



SP60 GNSS Receiver



User Guide

August 2016 Release



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SP60 User Guide, Rev. C, August 2016.

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 Spectra Precision product (the "Product") will substantially conform to our 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 solely for use with or as an integral part of the Product and is not sold. The terms of the end user license agreement govern the use of the Product Software, including any differing limited warranty terms, exclusions and limitations, which shall control over the terms and conditions set forth in the limited Product warranty.

Warranty Remedies. If the Product fails during the warranty period for reasons covered by this limited warranty and you notify us of such failure during the warranty period, we will repair OR replace the nonconforming Product with new, equivalent to new, or reconditioned parts or Product, OR refund the Product purchase price paid by you, at our option, upon your return of the Product in accordance with our product return procedures then in effect.

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 or 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

The digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de Classe B prescrites dans le règlement sur le brouillage radioélectrique édicté par le Ministère des Communications du Canada.

Europe



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 sales within the European Economic Area (EEA). These requirements are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential or commercial environment.

Notice to Our European Union Customers



For product recycling instructions and more information, please go to <http://www.spectraprecision.com/footer/weee-and-rohs/>.

Recycling in Europe: To recycle Spectra Precision WEEE (Waste Electrical and Electronic Equipment products that run on electric 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

Declaration of Conformity

We, Spectra Precision,
declare under sole responsibility that the product:
SP60 GNSS receiver
complies with Part 15 of FCC Rules.

Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference,
- (2) and this device must accept any interference received, including interference that may cause undesired operation.

Rechargeable Lithium-ion Battery

This receiver uses a rechargeable Lithium-ion battery.

WARNING - Do not damage the rechargeable Lithium-ion battery. A damaged battery can cause an explosion or fire, and can result in personal injury and/or property damage. To prevent injury or damage:

- Do not use or charge the battery if it appears to be damaged. Signs of damage include, but are not limited to, discoloration, warping, and leaking battery fluid.
- Do not expose the battery to fire, high temperature, or direct sunlight.
- Do not immerse the battery in water.
- Do not use or store the battery inside a vehicle during hot weather.
- Do not drop or puncture the battery.
- Do not open the battery or short-circuit its contacts.

WARNING - Avoid contact with a 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 a 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 unapproved equipment can cause an explosion or fire, and can result in personal injury or/and equipment damage. To prevent injury or damage:

- Do not charge a battery if it appears to be damaged or leaking.
- USE EXCLUSIVELY the dual-battery charger (P/N 53018010-SPN) with the AC/DC power block (model ADP-65JH AB, P/N 78650) to charge the SP60 Lithium-ion battery. See instructions in this guide. These two devices are part of the SP60 standard accessories list.

CHARGE THE BATTERY ONLY IN THE TEMPERATURE RANGE 0° to +40°C (32° to 104°F), at a maximum altitude of 2,000 meters (6,562 feet).

- Discontinue charging a battery that gives off extreme heat or a burning odor.
- Use the battery only in Spectra Precision equipment that is specified to use it.
- Use the battery only for its intended use and according to the instructions in the product documentation.

Disposing of Rechargeable Lithium-ion Battery

Discharge Lithium-ion battery before disposing of it. When disposing of a battery, be sure to do so in an environmentally sensitive manner. Adhere to any local and national regulations concerning battery disposal or recycling.

Receiver Use and Care

The receiver can withstand the rough treatment that typically occurs in the field. 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 Physical Specifications in this guide.

High-power signals from a nearby radio or radar transmitter can overwhelm the receiver circuits. This does not harm the instrument, but it can prevent the receiver from functioning correctly. Do not use the receiver within 400 meters (1312 feet) of powerful radar, television or other transmitters. Low-power transmitters such as those used in cell phones and two-way radios do not normally interfere with receiver operations.

For more information, contact your Spectra Precision distributor.

Bluetooth Radio

The radiated output power of the wireless radio is far below the FCC radio-frequency exposure limits. Nevertheless, the wireless radio shall be used in such a manner that the Spectra Precision receiver is 20 cm or further from the human body.

The internal wireless radio operates within guidelines found in radio-frequency safety standards and recommendations, which reflect the consensus of the scientific community. Spectra precision 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 radios.

COCOM Limits

The US Department of Commerce requires that all exportable GNSS products contain performance limitations so that they cannot be used in a manner that could threaten the security of the United States.

The following limitation is implemented on the receiver: Immediate access to satellite measurements and navigation results is disabled when the receiver's velocity is computed to be greater than 1000 knots, or its altitude is computed to be above 17,000 meters (59,055 feet). The receiver continuously resets until the COCOM situation is cleared.

Technical Assistance

If you have a problem and cannot find the information you need in the product documentation, contact your local distributor. Alternatively, request technical support using the Spectra Precision website at www.spectraprecision.com.

Your Comments

Your feedback about the supporting documentation helps us improve it with each revision. Email your comments to documentation_feedback@spectraprecision.com.

UHF Radios

Regulations and Safety. The receiver may be fitted with an internal radio as an option. It can also be connected to an external UHF radio.

Regulations regarding the use of Ultra High Frequency (UHF) radio-modems vary greatly from country to country. In some countries, the UHF kit may be used without obtaining an end-user license. Other countries require end-user licensing. For licensing information, consult your local Spectra Precision dealer.

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

Exposure to RF energy is an important safety consideration. The FCC has adopted a safety standard for human exposure to radio-frequency electromagnetic energy.

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

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

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About Spectra Precision SP60



Challenging environments will no longer be a nightmare for you or your crew: The Spectra Precision SP60 is a new generation GNSS receiver offering a high level of flexibility. It is designed to cover any survey demand from simple post-processing, through standard UHF or unique Long-Range Bluetooth base and rover systems to sophisticated RTK and Trimble RTX rover solutions.

Combining the unique all-signals tracking and processing Z-Blade GNSS centric technology and L-band capability for satellite-delivered Trimble corrections RTX service, the SP60 receiver provides the most reliable measurements and the highest possible accuracy under any conditions anywhere in the world.

The key features of the SP60 are:

- Extended survey capability
- New 240-channel 6G ASIC
- Z-Blade GNSS-centric
- Internal TRx UHF radio (option)
- Long-Range Bluetooth
- Anti-theft and startup protections

SP60 Packout

Basic Supply

NOTE: Spectra Precision reserves the right to make changes to the lists of items provided below without prior notice.

Depending on the ordered SP60 single receiver kit, the basic supply will be as follows.

SP60 Single Receiver Kit	P/N	UHF Kit	Office Power Kit	Field Power Kit	Standard Items
SP60 L1 GPS	104234-00				•
SP60 L1 GNSS	104234-01				•
SP60 L1/L2 GPS	104234-02				•
SP60 L1/L2 GNSS	104234-03				•
SP60 GIS 7/2 (L1/L2 GPS only)	104234-85				•
SP60 GIS 30/30 (L1/L2 GPS only)	104234-80				•
SP60 L1/L2 GNSS+UHF radio*	104234-10	•	•		•
SP60 L1/L2 GNSS+UHF radio**	104234-50	•	•		•

*: 410-430 MHz, 2 W TRx

**: 430-470 MHz, 2 W TRx

UHF Kit PN92673-00

Item	Picture	Spare Part (1)
UHF Module (2)	A photograph of two black rectangular modules with multiple pins and connectors.	(Not Applicable)
Base Pole Extension, 25 cm (9.5") long, with oblong aperture	A photograph of a black cylindrical extension pole with a rectangular aperture at the top.	95672
Rover Range Pole, 2 m (6.5 ft) long, fiber-glass, two parts, with specific tapping on top part	A photograph of a long, thin, tapered fiber-glass pole with a ribbed top section.	89937-10
Soft Bag for Range Pole	A photograph of a blue and black padded bag designed to hold the range pole.	95860
T25 Torx Screwdriver, "L" shaped	A photograph of a standard L-shaped Torx screwdriver.	(Not Applicable)

(1) When applicable, the items part of this kit may be ordered separately as spare parts, using the P/Ns specified in this column.

(2) DOES NOT include the UHF antenna. See other optional accessories below.

Office Power Kit

P/N 94336

Item	Picture	Spare Part (1)
Power/Data cable, 1.5 m, DB9-f to OS/7P/M to SAE		59044-10-SPN
Adapter cable, 0.15 m, SAE to DC socket (2.1 mm)		88769-SPN
RS232-to-USB adapter cable		90938-SPN

(1) When applicable, the items part of this kit may be ordered separately as spare parts, using the P/Ns specified in this column.

Field Power Kit

P/N 94335

Item	Picture	Spare Part (1)
Power cable, 0.6 m, 7P Lemo to SAE		95715
Power cable, 1.8 m, SAE to battery clips (2)		83223-02-SPN

(1) When applicable, the items part of this kit may be ordered separately as spare parts, using the P/Ns specified in this column.

(2) If you need to change the fuse on this cable, please use the same type of fuse as the one originally provided (15 A @32 V). This is mandatory.

Standard Items

Item	Picture	Spare Part (1)
SP60 GNSS receiver		(Not applicable)
Li-Ion Battery, 2.6 Ah, 7.4 V, 19.2 Wh		92600-10
Dual Li-Ion Battery Charger (does not include AC/DC power supply and cable)		(Not applicable)
AC/DC Power Block, 65 W, 19 V, 3.42 A, 100-240 VAC		78650-SPN
Power Cord Kit (four types) for use with AC/DC Power Block		78651-SPN
Tape Measure, 3.6 m (12 feet)		93374
Pole Extension, 7 cm, for use on tripod		88400-50-SPN
USB-to-USB mini Cable		67901-11
Soft bag, field transport		206490-ASH
Product Software and Documentation Leaflet, Quick Start Guide, Anti-theft sticker.		(Not applicable)
Two-year warranty		(Not applicable)

(1) When applicable, the items part of the standard packout may be ordered separately as spare parts, using the P/Ns specified in this column.

NOTE: The SP60 User Guide may be downloaded from:

<http://www.spectraprecision.com/eng/sp60.htm#.VdWdb5dWIQo>

Other Optional Accessories

Item	Ordering P/N:	Picture
Large soft bag, field transport	95858	
Universal Hard Shell, gray, Spectra Precision:		
• Bare	104342-02	
• With two soft bags	104342-03	
• With one large soft bag	104342-04	
UHF whip antenna, 1/4 wave, with TNC adapter:		
• 410-430 MHz	67410-12	
• 430-470 MHz	67410-11	
Coaxial adapter cable (for use with P/N 95672)	96845	
Y cable, receiver-to-PacCrest HPB & Battery, 3.0 m (OS7P to 1S5P)	PCC-A02507	
Dual Li-Ion battery charger kit (including cable and power supply)	53021010-SPN	

Firmware Options

These firmware options can be ordered separately.

Firmware Option	P/N	Features Added
SP60 GNSS L1	105759-01	GLONASS, Galileo, Beidou (L1, E1, B1)
SP60 L2	105759-02	L2 GPS, L2/L3 GLONASS, Galileo E5B, Beidou B2, L2 QZSS
SP60 GNSS + L2	105759-03	L2 GPS, L1/L2/L3 GLONASS, L2 QZSS, Galileo E1, E5B, Beidou B1, B2
7/2	109162-01	Dithered RTK 7/2: 7cm Horizontal Precision, 2cm Vertical Precision.
RTK	109163-01	Full RTK option

Trimble RTX Corrections Services

The services below can be used in the SP60 after you have subscribed to one of them:

- CenterPoint RTX®
- FieldPoint RTX®
- RangePoint RTX®
- ViewPoint RTX®

Refer to *Technical Specifications on page 48* and next ones so you can choose the type of Trimble RTX service you should subscribe to, depending on the level of accuracy you need.

To subscribe to one of these services, do the following:

- Contact your dealer, who will help you make the necessary steps to get an RTX subscription from Trimble.

- Once you get your subscription, refer to *Validating RTX Subscription on page 41* to make it active in your SP60.

IMPORTANT: The best accuracy the SP60 can deliver depends on the RTK option installed, regardless of the subscribed RTX service. For example, it wouldn't make sense to purchase a subscription to CenterPoint RTX if the receiver can only operate in 30/30 RTK.

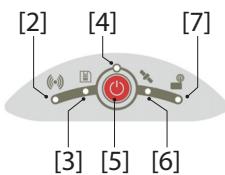
External Radio Kits & Antennas

Item	Ordering P/N:	Picture
UHF whip antenna, Procom, half-wave, with TNC adapter: • 410-430 MHz • 430-450 MHz • 450-470 MHz	C3310190 C3310196 C3310188	
ADL Vantage Pro Accessories Kit. Choose P/N according to UHF band used: • 450-470 MHz • 430-450 MHz • 410-430 MHz The kit includes the following items: • Unity-gain antenna (compatible with chosen band, see above) • Range pole mount • Tripod mount system • HPB-Battery bag with cables (specific to ADL Vantage Pro) • HPB-Programming cable (ADL Vantage Pro unit NOT included in the kit.)	87400-10 87400-20 87410-10	
ADL Vantage Accessories Kit. Choose P/N according to UHF band used: • 450-470 MHz • 430-450 MHz • 410-430 MHz The kit includes the following items: • Unity-gain antenna (compatible with chosen band, see above) • Range pole mount • Tripod mount system • HPB-Battery bag with cables (specific to ADL Vantage) • HPB-Programming cable (ADL Vantage unit NOT included in the kit.)	87330-10 87330-20 87310-10	

Discover Your New Equipment

Take a few minutes to discover your new SP60.

Front Panel

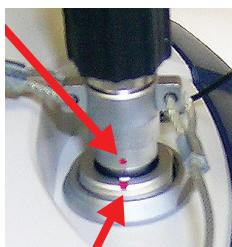


- [1]: Control panel, consists of the following items, from left to right (see picture):
 - [2]: Bluetooth LED
 - [3]: Data recording LED
 - [4]: Power LED
 - [5]: Power/Configuration button
 - [6]: Satellite tracking/Position LED
 - [7]: UHF Radio LED

See *SP60 Control Panel Description on page 14* for more information.

- [8]: 5/8" threaded insert for rod mounting. This part is securely mounted on a removable plate, thus making up an assembly that can be replaced with a UHF module (optional accessory) fitted with its own, specific threaded hole and central coaxial socket for antenna connection (see *Using the UHF Kit Option on page 23*).
- [9]: Power/data connector (DC input + RS232 serial port A). The connector socket is protected by a black rubber cap attached to the receiver case. Always keep the protection cap on when the connector is not used. This cap is a non-polarized one.

IMPORTANT: When you connect a cable to that connector, be sure you align the red markings (a red dot on the plug, a red line on the socket) before pushing the Lemo plug in.



Conversely, when it's time to disconnect the Lemo plug, please use the attached metal strap to pull the plug out.

- [10]: Battery compartment.

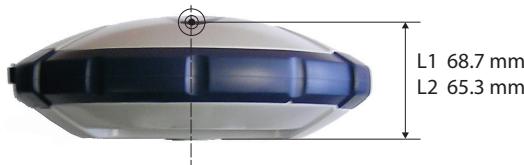
CAUTION - THE TRAPDOOR SHOULD BE REMOVED ONLY FOR INSERTING OR REPLACING A BATTERY. THE REST OF THE TIME, PLEASE ALWAYS KEEP FULLY CLOSE.



- [11]: Mini-USB connector (standard USB 2.0, up to 12 MHz, OTG (host & device)).
- [12]: Shock absorber making up a robust protection belt for the receiver against drops to the ground. The height mark is nested in the shock absorber. See below.
- [13]: Height mark.

Phase Center Location

See diagram below. These are relative measurements.



The field software usually calculates the real height of the instrument, based on the location of the L1 phase center. Whether you provide a vertical or slant measurement of the antenna base (ARP), the field software you are using should be able to deduce the real height of the instrument, using the pre-loaded dimensional parameters (antenna radius, etc.) specific to the model of GNSS antenna used.

In the case of a slant measurement, the software will also use the radius of the antenna to determine the instrument height.

Height Mark

The height mark ([8]) is nested in the shock absorber, near the serial connector.



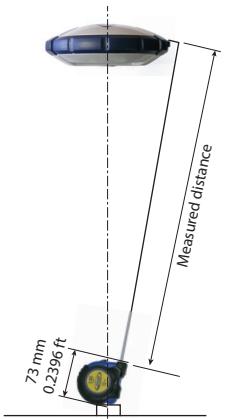
When the receiver is mounted on a tripod – for example – making a slant measurement to determine the instrument height is often more convenient than making a vertical measurement from the ground mark to the antenna base.

In this case, the height mark can be used to hook the measure tape (standard accessory) so you can unroll the tape down to the ground mark and conveniently measure the distance between these two points. However because the housing of the measure tape is inserted in the path between the two points, you should make the following correction to obtain the real value of slant measurement:

$$\text{Slant Measurement} = \text{Measured Distance} + \Delta L$$

Where “ ΔL ” is the length of the tape measure housing.

$\Delta L = 0.073 \text{ m or } 0.2396 \text{ ft (2 7/8 inches)}$, as mentioned on the housing.



When the field software requests your input to determine the instrument height, you will then choose to enter the slant measurement, rather than the vertical one. The software will then be able to deduce the real height of the instrument from the known dimensional parameters of the antenna and the slant measurement you will have entered.

Buzzer

The buzzer can be heard in the following cases:

- **Bluetooth:**
 - When the data collector establishes a Bluetooth connection with the receiver,
 - When this connection gets lost.
- **Internal battery:** When the internal battery gets low (less than 20% of nominal charge), the buzzer sounds briefly. When less than 10% is left, the buzzer sounds continuously for a few seconds until the receiver safely shuts down.
- **Power button:** After a long press (2-3 seconds) on this button:
 - To start or stop data logging (see also below).
 - To enter the radio mode
 - To power off the receiver.

In all three cases, hearing the buzzer means your request has been acknowledged and you can release the button.

- **When entering the radio mode.**
- **Enabling/Disabling Data Logging** from the Power button: The buzzer will sound at the end of the 2 or 3 seconds of holding down the Power button to either start or stop data logging (see also *Raw Data Logging in Standalone Mode on page 35*).
- **Downloading Files:** After connecting a USB key to the receiver, the buzzer will first sound when the USB key is ready for use, and then after you have pressed briefly the Power button to start downloading files to the USB key. Another beep will finally be heard when the file transfer is complete (see *Downloading Raw Data Files to a USB Key on page 36*).

Using SP60 for the First Time



WARNING - This receiver uses a rechargeable Lithium-ion battery. To avoid personal injury or equipment damage, make sure that you read and understand the safety information at the front of this guide.

The battery is shipped partially charged. Depending on the time elapsed since then, the remaining charge may be even less. For this reason, you should first recharge the battery completely before first use. (See warnings and safety information at the front of this guide.)

Charging the Battery



1. Set up the battery charger as follows:
 - Connect the output cable ([1]) of the AC/DC power block ([2]) to the battery charger input ([3]).
 - Choose the power cord ([4]) that is suitable for your country.
 - Connect the end of the power cord to the AC/DC block input ([5]), and the other to a power outlet ([6]). This powers up the battery charger, causing the two LEDs [8] to turn solid red.
2. Insert the battery ([7]) into one of the two slots on the battery charger (give the right orientation to the battery). When the battery is detected, the corresponding red LED ([8]) will go off and the nearby LED ([9]) will start blinking green to indicate that the battery is being charged.



3. Charging the battery will take a few hours. When the battery reaches full charge, the LED ([9]) will turn solid green (see also printed instructions provided with the charger).
4. Remove the battery from the charger when fully charged.

NOTE 1: The battery may be left on the charger for an indefinite period of time without causing any damage to the charger or the battery.

NOTE 2: If you also have a spare battery, the two batteries can be inserted onto the charger. The batteries will be charged one after the other.

Inserting the Battery



As opposed to previous receiver models, the battery trapdoor of the SP60 can entirely be detached from the receiver case.

As explained below, the battery is first inserted into the inner side of the trapdoor and then inserted into the receiver case, together with the trapdoor.

- Open the battery trapdoor: Using your thumb and middle finger, press on the two locks to free and remove the trapdoor ([10]).
- Place the trapdoor upside down on a horizontal plane, curved edge to the right. Place the battery nearby, electric contacts upward, and as shown ([11]).
- Take the battery and insert one of its end into the trapdoor ([12]), then gently push the other end until the battery is fully inserted ([13]).

The trapdoor is fitted with an auto-locking system ([14]) at both ends of the battery that will keep the battery firmly in position once fully inserted.

- Hold the receiver case upside down in one hand, take the battery and trapdoor in the other hand and insert them into the battery compartment ([15]). A click can be heard when the trapdoor gets locked into the receiver case.

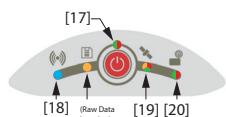
Note: To remove the battery from the trapdoor, gently push aside one of the locking legs to free that end of the battery. Then it's easy taking the battery out of the trapdoor.

Setting up the SP60



1. Mount the receiver and data collector on a range pole (rover), or a tripod (base).
2. Measure and write down the vertical (*Hv*) or slant (*Hs*) distance from the ground mark to respectively the lower part of the receiver (ARP) (rover) or to the height mark (base) (see [16]). This measurement will be required by your field software in a further step.
3. Turn on the SP60 by holding [17] depressed for about 3 seconds. The Power LED ([17]) turns solid orange for about 15 seconds (receiver booting...), then solid green (with internal battery) or solid red (if an external power supply is used). The receiver is ready to use.
4. Meanwhile, turn on the data collector and run your field software.

Running a Survey



1. Follow the instructions provided by your field software to use the SP60 as desired (rover or base). The receiver will beep, and the Bluetooth LED ([18]) will stay solid blue, when a Bluetooth connection is established with the data collector.
- In a rover, the Satellites/Position LED ([19]) will stay solid green when a fixed position solution is computed. With a rover using the internal radio (option), the Radio LED ([20]) will turn green when corrections are being received.
2. Start your survey job when ready.
3. From time to time, take a look at the Power LED ([17]) on the control panel.

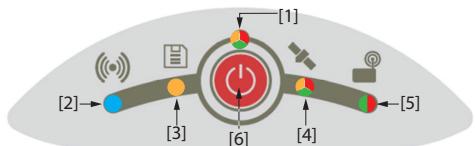
When the Power LED starts blinking green – first at a slow rate (1 sec), then at a faster rate (5 flashes a second) – that will mean the battery is too low and the receiver will soon shut down.

Ending a Survey

1. After your field survey is complete, hold [17] depressed for about 3 seconds. Release it when the Buzzer emits a sound. The Satellites/Position LED ([19]) starts blinking at a fast rate. The receiver will shut down after about 10 seconds.
2. Don't forget to charge the battery at the end of your day. The battery will charge overnight.

NOTE: Need to download raw data files from the receiver? Refer to *Collecting Raw Data Files on page 35*.

SP60 Control Panel Description



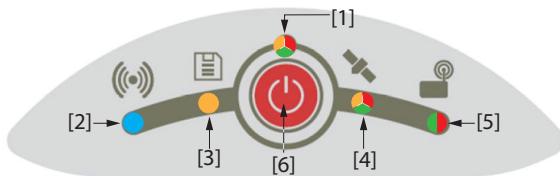
No.	Blinking Rate*	Color	Meaning
Power LED [1]	• On • Slow • Fast	● (green)	• Internal battery is used. Remaining charge > 20%. • Internal battery is used. 10% < remaining charge < 20%. Short beep heard at 20% • Internal battery is used. Remaining charge < 10%. Buzzer emits continuous sound. Only a few seconds left before SP60 safely shuts down.
	• On • Fast	● (red)	• External power source is used. Input voltage is within expected range. • External power source is used. Input voltage is out of range. Please change the power source immediately.
	• On	● (yellow)	• Power-on sequence in progress.
Bluetooth LED [2]	• Slow • On Base***: •   • 	● (blue)	• Bluetooth is on but no connection is active yet. • Bluetooth connection to communicate with a data collector is active. Base: • Two Bluetooth connections are active: Long-range Bluetooth and data collector. • One Bluetooth connection is active: Long-range Bluetooth (sending corrections to rover).
	Rover***: •   • 	● (blue)	Rover: • Two Bluetooth connections are active: Long-range Bluetooth and data collector. • One Bluetooth connection is active: Long-range Bluetooth (receiving corrections from base).
Log LED [3]	• Off • On • Slow • Fast	● (yellow)	• No data logging is in progress. • Data is being logged to internal memory. • Space available in internal memory is getting low. • No more space is available in memory. End of data logging is imminent.
Sat/Pos LED [4]	• Slow • Fast	● (red)	• No satellites are tracked. • During a power-off sequence, starting when the buzzer emits a sound.
	Mixed	● (green)	• Satellites are tracked but no position is available yet. Green flashes indicate the number of satellites tracked. 5 green flashes means 5 or more satellites tracked. Red flash is just a delimiter.
	• On	● (yellow)	• Autonomous, DGPS or SDGPS position solution is available
Radio LED [5]	• Slow • On	● (green)	• Floating position solution is available. • Fixed position solution is available.
	• Off • Variable	● (green)	• No corrections data are received. • Corrections data are being received.**
Radio LED [5]	• Off • Variable	● (red)	• No corrections data are sent out. • Corrections data are being sent out.**

*: All the terms used to describe blinking rates are clarified in the table on the next page.

** LED stays lit from beginning to end of data reception / transmission.

*** Does not necessarily mean corrections are being received or sent.

Blinking Rate	Description	General Meaning
Off	LED is off	Receiver or function turned off
On	LED permanently lit (solid color)	Normal operation
Slow	0.5 s (equal On/Off times)	Normal operation
Very slow	1.5 s (equal On/Off times)	Radio configuration mode (see flowchart below)
Fast	0.1 s (equal On/Off times)	Alert
Variable	LED stays lit for a certain time	Refer to radio LED; See previous page.
Mixed	Mixed colors: red and green alternate	See satellite/position LED on previous page.
ON OFF [1]	Off but with one brief blue flash every 3 sec.	Specific to Bluetooth LED; See previous page.
ON OFF [2]	Solid blue with one brief "off" time every 3 sec.	
ON OFF [3]	Off but with two brief blue flashes every 3 sec.	
ON OFF [4]	Solid blue with two brief "off" times every 3 sec.	



Power button [6] is primarily used to control receiver power:

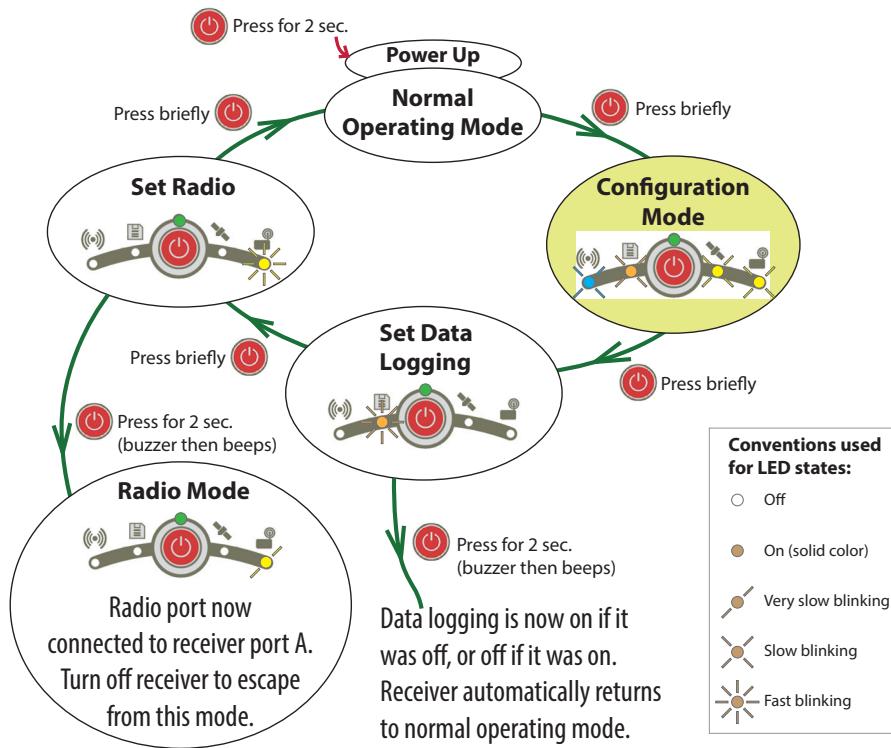
- **Turning On the Receiver:** Hold the button depressed until the Power LED turns solid orange (this takes about 2 to 3 seconds). Then release the button. This starts a power-on sequence. A few seconds later, the Power LED will turn solid green (with internal battery) or solid red (with external power supply), meaning the receiver is on and ready for use.
- **Turning Off the Receiver:** Hold the button depressed for about 2 to 3 seconds, until the buzzer emits a sound, then you *must* right away release the button. This starts a power-off sequence, with the Satellites/Position LED blinking red at a fast rate. The LED will go off a few seconds later, meaning the receiver is off.

Power button [6] is also used to reset the receiver (see *Restoring Factory Settings on page 47*) and to download raw data files to a USB key (see *Downloading Raw Data Files to a USB Key on page 36*).

Power button [6] is also used to access the two functions below. This is achieved by combining short and long presses on the button.

- **Raw Data Logging:** Enabling/disabling raw data logging.
- **Radio Configuration:** If an internal radio is used, making its port accessible through receiver port A for radio configuration (later you will need to turn off the SP60 to exit this mode).

For more details on these two settings, see flowchart below.



On the flowchart, each step is identified by a particular combination of LED states. Whatever the step, normal operating mode is restored after 10 seconds of user inactivity.

NOTE: Other actions are possible from the control panel. See *Downloading Raw Data Files to a USB Key* on page 36 and *Restoring Factory Settings* on page 47.

Introducing SP60 as Rover

Network Rover



The SP60 has no network connectivity device of its own, but the data collector, to which it is connected over Bluetooth to run the field software, may have this capability (internal modem operated in GPRS mode, using a suitable SIM card). So network corrections received using the data collector modem will be forwarded to the SP60 over Bluetooth as well. In this case of use, the SP60 will be able to deliver RTK positions using one of the following standard network connection types:

- NTRIP
- Direct IP (TCP/IP Direct)

Additionally, the SP60 can compute and deliver positions using one of the possible Trimble RTX corrections services, also through a network connection called “RTX”. This option is a special case of Direct IP connection where the preset corrections provider is *Trimble RTX Services*. A subscription is needed to operate the receiver in this mode.

Rover Using Local Base



The expression “local base” refers to a base you own and can fully control (operating sessions, location, etc.).

The rover can receive RTK corrections from the local base via:

- Long-range Bluetooth
- Radio (internal at the rover, internal or external at the base). See *Using the UHF Kit Option on page 23*.
- *Central* (Spectra Precision cloud application). Available only if Survey Pro is used as field software.

NOTE: Using *Central* relies on the use of a network connection of the NTRIP type, entirely managed by Survey Pro. The local base receiver should integrate a GPRS modem so it can support this connection on its own (no external device or data collector needed). Typically, the receiver used will be an SP80, and not an SP60.

- Data collector modem or cell phone used in CSD mode (only if FAST Survey is used as field software and a suitable SIM card is used). The rover will acquire RTK corrections in “Direct-Dial” mode (the rover will start a phone-like connection with the base (e.g. an SP80, which has a built-in modem) by dialing the preset phone number).

L-Band Rover (Trimble RTX)

The SP60 is L-band ready (no firmware option needed), which means it can receive corrections from a *Trimble RTX corrections service*, via an L-band geostationary satellite, provided you have subscribed to this service. With a currently valid subscription, the SP60 will be able to compute and deliver positions with the announced accuracy for the chosen service, provided it is in line with the RTK option installed.

For more information about Trimble RTX corrections services, refer to *Trimble RTX Corrections Services on page 5* and *Technical Specifications on page 48*.

NOTE: When using corrections from Trimble RTX services, be aware that by default, position is computed:

- Directly in the local datum if you are using Survey Pro. The computed coordinates are therefore very close to the coordinates you would get in RTK.
- In ITRF2008 epoch 2005 if you are using FAST Survey (but datum transformation is possible).

Introducing SP60 as Local Base

Possible Local Base Configurations

The SP60 can be used as a local base, delivering its corrections through one of the following devices:

- Long-Range Bluetooth: For baselines less than 800 meters (0.5 mile), the local base will be able to deliver its corrections to a rover over a long-range Bluetooth connection.
- UHF radio (optional accessory): The local base may be fitted with an internal radio module (internal UHF radio, 2 W TRx), or an external radio delivering more RF power. For more information on the internal radio module, see *Using the UHF Kit Option on page 23*.

Internal vs. External Power Source

Consider the following before setting up a local base:

- If the base is left unattended for the whole day, you may want to power it from an external power source that will provide enough power for your work day.

In this case, you may use the Field Power kit (see *Field Power Kit P/N 94335 on page 3*) to connect the receiver to an external 12-Volt battery. See diagram in which [1] is cable P/N 95715 and [2] is cable P/N 83223-02.

NOTE: If you need to change the fuse on cable P/N 83223-02, please use the same type of fuse as the one originally provided (15 A @32 V). This is mandatory.

- If you intend to work close enough to the base, or someone is in charge of keeping the base running throughout the day, you may decide to power the base from its internal battery.

For a day's work, you may need two batteries: A fresh one inserted in the receiver at the beginning of the day, and the second one may be needed sometime before the end of the day.



Configuring SP60

NOTICE: It is assumed you have a good knowledge of the field software you are using. This section will only focus on the key settings for implementing each of the available SP60 operating modes as rover or base. Remember other settings may be required as you go along.

For more general information on the field software used, please refer to the corresponding documentation.

With Survey Pro

- Power on the SP60. Wait until the boot sequence is over.
- On the data collector, launch Survey Pro and open a job.
- Select **Switch to GNSS** to choose the GNSS survey mode.
- Using the **Spectra Auto-Configure** function, connect Survey Pro to your SP60 via Bluetooth.
- Create the suitable receiver profile for your SP60:

SP60 Used As:	Required Receiver Profile:
Network Rover	"Net" (e.g. "SP60 0015 Net")
L-Band Rover (RTX)	"RTX" (e.g. "SP60 0015" RTX")

SP60 Base/Rover System Uses:	Receiver Function	Required Receiver Profile :
1) Long-range Bluetooth, or 2) Radio link	Base	"Base" (e.g. "SP60 0015 Base")
	Rover	"Rover" (e.g. "SP60 0015 Rover")
Central*	Base	"Net Base" (typically a GNSS receiver with built-in GPRS modem, e.g. SP80)
	Rover	"Net" (e.g. "SP60 0015 Net")

*: On rover side, the data collector should first be connected to the same Central account as the local base delivering corrections; Then select the network named "Central Cloud Corrections" to acquire these corrections.

- Go back to **Manage Instruments** and select the receiver profile you have just created.

- Tap on . Make the following additional settings:

SP60 Used As:	Parameters:
Network Rover	Modem tab: Select "Current Internet". When starting a survey, define the network to connect to (tap Manage Networks , Add Network ..., create then select this network).
L-Band Rover (RTX)	Survey tab: Choose a datum General tab: Make sure "L-Band" is selected

SP60 Base/Rover System Uses:	Receiver Function	Parameters:
Long-range Bluetooth. Set the base first!	Base	Survey tab: Choose format of corrections Modem tab: Set Data Modem= "Long-Range Bluetooth"
	Rover	Modem tab: Set Data Modem= "Long-Range Bluetooth"; Scan for base Bluetooth device. Pair with it
Radio link	Base	Survey tab: Choose format of corrections Modem tab: Choose the model of radio the SP60 is using. Set the radio.
	Rover	Modem tab: Choose the model of radio the SP60 is using. Set the radio.
Central	Base	(Typically not an SP60) Survey tab: Choose format of corrections Modem tab: Select the device you wish to use to let the base deliver its corrections over the Internet. Select the network named "Central Cloud Corrections" when starting a survey.
	Rover	Select the network named "Central Cloud Corrections" when starting a survey.

With FAST Survey

- Power on the SP60. Wait until the boot sequence is over.
- On the data collector, launch FAST Survey and open a job.
- In the **Equip** menu, tap **GPS Rover** or **GPS Base** (depending on the function you want to assign to the receiver). Do the following:
 - Current** tab: **Manufacturer**= "Spectra Precision" and **Model**= "SP60".
 - Comms** tab: Type= "Bluetooth", find the SP60 Bluetooth device, select it, tap  to establish the connection.
 - Receiver** tab: Enter the antenna height, and in L-Band only, choose a datum or enter the parameters of a custom datum if it is unknown to FAST Survey (see first table below).

- **RTK** tab: See the two tables below for the required settings.
- For a base, as recalled in these two tables, choose the format of corrections (ATOM, RTCM, CMR)
- Tap to complete the receiver configuration.

1) SP60 Standalone Rover

SP60 Used As:	Set "Device" to:	Set "Network" to:	Other Settings:
Network Rover	“Data Collector Internet”	1) “TCP/IP Direct” 2) “UDP/IP Direct” 3) “NTRIP”	1) Network parameters, 2) Modem APN and PIN
L-Band Rover (RTX)	“LBand”	(RTX)	Datum on Receiver tab (see NOTE below)

NOTE: To choose a datum other than ITRF08 after having selected “RTX”, go back to the **Receiver** tab and tap **14 Parameter Datum**.

Choose a different datum from the **Datum Name** scroll-down list. To enter a custom datum, select “<New>” from the same list and enter the datum parameters in the fields underneath.

2) SP60 Base-Rover System

Base/Rover System Uses:	Receiver Function	Set "Device" to:	Set "Network" to:	Other Settings:
Long-range Bluetooth: Set the base first!	Base	“Receiver Bluetooth”	(None)	1) Keep baud rate at 115200 2) Message type
	Rover	“Receiver Bluetooth”	(None)	1) Keep baud rate at 115200 2) Scan for base Bluetooth device and pair with it.
Radio link	Base	1) “Internal XDL” 2) “Pacific Crest PDL” 3) “ADL Vantage (Pro)”	(None)	1) Radio settings 2) Baud rate 3) Message type
	Rover	“Internal XDL”	(None)	Radio settings
CSD link*	Rover	“Data Collector Phone”	“Direct Dial”	1) Define a base name 2) Enter its phone number
		(Base: Typically not an SP60)		

* Provided the data collector modem supports this mode.

Using the UHF Kit Option

The UHF kit is an option that you can use to implement a radio-based, standalone RTK base/rover system (see *UHF Kit PN92673-00 on page 2* for more details on all the items provided in this kit).

With this configuration, you have full control of your base as you can choose where and when to install and operate it.

You will need two UHF kits to implement a complete radio-based RTK base/rover system. One kit will be installed on base side, the other on rover side.

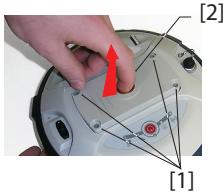
You will also need two UHF whip antennas, one at the base, one at the rover. UHF antennas may be ordered separately, or as part of specific accessories kits that you may need if you wish to install the UHF antenna used at the base on a separate pole. See *Other Optional Accessories on page 5* for further details.

Configuring your radio modules is required before you can use them. This procedure is discussed in *Configuring the UHF Module on page 25*.

Internal vs. External Power Source for a Base Using a UHF Radio Transmitter: This point has already been discussed when introducing the possible base setups. Please refer to *Internal vs. External Power Source on page 19*.

When a radio is used at the base, there is more power needed than in any other base setup. In this case, the use of an external power source (a 12 V battery) is recommended, especially if the base is operated unattended for a full day's work.

Installing the UHF Module into the Receiver



- Power off the SP60 and turn it upside down.
- Use the L-shaped Torx screwdriver provided in the SP60 UHF kit to loosen and remove the four screws ([1]) securing the 5/8" threaded insert plate.
- Insert a finger into the 5/8" threaded hole ([2]), then gently pull the plate out of the receiver, making sure you free the ribbon cable anchored to the plate without damaging it ([3]).
- Put away the 5/8" threaded insert plate in a safe place, possibly for subsequent use.
- Take a look at the instructions printed on the label located in the bottom of the recess.
- Connect the end of the ribbon cable (a 12-contact flat connector) to the UHF module ([4]) as instructed on the label (point 1).
- Insert the UHF module into the recess ([5]) as instructed on the label (point 2).
- Re-use the four screws and Torx screwdriver to secure the UHF module onto the receiver. Tighten the screws to preserve receiver watertightness (torque meter: 3 N.m).
IMPORTANT: After installing (or removing) the internal radio, you must reset the receiver (through hard reset or via field software).

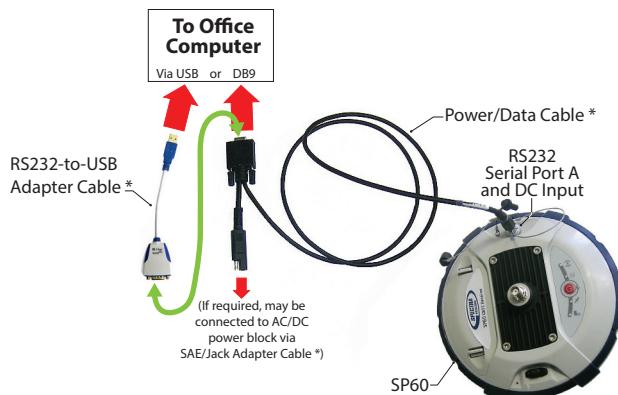
NOTE: The insertion of the UHF module **DOES NOT** modify the ARP (*Antenna Reference Point*) of the GNSS antenna.

Configuring the UHF Module

The standard settings of the UHF module can easily be changed from the field software.

For more advanced radio settings, use the procedure below:

- Use cable P/N59044-10-SPN from the Office Power Kit to connect the receiver to the computer (see diagram below).



*: All these items are part of the Office Power Kit P/N 94336 (option). Use the RS232-to-USB adapter cable if your computer is fitted with USB connectors (and no DB9 connector).

NOTE: Cable P/N59044-10-SPN is a Y-shaped cable also allowing you to power the receiver from an AC outlet (via the AC/DC power block) rather than from the receiver battery (see also *Connecting SP60 to your Computer on page 42*). When applied to the receiver's DC input, the external power source has priority over the internal battery, which means the battery can be left safely inside the receiver (it won't be drained).

- Make three brief presses on , then hold this button depressed for about 2 seconds until the buzzer beeps. As a result, the receiver switches to radio mode, providing direct access to the UHF module via the receiver's port A.
- Run Pacific Crest *ADLCONF* software on the computer and configure the radio to meet your requirements. Refer to *ADLCONF* instructions to complete this step.

Completing Rover Radio Setup



[6]



[7]

Once the UHF module has been secured to the receiver (see *Installing the UHF Module into the Receiver* on page 24) and properly configured, do the following:

- Screw the UHF whip antenna onto the coaxial connector of the UHF module ([6]). The antenna will therefore be oriented vertically upside down when used.

NOTE: Being placed in vertical position, the UHF antenna will stay as sensitive as if it were oriented the other way round.

- Take the top rod of the fiberglass range pole provided in the UHF kit. Insert first its end with special tapping, not 5/8" tapping, around the UHF antenna ([7]).

CAUTION - This special tapping uses a thinner thread compared to the standard 5/8" one. For this reason, be careful when you start screwing the rod into the UHF module. Make sure the rod fits well in the threaded part of the UHF module.

- Screw the top rod onto the threaded part of the UHF module. Spin the rod, rather than the receiver, when doing this.
- The receiver + top rod assembly can then be mounted on top of the other part of the range pole (the bottom rod).
- Complete the setup of your SP60 + UHF radio rover system by attaching the data collector onto the range pole. You are now ready for a survey.

Completing Base Radio Setup With External UHF Antenna



Two types of base setups are possible with an external UHF antenna:

- **The UHF antenna may be installed in vertical position on the same tripod as the base receiver.**

For this setup, you may use one of the available two PacCrest radio accessory kit options. (see *Other Optional Accessories on page 5*; the two kits are similar in terms of the hardware provided to install the UHF antenna).

Follow the instructions below:

- Secure the bracket onto one of the legs of the tripod (see [8]).
- If you wish to keep GNSS reception optimum, you may keep the UHF antenna below the GNSS receiver by fastening the counterpoise of the antenna directly onto the bracket (see [9]). (The antenna counterpoise is part of, and is located at one end of the coaxial cable provided.)

Then screw the antenna support onto the counterpoise and mount the UHF antenna on top of it (see [10]).

- If you prefer to optimize the radio range with this setup, raise the UHF antenna by inserting the two-element pole provided between the bracket and the antenna counterpoise (see [11]).

- **The UHF antenna may be installed on a separate tripod at some distance from the base receiver**, but still remaining compatible with the length of the coaxial cable you will be using. The UHF antenna should be installed at the highest possible height.



On receiver side, after the UHF module has been secured to the receiver and properly configured, do the following whatever your choice of antenna setup:

- Pass the male connector of the coaxial adapter cable (PN 96845) through the oblong hole of the pole extension (PN 95672) and make it go out of it at its upper end (see [12]).
- Connect it to the coaxial output of the UHF module.
- Screw the pole extension to the threaded part on the UHF module (see [13]). Spin the pole extension, rather than the receiver, taking care not to jam the coaxial cable extension when doing this.
- Secure the receiver/pole extension assembly onto the tripod.
- Connect the other end (female connector) of the coaxial cable extension to the coaxial cable coming down from the UHF antenna.
- Set up the base on the chosen reference point.

Completing Base Radio Setup With Internal UHF Antenna

The UHF antenna is connected directly to the UHF module and is hidden in the pole. The pole is installed on top of a tripod. Follow the same instructions as with a rover (see *Completing Rover Radio Setup on page 26*) to install the internal UHF antenna, but this time you will be using:

- A quarter-wave antenna (P/N 67410-11 or 67410-12, depending on the frequency band used) instead of a half-wave antenna. This shorter antenna is available as an optional accessory (see *Other Optional Accessories on page 5*).
- The pole extension with the oblong hole (from the UHF kit). You don't need to use the coaxial adapter cable.



Anti-Theft Protection



Purpose

The SP60 integrates an anti-theft function to protect your equipment while it is left operating unattended. This protection is intended for a SP60 operated as a base. The anti-theft protection will discourage the theft of an SP60 receiver by rendering it useless without the anti-theft password.

Enabling/Disabling the Anti-Theft Protection

The anti-theft protection is enabled and disabled from the data collector controlling the receiver. If you use the Spectra Precision Survey Pro or FAST Survey on your data collector, a user-friendly interface will let you quickly enable or disable the anti-theft protection (see *Using Anti-Theft and Startup Protections in Survey Pro* on page 32 and *Using Anti-Theft and Startup Protections in FAST Survey* on page 34).

If you are using other software, please contact Technical Support for more information.

How the Receiver Operates With the Anti-Theft On

With the anti-theft protection enabled, and as long as no theft is detected, the receiver will operate normally.

What the Anti-Theft Protection Does Initially

At the time the anti-theft protection is enabled, the last valid position computed by the receiver is saved in memory. This position is saved as the *anti-theft position*.

NOTE: You won't be allowed to enable the anti-theft protection until the receiver can compute a position solution in standalone mode for its location.

What Events Will Trigger a Theft Alarm?

From the moment the anti-theft protection is enabled (and an *anti-theft position* has been saved in the receiver), a theft condition will be detected, and an alert will be issued:

- If the receiver has unexpectedly been unable to deliver a valid position for the last 20 seconds or so.
- Whenever the protected receiver computes a valid position that is distant by more than 100 meters (around 330 feet) from the *anti-theft position*.

What Will Happen When a Theft is Detected?

The protected receiver will switch to “theft mode”, that is:

- The buzzer will regularly emit a sound alarm in quick succession, and for an indefinite period of time.
- All output messages will be stopped (the protected base receiver will no longer generate and transmit corrections, or any other NMEA or raw data messages).
- The power button of the protected receiver will be made inactive, which means no one can:
 - Reset the receiver
 - Upgrade the receiver.

What if the Thief Removes the Battery?

If the thief removes the battery before vanishing into thin air with your receiver, be sure the theft will be detected sooner or later. Next time the receiver is powered back on, because the protection is still active, the theft alarm will be set as soon as a valid position is computed and found distant by more than 100 meters from the memorized *anti-theft position*, or no valid position is delivered for 20 seconds or so.

There won't be any possibility for the thief to quit that mode and so the receiver will stay completely unusable.

Disabling Anti-Theft Before Turning Off the Receiver

If your base is set up every day at the same location and you wish to keep the protection active day after day, the anti-theft protection may be left enabled between work sessions. This will not trigger any false Anti-Theft alarm.

On the contrary, if the base is moved to a different location every day, we recommend you disable the anti-theft protection before you turn off the receiver. If you don't, when starting the next operating session on a new location, an Anti-Theft alarm will be raised mistakenly, requiring that you enter the Anti-Theft password on the data collector to remove the protection and stop the alarm, which may be annoying and a waste of time.

Lost your Anti-Theft Password?

If you lose that password, you will be unable to remove the Anti-Theft protection. You will need to call Technical Support, which will provide a specific password so you can disable the protection.

Startup Protection

Purpose

The SP60 integrates a protection from illegal use. With this protection active, only authorized operators will be allowed to use the receiver, after they have entered their password.

Enabling/Disabling Startup Protection

This protection may be enabled or disabled from the data collector controlling the receiver. If you use the Spectra Precision Survey Pro or FAST Survey on your data collector, a user-friendly interface will let you quickly enable or disable the startup protection (see *Using Anti-Theft and Startup Protections in Survey Pro* on page 32 and *Using Anti-Theft and Startup Protections in FAST Survey* on page 34).

If you are using other software, please contact Technical Support for more information.

How SP60 Operates with Startup Protection Active

The receiver operates with minimum functionality as long as the password has not been typed in from the data collector keyboard. It will operate normally as soon as the requested password has been entered.

Remember the password needs to be entered after each power-up sequence (and not only once), and as long as the protection is kept active.

When you enter the password to unlock the receiver, you can however decide at the same time that the startup protection should be deactivated (in that case, the password will not be required next time you start a new working session).

Difference Between Startup and Anti-Theft Protections

The difference is that startup protection prevents the receiver from being used illegally, whereas anti-theft protection is used to detect a possible theft after the receiver has been left operating unattended as a base.

Shared Resources

Anti-Theft and startup protections share the same password. If you change the password for anti-theft, then you have also changed the password for startup protection (and vice versa).

Can Anti-Theft and Startup Protections Be Both Active?

Yes. There is no contradiction between the two protections, which complement each other. If the startup protection is active and a theft alarm occurs, then you will have to enter the password twice: The first one will deactivate the anti-theft

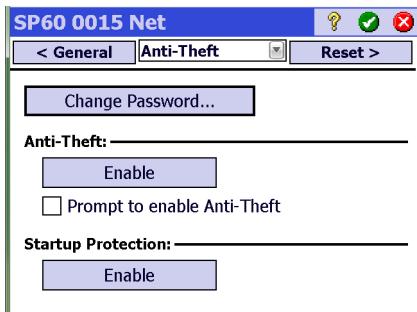
Using Anti-Theft and Startup Protections in Survey Pro

alarm, and the second one will make you a legal user of the receiver.

- Power on the SP60. Wait until the boot sequence is over.
- On the data collector, launch Survey Pro and open a job.
- Select **Switch to GNSS** to select the GNSS survey mode.
- Connect Survey Pro to your SP60 via Bluetooth.
- Create the suitable receiver profile for your SP60.
- Go back to **Manage Instruments** and select the receiver profile you have just created.

• Tap on .

- Open the **Anti-Theft** tab. This tab contains all the information you need to set the anti-theft and startup protections:



- **Change Password:** Tap on this button to enter and confirm the password that will allow the field operator to disable the anti-theft and startup protections.
NOTE: You cannot change the password while the anti-theft protection is active.
- **Enable** (anti-theft): This button allows you to enable the anti-theft function directly from this screen (as you would from **Survey > Anti-Theft**).
Before you enable anti-theft, please read the currently active password shown in plain on the screen. This is to make sure you will keep it in mind (you'll need it to disable the anti-theft protection). After anti-theft has been enabled, the **Enable** button turns into a **Disable** button.
- **Prompt to enable Anti-Theft:** When this box is enabled, users will be prompted to turn anti-theft on when they

set a base or start a standalone, static, post-processing session.

Keeping this box disabled means users will not be prompted.

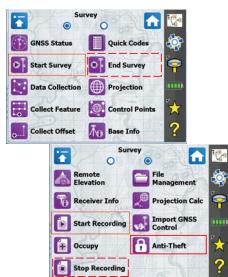
Users may enable or disable anti-theft protection at any time through **Survey > Anti-Theft**.

- **Enable** (startup protection): This button allows you to enable the startup protection.

Before you enable the startup protection, please read the currently active password shown in plain on the screen. This is to make sure you will keep it in mind (you'll need it to be allowed to use the receiver next time you turn it on). After the startup protection has been enabled, the **Enable** button turns into a **Disable** button.

Enabling/Disabling the Anti-Theft Protection

After you have set the receiver's **Anti-Theft** tab to meet your requirements, go to the **Survey** menu and then select one of the following functions:



- **Anti-Theft**: This function shows the current status of the anti-theft protection (**Enabled**, **Disabled** or **Alarm Raised**). It can be used to enable or disable the protection at any time.

You need to enter the password previously defined on the **Anti-Theft** tab before you are allowed to disable the anti-theft protection. If the theft alarm has been raised, you can only disable the anti-theft protection.

- **Start Survey**: When you use this function to set an RTK base, and provided the **Prompt to enable Anti-Theft** box has been enabled, the anti-theft protection will be enabled automatically. (A message will warn you that the protection has been activated and information will be given to tell you how to disable it.)

Later the protection will be disabled automatically when you use the **End Survey** function.

- **Start Recording**: When you use this function to start data recording, and provided the **Prompt to enable Anti-Theft** box has been enabled, the anti-theft protection will be enabled automatically. (A message will warn you that the protection has been activated and information will be given to tell you how to disable it.)

Later the protection will be disabled automatically when you use the **Stop Recording** function.

Using Anti-Theft and Startup Protections in FAST Survey

- Power on the SP60. Wait until the boot sequence is over.
- On the data collector, launch FAST Survey and open a job.
- Tap **Equip** to access the equipment menu.
- Tap on **GPS Base** or **GPS Rover**. Through the four tabs presented, configure your SP60 as desired.

REMINDER: Anti-Theft protection only makes sense for a base.

- Tap to complete the receiver configuration.
- Still from the **Equip** menu, tap on the **GPS Utilities** button. This opens a menu now including the **Theft Protection** button (this button is added to the menu following the selection of the SP60 as the type of receiver used).
- Tap on the **Theft Protection** button. This opens a new window showing the following parameters:
 - **Enable Startup Protection** button: Allows you to activate the startup protection after you have entered the correct password, as defined below.
 - **Enable Anti-Theft** button: Allows you to activate the anti-theft protection after you have entered the correct password, as defined below.
 - **Password** button: Is used to define the password needed to activate/deactivate the anti-theft and startup protections.

Once one of the two protections has been activated, you can no longer change the password.



Collecting Raw Data Files

Raw Data Logging in Standalone Mode

You can control raw data logging sessions directly from the SP60, without the need for a data collector. After turning on the receiver, do the following to enable raw data logging:

- Make a brief press on . The receiver enters the configuration mode (LEDs are all in slow blinking state).
- Make another brief press on . The data logging LED starts blinking amber at a fast rate.
- Hold  depressed for about 2-3 seconds until the buzzer emits a sound. Data logging is then started and you will see the data logging LED now solid amber. The receiver has automatically escaped from the configuration mode and is now operating in normal mode.

To stop data logging, repeat exactly the previous three steps. See also flowchart on *page 16*. This will turn off the data logging LED.

Raw Data Logging from Field Software

With Survey Pro:

- To start data logging, open the **Survey** menu and select **Start Recording**. While data are being logged, the screen shows, by default, the **Post-Process** tab from the **GNSS Status** function.
- To end data logging, open the **Survey** menu and select **Stop Recording**. Survey Pro will then prompt you to download the raw data file to the data collector.

With FAST Survey:

- To start data logging, open the **Survey** menu, select **Log Raw GPS**, then **Start File**. Tap on .
- To end data logging, just select **Close File**.

Downloading Raw Data Files to a USB Key



The first time you connect the USB port to a computer, the required driver is installed automatically on the computer. After the driver has been installed, follow the instructions below.

- Connect the USB key to a mini-USB-to-USB adapter (see picture). (This adapter is not provided.)
- Connect the other end of the adapter to the SP60. After about 2 seconds, the buzzer sounds briefly, meaning the USB key is ready for use, and the Log LED starts flashing amber at a fast rate. If you do nothing in the next 4 seconds, the Log LED will turn off and you won't be able to start the download sequence.
- So while the Log LED is still flashing, press the Power button. This causes the buzzer to sound briefly meaning the receiver is now downloading all its G-files to the USB key. The buzzer will emit another brief sound when the file transfer is complete.
- Disconnect the mini-USB-to-USB adapter from the SP60.

NOTE: This procedure will not delete the downloaded files from the receiver.

Downloading Raw Data Files Directly to a Computer

Use *SP File Manager*. See *SP File Manager Software Utility on page 42*.

Files can also be downloaded to the data collector using Survey Pro (**Survey** menu > **File Management**) or FAST Survey (**Survey** menu, **Log Raw GPS** > **File Manager** button) field software.

Post-Processing Raw Data Files

This can be done using *Spectra Precision Survey Office (SPSO)* software.

Using the SP60 From an Android Platform

SP60 can be controlled from an Android platform, such as the Spectra Precision MobileMapper 50. This section explains what to use this type of platform with the SP60.

Connecting an Android Platform to the SP60

Connecting an Android platform to the SP60 is not just a matter of making a physical connection via Bluetooth. Beforehand, you also need to install and run a specific software interface on the Android platform. This application is called “SPace” and is available from Spectra Precision via Google Play.

SPace will smoothly let your Android application use position data delivered by the SP60.

Installing SPace

SPace may be downloaded from Google Play (search for “Spectraprecision” applications and then find “SPace” in the list of available applications).

Direct link to installation file: <https://play.google.com/store/apps/details?id=com.spectraprecision.android.space>

Then follow the instructions to install the application on your Android platform.

Making SP60 the “Position Provider”

The first time you run SPace on your Android platform, a message will show up asking you to activate **Allow mock locations** (unless already done).

- Tap **Yes**. This opens the **Developer Options** submenu in the **Settings** menu.
- Scroll down until you see the **Allow mock locations** option.
- Activate this option and then return to the home screen.

NOTE: Enabling **Allow mock locations** allows the Android platform to use the position provided by the SP60 rather than the one delivered by its own embedded GNSS receiver. When you are finished using SP60, disable **Allow mock locations** on the Android platform. The function of “position provider” will then be restored to the embedded GNSS receiver.

More Information about SPace

You may read more information about SPace by opening its on-line help file. To open this file:

- Tap 
- Tap **Help**.

Appendix

SP Loader Software Utility

Use Spectra Precision *SP Loader* software to:

1. Upgrade the receiver firmware
2. Install new firmware options
3. Validate RTX subscription.
4. Read the warranty expiration date of a GNSS receiver.

Installing SP Loader

SP Loader can be downloaded from:

<http://www.spectraprecision.com/eng/sp60.html#.VdWdb5dWIQo>

(Click on the Support button to access the download link.)

The install file is an exe file. Simply double-click on this file to start installation. Follow the instructions on the screen to complete the installation.

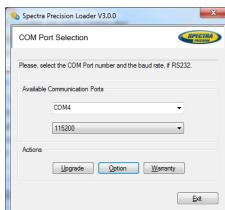
Getting Started With SP Loader

SP Loader will use either a serial (RS232), Bluetooth or USB connection to communicate with the receiver. USB is recommended

1. Connect your computer to the SP60 using a USB connection.
2. Run *SP Loader* on your computer.
3. Select the computer's port ID used to communicate with the receiver. This port ID should correspond to the computer's USB port.

NOTE: An easy way to identify which port ID on your computer is the USB port is to run *SP Loader* first without the USB connection and read the list of available ports in *SP Loader*. After restoring the USB connection with the receiver, check that list again. An extra port ID will then be listed, being the one assigned to the USB port. Select that port. (You don't need to define a baud rate for a USB port.)

4. To upgrade receiver firmware, install a new firmware option or validate an RTX subscription, see sub-sections below.



Upgrading Receiver Firmware

You are not allowed to upgrade a receiver if anti-theft or/and start up protection is active or if the receiver is operated with an in-progress or expired validity period.

Firmware upgrades will be downloadable from the Spectra Precision website in the form of compressed ".tar" files. The name of the ".tar" file, as well as the step-by step upgrade procedure will be given in the accompanying *Release Note*. Completing a firmware upgrade procedure will take up to 10 minutes. For this reason, it must be run with the receiver powered from either a properly charged internal battery or using an external power source.

Unless otherwise specified in the *Release Note* attached to the upgrade package, follow the instructions below to complete the upgrade of your receiver:

1. Follow the first three steps described in *Getting Started With SP Loader on page 38*.
2. Click **Upgrade**. Wait until SP Loader has detected the receiver.
3. Browse your computer in search of the upgrade file.
4. Select the file and click **Open**. SP Loader then provides information on the currently installed firmware, the new firmware as well as the current state of the battery (if the internal battery is used).

This should tell you if you can run the upgrade with the battery, or rather use a fresh one or an external power supply.



5. When you are ready, click on the **Update** button.
6. Let the receiver proceed with the upgrade (a status window is displayed showing a progress bar). **Take care not to turn off the receiver while the upgrade is in progress.**
7. After successful completion of the upgrade, click **Close** to close the status window. Check that the new firmware is now installed (version and date displayed in the SP Loader main window).
8. Click **Close** again, then **Exit** to quit SP Loader.

Installing a Firmware Option

Before you start this procedure, make sure you have received an email from Spectra Precision containing the POPN corresponding to the firmware option you have purchased.

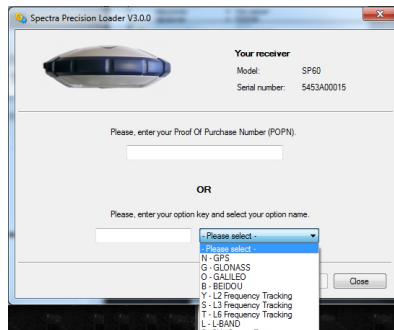
NOTE : Your computer needs an Internet connection to install a firmware option using a POPN.

With the POPN now in your possession, do the following to install a new firmware option:

- Follow the first three steps described in *Getting Started With SP Loader on page 38*.
- Click **Option**. Wait until SP Loader has detected the receiver.

SP Loader then displays the serial number of your receiver and prompts you to enter the POPN.

(There is an alternate method to activate a firmware option, which is to enter the option key (provided by Spectra Precision) corresponding to the desired firmware option, and to specify that option in the nearby field.)



- Enter the POPN and then click on **Update**. Let the receiver proceed with the installation of the firmware option (a status window is displayed showing a progress bar). **Take care not to turn off the receiver while the installation is in progress.**
- After successful completion of the installation, click **Close** to close the status window.
- Click **Close** again, then **Exit** to quit SP Loader.

Validating RTX Subscription

After you have purchased an RTX subscription, *Trimble Positioning Services* will email you a validation code. You may purchase a subscription for working in:

- CenterPoint RTX
- FieldPoint RTX
- RangePoint RTX
- ViewPoint RTX

Use the same procedure as the one used to install a firmware option (see *Installing a Firmware Option on page 40*); the available RTX subscriptions are listed as firmware options. The only difference is that no POPN is provided for this procedure. Just enter the code provided by *Trimble Positioning Services* and specify the type of subscription you purchased before you click **Update**.

Reading Receiver Warranty Expiration Date

SP Loader can be used to query the Spectra Precision database for the warranty expiration date of your GNSS receiver. (After a receiver warranty has expired, remember receiver firmware upgrades are no longer free of charge.)

You don't need to have your receiver connected to *SP Loader* to read its warranty expiration date. Just enter its type and serial number and *SP Loader* will return this information to you, provided there is an active Internet connection on your computer, and your receiver is known to the database.

- Run *SP Loader* on your computer.
- Click on **Warranty**
- Select the type of your receiver and enter its serial number
- Click on **Compute**. *SP Loader* returns the warranty expiration date in a field underneath the **Compute** button.

Additionally, *SP Loader* generates a proprietary command that you can run in your receiver if you want to be sure your receiver has the correct warranty expiration date in memory. Carefully write down this command

Use **Terminal Window** in Survey Pro, or **GPS Utility > Send Command** in FAST Survey to apply this command to the receiver.

NOTE: When upgrading the receiver firmware using a computer with an Internet connection, be aware *SP Loader* will at the same time automatically check the warranty expiration date of your receiver. *SP Loader* will ask you if it can update this date if it is found wrong.

SP File Manager Software Utility

SP File Manager allows you to copy “log” files and G-files directly from the receiver’s internal memory to the desired folder on your office computer.

Additionally you can delete any G-file or “log” file from the receiver’s internal memory.

G-files are GNSS raw data files in proprietary format (ATOM). “Log” files are editable text files listing all the operations performed by the receiver in one day.

SP File Manager is available from the Spectra Precision website as an exe file (*SPFileManagerSetup.exe*) through the link below:

<http://www.spectraprecision.com/eng/sp60.html#.VdWdb5dWIQo>

(Click on the Support button to access the download link.)

Installing SP File Manager

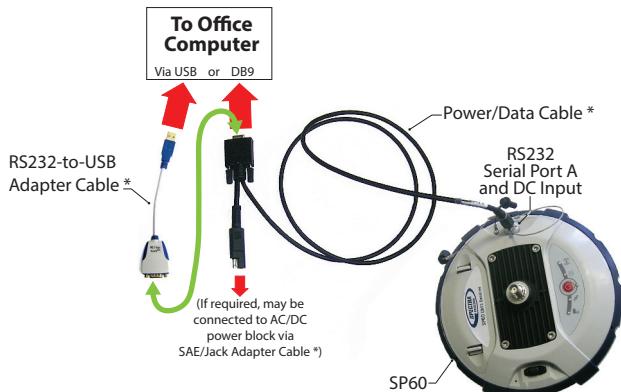
SP File Manager is very easy to install:

- Download the exe file from the Spectra Precision website (use above link).
- Double-click on the exe file to complete the installation.

Connecting SP60 to your Computer

There are different ways of communicating with the receiver:

- **Through Bluetooth.**
- **Through an RS232 line**, using port A on the receiver, and a DB9 or USB socket, on computer side (see illustration below). The default speed for port A on receiver side is 115200 Bd.



*: All these items are part of the Office Power Kit P/N 94336 (option).

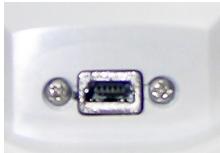
The Office Power Kit required for this serial connection is designed to let you power the receiver from an AC outlet rather than from the receiver battery (see illustration above).



When applied to the receiver's DC input, the external power source has priority over the internal battery, which means the battery can be left safely inside the receiver (it won't be drained).

IMPORTANT: Be sure you align the red markings (a red dot on the connector, a red line on the socket) before pushing the Lemo connector in. Conversely, when it's time to disconnect the Lemo connector, please use the attached metal strap to pull the connector out.

- **Through USB.** Connect the SP60 to the computer via the USB-to Mini Universal cable provided.



The first time you make this connection, the required USB driver will be installed automatically on the computer to make that connection possible.

When using the receiver's USB port, you can still use the previous setup to power the receiver through its DC input (in this case, you don't need to connect the DB9 connector of the Power/Data cable to the computer).

In this setup, you can alternately replace the Power/Data cable (P/N 59044-10) from the Office Power Kit with cable P/N 95715 from the Field Power Kit (option). See diagram below.



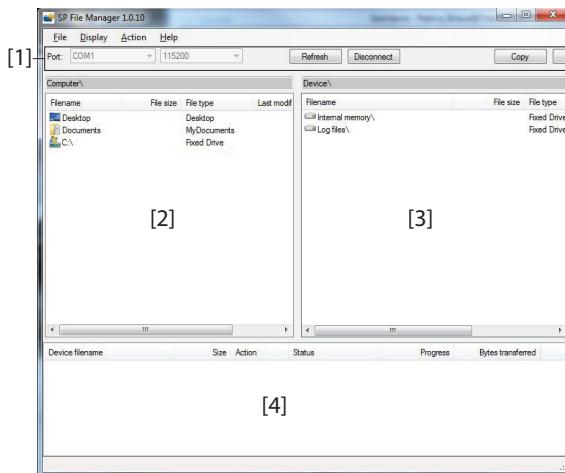
*: This item is part of the Office Power Kit P/N 94336 (option).

**: This item is part of the Field Power Kit P/N 94335 (option)

IMPORTANT: After removing the USB cable, and before going back to the field with your receiver, please place the protection lid back on the USB connector.

Getting Started With SP File Manager

Double-click on  . The *SP File Manager* window which then appears is detailed below.



[1]: SP File Manager toolbar. This toolbar consists of the following items:

- **Port** and baud rate scroll-down lists: Let you choose which serial port is used on computer side for the connection with the receiver (baud rate only makes sense when an RS232 serial line is used). Use 115200 Bd to communicate with SP60.
- **Connect / Refresh** button: **Connect** allows you to activate the connection between the computer and the receiver via the chosen serial line. When the connection is established, the button is changed into **Refresh**, which allows you to update the content of the two *SP File Manager* panes ([2] and [3] described below)
- **Disconnect** button: Allows you to deactivate the connection currently established between the computer and the receiver.
- **Copy** button: Copies the file(s) selected in pane [3] to pane [2]. In pane [2], you have to open the folder where to copy to before clicking on the **Copy** button.

NOTE: Copied files have different creation dates and times compared to those of their respective original files. The new dates and times are those corresponding to when the files were copied.

- **Delete** button: Deletes the files currently selected in pane **[2]** or **[3]**.

[2]: Pane showing the content of the currently open folder on computer side.

[3]: Pane showing the content of the currently open folder on receiver side. The receiver's root folder contains two or three sub-folders:

- **Internal memory:** Lists all G-files recorded by the receiver in its internal memory
- **Log files:** Contains log files (one per day). Each log file lists all the actions performed by the receiver in one day.
- **USB key,** if one is currently connected to the receiver.

To open a folder, double-click on it. To go back to the parent folder, click on  ...

[4]: Pane showing copy/delete operations in progress, and all those completed since the connection with the receiver was established. This pane is cleared at the beginning of each new working session of *SP File Manager*.

Establishing a Connection with the Receiver

- Set up the physical connection (RS232 or USB as explained in *Connecting SP60 to your Computer on page 42*)
- Turn on the receiver.
- Launch *SP File Manager* on your computer. This opens the *SP File Manager* window.
- For an RS232 connection, first edit the line settings (default baud rate for receiver is 115200 Bd) then click on the **Connect** button. For a USB connection, select the right COM port (see also the Note in *Getting Started With SP Loader on page 38*) and then click on the **Connect** button.

As a result, the pane on the right-hand side of the window lists the two or three folders that can be seen on the receiver.

Copying Files to the Office Computer

- In the right-hand side of the window, double-click on the sub-folder containing the files you want to copy to the computer.

(If needed, click on  ... to go back to the parent folder and open another sub-folder.)

- In the left-hand side of the window, browse your computer to the folder where to copy the files (recipient folder).
- In the right-hand side of the window, highlight the file(s) you want to copy.
- Click on the **Copy** button. Files are then copied, as requested. The lower part of the screen provides reports information on the copy operations in progress.

Deleting Files from the Receiver

- In the right-hand side of the window, double-click on the sub-folder containing the files you want to delete from the receiver.
(If needed, click on  to go back to the parent folder and open another sub-folder.)
- Still in the right-hand side of the window, highlight the file(s) you want to delete.
- Click on the **Delete** button. Files are then deleted. The lower part of the screen provides reports information on the delete operations in progress.

Restoring Factory Settings

This can be done starting from a powered-off receiver. Just hold down the Power button for about 10 seconds. This causes a reset procedure to be started. At the end of this procedure, all factory settings are restored, except the following, which are kept unchanged:

- Bluetooth
 - PIN code
 - Receiver's Bluetooth name
- Anti-Theft & startup protections
 - Current states (enabled or disabled)
 - Password
 - Anti-Theft position
 - Last position computed

Restoring factory settings is not allowed if one of these cases:

- Anti-theft protection is active
- Startup protection is active
- A validity period is active (whether still in progress or over). (Validity periods are designed to let users work with the receiver in a predefined configuration and for a limited period of time.)

Technical Specifications

GNSS Characteristics

- 240 GNSS channels
 - GPS L1 C/A, L1P (Y), L2P (Y), L2C
 - GLONASS L1 C/A, L2 C/A, L3
 - BeiDou B1 (phase 2), B2
 - Galileo E1, E5b
 - QZSS L1 C/A, L2C, L1 SAIF
 - SBAS L1 C/A
 - L-Band
- Patented Z-Blade technology for optimal GNSS performance:
 - Full utilization of signals from all 6 GNSS systems (GPS, GLONASS, BeiDou, Galileo, QZSS and SBAS)
 - Enhanced GNSS-centric algorithm: Fully independent GNSS signal tracking and optimal data processing, including GPS-only, GLONASS-only or BeiDou-only solution (Autonomous to full RTK)
 - Fast Search engine for quick acquisition and re-acquisition of GNSS signals.
- Patented SBAS ranging for using SBAS code & carrier observations and orbits in RTK processing
- Patented Strobe™ Correlator for reduced GNSS multi-path
- Up to 10 Hz real-time raw data (code & carrier and position output)
- Supported data formats: ATOM, CMR, CMR+, RTCM 2.1, 2.3, 3.1 and 3.2 (including MSM). In rover only: CMRx and sCMRx.
- NMEA 0183 messages output

Real-Time Accuracy (RMS)

(1) (2)

SBAS (WAAS/EGNOS/MSAS/GAGAN):

- Horizontal: < 50 cm (1.64 ft)
- Vertical: < 85 cm (2.79 ft)

Real-Time DGPS Position:

- Horizontal: 25 cm (0.82 ft) + 1 ppm
- Vertical: 50 cm (1.64 ft) + 1 ppm

Real-Time Kinematic Position (RTK):

- Horizontal: 8 mm (0.026 ft) + 1 ppm

- Vertical: 15 mm (0.049 ft) + 1 ppm

Subscriptions to Trimble RTX Corrections Services Supported by SP60

(1) (2)

Service	Horizontal Accuracy (RMS)	Initialization Time	GNSS Frequencies
CenterPoint RTX	< 4 cm	< 30 min, or <5 min (*)	L1+L2
FieldPoint RTX	< 10 cm	< 15 min, or <5 min (*)	L1+L2
RangePoint RTX	< 30 cm	<5 min (**)	L1+L2
ViewPoint RTX	< 50 cm	<5 min (**)	L1

(*) First figure is without RAM available (RAM: Regional Atmospheric Model), second figure is with RAM available.

(**) With or without RAM available.

Real-Time Performance

- Instant-RTK® initialization
 - Typically 2 seconds for baselines less than 20 km
 - Reliability: up to 99.9%
- RTK initialization range: over 40 km

Post-Processing Accuracy (RMS)

(1) (2)

Static & Fast Static:

- Horizontal: 3 mm (0.118") + 0.5 ppm
- Vertical: 5 mm (0.196") + 0.5 ppm

High-precision Static (3):

- Horizontal: 3 mm (0.118") + 0.1 ppm
- Vertical: 3.5 mm (0.137") + 0.4 ppm

Data Logging Characteristics

Recording Interval: 0.1 - 999 seconds

Physical Characteristics

- Size: 21 x 21 x 7 cm (8.3 x 8.3 x 2.3")
- Weight: 0.930 kg (2.08 lb)
- User interface: Five LEDs for power, tracking, Bluetooth, data logging and radio
- I/O interface:
 - RS232 serial link
 - USB 2.0/UART and USB OTG

- Bluetooth 2.1 + EDR, long range: class 1 (19 dBm)
- Memory:
 - 256 MB internal memory NAND Flash
 - Over a month of 15 sec. raw GNSS data from 14 satellites
- Operation:
 - RTK rover & base
 - RTK network rover: VRS, FKP, MAC
 - CenterPoint RTX (IP and satellite)
 - NTRIP, Direct IP
 - Post-processing
- Environmental characteristics:
 - Operating temperature: -40° to +65°C (-40° to +149°F) (4) (7)
 - Storage temperature: -40° to +85°C (-40° to +185°F) (5)
 - Humidity: 100% condensing
 - IP67 waterproof, sealed against sand and dust
 - Drop: 2 m pole drop on concrete
 - Shocks MIL STD 810 (fig. 516.5-10)(01/2000) (8)
 - Vibrations: MIL-STD-810F (fig 514.5C-17)(01/2000) (8)
- Power characteristics:
 - Li-Ion battery, 7.4 V, 2600 mAh
 - Battery life time: 10 hrs (GNSS On, and UHF Rx Off); or 8 hrs (GNS On, UHF Rx On)
 - External DC power: 9-28 V
- Optional system Components:
 - UHF kit (410-470 MHz, 2 W, TRx)
 - Field Power Kit
 - Office Power Kit
 - Data collectors: Ranger 3, T41, MobileMapper 20, ProMark 120
 - Field Software: Survey Pro, FAST Survey, ProMark Field

Standard & Optional System Components

See *SP60 Packout* on page 2.

Data Collectors and Software

The following options are available for use with SP60.

Data collectors:

- Ranger 3
- T41
- MobileMapper 20
- ProMark 120

Field software:

- Survey Pro
- FAST Survey

- (1) Accuracy and TTFF specifications may be affected by atmospheric conditions, signal multipath, satellite geometry and corrections availability and quality.
- (2) Performance values assume minimum of five satellites, following the procedures recommended in the product manual. High multipath areas, high PDOP values and periods of severe atmospheric conditions may degrade performance.
- (3) Long baselines, long occupations, precise ephemeris used
- (4) At very high temperatures, the UHF module should not be used in the transmitter mode.
- (5) Without battery. Battery can be stored up to +70°C.
- (6) Receiver convergence time varies, based on GNSS constellation health, level of multipath, and proximity to obstructions such as large trees and buildings.
- (7) With the UHF module (optional kit), used as a transmitter and radiating 2 W of RF power, the operating temperature range is limited to -40° to +55°C (-40° to +131°F)
- (8) 3D vibrations & shocks were tested resulting in no mechanical or GNSS performance issues detected.

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SP60 GNSS Receiver

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