SP80 GNSS Receiver

User Guide

June 2016
From v3.10 Firmware

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

$C\epsilon$

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:
SP80 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 Batteries

This receiver uses one or two rechargeable Lithium-ion batteries.

⚠️ **WARNING** - Do not damage the rechargeable Lithium-ion batteries. 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 batteries if they appear to be damaged. Signs of damage include, but are not limited to, discoloration, warping, and leaking battery fluid.

- Do not expose the batteries to fire, high temperature, or direct sunlight.

- Do not immerse the batteries in water.

- Do not use or store the batteries inside a vehicle during hot weather.

- Do not drop or puncture the batteries.

- Do not open the batteries or short-circuit their 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 batteries only in strict accordance with the instructions. Charging or using the batteries in unauthorized 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 61116-10) or the AC/DC power block (model ADP-65JH AB, P/N 78650-SPN) to charge the SP80 Lithium-ion batteries. See instructions in this guide. These two devices are part of the SP80 standard accessories list.

  CHARGE THE BATTERIES 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 batteries only in Spectra Precision equipment that is specified to use them.

- Use the batteries only for their intended use and according to the instructions in the product documentation.

Disposing of Rechargeable Lithium-ion Batteries

Discharge Lithium-ion batteries before disposing of them. When disposing of batteries, 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 & Wifi Radios

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

The internal wireless radios operate 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 radios are 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.

Table of Contents

About Spectra Precision SP80

The Spectra Precision SP80 is a new-generation GNSS receiver that combines decades of GNSS RTK technology with a revolutionary new GNSS processing. Featuring the new 240-channel "6G" chipset, the SP80 system is optimized for tracking and processing signals from all GNSS constellations.

In addition, SP80 is the most connected GNSS receiver in the industry. It is the first to offer a unique combination of integrated 3.5G cellular, WiFi and UHF communications with SMS, email and anti-theft features.

These powerful capabilities, packaged in an ultra-rugged and cable-free housing with unlimited operation time (hot-swappable batteries) make SP80 an extremely versatile turnkey solution.

The key features of the SP80 are:

• Patented Z-Blade technology
• WiFi, SMS and e-mail communication
• Anti-theft technology
• elevel technology
• Backup RTK and RTK Bridge
• Hot-swappable batteries
• 3.5G cellular modem
• Trimble CenterPoint® RTX capable

SP80 Packout

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

Standard Accessories

The SP80 GNSS Single Receiver Kit (P/N 94334-00) consists of the following items.

Item	Picture	Spare Part (1)
SP80 GNSS receiver		(Not Applicable)
Li-Ion Battery, 2.6 Ah, 7.4 V, 19.2 Wh (Qty: 2)		92600-10 (one battery)
Dual Li-Ion Battery Charger (does not include AC/DC power supply and cable)		53018010-SPN
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-Mini Universal Cable		67901-11
Universal Hard Case, including large, soft bag for field transport		802142-02
Product Software and Documentation Leaflet, Quick Start Guide and Anti-Theft Technology Adhesive Sticker.		(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 SP80 User Guide may be downloaded from:
http://www.spectraprecision.com/eng/sp80.html#.Vd72BpdWIQo/

Optional Accessories

Three different kits are available as optional accessories.

Item	Picture	Spare Part (1)
SP80 UHF Kit P/N 92673-00 (2):		
UHF Module		(Not Applicable)
Base Pole Extension, 25 cm (9.5") long, with oblong aperture		95672
Rover Range Pole, 2 m (6.5 ft) long, fiber-glass, two parts, with specific tapping on top part		89937-10
Soft Bag for Range Pole		95860
T25 Torx Screwdriver, "L" shaped		(Not Applicable)
SP80 Field Power Kit P/N 94335:		
Power cable, 0.6 m, 7P Lemo to SAE		95715
Power cable, 1.8 m, SAE to battery clips (3)		83223-02-SPN
SP80 Office Power Kit P/N 94336:		
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 these three SP80-specific kits 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.
(3) 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.

Other Optional Accessories

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	
UHF whip antenna, ¼ wave, with TNC adapter: • 410-430 MHz • 430-470 MHz	 67410-12 67410-11	
Coaxial adapter cable (for use with P/N 95672)	96845	
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	
Y cable, receiver-to-PacCrest HPB & Battery, 3.0 m (OS7P to 1S5P)	PCC-A02507	

Discover Your New Equipment

Take a few minutes to discover your new SP80.

Front Panel

- **[1]**: **Power** button. Hold the button depressed for about two seconds to turn on or off the receiver.
- **[2]**: Display screen
- **[3]**: Battery A LED indicator.
- **[4]**: Battery A compartment.
- **[5]**: Battery B LED indicator.
- **[6]**: Battery B compartment.
- **[7]**: **Scroll** button. Press this button to scroll through all the display functions (including alarm screens if any). Also used to accept or reject prompts in some particular contexts.
- **[8]**: **Log** button. From the General Status screen, press this button to start or stop GNSS raw data recording. From all other screens, pressing this button takes you back to the General Status screen. Also used to accept or reject prompts in some particular contexts.

  NOTE: Pressing these buttons simultaneously gives access to special receiver functions. See all the possible combinations in *Special Key Combinations on page 10*.

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Bottom View
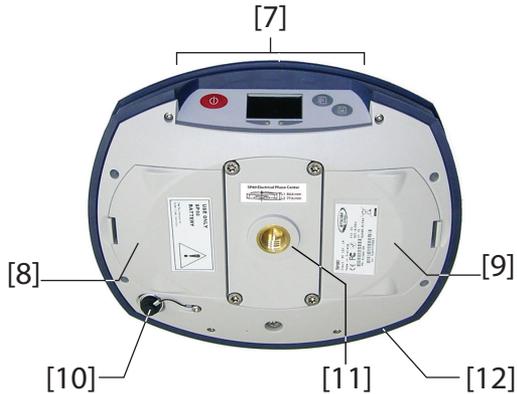
- **[7]**: Front panel (see details above)
- **[8]**: Battery A compartment trapdoor
- **[9]**: Battery B compartment trapdoor

  CAUTION - THE TWO TRAPDOORS SHOULD BE OPENED ONLY FOR INSERTING OR REMOVING BATTERIES. THE REST OF THE TIME, PLEASE ALWAYS KEEP THEM FULLY CLOSE TO PRESERVE WATERTIGHTNESS.

- **[10]**: 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.

- **[11]**: 5/8" threaded insert. 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 83*).

- **[12]**: Shock absorber making up a robust protection belt for the receiver against drops to the ground. The shock absorber houses two flaps for access to two card slots and to a USB connector. The height mark is also nested in the shock absorber. See below.

Right-Side View

[13] [14]

[15]

- **[13]**: SD card holder. An SD Card is a removable memory extension that can be used to:
  – Record GNSS raw data
  – Copy G-files from the internal memory
  – Or install firmware upgrades

  Maximum capacity according to SDHC standard: 32 GB
  The SD Card should be inserted into the receiver with its label side oriented downward (pins upward).

- **[14]**: Standard (Mini) SIM card holder. A SIM card is required to operate the internal cell modem when the receiver is used in Direct IP, NTRIP or CSD. Please contact your Internet Service Provider (ISP) to get the SIM card you need.
  The SIM card should be inserted into the receiver with its label side oriented downward (visible chip upward).
  WARNING - MAKE SURE YOU INSERT THE SIM CARD INTO THE SIM CARD HOLDER AND NOT ELSEWHERE.

- **[15]**: Rubber flap protecting the SD card and SIM card holders. To preserve watertightness, **ALWAYS KEEP FULLY CLOSE** when you don't need to access the card slots.

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Left-Side View
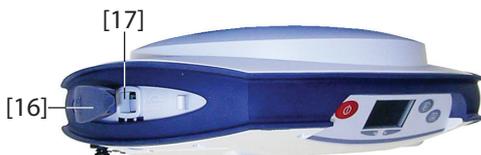
- **[16]**: Rubber flap protecting the USB connector. To preserve watertightness, **ALWAYS KEEP FULLY CLOSE** when you don't need to use the USB port.

- **[17]**: USB connector emulating standard RS232 serial port (port B). Used typically for downloading/deleting files using *SP File Manager*, or upgrading firmware/warranty date using *SP Loader*.

  The first time you connect the SP80 to a computer through a USB connection, the required driver will automatically be installed on the computer. If however the installed driver does not work, you may replace it with one of the two drivers posted on the Spectra Precision website:

  http://www.spectraprecision.com/eng/sp80.html#.Vd72BpdWlQo
  USB driver for 64-bit OS: SpectraPrecisionUSBSerialSetup_x64.exe file
  USB driver for 32-bit OS: SpectraPrecisionUSBSerialSetup_x86.exe file
  Double-click on the downloaded file to install the driver.

Phase Center Location

See diagram below. These are relative measurements.

L1 84.6 mm
L2 77.6 mm
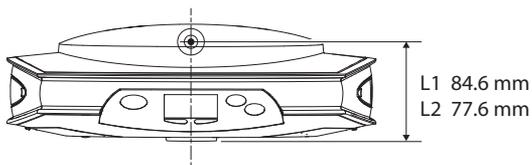
The field software usually calculates the real height of the instrument, based on the location of the L1 phase center.

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 (**[18]**) is nested on the shock absorber diagonally to the front panel.

[18]

When the receiver is mounted on a tripod – for use as a base 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:

Slant Measurement = Measured Distance + Delta L
Where "Delta L" is the length of the tape measure housing.
Delta L= 0.073 m or 0.2396 ft (2 7/8 inches), as mentioned on the housing.
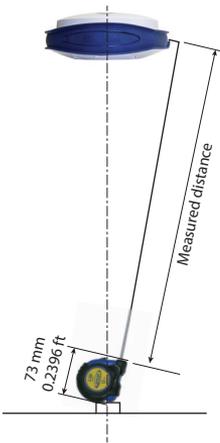
When the field software requests your input to determine the instrument height, you will then choose to enter the slant measurement, rather than the vertical one. The software will then be able to deduce the real height of the instrument from the known dimensional parameters of the antenna and the slant measurement you will have entered.

Measured distance

73 mm
0.2396 ft

Special Key Combinations

The SP80 has three different key combinations requiring that the receiver be initially turned off. See table below for details.

Key combination	Function
+ (Power + Scroll buttons)	Starts a firmware upgrade sequence from the file stored in the SD Card.
+ (Power + Log buttons)	Enters the Service mode in which the UHF module, if any, is temporarily connected to the receiver's serial port A for radio settings. Refer to *Using the UHF Kit Option on page 83*.
+ + (Power + Scroll + Log buttons)	Restores factory settings (see list in *Restoring Factory Settings on page 103*).

Screen Illumination & Buzzer

Screen illumination is automatically turned off if no button has been pressed for 10 minutes of receiver operation. The screen will then become entirely blank.

Screen illumination will be reactivated through one of the following actions or events:

• By pressing shortly on the **Log** or **Scroll** button, which will then recover their usual functions,

• On inserting an SD Card into the receiver,

• On occurrence of an alarm.

The buzzer can be heard in the following cases:

• When your data collector establishes a Bluetooth connection with the receiver,

• On occurrence of an alarm.

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Using SP80 for the First Time

⚠

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

The batteries are 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 batteries completely before first use. (See warnings and safety information at the front of this guide.)

Charging the Batteries

1. Set up the battery charger as explained:
   - 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 POWER LED to turn solid green.

2. Insert the two batteries (**[7]**) onto the battery charger (give the right orientation to the battery). For each battery, the CONTACT LED will turn solid orange when the battery is detected. The CHARGE LED will start blinking green at a fast rate to indicate that the battery is being charged.

3. The batteries charge one after the other. This will take a few hours. When a battery reaches full charge, the corresponding CHARGE LED turns solid green.

4. Remove the batteries from the charger when both fully charged.

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

—[6]

[4]—

—[5]

[2]—

[1]—

—[7]

[3]—

11

Inserting the Batteries

[8] [9] [10]

[11]

[12]
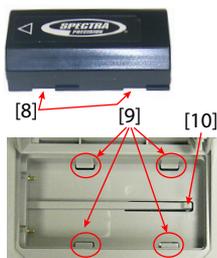
Each battery is fitted with four recesses, two on each side (see **[8]**).

These allow you to slide the battery into tabs located at the bottom of the compartment (see **[9]**).

Once the battery is fully inserted, a stop mechanism (**[10])** is released by the battery to secure the electrical connection to the receiver (this mechanism prevents the battery from moving longitudinally).

> The combination of these two mechanisms (slide + stop) will guarantee a secure electrical connection to the receiver in all circumstances.

The two battery compartments are accessible from underneath the receiver. Follow this procedure to insert a battery into its compartment:

1. Turn the receiver upside down.
2. With a finger, push the snap-in hook inward to unlock the trapdoor (see **[11]**), then pull it open (see **[12]**).
3. Give the right orientation to the battery, prop it against the right inner side of the compartment (see **[13]**), then push the battery in so that it fits into the four tabs.
4. Push the battery fully to the left (see **[14]**). This releases the stop mechanism underneath the battery.
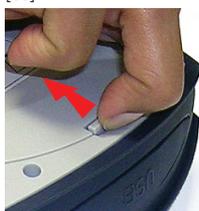
[13]

[14]

5. Close the trapdoor: It is good practice to use your two thumbs pushing thoroughly from the two corners of the trapdoor. By doing this, you will lock the snap-in hook properly and you will make the battery compartment fully waterproof.
6. Put back the receiver the right way up.

> When later the receiver is placed on top of a pole, you will be able to safely remove/replace a discharged battery (it won't drop when you open the compartment) while the receiver continues to operate normally, tacking satellites, being powered from the other battery.

NOTE: The batteries will be used one after the other. The receiver will determine which battery should be used first.

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Inserting Cards

A **SIM card** is needed to operate the internal modem when the receiver is used in Direct IP, NTRIP or CSD mode.

You may also want the receiver to record GNSS raw data on an **SD card** rather than in its internal memory.

In either case, insert the card through the procedure described below:
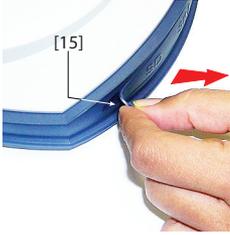
1. Open the rubber flap with the "SD" and "SIM" markings (on the right), pulling its tongue gently to the right. The tongue is that small part protruding from one end of the flap (**[15]**).

2. Turn the card upside down (label side oriented downward) (see SIM card in **[16]**), then push it in until you hear a click.

   WARNING - PLEASE MAKE SURE YOU INSERT THE SIM CARD INTO THE SIM CARD HOLDER AND NOT ELSEWHERE.

3. Put the rubber flap back in place. This is a five-step operation to be observed with care. The inner side of the flap is fitted with molded parts (see **[17]**) that are intended to fit into the card slots. Starting from the flap hinge, these should be inserted successively into:

   – The block the closest to the hinge (**[18]**)

   – The SIM card holder (**[19]**)

   – The SD card holder (**[20]**)

   – The second block (**[21]**)

   – Then run a thumb along the flap, starting from the hinge and all the way to the other end, exerting pressure as many times as necessary to make sure the flap is thoroughly inserted.

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[22]
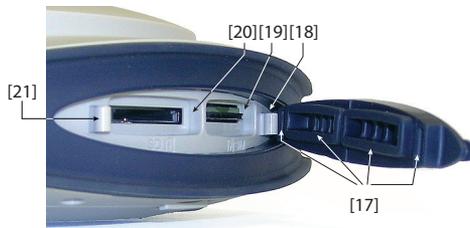
NOTE 1: If you only need to access the SD card holder, you may half-open the rubber flap. To do this, place three fingers on the area marked "SIM" on the flap while grasping the tongue to open the flap halfway (see **[22]**).

NOTE 2: To remove a SIM or SD card, simply push the card a little bit further in causing the lock mechanism to be released (a click can be heard). Then release the card, which will then be automatically ejected.

Setting up the Receiver

1. Mount the receiver and data collector on a range pole (rover), or a tripod (base).

2. Measure and write down the vertical or slant distance from the ground mark to respectively the lower part of the receiver (ARP) (rover) or to the height mark (base). This measurement will be required by your field software in a further step.

3. Turn on the SP80 by holding ⏻ depressed for about 2 seconds until the screen lights up. The status LED of the battery being used turns solid green. Let the receiver boot.

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 SP80 as desired (rover or base). The receiver will beep when a Bluetooth connection is established with the data collector.

2. Start your survey job when ready.

3. From time to time, take a look at the battery LEDs on the front panel. As long as the two LEDs are solid green, that means the first battery used has enough energy left to operate the receiver.

   When the LED corresponding to the first battery used 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 power will soon switch automatically to the other battery.

   Note that there won't be any disruption in receiver operation when passing from the low to the fresh battery.

   There won't be any disruption either if you replace the low battery with a new fresh one. This third battery will power the receiver later when the second battery gets in turn too low.

Ending the Survey

1. After your field survey is complete, hold ⏻ depressed for about 2 seconds to turn off the SP80.
2. Don't forget to charge the batteries at the end of your day. Batteries will charge overnight.

NOTE: Need to download raw data files from the receiver? Refer to *Downloading Raw Data Files on page 50*.

Front Panel Displays

The diagram below explains how to scroll through the different displays using the **Scroll** button. A detailed description of each of them is provided in this section.

*: Skipped (not shown) if device absent (radio only) or off.
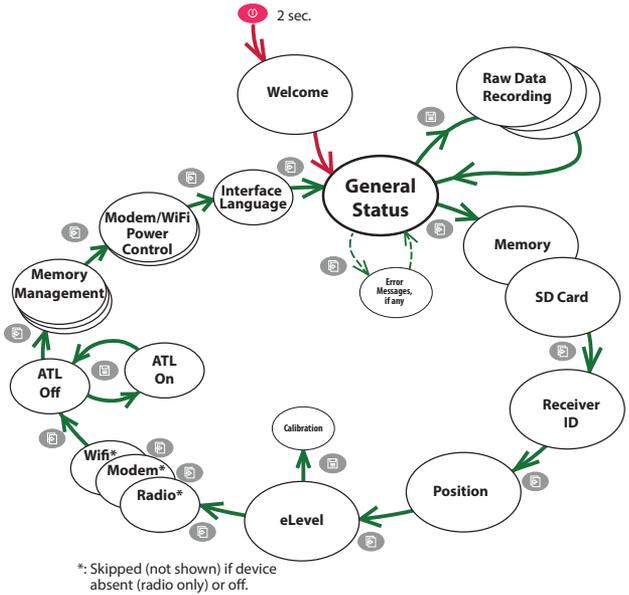
NOTE: The screen shots illustrating this section are only examples. Your receiver may report different information depending on its configuration.

Welcome Screen

This screen appears after about 2 seconds of depressing the Power button. (You may then release this button.)

After about 30 seconds, corresponding to the receiver boot sequence, the General Status screen will appear automatically.

General Status   See examples below for a rover (left) and a base (right). Refer to the tables below for more details on each of the icons or data reported on this screen.
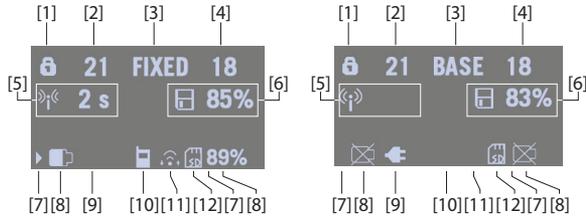
NOTE: In the second column, the slash symbol ("/") is used between icons to indicate that these icons occupy the area successively at the indicated displaying rate.

Area	Icon or Data Reported	Meaning
[1]	🔒	Anti-theft or/and startup protection active (solid icon).
	ⓘ	One or more alarms set (blinking icon). Press the Scroll button as many times as necessary to read and acknowledge the alarms.
	🔒 / ⓘ	One or more alarms set and anti-theft or/and startup protection active. Icons appear in succession every 1 second.
	(Blank)	No alarm set and anti-theft protection inactive.
[2]	{a number}	Number of satellites received (all GNSS's taken together)
[3]	{a text string}	Position solution status: – NONE: Position not available – AUTO: Autonomous GNSS position – DGPS: Differential GNSS position – S DGPS: SBAS Differential GNSS position – FLOAT: Float solution – FIXED: Fixed solution (RTK is operational) – RTX: CenterPoint® RTX solution – BASE: Receiver configured as a base.
[4]	{a number}	Number of satellites used (all GNSSs taken together).
[5]	**Data link information**:	
	📶 {x seconds}	For a rover: Corrections received. The age of corrections is displayed after the icon, when available.
	📡	For a base: Corrections generated and transmitted.
	(Blank)	No corrections received or transmitted.
[6]	**Memory information and raw data recording**:	
	💾 {percent}	No data recording in progress (static icon). Percentage of free memory in the storage medium used.
	💾 / 💾 {percent}	Data recording in progress (dynamic icon). Percentage of free memory in the storage medium used. Icons appear in succession every 1 second.
[7]	▶	Where located, the right arrow indicates which battery is currently used.

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Area	Icon or Data Reported	Meaning
	Batteries:	
[8]	/ {percent}	A battery has been inserted in the compartment and the energy left in the battery is represented both visually and as a percentage. These two indications are shown successively (percentage appears for 1 second every 5 seconds).
		The battery is missing (battery compartment empty).
[9]		The receiver is powered from the AC/DC power block, not by one of its batteries.
[8] + [9]	/ {percent}	(Battery B only) Case where the receiver is powered from the AC/DC power block and battery B is present with a certain percentage of remaining power.
	Modem:	
	(Blank)	Modem turned off.
[10]	or	Modem turned on: • Blinking: Not initialized yet • Static: Initialized and ready for a connection The vertical bars indicate the signal strength at the modem antenna input. The higher the number of bars the better. The antenna symbol shown in the upper left corner stands for "2G". If the modem detects a 3G network, "3G" is displayed instead.
		When the signal strength is very weak, four dots appear at the bottom of the icon, instead of vertical bars.
		Modem on line.
	WiFi:	
	(Blank)	WiFi turned off.
[11]		WiFi connection active (1 to 3 waves depending on signal level).(1 wave: no signal yet). (Blinking icon= WiFi Initializing) (Inverted icon: WiFi Access Point)
		Data being transmitted over Wifi (2 to 3 waves).
	SD Card, Bluetooth, Radio, USB:	
		SD card present
		Bluetooth connection active
		Internal radio detected, but not used
[12]		Internal radio used respectively as receiver, transmitter and repeater
		USB connection active
	/ / / /	Any combination of the five icons is possible. Icons appear in succession every 1 second.
	(Blank)	No SD card present, No Bluetooth or USB connection active, no internal radio installed.

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Memory/SD Card

See examples below for Internal Memory (left) and SD card (right).

▶Memory 1.4GB Free: 1.2GB 85% G-Files: 8 GO107A13.310	SD-Card 484MB Free: 122MB 25% G-Files: 37

- 1st line: Memory identifier and capacity. If a left arrow appears at the beginning of the line, this means this memory is currently selected to collect data.
- 2nd line: Free memory left (in bytes and percentage of nominal size)
- 3rd line: Number of G-files currently stored in memory
- 4th line: If data recording is in progress, name of the G-file currently created. Otherwise, this line is empty.

Receiver Identification

From top to bottom (see screen example):

SN: 5327A00107
FW: 1.0
BT: SP_270107
IP: 192.168.1.19

- Receiver serial number (SN)
- Firmware version currently installed (FW)
- Receiver Bluetooth name (BT)
- Receiver IP address (IP)

Position Solution

If the receiver is a rover, the displayed position will be the last computed position. The coordinates will be local ("LOC") only if the rover receives specific RTCM messages from the base describing the local system used by the base.

If the receiver is a base, the displayed coordinates are set ones (not computed ones) representing the WGS84 or local reference position assigned to the base.

See screen example for a rover delivering WGS84 coordinates.

- First line: Number of satellites tracked; Current position solution status; Number of satellites used.
- Next three lines: Receiver position. This may be:

  17 FIXED 15
  47° 17' 56.2926 N
  001° 30' 32.5897 W
  W84 +76.36 m

  – Either WGS84 coordinates ("W84" displayed at the beginning of the last line). Coordinates are Latitude (2nd line), Longitude (3rd line) and ellipsoidal height (4th line).
  – Or local coordinates ("LOC" displayed at the beginning of the last line). Depending on whether or not a

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projection is defined in the local coordinate system used, coordinates may be either Easting (2nd line), Northing (3rd line), Elevation (4th line), or Latitude (2nd line), Longitude (3rd line) and Ellipsoidal Height (4th line).

eLevel Screen   This screen displays the magnitude of tilt of the SP80, as measured by the built-in electronic tiltmeter. This information is also forwarded to the data collector screen so you can level the SP80 directly from the data collector screen, just before logging a point.

After the eLevel has been calibrated, the small moving circle on the screen (i.e. the "e-bubble") is empty. The number of days elapsed since the calibration was performed is displayed at the bottom left of the screen, starting the day after the calibration, meaning "0" is never displayed and the first number displayed is "1".

When the eLevel needs calibrating, a cross appears within the small moving circle and the number of elapsed days since the last calibration is no longer valid and so is no longer displayed.

The eLevel can be calibrated directly from the receiver, or from a data collector. For more information, please refer to *Using the SP80 Built-in Electronic Tiltmeter on page 76*.

Devices   Devices are always listed in this order: radio (if any), modem and WiFi. See screen examples and descriptions below. If one of these screens is not shown, that means the corresponding device is absent (radio only) or off.

- **Radio**:
  – First line: Receiver port that the radio is connected to (A= external radio; D= internal radio) followed by the radio function ("Rx" for receiver, "Tx" for transmitter), the name of the radio model and its current power status (ON or OFF).

Rover screen example:

```
D Rx XDL ON
2 445.1625 MHz
TRANS  9600 Bds
MED FEC SCR 4FSK
```

  – Second line: Channel number used and its corresponding frequency, in MHz.
  – Third line: Protocol used and transmission speed (baud rate).
  – Fourth line: See below.

    For a rover, current reception sensitivity (low, medium or high), followed by "FEC" (Forward Error Correction) and "SCR" (Scrambling) if these two functions are enabled, followed by the type of modulation used and "REP" if the radio is used as a repeater.

Base screen example

```
D Tx XDL ON
2 445.1625 MHz
TRANS  9600 Bds
1 W FEC SCR 4FSK
```

    For a base, radiated power (500 mW, 1 W or 2 W), followed by "FEC" (Forward Error Correction) and "SCR" (Scrambling) if these two functions are enabled, followed by the type of modulation used.

- **Modem**:
  – First line: Current modem status (OFF, ONLINE, READY, DIALING or ON)
  – Second line: Identification of the service provider (ISP)

```
GSM    ONLINE
"Orange F"
3G       60%
NTRIP: BRSTO
```

  – Third line: Network type (2G or 3G) and measured signal level (in 20% steps; 100%: +43 dBm)
  – Fourth line: Connection type (NTRIP or Direct IP) followed by mount point name (in NTRIP), or server address, i.e. host name or IP address (in Direct IP).

- **WiFi**:

  WiFi device in Access Point mode (used to run SP80 Web Server interface):

```
WiFi Access Point
SP80_40007
192.168.130.1
```

  – First line: "WiFi Access Point"
  – 2nd line: Receiver model & S/N (last 6 figures)
  – Third line: Fixed IP address of WiFi access point

Wifi   CONNECTED
Livebox-093c
80%
NTRIP: BRSTO

WiFi device in Client mode (used to receive RTK corrections):

– First line: Current WiFi status (CONNECTED, ON, OFF)
– Second line: Identification of the WiFi server
– 3rd line: Signal level (in 20% steps; 100%: +43 dBm)
– Fourth line: Same as Modem's fourth line above.

NOTE 1: When its is powered on from the dedicated display screen (see *Wifi Power Control Screen on page 24*), the WiFi device is automatically set as a WiFi Access Point. If you ask your field software (Survey Pro or FAST Survey) to scan for WiFi devices, then the WiFi device will automatically be switched to client mode. To switch back to WiFi access point, you need to reset the SP80 (see *Restoring Factory Settings on page 103*).

NOTE 2: The WiFi device cannot be used in client mode and access point mode at the same time.

ATL Recording Screen

The ATL Recording screen looks like one of the following, depending on whether an SD Card is inserted in the receiver (right-hand screen) or not (left-hand screen).

ATL is off.   ✗   ATL is off.   ✗
Start ATL in   Start ATL on
Memory?   ✓   SD Card?   ✓

You don't normally have to record ATL data, but if for troubleshooting purposes, Technical Support asks you to do so, then proceed as follows:

• With the ATL recording screen currently displayed, press the **Log** button. This will cause the receiver to start recording ATL data on the specified storage medium. The screen will then look like this:

ATL is on.   ✗
Stop ATL?
                    ✓
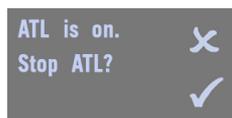
You can then freely use the **Scroll** button to access other screens without affecting the ATL data collection in progress (pressing the **Scroll** button from this screen will take you to the Memory Management screen).

• When enough ATL data have been recorded (Tech Support will normally indicate the duration of ATL data collection needed for troubleshooting), come back to the ATL Recording screen and simply press on the **Log** button again to stop the recording.

NOTE 1: ATL data recording is totally independent of raw data recording: controlling ATL recording is done exclusively from the ATL recording screen, while raw data recording is controlled from any other screen.

NOTE 2: When ATL recording is in progress, ⚠️ is displayed in area **[6]** (see *General Status on page 17*). In this icon, the warning triangle symbol, which is indicative of ATL data recording in progress, is dynamic as is the diskette symbol when raw data recording is in progress. Raw data recording and ATL recording may be performed at the same time.

NOTE 3: Before inserting an SD Card to record ATL data, make sure there is no "*.par" files stored on the SD Card as the presence of this type of file would initiate automatically some other functions in the receiver.

Memory Management

The flowchart below summarizes the different tasks you can perform at this point in the management of the receiver memory.
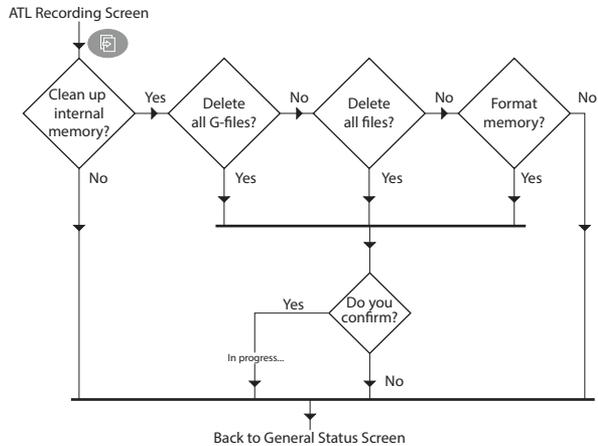
Modem Power Control Screen

This screen gives control over the GSM modem, which you can power on or off at your convenience. This may be useful to allow, or not allow, the receiver to process incoming SMS's.

> GSM modem
> is off.
> Turn it on?   ✗ ✓

When you change the state, a message is displayed asking you to wait before the GSM modem is in the required state:

> GSM modem
> being turned on
> Please wait.

NOTE: Turning on the modem from this screen is possible only after you have entered the modem settings. (APN, etc.).

Wifi Power Control Screen

This screen gives control over the Wifi device, which you can power on or off at your convenience.

> Wifi
> is off.
> Turn it on?   ✗ ✓

When you change the state, a message is displayed asking you to wait before the Wifi device is in the required state.

> Wifi
> being turned on
> Please wait.

Interface Language Screen

This screen allows you to select the interface language:

> Change
> language?   ✗ ✓
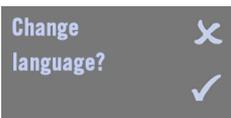
Press the **Log** button until the desired language is displayed, and then press the **Scroll** button to validate the new language.

Available languages are: English (default), German, French, Spanish and Portuguese.

Power Off Screen

When you hold down the **Power** button for a couple of seconds, the Spectra Precision logo will appear on the screen.

After a few seconds, the message "**Powering off...**" will follow, indicating that the receiver is being turned off.

If the anti-theft protection is still enabled when you attempt to turn off the receiver, a message will ask you to confirm this action.

If you confirm (by pressing **Log**), the receiver executes the power off sequence as described above

Raw Data Recording Screen

Refer to *Recording/Downloading GNSS Raw Data on page 47*.

Monitoring Batteries

Take a look at the LED indicators on the SP80 front panel to read the discharging status of your batteries (Battery A LED is on the left, Battery B LED on the right).

Conventions Used
The following color conventions are used to describe the status of each of the two batteries:

Color	Graphics	Meaning
Green	🟢	The battery is being used to power the receiver, or is fully charged and not used.
Red	🔴	The AC/DC power block has been connected to the receiver. The battery is being charged, or is fully charged and not used.
White	⚪	The battery is missing or not used (the LED is extinguished)

The words "high", "low" and "very low" used to depict the energy left in a battery are explained in the table below.

Word Used	Remaining Charge
High	More than 20% of nominal charge left.
Low	Between 20% and 1% of nominal charge left.
Very low	About 4 minutes of operation left before the receiver shuts down.

The graphic conventions used in this guide to depict a blinking or non-blinking LED are provided in the table below. This table also indicates the possible meanings of each blinking mode.

Blinking Rate	Graphics	Meaning
Solid (not blinking)		Battery missing, not used or with sufficient charge level
Slow (1 flash per second)		Normally charging or battery running low (discharging)
Fast (4 flashes per second)		Temperature alarm or battery too low

Refer to the three sections below to read all the details about the status of your batteries.

Possible Battery Statuses in the Field

LED indications	Meaning
Only Battery A inserted	
	Battery A high
	Battery A running low
	Battery A running very low (1)
Only Battery B inserted	
	Battery B high
	Battery B running low
	Battery B running very low (1)
Batteries A and B inserted	
	Arrow on general status screen indicates which battery is being used.
	Battery A being used is now low. Battery B is high and potentially usable. Next status below should logically follow when battery drops below 1%.
	Battery A being used is now very low and the corresponding LED will go off very shortly after reaching this state. Battery B is high and potentially usable. Power will switch automatically to Battery B after Battery A has reached the battery-very-low threshold. (2)
	Battery B being used is now low. Battery A is high and potentially usable. Next status below should logically follow when the battery drops below 1%.
	Battery B being used is now very low. Battery A is high and potentially usable. Power will switch automatically to Battery A after Battery B has reached the battery-very-low threshold. (2)
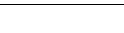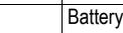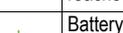
(1): This status may also be indicative of a temperature problem. See *Possible Error Statuses on page 29*.

(2): The receiver will continue to operate smoothly while power switches from one battery to the other.

Possible Battery Statuses With AC/ DC Power Block Used

LED indications	Meaning
AC/DC Power Block Connected to Receiver, No Battery Inserted	
🔴 🔴	This LED color combination is obtained only after the receiver has been powered on.
AC/DC Power Block Connected to Receiver, Battery A Inserted	
🔴 ⚪	Battery A fully charged and not used.
🔴 ⚪	Battery A being charged from the AC/DC power block (3).
AC/DC Power Block Connected to Receiver, Battery B Inserted	
⚪ 🔴	Battery B fully charged and not used.
⚪ 🔴	Battery B being charged from the AC/DC power block (3).
AC/DC Power Block Connected to Receiver, Batteries A and B Inserted	
🔴 🔴	The two batteries are fully charged and not used. This status is provided whether the receiver is on or off.
🟢 🔴	Battery A is usable. Battery B is being charged from the AC/DC power block (3).
🔴 🟢	Battery A is being charged from the AC/DC power block (3). Battery B is usable.

(3): Charging will take place only if the receiver is off.

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Possible Error Statuses

LED indications	Meaning
Only Battery A inserted	
🟢 ⚪	Battery temperature outside of permitted range (1).
Only Battery B inserted	
⚪ 🟢	Battery temperature outside of permitted range (1).
Batteries A and B inserted	
🟢 🟢	Battery temperature outside of permitted temperature range. Use of any of the two batteries is prohibited (no discharging allowed). (1)
AC/DC Adapter Connected to the Receiver, Battery A Inserted	
🔴 ⚪	Battery temperature outside of permitted temperature range. Battery A charging suspended.
AC/DC Power Block Connected to Receiver, Battery B Inserted	
⚪ 🔴	Battery temperature outside of permitted temperature range. Battery B charging suspended.
AC/DC Power Block Connected to Receiver, Batteries A and B Inserted	
🔴 🔴	Battery temperature outside of permitted temperature range. Battery charging suspended, whichever was being charged.

(1) The receiver will shut down very shortly and will not restart until the battery temperature comes back within the permitted temperature range. Fast blinking will also occur if the same problem is detected while you are attempting to power up the receiver (will stop when you release the Power button).

Remote Battery Monitoring

When a receiver powered from its battery is left unattended to operate as an RTK base, a special function is implemented in the receiver to let the rover operator (for example) be warned when the last battery in the base is getting low.

When this occurs, and provided the underlying communication means are implemented, a text message and an email will be sent respectively to the phone number and email address that you entered while setting the receiver.

Lithium-Ion Battery Storage

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

Below is a summary of all the recommendations for best use of your batteries:

• Fully charge all new batteries prior to use.

• Do not allow the batteries to discharge below 5 V. When used in the SP80, the built-in power controller will make sure this never happens.

• Keep all batteries on continuous charge when not in use. Batteries may be kept on charge indefinitely without damage to the receiver or batteries.

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

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Introducing SP80 as Rover

Network Rover

As a network rover, the SP80 can deliver RTK positions using one of the following standard network connection types:

• NTRIP
• Direct IP (TCP/IP Direct)

Receiving RTK corrections over the Internet can be done in three different ways:

• Using the built-in cell modem, which can be operated after having inserted the SIM card purchased for this purpose.

   NOTE: Turn the SIM Card upside down (label facing upward) before inserting it. Once the card has been inserted, close the rubber flap.

   WARNING - PLEASE, MAKE SURE YOU INSERT THE SIM CARD INTO THE SIM CARD HOLDER AND NOT ELSEWHERE.

   Then you need to select this modem when configuring your receiver for RTK operation (from the field software).

• Using the built-in WiFi device. You simply need to select this device when configuring your rover receiver for RTK operation (from the field software).

• Using the data collector's internal cell phone. RTK corrections are forwarded to the receiver over Bluetooth.

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:

• Radio (internal at the rover, internal or external at the base). See *Using the UHF Kit Option on page 83*.

• *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. Typically, the receiver used may be an SP80 as well.

• CSD mode. The SIM card used in that case is set to allow the rover to call the base directly through a phone number. Double-check with your ISP provider that CSD (or GSM data) is available and activated in your subscription. The rover will acquire RTK corrections in "Direct-Dial" mode.

The rover will start a phone-like connection with the base (e.g. another SP80) by dialing the preset phone number.

Other Use Cases

Trimble RTX

Trimble RTX (Real Time eXtended) is a high-accuracy GNSS correction service delivering repeatable centimeter level positions worldwide. Combining real-time data with innovative positioning and compression algorithms, Trimble RTX utilizes an established global reference station network along with satellite orbit and clock information to compute high accuracy positions. The real-time technology is available via satellite or IP delivery across most of the world and supports GPS, GLONASS, QZSS, and BeiDou constellations.

Horizontal accuracy is 4 cm with less than 30 minutes of convergence time (horizontal accuracies of 30 cm and 20 cm are typically achieved after 10 minutes and 15 minutes respectively).

The SP80 computes high-accuracy CenterPoint RTX positions when receiving CenterPoint RTX corrections through a network connection referred to as "RTX" in the field software. This is a pre-configured network connection directly connecting to the Trimble RTX corrections service. Firmware option [C] is required in the SP80: This is a subscription for CenterPoint RTX that needs to be purchased from Trimble Positioning Services and then activated on the SP80.

When Trimble RTX operation is effective, "RTX" is reported on the receiver's General Status screen.

Backup RTK

Backup RTK should be used when a second correction source is available. Backup RTK will allow a rover to switch from a primary correction source (e.g. radio) automatically to a second correction source (e.g. GPRS) if the primary correction source is unavailable (e.g. obstructions).

Backup RTK operation does not report any special status on the General Status screen. As long as the receiver can compute a fixed position, the "FIXED" status is reported.

UHF Networking

This feature allows a rover to receive corrections from up to three different bases broadcasting separately their corrections via radio, on the same frequency channel, but at different times because otherwise the rover wouldn't be able to receive these corrections properly.

UHF networking can be implemented in SP80 only, and provided you use Survey Pro as the field software.

UHF networking may be used in two different modes:

• Manual: The rover operator chooses which of the bases to work with. The bases will all be within range so the operator can at all times change the base used (see diagram below).

Typically, the manual mode is used when redundancy is required in terms of corrections availability within a working area. On the diagram below, the darker area represents the area where the rover can operate from any of the two bases.

Base 1 Base 2
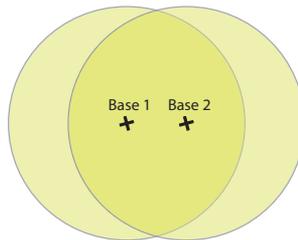
• Automatic: The rover will automatically switch to the base within range that provides the best quality of corrections. Typically the automatic mode is used when you need to extend the UHF radio coverage.

Base 1   Base 2   Base 3
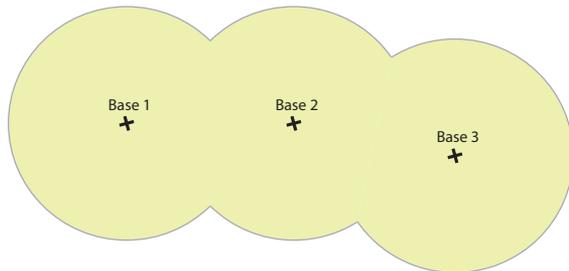
Implementing UHF networking on rover side consists of:

1. Activating this mode.
2. Choosing between automatic or manual selection of the base used (In Survey Pro, this setting is accessible from the **GNSS Status** function after you have started a survey).

Selecting the manual mode means specifying the ID of the base you would like to work with.

RTK Bridge

If you are operating several rovers on a site and you wish to use network corrections, RTK Bridge can help you save money on your mobile communication costs:

- You will choose one of the SP80 in the field to be the relaying rover: it will receive network corrections via its built-in modem or WiFi and will forward them to the other rovers through its internal radio.

- All other rovers will receive corrections via radio from the relaying rover, and not from the Internet.

Hardware-wise, the relaying rover will be fitted with a SIM card and an internal radio used as transmitter. All other rovers won't need a SIM card but will each be fitted with a radio receiver.

and will be displayed successively on the General Status screen of the relaying rover when RTK Bridge is operational, indicating that the rover receives corrections and then forwards them over its radio.

Introducing SP80 as Base

Network Base   As a network base, the SP80 can deliver RTK corrections over the Internet using one of the following standard network connection types:

- NTRIP (including Central Cloud Corrections)
- Direct IP (TCP/IP Direct)

Delivering RTK corrections over the Internet can be done in one of two ways:

- Using the built-in cell modem, which can be used after having inserted the SIM card purchased for this purpose.

   NOTE: Turn the SIM Card upside down (label facing upward) before inserting it. Once the card has been inserted, close the rubber flap.

   WARNING - PLEASE, MAKE SURE YOU INSERT THE SIM CARD INTO THE SIM CARD HOLDER AND NOT ELSEWHERE.

   Then you need to select this modem when configuring your base receiver for RTK operation (done from the field software).

- Using the built-in WiFi device. You simply need to select this device when configuring your base receiver for RTK operation (this is done from the field software).

Local Base   The SP80 can be used as a local base, delivering its corrections through one of the following devices:

- 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 83*.

- Modem in CSD mode: The SIM card used in that case is set to allow the base to be called by a rover through a phone number. Double-check with your ISP provider that CSD (or GSM data) is available and activated in your subscription.

- "UHF+CSD" base mode: When the SP80 is used with the internal radio option to transmit corrections, you may implement a second transmission channel in parallel to deliver the same corrections, but this time through the internal modem used in CSD mode.

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In practice, if a rover does no longer receive corrections through the radio transmission channel (because it's too far away from the base for instance), it can quickly be set to work with the other transmission channel. In the rover, choose the CSD modem instead of the radio as communication device, and then let the receiver dial the base phone number. The rover will then get the corrections still from the same base, but this time through its modem.

NOTE: A SIM card enabling phone-like connections is required on both the base and rover.

UHF Networking See theory of operation in *UHF Networking on page 32*.

Implementing UHF networking on base side consists of introducing a delay specific to each of the bases used in the broadcasting of their corrections. **UHF networking won't work if all the bases broadcast their corrections at the same time**.

Since all the bases are steered by the same clock (GNSS time) and a different delay is introduced for each base, then each of them will broadcast its corrections over a specific time, and the rover will be able to sort out and recognize each set of corrections that it receives from the different bases.
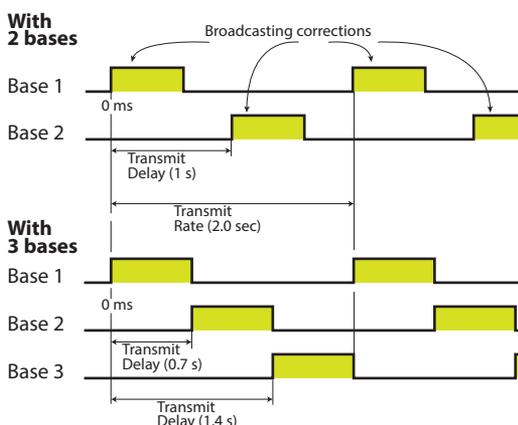
To be on the safe side, the highest transmit rate possible you should use is 2 seconds because a base needs a maximum of 700 ms to broadcast its corrections, assuming the following:

• Corrections are broadcast for all available satellite constellations (no disabled constellations).

• The ATOM super-compact format is used to broadcast corrections

NOTE: This implementation scheme may be extended to more than three bases if for example you need to extend the UHF coverage along a corridor (case where the rover is typically operated in automatic mode).

In this case, you will re-use the "0 ms", "700 ms" and "1400 ms" delays on the additional bases, **making sure the bases using the same delays are definitely out of range from each other**.

Internal vs. External Power Source
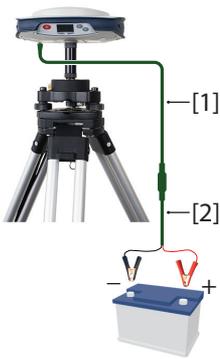
Consider the following before setting up a local base:

- 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 *Optional Accessories 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 SP80

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 SP80 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 SP80. 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 SP80 via Bluetooth.
- Create the suitable receiver profile for your SP80:

SP80 Used As:	Required Receiver Profile:
Network Rover	"Net" (e.g. "SP80 0035 Net")
RTX Rover	"RTX" (e.g. "SP80 0035 RTX")
Network Base	"Net Base" (e.g. "SP80 0035 Net Base")

SP80 Base/Rover System Uses:	Receiver Function	Required Receiver Profile :
1) Radio link or 2) CSD	Base	"Base" (e.g. "SP80 0035 Base")
	Rover	"Rover" (e.g. "SP80 0035 Rover)
Central*	Base	"Net Base" (e.g. "SP80 0035 Net Base")
	Rover	"Net" (e.g. ""SP80 0035 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:

SP80 Used As:	Parameters:
Network Rover	**Modem** tab: Select "Internal GPRS modem", "Internal Wi-Fi" or "Current Internet", depending on which device you wish to use to let the receiver acquire corrections. When starting a survey, define the network to connect to (tap **Manage Networks**, **Add Network....**, create then select this network).
RTX Rover	**Modem** tab: Select "Internal GPRS modem". When starting a survey, you don't need to define the network to connect to. This selection is fully managed by Survey Pro. See also *Trimble RTX on page 40* below.
Network Base	**Survey** tab: Choose format of corrections **Modem** tab: Select "Internal GPRS modem" When starting a survey, define the network to connect to (tap **Manage Networks**, **Add Network....**, create then select this network).

SP80 Base/Rover System Uses:	Receiver Function	Parameters:
CSD link	Base	**Survey** tab: Choose format of corrections. **Modem** tab: Set Data Modem= "Internal GSM" Enter SIM card PIN.
	Rover	**Modem** tab: Set Data Modem= "Internal GSM" Enter base phone number and SIM card PIN.
Radio link	Base	**Survey** tab: Choose format of corrections. **Modem** tab: Choose the model of radio the SP80 is using. Set the radio.
	Rover	**Modem** tab: Choose the model of radio the SP80 is using. Set the radio.
Central	Base	**Survey** tab: Choose format of corrections. **Modem** tab: Select "Internal GPRS modem" or "Internal Wi-Fi", depending on which device you wish to use to let the receiver deliver its corrections. Select the network named "Central Cloud Corrections when starting a survey.
	Rover	**Modem** tab: Select "Internal GPRS modem", "Internal Wi-Fi" or "Current Internet", depending on which device you wish to use to let the receiver acquire corrections. Select the network named "Central Cloud Corrections" when starting a survey.

Trimble RTX

You've already added and selected a "network rover" receiver profile for your SP80.

- Go to **Manage Instruments** and select this receiver profile.

- Tap on the 🔧 button corresponding to this receiver profile.

- Open the **Survey** tab.

- Select "**RTX**" from the **Setup Type** drop-down list.

- Tap ✅ and then start a survey. The network profile required to receive CenterPoint RTX corrections having been predefined in Survey Pro, it is selected automatically for use, which means you are not requested to make a network selection when starting the survey.

Backup RTK

Backup RTK may only be made active in a rover configured to primarily receive corrections via radio. In this configuration, you may add a second source of corrections, necessarily a network-based one.

You've already added and selected a "rover" receiver profile for your SP80.

- Go to **Manage Instruments** and select this receiver profile

- Tap on the 🔧 button corresponding to this receiver profile

- Open the **Multi-Base** tab.

- Select "**Backup RTK**" from the **Mode** drop-down list.

- In the **Modem** drop-down list just below, select the device through which network corrections (the "backup" corrections) will enter the receiver. This may be "**Current Internet**" (i.e. the data collector's internal modem), "**Internal GPRS modem**" (i.e. the SP80's internal modem) or "**Internal WiFi**" (i.e. the SP80's internal WiFi). Then make the additional settings relevant to your choice of device.

- Tap ✅.

- Tap **Start Survey** in the menu. Survey Pro shows the currently selected receiver profile and the current radio settings (radio type, frequency, channel).

- Tap **Connect**.
  - If you selected "**RTX**", there is nothing else to be done to start the survey.
  - If you selected "**Network Rover**", Survey Pro asks you to specify the network profile used as the backup source of corrections. Choose one or define one and select it, then tap **Connect**. This starts the survey.

UHF Networking - Bases

In each of the bases used, assuming you have already made the usual settings for operating a base with a UHF radio transmitter (i.e. "base" receiver profile created and selected), you just need to make these additional settings:

- Go to **Manage Instruments**

- Tap on the ⚙ button next to the selected receiver profile.
- Open the **Survey** tab.
- Define the following parameters: **Corrections** ("ATOM Super Compact" highly recommended), **Station ID**, **Transmit Rate** (typically 2 seconds) and **Transmit Delay** (0 ms for first base, etc. See *UHF Networking on page 36*).

- Tap ✅.

IMPORTANT: All bases should run with GNSS firmware v3 or higher.

UHF Networking - Rover

See theory of operation in *UHF Networking on page 32*).

Assuming you have already made the usual settings for operating a rover with a UHF radio receiver (i.e. "rover" receiver profile created and selected), you just need to make these additional settings:

- Go to **Manage Instruments**

- Tap on the ⚙ button next to the selected receiver profile.
- Open the **Multi-Base** tab.
- Select "**UHF Networking**" from the **Mode** drop-down list.
- Tap ✅.
- Go back to Survey Pro Home screen and start a survey.
- Tap on **GNSS Status** and then open the **Multi-Base** tab.
- Use the **Station ID** drop-down list, below the map view, to select either "**Automatic**" or the ID of a particular base you would like to work with. Only the Base IDs of bases within radio range will appear in this list.

IMPORTANT: The rover should also run with GNSS firmware v3 or higher.

RTK Bridge

Assuming you have already made the usual settings for operating a network rover (i.e. "network rover" receiver profile created and selected, required network profile created and selected), you just need to make this additional setting on the relaying rover:

- Go to **Manage Instruments**
- Tap on the 🔧 button next to the selected receiver profile.
- Open the **General** tab.
- Set the **RTK Bridge** field to "**On**".
- Tap ✅.
- Start a survey. You then need to define the network profile providing corrections.

The other rovers do not need additional settings, apart from being set with a "rover" receiver profile and operate with their radio.

Base Offering Two Independent Transmission Channels for Delivering Corrections

You've already added and selected a "base" receiver profile for your SP80.

- Go to **Manage Instruments** and select this receiver profile.
- Tap on the 🔧 button corresponding to this receiver profile.
- Open the **General** tab.
- Select "**Internal GSM**" from the **Backup Base Modem** drop-down list.
- Tap ✅.
- Tap **Start Survey** from the **Survey** menu. Survey Pro shows the currently selected receiver profile and the current radio settings (radio type, frequency, channel).
- Tap **Connect** to start operating the SP80 as a base.

On rover side, do the following if the rover does no longer receiver corrections via its radio:

- End the survey in progress.
- Go to **Manage Instruments** and select the receiver profile currently used.
- Tap on the 🔧 button corresponding to this receiver profile.
- Open the **Modem** tab.
- In the Data Modem scroll-down list, select "**Internal GSM**" and then enter the required parameters (base phone number, PIN).

- Start a new survey. When tapping on **Connect**, the modem will automatically call the base for corrections.

Configuring the SP80 WiFi Device

Before firmware version 3, the SP80 WiFi device could only be used as a client. From v3, the device can also be used as a WiFi Access Point (or Hotspot). The main purpose is to allow you to run the SP80 Web Server interface directly from your data collector without the need for an external network connection.

To set the Wi-Fi device, do the following:

- Go to **Manage Instruments** and select your receiver profile.

- Tap on the 🔧 button corresponding to this receiver profile.
- Open the **Alerts** tab.
- Tap on the **Internet Connections** button.
- Open the **Internal Wi-Fi** tab. From there, enable WiFi, which is then set in client mode. After a while, the screen will list the WiFi networks within range.
- To switch the device to Wi-Fi Access Point mode, tap on the **Hotspot** button.
- Check on the **Enable Wi-Fi Hotspot** button. You may change the Default SSID and key parameters if you wish:

  Default SSID is:
  <receiver model>_<last 6 figures from S/N>
  Default key is:
  <receiver serial number>

- Tap ✅. Survey Pro goes back to the previous screen listing all the parameters you have just defined + a fixed IP address for the WiFi access point which is 192.168.130.1.

- Tap ✅.

To run the SP80 Web Server interface from the data collector, open a web browser and type this IP address:

  192.168.130.1

NOTE: When you turn it on from the SP80 display screen, the WiFi device is set as an access point. But when scanning for Wi-Fi devices from a data collector running Survey Pro, the WiFi device will automatically be switched to client mode.

With FAST Survey

- Power on the SP80. 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**= "SP80".
  - **Comms** tab: Type= "Bluetooth", find the SP80 Bluetooth device, select it, tap 🔳 to establish the connection.
  - **Receiver** tab: Enter the antenna height.
  - **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) SP80 Standalone

SP80 Used As:	Set "Device" to:	Set "Network" to:	Other Settings:
1) Network Rover or 2) Network Base	"Internal GSM", "Receiver Wifi" or "Data Collector Internet"	1) "TCP/IP Direct" 2) "UDP/IP Direct" 3) "NTRIP"	1) Network parameters, 2) Modem APN and PIN
RTX Rover	"Internal GSM", "Receiver Wifi" or "Data Collector Internet"	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) SP80 Base-Rover System

Base/Rover System Uses:	Receiver Function	Set "Device" to:	Set "Network" to:	Other Settings:
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	Base	"Internal GSM"	"Direct Dial"	Define format of corrections
	Rover	"Internal GSM"	"Direct Dial"	Define a base ID (name and phone number)

Trimble RTX

First you must turn on the internal modem from the SP80 control screen, if not done yet.

- In **Equip**, tap **GPS Rover** and set the SP80 as you would normally do.
- Open the **RTK** tab.
- Set **Device**= "**Internal GSM**" and **Network**= "**RTX**". The network profile required to receive CenterPoint RTX corrections having been predefined in FAST Survey, it is selected automatically for use.
- Tap ✅ when you're finished.

Backup RTK

Backup RTK is named "Dual RTK" in FAST Survey.

- In **Equip**, tap **GPS Rover** and set the SP80 as you would normally do to operate in RTK, but don't tap 🟢 yet.
- Tap 🔴RTK+ located in the title bar.
- Open the **Dual RTK** tab.
- Use the **Device** field to select the device intended to receive the backup source of corrections (this may be **Internal GSM** or **Internal XDL**) and then complete the settings for this device.

  If you selected a radio link (**Internal XDL** selected) as the primary source of corrections, then choose **Internal GSM** as the device providing the backup source of corrections (or the other around).
- Tap ✅ when you're finished.

  NOTE: The RTK+ button turns green when Backup RTK is active.

RTK Bridge

- In **Equip**, tap **GPS Rover** and set the SP80 as you would normally do, but don't tap ✅ yet.

- Tap **RTK+** located in the title bar.

- Open the **RTK Bridge** tab.

- Set **Device** = "**Internal XDL**" and then configure the radio if necessary.

- Tap ✅ when you're finished. The other rovers do not need additional settings, apart from being operated with their radio.

  NOTE: The RTK+ button turns green when RTK Bridge is active.

Base Offering Two Independent Transmission Channels for Delivering Corrections

- In **Equip**, tap **GPS Base** and set the SP80 as you would normally do to operate it as a base, but don't tap ✅ yet.

- Tap **RTK+** located in the title bar. This opens the UHF+CSD tab.

- Set **Device**= **Internal GSM**. As a result the field just underneath (**Network**) is set to **Direct Dial** without any possibility to change it.

- Tap ✅ when you're finished.

  NOTE: The "RTK+" button turns green when UHF+CSD is active.

Recording/Downloading GNSS Raw Data

Data Recording Flowchart

NOTE: Dotted diamond shapes hold questions solved by the firmware, solid ones those answered by the user.

Step-by-Step Procedure

The SP80 can at your request record GNSS raw data on the selected storage medium. Raw data recording may take place in the background while making a real-time RTK survey. The name of the file being recorded may be read on the Memory/SD card screen (see *Memory/SD Card on page 19*).

The SP80 is designed to let you easily control both the beginning and end of data recording.

In Stop & Go, the SP80 will allow you to define beginnings and ends of static occupations (periods of time during which the receiver is kept stationary).

This will translate into adequate tags inserted into the raw data file at their exact times of occurrence. When post-processing the file, the office software will be able to process these tags as well.

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To start raw data recording:

- Have the General Status screen displayed on the front panel display.

- Press the **Log** button.

  If an SD card is present, you will be asked to specify the storage medium on which to record data:

> Select
> SD-Card or
> memory?   ✓✓

  – Press the **Log** button to select the SD Card
  – Or press the **Scroll** button to select the internal memory.

  With no SD Card present, the above screen will be skipped as data recording will necessarily take place in the internal memory.

  You will then be asked to confirm the beginning of data recording:

> Start   ✗
> recording
> on memory?   ✓

  (Other possible message if the SD card has been selected: **Start recording on SD-Card?**)

- Press the **Log** button. The receiver prompts you to record data in Stop & Go mode, through which you can time tag static occupations.

> Stop   ✗
> And Go?
>   ✓

  If you press the **Scroll** button, data recording starts right away and the receiver goes back to the General Status screen. Make this choice if you are not interested in tagging static occupations during the data recording session.

If you press the **Log** button, data recording starts right away and a new message appears prompting you to start an occupation:

Start Occupation? ✕ ✓

Choose what's best appropriate at this time of your survey:

1. If you are not occupying a point (kinematic sequence) or you don't wish to keep track of the current static sequence, press the **Scroll** button. This takes you back to the General Status screen.

2. If you are occupying a point (the receiver is static) and you wish to keep track of that occupation, press the **Log** button to mark the beginning of the occupation. This takes you back to the General Status screen as well.

To stop an occupation:

- From the General Status screen, press the **Log** button. The following screen is then displayed.

Stop Occupation? ✕ ✓

- Press the **Log** button. This takes you back to the General Status screen. Note that raw data recording is still in progress.

To start a new occupation (raw data recording still in progress):

- From the General Status screen, press the **Log** button twice.

To stop data recording:

- From the General Status screen, press the **Log** button.
- Whether an occupation is in progress or not, just press the **Scroll** button.

  The following screen is then displayed:

Stop
recording?

- Press the **Log** button. Data recording stops right away and the receiver comes back to the General Status screen. If an occupation is in progress, the end of data recording will also be the end of the occupation.

Downloading Raw Data Files

GNSS raw data files (G-files) recorded by the receiver (see *Step-by-Step Procedure on page 47*) can be made available to the post-processing software in one of four ways:

- Either you record them directly to the SD card you've inserted into the receiver. Back in the office, just remove the SD card from the receiver, insert it into the computer's SD card reader and start the post-processing phase.
- Or you first record them to the receiver's internal memory. Back in the office, turn on the receiver and wait until it has booted. Then insert an SD card into the receiver.

  When you insert an SD Card while the receiver is on, the front panel display prompts you to copy all the G-files from the internal memory to the SD Card, which you can accept by pressing the **Scroll** button. After the files have been copied to the SD card, remove that card, insert it into the computer's SD card reader and start the post-processing phase.

- Or using your field software (Survey Pro or FAST Survey). These applications can also be used to delete G-files directly from the receiver.
- Or using *SP File Manager* software (see *SP File Manager Software Utility on page 98*). This utility also allows you to delete files from the receiver.

Once your G-files have been duplicated by your post-processing software, they may be deleted from the SD card.

If they were initially recorded in the receiver's internal memory, use the SP80 embedded function accessible via the front panel display, or use *SP File Manager* software (as mentioned above), to delete either all G-files, or all types of files, from the internal memory.

The SP80 embedded function can also be used to reformat the entire memory. See function flowchart below. See also *Memory Management on page 23*.

Back to General Status Screen

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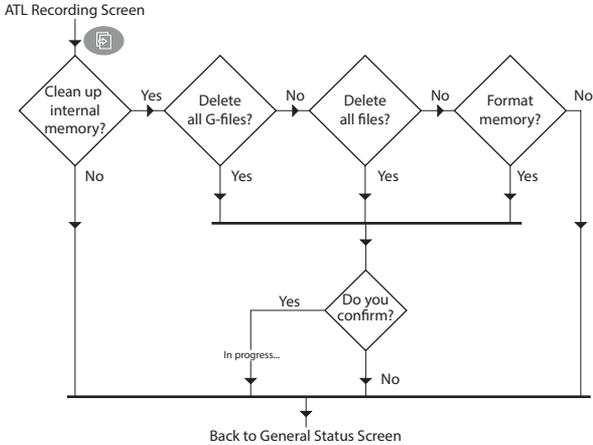
Batteries Vs. External Power Source

The SP80 can be powered by its internal, removable batteries, or by an external power source connected to its Power/Data connector (serial port A; DC input).

Typically, one 2.6 Ah battery provides approximately 5.0 hours of operation during an RTK survey. If you insert two fresh batteries in the receiver, you will get up to 10 hours of total operation (the two batteries are used one after the other with smooth automatic switching from the low to the fresh one without causing operation disruption).

If an external power source is connected to the power/data connector via the AC/DC power block, **it is used in preference to the internal batteries**. When there is no external power source connected, or if the connected one is not working, then the internal batteries will be used.

When a UHF Kit option is used in a base receiver operated for a whole day's work without interruption, Spectra Precision recommends that the receiver be powered from an external 12-V battery with higher capacity. The operating time will depend on the battery capacity and charge as well as the output power level set for the radio transmitter. See *Completing Base Radio Setup With External UHF Antenna on page 87*.

Charging Batteries, Scenario #1

• Remove the batteries from the receiver.
• Use the separate battery charger (**[1])** and AC/DC power block (**[2]**) provided. The battery charger can accommodate two batteries (**[3]**) and charges them one after the other.
• Connect the AC/DC power block to a power outlet using the appropriate power cord (**[4]**). For charging instructions refer to *Charging the Batteries on page 11*.
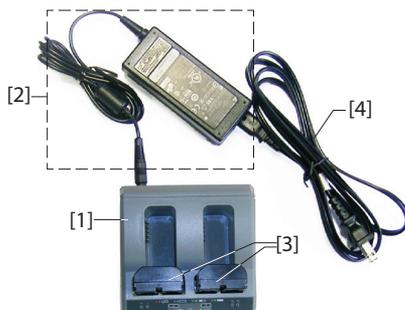
Charging Batteries, Scenario #2

- Keep the batteries in the receiver.
- Use the AC/DC power block (**[1]**) that you connect to the receiver's serial port through a jack/SAE adapter (**[2]**) and one of the possible two SAE/Lemo cables (**[3]**).
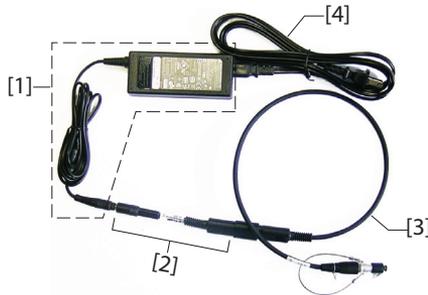
More details are provided on the next page explaining which cables can be used as cable **[3]**.

- Connect the AC/DC block to the power line using the appropriate power cord (**[4]**).

As in scenario #1, only one battery is charged at a time with this scenario, **provided the receiver is kept turned off and the internal temperature is within tolerances**. Charging will start automatically for the second battery when it is complete for the first one.

NOTICE - If your receiver is used with the UHF kit option, the temperature inside the receiver may be greater than 40°C at the end of your day. This may be due to the additional power consumed in the radio module or/and to high ambient temperature.

If this happens and you attempt to charge the batteries right at the end of your day using the AC/DC power block (that means, with one, or the two batteries left inside the receiver), the two battery LED indicators will start blinking red at a fast rate, meaning battery charging is not allowed to start at that time (see *Possible Error Statuses on page 29*).

You should not however worry too much and just keep the AC/DC power block connected to the receiver. As soon as the receiver temperature drops below 40°C, battery charging will start. One of the battery LED indicators will then start blinking red at a slow rate, meaning the corresponding battery is being charged. Then the second battery will be charged in turn. You can be sure your two batteries will fully charge overnight.

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Using Cable P/N 59044-10-SPN from the Office Power Kit

AC/DC
Power Block

Power/Data Cable *

Power
Cord

Power/Data
Connector

SAE/Jack-f
Adapter
Cable *

To AC
Outlet
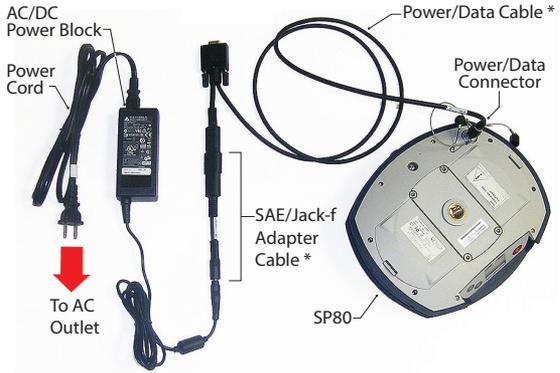
SP80

*: These items are part of the SP80 Office Power Kit P/N 94336 (option).

Using Cable P/N 95715 from the Field Power Kit

This cable is primarily designed to power an RTK base from an external battery (see *Completing Base Radio Setup With External UHF Antenna on page 87*). But it can also be used in the office to connect to the AC/DC power block.

Power Cable **

AC/DC
Power Block

Power
Cord

Power/Data
Connector

SAE/Jack-f
Adapter
Cable *

To AC
Outlet
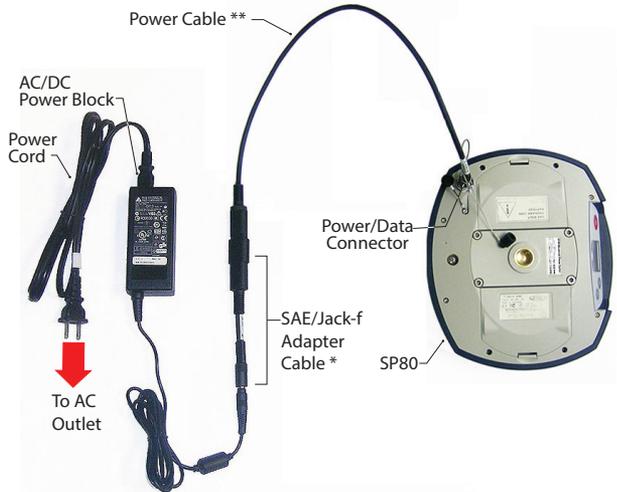
SP80

*: This item is part of the SP80 Office Power Kit P/N 94336 (option).

**: This item is part of the SP80 Field Power Kit P/N 94335 (option)

Anti-Theft Protection

Purpose

The SP80 integrates an anti-theft function to protect your equipment while it is left operating unattended.

This protection is intended for a SP80 operated as a base.

The anti-theft protection will discourage the theft of an SP80 receiver by rendering it useless without the anti-theft password. It will also aid in recovery of a stolen receiver by sending messages to its real owner with the receiver's current location.

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* software 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 59* and *Using Anti-Theft and Startup Protections in FAST Survey on page 63*).

If you are using other field 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, and the communication means (modem, WiFi) are operational to forward an alert in case of theft.

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:

ANTI-THEFT

ALARM

• The buzzer will regularly emit a sound alarm in quick succession, and for an indefinite period of time.

• The front panel display will read: "**ANTI-THEFT ALARM**".

• 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).

• If the internal GSM modem is used, a text message (SMS) and/or an email will be sent every 1 minute to, respectively, the phone number(s) and/or email recipient(s) you indicated when programming the anti-theft protection. Both the text message and email will contain the base's last computed position to help you track the thief.

• The three front panel buttons of the protected receiver will be made inactive, which means no one can:
  – Power off the receiver
  – Reset the receiver
  – Upgrade the receiver.

What if the Thief Removes the Batteries?

If the thief removes the batteries 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 (even if the SIM card is removed with intent to use a radio link instead for example). A theft alert will be issued however only if the communication channel (cellular modem, WiFi) has been left operational.

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.

As a safety measure, a power-off confirmation message will show up if you attempt to turn off the receiver with the anti-theft protection still active (see screen in the left-hand column). Confirm power off by pressing the **Log** button (otherwise, press **Scroll** to reject the request so you can disable the Anti-Theft protection, using your field software, before turning off the receiver).

Anti-Theft still active Continue? ✖ ✔

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.

The Theft Alarm is Part of the Level-1 Alarms List

The theft alarm is managed as a level-1 alert (see *Alerts on page 105*). As such, it is submitted to the same rules as the other level-1 alerts when it comes to issuing a notification email or SMS.

However, in both Survey Pro and FAST Survey, you are given the ability to configure the receiver to issue notification emails or SMS only for the theft alert.

Startup Protection

Purpose

The SP80 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* software 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 59* and *Using Anti-Theft and Startup Protections in FAST Survey on page 63*).

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

How SP80 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 power up the receiver).

Difference Between Startup and Anti-Theft Protections

The difference is that startup protection only 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 (assuming you've recovered the stolen

receiver): The first one will deactivate the anti-theft alarm, and the second one will make you a legal user of the receiver.

Using Anti-Theft and Startup Protections in Survey Pro

- Power on the SP80. 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 SP80 via Bluetooth.
- Create the suitable receiver profile for your SP80.
- Go back to **Manage Instruments** and select the receiver profile you have just created.
- Tap on 🔧.
- First select the **Alerts** tab, then the **Anti-Theft** tab. These two tabs contain all the information you need to set the anti-theft and startup protections. These are detailed below.

Alerts Tab
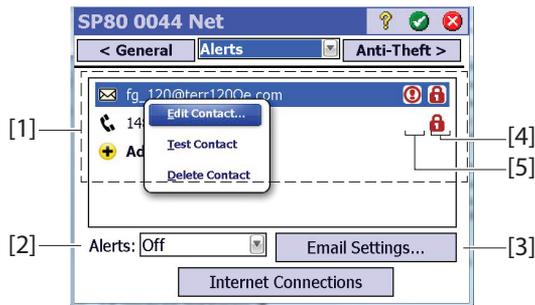
- **[1]** List of contacts (email addresses, phone numbers) notified of alerts, including theft, when these occur. See *Managing Contacts and Notifications on page 61*
- **[2] Alerts**: Select which alerts will be notified to the registered contacts.

Alert Field Setting	Notifications
Off	None
Standard	Only for level-1 alerts
Full	For level-1 and level-2 alerts

– **[3] Email Settings**: This button allows you to configure your email account (i.e. that of the embedded email sender).

You need to provide Survey Pro with the SMTP server name, the SMTP port number (default: 25), the user name and password for outgoing mail, and the sender's email address (noreply@SP80.com by default).

– **[4]**: Exclamation mark shown in this column for all contacts defined to receive alert messages.

– **[5]**: Padlock shown in this column for all contacts defined to receive anti-theft messages.

Anti-Theft tab

- **[6] Change Password**: Tap on this button to enter and confirm the password that will allow the field operator to disable the anti-theft protection and startup protection (see *Startup Protection on page 58*).

  NOTE: You cannot change the password while the anti-theft protection is active.

- **[7] 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.

- **[8] 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**.

- **[9] Test**: Tapping on this button will cause the receiver front panel to display "ANTI-THEFT ALARM" for about 10 seconds. Notifications will be sent via email or/and SMS text messaging to the registered contacts, as appropriate. This test is useful to check that there is no mistake in the entered email addresses and phone numbers.

- **[10] Enable** (startup protection): This button allows you to enable the startup protection. For more information on this function, please refer to *Startup Protection on page 58*.

  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.

Managing Contacts and Notifications

This area on the **Alerts** tab allows you to define which contacts should be informed, through which transmission media, and which type of notification they should receive.

- Tap on **Add Contact**.

  For each new contact you add, you need to define:

  – The communication media used for this contact (email or phone)

  – The contact's email address or phone number

  – **Send Alert Messages**: Check this box if the contact is supposed to receive alert messages. Keep it cleared otherwise.

  – **Send Anti-theft Messages**: Check this box if the contact is supposed to receive anti-theft messages. Keep it cleared otherwise.

- Tap ✓ to save the new contact.

- Create as many contacts as necessary through the same procedure.

- Tap ✓ again when you are done with the list of contacts.

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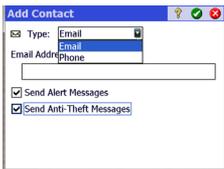
Enabling/Disabling the Anti-Theft Protection

After you have set the receiver's **Alerts** and **Anti-Theft** tabs to meet your requirements, go to the **Survey** menu and then select one of the following functions:
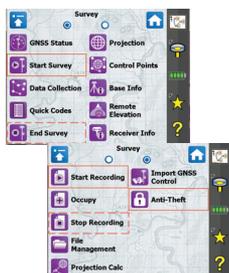
• **Anti-Theft**: This function shows the current status of the anti-theft protection (**Enabled**, **Disabled** or **Alarm Raised**). It can be used to enable or disable the protection at any time.

  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 (see *Anti-Theft tab on page 60*), 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 a static data recording, and provided the **Prompt to enable Anti-Theft** box has been enabled (see *Anti-Theft tab on page 60*), 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 SP80. 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**. Through the four tabs presented, configure your SP80 base as desired.
- Tap ☑ to complete the base configuration.
- Still from the **Equip** menu, tap on the **GPS Utility** button. This opens a menu now including the **Theft Protection** button (this button is added to the menu following the selection of the SP80 as the type of receiver used).
- Tap on the **Theft Protection** button. Wait a few seconds until a four-tab dialog opens through which you can define the different parameters needed to set the remote notification of alerts:

  1. **Networks** tab: If "connected" is displayed in the upper part of this tab, nothing needs to be done on this tab. Alerts when they occur will be forwarded to their recipients, as expected.

     If "Disconnected" is displayed, you need choose the communication device (WiFi or GSM) over which notification emails or/and SMS will be sent to the registered recipients. Typically, you need to make this setting when a radio data link is used to route RTK corrections.

  2. **Email** tab: Allows you to enter up to 5 different email addresses that will receive warning emails, should alerts be set.

     The check box placed before each email address entry allows you to include or reject the email address from the email distribution list. You can for example reject an email address but keep it in memory for future use.
     Alert Level scroll-down list: Allows you to choose which alerts should be notified to the remote operator through emails. See table below.

Alert Level Field Setting	Notifications
None	None
Standard	Only for level-1 alerts, except for theft alert
Full	For level-1 and level-2 alerts, except for theft alert

Receive Theft Alerts check box: Tell FAST Survey whether or not theft alerts, when triggered, should be forwarded via email to the registered recipients (check the box if this is what you want, otherwise clear it).

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Email Settings button: Tap on this button to access the email server settings (SMTP server, sender's email address, port ID, user name and password). This screen includes the **Test Settings** button, which can be used to send a test email to the programmed recipients. If the test is successful, this will confirm that the emailing communication channel used to report alerts is fully operational.

3. **SMS** tab: Allows you to enter up to 5 different phone numbers that will receive warning SMS, should alerts be set.

   The check box placed before each phone number entry allows you to quickly include or reject the phone number from the SMS distribution list. You can for example reject a phone number but keep it in memory for future use.

   Alert Level scroll-down list: Allows you to choose which alerts should be notified to the remote operator through SMS. See previous table for alerts classification.

   Receive Theft Alerts check box: Tell FAST Survey whether or not theft alerts, when triggered, should be forwarded via SMS to the registered recipients (check the box if this is what you want, otherwise clear it).

4. **Anti-Theft** tab: Includes four buttons when none of the protections are active:

   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.

   Test Anti-Theft button: Will cause the message "ANTI-THEFT ALARM" to appear for about 10 seconds on the SP80 front panel screen. This test is useful to check that there is no mistake in the entered email addresses and phone numbers.

   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.

Communicating with SP80 Using a Mobile Phone

Introduction The SP80 can receive and process specially formatted SMS's causing it to respond accordingly. This functionality gives you extra flexibility for remote control and monitoring of your SP80.

Typically, you will use this functionality if you are operating your own base/rover system and, being at some distance from your base, you would like to communicate with it for monitoring or remote control purposes. The use of SMS's is however not restricted to communicating with a base: You can also use them to communicate with a rover.

SP80's SMS functionality may be:

- Disabled
- Set up to process SMS's only from registered phone numbers.
- Or set up to process SMS's from any phone number.

By default, the SP80 accepts SMS's from any phone number.

Any command you send should be in the form:

> **Command_name[<sp>parameter_1][<sp>parameter_2]**
> **[<sp>parameter_3][<sp>parameter_4]**

(Commands may be typed in using upper- or lower-case characters.)

Any response the remote SP80 returns will be in the form:

> SP80<sp>{Receiver Serial Number}
> HH:MM:SS
>
> Command_name[<sp>parameter_1][<sp>parameter_2]
> [<sp>parameter_3][<sp>parameter_4]:<sp>OK
> [Optional_parameters_when_appropriate]

Where:

- <sp>: Space character
- {…}: Definition of the parameter you must type (and not the parameter itself).
- […]: Parameter required for some commands only.
- Date expressed in day/month/year and time in hours:minutes:seconds.
- Line in bold characters: Command SMS sent to SP80
- Line in normal characters: Response SMS from SP80

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Commands List

Command Name & Syntax	Function
ANH VERT x.xx	Sets antenna height (vertical measurement)
ANH SLANT y.yy	Sets antenna height (slant measurement)
ANR OFF	Sets L1 phase center as reference location
ANR PC1	Sets L1 phase center as reference location
ANR ON	Sets ground mark as antenna reference location
ANR SPT	Sets ground mark as antenna reference location
ANR ARP	Sets ARP as reference location
ATH ON	Activates anti-theft function
ATH OFF {password}	Deactivates anti-theft function
GETID	Returns SP80 identification information
GETMEM	Returns memory status
GETPOS	Returns last computed position
GETPOWER	Returns power status
HELP	Returns the list of available commands
HELP {command name}	Returns the syntax of the specified command
MEM INT	Sets internal memory as current memory
MEM SD	Sets external SD card as current memory
MODE BASE	Sets the SP80 as a base receiver
MODE ROVER	Sets the SP80 as a rover receiver
POS...	Provides coordinates to be the reference position
POS CUR	Sets last computed position as reference position
RADIO ON	Powers up the radio
RADIO CHN INT {channel}	Sets channel number in internal radio device
RADIO CHN EXT {channel}	Sets channel number in external radio device
RADIO OFF	Turns off radio
REC ON	Starts data recording at currently set recording rate
REC ON 0.5	Same but you choose the recording rate
REC OFF	Stops data recording
SEND LOG n ...@...	Asks the SP80 to email its last "n" log files to the specified email recipient
SEND PAR ...@...	Asks the SP80 to email its operating parameters to the specified email recipient

See below for details.

ANH: Setting Antenna Height

Send this SMS to change the receiver antenna height. You can either send a vertical or slant measurement (both in meters) of the antenna height.

Command Syntax:

ANH<sp>VERT<sp>{vertical measurement}
or
ANH<sp>SLANT<sp>{slant measurement}

Example 1: Sending vertical height measurement

ANH VERT 2.124
SP80 5345900003
11:02:14

ANH VERT 2.124 m: OK

Example 2: Sending slant height measurement:

ANH SLANT 1.645
SP80 5345900003
11:02:14

ANH SLANT 1.645 m: OK

ANR: Setting Antenna Reduction Mode

Send this SMS to change the location for which the receiver computes a position.

Command Syntax:

1) Position computed for antenna L1 phase center location:

ANR<sp>OFF
or
ANR<sp>PC1

2) Position computed for ground mark location:

ANR<sp>ON
or
ANR<sp>SPT

3) Position computed for antenna reference point (ARP):

ANR<sp>ARP

Example:

ANR ON
SP80 5345900003
11:03:40

ANR ON: OK

ATH: Setting Anti-Theft

Send this SMS to enable or disable the anti-theft function. For example, anti-theft can be disabled remotely just at the end of a work day to allow another operator not working with a data collector to be able to fetch the base without causing the anti-theft alarm to go off.

Command Syntax:

1) Enabling anti-theft (be sure to know the password before you send this SMS):

ATH<sp>ON

2) Disabling anti-theft:

ATH<sp>OFF<sp>{password}

Example:

ATH ON
SP80 5345900003
11:04:25

ATH ON: OK

GETID: Reading Receiver Identification Information

Send this SMS to query the receiver for its serial number, firmware version and warranty expiration date. (The SP80 serial number is part of almost every SMS the SP80 sends back in response to a command.)

Command Syntax:

GETID

Example:

GETID
SP80 5345900003
11:05:01

Version: 2.00
Version date: 01/03/2015
Expiration date: 26/11/2015

GETMEM: Reading Memory Status

Send this SMS to query the receiver for the status of the currently used memory.

Command Syntax:

GETMEM

Example:

GETMEM
SP80 5345900003
11:08:29

Current memory: internal
    Free memory: 1.4GB (99%)
    G-Files: 3
    ATL Files: 1
    Free SD Card: 7.2GB (99%)
    G-Files: 2
    ATL Files: 0

GETPOS: Reading Computed Position

Send this SMS to query the receiver for the last computed position.

Command Syntax:

    GETPOS

Example:

    GETPOS
    SP80 5345900003
    11:11:17

     47 17'12.12345"N
        001 30'14.54321"W
         +75.254 m (SPT)
        Type: FIXED
        Mode: ROVER
        Age: 1 s
        Satellites: 22
        Antenna height: 2.000 m (vert)

GETPOWER: Reading Receiver Power Status

Send this SMS to query the receiver for the current status of its power supply.

Command Syntax:

    GETPOWER

Example 1:

    GETPOWER
    SP80 5345900003
    11:13:47

    Source: left-hand battery
    Left battery: 80% (7.3V)
    Right battery:
    External power:

Example 2:

    GETPOWER
    SP80 5345900003
    11:14:04

     Source: external power

Left battery: 80% (7.3V)
Right battery: 100% (7.4V)
External power: 12.2 V

HELP: Reading the List of Commands

1. Send this SMS if you want to be reminded of all the possible commands you may use to control/monitor a receiver through SMS's.

   Command Syntax and SP80 Response:

   HELP

   ANH
   ANR
   ATH
   GETID
   GETMEM
   GETPOS
   GETPOWER
   MEM
   MODE
   POS
   RADIO
   REC
   SEND

2. The receiver can return the syntax of each of the above commands by sending the following SMS:

   HELP<sp>command_name
   {Detail of command syntax returned}
   + Command explanation in plain

   Example:

   HELP MEM
   MEM <INT/SD>
   Sets recording memory

MEM: Setting Current Memory

Send this SMS to change the memory used by the receiver. This may be the internal memory or an external SD card connected to the receiver.

Command Syntax:

MEM<sp>INT
or
MEM<sp>SD

Example 1: Choosing the internal memory

MEM INT
SP80 5345900003
11:05:09

MEM INT: OK

Example 2: Choosing the external SD card:

MEM SD
SP80 5345900003
11:05:18

MEM SD: OK

MODE: Setting Receiver Mode

Send this SMS to change the receiver's operating mode: rover or base.

Command Syntax:

MODE<sp>BASE
or
MODE<sp>ROVER

Example 1: Selecting Base Mode

MODE BASE
SP80 5345900003
11:12:25

MODE BASE: OK

Example 2: Selecting Rover Mode

MODE ROVER
SP80 5345900003
11:12:45

MODE ROVER: OK

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POS: Setting Reference Position

Send this SMS to change the receiver's reference position. You can choose to send the coordinates of this position or ask the receiver to use the last position it computed (and then keep the reference position to this value).

Command Syntax:

POS<sp>{Attribute}<sp>{Latitude}<sp>{Longitude}<sp>{Height}
or
POS<sp>CUR

Parameter	Description	Range
Attribute	Position attribute: • PC1: Position attached to L1 phase center (default) • ARP: Position attached to ARP (Antenna Reference Position) • SPT: Position attached to ground mark (surveyed point)	PC1, ARP, SPT
Latitude	Latitude in degrees, minutes, seconds and fraction of second (5 decimal places) (ddmmss.sssss)	0 to ±90
Longitude	Longitude in degrees, minutes, seconds and fraction of second (5 decimal places) (dddmmss.sssss)	0 to ±180
Height	Height in meters	0 to ±9999.9999

Example 1: Sending the coordinates of the reference position

POS PC1 471756.29054 -13032.58254 88.225
SP80 5345900003
11:20:25

SET BASE POSTION: OK
Type: PC1
Latitude: 47 17'56.29054"N
Longitude: 001 30'32.58254"W
Height: +88.225m

Example 2: Asking the receiver to use the last computed position as the reference position

POS CUR
SP80 5345900003
11:21:15

SET BASE POSITION: OK
Type: PC1
Latitude: 47 17'56.29054"N
Longitude: 001 30'32.58254"W
Height: +88.225m

RADIO: Setting the Radio

Send this SMS to control the radio attached to the SP80.

Command Syntax:

1) Turning on the internal radio:
   RADIO<sp>ON

2) Setting the radio channel after turning on the radio:
   RADIO<sp>CHN<sp>{internal_or_external_radio}<sp>{radio_channel}

3) Turning off the internal radio:
   RADIO<sp>OFF

Example 1: Turning on the radio:
RADIO ON
SP80 5345900003
11:18:05

RADIO ON: OK

Example 2: Setting the internal radio to use channel 2:
RADIO CHN INT 2
SP80 5345900003
11:13:05

RADIO CHN INT 2: OK
Channel: 2
RX Frequency: 444.0000MHz
TX Frequency: 445.0000MHz

NOTE: The SP80 response also returns the two frequencies corresponding to the choice of a given channel.

Example 3: Turning off the radio:
RADIO OFF
SP80 5345900003
11:27:16

RADIO OFF: OK

REC: Setting the Recording Mode

Send this SMS to control raw data recording in a remote SP80.

Command Syntax:

1) Starting recording raw data to the current memory at the currently selected recording rate:

REC<sp>ON

2) Starting recording raw data to the current memory at the specified recording rate:

REC<sp>ON<sp>{recording_rate}

3) Ending raw data recording:

REC<sp>OFF

Example 1: Starting raw data recording at 0.1 second:

REC ON 0.1
SP80 5345900003
11:32:04

REC ON 0.10: OK

Example 2: Ending raw data recording:

REC OFF
SP80 5345900003
11:35:19

REC OFF: OK

SEND LOG:
Emailing Log Files

Send this SMS to ask the remote SP80 to email its last log files to the specified email address.

Command Syntax:

    SEND\<sp>LOG\<sp>{x_last_log_files}\<sp>{email_address}

Example: Emailing the last 4 log files to the specified email address:

    SEND LOG 4 rxg217@mmwerx.com
    SP80 5345900003
    11:40:11

    SEND LOG 4 rxg217@mmwerx.com: OK
    4 log file(s) sent

SEND PAR:
Emailing Receiver
Parameters

Send this SMS to ask the remote SP80 to email all its operating parameters to the specified email address.

Command SMS Syntax:

    SEND\<sp>PAR\<sp>{email_address}

Example: Emailing all SP80 operating parameters to the specified email address:

    SEND PAR rxg217@mmwerx.com
    SP80 5345900003
    11:42:51

    SEND PAR rxg217@mmwerx.com: OK

Using the SP80 Built-in Electronic Tiltmeter

Benefit When using the pole level to place the antenna phase center exactly over the surveyed point just before logging its position, you need to have an eye on the pole level and the other on the data collector screen, making your best to have the pole vertical at the very moment the point position is being logged. This is a critical phase.

With the SP80 built-in tiltmeter, the level information is forwarded directly to the field software and you don't need to look away from the data collector screen during the procedure:

- First you make the pole vertical following the eLevel instructions displayed on the data collector screen.
- Then, still looking at the data collector screen and keeping an eye on the eLevel, you can more comfortably take the necessary steps to log the point position while keeping the pole vertical.

Rover Setup

Making the pole vertical by reading the eLevel information displayed on the data collector screen will be more intuitive if you set up the rover as follows:

- First you secure the SP80 at the top of the pole.
- Then you mount the data collector on the pole, **making sure the orientation of its longitudinal axis is perpendicular to the SP80 front panel** (see picture).

Calibrating the Tiltmeter

Calibration Methods

Use one of the two methods below to calibrate the tiltmeter:

- **Auto-Null Method** (Stable Method). This is the simplest method:
    - Secure the SP80 on top of an accurately leveled tripod or range pole and turn it on.

        NOTE: The accuracy of the eBubble depends on the accuracy of the physical bubble used to calibrate it. Thus it is important that the physical bubble be properly calibrated.
    - Run a calibration (this can be done either directly from the receiver itself, or from the field software used). Let the system complete the calibration on its own.

        (The SP80 does not need to be rotated around its axis.)

- **Rotation Method** ("V-Groove method"). You need to prop and rotate the SP80 range pole against a V-shaped groove fitted on a wall, at some height above the ground (the higher the better; see diagram).
    - Avoid slippery floor to better control the rotating movement.
    - The range pole does not need to be strictly vertical. A tilt angle of ±5° maximum while rotating the pole is tolerated throughout the calibration procedure.
    - After turning on the SP80 and starting calibration (either from the receiver or the field software), start rotating the pole around its axis at a regular and slow speed, keeping the pole blocked into the V-groove (rotate clockwise or anti-clockwise, but always in the same direction).
    - Keep the pole rotating to cover an angle of between 360° and 540° (one to 1.5 full rotation) within the next 30 seconds.

        If calibration is successful, the receiver will buzz once: you can stop rotating the receiver around its pole. It will buzz twice if calibration fails, prompting you to resume the procedure. A failing calibration is usually the result of unsteady, too slow or too fast rotation.

±5° max.

(Top View)
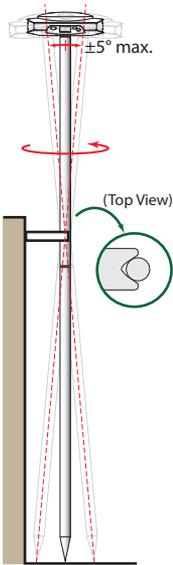
How Often Do I Need to Calibrate the Built-in Tiltmeter? The SP80 tiltmeter should be calibrated every 30 days, or more often if a message issued by the SP80 asks you to do so. You may re-calibrate the tiltmeter as often as you wish.

NOTE: The electronic tiltmeter is affected by the temperature of the receiver, which will expire the calibration if the current temperature inside the receiver is more than 30 degrees Celsius different to when the last calibration was performed. This forces you to recalibrate the electronic tiltmeter.

When calibrating the electronic tiltmeter, the pole the GNSS receiver is on should be as vertical and as stable as possible. In practice this means using at least a bipod to hold the pole as still as possible.

Furthermore, a bent pole will affect the measured tilt. If you calibrate the electronic tiltmeter using a bent pole and then change poles, the accuracy of points will be affected. Also, if you calibrate using a straight pole and then change to a bent pole, the receiver will not be plumb even though the electronic bubble will say it is, again affecting the accuracy of the measured points.

Calibrating the Tiltmeter in Standalone Mode

The tiltmeter can be calibrated directly from the SP80 front panel screen.

• Press 🔁 repeatedly until the eLevel screen is displayed.

- Then press ⊟ to enter the calibration mode. Follow the instructions in the flowchart below to complete a calibration according to one of the two possible methods.
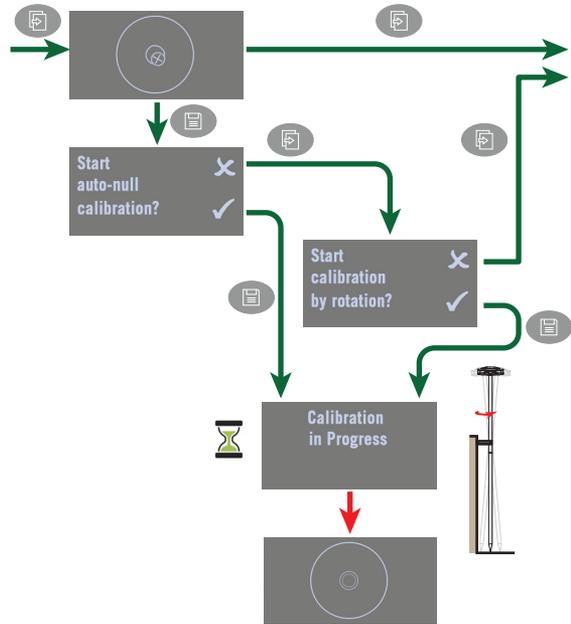
Calibrating the Tiltmeter With Survey Pro

Unless already there, make the eLevel function available in Quick Pick (i.e. from the yellow star located in the Survey Pro command bar). You need to do this only once:

- Click on Quick Pick in the command bar and select **Quick Pick Editor** at the bottom of the list.
- Select **Extras** from the **Menu Items** field.
- Select **eLevel Bubble** in the list just underneath.
- Tap on the **Add-->** button. The **eLevel Bubble** function is added at the bottom of the Quick Pick list. It can now be run directly from this list.

Configure Survey Pro to operate with your SP80 using the desired receiver profile, then start calibration:

- Run **eLevel Bubble** from Quick Pick
- Tap on **Calibrate**. This opens the **Calibration** screen.
  At the top of the screen is the remaining time before calibration should be resumed.
  At the bottom of the screen you may choose the time allowed between two calibrations (can be set between 1 and 30 days)
- Choose the calibration method (**Auto-Null** or **Rotate**)
- Tap **Start** and follow the instructions. When calibration is complete, the message "**Calibration is done.**" is displayed.
- Tap **OK**, close the **Calibration** window, then the **eLevel Bubble** window.

Calibrating the Tiltmeter With FAST Survey

Only the rotation method can be used in FAST Survey.

- Configure FAST Survey to operate with your SP80.
- Then go to **Equip** > **GPS Utility** and tap on the **Sensor Calibration** button.
- Read the instructions on the screen and then tap on **Start Calibration**.
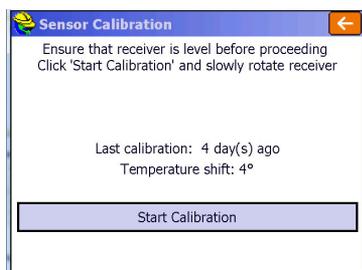
Using the eLevel

In Survey Pro

The eLevel is always shown on the point logging screens.
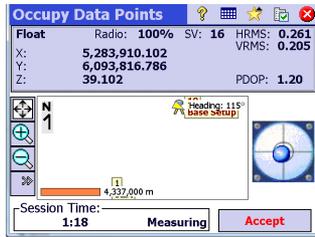
If the **eLevel Bubble** check box has been activated on the **Meas.Mode** tab for a given type of point (**Data**, **Topo**, **Check**, etc.), Survey Pro will check that the receiver is level before logging this type of point. If it's not, you won't be allowed to log the point.

If the **eLevel Bubble** check box is deactivated, you will still see the eLevel on the screen but Survey Pro will not stop you from logging the point if the receiver is not level.

REMINDER: To open the **Meas. Mode** tab, tap on top of the logging screen.

In FAST Survey

The electronic tiltmeter may be enabled or disabled by setting the **Use eLevel** box accordingly. To access this setting, go to **Equip** > **GPS Rover** / **GPS Base**, open the **Receiver** tab and then tap on the **Advanced** button.

To view the eLevel on the screen while storing or staking points, do the following:

- Tap on on the Store Points or Stake Points screen.
- On the **View** tab, enable the **View GNSS Level** box.

- Tap to go back to the map screen. The eLevel appears on the screen (see example below).
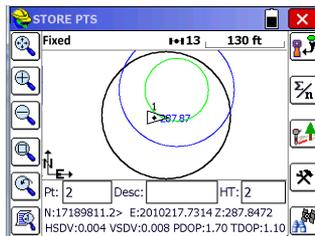
The eLevel is a transparent object consisting of three circles placed over the map. The black circle is static and

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stands for the eLevel body. The other two circles are always concentric and move as the receiver tilt angle changes. The blue circle is the same size as the black circle. **The smallest circle is green if the receiver is level, red otherwise**. When the receiver is strictly level, the three circles are concentric, the smaller circle is green and the other two circles (the blue and black ones) are exactly one over the other.

Using the UHF Kit Option

The SP80 UHF kit is an option that you can use to implement a radio-based, standalone RTK base/rover system (see Optional Accessories on page 3 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 SP80 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 4* 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 85*.

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 37*.

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
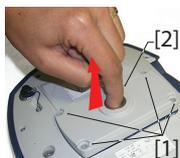
- Power off the SP80 and turn it upside down.
- Use the L-shaped Torx screwdriver provided in the SP80 UHF kit to loosen and remove the four screws (**[1]**) securing the 5/8" threaded insert plate.
- Insert a finger into the 5/8" threaded hole (**[2]**), then gently pull the plate out of the receiver, 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).

NOTE: The insertion of the UHF module slightly modifies the ARP (*Antenna Reference Point*) of the GNSS antenna, thus reducing the antenna phase center offset by 2mm (see diagram below).

L1 82.6 mm
L2 75.6 mm
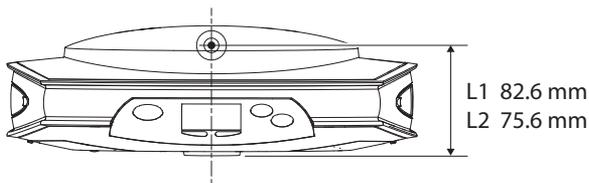
Be aware that the receiver will automatically apply this delta following the installation of the UHF module by assigning a different antenna name to the SP80. In fact, two distinct antenna names exist for the SP80. One describes the antenna parameters when no UHF module is used (antenna name with "-1" suffix), and the other when the UHF module is used ("-2" suffix).

When post-processing SP80 raw data files (G-files), SPSO (*Spectra Precision Survey Office* software) will automatically recognize the presence or not of the UHF module while you collected your raw data by analyzing the antenna name mentioned in the G-files.

Configuring the UHF Module

- Use cable P/N59044-10-SPN from the SP80 Office Power Kit to connect the receiver to the computer (see diagram below).
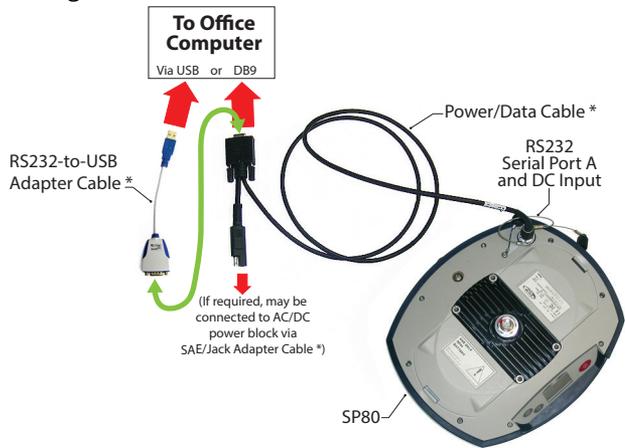
*: All these items are part of the SP80 Office Power Kit P/N 94336 (option). Use the RS232-to-USB adapter cable if your computer is fitted with USB connectors (and no DB9 connector).

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 batteries (see also *Charging Batteries, Scenario #2 on page 53*). When applied to the receiver's DC input, the external power source has priority over the internal batteries, which means the battery or batteries can be left safely inside the receiver (none of them will be drained).

- Press simultaneously ⏻ + ▤ to switch the receiver to **Service mode**. Through this mode, the receiver offers 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

Once the UHF module has been secured to the receiver (see *Installing the UHF Module into the Receiver on page 84*) and properly configured, do the following:

[6]

*   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 SP80 UHF kit. Insert first its end with special tapping, not 5/8" tapping, around the UHF antenna (**[7]**).

[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 SP80 + 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 4*; 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.

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[12]

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.

[13]

• 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 86*) 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 4*).

• The pole extension with the oblong hole (from the UHF option kit). You don't need to use the coaxial adapter cable.

Running the SP80 Web Server Interface

Introduction The SP80 Web Server interface is a web-based, receiver built-in application providing remote access to the receiver's operating parameters. The Web Server is a first-choice tool to review or modify the configuration of a receiver.

You need a web browser running on a controller (data collector, field computer, mobile phone, etc.) to start the Web Server.

Running the Web Server requires that an IP connection be implemented between the controller and the SP80. On receiver side, WiFi must be used (the receiver modem cannot be used here because it is more and more difficult, not to say impossible, to connect to a modem through a public, static IP address).

The embedded WiFi device may be used in two different modes:

• Access Point mode
• Client mode.

The easiest way to run the Web Server is undoubtedly to set the WiFi device in Access Point mode. This chapter however deals with the two possible WiFi modes through which you can access the SP80 Web Server interface.

WiFi in Access Point Mode This is the easiest way to implement the IP connection.

• Turn on the WiFi device from the dedicated SP80 display screen (see *Wifi Power Control Screen on page 24*). The device is then automatically switched to the WiFi Access Point mode.
• Then type the following IP address in the web browser:
   192.168.130.1

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Enter the login and password (defaults: "admin" for login, "password" for password). This launches the SP80 Web Server interface: Its home page appears in the web browser.

WiFi in Client Mode

If however the SP80 WiFi device is currently used in client mode (busy receiving RTK corrections for example), then you may still use it in this mode to run the SP80 Web Server interface (see the three possible cases in the diagram below).
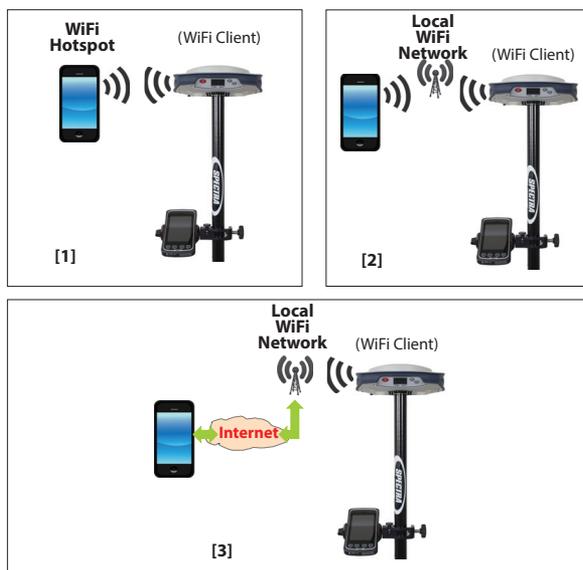
- **[1]**: The smart phone can be set to be a *WiFi hotspot*. The SP80 just has to connect to the WiFi network controlled by the smart phone. Once connected to this network, the SP80 provides its IP address on the Receiver Identification screen. Just type this address in a web browser on the smart phone to start the SP80 Web Server interface.
- **[2]**: Both the smart phone and the SP80 are in the vicinity of a third-party local WiFi network. Once the SP80 and smart phone are both connected to the WiFi network, read the SP80's IP address on the receiver identification screen. On the smart phone, run a web browser and type the IP address. This starts the SP80 Web Server interface.
- **[3]**: The path used for the IP connection is here more heterogeneous (modem on controller side, Internet, local WiFi network on receiver side): You will probably need

help from a network specialist to make that connection work.

The general procedure to run the SP80 Web Server interface in this case is outlined below:

1. Use your field software (Survey Pro or FAST Survey - see the two subsections below for details) to search for and connect to a local WiFi network (this automatically turns the WiFi device into Client mode).

   If you are using another field software application, please contact Technical Support.

2. Use the SP80 front panel screen to turn on WiFi. After the WiFi device has been turned on, two scenarios are then possible:

   – The SP80 has the name of a WiFi network in memory and automatic connection to this network at power up has been requested. If this network is working and within range, then the SP80 will automatically connect to this network.

   – The SP80 has no WiFi network name in memory. Then you should find which WiFi network to use and ask the SP80 to connect to it before you move on to the next step. See the two subsections below.

3. Select the Receiver ID screen on the front panel display to read and write down the receiver's IP address. This address is provided by the local WiFi network and is shown on the Receiver ID screen, in the lower line (see *Receiver Identification on page 19*).

4. If you are using setup type **[2]**, make sure the controller is connected to the same WiFi network as the SP80.

5. On your controller, run a web browser and then type the IP address you read on the SP80 front panel. Enter the login and password (defaults: "admin" for login, "changeme" for password). This launches the SP80 Web Server interface: Its home page appears in the web browser.

   For more information on the application, open its on-line Help.

Connecting to a WiFi Network Using Survey Pro

- Create a "Net" receiver profile for your receiver.
- Go to **Manage Instruments** and select this receiver profile.
- Tap on the 🔧 button corresponding to this receiver profile.
- Open the **Modem** tab.
- Select **Internal WiFi** in the **Data Modem** scroll-down list. Survey Pro lists the detected local WiFi networks. You may use the **Refresh** button to update the list of available networks (tapping on this button starts a new WiFi scan).
- In the list, tap and hold down the name of the chosen WiFi network, then select **Connect** from the pop-up menu.
- Enter the WiFi key specific to this network and check on **Connect to this network automatically when available**.
- Tap ✅ and let the receiver connect to the WiFi network.
- Tap ✅ and proceed with step 2 in the General Procedure.

Connecting to a WiFi Network Using FAST Survey

- In the **Equip** menu, tap **GPS Rover** or **GPS Base**. Do the usual settings on the first three tabs to communicate with the SP80 through Bluetooth.
- On the **RTK** tab, select **Receiver Wifi** in the **Device** scroll-down list. The **Network** scroll-down list may be set to any option.
- Tap 🛠 to read the list of detected WiFi networks. You may use the **Scan** button to refresh the list of available WiFi networks.
- Select the desired WiFi network.
- Tap **Set Username/Password**, enter the WiFi key (**Password**) and check on the **Auto Connect** option.
- Tap ✅, then 🗍. Let the receiver connect to the chosen WiFi network.
- Tap ✅ and proceed with step 2 in the General Procedure.

Appendix

SP Loader Software Utility

Use Spectra Precision *SP Loader* software to:

1. Upgrade the receiver firmware
2. Install new firmware options
3. Validate CenterPoint 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/sp80.html#.Vd72BpdWIQo
(Click on the Support tab 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 SP80 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 a CenterPoint RTX subscription, see sub-sections below.
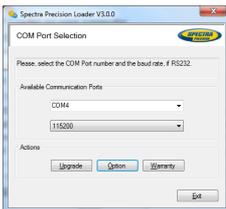
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Upgrading Receiver Firmware

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 93*.
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.
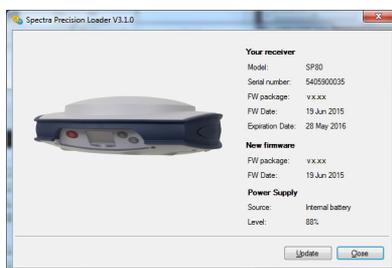
5. When you are ready, click on the **Update** button.
6. Let the receiver proceed with the upgrade (a status window is displayed showing a progress bar). **Take care not to turn off the receiver while the upgrade is in progress**.
7. After successful completion of the upgrade, click **Close** to close 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.

Other Receiver Firmware Upgrade Method Just Using a Properly Formatted SD Card (64 MB minimum in size):

1. Check that the SD card used for the upgrade is not write-protected and then insert it into your computer.

2. Using a file browser, copy the ".tar" file to the root directory of the SD card. Make sure there is only one ".tar" file present on the SD card. Delete those not used.

3. Remove the SD card from the computer.

4. Make sure the receiver you want to upgrade is OFF and ready for upgrade (i.e. one sufficiently charged battery present or external AC/DC power block connected and on).

5. Insert the SD card now containing the upgrade file into the receiver.

6. Hold down ⬛ and then press ⭕ for about 2 to 3 seconds. After about 10 seconds, the Spectra Precision logo shown on the screen is replaced with the "**Uploading mode**" message, meaning that the upgrade procedure has now started.

7. Let the receiver proceed with the upgrade. **Take care not to turn off the receiver while the upgrade is in progress**.

    The receiver screen will display successively:

    Uploading mode
    Upgrading Firmware
    Start Upgrade
    Step 1/9
    Step 2/9
    Step 3/9
    Step 4/9
    Step 5/9
    Rebooting
    <Blank>
    Updating System
    {Spectra Precision logo}
    Upgrading Firmware
    Start Upgrade
    Step 6/9
    Step 7/9
    Step 8/9
    Step 9/9
    Rebooting
    <Blank>
    {Spectra Precision logo}
    {Normal receiver startup}

8. Remove the SD card from the receiver.

9. Check that the new firmware is installed (read the second line on the Receiver Identification Screen).

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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 93*.

• 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.)
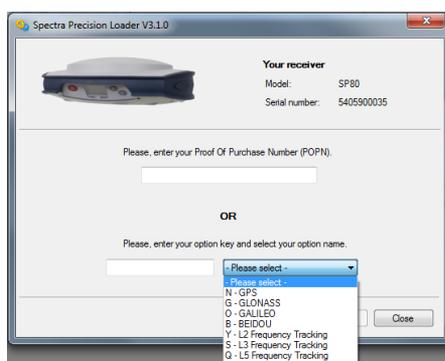
• Enter the POPN and then click on **Update**. Let the receiver proceed with the installation of the firmware option (a status window is displayed showing a progress bar). **Take care not to turn off the receiver while the installation is in progress**.

• After successful completion of the installation, click **Close** to close the status window.

• Click **Close** again, then **Exit** to quit SP Loader.

Activating a CenterPoint RTX Subscription

After you have purchased a CenterPoint RTX subscription, *Trimble Positioning Services* will email you an activation code.

Use the same procedure as the one used to install a firmware option (see *Installing a Firmware Option on page 96*; 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**.

NOTE: SP80 only supports CenterPoint RTX.

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/sp80.html#.Vd72BpdWlQo
(Click on the Support tab 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 SP80 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.

To Office Computer
Via USB   or   DB9

Power/Data Cable *

RS232-to-USB Adapter Cable *

RS232 Serial Port A and DC Input

(If required, may be connected to AC/DC power block via SAE/Jack Adapter Cable *)

SP80
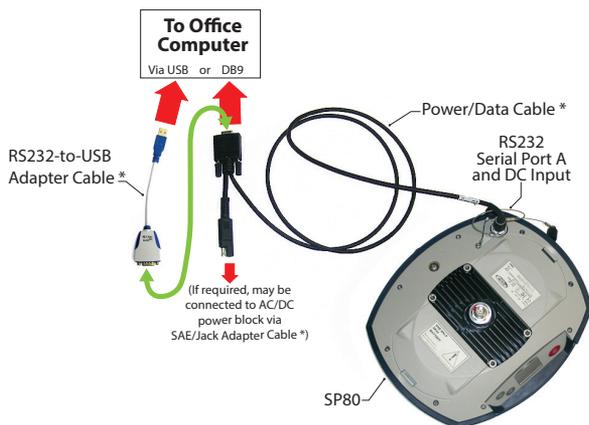
*: All these items are part of the Office Power Kit P/N 94336 (option).

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 SP80 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 flap 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.
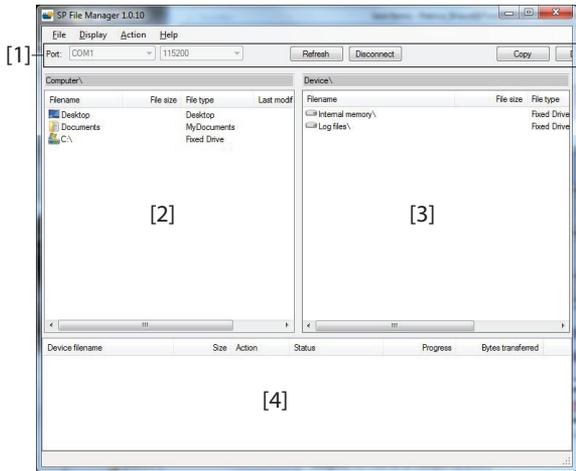
[1]: SP File Manager toolbar. This toolbar consists of the following items:

- **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 SP80.
- **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.

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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 to four 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.
- **SD Card**, if one is currently inserted in the receiver.
- **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 SP80 to your Computer on page 98*)
- 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 93*) 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 is done by pressing simultaneously the three front panel buttons (Power + Scroll + Log). All factory settings are restored, except the following, which are kept unchanged:

• GSM
  – PIN code
  – APN
  – Login
  – Password
  – Network

• Bluetooth
  – PIN code
  – Receiver's Bluetooth name

• WiFi

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- IP
- Mask
- Gateway
- DNS1, DNS2

- Anti-Theft & startup protections
  - Current states (enabled or disabled)
  - Password
  - Anti-Theft position
  - Last position computed
  - Phone numbers and email addresses programmed to receive alerts in case of theft.

- E-mail settings.

Restoring factory settings is not allowed in any of the following 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.)

Alerts   The table below lists some of the level-1 and level-2 alerts you should know.

All indicate problems that can be remedied without external support. The ANTI-THEFT ALARM is a special one as it requires that you take the necessary steps to get your receiver back. These are left to your own initiative.

#	Alert	Remedy	Level
30	No SIM card detected	Insert SIM card, or replace (silent) SIM card.	2
41	Memory Full	Free memory space before doing anything else.	1
42	SDCard removed while file opened	File may not have been closed correctly and so the file may be lost. Insert the SD card back and start a new recording sequence. Data will be recorded in a new file. Remember you shouldn't remove the SD card while it's being used.	2
49	Current Power not allowed	May happen when the UHF option is used as a transmitter and the internal temperature does not allow the initially requested power to be radiated. Full power will be restored when the internal temperature allows it.	2
58	Low battery	Receiver's last battery going low. Insert fresh batteries.	1
59	Low voltage	External power source going low. Change external power source.	1
82	Not enough space left	Free memory space before doing anything else.	2
88	WARRANTY END DATE	Your receiver's warranty for major free firmware upgrades has expired.	1
96	ANTI-THEFT ALARM	Theft detected: • Take the necessary steps based on the notifications received via email or SMS. • If it's a false alarm due to misuse of the anti-theft protection (you are standing next to the receiver), use your data collector to deactivate the Anti-Theft protection and stop the alarm.	1
99	SIM Card Locked	Take the necessary steps to unlock the SIM card, then try again.	1
103	No SD Card Detected	Insert SD card, or replace (silent) SD card.	2
104	UPGRADE FAILED	Resume upgrade procedure from the beginning.	1

If the receiver reports some other alerts, these may result only from temporary problems (e.g. from the configuration or operation of the modem, WiFi, network, UHF option, etc.).

Acknowledge the alert from the receiver front panel, make the necessary corrections (if required) and check that everything goes back to normal afterwards.

If the problem persists, please contact Technical Support.

Technical Specifications   **GNSS Characteristics**
• 240 GNSS channels
  – GPS L1 C/A, L1P (Y), L2P (Y), L2C, L5
  – GLONASS L1 C/A, L2 C/A, L3
  – BeiDou B1 (phase 2), B2
  – Galileo E1, E5a, E5b

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– QZSS L1 C/A, L2C, L1 SAIF, L5
– SBAS (WAAS/EGNOS/MSAS/GAGAN) L1 C/A

- 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 20 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)
- 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

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: 0.05 - 999 seconds

Physical Characteristics

- Size: 22.2 x 19.4 x 7.5 cm (8.7 x 7.6 x 3.0")
- Weight: 1.17 kg (2.57 lb)
- User interface: Graphical PMOLED display
- I/O interface:
  - RS232 serial link
  - USB 2.0/UART
  - Bluetooth 2.1 + EDR
  - WiFi (802.11 b/g/n)
  - 3.5G quad-band GSM/penta-band UMTS module (800/850/900/1900/2100 MHz)

- Memory:
  - 2 GB internal memory (1.5 GB user data)
  - Over a year of 15 sec. raw GNSS data from 14 satellites
  - Removable SD/SDHC memory card (up to 32 GB)

- Operation:
  - RTK rover & base
  - RTK network rover: VRS, FKP, MAC
  - NTRIP, Direct IP
  - CSD mode
  - Post-processing

- Environmental characteristics:
  - Operating temperature: -40° to +65°C (-40° to +149°F) (4) (5) (6)
  - Charging batteries left inside the receiver using an external power source: The ambient temperature should not exceed +40°C (104°F)
  - Storage temperature: -40° to +85°C (-40° to +185°F) (7)
  - Humidity: 100% condensing
  - IP67 waterproof, sealed against sand and dust
  - Drop: 2 m pole drop on concrete
  - Shock: ETS300 019
  - Vibration: MIL-STD-810F
- Power characteristics:
  - 2 Li-Ion hot-swappable batteries, 38.5 Wh (2 x 7.4 V, 2600 mAh)
  - Battery life time with two batteries: 10 hrs (GNSS On, and GSM or UHF Rx On)
  - External DC power: 9-28 V

(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 extreme temperatures, the UHF module should not be used in the transmitter mode.
(5) At very high temperatures, an external battery may be required.
(6) 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).
(7) Without batteries. Batteries can be stored up to +70°C.

Standard & Optional System Components

See *SP80 Packout on page 2*.

Data Collectors and Software

The following options are available for use with SP80.
Data collectors:

- Ranger 3
- T41
- MobileMapper 20

- ProMark 120

Field software:
- Survey Pro
- FAST Survey

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SP80 GNSS Receiver

User Guide

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