Trimble R10 Receiver Help

This Help describes how to use the Trimble R10 receiver.

Even if you have used other GNSS or GPS products before, Trimble recommends that you spend some time reading this manual to learn about the special features of this product. If you are not familiar with GNSS or GPS, visit the Trimble website (www.trimble.com).

Introduction

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.

Technical support

If you have a problem and cannot find the information you need in the product documentation, contact your local dealer. Alternatively, go to the Support area of the Trimble website (www.trimble.com/support.shtml). Select the product you need information on. Product updates, documentation, and any support issues are available for download.

If you need to contact Trimble technical support, complete the online inquiry form at www.trimble.com/support_form.asp.

R10 Getting Started Guide

Introduction

The R10 receiver 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 status, and power. Bluetooth wireless technology provides cable-free communications between the receiver and controller.

You can use the R10 receiver as part of an RTK GNSS system with the Trimble Access software. The receiver can optionally record GNSS data to the receiver's internal memory and download to a computer.

The R10 receiver has no front panel controls for changing settings. To configure the receiver, use the web interface.

Safety Information

Before you use your Trimble product, make sure that you have read and understood all safety requirements.

WARNING – This alert warns of a potential hazard which, if not avoided, could result in severe injury or even death.

CAUTION – This alert warns of a potential hazard or unsafe practice that could result in minor injury or property damage or irretrievable data loss.

Note – An absence of specific alerts does not mean that there are no safety risks involved.

Use and care

This product is designed to withstand the rough treatment and tough environment that typically occurs in construction applications. However, the receiver is a high-precision electronic instrument and should be treated with reasonable care.

CAUTION – Operating or storing the receiver outside the specified temperature range can damage it.

Regulations and safety

Some receiver models with base station capability contain an internal radio-modem for transmission or can transmit through an external data communications radio. Regulations regarding the use of the 410 MHz to 470 MHz radio-modems vary greatly from country to country.

In some countries, the unit can be used without obtaining an end-user license. Other countries require end-user licensing. For licensing information, consult your local Trimble dealer.

The R10 receiver is capable of transmitting data through Bluetooth wireless technology. Bluetooth wireless technology operates in license-free bands.

Before operating a Trimble receiver or GSM modem, determine if authorization or a license to operate the unit is required in your country. It is the responsibility of the end user to obtain an operator's permit or license for the receiver for the location or country of use.

For FCC regulations, see Notices.

Type approval

Type approval, or acceptance, covers technical parameters of the equipment related to emissions that can cause interference. Type approval is granted to the manufacturer of the transmission equipment, independent from the operation or licensing of the units. Some countries have unique technical requirements for operation in particular radio-modem frequency bands. To comply with those requirements, Trimble may have modified your equipment to be granted Type approval.

Unauthorized modification of the units voids the Type approval, the warranty, and the operational license of the equipment.

Exposure to radio frequency radiation

For 450 MHz radio

Safety. Exposure to RF energy is an important safety consideration. The FCC has adopted a safety standard for human exposure to radio frequency electromagnetic energy emitted by FCC regulated equipment as a result of its actions in General Docket 79-144 on March 13, 1986.

Proper use of this radio modem results in exposure below government limits. The following precautions are recommended:

- ***DO NOT*** operate the transmitter when someone is within 20 cm (7.8 inches) of the antenna.
- ***DO NOT*** operate the transmitter unless all RF connectors are secure and any open connectors are properly terminated.
- ***DO NOT*** operate the equipment near electrical blasting caps or in an explosive atmosphere.
- All equipment must be properly grounded according to Trimble installation instructions for safe operation.
- All equipment should be serviced only by a qualified technician.

For Bluetooth radio

The radiated output power of the internal Bluetooth wireless radio is far below the FCC radio frequency exposure limits. Nevertheless, the wireless radio shall be used in such a manner that the Trimble receiver is 20 cm or further from the human body. The internal wireless radio operates within guidelines found in radio frequency safety standards and recommendations, which reflect the consensus of the scientific community. Trimble therefore believes that the internal wireless

radio is safe for use by consumers. The level of energy emitted is far less than the electromagnetic energy emitted by wireless devices such as mobile phones. However, the use of wireless radios may be restricted in some situations or environments, such as on aircraft. If you are unsure of restrictions, you are encouraged to ask for authorization before turning on the wireless radio.

For GSM/GPRS radio

Safety. Exposure to RF energy is an important safety consideration. The FCC has adopted a safety standard for human exposure to radio frequency electromagnetic energy emitted by FCC regulated equipment as a result of its actions in General Docket 79-144 on March 13, 1986.

Proper use of this radio modem results in exposure below government limits. The following precautions are recommended:

- ***DO NOT*** operate the transmitter when someone is within 28 cm (11 inches) of the antenna.
- All equipment should be serviced only by a qualified technician.

For 900 MHz radio

Safety. Exposure to RF energy is an important safety consideration. The FCC has adopted a safety standard for human exposure to radio frequency electromagnetic energy emitted by FCC regulated equipment as a result of its actions in General Docket 79-144 on March 13, 1986.

Proper use of this radio modem results in exposure below government limits. The following precautions are recommended:

- ***DO NOT*** operate the transmitter when someone is within 20 cm (7.8 inches) of the antenna.
- ***DO NOT*** operate the transmitter with any antenna other than those provided by the manufacturer.

Installing antennas

CAUTION – For your own safety, and in terms of the RF exposure requirements of the FCC, always observe these precautions:
– Always maintain a minimum separation distance of 20 cm (7.8 inches) between yourself and the radiating antenna.
– Do not co-locate the antenna with any other transmitting device.

WARNING – The GNSS antenna and its cabling should be installed in accordance with all national and local electrical codes, regulations, and practices.
The antenna and cabling should be installed where they will not become energized as a result of falling nearby power lines, nor be mounted where they are subjected to over-voltage transients, particularly lightning. Such installations require additional protective means that are detailed in national and local electrical codes.

Trimble receiver internal radios have been designed to operate with the antennas listed below. Antennas not included in this list are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

The antennas that can be used (country dependent) with the:

- ***450 MHz radio*** are 0 dBi and 5 dBi whip antennas
- ***900 MHz radio*** are 0 dBi antennas

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen so that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

Battery safety

Removable lithium-ion battery

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.

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.

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.

Wet locations

WARNING – This product is not intended to be used outdoors or in a wet location when it is powered by the external power supply. The connection is not waterproof and could be subject to electrical shorting.

WARNING – The external power adaptor and its associated power cord and plug are not intended to be installed outdoors, or in a wet location.

Batteries and Power

Batteries for the R10

The R10 receiver has one rechargeable and removable Lithium-ion battery, which can be detached for charging. You can also connect the receiver to an external power source through Port 1.

During measurement operations, each internal battery typically provides about 5 hours of power if using the internal Rx (receive) radio and about 4 hours operating as a base station using the internal 450 MHz Tx (transmit) or 900 MHz radios. 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 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 charge can charge the following types of batteries:

- Lithium-ion Rechargeable Battery (Smart Battery), 4.4 Ah, 11.1 V, Part No 49400
- i-Ion Rechargeable Battery, 2.4 Ah, 7.4 V, Part No 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 car voltage (12 V, using a Cable Car to Dual-Slot Charger).

Mains power

Mains power supply is an external adapter worldwide useable. Different cords for different countries are supplied with adapter (Cable Kit AC for Power Supply).

Vehicle power

The charger can be powered by vehicle voltage of nominal 12 V. It can withstand voltages of a vehicle voltage of nominal 24 V (maximum 32 V). So if the user connects the vehicle cable by mistake to a 24 V socket in a vehicle the charger does not start charging but latches in fault condition and flashes all green LEDs. The power must be removed to reset the fault condition.

Technical data

Power Supply	Receiver Connection
AC Input Voltage	100 to 240 V AC +/-10%
AC Frequency	50 to 60 Hz
DC Output Voltage	19 V
DC Output current charger	Approx. 3.5 A
DC Power Input Voltage operation	10V to 21 V Unit switch off if voltage is out of range

Power Supply	Receiver Connection
DC Power Input Voltage limits	8 V to 32 V
Absolute maximum input voltage	32 V
Over voltage	21 V to 32 V
Working voltage	10 V to 21 V
Under voltage charging	<10V
Sum of charge time for all batteries	5 to 6 hours
Charger in first hour	>60%

Charging the battery

Caution – Ensure that nothing obstructs the vents in the back and bottom of the charger.

The battery is supplied partially charged. Charge the battery completely before using it for the first time.

- To charge the battery, use only a charger that Trimble recommends for charging the Lithium-ion battery.
- If the equipment has been stored for longer than six months, charge the battery before using the R10 receiver.

The charger operates between 0 C (32 F) and 40 C (104 F). Charging a battery at temperatures in the range of 0 C (32 F) to 5 C (41 F) will take longer than charging at room temperature.

To charge the battery:

1. Ensure that the vents in the back and bottom of the charger are unobstructed.
2. Place the charger on a hard, flat and level surface, to ensure that there is airflow under the charger.
3. To apply power to the charger, use the AC to DC converter or 12 V cigarette plug. The charger scans the slots for a battery.
4. Place the battery in any of the slots. The red light turns off (can take up to 5s). For an explanation of the LED, see LED Status Indicator.
5. Charging takes approximately 3 hours per battery at room temperature. If several batteries are charging in the battery charger, the batteries will be charged sequentially, from left to right.

Leave a deeply discharged or shorted battery overnight in the charger to attempt to revive the battery. A shorted battery is typically revived as soon as the slot is scanned. If the red LED turns off, the battery is revived. If the red LED stays on, the battery is no longer functional and needs to be replaced.

LED status indicator

Beside each slot are two LED indicators (Red and Green) to display the battery status:

Status	Red	Green
No battery detected(means no battery present or battery defect)	On	Off
Battery detected (charging not started yet) - Conditioning not required - Conditioning required	 Off Blinking	 Off Off
Charging in progress - Conditioning not required - Conditioning required - Over/under temperature (charge is inhibited)	 Off Blinking One flash every 2.5 seconds	 Off Blinking Blinking
Conditioning in progress	On	Blinking
Conditioning done (battery fully charged)	On	On
Battery fully charged - Conditioning not required - Conditioning required	 Off Blinking	 On On
Power supply over/under voltage	Off	One flash every 2.5 seconds

Troubleshooting

Issue	Solution
Battery is not detected (Red LED does not turn off)	The battery is not properly inserted. Reinsert battery into battery charger slot.
Battery contacts contaminated.	Clean the battery (for example, by inserting and removing the battery several times) or replace the battery.
Deeply discharged.	Leave the battery overnight in the charger to attempt to revive the battery.
Battery defective.	Replace the battery.

Using the Lithium-ion battery as a Universal Power Supply (UPS)

The internal battery will only charge from an external power source as long as that source can support the power drain, for example, an AC power adaptor. The receiver is supplied with an AC power (also known as ***mains power***) supply unit that recharges the battery inside the receiver when it is connected through the adaptor to the modem port or the Lemo port. When you use the receiver on large projects, from a permanent or semi-permanent base station location in a site

trailer, Trimble recommends that you use this power supply at all times to keep the internal battery charged. This provides an uninterrupted power supply and will keep the site operational for more than 10 hours after a power failure.

Keep all batteries on continuous charge when not in use. You can keep batteries on charge indefinitely without damage to the receiver or to the batteries.

Storing the Lithium-ion battery

Do not store batteries in the receiver or in the external charger unless power is applied.

Keep all batteries on continuous charge when not in use. You can keep batteries on charge indefinitely without damage to the batteries.

Removing the rechargeable Lithium-ion battery

The internal Lithium-ion battery should be removed only at an authorized Trimble Service Center. If the battery is removed at an unauthorized service center, the remaining warranty on the product will be void.

Disposing of the rechargeable Lithium-ion battery

Discharge a Lithium-ion battery before disposing of it. Dispose of batteries in an environmentally sensitive manner, and adhere to any local and national regulations concerning battery disposal or recycling.

External Power

Sources of external power include:

- AC power
- 12 V vehicle battery
- Trimble custom external battery pack

WARNING – When connecting an external battery, such as a vehicle battery, to the receiver, ensure that you 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.

Parts of the R10 receiver

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

Front panel

The following figure shows a front view of the R10 receiver. The front panel contains the four indicator LEDs and the Power button.

The Power button controls the receiver's power on or off functions. See Power button operations.

The indicator LEDs show the status of power, satellite tracking, and radio reception. See LED behavior.

Lower housing

The following figure shows the lower housing of the R10 receiver. The housing contains the two serial ports, one TNC radio antenna connector, the removable battery compartment, and the 5/8-11 threaded insert.

Each port or connector is marked with an icon to indicate its main function, as shown in the following table:

Receiver ports

Icon	Name	Connections
	Port 1	Device, computer, external radio, power in
	Port 2	Device, computer, external radio
	RADIO	Radio communications antenna

Port 1 is a 7-pin 0-shell Lemo connector that supports RS-232 communications and external power input. Port 1 has no power outputs.

Port 2 is a DB-9 male connector that allows for full 9-pin RS-232 communications. Port 2 does not support power in or out. For more information on default port settings, see Default receiver settings .

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 for units with internal UHF or 900 MHz radios. 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, see Connecting the receiver to external devices

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.

Action	Power button	Description
Clear the ephemeris file and reset the smart antenna to the factory defaults	Hold for 15 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 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

Radio mode	Radio LED Amber	Description
		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 section above.
	Off

LED behavior

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 much longer than it is on.
Medium flash	off and on equally.
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.
On	is lit steady.
Off	is unlit.

LED flash patterns

The following table details the possible flash patterns to indicate various states of receiver operation.

Receiver mode	Power button	Radio LED	Satellite LED	Data LED	Wi-Fi LED
Receiver OFF	OFF	OFF	OFF	OFF	OFF
Receiver ON, healthy power	ON	N/A	N/A	N/A	N/A
Low power	Fast flash	N/A	N/A	N/A	N/A
Transmitting from internal radio	N/A	Flashes off when transmitting	N/A	N/A	N/A
Receiving valid data packets	N/A	Slow flash	N/A	N/A	N/A
Tracking <4 SVs	ON	N/A	Fast flash	N/A	N/A
Tracking >4 SVs	ON	N/A	Slow flash	N/A	N/A
Logging data internally	N/A	N/A	N/A	Solid	N/A

Receiver mode	Power button	Radio LED	Satellite LED	Data LED	Wi-Fi LED
Transferring data to thumb drive	N/A	N/A	N/A	Slow flash	N/A
All data transferred to thumb drive	N/A	N/A	N/A	Very slow flash	N/A
Thumb drive full	N/A	N/A	N/A	Fast flash	N/A
Wi-Fi configured as an Access Point	N/A	N/A	N/A	N/A	Slow flash
Wi-Fi configured as a client	N/A	N/A	N/A	N/A	On
Receiver in monitor mode	?	?	?	?	?

{b}Note – {/b} If a column shows "N/A", that specific LED may or may not be on, but it is not relevant to that particular mode.

Connecting to the office computer

{b}Note – {/b} SPS985 only

The receiver can communicate with the office computer using a serial connection by either using the USB to Serial Cable (P/N 87144), or by using the USB cable (P/N 80751-HH) and then Configuring a PC USB port as a virtual serial port. Before you connect to the office computer, ensure that the receiver battery is fully charged.

Default Settings

Default receiver settings

These settings are defined in the default application file.

Function	Settings	Factory default
SV Enable	-	All SVs enabled
General Controls	Elevation mask	10°
	PDOP mask	25
	RTK positioning mode	Low Latency
	Motion	Kinematic

Function	Settings	Factory default
Serial Port 1	Baud rate	38,400
	Format	8-None-1
	Flow control	None
Serial Port 2	Baud rate	38,400
	Format	8-None-1
	Flow control	None
Input Setup	Station	Any
NMEA/ASCII (all supported messages)		All ports Off
Streamed Output		All types Off
		Offset=00
RT17/Binary		All ports Off
Reference Position	Latitude	0°
	Longitude	0°
	Altitude	0.00 m HAE
Antenna	Type	Trimble SPS985, Internal
	Height (true vertical)	0.00 m
	Group	All
	Measurement method	Antenna Phase Center

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.

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 SPS985 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

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
The receiver needs a full reset.	Press the Power button for 30 seconds. For more information, see Button and LED operations.

Troubleshooting base station setup and static measurement problems

{b}Note – {/b} SPS985 only.

This section describes some possible station setup and static measurement issues, possible causes, and how to solve them.

Trimble recommends that you use the SCS900 software to restart or configure base and rover receivers. The SCS900 software sets up all radio and receiver operating parameters, and is the most likely route to a successful problem resolution once you have checked all connections, cables, and batteries.

The roving receiver is not receiving radio from the base station

Possible cause	Solution
The base station is not broadcasting.	See "Base station is not broadcasting" above.
Incorrect over air baud rates between base station and rover.	Connect to the roving receiver's radio and make sure that it has the same setting as the base station receiver.
Mismatched channel or network number selection.	Match the base station and rover radio channels/network number and try again.
Incorrect port settings between the rover external radio and receiver.	If the radio is receiving data (the Radio LED is flashing) and the receiver is not receiving data, check the port settings of the receiver and radio using the Trimble SCS900 Site Controller software; match the settings and try again.
The radio antenna	Make sure that the radio antenna cable (with the

Possible cause	Solution
cable and GPS antenna cable are mixed up.	blue over-mould) is connected between the blue TNC connector marked RADIO and the radio antenna.

The base station is not broadcasting

Possible cause	Solution
Port settings between base receiver and external radio are incorrect. *{b}Note – {/b} The R10 receiver has the option for an integrated Tx radio that allows it to be used without an external radio at the base and rover location. The R10 receiver can also be connected to an external high power radio in certain countries.*	Use Trimble Access software to connect to the radio through the receiver. If no connection is made, connect directly to the radio and change the port settings. Try to connect through the receiver again to ensure that they are communicating. *{b}Note – {/b} Trimble Access software does not support direct connection to the external radio; it only allows configuration through the receiver.*
Faulty cable between receiver and external radio.	Do one of the following: • Try a different cable • Examine the ports for missing pins • Use a multimeter to check the pins
No power to radio.	If the radio has its own power supply, check the charge and connections.
No Bluetooth connections	Make sure that the radio and receiver are within Bluetooth range of each other and that the Bluetooth antennas are visible to each other.

Troubleshooting LED conditions

{b}Note – {/b} SPS985 only

The receiver has a simple display panel with LEDs to indicate the current status of the receiver. If you need more detailed information about what the receiver is doing, use Trimble Access or a laptop computer to connect to the receiver.

This section describes how the LED lights are used on the receiver to indicate current status. An LED that is flashing quickly indicates a condition that may require attention, and an unlit LED indicates

that no operation is occurring. This section describes some LED conditions, possible causes, and how to solve them.

The SV Tracking LED is lit solidly and the Logging/Memory LED is flashing slowly

Possible cause	Solution
The receiver is in Monitor mode, ready for new firmware to be loaded or new options to be added.	Turn on or turn off the receiver. If that does not fix the problem, load the latest version of the firmware, which you can download from the Trimble website (www.trimble.com/support.shtml / <product> / *Downloads*).

The SV Tracking LED is not flashing

Possible cause	Solution
The receiver is tracking fewer than four satellites.	Wait until the SV Tracking LED is flashing slowly.

Base Applications

Base station operation guidelines

This topic introduces the concept of base station operation, provides information to help you identify good setup locations, describes best practices for setting up the equipment, and outlines the precautions that you need to take to protect the equipment.

Real-Time Kinematic (RTK) operation provides centimeter-level accuracy by eliminating errors that are present in the GNSS system. For all RTK, Location RTK, or DGPS operations, you require both a rover receiver and a source of corrections from a base station or network of base stations.

A base station consists of a receiver that is placed at a known (and fixed) position. The receiver tracks the same satellites that are being tracked by the rover receiver, at the same time that the rover is tracking them. Errors in the GNSS system are monitored at the fixed (and known) base station, and a series of position corrections are computed. The messages are sent through a radio link to the rover receiver, where they are used to correct the real time positions of the rover.

Base station components

The base station has the following components:

- GNSS receiver
- GNSS antenna
- Base station radio
- Power supply

GNSS receiver and GNSS antenna

The base station GNSS receiver can be one of following types:

- An integrated receiver that incorporates a GNSS receiver, GNSS antenna, power supply, and radio into a single compact unit. A Smart GPS antenna can be rapidly set up on a tripod, fixed height tripod, or T-Bar anywhere that is convenient on the jobsite.
- A modular receiver that incorporates a GNSS receiver and separate GNSS antenna. The GNSS antenna (and, optionally, the base station radio antenna) is separate from the receiver. Because the GNSS antenna is separate, you can use the following optimized components:
    - a geodetic antenna with large ground plane, to eliminate multipath (the major source of GNSS errors) at the base station
    - a high-gain or directional radio antenna, to increase broadcast range and to provide maximum coverage

      You can also place a modular receiver in an easily accessible and secure location, safe from theft and the weather, while the antennas are placed high on a tower or building, clear of obstructions and able to deliver maximum performance.

You can use either type of receiver in a permanent, semi-permanent, or daily quick setup configuration. If semi-permanent or permanent operation is required, however, the modular receiver delivers significant advantages.

Base station setup guidelines

For good performance, observe the following base station setup guidelines:

- Place the GNSS receiver in a location on the jobsite where equal range in all directions provides full coverage of the site. This is more important on larger jobsites, where the broadcast range of the base station radio may limit the operations of the system.
- Place the GNSS antenna in a location that has a clear line of sight to the sky in all directions. Do not place the antenna near vertical obstructions such as buildings, deep cuttings, site vehicles, towers, or tree canopy.
- Place the GNSS and radio antennas as high as practical. This minimizes multipath from the surrounding area, and enables the radio to broadcast to the maximum distance.

{b}Note – {/b} The GNSS antenna must have a clear line of sight to the sky at all times during operation.

- Choose the most appropriate radio antenna for the size and footprint of the site. The higher the gain on the antenna, the longer the range. If there is more focus on the transmission signal, there is a reduced coverage area. A 3 db or 5 db gain antenna provides a mix of good range and reasonable directional coverage.
- Make sure that the GNSS receiver does not lose power. To operate continuously for more than a few hours without loss of power at the base station, provide external power. Sources of external power include:
    - AC power
    - 12 V vehicle battery
    - Trimble custom external battery pack
    - Generator power
    - Solar panel

      When you use an external power supply, the integrated battery provides a backup power supply, enabling you to maintain continuous operation through a mains power failure.
- Do not locate a GNSS receiver, GNSS antenna, or radio antenna within 400 meters (about 1,300 feet) of:
    - a powerful radar, television, or cellular communications tower
    - another transmitter
    - another GNSS antenna

      Cell phone towers can interfere with the base station radio broadcast and can stop corrections from reaching the rover receiver. High-power signals from a nearby radio or

radar transmitter can overwhelm the receiver circuits. This does not harm the receiver, but can prevent the receiver electronics from functioning correctly.

Low-power transmitters, such as those in cell phones and two-way radios, do not interfere with receiver operations

- Do not set up the base station directly beneath or close to overhead power lines or electrical generation facilities. The electromagnetic fields associated with these utilities can interfere with GNSS receiver operation. Other sources of electromagnetic interference include:
  - Gasoline engines (spark plugs)
  - Televisions and computer monitors
  - Alternators and generators
  - Electric motors
  - Equipment with DC-to-AC converters
  - Fluorescent lights
  - Switching power supplies
- Place the GNSS receivers in a protected and secure location. If the base station is in the center of a jobsite where heavy machinery is operating, place flags around the base station to warn operators of its existence.
- If you place the receiver in a lock box on the jobsite to protect the receiver from theft or from the weather, shield the lock box from direct sunlight and provide ventilation for the receiver through an inlet and extractor fan. A receiver that has a broadcast radio generates significant heat. Do not allow the temperature in the box to exceed 50 °C (122 °F).

  If working in a cold climate, you may need to provide heat to the receiver. Do not operate the receiver below –40 °C (–40 °F)
- Trimble recommends that, wherever possible, you keep GNSS receiver equipment dry. The receivers are designed to withstand wet weather, but keeping them dry prolongs their life and reduces the effects of corrosion on ports and connectors. If the equipment gets wet, use a clean dry cloth to dry the equipment and then leave the equipment open to the air to dry. Do not lock wet equipment in a transport case for prolonged periods. Avoid exposing the receiver to corrosive liquids and salt water wherever possible.
- Trimble recommends that you install lightning protection equipment at permanent base station locations. Equipment should include a gas capsule lightning protector in the GNSS and radio antenna feed line and appropriate safety grounding. A static dissipater near the antennas can reduce the likelihood of a direct lightning strike. Also protect any communications and power lines at building entry points. For more information, contact your local Trimble dealer, or go to the Huber and Suhner website (www.hubersuhnerinc.com).
- Trimble recommends that you use surge protection equipment on all permanently installed equipment.

Common ways to set up a base station

Trimble recommends that you use either a tripod and tribrach setup, or a fixed height tripod.

The fixed height tripod is quicker and easier to set up over a control point.

Take great care to ensure that the GNSS antenna is set up accurately over the control point, and that the GNSS antenna height is measured accurately, in the right way (vertical or slope height) to the right location on the antenna (base of antenna or to a specified location on the antenna). When you start the rover receiver, it is extremely important to check in, at one or more known locations, to check for possible position or height errors. Checking in at a known location is good practice and can avoid costly errors caused by a bad setup.

Typically, the tripod and fixed height tripod methods do not give significant height clearance above the ground, and can reduce the range of operation caused by radio limitations.

Tripod and tribrach setup

In the tripod setup, the tripod is located over the control point, and the tribrach and tribrach adaptor is mounted on the tripod and centered over the point.

1. Mount the GNSS antenna on the tribrach adaptor.
2. If required, connect the GNSS receiver to an external 12 V power supply. Use the crocodile clip cable or the Trimble custom power pack.

Fixed height tripod setup

A fixed height tripod setup is similar to a tripod setup, but is simplified by the central leg of the tripod, which is placed directly on the control point. If the central leg is leveled accurately, the fixed height tripod is quick and easy to set up, and provides an accurate way to measure the true antenna height.

1. Set up the tripod over the control point.
2. Attach the GNSS antenna to the head of the tripod.
3. If using an external high-gain radio antenna, mount the radio antenna to the radio antenna bracket that is attached to the head of the tripod (beneath the GNSS antenna). See the figure below.
4. Mount the antenna using the 25 cm spacer rod (supplied with the Accessory kit, P/N 50590-50), so that the radio antenna clears the head of the tripod.

Outputting corrections using an TDL450/HPB450 radio-modem

The TDL450/HPB450 radio comes with a 5-pin Lemo to 7-pin Lemo connector with a power connection lead:

1. Connect the 7-pin Lemo connector to the connector on the receiver.
2. Connect the 5-pin Lemo connector to the TDL450/HPB450radio.
3. Connect the DC power lead to an external power source.
4. Turn on the TDL450/HPB450 radio.

To configure the system, do one of the following:

- Use the Trimble Access software to connect to the receiver. Set up the base station with the external radio. The Trimble Access software will locate the TDL450/HPB450 radio and then allow you to set the radio channel.
- Use the web interface to configure the settings. Select *I/O Configuration* / *Port Configuration*. Select the *Serial 1 / Lemo* option and select corrections to be sent on the Lemo port at those baud rate settings (the TDL450/HPB450 serial interface is shipped with the default rates 38400 8/N/1). While in the *Port Configuration* menu, also set the internal radio to transmit corrections.

Configuration software accompanies the TDL450/HPB450 radio if you need to change the serial connection baud rate.

Supported file types

The following table shows the file types that you can transfer to or from the receiver, and the software or utility that you must use to transfer each file type.

File type	Extension	Transfer from receiver	Transfer to receiver	Software
Raw observations	.T02, .dat	Yes	No	Data Transfer or web interface
Receiver firmware files	.timg	No	Yes	WinFlash utility or web interface
Application files	.cfg	Yes	Yes	Web interface

Deleting files in the receiver

You can delete files stored in the receiver at any time. Do one of the following:

- Press for 30 seconds after the receiver is turned on. (When you use this method, all data is deleted.)
- Use the Data Transfer utility.
- Use the web interface (Data Logging menu).

Upgrading the receiver firmware

Your receiver is supplied with the latest version of the receiver firmware already installed. If a later version of the firmware becomes available, you can use the WinFlash utility to upgrade the firmware on your receiver as long as your receiver has a current warranty.

If your receiver can access the Internet, you can also upgrade it through the Web browser (see Configuring the receiver using a web browser).Whenever Trimble releases new firmware your receiver will check and display the new firmware version number in the Web browser. You can then decide to install the newer firmware from the Web browser.

Firmware updates are available to download from the Trimble website. Go to www.trimble.com/support.shtml. Select the link to the receiver that you need updates for and then click **Downloads**.

To upgrade the firmware

1. Start the WinFlash utility. The *Device Configuration* screen appears.
2. From the *Device type* list, select the receiver.
3. From the *PC serial port* field, select the serial (COM) or USB port on the computer that the receiver is connected to.
4. Click **Next**.

   The *Operation Selection* screen appears. The *Operations* list shows all of the supported operations for the selected device. A description of the selected operation is shown in the *Description* field.
5. Select *Load GPS software* and then click **Next**.

   The *GPS Software Selection* window appears. This screen prompts you to select the software that you want to install on the receiver.
6. From the *Available Software* list, select the latest version and then click **Next**.

   The *Settings Review* window appears. This screen prompts you to connect the receiver, suggests a connection method and then lists the receiver configuration and selected operation.
7. If all is correct, click **Finish**.

   Based on your selections, the *Software Upgrade* window appears and shows the status of the operation, for example, `Establishing communication with <your receiver>. Please wait.`
8. Click **OK**.

The *Software Upgrade* window appears again with a message that the operation was completed successfully.

9. To select another operation, click **Menu**; to quit the WinFlash utility, click **Exit**.

   If you click **Exit**, the system prompts you to confirm.

10. Click **OK**.

Rover Applications

Setup Operation Guidelines

Rover operation guidelines

Real-Time Kinematic (RTK) operation provides centimeter-level accuracy by eliminating errors that are present in the GNSS system. For all RTK, Location RTK, or DGPS operations, you require both a rover receiver and a source of corrections from a base station or network of base stations.

This topic introduces the concept of rover operation, provides information to help you identify good setup locations, describes best practices for setting up the equipment, and outlines the precautions that you need to take to protect the equipment.

The second part of the RTK GNSS system is the rover receiver. The rover receiver is moved between the points that require measurement or stakeout. The rover receiver is connected to a base station or to a source of RTK corrections such as a VRS system. The connection is provided by:

- an integrated radio
- an integrated cellular modem
- a cellular modem in the controller
- an external cellular phone that is connected to the receiver either by Bluetooth wireless technology or by means of a cable

In most rover applications, the receiver operates entirely from its own integrated battery unit. However, you can use an external power supply if one is provided. The internal battery then acts as an uninterruptible power supply, covering any external power failures.

Choose a rover receiver according to the needs of the job:

- A GNSS Smart antenna incorporates the GPS receiver, GPS antenna, power supply, and receive radio into a single compact unit. A Smart GPS antenna can be rapidly set up on a pole, vehicle, or backpack. This makes it easy to carry when you are measuring around the jobsite.

For good rover operation, observe the following setup guidelines:

- Place the GNSS antenna in a location that has a clear line of sight to the sky in all directions. Do not place the antenna near vertical obstructions such as buildings, deep cuttings, site vehicles, towers, or tree canopy. GNSS rovers and the base station receive the same satellite signals from the same satellites. The system needs five common satellites to provide RTK positioning.
- **WARNING –** The GNSS antenna and its cabling should be installed in accordance with all national and local electrical codes, regulations, and practices.
  The antenna and cabling should be installed where they will not become energized as a result of falling nearby power lines, nor be mounted where they are subjected to over-voltage transients, particularly lightning. Such installations require additional protective means that are detailed in national and local electrical codes.

- The antenna and cabling should be installed where they will not become energized as a result of falling nearby power lines, nor be mounted where they are subjected to over-voltage transients, particularly lightning. Such installations require additional protective means that are detailed in national and local electrical codes.
- GNSS satellites are constantly moving. Because you cannot measure at a specific location now does not mean that you will not be able to measure there later, when satellite coverage at the location improves. Use GNSS planning software to identify the daily best and worst satellite coverage times for your location and then choose measurement times that coincide with optimal GNSS performance. This is especially important when operating in the worst GNSS locations. You can download the Trimble Planning software from the Trimble website (www.trimble.com/planningsoftware_ts.asp).
- To get a fixed position solution with centimeter accuracy, initialize the Precision RTK rover receiver. For initialization to take place, the receiver must track at least five satellites that the base station is also tracking. In a dual-satellite constellation operation, for example, GPS and GLONASS, the receiver must track at least six satellites.
- To maintain a fixed position solution, the rover must continuously track at least four satellites that the base station is also tracking.The radio link between the base and rover receivers must also be maintained.
- Loss of the satellite signals or loss of the radio link will result in a loss of centimeter position accuracy.
- In Autonomous mode, the rover has lost radio contact with the base station receiver, and is working by itself with the available GNSS signals

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Caution – The R10 receiver is not suited to on-vehicle operation where it will be subject to heavy vibration, that is, operation in rough ungraded terrain. Use in these conditions can damage the receiver.

Connecting the receiver to external devices

You can connect the receiver to the following devices:

- a Trimble controller running Trimble Survey Controller or Trimble Access software
- an external radio-modem

Connecting to a Trimble controller running the Trimble Survey Controller or Trimble Access software

You can operate an R10 receiver with any Trimble controller, for example, a TSC3 or a Trimble Tablet. Typically, the receiver and the controller operate from their own individual power sources. The receiver and controller can communicate through Bluetooth wireless technology and can be connected without a cable. However, if a cable is required, the following table lists the cables available for the R10.

To connect a...	to a...	Use cable P/N...	Use cable connector...	and connect the cable to the...
R10	computer serial port	59044	7-pin serial Lemo DB-9	R10 Computer
	computer USB port	80751	7-pin USB Lemo USB	R10 Computer
	TSC2, TSC3, or Trimble Tablet	59046	DB-9 Serial Lemo	TSC R10
	USB flash drive	80799	7-pin USB Lemo USB flash drive	R10 Flash drive
	TDL450		7-pin serial Lemo 5-pin Lemo	R10 TDL450

Internal radio-modems

The most common data link for Real-Time Kinematic (RTK) operation is a radio. The receiver (excluding the SPS351) is available with the following internal radios:

- 410 MHz – 470 MHz (Tx/Rx, Rx only, or Tx only)

{b}Note – {/b} "Tx" indicates that the radio transmits corrections. "Rx" indicates that the receiver receives corrections. "Tx/Rx" indicates that the radio both transmits and receives corrections.

External radio-modems

The most common data link for Real-Time Kinematic (RTK) operation is a radio. The GNSS Smart antenna is available with the following internal radios:

The most common data link for Real-Time Kinematic (RTK) operation is a radio. The receiver is available with the following internal radios:

- 410 MHz – 470 MHz (Tx/Rx, Rx only, or Tx only)
- 900 MHz (Tx/Rx, Rx only, or Tx only)

{b}Note – {/b} "Tx" indicates that the radio transmits corrections. "Rx" indicates that the receiver receives corrections. "Tx/Rx" indicates that the radio both transmits and receives corrections.

If the receiver does not have an internal transmit radio, or you want to connect to a higher powered external transmit radio or cellular modem, use the Lemo serial port or Bluetooth wireless technology.

The R10 receiver supports the following Trimble base radios:

- Trimble TDL450
- Trimble SNB900
- Legacy radios such as the Trimble PDL450, Trimble HPB450, and TRIMMARK 3

The receiver also supports third-party transparent radios and third-party cellular modems.

To use an external radio with the receiver, you need an external power source for the radio—except for the SNB900 radio, which contains an internal battery. To configure the radio modem separately, use the external radio's configuration program, or the display and keypad.

Configuring the Receiver

Configuring the receiver

You can configure the receiver in a number of ways. These topics describe the different configuration methods, and explains when and why each method is used.

Trimble Access software is likely to be your main tool to set up and operate the receiver on a daily basis. All required field configurations are handled through the Trimble Access software running on a Trimble Tablet, TSC3, or Trimble CU controller. For more information, refer to the *Trimble Access Software User Guide*.

Configuring the receiver to use specific settings when it is turned on

The power up application file (Power_up.cfg) is used to set the receiver to a specific configuration any time the unit is turned on.

In this file, you can select to reset the receiver to defaults before the power up settings are applied. This ensures that when you restart the receiver, it always resets to factory defaults before applying the power up application file.

Alternatively, you can specify that the power up settings are applied immediately after the current application file's settings have been applied. Restarting the receiver results in a configuration that uses your default settings for the options you define in the power up file, but the current settings for all other options.

By default, there is no power_up application file on the receiver. To use a power up application file, you must create and save a power_up application file in the GPS Configurator software. If you save this file to disk, the file is called power_up.cfg. The extension .cfg is used, by convention, to identify application files on the office computer. When you transfer this file to the receiver, the file is saved on the receiver as power_up, and becomes the new power up file.

Configuring the receiver using application files

An application file contains information for configuring a receiver. To configure a receiver using an application file, you need to create the application file, transfer it to the receiver and then apply the file's settings. The GPS Configurator software does this automatically when you work with configuration files.

Overview

An application file is organized into records. Each record stores configuration information for a particular area of receiver operation. Application files can include the following records:

- File storage
- General controls
- Serial port baud rate/format
- Reference position
- Logging rate
- SV enable/disable
- Output message
- Antenna
- Device control
- Static/Kinematic
- Input message
- Projection and calibration files (DC file extension)
- User-defined subgridded geoid

An application file does not have to contain all of these records. When you apply an application file, any option that is not included in the records in the file remains at its current setting. For example, if you apply an application file that only specifies the elevation mask to use, all other settings remain as they were before the application file was applied.

You can store up to 11 different application files in the receiver. You can apply an application file's settings at the time it is transferred to the receiver, or at any time afterwards.

Special application files

The receiver has three special application files, which control important aspects of the receiver's configuration.

Default application file

The default application file (Default.cfg) contains the original receiver configuration, and cannot be changed. This file configures the receiver after it is reset.

Although you cannot change or delete the default application file, you can use a power up application file to override any or all of the default settings.

Current application file

The current application file (Current.cfg) reflects the current receiver configuration. Whenever you change the receiver's configuration, either in real time or by applying an application file, the current file changes to match the new configuration.

You cannot delete the current file or change it directly, but every change to the receiver's current configuration is applied to the current file as well.

When you switch off the receiver and then turn it on again, all the settings from the current application file are applied, so you do not lose any changes that you have made. The only exceptions are the following logging parameters:

- Logging rate
- Position rate
- Elevation mask

These parameters are always reset to the factory default values when the receiver is switched off.

Power Up application file

The power up application file (Power_up.cfg) is used to set the receiver to a specific configuration any time the unit is powered up.

In this file, you can specify that the receiver is reset to defaults before the power up settings are applied. This ensures that restarting the receiver always resets it to factory defaults before applying the power up application file.

Alternatively, you can specify that the power up settings are applied immediately after the current application file's settings have been applied. Restarting the receiver results in a configuration that uses your default settings for the options you define in the power up file, but the current settings for all other options.

By default, there is no power_up application file on the receiver. To use a power up application file, you must create and save a power_up application file in the GPS Configurator software. If you save this file to disk, the file is called power_up.cfg. The extension .cfg is used, by convention, to identify application files on the office computer. When you transfer this file to the receiver, the file is saved on the receiver as power_up, and becomes the new power up file.

Applying application files

An application file's settings do not affect the receiver's configuration until you ***apply*** the application file. You can do this at the same time that you save the file. Alternatively, you can save the file on the computer or on the receiver, then open it later and apply its settings.

Storing application files

You can store application files that you create in the GPS Configurator software on the receiver and on the computer. For example, each file can represent a different user sharing the same receiver, or a particular mode of operation. Saving application files on your computer as well as in your receiver is optional, but it is useful because:

- it gives you a permanent copy of the settings you have sent to a receiver, for audit purposes or for your own reference.
- you can use the same file to configure multiple receivers identically.
- you can use an existing application file as a template to create other application files with similar settings.

Naming application files

The application filename in the office computer and in the receiver are always the same. This makes it easier to recognize and keep track of your application files.

When you change the name of the application file in the receiver, this changes the application filename on your computer. When you transfer an application file from the receiver and save it to

the computer, the system renames the file to match the internal receiver file. However, if you use Windows Explorer, for example, to change the .cfg filename on the computer, this ***does not*** change the internal receiver filename. This means that the GNSS receiver will not recognize the change to the filename on the computer.

Configuring the receiver in real time

You can configure the receiver in real time using the web interface. When you apply the changes you have made to the settings in the web interface, the receiver settings change immediately.

Any changes that you apply to the receiver are reflected in the current application file, which is always present in the receiver. The current application file always records the most recent configuration, so if you apply further changes (either in real time or using an application file) the current file is updated and there is no record of the changes that you applied originally.

Configuring Ethernet settings

The receiver has a Wi-Fi port so that the receiver can connect to a wireless network. You can use the Wi-Fi network to access, configure, and monitor the receiver. No serial cable connection to the receiver is required.

The receiver requires the following Ethernet settings:

- IP setup: Static or DHCP
- IP address
- Netmask (submask)
- Broadcast IP address
- Gateway IP address
- DNS IP address
- HTTP port

The default setting for the HTTP port is 80. The HTTP port is not assigned by the network. HTTP port 80 is the standard port for web servers. This allows you to connect to the receiver by entering only the IP address of the receiver in a web browser. If the receiver is set up to use a port other than 80, you will need to enter the IP address followed by the port number in a web browser.

For example:

- Connecting to the receiver using port 80: http://169.254.1.0
- Connecting to the receiver using port 4000: http://169.254.1.0:4000

The default setting of the receiver is DHCP enabled. Using DHCP allows the receiver to automatically obtain the IP address, Netmask, Broadcast, Gateway, and DNS address from the network.

When a receiver is connected to a network using DHCP, the network assigns an IP address to the receiver.

If your network installation requires the receiver to be configured with a static IP address, you can configure the Ethernet settings using the web server or the WinFlash utility. You can only use the web server when the receiver is connected to a network and has a valid Ethernet configuration. When DHCP fails, the receiver uses a private IP.

Use the WinFlash utility to configure the Ethernet settings of a receiver that is to be connected to a network that requires static IP addresses:

1. Contact the network administrator for the correct settings for the receiver.
2. Use the serial cable provided with the receiver to connect the receiver to a computer running the WinFlash utility.
3. Turn on the receiver.
4. On the computer, start the WinFlash utility. A dialog similar to the following appears:

5. Select the Trimble receiver. From the list, select the appropriate serial port on the computer and then click **Next**:

6. Select *Configure ethernet settings*, and then click **Next**. The *Settings Review* screen appears.
7. Review the setting and then click **Finish**.
8. Once the WinFlash utility connects to the receiver, the *Ethernet Configuration* dialog appears:

9. Enter the network settings in the *Ethernet Configuration* dialog and then click **OK**.

The Broadcast setting is the IP address that is used to broadcast to all devices on the subnet. This is usually the highest address (commonly 255) in the subnet.

Configuring the receiver using a web browser and Bluetooth wireless technology (Windows XP)

The receiver can be configured using the keypad and display, the Trimble SCS900 Site Controller software, or a web browser. This topic describes how to set up the receiver using a web browser running on the Windows XP operating system. The computer must be connected to the receiver in one of the following ways:

- Peer-to-peer using Ethernet cross-over cable or Bluetooth wireless technology
- Through a Local Area Network (LAN)
- Through the Internet

Connecting to the receiver using a web browser

1. Enter the IP address of your receiver into the address bar of the web browser as shown:

2. If security is enabled on the receiver, the web browser prompts you to enter a username and password:

   The default login values for the receiver are:

   - User Name: admin
   - Password: password

   If you cannot connect to the receiver, the password for the admin account may have been changed, or a different account may be in use. Contact your receiver administrator for the appropriate login information.

Connecting to the receiver using a web browser and Bluetooth wireless technology

This section describes how to access the web interface on a SPS Modular receiver that has firmware version 3.32 or later installed, using Bluetooth wireless technology on an office computer that has Service Pack 2 of the Windows XP operating system (Professional Edition) installed.

1. On the office computer, open the Control Panel. Open Bluetooth Configuration and go to the *Client Applications* tab. The following dialog appears:

2. Add at least one Bluetooth Serial port. To do this, click **Add COM port** and then follow the steps at the wizard. Name the COM port appropriately and clear the *Secure Connection* check box.
3. Start the *Bluetooth Setup* wizard (click *Start* / *All Programs* / *My Bluetooth Places*):

4. The *Bluetooth Setup* wizard starts. Use the settings shown below and then click **Next**:

   The following dialog appears:

5. Select the Bluetooth serial port you created and then click **Next**. The following dialog appears:

6. In the *Search criteria* list, change the search to *Show all devices* and then select the SPS Modular receiver that you want to connect to. Click **Next**:

7. Click **Configure** to select the COM port on your office computer. Think of Bluetooth as a cable replacement and the COM port as the serial port on your office computer into which the Bluetooth 'cable' will be connected. The following dialog appears:

8. Clear the *Secure Connection* check box and then tap **OK**.
9. Tap **Finish**. The new Bluetooth connection appears in *My Bluetooth places*:

10. Double-click the icon to connect.

Creating a new connection

1. From your Windows Control Panel, open Network Connections and then click **Create a new connection**:

2. The *New Connection* wizard starts. Use the following settings to:
   - Set up an advanced connection
   - Connect directly to another computer
   - Connect as a Guest

3. Give the connection a name that relates to the COM port used on the office computer. This is like a cable connection between two computers, but the cable is replaced by a Bluetooth wireless connection. Tap **Next**. The following dialog appears:

4. Select the correct COM port from the list and then tap **Next**:

   The defaults for the SPS Modular receiver are:
   - User name: admin
   - Password: password

5. The new Direct connection appears in the Network Connections folder. If that status shows as Connected, you can continue to the web interface.

6. Right-click on the connection and then select *Status*:

7. The *Details* tab shows the Server IP address. Use this IP to connect to the receiver using the web interface.

{b}Tip – {/b} To get the PPP address from the front panel of the receiver, press  from the Home screen.

Configuring the receiver using a web browser and Bluetooth wireless technology (Windows Vista)

The receiver can be configured using the keypad and display, the Trimble SCS900 Site Controller software, or a web browser. This topic describes how to set up the receiver using a web browser running on the Windows Vista operating system. The computer must be connected to the receiver in one of the following ways:

- Peer-to-peer using Ethernet cross-over cable or Bluetooth wireless technology
- Through a Local Area Network (LAN)
- Through the Internet

See also Changing the receiver settings using the web interface.

Connecting to the receiver using a web browser

1. Enter the IP address of your receiver into the address bar of the web browser as shown:

2. If security is enabled on the receiver, the web browser prompts you to enter a username and password:

The default login values for the receiver are:

- User Name: admin
- Password: password

If you cannot connect to the receiver, the password for the admin account may have been changed, or a different account may be in use. Contact your receiver administrator for the appropriate login information.

Steps

The steps required are:

1. Create a Bluetooth connection between the computer and the receiver.
2. Set up and configure the modem hardware.
3. Create a Network/Internet connection to access the Trimble receiver through a web browser.

{b}Note – {/b} These instructions can also be used to connect to a SNB900 radio-modem.

Section 1 - Creating a Bluetooth connection between the computer and the receiver

1. Double-click the Bluetooth Manager icon in the system Status tray (lower right corner of the Windows taskbar).
2. Click **New Connection**:

3. Select the *Custom Mode* option and then click **Next**:

4. In the *Bluetooth device* list, locate and select the Bluetooth device, for example, R8-3, 4906165381: Trimble) and then click **Next**:

   Wait while the connection is established...

5. Select Serial Port COM3 and then click **Next**.

   *{b}Note – {/b} If the receiver reports Bluetooth Dial-Up Networking, **do not** select it or the **Serial Port COM4_RESERVED** service. Trimble recommends that you select COM3.*

   Windows assigns a default COM port, for example, COM40.

6. Ensure the *Use default COM port* check box is selected and write down the COM port name for future reference (Section 2, step 12 below) and then click **Next** :

7. If required, rename the Bluetooth connection name and then click **Next**:

8. Click **Finish**:

9. A Bluetooth connection between the receiver and the computer is not yet required; this connection is required in Section 3, step 21. Click **Close** to close the *Bluetooth Settings* dialog:

Section 2 - Setting up and configuring the modem

1. Click the Windows **Start** button and then select *Control Panel*.
2. Click the *Hardware and Sound* link:

3. Click the *Phone and Modem Options* link:

4. Enter an area code. Any number except 800 is suitable. No other information is required; that is, carrier code or outside line fields can be left blank.

   *{b}Note – {/b} Clicking **OK** without an area code brings up an error. You must enter some type of area code or city code, no matter which country/region you choose.Click **OK** to close the message.*

5. Click **OK**. A new modem location is created. In this example, it is My Location:

6. Assign “My Location” a unique name. This enables you to manage a number of different devices without confusion. Click **Edit**:

7. Enter a unique *Location name* to match the Bluetooth connection name and then click **OK**.
8. Select the *Modems* tab.
9. Click **Add.**
10. Ensure that you select the *Don't detect my modem* check box and then click **Next**:

11. Even though you are creating a Bluetooth connection, select the *Communications cable between two computers* option and then click **Next**.

12. Select the appropriate COM port for your device. Select COM40, the default COM Port setting from the earlier Bluetooth pairing (Section 1, step 6 above), and then click **Next**:

13. Click **Finish**.

14. Verify that the creation of the new modem device is correct. Check that it is attached to COM40. Click **OK**.

The Bluetooth pairing and hardware setup are now complete.

Section 3 - Creating an Internet connection

1. Click the Windows **Start** button and then select *Control Panel*.
2. Click the *Network and Internet* link.
3. Click the *Network and Sharing Center* link:

   {b}Note – {/b} If there no wireless connections or wireless networks are available, the following screen appears:

4. Select the *Connect to a network* option.
5. Select the *Set up a connection or network* link:

6. Select the *Set up a dial-up connection* option and then click **Next**:

7. In the *Dial-up phone number* field, enter a unique name or number. This example shows the name BERT. To enable other users to use this connection, select the *Allow other people to use this connection* check box. Click **Connect**.

   Windows automatically starts testing the Internet connection. Click **Skip**. The message `The Internet connectivity test was unsuccessful` appears:

8. Select the *Set up the connection anyway* option. The message `The connection to the Internet is ready to use` appears:

9. Click **Close**.

   *{b}Note – {/b} Clicking **Close** on the page does not affect the ability to connect to the Internet or the GNSS receiver web interface.*

10. Back at the *Network and Sharing Center*, select the *Manage network connections* link:

    The *Network Connections* screen appears:

11. Select and right-click on the new dial-up connection and then select *Rename*:

12. Rename the device using a unique identifier and then press **Enter**
13. Double-click the new dial-up connection.
14. Select **Properties**.
15. Select the *Networking* tab and then click **Properties**.

16. Click **Advanced**:

17. Clear the *Use Default gateway on remote network* check box and then click **OK**:

18. Click **OK**:

19. Click **OK**.

20. Before creating the PPP connection, a Bluetooth connection is required. Create a Bluetooth connection between the computer and the receiver, for example, Copperhead). In the System tray, double-click the Bluetooth Manager icon  .

21. Double-click the “Bert” icon to create a Bluetooth connection between devices. The icon should appear as follows:

    The Bluetooth connection is now complete. Minimize this screen and continue to create the PPP connection.

22. Double-click on the dial-up connection:

23. No user name or password are required yet. Click **Dial**:

24. Select a location for the ‘Bert’ network. Select the *Work* option:

25. Click the *View or change network and sharing settings in Network and Sharing Center* link:

26. In the *Network and Sharing Center*, locate the connection (in this example, it is called “Bert”) and then click **View Status**.

27. Select the *Details* tab:

28. Write down the IPv Server 4 address, for example, 192.168.100.160.
29. Open a web browser. Enter the Server IP address into the *address* field and then press **Enter**.

    A new *Connect to* dialog appears:

30. Enter the user name and password. The default settings for a Trimble GNSS receiver are:
    - User name: admin
    - Password: password
31. Click **OK**. You are now connected to your receiver through the web interface.

Configuring the receiver using a web browser and Bluetooth wireless technology (Windows 7)

The receiver can be configured using the keypad and display, the Trimble SCS900 Site Controller software, or a web browser. This topic describes how to set up the receiver using a web browser

running on the Windows 7 operating system. The computer must be connected to the receiver in one of the following ways:

- Peer-to-peer using Ethernet cross-over cable or Bluetooth wireless technology
- Through a Local Area Network (LAN)
- Through the Internet

See also Changing the receiver settings using the web interface.

Connecting to the receiver using a web browser

1. Enter the IP address of your receiver into the address bar of the web browser as shown:

2. If security is enabled on the receiver, the web browser prompts you to enter a username and password:

The default login values for the receiver are:

- User Name: admin
- Password: password

If you cannot connect to the receiver, the password for the admin account may have been changed, or a different account may be in use. Contact your receiver administrator for the appropriate login information.

Steps

The steps required are:

1. Create a Bluetooth connection between the computer and the receiver.
2. Set up and configure the modem hardware.
3. Create a Network/Internet connection to access the Trimble receiver through a web browser.

{b}Note – {/b} These instructions can also be used to connect to a SNB900 radio-modem.

Section 1 - Creating a Bluetooth connection between the computer and the receiver

1. In the system tray (in the lower right corner of the Windows taskbar), click the Up arrow and then click the Bluetooth icon. From the shortcut menu that appears, select Add a Device:

2. Windows 7 searches for the Bluetooth device. Ensure that it is switched on. Match the model and serial number to the one shown on the screen. Select the correct device and then click **Next**:

3. Select the *Enter the device's pairing code* option:

4. By default, the pairing code is 0000. Enter it in the dialog and then click **Next**:

5. After the device has been successfully added you need to inspect its properties. Click on the *Devices and Printers* link in the success window:

   Alternatively, select *Show Bluetooth Devices* from the Bluetooth context menu:

6. In the *Bluetooth Device* window, right-click the device and then select *Properties* from the shortcut menu:

7. In the *Services* tab, clear the check boxes for COM1 and COM2 services. Take note of the local COM port for COM3 (this is COM11 in the example below). You will need to know this COM port for Section 2, step 7:

Section 2 - Setting up and configuring the modem

1. Return to the *Control Panel* and use the search field in the top right corner to search for "phone".

2. Select *Phone and Modem*:

3. Select the *Modems* tab:

4. Click **Add**. The following wizard appears:

5. Select the *Don't detect my modem; I will select it from a list* check box and then click **Next**. Wait a minute while the Windows 7 operating system populates the list:

6. From the *Models* list, select the *Communications cable between two computers* option and then click **Next**.

   {b}Note – {/b} Even though you are using a Bluetooth connection you are effectively using it as a "cable" between the devices.

   The following dialog appears:

7. The COM port you noted earlier (Section 1, step 7) should be displayed below *Selected ports*. Click the port to select it and then click **Next**.
8. Wait while Windows 7 installs the modem.

The Bluetooth pairing and hardware setup are now complete.

Section 3 - Creating an Internet connection

1. In the *Control Panel*, click the *View network status and tasks* link:

   The following screen appears:

2. Click the *Set up a new connection or network* link. The following screen appears:

3. Select *Set up a dial-up connection* and then click **Next**:

4. The *Communications cable between two computers* modem you created in Section 2 should be visible. Click on it to continue. The following screen appears:

5. In the *Dial-up phone number* field, enter 1. This is a placeholder number that you will delete later. after you enter it you will be able to click **Connect**. After you click **Connect**, the following screen appears:

6. Windows 7 attempts to connect to the Internet using the connection. As it is not yet configured this will not work. Click **Skip** to continue. The following screen appears:

7. Return to the *Network and Sharing Center* in the *Control Panel*. Click the *Connect to a network* link. The following screen appears:

8. Right-click the *Dial-up Connection* link and then from the shortcut menu that appears select *Properties*. The following dialog appears:

9. In the *Phone number* field, remove the placeholder "1" and then click **OK**. The following screen appears:

10. Click the *Connect to a network* link again (see Step 7), right-click the *Dial-up connection* and from the shortcut menu that appears, select *Connect*:

11. Click **Dial**.
12. Next to your dial-up connection, click on the blue *Dial-up Connection* link. The following screen appears:

13. In the *Details* tab, note the *Server IPv4 address*. This is the IP address to connect to the receiver web interface.
14. Enter the IP address in your browser. The connection can be a little slow so please be patient. The following screen appears:

15. Enter the user name and password. The default settings for a Trimble GNSS receiver are:
    - User name: admin
    - Password: password
16. Click **OK**. You are now connected to your receiver through the web interface.

Web interface menus

Use the web interface to configure the receiver settings

The web interface is available in the following languages:

- English (en)
- Chinese (zh)
- Dutch (nl)
- Finnish (fi)
- French (fr)
- German (de)
- Italian (it)
- Japanese (ja)
- Norwegian (n)
- Polish (pl)
- Russian (ru)
- Spanish (es)
- Swedish (sv)

The web interface shows the configuration menus on the left of the browser window, and the settings on the right. Each configuration menu contains related submenus to configure the receiver and monitor receiver performance.

Supported browsers

For PCs and laptops:

- Google Chrome

- Mozilla Firefox (version 1.50 or later is recommended for Windows, Macintosh, and Linux operating systems)
- Microsoft Internet Explorer for Windows operating systems
- Opera
- Apple Safari

To access the web interface on a SPS985 smart antenna using a PDA or a smartphone with the Wi-Fi link to the SPS985 smart antenna, Trimble recommends:

- Opera Mobile for Android-based units
- Apple Safari

The following configuration menus are available.

Receiver Status menu

The *Receiver Status* menu provides a quick link to review the receiver's available options, current firmware version, IP address, temperature, runtime, satellites tracked, current outputs, available memory, position information, and more.

Satellites menu

Use the *Satellites* menu to view satellite tracking details and enable/disable GPS, GLONASS, and SBAS satellites.

{b}Note – {/b} To configure the receiver for OmniSTAR, use the OmniSTAR menu.

Data Logging menu

Use the *Data Logging* menu to set up the receiver to log static GNSS data. This menu is available only if the receiver has the Data Logging option enabled. You can also configure settings such as observable rate, position rate, continuous logging, continuous logging rate, and whether to auto delete old files if memory is low.

Receiver Configuration menu

Use the *Receiver Configuration* menu to configure such settings as elevation mask and PDOP mask, the antenna type and height, the reference station position, and the reference station name and code.

I/O Configuration menu

Use the *I/O Configuration* menu to set up all outputs of the receiver. Depending on the receiver's specification it may output CMR, RTCM, RTCM-REPEAT, RT17/RT27, NMEA, GSOF, or BINEX messages on a variety of ports including TCP/IP, NTRIP, UDP, serial, .

Bluetooth menu

Use the *Bluetooth* menu to configure the receiver to connect to other devices that use Bluetooth wireless technology. These devices can be used to configure the receiver, and generate or receive corrections.

The following Trimble devices can be connected to the receiver using Bluetooth wireless technology:

- TSC3 controller
- Trimble Tablet
- Other Bluetooth-enabled devices

Radio menu

Use the *Radio* menu to configure the internal radio of the receiver, if applicable. The receivers are available with 410 MHz to 430 MHz, or 900 MHz radios.

GSM/GPRS modem menu

[please provide text]

OmniSTAR menu

The receiver can receive OmniSTAR corrections.

To receive OmniSTAR corrections, you must enable the receiver to track OmniSTAR satellites and it must have a valid OmniSTAR subscription.

To obtain an OmniSTAR subscription or contact support, go to www.omnistar.com/servicemap.html.

Network Configuration menu

Use the *Network Configuration* menu to configure Ethernet settings, email alerts, PPP connection, HTTP port, and FTP port settings of the receiver. For information on the Ethernet settings, see Configuring Ethernet settings.

Wi-Fi

Use the *Wi-Fi* menu to configure the Wi-Fi access mode and access point, so that using a Wi-Fi enabled device such as a smartphone, you can access the web interface of a SPS985 smart antenna.

Wi-Fi Client menu

[please provide text]

Wi-Fi Access Point menu

[please provide text]

Security menu

Use the *Security* menu to configure the login accounts for all users who will be permitted to configure the receiver using a web browser. Each account consists of a username, password, and permissions. Administrators can use this feature to limit access to other users. Security can be disabled for a receiver. However, Trimble discourages this as it makes the receiver susceptible to unauthorized configuration changes.

Firmware menu

Use the *Firmware* menu to verify the current firmware and load new firmware to the receiver. You can upgrade firmware across a network or from a remote location without having to connect to the receiver with a serial cable.

Help menu

The *Help* menu provides information each of the receiver settings available in the web browser. The Help files are stored on the Trimble Internet site and updated between firmware releases. For example, www.trimble.com/EC_ReceiverHelp/v4.60/en. For languages other than English, replace en with the appropriate two-letter country code (see above).

To access the Help, your computer must be connected to the Internet. If you do not have access to the Internet, there is also a copy of the receiver Help files on the support area of the Trimble website (www.trimble.com/support.shtml).

Outputting Data

RT17/RT27 Streamed Data service

Using the keypad and display to configure RT17/RT27 outputs

You can configure RT17/RT27 output during the base and rover setup using the keypad and display. See Outputting corrections.

Using the web interface to configure RT17/RT27 outputs

You can configure RT17/RT27 output using the I/O Configuration menu of the web interface of the receiver. Configure the stream to allow multiple client connections on a single port, or restrict the stream to a single client connection. To allow only authorized connections on the port, protect the output stream by requiring a password.

Outputting heights based on the geoid or an approximation to the geoid

When you want heights output from the receiver that are based on gravity datums rather than the ellipsoid that GPS typically outputs, there are two methods:

- Use of a geoid model file, which relates the ellipsoidal height to a geoidal (orthometric) height that is a constant gravity surface.

This geoidal height will agree with local height datums more accurately. It is possible to upload a subgridded geoid model file rather a global geoid model file. A global geoid model file is too large to load into receivers, so you need to reduce its size to less than 1 Kb.

1. Use the Trimble Business Center software - Heavy Construction Edition to subgrid the file. It produces a *.ggf file, which you must rename to a *.sgd file.
2. Import it into an application file in the Configuration ToolBox utility.
3. Use the Configuration ToolBox utility to select the coordinate system to upload the *.sgd file.
4. Use the Configuration ToolBox utility to load that file directly, if your computer is connected to the receiver. Otherwise, import the application file using the web interface (select *Receiver Configuration* / *Application Files*).

- In many cases the inclined plane method is used as it is often easier to get this from a site calibration. If four or more control points are well distributed around the site, then the SCS900 site calibration process gives the option to fit an inclined plane to map the GPS ellipsoidal heights to local datum heights. To import the relevant file, see Outputting local site or map projection coordinates (NEE).

Once it is loaded into the receiver, the receiver can then output the elevation values. For example, the NMEA GGA message will now output geoidal heights.

Outputting local site or map projection coordinates (NEE)

If you require North, East, Elevation (NEE) output from the receiver, you must either:

- Use the Configuration ToolBox utility (*Coordinate System* menu) to select a map projection or a site calibration and then create an application file (*.cfg) and load that into the receiver. You can use Configuration ToolBox utility to load the file directly if your computer is connected to the receiver, otherwise you can import the application file using the web interface (select *Receiver Configuration* / *Application File*).
- Use a Trimble calibration file (*.dc, or *.cal) created by the SCS900 software, the Trimble Business Center software, or a Trimble utility. Upload the file using the web interface (select *Receiver Configuration* / *Application Files*. From the *Operation* list, select the *Upload & Apply Projection and Calibration file* option.)

Once the required file is loaded on the receiver, the receiver can output the map projection or site coordinates North, Easting, Elevation values. For example, the NMEA PJK message outputs NEE if a valid DC or Projection file is loaded.

Outputting precision site coordinates (NEE) and precise orthometric heights

Outputting north east elevation (NEE) site or map projection coordinates

Do one of the following:

- Use the Configuration Toolbox utility to select a coordinate system from the database. Create the application file (*.cfg), and then do one of the following:
    1. Load the application file into the receiver using the Configuration Toolbox utility.

2. Using the receiver web interface, select *Receiver Configuration* / *Application Files*. Click **Upload** and then click **Start Now**.

- After a site calibration is performed with the SCS900 software, upload that information directly into the receiver:
  1. Load the *.dc or the *.cal file into your computer.
  2. Using the receiver web interface, select *Receiver Configuration* / *Application Files*. Click **Upload** and then click **Apply Projection and Calibration file**.

If an inclined plane is in the site calibration, then heights (GHT) are available that are based on the inclined plane.

Outputting elevations based on a geoid

The receiver computes ellipsoidal heights that are converted by the SCS900 software into local elevations using the inclined plane method or a geoid.

If you require the receiver to output elevations for another application in terms of the geoid (orthometric heights), then the default geoid model in the receiver is not accurate enough for precise positioning.

To load and use a precise geoid model:

- The receiver need 4.12 firmware or later.
- The file size of the user geoid file needs to be 1 Kb or smaller. The file must have a suffix of .sgd.

Using the Configuration Toolbox utility, click **Select** and then select a coordinate system:

1. Select **Apply Geoid Grid** to load the Geoid SubGrid file (*.sgd).
2. Create the Application file (*.cfg) and upload it to the receiver using Configuration Toolbox or the receiver web interface.
3. Using the receiver web interface, select *Receiver Configuration* / *Application Files*.
4. Click **Upload** and then click **Start Now**.

{b}Note – {/b} To create a geoid file that is less than 1 Kb in file size, use one of the following programs:
Trimble Site Vision Office to trim the geoid file down to this size.
Trimble Grid Factory to store the subgridded geoid file with the .sgd file extension rather than the .ggf file extension.
Trimble Geomatic Office and Trimble Business Center - Heavy Construction Edition software also enables the creation of sub-grids of geoid models. In this case, it is necessary to set up a project that references the full geoid model so that sub-grids of it can be exported.

Supported file types

The following table shows the file types that you can transfer to or from the receiver, and the software or utility that you must use to transfer each file type.

File type	Extension	Transfer from receiver	Transfer to receiver	Software
Raw observations	.T02, .dat	Yes	No	Data Transfer or web interface
Receiver firmware files	.timg	No	Yes	WinFlash utility or web interface
Application files	.cfg	Yes	Yes	Web interface

Transferring files directly from a receiver

Data is stored in the internal flash memory. To transfer files between the receiver and your office computer, connect the receiver to the office computer and use the web interface or the Data Transfer utility to transfer files.

When you use the Data Transfer utility to transfer data files from the receiver, the Data Transfer utility converts the raw receiver data (.T02) files you select into the Trimble DAT file format.

You can convert receiver data files by using a Windows Explorer extension that is installed on your computer when you install the Data Transfer utility.

Deleting files in the receiver

You can delete files stored in the receiver at any time. Do one of the following:

- Press  for 30 seconds after the receiver is turned on. (When you use this method, all data is deleted.)
- Use the Data Transfer utility.
- Use the web interface (Data Logging menu).

Upgrading the receiver firmware

Your receiver is supplied with the latest version of the receiver firmware already installed. If a later version of the firmware becomes available, you can use the WinFlash utility to upgrade the firmware on your receiver as long as your receiver has a current warranty.

If your receiver can access the Internet, you can also upgrade it through the Web browser (see Configuring the receiver using a web browser).Whenever Trimble releases new firmware your receiver will check and display the new firmware version number in the Web browser. You can then decide to install the newer firmware from the Web browser.

Firmware updates are available to download from the Trimble website. Go to www.trimble.com/support.shtml. Select the link to the receiver that you need updates for and then click **Downloads**.

To upgrade the firmware

1. Start the WinFlash utility. The *Device Configuration* screen appears.
2. From the *Device type* list, select the receiver.
3. From the *PC serial port* field, select the serial (COM) or USB port on the computer that the receiver is connected to.
4. Click **Next**.

   The *Operation Selection* screen appears. The *Operations* list shows all of the supported operations for the selected device. A description of the selected operation is shown in the *Description* field.
5. Select *Load GPS software* and then click **Next**.

   The *GPS Software Selection* window appears. This screen prompts you to select the software that you want to install on the receiver.
6. From the *Available Software* list, select the latest version and then click **Next**.

   The *Settings Review* window appears. This screen prompts you to connect the receiver, suggests a connection method and then lists the receiver configuration and selected operation.
7. If all is correct, click **Finish**.

   Based on your selections, the *Software Upgrade* window appears and shows the status of the operation, for example, `Establishing communication with <your receiver>. Please wait.`
8. Click **OK**.

   The *Software Upgrade* window appears again with a message that the operation was completed successfully.
9. To select another operation, click **Menu**; to quit the WinFlash utility, click **Exit**.

   If you click **Exit**, the system prompts you to confirm.
10. Click **OK**.

WinFlash Utility

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

{b}Note – {/b} 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.

{b}Note – {/b} 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.

To install the WinFlash utility from the CD: [will the R10 come with a CD??]

1. Insert the disk into the CD drive on your computer.
2. From the main menu select *Install individual software packages*.
3. Select *Install WinFlash*.
4. Select *Install WinFlash vx.xxx for R/5000/NetR5 receivers*. Will this have a different name?
5. Follow the on-screen instructions.

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

Upgrading the receiver firmware

Your receiver is supplied with the latest version of the receiver firmware already installed. If a later version of the firmware becomes available, you can use the WinFlash utility to upgrade the firmware on your receiver as long as your receiver has a current warranty.

If your receiver can access the Internet, you can also upgrade it through the Web browser (see Configuring the receiver using a web browser).Whenever Trimble releases new firmware your receiver will check and display the new firmware version number in the Web browser. You can then decide to install the newer firmware from the Web browser.

Firmware updates are available to download from the Trimble website. Go to www.trimble.com/support.shtml. Select the link to the receiver that you need updates for and then click **Downloads**.

To upgrade the firmware

1. Start the WinFlash utility. The *Device Configuration* screen appears.
2. From the *Device type* list, select the receiver.
3. From the *PC serial port* field, select the serial (COM) or USB port on the computer that the receiver is connected to.
4. Click **Next**.

   The *Operation Selection* screen appears. The *Operations* list shows all of the supported operations for the selected device. A description of the selected operation is shown in the *Description* field.
5. Select *Load GPS software* and then click **Next**.

   The *GPS Software Selection* window appears. This screen prompts you to select the software that you want to install on the receiver.
6. From the *Available Software* list, select the latest version and then click **Next**.

   The *Settings Review* window appears. This screen prompts you to connect the receiver, suggests a connection method and then lists the receiver configuration and selected operation.
7. If all is correct, click **Finish**.

   Based on your selections, the *Software Upgrade* window appears and shows the status of the operation, for example, `Establishing communication with <your receiver>. Please wait.`
8. Click **OK**.

   The *Software Upgrade* window appears again with a message that the operation was completed successfully.
9. To select another operation, click **Menu**; to quit the WinFlash utility, click **Exit**.

   If you click **Exit**, the system prompts you to confirm.
10. Click **OK**.

Adding frequencies for the 450 MHz internal radio using the WinFlash utility

If your receiver has the optional internal radio installed, you can use the WinFlash utility to add receiving frequencies to the default list.

You can also use the web interface to add and manage receiver 450 MHz frequencies.

If you purchase a transmit upgrade (after initial purchase), the broadcast frequencies must be programmed using a .set file obtained from a Trimble service provider.

1. Start the WinFlash utility. The *Device Configuration* screen appears.
2. From the *Device type* list, select the receiver.

3. From the *PC serial port* field, select the serial (COM) port or USB port on the computer that the receiver is connected to.
4. Click **Next**.

   The *Operation Selection* screen appears. The *Operations* list shows all of the supported operations for the selected device. A description of the selected operation is shown in the *Description* field.
5. Select *Configure Radio* and then click **Next**.

   The *Frequency Selection* dialog appears.
6. In the *Wireless Format* group, select the appropriate channel and wireless mode. The wireless mode must be the same for all radios in your network.
7. In the Specify Frequency field, enter the frequency you require.
8. Click **Add**. The new frequency appears in the *Selected Frequencies* list.

   *{b}Note – {/b} The frequencies that you program must conform to the channel spacing and minimum tuning requirements for the radio. To view this information, click **Radio Info**. You may select either 12.5 or 25 kHz channel spacing. All radios in your network must use the same channel spacing.*
9. When you have configured all the frequencies you require, click **OK**.

   The WinFlash utility updates the receiver radio frequencies and then restarts the receiver.

   {b}Note – {/b} You can only configure receive frequencies. The FCC-approved transmit frequencies must be specified and configured by Trimble.

Configuring the internal transceiver

Use the WinFlash utility *Internal Transceiver Configuration* dialog to configure the internal transceiver.

{b}Tip – {/b} To view a list of all radio information, including the current configuration, click **Radio Info**.

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1. In the *Internal Transceiver Configuration* dialog, select the current channel. This determines the radio operating frequency.
2. Select the wireless mode, which determines the over-the-air communications parameters.

   To reduce battery consumption on your base receiver, set the wireless mode as high as possible. For example, 9600 bps (bits per second) consumes half the power of 4800 bps for the same data format and time of operation.

   {b}Note – {/b} All radios in the network must be configured with the same wireless setting.
3. Select the appropriate operating mode, depending on how you intend to use the receiver. For example, select "Base with No Repeaters".
4. For base modes only, select one of the following channel-sharing configurations: (this is not available for rover modes)

- *Off*. The carrier detect mode is off. The unit will ignore other transmissions on your frequency and continue to transmit data.

  {b}Note – {/b} It may be illegal in your country of use to set channel sharing to off. You may be subject to penalties or fines based upon the specific licensing requirements of your country of use. Please consult your radio license documentation or licensing agency for operational guidelines.

- *Avoid Weak Signals*. The carrier detect mode is on. The radio will cease transmitting if it detects another radio transmission on its frequency. It will resume transmission when the channel is free of radio traffic.
- *Avoid Strong Signals*. The carrier detect mode is on, but the radio will stop transmitting only when there is a strong signal present (receive level greater than 90 dBm).

5. If you are operating in base mode, select the *Enable Station ID* check box and then enter your call sign in the *Call Sign* field. This FCC requirement is for U.S. licensed users. It sets your radio to transmit your call sign in Morse code every 15 minutes.
6. To update the configuration, click **OK**.

   In the *Status* dialog that appears, select an option to return to the main menu or to exit the WinFlash utility.

{b}Tip – {/b} You can print or save the radio configuration information for future reference. If required, you can fax or email the file to Trimble Support to aid in troubleshooting radio issues.

Updating the frequency list

You can program the internal transceiver modem with a list of up to 20 frequencies, which are stored in non-volatile memory. This list is pre-configured based on the frequencies that you requested when you ordered the unit. Government regulations stipulate that only manufacturers or authorized dealers can create this frequency list and that all frequencies programmed into a unit must comply with the host country regulations. If you need to add, delete, or replace frequencies, contact your Trimble dealer, and provide the radio modem serial number and an updated list of the frequencies you require. Once you receive the frequency file, you can upgrade the radio using the WinFlash utility.

Configuring a PC USB port as a virtual serial port

It is possible to use the USB interface from an R10 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 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.

   {b}Note – {/b} 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. Alternatively, go to the SPS site in the Trimble Connected Community (www.myconnectedsite.com). In the Downloads 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. 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. Alternatively, go to the SPS site in the Trimble Connected Community (www.myconnectedsite.com). In the Downloads 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.

{b}Note – {/b} 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.

Receiver Web Application Settings

Web interface menus

Use the web interface to configure the receiver settings

The web interface is available in the following languages:

- English (en)
- Chinese (zh)
- Dutch (nl)
- Finnish (fi)
- French (fr)
- German (de)
- Italian (it)
- Japanese (ja)
- Norwegian (n)
- Polish (pl)
- Russian (ru)
- Spanish (es)
- Swedish (sv)

The web interface shows the configuration menus on the left of the browser window, and the settings on the right. Each configuration menu contains related submenus to configure the receiver and monitor receiver performance.

Supported browsers

For PCs and laptops:

- Google Chrome
- Mozilla Firefox (version 1.50 or later is recommended for Windows, Macintosh, and Linux operating systems)
- Microsoft Internet Explorer for Windows operating systems
- Opera
- Apple Safari

To access the web interface on a SPS985 smart antenna using a PDA or a smartphone with the Wi-Fi link to the SPS985 smart antenna, Trimble recommends:

- Opera Mobile for Android-based units

- Apple Safari

The following configuration menus are available.

Receiver Status menu

The *Receiver Status* menu provides a quick link to review the receiver's available options, current firmware version, IP address, temperature, runtime, satellites tracked, current outputs, available memory, position information, and more.

Satellites menu

Use the *Satellites* menu to view satellite tracking details and enable/disable GPS, GLONASS, and SBAS satellites.

{b}Note – {/b} To configure the receiver for OmniSTAR, use the OmniSTAR menu.

Data Logging menu

Use the *Data Logging* menu to set up the receiver to log static GNSS data. This menu is available only if the receiver has the Data Logging option enabled. You can also configure settings such as observable rate, position rate, continuous logging, continuous logging rate, and whether to auto delete old files if memory is low.

Receiver Configuration menu

Use the *Receiver Configuration* menu to configure such settings as elevation mask and PDOP mask, the antenna type and height, the reference station position, and the reference station name and code.

I/O Configuration menu

Use the *I/O Configuration* menu to set up all outputs of the receiver. Depending on the receiver's specification it may output CMR, RTCM, RTCM-REPEAT, RT17/RT27, NMEA, GSOF, or BINEX messages on a variety of ports including TCP/IP, NTRIP, UDP, serial, .

Bluetooth menu

Use the *Bluetooth* menu to configure the receiver to connect to other devices that use Bluetooth wireless technology. These devices can be used to configure the receiver, and generate or receive corrections.

The following Trimble devices can be connected to the receiver using Bluetooth wireless technology:

- TSC3 controller

- Trimble Tablet
- Other Bluetooth-enabled devices

Radio menu

Use the *Radio* menu to configure the internal radio of the receiver, if applicable. The receivers are available with 410 MHz to 430 MHz, or 900 MHz radios.

GSM/GPRS modem menu

[please provide text]

OmniSTAR menu

The receiver can receive OmniSTAR corrections.

To receive OmniSTAR corrections, you must enable the receiver to track OmniSTAR satellites and it must have a valid OmniSTAR subscription.

To obtain an OmniSTAR subscription or contact support, go to www.omnistar.com/servicemap.html.

Network Configuration menu

Use the *Network Configuration* menu to configure Ethernet settings, email alerts, PPP connection, HTTP port, and FTP port settings of the receiver. For information on the Ethernet settings, see Configuring Ethernet settings.

Wi-Fi

Use the *Wi-Fi* menu to configure the Wi-Fi access mode and access point, so that using a Wi-Fi enabled device such as a smartphone, you can access the web interface of a SPS985 smart antenna.

Wi-Fi Client menu

[please provide text]

Wi-Fi Access Point menu

[please provide text]

Security menu

Use the *Security* menu to configure the login accounts for all users who will be permitted to configure the receiver using a web browser. Each account consists of a username, password, and

permissions. Administrators can use this feature to limit access to other users. Security can be disabled for a receiver. However, Trimble discourages this as it makes the receiver susceptible to unauthorized configuration changes.

Firmware menu

Use the *Firmware* menu to verify the current firmware and load new firmware to the receiver. You can upgrade firmware across a network or from a remote location without having to connect to the receiver with a serial cable.

Help menu

The *Help* menu provides information each of the receiver settings available in the web browser. The Help files are stored on the Trimble Internet site and updated between firmware releases. For example, www.trimble.com/EC_ReceiverHelp/v4.60/en. For languages other than English, replace en with the appropriate two-letter country code (see above).

To access the Help, your computer must be connected to the Internet. If you do not have access to the Internet, there is also a copy of the receiver Help files on the support area of the Trimble website (www.trimble.com/support.shtml).

Receiver Status menu

Receiver Status – Identity

This page shows information about the identity of the Trimble receiver.

System Name – Provides a way to distinguish between receivers. In the System Name field at the bottom of the screen, enter a logical name to identify the receiver such as "WorkSite Alpha Rxr". To help recognize the receiver when using the Zero Configuration service discovery, enter a name that is clear and obvious. This name is visible when on a computer that is on the same subnet as the receiver. You should plan the assignment of system names, especially in large networks, to help network administration.

Serial Number – Shows the serial number of the Trimble receiver. This number is unique across all Trimble receivers, and is the most reliable way to identify a specific receiver.

Ethernet MAC Address – Shows the Ethernet MAC (Media Access Control) Address, which is an Ethernet hardware address that uniquely identifies each device on a network. The Trimble receiver has a unique address and you can use it to distinguish between multiple receivers on a network.

Ethernet IP – Shows the Ethernet IP address assigned to the receiver. This address is used to connect to the receiver using the Ethernet port. This address may be static, or it may change over time (DHCP), depending on the Ethernet configuration of the receiver.

DNS Address – Shows the IP address of the DNS server.

Secondary DNS Address – Shows the IP address of the secondary DNS server.

DNS resolved name – Shows the DNS (Domain Name System) name, which is an alternate way of addressing the receiver on the network. The name is used as an alias for the Ethernet IP. It is a

combination of the System Name and Domain, which are specified using the Ethernet Configuration menu and the WinFlash utility.

Zeroconf/mDNS address – Shows the address used for the hardware when Zero Configuration service discovery (mDNS/DNS-SD) is enabled and in use.

Bluetooth MAC Address – Show the Bluetooth hardware address that uniquely identifies each device of a network. The Trimble receiver has a unique address and can be used to distinguish between multiple receivers on a network.

Firmware Version – Identifies the current software version running on the Trimble receiver. Usually this will be the same as the Core Engine version unless some additional functionality has been added that is independent of the core receiver operation.

Core Engine Version – Identifies the current core software running on the Trimble receiver. This information is used to determine if more recent firmware is available from Trimble, and also to identify the firmware if you need to contact Trimble Support. Receiver firmware is loaded using the Install New Firmware menu.

Firmware Date – Identifies the date that the current software running on the Trimble receiver was released.

Monitor Version – Identifies the current monitor version on the Trimble receiver.

Antenna Database Version - Identifies the current Antenna database version installed on the Trimble receiver

Hardware Version – Identifies the hardware version of the receiver.

Receiver Status – Options

This page shows which functionality the Trimble receiver has enabled.

L2 Tracking – The receiver is capable of tracking the GPS L2 signal (often referred to as L2E).

L2C – The receiver is capable of tracking the Civilian code on the GPS L2 signal (also referred to as L2CS).

L5 Tracking – The receiver is capable of tracking the GPS L5 signal.

GLONASS – The receiver is capable of tracking the GLONASS L1 and L2 signal (also referred to as G1/G2).

GIOVE – The receiver is capable of tracking the Galileo In Orbit Validation Element satellites. These are not used for positioning.

Galileo– The receiver is capable of tracking the Galileo satellites. This will be available in the future as a chargeable upgrade.

QZSS – The receiver is capable of tracking the Quasi-Zenith Satellite System available in Japan.

Everest – The receiver is capable of using the Everest Multipath Mitigation technology.

Maximum Observable Rate – The maximum rate at which observable data can be logged.

Moving Base – The receiver can operate as a kinematic base receiver and provide corrections to another GNSS receiver for determining heading and attitude between the units.

VRS – The receiver can be used as a rover in a VRS network.

HTTPS – The receiver can support a secure HTTP link, with encryption limited to a 56-bit encryption.

{b}Note – {/b} By default, Mozilla Firefox does not support this low grade encryption. To turn on the SSL 3.0 encryption, select the Encryption tab in the Advanced Options of Firefox.

OmniSTAR-HP – The receiver is capable of tracking the OmniSTAR-HP, OmniSTAR-XP, and OmniSTAR VBS signals.

CMR Input – The receiver is capable of accepting CMR corrections on a serial port, TCP/IP port, UDP port, or internal radio.

No Static CMR Input – The receiver is capable of only accepting CMR corrections on a serial port, TCP/IP port, or UDP port for moving base applications.

CMR Output – The receiver is capable of generating CMR corrections for output on a serial port, TCP/IP port, UDP port, or internal radio.

No Static CMR Output – The receiver is capable of only generating CMR corrections on a serial port, TCP/IP port, or UDP port for moving base applications.

Force Float Position With Static CMR – The best RTK solution that the receiver can obtain is RTK Float. The receiver will never obtain an RTK Fixed solution.

CMRx Input – The receiver is capable of accepting CMRx corrections on a serial port, TCP/IP port, UDP port, or internal radio.

CMRx Output – The receiver is capable of generating CMRx corrections for output on a serial port, TCP/IP port, UDP port, or internal radio.

RTCM Input – The receiver is capable of accepting RTCM (2.x and 3.0) corrections on a serial port, TCP/IP port, UDP port, or internal radio.

RTCM Output – The receiver is capable of generating RTCM (2.x and 3.0) corrections for output on a serial port, TCP/IP port, UDP port, or internal radio.

RTCM DGNSS Input – The receiver is capable of accepting RTCM 2.X (excluding all RTK corrections)) inputs that support GNSS constellations.

RTCM DGNSS Output – The receiver is capable of generating RTCM 2.X (excluding all RTK corrections) outputs to support GNSS constellation.

Heading Mode Only – The receiver is only capable of acting as a heading unit in moving base applications.

RTK Baseline Length Limit – The range from the RTK Base at which the receiver will no longer work as an RTK rover.

Location RTK – Indicates the Horizontal/Vertical precision (1 sigma) capability of the Trimble receiver. Can be changed by purchasing the appropriate upgrade.

NMEA – The receiver is capable of generating and receiving NMEA (National Marine Electronics Association) messages.

Data Collector – The receiver is capable of being controlled by a data collector. For the data collector to communicate with the receiver, the software installed on the data collector must be an approved Trimble or third-party software.

Data Collector Lite – The data collector used to connect to the receiver may have limited support of the receiver's functionality.

Binary Outputs – Allows the receiver to output raw GPS and optional GLONASS data in a Trimble proprietary format for use with Reference Station software.

Data Logging – The receiver is capable of logging raw GPS and GLONASS data to internal memory or an external USB hard drive (if this option is enabled).

Bluetooth – The receiver is capable of using Bluetooth for communications.

Transmit – The internal UHF radio (if installed) is capable of transmitting data.

GPRS – The receiver is capable of supporting a GSM/GPRS cellular modem.

UHF 2 watt – The internal UHF radio (if installed) is capable of 2 watt transmission power if you have a radio licence that permits 2 watt transmission.

Advanced RTCM output – Provides additional RTCM output controls for variable output rate, format, and message types.

TRIMCOMM Login req. – When enabled, the receiver requires a proprietary login code when an external application tries to access it using the proprietry TRIMCOMM commands.

Enable 1PPS – When enabled, the receiver is capable of outputting the 1PPS (Pulse per second) pulse for precise timing.

RTK Support – Indicates the receiver has RTK support. The nature of the support depends on other options that jointly indicate if one or more of the following RTK modes are supported. L1/L2 Precision RTK, L1/L2 Location RTK, L1-Only RTK, or Moving Base RTK.

Low Latency – Base measurements are predicted so that position updates are generated with only minimal latency (20 ms).

SBAS PRN – Pseudorandom number of satellites (1–32).

Firmware Warranty Date – The date on which support for this receiver expires. Any firmware that is dated earlier than this may be installed on the receiver. For firmware patches, the Firmware Warranty Date may be earlier than the Firmware Date. To purchase an extended warranty for the receiver, contact your local Trimble dealer.

Option Code – Enter an option code supplied by Trimble and then click **Install Option**. Option codes are used to enable new functionality in the receiver.

Receiver Status – Activity

This page shows general information about the current state of the receiver:

Satellites Tracked – Shows a list of all the satellites that the receiver is currently tracking. The number of satellites being tracked depends on controls specified on the Satellites and Receiver Configuration pages. This list contains the GPS, GLONASS, OmniSTAR, and SBAS satellite IDs that are being tracked.

Data Logging – If the Data Logging option is installed and Logging is enabled, the name of the data file currently being logged appears.

Input/Output – A list of all input and output activity currently enabled in the receiver.

Temperature – Displays the internal temperature of the receiver. This value is typically 10 °C higher than the ambient temperature.

Runtime – Displays the current uptime of the receiver. The runtime value is reset to zero when you restart the Trimble receiver.

Power Source – Displays the current source of power to the receiver.

Disk – If the Data Logging option is installed, the current availability of the internal memory of the receiver.

Port 1, Port 2, Battery 1 – Displays the estimated percentage of power remaining. The voltage of the power source is also shown.

Battery– Displays the estimated percentage of internal battery remaining. The voltage of the battery is also shown. Yellow (Charging), Green (Charged).

Receiver Status – Position

This page shows general information about the current position solution derived from satellite measurements. This information includes:

Position – Shows the current position solution.

- *Lat* – Latitude in degrees, minutes, and seconds.
- *Lon* – Longitude in degrees, minutes, and seconds.
- *Hgt* – Height above the Antenna Phase Center in meters.
- *Type* – Current solution type.
- *Datum* – Displays the datum that the position is referenced to.

Position Solution Detail – Shows the following information:

- **Position Dimension –**
    - *Clock Only* – Accurate time is computed.
    - *1D* – Vertical position only is being computed.
    - *2D* – Horizontal position only computed.
    - *3D* – Horizontal and Vertical position computed.
- **Position Type –**
    - *Old* – No updated position available.
    - *Autonomous* – Position has no satellite corrections applied.
    - *Code Diff*– Code differential solution – typically a single-frequency solution.
    - *Phase Diff*– Carrier phase differential solution (also known as Real-Time Kinematic (RTK) solution) – typically a dual-frequency solution.
    - *Beacon DGPS* – Code phase differential solution using RTCM correction from an internal IALA MSK beacon receiver.
    - *OmniSTAR VBS* – Position using OmniSTAR VBS satellite-based correction service.
    - *OmniSTAR XP* – Position using OmniSTAR XP satellite-based correction service.

- *OmniSTAR HP* – Position using OmniSTAR HP satellite-based correction service.
- *OmniSTAR HP+G2* – Position using OmniSTAR HP and G2 satellite-based correction service.
- *CDGP*– Position using the Canadian DGPS corrections.
- *SBAS+*– Position using the SBAS Plus corrections.
- *SBAS*– Position using SBAS corrections.
    - *CDGPS*– Position using the Canadian DGPS corrections.
    - *SBAS+*– Position using the SBAS plus corrections.
    - *SBAS*– Position using the SBAS corrections.
- *RTK and RTK Location* – Carrier phase double difference position correction service.

- **Position Engine –**
    - *Kalman*– By default,the Kalman filter is enabled. This results in a higher quality position solution for autonomous or DGPS solutions when compared with a Least Squares solution. The Kalman selection works substantially better than a Least Squares solution in a mobile vehicle when there are frequent satellite signal dropouts around bridges or high buildings, and gives improved performance around forested areas.
    - *Least Squares*– If Least Squares is enabled. A Kalman solution uses the time history of the position and velocity it has created, whereas a Least Squares option does not use the time history. Trimble recommends that you use the Kalman filter. The Least Squares option is available for rare cases if you decide to trial it.
- **Motion Info –**
    - *Roving* – Antenna can be in motion or static. Also known as Kinematic.
    - *Static* – Antenna is known to be static. This does provide some improvement in accuracy for RTK applications. When the receiver is in static mode, the antenna should not move at all.
- **Augmentation –**
    - *GPS* – GPS satellites only used in computation of the position.
    - *GPS+GLN* – GPS and GLONASS satellites used.
- **RTK Solution –**
    - *Normal*– Normal dual-frequency RTK solution
    - *L1 Only*– Solution uses L1 frequency only.
    - *N/A*– Non-RTK position.
- **RTK Init –**
    - *Fixed* – Fixed Integer RTK initialization.
    - *Float* – Float RTK initialization.

- *Location* – Location RTK initialization.
- *RTx*– Initialization using the Trimble RTx global correction service
- *N/A*– Non-RTK position.

- **RTK Mode –**
  - *Synchronized* – Position updates are synchronized with the appropriate CMR input, which is subject to the latency of the transport (radio).
  - *Low Latency* – Base measurements are predicted so that position updates are generated with only minimal latency (20 ms).
  - *N/A*– Non-RTK position.
- **RTK Network Mode –**
  - *Location* – Location RTK solution. Only receivers can produce this solution type.
  - *Single Base Line* – Single RTK base station.
  - *Network*– Such as the Trimble VRS Network.
  - *Global*– Such as the Trimble RTx service.
  - *N/A*– Non-RTK position.
- **Age of Corrections**– The age of the differential corrections, in seconds, at the time of the page update.
- **SBAS PRN**– If the receiver is in SBAS mode (WAAS/EGNOS etc), this shows which of the tracked SBAS satellites the receiver is using corrections from to generate the corrected position.
- **Height Mode –**
  - *Normal* – Not constrained by height input.
  - *Constrained Height* – An external height constraint for the antenna position. The receiver will produce a height value within the constraints provided by the external application.

Satellites Used – Shows the list of satellites used in the current position solution. Satellites may be tracked by the receiver but not used in the position solution. Satellites may not be used if no ephemeris available, measurements do not meet the receiver's quality requirements, or differential correction data is not available.

Satellites Tracked – Shows the list of all satellites being tracked by the receiver. Some of the satellites tracked may not be used in the position solution. The number of satellites tracked by each antenna is shown in brackets For dual-antenna receivers the first number is for antenna 1-Pos and the second number is for antenna 2-vector.

Receiver Clock – Shows information about the receiver clock performance.

- *GPS Week*– Current GPS week. Incremental number of weeks, starting at 0 hour UTC on the date January 6, 1980 .

- *GPS Seconds*– Current time in GPS seconds. Incremental number of seconds, starting at 0 hour UTC on the date January 6, 1980.
- *Offset* – The difference between the current time as reported by the clock and the time derived from the GPS position solution.
- *Drift* – The rate at which the receiver clock is drifting from the time derived from the GPS position solution.

Multi-system clock offsets – Shows information about the time differences between the clocks used by different satellite systems.

- *Master Clock System* – The satellite system clock being used by the receiver.
- *GLONASS Offset* – The offset between the master clock and the GLONASS clock when GLONASS satellites are being tracked.
- *GLONASS Drift* – The rate at which the offset between the master clock and the GLONASS clock is changing when GLONASS satellites are being tracked.

Velocity – Shows the apparent velocity of the receiver derived from the difference of the current position relative to the previous position.

- *North* – The apparent velocity in the grid north direction, in meters per second.
- *East* – The apparent velocity in the grid east direction, in meters per second.
- *Up* – The apparent velocity in the vertical direction, in meters per second.

{b}Note – {/b} A stationary receiver shows some velocity due to minor differences in the position solution each time it is computed. The receiver must be moving for these values to be meaningful for anything other than general status information.

Error Estimates (1-Sigma) – Shows the variation of the current position with a 68% confidence.

- *North* – The apparent variation of the receiver position in the grid north direction, in meters.
- *East* – The apparent variation of the receiver position in the grid east direction, in meters.
- *Up* – The apparent variation of the receiver position in the vertical direction, in meters.
- *Semi Major Axis* – The semi major axis of the error ellipse.
- *Semi Minor Axis* – The semi minor axis of the error ellipse.
- *Orientation* – The orientation of the major axis of the error ellipse.

Dilutions of Precision – Shows information about the strength of the satellite constellation with respect to a specific position attribute. The various DOPs take into account the location of each satellite relative to other satellites in the constellation, as well as their location relative to the receiver. Low DOP values indicate a higher probability of accuracy.

- *PDOP* – Position DOP, indicates the strength of the satellite constellation for general position accuracy.
- *HDOP* – Horizontal DOP, indicates the strength of the satellite constellation for horizontal position accuracy.
- *VDOP* – Vertical DOP, indicates the strength of the satellite constellation for vertical position accuracy.

- *TDOP* – Time DOP, indicates the strength of the satellite constellation for determining time and the clock offset.

Current Date/Time –At the very bottom of the Position page the current UTC date and time is displayed in the format YYYY-MM-DDTHH:MM:SSZ (UTC)

Position (Graph)

The graph(s) provide historical position information for the receiver, showing the selected data source over time.

Data Source – East, North, Height, East/North, Horizontal, PDOP/SVs, Age of Corrections, Heading, OmniSTAR.

Data Rate – Determines which data buffer is used. The receiver has two buffers, both buffers are volatile so reset if the receiver is restarted.

- *10 Second Positions* - The "10 Second" buffer contains data for up to the last 24 hours at 10 second intervals. The graphs displayed update every 10 seconds as new data is sent from the receiver to the browser.
- *High Rate Positions* - The "High Rate" buffer is 5,000 elements long and contains the last 5,000 positions the receiver computed. The time-span depends on the position rate of the receiver. Once the graph is drawn, data is sent from the receiver to the browser at the position rate, so the graphs update in real time only, subject to network and browser latencies.

New Window – When you click this, the graph is drawn on its own in a new window. The URL can be wrapped in an iFrame, which can be used in the Trimble Connected Community or other applications.

{b}Note – {/b} You need version 9 or 10 of the Adobe Flash Plugin installed. As all the graphics handling is done in the browser using Adobe Flash Player, the load on the receiver is minimal.

Other Operations

- *Zoom-in* – Click in the graph area, hold down the mouse and then define the area you want to zoom into. Release the mouse. The plot zooms in to the selected area.
- *Zoom-out* – Right-click. From the shortcut menu, choose to zoom to the previous zoom level, zoom to the original view, or zoom out by a factor of 2. You can do this numerous times to make the graph canvas larger than the original view. The keyboard shortcuts are: p-previous, r-reset view, and o-zoom out by a factor of 2.
- *Print* – Right-click. A shortcut menu appears. Print the graph to a printer.
- *Save as PNG* – Saves the graph as a PNG file.

Data Handling - If you do not change the data view and the browser does not redraw the view, new data is added to the graph without a redraw. If a redraw is done for any reason, one data cached by the browser is re-drawn. The browser has an 18,000 point historical buffer of points it will attempt to redraw. When the buffer is full, old points are dropped.

Symbol key - The cyan-colored cross shows the current position. The red-colored cross shows the receiver's reference position. If no reference position is present, the red cross does not appear.

Receiver Status – Vector

This page shows the RTK vector information. The RTK vector information is available only when the Trimble receiver is receiving RTK corrections from a static RTK base. The vector information includes:

Vector – The RTK vector between the base and rover antennas. The RTK information is only displayed if the receiver is receiving valid RTK correction data.

Position or Position Antenna – The current position solution in the satellite reference system of the position antenna.

- *Lat* – Latitude in degrees, minutes, and seconds.
- *Lon* – Longitude in degrees, minutes, and seconds.
- *Hgt* – Height above the Antenna Phase Center in meters.
- *Type* – Current GNSS solution type.
- *Datum* – Displays the datum that the position is referenced to.

Dilutions of Precision – Information about the strength of the satellite constellation with respect to a specific position attribute. The various Dilution of Precision (DOP) values take into account the location of each satellite relative to other satellites in the constellation, as well as their location relative to the receiver. Low DOP values indicate a higher probability of accuracy.

- *PDOP* – (Position DOP). Indicates the strength of the satellite constellation for general position accuracy.
- *HDOP* – (Horizontal DOP). Indicates the strength of the satellite constellation for horizontal position accuracy.
- *VDOP* – (Vertical DOP). Indicates the strength of the satellite constellation for vertical position accuracy.
- *TDOP* – (Time DOP). Indicates the strength of the satellite constellation for determining time and the clock offset.

Link Quality – The ID and quality of the correction transmissions.

RTK – Details of the RTK vector. The RTK information is only displayed if the receiver is currently receiving RTK corrections from a static or moving base.

- *RMS* – (Root Mean Square). This represents the uncertainty in the RTK solution. Traditionally has been used as an indicator of position quality.
- *Epochs* – Number of epochs of observation data used in the determination of the current position.

Tabulated data

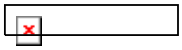
- *SV* – Satellite number
- *Type* - Constellation type, for example, GPS
- *Elev [Deg]* – The elevation of the satellite above the antenna horizon.
- *L1 Integers* – The status of the integer resolution for each satellite on the L1 frequency used in the RTK solution. R=Resolved, F=Float

- *L2 Integers* – The status of the integer resolution for each satellite on the L2 frequency used in the RTK solution. R=Resolved, F=Float
- *L5 Integers* – The status of the integer resolution for each satellite on the L5 frequency used in the RTK solution. R=Resolved, F=Float
- *L1 C/No [dB Hz]* – This is the signal-to-noise ratio (SNR) for the satellite.
- *L2 C/No [dB Hz]* – This is the SNR for the satellite.
- *L5 C/No [dB Hz]* – This is the SNR for the satellite.

Google Earth

To use this feature, you must have Google Earth 4.1 or later installed. To download Google Earth, go to http://earth.google.com/download-earth.html.

Use the Google Earth menu to open Google Earth through a link in the receiver. This sets up a network link between the receiver and Google Earth. Google Earth shows the current position of the receiver; this is refreshed every 30 seconds.

To open Google Earth, click  and then click **OK**. When Google Earth opens, you will see a placemarker showing the current position of the receiver.

{b}Note – {/b} If you have security enabled, enter your username and password for the receiver's web interface into the Google Earth login box.

Once the data has loaded into Google Earth, it should look similar to the following screen. The point name shown is the serial number of the receiver:

Every 30 seconds, the position of the placemarker updates with the current position of the receiver. Click the placemarker in Google Earth to view information about the current position and the number of satellites tracked.

The receiver provides you with the option of sending up to approximately 200 bytes of HTML to the placemarker (shown when you click the placemarker). This information must be well-formed HTML and can be used to provide links to other web pages and/or an image of the receiver.

{b}Note – {/b} Version 4.10 of Google Earth does not allow you to use iframes. An example is shown of what could be added to the HTML field in the receiver, where "myServer" is a web server:

<img width="500" src='http://myServer/AntennaLocation.png'></img>

Then, when you click the placemarker it also downloads and shows "AntennaLocation.png", as shown in the following graphic. Approximately every 30 seconds the placemarker disappears as Google Earth refreshes to show the receiver's position.

Satellites menu

Satellites – General Information

This page shows overview information about the satellites being tracked and the overall satellite constellation. The information on this display is updated every five seconds.

Satellites Tracked – Shows the total count and PRN numbers of the satellites currently being tracked. This display includes GPS, SBAS, OmniSTAR, GLONASS, Galileo.

Total Satellites in <name> Constellation – Shows how many satellites are currently in orbit for the named constellation.

Healthy Satellites – Shows how many satellites are currently thought to be healthy, that is, fully operational. This information comes from the most recent data transmitted in satellite almanacs.

Unhealthy Satellites – Shows how many satellites are currently thought to be unhealthy. Typically, unhealthy satellites will not be tracked, measured, or used in position calculations.

Satellites – Tracking Information (Table)

This table shows information about the satellites that are currently being tracked. To sort the table based on column values, click the header at the top of the column.

If the background color of a given GPS, GLONASS, Galileo or SBAS satellite is **red**, the satellite is unhealthy. Data from unhealthy satellites is logged but is not used in the position solution.

If the background color of a given satellite on the table is **orange**, the receivers RAIM (Receiver Autonomous Integrity Monitoring) algorithm has either detected a problem with the satellite or, if you are tracking SBAS, the corrections indicate there is an integrity problem with the satellite. In either case, the satellite is not used in the position solution.

A line of information shown with a blue bar indicates that the satellite is tracked, but not yet fully phase locked, so it is not yet available for use in RTK. This typically occurs very briefly when a satellite is first acquired or when the environment is hostile to GNSS.

SV – The numeric identifier of the satellite tracked on the channel.

Type – Indicates if the satellite is GPS, GLONASS, WAAS/EGNOS, MSAS, Galileo or OmniSTAR.

Elev [Deg] – The elevation of the satellite, in degrees above the horizon.

Azim [Deg] – The azimuth (direction) of the satellite, in degrees clockwise from True North.

L1-C/No [dBHz] / L2-C/No [dBHz] / L5-C/No [dBHz] – The signal-to-noise ratio of the satellite on either the L1, L2, or L5 frequency. Scaled to a 1 Hertz bandwidth. The SNRs are available for both Position antenna 1 (POS) and Vector antenna 2 (VECT) for dual-antenna systems.

L1 – The L1 carrier signal being tracked. If C is displayed, the civilian code of the satellite is being tracked. If P is displayed, the P code of the satellite is being tracked (for GLONASS satellites).

L2 – The L2 carrier signal is being tracked. If E is displayed, the receiver is tracking the L2 carrier wave using the legacy technique. If C is displayed, the receiver is tracking the L2 carrier wave using the L2C code of the satellite. If P is displayed, the P code of the satellite is being tracked (for GLONASS satellites).

IODE (*Issue of Data Ephemeris*) – The numeric identifier for the latest ephemeris data collected from this satellite.

URA [m] (*User Range Accuracy*) – The satellite's estimate of the accuracy of its ranging signals, in meters.

Type – Indicates which satellite model or generation is being tracked (if known).

Satellites – Tracking Information (Graph)

This graph shows information about the satellites that are currently tracked.

To view the graph, you need SVG support.

The graph can be sorted based on the ***satellite ID*** or the ***elevation angle***. To change the ordering sequence, click **Order by** below the graph.

Type – Apply a filter by selecting or deselecting the type of satellite and frequency displayed. For dual-antenna systems you can select both the position and vector antenna frequencies.

SV – The numeric identifier of the satellite tracked on the channel.

C/No – The SNR of the satellite on the selected frequencies. Scaled to a 1 Hz bandwidth.

Elev [Deg] – The elevation of the satellite, in degrees above the horizon.

Satellites – Tracking Skyplot

This plot shows the locations of the satellites that are currently being tracked centered on the receiver's antenna location.

To view the graph, you need SVG support.

The numbers on the outermost circle indicate the azimuth angle values.

The numbers on each of the inner circles indicate the elevation angle values.

The color of the satellites signify its tracking status:

- **Blue** – Tracking GPS satellite
- **Red** – Tracking GLONASS
- **Dark Green** – Tracking an OmniSTAR satellite
- **Green** – Tracking SBAS satellite
- **Gray** – Satellite is above elevation mask but it is not yet being tracked
- **Yellow** – Tracking GIOVE or Galileo satellites

GPS Satellite Enable/Disable

A separate page is available for each tracked constellation such as GPS, GLONASS, and Galileo.

Use the page to show and to control which satellites are enabled or are set to ignore bad health status. Each GPS satellite has two check boxes associated with it. These check boxes control how the receiver treats each satellite.

An overall option to turn all SBAS tracking on or off is available on the Tracking page.

SV – The numeric identifier of the satellite.

Enable – If the Enable check box is selected, the receiver uses the satellite in positioning and places the measurements from that satellite in logged data files, as long as the satellite is reported to be healthy, or as long as the Ignore Health check box is checked.

If the Enable check box is not selected, the receiver does not use the satellite in positioning, and does not place the measurements in logged data files, regardless of the reported health or the state of the Ignore Health check box. It is not recommended that GPS satellites be explicitly disabled.

Ignore Health – The receiver does not normally track satellites that are considered unhealthy. However, if the Ignore Health check box is selected for a satellite, then the receiver tracks that satellite ***even*** if it is considered unhealthy. Measurements from that satellite are used in all outputs such as logged measurements, logged ephemeris files, and in any other output that gives raw measurement values. Regardless of this setting, unhealthy satellites are never used to calculate the position of the receiver. Trimble recommends that you ***do not*** track unhealthy satellites in normal (non-scientific) applications.

Use the **Enable All** and **Disable All** buttons as a quick way to turn on or off the use of all satellites if several have been disabled.

GLONASS Satellite Enable/Disable

A separate page is available for each tracked constellation such as GPS, GLONASS, and Galileo.

This page is used to show and to control which satellites are enabled or are set to ignore bad health status. Each GLONASS satellite has two check boxes associated with it. These check boxes control how the receiver treats each satellite.

An overall option to turn all GLONASS tracking on or off is available on the Tracking page.

SV – The numeric identifier of the satellite.

Enable – If this check box is selected, the receiver uses the satellite in positioning and places the measurements from that satellite in logged data files, as long as the satellite is reported to be healthy, or as long as the Ignore Health check box is selected.

If the Enable check box is not selected, the receiver does not use the satellite in positioning, and does not place the measurements in logged data files, regardless of the reported health or the state of the Ignore Health check box. Trimble recommends that you do not explicitly disable GLONASS satellites.

Ignore Health – The receiver does not normally track satellites that are considered unhealthy. However, if the Ignore Health check box is selected for a satellite, then the receiver tracks that satellite ***even*** if it is considered unhealthy. Measurements from that satellite will also be used in all outputs such as logged measurements, logged ephemeris files, and in any other output that gives raw measurement values. Regardless of this setting, unhealthy satellites will never be used to

calculate the position of the receiver. Trimble recommends that you ***do not*** track unhealthy satellites in normal (non-scientific) applications.

The **Enable All** and **Disable All** buttons can be used as a quick way to turn on or off the use of all satellites if several have been disabled.

SBAS Satellite Enable/Disable

These settings show and control which Satellite-Based Augmentation System (SBAS) satellites are enabled or are set to ignore bad health status. An overall option is available to turn all SBAS tracking on or off. In addition, each SBAS satellite has a setting list associated with it so you can select how the receiver treats each satellite.

An overall option to turn all SBAS tracking on or off is available on the Tracking page.

SV – Shows the satellite ID.

Satellite – Displays the SBAS type and satellite identifier.

Setting –

- *Off* – The individual satellite is not tracked even if SBAS Tracking is set to Enabled on the Tracking page.
- *Enable* – The receiver uses the satellite in positioning as long as the satellite is reported to be healthy. For the selected satellites to be tracked, you must set global SBAS Tracking to Enable SBAS tracking on the Tracking page.
- *Ignore Health* – The receiver does not normally track satellites that are considered unhealthy. However, if the Ignore Health check box is selected for a satellite, then the receiver tracks that satellite ***even*** if it is considered unhealthy. Measurements from that satellite will also be used in all outputs such as logged measurements. Regardless of this setting, unhealthy satellites are never used to calculate the position of the receiver. Trimble recommends that you ***do not*** track unhealthy satellites in normal (non-scientific) applications.
- *Auto Enable* – The WAAS/EGNOS/MSAS satellites are associated with a region of operation. The receiver detects the region of operation based on its location and uses only those satellites associated with it. To override this setting, set the satellite to Enable to track the satellite irrespective of location; the receiver attempts to use the data.
- *Use Obs* – The receiver uses the pseudorange in the SBAS corrected position solution. The receiver does not use it in any other position solution type.

{b}Tip – {/b} To view the current status of the EGNOS system, go to www.egnos-pro.esa.int/index.html.

Satellite Almanacs

This page enables you to download the current receiver almanac. The file can then be imported into the Trimble Planning software.

This software is available as a free download from www.trimble.com/planningsoftware_ts.asp.

Predicted Satellite Elevation Angle

Use this page to view the predicted elevation angle of a particular satellite.

To view the graph, you need SVG support.

Satellite Type and Satellite ID – Select a satellite that you want to view:

- The GPS selection is available for all receivers.
- The other constellations (GLONASS, Galileo) are available only if the receiver is tracking them.
- Satellite numbers shown in red are unhealthy satellites.

For more information, see GPS Satellite Enable/Disable or GLONASS Satellite Enable/Disable.

Use Receiver Position – Select this check box to view the elevation angle of the predicted satellite for the receiver's current position.

Select Position from a list – This option becomes available once you clear the Use Receiver Position check box. This enables you to select a major city from the list. To view the predicted satellite elevation angle for a particular location, clear the check box. Fields then appear where you can enter the location's latitude and longitude.

Predicted Number of Satellites

Use this page to view the predicted number of satellites available per constellation from a specific location for the next 24 hour period.

To view the graph, you need SVG support.

Ignore Health – Select this check box to view both healthy and unhealthy satellites. By default, this check box is cleared as the receiver does not normally track satellites that are considered unhealthy. For more information, see GPS Satellite Enable/Disable or GLONASS Satellite Enable/Disable.

Elevation Mask – Select this check box to view the predicted satellite constellation for the elevation angle mask at the receiver's current position.

Use Receiver Position – Select this check box to view the satellite constellation for the receiver's current position.

Select Position from a list – This option becomes available once you clear the *Use Receiver Position* check box. This enables you to select a major city from the list. To view the predicted satellite constellation for a particular location, clear the check box. Fields then appear where you can enter the location's latitude and longitude.

Current Satellite Constellation

Use this page to view the current position of the entire constellation of satellites. The labels show the point on the earth directly beneath the satellite.

To view the graph, you need SVG support.

- **Blue** – GPS satellites

- **Red** – GLONASS satellites
- **Magenta** – GIOVE/Galileo satellites
- **Green circles** – Visible satellites
- **Yellow dot** – Current receiver position

Satellite Ground Track

Use this page to view an orbit of a given satellite projected onto the earth. The graph shows the current position of the satellite and the time (in UTC format) that it will pass over various locations.

To view the graph, you need SVG support.

Select the satellite type from the list of available constellations and ID:

- The current location of the selected satellite above the earth is shown by in **red**.
- The UTC hour is shown for each location along the orbit.
- The current Receiver position is shown as a **yellow**dot.
- The satellite is visible from the Receiver position when the orbit is **green**.
- The satellite is not visible from the Receiver position when the orbit is **blue**.

Rise/Set (Table)

This table provides the UTC time at which the satellites currently being tracked by the receiver will rise above and set below the selected elevation mask at the selected location.

Ignore Health– Select this check box to view both healthy and unhealthy satellites in the predictions.

Elevation Mask – Enter the minimum elevation that you want to compute the satellites rise/set times. The rise and set times are based on when the satellites meets this criteria.

Use Receiver Position – Select this check box to use the current receiver latitude/longitude to compute rise / set times.

Select Position from a list– This option becomes available once you clear the Use Receiver Position check box. This enables you to select a major city from the list. To view the rise/set times for a particular location, clear the check box. Fields then appear where you can enter the location's latitude and longitude.

Click**Update** to show the predictions based on the data selected.

Rise/Set (Graph)

Satellite Type– Select the type of satellites to view the rise and set times from.

Ignore Health– Select this check box to view both healthy and unhealthy satellites in the predictions.

Elevation Mask– Enter the minimum elevation that you want to compute the satellites rise/set times. The rise and set times are based on when the satellites meets this criteria.

Use Receiver Position– Select this check box to use the current receiver latitude/longitude to compute rise/set times.

Use Receiver Position – This option becomes available once you clear the Use Receiver Position check box. This enables you to select a major city from the list. To view the predicted satellite elevation angle for a particular location, clear the check box. Fields appear where you can enter the location's latitude and longitude.

Select Position from a List– Select this check box to select positions from the main cities. Clear this check box to enter a latitude and longitude of the position you want to get predictions from

Update– Click**Update** to show the predictions based on the data selected.

Data Logging menu

Data Logging

Data logging refers to the process of collecting GNSS measurements, positions, and other information into data files. The collected information can be downloaded into another system for postprocessing. Data logging is activated by creating and starting “sessions”. A session describes the types and storage intervals for logged information, the scheduled time and duration of logging, the file system, the file naming convention, and other attributes.

The receiver provides ***single-session*** capabilities, which means that just one form of logging can be active at any time. The session is always named DEFAULT and can be configured but never deleted. This session is designed for backward compatibility with older application software.

To view, download, and manage the files that are created by data logging, select *Data Logging* / *Data Files*.

This screen provides a summary of current data logging settings for the receiver.

The page shows two tables:

- The first table describes the status of one or two file systems.
- The second table describes the status of the session.

File System – Shows the starting path to a file system:

- /Internal (built-in Flash memory)
- /External (removable Flash memory)

{b}Note – {/b} The receiver does not support external data logging.

Click on the file system path to switch the page to view the data files information at the top of that file system.

Size – The maximum storage space available, in megabytes (MB).

Available – The amount of storage space that is available for new files. This is shown in megabytes (MB) and as a percent of the maximum size.

Auto Delete – If this check box is selected, the receiver automatically delete files when the available space drops below 500 Kbytes. The receiver deletes the oldest files first. If this check box is not selected, all data logging stops whenever there is insufficient available space for new data to be logged. Changes take effect immediately after you select the check box.

Session – This field shows the GNSS Measurements and Position storage intervals and a **Configure** button. Click **Configure** to open the Data Logging Configuration page to view and edit the complete session configuration.

Schedule – Shows the type of schedule configured for the session.

Status – Shows the current status of the session. If the session is actively logging data, then the pathname of the file is shown. Other information may be shown, depending on the session configuration. Click the name of an active file to switch to the Data Files page showing the directory containing that file.

Enable – Select this check box to immediately enable the session. Depending on the session's schedule mode, logging might not start immediately. If you clear the check box on an active session, you are asked to confirm that you want to stop the session.

Data Files

Use the first table to navigate around the file system. The top row shows the path to the directory you are viewing. Click that path to refresh the page to show any recent changes. The rows below that enable you to move upward or downward in the directory structure.

To go to the top of the file system structure, click the **Home** icon or **Top Level Directory**.

To go up one level, click **Parent Directory**. Any subdirectories are shown by name. Click them to view.

The page shows any data files. Each file shows the filename, created date and time, and size. To download the file, click the file icon or filename. Each file has a check box that you can use to select it for deletion; To select all of the shown files for deletion, click the icon next to the **Select All** button. To delete the files, click the icon next to the **Delete Selected Files** button and then click **OK** to confirm the deletion.

To delete ***all*** files within the subdirectory, click **X** on the subdirectory and then click **OK** to confirm the deletion.

A file that is actively being written appears in the list, but cannot be downloaded or selected for deletion. Typically, the name is not shown in bold and the Delete check box does not appear.

Graph (icon) - The Graph function opens the Position (Graph) and plots the Height, East, North or East/North data from the position records of the *.T01 or *.T02 files.

For more information, see Position (Graph).

Convert - Click **Convert** to convert the raw data logged in a T01 or T02 file to a number of different formats including RINEX, BINEX, and Google Earth (KML).

RINEX Conversion - T01 and especially T02 files are more compact than RINEX files and hold more information. Use the RINEX converter if you require an industry standard file format. The converter does a data conversion on-the-fly when the user requests a RINEX download. As this is done in a single pass and there is no way to predict the size of the file, the one limitation is the size of the file

is unknown on download as the web interface only displays the T01/T02 file length. This does not violate FTP/HTTP download standards.

The receiver supports the download of RINEX, Hatanaka RINEX, gzipped versions of RINEX and Hatanaka RINEX, and the GPS and GLONASS ephemeris in RINEX format.

You can also set the RINEX version. Trimble currently supports version 2.11 and 3.00. The receiver's FTP server also supports a convert on download. As the size is not know, it is not given in the directory listing.

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FTP Push – Internet Configuration

The FTP Push feature allows logged data files to be automatically copied using FTP to a user-specified server. The logged data files are copied to the server as soon as the data file is closed.

Server Address – Enter the address of the server in which the data is to be copied to. Enter the address either as a numeric IP address or a valid DNS address. For example, ftp.trimble.com.

Username– Enter the (case sensitive) username required to login to the server.

Password – Enter the (case sensitive) password required to login to the server.

Verify Password – Re-enter the password required to login to the server.

When choosing an FTP Server password, remember the following limits:

- 60 characters for the server address
- 12 characters for the user name
- 15 characters for the password
- 60 characters for the remote directory

Delay– When the file roles instead of pushing the data immediately, the push is delayed by "delay" minutes. If there are a number of receivers on the same network all FTP-pushing, each receiver should have a unique delay to avoid overloading the network by all the receivers trying to FTP-push at the same time.

Remote Directory – The remote directory is the directory structure that the FTP Push should follow to write the data.

Example: \Data_Files\Trimble\

Path Style – Select one of two directory structures for the created files:

- *Flat* – Files are all created at the top-level directory of the selected file system. No subdirectories are used.

  {b}Note – {/b} This can result in a large number of files in a single directory, which can cause slow responses when listing directories, etc.

  {b}Note – {/b} Some file systems have limitations on the number of files that can be created in a top-level directory. You should not use this path style if a large number of files will be created.

- **Type/YYY/DDD/site** – Files will be stored in a structure of the form /type/YYYY/DDD/site/filename.T01. The site is the station name. The date chosen corresponds to the expected start time of the session.

Rename – Select one of two options:

- *No* – This leaves the file name format as previously selected when using FTP Push.
- *##########YYYYMMDDhhmm*: Creates a twenty-two character name consisting of: The full ten-digit serial number (##########)
  - The four-digit year (YYYY)
  - A two-digit month (MM, 01 = January)

- A two-digit day-of-month (DD, 01=first day of month)
- A two-digit hour (00 to 23)
- A two-digit minute (00 to 59)

  The time encoded is the theoretical start time when the file would be created. Typically, it is the start time of the session. However, if a scheduled file starts later than its scheduled time (for example, due to a power failure), then the file will be named as if it actually started on time.

Transfer Mode

- *Passive with fallback to Active* – This is the default setting. Trimble recommends that you select this option.
- *Passive* – The client sends a PASV command to the server and then receives an IP address and port number. The client uses these to open the data connection to the server. Use this option in situations where the client is behind a firewall and cannot accept incoming TCP connections.
- *Active* – The client sends the server, the IP address and port number on which the client will listen, and the server initiates the TCP connection.

  *{b}Note – {/b} When you click Test at the bottom of the screen, the receiver attempts to connect to the server and publishes a test file to verify that the information is correctly entered. When you click **Test**, a file called Hi.txt is pushed to the server. To push logged files, you must enable FTP Push on the Logging Setup page.*

  {b}Note – {/b} Data Files are only pushed when a data logging file is closed.

FTP Push Log

The FTP Push Log provides a summary of the FTP transfers attempted by the receiver.

Time – Indicates when the receiver attempted to transfer a logged data file to a server.

Status – Indicates if the FTP transfer was successful or if it failed. Successful transfers are indicated by the text “OK”.

Local File Name – Displays the name of the logged data file that the receiver attempted to transfer to a server.

Receiver Configuration menu

Receiver Configuration

This page displays the current settings of the receiver.

Select *Receiver Configuration* / *Summary*.

Elevation Mask – The elevation mask below which the receiver will not track satellites.

PDOP Mask – The value for PDOP above which the calculation of new positions is suspended until the PDOP falls below the mask value again.

Horizontal Precision – The required horizontal precision that you set to determine when the horizontal quality indicator on the receiver display switches from flashing (precision threshold not met) to not flashing (precision threshold met). It also determines when an OmniSTAR solution has initialized.

Vertical Precision – The required vertical precision that you set. This threshold determines when the vertical quality indicator on the receiver display switches from flashing (precision threshold not met) to not flashing (precision threshold met).

Everest™ Multipath Mitigation– Trimble proprietary multipath mitigation algorithm. Enabled by default.

Clock Steering– When enabled, the receiver clock is steered to GPS system time rather than periodically introducing 1 ms steps and constraining the clock to ± 0.5 ms. Enabled by default.

Antenna ID – A numeric representation of the selected antenna type being used with the receiver.

Antenna Type – The selected antenna type being used with the receiver.

Antenna Height – The height of the antenna reference point.

1PPS On/Off – Indicates the state of the 1PPS output on Serial 3 port.

RTK Mode – Indicates if the receiver is in a synchronized or low latency RTK mode.

Motion – Indicates if the receiver is set to operate as a static or kinematic receiver. This mode determines if the unit is Static or Moving for base station applications and OmniSTAR initialization.

CMR Input Filter – Shows whether or not CMR corrections are being used from a specific base station.

Reference Latitude – The WGS-84 reference station latitude.

Reference Longitude – The WGS-84 reference station longitude.

Reference Height – The WGS-84 reference station ellipsoid height.

RTCM 2.x ID – A unique identifier for the RTCM messages. Can be any value from 0 through 1023.

RTCM 3.x ID – A unique identifier for the RTCM messages. Can be any value from 0 through 4095.

CMR ID – A unique identifier for the CMR message. Can be any value between 0 through 31.

Station Name – The sixteen-character name of the reference station.

Ethernet IP – The Ethernet IP address of the receiver.

System Name – The unique system name for the receiver.

DNS Resolved Name – The name returned by the DNS system.

Serial Number – The serial number of the receiver.

Firmware Version – The version of the firmware currently installed in the receiver.

Firmware Date – The production date of the firmware currently installed in the receiver.

Antenna Configuration

Use these settings to define the antenna being used by the receiver.

Antenna Type – Select the type of antenna being used with the receiver.

Antenna Serial Number – Enter the serial number of the antenna being used.

Antenna Measurement Method – Select how the antenna height is being measured.

Antenna Height [m] – Enter the measured height of the antenna. This is typically measured from a ground marker or the mounting point of the antenna.

{b}Note – {/b} If available, an image of the selected antenna is displayed, so that you can confirm that you have selected the correct antenna.

Antenna Configuration

Use these settings to define the antenna being used by the receiver.

Antenna Type – Select the type of antenna being used with the receiver.

Antenna Serial Number – Enter the serial number of the antenna being used.

Antenna Measurement Method – Select how the antenna height is being measured.

Antenna Height [m] – Enter the measured height of the antenna. This is typically measured from a ground marker or the mounting point of the antenna.

{b}Note – {/b} If available, an image of the selected antenna is displayed, so that you can confirm that you have selected the correct antenna.

Reference Station

Use these settings to set the position of the receiver and the ID of the data for use in RTCM and CMR output.

Select *Receiver Configuration* / *Reference Station*.

CMR ID – Enter a station ID for CMR corrections generated by the receiver (0 through 31).

RTCM 2.x ID – Enter a station ID for RTCM 2.x corrections generated by the receiver (0 through 1023).

RTCM 3.x ID – Enter a station ID for RTCM 3 corrections generated by the receiver (0 through 4095).

Station Name – Enter a name for the reference station (up to 16 characters).

Station Code – Enter a description for the reference station (up to 16 characters).

Reference Latitude – Enter the latitude of the reference station in degrees, minutes, seconds, and north or south hemisphere. Enter a WGS-84 position only.

Reference Longitude – Enter the longitude of the reference station in degrees, minutes, seconds, and east or west hemisphere. Enter a WGS-84 position only.

Reference Height – Enter the ellipsoidal height of the reference station in meters. Enter a WGS-84 height only. The Antenna Phase Center must be directly vertically above the station.

Here – Click to load the current position of the receiver as the reference station position.

*{b}Note – {/b} The above settings are not applied until you click **OK**.*

Receiver Configuration – Tracking

Elevation Mask – Enter the elevation, in degrees, below which the receiver will not track satellites.

Everest™ Multipath Mitigation– Trimble proprietary multipath mitigation algorithm. Enabled by default.

Clock Steering– When enabled, the receiver clock is steered to GPS system time rather than periodically introducing 1 ms steps and constraining the clock to ± 0.5 ms. Enabled by default.

Type	Signal	Description
GPS	L2	Set which information of the L2 signal the receiver is to observe.
	L2 – Legacy	The receiver will track the full cycle carrier phase of the L2 signal. CS code will not be tracked even if available.
	L2CS with Legacy fallback	The receiver will track the CS code on the L2 signal if available. If CS code is not available, the receiver will track full cycle carrier phase in Legacy mode.
	L2CS with Legacy	The receiver will track both CS and Legacy code simultaneously.
	L2 – CS	The receiver will track the CS code on the L2 signal if available. If CS code is not available, the receiver tracks full cycle carrier phase in Legacy mode.
	L2CS – CM/CL	The receiver will track both the CM and CL code broadcast by the satellite simultaneously. Trimble recommends that you use this setting.
	L2CS – CL	The receiver will track only the CL code broadcast by the satellite.
	GPS L5	If L5 is installed, this menu item is displayed. If selected, it allows tracking of the L5 signal. Set which code the receiver is to track on the L5 signal: L5 – Q – The receiver will track only the Q code broadcast by the satellite. L5 – I + Q – The receiver will track both the I and Q code broadcast by the satellite simultaneously. Trimble recommends that you use this setting.
SBAS	L1 - C/A	Enable or disable the tracking of the L1 C/A signal transmitted from a SBAS satellites such as WAAS.
	L5	Enable or disable the tracking of the L5 C/A signal transmitted from a SBAS satellites such as WAAS.
GLONASS	L1	Enable or disable the tracking of GLONASS signals by the receiver.
	CA and P	The receiver will simultaneously track both the CA and P code of the GLONASS satellite if both are selected. This is the recommended setting.
	L2	Select from the following options: Disable, L2- C/A(M), L2-P. L2-P is the recommended setting.
GALILEO	E1	Enable or disable the tracking of GALILEO signals by the receiver.
	E5-A	Enable or disable the tracking of the GALILEO E5-A signal by the receiver.
	E5-B	Enable or disable the tracking of the GALILEO E5-B signal by the receiver.

Type	Signal	Description
	E5-AltBOC	Enable or disable the tracking of the GALILEO E5-AltBOC signal by the receiver.
COMPASS	B1	Enable or disable the tracking of the Compass B1 signal by the receiver.
	B3	Enable or disable the tracking of the Compass B3 signal by the receiver.
QZSS	L1-CA	Enable or disable the tracking of the QZSS L1-CA signal by the receiver. The default setting is Enabled.
	L1 - SAIF	Enable or disable the tracking of the QZSS L1-SAIF signal by the receiver. This signal is only of use for SBAS operation when in the Japan territory. The default setting is Disabled.
	L1 - C	Enable or disable the tracking of the QZSS L1-C signal by the receiver. The default setting is Disabled.
	L2 - C	Enable or disable the tracking of the QZSS L2-C signal by the receiver. The default setting is Enabled.
	LEX	Enable or disable the tracking of the QZSS LEX signal by the receiver. The default setting is Disabled.

Position

Use this page to set receiver position-related settings.

Select *Receiver Configuration* / *Position*.

PDOP Mask – Use the PDOP mask to enter the value for PDOP above which the calculation of new positions is suspended until the PDOP falls below the mask value again.

{b}Note – {/b} This applies only to the calculation of position solutions. It does not affect the logging or streaming of GNSS measurements.

RTK Mode – Set the RTK Mode to Synchronous or Low Latency.

- *Synchronous* – The rover receiver must wait until the base station measurements are received before computing a baseline vector. Therefore, the latency of the synchronous position depends on the data link delay. A synchronous RTK solution yields the highest precision possible but is subject to latency. This mode is suitable for static and low-dynamic positioning.
- *Low Latency* – Provides a slightly lower precision solution than Synchronous mode but with a constant low latency of 20 msec. This mode is ideal for high-dynamic positioning where latency is an issue.

Motion - Set to operate as a static or kinematic receiver. This mode determines if the unit is Static or Moving for base station applications and OmniSTAR initialization.

RTCM 2 Type 31 Input GLONASS Datum – If receiving RTCM 2 corrections from a GLONASS source, you can select the datum (PZ90 or PZ90.02) that they are based on.

Autonomous/Differential Engine – By default, the Kalman filter is on and results in higher quality position solution for autonomous or DGPS solutions when compared with a Least Squares solution.

The Kalman selection works substantially better than a Least Squares solution in a mobile vehicle when there are frequent satellite signal dropouts around bridges or high buildings, and gives improved performance around forested areas.

A Kalman solution uses the time history of the position and velocity it has created, whereas a Least Squares option does not use the time history. Trimble recommends that you use the Kalman filter. The Least Squares option is available for rare cases if you decide to trial it.

Horizontal Precision – The required horizontal precision that you set to determine when the horizontal quality indicator on the receiver display switches from flashing (precision threshold not met) to not flashing (precision threshold met). It also determines when an OmniSTAR solution has initialized.

Vertical Precision – The required vertical precision that you set. This threshold determines when the vertical quality indicator on the receiver display switches from flashing (precision threshold not met) to not flashing (precision threshold met).

DGNSS Age of corrections – Defines the maximum age of the GPS and GLONASS DGPS corrections in seconds. When this maximum age is exceeded, the corrections are not used in the position solution.

Click **OK** to apply the changed settings to the receiver.

Correction Controls

Select *Receiver Configuration* / *Correction Controls*.

Use these settings to manage the use of incoming RTK and DGNSS correction streams. If you are receiving more than one correction stream or the same stream on different channels (such as radio, serial port, and Ethernet), you can choose to switch from one to another based on predefined criteria.

The receiver always attempts to use the most precise positioning solution by using the following correction types in order:

1. RTK.
2. OmniSTAR XP/HP/G2.
3. Differential (DGPS, DGNSS).
4. OmniSTAR VBS.
5. Beacon DGPS.
6. SBAS.
7. Autonomous.

The correction streams are grouped into three categories according to how they will be processed:

- RTK
- DGNSS
- OmniSTAR

If there are multiple correction streams within any one of the three categories, the selection is made by the following rules in order:

1. Use the CMR Input Filter and RTCM Input Filter.
2. Use the user-defined Correction Controls.
3. If the category is RTK, use CMRx over CMR+™ over RTCM 3 over RTCM 2 (RTK).
4. If streams are of the same types, use the lowest RefStnId.
5. If the sources are identical, remain with the currently used channel.

CMR Input Filter – Select this check box to use CMR corrections from a single specific base station. In the ID field, enter a base station ID between 0 through 31.

RTCM Input Filter – Select this check box to use RTCM corrections from a single specific base station. In the ID field, enter a base station ID between 0 through 1023.

RTK – Use this control to use the rules manager to select which RTK service will be used based on user-defined criteria. By default it is set to *Any Channel* with the option to *Reject All Channels* instead.

To select a channel based on user-defined criteria, click the Add Channel button (**+**). To add additional fall-back channels and criteria, click the Add Channel button (**+**) next to the *Else* field.

Use the *Change Channel* drop-down list to select an I/O port as the primary correction source, and the *Else* field to select either the Any Channel or Reject All Channels option if the primary source is unavailable (or does not meet the specified criteria).

Once you have selected a primary correction source, you can click the Add Qualifier button (**+** on the right of the source) to select the *Choose Qualifier* option to specify when the primary source will be rejected.

Qualifiers can be set either by:

- Correction Age (user-specified period in seconds after the selected channel stops getting a valid correction stream before switching to the next source). *Note*: This is not the same as the DGNSS Age of corrections.)
- Base ID (user-specified from 0 through 9999)

To remove rules for channels and qualifiers, click the red **X** button next to the item you want to remove.

For example:

Serial 2 / Modem 1 where Correction Age ≤ 20 seconds
Else
Radio where Base ID = 37
Else
Reject All Channels

DGNSS – Use this control to use the rules manager to select which DGNSS service will be used based on user-defined criteria in the same manner as RTK (see above).

Receiver Configuration – General

Use this page to set the general receiver settings.

{b}Note – {/b} For SPS GNSS systems with a two-line display, the Mode Settings / System Setup / AutoBase menu now enables you to select one of the above settings. There is now no separate Autobase Warning display.

Operation Mode – Choose between Base, Rover, Moving Base, and Heading modes.

- *Base* – Provides base station functionality. The Motion is set to Static.
- *Rover* – Provides rover functionality. The Motion is set to Kinematic.

Power on voltage – The default is 11.0 V DC. Power On Minimum Range can be set between 10.8 V DC and 15.0 V DC.

VFD Rotation – (SPSx52 only) When enabled, the front panel display and use of buttons is inverted to accommodate ease of use for a range of mounting scenarios.

Receiver Reset

Reboot Receiver – Select this option to restart the receiver. All data and settings are kept.

Use Default Application file – Select this option to reset the receiver to its factory default settings. The satellite ephemeris and almanac data and all logged data files are kept. The receiver does not restart.

Clear Satellite Data – The satellite ephemeris and almanac data is cleared, and the receiver restarts.

Clear Application Files – Select this option for the receiver to perform the two operations above and also clear any application files resident in non-volatile memory. The receiver restarts. All Ethernet network settings are kept.

Clear All Receiver Settings – Select this option for the receiver to perform the three operations above and also clear all Ethernet network settings. The receiver restarts.

Default Web Interface Language

Use this menu to select the default language of the web interface. The receiver language setting is contained in the web browser cache. To see the language change, clear the browser cache or open a new browser.

Select *Receiver Configuration* / *Default Language*.

The following languages are available:

- English
- Chinese (simplified)
- Finnish
- French
- German

- Italian
- Japanese
- Dutch
- Norwegian
- Polish
- Portuguese
- Russian
- Spanish
- Swedish

To change the language, click the option next to the corresponding country flag.

I/O Configuration menu

I/O Configuration (Port Summary)

This page displays the current receiver I/O configuration.

Type – Indicates what types of inputs/outputs are available.

- *TCP/IP* (Transmission Control Protocol/Internet Protocol) – A connection over an IP network.
- *UDP* (User Datagram Protocol) – A connection over an IP network.
- *IBSS/NTRIP Client* – A connection to IBSS or an NTRIP Caster for receiving correction data.
- *IBSS/NTRIP Server* – A connection to IBSS or an NTRIP Caster for sending correction data.
- *NTRIP Caster 1* – Allows up to ten users (NTRIP Clients) per port to request single base correction data.
- *NTRIP Caster 2* – Allows up to ten users (NTRIP Clients) per port to request single base correction data.
- *NTRIP Caster 3* – Allows up to ten users (NTRIP Clients) per port to request single base correction data.
- *Serial* – An RS-232 connection.
- *Bluetooth* – A short range wireless connection.
- *USB* (Universal Serial Bus) – A connection over USB.
- *Radio* – A connection using the receiver's internal radio.

{b}Note – {/b} NTRIP is Networked Transport of RTCM via Internet Protocol. IBSS is Internet Base Station Service.

Port – Which port the input/output is being transferred on.

- *TCP/IP or UDP* – The port number will be displayed.

- *IBSS/NTRIP Client* - The type of the service and the name of the Base station or Mountpoint its connected to.
- *IBSS/NTRIP Server* - The type of the service and the name of the Base station or Mountpoint being sent to the NTRIP Caster
- *Serial* – Serial ports will indicate the receiver connector, baud rate, data bits, parity, and stop bits settings of the port.
- *Bluetooth* – The Bluetooth port number will be displayed.
- *USB* – No port will be displayed.
- *Radio* – No port will be displayed.

Input – The type of input that is received on the port. The correction stream input currently being used in the position solution will be shown in **bold** text.

Output – The type of output that is sent on the port.

Connection Colors – The color of the connection provides additional status information.

- Green – Indicates an active connection from another device on that port.
- Yellow – Indicates a connection is having problems or is not functioning properly.
- Red – Indicates no connection from another device on that port.
- No highlight – The serial port connections are not highlighted since it is not possible to distinguish if there is a connection from another device.
- Bold – Indicates that this correction stream input is currently being used for the position solution.

I/O Configuration (Port Configuration)

Use these settings to set up the receiver inputs and outputs.

Select one of the following options:

- TCP/IP 5017
- TCP/IP 5018
- Add TCP/IP or UDP Port
- NTRIP Client
- NTRIP Server
- NTRIP Caster 1
- NTRIP Caster 2
- NTRIP Caster 3
- Serial1 / Lemo
- Bluetooth 1
- Bluetooth 2

- Bluetooth 3
- USB
- Radio

TCP/IP 5017 and TCP/IP 5018

By default, these ports are available. However, you can change them and add or remove other ports.

Client – Select this check box to enter a Remote IP and port. This enables the receiver to initiate a connection to the remote server. This can be used when the receiver is behind a network firewall or has a dynamic IP address.

Output Only/ Allow Multiple TCP/IP Connections – Select this check box to configure the receiver so that it can broadcast to multiple simultaneous remotes. The remotes are unable to send data back to the receiver. Trimble strongly recommends this setting for all ports without a two-way data requirement. If this is not enabled, remotes can reconfigure the receiver.

UDP Mode – Select this check box to use UDP (User Datagram Protocol) instead of TCP. You can edit a UDP timeout. By default, it is set to 60 seconds.

Authenticate, set password – Select this check box so that all incoming connections are required to enter a password to authenticate the connection. This is not NTRIP authentication.

Port Selection

- *Port* – The first drop-down list displays which type of port is available for configuration.
- *Output Type* – The second drop-down list displays which output type is sent out of each port.

One of the following output groups appears with configuration settings, depending on the option that you select in the drop-down list at the top of the page:

- CMR
- RTCM
- NMEA
- RT17/RT27
- BINEX
- GSOF
- OMNISTAR

Add TCP/IP or UDP Port

Select this option to add a new TCP/IP port to the receiver.

UDP Mode – Select this check box to use UDP (User Datagram Protocol) instead of TCP.

Local Port# – Select the port number that is to be used and then click **Add** to create the configuration.

One of the following groups appears, depending on the option that you select in the drop-down list at the top of the page:

- CMR
- RTCM
- NMEA
- RT17/RT27
- BINEX
- GSOF
- OMNISTAR

NTRIP Client

This option allows correction data to be received securely from an NTRIP Caster. The NTRIP source may be:

- A Trimble VRS Network
- A Trimble NTRIP Caster
- Another NTRIP compliant correction source

NTRIP version 2 is supported in firmware version 4.14 and later.

Status – Indicates the current status of the NTRIP connection:

Status	Meaning
Init	NTRIP Client disabled.
Up and Connected	NTRIP Client is connected to a source of corrections and receiving data.
Invalid Mountpoint	NTRIP error 404 returned from NTRIP Caster.
Invalid Username or Password	NTRIP error 401 returned from NTRIP Caster.
Failed to connect to remote NTRIP Caster	Connection failed due to an Internet-related issue.
No GNSS data from Caster	NTRIP error 503 returned from NTRIP Caster. No data available from the NTRIP Caster.
Unexpected internal error	NTRIP Caster internal error.
Incorrect NTRIP Caster response	NTRIP error 602 returned from NTRIP Caster.
No output stream is configured	NTRIP error 604 returned from NTRIP Caster.
Connection in progress	The NTRIP Client is in the process of connecting to the NTRIP Caster.
Unknown Ntrip Status	The status is not one of those listed above.

Enable – Select to enable NTRIP Client.

NTRIP Caster HTTP:// – The address and port of the NTRIP Caster that the receiver will connect to to receive correction data.

Username – Enter the username required to log on to the server.

Password – Enter the password required to log on to the server.

Verify Password – Re-enter the password required to log on to the server.

Mount Point – Enter name of the correction stream to which you are connecting on the NTRIP Caster if known or select from the list using the Get Mount Points button.

Get Mount Points – Use this button to obtain a list of available IBSS base stations for selection. The list is ordered with the closest at the top of the list and includes the distance from your current location in km.

Glossary of terms

NTRIP Server

This option enables the receiver to connect to IBSS or an NTRIP Caster to send correction data securely across the internet.

Status – Indicates the current status of the NTRIP connection:

Status	Meaning
Init	NTRIP Server disabled.
Up and Connected	NTRIP Server is connected to an NTRIP Caster and sending correction data.
Invalid Mountpoint	NTRIP error 404 returned from NTRIP Caster.
Invalid Username or Password	NTRIP error 401 returned from NTRIP Caster.
Failed to connect to remote NTRIP Caster	Connection failed due to an Internet-related issue.
No GNSS data from Caster	NTRIP error 503 returned from NTRIP Caster. No data available from the NTRIP Caster.
Unexpected internal error	NTRIP Caster internal error.
Incorrect NTRIP Caster response	NTRIP error 602 returned from NTRIP Caster.
Rejected by remote Caster due to mount point in use	NTRIP error 603 returned from NTRIP Caster.
No output stream is configured	NTRIP error 604 returned from NTRIP Caster.
Connection in progress	The NTRIP Server is in the process of connecting to the NTRIP Caster.
Unknown Ntrip Status	The status is not one of those listed above.

Enable – Select this check box to enable NTRIP Server.

NTRIP Version - NTRIP Server supports either NTRIP version 1 or 2.

NTRIP Caster http:// – The address and port of the NTRIP Caster that the receiver will connect to to send or receive data.

Mount Point – The name of the correction stream you are supplying to the NTRIP Caster.

Username – Enter the username required to log on to the server.

Password – Enter the password required to log on to the server.

Verify Password – Re-enter the password required to log on to the server.

Identifier – The unique identifier for the receiver (NTRIP Server) supplying the correction stream.

Country – An optional identifier to help distinguish which country the NTRIP Server is in.

Network – An optional identifier to help distinguish which network the NTRIP Server is a part of.

Select the correction type to output:

- CMR
- RTCM
- OMNISTAR

Glossary of terms

NTRIP Caster

There are three NTRIP Caster ports available. For each port, a maximum of 10 users can request data, which means that a total of 30 users can simultaneously request data.

Enable – Select this check box to enable this NTRIP Caster port.

Port – Source Port number of the caster host.

Country – Enter the character country code, for example USA, DE.

Identifier – The unique identifier for the NTRIP Caster.

Mount Point – Enter the name of the output stream, such as its type. Users must enter this name to connect to the port.

Authentication – This is set to Basic so you will require a login username and password.

Generator – Set to Trimble.

Fee – Set to no fee per connection. There is no billing model in this receiver.

NMEA Required – Set to No as this is a single base solution.

Mount Point – Enter the name of the receiver, such as its location. This name is required by the users.

Select one source of corrections:

- CMR
- RTCM

- RT17/RT27
- OMNISTAR

Glossary of terms

Serial 1 / Lemo

Serial Port Setup – Set the appropriate baud rate, parity, and flow control for the port.

One of the following groups appears, depending on the option that you select in the drop-down list at the top of the page:

- CMR
- RTCM
- NMEA
- RT17/RT27
- BINEX
- GSOF
- OMNISTAR

Bluetooth Port

You can stream any available data over a Bluetooth connection.

Maintain configuration when connection dropped - Select this for the receiver to maintain the output configuration on the selected Bluetooth port when the wireless link is dropped. The output resumes when the wireless link is re-established.

One of the following groups appears, depending on the option that you select in the drop-down list at the top of the page:

- CMR
- RTCM
- NMEA
- RT17/RT27
- BINEX
- GSOF
- OMNISTAR

USB

USB Port – You can stream any available data over a USB connection.

One of the following groups appears, depending on the option that you select in the drop-down list at the top of the page:

- CMR

- RTCM
- NMEA
- RT17/RT27
- BINEX
- GSOF
- OMNISTAR

Radio

Radio – You can stream CMR outputs from the internal 450 MHz radio when in Base Operation mode. Inputs are automatically handled when in other Operation Modes. The 450 MHz internal radio can also output an RTCM correction stream.

One of the following groups appears, depending on the option that you select in the drop-down list at the top of the page:

- CMR
- RTCM

CMR

The following fields appear when you select CMR from the list at the top of the page.

CMR – Select which CMR corrections will be output on this port. If transmitting CMRx messages, ensure that all rovers and machines have firmware that will accept CMRx. CMRx was introduced in receiver firmware version 4.0.

Delay – Select the time delay for the CMR output. This is used in multi-base applications.

RTCM

The following fields appear when you select RTCM from the list at the top of the page.

Enable/Disable – Select if RTCM output is to be enabled on this port.

Version – Select which version of RTCM message will be output on this port. (Use version 2.X to transmit a version of RTCM that is compatible when multiple rovers are being used and they are not all compatible with the same version of RTCM message. That is, one rover might only support version 2.1 and the other requires version 2.3.)

RTCM version 3 is available when the base station is used by a mixed fleet of RTK receivers from a number of manufacturers. RTCM version 3 is more efficient, handles GLONASS, and is more suitable for networked RTK than version 2.x. If the GLONASS option is installed in the base station (receiver firmware version 4.13 and later), then both GPS and GLONASS measurements are output.

Bandwidth limit – This option is available once RTCM version 3 is selected. If the radio link being used has a known maximum data throughput rate, then enter that value into this field in bytes per second. The receiver will then logically reduce the number of satellite messages so that maximum rate is not exceeded.

Type – Select which type of RTCM message will be output on this port.

NMEA

The following fields appear when you select NMEA from the list at the top of the page.

NMEA Messages – Select which NMEA messages will be output on this port.

Standard – Select which standard to use for the compliant messages.

- *NMEA* – Output messages will comply with the National Marine Electronics Association (NMEA) 0183 Standard for Interfacing Marine Electronic Devices, Version 4.0, November 1, 2008. This is the default selection.
- *IEC61162-1:2010* – Output messages will comply with the International Electrotechnical Commission (IEC) 61162-1, Edition 4 2010-11

Report max DQI=2 NMEA GGA string – When enabled, the Quality Indicator field in the GGA output message will never be greater than 2 (Differential GPS). Use this only with legacy systems that do not fully support the NMEA standard.

Report max correction age 9 sec in NMEA GGA string – When enabled, the Age of differential data field in the GGA message will never be greater than 9 sec. Use this only with legacy systems that do not fully support the NMEA standard.

Report extended information in NMEA GGA and RMC strings - By default, this check box is enabled to provide high precision position data in the NMEA messages. Clear this check box to conform with the NMEA standard message length of 82 characters. However, if you do, the precision of the position and altitude data is reduced by truncating the number of decimal places.

Report GST message always as GPGST - When enabled, the NMEA talker ID will always be $GP for the GST message no matter what constellation is being tracked. This is required for some legacy systems using this NMEA output which have not yet been updated to follow the NMEA standard. By default this will be disabled.

RT17/RT27

The RT17/RT27 option is only available when the Binary Outputs option is installed in the receiver.

The following fields appear when you select RT17/RT27 from the list at the top of the page.

Epoch Interval – This defines the rate at which the RT17/RT27 messages are output. Check boxes are provided to enable the output of measurements and/or positions.

Measurements – Select this check box to output raw observables.

Positions – Select this check box to output position measurements.

Concise – Select this check box to output a more compact message containing the raw observables. This should always be enabled.

R-T Flag – Select this check box to output IODE values and cycle-slip counts.

Ephemeris – Select this check box to output the satellite ephemeris when received.

Send Raw GPS Data – Select this check box to output the raw data extracted from the satellites.

Multi-System Support – Select this check box to output the GPS L5 and GLONASS observables.

Smooth Pseudorange – Enable Pseudorange smoothing.

Smooth Phase – Enable Phase smoothing.

Send Raw WAAS Data – Select this box to output the raw data extracted from the SBAS satellites.

BINEX

The following fields appear when you select BINEX from the list at the top of the page.

Observable Rate – Select the output rate for the raw observables.

Smooth Pseudorange – Enable Pseudorange smoothing.

Smooth Phase – Enable Phase smoothing.

GSOF

The following fields appear when you select GSOF (General Survey Output Format) message from the list at the top of the page.

GSOF Messages – Select which GSOF messages will be output on this port.

OmniSTAR

DATA for OmniSTAR – Enables the demodulated OmniSTAR data output on this port. This output can then be used as an External OmniSTAR input on a non-Trimble OmniSTAR-capable receiver that has a valid and appropriate OmniSTAR subscription.

DATA for Trimble – Enables the demodulated OmniSTAR data output on this port. This output is the same raw data as above with a TRIMCOMM wrapper (0xC4) to support use as an External OmniSTAR input on an Trimble receiver. The receiver must have a valid and appropriate OmniSTAR subscription.

DEBUG – Enables/Disables DEBUG OmniSTAR output on this port.

Bluetooth menu

Bluetooth Info

Module Info – This is the model of the Bluetooth module used in the receiver.

Stack Version – The stack version is the Trimble firmware version of the Bluetooth module used in the receiver.

Local Name – The name of the device that appears when it is discovered by another Bluetooth-enabled device. Made up of the Receiver Model name, Serial number, and System Name. See Identity Information.

Bluetooth MAC Address – The Bluetooth MAC (Media Access Control) address of the Bluetooth module used in the receiver.

Discoverable – Set this field to True or False. When this field is set to True, the receiver will be shown when it is discovered by another Bluetooth-enabled device. If this field is set to False, the receiver is not shown in the discovery list.

Pin Code – The password that is required to pair the receiver with another Bluetooth-enabled device.

Bluetooth Configuration

Discoverable – Set this field to True or False. When this field is set to True, the receiver will be shown when it is discovered by another Bluetooth-enabled device. If this field is set to False, the receiver is not shown in the discovery list.

Pin Code – The password that is required to pair the Trimble receiver with another Bluetooth-enabled device. The pin code is user-defined and should consist of at least four numbers.

Click **OK** to apply any changed settings to the Trimble receiver.

Bluetooth Inquiry and Remote Connection

Use this screen to search for nearby Bluetooth-enabled devices.

A Bluetooth port can be used to transport most outputs available on the receiver to and from another Bluetooth device such as a controller, laptop, or another receiver.

Max. devices to find – Limits the inquiry search to information only for the number of devices specified.

Perform New Inquiry – Click this button to put the receiver into a discovery mode and to search for nearby Bluetooth-enabled devices.

Number of new devices found – Displays the number of Bluetooth-enabled devices that are discovered. The devices will only be displayed once a search is made.

Add Bluetooth address to inquiry results table – Instead of doing a manual search, manually enter the MAC address of the Bluetooth device being searched for (if known).

Number of remote devices – Shows the number of devices currently paired with the receiver.

The search results will appear in a table showing the MAC Address and Local Name of each device.

Save – Click Save to save this device so that it remains in the table when you search for more devices.

Update – Click Update to show the Remote Services for a specific device.

Connect – Select the Remote Service to connect and then click Connect. Once connected, another table appears below the remote device table showing details of the connected remote devices.

Reconnect at startup and **Disconnect** buttons can be used to toggle these settings. The reconnect function allows the connection to be re-established without any user intervention when the receiver is rebooted.

Radio menu

Radio Configuration

Hardware Type – Indicates which radio is in the receiver.

Hardware ID – Trimble Support uses this to identify the model of radio board that is installed in the receiver.

Hardware Version – Identifies which version of the radio board is installed in the receiver.

Firmware Version – Indicates the version of firmware for the internal radio.

Radio State – Indicates if the internal radio has any errors or failures.

Radio Mode – Set the internal radio to transmit or receive if a receiver is a rover only or base only.

Radio Country Code – Indicates the country configuration.

450 MHz Radio parameters

Frequency Range (MHz) – Identifies the frequency range that the internal radio operates in. This is only available for radios from 410 MHz through 470 MHz.

Channel Spacing (kHz) – Indicates the channel spacing of the internal radio. This is only available for radios from 410 MHz through 470 MHz.

Current Channel (MHz) – Select the current channel for the internal radio to operate on. This is only available for radios from 410 MHz through 470 MHz.

Wireless Mode – Select the current wireless mode for the internal radio. This is only available for radios from 410 MHz through 470 MHz.

Channel sharing Mode – For base mode only. Select one of the following:

- *Off* – The carrier detect mode is OFF. The receiver ignores other transmissions on your frequency and continues to transmit data. Latitude is in degrees, minutes, and seconds.

  {b}Note – {/b} Channel Sharing set to Off may be illegal in your country-of-use. You may be subject to penalties or fines dependant upon the specific licensing requirements for your country-of-use. Please consult your radio license documentation or licensing agency for operational guidelines.

- *Avoid Weak Signals* – The carrier detect mode is ON. If the radio detects another radio transmission on its frequency, it stops transmitting. When the channel is free of radio traffic, the radio resumes transmission.

- *Avoid Strong Signals* – The carrier detect mode is ON, but the radio will only stop transmitting when there is a strong signal present. Receive level greater than -90 dB.

Enable call sign – This is a Federal Communications Commission (FCC) requirement for USA licensed users. This sets your radio to transmit your call sign in Morse code every 15 minutes.

RF Power level – If your receiver has an internal 410 MHz through 470 MHz radio installed, ***and*** if the 2 Watts radio option is loaded, you can set the receiver to 0.5 Watt or 2 Watts.

Radio Frequency Management

Configuration Details

Hardware Type – Indicates which radio is in the receiver. This screen controls the 450 MHz UHF Internal radio only.

Frequency Range – Usually one of the following MHz ranges: 410-470, 410-430, 430-450, or 450-470.

Tuning step (kHz) – This value is preset dependent on the locality/country the equipment is being used in. Contact your Trimble dealer if this needs to be changed.

Maximum Number of Channels – Reports the maximum number of transmit and receive frequencies possible for the internal radio.

Current Number Used – Displays the number of receive only or transmit/receive frequencies already input.

Frequency Management – Add or delete radio frequencies.

{b}Note – {/b} The ability to add or delete 450 MHz UHF radio frequencies is only applicable to Receive frequencies. If new Transmit frequencies are required, please contact your Trimble dealer.

Add Channel – Enter a valid frequency that meet the rules bounded by the available frequencies for the radio and the Tuning step. When a valid frequency is added, the value in the “Current Number used” field increments.

Delete Channel – Select a receive frequency from the list to remove it.

GSM/GPRS modem

Use these settings to??

[Describe the fields/options on this page]

OmniSTAR menu

OmniSTAR Summary

This page provides a summary of the OmniSTAR information.

Signal Source – Displays the source of the OmniSTAR signal, which can either be from the internal OmniSTAR demodulator or from an external source through a serial, TCP/IP, or Bluetooth port.

SV Name – Displays the name of the OmniSTAR satellite currently being tracked. "Auto" indicates that the satellite was selected based on geographical location.

Frequency (MHz) – Displays the frequency that the OmniSTAR satellite that is currently tracked is broadcasting on.

Bit Rate (Hz) – Display the rate at which the tracked OmniSTAR data is modulated to the carrier wave.

Setting – Indicates if the receiver is set to track OmniSTAR satellites.

Mode – Indicates if the internal demodulator is currently tracking an OmniSTAR satellite, or if external OmniSTAR data is being received from another source.

C/No [dBHz] – Displays the signal-to-noise ratio in a 1 Hz bandwidth of the signal being tracked.

SNR (Eb/No) – Displays the signal-to-noise ratio of the signal being tracked.

Total Messages – Displays the total number of messages received from the OmniSTAR satellite.

Bad Messages – Displays the number of OmniSTAR messages that the receiver has distinguished as not usable.

Total Unique Word Bits – The total number of bits in unique words you have received. Trimble Support can use this to troubleshoot OmniSTAR tracking problems.

Bad Unique Word Bits – The total number of error bits detected in unique words. Trimble Support can use this to troubleshoot OmniSTAR tracking problems.

Total Viterbi symbols – The total number of Viterbi-encoded symbols you have received. Trimble Support can use this to troubleshoot OmniSTAR tracking problems.

Corrected Viterbi symbols – The total number of Viterbi-encoded symbols that were automatically corrected by the decoding algorithm. Trimble Support can use this to troubleshoot OmniSTAR tracking problems.

Estimated BER – Estimated Bit Error Rate.

I/Q Ratio – The ratio of in-phase to quadrature carrier tracking loop signal strength. Trimble Support can use this to troubleshoot OmniSTAR tracking problems.

Unique Words with Bit errors – The total number of received unique words with at least a 1-bit error. Trimble Support can use this to troubleshoot OmniSTAR tracking problems.

OmniSTAR Configuration

Use this page to configure the receiver to track OmniSTAR satellites.

{b}Note – {/b} There must be a valid OmniSTAR subscription on the receiver before it can use internal or external OmniSTAR data for positioning.

Preferred Source of Data – Select either External or Internal. If the receiver is configured below to use both internal and external OmniSTAR data, it uses the preferred source when both are available:

- Internal – The OmniSTAR data is derived from the L-Band signal received via an appropriate antenna (e.g., GA810).
- External – The OmniSTAR data is derived from an external source such as an NTRIP Client over an Internet connection.

External OmniSTAR Data – Set the receiver to use an external OmniSTAR data stream if available on an Ethernet, NTRIP, serial, Bluetooth, or USB port and then use one of the following modes:

- **Don't Use** – Do not use an external source of OmniSTAR data.
- **Auto** – Tracking is enabled and, if more than one external OmniSTAR service is available, the most precise mode is used.
- **Selecting specific services** – The following specific services are available for selection if the receiver has an appropriate valid subscription. Selecting one of these modes restricts the receiver from using other external OmniSTAR services:
    - *HP Only*
    - *G2 Only*
    - *HP+G2*

- *HP+XP*
- *XP Only*
- *VBS Only*

Internal OmniSTAR Demodulator – Set the internal OmniSTAR demodulator to the required mode.

- **Off** – OmniSTAR tracking is disabled.
- **Auto** – Provides the best solution based on the error estimates. This delays the transition to OmniSTAR HP until the HP solution reports it is better than the VBS solution.

  {b}Note – {/b} Be careful how you treat VBS; in some locations it is in NAD-83. By default, the receiver provides NAD-83 VBS (in the USA) positions and ITRF2005 for HP. However, you can configure the receiver to transform the NAD-83 VBS positions to ITRF by selecting the following check box.
- **Selecting specific services** – The following specific services are available if the receiver has an appropriate valid subscription. Selecting one of these modes restricts the receiver from using other internal OmniSTAR services:
  - *HP Only*
  - *G2 Only*
  - *HP+G2*
  - *HP+XP*
  - *XP Only*
  - *VBS Only*

SV Name – Select which OmniSTAR satellite is to be tracked by the receiver. If you do not know the appropriate OmniSTAR satellite name, select Auto so that the receiver scans for the OmniSTAR satellite whose spot beam is closest to your current location. If the required SV Name does not appear in the list, select Custom and then enter the Frequency and Bit rate of the required satellite.

{b}Note – {/b} The SV Name list is automatically updated by OmniSTAR broadcasts, which contain the satellite name and ID, and coverage area. If this information is not currently available from OmniSTAR, the list may be incomplete or out of date. If this occurs, the SV Name Auto option may not select the most appropriate spot beam; instead you should select the Custom option.

Seed with RTK – Select this option if the primary positioning mode is RTK and you need to use the OmniSTAR solution for short RTK outages. The OmniSTAR engine is seeded with the current RTK Fixed position at a 1 Hz rate. If an RTK Fixed position solution becomes unavailable, the OmniSTAR HP position solution will be used until it is restored. The RTK position is transformed into the OmniSTAR HP datum by using the Datum Offset parameters. You can manually enter the **Datum Offset** parameters or have them measured using the SCS900 Site Controller software.

NAD83 - ITRF Transformation – In North America, the OmniSTAR VRS datum is NAD-83, all other OmniSTAR services use the ITRF datum. Enable this feature to transform the VBS positions from NAD-83 to ITRF datum.

OmniSTAR Subscription Information

This page provides information about the OmniSTAR subscription.

If the receiver is connected to an OmniSTAR-capable antenna with OmniSTAR reception, OmniSTAR subscriptions can be activated remotely.

HP/XP or VBS Expiration Date UTC – Shows when the current OmniSTAR subscriptions will expire. The receivers do not ship with an active subscription. Contact Omnistar for a subscription activation.

HP/XP Engine Mode – When the receiver has a valid subscription, the engine mode indicates which services are available.

HP/XP or VBS Firmware Version – Displays the current version of OmniSTAR firmware that is loaded in the receiver.

Serial Number – A 10-digit number, for example, 1010012017.

{b}Note – {/b} When ordering a subscription from OmniSTAR, you must refer to this serial number. Please do not send the serial number (for example, 5221F12345) of the actual receiver.

OmniSTAR Status

Use this page to monitor the status of the OmniSTAR satellite, subscriptions, and solution.

OmniSTAR Configuration

Provides the current OmniSTAR configuration settings.

External Data Mode – The mode setting set in the OmniSTAR Configuration page.

- *Don't Use* – OmniSTAR off.
- *Auto* – OmniSTAR auto tracking mode. When an HP or XP solution is available, output an HP or XP solution. When an HP or XP solution is not available but a VBS solution is available, output VBS solution.
- *HP+G2* - OmniSTAR HP and G2 mode.
- *G2 Only* - OmniSTAR G2 mode.
- *HP+XP* - OmniSTAR HP and XP mode.
- *HP Only* – OmniSTAR HP only mode.
- *XP Only* – OmniSTAR XP only mode.
- *VBS Only* – OmniSTAR VBS only mode.

Internal Data Mode – The mode setting set in the OmniSTAR Configuration page.

- *Off* – OmniSTAR off.
- *Auto* – OmniSTAR auto tracking mode. When an HP or XP solution is available, output an HP or XP solution. When an HP or XP solution is not available, but a VBS solution is available, output VBS solution.
- *HP+G2* – OmniSTAR HP and G2 mode.

- *G2 Only* – OmniSTAR G2 mode.
- *HP+XP* – OmniSTAR HP and XP mode.
- *HP Only* – OmniSTAR HP only mode.
- *XP Only* – OmniSTAR XP only mode.
- *VBS Only* – OmniSTAR VBS only mode.

Internal HP/XP Link ID – The configured HP/XP satellite ID used by the internal demodulator.

Internal HP/XP Link Name – The configured HP/XP satellite name used by the internal demodulator.

Internal VBS Satellite Link ID – The configured VBS satellite ID used by the internal demodulator.

Internal VBS Satellite Link Name – The configured VBS satellite name used by the internal demodulator.

Custom Frequency [MHz] – Manually entered OmniSTAR signal frequency stored for Custom mode.

Custom Bit Rate [Hz] – Manually entered OmniSTAR bit rate stored for Custom mode.

L-Band Beam Status

Provides information relating to the currently-tracked OmniSTAR signal (spot beam).

Signal Source

- *Demodulator* – The receiver is using the OmniSTAR data from the internal demodulator.
- *External* – The receiver is using the OmniSTAR data from an external source through a serial, Ethernet, or NTRIP port.
- *Off* – OmniSTAR data is not being used.

Tracking Mode

- *Off* – OmniSTAR signal tracking is off.
- *Search* – Initializing – Searching for Omnistar satellite, initializing.
- *Searching* – Searching for Omnistar satellite, running.
- *Track* – Initializing – Found Omnistar satellite, tracking initialization.
- *Full Tracking* – Found Omnistar satellite, verifying data stream.
- *Full Tracking (Service)* – Fully tracking Omnistar satellite and using the service indicated in the brackets.

Satellite Link ID – ID of the OmniSTAR satellite link.

Satellite Link Name – Name of the OmniSTAR satellite link.

Frequency [MHz] – Frequency of the OmniSTAR signal.

Bit Rate – Bit rate of the OmniSTAR signal.

Eb/No [dB] – Signal strength.

C/No [dBHz]– Signal-to-Noise ratio (SNR) of OmniSTAR signal.

HP/XP Library Status

Provides information relating to the HP/XP Library (software supplied by OmniSTAR used to decode and process the OmniSTAR signal). Also referred to as the OmniSTAR Engine.

Internal Library – The current status of the HP/XP Library. It can be Active or Not Active.

Engine – The mode used by the library. It can be HP, XP, G2, HP+G2, HP+XP, or Unknown.

Subscription Start/Expiry – OmniSTAR HP/XP subscription start and expiry dates. OmniSTAR services cannot be used without a valid OmniSTAR subscription for the appropriate service.

Subscribed Engine – The OmniSTAR subscribed service currently in use by the OmniSTAR library.

Horizontal Precision [m] – A user-defined horizontal 3-sigma precision tolerance for the receiver, which is also used to determine when the OmniSTAR solution has converged. To edit this value, go to *Receiver Configuration* / *Masks*.

Vertical Precision [m] – a user-defined vertical 3-sigma precision tolerance for the receiver, which is also used to determine when the OmniSTAR solution has converged. To edit this value, go to Receiver Configuration / Masks.

Receiver Motion – The current motion setting for the receiver. It can be Kinematic (Moving) or Static. OmniSTAR initialization time can be reduced by correctly setting the receiver motion. To change this setting, go to *Receiver Configuration* / *Advanced Settings*.

OmniSTAR Motion – The motion of the GNSS antenna as determined by the OmniSTAR Library. It can be Static, Kinematic (Moving), or Unknown.

Seed with Last known Pos – If enabled, the Last Known position stored in the receiver when it was last turned off is used to seed the OmniSTAR Library. Seeding is a method of speeding up the initialization process by telling the OmniSTAR Library the location of the GNSS antenna. The Last Known Position function can be used when a vehicle-mounted system is parked overnight and is powered down and powered up without the vehicle having moved. (This function can only be configured by application software.)

Seed with Fixed RTK Pos – If enabled, and if the receiver is in Kinematic mode and computing valid Fixed RTK positions, the OmniSTAR Library is continually seeded with Fixed RTK positions. If in Static mode, the OmniSTAR library is seeded with the first computed Fixed RTK position only. This function enables the OmniSTAR HP/XP Library to continue to provide a precise positioning solution for short periods when an RTK solution is not available because of a radio drop-out or other interference. To enable this feature, go to *OmniSTAR* / *Configuration*.

Seed Quality –

- *Unknown* – There is no seed available. The receiver does not have an SBAS or OmniSTAR VBS position.
- *Valid, source unknown* – There is a valid seed available but the source is unknown.
- *Invalid, low confidence level* – When using the last known position for seeding, if the last known position from the previous session has a low confidence level, it will be rejected. One of the causes of low confidence level is a high velocity associated with the position, suggesting that the receiver was moving when it was powered down.

- *Invalid, high variance, source unknown* – When static seeding, either the horizontal or the vertical variance of the seed position is higher than the precision thresholds configured in the receiver.
- *Invalid, wrong location* – When static seeding, a check is made to verify if the antenna is on the correct point by comparing the seed position with the current position. The ECEF XYZ of the current position must be within tolerance (5 m for SBAS, 3 m for OmniSTAR VBS) of the seed position; otherwise it is rejected.
- *Invalid, receiver does not have threshold* – Retrieving the precision threshold from the receiver failed. There is no threshold value to compare to the seed's variance. (This should not happen, because the receiver has default threshold value.)
- *Invalid, no seed found* – When Seed with Last Known Position is active, but the receiver does not have the seed position from the previous session.
- *Invalid, SBAS with high variance* – The SBAS position is higher than the receiver's precision threshold values.
- *Invalid, VBS with high variance* – The VBS position is higher than the receiver's precision threshold values.
- *Valid, SBAS* – The SBAS position is a valid seed.
- *Valid, OmniSTAR VBS* – The VBS position is a valid seed.
- *Valid, Fixed RTK* – The Fixed RTK position is a valid seed.
- *Valid, Last Known Pos* – The last known position is a valid seed.
- *Valid, User Defined* – The user-defined known position is a valid seed.

VBS Library status

Internal Library – The current status of the VBS Library. It can be Active or Not Active.

Subscription Start/Expiry – OmniSTAR VBS subscription start and expiry dates. OmniSTAR services cannot be used without a valid OmniSTAR subscription for the appropriate service. For more information on the current subscription and how to subscribe, go to OmniSTAR Subscription.

Last Known Position

The WGS-84 geographical position and quality of the Last Known position stored in the receiver when it was last turned off.

Datum Offset

The WGS-84 geographical offset between two datums. It can be the difference between the site datum and another datum such as ITRF00 (used by OmniSTAR) as measured using the SCS Site Controller software, or it can be input manually on the *OmniSTAR* / Configuration page. This offset needs to be defined before OmniSTAR Known point initializations, RTK Seeding, or other functions involving different datums are carried out.

NMEA Encryption

This is not supported.

Network Configuration menu

Network Configuration (Summary)

These settings display the current receiver Internet configuration.

DHCP Status – Indicates if DHCP is on or off. If DHCP is on, the receiver is automatically assigned an IP address from the network.

The receiver can recover its IP address when in DHCP mode whenever it is connected to a DHCP server that is temporarily unavailable. If the receiver is connected to a DHCP server which is then not available and its “lease” has expired, the receiver switches to IP address 169.254.1.XXX. Every 60 seconds, the receiver tries to reconnect to the DHCP server to obtain a new IP address. This is useful when the receiver “drops off” the DHCP server and does not require a manual power cycle.

Ethernet IP – Displays the current Ethernet IP address of the receiver.

DNS Address – Displays the IP address of the current Domain Name Server.

Secondary DNS Address – Displays the IP address of the Secondary Domain Name Server

FTP Push – Indicates if FTP Push is on or off.

HTTP Server Port – Displays the port on which the web server is currently running. The default HTTP port is 80.

Network Address Translation – Displays whether NAT is Enabled or Disabled.

If PPP is enabled, the following information is displayed:

PPP Port – Displays the port on which the PPP connection is established.

PPP State – Indicates if a PPP connection is currently established.

PPP Local Address – Displays the IP address of the receiver on the PPP connection.

PPP Remote Address – Displays the IP address of the device that the receiver is connected to on the PPP connection. The receiver assigns this address to the connecting device on connection.

If Data Logging and FTP Push are both enabled, the following information is displayed:

FTP Push Server – Displays the server address that files will be pushed to.

Ethernet Configuration

Use these settings to change the Ethernet configuration of the receiver.

IP Setup – Set the receiver to obtain an IP address using DHCP (Dynamic Host Configuration Protocol) or a Static IP.

IP Address – Enter a static IP address for the receiver to use when connected to a network. This field cannot be edited when using DHCP.

Netmask – Enter the netmask for the network that the receiver will be connected to. This field cannot be edited when using DHCP.

Broadcast – The broadcast address is for informational purposes. This address allows packets to be sent to all devices on a network. This field cannot be edited when using DHCP.

Gateway – Enter the Gateway IP address for the network that the receiver will be connected to. This is typically the Local Area Network IP address of the router that links the receiver to the Internet. This field cannot be edited when using DHCP.

Hostname – Enter a name for the device. This name can be used to connect to the receiver over a network when DHCP is enabled and the IP address of the receiver is unknown.

MTU – Maximum Transmission Unit. The greatest amount of data or "packet" size that can be transferred in one physical frame on a network. The default is 1,500 bytes and is common for Ethernet and dial-up links.

{b}Note – {/b} The suggested smallest MTU is 576. When MTU is set a value less than 576, networking activity is not guaranteed to work.

Change Configuration – Click to view the stored settings and reset the receiver any changes to take effect. If you do not want to change the current settings, click any other page.

Renew DHCP – DHCP renew is automatically done, but you can also do it manually by clicking this button. Also, click this button to renew the DHCP settings if the server has restarted.

Current Settings – Displays the current network configuration.

Lease time – Lease time is assigned by the DHCP server; you cannot change it. This is for information only to let you know how long before the lease is due to expire. The receiver system automatically renews the lease before its expiration.

DNS Configuration

Use this page if you need to set your special DNS IP address.

If the receiver I/O configuration is using any domain name (such as “ntrip1.trimblehh.com”), the receiver needs to resolve the domain name string to an IP address; the DNS server serves that purpose. Many systems, such as the Microsoft Windows operating system, have two DNS IP addresses; primary DNS and secondary DNS. If the primary DNS cannot be reached, the secondary DNS is used. If the secondary DNS also fails, then the domain name cannot be resolved and the system cannot reach the specified address.

Usually when a receiver is configured in DHCP mode, the DHCP server assigns an IP address to the receiver along with a DNS IP address (both primary and secondary DNS). By default, the receiver uses the DHCP assigned DNS address. You do not have to do anything on this settings page unless you do not want to use the assigned DNS IP address.

If the receiver is configured as static mode, you must configure the DNS address in addition to the Ethernet Configuration page where you configure the IP address, Netmask, Broadcast, Gateway, hostname, and MTU settings.

The DNS address will be changed accordingly when the default interface is changed. For example, when using PPP over internal/external GPRS modem, the default interface is set to PPP over GPRS modem, and the PPP server will assign its special DNS address to the connection. The system will obtain a DNS address from the PPP connection unless it is “forced”. When PPP is disconnected, the DNS address will be changed back to the Ethernet DNS address. The priority of DNS addresses and default route is:

1. PPP over GPRS connection.
2. Ethernet.
3. Other PPPs.
4. Wi-Fi connection.

DNS Address – Displays the current DNS address.

Secondary DNS Address – Displays the secondary DNS address.

Force DNS Address – When you select this check box, you can enter a specific DNS Server IP address and DNS Domain Name. After you click **Change Configuration**, this DNS IP address and DNS Domain Name is used in the system. If this check box is selected, the system uses the supplied DNS address and ignores any DNS address assigned by an DHCP server or PPP server. Whether you have Ethernet or PPP, the DNS IP address is forced.

DNS Address – Enter the DNS (Domain Name Server) address for the network that the receiver will connect to. This field cannot be edited when using DHCP. In DHCP mode, the DNS Address is sent to the receiver and is unique for each customer's LAN. If you require a static IP setup, this DNS address will have to be obtained by an system administrator.

Sec DNS Addr – Enter the Secondary DNS (Domain Name Server) address for the network that the receiver will connect to.

DNS Domain – Enter the DNS domain for the network that the receiver will connect to. This field cannot be edited when using DHCP. The DNS Domain name also comes from the DHCP server and is mainly used by mDNS and UPnP.

Change Configuration – When this is pressed these new settings will be applied for the static configuration. Any static settings will be over written if the system goes to factory defaults (DHCP). If “Force DNS Address” is not selected and “Change Configuration” is pressed, then the provided DNS will be set to the system once, but it will not be forced and in the DHCP case the next DHCP renew will overwrite the DNS addresses that you just set.

PPP Configuration

Use these settings to change the receiver PPP (Point-to-Point Protocol) configuration, which is used to make Internet connections through Bluetooth wireless technology or a wired serial connection.

Port – Indicates which receiver port the PPP connection is to be established on.

State – Indicates if a PPP connection is currently connected.

Auto Restart – Select this check box to have the receiver automatically re-establish the PPP connection if it is dropped.

Startup script type – Select a startup script for the receiver. The script is sent to the PPP CHAP (Challenge Handshake Authentication Protocol) program so that user names and passwords can be checked.

- *No Startup Script* – Does not run CHAP before PPP is established.
- *Windows script* – Serves the Microsoft Windows XP "clientclient" handshaking mechanism.
- *GPRS script* – Only available when a GSM/GPRS modem is connected to the receiver and is detected. The initstring and dialstring, user name and password, and possibly CPIN in "Advanced settings" will be used in CHAP.
- *External modem script* – Select this option when a circuit-switched or packet-switched modem is connected to the receiver.

Enable CPIN Check - This check box becomes available when you select the External modem script option from the Startup script type list. Checks and verifies that the CPIN defined in the Advanced Settings is valid for the SIM being used in the external modem.

Use External Modem Default - This check box becomes available when you select the External modem script option from the Startup script type list. When this check box is selected, the dial string uses "ATD*99#" and will not use any value set in the init string. The "ATD*99#" dial string forces the PPP to use the external modem's default settings, which the receiver does not know.

Use Int/Dial string - This check box becomes available when you select either the GPRS script option or the External modem script option from the Startup script type list. When this check box is selected, you can manually enter the Modem Init string and the Modem Dial string as supplied by the carrier.

- **Modem Init. String** – Enter the initialization string required by the modem. This string contains APN information. By default, it is the Windows "clientclient". However, for the GSM/GPRS Modem port, the Init String is similar to the following example:
  - *For T-Mobile*: AT+CGDCONT=2,"IP","internet2.voicestream.com"
  - *For Cingular*: AT+CGDCONT=2,"IP","WAP.CINGULAR"
- **Modem Dial String** – Enter the dial string required by the modem. Normally, you use the default setting "ATD*99***2#" where 2 in this string is matched with the 2 in "Modem Init String".

Use Trimble APN Database - This check box becomes available when you select either the GPRS script option or the External modem script option from the Startup script type list. The receiver firmware contains a database of known carriers with associated Modem Init and Modem Dial strings, which you can select by Country, Provider, and Service plan. This database is updated with new carrier information at each firmware release.

Access Point Name - The APN can be entered manually or generated by using the Trimble APN Database.

CID - Caller Identification. Should be in the range (1-2). The default is 2.

Username – Enter the username (if required) to log on to the carrier network that the modem connects to.

Password – Enter the password (if required) to log on to the carrier network that the modem connects to.

Verify Password – Re-enter the password (if required).

See advanced settings – Select this check box to view and change advanced settings.

Default Local Address – Enter the IP address that is assigned to the receiver when a PPP connection is established.

Default Remote Address – Enter the IP address that is assigned to the remote device when a PPP connection is established.

DNS Address – Enter the default DNS IP Address.

Refuse PAP – By default, this check box is not selected. If it is selected, no PAP (Password Authentication Protocol) is enforced in the system.

Refuse CHAP – By default, this check box is not selected. If it is selected, the system does not use CHAP (Challenge Handshake Authentication Protocol).

Enable ACCM negotiation – ACCM (Asynchronous Control Character Map) is one of the LCP-negotiated options within the CONFREQ frame. ACCM sets the character escape sequences, which tells the port to ignore specified control characters within the data stream. If the router at the other end of the connection does not support ACCM negotiation, the port is forced to use FFFFFFFF. By default, this check box is selected.

Enable ACCM configuration – ACCM Configuration is one of options in PPP LCP layer, and allows LCP Configure-Ack to do ACCM mapping. By default, this check box is not selected.

Max idle time [minutes] – The PPP connection is dropped after this length of idle time.

Max connect time [minutes] – The PPP connection is dropped after this amount of connection time. If it is set to 0, the maximum connection time is not limited. That is, there is an infinite connection time.

CPIN – SIM PIN (Personal Identification Number). The GSM/GPRS Modem has a SIM card. For some European countries, before dialing, a PIN is required for the modem. The CPIN has a value of 4 to 8 digits, if required. If a user tries to make a PPP connection before the SIM PIN code is confirmed, it refuses the “ATD” command with an error. However, after three unsuccessful attempts to enter the PIN, the PUK (Personal Unblocking Key) is required to force the user to enter a new PIN code.

Verify CPIN – Re-enter the SIM PIN code to verify the digits entered in the CPIN field.

Save – Saves the configuration into the receiver's Application File (Appfile) without attempting to make a PPP connection.

Connect – Starts the PPP connection based on the above configuration and saves any changes to the receiver's Appfile.

Disconnect – Disconnects any PPP connection.

Go Back To Defaults – Sets the port configuration to its default settings.

Routing Table Configuration

Uses these settings to connect to a sub-network, such as behind a gateway, or to add static routes to a network. This page is for advanced users.

E-Mail Client

Use these settings to configure the receiver to use a specific email client which can be used to send E-Mail Alerts regarding the status of the receiver.

{b}Note – {/b} The email server needs to support SMTP without encryption.

E-Mail Authorization Required – Select this check box if the e-mail server requires authorization.

SMTP Server – Enter the SMTP (outgoing mail server) address that the e-mail will be sent from.

SMTP Port – Enter the SMTP port that the receiver connects to on the e-mail server. The most common SMTP Port is 25.

From E-Mail Address – Enter an address from which the e-mail will be sent.

E-Mail Login Name – Enter the login name (if required) that is required to send an e-mail on the SMTP server listed above.

E-Mail Login Password – Enter the login password (if required) that is required to send an e-mail on the SMTP server listed above.

Verify Password – Re-enter the login password.

E-Mail Alerts

Use these settings to configure the receiver to send e-mail to a specified address with detailed information regarding the state of the receiver.

{b}Note – {/b} You must first configure the E-Mail Client.

Enable – Select this check box to enable e-mail alerts.

To E-Mail Address – Enter the address that the email will be sent to. (Only one email address is supported).

Selection Boxes – Select which events will cause the receiver to send an email.

{b}Note – {/b} To check if all e-mail alert settings are correct and to send a test e-mail, click Test.

HTTP Server Config

Use this setting to configure the HTTP Server Port on which the web server will run.

HTTP Server Port – Enter the port number for the HTTP server. The default is port 80.

HTTP Secure Enable - Enter the port number for the HTTPS server. The default is 443.

These settings are only available if the HTTPS option is installed.

The receiver can support a secure HTTP link, with encryption limited to a 56-bit encryption.

{b}Note – {/b} By default, Mozilla Firefox does not support this low grade encryption. Turn on the security.ssl3.rsa_1024_rc4_56_sha option by going to about:config in Firefox.

Proxy Configuration

Use these settings to configure the proxy settings for the receiver.

Enable HTTP proxy – If the receiver is on a network that uses a proxy server, or if you find the NTRIP service or the Firmware Upgrade Check feature is not functioning, then select this check box.

HTTP proxy – Contact your network administrator to get this value.

HTTP proxy port – Contact your network administrator to get this value.

*{b}Note – {/b} Enter the server name and IP address without adding the protocol in front. That is, enter **/companyx.com**, not **http://companyx.com**.*

Configure TCC

Use this page to configure your receiver so it can benefit from services available in the Connected Community. This is needed if you are using the Internet Base Station Service (IBSS) and other functions such as sending receiver positions to the Connected Community Visual Organizer.

Organization – Enter the name of the Connected Community organization, for example, 'Company ABC Interstate Project'.

Device ID – This is automatically generated and cannot be edited.

Password and Verify Password – Enter the receiver password. This must match the the receiver password that is registered in the Connected Community.

Push positions to TCC – If the receiver is connected to the Internet, then you can optionally send receiver antenna positions to the Connected Community so they can be displayed on the Visual Organizer.

Period(s) – Enter the interval, in seconds, that you want to send the receivers position to the Connected Community.

Test – If the receiver is connected to the Internet, press **Test** to confirm the connection to the Connected Community.

FTP Server Configuration

Use these settings to configure the FTP Server settings for the receiver.

FTP Server Enable – Select this check box to enable the receiver to act as an FTP (File Transfer Protocol) server. If security is disabled, then anyone has access. To restrict access you must enable security. Once enabled, the access settings are controlled by the File Download and File Delete settings for a particular user. To set this up, see Security Configuration.

FTP Server Port – Enter the port on which the FTP Server will run. The default port is 21.

NTP Configuration

Use these settings to configure the NTP (Network Time Protocol) Client settings for the receiver.

Client

External Time Servers – Enter the IP address or DNS address and port of the NTP server that the receiver will connect to. This allows the receiver to synchronize the internal receiver clock to an Internet time source, which can improve satellite acquisition if the receiver was powered off for a long period of time. The receiver is preconfigured with three default time servers.

Enable NTP Client – Select this check box if you require the receiver to be an NTP client. Use this feature to synchronize the receiver time using an external time source.

Server

Enable NTP server – Select this check box if you require the receiver to be an NTP server. Use this feature to synchronize devices on a network, for example, other computers. This is useful on an offshore installation when an external NTP time server is not available and other devices on the network cannot access the 1PPS, but they are on a local network (wired or wireless) and require time synchronization.

Reference clock offset – If an accurate absolute time service is required, then the delay caused by the length of the antenna cable needs to be determined and entered as nanoseconds delay.

VFD Server

Use these settings to configure the VFD (Vacuum Fluorescent Display) server settings for the receiver. The VFD server enables you to connect to the receiver using an unsupported Trimble utility (SPS Modular Remote Front) to view and control the receiver with a front panel display and keypad emulator. The SPS Modular Remote Front utility is available as a download from Trimble.com

VFD Server – Enable or disable the VFD server. The default setting is Disabled.

{b}Note – {/b} The VFD Server setting is not retained when the receiver is turned off.

VFD Server Port – Enter a port number on which the VFD server will run.

DDNS Configuration

Use these settings to set up a Dynamic DNS (DDNS) Client in the receiver.

The main reason for setting up a DDSN Client is to solve the problem of the base station using the NTRIP Caster function to make a correction stream available directly from its router, or a cell phone changing its IP address as determined by the service provider. When this occurs, rover systems can no longer connect to and use this source of Internet corrections. This DDNS feature can be used when your router does not have an inbuilt DDNS Client or when you are using a cell phone at the base station in which the IP address is randomly changing.

DDNS is often used in conjunction with NTrip Caster in the role of an Internet-capable base station. Before setting up the DDNS, do the following:

- Set up the base station NTrip Caster parameters.
- Set up an account on a free DDNS Server such as at DynDNS (www.dyndns.com).

Last Update Time – The time period since the last successful update was made. The format is dd (days) hh (hours) mm (minutes) ss (seconds). The field is updated every 5 seconds and starts again after a "forced update period" occurs.

Update Status – This field shows one of the following:

Status Message	Meaning
`Good`	The update was successful.
`Invalid Remote Address`	The DDNS Server IP address cannot be resolved.
`TCP/IP connect() failed`	The connect() due to the device is behind a NAT (Network Address Translation or Network Address Translator) or a firewall.
`TCP/IP send() or rcv() failed`	The send or receive failed.
`Invalid Response from IP Check Server`	The response from the IP Check Server is not expected.
`Invalid Response from DNS Server`	The response from the DNS server is not expected.
`Internet error`	Other errors occurred in the implementation.

Enable – Select this check box to enable the DDNS feature.

Server ID – Select from a list of common DDNS servers, for example, www.dyndns.com. The dyndns.org dynamic setting is used when your Internet connection has a public routable IP address. This is probably the most common setting. For information about the Custom setting, go to www.dyndns.com.

The receiver supports the following DDNS servers:

- dyndns.com
- freedns.afraid.org
- zoneedit.com
- no-ip.com

Client Name – Enter an existing URL, for example, SiteAlphaBase.dyndns.org.

User Name and Password – Enter the name and password that you chose when you set up your DDNS Server account.

Forced Update Period – The receiver automatically updates the DNS information within 120 seconds (2 minutes) of the IP address changing. You can also specify a time frequency for the receiver to update DNS information at, even if the information has not changed. This is the "Forced Update Period". The minimum Forced Update Period is 5 minutes; the default is 40320 minutes (28 days).

Click **OK** to apply the changed settings to the receiver.

{b}Tip – {/b} You can set up an alert, so that an email is sent to you if the DDNS update process fails. Select *Network Configuration* / *E-Mail Alerts* and then select the Alert when DDNS update failed check box.

Zero Configuration / Universal Plug and Play

This feature enables a computer on the same subnet as the receiver to discover the IP address of the receiver and then discover what services and ports the receiver has enabled. The computer client can then access datafiles, configure the receiver, connect to NMEA/CMR streams, send CMR streams to the receiver, and so on.

It enables users with no networking experience to connect directly to the receiver without having to know or enter an IP address.

Use Bonjour or uPnP on your local computer.

Enable Zeroconf service discovery (mDNS/DNS-SD) – This is enabled, by default, and enables computers on the subnet using Bonjour to discover this receiver.

For Windows, download Bonjour For Windows (http://support.apple.com/downloads/Bonjour_for_Windows). When you open Internet Explorer or Safari, a new icon appears that lets you browse for devices. Click on the Bonjour devices; it scans the network and shows all the GNSS devices on the subnet.

The local name string applied to the receiver is the same as the Bluetooth string:

Product Name, Serial Number: System Name

Where:

Product Name is the name of the product.

Serial Number is the Trimble 10-character serial number.

System Name - Entered using either the WinFlash utility or the web interface.

For other browsers and operating systems:

- ***After*** installing Bonjour for Windows, you can install BonjourFoxy for Firefox browser support.
- For Linux, install avahi and do "avahi-browse -a".
- In Mac OSX, Bonjour is installed as standard.

Bonjour also enables the receiver to advertise other services it has today. Trimble advertises HTTP and FTP, if the services are enabled.

Enable UPnP service discovery – By default, this check box is selected. It enables computers on the subnet using Universal Plug and Play to discover this receiver.

A similar technology to Bonjour is UPnP, however it does not provide as much functionality as Bonjour (you cannot advertise FTP, NTP, and so forth, but you can advertise that the receiver is a web server).

While Microsoft has included this as part of their Windows operating systems, it is not integrated as cleanly into Internet Explorer as it is in Bonjour; there are also no known Firefox plugins that

support UPnP. However, the Microsoft Windows API does give programmatic access to UPnP (search the MSDN documentation). From version 4.12 firmware, the receiver implements UPnP. To connect to the receiver, without knowing the IP address, using this technology under Windows XP open "My Network Places". If you have UPnP discovery enabled, you see a list of receivers. If you do not see the list, and you know there are receivers with this functionality enabled on your subnet, make sure that you have select the Show UPnP ... option.

Forward HTTP – The Forward options relate to UPnP and routers/firewalls.

Use these options if you place a receiver behind your router/firewall at a site office and you need to access the receiver from another location (anywhere besides the site office). If you select this check box, then the receivers performs a UPnP search for a router and automatically tries to forward the HTTP port externally. If it succeeds, you should be able to point your web browser to the IP address listed next to the "Internet Gateway Device IP".

{b}Note – {/b} You must have UPnP enabled on your site office firewall/router. By default, some routers are UPnP enabled. However, some require you to enable it using the router web interface.

For a diagram of a setup that might want port forwarding, see www.knoxscape.com/Upnp/NAT.htm. The article also shows how to manually configure port forwarding on a LinkSys router (*Note – The configuration differs between routers*.)

Forward FTP – Is the same as the Forward HTTP check box except for your FTP port.

Forward IO – Select one of the following options:

- *None* – Do not forward any I/O ports through the local firewall/router.
- *Output-only* – Forward all server I/O ports marked "Output only/Allow multiple connections" and NTRIP caster ports.
- *All* – Forward all server I/O ports and NTRIP caster ports.

Wi-Fi mode

Use these settings to??

[Describe the fields/options on this page]

Wi-Fi Client Configuration

Use these settings to set the Client mode. The site should have at least one Access Point that this receiver can connect too. This allows:

- Satellite corrections to sent to the "Client" receiver
- Positions to be sent from the "Client" receiver to the Access Point
- Access to the web interface of the "Client" receiver

Enable the Wi-Fi Client – Select this check box if the receiver is to be a Client.

SSID naming– SSID stands for service set identifier, a 32-character unique identifier attached to the header of packets sent over a WLAN that acts as a password when a mobile device tries to connect to an Access Point. An SSID is also referred to as a network name as it identifies a wireless network.

Access Point Configuration

Use these settings to modify the Wi-Fi Access Point settings. In most cases the factory defaults will be suitable for most operations.

Enable the Wi-Fi Access Point– Select this check box to enable the Wi-Fi Access Point, so it will broadcast its SSID for users to log in to the web interface of the receiver. The Access Point mode is also set when the receiver is acting as a base station.

SSID – SSID stands for service set identifier, a 32-character unique identifier attached to the header of packets sent over a WLAN that acts as a password when a mobile device tries to connect to an Access Point. An SSID is also referred to as a network name as it identifies a wireless network.

- Factory Default SSID for the SPS985 (requires SPS985 to be Activated):
- Trimble GNSS NNNN (last four Serial number digits) when a Rover or Rover/Base configuration is loaded.
- Trimble Base NNNN when a Base-ONLY configuration is loaded.
- If AutoBase technology is used, then the format is Trimble Base NNNN, for example.
- The user can alter the SSID name that trails the word 'Trimble'.

Encryption Type – Either WEP64 or WEP128. The factory default is WEP64.

Encryption Key – The factory default is abcdeabcde.

Channel Number – By default, the receiver will set the channel number automatically. The range is 1 to 11.

Broadcast SSID – Select this if you want devices, such as your computer to see the SSID name or untick it if you do not want mobile devices to see the SSID.

DHCP IP Range – These settings are for advanced users with IT knowledge.

Security menu

Security Summary

Use this page to review the current security settings of the receiver. The table on the page provides a summary of all users and their security privileges.

Security – There are three different types of security access for the receiver:

- Enabled
- Enabled with Anonymous Access
- Disabled

Security Configuration

Use these settings to configure the security settings of the Trimble receiver.

Security

- *Enable* – Requires all users to log in to access the receiver.
- *Enable with Anonymous Access* – Any user can access the receiver without logging in. If enabled, Anonymous users can be permitted to download and delete files. Users are required to login when attempting to change any of the receiver settings.
- *Disable* – Any user can gain access to the receiver without logging in. All users have complete control of the receiver.

User Summary Table – The table provides a summary of all users and their security privileges. The privileges of the admin user cannot be changed and the admin user cannot be deleted. Only the password of the admin user can be changed.

Add User – Enter a username and password for a new user. To enable the privileges for the user, select the appropriate check boxes. To create a new user, click **Add User**.

Change Password

Use these settings to change the password for an existing user.

Username – Enter the existing username for which the password is to be changed.

New Password – Enter the new password for the user.

Verify New Password – Re-enter the new password for the user.

Firmware menu

Install new firmware

This page provides a summary of the firmware currently installed on the Trimble receiver. You can also use it to install new firmware on the receiver.

> **CAUTION –** All data files are deleted when you install new firmware. Before you install the new firmware, ensure that you first download any data files to your computer.

Firmware Warranty Date – Indicates when the firmware support for the receiver will expire. Once the date shown has passed, the receiver will not install new firmware. Before new firmware is loaded to the receiver, an Extended Warranty must be purchased from Trimble and the receiver must be updated.

Active Firmware Version – Shows the version of firmware that is currently installed on the receiver.

Active Core Engine Version – Shows the core firmware version. Use this when reporting problems or issues to Trimble Support.

Active Firmware Release Date – Shows the date that the firmware currently installed on the receiver was produced.

Active Firmware Warranty Date – Shows the warranty date for the firmware currently installed on the receiver. This can be different to the Active Firmware Release Date. The firmware will only load into the receiver if this date is prior to the Firmware Warranty Date set in the receiver.

Active Firmware Checksum – Used by Trimble support to verify that the current firmware of the receiver is correctly installed.

Browse – Click **Browse** to locate new firmware on your computer to install on the receiver.

Install New Firmware – Begins the installation of the newly uploaded firmware to the receiver. Status updates are given at the bottom of the page during a new firmware installation.

Check for Firmware Upgrades

The receiver can automatically check for firmware upgrades from the Trimble website if this option is enabled (Default is enabled).

If your network requires that you pass through a proxy server, you can configure the IP address of the server and the port through which the Internet is accessed from Network Configuration - Proxy.

Update Available – This field is visible if there is a more recent firmware version than the receiver has installed. If the receiver is under warranty support, select the *Firmware* / *Install* option to open the Install New Firmware page.

Help menu

Help

Here you can access the help files for the receiver. You can search for topics and browse the contents for the information you are looking for.

If the receiver is connected to the Internet, you can access the latest files online using the default link www.trimble.com/EC_ReceiverHelp/Vx.xx (where x.xx is the firmware version).

Alternatively, you can download the files to a local windows computer and view them using a web browser. See Help Location for details.

To download the Help files, paste the following link into a web browser, after replacing the x.xx with the firmware version.

http://www.trimble.com/EC_ReceiverHelp/Vx.xx/en/Help.zip

Help Location

Use the *Help Link* field to point to the location of the Help files.

The Help Link enables you to host the online Help on either a local computer or a LAN running a web server. This is useful if you use a computer to access the web interface, but you do not have a permanent Internet connection. Usually the help files are hosted on www.trimble.com. Various web servers can be used to host the help files. The following example explains how to use Apache:

1. Go to the Apache website at http://httpd.apache.org/.
2. Find the most recently released version. As of February 2010, this is version 2.2.14. Click on it and then install the "Win32 without crypto" version.
3. By default, Apache 2.2 uses the following location for the root of the web server content C:\Program Files\Apache Software Foundation\Apache2.2\htdocs.

4. For the English help in the Apache root directory, add a folder “en”.
5. In the “en” folder, download and then unzip the receiver Help. From the *Contents* tab, select *Download Guides* / *Download Help (.zip file)*.
6. Open a browser on the computer that is running Apache. The help should now be located at http://localhost/en.
7. On the Help Location page, enter **localhost** in the *Help Link* field. The receiver web interface appends the prefix and the two character language code (“en” in this case) based on the language that the web interface is operating in.
8. Click **OK**. The help links are now serviced from the local computer. This computer does not need to be local and can be a computer on the local LAN. Instead of “localhost”, enter the name or IP address of the machine that is running Apache.
9. When new firmware is released, ensure that you download the latest files and update the local help files.

Log in

Enables you to log in to the receiver. Select the *Log in* field and when prompted enter a username and password. To log out, return to this menu and click **Log out**.

The default username is **admin**. The default password is **password**.

Output Messages

NMEA-0183 Messages

NMEA-0183 messages: Overview

When NMEA-0183 output is enabled, a subset of NMEA-0183 messages can be output to external instruments and equipment connected to the receiver serial ports. These NMEA-0183 messages let external devices use selected data collected or computed by the GNSS receiver.

All messages conform to the NMEA-0183 version 3.01 format. All begin with $ and end with a carriage return and a line feed. Data fields follow comma (,) delimiters and are variable in length. Null fields still follow comma (,) delimiters, but contain no information.

An asterisk (*) delimiter and checksum value follow the last field of data contained in an NMEA-0183 message. The checksum is the 8-bit exclusive of all characters in the message, including the commas between fields, but not including the $ and asterisk delimiters. The hexadecimal result is converted to two ASCII characters (0–9, A–F). The most significant character appears first.

The following table summarizes the set of NMEA messages supported by the receiver, and shows the page that contains detailed information about each message.

Message	Function
GBS	GNSS satellite fault detection (RAIM support)
GGA	Time, position, and fix related data
GNS	GNS Fix data
GSA	GPS DOP and active satellites
GST	Position error statistics
GSV	Number of SVs in view, PRN, elevation, azimuth, and SNR
HDT	Heading from True North
LLQ	Leica local position and quality
PTNL,AVR	Time, yaw, tilt, range, mode, PDOP, and number of SVs for Moving Baseline RTK
PTNL,BPQ	Base station position and position quality indicator
PTNL,DG	L-band corrections and beacon signal strength and related information
PTNL,GGK	Time, position, position type, and DOP values
PTNL,PJK	Time, position, position type, and DOP values
PTNL,VGK	Time, locator vector, type, and DOP values

Message	Function
PTNL,VHD	Heading Information
RMC	Position, Velocity, and Time
ROT	Rate of turn
VTG	Actual track made good and speed over ground
ZDA	UTC day, month, and year, and local time zone offset

To enable or disable the output of individual NMEA messages, do one of the following:

- Create an application file in the Configuration Toolbox software that contains NMEA output settings and then send the file to the receiver.
- Add NMEA outputs in the *Serial outputs* tab of the GPS Configurator software and then apply the settings.

For a copy of the NMEA-0183 Standard, go to the National Marine Electronics Association website at www.nmea.org.

NMEA-0183 messages: Common message elements

Each message contains:

- a message ID consisting of $GP followed by the message type. For example, the message ID of the GGA message is $GPGGA.
- a comma.
- a number of fields, depending on the message type, separated by commas.
- an asterisk.
- a checksum value.

The following example shows a simple message with a message ID ($GPGGA), followed by 13 fields and a checksum value:

$GPGGA,172814.0,3723.46587704,N,12202.26957864,W,2,6,1.2,18.893,M,-25.669,M,2.0,0031*4F

Message values

NMEA messages that the receiver generates contains the following values:

Value	Description
Latitude and Longitude	Latitude is represented as *ddmm.mmmm* and longitude is represented as *dddmm.mmmm*, where: • *dd* or *ddd* is degrees

Value	Description
	• *mm.mmmm* is minutes and decimal fractions of minutes
Direction	Direction (north, south, east, or west) is represented by a single character: *N* , *S* , *E* , or *W*.
Time	Time values are presented in Universal Time Coordinated (UTC) and are represented as *hhmmss.ss*, where: • *hh* is hours, from 00 through 23 • *mm* is minutes • *ss.ss* is seconds with variable length decimal-fraction of seconds

GSOF Messages

GSOF Messages

These topics provides information on the General Serial Output Format (GSOF) messages. GSOF messages are a Trimble proprietary format and can be used to send information such as position and status to a third-party device.

This table summarizes the GSOF messages that the receiver supports. When GSOF output is enabled, the following messages can be generated:

Message	Function
TIME	Position time
LLH	Latitude, longitude, height
ECEF	Earth-Centered, Earth-Fixed position
Local Zone Position	Local zone north, east, and height - projection/calibration based
ECEF DELTA	Earth-Centered, Earth-Fixed Delta position
TPlane ENU	Tangent Plane Delta
Velocity	Velocity data
PDOP	PDOP info
SIGMA	Position sigma info
SV Brief	SV Brief info

Message	Function
SV Detail	SV Detailed info
UTC	Current UTC time
BATT/MEM	Receiver battery and memory status
ATTITUDE	Attitude info
BASE POSITION AND QUALITY INDICATOR	Base station position and its quality

For information on how to output GSOF messages, see Configuring the Receiver.

GSOF messages: General Serial Output Format

Report packet 40h structure (GENOUT)

Byte	Item	Type	Value	Meaning
0	STX	Char	02h	Start transmission
1	STATUS	Char	See Receiver status code	Receiver status code
2	PACKET TYPE	Char	40h	Report Packet 40h (GENOUT)
3	LENGTH	Char	00h–FAh	Data byte count
4	TRANSMISSION NUMBER	Char		Unique number assigned to a group of record packet pages. Prevents page mismatches when multiple sets of record packets exist in output stream.
5	PAGE INDEX	Char	00h–FFh	Index of current packet page.
6	MAX PAGE INDEX	Char	00h–FFh	Maximum index of last packet in one group of records.
One or more GSOF messages				
	Output record type	Char	01h	For example, Time (Type 1 Record)
	Record length	Char	0Ah	Bytes in record
Various fields depending on Output record type There can be various records in one GENOUT packet. There could be multiple GENOUT packets per epoch. Records may be split over two consecutive packets.				
Length + 4	CHECKSUM	–	–	(Status + type + length + data bytes) modulo 256

Byte	Item	Type	Value	Meaning
Length + 5	ETX		03h	End transmission

Each message begins with a 4-byte header, followed by the bytes of data in each packet. The packet ends with a 2-byte trailer. Byte 3 is set to 0 (00h) when the packet contains no data. Most data is transmitted between the receiver and remote device in binary format.

Receiver Status code

Byte number	Message	Description
Bit 0	1	Reserved
Bit 1	1	Low battery
Bit 2–7	0–63	Reserved

GSOF messages: Reading binary values (Motorola format)

The receivers store numbers in Motorola format. The byte order of these numbers is the opposite of what personal computers (Intel format) expect. To supply or interpret binary numbers (8-byte DOUBLES, 4-byte LONGS, and 2-byte INTEGERS), the byte order of these values must be reversed. This section contains a detailed description of the Motorola format.

INTEGER data types

The INTEGER data types (CHAR, SHORT, and LONG) can be signed or unsigned. By default, they are unsigned. All integer data types use two's complement representation. The following table lists the integer data types:

Type	# of bits	Range of values (Signed)	Unsigned
Char	8	-128 to 127	0 to 255
Short	16	-32768 to 32767	0 to 65535
Long	32	–2147483648 to 2147483647	0 to 4294967295

FLOATING-POINT data types

Floating-point data types are stored in the IEEE SINGLE and DOUBLE precision formats. Both formats have a sign bit field, an exponent field, and a fraction field. The fields represent floating-point numbers in the following manner:

Floating-Point Number = <sign> 1.<fraction field> x 2(<exponent field> - bias)

Sign bit field

The sign bit field is the most significant bit of the floating-point number. The sign bit is 0 for positive numbers and 1 for negative numbers.

Fraction field

The fraction field contains the fractional part of a normalized number. Normalized numbers are greater than or equal to 1 and less than 2. Since all normalized numbers are of the form 1.XXXXXXXX, the 1 becomes implicit and is not stored in memory. The bits in the fraction field are the bits to the right of the binary point, and they represent negative powers of 2.

For example:

0.011 (binary) = 2-2 + 2-3 = 0.25 + 0.125 = 0.375

Exponent field

The exponent field contains a biased exponent; that is, a constant bias is subtracted from the number in the exponent field to yield the actual exponent. (The bias makes negative exponents possible.)

If both the exponent field and the fraction field are zero, the floating-point number is zero.

NaN

A NaN (Not a Number) is a special value that is used when the result of an operation is undefined. For example, adding positive infinity to negative infinity results in a NaN.

FLOAT data type

The FLOAT data type is stored in the IEEE single-precision format which is 32 bits long. The most significant bit is the sign bit, the next 8 most significant bits are the exponent field, and the remaining 23 bits are the fraction field. The bias of the exponent is 127. The range of single-precision format values is from 1.18 x 10–38 to 3.4 x 1038. The floating-point number is precise to 6 decimal digits.

0 000 0000 0 000 0000 0000 0000 0000 0000 = 0.0

0 011 1111 1 000 0000 0000 0000 0000 0000 = 1.0

1 011 1111 1 011 0000 0000 0000 0000 0000 = -1.375

1 111 1111 1 111 1111 1111 1111 1111 1111 = NaN

DOUBLE

The DOUBLE data type is stored in the IEEE double-precision format which is 64 bits long. The most significant bit is the sign bit, the next 11 most significant bits are the exponent field, and the remaining 52 bits are the fractional field. The bias of the exponent is 1023. The range of single precision format values is from 2.23 × 10–308 to 1.8 × 10308. The floating-point number is precise to 15 decimal digits.

0 000 0000 0000 0000 0000 ... 0000 0000 0000 = 0.0

0 011 1111 1111 0000 0000 ... 0000 0000 0000 = 1.0

1 011 1111 1110 0110 0000 ... 0000 0000 0000 = -0.6875

1 111 1111 1111 1111 1111 ... 1111 1111 1111 = NaN

Login authentication

If you interface to the receivers using binary commands over serial communications, you may need login authentication. This is added to receiver models that run firmware version 3.30 or later.

If utilities such as the WinFlash utility or the Configuration ToolBox software do not work with the receivers running firmware version 3.30 or later, go to the Trimble website and then download the latest versions of these utilities. If your own application software no longer communicates with the receiver, contact Trimble Support for information about how to use the receiver in these cases.

Cables, Connectors, and Dimensions

Pinout Information

Receiver Connector Pinout Information

Lemo connector (SPS Modular only)

Pin	Usage
1	RS-232 Signal GND
2	GND
3	RS-232 Serial data out
4	CAN-
5	CAN+
6	DC Power In (+) 11.5 to 28 V DC
7	RS-232 Serial data in

USB office cable

Provide drawing and pinout info??

USB field cable

Provide drawing and pinout information??

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To add

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.
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.

Legal Notices

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Legal Notices

NTP Software Copyright

Release Notice

This is the February 2012 release (Revision A) of the R10 Receiver documentation. It applies to version 4.43 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.

COCOM limits

The U.S. Department of Commerce requires that all exportable GPS products contain performance limitations so that they cannot be used in a manner that could threaten the security of the United States. The following limitations are implemented on this product:

– Immediate access to satellite measurements and navigation results is disabled when the receiver velocity is computed to be greater than 1,000 knots, or its altitude is computed to be above 18,000 meters. The receiver GPS subsystem resets until the COCOM situation clears. As a result, all logging and stream configurations stop until the GPS subsystem is cleared.

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 and 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.

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.