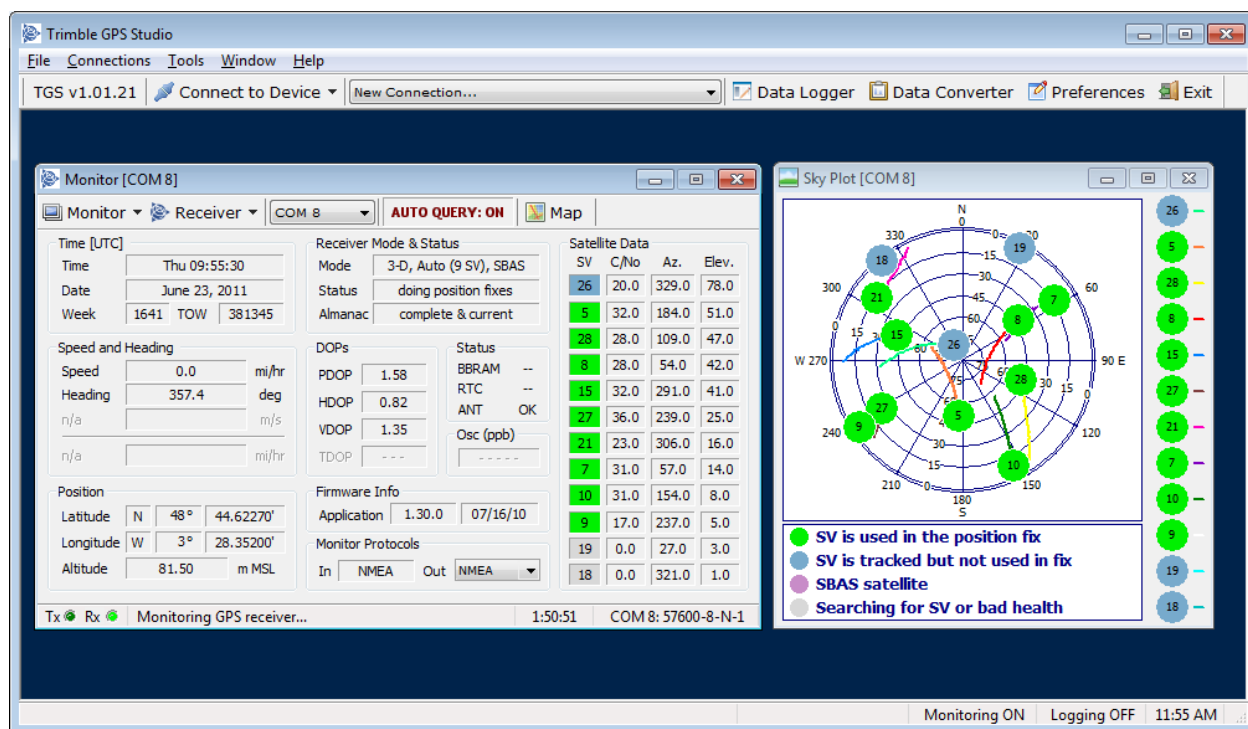


The *New Connection...* box closes and the *Monitor* window opens. If the receiver is detected, the *Monitor* window is filled with data, and a message bubble reports success.



5. Click into the bubble to close it.

6. The Trimble GPS Studio is now connected to the GPS receiver! You can now use the GPS Studio to monitor the performance of the GPS receiver.



*Example with 9 GPS satellites in view  
 (z050 indoor with external GPS antenna near a window facing South-East)*

Please refer to Trimble GPS Studio Application User Guide for more information.

## TSS-P Software

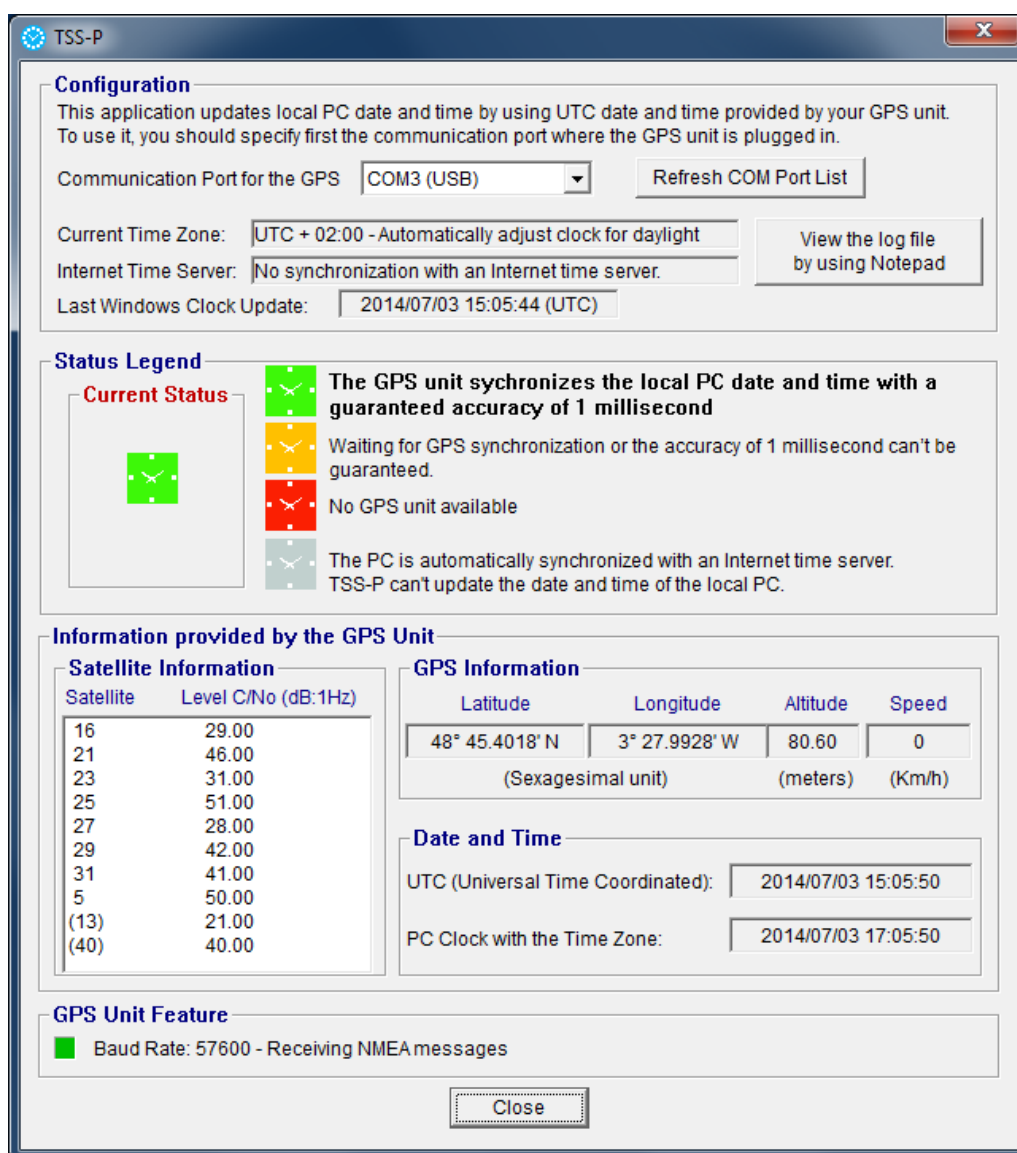
High Precision **Time Service Software (TSS-P)** software provides accurate time synchronization and updates automatically the PC clock.

Synchronized to GPS/UTC (typically 25 ns) with the PPS signal delivered by the z050 USB GPS dongle, **TSS-P** delivers a guaranteed accuracy of 1 millisecond thanks to sophisticated calculations and corrections algorithms developed by ZTI Communications.

PC clock is updated by TSS-P if the PC is not set to automatically synchronize with an Internet time server.

TSS-P is compatible with Windows XP, Vista and Seven (32 or 64-bit platforms).

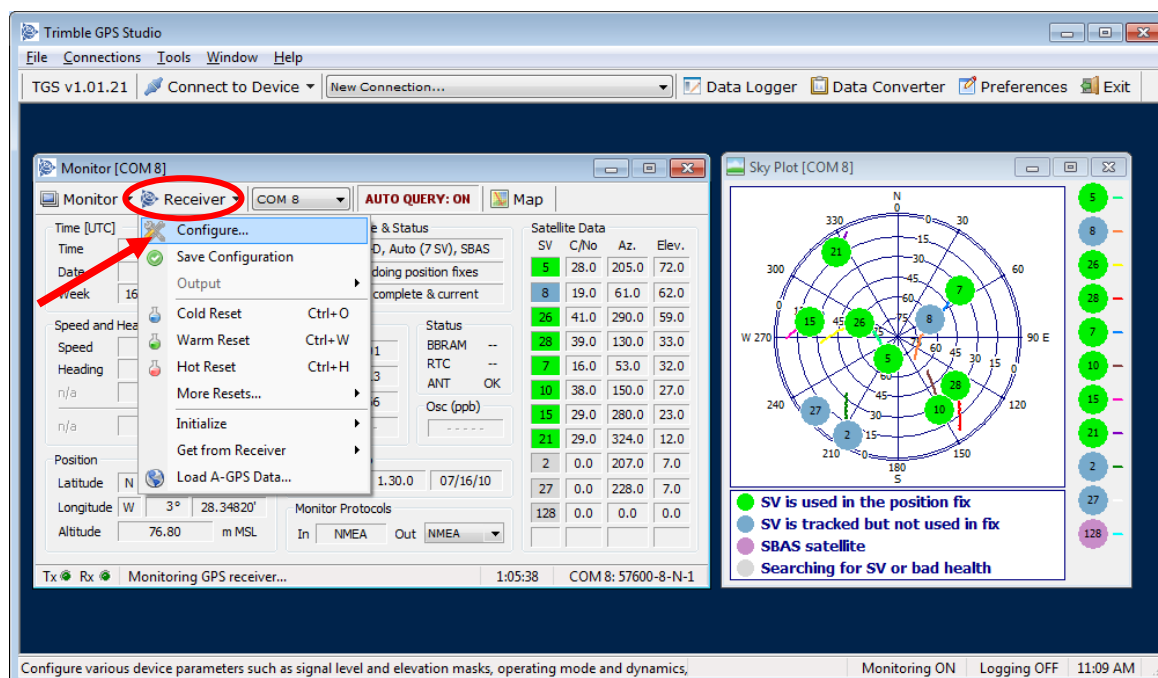
To install the software included on the CD-ROM, launch the TSS-P setup procedure and refer to TSS-P User Guide for more information.



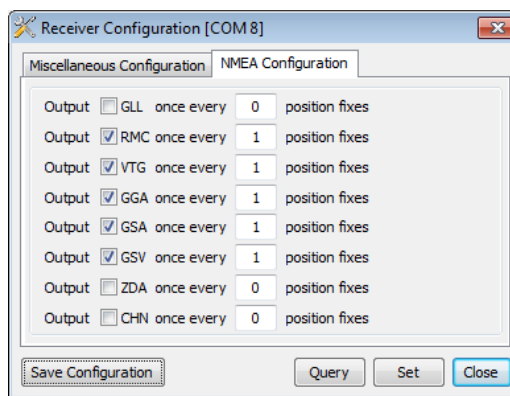
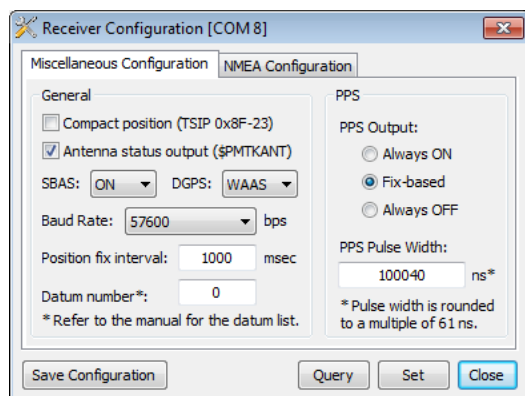
## Configuration by default for the z050 USB GPS Dongle

- Baud Rate: 57600, N, 8, 1
- PPS Pulse Width: 100040 ns (rounded to a multiple of 61ns)
- Update rate: 1Hz
- NMEA messages:
  - RMC (Recommended minimum specific GPS/Transit data)
  - VTG (Track Made Good and Ground Speed)
  - GGA (GPS fix data)
  - GSA (GPS DOP and active satellites)
  - GSV (GPS satellites in view)
- PPS Output: Fix-based

You can modify the default parameters of the z050 USB GPS Dongle by using the Trimble GPS Studio application.



Click the **Receiver... ▼** chooser, and then select **Configure...**  
Two tabs allow modifying the parameters, as shown below.



## Using the z050 USB GPS Dongle with Linux

### *Linux driver installation and checking*

#### Installation of the Linux driver

The z050 GPS receiver embeds a FTDI chipset to output NMEA messages and PPS information to the USB interface. The FTDI driver is included in the recent Linux kernels. Answer to your questions about the Linux kernel and the FTDI chipset driver might be located at <http://ftdi-usb-sio.sourceforge.net/>

When you plug a z050 device, a `/dev/ttyUSBxx` should be automatically setup.

The Linux command `dmesg | grep -i ftdi` gives you the `ttyUSBxx` device description allocated to the GPS receiver.

#### Checking the z050

As far as you know the `ttyUSBxx` description, you might get the NMEA messages through a terminal emulator like minicom.

Assuming the z050 got the `/dev/ttyUSB0`, the minicom configuration looks like the following:



```
+-----+
| A -   Serial Device       : /dev/ttyUSB0 |
| B - Lockfile Location    : /var/lock    |
| C - Callin Program       :              |
| D - Callout Program      :              |
| E -   Bps/Par/Bits       : 9600 8N1    |
| F - Hardware Flow Control : No          |
| G - Software Flow Control : No          |
|-----+
|           Change which setting?         |
|-----+
| | Screen and keyboard | |
| | Save setup as dfl   | |
| | Save setup as..    | |
| | Exit               | |
| | Exit from Minicom  | |
+-----+
```

Next figure shows z050 NMEA frames, captured from the minicom user interface:

```
$GPGSV,3,3,11,14,15,314,23,26,07,142,20,09,02,095,*4E
$GPRMC,132122.000,A,4844.6272,N,00328.3590,W,0.03,57.26,230513,2.5,W,D*3E
$PMTKANT,1*44
$GPGGA,132123.000,4844.6272,N,00328.3590,W,2,8,0.92,79.8,M,50.4,M,0000,0000*72
$GPGSA,A,3,12,22,18,26,17,25,24,14,,,,,1.61,0.92,1.32*03
$GPGSV,3,1,11,24,82,004,22,12,56,217,33,15,45,164,,33,32,195,*7D
$GPGSV,3,2,11,17,30,059,22,18,26,255,27,22,24,291,24,25,21,226,24*75
$GPGSV,3,3,11,14,15,314,23,26,07,142,20,09,02,095,*4E
$GPRMC,132123.000,A,4844.6272,N,00328.3590,W,0.02,57.26,230513,2.5,W,D*3E
$PMTKANT,1*44
$GPGGA,132124.000,4844.6272,N,00328.3590,W,2,8,0.92,79.8,M,50.4,M,0000,0000*75
$GPGSA,A,3,12,22,18,26,17,25,24,14,,,,,1.61,0.92,1.32*03
$GPGSV,3,1,11,24,82,004,22,12,56,217,33,15,45,164,,33,32,195,*7D
$GPGSV,3,2,11,17,30,059,22,18,26,255,27,22,24,291,24,25,21,226,25*74
$GPGSV,3,3,11,14,15,314,23,26,07,142,20,09,02,095,*4E
$GPRMC,132124.000,A,4844.6272,N,00328.3590,W,0.03,57.26,230513,2.5,W,D*38
$PMTKANT,1*44
$GPGGA,132125.000,4844.6272,N,00328.3590,W,2,8,0.92,79.8,M,50.4,M,0000,0000*74
$GPGSA,A,3,12,22,18,26,17,25,24,14,,,,,1.61,0.92,1.32*03
$GPGSV,3,1,11,24,82,004,22,12,56,217,33,15,45,164,,33,32,195,*7D
$GPGSV,3,2,11,17,30,059,22,18,26,255,27,22,24,291,23,25,21,226,24*72
$GPGSV,3,3,11,14,15,314,23,26,07,142,20,09,02,095,*4E
$GPRMC,132125.000,A,4844.6272,N,00328.3590,W,0.02,57.26,230513,2.5,W,D*38
```

## Software

Updating the local clock using a z050 GPS receiver is often based on the `gpsd` and `nptd` Linux daemons. Next paragraphs give hints about the download and installation for these daemons.

### GPSD daemon

`gpsd` software can be downloaded through you Linux update system e.g. `apt-get` or the source code from <http://download-mirror.savannah.gnu.org/releases/gpsd/>

Installation of `gpsd` is detailed at <http://www.catb.org/gpsd/installation.html>

Note that the `--enable-pps-cts` configure option should be activated. If this is not the case in your installation, you have to download the source code and recompile it accordingly.

The options for `gpsd` can be found at <http://gpsd.berlios.de/gpsd.html> where you may read a paragraph "Use with NTP" describing the interface between `gpsd` and `ntpd` that includes details about the `ntp.conf` instruction for the dialog with `gpsd`.

### NTPD daemon

`ntpd` software is available with most of Linux distributions. It can be downloaded from the update repository of your distribution or the source code from <http://www.eecis.udel.edu/~mills/ntp/html/index.html>

## PPS signal (Pulse Per Second)

The z050 GPS receiver is outputting a PPS signal as a RS232 CTS signal emulation.

By default configuration, the PPS is delivered when the GPS receiver of the z050 dongle has 3Dfix state i.e. enough satellites to insure the best accuracy.