USER GUIDE

Trimble® SPSx50 Modular GPS Receiver

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Trimble

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Release Notice

This is the February 2006 release (Revision A) of the SPSx50 Modular GPS Receiver User Guide. It applies to version 1.0 of the SPSx50 Modular GPS receiver.

Limited Warranty Terms and Conditions

Product Limited Warranty

Subject to the terms and conditions set forth herein, Trimble Navigation Limited ("Trimble") warrants that for a period of (1) year from date of purchase this Trimble product (the "Product") will substantially conform to Trimble's publicly available specifications for the Product and that the hardware and any storage media components of the Product will be substantially free from defects in materials and workmanship.

Product Software

Product software, whether built into hardware circuitry as firmware, provided as a standalone computer software product, embedded in flash memory, or stored on magnetic or other media, is licensed and not sold. If accompanied by a separate end user license agreement, use of any such software will be subject to the terms of such end user license agreement (including any differing limited warranty terms, exclusions and limitations), which shall control over the terms and conditions set forth in this limited warranty).

Software Updates

During the limited warranty period you will be entitled to receive such Fix Updates and Minor Updates to the Product software that Trimble releases and makes commercially available and for which it does not charge separately, subject to the procedures for delivery to purchasers of Trimble products generally. If you have purchased the Product from an authorized Trimble distributor rather than from Trimble directly, Trimble may, at its option, forward the software Fix Update or Minor Update to the Trimble distributor for final distribution to you. Major Upgrades, new products, or substantially new software releases, as identified by Trimble are expressly excluded from this update process and limited warranty. Receipt of software updates shall not serve to extend the limited warranty period.

For purposes of this warranty the following definitions shall apply: (1) "Fix Update" means an error correction or other update created to fix a previous software version that does not substantially conform to its published specifications; (2) "Minor Update" occurs when enhancements are made to current features in a software program; and (3) "Major Upgrade" occurs when significant new features are added to software, or when a new product containing new features replaces the further development of a current product line. Trimble reserves the right to determine, in its sole discretion, what constitutes a significant new feature and Major Upgrade.

Warranty Remedies

If the Trimble Product fails during the warranty period for reasons covered by this Limited Warranty and you notify Trimble of such failure during the warranty period, Trimble at its option will repair OR replace the nonconforming Product, OR refund the purchase price paid by you for the Product, upon your return of the Product to Trimble in accordance with Trimble's standard return material authorization procedures.

How to Obtain Warranty Service

To obtain warranty service for the Product, please contact your Trimble dealer. Alternatively, you may contact Trimble to request warranty service at +1-408-481-6940 (24 hours a day) or e-mail your request to trimble_support@trimble.com. Please be prepared to provide:

- your name, address, and telephone numbers
- proof of purchase
- this Trimble warranty card
- a description of the nonconforming Product including the model number
- an explanation of the problem.

The customer service representative may need additional information from you depending on the nature of the problem.

Warranty Exclusions and Disclaimer

This Product limited warranty shall only apply in the event and to the extent that (i) the Product is properly and correctly installed, configured, interfaced, maintained, stored, and operated in accordance with Trimble's applicable operator's manual and specifications, and; (ii) the Product is not modified or misused. This Product limited warranty shall not apply to, and Trimble shall not be responsible for defects or performance problems resulting from (i) the combination or utilization of the Product with hardware or software products, information, data, systems, interfaces or devices not made, supplied or specified by Trimble; (ii) the operation of the Product under any specification other than, or in addition to, Trimble's standard specifications for its products; (iii) the unauthorized, installation, modification, or use of the Product; (iv) damage caused by: accident, lightning or other electrical discharge, fresh or salt water immersion or spray; or exposure to environmental conditions for which the Product is not intended; or (v) normal wear and tear on consumable parts (e.g., batteries). Trimble does not warrant or guarantee the results obtained through the use of the Product. NOTICE REGARDING PRODUCTS EQUIPPED WITH GPS TECHNOLOGY: TRIMBLE IS NOT RESPONSIBLE FOR THE OPERATION OR FAILURE OF OPERATION OF GPS SATELLITES OR THE AVAILABILITY OF GPS SATELLITE SIGNALS.

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Registration

To receive information regarding updates and new products, please contact your local dealer or visit the Trimble website at www.trimble.com/register. Upon registration you may select the newsletter, upgrade or new product information you desire.

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. 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:

- Reorient or relocate the receiving antenna.
- 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.

Europe

This product (the SPSx50 Modular GPS receiver) is intended to be used in all EU member countries.

This product has 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 Infineon radio module ROK 104001. These requirements are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential or commercial environment.

Australia and New Zealand

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

(5) Are Taiwanese battery recycling requirements required? Yes/No

Taiwan – Battery Recycling Requirements

The product contains a removable Lithium-ion battery. Taiwanese regulations require that waste batteries are recycled.

Directive 1999/5/EC

Hereby, Trimble Navigation, declares that the SPSx50 GPS Receiver is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

Notice to Our European Union Customers

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

Safety Information

Before you use the SPS GPS receivers, make sure that you have read and understood all safety requirements.

Regulations and safety

The Bluetooth module inside the SPSx50 Modular GPS receiver, the SPSx80 Smart GPS antenna, and the ACU, TSC2, and TCU controllers is a radio-modem transmitter and receiver.

Regulations regarding the use of the 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.

Before operating an SPSx50 Modular GPS receiver or SPSx80 Smart GPS antenna, 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, page iii.

*****Query from RobMiller - SPSx50 and SPSx80 receivers also contain internal transmit radios. Does this information apply to them as well? If not - more needs to be added here.

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 radiomodem 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

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 2.0 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 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.

*****Query from RobMiller - SPSx50 and SPSx80 receivers also contain internal transmit radios. Does this information apply to them as well? If not - more needs to be added here.

Battery safety

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.

Contents

CHAPTER

1

Introduction

Welcome to the *SPSx50 Modular GPS Receiver User Guide*. This manual describes how to set up and use the Trimble® SPSx50 Modular GPS receivers.

Even if you have used other Global Positioning System (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 GPS, visit the Trimble website (www.trimble.com) for an interactive look at Trimble and GPS.

About the SPSx50 receivers

The SPSx50 Modular GPS receiver family comprises the following receivers:

- SPS550
- SPS550H
- SPS750 Basic base
- SPS750 Basic rover
- SPS750 Max
- SPS850 Extreme

SPS550 GPS receiver

The Trimble SPS550 is a dual-frequency location GPS receiver. The SPS550 can operate as a DGPS reference station or as a DGPS rover receiver, and can use Satellite Based Augmentation Systems (SBAS). The receiver can also function as a rover receiver that uses OmniSTAR XP or HP correction services. The SPS550 is ideal for mobile applications on marine vessels and site vehicles where RTK accuracy is not needed. The SPS550 can be used with the SPS550H GPS receiver to provide both position and precise heading solutions for marine applications.

SPS550H GPS receiver

The Trimble SPS550H is an add-on receiver that can be combined with any SPSx50 receiver to provide a precise heading capability using Trimble moving base technology.

SPS750 GPS receiver

The Trimble SPS750 is a dual-frequency GPS receiver with the ability to receive OmniSTAR corrections. The receiver is available in the following configurations:

- SPS750 Basic base
- SPS750 Basic rover
- SPS750 Max

The SPS750 can be configured using the keypad and display, a web browser, or the Trimble SCS900 Site Controller software. The SPS750 makes it easy to set up a mobile base station or a permanent base station for continuous operation. The SPS750 is also an ideal mobile receiver for semi-permanent mounting on vehicles and marine vessels.

SPS850 Extreme GPS receiver

The Trimble SPS850 Extreme is a triple-frequency GPS plus GLONASS receiver with the ability to receive OmniSTAR corrections. The SPS850 Extreme can operate as a base station or rover. The receiver can be configured using the keypad and display, web browser, or Trimble SCS900 Site Controller software. The SPS850 Extreme makes it easy to set up a mobile base station or a permanent base station for continuous operation. The SPS850 Extreme is also an ideal mobile receiver for semi-permanent mounting on vehicles and marine vessels.

Related Information

Sources of related information include the following:

- Help – The SCS900 Site Controller software has built-in, context-sensitive help that lets you quickly find the information you need. Access it from the *Help* menu. Alternatively, click the **?** button in a dialog, or press F1. On a Windows CE device, select *Start* / *Help*.
- Release notes – The release notes describe new features of the product, information not included in the manuals, and any changes to the manuals. They are provided as a .pdf file on the *Trimble SPS GPS Receiver CD*.
- Trimble training courses – Consider a training course to help you use your GPS 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).

Your Comments

Your feedback about the supporting documentation helps us to improve it with each revision. E-mail your comments to ReaderFeedback@trimble.com.

<<may add overview info of utilities here. How to get them (CD or web). etc>>

CHAPTER

2

Features and Functions

In this chapter:

Note – A model name is included if the information is specific to a particular GPS receiver.

Trimble SPSx50 GPS receivers are ideal for the following infrastructure development, site development, and marine construction applications:

- Mobile base station for RTK or DGPS applications
- Permanent base station for VRS, RTK, or DGPS applications (SPS550, SPS750, and SPS850 only).

Note – The permanent base station for VRS requires an option to be enabled. For more information, please contact your Trimble dealer.

- RTK rover on rod, backpack, site vehicle, or marine vessel
- Site and marine location applications using OmniSTAR HP or XP corrections
- Site and marine location applications using DGPS RTCM corrections

You can use the SPSx50 GPS receivers with the Trimble SCS900 Site Controller software.

These receivers all feature a keypad and display so you can to configure the receiver without using a a controller or computer. The receivers can all record GPS data to the internal memory, and optionally transfer the data over a USB or serial connection, or download data via an Ethernet connection.

SPS550 features

The SPS550 receivers have the following features:

- Location GPS – Sub-meter DGPS rover and base station capability
- Decimeter accuracy when using RTK corrections by radio link or VRS
- OmniSTAR XP/HP for a base station free service
- Internal 450 MHz (3 frequency bands) radio with transmit and receive capability (SPS550 only)
- WAAS/EGNOS & MSAS Satellite Based Augmentation (SBAS) compatibility
- 24-channel L1/L2 GPS receiver – Single-frequency GPS for DGPS position solution and dual-frequency GPS for OmniSTAR XP/HP and heading solution
- Long-life integrated battery, typically 12 hours operation as a base station or 20 hours as a rover
- Integrated display and keypad for rapid system configuration and status checking, without the need for a controller
- Integrated Bluetooth wireless technology for cable-free configuration and operation with a controller
- Ethernet support so that the receiver can be configured remotely across an Ethernet network or the Internet
- Attached or external radio antenna option for rover or “High Gain” base station operation
- Small, lightweight design – 1.65 kg (3.64 lbs) receiver only, with battery
- Permanent/semi-permanent and mobile quick setup DGPS base station capability
- The ability to broadcast corrections via multiple radio links from one base station receiver (for example, via an internal 450 MHz radio and an external 900 MHz radio)
- Tough aluminum housing
- IP67 environmental rating
- –40° C to +65° C (–40° F to +149° F) operating temperature range
- 9 V to 30 V DC input power range with over-voltage protection

SPS550H features

The SPS550H receivers have the following features:

- Precise Heading Add On GPS receiver
- 24-channel L1/L2 GPS receiver for heading solution
- Long-life integrated battery, typically 20 hours as a rover
- Integrated display and keypad for rapid system configuration and status checking, without the need for a controller
- Integrated Bluetooth wireless technology for cable-free configuration and operation with a controller
- Ethernet support, so that the receiver can be configured remotely across and Ethernet network or the Internet
- Dual-frequency antenna, dual SPS receiver mounting frame, and interconnecting cable
- Small, lightweight design – 1.65 kg (3.64 lbs) receiver only, with battery
- Tough aluminum housing
- IP67 environmental rating
- –40° C to +65° C (–40° F to +149° F) operating temperature range
- 9 V to 30 V DC input power range, with over-voltage protection

SPS750 features

The SPS750 receivers have the following standard features. For features specific to each model, see below.

SPS750 standard features

- Integrated GPS receiver and radio
- 450 or 900 MHz radio with transmit and/or (SPS750 Max only) receive capability
- 24-channel L1/L2 GPS receiver
- OmniSTAR XP and HP service capability
- WAAS/EGNOS (Wide Area Augmentation System/European Geo-Stationary Navigation System), and MSAS Satellite Based Augmentation (SBAS) compatibility
- Rugged, weatherproof construction with an IP67 environmental rating
- –40° C to +65° C (–40° F to +149° F) operating temperature range
- 9 V DC to 30 V DC input power range with over-voltage protection

- Long- life integrated battery, typically >12 hours operation as a base station or >20 hours as a rover
- Operation parameters configured using the WinFlash utility, Trimble SCS900 site controller software, the integrated display and keyboard for system configuration with a controller, or the Web receiver interface
- Integrated Bluetooth wireless technology for cable-free configuration and operation with a controller
- External GPS antenna choice for base station or rover operation
- Attached or external radio antenna option for rover or high-gain base station radio operation
- Small, lightweight design – 1.65 kg (3.64 lbs) receiver only, with battery; 4 kg (8.82 lbs) complete system weight (rover including controller and rod)
- Permanent/semi-permanent and mobile quick setup base station capability
- Backpack, belt, rod, truck, and marine vessel mounting options for rover applications
- Capable of all site measurement and stakeout operations within 1.5 km (SPS750 Basic) and typically >5 km (SPS750 Max)
- Easy-to-use menu system for rapid configuration and status checking
- Autobase for rapid and automated repeated daily base station setups
- IP (Internet Protocol) support, so receivers can be configured and checked remotely over the Internet via an Ethernet port
- The ability to broadcast corrections via multiple radio links from one base station receiver (for example, via an internal 450 MHz radio and an external 900 MHz radio)

<*****the following features are not in the data sheet. Do you want them left here or deleted?>

- Two-line, 16-character VFD (Vacuum Fluorescent Display) display
- CAN (Controller Area Network) support
- For marine applications: Moving baseline and heading capability when combined with an SPS550H GPS receiver or an RTK rover-capable SPSx50 GPS receiver

SPS750 Basic

- Base station only, or Rover only, operation

SPS750 Basic base

- Entry level, low cost RTK base station
- Unrestricted operational range for rovers and grade control systems

- Integrated transmit-only radio

SPS750 Basic rover

- Entry level, low cost RTK rover receiver
- 2 Hz measurement update rate
- 1.5 mile (2.4 km) operational range from the base station
- Integrated receive-only radio
- Ideal for contractors new to GPS as a starter system or for operating multiple small projects
- Easily upgraded to the SPS750 Max
- Rover operates with OmniSTAR HP or XP services, for base station-free rover capability with <30 cm (1 ft) accuracy

SPS750 Max

- RTK base station and rover operation in a single receiver
- Integrated receive/transmit radio
- 5/10 Hz measurement update rate
- Unrestricted rover operation range from a base station
- Operates within a VRS network, for base station-free rover capability

SPS850 features

The SPS850 receivers have the following standard features. For features specific to each model, see below

- Integrated GPS receiver and radio
- 450 or 900 MHz radio with transmit/receive capability
- 72 Channel L1/L2/L2C/L5 GPS plus L1/L2 GLONASS receiver
- OmniSTAR XP and HP service capability
- L1/L2 GLONASS compatibility
- WAAS/EGNOS, and MSAS Satellite Based Augmentation (SBAS) compatibility
- Rugged, weatherproof construction with an IP67 environmental rating
- –40° C to +65° C (–40° F to +149° F) operating temperature range
- 9 V to 30 V DC input power range, with over-voltage protection
- Long- life integrated battery, typically >15 hours operation as a base station or >20 hours as a rover

- Integrated display and keypad for system configuration without a controller
- Integrated Bluetooth wireless technology for cable-free configuration and operation with a controller
- External GPS antenna choice for base station or rover operation
- Attached or external radio antenna option for rover or "High Gain" base station operation
- Small, lightweight design – 1.65 kg (3.64 lbs) receiver only, with battery; 4 kg (8.82 lbs) complete system weight (rover including controller and rod)
- Permanent/semi-permanent and mobile quick setup base station capability
- Backpack, belt, rod, truck, and marine vessel mounting options for rover applications
- Within radio or cellular coverage, full site measurement and stakeout capability
- Rover operation capability within a VRS (Virtual Reference Station) network
- Easy-to-use menu system for rapid configuration and status checking
- Autobase for rapid and automated repeated daily base station setups
- The ability to broadcast corrections via multiple radio links from one base station receiver (for example, via an internal 450 MHz radio and an external 900 MHz radio)

SPS850 Extreme features

Base Station

- Unrestricted operational range for rovers and grade control systems
- Base station and rover operation in a single receiver
- Integrated receive/transmit radio
- Integrated Ethernet and IP capability facilitates base station and receiver configuration over the Internet or via Ethernet connection on a computer network

Rover

- 5/10/20 Hz measurement update rate
- Unrestricted rover operation range from a base station
- Base station-free rover capability within a VRS network
- Base station-free rover capability using OmniSTAR HP or XP services, with <30 cm (1 ft) accuracy
- Ideal for contractors who operate mid to large size projects with machine control

Use and care

The SPSx50 receiver 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.

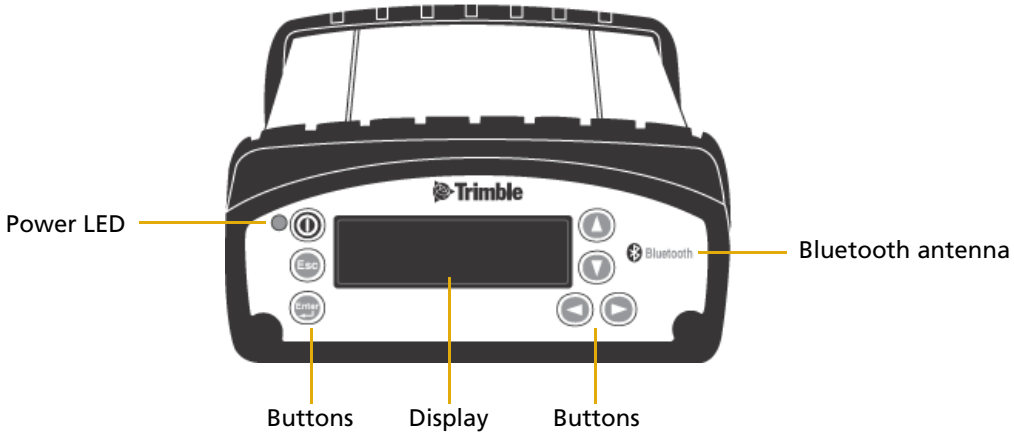
CAUTION – Operating or storing the receiver outside the specified temperature range can damage it. For more information, see Appendix A, Specifications.

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 the SPSx50 receiver: Immediate access to satellite measurements and navigation results is disabled when the receiver velocity is computed to be greater than 1000 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.

Keypad and display

Figure 2.1 shows the front features of the SPSx50 GPS receiver.

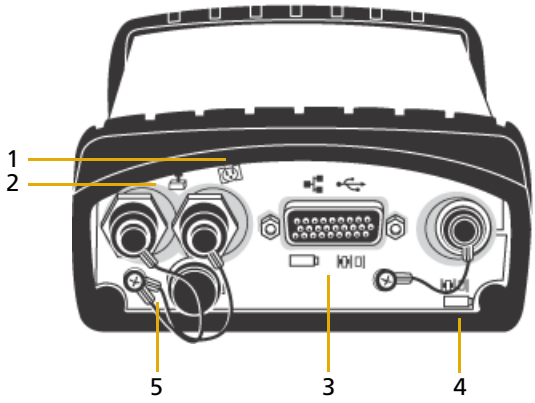


Feature	Description
Display	The receiver has a Vacuum Fluorescent Display. This display allows you to see how the receiver is operating and view the configuration settings.
Buttons	Used to turn on and configure the receiver (see Button functions, page 24).
Power LED	Indicates if the receiver is turned on or off.
Bluetooth antenna	Location of the Bluetooth antenna.

Figure 2.1 Front view of the SPSx50 GPS receiver

Rear connectors

Figure 2.2 shows the rear connectors of the SPSx50 GPS receiver.



	Connector type	Description
1	TNC	Connect to the GNSS antenna
2	• TNC (450 MHz Internal radio) • Reverse polarity TNC (900MHz internal radio) • Not installed, system without internal radio	Connect to the radio antenna
3	High Density DB26	• Ethernet connectivity to a 10/100 Base-T network through an RJ45 jack on a multiport adaptor (P/N 57167) • 'Slave' USB communications through the USB type B connector on the Multiport adaptor (P/N 57167) • 'Host' USB communications through the USB type A connector on the 26-pin to Hirose adaptor (P/N 56653) and Hirose to USB type A cable (P/N 73841001) • Primary power from a Trimble AC/DC power supply (P/N 48800-00) using the multiport adaptor (P/N 57167) • Power input from an SPS700 total station battery cradle system using the adaptor (P/N 56653) • Full 8 wire RS-232 serial communications using the 26-9-pin multiport adaptor (P/N 57168) or a 26-pin serial communications cable • 3 wire RS-232 serial adaptor
4	Lemo (7-pin/ 0-shell)	• 3 wire RS-232 serial communications using a 7-pin/ 0 shell Lemo cable • Secondary power from a Trimble battery (P/N 32364-00 or 32365-00) or a 12 V battery using the Fused Lemo Power Cable (P/N 46125-00) • CAN
5	Vent plug	External venting plug for pressure equalization

Figure 2.2 Rear view of the SPSx50 GPS receiver

Button functions

The SPSx50 has seven buttons on the front panel to control the receiver. Use the buttons to turn the receiver on and off and to check or change the receiver settings.

Button	Name	Function
	Power	Turns the receiver on and off. To turn the receiver off, hold the **Power** button for two seconds.
	Escape	Returns to the previous screen or cancels changes being made on a screen.
	Enter	Advances to the next screen or accepts changes made on a screen.
	Up	Moves the cursor between multiple fields on a screen or makes changes to an editable field.
	Down	Moves the cursor between multiple fields on a screen or makes changes to an editable field.
	Left	Moves the cursor between characters in a field that can be changed.
	Right	Moves the cursor between characters in a field that can be changed. Press this button to enter Edit mode.

Power button operations

Press the Power button to turn the receiver on and off. In addition, you can tap the Power button to return to the Home screen, or hold down the Power button to perform the following operations:

To ...	Hold the Power button for ...	Notes
turn off the receiver	two seconds	The display shows a countdown timer. When the display goes blank, release the Power button.
clear the almanac, ephemeris, and SV information	15 seconds	The display show a countdown timer. When the display goes blank, continue to hold the Power button. The display shows a countdown time to clear the almanac and ephemeris. When the counter reaches 0, release the Power button.

To ...	Hold the Power button for ...	Notes
reset the receiver to its factory defaults and the default application file	30 seconds	The display show a countdown timer to power off. When the display goes blank, continue to hold the Power button. The display show a countdown to clear the almanac and ephemeris. When the counter reaches 0, continue to hold the Power button. The display indicates a countdown to resetting the receiver. When the counter reaches 0, release the Power button.
force the receiver to power down	at least 60 seconds	If the method above does not work, use this method to force the receiver to power down. When the power LED goes off, release the Power button.

Forcing the receiver into Monitor mode

If the receiver will not go into Monitor mode to load new firmware, complete the following steps:

1. Turn off the receiver.
2. Hold down the Esc button while turning on the receiver.
3. Continue to hold the Esc button as the display shows the countdown timer.
4. Once the display shows Remote Monitor Active:1, release the Esc button.

   The receiver is forced into Monitor mode and you can load the new firmware.

CHAPTER

3

Batteries and Power

In this chapter:

The SPSx50 GPS receiver uses an internal rechargeable Lithium-ion battery.

The battery can be replaced only at an Authorized Trimble Service Center.

The receiver can also be powered by an external power source that is connected to the Lemo or modem port.

The operational time provided by the internal battery depends on the type of measurement and operating conditions. Typically the internal battery provides >15 hours operation as a base station and >20 hours as a rover during measurement operations using the internal radio.

<<I've entered the information from page 1 of the datasheet in the first part of the sentence, above - however, the operating hours on p 3 are not specified in the datasheet yet, so not sure whether this is correct. Rob says that Nick will provide information.>

<<Product team. Please check number of hours listed here against number of hours listed in the Tech. Specs. chapter. Different numbers. Needs clarification>>

<<Note to Product team: All warnings need to be repeated in Safety Information chapter. Sorry for the duplication but it is part of our legal requirements.>>

External power

The external power source is always used in preference to the internal batteries. When there is no external power source connected, or if the external power supply fails, the internal battery is automatically used. In this way the internal battery acts as an uninterruptible power supply covering times of power failure. The internal battery will only charge from an external power source which delivers more than 15 volts, for example, an AC power adaptor.

During static measurement data logging, if no external power is supplied and the internal battery is drained, the receiver will switch off. However, all collected data is secure. If the receiver is operating as a base station when this happens, the receiver will power down and stop transmitting corrections. When power is restored to the receiver, it will resume operation in the same status that it was in when power was lost, using the same settings as before the shut down.

Battery performance

Batteries perform best when they are not used in extreme temperature conditions. The receiver is designed to be used in operating temperatures of –40 °C to +65 °C (–40 °F to +149 °F). However, extremely cold temperatures of less than 0 °C (32 °F) can cause the battery life to quickly drop. Do not expose the receiver to storage temperatures outside the range –40 °C to +70 °C (–40 °F to +158 °F).

To protect the battery from deep discharge (5 V or less), the receiver is designed to switch power sources or cease drawing power when the battery pack discharges to 5.9 V. A battery that has reached the deep discharge level cannot be recharged and must be replaced. The following recommendations provide optimal performance and extend the life of your batteries:

- Fully charge all new batteries before use.
- Do not allow the batteries to discharge below 5 V.
- Keep all batteries on continuous charge when not in use. Batteries may be kept on charge indefinitely without damage to the receiver or batteries.

Battery safety

The receiver is powered by a rechargable Lithium-ion battery. Charge and use the battery only in strict accordance with the instructions below.

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.

Battery charging and storage

All battery types discharge over time when they are not being used. Batteries also discharge faster in colder temperatures. If a Lithium-ion battery is to be stored for long periods of time, make sure it is fully charged before storing and re-charged at least every three months.

The SPSx50 receiver has an integrated Lithium-ion battery and the charging circuitry is integrated into the receiver. The battery is charged when it is connected to a power source delivering greater than 15 V. The receiver is supplied with a mains power supply unit that recharges the battery inside the receiver when it is connected through the adapter 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 cabin, Trimble recommends that you use this power supply at all times to keep the internal battery charged. This provides an uninterrupted power supply during mains power outages and will keep the site operational for more than 10 hours after a power failure.

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 with 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.

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.

The internal battery charges fully in 8 hours when connected to a suitable power source.

Disposing of the rechargeable Lithium-ion battery

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

After you remove the Lithium-ion battery, discharge it fully before disposing of it. When disposing of the battery, be sure to do so in an environmentally sensitive manner. Adhere to any local and national regulations concerning battery disposal or recycling.

Operating with the controller or laptop computer

During operation, the controller will typically be connected to the receiver using the Bluetooth cable free connection. Where a serial connection is used, the receiver delivers no power through its communications ports to the controller, which must have its own source of power in order to operate.

CHAPTER

4

Setup Guidelines

In this chapter:

This chapter introduces the concepts of base station and 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.

Base station operation guidelines

For all GPS Real-Time Kinematic (RTK) operations, you require both a base station and a rover.

RTK operation provides centimeter-level accuracy by eliminating errors that are present in the GPS system. A receiver placed at a known position (the base station) tracks the satellites that are being tracked by the rover receiver, at the same time that the rover is tracking them. Errors in the GPS system are monitored at the fixed (and known) base station, and a series of position corrections are computed. The corrections are sent through a radio link to the rover receiver, where they are used to correct the real time positions of the rover.

This section discusses the base station component and its role in providing an RTK solution.

Base station components

The base station has the following components:

- GPS receiver
- GPS antenna
- base station radio
- power supply

GPS receiver and GPS antenna

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

- A Smart GPS antenna, such as the SPSx80 receiver, incorporates a GPS receiver, GPS antenna, power supply, and base station 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 GPS receiver, such as the SPSx50 receiver, incorporates a GPS receiver, power supply, and base station radio in a single unit. The GPS antenna and, optionally, the base station radio antenna is separate from the receiver. Because the GPS antenna is separate, you can use the following optimized components:
  - a geodetic antenna with large ground plane, to eliminate multipath (the major source of GPS 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 GPS 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 GPS 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 GPS system.
- Place the GPS antenna in a location that has a clear line of sight to the sky in all directions. Do not place the GPS antenna near vertical obstructions such as buildings, deep cuttings, site vehicles, towers, or tree canopy.
- Place the radio antenna as high as practical. This minimizes multipath from the surrounding area, and enables the radio to broadcast to the maximum distance.

Note – *The radio 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 GPS receiver does not lose power. The GPS receiver has an integrated battery, which has to be charged. To operate for the full day without loss of power at the base station, provide external power. Sources of external power include:
  - AC power
  - 12 V car or truck 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 power outages. When the GPS receiver is connected to a power source greater than 15 V, the integrated battery is continuously charged from the connected power source. This helps to ensure that the battery stays charged.
- Do not locate a GPS receiver, GPS antenna, or radio antenna within 400 meters (about 1312 feet) of:
  - a powerful radar, television, or cellular communications tower
  - another transmitter
  - another GPS antenna

Cellular 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 cellular 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 GPS 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 GPS 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 SPSx50 Modular GPS receiver or SPS770 GPS 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 65 °C (149 °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 GPS 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, dry the equipment with a clean dry cloth, and leave the equipment open to the air to dry. Do not lock wet equipment in a transport case for prolonged periods. Avoid exposing the GPS 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 GPS 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.

Permanent installation antenna cabling for the SPSx50 Modular GPS receiver and SPS770 GPS receiver

Many permanent base station installations have unique cabling requirements. Depending on the available infrastructure, you may need to mount the antenna a considerable distance from the receiver.

The SPSx50 and SPS770 can withstand a loss of 12 dB between the GPS antenna and the receiver. The degree of loss in a coaxial cable depends on the frequency of the signal passing through it. Table 4.1 lists some common cable types and the maximum length you can use before an inline amplifier for GPS frequencies is required.

Table 4.1 Maximum cable lenghts

Cable type	Maximum length (for use without an inline amplifier)
RG-214	30 m (100 ft)
LMR-400	70 m (230 ft)
LMR-500	85 m (280 ft)
LMR-600	106 m (350 ft)
Heliax LDF4/50	165 m (540 ft)
Heliax LDF4.5/40	225 m (740 ft)

Rover receiver operation guidelines

The second part of the RTK GPS system is the rover receiver.

The rover receiver is mounted on a pole, vehicle, marine vessel, or in a backpack, and 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 Virtual

Reference Station (VRS™) system. The connection is provided by an integrated radio, a cellular modem in the controller, or through an external cellular phone that is connected to the receiver either by Bluetooth wireless technogy or by means of a cable.

The correction stream for some other positioning solutions, such as SBAS (WAAS/EGNOS, MSAS) and the OmniSTAR XP or HP service[1], is broadcast through geostationary satellites, and detected by the GPS antenna itself. No integrated radio or base station is required.

Rover receiver components

The rover receiver has the following components:

- GPS receiver
- GPS antenna
- Optional integrated radio receiver and antenna for RTK operations
- Optional items for the different mounting options (see below)

In most rover applications, the receiver operates entirely from its own integrated battery unit. On a vehicle or on a marine vessel, however, an external power supply can be used. Use an external power supply if one is provided. The internal battery then acts as a uninterruptible power supply, covering any power outages.

Choose a rover receiver according to the application and the use case:

1. A Smart GPS antenna, such as the SPSx80 GPS receiver, 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.
2. A Modular GPS receiver, such as the SPSx50 GPS receiver, incorporates the GPS receiver, receive radio, and power supply into a single unit. The GPS antenna and, optionally, the receive radio antenna, is separate from the receiver. When you use a modular receiver as a rover, you can use optimized components placed in the best locations for your application. For example:
   - A small, lightweight rover antenna can be mounted on a pole or backpack; placed in a high, inaccessible location on a marine vessel mast or cabin; or placed on a site vehicle roof or truck bed.
   - A rubber duck radio antenna, or an external radio antenna, can be mounted on a vehicle or vessel roof to provide maximum coverage.

   A Modular GPS receiver can be placed in a location that is both easily accessible and safe from theft and the weather. The antennas can be placed high on a vehicle or vessel roof, clear of obstructions and able to deliver maximum performance.

1. OmniSTAR is only available with the SPSx50 Modular GPS receiver.

Rover receiver setup guidelines

For good rover operation, observe the following setup guidelines:

- Place the GPS 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. GPS rovers and the base station receive the same satellite signals from the same satellites: if you obscure the signals at times, the system will be unable to provide RTK Fixed positions.
- Place the GPS and radio antennas as high as possible to minimize multipath from the surrounding area. The receiver must have a clear line of sight to the sky at all times during operation.
- GPS 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 or location improves. Use GPS planning software to identify the daily best and worst satellite coverage times for your location, and then choose measurement times that coincide with optimal GPS performance. This is especially important when operating in the worst GPS locations.
- The SPS850 Extreme and SPS880 Extreme GPS receivers have the ability to track the GPS modernization signals L2C and L5, and the GLONASS satellite constellation. These signals help you to get positions at the worst times of the day and in the worst GPS locations, but do not guarantee that you will.
- To get a fixed position solution with centimeter accuracy, initialize the rover receiver. For initialization to take place, the receiver must track at least five satellites that the base station is also tracking.
- 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 base and rover receivers must also be maintained.
- Loss of the satellite signals or loss of the radio link results in a loss of centimeter position accuracy. From Fixed, the receiver changes to Float or Autonomous mode:
  - In Float mode, the rover has connection to the base station through a radio, but has not yet initialized.
  - In Autonomous mode, the rover has lost radio contact with the base station receiver, and is working by itself with the available GPS signals.
- On a vehicle or marine vessel, place the GPS antenna in a location as free from shock and vibration as possible. For the modular receivers, a single magnetic mount is normally sufficient to hold the antenna in a suitable location, whereas for the larger smart antenna, a triple magnetic mount is normally recommended. Alternatively, a 5/8 thread bolt in a suitable location on the roof bars, or a door mounted pole bracket is a good option.

- To mount the modular receiver on a pole use the pole mounting brackets (2) and a second tripod clip (P/N 571 204 300) as shown below.

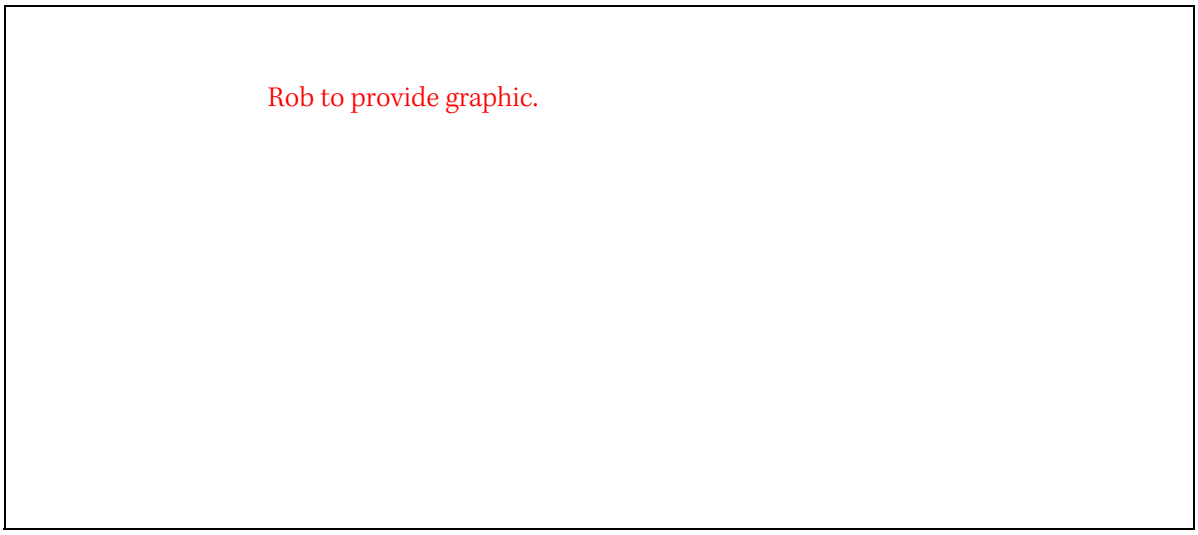


Figure 4.1 Rod mount for modular receiver

To mount the modular receiver on a marine vessel use the receiver bracket (P/N 56830-00**)**. The receiver bracket allows two receivers to be mounted together for marine moving base and heading applications (see chapter XXX Page XXX)

- Make sure the rover receiver does not lose power. The rover receivers are typically powered from their internal batteries all day. The batteries in the SPSx80 receiver can be changed when flat. The battery in the SPSx50 receiver cannot be changed, but it last longer than a day (see Chapter 10, Specifications). If you do not use the rover receiver very often, ensure that it is charged at least every three months. For vehicle operation or marine vessel operation, Trimble recommends that you use an external power source so that the internal battery can be saved for times when the receiver is being used off the vehicle or vessel.
- Avoid locating the receiver or antenna within 400 meters of powerful radar, television, cellular communications tower, or other transmitters or GPS antennas. Low-power transmitters, such as those in cell phones and two-way radios, normally do not interfere with receiver operations. Cell towers can interfere with the radio and can interfere with GPS signals entering the receiver. High-power signals from a nearby radio or radar transmitter can overwhelm the receiver circuits. This does not harm the receiver, but it can prevent the receiver electronics from functioning correctly.
- Do not use the rover receiver directly beneath or close to overhead power lines or electrical generation facilities. The electromagnetic fields associated with these utilities can interfere with GPS 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
- Trimble recommends that wherever possible all GPS receiver equipment is protected from rain or water ingress. The receivers are designed to withstand all wet weather conditions, however keeping the receivers dry prolongs the life of the equipment and reduces the effects of corrosion on ports and connectors. If the equipment does get wet, dry the equipment with a dry cloth, and leave the equipment open to the air to dry. Do not lock wet equipment in a transport case for prolonged periods. Avoid exposing the GPS receiver to corrosive liquids and salt water wherever possible.
- When using the rover receiver in open spaces, Trimble recommends that you stop work during electrical storms where the risk of lightning strike is high.
- Where cables are involved, Trimble recommends that you use cable ties to secure the cables to the rod or other equipment to avoid inadvertent snagging while moving about the jobsite. Be careful not to kink, twist, or unnecessarily extend cables, and avoid trapping them in car doors or windows. Damage to cables can reduce the performance of GPS equipment.

Internal radio setup for rover operations

The internal radio of the SPS GPS receiver is delivered with the TX radio frequencies preprogrammed into the receiver. To add more RX radio frequencies, use the WinFlash utility (see Appendix C, Adding Internal Radio Frequencies).

Once the radio frequencies are configured, use the SCS900 software to select channel frequencies during base station or rover setup operations.

For more information, refer to the the WinFlash Help, or the *SCS900 User Guide*.

External radio setup

To use an external radio with the SPS770 GPS receiver, you need an external power source for the radio.

To set up the receiver using an external radio:

1. Connect one end of the yellow GPS antenna cable to the yellow TNC port on the receiver.
2. Connect the other end of the GPS antenna cable to a Zephyr or Zephyr Geodetic antenna.
3. Connect the external radio to Port 3 on the receiver.

4. Connect a radio antenna to the external radio as shown in the following figure..

Figure 4.2 Connecting an external radio

5. Connect an external power source to Port 2 on the receiver.

Note – *External rover radios must have their own power source because the internal Lithium-Ion batteries do not supply enough voltage. Alternatively, supply external power to port 2 of the receiver, and enable power out on port 3.*
Base radios must have their own power source because of their high power consumption.

Cellular modem and external radio

Instead of the internal radio, you can use a cellular modem or an external radio as your data communications link.

To connect a cellular modem to an SPSx80 Smart GPS antenna, you need the following:

- SPSx80 Smart GPS antenna.
- One of the following:
  - TSC2 controller with CompactFlash card cellular modem, for example, a Audiovox modem card
  - Cellular modem or a cellphone that can transmit data
- Serial (cellphone to DB9) cable (supplied with the cellular modem or phone).
- Port 2 of the SPSx80 supports full RS-232 protocol, and should function properly with most cellular phone cables. Some cellular units may require custom cabling.

  Alternatively, the receiver also supports a cable-free Bluetooth connection with Bluetooth enabled cell phones.

For more information on using a cellular modem as a data link, refer to the *SCS900 User Guide*.

CHAPTER

5

Setting up the Receiver

- Connecting the receiver to external devices
- Common ways to set up a base station
- Common ways to set up a rover receiver
- Setting up a pair of SPSx50 GPS receivers to provide heading

Connecting the receiver to external devices

You can connect an SPS GPS receiver to the following external devices:

- a Trimble controller running Trimble SCS900 Site Controller software
- an external radio-modem
- HYDROpro™ software

Trimble controller with SCS900 Site Controller software

To connect a Trimble controller that is running the SCS900 Site Controller software to an SPS GPS receiver, use Bluetooth wireless technology (for all except the SPS770 Modular GPS receiver) or a serial cable. Table 5.1 shows how to connect the cables for each combination of SPS GPS receiver and Trimble controller.

Table 5.1 Connecting to a Trimble controller running the SCS900 Site Controller software

Controller	Cable connectors	Connect this cable to ...	Part number
SPSx50 Modular GPS receiver			
TSC2	DB9	TSC2	32960
	Lemo	SPSx50	
TCU	6-pin Hirose	TCU	53004007
	Lemo	SPSx50	
TSCe	Lemo	TSCe	31288-*xx*
	Lemo	SPSx50	This cable is available in different lengths. The -*xx* indicates the length of the cable, in meters.
ACU	4-pin Hirose	ACU	44147
	Lemo	SPSx50	
SPS770 Modular GPS receiver			
TSC2	DB9	TSC2	32960
	Lemo (Port 1)	SPS770	
TCU	6-pin Hirose	TCU	53004007
	Lemo (Port 1)	SPS770	
TSCe	Lemo	TSCe	31288-*xx*
	Lemo (Port 1)	SPS770	This cable is available in different lengths. The -*xx* indicates the length of the cable, in meters.
ACU	4-pin Hirose	ACU	44147
	Lemo	SPSx50	
SPSx80 Smart GPS antenna			
TSC2			
TCU			
TSCe			

Table 5.1 Connecting to a Trimble controller running the SCS900 Site Controller software

Controller	Cable connectors	Connect this cable to ...	Part number
ACU			

External Radio Modems

SPSx50 receiver

The most common data link for Real-Time Kinematic (RTK) operation is a radio. The SPSx50 receiver is available with the following internal radios:

- 410–430 MHz (Tx/Rx, Rx only, or Tx only)
- 430–450 MHz (Tx/Rx, Rx only, or Tx only)
- 450–470 MHz (Tx/Rx, Rx only, or Tx only)
- 900 MHz (Tx/Rx, Rx only, or Tx only)

Note – *"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 SPSx50 receiver does not have an internal transmit radio, or you want to connect to higher power or to a secondary external transmit radio or cellular phone, use the 26-pin port, the Lemo port, or Bluetooth wireless technology.

The SPSx50 receiver supports the following Trimble base radios:

- TRIMMARK 3
- Trimble SNB900
- Trimble PDL450
- Trimble HPB450

The SPSx50 receiver also supports third-party transparent radios and third-party cellular modems.

When used with an SPSx50 GPS receiver, most external radios require an external power source. Only the Trimble SNB900 radio-modem has an internal battery and does not require external power.

Configure the external radio separately, using either the configuration program for the external radio or the radio display and keypad.

To configure the SPSx50 for RTK operation, follow the base setup procedure to set the following parameters:

- Set the base station coordinates
- Enable the RTCM or CMR+ corrections stream on the selected serial port

For more information, see Chapters 5 and 7, and the SCS900 Site Controller Software User Guide <UPDATE CROSS-REF>.

SPS770 Modular GPS receiver

The most common data link for Real-Time Kinematic (RTK) operation is a radio. The SPS770 receiver is available with the following internal radios:

- 410–430 MHz (Rx only)
- 430–450 MHz (Rx only)
- 450–470 MHz (Rx only)

Note – *"Rx" indicates that the receiver receives corrections.*

The SPS770 GPS receiver does not have an internal transmit radio. To broadcast corrections, connect the receiver Lemo port (Port 3) to an external transmit radio or a cell phone.

The SPS770 receiver supports the following Trimble base radios:

- TRIMMARK 3
- Trimble SNB900
- Trimble PDL450
- Trimble HPB450

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

To use an external radio with the SPS770 receiver, you need an external power source for the radio—except for the SNB900. The SNB900 radio contains an internal battery. Use the external radio's configuration program, or display and keypad, to configure the radio modem separately.

For more information, see Chapters 5 and 7, along with the SCS900 User Guide <UPDATE CROSS-REF>

SPSx80 Smart GPS antenna<this section needs to be updated for the x80. Copied from the SPS770>

The most common data link for Real-Time Kinematic (RTK) operation is a radio. The SPS770 receiver is available with the following internal radios:

- 410 – 430 MHz (Rx only)
- 430 – 450 MHz (Rx only)
- 450 – 470 MHz (Rx only)

Note – *Rx indicates that the receiver receives corrections.*

The SPS770 receiver does not have an internal transmit radio. To broadcast corrections, connect the receiver Lemo port (Port 3) to an external transmit radio or a cellphone.

The SPS770 receiver supports the following Trimble base radios:

- TRIMMARK 3
- Trimble SNB900
- Trimble PDL450
- Trimble HPB450

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

To use an external radio with the SPS770 receiver, you need an external power source for the radio—except for the SNB900. The SNB900 radio contains an internal battery. Use the external radio's configuration program, or display and keypad, to configure the radio modem separately.

For more information, see Chapters 5 and 7, along with the SCS900 User Guide <UPDATE CROSS-REF>

Common ways to set up a base station

The following sections describe how to set up a base station in different ways depending on the application, coverage area, degree of permanence versus mobility, and available infrastructure.

Setting up a base station for permanent or semi-permanent installation

For construction applications, where machine and site positioning operations using GPS will be carried out over a long time (weeks, months, or years), ensure that you carefully choose the base station location.

The degree of permanence of the setup increases with the expected duration of operational requirements. The more assets that use the base station as a source of corrections, increases the cost of any base station downtime, and increases the requirements for a permanent base station setup. Providing a semi-permanent or permanent setup can also reduce potential sources of error over time caused by repeated daily setup and the potential to put the GPS antenna in the wrong place (that is, not at the original location).

On the largest and longest operational jobsites, the permanent or semi-permanent installation is the most common solution. In these cases it is most common to find the SPSx50 Modular GPS receiver or the SPS770 Modular GPS receiver used as the base station. In these installations, the GPS receiver is located typically in a site office or trailer where it is easy to access to check or configure, and where it is secure from theft

and the weather. The GPS and radio antennas are normally mounted on a permanent structure on the roof of the building, where they are high and clear from obstructions and where the radio antenna can provide the maximum range of operation.

The GPS antenna used is most commonly the Zephyr Geodetic – Model 2 antenna, which has a large ground plane that eliminates multipath, providing the best GPS performance at the base location. The antennas are connected to the receiver by high quality RF cables.

The receiver is connected to a permanent power supply (mains or generator power). The internal battery of the receiver is always being charged, and acts as an uninterruptible power supply if there is a power outage. In some cases, the receiver may also be connected by an Ethernet cable to the Internet, so that it can be monitored and configured from a remote location, and warn an administrator by e-mail or text message if there is a change to the configuration. In these situations, the receiver can transmit GPS RTK corrections to a remote radio or receiver over the Internet for rebroadcast requirements without using repeaters.

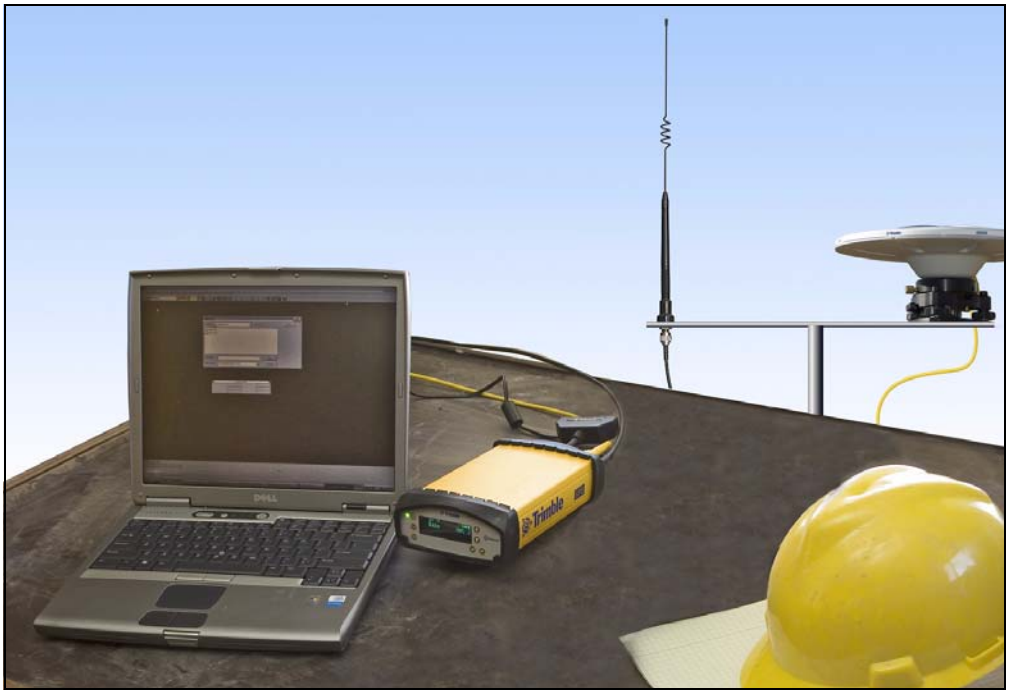


Figure 5.1 SPSx50 receiver permanent installation

Setting up a Base Station for Daily Site Use: T-Bar

For construction applications where a daily setup and takedown of equipment is required for security reasons, Trimble recommends that you use a T-Bar setup.

The T-Bar consists of a post mounted in concrete (so it cannot move), which has a solid metal Bar T piece mounted to it to provide lateral separation between the GPS antenna and radio antenna. The T piece of the T-Bar will have vertical rods at either end, terminating in a 5/8 thread to which the antennas can be mounted. Trimble

recommends that each end is clearly marked ***GPS*** and ***Radio*** respectively, to ensure that at each daily setup the GPS and Radio antennas are mounted at the same location. Switching antennas by mistake introduces a position error in all resulting measurements. The equipment required to fabricate a T-Bar can be purchased in any reputable hardware store. Take care to ensure that the T-Bar cannot rotate after construction. Rotation of the T-Bar can introduce a position error into all subsequent measurements.

On the upright post, either mount a bracket to which the GPS receiver can be mounted, or place a lock box with ventilation on the post, in which the GPS receiver itself can be secured.

Each day, mount the GPS antenna on the GPS end of the T-Bar and the radio antenna on the Radio end of the T-Bar. Connect the Radio and GPS Antenna to the receiver using the appropriate cables. In these scenarios, the receiver will operate from its own integrated battery or from an external 12 V battery through use of the 12 V crocodile clips cable provided with the receiver. If AC power is available, this can be used, however the heat generated by the charging process and the radio transmitter increases the need for good ventilation around the receiver to dissipate the heat.

In these scenarios an SPSx80 smart GPS antenna is also often used, in which case the receiver only needs to be mounted on the T-Bar and optionally connected to an external battery or radio unit.

The benefit of the T-Bar setup is that it is easy to ensure that the base station is set up daily in the exact same location each day in terms of position and height, that will eliminate the errors typically associated with daily setup on a tripod (wrong antenna heights, not setup over the point, setup in the wrong location etc.)

Figure 5.2 System set up on a T-bar

Setting up a Mobile Base Station: Tripod and Fixed Height Tripod

For construction applications where you are repeatedly moving between jobsites, or you are visiting a jobsite for the first time before a T-bar or similar setup can be established, 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 setup over a control point. In these situations, you need to take great care to ensure that the GPS antenna is set up accurately over the control point, and that the GPS 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). It is also more important for operators using these types of setup to check in, at one or more known locations, on starting the rover receiver to check for possible position or height errors before starting work. Checking in at a known location is good practice and can avoid costly errors caused by a bad setup.

The tripod and fixed height tripod method, typically does not give a significant height clearance above the ground, and can result in reduced range of operation caused by radio limitations.

Tripod Setup

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

1. Mount the GPS antenna on the tribrach adaptor.
2. If you are using a SPSx80 smart GPS antenna, use the 25 cm spacer rod provided with the SPSx80 base station accessory kit to allow the radio antenna in the receiver to clear the head of the tripod.
3. Clip the GPS receiver to the tripod (SPSx50 Modular GPS receiver and SPS770 GPS receiver).
4. Connect the GPS antenna using the appropriate cable (SPSx50 Modular GPS receiver and SPS770 GPS receiver).
5. If necessary, connect the GPS receiver to an external 12 V power supply using the crocodile clip cable or the Trimble custom power pack.

Figure 5.3 Tripod and tribrach setup for the SPSx50 Modular GPS receiver and SPSx80 Smart GPS antenna

Fixed Height Tripod Setup

Using a fixed height tripod, the setup is similar to that of the tripod setup, however the setup is simplified by the central leg of the tripod, that is placed directly on the control point. Provided the central leg is leveled accurately, the fixed height tripod is quick and easy to set up, and provides an easy and accurate means of measuring the true antenna height.

1. Set up the tripod over the control point.
2. Attach the GPS antenna to the head of the tripod
3. When using a high-gain external radio antenna, mount the radio antenna to the radio antenna bracket, which is attached to the head of the tripod beneath the GPS antenna. See Figure 5.4.
4. If you are using theSPSx50 Modular GPS receiver, you can hook it to the center leg of the tripod using the tripod clip.
5. If you are using the SPSx80 Smart GPS antenna, you can mount the antenna using the 25 cm spacer rod (supplied with the SPSx80 Base Station Accessory kit) so that the radio antenna clears the head of the tripod.

Figure 5.4 Fixed height tripod setup for the SPSx50 Modular GPS receiver and SPSx80 Smart GPS antenna

Common ways to set up a rover receiver

This section describes how to set up a rover receiver in different ways depending on the application. The components that make up a rover receiver are:

- GPS receiver
- GPS antenna
- Controller/Computer
- Rod mounting equipment including a rod, receiver bracket, and controller bracket
- Vehicle mounting equipment including a suction cup and ball joint, extension arm, controller bracket, magnetic antenna mount, and necessary cables.
- Backpack equipment including backpack and antenna-mounting rod
- Marine vessel mounting equipment including receiver bracket, cables, antenna, and radio antenna brackets.

Setting up the rover receiver on a jobsite vehicle

CAUTION – This solution is suited for off road use while operating a vehicle on a jobsite. This setup is not recommended, or designed, for on road use while driving a vehicle at speed in traffic.

To use the receiver as a vehicle-mounted rover receiver, set up the equipment as follows:

1. Do one of the following depending on your receiver:
   - For the SPSx50 or SPS770, mount the GPS antenna for the receiver on the roof of the vehicle, using either a single magnetic mount or a 5/8 thread attached to the roof bars.
   - For the SPSx80, mount the receiver to the roof of the vehicle using either a triple magnetic mount or a 5/8 thread bolt attached to the roof bars.
2. For the SPSx50 or SPS770, run the GPS antenna cable for the receiver into the vehicle either through a rubber grommet in the roof, or through the passenger door window, which needs to be left slightly open during operation.
3. For the SPSx50 or SPS770, place and secure the GPS receiver in a convenient location in the vehicle.

   The GPS receiver can be controlled via the controller connected using Bluetooth wireless technology (cable free) (SPSx50 or SPSx80) or a cable connected to a port on the receiver (SPS770).

The receiver needs to be accessed only to turn it on at the start of each measurement session. It may be more convenient if the SPSx50 is placed in a location where the vehicle operator can see the keypad and display, to monitor receiver status and to configure settings as required. Most receiver capability can be controlled using the SCS900 controller software.

4. Attach the suction cup to either the front windscreen, dashboard, or other convenient location in the vehicle making sure that it does not obstruct the drivers view.
5. Attach the RAM extension arm to the suction cup, and the controller bracket to the RAM extension arm.
6. Lock the controller into the controller bracket, and adjust the bracket until the controller is in the most convenient location. Make sure that the controller does not restrict visibility through the front windscreen during vehicle use.
7. Lock the brackets so that the controller is held securely. If required, connect either the GPS receiver or the controller to in vehicle power supplies as needed.

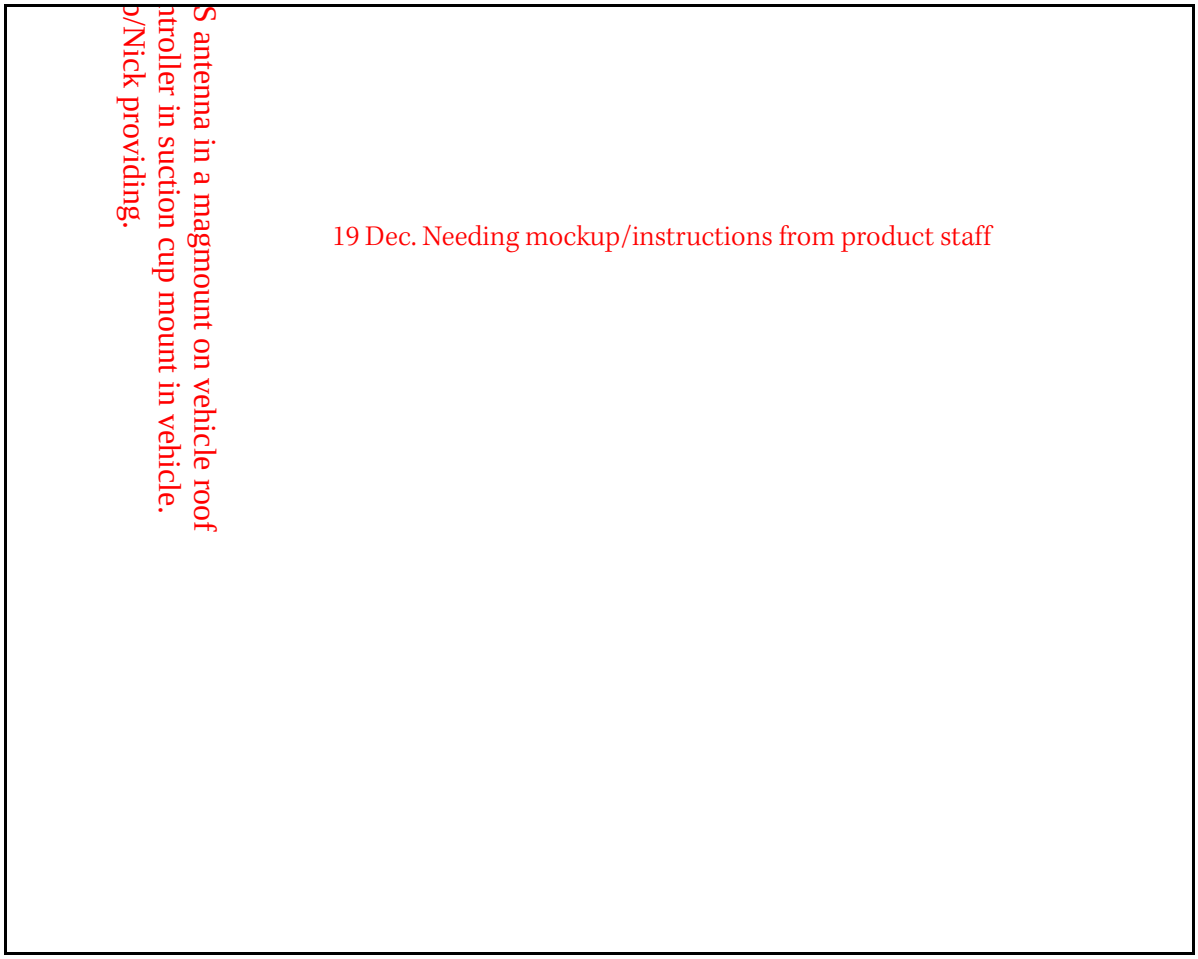


Figure 5.5

Setting up the rover receiver on a rod

For rod-based operation, mount the SPSx50 Modular GPS receiver or SPS770 Modular GPS receiver using the two rod brackets as follows:

19 Dec. With Vanessa.

SPSx50 Rover ISO.jpg

1. Mount the two rod brackets on the rod.
2. Tighten the uppermost of the two making sure that it is at a convienent height for the receiver.
3. Place the receiver into the slot in the rod bracket, and secure it with the tripod clip.
4. Lower the lower of the two rod brackets over the second tripod clip on the receiver, and tighten onto the rod. The receiver is held in place between the two brackets.
5. Mount the controller into the controller bracket as shown <?>.
6. Attach the GPS antenna to the top of the rod using the 5/8 thread.
7. Connect the receiver to the GPS antenna using the antenna cable.

For rod-based operation, mount the SPSx80 Smart GPS antenna as follows:

1. Mount the receiver to the top of the rod using the 5/8-11 thread in the base of the SPSx80.
2. Mount the controller into the controller bracket as shown <?>.
3. The SPSx80 and controller will communicate through Bluetooth wireless technology. However, if a cable is required, connect the cable between the controller and receiver (see Figure 5.6 through Figure 5.8). **<<I NEED TO KNOW WHICH CABLES SO VANESSA CAN ILLUSTRATE CORRECTLY>>**

Figure 5.6 Connections for a rover SPSx80 setup, a TSC2 or TCU controller, and a 450 Mhz base station

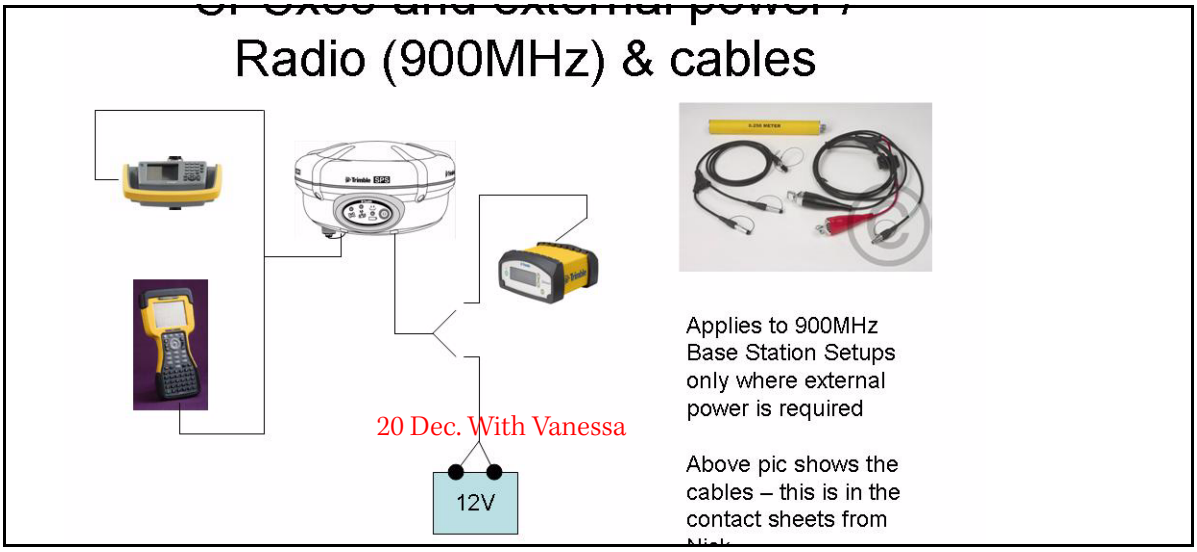


Figure 5.7 Cabled connections for a SPSx80 setup, a TSC2 or TCU controller, and a 900 Mhz base station (with external power)

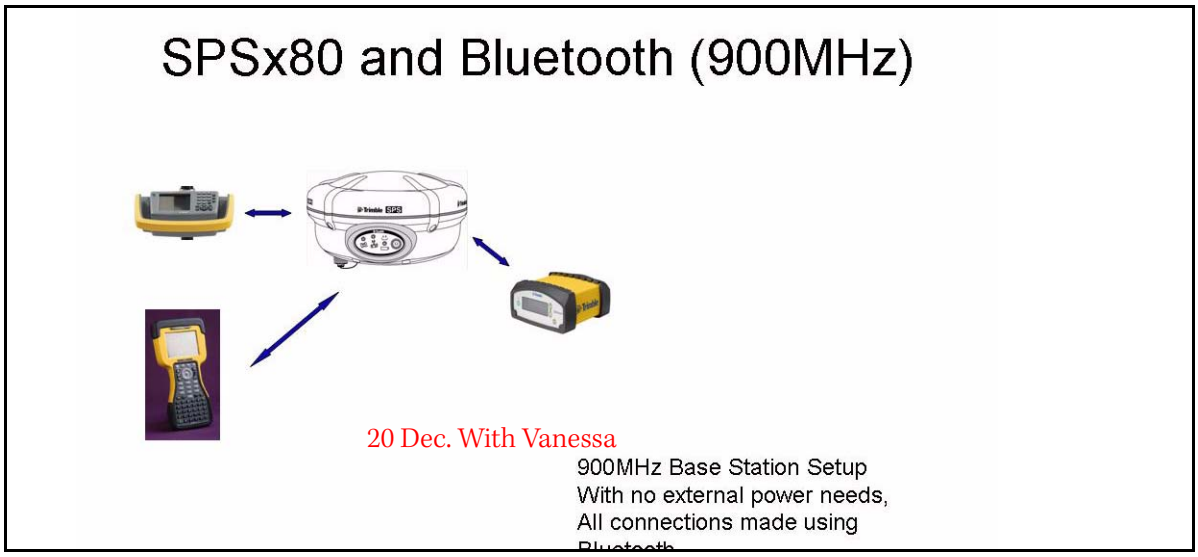


Figure 5.8 Cable-free connections using Bluetooth wireless technology for a rover SPSx80 setup, a TSC2 or TCU controller, and a 900 Mhz base station (with no external power)

Setting up a rover receiver on a belt or in a backpack

The receiver can be work on a belt or carried in a backpack to eliminate weight from the pole as needed. When you wear the receiver on a belt, ensure that the display is always visible so that you can easily check the status of the receiver. If you carry the receiver in a backpack, you should use an external radio antenna mount to allow for optimal radio signal reception. If you use a low gain antenna mounted directly on the receiver in a backpack, it may affect the radio signal reception thereby reducing the likelihood of obtaining an RTK Fixed solution.

Setting up a pair of SPSx50 GPS receivers to provide heading

The SPS550H receiver is permanently in Heading mode and, when combined with a suitable Trimble receiver, provides GPS heading. Other SPSx50 GPS receivers can be used for heading only if they can operate in Heading mode (see Configuring the receiver pair, page 64).

The SPS550H is a dual-frequency GPS receiver with a dual-frequency antenna, but it does not operate as a stand-alone DGPS receiver. To compute a true north heading and to be capable of positioning, the receiver requires an output message from another SPSx50 receiver. To determine the precise vector between two moving objects, pair the SPS550H heading add-on with any one of the following SPSx50 receivers:

- SPS550
- SPS750 Max
- SPS850

Connect the antenna on the SPS550H to the other SPSx50 receiver to determine the precise GPS heading between the two antennas. The SPS550H GPS receiver displays the heading on the two-line display, and outputs the heading data in NMEA or binary format.

Tip – To create a single, compact GPS position and heading unit, use the mounting frame provided to stack the SPS550H GPS receiver on top of another SPSx50 GPS receiver. See below. Use the Marine Heading Cable (P/N 57169) provided.

The Moving Baseline RTK positioning technique

In most RTK applications, the reference receiver remains stationary at a known location and the rover receiver can move. However, Moving Baseline RTK is an RTK positioning technique in which both reference and rover receivers can move about. Moving Baseline RTK is useful for GPS applications that require vessel orientation.

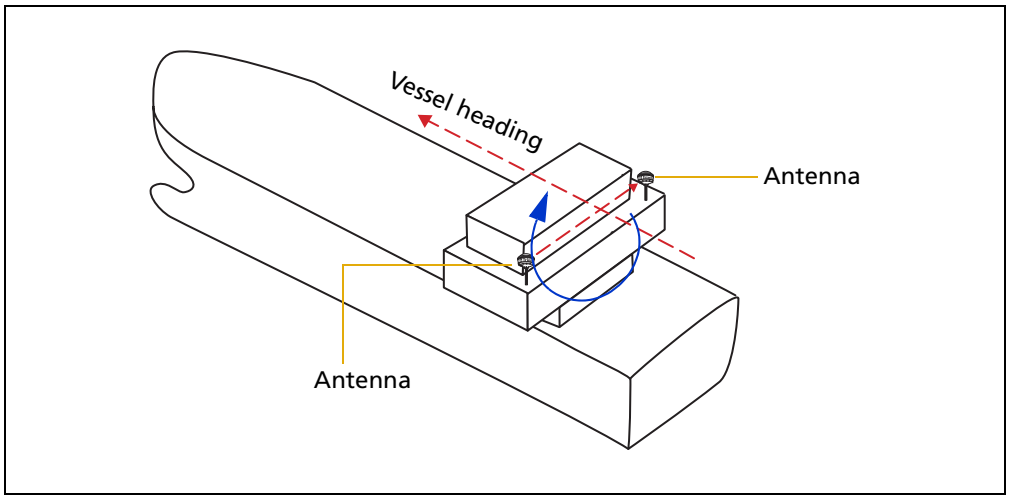


Figure 5.9 Vessel heading from Moving Baseline RTK

With Moving Baseline RTK, the reference receiver broadcasts Compact Measurement Record (CMR) data every epoch, while the rover receiver performs a synchronized baseline solution at 10 Hz. The resultant baseline solution has centimeter-level accuracy. To increase the accuracy of the absolute location of the two antennas, the Moving Reference receiver can use differential corrections from a static source, such as a shore-based reference station.

Mounting a pair of SPSx50 GPS receivers

To obtain a position and heading solution, you need to connect two SPSx50 receivers to make one compact unit. A mounting bracket and interconnecting cable is supplied with the SPS550H receiver. Set up the receivers, antennas, and cables as shown in Figure 5.2.

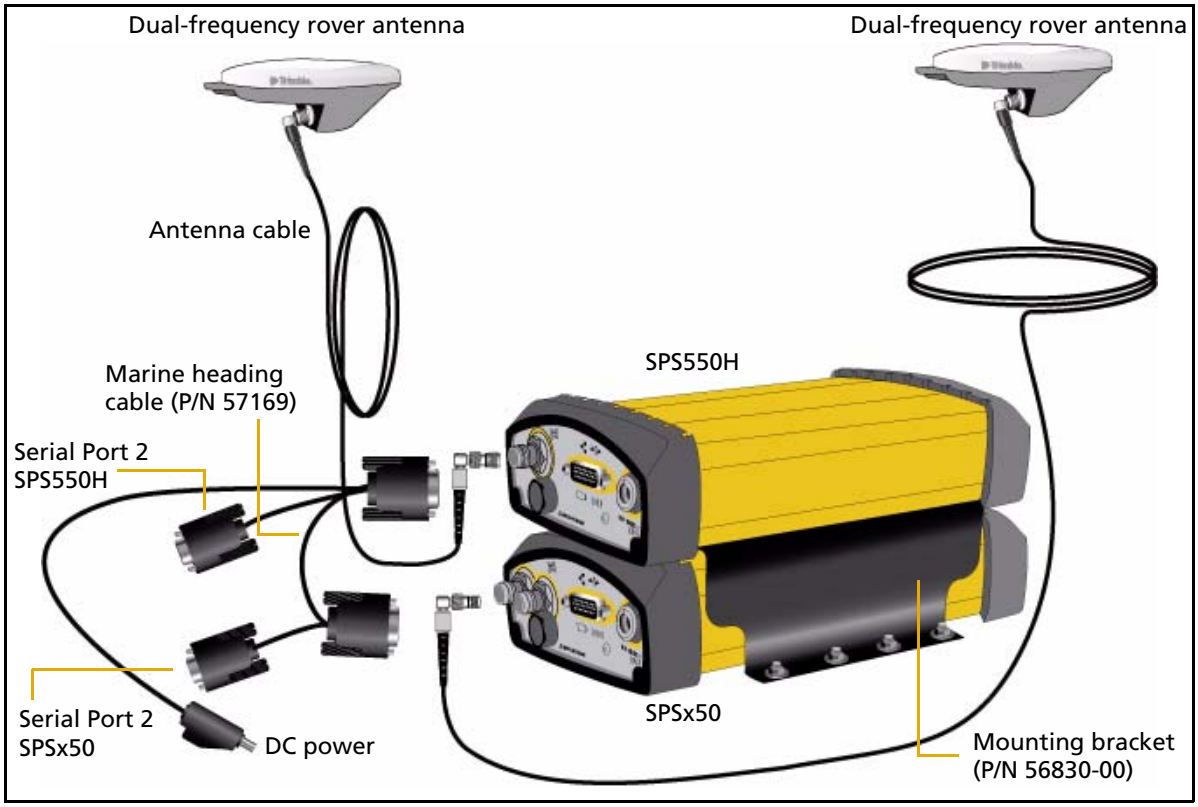


Figure 5.10 Installation setup for the SPS550H with another SPSx50 receiver for position and heading

Assembling the receivers

Figure 5.11 shows a SPS550 and a SPS550H set up to provide a Heading solution. To assemble the receivers you need a Phillips head #1 screwdriver and a 1/4" socket set or wrench (spanner).

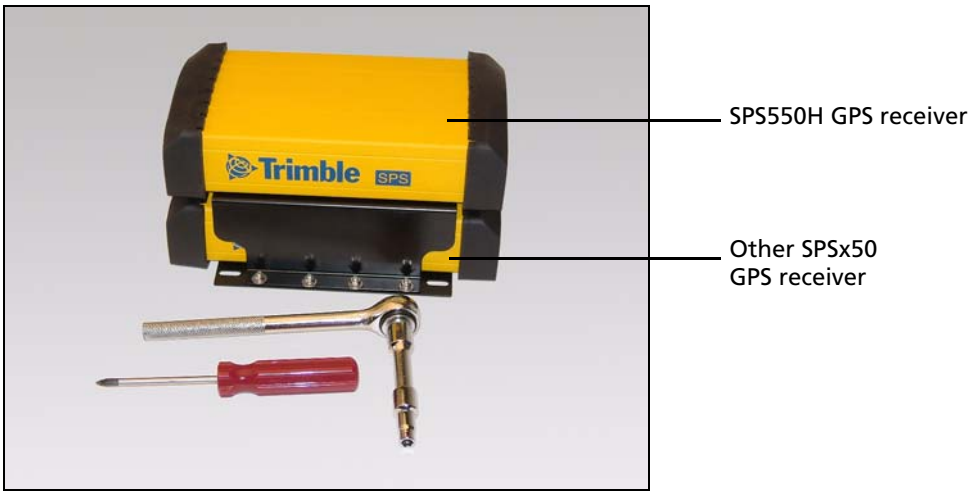
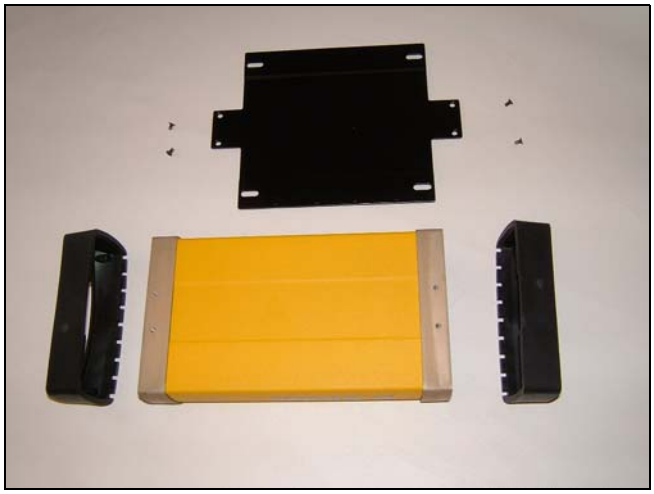


Figure 5.11 Completed assembly with SPS550H GPS receiver on top

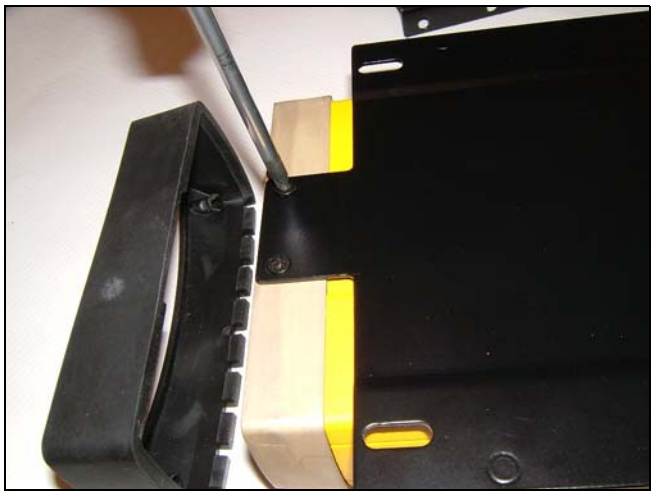
To assemble the receivers using the mounting frame that is provided:

1. Invert the SPSx50 GPS receiver and remove the rubber endcaps.

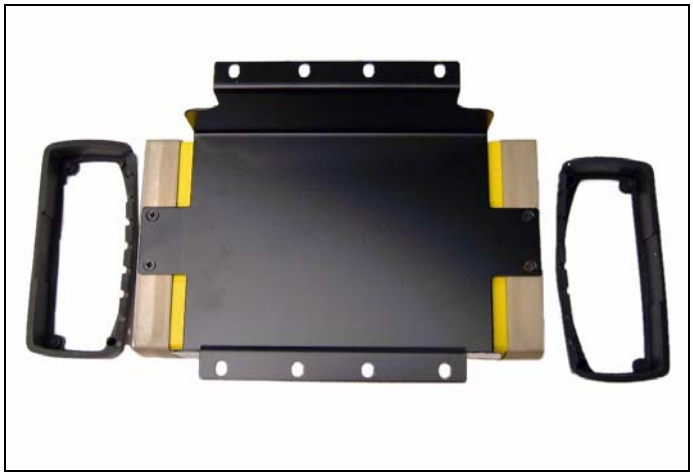


2. Prepare the flat black plate and the four Posi screws. (These are part of the mounting frame.)
3. Position the black plate on the SPSx50 GPS receiver.

4. Use the four Posi screws to secure the plate to the receiver. (Secure two screws at each end.) The black plate is now attached to the bottom of the SPSx50 GPS receiver.

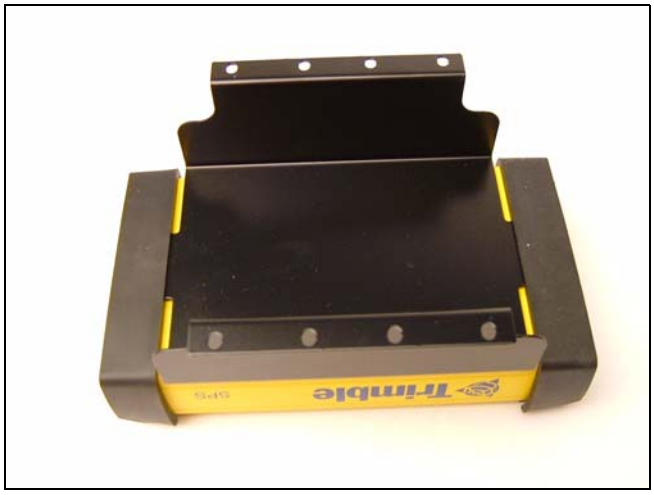


5. Replace the rubber endcaps.
6. Invert the SPSx50 receiver again. This returns the receiver to its normal orientation.
7. Set aside the SPSx50 receiver.
8. Invert the SPS550H receiver and remove the rubber endcaps.



9. Position the black cradle on the SPS550H GPS receiver. (The black cradle is part of the mounting frame.)
10. Use the four Posi screws to attach the black cradle to the receiver. The black cradle is now attached to the bottom of the SPS550H.

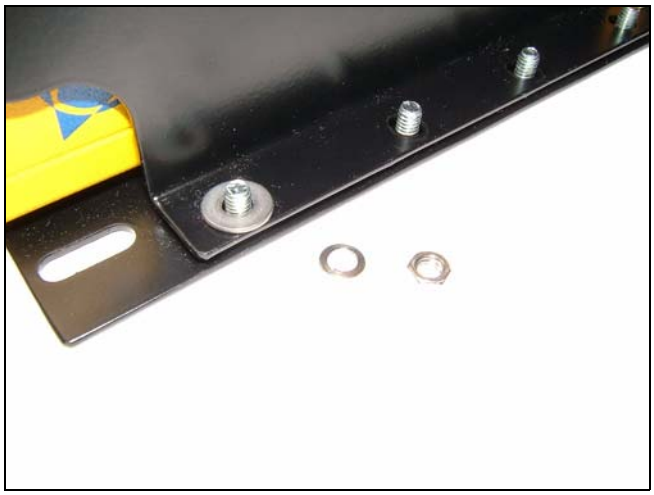
11. Replace the rubber endcaps.



12. Place the black cradle on the black base plate. This places the SPS550H GPS receiver on top of the SPSx50 GPS receiver..

13. Make sure that the display is facing in the same direction on both receivers.
14. Prepare the eight nuts, spring washers, and flat washers.

15. Insert the first bolt. Attach the flat washer, the spring washer, and finally the nut and then tighten firmly. Secure all eight bolts in this way..



16. Attach one connector from the Marine Heading Cable (P/N 57169) to the 26-pin connector on the rear of the SPS550H GPS receiver. Attach the other connector from the cable to the 26-pin connector on the rear of the SPSx50 receiver. The cable can be connected either way around.

The cable connects the two GPS receivers so that the Heading solution is available. The DC power lead on the cable is used to supply power to both receivers in the stack. The two DB9 female connectors on the cable access serial port 2 on each receiver.

Installing the receiver

Select a location at which all of the following conditions are met:

- the receiver is not exposed to temperature extremes

- the receiver is not exposed to moisture extremes (such as rain, snow, water blasters, or wash systems)
- the receiver is protected from mechanical damage
- you can connect and disconnect cables without placing undue stress on them

Mounting the antennas

It is critical that you install each antenna at the correct location. Poor or incorrect placement can influence accuracy and reliability.

Ideally, mount the two antennas as far apart as possible and at about the same height on the structure. Mount the antennas fore and aft along the vessel centerline or on a line that is at a known orientation to the centerline. Always mount an antenna at a location that ensures a good view of the sky.

Follow these guidelines to select the antenna location:

- Choose an area with a clear view of the sky. The antenna must be above any metallic objects.
- Do not mount the antenna close to stays, electrical cables, metal masts, or other antennas.
- Do not mount the antenna near a transmitting antenna, a radar array, or near satellite communication equipment.
- Avoid areas with high vibration, excessive heat, electrical interference, and strong magnetic fields.

Use a 5/8" stainless steel bolt to mount each of the antennas. There is a threaded bolt hole in the base of the antenna.

Configuring the receiver pair

One of the receivers must be nominated as a Heading unit. The other receiver is nominated as a Moving Base unit. For this configuration to work, you must use the Marine heading cable (P/N 57169).

To set up the Heading unit:

1. From the Home screen press <enter><enter>. The Mode screen appears.
2. Select *Heading* mode. The SPSx50 display shows two extra settings for heading:
   - *Heading Adjustment*. Enter a positive value in decimal degrees. The value is applied to the raw heading value before it is output in the NMEA HDT message or displayed on the front panel of the receiver. This value is used when the two antennas are not mounted parallel to the vessel axis.

– *Minimum Heading Solution*. Enter the minimum requirement for the GPS solution that will provide the heading value. The default of RTK Fixed provides the highest precision, but in conditions of extreme multipath or obstruction, an RTK Fixed solution may not be continuously available. In such conditions, select RTK Float if a lower precision is acceptable.

To set up the Moving Base unit:

1. From the Home screen press <enter><enter>. The Mode screen appears.
2. Select Moving Base mode.

Interfacing using the NMEA protocol

The SPS550H GPS receiver can output messages such as NMEA HDT for heading, and NMEA GGA for position. The SPS550H always reports the solution status of the moving baseline solution that is being used to compute the heading. For example, Modem (serial port 2) on SPS750, which is typically RTK Fixed Integer. However, if the external computer must know the exact quality of the position, you can use the NMEA output from the base receiver. The base receiver reports the solution status of the position, for example, Fixed Integer, Floating, orDGPS.

CHAPTER

6

Configuring the SPSx50 Modular GPS Receiver Using the Keypad and Display

In this chapter:

Home screen

The *Home* screen is the main screen displayed on the SPSx50 receiver. If the receiver is displaying another screen and is left idle for 60 seconds, you are returned to this screen. The *Home* screen shows the following information:

- Number of satellites being tracked
- Internal battery power remaining
- Current mode configuration
- Internal radio activity
- Internal radio channel or network

Status screens

The SPSx50 GPS receivers have several view-only status screens that allow you to review the current settings of the receiver. The status screens provide the following information:

- Position solution
- CMR and RTCM IDs
- Base name and code
- Latitude, longitude, and height
- Antenna height
- Horizontal and vertical precision
- Receiver firmware version
- Receiver serial number
- Receiver IP address

To access these screens from the *Home* screen, press **Up** or **Down**.

Configuring the SPSx50 as a base receiver

To set up the SPSx50 base receiver use the Autobase feature, the Trimble SCS900 Site Controller software, or the receiver keypad.

The Autobase feature automatically configures the receiver settings for you; there is no need to use the keypad. The receiver obtains a position and outputs RTK corrections on the internal radio (if available) or on the LEMO port. See Chapter 7, Autobase Feature.

The receiver is configured step by step to ensure that all appropriate settings are configured. To move between steps in the configuration process, press **Enter**.

Configuring the receiver

1. In the *Home* screen, press **Enter**. Use the *Operation Mode* screen to configure system settings, mode settings, or to view the SV (satellite) status. Mode Settings is the default setting.
2. Press **Enter**. Use the *Mode* screen to select whether the receiver will operate as a base or rover. Base is the default setting.
3. Press **Enter**. Use the *Base Station* screen to select whether the receiver is going to use a "Here" position or if the current coordinates in the receiver will be changed.
4. Press **Right**. When Edit Current begins to flash, the receiver is in Edit mode and you can change the current setting.
5. Press **Down**. The setting changes to New Base (Here).
6. Press **Enter** to accept the change.
7. Press **Enter** again. The *Base Name* screen appears. See next.

Changing the name and description of the base station

In the *Base Name* screen:

1. Press **Right**. When the first character of the base name begins to flash, the receiver is in Edit mode and you can change the current setting.
2. Press **Up** or **Down** to change the value of the character.
3. Press **Right** to move the cursor to the next character.
4. Repeat Step 2 through Step 3 to enter the name of the base station. The name can be up to 16 characters. Press **Enter** to accept the change.
5. Press **Enter** again. Use the *Base Code* screen to change the code (description) for the base station.
6. Press **Right**. When the first character of the base code begins to flash, the receiver is in Edit mode and you can change the current setting.
7. Press **Up** or **Down** to change the value of the character.
8. Press **Right** to move the cursor to the next character.
9. Repeat Step 7 through Step 8 to enter the code of the base station. The code can be up to 16 characters.
10. Press **Enter** to accept the change.
11. Press **Enter** again. The *Base Latitude* screen appears. See next.

Setting the reference latitude, longitude, and height of the base station

In the *Base Latitude* screen:

1. The base was set up with a "Here" position, so press **Enter**.
2. The *Base Longitude* screen is used to change the reference longitude of the base station. The base was set up with a "Here" position, so press **Enter**.
3. The *Point Height* screen is used to change the reference height of the base station. The base was set up with a "Here" position, so press **Enter**.
4. Use the *Antenna Type* screen to select the type of antenna used with the receiver. Press **Right**. When the antenna name begins to flash, the receiver is in Edit mode and you can select an antenna.
5. Press **Down** to scroll through the antenna models.
6. Once the correct antenna name is displayed, press **Enter** to accept the change.
7. Press **Enter** again. The *Measured To* screen appears. See next.

Measuring and changing the antenna height

In the *Measured To* screen:

1. Press **Right**. When the antenna measurement method begins to flash, the receiver is in Edit mode and you can select an antenna measurement method.
2. Press **Down** to scroll through the measurement methods. Once the correct measurement method appears, press **Enter** to accept the change.
3. Press **Enter**.
4. Use the *Antenna Height* screen to change the height of the antenna. Press **Enter**. When the first character of the antenna height begins to flash, the receiver is in Edit mode and you can change the antenna height.
5. Press **Up** or **Down** to change the value of the character.
6. Press **Right** to move the cursor to the next character.
7. Repeat Step 5 through Step 6 to enter the height of the antenna.
8. Press **Enter** to accept the change.
9. Press **Enter** again. The *Output* screen appears. See next.

Outputting corrections

In the *Output* screen :

1. Press **Right** to enter Edit mode for the port.
2. Press **Up** or **Down** to change which port will be used to output corrections.
3. Press **Enter** to accept the change.
4. Press **Down** to move the cursor to the *Format* field.

5. Press **Right** to enter Edit mode for the format.
6. Press **Up** or **Down** to change which correction message will be output on the port.
7. Press **Enter** to accept the change.
8. Press **Enter** again.
9. Use the *NMEA* screen to set up NMEA outputs from the receiver. Press **Enter** to accept the default of no NMEA messages.
10. Use the *GSOF* screen to set up GSOF outputs from the receiver. Press **Enter** to accept the default of no GSOF messages.
11. Use the *RT17* screen to set up RT17 outputs from the receiver. Press **Enter** to accept the default of no RT17 messages. The *Home* screen appears and the base setup is complete.

Configuring the SPSx50 as a rover receiver

You can use the Trimble SCS900 Site Controller software or the receiver keypad to set up the SPSx50 base receiver.

The receiver is configured step by step to ensure that all appropriate settings are configured. To move between steps in the configuration process, press **Enter**.

Configuring the receiver

1. In the *Home* screen, press **Enter**. Use the *Operation Mode* screen to configure system settings, mode settings, or to view the SV (satellite) status. Mode Settings is the default setting.
2. Press **Enter**. Use the *Mode* screen to select whether the receiver will operate as a base or rover.
3. Press **Right**. When the mode begins to flash, the receiver is in Edit mode and you can change this setting.
4. Press **Down** to change to Rover.
5. Press **Enter** to accept the change.
6. Press **Enter** again to move to the next screen. <<screen name? provides a neat link>>See next.

Changing the elevation mask and RTK mode

1. Press **Right** . When the value for the current elevation mask begins to flash, the receiver is in Edit mode and you can change the setting.
2. Press **Down** to change the elevation mask to the required value.

Note – *Trimble recommends that you do not set the elevation mask to a value lower than 10 degrees.*

3. Press **Enter** to accept the change.
4. Press **Down**.
5. In the *Mode* field, press **Right**. When the current mode begins to flash, the receiver is in Edit mode and you can change this setting.
6. Press **Down** to change the desired RTK mode of the receiver.
7. Press **Enter** to accept the change.
8. Press **Enter** again. The *Antenna Type* screen appears. See next.

Selecting the antenna

In the *Antenna Type* screen:

1. Press **Right**. When the antenna name begins to flash, the receiver is in Edit mode and you can select the type of antenna that is to be used with the receiver.
2. Press **Down** to scroll through the antenna models.
3. Once the correct antenna name is displayed, press **Enter** to accept the change.
4. Press **Enter** again. The *NMEA* screen appears. See next.

Outputting corrections

In the *NMEA* screen, set up outputs from the receiver:

1. Press **Enter** to accept the default (No NMEA messages). Use the *GSOF* screen to set up GSOF outputs from the receiver.
2. Press **Enter** to accept the default of no GSOF messages. Use the *RT17* screen to set up RT17 outputs from the receiver.
3. Press **Enter** to accept the default of no RT17 messages. The *Home* screen appears, and the base setup is complete.

Configuring system settings

You can use the keypad and display of the SPSx50 receiver to configure the following receiver settings:

- Display language
- Display and input units
- Baud rate, parity, data bits, and stop bits for serial ports
- Display power saver
- Autobase warning

To access these receiver settings:

1. In the *Home* screen, press **Enter**. Use the *Operation Mode* screen to configure system settings or mode settings, and to view the SV (satellite) status. Mode Settings is the default setting.
2. Press **Right**. When the operation mode begins to flash, the receiver is in Edit mode and you can change this setting.
3. Press **Down** to change to System Setup.
4. Press **Enter** to accept the change.
5. Press **Enter** again.
6. Use the *Display Language* screen, if necessary, to change the language. Choose English, French, German, Italian, or Spanish. Press **Enter** to accept the change.
7. Press **Enter** again. Use the *Display and Input Units* screen, if necessary, to change the units to Meters or Feet.
8. Press **Enter** to accept the change.
9. Press **Enter** again. Use the *Port Settings* screen, if necessary, to change the port.
10. Press **Enter** to accept the change.
11. Press **Enter** again. Use the *Screen Pwr Savr* screen to choose whether On, Off, or Auto. If you use the Auto setting, 60 seconds. This setting turns the screen off after a specified period of inactivity. The Power LED remain lit so you can tell if the receiver is on or off. If an error message appears, the screen comes back on. Press **Enter** to accept the change and then press **Enter** again to move to the next screen.
12. The *Autobase warning* screen appears. <<when I used the x50, this screen didn't appear? Dianne> See Chapter 7, Autobase Feature.
13. Press **Enter** to accept the change.
14. Press **Enter** again. When the *Home* screen appears, the system setup is complete.

CHAPTER

7

Configuring the Receiver Settings

In this chapter:

You can configure the SPS GPS receiver family in a variety of ways. This appendix describes the different configuration methods, and explains when and why each method is used.

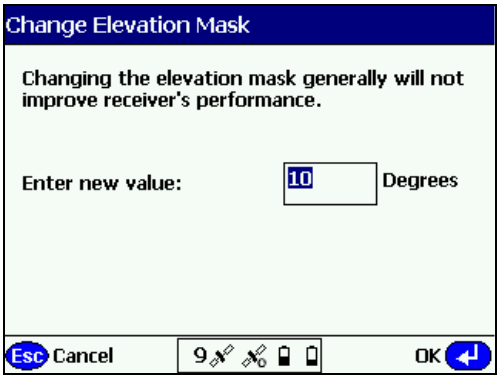
The SCS900 Site Controller software is likely to be your main tool to set up and operate the receiver on a daily basis. For more information, refer to the *Trimble SCS900 Site Controller Software Getting Started Guide* or the *Trimble SCS900 Site Controller Software Office Guide*.

The external software detailed in this appendix is primarily used to update the receiver firmware and to configure upgrades or radio channels. All necessary field configurations are handled through the SCS900 software running on a TSC2™ or TCU controller.

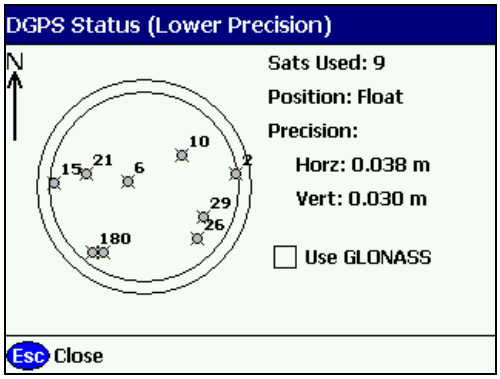
Using the SCS900 Site Controller software to configure the base station, rover, and the radios

As a total system solution for construction applications, the SPS GPS receivers are operated by a TSCe™, ACU, TCU, or TSC2 controller running the SCS900 Site Controller software. The SCS900 system provides the tools to configure and start the GPS receiver in the modes used by the SCS900 system: Base Station, RTK Rover, Location RTK Rover, OmniSTAR Rover, and DGPS Rover using SBAS (WAAS/EGNOS and MSAS). The SCS900 software provide wizards to help you through the process and, where possible, assigns suitable default operational parameters to the system. This eliminates the need for an operator to know how to configure the receiver with the right settings.

The SCS900 system takes care of operating the receiver with both internal and external radios, cellular communications components (modems and cellphones), and use of the Bluetooth wireless technology. The software also takes care of scanning communication ports to identify connected devices, and offers selection options wherever necessary often with pictures to facilitate the correct component selection at times when it cannot automatically identify the connected component, for example, GPS antennas.



Press Ctrl+M to open this screen



The SCS900 Sky Plot screen

The SCS900 system allows you to specify operational tolerances, which have to be achieved for measurements to be accepted. When outside of these tolerances, the SCS900 system warns you through on-screen messages or indications, and the non automatic acceptance of recorded positions. To set operational tolerances, go to the the *Settings* menu in the SCS900 software.

Configuring the receiver to log data for postprocessing

The SPS GPS receivers do not come equipped with the Data Logging option. The receivers can have this added either at the time of purchase, or at a later date as an option. With the Data Logging option enabled, the receiver has available memory, that facilitates the collection of GPS observations over a period of time, which can be used with GPS postprocessing software such as Trimble Geomatics Office or Trimble Total Control, for the computation of control networks and baselines.

The SCS900 system does not provide support for postprocessed applications. Trimble recommends that you use either the front panel keypad and display, the Web User Interface, or (SPS770, SPSx80 only) the GPS Configurator software to configure the receiver for postprocessed measurement sessions.

Configuring Ethernet Settings

The SPSx50 receiver has an Ethernet port so that the receiver can connect to an Ethernet network. The receiver can be accessed across the network giving you the ability to configure and monitor the receiver without needing to connect to the receiver with a serial cable.

The SPSx50 receiver requires the following Ethernet settings:

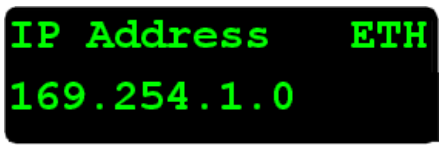
- IP setup: Static or DHCP
- IP address
- Netmask
- Broadcast
- Gateway
- DNS address
- HTTP port

The factory default configuration of the SPSx50 receiver is to use DHCP. Using DHCP enables the receiver to obtain the IP address, Netmask, Broadcast, Gateway, and DNS address from the network. 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 SPSx50 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.

Example of connecting to the receiver using port 80: http://169.254.1.0

Example of connecting to the receiver using port 4000: http://169.254.1.0:4000

When an SPSx50 receiver is connected to a network using DHCP, an IP address is assigned to the receiver by the network. To verify the IP address of the receiver, select the up button from the keypad when the *Home* screen is displayed. The display will show the Ethernet IP address as shown.

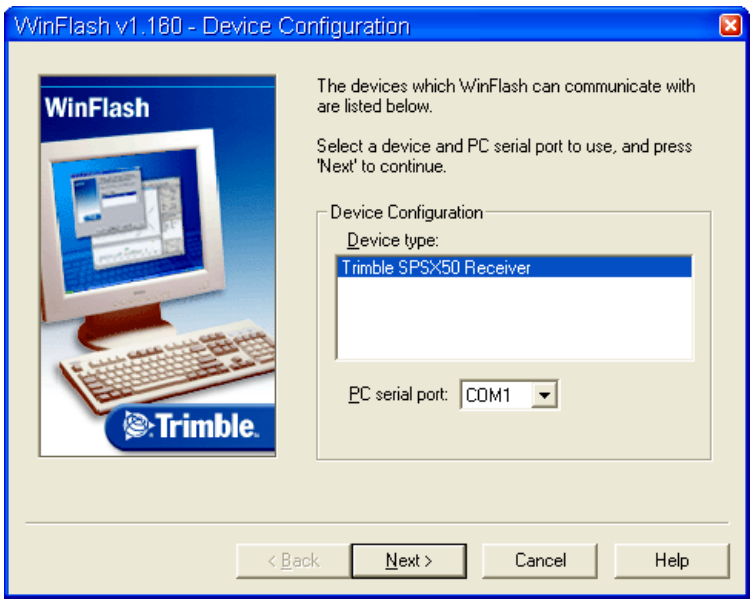


If your network installation requires the receiver to be configured with a static IP address, you can configure the Ethernet settings using the web server or the WinFlash software. The web server can be only used when the receiver is connected to a network and has a valid Ethernet configuration.

You should use the WinFlash software to configure the Ethernet settings of a receiver that is to be connected to a network that requires static IP addresses. If a network requires static IP addresses, contact the network administrator for the correct settings for the SPSx50 receiver.

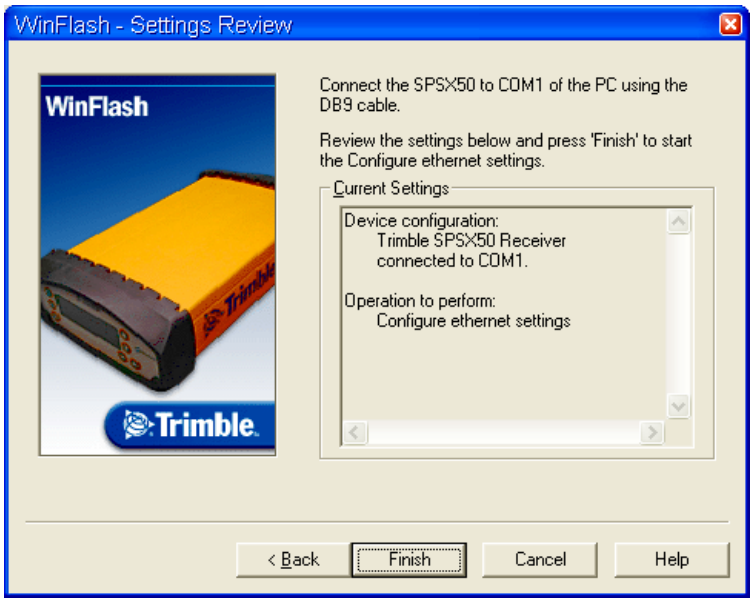
To configure the Ethernet settings using the WinFlash software:

1. Connect the SPSx50 receiver to a computer running the WinFlash software using the serial cable provided with the receiver.
2. Turn on the SPSx50 receiver.
3. On the computer, start the WinFlash software.
4. From the *Device* screen, select Trimble SPSx50 Receiver, and then from the *PC serial port* list, select the appropriate PC serial port. Click **Next**:



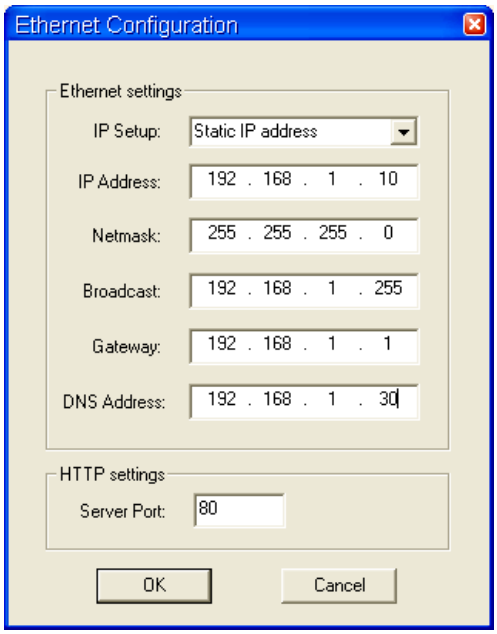
5. From the *Operation Selection* screen, select Configure ethernet settings, and then click **Next**:

6. From the *Settings Review* screen, click **Finish**.



Once the WinFlash software connects to the receiver, the *Ethernet Configuration* dialog appears.

7. Enter the network settings (obtain these from your network administrator), 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 in the subnet, which is usually .255.