GETTING STARTED GUIDE

Trimble SPS985 GNSS Smart Antenna

Version 4.60
Revision A
June 2012

Trimble

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Legal Notices

NTP Software Copyright

Release Notice

This is the April 2012 release (Revision A) of the SPS Modular Receiver documentation. It applies to version 4.60 of the receiver firmware.

Product Limited Warranty Information

For applicable product Limited Warranty information, please refer to the Limited Warranty Card included with this Trimble product, or consult your local Trimble authorized dealer.

Notices

Class B Statement – Notice to Users. This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. Some equipment configurations include an optional 410 MHz to 470 MHz UHF radio transceiver module compliant with Part 90. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
– Increase the separation between the equipment and the receiver.
– Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
– Consult the dealer or an experienced radio/TV technician for help.

Changes and modifications not expressly approved by the manufacturer or registrant of this equipment can void your authority to operate this equipment under Federal Communications Commission rules.
This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operated in conjunction with any other antenna or transmitters (except in accordance with the FCC multi - transmitter product procedures).

Canada

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.
This apparatus complies with Canadian RSS-GEN, RSS-310, RSS-210, and RSS-119.
Cet appareil est conforme à la norme CNR-GEN, CNR-310, CNR-210, et CNR-119 du Canada.

Europe

The product covered by this guide are intended to be used in all EU member countries, Norway, and Switzerland. Products been tested and found to comply with the requirements for a Class B device pursuant to European Council Directive 89/336/EEC on EMC, thereby satisfying the requirements for CE Marking and sale within the European Economic Area (EEA). Contains a Bluetooth radio module. These requirements are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential or commercial environment. The 450 MHZ (PMR) bands and 2.4 GHz are non-harmonized throughout Europe.

CE Declaration of Conformity

Hereby, Trimble Navigation, declares that the GPS receivers are in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

Australia and New Zealand

This product conforms with the regulatory requirements of the Australian Communications and Media Authority (ACMA) EMC framework, thus satisfying the requirements for C-Tick Marking and sale within Australia and New Zealand.

Restriction of Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS)

Trimble products in this guide comply in all material respects with DIRECTIVE 2002/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive) and Amendment 2005/618/EC filed under C(2005) 3143, with exemptions for lead in solder pursuant to Paragraph 7 of the Annex to the RoHS Directive applied.

Waste Electrical and Electronic Equipment (WEEE)

For product recycling instructions and more information, please go to www.trimble.com/ev.shtml.
Recycling in Europe: To recycle Trimble WEEE (Waste Electrical and Electronic Equipment, products that run on electrical power.), Call +31 497 53 24 30, and ask for the "WEEE Associate". Or, mail a request for recycling instructions to:
Trimble Europe BV
c/o Menlo Worldwide Logistics
Meerheide 45
5521 DZ Eersel, NL

FCC Declaration of Conformity

We, Trimble Navigation Limited.

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Declare under sole responsibility that DoC products comply with Part 15 of FCC Rules.

Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.

Unlicensed radios in products

This device complies with part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.

Licensed radios in products

This device complies with part 15 of the FCC Rules.
Operation is subject to the condition that this device may not cause harmful interference.

Contents

Introduction

The SPS985 GNSS smart antenna can be used for the following infrastructure and site development applications:

- Layout of structure foundations, caissons, and piles
- Earthworks, fine grading and finishing stakeout operations
- Initial site measurements to verify design levels and regular subsequent measurements to determine progress volumes
- Vehicular-mounted site supervisor applications
- Measurements and grade/thickness checks on laid materials

The GNSS smart antenna incorporates a GNSS antenna, receiver, internal radio, and battery in a rugged light-weight unit that is ideally suited as an all-on-the-pole RTK rover or quick setup/rapid mobilization base station. LEDs enable you to monitor satellite tracking, radio reception, data logging status, Wi-Fi, and power. Bluetooth wireless technology provides cable-free communications between the receiver and controller.

You can use the SPS985 smart antenna as part of an RTK GNSS system with the Trimble SCS900 Site Controller software. The receiver can optionally record GPS data to the receiver's optional internal memory and download to a computer using the serial connection.

The GNSS smart antenna has no front panel controls for changing settings. To configure these receivers:

- In real time, use external software such as the SPS web interface, the HYDRO*pro* software, or the WinFlash utility.
- Use an application file. To edit an application file, use the Configuration Toolbox utility.

Related information

Sources of related information include the following:

- Release notes – The release notes describe new features of the product, information not included in the manuals, and any changes to the manuals. They can be downloaded from the Trimble website at www.trimble.com/support.shtml.
- Trimble training courses – Consider a training course to help you use your GNSS system to its fullest potential. For more information, go to the Trimble website at www.trimble.com/training.html.

Batteries

The SPS985 GNSS smart antenna has one Lithium-ion battery which can be charged when it is plugged into an external power source through Port 1, or the battery can be removed for charging.

During measurement operations, each internal battery typically provides about 4 hours of power if using the internal Rx (receive) radio and about 3.5 hours operating as a base station using the internal transmit radio. These times vary according to the type of measurement and the operating conditions.

Battery safety

Charge and use the battery only in strict accordance with the instructions provided.

WARNING – Do not damage the rechargeable Lithium-ion battery. A damaged battery can cause an explosion or fire, and can result in personal injury and/or property damage.
To prevent injury or damage:
– Do not use or charge the battery if it appears to be damaged. Signs of damage include, but are not limited to, discoloration, warping, and leaking battery fluid.
– Do not expose the battery to fire, high temperature, or direct sunlight.
– Do not immerse the battery in water.
– Do not use or store the battery inside a vehicle during hot weather.
– Do not drop or puncture the battery.
– Do not open the battery or short-circuit its contacts.

WARNING – Avoid contact with the rechargeable Lithium-ion battery if it appears to be leaking. Battery fluid is corrosive, and contact with it can result in personal injury and/or property damage.
To prevent injury or damage:
– If the battery leaks, avoid contact with the battery fluid.
– If battery fluid gets into your eyes, immediately rinse your eyes with clean water and seek medical attention. Do not rub your eyes!
– If battery fluid gets onto your skin or clothing, immediately use clean water to wash off the battery fluid.

Connecting the receiver to a vehicle battery

WARNING – Use caution when connecting battery cable's clip leads to a vehicle battery. Do not allow any metal object or jewelry to connect (short) the battery's positive (+) terminal to either the negative (-) terminal or the metal of the vehicle connected to the battery. This could result in high current, arcing, and high temperatures, exposing the user to possible injury.

WARNING – When connecting an external battery, such as a vehicle battery, to the receiver, be sure to use the Trimble cable with proper over-current protection intended for this purpose, to avoid a safety hazard to the user or damage to the product.

Charging the Lithium-ion battery

The rechargeable Lithium-ion battery is supplied partially charged. Charge the battery completely before using it for the first time. If the battery has been stored for longer than three months, charge it before use.

WARNING Charge and use the rechargeable Lithium-ion battery only in strict accordance with the instructions. Charging or using the battery in unauthorized equipment can cause an explosion or fire, and can result in personal injury and/or equipment damage.
To prevent injury or damage:
– Do not charge or use the battery if it appears to be damaged or leaking.
– Charge the Lithium-ion battery only in a Trimble product that is specified to charge it. Be sure to follow all instructions that are provided with the battery charger.
– Discontinue charging a battery that gives off extreme heat or a burning odor.
– Use the battery only in Trimble equipment that is specified to use it.
– Use the battery only for its intended use and according to the instructions in the product documentation.

To charge the battery, first remove the battery from the receiver, and then place it in the battery charger, which is connected to mains power.

Battery charger

The charger can charge two types of Lithium-ion batteries. It can be powered by mains or vehicle battery. The following figure shows the GPS and Total Station battery, dual slot battery charger (P/N 53018010), power supply (P/N 78650) and AC power cable (P/N 78651):

The Charger Kit Dual Slot consists of:

- Charger dual-battery slot
- Power supply for charger
- Cable AC kit AC for power supply

Chargeable batteries

The charger can charge the following types of batteries:

- Lithium-ion Rechargeable Battery (Smart Battery), 4.4 Ah, 11.1 V, P/N 49400
- Lithium-ion Rechargeable Battery, 2.6 Ah, 7.4 V, P/N 92600-HH
- Lithium-ion Rechargeable Battery, 2.4 Ah, 7.4 V, P/N 54344

Charger slots

The charger has two slots. Each slot can charger either type of a battery. Batteries are charged sequentially. Beside each slot are two LED indicators (red and green) to indicate the battery status.

Power supply

The charger can be powered by mains (using the power supply for the charger) or by using a 12 V car adapter-to-charger cable.

Removing the battery

1. Open the battery slot, which is on the side of the smart antenna.

2. Pull the battery out of the slot.

Parts of the SPS985 Smart GNSS antenna

All operating controls are located on the front panel. Ports and connectors are located on the bottom of the unit.

Front panel

The front panel contains the Power button and four indicator LEDs.

- The Power button controls the receiver's power on or off functions.
- The indicator LEDs show the status of power, satellite tracking, Wi-Fi, and radio reception.

Icon	Connections
	Power button
	Satellites
	Radio
	Battery status
	Wi-Fi

The LEDs on the front panel indicate various operating conditions. Generally, a lit or slowly flashing LED indicates normal operation, a LED that is flashing quickly indicates a condition that may require attention, and an unlit LED indicates that no operation is occurring. For more information, see Button and LED operations, page 12.

Lower housing

Each item is marked with a number to indicate its main function, as shown in the following table:

Icon	Name	Connections/Description
1	Label	The icon on the label shows if the antenna contains an internal radio or if it a Wi-Fi only smart antenna
2	TNC radio antenna connection	Communications antenna
3	Label	Shows the serial number of the smart antenna
4	Battery door	Removable Lithium-ion battery
5	5/8" insert	Range pole or quick release adapter
6	Lemo port	USB and DC power in

Lemo port is a 7-pin 0-shell 2-key Lemo connector that supports USB communications and external power input. The Lemo port has no power outputs.

The TNC port connector is for connecting a radio antenna to the receiver internal radio. A whip “rubber duck” antenna is supplied with the system. This connector is not used if you are using an

external radio receiver. For longer range operation (to provide higher gain and to raise the antenna higher above the ground), you can use a cable to connect an external radio antenna to the TNC port. For more information, refer to the topic "Connecting the receiver to external devices" in the Web Help.

Button and LED operations

Note – *SPS985 only*

The LEDs on the front panel indicate various operating conditions. Generally, a lit or slowly flashing LED indicates normal operation, a LED that is flashing quickly indicates a condition that may require attention, and an unlit LED indicates that no operation is occurring. The following table defines each possible LED state:

The term...	means that the LED...
Very slow flash	is off and on equally with a 1.5 second cycle.
Slow flash	alternates on/off every ½ second.
Radio slow flash	is ***off longer than it is on*** when the smart antenna is ***receiving corrections***. The smart antenna repeats this cycle typically once per second. is ***on more than off*** when the smart antenna is ***transmitting corrections***. The smart antenna repeats this cycle typically once per second.
Medium flash	is off and on equally more than once per second.
Fast flash	alternates rapidly on/off every 1/10 of a second.
On	is lit steady.
Off	is unlit.

Power button

Action	Power button	Description
Turn on the smart antenna	Press (see the note below)	All four LEDs light up and remain lit for 3 seconds. Then all LEDs go off and then the power LED immediately comes back on.
Turn off the receiver	Hold for 2 seconds and then release	When holding down the Power button; the battery LED remains on. The Wi-Fi LED remains in its state and then turns off after 2 seconds. The Satellite LED turns constant and then turns off after 2 seconds. After releasing the power button, the battery LED stays lit for about 5 seconds and then all LEDs go blank.
Clear the	Hold for 15	The Radio, Wi-Fi, and Satellite LEDs turn off after 2 seconds. The battery LED

Action	Power button	Description
ephemeris file and reset the smart antenna to the factory defaults	seconds	remains on. After 15 seconds, the Satellite LED comes on to indicate that it is time to release the Power button.
Delete application files	Hold for 30 seconds	The Radio, Wi-Fi, and Satellite LEDs turn off after 2 seconds. The battery LED remains on. After 15 seconds, the Satellite LED comes on and stays on for 15 seconds, then turns off to indicate that it is time to release the Power button. The battery LED then remains on for 15 seconds after releasing the Power button. The smart antenna then restarts.

Note – *The term "press" means to press the button and release it immediately. The term "hold" means to press the button and hold it down for the given time.*

Satellite LED

Receiver mode	Satellite LED Amber
No satellites or < 1 satellite tracked	Off
Boot up or in Monitor mode	On
Tracking <4 SVs	Fast flash
Tracking >4 SVs	Slow flash

Radio LED

Radio mode	Radio LED Amber	Description
No receive or transmit	Off	
Receive	Radio slow flash	See the table at the top of this topic. This LED also flashes when using the Wi-Fi only for receiving corrections.
Transmit	Radio slow flash	See the table at the top of this topic. This LED also flashes when using the Wi-Fi only for transmitting corrections

Wi-Fi LED

Receiver mode	Wi-Fi LED Amber
Wi-Fi off	Off
Wi-Fi is Access Point (Base mode / sending corrections)	Medium flash
Wi-Fi is client (and not connected to an Access Point)	Off
Wi-Fi as client (Rover mode receiving corrections)	Very slow flash

Battery LED

Receiver mode	Power LED Green	Description
Off	Off	
On. Healthy power	On	Either internal battery or external power
Low power	Fast flash	(<about 15% power)
Logging data internally	Flashes off every three seconds	

Lemo port

When you load firmware using the WinFlash utility, the LEDs show as:

Button/LED	Appears
	On
	Off
	See the Satellite LED, page 13 section above.
	Off

Activation

Activating your SPS GNSS Receiver

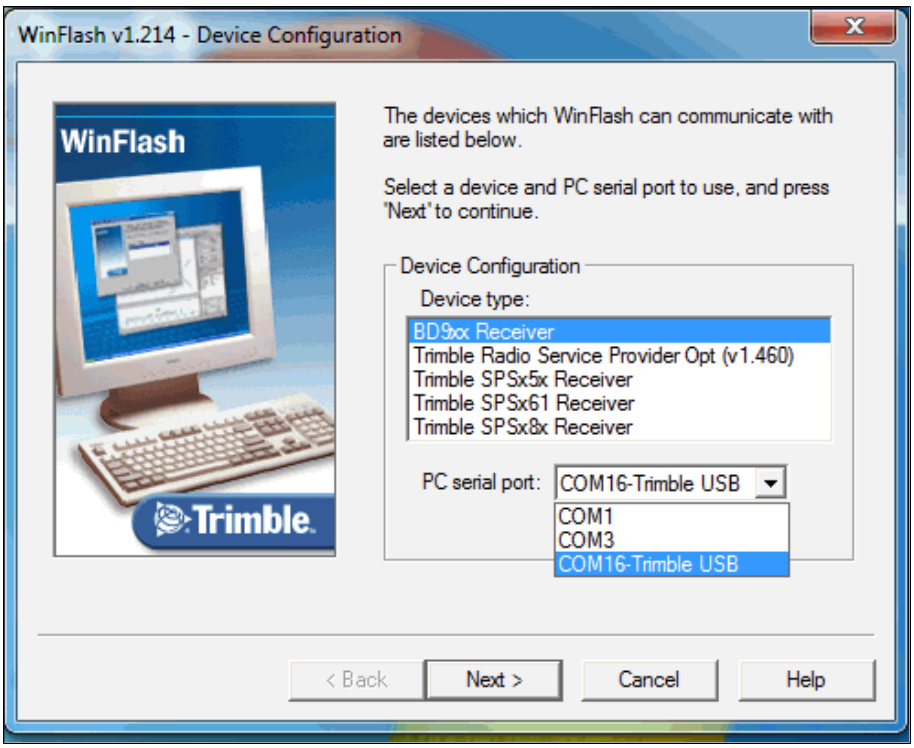
Before you can use your SPS GNSS receiver, it must be activated with an Activation code. Usually your Trimble dealer will do this for you. If you need to do it yourself, you must connect a computer that has the Trimble WinFlash utility installed to the SPS GNSS receiver, and then use the WinFlash utility to load the Activation code onto your receiver. The Activation code also enables the Wi-Fi (SPS985 only) and Bluetooth wireless technology services in your SPS GNSS receiver.

SPS985 smart antenna

The SPS985 smart antenna is shipped with Wi-Fi and Bluetooth wireless technology services ***disabled***.

To activate the smart antenna and to enable Wi-Fi and Bluetooth wireless technology services:

1. The SPS985 smart antenna only has a USB interface. Use cable P/N 80751-HH to connect the smart antenna to the computer and the USB port.
2. Download and install the WinFlash utility. See The WinFlash utility, page 17.
3. On the computer, load a virtual COM port driver to emulate a serial port. Ensure that you follow all the instructions in the topic, Configuring a PC USB port as a virtual serial port, page 24.
4. In the Device Configuration screen, select Trimble SPSx8x Receiver and then select the virtual serial COM port set up in the previous steps. The following example shows COM16 is allocated to the Trimble-USB connection:



5. Click **Next**.
6. In the Operation Selection screen, select Update Receiver Options and then click **Next**.
7. In the Upgrade Option Password Entry screen, select the Option key option and then in the Option Password field enter the password. Click **Next**.
8. In the Settings Review screen, check that settings that you want to make and then click **Finish**.

You can now continue to use the WinFlash utility or use the Wi-Fi and web interface to make any changes to the settings (see below).

Loading the Operating mode code

The next task is to load the Operating Mode code into the SPS GNSS receiver. The Operating Mode will be one of the following depending on your receiver and the option you have purchased:

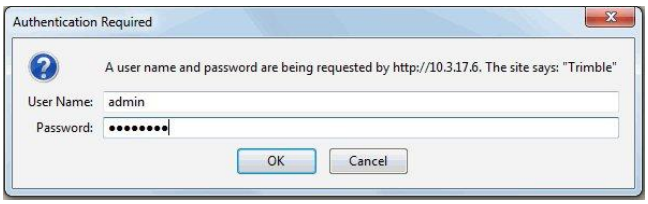
- DGPS Base
- Precise Base
- Location RTK Rover
- Precise RTK Rover
- Precise Base/Rover
- Moving Base/Heading mode
- Heading mode

Using the WinFlash utility

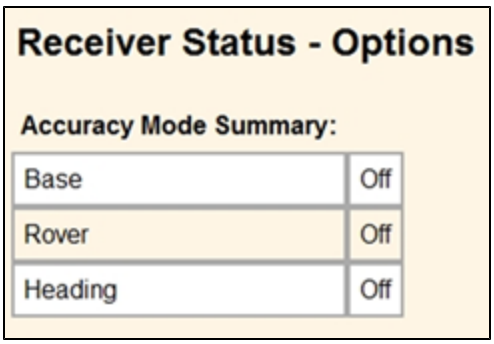
1. In the Operation Selection screen, select Update Receiver Options and then click **Next**.
2. Enter the option code and then click **Next** to load the option code.

Using the web interface

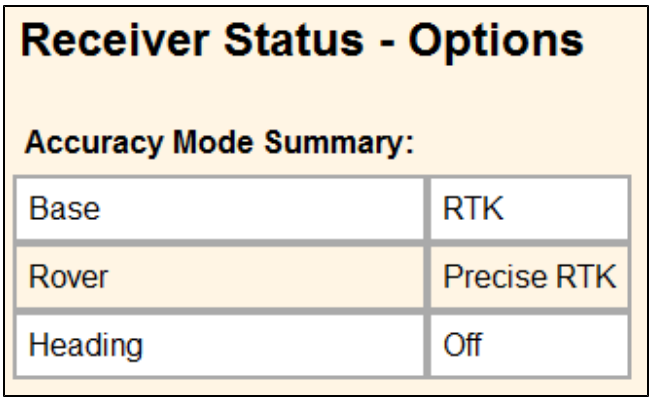
1. Log in to the web interface, select (Select *Security*/ *Login* and enter the password.



2. In the web interface, select (Select *Receiver* / *Options*). The Operating mode is set to Off.



3. Install the Operating Mode option. To do this, in the Option Code field, enter the information provided to you by your Trimble dealer and then click **Install Option**.
4. You must now do a full receiver reset to set it back to the factory defaults. Hold the Power button down for 30 seconds or use the web interface and select Receiver Configuration / Reset. Select Clear all receiver settings. The following screen show Precise Base and Rover modes loaded and that MovingBase/Heading mode is not loaded.



Loading extra options

After you have activated the receiver and loaded the Operating mode code, you can then load extra options you have purchased such as GLONASS.

Using the WinFlash utility

In the Operation Selection screen, select Update receiver options and then click **Next**.Enter the option code and then click **Next**. In the Settings Review screen, click **Finish**.

Using the web interface

1. Select *Receiver Status*/ *Receiver Options*.
2. Install the option. To do this, in the Option Code field, enter the password provided to you by your Trimble dealer and then click **Install Option**.

The WinFlash utility

The WinFlash utility communicates with Trimble products to perform various functions including:

- installing software, firmware, and option upgrades
- running diagnostics (for example, retrieving configuration information)
- configuring radios

Note – *The WinFlash utility runs on Windows 2000, XP, Windows Vista®, and Windows 7 operating systems.*

Installing the WinFlash utility

You can download and install the WinFlash utility from the Trimble website.

1. Go to www.trimble.com/support.shtml#S.
2. Select your product from the list.
3. If necessary, click the **Support** tab.
4. Select the Downloads link.
5. Select the Latest SPS GNSS Firmware and Utilities link.
6. Select the firmware that you want to download. Ensure that you select a file that contains the WinFlash utility.
7. Download the ZIP file to your computer and then open it.
8. Extract the files and then run the WinFlash utility.

Note – *If your computer or laptop only has USB ports, then you must set up a virtual serial port.* *See Configuring a PC USB port as a virtual serial port, page 24.*

The WinFlash utility guides you through the firmware upgrade process. For more information, refer to the WinFlash Help.

Wi-Fi Settings

The SPS985 smart antenna is the first SPS GNSS receiver with Wi-Fi. Please take the time to understand its powerful capabilities.

Before you use an SPS985 smart antenna, ensure that the dealer has activated it. The smart antenna, shipped from Trimble, does not have Wi-Fi or Bluetooth® wireless technology enabled. Your Trimble dealer must load the activation code before these services are available. If you need to load the Activation code yourself, see Activating your SPS GNSS Receiver, page 15.

The smart antenna can be used as a Wi-Fi Access Point or a Wi-Fi Client.

Access Point mode

You use this mode when the smart antenna is set up as a base station. Access Point mode enables other Wi-Fi devices to communicate with the smart antenna without needing another Wi-Fi device. Up to five devices can simultaneously connect to the smart antenna. Devices connected to the smart antenna in Access Point mode can communicate with each other, not just the SPS985 smart antenna. After you have connected to the smart antenna, you can use the web interface to review and change the settings of the smart antenna. This mode is useful if you are in the field, but do not have a Trimble Tablet or SCS900 software.

In this mode, you can scan for the smart antenna from a laptop, Smartphone, or other Wi-Fi enabled device, to locate the SPS985 Access Point:

1. Turn on the SPS985 in Access point mode. The Wi-Fi light will flash.

   By default, the SPS985 is in Access point mode. If you are not sure if the SPS985 is in Access point mode, you can reset it to the factory defaults by pressing the Power button for 15 seconds.

2. From a Wi-Fi enabled device such as a laptop, connect to the SPS985 smart antenna.

   On a computer running the Windows operating system, click the Network icon in the status bar  . The smart antenna will be called something like "Trimble GNSS 2201". Select it and then click **Connect**.

   For information on how to change the wireless identification of the smart antenna, see SSID Identification, page 23.

3. Enter the encryption key. By default, it is **abcdeabcde**.

4. Open a web browser on your Wi-Fi enabled device and then type **GNSS** into the address bar.

   The SPS985 web interface appears. With some devices, you may need to enter either **http://GNSS** or **192.168.142.1** to access the web interface.

   On Android PDAs, Trimble recommends that you install the free Opera Mobile browser for this feature to work.

5. Log in to the web interface. Select *Security* / *Login*. The default username is **admin**. The default password is **password**.

Client mode

You use this mode when the smart antenna is set up as a rover. In this mode, the smart antenna is connected to an Access Point. You can view the web interface of the smart antenna in Client mode via the Access Point. An Access Point on a site could be another SPS985 smart antenna or a Cisco router.

When the smart antenna is in Client mode and is connected to an Access Point, you cannot use http://GNSS to communicate with the smart antenna. Instead, you need to use the applications Bonjour (Zero Configuration Networking), UPNP, or get the IP address from the Access Point.

Note – *The smart antenna with internal radio has an internal Wi-Fi antenna. It is in the white radome on the side of the smart antenna, however the antenna gain is equal in all directions so the base station radome does not need to point to the work area, and the rover radome does not need to point to the base station. In the smart antenna with no internal radio, then the Wi-Fi antenna is routed to the TNC connector, so when using Wi-Fi in this receiver, it is essential to use the supplied black whip antenna.*

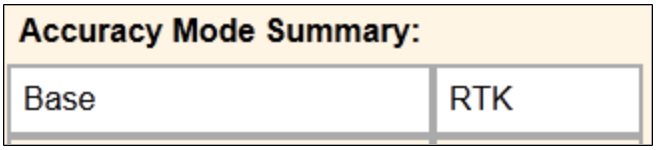
Using the SPS985 Wi-Fi with the SCS900 software

To set up the SPS985 Wi-Fi to both transmit GNSS corrections (in the case of a base station) and set up a SPS985 internal Wi-Fi to receive GNSS corrections (in the case of a rover), you will need version 2.91 or later of the SCS900 software. When using the SCS900 software, the SPS985 base station is automatically configured as an Access Point and the SPS985 rover is configured as a Client.

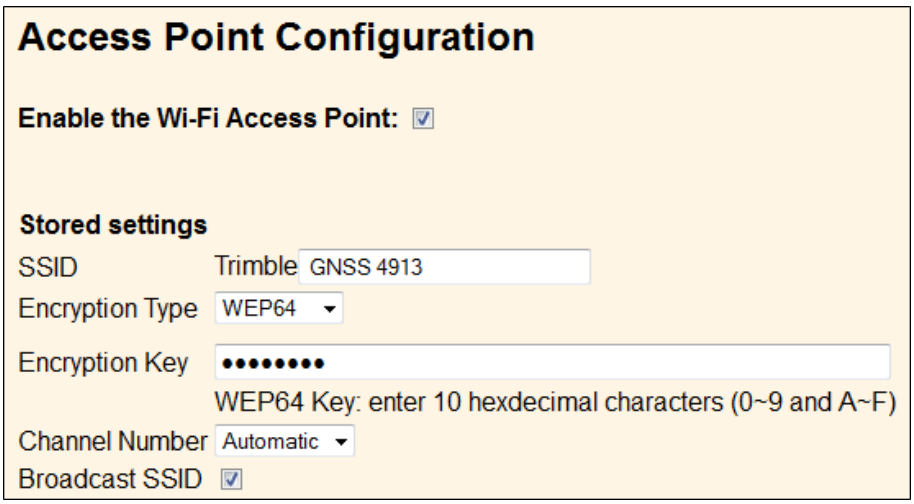
The use of Wi-Fi in the smart antenna is licence free. The line-of-sight range can be greater than 300 m although it is restricted if trees, machines, or buildings are between the base station and the rover receiver.

Setting up an SPS985 as a Wi-Fi base station without the SCS900 software

1. Ensure the smart antenna has the Accuracy mode to set Base (Precise Base mode) (Select *Receiver Status* / *Receiver Options*):

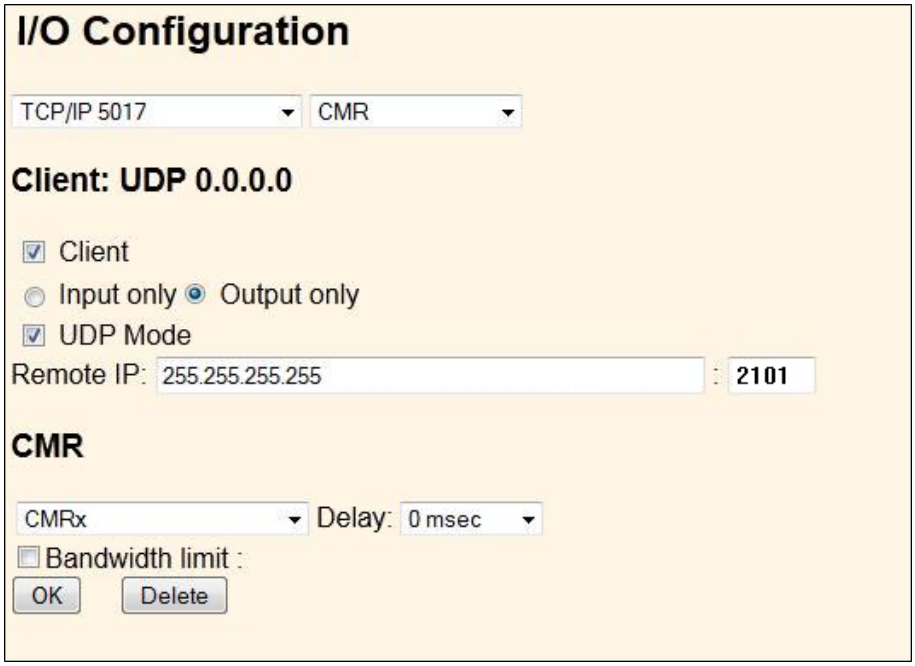


2. Set the smart antenna as the Access Point. To do this, select *Wi-Fi* / *Access point* with the following configuration:

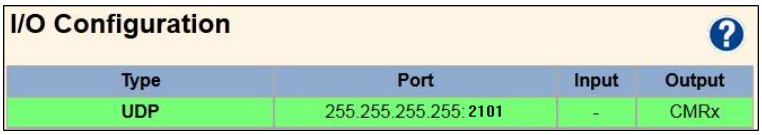


3. Select I/O Configuration / *Port Configuration*.
4. Create a UDP. To do this:
   a. Select the Client check box (because we are sending. Clients send, Servers listen).
   b. Select the Output only option.
   c. Select the UDP Mode check box.

d. In the Remote IP field, enter **255.255.255.255**, Port: **2101**.



5. Click **OK**. The following port information is displayed in the I/O Configuration page:



6. Save the configuration. Select *Receiver Configuration* / *Application File*. Select the Store Current File option.
7. Turn off the smart antenna and then turn on again. Wait for two minutes until the SSID is updated.

Setting up an SPS985 Wi-Fi Rover without the SCS900 software

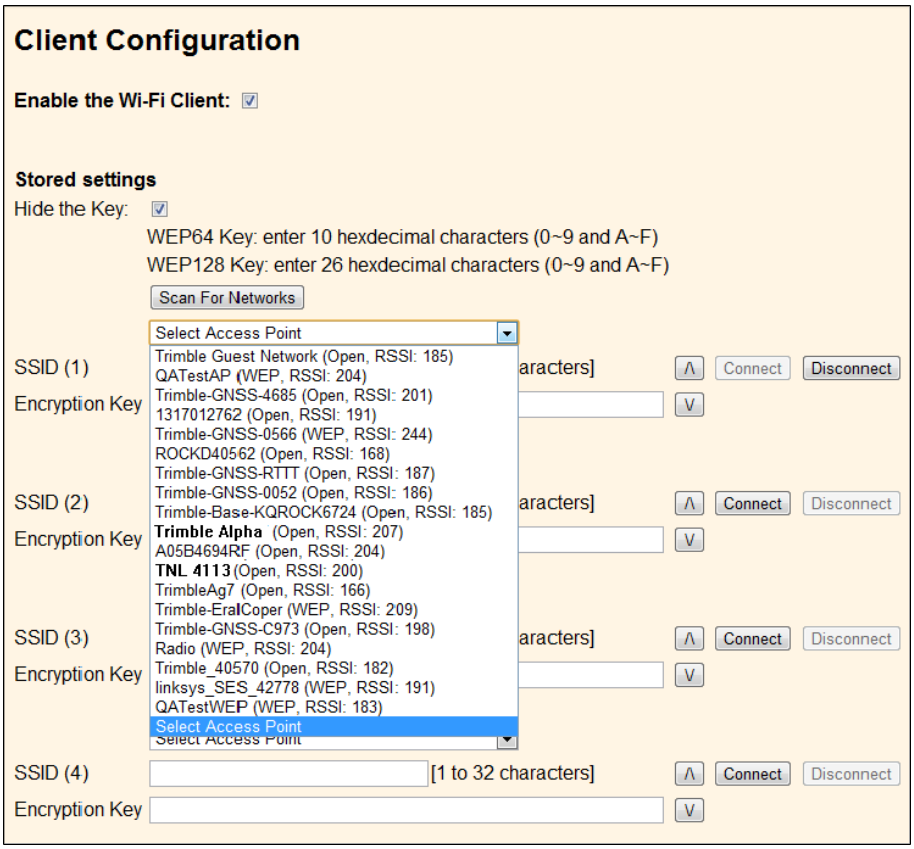
1. You must have the Rover mode (Location RTK or Precise RTK) selected.

   Set the smart antenna as the client. To do this, select *Wi-Fi* / *Client* under Client Configuration.

2. Click **Save and Reboot**. The receiver is now in Client mode, which means it is not in Access Point mode so your computer will not see an SSID (you will not be able to log in using Wi-Fi).
3. Connect your computer to the SPS985 Rover web interface. To do this, either use the USB cable that is supplied with the SPS985 smart antenna, or use Bluetooth wireless technology. To set up the PPP connection from a computer to the smart antenna, see Configuring the receiver

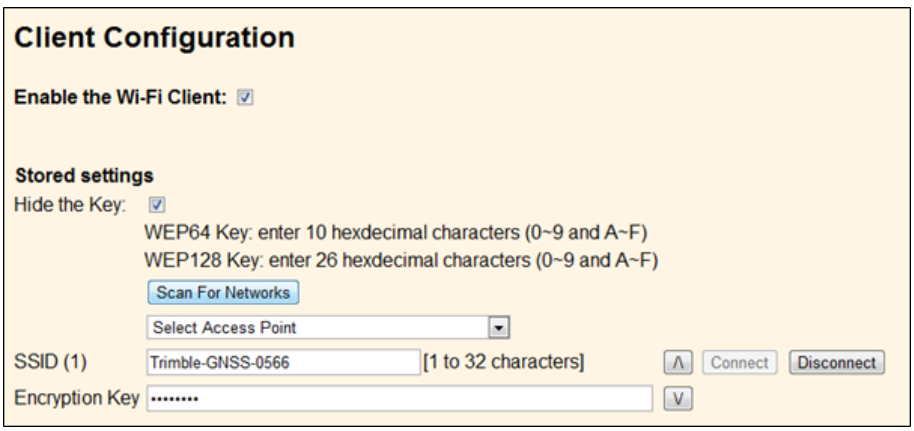
using a web browser and Bluetooth wireless technology (Windows 7), page 1.

4. Go to the Client web interface page (see Client mode).

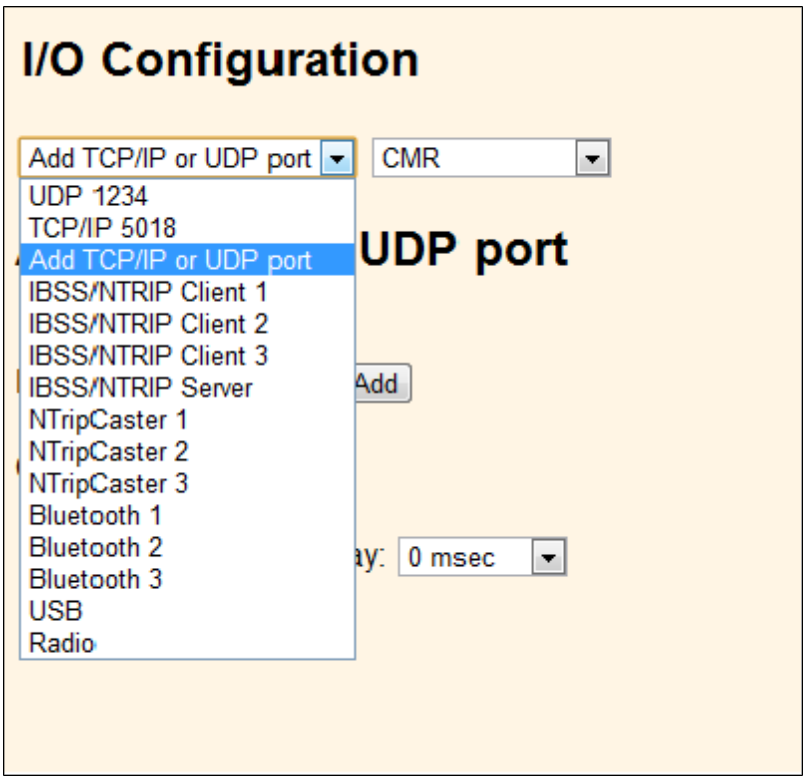


5. Under Client Configuration, select Scan For Networks. Select your Access Point from the drop-down list.

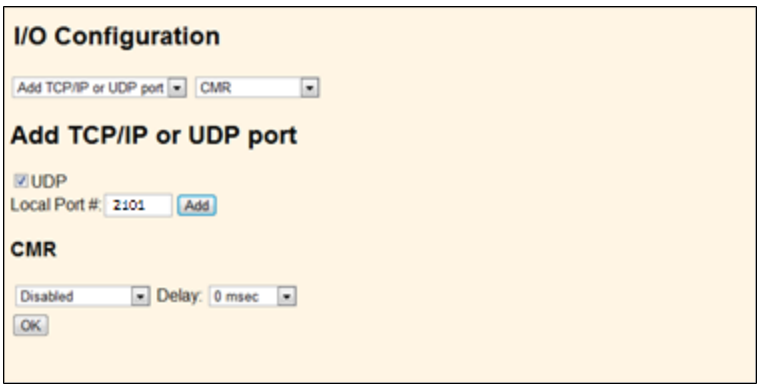
6. Enter the Access Points Encryption key and click **Connect**:



7. In the I/O page create an UDP port with the same port number as created on the base station previously.



8. The SPS985 I/O Configuration should be as follows:



SSID Identification

An SSID is a 32-character alphanumeric key that uniquely identifies a wireless LAN. It enables wireless equipment such as a computer to access the Wi-Fi enabled SPS985 smart antenna.

By default, the SPS receivers uses the following identification:

- "Trimble GNSS NNNN" (NNNN = the last four digits of the serial number) - Rover or Rover/Base configured SPS985
- "Trimble Base NNNN" - Base ONLY capable SPS985

By default, the password for the SSID is: **abcdeabcde**.

For more information, see the topic called SSID Identification in the online Help.

Configuring a PC USB port as a virtual serial port

It is possible to use the USB interface from an SPS GNSS receiver with a software application that requires a serial port.

For example, the Trimble WinFlash utility can be run on a computer that has no serial port by connecting the USB cable between the computer and the receiver.

Another example would allow the receiver to stream NMEA messages over a USB interface into a computer's virtual serial port, allowing applications such as the HYDROpro software to use the NMEA messages on a computer that has no physical serial ports.

The SPS985 smart antenna has USB cable P/N 80751-HH that can be connected to the receiver. The other end of the USB cable then connects to a computer.

The receiver must be running firmware version 4.15 or later.

Windows 7 Professional operating system

1. The simplest way to install the Virtual Serial port for the USB interface to the SPS receivers is to go to the Trimble Support website (www.trimble.com/support) and search for the SPS GNSS receiver you have. In the Downloads section, download the file called *Windows7 USB Installer* to your computer or USB drive.

   This file contains a Support Note and installation program.

2. Run the installation program. It will load the Virtual Serial port for the USB interface on your computer or USB drive.

   Note – *If you have installed the Trimble WinFlash utility (www.trimble.com/support) on your computer, then another way to install the Virtual serial port for the USB interface is to run the USB Installer program, which is located in C:\Program Files\Common Files\Trimble\USBDriver.*

If this process does not work for your computer, or if you have a different Windows operating system on your computer, then follow the procedure below.

Windows Vista and Windows 7 operating system

1. Go to the Trimble Support website (www.trimble.com/support) and search for the SPS GNSS receiver you have. In the Support Notes section, download the file called *SPS GNSS Interface to a Virtual COM port on a Computer* to your computer or USB drive.
2. Open the file and place the trmbUsb.inf file in a temporary folder on your computer of USB drive.
3. On the computer, select *Control Panel* / *Device Manager*.
4. Click on the name of the computer and then from the *Action* menu, select *Add Legacy Driver*.
5. A wizard prompts you to locate the TrimbleUsb.inf file. Locate the file and then follow the prompts in the wizard to continue.

Windows XP operating system

1. Go to the Trimble Support website (www.trimble.com/support) and search for the SPS GNSS receiver you have. In the Support Notes section, download the file called *SPS GNSS Interface to a Virtual COM port on a Computer* to your computer or USB drive.
2. Open the file and place the trimble.Usb.INF file in a temporary folder on your computer of USB drive.
3. Turn on the receiver and then connect the USB cable to the computer. The New Hardware wizard appears.
4. Select the No, not this time option and then click Next.
5. A dialog prompts you to specify the location of the USBSer.sys file. For example, C:\Windows\System32\Drivers.
6. On some computers you may need to repeat Step 4 for the TrimbleUsb.inf file.
7. Check that the receiver is available for use. Go to the *Device Manager* menu on the computer. The receiver should appear in the *Ports* list.

Note – *If you are running an application such as the HYDROpro software on the computer and you physically disconnect the USB cable from the computer and then reconnect it, it does not always re-establish the connection. This is because opening the serial port from the application locks the device handle and when the USB device is disconnected, the application does not close the serial port and the device handle is still locked. On reconnecting, the USB cable is unable to get the device handle since it is locked. You must close the application before the reconnect to the port will work. This limitation is due to the behavior of the Microsoft USB serial driver.*

Logging data

Data logging involves the collection of GNSS measurement data over a period of time at a static point or points, and subsequent postprocessing of the information to accurately compute baseline information. Data logging using receivers requires access to suitable GNSS postprocessing software such as the Trimble Business Center software.

Postprocessed GNSS data is typically used for control network measurement applications and precise monitoring. GNSS measurement data is collected over a period of time at a static point or points and then postprocessed to accurately compute baseline information.

By default, the Data Logging option is turned off. For information on how to enable the Data Logging option, and the required postprocessing software options, contact your Trimble dealer.

Logging data after a power loss

If power is unexpectedly lost while the receiver is logging data, the receiver tries to return to the state it was in immediately before the power loss. The receiver does not reset itself to default settings.

If the receiver was logging data when power was lost, it resumes logging data when power is restored.

Troubleshooting

Troubleshooting receiver issues

This section describes some possible receiver issues, possible causes, and how to solve them. Please read this section before you contact Technical Support.

The receiver does not turn on

Possible cause	Solution
External power is too low.	Check the charge on the external power supply, and check the fuse if applicable. If required, replace the battery.
Internal power is too low.	Do the following: • Check the charge on the internal batteries and replace if required. • Ensure battery contacts are clean.
External power is not properly connected.	Do the following: • Check that the Lemo connection is seated properly. • Check for broken or bent pins in the connector.
Faulty external power cable.	Do the following: • Try a different cable. • Check pinouts with multimeter to ensure internal wiring is intact.

The receiver is not tracking any satellites

Possible cause	Solution
The GNSS antenna does not have clear line of sight to the sky.	Ensure that the antenna has a clear line of sight.

The receiver does not log data

Possible cause	Solution
Insufficient memory in the internal memory.	Delete old files. Press the Power button for 30 seconds.

The receiver is not responding

Possible cause	Solution
The receiver needs a soft reset.	Turn off the receiver and then turn it back on again. For more information, see Button and LED operations, page 12
The receiver needs a full reset.	Press the Power button for 30 seconds. For more information, see Button and LED operations, page 12.

Glossary

1PPS	Pulse-per-second. Used in hardware timing. A pulse is generated in conjunction with a time stamp. This defines the instant when the time stamp is applicable.
almanac	A file that contains orbit information on all the satellites, clock corrections, and atmospheric delay parameters. The almanac is transmitted by a GNSS satellite to a GNSS receiver, where it facilitates rapid acquisition of GNSS signals when you start collecting data, or when you have lost track of satellites and are trying to regain GNSS signals. The orbit information is a subset of the ephemeris/ephemerides data.
AutoBase	AutoBase technology uses the position of the receiver to automatically select the correct base station; allowing for one button press operation of a base station. It shortens setup time associated with repeated daily base station setups at the same location on jobsites.
base station	Also called *reference station*. In construction, a base station is a receiver placed at a known point on a jobsite that tracks the same satellites as an RTK rover, and provides a real-time differential correction message stream through radio to the rover, to obtain centimeter level positions on a continuous real-time basis. A base station can also be a part of a virtual reference station network, or a location at which GNSS observations are collected over a period of time, for subsequent postprocessing to obtain the most accurate position for the location.
beacon	Source of RTCM DGPS corrections transmitted from coastal reference stations in the 283.5 to 325.0 kHz range.
BINEX	BInary EXchange format. BINEX is an operational binary format standard for GPS/GLONASS/SBAS research purposes. It is designed to grow and allow encapsulation of all (or most) of the information currently allowed for in a range of other formats.
broadcast server	An Internet server that manages authentication and password control for a network of VRS servers, and relays VRS corrections from the VRS server that you select.
carrier	A radio wave having at least one characteristic (such as frequency, amplitude, or phase) that can be varied from a known reference value by modulation.
carrier frequency	The frequency of the unmodulated fundamental output of a radio transmitter. The GPS L1 carrier frequency is 1575.42 MHz.
carrier phase	Is the cumulative phase count of the GPS or GLONASS carrier signal at a given time.
cellular modems	A wireless adaptor that connects a laptop computer to a cellular phone system for data transfer. Cellular modems, which contain their own antennas, plug into a PC Card slot or into the USB port of the computer and are available for a variety of wireless data services such as GPRS.
CMR/CMR+	Compact Measurement Record. A real-time message format developed by Trimble for broadcasting corrections to other Trimble receivers. CMR is a more efficient alternative to RTCM.
CMRx	A real-time message format developed by Trimble for transmitting more satellite

	corrections resulting from more satellite signals, more constellations, and more satellites. Its compactness means more repeaters can be used on a site.
Compass	The BeiDou Navigation Satellite System (Compass) is a Chinese satellite navigation system. The first BeiDou system (known as BeiDou-1), consists of three satellites and has limited coverage and applications. It has been offering navigation services mainly for customers in China and from neighboring regions since 2000. The second generation of the system (known as Compass or BeiDou-2) consists of 35 satellites. It became operational with coverage of China in December 2011 with 10 satellites in use. It is planned to offer services to customers in Asia-Pacific region by 2012 and the global system should be finished by 2020.
covariance	A statistical measure of the variance of two random variables that are observed or measured in the same mean time period. This measure is equal to the product of the deviations of corresponding values of the two variables from their respective means.
datum	Also called *geodetic datum*. A mathematical model designed to best fit the geoid, defined by the relationship between an ellipsoid and, a point on the topographic surface, established as the origin of the datum. World geodetic datums are typically defined by the size and shape of an ellipsoid and the relationship between the center of the ellipsoid and the center of the earth. Because the earth is not a perfect ellipsoid, any single datum will provide a better model in some locations than in others. Therefore, various datums have been established to suit particular regions. For example, maps in Europe are often based on the European datum of 1950 (ED-50). Maps in the United States are often based on the North American datum of 1927 (NAD-27) or 1983 (NAD-83). All GPS coordinates are based on the WGS-84 datum surface.
deep discharge	Withdrawal of all electrical energy to the end-point voltage before the cell or battery is recharged.
DGPS	See real-time differential GPS.
differential correction	Differential correction is the process of correcting GNSS data collected on a rover with data collected simultaneously at a base station. Because the base station is on a known location, any errors in data collected at the base station can be measured, and the necessary corrections applied to the rover data. Differential correction can be done in real-time, or after the data is collected by postprocessing.
differential GPS	See real-time differential GPS.
DOP	Dilution of Precision. A measure of the quality of GNSS positions, based on the geometry of the satellites used to compute the positions. When satellites are widely spaced relative to each other, the DOP value is lower, and position accuracy is greater. When satellites are close together in the sky, the DOP is higher and GNSS positions may contain a greater level of error. PDOP (Position DOP) indicates the three-dimensional geometry of the satellites. Other DOP values include HDOP (Horizontal DOP) and VDOP (Vertical DOP),

	which indicate the accuracy of horizontal measurements (latitude and longitude) and vertical measurements respectively. PDOP is related to HDOP and VDOP as follows: $PDOP^2 = HDOP^2 + VDOP^2$.
dual-frequency GPS	A type of receiver that uses both L1 and L2 signals from GPS satellites. A dual-frequency receiver can compute more precise position fixes over longer distances and under more adverse conditions because it compensates for ionospheric delays.
EGNOS	European Geostationary Navigation Overlay Service. A Satellite-Based Augmentation System (SBAS) that provides a free-to-air differential correction service for GNSS. EGNOS is the European equivalent of WAAS, which is available in the United States.
elevation mask	The angle below which the receiver will not track satellites. Normally set to 10 degrees to avoid interference problems caused by buildings and trees, atmospheric issues, and multipath errors.
ellipsoid	An ellipsoid is the three-dimensional shape that is used as the basis for mathematically modeling the earth's surface. The ellipsoid is defined by the lengths of the minor and major axes. The earth's minor axis is the polar axis and the major axis is the equatorial axis.
EHT	Height above ellipsoid.
ephemeris/ephemerides	A list of predicted (accurate) positions or locations of satellites as a function of time. A set of numerical parameters that can be used to determine a satellite's position. Available as broadcast ephemeris or as postprocessed precise ephemeris.
epoch	The measurement interval of a GNSS receiver. The epoch varies according to the measurement type: for real-time measurement it is set at one second; for postprocessed measurement it can be set to a rate of between one second and one minute. For example, if data is measured every 15 seconds, loading data using 30-second epochs means loading every alternate measurement.
feature	A feature is a physical object or event that has a location in the real world, which you want to collect position and/or descriptive information (attributes) about. Features can be classified as surface or non-surface features, and again as points, lines/breaklines, or boundaries/areas.
firmware	The program inside the receiver that controls receiver operations and hardware.
Galileo	Galileo is a GNSS system built by the European Union and the European Space Agency. It is complimentary to GPS and GLONASS.
GHT	Height above geoid.
GIOVE	Galileo In-Orbit Validation Element. The name of each satellite for the European Space Agency to test the Galileo positioning system.
GLONASS	Global Orbiting Navigation Satellite System. GLONASS is a Soviet space-based navigation system comparable to the American GPS system. The operational system consists of 21 operational and 3 non-operational satellites in 3 orbit planes.

GNSS	Global Navigation Satellite System.
GSOF	General Serial Output Format. A Trimble proprietary message format.
HDOP	Horizontal Dilution of Precision. HDOP is a DOP value that indicates the accuracy of horizontal measurements. Other DOP values include VDOP (vertical DOP) and PDOP (Position DOP). Using a maximum HDOP is ideal for situations where vertical precision is not particularly important, and your position yield would be decreased by the vertical component of the PDOP (for example, if you are collecting data under canopy).
IBSS	Internet Base Station Service. This Trimble service makes the setup of an Internet-capable receiver as simple as possible. The base station can be connected to the Internet (cable or wirelessly). To access the distribution server, the user enter a password into the receiver. To use the server, the user must have a Trimble Connected Community site license.
L1	The primary L-band carrier used by GPS and GLONASS satellites to transmit satellite data.
L2	The secondary L-band carrier used by GPS and GLONASS satellites to transmit satellite data.
L2C	A modernized code that allows significantly better ability to track the L2 frequency.
L5	The third L-band carrier used by GPS satellites to transmit satellite data. L5 will provide a higher power level than the other carriers. As a result, acquiring and tracking weak signals will be easier.
Location RTK	Some applications such as vehicular-mounted site supervisor systems do not require Precision RTK accuracy. Location RTK is a mode in which, once initialized, the receiver will operate either in 10 cm horizontal and 10 cm vertical accuracy, or in 10 cm horizontal and and 2 cm vertical accuracy.
Mountpoint	Every single NTripSource needs a unique mountpoint on an NTripCaster. Before transmitting GNSS data to the NTripCaster, the NTripServer sends an assignment of the mountpoint.
Moving Base	Moving Base is an RTK positioning technique in which both reference and rover receivers are mobile. Corrections are sent from a “base” receiver to a “rover” receiver and the resultant baseline (vector) has centimeter-level accuracy.
MSAS	MTSAT Satellite-Based Augmentation System. A Satellite-Based Augmentation System (SBAS) that provides a free-to-air differential correction service for GNSS. MSAS is the Japanese equivalent of WAAS, which is available in the United States.
multipath	Interference, similar to ghosts on an analog television screen, that occurs when GNSS signals arrive at an antenna having traversed different paths. The signal traversing the longer path yields a larger pseudorange estimate and increases the error. Multiple paths can arise from reflections off the ground or off structures near the antenna.
NMEA	National Marine Electronics Association. NMEA 0183 defines the standard for interfacing marine electronic navigational devices. This standard defines a

	number of 'strings' referred to as NMEA strings that contain navigational details such as positions. Most Trimble GNSS receivers can output positions as NMEA strings.
NTrip Protocol	Networked Transport of RTCM via Internet Protocol (NTrip) is an application-level protocol that supports streaming Global Navigation Satellite System (GNSS) data over the Internet. NTrip is a generic, stateless protocol based on the Hypertext Transfer Protocol (HTTP). The HTTP objects are extended to GNSS data streams.
NTripCaster	The NTripCaster is basically an HTTP server supporting a subset of HTTP request/response messages and adjusted to low-bandwidth streaming data. The NTripCaster accepts request messages on a single port from either the NTripServer or the NTripClient. Depending on these messages, the NTripCaster decides whether there is streaming data to receive or to send. Trimble NTripCaster integrates the NTripServer and the NTripCaster. This port is used only to accept requests from NTripClients.
NTripClient	An NTripClient will be accepted by and receive data from an NTripCaster, if the NTripClient sends the correct request message (TCP/UDP connection to the specified NTripCaster IP and listening port).
NTripServer	The NTripServer is used to transfer GNSS data of an NTripSource to the NTripCaster. An NTripServer in its simplest setup is a computer program running on a PC that sends correction data of an NTripSource (for example, as received through the serial communication port from a GNSS receiver) to the NTripCaster. The NTripServer - NTripCaster communication extends HTTP by additional message formats and status codes.
NTripSource	The NTripSources provide continuous GNSS data (for example, RTCM-104 corrections) as streaming data. A single source represents GNSS data referring to a specific location. Source description parameters are compiled in the source-table.
OmniSTAR	The OmniSTAR HP/XP service allows the use of new generation dual-frequency receivers with the OmniSTAR service. The HP/XP service does not rely on local reference stations for its signal, but utilizes a global satellite monitoring network. Additionally, while most current dual-frequency GNSS systems are accurate to within a meter or so, OmniSTAR with XP is accurate in 3D to better than 30 cm.
PDOP	Position Dilution of Precision. PDOP is a DOP value that indicates the accuracy of three-dimensional measurements. Other DOP values include VDOP (vertical DOP) and HDOP (Horizontal Dilution of Precision). Using a maximum PDOP value is ideal for situations where both vertical and horizontal precision are important.
POE	Power Over Ethernet. Provides DC power to the receiver using an Ethernet cable.
postprocessing	Postprocessing is the processing of satellite data after it is collected, in order to eliminate error. This involves using computer software to compare data from the rover with data collected at the base station.
QZSS	Quasi-Zenith Satellite System. A Japanese regional GNSS eventually consisting of three geosynchronous satellites over Japan.

real-time differential GPS	Also known as *real-time differential correction* or *DGPS*. Real-time differential GPS is the process of correcting GPS data as you collect it. Corrections are calculated at a base station and then sent to the receiver through a radio link. As the rover receives the position it applies the corrections to give you a very accurate position in the field. Most real-time differential correction methods apply corrections to code phase positions. While DGPS is a generic term, its common interpretation is that it entails the use of single-frequency code phase data sent from a GNSS base station to a rover GNSS receiver to provide sub-meter position accuracy. The rover receiver can be at a long range (greater than 100 kms (62 miles)) from the base station.
rover	A rover is any mobile GNSS receiver that is used to collect or update data in the field, typically at an unknown location.
Roving mode	Roving mode applies to the use of a rover receiver to collect data, stakeout, or control earthmoving machinery in real time using RTK techniques.
RTCM	Radio Technical Commission for Maritime Services. A commission established to define a differential data link for the real-time differential correction of roving GNSS receivers. There are three versions of RTCM correction messages. All Trimble GNSS receivers use Version 2 protocol for single-frequency DGPS type corrections. Carrier phase corrections are available on Version 2, or on the newer Version 3 RTCM protocol, which is available on certain Trimble dual-frequency receivers. The Version 3 RTCM protocol is more compact but is not as widely supported as Version 2.
RTK	real-time kinematic. A real-time differential GPS method that uses carrier phase measurements for greater accuracy.
SBAS	Satellite-Based Augmentation System. SBAS is based on differential GPS, but applies to wide area (WAAS/EGNOS/MSAS) networks of reference stations. Corrections and additional information are broadcast using geostationary satellites.
signal-to-noise ratio	SNR. The signal strength of a satellite is a measure of the information content of the signal, relative to the signal's noise. The typical SNR of a satellite at 30° elevation is between 47 and 50 dBHz.
skyplot	The satellite skyplot confirms reception of a differentially corrected GNSS signal and displays the number of satellites tracked by the GNSS receiver, as well as their relative positions.
SNR	See signal-to-noise ratio.
Source-table	The NTripCaster maintains a source-table containing information on available NTripSources, networks of NTripSources, and NTripCasters, to be sent to an NTripClient on request. Source-table records are dedicated to one of the following: • data STReams (record type STR) • CASters (record type CAS) • NETworks of data streams (record type NET)

	All NTripClients must be able to decode record type STR. Decoding types CAS and NET is an optional feature. All data fields in the source-table records are separated using the semicolon character.
triple frequency GPS	A type of receiver that uses three carrier phase measurements (L1, L2, and L5).
UTC	Universal Time Coordinated. A time standard based on local solar mean time at the Greenwich meridian.
VRS	Virtual Reference Station. A VRS system consists of GNSS hardware, software, and communication links. It uses data from a network of base stations to provide corrections to each rover that are more accurate than corrections from a single base station. To start using VRS corrections, the rover sends its position to the VRS server. The VRS server uses the base station data to model systematic errors (such as ionospheric noise) at the rover position. It then sends RTCM correction messages back to the rover.
WAAS	Wide Area Augmentation System. WAAS was established by the Federal Aviation Administration (FAA) for flight and approach navigation for civil aviation. WAAS improves the accuracy and availability of the basic GNSS signals over its coverage area, which includes the continental United States and outlying parts of Canada and Mexico. The WAAS system provides correction data for visible satellites. Corrections are computed from ground station observations and then uploaded to two geostationary satellites. This data is then broadcast on the L1 frequency, and is tracked using a channel on the GNSS receiver, exactly like a GNSS satellite. Use WAAS when other correction sources are unavailable, to obtain greater accuracy than autonomous positions. For more information on WAAS, refer to the FAA website at http://gps.faa.gov. The EGNOS service is the European equivalent and MSAS is the Japanese equivalent of WAAS.
WGS-84	World Geodetic System 1984. Since January 1987, WGS-84 has superseded WGS-72 as the datum used by GPS. The WGS-84 datum is based on the ellipsoid of the same name.